



NOTE: This manual will cover most of the troubleshooting and repair procedures for the code numbers listed. Some variances may exist when troubleshooting/repairing later code numbers.

POWER-ARC™ 4000

For use with machines having Code Numbers:

10083

SERVICE MANUAL

SAFETY

WARNING

CALIFORNIA PROPOSITION 65 WARNINGS

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

The Above For Diesel Engines

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

The Above For Gasoline Engines

ARC WELDING CAN BE HAZARDOUS. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING.

Read and understand the following safety highlights. For additional safety information, it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting - ANSI Standard Z49.1" from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Standard W117.2-1974. A Free copy of "Arc Welding Safety" booklet E205 is available from the Lincoln Electric Company, 22801 St. Clair Avenue, Cleveland, Ohio 44117-1199.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE



FOR ENGINE powered equipment.

1.a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.



1.b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.



1.c. Do not add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.



1.d. Keep all equipment safety guards, covers and devices in position and in good repair. Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

1.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.

1.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.



1.h. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.



ELECTRIC AND MAGNETIC FIELDS may be dangerous

2.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines

2.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.

2.c. Exposure to EMF fields in welding may have other health effects which are now not known.

2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:

2.d.1. Route the electrode and work cables together - Secure them with tape when possible.

2.d.2. Never coil the electrode lead around your body.

2.d.3. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.

2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.

2.d.5. Do not work next to welding power source.

Mar '95

SAFETY



ELECTRIC SHOCK can kill.

3.a. The electrode and work (or ground) circuits are electrically "hot" when the welder is on. Do not touch these "hot" parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.

3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:

- Semiautomatic DC Constant Voltage (Wire) Welder.
- DC Manual (Stick) Welder.
- AC Welder with Reduced Voltage Control.

3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically "hot".

3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.

3.e. Ground the work or metal to be welded to a good electrical (earth) ground.

3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.

3.g. Never dip the electrode in water for cooling.

3.h. Never simultaneously touch electrically "hot" parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.

3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.

3.j. Also see Items 6.c. and 8.



ARC RAYS can burn.

4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87.1 standards.

4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.

4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.



FUMES AND GASES can be dangerous.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep

fumes and gases away from the breathing zone. **When welding with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and below Threshold Limit Values (TLV) using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.**

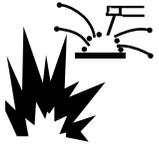
5.b. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

5.c. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.

5.d. Read and understand the manufacturer's instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer's safety practices. MSDS forms are available from your welding distributor or from the manufacturer.

5.e. Also see item 1.b.

Mar '95



WELDING SPARKS can cause fire or explosion.

6.a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire.

Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.

- 6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to "Safety in Welding and Cutting" (ANSI Standard Z49.1) and the operating information for the equipment being used.
- 6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.
- 6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned". For information, purchase "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", AWS F4.1 from the American Welding Society (see address above).
- 6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.
- 6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.
- 6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.
- 6.h. Also see item 1.c.



CYLINDER may explode if damaged.

7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.

- 7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.
- 7.c. Cylinders should be located:
 - Away from areas where they may be struck or subjected to physical damage.
 - A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.
- 7.d. Never allow the electrode, electrode holder or any other electrically "hot" parts to touch a cylinder.
- 7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.
- 7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.
- 7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-1, "Precautions for Safe Handling of Compressed Gases in Cylinders," available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.



FOR ELECTRICALLY powered equipment.

- 8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.
- 8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer's recommendations.
- 8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

Mar '95

SAFETY

PRÉCAUTIONS DE SÛRETÉ

Pour votre propre protection lire et observer toutes les instructions et les précautions de sûreté spécifiques qui paraissent dans ce manuel aussi bien que les précautions de sûreté générales suivantes:

Sûreté Pour Soudage A L'Arc

1. Protégez-vous contre la secousse électrique:
 - a. Les circuits à l'électrode et à la pièce sont sous tension quand la machine à souder est en marche. Eviter toujours tout contact entre les parties sous tension et la peau nue ou les vêtements mouillés. Porter des gants secs et sans trous pour isoler les mains.
 - b. Faire très attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher métallique ou des grilles métalliques, principalement dans les positions assis ou couché pour lesquelles une grande partie du corps peut être en contact avec la masse.
 - c. Maintenir le porte-électrode, la pince de masse, le câble de soudage et la machine à souder en bon et sûr état de fonctionnement.
 - d. Ne jamais plonger le porte-électrode dans l'eau pour le refroidir.
 - e. Ne jamais toucher simultanément les parties sous tension des porte-électrodes connectés à deux machines à souder parce que la tension entre les deux pinces peut être le total de la tension à vide des deux machines.
2. Dans le cas de travail au dessus du niveau du sol, se protéger contre les chutes dans le cas où on recoit un choc. Ne jamais enrôler le câble-électrode autour de n'importe quelle partie du corps.
3. Un coup d'arc peut être plus sévère qu'un coup de soleil, donc:
 - a. Utiliser un bon masque avec un verre filtrant approprié ainsi qu'un verre blanc afin de se protéger les yeux du rayonnement de l'arc et des projections quand on soude ou quand on regarde l'arc.
 - b. Porter des vêtements convenables afin de protéger la peau de soudeur et des aides contre le rayonnement de l'arc.
 - c. Protéger l'autre personnel travaillant à proximité au soudage à l'aide d'écrans appropriés et non-inflammables.
4. Des gouttes de laitier en fusion sont émises de l'arc de soudage. Se protéger avec des vêtements de protection libres de l'huile, tels que les gants en cuir, chemise épaisse, pantalons sans revers, et chaussures montantes.
5. Toujours porter des lunettes de sécurité dans la zone de soudage. Utiliser des lunettes avec écrans latéraux dans les zones où l'on pique le laitier.
6. Eloigner les matériaux inflammables ou les recouvrir afin de prévenir tout risque d'incendie dû étincelles.

7. Quand on ne soude pas, poser la pince à un endroit isolé de la masse. Un court-circuit accidentel peut provoquer un échauffement et un risque d'incendie.
8. S'assurer que la masse est connectée le plus près possible de la zone de travail qu'il est pratique de la faire. Si on place la masse sur la charpente de la construction ou d'autres endroits éloignés de la zone de travail, on augmente le risque de voir passer le courant de soudage par les chaînes de levage, câbles de grue, ou autres circuits. Cela peut provoquer des risques d'incendie ou d'échauffement des chaînes et des câbles jusqu'à ce qu'ils se rompent.
9. Assurer une ventilation suffisante dans la zone de soudage. Ceci est particulièrement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumées toxiques.
10. Ne pas souder en présence de vapeurs de chlore provenant d'opérations de dégraissage, nettoyage ou pistelage. La chaleur ou les rayons de l'arc peuvent réagir avec les vapeurs du solvant pour produire du phosgène (gas fortement toxique) ou autres produits irritants.

PRÉCAUTIONS DE SÛRETÉ POUR LES MACHINES À SOUDER À TRANSFORMATEUR ET À REDRESSEUR

1. Reller à la terre le châssis du poste conformément au code de l'électricité et aux recommandations du fabricant. Le dispositif de montage ou la pièce à souder doit être branché à une bonne mise à la terre.
2. Autant que possible, l'installation et l'entretien du poste seront effectués par un électricien qualifié.
3. Avant de faire des travaux à l'intérieur de poste, la débrancher à l'interrupteur à la boîte de fusibles.
4. Garder tous les couvercles et dispositifs de sûreté à leur place.

MASTER TABLE OF CONTENTS FOR ALL SECTIONS

	Page
Safety	i-iv
<hr/>	
Installation	Section A
Technical Specifications	A-1
Safety Precautions	A-2
Location and Ventilation	A-2
Pre-operation Engine Service	A-3
Electrical Output Connections	A-4
<hr/>	
Operation	Section B
Safety Instructions	B-1
General Description	B-1
Recommended Applications	B-2
Operational Features and Controls	B-2
Design Features and Advantages	B-2
Welding Capability	B-2
Limitations	B-2
Controls and Settings	B-3
Engine Operation	B-5
<hr/>	
Accessories	Section C
<hr/>	
Maintenance	Section D
Safety Precautions	D-1
Routine and Periodic Maintenance	D-1
Major Component Locations	D-5
<hr/>	
Theory of Operation	Section E
<hr/>	
Troubleshooting and Repair	Section F
<hr/>	
Electrical Diagrams	Section G
<hr/>	
Parts Manual	P-233

TABLE OF CONTENTS

- INSTALLATION SECTION -

Installation

Technical Specifications	A-1
Safety Precautions	A-2
Location and Ventilation	A-2
Storing	A-2
Stacking.....	A-3
Tilting	A-3
Lifting	A-3
Pre-operation Engine Service	A-3
Oil	A-3
Fuel.....	A-3
Muffler Deflector.....	A-3
Spark Arrester	A-3
Electrical Output Connections.....	A-4
Welding Cable Connections.....	A-4
Cable Size and Length	A-4
Cable Installation.....	A-5
Machine Grounding.....	A-5
Plugs and Hand-Held Equipment	A-5
Auxiliary Power Receptacles.....	A-5
Premises Wiring.....	A-6
Circuit Breakers.....	A-6

INSTALLATION

TECHNICAL SPECIFICATIONS - POWER-ARC 4000

INPUT - GASOLINE ENGINE

<u>Manufacturer</u>	<u>Description</u>	<u>Speed</u>	<u>Displacement</u>	<u>Ignition</u>	<u>Capacities</u>
Briggs & Stratton Cool-Bore®	1 cyl., 4 cycle air-cooled gasoline 8 HP @ 3750 RPM	3700 RPM ± 50 RPM at no load	19.4 cu. in. (319 cc)	Manual, Recoil start; Manual choke	Fuel: 1.0 gal. (3.8 l) Oil: 1.4 qt. (1.3 l)

RATED OUTPUT - WELDER

<u>Duty Cycle</u>	<u>Amps</u>	<u>Volts at Rated Amperes</u>
30% Duty Cycle	125	18 VAC
60% Duty Cycle	100	25 VAC

OUTPUT - WELDER AND GENERATOR

<u>Welding Ranges</u>	<u>Welder Open Circuit Voltage</u>	<u>AC Auxiliary Power</u>
70 - 125 Amps	62 VAC Max.	4000 Continuous Watts 4400 Surge Watts

PHYSICAL DIMENSIONS

<u>Height</u>	<u>Width</u>	<u>Depth</u>	<u>Weight</u>
20.9 in. 530 mm	20 in. 508 mm	30 in. 762 mm	160 lb. 72.5 kg

INSTALLATION

Read this entire installation section before you start installation.

SAFETY PRECAUTIONS

⚠ WARNING

Do not attempt to use this equipment until you have thoroughly read all the operation and maintenance manuals supplied with your machine. They include important safety precautions; detailed engine starting, operating, and maintenance instructions; and parts lists.

ELECTRIC SHOCK can kill.



- Do not touch electrically live parts or electrodes with your skin or wet clothing.
- Insulate yourself from the work and ground.

- Always wear dry insulating gloves.



ENGINE EXHAUST can kill.

- Use in open, well ventilated areas or vent exhaust to the outside.

- Do not stack anything on or near the engine.

MOVING PARTS can injure.



- Do not operate this equipment with any of its doors open or guards off.
- Stop the engine before servicing it.

- Keep away from moving parts.

Only qualified personnel should install, use, or service this equipment.

LOCATION AND VENTILATION

Whenever you use the POWER-ARC 4000, be sure that clean cooling air can flow through the machine's gasoline engine and the generator. Avoid dusty, dirty areas. Also, keep the machine away from heat sources. Do not place the back end of the generator anywhere near hot engine exhaust from another machine. And of course, make sure that engine exhaust is ventilated to an open, outside area.

The POWER-ARC 4000 may be used outdoors. Do not set the machine in puddles or otherwise submerge it in water. Such practices pose safety hazards and cause improper operation and corrosion of parts.

Always operate the POWER-ARC 4000 with the case roof on and all machine components completely assembled. This will protect you from the dangers of moving parts, hot metal surfaces, and live electrical devices.

STORING

1. Store the machine in a cool, dry place when it's not in use. Protect it from dust and dirt. Keep it where it can't be accidentally damaged from construction activities, moving vehicles, and other hazards.
2. If you will be storing the machine for over 30 days, you should drain the fuel to protect fuel system and carburetor parts from gum deposits. Empty all fuel from the tank and run the engine until it stops from lack of fuel.
3. You can store the machine for up to 24 months if you use Briggs & Stratton Gasoline Additive, Part No. 5041 (available from any Authorized Briggs & Stratton Service Center), in the fuel system. Mix the additive with the fuel in the tank and run the engine for a short time to circulate the additive through the carburetor.
4. While the engine is still warm, drain the oil and refill with fresh 10W30 oil.
5. Remove the spark plug and pour approximately 1/2 ounce (15 ml) of engine oil into the cylinder. Replace the spark plug and crank the engine slowly to distribute the oil.
6. Clean any dirt and debris from the cylinder and cylinder head fins and housing, rotating screen, and muffler areas.
7. Store in a clean, dry area.

INSTALLATION

STACKING

POWER-ARC 4000 machines CANNOT be stacked.

TILTING

Place the machine on a secure, level surface whenever you use it or store it. Any surfaces you place it on other than the ground must be firm, non-skid, and structurally sound.

The gasoline engine is designed to run in a level position for best performance. It can operate at an angle, but this should never be more than 15 degrees in any direction. If you do operate it at a slight angle, be sure to check the oil regularly and keep the oil level full. Also, fuel capacity will be a little less at an angle.

LIFTING

The POWER-ARC 4000 should be lifted by two people. (It weighs 160 lbs/72.5 kg.) Its welded tube roll cage is designed to make lifting easy.

PRE-OPERATION ENGINE SERVICE

Read and understand the information about the gasoline engine in the OPERATION and MAINTENANCE sections of this manual before you operate the POWER-ARC 4000.

⚠ WARNING

- Keep hands away from the engine muffler or HOT engine parts.
- Stop the engine when fueling.
- Do not smoke when fueling.
- Remove the fuel cap slowly to release pressure.
- Do not overfill the fuel tank.
- Wipe up spilled fuel and allow the fumes to clear before starting the engine.
- Keep sparks and flame away from the fuel tank.

OIL



The POWER-ARC 4000 is shipped with the engine filled with SAE 10W-30 oil.

CHECK THE OIL LEVEL BEFORE YOU START THE ENGINE. This is an added precaution. When full, the oil level should be at the top of the fill plug hole. If it is not full, add enough oil to fill it. Be sure the fill plug is tight.

For more oil fill and service information, see the MAINTENANCE section of this manual.

FUEL



Fill the fuel tank with clean, fresh, regular grade lead-free gasoline. **DO NOT MIX OIL WITH THE GASOLINE.**

The POWER-ARC 4000 has a plastic, 1.00 gallon (3.8) fuel tank mounted on the engine. See the OPERATION and MAINTENANCE sections of this manual for more details about fuel.

MUFFLER DEFLECTOR

The POWER-ARC 4000 is shipped with an exhaust deflector. You can mount it yourself on the gasoline engine.

To install the deflector, do the following:

- Align the holes on the deflector plate with the holes on the muffler.
- Position the deflector so that the opening points either right, left, or downward, away from the operator.

⚠ CAUTION

Never position the deflector upward. Moisture or debris can enter the engine and damage it. As a general safety practice, position the deflector to direct exhaust gases away from the operator's face and eyes.

- Fasten the deflector onto the muffler with the screws provided.

NOTE: The deflector reduces generator output power up to 100 watts.

SPARK ARRESTER

Gasoline engine mufflers may emit sparks when the engine is running. Some federal, state, or local laws require spark arresters in locations where unarrested sparks could present a fire hazard.

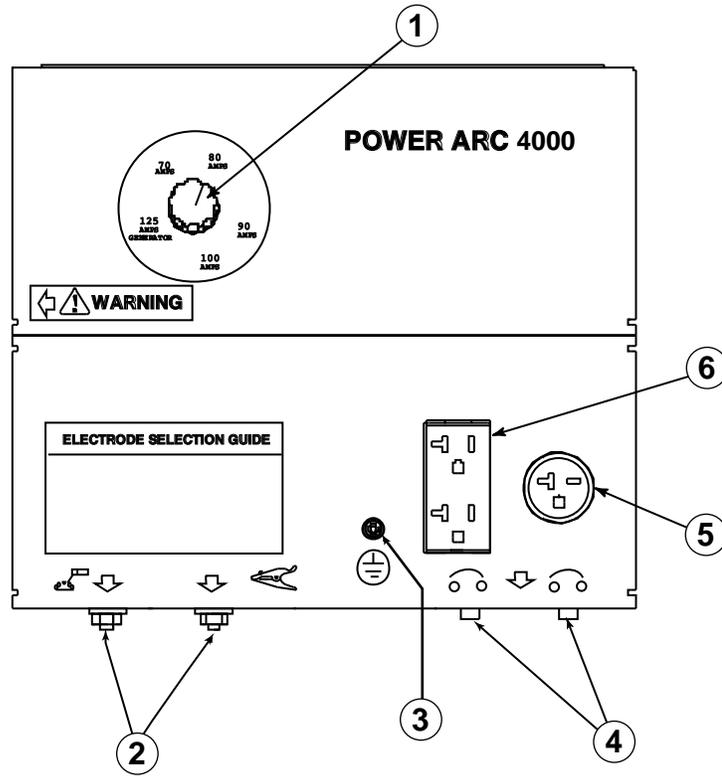
Standard mufflers and deflectors (like the ones included with the POWER-ARC 4000) do not act as spark arresters. When local laws require it, a spark arrester must be installed on the machine and properly maintained. An optional spark arrester kit is available for your POWER-ARC 4000. See the ACCESSORIES section of this manual for more information.

⚠ CAUTION

An incorrect spark arrester may lead to damage to the engine or reduce performance. A suitable spark arrester for the Briggs & Stratton 8 HP Cool Bore® engine is available as a Lincoln field-installed option.

INSTALLATION

FIGURE A.1 - POWER-ARC 4000 OUTPUT CONNECTIONS



- 1. CURRENT CONTROL DIAL
- 2. WELD OUTPUT TERMINALS (2)
- 3. GROUND STUD
- 4. CIRCUIT BREAKERS (2) - 20 AMP
- 5. RECEPTACLE - 240 VOLT, 20 AMP
- 6. DUPLEX RECEPTACLE - 120 VOLT, 20 AMP

ELECTRICAL OUTPUT CONNECTIONS

See Figure A.1 for the location of the current control dial, weld output terminals, ground stud, circuit breakers, 240 and 120 volt receptacles.

WELDING CABLE CONNECTIONS

Cable Size and Length

Be sure to use welding cables that are large enough. The correct size and length becomes especially important when you are welding at a distance from the welder.

Table A.1 lists recommended cable sizes and lengths for rated current and duty cycle. Length refers to the distance from the welder to the work and back to the welder. Cable diameters are increased for long cable lengths to reduce voltage drops.

**TABLE A.1
RECOMMENDED WELDING CABLE
SIZE AND LENGTH**

TOTAL COMBINED LENGTH OF ELECTRODE AND WORK CABLES

Cable Length	Cable Size for 125 amp/ 30% Duty Cycle
0-50 feet (0-15 meters)	6 AWG
50-100 feet (15-39 meters)	4 AWG
100-150 feet (30-46 meters)	3 AWG
150-200 feet (46-61 meters)	2 AWG
200-250 feet (61-76 meters)	1 AWG

Return to Section TOC
Return to Section TOC
Return to Section TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

INSTALLATION

Cable Installation

Install the welding cables to your POWER-ARC 4000 as follows. See Figure A.1 for the location of parts.

