RV 45/55/65

DIAGNOSTIC REPAIR MANUAL

RECREATIONAL VEHICLE GENERATOR

MODELS 5410, 5411, 5412, 5413, 5414 & 5415

GUARDIAN®
by Generac Power Systems, Inc.

SAFETY

Throughout this publication, "DANGER!" and "CAUTION!" blocks are used to alert the mechanic to special instructions concerning a particular service or operation that might be hazardous if performed incorrectly or carelessly. PAY CLOSE ATTENTION TO THEM.

⚠ **DANGER! UNDER THIS HEADING WILL BE FOUND SPECIAL INSTRUCTIONS WHICH, IF NOT COMPLIED WITH, COULD RESULT IN PERSONAL INJURY OR DEATH.**

⚠ **CAUTION! Under this heading will be found special instructions which, if not complied with, could result in damage to equipment and/or property.**

These "Safety Alerts" alone cannot eliminate the hazards that they signal. Strict compliance with these special Instructions plus "common sense" are major accident prevention measures.

NOTICE TO USERS OF THIS MANUAL

This SERVICE MANUAL has been written and published by Generac to aid our dealers' mechanics and company service personnel when servicing the products described herein.

It is assumed that these personnel are familiar with the servicing procedures for these products, or like or similar products manufactured and marketed by Generac. That they have been trained in the recommended servicing procedures for these products, including the use of common hand tools and any special Generac tools or tools from other suppliers.

Generac could not possibly know of and advise the service trade of all conceivable procedures by which a service might be performed and of the possible hazards and/or results of each method. We have not undertaken any such wide evaluation. Therefore, anyone who uses a procedure or tool not recommended by Generac must first satisfy himself that neither his nor the products safety will be endangered by the service procedure selected.

All information, illustrations and specifications in this manual are based on the latest product information available at the time of publication.

When working on these products, remember that the electrical system and engine ignition system are capable of violent and damaging short circuits or severe electrical shocks. If you intend to perform work where electrical terminals could be grounded or touched, the battery cables should be disconnected at the battery.

Any time the intake or exhaust openings of the engine are exposed during service, they should be covered to prevent accidental entry of foreign material. Entry of such materials will result in extensive damage when the engine Is started.

During any maintenance procedure, replacement fasteners must have the same measurements and strength as the fasteners that were removed. Metric bolts and nuts have numbers that indicate their strength. Customary bolts use radial lines to indicate strength while most customary nuts do not have strength markings. Mismatched or incorrect fasteners can cause damage, malfunction and possible injury.

REPLACEMENT PARTS

Components on Generac recreational vehicle generators are designed and manufactured to comply with Recreational Vehicle Industry Association (RVIA) Rules and Regulations to minimize the risk of fire or explosion. The use of replacement parts that are not in compliance with such Rules and Regulations could result in a fire or explosion hazard. When servicing this equipment, It is extremely important that all components be properly installed and tightened. If Improperly Installed and tightened, sparks could Ignite fuel vapors from fuel system leaks.

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MAGNETISM

Magnetism can be used to produce electricity and electricity can be used to produce magnetism.

Much about magnetism cannot be explained by our present knowledge. However, there are certain patterns of behavior that are known. Application of these behavior patterns has led to the development of generators, motors and numerous other devices that utilize magnetism to produce and use electrical energy.

See Figure 1-1. The space surrounding a magnet is permeated by magnetic lines of force called "flux". These lines of force are concentrated at the magnet's north and south poles. They are directed away from the magnet at its north pole, travel in a loop and re-enter the magnet at its south pole. The lines of force form definite patterns which vary in intensity depending on the strength of the magnet. The lines of force never cross one another. The area surrounding a magnet in which its lines of force are effective is called a "magnetic field".

Like poles of a magnet repel each other, while unlike poles attract each other.

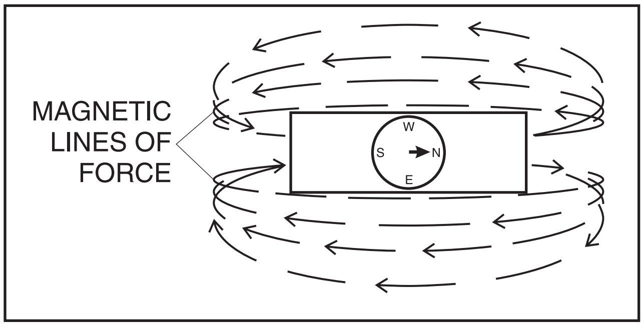


Figure 1-1. – Magnetic Lines of Force

ELECTROMAGNETIC FIELDS

All conductors through which an electric current is flowing have a magnetic field surrounding them. This field is always at right angles to the conductor. If a compass is placed near the conductor, the compass needle will move to a right angle with the conductor. The following rules apply:

- The greater the current flow through the conductor, the stronger the magnetic field around the conductor.
- The increase in the number of lines of force is directly proportional to the increase in current flow and the field is distributed along the full length of the conductor.
- The direction of the lines of force around a conductor can be determined by what is called the "right hand rule". To apply this rule, place your right hand around the conductor with the thumb pointing in the direction of current flow. The fingers will then be pointing in the direction of the lines of force.

NOTE: The "right hand rule" is based on the "current flow" theory which assumes that current flows from positive to negative. This is opposite the "electron" theory, which states that current flows from negative to positive.

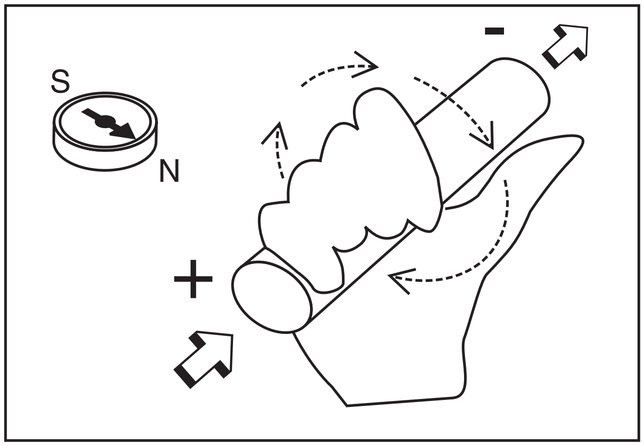


Figure 1-2. – The Right Hand Rule

ELECTROMAGNETIC INDUCTION

An electromotive force (EMF) or voltage can be produced in a conductor by moving the conductor so that it cuts across the lines of force of a magnetic field.

Similarly, if the magnetic lines of force are moved so that they cut across a conductor, an EMF (voltage) will be produced in the conductor. This is the basic principal of the revolving field generator.

Figure 1-3, below, illustrates a simple revolving field generator. The magnetic field (Rotor) is rotated so that its lines of magnetic force cut across a coil of wires called a Stator. A voltage is then induced into the Stator windings. If the Stator circuit is completed by connecting a load (such as a light bulb), current will flow in the circuit and the bulb will light.

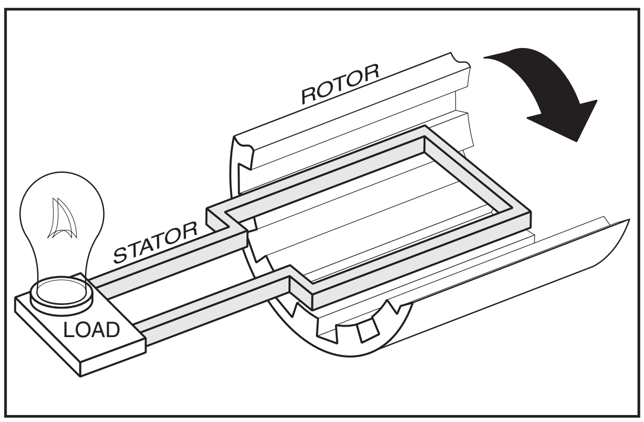


Figure 1-3. – A Simple Revolving Field Generator

A SIMPLE AC GENERATOR

Figure 1-4 shows a very simple AC Generator. The generator consists of a rotating magnetic field called a ROTOR and a stationary coil of wire called a STATOR. The ROTOR is a permanent magnet which consists of a SOUTH magnetic pole and a NORTH magnetic pole.

As the ROTOR turns, its magnetic field cuts across the stationary STATOR. A voltage is induced Into the STATOR windings. When the magnet's NORTH pole passes the STATOR, current flows in one direction. Current flows in the opposite direction when the magnet's SOUTH pole passes the STATOR. This constant reversal of current flow results in an alternating current (AC) waveform that can be diagrammed as shown in Figure 1-5.

The ROTOR may be a 2-pole type having a single NORTH and a single SOUTH magnetic pole. Some ROTORS are 4-pole type with two SOUTH and two NORTH magnetic poles. The following apply:

1. The 2-pole ROTOR must be turned at 3600 rpm to produce an AC frequency of 60 Hertz, or at 3000 rpm to deliver an AC frequency of 50 Hertz.
2. The 4-pole ROTOR must operate at 1800 rpm to deliver a 60 Hertz AC frequency or at 1500 rpm to deliver a 50 Hertz AC frequency.

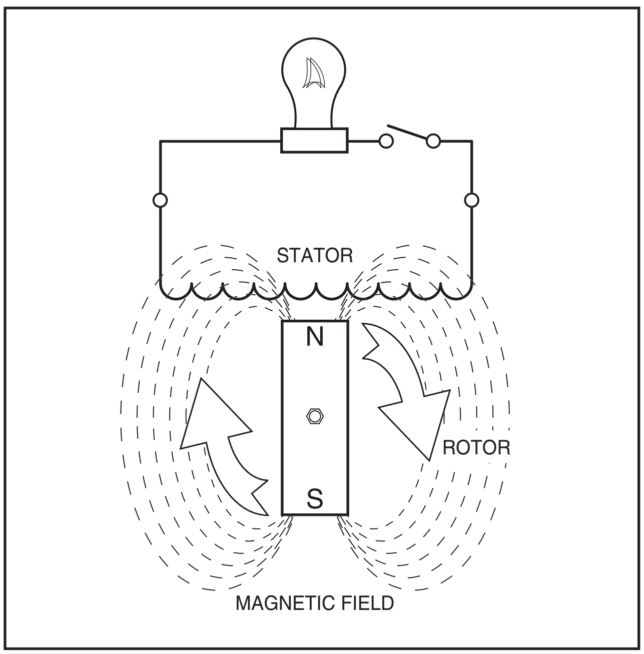


Figure 1-4. – A Simple AC Generator

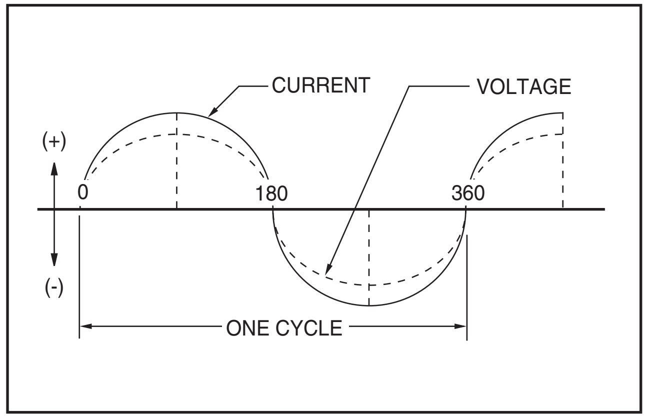


Figure 1-5. – Alternating Current Sine Wave

A MORE SOPHISTICATED AC GENERATOR

Figure 1-6 represents a more sophisticated generator. A regulated direct current is delivered into the ROTOR windings via carbon BRUSHES AND SLIP RINGS. This results in the creation of a regulated magnetic field around the ROTOR. As a result, a regulated voltage is induced into the STATOR. Regulated current delivered to the ROTOR is called "EXCITATION" current.

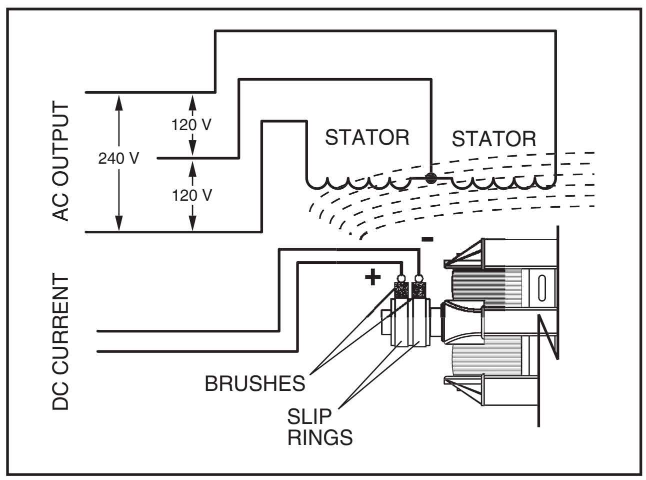


Figure 1-6. – A More Sophisticated Generator

See Figure 1-7 (next page). The revolving magnetic field (ROTOR) is driven by the engine at a constant speed. This constant speed is maintained by a mechanical engine governor. Units with a 2-pole rotor require an operating speed of 3600 rpm to deliver a 60 Hertz AC output. Engine governors are set to maintain approximately 3720 rpm when no electrical loads are connected to the generator.

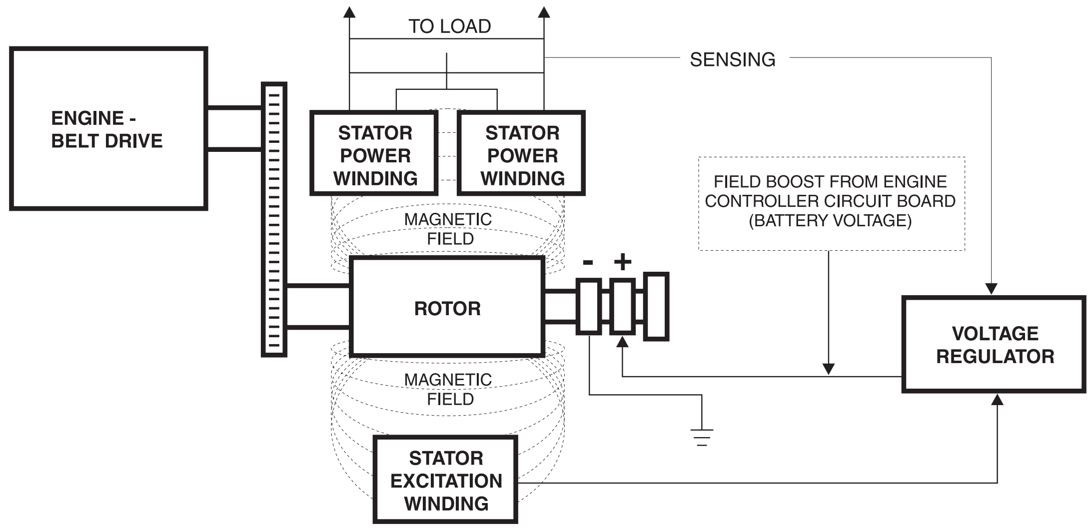


Figure 1-7. – Generator Operating Diagram

NOTE: AC output frequency at 3720 rpm will be about 60 Hertz. The "No-Load" is set slightly high to prevent excessive rpm, frequency and voltage droop under heavy electrical loading.

Generator operation may be described briefly as follows:

1. Some "residual" magnetism is normally present in the Rotor and is sufficient to induce approximately 7 to 12 volts AC Into the STATOR's AC power windings.
2. During startup, a Printed Circuit Board (PCB) delivers battery voltage to the ROTOR, via the brushes and slip rings.
   a. The battery voltage is called "Field Boost".
   b. Flow of direct current through the ROTOR increases the strength of the magnetic field above that of "residual" magnetism alone.
3. "Residual" plus "Field Boost" magnetism induces a voltage into the Stator excitation (DPE) and AC Power windings.
4. Excitation winding unregulated AC output is delivered to an electronic voltage regulator, via an excitation circuit breaker.
   a. A "Reference" voltage has been preset into the Voltage Regulator.
   b. An "Actual" ("sensing") voltage is delivered to the Voltage Regulator via sensing leads from the Stator AC power windings.
   c. The Regulator "compares" the actual (sensing) voltage to its pre-set reference voltage.
      (1) If the actual (sensing) voltage is greater than the pre-set reference voltage, the Regulator will decrease the regulated current flow to the Rotor.
      (2) If the actual (sensing) voltage is less than the pre-set reference voltage, the Regulator will increase the regulated current flow to the Rotor.
      (3) In the manner described, the Regulator maintains an actual (sensing) voltage that is equal to the pre-set reference voltage.

NOTE: The Voltage Regulator also changes the Stator excitation windings alternating current (AC) output to direct current (DC).

5. When an electrical load is connected across the Stator power windings, the circuit is completed and an electrical current will flow.
6. The Rotor's magnetic field also induces a voltage into the Stator battery charge windings.

FIELD BOOST

When the engine is cranked during startup, the starter contactor is energized closed. Battery voltage is then delivered to the starter motor and the engine cranks.

During cranking, battery voltage flows through a resistor and a field boost diode in the Printed Circuit Board, then to the Rotor via brushes and slip rings. This is called "Field Boost" voltage.

Field boost voltage is delivered to the Rotor only while the engine is cranking. The effect is to "flash the field" every time the engine is cranked. Field boost voltage helps ensure that sufficient "pickup" voltage is available on every startup to turn the Voltage Regulator on and build AC output voltage.

NOTE: Loss of the Field Boost function may or may not result in loss of AC power winding output. If Rotor residual magnetism alone is sufficient to turn the Regulator on, loss of Field Boost may go unnoticed. However, if residual magnetism alone is not enough to turn the Regulator on, loss of the Field Boost function will result in loss of AC power winding output to the load. The AC output voltage will then drop to a value commensurate with the Rotor's residual magnetism (about 7-12 VAC).

GENERATOR AC CONNECTION SYSTEM

These air-cooled generator sets are equipped with dual stator AC power windings. These two stator windings supply electrical power to customer electrical loads by means of a dual 2-wire connection system.

Generators may be installed to provide the following outputs:

1. 120 VAC loads only — one load with a maximum total wattage requirement equal to the generator's rated power output (in watts), and 120 VAC across the generator output terminals. Figure 1-8, page 7, shows the generator lead wire connections for 120 VAC ONLY.

2. 120/240 VAC loads — one load with a maximum total wattage requirement equal to the generator's rated power output, and 240 VAC across the generator output terminals; or two separate loads, each with a maximum total wattage requirement equal to half of the generator's rated power output (in watts), and 120 VAC across the generator output terminals. Figure 1-9 on page 7, shows the generator lead wire connections for 120/240 VAC loads.

You can use your generator set to supply electrical power for operating one of the following electrical loads:

- RV 45G & LP: 120 and/or 240 volts, single phase, 60 Hz electrical loads. These loads can require up to 4500 watts (4.5 kW) of total power, but cannot exceed 45.8 AC amperes of current at 120 volts or exceed 22.9 AC amperes at 240 volts.
- RV 55G & LP: 120 and/or 240 volts, single phase, 60 Hz electrical loads. These loads can require up to 5500 watts (5.5 kW) of total power, but cannot exceed 54.1 AC amperes of current at 120 volts or exceed 27 AC amperes at 240 volts.
- RV 65G & LP: 120 and/or 240 volts, single phase, 60 Hz electrical loads. These loads can require up to 6500 watts (6.5 kW) of total power, but cannot exceed 62.5 AC amperes of current at 120 volts or exceed 31.2 AC amperes at 240 volts.

Caution! Do not overload the generator. Some installations may require that electrical loads be alternated to avoid overloading. Applying excessively high electrical loads may damage the generator and may shorten its life. Add up the rated watts of all electrical lighting, appliance, tool and motor loads the generator will power at one time. This total should not be greater than the wattage capacity of the generator. If an electrical device nameplate gives only volts and amps, multiply volts times amps to obtain watts (volts x amps = watts). Some electric motors require more watts of power (or amps of current) for starting than for continuous operation.

<u>LINE BREAKERS (120 VOLTS ONLY):</u>

Protects generator's AC output circuit against overload, i.e., prevents unit from exceeding wattage/amperage capacity. The circuit breaker ratings are as follows:

Model	Cir. Breaker 1	Cir. Breaker 2	240 Volt
RV 45	20A	20A	20A 2P
RV 55	20A	30A	25A 2P
RV 65	30A	30A	30A 2P

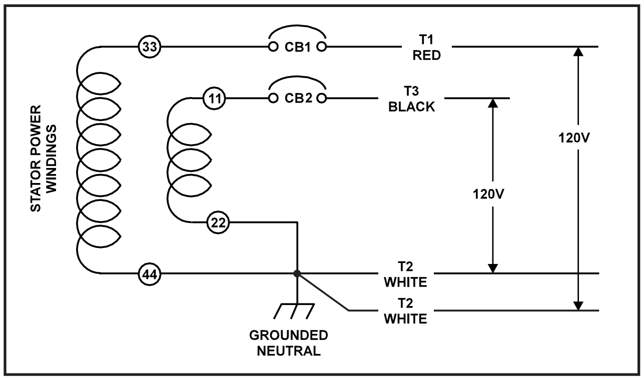


Figure 1-8. – Connection for 120 Volts Only

RECONNECTION FOR DUAL VOLTAGE OUTPUT:

When connected for dual voltage output, Stator output leads 11 and 44 form two "hot" leads (T1 – Red, and T3 – Black). The junction of leads 22 and 33 form the "Neutral" line (T2 – White).

For dual voltage output, the "Neutral" line remains grounded.

NOTE: For units with two 20 amp or two 30 amp main breakers, the existing breakers may be re-used when reconnecting for dual voltage output. However, on units with a 30 amp and a 20 amp main breaker, you may wish to install a 2-pole breaker that is rated closer to the unit's rated capacity (use two 25 amp main breakers).

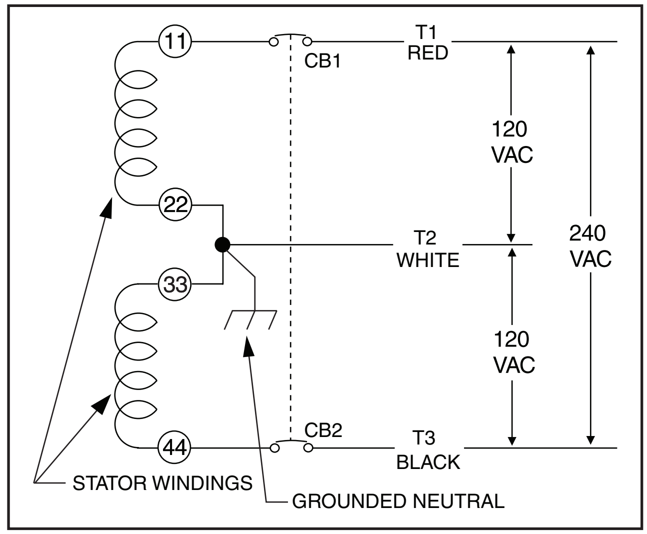


Figure 1-9 - Connection for 120/240 Volts

NOTE: If this generator has been reconnected for dual voltage AC output (120/240 volts), the replacement line breakers should consist of two separate breakers with a connecting piece between the breaker handles (so that both breakers operate at the same time). If the unit is reconnected for dual voltage, it is no longer RVIA listed.

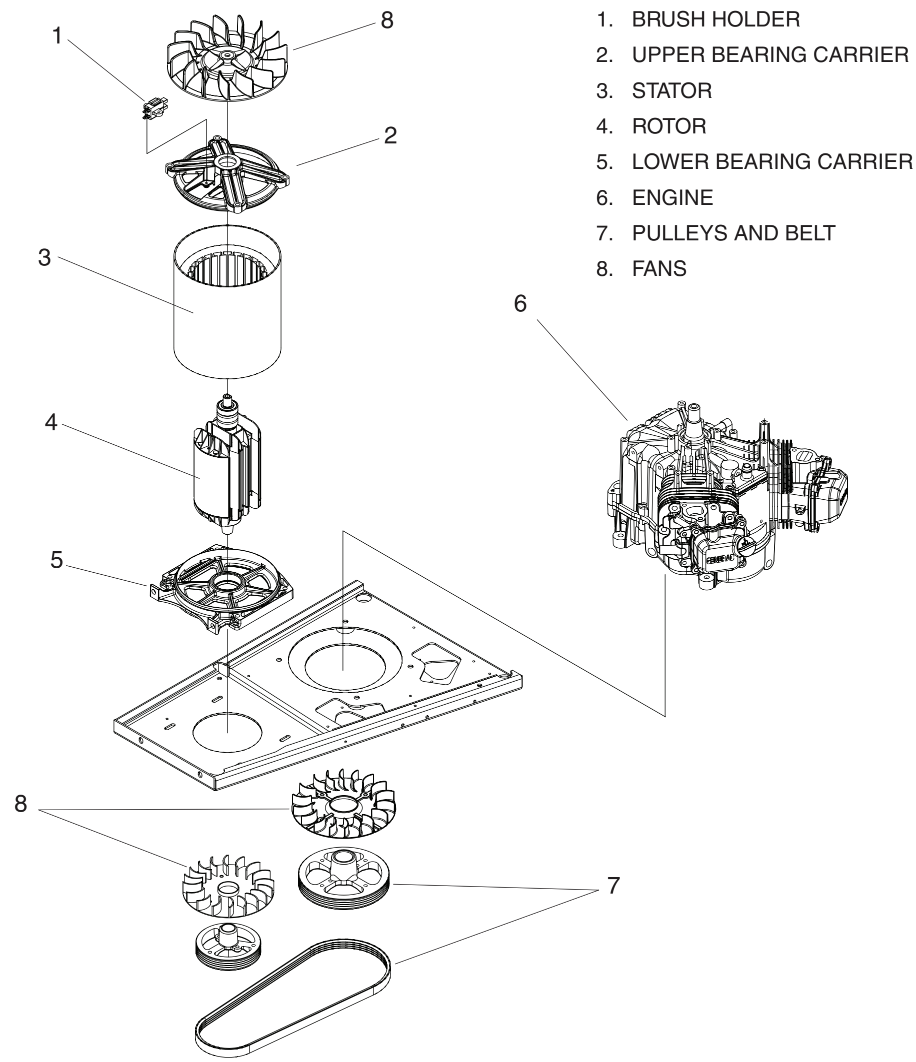


Figure 2-1. Exploded View of Generator

ROTOR ASSEMBLY

The Rotor is sometimes called the “revolving field”, since it provides the magnetic field that induces a voltage into the stationary Stator windings. Slip rings on the Rotor shaft allow excitation current from the voltage regulator to be delivered to the Rotor windings. The Rotor is driven by the engine at a constant speed through a pulley and belt arrangement.

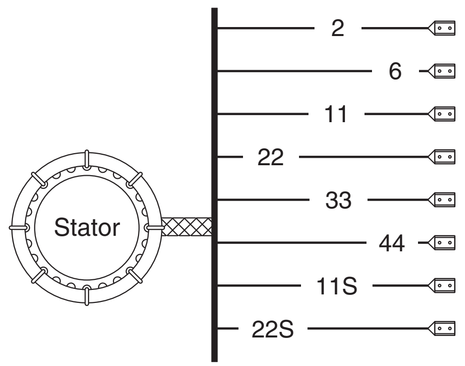
All generator models in this manual utilize a 2-pole Rotor, i.e., one having a single north and a single south pole. This type of Rotor must be driven at 3600 rpm for a 60 Hertz AC output, or at 3000 rpm for a 50 Hertz output.

Slip rings may be cleaned. If dull or tarnished, clean them with fine sandpaper (a 400 grit wet sandpaper is recommended). DO NOT USE ANY MATERIAL CONTAINING METALLIC GRIT TO CLEAN SLIP RINGS.

STATOR ASSEMBLY

The Stator is “sandwiched” between the upper and lower bearing carriers and retained in that position by four Stator studs. A total of eight (8) leads are brought out of the Stator as follows:

1. Four (4) Stator power winding output leads (Wires No. 11, 22, 33 and 44). These leads deliver power to connected electrical loads.
2. Stator power winding “sensing” leads (11S and 22S). These leads deliver an “actual voltage signal to the electronic Voltage Regulator.
3. Two excitation winding output leads (No. 2 and 6). These leads deliver unregulated excitation current to the voltage regulator.



Leads 2 & 6 = Stator Excitation Winding
Leads 11S & 22S = Voltage Sensing Leads
Leads 11 & 22, 33 & 44 = AC Power Windings

Figure 2-2. – Stator Output Leads

BRUSH HOLDER

The brush holder is retained in the rear bearing carrier by two M5 screws. It retains two brushes, which contact the Rotor slip rings and allow current flow from stationary parts to the revolving Rotor. The positive (+) brush is located nearest the Rotor bearing.

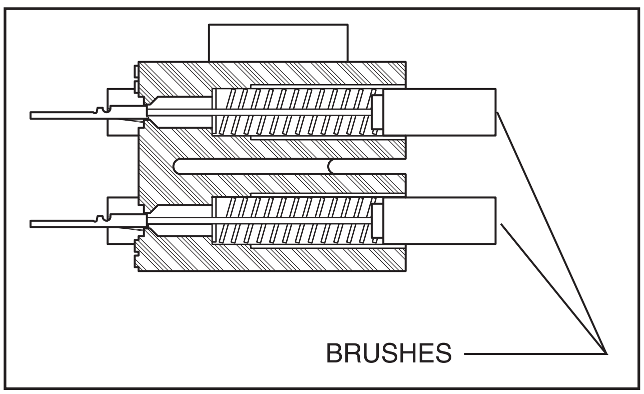


Figure 2-3. – Brush Holder

EXCITATION CIRCUIT COMPONENTS

GENERAL:

During operation, the Rotor's magnetic field induces a voltage and current flow into the Stator excitation winding. This results in AC output delivered to a voltage regulator via Wires 2 and 6.

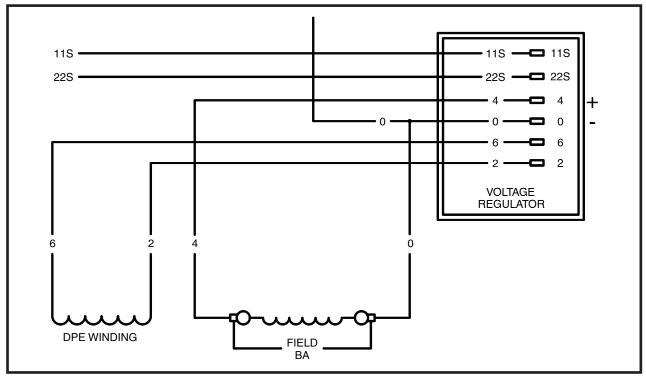


Figure 2-5. – Schematic: Excitation Circuit

VOLTAGE REGULATOR:

Six (6) leads are connected to the voltage regulator as follows:

- Two (2) SENSING leads deliver ACTUAL AC output voltage signals to the regulator. These are Wires 11S and 22S.
- Two (2) leads (Wires 4 and 0) deliver the regulated direct current to the Rotor, via brushes and slip rings.
- Two (2) leads (Wires 6 and 2) deliver Stator excitation winding AC output to the regulator.

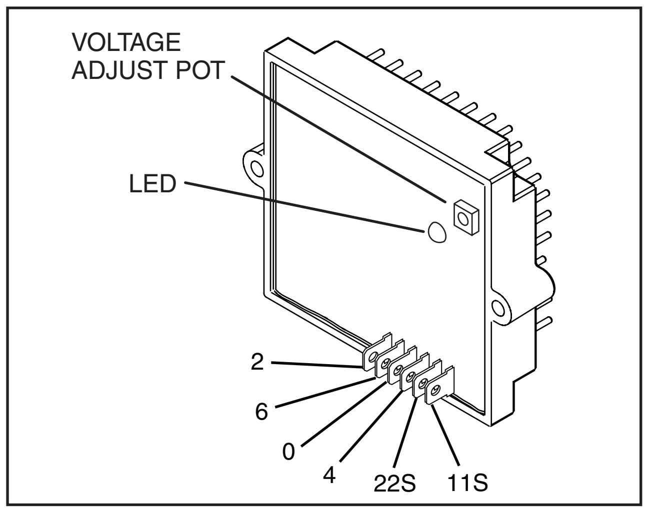


Figure 2-7. – Voltage Regulator

The regulator mounts a "VOLTAGE ADJUST" potentiometer, used for adjustment of the pre-set REFERENCE voltage. A lamp (LED) will turn on to indicate that SENSING voltage is available to the regulator and that the regulator is turned on.

ADJUSTMENT PROCEDURE:

With the frequency set at 60 Hertz and no load on the generator, slowly turn the voltage adjust pot on the voltage regulator until 122-126 VAC is measured. If voltage is not adjustable, proceed to Section 6 – Troubleshooting.

NOTE: If, for any reason, sensing voltage to the regulator is lost, the regulator will shut down and excitation output to the Rotor will be lost. The AC output voltage will then drop to a value that is commensurate with Rotor residual magnetism (about 7-12 VAC). Without this automatic shut-down feature, loss of sensing (actual) voltage to the regulator would result in a "full field" or "full excitation" condition and an extremely high AC output voltage.

NOTE: Adjustment of the regulator's "VOLTAGE ADJUST" potentiometer must be done only when the unit is running at its correct governed no-load speed. Speed is correct when the unit's no-load AC output frequency is about 60.0-60.5 Hertz. At the stated frequency, AC output voltage should be about 124 volts.

CRANKCASE BREATHER

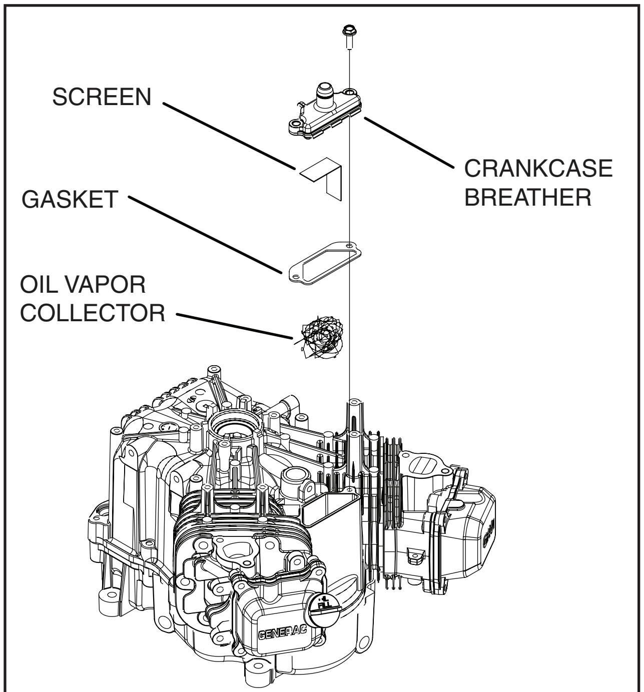


Figure 2-8. – Crankcase Breather

DESCRIPTION:

The crankcase breather is equipped with a reed valve to control and maintain a partial vacuum in the crankcase. The breather is vented to the airbox. The breather chamber contains a removable oil vapor collector. Oil vapor is condensed on the collector material and drains back into the crankcase, which minimizes the amount of oil vapor entering the breather.

CHECK BREATHER:

1. Disconnect breather tube and remove two screws and breather. Discard gasket.
2. Remove oil vapor collector and retainer.
3. Check collector for deterioration and replace if necessary.

INSTALL BREATHER:

1. Install oil vapor collector and retainer.

Note: Push oil vapor collector and retainer in until it bottoms.

2. Install breather with new gasket (Figure 2-8).
   a. Torque screws to 5-8 ft-lbs.
3. Assemble breather tube to intake elbow.

CONTROL PANEL COMPONENT IDENTIFICATION

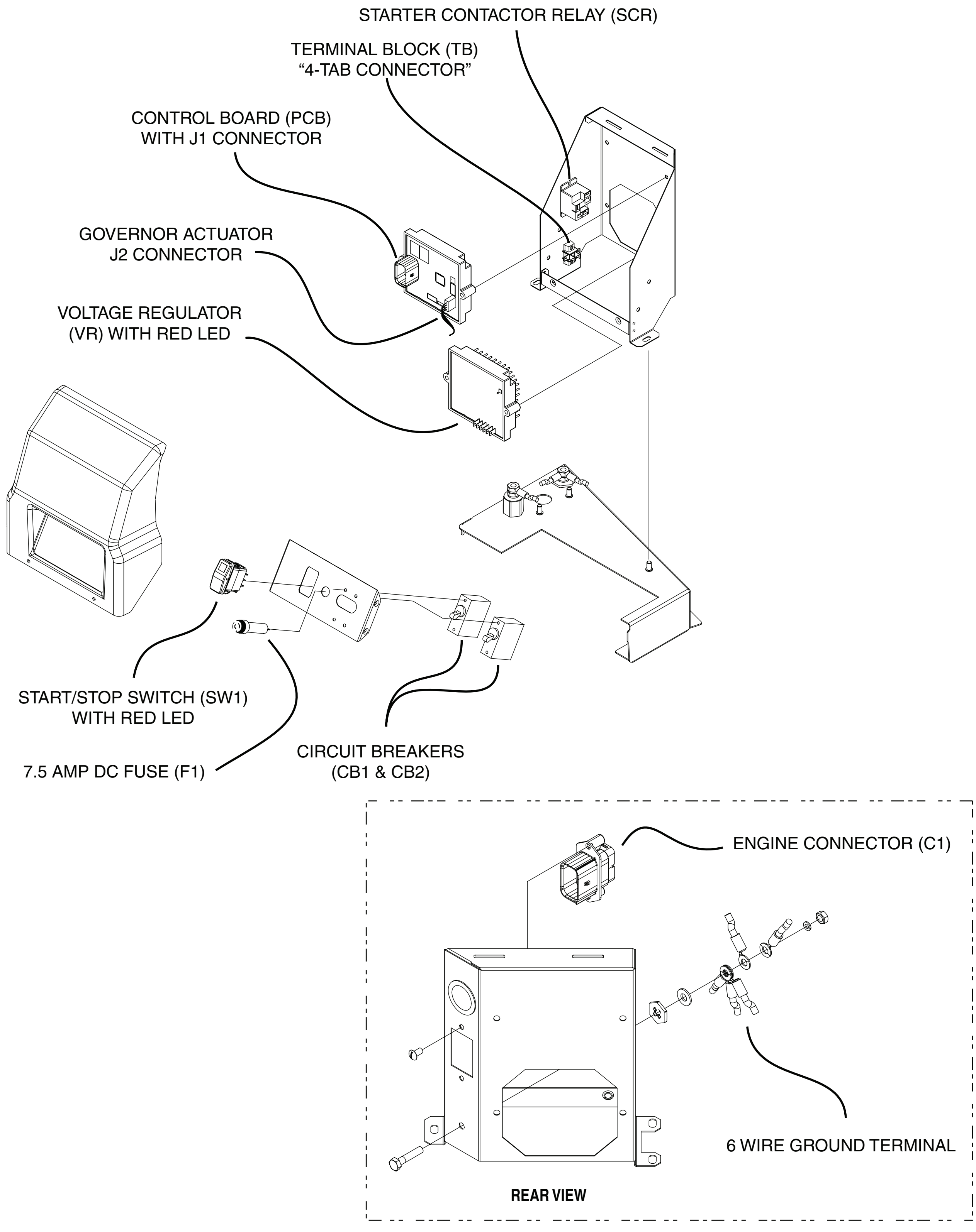


Figure 2-9. – Control Panel Components

EFFECTS OF DIRT AND MOISTURE

Moisture and dirt are detrimental to the continued good operation of any generator set.

If moisture is allowed to remain in contact with the Stator and Rotor windings, some of the moisture will be retained in voids and cracks of the winding insulation. This will result in a reduced Insulation resistance and, eventually, the unit's AC output will be affected.

