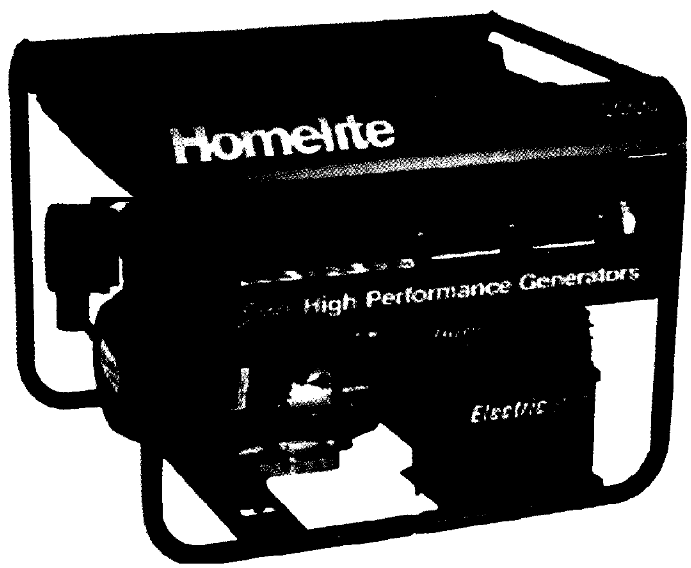
Homelite®

Generator Basics

Dealer Service Guide



JOHN DEERE

Consumer Products

P/N ST01375

THE IMPACT OF ELECTRICITY

In the history of man, there have been few forces that produced so great an effect in so brief a period, as has electricity. Since 1881, when the Brush Electric Light Company in Philadelphia initiated the first Central Station Service in the U. S., electricity has become the single most essential force in our economy. Without electrical power, our cities would be paralyzed.

Our near-total dependence on electrical power to operate appliances, tools and equipment for both home and on the job has lead to the development of stand-by generators to provide electricity when regular line power has failed or is not available.

Charles H. Ferguson designed a small lightweight gasoline engine driven generator in 1921 to light homes in rural areas where electrical power was not available. His company, the Home Electrical Lighting Company, was renamed Homelite in 1924. By 1929, Homelite was producing 9 different products including generators, pumps, and blowers.

During the 40's, Homelite produced a number of different generators for various applications in the Allied World War II effort.

In 1946, Homelite entered the chain saw market with an electric driven chain saw powered by its latest development, a new Hi-Cycle Generator!

In the subsequent years Homelite Generators have been providing dependable portable power for, construction sites, remote areas without electrical power, disaster victims and a variety of other applications, all over the world!

Today, Homelite generators are proudly produced and distributed by John Deere Consumer Products.

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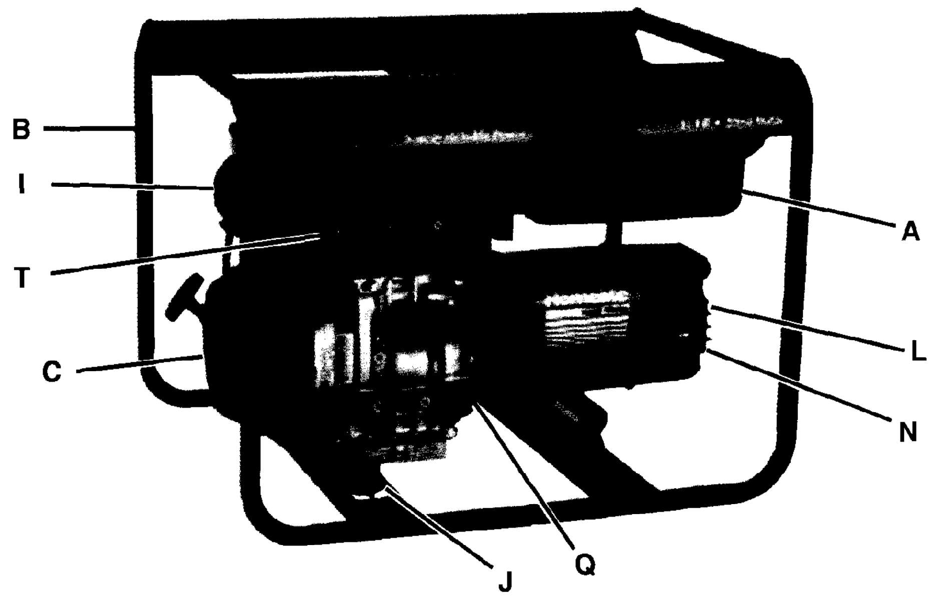
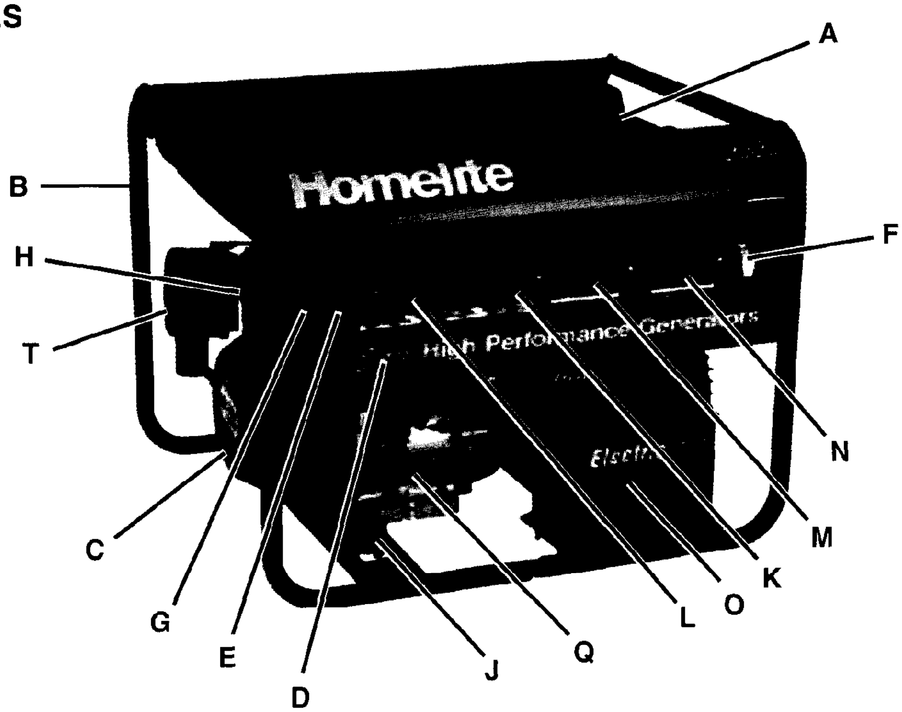
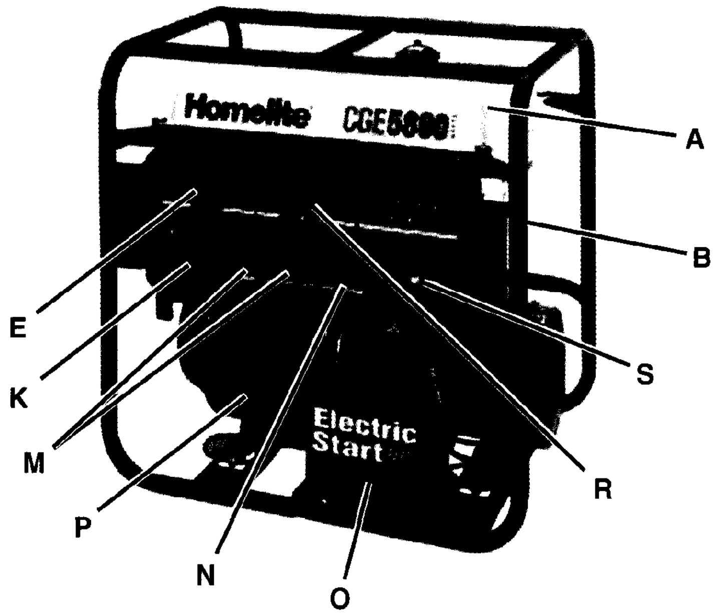


LRX SERIES



SPECIFICATIONS

CG SERIES

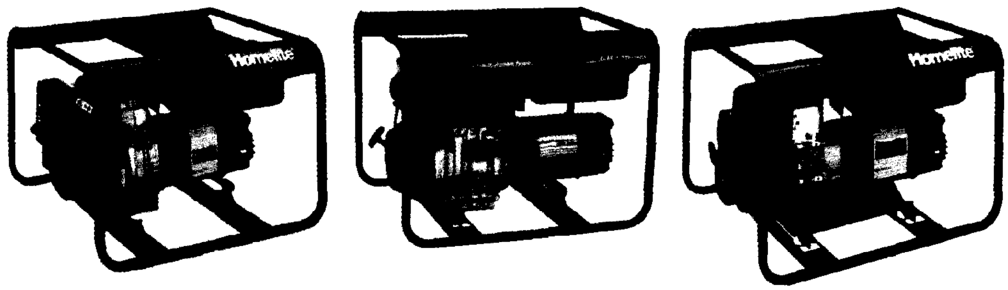


A.	Fuel Tank	K.	120 V. GFCI Receptacle
B.	Roll Cage	L.	120 V. Receptacle
C.	Recoil Starter	M.	120 V. Receptacle (Locking)
D.	Control Panel	N.	240 V. Receptacle (Locking)
E.	Idle-Start Switch	O.	Battery
F.	Volt Meter	P.	Electric Start Switch
G.	Hour Meter	Q.	Oil Sensor Switch
H.	Engine Run Switch	R.	Max Power Switch
I.	Air Filter	S.	Circuit Breaker
J.	Vibration Isolator	T.	Muffler

SPECIFICATIONS

UNIT SPECIFICATIONS

LR SERIES

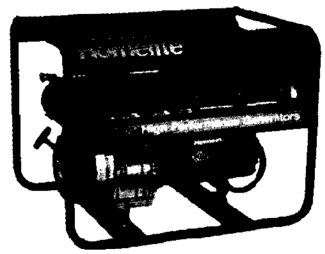
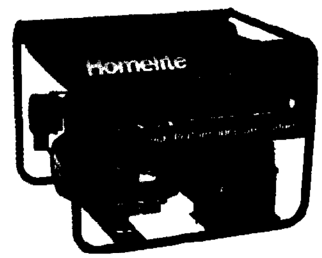


MODEL	LR4300	LR5550 LRE5550*	LR5000T
ENGINE			
Model	EY28 Robin	EH34 Robin Ohv	Tecumseh HM100
Horsepower	7.5 Hp	11 Hp	10 Hp
Starting	Automatic Rewind	Automatic Rewind Automatic Rewind/Electric*	Automatic Rewind
Run Time Full Load	6 Hours	5 Hours	5.5 Hours
FUEL SYSTEM			
Fuel Type	Automotive	Automotive	Automotive
Fuel Capacity	5 Gallons	5 Gallons	5 Gallons
ELECTRICAL			
AC Watts - Maximum	4300	5550	5000
AC Watts - Continuous	3800	5000	4600
AC Volts Output	120/240	120/240	120/240
Voltage Regulation	Inherent, +/-15%	Inherent, +/-15%	Inherent, +/-15%
Frequency	60 Hertz	60 Hertz	60 Hertz
Rated Amperage	31.7/15.8	41.7/20.8	38.3/19.2
Outlets	20 amp, 120V Type 5-20R 20 amp, 120/240V Type L14-20R	20 amp, 120V Type 5-20R 20 amp, 120/240V Type L14-20R	20 amp, 120V Type 5-20R 20 amp, 120/240V Type L14-20R
GENERAL			
Sound Level @ 50 ft.	68 dBA	76 dBA	83 dBA
Warranty-Consumer	1 Year Limited	1 Year Limited	1 Year Limited
Warranty-Commercial	90 Day Limited	90 Day Limited	90 Day Limited

Unit model number and specifications subject to change without notice

SPECIFICATIONS

LRX SERIES

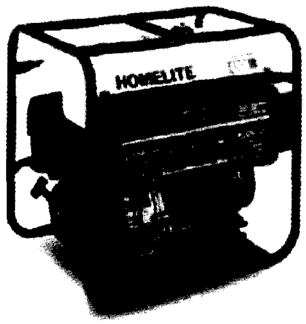




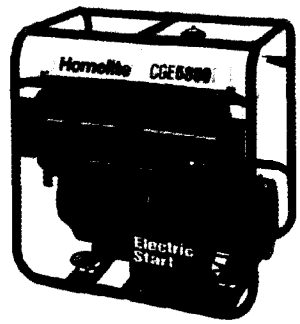
MODEL	**LRX3000**	**LRX4500** **LRXE4500***	**LRX5600** **LRXE5600***
ENGINE			
Model	EH17 Robin Ohv	EH25 Robin Ohv	EH36 Robin Ohv
Horsepower	6 Hp	8.5 Hp	11.5 Hp
Starting	Automatic Rewind	Automatic Rewind Auto Rewind/Electric*	Automatic Rewind Auto Rewind/Electric*
Run Time Full Load	6.5 Hours	7.9 Hours	9.3 Hours
FUEL SYSTEM			
Fuel Type	Automotive	Automotive	Automotive
Fuel Capacity	3 Gallons	5 Gallons	8 Gallons
ELECTRICAL			
AC Watts - Maximum	3000	4500	5600
AC Watts - Continuous	2300	4000	5000
AC Volts Output	120 Only	120/240	120/240
Voltage Regulation	Electronic, +/- 6%	Electronic, +/- 6%	Electronic, +/- 6%
Frequency	60 Hertz	60 Hertz	60 Hertz
Rated Amperage	19.2	33.3/16.7	41.7/20.8
Outlets	(1) 20 amp, 120V Type 5-20R (1) 20 amp, 120V GFCI	(1) 20 amp, 120V Type 5-20R (1) 20 amp, 120V GFCI (1) 30 amp, 120V Type L5-30R (1) 20 amp, 120/240V Type L14-20R	(1) 20 amp, 120V Type 5-20R (1) 20 amp, 120V GFCI (1) 30 amp, 120V Type L5-30R (1) 20 amp, 120/240V Type L14-20R
GENERAL			
Sound Level @ 50 ft.	69 dBA	72 dBA	74 dBA
Warranty-Consumer	1 Year Limited	1 Year Limited	1 Year Limited
Warranty-Commercial	90 Day Limited	90 Day Limited	90 Day Limited

Unit model number and specifications subject to change without notice.

SPECIFICATIONS

CG SERIES





MODEL	CG4400	CG5800 CGE5800*
ENGINE		
Model	Honda Ohv	Honda Ohv
Horsepower	8 Hp Ohv	11 Hp
Starting	Automatic Rewind	Automatic Rewind Auto Rewind/Electric*
Run Time Full Load	11 Hours	9 Hours
FUEL SYSTEM		
Fuel Type	Automotive	Automotive
Fuel Capacity	5 Gallons	5 Gallons
ELECTRICAL		
AC Watts - Maximum	4400	5800
AC Watts - Continuous	4000	5200
AC Volts Output	120/240	120/240
Voltage Regulation	Electronic, +/- 2%	Electronic, +/- 2%
Frequency	60 Hertz	60 Hertz
Rated Amperage	33.3/16.7	43.3/21.7
Outlets	(1) 20 amp, 120V Type L5-20R (1) 20 amp, 120V GFCI (1) 30 amp, 120V Type L5-30R (1) 30 amp, 120/240 Type L14-20R	(1) 20 amp, 120V Type L5-20R (1) 20 amp, 120V GFCI (1) 30 amp, 120V Type L5-30R (1) 30 amp, 120/240 Type L14-20R
GENERAL		
Sound Level @ 50 ft.	76 dBA	73 dBA
Warranty-Consumer	1 Year Limited	1 Year Limited
Warranty-Commercial	1 Year Limited	1 Year Limited

Unit model number and specifications subject to change without notice

SPECIFICATIONS

TORQUE SPECIFICATIONS

Designated for 2000 units, the fastener torque values in this section also are useful for similar applications to units of other model years.

NOTE: TORQUE SPECIFICATIONS ARE GIVEN IN INCH POUNDS AND NEWTON METERS (N•M)

SIZE & TYPE	QTY	APPLICATION	TORQUE LIMITS (IN. LBS)	TORQUE LIMITS (N•m)
5/16-24 X .750*	4	End Bell to Engine	120-150	13.6-16.9
1/4-20 X 4.00	4	Stator Bolts	60-80	6.8-9.0
5/16-24	1	Rotor Bolt	100-140	11.3-15.8
6-19 X .75 Plastite	2	Brush Holder	12-16	1.4-1.8
5/16-18 X .75	2	Stator to Bracket	150-155	16.9-17.5
6-32 X .50	2	Receptacle	9-13	1.0-1.5
6-19 X .75 Plastite	4	Fan to Rotor	12-16	1.4-1.8
5/16-18 Nut	4	Isolator to Frame	145-155	16.4-17.5
5/16-18 X 2.00	2	Engine to Engine Support	145-155	16.4-17.5
10-24 X .75 Taptite	1	Ground Wire to Stator	45-55	5.1-6.2
10-24 X .50 Mach. Torx	8	Tank Support to Frame	25-35	2.8-4.0
8-32 X .875 Mach-Pan	2	Heat Shield to Tank Support	8-12	0.9-1.4
5/16-18 X 1.25 Screw	2	Generator Support Bracket to Eng / Gen Support	145-155	16.4-17.5
10-24 X .50 Mach. Torx	4	Panel to Frame	20-25	2.4-2.8
8-32 X .375 Screw	4	Receptacles to Panels	12-14	1.4-1.6
7/16-18 Knurl Nut	1 or 2	Circuit to Panel	15-20	1.8-2.4
8-16 X .75 Plastite	8	Front to Back Panel	15-20	1.8-2.4
1/4-20 Screw, Hex Head	1	Idle Bracket to Engine	60-70	6.8-7.9
8-32 X .375	1	Idle Paddle to Governor Arm	14-18	1.6-2.0

3/8-16 X .875*	4	End Bell to Engine	240-250	27.1-28.2
1/4-20 X 6.160	4	Stator Bolts	60-80	6.8-9.0
5/16-24 X 8.250	1	Rotor Bolt	100-140	11.3-15.8
6-19 X .75 Plastite	2	Brush Holder	12-16	1.4-1.8
5/16-18 X .75	2	Stator to Bracket	150-155	16.9-17.5
6-19 X .75 Plastite	4	Fan to Rotor	12-16	1.4-1.8
5/16-18 Nut	4	Isolator to Frame	145-155	16.4-17.5
5/16-18 Nut	2	Generator Bracket to Isolator	145-155	16.4-17.5
5/16-18 X 2.00	2	Engine to Engine Support	145-155	16.4-17.5
5/16-18 Nut	2	Engine Support to Isolator	145-155	16.4-17.5
10-24 X .75 Taptite	1	Ground Wire to Stator	45-55	5.1-6.2
10-24 X .50 Mach. Torx	8	Tank Support to Frame	25-35	2.8-4.0
8-32 X .875 Mach-Pan	2	Heat Shield to Tank Support	8-12	0.9-1.4
5/16-18 X 1.25 Screw	1	Ground Screw	145-155	16.4-17.5
1/4-20 Nut**	2	Switch to Battery Plate	70-80	7.9-9.0
10-32 Nut**	2	Battery Strap to Plate	12-16	1.4-1.8
1/4-20 X .625 Screw**	2	Battery Cables to Battery	40-50	4.5-5.6

*APPLY LOCTITE RED 277

SPECIFICATIONS

TORQUE SPECIFICATIONS (continued)

SIZE & TYPE	QTY	APPLICATION	TORQUE LIMITS (IN. LBS)	TORQUE LIMITS (N•m)
1/4-20 X 10.50	4	Stator Bolts	65-75	7.3-8.5
5/16-24 X 8.00	1	Rotor Bolt	120-150	13.5-16.9
10-24 X .50 Mach. Torx	8	Tank Support To Frame	25-35	2.8-4.0
8-32 X .875 Mach-pan	2	Heat Shield To Tank Support	8-12	0.9-1.4
5/16-18 X 1.25 Screw	1	Ground Screw	145-155	16.4-17.5
1/4-20 Nut**	2	Switch To Battery Plate	70-80	7.9-9.0
10-32 Nut**	2	Battery Strap To Plate	12-16	1.4-1.8
1/4-20 X .625 Screw**	2	Battery Cables To Battery	40-50	4.5-5.6
5/16-24 Nut**	2	Battery Cables To Starter Sw	50-60	5.6-6.8
1/4-20 Nut**	1	Battery Cable To Starter	30-40	3.4-4.5
10-24 X .50 Mach. Torx	4	Panel To Frame	20-25	2.4-2.8
8-23 X .375 Screw	8	Receptacles To Panels	12-14	1.4-1.6
7/16-18 Knurl Nut	3	Circuit Breaker To Panel	15-20	1.8-2.4
8-16 X .75 Plastite	10	Front To Back Panel	15-20	1.8-2.4

1/4-20 X 7.00	4	Stator Bolts	60-80	6.8-9.0
5/16-24	1	Rotor Bolt	100-140	11.3-15.8
5/16-18 Hex Nut	1	Idle Bracket To Muffler Bracket	145-155	16.4-17.5
8-32 X 3.75	1	Idle Bracket (Clamp)	14-18	1.6-2.0
8-32 X 3.75	1	Idle Paddle (Clamp)	14-18	1.6-2.0
8-32 X .75	1	Rectifier	18-22	2.0-2.5
8-32 X .50	2	Brush Holder	18-22	2.0-2.5
8-32 X .50	4	Brush Head Cover	18-22	2.0-2.5
5/16-18 X 1.00	2	Generator To Cross Member	220-250	24.9-28.2
5/16-18 X 1.75	2	Engine To Cross Member	145-155	16.4-17.5
5/16-18 X 2.00	2	Engine To Cross Member	145-155	16.4-17.5
5/16-18 X 1.00	1	Magnet Bracket To Engine	130-140	14.7-15.8
8-32 Nut	8	Receptacles To Panel	12-14	1.4-1.6
8-32 X .375	8	Receptacles To Panel	12-14	1.4-1.6
10-24 X .5	2	Throttle Arm To Engine	35-45	3.4-5.1
8-32 X .50	1	Grd Lead (Inside B/Head 18-22		
1/4-20 X .75	4	Control Box To Frame	70-80	7.9-9.0

*APPLY LOCTITE RED 277

ELECTRICAL SAFETY

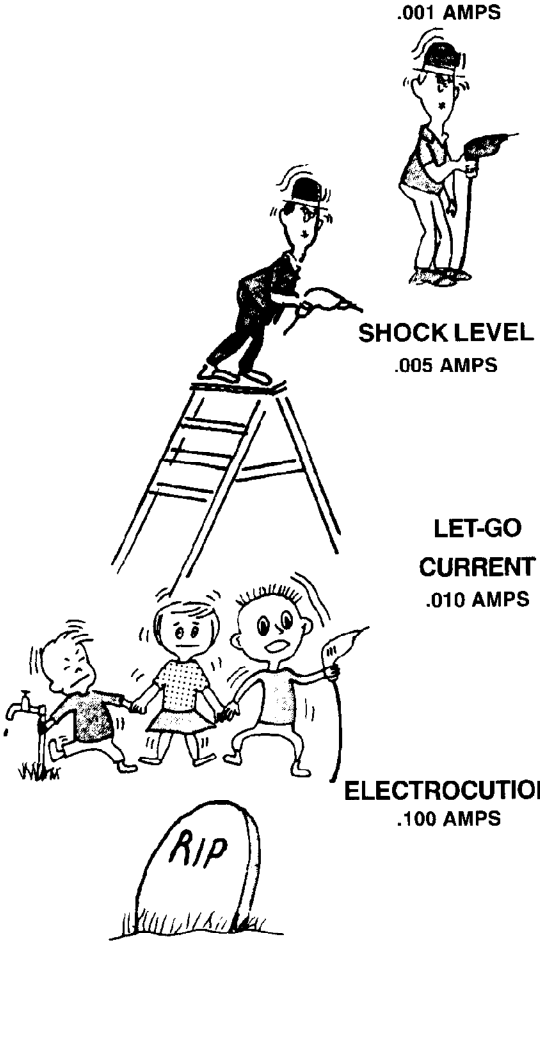
Electrocutions are few in this country, about 1,000 per year, but there are 30 times that many people injured through electrical shock. Portable, electrically operated tools account for the second largest number of injuries, with the plug or cord at fault in two-thirds of the incidents.

Insurance company statistics indicate that rental equipment is involved in a high percentage of such accidents, and it is important to realize that the rental operator is liable for those defects of which he is aware, as well as those which would have been disclosed by a reasonable investigation.

LEAKAGE CURRENT

One of the most important checks to be sure a tool is safe is for excessive leakage current. Leakage current flows from the internal wiring to metal portions of the equipment housing or enclosure.

The skin offers a barrier to the flow of leakage current. It is not until the voltage exceeds about 48 volts that a hazard exists. At a common supply voltage of 120 volts, current can easily pass through the skin. Once the current starts to flow, the skin resistance decreases further, allowing an increasing flow of current to pass through the body.



PERCEPTION CURRENT
.001 AMPS

One milliampere (1/1000 of an ampere) will be felt by most individuals as a slight tingling sensation. A defective hand drill or floor polisher might allow this amount of current to flow through a person standing on a dry wooden floor. Not bothered by it, he continues to use the equipment, until he happens to touch a water connection, heating register, metal window sash or other grounded metal object. He has now completed the circuit to ground and a much larger current will flow through his body.

SHOCK LEVEL
.005 AMPS

If only five milliamperes (1/43 of the current required to operate a 25-watt lamp) flow through his body, it will result in a violet muscle reaction, throwing him away from the equipment.

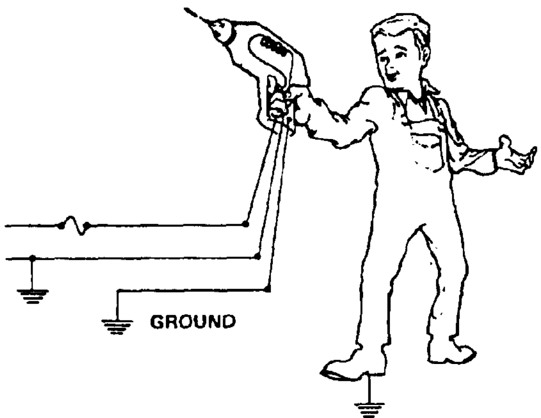
LET-GO CURRENT
.010 AMPS

If the current is much above 10 milliamperes, the person will lose his ability to release his grip on the electrical equipment. While the heart normally can continue to function, fatigue sets in, followed by death if no help is available.

ELECTROCUTION
.100 AMPS

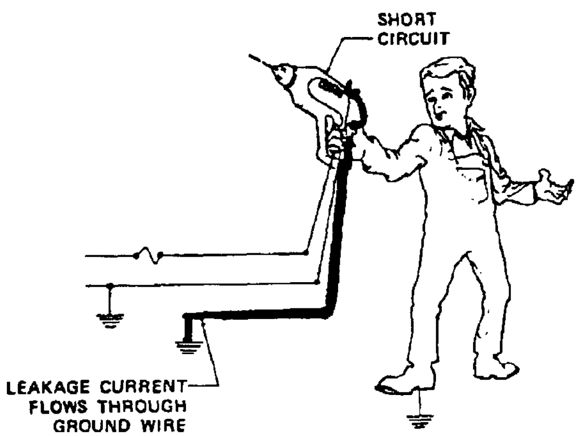
At about 100 milliamperes (less than half that used by a 25-watt lamp) ventricular fibrillation occurs, the muscle fibers lose control and the heart is no longer able to pump blood.

NORMAL OPERATION



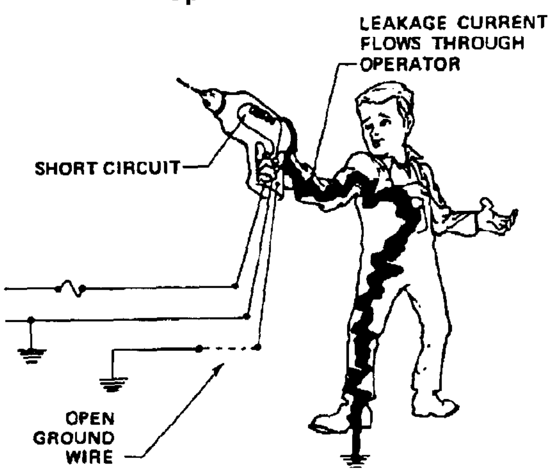
When a tool is operating normally, electricity passes through one wire into the tool and back out the second wire. Little or no current should travel down the ground wire.

SHORTED TOOL
GOOD GROUND WIRE



If a tool's insulation becomes defective, some of the electrical current will pass through the tool's case to the ground wire and back to the ground. The person holding the tool will not be injured. If enough leakage current flows, the line fuse will open. The only problem is that this depends on a good ground path all the way back to the ground itself.

SHORTED TOOL
Open Ground Wire



If the ground wire does not make a perfect contact all the way back to the ground, the leakage current will flow through the operator to the ground. The amount of shock the person receives will depend on how defective the tool's insulation is and how well grounded the main is.

GENERATOR SAFETY

WARNING: FOR SAFE OPERATION, READ THESE INSTRUCTIONS BEFORE USING YOUR GENERATOR. FOLLOW ALL INSTRUCTIONS FOR SAFE OPERATION.

SAFETY PRECAUTIONS

- If this generator is used for emergency standby service it will be necessary to install a **manual transfer switch** between the electric utility's meter and the building's distribution panel. The transfer switch isolates the generator and load from the utility power line, thus avoiding any danger of electricity being fed back to the utility lines. The installation should be done by a licensed electrician.
- Never operate the machine in an explosive atmosphere, near combustible materials or where ventilation is not sufficient to carry away exhaust fumes. **Exhaust fumes can cause serious injury or death.**
- When starting the machine, be sure that nothing is in a position to be hit by the operators hand or arm.
- Be sure the switch on electric power tools is in the "OFF" position before plugging them into the machine.

FOLLOW THESE INSTRUCTIONS TO REDUCE THE RISK OF INJURY.

- This generator is equipped with a grounding terminal for your protection. Always complete the ground path from the generator to an external ground source as instructed in the section labeled "Grounding the Generator".
- Keep the immediate area free of all bystanders.
- Be sure each person who operates this machine is properly instructed in its safe operation.
- Do not operate this machine or any electrical tool in any area where water or similar materials constitute an electrical hazard to the operator. **Do not operate on wet surfaces or in the rain.**
- Always be sure that the machine is on secure footing so that it cannot slide or shift around, endangering workers.
- Avoid contacting the hot exhaust manifold, muffler or cylinder. Keep clear of all rotating parts.
- Unless the tool or appliance is double insulated, ground it. Tools and appliances which have 3 prong plugs must be plugged into extension cords and electrical receptacles with 3 holes. Before operating any electrical item, be sure it is in good repair.
- Follow instructions in this manual when testing Ground Fault Circuit Interrupter to insure reliable operation.
- **BEWARE OF USING THIS EQUIPMENT IN CONFINED SPACES**
  Confined spaces, without sufficient fresh air ventilation, can contain dangerous gases. Running gasoline engines in such environments can lead to deadly explosions and/or asphyxiation.

MAINTENANCE

- Use **HOMELITE®** genuine replacement parts. Failure to do so may cause poor fit and injury.
- Never operate machine with any guard removed.
- Shut off the engine and disconnect the spark plug wire before working on any part of this machine.
- Always keep the machine and all associated equipment clean, properly serviced and maintained.

REFUELING (DO NOT SMOKE!)

- Observe all safety regulations for the safe handling of fuel.
- Handle fuel in safety containers.
- If container does not have a spout, use a funnel.
- Do not refill fuel tank while the engine is running.
- Fill the tank only on an area of bare ground. While filling the tank, keep heat, sparks and open flame away. Carefully clean up any spilled fuel before starting engine.

⚠ GROUND FAULT CIRCUIT INTERRUPTER

These generators are equipped with a GFCI (Ground Fault Circuit Interrupter) located at the 120V duplex receptacle for protection against the hazards of electrical shock from defective attachments such as tools, cords, and cables.