1. The gasoline engine must be OFF to install welding cables.
2. Remove the 1/2 - 13 flanged nuts from the output terminals.
3. Connect the electrode holder and work cables to the weld output terminals. You can connect either cable to either terminal, since the POWER-ARC 4000 provides AC weld current.
4. Tighten the flanged nuts securely.
5. Be certain that the metal piece you are welding (the "work") is securely connected to the work clamp and cable.
6. Check and tighten the connections periodically.

⚠ CAUTION

- Loose connections will cause the output terminals to overheat. The terminals may eventually melt.
- Do not cross the welding cables at the output terminal connection. Keep the cables isolated and separate from one another.

Lincoln Electric offers a welding accessory kit with the properly specified welding cables. See the **ACCESSORIES** section of this manual for more information.

MACHINE GROUNDING

Because the POWER-ARC 4000 creates its own power from its gasoline-engine driven generator, you do not need to connect the machine frame to an earth ground. However, for best protection against electrical shock, connect a heavy gauge wire from the ground stud located on the bottom center of the output panel (see Figure A.1) to a suitable earth ground such as a metal pipe driven into the ground.



⚠ WARNING

Do not ground the machine to a pipe that carries explosive or combustible material.

When the POWER-ARC 4000 is mounted on a truck or a trailer, the machine generator ground stud **MUST** be securely connected to the metal frame of the vehicle. See Figure A.1. The ground stud is marked with the symbol.



PLUGS AND HAND-HELD EQUIPMENT

For further protection against electric shock, any electrical equipment connected to the generator receptacles must use a three-blade, grounded type plug or an Underwriter's Laboratories (UL) approved double insulation system with a two-blade plug. Lincoln offers an accessory plug kit that has the right type of plugs. See the **ACCESSORIES** section of this manual for details.

If you need ground fault protection for hand-held equipment, in-line ground fault current interrupter (GFCI) cord sets that meet UL and OSHA requirements are available from:

Ericson Manufacturing Company
Willoughby, Ohio 44094
(216) 951-8000 (Ohio)
1-800-972-5109 (outside Ohio)

AUXILIARY POWER RECEPTACLES

The control panel of the POWER-ARC 4000 features two auxiliary power receptacles:

- A 20 amp, 120 volt duplex (double outlet) receptacle
- A 20 amp 240 volt simplex (single outlet) receptacle.

See Figure A.1.

Through these receptacles the machine can supply up to 4,000 rated continuous watts and 4,400 surge watts of single-phase AC power. The machine output voltages meet UL standards and fall within $\pm 10\%$ of the rated voltage. The output frequency falls within $\pm 3\%$ of rated frequency (60 Hz).

INSTALLATION

PREMISES WIRING

The POWER-ARC 4000 three-wire, grounded neutral generator allows it to be connected to premises wiring. However, the wiring procedure needed to meet the National Electric Code (NEC) regulations as well as city ordinances can be confusing. Matters get worse depending on whether you want the machine to be “hardwired” to the premises or only connected temporarily.

⚠ WARNING

Only a licensed, certified, trained electrician should install the machine to a premises or residential electrical system. Be certain that:

- The premises is isolated and no feedbacking into the utility system can occur. Certain state and local laws require the premises to be isolated before the generator is linked to the premises. Check your state and local requirements.
- A double pole, double throw transfer switch in conjunction with the properly rated double throw circuit breaker is connected between the generator power and the utility meter.

The POWER-ARC 4000 (unlike other Lincoln Electric equipment) does not have a combined 120/240 volt twist-lock receptacle and cannot be connected to a premises as described in other Lincoln literature.

Remember that the POWER-ARC 4000 is intended only for backup, intermittent use. The gasoline engine has a rated life of 500 hours. It cannot withstand long-term use without proper maintenance. See the **MAINTENANCE** section of this manual for more information.

Certain electrical devices cannot be powered by the POWER-ARC 4000. Refer to Table A.2 for these devices.

CIRCUIT BREAKERS

The POWER-ARC 4000 has its own 20 amp circuit breakers for overload protection. When the machine is operated in high temperature environments, the breakers may tend to trip at lower loads than normally.



⚠ CAUTION

Never bypass the circuit breakers. Without overload protection, the power-arc 4000 could overheat and/or cause damage to the equipment being used.

INSTALLATION

⚠ CAUTION

Certain Electrical devices cannot be powered by the POWER-ARC 4000. See Table A.2.

TABLE A.2
ELECTRICAL DEVICE USE WITH THE POWER-ARC 4000.

Type	Common Electrical Devices	Possible Concerns
Resistive	Heaters, toasters, incandescent light bulbs, electric range, hot pan, skillet, coffee maker.	NONE
Capacitive	TV sets, radios, microwaves, appliances with electrical control.	Voltage spikes or high voltage regulation can cause the capacitive elements to fail. Surge protection, transient protection, and additional loading is recommended for 100% fail-safe operation. DO NOT RUN THESE DEVICES WITHOUT ADDITIONAL RESISTIVE TYPE LOADS.
Inductive	Single-phase induction motors, drills, well pumps, grinders, small refrigerators, weed and hedge trimmers	These devices require large current inrush for starting. (See Table B.3, GENERATOR POWER APPLICATIONS, in the OPERATION section of this manual for required starting wattages.) Some synchronous motors may be frequency sensitive to attain maximum output torque, but they SHOULD BE SAFE from any frequency induced failures.
Capacitive/Inductive	Computers, high resolution TV sets, complicated electrical equipment.	An inductive type line conditioner along with transient and surge protection is required, and liabilities still exist. DO NOT USE THESE DEVICES WITH A POWER-ARC 4000.

The Lincoln Electric Company is not responsible for any damage to electrical components improperly connected to the POWER-ARC 4000.

TABLE OF CONTENTS - OPERATION SECTION -

Operation.....	Section B
Safety Instructions	B-1
General Description	B-1
Recommended Applications	B-2
Generator	
Welder	
Operational Features and Controls	B-2
Design Features and Advantages	B-2
Welding Capability.....	B-2
Limitations	B-2
Controls and Settings	B-3
Generator/Welder Controls	B-3
Gasoline Engine Controls.....	B-4
Engine Operation.....	B-5
Before Starting the Engine	B-5
Starting the Engine	B-5
Stopping the Engine	B-6
Running the Engine	B-6
Break-in Period	B-6
Generator Operation.....	B-7
Welding Operation.....	B-9
Welding Guidelines.....	B-10

OPERATING INSTRUCTIONS

Read and understand this entire section before operating your POWER-ARC 4000.

SAFETY INSTRUCTIONS

⚠ WARNING

Do not attempt to use this equipment until you have thoroughly read all the operation and maintenance manuals supplied with your machine. They include important safety precautions; detailed engine starting, operating, and maintenance instructions; and parts lists.



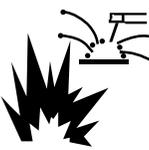
ELECTRIC SHOCK can kill.

- Do not touch electrically live parts or electrodes with your skin or wet clothing.
- Insulate yourself from the work and ground.
- Always wear dry insulating gloves.



FUMES AND GASES can be dangerous.

- Keep your head out of fumes.
- Use ventilation or exhaust to remove fumes from breathing zone.



WELDING SPARKS can cause fire or explosion.

- Keep flammable material away.
- Do not weld on containers that have held combustibles.

⚠ WARNING



ARC RAYS can burn.

- Wear eye, ear, and body protection.



ENGINE EXHAUST can kill.

- Use in open, well ventilated areas or vent exhaust to the outside.
- Do not stack anything on or near the engine.



MOVING PARTS can injure.

- Do not operate this equipment with any of its doors open or guards off.
- Stop the engine before servicing it.
- Keep away from moving parts.

Only qualified personnel should install, use, or service this equipment.

GENERAL DESCRIPTION

The POWER-ARC 4000 is a low-cost generator/welder designed for home use and other non-commercial applications. As a generator it can supply up to 4,000 continuous watts (or 4,400 surge watts) of 120/240 volt, single-phase AC power. As a welder it provides 125 amps of AC current for welding with AC stick electrodes. A single dial provides continuous adjustment of welding output. The machine is lightweight, portable, and can be lifted easily by two people.

A Briggs & Stratton 8 HP standard Cool-Bore® air-cooled, gasoline engine powers the generator/welder. The engine has an approximate operating life of 500 hours.

OPERATION

The POWER-ARC 4000 warranty covers the machine for one year from the date of purchase. For non-engine warranty claims, contact your nearest Lincoln Authorized Field Service Facility. For engine warranty claims, contact your nearest Briggs & Stratton service center.

NOTE: The POWER-ARC 4000 is not meant for rental or other commercial use.

RECOMMENDED APPLICATIONS

GENERATOR

The POWER-ARC 4000 gives smooth AC generator output for medium use, non-commercial demands. For more details on operating the generator, see GENERATOR OPERATION in the OPERATION section of this manual.

WELDER

The POWER-ARC 4000 provides excellent constant current AC welding output for stick (SMAW) welding. For more details on using the machine as a welder, see WELDING OPERATION in the OPERATION section of this manual.

OPERATIONAL FEATURES AND CONTROLS

The POWER-ARC 4000 was designed for simplicity. Therefore, it has very few operating controls. A single dial on the control panel lets you select either generator or welding use. For welding, the same dial selects continuous current output over the machine's 70 to 125 amp range.

The 8 HP Briggs & Stratton gasoline engine controls include a recoil starter, choke, throttle control, and piercing stop switch. See ENGINE OPERATION in the OPERATION section of this manual for details about starting, running, stopping, and breaking in the gasoline engine.

DESIGN FEATURES AND ADVANTAGES

- Stick welding (SMAW) process capability with output range from 70 - 125 amps.
- Single-dial current output selection.
- Work and Electrode welding cable mounting terminals.

- Separate ground stud for safe connection of case to earth ground. Single 20 amp, 240 volt generator receptacle.
- Duplex 20 amp, 120 volt generator receptacle.
- Integrated generator output overload protection through two 20 amp circuit breakers.
- Welded-tube, full roll cage frame protects engine and generator/welder.
- Lightweight, portable design.
- Rubber mounting isolates engine and generator from frame to prevent machine "walking" during use.
- Lo-Tone® engine muffler for quieter operation. (A Super Lo-Tone® muffler is available from Briggs & Stratton.) Easy-starting Electronic Magnetron® ignition.
- Optional Oil Gard® low oil level engine shutdown kit available from Briggs & Stratton.

WELDING CAPABILITY

The POWER-ARC 4000 is rated 125 amps, 18 volts at 30% duty cycle on a ten-minute basis. This means that you can load the welder to 125 amps for three minutes out of every ten-minute period. The machine is capable of higher duty cycles at lower output currents. For example, you can load the welder to 100 amps for six minutes out of ten for a 60% duty cycle.

The current is continuously variable from 70 to 125 amps AC. The POWER-ARC 4000 can, therefore, weld with all 3/32 and most 1/8 inch diameter Lincoln AC electrodes.

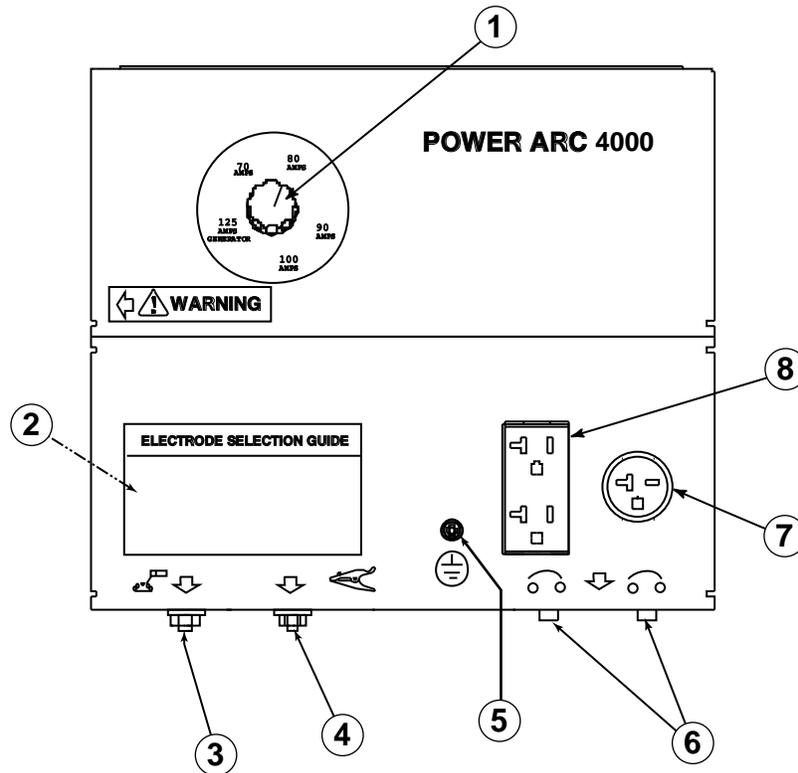
LIMITATIONS

- The POWER-ARC 4000 is not recommended for any processes besides those that are normally performed using stick welding (SMAW) procedures.
- The POWER-ARC 4000 is not recommended for pipe thawing.
- During welding, generator power is limited to 100 watts, and output voltages can drop from 120 to 80 volts and 240 to 160 volts. Therefore, DO NOT OPERATE ANY SENSITIVE ELECTRICAL EQUIPMENT WHILE YOU ARE WELDING.

CONTROLS AND SETTINGS

All generator/welder controls are located on the Output Control Panel. Gasoline engine controls are mounted on the engine. See Figures B.1 and B.2 and the explanations that follow.

FIGURE B.1 – OUTPUT PANEL CONTROLS



1. CURRENT CONTROL DIAL
2. ELECTRODE SELECTION GUIDE
3. WELD OUTPUT TERMINAL (TO ELECTRODE HOLDER) WITH 1/2 - 13 FLANGE NUT
4. WELD OUTPUT TERMINAL (TO WORK) WITH 1/2 - 13 FLANGE NUT
5. GROUND STUD
6. 20 AMP CIRCUIT BREAKERS (2)
7. 20 AMP, 240 VOLT RECEPTACLE
8. 20 AMP, 120 VOLT DUPLEX RECEPTACLE

GENERATOR/WELDER CONTROLS

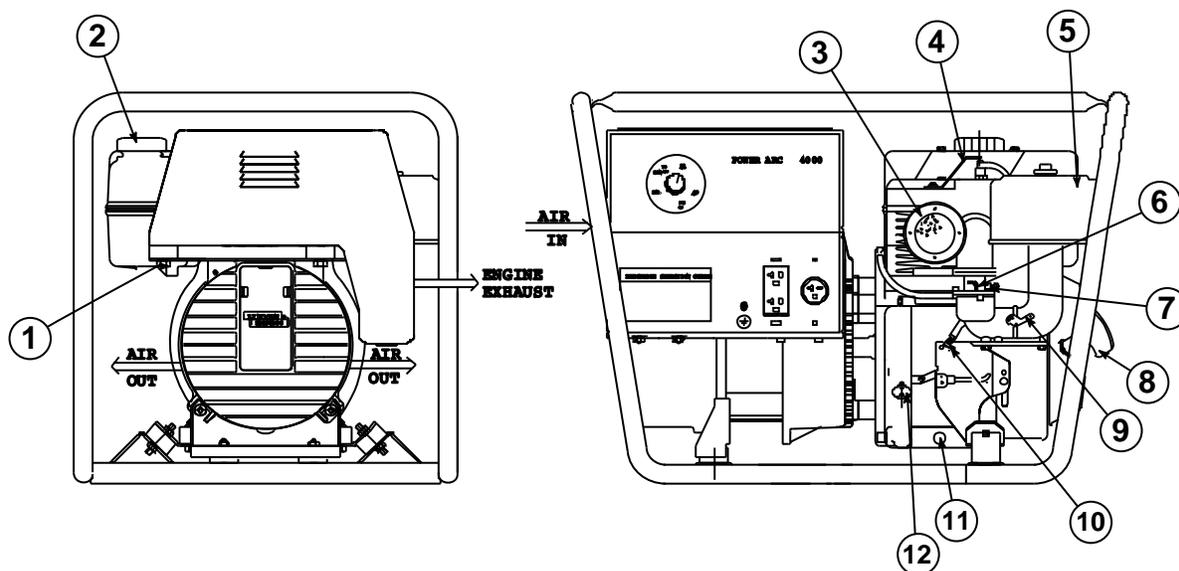
See Figure B.1 for the location of the following features:

1. **CURRENT CONTROL DIAL:** Adjusts continuous current output. The amperages on the dial correspond to the average amperages needed for specific Lincoln welder rods.
2. **ELECTRODE SELECTION GUIDE:** Provides recommended electrode type, size, and welder output setting based on the thickness of the work.
3. **WELD OUTPUT TERMINAL (TO ELECTRODE HOLDER) WITH 1/2 - 13 FLANGE NUT:** Provides the connection point for either the electrode holder or the work cable. (Because the POWER-ARC 4000 is an AC output machine, either output terminal can be used for either cable.)
4. **WELD OUTPUT TERMINAL (TO WORK) WITH 1/2 - 13 FLANGE NUT:** Provides the connection point for either the electrode holder or the work cable. (Because the POWER-ARC 4000 is an AC output machine, either output terminal can be used for either cable.)

OPERATION

5. GROUND STUD: Provides a connection point for connecting the machine case to earth ground for the safest grounding procedure.
6. 20 AMP CIRCUIT BREAKERS (2): Provide separate overload current protection for the 120 volt and 240 volt receptacles.
7. 20 AMP, 240 VOLT RECEPTACLE: Connection point for supplying 240 volt power to operate one electrical device.
8. 20 AMP, 120 VOLT DUPLEX RECEPTACLE: Connection point for supplying 120 volt power to operate one or two electrical devices.

FIGURE B.2 – GASOLINE ENGINE CONTROLS



1. FUEL SHUTOFF VALVE
2. FUEL TANK AND CAP
3. MUFFLER
4. PIERCING STOP SWITCH
5. AIR CLEANER
6. THROTTLE

7. AIR MIXTURE ADJUSTMENT SCREW
8. RECOIL STARTER
9. CHOKE
10. FUEL MIXTURE ADJUSTMENT SCREW
11. OIL DRAIN PLUG
12. OIL FILL PLUG

GASOLINE ENGINE CONTROLS

See Figure B.2 for the location of the following features:

1. FUEL SHUTOFF VALVE: Stops the flow of gasoline from the fuel tank to the carburetor. Should be closed whenever you are finished using the POWER-ARC 4000. Must be opened before you start the engine.
2. FUEL TANK AND CAP: Holds 1.0 gallon (3.8 liters) of unleaded gasoline. Contains a 50 micron fuel filter molded at the outlet port.

NOTE: If you use any other alternate fuel tank or supply, be sure to use a recommended in-line fuel filter.

3. MUFFLER: Reduces engine noise output. Does not serve as a spark arrester. See **SPARK ARRESTER** in the **INSTALLATION** section of this manual.
4. PIERCING STOP SWITCH: Stops the engine by grounding the spark plug.
5. AIR CLEANER: Filters intake air to the carburetor. See **ENGINE MAINTENANCE** in the **MAINTENANCE** section of this manual for details about the specific type of air cleaner to use.
6. THROTTLE: Adjusts the running speed of the engine. The engine runs at high idle when not under load. Rotating the spring-loaded throttle clockwise can temporarily reduce engine speed to low idle speed. Releasing the throttle returns the speed to high idle.