Insulation used in the generator is moisture resistant. However, prolonged exposure to moisture will gradually reduce the resistance of the winding insulation.

Dirt can make the problem worse, since it tends to hold moisture Into contact with the windings. Salt, as from sea air, contributes to the problem since salt can absorb moisture from the air. When salt and moisture combine, they make a good electrical conductor.

Because of the detrimental affects of dirt and moisture, the generator should be kept as clean and as dry as possible. Rotor and Stator windings should be tested periodically with an insulation resistance tester (such as a megohmmeter or hi-pot tester).

If the Insulation resistance is excessively low, drying may be required to remove accumulated moisture. After drying, perform a second insulation resistance test. If resistance is still low after drying, replacement of the defective Rotor or Stator may be required.

INSULATION RESISTANCE TESTERS

Figure 3-1 shows one kind of hi-pot tester. The tester shown has a "Breakdown" lamp that will glow during the test procedure to indicate an insulation breakdown in the winding being tested.

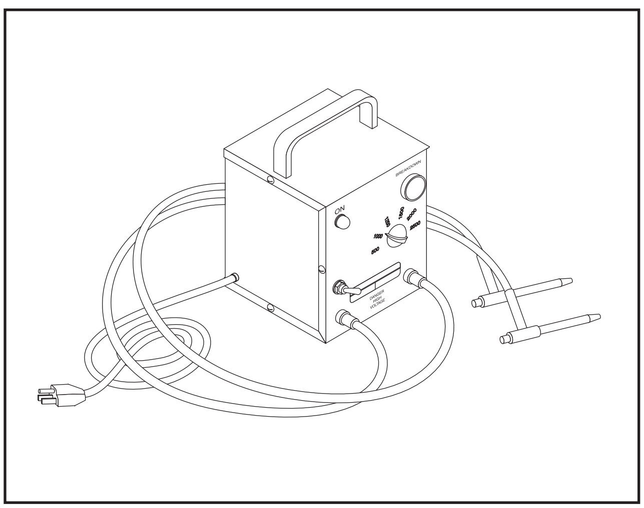


Figure 3-1. – One Type of Hi-Pot Tester

DANGER! INSULATION RESISTANCE TESTERS SUCH AS HI-POT TESTERS AND MEGOHMMETERS ARE A SOURCE OF HIGH AND DANGEROUS ELECTRICAL VOLTAGE. FOLLOW THE TESTER MANUFACTURER'S INSTRUCTIONS CAREFULLY. USE COMMON SENSE TO AVOID DANGEROUS ELECTRICAL SHOCK

DRYING THE GENERATOR

GENERAL:

If tests indicate the insulation resistance of a winding is below a safe value, the winding should be dried before operating the generator. Some recommended drying procedures include (a) heating units and (b) forced air.

HEATING UNITS:

If drying is needed, the generator can be enclosed in a covering. Heating units can then be installed to raise the temperature about 15°-18° F (8°-10° C) above ambient temperature.

FORCED AIR:

Portable forced air heaters can be used to dry the generator. Direct the heated air into the generator's air intake openings. Remove the voltage regulator and run the unit at no-load. Air temperature at the point of entry into the generator should not exceed 150° F. (66° C.).

CLEANING THE GENERATOR

GENERAL:

The generator can be cleaned properly only while it is disassembled. The cleaning method used should be determined by the type of dirt to be removed. Be sure to dry the unit after it has been cleaned.

NOTE: A shop that repairs electric motors may be able to assist you with the proper cleaning of generator windings. Such shops are often experienced in special problems such as a sea coast environment, marine or wetland applications, mining, etc.

USING SOLVENTS FOR CLEANING:

If dirt contains oil or grease a solvent is generally required. Only petroleum distillates should be used to clean electrical components. Recommended are safety type petroleum solvents having a flash point greater than 100° F. (38° C.).

CAUTION!: Some generators may use epoxy or polyester base winding varnishes. Use sol-

vents that will not attack such materials.

Use a soft brush or cloth to apply the solvent. Be careful to avoid damage to wire or winding insulation. After cleaning, dry all components thoroughly using moisture-free, low-pressure compressed air.

DANGER!: DO NOT ATTEMPT TO WORK WITH SOLVENTS IN ANY ENCLOSED AREA. PROVIDE ADEQUATE VENTILATION WHEN WORKING WITH SOLVENTS. WITHOUT ADEQUATE VENTILATION, FIRE, EXPLOSION OR HEALTH HAZARDS MAY EXIST . WEAR EYE PROTECTION. WEAR RUBBER GLOVES TO PROTECT THE HANDS.

CLOTH OR COMPRESSED AIR:

For small parts or when dry dirt is to be removed, a dry cloth may be sufficient. Wipe the parts clean, then use low pressure air at 30 psi (206 Kpa) to blow dust away.

BRUSHING AND VACUUM CLEANING:

Brushing with a soft bristle brush followed by vacuum cleaning is a good method of removing dust and dirt. Use the soft brush to loosen the dirt, then remove it with the vacuum.

STATOR INSULATION RESISTANCE

GENERAL:

Insulation resistance is a measure of the integrity of the insulating materials that separate electrical windings from the generator's steel core. This resistance can degrade over time due to the presence of contaminants, dust, dirt, grease and especially moisture.

The normal insulation resistance for generator windings is on the order of "millions of ohms" or "megohms".

When checking the insulation resistance, follow the tester manufacturer's Instructions carefully. Do NOT exceed the applied voltages recommended in this manual. Do NOT apply the voltage longer than one (1) second.

CAUTION!: DO NOT connect the Hi-Pot Tester or Megohmmeter test leads to any leads that are routed into the generator control panel. Connect the tester leads to the Stator or Rotor leads only.

STATOR SHORT-TO-GROUND TESTS:

See Figure 3-2. To test the Stator for a short-to-ground condition, proceed as follows:

1. Disconnect and Isolate all Stator leads as follows:
   a. Disconnect sensing leads 11S and 22S from the voltage regulator.
   b. Disconnect excitation winding lead No. 6 from the voltage regulator.
   c. Disconnect excitation lead No. 2 from the voltage regulator (VR).
   e. At the main circuit breakers, disconnect AC power leads No. 11 and 33.
   f. At the 4-tab ground terminal (GRD2), disconnect Stator power leads No. 22 and 44.
2. When all leads have been disconnected as outlined in Step 1 above, test for a short-to-ground condition as follows:
   a. Connect the terminal ends of all Stator leads together (11S, 22S, 11, 22, 33, 44, 2, & 6).
   b. Follow the tester manufacturer's instructions carefully. Connect the tester leads across all Stator leads and to frame ground on the Stator can. Apply a voltage of 1500 volts. Do NOT apply voltage longer than one (1) second.

If the test indicates a breakdown in insulation, the Stator should be cleaned, dried and re-tested. If the winding fails the second test (after cleaning and drying), replace the Stator assembly.

TEST BETWEEN ISOLATED WINDINGS:

1. Follow the tester manufacturer's instructions carefully. Connect the tester test leads across Stator leads No. 11 and 2. Apply a voltage of 1500 volts- DO NOT EXCEED 1 SECOND.
2. Repeat Step 1 with the tester leads connected across the following Stator leads:
   a. Across Wires No. 33 and 2.
   b. Across Wires No. 11 and 33.
   c. Across Wires No. 11 and 2.

If a breakdown in the insulation between isolated windings is indicated, clean and dry the Stator. Then, repeat the test. If the Stator fails the second test, replace the Stator assembly.

TEST BETWEEN PARALLEL WINDINGS:

Connect the tester leads across Stator leads No. 11 and 33. Apply a voltage of 1500 volts. If an insulation breakdown is indicated, clean and dry the Stator. Then, repeat the test between parallel windings. If the Stator fails the second test, replace it.

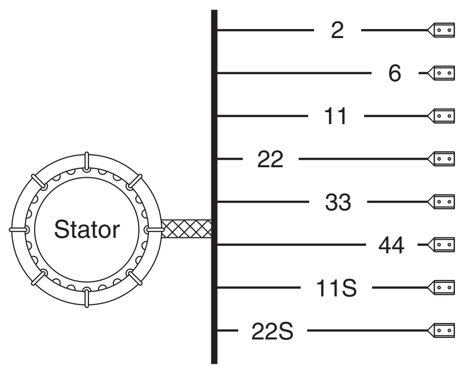


Figure 3-2. – Stator Leads

TESTING ROTOR INSULATION

To test the Rotor for insulation breakdown, proceed as follows:

1. Disconnect wires from the Rotor brushes or remove the brush holders with brushes.
2. Connect the tester positive (+) test lead to the positive (+) slip ring (nearest the Rotor bearing). Connect the tester negative (-) test lead to a clean frame ground (like the Rotor shaft).

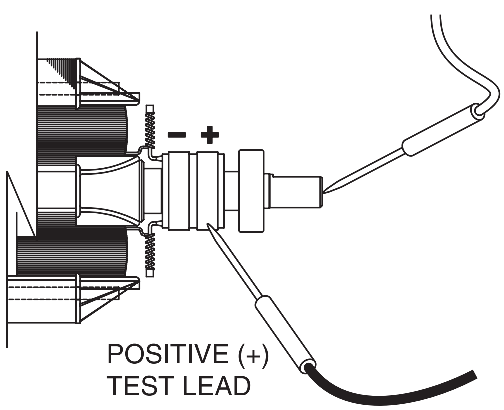


Figure 3-3. – Rotor Test Points

3. Apply 1000 volts. DO NOT APPLY VOLTAGE LONGER THAN 1 SECOND.

If an insulation breakdown is indicated, clean and dry the Rotor then repeat the test. Replace the Rotor if it fails the second test (after cleaning and drying).

THE MEGOHMMETER

GENERAL:

A megohmmeter, often called a “megger”, consists of a meter calibrated in megohms and a power supply. Use a power supply of 1500 volts when testing Stators; or 1000 volts when testing the Rotor. DO NOT APPLY VOLTAGE LONGER THAN ONE (1) SECOND.

TESTING STATOR INSULATION:

All parts that might be damaged by the high megger voltages must be disconnected before testing. Isolate all Stator leads (Figure 3-2) and connect all of the Stator leads together. FOLLOW THE MEGGER MANUFACTURER’S INSTRUCTIONS CAREFULLY.

Use a megger power setting of 1500 volts. Connect one megger test lead to the junction of all Stator leads, the other test lead to frame ground on the Stator can. Read the number of megohms on the meter.

$$\text{MINIMUM INSULATION RESISTANCE (in “Megohms”)} = \frac{\text{GENERATOR RATED VOLTS}}{1000} + 1$$

The MINIMUM acceptable megger reading for Stators may be calculated using the following formula:

EXAMPLE: Generator is rated at 120 volts AC. Divide “120” by “1000” to obtain “0.12”. Then add “1” to obtain “1.12” megohms. Minimum Insulation resistance for a 120 VAC Stator Is 1.12 megohms.

If the Stator insulation resistance is less than the calculated minimum resistance, clean and dry the Stator. Then, repeat the test. If resistance is still low, replace the Stator.

Use the Megger to test for shorts between isolated windings as outlined “Stator Insulation Resistance”.

Also test between parallel windings. See “Test Between Parallel Windings” on this page.

TESTING ROTOR INSULATION:

Apply a voltage of 1000 volts across the Rotor positive (+) slip ring (nearest the rotor bearing), and a clean frame ground (i.e. the Rotor Shaft). DO NOT EXCEED 1000 VOLTS AND DO NOT APPLY VOLTAGE LONGER THAN 1 SECOND. FOLLOW THE MEGGER MANUFACTURER’S INSTRUCTIONS CAREFULLY.

ROTOR MINIMUM INSULATION RESISTANCE:

1.5 megohms

METERS

Devices used to measure electrical properties are called meters. Meters are available that allow one to measure (a) AC voltage, (b) DC voltage, (c) AC frequency, and (d) resistance in ohms. The following apply:

- ❏ To measure AC voltage, use an AC voltmeter.
- ❏ To measure DC voltage, use a DC voltmeter.
- ❏ Use a frequency meter to measure AC frequency In "Hertz" or "cycles per second"..
- ❏ Use an ohmmeter to read circuit resistance, in "ohms".

THE VOM

A meter that will permit both voltage and resistance to be read is the "volt-ohm-milliammeter" or "VOM".

Some VOM's are of the "analog" type (not shown). These meters display the value being measured by physically deflecting a needle across a graduated scale. The scale used must be interpreted by the user.

"Digital" VOM's (Figure 4-1) are also available and are generally very accurate. Digital meters display the measured values directly by converting the values to numbers.

NOTE: Standard AC voltmeters react to the AVERAGE value of alternating current. When working with AC, the effective value is used. For that reason a different scale is used on an AC voltmeter. The scale is marked with the effective or "rms" value even though the meter actually reacts to the average value. That is why the AC voltmeter will give an incorrect reading if used to measure direct current (DC).

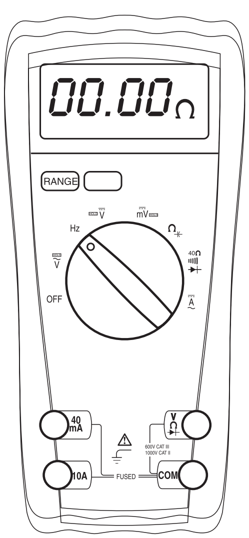


Figure 4-1. – Digital VOM

MEASURING AC VOLTAGE

An accurate AC voltmeter or a VOM may be used to read the generator's AC output voltage. The following apply:

1. Always read the generator's AC output voltage only at the unit's rated operating speed and AC frequency.
2. The generator's voltage regulator can be adjusted for correct output voltage only while the unit is operating at its correct rated speed and frequency.
3. Only an AC voltmeter may be used to measure AC voltage. DO NOT USE A DC VOLTMETER FOR THIS PURPOSE.

⚠ **DANGER!: RV GENERATORS PRODUCE HIGH AND DANGEROUS VOLTAGES. CONTACT WITH HIGH VOLTAGE TERMINALS WILL RESULT IN DANGEROUS AND POSSIBLY LETHAL ELECTRICAL SHOCK.**

MEASURING DC VOLTAGE

A DC voltmeter or a VOM may be used to measure DC voltages. Always observe the following rules:

1. Always observe correct DC polarity.
   a. Some VOM's may be equipped with a polarity switch.
   b. On meters that do not have a polarity switch, DC polarity must be reversed by reversing the test leads.
2. Before reading a DC voltage, always set the meter to a higher voltage scale than the anticipated reading. If in doubt, start at the highest scale and adjust the scale downward until correct readings are obtained.
3. The design of some meters is based on the "current flow" theory while others are based on the "electron flow" theory.
   a. The "current flow" theory assumes that direct current flows from the positive (+) to the negative (-).
   b. The "electron flow" theory assumes that current flows from negative (-) to positive (+).

NOTE: When testing generators, the "current flow" theory is applied. That is, current is assumed to flow from positive (+) to negative (-).

MEASURING AC FREQUENCY

The generator's AC output frequency is proportional to Rotor speed. Generators equipped with a 2-pole Rotor must operate at 3600 rpm to supply a frequency of 60 Hertz. Units with 4-pole Rotor must run at 1800 rpm to deliver 60 Hertz.

Correct engine and Rotor speed is maintained by a stepper motor governor. For models rated 60 Hertz, the governor is generally set to maintain a no-load frequency of about 60 Hertz with a corresponding output voltage of about 124 volts AC line-to-neutral.

MEASURING CURRENT

To read the current flow, in AMPERES, a clamp-on ammeter may be used. This type of meter indicates current flow through a conductor by measuring the strength of the magnetic field around that conductor. The meter consists essentially of a current transformer with a split core and a rectifier type instrument connected to the secondary. The primary of the current transformer is the conductor through which the current to be measured flows. The split core allows the Instrument to be clamped around the conductor without disconnecting it.

Current flowing through a conductor may be measured safely and easily. A line-splitter can be used to measure current in a cord without separating the conductors.

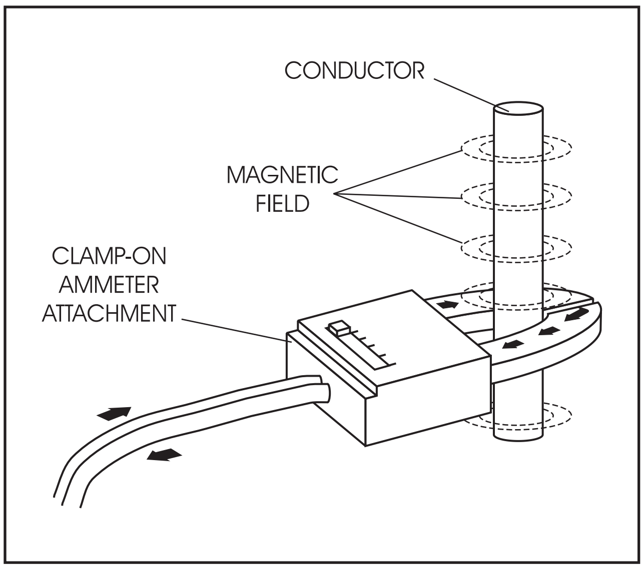


Figure 4-2. – Clamp-On Ammeter

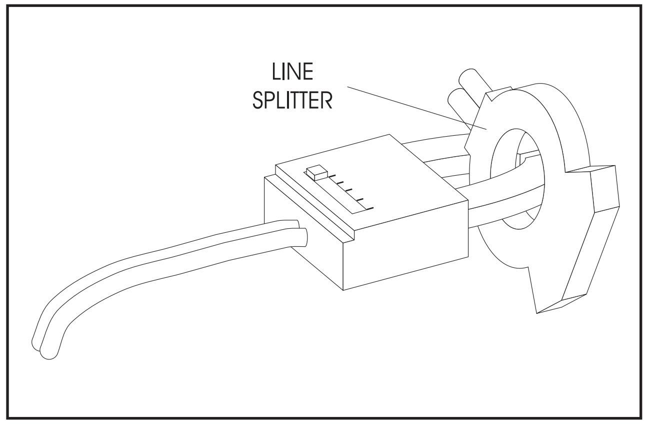


Figure 4-3. – A Line-Splitter

NOTE: If the physical size of the conductor or ammeter capacity does not permit all lines to be measured simultaneously, measure current flow in each individual line. Then, add the Individual readings.

MEASURING RESISTANCE

The volt-ohm-milliammeter may be used to measure the resistance in a circuit. Resistance values can be very valuable when testing coils or windings, such as the Stator and Rotor windings.

When testing Stator windings, keep in mind that the resistance of these windings is very low. Some meters are not capable of reading such a low resistance and will simply read “continuity”.

If proper procedures are used, the following conditions can be detected using a VOM:

❏ A “short-to-ground” condition in any Stator or Rotor winding.
❏ Shorting together of any two parallel Stator windings.
❏ Shorting together of any two isolated Stator windings.
❏ An open condition in any Stator or Rotor winding.

Component testing may require a specific resistance value or a test for “infinity” or “continuity.” Infinity is an OPEN condition between two electrical points, which would read as no resistance on a VOM. Continuity is a closed condition between two electrical points, which would be indicated as very low resistance or “ZERO” on a VOM.

ELECTRICAL UNITS

AMPERE:

The rate of electron flow in a circuit is represented by the AMPERE. The ampere is the number of electrons flowing past a given point at a given time. One AMPERE is equal to just slightly more than six thousand million billion electrons per second.

With alternating current (AC), the electrons flow first in one direction, then reverse and move in the opposite direction. They will repeat this cycle at regular intervals. A wave diagram, called a “sine wave” shows that current goes from zero to maximum positive value, then reverses and goes from zero to maximum negative value. Two reversals of current flow is called a cycle. The number of cycles per second is called frequency and is usually stated in “Hertz”.

VOLT:

The VOLT is the unit used to measure electrical PRESSURE, or the difference in electrical potential that causes electrons to flow. Very few electrons will flow when voltage is weak. More electrons will flow as voltage becomes stronger. VOLTAGE may be considered to be a state of unbalance and current flow as an attempt to regain balance. One volt is the amount of EMF that will cause a current of 1 ampere to flow through 1 ohm of resistance.

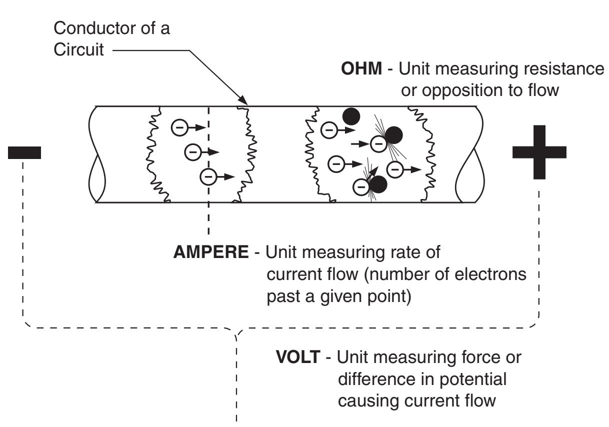


Figure 4-4. – Electrical Units

OHM:

The OHM is the unit of RESISTANCE. In every circuit there is a natural resistance or opposition to the flow of electrons. When an EMF is applied to a complete circuit, the electrons are forced to flow in a single direction rather than their free or orbiting pattern. The resistance of a conductor depends on (a) its physical makeup, (b) its cross-sectional area, (c) its length, and (d) its temperature. As the conductor’s temperature increases, its resistance increases in direct proportion. One (1) ohm of resistance will permit one (1) ampere of current to flow when one (1) volt of electromotive force (EMF) is applied.

OHM’S LAW

A definite and exact relationship exists between VOLTS, OHMS and AMPERES. The value of one can be calculated when the value of the other two are known. Ohm’s Law states that in any circuit the current will increase when voltage increases but resistance remains the same, and current will decrease when resistance Increases and voltage remains the same.

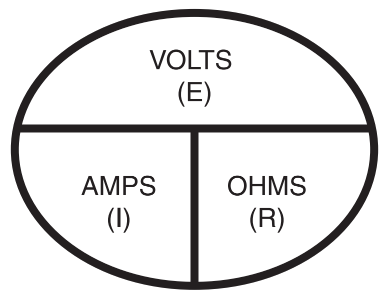


Figure 4-5.

If AMPERES is unknown while VOLTS and OHMS are known, use the following formula:

$$\textit{AMPERES} = \frac{\textit{VOLTS}}{\textit{OHMS}}$$

If VOLTS is unknown while AMPERES and OHMS are known, use the following formula:

VOLTS = AMPERES x OHMS

If OHMS is unknown but VOLTS and AMPERES are known, use the following:

$$\textit{OHMS} = \frac{\textit{VOLTS}}{\textit{AMPERES}}$$

INTRODUCTION

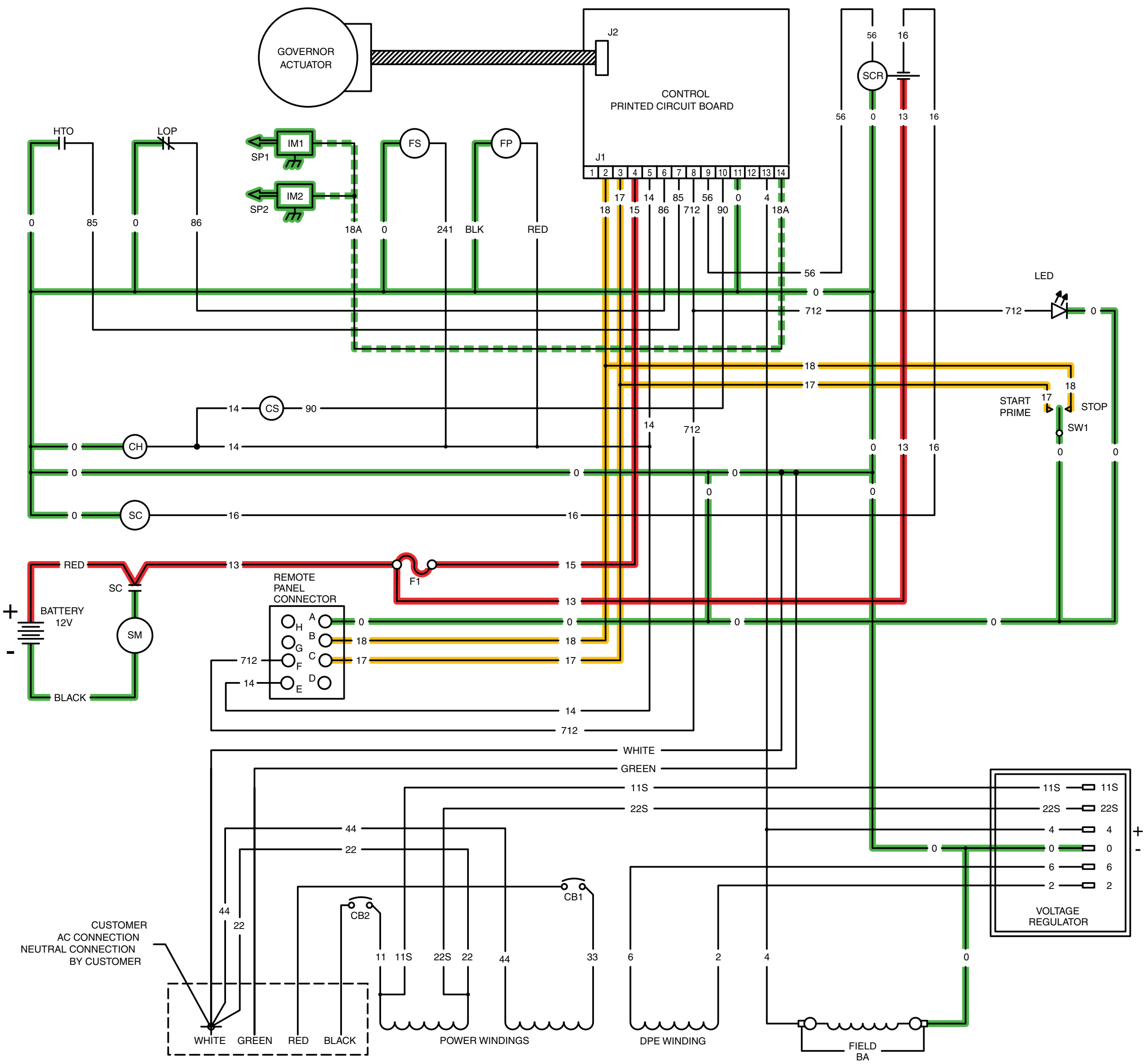
The engine DC control system includes all components necessary for the operation of the engine. Operation includes rest, priming, cranking, starting, running and shutdown. The system is shown schematically.

OPERATIONAL ANALYSIS

CIRCUIT CONDITION – REST:

Battery voltage is available to the Printed Circuit Board (PCB) from the vehicle BATTERY via the positive (RED) battery cable to the isolated positive (RED) terminal stud, located in the control panel. The power is supplied to Wire 13, a 7.5 amp FUSE (F1), the STARTER CONTACTOR RELAY (SCR) and Wire 15/Pin 4 on the PCB. However, PCB action is holding the circuits open, and no action can occur.

Printed Circuit Board action (only) allows voltage to be supplied to Wires 17 and 18 for start and stop actions on the START-STOP SWITCH (SW1) and remote panel connector.



LEGEND

BA - BRUSH ASSEMBLY
CB 1 / CB 2 - SEE CHART
CH - CHOKE HEATER
CS - CHOKE SOLENOID
F1 - FUSE, 7.5A
FP - FUEL PUMP
FS - FUEL SOLENOID
GRD1 - CONTROL PANEL GROUND
GRD2 - UNIT GROUND STUD
HTO - HIGH OIL TEMPERATURE SWITCH
IM1 - IGNITION MODULE, CYL. 1
IM2 - IGNITION MODULE, CYL. 2
IMS - IGNITION MODULE STUD
LED - ALARM INDICATOR
LOP - LOW OIL PRESSURE SWITCH
SC - STARTER CONTACTOR
SCR - STARTER CONTACTOR RELAY
SM - STARTER MOTOR
SP1 - SPARK PLUG, CYL. 1
SP2 - SPARK PLUG, CYL. 2
SW1 - PRIME/START-RUN-OFF SWITCH
TB - TERMINAL BLOCK, 4 TAB

= 12 VOLTS DC
= ALARM CONTROL (PCB)
= DC CONTROL VOLTAGE (PCB)
= SHUTDOWN CONTROL (PCB)
= AC VOLTAGE
= GROUND
= GROUND CONTROL (PCB)
= FIELD BOOST
= VOLTAGE REGULATOR DC OUTPUT

CIRCUIT CONDITION – CRANKING:

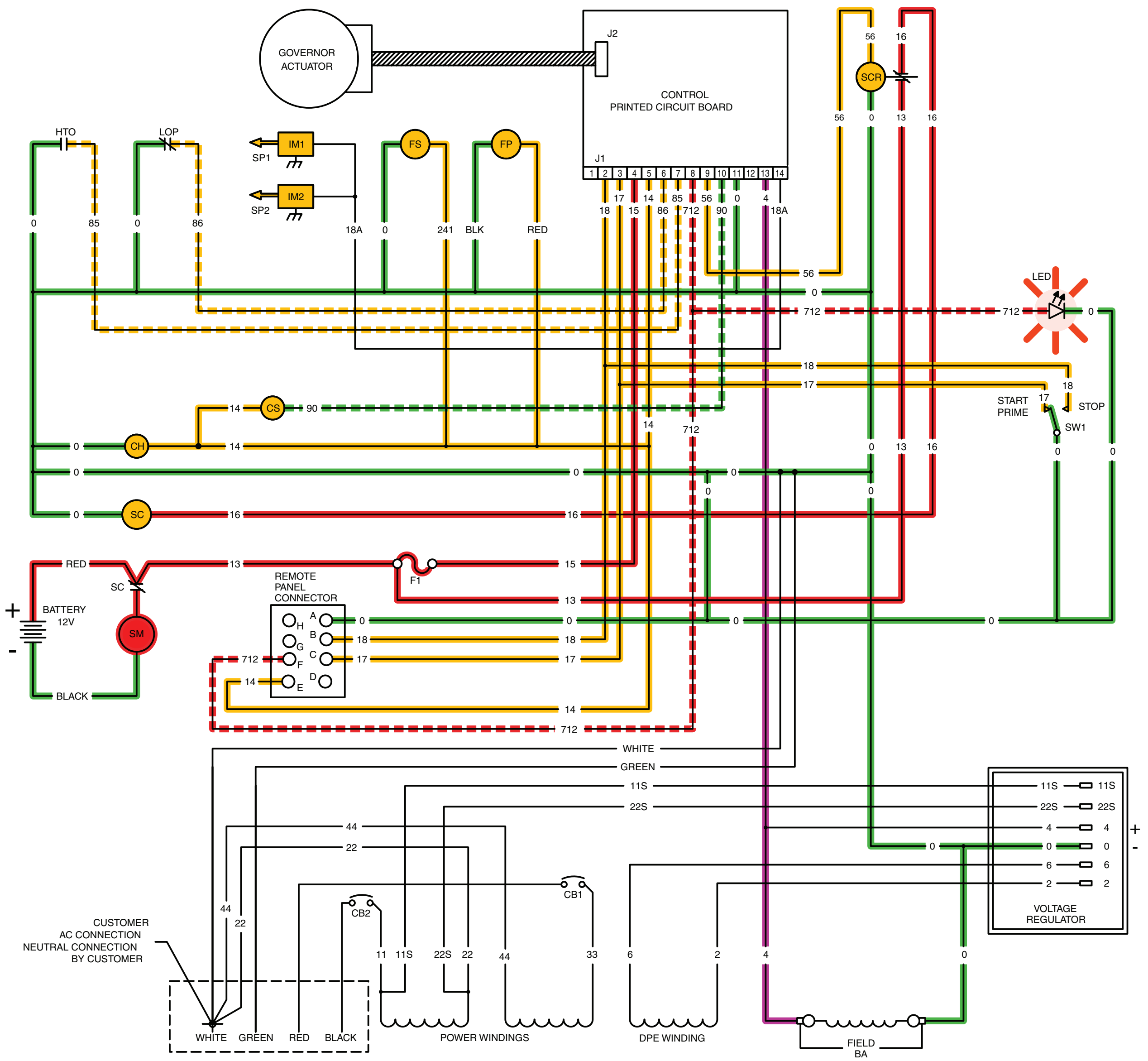
When the START-STOP SWITCH (SW1) or REMOTE PANEL START SWITCH is momentarily held in the “START” position and then released, Wire 17 from the Printed Circuit Board (PCB) is connected to frame Ground. PCB action will then deliver battery voltage to a STARTER CONTACTOR RELAY (SCR) via Wire 56, and to an automatic CHOKE SOLENOID (CS) via Wire 14.

When battery voltage energizes the STARTER CONTACTOR RELAY (SCR), it’s contacts close and battery output is delivered to the STARTER CONTACTOR (SC) via Wire 16. When the STARTER CONTACTOR (SC) energizes, it’s contacts close, and battery output is delivered to the STARTER MOTOR (SM) via Wire 16. The STARTER MOTOR energizes and the engine cranks.

When the STARTER CONTACTOR RELAY (SCR) closes, battery voltage is also delivered to PCB Pin 13 . This voltage is reduced for use as field boost and is output from PCB Pin 13 to the rotor. While cranking, the CHOKE SOLENOID (CS) is energized by grounding Wire 90 cyclically by PCB action (two seconds on, two seconds off).

Also while cranking, PCB action energizes Pin 5, and delivers battery voltage to the Wire 14 circuit. This energizes the FUEL PUMP (FP) via a Red wire, FUEL SOLENOID (FS) via Wire 241 and CHOKE HEATER (CH) via Wire 14. Battery voltage is also delivered to an optional light or hour meter in the Remote Panel, if equipped.

PCB action now holds open Wire 18A to common ground, and the Magneto will induce a spark during cranking.



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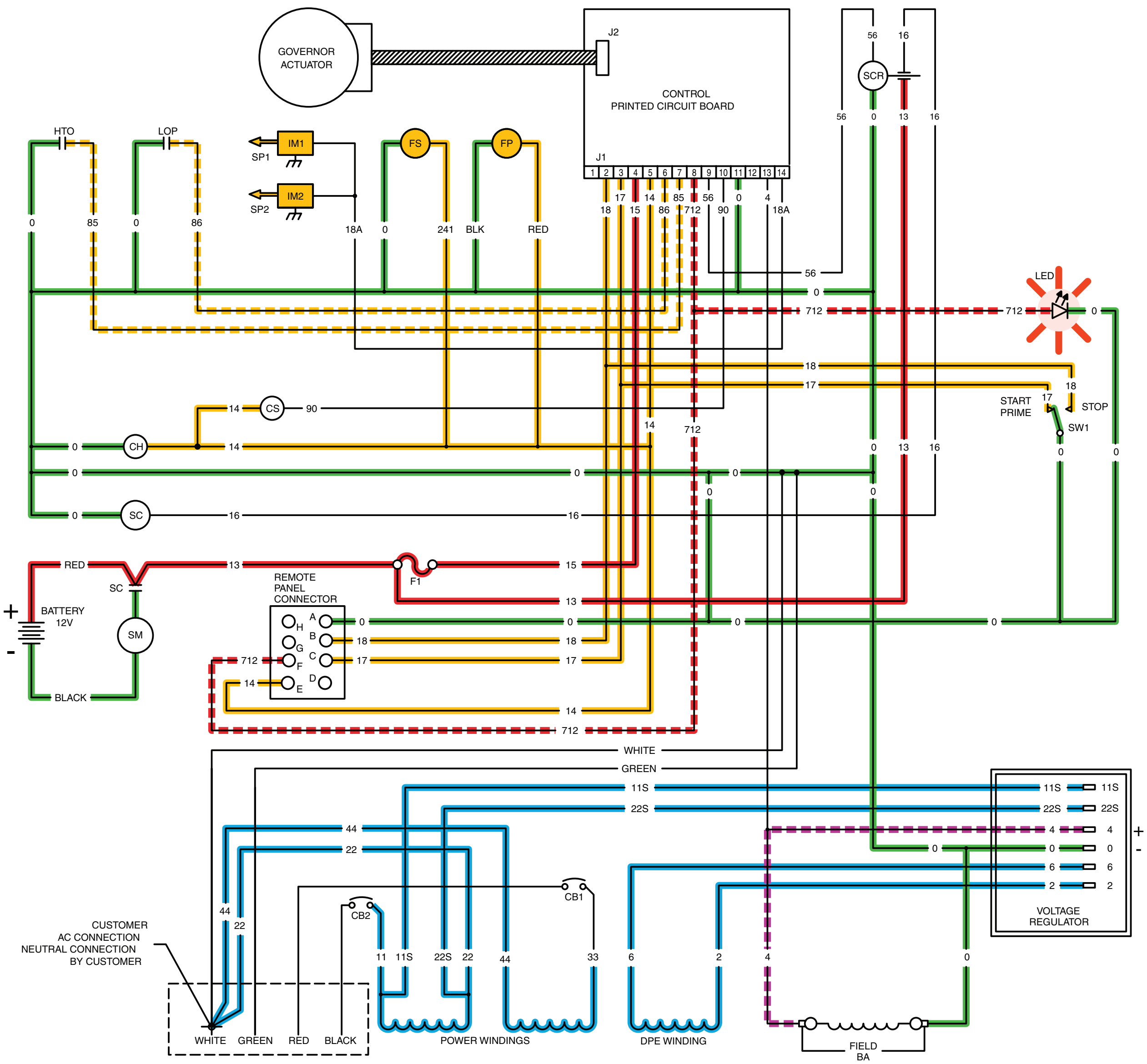
CIRCUIT CONDITION – RUNNING:

With the FUEL PUMP (FP) and FUEL SOLENOID (FS) operating and ignition occurring, the engine should start, and the START-STOP SWITCH (SW1) is released. This voltage is delivered to the PCB via Wire 18A to prevent STARTER MOTOR engagement above a certain rpm.

Printed Circuit Board action terminates DC output to the STARTER CONTACTOR RELAY (SCR), which then de-energizes to end cranking. PCB action terminates DC output to the CHOKE SOLENOID (CS).

The choke will go to a position determined by the CHOKE HEATER (CH).

The LOW OIL PRESSURE SWITCH (LOP) is normally closed. After startup, engine oil pressure will open the LOP.



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CIRCUIT CONDITION – SHUTDOWN:

Setting the START-STOP SWITCH (SW1) or the REMOTE PANEL START-STOP SWITCH to its “STOP” position connects the Wire 18 circuit to frame ground. Printed Circuit Board action then closes the circuit to Wire 18A, grounding the ignition magneto. PCB action de-energizes DC output to J1 plug to the FUEL PUMP (FP), FUEL SOLENOID (FS) and CHOKE HEATER (CH) are de-energized by the loss of DC to Wire 14. Ignition and fuel flow are terminated, and the engine shuts down.

