

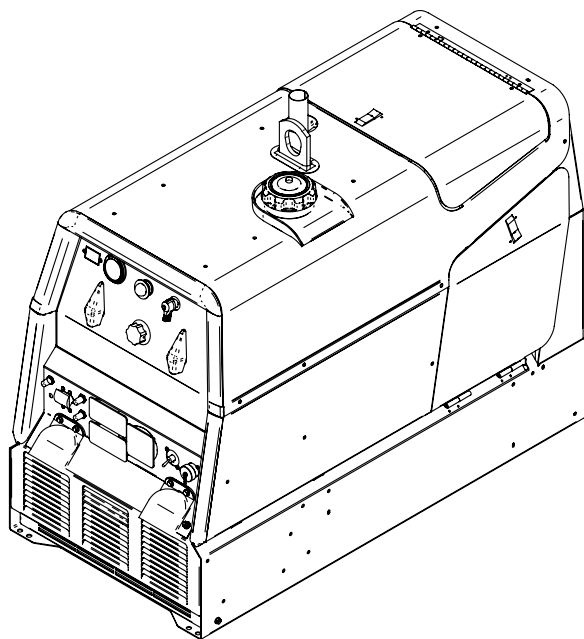


## RANGER® 250 GXT

For use with machines having Code Numbers:

**11269, 11400, 11420, 11493, 12539**

# 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)  
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## ⚠ 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.

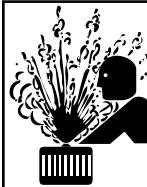
1.d. Keep all equipment safety guards, covers and devices in position and in good repair. Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

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.**

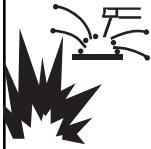
5.b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically 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.

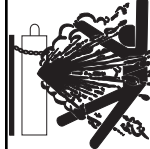
5.f. Also see item 1.b.



## 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 pistologie. 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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## SAFETY PRECAUTIONS

### ⚠ WARNING

Do not attempt to use this equipment until you have thoroughly read the engine manufacturer's manual supplied with your welder. It includes important safety precautions, detailed engine starting, operating and maintenance instructions, and parts lists.



#### ELECTRIC SHOCK can kill.

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



#### ENGINE EXHAUST can kill.

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



#### MOVING PARTS can injure.

- Do not operate with doors open or guards off.
- Stop engine before servicing.
- Keep away from moving parts.

See additional warning information at front of this operator's manual.

## MACHINE GROUNDING

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

### ⚠ WARNING

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

- be grounded to the frame of the welder using a grounded type plug, or be double insulated.

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

When this welder is mounted on a truck or trailer, its frame must be electrically bonded to the metal frame of the vehicle. Use a #8 or larger copper wire connected between the machine grounding stud and the frame of the vehicle.

Where this engine driven welder is connected to premises wiring such as that in your home or shop, its frame must be connected to the system earth ground. See further connection instructions in the section entitled "Standby Power Connections", as well as the article on grounding in the latest National Electrical Code and the local code.

In general, if the machine is to be grounded, it should be connected with a #8 or larger copper wire to a solid earth ground such as a metal water pipe going into the ground for at least ten feet and having no insulated joints, or to the metal framework of a building which has been effectively grounded. The National Electrical Code lists a number of alternate means of grounding electrical equipment. A machine grounding stud marked with the symbol  $\oplus$  is provided on the front of the welder.

## SPARK ARRESTER

Some federal, state, or local laws may require that gasoline engines 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 welder does not qualify as a spark arrester. When required by local regulations, the K1898-1 spark arrester must be installed and properly maintained.

### ⚠ CAUTION

An incorrect arrester may lead to damage to the engine or adversely affect performance.

## TOWING

The recommended trailer for use with this equipment for road, in-plant and yard towing by a vehicle<sup>(1)</sup> is Lincoln's K957-1. If the user adapts a non-Lincoln trailer, he must assume responsibility that the method of attachment and usage does not result in a safety hazard nor damage the welding equipment. Some of the factors to be considered are as follows:

1. Design capacity of trailer vs. weight of Lincoln equipment and likely additional attachments.
2. Proper support of, and attachment to, the base of the welding equipment so there will be no undue stress to the framework.

3. Proper placement of the equipment on the trailer to insure stability side to side and front to back when being moved and when standing by itself while being operated or serviced.

4. Typical conditions of use, i.e., travel speed; roughness of surface on which the trailer will be operated; environmental conditions.

5. Conformance with federal, state and local laws<sup>(1)</sup>

(1) Consult applicable federal, state and local laws regarding specific requirements for use on public highways.

#### VEHICLE MOUNTING

### WARNING

Improperly mounted concentrated loads may cause unstable vehicle handling and tires or other components to fail.

- Only transport this Equipment on serviceable vehicles which are rated and designed for such loads.
- Distribute, balance and secure loads so vehicle is stable under conditions of use.
- Do not exceed maximum rated loads for components such as suspension, axles and tires.
- Mount equipment base to metal bed or frame of vehicle.
- Follow vehicle manufacturer's instructions.

#### PRE-OPERATION SERVICE

### CAUTION

READ the engine operating and maintenance instructions supplied with this machine.

### WARNING



**GASOLINE** can cause fire or explosion.

- Stop engine while 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.

#### **GASOLINE FUEL ONLY**

#### FUEL



Fill the fuel tank with clean, fresh, lead-free gasoline. Observe fuel gauge while filling to prevent over filling.

### WARNING



- Damage to the fuel tank may cause fire or explosion. Do not drill holes in the Ranger® 250 GXTbase or weld to the Ranger® 250 GXTbase.

#### OIL



LUBRICATION SYSTEM CAPACITY  
(INCLUDING FILTER)  
Kohler CH235 - 2.0 Quarts (1.9 Liters)

The Ranger® 250 GXT is shipped with the engine crankcase filled with SAE 10W-30 oil. Check the oil level before starting the engine. If it is not up to the full mark on the dip stick, add oil as required. Make certain that the oil filler cap is tightened securely. Refer to the engine Owner's Manual for specific oil recommendations.

#### BATTERY CONNECTIONS

### CAUTION



Use caution as the electrolyte is a strong acid that can burn skin and damage eyes.

This welder is shipped with the negative battery cable disconnected. Make sure that the Engine Switch is in the "STOP" position and attach the disconnected cable securely to the negative battery terminal before attempting to operate the machine. If the battery is discharged and does not have enough power to start the engine, see the battery charging instructions in the Battery section.

**NOTE:** This machine is furnished with a wet charged battery; if unused for several months, the battery may require a booster charge. Be careful to charge the battery with the correct polarity.

## WELDING OUTPUT CABLES

With the engine off, connect the electrode and work cables to the studs provided. These connections should be checked periodically and tightened if necessary. Loose connections will result in overheating of the output studs.

When welding at a considerable distance from the welder, be sure you use ample size welding cables. Listed below are copper cable sizes recommended for the rated current and duty cycle. Lengths stipulated are the distance from the welder to work and back to the welder again. Cable sizes are increased for greater lengths primarily for the purpose of minimizing cable voltage drop.

| TOTAL COMBINED LENGTH OF ELECTRODE AND WORK CABLES |                             |
|--|-----------------------------|
|  | 250 Amps<br>100% Duty Cycle |
| 0-100 Ft. (0-31m)                                  | 1 AWG                       |
| 100-150 Ft. (31-46m)                               | 1 AWG                       |
| 150-200 Ft. (46-61m)                               | 1/0 AWG                     |

## ANGLE OF OPERATION

Internal combustion engines are designed to run in a level condition which is where the optimum performance is achieved. The maximum angle of operation for the engine is 15 degrees from horizontal in any direction. If the engine is to be operated at an angle, provisions must be made for checking and maintaining the oil at the normal (FULL) oil capacity in the crankcase in a level condition.

When operating at an angle, the effective fuel capacity will be slightly less than the specified 12 Gal. (45 L).

## LIFTING

The Ranger® 250 GXT weighs approximately 685lbs.(411kg) with a full tank of gasoline. A lift bail is mounted to the machine and should always be used when lifting the machine.

## ADDITIONAL SAFETY PRECAUTION HIGH ALTITUDE OPERATION

### ⚠ WARNING



**FALLING  
EQUIPMENT can  
cause injury.**

- Lift only with equipment of adequate lifting capacity.
- Be sure machine is stable when lifting.
- Do not lift this machine using lift bail if it is equipped with a heavy accessory such as trailer or gas cylinder.
- Do not lift machine if lift bail is damaged.
- Do not operate machine while suspended from lift bail.

At higher altitudes, Welder output de-rating may be necessary. For maximum rating, de-rate the welder output 3.5% for every 1000 ft. (305m) above 3000 ft. (914m). If operation will consistently be at altitudes above 5,000 ft. (1525m), a carburetor jet designed for high altitudes should be installed. This will result in better fuel economy, cleaner exhaust and longer spark plug life. It will not give increased power. Contact your local authorized engine service shop for high altitude jet kits that are available from the engine manufacturer.

### ⚠ CAUTION

**Do not operate with a high altitude jet installed at altitudes below 5000 ft. This will result in the engine running too lean and result in higher engine operating temperatures which can shorten engine life.**

## MUFFLER OUTLET PIPE

Using the clamp provided secure the outlet pipe to the outlet tube with the pipe positioned such that it will direct the exhaust in the desired direction. Tighten using a 9/16" socket or wrench.

RANGER® 250 GXT



## LOCATION / VENTILATION

The welder should be located to provide an unrestricted flow of clean, cool air to the cooling air inlets and to avoid heated air coming out of the welder recirculating back to the cooling air inlet. Also, locate the welder so that engine exhaust fumes are properly vented to an outside area.

## STACKING

Ranger® 250 GXT machines cannot be stacked.

## CONNECTION OF LINCOLN ELECTRIC WIRE FEEDERS

### WARNING

Shut off welder before making any electrical connections.

#### WIRE FEED (CONSTANT VOLTAGE) CONNECTION OF LN-15 ACROSS-THE-ARC WIRE FEEDER

The LN-15 has an internal contactor and the electrode is not energized until the gun trigger is closed. When the gun trigger is closed the wire will begin to feed and the welding process is started.

- Shut the welder off.
- Connect the electrode cable from the LN-15 to the "ELECTRODE" terminal of the welder. Connect the work cable to the "TO WORK" terminal of the welder.
- Set the Polarity switch to the desired polarity, either DC (-) or DC (+).
- Attach the single lead from the front of the LN-15 to work using the spring clip at the end of the lead. This is a control lead to supply current to the wire feeder motor; it does not carry welding current.
- Set the "RANGE" switch to the "WIRE FEED-CV" position
- Place the Engine switch in the "Auto Idle" position when welding with MIG wire instead of self-shielded core wire, weld starts can be improved by setting the idle mode to "HIGH".
- Adjust the wire feed speed at the LN-15 and adjust the welding voltage with the output "CONTROL" at the welder. Output "CONTROL" must be set above 3 when welding with MIG wire instead of self-shielded core wire, weld starts can be improved by setting the idle mode to "HIGH".

**NOTE:** LN-15 Control Cable model will not work with the RANGER® 250 GXT.

- Position the "RANGE" switch to the "WIRE FEED CV" position.
- Attach the single lead from the LN-25 control box to the work using the spring clip on the end of the lead - it carries no welding current.
- Place the engine switch in the "AUTO IDLE" position.
- When welding with MIG wire instead of self-shielded core wire, weld starts can be improved by setting the idle mode to "HIGH".
- Adjust wire feed speed at the LN-25 and adjust the welding voltage with the output "CONTROL" at the welder.

**NOTE:** The welding electrode is energized at all times, unless an LN-25 with built-in contactor is used. If the output "CONTROL" is set below "3", the LN-25 contactor may not pull in.

#### CONNECTION OF THE LN-25 TO THE Ranger® 250 GXT

- Shut the welder off.
- Connect the electrode cable from the LN-25 to the "ELECTRODE" terminal of the welder. Connect the work cable to the "TO WORK" terminal of the welder.
- Position the welder "Polarity" switch to the desired polarity, either DC (-) or DC (+).

#### CONNECTION OF K930-2 TIG MODULE TO THE RANGER® GXT.

The TIG Module is an accessory that provides high frequency and shielding gas control for AC and DC GTAW (TIG) welding. See IM528 supplied with the TIG Module for installation instructions.

**NOTE:** The TIG Module does not require the use of a high frequency bypass capacitor. However, if the Ranger® 250 GXT is used with any other high frequency equipment, the bypass capacitor must be installed, order kit T12246.

## INSTRUCTIONS

### ADDITIONAL SAFETY PRECAUTIONS

Always operate the welder with the roof and case sides in place as this provides maximum protection from moving parts and assures proper cooling air flow.

Read and understand all Safety Precautions before operating this machine. Always follow these and any other safety procedures included in this manual and in the Engine Owner's Manual.

RANGER® 250 GXT



## WELDER OPERATION

### WELDER OUTPUT

- Maximum Open Circuit Voltage at 3700 RPM is 80 Volts RMS.
- Duty Cycle is the percentage of time the load is being applied in a 10 minute period. For example, a 60% duty cycle represents 6 minutes of load and 4 minutes of no load in a 10 minute period. Duty Cycle for the Ranger® 250 GXT is 100%.

| RANGER® GXT             |  |
|-------------------------|--|
| <b>Constant Current</b> | 250 Amps AC @ 25 Volts<br>250 Amps DC @ 25 Volts |
| <b>Constant Voltage</b> | 250 Amps DC @ 25 Volts                           |

### AUXILIARY POWER

The Ranger® 250 GXT can provide up to 10,000 watts of 120/240 volts AC, single phase 60Hz power for continuous use, and up to 11,000 watts of 120/240 volts AC, single phase 60Hz power peak use. The front of the machine includes three receptacles for connecting the AC power plugs; one 50 amp 120/240 volt NEMA 14-50R receptacle and two 20 amp 120 volt NEMA 5-20R receptacles. Output voltage is within +/-10% at all loads up to rated capacity.

All auxiliary power is protected by circuit breakers. The 120V has 20 Amp circuit breakers for each duplex receptacle. The 120/240V Single Phase has a 50 Amp 2-pole Circuit Breaker that disconnects both hot leads simultaneously.

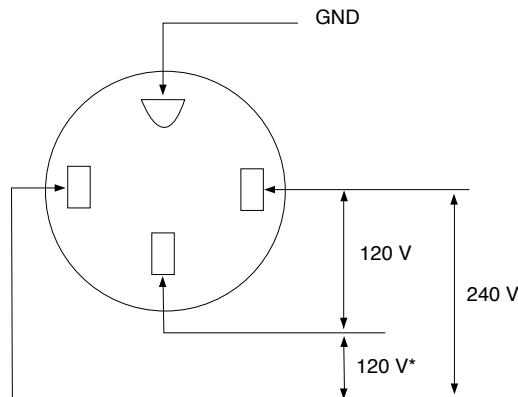
## ⚠ CAUTION

**Do not connect any plugs that connect to the power receptacles in parallel.**

Start the engine and set the "IDLER" control switch to the desired operating mode. Set the "CONTROL" to 10. Voltage is now correct at the receptacles for auxiliary power.

## 120/240 VOLT DUAL VOLTAGE RECEPTACLE

The 120/240 volt receptacle can supply up to 42 amps of 240 volt power to a two wire circuit, up to 42 amps of 120 volts power from each side of a three wire circuit (up to 84 amps total). Do not connect the 120 volt circuits in parallel. Current sensing for the automatic idle feature is only in one leg of the three wire circuit as shown in the following column.



\*Current Sensing for Automatic Idle.  
(Receptacle viewed from front of Machine)

## 120 V DUPLEX RECEPTACLES

The 120V auxiliary power receptacles should only be used with three wire grounded type plugs or approved double insulated tools with two wire plugs.

The current rating of any plug used with the system must be at least equal to the current load through the associated receptacle.

## MOTOR STARTING

Most 1.5 hp AC single phase motors can be started if there is no load on the motor or other load connected to the machine, since the full load current rating of a 1.5 hp motor is approximately 20 amperes (10 amperes for 240 volt motors). The motor may be run at full load when plugged into only one side of the duplex receptacle. Larger motors through 2 hp can be run provided the receptacle rating as previously stated is not exceeded. This may necessitate 240V operation only.

### Ranger® 250 GXT Extension Cord Length Recommendations (Use the shortest length extension cord possible sized per the following table.)

| Current (Amps) | Voltage Volts | Load (Watts) | Maximum Allowable Cord Length in ft. (m) for Conductor Size |         |          |          |           |           |  |  |
|----------------|---------------|--------------|---|---------|----------|----------|-----------|-----------|--|--|
|                |               |              | 14 AWG  | 12 AWG  | 10 AWG   | 8 AWG    | 6 AWG     | 4 AWG     |  |  |
| 15             | 120           | 1800         | 30 (9)  | 40 (12) | 75 (23)  | 125 (38) | 175 (53)  | 300 (91)  |  |  |
| 20             | 120           | 2400         |   | 30 (9)  | 50 (15)  | 88 (27)  | 138 (42)  | 225 (69)  |  |  |
| 15             | 240           | 3600         | 60 (18)   | 75 (23) | 150 (46) | 225 (69) | 350 (107) | 600 (183) |  |  |
| 20             | 240           | 4800         |   | 60 (18) | 100 (30) | 175 (53) | 275 (84)  | 450 (137) |  |  |
| 42             | 240           | 10,000       |   |         | 50 (15)  | 90 (27)  | 150 (46)  | 225 (69)  |  |  |

Conductor size is based on maximum 2.0% voltage drop.

**RANGER® 250 GXT**



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**TABLE III  
ELECTRICAL DEVICE USE WITH THE RANGER® GXT.**

| 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. 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 RANGER® GXT</b>   |

The Lincoln Electric Company is not responsible for any damage to electrical components improperly connected to the RANGER® 250 GXT.



## AUXILIARY POWER WHILE WELDING

Simultaneous welding and power loads are permitted by following Table I. The permissible currents shown assume that current is being drawn from either the 120V or 240V supply (not both at the same time). Also, the "Output Control" is set at "10" for maximum auxiliary power.

| TABLE I<br>SIMULTANEOUS WELDING AND POWER |  |  |    |
|---|--|--|----|
| Output Selector Setting                   | Permissible Power Watts (Unity Power Factor) | Permissible Auxiliary Current in Amperes @ 120V *-or- @ 240V |    |
|   |  |  |    |
| Max. Stick or Wire Feed Setting           | None   | 0  | 0  |
| 180 Stick Setting                         | 5100   | 42   | 21 |
| 130 Stick Setting                         | 7200   | 60**   | 30 |
| 80 Stick Setting                          | 8750   | 72**   | 36 |
| No Welding                                | 10,000                                       | 84**   | 42 |

\* Each duplex receptacle is limited to 20 amps.

\*\*Not to exceed 50A per 120VAC branch circuit when splitting the 240 VAC output.

## STANDBY POWER CONNECTIONS

The Ranger® 250 GXT is suitable for temporary, standby, or emergency power using the engine manufacturer's recommended maintenance schedule.

The Ranger® 250 GXT can be permanently installed as a standby power unit for 240V-3 wire, single phase 42 ampere service.

### WARNING

(Connections must be made by a licensed electrician who can determine how the 120/240V power can be adapted to the particular installation and comply with all applicable electrical codes.) The following information can be used as a guide by the electrician for most applications (refer also to the connection diagram shown in *Figure A.1.*)

1. Install a double pole, double throw switch between the power company meter and the premises disconnect.

Switch rating must be the same or greater than the customer's premises disconnect and service overcurrent protection.

2. Take necessary steps to assure load is limited to the capacity of the Ranger® 250 GXT by installing a 50 amp 240V double pole circuit breaker. Maximum rated load for the 240V auxiliary is 42 amperes. Loading above 42 amperes will reduce output voltage below the allowable -10% of rated voltage which may damage appliances or other motor-driven equipment.
3. Install a 50 amp 120/240V plug (NEMA type 14-50) to the Double Pole Circuit Breaker using No. 8, 4 conductor cable of the desired length. (The 50 amp 120/240V plug is available in the optional plug kit.)
4. Plug this cable into the 50 amp 120/240V receptacle on the Ranger® 250 GXT case front.