7. **AIR MIXTURE ADJUSTMENT SCREW:** Adjusts the amount of air mixed with fuel to obtain the smoothest operation under load or at idle. The POWER-ARC 4000 is shipped with the proper adjustment already set. **DO NOT ADJUST THE AIR MIXTURE SCREW WITHOUT FOLLOWING THE PROCEDURES OUTLINED BY BRIGGS & STRATTON.**

8. **RECOIL STARTER:** Manual, rope-type starter. The handle position allows easy starting from either ground level or pickup-truck level.

9. **CHOKE:** Provides a richer air/fuel mixture for cold engine starting conditions. See the topic ENGINE OPERATION, below, for details on setting the choke.



10. **FUEL MIXTURE ADJUSTMENT SCREW:** Adjusts the amount of fuel mixed with air to obtain the smoothest operation under load or at idle. The POWER-ARC 4000 is shipped with the proper adjustment already set. **DO NOT ADJUST THE FUEL MIXTURE SCREW WITHOUT FOLLOWING THE PROCEDURES OUTLINED BY BRIGGS & STRATTON.**

11. **OIL DRAIN PLUG:** Permits convenient draining of engine oil during maintenance. Both sides of the engine are equipped with an oil drain plug.

12. **OIL FILL PLUG:** Permits convenient filling of engine oil during maintenance. Both sides of the engine are equipped with an oil fill plug.

ENGINE OPERATION

WARNING

DO NOT RUN THE ENGINE AT EXCESSIVE SPEEDS. The maximum allowable high idle speed for the POWER-ARC 4000 is 3750 RPM, no load. Do NOT adjust the governor screw on the engine. Severe personal injury and damage to the machine can result if it is operated at speeds above the maximum rated speed.

Read and understand all safety instructions included in the Briggs & Stratton **Operating and Maintenance Instructions** manual that is shipped with the POWER-ARC 4000.

BEFORE STARTING THE ENGINE

CHECK AND FILL THE ENGINE OIL LEVEL:

1. Place the machine on a level surface. 
2. Open the oil fill plug.
3. Fill (if necessary) until oil flows out the top of the fill plug hole.
4. Replace the fill plug and tighten securely.

CHECK AND FILL THE ENGINE FUEL TANK:

1. Remove the fuel tank cap.
2. Fill the tank to allow approximately 1/4 inch (5 mm) of tank space for fuel expansion. **DO NOT FILL THE TANK TO THE POINT OF OVERFLOW.** 
3. Replace the fuel tank cap and tighten securely.

NOTE: The engine will operate satisfactorily on any gasoline meant for automotive use. A minimum of 87 octane is recommended. **DO NOT MIX OIL WITH THE GASOLINE.**

Use clean, fresh, lead-free gasoline. Leaded gasoline may be used if lead-free is not available. However, lead-free gasoline leaves fewer combustion deposits and gives longer valve life. For engine protection from fuel deposits, use Briggs & Stratton Gasoline Additive, part number 5041. Purchase gasoline in quantities that will be used within 30 days, to assure freshness.

NOTE: We DO NOT recommend using gasoline that contains alcohol, such as gasohol. However, if gasoline with alcohol is used, it **MUST NOT** contain more than 10% Ethanol and **MUST** be removed from the engine during storage. **DO NOT** use gasoline containing Methanol.

STARTING THE ENGINE

NOTE: Remove all loads connected to the AC power receptacles before starting the gasoline engine.

FOR A "COLD" ENGINE:

1. Open the fuel shutoff valve on the bottom of the fuel tank.
2. Place the choke lever in the lowest, downward position.
3. Pull slightly on the recoil starter handle until resistance is felt. 

OPERATION

- Pull the cord rapidly.
- If the engine does not start, open the choke slightly (move lever upward) and pull the starter cord rapidly again.

When the engine starts, gradually open the choke to the highest, upward position.

FOR A "HOT" ENGINE:

- Open the fuel shutoff valve on the bottom of the fuel tank.
- Place the choke lever in the highest, upward position. Closing the choke of a hot engine will flood the carburetor and prevent starting.
- Pull slightly on the recoil starter handle until resistance is felt.
- Pull the cord rapidly.



FOR BEST ENGINE STARTING:

- Do not adjust air or fuel mixtures without following the procedures in the Briggs & Stratton **Operating and Maintenance Instructions** manual.
- Always use fresh gasoline and be sure the filter is clean and properly maintained.
- If you use an alternate fuel tank or supply, be sure to install an in-line fuel filter.
- Do not pull the recoil starter with the choke in the downward position more than one time. Repeated pulls on a choked engine will flood the carburetor.
- If you don't feel resistance when you pull the recoil cord, gently hit the starter housing and/or pull the cord out to its fully extended position and wiggle it rapidly. Repeat this if necessary until the clutch engages the shaft and you feel resistance when you pull the cord.
- If the engine will not start, see the **TROUBLESHOOTING** section of this manual.



STOPPING THE ENGINE

- Remove all welding and generator power loads and let the engine cool by running it for several minutes.
- Stop the engine by pressing downward on the piercing stop switch lever.
- Hold the lever down firmly until the engine completely stops. Otherwise, the engine may restart or sputter as it stops.
- Close the fuel shutoff valve at the bottom of the fuel tank.

FOR BEST ENGINE STOPPING:

- Do not remove the rubber spark plug boot.
- Be sure the piercing point on the piercing stop switch lever firmly contacts the spark plug.
- Do not apply excessive force to or bend the piercing stop switch lever.

⚠ WARNING

Close the fuel valve when the machine is transported to prevent fuel leakage from the carburetor. Drain the tank before transporting the machine in a vehicle.

For long periods of storage, turn off the fuel shutoff valve (lowest, downward position) and let the engine run until there is no more fuel in the line. Use a fuel additive such as Sta-Bil to minimize fuel gum deposits.

RUNNING THE ENGINE

The engine is set at the factory to run at high idle speed when not under load. You should not adjust this setting yourself.

BREAK-IN PERIOD

Any engine will use a small amount of oil during its "break-in" period. For the gasoline engine on the POWER-ARC 4000, break-in is about 12 running hours.

Check the oil frequently during break-in. Change the oil after the first 5 hours of operation. For more details, see the MAINTENANCE section of this manual.

⚠ CAUTION

During break-in, subject the POWER-ARC 4000 to only moderate loads. Avoid long periods running at idle. Before stopping the engine, remove all loads and allow the engine to cool several minutes.

GENERATOR OPERATION

⚠ CAUTION

Be sure that any electrical equipment plugged into the generator's AC power receptacles can withstand a $\pm 10\%$ voltage and a $\pm 3\%$ frequency variation. Some electronic devices cannot be powered by the POWER-ARC 4000. Refer to Table A.2, ELECTRICAL DEVICE USE WITH THE POWER-ARC 4000, in the INSTALLATION section of this manual.

GENERAL INFORMATION

The POWER-ARC 4000 generator is rated at 4000 continuous watts (4400 surge watts). It provides both 120 volt and 240 volt power. You can draw up to 20 amps from either side of the 120 volt duplex receptacle, but no more than 37 amps from both sides at once. Up to 18 amps can be drawn from the single 240 volt receptacle.

Electrical loads in watts are calculated by multiplying the voltage rating of the load by the number of amps it

draws. (This information is given on the load device nameplate.) For example, a device rated 115 volts, 2 amps will need 230 watts of power ($115 \times 2 = 230$).

You can use Table B.3, GENERATOR POWER APPLICATIONS, to determine the wattage requirements of the most common types of loads you can power with the POWER-ARC 4000. Be sure to read the notes at the bottom of the table.

TO USE THE GENERATOR AS AN AUXILIARY POWER SUPPLY:

1. Start the gasoline engine. See **ENGINE OPERATION** in this section of the manual.
2. Set the current control dial on the output control panel to "GENERATOR." See Figure B.1.
3. Plug the load(s) into the appropriate 120 volt or 240 volt power receptacle.

NOTE: During welding, the maximum generator output for auxiliary loads is 100 watts.

NOTE: You can supply multiple loads as long as the total load does not exceed 4,000 watts. Be sure to start the largest loads first.

OPERATION

**TABLE B.3
GENERATOR POWER APPLICATIONS**

Suggested Power Applications	Running Watts	*Start-up Watts
*Air Compressor - 3/4 HP	1,250	3,100 - 5,000
*Airless Sprayer - 1/3 HP	600	1,500 - 2,400
Chain Saw 1,200		
Circular Saw	1,200	
Coffee Maker	1,000	
*Deep Freezer	500	750 - 2,000
*Electric Motor - 1 HP	1,000	2,500 - 4,000
Electric Range (1 element)	1,500	
Electric Skillet	1,250	
*Furnace Fan - 1/3 HP	1,200	3,000 - 4,800
Portable Grinder (4 1/2")	600	
Portable Grinder (7")	2,000	
Halogen Work Light	500	
Hand Drill - 1/4"	500	
Hand Drill - 3/8"	700	
1500 Watt Heater	1,750	
Hedge Trimmer	450	
Light Bulb 100		
Reciprocating Saw	900	
Radial Arm Saw	2,600	
Radio 50		
*Refrigerator/Freezer (small)	600	1,500 - 2,400
Slow Cooker	200	
*Submersible Pump - 1 HP	1,000	2,500 - 4,000
*Sump Pump	600	1,500 - 2,400
Toaster 1,100		
Weed Trimmer	500	
Lincoln 100 or 125 Amp Wire Feeder/Welder	4,000	

NOTES:

Wattages listed are approximate. Check your equipment for actual wattage.

Equipment with unusually high *START-UP WATTS are listed. For start-up of other equipment listed in the table, multiply RUNNING WATTS by 2.

Multiple loads can be used as long as the total load does not exceed 4,000 watts. Be sure to start the largest loads first. For example, a 1 HP motor needs approximately 1,000 watts while running but may require 2,500 watts to start. Some inductive motors may require as much as 4 times running watts to start.

WELDING OPERATION

GENERAL INFORMATION

⚠ WARNING

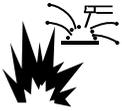


Do not touch electrically live parts or electrodes with your skin or wet clothing.



Do not breathe welding fumes or gases.

Use ventilation or exhaust to remove welding fumes from the breathing area.



Keep flammable material away.

Wear eye, ear, and body protection.

The POWER-ARC 4000 generator/welder can deliver from 70 to 125 amps of continuous welding output current. Output can be adjusted by setting the current control dial on the output control panel.

You can get maximum welding output by setting the dial to 125 AMPS. At high current settings like this, some output may decrease as the machine is used. If you are welding for a long time, you may need to turn the dial slightly upward to maintain the same results.

The numbers on the dial correspond to the average amps needed to weld using specific Lincoln welding rods. Table B.4, WELDING APPLICATIONS, gives you the recommended dial settings based on the thickness of the work and the size and type of rod you're using.

TO USE THE POWER-ARC 4000 FOR WELDING:

1. Remove the flange nuts from the weld output terminals and place the work and electrode welding cables over the terminals. See Figure B.1. Replace and tighten the flange nuts securely. Be sure the connections are tight.
2. Select the appropriate electrode. See Table B.4, WELDING APPLICATIONS, or the ELECTRODE SELECTION GUIDE on the machine Output Control Panel.

3. Attach the work clamp securely to the work you are welding.
4. Insert the electrode into the electrode holder.
5. Set the current control dial to the desired output current.
6. Start the gasoline engine. See **ENGINE OPERATION** in this section of the manual.
7. Strike an arc and begin welding. For information on welding techniques, see **WELDING GUIDELINES** in this section of the manual.

AFTER YOU FINISH THE WELD:

1. Stop the gasoline engine. See **ENGINE OPERATION** in this section of the manual.
2. Allow the electrode and work to cool completely.
3. Remove the work clamp from the work.
4. Remove any remaining piece of electrode from the electrode holder.
5. If you are finished using the POWER-ARC 4000 for welding, disconnect the welding cables from the weld output terminals. Reattach the flange nuts and leave them on the terminals.

OPERATION

WELDING GUIDELINES

TABLE B.4
WELDING APPLICATIONS/ELECTRODE SELECTION GUIDE

Material Thickness	Electrode Type	Size	Setting
1/8" and thinner	FLEETWELD® 37	3/32"	90 amps
	¹ AWS E6013		70 amps
	FLEETWELD® 180		90 amps
	AWS E6011		
	STABLE ARC™ 7018		
	AWS E7018		
3/16" Maximum	FLEETWELD® 37 AWS E6013	1/8"	125 amps
5/16" Maximum	FLEETWELD® 180 AWS E6011	1/8"	90 amps
Any Thickness	WEARSHIELD®	1/8"	100 amps

NOTES:

The values listed are suggested settings. Actual setting may vary depending on individual preference and/or specific application. Beginners should use STABLE ARC E7018.

For electrodes not listed, follow tables that are packed with the electrodes.

Ask for the Lincoln WELD DIRECTORY (Publication M210) for a complete listing of all Lincoln stick electrodes available.

¹AWS = American Welding Society

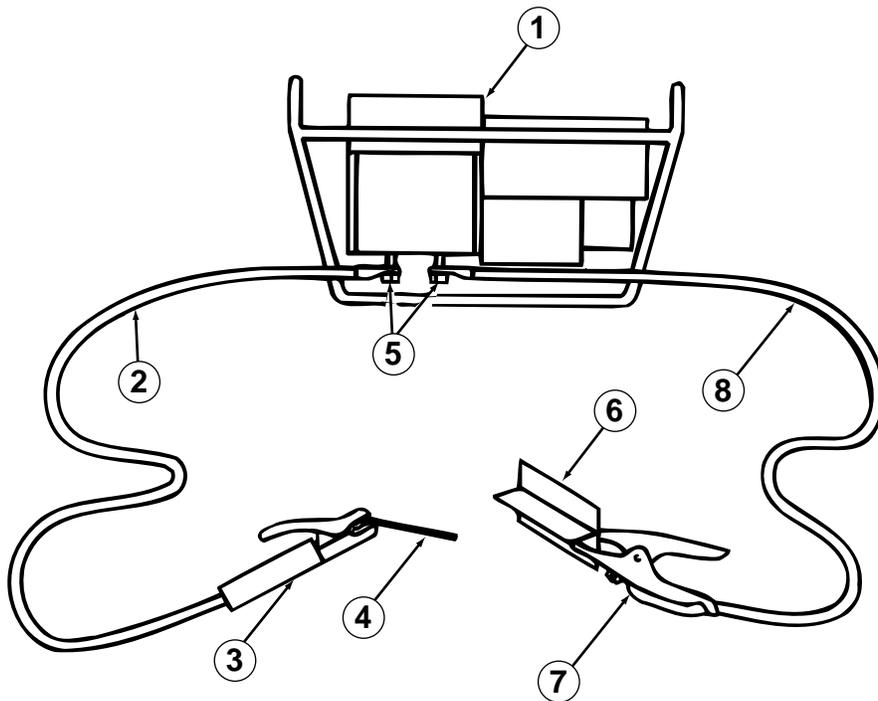
NOTE: The serviceability of a product or structure utilizing this type of information is and must be the sole responsibility of the builder/user. Many variables beyond the control of The Lincoln Electric Company affect the results obtained in applying this type of information. These variables include, but are not limited to, welding procedure, plate chemistry and temperature, weldment design, fabrication methods and service requirements.

STICK WELDING

Stick welding is probably the most familiar welding process known. A coated ELECTRODE, the welding rod, is clamped into an ELECTRODE HOLDER, an insulated clamping device, which is connected to the ELECTRODE CABLE, a heavy wire. The WORK, the piece of metal to be welded, is connected to the WORK CABLE, a heavy wire with a WORK CLAMP on one end. The two cables connect to OUTPUT TERMINALS on the welder, which is a high current power source. See Figure B.3.

OPERATION

FIGURE B.3 – WELDING CIRCUIT CONNECTIONS



1. POWER SOURCE
2. ELECTRODE CABLE
3. ELECTRODE HOLDER
4. ELECTRODE
5. OUTPUT TERMINALS
6. WORK
7. WORK CLAMP
8. WORK CABLE

THE WELDING CIRCUIT

When everything is connected properly, the current from the power source causes the electrode to melt and bond the metal being welded. Figure B.3. shows the components of the basic welding circuit. The circuit starts at the electrode cable connection and ends at the work cable connection. Current flows from the POWER-ARC 4000 through the electrode cable, the electrode holder, the electrode, and across the arc.

On the work side of the arc, current flows through the work to the work clamp, the work cable, and back to the machine. The circuit must be complete for current to flow. That means the work clamp must be tightly connected to clean base metal. You should remove any paint or rust as necessary to get a good connection. Also, you need to connect the work clamp as close as possible to the area you want to weld. Avoid letting the welding circuit pass through hinges, bearings, electronic components or similar devices that can be damaged by high current.

THE ARC

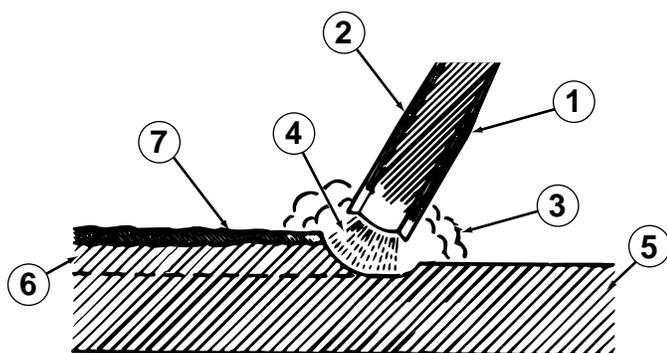
The electric arc is made between the work and the tip of the electrode. You make a gap for the arc in the welding circuit by holding the electrode tip 1/16 to 1/8 inch (1.6 to 3.2 mm) away from the work. You must establish the arc and hold it as you move the arc along the joint you're welding. The arc melts both the electrode and the base metal of the work as you move.

Figure B.4. shows what's happening in the welding arc. The arc itself is the electric current flowing between the tip of the electrode and the work. Its temperature is about 6000°F (3316°C). The arc is very bright and cannot be looked at with the naked eye without risk of painful and perhaps permanent injury. A very dark lens specifically designed for arc welding must be used with the handshield or headshield whenever viewing the arc.

The arc melts the base metal and actually digs into it. The molten metal forms a pool or crater and tends to flow away from the arc. As it moves away, it cools and solidifies. Slag forms on the top of the weld and protects it as it cools.

OPERATION

FIGURE B.4 – THE WELDING ARC



1. ELECTRODE
2. COATING
3. SHIELDING GAS
4. ARC
5. BASE METAL
6. WELD METAL
7. SOLIDIFIED SLAG

Obviously, stick arc welding is a manual skill requiring a steady hand, good physical condition, and good eyesight. The quality of the weld depends on the skill of the welder to hold and control the welding arc.

THE ELECTRODE

Besides diameter, the main difference between electrodes is their type of coating. This coating helps make the arc steady, shields the arc to keep oxygen and nitrogen in the air away from the molten metal, and provide a flux that picks up impurities which could weaken the weld.

The best coating for the job depends on a number of factors:

- The type of deposit you want, such as mild steel, stainless steel, low alloy, or hardfacing.
- The thickness of the plate you want to weld.
- The position you will be welding in (vertical, horizontal, downhand, out-of-position).
- The surface condition of the work.
- Your ability to handle and obtain the desired electrode.