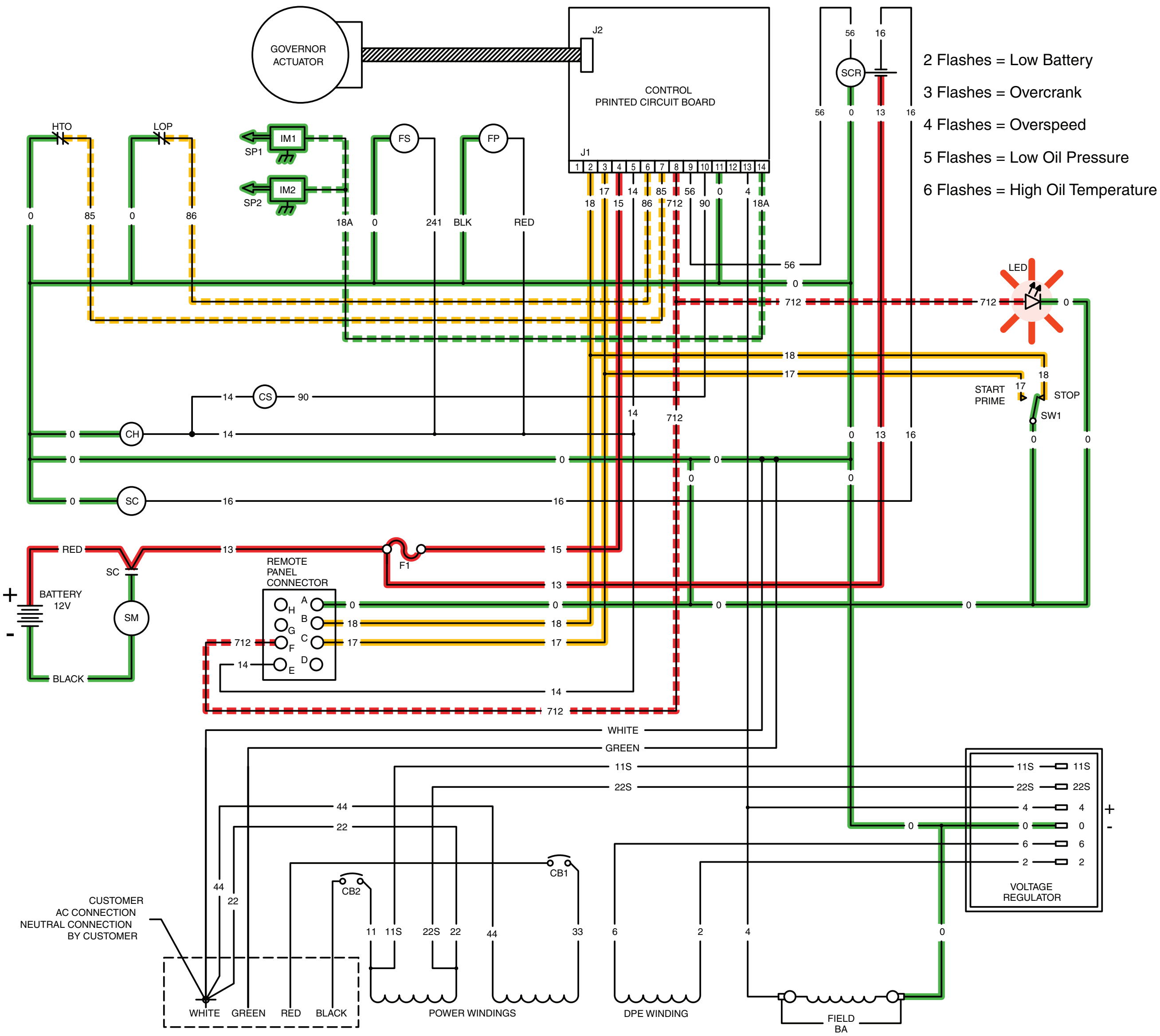
CIRCUIT CONDITION – FAULT SHUTDOWN:

The engine mounts a HIGH OIL TEMPERATURE SWITCH (HTO) and a LOW OIL PRESSURE SWITCH (LOP).

Should engine oil temperature exceed a preset value, the switch contacts will close. Wire 85 from the Printed Circuit Board will connect to frame ground. PCB action will then initiate a shutdown and will cause the red led light on SW1 to flash 6 times then repeat.

Should engine oil pressure drop below a safe pre-set value, the LOP switch contacts will close. On contact closure, Wire 86 will be connected to frame ground and PCB action will initiate an engine shutdown and will cause the red led light on SW1 to flash 5 times then repeat.

The PCB has a built-in time delay for the Wire 85 fault shutdown. At STARTUP ONLY the circuit board will wait approximately 6 seconds before looking at the Wire 85 fault shutdowns. Once running, after the 6 second time delay, grounding Wire 85 through either switch will cause an immediate shutdown.



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= FIELD BOOST
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PRINTED CIRCUIT BOARD

GENERAL:

The Printed Circuit Board (PCB) mounted inside the generator control panel is responsible for cranking, startup, running and shutdown operations. The board interconnects with other components of the DC control system to turn them on and off at the proper times. It is powered by fused 12 VDC power from the unit battery.

CIRCUIT BOARD CONNECTIONS:

The circuit board mounts a 14-pin receptacle (J1) and a six pin terminal (J2, see Figure 5-2). Figure 5-1 shows the 14-pin receptacle (J1), the associated wires and the function(s) of each pin and wire.

PIN	WIRE	FUNCTION
1	N/A	NOT USED
2	18	To Start-Stop switch. When grounded by setting Start-Stop switch to “STOP” engine shuts down
3	17	To Start-Stop switch. When grounded by setting the Start-Stop switch to “START” the engine start cycle begins.
4	15	Delivers fused 12 VDC to PCB
5	14	PCB control. During cranking and running, supplies 12 VDC to fuel pump, choke solenoid, choke heater, fuel solenoid
6	86	Low Oil Pressure switch / Safety shutdown
7	85	High Temperature switch / Safety shutdown
8	712	PCB control/Alarm led
9	56	Delivers 12 VDC to Starter Contactor (SC) (cranking only)
10	90	To Choke Solenoid. When grounded by the PCB the choke operates at two seconds ON , two second OFF intervals (cranking only)
11	0	Common Ground
12	N/A	Not Used
13	4	Field Boost DC to the Voltage Regulator and to the Rotor Winding
14	18A	Ground to Magneto for Shutdown

Figure 5-1. – Receptacle J1

CIRCUIT BOARD DIP SWITCHES:

The circuit board mounts a pair of dip switches which are factory set in the “OFF” (down) position. These dip switches should remain in the factory setting.

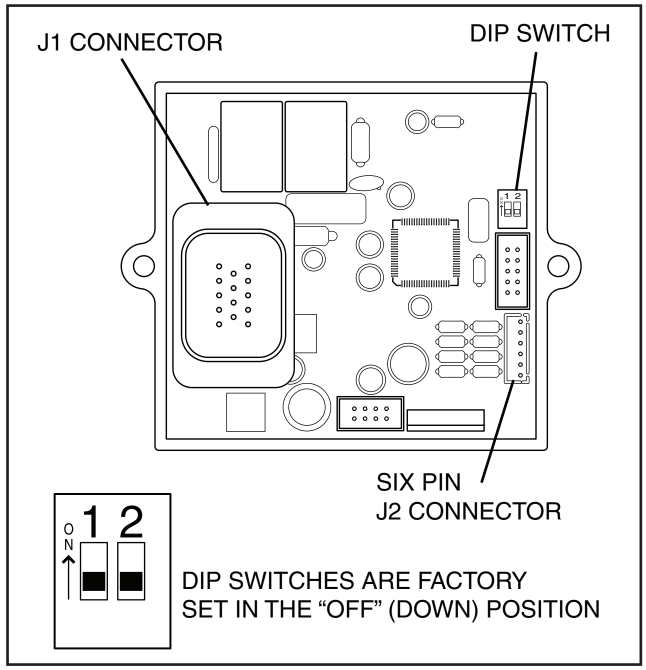


Figure 5-2. – Printed Circuit Board

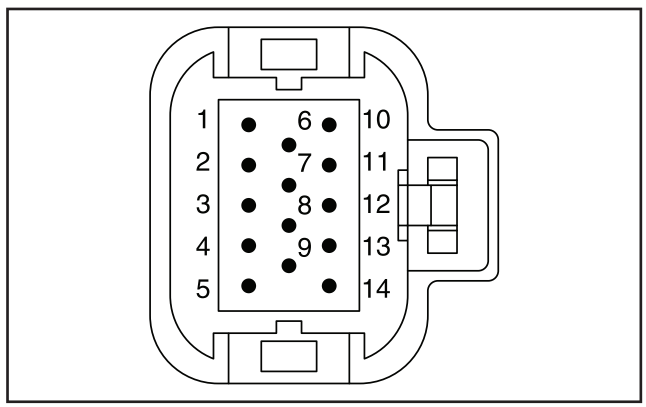


Figure 5-3. – J1 Connector, Harness End

BATTERY

RECOMMENDED BATTERY:

When anticipated ambient temperatures will be consistently above 32° F (0° C), use a 12 volts automotive type storage battery rated 70 amp-hours and capable of delivering at least 400 cold cranking amperes.

If ambient temperatures will be below 32° F (0° C), use a 12 volt battery rated 95 amp-hours and having a cold cranking capacity of 400 amperes.

BATTERY CABLES:

Use of battery cables that are too long or too small in diameter will result in excessive voltage drop. For best cold weather starting, voltage drop between the battery and starter should not exceed 0.12 volt per 100 amperes of cranking current.

Select the battery cables based on total cable length and prevailing ambient temperature. Generally, the longer the cable and the colder the weather, the larger the required cable diameter.

The following chart applies:

CABLE LENGTH (IN FEET)	RECOMMENDED CABLE SIZE
0-10	No. 2
11-15	No. 0
16-20	No. 000

EFFECTS OF TEMPERATURE:

Battery efficiency is greatly reduced by a decreased electrolyte temperature. Such low temperatures have a decided numbing effect on the electrochemical action. Under high discharge rates (such as cranking), battery voltage will drop to much lower values in cold temperatures than in warmer temperatures. The freezing point of battery electrolyte fluid is affected by the state of charge of the electrolyte as indicated below:

SPECIFIC GRAVITY	FREEZING POINT
1.220	-35° F. (-37° C.)
1.200	--20° F. (-29° C.)
1.160	0° F. (-18° C.)

ADDING WATER:

Water is lost from a battery as a result of charging and discharging and must be replaced. If the water is not replaced and the plates become exposed, they may become permanently sulfated. In addition, the plates cannot take full part in the battery action unless they are completely immersed in electrolyte. Add only DISTILLED WATER to the battery. DO NOT USE TAP WATER.

NOTE: Water cannot be added to some "maintenance-free" batteries.

CHECKING BATTERY STATE OF CHARGE:

Use an automotive type battery hydrometer to test the battery state of charge. Follow the hydrometer manufacturer's instructions carefully. Generally, a battery may be considered fully charged when the specific gravity of its electrolyte is 1.260. If the hydrometer used does not have a "Percentage of Charge" scale, compare the readings obtained with the following:

SPECIFIC GRAVITY	PERCENTAGE OF CHARGE
1.260	100%
1.230	75%
1.200	50%
1.170	25%

CHARGING A BATTERY:

Use an automotive type battery charger to recharge a battery. Battery fluid is an extremely corrosive, sulfuric acid solution that can cause severe burns. For that reason, the following precautions must be observed:

❏ The area in which the battery is being charged must be well ventilated. When charging a battery, an explosive gas mixture forms in each cell.

❏ Do not smoke or break a live circuit near the top of the battery. Sparking could cause an explosion.

❏ Avoid spillage of battery fluid. If spillage occurs, flush the affected area with clear water immediately.

❏ Wear eye protection when handling a battery.

7.5 AMP FUSE

This panel-mounted Fuse protects the DC control circuit against overload and possible damage. If the Fuse has melted open due to an overload, neither the priming function nor the cranking function will be available.

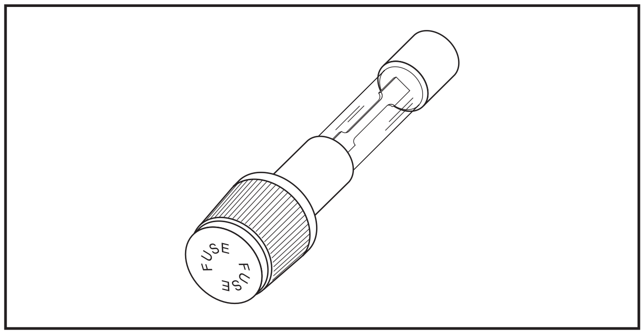


Figure 5-4. – Typical Fuse

START-STOP SWITCH

The Start-Stop Switch allows the operator to control cranking, startup and shutdown. The top half of this momentary switch is pushed and held for one (1) second and then released. An indicator light on the switch begins to flash. The fuel pump engages automatically for a three (3) to five (5) second delay before the starter motor cranks the engine for 16 seconds or until the engine starts. If the engine does not start, the starter will cool for seven (7) seconds and crank the engine again for 16 seconds. If the engine does not start, the starter will cool for seven (7) seconds before cranking for seven (7) seconds to a maximum cycle total of 90 seconds. Once started, the light on the switch stays on continuously. If the generator does not start at the end of the start sequence, a fault code will flash on the switch (see Diagnostics).

The switch center position is the RUN position.

A running engine is stopped by momentarily pressing the bottom half of the switch to kill the ignition.

The following wires connect to the Start-Stop Switch:

1. Wire No. 17 from the Printed Circuit Board. This Is the CRANK and START circuit. When the Switch is set to "START", Wire 17 is connected to frame ground via Wire 0.

a. With Wire 17 grounded, a Crank Relay on the circuit board energizes and battery voltage is delivered to the Starter Contactor Relay via Wire 56. The Starter Contactor Relay energizes, its contacts close and the Starter Contactor is energized via wire 16. Its contacts close and the engine cranks.

b. With Wire 17 grounded, a Run Relay on the circuit board energizes and battery voltage is delivered to the Wire 14 circuit. Battery voltage is delivered to the Fuel Pump, Fuel Solenoid, Choke Heater and the Remote Harness.

2. Wire 18 from the Printed Circuit Board. This Is the ENGINE STOP circuit. When the Start-Stop Switch is set to "STOP", Wire 18 is connected to frame ground via Wire No. 0. Circuit board action then opens the circuit to Wire 14, and grounds Wire 18A. Fuel flow to the carburetor and ignition are terminated.

3. Wire 0 connects the Switch to frame ground.

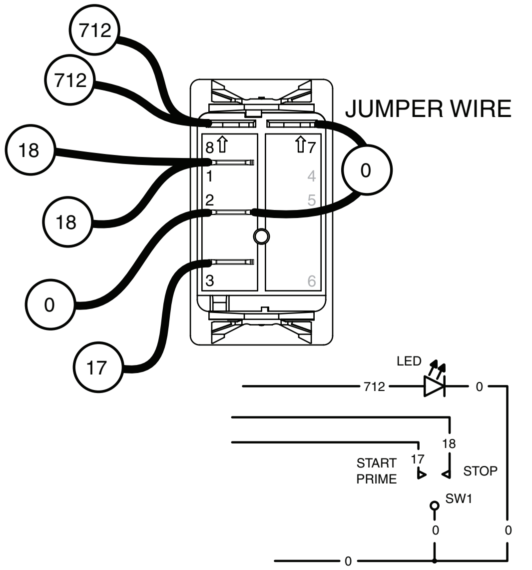


Figure 5-5. – Start-Stop Switch

STARTER CONTACTOR RELAY & STARTER MOTOR

The positive (+) battery cable attaches to the large lug on the STARTER CONTACTOR. Wire 13 then attaches to one side of the STARTER CONTACTOR RELAY contact, from this point Wire 13 attaches to the fuse F1 to supply battery voltage to the DC control system. The opposite side of the starter contactor relay contact is connected to Wire 16.

Wire 16 will supply battery power to the starter contactor and to the Printed Circuit Board for field flash when the starter contactor relay is energized. Attached to the starter contactor relay coil is Wire 56 (positive supply during cranking) and Wire 0 (ground).

When the Start-Stop switch is set to "START", the circuit board delivers battery voltage to the Starter Contactor Relay via Wire 56. The Starter Contactor Relay energizes, its contacts close and the Starter Contactor is energized via wire 16. Its contacts close and battery voltage is available to the starter motor, and the engine cranks.

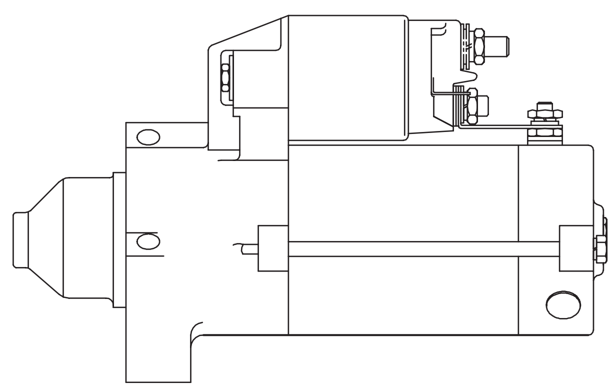


Figure 5-6. – Starter Motor

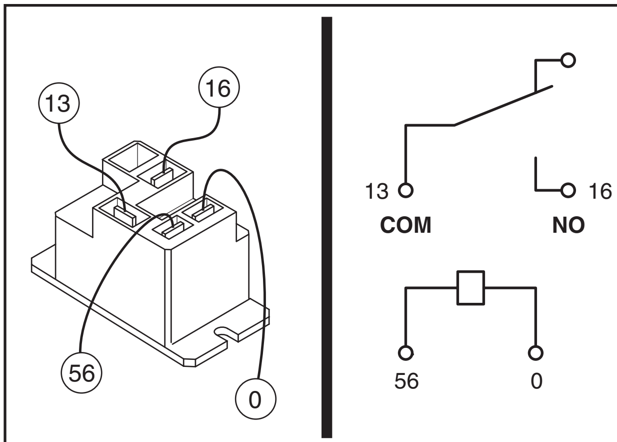


Figure 5-7. – Starter Contactor Relay

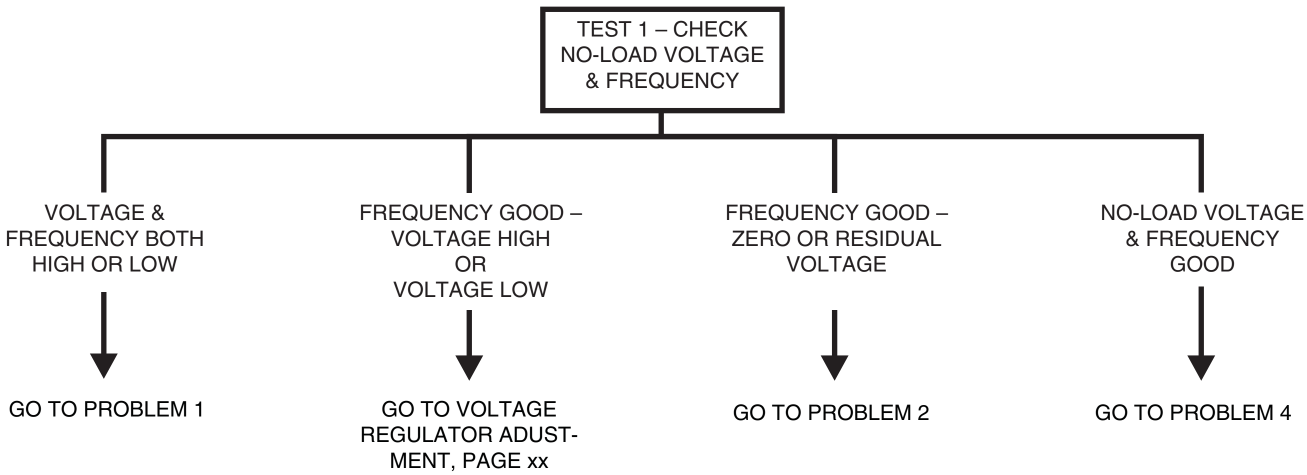
INTRODUCTION

The "Flow Charts" in this section may be used in conjunction with the "Diagnostic Tests" of Section 7. Numbered tests in the Flow Charts correspond to identically numbered tests of Section 7.

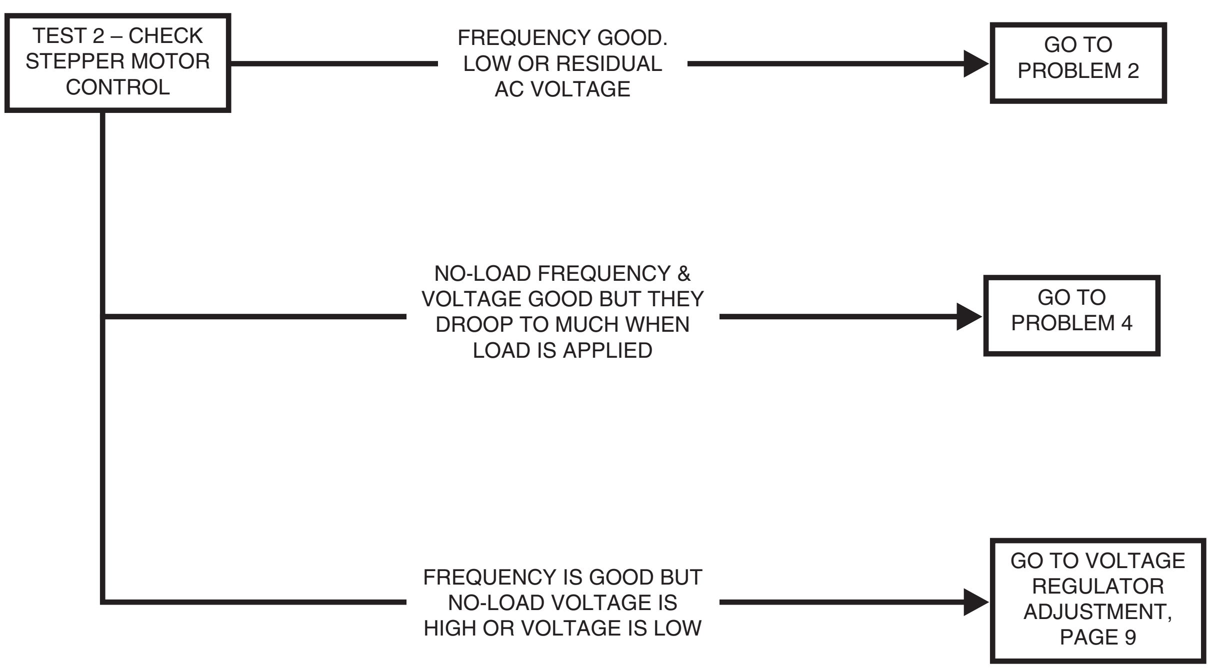
Problems 1 through 4 apply to the AC generator only.

Beginning with Problem 5, the engine DC control system is dealt with.

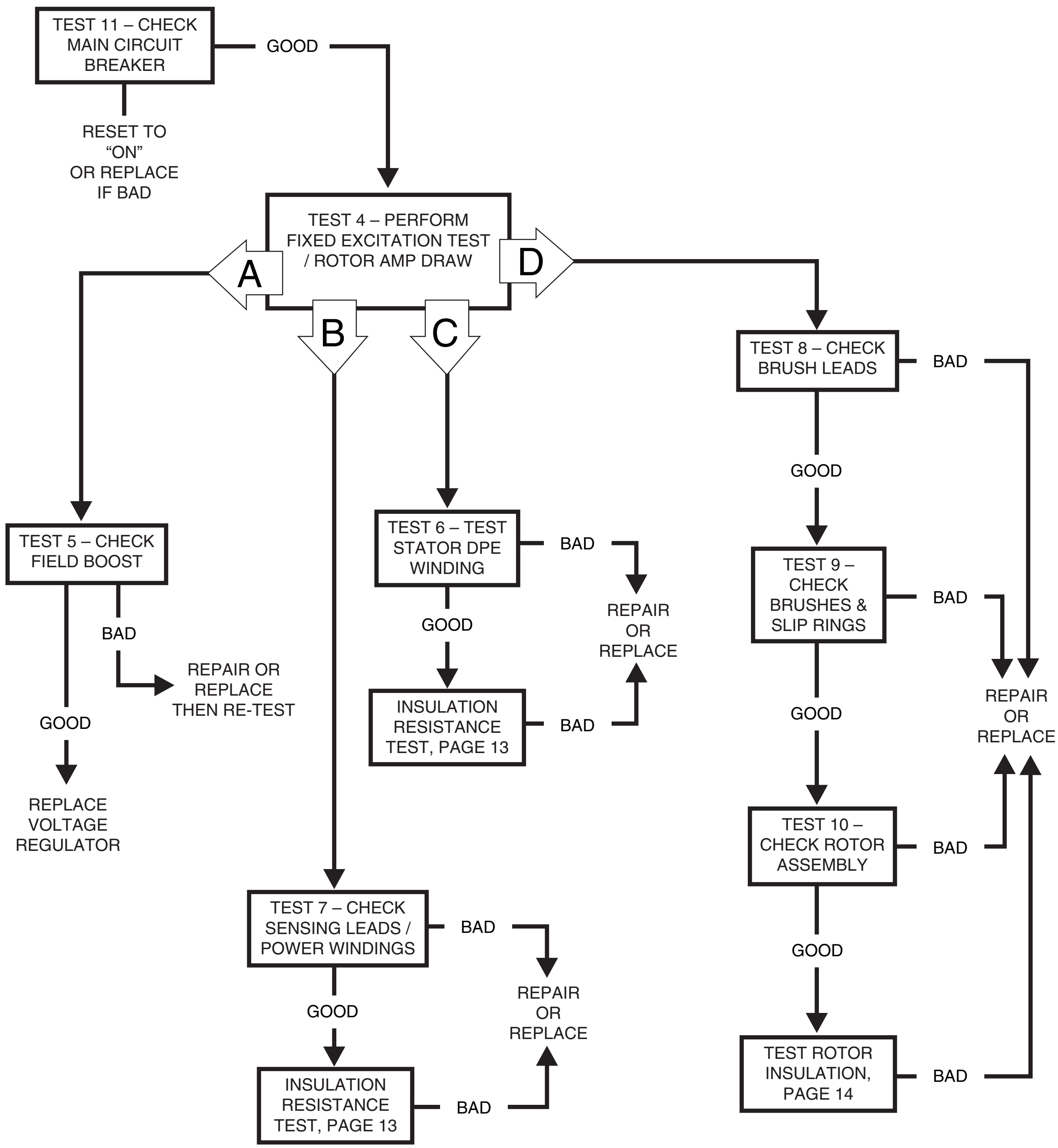
If Problem Involves AC Output



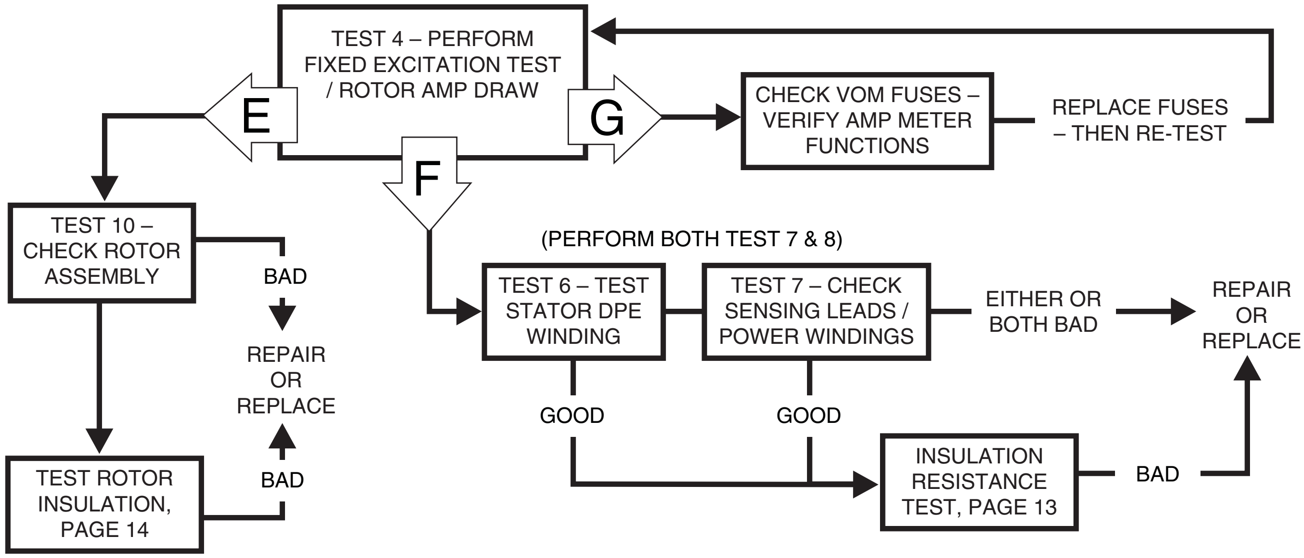
Problem 1 – Voltage & Frequency Are Both High or Low



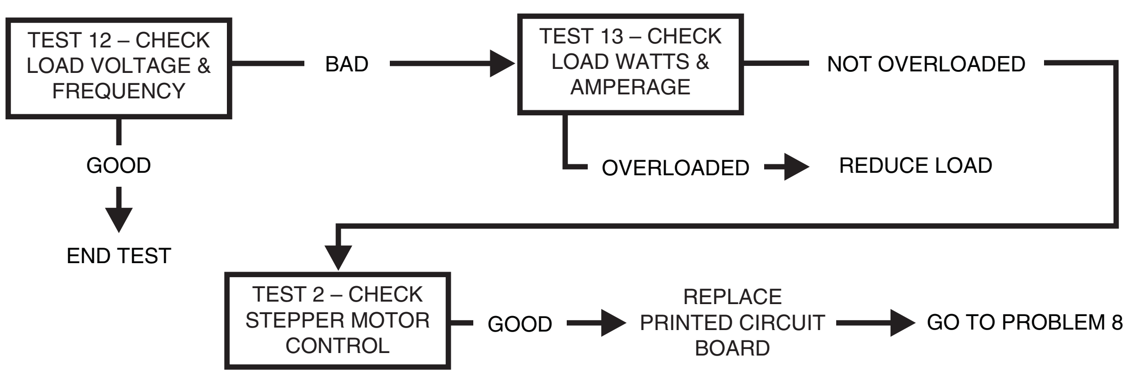
Problem 2 – Generator Produces Zero Voltage or Residual Voltage (5-12VAC)



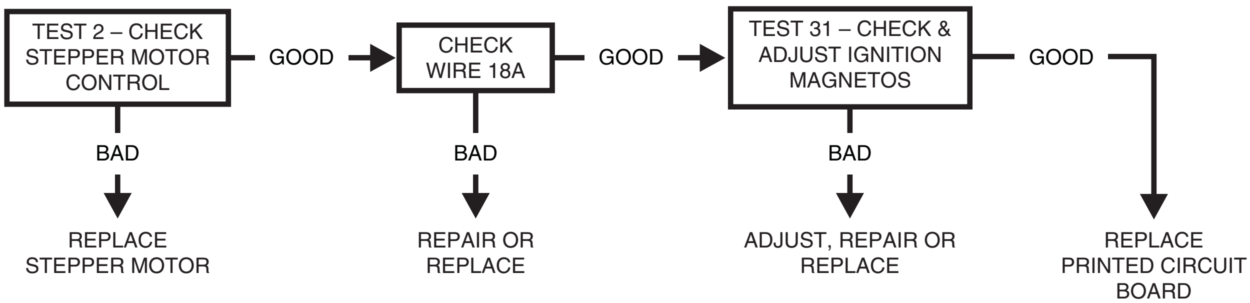
Problem 2 – Generator Produces Zero Voltage or ResidualVoltage (5-12VAC) (continued)



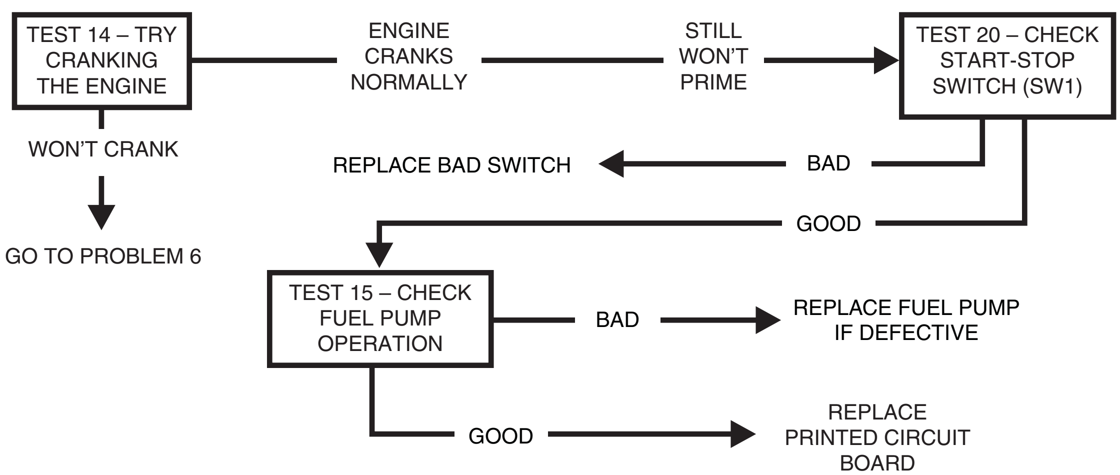
Problem 3 – Excessive Voltage/Frequency Droop When Load is Applied (Underspeed Warning – 4 Flashes on SW1 LED)



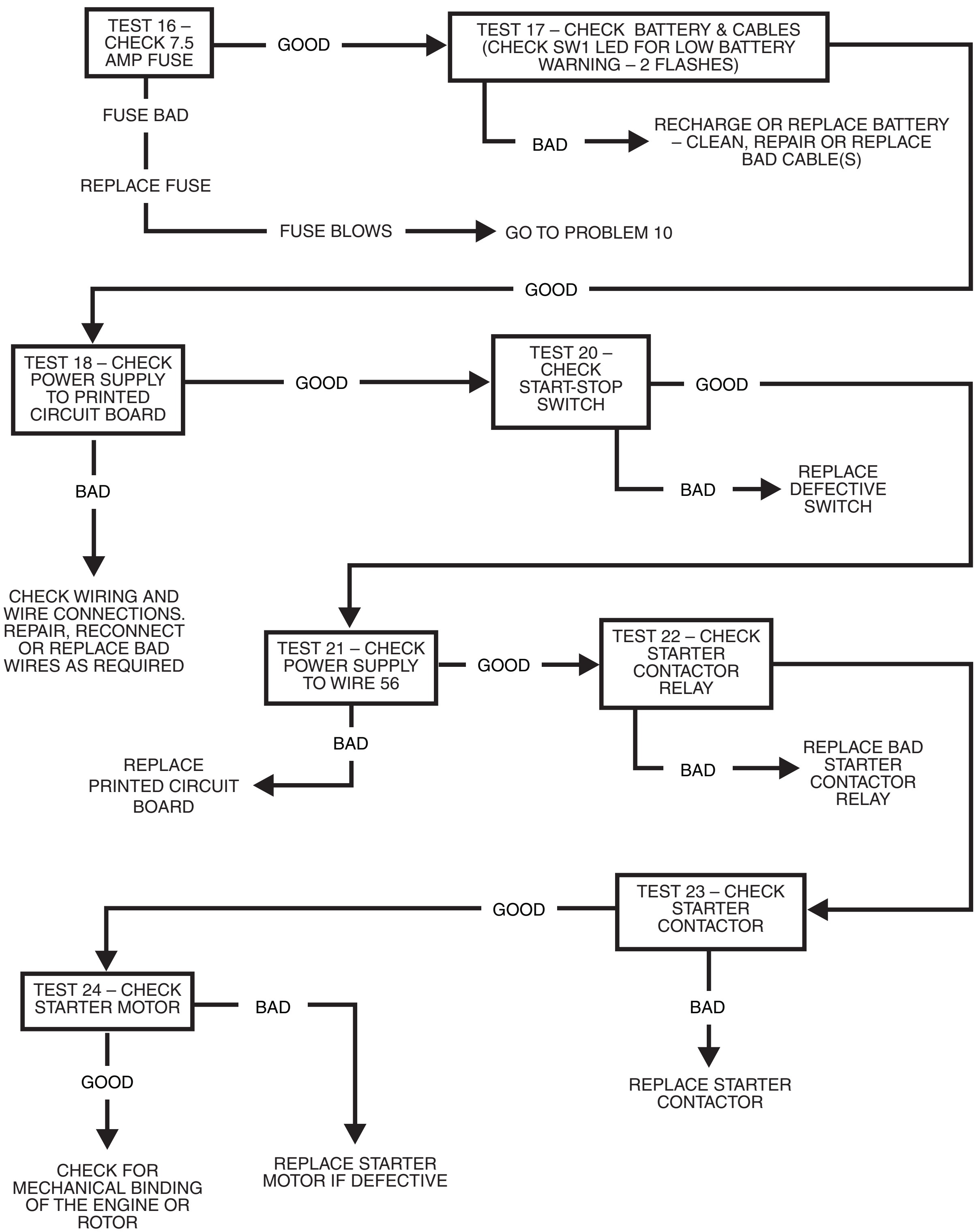
Problem 4 – Engine Overspeed Warning Code Flashing on SW1 LED (4 Flashes)



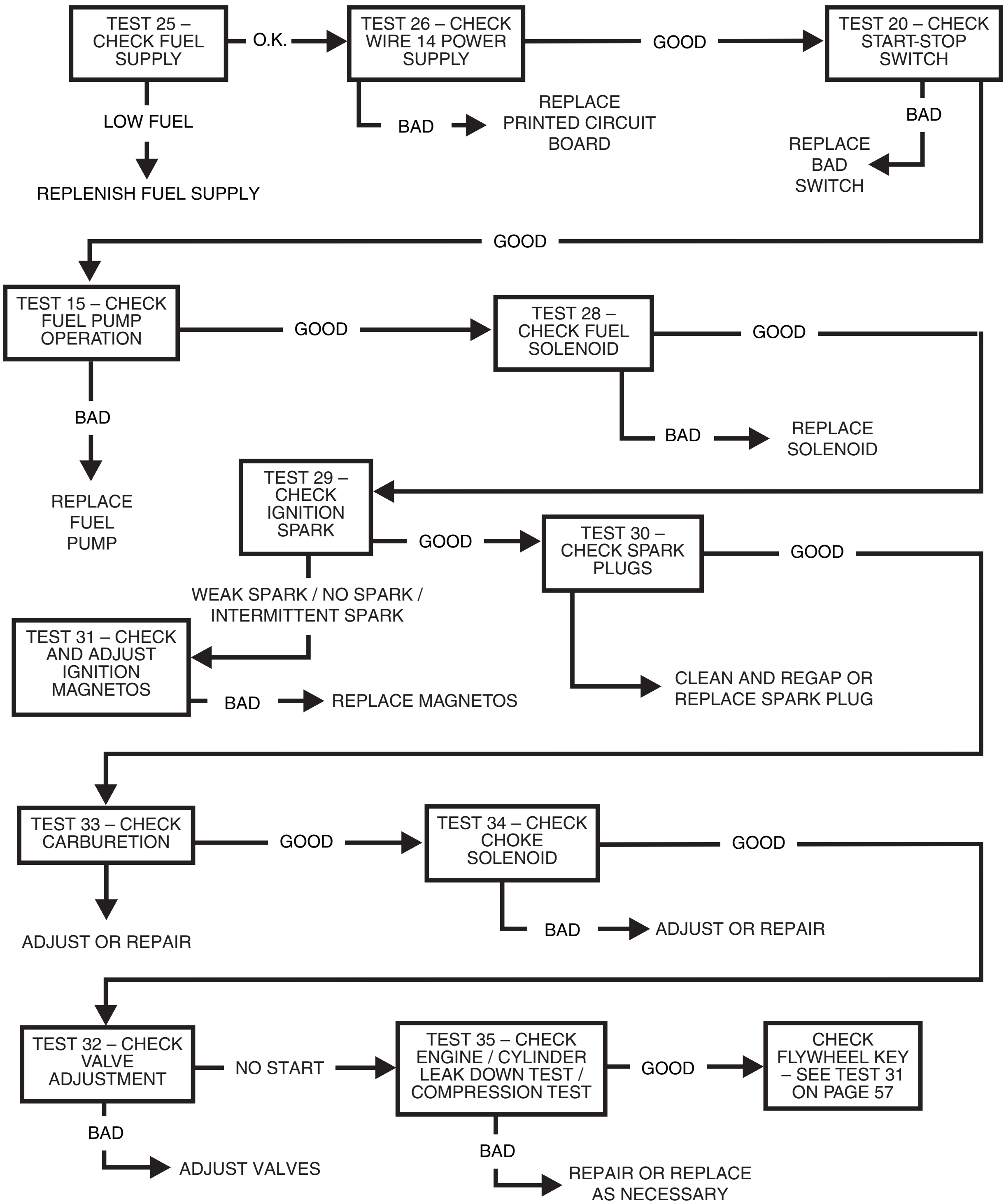
Proble 5 – Priming Function Does Not Work (Gasoline Models)



