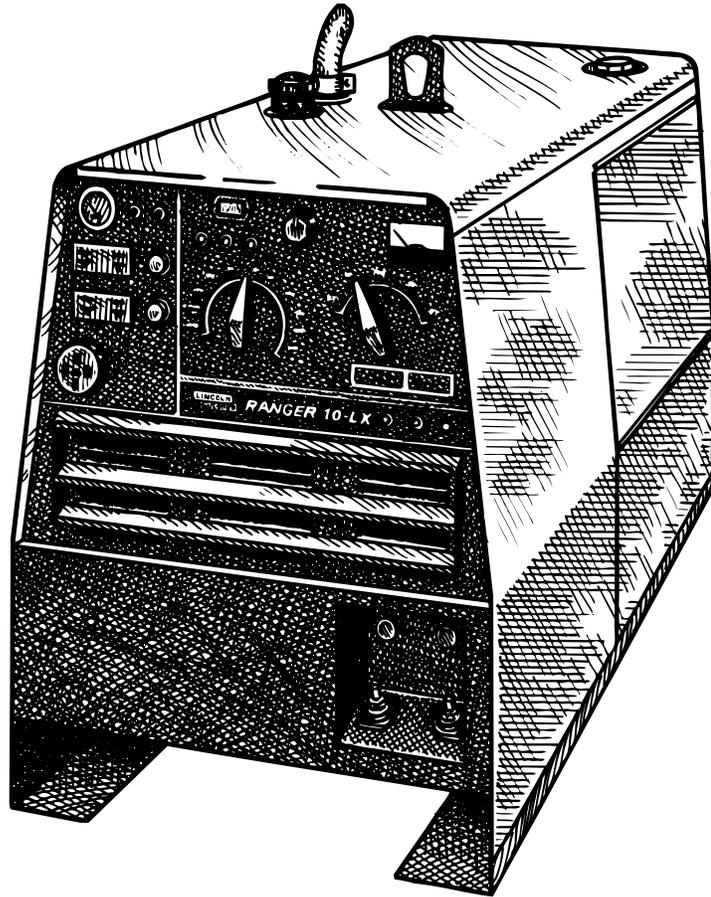


RANGER™ 10-LX

For use with machine code numbers 9815 and 9816

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



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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.**

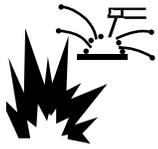
5.b. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

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. Eviter toujours tout contact entre les parties sous tension et la peau nue ou les vêtements mouillés. Porter des gants secs et sans trous pour isoler les mains.
 - b. Faire très attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher métallique ou des grilles métalliques, principalement dans les positions assis ou couché pour lesquelles une grande partie du corps peut être en contact avec la masse.
 - c. Maintenir le porte-électrode, la pince de masse, le câble de soudage et la machine à souder en bon et sûr état de fonctionnement.
 - d. Ne jamais plonger le porte-électrode dans l'eau pour le refroidir.
 - e. Ne jamais toucher simultanément les parties sous tension des porte-électrodes connectés à deux machines à souder parce que la tension entre les deux pinces peut être le total de la tension à vide des deux machines.
 - f. Si on utilise la machine à souder comme une source de courant pour soudage semi-automatique, ces précautions pour le porte-électrode s'appliquent aussi au pistolet de soudage.
2. Dans le cas de travail au dessus du niveau du sol, se protéger contre les chutes dans le cas où on reçoit un choc. Ne jamais enrouler le câble-électrode autour de n'importe quelle partie du corps.
3. Un coup d'arc peut être plus sévère qu'un coup de 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.

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RANGER 10-LX



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INSTALLATION

TECHNICAL SPECIFICATIONS - RANGER 10-LX

INPUT - DIESEL ENGINE					
<u>Manufacturer</u>	<u>Description</u>	<u>Speed</u>	<u>Displacement</u>	<u>Ignition</u>	<u>Capacities</u>
KUBOTA DH850B-88	3 cyl., liquid-cooled diesel 23 HP @ 3600 RPM	3600 RPM Full load 3750 RPM High idle 2150 RPM Low idle	52.17 cu. in. (855 cc)	Electric	Fuel: 10 gal. (38 l) Oil: 3.9 qt. (3.7 l) Cooling system: 5.4 qts. (5.1 l)
RATED OUTPUT - WELDER					
<u>Duty Cycle</u>		<u>Amps</u>		<u>Volts at Rated Amperes</u>	
100% Duty Cycle		250 AC Constant Current		25	
100% Duty Cycle		250 DC Constant Current		25	
100% Duty Cycle		250 DC Constant Voltage		30	
OUTPUT - WELDER AND GENERATOR					
<u>Welding Ranges</u>	<u>Max. Open Circuit Voltage</u>	<u>Auxiliary Power⁽¹⁾</u>		<u>Auxiliary Power for Wire Feeders</u>	
45- 250 Amps	80 Volts RMS @ 3700 RPM	10000 Continuous Watts 87 Amps @ 115 V 43.5 Amps @ 230 V		42V, 60 Hz, 8 Amps 115V, 60 Hz, 8 Amps	
PHYSICAL DIMENSIONS					
<u>Height</u>	<u>Width</u>	<u>Depth</u>	<u>Weight</u>		
37.4 in. 949 mm	24.8 in. 629 mm	60.5 in. 1529 mm	1100 lb. 499 kg		

⁽¹⁾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.

RANGER 10-LX



Read this entire installation section before you start installation.

SAFETY PRECAUTIONS

WARNING

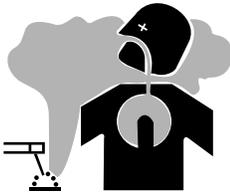
Do not attempt to use this equipment until you have thoroughly read all the operation and maintenance manuals supplied with your machine. They include important safety precautions; detailed engine starting, operating, and maintenance instructions; and parts lists.

ELECTRIC SHOCK can kill.



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

ENGINE EXHAUST can kill.



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

MOVING PARTS can injure.



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

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

LOCATION AND VENTILATION

Whenever you use the RANGER 10-LX, 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 back end of the generator anywhere near hot engine exhaust from another machine. And of course, make sure that engine exhaust is ventilated to an open, outside area.

The RANGER 10-LX 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 10-LX with the case roof on and all machine components completely assembled. This will protect you from the dangers of moving parts, hot metal surfaces, and live electrical devices.

STORING

1. Store the machine in a cool, dry place when it's not in use. Protect it from dust and dirt. Keep it where it can't be accidentally damaged from construction activities, moving vehicles, and other hazards.
2. 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.

RANGER 10-LX



STACKING

RANGER 10-LX 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.

LIFTING

The RANGER 10-LX weighs 1100 lbs/499 kg. A lift bail is mounted to the machine frame and should always be used when lifting the machine.

HIGH ALTITUDE OPERATION

It may be necessary to derate 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. Contact a Kubota Service Representative.

PRE-OPERATION ENGINE SERVICE

Read and understand the information about the diesel engine in the **Operation** and **Maintenance** sections of this manual before you operate the RANGER 10-LX.

⚠ WARNING

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

OIL



The RANGER 10-LX is shipped with the engine filled with SAE 10W-30 oil (API class CC/DO). **CHECK THE OIL LEVEL BEFORE YOU START THE ENGINE.** This is an added precaution. When full, the oil level should be up to but not over the FULL mark on the dipstick. If it is not full, add enough oil to fill it to the full mark.

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

FUEL



Fill the fuel tank with clean, diesel fuel only.

The RANGER 10-LX has a 10 gallon (38 litre) 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

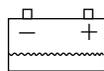


HOT COOLANT can burn skin.

- 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



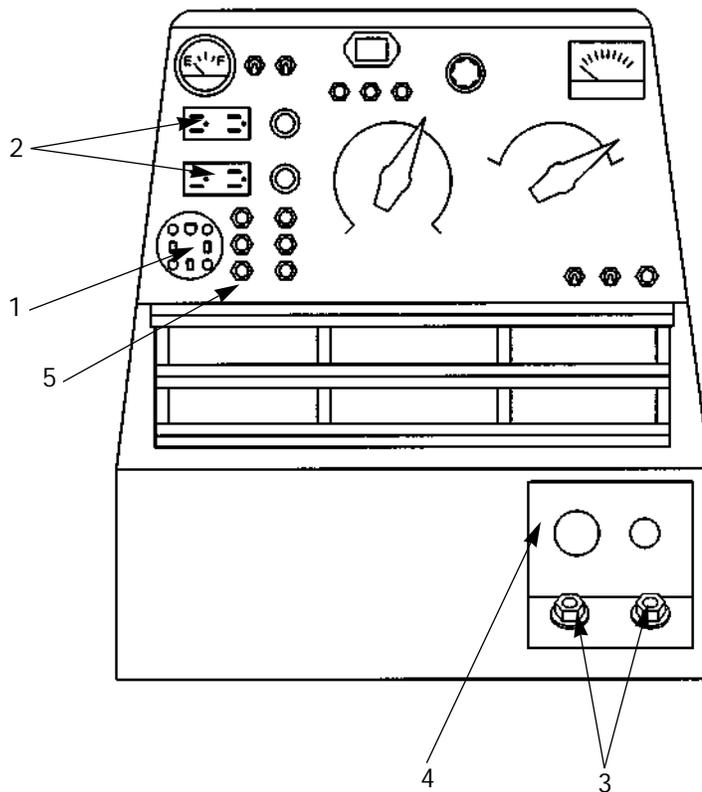
The RANGER 10-LX is shipped with the negative battery cable disconnected. Before you operate the machine, make sure the Engine Switch is in the STOP position and attach the disconnected cable securely to the battery terminal. If the battery is discharged and won't start the engine, see the battery charging instructions in the **Maintenance** section.

RANGER 10-LX



INSTALLATION

FIGURE A.1 - RANGER 10-LX OUTPUT CONNECTIONS



1. 115/230 VOLT, 50 AMP RECEPTACLE
2. 115 VOLT, 20 AMP RECEPTACLES (2)
3. WELD OUTPUT TERMINALS (2)
4. GROUND STUD (LOCATION)
5. CIRCUIT BREAKERS (CSA machines only)

MUFFLER RELOCATION

⚠ WARNING

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

The RANGER 10-LX is shipped with the exhaust directed toward the rear. It can be changed to the right side by loosening the clamp that holds the exhaust deflector in place and rotating the deflector to the desired direction.

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 mufflers and deflectors (like the ones included with the RANGER 10-LX) 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 10-LX. 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.

ELECTRICAL OUTPUT CONNECTIONS

See Figure A.1 for the location of the 115 and 230 volt receptacles, weld output terminals, circuit breakers and ground stud.

RANGER 10-LX



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Return to Master TOC

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 - RECOMMENDED WELDING CABLE SIZE AND LENGTH
TOTAL COMBINED LENGTH OF ELECTRODE AND WORK CABLES**

Cable Length	Cable Size for 250 Amp 40% Duty Cycle	Cable Size for 250 Amp 100% Duty Cycle
0-50 feet (0-15 meters)	2 AWG	1 AWG
50-100 feet (15-39 meters)	2 AWG	1 AWG
100-150 feet (30-46 meters)	1 AWG	1 AWG
150-200 feet (46-61 meters)	1 AWG	1 AWG
200-250 feet (61-76 meters)	1/0 AWG	1/0 AWG

CABLE INSTALLATION

Install the welding cables to your RANGER 10-LX as follows. See Figure A.1 for the location of parts.

1. The diesel engine must be OFF to install welding cables.
2. Remove the flanged nuts from the 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.

MACHINE GROUNDING



Because the RANGER 10-LX creates its own power from its diesel-engine driven generator, you do not need to connect the machine frame to an earth ground. However, for best protection against electrical shock, connect a heavy gauge wire (#8 AWG or larger) from the ground stud located on the bottom of the output panel (see Figure A.1) to a suitable earth ground such as a metal pipe driven into the ground.

⚠ WARNING

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

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When the RANGER 10-LX is mounted on a truck or a trailer, the machine generator ground stud **MUST** be securely connected to the metal frame of the vehicle. See Figure A.1. The ground stud is marked with the ground symbol.

If the RANGER 10-LX is connected to premises wiring such as a home or shop, it must be properly connected to the system earth ground. See the **Premises Wiring** section of this manual for details.

AUXILIARY POWER RECEPTACLES, PLUGS, AND HAND-HELD EQUIPMENT

The control panel of the RANGER 10-LX features three auxiliary power receptacles: See Figure A.1.

- Two 20 amp, 125 volt duplex (double outlet) receptacles.
- One 50 amp 115/230 volt simplex (single outlet) receptacle.

Through these receptacles the machine can supply up to 10,000 rated continuous watts of single-phase, 60 Hz AC power. The machine output voltages fall within $\pm 10\%$ of the rated voltage.

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

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

CIRCUIT BREAKERS

Canadian Standards Association (CSA) versions of the RANGER 10-LX are equipped with 50 amp circuit breakers on the 115/230 V receptacle and 15 amp circuit breakers on the 115 V receptacles for overload protection. Under high heat a breaker may tend to trip at lower loads than it would normally.



⚠ CAUTION

Never bypass the circuit breakers. Without overload protection, the RANGER 10-LX could overheat and/or cause damage to the equipment being used.

PREMISES WIRING

The RANGER 10-LX 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 230 volt, three-wire, single phase 43 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.

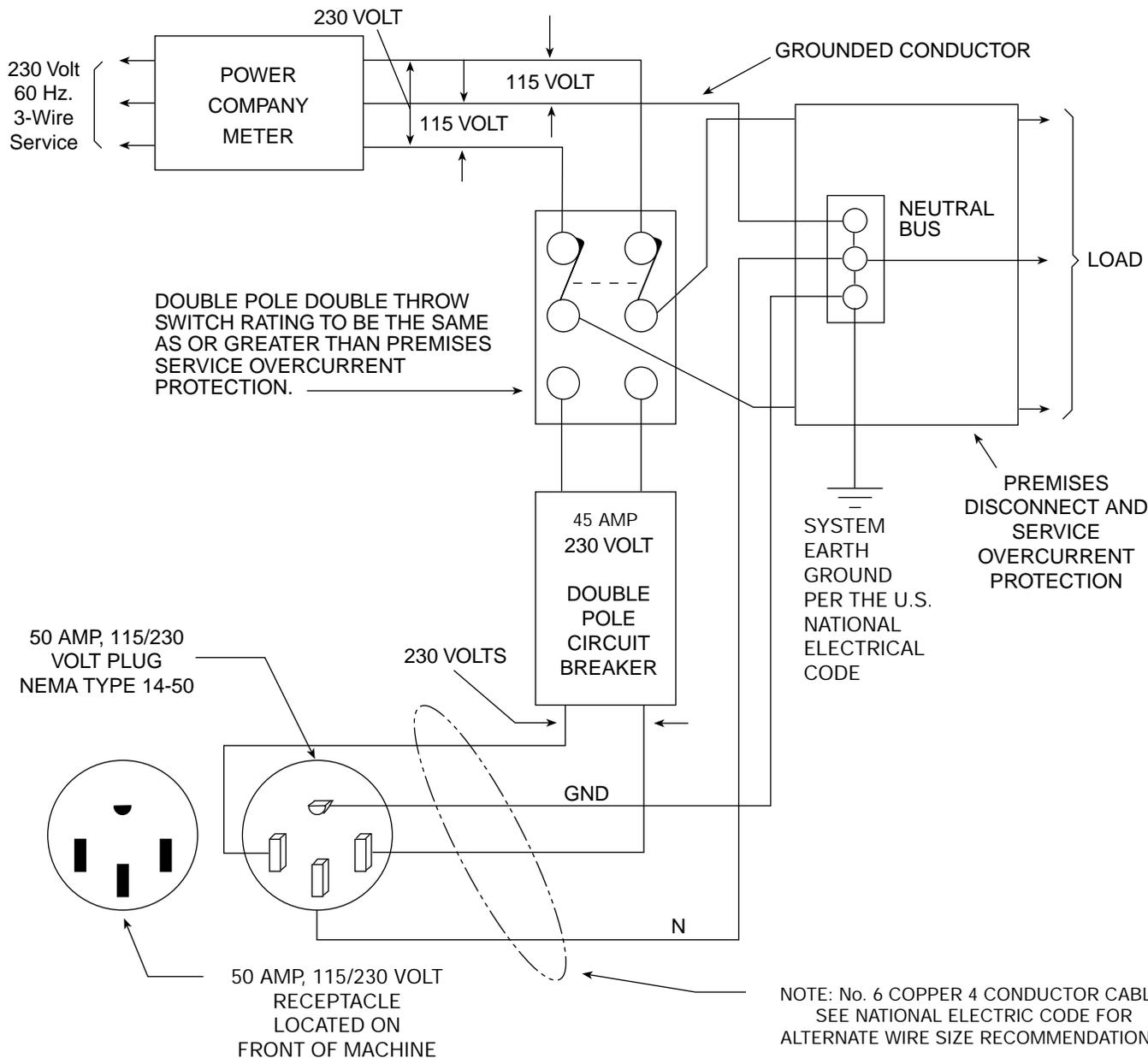
1. Install a double pole, double throw switch between the power company meter and the premises disconnect. **The switch rating must be the same as or greater than the premises disconnect and service overcurrent protection.**
2. Take the necessary steps to assure that the load is limited to the capacity of the RANGER 10-LX by installing a 45 amp 230 volt double pole circuit breaker. Maximum rated load for the 230 volt auxiliary is 43 amperes. Loading above 43 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 115/230 volt plug (NEMA type 14-50) to a double pole circuit breaker using No. 6, 4 conductor cable of the desired length. (The 50 amp 115/230 volt plug is available in the optional power plug kit. See the **Accessories** section for details.)
4. Plug this cable into the 50 amp 115/230 volt receptacle on the RANGER 10-LX case front.