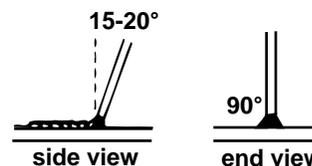
THE FOUR FACTORS OF SUCCESSFUL WELDING

Controlling the arc to make a successful weld depends on four factors. How well you control them will determine whether your welds succeed or fail. The four factors include:

- The Correct Welding Position
- The Correct Way to Strike an Arc
- The Correct Arc Length The Correct Welding Speed
- The Correct Welding Position

Figure B.5 shows the correct position for right-handed people. (If you are left-handed, the correct position is opposite the one shown.) Whenever possible, weld from left to right so that you can see clearly what you are doing. Notice that the electrode should be held at a slight angle, 15 to 20 degrees from the perpendicular.

FIGURE B.5 – CORRECT WELDING POSITION



THE CORRECT WAY TO STRIKE AN ARC

First be sure that the work clamp is making a good connection to the work. Lower your headshield and scratch the electrode slowly over the metal. Sparks will fly. While scratching, lift the electrode 1/8 inch (3.2 mm) and the arc will be established.

NOTE: If you stop moving the electrode while scratching, the electrode will stick to the work.

Most beginners try to strike the arc by a fast jabbing motion down onto the plate. Result: They either stick the electrode or their motion is so fast that they break the arc immediately.

OPERATION

THE CORRECT ARC LENGTH

The arc length is the distance from the tip of the electrode core wire to the base metal.

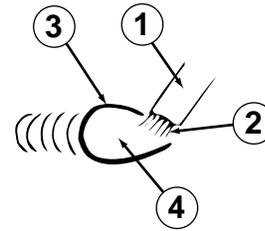
Once you've established the arc, maintaining the correct arc length is critical. It should be short, 1/16 to 1/8 inch (3.2 mm) long. As the electrode burns off, you must continue to feed it into the work to keep the arc length correct.

The easiest way to tell if the arc length is correct is to listen to it. A nice, short arc has a distinctive "crackling" sound, like eggs frying in a pan. A long, incorrect, arc has a hollow, blowing or hissing sound.

THE CORRECT WELDING SPEED

To know whether your welding speed is correct, you must watch the puddle of molten metal behind the arc. **DO NOT WATCH THE ARC ITSELF.** The appearance of the puddle and the ridge where it solidifies tells the tale. The ridge should be approximately 3/8 inch (9.5 mm) behind the electrode. See Figure B.6.

FIGURE B.6 – MOLTEN METAL PUDDLE AND CORRECT WELD SPEED



1. ELECTRODE
2. ARC
3. RIDGE OF MOLTEN METAL
4. WELD PUDDLE

Most beginners tend to weld too fast, which gives a thin, uneven, "wormy" looking bead. They are not watching the molten metal puddle.

NOTE: When welding on thin plate, you will find that you have to increase welding speed. On heavy plate, you will have to go more slowly to ensure fusion and penetration.

The key to developing welding skill is PRACTICE. No one can learn to weld just by reading about it. If you are an inexperienced welder, the information here will help you understand some basic welding principles you should know before you use your POWER-ARC 4000 for stick welding. For more detailed information, order a copy of the book *New Lessons in Arc Welding*, available from the Book Division of Lincoln Electric. See the form located at the back of this manual for ordering information!

TABLE OF CONTENTS

- ACCESSORIES -

Accessories.....	Section C
Options/Accessories.....	C-1
Lincoln Electric Accessories	C-1
Briggs and Stratton Accessories	C-1
Semiautomatic Mig Welding with a Lincoln/Weld-Pak 100 or Weld-Pak 125.....	C-1

Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

OPTIONS/ACCESSORIES

LINCOLN ELECTRIC ACCESSORIES

The following options/accessories are available for your POWER-ARC 4000 from your local Lincoln Distributor.

Power Plug Kit (K802T) – Provides three plugs, two for the 120 volt duplex receptacle and one for the 240 volt receptacle.

Accessory Set (K875) – Includes the following:

- Twenty feet (6.1 meters) of #6 AWG electrode cable
- Fifteen feet (4.6 meters) of #6 work cable
- Headshield with No. 10 filter, work clamp
- Insulated electrode holder and sample electrodes

The cables are rated at 150 amps, 40% duty cycle.

Spark Arrester (K883-1) – A field-installed kit for the 8 HP Briggs & Stratton Cool-Bore® engine. The spark arrester attaches to the muffler to reduce the change of sparks being emitted from the muffler.

Rotor Removal Kit (S20925) – A service kit with thru and impact bolts for removing the generator rotor from the tapered engine crankshaft.

BRIGGS AND STRATTON ACCESSORIES

The following options/accessories are available for your POWER-ARC 4000 from your local Briggs & Stratton Distributor.

Foam Pre-cleaner (REF 271794) – Provides a foam cleaner for replacement around the paper cartridge air cleaner. Increases protection in extremely dusty or dirty environments.

Oil Gard® Low Oil Shutdown Kit (REF 398182) – Installs in the crankcase access port standard on all POWER-ARC models. Senses low oil conditions and automatically stops the engine. The engine cannot be restarted until sufficient oil is added.

Super Lo-Tone® Muffler - Square (REF 494221) – Replaces the round Lo-Tone muffler that comes installed on the engine. Limits exhaust noise but reduces maximum generator output by 200-300 watts.

Muffler Guard (REF 494868) – Installs onto the muffler with a supplied bracket. Protects against accidental contact with a hot muffler. Must not be used in tandem with both a deflector and a spark arrester.

SEMI-AUTOMATIC MIG WELDING WITH A LINCOLN WELD-PAK 100 OR WELD-PAK 125

In addition to using the accessories/options listed above, the POWER-ARC 4000 generator can supply power to a Lincoln Electric Weld-Pak 100 or Weld-Pak 125 wire feed welder. The Weld-Pak comes with all the supplies needed for Flux-Cored Arc Welding (FCAW).

A K610-1 MIG (Metal Inert Gas) Conversion Kit is also available for the Weld-Pak. The kit provides everything needed for Gas Metal Arc Welding (GMAW) or MIG processes. Contact your local authorized Lincoln representative for details about the Weld-Pak and MIG Conversion Kit.

TABLE OF CONTENTS -MAINTENANCE-

Maintenance	Section D
Routine and Periodic Maintenance	D-1
Engine Maintenance.....	D-1
Generator/Welder Maintenance	D-4
Major Component Locations	D-5

Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

SAFETY PRECAUTIONS

⚠ WARNING

- Have qualified personnel do all maintenance and troubleshooting work.
- Turn the engine off before working inside the machine.
- Remove guards only when necessary to perform maintenance and replace them when the maintenance requiring their removal is complete.
- If guards are missing from the machine, get replacements from a Lincoln Distributor. See the EXPLODED VIEW AND PARTS LIST at the back of this manual.

Read the Safety Precautions in the front of this manual and in the Briggs & Stratton **Operating and Maintenance Instructions** manual before working on the POWER-ARC 4000.

Keep all equipment safety guards, covers, and devices in position and in good repair. Keep your hands, hair, clothing, and tools away from the recoil housing, fans, and all other moving parts when starting, operating, or repairing this machine.

ROUTINE AND PERIODIC MAINTENANCE

ENGINE MAINTENANCE

⚠ CAUTION

To prevent the engine from accidentally starting, disconnect the spark plug lead before servicing the engine.

See Table D.1 for a summary of maintenance intervals for the items listed below. Follow either the hourly or the calendar intervals, whichever come first. More frequent service may be required, depending on your specific application and operating conditions. Table D.2 shows engine maintenance replacement parts and numbers.

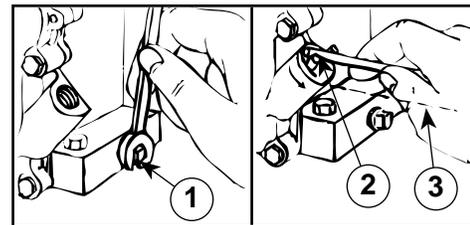


OIL: Check the oil level after every 5 hours of operation or daily. BE SURE TO MAINTAIN THE OIL LEVEL.

Change the oil the first time after 5 hours of operation. Then, under normal operating conditions, change the oil after every 50 hours or once a year, whichever occurs first. If the engine is operated under heavy load or in high ambient temperatures, change the oil every 25 hours.

Drain the oil from the drain plug located on either side of the engine bottom, as shown in Figure D.1. Refill through the oil fill plug until the oil reaches the top of the fill hole. Use SAE 10W-30 grade oil.

FIGURE D.1 - OIL DRAIN AND REFILL LOCATION



1. OIL DRAIN PLUG
2. OIL FILL PLUG
3. OIL LEVEL

FUEL: At the end of each day's use, refill the fuel tank to minimize moisture condensation and dirt contamination in the fuel line.



MAINTENANCE



AIR CLEANER: Your air cleaner may have only the paper cartridge, or it may have the cartridge and a foam pre-cleaner. If it has the pre-cleaner, service the cartridge every 100 hours and the pre-cleaner every 25 hours or once a year, whichever comes first. If the air cleaner doesn't have the pre-cleaner, service the cartridge every 25 hours or once a year, whichever comes first. Under dusty conditions, service more often.

⚠ CAUTION

Do not use petroleum solvents such as kerosene to clean the cartridge. They may cause deterioration of the cartridge. **DO NOT OIL THE CARTRIDGE OR USE PRESSURIZED AIR TO CLEAN OR DRY THE CARTRIDGE.**

Remove the wing nut and cover. Carefully remove the foam pre-cleaner, if equipped, from the cartridge.

To service the pre-cleaner:

1. Wash in liquid detergent and water.
2. Squeeze dry in a clean cloth.
3. Saturate in clean engine oil.
4. Squeeze in a clean, absorbent cloth to remove all excess oil.

To service the cartridge:

1. Tap gently on a clean surface.
2. Replace if very dirty or wash in a non-sudsing detergent and warm water solution.
3. Rinse thoroughly from the mesh side with flowing water until the water is clear.
4. Allow to stand and air dry before reinstalling.

Carefully place the pre-cleaner back over the cartridge and reinstall the air cleaner cover and wingnut.

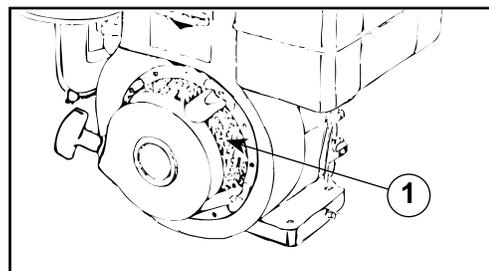
CLEAN ENGINE: Remove dirt and debris with a cloth or a brush. Do not clean with a forceful spray of water. Water might contaminate the fuel system.

⚠ CAUTION

Periodically clean the muffler area to remove combustible debris.

Clean Rotating Screen: See Figure D.2. Clean the rotating screen on your machine's engine as often as needed to remove dirt or debris that may collect on the screen. A dirty screen can result in engine overheating and damage.

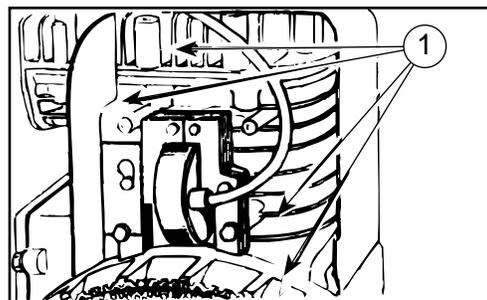
FIGURE D.2 - CLEAN ROTATING SCREEN/FINGER GUARD/DEBRIS GUARD



1. ROTATING SCREEN

CLEAN COOLING SYSTEM: See Figure D.3. Clean the internal cooling fins and surfaces to prevent overspeeding, overheating, and engine damage. Clean every 100 operating hours or as often as necessary.

FIGURE D.3 - CLEAN COOLING SYSTEM

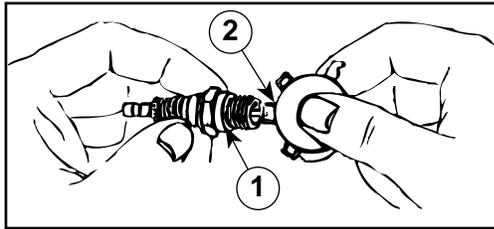


1. REMOVE CHAFF AND DIRT FROM THESE AREAS.

MAINTENANCE

CLEAN OR REPLACE SPARK PLUG: Clean or replace the spark plug after every 100 hours of operation or every season, whichever comes first. Do not blast the spark plug clean with an abrasive cleaning device. Clean the plug by scraping it or by using a wire brush. Wash the plug with a commercial solvent. After cleaning or when installing a new spark plug, set the terminal gap to .030 inch (.76 mm) with a feeler gauge. See Figure D.4.

FIGURE D.4 - SET SPARK PLUG GAP



1. SPARK PLUG (STANDARD, PART NO. 492167; RESISTOR, PART NO. 802592)
2. FEELER GAUGE (.030 INCH, 76mm)

CLEAN SPARK ARRESTER SCREEN: If the muffler has the optional spark arrester assembly, remove it every 50 hours or once a year, whichever comes first, and inspect it. Clean the arrester. Replace it if you find any damage.

REMOVE COMBUSTION DEPOSITS: After every 100 to 300 hours of operation, remove the engine cylinder head. Scrape and wire brush the combustion deposits from the cylinder, cylinder head, top of the piston, and around the valves. Refit the gasket (replace it if damaged) and reassemble the cylinder head and block. Turn down the screws finger tight with the three long screws around the exhaust valve (if so equipped). Torque the screws in a staggered sequence to 165 inch-pounds (19 N·m).

**TABLE D.1
ENGINE MAINTENANCE SCHEDULE**

Maintenance Operation	Every 5 Hours or Daily	25 Hours or Yearly	50 Hours or Yearly	100 Hours or Yearly	100-300 Hours
Check Oil Level	●				
Change Oil ♦			● Note 1		
Clean Rotating Screen, Finger Guard, or Debris Screen	● Note 2				
Service Foam Pre-Cleaner or Oil Foam® Element		● Note 2			
Service Air Cleaner Cartridge (if no pre-cleaner)		● Note 2			
Service Air Cleaner Cartridge (if pre-cleaner present)				● Note 2	
Clean Cooling System				●	
Inspect Spark Arrester (Option)			●		
Clean or Replace Spark Plug				●	
Replace In-Line Fuel Filter (Option)				●	
Remove Combustion Deposits					●

♦ Change oil after first 5 hours, then after every 50 hours or once a year.

Note 1: Change oil every 25 hours when operating under heavy load in high ambient temperatures.

Note 2: Clean more often under dusty conditions or when airborne debris is present.

MAINTENANCE

TABLE D.2 – ENGINE MAINTENANCE PARTS

Part	Part Number
OIL FILTER	NONE
SPARK PLUG (STANDARD)	B&S 492167 CHAMPION J19LM
SPARK PLUG (RESISTOR)	B&S 802592 CHAMPION RJ19LM
FUEL FILTER	B&S 298090 (for .25i I.D. hose)
AIR CLEANER CARTRIDGE	B&S 393957 (CAN BE CLEANED AND REUSED)
AIR PRE-CLEANER (AS NEEDED)	B&S 271794 (CAN BE CLEANED AND REUSED)

GENERATOR/WELDER MAINTENANCE

STORAGE: Store the POWER-ARC 4000 in clean, dry, protected areas.

CLEANING: Blow out the generator and controls periodically with low pressure air. Do this at least once a week in particularly dirty areas.

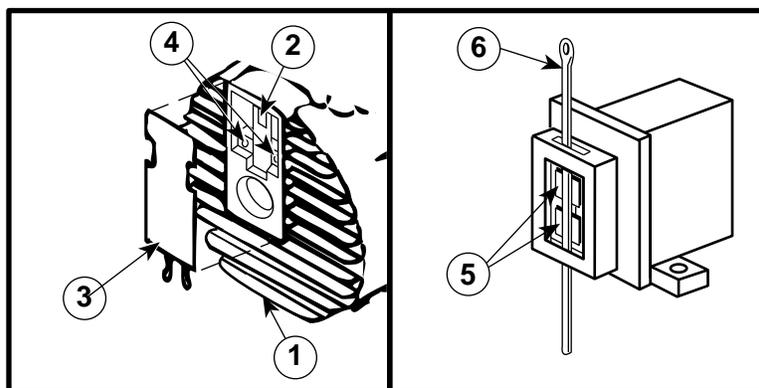
BRUSH REMOVAL AND REPLACEMENT: See Figure D.5. It's normal for the brushes and slip rings to wear and darken slightly. Inspect the brushes when a generator overhaul is necessary. Remove the brushes and clean the slip rings with fine grit sandpaper. To reinstall the brushes, press them upward and slide a cable tie or wooden stick

through the brush holder tabs. Install the brush holder into the bearing end bracket and secure with the screws previously removed. Remove the cable tie or wooden stick and the brushes will seat onto the slip rings.

RECEPTACLES: Keep the electrical receptacles in good condition. Remove any dirt, oil, or other debris from their surfaces and holes.

CABLE CONNECTIONS: Check the welding cable connections at the weld output terminals often. Be sure that the connections are always firm.