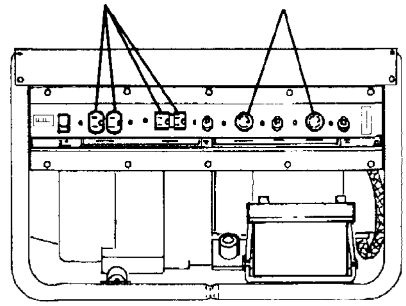
WARNING

The GFCI may not function unless the generator is properly grounded. Follow the correct grounding procedure specified below.

The GFCI is a device that interrupts electricity from either the utility or generator by means of a special type of circuit breaker if a fault current flow to the ground occurs.

WARNING

ON THE LRX4500, LRXE4500, LRX5600 & LRXE5600 MODELS, ONLY THE 120V DUPLEX RECEPTACLES ARE PROTECTED BY THE GFCI.



For additional protection against shock hazards due to defective equipment attached to the twist-lock receptacles, consider the use of a GFCI on each of these receptacles as well.

A GFCI can be used only with generators that have the neutral wire internally bonded to the frame, and the frame properly grounded to the earth. A GFCI will not work on generators that do not have the neutral wire bonded to the frame, or on generators which have not been properly grounded.

A GFCI may be required by OSHA regulations, the National Electric Code and/or local and federal codes when operating a generator.

GFCI and GFCI protected cord sets and cables may be purchased from local electrical supply houses.

As with any other safety devices, the GFCI supplied with these generators must be checked every month to insure that it is functioning properly. To test the GFCI, follow the instructions below.

1. With the generator running with the idle control switch in the "START" position, push the "TEST" button. The "RESET" button should pop out. This should result in the power being off at both outlets of the duplex receptacles. Verify this by plugging a test lamp into each outlet.

WARNING

If the "RESET" button does not pop out or the test lamp lights when the "RESET" button does pop out, DO NOT USE ANY OF THE FOUR OUTLETS OF THE DUPLEX RECEPTACLES. Have the units serviced by an authorized servicing dealer immediately.

2. If the GFCI tests correctly, restore power by FIRMLY pushing the "RESET" button back in until you hear or feel a distinctive "click." IF THE GFCI FAILS TO RESET PROPERLY, DO NOT USE EITHER OUTLET OF EITHER DUPLEX RECEPTACLE. Have the unit serviced by an authorized servicing dealer immediately.
3. High vibration or severe mechanical shock loads may cause the GFCI to trip. IF THE GFCI TRIPS BY ITSELF AT ANY TIME, reset it and perform test procedures 1. and 2.

WARNING

Although the above test procedures will indicate proper GFCI operation on an ungrounded or improperly grounded generator, the generator MUST still be properly grounded for the GFCI to function properly and protect the user from electrical faults.

GFCI PRINCIPLES OF OPERATION

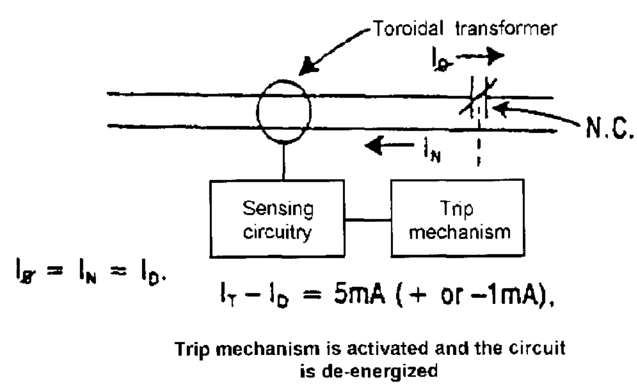
Ground Fault Circuit Interrupters (GFCI) generally operate on the principle that any ground fault will create a difference in current flow between the phase conductor (hot leg) and neutral conductor (return leg) in an AC circuit. For example, in a circuit supplying single phase, 120V load, under normal conditions, current flows from the circuit source (generator, distribution panel, etc) to the hot and back through the neutral (return) conductor.

Under normal conditions (no ground fault), the current flow in the phase conductor and neutral conductor are of equal value and 180° out of phase. This results in zero difference between the electromagnetic fields produced by the two conductors. However, if a ground fault should occur as a result of insulation breakdown or equipment being fed, a differential current is created because the phase conductor, which is supplying the fault, is greater than the current flow in the neutral conductor. When the GFCI senses the difference in current flow between the two conductors (caused by the ground fault), it activates a trip mechanism to interrupt supply.

In order to sense the difference in current flow between phase and neutral conductors (or two phase conductors), most GFCI's use what is known as a "Toroidal Transforme". A Toroidal Transformer is a donut-shaped piece of magnetic material with a very fine wire coil wrapping. This type of transformer is very sensitive and small enough to fit within the receptacle or as a circuit breaker.

A GFCI must be capable of detecting and interrupting fault currents as low as 5 mA (.005A) and ignore those below 4 mA, and that differential must be detected where the load supplied can be rated for 15A, or more.

The phase and neutral conductors are passed through the "Toroidal Transformer" within the GFCI. This permits sensing of current flow downstream (see the diagram below for more details). Remember that any difference in the phase or neutral current flow that exceeds 5 mA will cause the GFCI to operate.



Simplified Diagram of a GFCI Protective Device

SAFETY AND APPLICATION

WARNING

Situations exist where the GFCI will not afford any protection against the hazards of electrical shock. EXAMPLE: if a person touches two or more conductors from a damaged cord set and is not in direct contact with the ground, he may receive a shock. Since there is no path to ground for a ground fault current to flow through, the GFCI will not operate and serious injury may result.

The GFCI is merely an added safety feature. There are no substitutes for good safety precautions, correct electrical practices and proper maintenance of cords, equipment and connections.

GROUNDING THE GENERATOR

The wing nut and ground terminal on the frame must always be used to connect the generator to a suitable ground source. The ground path should be made with #8 size wire. Connect the terminal of the ground wire between the lock washer and the wing nut, and tighten the wing nut fully. Connect the other end of the wire securely to a suitable ground source.

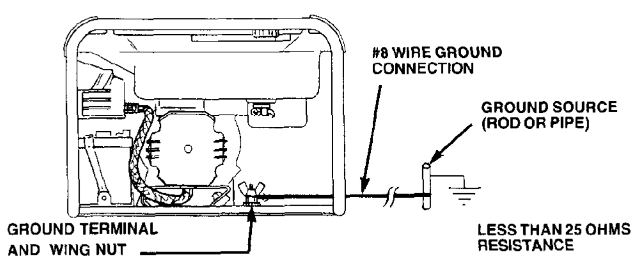
The National Electric Code contains several practical ways in which to establish a good ground source. Examples given below illustrate a few of the ways in which a good ground source may be established.

A metal underground water pipe in direct contact with the earth for at least 10 feet can be used as a grounding source. If an underground pipe is unavailable, an 8 foot length of pipe or rod may be used as the ground source. The pipe should be 3/4 inch trade size or larger and the outer surface must be noncorrosive. If a steel or iron rod is used it should be at least 5/8 inch diameter and if a nonferrous rod is used it should be at least 1/2 inch diameter and be listed as material for grounding. Drive the rod or pipe to a depth of 8 feet. If a rock bottom is encountered less than 4 feet down, bury the rod or pipe in a trench. All electrical tools and appliances operated from this generator, must be properly grounded by use of a third wire or be "Double Insulated".

It is recommended to:

1. Use electrical devices with 3 prong power cords.
2. Use an extension cord with a 3 hole receptacle and a 3 prong plug at opposite ends to ensure continuity of the ground protection from the generator to appliance.

We strongly recommend that all applicable federal, state and local regulations relating to grounding specifications be checked and adhered to.



LINE TRANSFER SWITCH

If this generator is used for standby service, it must have a transfer switch between the utility power service and the generator. The transfer switch not only prevents the utility power from feeding into the generator, but it also prevents the generator from feeding out into the utility company's lines. This is intended to protect a serviceman who may be working on a damaged line. **THIS INSTALLATION MUST BE DONE BY A LICENSED ELECTRICIAN AND ALL LOCAL CODES MUST BE FOLLOWED.**

WATTAGE CALCULATION

The biggest problem in selecting a generator is determining the power requirements that must be met under operating conditions.

Under-sizing of the generator is the single most common mistake and can be avoided by considering **ALL** the loads to be connected to the generator. Additionally, calculating the starting requirements of any electric motor operated equipment is a very important consideration.

An estimate of the total load that will be connected to the generator can be made by getting the nameplate amperage of all equipment or tools to be used. The nameplate, showing the electrical requirements, is found on all electric powered tools, appliances, electric motors or devices. It lists such information as running amperage, the speed at which the tool operates; hertz, or frequency; phase; and for electric motors, the code specification.

Once the total amperage draw for all tools and equipment is known, the following can be used to establish starting wattage required:

If the equipment is for heating or lighting and contains no electric motors, multiply the running amperage requirement times 1, times the voltage rating or requirement. The result will tell the wattage required for this application. Heaters, light bulbs, coffee makers, hot plates, are referred to as **resistive** loads. This type of equipment draws a constant amount of current while operating.

If the equipment to be powered consists of hand tools, such as saws, drills or other, handheld types of equipment; multiply the running amperage, times 2, times the voltage requirement. Again, the result will tell the wattage required for this application. These types of equipment typically draw twice their normal, free running amperage when used at full capacity or when starting the motor.

If the equipment being run is stationary equipment or appliances containing electric motors, multiply the running amperage times, 3, times the voltage requirement. Once again, the result will tell the wattage required for this application. Electric motor driven stationary equipment typically requires up to three times the running amperage when starting, until the machine's motor comes up to operating speed.

Generator wattage required = (amps) x (volts) x (1, 2 or 3)

This example will help to explain these requirements.

A customer wants to operate the following equipment on a generator: (1) A Radiant Heater, (2) a Freezer, (3) a Small Refrigerator, (4) a microwave oven and (5) Four sixty-watt light bulbs.

The starting wattage of the radiant heater would be 1,250 watts, the freezer – 1,000 watts, the small refrigerator - 1,000 watts, the microwave – 1,500 watts and the four light bulbs at 240 watts.

Tools/Equipment	Name Plate Running Watts	Times (x) 1, 2, 3	Starting Watts
Radiant Heater	1,250	1	1,250
Freezer	400	3	1,200
Small Refrigerator	400	3	1,200
Microwave Oven	750	1	750
(4) 60 Watt Light Bulbs	240	1	240
Total	**3,840**		**4,640**

A total of 4,640 starting watts are required if all of the items were started simultaneously. This would require the use of a generator with a minimum continuous rating of 5,000 watts.

LOAD APPLICATION

Always be sure (by checking the generator and equipment name plates) that the voltage, amperage and frequency requirements of the equipment to be used can be satisfied by the generator.

Refer to the two tables, "Cable Size" and "Wattage Consumption for Typical Equipment" to be sure that the loads you are connecting are within the capacity of the generator. Incandescent lights, electric motors, and resistance coil devices, such as heaters, draw much greater current for start-up than after they are operating. Inadequate size connecting cables, which cannot carry the required load, can cause a voltage drop which can burn out the appliance and overheat the cable.

CABLE SIZE

Equipment damage can result from low voltage. Therefore, to prevent excessive voltage drop between the generator and the equipment, the cable should be of adequate gauge for the length used. The table below gives the maximum cable length for various gauges of wire.

CURRENT IN AMPERES	LOAD IN WATTS		MAXIMUM ALLOWABLE CABLE LENGTH				
	AT 120 VOLTS	AT 240 VOLTS	#8 WIRE	#10 WIRE	#12 WIRE	#14 WIRE	#16 WIRE
2.5	300	600		1000 ft.	600 ft.	375 ft.	250 ft.
5	600	1200		500	300	200	125
7.5	900	1800		350	200	125	100
10	1200	2400		250	150	100	50
15	1800	3600		150	100	65	
20	2400	4800	175 ft.	125	75	50	
25	3000	6000	150	100	60		
30	3600	7200	125	65			
40	4800	9600	90				

NOTE: Amperage will be limited by receptacle rating and the cable which will fit the mating plug.

ELECTRIC MOTOR LOADS

It is characteristic of common electric motors in normal operation to draw up to **six times** their running current while starting. This table may be used to estimate the watts required to start "CODE G" electric motors, however if an electric motor fails to start or reach running speed, turn off the appliance or tool immediately to avoid equipment damage. Always check the requirements of the tool or appliance being used compared to the rated output of the generator.

Motor Size (H.P.)	Running Watts	Watts Required to Start Motor		
		Repulsion Induction	Capacitor	Split Phase
1/8	275	600	850	1200
1/6	275	600	850	2050
1/4	400	850	1050	2400
1/3	450	975	1350	2700
1/2	600	1300	1800	3600
3/4	850	1900	2600	-
1	1100	2500	3300	-

SELECTING A GENERATOR

TYPICAL EQUIPMENT REQUIREMENTS

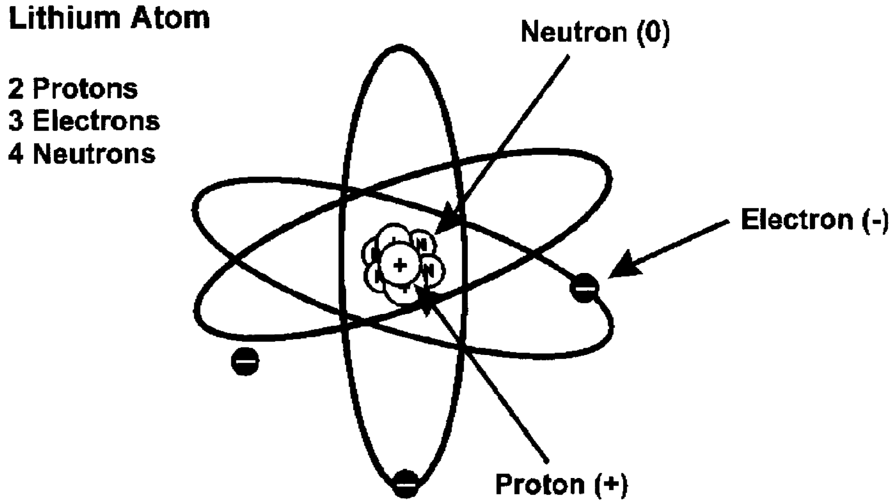
Appliance	Watts	Appliance	Watts
Light Bulb	See Bulb	Coffeemakers	400-700
Clothes Dryer (Electric)	5000-10,000	Window Fan	200
Iron (Hand)	500-1500	Radio	50-200
Portable Heater	600-4800	Air Conditioner (10,000 BTU)	2000-3000
Toaster	900-1650	Automatic Washer	150-1500
0-1/2 Inch Hand Saw	1000-2500	Refrigerator	600-2000
Water Heater	3000-5000	Television	100-500
Water Pump	1000-3000	Vacuum Cleaner	200-300
Sump Pump	400-3000	Electric Drill	225-100
Food Freezer	300-500	Hot Plate	330-1100

BASIC ELECTRICITY

Electricity is a basic "ingredient" of ALL matter. To more easily understand the nature of electricity, we must first (briefly) examine the Basic Building Blocks of Matter itself.

Normally, an Atom has equal numbers of electrons and protons. Therefore it's net charge is neutral. ATOMS WANT TO BE NEUTRAL!

It is possible to "dislodge" one or more electrons from most atoms. When this occurs, the atom is left with a positive (+) net charge and is referred to as a POSITIVE ION. If a stray electron combines with a neutral atom, the atom takes on a negative (-) net charge and is referred to as a NEGATIVE ION.



ATOMS DON'T LIKE BEING IONS !!

A Negative ion seeks to rid itself of its extra electron. A Positive ion seeks to re-gain its missing electron. Ah yes, a marriage made in Heaven!

Under the right conditions, an Electron can be transferred from the Negative ion to the Positive ion, resulting in two happy (and neutral) atoms.

THIS IS THE BASIC PHYSICS BEHIND ELECTRICITY!

Rather simple, isn't it?

In short:

Electricity is the flow of Electrons from a point relatively rich in electrons to a point relatively low in electrons. (Usually)

ELECTRICAL VOLTAGE (V)

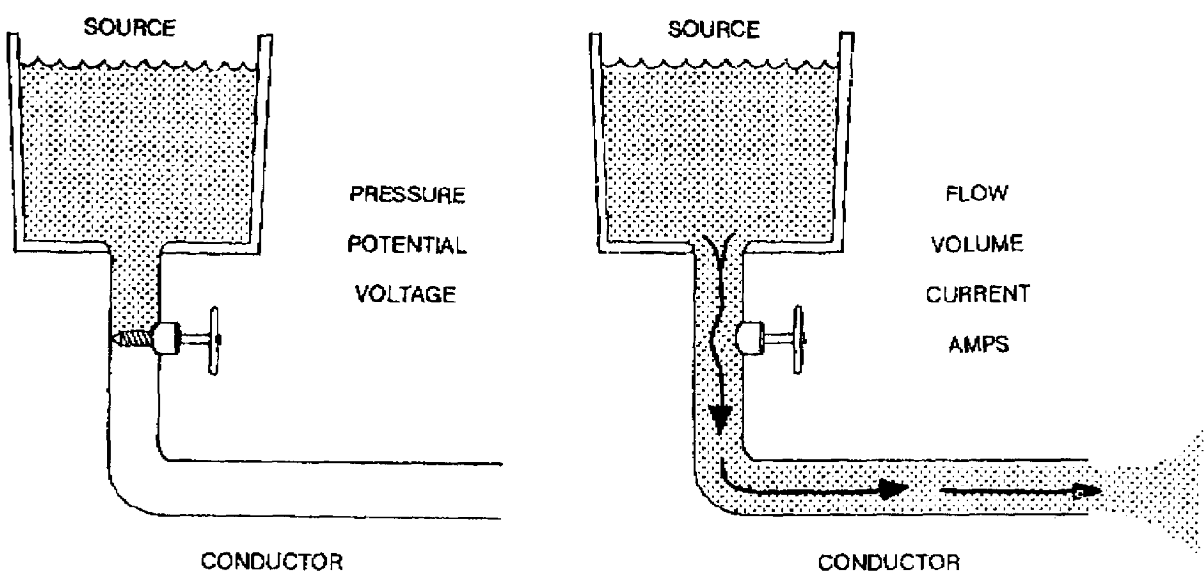
Voltage is electrical pressure or force. Voltage basically refers to the Potential for current to flow from one point to another, for that reason, voltage is sometimes called ELECTRICAL POTENTIAL.

Electrical current tends to flow from points of high POTENTIAL to points of lower POTENTIAL, i.e; from an area with a surplus of Electrons to an area low in Electrons: - to +.

Unfortunately, many years ago, before anyone knew what an Electron was, the direction of current flow was chosen by convention to be from + to -. (They thought the Positive Ions traveled to combine with the Electrons.) Although confusing, we are stuck with the "Backwards" standard.

Voltage is measured in units of Volts, which is abbreviated "V". Likewise, the symbol for voltage is "V". Sometimes, voltage is also referred to as Electro-Motive Force or EMF (symbol is "E").

The following "Water Analogy" may be helpful in understanding electrical terms:



ELECTRICAL CURRENT (I)

Electrons can easily travel through metals or conductive materials.

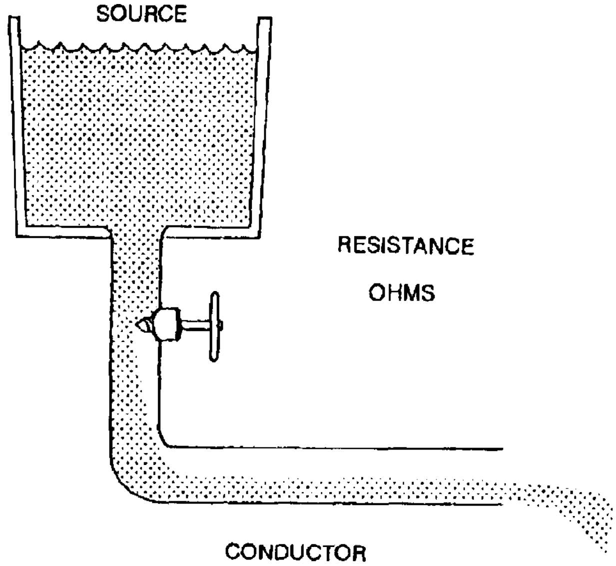
Naturally, electrons cannot easily travel through an insulator (like glass, plastic or rubber).

The quantity of Electrons flowing past a given point in a conductor is known as CURRENT. Electrical current is measured in units of: AMPERES (abbreviated AMPS or "A"). The symbol for electric current is "I".

Fascinating Fact:
One Ampere is 6,250,000,000,000,000 electrons passing a point in one second!

RESISTANCE (R)

Conductors are not perfect. They resist, to some degree, the flow of current. The degree to which a conductor resists the flow of current is known as Resistance (abbreviated "R"). Resistance is measured in units known as OHMS. The symbol for the OHM is the greek letter Omega: Ω



OHM'S LAW

A potential of 1 volt will force a current of 1 AMP through a resistance of 1 OHM.

This relationship is called OHM'S LAW and is mathematically:

Volts = Amps x Ohms or

Amps = Volts / Ohms or

Ohms = Volts / Amps

POWER (W) OR (P)

The work performed by an electrical current is called **POWER**. The unit for power is the **WATT (W)**. The power of a direct current is its voltage times its current.

P = I x V

WATTS (POWER) =AMPS x VOLTS

The 178V152 is rated for 4600 W continuous POWER at 120 V. How many AMPS can it supply at full load?

P = I x V

4600W = I x 120V

4600W / 120V = I

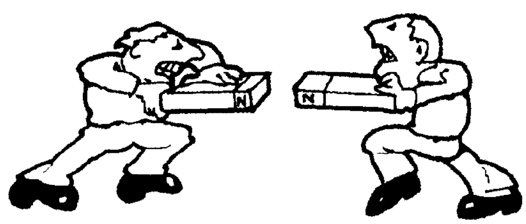
38.3 A = I

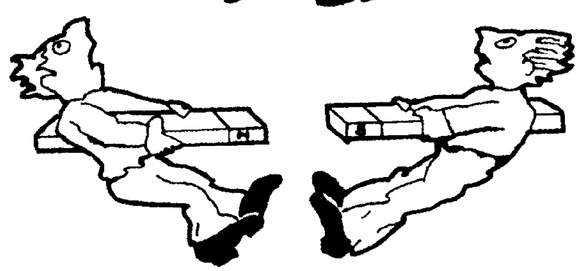
MAGNETISM

In the first section we learned some of the basic principles of electricity. We are now ready to to learn how generators "produce" electricity. We will begin with Magnetism.

A magnet is any material that attracts iron and steel. The attraction of magnets, greatest at the ends (or poles), occurs according to the following principle: like poles of magnets oppose each other, while unlike poles attract each other.

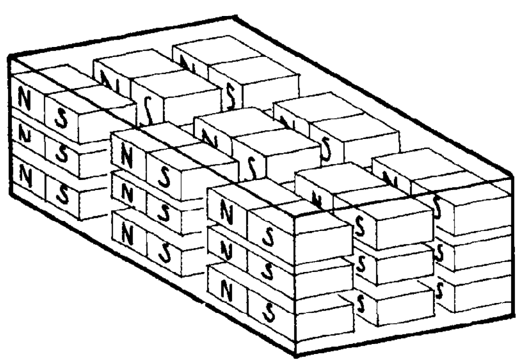
Like poles repel



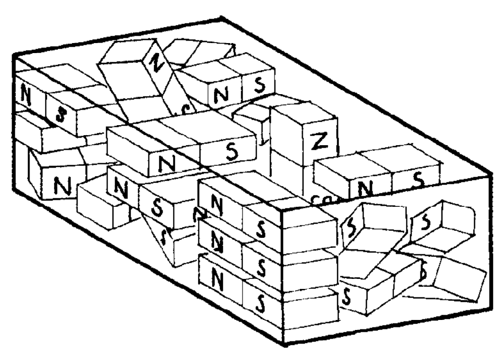


Unlike poles attract

When the atoms in certain magnets are aligned with each other in a particular manner, magnetism results. The second bar illustrated has non-aligned atoms, therefore it has no magnetism.



Magnetized Bar



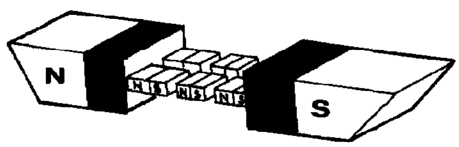
Un-Magnetized Bar

GENERATOR THEORY

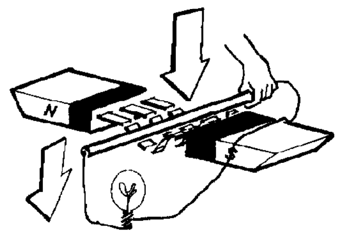
ELECTROMAGNETIC INDUCTION

Around every magnet is a magnetic field, One can actually "see" the magnetic lines of force if a magnet is covered with a thin sheet of paper and soft-iron filings are sprinkled on the paper.

If a conductor cuts through the lines of force in a magnetic field, a voltage will be induced in the conductor. This is called ELECTROMAGNETIC INDUCTION.



Put Simply:



To generate voltage, we need:

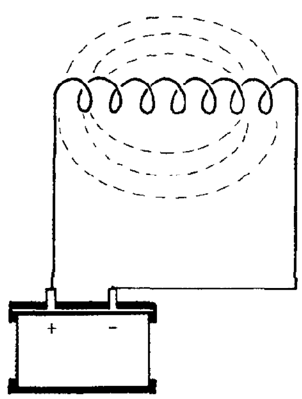
1. A conductor
2. A magnetic field
3. MOTION of the magnetic field OR conductor which causes the conductor to cross magnetic lines of force.

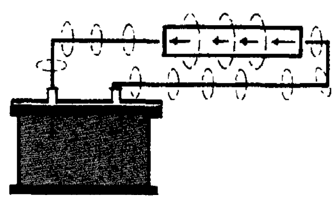
A current flowing through a wire creates a MAGNETIC FIELD around the wire.

The direction (or polarity) of the magnetic field depends on the direction of the current.

We can make an even stronger magnetic field by wrapping many turns of wire around an iron core. The iron core "concentrates" the magnetic field. This is called an ELECTROMAGNET.

Notice that the iron still retains some magnetism after the coil is de-energized. This will become important later!





GENERATOR THEORY

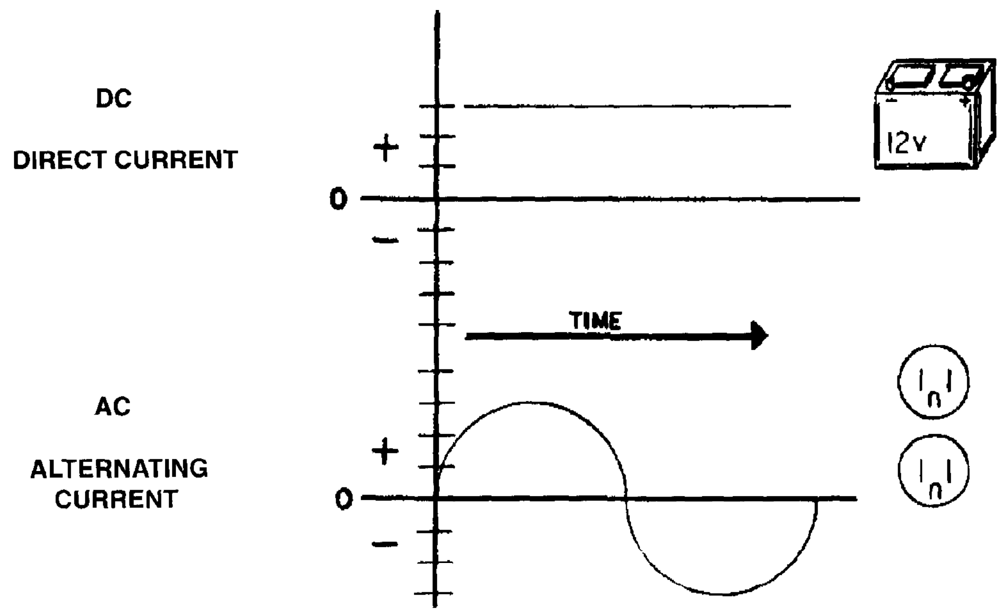
AC vs DC

When a voltage is at a (more or less) constant level, and does not change polarity (direction of current flow), it is known as a DC voltage. DC stands for Direct Current, which refers to the fact that the current flows "directly" or in one direction only.

When voltage changes polarity back and forth, it is known as AC voltage, AC stands for Alternating Current, which refers to the fact that the current flows back and forth, in alternating directions,

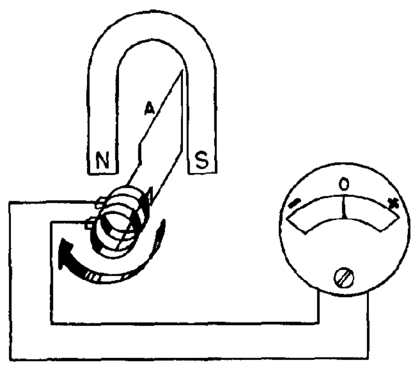
One complete reversal of an alternating current is known as a CYCLE. The number of times this complete reversal takes place in one second is known as Frequency and is expressed in units of Hertz (Hz) - which simply means "CYCLES PER SECOND".

Household power is AC. In the U.S., the frequency of the A.C has been chosen to be 60 Hz. In Europe, the frequency is 50 Hz; also, household AC power varies in voltage and reverses in such a way as to follow a sine wave pattern. Below, is what one cycle (1/60th of a second) of AC voltage looks like.

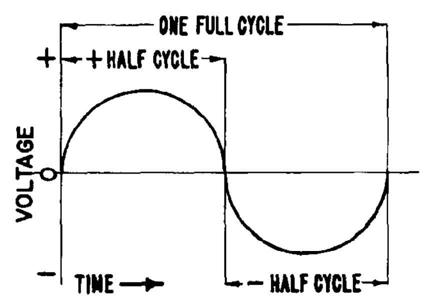


GENERATOR CONSTRUCTION

A simple generator can be built with a single wire loop and a permanent magnet. If you connect the ends of the wire loop to collector rings and let a brush ride on each ring; you can observe the output of this simple generator on a sensitive meter. As you rotate the wire loop through the magnetic field which exists between the poles of a horseshoe magnet, current starts to flow through the meter, it gets stronger as leg A of the loop approaches the South Pole of the magnet and the needle of the meter is deflected toward the + side. The current reaches maximum + value as loop A passes opposite the S pole. Then the current gets smaller and reaches 0 as leg A is now centered on the bottom between the two poles of the magnet. As leg A approaches the North Pole of the magnet, current again rises but this time it deflects the meter to the - side, It reaches a maximum value and then drops to zero when leg A is back in its original position. We have completed 1 revolution and 1 cycle.



Why does the voltage build up and fall like this? If you could see a magnetic field, you would see that the magnetic lines of force are concentrated near the poles (ends) of the magnet, and they spread out as they get near the center between the two poles of the magnet. If the loop is rotated at a constant speed, the number of lines of force being cut is greatest when the loop is nearest the North or South Pole and no lines of force are being cut when the loop is vertical as the loop is traveling parallel to the lines of force. The intensity of current is directly proportional to the number of lines of force being cut. If we were to graph one revolution we would get a sine curve that looks like this:



This is one cycle. If we rotate our loop 60 times per second, we have 60 cycles alternating current or more commonly called 60 AC. Most recently the electrical terminology has changed and a cycle is being referred to as a Hertz (Hz). So the modern designation is 60 Hz.

AC or alternating current describes a current which has a + value part of the time and a - value part of the time, or a current which changes direction. Our one loop AC generator does not produce a great deal of electrical energy so we must find ways to increase the output.

GENERATOR THEORY

INCREASING ELECTRICAL ENERGY

The electrical energy can be increased in these ways:

1. By using a stronger magnet field.
2. By using more loops of wire.
3. By increasing the speed with which we cut the magnetic lines of force.

