



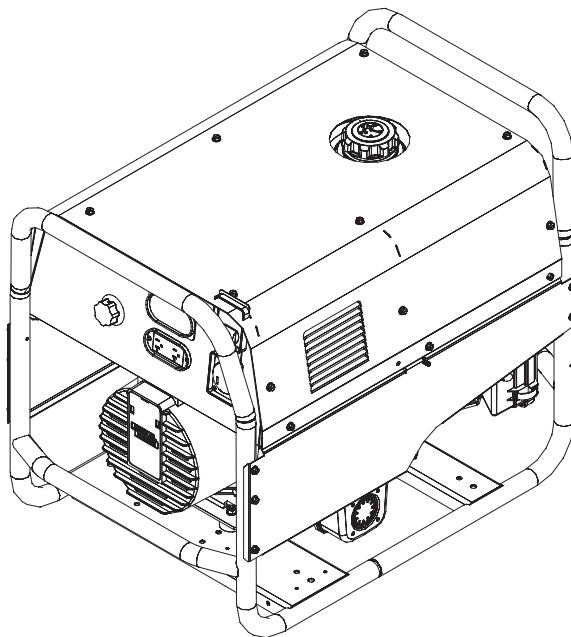
**NOTE:** This manual will cover most of the troubleshooting and repair procedures for the code numbers listed. Some variances may exist when troubleshooting/repairing later code numbers.

## **BULLDOG® 140**

For use with machines having Code Numbers:

**11518, 11688, 11733**

# **SERVICE MANUAL**



**Need Help? Call 1.888.935.3877**  
to talk to a Service Representative

**Hours of Operation:**  
8:00 AM to 6:00 PM (ET) Mon. thru Fri.

**After hours?**  
Use "Ask the Experts" at [lincolnelectric.com](http://lincolnelectric.com)  
A Lincoln Service Representative will contact you  
no later than the following business day.

**For Service outside the USA:**  
Email: [globalservice@lincolnelectric.com](mailto:globalservice@lincolnelectric.com)

## ⚠ 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 PERFORMED ONLY BY QUALIFIED INDIVIDUALS.**



### 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.g. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.



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.



### 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 within applicable OSHA PEL and ACGIH TLV limits 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. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.

5.c. 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.d. 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.e. 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.f. Also see item 1.b.



## WELDING and CUTTING 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.
- 6.i. Read and follow NFPA 51B "Standard for Fire Prevention During Welding, Cutting and Other Hot Work", available from NFPA, 1 Batterymarch Park, PO box 9101, Quincy, Ma 022690-9101.
- 6.j. Do not use a welding power source for pipe thawing.



## 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.

Refer to <http://www.lincolnelectric.com/safety> for additional safety information.

## 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.
  - f. Si on utilise la machine à souder comme une source de courant pour soudage semi-automatique, ces précautions pour le porte-électrode s'appliquent aussi au pistolet de soudage.
2. Dans le cas de travail au dessus du niveau du sol, se protéger contre les chutes dans le cas où on reçoit un choc. Ne jamais enrouler le câble-électrode autour de n'importe quelle partie du corps.
3. Un coup d'arc peut être plus sévère qu'un coup de soliel, 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 aux 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 le 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 pistolage. 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.
11. Pour obtenir de plus amples renseignements sur la sûreté, voir le code "Code for safety in welding and cutting" CSA Standard W 117.2-1974.

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

1. Relier 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.

## Electromagnetic Compatibility (EMC)

### Conformance

Products displaying the CE mark are in conformity with European Community Council Directive of 15 Dec 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility, 2004/108/EC. It was manufactured in conformity with a national standard that implements a harmonized standard: EN 60974-10 Electromagnetic Compatibility (EMC) Product Standard for Arc Welding Equipment. It is for use with other Lincoln Electric equipment. It is designed for industrial and professional use.

### Introduction

All electrical equipment generates small amounts of electromagnetic emission. Electrical emission may be transmitted through power lines or radiated through space, similar to a radio transmitter. When emissions are received by other equipment, electrical interference may result. Electrical emissions may affect many kinds of electrical equipment; other nearby welding equipment, radio and TV reception, numerical controlled machines, telephone systems, computers, etc. Be aware that interference may result and extra precautions may be required when a welding power source is used in a domestic establishment.

### Installation and Use

The user is responsible for installing and using the welding equipment according to the manufacturer's instructions. If electromagnetic disturbances are detected then it shall be the responsibility of the user of the welding equipment to resolve the situation with the technical assistance of the manufacturer. In some cases this remedial action may be as simple as earthing (grounding) the welding circuit, see Note. In other cases it could involve construction of an electromagnetic screen enclosing the power source and the work complete with associated input filters. In all cases electromagnetic disturbances must be reduced to the point where they are no longer troublesome.

Note: The welding circuit may or may not be earthed for safety reasons according to national codes. Changing the earthing arrangements should only be authorized by a person who is competent to access whether the changes will increase the risk of injury, e.g., by allowing parallel welding current return paths which may damage the earth circuits of other equipment.

### Assessment of Area

Before installing welding equipment the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:

- a) other supply cables, control cables, signaling and telephone cables; above, below and adjacent to the welding equipment;
- b) radio and television transmitters and receivers;
- c) computer and other control equipment;
- d) safety critical equipment, e.g., guarding of industrial equipment;
- e) the health of the people around, e.g., the use of pacemakers and hearing aids;
- f) equipment used for calibration or measurement
- g) the immunity of other equipment in the environment. The user shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures;
- h) the time of day that welding or other activities are to be carried out.

## Electromagnetic Compatibility (EMC)

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

### Methods of Reducing Emissions

#### Mains Supply

Welding equipment should be connected to the mains supply according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the mains supply. Consideration should be given to shielding the supply cable of permanently installed welding equipment, in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length. The shielding should be connected to the welding power source so that good electrical contact is maintained between the conduit and the welding power source enclosure.

#### Maintenance of the Welding Equipment

The welding equipment should be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the welding equipment is in operation. The welding equipment should not be modified in any way except for those changes and adjustments covered in the manufacturer's instructions. In particular, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendations.

#### Welding Cables

The welding cables should be kept as short as possible and should be positioned close together, running at or close to floor level.

#### Equipotential Bonding

Bonding of all metallic components in the welding installation and adjacent to it should be considered. However, metallic components bonded to the work piece will increase the risk that the operator could receive a shock by touching these metallic components and the electrode at the same time. The operator should be insulated from all such bonded metallic components.

#### Earthing of the Workpiece

Where the workpiece is not bonded to earth for electrical safety, not connected to earth because of its size and position, e.g., ships hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

#### Screening and Shielding

Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire welding installation may be considered for special applications.<sup>1</sup>

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<sup>1</sup> Portions of the preceding text are contained in EN 60974-10: "Electromagnetic Compatibility (EMC) product standard for arc welding equipment."

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## TECHNICAL SPECIFICATIONS - Bulldog® 140 K2708-1

<b>INPUT - GASOLINE ENGINE</b>					
<u>Manufacturer</u>	<u>Description</u>	<u>Speed</u>	<u>Displacement</u>	<u>Ignition</u>	<u>Capacities</u>
Robin / Subaru EX 30 Code (11518)	1 cyl., 4 cycle air-cooled OHC gasoline 10 HP @ 3600 RPM Aluminum Block with Cast Iron Sleeve	3700 RPM ± 50 RPM at no load	17.51 cu. in. (287 cc)  Bore x Stroke 2.95" x 2.56" (76mm x 65mm)	Manual, Recoil start; Manual choke	Fuel: 6.86 gal. (24.9 l)  Oil: 1.1 qts.(1.0 l)
<b>RATED OUTPUT - WELDER</b>					
<u>Duty Cycle</u>		<u>Amps AC</u>		<u>Volts at Rated Amperes</u>	
30% Duty Cycle		125 Amps AC Constant Current		20 VAC	
60% Duty Cycle		100 Amps AC Constant Current		25 VAC	
<b>OUTPUT - WELDER AND GENERATOR</b>					
<u>Welding Ranges</u>		<u>Welder Open Circuit Voltage</u>		<u>AC Auxiliary Power</u>	
70 - 140 Amps AC		66 VAC Max.		4000 Continuous Watts  5500 Surge Watts	
<b>PHYSICAL DIMENSIONS</b>					
<u>Height</u>		<u>Width</u>		<u>Depth</u>	
25.47 in.		21.12 in.		31.48 in.	
646 mm		536.45 mm		799.59 mm	
				<u>Weight</u>	
				205 lb.	
				93 kg	

BULLDOG® 140



## SAFETY PRECAUTIONS

Read this entire installation section before you start installation.



### 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 Bulldog® 140, 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 Bulldog® 140 must 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 Bulldog® 140 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 a gasoline stabilizing additive 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 oil per the engine manual.
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.

**STACKING**

Bulldog® 140 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 Bulldog® 140 should be lifted by two people. (See **Specification** section for weight). The LowLift™ grab bars on both ends make lifting easier.

**PRE-OPERATION ENGINE SERVICE**

Read and understand the engine operating and maintenance instructions supplied with this machine before you operate the Bulldog® 140.

**⚠ WARNING**

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

**OIL** 

The Bulldog® 140 is shipped with the engine filled with SAE 10W30 oil. **CHECK THE OIL LEVEL BEFORE YOU START THE ENGINE.** This is an added precaution. Do not screw in dipstick when checking oil level. **DO NOT OVERFILL.** Be sure the fill plug is tight after servicing.

**FUEL** 

Fill the fuel tank with clean, fresh, regular grade (minimum 87 octane lead free gasoline. DO NOT MIX OIL WITH GAS. The Bulldog® 140 capacity is approximately 6.8 gallons (25.74 Liter). **DO NOT OVERFILL,** allow room in the fuel tank for fuel expansion.

**SPARK ARRESTER**

Some federal, state or local laws may require gasoline engines to be equipped with exhaust spark arresters when they are operated in certain locations where unarrested sparks may present a fire hazard. The standard muffler included with this machine does qualify as a spark arrester.


**Bulldog® 140 Typical Fuel Consumption**

	Robin / Subaru 10 HP Carb. Certified EX 30
No Load 3750 RPM ±100 R.P.M.	.31 Gallons/Hour (1.16 Liters/Hour)
AC CC Weld Output 80 Amps @ 25 Volts	.53 Gallons/Hour (2.02 Liters/Hour)
Auxiliary Power 4000 Watts (120/240 Volts)	.70 Gallons/Hour (2.65 Liters/Hour)


**⚠ WARNING**

- Stop engine when fueling.
- Do not smoke when fueling.
- Keep sparks and flame away from tank.
- Do not leave unattended while fueling.
- Wipe up spilled fuel and allow fumes to clear before starting engine.
- Do not overfill tank, fuel expansion may cause overflow.
- Close fuel shut off valve when transporting or not operating machine.


**GASOLINE FUEL ONLY**




**GASOLINE**  
can cause fire or explosion



**ENGINE EXHAUST**  
can kill



**MOVING PARTS**  
can injure



• Keep away from moving parts.  
• Do not operate with panels open or guards off.

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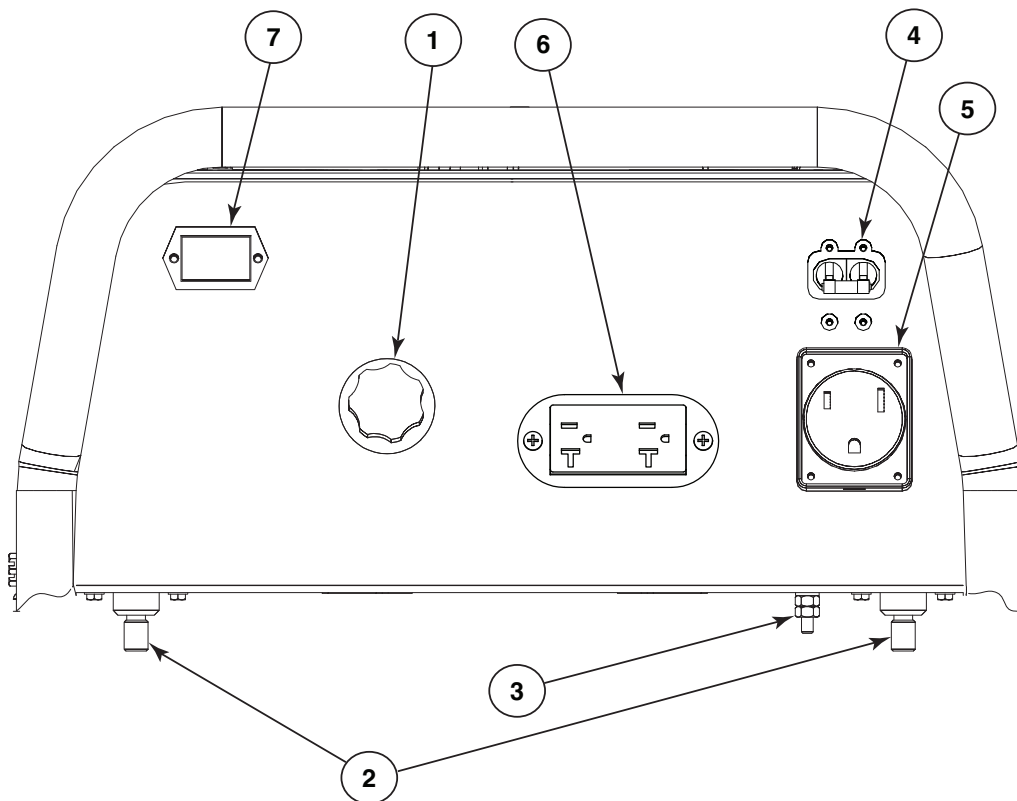
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## Bulldog® 140 OUTPUT CONNECTIONS

FIGURE A.1



- 1. CURRENT CONTROL DIAL
- 2. WELD OUTPUT TERMINALS (2)
- 3. GROUND STUD
- 4. CIRCUIT BREAKER 20 Amp
- 5. RECEPTACLE - 240 VOLT, 50 AMP
- 6. DUPLEX RECEPTACLE (2)- 120 VOLT, 20 AMP
- 7. HOUR METER

### 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	125 Amps 30% Duty Cycle
0-50 ft (0-15m)	6 AWG
50-100 ft (15-30 m)	5 AWG
100-150 ft (30-46 m)	3 AWG
150-200 ft (46-61 m)	2 AWG
200-250 ft (61-76m)	1 AWG

## Cable Installation

Install the welding cables to your Bulldog® 140 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 Bulldog® 140 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.

## ELECTRICAL CONNECTIONS

### MACHINE GROUNDING

Because this portable engine driven welder  creates its own power, it is not necessary to connect its frame to an earth ground, unless the machine is connected to premises wiring (home, shop, etc.)


To prevent dangerous electric shock, other equipment to which this engine driven welder supplies power must:



## WARNING

1. **Be grounded to the frame of the welder using a grounded type plug.**
2. **Be double insulated.**

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

When the Bulldog® 140 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.

Ground fault protection is recommended for hand held equipment.



## WARNING

**Never operate this machine with damaged or defective cords. All electrical equipment must be in safe condition.**

## AUXILIARY POWER RECEPTACLES

The control panel of the Bulldog® 140 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 5,500 surge watts of single-phase AC power.

## PREMISES WIRING

The Bulldog® 140 is not recommended for premises wiring.

The Bulldog® 140 does not have a combined 120/240 volt receptacle and cannot be connected to a premises as described in other Lincoln literature.

Remember that the Bulldog® 140 is intended only for backup, intermittent use power.

Certain electrical devices cannot be powered by the Bulldog® 140. Refer to **Table A.2** for these devices.

## CIRCUIT BREAKERS



Auxiliary power is protected by circuit breakers. 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 Bulldog® 140 could overheat and/or cause damage to the equipment being used.**

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**CAUTION**

Certain Electrical devices cannot be powered by the Bulldog® 140. See Table A.2.

**TABLE A.2**  
**ELECTRICAL DEVICE USE WITH THE Bulldog® 140.**

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. <b>DO NOT RUN THESE DEVICES WITHOUT ADDITIONAL RESISTIVE TYPE LOADS.</b>
Inductive	Single-phase induction motors, drills, well pumps, grinders, small refrigerators, weed and hedge trimmers	These devices require large current inrush for starting. (See <b>Table B.1</b> , 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 <b>SHOULD BE SAFE</b> 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. <b>DO NOT USE THESE DEVICES WITH A Bulldog® 140.</b>

The Lincoln Electric Company is not responsible for any damage to electrical components improperly connected to the Bulldog® 140.

**BULLDOG® 140**





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## SAFETY INSTRUCTIONS

Read and understand this entire section before operating your Bulldog® 140.



### 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.



### 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 Bulldog® 140 is a generator/welder designed for home use and other non-commercial applications. As a generator it can supply up to 4,000 continuous watts (or 5,500 surge watts) of 120/240 volt, single-phase AC power. As a welder it provides 125 amps of AC constant 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 by two people.

The Lincoln warranty covers the Bulldog® 140 (excluding the engine) for 3 years from the date of purchase. The engine is covered by the engine manufacturer's warranty policy.

## RECOMMENDED APPLICATIONS

### GENERATOR

The Bulldog® 140 gives 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 Bulldog® 140 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 Bulldog® 140 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 gasoline engine controls include a recoil starter, choke, and rotary stop switch. See **ENGINE OPERATION** in the OPERATION section of this manual and the engine owner's manual for details about starting, running, stopping, and breaking in the gasoline engine.

## WELDING CAPABILITY

The Bulldog® 140 is rated 125 amps, 20 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 also capable of higher duty cycles at lower output currents. 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 Bulldog® 140 can weld with all 3/32 and most 1/8 inch diameter Lincoln AC electrodes.

BULLDOG® 140



## LIMITATIONS

- The Bulldog® 140 is not recommended for any processes besides those that are normally performed using stick welding (SMAW) procedures.
- The Bulldog® 140 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 welder/generator controls are located on the Output Control Panel. Gasoline engine controls are mounted on the engine. See Figure B.1 and the figures in engine operation section.

## WELDER/GENERATOR CONTROLS

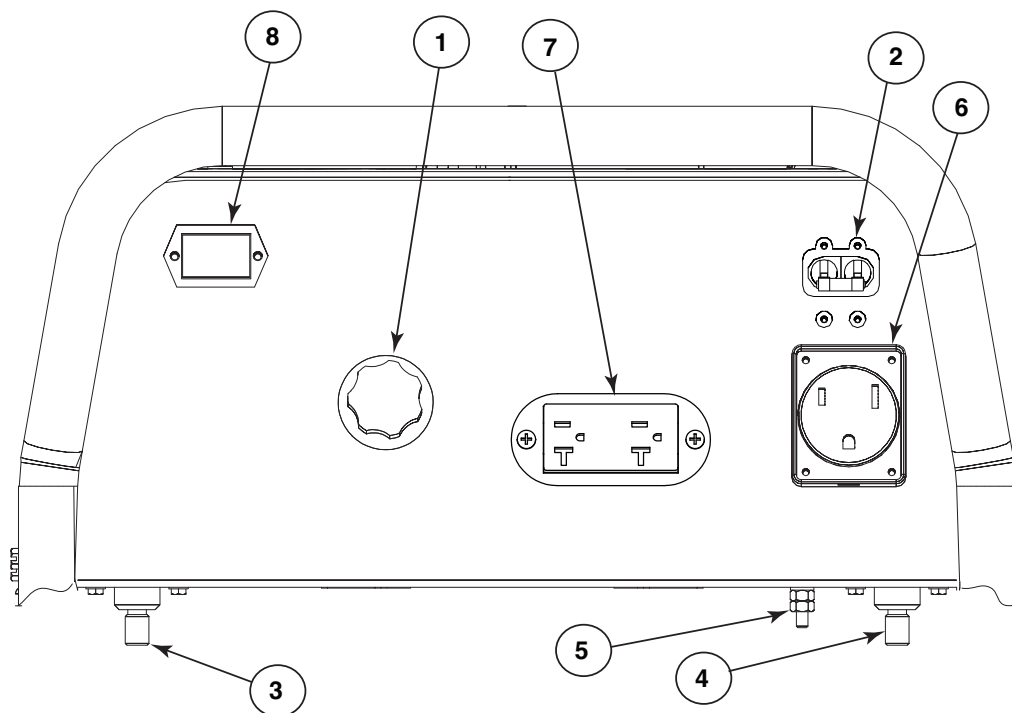
See Figure B.1 for the location of the following features:

1. **CURRENT CONTROL DIAL:** Adjusts continuous current output. The amperages on the dial correspond to the approximate amperages needed for specific Lincoln welding electrodes.
2. **20 AMP CIRCUIT BREAKER:** Provide separate overload current protection for the 120 Volt and 240 Volt Receptacles

3. **WELD ELECTRODE OUTPUT TERMINAL:** Provides the connection point for the electrode holder cable.
4. **WELD WORK OUTPUT TERMINAL:** Provides the connection point for the work cable.
5. **GROUND STUD:** Provides a connection point for connecting the machine case to earth ground.
6. **240 VOLT RECEPTACLE:** Connection point for sup 240 Volt power to operate one electrical device.
7. **120 VOLT DUPLEX RECEPTACLES (2):** Connection point for supplying 120 Volt power.
8. **HOUR METER:** Records the time that the engine has run for maintenance purposes.