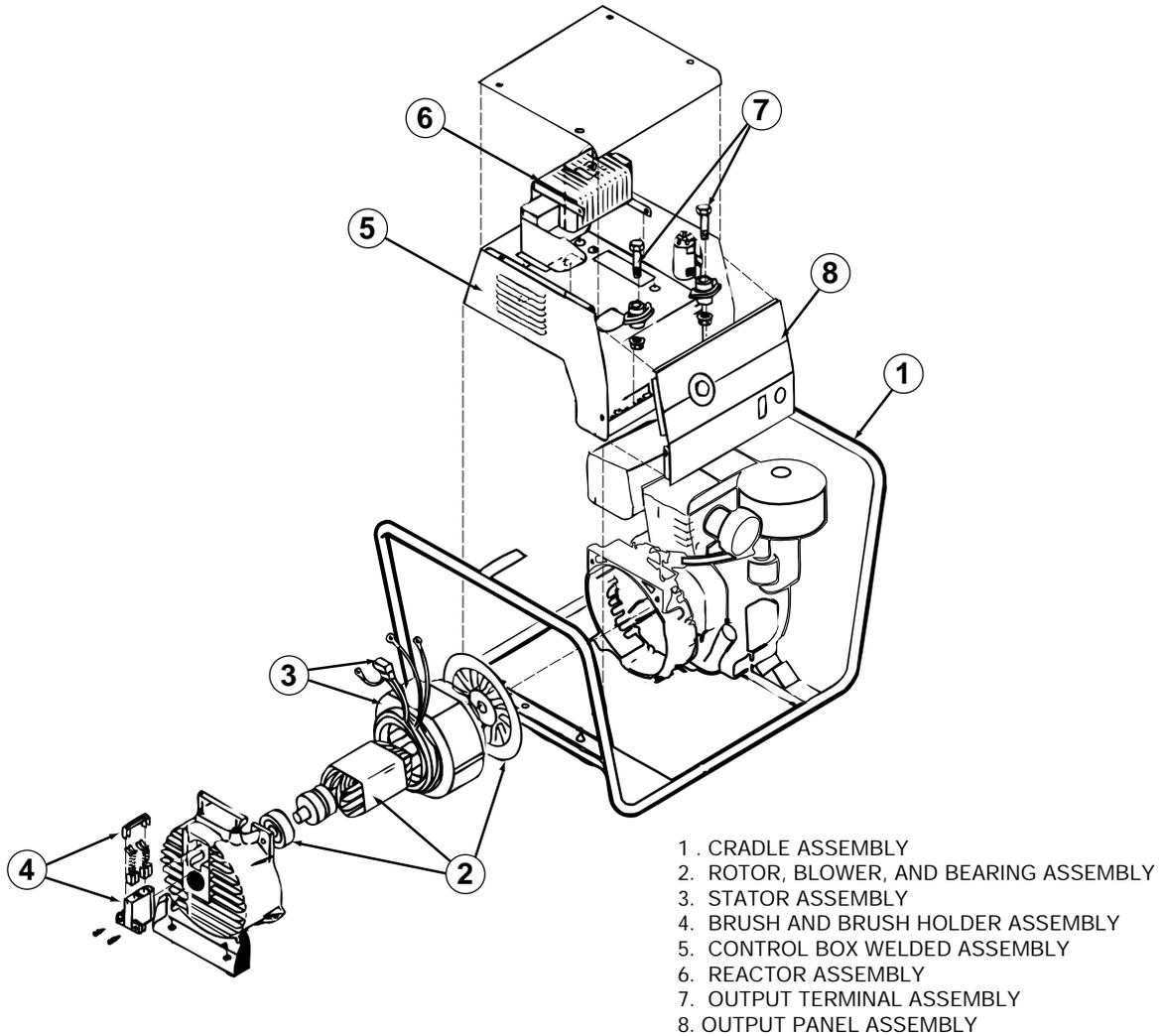
FIGURE D.5. – BRUSH REMOVAL AND REPLACEMENT



1. GENERATOR END BRACKET
2. BRUSH HOLDER ASSEMBLY
3. COVER
4. SCREWS (2)
5. BRUSHES
6. CABLE TIE

MAINTENANCE

FIGURE D.6. - MAJOR COMPONENT LOCATIONS



- 1 . CRADLE ASSEMBLY
2. ROTOR, BLOWER, AND BEARING ASSEMBLY
3. STATOR ASSEMBLY
4. BRUSH AND BRUSH HOLDER ASSEMBLY
5. CONTROL BOX WELDED ASSEMBLY
6. REACTOR ASSEMBLY
7. OUTPUT TERMINAL ASSEMBLY
8. OUTPUT PANEL ASSEMBLY

TABLE OF CONTENTS -THEORY OF OPERATION SECTION-

Theory of Operation	Section E
Power Supply Operation	E-1 - E-3
Engine, Excitation, Rotor and Stator	E-1
Rotor Field Feedback and Auxiliary Power.....	E-2
Weld Winding and Reactor	E-3
Auxiliary Power Overcurrent Protection	E-4

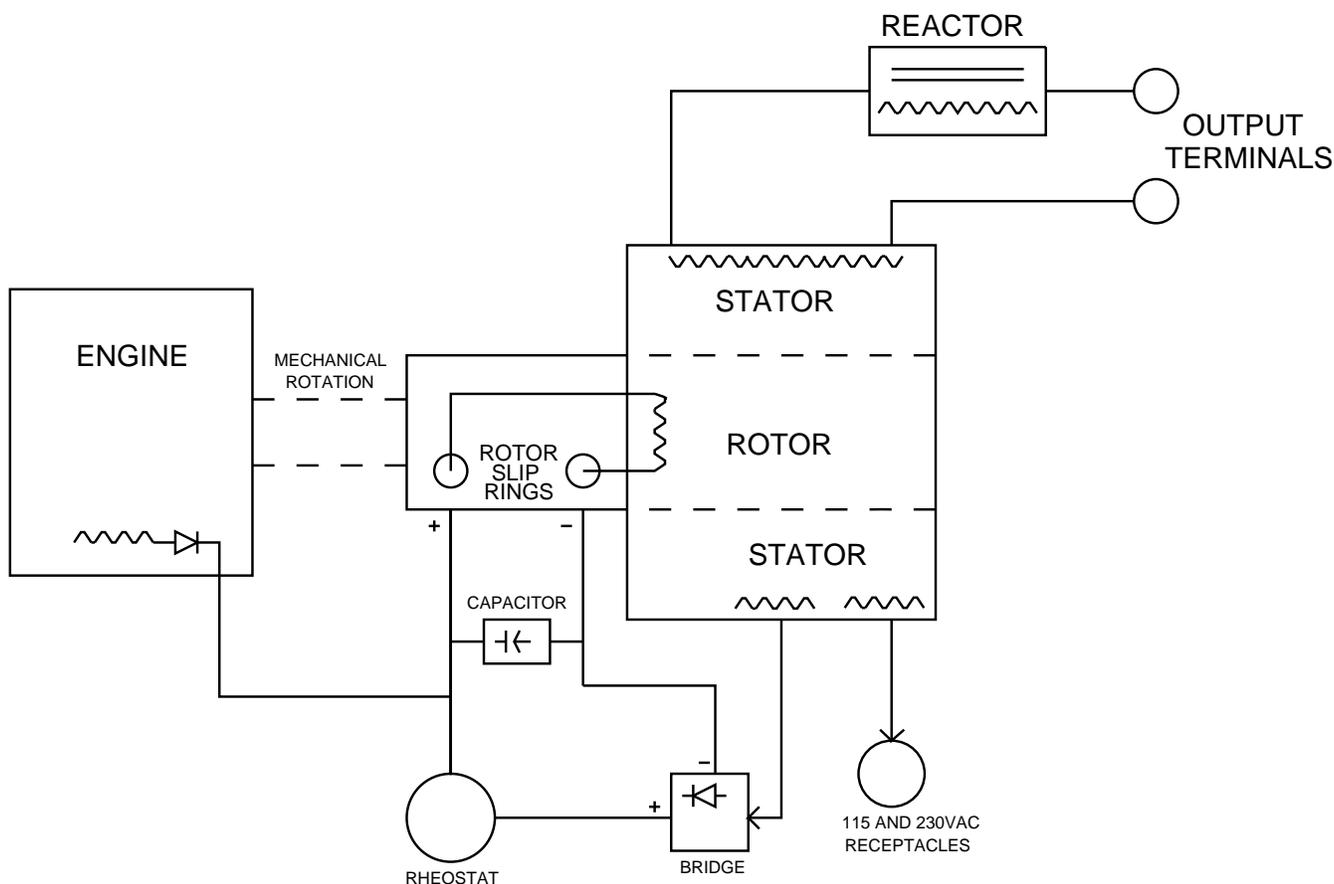


FIGURE E.1 – POWER-ARC 4000 BLOCK LOGIC DIAGRAM

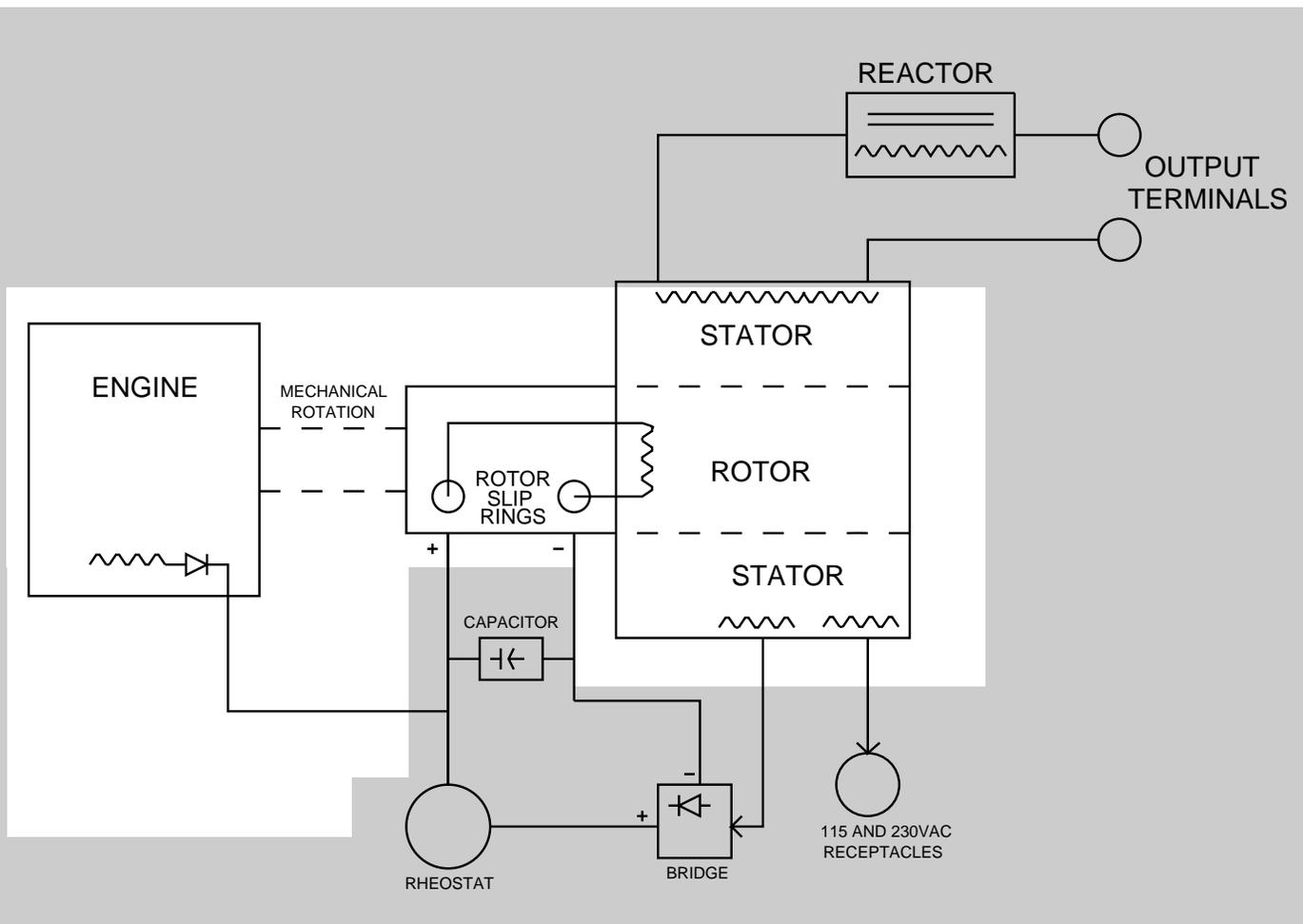
Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

FIGURE E.2 – ENGINE, ROTOR AND STATOR



ENGINE, EXCITATION, ROTOR AND STATOR

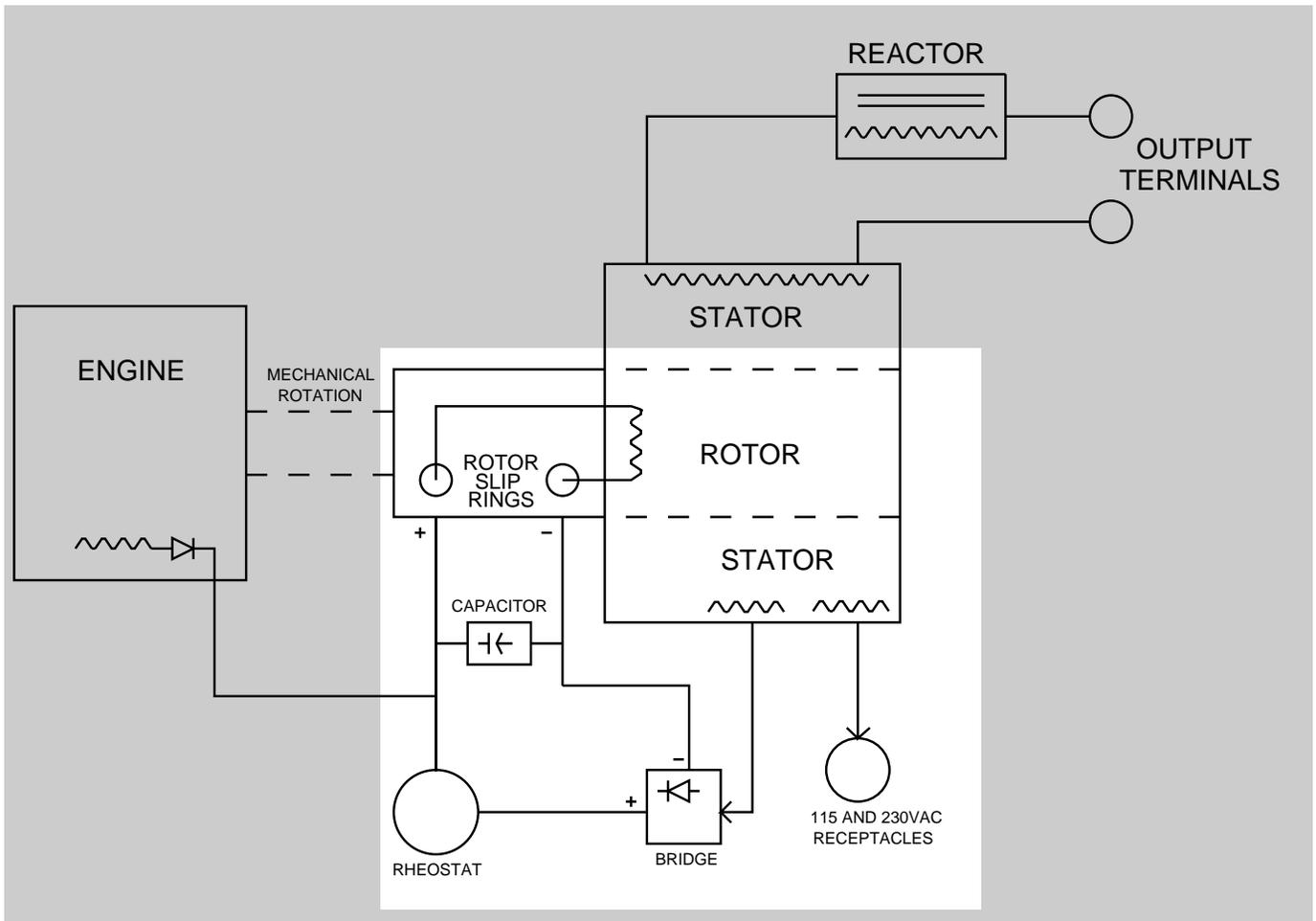
A small DC voltage developed by the flywheel alternator in the Briggs & Stratton engine is fed to the rotating field coil in the rotor via a brush and slip ring configuration. This excitation ("flashing") voltage magnetizes the rotor lamination. The rotor is mechanically coupled to the engine. The rotating magnet induces a voltage in the stationary windings of the main alternator (stator).

Three separate and isolated windings are incorporated in the stator lamination assembly. Each winding set has a different number of turns, producing different magnitudes of AC output voltages. The three windings are the weld winding, the auxiliary power winding and the field feedback winding. The field feedback winding provides rotor current during machine operation. The output of the PowerArc 4000 is dependent on two criteria: the engine RPM and the amount of current in the rotor winding.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion.

THEORY OF OPERATION

FIGURE E.3 – FIELD EXCITATION AND AUXILIARY POWER



ROTOR FIELD FEEDBACK AND AUXILIARY POWER

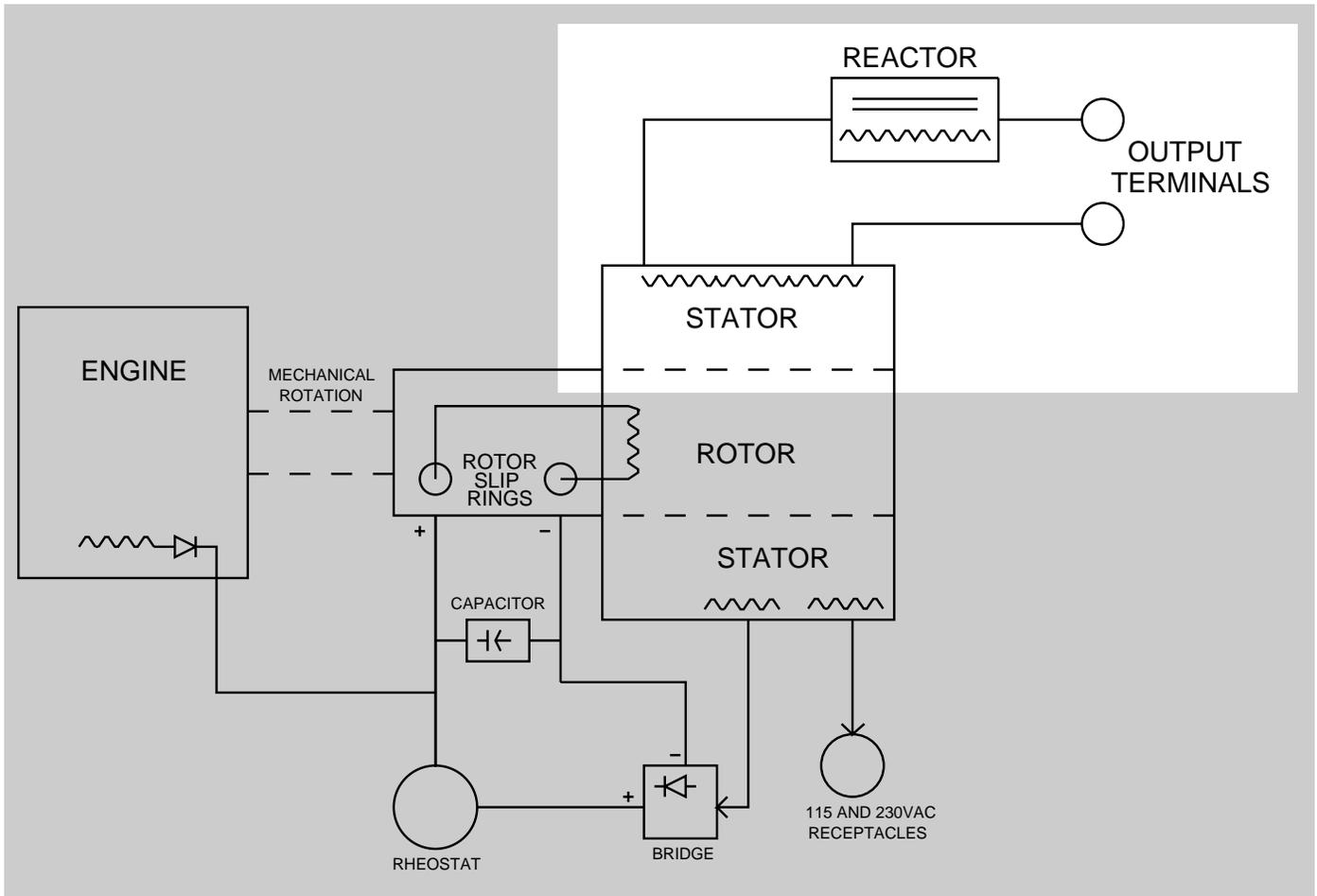
The AC voltage developed in the field winding is fed to the full wave bridge. The DC output of the bridge is filtered by the field capacitor and controlled by the output rheostat.

This filtered and controlled feedback voltage is fed to the rotor winding via the brush and slip ring configuration. As the feedback voltage is increased or decreased, the outputs of the weld and auxiliary windings are likewise increased or decreased.

When full field voltage is applied to the rotor and the engine is running at high speed (3700 RPM), a 230 VAC voltage is developed in the stator auxiliary winding. This winding is tapped to provide 115 VAC. The two voltages (115 VAC and 230 VAC) are connected to the appropriate receptacles and offer 4000 watts (total) of AC power.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion.

FIGURE E.4 – WELDING OUTPUT SHADE



WELD WINDING AND REACTOR

The AC voltage developed in the stator weld winding is delivered, through the reactor, to the machine output terminals. The PowerArc 4000 provides the user with 125 amps of constant current AC welding for stick electrodes. The reactor stores energy, and this energy is released into the welding arc when the AC voltage passes through the zero point. In this manner the reactor enhances and stabilizes the AC welding arc. The reactor is designed to provide optimum welding characteristics when used with the recommended electrodes.