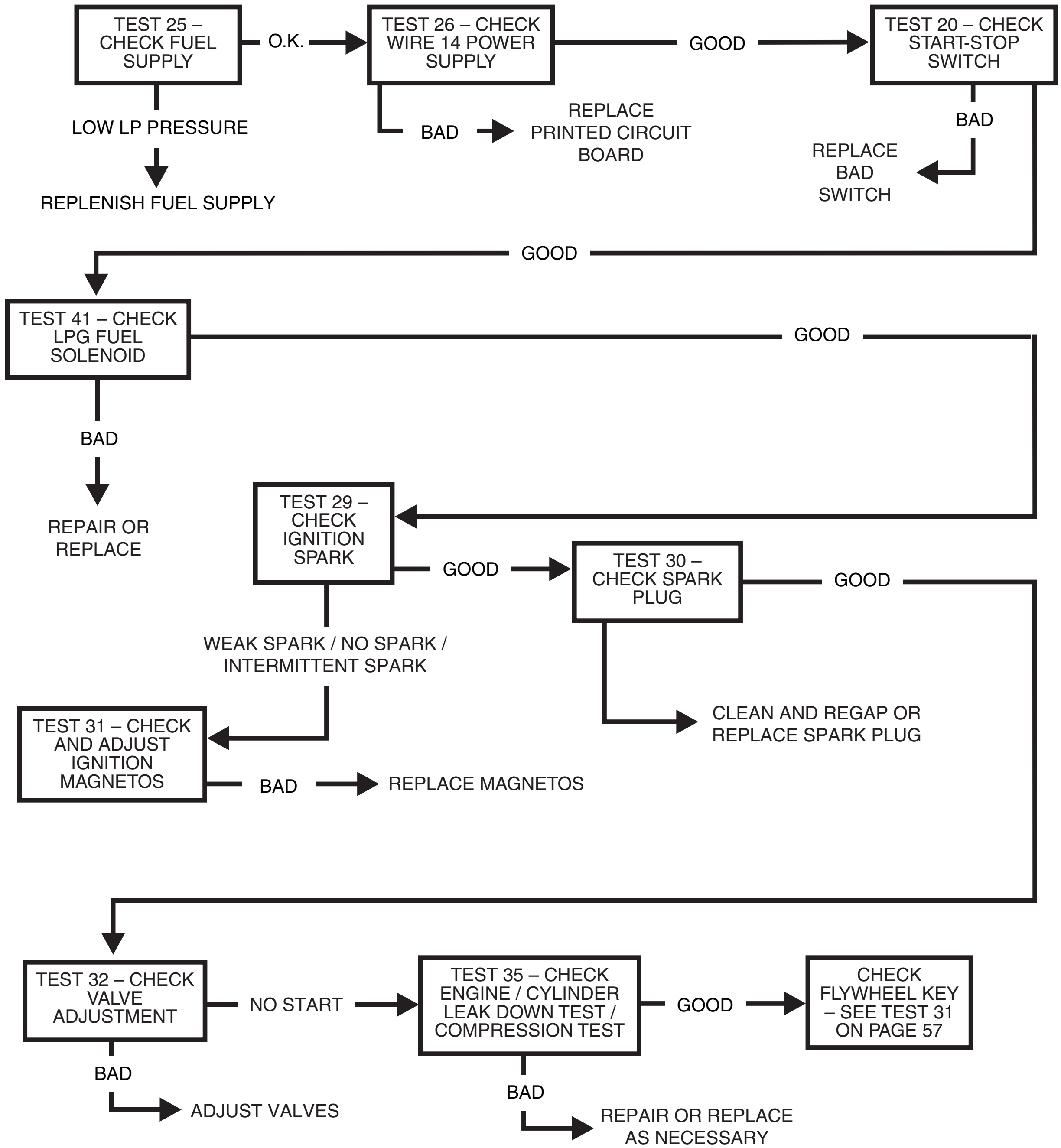
Problem 6 - Engine Will Not Crank



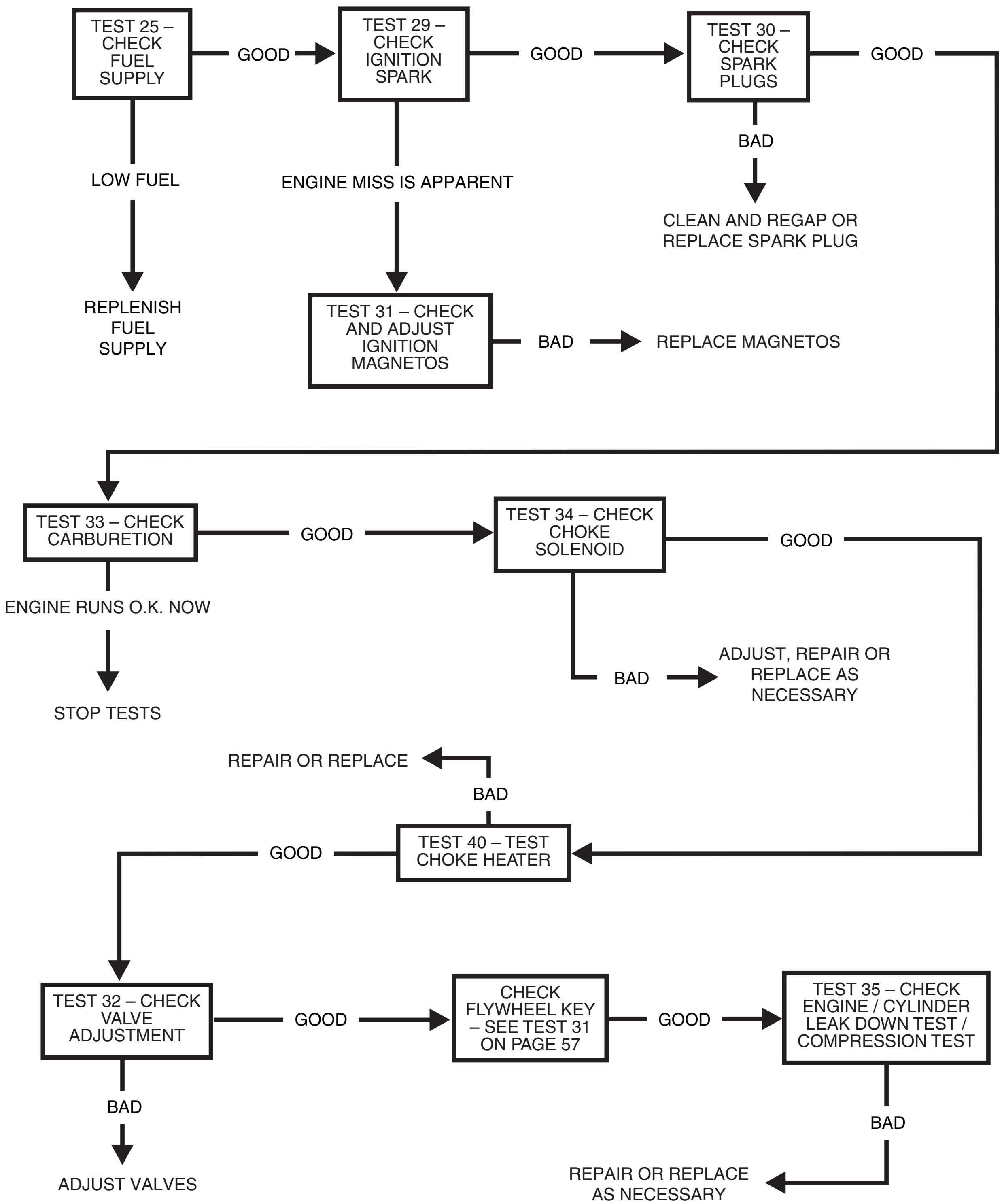
Problem 7 – Engine Cranks But Will Not Start (Gasoline Units) (Overcrank Warning Code on SW1 LED – 3 Flashes)



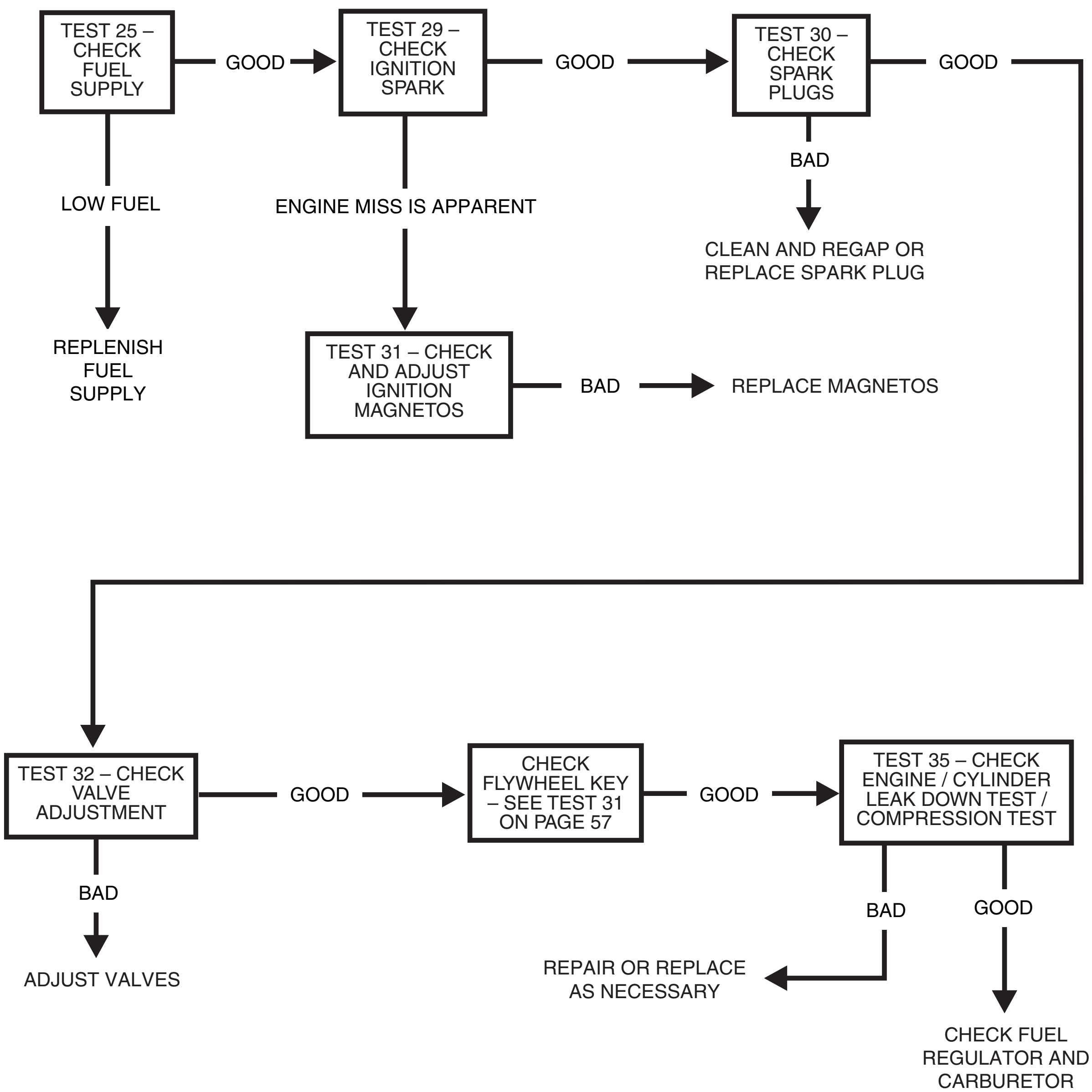
Problem 7 – Engine Cranks But Will Not Start (LP Units)
(Overcrank Warning Code on SW1 LED – 3 Flashes)



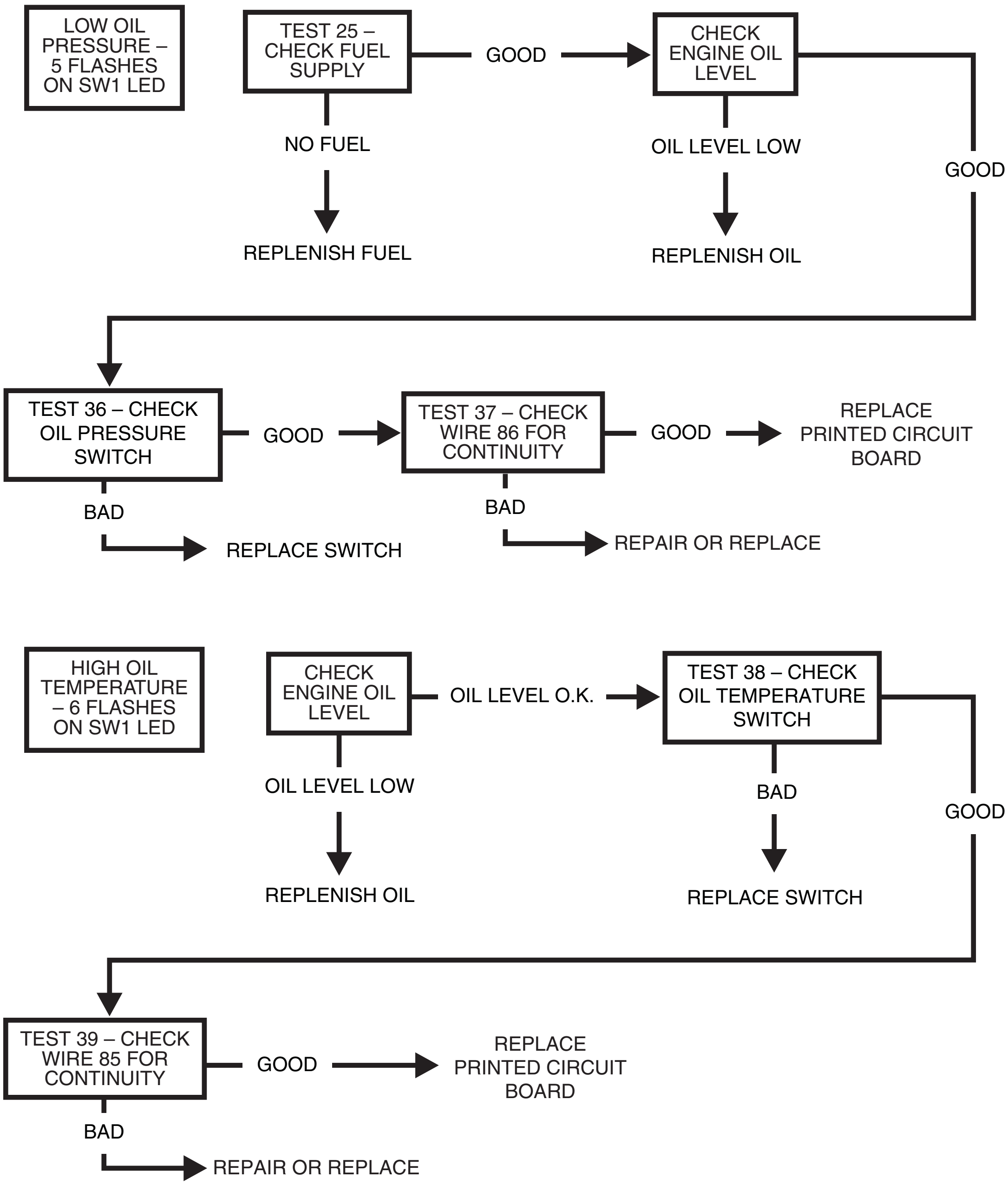
Problem 8 – Engine Starts Hard and Runs Rough (Gasoline Units)



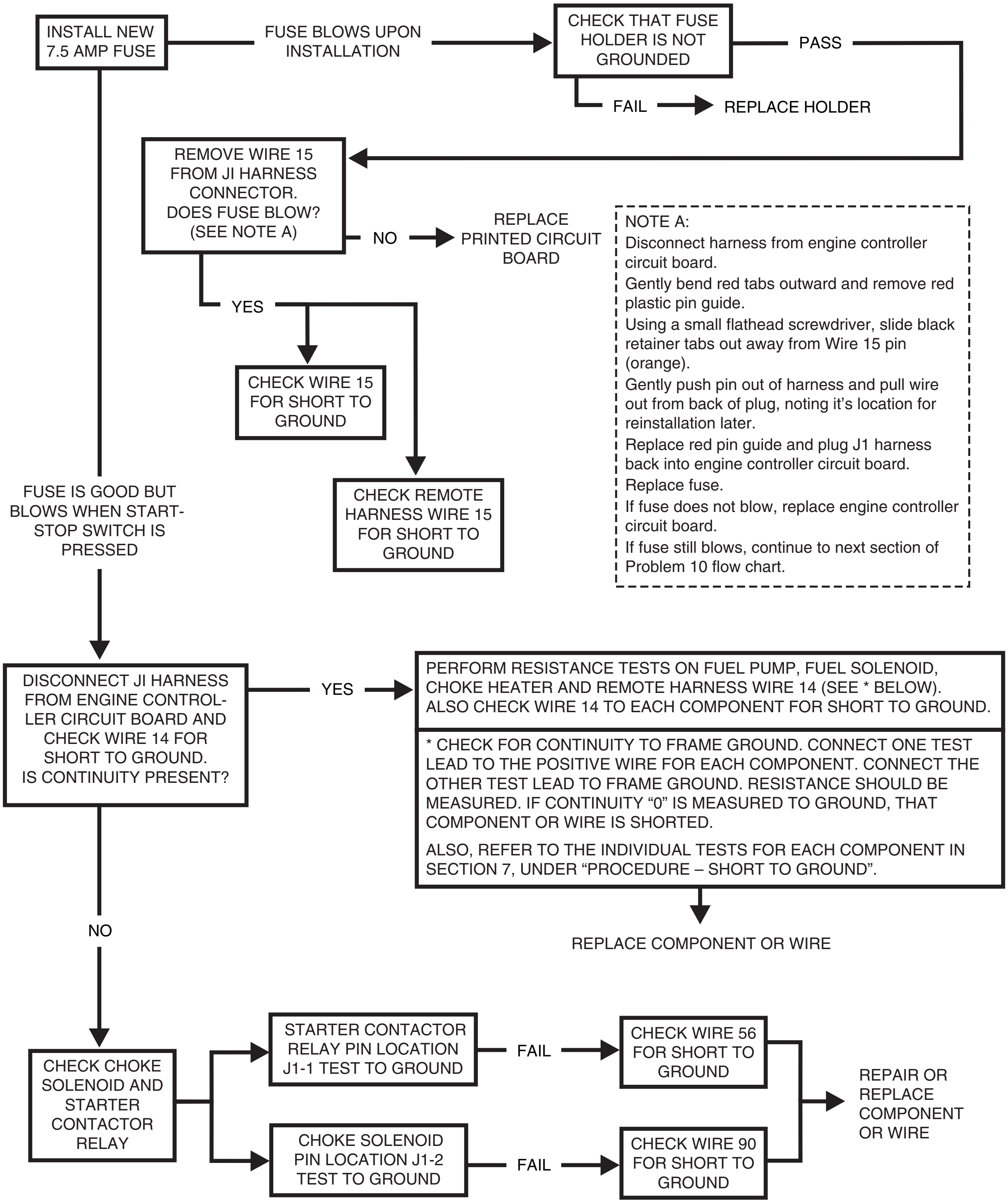
Problem 8 – Engine Starts Hard and Runs Rough (LP Units)



Problem 9 – High Oil Temperature Fault (6 Flashes) or Low Oil Pressure Fault (5 Flashes)



Problem 10 – 7.5A (F1) Fuse Blowing



INTRODUCTION

The “Diagnostic Tests” in this chapter may be performed in conjunction with the “Flow Charts” of Section 6. Test numbers in this chapter correspond to the numbered tests in the “Flow Charts”.

Tests 1 through 13 are procedures involving problems with the generator’s AC output voltage and frequency (Problems 1 through 3 in the “Flow Charts”).

Tests 14 through 41 are procedures involving problems with engine operation (Problems 3 through 10 in the “Troubleshooting Flow Charts”).

You may wish to read Section 4, “Measuring Electricity”.

NOTE: Test procedures in this Manual are not necessarily the only acceptable methods for diagnosing the condition of components and circuits. All possible methods that might be used for system diagnosis have not been evaluated. If you use any diagnostic method other than the method presented in this Manual, you must ensure that neither your safety nor the product’s safety will be endangered by the procedure or method you have selected.

TEST 1 – CHECK NO-LOAD VOLTAGE AND FREQUENCY

DISCUSSION:

The first step in analyzing any problem with the AC generator is to determine the unit’s AC output voltage and frequency. Once that has been done, you will know how to proceed with specific diagnostic tests.

PROCEDURE:

1. Set a volt-ohm-milliammeter (VOM) to read AC voltage. Connect the meter test leads across customer connection leads T1 (Red) and T2 (White).
2. Disconnect or turn OFF all electrical loads. Initial checks and adjustments are accomplished at no-load.
3. Start the engine, let it stabilize and warm up.
4. Read the AC voltage.
5. Connect an AC frequency meter across AC output leads T1 (Red) and T2 (White). Repeat the above procedure.

RESULTS:

For units rated 60 Hertz, no-load voltage and frequency should be approximately 122-126 VAC and 60.0-60.5 Hertz respectively.

1. If AC voltage and frequency are BOTH correspondingly high or low, go to Test 2.
2. If AC frequency is good but low or residual voltage is indicated, go to Test 4.
3. If AC output voltage and frequency are both “zero”, go to Test 11.
4. If the no-load voltage and frequency are within the stated limits, go to Test 12.

NOTE: The term “low voltage” refers to any voltage reading that is lower than the unit’s rated voltage. The term “residual voltage” refers to the output voltage supplied as a result of Rotor residual magnetism (approximately 5-12 VAC).

TEST 2 – CHECK STEPPER MOTOR CONTROL

⚠ Caution! Do not stand in front of carburetor when checking the stepper motor movement due to possible backfire from the carburetor.

PROCEDURE:

1. Remove air cleaner cover to access stepper motor.
2. Physically grab the throttle and verify the stepper motor, linkage and throttle do not bind in any way. If any binding is felt, repair or replace components as needed. Some resistance should be felt as the stepper motor moves through it’s travel.
3. Physically move the throttle to the closed position by pulling the stepper motor arm towards the idle stop.
   a. Press the Start-Stop switch (SW1) to “START” and watch for stepper motor movement. It should move to the wide open (down) position during cranking. Once the unit starts the stepper motor should move the throttle to a position to maintain 60.0-60.5 Hertz.

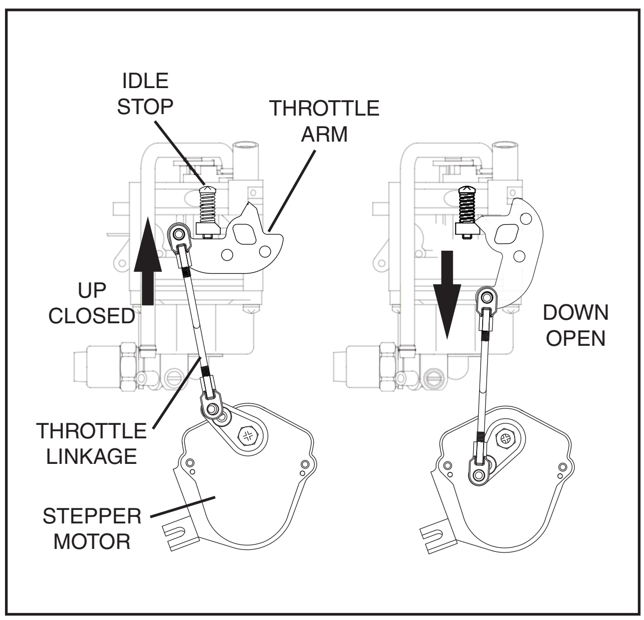


Figure 7-1. Throttle Position

4. If no movement is seen in Step 3 remove the control panel cover. Verify the six pin connector (J2) on the Printed Circuit Board is seated properly, remove the connector and then replace it and test again. Verify the dip switches are correctly set.

NOTE: The dip switches on the Printed Circuit Board are factory set in the "OFF" or DOWN position. Refer to Figure 5.2 on Page 22.

5. If problem continues remove six pin connector (J2) from Printed Circuit Board. Set Volt meter to measure ohms. Carefully measure from the end of the six pin harness as follows:

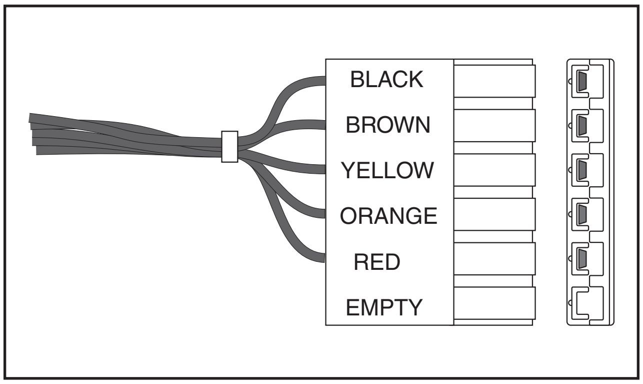


Figure 7-2. Six Pin J2 Connector Wire Colors

NOTE: Press down with the meter leads on the connectors exposed terminals, do not probe into the connector.

a. Connect one meter lead to Red, connect the remaining test lead to Orange, approximately 10 ohms should be measured.

b. Connect one meter lead to Red, connect the remaining test lead to Yellow, approximately 10 ohms should be measured.

c. Connect one meter lead to Red, connect the remaining test lead to Brown, approximately 10 ohms should be measured.

d. Connect one meter lead to Red, connect the remaining test lead to Black, approximately 10 ohms should be measured.

e. Connect one meter lead to Red, connect the remaining test to the stepper motor case. No resistance should be measured ("Infinity" or Open).

RESULTS:

1. If the stepper motor fails any part of Step 5 replace the stepper motor.
2. If the stepper motor passes all steps replace the Printed Circuit Board.

TEST 4 – FIXED EXCITATION TEST/ROTOR AMP DRAW

DISCUSSION:

The fixed excitation test consists of applying battery voltage (12 VDC) to the Rotor windings. This allows that portion of the excitation circuit between the Voltage Regulator and the Rotor (including the Rotor itself) to be checked as a possible cause of the problem. When battery voltage is applied to the Rotor, the resulting magnetic field around the Rotor should induce a Stator power winding voltage equal to about one-half the unit's rated output voltage.

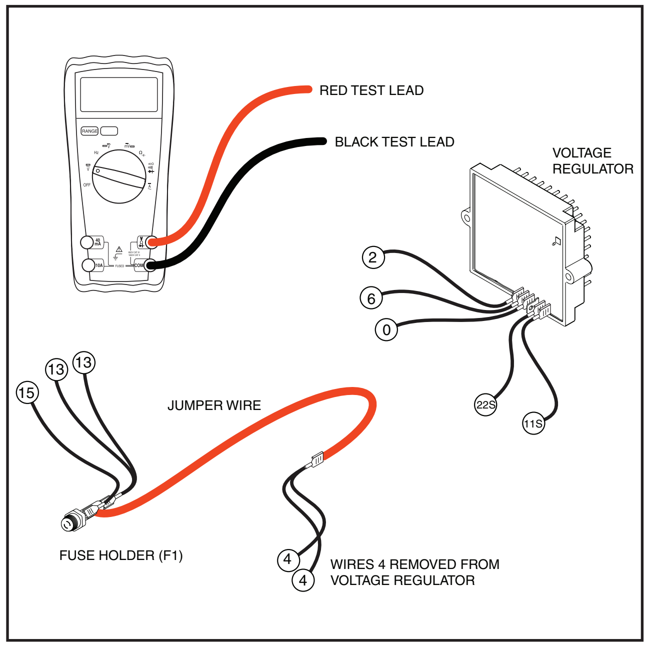


Figure 7-3. – Fixed Excitation Test, Step A

PROCEDURE:

1. Disconnect Wire 4 from the Voltage Regulator (VR). (Third terminal from the right side of VR).
2. Connect a jumper wire to Wire 4 and to the 12 volt fused battery positive supply Wire 15, located at the fuse (F1) holder (see Figure 7-3).

NOTE: During this test, Wire 15 must remain connected to the fuse (F1) holder.

3. Set the VOM to measure AC voltage.

TEST 4 RESULTS							
	A	B	C	D	E	F	G
VOLTAGE RESULTS WIRE 2 & 6 EXCITATION WINDING	ABOVE 60 VAC	ABOVE 60 VAC	BELOW 60 VAC	ZERO OR RESIDUAL VOLTAGE (5-12 VAC)	BELOW	BELOW 60 VAC	ABOVE 60 VAC
VOLTAGE RESULTS WIRE 11S & 22S POWER WINDING SENSE LEADS	ABOVE 60 VAC	BELOW 60 VAC	ABOVE 60 VAC	ZERO OR RESIDUAL VOLTAGE (5-12 VAC)	BELOW	BELOW 60 VAC	ABOVE 60 VAC
ROTOR AMP DRAW RV45 (MODEL 5410/5411)	1.1 A ± 20%	1.1 A ± 20%	1.1 A ± 20%	ZERO CURRENT DRAW	≥1.4 A	.85 A ± 20%	ZERO CURRENT DRAW
ROTOR AMP DRAW RV55 (MODEL 5412/5413)	.85 A ± 20%	.85 A ± 20%	.85 A ± 20%	ZERO CURRENT DRAW	≥1.2 A	.85 A ± 20%	ZERO CURRENT DRAW
ROTOR AMP DRAW RV65 (MODEL 5414/5415)	1.2 A ± 20%	1.2 A ± 20%	1.2 A ± 20%	ZERO CURRENT DRAW	≥1.5 A	1.2 A ± 20%	ZERO CURRENT DRAW
(MATCH RESULTS WITH LETTER AND REFER TO FLOW CHART – Problem 2 on Pages 28 & 29)							

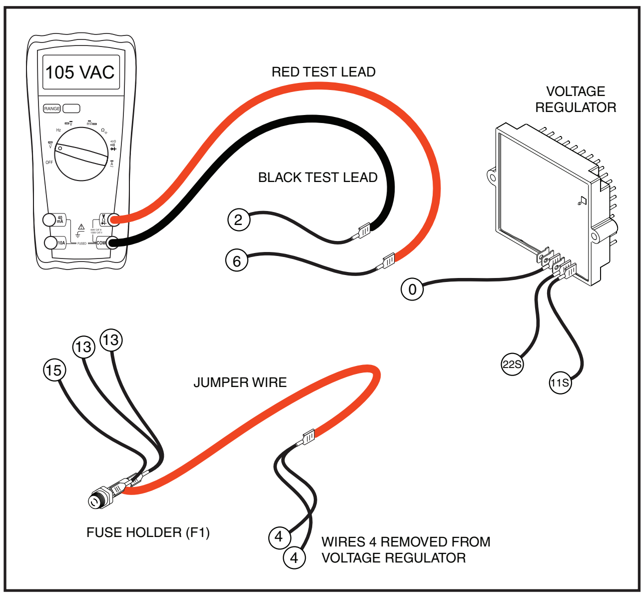


Figure 7-4. – Fixed Excitation Test, Step B

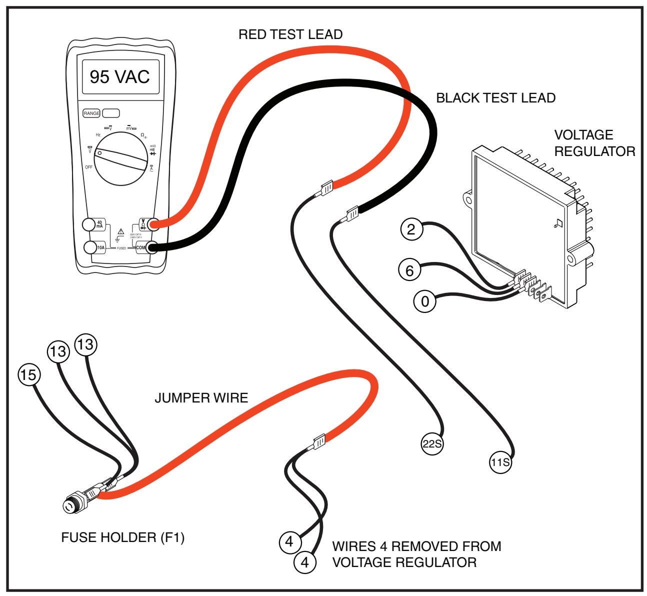


Figure 7-5. – Fixed Excitation Test, Step C

4. Disconnect Wire 2 from the Voltage Regulator (VR) and connect one meter test lead to that wire. Disconnect Wire 6 from the Voltage Regulator and connect the other meter test lead to that wire. See Figure 7-4. Start the generator and measure the AC voltage. It should be above 60 volts. Record the results and stop the generator.

5. Re-connect Wire 2 and Wire 6 to the Voltage Regulator.

6. Disconnect Wire 11S from the Voltage Regulator (VR) and connect one meter test lead to that wire. Disconnect Wire 22S from the Voltage Regulator and connect the other meter test lead to that wire. See Figure 7-5. Start the generator and measure the AC voltage. It should be above 60 volts. Record the results and stop the generator.

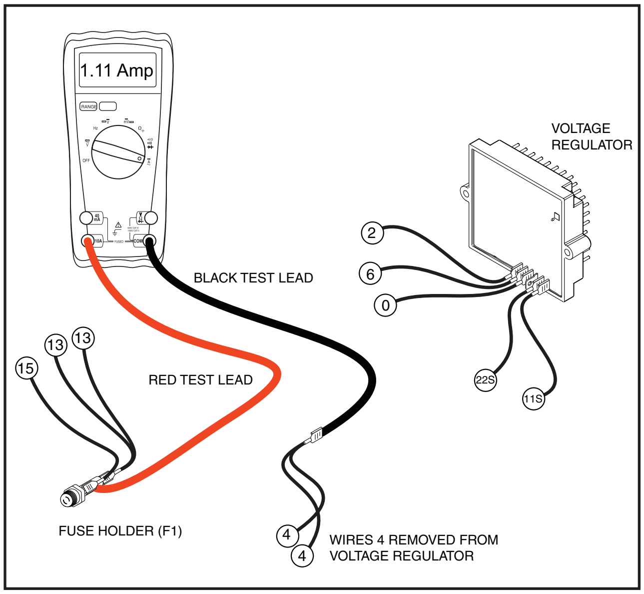


Figure 7-6. – Fixed Excitation Test, Step D

7. Re-connect Wire 11S and Wire 22S to the Voltage Regulator.
8. Remove the jumper wire between Wire 4 and 12 volt supply.
9. Set the VOM to measure DC amps.
10. Connect one meter test lead to the 12 volt fused battery supply Wire 15, and connect the other meter test lead to Wire 4 (should still be disconnected from the VR). See Figure 7-6.
11. Start the generator. Measure the DC current. Record the rotor amp draw.
12. Stop the generator. Re-connect Wire 4 to the Voltage Regulator.

RESULTS:

AC Voltage across Wires 2 and 6 = __________

AC Voltage across Wires 11S and 22S = __________

Proceed to "TEST 4 RESULTS" (top of page 40). Match all results to corresponding column in the chart. The column letter refers to the Problem 4 flow charts on pages 28 and 29.

TEST 5 – CHECK FIELD BOOST

DISCUSSION:

Field boost current is delivered to the Rotor only while the engine is being cranked. This current helps ensure that adequate "pickup" voltage is available to turn the Voltage Regulator on and build AC output voltage.

Loss of the field boost function may or may not result in a problem with AC output voltage. If the Rotor's residual magnetism is sufficient to turn the Regulator on, loss of the function may go unnoticed. However, if the Rotor's residual magnetism is not enough to turn the Regulator on, loss of field boost can result in failure of the unit to generate an output voltage.

PROCEDURE:
1. Set VOM to measure DC voltage.
2. Disconnect Wire 4 from the Voltage Regulator and connect the positive (+) test lead to it. Connect the negative (-) test lead to a clean frame ground.
3. Set the Start-Stop Switch to "START." During cranking only, measure DC voltage. It should read 3-5 VDC. Reconnect Wire 4 to the Voltage Regulator.

RESULTS:
1. If field boost checks good, replace the Voltage Regulator.
2. If voltage is not measured, replace the PCB.

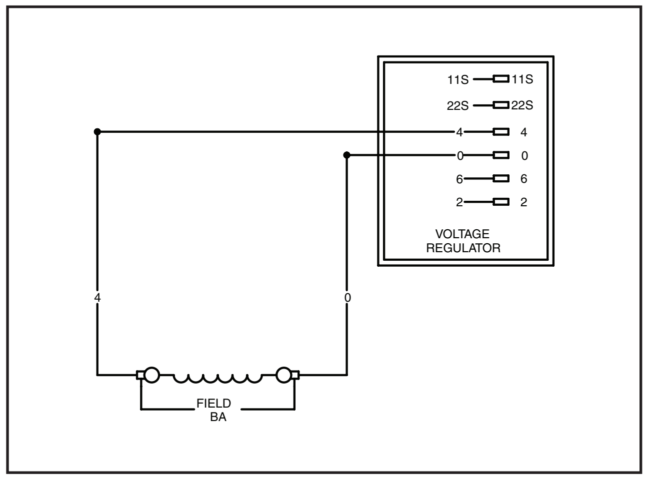


Figure 7-7. – The Field Boost Circuit

TEST 6 – TEST STATOR DPE WINDING

DISCUSSION:

An open circuit in the Stator excitation windings will result in a loss of unregulated excitation current to the Voltage Regulator. The flow of regulated excitation current to the Rotor will then terminate and the unit's AC output voltage will drop to a value that is commensurate with the rotor's residual magnetism (about 5 - 12 VAC).

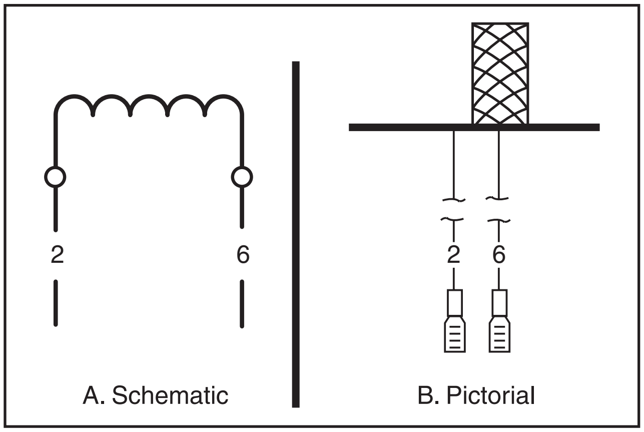


Figure 7-8. – Stator Excitation Winding

PROCEDURE:
1. Disconnect Wire 2 from the Voltage Regulator.
2. Disconnect Wire 6 from the Voltage Regulator.
3. Set a VOM to its “Rx1” scale and zero the meter.
4. Connect the VOM test leads across the terminal ends of Wires 2 and 6. The VOM should indicate the resistance of the Stator Excitation (DPE) Windings.