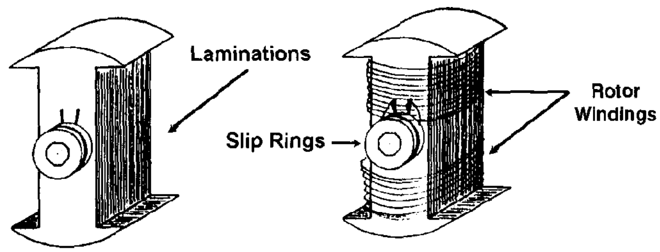
Number 3 above can be eliminated because we have decided that 60 Hz is the standard frequency that we want to use, and increasing the speed would change the frequency.

In order to increase the number of loops of wire we simply wind many more turns of wire on a suitable holder.

Turning a loop of wire in a magnetic field will create a current and likewise, turning a magnet in a coil will also create a current. In our Homelite generators we have chosen to turn a magnet inside of a coil to generate power in the coil. The coil is wound on a laminated steel core, which is known as the stator. The stator is the stationary part of the generator, and is the power producing part as well.

We increase the amount of electrical energy that we generate by increasing the magnetic field.

In order to increase the magnetic field we press steel laminations onto a shaft and wind coils around the steel. This is called an Electro-Magnet, and is used because the strength of the magnet can be controlled by the amount of current flowing through the coils.



This assembly is better known as the ROTOR. It is known as a rotor because it is the part that rotates inside of the stator. It is also the part that produces the magnetic field needed to generate power in the stator coils.

Since this whole assembly rotates, we cannot simply connect wires to it in order to energize it. So, slip rings and brushes are provided in order to transfer the necessary current to the rotating rotor.

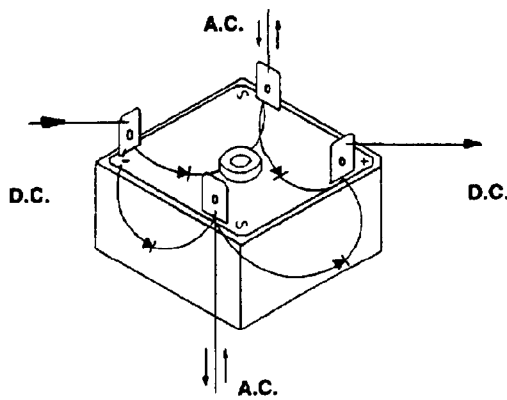
Think of a rotor as a powerful rotating magnet which takes electric current to generate the magnetism. The strength of the magnetic field is determined by how much current is sent through the rotor coils.

For the Electro-Magnet to operate we must use direct current because alternating current would make the Electro-Magnet change polarity and would not provide a constant magnetic field. To provide the direct current a bridge rectifier (full wave rectifier) is used to change the AC output from the excitation winding into DC

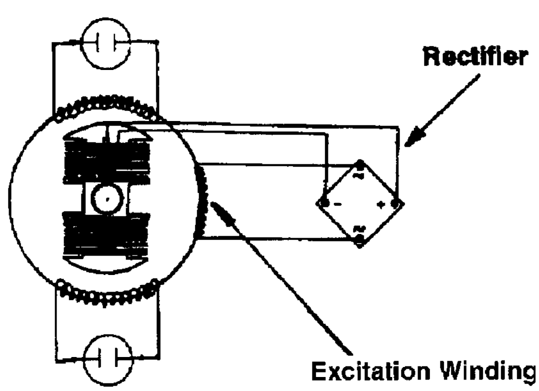
OUTPUT FROM THE EXCITATION WINDING INTO DC

To understand the workings of the bridge rectifier we first must understand how the rectifier works. The rectifier is made up of four diodes. Diodes allow current to pass freely in one direction but block current flow in the opposite direction. To understand how Diodes work would require an extensive knowledge of chemistry and physics. The important thing we must remember is that they allow current flow in one direction only. A bridge rectifier uses four diodes connected in such a way that the alternating current fed Into is changed into direct current.

FULL WAVE BRIDGE RECTIFIER



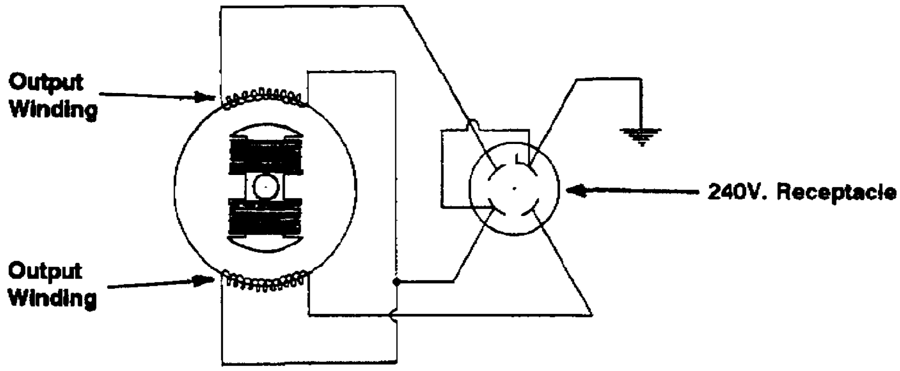
Rather than using current from the main output windings to power the rotor, we use an extra winding dedicated to that purpose. This winding is called an **excitation winding.** Winding the proper number of turns of wire into the stator main and excitation windings, and a proportionate number of turns on the rotor, our generator will produce the voltage desired (120 volts or 240 volts).



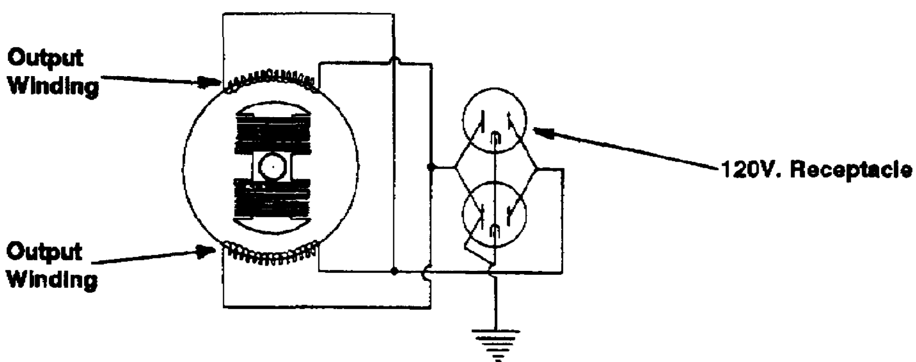
As a load is applied to the output of the generator the voltage drops off. If the load applied is beyond the rated output, the voltage will drop to a point where it will no longer operate the tools or appliances correctly. Also, the excessive load will cause the engine to labor.

In order to obtain 240 volt output, another winding identical to the first winding is wound in the stator, if we hook the two windings in series, so that the start of the second winding is attached to the end of the first winding, we will in effect double the number of windings, therefore doubling the voltage.

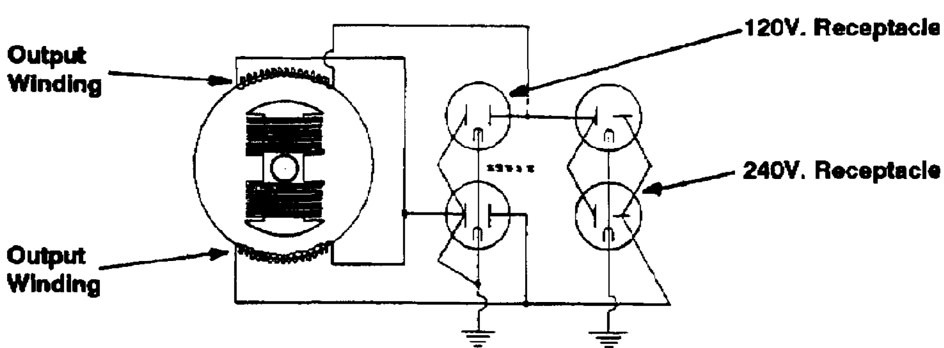
GENERATOR THEORY



Homelite contractor series generators utilize a "Max Power Switch" which allows the output windings to be placed in series for 240V use, or parallel for obtaining maximum rated output from the 120V receptacles.
If we hook the two windings in parallel, that is the start of the second winding is hooked to the start of the first winding and the end of the second winding is hooked to the end of the first winding, we will maintain the same voltage but double the current capabilities, because we have effectively doubled the size of the wire.



In Homelite consumer generators with 240V output, the stator windings are hard wired to provide 120V and 240V. Notice in the illustration that the tab is removed on the 'hot' side of the receptacle so that the two windings can not oppose each other. Full power can be drawn from the 240V receptacle.



VOLTAGE REGULATION

In the previous sections we learned basic electricity and generator principles. In this section we will learn of topics specifically related to Homelite generators

Voltage regulation refers to a generator's ability to maintain a **constant output voltage** from no-load to full-load conditions.

Voltage regulation is usually expressed as a percent and is calculated by:

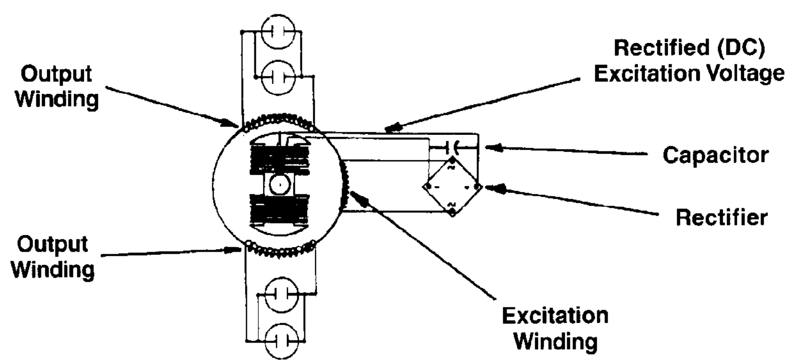
$$\text{Percent Voltage Regulation} = \frac{V_{nl} - V_{fl} \times 100}{V_{fl}}$$

Vnl = Voltage @ no load
Vfl = Voltage @ full load

Through the years, many different methods to regulate the voltage of a generator have been devised. Currently, we only employ two different methods:

INHERENT VOLTAGE REGULATION:

Homelite's HL, EH, HRL, EHRL and LR series of generators employ this method of voltage regulation. Basically, a separate excitation coil is wound on the stator. This excitation coil produces AC power which is rectified by a bridge rectifier and then filtered by a capacitor. This DC voltage is then supplied directly to the rotor through the slip rings. Under no-load conditions, the excitation winding is only energized by the rotating field. As load is added to the main windings, a little extra magnetic flux is produced by the load current flowing through the main windings which tends to "boost" the output of the excitation winding, In this way, the generator can give itself a little extra exciter voltage (and thus output voltage) during heavy loads. Voltage regulation tends to be between 15% and 20% for this series of generators. This boils down to no-load voltages as high as 145 VAC and full load voltages as low as 110 VAC (these figures include manufacturing tolerances). In short, the generator's voltage is controlled by the Inherent qualities of the winding design.



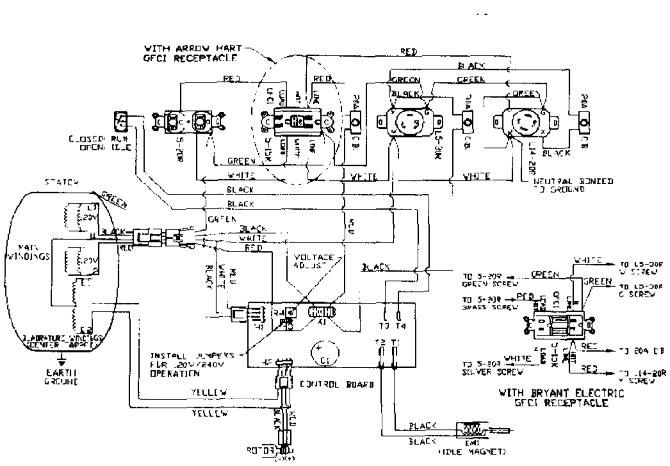
ELECTRONIC VOLTAGE REGULATION:

Homelite generators employ an electronic voltage regulator to maintain output voltage levels. In this method, a separate exciter winding is also wound on the stator. Current from an overly powerful quad circuit after being rectified, is "reduced" by an electronic voltage regulator to a more appropriate level.

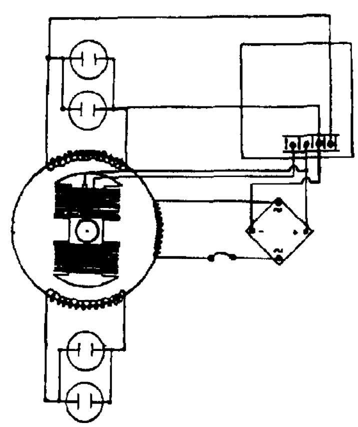
The patented Homelite electronic voltage regulator (EVR) utilizes generator field control for regulating the output voltage of an AC generator, providing improved motor starting ability. The EVR makes it possible to regulate the output voltage of the generator from 2%-6% and provides motor starting ability of about 0.75 hp/kw.

When a load is applied to the generator, the AC output voltage will tend to decrease. The voltage regulator through connections to the receptacles senses this decrease. When a voltage drop is detected, rectified quad voltage is allowed to pass through the voltage regulator to the rotor windings, increasing its magnetic strength. This increase compensates for the additional load and maintains the generator's constant AC output voltage.

Consumer Generator



Contractor Generator



The regulator also has a bypass circuit for facilitating generator start-up by allowing the residual voltage of the generator to feed unimpeded into the generator field until the output voltage of the generator has built up. The Homelite contractor series electronic voltage regulator gives exceptionally good regulation of less than 2%. Homelite consumer series electronic voltage regulator will maintain 6% regulation. In addition, the unique design of these regulators gives our generators extremely good motor starting capability. Voltage regulation is important to the user in that most appliances and tools are designed with the local power company's regulation of 6% in mind.

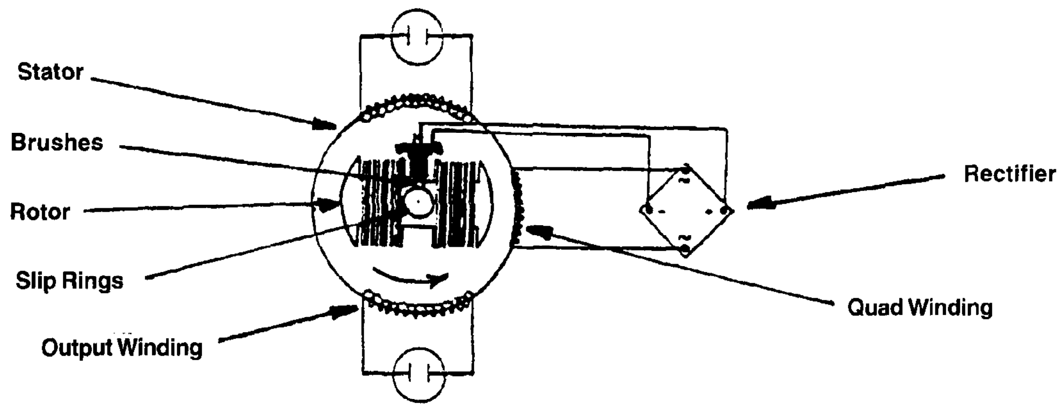
Although most appliances and tools will run perfectly well on reduced or increased voltage, the overall life and performance may be degraded. Also, there is nothing more annoying than watching the lights dim every time you pull the trigger on your electric drill. For this reason, serious generator users generally prefer electronically regulated models. Inherently regulated models, however, still offer a low cost alternative for users who may not be as concerned about voltage fluctuations.

"BRUSH" VS. "BRUSHLESS" DESIGN

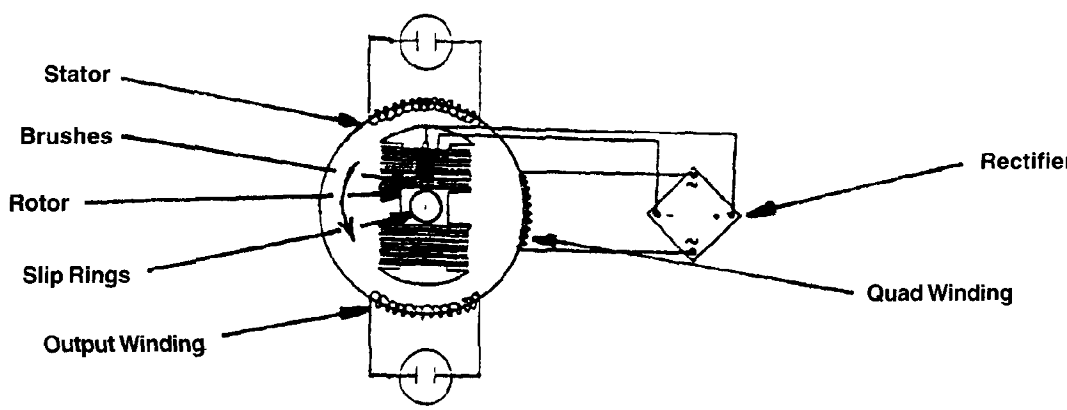
There seems to be a common belief that brushless generators are better than generators that employ brushes for excitation. The facts are that during extensive testing of Homelite generator ends, brushes typically last for more than 1000 hours of operation, which is more than adequate. Also, generators that use brushes have better control of the rotor magnetism, which allows for better voltage regulation (both inherent and electronic), and much better motor starting.

"BRUSH" GENERATOR THEORY

As the rotor begins turning, the residual magnetism retained by the rotor induces (causes) a voltage in the excitation winding. The bridge rectifier then converts the AC voltage from the excitation winding to DC The rectified excitation voltage is then applied to the rotor windings through the brushes and slip rings, causing the rotor's magnetic strength to increase.

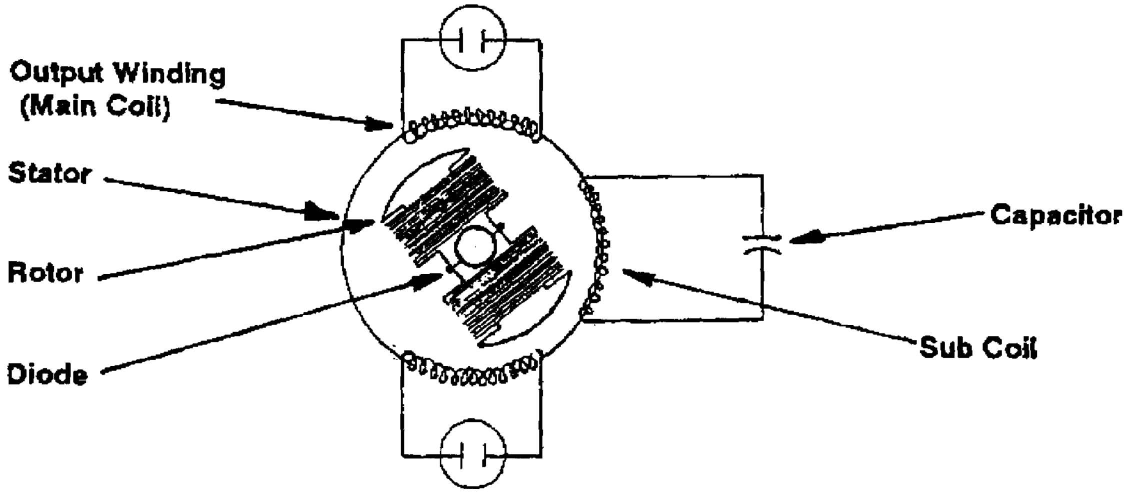


This increase in the rotor's magnetism is induced into the output windings at the same time. A proportionate number of turns of wire in the rotor, excitation and output windings results in a build-up of voltage to a useful level (120v. AC) when the rotor reaches it's magnetic saturation point.

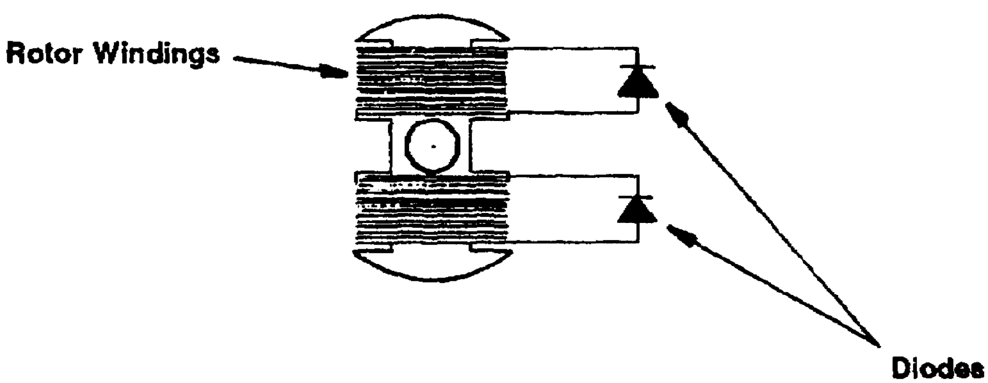


"BRUSHLESS" GENERATOR THEORY

As the rotor begins turning, the residual magnetism retained by the rotor core causes the stator sub-coil (similar to excitation winding) to produce a voltage. This voltage is applied to the condenser (capacitor) connected to the sub-coil. The condenser builds a charge and then releases it when it reaches a certain value. This building of a charge causes a current to flow in the sub-coil, which creates a strong magnetic field just as the rotor coils begin to pass by the sub-coil.



The magnetic field in the sub-coil induces an AC voltage, which is rectified to DC by two diodes on the rotor. This DC is fed through the rotor windings, boosting the strength of the rotor magnet, and increasing output to the rated voltage.



When a Load is applied to the receptacle, the current magnetizes the main coil. Since the main coil and sub-coil share a common core, the main coil acts as a primary winding, inducing a current flow in the sub-coil. This current flow increases the strength of the magnetic field in the sub-coil, which increases the strength of the field in the rotor coils by induction. When the rotor's magnetic strength is increased; the generator's output is increased.

FLASHING THE FIELD

In Homelite generators, the steel laminations used to construct the rotor are designed to retain a little magnetism when the rotor is powered down. This residual magnetism is first put into the unit during the manufacturing process, by applying an external source of DC voltage of the proper polarity to the rotor. This is called **Flashing the Field**.

Occasionally, a generator will lose its residual magnetism (due to vibration during shipping, for instance), and it will be necessary to again flash the field. This can be accomplished using a 6, 9, or 12-Volt Lawn and Garden battery. With the generator running, touch a lead connected from the positive battery terminal to the positive brush terminal, and a lead from the negative battery terminal to the negative brush terminal. The DC voltage fed through the rotor windings should restore magnetism. If the generator does not show any output after flashing the field, refer to the troubleshooting section for that generator.

Some manufacturers build small permanent magnets into their rotors in order to insure the presence of a residual magnetic field. Occasionally, even these units will require flashing due to the "permanent' magnet losing its magnetism.

WINDING INSULATION

Electrical insulation is classified by it's ability to withstand high temperatures.

The most common insulation classes are as follows:

Class A:	105°C
Class B:	130°C
Class F:	155°C
Class H:	180°C

An insulation system is classified by its weakest link. That is, if all of the different insulating parts that make up a generator meet Class H requirements, except one which meets only Class B requirements, the generator is only considered to meed Class B insulation requirements. As advertised, the insulation system used in our generators meets and exceeds Class F requirements.

Naturally, the generator does not run that hot. Under normal circumstances, generator temperatures rarely exceed 125°C. However, if something should go wrong (i.e., an extreme overload, repetitive short circuits, etc.), the high temperature capability of these units will allow them to survive where lower class insulation systems may not.

GENERATOR COMPONENTS AND FUNCTIONS

OUTPUT CIRCUIT

OUTPUT WINDINGS: Deliver voltage, induced by the rotating field of the rotor magnet, to the receptacles.

RECEPTACLES, SWITCHES, METERS: Allow access to and control of output. "Max Power Switch" allows output windings to be placed in series for 240V. use or parallel to obtain maximum rated output from the 120V. receptacles.

EXCITATION CIRCUIT

EXCITATION WINDINGS: AC current is induced by the rotating field of the rotor magnet for the purpose of returning to the rotor windings after it has been rectified (changed to DC) to increase the magnetic strength of the rotor.

ROTOR: Turns within the stator supplying a charge to the output and excitation windings in the stator through induction.

MAGNET: initial source of energy when the generator starts up, inducing voltage in the stator's quad windings (The generator "magnet" is actually laminated steel with magnetic properties, not a true permanent magnet.)

ROTOR WINDINGS: allow voltage to be fed around the rotor magnet to increase its strength and to control or regulate the generator output.

SLIP RINGS: Since the rotor is moving and the excitation voltage is coming from the non-moving excitation windings, the slip rings allow contact between the stationary stator and moving rotor.

BRUSHES: Feed excitation voltage through the slip rings into the rotor windings (after it has been rectified) so that the proper control over output voltage level can be maintained.

RECTIFIER: The excitation windings produce AC like the output circuit, but the magnet (rotor) must be charged with DC The rectifier changes the excitation winding's AC current to DC using a series of four diodes. The diodes block electrical flow in one direction and allow it to flow in the other.

ELECTRONIC VOLTAGE REGULATOR: Senses output voltage and regulates the amount of DC voltage that goes to the rotor windings. The negative (white) wire from the rectifier is connected to the voltage regulator and the voltage needed is allowed back to the brushes through the black wire. The natural output (unregulated) is approximately 150 V.AC

CIRCUIT BREAKER: **Contractor Generators** - The circuit breaker interrupts the voltage at the excitation winding when it heats up from an overload. This usually happens when the excitation circuit is working too hard to keep the rotor sufficiently boosted. **Consumer Generators** - The circuit breaker interrupts the voltage to the receptacle when an overload causes it to heat up.
NOTE: The output should still be approximately 3 V AC because the rotor magnet is still turning within the output windings, it's just not being excited.

CAPACITOR: Smoothes out or filters the pulsating DC current from the rectifier to the rotor for improved motor starting.

GENERATOR THEORY

IDLE CONTROL BOARD: Sends 60 V.DC to the electromagnet when there is no current sensed in the output circuit. The board runs on 120 V. output voltage. (At idle it's more like 90V.)

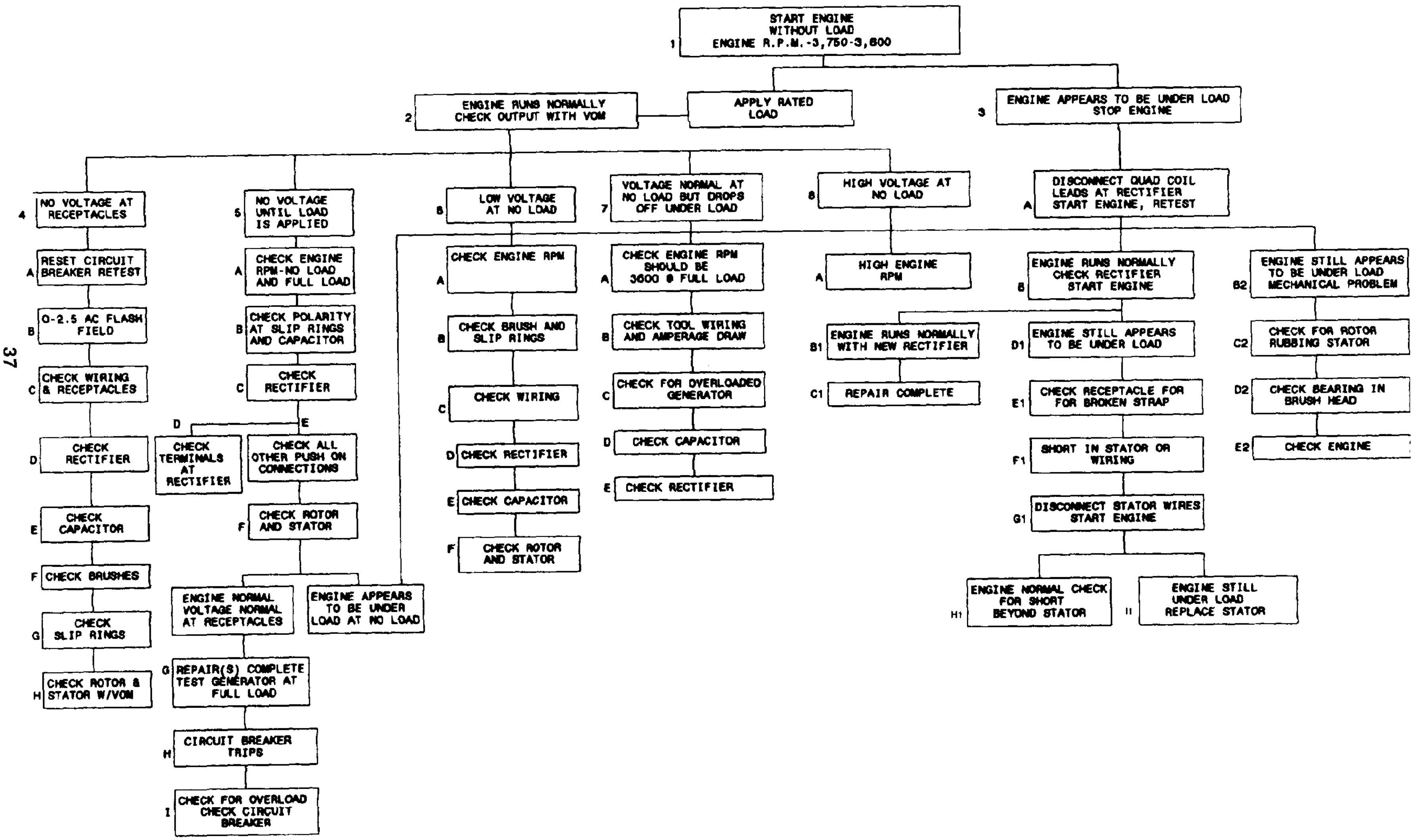
TRANSFORMER: Senses output current by induction, having two output leads pass through it.

FUSE: Protects the idle control board from short-circuited electromagnet.

ELECTROMAGNET: When energized, magnetically pulls governor arm to itself to reduce engine R.P.M.'s to around 2650. When the transformer senses a load, it shuts off voltage to the electromagnet, causing the electromagnet to release control of the engine speed to the governor and load.

GROUND FAULT CIRCUIT INTERRUPTER: Measures voltages in the "hot" wire and the "neutral" wire. When the voltage measured is greater in the "hot" wire than the "neutral", the circuit breaker trips, cutting off power to the receptacle.

TROUBLESHOOTING GUIDE
INHERENT VOLTAGE REGULATION
LR/EH/HL GENERATORS



INHERENT VOLTAGE REGULATION

1 **START ENGINE WITHOUT LOAD ENGINE R.P.M. – 3,750 – 3,800**

Start and run the generator; use a tachometer (Homelite Part Number 18416) to check engine RPM. No-load RPM should be 3,750 - 3,800 RPM.

2 **ENGINE RUNS NORMALLY CHECK OUTPUT WITH VOM** — **APPLY RATED LOAD**

Check rated output. Use a volt-ohm-milliamp (VOM) meter set on AC volt scale and insert the VOM probes into the 120V receptacle. Voltage at no-load should be 135-140 volts AC. 240 receptacle output should be 263-268 volts AC.

Apply rated load (2,300, 4,000 or 5,000 watts) to the generator. If the engine speed drops below 3,550 RPM, the problem is low engine power. Check the engine to find the cause of low power.

SERVICE NOTE: If the speed and voltage are correct, use an ammeter to check the amperage draw of the tool or tools being used. Also, check to make sure the total amperage draw (starting and running) does not exceed the generator rated capacity. Check extension cords for proper size; look for long extension cord lengths, damaged insulation, exposed conductors or strained plugs.

INHERENT VOLTAGE REGULATION (continued)

Many times generator problems result from improper use and application rather than problems relating to malfunction or failure of the generator itself.

4 **NO VOLTAGE AT RECEPTACLE**

A **RESET CIRCUIT BREAKER RETEST**

If the running test indicated no output, reset the circuit breaker(s) and re-test for voltage.

To test the circuit breakers, remove the red and black wires from each circuit breaker terminal. Use a VOM meter on RX1 scale and place the meter probes on the two circuit breaker terminals. There should be straight continuity. Replace the circuit breaker if no continuity or high resistance is shown.