AUXILIARY POWER OVERCURRENT PROTECTION

The 4000 watt auxiliary power winding and circuitry is protected from an overload condition by two 20 amp circuit breakers. The circuit breakers are located below the output receptacles. They can be manually reset.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion.

TABLE OF CONTENTS

TROUBLE SHOOTING & REPAIR SECTION

Troubleshooting & Repair Section.....	Section F
Safety Precautions.....	F-1
How to Use Troubleshooting Guide.....	F-1
Troubleshooting Guide.....	F1 - F-9
Test Procedures	
Rotor Voltage Test	F-10
Rotor Resistance Test.....	F-12
Engine Throttle Adjustment Test.....	F-15
Oscilloscope Waveforms	
Normal Open Circuit Weld Voltage Waveform	F-18
Normal Open Circuit Weld Voltage Waveform (115 VAC Supply).....	F-19
Typical Weld Output Waveform - Machine Loaded	F-20
Replacement Procedures	
Brush Removal and Replacement	F-21
Rheostat Removal and Replacement	F-23
Capacitor and Diode Bridge Removal and Replacement.....	F-25
Stator/Rotor Removal and Replacement (Kit S20925)	F-27
Retest After Repair	F-32

Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric Factory Trained Personnel. Unauthorized repairs performed on this equipment may result in danger to the technician and machine operator and will invalidate your factory warranty. For your safety and to avoid Electrical Shock, please observe all safety notes and precautions detailed throughout this manual.

This Troubleshooting Guide is provided to help you locate and repair possible machine malfunctions. Simply follow the three-step procedure listed below.

Step 1. LOCATE PROBLEM (SYMPTOM). Look under the column labeled " PROBLEM (SYMPTOMS)". This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. Symptoms are grouped into three main categories: Welding Problems, Engine Problems, and Output Problems.

Step 2. PERFORM EXTERNAL TESTS. The second column, labeled "POSSIBLE AREAS OF MISADJUSTMENT(S)", lists the obvious external possibilities that may contribute to the machine symptom. Perform these tests/checks in the order listed. In general, these tests can be conducted without removing the case wrap-around cover.

Step 3. PERFORM COMPONENT TESTS. The last column, labeled "Recommended Course of Action lists the most likely components that may have failed in your machine. It also specifies the appropriate test procedure to verify that the subject component is either good or bad. If there are a number of possible components, check the components in the order listed to eliminate one possibility at a time until you locate the cause of your problem.

All of the referenced test procedures referred to in the Troubleshooting Guide are described in detail at the end of this chapter. Refer to the Troubleshooting and Repair Table of Contents to locate each specific Test Procedure. All of the referred to test points, components, terminal strips, etc., can be found on the referenced electrical wiring diagrams and schematics. Refer to the Electrical Diagrams Section Table of Contents to locate the appropriate diagram.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-888-935-3877.

TROUBLESHOOTING GUIDE

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Major physical or electrical damage is evident.	Contact the Lincoln Electric Service Department at (216) 383-2531 or 1-888-935-3877.	

CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-888-935-3877.

Return to Section TOC

Return to Master TOC

TROUBLESHOOTING GUIDE

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
No weld output and no auxiliary output - engine runs normally.	1. The generator brushes may be worn or faulty. See the Maintenance section of this manual or contact your local Lincoln Electric Authorized Field Service Facility.	<ol style="list-style-type: none"> 1. Perform the Rotor Voltage Test. 2. If the rotor voltage is zero to 3 VDC, check the flywheel alternator and associated wires 200A, 202, and 202A for continuity. The voltage from lead 200A to ground should be at least 18 to 21 VDC at high idle (3700 RPM). Normal voltage is 46 VDC. If the voltage is low or missing, the flywheel alternator may be faulty. See the wiring diagram. 3. Check lead 201B (green) for continuity (zero ohms) to ground. See wiring diagram. 4. The field capacitor (C1) or bridge (D1) may be faulty. Test or replace. 5. Test the rheostat (R1). Normal resistance is 3.3 ohms. See the Rheostat Replacement drawing. 6. The rotor may be faulty. Perform the Rotor Resistance Test.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-888-935-3877.

TROUBLESHOOTING GUIDE

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
<p>No weld output - auxiliary power (230 - 115 VAC) operates normally - engine runs normally.</p>	<ol style="list-style-type: none"> 1. Check the open circuit voltage (OCV) at the welder output terminals. If OCV is okay, go to Step 2, below. <p>If OCV is not present at the welder output terminals, contact your local Lincoln Electric Authorized Field Service Facility.</p> <ol style="list-style-type: none"> 2. Check the welding cables, clamps and electrode holder for loose or broken connections. 	<ol style="list-style-type: none"> 1. Check continuity (zero ohms) of lead W1A (black) from output terminal to reactor (L1). See the Wiring Diagram. 2. Check continuity (zero ohms) of lead W2 (black) from output terminal to stator winding. See the Wiring Diagram. 3. Check continuity (zero ohms) of lead W1 (black) from reactor (L1) to stator winding. See the Wiring Diagram. 4. Check reactor (L1) for continuity of winding. See the Wiring Diagram. 5. Check the stator for continuity of winding. See the Wiring Diagram. 6. Make certain the reactor and/or stator are NOT grounded. Minimum acceptable resistance to ground is 500 K-ohms.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-888-935-3877.

Return to Section TOC

Return to Master TOC

TROUBLESHOOTING GUIDE

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
No auxiliary power - welding output is normal - engine runs normally.	<ol style="list-style-type: none"> 1. Check circuit breakers CB1 and CB2. Reset if tripped. 2. Make sure that the control rheostat (R1) is set at "GENERATOR" (maximum). 3. Check for loose or faulty plug at power receptacle. 	<ol style="list-style-type: none"> 1. Check the auxiliary power receptacles and associated wires for loose or faulty connections. 2. Check the continuity (zero ohms) of leads 3, 3A (black); 6, 6A (yellow); and 5 (white) from the receptacles to the stator windings. See the Wiring Diagram. 3. Make sure lead 5 (white) is grounded to the machine frame (zero ohms). 4. Check for an open or grounded auxiliary winding in the stator, 6 (yellow) to 3 (black). See the Wiring Diagram.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-888-935-3877.

TROUBLESHOOTING GUIDE

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Low weld output and low auxiliary output.	<ol style="list-style-type: none"> 1. The generator brushes may be worn. See the Maintenance section of this manual or contact your local Lincoln Electric Authorized Field Service Facility. 2. The engine RPM may be low. 	<ol style="list-style-type: none"> 1. Perform the Rotor Voltage Test. 2. If the rotor voltage is low, the field capacitor (C1) or bridge (D1) may be faulty. Test or replace. 3. Check the rheostat (R1). Normal resistance is 3.3 ohm. See the Rheostat Replacement drawing. 4. The rotor may be faulty. Perform the Rotor Resistance Test. 5. The engine RPM may be low. Perform the Engine Throttle Adjustment Test. 6. If engine idle RPM is okay, the engine may have lost horsepower and be in need of major repair.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-888-935-3877.

Return to Section TOC
 Return to Master TOC

TROUBLESHOOTING GUIDE

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
Engine will not start.	<ol style="list-style-type: none"> 1. Make sure the piecing stop switch is NOT touching the spark plug boot. 2. Check spark plug boot and wire for loose or faulty connection. 3. Make sure that the fuel shutoff valve is in the farthest upward position. 4. Make certain that the engine has adequate fuel and oil. 5. Adjust the choke to prevent carburetor flooding. 6. The recoil starter may not be engaged with the engine. gently hit the blower housing and/or pull the rope to its fully extended position and rapidly wiggle it. Repeat until the clutch engages with the engine shaft and resistance is felt. 	<ol style="list-style-type: none"> 1. Check the fuel line for breaks or obstructions. Replace the fuel filter. DO NOT RUN THE ENGINE WITHOUT AN IN-LINE FUEL FILTER. 2. The spark plug may be faulty. Replace. 3. Service the engine as outlined in the Maintenance section of this manual. 4. The engine magneto may be faulty. Consult Briggs & Stratton owner's manual. 5. The engine may be faulty. Replace.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-888-935-3877.

TROUBLESHOOTING & REPAIR

TROUBLESHOOTING GUIDE

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
Engine will not stop running.	<ol style="list-style-type: none"> 1. The piercing stop switch may not be contacting the spark plug. Make certain that the pointed end of the lever firmly contacts the spark plug tip. 	<ol style="list-style-type: none"> 1. Be sure the piercing stop switch is securely mounted to the engine.
Engine runs erratically or stops running.	<ol style="list-style-type: none"> 1. Check the spark plug boot and wire for loose or faulty connection. 2. The spark plug may be faulty. Replace. 3. The fuel and air mixture may be out of adjustment. Consult Briggs & Stratton owner's manual. 4. The fuel supply may be contaminated with water. 	<ol style="list-style-type: none"> 1. The engine may require service to the head or carburetor.
Engine sputters but will not start.	<ol style="list-style-type: none"> 1. The spark plug may be faulty. 2. The fuel supply may be contaminated with water. 3. The air filter may be clogged. Replace. 4. The fuel and air mixture may be out of adjustment. 	Consult Briggs & Stratton owner's manual.

CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-888-935-3877.

ROTOR VOLTAGE TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-888-935-3877 (WELD).

TEST DESCRIPTION

This test will determine if the correct DC voltage is being applied to the rotor at maximum engine speed (3700 RPM). This information will aid the technician in determining if the generator field is operating properly.

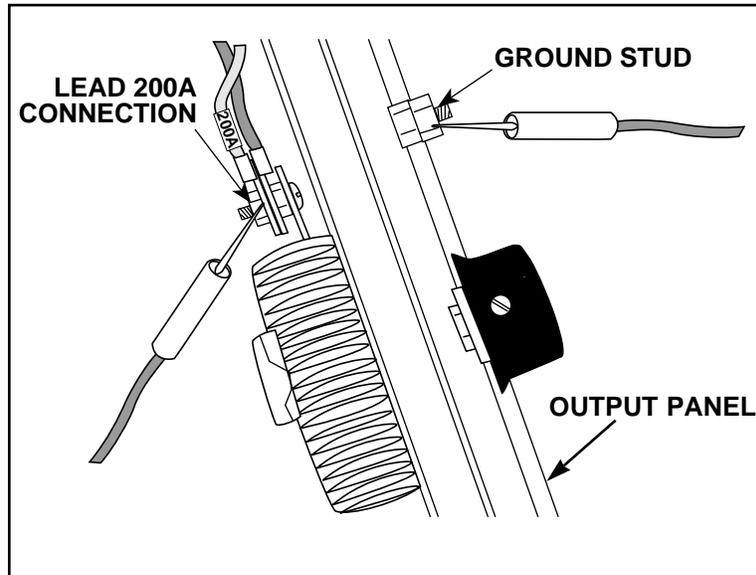
MATERIALS NEEDED

Volt/Ohmmeter
5/16" Nut driver
Wiring Diagram

TROUBLESHOOTING & REPAIR

ROTOR VOLTAGE TEST *(continued)*

FIGURE F.1 - LOCATION OF LEAD 200A FOR ROTOR VOLTAGE TEST



TEST PROCEDURE

1. With the 5/16" nut driver, remove the 4 sheet metal screws that hold the top cover to the control box. Remove the top cover.
2. Start the machine and run it at high idle. Set the output control (rheostat) at the MAXIMUM or GENERATOR setting.
3. Set the volt/ohmmeter at the DC position.
4. Place the positive probe on lead 200A (Blue and Brown wires joined together) where it connects at the back of the rheostat. See Figure F.1 for location. Place the negative probe on the machine ground stud or any other good, unpainted ground.
5. Check the voltage reading on the volt/ohmmeter. It should read 45 - 48 VDC.
6. If the voltage is low or not present, the generator field circuit is not functioning correctly. Proceed with the Rotor Resistance Test. C1, R1, or D1 may also be faulty.
7. If rotor voltage is correct, the generator field is okay. Replace the top cover on the control box. Tighten the 4 sheet metal screws with the 5/16" nut driver.

ROTOR RESISTANCE TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-888-935-3877.

TEST DESCRIPTION

This test will determine if there is a shorted winding in the rotor or if the rotor is grounded.

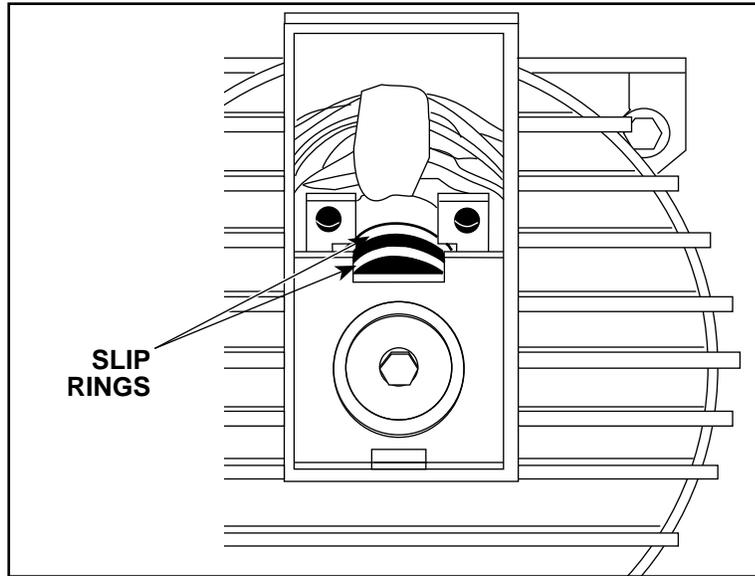
MATERIALS NEEDED

Volt/Ohmmeter
1/4" Nut driver
Small slot head screw driver
Wiring Diagram

ROTOR RESISTANCE TEST *(continued)*

FIGURE F.2

LOCATION OF ROTOR SLIP RINGS - BRUSH HOLDER ASSEMBLY REMOVED



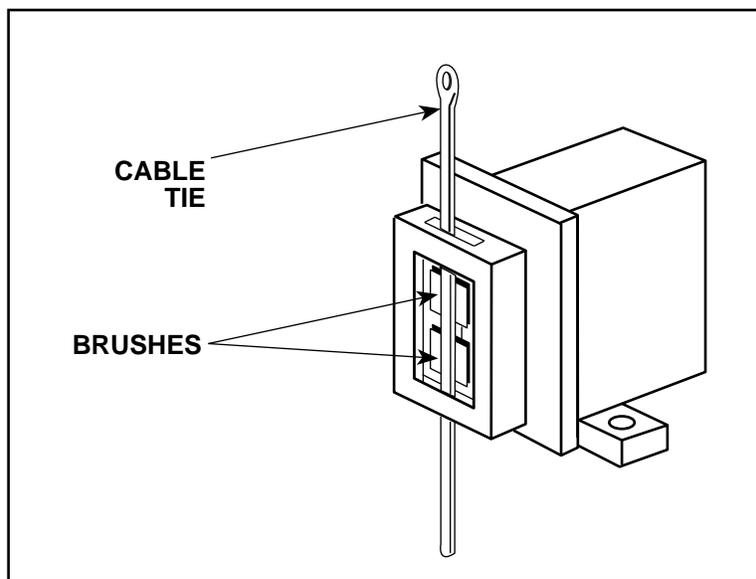
TEST PROCEDURE

1. Conduct the test with the gasoline engine OFF.
2. Remove the spark plug wire to prevent accidental engine kickback or starting.
3. Isolate the rotor electrically by removing the generator brushes. Refer to Figure F.2 as you perform the remaining steps.
4. Open the brush holder assembly cover. Squeeze the 2 tabs and depress the cover at the top with a screw driver or your fingernail. The cover will drop open on its bottom hinge.
5. With the 1/4" nut driver, remove the 2 screws that hold the brush holder assembly in place.
6. Slide the brush holder assembly out and lay it aside, held by the 2 wires attached.
7. Measure the resistance across the rotor slip rings.
 - A. Set the ohmmeter on the low scale (X1).
 - B. Place one meter probe on one of the rotor slip rings. Place the other probe on the other slip ring.
 - C. Check the resistance across the slip rings. It should read 7 - 8 ohms.
8. Measure the resistance to ground.
 - A. Set the ohmmeter on the high scale (X100,000).
 - B. Place one probe on either of the slip rings. Place the other probe on any good, unpainted ground. Use the ground stud or the rotor thru-bolt.
 - C. Check the resistance. It should read very high, at least .5 megohm (500,000 ohms).

If the resistance checks meet the specifications, then the rotor is okay.

ROTOR RESISTANCE TEST *(continued)*

FIGURE F.3 - BRUSHES RETAINED WITH CABLE TIE



9. Reinstall the brush holder assembly after the test. Depress the spring-loaded brushes into the holder and slip a suitable non-metallic, fairly stiff retainer through the slots at the top and bottom of the holder. A cable tie works well; see Figure F.3. This will hold the brushes up so that you can easily install the holder.
10. Slip the holder into position in the generator end bracket. Be careful not to loosen the 2 attached wires.
11. Reinstall and tighten the 2 screws with the 1/4" nut driver.
12. Slowly remove the non-metallic retainer from the brush holder and let the brushes snap back against the slip rings.
13. Snap the brush holder cover back into position.

ENGINE THROTTLE ADJUSTMENT TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-888-935-3877.

TEST DESCRIPTION

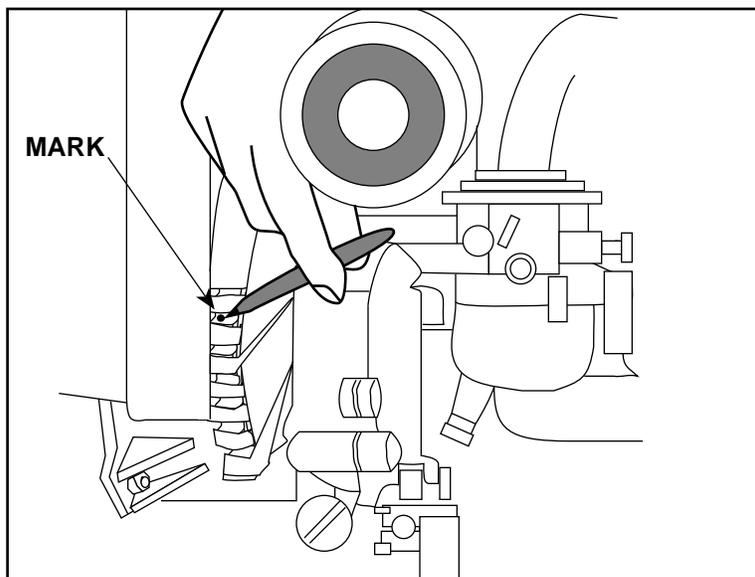
If the machine output is low, this test will determine whether the gasoline engine high idle speed is set for the correct maximum RPM.

MATERIALS NEEDED

- 7/16" open end or box wrench
- Frequency counter or strobe-tach
- Black or red marking pencil

ENGINE THROTTLE ADJUSTMENT TEST *(continued)*

FIGURE F.4 - BLOWER PADDLE MARKED FOR STROBE-TACH METHOD

**TEST PROCEDURE**

This test can be conducted by any of three methods.