EXCITATION “DPE” WINDING RESISTANCE * (Measured Across Wires 2 & 6)	
MODEL	**OHMS**
RV45 (5410/5411)	2.59Ω
RV55 (5412/5413)	1.41Ω – 1.63Ω
RV65 (5414/5415)	1.59Ω – 1.84Ω

* Resistance values In ohms (Ω) at 20°C. (68°F.). Actual readings may vary depending on ambient temperature. A tolerance of plus or minus 5% is allowed.

5. Now, set the meter to its “Rx1 K” or “Rx10,000” scale and zero the meter. Test for a “short-to-ground” condition as follows:
   a. Connect one meter test lead to Stator lead No. 2, the other test lead to a clean frame ground.
   b. The meter should read “Infinity”. Any other reading indicates a “short-to-ground” condition and the Stator should be replaced.
6. Test for a short between windings as follows:
   a. Meter should be set to its “Rx1 K” or “Rx10,000” scale.
   b. Connect one meter test lead to Stator lead 2, the other test lead to Stator lead 11. The meter should read “Infinity”.
   c. Connect one VOM test lead to Stator lead 2 the other test lead to Stator lead 33. “Infinity” should be indicated.

RESULTS:
1. If the Stator excitation (DPE) windings are open or shorted, replace the Stator assembly.
2. If the excitation windings are good, perform “Insulation Resistance Test”, page 13.

TEST 7 – CHECK SENSING LEADS / POWER WINDINGS

DISCUSSION:

The Voltage Regulator “regulates” excitation current flow to the Rotor by electronically comparing sensing voltage to a pre-set reference voltage. The sensing voltage is delivered to the Voltage Regulator via Wires 11S and 22S.

If an open circuit exists in sensing leads 11S or 22S, the normal reaction of an unprotected Regulator would be to increase the excitation current to the Rotor in an effort to increase the actual AC output voltage. This would result in a “full field” condition and an extremely high AC output voltage.

To protect the system against such a high AC output voltage, the Voltage Regulator will shut down if sensing voltage signals are lost.

If the regulator shuts down, the generator’s AC output voltage will decrease to a value that is commensurate with the Rotor’s residual magnetism (about 5-12 VAC).

PROCEDURE:

Gain access to the generator control panel interior. Test the Stator power windings, as follows:
1. From main breaker, disconnect Wires 11 and 33.
2. Also disconnect Wires 22 and 44 from the ground terminal.
3. Disconnect Wires 11S and 22S from the Voltage Regulator.
4. Set a VOM to its “Rx1” scale and zero the meter.
5. Connect the meter test leads across Stator leads 11 and 22. Normal power winding resistance should be read.
6. Connect the meter test leads across Stator leads 33 and 44. Normal power winding resistance should be read.
7. Connect the meter test leads across Stator leads 11S and 22S. Normal Power Winding resistance should be read.

AC POWER WINDING RESISTANCE * RV45 (Model 5410/5411)	
ACROSS WIRES:	OHMS
11 & 22	0.396Ω
11S & 22S	0.396Ω
33 & 44	0.396Ω

AC POWER WINDING RESISTANCE * RV55 (Model 5412/5413)	
ACROSS WIRES:	OHMS
11 & 22	0.28Ω – 0.32Ω
11S & 22S	0.28Ω – 0.32Ω
33 & 44	0.28Ω – 0.32Ω

AC POWER WINDING RESISTANCE * RV65 (Model 5414/5415)	
ACROSS WIRES:	OHMS
11 & 22	0.209Ω – 0.242Ω
11S & 22S	0.209Ω – 0.242Ω
33 & 44	0.209Ω – 0.242Ω

* Resistance values In ohms at 20° C. (68° F.). Actual readings may vary depending on ambient temperature. A tolerance of plus or minus 5% is allowed.

8. Now, set the VOM to its “Rx1 K” or “Rx10,000” scale and zero the meter.
9. Connect the meter test leads across Stator lead 11 and frame ground. “Infinity” should be read.
10. Connect the meter test leads across Stator lead 33 and frame ground. The reading should be “Infinity”.
11. Connect the meter test leads across Stator leads Wire 11 and Wire 33. The reading should be “Infinity”.
12. Connect the meter test leads across Stator leads Wire 11 and Wire 2. The reading should be “Infinity”.
13. Connect the meter test leads across Stator leads Wire 33 and Wire 2. The reading should be “Infinity”.

RESULTS:
1. If the Stator passes all steps except Step 7, repair, re-connect or replace Sensing leads 11S and 22S.
2. Replace the Stator if it’s power windings fail the test. (Note Result No. 1).
3. If the Power Windings test good, perform the “Insulation Resistance Test” on Page 13.

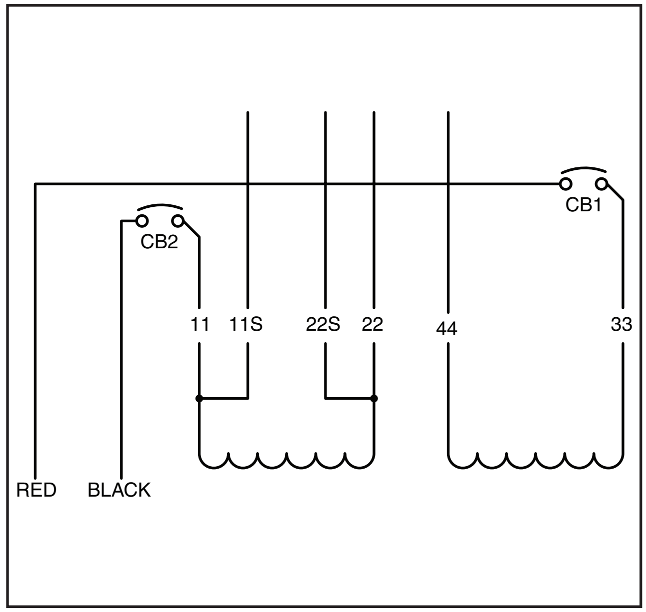


Figure 7-9. – Stator Power Winding Leads

TEST 8 – CHECK BRUSH LEADS

DISCUSSION:
In Test 4, if application of battery voltage to the Rotor did NOT result in an output of about one-half rated voltage, the brush leads could be one possible cause of the problem. This test will check Wires 4 and 0 for an open circuit condition.

PROCEDURE:
1. Set a VOM to its “Rx1” scale and zero the meter.
2. Disconnect Wire 4 from the Voltage Regulator and from the Rotor brush terminal.
3. Connect the VOM test leads across each end of the wire. The meter should read “Continuity”.
4. Disconnect Wire 0 from the Rotor Brush Terminal. Connect one meter test lead to Wire 0. Connect the other test lead to a clean frame ground. The meter should read “Continuity”.

RESULTS:
1. Repair, reconnect or replace any defective wire(s).
2. If wires check good, go to Test 9.

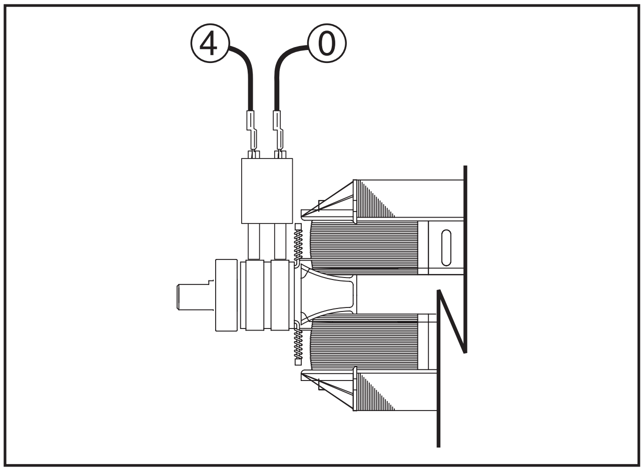


Figure 7-10. – Brush Leads

TEST 9 – CHECK BRUSHES & SLIP RINGS

DISCUSSION:

Brushes and slip rings are made of special materials that will provide hundreds of hours of service with little wear. However, when the generator has been idle for some time, an oxide film can develop on the slip rings. This film acts as an insulator and impedes the flow of excitation current to the Rotor.

If Test 4 resulted in less than one-half rated output voltage, it is possible that the brushes and slip rings are at fault.

PROCEDURE:

1. Gain access to the brushes and slip rings.
2. Remove Wire 4 from the positive (+) brush terminal.
3. Remove the ground wire (Wire 0) from the negative (-) brush.
4. Remove the brush holder, with brushes.
5. Inspect the brushes for excessive wear, damage, cracks, chipping, etc.
6. Inspect the brush holder, replace if damaged.
7. Inspect the slip rings.
   a. If slip rings appear dull or tarnished they may be cleaned and polished with fine sandpaper. DO NOT USE ANY METALLIC GRIT TO CLEAN SLIP RINGS. (A 400 grit wet sandpaper is recommended).
   b. After cleaning slip rings, blow away any sandpaper residue.

RESULTS:

1. Replace bad brushes. Clean slip rings, if necessary.
2. If brushes and rings are good, go to Test 10.

TEST 10 – CHECK ROTOR ASSEMBLY

DISCUSSION:

During the “Test 4 – Fixed Excitation Test,” if AC output voltage did not come up to about one-half rated volts, one possible cause might be a defective Rotor. The Rotor can be tested for an open or shorted condition using a volt-ohm-milliammeter (VOM).

Also see Chapter Three, “INSULATION RESISTANCE TESTS”.

PROCEDURE:

Gain access to the brushes and slip rings. Disconnect Wire 4 and Wire 0 from their respective brushes and remove the brush holder. Then, test the Rotor as follows:

1. Set a VOM to its “Rx1” scale and zero the meter.
2. Connect the positive (+) meter test lead to the positive (+) slip ring (nearest the Rotor bearing). Connect the common (-) test lead to the negative (-) slip ring. Read the resistance of the Rotor windings, in OHMS.

ROTOR RESISTANCE *	
MODEL	**OHMS**
RV45 5410/5411	13.4Ω
RV55 5412/5413	14.88Ω
RV65 5414/5415	10.81Ω

* Resistance values In ohms at 20° C. (68° F.). Actual readings may vary depending on ambient temperature. A tolerance of plus or minus 5% is allowed.

3. Set the VOM to its “Rx1 K” or “Rx10,000” scale and zero the meter.
4. Connect the positive (+) meter test lead to the positive (+) slip ring, the common (-) test lead to a clean frame ground (such as the Rotor shaft). The meter should read “Infinity”.

RESULTS:

1. Replace the Rotor if it fails the test.
2. If Rotor checks good, perform “Insulation Resistance Test,” on Page 14.

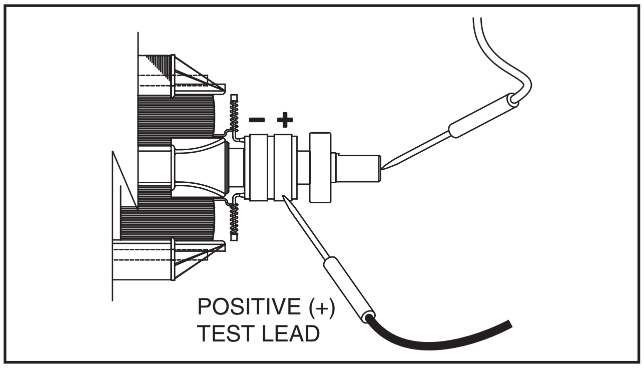


Figure 7-11. – Rotor Assembly

TEST 11 – CHECK MAIN CIRCUIT BREAKER

DISCUSSION:

The main circuit breaker on the generator panel must be closed or no output to the load will be available. A defective breaker may not be able to pass current even though it is in the “ON” position.

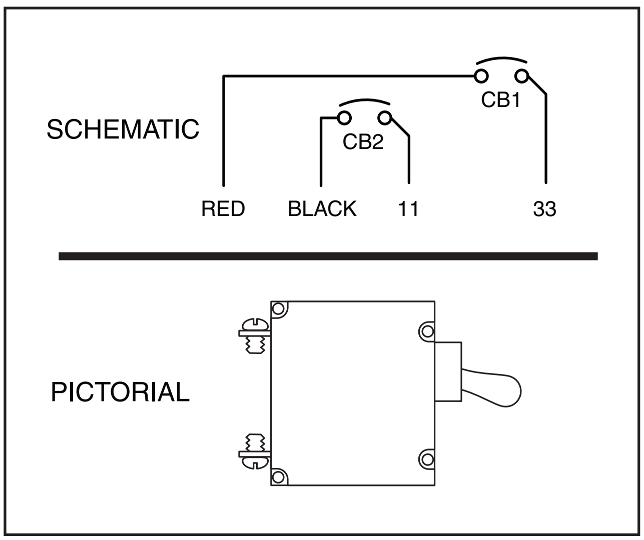


Figure 7-12. – Main Breaker (Typical)

PROCEDURE:

Set the coach main breaker to it’s “OFF” position. Check that the appropriate main breaker on the generator panel is set to its “ON” (closed) position. Set a VOM to measure resistance and use it to check for continuity across the breaker terminals.

RESULTS:

1. If breaker is “ON” and “Continuity” is measured, go to Test 3.
2. If breaker is “OFF”, reset to the “ON” position and check for AC output.
3. If breaker is “ON” and “Continuity” is not measured, replace the defective circuit breaker.

TEST 12 – CHECK LOAD VOLTAGE & FREQUENCY

DISCUSSION:

If engine speed appears to drop off excessively when electrical loads are applied to the generator, the load voltage and frequency should be checked.

PROCEDURE:

Perform this test in the same manner as Test 1, but apply a load to the generator equal to its rated capacity. With load applied check voltage and frequency.

Frequency should not drop below about 60 Hertz with the load applied.

Voltage should not drop below about 120 VAC with load applied.

RESULTS:

1. If voltage and/or frequency drop excessively when the load is applied, go to Test 13.
2. If load voltage and frequency are within limits, end tests.

TEST 13 – CHECK LOAD WATTS & AMPERAGE

DISCUSSION:

This test will determine if the generator’s rated wattage/amperage capacity has been exceeded.

Continuous electrical loading should not be greater than the unit’s rated capacity.

PROCEDURE:

Add up the wattages or amperages of all loads powered by the generator at one time. If desired, a clamp-on ammeter may be used to measure current flow. See “Measuring Current” on Page 16.

RESULTS:

1. If the unit is overloaded, reduce the load.
2. If load is within limits, but frequency and voltage still drop excessively, complete Test 2, “Check Stepper Motor Control”. If stepper motor adjustment does not correct the problem, go to Problem 8 (Flow Chart, Pages 32 and 33).

TEST 14 – TRY CRANKING THE ENGINE

DISCUSSION:

If the Start-Stop Switch on the generator panel is actuated, but the Fuel Pump does not run (priming function doesn't work), perhaps battery voltage is not available.

PROCEDURE:

Hold the Start-Stop Switch at "START". The engine should crank and start.

RESULTS:

1. If the engine cranks normally, but the priming function still doesn't work, go to Test 20.
2. If engine will not crank, go to Test 16. Refer to Problem 6 of Section 6.
3. If engine cranks but won't start, go to Problem 7 of Section 6.
4. If engine starts hard and runs rough, go to Problem 8 of Section 6.

TEST 15 – CHECK FUEL PUMP

DISCUSSION:

An inoperative Fuel Pump will (a) prevent the priming function from working and (b) prevent the engine from starting.

PROCEDURE:

1. Remove Fuel Filter and verify that filter is not clogged. Replace filter if necessary.
2. Verify that fuel is available to Fuel Filter inlet. Use an alternative fuel supply if questionable.
3. Remove air filter access panel and air filter. Remove fuel hose from pump. Place a suitable container to catch fuel from fuel pump line. Activate fuel primer switch. Pump should operate and fuel should flow. If pump does not operate, proceed to Step 4.
4. This step will test the ground wire. Disconnect Connector 2 at the Fuel Pump. Set the VOM to measure resistance. Connect one test lead to the Black wire, (Pin 2 of Connector 2) that goes to the Control Panel (see Figure 7-14). Connect the other test lead to a clean frame ground . "Continuity" should be measured.
5. To test for an open fuel pump coil, connect one test lead to the Red Wire (Pin 1 of Connector 2) going to the fuel pump. Connect the other test lead to the Black Wire (Pin 2 of Connector 2) going to the Fuel Pump (see Figure 7-14). The VOM should indicate Fuel Pump coil resistance of about 29.5 kW. (Current draw of the pump at nominal voltage is approximately 1.4 amperes MAXIMUM).

Short to Ground:

6. To test for a shorted fuel pump coil, connect one test lead to the Red Wire (Pin 2 of Connector 2, see Figure 7-14). Connect the other test lead to the fuel pump housing. "Infinity" should be measured.

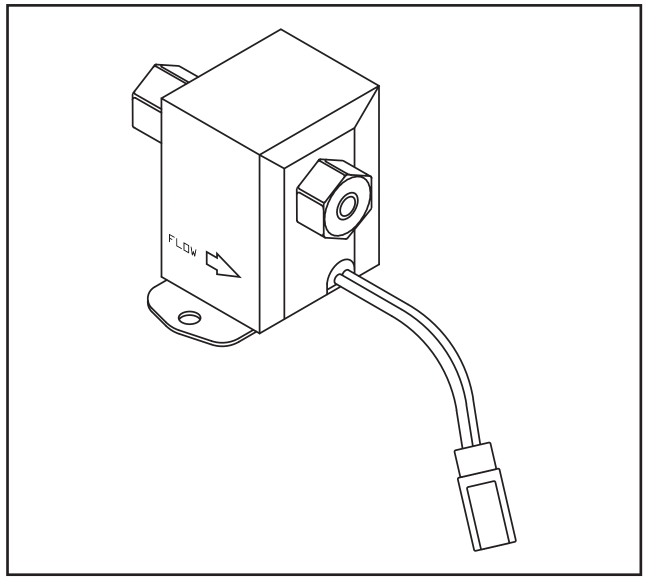


Figure 7-13. – Electric Fuel Pump

RESULTS:

1. If "Continuity" was not measured in Step 4, repair or replace Wire 0 between Connector 2 and the ground terminal.
2. If "Continuity" is measured in Step 4, but pump does not operate in Step 3, replace the Fuel Pump.
3. If the pump fails Step 5 or Step 6, replace the Fuel Pump.

Note: If desired, a pressure gauge can be attached to the pumps outlet side. Pump outlet pressure should be 2.0 to 3.5 psi.

4. If the pump operates normally, go to Test 28.

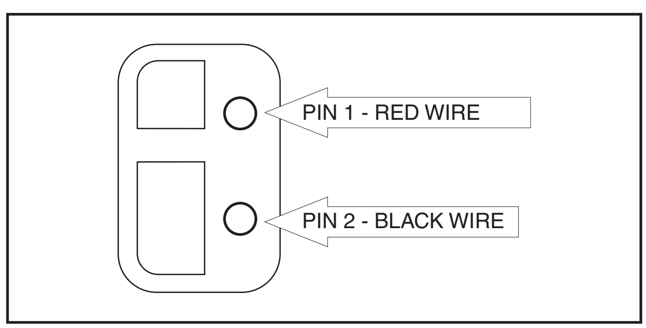


Figure 7-14. – Harness to Fuel Pump

TEST 16 – CHECK 7.5 AMP FUSE

DISCUSSION:

If the panel-mounted 7.5 amp fuse (F1) has blown, engine cranking will not be possible.

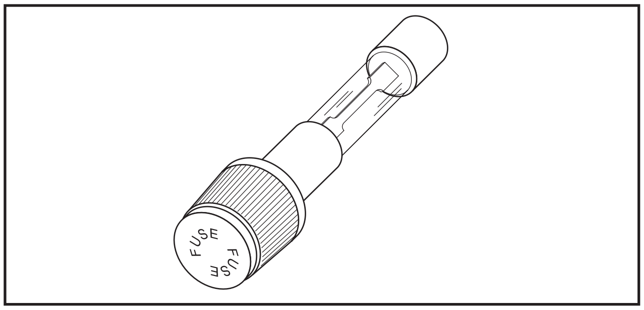


Figure 7-15. – 7.5 Amp Fuse

PROCEDURE:

Push In on fuse holder cap and turn counterclockwise. Then, remove the cap with fuse. Inspect the Fuse.

RESULTS:

If the Fuse element has melted open, replace the Fuse with an identical size fuse. If Fuse is good, go to Test 17.

TEST 17 – CHECK BATTERY & CABLES

DISCUSSION:

If the engine won't crank or cranks too slowly, the battery may be weak or discharged. See "Battery" on Page 22.

PROCEDURE:

1. Inspect the battery cables and battery posts or terminals for corrosion or tightness. Measure the voltage at the terminal of the starter contactor and verify 11-12 volts DC is available to the generator during cranking. If voltage is below 11 volts DC, measure at the battery terminals during cranking. If battery voltage is below 11 volts DC, recharge/replace battery. If battery voltage is above 11 volts DC, check for proper battery cable sizing (see "BATTERY CABLES" on Page 24). If battery or cables are still suspected, connect an alternate battery and cables to the generator and retest.
2. Use a battery hydrometer to test the battery for (a) state of charge and (b) condition. Follow the hydrometer manufacturer's instructions carefully.

RESULTS:

1. Clean battery posts and cables as necessary. Make sure battery cables are tight.
2. Recharge the battery, if necessary.
3. Replace the battery, if necessary.
4. If battery is good, but engine will not crank, go to Test 18.

TEST 18 – CHECK POWER SUPPLY TO PRINTED CIRCUIT BOARD

DISCUSSION:

If battery voltage is not available to the Printed Circuit Board (PCB), engine cranking and running will not be possible.

If battery voltage is available to the PCB, but no DC output is delivered to the board's Wire 56 terminal while attempting to crank, either the Printed Circuit Board is defective or the Start-Stop Switch has failed.

This test will determine if battery voltage is available to the Printed Circuit Board. Test 20 will check the Start-Stop Switch. Test 21 will check the DC power supply to the Printed Circuit Board's Wire 56 terminal (J1 Connector, Pin 9).

PROCEDURE:

1. Disconnect J1 Connector from the PCB.
2. On the harness end of the J1 Connector, locate J1, Pin 4 (Wire 15) (see Figure 5-3 on Page 22).
3. Set a VOM to read battery voltage. Connect the meter test leads across Printed Circuit Board Terminal J1, Pin 4 and frame ground. The meter should read battery voltage.
4. Set the VOM to measure resistance ("Rx1" scale). Connect one meter test lead to Wire 0, Pin location J1-11 on the Printed Circuit Board. Connect the other test lead to a clean frame ground. "Continuity" should be measured.

RESULTS:

1. If battery voltage is NOT indicated in Step 3, check continuity of:
   a. Wire 13 between Starter Contactor and Starter Contactor Relay.
   b. Wire 13 between Starter Contactor Relay and 7.5 Amp Fuse (F1).
   c. Wire 15 to Wire 13 on the 7.5 Amp fuse holder (F1).

   Repair, reconnect or Replace bad wiring as necessary.
2. If battery voltage is indicated but engine will not crank, go to Test 20.
3. If "Continuity" was not measured in Step 4, repair or replace Wire 0 between the Printed Circuit Board and the Ground Terminal.

TEST 19 – CHECK CONTINUITY OF WIRE 17

DISCUSSION:

A faulty condition in Wire 17 could prevent the unit from cranking when the Start-Stop switch is held in the "START" position.

PROCEDURE:

1. Disconnect Wire 17 from its Switch terminal and connect it to frame ground. The engine should crank. If unit cranks, proceed to Step 2. If unit does not crank when grounding Wire 17, go back to Test 18 "Check Power Supply to Printed Circuit Board", then repeat Step 1. If unit cranks, proceed to Test 20.
2. With Wire 17 still disconnected from SW1, disconnect the J1 Connector from the PCB.
3. Set a VOM to its "Rx1" scale and zero the meter.
4. Connect one meter test lead to each end of Wire 17.
5. "Continuity" should be measured.

RESULTS:

1. If "Continuity" is not measured in Step 5, repair or replace Wire 17.
2. If "Continuity" is measured in Step 5, replace PCB.

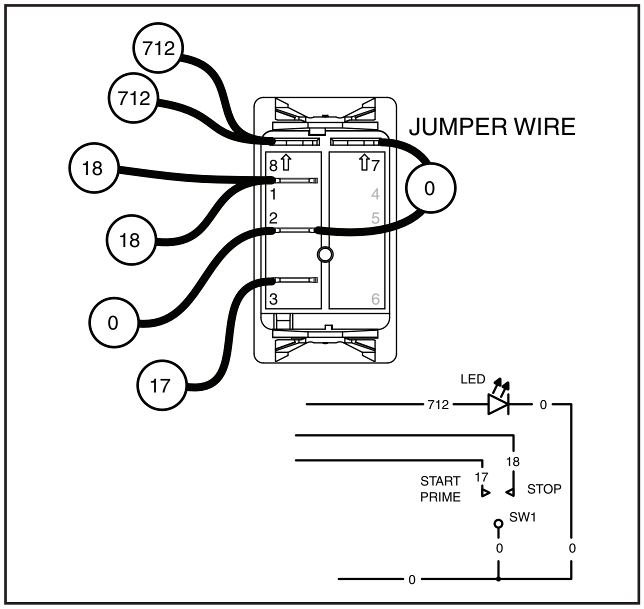


Figure 7-16. – Start-Stop Switch

TEST 20 – CHECK START-STOP SWITCH

DISCUSSION:

Engine cranking and startup is initiated when Wire 17 from the Printed Circuit Board (PCB) is connected to frame ground by setting the Start-Stop Switch to "START".

Engine shutdown occurs when Wire 18 from the PCB is connected to frame ground by the Start-Stop Switch.

A defective Start-Stop Switch can result in (a) failure to crank when the switch is set to "START", and/or (b) failure to shut down when the switch is set to "STOP".

PROCEDURE:

Refer to Problem 6 (Section 6).

1. Set a VOM to its "Rx1" scale and zero the meter.
2. Remove the 7.5 amp fuse. Disconnect all wires from Start-Stop Switch (SW1).
3. Inspect the ground Wire 0, between the Start-Stop Switch and the grounding terminal. Connect one meter test lead to Wire 0 on SW1. Connect the other test lead to a clean frame ground. "Continuity" should be measured.

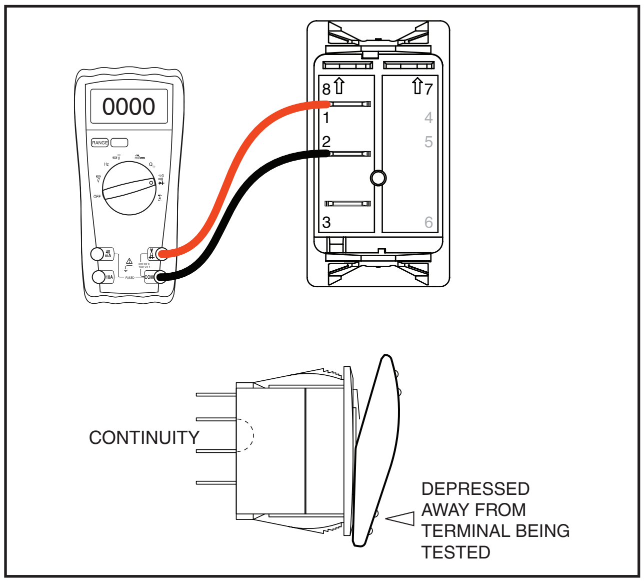


Figure 7-17. – Test 20, Step 5

5. Connect one test lead to the Terminal 1 of SW1 (see Figure 7-17). Connect the other test lead to Terminal 2 of SW1. "Continuity" should be measured.
6. Connect one test lead to the Terminal 2 of SW1 (see Figure 7-18). Connect the other test lead to Terminal 3 of SW1. "Continuity" should be measured.

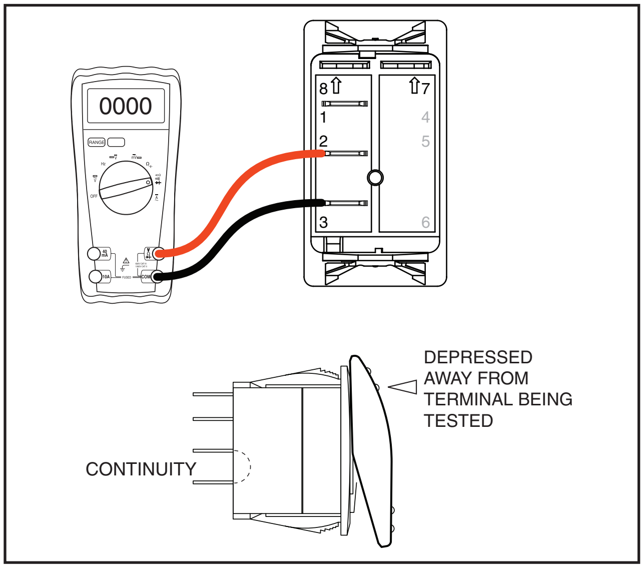


Figure 7-18. – Test 20, Step 6

RESULTS:

1. If "Continuity" is not measured in Step 3, repair, reconnect or replace Wire 0 (between Start-Stop Switch and ground terminal) as necessary.
2. If the Start-Stop Switch (SW1) failed any part of Steps 2 or 3, replace the switch.
5. If switch tests GOOD, go to Test 21.

TEST 21 – CHECK POWER SUPPLY TO WIRE 56

DISCUSSION:

If battery voltage is available to the Printed Circuit Board in Test 18, then DC voltage should be delivered to Wire 56 when the Start-Stop Switch is set to "START" (Test 20). This test will check to see if the Printed Circuit Board is delivering battery voltage to the Wire 56 terminal.

PROCEDURE:

1. Set a VOM to measure DC voltage (12 VDC).
2. Disconnect Wire 56 from its Starter Contactor Relay terminal.
3. Connect the meter positive (+) test lead to the disconnected end of Wire 56. Connect the other test lead to frame ground. No voltage should be indicated.
4. Actuate the Start-Stop Switch to its "START" position. The meter should indicate battery voltage. If battery voltage is present, stop the procedure.
5. Connect the VOM positive (+) test lead to Wire 56 (Pin Location J1-9) at the Printed Circuit Board. Connect the other test lead to frame ground.
6. Actuate the Start-Stop Switch to the "START" position. The meter should indicate battery voltage.

RESULTS:

1. If battery voltage was measured in Step 6, but not in Step 4, repair or replace Wire 56 between the Printed Circuit Board and Starter Contactor Relay.
2. If battery voltage was not available in Step 6, replace the Printed Circuit Board.
3. If battery voltage is available in Step 4 but engine does not crank, go to Test 22.

TEST 22 – CHECK STARTER CONTACTOR RELAY

DISCUSSION:

If battery voltage is available to Wire 56 but the engine won't crank, the possible cause could be a failed Starter Contactor Relay.

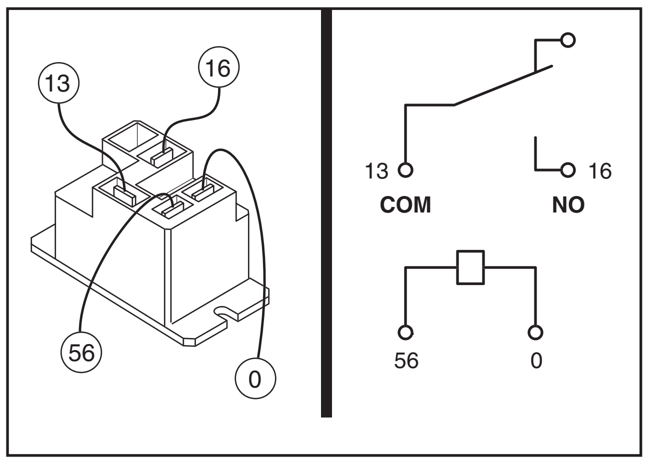


Figure 7-19. – Starter Contactor Relay

PROCEDURE:

1. Set the VOM to measure resistance ("R x 1" scale). Remove Wire 0 from the Starter Contactor Relay (SCR). Connect one meter test lead to Wire 0, and connect the other meter test lead to frame ground. "Continuity" should be measured. Reconnect Wire 0.
2. Set the VOM to measure resistance ("R x 1" scale). Disconnect Wire 16 and Wire 13 (Wire 13 is 12 VDC isolate from ground) from the Starter Contactor Relay (SCR). Connect one meter test lead to an SCR terminal, and connect the other meter test lead to the remaining SCR terminal.

"Infinity" should be measured. Set the Start-Stop Switch to "START". The meter should now read "Continuity".

Short to Ground:

3. Set the VOM to measure resistance ("R x 1" scale). Disconnect Wire 56 from the Starter Contactor Relay (SCR). Connect one meter test lead to the SCR terminal from which Wire 56 was just removed. Connect the other meter test lead to a clean frame ground. Starter Contactor Relay coil resistance of 155 ohms should be measured. If "Continuity" is measured a short to ground exists.

Note: Current draw of the Starter Contactor Relay coil at nominal voltage is approximately 80ma.

RESULTS:

1. If "Continuity" is not measured in Step 1, repair or replace Wire 0 between the Starter Contactor Relay and the ground terminal.
2. If "Continuity" was not measured in Step 2 when the Start-Stop switch was activated to "START", replace the Starter Contactor Relay.
3. If "Continuity" is measured in Step 2, go to Test 23.

TEST 23 – CHECK STARTER CONTACTOR

DISCUSSION:

The Starter Contactor (SC) must energize and it's heavy duty contacts must close or the engine will not crank. This test will determine if the Starter Contactor is in working order. The Starter Contactor is connected to the Starter Motor (see Figure 7-20).

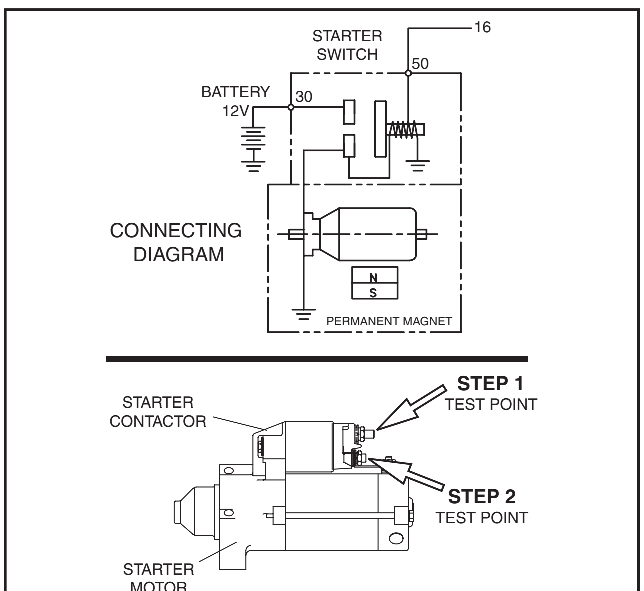


Figure 7-20. – The Starter Contactor (SC)

PROCEDURE:

1. Carefully inspect the starter motor cable that runs from the Battery to the Starter Motor. Cable connections should be clean and tight. If connections are dirty or corroded, remove cable and clean cable terminals and studs. Replace any cable that is defective or badly corroded. Set the VOM to measure DC voltage. Connect the positive (+) meter test lead to the Starter Contactor stud that the battery cable is connected to. Connect the negative (-) meter test lead to a clean frame ground. Battery voltage should be measured (see Figure 7-20, **STEP 1 TEST POINT**).
2. Set the VOM to measure DC voltage. Disconnect Wire 16 from the Starter Contactor. Connect the positive (+) meter test lead to Wire 16. Connect the negative (-) meter test lead to a clean frame ground. Set the Start-Stop Switch to "START". Battery voltage should be indicated. Reconnect Wire 16 to the Starter Contactor.
3. Set the VOM to measure DC voltage. Connect the positive (+) meter test lead to the Starter Contactor stud that has the small jumper wire connected to the Starter. Connect the negative (-) meter test lead to a clean frame ground. Set the Start-Stop Switch to "START". Battery voltage should be measured (see Figure 7-20, **STEP 2 TEST POINT**).

RESULTS:

1. If battery voltage was not measured in Step 1, repeat Test 17.
2. If battery voltage was not measured in Step 2, repair or replace Wire 16 between the Starter Contactor Relay (SCR) and the Starter Contactor (SC).
3. If battery voltage was measured in Step 1, but not in Step 3, replace the Starter Contactor.
4. If battery voltage was measured in Step 3 but the engine still does not crank, go to Test 24.

TEST 24 – CHECK STARTER MOTOR

CONDITIONS AFFECTING STARTER MOTOR PERFORMANCE:

1. A binding or seizing condition in the Starter Motor bearings.
2. A shorted, open or grounded armature.
   a. Shorted, armature (wire insulation worn and wires touching one another). Will be indicated by low or no RPM.
   b. Open armature (wire broken) will be indicated by low or no RPM and excessive current draw.
   c. Grounded armature (wire insulation worn and wire touching armature lamination or shaft). Will

be indicated by excessive current draw or no RPM.

3. A defective Starter Motor switch.
4. Broken, damaged or weak magnets.
5. Starter drive dirty or binding.

DISCUSSION:

Test 21 verified that Printed Circuit Board action is delivering DC voltage to the Starter Contactor Relay (SCR). Test 22 verified the operation of the SCR. Test 23 verified the operation of the Starter Contactor (SC). Another possible cause of an “engine won’t crank” problem is a failure of the Starter Motor.

PROCEDURE:

The battery should have been checked prior to this test and should be fully charged.

Set a VOM to measure DC voltage (12 VDC). Connect the meter positive (+) test lead to the Starter Contactor stud which has the small jumper wire connected to the Starter. Connect the common (-) test lead to the Starter Motor frame.

Set the Start-Stop Switch to its “START” position and observe the meter. Meter should Indicate battery voltage, Starter Motor should operate and engine should crank.

RESULTS:

1. If battery voltage is indicated on the meter but Starter Motor did not operate, remove and bench test the Starter Motor (see following test).
2. If battery voltage was indicated and the Starter Motor tried to engage (pinion engaged), but engine did not crank, check for mechanical binding of the engine or rotor.

If engine turns over slightly, go to Test 32 “Check and Adjust Valves.”

NOTE: If a starting problem is encountered, the engine itself should be thoroughly checked to eliminate it as the cause of starting difficulty. It is a good practice to check the engine for freedom of rotation by removing the spark plugs and turning the crankshaft over slowly by hand, to be sure it rotates freely.

WARNING! DO NOT ROTATE ENGINE WITH ELECTRIC STARTER WITH SPARK PLUGS REMOVED. ARCING AT THE SPARK PLUG ENDS MAY IGNITE THE GASOLINE VAPOR EXITING THE SPARK PLUG HOLE.

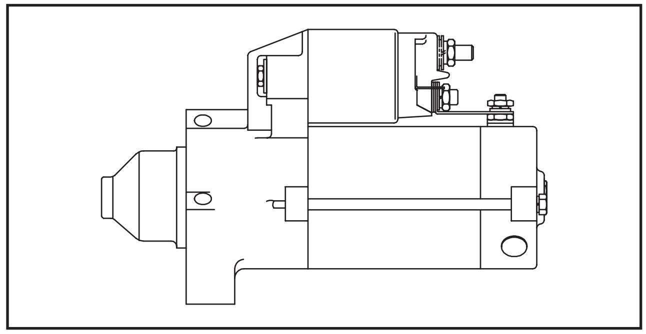


Figure 7-21. – Starter Motor (SM)

CHECKING THE PINION:

When the Starter Motor is activated, the pinion gear should move and engage the flywheel ring gear. If the pinion does not move normally, inspect the pinion for binding or sticking.