**Operation** ..... **B-1**

    Safety Precautions ..... B-2

    General Description ..... B-2

    Range Switch and Polarity Switch ..... B-3

    Starting/Shutdown Instructions ..... B-4

    Break-In Period ..... B-4

    Stick/Tig Welding ..... B-5

    Summary of Welding Processes ..... B-6

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## SAFETY PRECAUTIONS

Do not attempt to use this equipment until you have thoroughly read the engine manufacturer's manual supplied with your welder. It includes important safety precautions, detailed engine starting, operating and maintenance instructions, and parts lists.



### ELECTRIC SHOCK can kill.

- Do not touch electrically live parts or electrode with skin or wet clothing.
  - Insulate yourself from work and ground
  - Always wear dry insulating gloves.
- Always operate the welder with the hinged door closed and the side panels in place.
  - Read carefully the Safety Precautions page before operating this machine. Always follow these and any other safety procedures included in this manual and in the Engine Instruction Manual.


## GENERAL DESCRIPTION


The Ranger® 250 GXT is a twin-cylinder, gasoline driven, multiprocess arc welder and AC power generator. It is built in a heavy gauge steel case for durability on the job site.

## WELDER CONTROLS - FUNCTION AND OPERATION


### ENGINE SWITCH

The engine switch is used to Start the Engine, Select High Idle or Auto Idle while the engine is running, and stop the Engine.

When placed in the "OFF"  position, the ignition circuit is de-energized to shut down the engine.

When held in the "START"  position, the engine starter motor is energized.

When in "HIGH IDLE" () position, the engine will run continuously at high idle.

When in "AUTO IDLE" () position, the engine will run continuously and the idler operates as follows:

- Welding

When the electrode touches the work, the welding arc is initiated and the engine accelerates to full speed.

After welding ceases (and no auxiliary power is being drawn), the engine will return to low idle after approximately 10 to 14 seconds.

- Auxiliary Power

With the engine running at low idle and auxiliary power for lights or tools is drawn (approximately 100-150 watts or greater) from the receptacles, the engine will accelerate to high speed. If no power is being drawn from the receptacles (and not welding) for 10-14 seconds, the idler reduces the engine speed to low idle.

**“ RANGE” SWITCH**

The “Range” switch is used to select one of four amperage ranges with generous overlap for Stick/TIG welding, or one Wire Feed welding range.

| Process   | Range Setting          | Current Range   |
|---|------------------------|-----------------|
| STICK/TIG<br>(constant current)<br>(4 range settings) | 80 Max.                | 50 to 80 Amps   |
|   | 130 Max.               | 70 to 130 Amps  |
|   | 180 Max.               | 110 to 180 Amps |
|   | 250 Max.               | 160 to 250 Amps |
| WIRE FEED<br>(constant voltage)<br>(2 range setting)  | 14 to 22V<br>18 to 28V | Up to 250 Amps  |

** CAUTION**

**Never change the “RANGE” Switch setting while welding. This will damage the switch.**

**“ CONTROL” DIAL**

Provides a fine welding current adjustment within the Range Switch settings in the STICK mode and welding voltage control with the Range switch set in the wire feed mode.

**POLARITY SWITCH**

Provides three selectable welding polarities:  
AC, DC+ & DC-

** CAUTION**

**Never change the Polarity switch setting while welding. This will damage the switch.**

**6-PIN CONNECTOR**

For attaching optional remote control equipment.

**LOCAL / REMOTE CONTROL SWITCH**

(See *Accessory Section* For “K” numbers)

The toggle switch on the control panel labeled "LOCAL" and "REMOTE" provides the option of controlling the welding output at the control panel or remotely. Remote connections are made at the 6-pin connector. For control at the control panel set the switch in the "LOCAL" position.

For remote control set the switch in the "REMOTE" position.

**Ranger® 250 GXT APPROXIMATE FUEL CONSUMPTION**

|  | KOHLER<br>20 H.P. COMMAND               |
|--|---|
| Low Idle - No Load<br>2400 RPM           | .40 Gallons/Hour<br>(1.50 Liters/Hour)  |
| High Idle - No Load<br>3700 RPM          | .77 Gallons/Hour<br>(2.91 Liters/Hour)  |
| AC CC Weld Output<br>250 Amps @ 25 Volts | 1.27 Gallons/Hour<br>(4.82 Liters/Hour) |
| DC CC Weld Output<br>250 Amps @ 25 Volts | 1.50 Gallons/Hour<br>(5.69 Liters/Hour) |
| DC CV Weld Output<br>250 Amps @ 25 Volts | 1.41 Gallons/Hour<br>(5.33 Liters/Hour) |
| Auxiliary Power<br>10,000 Watts          | 1.48 Gallons/Hour<br>(5.62 Liters/Hour) |

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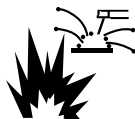
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**STARTING/SHUTDOWN INSTRUCTIONS****STARTING THE ENGINE****⚠ WARNING**

- Do not touch electrically live parts of electrode with skin or wet clothing.



- Keep flammable material away.



- Insulate yourself from work and ground. Wear eye, ear, and body protection.






- Keep your head out of the fumes.

- Use ventilation or exhaust to remove fumes from breathing zone.

Be sure all Pre-Operation Maintenance has been performed. Also, read the Engine Owner's Manual before starting for the first time.

Remove all loads connected to the AC power receptacles. Use the choke control as follows:

**KOHLER ENGINE - Always** pull the choke control out when starting the engine; cold, warm or hot.


Turn the engine switch to the "start"  position and crank the engine until it starts. Release the switch as soon as the engine starts, slowly return the choke control to the full "in" position (choke open), and turn the switch to the Auto Idle ( /  ) position. Do not turn the switch to the "start" position while the engine is running because this will cause damage to the ring gear and/or starter motor

After running at high engine speed for 10-14 seconds, the engine will go to low idle.

Allow the engine to warm up by letting it run at low idle for a few minutes.

**STOPPING THE ENGINE**

Remove all welding and auxiliary power loads and allow engine to run at low idle speed for a few minutes to cool the engine.

Stop the engine by placing the Engine switch in the "OFF"  position.

A fuel shut off valve is not required on the Ranger® 250 GXT because the fuel tank is mounted below the engine.

**BREAK-IN PERIOD**

It is normal for any engine to use a greater amount of oil until the break-in is accomplished. Check the oil level twice a day during the break-in period (approximately 50 running hours).

**IMPORTANT: IN ORDER TO ACCOMPLISH THIS BREAK-IN, THE UNIT SHOULD BE SUBJECTED TO MODERATE LOADS, WITHIN THE RATING OF THE MACHINE. AVOID LONG IDLE RUNNING PERIODS. REMOVE LOADS AND ALLOW ENGINE TO COOL BEFORE SHUTDOWN.**

The engine manufacturer's recommendation for the running time until the first oil change is as follows:

|                 |
|-----------------|
| KOHLER<br>CH23S |
| 5 HRS           |

The oil filter is to be changed at the second oil change. Refer to the Engine Owner's Manual for more information.

## WELDING PROCESS

For any electrodes the procedures should be kept within the rating of the machine. For electrode information see the appropriate Lincoln publication.

### STICK (CONSTANT CURRENT) WELDING

Connect welding cables to the "TO WORK" and "ELECTRODE" studs. Start the engine. Set the "Polarity" switch to the desired polarity. The "RANGE" switch markings indicate the maximum current for that range as well as the typical electrode size for that range. The "OUTPUT" Control provides fine adjustment of the welding current within the select range. For maximum output within a selected range set the "OUTPUT" Control at 10. For minimum output within a selected range set the "OUTPUT" Control at 5. ("OUTPUT" Control settings below 5 may reduce arc stability) For best overall welding performance set the "RANGE" Switch to the lowest setting and the "OUTPUT" Control near the maximum to achieve the desired welding current.

| RANGE SETTING | TYPICAL ELECTRODE SIZE | CURRENT RANGE   |
|---------------|------------------------|-----------------|
| 80 MAX.       | 3/32                   | 50 TO 80 AMPS   |
| 130 MAX.      | 1/8                    | 70 TO 130 AMPS  |
| 180 MAX.      | 5/32                   | 110 TO 180 AMPS |
| 250 MAX.      | 3/16                   | 160 TO 250 AMPS |

The Ranger® 250 GXT can be used with a broad range of AC and DC stick electrodes. See "Welding Tips 1" included with the Ranger® 250 GXT for electrodes within the rating of this unit and recommended welding currents of each.

### TIG (CONSTANT CURRENT) WELDING

The Ranger® 250 GXT can be used in a wide variety of AC and DC Tungsten Inert Gas (TIG) welding applications for AC TIG Welding up to 200 amps and DC TIG welding up to 250 amps.

The K930 [ ] TIG Module installed on a Ranger® 250 GXT provides high frequency and shielding gas control for AC and DC GTAW (TIG) welding processes. The TIG Module allows full range output control.

When using the Ranger® 250 GXT for AC TIG welding of aluminum the following settings and electrodes are recommended:

| SETTINGS FOR PURE TUNGSTEN |                       |                           |
|----------------------------|-----------------------|---------------------------|
| TUNGSTEN DIAMETER (in.)    | RANGE SWITCH SETTINGS | APPROXIMATE CURRENT RANGE |
| 1/8                        | 80 or 130             | 100 - 300 Amps            |
| 3/32                       | 80                    | 45 - 140 Amps             |
| 1/16                       | 80                    | 45 - 100 Amps             |

### SETTINGS FOR 1% THORIATED TUNGSTEN

| TUNGSTEN DIAMETER (in.) | RANGE SWITCH SETTINGS | APPROXIMATE CURRENT RANGE |
|-------------------------|-----------------------|---------------------------|
| 1/8                     | 80, 130, or 180       | 80 - 225 Amps             |
| 3/32                    | 80 or 130             | 50 - 180 Amps             |
| 1/16                    | 80                    | 45 - 120 Amps             |

For AC TIG Welding, the maximum TIG Welding output currents on each range setting will be approximately 50% higher than those marked on the nameplate. This is due to the special nature of the AC TIG welding arc. Do not AC TIG weld on the 250 Amp setting. The output may exceed the rating of the Ranger® GXT.

### WIRE FEED WELDING PROCESSES (CONSTANT VOLTAGE)

The Innershield® electrode recommended for use with the Ranger® 250 GXT is NR<sub>s</sub>-211-MP. The electrode sizes and welding ranges that can be used with the Ranger® 250 GXT are shown in the following table:

| Diameter (in.) | Wire Speed Range In./Min. | Approximate Current Range |
|----------------|---------------------------|---------------------------|
| .035           | 80 - 110                  | 75A to 120A               |
| .045           | 70 - 130                  | 120A to 170A              |
| .068           | 40 - 90                   | 125A to 210A              |
| 5/64           | 50 - 75                   | 180A to 235A              |

The Ranger® 250 GXT is recommended for limited "MIG" welding (GMAW - gas metal arc welding). The recommended electrodes are .030" and .035" L-50 and L-56. They must be used with a blended shielding gas such as C25 (75% Argon - 25% CO<sub>2</sub>). The welding ranges that can be used with the Ranger® 250 GXT are shown in the following table:

| Diameter (in.) | Wire Speed Range In./Min. | Approximate Current Range |
|----------------|---------------------------|---------------------------|
| .030           | 75 - 300                  | 50A to 130A               |
| .035           | 100 - 250                 | 80A to 175A               |
| .045           | 125 - 200                 | 145A to 200A              |

### ARC GOUGING

The Ranger® 250 GXT can be used for limited arc gouging.

Set the Range switch to adjust output current to the desired level for the gouging electrode being used according to the ratings in the following table:

| ELECTRODE SETTING | CURRENT RANGE (DC, electrode positive) |
|-------------------|--|
| 1/8               | 30 - 60 Amps                           |
| 5/32              | 90 - 150 Amps                          |
| 3/16              | 150 - 250 Amps                         |

RANGER® 250 GXT



## SUMMARY OF WELDING PROCESSES

| PROCESS   | CONTROL CABLE USED | IDLE MODE | ELECTRODE WHEN NOT WELDING | TO START WELDING   |
|---|--------------------|-----------|----------------------------|--|
| STICK   | No                 | AUTO      | Hot                        | Touch electrode to work. Welding starts immediately and engine goes to high idle.  |
| WIRE FEED, LN-25 WITH INTERNAL CONTACTOR                    | No                 | AUTO      | Cold                       | Press gun trigger, LN-25 contactor closes. Welding starts immediately and engine goes to high idle.<br><b>NOTE:</b> Output Control must be set above "3".*   |
| TIG, TIG MODULE WITH CONTACTOR KIT CONTROL CABLE, & AMPTROL | Yes                | HIGH      | Cold                       | Press Amptrol, contactor closes, welding starts immediately.   |
| WIRE FEED, LN-15 ACROSS the ARC (has internal contactor)    | No                 | AUTO      | Cold                       | Press gun trigger. LN-15 contactor closes, Welding starts immediately and engine goes to "HIGH" Idle.<br><b>NOTE:</b> Output Control must be set above "3".* |

\*When welding with MIG wire instead of self-shielded core wire, weld starts can be improved by setting the idle mode to "HIGH".



**Accessories** .....C-1

Optional Equipment .....C-2

Recommended Equipment .....C-3

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**OPTIONAL EQUIPMENT** (Field Installed)

**K957-1 HEAVY DUTY, TWO WHEEL TRAILER FOR SMALL WELDERS** - For road, off-road, in-plant and yard towing. (For highway use, consult applicable federal, state and local laws regarding requirements for brakes, lights, fenders, etc.)

Order K957-1 Trailer  
 K958-1 Ball Hitch  
 K958-2 Lunette Eye Hitch  
 K959-2 Fender & Light Kit  
 K965-1 Cable Storage Rack

**K1737-1 FOUR WHEEL ALL-TERRAIN UNDER-CARRIAGE** - For moving by hand at construction sites. Heavy duty puncture resistant pneumatic tires.

**K1770-1 UNDERCARRIAGE (FACTORY)** - For moving by hand on a smooth surface. One or two gas cylinders can be mounted on the rear of the undercarriage with the installation of K1745-1 Cylinder Holder(s). Heavy duty puncture resistant pneumatic tires and front caster.

**K1745-1 WELDING GAS CYLINDER LPG TANK HOLDER**

Holds Welding Gas Cylinder for use on K1770-1 Undercarriage. One or two may be installed on an undercarriage.

**K1788-1 ROLL CAGE** - Gives added damage protection. Attaches to K1737-1, K1770-1, and K957-1.

**K886-2 Canvas Cover** -To protect the Ranger® 250 GXT when not in use. Made from attractive red canvas material which is flame retardant, mildew resistant, and water repellent.

**K802R Power Plug Kit** - provides four 120V plugs rated at 15 amps each and one dual voltage, Full KVA plug rated at 120/240V, 50 amps.

**K802N Power Plug Kit** - Provides four 120V plugs rated at 20 amps each and one dual voltage, full KVA plug rated at 120/240V, 50 amps.

**K857 (25 ft.(7.5m) or K857-1(100 ft.(30.4m)**

**Remote Control**- Portable control provides same dial range as the output control on the welder. Has a convenient 6-pin plug for easy connection to the welder.

**K704 Accessory Kit** - Includes 35 ft (10.7m) 2/0 AWG electrode cable, 30 ft. (9.1m) 2/0 AWG work cable, headshield with No. 12 filter, GC300 work clamp and Cooltong® 300 electrode holder. Cables are rated at 300 amps, 100% duty cycle.

**K875 Accessory Kit** - For Stick welding. Includes 20ft.(6.1m)#6 electrode cable with lug. 15ft.(4.6m)#6 work cable with lugs, headshield, filter plate, work clamp, electrode holder and sample pack of mild steel electrode. 150 amp capacity.

**K1898-1 Spark Arrester Kit** - Attaches between muffler and exhaust elbow. Virtually eliminates spark emissions.

**K1690-1 GFCI RECEPTACLE KIT** - Includes one UL approved 120V ground fault circuit interrupter duplex type receptacle with cover and installation instructions. Replaces the factory installed 120V duplex receptacle. Each receptacle of the GFCI Duplex is rated at 20 Amps, the maximum total current from the GFCI Duplex is limited to the 20 Amps. Two kits are required.

**K1816-1 FULL KVA ADAPTER KIT** - Plugs into the 120/240V NEMA 14-50R receptacle on the case front (which accepts 4-prong plugs) and converts it to a NEMA 6-50R receptacle, (which accepts 3-prong plugs.)

**T12153-9 Full-KVA Power Plug** - One dual voltage plug rated at 120/240V, 50 amps.

## RECOMMENDED EQUIPMENT

### STICK

K704 Accessory Kit- (400 AMP Capacity) which includes:

- Electrode Holder & Cable
- Work Clamp & Cable
- Headshield

K875 Accessory Kit- (150 AMP Capacity)

### WIRE FEED

**K449 LN-25** - Includes internal contactor for across the arc operation (no control cable). Provides "cold" electrode until gun trigger is pressed. Includes gas solenoid.

Magnum Gun and Magnum Gun Connector Kit are required for gas-shielded welding. Innershield Gun is required for gasless welding.

- K126-2** Magnum 350 Innershield Gun
- K1802-1** Magnum 300 MIG Gun (for LN-25)
- K470-2** Magnum 300 MIG Gun (for LN-15)
- K466-10** Connector Kit (for LN-15, K470-2)
- K1500-1** Gun Receiver Bushing (for LN-15 & K126-2)
- K1870-1** LN-15 Across the Arc Model

### TIG

Magnum™ TIG Torch  
**K1783-4** - TIG Torch

Magnum Parts Kit and Argon Gas

**K930-2 TIG Module** - Provides high frequency and shielding gas control for AC and DC GTAW (TIG) welding applications. Its compact case is designed for easy carrying, complete with a handle. High frequency bypass is built in. Requires **K938-1** Contactor Kit, **K936-3** Control Cable, and **K814** Arc Start Switch.

**K938-1** Contactor Kit - For use with TIG Module, Provides a "cold" electrode until the triggering device (Arc Start Switch) is pressed.

**K936-3** Control Cable - Connects TIG Module to RANGER® GXT.

Optional TIG Equipment:

**K939-1** Docking Kit - For Mounting the K930-2 TIG Module on top of the RANGER® GXT.

**K937-45** Control Cable Extension - Allows TIG Module to be operated at distances up to 200ft. from the power source. Available in 45ft. (13.7m).

**K963-3** Hand Amptrol

**K870** Foot Amptrol

### **REMOTE OUTPUT CONTROL**

(See Operations Section for reference)

The Ranger® 250 GXT is equipped with a 6-pin connector. The 6-pin connector is for connecting the **K857** or **K857-1** Remote Control (optional) or for TIG welding, the **K870 Foot Amptrol** or the **K963-3 Hand Amptrol**. When remote control is used set the LOCAL / REMOTE switch in the "REMOTE" position.

### **Plasma**

**K1580-1** Pro-Cut 55  
 (Requires Full KVA Adapter **K1816-1**)

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RANGER® 250 GXT



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    Service Instructions .....D-2

    Safety Precautions .....D-3

    Oil Filter and Air Cleaner .....D-4

    Engine Adjustments .....D-5

    Major Component Location .....D-6

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## Service Instructions

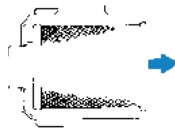
### Single- and Two-Stage Engine Air Cleaners

#### 1 Remove the Filter



Rotate the filter while pulling straight out.

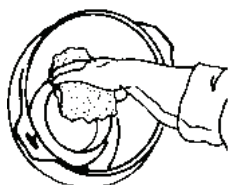
Unfasten or unlatch the service cover. Because the filter fits tightly over the outlet tube to create the critical seal, there will be some initial resistance, similar to breaking the seal on a jar. Gently move the end of the filter back and forth to break the seal then rotate while pulling straight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

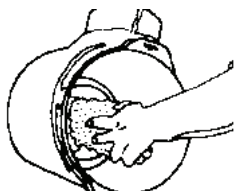
#### 2 Clean Both Surfaces of the Outlet Tube and Check the Vacuator™ Valve

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.



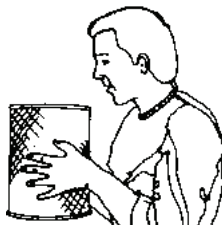
Inner edge of the outlet tube

**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

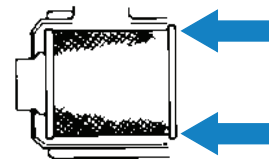
Inspect the new filter carefully, paying attention to the inside of the open end, which is the sealing area. NEVER install a damaged filter. A new Donaldson radial seal filter may have a dry lubricant on the seal to aid installation.



#### 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!

## SAFETY PRECAUTIONS

**⚠ WARNING**

Have qualified personnel do the maintenance work. Turn the engine off before working inside the machine. 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.

Do not put your hands near the engine cooling blower fan. If a problem cannot be corrected by following the instructions, take the machine to the nearest Lincoln Field Service Shop.

**ELECTRIC SHOCK can kill.**

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

**ENGINE EXHAUST can kill.**

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

**MOVING PARTS can injure.**

- Do not operate with doors open or guards off.
- Stop engine before servicing.
- Keep away from moving parts.

See additional warning information throughout this operator's manual and the Engine manual as well.

Read the Safety Precautions in the front of this manual and the engine instruction manual before working on this machine.

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

**Routine Maintenance**

- At the end of each day's use, refill the fuel tank to minimize moisture condensation in the tank. Running out of fuel tends to draw dirt into the fuel system. Also, check the crankcase oil level and add oil if indicated.

**⚠ CAUTION**

Make certain that the oil filler cap is securely tightened after checking or adding oil. If the cap is not tight, oil consumption can increase significantly which may be evidenced by white smoke coming from the exhaust.

- OIL - Maintenance schedule for changing the oil and oil filter after break-in :

|            |                 |
|------------|-----------------|
|            | Kohler<br>CH23S |
| Oil        | 100 Hrs.        |
| Oil Filter | 200 Hrs.        |

The above schedule is for normal operating conditions. More frequent oil changes are required with dusty, high temperature and other severe operating conditions. Refer to the maintenance section of the Engine Owner's Manual for more information.

**NOTE:** Engine life will be reduced if the oil and oil filter are not changed according to the manufacturer's recommendation.

**ENGINE OIL CHANGE**

Drain the oil while the engine is warm to assure rapid and complete draining.

- Remove the oil filler cap and dipstick. Remove the yellow cap from the oil drain valve and attach the flexible drain tube supplied with the machine. Push in and twist the drain valve counterclockwise. Pull the valve out and drain the oil into a suitable container.
- Close the drain valve by pushing in and twisting clockwise. Replace the yellow cap.
- Refill to the upper limit mark on the dipstick with the recommended oil. Tighten the oil filler cap securely.

**ENGINE OIL REFILL CAPACITIES**

Without oil filter replacement:

- 1.7qt. (1.6 liter)-Kohler

With oil filter replacement:

- 2.0qt. (1.9 liter)-Kohler

Use 4-stroke motor oil that meets or exceeds the requirements for API service classification SG or SH. Always check the API SERVICE label on the oil container to be sure it includes the letters SG or SH.

SAE 10W-30 is recommended for general, all-temperature use, -5 F to 104 F (-20 C to 40 C).

See Engine Owner's Manual for more specific information on oil viscosity recommendations.

Wash your hands with soap and water after handling used oil.

Please dispose of used motor oil in a manner that is compatible with the environment. We suggest you take it in a sealed container to your local service station or recycling center for reclamation.

Do not throw it in the trash, pour it on the ground or down a drain.

## OIL FILTER CHANGE

1. Drain the engine oil.
2. Remove the oil filter, and drain the oil into a suitable container. Discard the used oil filter.
3. Clean the filter mounting base, and coat the gasket of the new oil filter with clean engine oil.
4. Screw on the new oil filter by hand, until the gasket contacts the filter mounting base, then use an oil filter socket tool to tighten the filter an additional 1/2 to 7/8 turn.
5. Refill the crankcase with the specified amount of the recommended oil. Reinstall the oil filler cap.
6. Start the engine and check for oil filter leaks.
7. Stop the engine, and check the oil level. If necessary, add oil to the upper limit mark on the dipstick.

## AIR CLEANER AND OTHER MAINTENANCE

- Air Cleaner - With normal operating conditions, the maintenance schedule for cleaning and re-oiling the foam pre-filter is every 25 hours and replacement of the air cleaner filter every 100 hours. More frequent servicing is required with dusty operating conditions. Refer to the maintenance section of the Engine Owner's Manual for more information.
- Refer to the maintenance section of the Engine Owner's Manual for the maintenance schedule, spark plug servicing, cooling system servicing, and fuel filter replacement.
- Blow out the machine with low pressure air periodically. In particularly dirty locations, this may be required once a week.
- Output Ranger® Selector and Polarity Switches: Switch contacts should not be greased. To keep contacts clean, rotate the switch through its entire range frequently. Good practice is to turn the handle from maximum to minimum setting twice each morning before starting to weld.



**ENGINE ADJUSTMENTS**

**OVERSPEED IS HAZARDOUS**

**⚠ WARNING**

The maximum allowable high idle speed for this machine is 3750 RPM, no load. Do NOT tamper with 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.

**SLIP RINGS**

A slight amount of darkening and wear of the slip rings and brushes is normal. Brushes should be inspected when a general overhaul is necessary. If brushes are to be replaced, clean slip rings with a fine emery paper.

**⚠ CAUTION**

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

**⚠ WARNING**



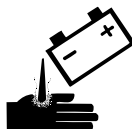
GASES FROM BATTERY can explode.  
 • Keep sparks, flame and cigarettes away from battery.

To prevent EXPLOSION when:  
 • **INSTALLING A NEW BATTERY** - disconnect negative cable from old battery first and connect to new battery last.



• **CONNECTING A BATTERY CHARGER** - Remove battery from welder by disconnecting negative cable first, then positive cable and battery clamp. When reinstalling, connect negative cable last. Keep well ventilated.

• **USING A BOOSTER** - connect positive lead to battery first then connect negative lead to engine foot.



**BATTERY ACID CAN BURN EYES AND SKIN.**  
 • Wear gloves and eye protection and be careful when working near battery. Follow instructions printed on battery.

**BATTERY**

1. When replacing, jumping, or otherwise connecting the battery to the battery cables, the proper polarity must be observed. Failure to observe the proper polarity could result in damage to the charging circuit. The positive (+) battery cable has a red terminal cover.
2. If the battery requires charging from an external charger, disconnect the negative battery cable first and then the positive battery cable before attaching the charger leads. Failure to do so can result in damage to the internal charger components. When reconnecting the cables, connect the positive cable first and the negative cable last.

**HARDWARE**

Both English and Metric fasteners are used in this welder.

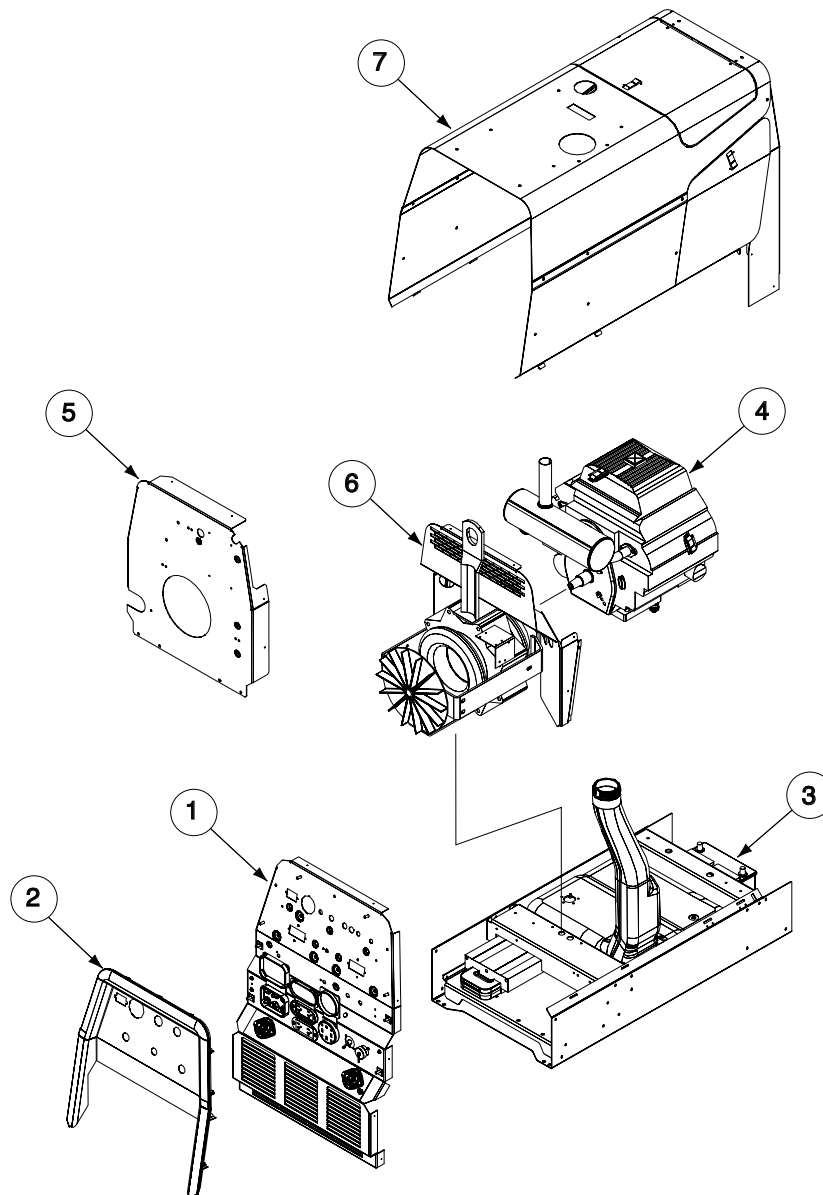
**ENGINE MAINTENANCE PARTS**

|                                    | <b>KOHLER C23S</b>               |
|------------------------------------|----------------------------------|
| <b>Oil Filter</b>                  | KOHLER 12 050 01<br>FRAM PH8172* |
| <b>Air Filter Element</b>          | KOHLER 47 083 03<br>FRAM CA79    |
| <b>Air Filter Pre-Cleaner</b>      | KOHLER 24 083 02                 |
| <b>Fuel Filter</b>                 | KOHLER 24 050 10                 |
| <b>Spark Plugs (Resistor Type)</b> | CHAMPION RC12YC<br>(.030" GAP)   |

\* Oil capacity increases from 2.0 Qts. to 2.1 Qts. when using this filter.

1. Case Front Assembly
2. Control Panel Assembly
3. Base/Fuel Tank/Battery Assembly
4. Engine Assembly
5. Blower Baffle Assembly
6. Stator/Rotor Assembly
7. Covers & Case Assembly

FIGURE D.1 - MAJOR COMPONENT LOCATION



RANGER® 250 GXT



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

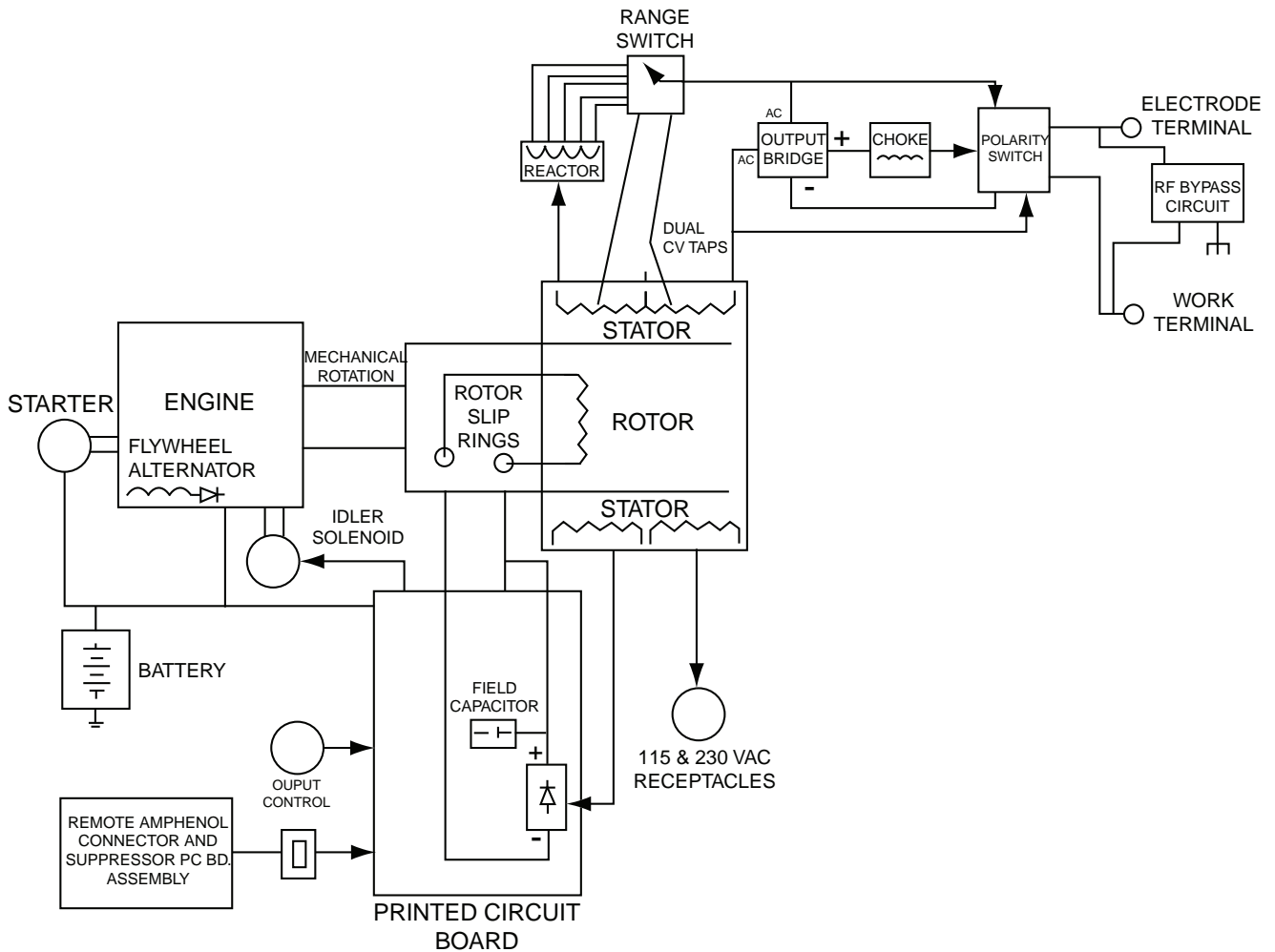
Battery, Starter, Engine, Rotor, Stator ..... E-2

Feedback and Auxiliary Power ..... E-3

Weld Winding, Reactor & Range Switch ..... E-4

Output Bridge, Choke & Polarity Switch ..... E-5

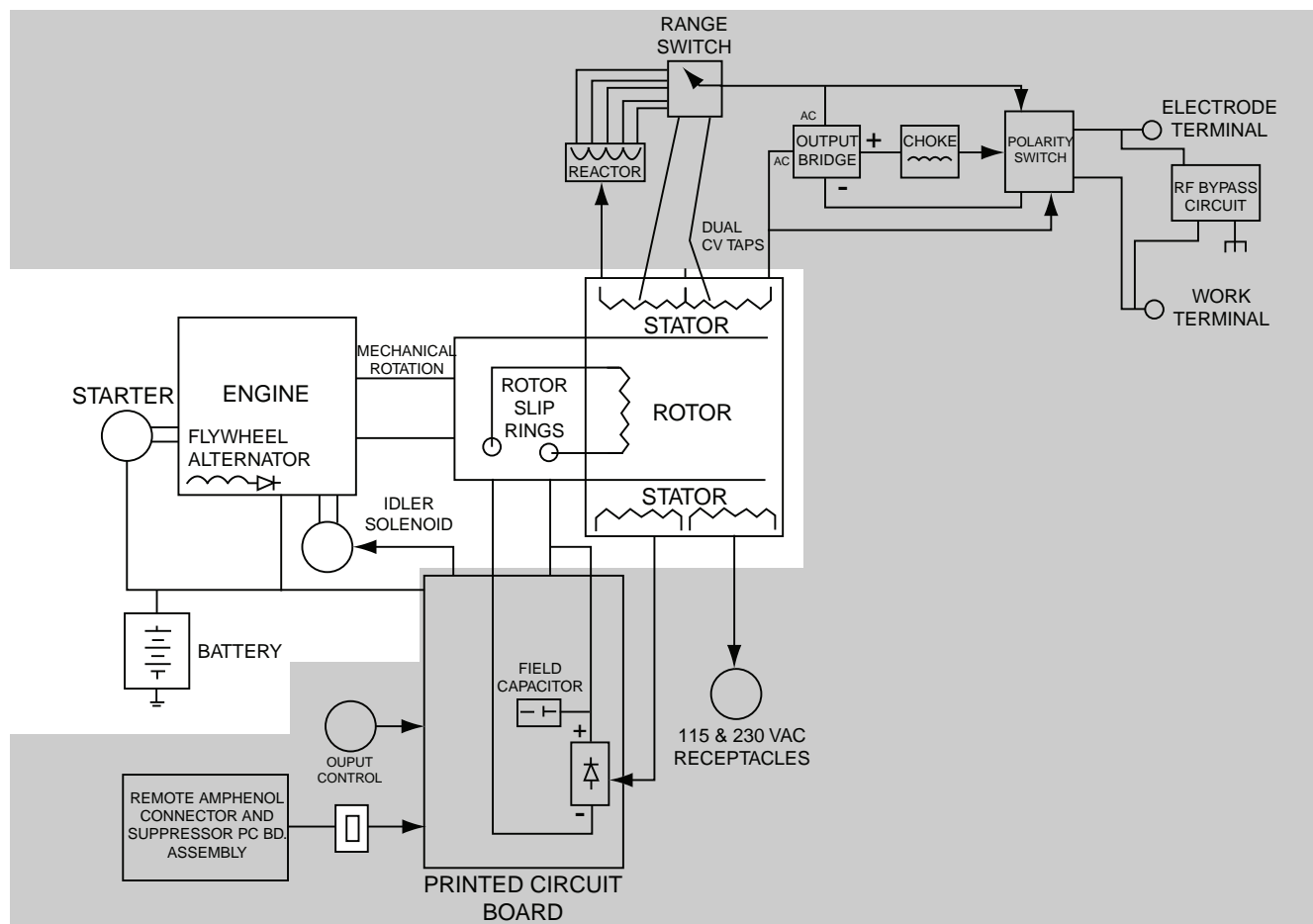
**FIGURE E.1 RANGER® 250 GXT BLOCK LOGIC DIAGRAM**



**RANGER® 250 GXT**



FIGURE E.2 – BATTERY, STARTER, ENGINE, ROTOR, STATOR AND IDLER SOLENOID



## BATTERY, STARTER, ENGINE, ROTOR, STATOR, AND IDLER SOLENOID

The 12VDC battery powers the starter motor. When the engine is started and running, the battery circuit voltage is fed, through the printed circuit board, 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. This 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 RANGER® 250 GXT is dependent on two criteria: the engine RPM and the amount of current in the rotor winding.

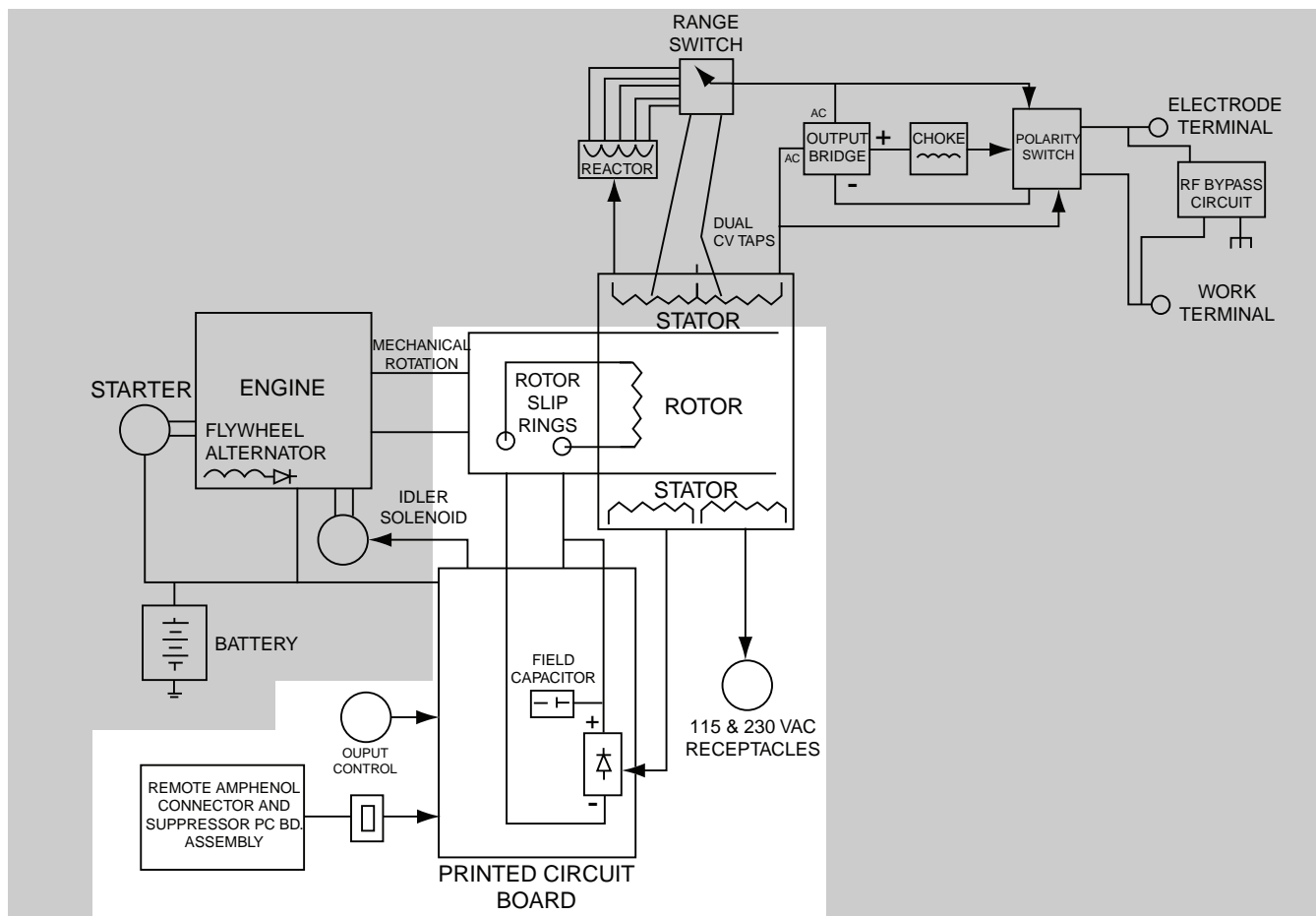
The flywheel alternator, located on the engine, supplies “charging” current for the battery circuit. The battery circuit provides power for the printed circuit board and also for the idler solenoid. The idler solenoid is mechanically connected to the engine throttle linkage. If no current is being drawn from the RANGER® 250 GXT the printed circuit board along with the current sensing toroid located off the board activates the idler solenoid, which then brings the engine to a low idle state. When output current is sensed, either weld or auxiliary, the printed circuit board deactivates the idler solenoid, and the engine returns to high RPM.

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

RANGER® 250 GXT

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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 field bridge located on the PC board. The DC output of the bridge is filtered by the field capacitor and controlled by the printed circuit board according to the output control setting. This filtered and controlled 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 increased or decreased.

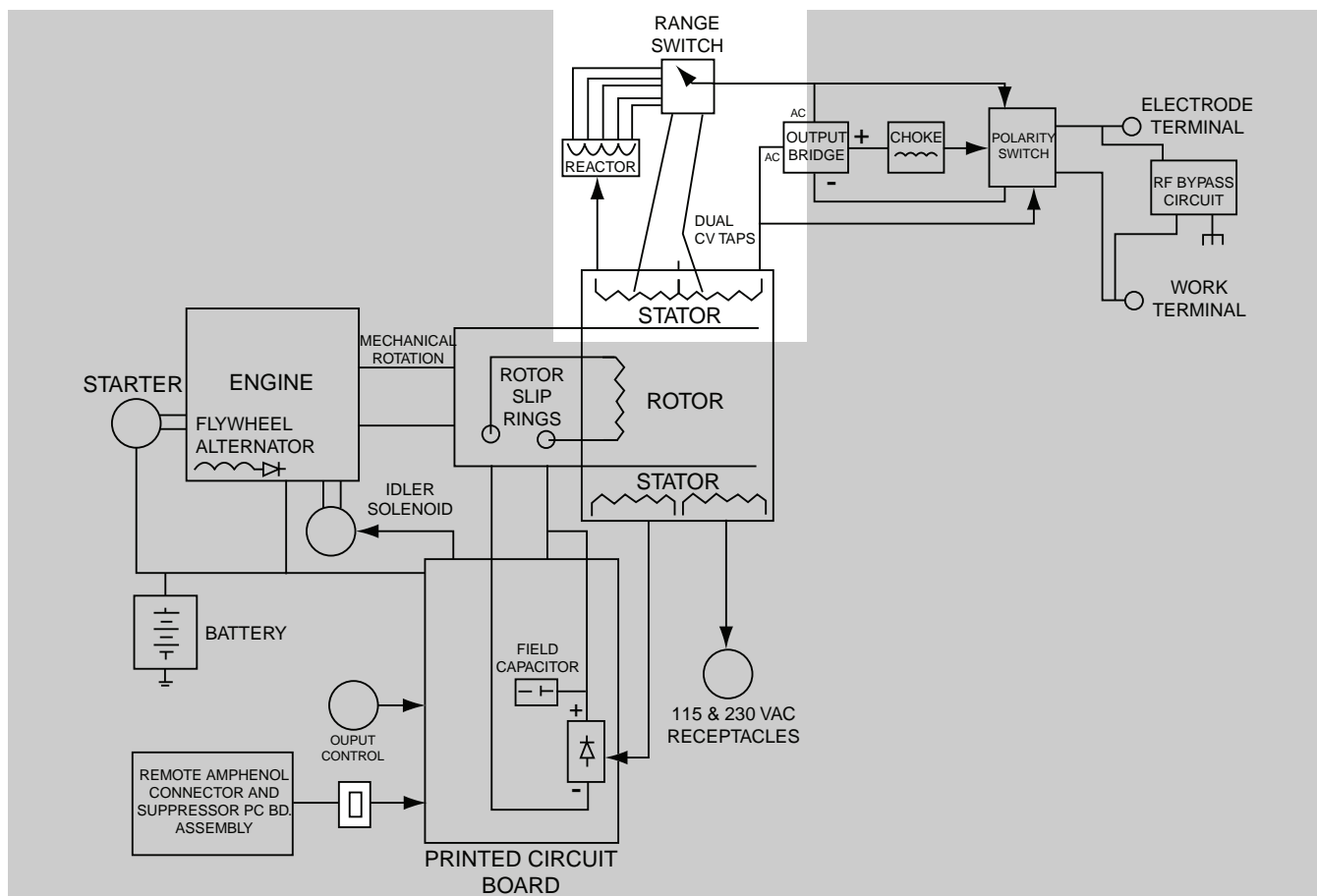
When full field voltage is applied to the rotor and the engine is running at high speed (3700 RPM), a 230 AC voltage is developed in the stator auxiliary winding. This winding is tapped to provide 115 VAC. The two voltages, (115 VAC and 230 VAC), are connected to the appropriate receptacles and offer 10,000 continuous and 11,000 peak watts of AC power. The RANGER® 250 GXT is also equipped with a remote Amphenol connector and suppressor PC board assembly along with a local/remote switch. When used in conjunction with the K924-1, this can provide voltage control up to 100 feet from the unit.

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

RANGER® 250 GXT

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FIGURE E.4 – WELD WINDING, REACTOR, AND RANGE SWITCH



## WELD WINDING, REACTOR, AND RANGE SWITCH

The stator weld winding is connected to the reactor and range switch. The inductance in the reactor offers an impedance to current flow. The reactor coil is tapped at various points. As the range switch is rotated, different amounts of reactor coil are brought into the current path. As more turns of reactor are brought into the circuit, the more impedance there is to current flow. Simply stated, the more reactor in the circuit, the lower the welding current.

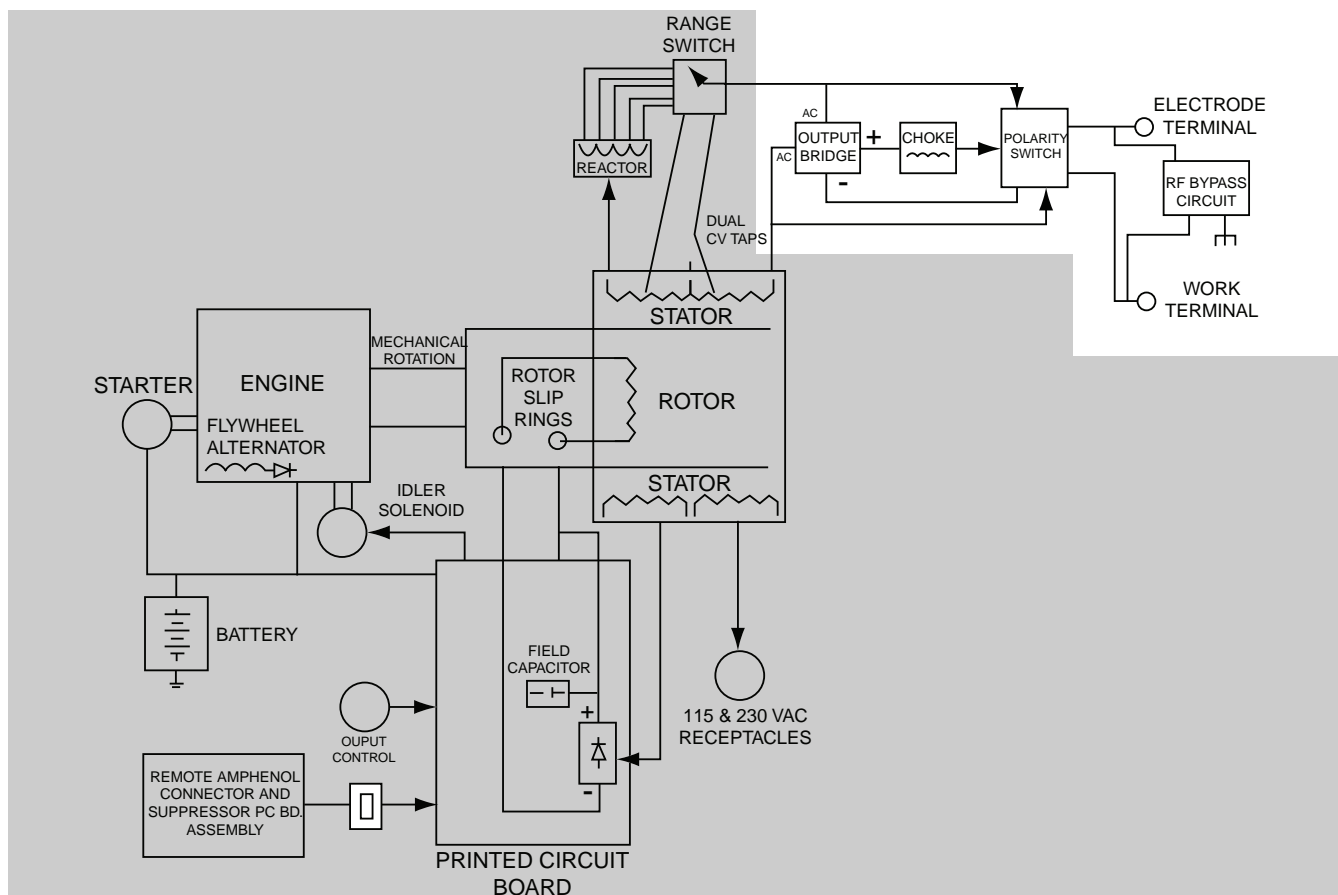
If a constant voltage is desired for wire feeding, then the reactor is bypassed and the range switch is connected to one of two taps on the stator weld winding to provide a lower but stiffer output voltage. One tap provides a voltage range from 14-22 VDC, while the other provides a voltage range from 18-28 VDC.

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

RANGER® 250 GXT

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FIGURE E.5 – OUTPUT BRIDGE, CHOKE, POLARITY SWITCH, AND OUTPUT TERMINALS



## OUTPUT BRIDGE, CHOKE, POLARITY SWITCH, AND OUTPUT TERMINALS

The AC voltage developed in the stator weld winding is delivered, through the reactor and range switch, to the output bridge and polarity switch. Depending upon the setting of the polarity switch, either AC voltage or DC voltage is delivered to the output terminals. If AC output is selected, then the current path is from the stator weld winding through the reactor, range switch and polarity switch to the output terminals. If a DC output is called for then the current path is through the Output Bridge, where the AC voltage is rectified to a DC voltage, and then to the choke, where the DC output is filtered. The filtered DC current path is through the Polarity Switch and on to the Output Terminals.

There is also a bypass circuit on the RANGER® 250 GXT. This is located between the output studs and provides protection from high frequency voltage spikes.

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

RANGER® 250 GXT

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**Troubleshooting and Repair** .....F-1

    How to Use Troubleshooting Guide ..... F-2

    PC Board Troubleshooting Procedures ..... F-3

    Troubleshooting Guide ..... F-4

    Test Procedures ..... F-15

        Rotor Voltage Test ..... F-15

        Rotor Resistance Test ..... F-17

        Auxiliary and Field Winding Test ..... F-21

        Output Rectifier Bridge Test ..... F-25

        Charging Circuit Test ..... F-27

        Engine Throttle Adjustment Test ..... F-29

    Removal and Replacement Procedures ..... F-43

        Brush Removal and Replacement ..... F-43

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        Output Rectifier Bridge Removal and Replacement ..... F-51

        Engine Rotor Removal and Replacement ..... F-53

    Retest after Repair ..... F-57

## 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.**

- 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.              | 1. Contact your local Lincoln Authorized Field Service                    | 1. Contact The Lincoln Electric Service Dept. 1-888-935-3877.   |
| No weld output and no auxiliary power. Engine runs normally. | 1. Check the brushes for wear and proper contact to the rotor slip rings. | 1. Perform the <b>Rotor Voltage Test</b> .<br>2. Check for the presence of 2.5 VDC (at the pc board) from lead 200A to 219. The actual voltage will be slightly lower across the slip rings. This is the “flashing” voltage and is present only when the Engine Control Switch S3 is in the “Run” position.<br>If the 2.5 VDC is missing, check for the presence of 12 VDC (at the pc board) from lead #224 to frame ground. This is the supply voltage to the board and is present when the engine is running and the S3 switch is in the “Run” position. If the 12VDC is missing check the leads, switches and connections associated with the lead #224. See Wiring Diagram.<br>3. If Rotor Voltage Test is normal, then preform the <b>Rotor Resistance Test</b> .<br>4. If the Rotor Voltage Test is NOT normal, perform the <b>Auxiliary and Field Winding Voltage Test</b> . Circuit Board may be faulty. Replace. |

**⚠ 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, the auxiliary power (230-115VAC) is operating normally. Engine runs normally.</p> | <ol style="list-style-type: none"> <li>1. Check the open circuit voltage (OCV) at the welder output terminals, engine at high idle (3700 RPM). Normal OCV is 80 Volts RMS. Normal DC maximum is 64 to 68VDC. If the OCV is OK then proceed to Step #2. If the OCV is not present at the welder output terminals, contact your local Lincoln Authorized Field Service Facility.</li> <li>2. Check the welding cables, clamps and electrode holder for loose or broken connections.</li> </ol> | <ol style="list-style-type: none"> <li>1. Disconnect lead W1 from the Output Bridge (D1) and check for the presence of 74-78VAC from lead W1 to lead W2 on the main stator winding. See wiring diagram. If the AC voltage is NOT present, the winding in the stator may be faulty. Check the winding for continuity and test to be sure it is NOT grounded to the stator iron. Replace if necessary. If the correct AC voltage is present, proceed to step #2.</li> <li>2. Check the Reactor, Range Switch (S1) and associated wires for loose or faulty connections. Check the reactor winding for continuity and test to be sure it is NOT grounded to the reactor iron.</li> <li>3. Check the Choke (L1), Polarity Switch (S2) and associated wires for loose or faulty connections. Check the choke winding for continuity and test to be sure it is NOT grounded to the choke iron.</li> <li>4. Check the weld output terminals and associated wires for loose or faulty connections.</li> <li>5. Perform the <b>Output Bridge 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>  |   |   |
| No auxiliary power, welding output is normal. Engine runs normally. | <ol style="list-style-type: none"> <li>1. Check circuit breakers CB1 thru CB4. Reset if tripped.</li> <li>2. Make sure the Output Control (R1) is set at the maximum position.</li> <li>3. Check for loose or faulty plug(s) at the power receptacle(s).</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. Perform the <b>Auxiliary and Field Winding Voltage Test</b>.</li> <li>3. If machine is equipped with circuit breakers, check for faulty breakers and loose or faulty connections on associated wiring.</li> </ol> |

**⚠ CAUTION**

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|---|--|--|
| <b>OUTPUT PROBLEMS</b>  |  |  |
| <p>Machine has low welding output and low auxiliary output.</p> | <ol style="list-style-type: none"> <li>1. The brushes may be worn. Contact your local Lincoln Authorized Service Facility.</li> <li>2. The engine RPM may be low.</li> </ol> | <ol style="list-style-type: none"> <li>1. If the engine HIGH IDLE RPM is low, then perform the <b>Throttle Adjustment Test</b>.</li> <li>2. Perform the <b>Rotor Voltage Test</b>.</li> <li>3. Check the Output Control Potentiometer. Normal resistance is 10,000 ohms. Also check associated wiring for loose or faulty connections.</li> <li>4. The Rotor may be faulty. Perform the <b>Rotor Resistance Test</b>.</li> <li>5. The Printed Circuit Board may be faulty. Replace.</li> <li>6. If the engine HIGH IDLE RPM is OK, then the engine may have lost horsepower and be in need of major repair.</li> </ol> |

**⚠ CAUTION**

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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 DC welding output. AC welding output and auxiliary power is normal.</p> | <ol style="list-style-type: none"> <li>1. Make sure the Polarity Switch is in the proper position and is "seated" correctly.</li> <li>2. Make sure the electrode and polarity are correct for the process being used.</li> </ol>  | <ol style="list-style-type: none"> <li>1. Perform the <b>Output Bridge Test</b>.</li> <li>2. Check the Choke (L1), the Polarity Switch (S2) and associated wires for loose or faulty connections. Check the choke winding for continuity and test to be sure it is NOT grounded the choke iron.</li> </ol> |
| <p>No AC welding output. DC welding output and auxiliary power is normal.</p> | <ol style="list-style-type: none"> <li>1. Make sure the Polarity Switch is in the proper position and is "seated" correctly.</li> <li>2. Make sure the electrode is correct for the process being used.</li> <li>3. Make sure the welding cables are not coiled or too long.</li> </ol> | <ol style="list-style-type: none"> <li>1. Check the operation of the Polarity Switch (S2). Also check the associated wires for loose or faulty connections. See Wiring Diagram.</li> <li>2. Check for continuity from lead "S2" to lead "E" located in the reactor. See Wiring Diagram.</li> </ol>         |

**⚠ CAUTION**

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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 constant voltage (CV) welding output. Constant current (CC) and the auxiliary power are operating normally.</p> | <ol style="list-style-type: none"> <li>1. Make sure the Range Switch (S1) is in the proper position (CV) and "seated" correctly.</li> <li>2. Make sure the wire feeder is connected correctly.</li> <li>3. Local remote switch could be faulty.</li> <li>4. The remote amphenol connector and suppressor assembly could be faulty.</li> </ol> | <ol style="list-style-type: none"> <li>1. Check the operation of the Range Switch (S1) and check the associated wires for loose or faulty connections. See Wiring Diagram.</li> <li>2. Check for continuity from leads C1 and C2 to lead W1 located in the main stator. See Wiring Diagram.</li> <li>3. Check local remote switch for proper operation.</li> <li>4. Check the remote amphenol connector and suppressor board assembly and associated wires. Replace if necessary.</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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| PROBLEMS (SYMPTOMS)  | POSSIBLE AREAS OF MISADJUSTMENT(S)  | RECOMMENDED COURSE OF ACTION  |
|--|---|---|
| <b>ENGINE PROBLEMS</b>   |   |   |
| <p>Engine will not idle down to low speed. Machine has normal weld output and auxiliary power.</p> | <ol style="list-style-type: none"> <li>1. Make sure the Engine Control Switch (S3) is in the "Auto" position.</li> <li>2. Make sure there is NOT an external load on the weld terminals nor the auxiliary power receptacles.</li> </ol> | <ol style="list-style-type: none"> <li>1. With the Engine Control Switch (S3) in the "Auto" position, check for the presence of 12VDC at leads #213 to #215 located at the Idler Solenoid. If 12VDC is present and the Idler Solenoid is not activating, then the solenoid may be faulty or there is a mechanical restriction preventing it from functioning.</li> <li>2. If there is NOT 12VDC at leads #213 to #215, then test for 12VDC from lead #213 to ground (lead #5). See Wiring Diagram. If 12VDC is present, then check lead #215 for continuity (zero ohms) from the Idler Solenoid to the Printed Circuit Board plug 3J1. If lead #215 is OK, then the Printed Circuit Board may be faulty. Replace.</li> <li>3. If there is NOT 12VDC from lead #213 to ground (lead #5), then check the Engine Control Switch (S3) for proper operation and associated wires for loose or faulty connections. See 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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| PROBLEMS (SYMPTOMS)  | POSSIBLE AREAS OF MISADJUSTMENT(S)  | RECOMMENDED COURSE OF ACTION   |
|--|---|--|
| <b>ENGINE PROBLEMS</b>   |   |  |
| <p>Engine will not go to high idle when attempting to weld. Welding output is normal when Idler Switch is in "HIGH" position. Automatic idle function works properly when the auxiliary power is loaded.</p> | <p>1. Make sure the welding cables and connections are tight.</p>   | <p>1. Check for broken or faulty connections in the sensing lead #254. Make sure the connection is tight at the Range Selector Switch and also at the Output Bridge. See Wiring Diagram.</p> <p>2. Make sure that lead #254 is looped one time through the current sensor.</p>   |
| <p>Engine will not go to high idle when attempting to weld or when the auxiliary power is loaded. Welding output and auxiliary power output is normal when Idler Switch is in the "HIGH" position.</p>       | <p>1. Make sure the welding cables and connections are tight.</p> <p>2. Automatic idler may not function if the auxiliary power is loaded to less than 100 Watts.</p> | <p>1. Check for broken or faulty connections in the sensing lead #254. Make sure the connection is tight at the D1 bridge and the S1 selector switch. See wiring diagram.</p> <p>2. Check leads #3 and #6, making sure they are looped through the current sensor. See Wiring Diagram.</p> <p>3. The Printed Circuit Board may be faulty. Replace.</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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| PROBLEMS (SYMPTOMS)                        | POSSIBLE AREAS OF MISADJUSTMENT(S)   | RECOMMENDED COURSE OF ACTION  |
|--|--|---|
| <b>ENGINE PROBLEMS</b>                     |  |   |
| Engine will not crank or cranks very slow. | <ol style="list-style-type: none"> <li>1. Check for loose or faulty battery cable connections.</li> <li>2. The battery may be faulty.</li> <li>3. Check the ammeter to see if the battery is charging. If not, the charging circuit may be defective.</li> </ol> | <ol style="list-style-type: none"> <li>1. If the battery is replaced or tests good, then the charging circuit may be faulty. Perform the <b>Charging Circuit Test</b>.</li> <li>2. The starter motor or starter solenoid may be faulty.</li> <li>3. The Engine may be hard to crank due to a mechanical failure in the engine.</li> </ol> |
| The Engine shuts off.                      | <ol style="list-style-type: none"> <li>1. The Engine may be low on or out of fuel.</li> <li>2. The Oil level may be low. Check and fill to proper level.</li> <li>3. The fuel filter may be clogged.</li> </ol>  | <ol style="list-style-type: none"> <li>1. The oil pressure switch may be faulty. Replace if necessary.</li> <li>2. The fuel shut-off solenoid may be faulty.</li> <li>3. CB5 could have tripped reset.</li> </ol>   |
| Engine does not develop full power.        | <ol style="list-style-type: none"> <li>1. The fuel filter may be clogged. Replace if necessary.</li> <li>2. The air filter may be clogged. Replace if necessary.</li> <li>3. The spark plug(s) may be faulty. Replace if necessary.</li> </ol>                   | <ol style="list-style-type: none"> <li>1. Due to wear, the engine may be in need of repair.</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.

RANGER® 250 GXT



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.” 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 (76VAC Max. 68VDC Max.). If the correct voltage is present at the output terminals, check for loose connections on the heavy current carrying leads inside the RANGER® 250 GXT. See Wiring Diagram.</li> <li>2. If the OCV is low at the welder output terminals, then Perform the <b>Engine Throttle Adjustment Test</b>.</li> <li>3. Perform the Output Rectifier Bridge Test.</li> <li>4. Check for shorted or grounded windings in the reactor and also in the main stator. See 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 PROCEDURE****⚠ WARNING**

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

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

**TEST DESCRIPTION**

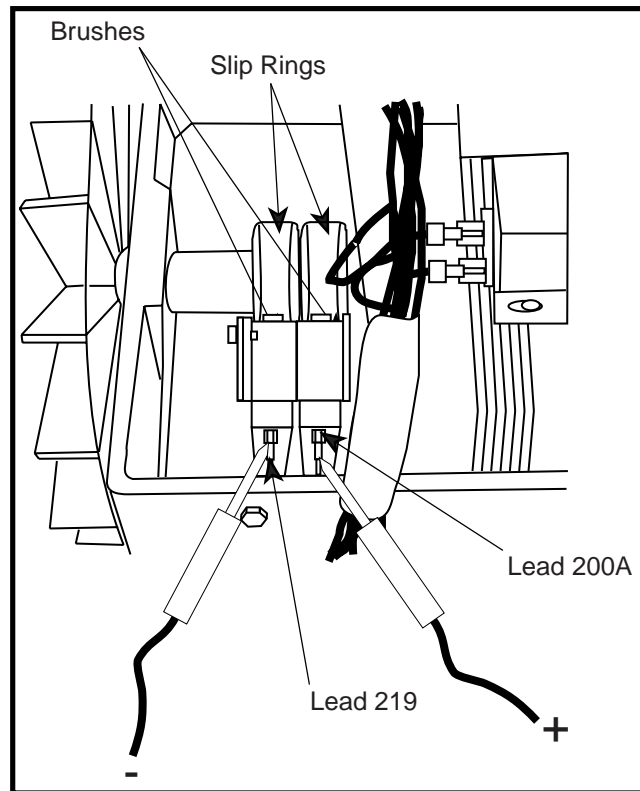
This test will determine if the correct DC voltage is being applied to the rotor at maximum engine speed (3700 RPM). This information will aid the technician in determining if the generator field is operating properly.

**MATERIALS NEEDED**

Volt/Ohmmeter  
Misc. Hand Tools  
Wiring Diagram

## ROTOR VOLTAGE TEST PROCEDURE (continued)

FIGURE F.1 - LOCATION OF LEAD 200A AND 219 FOR ROTOR VOLTAGE TEST



### PROCEDURE

1. Remove the sheet metal screws from the case top.
2. Remove the rubber gasket (cover seal) from the lift bail.
3. Remove the fuel cap. The rubber gasket for the fill tube will come off with the case top.
4. Remove the case top, **then reinstall the fuel cap.**
5. Remove the screws holding the right case side.
6. Remove the right case side by lifting up and out.
7. Set the volt/ohmmeter to the DC volts position.
8. Connect the positive meter probe to the brush nearest the rotor lamination (lead 200A). See Figure F.1 for location.
9. Connect the negative meter probe to the other brush (lead 219).
10. Start the engine and run it at high idle (3700 RPM). Set the output control to the MAXIMUM position (position 10).]
11. Check the voltage reading on the voltmeter. It should read between 37 and 46 VDC.
12. If the voltage reading is low or not present, the generator field is not functioning properly. Perform the **Rotor Resistance Test**. The Printed Circuit Board may be faulty.
13. If the voltage reading is normal, the field circuit is functioning properly. Reinstall the case side and top.



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

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

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

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**TEST DESCRIPTION**

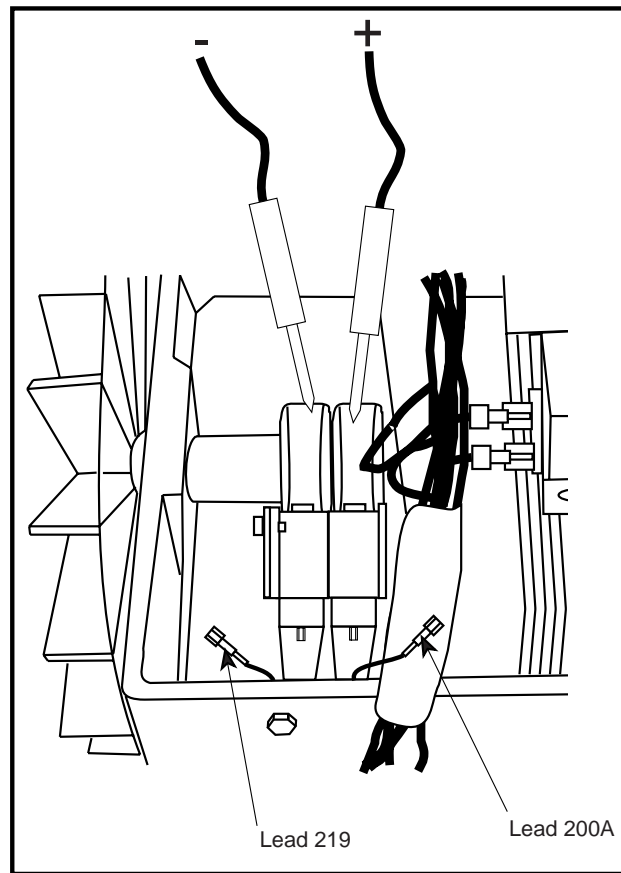
This test will determine if there is a shorted winding in the rotor or if the rotor is grounded.

**MATERIALS NEEDED**

Volt/Ohmmeter  
Misc. Hand Tools  
Wiring Diagram

## ROTOR RESISTANCE TEST PROCEDURE (continued)

FIGURE F.2 – LOCATION OF ROTOR SLIP RINGS



### TEST PROCEDURE

1. Remove the sheet metal screws from the case top.
2. Remove the rubber gasket (cover seal) from the lift bail.
3. Remove the fuel cap. The rubber gasket for the fill tube will come off with the case top.
4. Remove the case top, **then replace the fuel cap.**
5. Remove the screws holding the right case side.
6. Remove the right case side by lifting up and out.
7. Conduct the test with the engine OFF.
8. Remove the spark plug wires to prevent accidental engine kickback or starting.
9. Isolate the rotor electrically by removing the generator brush leads. Refer to Figure F.2 as you perform the remaining steps.
10. Remove lead 219 from the negative brush.
11. Remove lead 200A from the positive brush.
12. 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 approximately 8 ohms.

**ROTOR RESISTANCE TEST PROCEDURE (continued)**

13. 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. The machine ground stud works well.
  - C. Check the resistance. It should read very high, at least 0.5 megohm (500,000 ohms).
14. Connect lead 200A to the positive brush, which is the one nearest the rotor lamination. Connect lead 219 to the negative brush.
15. Reinstall the case side, case top, fuel cap, lift bail gasket and spark plug wires.

If the test does not meet the resistance specifications, then the rotor may be faulty. Replace the rotor.

If the test does meet the resistance specifications, then the rotor is okay.

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**AUXILIARY AND FIELD WINDING TEST PROCEDURE****⚠ WARNING**

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

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

**TEST DESCRIPTION**

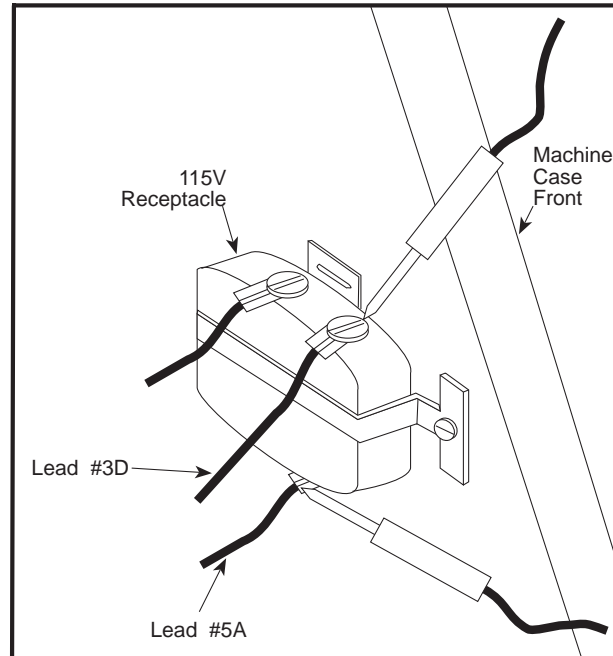
This test will determine if the correct AC voltages are being generated from the stator windings.

**MATERIALS NEEDED**

Volt/Ohmmeter  
5/16" Nut driver  
Wiring Diagram

## AUXILIARY AND FIELD WINDING TEST PROCEDURE (continued)

FIGURE F.3 – LOCATION OF LEADS #3 AND #5



### TEST PROCEDURE

#### To test the 115 VAC winding:

1. Remove the fuel cap and lift bail rubber gasket. With the 5/16" nut driver, remove the case top and left side; then reinstall the fuel cap.
2. Connect the volt/ohmmeter probes to leads #3D and #5A or 6B and 5B where they connect to the 115 VAC receptacles. See Figure F.3.
3. Start the engine and run it at high idle (3700 RPM).
4. Set the output control to the maximum position (position 10).
5. Check the AC voltage reading. It should be approximately 125 VAC.
6. If the readings are not correct, check the circuit breakers, associated connections and leads. See the Wiring Diagram.

#### To test the 230 VAC winding:

1. Remove the fuel cap and lift bail rubber gasket. With the 5/16" nut driver, remove the case top and left side; **then reinstall the fuel cap.**
2. Connect the volt/ohmmeter probes to leads #6 and #3 where they connect to the 230 VAC receptacle.

**NOTE:** It is easier to insert the probes directly into the receptacle to perform this test. However, the probes may not reach in far enough to make or keep a good connection. In this case, before you start the gasoline engine, insert two test probes into the receptacle. Hold the test probes firmly in place to measure voltage (Step 5).

3. Start the engine and run it at high idle (3700 RPM)
4. Set the output control to the maximum position (position 10).
5. Check the AC voltage reading. It should be approximately 240 VAC.
6. If the readings are not correct, check the circuit breakers, associated connections and leads. See the Wiring Diagram.

## AUXILIARY AND FIELD WINDING TEST PROCEDURE (continued)

### To test the field winding:

1. Remove the fuel cap and lift bail rubber gasket. With the 5/16" nut driver, remove the case top and left side; **then reinstall the fuel cap.**
2. Connect the volt/ohmmeter probes to leads #7 and #9 where they connect to the Field Idle Control P.C. Board.
3. Start the engine and run it at high idle (3700 RPM).
4. Set the output control to the maximum position (position 10).
5. Check the AC voltage reading. It should be between 41 and 45 VAC.

If any one or more of the readings are missing or not within specifications, then check for loose or broken wires between the test points and the stator windings. See the Wiring Diagram. Make sure the windings are NOT grounded internally to the stator iron. If the leads are intact, then the stator may be faulty. Replace the stator.

If the voltage readings are within specifications, then the windings are good and functioning properly.

6. Reinstall the case side, case top, fuel cap, and lift bail gasket.

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## OUTPUT RECTIFIER BRIDGE TEST PROCEDURE

### WARNING

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

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

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### TEST DESCRIPTION

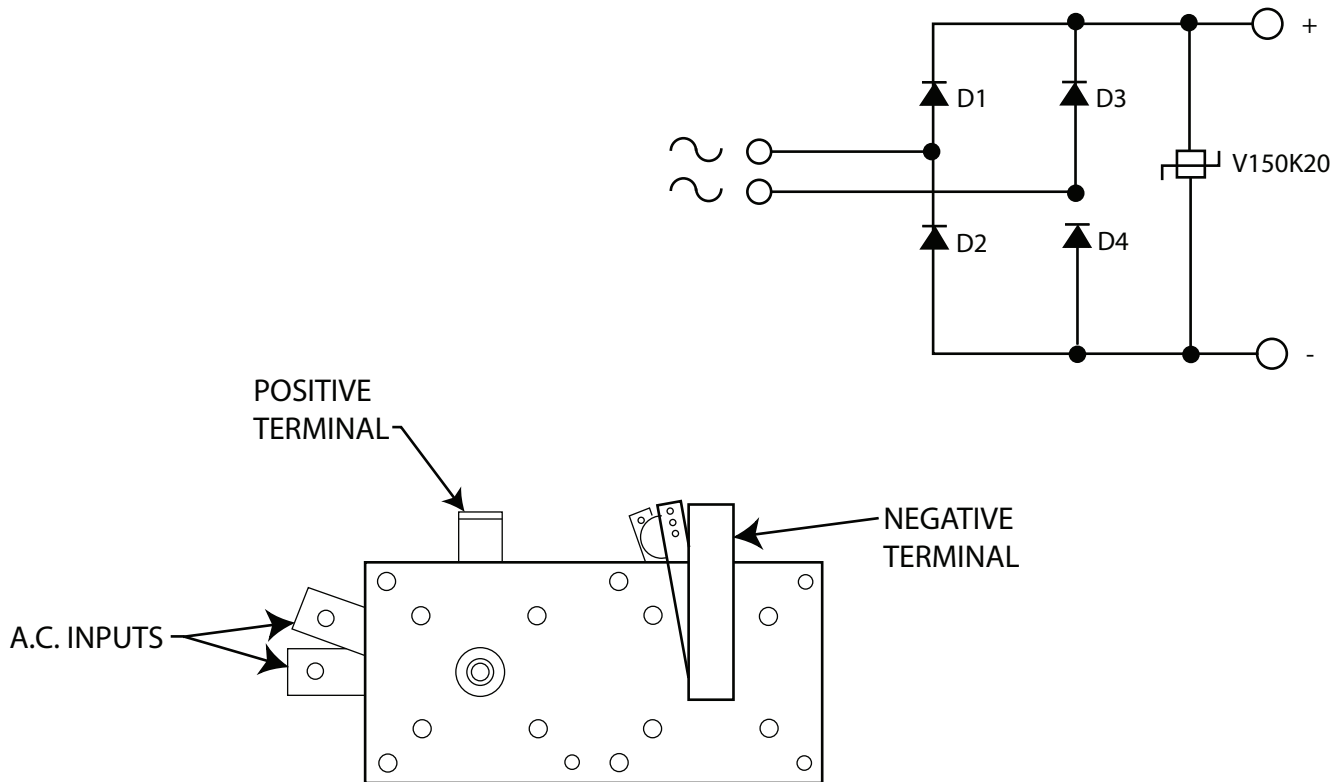
This test will determine if there are faulty diodes in the Output Rectifier Bridge.

### MATERIALS NEEDED

- Analog Volt/Ohmmeter
- Misc. Hand Tools
- Wiring Diagram

## OUTPUT RECTIFIER BRIDGE TEST PROCEDURE (continued)

FIGURE F.4 – LOCATION OF OUTPUT RECTIFIER LEADS



### TEST PROCEDURE

1. Remove the spark plug wires to prevent accidental engine kickback or starting.
2. Remove the sheet metal screws from the case top.
3. Remove the rubber gasket (cover seal) from the lift bail.
4. Remove the fuel cap. The rubber gasket for the fill tube will come off with the case top.
5. Remove the case top, **then replace the fuel cap.**
6. Remove the screws holding the right case side.
7. Remove the right case side by lifting up and out.
8. Conduct the test with the gasoline engine OFF.
9. Locate the Output Rectifier Bridge behind the Blower Baffle Assembly.
10. Remove the nuts and washers holding the leads to the output diode bridge. Note and label their locations and the order of fasteners for reassembly.
11. Perform a forward and reverse bias test. The forward bias will indicate low resistance and reverse bias will indicate high resistance. Ohm values will vary with the equipment used.
12. If the bridge fails this test, it must be replaced in whole.  
NOTE: Individual diodes are not replaceable.
13. Reconnect the diode connectors and heavy leads to their respective studs.
14. Reinstall the case side, case top, fuel cap, lift bail gasket and spark plug wires.

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**CHARGING CIRCUIT TEST PROCEDURE****⚠ WARNING**

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

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

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**TEST DESCRIPTION**

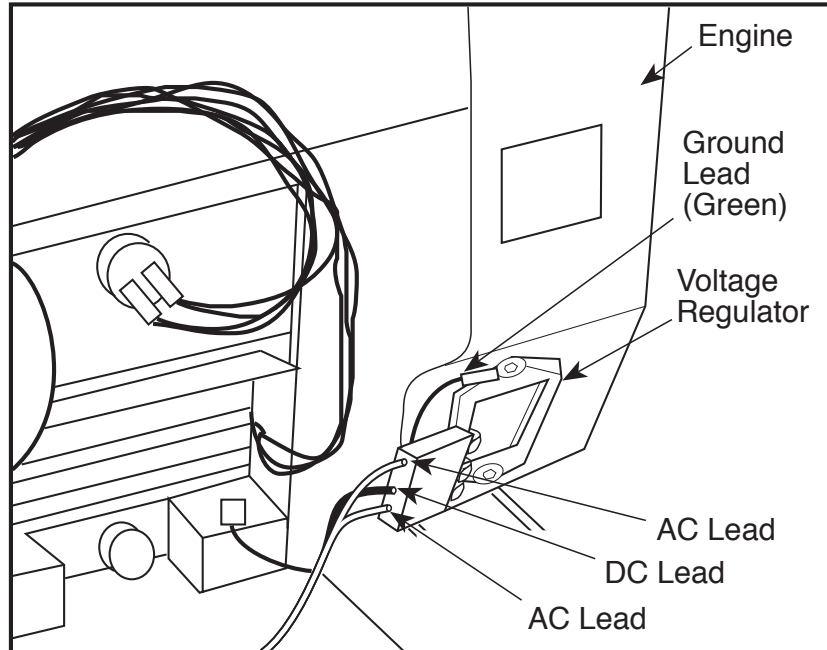
This test will determine if the Flywheel Alternator, Regulator, and associated circuitry are functioning properly.

**MATERIALS NEEDED**

Volt/Ohmmeter  
5/16" Nut driver  
Wiring Diagram

## CHARGING CIRCUIT TEST PROCEDURE (continued)

FIGURE F.5 – LOCATION OF VOLTAGE REGULATOR



### TEST PROCEDURE

1. Start the engine and run it at high idle (3700 RPM).
2. Set the voltmeter for AC volts and place one meter probe on each of the two outside leads that attach to the engine voltage regulator. See Figure F.5 for location. Check for 44-45 VAC at the voltage regulator.
3. If the AC voltage is low or not present, the engine flywheel alternator may be faulty. This is an engine problem; consult your local engine repair facility.
4. If the voltage reading is correct, then check the output of the voltage regulator to determine the charging voltage for the battery. Run the engine at high idle (3700 RPM). Set the voltmeter for DC volts and place one meter probe on the middle lead and one probe on the green ground wire connected to the voltage regulator. See Figure F.5 for location. Check for 13-15 VDC.
5. If the DC voltage reading is incorrect or not present, the voltage regulator may be faulty. Replace the entire voltage regulator module.
6. If the DC voltage reading is correct, check the associated wiring and circuitry. See the Wiring Diagram.

## ENGINE THROTTLE ADJUSTMENT TEST PROCEDURE

### WARNING

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

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

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### TEST DESCRIPTION

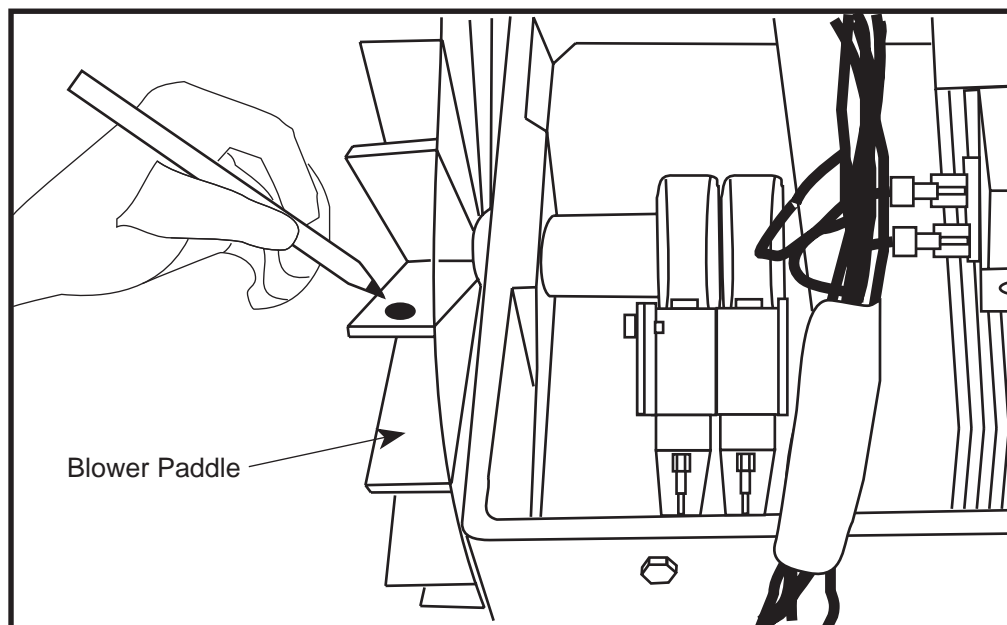
If the machine output is low, this test will determine whether the gasoline engine is operating at the correct speed (RPM) during both HIGH and LOW idle conditions. Directions for adjusting the throttle to the correct RPM are given.

### MATERIALS NEEDED

Misc. Hand Tools  
Strobe-tach, frequency counter, oscilloscope, or vibratach  
Black or red marking pencil

## ENGINE THROTTLE ADJUSTMENT TEST PROCEDURE (continued)

FIGURE F.6 – BLOWER PADDLE MARKED FOR STROBE-TACH METHOD



### TEST PROCEDURE

This test can be conducted by any one of four methods.

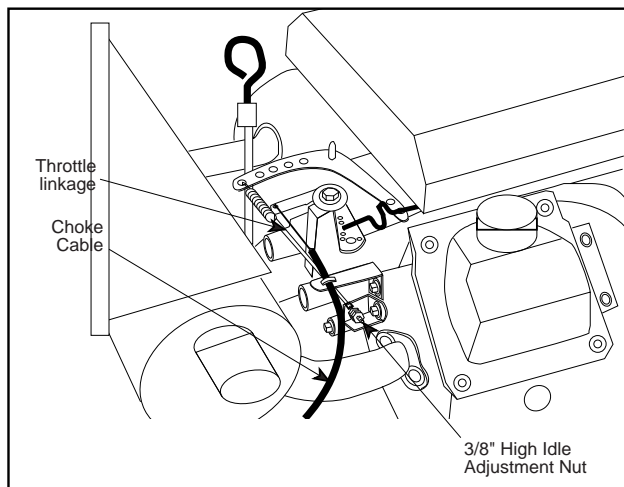
#### **Strobe-tach Method:**

1. With the 5/16" nut driver, remove the 6 sheet metal screws from the case top.
2. Remove the rubber gasket (cover seal) from the lift bail.
3. Remove the fuel cap. The rubber gasket for the fill tube will come off with the case top.
4. Remove the case top, **then replace the fuel cap.**
5. Conduct this procedure with the gasoline engine OFF.
6. Remove the spark plug wires to prevent accidental engine kickback or starting.
7. With the black or red marking pencil, place a mark on one of the blower paddles. See Figure F.6 for location.
8. Connect the strobe-tach according the manufacturer's instructions.
9. Reconnect the spark plug wires and start the engine. Direct the strobe-tach light on the blower paddle and synchronize it to the rotating mark.
10. With the machine at HIGH IDLE the tach should read between 3650 and 3750 RPM.

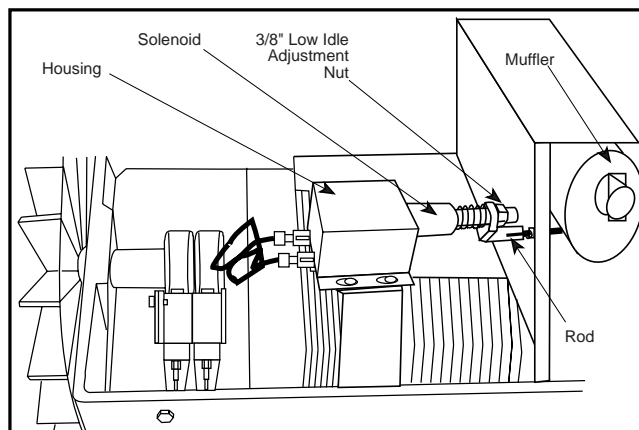
With the machine at LOW IDLE the tach should read between 2150 and 2250 RPM.

## ENGINE THROTTLE ADJUSTMENT TEST PROCEDURE (continued)

**FIGURE F.7**  
HIGH IDLE ADJUSTMENT NUT



**FIGURE F.8**  
LOW IDLE ADJUSTMENT NUT



11. If either of the readings is incorrect, adjust the throttle as follows:

**Adjust HIGH IDLE:** Use the 3/8" wrench to turn the spring-loaded adjustment nut. See Figure F.7 for location of the adjustment nut. Turn the nut clockwise to increase HIGH IDLE speed. Adjust the speed until the tach reads between 3650 and 3750 RPM.

**Adjust LOW IDLE:** First make sure there is no load on the machine. Set the IDLE switch to AUTO and wait for the engine to change to low idle speed. Use the 3/8" wrench to adjust the solenoid nut, which changes the amount of throw in the throttle lever arm. See Figure F.8 for location of the adjustment nut. Adjust the nut until the tach reads between 2150 and 2250 RPM.

#### **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 HIGH IDLE (3700 RPM), the counter should read 60.8 to 62.5 Hz. At LOW IDLE (2200 RPM), the counter should read 35.8 to 37.5 Hz. Note that these are median measurements; hertz readings may vary slightly above or below.

3. If either of the readings is incorrect, adjust the throttle as follows:

**Adjust HIGH IDLE:** Use the 3/8" wrench to turn the spring-loaded adjustment nut. See Figure F.7 for location of the adjustment nut. Turn the nut clockwise to increase HIGH IDLE speed. Adjust the speed until the frequency reads between 60.8 and 62.5 Hz.

**Adjust LOW IDLE:** First make sure there is no load on the machine. Set the IDLER switch to AUTO and wait for the engine to change to low idle speed. Use the 3/8" wrench to adjust the solenoid nut, which changes the amount of throw in the throttle lever arm. See Figure F.8 for location of the adjustment nut. Adjust the nut until the frequency reads between 35.8 and 37.5 Hz.

## ENGINE THROTTLE ADJUSTMENT TEST PROCEDURE (continued)

### Oscilloscope Method:

1. Connect the oscilloscope to the 115 VAC receptacle, according to the manufacturer's instructions. At 3700 RPM, the waveform should exhibit a period of 16.2 milliseconds. At 2200 RPM, the waveform should exhibit a period of 27.3 milliseconds. Refer to **NORMAL OPEN CIRCUIT VOLTAGE WAVEFORM (115 VAC SUPPLY) HIGH IDLE - NO LOAD** in this section of the manual.
2. If either waveform periods is incorrect, adjust the throttle as follows:

Adjust HIGH IDLE: Use the 3/8" wrench to turn the spring-loaded adjustment nut. See **Figure F.7** for location of the adjustment nut. Adjust the speed until the period is 16.2 milliseconds.

Adjust LOW IDLE: First make sure there is no load on the machine. Set the IDLER switch to AUTO and wait for the engine to change to low idle speed. Use the 3/8" wrench to adjust the solenoid nut, which changes the amount of throw in the throttle lever arm. See **Figure F.8** for location of the adjustment nut. Adjust the speed until the period is 27.3 milliseconds.

### Vibratach Method:

1. Place the vibratach as close to the engine as possible. With the machine case top removed, the top of the air cleaner is the best location.
2. Start the engine and observe the whip handle of the vibratach. At HIGH IDLE (3700 RPM), the whip handle should exhibit maximum oscillation. At LOW IDLE (2200 RPM), the whip handle should exhibit minimum oscillation. Note that these are median measurements; vibratach readings may vary slightly above or below:
3. If either of the vibratach indications is incorrect, adjust the throttle as follows:

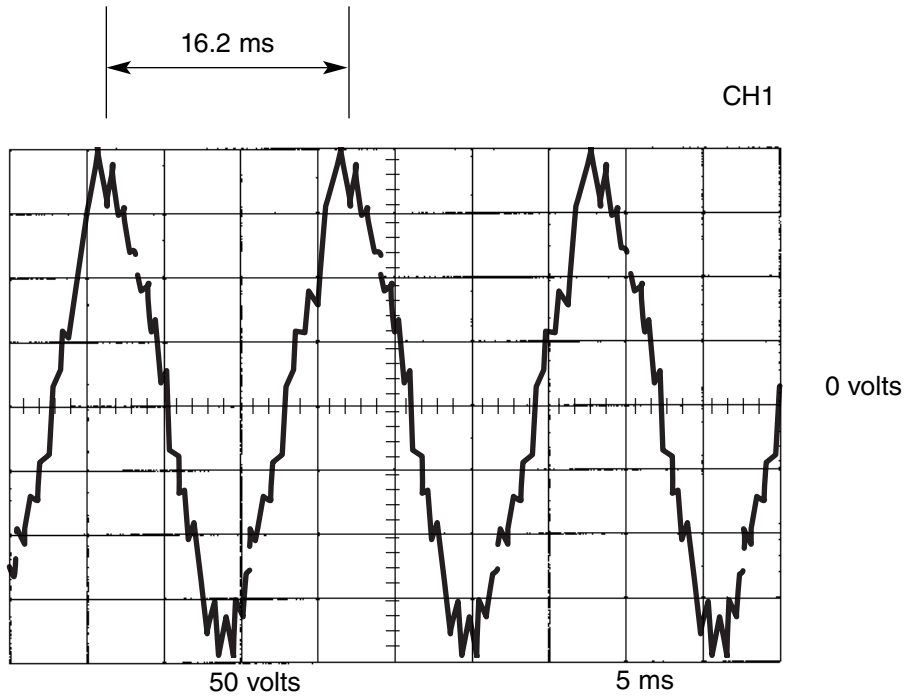
Adjust HIGH IDLE: Use the 3/8" wrench to turn the spring-loaded adjustment nut. See **Figure F.7** for location of the adjustment nut. Turn the nut clockwise to increase HIGH IDLE speed. Adjust the speed until the vibratach whip handle exhibits maximum oscillation at 3650 to 3750 RPM.

Adjust LOW IDLE: First make sure that there is no load on the machine. Set the IDLER switch to AUTO and wait for the engine to change to low idle speed. Use the 3/8" wrench to adjust the solenoid nut, which changes the amount of throw in the throttle lever arm. See **Figure F.8** for location of the adjustment nut. Adjust the speed until the vibratach whip handle exhibits minimum oscillation at 2150 to 2250 RPM.



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

### HIGH IDLE – NO LOAD – OUTPUT CONTROL AT MAXIMUM



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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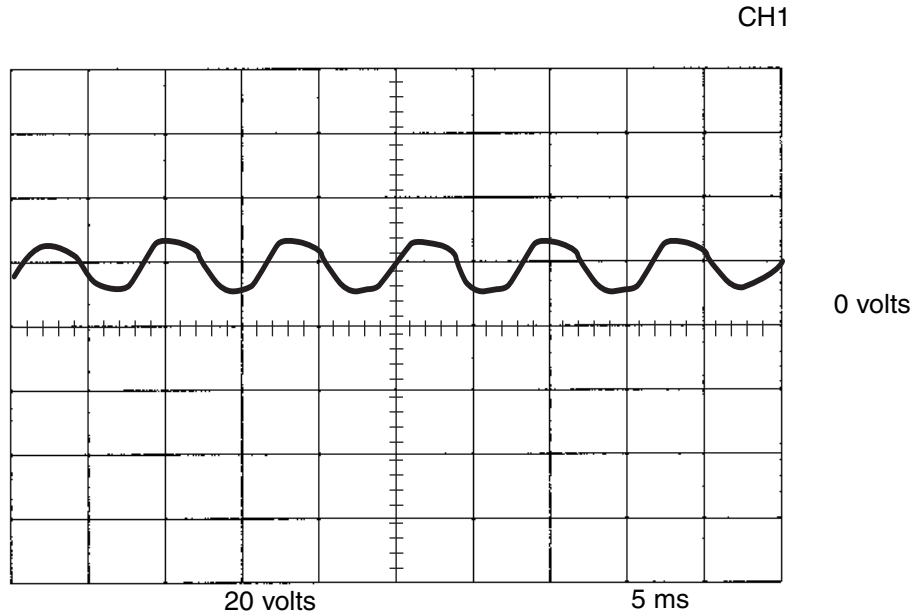
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### TYPICAL DC WELD OUTPUT WAVEFORM (CV MODE) MACHINE LOADED



#### MACHINE LOADED TO 200 AMPS AT 20 VDC

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

Note: Scope probes connected at machine output terminals.

#### SCOPE SETTINGS

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

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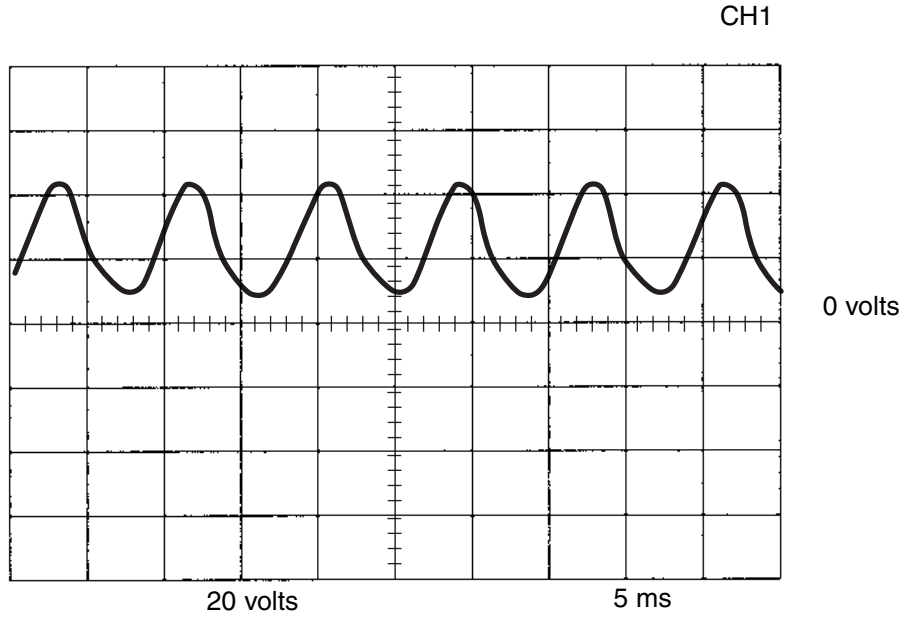
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TYPICAL DC WELD OUTPUT WAVEFORM (CC MODE)  
MACHINE LOADED



MACHINE LOADED TO 200 AMPS AT 26 VDC

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

Note: Scope probes connected at machine output terminals.

SCOPE SETTINGS

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

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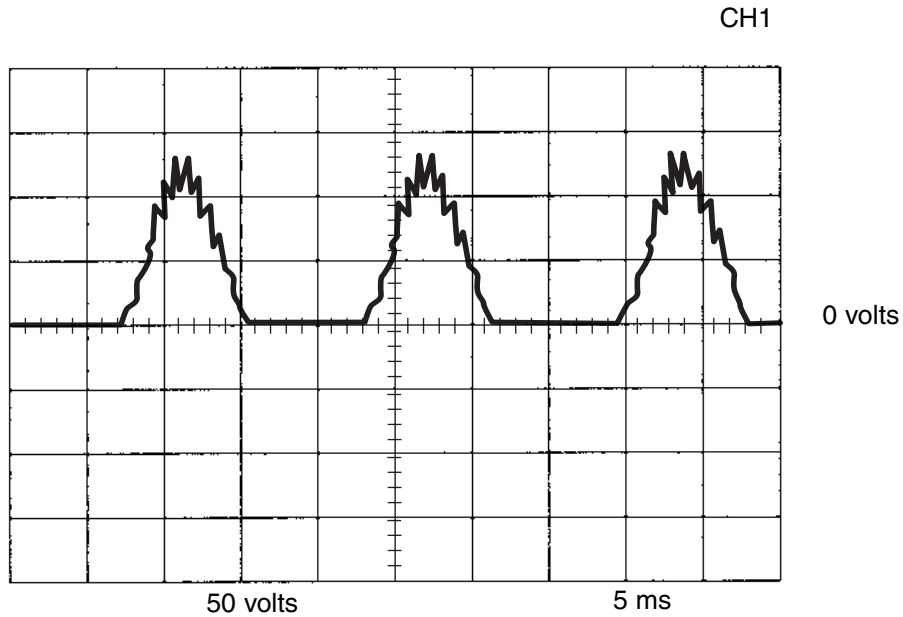
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**ABNORMAL OPEN CIRCUIT DC WELD VOLTAGE WAVEFORM**

**HIGH IDLE - NO LOAD - OUTPUT CONTROL AT MAXIMUM  
ONE OUTPUT DIODE NOT FUNCTIONING**



This is NOT the typical DC (+) output voltage waveform. One output diode is not functioning. Note the “gap” in the waveform. One output diode was disconnected to simulate an open or nonfunctioning output diode. Each vertical division represents 50 volts and each horizontal division represents 5 milliseconds in time.

Note: Scope probes connected at machine output terminals.

**SCOPE SETTINGS**

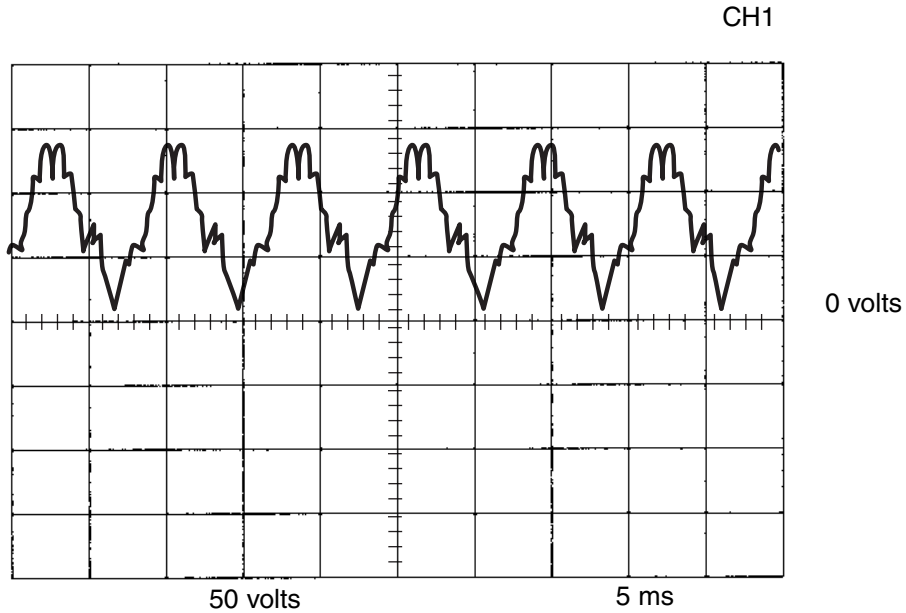
|                        |           |
|------------------------|-----------|
| Volts/Div .....        | 50V/Div.  |
| Horizontal Sweep ..... | 5 ms/Div. |
| Coupling .....         | DC        |
| Trigger .....          | Internal  |

Return to Section TOC

Return to Master TOC



**NORMAL OPEN CIRCUIT DC WELD VOLTAGE WAVEFORM (CC MODE)  
HIGH IDLE - NO LOAD - OUTPUT CONTROL AT MAXIMUM**



This is the typical DC 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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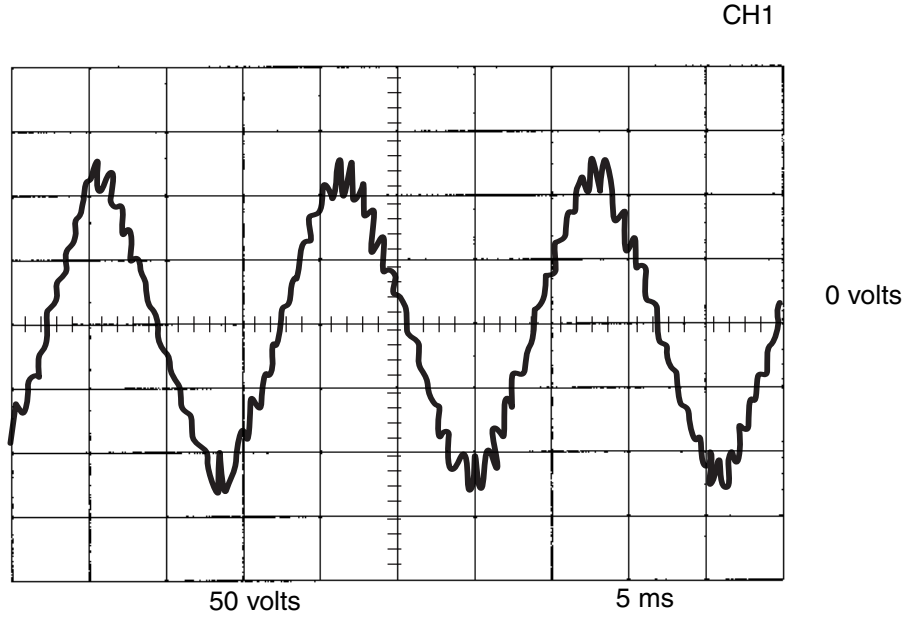
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**NORMAL OPEN CIRCUIT AC WELD VOLTAGE WAVEFORM  
HIGH IDLE - NO LOAD - OUTPUT CONTROL AT MAXIMUM**



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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RANGER® 250 GXT



**BRUSH REMOVAL AND REPLACEMENT PROCEDURE****⚠ 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 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.

**DESCRIPTION**

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

**MATERIALS NEEDED**

Misc. Hand Tools  
Slot head screw driver  
Needle nose pliers

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## BRUSH REMOVAL AND REPLACEMENT PROCEDURE (continued)

### PROCEDURE

1. Remove the spark plug wires.
2. Remove the case top.
3. Remove the rubber gasket (cover seal) from the lift bail.
4. Remove the fuel cap. The rubber gasket for the fill tube will come off with the case top.
5. Remove the case top, **then reinstall the fuel cap.**
6. Remove the right case side.
7. Remove the right case side by lifting up and out.
8. With the needle nose pliers, gently remove leads #219 and #200A from the brushes. **See Figure F.9.**
9. Remove the brush holder assembly bracket from the stator frame.
10. Remove the two screws that secure the brush holder assembly to the bracket. Slide the brush holder assembly out of the bracket.
11. To change the brushes, use the slot head screw driver to pop off the plastic retainer on the back of the brush holder assembly.
12. Remove the old brushes and insert the new ones. One corner of the terminal clip is beveled so that the brush can go in only one way.
13. 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.
14. To reinstall the brushes, 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.9.** This will hold the brushes up so that you can easily install the holder.
15. Slide the brush holder assembly back into the bracket and install the two screws that hold it in place.
16. Install the brush holder assembly bracket to the stator frame.
17. Slowly remove the non-metallic retainer from the brush holder and let the brushes snap back against the slip rings.
18. With the needle nose pliers, connect the red and the black wires to the appropriate terminals on the brushes. The #200A lead is inboard.
19. Check the wire connections for clearance and tightness.
20. Reinstall the case side, fuel cap, lift bail gasket, case top, and spark plug wires.

BRUSH REMOVAL AND REPLACEMENT PROCEDURE (continued)

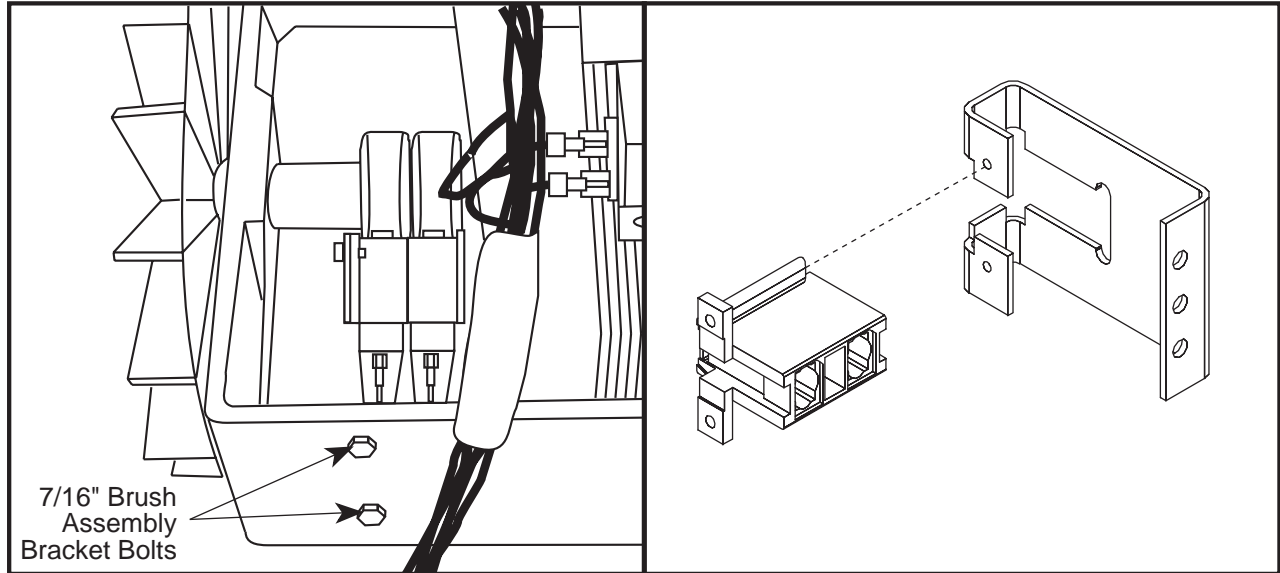
SLIP RINGS

A slight amount of darkening and wear of the slip rings and brushes is normal. Brushes should be inspected when a general overhaul is necessary. If brushes are to be replaced, clean slip rings with a fine emery paper.

**CAUTION**

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

FIGURE F.9 - BRUSH LEADS/BRUSHES



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RANGER® 250 GXT



## PRINTED CIRCUIT BOARD REMOVAL AND REPLACEMENT

### 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 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.

### DESCRIPTION

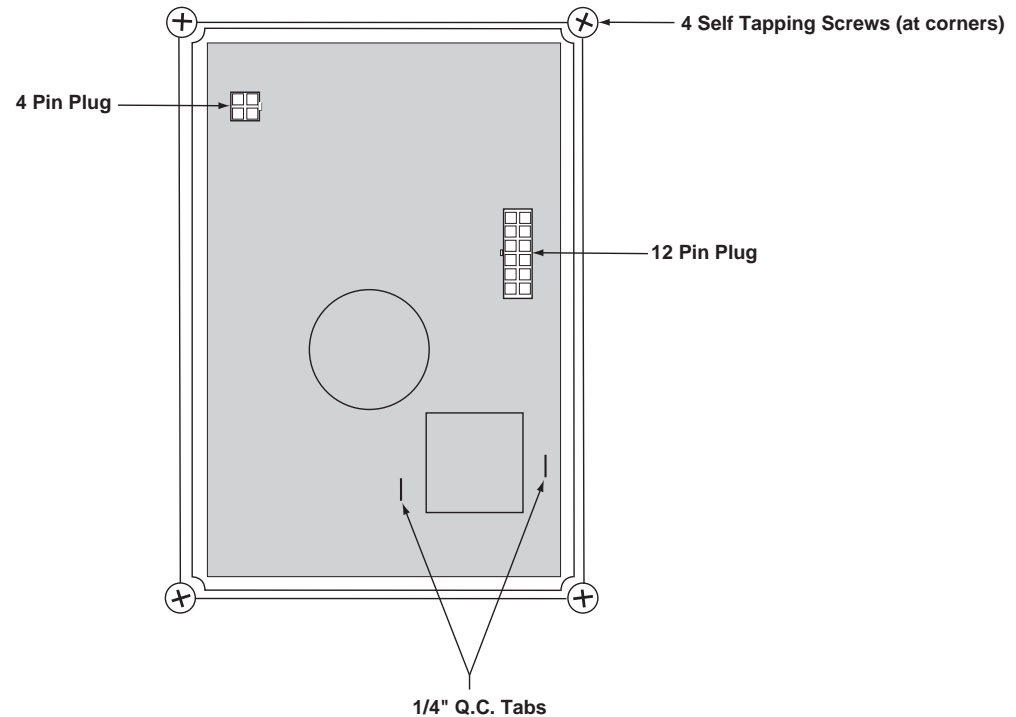
The following procedure will aid the technician in removing the printed circuit board for maintenance or replacement.

### MATERIALS NEEDED

Misc. Hand Tools  
Wiring Diagram

## PRINTED CIRCUIT BOARD REMOVAL AND REPLACEMENT (continued)

FIGURE F.10 - PRINTED CIRCUIT BOARD LOCATION



### PROCEDURE

Before starting the following procedure, refer to the topic "PC Board Troubleshooting Procedures" at the beginning of this section.

1. Remove the engine spark plug wires.
2. Remove the sheet metal screws from the case top.
3. Remove the rubber gasket (cover seal) from the lift bail.
4. Remove the fuel cap. The rubber gasket for the fill tube will come off with the case top.
5. Remove the case top, **then reinstall the fuel cap.**
6. Remove the screws holding the right case side.
7. Remove the right case side by lifting up and out.
8. Remove the 12-pin molex plug (J1) from the Weld Control Board.
9. Remove 4-pin molex (J2) from the weld control board.
10. Remove leads #7 and #9 from two 1/4" Q.C. connectors.



**PRINTED CIRCUIT BOARD REMOVAL AND REPLACEMENT (continued)****⚠ CAUTION**

Be sure to follow the recommended static-free methods for handling printed circuit boards. Failure to do so can result in permanent damage to the equipment.

12. With the 1/4" phillips head screw driver, remove four self tapping screws holding the printed circuit board.
13. Replace the old printed circuit board with a new one.
14. Connect the 12-pin molex plug.
15. Connect the 4-pin molex plug.
16. Connect two 1/4" Q.C. wires to P.C. Board.
17. Replace any cable ties that were cut during the removal procedure.
18. Replace screws previously removed.
19. Reinstall the case side, fuel cap, lift bail gasket, case top, and spark plug wires.

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RANGER® 250 GXT



## OUTPUT RECTIFIER BRIDGE REMOVAL AND REPLACEMENT

### **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 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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### **DESCRIPTION**

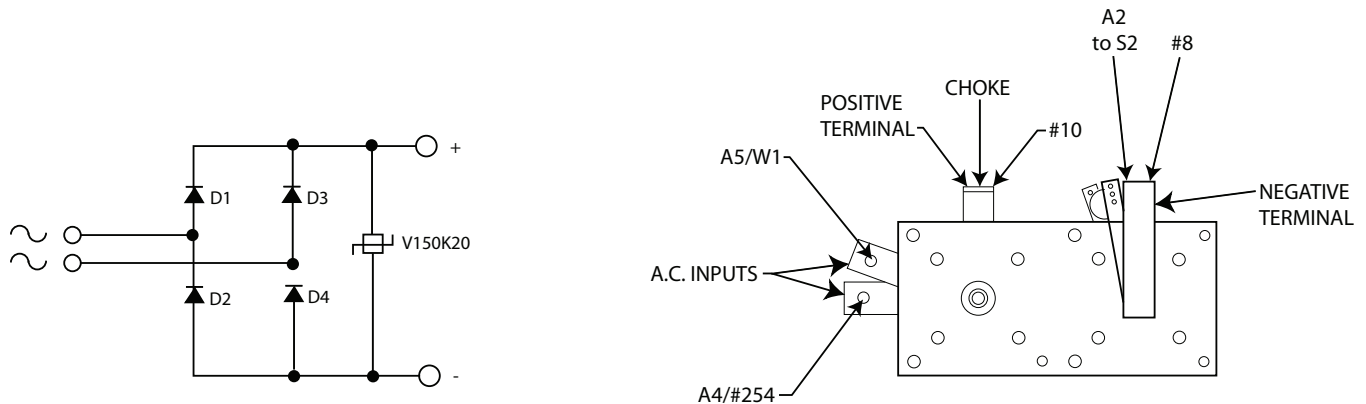
The following procedure will aid the technician in removing the output rectifier bridge for maintenance or replacement.

### **MATERIALS NEEDED**

- Misc. Hand Tools
- Dow Corning 340
- Wiring Diagram

## OUTPUT RECTIFIER BRIDGE REMOVAL AND REPLACEMENT (continued)

FIGURE F.11 – OUTPUT RECTIFIER CONNECTIONS



### PROCEDURE

1. Remove the engine spark plug wires.
2. With the 5/16" nut driver, remove the 6 sheet metal screws from the case top.
3. Remove the rubber gasket (cover seal) from the lift bail.
4. Remove the fuel cap. The rubber gasket for the fill tube will come off with the case top.
5. Remove the case top, then **reinstall the fuel cap.**
6. Remove both case sides to access the baffle assembly.
7. Mark and disconnect all of the leads from the rectifier. See Figure F.11.
8. Remove the rectifier from the baffle assembly and set aside.
9. Reassemble. Refer to Wiring Diagram for proper connections - use DOW 340 on all aluminum connection surfaces.
10. Reassemble the case sides and top in reverse order.

## ENGINE/ROTOR REMOVAL AND REPLACEMENT

### 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 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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### DESCRIPTION

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

**NOTE:** The procedures described here are for a Kohler engine. The same basic procedures apply to the other engine, although there may be a few slight wiring variations.

### MATERIALS NEEDED

#### Lincoln Electric Rotor Removal Kit (S20788) - FOR ROTOR REMOVAL ONLY

- Misc. Hand Tools
- Locking pliers
- Needle nose pliers
- Diagonal cutters
- Impact wrench
- Torque wrench (ft lbs)
- Feeler gauge (.017)

### INSTRUCTIONS

For Engine and Rotor removal only, follow steps 1-25 under ENGINE AND ROTOR REMOVAL PROCEDURE. For reassembly of engine and rotor go to REASSEMBLY PROCEDURE.

For rotor removal, follow the ENGINE AND ROTOR REMOVAL PROCEDURE and ROTOR REMOVAL PROCEDURE.

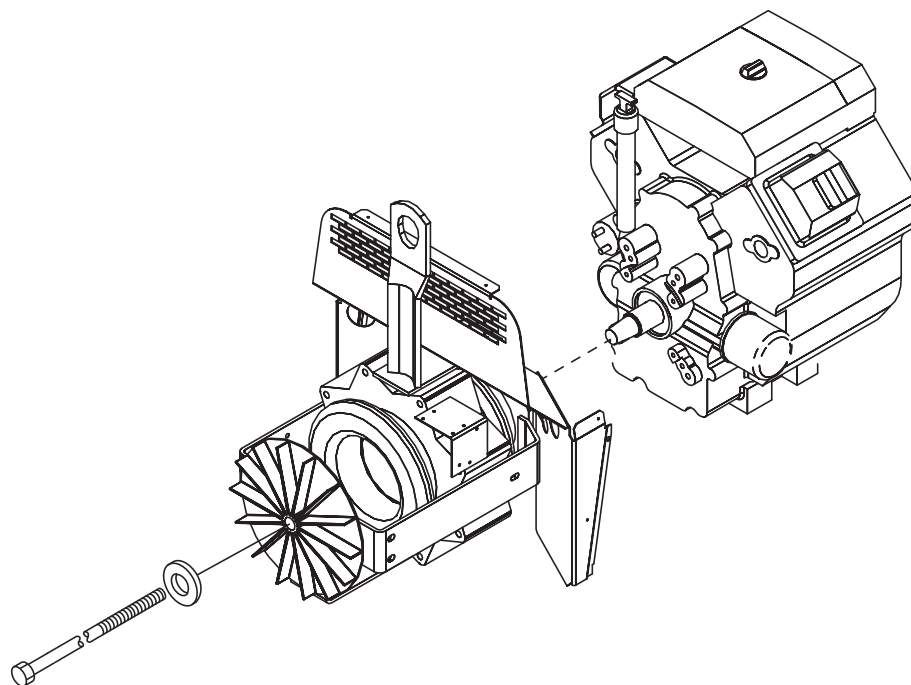
## ENGINE/ROTOR REMOVAL AND REPLACEMENT (continued)

### ENGINE AND ROTOR REMOVAL PROCEDURE

1. Refer to **Figure F.12** for component locations.
2. Remove the engine spark plug wires.
3. Remove the sheet metal screws from the case top.
4. Remove the rubber gasket (cover seal) from the lift bail.
5. Remove the fuel cap. The rubber gasket for the fill tube will come off with the case top.
6. Remove the case top, then **reinstall the fuel cap**.
7. Remove the screws holding the right case side and the screws holding the left case side.
8. Remove the case sides by lifting up and out.
9. With the 3/8" wrench, remove the battery cover.
10. Disconnect the negative battery cable, then the positive battery cable. **BE SURE TO DISCONNECT THE NEGATIVE BATTERY CABLE FIRST.** Remove the battery and set it aside.
11. With the diagonal cutters, cut the cable ties around the leads from the starter solenoid and disconnect the leads. Remove lead 209A from the harness bundle.
12. Disconnect the large black plug in front of the fuel tank spout.
13. Remove the two screws that hold the vertical fan baffle in place. Slide the baffle forward toward the rectifier bridge heat sink assembly.
14. Hold the rotor shaft with locking pliers and unscrew the blower fan. Turn the fan counterclockwise. You do not need to remove the fan from the machine, but be sure it is completely unscrewed from the rotor shaft.
15. Disconnect the engine choke cable from the engine. Mark the location of the retainer for reassembly. The other end can remain connected.
16. Disconnect the idle linkage by unsnapping the plastic clip at the engine end of the idler rod. Snap the clip back onto the rod to avoid losing it; remove the rod for reassembly.
17. Disconnect the fuel line from the fuel tank. Plug the hose and also plug the connection at the fuel tank to prevent the escape of gasoline fumes.
18. Cut the cable ties and remove leads 224C and 210 from the oil pressure switch.
19. Remove the ground lead from the right engine foot mounting bolt.
20. Remove the brush holder bracket and leads #219 & 200A from the stator frame.
21. Support the engine with a chain hoist.
22. With the 9/16" wrench, remove the right and left engine foot mounting bolts.
23. Remove the four bolts that hold the stator to the engine. There is one lock washer per bolt.
24. With the chain hoist, unweight the engine gently. Use a pry bar to carefully pry between the engine and the stator frame in order to unseat the bearing on the end of the rotor shaft. Separate the engine and rotor from the stator frame, supporting the rotor by hand to prevent damage to the rotor core.
25. Move the engine and rotor assembly to a bench. The engine is off balance with the rotor still attached; therefore, support the end of the rotor with a wooden two-by-four before unhooking the chain hoist.

## ENGINE/ROTOR REMOVAL AND REPLACEMENT (continued)

FIGURE F.12 - ENGINE AND ROTOR REMOVED FROM STATOR



### ROTOR REMOVAL PROCEDURE

1. To remove the rotor, **double-check that the engine spark plug wires are 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.12. If an impact wrench is not available, use the 5/8" 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 appropriate long thru-bolt (two are provided) supplied with Lincoln Electric Rotor Removal Kit S20788. 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 left-hand thread rotor removal tool from the kit into the rotor shaft. Support the rotor with one hand and tighten the tool to approximately 50 ft lbs with the torque or impact wrench.
  5. If the rotor does not pop off, tighten the rotor removal tool an additional 5 ft lbs. Hold the rotor with one hand until the rotor pops off the engine crankshaft.
- HINT:** If the rotor does not pop off, hit the end of the rotor removal tool with a hammer.
6. Slide the rotor the rest of the way off the crankshaft. Be careful not to lose the washer that fits between the blower fan and the rotor.

## ENGINE/ROTOR REMOVAL AND REPLACEMENT (KIT S20788) (continued)

### REASSEMBLY PROCEDURE

**NOTE:** Lincoln Electric recommends that a new bearing (Lincoln part #M9300-85) be installed when you replace the rotor and blower assembly.

- Clean the tapered engine crankshaft. Slide the rotor onto the shaft.
- Insert the rotor thru-bolt, and with the torque wrench tighten the bolt to 50 ft lbs.
- Support the engine/rotor assembly with the chain hoist. Fit the rotor into the stator frame, being careful not to damage the rotor core against the stator. The bearing will seat into its race about half way.
- Insert the four bolts and lock washers that hold the engine to the stator. With the 9/16" wrench, draw the bolts up evenly in order to seat the bearing properly. Tighten to 22 ft-lb. moving diagonally from bolt to bolt.
- Check the rotor-stator air gap with the .017 feeler gauge. The measurement is taken at the blower end of the rotor before the fan is reinstalled. Turn the rotor with a pair of locking pliers as necessary 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 engine/stator bolts; retighten the bolts and recheck the air gap. Repeat until the proper .017 minimum air gap is achieved.
- Fasten the ground lead to the right engine mounting bolt and install both bolts.
- Install the brush holder bracket back into the stator frame. Refer to the topic **Brush Removal and Replacement** in this section of the manual.
- Attach leads to the oil pressure switch refer to wiring diagram. Replace any cut cable ties.
- Unplug the fuel tank connection and fuel hose and connect them.
- Connect the idle linkage to the idler rod. Snap the plastic clip back into place.
- Connect the engine choke cable at the position marked during disassembly.
- Screw the blower fan back onto the end of the rotor shaft. Be sure the washer is in place and hand tighten the fan only.
- Reposition the vertical fan baffle and secure it with the two screws.
- Install the two cowling covers at the rear of the stator.
- Connect the black plug in front of the fuel tank fill spout.
- Connect the leads to the starter solenoid and replace any cable ties cut during disassembly.
- Install the battery. Connect the positive battery cable, then the negative battery cable. **BE SURE TO CONNECT THE POSITIVE BATTERY CABLE FIRST.**
- Replace the battery cover.
- Reinstall the case side, fuel cap, lift bail gasket, and case top. Connect the spark plug wires.
- 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

| Mode      | No Load RPM | Load RPM  |
|-----------|-------------|-----------|
| Low Idle  | 2150-2250   | NA        |
| High Idle | 3700-3750   | 3100-3600 |

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

| Output Control | Range Switch | Open Circuit Volts | Load Volts | Load Amps |
|----------------|--------------|--------------------|------------|-----------|
| Maximum        | Maximum      | 65 - 68            | 21 - 26.5  | 205 - 240 |

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

| Output Control | Range Switch | Open Circuit Volts | Load Volts | Load Amps |
|----------------|--------------|--------------------|------------|-----------|
| Maximum        | Maximum      | 71 - 76            | 25 - 32    | 225 - 275 |

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

| Output Control | Range Switch | Open Circuit Volts                | Load Volts | Load Amps |
|----------------|--------------|-----------------------------------|------------|-----------|
| Maximum        | Wire Feed CV | CV LOW 30 - 32<br>CV HIGH 44 - 47 | 19 - 22    | 200 - 220 |

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

| 230 Volt Receptacle  |            |           | 115 Volt Receptacle <sup>2</sup> |            |           |
|----------------------|------------|-----------|----------------------------------|------------|-----------|
| Open Circuit Voltage | Load Volts | Load Amps | Open Circuit Voltage             | Load Volts | Load Amps |
| 246 - 264            | 216 - 250  | 34 - 41.5 | 123- 132                         | 114 - 126  | 35 - 42   |

### FIELD AMPS AND VOLTS

| Slip Ring Volts | Field Amps    |
|-----------------|---------------|
| 10.0 - 50.0 VDC | 0.8 - 5.8 VDC |

<sup>1</sup> OUTPUT CONTROL switch set at MAXIMUM (position 10).

<sup>2</sup> Output values of each receptacle can vary within the range shown but must be within 2 volts of each other.

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**Electrical Diagrams** ..... **G-1**

    Wiring Diagram (M20443) ..... G-2

    Schematic – Complete Machine (L12330) ..... G-3

    Schematic – Idler/Field - Weld Control PC Board (L12197) ..... G-4

    Schematic – 6 Pin Amphenol PC Board (M20462-1) ..... G-5

**\* NOTE:** Many PC Board Assemblies are now totally encapsulated, surface mounted and or multi-layered and are therefore considered to be unserviceable. Assembly drawings of these boards are no longer provided.

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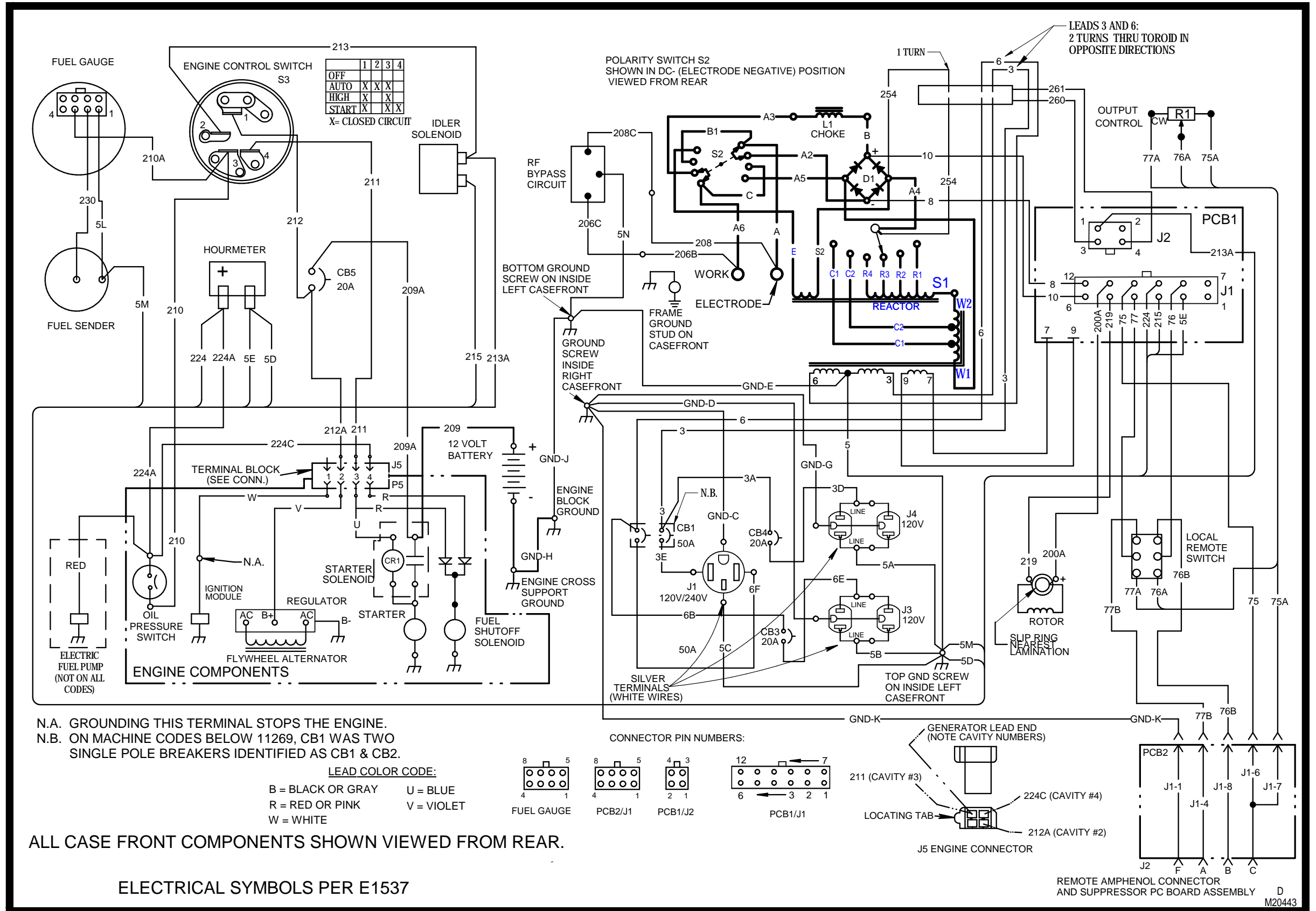
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WIRING DIAGRAM - (M20443)

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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.

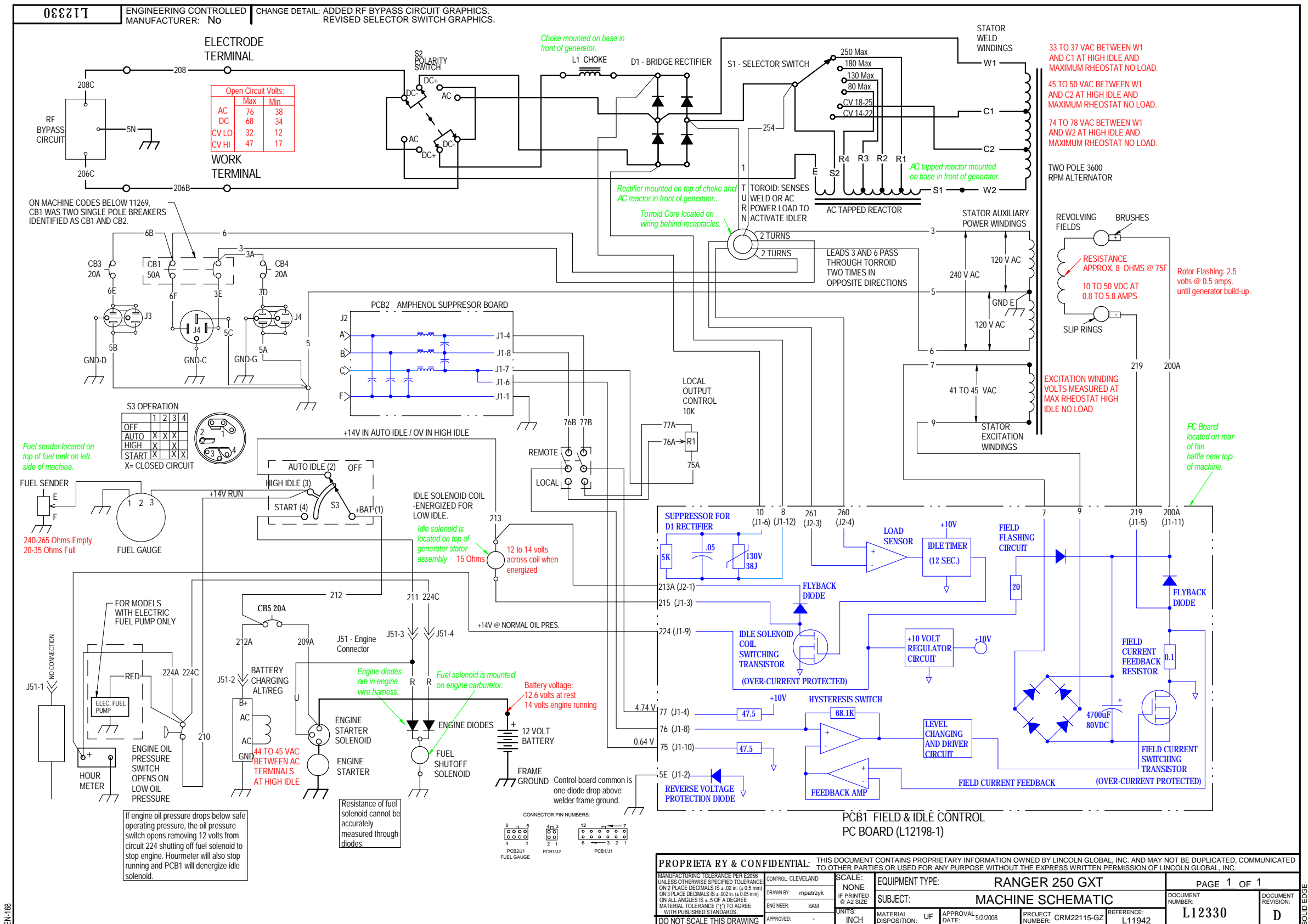
SCHEMATIC - ENTIRE MACHINE (L12330)

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



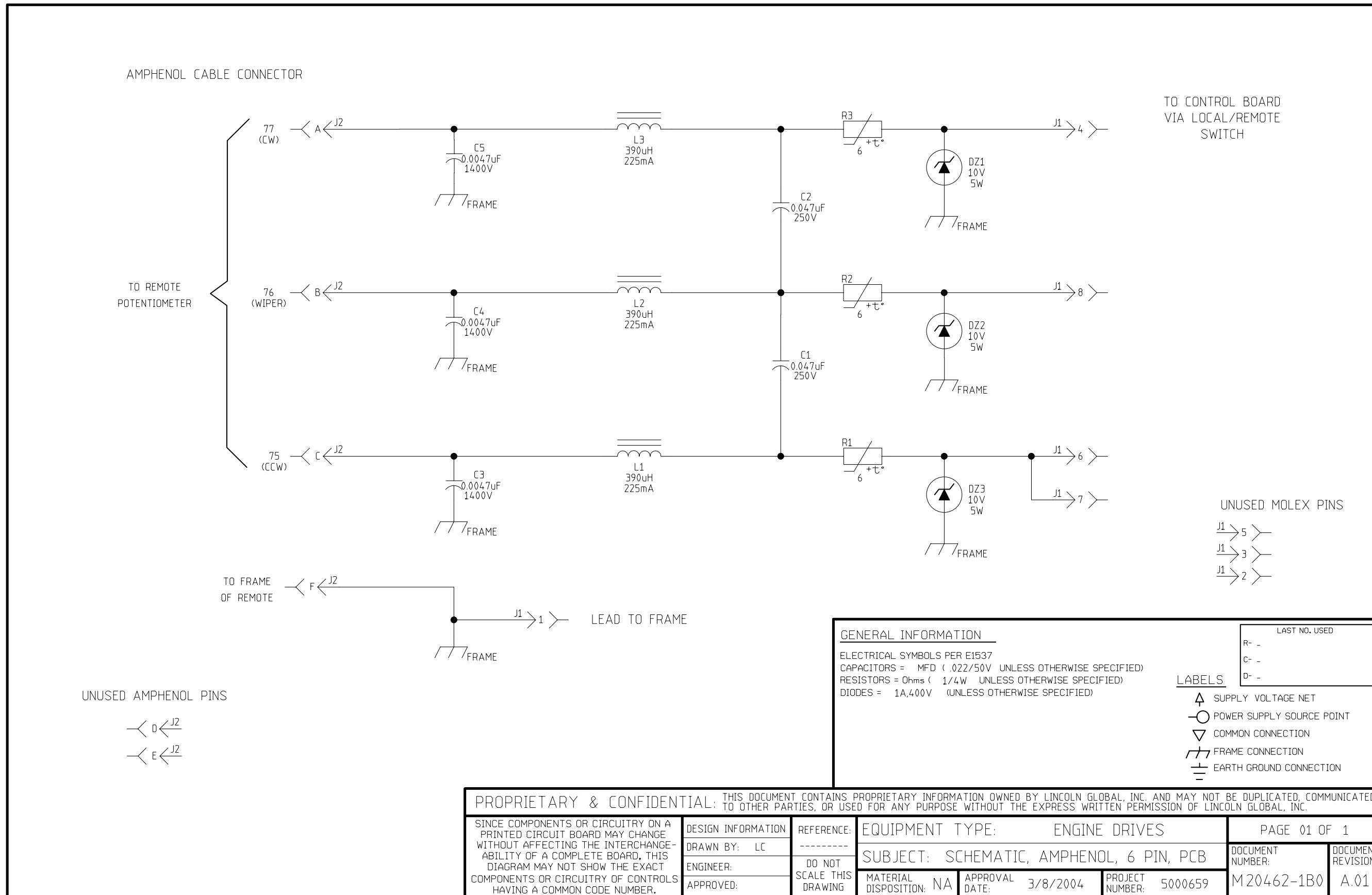
SCHEMATIC - 6 PIN AMPHENOL PC BOARD (M20462-1)

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