An Important Word of Caution:
The generator uses a vibration system that allows the generator and engine to "float" in the roll cage. The vibration isolation is nullified if the shipping block or cardboard under the engine is not removed when preparing the unit for operation. Failure to remove this packing material can lead to serious damage to the entire machine!

INHERENT VOLTAGE REGULATION (continued)

B | **0 –2.9 VOLTS AC FLASH FIELD**

If voltage readings are below 3 volts AC or if there is 0 volts AC, the generator may have lost it's residual magnetism. See the section on "Flashing the Field" for more details on residual magnetism and generator operation.

Residual magnetism can be restored by using a 6 or 12 volt battery, and two test leads (with probes) attached to the battery.

Start and run the generator. Hold the negative battery lead probe on the silver pin protruding from the brush holder (with the black negative brush lead attached to the other end of the pin).

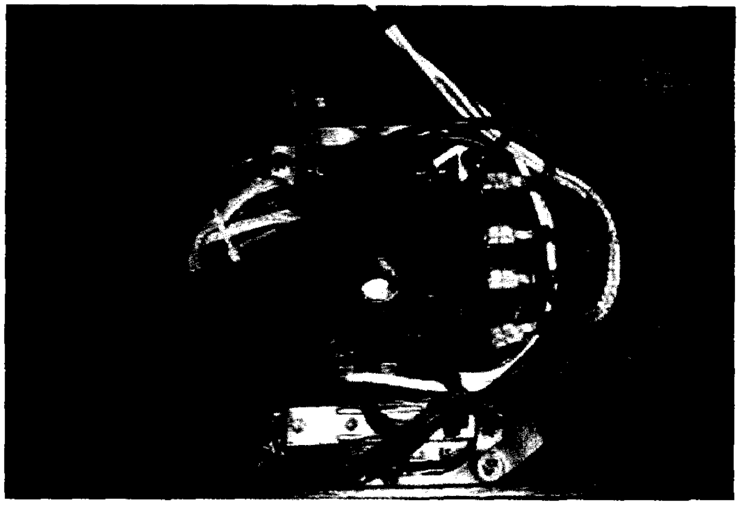
Now, momentarily touch the positive battery lead probe to the other silver pin (with the red positive brush lead attached to the pin). Correct polarity must be maintained. This process will feed the rotor, via the brushes, with either 6 or 12 volts DC; which will re-establish residual magnetism to the rotor.

A much easier and safer way to flash the field is to use a "Field Flasher", part number UP00457. Simply flip the switch on the field flasher to the **"ON"** position and plug it into the 120-volt AC receptacle of a running generator.

INHERENT VOLTAGE REGULATION (continued)

C — CHECK WIRING AND RECEPTACLES

No voltage at either 120V or 240V receptacles can be caused by broken or loose wires, or burned or broken receptacles. This is especially true when voltage is present at one receptacle and not another. This is why it is necessary to check voltage at all receptacles and outlets when testing the generator output.

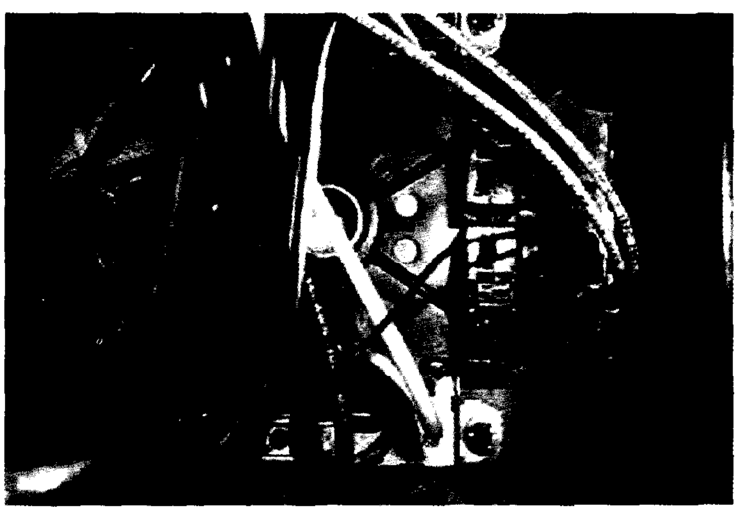


Unscrew the four brush head bolts and carefully remove the brush head. The brushes are spring loaded and will pop out when the brush head is removed. Inspect all output wires from the stator to the receptacles.

Also, inspect the excitation winding and brush lead terminals at the rectifier. If wire terminals are loose, flow solder onto the terminal and wire to give a good electrical connection.

D — CHECK RECTIFIER

Remove the two yellow AC leads and the black (negative) and red (positive) brush leads from the rectifier.



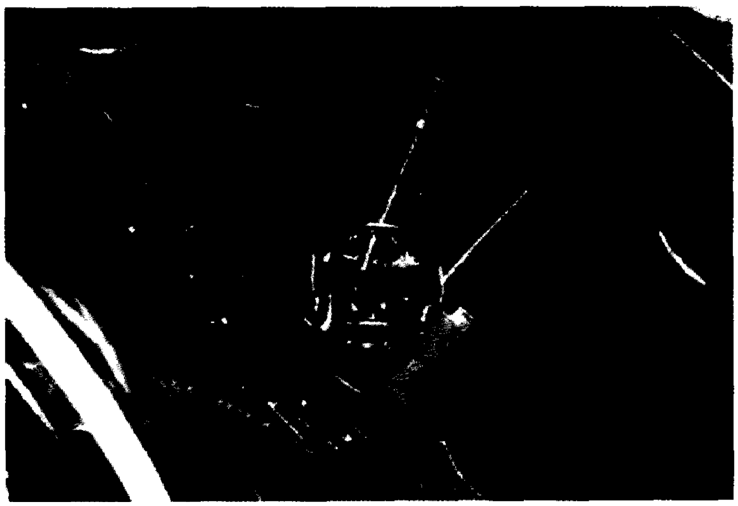
INHERENT VOLTAGE REGULATION (continued)

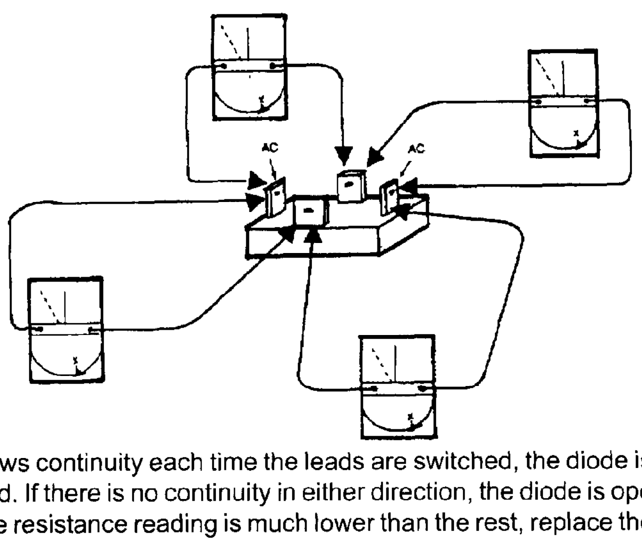
Place a VOM on the RX1 scale or equivalent. Touch the VOM probes to any two rectifier terminals that are next to each other.

If there is continuity, note the resistance reading. Now, switch the leads between the two terminals. There should be no continuity. If there was no continuity when the meter probes were placed on the rectifier, switch the VOM probes between the two terminals. There should now be continuity. Once again, the resistance reading should be noted. This test should be performed on all four rectifier terminals.

When completed, the test should look like this:

Terminals 1 and 2:	Continuity, No Continuity
Terminals 2 and 3:	Continuity, No Continuity
Terminals 3 and 4:	Continuity, No Continuity
Terminals 4 and 1:	Continuity, No Continuity





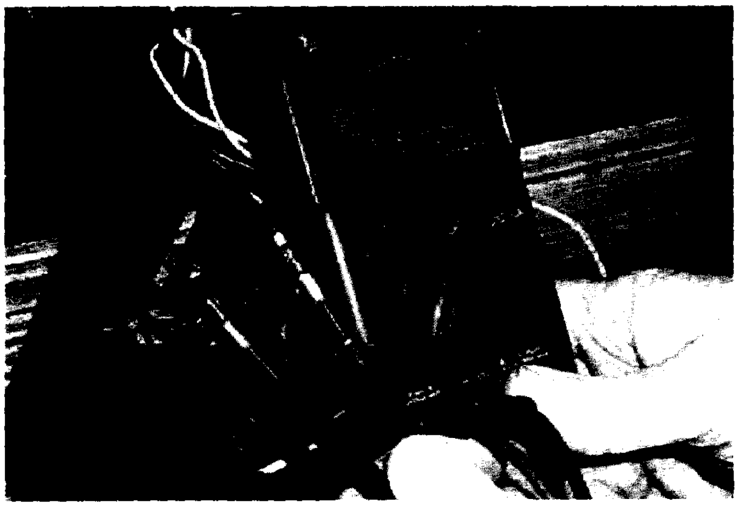
If the diode under test shows continuity each time the leads are switched, the diode is shorted out and the rectifier should be replaced. If there is no continuity in either direction, the diode is open, and the rectifier should be replaced. If one or more resistance reading is much lower than the rest, replace the rectifier.

SERVICE NOTE: If diodes in the rectifier were shorted out, the rotor may have been fed AC current. Residual magnetism will have to be re-established by flashing the field.

INHERENT VOLTAGE REGULATION (continued)

E CHECK CAPACITOR

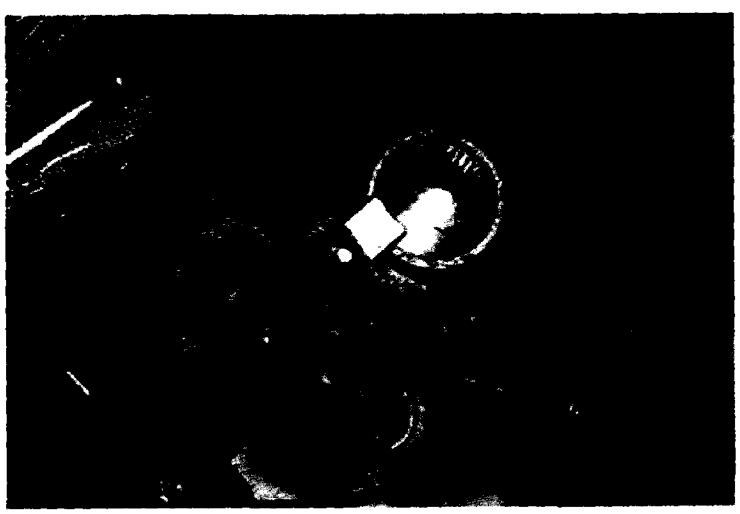
Place VOM on RX100 minimum or highest ohm scale on the meter. Disconnect the capacitor leads from the circuit. Place the two VOM lead probes on each capacitor lead. The needle should swing sharply from straight continuity towards infinity. The needle should rise until resistance in the capacitor stops the rise, then the VOM should show a stable, charged state (no increase or decrease). NOTE: Analog meters will show a rise to infinity, then the needle will drop towards zero once resistance is high enough in the capacitor. Digital meters will rise towards infinity until the capacitor is fully charged, then the meter will go to the overscale/no continuity mode.



Switch the VOM leads. There should be a rapid decrease in value until the VOM reads zero ohms. If the VOM reads straight continuity at the capacitor leads, the capacitor is shorted. If the VOM reading fluctuates between straight continuity and infinity, the capacitor is leaking. If either of these conditions exist, replace the capacitor.

F CHECK BRUSHES

Inspect the brush lead connections with the brush holder. The prongs on the brush leads must be locked in place on the brush holder; otherwise the leads can loose contact with the brush springs.

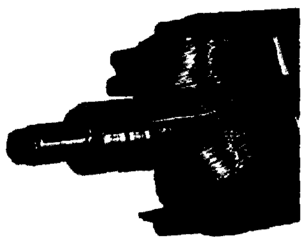


INHERENT VOLTAGE REGULATION (continued)

Use a VOM meter on RX1 scale to check continuity through each brush lead and brush, Place one VOM probe on the lead (disconnected from the rectifier) and one probe on the brush pushed into the brush holder. There should be straight continuity. If not, disconnect the brush lead(s) from the brush holder and test the leads and brushes separately.

Examine the brushes. If they are worn to 9/16" (14mm) or less, replace them. Worn brushes can "bounce" on the slip rings causing intermittent or low output.

G CHECK SLIP RINGS



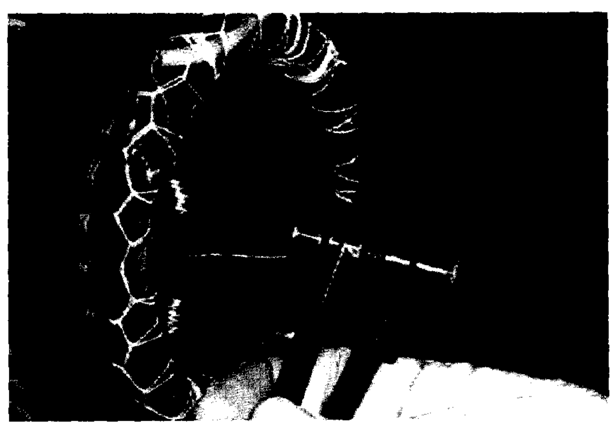
Examine the slip rings for excessive wear and/or damage. Grooves in the slip rings are not acceptable. A carbon path (black discoloration) on the slip rings is normal, however a severe build up of carbon may cause the brushes to lose contact with the slip rings. Use a pot scrubber pad, or a pad such as a 3M Scotchbrite, to clean the slip rings.

H CHECK ROTOR AND STATOR WITH VOM

Visually inspect the rotor for broken wires at the slip rings and field coil. Re-solder the connections or replace the rotor if any connections are broken.

Put VOM selector switch in the RX1 position or equivalent. Place one VOM lead probe on each slip ring. Check the proper resistance specification in the **Rotor and Stator Resistance Chart**.

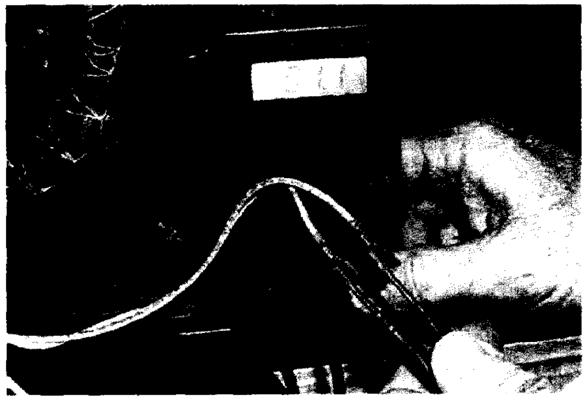
If the resistance reading is lower than that specified, the rotor has shorted turns and should be replaced.



Touch one rotor slip ring with one of the VOM probes. Place the other VOM probe on the rotor shaft. There should be no continuity. If continuity exists on either slip ring, the coil is shorted to the shaft. The rotor must be replaced.

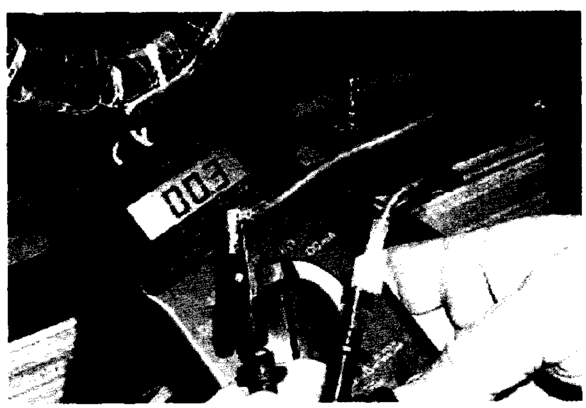
INHERENT VOLTAGE REGULATION (continued)

Disconnect the two yellow AC excitation winding leads from the rectifier. Select RX1 or lowest ohm scale on the VOM. Measure the excitation winding resistance.



Check the proper resistance specification in the **Rotor and Stator Resistance Chart**.
If the readings are not within the specified range, replace the stator.

With the VOM set on RX1 or lower, touch one VOM probe to a yellow excitation winding lead. Touch the other probe to the stator laminations. Test both wires in turn. If continuity exists on either wire, the stator windings are shorted and the stator must be replaced.



With VOM selector switch in the RX1 position or lowest scale possible, measure the resistance between the stator main output winding (single voltage 120VAC) or windings (dual voltage 120/240 VAC).

Refer to the wiring diagrams in this Service Guide or the generator's operator's manual for color codes on the main winding leads.

Measure the resistance between the two correct colored leads.

If any of the resistance readings are substantially less than the specifications or if there is no continuity, replace the stator.

Place one VOM probe on each of the stator leads in turn and the other VOM probe on the stator laminations. There should be no continuity. If continuity exists, replace the stator.

INHERENT VOLTAGE REGULATION (continued)

5 **NO VOLTAGE UNTIL LOAD IS APPLIED**

A **CHECK ENGINE RPM NO LOAD AND FULL LOAD**

Check engine speed to make sure it meets the 3,750-3,800 RPM no load and 3,600 RPM full load.

B **CHECK POLARITY AT SLIP RING AND CAPACITOR**

Inspect the polarity of the brush/capacitor leads at the brush holder. The red or positive leads should be attached to the brush that is closest to the brush head bearing. This brush rides on the outer slip ring. The black brush/capacitor lead should be attached to the brush closest to the stator. This brush rides on the inner slip ring.

Check the polarity of the brush leads at the rectifier. The red (+) lead goes on the + terminal of the rectifier. The black (-) lead goes on the - terminal of the rectifier.

SERVICE NOTE: Care must be taken to establish proper polarity of the brush leads, as improper installation will blow the capacitor.

C **CHECK RECTIFIER**

The rectifier check is the same as shown in **section 4D**

D **CHECK FLAG TERMINALS AT RECTIFIER**

Flag terminal on the AC (yellow) excitation winding leads and the brush leads (red and black) can be loose and cause a loss of field build up in two ways.

First, the flag terminals can be loose on the rectifier terminals, resulting in an intermittent loss of the electrical path. When a load is applied the boost in the excitation winding output can jump a loose terminal resulting in output. The flag terminals must be tight on the rectifier terminals.

Second, the flag terminals can be loose on the AC or brush wires and not making a 100% electrical connection. If the terminals are loose, flow solder into the terminal/wire joint to make sure a good connection is maintained.

E **CHECK ALL OTHER PUSH ON CONNECTIONS**

Check all other push on connections, including at the 120V AC receptacle (white and brown stator leads) and the black and red leads at the circuit breaker(s).

F **CHECK ROTOR AND STATOR**

Visually inspect the rotor slip ring and rotor coil connections. A loose connection can cause output when a load is applied.

INHERENT VOLTAGE REGULATION (continued)

Use a VOM meter to measure continuity in the rotor. The VOM meter uses a small electrical current to measure continuity. If there is a bad electrical connection that is made when a load is applied, it will show as no continuity with a VOM meter. As with the rotor, the stator wires can have a small break and only show output when a load "boost" is applied to the stator windings. It is much like the arcing that is generated when a light switch is thrown.

Use a VOM meter to test stator continuity; any bad electrical connections will show as no continuity.

G **REPAIR(S) COMPLETE – TEST GENERATOR AT FULL LOAD**

When completing repairs on a generator, it is a must that full load be drawn. This tests generator output, engine performance and proper voltage levels and hertz.

H **CIRCUIT BREAKER TRIPS**

The circuit breaker(s) are in series with the output of the generator and will protect the generator from severe overloads, bad tools or equipment and dead shorts.

I **CHECK FOR OVERLOAD CHECK CIRCUIT BREAKER**

If there is more than one load on the generator, reduce the load. If the circuit breaker trips, examine the tools or equipment with an ammeter to determine amperage draw.

Use an ammeter to determine what amperage draw is tripping the circuit breaker. If it is below rated amperage, replace the circuit breaker.

6 **LOW VOLTAGE AT NO LOAD**

A **CHECK ENGINE R.P.M.**

Engine RPM must be 3,750-3,800 RPM No-load. Use a good quality tachometer (Homelite P/N 18416) to test the no load speed.

Low engine RPM will result in low voltage under load. This can damage the generator. Tools and equipment may also be damaged.

B **CHECK BRUSHES AND SLIP RINGS**

Follow the test and inspection procedures as outlined in **sections 4F and 4G**.
Brushes or springs that are worn can "bounce" on the slip rings, causing the voltage at no load to be low or intermittent.

INHERENT VOLTAGE REGULATION (continued)

C CHECK WIRING

Examine the wiring carefully for chafing, loss of insulation, and separated wires and terminals.

For example, if the capacitor is not in the circuit because of a loose connection or broken wire, no load voltage will decrease to approximately 90V AC.

D CHECK RECTIFIER

Use the 'Go-No Go" test method as outlined in **section 4D.**

A diode failure (open) can cause half-wave rectification, so that generator output is reduced by approximately one-half.

E CHECK CAPACITOR

Capacitor test instructions are located in **section 4E**.

An open capacitor can reduce AC output by causing a distortion in the AC waveform, which reduces the effective DC power to the rotor. This can reduce AC output by 25%.

A shorted capacitor can cause rectifier and rotor failure, as the capacitor is parallel to the rotor windings. Generally, the capacitor will blow, because amperage draw to the capacitor is greater than the design limits of the canister.

F CHECK ROTOR

A layer short within the rotor coils can reduce AC output by reducing the strength of the magnetic field,

Use the test instructions in **sections 4H and 5F** to troubleshooting the rotor.

Use a VOM meter to test the stator windings. A layer short in the stator can reduce AC output, although in most cases, there will be no output. Test the stator as in **sections 4H and 5F.**

7 VOLTAGE NORMAL BUT DROPS OFF UNDER LOAD

A CHECK ENGINE RPM – SHOULD BE 3.600 RPM AT FULL LOAD

No load engine speed must be set slightly above full load speed of 3,600 RPM in order to maintain 60 Hertz at full load. No load speed should be 3,750-3,800 RPM.

INHERENT VOLTAGE REGULATION (continued)

B CHECK TOOL WIRING AND AMPERAGE DRAW

Examine all tools and/or equipment drawing amperage from the generator. Faulty cord sets, worn tools can cause short circuits and heavy amperage draw. Use an ammeter to test the current draw of the tools and/or equipment.

C CHECK FOR OVERLOADED GENERATOR

Check the nameplate ratings of tools or equipment being used with the generator. The nameplate amperage rating indicates running amperage draw only. Use the following rough estimate to determine starting amperage for various tools and equipment.

Multiply x 1 - if the generator is operating heating or lighting equipment. Example: 10-100 watt light bulbs draw a constant 8.3 amps (10 x 100 / 120 = 8.3 amps).

Multiply x 2 - if a hand tool is being used. They typically use twice their rated amperage under full load as they do under no load conditions. Example: a hand drill that requires 7 amps no load may require up to 14 amps at full load use.

Multiply x 3 - if an electric motor is used to operate a piece of equipment. They require up to three times their rated amperage to start as they do when they come up to speed. Example: a 1 HP capacitor start motor typically requires approximately 9 amps to run, 27 amps to start.

Generator watts required = amps x volts x 1, 2 or 3. This is a good minimum estimate of equipment or tool amperage draw. Remember that the total amperage draw must not exceed the amperage rating of the 120 or 240-volt receptacles.

Large generator loads should always be started first, followed by the next largest load. The smallest loads should be started last.

D CHECK CAPACITOR

If the capacitor is breaking down under load, voltage will drop as load is applied. Use test instructions in **section 4E** for troubleshooting information.

E CHECK RECETIFIER

No load voltage may appear normal, however as load is applied a marginal diode can fail, causing a drop or loss of the magnetic field, reducing voltage at the receptacles. Use **section 4D** for testing the rectifier.

INHERENT VOLTAGE REGULATION (continued)

8 HIGH VOLTAGE AT NO LOAD

A HIGH ENGINE RPM

Engine must be run at no load, which should be 3,750-3,800 RPM.

Run the generator under full load (2300 watts, 4000 watts, or 5000 watts)

The unit should run at 3,600 RPM.

3 ENGINE APPEARS TO BE UNDER LOAD - STOP ENGINE

A DISCONNECT EXCITATION WINDING LEADS AT RECTIFIER – START ENGINE - RETEST

B ENGINE RUNS NORMALLY – CHECK RECTIFIER – START ENGINE

A rectifier that is shorted to ground will overload the generator. Up to 100 amps can flow through a shorted rectifier, so the simplest way to test for this fault is to disconnect the two yellow (AC) excitation winding leads from the rectifier.

Perform the Go-No Go rectifier test shown in **Section 4D.**

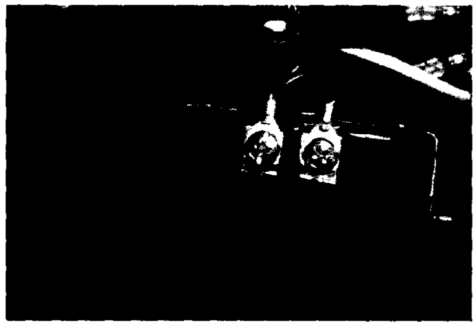
B1 ENGINE RUNS NORMALLY WITH NEW RECTIFIER

C1 REPAIR COMPLETE

D1 ENGINE STILL APPEARS TO BE UNDER LOAD

E1 CHECK RECEPTACLE FOR BROKEN STRAP

INHERENT VOLTAGE REGULATION (continued)



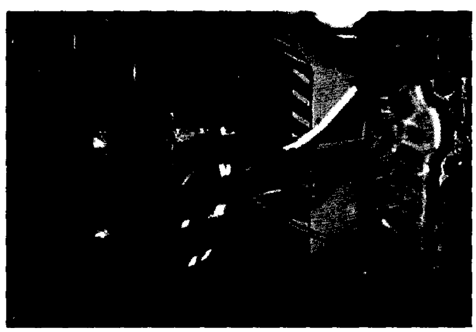
Dual voltage models must have the strap on the hot (brass screw) side of the 120V receptacle broken prior to installation or the two stator output windings will oppose one another causing a load on the engine. Examine.

F1 | **SHORT IN STATOR OR BRUSHHEAD WIRING**

A loaded condition on start up indicates a wiring problem (neutral, hot wires on same side of receptacle), or a short to ground in the stator winding.

G1 | **DISCONNECT STATOR LEADS START ENGINE**

To determine where the short to ground is (wiring or stator) disconnect the stator leads from the brush head components. Use electrical tape to insulate each stator lead from possible grounding.



Just prior to brush head re-installation, route the four leads through a slot in the brush head so they are hanging outside. Start the engine.

H1 | **ENGINE NORMAL – CHECK FOR SHORT BEYOND STATOR**

If the engine runs normally, there is mis-wiring in the brush head. Use the electrical schematic for the unit to check for wiring faults.

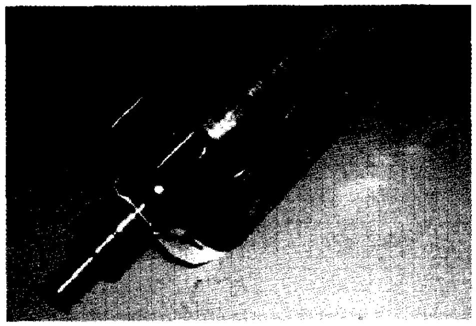
I1 | **ENGINE STILL UNDER LOAD – REPLACE STATOR**

Check the four wires for signs of chafing or rubbing; shorted wires may cause an artificial load. Use a VOM meter to test each stator lead to ground. Continuity with any lead indicates a short to ground. Replace the stator.

INHERENT VOLTAGE REGULATION (continued)

B2 **ENGINE STILL APPEARS UNDER LOAD – MECHANICAL PROBLEM**

C2 **CHECK FOR ROTOR RUBBING STATOR**

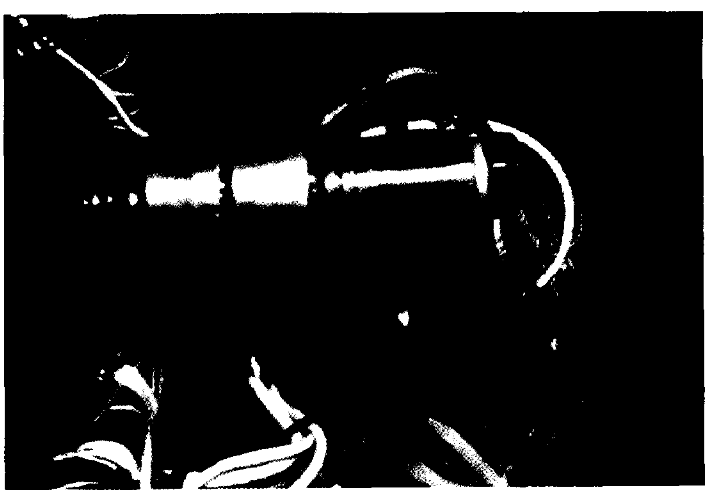


If the generator is running, listen for abnormal noise coming out of the generator end. If the unit is not running, pull on the starter grip (high-tension lead disconnected) to listen for possible mechanical noises.

Remove the four stator bolts (nuts) and brush head. Find and remove the two brushes and springs from the brush head. Physically inspect the leading edge of the rotor and stator for signs of rubbing. It may be necessary to remove the stator to thoroughly inspect the rotor and stator.

Causes of rotor and stator rubbing are: end bell misalignment (bolts loose, bolt holes mis-drilled), incorrect stator manufacturing, brush head misalignment, brush head bearing failure, varnish or bent lamination at stator to end bell mounting surface.

D2 **CHECK BEARING IN BRUSH HEAD**



Inspect the bearing and/or rotor shaft (where it runs on bearing I.D.*) for signs of burning, bluing or scoring. A worn or damaged bearing can cause abnormal loading on the engine.

**I.D. = Inside Diameter*

INHERENT VOLTAGE REGULATION (continued)

E2 | **CHECK ENGINE**

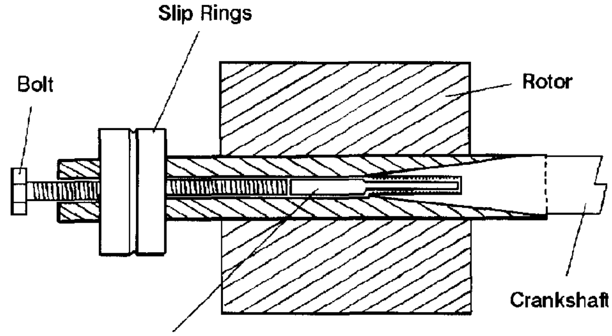
Low engine power is obvious once full load is applied. If voltage is normal, but engine speed drops below 3,550 RPM, then the engine needs servicing. Severe engine damage may cause hard starting and the appearance of being under a slight load.

GENERATOR END DISASSEMBLY AND ASSEMBLY (EH, HL, HRL, LR SERIES)

To disassemble the generator end, use a one-half inch wrench or socket to remove the two nuts and lock washers that secure the stator to the mounting bracket. Use a three-eighths or seven-sixteenths wrench or socket to remove the four bolts that secure the brush head to the stator.

Lift up on the stator and support the end bell with a block of wood. Be sure the stator bolts clear the mounting bracket. Gently remove the stator and brush head assembly by pulling straight out from the end bell.

Use a one-half inch wrench or socket to remove the long rotor bolt from the center shaft of the rotor. Remove the rotor using one of the following methods.



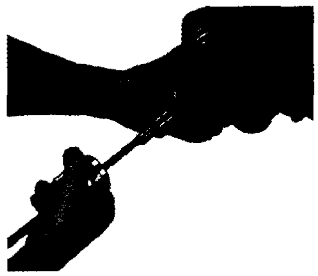
Method 1:
Prior to removing the generator rotor, obtain a rotor removal pin part number 22272 and cut it into various lengths. From the machined end, cut the pin to a length of three inches. Cut the left over length of the rotor pin into the following pieces:

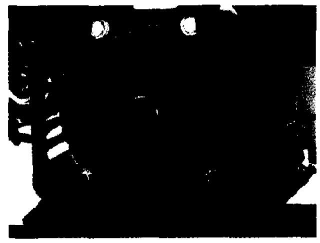
One-quarter inch, one-half inch, three-quarter inch, one inch, and two and one-half inch.
Insert the rotor pin and add pieces of the pin to obtain an overall length that is three and one half inches shorter than the rotor shaft.