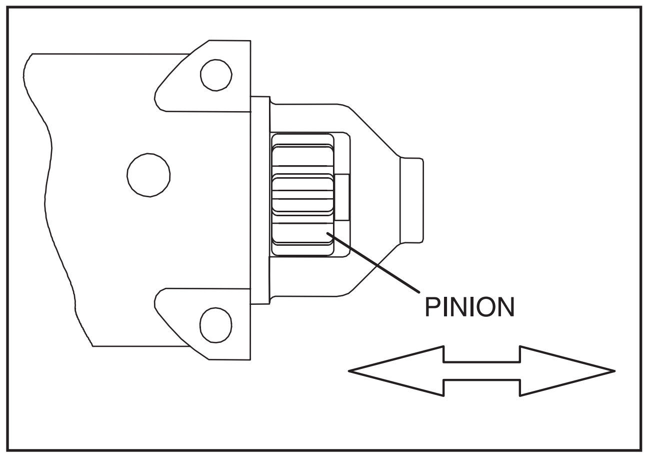


Figure 7-22. – Check Pinion Gear Operation

TOOLS FOR STARTER PERFORMANCE TEST:

The following equipment may be used to complete a performance test of the Starter Motor:

❏ A clamp-on ammeter.
❏ A tachometer capable of reading up to 10,000 rpm.
❏ A fully charged 12-volt battery.

MEASURING CURRENT:

To read the current flow, in AMPERES, a clamp-on ammeter may be used. This type of meter indicates current flow through a conductor by measuring the strength of the magnetic field around that conductor.

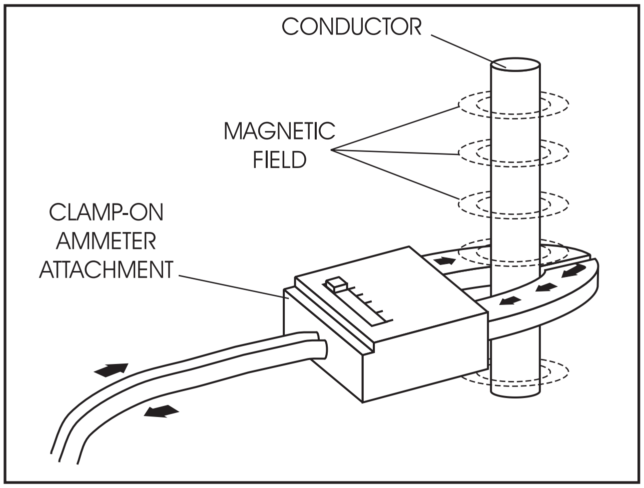


Figure 7-23. – Clamp-On Ammeter

TACHOMETER:

A tachometer is available from your Generac Power Systems source of supply. Order as P/N 042223. The tachometer measures from 800 to 50,000 RPM (see Figure 7-24).

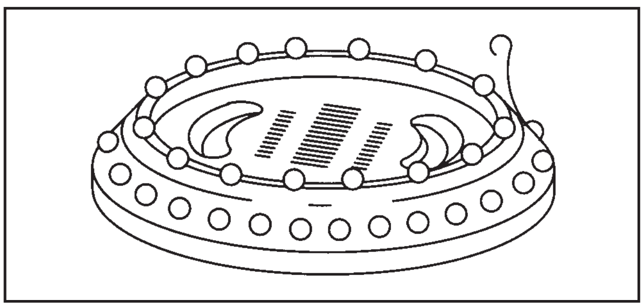


Figure 7-24. – Tachometer

TEST BRACKET:

A starter motor test bracket may be made as shown in Figure 7-25.

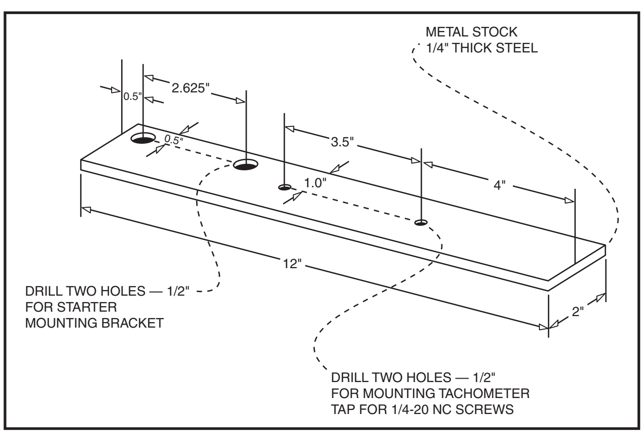


Figure 7-25. – Test Bracket

REMOVE STARTER MOTOR:

It is recommended that the Starter Motor be removed from the engine when testing Starter Motor performance. Assemble starter to test bracket and clamp test bracket in vise (Figure 7-26).

TESTING STARTER MOTOR:

1. A fully charged 12 volt battery is required.
2. Connect jumper cables and clamp-on ammeter as shown in Figure 7-26.
3. With the Starter Motor activated (jump the terminal on the Starter Contactor to battery voltage), note the reading on the clamp-on ammeter and on the tachometer (rpm).

Note: Take the reading after the ammeter and tachometer are stabilized, approximately 2-4 seconds.

4. A starter motor in good condition will be within the following specifications:

Minimum rpm	**4500**
Maximum Amps	**50**

Note: Nominal amp draw of starter in generator is 60 amps.

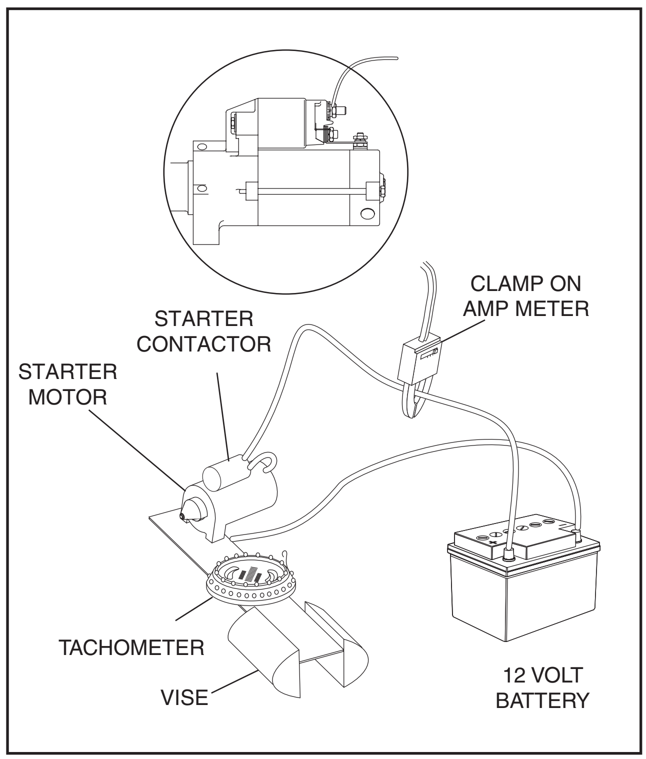


Figure 7-26. – Testing Starter Motor Performance

TEST 25 – CHECK FUEL SUPPLY

DISCUSSION (GASOLINE MODELS):

If the engine cranks but won't start, don't overlook the obvious. The fuel supply may be low. Many RV generator installations "share" the fuel tank with the vehicle engine. When such is the case, the Installer may have used a generator fuel pickup tube that is shorter than the vehicle engine's pickup tube. Thus, the generator will run out of gas before the vehicle engine.

PROCEDURE:

Check fuel level in the supply tank. Attach a fresh fuel supply if necessary and restart. Fuel may be stale, causing a hard start.

RESULTS:

1. If necessary, replenish fuel supply.
2. If fuel is good, go to Test 26 (for Problem 7, Section 6).
   Go to Test 29 for Problem 8 (Section 6).

DISCUSSION (LPG MODELS):

LP gas is stored in pressure tanks as a liquid. The gas systems used with these generators were designed only for vapor withdrawal type systems. Vapor withdrawal systems use the gas vapors that form above the liquid fuel in the tank. Do NOT attempt to use the generator with any liquid withdrawal type system.

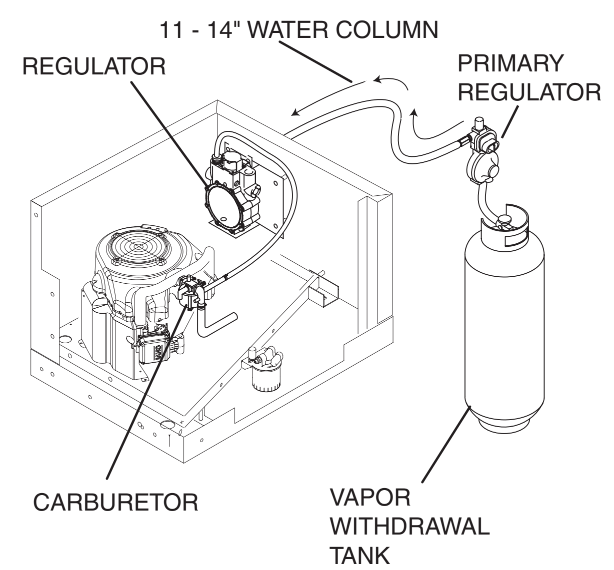


Figure 7-27 – Typical Propane Gas Fuel System

Gas pressure delivered to the solenoid valve must be properly regulated by means of a primary gas regulator. Mount the primary regulator at the gas tank outlet or in the supply line from the gas tank. The following rules apply:

- For best results, the primary regulator supplies gaseous fuel to the secondary regulator at 11 inches water column. Do NOT exceed 14 inches water column.
- The installer must be sure the primary regulator is rated at sufficient gas flow to operate the generator plus all other gas appliances in the circuit.

NOTE: Recommended MINIMUM gas flow rate for all air-cooled RV series generators is 67 cubic feet per hour.

If an existing primary gas regulator does not have a sufficient flow capacity for the generator and other gas appliances in the circuit, (a) install a primary regulator with adequate flow rate, or (b) install a separate regulator only and rated at least 67 cubic feet per hour. The inlet side of any primary regulator that supplies the generator must connect directly to a gas pressure tank. Do NOT tee the generator line into a gas circuit feeding other areas.

CAUTION! Use only approved components in the fuel supply system. All components must be properly installed in accordance with applicable codes. Improper installation or use of unauthorized components may result in fire or an explosion. Follow approved methods to test the system for leaks. No leakage is permitted. Do not allow fuel vapors to enter the vehicle interior.

LP gas vapors should be supplied to the secondary regulator inlet at about 11 inches water column (positive pressure). The engine pistons draw air in during the intake stroke (Figure 7-28). This air passes through a carburetor venturi, which creates a low pressure that is proportional to the quantity of air being pumped. The low pressure from the carburetor venturi acts on the regulator diaphragm to pull the diaphragm toward the source of low pressure. A lever attached to the diaphragm opens a valve to permit gas glow through the carburetor.

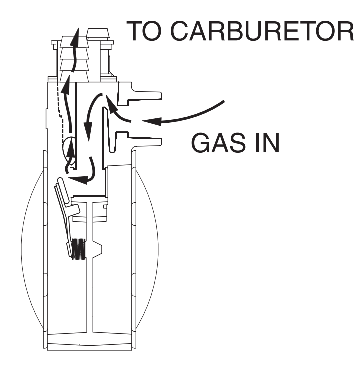


Figure 7-28 – LP Gas Carburetion Diagram

The greater the airflow through the carburetor venturi, the lower the pressure at the venturi throat. The lower the pressure at the venturi throat, the greater the diaphragm movement, and the greater the movement of the regulator valve. The more the regulator valve opens, the greater the gas flow that is proportional to airflow through the generator.

The following facts about the secondary regulator must be emphasized:

- The regulator must be sensitive to venturi throat pressure changes throughout the operating range.
- The regulator must be properly adjusted so it will stop the flow of gas when the engine is not running (no air flow through the carburetor).
- The slightest airflow (and vacuum in the venturi throat) should move the regulator valve off its seat and permit gas to flow.

PROCEDURE:

A water manometer or a gauge that is calibrated in "ounces per square inch" may be used to measure the fuel pressure. Fuel pressure at the inlet side of the LPG Shut Off Valve should be between 11-14 inches water column as measured with a manometer. The LP system must be able to maintain 11-14 inches water column under all load requirements.

1. Turn LP supply to generator off.
2. Remove the Gas Pressure Tap from the fuel regulator and install manometer to this port.
3. Turn LP supply to generator on, the gauge should read 11-14 inches water column.
4. For Problem 8 only (Section 6), start the engine and the gauge should read 11-14 inches water column.

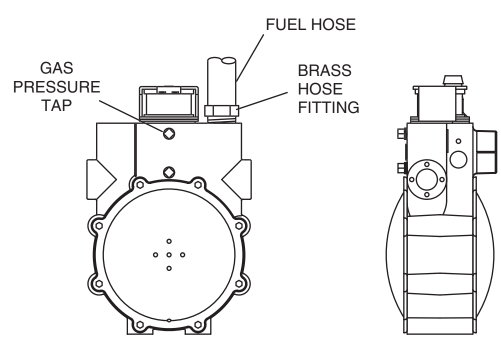


Figure 7-29. – Fuel Regulator

RESULTS:

1. If the LP gas pressure is less than 11-14 inches water column the fuel supply system must be corrected in order to maintain 11-14 inches water column.
2. If the LP gas pressure is between 11-14 inches water Column, proceed to Test 26 for Problem 7 (Section 6). Proceed to Test 29 for Problem 8 (Section 6).

TEST 26 – CHECK WIRE 14 POWER SUPPLY

DISCUSSION:

When the engine is cranked, Printed Circuit Board action must deliver battery voltage to the Wire 14 circuit, or the engine will not start. This is because the Wire 14 circuit will operate the Fuel Pump and Fuel Solenoid on Gasoline models. On LP models it operates the LPG Shut-off valve.

PROCEDURE:

Inside the generator panel, locate the 4-tab Connector (Figure 7-30). Then, proceed as follows:

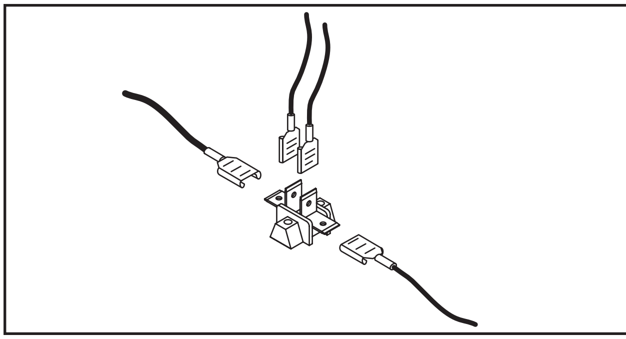


Figure 7-30. – The 4-tab Connector

1. Set a VOM to read battery voltage (12 VDC).
2. Connect the meter positive (+) test lead to the 4-tab Connector, the common (-) test lead to frame ground.
3. Crank the engine and the meter should read battery voltage. If battery voltage is not measured, proceed to Step 4.
4. Check Wire 14 for poor connection from the 4-tab Connector to the Printed Circuit Board.
5. Crank the engine. The meter should indicate battery voltage.

RESULTS:

1. If the meter indicated battery voltage, go to Test 20 "Check Start-Stop Switch".
2. If battery voltage was NOT indicated in Step 3 but is indicated in Step 5, check Wire 14 between the 4-tab Connector and the Printed Circuit Board.
   a. Repair, reconnect or replace Wire 14 as necessary.
3. If battery voltage was not indicated in Step 5, replace the Printed Circuit Board.

TEST 27 – CHECK WIRE 18

DISCUSSION:

Wire 18 controls sending the STOP signal to the Printed Circuit Board. Coach manufacturers sometimes install a 15 to 30 foot remote harness. If unit shuts down or will not start, a possible ground exists on Wire 18.

PROCEDURE:

1. Disconnect the customer installed remote harness connector from the generator. Then press the generator Start-Stop switch to the "START" position. If generator starts and continues to run, a short is present in the coach remote harness. Repair or replace the remote harness.
2. Remove the J1 connector from the Printed Circuit Board. Set the VOM to measure resistance. Connect one test lead to Pin Location J1-2. Connect the other test lead to a clean frame ground. "Infinity" should be measured.

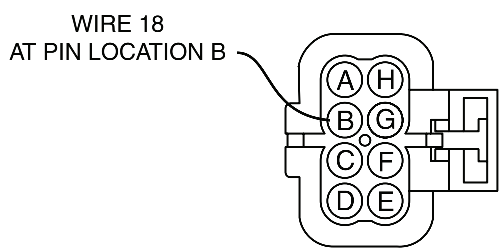


Figure 7-31. – Remote Harness Connector

3. Connect one test lead to Pin Location B on the Remote Harness connector (see Figure 7-31). Connect the other test lead to a clean frame ground. "Infinity" should be measured.

RESULTS:

1. If "Continuity" is measured in Step 2, repair or replace shorted Wire 18 between J1 Connector and Start-Stop Switch.
2. If "Continuity" was measured in Step 3, repair or replace shorted Wire 18 between J1 Connector and remote panel connector.
3. If Wire 18 checks GOOD, proceed to Problem 8 (Section 6).

TEST 28 – CHECK FUEL SOLENOID (GASOLINE MODELS)

DISCUSSION:

If the Fuel Solenoid fails to open, the engine will not start.

PROCEDURE:

1. Remove Control Panel cover. Remove Wire 56 from the Starter Contactor Relay. This will prevent the unit from cranking during test (see Figure 7-19, Page 47).
2. Remove air filter cover. Disconnect Connector 2 which connects to the fuel pump.
3. Activate the Start-Stop Switch (SW1) to the "START" position and hold. This will activate the fuel solenoid. The fuel solenoid should energize and produce an audible click. If the fuel solenoid does not operate, proceed to Step 4. Reconnect Connector 2 back to the fuel pump.
4. Set the VOM to measure DC voltage. Disconnect Wire 14 from the Fuel Solenoid. Connect the positive (+) meter test lead to Wire 14 that goes to the control panel. Connect the negative (-) test lead to a clean frame ground. Activate the Start-Stop Switch (SW1) to the "START" position and hold. Battery voltage should be measured.
5. Set the VOM to measure resistance. Disconnect Wire 0 from the Carburetor at the bullet connector. Connect one test lead to Wire 0 that goes to the control panel. Connect the other test lead to a clean frame ground. "Continuity" should be measured.
6. Connect one test lead to the Green Wire going to the carburetor. Connect the other test lead to the carburetor body. "Continuity" should be measured.

Short to Ground:

7. Set the VOM to measure resistance. Disconnect the bullet connector going to the Fuel Solenoid. Connect one meter test lead to the Red Wire going to the Fuel Solenoid. Connect the other meter test lead to the Fuel Solenoid housing. A reading of 38.0 ohms should be measured. If very low resistance is measured, a short to ground exists. (Fuel Solenoid coil resistance is approximately 38.0 ohms. Current draw of the Fuel Solenoid at nominal voltage is approximately 331 milliamps or 0.331 amps).

RESULTS:

1. If the Fuel Solenoid passes Steps 4 & 5 but does NOT operate in Step 3, replace or repair Fuel Solenoid.
2. If battery voltage is not measured in Step 4, repair or replace Wire 14 between the 4-tab Connector and the Fuel Solenoid.

3. If “Continuity” is not measured in Step 5, repair or replace Wire 0 between the Fuel Solenoid and ground terminal.
4. If “Continuity” is not measured in Step 6, repair or replace Carburetor ground wire.
5. If the Fuel Solenoid operates, proceed to Test 29.

TEST 29 – CHECK IGNITION SPARK

DISCUSSION:

A problem in the engine ignition system can cause any of the following:

- Engine will not start.
- Engine starts hard, runs rough.

A commercially available spark tester may be used to test the engine ignition system. One can also be purchased from Generac Power Systems (P/N 0C5969).

PROCEDURE:

1. Disconnect a high tension lead from a spark plug.
2. Attach the high tension lead to the spark tester terminal.
3. Ground the spark tester clamp by attaching to the cylinder head (see Figure 7-32).

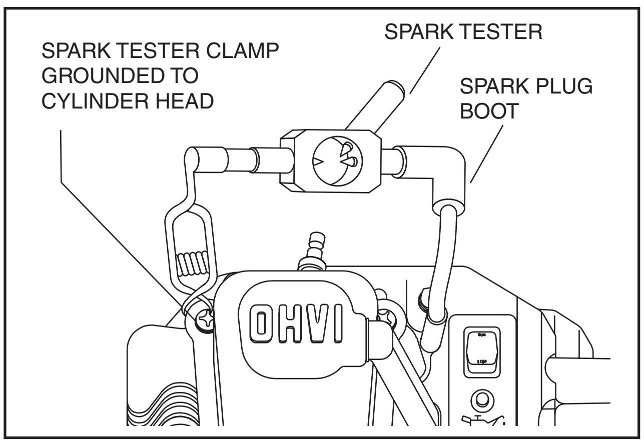


Figure 7-32. – Testing Ignition System

4. Crank the engine rapidly. Engine must be cranking at 350 rpm or more. If spark jumps the tester gap, you may assume the ignition system is working properly. Repeat on remaining cylinder spark plug.
5. To determine if an engine miss is ignition related, connect the spark tester in series with the high tension lead and the spark plug. Then, start the engine. If spark jumps the tester gap at regular Intervals, but the engine miss continues, the problem may be in the spark plug or fuel system. Repeat on remaining cylinder spark plug. Proceed to Test 30.
6. If spark jumps the tester gap intermittently, the problem may be in the Ignition Magneto. Proceed to Test 31.

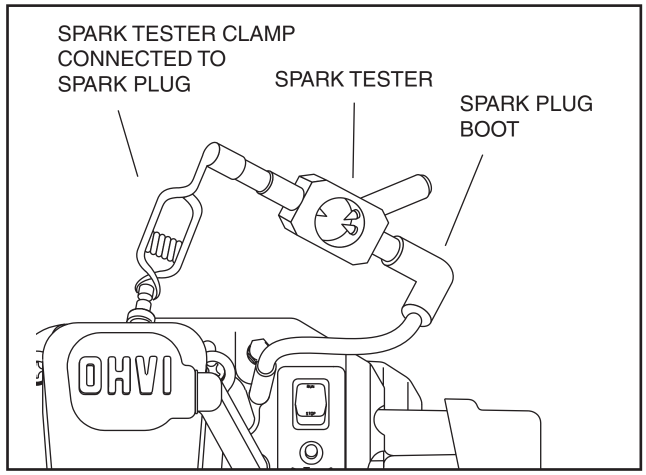


Figure 7-33. – Checking Engine Miss

RESULTS:

1. If no spark or if engine miss is apparent, go to Test 31.
2. If ignition spark is good, go to Test 30.

CYLINDER BALANCE TEST:

If the engine is hard starting, runs rough, misses or lacks power, perform a cylinder balance test to determine whether both cylinders are operating to their full potential.

Tools Required:Two Ignition Testers (Generac P/N 0C5969)

Attach an ignition tester between the spark plug lead and each spark plug (Figure 7-33).

Start and run engine running at top no load speed and note spark at ignition testers. If the spark is equal at both ignition testers, the problem is not ignition related. A spark miss will be readily apparent. Now note RPM of engine. Ground out one cylinder by contacting ignition tester and a good ground on engine as shown in Figure 7-34. Note RPM loss. Reattach plug wire then repeat procedure with the other cylinder. Note the RPM loss. If the difference between the two cylinders does not exceed 75 RPM, the amount of work the two cylinders are doing should be considered equal.

If the RPM loss is greater than 75 RPM this indicates that the grounded cylinder with the least RPM loss is the weakest of the two cylinders. Look to that cylinder for a problem.

Example:

Engine RPM - Both Cylinders = 2570 RPM
Engine RPM - No. 1 Cylinder Grounded = 2500 RPM
Engine RPM - No. 2 Cylinder Grounded = 2300 RPM

Conclusion: No. 1 cylinder is weakest of the two cylinders.

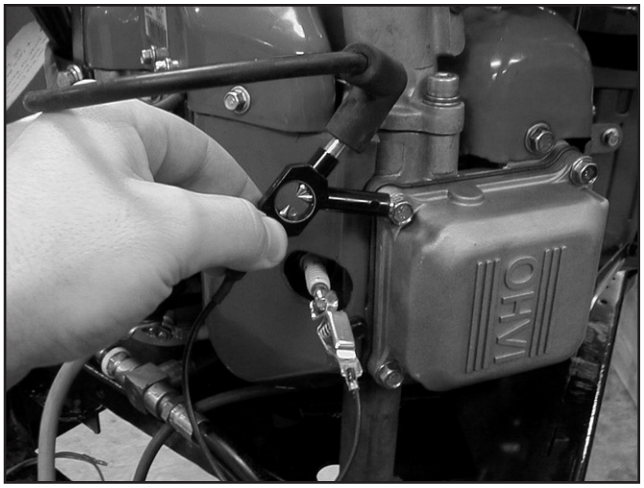


Figure 7-34. – Cylinder Balance Test

The cylinder balance test will also detect a cylinder that is not functioning. When grounding out one cylinder there will be no RPM loss. When the other cylinder is grounded out the engine will stop.

TEST 30 - CHECK SPARK PLUGS

DISCUSSION:

During Test 29, if spark jumped the tester gap, the ignition system must be functioning properly. However, if the engine misses the spark plug itself may be fouled.

PROCEDURE:

Remove spark plugs. Clean with a commercial solvent. DO NOT BLAST CLEAN SPARK PLUGS. Replace spark plugs if badly fouled, if ceramic is cracked, or if badly worn or damaged. Set gap to 0.030 inch (0.76mm). Use a NGK BPR6HS (or equivalent) replacement spark plug.

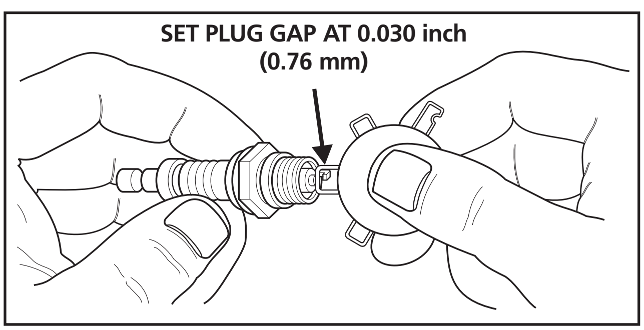


Figure 7-35 – Setting Spark Plug Gap

RESULTS:

1. Clean and regap or replace sparks plug as necessary.
2. If spark plugs are good for gasoline models, go to Test 33. For LPG models, go to Test 32.

TEST 31 – CHECK AND ADJUST IGNITION MAGNETOS

DISCUSSION:

The ignition system used on GT-530 engines is a solid-state (breakerless) type. The system utilizes a magnet on the engine flywheel to induce a relatively low voltage into an ignition magneto assembly. Ignition magneto internal components increase the voltage and deliver the resulting high voltage across the spark plug gap.

The ignition magneto houses a solid state-circuit board that controls ignition timing. Timing is fixed and spark advance is automatic.

Major components of the ignition system include (a) two ignition magneto assemblies, (b) the spark plugs, (c) the engine control printed circuit board and (d) the engine flywheel.

Solid-state components encapsulated in the ignition magneto are not accessible and cannot be serviced. If the magneto is defective, the entire assembly must be replaced. The air gap between the magneto and the flywheel magnet is between 0.012" to 0.015".

The ignition magneto assembly (Figure 7-36) consists of (a) ignition magneto, (b) spark plug high tension lead and (c) spark plug boot.

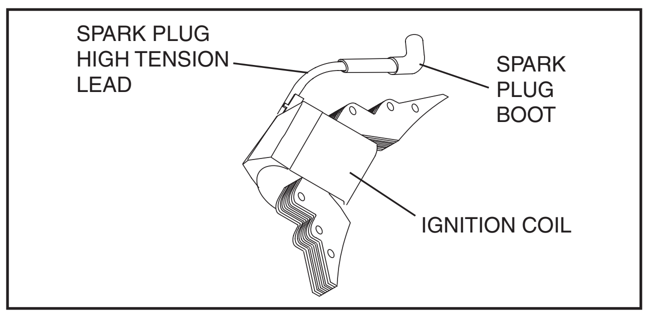


Figure 7-36. – Ignition Magneto Assembly

In Test 29, a spark tester was used to check for engine ignition. If sparking or weak spark occurred, one possible cause might be the ignition magneto(s). This test consists of adjusting the air gap between the ignition magneto(s) and the flywheel. The flywheel and flywheel key will also be checked during this test. If no sparking occurs, the ground harness may be at fault.

PROCEDURE:

1. Disconnect the J1 connector from the Printed Circuit Board. Carefully remove Wire 18A from Pin Location J1-14. Connect the J1 connector back to the Printed Circuit Board. Repeat Test 29 "Check Ignition Spark". If the unit now produces spark go

to Step 2. If the unit does not produce spark or has weak spark go to Step 4.

2. Do the following:
   a. Set a VOM to measure resistance. Connect the positive (+) meter test lead to Wire 18A (Wire 18A still removed from the J1 connector) Connect the negative (-) meter test lead to a clean frame ground. “Infinity” should be measured, or 0.5 to 1M ohms, depending upon the type of VOM used. If “Continuity” is measured proceed to Step 12.
   b. Set a VOM to the diode test range. Attach the negative (-) meter test lead to Pin Location J1-14 on the Printed Circuit Board. (Wire 18A still removed from the J1 connector) Attach the positive (+) meter test lead to frame ground. Set the Start-Stop Switch to “START”. “Infinity” should be measure during cranking and running. If the VOM does not have a diode test range, set VOM to measure resistance again. “Infinity” should be measured.
3. If Step 1 produced spark and Step 2 tested good, set the VOM to measure DC voltage. Connect one test lead to Wire 15 (J1-4) on PCB. Connect the other test lead to frame ground. Battery voltage should be measured. Verify that Wire 15 is connected to J1 and that Wire 14 is connected to J1-5; if reversed the unit will produce no spark.
4. Rotate the flywheel until the magnet is under the module (armature) laminations (see Figure 7-37).
5. Place a 0.012-0.015 inch thickness gauge between the flywheel magnet and the module laminations.

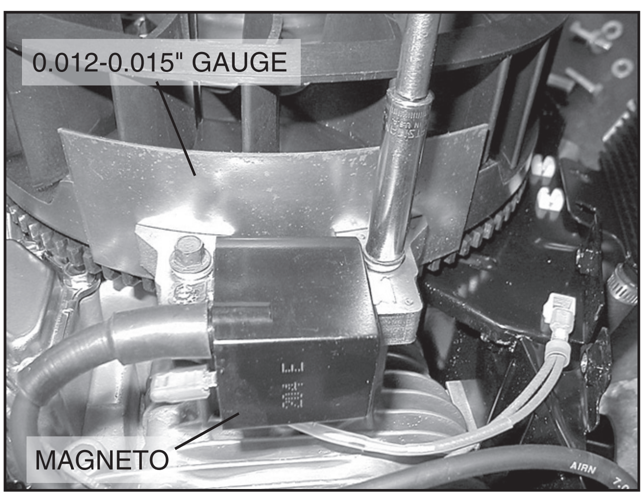


Figure 7-37. – Setting Ignition Magneto (Armature) Air Gap

6. Loosen the mounting screws and let the magnet pull the magneto down against the thickness gauge.
7. Tighten both mounting screws.
8. To remove the thickness gauge, rotate the flywheel.
9. Repeat the above procedure for the second magneto.
10. Repeat Test 55 and check for spark across the spark tester gap.
11. If air gap was not out of adjustment, test ground wires.
12. Set the VOM to the diode test position. The meter will display forward voltage drop across the diode. If the voltage drop is less than 0.7 volts, the meter will “Beep” once as well as display the voltage drop. A continuous tone indicates “Continuity” (shorted diode). An incomplete circuit (open diode) will be displayed as “OL.”
13. Disconnect the engine ground harness from the ignition magnetos and stud connector (see Figure 7-38).

<u>RESULTS:</u>

1. If “Infinity” was not measured in Step 2b, replace the Printed Circuit Board.

Note: If VOM was set to Diode test, a reading of 0.5 volts would be observed when the Start-Stop Switch is set to “STOP”. If the VOM was set to resistance, a reading of 0.5 to 1.5M ohms would be measured. During cranking and running this reading should go to “Infinity”. Verify that the meter leads were properly connected as per Step 2 instructions.

2. If battery voltage was not measured in Step 3, reconnect Wire 15 and Wire 14 to their correct terminal locations.

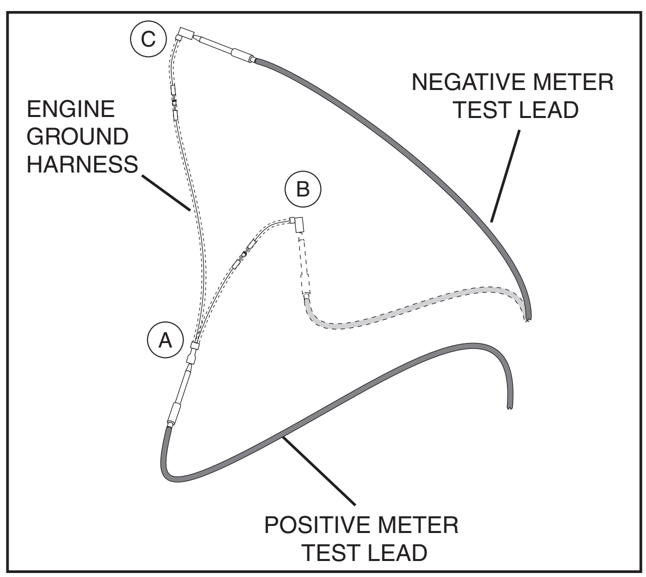


Figure 7-38. – Engine Ground Harness Test Points

3. If “Infinity” was not measured in Step 15, repair or replace grounded Wire 18A between the J1 Connector and the insulated terminal stud or defective insulated terminal stud.
4. If sparking still does not occur after adjusting the armature air gap, testing the ground wires and performing the basic flywheel test, replace the ignition magneto(s).

Note: Before replacing the Ignition Magneto, check the Flywheel Magnet.

CHECKING FLYWHEEL MAGNET:

The flywheel magnet rarely loses its magnetism. If you suspect a magnet might be defective, a rough test can be performed as follows:

1. Place the flywheel on a wooden surface.
2. Hold a screwdriver at the extreme end of its handle and with its point down.
3. Move the tip of the screwdriver to about 3/4 inch (19mm) from the magnet. The screwdriver blade should be pulled in against the magnet.

FLYWHEEL KEY:

In all cases, the flywheel taper is locked on the crankshaft taper by the torque of the flywheel nut. A keyway is provided for alignment only and theoretically carries no load.

If the flywheel key becomes sheared or even partially sheared, ignition timing can change. Incorrect timing can result in hard starting or failure to start.

Remove and inspect flywheel key for damage.

TEST 32 – CHECK VALVE ADJUSTMENT

DISCUSSION:

The valve lash must be adjusted correctly in order to provide the proper air/fuel mixture to the combustion chamber.

ADJUSTING VALVE CLEARANCE:

Adjust valve clearance with the engine at room temperature. The piston should be at top dead center (TDC) of its compression stroke (both valves closed).

An alternative method is to turn the engine over and position the intake valve fully open (intake valve spring compressed) and adjust the exhaust valve clearance. Turn the engine over and position the exhaust valve fully open (exhaust valve spring compressed) and adjust the intake valve clearance.

Correct valve clearance is given below, in INCHES (MILLIMETERS).

Intake Valve	**0.002-0.004 (0.05-0.1)**
Exhaust Valve	**0.002-0.004 (0.05-0.1)**

1. Loosen the rocker arm jam nut. Use a 10mm allen wrench to turn the pivot ball stud while checking the clearance between the rocker arm and valve stem with a feeler gauge (see Figure 7-39).
2. When clearance is correct, hold the pivot ball stud with the allen wrench and tighten the rocker arm jam nut to the specified torque with a crow’s foot. After tightening the jam nut, recheck valve clearance to make sure it did not change.

TORQUE SPECIFICATION
ROCKER ARM JAM NUT
174 inch-pounds

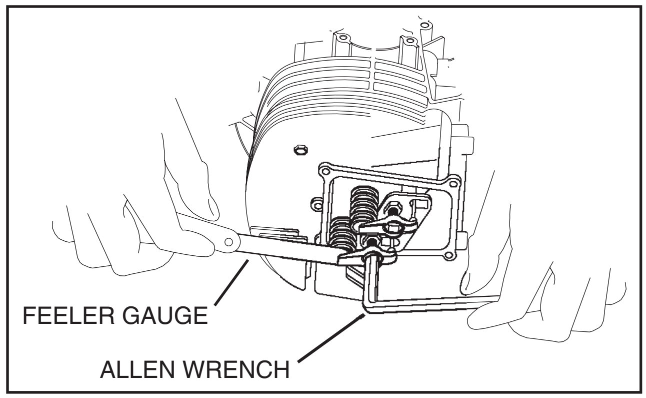


Figure 7-39 – Adjusting Valve Clearance

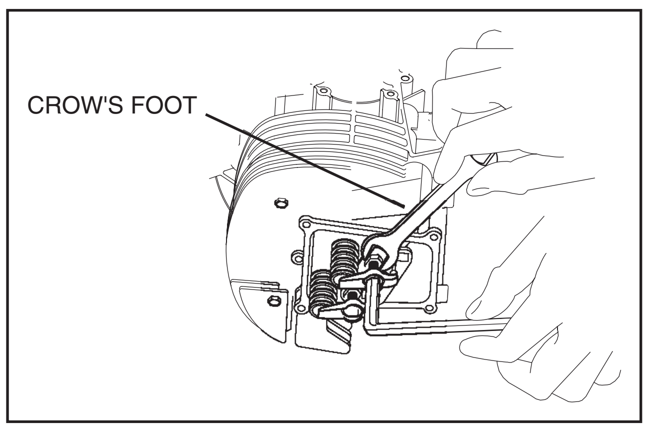


Figure 7-40 – Tightening the Jam Nut

INSTALL ROCKER ARM COVER

1. Use a new rocker arm cover gasket. Install the rocker arm cover and retain with four screws.

RESULTS:

Adjust valves to specification and retest. If problem continues, go to Test 35.

TEST 33 – CHECK CARBURETION

DISCUSSION:

If the engine cranks but will not start, one possible cause of the problem might be the carburetion system.

PROCEDURE:

Before making a carburetion check, be sure the fuel supply tank has an ample supply of fresh, clean gasoline.

Check that all shutoff valves are open and fuel flows freely through the fuel line.

Make sure the automatic choke operates properly.

If the engine will not start, remove and inspect the spark plug. If the spark plug is wet, look for the following:

❏ Overchoking.
❏ Excessively rich fuel mixture.
❏ Water in fuel.
❏ Intake valve stuck open.
❏ Needle/float stuck open.

If the spark plug is dry look for the following:

❏ Leaking carburetor mounting gaskets.
❏ Intake valve stuck closed.
❏ Inoperative fuel pump.
❏ Plugged fuel filter(s).
❏ Varnished carburetor

If the engine starts hard or will not start, look for the following:

❏ Physical damage to the AC generator. Check the Rotor for contact with the Stator.
❏ Starting under load. Make sure all loads are disconnected or turned off before attempting to crank and start the engine.
❏ Check that the automatic choke is working properly.

RESULTS:

If problem has not been solved, go to Test 34. If carburetor is varnished, clean or replace.