RANGER 10-LX



INSTALLATION

FIGURE A.2 - CONNECTION OF RANGER 10-LX TO PREMISES WIRING



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OPERATION

OPERATING INSTRUCTIONS

Read and understand this entire section before operating your RANGER 10-LX.

SAFETY INSTRUCTIONS

⚠ WARNING

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

ELECTRIC SHOCK can kill.



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

FUMES AND GASES can be dangerous.



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

WELDING SPARKS can cause fire or explosion.



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

⚠ WARNING



ARC RAYS can burn.

- Wear eye, ear, and body protection.

ENGINE EXHAUST can kill.



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

MOVING PARTS can injure.



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

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

GENERAL DESCRIPTION

The RANGER 10-LX 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 10,000 continuous watts of 115/230 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 250 amps of AC current for welding with AC stick electrodes or 250 amps of DC current for DC stick welding. The RANGER 10-LX can also perform AC/DC TIG welding and DC semiautomatic wire feed welding.

The RANGER 10-LX is powered by the Kubota DH850B-88 water-cooled, three-cylinder diesel engine.

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RECOMMENDED APPLICATIONS

WELDER

The RANGER 10-LX 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. For more details on using the machine as a welder, see **Welding Operation** in the Operation section of this manual.

GENERATOR

The RANGER 10-LX gives AC generator output for medium use demands. For more details on operating the generator, see **Auxiliary Power** in the Operation section of this manual.

DESIGN FEATURES AND ADVANTAGES

- 10,000 watts of auxiliary power
- Enhanced constant voltage capability with low (9-19 volts), medium low (10-24 volts), medium high (15-29 volts) and high (22-40 volts) range settings for greater control of wire feed applications.
- Built-in contactor with front panel selection of "cold" or "hot" welding terminals.
- Constant current AC/DC Stick welding (SMAW) process capability with output range from 45-250 amps (AC) or 45-250 amps (DC).
- Constant voltage DC Semiautomatic Wire Feed Welding with output range from 45-250 amps.
- Constant current AC/DC TIG Welding with output across the entire range of settings.
- Polarity switch for selecting DC+, DC-, or AC welding output.
- Separate ground stud for safe connection of case to earth ground.
- Single 50 amp, 230 volt, full 10 kVA auxiliary power receptacle.
- Double duplex 20 amp, 125 volt auxiliary power receptacles.
- Electric starting.
- Battery Charging Ammeter.
- Engine Hour Meter for determining periodic maintenance.
- 23 HP Kubota DH850B-88 diesel engine.
- Durable, heavy-gauge steel case.

- Top-mounted 10 gallon (38.0 litre) fuel tank with convenient top fill.
- Front-panel mounted fuel gauge.
- Quiet engine muffler and insonorized case for extremely quiet operation.
- All copper alternator windings and high quality insulation for dependable long life.
- Automatic engine shutdown protection for low oil pressure.
- Automatic engine idler goes to low idle 10 to 14 seconds after welding for greater fuel economy; includes high idle switch.
- Standard Remote Control Receptacle provides interface for Lincoln remote control accessories. Both 6 pin and 14 pin amphenols are provided for ease in hooking up wire feeders.
- Canadian Standard Association (CSA) approved models available; include integrated generator output overload protection through circuit breakers.

WELDING CAPABILITY

The RANGER 10-LX is rated 250 amps, 25 volts constant current AC or 250 amps, 25 volts constant current DC (250 amps 30 volts constant voltage DC) at 100% duty cycle on a ten-minute basis.

The current is continuously variable from 45 to 250 amps AC or 45 to 250 amps DC. The RANGER 10-LX can weld with all 3/32 and most 1/8 inch and 1/16 diameter Lincoln AC stick electrodes. Wire feed processes using wire diameters from .030 to .068 inch are possible, depending on the specific process and wire feeder. (See LIMITATIONS.)

LIMITATIONS

- The RANGER 10-LX 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. Specific limitations on using the RANGER 10-LX for these processes are described in the **Welding Operation** section of this manual.
- The RANGER 10-LX 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.4** for permissible simultaneous welding and auxiliary power loads.

RANGER 10-LX



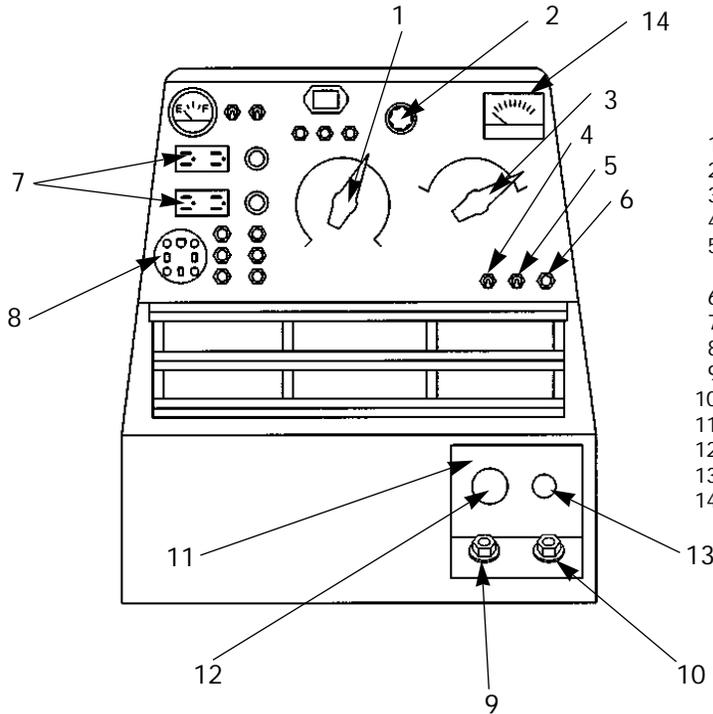
OPERATION

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



1. OUTPUT RANGE SELECTOR
2. FINE OUTPUT CONTROL
3. POLARITY SWITCH
4. CONTROL AT WELDER/REMOTE CONTROL SWITCH
5. WIRE FEEDER NO CONTROL CABLE/WIRE FEEDER WITH CONTROL CABLE SWITCH
6. WIRE FEEDER POWER CIRCUIT BREAKER
7. 115 VOLT, 20 AMP RECEPTACLES (2)
8. 115/230 VOLT, 50 AMP RECEPTACLE
9. WELD OUTPUT TERMINAL (TO WORK)
10. WELD OUTPUT TERMINAL (TO ELECTRODE HOLDER)
11. GROUND STUD (LOCATION)
12. 14 PIN AMPHENOL
13. 6 PIN AMPHENOL
14. VOLTMETER

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 (white 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 (white) polarity setting. 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.
5. **WIRE FEEDER NO CONTROL CABLE/WIRE FEEDER WITH CONTROL CABLE SWITCH:** Allows control of the RANGER 10-LX output contactor. In the "NO CONTROL CABLE" position, the switch closes the output contactor, and welding begins when an arc is struck between the electrode and the workpiece. In the "WITH CONTROL CABLE" position, the switch places control of the contactor at the wire feeder. The contactor closes when the wire feeder gun trigger or amptrol switch closes and opens when it is released.
6. **WIRE FEEDER POWER CIRCUIT BREAKER:** Opens the wire feeder circuit and disables the feeder if a fault is detected in the circuit.

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7. **20 AMP, 115 VOLT DUPLEX RECEPTACLES:**
Connection point for supplying 115 volt power to operate one or two electrical devices.
8. **50 AMP, 230/115 VOLT RECEPTACLE:**
Connection point for supplying 230 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. **14 PIN AMPHENOL:** For attaching wire feeder control cables to the RANGER 10-LX. (Includes contactor closure circuit, remote control circuit, wire feeder 115/42 volt power source.)
13. **6 PIN AMPHENOL:** For attaching optional remote control equipment to the RANGER 10-LX. (Includes contactor closure circuit & remote control circuit.)
14. **VOLTMETER** – Displays actual voltage at the output terminals when welding in CV-mode.

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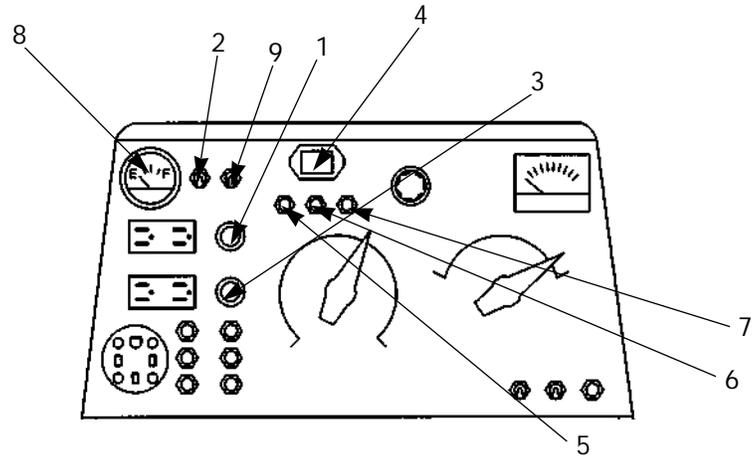


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FIGURE B.2 – ENGINE CONTROLS

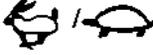
1. ENGINE GLOW PLUG PUSHBUTTON
2. IDLER CONTROL SWITCH
3. START PUSHBUTTON
4. ENGINE HOUR METER
5. BATTERY CHARGER LIGHT
6. OIL PRESSURE LIGHT
7. WATER TEMPERATURE LIGHT
8. FUEL LEVEL GAUGE
9. ENGINE ON-OFF SWITCH



DIESEL ENGINE CONTROLS

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

1. **GLOW PLUG PUSHBUTTON:** Activates glow plugs to preheat engine for starting. 
2. **IDLER CONTROL SWITCH:** Adjusts the running speed of the engine. The switch has two positions, HIGH and AUTO. In HIGH, the engine runs continuously at high idle. In AUTO, the idler control works as follows: 

Stick Welding; Wire Feeder switch in "NO CONTROL CABLE" position: 
The engine accelerates to high speed when the electrode touches the work and strikes a welding arc. The engine returns to low idle approximately 10-14 seconds after welding stops, as long as no auxiliary power is being drawn.

Wire Welding; Wire Feeder switch in "WITH CONTROL CABLE" position: The engine accelerates to high speed when the electrode touches the workpiece. The engine returns to low idle approximately 10-14 seconds after the gun trigger is released and the welding stops, provided that no auxiliary power is being drawn.

Auxiliary Power: The engine accelerates to high speed when power is drawn at the receptacles for lights or tools. The engine returns to low idle approximately 10-14 seconds after demand for auxiliary power stops.

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

WARNING

MOVING PARTS can injure.



- Have qualified personnel do maintenance and troubleshooting work.
- If possible, turn the engine off and disconnect the battery before working inside the machine.
- Remove guards only when necessary to perform maintenance, and replace them when the maintenance requiring their removal is complete.
- If fan guards are missing from a machine, obtain replacements from a Lincoln Distributor. (See Parts List.)

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6. **OIL PRESSURE LIGHT:** Remains off with proper oil pressure. If light turns on, the engine protection system will stop the engine. The light will go on when the "Engine" switch is switched to the "ON" position with engine not running. It will go off after one minute if the engine is not started.



7. **WATER TEMPERATURE LIGHT:** Remains off under normal operating temperatures. If 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).



⚠ WARNING



HOT COOLANT can burn skin.

- Do not remove cap if radiator is hot.

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.

ENGINE OPERATION

⚠ WARNING

DO NOT RUN THE ENGINE AT EXCESSIVE SPEEDS. The maximum allowable high idle speed for the RANGER 10-LX is 3750 RPM, no load. Do NOT adjust the governor screw on the engine. Severe personal injury and damage to the machine can result if it is operated at speeds above the maximum rated speed.

Read and understand all safety instructions included in the Kubota instruction manual that is shipped with your RANGER 10-LX.

Refer to **Pre-Operation Engine Service** in the **Installation** section of this manual.

BEFORE STARTING THE ENGINE

Check and fill the engine oil level:



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. See **Figure D.1** in the **Maintenance** section of this manual.
3. Add oil (if necessary) to bring the level up to the full mark. Do not overfill.

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.
- Remove cap slowly to release pressure.
- Do not overfill tank.
- Wipe up spilled fuel and allow fumes to clear before starting engine.
- Keep sparks and flame away from tank.

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 10-LX to run out of fuel. If it does, you will have to bleed the injection system.

NOTE: USE DIESEL FUEL ONLY.

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

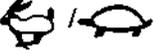
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OPERATION

STARTING THE ENGINE

NOTE: Remove all loads connected to the AC power receptacles 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.
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 10-LX TO RUN OUT OF FUEL). 
6. Press the "GLOW PLUG" button for 15 seconds (30 seconds if below 0°C/32°F) and then press the "START BUTTON". 
7. Release both buttons 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.

If the engine will not start, see the **Troubleshooting** section of this manual.

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

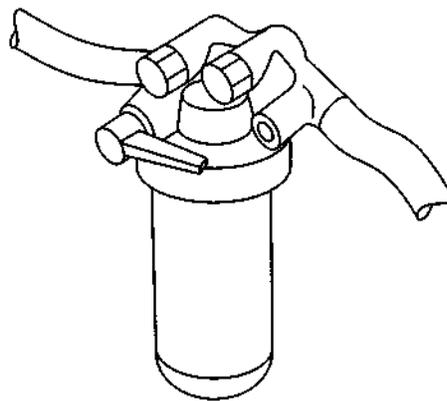
Any engine will use a small amount of oil during its "break-in" period. For the diesel engine on the RANGER 10-LX, break-in is about 50 running hours.

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. For more details, see the **Maintenance** section of this manual.

CAUTION

During break-in, subject the RANGER 10-LX to moderate loads. Avoid long periods running at idle. Before stopping the engine, remove all loads and allow the engine to cool several minutes.

FIGURE B.3 – FUEL SHUTOFF VALVE



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TABLE B.1
TYPICAL RANGER 10-LX FUEL CONSUMPTION

KUBOTA DH850-B-88	
Low Idle – No Load, 2150 RPM	.30 Gallons/hour (1.0 liters/hour)
High Idle – No Load, 3750 RPM	.60 Gallons/hour (2.2 liters/hour)
AC CC Weld Output, 250 Amps @ 25 Volts	1.1 Gallons/hour (4.2 liters/hour)
DC CC Weld Output, 250 Amps @ 25 Volts	1.2 Gallons/hour (4.6 liters/hour)
DC CV Weld Output, 250 Amps @ 30 Volts	.90 Gallons/hour (3.6 liters/hour)
Auxiliary Power, 10,000 kVA	1.3 Gallons/hour (4.9 liters/hour)

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WELDING OPERATION

GENERAL INFORMATION

⚠ WARNING



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



- Do not breathe welding fumes or gases.
- Use ventilation or exhaust to remove welding fumes from the breathing area.



- Keep flammable material away.
- Wear eye, ear, and body protection.

The RANGER 10-LX can deliver from 45 to 250 amps of constant current for AC/DC stick welding or from 45 to 250 amps of constant voltage current for DC semi-automatic wire feed welding. AC/DC TIG welding is possible across the entire range from 45 to to maximum rated output. 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.

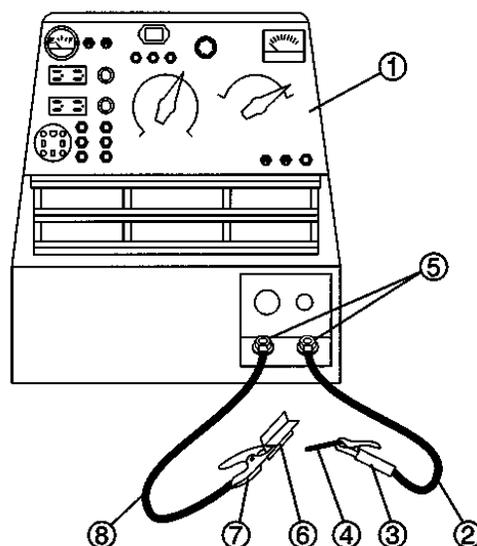
To use the RANGER 10-LX for AC/DC Constant Current Stick Welding:

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 10-LX.
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. See **Engine Operation** in this section of the manual.
6. Set the OUTPUT RANGE dial to a setting equal to or slightly higher than the welding current recommended for the electrode being used.
7. Set the POLARITY SWITCH to the desired polarity.
8. Set the FINE OUTPUT CONTROL. Use a setting that results in the highest output at the lowest setting of the RANGE switch for the application.
9. Strike an arc and begin welding.

After you finish welding:

1. Stop the diesel engine. See **Engine Operation** in this section of the manual.
2. Allow the electrode and work to cool completely.
3. Remove the work clamp from the work.
4. Remove any remaining piece of electrode from the electrode holder.
5. If you are finished using the RANGER 10-LX for welding, disconnect the welding cables from the weld output terminals. Reattach the flange nuts and leave them on the terminals.

FIGURE B.4 – WELDING CIRCUIT CONNECTIONS FOR STICK WELDING



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

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To Use the RANGER 10-LX for AC/DC TIG (Constant Current) Welding:

1. Connect the K930-1 TIG Module to the RANGER 10-LX. Follow the installation instructions provided with the kit. Also be sure to follow the special machine grounding instructions given in the manual.
2. Refer to the instruction manual with the TIG module (IM 528) for operation with a RANGER 10-LX and proper machine settings.
3. Set the OUTPUT RANGE dial 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 250 AC range setting. The output current may exceed the rating of the RANGER 10-LX.
6. Start the arc and begin welding.

NOTE: When using the RANGER 10-LX for AC TIG welding of aluminum, the TIG Module is to be set for CONTINUOUS HF.

After you finish welding:

1. Stop the diesel engine. See **Engine Operation** in this section of the manual.
2. Allow the electrode and work to cool completely.
3. Remove the work clamp from the work.

TABLE B.2 - AC TIG WELDING - TIG ELECTRODE/RANGE SETTINGS

Settings for Pure Tungsten		
Tungsten Diameter (inches)	Range Switch Settings	Appropriate Current Range
1/8	65, 90 or 120 ⁽¹⁾	100 - 200 Amps
3/32	45, 65 or 90	50 - 100 Amps
1/16	45, 65 or 90	45 - 150 Amps

Settings for 1% Thoriated Tungsten		
Tungsten Diameter (inches)	Range Switch Settings	Appropriate Current Range
1/8	90, 120, or 160	160 - 250 Amps
3/32	45, 90, or 120	100 - 180 Amps
1/16	45 or 90	60 - 120 Amps

⁽¹⁾ 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.

RANGER 10-LX



OPERATION

To Use the RANGER 10-LX for DC Wire Feed Welding (Constant Voltage):

1. Connect one of the following: the LN-25, LN-7 or LN-8 Wire Feeder. Follow the installation instructions in the **Accessories** section of this manual.
2. Some recommended Innershield electrodes are: NR-211MP, NR-311, NR-203 series, as well as Lincore® 33 and 55 hardfacing electrodes. Diameters from .035 (0.9mm) up to and including 5/64" (2.0mm) can be used. 5/64" (2.0mm) NS-3M can be used in limited applications. 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% CO²). Request Lincoln publication GS-100 for additional information.
3. Set the IDLER CONTROL to "AUTO" for the LN-25 "HIGH" for the LN-7 or LN-8 and start the diesel engine. See **Engine Operation** in this section of the manual.

4. Set the OUTPUT RANGE dial to either HIGH, MEDIUM HIGH, MEDIUM LOW, or LOW depending on your wire size and speed.
5. Set the POLARITY SWITCH to either WIRE FEED DC+ or WIRE FEED DC- (white), depending on the electrode.
6. Set the FINE OUTPUT CONTROL to a setting that gives the most stable arc for the application.
7. Strike an arc and begin welding.

After you finish welding:

1. Stop the engine. See **Engine Operation** in this section of the manual.
2. Allow the work to cool completely. The wire gun and wire are "cold."
3. Remove the work clamp from the work.

RANGER 10-LX



OPERATION

SUMMARY OF WELDING PROCESSES AND MACHINE SETTINGS

Table B.3 summarizes the requirements for various welding processes you can perform with the RANGER 10-LX.

TABLE B.3 - SUMMARY OF WELDING PROCESSES

Process	Control Cable Used	Idle Mode	Output Control Switch	Wire Feeder Switch	Electrode State When Not Welding	To Start Welding
Stick - CC	No	Auto	At Welder	No Control Cable	Hot	Touch electrode to work. Welding starts immediately and engine goes to high idle.
TIG - CC K930-1/K936-1 (With Amptrol)	Yes	Auto	Remote	With Control Cable	Cold	Press Amptrol. Welding starts immediately.
Wire Feed - CV, LN-25 with 42V Remote Control Kit	Yes	Auto	Remote	With Control Cable	Cold	Press gun trigger, RANGER 10-LX contactor closes. Welding starts immediately and engine goes to high idle.
Wire Feed - CV LN-25 with internal contactor	No	Auto	At Welder	No Control Cable	Cold	Press gun trigger, LN-25 contactor closes. Welding starts immediately and engine goes to high idle.
Wire Feed - CV, LN-7 or LN-8	Yes	High	Remote	With Control Cable	Cold	Press gun trigger, RANGER 10-LX contactor closes. Welding starts immediately.

RANGER 10-LX



AUXILIARY POWER

⚠ WARNING

Be sure that any electrical equipment plugged into the generator AC power receptacles can withstand a $\pm 10\%$ voltage and a $\pm 3\%$ frequency variation.

GENERAL INFORMATION

The RANGER 10-LX generator is rated at 10,000 continuous watts. It provides both 115 volt and 230 volt power. You can draw up to 87 amps total, but no more than 20 amps (15 amps CSA) from each 115V receptacle at once. Up to 43.5 amps can be drawn from the single 230 volt receptacle.

The current rating of any plug used must be at least equal to the current load being drawn from the receptacle. Do not try to connect the receptacles in parallel.

Electrical loads in watts are calculated by multiplying the voltage rating of the load by the number of amps it draws. (This information is given on the load device nameplate.) For example, a device rated 115 volts, 2 amps will need 230 watts of power ($115 \times 2 = 230$).

You can use **Table B.5**, GENERATOR POWER APPLICATIONS, to determine the wattage requirements of some common types of loads you can power with the RANGER 10-LX. Be sure to read the notes at the bottom of the table.

Powering Motors

You can start most 1.5 HP, single-phase electric motors if there is no load on the motor or other load connected to the RANGER 10-LX. After starting, the motor may be run at full load. Larger motors (up to 2 HP) may be started and run as long as you don't exceed the current rating of the receptacle. This may mean that only 230 volt motors of this size may be operated.

Using Auxiliary Power and Welding at the Same Time

It is possible to weld and use the RANGER 10-LX for auxiliary power at the same time. However, the size of the loads you can power is reduced when you weld. See **Table B.4** in this section of the manual for a list of permissible simultaneous welding and load ratings. The table assumes that power is being drawn from either a 115 volt or the 230 volt receptacle, but not both at the same time.

NOTE: For simultaneous welding and power, set the OUTPUT CONTROL at "10" for maximum auxiliary power. At settings below "10," only incandescent loads should be connected to the auxiliary receptacles.

To use the generator as an auxiliary power supply:

1. Start the engine. See **Engine Operation** in this section of the manual.
2. Set the IDLER CONTROL to the desired operating mode, HIGH or AUTO. Set the OUTPUT CONTROL to "10." See **Figure B.1**.
3. Plug the load(s) into the appropriate 115 volt or 230 volt power receptacle.

NOTE: The 115 volt auxiliary power receptacles should only be used with three-wire grounded type plugs or approved double insulated devices with two-wire plugs.

OPERATION

TABLE B.4 - SIMULTANEOUS WELDING AND AUXILIARY POWER

Output Selector Setting	Welding Output	Permissible Power in Watts (Unity Power Factor)	Permissible Auxiliary Current in Amperes	
			@ 115V	@230V
250 200	250 200	None 3000	— 26	— 13
160 120	160 120	3500 5500	30 48	15 24
90 65 45	90 65 45	6500 7500 8500	56 65 74	28 32.5 37
CV Low	200 40	7000 9500	60 82	30 41
CV Medium Low	250 60	5500 8500	48 74	24 37
CV Medium High	250 80	3500 7000	30 60	15 30
CV High	250 100	1500 6000	13 52	6.5 26

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OPERATION

**TABLE B.5
TYPICAL GENERATOR POWER APPLICATIONS**

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

NOTES:

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

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

Multiple loads can be used as long as the total load does not exceed 10,000 watts. Be sure to start the largest loads first. For example, a 1 HP motor needs approximately 1,000 watts while running but may require 2,500 watts to start. Some inductive motors may require as much as 4 times running watts to start.

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ACCESSORIES

OPTIONS/ACCESSORIES

The following options/accessories are available for your RANGER 10-LX from your local Lincoln Distributor.

Two-Wheel Trailer (K768) – For in-plant or yard towing of the RANGER 10-LX. (Not intended for highway towing as equipped. For highway use of this trailer, consult applicable federal, state, and local laws about possible requirements for brakes, lights, fenders, etc.)

Power Plug Kit (K802-N) – Provides four 20 amp, 115 volt plugs and one 50 amp, dual voltage (115/230V), full kVA plug. NOTE: For CSA machines and machines with GFCI receptacles, use Power Plug Kit K802-R.)

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

Accessory Kit (K702) – Includes the following:

- Thirty-five feet (10.5 meters) of #2 AWG electrode cable
- Thirty feet (9.1 meters) of #2 AWG work cable
- Headshield with No. 12 filter.
- GC300 work clamp
- Cooltong® 300 insulated electrode holder

The cables are rated at 250 amps, 40% duty cycle.

Spark Arrester Kit (K903-1) – A field-installed kit for the RANGER 10-LX engine muffler exhaust pipe (either engine option). Includes a heavy-gauge steel, approved spark arrester, mounting clamp and adapter.

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

GFCI Receptacle Kit (K896-1) – Includes two UL approved 115 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 115 volt duplex receptacles.

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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 RANGER 10-LX TO WIRE FEEDERS USING K867 UNIVERSAL ADAPTER (SEE FIGURE C.1)

NOTE: When you use the RANGER 10-LX with non-Lincoln Electric wire feeders or with certain earlier models of Lincoln wire feeders, you will require the K867 Universal Adapter. The following discussion and connection diagram explain in general how to make the proper connections.

1. Shut the welder off.
2. Connect the electrode cable from the wire feeder to the "ELECTRODE" terminal of the welder. Connect the work cable to the "TO WORK" terminal of the welder.

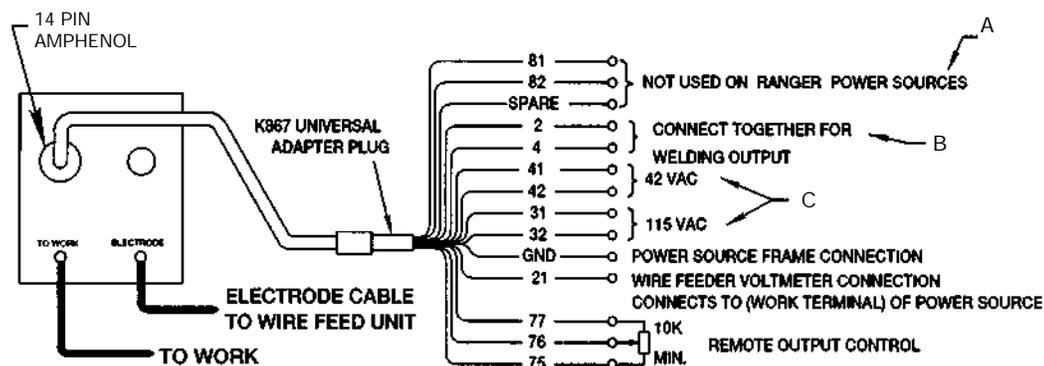
NOTE: Welding cable must be sized for current and duty cycle of application.

3. Connect the K867 Universal Adapter to the 14 pin amphenol of the RANGER 10-LX as shown in Figure C.1. Make the proper connections for local or remote control according to Figure C.1 and the following NOTES, indicated on the figure:
 - A. These leads are not used for the RANGER 10-LX. Insulate each unused lead individually.
 - B. For wire feeders that return a signal for welding output, use an isolation relay to close leads 2 and 4.
 - C. Refer to the **Operation** section of this manual for maximum auxiliary current draw.
4. Set the welder "polarity" switch to the desired polarity, either DC (-) or DC (+).
5. Set the "RANGE" switch to the "WIRE FEED" position.
6. 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.

FIGURE C.1 – RANGER 10-LX/K867 UNIVERSAL ADAPTER CONNECTION DIAGRAM



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- Place the WIRE FEEDER switch in the "WITH CONTROL CABLE" position.
- Adjust wire feed speed at the wire feeder and set the welding voltage with the output "CONTROL" to a CV (constant voltage) position at the welder.

NOTE: If optional remote control is used, place the output control switch in the "CONTROL REMOTE" position.

CONNECTION OF THE LN-25 TO THE RANGER 10-LX "ACROSS THE ARC" (SEE FIGURE C.2.)

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

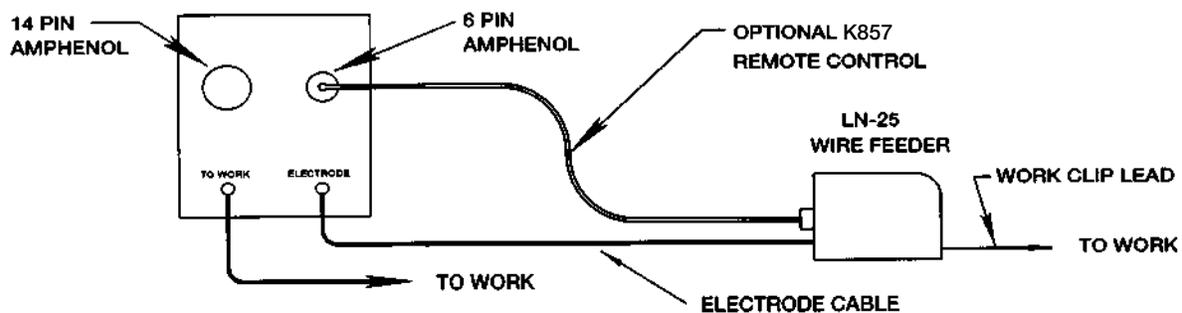
NOTE: Welding cable must be sized for current and duty cycle of application.

- Set the welder "polarity" switch to the desired polarity, either DC (-) or DC (+).
- Set the "RANGE" switch to the "WIRE FEED" position.
- Attach the single lead from the LN-25 control box to the work using the spring clip on the end of the lead. This is only a control lead — it carries no welding current.

- Place the "IDLER" switch in the "AUTO" position.
- Place the WIRE FEEDER switch in the "NO CONTROL CABLE" position.
- Adjust wire feed speed at the LN-25 and adjust the welding voltage with the output "CONTROL" at the welder.

NOTE: If optional remote control is used, place the output control switch in the "CONTROL REMOTE" position.

FIGURE C.2 – RANGER 10-LX/LN-25 ACROSS THE ARC CONNECTION DIAGRAM



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CONNECTION OF THE LN-7 TO THE RANGER 10-LX USING K584 INPUT CABLE ASSEMBLY (SEE FIGURE C.3.)

NOTE: If your LN-7 comes equipped with a K291 or K404 Input cable, refer to **Connection of the LN-7 Using K867 Universal Adapter**, rather than this discussion, to connect your RANGER 10-LX for wire feed welding.

1. Shut the welder off.
2. Connect the electrode cable from the K584-XX Input Cable Assembly to the "ELECTRODE" terminal of the welder and to the LN-7 wire feeder. Connect the work cable to the "TO WORK" terminal of the welder.

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

3. Connect the input cable from the K584-XX Input Cable Assembly to the 14 pin amphenol on the RANGER 10-LX and the input cable plug on the LN-7.
4. Set the welder "polarity" switch to the desired polarity, either DC (-) or DC (+).
5. Set the "RANGE" switch to the "WIRE FEED" position.
6. Place the "IDLER" switch in the "HIGH" position.

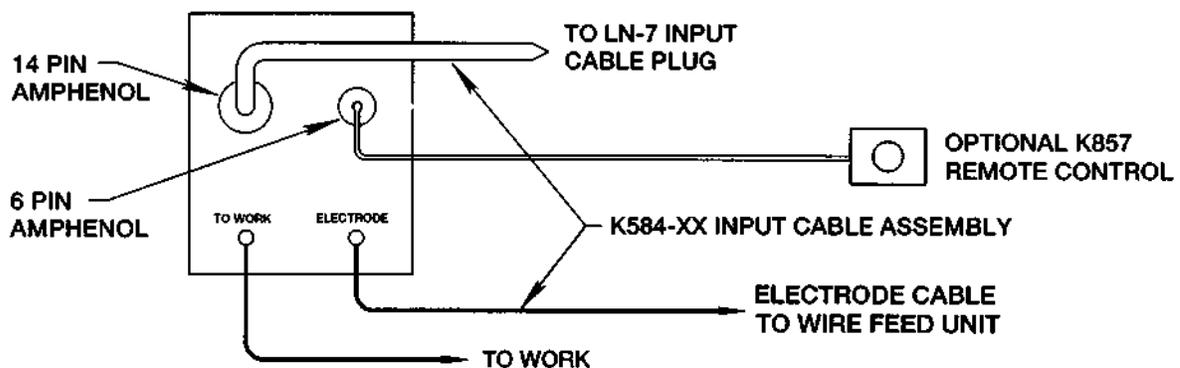
⚠ CAUTION

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.

7. Place the WIRE FEEDER switch in the "WITH CONTROL CABLE" position.
8. Adjust wire feed speed at the LN-7 and set the welding voltage with the output "CONTROL" at a CV (constant voltage) position at the welder.

NOTE: If optional remote control is used, place the output control switch in the "CONTROL REMOTE" position.

FIGURE C.3
RANGER 10-LX/LN-7 WITH K584 INPUT CABLE ASSEMBLY CONNECTION DIAGRAM



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ACCESSORIES

CONNECTION OF THE LN-7 TO THE RANGER 10-LX USING K867 UNIVERSAL ADAPTER (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 "TO WORK" terminal of the welder.

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

3. Connect the K867 Universal Adapter to the LN-7 wire feeder and the 14 pin amphenol of the RANGER 10-LX as indicated in Figure C.4. Make the proper connections for local or remote control according Figure C.4 and the following NOTES, indicated on the figure.
4. Set the welder "polarity" switch to the desired polarity, either DC (-) or DC (+).
5. Set the "RANGE" switch to the "WIRE FEED" position.
6. Place the "IDLER" switch in the "HIGH" position.

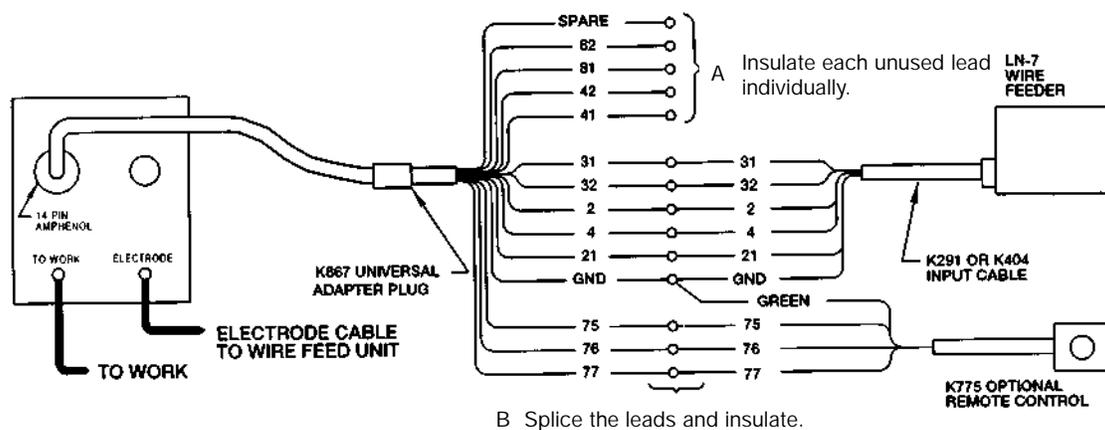
⚠ CAUTION

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.

7. Place the WIRE FEEDER switch in the "WITH CONTROL CABLE" position.
8. Adjust wire feed speed at the LN-7 and set the welding voltage with the output "CONTROL" to a CV (constant voltage) position at the welder.

NOTE: If optional remote control is used, place the output control switch in the "CONTROL REMOTE" position.

FIGURE C.4
RANGER 10-LX/LN-7 WITH K867 ADAPTER CONNECTION DIAGRAM



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CONNECTION OF THE LN-8 TO THE RANGER 10-LX (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 "TO WORK" terminal of the welder.

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

3. Connect the K867 Universal adapter to the LN-8 wire feeder and the 14 pin amphenol of the RANGER 10-LX as indicated in Figure C.5. Make the proper connections for local or remote control according to Figure C.5 and the following NOTES, indicated on the figure.

NOTE: If K595 control cable assembly is available, K867 universal adapter is not required.

4. Set the welder "polarity" switch to the desired polarity, either DC (-) or DC (+).
5. Set the "RANGE" switch to the "WIRE FEED" position.
6. Place the "IDLER" switch in the "HIGH" position.

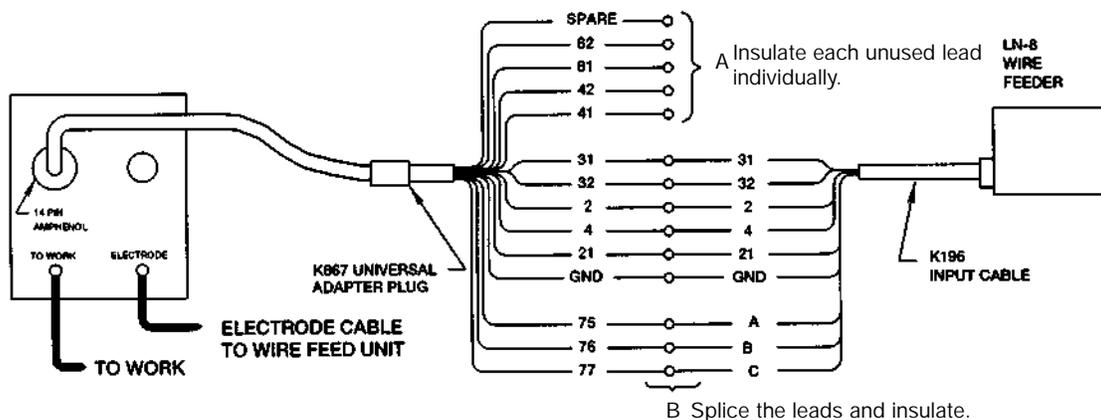
⚠ CAUTION

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.

7. Place the WIRE FEEDER switch in the "WITH CONTROL CABLE" position.
8. Adjust wire feed speed at the LN-8 and set the welding voltage with the output "CONTROL" to a CV (constant voltage) position at the welder.

NOTE: If optional remote control is used, place the output control switch in the "CONTROL REMOTE" position.

FIGURE C.5
RANGER 10-LX/LN-8 CONNECTION DIAGRAM



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CONNECTION OF THE K488 SG CONTROL MODULE AND K487 MAGNUM SPOOL GUN TO THE RANGER 10-LX (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 "TO WORK" terminal of the welder.

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

3. Connect the K691-10 Input Cable to the SG Control Module and the 14 pin amphenol of the RANGER 10-LX as indicated in Figure C.6.
4. Set the slide switch on the SG Control Module to the "Lincoln" position.

⚠ CAUTION

Be sure this 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 10-LX.

5. Set the welder "polarity" switch to the desired polarity, either DC (-) or DC (+).
6. Set the "RANGE" switch to the "WIRE FEED" position.
7. Place the "IDLER" switch in the "HIGH" position.

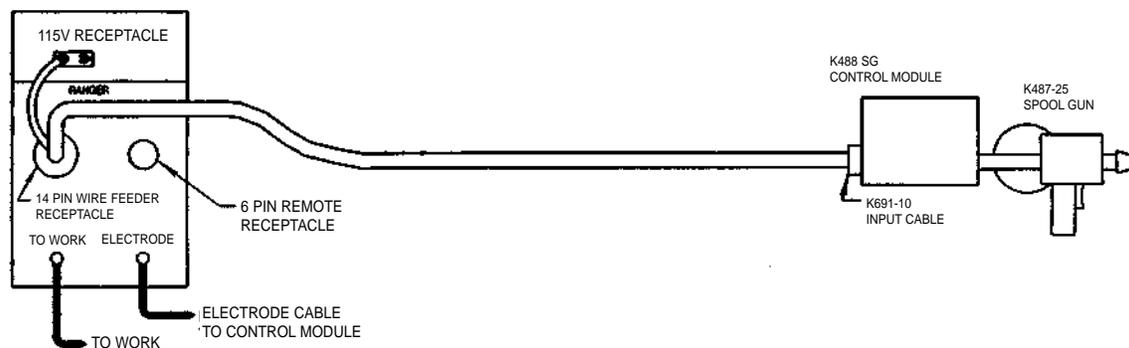
⚠ CAUTION

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.

8. Place the WIRE FEEDER switch in the "WITH CONTROL CABLE" position.
9. Adjust wire feed speed at the SG Control Module and set the welding voltage with the output "CONTROL" to a CV (constant voltage) position at the welder.

NOTE: If optional remote control is used, place the output control switch in the "CONTROL REMOTE" position.

FIGURE C.6
RANGER 10LX/K691-10/K488/K487 SPOOL GUN CONNECTION DIAGRAM



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SAFETY PRECAUTIONS

⚠ WARNING

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

Read the Safety Precautions in the front of this manual and in the instruction manual for the Kubota diesel engine used with your machine before working on the RANGER 10-LX.

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

ROUTINE AND PERIODIC MAINTENANCE

ENGINE MAINTENANCE

⚠ CAUTION

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

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



OIL: Check the oil level before starting engine or daily. **BE SURE TO MAINTAIN THE OIL LEVEL.** Change the oil the first time after 50 hours of operation. Then, under normal operating conditions, change the oil as specified in **Table D.1**. If the engine is operated under heavy load or in high ambient temperatures, change the oil more frequently.

CHANGE THE OIL

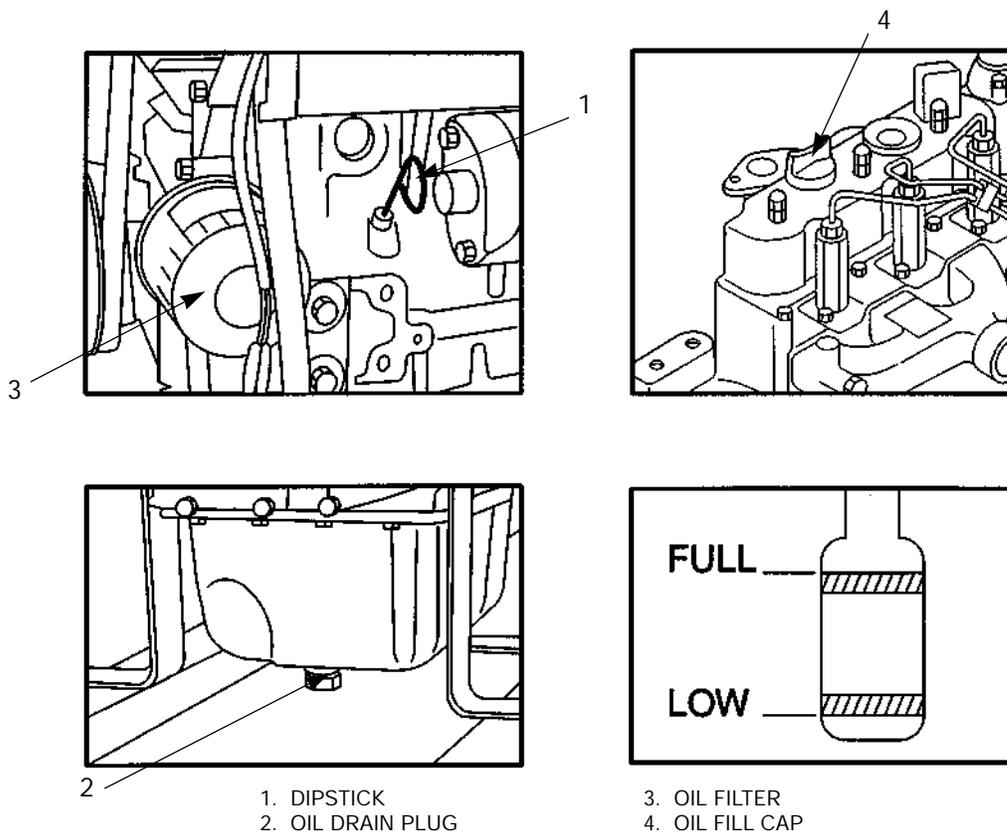
Change the oil, while the engine is still warm, as follows:

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. Use high quality detergent oil of API service class CC/CD/CE, oil viscosity grade 10W30. Always check the level with the dipstick before adding more oil.
4. Reinstall the oil fill cap and the dipstick.

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FIGURE D.1 - OIL DRAIN AND REFILL LOCATION



CHANGE THE OIL FILTER

Change the oil filter the first time after 50 hours of operation. Then, under normal operating conditions, change the oil filter after every 200 hours of operation. If the engine is operated under heavy load or in high ambient temperatures, change the oil filter more frequently. See **Table D.1** for recommended maintenance intervals.

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 onto 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 Change the Oil section, above. 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 10-LX 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.

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 oil. Do not use kerosene.

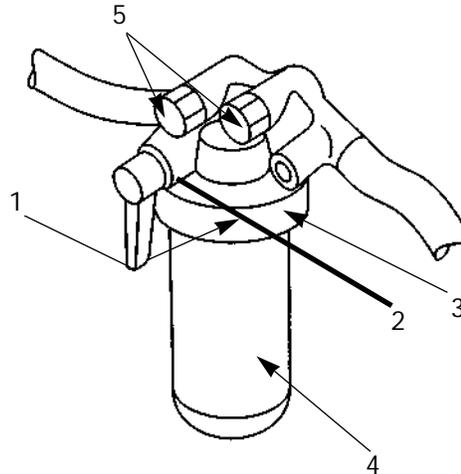
FUEL FILTER: Clean the fuel filter every 100 hours of operation. Be sure to clean the fuel filter regularly. Dust and dirt in the fuel system can cause the injection pump and injection nozzle to wear quickly. Clean the fuel filter as follows (See **Figure D.2**):

1. Close the fuel filter cock.
2. Loosen the ring screw on the top of the filter pot, remove the pot and remove the element from inside the pot. Clean the inside of the pot with clean diesel fuel.
3. Rinse the element with clean diesel fuel.

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FIGURE D.2 - FUEL FILTER



1. COCK - CLOSED
2. COCK - OPEN POSITION
3. RING SCREW
4. FILTER POT (ELEMENT INSIDE)
5. VENT PLUGS

4. Carefully place the element back into the fuel pot. Be careful not to allow any dirt to stick to the element.
5. Reassemble the filter pot and tighten the ring screw at the top.
6. Open the fuel cock and loosen the two air vent plugs a few turns. When bubbles no longer appear around the plugs, screw them back in.
7. Bleed the fuel injection pump. (See the next section.)

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:

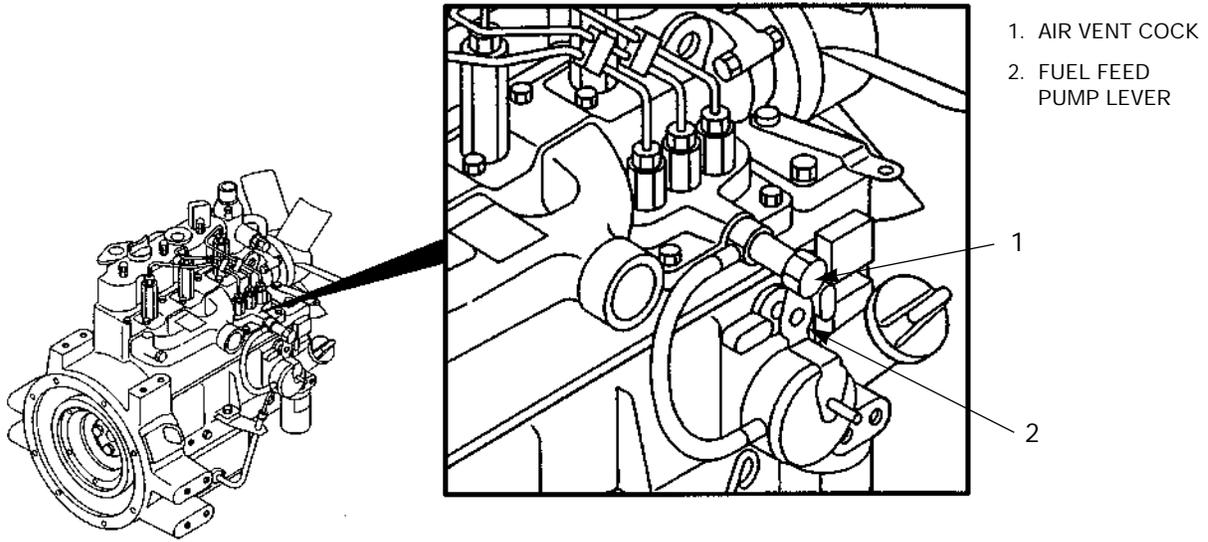
⚠ CAUTION

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.

1. Fill the fuel tank. Open the fuel cock.
2. Loosen the fuel filter air vent plugs a few turns. See Figure D.2. When bubbles no longer appear, tighten the plugs.
3. Open the air vent cock on the top of the fuel injection pump. See **Figure D.3**.
4. Move the fuel feed pump lever by hand.
5. When bubbles no longer appear around the air vent cock on the injection pump, close the cock.

NOTE: Always keep the air vent cock on the fuel injection pump closed except when air is vented. Opening the air vent cock may cause the engine to stop.

FIGURE D.3 – FUEL SYSTEM BLEEDING



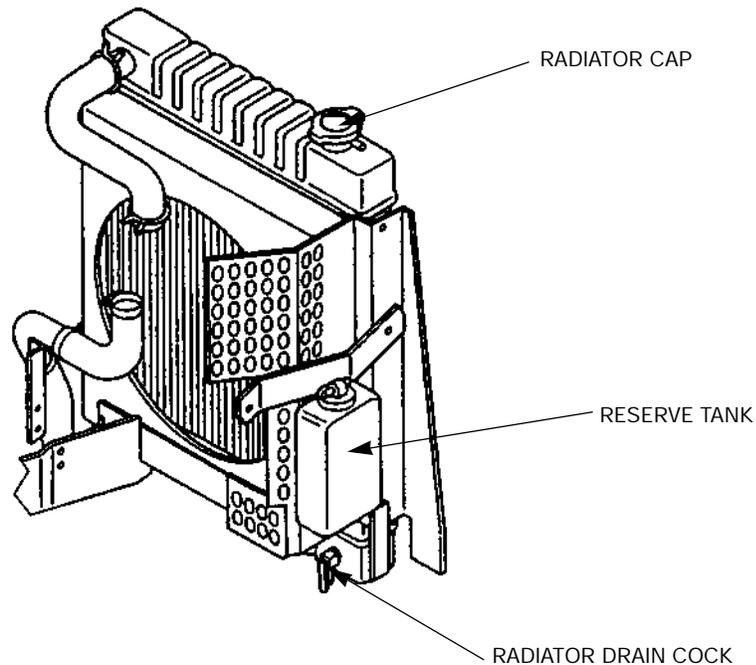
AIR CLEANER: The Kubota diesel engine is equipped with a dry type air filter. Never apply oil to it. Service the air cleaner as follows:

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 686 kPa (7 kgf/cm², 99 psi).
3. If carbon or oil sticks to the element, soak it in detergent for 15 minutes. Then wash the element in water, rinse it with clean water and let it air dry. Check the element for damage before reassembling the air cleaner.
4. Replace the element at least every year or every six cleanings.

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 mid-way between the pulleys. It should deflect about 7 to 9 mm (0.28 to 0.35 in.) under a load of 10 kgf (22.1 lbs.).

Refer to the Kubota Operator's Manual for the adjustment procedure.

FIGURE D.4 – COOLING SYSTEM



CHECKING/ADDING/DRAINING RADIATOR COOLANT: Check the level of coolant in the reserve tank. The level is sufficient if it is between the "FULL" and the "LOW" marks. If the level is below the "LOW" mark, add fresh, water/antifreeze mixture to the "FULL" mark. Check the two drain cocks for tightness (one at the bottom side of the radiator, one on the side of the engine). See Figure D.4.

CLEAN 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.

⚠ WARNING

To avoid personal injury, never remove the radiator pressure cap nor the reserve tank cap while the engine is running under heavy load or immediately after it has stopped. Hot water may gush out, which can scald people nearby.

To drain the cooling system, open both the radiator and the engine drain cocks (Figure D.4). Also open the radiator cap. Tighten both cocks and refill the radiator with fresh coolant. A 50/50 antifreeze/water solution should be used year round.

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MAINTENANCE

TABLE D.1
KUBOTA ENGINE MAINTENANCE SCHEDULE

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

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

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MAINTENANCE

BATTERY MAINTENANCE

⚠ WARNING



GASES FROM BATTERY can explode.

- Keep sparks, flame, and cigarettes away from battery.

To prevent EXPLOSION when:

- **INSTALLING A NEW BATTERY** - Disconnect the negative cable from the old battery first and connect to the new battery last.



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

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



BATTERY ACID CAN BURN EYES AND SKIN.

- Wear gloves and eye protection and be careful when working near a battery. Follow the instructions printed on the battery.

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 (0.113 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 clear 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 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, 495 amps cold cranking.

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 10-LX 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 10-LX 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's normal for the brushes and slip rings to wear and darken slightly. Inspect the brushes when a generator overhaul is necessary. Remove the brushes and clean the slip rings with fine emery paper. Refer to the "Brush Removal and Replacement" procedure in the **Troubleshooting and Repair** section of this manual.

⚠ CAUTION

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

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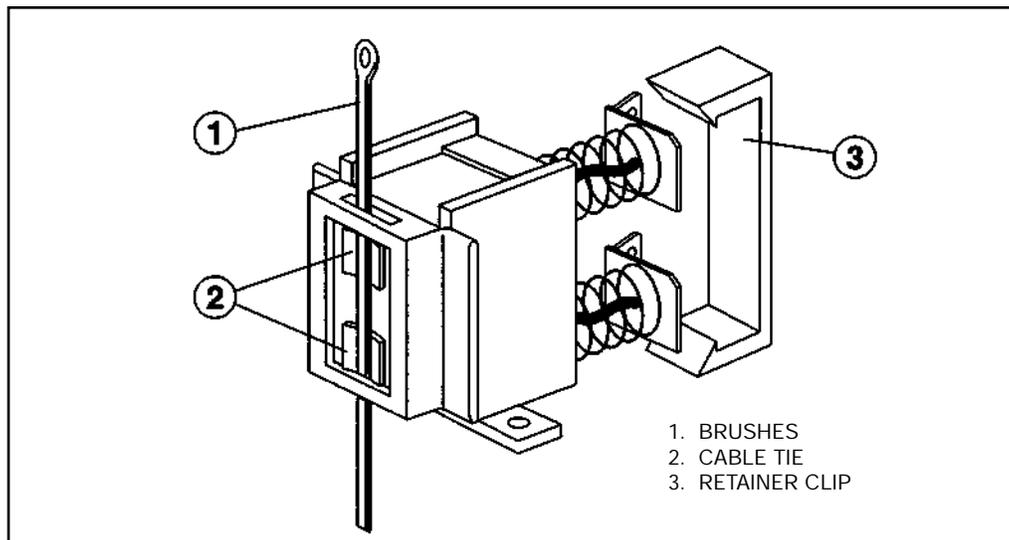


To reinstall the brushes, press them upward and slide a cable tie or wooden stick through the brush holder tabs. See Figure D.5. Install the brush holder into position and secure with the screws previously removed. Remove the cable tie or wooden stick and the brushes will seat onto the slip rings.

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

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

FIGURE D.5 - BRUSH REMOVAL AND REPLACEMENT

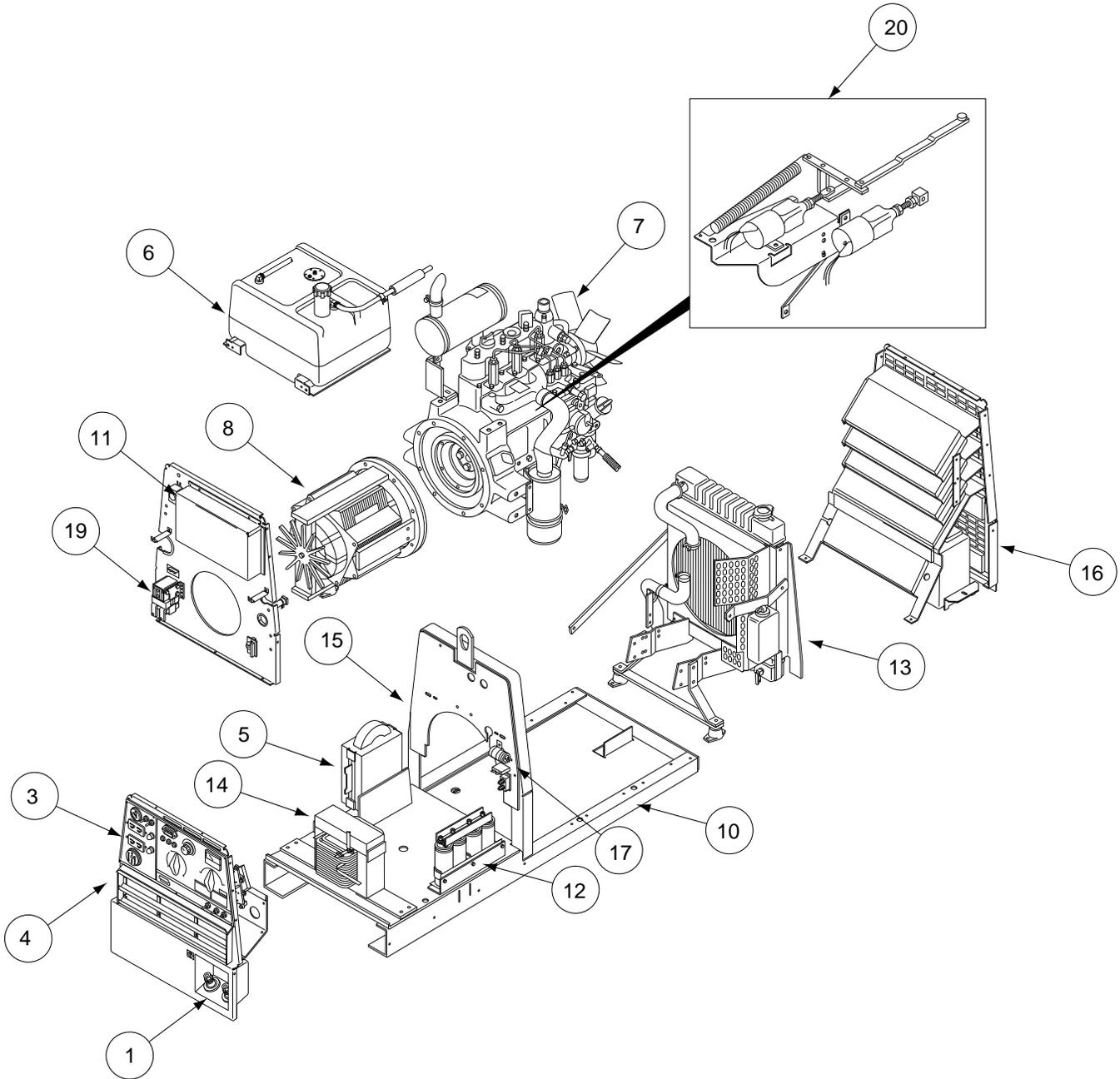


MAINTENANCE

FIGURE D.6 - MAJOR COMPONENT LOCATIONS

1. OUTPUT TERMINALS (LOCATION)
2. ENGINE CONTROLS (on Control Panel)
3. AUXILIARY POWER RECEPTACLES
4. OUTPUT CONTROL PANEL
5. REACTOR ASSEMBLY
6. FUEL TANK
7. DIESEL ENGINE
8. ROTOR/STATOR ASSEMBLY
9. BATTERY (not shown)
10. BASE WELDED ASSEMBLY

11. PC. BOARD COVER
12. CAPACITOR BANK
13. RADIATOR ASSEMBLY
14. CHOKE ASSEMBLY
15. LIFT BAIL WELDED ASSEMBLY
16. CASE BACK ASSEMBLY
17. FIELD CAPACITOR
18. RECTIFIER BRIDGE (on fuel tank rail)
19. CONTACTOR
20. SHUTOFF & IDLER ASSEMBLY



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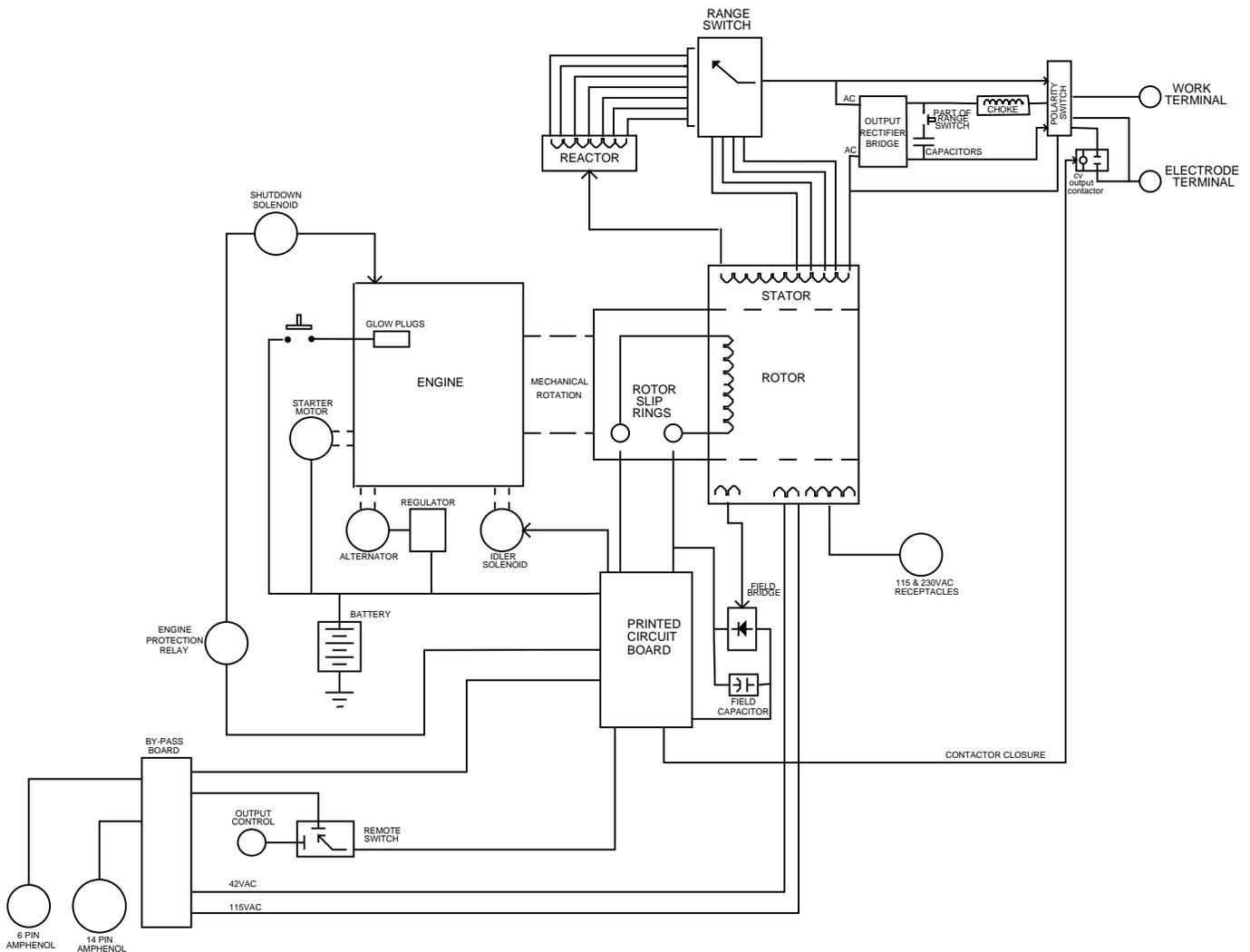
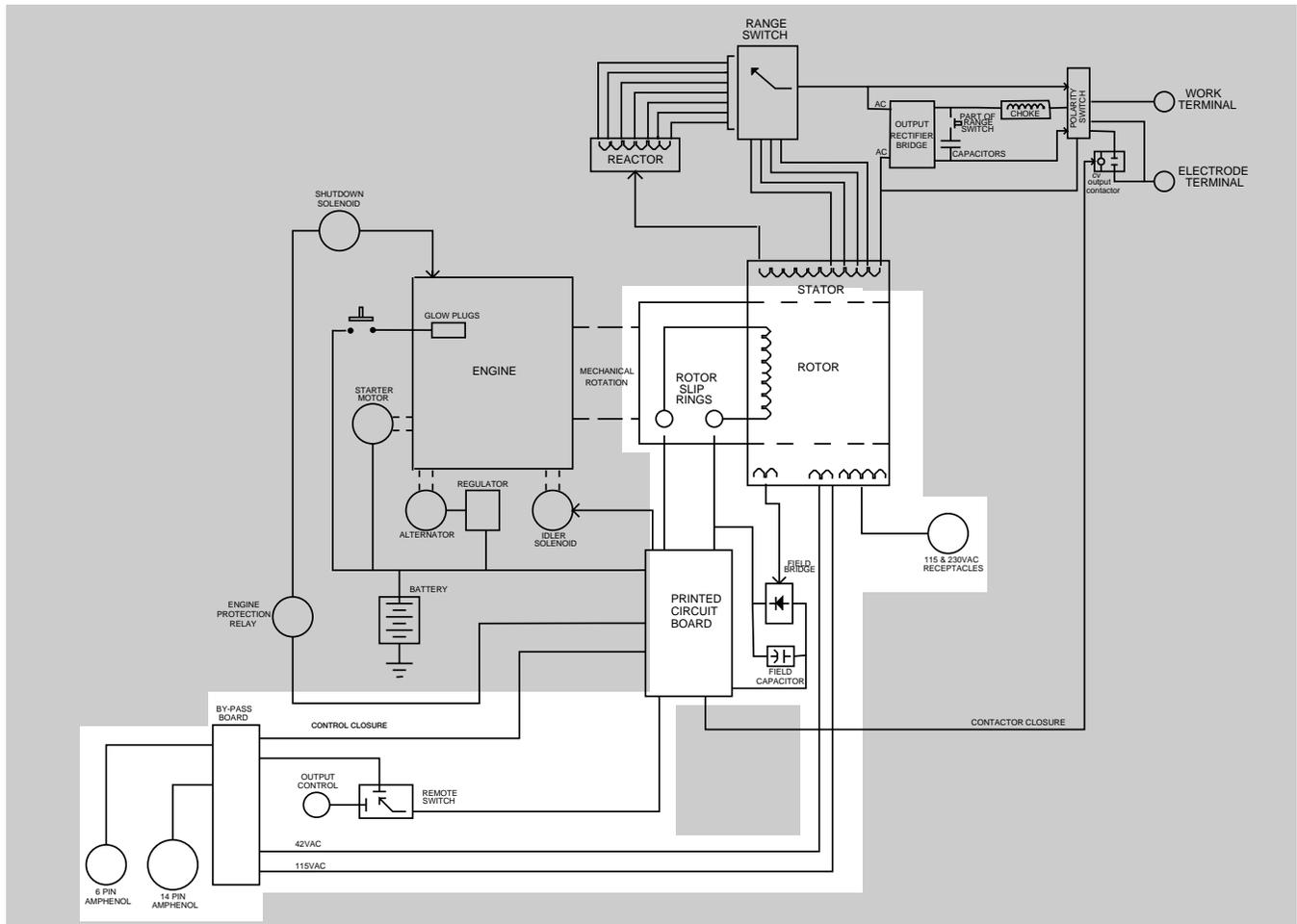


FIGURE E.1 – RANGER 10-LX BLOCK LOGIC DIAGRAM

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

When full field voltage is applied to the rotor and the engine is running at high speed (3700 RPM), a 230AC voltage is developed in the stator auxiliary winding. This winding is tapped to provide 115 VAC. The two voltages (115VAC and 230VAC), are connected to the appropriate receptacles and offer 10,000 watts (total) of AC power.

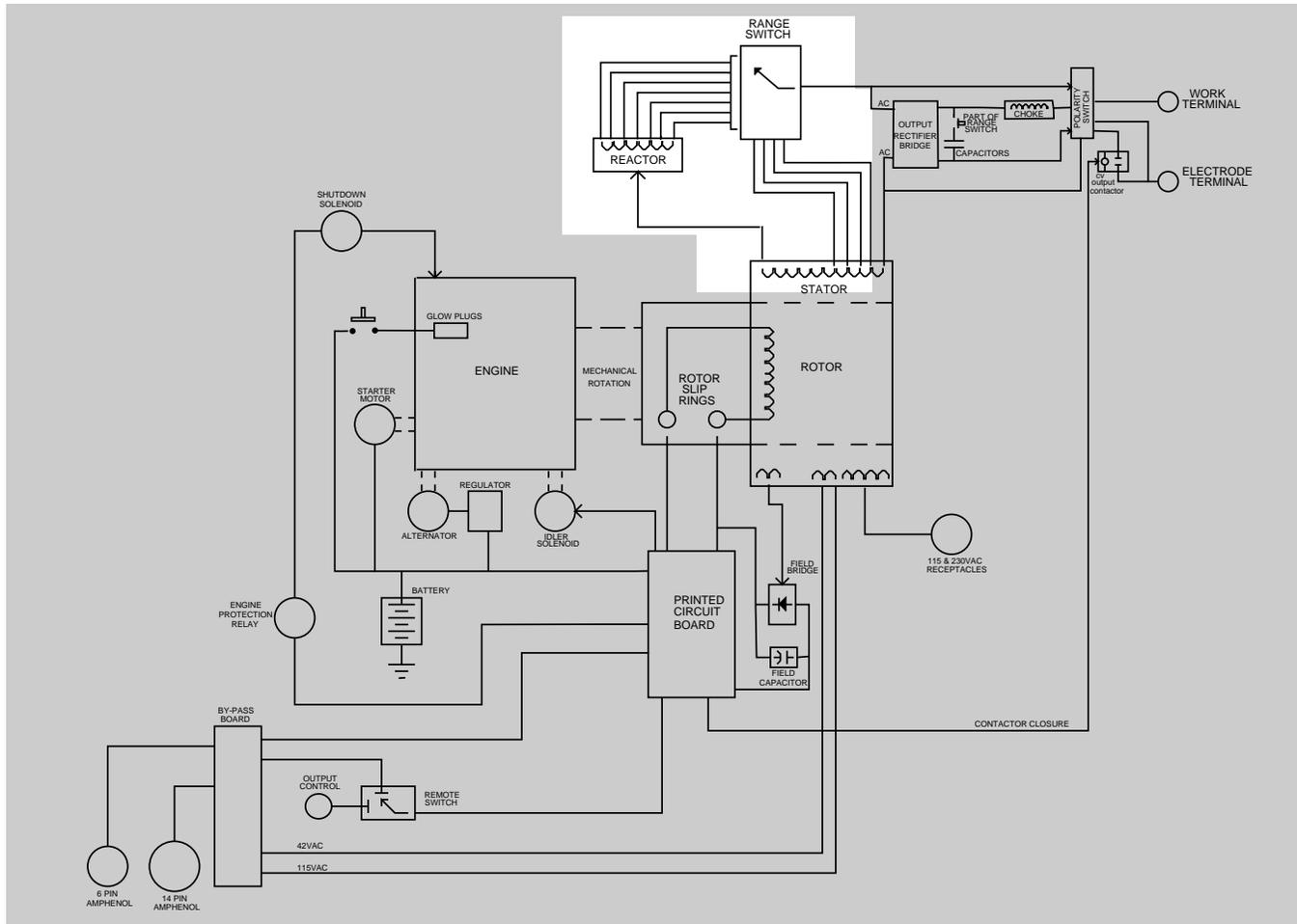
The auxiliary wire feeder winding offers 115VAC and is tapped to also provide 42VAC. The current draw from this winding should be limited to 8 amps. These voltages and remote control signals are fed through the bypass (filter) board to the amphenol receptacles.

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

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



WELD WINDING, REACTOR, AND RANGE SWITCH

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

If a constant voltage is desired for wire feeding, then the reactor is bypassed and the range switch is connected to one of four taps on the stator weld winding to provide a lower but "stiffer" output voltage.

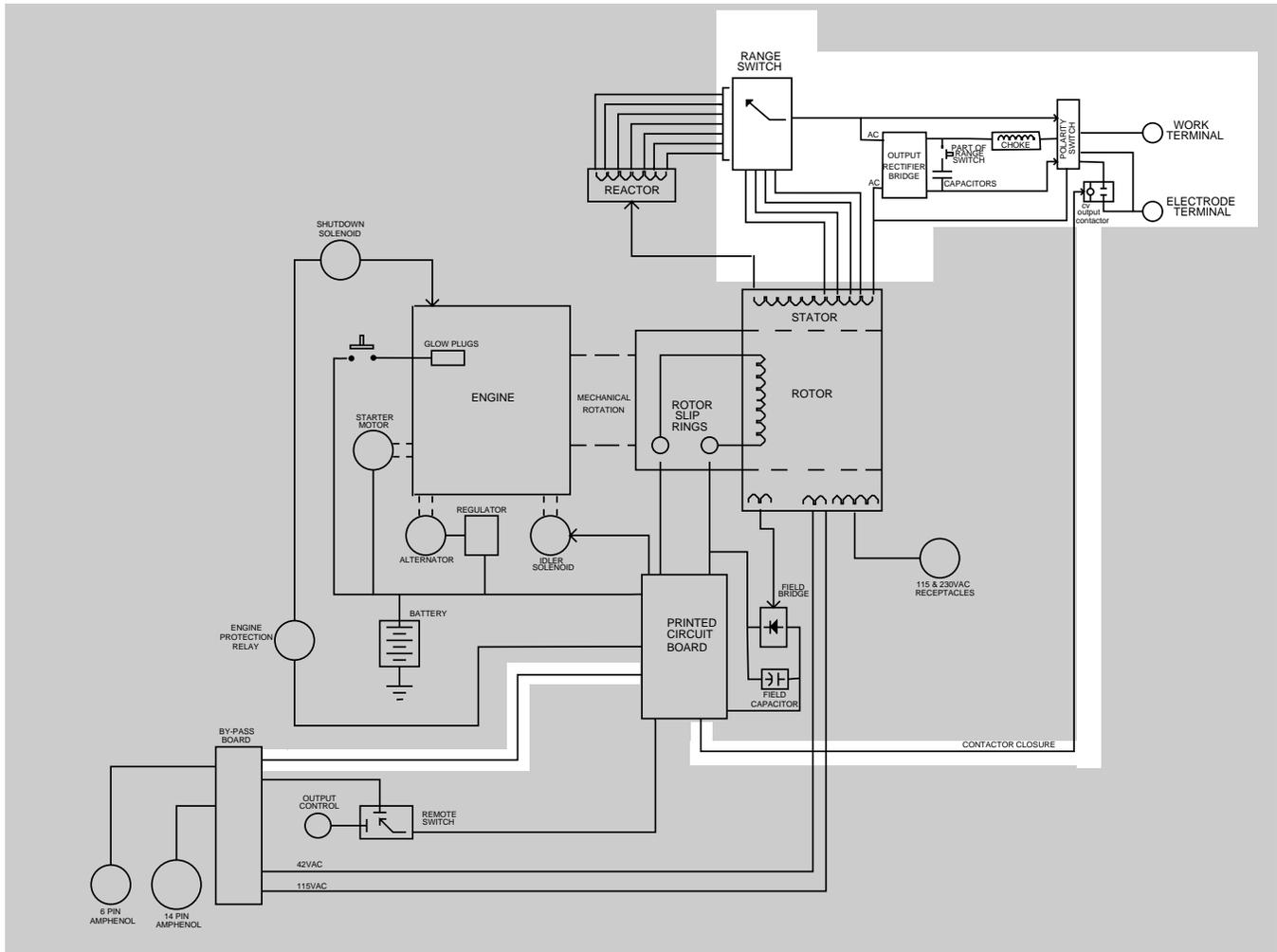
NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion.

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THEORY OF OPERATION

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



OUTPUT BRIDGE, CHOKE, POLARITY SWITCH, CV CONTACTOR AND OUTPUT TERMINALS

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

When a CV (constant voltage) is desired, the reactor is passed by. The range switch applies a lower AC voltage to the rectifier bridge. The DC output of the bridge is filtered and "stiffened" by the capacitors. This lower but "stiffer" DC output is passed through the choke, polarity switch, and CV output contactor to the output terminals. The CV output contactor provides for an electrically "cold" electrode when in the constant voltage mode.

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

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HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

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

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

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

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

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

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

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353.

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PC BOARD TROUBLESHOOTING PROCEDURES

⚠ WARNING**ELECTRIC SHOCK can kill.**

Have an electrician install and service this equipment. Turn the machine OFF before working on equipment. Do not touch electrically hot parts.

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:



ATTENTION
Static-Sensitive
Devices
Handle only at
Static-Safe
Workstations

Reusable
Container
Do Not Destroy

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 unpainted, 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: 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

TROUBLESHOOTING GUIDE

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Major physical or electrical damage is evident.	1. Contact your local Lincoln Authorized Field Service Facility.	1. Contact The Lincoln Electric Service Dept. (216) 383-2531 or 1-800-833-9353 (WELD).
No weld output and no auxiliary power. Engine operates normally.	<ol style="list-style-type: none"> 1. Make sure the REMOTE switch (S7) is in the proper position – "MACHINE CONTROL" if a remote control unit is NOT connected to the machine. 2. Check the brushes for wear and proper contact to the rotor slip rings. 	<ol style="list-style-type: none"> 1. Perform the Rotor Voltage Test. 2. If the Rotor Voltage Test is normal, then perform the Rotor Resistance Test. 3. If the Rotor Voltage Test is NOT normal, perform the Auxiliary and Field Winding Voltage Test. Then check the field diode bridge (D2), the field capacitor (C2), and the Output Control (R1). Replace if necessary. 4. The control board may be faulty. Replace.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353.

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TROUBLESHOOTING GUIDE

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
<p>No weld output, the auxiliary power (230-115VAC) is operating normally. Engine operates normally.</p>	<ol style="list-style-type: none"> 1. If the Polarity mode switch (S1) is in a constant voltage (CV) position, make sure the CV output contactor is activating. 2. With the Polarity mode switch (S1) is in a constant current (CC) position, check the open circuit voltage at the welder output terminals. Normal AC is 70 to 76VAC. Normal DC is 61 to 68VDC. If the OCV is OK, proceed to Step #2., If the OCV is NOT present at the welder output terminals, contact your local Lincoln Authorized Field Service Facility. 3. Check the welding cables, clamps, and electrode holder for loose or broken connections. 	<ol style="list-style-type: none"> 1. If OCV is present in the CC mode but NOT in the CV mode, check the CV output contactor and also the Polarity mode switch (S1). 2. If OCV is absent in both modes (CV and 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 transformer. See 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 correct voltage is present, proceed to step #3. 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. 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. 5. Check the weld output terminals and associated wires for loose or faulty connections. 6. Perform the Output Rectifier Bridge Test.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353.

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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
OUTPUT PROBLEMS		
<p>No auxiliary power at receptacles – welding output is normal – engine runs normally.</p>	<ol style="list-style-type: none"> 1. If the machine is equipped with circuit breakers, check circuit breakers. Reset if tripped. 2. Make sure the output control (R1) is set at the maximum position. 3. Check for loose or faulty plug(s) at the power receptacles. 	<ol style="list-style-type: none"> 1. Check the auxiliary power receptacles and associated wires for loose or faulty connections. 2. Perform the Auxiliary and Field Winding Voltage Test.

▲ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353.

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
<p>Machine has low welding output and low auxiliary output.</p>	<ol style="list-style-type: none"> 1. If a remote control unit is NOT connected to the machine, make sure the REMOTE switch is in the proper position – "MACHINE CONTROL." 2. The brushes may be worn. Contact your local Lincoln Authorized Field Service Facility. 3. The Engine RPM may be low. 	<ol style="list-style-type: none"> 1. If the engine high idle RPM is low, perform the Throttle Adjustment Test. 2. Perform the Rotor Voltage Test. 3. If the rotor voltage is low, the field capacitor (C1) or the field bridge (D2) may be faulty. Test and replace if necessary. 4. Check the output control potentiometer (R1). Normal resistance is 10,000 ohms. Also check associated wiring for loose or faulty connections. 5. The rotor may be faulty. Perform the Rotor Resistance Test. 6. The control board may be faulty. Replace. 7. If the engine high idle RPM is OK, then the engine may have lost horsepower and be in need of major repair.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353.

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
<p>No constant voltage (CV) welding output. Constant current (CC) and the auxiliary power are operating normally.</p>	<ol style="list-style-type: none"> 1. Make sure the Range switch (S2) is in the proper position and "seated" correctly. 2. Put the control cable switch (S8) in the "No control cable" position. If CV output is restored, the output contactor is functioning correctly. Place a jumper wire from pin "D" to Pin "C" in the 14 pin amphenol. If CV output is restored, the problem is in the control cable or wire feeder. If CV output is NOT restored, check the continuity of leads #2 and #4 within the wiring harness. See Wiring Diagram. 3. Make sure the wire feeder and welding cables are connected correctly. 	<ol style="list-style-type: none"> 1. Check the operation of the CV output contactor. Make certain it is "closing" and the contacts have continuity when contactor is activated. See Wiring Diagram. 2. Check the operation of the Range switch (S2), and check the associated wires for loose or faulty connections. See Wiring Diagram. 3. Check the continuity from leads C1, C2, C3, and C4 to lead W1 located in the main stator. See Wiring Diagram.
<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"> 1. Make sure the Range switch (S2) is in the proper position (CV) and "seated" correctly. 2. Make sure the wire feeder and welding cables are connected correctly. 	<ol style="list-style-type: none"> 1. Check the operation of the CV output contactor. Make sure it is "closing" and the contacts have continuity when the contactor is activated. See Wiring Diagram. 2. Check the operation of the Range switch (S2), and check the associated wires for loose or faulty connections. See Wiring Diagram. 3. The capacitor bank (C6, C7, C8, and C9) may be faulty. Check or replace.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353.

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
<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"> 1. Make sure the welding cables and connections are tight. 	<ol style="list-style-type: none"> 1. Check for broken or faulty connections in the sensing leads (#254 and #254A, #241 for CV mode). Make sure their connections are tight at the work output terminal, Polarity mode switch, and CV output contactor. See Wiring Diagram. 2. Make sure leads #254 and #254A are looped three times through the current sensor on the control board. For CV operation, make sure leads #240, #241, and #242 have continuity (zero ohms) from their connection points to the control board plug J2. See Wiring Diagram. 3. If the automatic idle function works correctly in the constant current (CC) mode but NOT in the constant voltage (CV) mode, the control board may be faulty. Replace.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353.

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
<p>The engine will not go to high idle when attempting to weld or when the auxiliary power is loaded. Welding output and auxiliary power output are normal when idler switch is in the "HIGH" position.</p>	<ol style="list-style-type: none"> 1. Make sure the welding cables and auxiliary power lead connections are tight. 2. Automatic idler may not function if the auxiliary power is loaded to less than 150 watts. 3. If using the 115/230 volt receptacle for 115 volts, try using the "other side" of the receptacle. The internal load sensing is only on one side of the receptacle. 	<ol style="list-style-type: none"> 1. Check for broken or faulty connections in the sensing leads (#254, 254A and lead #3). Make sure lead #3 is looped through the current sensor on the control board. 2. The control board may be faulty. Replace.
<p>The engine will not crank or cranks very slowly.</p>	<ol style="list-style-type: none"> 1. Check for loose or faulty battery cable connections. 2. The battery may be faulty. 	<ol style="list-style-type: none"> 1. If the battery is replaced or tests good, then the charging circuit may be faulty. Perform the Charging Circuit Test. 2. The starter motor or starter solenoid may be faulty. 3. The engine may be hard to crank due to a mechanical failure in the engine.

▲ CAUTION

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
<p>The engine cranks but will not start.</p>	<ol style="list-style-type: none"> 1. The engine may be low on or out of fuel. 2. 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. 3. The engine coolant may be overheated, causing the engine protection system to shut off fuel flow to the engine. Check the water temperature light. 4. The engine "glow" plugs may not be operating correctly. 	<ol style="list-style-type: none"> 1. The fuel solenoid may be faulty. Check or replace. 2. The engine protection relay (CR1) may be faulty. Perform the Protection Relay (CR1) Test. 3. The engine may be faulty.

⚠ CAUTION

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
<p>The engine goes to low idle but does not stay in low idle.</p>	<p>1. Make sure there is NOT an external load (auxiliary or weld) connected to the RANGER 10-LX.</p>	<p>1. The idler solenoid linkage may be misadjusted or damaged.</p> <p>2. The idler solenoid (L2) hold-in circuitry may be faulty. Check lead #214 for continuity (zero ohms) from the solenoid to the control board plug 5J1. See Wiring Diagram. With the Ranger 10-LX in the low idle mode, check for 10 to 12VDC from lead #222F to lead #214. If the correct DC voltage is present, the idler solenoid (L2) may be faulty. If the correct DC voltage is NOT present, the control board may be faulty.</p>

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353.

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
Output control on welder not functioning.	<ol style="list-style-type: none"> 1. Make sure the Remote switch (S7) is in the "MACHINE CONTROL" position. 2. The Output Control (R1) may be defective. 	<ol style="list-style-type: none"> 1. Check the Output Control (R1). Normal resistance is 10,000 ohms. Replace if defective. 2. Check the Remote switch (S7) and associated wiring. See Wiring Diagram (leads #75, #76, and #77). 3. The control board may be faulty. Replace.
Remote output control not functioning.	<ol style="list-style-type: none"> 1. Make sure the Remote switch (S7) is in the "REMOTE" position. 2. The remote control unit may be faulty. Repair or replace. 	<ol style="list-style-type: none"> 1. Check the Remote switch (S7) and associated wiring. See Wiring Diagram (leads #75, #76, and #77). 2. The RF bypass board may be defective. Check or replace.

⚠ **CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353.

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
The wire feeder does not work when connected to the welder amphenol.	<ol style="list-style-type: none"> 1. Check circuit breaker CB2. Reset if tripped. 2. The wire feeder control cable may be faulty. Check or replace. 3. The wire feeder may be faulty. Check or replace. 	<ol style="list-style-type: none"> 1. Check for the presence of 115VAC at leads #31A and #32. See Wiring Diagram. 2. Check for the presence of 42VAC at leads #31B to #42. See Wiring Diagram. 3. If any of the above voltages are missing or low, then check the circuit breaker CB2 for proper operation. 4. The RF bypass board may be faulty. Check or replace. 5. Perform the Auxiliary and Field Winding Test.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353.

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
<p>The CV output contactor does not pull in when using a wire feeder with a control cable connected to the RANGER 10-LX amphenol.</p>	<ol style="list-style-type: none"> 1. Make sure the Wire Feeder switch (S8) is in the "WITH CONTROL CABLE" position. 2. 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 10-LX. The wire feeder or control cable may be faulty. 	<ol style="list-style-type: none"> 1. With the jumper installed in pins "D" and "C" in the 14 pin amphenol, check for 12VDC from leads #224F(+) to #2C(-) at the CV output contactor. If 12VDC is present and the contactor does NOT activate, then the contactor may be defective. 2. If the correct voltage is NOT present in Step #1, check from lead #224F to ground (lead #5) for the presence of 12VDC. If 12VDC is present, then check the continuity of lead 2C through the RF bypass board to the 14 pin amphenol. See Wiring Diagram. 3. If 12VDC is NOT present from lead #224F to ground (lead #5), then check the #224F lead for an open circuit. See Wiring Diagram.

⚠ CAUTION

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
The CV output contactor does not pull in when the wire feeder switch (S8) is in the NO CONTROL CABLE position.	1. Make sure the wire feeder is connected correctly to the RANGER 10-LX.	1. Check the Wire Feeder switch (S8) and associated leads. See Wiring Diagram. 2. Check for loose or faulty connections on leads #224F, #2C, #2D, #244, and #243. Also check the sensing leads #240 and #242. 3. Check the Idler switch (S5) and associated leads. See Wiring Diagram. 4. The control board may be faulty.
The CV output contactor does not deactivate (drop out) when a wire feeder with a control cable is connected to the RANGER 10-LX.	1. Make certain the Wire Feeder switch (S8) is in the "WITH CONTROL CABLE" position. 2. The Wire Feeder control cable may be faulty. Check or replace. 3. The wire feeder may be faulty. Check or replace.	1. Check to make sure that lead #2C is not grounded. See Wiring Diagram. 2. Remove lead #224F from the CV output contactor. If the contactor does not deactivate, the contactor may be faulty. Repair or replace.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353.

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
The CV output contactor does not deactivate (drop out) when a wire feeder without a control cable is connected to the RANGER 10-LX.	<ol style="list-style-type: none"> 1. Make sure the wire feeder is connected properly to the RANGER 10-LX. 2. Make sure the Wire Feeder switch (S8) is in the "NO CONTROL CABLE" position. 3. The CV output contactor will normally be activated (closed) if the Idler switch (S5) is in the "HIGH" position. 	<ol style="list-style-type: none"> 1. Remove lead #224F from the CV output contactor. If the contactor does not deactivate, the contactor may be faulty. Repair or replace. 2. The control board may be faulty.
The battery does not stay charged.	<ol style="list-style-type: none"> 1. Check for loose or faulty connections at the battery and engine charging system. 2. The battery may be faulty. Check or replace. 	<ol style="list-style-type: none"> 1. Perform the Charging Circuit Test.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353.

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
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"> 1. Check for loose or faulty connections at the weld output terminals and welding cable connections. 2. The welding cables may be too long or coiled, causing an excessive voltage drop. 	<ol style="list-style-type: none"> 1. Check for the correct open circuit voltage (OCV) at the welding output terminals. If the correct voltage is present at the output terminals, then check for loose connections on the heavy current carrying leads inside the RANGER 10-LX. See Wiring Diagram. 2. If the OCV is low at the welder output terminals, perform the Engine Throttle Adjustment Test. 3. Perform the Output Rectifier Bridge Test. 4. Check for shorted or grounded windings in the reactor and also in the main stator. See Wiring Diagram.

⚠ **CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353.

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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 216-383-2531 or 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). This information will aid the technician in determining if the generator field is operating properly.

MATERIALS NEEDED

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

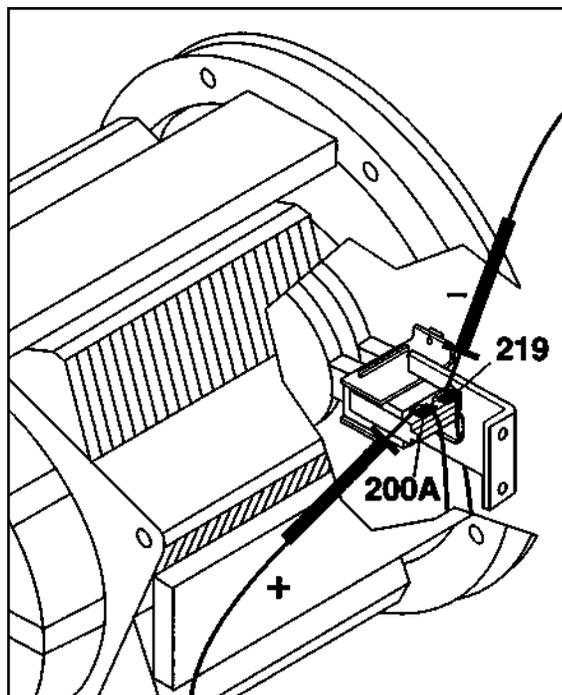
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TROUBLESHOOTING & REPAIR

ROTOR VOLTAGE TEST *(continued)*

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



TEST PROCEDURE

1. With the 5/16" and 3/8" nut driver, remove the sheet metal screws from the right hand case side.
2. Carefully remove the right case side.
3. Set the volt/ohmmeter to the DC volts position.
4. Connect the positive meter probe to the brush nearest the rotor lamination (lead #200A). See Figure F.1 for location.
5. Connect the negative meter probe to the other brush (lead #219).
6. Start the engine and run it at high idle (3700 RPM). Set the output control to the MAXIMUM position (position 10).
7. Check the voltage reading on the voltmeter. It should read between 37 and 47 VDC.
8. 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 (C2), and/or the control board may be faulty.
9. If the voltage reading is normal, the field circuit is functioning properly. Install the right case side with the sheet metal screws and the 5/16" and 3/8" nut drivers.

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ROTOR RESISTANCE TEST

⚠ WARNING

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353 (WELD).

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
Wiring Diagram

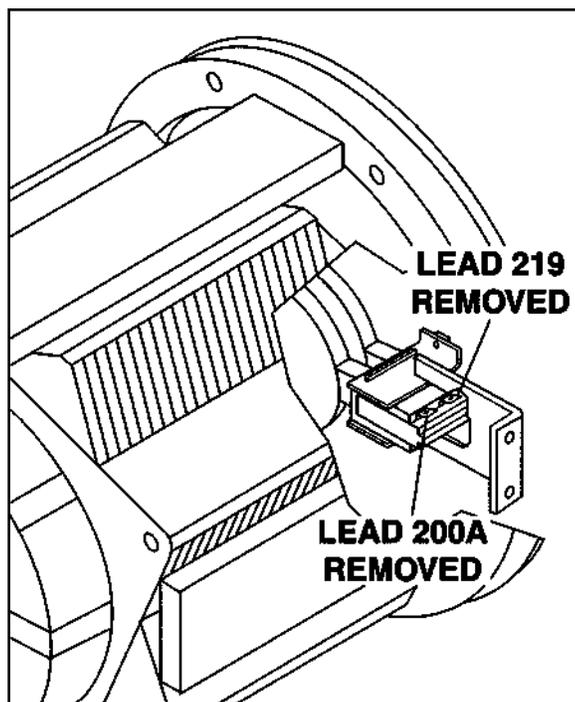
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TROUBLESHOOTING & REPAIR

ROTOR RESISTANCE TEST *(continued)*

FIGURE F.2 – LEADS 200A AND 219 REMOVED



TEST PROCEDURE

1. With the 5/16" and 3/8" nut drivers, remove the sheet metal screws from the right hand case side.
2. Carefully remove the right case side.
3. **Conduct the test with the engine OFF.**
4. Isolate the rotor electrically by removing the generator brush leads. Refer to Figure F.2 as you perform the remaining steps.
5. Remove lead #219 from the negative brush.
6. Remove lead #200A from the positive brush.
7. Measure the resistance across the rotor slip rings.
 - a. Set the ohmmeter on the low scale (X1).
 - b. Place one meter probe on one of the rotor slip rings. Place the other probe on the other slip ring.
 - c. Check the resistance across the slip rings. It should read approximately 5 or 6 ohms.
8. Measure the resistance to ground.
 - A. Set the ohmmeter on the high scale (X100,000).
 - B. Place one probe on either of the slip rings. Place the other probe on any good unpainted ground. The machine ground stud works well.
 - C. Check the resistance. It should read very high, at least 0.5 megohm (500,000 ohms).

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

If the test does meet the resistance specifications, then the rotor is okay.
9. Connect lead #200A to the positive brush, which is the one nearest the rotor lamination. Connect lead #219 to the negative brush.
10. Reinstall the right case side using the sheet metal screws and the 5/16" and 3/8" nut drivers.

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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 216-383-2531 or 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
4/8" Nut driver
Wiring Diagram

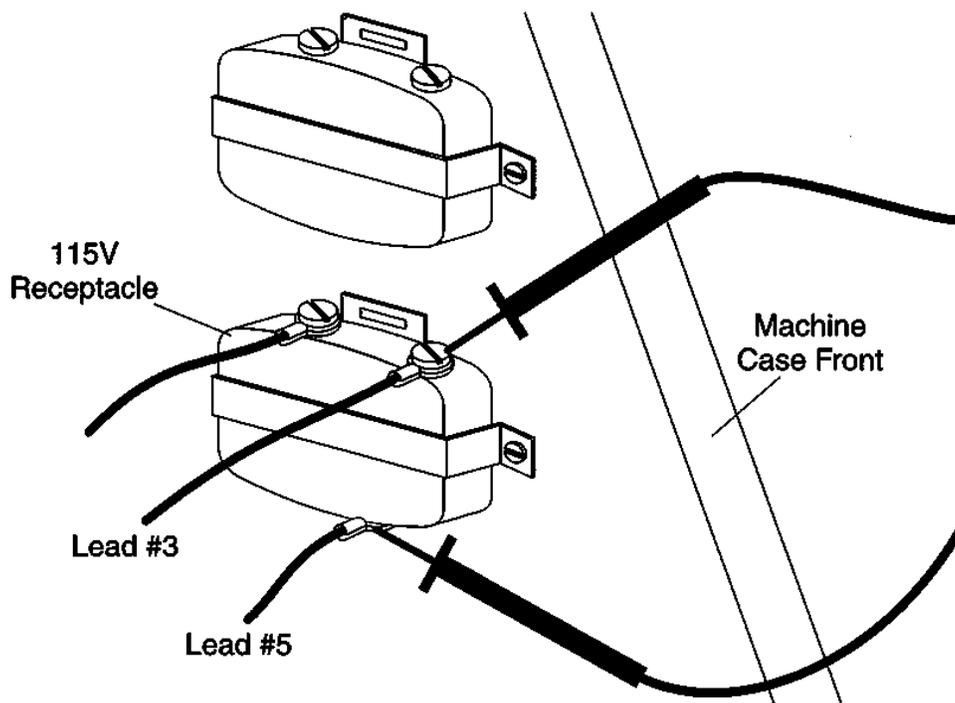
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AUXILIARY AND FIELD WINDING TEST (*continued*)

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



TEST PROCEDURE

To test the 115 VAC winding:

1. With the 5/16" and 3/8" nut drivers, remove the sheet metal screws from the left case side.
2. Carefully remove the left case side.
3. Set the voltmeter to the AC volts position.
4. Connect the voltmeter probes to leads #3 and #5 where they connect to the 115VAC receptacle. See Figure F.3.
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 125VAC.

To test the 230 VAC winding:

1. With the 5/16" and 3/8" nut drivers, remove the sheet metal screws from the left case side.
2. Carefully remove the left case side.
3. Set the voltmeter to the AC volts position.
4. Connect the voltmeter probes to leads #6 and #3 where they connect to the 230 VAC receptacle.

NOTE: It is easier to insert the probes directly into the receptacle to perform this test. However, the probes may not reach in far enough to make or keep a good connection. In this case, before you start the engine, insert two test probes into the receptacle. Hold the test probes firmly in place to measure voltage (step 7).

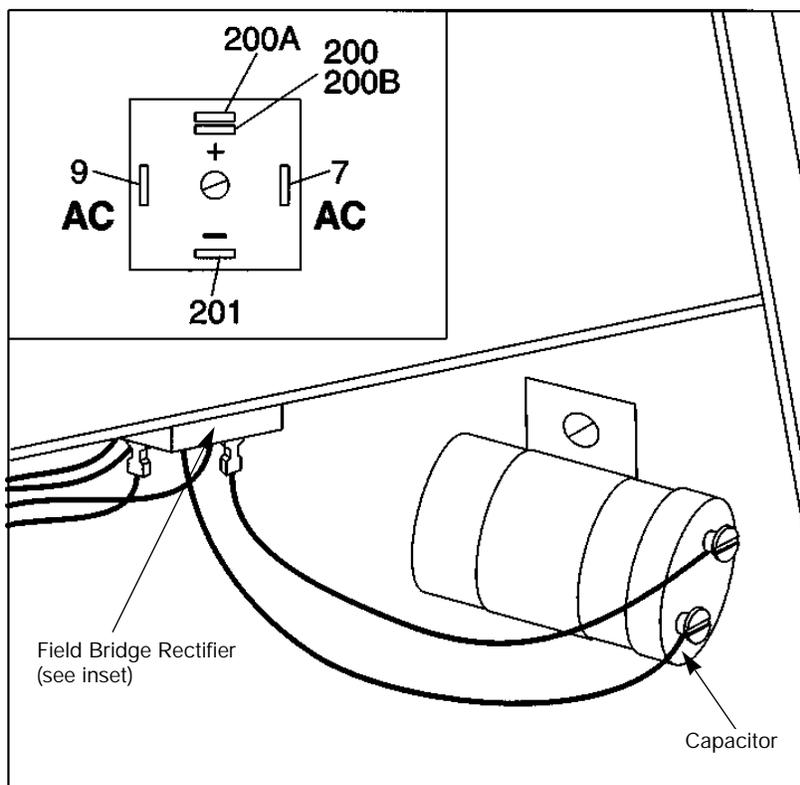
5. Start the engine and run it at high idle (3700 RPM)
6. Set the output control to the maximum position (position 10)
7. Check the AC voltage reading. It should be approximately 240 VAC.

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AUXILIARY AND FIELD WINDING TEST *(continued)*

FIGURE F.4 – 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 sheet metal screws from the right case side.
2. Carefully remove the right case side.
3. Set the voltmeter to the AC volts position.
4. Connect the voltmeter probes to leads #7 and #9 where they connect to the field bridge rectifier. See Figure F.4.
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 between 40 and 47 VAC.

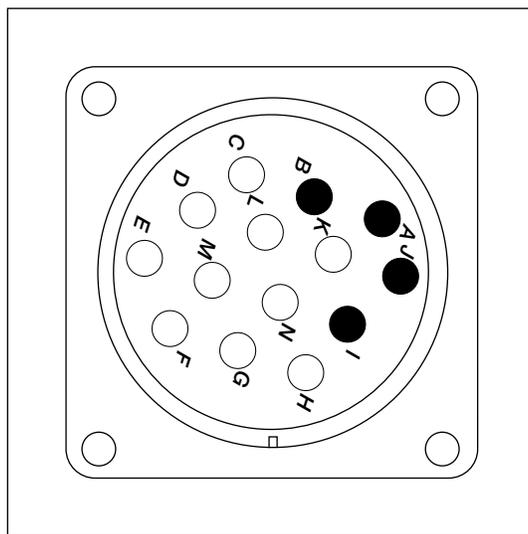
If any one or more of the readings are missing or not within specifications, then check for loose or broken wires between the test points and the stator windings. See the Wiring Diagram. Make sure the windings are NOT grounded internally to the stator iron. If the leads are intact, then the stator may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

7. Reinstall the right case side using the 5/16" and 1/8" nut drivers and sheet metal screws.

TROUBLESHOOTING & REPAIR

AUXILIARY AND FIELD WINDING TEST (continued)

FIGURE F.4A – 14 PIN AMPHENOL PIN ASSIGNMENTS



To test the feeder winding:

1. Using the 5/16" and 1/8" nut drivers, remove the sheet metal screws from the right case side.
2. Carefully remove the right case side.
3. Set the voltmeter to the AC volts position.
4. Connect the voltmeter probes to leads #31 and #32 where they connect to the circuit breaker CB2 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 A (for lead #32) and pin J (for lead #31A). See Figure F.4A. 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 and with one probe at the circuit breaker connection for lead #31 and the other probe at amphenol pin A.

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

9. Connect the voltmeter probes to leads #31 and #42 where they connect to the circuit breaker CB2 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 I (for lead #31B). See Figure 4A. 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.

10. Set the output control to the maximum position. (position 10).
11. 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 correctly.

If any one or more of the readings are missing or not within specifications, then check for loose or broken wires between the test points and the stator windings. See the wiring diagram. Make sure 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.

12. Reinstall the right case side using the 5/16" and 3/8" nut drivers and sheet metal screws.

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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 216-383-2531 or 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

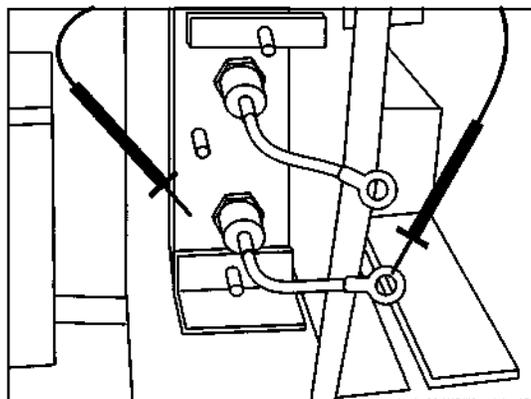
RANGER 10-LX



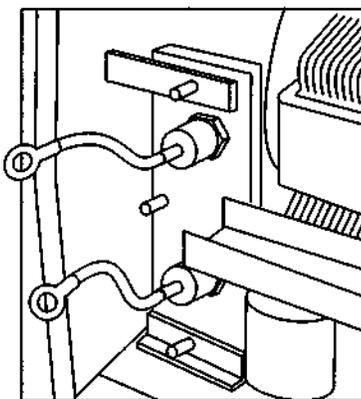
TROUBLESHOOTING & REPAIR

OUTPUT RECTIFIER BRIDGE TEST (continued)

FIGURE F.5 - LOCATION OF OUTPUT RECTIFIER DIODE LEADS



Left side (-)



Right side (+)

TEST PROCEDURE

- Using the 5/16" and 3/8" nut drivers, remove the sheet metal screws from the right and left case sides.
- Carefully remove the right and left case sides.
- Conduct this test with the engine OFF.
- 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.5.
- With the 1/2" wrench, remove the nuts and washers holding the diode pigtails and the heavy current-carrying leads to the studs located at the tops and bottoms of the rectifier plates. Note their locations and the order of fasteners for reassembly.
- Electrically isolate the diode pigtails by carefully bending them out into "free air."
- With an ohmmeter or diode tester, check each of the four diodes from their pigtails to their respective heat sinks.
- 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.
- Replace any "shorted" or "open" diode as the tests indicate.
- Reconnect the diode pigtails and heavy leads to their respective studs.
- Reinstall the left and right case sides using the 5/16" and 3/8" nut drivers and sheet metal screws.

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CHARGING CIRCUIT TEST

⚠ WARNING

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353 (WELD).

TEST DESCRIPTION

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

MATERIALS NEEDED

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

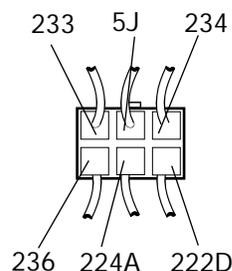
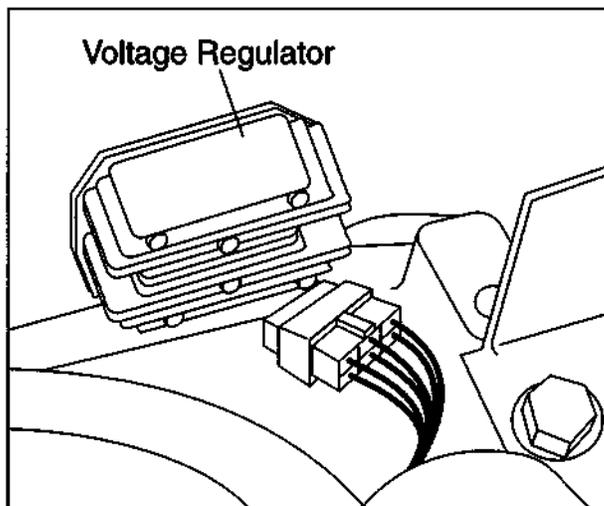
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CHARGING CIRCUIT TEST (continued)

FIGURE F.6 – LOCATION OF VOLTAGE REGULATOR



TEST PROCEDURE

1. With the 5/16" and 3/8" nut drivers, remove the sheet metal screws from the left case side.
2. Carefully remove the left case side.
3. Locate the engine alternator and regulator. See Figure F.6.
4. Start the engine and run it at high idle (3700 RPM).
5. Set the voltmeter for AC volts and measure the AC volts at leads #233 and #234. Normal is between 22 and 26 VAC.
6. Set the voltmeter for DC volts and measure the DC volts at leads #222D to lead #5J (case ground). Normal is 13.5 to 15 VDC.
7. If the correct AC volts are present at leads #233 to #234, the engine alternator is operating correctly. If the voltage is low or missing, the engine alternator may be faulty. Replace.
8. If the correct AC volts are present at leads #233 to #234 but the DC volts are incorrect at leads #222D to lead #5J (case ground), the regulator may be faulty. Before replacing the regulator, check the wiring from the regulator to the alternator and the charging circuit. See the Wiring Diagram.

NOTE: If you test with probes at the plug by the regulator and you get no reading, check the wires back to the alternator. The problem may be in the wiring, not the alternator.

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PROTECTION RELAY (CR1) TEST

⚠ WARNING

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353 (WELD).

TEST DESCRIPTION

This test will determine if the correct DC voltage is being applied to the coil of the relay and also if the relay contacts are functioning properly.

MATERIALS NEEDED

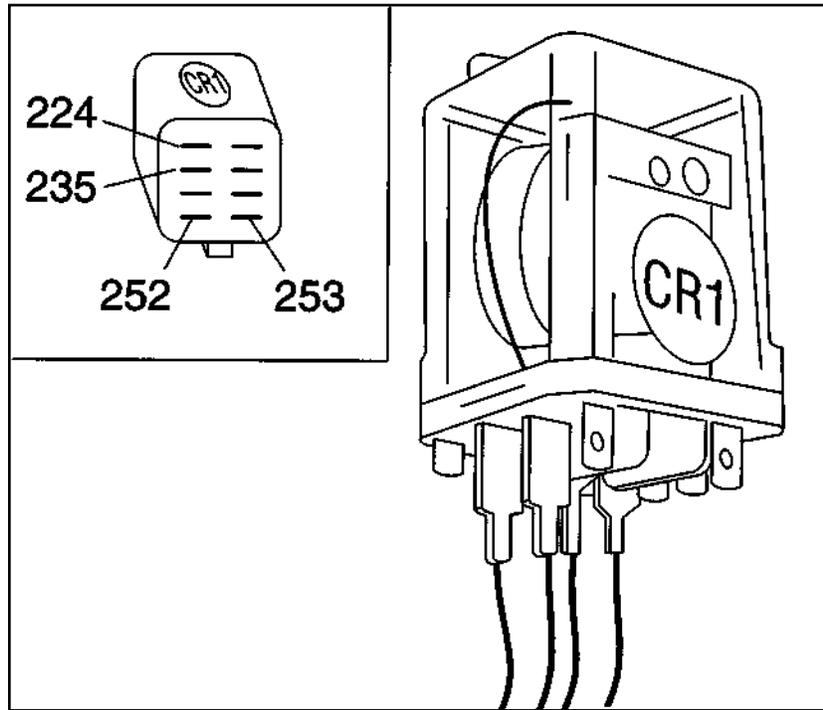
- Volt/Ohmmeter
- 5/16" Nut driver
- 3/8" Nut driver
- 12VDC power supply (battery)

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PROTECTION RELAY (CR1) TEST *(continued)*

FIGURE F.7 - CR1 LEAD CONNECTIONS

**TEST PROCEDURE**

1. Using the 5/16" and 3/8" nut drivers, remove the sheet metal screws from the left case side.
2. Carefully remove the left case side.
3. Conduct this test with the engine OFF.
4. Remove leads #252, #253, #224 and #235 from relay CR1. See Figure F.7.
5. Using the 12VDC power supply, apply 12VDC to the coil terminals "A" and "B" of the relay.
6. Check visually to see if the relay is operating when voltage is applied to the coil terminals. If the relay IS operating, proceed to step #7. If the relay is NOT operating when coil voltage is applied, then check the resistance of the coil. Normal coil resistance is 100 to 150 ohms. If the relay coil is "shorted" or "open," the relay will NOT operate. Replace the relay.
7. With 12VDC applied to the relay coil, use the ohmmeter to check for continuity (zero ohms) from terminals #4 to #7. If zero or a very low resistance is measured, the contacts are okay. If a high or infinite resistance is measured, the contacts are faulty. If NO voltage is applied to the coil terminals, the resistance from #4 to #7 should be infinite.
8. Install the left case side using the 5/16" and 3/8" nut drivers and sheet metal screws.

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 216-383-2531 or 1-800-833-9353 (WELD).

TEST DESCRIPTION

If the machine output is low, 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

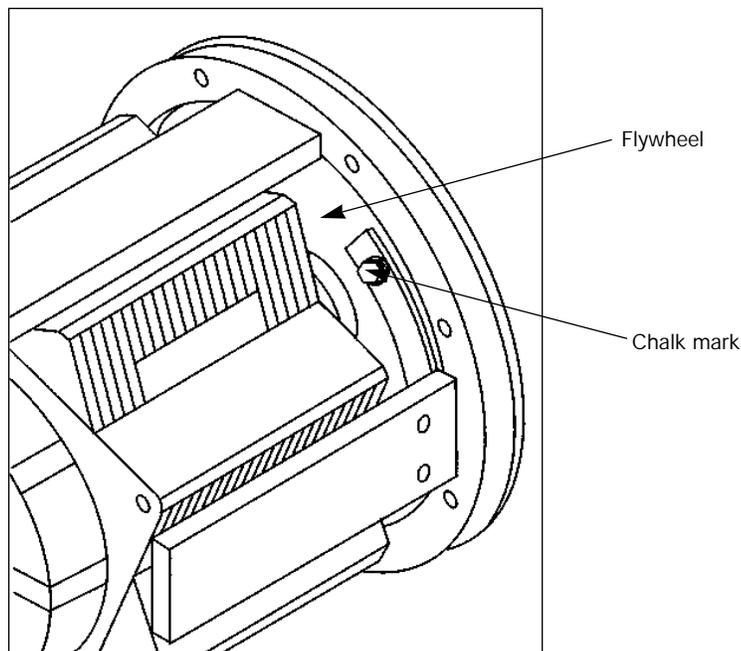
- 5/16" Nut driver
- 3/8" