

# RANGER™ 300 D and 300 DLX

For use with machine code numbers 10399 thru 10850

## Safety Depends on You

Lincoln arc welding and cutting equipment is designed and built with safety in mind. However, your overall safety can be increased by proper installation ... and thoughtful operation on your part. **DO NOT INSTALL, OPERATE OR REPAIR THIS EQUIPMENT WITHOUT READING THIS MANUAL AND THE SAFETY PRECAUTIONS CONTAINED THROUGHOUT.** And, most importantly, think before you act and be careful.



## SERVICE MANUAL

**LINCOLN**®  
**ELECTRIC**

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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.

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### ELECTRIC SHOCK can kill.

- 3.a. The electrode and work (or ground) circuits are electrically "hot" when the welder is on. Do not touch these "hot" parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.
- 3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.
- In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:**
- Semiautomatic DC Constant Voltage (Wire) Welder.
  - DC Manual (Stick) Welder.
  - AC Welder with Reduced Voltage Control.
- 3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically "hot".
- 3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.
- 3.e. Ground the work or metal to be welded to a good electrical (earth) ground.
- 3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.
- 3.g. Never dip the electrode in water for cooling.
- 3.h. Never simultaneously touch electrically "hot" parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.
- 3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.
- 3.j. Also see Items 6.c. and 8.



### ARC RAYS can burn.

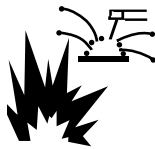
- 4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87.1 standards.
- 4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.
- 4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.



### FUMES AND GASES can be dangerous.

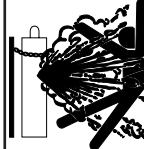
- 5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and below Threshold Limit Values (TLV) using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.**
- 5.b. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.
- 5.c. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.
- 5.d. Read and understand the manufacturer's instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer's safety practices. MSDS forms are available from your welding distributor or from the manufacturer.
- 5.e. Also see item 1.b.

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### WELDING SPARKS can cause fire or explosion.

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



### CYLINDER may explode if damaged.

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



### FOR ELECTRICALLY powered equipment.

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

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## 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. Éviter 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 recoit 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 soleil, donc:
  - a. Utiliser un bon masque avec un verre filtrant approprié ainsi qu'un verre blanc afin de se protéger les yeux du rayonnement de l'arc et des projections quand on soude ou quand on regarde l'arc.
  - b. Porter des vêtements convenables afin de protéger la peau de soudeur et des aides contre le rayonnement de l'arc.
  - c. Protéger l'autre personnel travaillant à proximité au soudage à l'aide d'écrans appropriés et non-inflammables.
4. Des gouttes de laitier en fusion sont émises de l'arc de soudage. Se protéger avec des vêtements de protection libres de l'huile, tels que les gants en cuir, chemise épaisse, pantalons sans revers, et chaussures montantes.
5. Toujours porter des lunettes de sécurité dans la zone de soudage. Utiliser des lunettes avec écrans latéraux dans les zones où l'on pique le laitier.

6. Eloigner les matériaux inflammables ou les recouvrir afin de prévenir tout risque d'incendie dû 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.

# NOTES

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# INSTALLATION

## TECHNICAL SPECIFICATIONS - RANGER 300 D AND 300 DLX

INPUT - DIESEL ENGINE					
<u>Manufacturer</u>	<u>Description</u>	<u>Speed</u>	<u>Displacement</u>	<u>Starting System</u>	<u>Capacities</u>
KUBOTA D905B-2	3 cyl., liquid-cooled diesel 26 HP @ 3600 RPM	3600 RPM Full load  3700 RPM High idle  2150 RPM Low idle	54.9 cu. in. (898 cc)	Electric 12 VDC battery	Fuel: 10 gal. (38 L)  Oil: 5.4 qt. (5.1 L)  Cooling system: 5.7 qts. (5.4 L)
RATED OUTPUT - WELDER					
<u>Duty Cycle</u>	<u>Amps</u>	<u>Volts at Rated Amperes</u>			
100% Duty Cycle	300 DC Constant Current	25			
100% Duty Cycle	300 AC Constant Current	25			
100% Duty Cycle	200 DC Constant Voltage (300 D)	20			
60% <sup>(1)</sup>	300 DC Constant Voltage (300 DLX)	30			
100%	280 DC Constant Voltage (300 DLX)	30			
OUTPUT - WELDER AND GENERATOR					
<u>Welding Ranges</u>	<u>Max. Open Circuit Voltage</u>	<u>Auxiliary Power<sup>(2)</sup></u>	<u>Auxiliary Power for Wire Feeders</u>		
40 - 300 Amps Constant Current	80 Volts RMS @ 3700 RPM	12,000 Continuous Watts 60 Hz, 120/240 VAC 100% Duty Cycle	42V, 60 Hz, 8 Amps <sup>(3)</sup>  120V, 60 Hz, 8 Amps <sup>(3)</sup>		
PHYSICAL DIMENSIONS					
<u>Height</u>	<u>Width</u>	<u>Depth</u>	<u>Weight</u>		
37.38 in. 949.4 mm	24.75 in. 628.7 mm	60.50 in. 1528.6 mm	1093 lbs. (300 D) 1133 lbs. (300 DLX) 480.8 kg (300 D) 499.0 kg (300 DLX)		

<sup>(1)</sup>Duty cycle is based on a 10-minute period. The machine can be loaded to 300 amps for 6 minutes out of every 10-minute period.

<sup>(2)</sup>Output rating in watts is equivalent to volt-amperes at unity power factor. Output voltage is within  $\pm 10\%$  at all loads up to rated capacity. When welding, available auxiliary power will be reduced.

<sup>(3)</sup>Ranger 300 DLX only.

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# INSTALLATION

Read this entire installation section before you start installation.

## SAFETY PRECAUTIONS

### ⚠ WARNING

Do not attempt to use this equipment until you have thoroughly read 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.

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

## LOCATION AND VENTILATION

Whenever you use the RANGER 300, be sure that clean cooling air can flow through the machine's diesel engine and the machine case. Avoid dusty, dirty areas. Also, keep the machine away from heat sources. Do not place the engine end of the machine anywhere near hot engine exhaust from another machine or closer than two feet from a wall. And of course, make sure that engine exhaust is ventilated to an open, outside area.

The RANGER 300 may be used outdoors. Do not set the machine in puddles or otherwise submerge it in water. Such practices pose safety hazards and cause improper operation and corrosion of parts.

Always operate the RANGER 300 with the case roof on and all machine components completely assembled. This will protect you from the dangers of moving parts, hot metal surfaces, and live electrical devices.

## STORING

1. Store the machine in a cool, dry place when it is not in use. Protect it from dust and dirt. Keep it where it can't be accidentally damaged from construction activities, moving vehicles, and other hazards.
2. Drain the engine oil and refill with fresh 10W30 oil. Run the engine for about five minutes to circulate oil to all the parts. See the **Maintenance** section of this manual for details on changing oil.
3. If you are storing the machine for more than 30 days, drain the coolant from the radiator. Open the cock at the bottom of the radiator and remove the pressure cap so that the coolant drains completely. Attach a note that says "NO WATER" on the radiator.
4. Remove the battery, recharge it, and adjust the electrolyte level. Store the battery in a dry, dark place.
5. If the engine is not used for a long period of time, every two to three months fill the radiator and run the engine for about five minutes to keep it free from rust.

## STACKING

RANGER 300 machines **CANNOT** be stacked.

## TILTING

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

The diesel engine is designed to run in a level position for best performance. It can operate at an angle, but this should never be more than 20 degrees in any direction. If you do operate it at a slight angle, be sure to check the oil regularly and keep the oil level at the FULL mark as it would be in its normal level condition. Also, fuel capacity will be a little less at an angle.

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# INSTALLATION

## HIGH ALTITUDE OPERATION

It may be necessary to de-rate the welder output at higher altitudes. Derate the welder output 0.4% for every 100 ft. (30 m) above 500 ft. (150 m). Some engine adjustment may be required above 5,000 ft. (1,500 m). Contact a Kubota Service Representative.

## 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 K-953-1. 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 the trailer vs. weight of the Lincoln equipment and likely additional attachments.
2. Proper support of and attachment to the base of the welding equipment so that there will be no undo stress to the trailer's framework.
3. Proper alignment of the equipment on the trailer to insure stability side-to-side and front-to-back when it is being moved and when standing by itself.
4. Typical conditions of use, such as travel speed, roughness of the surface on which the trailer will be operated, and environmental conditions.
5. Proper preventative maintenance of the trailer.
6. Conformance with federal, state, and local laws.<sup>1</sup>

<sup>1</sup>Consult applicable federal, state, and local laws regarding specific requirements for use on public highways.

## LIFTING

The RANGER 300 weighs approximately 1150 lbs/522 kg. A lift bail is mounted to the machine frame and should always be used when lifting the machine.

## ADDITIONAL SAFETY PRECAUTIONS

### ⚠ WARNING



**FALLING EQUIPMENT can cause injury.**

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

## PRE-OPERATION ENGINE SERVICE

### ⚠ CAUTION

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

### ⚠ WARNING

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

## OIL

The RANGER 300 is shipped with the engine filled with SAE 10W-30 oil. CHECK THE OIL LEVEL BEFORE YOU START THE ENGINE. If it is not full, add enough oil to fill it to the full mark.

Always use oil that is rated for diesel engine service (API classification of CD/CE).

For more information on oil viscosity and service conditions, see the **Maintenance** section of this manual and the engine Operator's Manual.

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# INSTALLATION

## FUEL

Fill the fuel tank with clean No. 2, diesel fuel only. Do not fill to the top of the filler neck to allow room for expansion.

The RANGER 300 has a 10 gallon (38 liter) fuel tank with a top fill and fuel gauge mounted on the control panel. See the **Operation** and **Maintenance** sections of this manual for more details about fuel.

## ENGINE COOLANT

### **WARNING**

**HOT COOLANT** can burn skin.

- Do not remove cap if radiator is hot.



The welder is shipped with the engine and radiator filled with a 50% mixture of ethylene glycol and water. The recovery bottle should be partially filled. See the **Maintenance** section and the engine Operator's Manual for more information on coolant.

## BATTERY CONNECTIONS

### **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 negative battery lead at 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.



**IMPORTANT:** To prevent **ELECTRICAL DAMAGE** WHEN:

- Installing new batteries.
- Using a booster.

Use correct polarity — **Negative Ground**.

The RANGER 300 is shipped with the negative battery cable disconnected. Before you operate the machine, make sure the Engine Switch is in the OFF position and attach the disconnected cable securely to the negative (-) battery terminal.

Remove the insulating cap from the negative battery terminal. Replace and tighten the negative battery cable terminal.

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

## EXHAUST DEFLECTOR

### **CAUTION**

Shut off the machine and allow the muffler to cool before touching the muffler.

The RANGER 300 is shipped with the exhaust deflector detached. Install it on the muffler outlet using the clamp supplied. Rotate the deflector to the desired direction before tightening the clamp.

## SPARK ARRESTER

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

Standard muffler and deflectors (like the ones included with the RANGER 300) do not act as spark arresters. When local laws require it, a spark arrester must be installed on the machine and properly maintained. An optional spark arrester kit (K903-1) is available for your RANGER 300. See the **Accessories** section of this manual for more information.

### **CAUTION**

An incorrect spark arrester may lead to damage to the engine or reduce performance.

RANGER 300 D AND 300 DLX



# INSTALLATION

## HIGH FREQUENCY GENERATORS FOR TIG APPLICATIONS

The K799 Hi-Freq Unit and the K930-1 or -2 TIG Module can be used with the Ranger 300. The machine is equipped with the required RF bypass circuitry for the connection of high frequency generating equipment. The high frequency bypass network supplied with the K799 Hi-Freq Unit does NOT need to be installed into the Ranger 300.

The Ranger 300 and any high frequency generating equipment must be properly grounded. See the K799 Hi-Freq Unit and the K930-1 TIG Module operating manuals for complete instructions on installation, operation, and maintenance. Also see the **Accessories** section of this manual.

## REMOTE CONTROL

The Ranger 300 DLX is equipped with a 6-pin and a 14-pin connector. The 6-pin connector is for connecting the K857 or K857-1 Remote Control (optional) or the K870 hand Amptrol or K812 foot Amptrol (TIG applications).

The 14-pin connector is used to connect a wire feeder or K930-1 TIG Module control cable. When a remote output control is used, the output control toggle switch must be set at REMOTE.

**NOTE:** When using the 14-pin connector, do NOT connect anything to the 6-pin connector if the wire feeder has a built-in power source output control.

Also see the **Accessories** section of this manual for more information on wire feeder connections.

## WELDING TERMINALS

The Ranger 300 DLX has a toggle switch for selecting "hot" welding terminals (WELDING TERMINALS ALWAYS ON position) or "cold" welding terminals (WELDING TERMINALS REMOTELY CONTROLLED position).

## ELECTRICAL CONNECTIONS

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

## MACHINE GROUNDING

Because the RANGER 300 creates its own power from its diesel-engine driven generator, and if the machine is not connected to premises wiring (home, shop, etc.), you do not need to connect the machine frame to an earth ground. However, for best protection against electrical shock, connect a heavy gauge wire (#8 AWG or larger) from the ground stud located on the bottom of the output panel (Figure A.1) to a suitable earth ground such as a metal pipe driven into the ground. The ground stud is marked with the ground symbol.

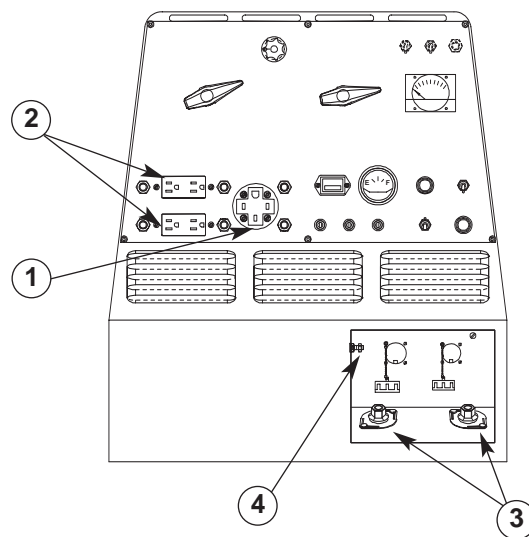
### WARNING

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

When the Ranger 300 is mounted on a truck or a trailer, the machine generator ground stud **MUST** be securely connected to the metal frame of the vehicle. See Figure A.1.

If the RANGER 300 is connected to premises wiring such as a home or shop, it must be properly connected to the system earth ground.

**FIGURE A.1**  
**RANGER 300 OUTPUT CONNECTIONS**



1. 120/240 VOLT, 50 AMP RECEPTACLE
2. 120 VOLT, 15 AMP RECEPTACLES (2)
3. WELD OUTPUT TERMINALS
4. GROUND STUD

## RANGER 300 D AND 300 DLX



# INSTALLATION

## WELDING CABLE CONNECTIONS

### CABLE SIZE AND LENGTH

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

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

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

TABLE A.1

TOTAL COMBINED LENGTH OF ELECTRODE AND WORK CABLES	
Cable Length	Cable Size for 300 Amps 100% Duty Cycle
0-50 Ft. (0-15 meters)	1/0 AWG
50-100 Ft. (15-30 meters)	1/0 AWG
100-150 Ft. (30-46 meters)	2/0 AWG
150-200 Ft. (46-61 meters)	2/0 AWG
200-250 Ft. (61-76 meters)	3/0 AWG

### CABLE INSTALLATION

Install the welding cables to your RANGER 300 as follows. See **Figure A.1** for location of parts.

1. The diesel engine must be OFF to install welding cables.
2. Remove the flanged nuts from the weld output terminals.
3. Connect the electrode holder and work cables to the weld output terminals. The terminals are identified on the case front.
4. Tighten the flanged nuts securely.
5. Be certain that the metal piece you are welding (the "work") is properly connected to the work clamp and cable.
6. Check and tighten the connections periodically.

## ⚠ CAUTION

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

## AUXILIARY POWER RECEPTACLES, PLUGS, AND HAND-HELD EQUIPMENT

The control panel of the RANGER 300 features three auxiliary power receptacles. See **Figure A.1**.

- Two 15 amp, 120 volt duplex (double outlet) receptacles.
- One 50 amp 120/240 volt simplex (single outlet) receptacle.

Through these receptacles the machine can supply up to 12,000 rated continuous watts of single-phase, 60 Hz AC power.

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

If you need ground fault protection for hand-held equipment, refer to the K896-1 GFCI Receptacle kit in the **Accessories** section of this manual for more information.

## CIRCUIT BREAKERS

The RANGER 300 machines are equipped with 50 amp circuit breakers on the 120/240 V receptacle and 15 amp circuit breakers on the 120 V receptacles for overload protection. Under high heat a breaker may tend to trip at lower loads than it would normally.

## RANGER 300 D AND 300 DLX



# INSTALLATION

## ⚠ CAUTION

Never bypass the circuit breakers. Without overload protection, the RANGER 300 D/DLX could overheat and/or cause damage to the equipment being used.

## PREMISES WIRING

The RANGER 300 is suitable for temporary, standby, or emergency power using the engine manufacturer's recommended maintenance schedule. With its three-wire grounded neutral generator, it can be permanently installed as a standby power unit for 240 volt, three-wire, single phase 50 ampere service.

## ⚠ WARNING

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

- The installation complies with the National Electrical Code and all other applicable electrical codes.
- The premises is isolated and no feedbacking into the utility system can occur. Certain state and local laws require the premises to be isolated before the generator is linked to the premises. Check your state and local requirements.

- A double pole, double throw transfer switch in conjunction with the properly rated double throw circuit breaker is connected between the generator power and the utility meter.

The following information and the connection diagram, **Figure A.2**, can be used as a guide by the electrician for most applications to premises wiring.

1. Install a double pole, double throw switch between the power company meter and the premises disconnect. **The switch rating must be the same as or greater than the premises disconnect and service overcurrent protection.**
2. Take the necessary steps to assure that the load is limited to the capacity of the RANGER 300 by installing a 50 amp 240 volt double pole circuit breaker. Maximum rated load for the 240 volt auxiliary is 50 amperes. Loading above 50 amperes will reduce output voltage below the allowable – 10% of rated voltage. This may damage appliances or other motor-driven equipment.
3. Install a 50 amp 120/240 volt plug (NEMA type 14-50) to a double pole circuit breaker using No. 8 or larger, 4 conductor cable of the desired length. (The 50 amp 120/240 volt plug is available in the optional power plug kit.)
4. Plug this cable into the 50 amp 120/240 volt receptacle on the RANGER 300 case front.

RANGER 300 D AND 300 DLX







# NOTES

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RANGER 300 D AND 300 DLX



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## RANGER 300 D AND 300 DLX



# OPERATION

## OPERATING INSTRUCTIONS

Read and understand this entire section before operating your RANGER 300.

## SAFETY INSTRUCTIONS

### ⚠ WARNING

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



#### **ELECTRIC SHOCK can kill.**

- Do not touch electrically live parts such as output terminals or internal wiring.
- Insulate yourself from the work and ground.
- Always wear dry insulating gloves.



#### **FUMES AND GASES can be dangerous.**

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



#### **WELDING SPARKS can cause fire or explosion.**

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

### ⚠ WARNING



#### **ARC RAYS can burn.**

- Wear eye, ear, and body protection.



#### **ENGINE EXHAUST can kill.**

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



#### **MOVING PARTS can injure.**

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

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

## ADDITIONAL SAFETY PRECAUTIONS

Always operate the welder with the hinged door closed and the side panels in place. These provide maximum protection from moving parts and insure proper cooling air flow.

RANGER 300 D AND 300 DLX



# OPERATION

## GENERAL DESCRIPTION

The RANGER 300 is a diesel-engine driven, multi-process AC and DC arc welder and AC power generator for commercial and residential applications. As a generator it can supply up to 12,000 continuous watts of 120/240 volt, 60 Hz, single-phase AC power to operate AC power tools, battery chargers, and lighting. It can also be used to provide standby power. As a welder it provides 300 amps of AC current for welding with AC stick electrodes or 300 amps of DC current for DC stick welding. The RANGER 300 can also perform AC/DC TIG welding and DC semiautomatic wire feed welding.

The engine used on the Ranger 300 machines is the Kubota "Super Five" water-cooled, 3 cylinder DH905 engine. The DH905 has an offset piston design with built-in steel strut and a more rigid crankcase. The Kubota "Three Vortex Combustion System" gives higher power output, lower fuel consumption, lower noise, and cleaner exhaust. The "Super Glow System" gives rapid pre-heating for easy starting in cold weather. The large oil sump adds to the long life of this engine. The high capacity 30 amp alternator gives fast charging of the 495 CCA battery. The engine is extremely smooth and has very low vibration, even at low idle speed.

The Ranger 300 machines are housed in a heavy gauge steel case that is protected by a durable powder paint finish. The case is completely insonorized for remarkably quiet operation. An easy to open hinged door allows access to the engine for single side service. The welder alternator has all copper windings and a high temperature insulation system that includes three coats of electrical grade varnish.

## DESIGN FEATURES - ALL MODELS

### FOR WELDING

- Excellent AC and DC constant current output for stick welding applications.
- 40 to 300 amps constant current output with seven range settings.
- Excellent semi-automatic wire feed welding on constant voltage output range(s).
- TIG welding - full range on DC and up to 250 amps on AC.
- 100% duty cycle rating on all output ranges.
- Remote control capability standard on all models. Amphenol receptacle for easy connection of Lincoln remote control accessories.

### FOR AUXILIARY POWER

- 12,000 watts of 120/240 volt 60Hz AC auxiliary power.
- Power for tools, lights, electric pumps and for standby emergency power.
- Ability to drive a 2 HP motor (provided it is started under no load).
- Two 15 amp industrial grade 120 volt duplex receptacles for up to 60 amps of 120 volt power.
- One 50 amp 120/240 volt dual voltage receptacle for up to 50 amps of 240 volt auxiliary power. Allows easy connection to premises wiring.
- Four 15 amp circuit breakers for 120V duplex receptacles and two 50 amp circuit breakers for 240V receptacle.
- Ability to weld and have AC power at the same time (within machine total capacity).
- Compatible with GFCIs (ground fault circuit interrupters).

### OTHER FEATURES

- Insonorized for extremely quiet operation [(99LW(A) and 74 db(A) @ 23 ft (7m)].
- Kubota 3-cylinder, liquid cooled, diesel engine. Designed for long life, easy maintenance, excellent fuel economy and low noise.
- Engine always starts in low idle for minimum engine wear in cold weather.
- Manual operated lift pump for easy priming of engine if it runs out of fuel.
- Engine protection system shuts engine down on low oil pressure or over temperature of coolant.
- Indicator lights for low oil pressure, over temperature and battery charger low output.
- Engine Hour Meter standard on all models.
- Engine coolant recovery bottle eliminates air in radiator and makes it easy to check coolant level.
- Battery with 495 cold cranking amps.
- Straight through ventilation - cooling air for welder alternator enters front of machine and is exhausted out rear.
- Large capacity 10 gallon (38 l) fuel tank.
- Automatic idler reduces engine speed when not welding or drawing auxiliary power. Machine always starts in low idle. Reduces fuel consumption and extends engine life.
- Compact size fits many smaller trucks.
- Single side engine service with easy to open access door.
- Copper alternator windings and high temperature insulation for dependability and long life.
- Powder painted case and base for outstanding corrosion protection.

## RANGER 300 D AND 300 DLX



# OPERATION

## ADDITIONAL FEATURES RANGER 300 D (K1522-1)

- One constant voltage wire-feed welding range - 80 to 200 amps.  
The wire feed setting permits the Ranger 300D to be used with the LN-25 Wire Feeder and .035, .045 or .068 NR®-211-MP Innershield electrodes. Limited MIG (GMAW) welding can also be done with .030 or .035 L-50 and L-56 using blended Argon shielding gas. "Auto-Idle" functions when using an LN-25 with an internal contactor.

## ADDITIONAL FEATURES RANGER 300 DLX (K1522-2)

- Four constant voltage (CV) wire-feed welding ranges with fine control on each range for welding at 40 to 300 amps.
- Excellent arc characteristics with MIG (GMAW) and recommended Innershield electrodes (FCAW).
- Wire feeder amphenol receptacle (14-pin) for quick connection of control cable.
- Voltmeter for reading CV wire-feed welding arc voltage.
- Built in contactor with front panel selection of "cold" or "hot" welding terminals.
- Aluminum TIG welding when used with K930-1 TIG Module. Output contactor control with Amptrol.
- Recommended wire feeders are the LN-25 with 42 Volt Remote Output Control Module or with internal contactor and all models of the LN-7.

## RECOMMENDED APPLICATIONS

### WELDER

The RANGER 300 provides excellent constant current AC/DC welding output for stick (SMAW) welding and for TIG welding, and it offers constant voltage output for DC semiautomatic wire feed welding.

### GENERATOR

The RANGER 300 gives AC generator output for medium use demands.

## LIMITATIONS

- The Ranger 300 is **not recommended** for any processes besides those that are normally performed using stick welding (SMAW), TIG welding (GTAW), MIG (GMAW) welding and Innershield® (FCAW) welding.
- The RANGER 300 D/DLX is **not recommended** for pipe thawing.
- During welding, generator power is limited and output voltages can drop. Therefore, **DO NOT OPERATE ANY SENSITIVE ELECTRICAL EQUIPMENT WHILE YOU ARE WELDING.** See *Table B.5* for permissible simultaneous welding and auxiliary power loads.

## RANGER 300 D AND 300 DLX

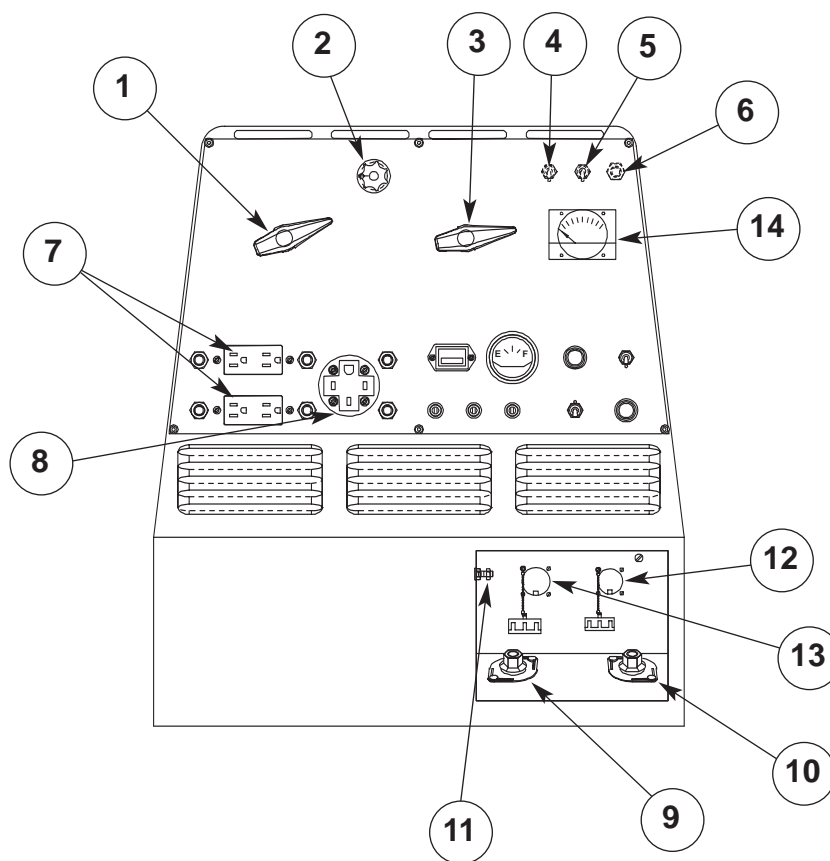


# OPERATION

## CONTROLS AND SETTINGS

All generator/welder controls are located on the Output Control Panel of the machine case front. Diesel engine glow plug, idler control, and start/stop controls are also on the case front. See Figure B.1 and the explanations that follow.

**FIGURE B.1  
OUTPUT PANEL CONTROLS**



### WELDER/GENERATOR CONTROLS

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

- 1. OUTPUT RANGE SELECTOR:** Selects continuous current output for constant current stick or TIG applications (blue settings) and constant voltage wire feed applications (red settings). The amperages on the dial correspond to the maximum amperages for each corresponding range setting. Never change the range switch setting while welding, since this could damage the switch.
- 2. FINE OUTPUT CONTROL:** Allows fine adjustment of current or voltage within the selected output range.
- 3. POLARITY SWITCH:** Selects DC+, DC- or AC welding output. Color codings aid in the proper selection of stick (blue) or wire feed (red) polarity setting. On the RANGER 300 DLX the color setting of the polarity switch must match the color setting of the OUTPUT RANGE SELECTOR. Never change the polarity switch setting while welding since this could damage the switch.
- 4. CONTROL AT WELDER/REMOTE CONTROL SWITCH:** Allows the operator to control welding output at the welding control panel or at a remote station. Remote connections are made at the 6 pin or 14 pin amphenol connector.

**RANGER 300 D AND 300 DLX**



## OPERATION

5. **WELDING TERMINALS SWITCH (DLX Model Only)**  
The toggle switch labeled “WELDING TERMINALS ALWAYS ON” and “WELDING TERMINALS REMOTELY CONTROLLED” is used to control the operation of the RANGER 300 DLX output contactor. With the switch in the “WELDING TERMINALS ALWAYS ON” position, the contactor is closed at low and high idle.

When a wire feeder or TIG Module control cable is attached to either the 6-pin or 14-pin amphenol connector and the Welding Terminals switch is in the “WELDING TERMINALS REMOTELY CONTROLLED” position, the contactor is open in low idle and high idle until and the wire feeder trigger or Amptrol is closed. This closes the 2-4 circuit. When the gun trigger or Amptrol is released, the contactor opens and there is no voltage present at the electrode (300 DLX only).

6. **WIRE FEEDER POWER CIRCUIT BREAKER:** Opens the wire feeder circuit and disables the feeder if a fault is detected in the circuit (300 DLX only).
7. **15 AMP, 120 VOLT DUPLEX RECEPTACLES:** Connection point for supplying 120 volt power to operate one or two electrical devices.
8. **50 AMP, 120/240 VOLT RECEPTACLE:** Connection point for supplying 240 volt power to operate one electrical device.