1. Remove fuel line at carburetor and ensure that there is an adequate amount of fuel entering the carburetor.
2. Remove the float bowl and check to see if there is any foreign matter in bottom of carburetor bowl.
3. The float is plastic and can be removed for access to the needle so it can be cleaned.
4. With all of this removed carburetor cleaner can be used to clean the rest of the carburetor before reassembly.
5. After cleaning carburetor with an approved carburetor cleaner, blow dry with compressed air and reassemble.

Shelf life on gasoline is 30 days. Proper procedures need to be taken for carburetors so that the fuel doesn't varnish over time. A fuel stabilizer must be used at all times in order to ensure that the fuel is fresh at all times.

TEST 34 – CHECK CHOKE SOLENOID

DISCUSSION:

The automatic choke is active only during cranking. When the Start-Stop Switch is held at "START", a crank relay on the Printed Circuit Board is energized closed to (a) crank the engine and (b) deliver a cyclic voltage to the Choke Solenoid via Wire 14. The Choke Solenoid will be pulled in for about two seconds, then deactivate for about two seconds. This cyclic choking action will continue as long as the engine is being cranked.

PROCEDURE:

1. Operational Check: Crank the engine. While cranking, the choke solenoid should pull in about every 2 seconds (2 seconds ON, 2 seconds OFF). If the choke solenoid does not pull in, try adjusting the choke as follows.
2. Pre-Choke Adjustment: With the CHOKE SOLENOID not actuated, the carburetor CHOKE PLATE should be approximately 1/8 Inch from its full open position. Verify choke is completely open once engine is warmed up. If not, power will be down and emissions will be up. Adjust position of BI-METAL HEATER ASSEMBLY by loosening screws until unit starts when cold and the choke closes when engine is up to temperature. Tighten the screws to complete the adjustment.

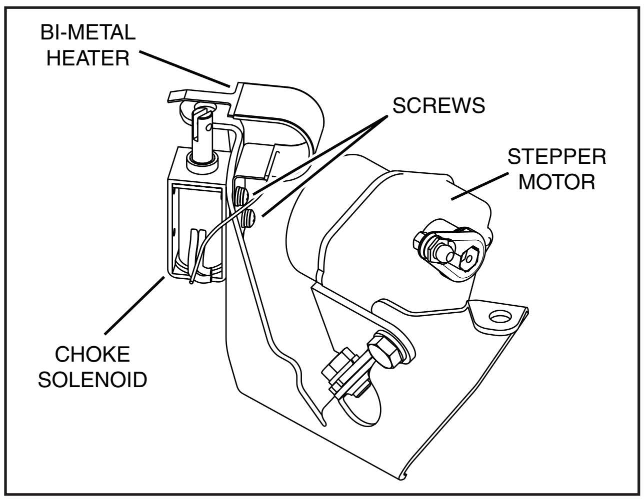


Figure 7-41. – Automatic Choke Assembly

3. Choke Solenoid Adjustment: Loosen the screws that retain the CHOKE SOLENOID to its bracket. Slide the CHOKE SOLENOID in the slotted holes of the bracket to adjust axial movement of the SOLENOID PLUNGER. Adjust SOLENOID PLUNGER movement until, with the carburetor CHOKE PLATE 0.5mm from closed, the CHOKE SOLENOID is bottomed in its coil (plunger at full actuated position). With the CHOKE PLATE 0.5mm from closed and the plunger bottomed

in its coil, tighten the two screws. Verify that the choke solenoid plunger and linkage move freely without any drag or resistance that may restrict movement.

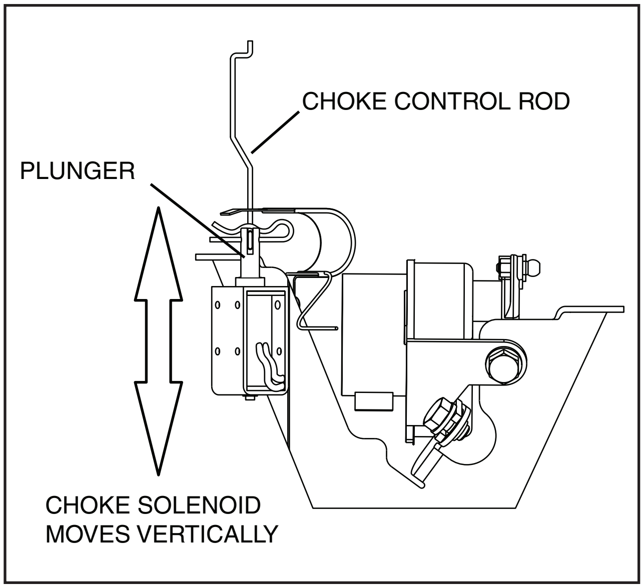


Figure 7-42. – Choke Solenoid Adjustment

4. Disconnect Connector 3: Set the VOM to measure DC voltage. Connect the positive (+) test lead to Wire 90 (Pin 2) of Connector 3 going to the control panel. Connect the negative (-) test lead to frame ground. Activate the Start-Stop Switch to "START." During cranking, battery voltage should be measured cyclically every two seconds.
5. If battery voltage was not measured in Step 4, check at J1 Connector: Connect positive (+) test lead to Pin Location J1-2 at the Printed Circuit Board. Connect the negative (-) test lead to frame ground. Activate the Start-Stop Switch to "START." During cranking, battery voltage should be measured cyclically every two seconds.

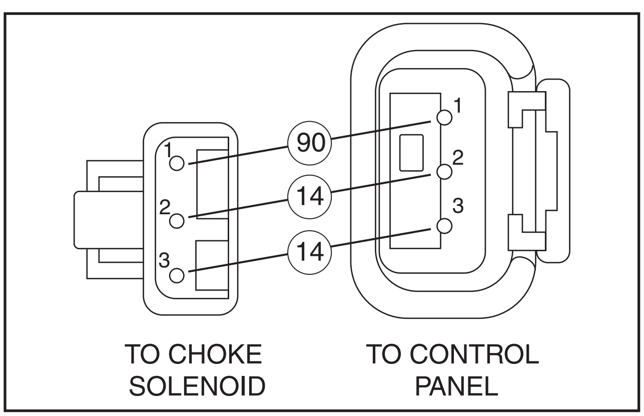


Figure 7-43. – Connector 3

6. Set the VOM to measure resistance. Disconnect Connector 3 from the Choke Solenoid. Connect one test lead to Wire 0 (Pin 1) of Connector 3, going to the control panel. Connect the other test lead to frame ground. "Continuity" should be measured.
7. Set the VOM to measure resistance. Disconnect Connector 3. Connect one meter test lead to Wire 90 (Connector 3, Pin 2) going to the Choke Solenoid. Connect the other meter test lead to Wire 0 (Connector 3, Pin 1). Approximately 3.7 ohms should be measured. (Current draw of Choke Solenoid at nominal voltage is 3.4 amps).

Short to Ground:

8. Set the VOM to measure resistance. Disconnect Connector 3. Connect one meter test lead to Wire 90 (Connector 3, Pin 2). Connect the other meter test lead to the metal Choke Solenoid housing. "Infinity" should be measured. If "Continuity" is measured, a short to ground exists.

RESULTS:

1. If Choke operation is good, go to Test 32 for Problem 7, "Engine Cranks but Won't Start" (Section 6). Go to Test 41 for Problem 8, "Engine Starts Hard and Runs Rough".
2. If battery voltage was measured in Step 5 but not measured in Step 4, repair or replace Wire 90 between Printed Circuit Board (PCB) and Connector 3.
3. If battery voltage is not measured in Step 5 during engine cranking, replace PCB.
4. If "Continuity" is not measured in Step 6, repair or replace Wire 0 between the ground terminal and Connector 3.
5. If Choke Solenoid coil resistance is not measured or is incorrect in Step 7, replace the Choke Solenoid.

TEST 35 – CHECK ENGINE / CYLINDER LEAK DOWN TEST / COMPRESSION TEST

GENERAL:

Most engine problems may be classified as one or a combination of the following:

❏ Will not start.
❏ Starts hard.
❏ Lack of power.
❏ Runs rough.
❏ Vibration.
❏ Overheating.
❏ High oil consumption.

DISCUSSION:

The Cylinder Leak Down Tester checks the sealing (compression) ability of the engine by measuring air leakage from the combustion chamber. Compression loss can present many different symptoms. This test is designed to detect the section of the engine where the fault lies before disassembling the engine.

PROCEDURE:

1. Remove a spark plug.
2. Gain access to the flywheel. Remove the valve cover.
3. Rotate the engine crankshaft until the piston reaches top dead center (TDC). Both valves should be closed.
4. Lock the flywheel at top dead center.
5. Attach cylinder leak down tester adapter to spark plug hole.
6. Connect an air source of at least 90 psi to the leak down tester.
7. Adjust the regulated pressure on the gauge to 80 psi.
8. Read the right hand gauge on the tester for cylinder pressure. 20 percent leakage is normally acceptable. Use good judgement, and listen for air escaping at the carburetor, the exhaust, and the crankcase breather. This will determine where the fault lies.
9. Repeat Steps 1 through 8 on remaining cylinder.

RESULTS:

❏ Air escapes at the carburetor – check intake valve.
❏ Air escapes through the exhaust – check exhaust valve.
❏ Air escapes through the breather – check piston rings.
❏ Air escapes from the cylinder head – the head gasket should be replaced.

CHECK COMPRESSION:

Lost or reduced engine compression can result in (a) failure of the engine to start, or (b) rough operation. One or more of the following will usually cause loss of compression:

❏ Blown or leaking cylinder head gasket.
❏ Improperly seated or sticking-valves.
❏ Worn Piston rings or cylinder. (This will also result in high oil consumption).

NOTE: It is extremely difficult to obtain an accurate compression reading without special equipment. For that reason, compression values are not published for the V-Twin engine. Testing has proven that an accurate compression indication can be obtained using the following method.

PROCEDURE:

1. Remove both spark plugs.
2. Insert a compression gauge into either cylinder.
3. Crank the engine until there is no further increase in pressure.
4. Record the highest reading obtained.
5. Repeat the procedure for the remaining cylinder and record the highest reading.

RESULTS:

The difference in pressure between the two cylinders should not exceed 25 percent. If the difference is greater than 25 percent, loss of compression in the lowest reading cylinder is indicated.

Example 1: *If the pressure reading of cylinder #1 is 165 psi and of cylinder #2, 160 psi, the difference is 5 psi. Divide "5" by the highest reading (165) to obtain the percentage of 3.0 percent.*

Example 2: *No. 1 cylinder reads 160 psi; No. 2 cylinder reads 100 psi. The difference is 60 psi. Divide "60" by "160" to obtain "37.5" percent. Loss of compression in No. 2 cylinder is indicated.*

If compression is poor, look for one or more of the following causes:

❏ Loose cylinder head bolts.
❏ Failed cylinder head gasket.
❏ Burned valves or valve seats.
❏ Insufficient valve clearance.
❏ Warped cylinder head.
❏ Warped valve stem.
❏ Worn or broken piston ring(s).
❏ Worn or damaged cylinder bore.
❏ Broken connecting rod.
❏ Worn valve seats or valves.
❏ Worn valve guides.

NOTE: Refer to Engine Service manual P/N xxxxxx for further engine service information.

TEST 36 – CHECK OIL PRESSURE SWITCH

DISCUSSION:

Also see "Operational Analysis" on Pages 18-23. The Low Oil Pressure Switch is normally-closed, but is held open by engine oil pressure during cranking and startup. Should oil pressure drop below a safe level, the switch contacts will close to ground the Wire 85 circuit. Printed Circuit Board action will then initiate an automatic shutdown.

If the switch fails CLOSED, the engine will crank and start, but will then shut down after a few seconds.

If the switch fails OPEN, low oil pressure will not result in automatic shutdown.

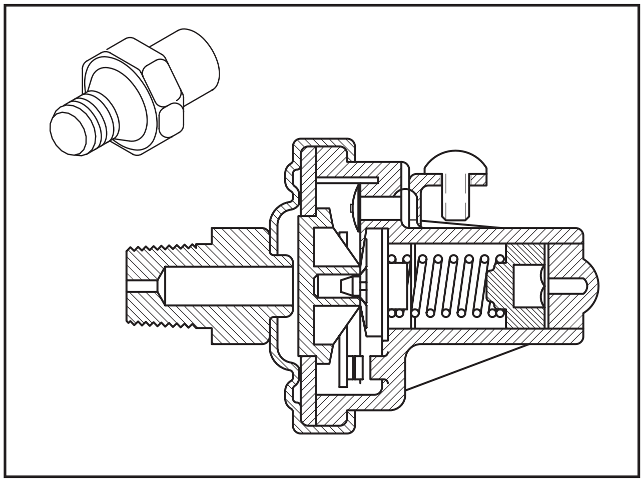


Figure 7-44. – Oil Pressure Switch

PROCEDURE:
1. Check engine oil level. If necessary, replenish oil level to the dipstick "FULL" mark.
2. Set a VOM to its "Rx1" scale and zero the meter.
3. Connect the meter test leads across the switch terminals, with engine shut down. The meter should read "Continuity". A small amount of resistance is acceptable.
4. Crank the engine. Oil pressure should open the switch contacts at some point while cranking and starting. Meter should then indicate "Infinity".
5. If the contacts did not open in Step 5, remove the low oil pressure switch and connect an oil pressure gauge in it's place. Start the engine and measure oil pressure. Pressure should be above 10 psi.

RESULTS:
1. In Step 3, if "Continuity" is not indicated, replace the switch.
2. If oil pressure checked good in Step 5, but Step 4 measured "Infinity," replace the low oil pressure switch.
3. If oil pressure is below 10 psi, determine cause of low oil pressure. Verify that the oil is the proper viscosity for the climate and season.
4. If all steps check GOOD, go to Test 37.

TEST 37 – CHECK WIRE 86 FOR CONTINUITY

PROCEDURE:
1. Disconnect the J1 Connector from the Printed Circuit Board.
2. Locate Pin Location J1-6 on the harness end of the J1 Connector.
3. Remove Wire 86 from the Low Oil Pressure switch (LOP).
4. Set a VOM to its "Rx1" scale and zero the meter.
5. Insert one meter test lead into the end of Wire 86 disconnected from the LOP. Insert the other meter test lead into Pin Location J1-6 on the harness end of the J1 Connector.

RESULTS:
1. If "Continuity" is not indicated, repair or replace Wire 86.
2. If "Continuity" is indicated, replace the Printed Circuit Board.

TEST 38 – TEST OIL TEMPERATURE SWITCH

DISCUSSION:
If the engine cranks, starts and then shuts down, one possible cause of the problem may be a high oil temperature condition. Protective shutdown is a normal occurrence if the oil temperature switch exceeds approximately 270° F for gasoline units, or 284° F for LP units.

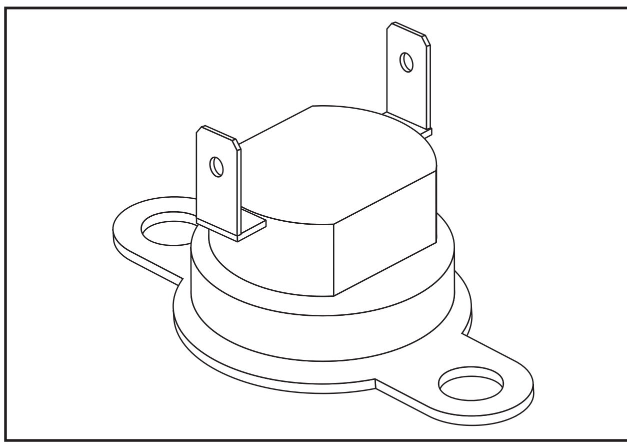


Figure 7-45. – Oil Temperature Switch

PROCEDURE:
1. Remove Wire 85 from Oil Temperature Switch terminal and start the generator. If engine starts and runs now, but shuts down when Wire 85 is connected to the switch terminal, the following possibilities exist:
   a. Oil temperature is too high.
   b. The oil temperature switch has failed closed or is shorted to ground.
2. Remove the switch and place its sensing tip into oil (Figure 7-46). Place a thermometer into the oil.

3. Connect the test leads of a VOM across the switch terminals. The meter should read “Infinity”.
4. Heat the oil. When oil temperature reaches approximately 270-284° F., the switch contacts should close and the meter should read “Continuity”.

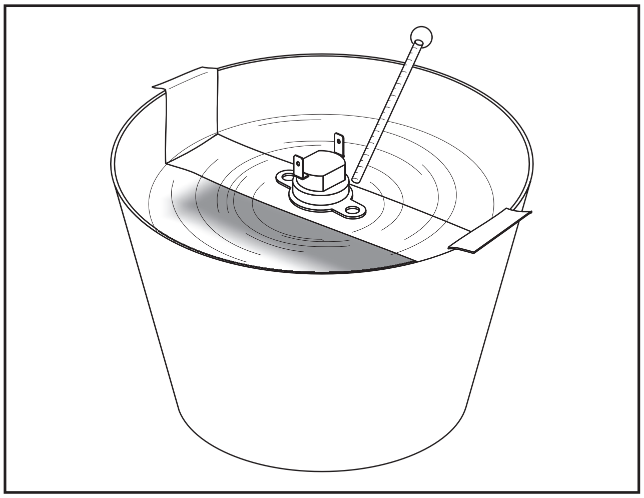


Figure 7-46. – Testing Oil Temperature Switch

RESULTS:
1. If the Oil Temperature Switch fails Step 3 or Step 4, replace the Oil Temperature Switch.
2. If the Oil Temperature Switch is good, an overheat condition may be occurring. Verify that the installation of the generator is within specified tolerances. The generator must receive the proper amount of incoming air, and also be able to exhaust the cooling air with NO RESTRICTIONS. Check to be sure that the exhaust pipe is not under the air intake. Refer to the Owner’s and Installation Manual for proper installation specifications. If installation is correct, go to Test 20.

TEST 39 – CHECK WIRE 85 FOR CONTINUITY

PROCEDURE:
1. Disconnect the J1 Connector from the Printed Circuit Board.
2. Locate Pin Location J1-7 on the harness end of the J1 Connector.
3. Remove Wire 85 from the High Oil Temperature switch (HOT).
4. Set a VOM to its “Rx1” scale and zero the meter.
5. Insert one meter test lead into the end of Wire 85 disconnected from the HOT. Insert the other meter test lead into Pin Location J1-7 on the harness end of the J1 Connector.

RESULTS:
1. If “Continuity” is not indicated, repair or replace Wire 85.
2. If “Continuity” is indicated, replace the Printed Circuit Board.

TEST 40 – TEST CHOKE HEATER

DISCUSSION:

The Choke Heater is a sensitive heating element wrapped around a temperature sensitive Bi-Metal strip. The BI-METAL HEATER ASSEMBLY positions the Choke Plate during startup. Once running, the Bi-Metal Heater Assembly will also allow the Choke Plate to fully open. Power for the heater element is supplied from Wire 14 to assist the Bi-Metal Heater Assembly in opening the Choke Plate after starting. Failure of the Choke Plate to open will cause an excessively rich fuel-air mixture and engine performance will suffer.

PROCEDURE:
1. Verify that the Choke Plate on the carburetor is mechanically free to move and is not binding. If the engine runs rough, check the operation of the BI-METAL HEATER ASSEMBLY. Allow the engine to run for five minutes, then inspect the choke position. The Bi-Metal strip should have been heated by the Choke Heater and should have expanded to allow the Choke Plate to open fully.
2. If the Choke Plate did not open in Step 1, check the Choke Heater. Set the VOM to measure DC voltage. Disconnect Connector 3 at the Choke Assembly. Connect the positive (+) meter test lead to Wire 14 (Connector 3, Pin 3) going to the control panel. Connect the negative (-) meter test lead to a clean frame ground. Set the Start-Stop Switch to “START.” Battery voltage should be measured (see Figure 7-43 on Page 63).
3. If battery voltage was not measured in Step 2, set the VOM to measure resistance. Disconnect Connector 3 at the Choke Assembly. Connect one meter test lead to Wire 14 (Connector 3, Pin 3) going to the control panel. Connect the other meter test lead to the 4-tab Connector for Wire 14 in the control panel. “Continuity” should be measured.

SHORT TO GROUND:

Set the VOM to measure resistance. Connect one meter test lead to Wire 14 (Connector 3, Pin 3) going to the Bi-Metal Heater Assembly. Connect the other meter test lead to the exposed steel portion of the Bi-Metal Heater Assembly. Approximately 37 ohms (±20%) should be measured. (Current draw of the Bi-Metal Heater Assembly at nominal voltage is approximately 340 milliamps or 0.340 amps). If “Continuity” is present the Bi-Metal Heater Assembly has a short to ground.

RESULTS:
1. If Choke Plate is binding in Step 1, repair or replace binding Choke Plate. If Bi-Metal Heater Assembly tests good, go to Test 32.
2. If continuity was not measured in Step 3, repair or replace Wire 14 between the 4-tab Connector and Connector 3.
3. If the resistance value is incorrect in the Short to Ground step, or the Bi-Metal Heater Assembly does not function with voltage present, replace the Bi-Metal Heater Assembly.

TEST 41 – CHECK LPG FUEL SOLENOID

DISCUSSION:

If the LPG Fuel Solenoid (FS) fails to open, fuel will not be available to the engine and it will not start.

PROCEDURE:
1. Place one hand on the top of the LPG Fuel Solenoid. Activate the Fuel Prime Switch. You should be able to feel as well as hear the solenoid energize. If solenoid energizes discontinue testing.
2. Set VOM to measure resistance. Disconnect Wire 0 from the LPG Fuel Solenoid. Connect one meter test lead to Wire 0. Connect the other test lead to a clean frame ground. “Continuity” should be measured. Reconnect Wire 0 to LPG shut off valve.

SHORT TO GROUND:

Set VOM to measure resistance. Disconnect Wire 14A from the LPG Fuel Solenoid. Connect one meter test lead to LPG Fuel Solenoid. terminal that Wire 14A was just removed from. Connect the other meter test lead to a clean frame ground. LPG Fuel Solenoid. Coil resistance of approximately 30-32 ohms Should be measured. Current draw of the LPG Fuel Solenoid at nominal voltage Is approximately 380 milliamps or 0.380 amps.

RESULTS:
1. If the solenoid energized in Step 1, proceed to Test 29.
2. If “Continuity” was not measured in Step 2 repair or replace Wire 0 between the LPG Fuel Solenoid (FS) and the Ground Terminal (GRD1) in the control panel.
3. If “Continuity” was measured in Step 2, repair or replace the Fuel Solenoid (FS).

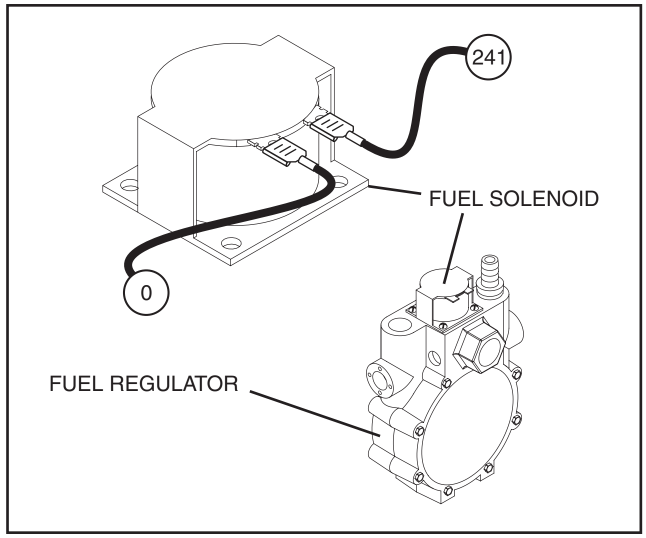
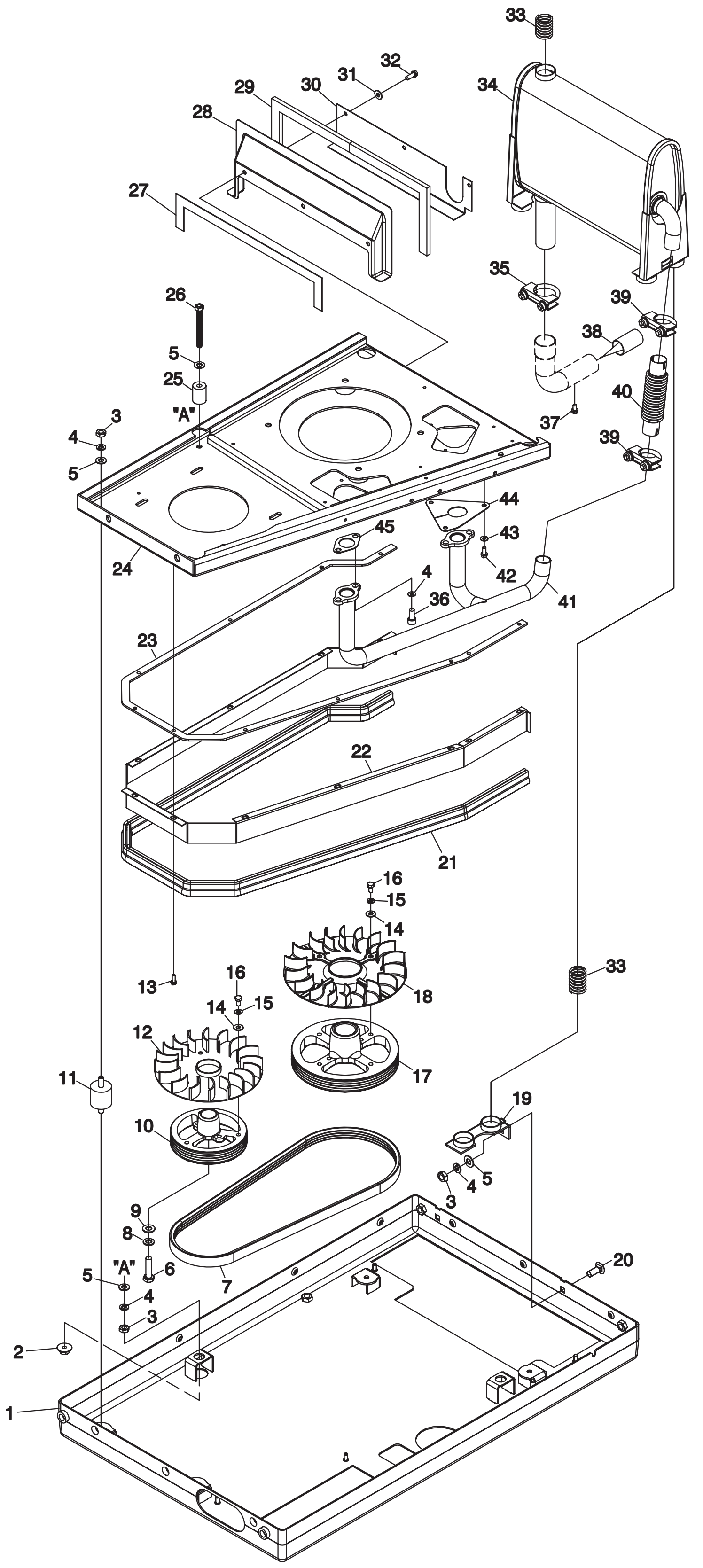


Figure 7-49. – Fuel Solenoid

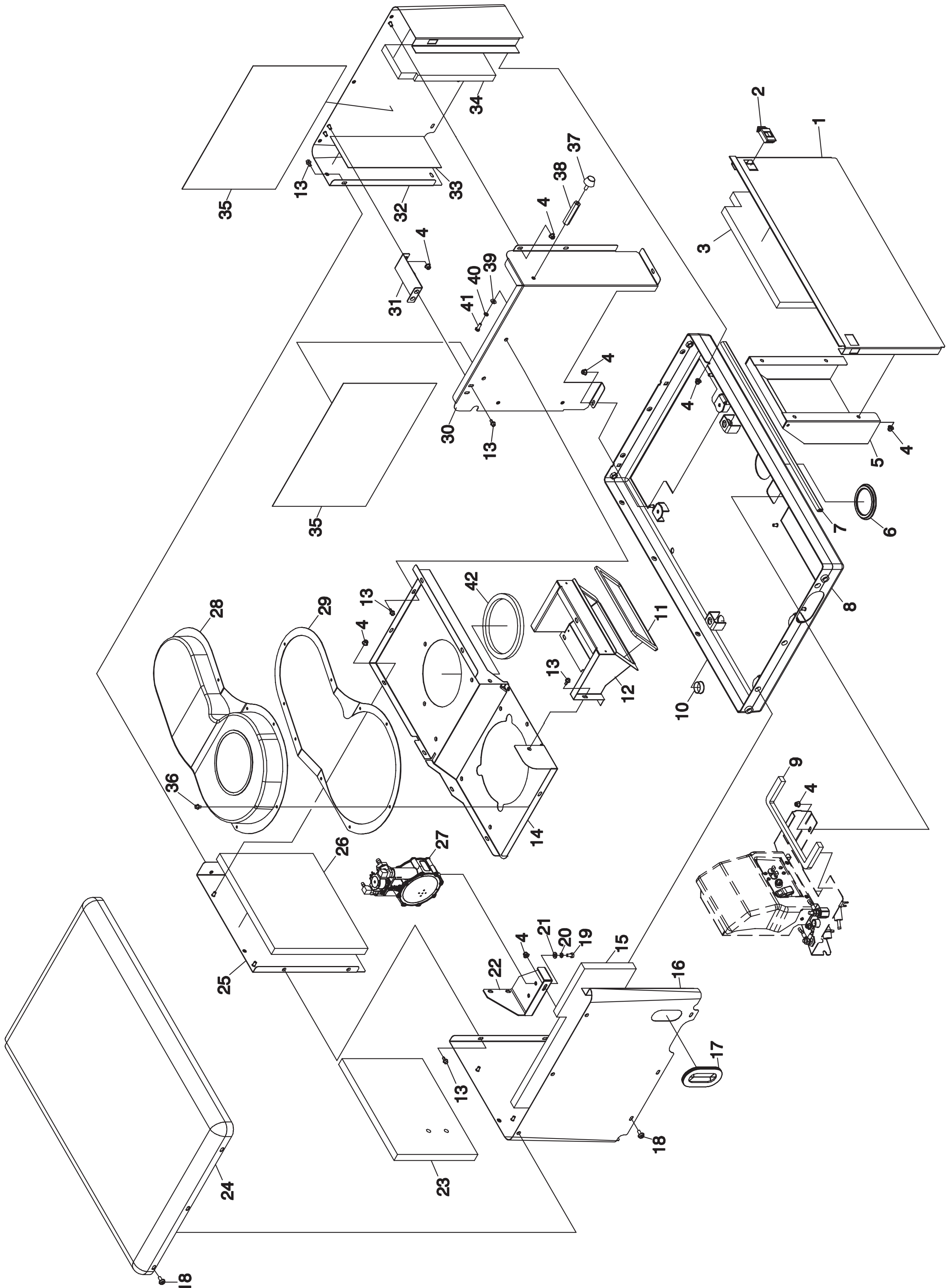
Base & Pulley – Drawing No. 0G7720-B



ITEM	QTY.	DESCRIPTION
1	1	TRAY, 530 RV
2	2	NUT FLANGE 5/16-18 LOCK
3	8	NUT HEX 5/16-18 STEEL
4	12	WASHER LOCK M8-5/16
5	13	WASHER FLAT 5/16-M8 ZINC
6	2	SCREW HHC 3/8-24 X 1-1/2 G8
7	1	BELT V-RIBBED 4L X 43.75" LG
8	2	WASHER LOCK M10
9	2	WASHER FLAT 3/8-M10 ZINC
10	1	ALTERNATOR PULLEY
11	4	VIB MNT 1.5X1.38X5/16-18 DR 45
12	1	FAN 7" DIA (NYLON)
13	11	SCREW HHTR #10-32 X 9/16
14	7	WASHER FLAT 1/4-M6 ZINC
15	7	WASHER LOCK M6-1/4
16	7	SCREW HHC M6-1.0 X 12 G8.8
17	1	ENGINE PULLEY
18	1	FAN ENGINE PULLEY RV
19	2	BRACKET MUFFLER SUPPORT
20	2	BOLT CARR 5/16-18 X 1
21	1	EDGE TRIM W/ 3/4" HOLLOW CYL.
22	1	BLOWER HOUSING WALL
23	1	GASKET, LOWER BLOWER HOUSING

ITEM	QTY.	DESCRIPTION
24	1	FRAME GT530 RV MOUNTING
25	1	SPACER, SAFETY BOLT .375 I.D.
26	2	SCREW HHC 5/16-18 X 3 SPC
27	1.5ft	TAPE ELEC UL FOAM 1/8 X 1/2
28	1	DUCT AIR OUT
29	1	GASKET, AIR OUT DUCT
	1	GASKET, AIR OUT DUCT OPPOSITE SIDE
30	1	SCREEN, BOTTOM AIR OUT
31	3	WASHER FLAT 1/4-M6 ZINC
32	3	SCREW SWAGE 1/4-20 X 1/2 ZYC
33	5	ISOLATION SPRING
34	1	MUFFLER, 530 RV
35	1	BOLT U 5/16-18 X 1.25 W/SADDLE
36	4	SCREW SHC M8-1.25 X 18 G8.8
37	1	SCREW CRIMPTITE 10-24 X 3/8
38	1	SCREEN SPARK ARRESTOR
39	2	CLAMP EXHAUST
40	1	EXHAUST FLEX
41	1	EXHAUST MANIFOLD
42	6	SCREW CRIMPTITE 10-24 X 1/2
43	6	WASHER FLAT #10 ZINC
44	2	GASKET, EXH BASE, 530 RV
45	2	GASKET, EXHAUST GT530

Enclosure – Drawing No. 0G3881-C

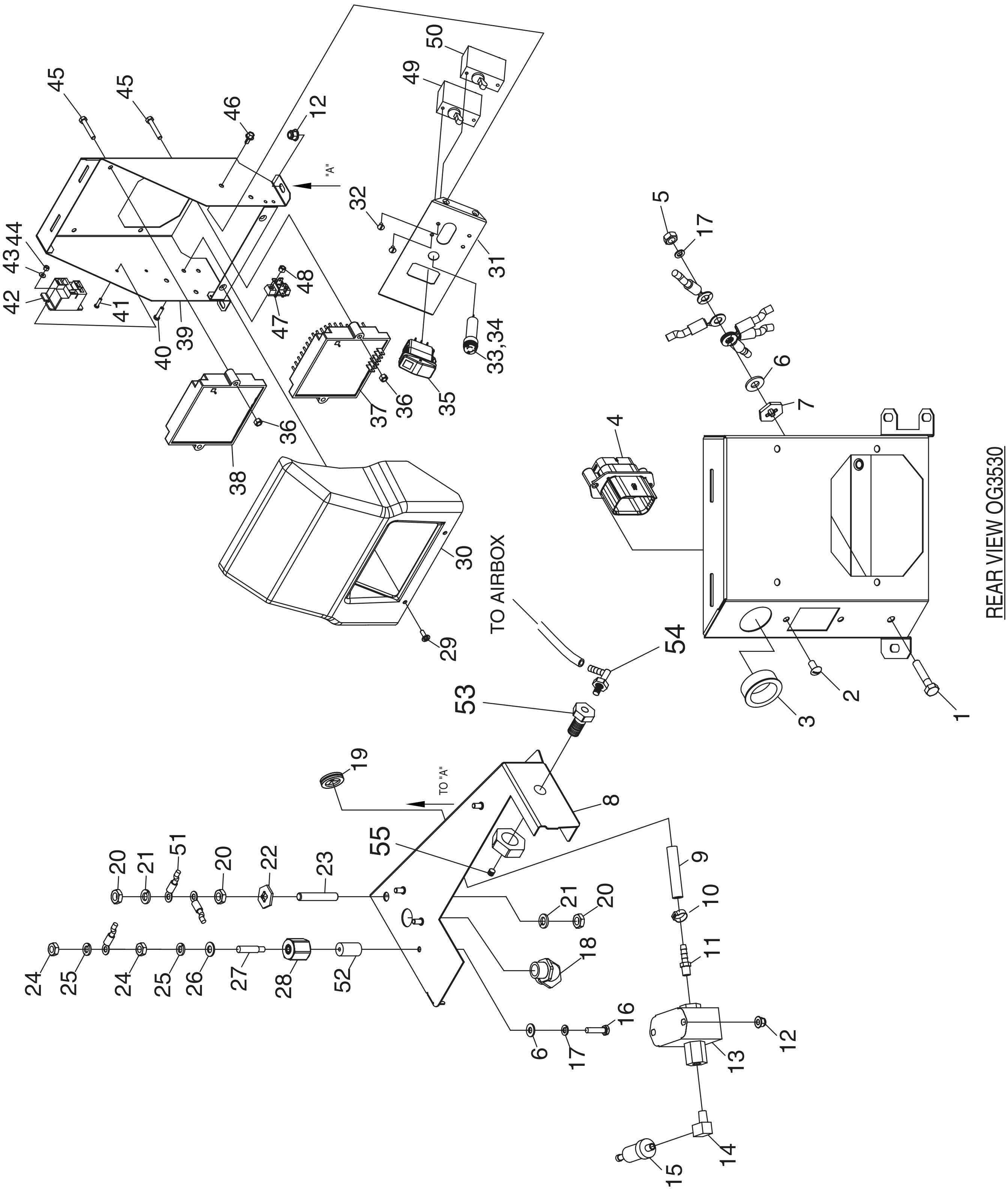


ITEM	QTY.	DESCRIPTION
1	1	ENCLOSURE DOOR
2	2	SLIDE LATCH, FLUSH
3	1	FOAM ENCLOSURE DOOR
4	23	NUT FLANGE M6-1.0 NYLOK
*	26	NUT FLANGE M6-1.0 NYLOK (LP)
5	1	BRACKET, ENCLOSURE ELECTRIC HTR
6	1	GROMMET, OIL FILTER
7	1	U CHANNEL 1/8”
8	1	TRAY, 530 RV
9	1	GASKET AIR IN BOTTOM DUCT
10	1	PLUG PLASTIC 1.093-1.125
11	1	GASKET AIR IN TOP DUCT
12	1	DUCT AIR IN ROOF
13	13	SCREW HHTT M6-1.0X12 ZINC
14	1	TOP DIVIDER PANEL
15	1	FOAM, SIDE ENCLOSURE
*	1	FOAM, SIDE ENCLOSURE (LP)
16	1	ENCLOSURE SIDE / BACK
17	1	GROMMET OVAL 31.75X50.8
18	18	SCREW SWT 1/4-20X5/8 W/W
19*	2	SCREW HHC M8-1.25X16 G8.8 (LP)
20*	2	WASHER LOCK M8-5/16 (LP)
21*	2	WASHER FLAT 5/16-M8 ZINC (LP)

ITEM	QTY.	DESCRIPTION
22*	1	BRACKET, 530 RV REGULATOR (LP)
23	1	FOAM BACK ENCLOSURE ALT SIDE
*	1	FOAM BACK ENCLOSURE ALT SIDE (LP)
24	1	ENCLOSURE ROOF
25	1	ENCLOSURE, BACK PANEL 530 RV
26	1	FOAM BACK PANEL ENCLOSURE
27*	1	REGULATOR ASSY, 530 RV LP (LP)
28	1	UPPER BLOWER HOUSING
29	1	UPPER BLOWER HOUSING GASKET
30	1	EXHAUST DIVIDER PANEL
31	1	MUFFLER HOLD DOWN BRACKET
32	1	ENCLOSURE EXHAUST SIDE PANEL
33	1	FBR GLASS, ENCLOSURE MFLR BACK
34	1	FOAM EXHAUST END ENCL FRONT
35	2	FBR GLASS, ENCLOSURE MFLR SIDE
36	9	SCREW HHTT M6-1.0X8 ZYC
37	1	BUMPER
38	1	STAND OFF
39	1	WASHER, FLAT 1/4”
40	1	WASHER, LOCK 1/4”
41	1	SCREW HHC 1/4-20 X 3/4” G5
42	1	GASKET, SCROLL DUCT