In earlier units the internal rotor threads are closer to the end of the rotor shaft. In this case, insert the rotor pin and add pieces of the pin to obtain an overall length that is three-eighths of an inch shorter than the rotor shaft.

GENERATOR END DISASSEMBLY AND ASSEMBLY (continued)

Install a 3/8-16 X 3 ¾ inch length bolt and tighten it against the rotor pin to force the rotor and fan assembly away from the crankshaft.





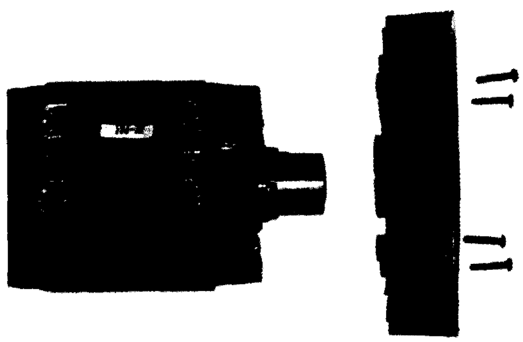
Method 2:

Screw a slide hammer into the rotor shaft. On some rotors with deep set internal threads you will add a 3/8-16 threaded extension to your slide hammer. While supporting the rotor, pop the rotor and fan assembly off of the crankshaft.

If it becomes necessary to work on the engine, remove the generator end bell by unscrewing the four bolts securing the end bell to the engine. Note that the solid side of the end bell is located at the top.

Assemble the generator by applying thread-locking compound to the bolts securing the generator end bell to the engine. Torque the bolts to the specifications listed in the Generator Basics Service Guide.

Wipe the engine crankshaft and rotor shaft taper clean of grease and debris. If a new rotor is being installed, remove the fan, if not damaged, from the defective rotor. Inspect varnish or bent lamination at stator to end bell mounting surface. Install the fan and four screws on the new rotor. Slide the rotor and fan assembly onto the crankshaft. Insert the long bolt through the lock washer and rotor into the crankshaft. Tighten the bolt finger tight.



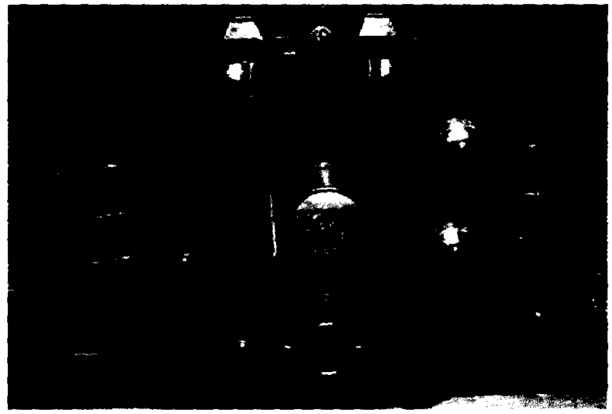
The rotor bolt will be tightened after the assembly of the stator and brush head is complete. The bolt needs to remain loose throughout the assembly procedure to allow the rotor and stator to align properly with the housing and crankshaft.

Gently slide the stator over the rotor; making sure the two bolts at the bottom of the stator seat into the mounting bracket and lock washers. Screw the two one-half inch nuts and lock washers hand tight. If a new stator or a new brush head is being installed reconnect the excitation winding and main output leads.

Connect the ground wire to the stator laminations. Use wire ties to neatly secure all of the electrical leads. Carefully, route the leads behind the circuit breakers so they will not contact the rotor.

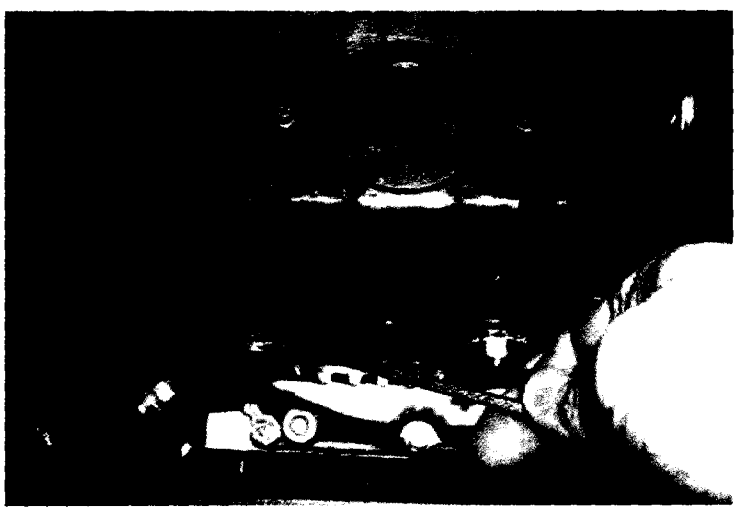
Install the brushes in the brush holder. Retain the brushes for assembly by inserting the brush holder tool or a straightened paper clip through the housing hole and the brush holder.

GENERATOR END DISASSEMBLY AND ASSEMBLY (continued)



Seat the brush head over the rotor and stator. Slide the two bolts into the slots at the bottom of the brush head and tighten them finger tight. Install the two bolts into the slots at the top of the brush head.

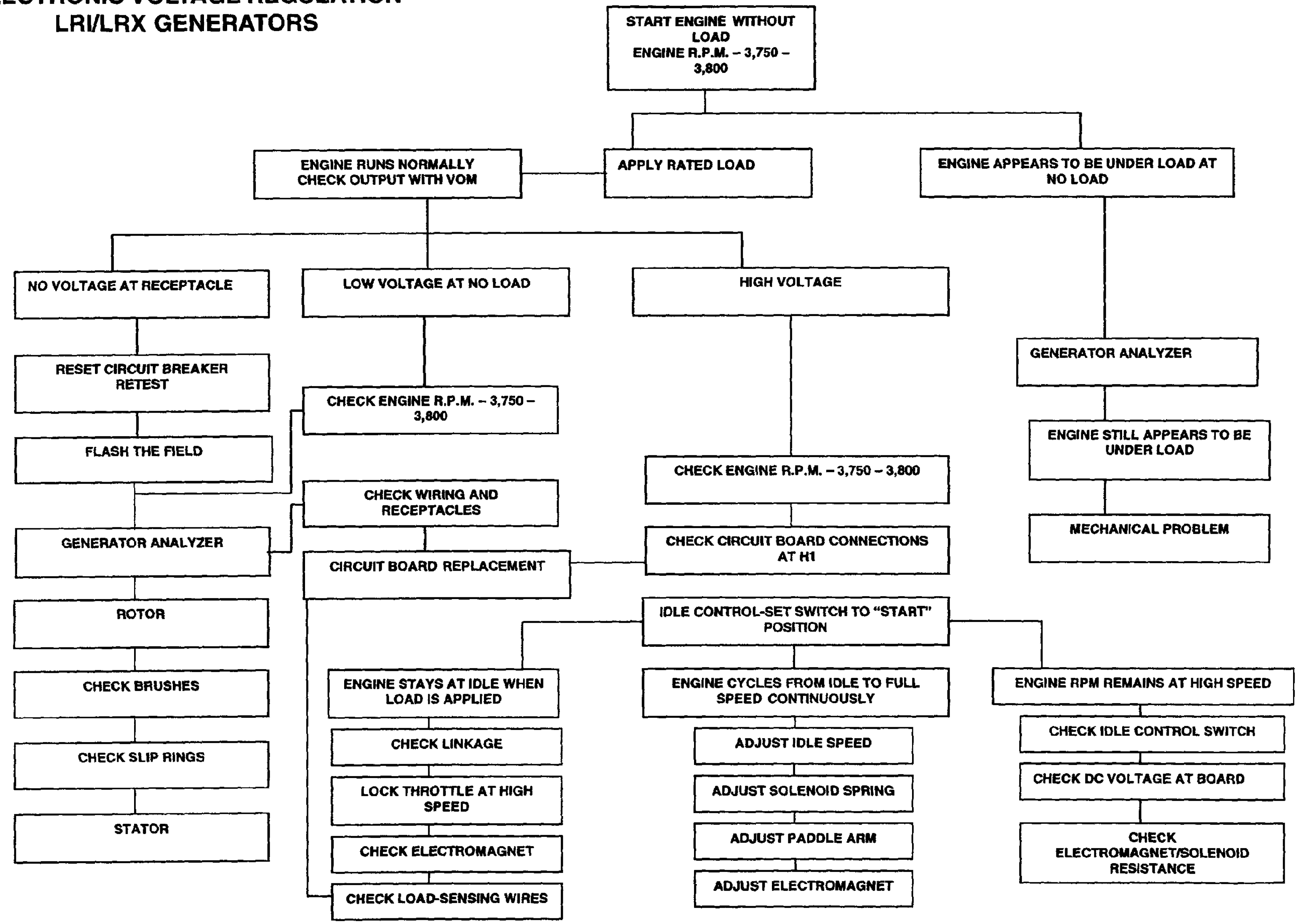
Tighten the rotor bolt slowly and ensure that the rotor turns smoothly inside of the stator. Torque the four bolts securing the brush head to the correct specifications. Tighten the rotor bolt to the proper torque specification. Install a new expansion plug into the rotor bolt opening on the brush head. Torque the two mounting bracket nuts to the proper specifications.



Important Note: Remove the tool holding the brushes in place.

After the generator has been properly assembled, start and run the unit. Apply the full rated load to the generator for at least five minutes.

TROUBLESHOOTING GUIDE
ELECTRONIC VOLTAGE REGULATION
LRI/LRX GENERATORS



ELECTRONIC VOLTAGE REGULATION

START ENGINE WITHOUT LOAD
ENGINE R.P.M. – 3,750 – 3,800

Start and run the generator; use a tachometer (Homelite Part Number 18416) to check engine RPM. No-load RPM should be 3,750 - 3,800 RPM.

ENGINE RUNS NORMALLY CHECK OUTPUT WITH VOM — **APPLY RATED LOAD**

Use a volt-ohm-milliamp, or VOM, meter set on the highest AC volt scale. This is to insure that an unexpected high voltage will not damage your meter.

Insert the VOM probes into the 120-volt receptacle. Voltage at no-load should be 120 volts AC +/- 6%. The 240-volt receptacle output should be 240 volts AC +/- 6%.

Apply *the rated load* of 2,300, 4,000 or 5,000 watts, depending on the unit – to the generator. If the engine speed drops below 3,550 RPM, low engine power may be the problem. Troubleshoot and repair the engine to correct the cause of the low engine power.

Service Note:
If the speed and voltage are correct, use an ammeter to check the amperage draw of the tool or tools being used. Also, check to make sure the total amperage draw, starting and running, does not exceed the generator rated capacity. Check extension cords for proper size. Look for long extension cord lengths, damaged insulation, exposed conductors or strained plugs.

Many times generator problems result from improper use and application rather than problems relating to malfunction or failure of the generator itself.

PLACE IDLE CONTROL SWITCH IN "IDLE" POSITION

Place the start/idle switch in the "idle" position. The electromagnet should energize and pull the engine throttle back to idle, after a three to five second delay. If the engine does not throttle back to idle speed, refer to the idle control troubleshooting section.

SERVICE NOTE: The idle control will only function if the generator has output. Be sure the generator is producing the required voltage before troubleshooting the idle control system.

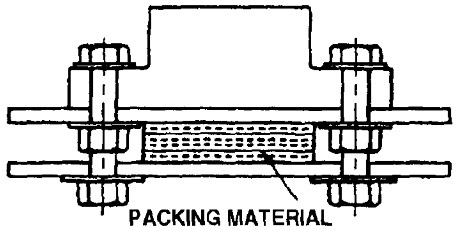
NO VOLTAGE AT RECEPTACLE

RESET CIRCUIT BREAKER RETEST

ELECTRONIC VOLTAGE REGULATION (continued)

An Important Word of Caution:

The generator uses a vibration system that allows the generator and engine to "float" in the roll cage. The vibration isolation is nullified if the shipping block or cardboard under the engine is not removed when preparing the unit for operation. Failure to remove this packing material can lead to serious damage to the entire machine!



One of the first symptoms of packing materials that have not been removed will be unexplained tripping of the GFCI. If the GFCI trips for no apparent, valid reason, check to ensure that the shipping material was removed.

If the running test has indicated no output, reset the circuit breakers and GFCI and test again for voltage.

To test the circuit breakers, remove the red and black wires from each circuit breaker terminal. Use a VOM meter on the R TIMES 1 scale and place the meter probes on the two circuit breaker terminals. The meter should indicate straight continuity. Replace the circuit breaker if no continuity or high resistance is shown.

Push in the reset button on the GFCI. If the GFCI now has output, the 120-volt duplex receptacle should also now have output, since it is protected by the GFCI.

No voltage at one or more receptacles after the circuit breakers and GFCI have been reset could be the result of problems in two areas.

The problem may be within the control panel that houses the electronic voltage regulator board.

Or, the problem may be within the generator end, which includes the brushes, rotor and main windings.

The electronic voltage regulator, a printed circuit board, has several components: a capacitor, transistors, and diodes. If any of these fail, the result could be no voltage at the receptacles.

Use the generator analyzer, part number 08371, to bypass the electronic voltage regulator circuit board. If an analyzer is not available, it will be necessary to proceed with the static testing of each component.

If voltage readings are below 3 volts AC or if there is 0 volts AC, the generator may have lost it's residual magnetism. See the section on "Flashing the Field" for more details on residual magnetism and generator operation.

Residual magnetism can be restored by using a 6 or 12 volt battery, and two test leads (with probes) attached to the battery.

Start and run the generator. Hold the negative battery lead probe on the silver pin protruding from the brush holder (with the black negative brush lead attached to the other end of the pin).

ELECTRONIC VOLTAGE REGULATION (continued)

FLASH THE FIELD

Now, momentarily touch the positive battery lead probe to the other silver pin (with the red positive brush lead attached to the pin). Correct polarity must be maintained. This process will feed the rotor, via the brushes, with either 6 or 12 volts DC; which will re-establish residual magnetism to the rotor.

A much easier and safer way to flash the field is to use a "Field Flasher", part number UP00457. Simply flip the switch on the field flasher to the **"ON"** position and plug it into the 120-volt AC receptacle of a running generator.

When the switch on the field flasher trips, the magnetic field is restored. If the voltage readings at all of the receptacles are correct after flashing the field, stop the engine and restart it. Measure the voltage at the 120-volt receptacle. If the measurement is 0 to 2.9 volts the rotor will not hold residual magnetism and needs to be replaced.

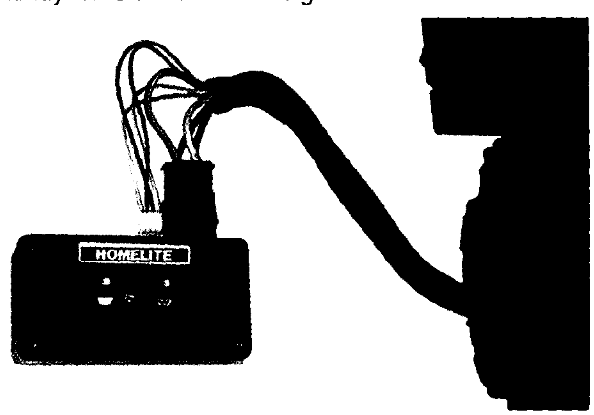
If the switch does not trip to the off position on the Homelite field flasher (the out put of the field flasher is 3+ volts dc) or voltage is not restored using a 6 or 12 volt battery and probes, then proceed with further testing.

GENERATOR ANALYZER

If there is no output at any receptacle, bypass the control panel by attaching the generator analyzer. With the generator not running, unplug the large, main connector and the small excitation connector, from the back of the control panel.

Plug the main and excitation connectors into the generator analyzer. Start and run the generator.

WARNING!
Do not unplug the generator from the analyzer at any time while the engine is running.



ELECTRONIC VOLTAGE REGULATION (continued)

On dual voltage units, two lights should be lit. On single voltage units, one light should be lit. The lights indicate that the rotor, the stator and the brush head are performing properly. If no neon lights are lit in the previous test, use the field flasher, UP-00457, to flash the field, by plugging it into the receptacle on the generator analyzer. If a field flasher is not available, refer to the previous troubleshooting section, for instructions on flashing the field with a battery.

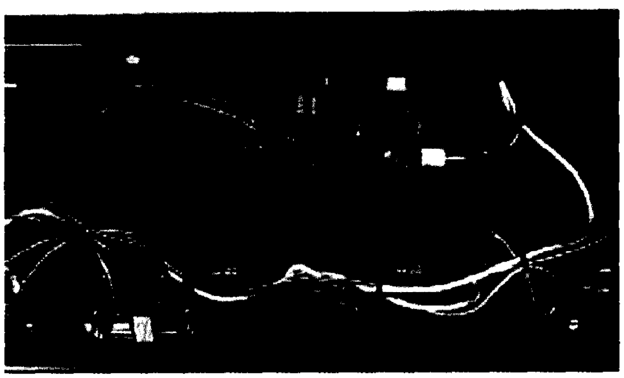
If both lights are still off, the problem is most likely located in the excitation circuit. If both lights become lit, after flashing the field, stop the engine and then, restart it. If both lights are off again, after using the field flasher, the rotor will not hold residual magnetism and needs to be replaced.

On dual voltage units, If one green light is not lit, then one output winding has an open or faulty circuit. If one green light is dim, that output winding is partially shorted. Run the generator for three minutes. If there is a layer short, the windings should begin to overheat and smoke. This indicates that the stator windings are faulty and need to be replaced.

If the running tests with the generator analyzer show the generator end to be functioning properly and there is still an output problem at the receptacles, the problem is in the control panel wiring or circuit board.

CHECK WIRING AND RECEPTACLES

Stop the engine, disconnect the battery, if so equipped, and disconnect the spark plug lead wire. To access the wiring or circuit board, simply remove the ten T-25 TORX Plastite screws securing the front panel cover. Swing the panel cover downward for inspection.



Visually inspect all of the wires, wire connections and receptacles.

No voltage at either 120V or 240V receptacles can be caused by broken or loose wires, or burned or broken receptacles. This is especially true when voltage is present at one receptacle and not another. This is why it is necessary to check voltage at all receptacles and outlets when testing the generator output.

Inspect all output wires from the large connector to the receptacles. If the wiring and receptacles check okay, the circuit board is defective and must be replaced.

ELECTRONIC VOLTAGE REGULATION (continued)

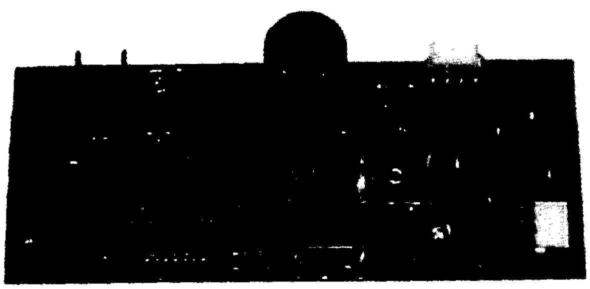
CIRCUIT BOARD REPLACEMENT

To remove the circuit board; disconnect the small excitation connector from the rear of the control panel. Disconnect the two electromagnet spade connectors from the rear of the control panel. Disconnect the red and black wires that feed through the coil on the circuit board, from their connections to the circuit breakers. Remove the two spade connectors that attach the idle control switch leads to the circuit board. Disconnect the 4-pin connector from the side of the circuit board.

Slide the circuit board out of the slots in the control panel.

Service Note:
If it is necessary to cut and remove the wire tie wraps, replace them with new tie wraps before reassembling the control panel.

Clean the contacts on the circuit board before installation. This will remove any residue and provide the best electrical contact. If the control board is being replaced on a single voltage generator, remove the two jumpers on the control board.



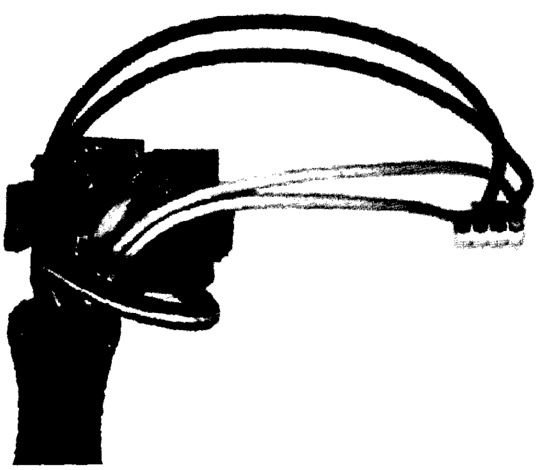
Do not remove these jumpers for use in the dual voltage generators. If jumpers are removed the generators will produce 120 volts only.

Slide the circuit board into place and reconnect the spade and 4-pin connectors. Be sure to route the red and black wires back through the coil on the circuit board correctly. Refer to the wiring diagram in the operator's manual or the reference section of this service guide for proper routing of these wires.

If the generator analyzer shows the generator end to be faulty or the analyzer is not available, static tests must be performed to determine which component is defective.

ROTOR

To check the rotor windings, unplug the small excitation harness connector from the rear of the control panel and take a resistance reading between the black and red wire.



Refer to the **Stator and Rotor Resistance Chart** in the reference section for proper resistance specifications.

If the reading does not meet specifications the brush head will have to be removed to check out the wires, brushes, rotor and slip rings.

ELECTRONIC VOLTAGE REGULATION (continued)

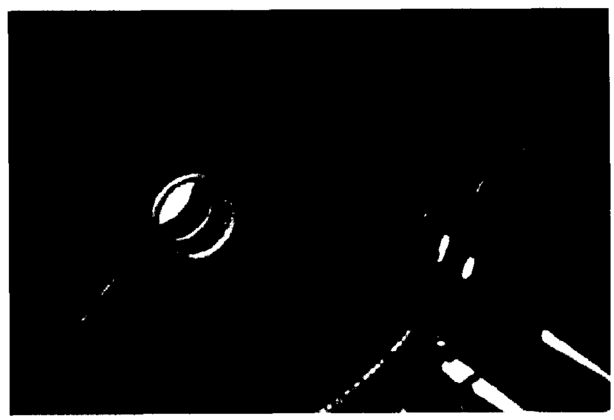
Remove the four bolts retaining the brush head and carefully pull the brush head off of the generator end. The brushes are spring loaded and will pop out as the brush head is removed.

CHECK BRUSHES

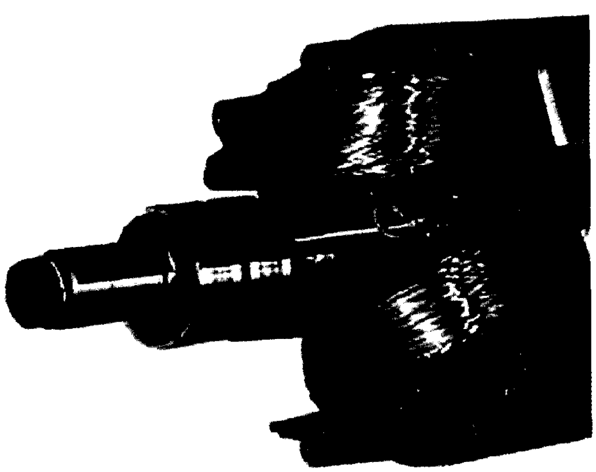
Inspect the brush lead connections with the brush holder. The prongs on the brush leads must be locked in place on the brush holder; otherwise the leads can lose contact with the brush springs.

Use a VOM meter on the R TIMES 1 scale to check continuity through each brush lead and brush. Place one VOM probe on the red lead in the small excitation circuit connector and one probe on the end of the brush associated with the red lead while it is pushed into the holder. The VOM should indicate straight continuity. If not, disconnect the brush leads from the brush holder. Test the leads and brushes separately.

Examine the brushes. If the brushes are worn to nine sixteenths of an inch, or 14 millimeter, or less, replace the brushes. Worn brushes can "bounce" on the slip rings causing intermittent or low output.



CHECK SLIP RINGS



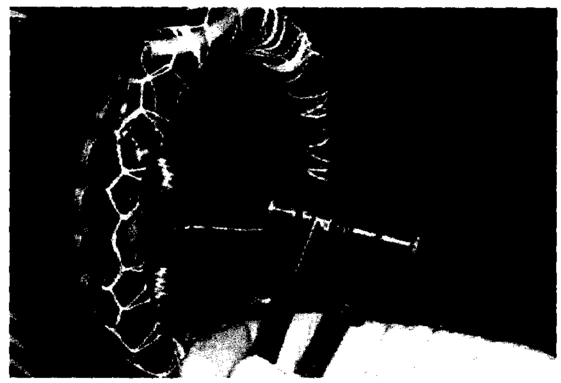
ELECTRONIC VOLTAGE REGULATION (continued)

Examine the slip rings for excessive wear and/or damage. Grooves in the slip rings are not acceptable. A carbon path, indicated by black discoloration, on the slip rings is normal. However, a severe build up of carbon may cause the brushes to lose contact with the slip rings. Use a pot scrubber pad, or a pad such as a 3M Scotchbrite, to clean the slip rings. Do not use steel wool, sandpaper or emery-cloth on the slip rings.

Visually inspect the rotor for broken wires at the slip rings and field coil. Re-solder the connections or replace the rotor if any connections are broken.

Put the VOM selector switch in the R times 1 position or equivalent. Place one VOM lead probe on each slip ring.

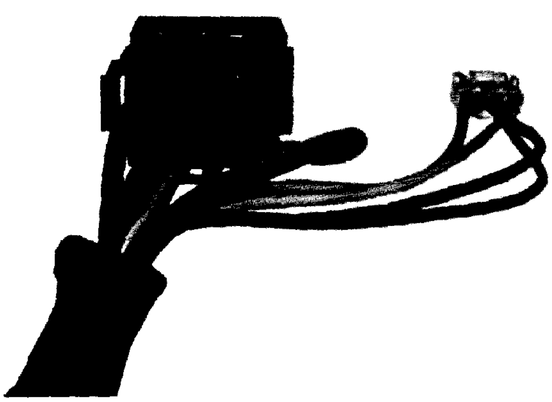
Refer to the **Stator and Rotor Resistance Chart** in the reference section for proper resistance specifications. The chart lists the resistance specifications by UT number, Model and Part Number. If the resistance reading is lower than that specified, the rotor has shorted turns and should be replaced.



Touch one rotor slip ring with one of the VOM probes. Place the other VOM probe on the rotor shaft. The meter should now indicate no continuity.

If continuity to the shaft exists on either slip ring, the coil is shorted to the shaft and the rotor must be replaced.

STATOR



To check the excitation winding and the stator main-windings, take resistance readings through the small excitation connector and the large main output winding connector.

With the VOM set to R times 1 or lowest Ohms scale, place one probe on the white wire in the large connector. Place the other probe on each of the two yellow wires in the small connector. The readings should be identical and/or within plus or minus six percent, of the specifications listed in the resistance chart.

Move the probe from the white wire to the stator body. There should be no continuity from the stator body to each of the yellow wires.

ELECTRONIC VOLTAGE REGULATION (continued)

Place one probe on the white wire. Measure the resistance to the black wire, on single voltage models; and to the black **and** red wires, on dual voltage models, in the large connector. The readings should be identical and/or within plus or minus six percent of the specifications listed in the **Stator and Rotor Resistance Chart.**

Move the probe from the white wire to the stator body. There should be no continuity from the stator body to the red or the black wires.

Place one probe on the green ground wire in the large connector and the other probe to the stator body. The resistance reading should be less than 0.5 ohms. If the resistance readings do not meet the required specifications, the stator should be replaced.

Disassembly and re-assembly for this type of generator end is the same as the inherent regulated type except for the following variations.

Before disassembly, disconnect the large main output winding connector and the small excitation winding connector from the back of the control panel.

When assembling the brush head to the generator end slide the rubber grommet and wiring harness into the exit slot on the bottom of the brush head.

LOW VOLTAGE AT NO LOAD

Make sure engine rpm is adjusted to proper specifications. Use a tachometer (Homelite part # 18416) to check engine rpms.No-load speed should be 3750-3800 rpms. Retest

The electronic voltage regulator(circuit board) has several components (capacitor, transistors, diodes) that can fail, producing low voltage at the receptacles. Use the generator analyzer (Homelite part# 08371) to bypass the circuit board. If an analyzer is not available, proceed with the static tests described in the previous section.

HIGH VOLTAGE

Make sure engine rpm is adjusted to proper specifications. Use a tachometer (Homelite part # 18416) to check engine RPM. No-load speed should be 3750-3800 RPM. Retest

Stop the engine and check circuit board connections at H1. Refer to the wiring diagram in the reference section for connection locations. If the connections are correct, the circuit board is defective and must be replaced.

ENGINE APPEARS TO BE UNDER LOAD AT NO LOAD

Stop the engine and disconnect the large main winding connector and the small excitation connector from the rear of the control panel. Attach the generator analyzer (Homelite part # 08371). Start the engine.
If the engine now runs normally check the control panel wiring and receptacles for evidence of shorting or miswiring.

If the engine appears to be under load, run the unit for 5 minutes. If there is a layer short the windings will heat up and smoke. Replace stator.

ELECTRONIC VOLTAGE REGULATION (continued)

ENGINE STILL APPEARS TO BE UNDER LOAD

MECHANICAL PROBLEM

If the generator is running, listen for abnormal noise coming out of the generator end. If the unit is not running, pull on the starter grip (high-tension lead disconnected) to listen for possible mechanical noises.

Remove the four stator bolts (nuts) and brush head. Find and remove the two brushes and springs from the brush head. Inspect the bearing and/or rotor shaft (where it runs on bearing I.D.) for signs of burning, bluing or scoring. A worn or damaged bearing can cause abnormal loading on the engine.

Physically inspect the leading edge of the rotor and stator for signs of rubbing. It may be necessary to remove the stator to thoroughly inspect the rotor and stator.

Causes of rotor and stator rubbing are: end bell mis-alignment (bolts loose, boltholes mis-drilled), incorrect stator manufacturing, brush head misalignment, or brush head bearing failure.

IDLE CONTROL

SERVICE NOTE: The idle control will only function if the generator has output. Be sure the generator is producing the required voltage before troubleshooting the idle control system.

Test the idle control.

Set the idle control switch to the start position. Start and run the engine for two minutes. Place the switch in the run or idle position. If the engine slows to idle speed apply a minimum of 50 watts load to the generator. The engine RPM should immediately increase to normal load speed.

ENGINE STAYS AT IDLE WHEN LOAD IS APPLIED

If the engine stays at idle when the load is applied make sure that the linkage is not catching, hanging or binding in any way.

Ensure that the engine throttle is set and locked at high speed.

Ensure that the electromagnet/solenoid has not become permanently magnetized.

Verify that the load sensing wires are routed correctly through the sensor coil on the circuit board.

If these areas check okay then the circuit board will have to be replaced.

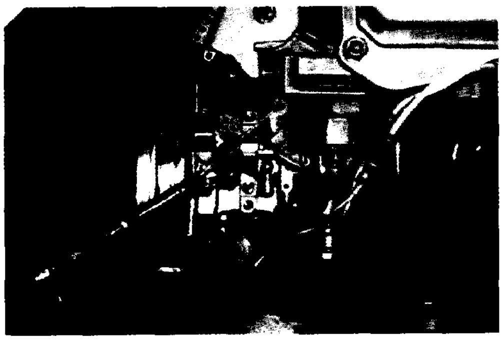
ELECTRONIC VOLTAGE REGULATION (continued)

ENGINE CYCLES FROM IDLE TO FULL SPEED CONTINUOUSLY

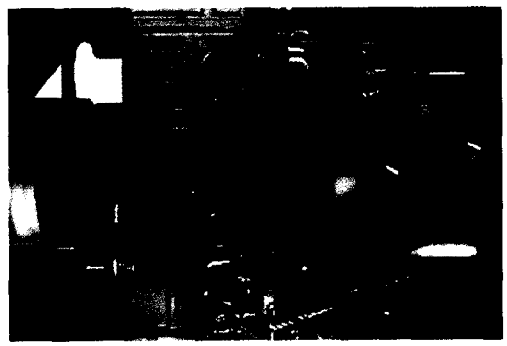
If the engine continuously cycles from idle to full speed check out the following solutions. The engine idle speed may be too low.

If the speed is too low the strength of the magnetic field in the idle-control electromagnet/solenoid will be too weak to hold the throttle arm in the idle position. Adjust the engine idle speed to the correct RPM (2640 to 2940 RPM).

On units equipped with a spring and lever design, adjust the solenoid so as to put slight tension on the spring.



On units equipped with a paddle arm design, the paddle arm may be bent or not parallel with the face of the electromagnet. Adjust the paddle arm until it is parallel to the face of the electromagnet.



The electromagnet is too far from the paddle. Adjust the electromagnet close enough to engage the paddle.

ENGINE RPM REMAINS AT HIGH SPEED

If the engine RPM remains at high-speed five seconds after the idle control switch is set to the idle position check out these possible solutions.

IDLE CONTROL SWITCH

The idle control switch may be defective. Perform a continuity test on the switch.
The Idle-Start switch is in series in the electromagnet circuit. Placing the switch in the IDLE position closes the switch and allows current flow to the electromagnet. To test the switch disconnect the battery (if equipped) and disconnect spark plug lead wire. Open front cover by removing the torx screws securing front cover to control panel body.

Disconnect the spade connectors from the switch. Make a continuity check on the switch. The VOM should show continuity with the switch in the IDLE position only. Replace switch if different readings are obtained.

ELECTRONIC VOLTAGE REGULATION (continued)

ELECTROMAGNET/SOLENOID

If the electromagnet/solenoid does not energize, test for DC voltage at the spade connectors on the circuit board.

At idle the measured voltage at the 120 V receptacle should be 80-95 VAC. Half wave rectified voltage is fed to the electromagnet providing it with 35 - 45 VDC.

The electromagnet must be positioned close enough to the paddle to insure proper speed at idle (2640-2940 RPM). With the idle speed set to 2640 RPM (minimum), loosen the locking nuts and adjust the electromagnet toward the paddle until the electromagnet will hold the paddle at idle.

The solenoid must be positioned to insure proper speed at idle (2640-2940 RPM). With the idle speed set to 2640 RPM (minimum), loosen the locking nuts and adjust the solenoid so that when engaged it will hold the throttle lever at idle.

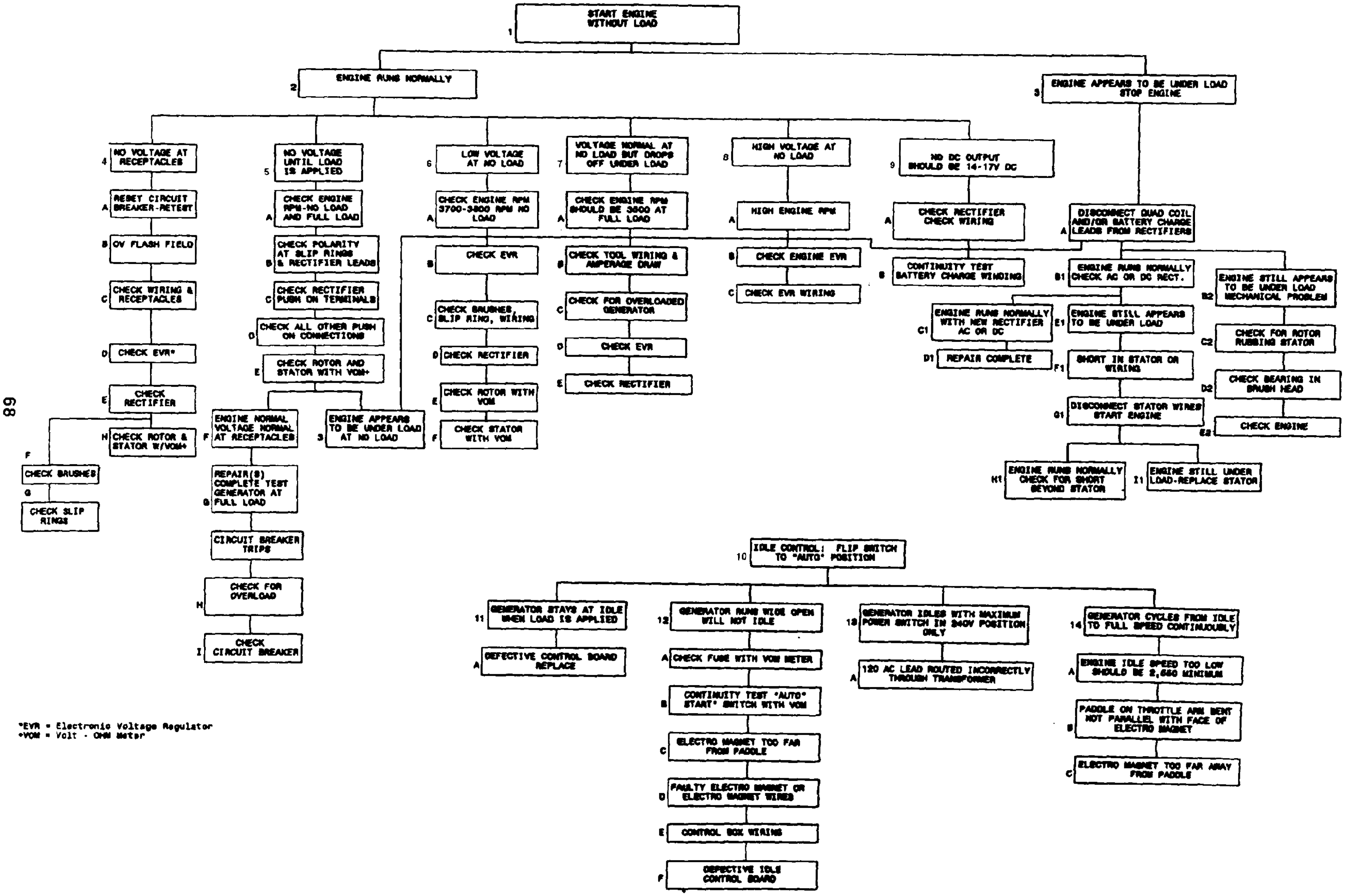
SERVICE NOTE
If the electromagnet cannot be adjusted far enough toward the paddle to hold the paddle, check the carburetor slow idle adjustment screw to see if it is interfering with the paddle full range of movement. The paddle linkage controls the engine governor and can be prevented from doing so if the idle stop screw is set in too far.

If the voltage is present and within specifications and the electromagnet/solenoid is not energizing, test the electromagnet/solenoid. Disconnect the electromagnet/solenoid wire connectors. Check the resistance between the electromagnet/solenoid wires.

The resistance reading should be 240 to 273 ohms. Replace the electromagnet/solenoid if resistance through the electromagnet/solenoid coil is abnormally low.

Check for continuity between each electromagnet/solenoid wire and the electromagnet/solenoid body. The VOM should indicate **NO** continuity. Continuity through either of the leads and the electromagnet/solenoid case constitutes a short to ground. If this is the case replace the electromagnet/solenoid.

TROUBLESHOOTING GUIDE
CONTRACTOR SERIES GENERATORS



*EVR = Electronic Voltage Regulator
+VOM = Volt - Ohm Meter

CONTRACTOR SERIES

1 **START ENGINE WITHOUT LOAD ENGINE R.P.M. – 3.750 – 3.800**

Start and run the generator; use a tachometer (Homelite Part Number 18416) to check engine RPM. No-load RPM should be 3,750 - 3,800 RPM.

2 **ENGINE RUNS NORMALLY CHECK OUTPUT WITH VOM** — **APPLY RATED LOAD**

Check rated output. Use a volt-ohm-milliamp (VOM) meter set on the highest AC volt scale and insert the VOM probes into the 120V receptacle. Voltage at no-load should be 120 volts AC +/- 2%. The 240 receptacle output should be 240 volts AC +/- 2%.

Apply rated load (4,000 or 5,000 watts) to the generator. If the engine speed drops below 3,550 RPM, the problem is low engine power. Check the engine to find the cause of low power.

4 **NO VOLTAGE AT RECEPTACLE**

A **RESET CIRCUIT BREAKER RETEST**

The contractor series generators utilize a single field circuit breaker. If tripped by an overload or dead short, this circuit breaker will open the excitation circuit and output will cease.

Reset the circuit breaker (if tripped), start the engine and use a VOM meter to measure 120/240 volt output. If 120/240 volt output is now normal, apply rated load. Run the generator at least five minutes.
Generally, the circuit breaker will only trip if amperage across the circuit breaker exceeds 2.5A. This can be a result of a short circuit in the quad windings or shorted diode in the rectifier, or an excessive overload to the generator. If the generator has normal output and the unit is not overloaded, the circuit breaker must be tested.

Disassemble the control panel to gain access to the circuit breaker. Start and run the generator, apply rated load, then place an ammeter probe around the blue or yellow lead that is connected to the circuit breaker. At rated load, the circuit breaker should not trip below 2.5. If it trips, replace the circuit breaker.

If the circuit breaker does not trip, find out what loads are being put on the generator, inspect and test all tools and equipment being used on the generator. Test all tools and equipment with an ammeter to determine total amperage requirements or for worn tools or equipment drawing excessive current. If an ammeter is not available, get the nameplate amperage draw (running) for each tool and piece of equipment.

CONTRACTOR SERIES (continued)

A general rule of establishing starting load current is:

Running amperage x 1 = for a purely resistive circuit (light bulbs, heaters). Starting up or operating amperage is the same.

Running am era e x 2 = tools with universal type AC/DC motors. Requires up to two times their free running amps as when they are operating under load.

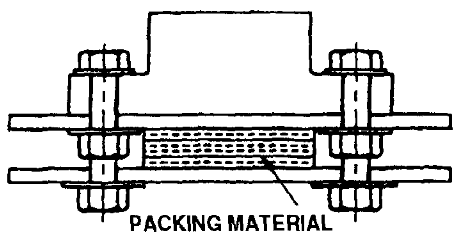
Running amperage x 3 = equipment that uses motors. They can use up to three times their running amps to start as to run.

These are the minimum amperage requirements. Find out the total length and AWG ratings for extension cords. The IR (voltage) drop across long cord runs can overload a generator. Use the **cable size chart** in the **selecting the right generator** section to determine cord applications. Check extension cords for proper size; look for long extension cord lengths, damaged insulation, exposed conductors or strained plugs.

Many times generator problems result from improper use and application rather than problems relating to malfunction or failure of the generator itself.

An Important Word of Caution:

The generator uses a vibration system that allows the generator and engine to "float" in the roll cage. The vibration isolation is nullified if the shipping block or cardboard under the engine is not removed when preparing the unit for operation. Failure to remove this packing material can lead to serious damage to the entire machine!

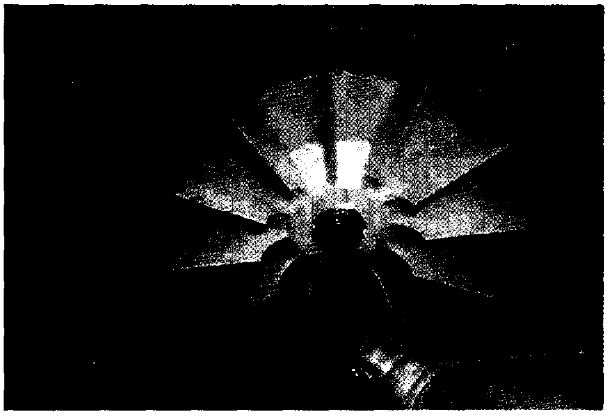


B	0 – 2.9 VOLTS AC FLASH FIELD

Check the voltage at each receptacle, 120V and 240V. If the voltage reading is 2.9 volts AC or less, the generator has probably lost its residual magnetism.

Applying 3 to 12 volts DC to the positive and negative brush terminals located on the brush head can restore residual magnetism.

CONTRACTOR SERIES (continued)



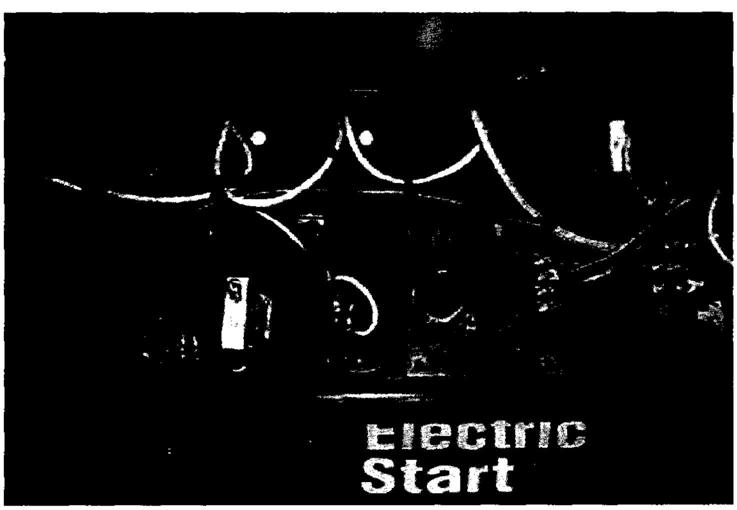
Remove the fan cover, rotor bolt and fan. Reinstall the rotor bolt and washer. Torque the rotor bolt. **Do not run the generator without the rotor bolt installed.**

Disconnect the positive and negative brush leads from the brush. Place the two leads away from the rotor, so they will not contact the rotor at start-up.

Start and run the generator. Place the negative battery terminal probe on the innermost brush terminal. Then, place the positive battery terminal lead on the outside brush terminal. As soon as contact is made with the positive brush terminal, the field will be flashed.

A much easier and safer way to flash the field is to use a "Field Flasher", Homelite part number UP00457. Simply flip the switch on the field flasher to the **"ON"** position and plug it into the 120-volt AC receptacle of a running generator. This flashes the field without disassembling the fan cover, rotor bolt or fan.

C CHECK WIRING AND RECEPTACLES



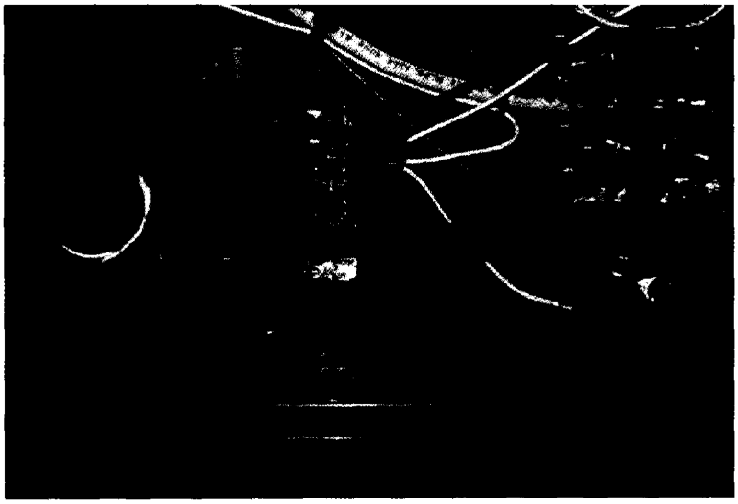
It is very important to visually inspect all wiring and terminals inside the control panel. Handle each wire; tug on the wire and terminal where it attaches to the terminal block, receptacle or board. Suspect a wiring problem if there is voltage at one receptacle and not another.

Check all push-on terminals in the control panel and brush head. There must be a 100% electrical connection between the push-on terminal and component.

Place a jumper across each outlet (generator side), and continuity test the receptacle between each hot leg and neutral. Also, test between each current carrying leg and ground.

CONTRACTOR SERIES (continued)

D CHECK EVR



Certain components on the EVR board can fail (Q1 Transistor, build-up circuit components, etc.) causing no output. We can remove the EVR from the circuit and then test for output.

Remove the yellow and white wires going from the EVR board (VR1) to the terminal board (TB1) at the terminal board end. Remove the red wire at the EVR board (VR1). Tape this lead terminal with plastic tape.

Remove the small black wire on the EVR board terminal strip (position #1) and move it to the terminal strip (position #3) where it joins the two small white leads.

Start and run the generator. With a VOM meter set on the 300 volt scale, measure the output at the 120V receptacle. This is unregulated voltage and should read approximately 150-160VAC.

No voltage indicates a problem in the excitation circuit (brushes, rectifier, slip rings/rotor) or stator.

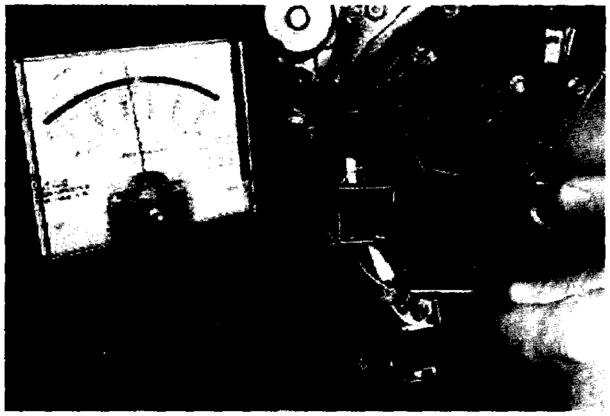
E CHECK RECTIFIER

Use a VOM meter to test the rectifier. Use the Go-No-Go method to continuity check the rectifier.

Remove the quad winding leads (blue/yellow) and the two brush leads (black/red) from the exciter rectifier. Use the following procedure and illustration to test the rectifier.

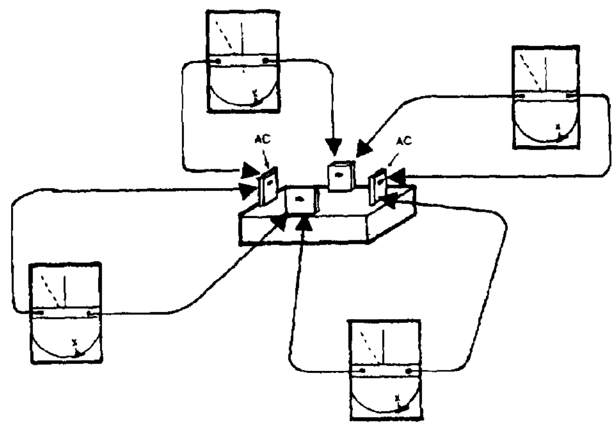
Place a VOM on the RX1 scale or equivalent. Touch the VOM probes to any two rectifier terminals that are adjacent to each other.

CONTRACTOR SERIES (continued)



If there is continuity, note the resistance reading. Now, switch the leads between the two terminals. There should be no continuity. If there was no continuity when the meter probes were placed on the rectifier, switch the VOM probes between the two terminals. There should now be continuity. Once again, the resistance reading should be noted. This test should be performed on all four rectifier terminals. When completed, the test should look like this:

Terminals 1 and 2:	Continuity, No Continuity
Terminals 2 and 3:	Continuity, No Continuity
Terminals 3 and 4:	Continuity, No Continuity
Terminals 4 and 1:	Continuity, No Continuity



If the diode under test shows continuity each time the leads are switched, the diode is shorted out and the rectifier should be replaced. If there is no continuity in either direction, the diode is open, replace the rectifier. If one or more resistance readings are abnormally lower than the rest, replace the rectifier.

A good practice is to go around the rectifier twice to insure that all terminals are checked.

SERVICE NOTE: If diodes in the rectifier were shorted out, the rotor may have been fed AC current. Residual magnetism will have to be re-established by flashing the field.

F — CHECK BRUSHES

Generally, brushes should be replaced every 1,000 hours or when the brush length is 3/8" (10 mm) or less. If the brushes are worn short enough, they can "bounce' causing intermittent output. Broken brushes, brush leads, or loose terminals can also cause the loss of magnetic field resulting in no output.

CONTRACTOR SERIES (continued)

Use a VOM meter on RX1 scale to check continuity through each brush lead and brush. Place one VOM probe on the positive (+) brush lead (disconnect from the rectifier), and the other probe on the slip ring. Repeat this same step for the black (-) brush lead.

There should be straight continuity. If not, disconnect each brush lead from the brush terminals and remove the brushes from the brush holder. Continuity test each lead, examine brushes for breakage, and spring tension on the brushes. Make sure the brushes slide up and down easily in the brush holder.

G CHECK SLIP RINGS

Examine the slip rings for excessive wear and/or damage. Grooves in the slip rings are not acceptable. A carbon path (black discoloration) on the slip rings is normal, however a severe build up of carbon may cause the brushes to lose contact with the slip rings. Use a pot scrubber pad, or a pad such as a 3M Scotchbrite, to clean the slip rings.

H CHECK ROTOR AND STATOR WITH VOM

Inspect the rotor slip ring wire connections with the field coil. Re-solder the connection(s) or replace the rotor if continuity cannot be established.

Use a VOM with the selector switch in the RX1 position. Place the red VOM probe on one slip ring, and the black VOM on the other slip ring. The rotor resistance is listed in the **Rotor and Stator Resistance Chart** located in the reference section of this service guide.

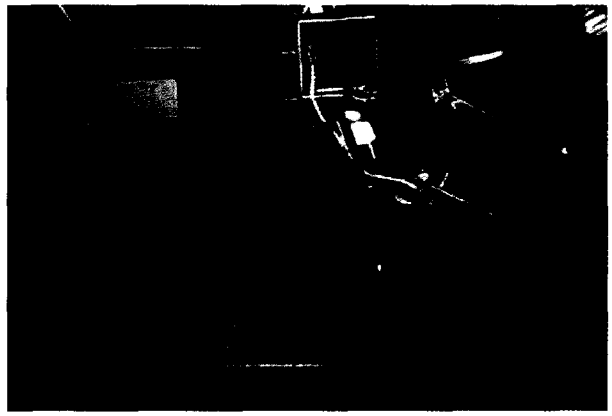
If the resistance is lower than those specified, the rotor has shorted turns and should be replaced.

Touch one slip ring with one of the VOM meter probes Place the other VOM meter probe on the rotor shaft, there should be no continuity. Test each slip ring in turn; if continuity exists with either slip ring, replace the rotor.

CONTRACTOR SERIES (continued)

TEST STATOR EXCITATION WINDING CONTINUITY

Remove the yellow and blue wires from the exciter rectifier. Use a VOM on RX1 scale or lowest scale to measure the excitation winding resistance at the yellow and blue wires. Check the spade terminal connection to be sure it is secure to the lead. The excitation winding resistance is listed in the **Rotor and Stator Resistance Chart** located in the reference section of this service guide.

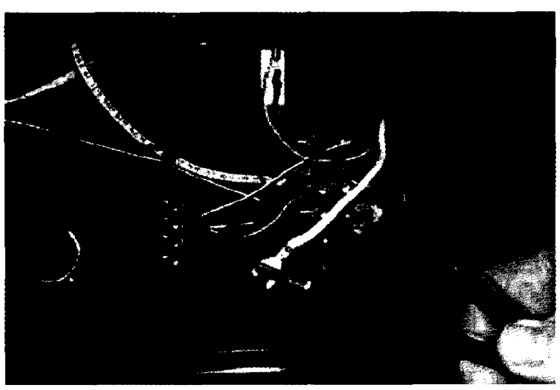


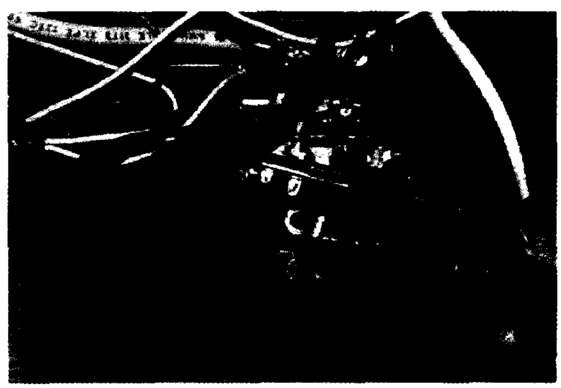
If the readings are not within the specified range, replace the stator.

SERVICE NOTE: If there is no continuity in the excitation winding, disconnect the yellow excitation winding at the circuit breaker. This will bypass the circuit breaker. If continuity now exists between the two yellow wires, use a VOM meter to test the circuit breaker and blue wire.

With the VOM set on RX1 or lower, touch one VOM probe to a yellow or blue excitation winding lead. Touch the other probe to the stator laminations. Test both wires in turn. If continuity exists on either wire, the stator windings are shorted and the stator must be replaced.

TEST STATOR MAIN WINDING CONTINUITY





With VOM selected switch in the RX1 position, or lowest scale possible, measure the resistance between the stator coil or coils. Remove the two (single voltage) or four (dual voltage) stator leads at the terminal block (TB1) or remove the stator leads from the receptacles (see schematics in reference section). Main winding resistance is listed in the **Rotor and Stator Resistance Chart** located in the reference section of this service guide.

If the resistance reading is substantially less than specified in the chart, or if there is no continuity, replace the stator.

Place one VOM probe on each of the stator leads in turn and the other VOM probe on the stator laminations. There should be no continuity. If continuity exists, replace the stator.

CONTRACTOR SERIES (continued)

5 **NO VOLTAGE UNTIL LOAD IS APPLIED**

A **CHECK ENGINE RPM NO LOAD AND FULL LOAD**

Check engine speed to make sure it meets the 3,750-3,800 RPM no load and 3,600 RPM full load specification.

B **CHECK POLARITY AT SLIP RINGS AND RECTIFIER LEADS**

Inspect the polarity of the brush leads at the brush holder. The red or positive lead should be attached to the brush that is closest to the fan. The brush rides on the outer slip ring. The black brush lead should be attached to the brush closest to the rotor. This brush rides on the inner slip ring.

Check the polarity of the brush leads at the rectifier. The red (+) lead goes on the + terminal of the rectifier. The black (-) lead goes on the - terminal of the rectifier.

SERVICE NOTE: Care must be taken to establish proper polarity of the brush leads, as improper installation will blow the capacitor.

C **CHECK RECTIFIER PUSH-ON TERMINAL**

Flag terminals on the brush leads (red and black) can be loose and cause a loss of field build-up in two ways:

First, the flag terminals can be loose on the rectifier terminals, resulting in an intermittent loss of electrical path. When a load is applied, the "boost" in excitation winding output can jump a loose terminal resulting in output. The flag terminals must be tight on the rectifier terminals.

Second, the flag terminals can be loose on the AC or brush wires and not making a 100% electrical connection. If the terminals are loose, flow solder into the terminal/wire joint to make sure a good connection is maintained.

D **CHECK ALL OTHER PUSH-ON CONNECTIONS**

Visually inspect the excitation winding terminals (blue/yellow) at the rectifier. Crimp the flag terminals if they are loose on the rectifier terminals. A 100% electrical connection is required. Also, arcing can burn out loose flag terminals.

E **CHECK ROTOR AND STATOR WITH VOM**

Visually inspect the rotor slip ring and rotor coil connections. A loose connection can cause output when a load is applied.

Use a VOM meter to measure continuity in the rotor. The VOM meter uses a small electrical current to measure continuity. If there is a bad electrical connection that is made when a load is applied, it will show as no continuity with a VOM meter. As with the rotor, the stator wires can have a small break and only show output when a load "boost" is applied to the stator windings. Use a VOM meter to test stator continuity; any bad electrical connections will show as no continuity.

CONTRACTOR SERIES (continued)

F — **ENGINE NORMAL VOLTAGE NORMAL AT RECEPTACLES**

G — **REPAIR (S) COMPLETE TEST GENERATOR AT FULL**

When completing repairs on a generator, it is a must that full load be drawn. This tests generator output, engine performance, proper voltage levels, and Hertz.

CIRCUIT BREAKER TRIPS

H — **CHECK FOR OVERLOAD**

Test all tools and equipment with an ammeter to determine total amperage requirements or for worn tools or equipment drawing excessive current.

If an ammeter is not available, get the nameplate amperage draw (running) for each tool and piece of equipment.

A general rule of establishing starting load current is:

Running amperage x 1 = for a purely resistive circuit (light bulbs, heaters). Starting up or operating amperage is the same.

Running amperage x 2 = tools with universal type AC/DC motors. Requires up to two times their free running amps as when they are operating under load.

Running amperage x 3 = equipment that uses motors. They can use up to three times their running amps to start as to run.

These are the minimum amperage requirements. Find out the total length and AWG ratings for extension cords. The IR (voltage) drop across long cord runs can overload a generator. Use the cable size chart in the reference section to determine cord applications.

I — **CHECK CIRCUIT BREAKER**

Generally, the circuit breaker will only trip if amperage across the circuit breaker exceeds 2.5A. This can be a result of a short circuit in the excitation windings or shorted diode in the rectifier, or an excessive overload to the generator. If the generator has normal output and the unit is not overloaded, the circuit breaker must be tested.

Disassemble the control panel to gain access to the circuit breaker. Start and run the generator, apply rated load, then place an ammeter probe around the blue or yellow lead that is connected to the circuit breaker. At rated load, the circuit breaker should not trip below 2.5 amps. If it trips, replace the circuit breaker.

CONTRACTOR SERIES (continued)

6 **LOW VOLTAGE AT NO LOAD**

A **CHECK ENGINE RPM 3750 – 3800 RPM NO LOAD**

B **CHECK EVR**

The electronic voltage regulator has several components (capacitor, transistors, and diodes) that can fail, producing low voltage in the output.

Use the Troubleshooting Information in **Section 4D** to test the EVR.

C **CHECK BRUSHES, SLIP RINGS, WIRING**

The brushes eventually wear out (after approximately 1,000 hours) causing the brushes to 'bounce' and lose contact with the slip rings. **Use Section 4F** information to test the brushes.

Damaged slip rings (grooves, carbon build-up) can provide a loss of electrical contact, resulting in low voltage. Examine the slip rings and clean, if required. **See Section 4F** for more details.

Partial contact between wires, connectors, terminals and receptacles can cause low or intermittent output. Use **Section 4C** for more information.

D **CHECK RECTIFIER**

An open diode in the exciter rectifier can cause a loss of approximately one-half of the normal voltage. Use the 'Go-No-Go" method as outlined in **Section 4E** to test the rectifier.

E **CHECK ROTOR WITH VOM**

A layer short within the rotor coils can reduce AC output by reducing the strength of the magnetic field. Use the test instructions in **Section 4H** to troubleshoot the rotor.

F **CHECK STATOR WITH VOM**

Remove the blue (T1), Brown (T2), White (T3) and Black (T4) stator leads from the terminal board. Also, remove the two excitation winding leads (yellow) from the circuit breaker and rectifier.

Use a VOM meter to test the stator windings. A layer short in the stator can reduce AC output, although in most cases, there will be no output. Test the stator as in **Sections 4H and 5E**.

CONTRACTOR SERIES (continued)

7 **VOLTAGE NORMAL AT NO LOAD BUT DROPS OFF UNDER LOAD**

A **CHECK ENGINE RPM - SHOULD BE 3600 AT FULL**

Engine speed should always be checked under full load conditions. Apply the rated load. Engine RPM should be 3,600. If engine speed drops below 3,550, the problem is low engine power. If engine speed remains constant, but voltage drops, there is a problem in the excitation circuit.

B **CHECK TOOL WIRING AND AMPERAGE**

Examine all tools and/or equipment drawing amperage from the generator. Faulty cord sets or worn tools can cause short circuits and heavy amperage draw, Use an ammeter to test the current draw of the tools and/or equipment.

C **CHECK FOR OVERLOADED GENERATOR**

Check the nameplate ratings of tools or equipment being used with the generator. The nameplate amperage rating indicates running amperage draw only. Use the following rough estimate to determine starting amperage for various tools and equipment.

Multiply x 1 - if the generator is operating heating or lighting equipment, Example: 10-100 watt light bulbs draw a constant 8.3 amps (10 x 100/120 = 8.3 amps).

Multiply x 2 - if a hand tool is being used, They typically use twice their rated amperage under full load as they do under no load conditions. Example: a hand drill that requires 7 amps no load may require up to 14 amps at full load use.