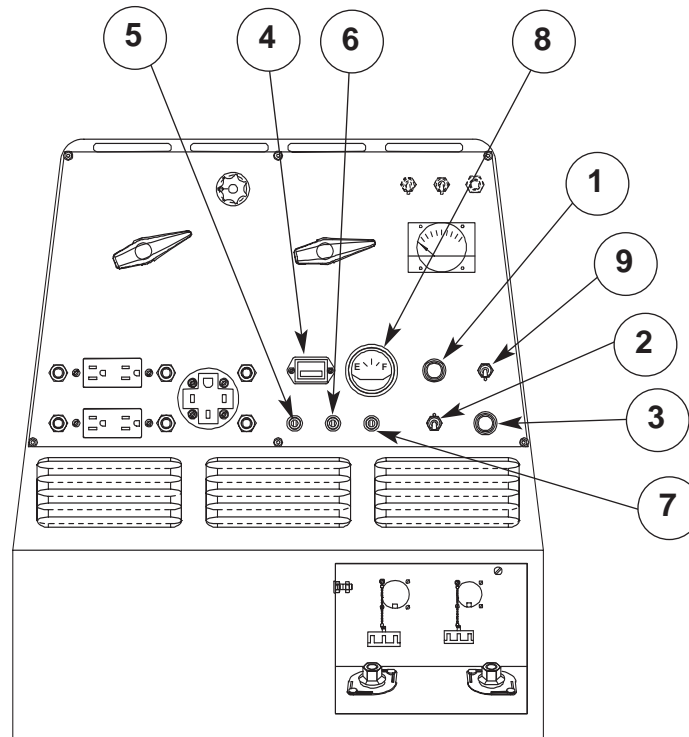
9. **WELD OUTPUT TERMINAL (TO WORK) WITH FLANGE NUT:** Provides the connection point for the work cable.
10. **WELD OUTPUT TERMINAL (TO ELECTRODE HOLDER) WITH FLANGE NUT:** Provides the connection point for the electrode holder.
11. **GROUND STUD:** Provides a connection point for connecting the machine case to earth ground for the safest grounding procedure.
12. **6-PIN AMPHENOL:** For attaching optional remote control equipment to the RANGER 300 D/DLX (Includes contactor closure circuit on the Ranger 300 DLX and remote control circuit).
13. **14-PIN AMPHENOL (DLX Model Only):** For attaching wire feeder control cables to the RANGER 300 DLX (Includes contractor closure circuit, remote control circuit, wire feeder 115/42 volt power source).
14. **VOLTMETER (DLX MODEL ONLY):** Displays actual voltage at the output terminals when welding in CV-mode.

**RANGER 300 D AND 300 DLX**




# OPERATION


FIGURE B.2  
ENGINE CONTROLS

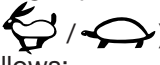


## ENGINE CONTROLS

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

1. GLOW PLUG PUSH-BUTTON: Activates glow plugs to preheat engine for starting. 
2. IDLER CONTROL SWITCH: The idler switch has two positions, "HIGH" and "AUTO".

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

When in "AUTO" (  ) idle position, the idler operates as follows:

### a) Welding

Low idle with Ranger 300 DLX in the "WELDING TERMINALS ALWAYS ON" mode or with a Ranger 300D - When the electrode touches work, the welding arc is initiated and the engine accelerates to full speed.

Low idle and in the "WELDING TERMINALS REMOTELY CONTROLLED" mode - Pressing the gun trigger or Amptrol closes the Ranger 300 DLX output contactor and causes the engine to accelerate to full speed.

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

### b) Auxiliary Power


With the engine running at low idle and auxiliary power for lights or tools drawing 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 engine returns to low idle.

RANGER 300 D AND 300 DLX






# OPERATION

3. **START PUSHBUTTON:** When the pushbutton is held, the starter motor cranks over the engine - release the button once the engine starts. 


**NOTE:** If you press the START pushbutton when the engine is running, you may damage the ring gear or starter motor.

4. **ENGINE HOUR METER:** Records engine running time. Use to determine when to perform required maintenance.
5. **BATTERY LIGHT:** Is off when battery charging system is functioning normally. If the red light turns on while the engine is running, the fan belt may be broken or the alternator or the voltage regulator may be defective.

It is normal for the light to go on when the "Engine" switch is switched to the "ON" position with the engine not running. It will go off after one minute to prevent discharging the battery if the engine is not started. If this happens, the engine protection circuit must be reset by turning the "Engine" switch to the "OFF" position and back to the "ON" position.

6. **OIL PRESSURE LIGHT:** Remains off with proper oil pressure. If the red light turns on while the engine is running, the engine protection system will stop the engine. 

It is normal for the light to go on when the "Engine" switch is switched to the "ON" position with the engine not running. It will go off after one minute to prevent discharging the battery if the engine is not started. If this happens, the engine protection circuit must be reset by turning the "Engine" switch to the "OFF" position and back to the "ON" position.

7. **WATER TEMPERATURE LIGHT:** Remains off under normal operating temperatures. If the red light turns on, the engine protection system will stop the engine. The light will remain on when the engine is over temperature and the "Engine" switch is in the "ON" position (engine not running) but will go off as the engine cools. 
8. **FUEL LEVEL GAUGE:** Displays the level of diesel fuel in the 10-gallon fuel tank.
9. **ENGINE ON-OFF SWITCH:** Energizes the fuel solenoid in the "ON" position. In the STOP position, stops fuel flow to the injection pump and stops the engine.

RANGER 300 D AND 300 DLX



# OPERATION


## ENGINE OPERATION

### ⚠ WARNING

DO NOT RUN THE ENGINE AT EXCESSIVE SPEEDS. The maximum allowable high idle speed for the RANGER 300 is 3700 RPM, no load. Do NOT adjust the governor screw on the engine. Severe personal injury and damage to the machine can result if it is operated at speeds above the maximum rated speed.


Read and understand all safety instructions included in the Kubota instruction manual that is shipped with your RANGER 300.

### BEFORE STARTING THE ENGINE

Check the engine oil level: 

See **Figure D.1** for location of dipstick.

1. Be sure the machine is on a level surface.
2. Remove the engine oil dipstick and wipe it with a clean cloth. Reinsert the dipstick and check the level on the dipstick.
3. Add oil (if necessary) to bring the level up to the full mark. Do not overfill.
4. Replace the dipstick.

Check and fill the engine fuel tank: 

### ⚠ WARNING



**DIESEL fuel can cause fire or explosion.**

- Stop engine when fueling.
  - Do not smoke when fueling.
  - Do not overfill tank.
- Keep sparks and flame away from tank.

1. Remove the fuel tank cap.
2. Fill the tank approximately 4 inches (100 mm) from the top of the filler neck to allow for fuel expansion (observe the fuel gauge.) **DO NOT FILL THE TANK TO THE POINT OF OVERFLOW.**
3. Replace the fuel tank cap and tighten securely.

**NOTE:** DO NOT allow the RANGER 300 to run out of fuel. If it does, you will have to bleed the injection system. See the **Maintenance** section of this manual and the Engine Operator's Manual for instructions on bleeding the fuel injection system.

### ⚠ CAUTION

#### USE DIESEL FUEL ONLY

Purchase diesel fuel in quantities that will be used within 30 days, to assure freshness.

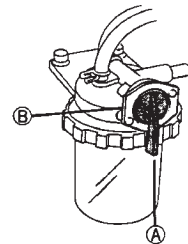
## STARTING THE ENGINE

### ⚠ CAUTION



Remove all loads connected to the AC power receptacles and the welder before starting the diesel engine.

1. Open the engine compartment door and check that the fuel shutoff valve located above the clear plastic fuel filter housing is in the open position (lever in the vertical position). See Figure B.3.

**FIGURE B.3**




(A) "ON"  
(B) "OFF"

2. Check for proper level of coolant in the plastic reserve overflow tank. The level should be between the full and the low marks.
3. Check for proper oil level on the oil dipstick. Close engine compartment door.
4. Set "IDLER" switch to "AUTO".  / 
5. Set the "ENGINE" switch to "ON". Observe that both the oil pressure light and battery charger light are on. Check the fuel gauge to make sure that there is an adequate fuel level. **(NEVER ALLOW THE RANGER 300 D/DLX TO RUN OUT OF FUEL.)**

RANGER 300 D AND 300 DLX




# OPERATION

6. Press the "GLOW PLUG" button to pre-heat the cylinders per the following table: 

Ambient Temperature	Pre-Heat Time
Above 50°F (10°C)	NOT REQUIRED
50°F (10°C) to 23°F (-5°C)	Approximately 5 seconds
Below 23°F (-5°C)	Approximately 10 seconds

## ⚠ CAUTION

Never press the Glow Plug button continuously for more than 20 seconds.

7. Release the "GLOW PLUG" button and press the "START" button to crank the engine. Release when the engine starts. 
8. Check that the indicator lights are off. If not, immediately stop the engine and investigate the indicated problem.
9. Allow the engine to warm up at low idle speed for several minutes before applying a load and/or switching to high idle. Allow a longer warm up time in cold weather.

**NOTE:** If the engine fails to start in 60 seconds or stops running, the "ENGINE" switch must be switched to "OFF" and then switched back to "ON" before attempting to restart the engine. This resets the engine protection circuit.

## COLD WEATHER STARTING AND OPERATION

The Kubota engine used in the Ranger 300 can be started in temperatures as low as 5°F (-15°C). At temperatures below 23°F (-5°C), it is recommended that No. 1D diesel fuel be used in place of No. 2D. Allow engine to warm up before applying a load or switching to HIGH idle.

## STOPPING THE ENGINE

1. Remove all welding and generator power loads and let the engine cool by running it for several minutes at low idle.
2. Stop the engine by placing the Engine Switch in the "OFF" position. This turns off the fuel solenoid. You can also stop the engine by turning off the fuel valve located on the fuel filter housing.

## BREAK-IN PERIOD

Any engine will use a small amount of oil during its "break-in" period. For the diesel engine on the RANGER 300, break-in is about 50 running hours.

Check the oil every four hours during break-in. Change the oil after the first 50 hours of operation, every 100 hours thereafter. Change the oil filter at the second oil change.

During break-in, subject the RANGER 300 to moderate loads. Avoid long periods running at idle. Before stopping the engine, remove all loads and allow the engine to cool several minutes.

**TABLE B.1  
TYPICAL RANGER 300 FUEL CONSUMPTION**

Low Idle - No Load 2000 RPM	.30 gallons/hour (1.0 liters/hour)
High Idle - No Load 3700 RPM	.60 gallons/hour (2.2 liters/hour)
AC CC Weld Output 300 Amps @ 25 Volts	1.1 gallons/hour (4.2 liters/hour)
DC CC Weld Output 300 Amps @ 25 Volts	1.2 gallons/hour (4.6 liters/hour)
DC CV Weld Output 300 Amps @ 28 Volts*	.90 gallons/hour (3.6 liters/hour)
Auxiliary Power 12,000 kVA	1.3 gallons/hour (4.9 liters/hour)

\* DLX model only

## RANGER 300 D AND 300 DLX



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## WELDING OPERATION

### ⚠ CAUTION

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.



#### **FUMES AND GASES can be dangerous.**

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



#### **MOVING PARTS can injure.**

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



#### **WELDING SPARKS can cause fire or explosion.**

- Keep flammable material away.



#### **ARC RAYS can burn.**

- Wear eye, ear and body protection.

See additional warning information throughout this operator's manual.

## GENERAL INFORMATION

The RANGER 300 machines can deliver from 45 to 300 amps of constant current for AC/DC stick welding. The Ranger 300 DLX can deliver 45 to 300 amps of constant voltage current for DC semiautomatic wire feed welding. The Ranger 300 D can deliver 45 to 200 amps of constant voltage current for DC semiautomatic wire feed welding. AC/DC constant current TIG welding is possible across the entire range from 45 to 300 amps, although 250 amps is the maximum recommended for AC TIG welding of aluminum.

Output can be adjusted by setting the POLARITY SWITCH, the OUTPUT RANGE dial, and the FINE CONTROL dial on the output control panel to the settings that are best for your selected welding process.

### AC/DC STICK (CONSTANT CURRENT) WELDING

1. Remove the flange nuts from output terminals and place the work and electrode welding cables over the terminals. See **Figure B.4**. Replace and tighten the flange nuts securely. Be sure the connections are tight.
2. Select the appropriate electrode. See "Welding Tips 1" included with your RANGER 300.
3. Attach the work clamp securely to the work you are welding.
4. Insert the electrode into the electrode holder.
5. Set the IDLER CONTROL to AUTO and start the diesel engine.
6. Set the RANGE switch to a setting equal to or slightly lower than the welding current recommended for the electrode being used. For the best welding performance, always set the RANGE switch to the lowest CC-blue setting that will give the desired weld current. This will assure that the OUTPUT dial is set towards the high end of the dial. If the OUTPUT dial is set at 10 and the welding current is set to low, move the RANGE switch to the next highest setting.
7. Set the POLARITY switch to the desired polarity (CC-blue setting).
8. Set the OUTPUT control. For stick welding, always use a setting between 5 and 10 on the dial (blue range).
9. Strike an arc and begin welding. The OUTPUT control can be adjusted while welding.

## RANGER 300 D AND 300 DLX



# OPERATION

## ⚠ CAUTION

DO NOT change the RANGE switch setting while welding. This can result in damage to the switch.

RANGE SETTING ON MACHINE	ACTUAL CURRENT RANGE
50	30 to 50 AMPS
75	50 to 75 AMPS
100	70 to 100 AMPS
140	95 to 140 AMPS
180	110 to 180 AMPS
225	130 to 225 AMPS
300	160 to 300 AMPS

### AFTER YOU FINISH WELDING:

1. Stop the engine.
2. Allow the electrode and work to cool completely.
3. Remove the work clamp from the work.
4. Remove any remaining piece of electrode from the electrode holder.
5. If you are finished using the RANGER 300 for welding, disconnect the welding cables from the weld output terminals. Reattach the flange nuts and leave them on the terminals.

### AC/DC TIG (CONSTANT CURRENT) WELDING

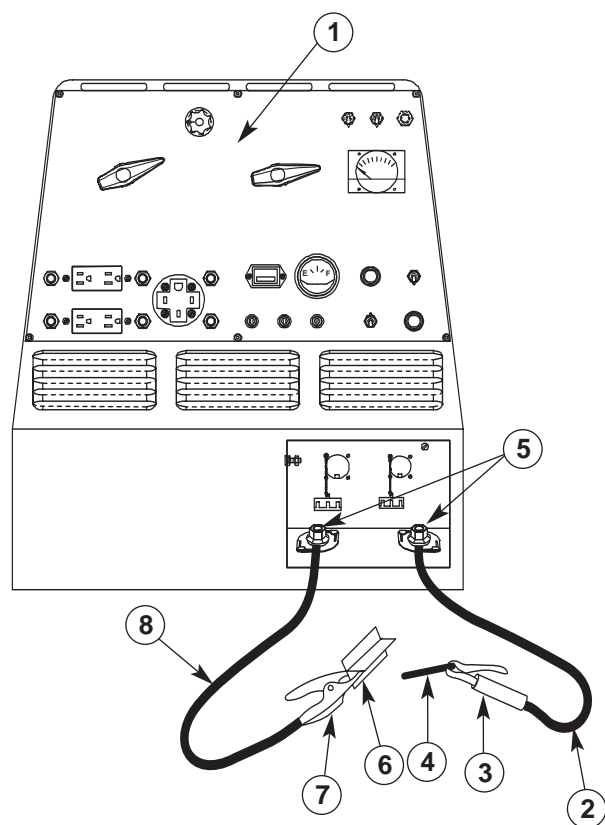
1. Connect the K930-1 TIG Module to the RANGER 300. Follow the installation instructions provided with the kit.
2. Refer to the instruction manual with the TIG module (IM-528) for operation with a RANGER 300 and proper machine settings.
3. Set the RANGE switch to the appropriate setting for the electrode you are using. Refer to IM-528 with the TIG module or refer to **Table B.2** for AC TIG welding.
4. Set the POLARITY SWITCH to the desired polarity.
5. Do not AC TIG weld on the 300 AC range setting. The output current may exceed the rating of the RANGER 300.
6. Start the arc and begin welding.

**NOTE:** When using the RANGER 300 for AC TIG welding of aluminum, the TIG Module is to be set for CONTINUOUS HF.

### AFTER YOU FINISH WELDING:

1. Stop the engine.
2. Allow the electrode and work to cool completely.
3. Remove the work clamp from the work.

**FIGURE B.4  
WELDING CIRCUIT CONNECTIONS**



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

### RANGER 300 D AND 300 DLX



# OPERATION

**TABLE B.2**  
**AC TIG WELDING – TIG ELECTRODE/RANGE SETTINGS**

Pure (EWP) Tungsten Diameter	“Range” Switch Settings	Appropriate Welding Current
1/8”	75, 100 or 140 <sup>(1)</sup>	100 - 200 amps
3/32”	50, 75 or 100	50 - 100 amps
1/16”	50, 75 or 100	45 - 150 amps

1% Thoriated Tungsten Diameter	“Range” Switch Settings	Appropriate Welding Current
1/8”	100, 140 or 180	160 - 250 amps
3/32”	50, 100 or 140	100 - 180 amps
1/16”	50 or 100	60 - 120 amps

<sup>(1)</sup> The welding current will be approximately 200 amps with the range switch set at 120 and the OUTPUT CONTROL set at 10. Do not use a range setting higher than 120 for AC TIG welding.

## DC WIRE FEED WELDING (CV) WITH RANGER 300 DLX

1. Connect one of the following: the LN-25, LN-7 or LN-8 Wire Feeder.
2. Some recommended Innershield electrodes are: .068 NR-211MP, .068 NR-232, NR-203 series, 5/64 NR-311, and 5/64 NS-3M. Lincore® 33 and 55 hardfacing electrodes can also be used. Cable length and other conditions can affect the ultimate results of this application. Request Lincoln publication N-675 for additional information.

Recommended Outershield electrodes are .045 (1.1 mm), .052 (1.3 mm), and 1/16 (1.6 mm) Outershield 71 and 1/16 (1.6 mm) Outershield 70. Request Lincoln publication GS-200 for additional information.

For MIG welding, the recommended electrodes are .030 (0.8 mm), .035 (0.9 mm) and .045 (1.1 mm) L-50 and L-56. You must use a blended shielding gas such as C25 (75% Argon, 25% CO<sub>2</sub>). Request Lincoln publication GS-100 for additional information.

3. Set the IDLER CONTROL to “AUTO” for the LN-25 or “HIGH” for the LN-7 or LN-8 and start the diesel engine.

4. Set the RANGE switch to either HIGH, MEDIUM HIGH, MEDIUM LOW, or LOW (CV-red) depending on your wire size and speed.
5. Set the POLARITY SWITCH to either WIRE WELDING DC+ or WIRE WELDING DC- depending on the electrode.
6. Set the OUTPUT control to a setting between 1 and 10 that gives the most stable arc for the application. Try a higher RANGE switch setting if the arc is unstable.
7. Strike an arc and begin welding. The OUTPUT control can be adjusted while welding. DO NOT change the RANGE switch setting while welding. This can result in damage to the switch.

### AFTER YOU FINISH WELDING:

1. Stop the engine.
2. Allow the work to cool completely.
3. Remove the work clamp from the work.

**RANGER 300 D AND 300 DLX**



# OPERATION

## DC WIRE FEED WELDING (CV) WITH RANGER 300 D

1. Connect an LN-25 with internal contactor to the Ranger 300 D.
2. The only Innershield electrode recommended for use with the Ranger 300 D is NR211MP. The electrode sizes and welding ranges that can be used with the Ranger 300 D are shown in the following table:

Electrode Diameter	Wire Speed in. / min.	Approximate Current Range
.035"	70 - 110	60 - 120 amps
.045"	70 - 130	120 - 170 amps
.068"	40 - 90	125 - 210 amps

The Ranger 300 D 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 .035 diameter electrode gives improved starting compared to .030 diameter. The welding ranges that can be used with the Ranger 300 D are shown in the following table:

Electrode Diameter	Wire Speed in. / min.	Approximate Current Range
.030"	150 - 450	80 - 170 amps
.035"	100 - 350	80 - 190 amps

3. Set the IDLER control to AUTO.
4. Set the RANGE switch to WIRE FEED (CV-red setting).
5. Set the POLARITY SWITCH to either WIRE WELDING DC+ (red) or WIRE WELDING DC- (red), depending on the electrode.
6. Set the OUTPUT control to a setting between 1 and 10 that gives the most stable arc for the application.
7. Strike an arc and begin welding. The OUTPUT control can be adjusted while welding. **DO NOT** change the RANGE switch setting while welding. This can result in damage to the switch.

### AFTER YOU FINISH WELDING:

1. Stop the engine.
2. Allow the work to cool completely.
3. Remove the work clamp from the work.

## CARBON ARC GOUGING (CONSTANT CURRENT)

1. The recommended electrode is a 3/16" (4.8 mm) dia. carbon.
2. Set the RANGE switch to 300.
3. Set the POLARITY switch to DC+ (cc - blue setting).
4. Set the OUTPUT control to 10.
5. Strike an arc and begin gouging.

### AFTER YOU FINISH GOUGING:

1. Stop the engine.
2. Allow the electrode and work to cool completely.
3. Remove the work clamp from the work.

## RANGER 300 D AND 300 DLX



# OPERATION

## SUMMARY OF WELDING PROCESSES AND MACHINE SETTINGS

**TABLE B.3**  
**SUMMARY OF WELDING PROCESSES FOR RANGER 300 DLX**

PROCESS	CONTROL CABLE & DIAGRAM	IDLE MODE	OUTPUT CONTROL SWITCH	WELDING TERMINALS SWITCH	ELECTRODE WHEN NOT WELDING	TO START WELDING
STICK - CC CARBON ARC GOUGING - CC	NO	AUTO	AT WELDER	ALWAYS ON	HOT	Touch electrode to work. Welding starts immediately and engine goes to high idle.
TIG - CC K930-1 TIG MODULE / K936-1 CONTROL CABLE	YES S23732-9	AUTO	REMOTE	REMOTE	COLD	Press Amptrol. Welding starts immediately.
WIRE FEED - CV, LN-25 WITH 42V RE- MOTE CONTROL KIT	YES S23732-3	AUTO	REMOTE	REMOTE	COLD	Press gun trigger, Ranger 300 DLX contactor closes. Welding starts immediately and engine goes to high idle.
WIRE FEED - CV, LN-25 WITH INTERNAL CONTACTOR	NO S23732-1 S23732-2	AUTO	AT WELDER	ALWAYS ON	COLD	Press gun trigger, LN-25 contactor closes. Welding starts immediately and engine goes to high idle.
WIRE FEED - CV, LN-742	YES S23732-5	AUTO	REMOTE	REMOTE	COLD	Press gun trigger, Ranger 300 DLX contactor closes. Welding starts immediately and engine goes to high idle.
WIRE FEED - CV, LN-7 or LN-8	YES S23732-4 S23732-6	HIGH	REMOTE	REMOTE	COLD	Press gun trigger, Ranger 300 DLX contactor closes. Welding starts immediately.
K487-15 WIRE FEED- CV SPOOL GUN / K488 CONTROL MODULE	YES S23732-8	HIGH	AT WELDER	REMOTE	COLD	Press gun trigger, Ranger 300 DLX contactor closes. Welding starts immediately.

RANGER 300 D AND 300 DLX





# INSTALLATION

## SUMMARY OF WELDING PROCESSES AND MACHINE SETTINGS, continued

**TABLE B.4  
SUMMARY OF WELDING PROCESSES FOR RANGER 300 D**

PROCESS	CONTROL CABLE & DIAGRAM	IDLE MODE	OUTPUT CONTROL SWITCH	ELECTRODE WHEN NOT WELDING	TO START WELDING
STICK - CC CARBON ARC GOUGING - CC	NO	AUTO	AT WELDER	HOT	Touch electrode to work. Welding starts immediately and engine goes to high idle.
TIG - CC K930-1 TIG MODULE / K936-1 CONTROL CABLE	YES S23732-10	AUTO	REMOTE	HOT	Press Amptrol. Welding starts immediately.
WIRE FEED - CV, LN-25 / INTERNAL CONTACTOR	NO S23732-1 S23732-2	AUTO	AT WELDER	COLD	Press gun trigger, LN-25 contactor closes. Electrode touches work, welding starts immediately and engine goes to high idle.
WIRE FEED - CV, LN-7 / K240 CONTACTOR KIT	YES S23732-11	HIGH	AT WELDER	COLD	Press gun trigger, K240 contactor closes. Welding starts immediately.

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## AUXILIARY POWER

The Ranger 300 can provide up to 12,000 watts of 120/240 volts AC, single-phase 60 HZ power for continuous use. The front of the machine includes three receptacles for connecting AC power plugs, one 50 amp 120/240 V NEMA 14-50R receptacle and two 15 amp 120 V NEMA 5-15R receptacles. 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.

Most single-phase motors through 2.0 HP can be started if there is no load on the motor or other load connected to the machine. Since the full load current of a 2.0 HP motor is typically 18 to 20 amps when

operated at 120 V or 9 to 11 amps when operated at 240 V, it should be connected to the 120/240 dual voltage receptacle. The full load current of a 1.5 HP motor is typically 15 to 17 amps when operated at 120 V or 7.5 to 8.5 amps when operated at 240 V. It also should be connected to the 120/240 dual voltage receptacle. A 1.0 HP motor that draws less than 15 amps at 120 V can be plugged into one of the 120 V duplex receptacles.

## SIMULTANEOUS WELDING AND POWER LOADS

Auxiliary power ratings are with no welding load. Simultaneous welding and power loads are permitted by the following table. The permissible currents shown assume that current is being drawn from either the 120 V or 240 V supply (not both at the same time).

**TABLE B.5**  
**RANGER 300 SIMULTANEOUS WELDING AND POWER LOADS**  
**(OUTPUT CONTROL SET AT 10)**

Output Selector Setting	Welding Output Amps	Permissible Power Watts (Unity Power)	Permissible Auxiliary Current in Amperes @ 120V	Permissible Auxiliary Current in Amperes @ 240V
300	300	NONE	0	0
225	225	3000	25	13
180	180	4800	40	20
140	140	6400	53	27
100	100	8000	60	33
75	75	9000	60	38
50	50	10,000	60	42
CV LOW (300 DLX)	200	4000	33	17
CV (300 D)	60	9600	60	40
CV MED. LOW (300 DLX)	225 80	3000 8800	25 60	13 27
CV MED. HIGH (300 DLX)	250 100	2000 8000	17 60	8 33
CV HIGH (300 DLX)	300 150	0 6000	0 50	0 25

**NOTE:** Voltage and permissible watts decrease as "CONTROL" is adjusted to settings less than 10. It is recommended that at settings less than 10, only incandescent lighting loads be connected to the auxiliary power receptacles.

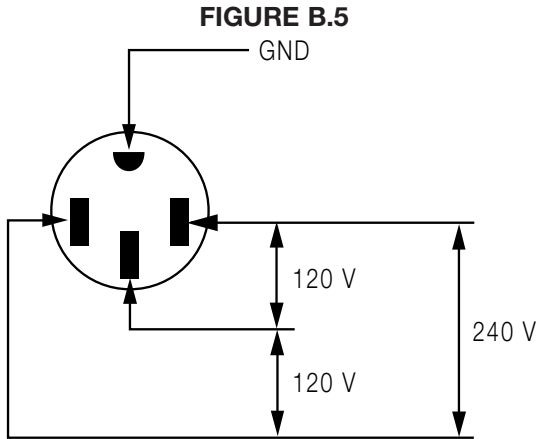
RANGER 300 D AND 300 DLX



# OPERATION

## 120/240 V DUAL VOLTAGE RECEPTACLE

The 120/240 V receptacle can supply up to 50 amps of 240 V power to a two wire circuit, up to 50 amps of 120 V power from each side of the three wire circuit, (up to 100 amps total). Do not connect the 115 V circuits in parallel. Current sensing for the automatic idle feature is in both legs of the three wire circuit as shown below.



## 120 V DUPLEX RECEPTACLES

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

## MAXIMUM CURRENT DRAW FROM 120 V DUPLEX RECEPTACLES - NO WELDING

240 V LOAD FROM FULL KVA RECEPTACLE	EACH HALF OF EACH 120 V DUPLEX	TOTAL FROM ONE 120 V DUPLEX	TOTAL FROM BOTH 120 V DUPLEXES
0	15 AMPS	30 AMPS	60 AMPS
20 AMPS	15 AMPS	30 AMPS	60 AMPS
30 AMPS	15 AMPS	30 AMPS	40 AMPS
40 AMPS	15 AMPS	20 AMPS	20 AMPS
50 AMPS	0	0	0

## MAXIMUM CURRENT DRAW FROM OPTIONAL 120 V GFCI DUPLEX RECEPTACLES - NO WELDING

240 V LOAD FROM FULL KVA RECEPTACLE	EACH HALF OF EACH 120 V DUPLEX	TOTAL FROM ONE 120 V DUPLEX	TOTAL FROM BOTH 120 V DUPLEXES
0	15 AMPS	15 AMPS	30 AMPS
35 AMPS	15 AMPS	15 AMPS	30 AMPS
50 AMPS	0	0	0

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**RANGER 300 D AND 300 DLX**



## ACCESSORIES

### GENERAL OPTIONS / ACCESSORIES

The following options/accessories are available for your RANGER 300 from your local Lincoln Distributor.

**K953-1 Two-Wheeled Trailer** - For in-plant or yard towing of the RANGER 300. Suitable for road towing with optional Fender and Light Kit. Load capacity is 2,100 lbs.

**K802-R Power Plug Kit** - Provides four 15 amp, 115 volt plugs and one 50 amp, dual voltage (115/230V), full kVA plug.

**K703 Accessory Kit** - Includes the following:

- Thirty-five feet (10.5 meters) of #1/0 AWG electrode cable.
- Thirty feet (9.1 meters) of # 1/0 AWG work cable.
- Headshield with No. 12 filter.
- GC500 work clamp.
- Cooltong® 300 insulated electrode holder.

The cables are rated at 300 amps, 100% duty cycle.

**K903-1 Spark Arrester Kit** - A field-installed kit for the RANGER 300 engine muffler exhaust pipe (either engine option). Includes a heavy-gauge steel, approved spark arrester, mounting clamp and adapter.

**K857 Remote Control** - Includes a control box with 25 feet (7.5 meters) of 4 conductor cable. Allows output voltage to be controlled remotely.

**K896-1 GFCI Receptacle Kit** - Includes two UL approved 120 volt ground fault circuit interrupter receptacles (duplex type) with covers and installation instructions. Each receptacle is rated 15 amps, but the maximum total current from each GFCI duplex is limited to 20 amps. The GFCI receptacles replace the two factory installed 120 volt duplex receptacles.

### TIG WELDING OPTIONS / ACCESSORIES

**K930-1 TIG Module** - The TIG Module is an accessory that provides high frequency and shielding gas control for AC and DC GTAW (TIG) welding applications. It provides contactor control of constant current welding power sources having an internal contactor.

The TIG Module is supplied without accessories. Arc Start switches, Amptrols, cables, torches and mounting brackets must be purchased separately.

**K939-1 Docking Kit** - For mounting the K930-1 TIG Module on top of the Ranger 300.

**K936-1 Control Cable** - Control cable for connecting the K930-1 TIG Module to a RANGER 300 DLX.

**K936-3 Control Cable** - Control cable for connecting the K930-1 TIG module to a Ranger 300 D.

**K814 Arc Start Switch** - A remote start switch used in conjunction with the K930-1 TIG Module to energize the RANGER 300 DLX output terminals via the TIG module.

**K963 Hand Amptrol** - Remote output control on RANGER 300 D/DLX and contactor control on Ranger 300 DLX.

**K870 Foot Amptrol** - Remote output control on RANGER 300 D/DLX and contactor control on Ranger 300 DLX.

### SEMI-AUTOMATIC FCAW AND MIG WELDING (RANGER 300 DLX) OPTIONS / ACCESSORIES

**LN-25 Wire Feeder** - This portable unit provides CC/CV for flux-cored arc welding (FCAW) and metal inert gas welding (MIG).

**LN-7 or LN-8 Wire Feeder** - Semiautomatic constant speed wire feeders.

**NOTE:** Gas-shielded welding requires a Magnum Gun. Gasless welding requires an Innershield Gun.

**K487-25 Magnum Spool Gun** - A lightweight, semi-automatic wire feeder for aluminum welding with argon gas. Has built-in remote wire speed control in the handle. Requires the K488 SG Control Module. Includes 50 feet (15.2 meters) of power cable.