*ITEM FOR MODELS WITH LP

Control Panel – Drawing No. 0G5489-D

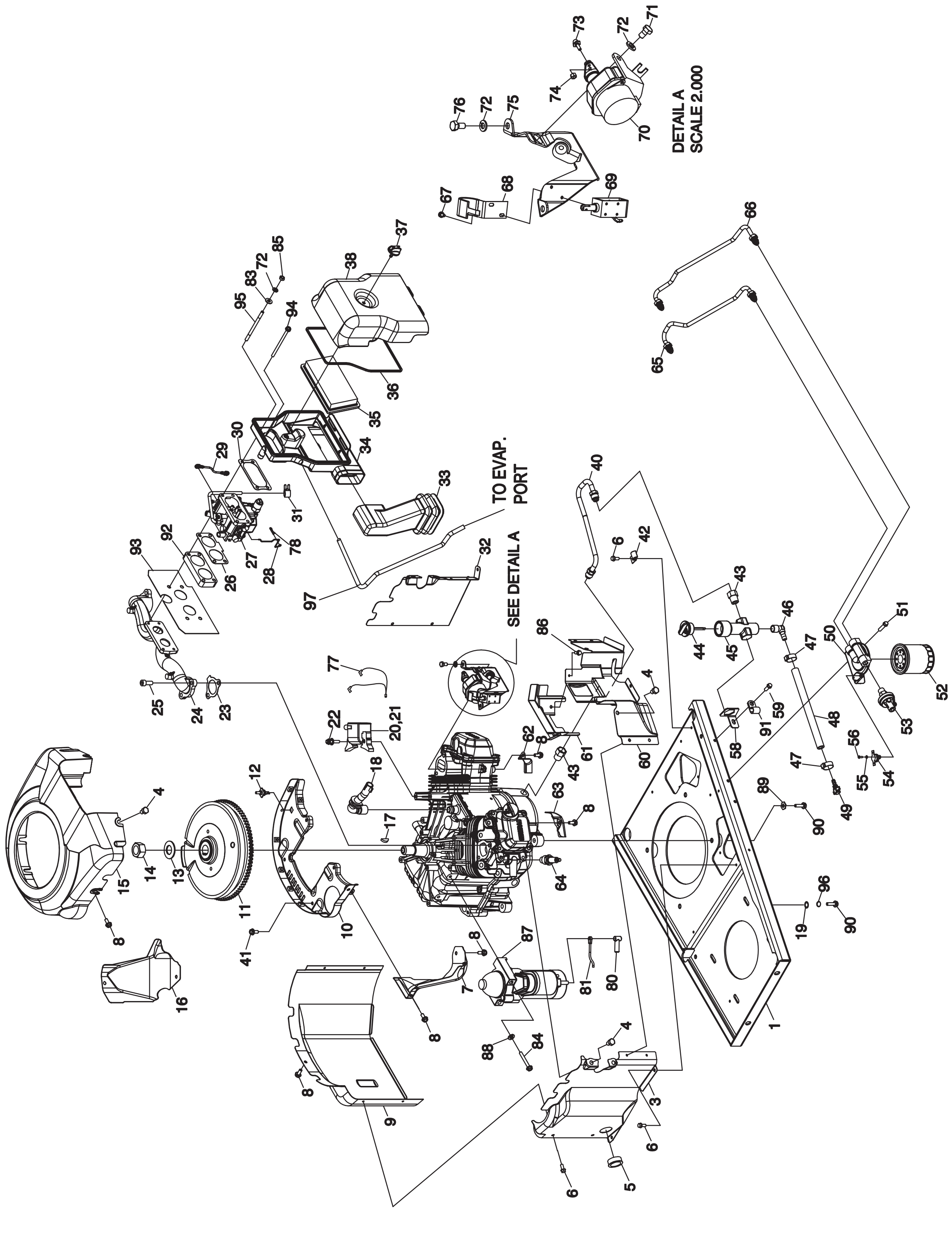


ITEM	QTY.	DESCRIPTION
1	1	SCREW HHC M6-1.0 X 25 G8.8
2	2	SCREW PLASTITE HI-LOW #10X3/8
3	1	BUSHING SNAP SB-1093-937
4	1	WIRE HARNESS C/PNL FRAME
5	1	NUT HEX M6 X 1.0 G8 YEL CHR
6	2	WASHER FLAT 1/4-M6 ZINC
7	1	WASHER LOCK SPECIAL 1/4"
8	1	FUEL PUMP MOUNTING BRACKET
9	28.75”	HOSE,1/4" SAE30R7
10	1	CLAMP,HOSE OETIKR STEPLSS 14.5
11	1	BARBED STR 1/8NPT X 1/4
12	5	NUT FLANGE M6-1.0 NYLOK
13	1	FUEL PUMP
14	1	ELBOW 90D STREET 1/8 BRASS
15	1	FILTER FUEL 1/8P-1/4H
16	1	SCREW HHC 1/4-20 X 2-1/4” G5
17	2	WASHER LOCK M6-1/4
18	1	AC HARNESS 530RV
19	1	GROMMET, DOUBLE SLIT
20	3	NUT HEX JAM 3/8-16 BRASS
21	2	WASHER LOCK 3/8
22	1	WASHER LOCK SPECIAL 3/8
23	1	STUD 3/8-16 X 2-1/4 BRASS
24	2	NUT HEX 5/16-18 STEEL
25	2	WASHER LOCK M8-5/16
26	1	WASHER FLAT 5/16-M8 ZINC
27	1	STUD, 1/4-20 TO 5/16-18
28	1	NEUTRAL CONNECTOR UL
29	2	SCREW PPHTF #8-18 X 1/2 AB
30	1	CONTROL PANEL COVER
31	1	C/PNL FACE

ITEM	QTY.	DESCRIPTION
32	4	SCREW PPHM #6-32 X 1/4 SEMS
33	1	FUSE 7.5AXBK/AGC7.5NX
34	1	HOLDER FUSE
35	1	SWITCH RKRSPDT(ON)OFF(ON)ILLUM
36	4	NUT HEX LOCK M5-0.8 NYINS ZINC
37	1	ASSY PCB VREG AIR COOLED 2006
38	1	ASSY PCB RV CONTROLLER
39	1	C/PNL FRAME RV
40	2	SCREW PPHM M4-0.7 X 16
41	2	SCREW PPHM M3-0.5 X 12
42	1	RELAY 12V 25A SPST
43	2	WASHER FLAT #4 ZINC
44	2	NUT HEX LOCK M3-0.5 NY INS
45	4	SCREW HHC M5-0.8 X 30 G8.8
46	4	SCREW HHTT M5-0.8 X 10 BP
47	1	BLOCK 1 POSITION, 4 TAB
48	2	NUT HEX LOCK M4-0.7 NY INS
49	1	CIRCT BRK 20X1 MAG 10-32 CARL (4500W)
		CIRCT BRK 20X1 MAG 10-32 CARL (5500W)
		CIRCT BRK 30X1 MAG 10-32 CARL (6500W)
50	1	CIRCT BRK 20X1 MAG 10-32 CARL (4500W)
		CIRCT BRK 30X1 MAG 10-32 CARL (5500W)
		CIRCT BRK 30X1 MAG 10-32 CARL (6500W)
51	1	EARTH STRAP
52	1	NYLON SPACER .26 X 1.00 X 1.73
53	1	BULKHEAD ADAPTER FITTING (5410-1/5412-1/5414-1 ONLY)
54	1	BARBED 90 ELBOW ¼ X ¼ NPT (5410-1/5412-1/5414-1 ONLY)
55	1	PLUG STD. PIPE ¼ COUNTERSINK (5410-1/5412-1/5414-1 ONLY)

*HARNESS NOT SHOWN

Engine Accessories – Drawing No. 0G7718-B

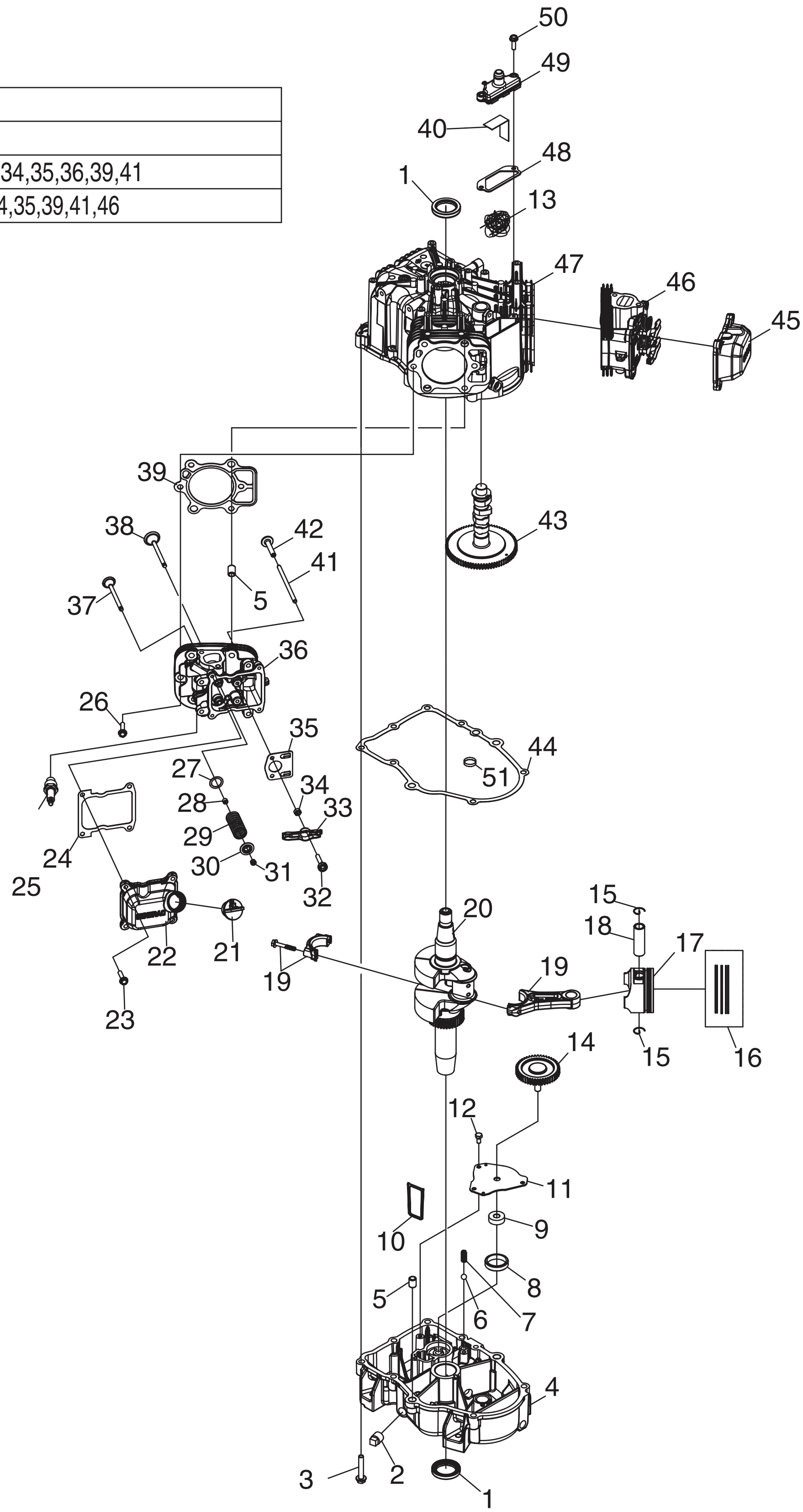


ITEM	QTY.	DESCRIPTION
1	1	FRAME
3	1	ENGINE WRAPPER, STARTER SIDE
4	8	SCREW HHFC M8-1.25 X 14
5	1	SNAP BUSHING
6	14	SCREW CRIMPTITE 10-24 X 1/2
7	1	SHIELD WRAPPER, CYLINDER #1
8	13	SCREW HHFC M6-1.0 X 12 G8.8
9	1	ENGINE WRAPPER, BACK
10	1	BACKPLATE
11	1	ASSY, FLYWHEEL & RING GEAR 29D
12	1	ASSY, GROUND WIRE CONNECTOR
13	1	WASHER,BELV-20 X 2.2
14	1	NUT HEX M20-1.5 G8
15	1	BLOWER HOUSING
16	1	SHIELD WRAPPER, CYLINDER #2
17	1	KEY, WOODRUFF 4 X 19D
18	1	BREATHER HOSE
19	3	WASHER FLAT 3/8 – M10 ZINC
20	1	IGNITION COIL CYLINDER #1
21	1	IGNITION COIL CYLINDER #2
22	4	SCREW HHFC M6-1.0 X 25 SEMS
23	2	GASKET, INTAKE
24	1	INTAKE MANIFOLD
25	4	SCREW SHC M8-1.25 X 20 G12.9
26	1	GASKET, MANIFOLD TO CARB/MIXER
27	1	CARBURETOR
28	1	ROD, CHOKE CONTROL
29	1	ASSY GOVERNOR ROD
30	1	GASKET, AIRBOX/CARB
31	1	CLAMP, HOSE OETIKER STEPLESS 14.5
32	1	WRAPPER, ENGINE OIL ADAPTOR
33	1	SNORKEL, AIR BOX
34	1	AIRBOX BASE
35	1	AIR FILTER
36	1	AIRBOX SEAL
37	1	AIRBOX QUARTER KNOB
38	1	AIRBOX COVER
40	1	OIL DRAIN LINE
41	4	SCREW HHTT M6-1.0 X 10 YELLOW CHROME
42	1	CLAMP, VINYL 9.5 O.D.
43	2	3/4 NPT TO 3/8 O.D. FLARE
44	1	ASSY, CAP AND DIPSTICK
45	1	OIL DRAIN/DIPSTICK TUBE
46	1	90 DEGREE ELBOW 3/8 NPT X 3/8 BARBED
47	2	HOSE OETIKER CLAMP
48	8”	HOSE, 3/8” I.D.

ITEM	QTY.	DESCRIPTION
49	1	ASSY, OIL DRAIN FITTING
50	1	OIL FILTER SUPPORT
51	2	SCREW SWAGE 1/4-20 X 1
52	1	OIL FILTER
53	1	OIL PRESSURE SWITCH 5 PSI
54	1	SWITCH, THERMAL 270F
55	2	WASHER, LOCK M3
56	2	SCREW PPHM M3-0.5 X 8
58	1	BRACKET, OIL CHECK TUBE
59	1	SCREW SWAGE 1/4-20 X 1/2
60	1	WRAPPER ENGINE VALLEY
61	1	WRAPPER UPPER VALLEY
62	1	WRAPPER INNER CYLINDER #2
63	1	WRAPPER INNER CYLINDER #1
64	2	SPARKPLUG
65	1	OIL LINE OUT
66	1	OIL LINE IN
67	2	SCREW PPHM #4-40 X 1/4
68	1	ASSEMBLY, BI-METAL/HEATER
69	1	CHOKE SOLENOID
70	1	CONTROLLER ASSEMBLY
71	2	SCREW HHC M6-1.0 X 10 G8.8
72	6	WASHER LOCK M6-1/4
73	1	BALL STUD, 10 MM
74	1	NUT HEX LOCK M3-0.5
75	1	BRACKET, CONTROLLER SUPPORT
76	2	SCREW HHC M6-1.0 X 12 G8.8
77	1	ASSY, GROUNDING WIRE W/O DIODES
78	1	COTTER PIN
80	1	BOOT, BATT. CABLE
81	1	WIRE ASSY. BATT. POS.
83	2	WASHER, FLAT 1/4-M6
84	2	SCREW HHC M8-1.25 X 85
85	2	NUT M6-1.0
86	2	SCREW CRIMPTITE 10-24 X 3/8
87	1	START MOTOR
88	2	WASHER, LOCK M8-5/16
89	1	WASHER, LOCK SPECIAL 3/8
90	4	SCREW HHC 3/8-16 X 1-3/4
91	1	CLAMP VINYL .75 X .343
92	1	INSULATOR
93	1	GASKET, MANIFOLD TO CARB/MIXER
94	2	BOLT,CARB MOUNT M6-1.0 X 95
95	2	STUD M6-1.0 X 100
96	3	WASHER LOCK M10
97	1	HOSE, EVAP. PORT

530 RV Engine – Drawing No. 0G7719-B

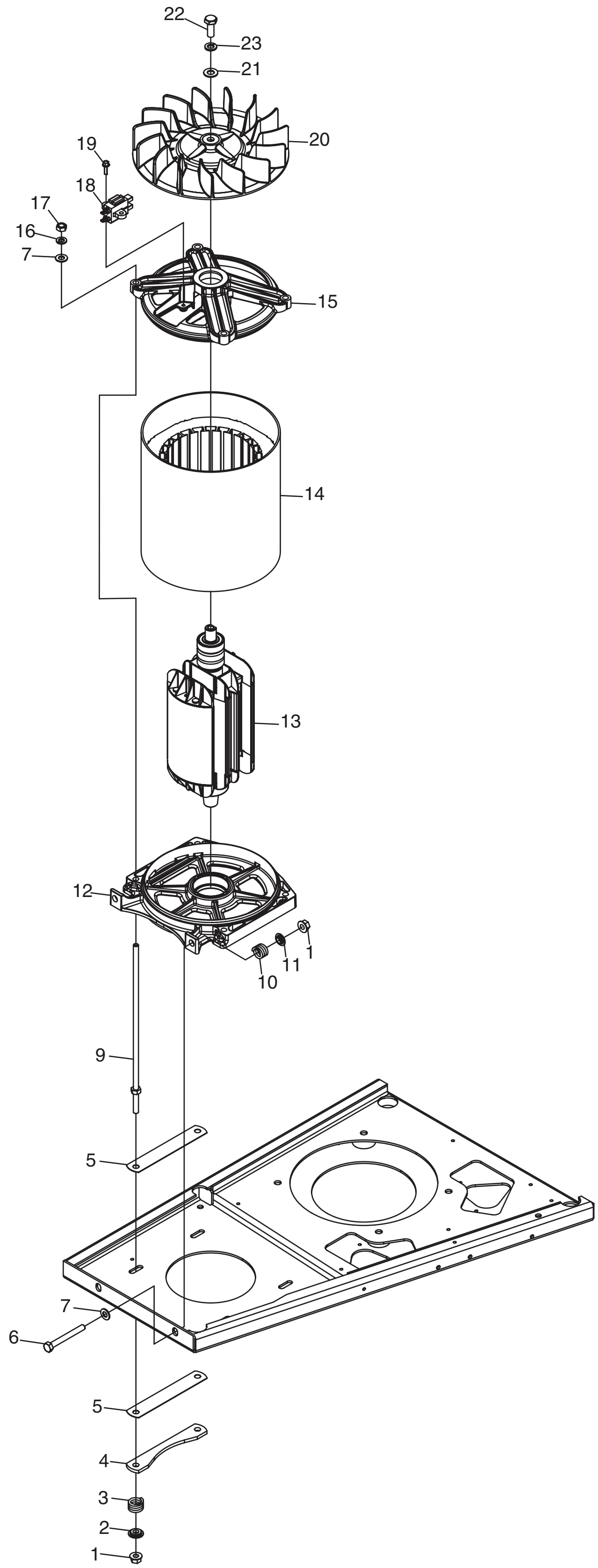
52	1,24,39,44,48
53	48,49
54	24,27,28,29,30,31,32,33,34,35,36,39,41
55	24,27,28,29,30,31,32,33,34,35,39,41,46



ITEM	QTY.	DESCRIPTION
1	2	SEAL D 35 X 48.2
2	1	3/8” SQUARE HEAD PLUG
3	9	SCREW HHFC M8 – 1.25 X 45
4	1	GEAR COVER
5	6	SLEEVE DOWEL PIN
6	1	11/32 DIAMETER PRESSURE RELIEF BALL
7	1	OIL PRESSURE SPRING
8	1	GEAROTOR, OUTER
9	1	GEAROTOR, INNER
10	1	SCREEN, OIL PICK-UP
11	1	COVER, GEROTOR
12	3	SCREW, HHFCS M6-1.0 x 12
13	1	BREATHER SEPARATOR
14	1	GEAR, GEAROTOR
15	4	RETAINER RING
16	2	PISTON RING SET
17	2	PISTON
18	2	PISTON PIN
19	2	CONNECTING ROD ASSEMBLY
20	1	CRANKSHAFT
21	1	OIL FILL CAP
22	1	COVER ROCKER W/FILL
23	8	SCREW HHFC M6-1.0 X 25
24	2	GASKET, VALVE COVER
25	2	SPARK PLUG
26	12	SCREW HHC M8-1.25 X 56
27	4	WASHER, VALVE SPRING
28	2	SEAL, VALVE STEM

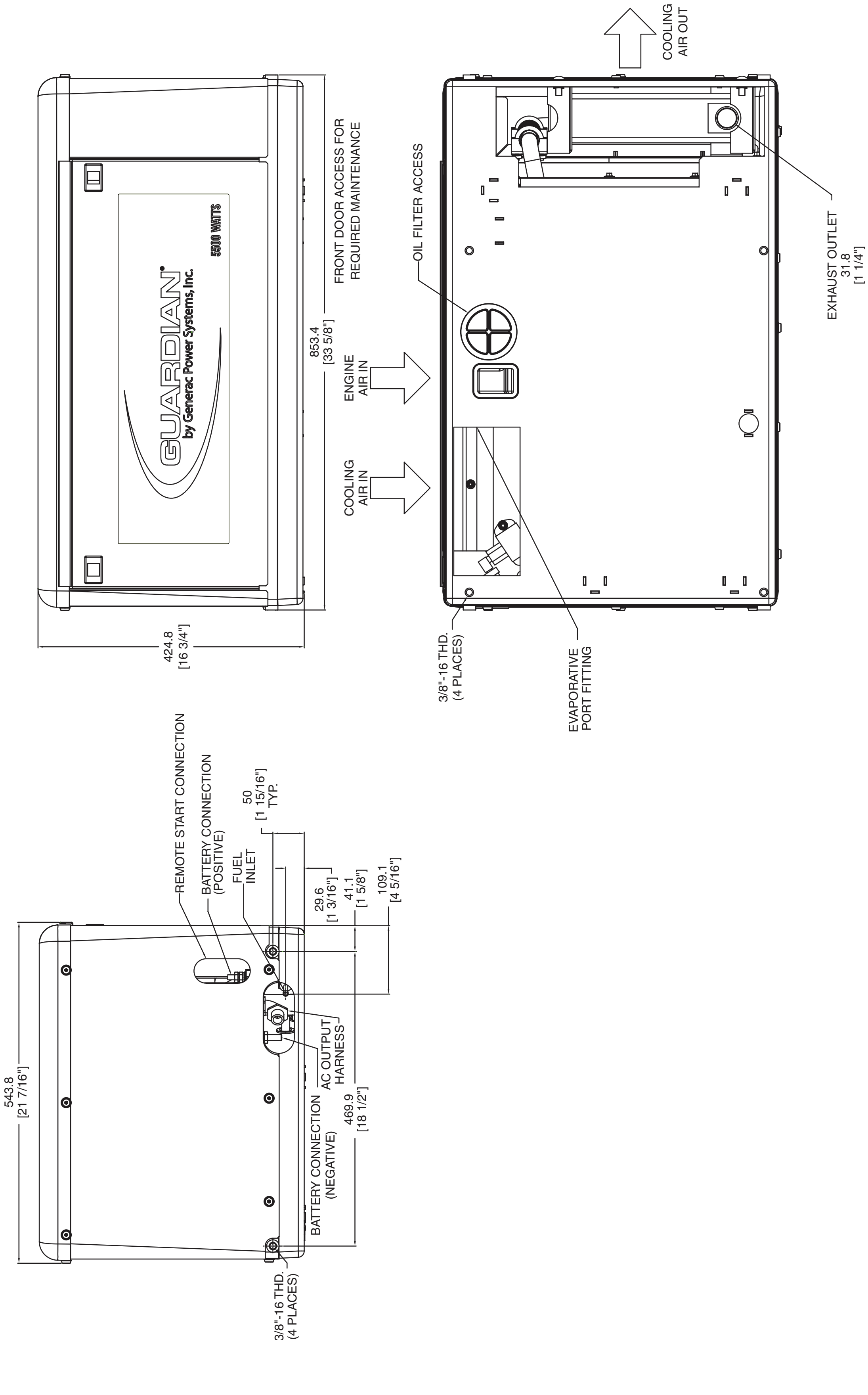
ITEM	QTY.	DESCRIPTION
29	4	VALVE SPRING
30	4	VALVE RETAINER
31	8	KEEPER, VALVE SPRING
32	4	STUD, ROCKER ARM
33	4	ROCKER ARM
34	4	JAM NUT, ROCKER ARM
35	2	PUSH ROD GUIDE PLATE
36	1	CYLINDER HEAD CYL. 1
37	2	INTAKE VALVE
38	2	EXHAUST VALVE
39	2	GASKET CYLINDER HEAD
40	1	SCREEN
41	4	PUSHROD
42	4	TAPPET
43	1	CAM SHAFT & GEAR
44	1	GASKET, CRANKCASE
45	1	COVER ROCKER
46	1	CYLINDER HEAD CYL 2
47	1	CRANKCASE
48	1	GASKET, BREATHER ASSEMBLY
49	1	BREATHER ASSY
50	1	SCREW HHFC M6-1.0 X 20
51	1	SEAL, OIL PASSAGE
52	1	GASKET KIT
53	1	BREATHER KIT
54	1	KIT HEAD ASSY CYLINDER #1
55	1	KIT HEAD ASSY CYLINDER #2

Rotor & Stator – Drawing No. 0G3953-b



ITEM	QTY.	DESCRIPTION
1	6	NUT TOP LOCK FL M8-1.25
2	4	WASHER, SPRNG CENTER
3	4	SPRING, GEN. MOUNT
4	2	SUPPORT, SLIDE
5	4	SLIDE, NYLON
6	2	SCREW HHC M8-1.25 X 70 G8.8
7	6	WASHER FLAT 5/16-M8 ZINC
9	4	STUD, 530 RV STATOR
10	2	TENSION SPRING
11	2	WASHER, SPRING CENTR
12	1	LOWER BEARING CARRIER
13	1	ROTOR
14	1	STATOR
15	1	UPPER BEARING CARRIER
16	4	WASHER LOCK M8-5/16
17	4	NUT HEX M8-1.25 G8 CLEAR ZINC
18	1	ASSEMBLY, BRUSH HOLDER
19	2	SCREW HHTT M5-0.8 X 16
20	1	FAN UPPER ALTERNATOR
21	1	WASHER FLAT 3/8-M10 ZINC
22	1	SCREW HHC 3/8-24 X 1 G5
23	1	WASHER LOCK 3/8

Major Features and Dimensions – Drawing No. 0G5519-b



GENERATOR SPECIFICATIONS

TYPE	RV 45G/LP	RV 55G/LP	RV 65G/LP
MODEL	5410/5411	5412/5413	5414/5415
WEIGHT	278/281 pounds	285/288 pounds	293/296 pounds
TYPE OF ROTOR	Two-pole	Two-pole	Two-pole
RATED WATTS	4500	5500	6500
RATED VOLTS	120	120	120
PHASE	1-Phase	1-Phase	1-Phase
RATED MAX. CONTINUOUS CURRENT AMPS (240V)	37.5 (18.7)	45.8 (22.9)	54.1 (27)
RATED FREQUENCY	60 Hz	60 Hz	60 Hz
OPERATING SPEED	2571 rpm	2571 rpm	2571 rpm
ENGINE MODEL	GT-530	GT-530	GT-530
TYPE OF ENGINE	Vertical Shaft	Vertical Shaft	Vertical Shaft
FUEL SYSTEM	Gasoline/LP	Gasoline/LP	Gasoline/LP
COOLING SYSTEM	Air-Cooled	Air-Cooled	Air-Cooled
OIL SYSTEM	Pressurized with Filter	Pressurized with Filter	Pressurized with Filter
OIL PUMP	Trochoid Type	Trochoid Type	Trochoid Type
AIR CLEANER	Paper element	Paper element	Paper element
STARTER	12 VDC electric	12 VDC electric	12 VDC electric
IGNITION SYSTEM	Solid State/Flywheel Magneto	Solid State/Flywheel Magneto	Solid State/Flywheel Magneto
SPARK PLUG	NGK BPR6HS	NGK BPR6HS	NGK BPR6HS
SPARK PLUG GAP	0.030 inch (0.76mm)	0.030 inch (0.76mm)	0.030 inch (0.76mm)

NOMINAL RESISTANCES OF GENERATOR WINDINGS AT 68°F

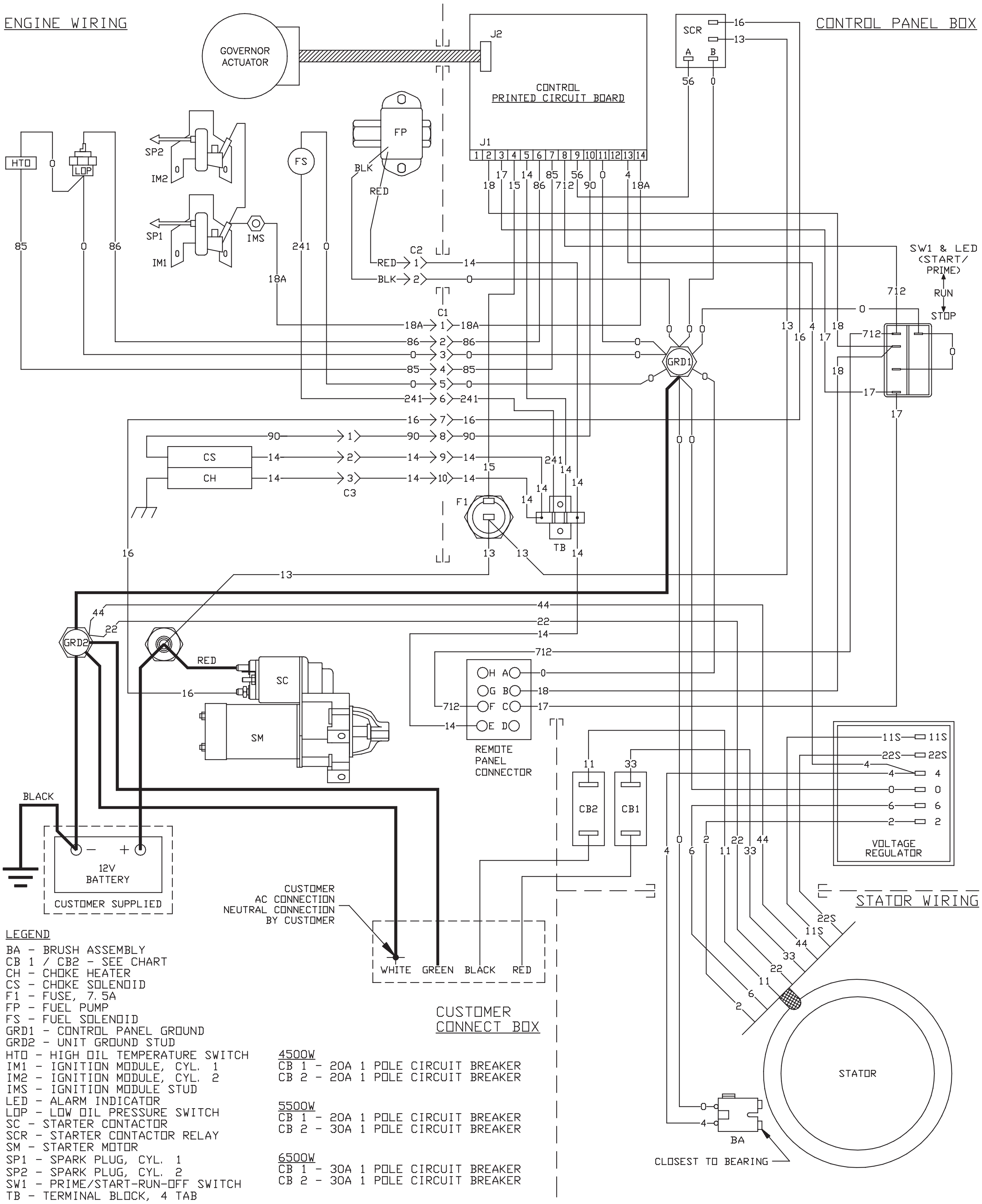
TYPE	RV 45G/LP	RV 55G/LP	RV 65G/LP
MODEL	5410/5411	5412/5413	5414/5415
Power Windings Lead 11 to 22 Lead 11S to 22S Lead 33 to 44	0.376 - 0.416 ohms	0.28 - 0.32 ohms	0.209 - 0.242 ohms
Excitation "DPE" Winding Lead 2 to 6	2.59 ohms	1.41 - 1.63 ohms	1.59 - 1.84 ohms
Rotor Winding Slip Ring to Slip Ring	13.4 ohms	14.88 ohms	10.81 ohms

TORQUE REQUIREMENTS (unless otherwise specified)

Stator Bolts .... 8 ft-lbs
Alternator Pulley .... 38 ft-lbs
Engine Pulley .... 38 ft-lbs
Oil Adaptor Bolt .... 4.5 ft-lbs
Oil Lines .... 70 in-lbs
Intake Manifold .... 18 ft-lbs
Exhaust Manifold .... 18 ft-lbs
M5-0.8 taptite screw into aluminum .... 25-50 in-lbs
M5-0.8 taptite screw into pierced hole .... 25-50 in-lbs
M6-1.0 taptite screw into aluminum .... 50-96 in-lbs
M6-1.0 taptite screw into pierced hole .... 50-96 in-lbs
M6-1.0 taptite screw into weldnut .... 50-96 in-lbs
M8-1.25 taptite screw into aluminum .... 12-18 ft-lbs
M6-1.0 nylok nut onto stud .... 16-65 in-lbs
Dipstick Casting Oil Line .... 250 in-lbs

Note: Torques are dynamic values with ±10 % tolerance unless otherwise noted.

Electrical Schematic and Wiring Diagram – Drawing No. 0G4221-B



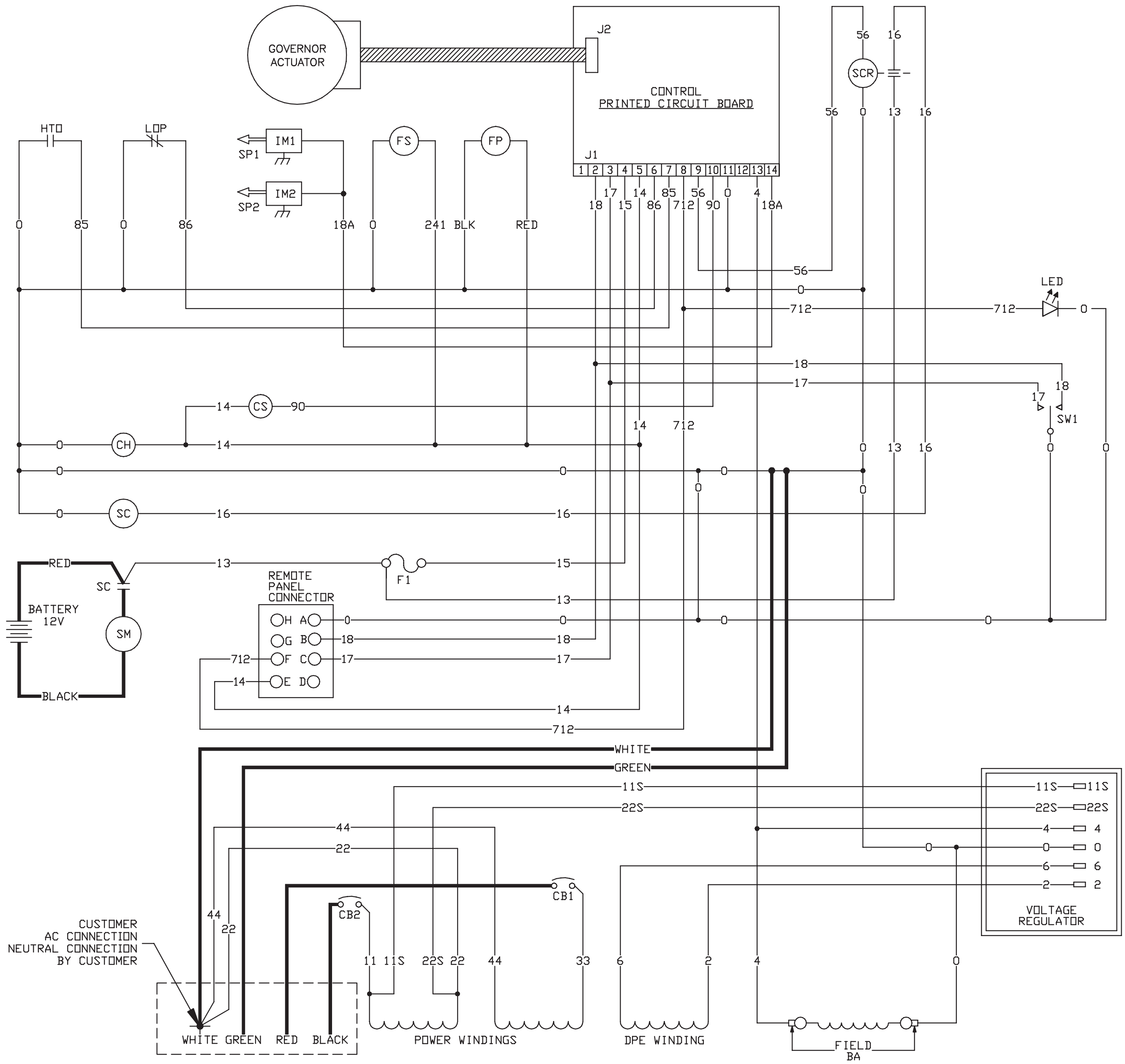
LEGEND
BA - BRUSH ASSEMBLY
CB 1 / CB2 - SEE CHART
CH - CHOKE HEATER
CS - CHOKE SOLENOID
F1 - FUSE, 7.5A
FP - FUEL PUMP
FS - FUEL SOLENOID
GRD1 - CONTROL PANEL GROUND
GRD2 - UNIT GROUND STUD
HTO - HIGH OIL TEMPERATURE SWITCH
IM1 - IGNITION MODULE, CYL. 1
IM2 - IGNITION MODULE, CYL. 2
IMS - IGNITION MODULE STUD
LED - ALARM INDICATOR
LOP - LOW OIL PRESSURE SWITCH
SC - STARTER CONTACTOR
SCR - STARTER CONTACTOR RELAY
SM - STARTER MOTOR
SP1 - SPARK PLUG, CYL. 1
SP2 - SPARK PLUG, CYL. 2
SW1 - PRIME/START-RUN-OFF SWITCH
TB - TERMINAL BLOCK, 4 TAB

4500W
CB 1 - 20A 1 POLE CIRCUIT BREAKER
CB 2 - 20A 1 POLE CIRCUIT BREAKER

5500W
CB 1 - 20A 1 POLE CIRCUIT BREAKER
CB 2 - 30A 1 POLE CIRCUIT BREAKER

6500W
CB 1 - 30A 1 POLE CIRCUIT BREAKER
CB 2 - 30A 1 POLE CIRCUIT BREAKER

Electrical Schematic and Wiring Diagram – Drawing No. 0G4221-B



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