## OUTPUT PANEL CONTROLS

FIGURE B.1



BULLDOG® 140



## GASOLINE ENGINE CONTROLS

Refer to your engine manual 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 Bulldog® 140. Must be opened before you start the engine.
2. **FUEL TANK AND CAP:** See **TECHNICAL SPECIFICATIONS** for capacity.

**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.  
See **SPARK ARRESTER** in the INSTALLATION section of this manual.
4. **“ON/OFF Switch:** A two position switch located on the rear of the engine. In the “ON”(I) position, the engine ignition circuit is energized and the engine can be started by pulling the recoil rope starter. In the “OFF”(O) position, the electronic ignition is grounded and the engine shuts down.
5. **AIR CLEANER:** Filters intake air to the carburetor. See **ENGINE MAINTENANCE** in the MAINTENANCE section of the engine owner’s manual for details about the specific type of air cleaner to use.
6. **CHOKE:** Provides a richer air/fuel mixture for cold engine starting conditions. See the topic **ENGINE OPERATION**, for details on setting the choke.

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



8. **OIL DRAIN PLUG:** Permits convenient draining of engine oil during maintenance. Both sides of the engine are equipped with an oil drain plug.
9. **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 Bulldog® 140 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 engine manufacturer’s **Operating and Maintenance Instructions** manual that is shipped with the Bulldog® 140.

**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.**

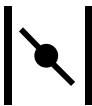
Use clean, fresh, lead-free gasoline. Leaded gasoline may be used if lead-free is not available. However, lead-free gasoline leaves fewer combustion deposits and gives longer valve life. Purchase gasoline in quantities that will be used within 30 days, to assure freshness.

**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. Put the "ON/OFF" Switch in the "ON"(I) position.

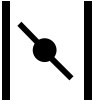
**FOR A "COLD" ENGINE:**

1. Open the fuel shutoff valve.
2. Place the choke lever in the "CHOKE" position. 
3. Pull slightly on the recoil starter handle until resistance is felt.

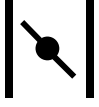
4. Pull the cord rapidly.
5. If the engine does not start, open the choke slightly and pull the starter cord rapidly again.

When the engine starts, gradually open the choke to the "RUN" position. To open the choke fully requires an engine warm-up period of several seconds to several minutes, depending on the temperature. After starting the engine, first open the choke (toward RUN) until the engine just begins to run smoothly. Then open the choke in small steps, allowing the engine to accept small changes in speed and load, until the choke is fully open (in RUN). During engine warm-up the equipment can be operated.

**FOR A "HOT" ENGINE:**

1. Open the fuel shutoff valve.
2. Place the choke lever in the "RUN" position. Closing the choke of a hot engine will flood the carburetor and prevent starting. 
3. Pull slightly on the recoil starter handle until resistance is felt.
4. Pull the cord rapidly.

**FOR BEST ENGINE STARTING:**

- 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 "CHOKE" position more than one time. Repeated pulls on a choked engine will flood the carburetor. 
- If the engine will not start, see the **TROUBLESHOOTING** section of this or the engine owner's manual.

## STOPPING THE ENGINE

1. Remove all welding and generator power loads and let the engine cool by running it for several minutes.
2. Stop the engine by placing the "ON/OFF" switch in the "OFF"(O) position.
3. Close the fuel shutoff valve.

### WARNING

Close the fuel valve when the machine is transported to prevent fuel leakage from the carburetor.

For long periods of storage, turn off the fuel shut-off valve 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

The engine will use a greater amount of oil during its "break-in" period. Check the oil frequently during break-in. For more details, see the **MAINTENANCE** section in the engine owner's manual.

### CAUTION

During break-in, the unit should be subjected to moderate loads. Before stopping the engine, remove all loads and allow the engine to cool several minutes.

## LOW OIL SENSING

This engine has a built in sensor which responds to low oil level (not pressure). When activated, the system will shut the engine down. The engine will not restart until sufficient oil is added. Check oil level frequently and add oil as required to the full mark on the dipstick. (**DO NOT OVERFILL**)

## 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  $\pm 4\%$  frequency variation. Some electronic devices cannot be powered by the Bulldog® 140. Refer to *Table A.2, ELECTRICAL DEVICE USE WITH THE Bulldog® 140*, in the **INSTALLATION** section of this manual.

## GENERAL INFORMATION

The Bulldog® 140 generator is rated at 4000 continuous watts (5500 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 33.3 amps from both sides at once. Up to 16.7 amps can be drawn from the single 240 volt receptacle.

Electrical loads in watts are approximately 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 120 volts, 2 amps will need 240 watts of power ( $120 \times 2 = 240$ ).

You can use **Table B.1, GENERATOR POWER APPLICATIONS**, to determine the wattage requirements of the most common types of loads you can power with the Bulldog® 140. Be sure to read the notes at the bottom of the table.

### TO USE THE Bulldog® 140 AS AN AUXILIARY POWER SUPPLY:

1. Start the gasoline engine. See **ENGINE OPERATION** in this section of the manual and the engine owner's 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 5,500 surge watts or 4,000 Continuous watts. Be sure to start the largest loads first.

**TABLE B.1  
GENERATOR POWER APPLICATIONS**

<b>Suggested Power Applications</b>	<b>Running Watts (Continuous)</b>	<b>*Start-up Watts (Surge)</b>
*Air Compressor - 1 HP	2,000	4,000 - 8,000
*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	1,500	
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 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 tabled equipment that uses a motor, allow up to 2 times the running watts shown above. For example a 1 HP motor requires approximately 1000 watts of power when running but may require  $(2.5 \times 1000) = 2500$  watts or  $(4.0 \times 1000) = 4000$  watts to start.

Multiple loads can be used as long as the total load does not exceed 5,500 surge watts or 4,000 continuous watts. Be certain to start the largest loads first.

Output rating in watts is equivalent to volt-amperes at unity power factor (resistive load) and is calculated as:  $WATTS = VOLTS \times AMPS$  DRAWN. for example a 120 volt device which is rated on its nameplate to draw 2 amps will need  $(120 \text{ VOLTS}) \times (2 \text{ AMPS}) = 240 \text{ WATTS OF POWER}$ . 1 KW = 1000 WATTS.

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## WELDING OPERATION

### ⚠ WARNING

#### GENERAL INFORMATION



**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.

The Bulldog® 140 has a voltage of up to 66 Volts AC which can shock. The Bulldog® 140 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.2, 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 Bulldog® 140 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.2**) 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 Bulldog® 140 for welding, disconnect the welding cables from the weld output terminals. Reattach the flange nuts and leave them on the terminals.

- NOTE:**
1. Welding current is continuously variable with 60% duty cycle applying to output currents 100 Amps and less and 30% duty cycle applying to currents above 100 Amps.
  2. Duty cycle is based on a ten minute period. The welder can be loaded to 125 Amps for three minutes out of every ten minute period or to 100 Amps for six minutes out of every ten minute period.

### CONTROL FUNCTION / OPERATION “Current Control Dial”

Provides welding current adjustment from 70 through 125 Amps.

To obtain maximum weld output, turn the “Current Control Dial” to “**125 Amps**” for either a cold or hot engine. As the machine is used, some welding voltage may decrease at high current settings. If you are welding for long periods of time, the dial may need to be slightly turned upward to provide the same welding results as when the machine was cold.

The numbers listed on the dial correspond to the average amperage needed to weld specific Lincoln rods. Refer to **Table B.2** “Welding Application Guide” and “Electrode Selection Guide” listed on the machine nameplate for proper current and electrode settings.

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## WELDING GUIDELINES

TABLE B.2  
WELDING APPLICATIONS/ELECTRODE SELECTION GUIDE

Material Thickness	Electrode Type	Size	Setting
1/8" and thinner	FLEETWELD® 37	3/32"	90 amps
	<sup>1</sup> AWS E6013		70 amps
	FLEETWELD® 180		90 amps
	AWS E6011 Lincoln 7018 AC 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® ABR	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 Lincoln E7018 AC.

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

Ask for the Lincoln WELD DIRECTORY (Publication C2.10) for a complete listing of all Lincoln stick electrodes available.

<sup>1</sup>AWS = American Welding Society

### ⚠ WARNING

**ARC RAYS can burn.**



• **When using an open arc process, it is necessary to use correct eye, head and body protection.**

### Semi-automatic, Wire Welding With a Lincoln Wire Feeder / Welder

The Bulldog® 140 generator power can be used to supply power up to 4,000 watts continuous input power to a Lincoln Wire Feeder/Welder. The Wire Feeder/Welder is equipped with all the supplies needed for Flux-Cored Arc Welding (FCAW). Also some Wire Feeder/Welders come equipped with the essentials needed for Gas Metal Arc Welding, GMAW, or MIG processes, while others require the purchase of a conversion kit. These products are available where Lincoln products are sold. Contact your local authorized Lincoln representative for more details.

### Stick Welding

Stick welding is probably the most familiar welding process known. A coated ELECTRODE, the weld rod, is clamped into an ELECTRODE HOLDER, an insulated clamping device, which in turn connects to the ELECTRODE CABLE, a heavy wire. The WORK, the metal piece to be welded, is connected to the WORK CABLE, a heavy wire which contains the WORK CLAMP. Quality Lincoln cables use many fine copper wires with a very flexible insulating covering for the electrode and work cables. When properly connected to the OUTPUT STUDS of a high current power source, the electrode melts and bonds the metal being repaired. See "Cable Installation" section for proper cable connection to a Power-Arc.

The Power-Arc provides excellent weld output characteristics when used in combination with Lincoln AC electrodes. Other AC electrodes may also be used.

Follow the settings listed in Table B.2 "Welding Application Guide" and the "Electrode Selection Guide" found on the nameplate of the machine.

### Learning To Stick Weld

**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.**

No one can learn to weld simply by reading about it. Skill comes only with practice. The following pages will help the inexperienced welder understand welding and develop his skill. For more detailed information, order a copy of the book "New Lessons in Arc Welding." (See Book Division section at rear of manual).

The operator's knowledge of arc welding must go beyond the arc itself. He must know how to control the arc, and this requires a knowledge of the welding circuit and the equipment that provides the electric current used in the arc. Figure 3 is a diagram of the welding circuit. The circuit begins where the electrode cable is attached to the welding machine and ends where the work cable is attached to the machine. Current flows through the electrode cable to the electrode holder, through the electrode holder to the electrode and across the arc. On the work side of the arc, the current flows through base metal to the work cable and back to the welding machine. The circuit must be complete for the current to flow. To weld, the work clamp must be tightly connected to clean base metal. Remove paint, rust, etc. as necessary to get a good connection. Connect the work clamp as close as possible to the area you are welding. Avoid allowing the welding circuit to pass through hinges, bearings, electronic components or similar devices that can be damaged.

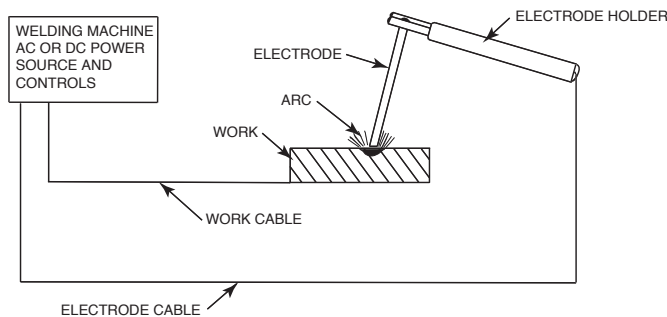


FIGURE 3 - The welding circuit for (Stick) shielded metal arc welding.

The electric arc is made between the work and the tip end of a small metal wire, the electrode, which is clamped in a holder that is held by the welder. A gap is made in the welding circuit (see Figure 3) by holding the tip of the electrode 1/16 - 1/8" (1.6-3.2mm) away from the work or base metal being welded. The electric arc is established in this gap and is held and moved along the joint to be welded, melting the metal as it is moved.

Arc welding is a manual skill requiring a steady hand, good physical condition, and good eyesight. The operator controls the welding arc and, therefore, the quality of the weld made.

### What Happens in the Arc?

Figure 4 illustrates the action that takes place in the electric arc. It closely resembles what is actually seen during welding.

The "arc stream" is seen in the middle of the picture. This is the electric arc created by the electric current flowing through the space between the end of the electrode and the work. The temperature of this arc is about 6000°F (3300°C) which is more than enough to melt metal. The arc is very bright, as well as hot, and cannot be looked at with the naked eye without risking painful and possibly 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, much like water through a garden hose nozzle digs into the earth. The molten metal forms a pool or crater and tends to flow away from the arc. As it moves away from the arc, it cools and solidifies. Slag forms on top of the weld to protect it during cooling.

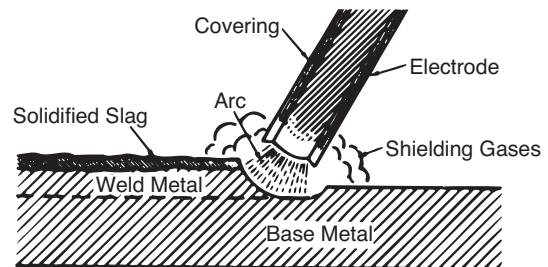


FIGURE 4 - The welding arc.

The function of the covered electrode is much more than simply to carry current to the arc. The electrode is composed of a core metal wire around which has been extruded and baked a chemical covering. The core wire melts into the arc and tiny droplets of molten metal shoot across the arc into the molten pool. The electrode provides additional filler metal for the joint to fill the groove or gap between the two pieces of the base metal. The covering also melts or burns in the arc. It has several functions. It makes the arc steadier, provides a shield of smoke-like gas around the arc to keep oxygen and nitrogen in the air away from the molten metal, and provides a flux for the molten pool. The flux picks up impurities and forms a protective slag. The principle differences between the various types of electrodes are in their coatings. By varying the coating, it is possible to greatly alter the operating characteristics of electrodes. By understanding the differences in the various coatings, you will gain a better understanding of selecting the best electrode for the job you have at hand. In selecting an electrode, you should consider:

1. The type of deposit you want, e.g., mild steel, stainless, low alloy, hardfacing.
2. The thickness of the plate you want to weld.
3. The position it must be welded in (downhand, out-of-position).
4. The surface condition of the metal to be welded.
5. Your ability to handle and obtain the desired electrode.

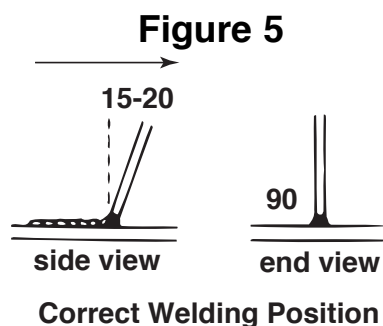
Four simple manipulations are of prime importance. **Without** complete mastery of these four, further attempts at welding are futile. **With** complete mastery of the four, welding will be easy.

## 1. The Correct Welding Position

Illustrated is the correct welding position for right-handed people. (For left-handed people it is opposite.)

Whenever possible, weld from left to right (if right-handed). This enables you to see clearly what you are doing.

Hold the electrode at a slight angle as shown in Figure 5.



## 2. The Correct Way to Strike An Arc

Be sure the work clamp makes good electrical contact to the work.

Lower your headshield and scratch the electrode slowly over the metal, and you will see sparks fly. While scratching, lift the electrode 1/8" (3.2mm) and the arc is established.

**NOTE:** If you stop moving the electrode while scratching, the electrode will stick. Most beginners try to strike the arc by a fast jabbing motion down on the plate. Result: They either stick their electrode or their motion is so fast that they break the arc immediately.

## 3. The Correct Arc Length

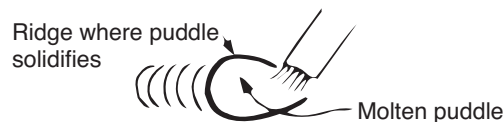
The arc length is the distance from the tip of the electrode core wire to the base metal.

Once the arc has been established, maintaining the correct arc length becomes extremely important. The arc should be short, approximately 1/16 to 1/8" (1.6-3.2mm) long. As the electrode burns off, the electrode must be fed to the work to maintain correct arc length.

The easiest way to tell whether the arc has the correct length is by listening to its sound. A nice, short arc has a distinctive, "crackling" sound, very much like eggs frying in a pan. The incorrect, long arc has a hollow, blowing or hissing sound.

## 4. The Correct Welding Speed

The important thing to watch while welding is the puddle of molten metal right behind the arc. **DO NOT WATCH THE ARC ITSELF.** The appearance of the puddle and the ridge where the molten puddle solidifies indicates correct welding speed. The ridge should be approximately 3/8" (9.5mm) behind the electrode.



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

**IMPORTANT:** It is not generally necessary to weave the arc forward, backward or sideways. Weld along at a steady pace, and you will have an easier time.

**NOTE:** When welding on thin plate, you will find that you have to increase the welding speed, whereas when welding on heavy plate, it is necessary to go more slowly to ensure fusion and penetration.

## PRACTICE

The best way of getting practice in the four skills that enable you to maintain:

1. Correct Welding Position.
2. Correct Way to Strike An Arc.
3. Correct Arc Length.
4. Correct Welding Speed.

is to spend a little more time on the following exercise.

### Use the following:

Mild Steel Plate:	3/16" (4.8mm), or heavier.
Electrode:	1/8" (3.2mm) AWS 6011 (Fleetweld® 180)
Current Setting:	90-125 Amps AC

### Do the following:

1. Learn to strike the arc by scratching the electrode over the plate. Be sure the angle of the electrode is right and be sure to use both hands.
2. When you can strike an arc without sticking, practice the correct arc length. Learn to distinguish it by its sound.
3. When you are sure that you can hold a short, crackling arc, start moving. Look at the molten puddle constantly, and look for the ridge where the metal solidifies.
4. Run beads on a flat plate. Run them parallel to the top edge (the edge farthest away from you). This gives you practice in running straight welds, and also, it gives you an easy way to check your progress. The 10th weld will look considerably better than the first weld. By constantly checking on your mistakes and your progress, welding will soon be a routine matter.

## Common Metals

Most metals found around the farm or small shop are low carbon steel, sometimes referred to as mild steel. Typical items made with this type of steel include most sheet metal, plate, pipe and rolled shapes such as channels, angle irons and "I" beams. This type of steel can usually be easily welded without special precautions. Some steel, however, contains higher carbon. Typical applications include wear plates, axles, connecting rods, shafts, plowshares and scraper blades.

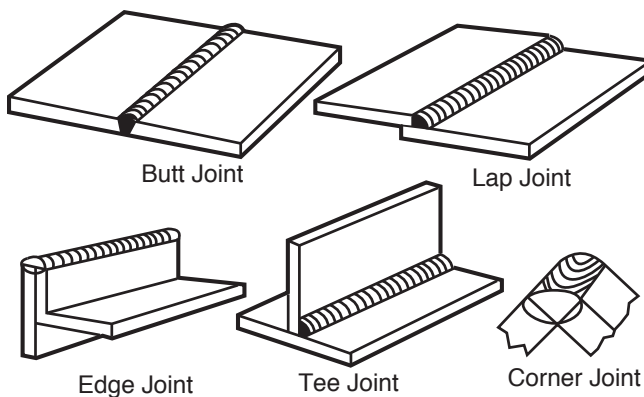
These higher carbon steels can be welded successfully in most cases; however, care must be taken to follow proper procedures, including preheating the metal to be welded and, in some cases, carefully controlling the temperature during and after the welding process. For further information on identifying various types of steel and other metals, and for proper procedures for welding them, we suggest you purchase a copy of "New Lessons in Arc Welding" (See Book Division section).