Strobe-tach Method:

1. Stop the engine and remove the spark plug wire to prevent accidental kickback or starting.
2. With the black or red marking pencil, place a mark on one of the blower paddles, which can be reached through the vent slots in the end bracket. See Figure F.4.
3. Connect the strobe-tach according to the manufacturer's instructions.
4. Reconnect the spark plug wire and start the engine. Direct the strobe-tach light on the blower paddle and synchronize it to the rotating mark. The tach should read 3700 RPM.
5. Use the 7/16 wrench to turn in the spring-loaded adjustment nut. Increase the high idle speed until the tach reads 3700 RPM. See Figure F.5 for location of the adjustment nut.

Frequency Counter Method:

1. Plug the frequency counter into one of the 115 VAC auxiliary receptacles.
2. Start the engine and check the frequency counter. At the proper RPM (3700), the counter should read 61.7 Hz.
3. Use the 7/16 wrench to turn in the spring-loaded adjustment nut. Increase the high idle speed until the frequency counter reads 61.7 Hz. See Figure F.5 for location of the adjustment nut.

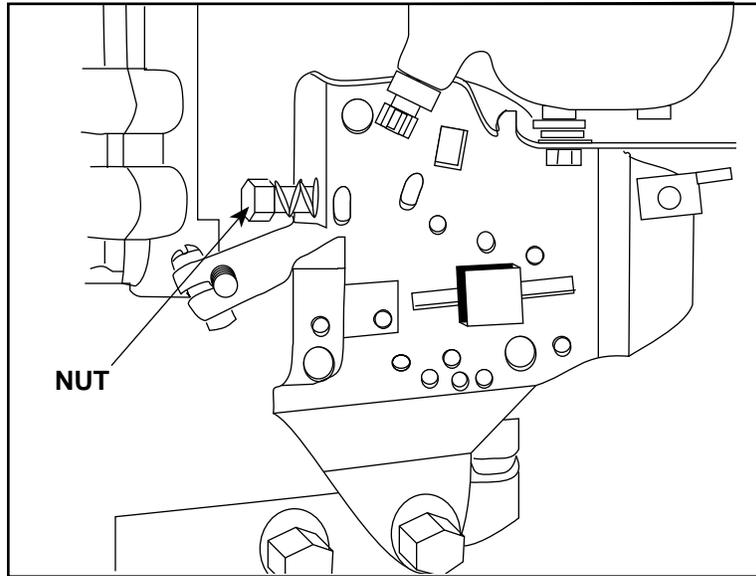
Oscilloscope Method:

1. Connect the oscilloscope according to the manufacturer's instructions. At 3700 RPM, the waveform should exhibit a period of 16.2 milliseconds. Refer to the NORMAL OPEN CIRCUIT VOLTAGE WAVEFORM (115 VAC SUPPLY) HIGH IDLE - NO LOAD in this section of the manual.

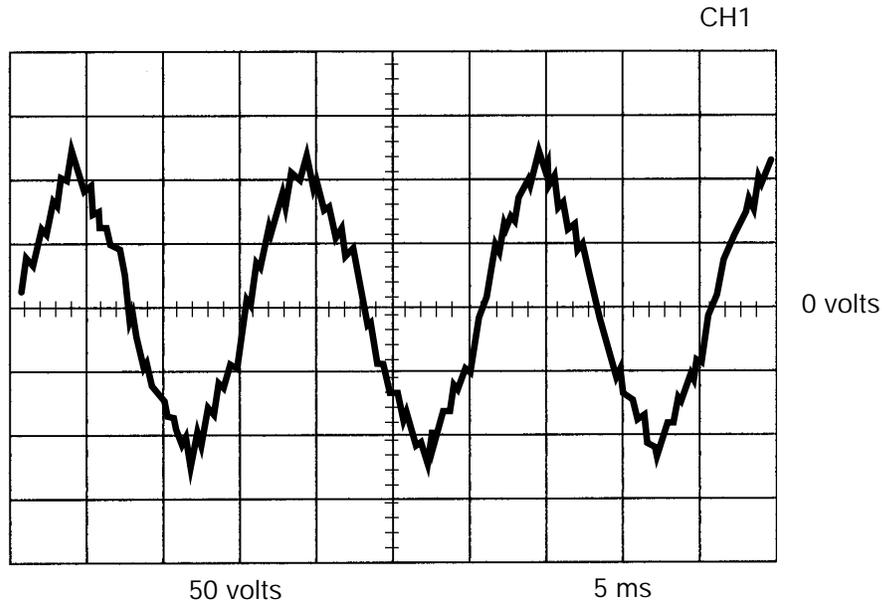
ENGINE THROTTLE ADJUSTMENT TEST *(continued)*

2. Use the 7/16 wrench to turn in the spring-loaded adjustment nut. Increase the high idle speed to adjust the waveform period to 16.2 milliseconds. See Figure F.5 for location of the adjustment nut.

FIGURE F.5 - LOCATION OF ENGINE THROTTLE ADJUSTMENT NUT



**NORMAL OPEN CIRCUIT WELD VOLTAGE WAVEFORM
HIGH IDLE – NO LOAD**



This is the typical AC output voltage generated from a properly operating machine. Note that each vertical division represents 50 volts and that each horizontal division represents 5 milliseconds in time.

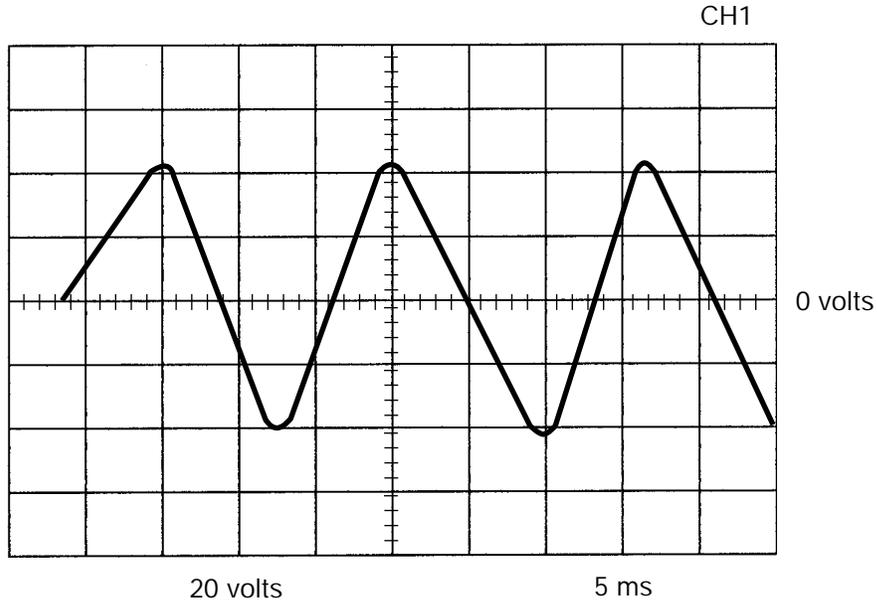
Note: Scope probes connected at machine output terminals.

SCOPE SETTINGS

Volts/Div	50V/Div.
Horizontal Sweep	5 ms/Div.
Coupling	DC
Trigger	Internal

[Return to Section TOC](#)
 [Return to Master TOC](#)

TYPICAL WELD OUTPUT WAVEFORM
MACHINE LOADED



MACHINE LOADED TO 125 AMPS AT 23 VAC

This is the typical AC output voltage generated from a properly operating machine. Note that each vertical division represents 20 volts and that each horizontal division represents 5 milliseconds in time. The machine was loaded with a resistance grid bank.

Note: Scope probes connected at machine output terminals.

SCOPE SETTINGS

Volts/Div	20V/Div.
Horizontal Sweep	5 ms/Div.
Coupling	DC
Trigger	Internal

[Return to Section TOC](#) [Return to Master TOC](#)

TROUBLESHOOTING & REPAIR

BRUSH REMOVAL AND REPLACEMENT

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-888-935-3877.

DESCRIPTION

The following procedure will aid the technician in accessing the generator brushes for maintenance or replacement.

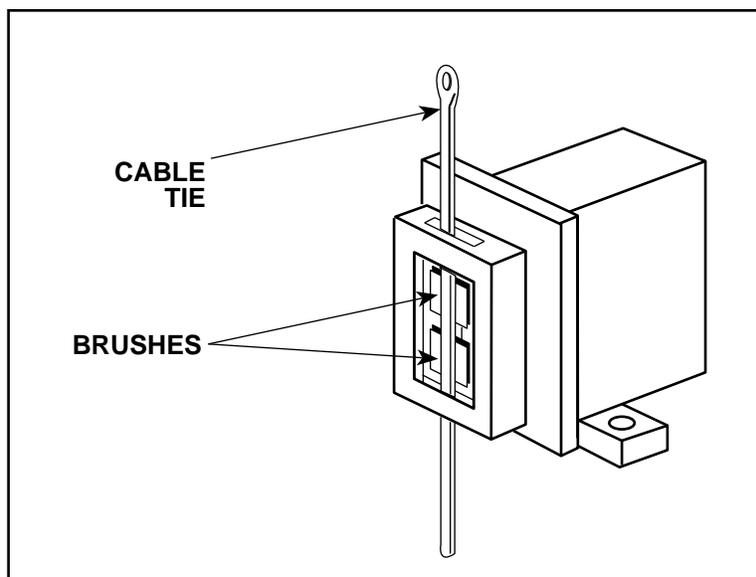
MATERIALS NEEDED

- Small slot head screw driver
- 1/4" Nut driver
- Needle nose pliers

TROUBLESHOOTING & REPAIR

BRUSH REMOVAL AND REPLACEMENT *(continued)*

FIGURE F.6 - BRUSHES RETAINED WITH CABLE TIE



PROCEDURE

1. Remove the spark plug wire.
2. Open the brush holder assembly cover. Squeeze the 2 tabs and depress the cover at the top with a screw driver or your fingernail. The cover will drop open on its bottom hinge.
3. With the 1/4" nut driver, remove the 2 screws that hold the brush holder assembly in place.
4. With the needle nose pliers, gently remove the black and the red wires.
5. To change the brushes, use the slot head screw driver to pop off the plastic retainer on the back of the brush holder assembly.
6. Remove the old brush assemblies and insert the new ones. One corner of the terminal clip is beveled so that the brush can go in only one way.
7. Snap the plastic retainer back onto the brush holder. The brushes may need some repositioning; wiggle them slightly to help them seat properly on the slip rings.

Note: The red wire is inboard. "RED" is marked on the brush holder beside the terminal for the red wire.

BRUSH REMOVAL AND REPLACEMENT *(continued)***PROCEDURE** *(continued)*

8. To reinstall the brush holder assembly, depress the spring-loaded brushes into the holder and slip a suitable non-metallic, fairly stiff retainer through the slots at the top and bottom of the holder. A cable tie works well; see Figure F.6. This will hold the brushes up so that you can easily install the holder.
9. With the needle nose pliers, reinstall the red and the black wires to the appropriate terminals on the brushes. The red wire is inboard.
10. Slip the holder into position in the generator end bracket. Be careful not to loosen the 2 attached wires.
11. Reinstall and tighten the 2 screws with the 1/4" nut driver.
12. Slowly remove the non-metallic retainer from the brush holder and let the brushes snap back against the slip rings.
13. Check the wire connections or clearance and tightness.
14. Snap the brush holder cover back into position.

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

TROUBLESHOOTING & REPAIR

RHEOSTAT REMOVAL AND REPLACEMENT

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-888-935-3877.

DESCRIPTION

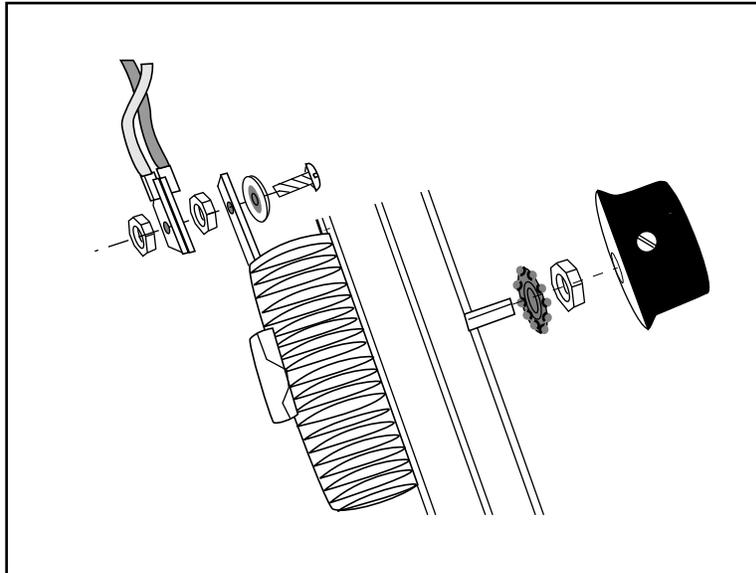
The following procedure will aid the technician in accessing and removing the output control rheostat for maintenance or replacement.

MATERIALS NEEDED

- 5/16" Nut driver
- Small slot head screw driver
- 9/16" Open or box end wrench
- 5/16" Open or box end wrench
- Needle nose pliers
- Wiring Diagram

RHEOSTAT REMOVAL AND REPLACEMENT

FIGURE F.7 - RHEOSTAT REMOVAL



See Figure F.7 for steps 3 - 9.

PROCEDURE

1. Remove the spark plug wire.
2. With the 5/16" nut driver, remove the 4 sheet metal screws that hold the top cover to the control box. Remove the top cover.
3. With the small slot head screw driver, loosen the screw that holds the knob to the rheostat shaft. The shaft has a flat for locating the knob at reassembly.
4. With a 9/16" open or box end wrench, remove the nut that holds the rheostat to the control panel. Support the rheostat with your hand as you turn the nut. There is a shake-proof washer under the nut.
5. Pull the rheostat back out of the control panel and lay it out on its wires to loosen the nuts that hold them.
6. With the 5/16" open or box end wrench, remove the brass nuts from the wire terminals. Support the terminals as you turn the wrench to avoid ripping the terminals from their foundations. Note the wire locations for reassembly.
7. To reinstall the rheostat, replace each of the brass screws. Place a shake-proof star washer under the head, insert the screw into the rheostat and tighten down one nut. Replace the appropriate wires and tighten down the second nut. Again, support the terminals as you turn the wrench to avoid ripping the terminals from their foundations.
8. Reassemble the rheostat to the front of the control panel. Line up the locating tab on the rheostat with the slot on the control panel hole.
9. Reassemble the shake-proof star washer and nut and tighten securely with the 9/16" wrench.
10. Locate the flat spot on the shaft, line up the knob locking screw, push the knob onto the shaft and tighten the screw with the small slot head screw driver.
11. Check the rheostat knob for proper rotation, minimum to maximum.
12. Replace the top cover of the control box and tighten the 4 sheet metal screws with the 5/16" nut driver.

Note: The brass screws are double-nutted with a shake-proof star washer under the screw head.

TROUBLESHOOTING & REPAIR

CAPACITOR AND/OR DIODE BRIDGE REMOVAL AND REPLACEMENT

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-888-935-3877.

DESCRIPTION

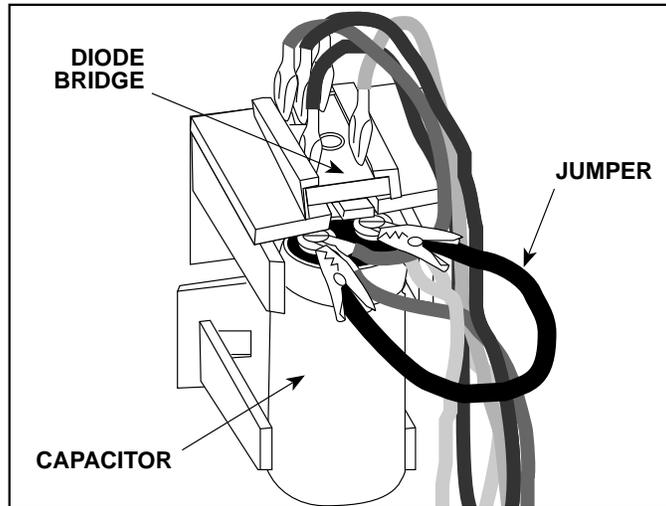
The following procedure will aid the technician in accessing and removing the capacitor and diode bridge for maintenance or replacement of either component.

MATERIALS NEEDED

- 5/16" Nut driver
- Jumper wire with alligator clips on each end for discharging the field capacitor
- Slot head screw driver
- Needle nose pliers
- Wiring Diagram

CAPACITOR AND/OR DIODE BRIDGE REMOVAL AND REPLACEMENT (continued)

FIGURE F.8 - DIODE BRIDGE LOCATION AND DISCHARGING THE FIELD CAPACITOR



PROCEDURE - CAPACITOR REMOVAL AND REPLACEMENT

1. Remove the engine spark plug wire.
2. With the 5/16" nut driver, remove the 4 sheet metal screws that hold the top cover to the control box. Remove the top cover.
3. Discharge the field capacitor by connecting the jumper wire clips on the black and the red wire terminals on the top of the capacitor. See Figure F.8 for location. Leave the clips on for at least 5 seconds, then remove.
4. Both the capacitor and the diode bridge are mounted in a molded plastic holder. To remove it, pull out on the top of the holder, then slide it upward.
5. Snap the capacitor out of the assembly.
6. Loosen the two screws on the top of the capacitor. Lead 202A (Red) attaches to the positive (+) terminal. Leads 201 and 201A (both Black) attach to the negative (-) terminal.
7. To replace the capacitor, reattach the leads to their respective terminals (202A Red to positive (+); 201 and 201A Black to negative (-) and tighten the screws securely. Snap the capacitor back into the molded plastic holder and slide the holder back into position in the panel. Replace the top cover of the control box and tighten down the 4 sheet metal screws with the 5/16" nut driver.

TROUBLESHOOTING & REPAIR

CAPACITOR AND/OR DIODE BRIDGE REMOVAL AND REPLACEMENT (continued)

PROCEDURE - DIODE BRIDGE REMOVAL AND REPLACEMENT

1. To remove the diode bridge, first you will have to remove the field capacitor. Follow Steps 1 - 5 on capacitor removal and replacement procedure.
2. Depress the retainer clip on the molded plastic holder and slide the diode bridge out.
3. With the needle nose pliers, gently remove the 4 wires from the diode bridge.
4. Replace the wires to their appropriate locations on the new diode bridge:

Lead 200 (Red) attaches to the positive (+) terminal. Depending on the bridge used, this corner may be beveled and/or marked with a + sign.

Lead 201 (Black) and 201B (Green) are piggybacked on the negative (-) terminal, which will always be located diagonally across from the positive (+) terminal.

The 2 Blue leads are the AC side of the bridge and attach to the other two corners. Either lead can go on either terminal.

5. Slide the bridge back into the molded plastic holder until the retainer clip snaps it securely in place. Snap the capacitor back into the holder and then slide the unit back into position in the panel.
6. Check that the leads are not grounded and for clearance and tightness.
7. Replace the top cover of the control box and tighten the 4 sheet metal screws with the 5/16" nut driver.

STATOR/ROTOR REMOVAL AND REPLACEMENT

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-888-935-3877.

DESCRIPTION

The following procedure will aid the technician in removing the stator and/or rotor for maintenance or replacement of either component.