Multiply x 3 - if an electric motor is used to operate a piece of equipment, They require up to three times their rated amperage to start. Example: a 1 HP capacitor start motor typically requires approximately 9 amps to run, 27 amps to start.

Generator watts required = amps x volts x 1, 2 or 3. This is a good minimum estimate of equipment or tool amperage draw. Remember that the total amperage draw must not exceed the amperage rating of the 120 or 240 volt receptacles.

Large generator loads should always be started first, followed by the next largest load. The smallest loads should be started last.

D **CHECK EVR**

The electronic voltage regulator controls the strength of the magnetic field produced by the rotor. Component failure on the EVR board can cause loss of voltage as a load is applied. Follow the test procedures as outlined in **Section 4D**.

CONTRACTOR SERIES (continued)

E — CHECK RECTIFIER

A diode within the exciter rectifier can break down under load causing low output. Use **Section 4E** for testing the rectifier.

8 — HIGH VOLTAGE AT NO LOAD

A — HIGH ENGINE RPM

Engine RPM must be 3,750-3,800 RPM No-Load, Use a good quality tachometer (Homelite Part Number 18416) to test the no load speed.

Low engine RPM will result in low voltage under load. This can damage the generator. Tools and equipment drawing amperage off the generator may also be damaged.

B — CHECK EVR

If the EVR is faulty, it can cause unregulated voltage of 150-160V at the 120V receptacle and 300+ volts AC at the 240V receptacle. Replace the board if the wiring is OK.

C — CHECK EVR WIRING

The yellow and white wires going from the EVR terminal strip to the terminal board (TB1) are part of the sensing circuit. If the terminals are loose or the wires are broken, unregulated voltage will go to the receptacles (see the wiring schematic for details).

9 — NO DC OUTPUT

A — CHECK RECTIFIER AND WIRING

DC output is dependent on rectifiedAC from the battery charge winding to the 12V DC terminal posts. The DC rectifier is the same component that is used in the excitation circuit. See Section 4E for test instructions.

Examine the rectifier wires. Check each push-on terminal for tightness. Look for possible chafing and/or shorted wires from interference with the fan.

B — CHECK RESISTANCE OF BATTERY CHARGE WINDING

Remove the fan cover, rotor bolt/washer and fan, Use a pair of needle nose pliers to disconnect the two black wires from the DC charging rectifier. With a VOM meter set on R X I or lowest scale, measure resistance between the two black wires. Battery charge winding resistance is listed in the **Rotor and Stator Resistance Chart** located in the reference section of this service guide.

CONTRACTOR SERIES (continued)

Replace the stator if the readings are substantially below those specified or there is no continuity. Place one VOM meter probe on either black battery charge winding lead. Place the other VOM probe to a suitable ground (stator laminations, brush head, etc.). There should be no continuity. Check the spade terminal connection to be sure it is secure to the lead.

3 **ENGINE APPEARS TO BE UNDER LOAD STOP ENGINE**

A **DISCONNECT EXCITATION WINDING AND BATTERY CHARGE WINDING, WHERE APPLICABLE, FROM THE RECTIFIER.**

B1 **ENGINE RUNS NORMALLY CHECK AC AND/OR DC RECTIFIER**

Use the "Go-No-Go' method with a VOM meter as outlined in **Section 4E**. Both AC and DC rectifiers are the same parts and testing is identical.

C1 **ENGINE RUNS NORMALLY WITH NEW RECTIFIER AC OR DC**

D1 **REPAIR COMPLETE**

E1 **ENGINE STILL APPEARS TO BE UNDER LOAD**

F1 **SHORT IN STATOR OR WIRING**

G1 **DISCONNECT STATOR WIRES START ENGINE**

Disconnect all stator winding wires (main, excitation, and battery charge) from the panel and brush heads. Tape each wire carefully and route any wires away from rotating parts (rotor, fan, etc.).

H1 **ENGINE RUNS NORMALLY CHECK FOR SHORT BEYOND STATOR**

Examine all wiring in the panel against the electrical schematic for your generator. Test each stator winding for a short to ground. See **Sections 4H and 5E** for details.

CONTRACTOR SERIES (continued)

I1 **STATOR STILL UNDER LOAD REPLACE STATOR**

B2 **ENGINE STILL APPEARS TO BE UNDER LOAD MECHANICAL PROBLEM**

C2 **CHECK FOR ROTOR RUBBING STATOR**

Remove the fan cover, rotor bolt/washer and fan. Pull on the stator rope. Look into the generator end. The rotor travel should be concentric. Any wobbling will cause the rotor to rub the stator as there is only .020" (0,5 mm) clearance between the two components.

Causes of misalignment are end bell misalignment (bolt holes mis-drilled), incorrect manufacturing of the stator, brush head misalignment or bearing failure.

D2 **CHECK BEARING IN BRUSH HEAD**

Listen for abnormal mechanical noises when running the unit or pulling the engine over by hand. The rotor shaft may be bad, causing the rotor to rub the stator. Examine the bearing for signs of burning or bluing. It may be necessary to remove the brush head in order to thoroughly inspect the bearings.

E2 **CHECK ENGINE**

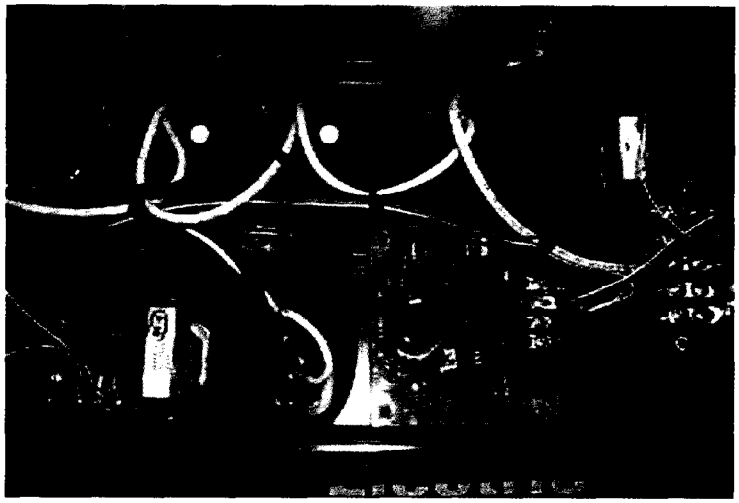
Low power from the engine is made apparent by fully loading the generator. If voltage is normal but engine speed drops below 3,550 RPM, then the engine needs servicing. Severe engine damage may cause hard starting, poor idling, and the appearance of being under a slight load.

10 **IDLE CONTROL: SET THE SWITCH TO THE AUTO POSITION**

11 **GENERATOR STAYS AT IDLE WHEN LOAD IS APPLIED**

A **DEFECTIVE CONTROL BOARD - REPLACE**

CONTRACTOR SERIES (continued)



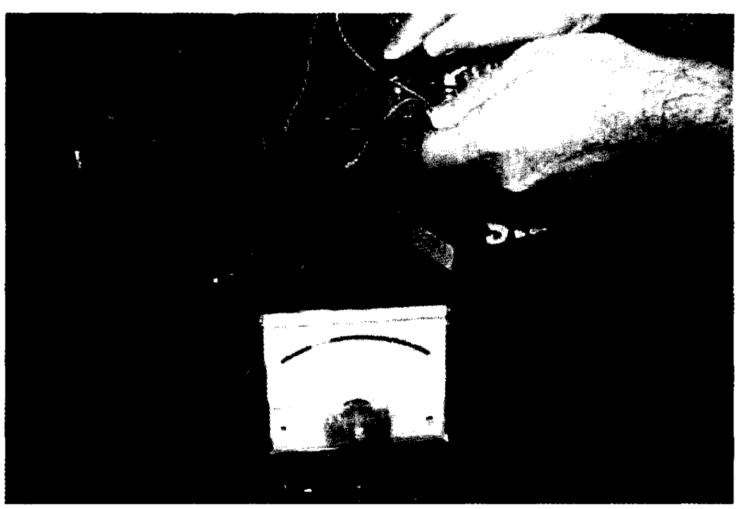
If the generator remains at idle when a load is applied (50-watt minimum), the control board must be replaced as certain components on the board have failed.

12 GENERATOR RUNS WIDE OPEN WILL NOT IDLE

A CHECK FUSE WITH VOM

Inspect the fuse to see if it is blown. If you are not sure, use a VOM meter on RX1 scale to test fuse continuity. If the fuse is blown, carefully inspect the electromagnet lead wires (yellow and red) for shorts to ground or each other. Replace the fuse with Homelite Part Number 49318 or 1/2 amp fuse only. Higher rated fuses will not protect the control board from possible damage.

B CONTINUITY TEST "AUTO-START" SWITCH WITH VOM

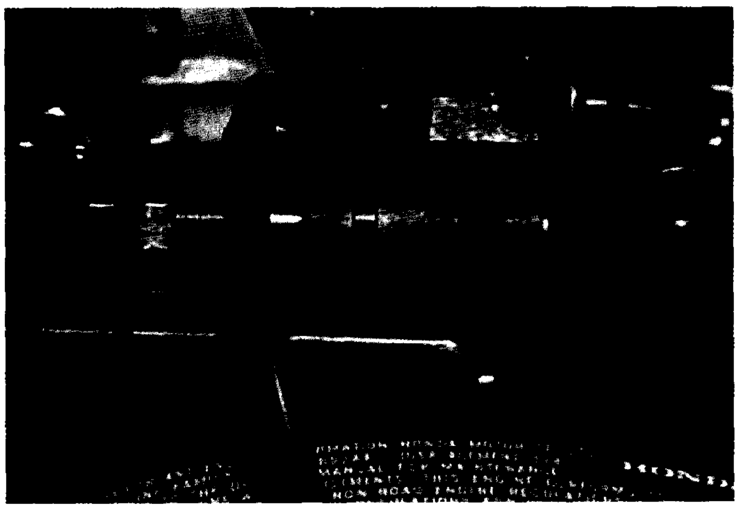


CONTRACTOR SERIES (continued)

Remove the two leads attached to the "Auto-Start" switch. Note which two switch terminals were occupied by the two yellow switch leads.

With a VOM meter on RX1 scale, place the VOM probes on each of the two switch terminals. There should be continuity in the "AUTO" position only.

C **ELECTROMAGNET TOO FAR FROM PADDLE**



The electromagnet is attached to a bracket and can slide in and out of the bracket for adjustments to the distance between the electromagnet and the paddle on the throttle arm. With the idle speed set at 2,640 RPM (minimum), adjust the electromagnet towards the paddle until the electromagnet will hold the paddle at idle.

D **FAULTY ELECTROMAGNET OR ELECTROMAGNET WIRES**

CONTRACTOR SERIES (continued)

Remove the two electromagnet wires (yellow and red) from the idle control boards. With the VOM meter set on R X I ohm scale, place a VOM probe on each electromagnet wire. The resistance rating should be 240-260 ohms. Remove one VOM probe and place it on the electromagnet casing. Test each wire in turn, There should be no continuity. Note: Electromagnet resistance on the 178VI52 is 150-160 ohms,

If the resistance figure you obtained is abnormally low, replace the electromagnet. Continuity between any electromagnet lead and the electromagnet casing constitutes a short to ground. Replace the electromagnet.

Inspect both red and yellow electromagnet leads for loss of insulation, chafing, or shorts to ground.

E — CONTROL BOX WIRING

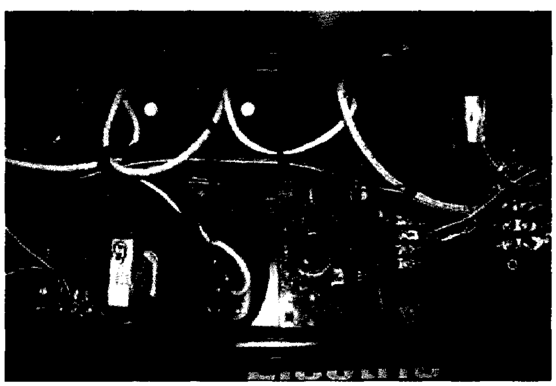
Inspect the yellow wire between the idle control board and the "auto-start" switch. Look for broken connections, chafing, rubbing, etc. Also examine the yellow wire from the switch to the terminal board (TB1), and the white wire from the idle control board to the terminal board (TB1). Poor or no connections at these points will render the idle control system inoperative.

F — DEFECTIVE IDLE CONTROL BOARD

Certain components on the idle control boards can fail, causing the idle control to quit working. Make sure all other tests have been completed prior to board replacement.

13 — GENERATOR IDLES WITH MAX. POWER SWITCH IN 240V POSITION ONLY

A — 120 AC LEAD ROUTED INCORRECTLY THROUGH TRANSFORMER



One of the two primary wires (#1 or #4) has been routed through the transformer from the wrong direction. To correct this problem, remove either #1 or #4 lead from the terminal board (TB1) or receptacle. Pull the wire out of the transformer bobbin and route it back through the transformer from the opposite direction. Use a cable tie to secure the wire to the transformer.

CONTRACTOR SERIES (continued)

14 **GENERATOR CYCLES FROM IDLE TO FULL SPEED CONTINUOUSLY**

A **ENGINE IDLE SPEED TOO LOW SHOULD BE 2640 RPM MINIMUM**

If the engine idle speed is too low, voltage to the idle control board and electromagnet is insufficient to hold the paddle. The engine will hunt, as the paddle is alternately held, then released. Adjust idle speed to 2,650 RPM minimum. Do not exceed 2,800 RPM. Note: 178VI52 idle speeds are 2,200-2,400 RPM.

B **PADDLE ON THE THROTTLE ARM BENT, NOT PARALLEL WITH FACE OF ELECTROMAGNET**

Pull the electromagnet paddle (throttle arm) up to the electromagnet. It should be parallel to the face of the electromagnet. If it is not parallel, the engine will hunt from full speed to idle and back to full speed. This will occur even though the electromagnet is properly adjusted. Bend the paddle until it is parallel to the face of the electromagnet.

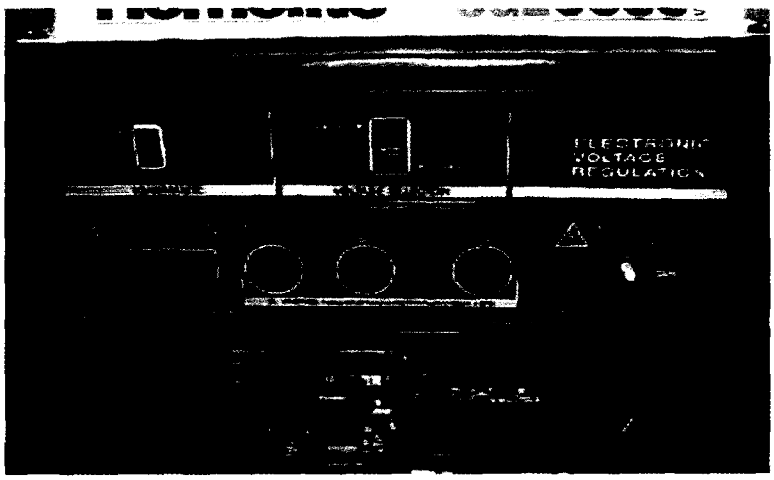
C **ELECTROMAGNET TOO FAR FROM PADDLE**

The electromagnet must be positioned close enough to the paddle (throttle arm) to insure proper speed at idle (2,650-2,800) (2,200-2,400 = 178VI52).

CONTRACTOR SERIES (continued)

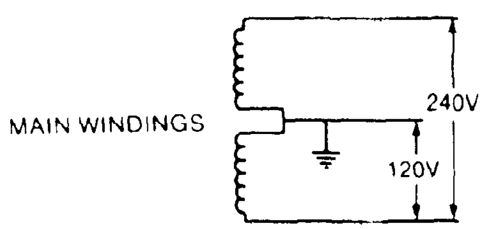
MAXIMUM (FULL) POWER SWITCH

The maximum (max) or full power switch is used on certain models of our contractor series generators. The maximum power switch in the 120V position parallels the two 120V stator windings. This, in effect, doubles the amperage available at the 120V duplex and twist lock receptacles. So, in the 120V position, the generator is wired as a single voltage generator. No output is available at the 240V receptacle, so the load does not have to be split.



With the maximum power switch in the 120/240V position, the two 120V windings are now hooked in series. It is now possible to draw both 120 and 240 volts at the same time. However, the load must be split between the 120 and 240 volt receptacles in order to pull rated load.

CONVENTIONAL WIRING



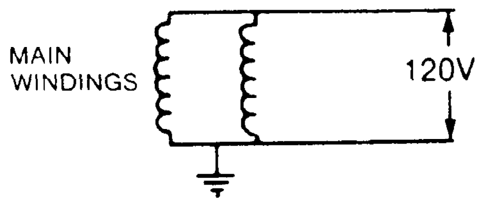
The above illustration shows a conventional 120/240V generator. If it is rated at 3,000 watts, each 120V winding has a 1,500 watt maximum capacity, and each winding is carrying one half the load. It would not be possible to use a 120V 2,500 watt load because it would overload either of the stator windings and cause excessive heat build-up in the generator.

In the first illustration, the conventionally wired generator could not handle a 2,500 watt load because output was split between the two windings. With the maximum power switch in the 120V AC position, this load is easily handled by a 30 amp twist lock receptacle.

CONTRACTOR SERIES (continued)

In the 120V/240V mode, the windings are switched to a series connection so that 240V is available. This means that maximum power can only be drawn by splitting the load between the 120V and 240V receptacles. For example: If 2,000 watts is being drawn off the 240V receptacle, 1,000 watts must be drawn off the 120V side to achieve maximum power.

MAXIMUM POWER SWITCH PARALLELS 120V WINDINGS



TESTING THE MAXIMUM (FULL) POWER SWITCH

With the maximum (full) power switch in the 120V AC only position, continuity (VOM meter = RX1) should exist between the center terminals (Brown, Blue), and each adjacent 120V terminal:

Brown - Black = Continuity

Blue - White = Continuity

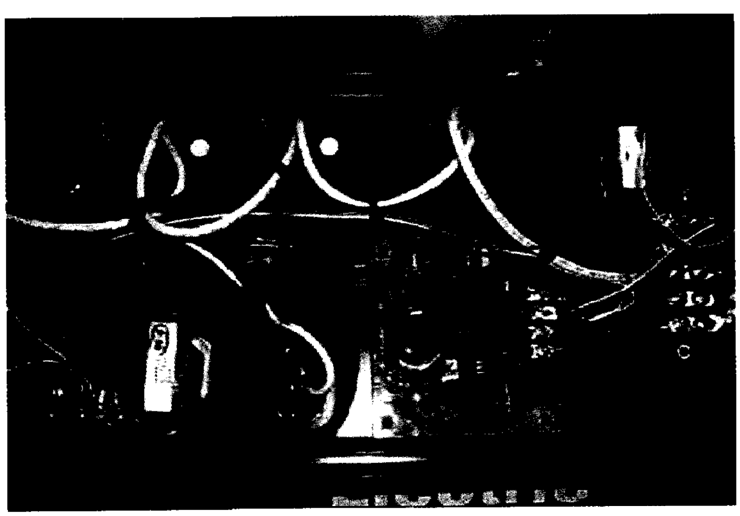
There should be no reading between the Black and White or Brown and Blue terminals. If there is, replace the switch.

With the maximum power switch in the 120/240 position, there should be continuity between the center terminals (Brown, Blue), and each adjacent 240V terminal:

Brown - White = Continuity

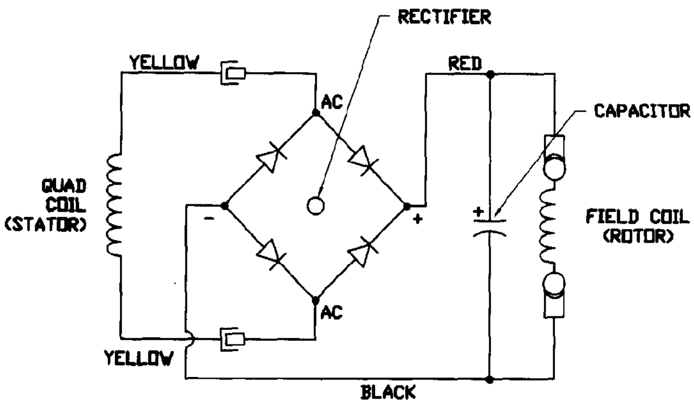
Blue - Red -- Continuity

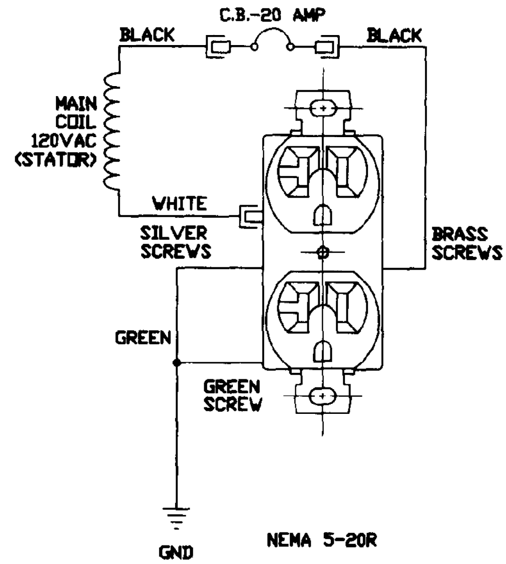
There should be no continuity between the Red and White or Blue and Red terminals. If there is, replace the switch.



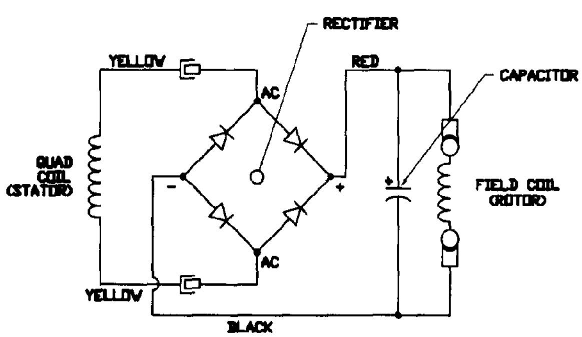
ELECTRICAL SCHEMATICS

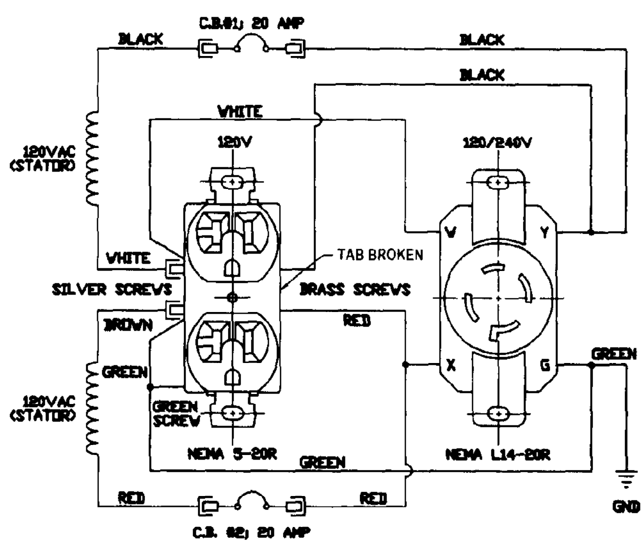
EH2500, HL2500 & LR 2500





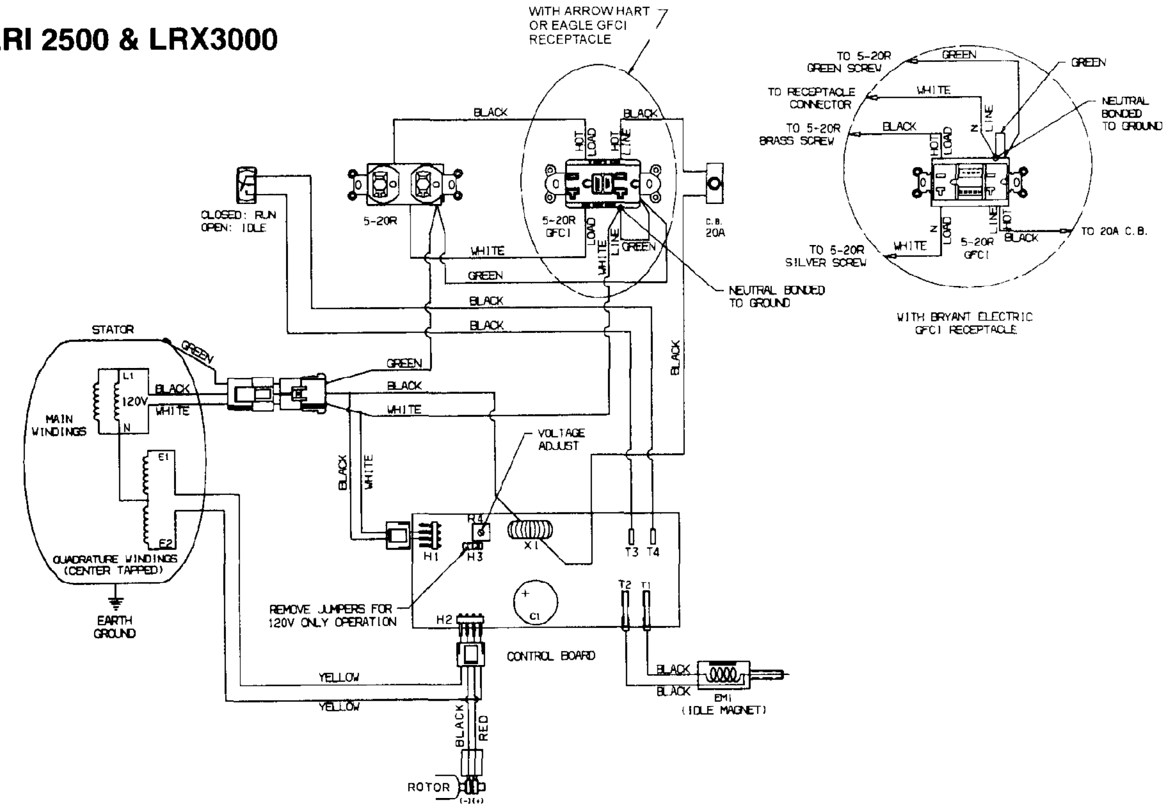
LR 4300, LR4400, LR5500, LR5550 & LR5000T



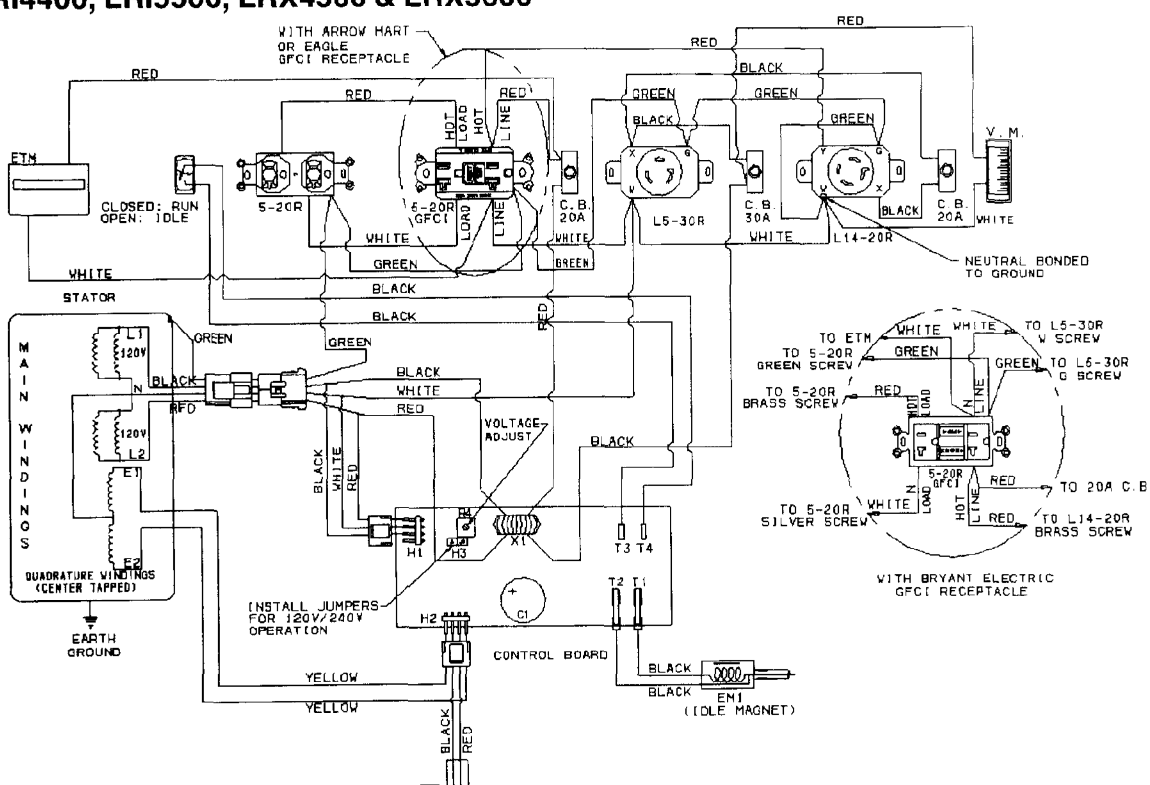


REFERENCE INFORMATION

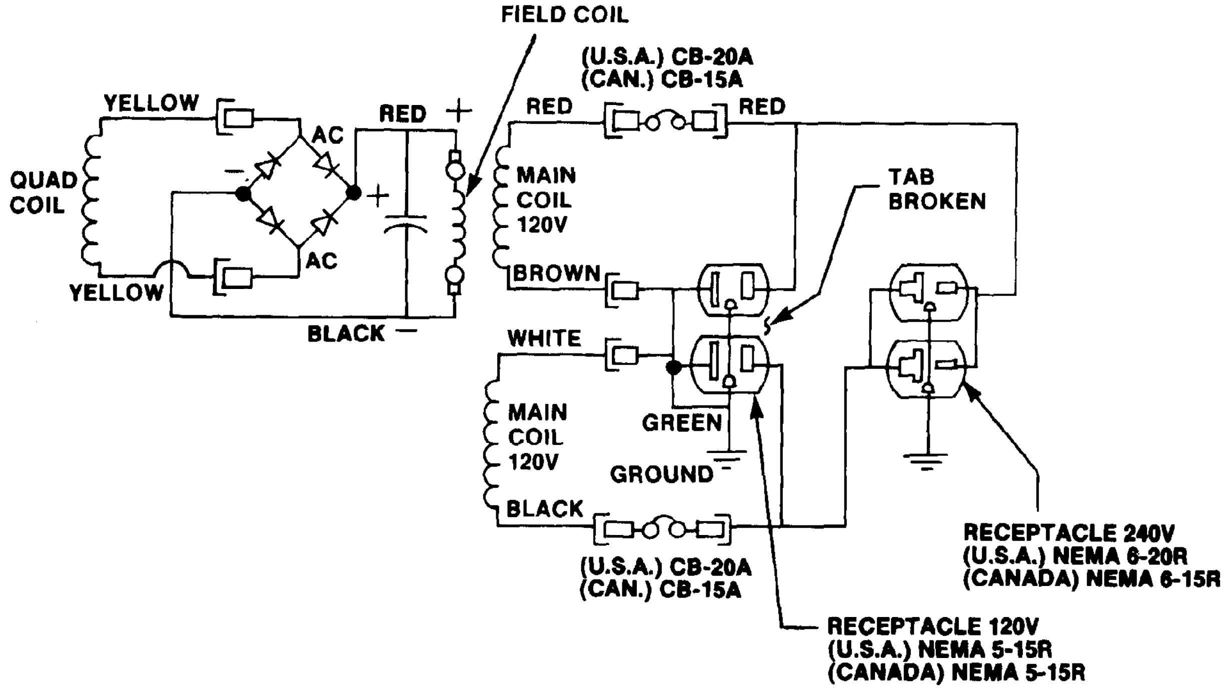
LRI 2500 & LRX3000



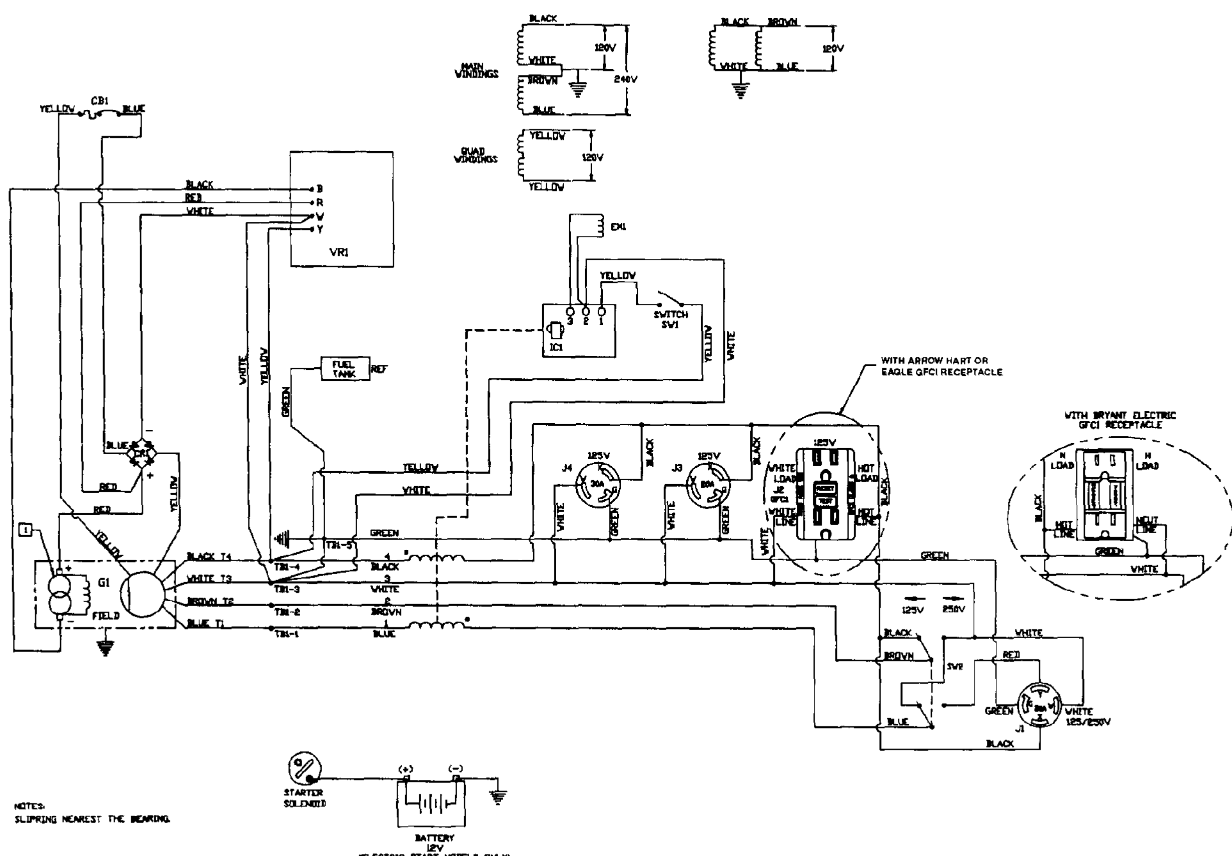
LRI4400, LRI5500, LRX4500 & LRX5600



EH4400, EH5500, HL4400 & HL5500



CONTRACTOR GENERATOR



REFERENCE INFORMATION

UT NUMBER/MODEL

UT NUMBER	MODEL	UT NUMBER	MODEL	UT NUMBER	MODEL	UT NUMBER	MODEL
UT03620	176B40	UT03702-A	EH5500HD	UT03760	EH4000HD	UT03787-A	LRI4400
UT03621	178B48	UT03702-R	EH5500HD	UT03761	HRL4000HD	UT03787-B	LRI4400
UT03622	180B62	UT03703	HLE4400	UT03762	178HI48	UT03787-R	LRI4400
UT03623	HG3500	UT03703-A	HLE4400	UT03762-A	CG4800	UT03788	LRI4400/CSA
UT03623-A	HG3500-A	UT03703-B	HLE4400	UT03762-B	CG4800	UT03788-A	LRI4400/CSA
UT03624	176R42	UT03703-C	HLE4400	UT03762-C	CG4800	UT03789	LRIE4400
UT03625	180R62	UT03703-R	HLE4400	UT03763	180HI63	UT03789-A	LRIE4400
UT03626	172B26	UT03704	HLE5500	UT03763-A	CG6300	UT03789-B	LRIE4400
UT03627	172R24	UT03705	EHE4400HD	UT03763-B	CG6300	UT03790	LRIE4400/CSA
UT03628	HG2500	UT03705-A	EHE4400HD	UT03763-C	CG6300	UT03790-A	LRIE4400/CSA
UT03628-A	HG2500-A	UT03705-R	EHE4400HD	UT03764	180HIE63	UT03791	LRI5500
UT03629	176BI40	UT03706	EHE5500HD	UT03764-A	CGE6300	UT03791-A	LRI5500
UT03629-A	176BI40	UT03706-A	EHE5500HD	UT03764-B	CGE6300	UT03792	LRI5500/CSA
UT03629-B	176BI40	UT03706-R	EHE5500HD	UT03764-C	CGE6300	UT03793	LR2500/CSA
UT03629-C	176BI40	UT03707	EH2500HD/CSA	UT03765	EH4400LT	UT03794	CG5200
UT03630	178BI48	UT03707-A	EH2500HD/CSA	UT03766	HL2500HD	UT03795	HL2500
UT03630-A	178BI48-A	UT03707-B	EH2500HD/CSA	UT03767	HL4400HD	UT03796	HL4400
UT03631	176RI42	UT03708	EH4400HD/CSA	UT03768	HLE4400HD	UT03797	HLE4400
UT03631-A	176RI42	UT03709	EH5500HD/CSA	UT03769	HRL4400HD	UT03798	LR2500
UT03632	180RI62	UT03709-A	EH5500HD/CSA	UT03771	HRL4400	UT03799	LRI2500
UT03632-A	180RI62	UT03710	HL2500/CSA	UT03773	LR2500	UT03800	LR4400
UT03633	170B16	UT03711	HL4400/CSA	UT03773-A	LR2500	UT03801	LRE4400
UT03634	170R18	UT03712	HL5500/CSA	UT03773-R	LR2500	UT03802	LR5500
UT03635	HG1500	UT03713	EHE4400HD/CSA	UT03774	LR5500	UT03803	LRE5500
UT03636	HG2100	UT03714	EHE5500HD/CSA	UT03774-A	LR5500	UT03804	LRI4400
UT03639	HGE3500	UT03714-A	EHE5500HD/CSA	UT03774-R	LR5500	UT03804-A	LRI4400
UT03643	180RIE62	UT03715	HLE4400/CSA	UT03775	LRE5500	UT03805	LRIE4400
UT03645	EH4000CSA	UT03716	HLE5500/CSA	UT03775-A	LRE5500	UT03805-A	LRIE4400
UT03647	EHE4000CSA	UT03751	HRL44HD	UT03776	HRL5500	UT03806	LRI5500
UT03696	EH1500	UT03752	HL4400HD	UT03777	LRI2500	UT03807	LRIE5500
UT03697	HL2500	UT03752-A	HL4400HD	UT03777-A	LRI2500	UT03808	250G
UT03697-A	HL2500	UT03753	HLE4400HD	UT03777-R	LRI2500	UT03809	440G
UT03697-B	HL2500	UT03753-A	HLE4400HD	UT03778	LRIE5500	UT03809-1	440G
UT03697-C	HL2500	UT03754	EH4000HD/CSA	UT03778-A	LRIE5500	UT03809-A	440G
UT03698	HL4400	UT03754-A	EH4000HD/CSA	UT03778-R	LRIE5500	UT03810	550G
UT03698-A	HL4400	UT03755	EHE4000HD/CSA	UT03779	LRIE5500/CSA	UT03819	LRX3000
UT03698-B	HL4400	UT03755-A	EHE4000HD/CSA	UT03780	LRI2500/CSA	UT03820	LRX4500
UT03698-R	HL4400	UT03756	EHRL4400HD	UT03781	LR4400	UT03821	LRXE4500
UT03699	HL5500	UT03756-A	EHRL4400HD	UT03781-A	LR4400	UT03822	LRX5600
UT03700	EH5500HD	UT03756-R	EHRL4400HD	UT03782	LR4400/CSA	UT03829	LR5000T
UT03700-A	EH5500HD	UT03757	HRL4400HD/CSA	UT03783	LRE4400	UT03833	LR5550
UT03700-R	EH5500HD	UT03757-A	HRL4400HD/CSA	UT03783-A	LRE4400	UT03834	LRE5550
UT03701	EH4400HD	UT03757-R	HRL4400HD/CSA	UT03784	LRE4400/CSA	UT03836	CG4400
UT03701-A	EH4400HD	UT03758	178VI52	UT03785	LR5500/CSA	UT03837	CG5800
UT03701-R	EH4400HD	UT03758-R	178VI52	UT03786	LRE5500/CSA	UT03838	CGE5800
UT03702	EH5500HD	UT03759	EH1800HD	UT03787	LRI4400		

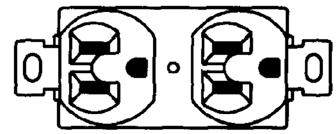
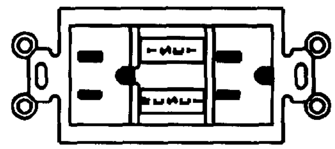
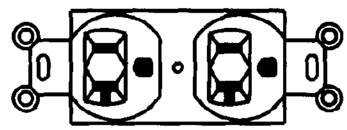
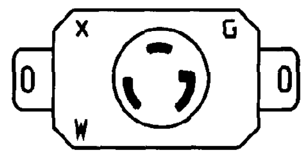
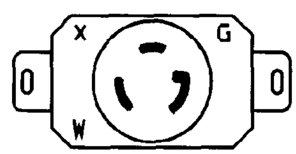
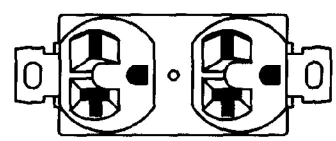
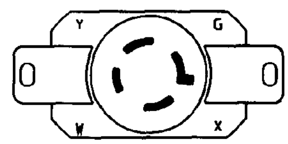
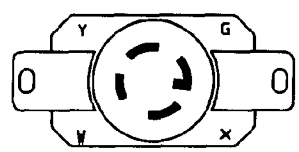
GENERATOR ROTOR AND STATOR RESISTANCE VALUES

MODEL #	UNIT #	ROTOR #	STATOR #	ROTOR	MAIN Ω	EXCITATION Ω	DC Ω
170A15-1A	03615	A53784S	A42917BS	30.5	.510		.240
170R18	03634	A49653S	A49638AS	29.0	T1.T2=.82	2.20	.100
172A20-1A&B	03585	A42215S	A43993AS	34.2	0.315		
172R24 & B26	03626 & 7	A49475S	A49476AS	32.0	T1,T2=.53	1.80	
174A27-1A&B	03597	A53785S	A42605AS	29.5	.56 X 2		
176A35-1A,B,C	03598	A53786S	A42606A	33.0	.31 X 2		
176B40	03620	A49089S	A49128S	37.4	T1,T2= .67 T3,T4 = .67	1.49	
176BI40	03629-A	A49089S	A49128S	37.4	T1,T2= .67 T3,T4 = .67	1.49	
176R42	03624	A49095S	A49330S	42.5	T1,T2=.358 T3,T4=.358	1.18	
176RI42	03631-A	A49095S	A49330S	42.5	T1,T2=.358 T3,T4=.358	1.18	
177D38-1	03581	A53787S	A42608-1	30.0	.352 X 2		
178A50-1A	03560	A53787S	A42608	30.0	.352 X 2		
178A50-1B	03599	A53787S	A47345AS	30.0	.352 X 2		
178B48	03621	A49095S	A49124S	42.5	T1,T2=.358 T3,T4=.358	1.18	
178BI48, HI48	03630A, 03762	A49095S	A49124S	42.5	T1,T2=.358 T3,T4=.358	1.18	
178VI52	03758	A49095S	A49124S	42.5	T1,T2=.358 T3,T4=.358	1.18	
180A75-1	03538	A42724S	A42728AS	22.8	.25 X 2		
180A75-1A&1B	03600	A42724S	A42728AS	22.8	.25 X 2		
180R62	03625	A49094S	A49331S	50.0	T1,T2=.225 T3,T4=.225	1.10	
180RI62, HI63	03632A, 03763	A49094S	A49331S	50.0	T1,T2=.225 T3,T4=.225	1.10	
180RIE62,HIE63	03643, 03764	A49094S	A49331S	50.0	T1,T2=.225 T3,T4=.225	1.10	
9A34-3	03320	A53789	A51134	33.0	31 X 2		
9A34-3A	03323	A53789	A51134	33.0	31 X 2		
E1350-1	03575	A53781S	A43985BS	46.5	.56	3.50	
E1700-1	03614	A53781S	A46644AS	46.5	.50	4.50	
E2250-1	03576-A	A53782S	A43990BS	52.6	.56		
E3000-1	03595	A46142S	A46144AS	64.2	.80 X 2	1.60	
E3000-1A	03595	A46142S	A47615AS	64.2	.326 X 2	1.63	
E4000-1	03596	A43427S	A43438A	76.0	.206 X 2	1.63	
E4000-1A	03596	A43427S	A47773AS	76.0	.206 X 2	1.61	
EH2500	03644	01209-03	01209-01	23.0	.60	7.20	
EH2500HD	03686	01209-03	01209-01	23.0	.60	7.20	
EH2500HD	03700	A02800AS	A02797AS	46.7	.389	1.18	
EH4400	03638	00782-04	00782-02	51.0	.71	1.20	
EH4400HD	03687	00782-04	00782-02	51.0	.71	1.20	
EH4400HD	03701	A02799AS	A02796AS	67.0	.278	0.999	
EH5500HD	03689	00782-43	01209-39	56.0	.47	1.10	
EH5500HD	03702	A02798AS	A02795AS	76.0	.208	0.973	
EHE4400	03637	00782-04	00782-02	51.0	.71	1.20	
EHE4400HD	03688	00782-04	00782-02	51.0	.71	1.20	
EHE4400HD	03705	A02799AS	A02796AS	67.0	.278	0.999	
EH5500HD	03690	00782-43	01209-39	56.0	.47	1.10	
EH5500HD	03706	A02798AS	A02795AS	76.0	.208 X 2	0.973	
EHRL4400HD	03756	A02799AS	A02796AS	67	0.278	0.888	
G11800-1	03567	A47224S	A47226S	15.8	.0694 X 2		
G12000-2	03572	A47224S	A47274	15.8	.0694 X 2		
G3600-1	03578	A47077S	A47081S	52.3	.25 X 2		
G3600-2	03562	A47077S	A04781S	52.3	.25 X 2		
G4800-1	03563	A47076S	A47082S	35.5	T1,T2=.069 T3,T4=.069		

GENERATOR ROTOR AND STATOR RESISTANCE VALUES

MODEL #	UNIT #	ROTOR #	STATOR #	ROTOR	MAIN Ω	EXCITATION Ω	DC Ω
G4800-2	03564	A47076S	A47082S	35.5	T1,T2=.069 T3,T4=.069		
G7200-1	03565	A47078S	A47083S	29.1	.153 X 2		
G7200-2	03566	A47078S	A46061	29.1	.153 X 2		
GD12000-1	03571	A47224S	A47226S	15.8	.0694 X 2		
GD12300-2	03572	A47224S	A47274	15.8	.0694 X 2		
GD7200-1	03569	A47078S	A47083S	29.1	.153 X 2		
GD7400-2	03570	A47078S	A46061	29.1	.153 X 2		
HG1400	04007	49027-51	49027-48	4.29	.69	2.61	.247
HG1500	03635	A49653S	A49638AS	29.0	T1,T2=.82	2.20	.100
HG2000	04018	A49030-75	49030-74	4.25	.47	1.80	.130
HG2100	03636	A49653S	A49638AS	29.0	T1,T2,=.82	2.20	.100
HG2500	03628	A49475S	A49476AS	32.0	T1,T2=.53	1.80	.160
HG2500A	03628-A	A49475S	A49793S	32.0	T1,T2=.53	1.80	.160
HG3500	03623	A49099S	A49127AS	33.5	T1,T2=.75 T3,T4=.75	1.33	.140
HG600	04005	49024-29	49024-28	13.9	2.1	4.00	.800
HGE3500	03639	A49099S	A49127AS	33.5	T1,T2=.75 T3,T4=.75	1.33	.140
HL2500	03681	01209-03	01209-01	23.0	.60	7.20	
HL2500	03697, & A	A02428AS	A02431AS	43.8	.458	1.09	
HL4400	03698 & A	A02429AS	A02432AS	61.1	.313 X 2	0.888	
HL5500	03699	A02430AS	A02433S	71.8	.228 X 2	0.843	
HLE4400	03703 & B	A02429AS	A02432AS	61.1	.313 X 2	0.888	
HLE5500	03704	A02430AS	A02433S	71.8	.228 X 2	0.843	
HRL4400HD	03751	A02799AS	A02796AS	67.0	.278 X 2	0.999	
HSB50-1	03593	A53787S	A42608-1	30.0	.325 X 2		
LR2500	03773	A02800AS	A02797AS	46.7	0.389	1.18	
LRI2500	03777	A02800AS	A06772S	46.7	0.4768	1.6643	
LR4400	03781	A02799AS	A02796AS	67	0.278	0.999	
LRE4400	03783	A02799AS	A02796AS	67	0.278	0.999	
LRI4400	03787	A02799AS	A06771S	67	0.3718	1.4274	
LR5500	03774	A02798AS	A02795AS	76	0.208	0.973	
LRI5500	03791	A02798AS	A06770S	76	0.2981	1.389	
LRE5500	03775	A02798AS	A02795AS	76	0.208	0.973	
LRIE4400	03789	A02799AS	A06771S	67	0.3718	1.4274	
LRIE5500	03778	A02798AS	A06770S	76	0.2981	1.389	
CG4800	03762	A49330S	A49095S	42.5	T1,T2=.358 T3,T4=.358	1.18	
CG5200	03794	A49330S	A49095S	42.5	T1,T2=.358 T3,T4=.358	1.18	
CG6300	03763	A49331S	A49094S	50	T1,T2=.225 T3,T4=.225	1.10	
CGE6300	03764	A49331S	A49094S	50	T1,T2=.225 T3,T4=.225	1.10	
CG4400	03762	A49330S	A49095S	42.5	T1,T2=.358 T3,T4=.358	1.18	
CG5800	03763	A49331S	A49094S	50	T1,T2=.225 T3,T4=.225	1.10	
CGE5800	03764	A49331S	A49094S	50	T1,T2=.225 T3,T4=.225	1.10	
LR4300	03828	A02799AS	A02796AS	67	0.278	0.999	
LR5000T	03829	A02798AS	A02795AS	76	0.208	0.973	
LR5550	03834	A02798AS	A02795AS	76	0.208	0.973	
LRX3000	03819	A02800AS	A00772S	40.7	0.4708	1.004	
LRX4500	03820	A02799AS	A06771S	67	0.3718	1.4274	
LRXE4500	03821	A02799AS	A06771S	67	0.3718	1.4274	
LRX5600	03822	A02798AS	A06770S	76	0.2981	1.389	
LRXE5600	03823	A02798AS	A06770S	76	0.2981	1.389	

GENERATOR PLUGS AND RECEPTACLES

SIZE / PART NUMBER	RECEPTACLE	PLUG	CONFIGURATION
VOLTAGE/AMPERAGE NEMA STANDARD HOMELITE P/N	120V 15AMP 5-15R 50991A	120V 15AMP 5-15P PURCHASE LOCALLY	
VOLTAGE/AMPERAGE NEMA STANDARD HOMELITE P/N	120V 20AMP 5-20R UP03110	120V 20AMP 5-20P PURCHASE LOCALLY	
VOLTAGE/AMPERAGE NEMA STANDARD HOMELITE P/N	120V 20AMP 5-20R 51373	120V 20AMP 5-20P PURCHASE LOCALLY	
VOLTAGE/AMPERAGE NEMA STANDARD HOMELITE P/N	120V 20AMP TWIST LOCK L5-20R 48978	120V 20AMP TWIST LOCK L5-20P 49676	
VOLTAGE/AMPERAGE NEMA STANDARD HOMELITE P/N	120V 30AMP TWIST LOCK L5-30R 42601	120V 30AMP TWIST LOCK L5-30P 43326	
VOLTAGE/AMPERAGE NEMA STANDARD HOMELITE P/N	240V 20AMP 6-20R 02863	240V 20AMP 6-20P 49709	
VOLTAGE/AMPERAGE NEMA STANDARD HOMELITE P/N	240V 20AMP TWIST LOCK L14-20R 46508	240V 20AMP TWIST LOCK L14-20P 47600	
VOLTAGE/AMPERAGE NEMA STANDARD HOMELITE P/N	240V 30AMP TWIST LOCK L14-30R 46718	240V 30AMP TWIST LOCK L14-30P 47601	

GENERATOR DOLLY KITS

Part No.	Fits Models	Fits UT #'s
A-07422	HL2500	03697, 03697-A & 03697-B
	HL2500/CARB	03795
	HG2200-50	03811
	EH2500HD/CSA	103707, 03707-A & 03707-B
	EH4000HD/CSA	03754 & 03754-A
	HL4400	03698 & 03698-A
	HL4400/CARB	03796
	HLE4400	03703, 03703-A & 03703-B
	HLE4400/CARB	03797
A-07423	LR2500	03773 & 03773-A
	LR2500/CARB	03798
	LR2500/CSA	03793
	LRI2500	03777 & 03777-A
	LRI2500/CARB	03799
	LRI2500/CSA	03780
	250G (DEERE)	03808
A-07424	HG3800-50	03812
	LR4400	03781 & 03781-A
	LR4400/CARB	03800
	LR4400/CSA	03782
	LRE4400	03783 & 03783-A
	LRE4400/CARB	03801
	LRE4400/CSA	03784
	LR5500	03774 & 03774-A
	LR5500/CARB	03802
	LR5500/CSA	03785
	LRE5500	03775 & 03775-A
	LRE5500/CARB	03803
	LRE5500/CSA	03786
	LRI4400	03787 & 03787-A
	LRI4400/CARB	03804
	LRI4400/CSA	03788
	440G (DEERE)	03809 & 03809-1
	LRIE4400	03789 & 03789-A
	LRIE4400/CARB	03805
	LRIE4400/CSA	03790
	LRI5500	03791 & 03791-A
	LRI5500/CARB	03806
	LRI5500/CSA	03792
	LRIE5500	03778 & 03778-A
	LRIE5500/CARB	03807
	LRIE5500/CSA	03779
	550GE (DEERE)	03810 & 03810-1
A-07425	CG4800(CG4400)	03762-A
	CG5200	03794
	CG6300(CG5800)	03763-A
	CGE6300	03764-A
	CHY5000	03772-A
UP05224 ALL OF THE ABOVE UNITS PLUS		
	LR4300	03828
	LR5550	03834
	LR5000T	03829
	ALL LRX SERIES	03819,03820,03821, 03822,03823

GENERATOR SOUND LEVELS

Model	Decibel Rating dB(A)*
CONTRACTOR GENERATORS	
178HI48	76
CG4400	76
CG4800	76
180HI63	76
180HIE63	73
CG5800	73
CGE5800	73
CG6300	73
CGE6300	73
190HHY50	73
CHY50	73
HL SERIES	
HL2500	72
HL4400	81
HLE4400	81
LR SERIES	
LR2500	70
LR4400	75
LRE4400	75
LR5500	74
LRE5500	74
LR4300	68
LR5000T	83
LR5550	76
LRI SERIES	
LRI2500	71
LRI4400	76
LRIE4400	76
LRI5500	75
LRIE5500	75
LRX SERIES	
LRX3000	69
LRX4500	72
LRXE4500	72
LRX5600	74
LRXE5600	74

*At 50' feet

USING A VOLT-OHM-MILLIAMP METER

Standardized components frequently encountered in electrical equipment are capacitors, resistors, and diodes, all of which can be tested on a multimeter.

Using a VOM Meter

The clip leads of a multimeter are plugged into the terminals marked COM and VOM. The markings on the range switch refer to full-scale readings.

Measuring Resistance

Place the selector in the "ohm" X1 position. The top scale is read directly: 0-500 omhs. If more sensitivity is desired, the X100 setting can be used, adding two zeros on to each reading: 0-50,000 ohms.

If the 1 K setting is used, add three zeros to each reading: 5,000-500,000 ohms.

Before using the meter on any of the ohms scale, touch the leads together and adjust the meter to zero ohms.

Some Rules

1. When the meter is in one of the ohms scales, never connect the leads across a battery or any other live circuit.

2. Always reset the zero adjustment on each scale.

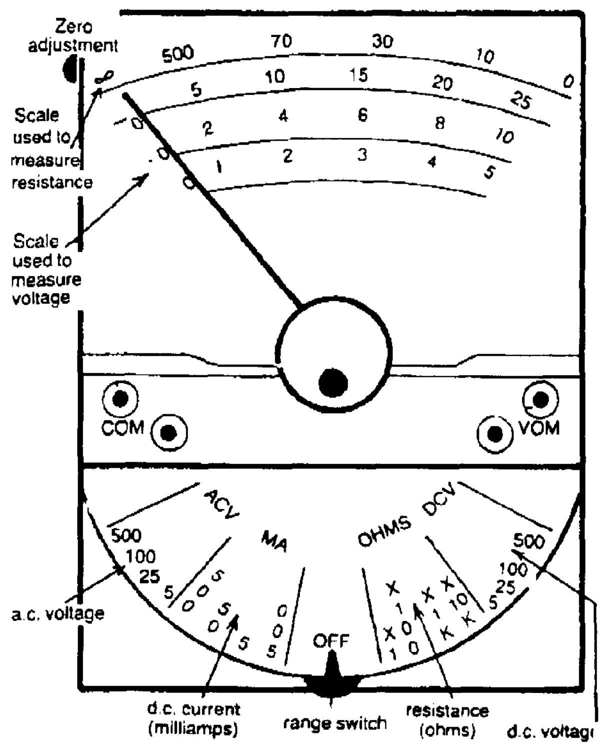
Measuring Voltage

The voltage markings on the range switch refer to the full-scale reading.

With the range switch set at 5VAC, the lower voltage scale is read. A reading of 5 would indicate 5 volts. If the switch is set at 100 VAC, the middle voltage is read and one zero added. For example, a reading of 10 would be 100 volts.

With the switch set at 500, the lower scale is read by adding two zeros. For example, 0500 volts.

Direct current voltage can be read in the same way by placing the switch in one of the DCV positions.



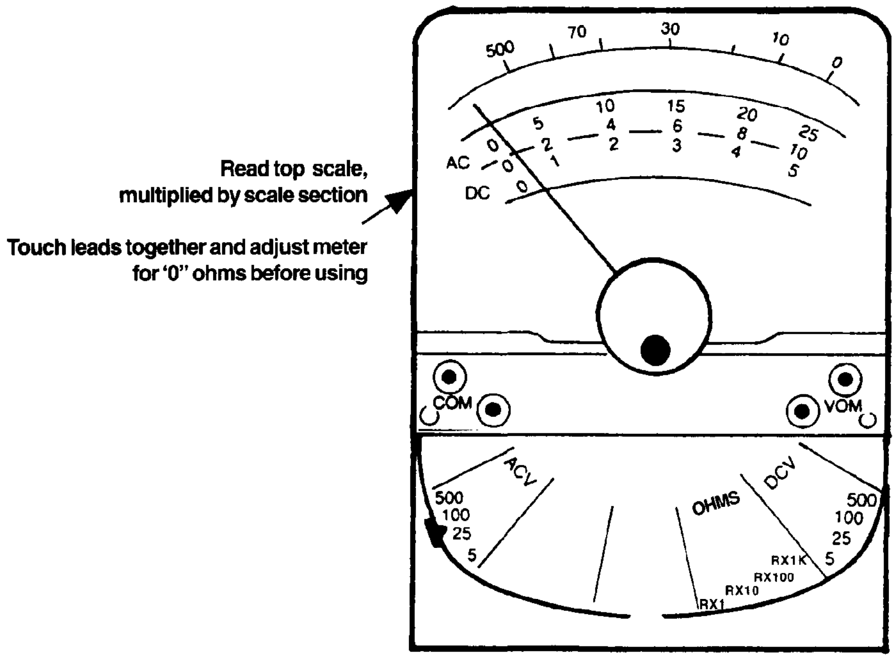
Some Rules

1. If you are not sure of the voltage, always use the highest scale and switch down if necessary for a reading.

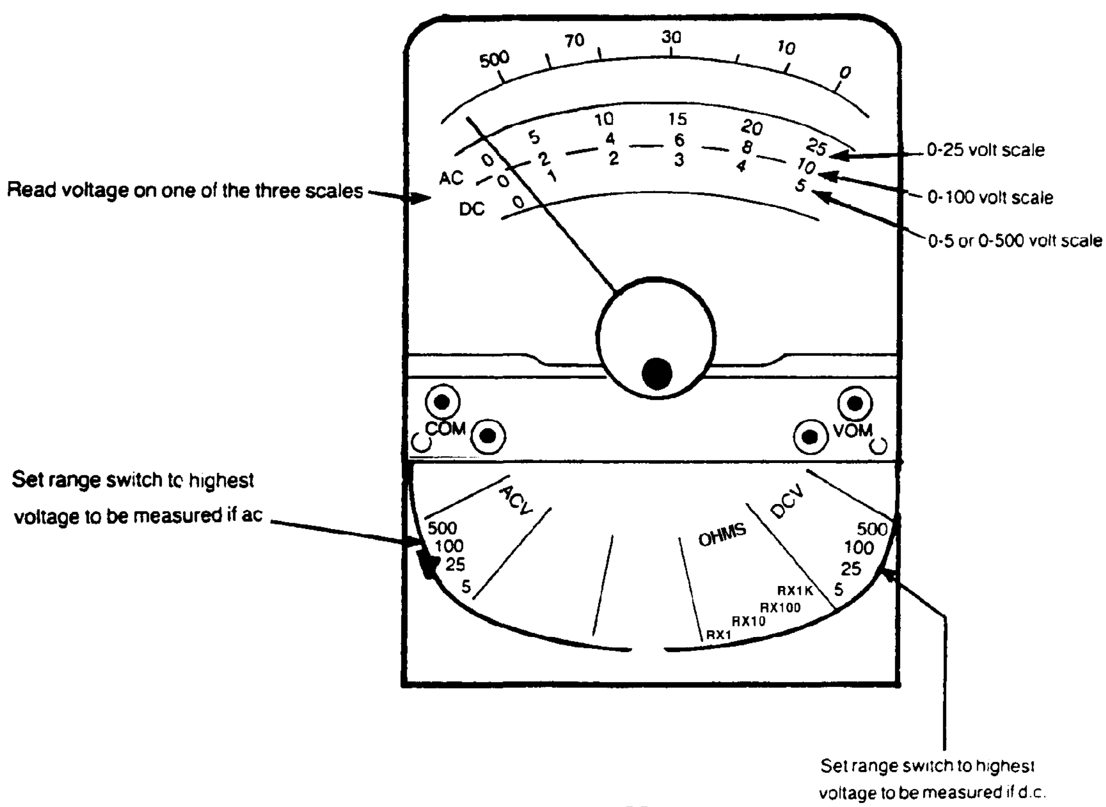
2. Always use great care when measuring voltage. Avoid touching the metal part of the clip leads or any part of the circuit.

REFERENCE INFORMATION

MEASURING RESISTANCE



MEASURING VOLTAGE



NOTES

WORLDWIDE COMMERCIAL & CONSUMER EQUIPMENT DIVISION

Consumer Products, P.O. Box 7047 Charlotte, N.C. 28241-7047

03/15/2000