Regardless of the type of metal being welded, in order to get a quality weld, it is important that it be free of oil, paint, rust or other contaminants.

## Types of Welds

Five types of welding joints are: Butt Joints, Tee Joints, Lap Joints, Edge Joints and Corner Joints.

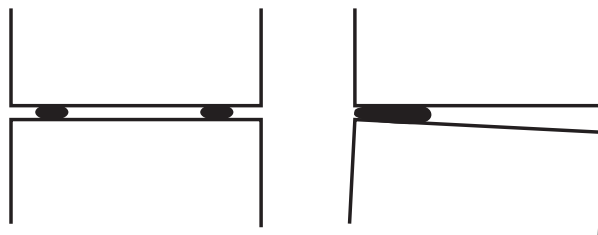
Of these, the Butt Joint and Tee Joint are the most common.



## Butt Joints

Butt Joints are the most widely used Joints. Place two plates side by side, leaving 1/16" (1.6mm) for thin metal to 1/8" (3.2mm) for heavy metal space between them in order to get deep penetration.

Tack the plates at both ends, otherwise the heat will cause the plates to move apart. (See drawing).



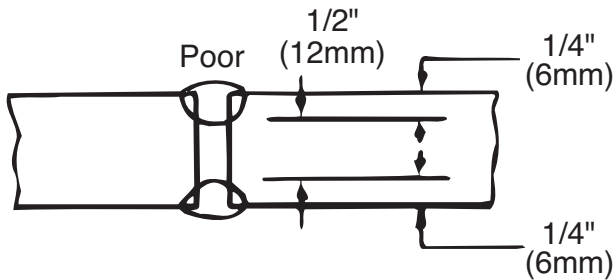
Now weld the two plates together. Weld from left to right (if right-handed). Point the electrode down in the gap between the two plates, keeping the electrodes slightly tilted in the direction of travel.



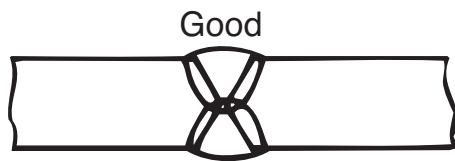
Watch the molten metal to be sure it distributes itself evenly on both edges and in between the plates.

### Penetration

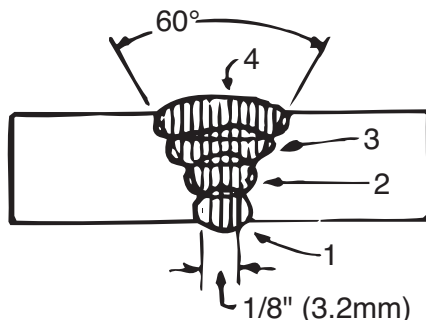
Unless a weld penetrates close to 100%, a butt joint will be weaker than the material welded together.



In this example, the total weld is only 1/2 the thickness of the material; thus, the weld is only approximately half as strong as the metal.



In this example, the joint has been flame beveled or ground prior to welding so that 100% penetration could be achieved. The weld, if properly made, is as strong or stronger than the original metal.

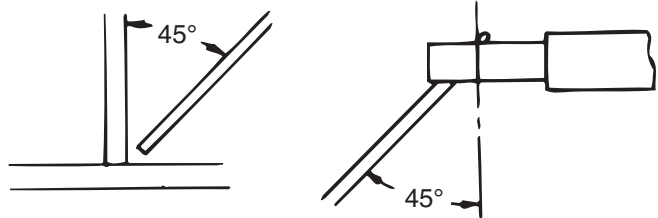


Successive passes must be used to build up butt welds on heavier metal.

### Fillet Joints

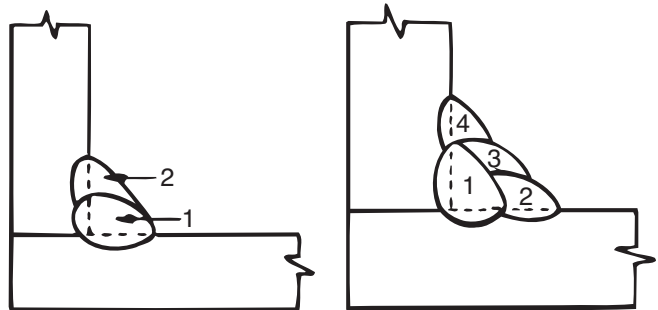
When welding fillet joints, it is very important to hold the electrode at a 45° angle between the two sides, or the metal will not distribute itself evenly.

To make it easier to get the 45° angle, it is best to put the electrode in the holder at a 45° angle, as shown.



### Multiple Pass Welds

Make multiple pass horizontal fillets as shown in the sketch. Put the first bead in the corner with fairly high current. Hold the electrode angle needed to deposit the filler beads as shown putting the final bead against the vertical plate.



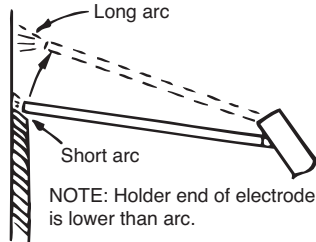
### Welding in the Vertical Position

Welding in the vertical position can be done either vertical-up or vertical-down. Vertical-up is used whenever a large, strong weld is desired. Vertical-down is used primarily on sheet metal for fast, low penetrating welds.

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## Vertical-Up Welding

The problem, when welding vertical-up, is to put the molten metal where it is wanted and make it stay there. If too much molten metal is deposited, gravity will pull it downwards and make it "drip". Therefore, a certain technique has to be followed:



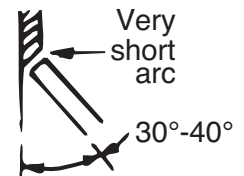
1. Use 1/8" (3.2mm) 90-115 amps or 3/32" (2.5mm) 70 amps AWS 6011.
2. When welding, the electrode should be kept horizontal or pointing slightly upwards. (See drawing above).
3. The arc is struck and metal deposited at the bottom of the two pieces to be welded together.
4. Before too much molten metal is deposited, the arc is SLOWLY moved 1/2-3/4" (12-20mm) upwards. This takes the heat away from the molten puddle, which solidifies. (If the arc is not taken away soon enough, too much metal will be deposited, and it will "drip".)
5. The upward motion of the arc is caused by a very slight wrist motion. Most definitely, the arm must not move in and out, as this makes the entire process very complicated and difficult to learn.
6. If the upward motion of the arc is done correctly with a wrist motion, the arc will automatically become a long arc that deposits little or no metal. (See drawing above.)
7. During this entire process, the ONLY thing to watch is the molten metal. As soon as it has solidified, the arc is SLOWLY brought back, and another few drops of metal are deposited. DO NOT FOLLOW THE UP AND DOWN MOVEMENT OF THE ARC WITH YOUR EYES. KEEP THEM ON THE MOLTEN METAL.

8. When the arc is brought back to the now solidified puddle, IT MUST BE SHORT, otherwise no metal will be deposited, the puddle will melt again, and it will "drip".
9. It is important to realize that the process consists of SLOW, DELIBERATE movements. There are no fast motions.

## Vertical-Down Welding

Vertical-down welds are applied at a fast pace. These welds are therefore shallow and narrow, and are excellent for sheet metal. Do not use the vertical-down technique on heavy metal. The welds will not be strong enough.

1. Use 1/8" (3.2m) or 3/32" (2.5mm) AWS 6011.
2. On thin metal use 70-75 amps. (14 ga. 75 A - 16 ga. 60 A.)
3. Hold the electrode in a 30-45° angle with the tip of the electrode pointing upwards.
4. Hold a VERY SHORT arc, but do not let the electrode touch the metal.
5. An up and down whipping motion will help prevent burn-through on very thin plate.



6. Watch the molten metal carefully.

The important thing is to continue lowering the entire arm as the weld is made so the angle of the electrode does not change. Move the electrode fast enough so that the slag does not catch up with the arc.

### Overhead Welding

Various techniques are used for overhead welding. However, in the interest of simplicity for the inexperienced welder, the following technique will probably take care of his needs for overhead welding:

1. Use 1/8" (3.2mm) 90-105 A or 3/32" (2.5mm) 70 A AWS 6011 electrode on AC.
2. Put the electrode in the holder so it sticks straight out.
3. Hold the electrode at an angle approximately 30° off vertical, both seen from the side and seen from end. (See drawing below.)



It is important to hold a VERY SHORT arc. (A long arc will result in falling molten metal; a short arc will make the metal stay.)

If necessary, and this is dictated by the appearance of the molten puddle, a slight back and forth whipping technique may be used to prevent "dripping".

### Welding Sheet Metal

Welding sheet metal presents an additional problem—burn through. Follow these simple rules:

1. Hold a very short arc. This, together with the proper travel speed, will eliminate burn through.
2. Use 1/8" (3.2mm) or 3/32" (2.5mm) AWS 6011.
3. Use low amperage. 75 A for 1/8" (3.2mm) electrode, 70 A for 3/32" (2.5mm) electrode.

4. Move rapidly enough to stay ahead of the molten slag. A whipping technique may be used to further minimize burn through.
5. If you have a choice, use lap joints rather than fillets or butts; the double thickness effect of a lap joint makes it much easier to weld without burning through.

### Hardfacing (To Reduce Wear)

There are several kinds of wear. The two most often encountered are:

1. Metal to Ground Wear: Plowshares, bulldozer blades, buckets, cultivator shares, and other metal parts moving in the soil.
2. Metal to Metal Wear: Trunnions, shafts, rollers and idlers, crane and mine car wheels, etc.

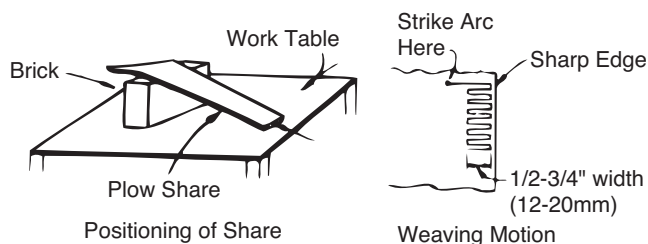
Each of these types of wear demands a different kind of hardfacing electrode.

When applying the proper electrode, the service life of the part will in most cases be more than double. For instance, hardfacing of plowshares results in 3-5 times more acreage plowed.

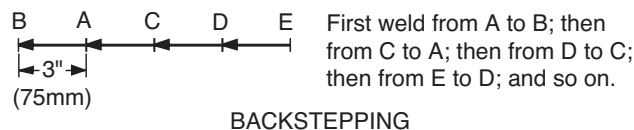
### How to Hardface the Sharp Edge (Metal to Ground Wear)

1. Grind the share, approximately one inch along the edge, so the metal is bright and clean.
2. Place the share on an incline of approximately 20-30°. The easiest way to do this is to put one end of the share on a brick. (See drawings) Most users will want to hardface the underside of the share, but some might find that the wear is on the top side. The important thing is to hardface the side that wears.
3. Use 1/8" (3.2mm) Wearshield at 80-100 A. Strike the arc about one inch from the sharp edge.

4. The bead should be put on with a weaving motion, and it should be  $1/2$ - $3/4$ " (12.7-19.0mm) wide. Do not let the arc blow over the edge, as that will dull the edge. (See drawing below.)



5. Use the back-stepping method. Begin to weld 3" (76mm) from the heel of the share and weld to the heel. The second weld will begin 6" (152mm) from the heel, the third weld 9" (229mm) from the heel, etc.

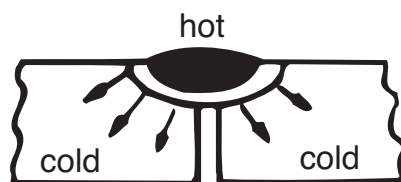


Backstepping greatly reduces the chances for cracking of the share, and it also greatly reduces warping.

**NOTE:** The entire process is rather fast. Many beginners go much too slowly when hardfacing plowshares, running the risk of burning through the thin metal.

### Welding Cast Iron

When welding on a piece of cold cast iron, the tremendous heat from the arc will be absorbed and distributed rapidly into the cold mass. This heating and sudden cooling creates WHITE, BRITTLE cast iron in the fusion zone. (See drawing below.)



White brittle cast iron

This is the reason why welds in cast iron break. Actually, one piece of the broken cast iron has the entire weld on it and the other piece has no weld on it. (See drawing below.)



When breaking the weld stays on one piece

To overcome this, the welding operator has two choices:

1. Preheat the entire casting to 500-1200°F (260-649°C) If the cast iron is hot before welding, there will be no sudden chilling which creates brittle white cast iron. The entire casting will cool slowly.
2. Weld  $1/2$ " (12.7mm) at a time, and do not weld at that spot again until the weld is cool.

This way, no large amount of heat is put into the mass.

Most inexperienced welders will probably use the second method, because they have no way of preheating large castings. Smaller castings can easily (and should) be preheated before welding. A forge, stove, fire, or the Arc Torch are all excellent means of pre-heating.

When using the  $1/2$ " (12.7mm) at a time method, it is recommended to start  $1/2$ " (12.7mm) away from the previous bead and weld into the previous bead. This is called backstepping.

After welding Cast Iron, protect the casting against fast cooling. Put it in a container of warm, dry sand or lime.

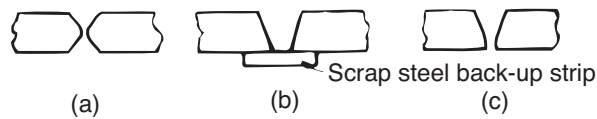
If sand or lime is not available, cover it with sheet metal or any other non-flammable material that will diminish drafts and retain heat.

### Cast Iron Plate Preparation

Wherever practical, the joint to be welded should be "veed" out by grinding or filing to give complete penetration as shown in figures (a), (b) and (c) below. This is especially important on thick castings where maximum strength is required.

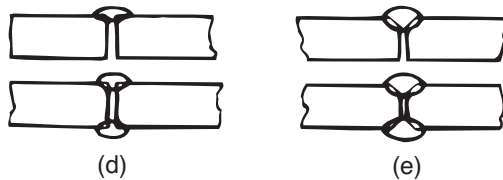


In some instances a back-up strip may be used and plates may be gapped 1/8" (3.2mm) or more, as shown in figure (b).



Three ways to prepare plates where complete penetration is necessary.

On sections where only a sealed joint is required and strength is not important, the joint may be welded after slightly veeing out the seam as shown in figure (d) below.



Single and double beads, with and without beveling for tight, partial strength joints.

## Selecting Electrodes

Which electrode is best for the particular job . . . how do you use it? These are important questions because the cost, quality, and appearance of your work depends on proper electrode selection and application. MILD STEEL ELECTRODES may be classified into the following groups:

### Out-of-Position Group (AWS E6011)

This group includes electrodes which have a snappy, deep penetrating arc and fast freezing deposits.

These electrodes are used for general purpose, all-position fabrication and repair welding. They are also the best choice for pipe welding and sheet metal butt, corner, and edge welds. They can be used for repair work when dirt, grease, plating or paint cannot be completely cleaned from the steel. These electrodes are typically used with motions "A" and "B" (see drawing) for the first pass on vertical-up welds.

### High-Speed Group (AWS E6013)

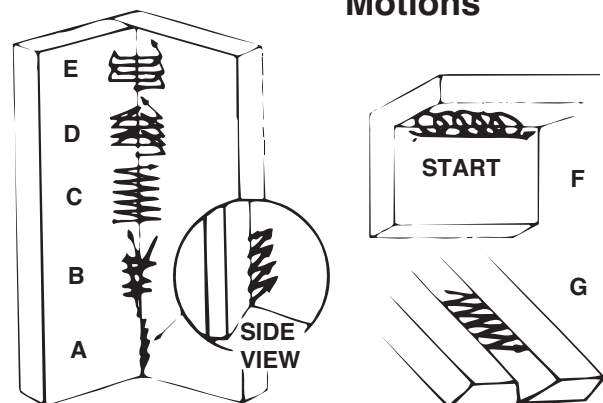
This group includes electrodes which have a moderately forceful arc and deposit rates between those of the out-of-position and high-deposit electrodes.

They are primarily general purpose production electrodes especially for downhill fillets and laps or short and irregular welds that change direction or position. They are also widely used in maintenance and recommended for sheet metal fillet and lap welds. Motion "D" (see drawing) is generally used for vertical-up welding, but motions "A" and "B" are also suitable.

### Low Hydrogen Group (AWS E7018)

These electrodes are generally called "low hydrogen". The name comes from the fact that their coating contains little hydrogen in either moisture or chemical form. Low hydrogen electrodes offer these benefits: outstanding crack resistance, lowest porosity on sulphur bearing steels, and X-ray quality deposit capability. Thus, they are the first choice when welding "problem" steels. E7018 can be used in all positions, with Motion "C" (below) recommended for the first pass on vertical-up welds. NEVER use a whipping technique or a long arc with these electrodes. ALWAYS fill craters by drawing electrode away slowly. ALWAYS keep these electrodes dry. Electrodes, when not used within a few hours after a container is opened, must be stored in heated cabinets.

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## OPTIONS/ACCESSORIES

### LINCOLN ELECTRIC ACCESSORIES

The following options/accessories are available for your Bulldog® 140 from your local Lincoln Distributor.

**Accessory Kit (K875)** – Includes the following:

- 20 Ft.(6.1m) #6 welding cable with lug.
- 15 Ft.(4.6) #6 work cable with lugs.
- 200 amp electrode holder.
- Light duty work clamp.
- Sample electrode pack.
- Welding Gloves.
- Helmet.
- Chipping Hammer and Brush.

**Undercarriage (K2722-1)** - A two-wheeled, hand movable undercarriage is available for field installation.

**Canvas Covers (K2804-1)** - To protect the Bulldog® 140 when not in use. Made from attractive red canvas which is flame retardant, mildew resistant and water repellent.

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

**K2819-1 Lift Bail Kit** - Easily installed kit for lifting the machine with a fixed lifting point.

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# Service Instructions

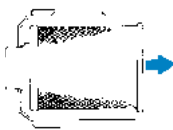
## Single- and Two-Stage Engine Air Cleaners

### 1 Remove the Filter



Rotate the filter while pulling straight out.

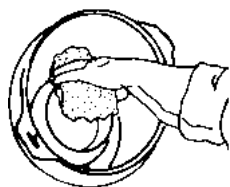
Unfasten or unlatch the service cover. Because the filter fits tightly over the outlet tube to create the critical seal, there will be some initial resistance, similar to breaking the seal on a jar. Gently move the end of the filter back and forth to break the seal then rotate while pulling straight out. Avoid knocking the filter against the housing.



If your air cleaner has a safety filter, replace it every third primary filter change. Remove the safety filter as you would the primary filter. Make sure you cover the air cleaner outlet tube to avoid any unfiltered contaminant dropping into the engine.

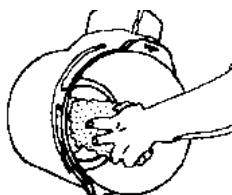
### 2 Clean Both Surfaces of the Outlet Tube and Check the Vacuator™ Valve

Use a clean cloth to wipe the filter sealing surface and the inside of the outlet tube. Contaminant on the sealing surface could hinder an effective seal and cause leakage. Make sure that all contaminant is removed before the new filter is inserted. Dirt accidentally transferred to the inside of the outlet tube will reach the engine and cause wear. Engine manufacturers say that it takes only a few grams of dirt to "dust" an engine! Be careful not to damage the sealing area on the tube.



Outer edge of the outlet tube

Wipe both sides of the outlet tube clean.



Inner edge of the outlet tube

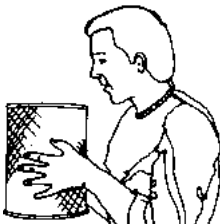
#### If your air cleaner is equipped with a Vacuator Valve

Visually check and physically squeeze to make sure the valve is flexible and not inverted, damaged or plugged.



### 3 Inspect the Old Filter for Leak Clues

Visually inspect the old filter for any signs of leaks. A streak of dust on the clean side of the filter is a telltale sign. Remove any cause of leaks before installing new filter.



### 4 Inspect the New Filter for Damage

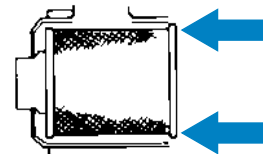
Inspect the new filter carefully, paying attention to the inside of the open end, which is the sealing area. NEVER install a damaged filter. A new Donaldson radial seal filter may have a dry lubricant on the seal to aid installation.



### 5 Insert the New Radial Seal Filter Properly

If you're servicing the safety filter, this should be seated into position before installing the primary filter.

Insert the new filter carefully. Seat the filter by hand, making certain it is completely into the air cleaner housing before securing the cover in place.



The critical sealing area will stretch slightly, adjust itself and distribute the sealing pressure evenly. To complete a tight seal, apply pressure by hand at the outer rim of the filter, not the flexible center. (Avoid pushing on the center of the urethane end cap.) No cover pressure is required to hold the seal. NEVER use the service cover to push the filter into place! Using the cover to push the filter in could cause damage to the housing, cover fasteners and will void the warranty.

If the service cover hits the filter before it is fully in place, remove the cover and push the filter (by hand) further into the air cleaner and try again. The cover should go on with no extra force.

Once the filter is in place, secure the service cover.



#### Caution

NEVER use the service cover to push the filter into place! Using the cover to push the filter in could cause damage to the housing, cover fasteners and will void the warranty.



### 6 Check Connectors for Tight Fit

Make sure that all mounting bands, clamps, bolts, and connections in the entire air cleaner system are tight. Check for holes in piping and repair if needed. Any leaks in your intake piping will send dust directly to the engine!

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## 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 engine owner's manual before working on the Bulldog® 140.

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 the engine owner's manual 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.1** shows engine maintenance replacement parts and numbers.

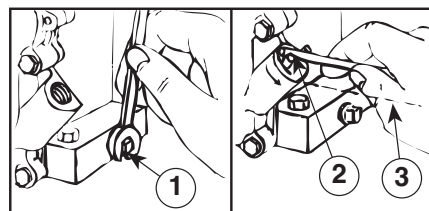


**OIL:** Check the oil level after every 5 hours of operation or daily. **BE SURE TO MAINTAIN THE OIL LEVEL.**

Change the oil the first time after 20 hours of operation. Then, under normal operating conditions, change the oil after every 100 hours or once every 6 months 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 the grade and viscosity recommended in the engine owner's manual.

**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.

## ENGINE ADJUSTMENTS

### ⚠ WARNING

**OVERSPEED IS HAZARDOUS** - The maximum allowable high idle speed for this machine is 3750 RPM, no load. **DO NOT** tamper with the governor components or setting or make any other adjustments to increase the maximum speed. Severe personal injury and damage to the machine can result if operated at speeds above maximum.

Adjustments to the engine are to be made only by a Lincoln Service Center or an authorized Field Service Shop.

### ⚠ CAUTION

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

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.

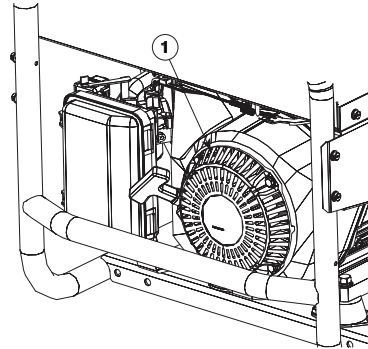
**CLEAN ENGINE:** Remove dirt and debris with a cloth or a brush. Do not clean with a forceful spray of water. Water might contaminate the fuel system.

### ⚠ CAUTION

**Periodically clean the muffler area to remove combustible debris.**

**Clean Finger Guard Area:** If your Bulldog® 140 is equipped with an engine that has a finger guard, you should clean it as often as needed, to remove dirt or debris that may collect on the fin areas. A dirty finger guard can result in overheating and damaging the engine. (See Figure D.2).

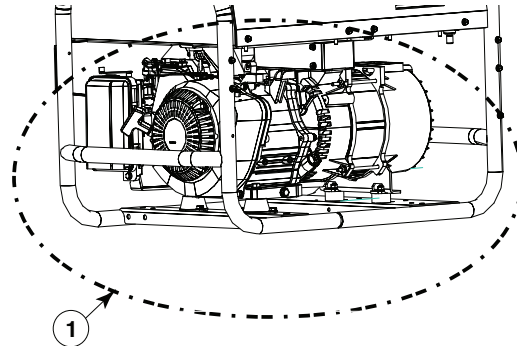
FIGURE D.2 - CLEAN AREA



1. FINGER GUARD AREA

**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



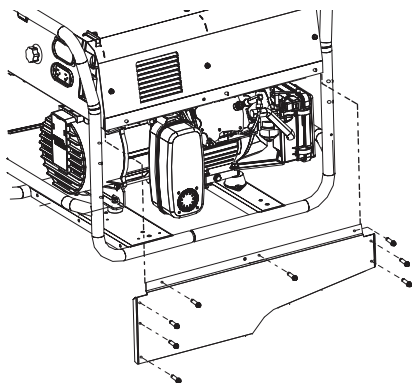
1. REMOVE DIRT AND DEBRIS FROM THIS LOWER AREA.



**SPARK PLUG SERVICE**

To service spark plug, remove the 8 screws securing the side panel. See Figure D.4.

**FIGURE D.4 - SIDE PANEL SCREW LOCATIONS**



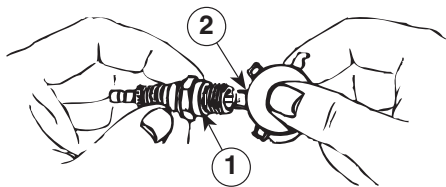
Replace or clean engine maintenance parts per the interval outlined in the engine owner's manual.

**OPERATIONAL CLEARANCE**

Approximately 12-18" of clearance should be around this unit during operation for air flow. Reducing this clearance will reduce air flow to the machine causing operational temperatures to increase. Possible damage to the machine can result if too much air flow is restricted.

**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 .025 inch (.65 mm) with a feeler gauge. See Figure D.5.

**FIGURE D.5 - SET SPARK PLUG GAP**



Use the engine owner's manual for latest Plug Gap Info.

**CLEAN SPARK ARRESTER SCREEN:** Refer to the engine owner's manual that was shipped with your Bulldog® 140 for the proper cleaning instructions.

**TABLE D.1  
ENGINE MAINTENANCE PARTS**

PART	ROBIN / SUBARU PART #
SPARK PLUG (RESISTOR)	Champion RL 86C (GAP .025" [.65mm])
AIR FILTER ELEMENT	279-32612-08

Refer to Table D.1 for engine maintenance parts. The part numbers are accurate at the time of printing. (Verify the current part number by referring to the engine owner's manual.

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## GENERATOR/WELDER MAINTENANCE

**STORAGE:** Store the Bulldog® 140 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.6. It's normal for the brushes and slip rings to wear and darken slightly. Inspect the brushes when a general overhaul is necessary. Remove the brushes and clean the slip rings with fine grit emery paper.

### ⚠ CAUTION

**Do not attempt to polish slip rings while engine is running.**

To reinstall the brushes (Item 5), press them upward and slide a cable tie (Item 6) through the brush holder tabs as shown in figure D.6. Install the brush holder (Item 1) into the bearing end bracket (Item 3) and secure with the screws (Item 4) previously removed. Remove the cable tie and the brushes will seat onto the slip rings and replace bearing bracket end cover (Item 2).

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

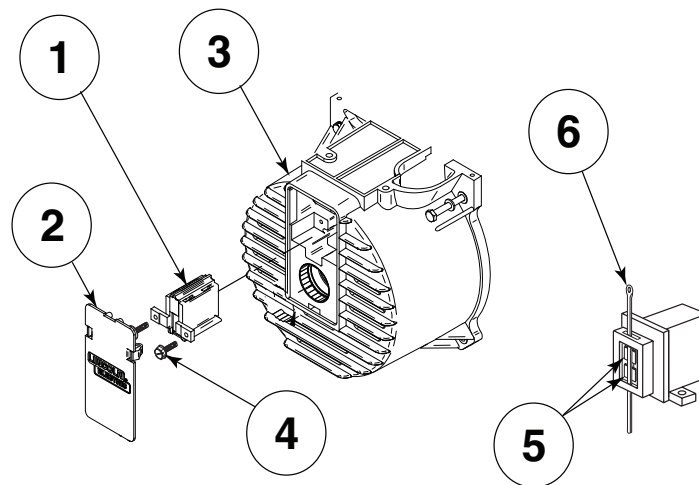
**CABLE CONNECTIONS:** Check the welding cable connections at the weld output terminals often. Be sure that the connections are always tight.

**NOTE:** Lincoln offers a rotor removal kit for any service which requires removal of the rotor from the engine. See the **ACCESSORIES** section for further details.

Removal of engine/generator assembly from the cradle can be achieved as follows:

- Remove the two 5/16-18 hex head cap screws from the engine block via the access hole located in the cradle cross support channel. Leave all other engine mountings intact.
- Remove the two hex nuts from the isolator threaded posts at the stator support bracket located opposite the engine. Leave all other stator mountings intact.
- With a jib hoist or crane, lift the unit upward and remove loose cradle from engine/generator assembly.

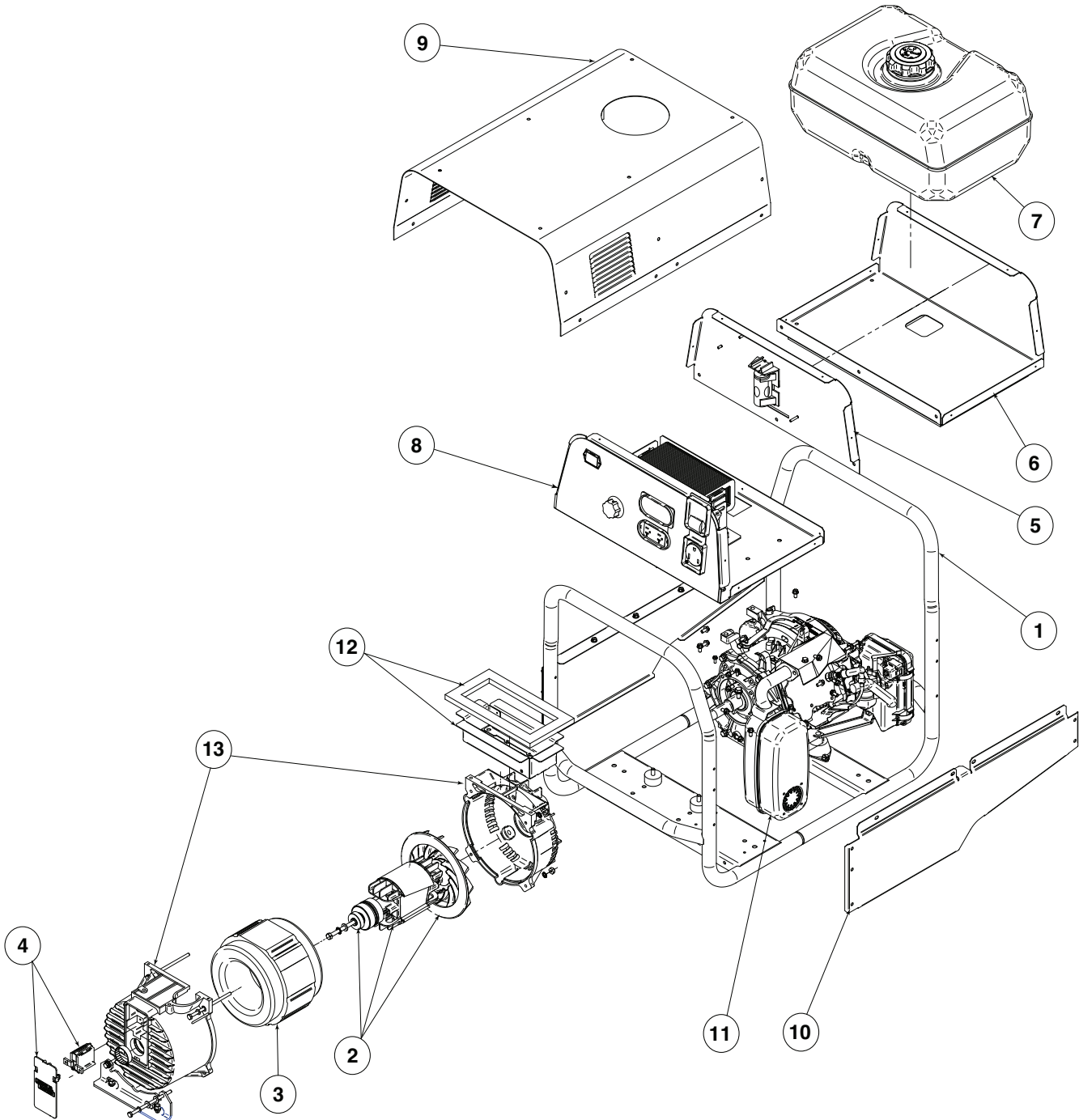
**FIGURE D.6. – BRUSH REMOVAL AND REPLACEMENT**



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

FIGURE D.7. - MAJOR COMPONENT LOCATIONS

1. CRADLE ASSEMBLY
2. ROTOR, BLOWER, AND BEARING ASSEMBLY
3. STATOR ASSEMBLY
4. BRUSH, BRUSH HOLDER ASSEMBLY AND BEARING BRACKET END COVER
5. REAR CONTROL PANEL
6. REAR PANEL ASSEMBLY
7. FUEL TANK ASSEMBLY
8. CONTROL PANEL ASSEMBLY
9. ROOF ASSEMBLY
10. SIDE PLATE
11. MUFFLER AND ENGINE
12. AIR DUCT AND FOAM
13. ENGINE END BRACKETS MACHINING



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**Theory of Operation** .....E-1

Engine, Excitation, Rotor And Stator .....E-2

Rotor Field Feedback And Auxiliary Power .....E-3

Weld Winding And Reactor .....E-4

Auxiliary Power Overcurrent Protection .....E-4

**FIGURE E.1 BLOCK LOGIC DIAGRAM**

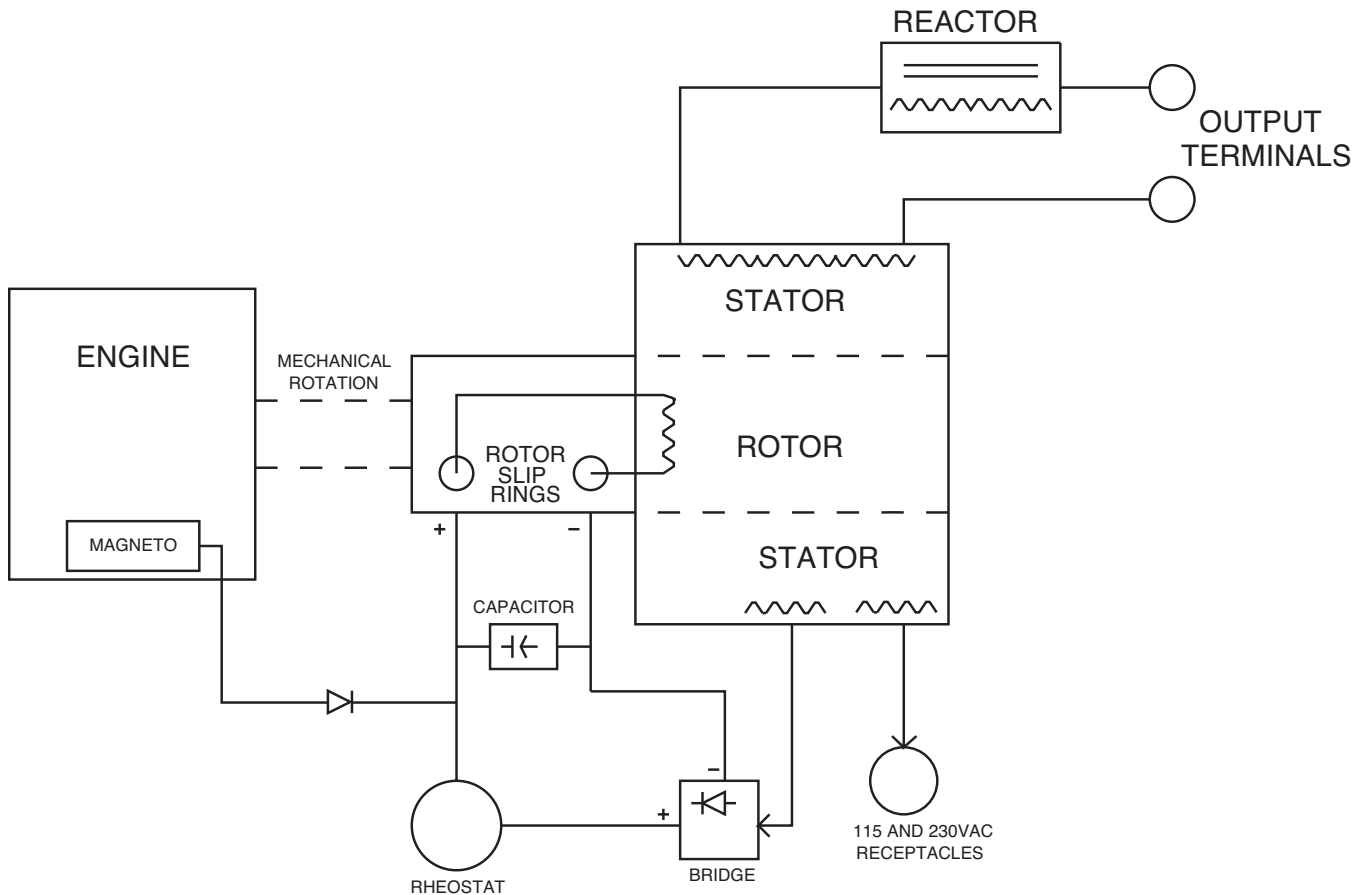
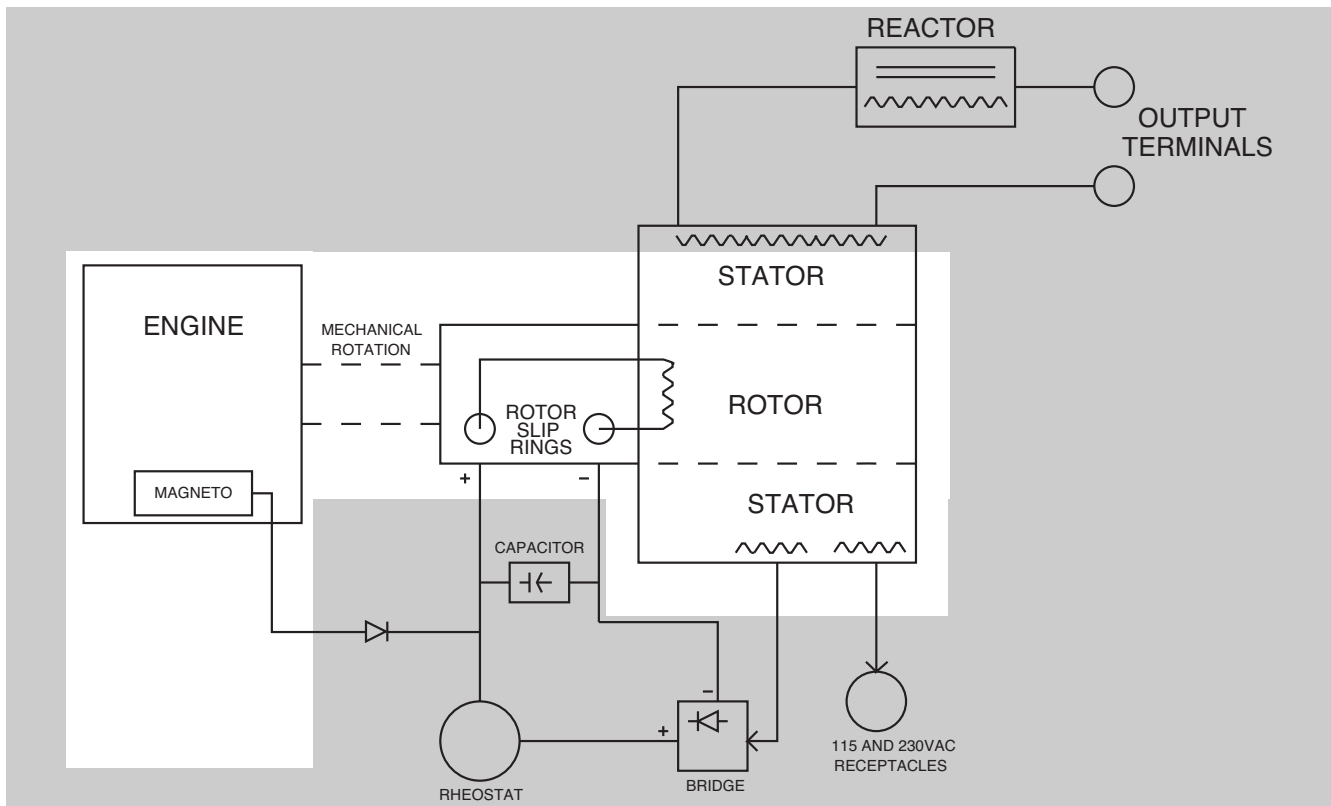


FIGURE E.2 - ENGINE, EXCITATION, ROTOR AND STATOR



## ENGINE, EXCITATION, ROTOR AND STATOR

A small voltage developed by the engine magneto is fed through a diode 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).

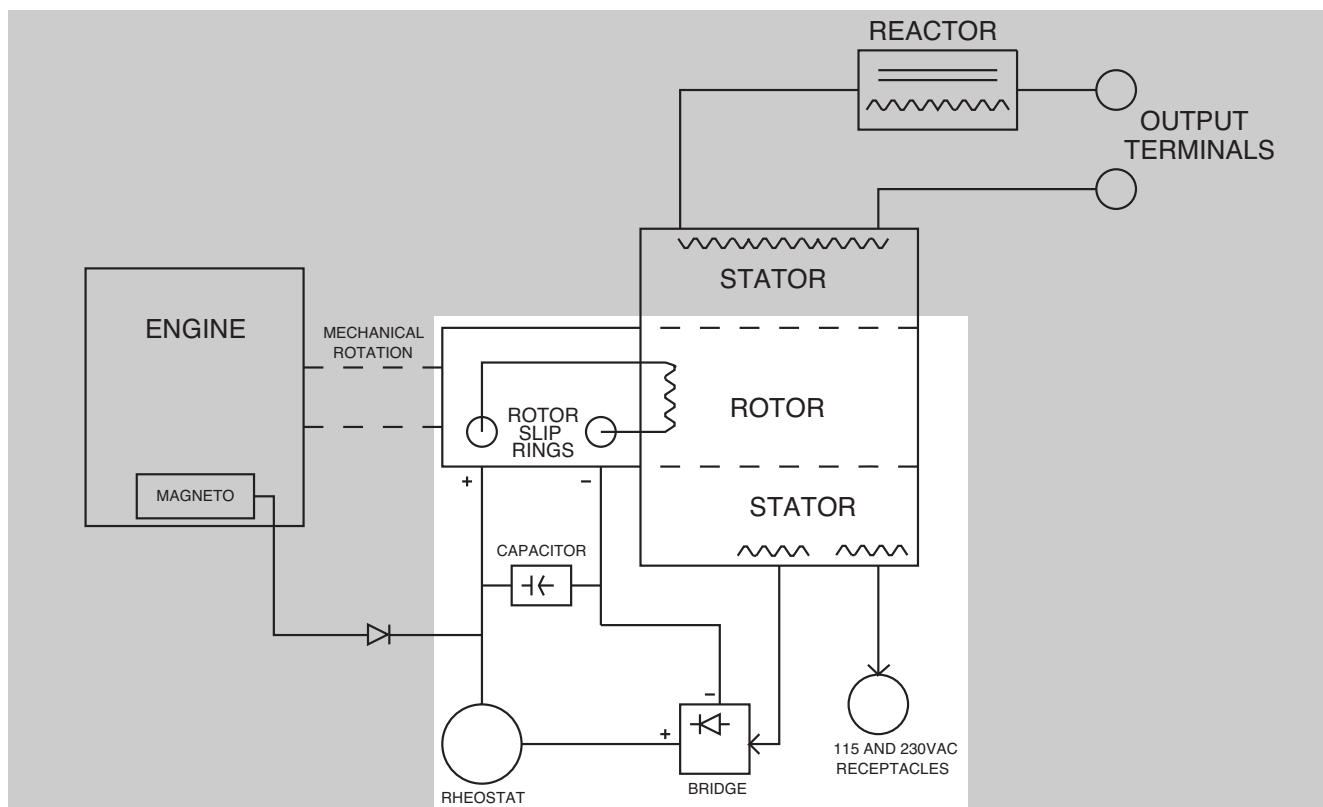
Three separate and isolated windings are incorporated in the stator lamination assembly. Each winding set has a different number of turns, producing different magnitudes of AC output voltages. The three windings are the weld winding, the auxiliary power winding and the field feedback winding. The field feedback winding provides rotor current during machine operation. The output of the BULLDOG 140 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

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FIGURE E.3 - ROTOR FIELD FEEDBACK 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.

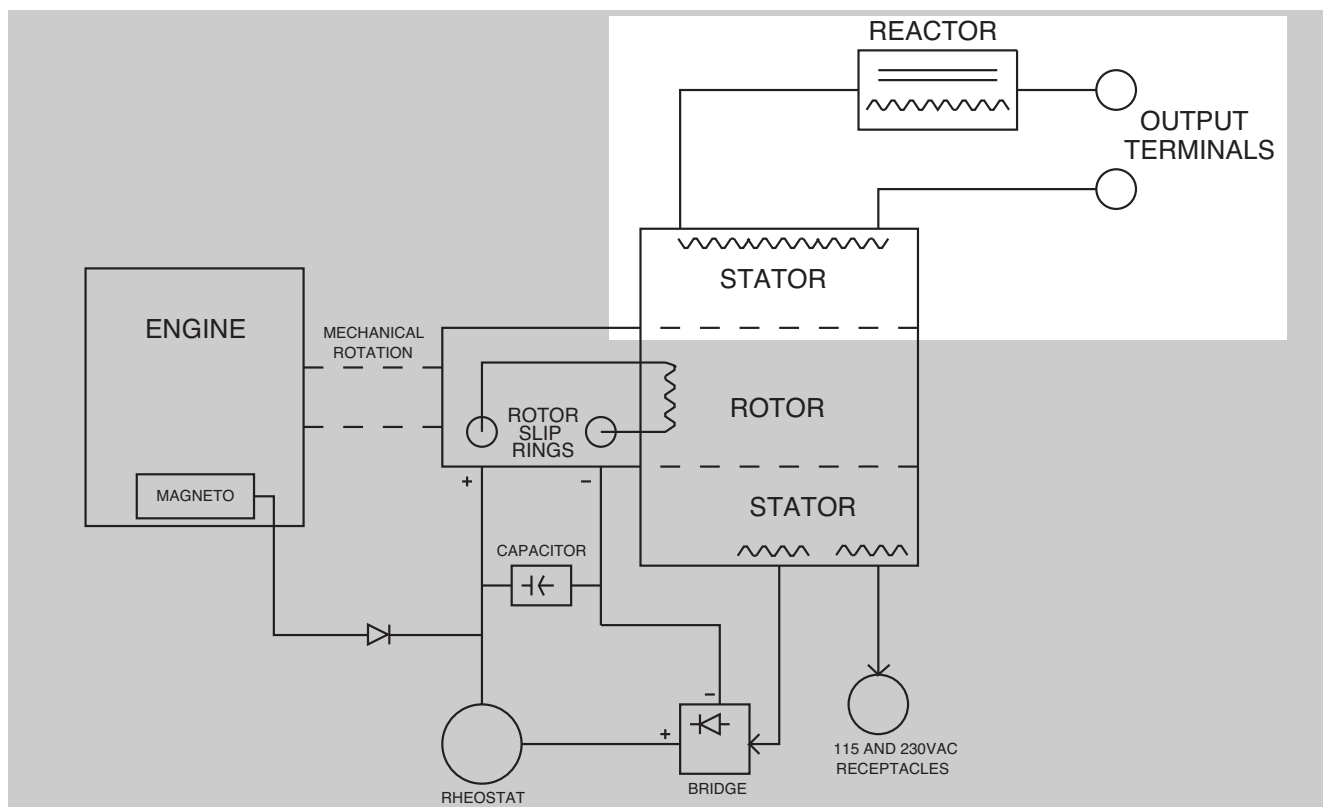
When full field voltage is applied to the rotor and the engine is running at high speed (3700 RPM), a 230 VAC voltage is developed in the stator auxiliary winding. This winding is tapped to provide 115 VAC. The two voltages (115 VAC and 230 VAC) are connected to the appropriate receptacles and offer 5500 watts (total) of AC power.

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

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FIGURE E.4 - WELD WINDING, REACTOR AND AUXILIARY POWER OVERCURRENT PROTECTION



## WELD WINDING AND REACTOR

The AC voltage developed in the stator weld winding is delivered, through the reactor, to the machine output terminals. The BULLDOG 140 provides the user up to 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

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## HOW TO USE TROUBLESHOOTING GUIDE

**⚠ WARNING**

Service and Repair should only be performed by 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 the following categories: output problems, engine problems and welding 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. RECOMMENDED****COURSE OF ACTION**

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 specified 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 tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

## PC BOARD TROUBLESHOOTING PROCEDURES

**⚠ WARNING****ELECTRIC SHOCK  
can kill.**

- Have an electrician install and service this equipment. Turn the input power OFF at the fuse box before working on equipment. Do not touch electrically hot parts.

**⚠ CAUTION**

Sometimes machine failures appear to be due to PC board failures. These problems can sometimes be traced to poor electrical connections. To avoid problems when troubleshooting and replacing PC boards, please use the following procedure:

1. Determine to the best of your technical ability that the PC board is the most likely component causing the failure symptom.
2. Check for loose connections at the PC board to assure that the PC board is properly connected.
3. If the problem persists, replace the suspect PC board using standard practices to avoid static electrical damage and electrical shock. Read the warning inside the static resistant bag and perform the following procedures:

**PC board can be damaged by static electricity.****ATTENTION  
Static-Sensitive  
Devices  
Handle only at  
Static-Safe  
Workstations**

- Remove your body's static charge before opening the static-shielding bag. Wear an anti-static wrist strap. For safety, use a 1 Meg ohm resistive cord connected to a grounded part of the equipment frame.

- If you don't have a wrist strap, touch an un-painted, grounded, part of the equipment frame. Keep touching the frame to prevent static build-up. Be sure not to touch any electrically live parts at the same time.

- Tools which come in contact with the PC board must be either conductive, anti-static or static-dissipative.

- Remove the PC board from the static-shielding bag and place it directly into the equipment. Don't set the PC board on or near paper, plastic or cloth which could have a static charge. If the PC board can't be installed immediately, put it back in the static-shielding bag.

- If the PC board uses protective shorting jumpers, don't remove them until installation is complete.

- If you return a PC board to The Lincoln Electric Company for credit, it must be in the static-shielding bag. This will prevent further damage and allow proper failure analysis.

4. Test the machine to determine if the failure symptom has been corrected by the replacement PC board.

**NOTE:** It is desirable to have a spare (known good) PC board available for PC board troubleshooting.

**NOTE:** Allow the machine to heat up so that all electrical components can reach their operating temperature.

5. Remove the replacement PC board and substitute it with the original PC board to recreate the original problem.

- a. If the original problem does not reappear by substituting the original board, then the PC board was not the problem. Continue to look for bad connections in the control wiring harness, junction blocks, and terminal strips.

- b. If the original problem is recreated by the substitution of the original board, then the PC board was the problem. Reinstall the replacement PC board and test the machine.

6. Always indicate that this procedure was followed when warranty reports are to be submitted.

**NOTE:** Following this procedure and writing on the warranty report, "INSTALLED AND SWITCHED PC BOARDS TO VERIFY PROBLEM," will help avoid denial of legitimate PC board warranty claims.

Observe Safety Guidelines detailed in the beginning of this manual.

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

**⚠ CAUTION**

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>OUTPUT PROBLEMS</b>		
<p>No weld output and no auxiliary output - engine runs normally.</p>	<p>1. The generator brushes may be worn or faulty. See the <b>Main - tenance Section</b> of this manual or <b>contact your local Lincoln Electric Authorized Field Service Facility</b>.</p>	<ol style="list-style-type: none"> <li>1. Perform the <b>Rotor Voltage Test</b>.</li> <li>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 (3700 RPM). Normal voltage is 37.5-42.5VDC. If the voltage is low or missing, the flywheel alternator may be faulty. See the Wiring Diagram. Check diode D3 &amp; lead #202C</li> <li>3. Check lead 201B (green) for continuity (zero ohms) to ground. See wiring diagram.</li> <li>4. The field capacitor (C1) or bridge (D2) may be faulty. Test or replace.</li> <li>5. Test the rheostat (R1). Normal resistance is 3.3 ohms. See the <b>Rheostat Removal and Replacement Procedure</b>.</li> <li>6. The rotor may be faulty. Perform the <b>Rotor Resistance Test</b>.</li> <li>7. Perform <b>Flashing Circuit Test</b>.</li> </ol>

**⚠ CAUTION**

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>OUTPUT PROBLEMS</b>		
<p>No weld output - auxiliary power (230 - 115 VAC) operates normally - engine runs normally.</p>	<p>1. Check the open circuit voltage (OCV) at the welder output terminals. If OCV is okay, go to Step 2, below.</p> <p>If OCV is not present at the welder output terminals, <b>contact your local Lincoln Electric Authorized Field Service Facility.</b></p> <p>2. Check the welding cables, clamps and electrode holder for loose or broken connections.</p>	<p>1. Check continuity (zero ohms) of lead W1A (black) from output terminal to reactor (L1). See the Wiring Diagram.</p> <p>2. Check continuity (zero ohms) of lead W2 (black) from output terminal to stator winding. See the Wiring Diagram.</p> <p>3. Check continuity (zero ohms) of lead W1 (black) from reactor (L1) to stator winding. See the Wiring Diagram.</p> <p>4. Check reactor (L1) for continuity of winding. See the Wiring Diagram.</p> <p>5. Check the stator for continuity of winding. See the Wiring Diagram.</p> <p>6. Make certain the reactor and/or stator are NOT grounded. Minimum acceptable resistance to ground is 500 K-ohms.</p>

**⚠ CAUTION**

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

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Observe Safety Guidelines detailed in the beginning of this manual.

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

**⚠ CAUTION**

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>OUTPUT PROBLEMS</b>		
<p>Low weld output and low auxiliary output.</p>	<ol style="list-style-type: none"> <li>1. The generator brushes may be worn. See the <b>Maintenance Section</b> of this manual or contact your local Lincoln Electric Authorized Field Service Facility.</li> <li>2. The engine RPM may be low.</li> </ol>	<ol style="list-style-type: none"> <li>1. Perform the <b>Rotor Voltage Test</b>.</li> <li>2. If the rotor voltage is low, the field capacitor (C1) or bridge (D2) may be faulty. Test or replace.</li> <li>3. Check the rheostat (R1). Normal resistance is 3.3 ohm. See the <b>Rheostat Removal and Replacement Procedure</b>.</li> <li>4. The rotor may be faulty. Perform the <b>Rotor Resistance Test</b>.</li> <li>5. The engine RPM may be low. Perform the <b>Engine Throttle Adjustment Test</b>.</li> <li>6. If engine idle RPM is okay, the engine may have lost horsepower and be in need of major repair.</li> <li>7. Perform <b>Field Diode Test</b>.</li> </ol>

**⚠ CAUTION**

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>ENGINE PROBLEMS</b>		
<p>Engine will not start.</p>	<ol style="list-style-type: none"> <li>1. Make sure the ON/OFF switch is in the "ON" position.</li> <li>2. Check spark plug boot and wire for loose or faulty connection.</li> <li>3. Make sure that the fuel shutoff valve is in the "ON" position.</li> <li>4. Make certain that the engine has adequate fuel and oil.</li> <li>5. Adjust the choke to prevent carburetor flooding.</li> <li>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.</li> <li>7. Low oil and engine low oil shutdown protection will not allow unit to start. Light in ON-OFF switch will flash when engine is cranked. (Engines equipped with low oil shutdown protection only).</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the fuel line for breaks or obstructions. Replace the fuel filter. <b>DO NOT RUN THE ENGINE WITHOUT AN IN-LINE FUEL FILTER.</b></li> <li>2. The spark plug may be faulty. Replace.</li> <li>3. Service the engine as outlined in the <b>Maintenance Section</b> of this manual.</li> <li>4. The engine magneto may be faulty. Consult Briggs &amp; Stratton owner's manual.</li> <li>5. The engine may be faulty. Replace.</li> </ol>

**⚠ CAUTION**

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>WELDING PROBLEMS</b>		
<p>The welding arc is “cold.” The engine runs normally (3700 RPM, no load). Auxiliary power is functioning normally.</p>	<ol style="list-style-type: none"> <li>1. Check for loose or faulty connections at the weld output terminals and welding cable connections.</li> <li>2. The welding cable may be too long or coiled, causing an excessive voltage drop.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check for the correct open circuit voltage (OCV) at the welder output terminals – 66 VAC is normal.  If the correct voltage is present at the output terminals, check for loose connections on the heavy current-carrying leads inside the BULLDOG 140. See the Wiring Diagram.</li> <li>2. If the OCV is low at the welder output terminals, perform <b>Engine Throttle Adjustment Test</b>.</li> <li>3. Check for shorted or grounded windings in the reactor (L1) and also in the main stator. See the Wiring Diagram.</li> </ol>

**⚠ CAUTION**

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

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**ROTOR VOLTAGE TEST****⚠ WARNING**

Service and repair should be performed only by 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 1-888-935-3877.

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**TEST DESCRIPTION**

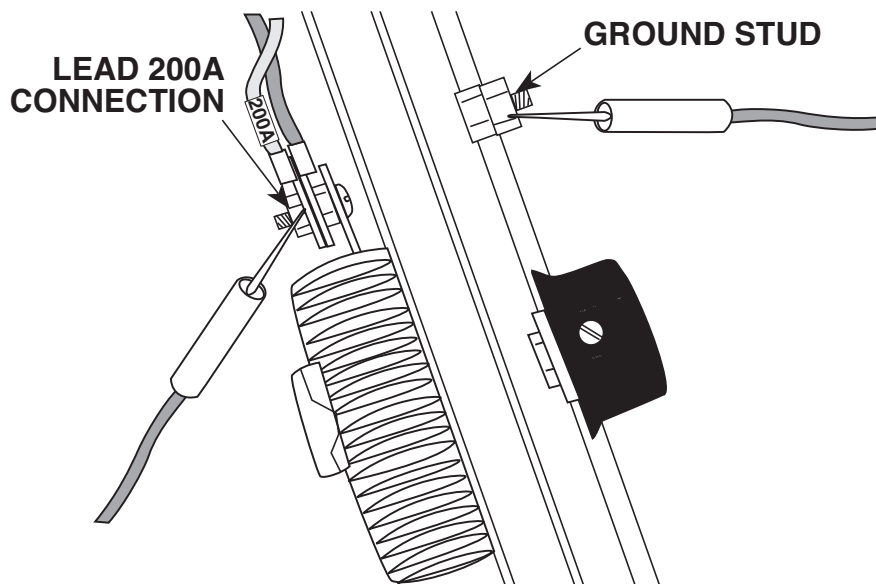
This test will determine if the correct DC voltage is being applied to the Rotor at maximum engine speed (3700 RPM). This information will aid the technician in determining if the Generator Field is operating properly.

**MATERIALS NEEDED**

- Volt/Ohmmeter
- 3/8" Nutdriver
- Wiring Diagram

## ROTOR VOLTAGE TEST (continued)

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



### PROCEDURE

1. With the 3/8" 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 37.5 - 42.5 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 D2 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 3/8" nut driver.

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**FIELD DIODE BRIDGE TEST****⚠ WARNING**

Service and repair should be performed only by 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 1-888-935-3877.

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**TEST DESCRIPTION**

This procedure will test the Diode Bridge for any faulty diodes and will help determine the configuration for the Bridge.

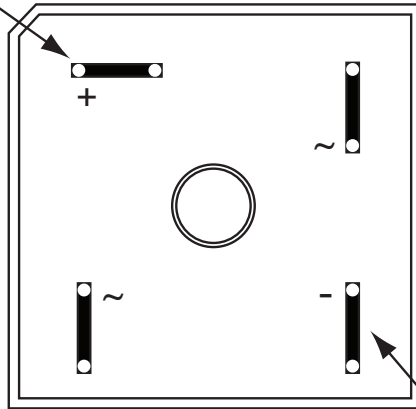
**MATERIALS NEEDED**

Volt/Ohmmeter  
Diode Tester

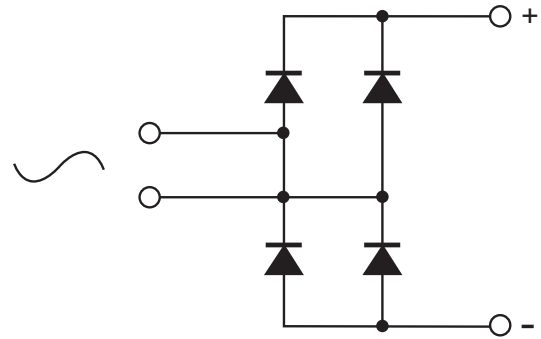
## FIELD DIODE BRIDGE TEST (continued)

FIGURE F.2 – DIODE BRIDGE CIRCUIT CONFIGURATION

POSITIVE DC



NEGATIVE DC

SINGLE PHASE BRIDGE  
CIRCUIT CONFIGURATION**PROCEDURE**

The diode bridge is configured as pictured above. The individual diodes can be tested using a diode tester or an ohm meter. The diodes will read open one way and shorted the other way. If any of the diodes read shorted or open in both directions, the diode bridge will need to be replaced.



**ROTOR “FLASHING” CIRCUIT TEST****⚠ WARNING**

Service and repair should be performed only by 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 1-888-935-3877.

**TEST DESCRIPTION**

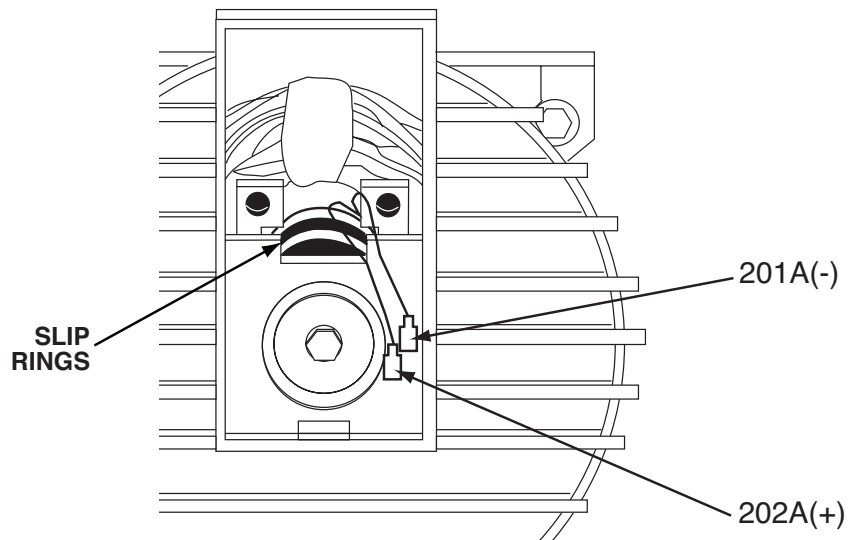
This test will determine if the Engine Magneto is supplying the proper “flashing” current to the Rotor.

**MATERIALS NEEDED**

Volt/Ohmmeter  
3/8" Nutdriver  
DC Ammeter  
Wiring Diagram

## ROTOR "FLASHING" CIRCUIT TEST (continued)

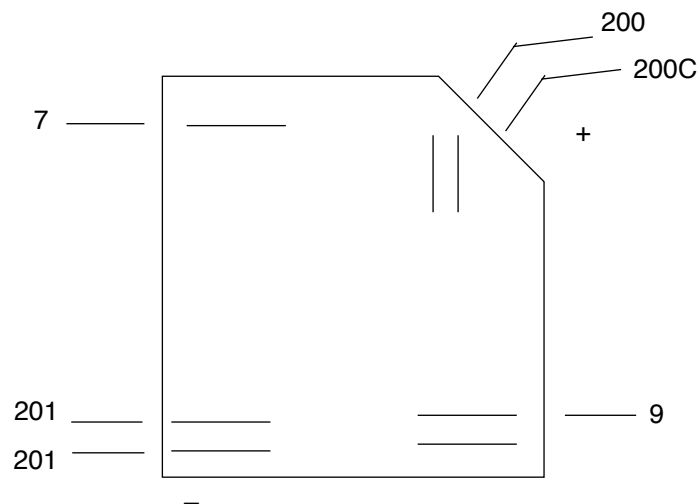
FIGURE F.3 – BRUSH HOLDER LEADS 201(-) AND 202B (+)



### PROCEDURE

1. With the 3/8" nutdriver, remove the 20 sheet metal screws that hold the top cover to the control box. Remove the top cover.
2. Locate and remove lead #201A from the brush holder. See Figure F.3 for location.
3. Connect the negative (-) lead of the DC ammeter to lead #201A and the positive (+) lead to the brush holder.
4. Remove lead #7 from field diode bridge rectifier D2. See Figure F.4. Electrically isolate the lead.

FIGURE F.4 – DIODE BRIDGE LEAD ASSIGNMENTS



## ROTOR "FLASHING" CIRCUIT TEST (continued)

**⚠ WARNING**

**MOVING PARTS** can injure.

Keep away from moving parts.



**ENGINE EXHAUST** can kill.

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

5. Start the engine and run it at High Idle (3700 - 3800 RPM).
6. The DC ammeter should read between 0.15 and 0.30 amps.
7. If the DC ammeter reads 0.0 amps, check for flashing voltage between lead #202 from the brush holder and case ground (lead #201). See **Figure F.4**, and the Wiring Diagram. Normal flashing voltage is 2.05 VDC.
8. If normal flashing voltage is present, perform the **Rotor Resistance Test**. Also be sure that all #201 leads have continuity (zero ohms) to case ground.
9. If flashing voltage is not measured, check from lead 205 on the diode bridge D3 to case ground. Normal readings are around 3 VAC. If no flashing voltage is present, the engine magneto may be faulty. Check lead 205 back to magneto and measure for voltage there.
10. If there is AC volts at the diode bridge, the diode may be open. Check diode and move leads over if need be.

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**ROTOR RESISTANCE TEST****⚠ WARNING**

Service and repair should be performed only by 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 1-888-935-3877.

**TEST DESCRIPTION**

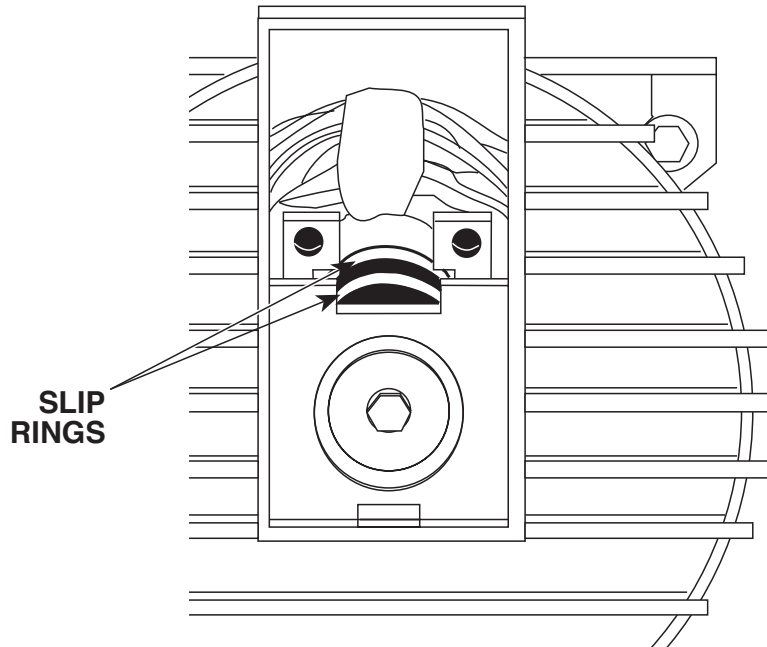
This test will determine if there is a shorted winding in the Rotor or if the Rotor is grounded.

**MATERIALS NEEDED**

- Volt/Ohmmeter
- 1/4" Nutdriver
- Small Slot Head Screwdriver
- Wiring Diagram

## ROTOR RESISTANCE TEST (continued)

FIGURE F.5 – LOCATION OF ROTOR SLIP RINGS - BRUSH HOLDER ASSEMBLY REMOVED



### 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.5 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 - 9 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).

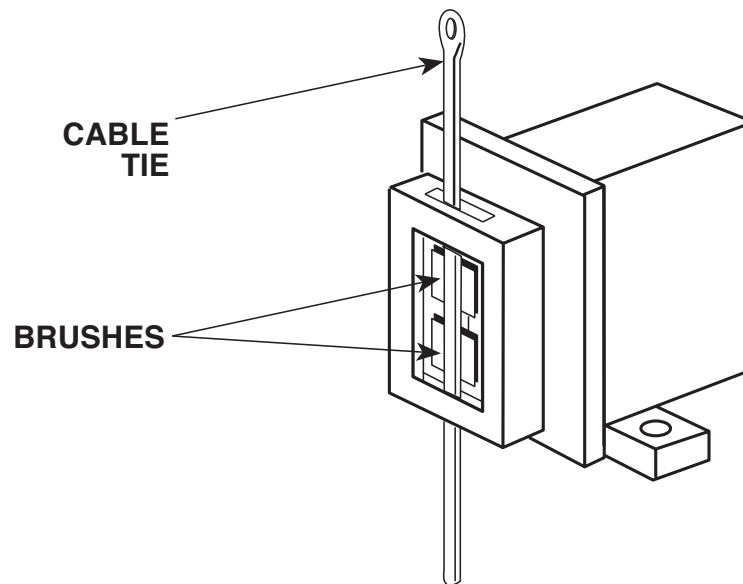
If the resistance checks meet the specifications, then the rotor is okay.

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## ROTOR RESISTANCE TEST (continued)

FIGURE F.6 – 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.6. 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" nutdriver.
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.

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# TROUBLESHOOTING AND REPAIR

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## ENGINE THROTTLE ADJUSTMENT TEST

### ROBIN/SUBARU ENGINE

#### **WARNING**

Service and repair should be performed only by 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 1-888-935-3877.

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#### **TEST DESCRIPTION**

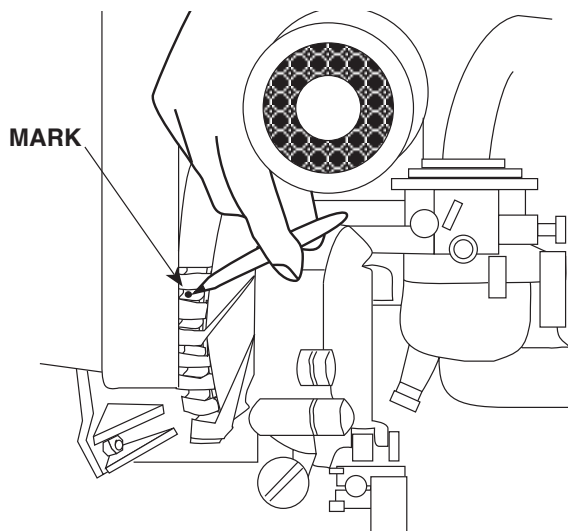
If the machine output is low, this test will determine whether the gasoline engine high idle speed is set for the correct maximum RPM.

#### **MATERIALS NEEDED**

- Screwdriver
- Frequency Counter or Strobe-tach or Oscilloscope
- Black or Red Marking Pencil
- 10mm Socket Wrench

## ENGINE THROTTLE ADJUSTMENT TEST ROBIN/SUBARU ENGINE (continued)

FIGURE F.7 – MARK LOCATION



### 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.7.
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. Using the 10mm socket wrench, slightly loosen the throttle locking nut. **See Figure F.8.**
5. Using the screwdriver adjust the high speed stop screw until the tach reads 3700 RPM. **See Figure F.9.**
5. Re-tighten the throttle locking nut. **See Figure F.8.**

#### Frequency Counter Method:

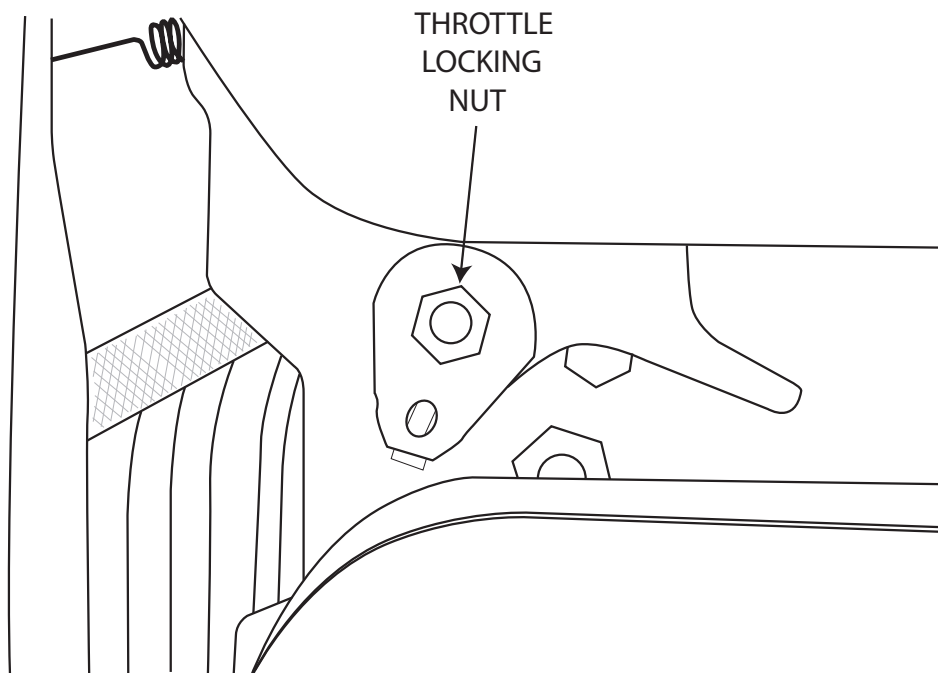
1. Plug the frequency counter into one of the 115 VAC auxiliary receptacles.
2. Start the engine and check the frequency counter. At the proper RPM (3700), the counter should read 62 Hz.
3. Using the 10mm socket wrench, slightly loosen the throttle locking nut. **See Figure F.8.**
4. Using the screwdriver, adjust the high speed stop screw until the frequency counter reads 3700 RPM. **See Figure F.9.**
5. Re-tighten the throttle locking nut. **See Figure F.8.**

#### 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.

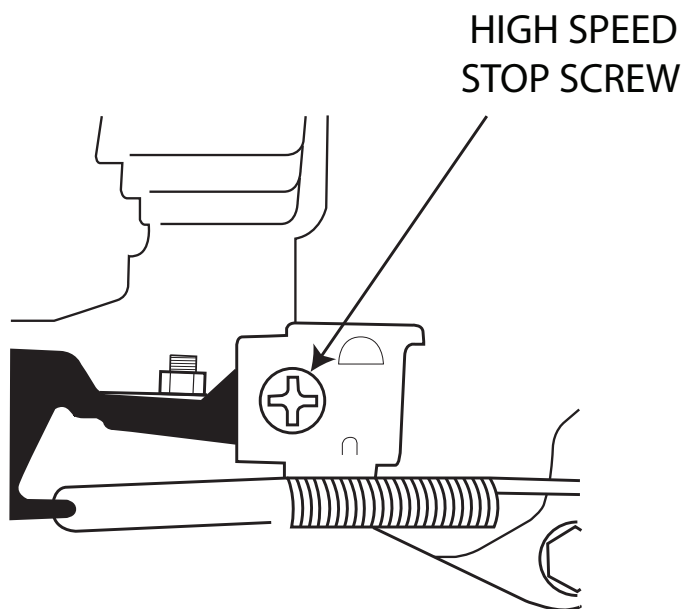
## ENGINE THROTTLE ADJUSTMENT TEST ROBIN/SUBARU ENGINE (continued)

### FIGURE F.8 – LOCKING NUT LOCATION



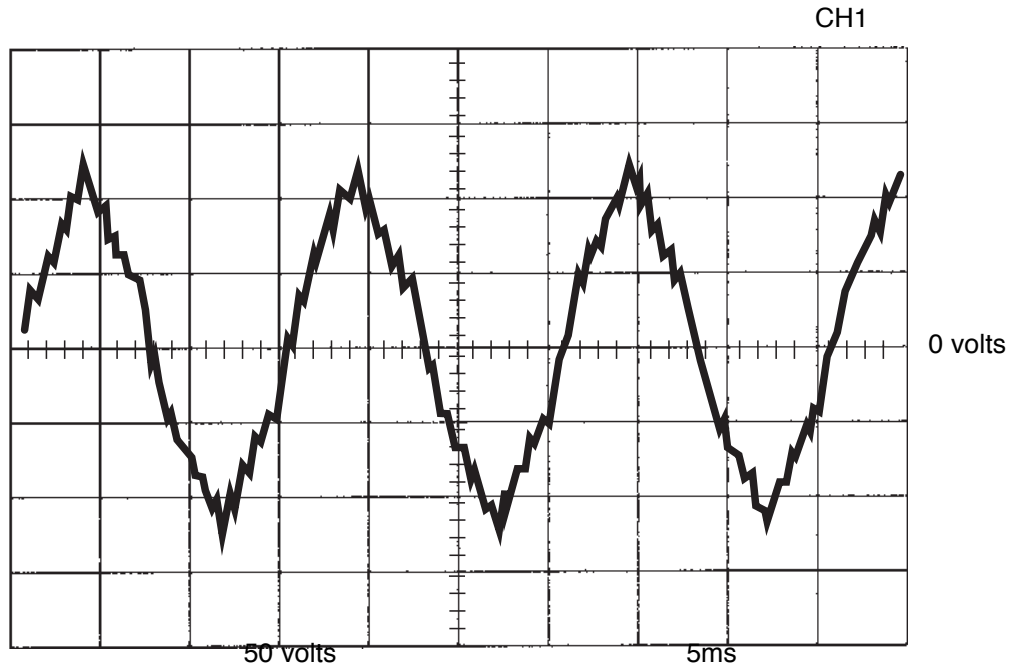
2. Using the 10mm socket wrench, slightly loosen the throttle locking nut. See Figure F.8.
3. Using the screwdriver, adjust the high speed stop screw until the waveform period is 16.2 milliseconds. See Figure F.9.
4. Re-tighten the throttle locking nut. See Figure F.8.

### FIGURE F.9 – STOP SCREW LOCATION



## 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

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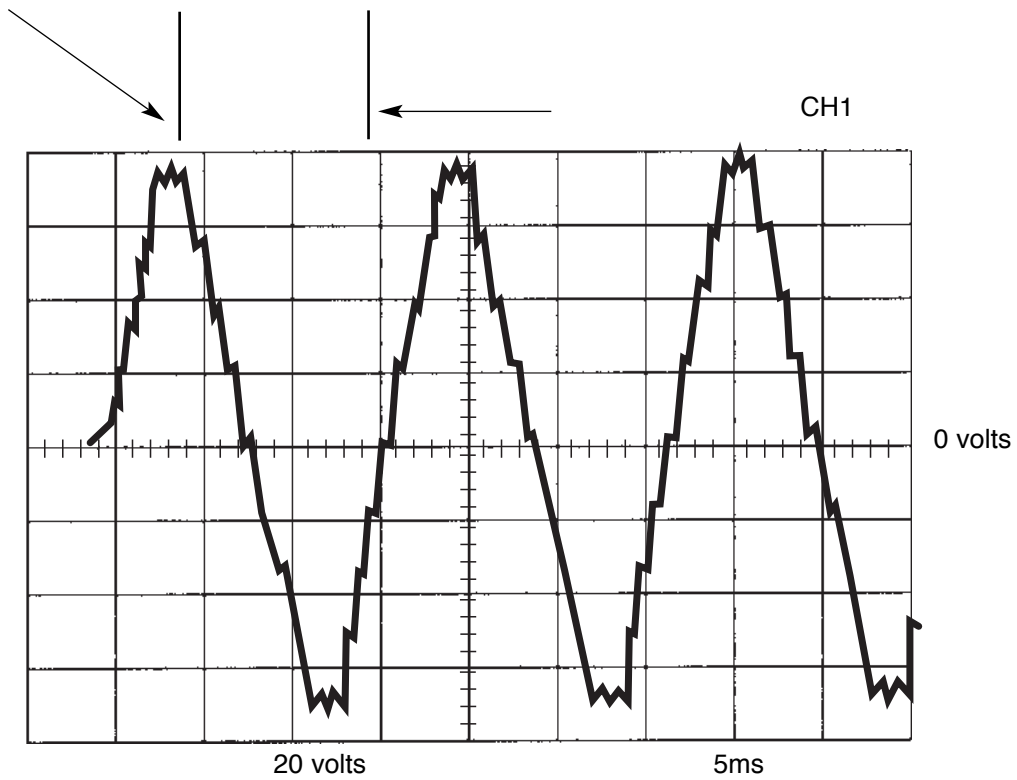
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## NORMAL OPEN CIRCUIT VOLTAGE WAVEFORM (115VAC SUPPLY)

### HIGH IDLE – NO LOAD

1 Period = 16.2 ms @ 3700 rpm



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 115 VAC receptacle.

### SCOPE SETTINGS

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

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# TROUBLESHOOTING AND REPAIR

## BRUSH REMOVAL AND REPLACEMENT

### **WARNING**

Service and repair should be performed only by 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 1-888-935-3877.

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### **TEST DESCRIPTION**

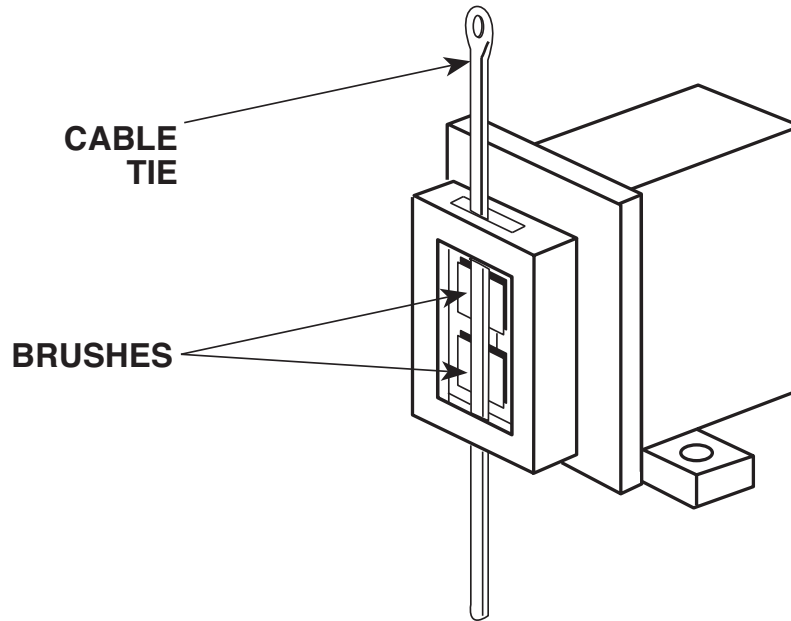
The following procedure will aid the technician in accessing the Generator Brushes for maintenance or replacement.

### **MATERIALS NEEDED**

- Small Slot Head Screwdriver
- 1/4" Nutdriver
- Needlenose Pliers

## BRUSH REMOVAL AND REPLACEMENT (continued)

FIGURE F.10 – 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 needlenose 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)**

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.10**. This will hold the brushes up so that you can easily install the holder.
9. With the needlenose 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.

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# TROUBLESHOOTING AND REPAIR

## RHEOSTAT REMOVAL AND REPLACEMENT

### WARNING

Service and repair should be performed only by 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 1-888-935-3877.

### TEST DESCRIPTION

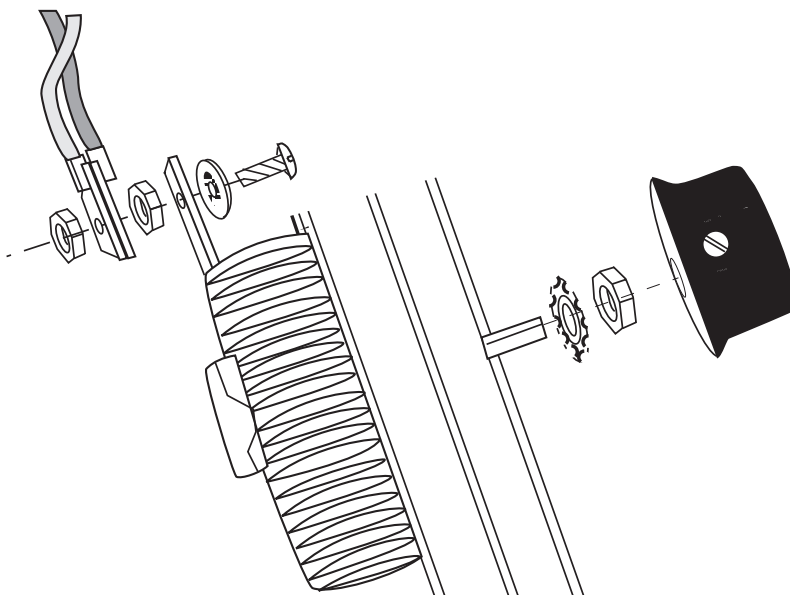
The following procedure will aid the technician in accessing and removing the Output Control Rheostat for maintenance or replacement.

### MATERIALS NEEDED

- 3/8" Nutdriver
- 5/16" Nutdriver
- Small Slot Head Screwdriver
- 9/16" Open or Box End Wrench
- 5/16" Open or Box End Wrench
- Needlenose Pliers
- Wiring Diagram

## RHEOSTAT REMOVAL AND REPLACEMENT (continued)

FIGURE F.11 – RHEOSTAT REMOVAL



## PROCEDURE

1. Remove the spark plug wire.
2. With the 3/8" 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.

**CAPACITOR AND/OR DIODE BRIDGE REMOVAL AND REPLACEMENT****⚠ WARNING**

Service and repair should be performed only by 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 1-888-935-3877.

**TEST DESCRIPTION**

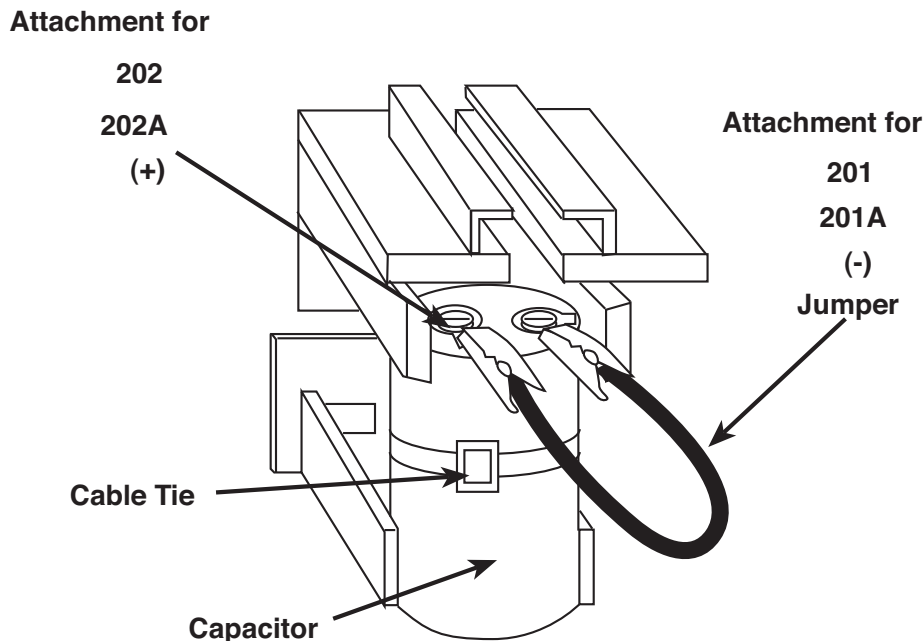
The following procedure will aid the technician in accessing and removing the Capacitor and Diode Bridge for maintenance or replacement of either component.

**MATERIALS NEEDED**

- 3/8" Nutdriver
- 5/16" Nutdriver
- Jumper Wire With Alligator Clips On Each End For Discharging The Field Capacitor
- Slot Head Screwdriver
- Needlenose Pliers
- Wiring Diagram

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

FIGURE F.12 – LOCATION AND DISCHARGING THE FIELD CAPACITOR

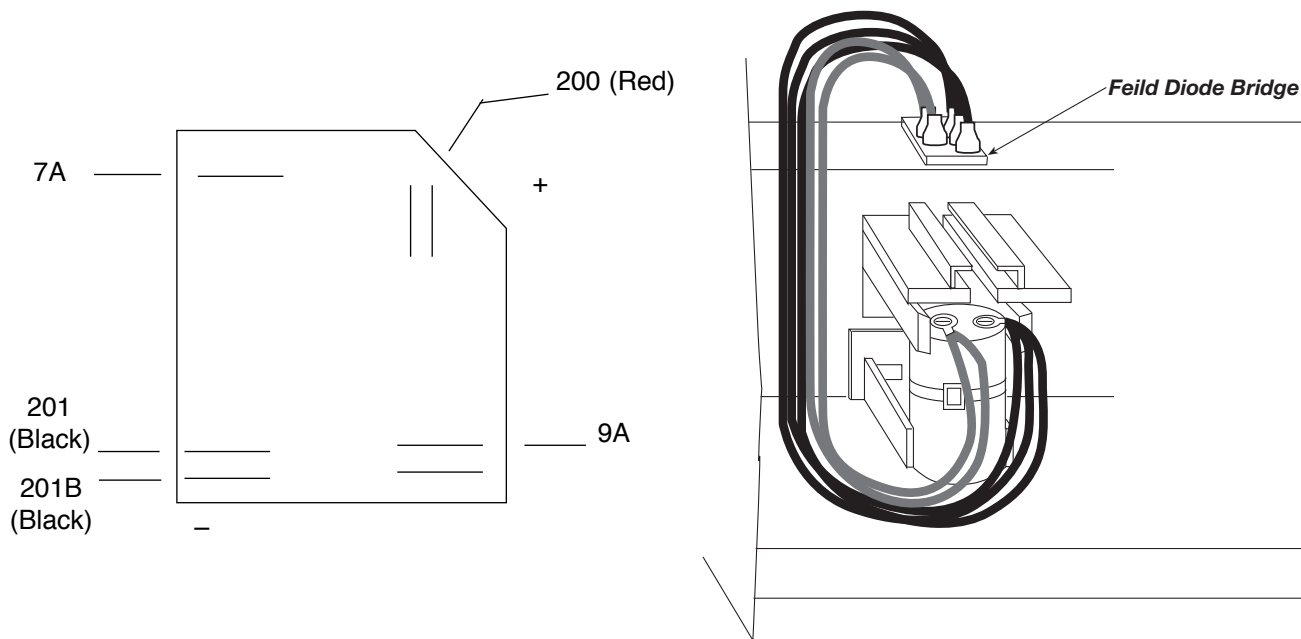


### PROCEDURE - CAPACITOR REMOVAL AND REPLACEMENT

1. Remove the engine spark plug wire.
2. With the 3/8" 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.12 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 3/8" nut driver.

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

FIGURE F.13 – FIELD DIODE BRIDGE LOCATION



### PROCEDURE - FIELD DIODE BRIDGE REMOVAL AND REPLACEMENT

1. Remove the engine spark plug wire.
2. With the 3/8" nut driver, remove the 8 sheet metal screws that hold the top cover to the control box. Remove the top cover.
3. With the 3/8" nut driver and wrench, remove the 6 screws that hold the control panel in place (2 in the front, 2 in the back, 2 in the bottom). Move the panel aside as far as the leads will allow.
4. 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.13 for location. Leave the clips on for at least 5 seconds, then remove.
5. The field diode bridge (D1) is mounted to the sheet metal just above the capacitor. See Figure F.13. Remove it using the phillips head screw driver.
6. With the needlenose pliers, gently remove the wires from the field diode bridge. Note lead locations.
7. Replace the wires to their appropriate locations on the new diode bridge:
  - Lead 200 attached to the positive (+) terminal. Depending on the bridge used, this corner may be beveled and/or marked with a + sign.
  - Lead 201 and 201B are piggy-backed on the negative (-) terminal, which will always be located diagonally across from the positive (+) terminal.
  - Leads 9A and 7A are attached to the AC side of the bridge and are attached to the other two corner terminals. Either lead can go on either terminal.
8. Mount the field diode bridge using the screw. Use the slot head screwdriver.
9. Check that the leads are not grounded and for clearance and tightness.
10. Replace the control panel and tighten the sheet metal screws with the 5/16" nut driver and 5/16" wrench.
11. Replace the top cover of the control box and tighten the sheet metal screws with the 3/8" nut driver.

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**BULLDOG® 140**





# TROUBLESHOOTING AND REPAIR

## STATOR/ROTOR REMOVAL AND REPLACEMENT

### WARNING

Service and repair should be performed only by 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 1-888-935-3877.

### TEST 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" Nutdriver
- 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
- Needlenose Pliers
- Diagonal Cutters
- Torque Wrench (ft lbs)
- Babbitt, Leather, or Wooden Mallet
- Volt/Ohmmeter
- 12" (long) Feeler Gauge (.010)

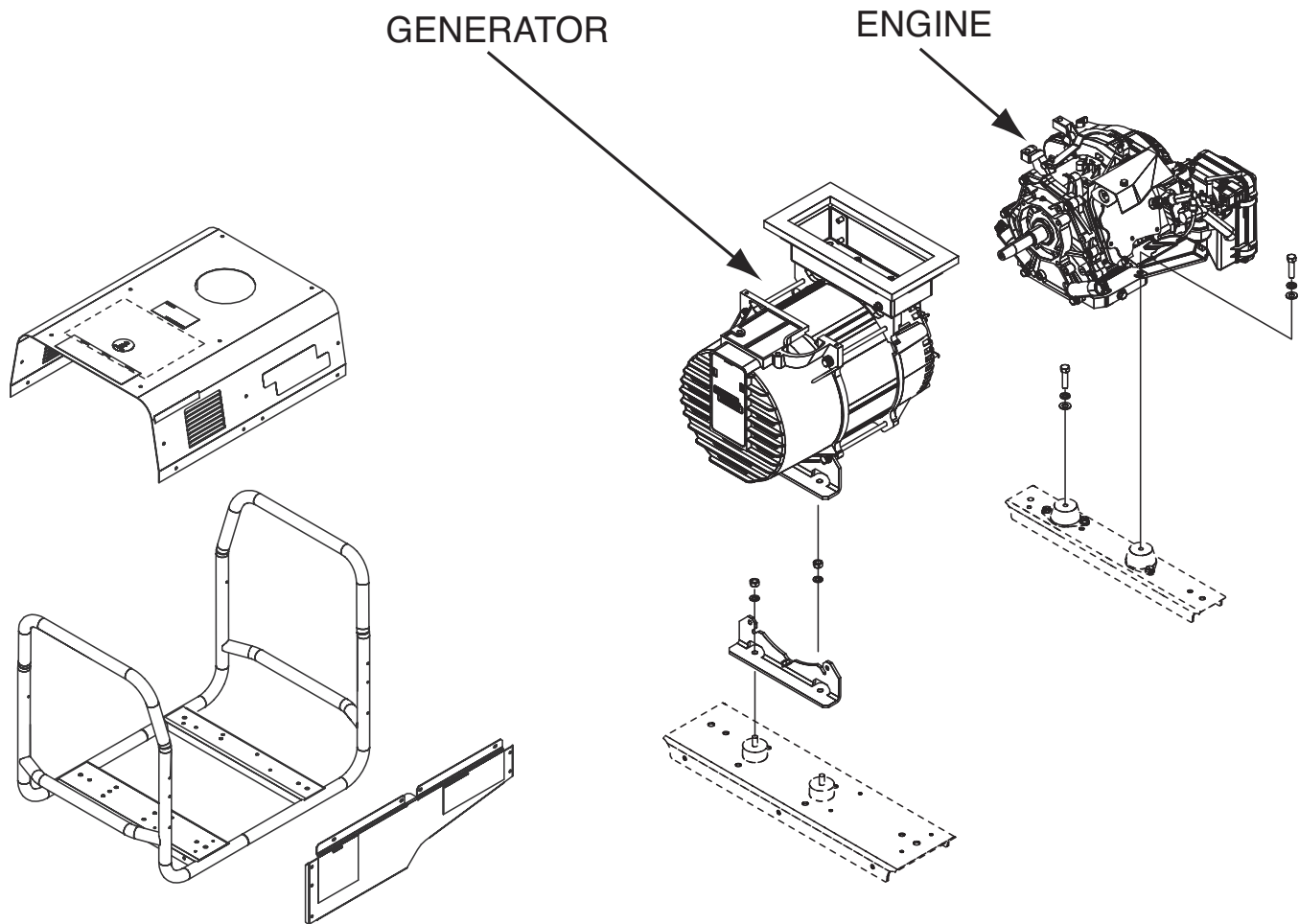
### INSTRUCTIONS

For stator removal only, follow steps 1 -8 under **STATOR REMOVAL PROCEDURE**.

For rotor removal, follow the **STATOR REMOVAL PROCEDURE, ROTOR REMOVAL PROCEDURE**.

## STATOR/ROTOR REMOVAL AND REPLACEMENT (continued)

FIGURE F.14 – GENERATOR AND ENGINE LOCATION

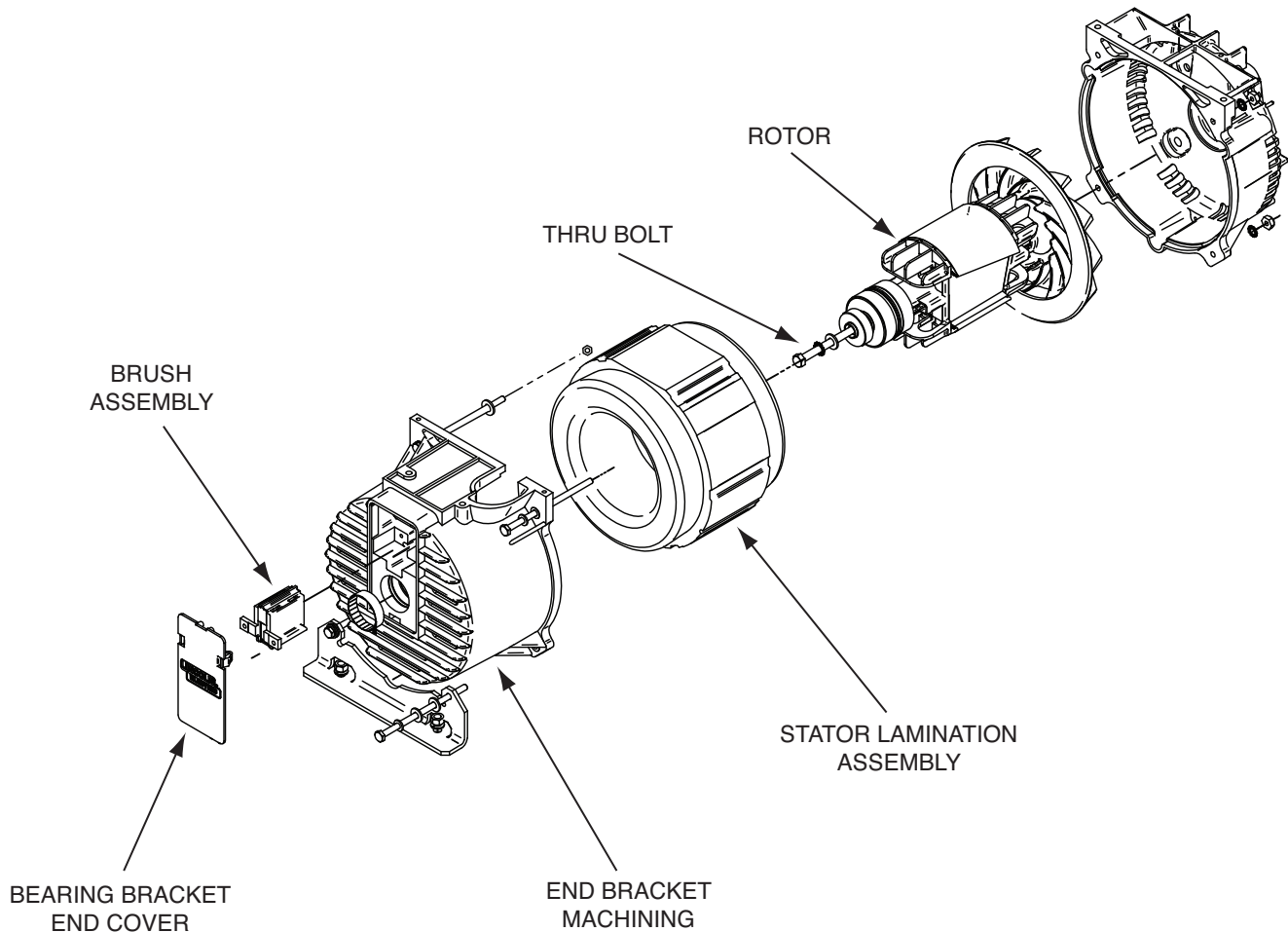


### PROCEDURE

1. Remove control panel cove by removing the 20 screws with a 3/8" nutdriver.
2. Remove the right case side by removing the 5 screws using a 3/8" nutdriver.
3. Make sure the run/off switch on the rear of the engine is in the off position. Remove the gas line from the engine by closing the gas valve and pinching open the clip using a pair of needlenose pliers.
4. Label and remove all of the leads that are coming up from the center hole in the control box from the stator. See Wiring Diagram.
5. The engine can be removed by unbolting the two 9/16" anchor bolts from the engine side and the two 1/2" bolts from the generator side. Pull the engine/generator from the right side of the welder.

## STATOR/ROTOR REMOVAL AND REPLACEMENT (continued)

FIGURE F.15 – GENERATOR COMPONENTS



6. Remove the brush assembly from the slip ring end bracket.
7. Remove the (4) long HHCS and hardware along with the slip ring end bracket.
8. Carefully remove the stator from the engine end bracket and cradle. IMPROPER HANDLING OF THE STATOR CAN RESULT IN SHORTED WINDINGS AND/OR LOST OUTPUT.
9. Remove the rotor thru bolt located at the bearing end of the rotor.
10. Install the 7.70" long thru bolt supplied with the kit into the rotor. THREAD BOLT UNTIL TIGHT TO ENGINE CRANKSHAFT.
11. Install the supplied, left hand impact bolt, (counter-clockwise) into the rotor shaft. Continue to tighten impact bolt until interference with thru bolt is felt.

**STATOR/ROTOR REMOVAL AND REPLACEMENT (continued)**

12. If impact wrench is available, rapidly torque impact bolt until rotor “pops” off of tapered engine crank.

If impact wrench is unavailable, restrain rotor and tighten bolt with socket wrench until rotor “pops” off. A slight tap of the impact bolt with a babbitt hammer may be required.

13. Replace rotor onto shaft. Be certain to:

- Tighten rotor to 22 - 25 ft.-lbs.
- Check air gap between stator and rotor. Gap must be .020” MIN.
- Tighten (4) long bracket bolts to 4.5 - 5.5 ft.-lbs.
- Rewire unit as detailed in diagram, pasted onto inside of roof.
- Tighten all hardware and insulate all leads accordingly.

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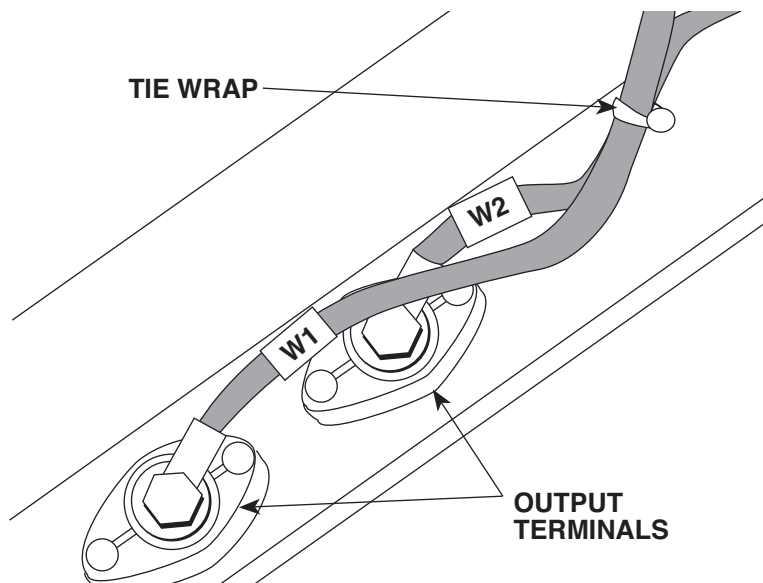
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## STATOR/ROTOR REMOVAL AND REPLACEMENT (continued)

FIGURE F.16 – OUTPUT LEAD LOCATION

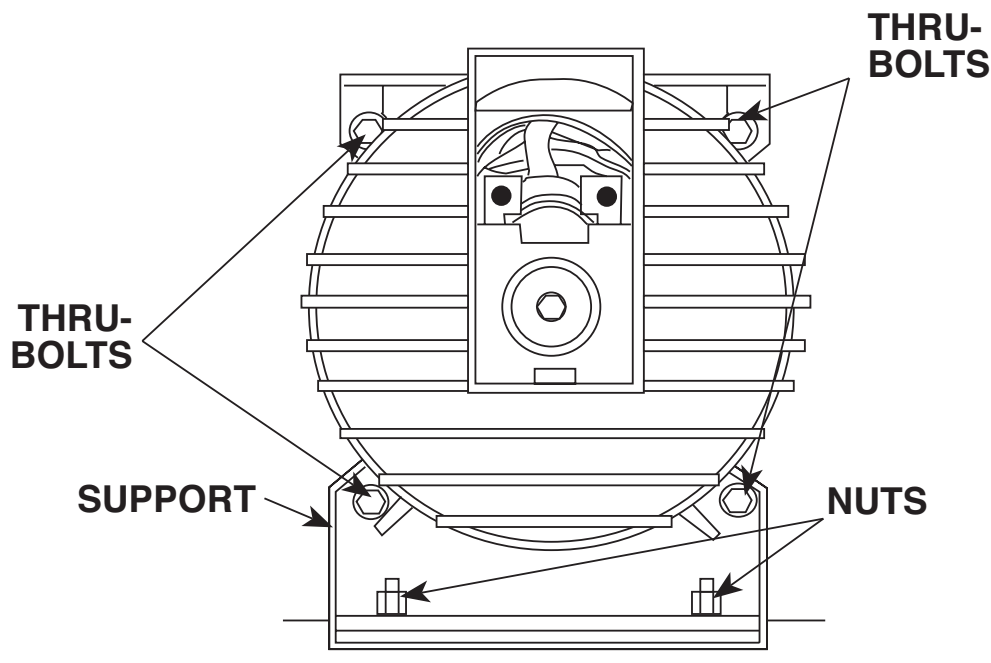


### STATOR REMOVAL PROCEDURE

1. Remove engine spark plug wire to prevent accidental kickback or starting.
2. With the 5/16" nutdriver, 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 W2 (Black) from the output terminal. See Figure F.16 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" nutdriver, remove the 2 screws that hold the brush holder assembly in place. With the needlenose 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, split-ring 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.

## STATOR/ROTOR REMOVAL AND REPLACEMENT (continued)

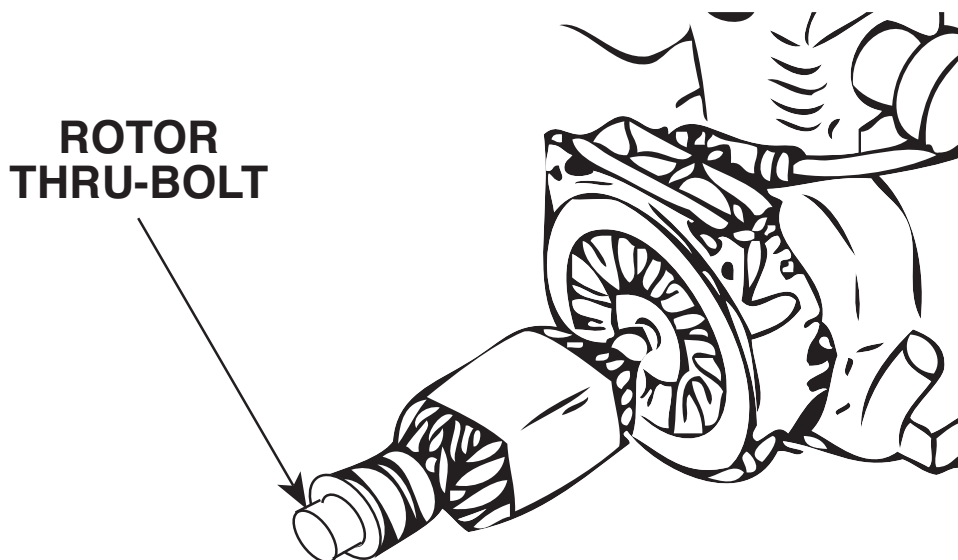
FIGURE F.17 – STATOR END BRACKET SUPPORT AND THRU-BOLTS



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.17 for location. There are 2 splitting 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.17. 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.

## STATOR/ROTOR REMOVAL AND REPLACEMENT (continued)

FIGURE F.18 – 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.18. 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.

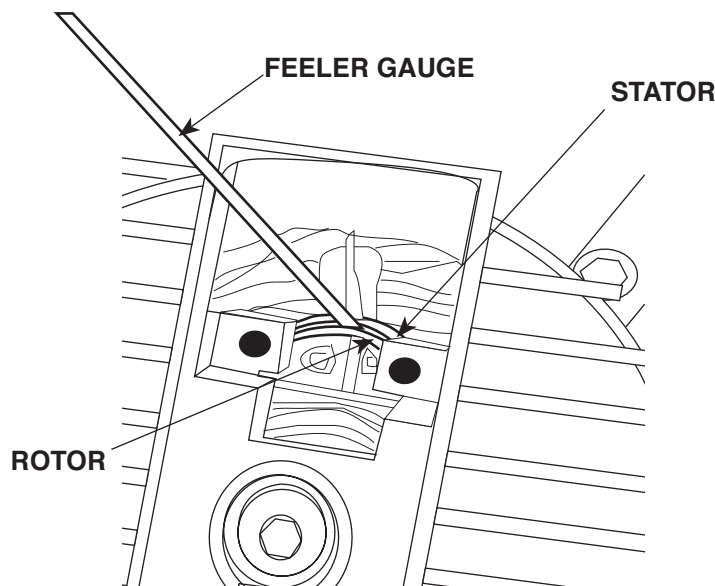
6. Slide the rotor and blower (press-fitted to the rotor) the rest of the way off the crankshaft.

### 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 (Locktite( 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)

FIGURE F.19 – CHECKING ROTOR-STATOR AIR GAP



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 F.19. 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 molex 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.



## 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	3800	3650
Minimum Speed	3700	3350

### WELDER/GENERATOR OUTPUT<sup>1</sup>

Output Control	Field Volts	Field Amps	Open Circuit Volts	Load Volts	Load Amps
Maximum	37.5 - 42.5	4.25 - 6.5	60 - 66	23 - 30	136 - 150
Minimum	–	–	55 - 62	28 - 36	50 - 85

### AUXILIARY POWER RECEPTACLE OUTPUT<sup>1</sup>

Output Control	230 Volt Receptacle			115 Volt Receptacle <sup>2</sup>		
	Open Circuit Volts	Load Volts	Load Amps	Open Circuit Volts	Load Volts	Load Amps
Maximum	240 - 260	216 - 240	19.2 - 22	120 - 130	108 - 120	17 - 20

<sup>1</sup> Current Control Dial set at MAXIMUM or GENERATOR.

<sup>2</sup> Output values of each receptacle can vary within the range shown

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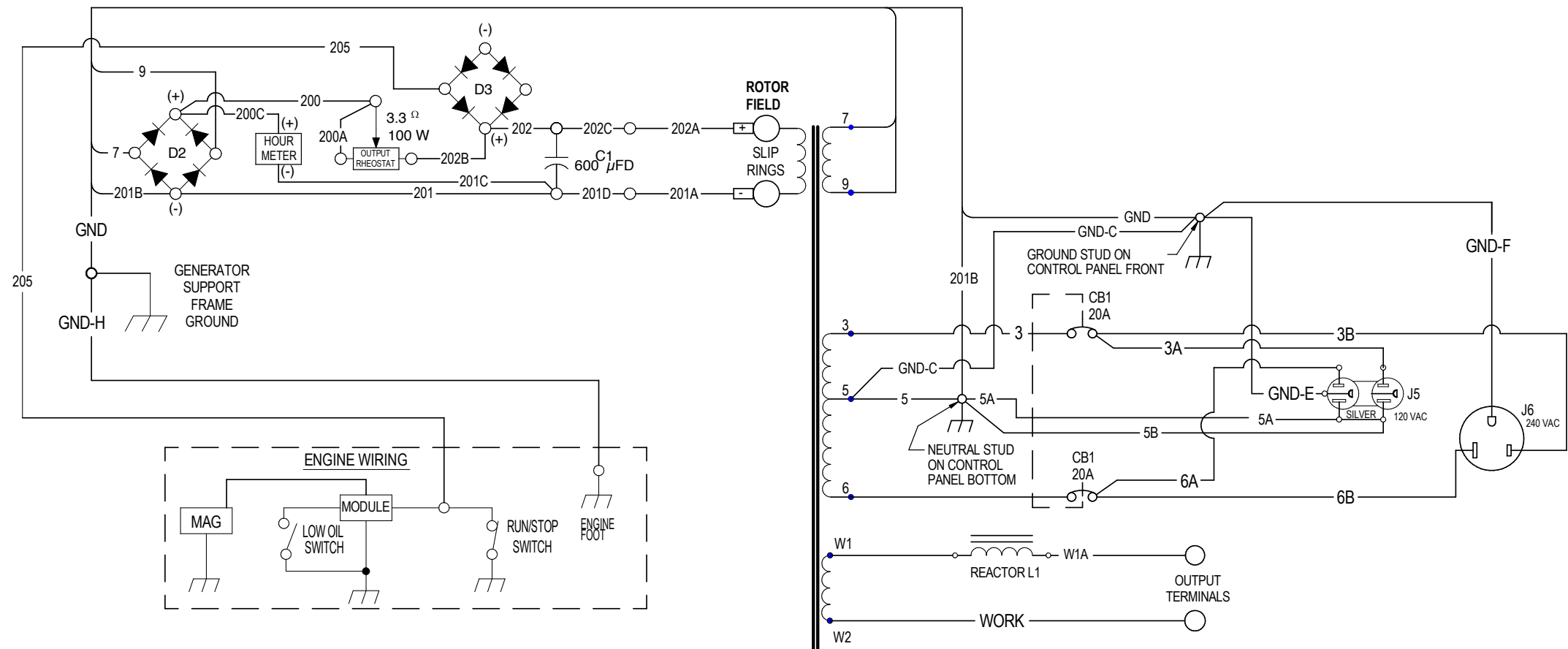
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WIRING DIAGRAM - COMPLETE MACHINE - (L15064)

# WIRING DIAGRAM - BULLDOG 140



L15064 A

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

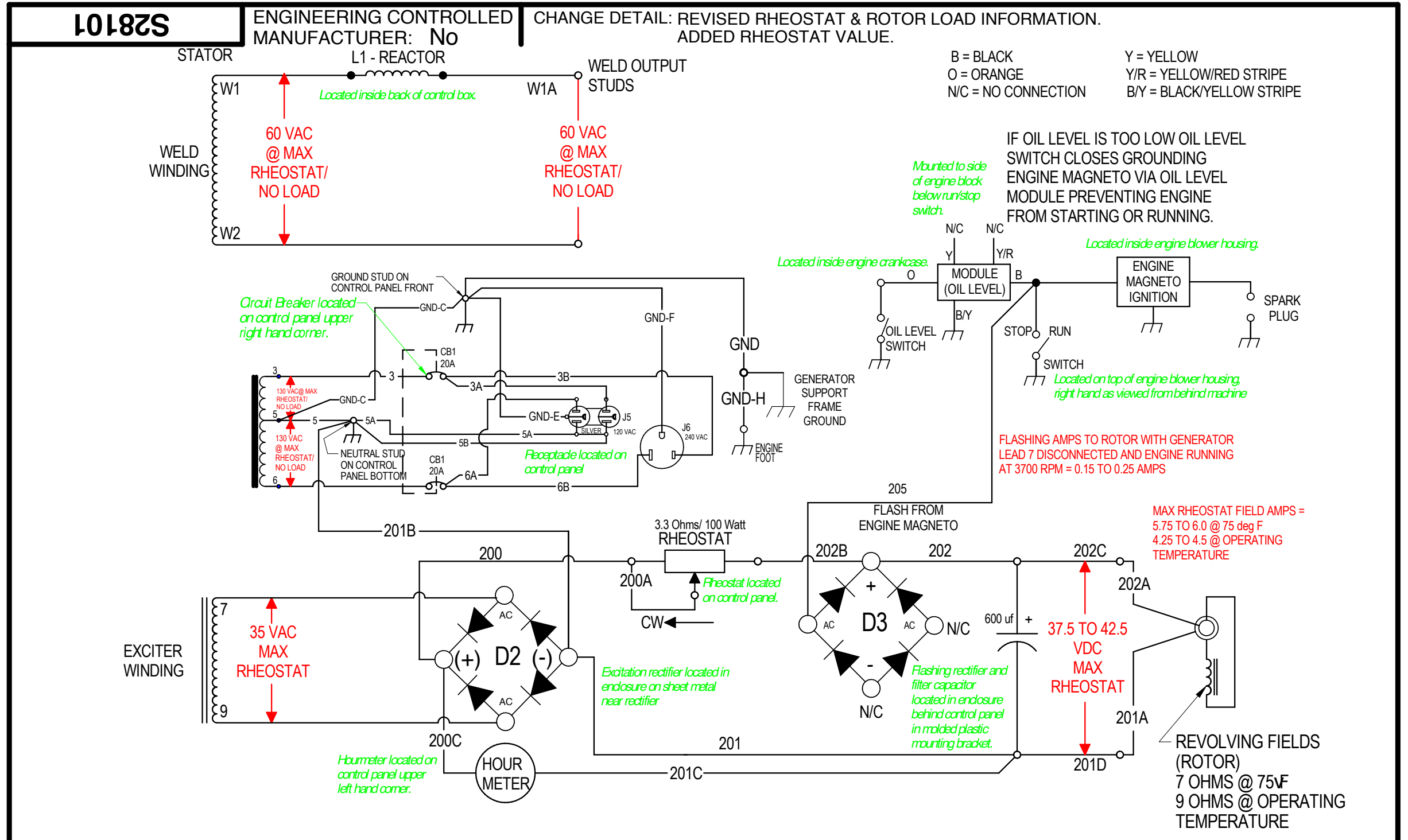
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SCHEMATIC - COMPLETE MACHINE - (S28101)



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MANUFACTURING TOLERANCE PER E2056 UNLESS OTHERWISE SPECIFIED TOLERANCE: ON 2 PLACE DECIMALS IS ± .02 in. (± 0.5 mm) ON 3 PLACE DECIMALS IS ± .002 in. (± 0.05 mm) ON ALL ANGLES IS ± .5 OF A DEGREE MATERIAL TOLERANCE ("+" TO AGREE WITH PUBLISHED STANDARDS. DO NOT SCALE THIS DRAWING	CONTROL: CLEVELAND	SCALE: NONE	EQUIPMENT TYPE: BULLDOG 140			PAGE 1 OF 1	
	DRAWN BY: mpatrzyk	IF PRINTED @ A4 SIZE	SUBJECT: MACHINE SCHEMATIC			DOCUMENT NUMBER: S28101	DOCUMENT REVISION: B
	ENGINEER: APM	UNITS: INCH	MATERIAL DISPOSITION: UF	APPROVAL DATE: 7/31/2009	PROJECT NUMBER: CRM40760-A	REFERENCE: S28100	
	APPROVED: DRS						

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.