MATERIALS NEEDED

Lincoln Electric Rotor Removal Kit (S20925) - **FOR ROTOR REMOVAL ONLY**

- 5/16" nut driver
- 1/2" socket wrench
- 6" socket extension
- Slot head screw driver
- 5/8" socket wrench
- 7/16" socket wrench
- 7/16" open or box end wrench
- 3/4" socket or box end wrench
- 1/2" socket or box end wrench
- Needle nose pliers
- Diagonal cutters
- Torque wrench (ft lbs)
- Babbitt, leather, or wooden mallet
- Volt/ohmmeter
- 12" (long) feeler gauge (.010)

INSTRUCTIONS

For stator removal only, follow steps 1 -17 under STATOR REMOVAL PROCEDURE. For reassembly of stator, go to REASSEMBLY PROCEDURE steps 3 - 18.

For rotor removal, follow the STATOR REMOVAL PROCEDURE, ROTOR REMOVAL PROCEDURE, and REASSEMBLY PROCEDURE.

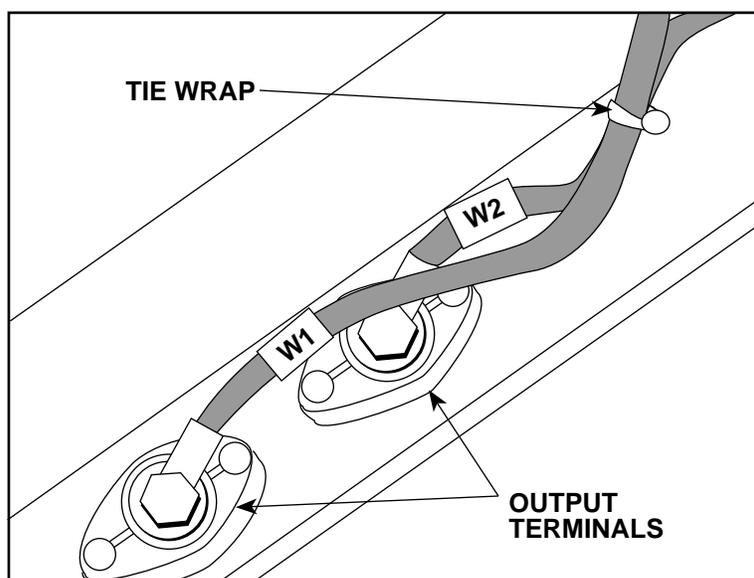
TROUBLESHOOTING & REPAIR

STATOR/ROTOR REMOVAL AND REPLACEMENT *(continued)*

STATOR REMOVAL PROCEDURE

1. Remove engine spark plug wire to prevent accidental kickback or starting.
2. With the 5/16" nut driver, remove the 4 sheet metal screws that hold the top cover to the control box. Remove the top cover.
3. Remove the 4 1/2" nuts and washers that anchor the control box to the stator frame. Two of the nuts also anchor the reactor. The reactor must be moved over to access the front left hand nut anchoring the control box. Be careful not to drop the washers into the machine.
4. Lift up the control box and unscrew the 4 rubber mounts. Set the control box onto the stator frame for the moment.
5. Pull apart the molex coupling that connects the stator to the wiring harness.
6. With the slot head screw driver, remove the 6 sheet metal screws that hold the control panel to the control box - 3 on each side. You may need to use the 5/16" end wrench on the engine side because of limited clearance. Pull the panel away from the control box.
7. With the 9/16" open end wrench, remove lead W1 (Black) from the output terminal. See Figure F.9 for location. With the diagonal cutters, cut the cable tie that holds the two output leads together. Pull lead W2 back out of the way; screw the bolt back into the output terminal hole loosely for reassembly. Set the control panel back on the control box and hold it in place with 1 sheet metal screw in each side.
8. Remove the brush holder assembly. Open the brush holder assembly cover. Squeeze the 2 tabs and depress the cover at the top with a screw driver or your fingernail. The cover will drop open on its bottom hinge. With the 1/4" nut driver, remove the 2 screws that hold the brush holder assembly in place. With the needle nose pliers, gently remove the black and the red wires. Set the brush holder aside. Pull the wires up into the control box.
9. Pull apart the molex coupling for the engine flywheel alternator. This is the single wire on the left side of the machine, running from the engine to the stator.
10. Disconnect lead W1 (Black) that connects to the reactor lead. Replace the nut, splitting lock washer, and flat washer finger tight on the bolt for reassembly.
11. Slide the control panel and box assembly out of the machine cradle. Carefully pull the wire leads down through the box as you remove it. Note that the reactor is loose inside the box and may slide around.

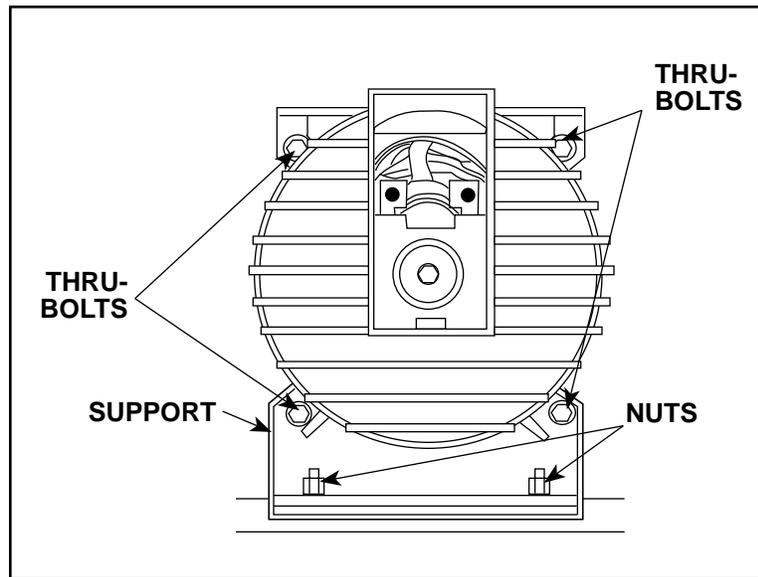
FIGURE F.9 - OUTPUT LEAD LOCATION



STATOR/ROTOR REMOVAL AND REPLACEMENT *(continued)*

12. Slide a short length of 2 X 4 under the engine to support it when the stator is removed.
13. With the 1/2" socket wrench, remove the 2 nuts that hold the stator end bracket support. See Figure F.10 for location. There are 2 split-ring lock washers and 2 flat washers along with the nuts.
14. With the 7/16" socket and 7/16" end wrench, remove the 4 thru-bolts for the generator assembly. See Figure F.10. Note the green grounding wire on the top right hand bolt. It has a flat washer. All 4 bolts have a split-ring lock washer under the head and a shake-proof star washer on the nut side. The bolts must point toward the engine for reassembly.
15. Lift up the stator and slide out the support bracket. The engine will now rest on the 2 X 4.
16. With the babbitt/leather/wooden mallet, tap off the end bracket. Alternate sides as you tap; watch the bearing to judge the amount of movement you're getting.
17. Once the end bracket is off, carefully pull off the stator. **IMPROPER HANDLING OF THE STATOR CAN RESULT IN SHORTED WINDINGS AND/OR LOST OUTPUT.**

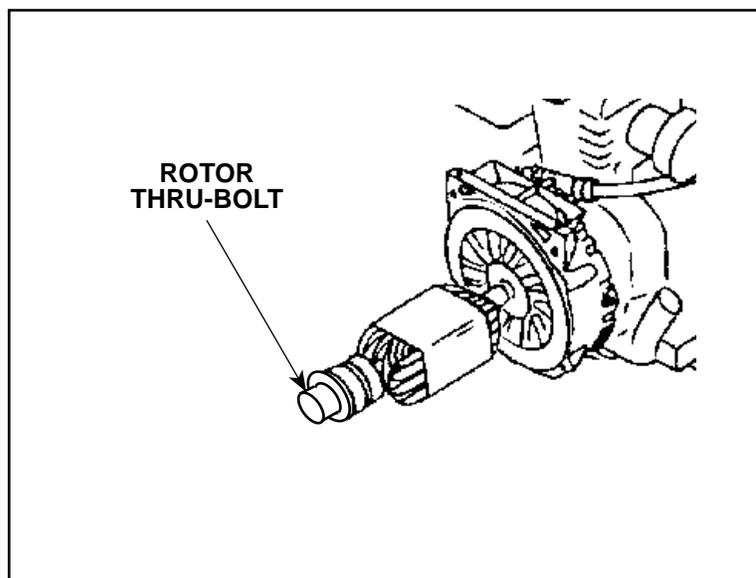
FIGURE F.10 – STATOR END BRACKET SUPPORT AND THRU-BOLTS



TROUBLESHOOTING & REPAIR

STATOR/ROTOR REMOVAL AND REPLACEMENT *(continued)*

FIGURE F.11 - ROTOR WITH STATOR REMOVED



ROTOR REMOVAL PROCEDURE

1. To remove the rotor, double check that the spark plug wire is disconnected. You will be turning the rotor during this procedure, and this could accidentally cause engine kickback.
2. With an impact wrench, remove the rotor thru-bolt. See Figure F.11. If an impact wrench is not available, use the 1/2" box wrench. Hold the rotor with one hand and shock the wrench with the mallet to loosen the thru-bolt. The thru-bolt has a star washer and lock washer, beveled to conform to the rotor shaft. Pull out the thru-bolt.
3. Install the long thru-bolt supplied with Lincoln Electric Rotor Removal Kit S20925. The slot head must face out. Screw in the bolt with the slot head screw driver until the bolt bottoms out on the engine crankshaft, about 3/4".
4. Turning it counterclockwise, screw in the reverse thread bolt from the kit into the rotor shaft until it bottoms out on the thru-bolt.
5. With an impact wrench, tighten the reverse thread bolt until the rotor pops off the engine crankshaft. If an impact wrench is not available, use the 1/2" box wrench. Hold the rotor with one hand and shock the

wrench with the mallet until the rotor pops off the engine crankshaft.

6. Slide the rotor and blower (press-fitted to the rotor) the rest of the way off the crankshaft.

REASSEMBLY PROCEDURE

1. Lubricate the tapered engine crankshaft. Slide the rotor onto the shaft.
2. Coat the rotor thru-bolt threads with Lincoln E177-R retaining compound (Loctite® 277). Place the beveled lock washers onto the thru-bolt and insert it into the rotor shaft. Hold the rotor and tighten the thru-bolt to 22 - 25 ft lbs.
3. Carefully install the stator, with the leads at the 1 o' clock position. IMPROPER HANDLING OF THE STATOR CAN RESULT IN SHORTED WINDINGS AND/OR LOST OUTPUT.
4. Install the end bracket. Slide it on and install the two top thru-bolts loosely to hold the end bracket for the next step.
5. Install the end bracket support.

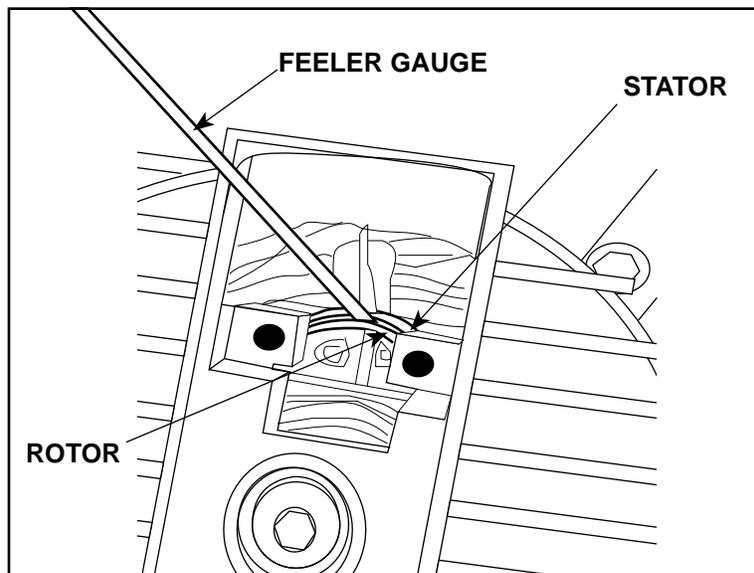
STATOR/ROTOR REMOVAL AND REPLACEMENT (*continued*)

6. Install the bottom two end bracket thru-bolts.

Note: The flat washer goes on the top right hand thru-bolt for the green ground wire.

7. Tap the end bracket with the mallet as necessary to position it. Tighten the bolts to 22 - 25 ft lbs. Alternate tightening in order to pull the assembly together evenly. As you tighten, look through the brush housing access door and watch the bearing to judge end bracket movement and alignment.
8. Check the rotor-stator air gap with the long .010 feeler gauge. The measurement is taken through the brush holder access door; see Figure F12. Turn the engine with the recoil starter rope slightly so that the rotor "iron" is up to take the measurement. (The rotor has two flat sides, which are not measured for air gap.) Slide in the gauge. Then rotate the shaft 180 degrees and measure again. If the gauge does not clear, loosen the four end bracket thru-bolts, reposition the end bracket, retighten the bolts, and recheck the air gap. Repeat until the proper .010 minimum air gap is achieved.
9. Tighten the end bracket support nuts and lock washers. Remove the 2 X 4 engine support.
10. Reinstall the brush holder assembly. Refer to the topic "BRUSH REMOVAL AND REPLACEMENT" in this section of the manual.
11. Slide the control box back into place. Pull the stator and ground wire up through.
12. Remove the control panel (2 screws) and reconnect the output terminal leads (W1, W2). Install a new cable tie to hold the leads together. Reconnect the stator wire/harness moxex coupling. Install the 6 screws that hold the control panel to the box.
13. Connect the engine flywheel alternator coupling.
14. Lift the control box and screw in the rubber mountings. Set the control box onto the mountings.
15. Install the front left hand washer and nut that anchors the control box to the stator frame. Position the reactor and install the remaining washers and nuts.
16. Check all terminal connections for clearance, grounding, and tightness.
17. Replace the top cover to the control box and tighten the 4 nuts.
18. Conduct the "RETEST AFTER REPAIR" procedure, the following topic in this section of the manual.

FIGURE F.12 - CHECKING ROTOR-STATOR AIR GAP



TROUBLESHOOTING & REPAIR

RETEST AFTER REPAIR

Retest a machine:

- If it is rejected under test for any reason that requires you to remove any mechanical part which could affect the machine's electrical characteristics.

OR

- If you repair or replace any electrical components.

ENGINE OUTPUT

	No Load RPM	Load RPM
Maximum Speed	3725	3650
Minimum Speed	3675	3400

WELDER/GENERATOR OUTPUT¹

Output Control	Field Volts	Field Amps	Open Circuit Volts	Load Volts	Load Amps
Maximum	43 - 49	4.8 - 5.8	60 - 63	12 - 25	120 - 125
Minimum	-	-	55 - 60	14 - 27	75 - 85

AUXILIARY POWER RECEPTACLE OUTPUT¹

Output Control	230 Volt Receptacle			115 Volt Receptacle ²		
	Open Circuit Volts	Load Volts	Load Amps	Open Circuit Volts	Load Volts	Load Amps
Maximum	255 - 267	215 - 230	18 - 20	127 - 133	112 - 120	18 - 20

¹ Current Control Dial set at MAXIMUM or GENERATOR.

² Output values of each receptacle can vary within the range shown

NOTES

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

TABLE OF CONTENTS - ELECTRICAL DIAGRAMS -

Electrical Diagrams.....	Section G
PowerArc 4000.....	G-1

Return to Master TOC

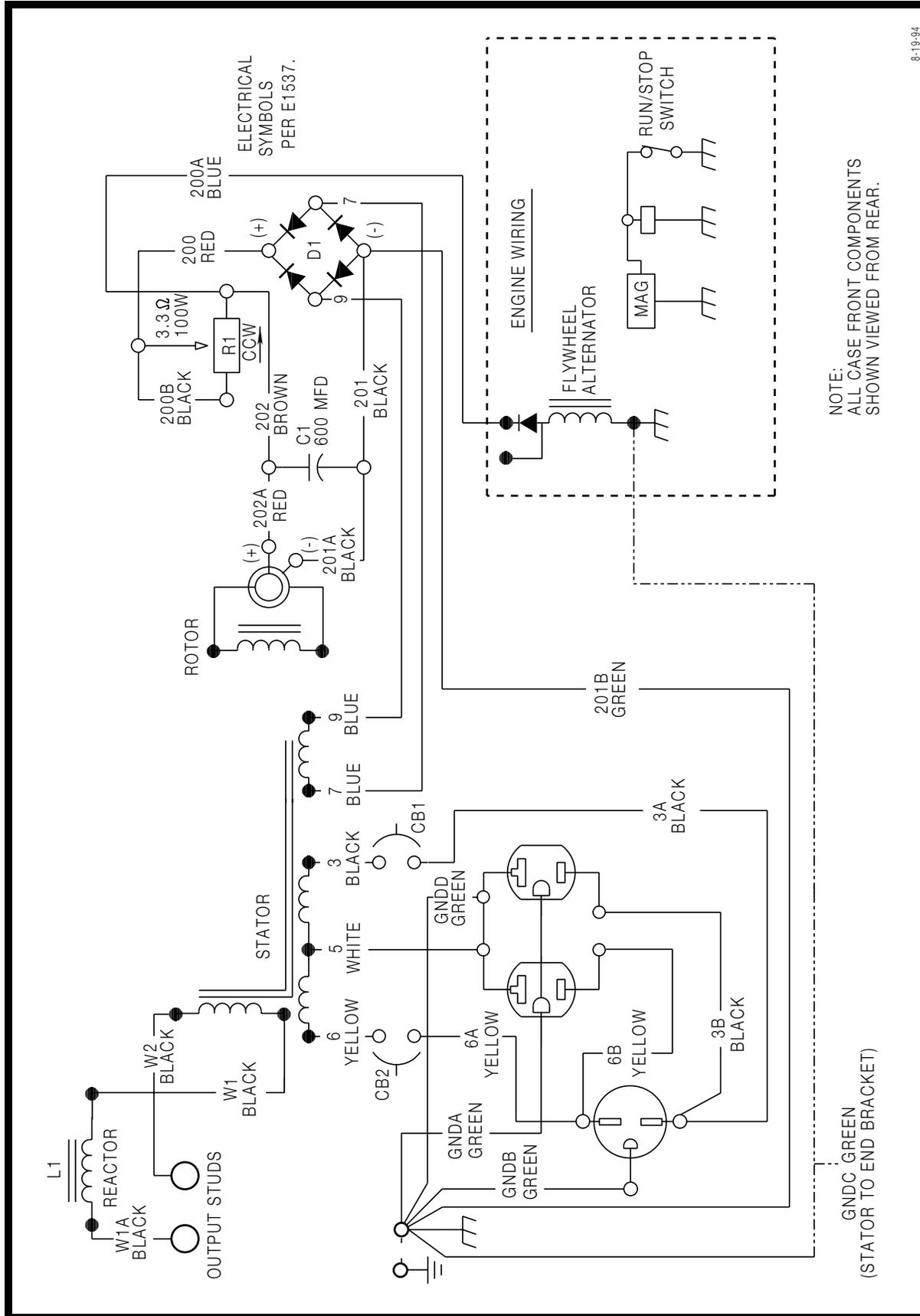
Return to Master TOC

Return to Master TOC

Return to Master TOC

- ELECTRICAL DIAGRAM -

WIRING DIAGRAM – Code 10083



NOTE:
ALL CASE FRONT COMPONENTS
SHOWN VIEWED FROM REAR.

8-19-94

SZ0003

CLEVELAND, OHIO U.S.A.

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The specific diagram for a particular code is pasted inside the machine on one of the enclosure panels.

Return to Section TOC

Return to Master TOC

NOTES

Return to Section TOC Return to Section TOC Return to Section TOC
Return to Master TOC Return to Master TOC Return to Master TOC



NOTES

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Section TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC

Return to Master TOC