**K488 SG Control Module** - Controls wire speed and gas flow. Provides the required control interface between the RANGER 300DLX and the K487-25 Magnum Spool Gun.

### SEMI-AUTOMATIC FCAW AND MIG WELDING (RANGER 300 D) OPTIONS / ACCESSORIES

**LN-25 Wire Feeder** - The recommended wire feeder for use with the Ranger 300 D is the K449 LN-25. This portable unit provides CC/CV for flux-cored arc welding (FCAW) and metal inert gas welding (MIG). For remote control use either a K857 Remote Control Kit (25 ft.) or a K444-1 Remote Voltage Control Kit (25 ft.), which mount inside the LN-25.

#### RANGER 300 D AND 300 DLX



# ACCESSORIES

## CONNECTION OF LINCOLN ELECTRIC WIRE FEEDERS

### ⚠ WARNING



#### ELECTRIC SHOCK can kill.

- Do not operate with panels open.
  - Disconnect NEGATIVE (-) BATTERY LEAD before servicing.
- Do not touch electrically live parts.



#### MOVING PARTS can injure.

- Keep guards in place.
- Keep away from moving parts.
- Only qualified personnel should install, use or service this equipment.

## CONNECTION OF THE LN-25 TO THE RANGER 300 D AND DLX “ACROSS THE ARC” USING THE K857 REMOTE CONTROL (SEE FIGURE C.1.)

1. Shut the welder off.
2. Connect the electrode cable from the LN-25 to the ELECTRODE terminal of the welder. Connect the work cable to the WORK terminal of the welder.

**NOTE:** Welding cable must be sized for current and duty cycle of application.

**NOTE:** Figure C.1 shows the electrode connected for negative polarity. Use the Polarity switch on the Ranger 300 to select the desired electrode polarity. Change the LN-25 polarity switch.

3. Attach the single lead from the LN-25 to the work using the spring clip on the end of the lead. This is only a sense lead - it carries no welding current.
4. Place the IDLER switch in the “AUTO” or “HIGH” position, as desired.

### ⚠ CAUTION

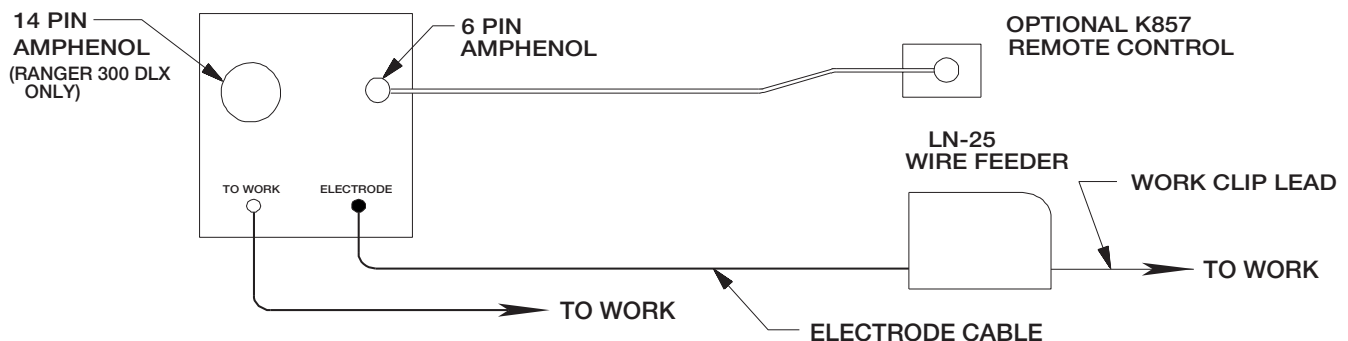
If you are using an LN-25 without an internal contactor, the electrode will be “HOT” when the Ranger 300 is started.

5. Set the OUTPUT RANGE switch to “WIRE WELDING CV.”
6. Set the WELDING TERMINALS switch to “WELDING TERMINALS ALWAYS ON.”
7. Adjust wire feed speed at the LN-25.
8. Set the LOCAL/REMOTE switch to “REMOTE” if a K857 remote control is used.

### ⚠ CAUTION

Electrode is always “HOT.”

**FIGURE C.1**  
RANGER 300/LN-25 ACROSS THE ARC CONNECTION DIAGRAM – K857 REMOTE CONTROL



RANGER 300 D AND 300 DLX



# ACCESSORIES

## CONNECTION OF THE LN-25 TO THE RANGER 300 D AND DLX "ACROSS THE ARC" USING THE K444-1 REMOTE CONTROL (SEE FIGURE C.2.)

1. Shut the welder off.
2. Connect the electrode cable from the LN-25 to the ELECTRODE terminal of the welder. Connect the work cable to the WORK terminal of the welder.

**NOTE:** Welding cable must be sized for current and duty cycle of application.

**NOTE:** Figure C.2 shows the electrode connected for negative polarity. Use the Polarity switch on the Ranger 300 to select the desired electrode polarity. Change the LN-25 polarity switch.

3. Attach the single lead from the LN-25 to the work using the spring clip on the end of the lead. This is only a sense lead - it carries no welding current.
4. Place the IDLER switch in the "AUTO" or "HIGH" position as desired.

### ⚠ CAUTION

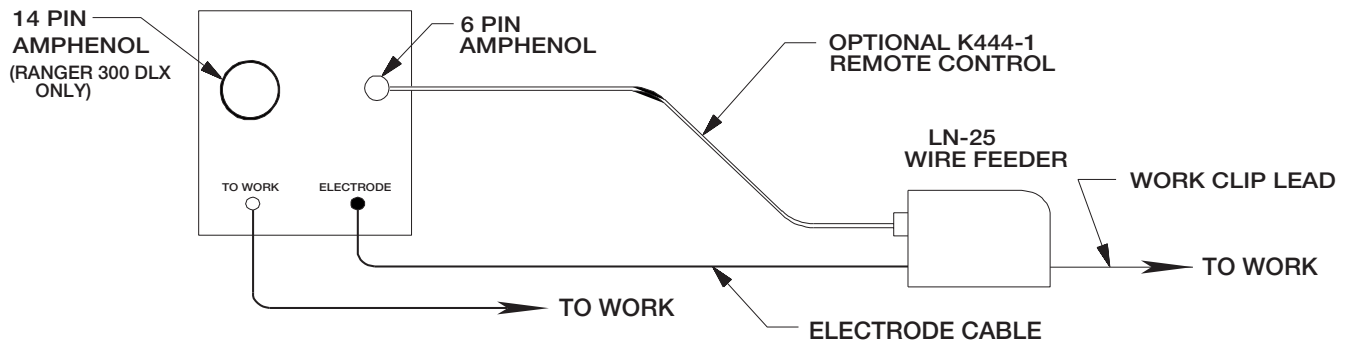
If you are using an LN-25 without an internal contactor, the electrode will be "HOT" when the Ranger 300 is started.

5. Set the OUTPUT RANGE switch to "WIRE WELDING CV."
6. Set the WELDING TERMINALS switch to "WELDING TERMINALS ALWAYS ON."
7. Adjust wire feed speed at the LN-25.
8. Set the LOCAL/REMOTE switch to "REMOTE" if a K444-1 remote control is used.

### ⚠ CAUTION

Electrode is always "HOT."

**FIGURE C.2  
RANGER 300/LN-25 ACROSS THE ARC CONNECTION DIAGRAM -  
K444-1 REMOTE CONTROL**



RANGER 300 D AND 300 DLX



### CONNECTION OF THE LN-25 TO THE RANGER 300 (DLX ONLY) USING THE K624-1 42V REMOTE CONTROL (SEE FIGURE C.3.)

1. Shut the welder off.
2. Connect the electrode cable from the LN-25 to the ELECTRODE terminal of the welder. Connect the work cable to the WORK terminal of the welder.

**NOTE:** Welding cable must be sized for current and duty cycle of application.

Use the Polarity switch on the Ranger 300 to select the desired electrode polarity. Change the LN-25 polarity switch.

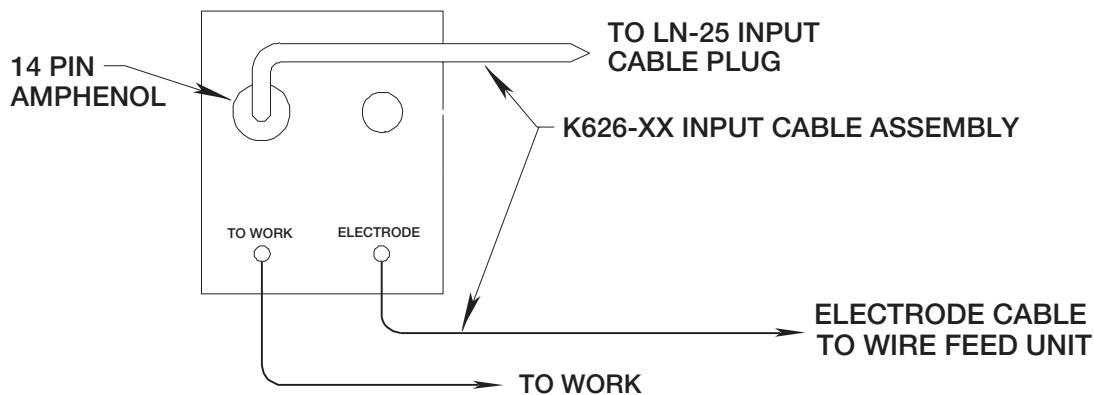
3. Connect the K626-XX Control Cable to the 14-pin amphenol of the Ranger 300 DLX as indicated in Figure C.3. Make the proper connections for local or remote control according to Figure C.3.
4. Connect the K626-XX Control Cable to the LN-25.

### ⚠ CAUTION

Any increase of the high idle engine RPM by changing the governor setting or overriding the throttle linkage will cause an increase in the AC auxiliary voltage. If this voltage goes over 140 volts, wire feeder control circuits may be damaged. The engine governor setting is preset at the factory - do not adjust above RPM specifications listed in this manual.

5. Set the OUTPUT RANGE switch to "WIRE WELDING CV."
6. Set the WELDING TERMINALS switch to "REMOTELY CONTROLLED."
7. Adjust wire feed speed at the LN-25.
8. Set the LOCAL/REMOTE switch to "REMOTE."

**FIGURE C.3**  
**RANGER 300 DLX/LN-25 WITH K624-1 42 VOLT REMOTE CONTROL**



**RANGER 300 D AND 300 DLX**





## CONNECTION OF THE LN-7 TO THE RANGER (300 DLX ONLY) USING K584 CONTROL CABLE (SEE FIGURE C.4.)

1. Shut the welder off.
2. Connect the electrode cable from the LN-7 to the ELECTRODE terminal of the welder. Connect the work cable to the WORK terminal of the welder.

**NOTE:** Welding cable must be sized for current and duty cycle of application.

**NOTE:** Figure C.4 shows the electrode connected for positive polarity. Use the Polarity switch on the Ranger 300 DLX to select the desired electrode polarity.

3. Connect the K584-XX Control Cable to the LN-7.
4. Connect the K584-XX Control Cable to the 14-pin amphenol on the Ranger 300 DLX.
5. Place the IDLER switch in the "HIGH" position.

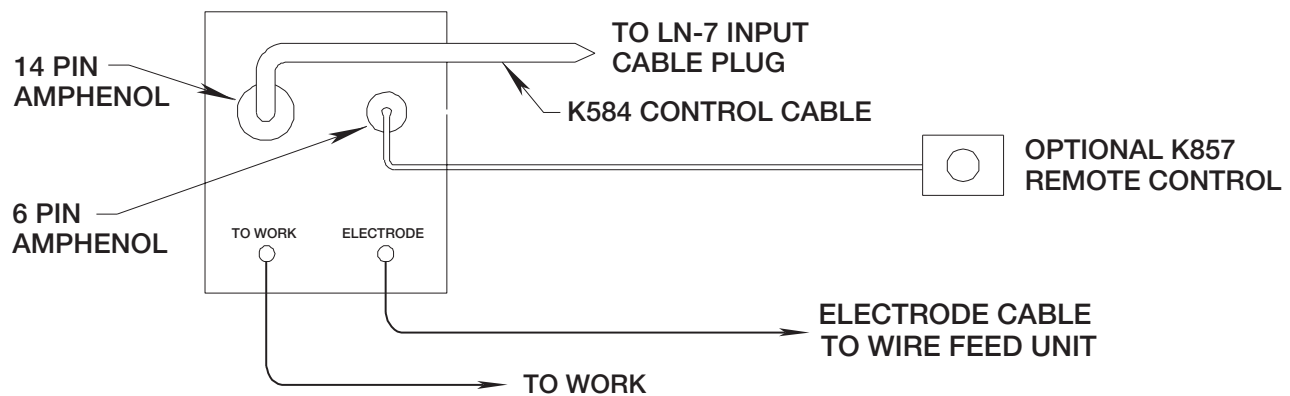
### ⚠ CAUTION

Any increase of the high idle engine RPM by changing the governor setting or overriding the throttle linkage will cause an increase in the AC auxiliary voltage. If this voltage goes over 140 volts, wire feeder control circuits may be damaged. The engine governor setting is preset at the factory - do not adjust above RPM specifications listed in this manual.

6. Set the LOCAL/REMOTE switch to "REMOTE" if a K857 remote control is used. Set the switch to "LOCAL" if no remote control is used.
7. Set the OUTPUT RANGE switch to "WIRE WELDING CV."
8. Set the WELDING TERMINALS switch to "WELDING TERMINALS REMOTELY CONTROLLED."
9. Adjust wire feed speed at the LN-7.

**NOTE:** For remote control, a K857 remote control is required. Connect it to the 6-pin amphenol.

**FIGURE C.4  
RANGER 300 DLX/LN-7 WITH K584 CONTROL CABLE CONNECTION DIAGRAM**



**RANGER 300 D AND 300 DLX**



# ACCESSORIES

## CONNECTION OF THE LN-8 TO THE RANGER 300 (DLX ONLY) USING K867 UNIVERSAL ADAPTER (SEE FIGURE C.5.)

1. Shut the welder off.
2. Connect the electrode cable from the LN-8 to the ELECTRODE terminal of the welder. Connect the work cable to the WORK terminal of the welder.

**NOTE:** Welding cable must be sized for current and duty cycle of application.

**NOTE:** Figure C.5 shows the electrode connected for positive polarity. Use the Polarity switch on the Ranger 300 to select the desired electrode polarity.

3. Connect the K867 Universal Adapter to the K196 input cable and the 14-pin amphenol of the Ranger 300 DLX as indicated in Figure C.5. Make the proper connections for local or remote control according to Figure C.5.
4. Connect the K196 input cable to the LN-8.

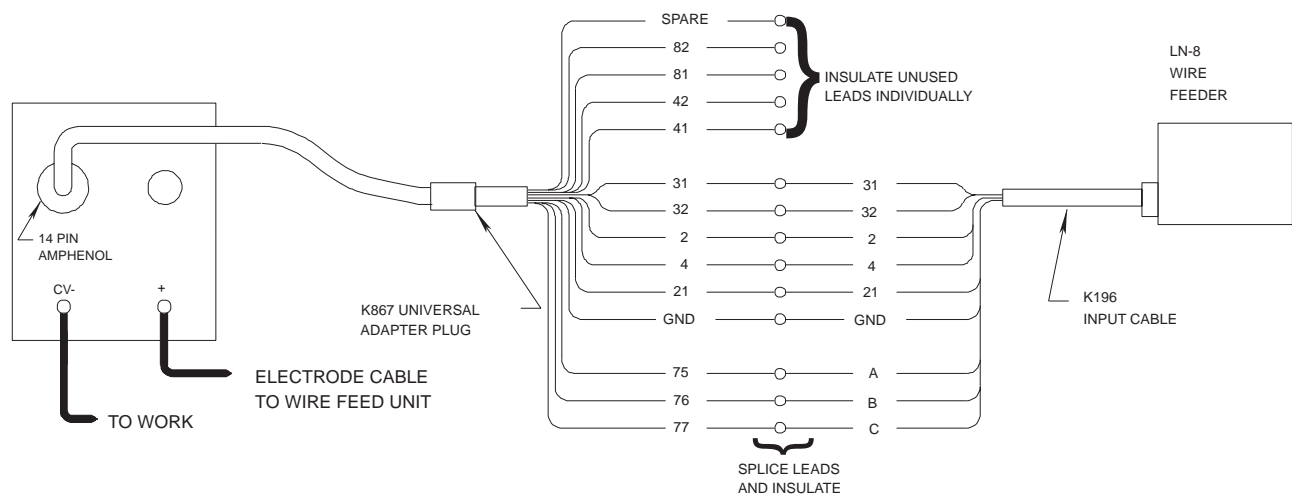
5. Place the IDLER switch in the "HIGH" position.

### **CAUTION**

Any increase of the high idle engine RPM by changing the governor setting or overriding the throttle linkage will cause an increase in the AC auxiliary voltage. If this voltage goes over 140 volts, wire feeder control circuits may be damaged. The engine governor setting is preset at the factory - do not adjust above RPM specifications listed in this manual.

6. Set the LOCAL/REMOTE switch to "REMOTE."
7. Set the OUTPUT RANGE switch to "WIRE WELDING CV."
8. Set the WELDING TERMINALS switch to "WELDING TERMINALS REMOTELY CONTROLLED."
9. Adjust wire feed speed and voltage at the LN-8.

**FIGURE C.5  
RANGER 300 DLX/LN-8 WITH K867 ADAPTER CONNECTION DIAGRAM**



RANGER 300 D AND 300 DLX



# ACCESSORIES

## CONNECTION OF THE K488 SG CONTROL MODULE AND K487 MAGNUM SPOOL GUN TO THE RANGER 300 (DLX ONLY) (SEE FIGURE C.6.)

1. Shut the welder off.
2. Connect the electrode cable from the SG Control Module to the ELECTRODE terminal of the welder. Connect the work cable to the WORK terminal of the welder.

**NOTE:** Welding cable must be sized for current and duty cycle of application.

**NOTE:** Figure C.6 shows the electrode connected for positive polarity. Use the Polarity switch on the Ranger 300 DLX to select the desired electrode polarity.

3. Connect the K691-10 Input Cable as shown in Figure C.6.
4. Set the slide switch on the SG Control Module to the "Lincoln" position.

### CAUTION

Be sure the switch is set to the "Lincoln" (contact closure) position before attempting to operate the SG Control Module. Incorrect switch position could result in damage to the SG Control Module and/or the Ranger 300 DLX.

5. Place the IDLER switch in the "HIGH" position.

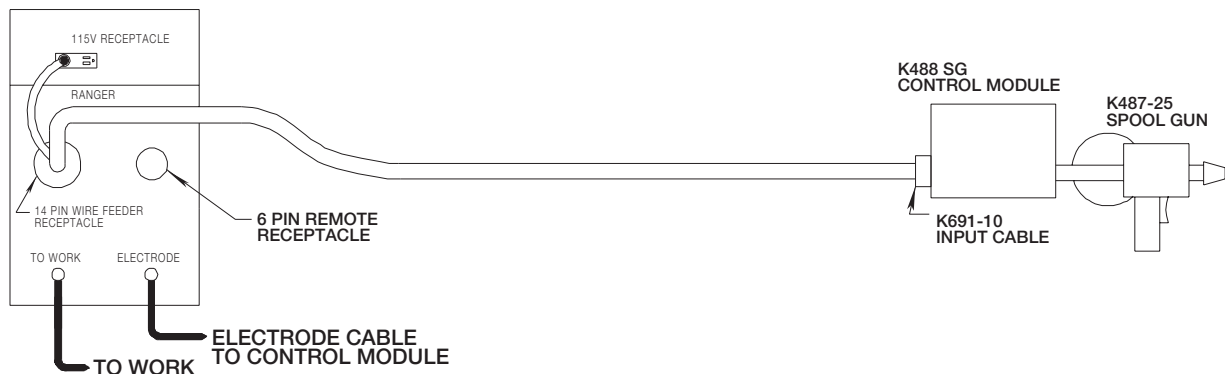
### CAUTION

Any increase of the high idle engine RPM by changing the governor setting or overriding the throttle linkage will cause an increase in the AC auxiliary voltage. If this voltage goes over 140 volts, wire feeder control circuits may be damaged. The engine governor setting is preset at the factory - do not adjust above RPM specifications listed in this manual.

6. Set the LOCAL/REMOTE switch to "REMOTE" if a K857 remote control is used. Set the switch to "LOCAL" if no remote control is used.
7. Set the OUTPUT RANGE switch to "WIRE WELDING CV."
8. Set the WELDING TERMINALS switch to "WELDING TERMINALS REMOTELY CONTROLLED."
9. Adjust wire feed speed at the SG Control Module.

**NOTE:** For remote control, a K857 remote control is required. Connect it to the 6-pin amphenol.

**FIGURE C.6**  
**RANGER 300 DLX/K691/K488/K487 SPOOL GUN CONNECTION DIAGRAM**



RANGER 300 D AND 300 DLX



# ACCESSORIES

## CONNECTION OF THE K930-1 TIG MODULE TO THE RANGER 300 (DLX ONLY) USING K936 CONTROL CABLE (SEE FIGURE C.7.)

1. Shut the welder off.
2. Connect the electrode cable from the K930-1 TIG Module to the ELECTRODE terminal of the welder. Connect the work cable to the WORK terminal of the welder.

**NOTE:** Welding cable must be sized for current and duty cycle of application.

**NOTE:** Figure C.7 shows the electrode connected for positive polarity. Use the Polarity switch on the Ranger 300 DLX to select the desired electrode polarity.

3. Connect the K936-1 Control Cable to the K930-1 TIG Module and to the 14-pin amphenol on the Ranger 300 DLX.
4. Connect the K870 Foot Amptrol or K963-1 Hand Amptrol or K814 Arc Start Switch to the K930-1 TIG Module.

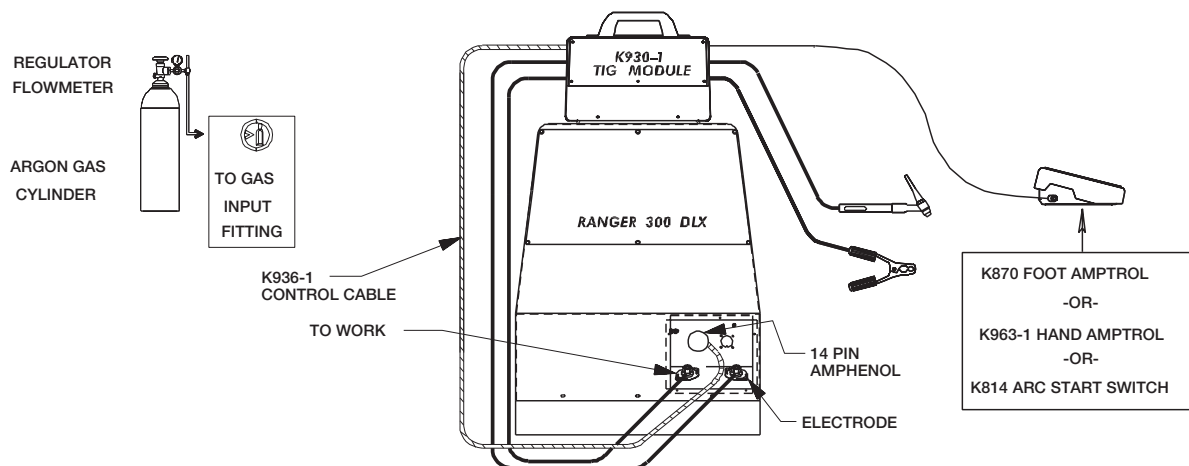
5. Place the IDLER switch in the "AUTO" or "HIGH" position as desired.

### ⚠ CAUTION

Any increase of the high idle engine RPM by changing the governor setting or overriding the throttle linkage will cause an increase in the AC auxiliary voltage. If this voltage goes over 140 volts, wire feeder control circuits may be damaged. The engine governor setting is preset at the factory - do not adjust above RPM specifications listed in this manual.

6. Set the LOCAL/REMOTE switch to "REMOTE."
7. Set the OUTPUT RANGE switch to "STICK WELDING."
8. Set the WELDING TERMINALS switch to "WELDING TERMINALS REMOTELY CONTROLLED."

**FIGURE C.7  
RANGER 300 DLX/K930-1 TIG MODULE CONNECTION DIAGRAM**



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# TABLE OF CONTENTS -MAINTENANCE-

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# MAINTENANCE

## 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 Kubota Engine Operator's Manual as well.

## KUBOTA ENGINE MAINTENANCE SCHEDULE

TABLE D.1

FREQUENCY	MAINTENANCE REQUIRED
Daily or Before Starting Engine	<ul style="list-style-type: none"> <li>• Fill fuel tank.</li> <li>• Check oil level.</li> <li>• Check air cleaner for dirty, loose, or damaged parts.</li> <li>• Check air intake and cooling areas, clean as necessary.</li> </ul>
Every 50 Hours	<ul style="list-style-type: none"> <li>• Check fuel lines and clamps.</li> </ul>
Every 100 Hours	<ul style="list-style-type: none"> <li>• Clean air filter element. <sup>(1)</sup></li> <li>• Check battery electrolyte level.</li> <li>• Check fan belt tightness.</li> </ul>
Every 200 Hours	<ul style="list-style-type: none"> <li>• Change engine oil. <sup>(2)</sup></li> <li>• Replace oil filter cartridge. <sup>(2)</sup></li> <li>• Check radiator hoses.</li> </ul>
Every 400 Hours	<ul style="list-style-type: none"> <li>• Replace fuel filter element.</li> </ul>

(1) Replace air filter element after 600 hours of operation or sooner under dusty operating conditions.

(2) If the engine is operated under heavy load, in high ambient temperatures, or under dusty conditions, change the oil and oil filter every 100 hours.

Refer to your Kubota Engine Operator's Manual for periodic maintenance at 500 hours and beyond.

## KUBOTA ENGINE MAINTENANCE COMPONENTS

TABLE D.2

ITEM	MAKE AND PART NUMBER
Oil Filter Element	Kubota 16271-32092 Fram PH 3593A
Air Cleaner Element	Donaldson P148970
Fuel Filter Element	Kubota 15231-43560 Fram C6921

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## ROUTINE AND PERIODIC MAINTENANCE

### ENGINE MAINTENANCE

(Refer to **Figure D.3** for the location of maintenance components.)

#### ⚠ CAUTION

To prevent the engine from accidentally starting, disconnect the negative battery cable before servicing the engine.

See **Table D.1** for a summary of maintenance intervals for the items listed below. More frequent service may be required, depending on your specific application and operating conditions. See the Kubota Engine Operator's Manual for further information.

#### OIL

Check the oil level before starting engine or daily. **BE SURE TO MAINTAIN THE OIL LEVEL.** Change the oil for the first time after 50 hours of operation. Then, under normal operating conditions, change the oil as specified in the maintenance schedule.



#### CHANGING THE OIL

Change the oil, while the engine is still warm, as follows:

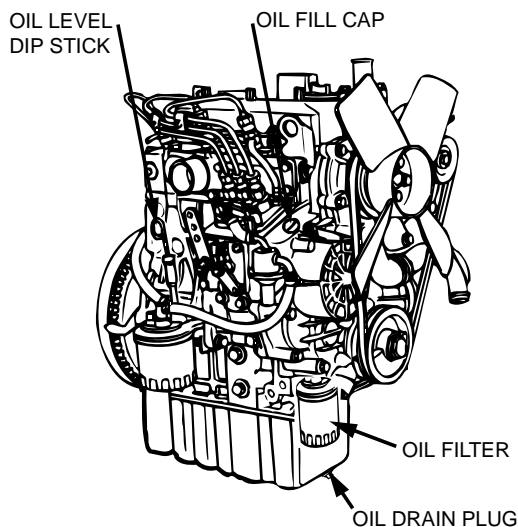
1. Drain the oil from the drain plug located on the engine bottom, as shown in Figure D.1.
2. Replace the plug and tighten it securely.
3. Remove the oil fill cap and add oil until the level reaches the full mark on the dipstick. The quantity of oil required for an oil and oil filter change is 5.4 quarts (5.1 L). Use oil that is rated for diesel engine service (API classification CD/CE). Use SAE viscosity grades per Table D.3.

**TABLE D.3**

Ambient Temperature	Viscosity Grades
Above 25°C (77°F)	SAE 10W-30, SAE10W-40 or SAE30
0°C (32°F) to 25°C (77°F)	SAE 10W-30, SAE10W-40 or SAE20
Below 0°C (32°F)	SAE 10W-30, SAE10W-40 or SAE10

4. Reinstall the oil fill cap and the dipstick and start the engine. Run for several minutes and stop engine. Wait 5 minutes to allow the oil to come down to the oil pan and check oil level again.

**FIGURE D.1**  
**OIL COMPONENT LOCATIONS**



#### OIL FILTER

Change the oil filter the first time after 50 hours of operation. Then, under normal operating conditions, change the oil filter at every oil change. See **Table D.2** for recommended oil filters.

Change the oil filter as follows:

1. Drain the oil from the engine and allow the oil filter to drain.
2. Remove the old filter (spin it off) and discard it. Wipe off the filter mounting surface and adapter.
3. Apply a thin coat of new oil to the rubber gasket on the new oil filter.
4. Spin the new filter on to the mounting adapter until the gasket just touches the mounting surface, then turn it down another 1/2 to 3/4 turn. Do not over-tighten the new filter.
5. Refill the engine with the proper amount and type of oil as described in the Changing the Oil section. Start the engine and check for leaks around the filter element. Correct any leaks (usually by retightening the filter, but only enough to stop leaks) before placing the RANGER 300 back in service.
6. If there are no leaks, stop the engine and recheck the oil level. If necessary, add oil to bring the level up to the FULL mark, but do not overfill.


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# MAINTENANCE

## FUEL

At the end of each day's use, refill the fuel tank  to minimize moisture condensation and dirt contamination in the fuel line. Do not overfill; leave room for the fuel to expand.

Use only fresh, No. 2 grade DIESEL fuel. Do not use kerosene.

See the Kubota Engine Operator's Manual for instructions on replacing the fuel filter. See **Table D.2** for recommended fuel filters.

## BLEEDING THE FUEL SYSTEM

You will need to bleed air from the fuel system any time the fuel filter or fuel lines have been detached and refitted; after the fuel tank has been run out of fuel; or before using the engine after long storage. Bleed the fuel system as follows:

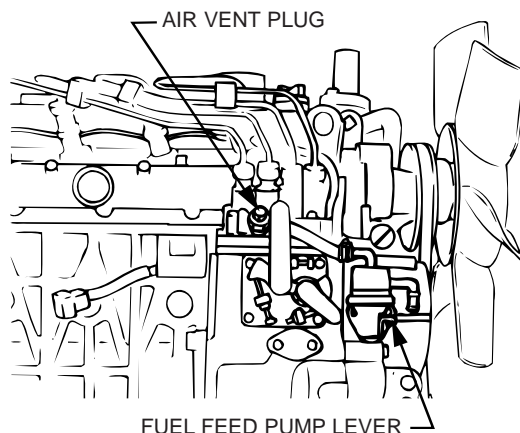
### WARNING

To avoid personal injury, do not bleed a hot engine. This could cause fuel to spill onto a hot exhaust manifold, creating a danger of fire.

Refer to Figure D.2

1. Fill the fuel tank. Open the fuel cock.
2. Open the air vent plug on the fuel injection pump two turns using a 10mm wrench.
3. Move the fuel feed pump lever by hand until fuel flows out of the air vent plug.
4. Tighten the air vent plug.

**FIGURE D.2**  
**FUEL BLEEDING COMPONENT LOCATIONS**



## AIR CLEANER

The Kubota diesel engine is equipped with a dry type air filter. Never apply oil to it. See **Table D.2** for recommended air cleaner. Service the air cleaner as follows:

1. Remove the dust cup from the bottom of the air cleaner housing. Clean out any accumulated dust.
2. If dust is sticking to the element, blow compressed air through the element from the inside out. Turn the element as you apply air. Air pressure should be under 99 psi (68 newton/cm<sup>2</sup>). Replace the filter if there is carbon or oil on the element.
3. Replace the element at least every 600 hours of operation and sooner under dusty conditions.

## TIGHTENING THE FAN BELT

If the fan belt is loose, the engine can overheat and the battery lose its charge. Check tightness by pressing on the belt midway between the pulleys. It should deflect about .25 in. (6 mm) under a load of 20 lbs. (9 Kg).

## COOLING SYSTEM

### WARNING

**HOT COOLANT** can burn skin.

- Do not remove cap if radiator is hot.



Check the coolant level by observing the level in the plastic reserve overflow tank. Add 50/50 antifreeze/water solution if the level is close to or below the "LOW" mark. Do not fill above the "FULL" mark. Remove radiator cap and add coolant to radiator if overflow tank is empty.

To drain the coolant, open the petcock at the bottom of the radiator. Open the radiator cap to allow complete drainage. (Tighten the petcock and refill with a 50/50 antifreeze/water solution.) Use an automotive grade (low silicate) ethylene glycol antifreeze. The cooling system capacity is 5.4 quarts (5.1l.). Replace and tighten the radiator cap.

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# MAINTENANCE

## ⚠ CAUTION

Always premix the antifreeze and clean tap water before adding to the radiator or the overflow tank. It is very important that a precise 50/50 solution be used with this engine year round. This gives proper cooling during hot weather and freezing protection to -34°F (-37°C).

Cooling solution exceeding 50% ethylene glycol can result in engine overheating and damage to the engine. Coolant solution must be premixed before adding to radiator.

Periodically remove the dirt from the radiator fins.

Periodically check the fan belt and radiator hoses. Replace if signs of deterioration are found.

### SPARK ARRESTER SCREEN

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

## BATTERY MAINTENANCE

### ⚠ CAUTION



**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 negative battery lead at 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.

To prevent **ELECTRICAL DAMAGE** when:

- Installing a battery.
- Using a booster.

Use correct polarity - **Negative Ground**.

To prevent **BATTERY DISCHARGE**, if you have an ignition switch, turn it off when engine is not running.

### CLEANING THE BATTERY

Keep the battery clean by wiping it with a damp cloth when dirty. If the terminals appear corroded, disconnect the battery cables and wash the terminals with an ammonia solution or a solution of 1/4 pound (0.1113 kg) of baking soda and 1 quart (0.946 l) of water. Be sure the battery vent plugs (if equipped) are tight so that none of the solution enters the cells.

After cleaning, flush the outside of the battery, the battery compartment, and surrounding areas with clean water. Coat the battery terminals lightly with petroleum jelly or a non-conductive grease to retard corrosion.

Keep the battery clean and dry. Moisture accumulation on the battery can lead to more rapid discharge and early battery failure.

### CHECKING SPECIFIC GRAVITY

Check each battery cell with a hydrometer. A fully charged battery will have a specific gravity of 1.260. Charge the battery if the reading is below 1.215.

**NOTE:** Correct the specific gravity reading by adding four gravity points (0.004) for every five degrees the electrolyte temperature is above 80°F (27°C). Subtract four gravity points (0.004) for every five degrees the electrolyte temperature is below 80°F (27°C).

### CHECKING ELECTROLYTE LEVEL

If battery cells are low, fill them to the neck of the filler hole with distilled water and recharge. If one cell is low, check for leaks.

The battery is a group 45, with a rating of 495 cold cranking amps.

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# MAINTENANCE

## CHARGING THE BATTERY

When you charge, jump, replace, or otherwise connect battery cables to the battery, be sure the polarity is correct. Improper polarity can damage the charging circuit. The RANGER 300 positive (+) battery terminal has a red terminal cover.

If you need to charge the battery with an external charger, disconnect the negative cable first, then the positive cable before you attach the charger leads. After the battery is charged, reconnect the positive battery cable first and the negative cable last. Failure to do so can result in damage to the internal charger components.

Follow the instructions of the battery charger manufacturer for proper charger settings and charging time.

## WELDER / GENERATOR MAINTENANCE

### STORAGE

Store the RANGER 300 in clean, dry protected areas.

### CLEANING

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

### BRUSH REMOVAL AND REPLACEMENT

It is normal for the brushes and slip rings to wear and darken slightly. Inspect the brushes when a generator overhaul is necessary.

### **⚠ WARNING**

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

---

## NAMEPLATES

Whenever routine maintenance is performed on this machine - or at least yearly - inspect all nameplates and labels for legibility. Replace nameplates that are no longer clear. Refer to the parts list for the replacement item number.

## RECEPTACLES

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

## CABLE CONNECTIONS

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

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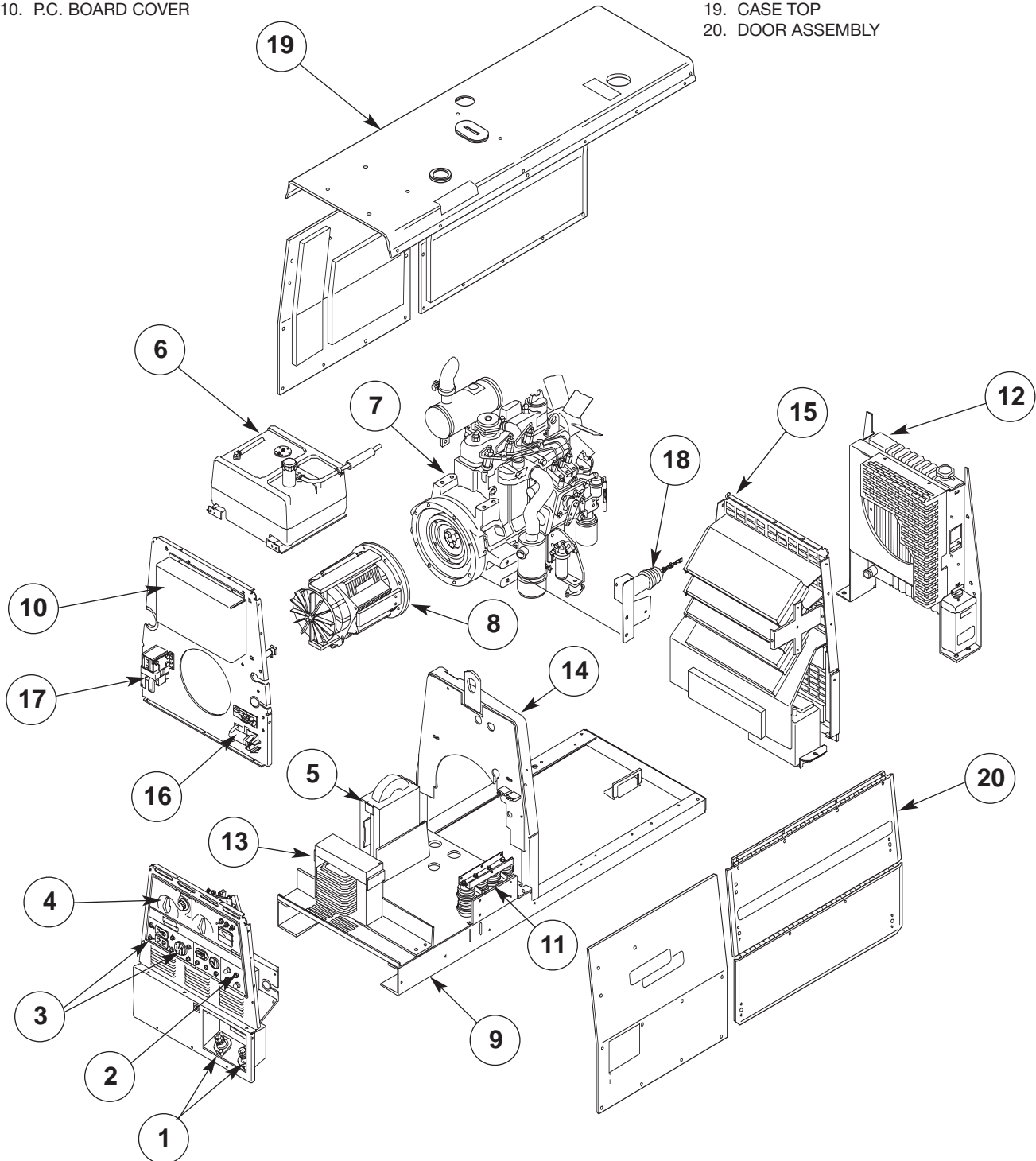


# MAINTENANCE

**FIGURE D.3  
MAJOR COMPONENT LOCATIONS**

1. OUTPUT TERMINALS
2. ENGINE CONTROLS
3. AUXILIARY POWER RECEPTACLES
4. OUTPUT CONTROL PANEL
5. REACTOR ASSEMBLY
6. FUEL TANK
7. DIESEL ENGINE
8. ROTOR/STATOR ASSEMBLY
9. BASE WELDED ASSEMBLY
10. P.C. BOARD COVER

11. CAPACITOR BANK (RANGER 300 DLX ONLY)
12. RADIATOR ASSEMBLY
13. CHOKE ASSEMBLY
14. LIFT BAIL WELDED ASSEMBLY
15. CASE BACK ASSEMBLY
16. FIELD CAPACITOR AND RECTIFIER BRIDGE
17. CONTACTOR (RANGER 300 DLX ONLY)
18. FUEL SHUTOFF & IDLER ASSEMBLY
19. CASE TOP
20. DOOR ASSEMBLY



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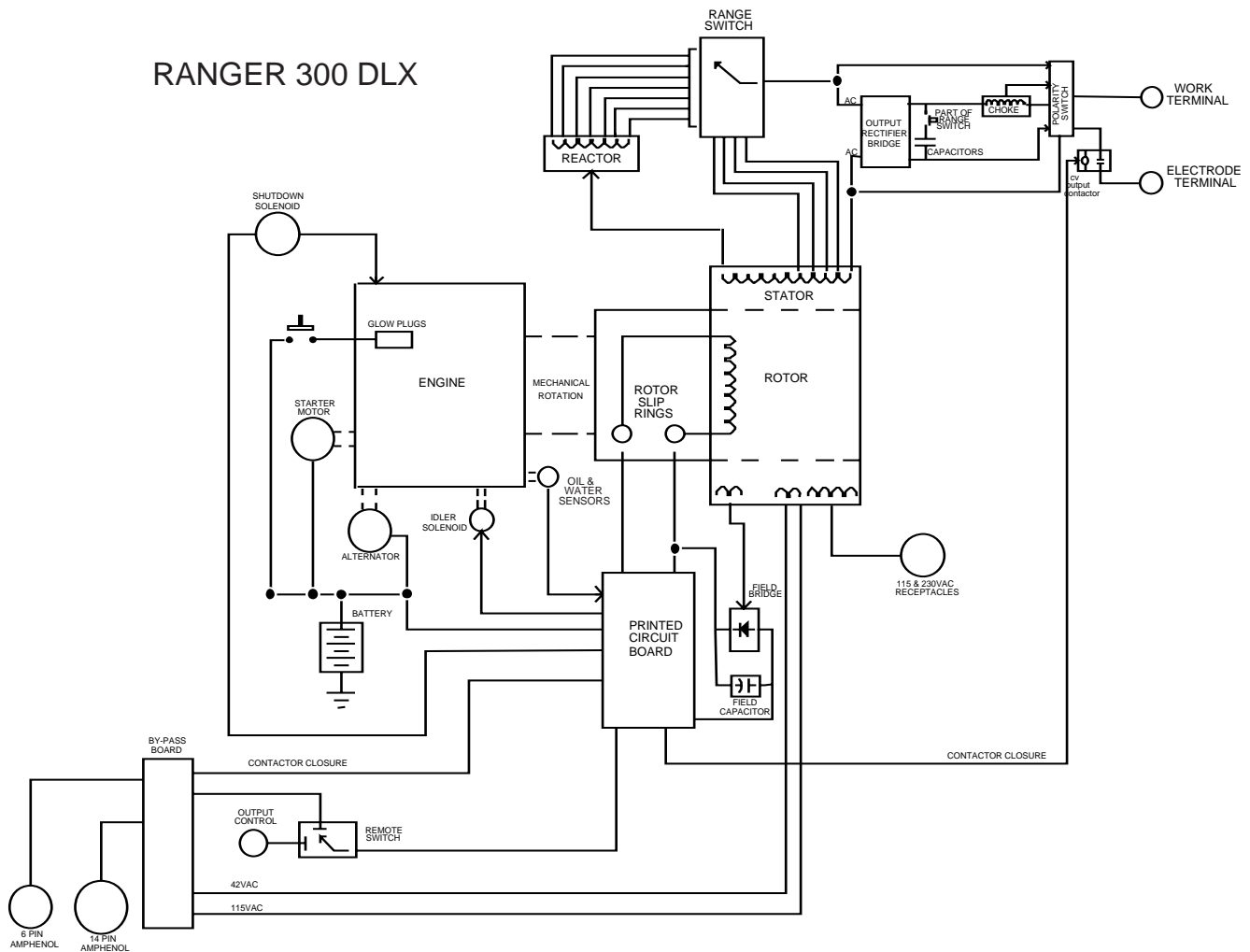
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**FIGURE E.1  
RANGER 300 BLOCK LOGIC DIAGRAM**



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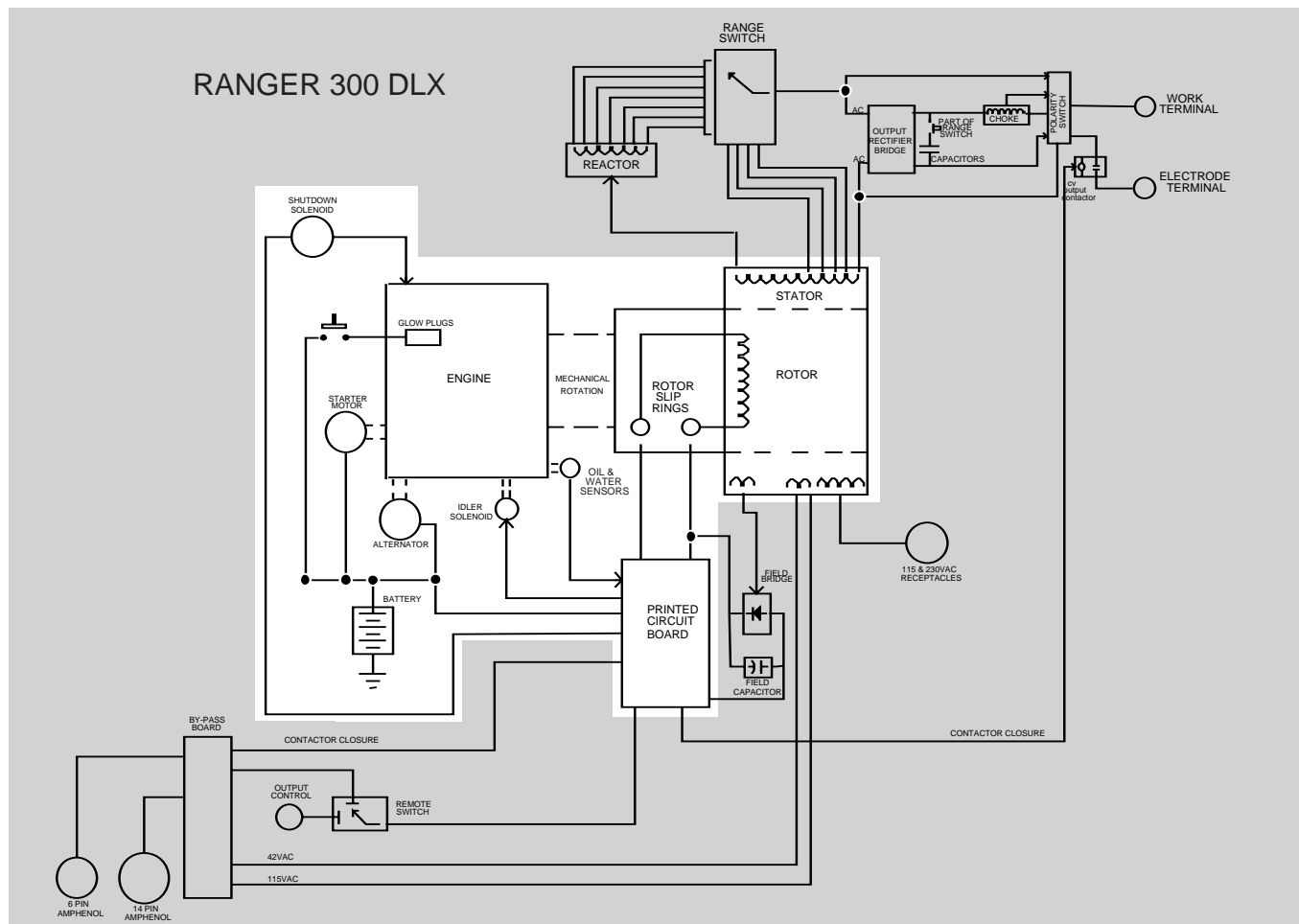
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# THEORY OF OPERATION

**FIGURE E.2**  
**BATTERY, STARTER, ENGINE, GLOW PLUGS, ENGINE PROTECTION,**  
**ROTOR, STATOR AND IDLER SOLENOID**



## BATTERY, STARTER, ENGINE, GLOW PLUGS, ENGINE PROTECTION, ROTOR, STATOR AND IDLER SOLENOID

The 12VDC battery powers the starter motor and glow plugs. The glow plugs are used to preheat the diesel engine to enhance starting. 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). There are four separate and isolated windings incorporated in the stator lamination assembly. Each set has a different number of turns producing different magnitudes of AC output voltages. These four windings are the weld winding, the auxiliary power winding, the field

feedback winding and the auxiliary power winding for wire feeders. The field feedback winding provides rotor current during machine operation. The output of the Ranger 300 is dependent on two criteria, the engine RPM and the amount of current in the rotor winding.

The engine alternator 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's throttle linkage. If welding or auxiliary current is being drawn from the Ranger 300, the printed circuit board activates the idler solenoid, which then brings the engine to the high RPM state. When no output current is sensed, either weld or auxiliary, the printed circuit board deactivates the idler solenoid and the engine returns to low RPM.

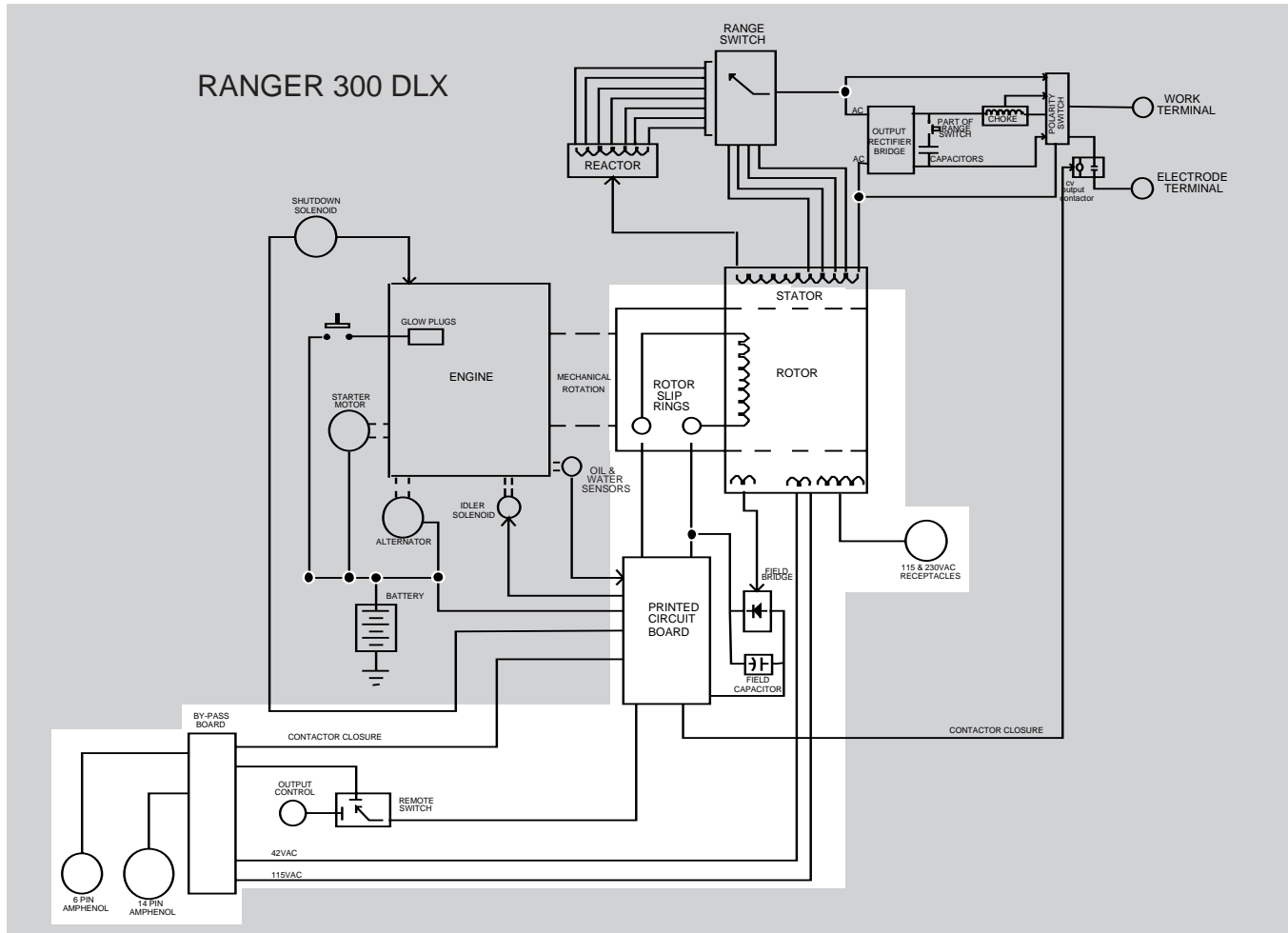
The engine protection circuit shuts the engine off in the event of low oil pressure or engine coolant over-temperature.

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

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FIGURE E.3  
 ROTOR FIELD FEEDBACK, AUXILIARY AND WIRE FEEDER POWER



## ROTOR FIELD FEEDBACK, AUXILIARY AND WIRE FEEDER POWER

The AC voltage developed in the field winding is fed to the full wave field bridge. The DC output of the field bridge is filtered by the field capacitor and controlled by the printed circuit board according to the setting of the machine's output control or remote control. 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 (3600 RPM), a 230VAC voltage is developed in the stator auxiliary winding. This winding is tapped to provide 115VAC. The two voltages (115VAC and 230VAC), are connected to the appropriate receptacles and offer 12,000 watts (total) of AC power.

The auxiliary wire feeder winding offers 115VAC and is tapped to also provide 42VAC. The current draw from this winding should be limited to 8 amps. These voltages and remote control signals are fed through the by-pass (filter) board to the amphenol receptacles.

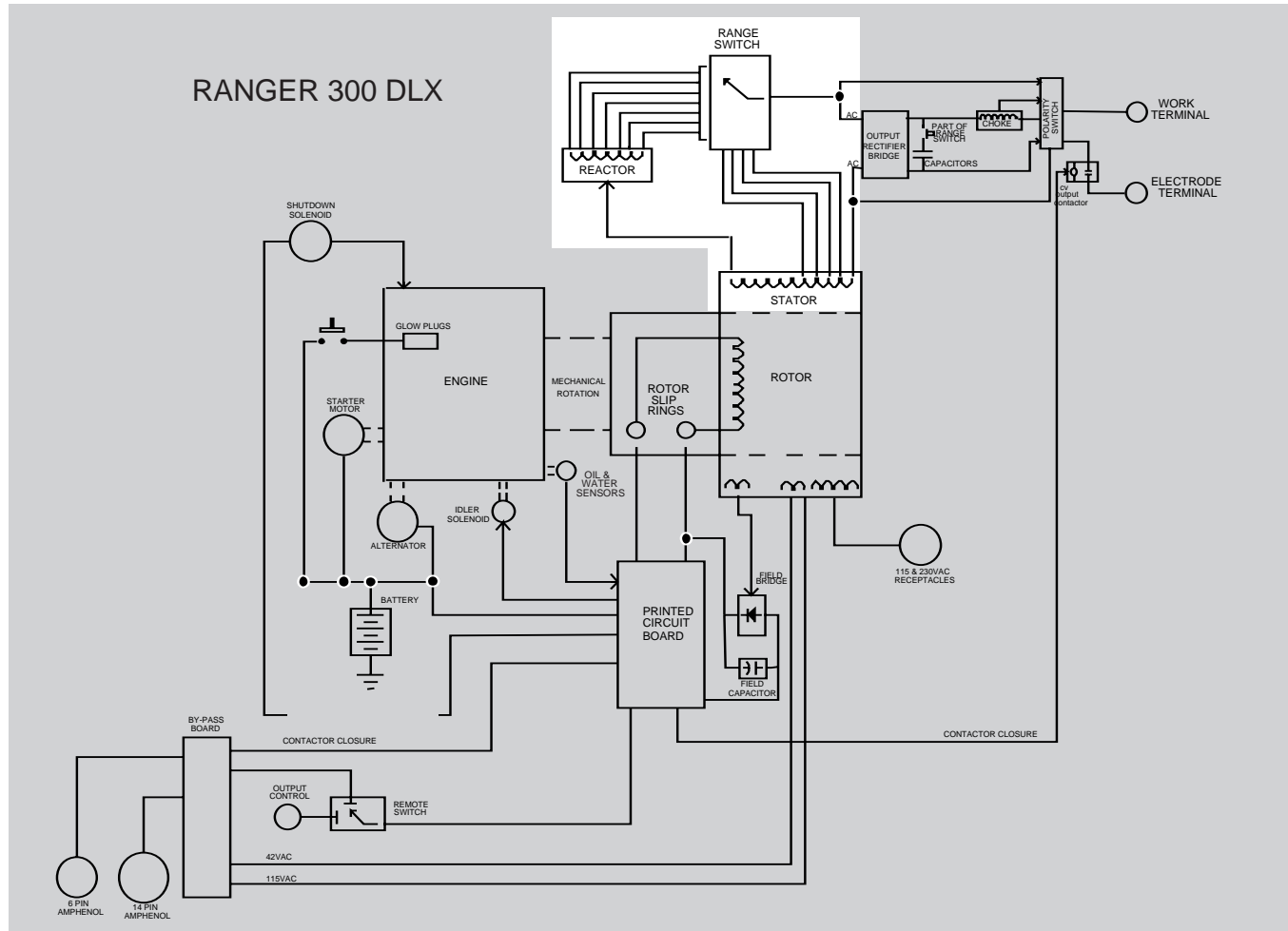
**NOTE:** Unshaded areas of Block Logic Diagram are the subject of discussion.  
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# THEORY OF OPERATION

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 four taps on the stator weld winding to provide a lower but “stiffer” output voltage.

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

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# TROUBLESHOOTING & REPAIR

## HOW TO USE TROUBLESHOOTING GUIDE

### WARNING

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

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

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

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

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

### CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

RANGER 300 D AND 300 DLX



# TROUBLESHOOTING & REPAIR

## 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.

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# TROUBLESHOOTING & REPAIR

OBSERVE SAFETY GUIDELINES  
DETAILED IN THE BEGINNING OF THIS MANUAL.

## TROUBLESHOOTING GUIDE

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 Facility.	1. Contact The Lincoln Electric Service Dept. 1-800-833-9353 (WELD).
No weld output and no auxiliary power. Engine operates normally.	<ol style="list-style-type: none"> <li>1. Make sure the REMOTE switch (S8) is in the proper position – “MACHINE CONTROL” – if a remote control unit is NOT connected to the machine.</li> <li>2. Check the brushes for wear and proper contact to the rotor slip rings.</li> </ol>	<ol style="list-style-type: none"> <li>1. Perform the <b>Rotor Voltage Test</b>.</li> <li>2. If the Rotor Voltage Test is normal, perform the <b>Rotor Resistance Test</b>.</li> <li>3. If the Rotor Voltage Test is NOT normal, perform the <b>Auxiliary and Field Winding Voltage Test</b>. Then check the field diode bridge (D2), the field capacitor (C1), and the Output Control (R3). Replace if necessary.</li> <li>4. The control board may be faulty. Replace.</li> </ol>

⚠ **CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

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# TROUBLESHOOTING & REPAIR

## TROUBLESHOOTING GUIDE

OBSERVE SAFETY GUIDELINES  
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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>OUTPUT PROBLEMS</b>		
No weld output, the auxiliary power (230-115VAC) is operating normally. Engine operates normally.	<ol style="list-style-type: none"> <li>1. On DLX machines, the output contactor must be activated (closed).</li> <li>2. Normal AC open circuit voltage is approximately 70 to 80 volts. Normal DC is 64 to 74VDC. If the open circuit voltage is NOT present at the welder output terminals, contact your local Lincoln Authorized Field Service Facility.</li> <li>3. If normal open circuit voltage is present at the output terminals, check the welding cables, clamps, and electrode holder for loose or broken connections.</li> </ol>	<ol style="list-style-type: none"> <li>1. On DLX machines, the output contactor or associated leads may be faulty. See the Wiring Diagram. The output contactor coil is energized by 12VDC. If the coil is not receiving 12VDC when the Welding Terminals Switch is in the "Always ON" position, the control board may be faulty. Also check associated leads #224 and #232.</li> <li>2. If OCV is absent in both modes (CV &amp; CC), disconnect lead W1 from the output bridge (D1). With the engine at high idle and the output control at maximum, check for 70 to 76VAC from lead W1 to lead W2 on the main stator winding. See the Wiring Diagram. If the AC voltage is NOT present, the winding 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 voltage is present, proceed to step #3.</li> </ol>

*(continued on page F-6)*

**⚠ CAUTION**

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## TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>OUTPUT PROBLEMS</b>		
<p><i>(continued from page F-5)</i></p>		<ol style="list-style-type: none"> <li>3. Check the reactor, range switch (S2) 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>4. Check the choke (L1), polarity mode switch (S1), 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>5. Check the weld output terminals and associated wires for loose or faulty connections.</li> <li>6. Perform the <b>Output Rectifier Bridge Test</b>.</li> </ol>

⚠ **CAUTION**

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>OUTPUT PROBLEMS</b>		
No auxiliary power at receptacles - welding output is normal - engine runs normally.	<ol style="list-style-type: none"> <li>1. If the machine is equipped with circuit breakers, check circuit breakers. Reset if tripped.</li> <li>2. Make sure the output control (R1) is set at the maximum position.</li> <li>3. Check for a loose or faulty plug(s) at the power receptacles.</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><i>Auxiliary and Field Winding Voltage Test.</i></b></li> </ol>

**⚠ CAUTION**

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>OUTPUT PROBLEMS</b>		
<p>Machine has low welding output and low auxiliary output.</p>	<ol style="list-style-type: none"> <li>1. If a remote control unit is NOT connected to the machine, make sure the REMOTE switch is in the proper position - "MACHINE CONTROL."</li> <li>2. The brushes may be worn. Contact your local Lincoln Authorized Field Service Facility.</li> <li>3. The Engine RPM may be low.</li> </ol>	<ol style="list-style-type: none"> <li>1. If the engine high idle RPM is low, perform the <b>Engine Throttle Adjustment Test</b>.</li> <li>2. Perform the <b>Rotor Voltage Test</b>.</li> <li>3. If the rotor voltage is low, the field capacitor (C1) or the field bridge (D2) may be faulty. Test and replace if necessary.</li> <li>4. Check the output control potentiometer (R3). Normal resistance is 10,000 ohms. Also check associated wiring for loose or faulty connections.</li> <li>5. The rotor may be faulty. Perform the <b>Rotor Resistance Test</b>.</li> <li>6. The control board may be faulty. Replace.</li> <li>7. If the engine high idle RPM is OK, the engine may have lost horsepower and be in need of major repair.</li> </ol>

**⚠ CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

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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 are normal.</p>	<ol style="list-style-type: none"> <li>1. Make sure the polarity mode switch (S1) 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 Rectifier Bridge Test</b>.</li> <li>2. Check the choke (L1), the polarity mode switch (S1) 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> </ol>
<p>No AC welding output. DC welding output and auxiliary power are normal.</p>	<ol style="list-style-type: none"> <li>1. Make sure the polarity mode switch (S1) 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 (S1). Also check the associated wires for loose or faulty connections. See the Wiring Diagram.</li> <li>2. Check for continuity from lead "A1" to lead "A2." See the Wiring Diagram.</li> </ol>

### CAUTION

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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 auxiliary power are operating normally.</p>	<ol style="list-style-type: none"> <li>1. Make sure the range switch (S2) is in the proper position and “seated” correctly.</li> <li>2. Make sure the wire feeder and welding cables are connected correctly.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the operation of the range switch (S2) and check the associated wires for loose or faulty connections. See the Wiring Diagram.</li> <li>2. Check the continuity from leads C1 to lead W1 located in the main stator. See the Wiring Diagram. On DLX machines, also check leads C2, C3, and C4 to lead W1.</li> <li>3. On DLX machines, check the capacitors and associated leads. See the Wiring Diagram.</li> </ol>
<p>The constant voltage (CV) welding output is low or unstable. Constant current (CC) and auxiliary power are operating normally.</p>	<ol style="list-style-type: none"> <li>1. Make sure the range switch and polarity switch are in the correct position (CV) and “seated” correctly.</li> <li>2. Make sure the wire feeder and welding cables are connected correctly.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the operation of the range switch (S2) and check the associated wires for loose or faulty connections. See the Wiring Diagram.</li> <li>2. On DLX machines the capacitor bank (C2, C3, C4, and C5) may be faulty. Check or replace.</li> </ol>

### ⚠ CAUTION

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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 idler switch (S5) 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 idler switch (S5) in the "Auto" position, no external load connected to the machine and the engine running, check the DC voltage at leads #222J to #214 located at the idler solenoid. Also check from leads #222H to #213. <b>No (zero) volts is normal.</b> If 12VDC IS present, the control board may be faulty. If no voltage is indicated and the solenoid is keeping the engine in a high speed condition, the idler solenoid may be faulty. Also check for a mechanical restriction in the throttle linkage.</li> </ol>

**⚠ CAUTION**

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## TROUBLESHOOTING GUIDE

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>	<ol style="list-style-type: none"> <li>1. Make sure the welding cables and connections are tight.</li> <li>2. If welding without a control cable connected to the DLX machine, the welding terminals switch (S7) must be in the "Always On" position.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check for broken or faulty connections in the sensing leads #254 and #254 A &amp; B). Make sure their connections are tight at the work output terminal and polarity mode switch. See the Wiring Diagram.</li> <li>2. Make sure leads #254 and #254C are looped three times through the current sensor on the control board. See the Wiring Diagram.</li> </ol>

**⚠ CAUTION**

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>ENGINE PROBLEMS</b>		
The engine will not go to high idle when attempting to weld or when the auxiliary power is loaded.	<ol style="list-style-type: none"> <li>1. Check circuit breaker CB8. Reset if tripped.</li> <li>2. Make sure the welding cables and auxiliary power lead connections are tight.</li> <li>3. Automatic idler may not function if the auxiliary power is loaded to less than 150 watts.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check for broken or faulty connections in the sensing leads (#254, #254A, and lead #3 and #6). Make sure leads #3 and #6 are looped through the AC current sensor.</li> <li>2. The control board may be faulty. Replace.</li> <li>3. Perform the <b>High Speed Solenoid Resistance Test</b>.</li> <li>4. Check the leads and associated connections between the high speed solenoid and the control board.</li> </ol>
The engine will not crank or cranks very slowly.	<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> </ol>	<ol style="list-style-type: none"> <li>1. If the battery is replaced or tests good, 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>

### ⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

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# TROUBLESHOOTING & REPAIR

OBSERVE SAFETY GUIDELINES  
DETAILED IN THE BEGINNING OF THIS MANUAL.

## TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>ENGINE PROBLEMS</b>		
<p>The engine cranks but will not start.</p>	<ol style="list-style-type: none"> <li>1. The engine may be low on or out of fuel.</li> <li>2. Make sure the on/off switch (S6) is in the "ON" position.</li> <li>3. The oil level or pressure may be low, causing the engine protection system to shut off fuel flow to the engine. Check the oil pressure light.</li> <li>4. The engine coolant may be overheated, causing the engine protection system to shut off fuel flow to the engine. Check the water temperature light.</li> <li>5. The engine "glow" plugs may not be operating correctly.</li> </ol>	<ol style="list-style-type: none"> <li>1. The fuel solenoid may be faulty. Perform the <b>Fuel Shutdown Solenoid Resistance Test</b>.</li> <li>2. The engine may be faulty.</li> <li>3. The control board may be faulty.</li> </ol>

⚠ **CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>ENGINE PROBLEMS</b>		
<p>The engine shuts off shortly after starting.</p>	<ol style="list-style-type: none"> <li>1. The oil level or pressure may be low, causing the engine protection system to shut off fuel flow to the engine. Check the oil pressure light.</li> <li>2. Check for adequate fuel supply.</li> <li>3. Circuit breaker CB9, located in the engine compartment, may be open. If CB9 is tripped, the oil pressure and charging indicator lights will not be on when the engine switch is in the "ON" position and the engine is not running.</li> </ol>	<ol style="list-style-type: none"> <li>1. The fuel shutdown solenoid may be faulty. Perform the <b>Fuel Shutdown Solenoid Resistance Test</b>.</li> <li>2. The control board may be faulty.</li> </ol>

### CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

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## TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>FUNCTION PROBLEMS</b>		
Output control on welder not functioning.	<ol style="list-style-type: none"> <li>1. Make sure the REMOTE switch (S8) is in the MACHINE CONTROL position.</li> <li>2. The output control (R3) may be defective.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the output control (R3). Normal resistance is 10,000 ohms. Replace if defective.</li> <li>2. Check the REMOTE switch (S8) and associated wiring. See the Wiring Diagram (leads #75, #76 and #77).</li> <li>3. The control board may be faulty. Replace.</li> </ol>
Remote output control not functioning.	<ol style="list-style-type: none"> <li>1. Make sure the remote switch (S8) is in the REMOTE position.</li> <li>2. The remote control unit may be faulty. Repair or replace.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the remote switch (S8) and associated wiring. See the Wiring Diagram (leads #75, #76 and #77).</li> <li>2. The RF bypass board may be defective. Check or replace.</li> </ol>

**⚠ CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>FUNCTION PROBLEMS</b>		
<p>The wire feeder does not work when connected to the welder 14-pin amphenol (DLX machines only).</p>	<ol style="list-style-type: none"> <li>1. Check circuit breaker CB1. Reset if tripped.</li> <li>2. The wire feeder control cable may be faulty. Check or replace.</li> <li>3. The wire feeder may be faulty. Check or replace.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check for the presence of 115VAC at leads #31A and 32. See the Wiring Diagram.</li> <li>2. Check for the presence of 42VAC at leads #31B to #42. See the Wiring Diagram.</li> <li>3. If any of the above voltages are missing or low, check the circuit breaker CB1 for proper operation.</li> <li>4. The RF bypass board may be faulty. Check or replace.</li> <li>5. Perform the <b><i>Auxiliary and Field Winding Voltage Test.</i></b></li> </ol>

⚠ **CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>FUNCTION PROBLEMS</b>		
<p>With the engine running, the output contactor does not pull in when using a wire feeder with a control cable connected to the RANGER 300 DLX amphenol.</p>	<ol style="list-style-type: none"> <li>1. Make sure the Welding Terminals switch (S8) is in the "Welding Terminals Remotely Controlled" position.</li> <li>2. If the output contactor activates (closes) when switch S8 is in the "Welding Terminals Always On" position, the contactor and control PC board are functioning.</li> <li>3. Install a jumper wire from pins "D" to "C" on the 14-pin amphenol. If the output contactor activates, the problem is external to the RANGER 300 DLX. The wire feeder or control cable may be faulty.</li> </ol>	<ol style="list-style-type: none"> <li>1. With Welding Terminals switch (S8) in the "Welding Terminals Always On" position, check for 12VDC from leads #224(+) to #232(-) at the output contactor. If 12VDC is present and the contactor does NOT activate, the contactor may be defective. See the Wiring Diagram.</li> <li>2. If the correct voltage is NOT present in Step #1, check from lead #224 to ground (lead #5) for the presence of 12VDC. If 12VDC IS present, check the continuity of lead #232 to 9J2 on the control board. See the Wiring Diagram.</li> <li>3. If 12VDC is NOT present from lead #224 to ground (lead #5), check the continuity of lead #224 to 1J1 on the control board. See the Wiring Diagram.</li> <li>4. The control board may be faulty.</li> </ol>

**⚠ CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

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# TROUBLESHOOTING & REPAIR

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
<b>FUNCTION PROBLEMS</b>		
The battery does not stay charged.	1. Check for loose or faulty connections at the battery and engine charging system.	1. Perform the <b><i>Charging Circuit Test.</i></b>

⚠ **CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

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## TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
WELDING PROBLEMS		
<p>The welding arc is “cold.” The engine runs normally (3700 RPM no load). The 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 cables 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 welding output terminals. If the correct voltage is present at the output terminals, check for loose connections on the heavy current carrying leads inside the Ranger 300 D. See the Wiring Diagram.</li> <li>2. If the OCV is low at the welder output terminals, perform the <b>Engine Throttle Adjustment Test</b>.</li> <li>3. Perform the <b>Output Rectifier Bridge Test</b>.</li> <li>4. Check for shorted or grounded windings in the reactor and also in the main stator. See the Wiring Diagram.</li> </ol>

**CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353.

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# TROUBLESHOOTING & REPAIR

## ROTOR RESISTANCE TEST

### WARNING

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

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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
- 5/16" Nut driver
- 3/8" Nut driver
- Need nose pliers
- Wiring Diagram

This procedure requires approximately 20 minutes to perform.

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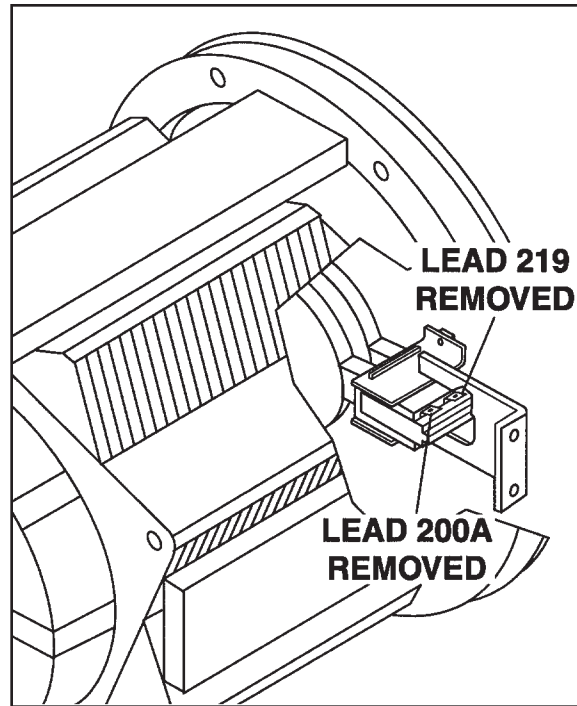




# TROUBLESHOOTING & REPAIR

## ROTOR RESISTANCE TEST *(continued)*

FIGURE F.1 – ROTOR BRUSH LEADS REMOVED



### TEST PROCEDURE

1. Conduct the test with the engine OFF.
2. Using the 5/16" and 3/8" nut drivers, remove the right front case side.
3. Locate, label and remove the two leads from the rotor brush holder assembly (lead #219 from the negative brush and lead #220A from the positive brush). See Figure F.1. This will electrically isolate the rotor windings.
4. Using the volt/ohmmeter, check the rotor winding resistance across the slip rings. Set the meter on the low scale (X1). Normal resistance is approximately 5 or 6 ohms.
5. Measure the resistance to ground. Set the meter on the high scale (X100,000). Place one meter probe on either of the slip rings. Place the other probe on any good unpainted ground. The resistance should be very high, at least 500,000 ohms.
6. If the test does not meet the resistance specifications, then the rotor may be faulty.
7. Connect the leads previously removed from the brush assembly. Make sure the leads are connected to the proper brushes - lead #219 to the negative brush, lead #200A to the positive brush.
8. Replace the right front case side previously removed.

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# TROUBLESHOOTING & REPAIR

## OUTPUT RECTIFIER BRIDGE TEST

### **⚠ WARNING**

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

### TEST DESCRIPTION

This test will determine if there are faulty diodes in the output rectifier bridge.

### MATERIALS NEEDED

- Volt/Ohmmeter (Diode Tester)
- 5/16" Nut driver
- 3/8" Nut driver
- 1/2" Wrench
- Wiring Diagram

This procedure requires approximately 35 minutes to perform.

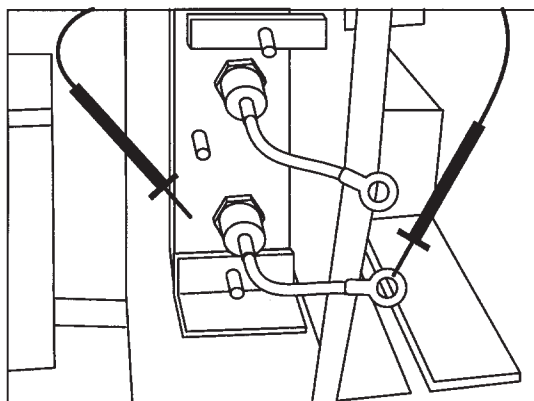
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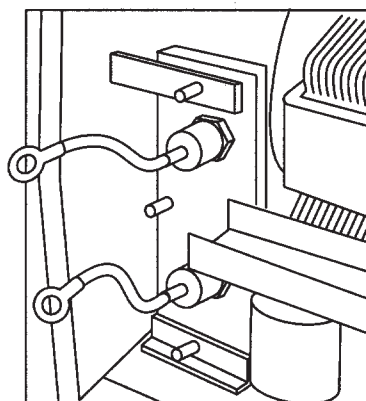
# TROUBLESHOOTING & REPAIR

## OUTPUT RECTIFIER BRIDGE TEST (*continued*)

FIGURE F.2 – LOCATION OF OUTPUT RECTIFIER DIODE LEADS



Left side (-)



Right side (+)

### TEST PROCEDURE

1. **Conduct this test with the engine off.**
2. Using the 3/8" wrench, remove the sheet metal screws from the right and left front case sides.
3. Carefully remove the right and left front case sides.
4. Locate the two halves of the output rectifier. The negative plate is located on the lower left side of the machine behind the case front. The positive plate is located on the lower right side of the machine behind the case front. See Figure F.2.
5. Using the 1/2" wrench, remove the nuts and washers holding the diode pigtails and the heavy current-carrying leads to the studs on the rectifier plates. Note leads and pigtail placement for reassembly.
6. Electrically isolate the diode pigtail leads by carefully bending them out into "free air."
7. With an ohmmeter or diode tester, check each of the four diodes from their pigtails to their respective heat sinks.
8. Reverse the tester leads and check the diodes again. Diodes should have a low resistance in one polarity and a very high resistance in the opposite polarity.
9. Replace any "shorted" or "open" diode as the tests indicate. See the ***Diode Removal and Replacement Procedure***.
10. Replace the pigtails and heavy leads onto the correct studs. Assemble the washers and nuts.
11. Replace the left and right front case sides.

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# TROUBLESHOOTING & REPAIR

## FUEL SHUTDOWN SOLENOID RESISTANCE TEST

### **⚠ WARNING**

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

### **TEST DESCRIPTION**

This test will determine if the shutdown solenoid coil resistances are normal.

### **MATERIALS NEEDED**

Ohmmeter  
Wiring Diagram

This procedure requires approximately 25 minutes to perform.

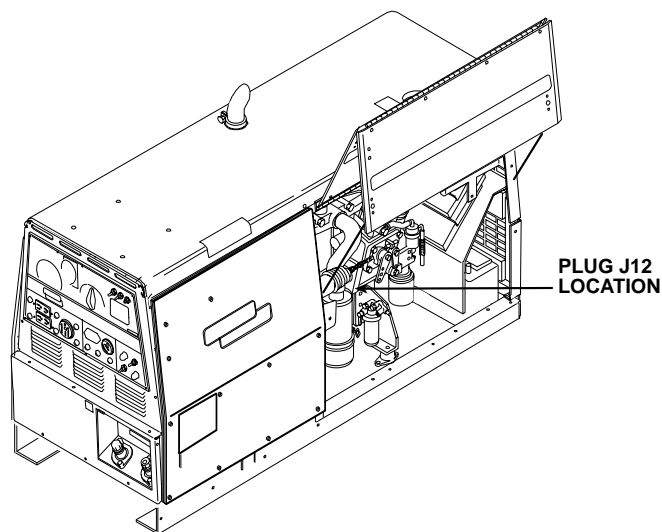
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# TROUBLESHOOTING & REPAIR

## FUEL SHUTDOWN SOLENOID RESISTANCE TEST (*continued*)

FIGURE F.3 – PLUG J12 LOCATION

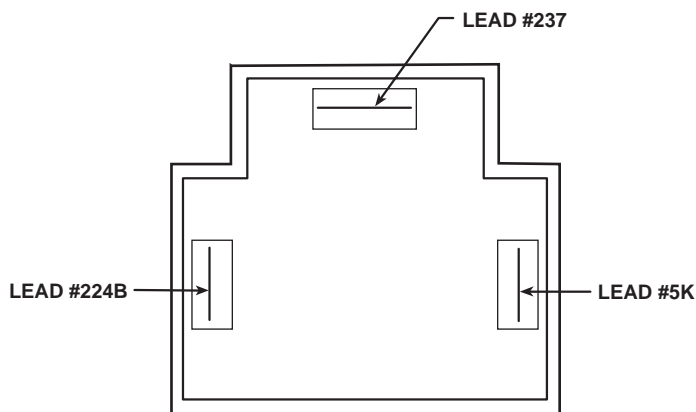


### TEST PROCEDURE

1. Conduct this test with the engine off.
2. Unlatch and open the right side engine access door.

3. Locate and disconnect plug J12. See Figure F.3. Also see the Wiring Diagram.

FIGURE F.4 – PLUG J12 PIN/LEAD ASSIGNMENTS



4. Using the ohmmeter, check the resistance from lead #237 to lead #5K. See Figure F.4. Normal resistance of the “pull-in” coil is approximately 0.5 ohms.
5. Using the ohmmeter, check the resistance from lead #224B to lead #5K. See Figure F.4. Normal resistance of the “hold-in” coil is approximately 11.5 ohms.

**NOTE:** This solenoid is activated with 12VDC. The “hold-in” voltage is derived from the control board. The “pull-in” voltage is derived from the starter contactor. See the Wiring Diagram. If the 12VDC is not present, check the leads and associated connections.

6. Reassemble plug J12 and close and latch the engine access door.

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# TROUBLESHOOTING & REPAIR

## HIGH SPEED SOLENOID TEST

### **⚠ WARNING**

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

### TEST DESCRIPTION

This test will determine if the solenoid coil resistance is normal and also if the solenoid is capable of functioning when it is energized with 12VDC.

### MATERIALS NEEDED

External 12VDC supply (30 amps)  
Wiring Diagram  
Volt/Ohmmeter

This procedure requires approximately 35 minutes to perform.

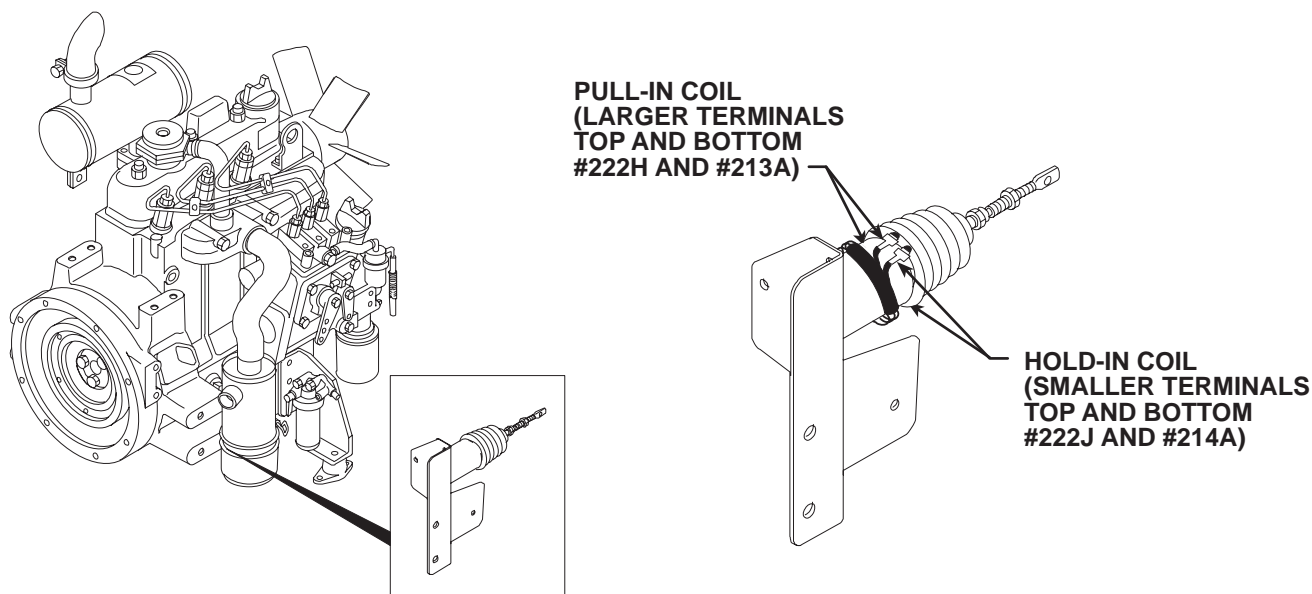
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# TROUBLESHOOTING & REPAIR

## HIGH SPEED SOLENOID TEST *(continued)*

FIGURE F.5 – SOLENOID LEADS



### TEST PROCEDURE

1. Turn the engine off.
2. Unlatch, lift and secure the right side engine service access door.
3. Locate and remove the four spade connectors that attach the solenoid terminals to the wiring harness leads (#222J, #222H, #213A and #214A). See Figure F.5 and the Wiring Diagram. Remove any necessary wire wraps.

4. Check the pull-in coil resistance (larger terminals #222H and #213A). The normal resistance is approximately 0.4 ohms.

Check the hold-in coil resistance (smaller terminals #222J and #214A). The normal resistance is approximately 20 ohms).

If either coil resistance is not correct, the solenoid may be faulty. Replace.

5. Using the external 12VDC supply, apply 12VDC to the larger solenoid terminals (#222H+ to #213A-). The solenoid should activate. The solenoid should deactivate when the 12VDC is removed.

### ⚠ CAUTION

When the solenoid activates, remove the voltage immediately. Do not leave the external supply connected to terminals #222H and #213A for longer than three seconds. Component damage could result.

8. If the solenoid does not operate properly, check for a mechanical restriction in the linkage.
9. Using the external 12VDC supply, apply 12VDC to the smaller solenoid terminals for the hold-in coil (#222J+ to #214A-). Push in the solenoid plunger. With the 12VDC applied to the hold-in coil, the plunger should stay in until the 12VDC is removed.
10. If the linkage is intact and the solenoid does not operate correctly when the 12VDC is applied, the solenoid may be faulty. Replace.
11. Replace the harness leads to the correct terminals. See Figure F.5 and the Wiring Diagram. Replace any previously removed wire wraps.
12. Close and secure the right side engine service access door.

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# TROUBLESHOOTING & REPAIR

## ENGINE THROTTLE ADJUSTMENT TEST

### **⚠ WARNING**

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

### TEST DESCRIPTION

If the machine output is low or high, this test will determine whether the 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

- 5/16" Nut driver
- 3/8" Nut driver
- 10mm Wrench
- 7/16" Wrench
- White or red marking pencil
- Strobe-tach, frequency counter, or oscilloscope

This procedure requires approximately 30 minutes to perform.

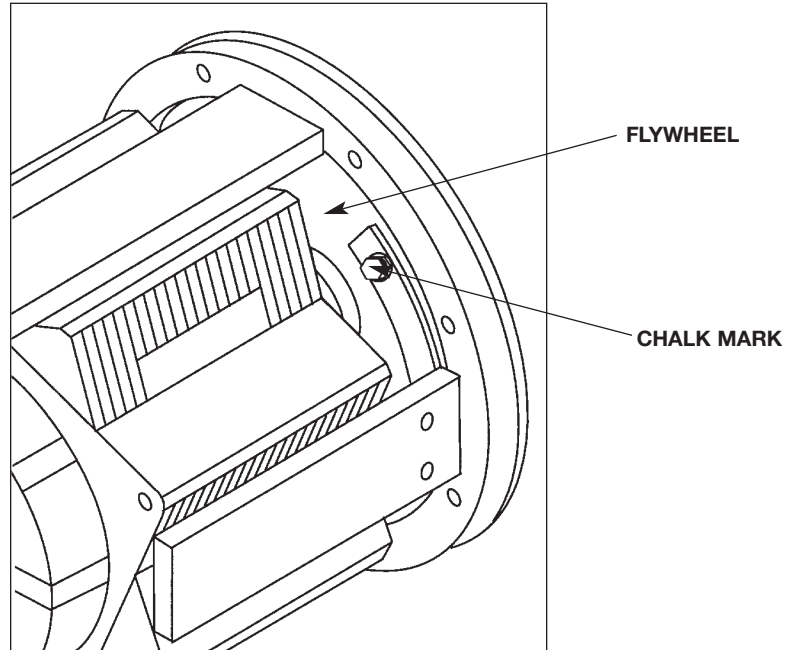
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## ENGINE THROTTLE ADJUSTMENT TEST *(continued)*

FIGURE F.6 – STROBE MARK LOCATION



### TEST PROCEDURE

1. **Conduct this procedure with the engine OFF.**
2. Unlatch, lift, and secure the right side service access door. With the 3/8" nut driver, remove the right front side cover.
3. With a white or red marking pencil, place a mark on one of the flywheel bolts. See Figure F.6 for location.
4. Connect the strobe-tach according to the manufacturer's instructions.
5. Start the engine and direct the strobe-tach light on the flywheel bolt. Synchronize it to the rotating mark.

With the machine at HIGH IDLE the tach should read between 3650 and 3700 RPM.

With the machine at LOW IDLE the tach should read between 2150 and 2220 RPM.

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# TROUBLESHOOTING & REPAIR

## ENGINE THROTTLE ADJUSTMENT TEST (continued)

FIGURE F.7 – HIGH IDLE ADJUSTMENT

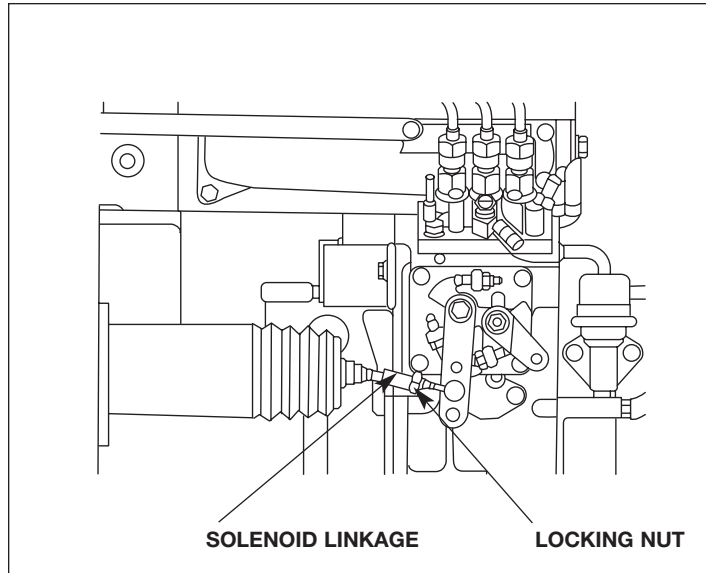
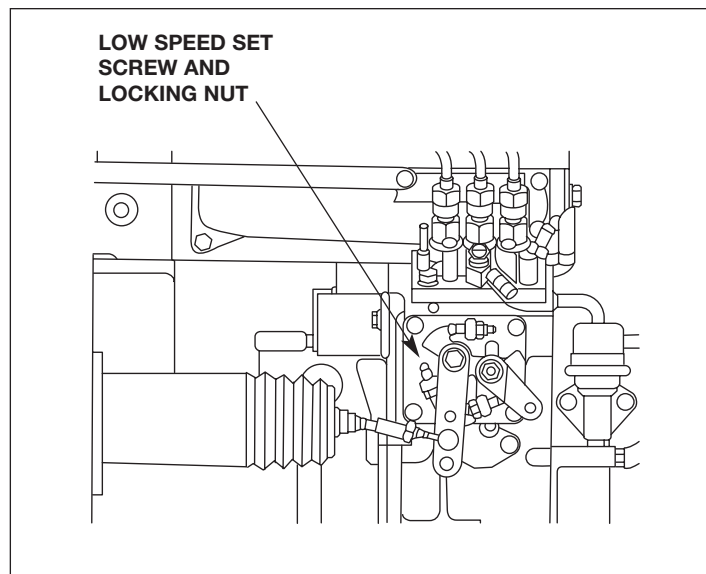


FIGURE F.8 – LOW IDLE ADJUSTMENT



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## ENGINE THROTTLE ADJUSTMENT TEST *(continued)*

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

Adjust HIGH IDLE: First make sure there is NOT a load on the machine. Set the IDLER switch to the HIGH position. The solenoid should activate. Using the 7/16" wrench, adjust the high speed solenoid linkage to lengthen the linkage until the engine speed starts to decrease. See **Figure F.7**. Adjust the linkage in the opposite direction until the engine speed is within limits (3650 - 3700 RPM). Tighten the locking nut. The high speed set screw is preset and sealed by the engine manufacturer and normally should not be adjusted.

Adjust LOW IDLE: First make sure there is NOT a load on the machine. Set the IDLER switch to AUTO and wait for the engine to change to low idle speed. Use the 10mm wrench to loosen the lock nut on the low speed set screw. See **Figure F.8**. Adjust the set screw until the engine speed is between 2150 and 2220 RPM. Tighten the lock nut.

### **Frequency Counter Method**

1. Plug the frequency counter into one of the 115 VAC receptacles.
2. Start the engine and check the frequency counter. At HIGH IDLE (3700 RPM), the counter should read 63 Hz. At LOW IDLE (2220 RPM), the counter should read 37 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: First make sure there is NOT a load on the machine. Set the IDLER switch to the HIGH position. The solenoid should activate. Using the 7/16" wrench, adjust the high speed solenoid linkage to lengthen the linkage until the engine speed starts to decrease. See **Figure F.7**. Adjust the linkage in the opposite direction until the frequency is 63 Hz. Tighten the locking nut. The high speed set screw is preset and sealed by the engine manufacturer and normally should not be adjusted.

Adjust LOW IDLE: First make sure there is NOT a load on the machine. Set the IDLER switch to AUTO and wait for the engine to change to low idle speed. Use the 10mm wrench to loosen the lock nut on the low speed set screw. See **Figure F.8**. Adjust the set screw until the frequency is 37 Hz. Tighten the lock nut.

### **Oscilloscope Method**

1. Connect the oscilloscope to the 115 VAC receptacle, according to the manufacturer's instructions. At HIGH IDLE (3700 RPM), the waveform should exhibit a period of 15.8 milliseconds. At LOW IDLE (2220 RPM), the waveform should exhibit a period of 27.02 milliseconds. Refer to the **NORMAL OPEN CIRCUIT VOLTAGE WAVEFORM (115VAC SUPPLY) HIGH IDLE - NO LOAD** in this section of the manual.
2. If either of these waveform periods is incorrect, adjust the throttle as follows:

Adjust HIGH IDLE: First make sure there is NOT a load on the machine. Set the IDLER switch to the HIGH position. The solenoid should activate. Using the 7/16" wrench, adjust the high speed solenoid linkage to lengthen the linkage until the engine speed starts to decrease. See **Figure F.7**. Adjust the linkage in the opposite direction until the period is 15.8 milliseconds. Tighten the locking nut. The high speed set screw is preset and sealed by the engine manufacturer and normally should not be adjusted.

Adjust LOW IDLE: First make sure there is NOT a load on the machine. Set the IDLER switch to AUTO and wait for the engine to change to low idle speed. Use the 10mm wrench to loosen the lock nut on the low speed set screw. See **Figure F.8**. Adjust the set screw until the period is 27.02 milliseconds. Tighten the lock nut.

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# TROUBLESHOOTING & REPAIR

## AUXILIARY AND FIELD WINDING TEST

### **⚠ WARNING**

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

### 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  
3/8" Nut driver  
Wiring Diagram

This procedure requires approximately 45 minutes to perform.

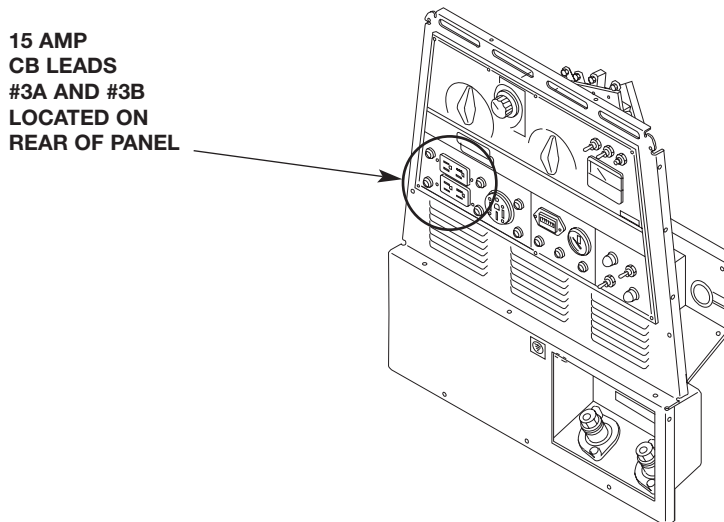
RANGER 300 D AND 300 DLX



# TROUBLESHOOTING & REPAIR

## AUXILIARY AND FIELD WINDING TEST (*continued*)

FIGURE F.9 – LOCATION OF LEADS #3A AND #3B



### TEST PROCEDURE

#### To test the 115 VAC winding:

1. With the 5/16" and 3/8" nut drivers, remove the case left side.
2. Make sure that the LOCAL/REMOTE switch (S8) is in the CONTROL AT WELDER position.
3. Set the voltmeter to the AC volts position.
4. Connect the volt/ohmmeter probes to leads #3A and #3B where they connect to the 15 amp circuit breakers. See Figure F.9.
5. Start the engine and run it at high idle (3700 RPM).
6. Set the output control to the maximum position (position 10).
7. Check the AC voltage reading. It should be approximately 125 VAC.

#### To test the 230 VAC winding:

1. With the 5/16" and 3/8" nut drivers, remove the case left side.
2. Set the voltmeter to the AC volts position.
3. Connect the volt/ohmmeter probes to leads #6 and #3 where they connect to the 50 amp circuit breakers. See the Wiring Diagram.

**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.

4. Start the engine and run it at high idle (3700 RPM).
5. Set the output control to the maximum position (position 10).
6. Check the AC voltage reading. It should be approximately 240 VAC.

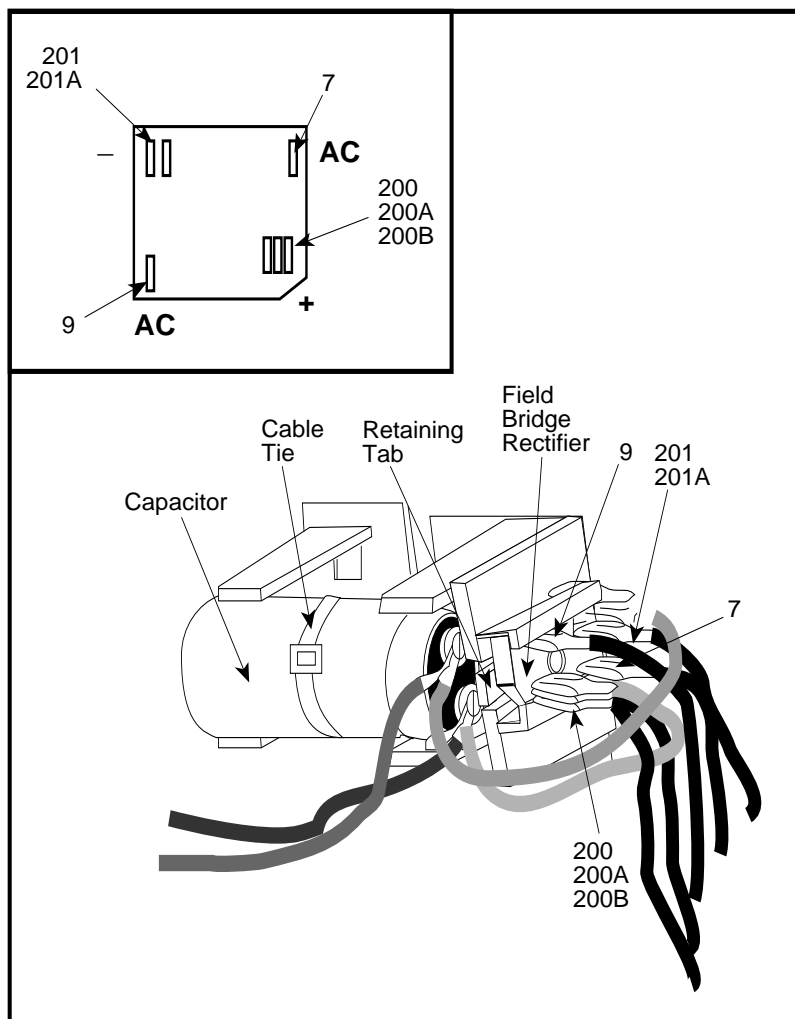
RANGER 300 D AND 300 DLX



# TROUBLESHOOTING & REPAIR

## AUXILIARY AND FIELD WINDING TEST (*continued*)

FIGURE F.10 – LOCATION OF LEADS #7 AND #9 AT FIELD BRIDGE RECTIFIER



### To test the field winding:

1. With the 5/16" and 3/8" nut drivers, remove the case right side.
2. Connect the volt/ohmmeter probes to leads #7 and #9 where they connect to the Field Bridge Rectifier. See Figure F.10.
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 40 and 47 VAC.  
If the reading is missing or not within specifications, check for loose or broken wires between the test points and the stator windings. See the Wiring Diagram. Make sure that 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 reading is within specifications, the windings are good and functioning properly.
6. Reinstall the right case side.

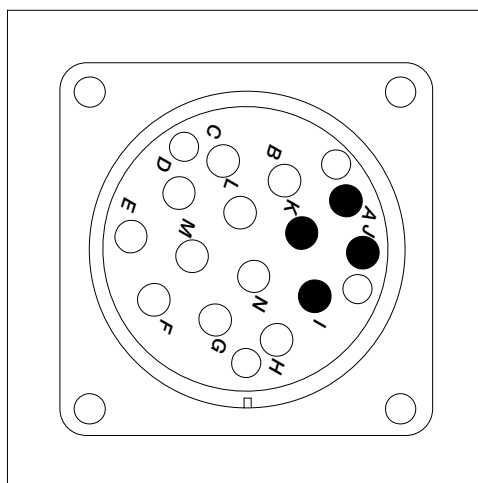
RANGER 300 D AND 300 DLX



# TROUBLESHOOTING & REPAIR

## AUXILIARY AND FIELD WINDING TEST (*continued*)

FIGURE F.11 – 14-PIN AMPHENOL PIN ASSIGNMENTS



### To test the feeder winding: Ranger 300 DLX Models

1. With the 5/16" and 3/8" nut drivers, remove the case left side.
2. Set the voltmeter to the AC volts position.
3. Connect the volt/ohmmeter probes to leads #31 and #32 where they connect to 15 amp circuit breaker CB1 and the 14-pin amphenol. See the Wiring Diagram. See Figure F.11.

**NOTE:** It is possible to check this voltage reading at the amphenol by inserting the test probes at pin A (for lead #32) and pin J (for lead #31A). See Figure F.11. However, if you use this method and get no voltage reading, it could mean there is a break or loose connection in the leads between the circuit breaker and the amphenol. Check the reading again with one probe at the circuit breaker connection for lead #31 and the other probe at amphenol pin A.

4. Start the engine and run it at high idle (3700 RPM).
5. Set the output control to the maximum position (position 10).
6. Check the AC voltage reading. It should be between 115 and 126 VAC.

7. Connect the volt/ohmmeter probes to leads #31 and #42 where they connect to 15 amp circuit breaker CB1 and the 14-pin amphenol. See the Wiring Diagram.

**NOTE:** It is possible to check this voltage reading at the amphenol by inserting the test probes at pin K (for lead #42) and pin I (for lead #31B). See Figure F.11. However, if you use this method and get no voltage reading, it could mean there is a break or loose connection in the leads between the circuit breaker and the amphenol. Check the reading again with one probe at the circuit breaker connection for lead #31 and the other probe at amphenol pin K.

8. Set the output control to the maximum position (position 10).
9. Check the AC voltage reading. It should be between 43 and 50 VAC.

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

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

10. Reinstall the right case side.

### RANGER 300 D AND 300 DLX



# TROUBLESHOOTING & REPAIR

## ROTOR VOLTAGE TEST

### **WARNING**

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

### TEST DESCRIPTION

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

### MATERIALS NEEDED

- Volt/Ohmmeter (Multimeter)
- 5/16" Nut driver
- 3/8" Nut driver
- Wiring Diagram

This procedure requires approximately 20 minutes to perform.

RANGER 300 D AND 300 DLX

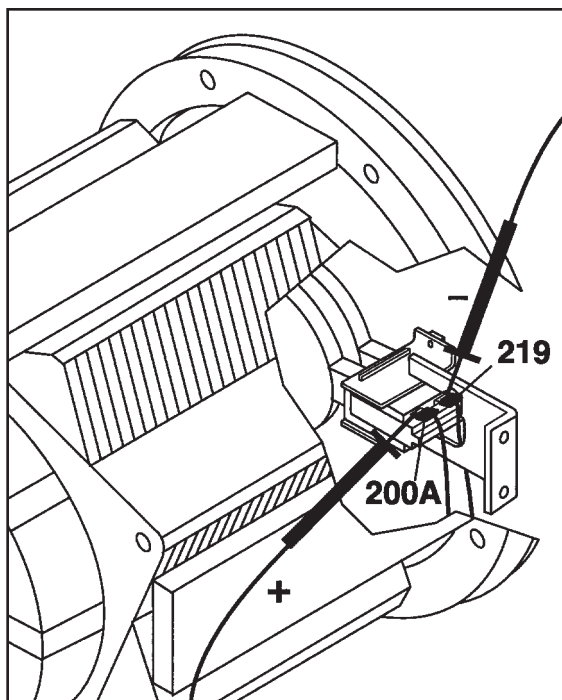




# TROUBLESHOOTING & REPAIR

## ROTOR VOLTAGE TEST (*continued*)

FIGURE F.12 – LOCATION OF LEADS 200A AND 219 FOR ROTOR VOLTAGE TEST



### TEST PROCEDURE

1. With the 5/16" and 3/8" nut drivers, remove the right case side.
2. Set the volt/ohmmeter to the DC volts position.
3. Connect the positive meter probe to the brush nearest the rotor lamination (lead #200A). See Figure F.12 for location.
4. Connect the negative meter probe to the other brush (lead #219).
5. Set the LOCAL/REMOTE switch (S8) to the CONTROL AT WELDER position. Start the engine and run it at high idle (3700 RPM). Set the output control to the MAXIMUM position (position 10).
6. Check the voltage reading on the voltmeter. It should read approximately 37-40 VDC.
7. If the voltage reading is low or not present, the generator field is not functioning properly. Perform the **Rotor Resistance Test**. The Field Diode Bridge (D2), the Field Capacitor (C1), and/or the control board may be faulty.
8. If the voltage reading is normal, the field circuit is functioning properly. Install the right case side.

RANGER 300 D AND 300 DLX



# INSTALLATION

## CHARGING CIRCUIT TEST

### **WARNING**

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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 1-800-833-9353 (WELD).

### TEST DESCRIPTION

This test will determine if the engine alternator and associated circuitry are functioning properly.

### MATERIALS NEEDED

Volt/Ohmmeter  
5/16" Nut driver  
3/8" Nut driver  
Wiring Diagram

This procedure requires approximately 20 minutes to perform.

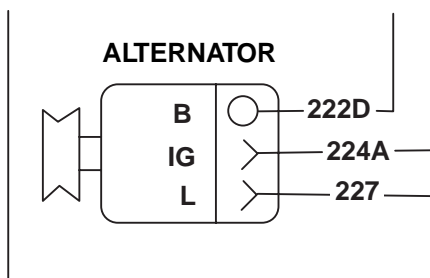
RANGER 300 D AND 300 DLX



# INSTALLATION

## CHARGING CIRCUIT TEST *(continued)*

FIGURE F.13 – VOLTAGE REGULATOR LEADS



### TEST PROCEDURE

1. With the 5/16" and 3/8" nut drivers, remove the right case side.
2. Locate the engine alternator and leads. See Figure F.13.
3. Set the voltmeter for DC volts and check for the typical DC voltages according to the Charging Circuit Test Chart below.
4. If the DC voltages are correct, the engine alternator is operating normally.

If any of the voltage readings are missing or not normal, the engine alternator or associated wiring may be faulty. See the Wiring Diagram.

### CHARGING CIRCUIT TEST CHART

TEST CONDITIONS	TEST POINTS	TYPICAL VOLTAGE
Ignition Switch Off	Lead 222D to Frame Ground	12 VDC
Ignition Switch Off	Lead 224A to Frame Ground	0 VDC
Ignition Switch Off	Lead 227 to Frame Ground	0 VDC
Ignition Switch On	Lead 222D to Frame Ground	12 VDC
Ignition Switch On	Lead 224A to Frame Ground	12 VDC
Ignition Switch On	Lead 227 to Frame Ground	0.7 VDC
Engine running at 3700 RPM	Lead 222D to Frame Ground	14.5 VDC
Engine running at 3700 RPM	Lead 224A to Frame Ground	14.3 VDC
Engine running at 3700 RPM	Lead 227 to Frame Ground	14.3 VDC

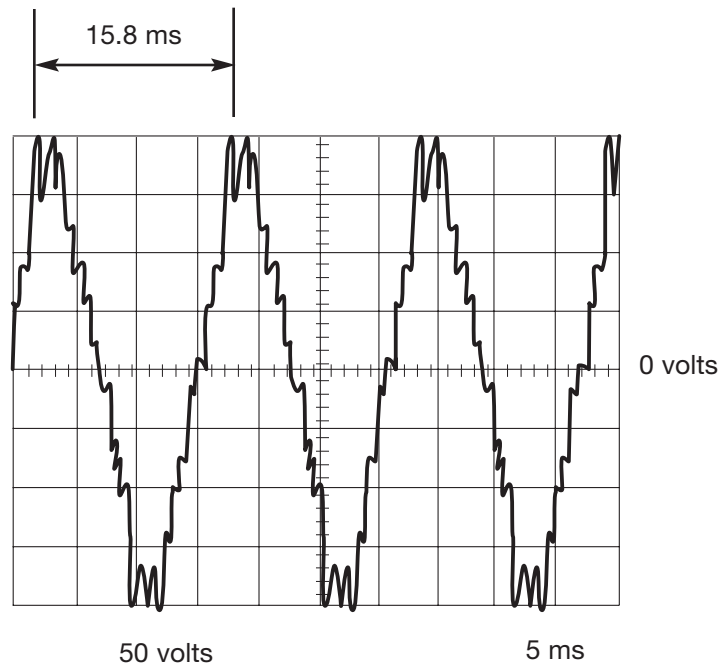
RANGER 300 D AND 300 DLX



# TROUBLESHOOTING & REPAIR

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

HIGH IDLE – NO LOAD – OUTPUT CONTROL AT MAXIMUM



This is the typical auxiliary 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 115VAC receptacle.

### SCOPE SETTINGS

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

RANGER 300 D AND 300 DLX



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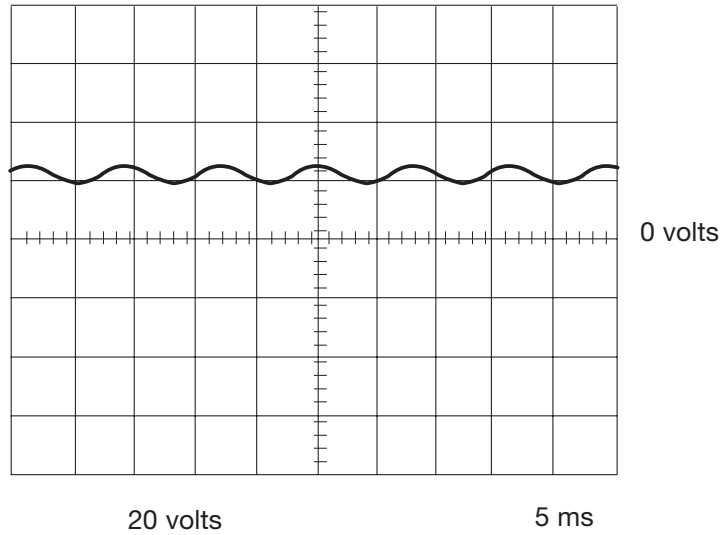
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# TROUBLESHOOTING & REPAIR

## TYPICAL DC WELD OUTPUT VOLTAGE WAVEFORM (CV MODE HIGH TAP)

### MACHINE LOADED



### MACHINE LOADED TO 250 AMPS AT 30VDC

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

RANGER 300 D AND 300 DLX



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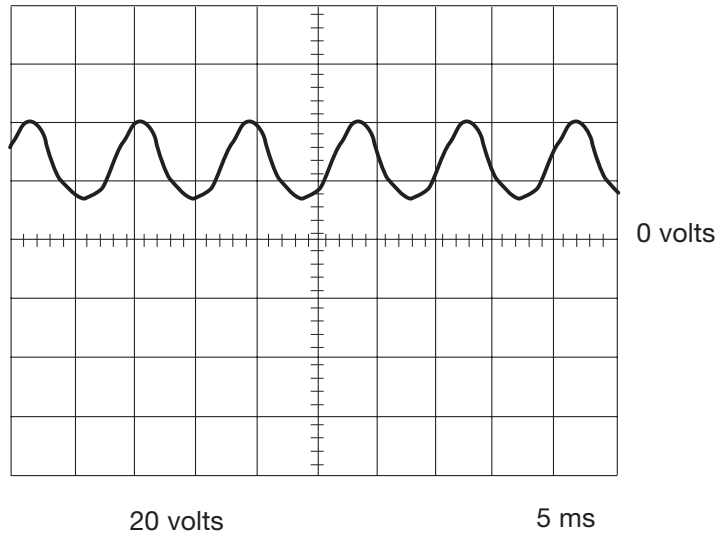
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# TROUBLESHOOTING & REPAIR

## TYPICAL DC WELD OUTPUT VOLTAGE WAVEFORM

### MACHINE LOADED



### MACHINE LOADED TO 250 AMPS AT 25 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

### RANGER 300 D AND 300 DLX



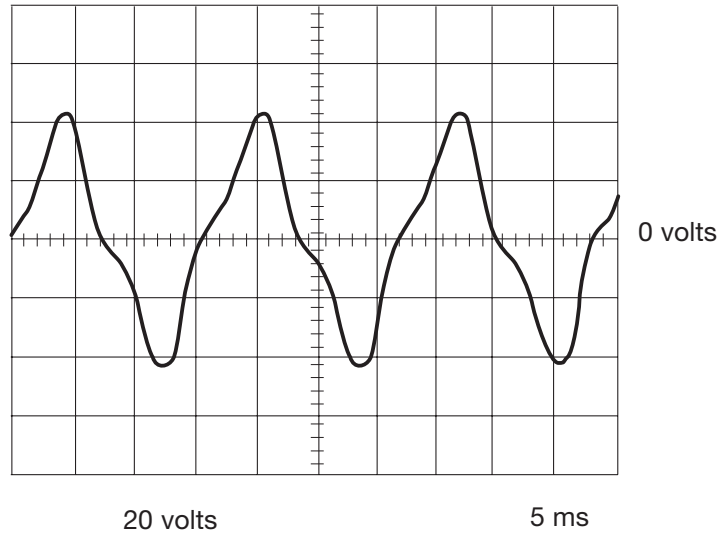
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# TROUBLESHOOTING & REPAIR

## TYPICAL AC WELD OUTPUT VOLTAGE WAVEFORM

### MACHINE LOADED



### MACHINE LOADED TO 250 AMPS AT 25VDC

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

Note: Scope probes connected at machine output terminals.

#### SCOPE SETTINGS

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

### RANGER 300 D AND 300 DLX



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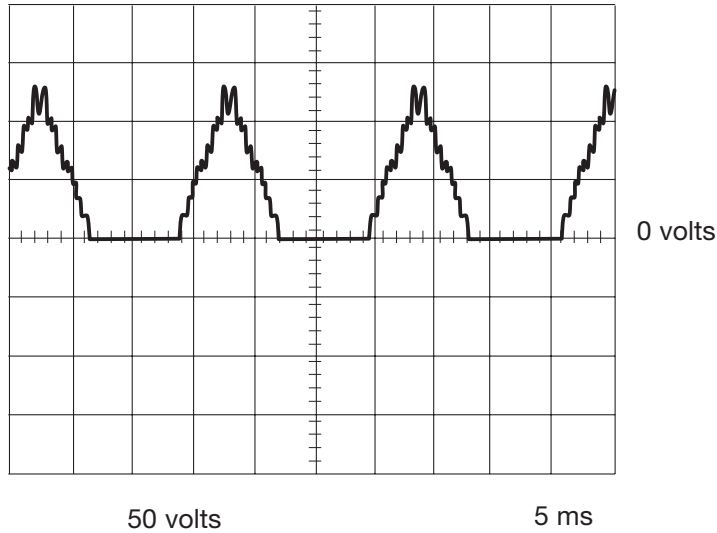
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# TROUBLESHOOTING & REPAIR

## 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 non-functioning 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

RANGER 300 D AND 300 DLX



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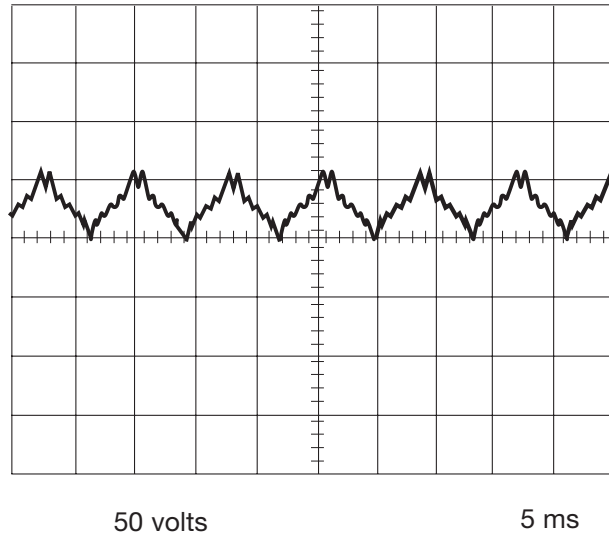
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# TROUBLESHOOTING & REPAIR

## ABNORMAL OPEN CIRCUIT WELD VOLTAGE WAVEFORM (HIGH CV MODE)

HIGH IDLE – NO LOAD – OUTPUT CONTROL AT MAXIMUM  
OUTPUT CAPACITOR BANK NOT FUNCTIONING



This is NOT the typical CV output voltage waveform. The capacitor bank is not functioning. Note the “ripple” in the waveform. The capacitor bank was disconnected to simulate an open or non-functioning capacitor bank. 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

RANGER 300 D AND 300 DLX



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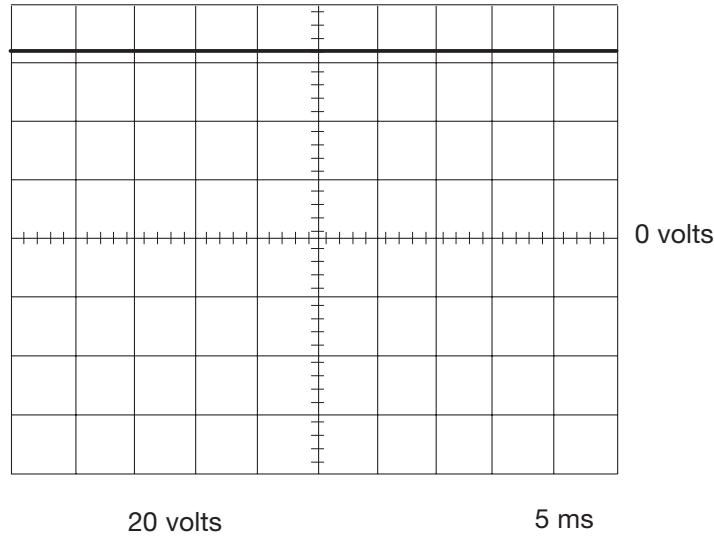
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# TROUBLESHOOTING & REPAIR

## NORMAL OPEN CIRCUIT WELD VOLTAGE WAVEFORM (HIGH CV MODE)

HIGH IDLE – NO LOAD – OUTPUT CONTROL AT MAXIMUM



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.

Note: Scope probes connected at machine output terminals.

### SCOPE SETTINGS

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

RANGER 300 D AND 300 DLX



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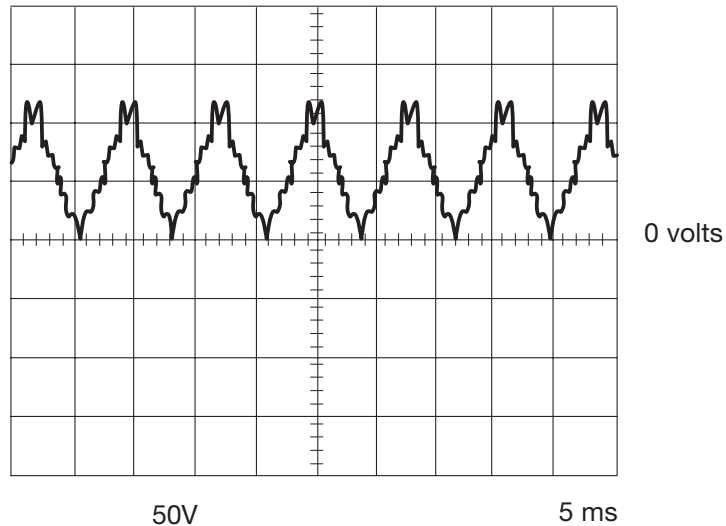
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# TROUBLESHOOTING & REPAIR

## NORMAL OPEN CIRCUIT DC WELD VOLTAGE WAVEFORM

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

RANGER 300 D AND 300 DLX



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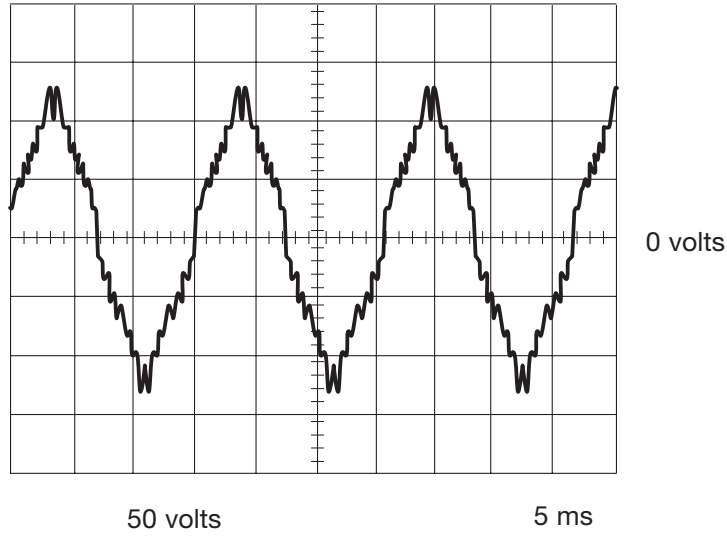
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# TROUBLESHOOTING & REPAIR

## 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

RANGER 300 D AND 300 DLX



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# TROUBLESHOOTING & REPAIR

## BRUSH REMOVAL AND REPLACEMENT

### **⚠ WARNING**

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

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### DESCRIPTION

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

### MATERIALS NEEDED

- 5/16" Nut driver
- 3/8" Nut driver
- 5/16" Wrench
- 7/16" Wrench
- Slot head screwdriver
- Needle nose pliers

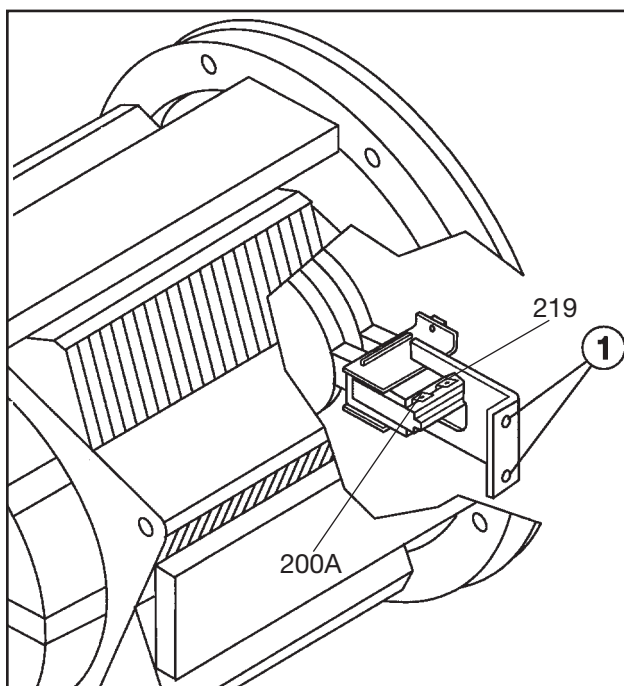
This procedure requires approximately 35 minutes to perform.

RANGER 300 D AND 300 DLX

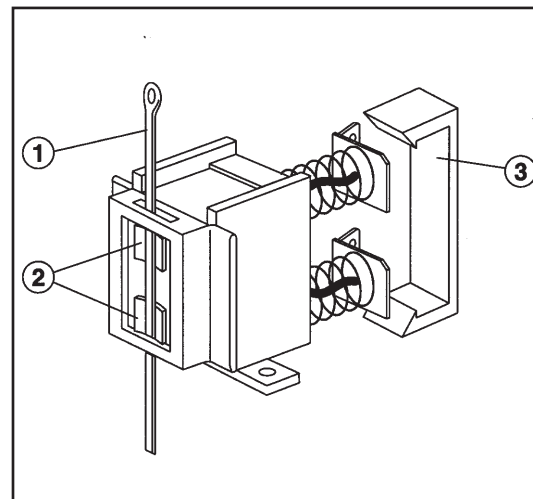


## BRUSH REMOVAL AND REPLACEMENT (continued)

FIGURE F.14 – BRUSH LEADS/BRUSHES RETAINED WITH CABLE TIE



1. BRACKET MOUNTING HOLES



1. BRUSHES  
2. CABLE TIE  
3. RETAINER CLIP

### PROCEDURE

1. Conduct this procedure with the engine OFF.
2. With the 5/16" and 3/8" nut drivers, remove the right case side.
3. With the needle nose pliers, gently remove the red and white wires from the brushes. See Figure F.14.
4. With the 7/16" wrench, remove the brush holder assembly bracket from the stator frame.
5. With the 5/16" wrench, remove the two screws that secure the brush holder assembly to the bracket. Slide the brush holder assembly out of the bracket.
6. To change the brushes, use the slot head screw driver to pop off the plastic retainer on the back of the brush holder assembly.
7. 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.
8. 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.
9. 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.14. This will hold the brushes up so that you can easily install the holder.
10. Slide the brush holder assembly back into the bracket and, with the 5/16" wrench, install the two screws that hold it in place.
11. With the 7/16" wrench, attach the brush holder assembly bracket to the stator frame.

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# TROUBLESHOOTING & REPAIR

## BRUSH REMOVAL AND REPLACEMENT (*continued*)

12. Slowly remove the non-metallic retainer from the brush holder and let the brushes snap back against the slip rings.
13. With the needle nose pliers, connect the red and the white wires to the appropriate terminals on the brushes. The red wire is nearest to the rotor lamination.
14. Check the wire connections for clearance and tightness.
15. Install the right case side.

**NOTE:** 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 the slip rings with a fine emery paper.

### CAUTION

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

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# TROUBLESHOOTING & REPAIR

## FIELD CAPACITOR AND/OR RECTIFIER BRIDGE REMOVAL AND REPLACEMENT

### **WARNING**

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

### **DESCRIPTION**

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

### **MATERIALS NEEDED**

- 5/16" Nut driver
- 3/8" Nut driver
- Jumper wire with alligator clips on each end for discharging the field capacitor
- Slot head screw driver
- Needle nose pliers
- Diagonal cutters
- Wiring Diagram

This procedure requires approximately 35 minutes to perform.

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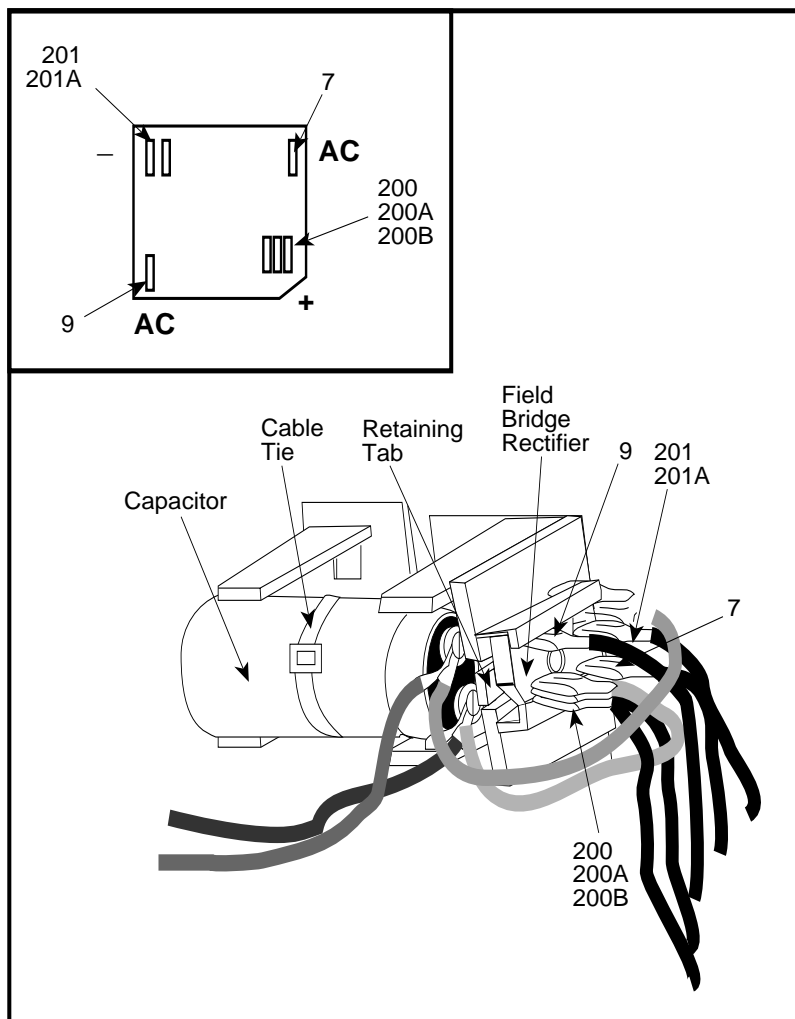




# TROUBLESHOOTING & REPAIR

## FIELD CAPACITOR AND/OR RECTIFIER BRIDGE REMOVAL AND REPLACEMENT (*continued*)

FIGURE F.15 – RECTIFIER BRIDGE LOCATION AND DISCHARGING THE FIELD CAPACITOR



### PROCEDURE

1. Conduct this procedure with the engine OFF.
2. With the 5/16" and 3/8" nut drivers, remove the right case side.
3. Discharge the field capacitor by connecting the jumper wire clips on the white and the red wire terminals on the top of the capacitor. See Figure F.15. Leave the clips on for at least 5 seconds, then remove.
4. With the needle nose pliers, gently remove the seven wires from the field rectifier bridge. Label the wires for reassembly.
5. Both the capacitor and the rectifier bridge are mounted in a molded plastic holder. To remove it, pull the assembly away from the metal baffle and slide the assembly outward.
6. With the diagonal cutters, cut the wire wrap from around the capacitor. Snap the capacitor out of the assembly. Slide the rectifier bridge out of its part of the plastic holder.
7. Install the new capacitor and rectifier bridge by inserting them into the plastic holder. Replace the wire wrap that secures the capacitor to the holder. Slide the holder back into position in the panel.

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## TROUBLESHOOTING & REPAIR

### FIELD CAPACITOR AND/OR RECTIFIER BRIDGE REMOVAL AND REPLACEMENT (*continued*)

8. Connect the wires to the proper terminals on the rectifier bridge. See **Figure F.15** and the Wiring Diagram.

Leads #200, #200A and #200B are piggy-backed on the positive (+) terminal. Depending on the bridge used, this corner may be beveled and/or marked with a + sign.

Leads #201 and #201A are located on the negative (-) terminal, which will always be located diagonally across from the positive (+) terminal.

The two leads #7 and #9 are the AC side of the bridge and attach to the other two corners of the rectifier. Either lead can go on either terminal.

9. Check that the leads are not grounded and also check for clearance and tightness.
10. Install the right case side.

RANGER 300 D AND 300 DLX



# TROUBLESHOOTING & REPAIR

## CONTROL BOARD REMOVAL AND REPLACEMENT

### **⚠ WARNING**

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

---

### DESCRIPTION

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

### MATERIALS NEEDED

- 5/16" Nut driver
- 3/8" Nut driver
- 1/4" Nut driver
- 1/2" Wrench
- 3/8" Wrench
- Slot head screw driver
- Diagonal cutters
- Wiring Diagram

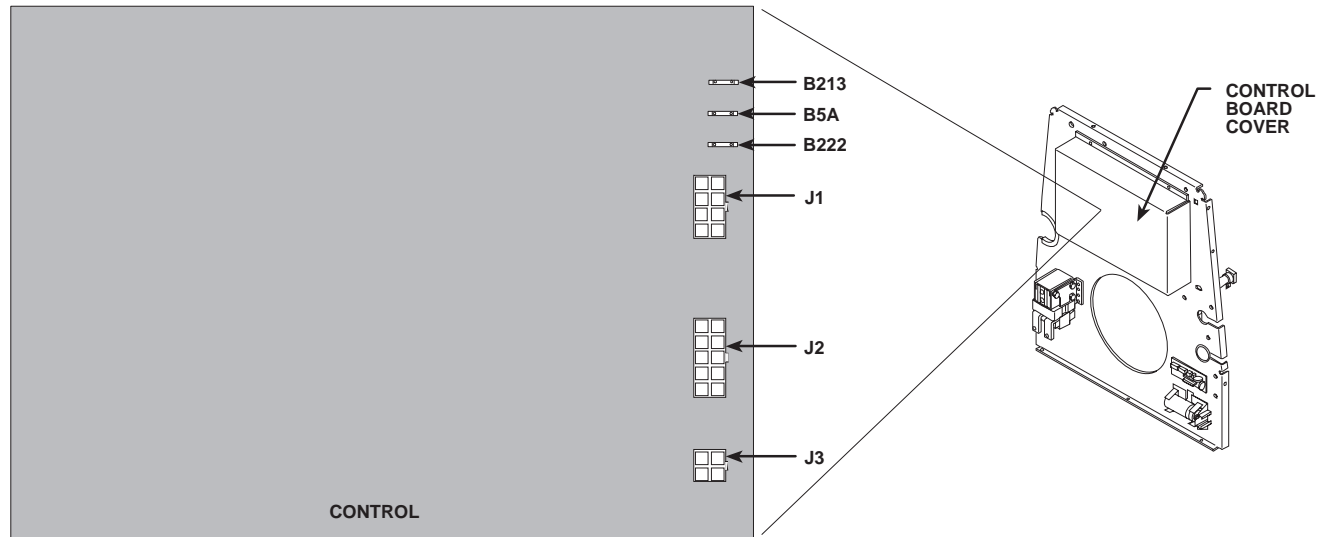
This procedure requires approximately 45 minutes to perform.

RANGER 300 D AND 300 DLX



## CONTROL BOARD REMOVAL AND REPLACEMENT *(continued)*

FIGURE F.16 – 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. **Conduct this procedure with the engine OFF.**
2. With the 5/16” and 3/8” nut drivers, remove screws from the case top.
3. With the 1/2” wrench, remove the exhaust pipe from the muffler.
4. Remove the rubber gasket (cover seal) from the lift bail.
5. Remove the fuel cap and the rubber gasket for the fill tube.
6. Unlatch the double door assembly and use the slot head screw driver and 3/8” wrench to remove the door support rod from the door assembly.
7. Remove the case top and door assembly, **then reinstall the fuel cap.**
8. With the 5/16” nut driver, remove the control board cover. See Figure F.16.
9. Remove the three molex plugs from the control board (J1, J2, J3). Also remove the three individual leads #213, #222, and #5A. See Figure F.16. Note lead placement.
10. Cut the wire ties and disconnect the bolted connections from the current sensing leads (#254, #254A and #254B - see the Wiring Diagram). Count the turns in the current sensor and note for reassembly.

### ⚠ 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.

RANGER 300 D AND 300 DLX



## TROUBLESHOOTING & REPAIR

### CONTROL BOARD REMOVAL AND REPLACEMENT (*continued*)

11. With the 1/4" nut driver, remove the screws holding the control board.
12. Replace the old control board with a new one.
13. Connect current sensing leads #254 and #254A. Thread the leads through the current sensor the same number of turns noted during removal. Connect the leads and install new wire ties. See the Wiring Diagram for the proper connections.
14. Connect the three molex plugs.
15. Connect the three individual leads #213, #222, and #5A.
16. Replace any wire ties that were cut during the removal procedure.
17. With the 5/16" nut driver, install the control board cover.
18. Install the case top, gaskets, and double door support rod.

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RANGER 300 D AND 300 DLX



# TROUBLESHOOTING & REPAIR

## OUTPUT RECTIFIER BRIDGE REMOVAL AND REPLACEMENT

### WARNING

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

---

### DESCRIPTION

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

### MATERIALS NEEDED

- 5/16" Nut driver
- 3/8" Nut driver
- 1/2" Wrench
- 7/16" Wrench
- Penetrox A-13
- Wiring Diagram

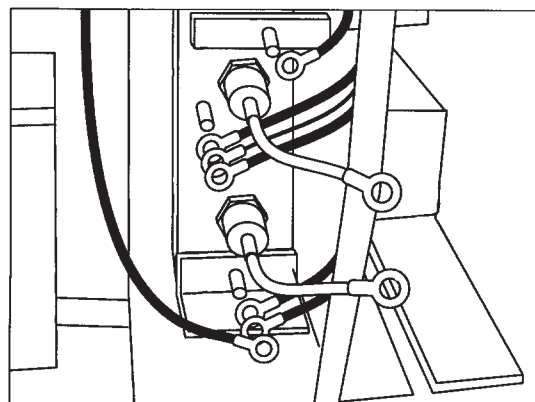
This procedure requires approximately 50 minutes to perform.

RANGER 300 D AND 300 DLX

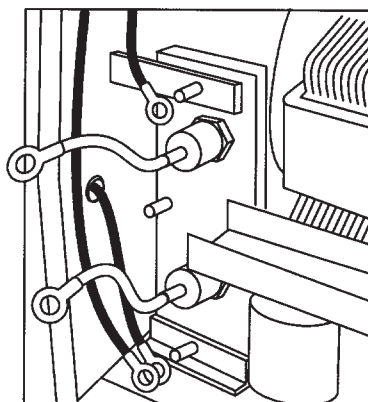


## OUTPUT RECTIFIER BRIDGE REMOVAL AND REPLACEMENT *(continued)*

FIGURE F.17 – OUTPUT RECTIFIER CONNECTIONS



Left Side (-)



Right Side (+)

### PROCEDURE

1. **Conduct this procedure with the engine OFF.**
2. With the 5/16" and 3/8" nut drivers, carefully remove the left and right case sides. Note that the output rectifier is divided into two parts. The positive portion is located on the lower right side and the negative portion on the lower left side of the machine.  
For the remaining steps, refer to Figure F.17.
3. With the 1/2" wrench, remove the diode pig-tails and heavy leads from the terminal studs. Note lead and washer placement: nut, split washer, flat washer, leads. Label leads for reassembly. See the Wiring Diagram.
4. With the 1/2" wrench, remove the two heavy leads and one small lead from the rectifier heat sink plate. Note that the small lead is always on top for reassembly.

5. With the 7/16" wrench, remove the nut and washers holding the top stud assembly to the rectifier mounting bolts.
6. With the 7/16" wrench, remove the nuts, lock washers, and flat washers from the two top mounting bolts. **Note insulator placement.**
7. With the 3/8" nut driver, remove the two bottom mounting screws. Note the placement of the nylon and Nomex insulators. **These must be in place when you reinstall the rectifier bridge assembly in order to electrically insulate the bridge from the frame.**
8. Clear the leads and carefully remove the heat sink assembly.
9. Repeat the above procedure to remove the other half of the output rectifier.

RANGER 300 D AND 300 DLX



OUTPUT RECTIFIER BRIDGE REMOVAL AND REPLACEMENT (continued)

Reassembly:

Refer to the Wiring Diagram for proper connections to the positive and negative sides of the rectifier assembly. The two sides of the bridge are marked + and -, respectively.

NOTE: Use Penetrox A-13 on aluminum electrical connection surfaces.

- 10. With the 3/8" nut driver, install the two bottom mounting screws. Note the placement of the nylon insulators. **These must be in place when you install the rectifier bridge assembly in order to electrically insulate the bridge from the frame.**
- 11. With the 7/16" wrench, install the washers and nuts to hold the top stud assembly to the rectifier mounting bolts. Install insulators as previously removed.

- 12. With the 7/16" wrench, install the flat washers, lock washers, and nuts to the two top mounting bolts. Install insulators as previously removed.
- 13. With the 1/2" wrench, install the two heavy leads and one small lead to the heat sink plate. The small lead goes on top.
- 14. With the 1/2" wrench, reattach the diode pigtails and heavy leads to the terminal studs. Placement is: leads, flat washer, split washer, nut.
- 15. Install the case sides.

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# TROUBLESHOOTING & REPAIR

## OUTPUT CAPACITOR BANK REMOVAL AND REPLACEMENT (RANGER 300 DLX ONLY)

### **⚠ 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 1-800-833-9353 (WELD).

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### DESCRIPTION

The following procedure will aid the technician in removing the output capacitor bank for maintenance or replacement. Ranger 300 D models do not have the capacitor bank.

### MATERIALS NEEDED

- Volt/Ohmmeter
- 25-watt resistor
- 5/16" Nut driver
- 3/8" Nut driver
- 1/2" Wrench
- Wiring Diagram

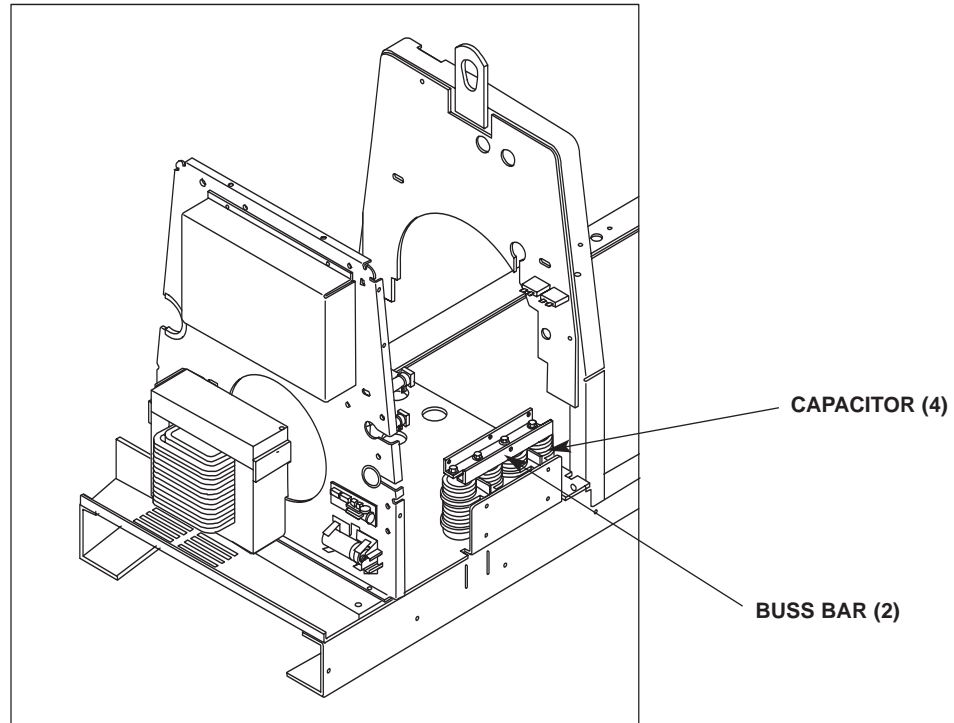
This procedure requires approximately 25 minutes to perform.

RANGER 300 D AND 300 DLX



## OUTPUT CAPACITOR BANK REMOVAL AND REPLACEMENT (RANGER 300 DLX ONLY) *(continued)*

FIGURE F.18 - OUTPUT CAPACITOR BANK



### PROCEDURE

1. **Conduct this procedure with the engine OFF.**
2. With the 5/16" and 3/8" nut drivers, remove the right case side.
3. With the voltmeter, check the voltage across each of the four output capacitors. If a voltage is present, use a 25-watt resistor to discharge each capacitor. See Figure F.18.
4. With the 1/2" wrench, remove the two nuts, bolts, and washers holding the two heavy leads (W14 and W3) and the two small leads (#236A negative and #245 red, positive) to the capacitor bank buss bars. Note lead placement.
5. With the 5/16" nut driver, remove the four mounting screws holding the capacitor bank assembly to the base of the machine.
6. Carefully remove the capacitor bank assembly.
7. To replace the capacitor bank assembly, mount the assembly to the base of the machine with the four screws previously removed.
8. With the 1/2" wrench, attach the two heavy leads and small lead previously removed to the positive and negative capacitor buss bars. Observe capacitor polarity.
9. Install the right case side.

RANGER 300 D AND 300 DLX



# TROUBLESHOOTING & REPAIR

## OUTPUT CONTACTOR REMOVAL AND REPLACEMENT (RANGER 300 DLX ONLY)

### **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 1-800-833-9353 (WELD).

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### DESCRIPTION

The following procedure will aid the technician in removing the Ranger 300 DLX output contactor for maintenance or replacement. Ranger 300 D models do not have the contactor.

### MATERIALS NEEDED

- 5/16" Nut driver
- 3/8" Nut driver
- 3/8" Wrench
- 1/2" Wrench
- Slot head screw driver
- Needle nose pliers
- Wiring Diagram

This procedure requires approximately 35 minutes to perform.

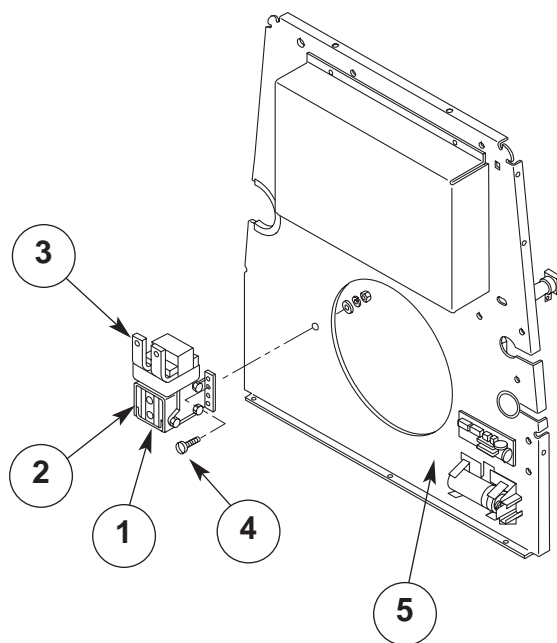
RANGER 300 D AND 300 DLX



# TROUBLESHOOTING & REPAIR

## OUTPUT CONTACTOR REMOVAL AND REPLACEMENT (RANGER 300 DLX ONLY) *(continued)*

FIGURE F.19 – OUTPUT CONTACTOR LOCATION



1. CONTACTOR
2. COIL LEAD CONNECTIONS
3. HEAVY LEAD CONNECTIONS
4. MOUNTING HARDWARE
5. VERTICAL BAFFLE

### PROCEDURE

1. **Conduct this procedure with the engine OFF.**
2. With the 5/16" and 3/8" nut drivers, remove the left case side.
3. With the needle nose pliers, remove the three small leads connected to the output contactor coil (leads #232, #224, and #224C). Note lead placement. See **Figure F.20**.
4. With the 1/2" wrench, remove the nut, bolt, and washers holding the heavy leads (W8 and W9) to the output contactor. See the Wiring Diagram.
5. With the slot head screw driver and the 3/8" nut driver, remove the three mounting screws, nuts, and washers that hold the contactor to the vertical baffle. The contactor can now be removed.
6. To reinstall the output contactor, use the slot head screw driver and 3/8" nut driver to attach the mounting screws, nuts, and washers to the vertical baffle.
7. With the 1/2" wrench, attach the heavy leads (W8 and W9) to the output contactor.
8. With the needle nose pliers, attach the three small leads to the contactor coil. See the Wiring Diagram and **Figure F.20**.
9. Install the left case side.

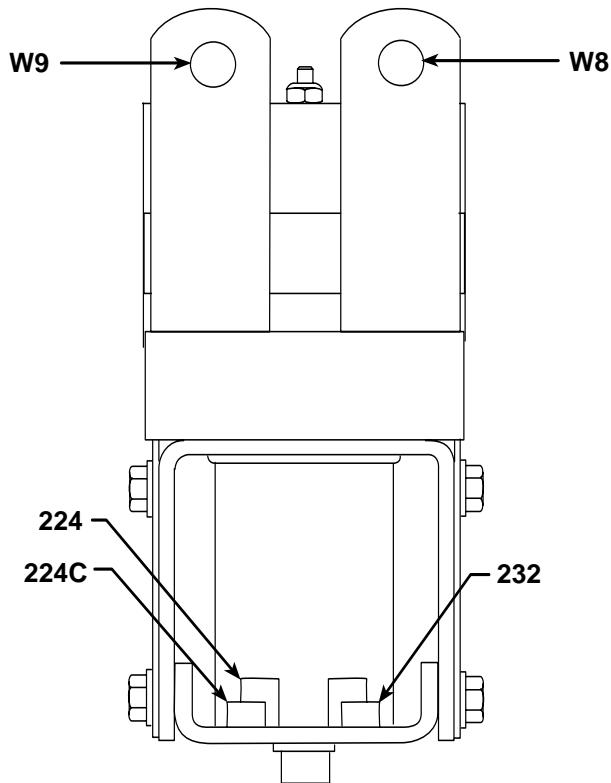
RANGER 300 D AND 300 DLX



# TROUBLESHOOTING & REPAIRS

## OUTPUT CONTACTOR REMOVAL AND REPLACEMENT (RANGER 300 DLX ONLY) *(continued)*

FIGURE F.20 – CONTACTOR COIL LEAD PLACEMENT



RANGER 300 D AND 300 DLX



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# TROUBLESHOOTING & REPAIR

## STATOR AND/OR ROTOR REMOVAL AND REPLACEMENT

### **⚠ WARNING**

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-800-833-9353 (WELD).

### DESCRIPTION

The following procedure will aid the technician in removing and replacing the Ranger 300 stator and rotor for maintenance or replacement. The key to successful stator removal is to free all stator connections in order to be able to pivot the machine case front to the side. This allows the stator to be pulled straight out from the engine.

### MATERIALS NEEDED

5/16" Nut driver	Needle nose pliers
3/8" Nut driver	Diagonal cutters
3/8" Wrench	Slot head screw driver
7/16" Wrench	Phillips head screw driver
1/2" Socket wrench	Gear puller (small)
Hoist	Socket wrench extension (8")
Feeler gauge (for air gap check)	

This procedure requires approximately 5½ hours to perform.

RANGER 300 D AND 300 DLX

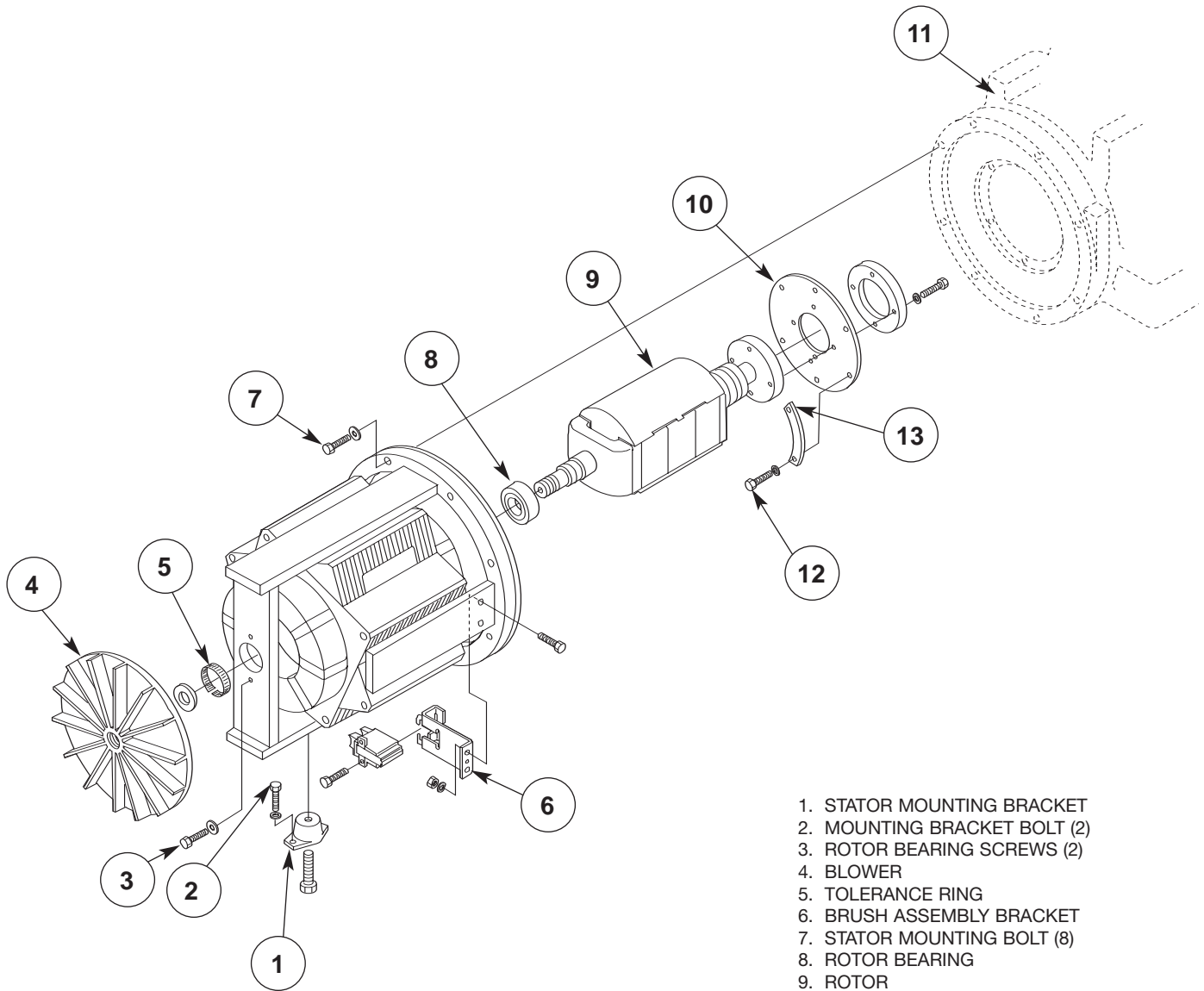


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# TROUBLESHOOTING & REPAIR

## STATOR AND/OR REMOVAL AND REPLACEMENT *(continued)*

FIGURE F.21 – COMPONENT LOCATIONS, STATOR/ROTOR REMOVAL



1. STATOR MOUNTING BRACKET
2. MOUNTING BRACKET BOLT (2)
3. ROTOR BEARING SCREWS (2)
4. BLOWER
5. TOLERANCE RING
6. BRUSH ASSEMBLY BRACKET
7. STATOR MOUNTING BOLT (8)
8. ROTOR BEARING
9. ROTOR
10. FLEX PLATE
11. ENGINE
12. ROTOR BOLT (6)
13. CLAMPING BAR (3)

RANGER 300 D AND 300 DLX



## STATOR AND/OR REMOVAL AND REPLACEMENT (*continued*)

### STATOR REMOVAL PROCEDURE

1. **Conduct this procedure with the engine OFF.**
2. With the 5/16" and 3/8" nut drivers, remove the screws from the case top and right and left case sides. If necessary, use the 1/2" socket wrench to remove the exhaust pipe from the muffler.
3. Remove the right and left case sides. Then remove the negative (-) and positive (+) cables from the battery.
4. Remove the rubber gasket (cover seal) from the lift bail.
5. Remove the fuel cap and the rubber gasket for the fill tube.
6. Unlatch the double door assembly and use the slot head screw driver and 3/8" wrench to remove the door support rod from the door assembly.
7. Remove the case top and door assembly, then reinstall the fuel cap.
8. With the 1/2" socket wrench and extension, remove the fuel tank. (Four bolts hold the fuel tank.) With the 3/8" nut driver, remove leads #226 and #5W from the fuel gauge. Label the leads for reassembly.
9. Perform the **Field Capacitor and Field Rectifier Bridge Removal Procedure**.
10. Perform the **Output Capacitor Bank Removal Procedure**. (Ranger 300 DLX only.)
11. Perform the **Brush Removal Procedure**.
12. Cut the cable ties from the reactor to the range switch.
13. Remove the fiber insulator plate from the hole in the vertical baffle.
14. Remove the four stator leads C1, C2, C3, C4 connected to the S2 range switch. Use care; excessive force will break the terminals away from the rivets. (DLX only. "D" machines have only one lead.)
15. Remove all stator leads from connection points on the front panel. See the Wiring Diagram. Remove lead #6 from circuit breaker CB2. Note that it passes through the idler current sensor. Remove lead #3 from circuit breaker CB3. Note that it passes through the idler current sensor. Disconnect the in-line connector on leads #42 and #32 located between the stator and the 14-pin amphenol.  
  
Disconnect lead #E from the common ground screw. Remove lead W1 (heavy stator lead) from the top left side of the negative (-) output rectifier assembly. Untape and disconnect W2 from lead R at the 1/2" bolted connection to separate the stator from the reactor. Disconnect heavy lead A1 from the bottom of the negative (-) output rectifier to the reactor.
16. Using the 3/8" nut driver, remove the four screws (2 on each side) holding the output rectifier assemblies to the base of the machine.
17. Using the 1/2" wrench, remove the four choke mounting bolts from the base of the machine. Push the choke forward, toward the front of the machine.
18. Ranger 300 DLX machines only: perform the **Output Contactor Removal Procedure**. This is required in order to remove the choke, step 20.  
  
**NOTE:** If the front of the machine is loose, it may not be necessary to remove the output contactor. The choke may be able to slide past the contactor if the front of the machine can be pulled forward.
19. Using the 1/2" wrench, remove heavy lead W4 from the choke to the center of the positive (+) output rectifier. On Ranger 300 DLX machines, also remove heavy leads W5 and W6 from the choke to the S2 range switch. See the Wiring Diagram.
20. Slide the choke assembly out of the machine.

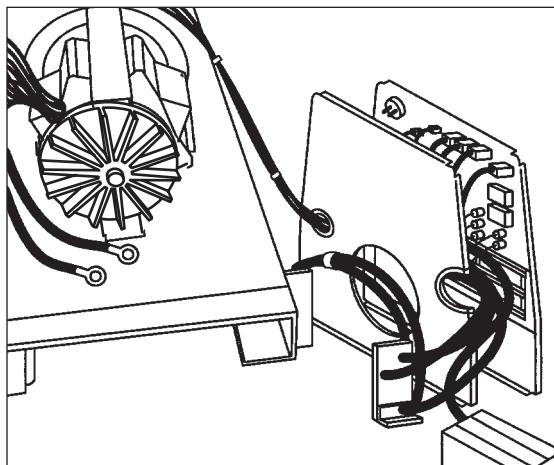
RANGER 300 D AND 300 DLX





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

FIGURE F.22  
MACHINE FRONT COMPONENTS PIVOTED TO SIDE



21. Using the 1/2" wrench, remove the three reactor mounting bolts from the machine base.
22. Using the 5/16" wrench, remove the three screws holding the front vertical baffle to the machine base.
23. Using the 1/2" wrench, remove the two screws holding the front vertical baffle to the fuel tank rails.
24. Using the 5/16" wrench, remove the three screws holding the front panel to the base of the machine. Clear all stator leads and cut any necessary cable ties.
25. Carefully lift and pivot the front panel assembly, along with the reactor, around to the right side of the machine. See Figure F.22. Support the unit with a box or large pan.
26. Remove the two 1/2" nuts and bolts that hold the stator mounting bracket to the base of the machine. See **Figure F.21**.
27. Remove the blower (fan) by turning it counterclockwise to unscrew it from the rotor shaft. Prevent engine rotation as you turn the blower.
28. Remove the two 3/8" screws that hold the rotor bearing in place.
29. Support the engine. Remove the eight 9/16" bolts that mount the stator to the engine.
30. Using a gear puller, carefully remove the stator.

### ROTOR REMOVAL PROCEDURE

1. Support the rotor. See **Figure F.21**.
2. Using the 1/2" wrench, remove the six 1/2" rotor bolts, lock washers, and three clamping bars. Caution: the rotor will be free to fall when the bolts are removed.
3. Remove the rotor bearing. It must be removed before the stator can be reinstalled.

RANGER 300 D AND 300 DLX



# TROUBLESHOOTING & REPAIR

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

### REASSEMBLY NOTES

1. Be sure to remove the rotor bearing from the stator frame before reinstalling the rotor/stator. Also remove the tolerance ring.
2. Install the rotor to the flex plate and install the flex plate to the engine.
3. Carefully install the stator. Tighten the eight bolts finger-tight only.
4. Install a new tolerance ring and press in a new rotor bearing.
5. Tighten stator bolts.
6. Check the air gap for .015" (minimum).
7. Position the front panel and the reactor in place.
8. Perform the **Brush Replacement Procedure**.
9. Perform the **Field Capacitor and Field Rectifier Bridge Replacement Procedure**. (Ranger 300 DLX only.)
10. Perform the **Output Capacitor Bank Replacement Procedure**.
11. After installing the choke, perform the **Output Contactor Replacement Procedure** (Ranger 300 DLX only, if removed).
12. Mount the choke, reactor, front panel, and vertical baffle.
13. Replace insulation and wire ties previously removed.
14. Mount the output rectifier assemblies.

### LEAD RECONNECTION CHECKLIST

#### ENGINE

- Lead #226 and #5W to fuel gauge

#### FRONT PANEL

- Lead #E to common ground screw
- Lead #6 to CB2 (note that it passes through the idler current sensor)
- Lead #3 to CB3 (note that it passes through the idler current sensor)
- Stator leads C1, C2, C3, and C4 to the S2 range switch (DLX machines)
- In-line connectors #32 and #42 to the 14-pin amphenol
- Lead W1 to the top of the negative (-) output rectifier (left side)
- Lead W4 to the center of the positive (+) output rectifier (right side)
- Lead W2 at lead R bolted connection (tape the connection)
- Leads W5 and W6 between the choke and polarity switch S1 (Ranger 300 DLX only)
- Lead A1 between the reactor and the bottom of the negative (-) output rectifier (left side)

RANGER 300 D AND 300 DLX



# TROUBLESHOOTING & REPAIR

## RETEST AFTER REPAIR

### Retest a machine:

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

OR

- If you repair or replace any electrical components.

### ENGINE OUTPUT

Mode	No Load RPM	Load RPM
Low Idle	2150 - 2220	NA
High Idle	3700 - 3650	3450-3670

### WELDER DC OUTPUT

Output Control	Range Switch	Open Circuit Volts	Load Volts	Load Amps
Maximum	Maximum	64 - 74	25 - 35	295 - 325

### WELDER AC OUTPUT

Output Control	Range Switch	Open Circuit Volts	Load Volts	Load Amps
Maximum	Maximum	70 - 79	27 - 35	295 - 325

### WELDER CV OUTPUT

Output Control	Range Switch	Open Circuit Volts	Load Volts	Load Amps
Maximum	Wire Feed CV High	62 - 71	27 - 34	295 - 325
Maximum	Wire Feed CV Med HI	46 - 53	25 - 30	220 - 240
Maximum	Wire Feed CV Med LO	46 - 53	20 - 25	155 - 170
Maximum	Wire Feed CV Low	46 - 53	15 - 20	135 - 155

### AUXILIARY POWER OUTPUT

230 Volt Receptacle			115 Volt Receptacle		
Open Circuit Voltage	Load Volts	Load Amps	Open Circuit Voltage	Load Volts	Load Amps
245 - 260	210 - 245	48 - 53	120 - 127	106 - 121	58 - 63

### AMPHENOL AUXILIARY OUTPUT

42 Volt Auxiliary		115 Volt Auxiliary	
Open Circuit Voltage	Load Volts	Open Circuit Voltage	Load Volts
40 - 46	38 - 42	115 - 128	114 - 126

RANGER 300 D AND 300 DLX



# ELECTRICAL DIAGRAMS

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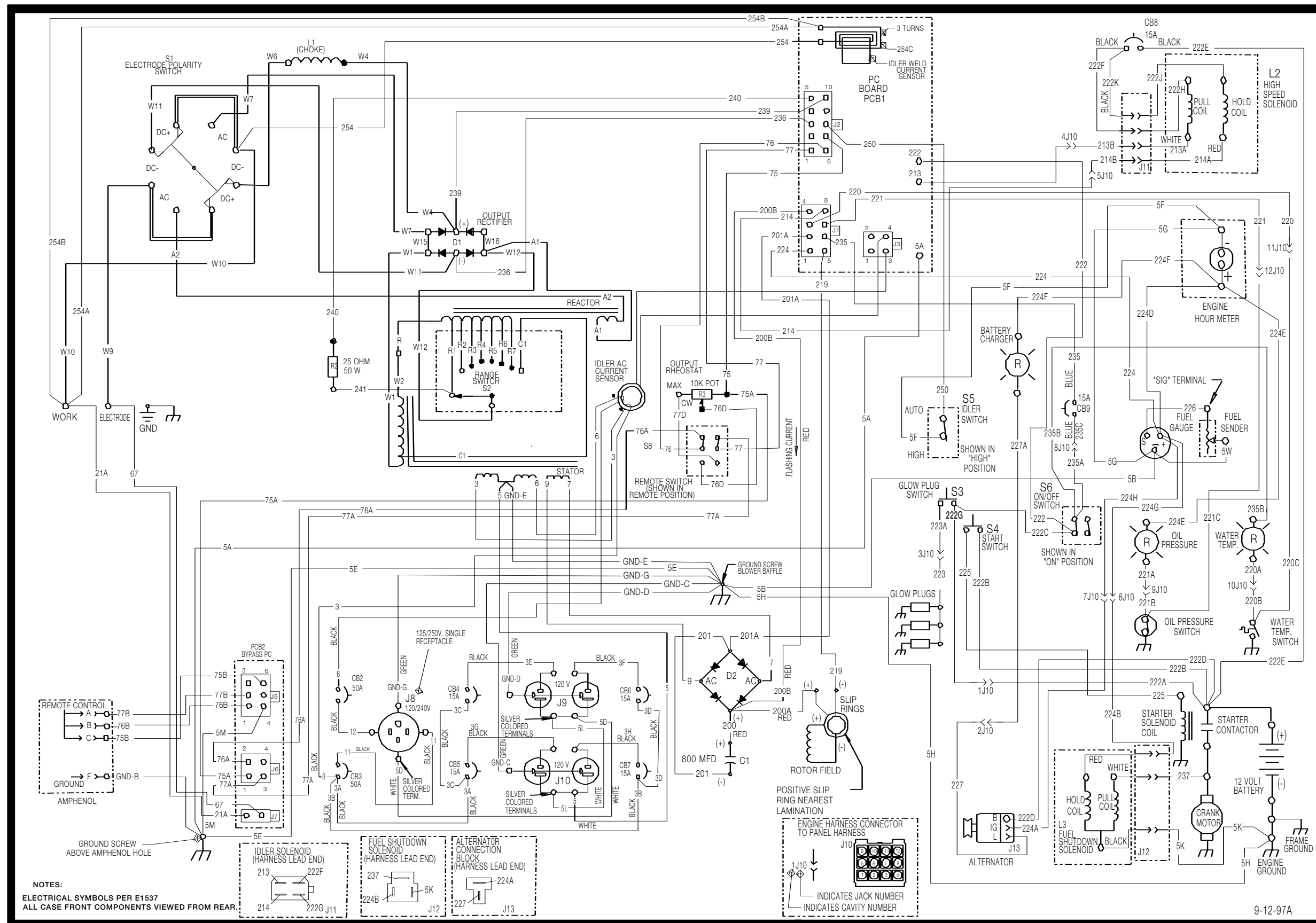
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RANGER 300 D AND 300 DLX



WIRING DIAGRAM - RANGER 300 D (CODE 10399)

WIRING DIAGRAM - RANGER 300 D



L10556

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

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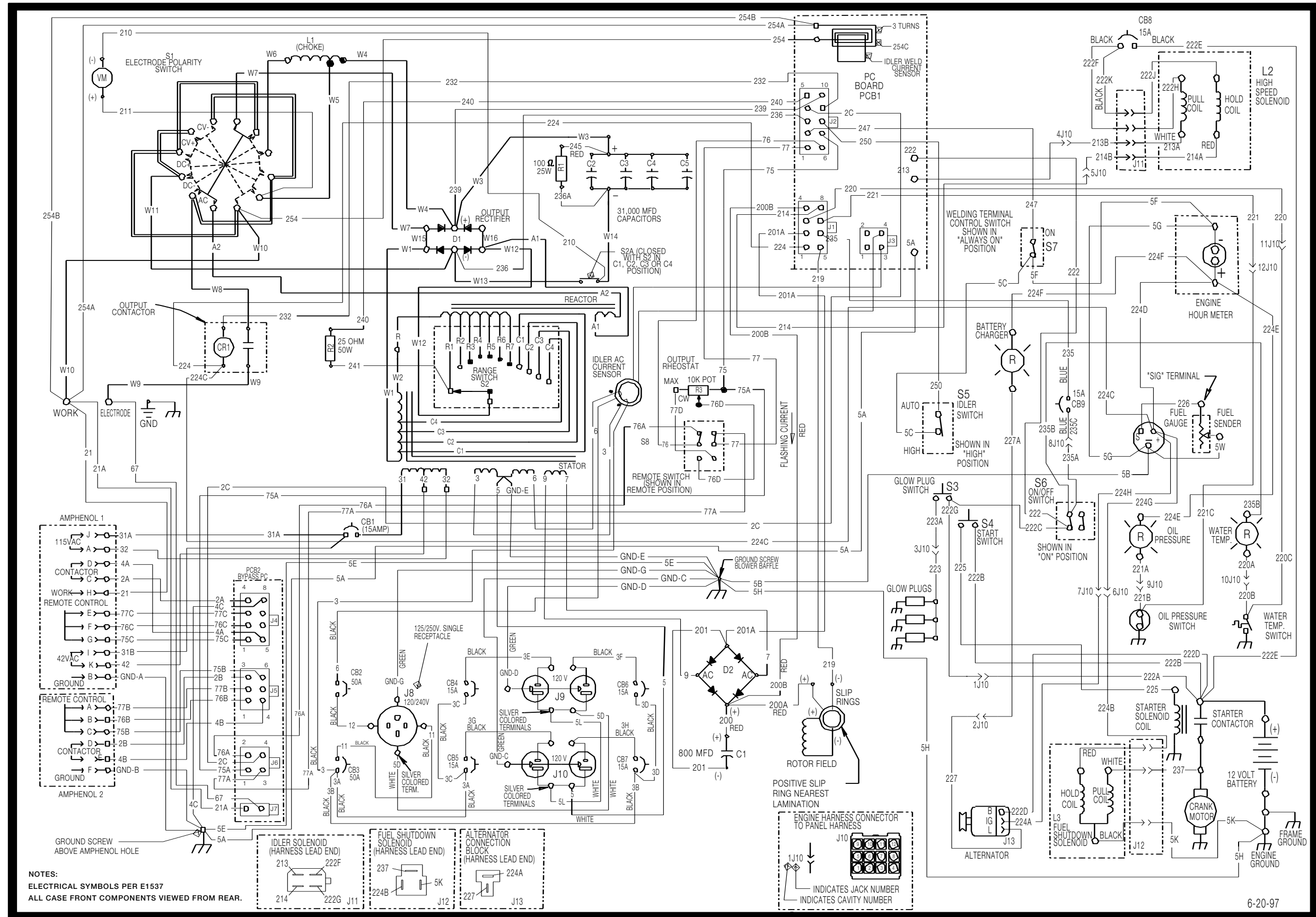
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WIRING DIAGRAM - RANGER 300 DLX (CODE 10400)

WIRING DIAGRAM - RANGER 300 DLX



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.









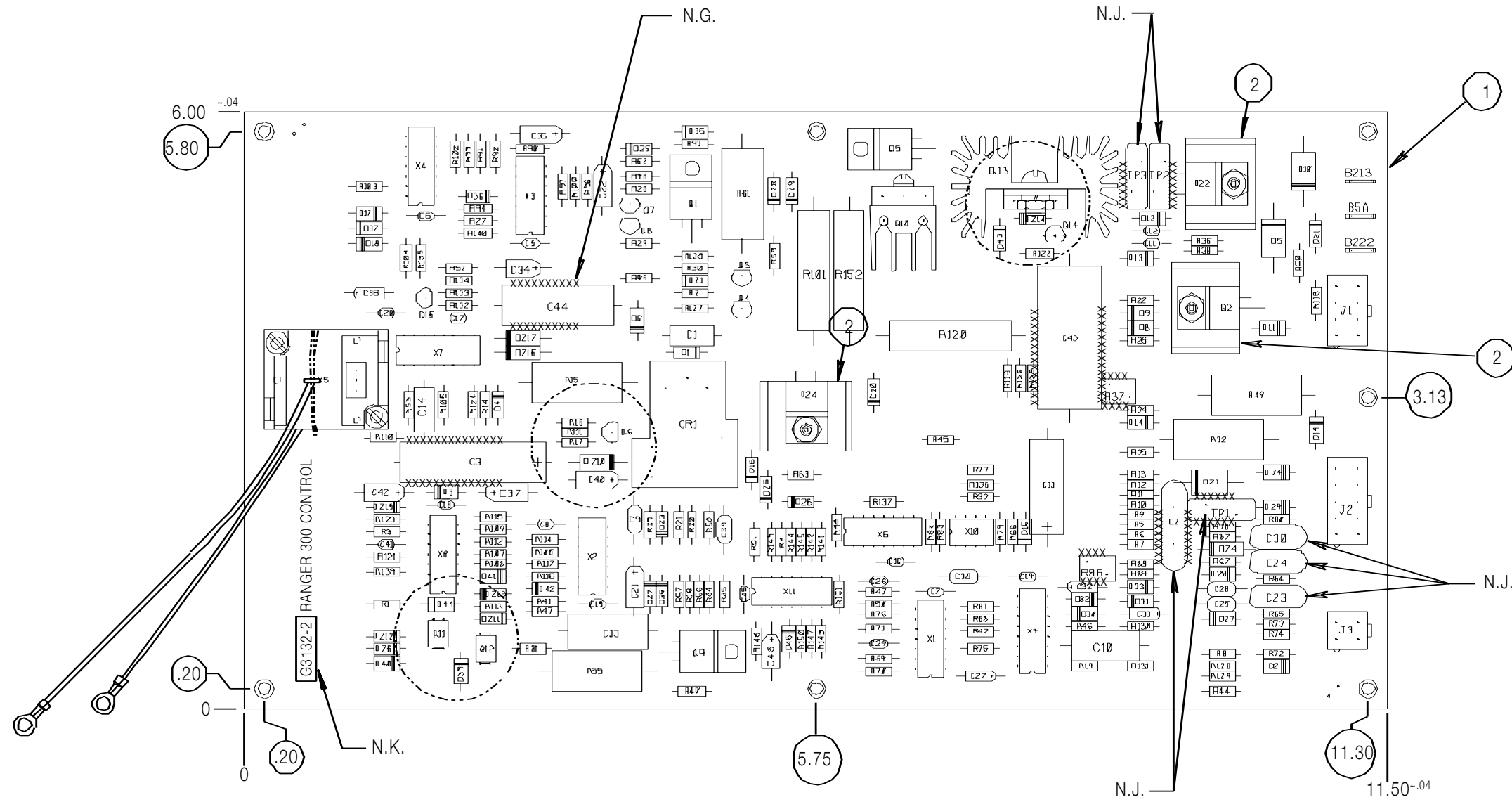
PC BOARD ASSEMBLY - CONTROL BOARD

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CAPACITORS - MFD/VALTS  
 RESISTORS - OHMS/1/4 WATT UNLESS OTHERWISE SPECIFIED.

ITEM	REQ D	PART No.	IDENTIFICATION
B5A, B213, B222	3	T11207-14	100 WPMWAL
C1, C14	2	S11400-102	.047/100V
C2	1	T11577-48	.05/500V
C3	1	S11400-71	100/50
C5, C6, C7, C11, C17, C18, C16	15	S11500-5	.022/50
C17, C18, C19, C20, C26, C29			
C41, C45			
C8	1	S11500-7	.020/1/50V
C9, C25, C28, C38, C39	5	S11500-11	.1/50
C10	1	S11400-4	.022/200V
C11	1	S11400-15	100/50
C21, C22, C29, C40, C42	5	S11400-39	10/15
C23, C24, C28	3	T11577-52	.0047 OR .005/1400
C27, C21, C27	3	S11400-11	1.0/20
C21	1	T11577-38	.047/200V
C24, C46	2	S11400-69	1.0/20
C26	1	S11400-135	1.0/50V
C27	1	S11400-38	3/1/10
C31	1	T11577-33	2200.0.480VDC CAPACITOR
C44	1	S11400-41	.47/50
D1	1	S1122-7	R.C. RELAY
D1, D4, D20, D71, D75, D76, D95	12	T11205-34	1N4136
D26, D27, D28, D42, D43			
D2, D3, D6, D8, D9, D11, D12, D13	25	T11219-1	1N4004
D15, D16, D17, D18, D19, D27			
D28, D29, D29, D31, D32, D31			
D29, D40, D41, D44, D45			
D5	1	T11205-14	1100E
D10, D23	2	T11205-24	1100E
D14, D24	2	T11219-2	1N4007
D22, D24	2	T11205-32	1100E
D21, D27, D28, D29, D31, D32, D33	7	T11202-24	1N4146A
D34			
D37	1	T11202-48	1N4175
D24, D210, D217	3	T11202-33	1N5247B
D28	1	T11202-40	1N4756A
D26, D212	2	T11202-46	1N4761A
D25	1	T11202-27	1N4740
D26	1	T11202-20	1N5237B
J1	1	S11240-0	HEADER
J2	1	S11240-10	HEADER
J3	1	S11240-4	HEADER
Q1, Q0, Q1	3	T11204-61	10A 200V MOSFET ISS1
Q2	1	T11204-44	TRANS (STR)
D7, D8, D35	3	T11204-60	2N4401
D4, D7, D14	3	T11204-64	2N4403
Q6	1	T11204-47	5AMP / 30V VOLT PNP
Q10	1	S11355-16	H.S. ASIST 1551
Q11, D12	2	T11204-73	1C P40 MOSFET 1551
Q13	1	S20305-1	HEXFET W/ H.S. ASIST 1551
R1, R3, R5, R6, R7, R9, R16, R11	14	S11400-1002	10K 1/4W
R12, R13, R14, R18, R22, R25			
R27, R29, R41, R68, R76, R85			
R92, R100, R112, R113, R115			
R117, R124, R137, R138, R141			
R142, R143, R144, R145			
R2, R8, R29, R30, R45, R46, R59	10	S11400-1000	100 1/4W
R67, R90, R119			
R9, R10, R77	3	S11400-3321	1.32K 1/4W
R15	1	T14640-7	470 5W
R16, R66, R69, R70, R75, R79	8	S11400-4750	470 1/4W
R100, R111	1	S11400-3320	332 1/4W
R19, R53, R148	1	S11400-3322	33.2K 1/4W
R20	1	S11400-6012	60.1K 1/4W
R21, R56, R90, R97	4	S11400-4752	47.5K 1/4W
R24, R106	2	S11400-3322	33.2K 1/4W
R27, R28, R20, R127, R351	5	S11400-1001	10K 1/4W
R22, R49	2	T14640-21	2.7 0.5W 5W
R29, R25, R60, R69	4	S11400-6001	60.1K 1/4W
R27, R46	2	S11300-1	PTC THERM (STR)
R29	1	S11400-2211	221K 1/4W
R40, R44	2	S11400-7000	70 1/4W
R42, R50, R60, R65, R77, R71	11	S11400-4751	4.75K
R74, R42, R81, R104, R110, R134			
R106			
R41, R57, R62, R63, R93, R94	6	S11400-2472	24.7K 1/4W
R46	1	S11400-1022	10.2K 1/4W
R47	1	S11400-1501	150K 1/4W
R52, R109	2	S11400-2001	2.0K 1/4W
R55, R61	2	T14640-24	0.5 0.5W 5 WATT RESISTOR
R58, R100	2	S11400-6113	6.11K 1/4W
R64, R67, R70, R48	4	S11400-4755	47.5K 1/4W
R71	1	S11400-3011	3.01K 1/4W
R81, R107, R119	3	S11400-1001	100K 1/4W
R84, R105, R91, R101	4	S11400-1321	132K 1/4W
R91, R121	2	S11400-2212	22.1K 1/4W
R95	1	S11400-1021	1.02K 1/4W
R103, R120, R152	3	T11200-77	0.1 0.5W 7WATT WIRE BOUND
R105	1	S11400-1372	13.7K 1/4W
R100, R122	2	S11400-6011	6.01K 1/4W
R114	1	S11400-1502	150K 1/4W
R116, R119	2	S11400-5272	52.7K 1/4W
R124, R125, R126	3	S11400-1500	15K 1/4W
R120	1	S11400-4753	470K 1/4W
R120, R124, R130, R131	4	S11400-1000	100 1/4W
R132, R147	2	S11400-1501	1.5K 1/4W
R133	1	S11400-1620	162 1/4W
R140	1	S11400-1023	102K 1/4W
R100	1	S11400-1023	102K 1/4W
TP1	1	T11640-12	10V
TP2, TP3	2	T11640-15	15J
X1	1	S11320-4	LM224 OP-AMP
X2, X3, X8, X11	4	S11320-11	14 PIN 5000V COMP PARTIAL
X4, X6	2	S11010-15	14 PIN J.C. ISS1
X5	1	S11004	CURRENT DETECTOR
X7, X9	2	S11010-13	16 PIN J.C. ISS1
X10	1	S11320-10	VOLTAGE REF.

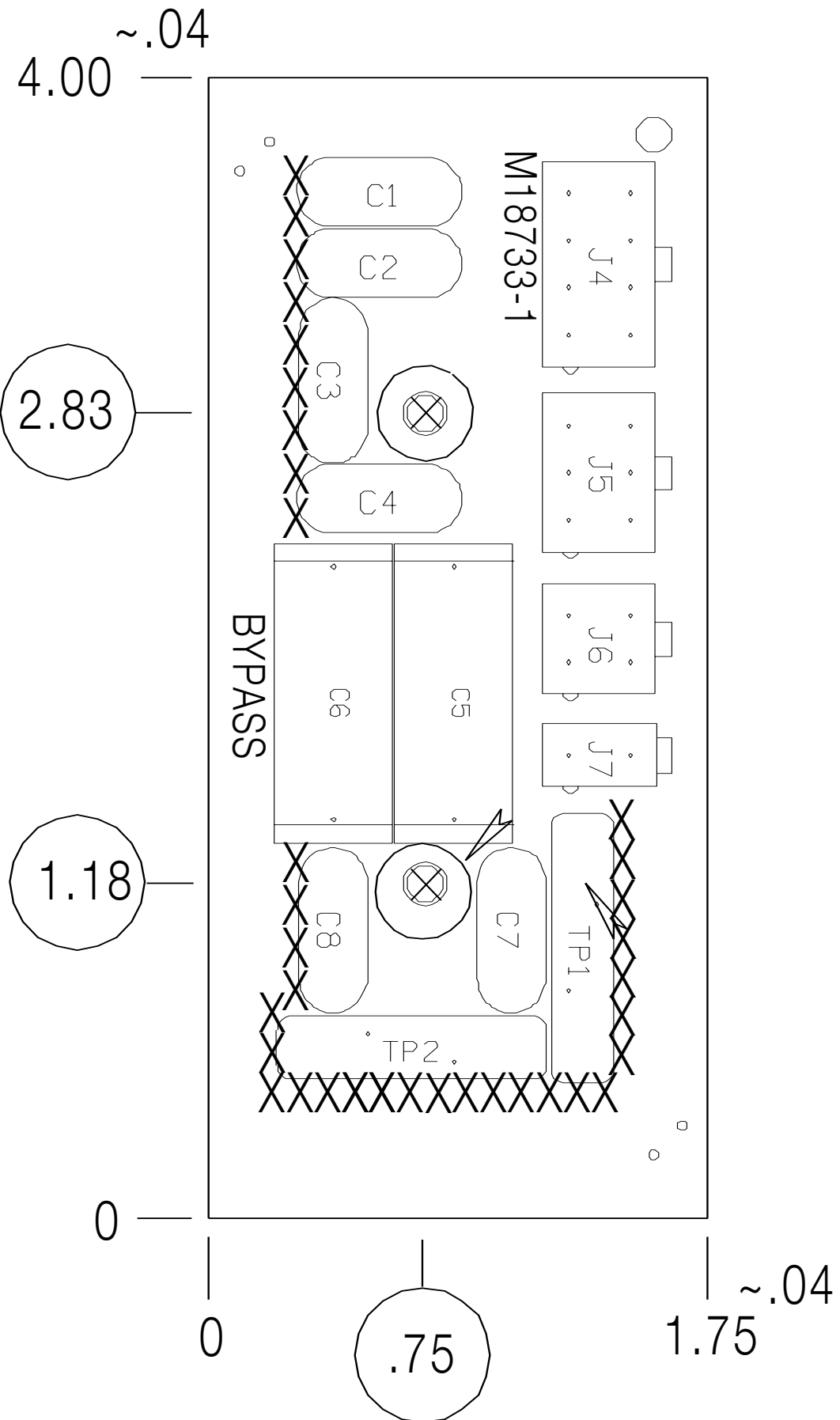
ENGINE WELDER  
 CONTROL P.C. BOARD ASSEMBLY  
 2-16-2001B  
 G 3132-2

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PC BOARD ASSEMBLY - BYPASS BOARD



ITEM	REQ'D	PART NO	DESCRIPTION
C1,C2,C3,C4,C7,C8	6	T11577-52	.0047 OR .005/1400
C5,C6	2	S20500-3	.22/400V
J4	1	S18248-8	HEADER
J5	1	S18248-6	HEADER
J6	1	S18248-4	HEADER
J7	1	S18248-2	HEADER
TP1,TP2	2	T13640-16	80J

CAPACITORS = MFD/VOLTS

ENGINE WELDERS  
 BYPASS P.C. BD. ASSEMBLY 11-20-98E

**M** 18733-1B

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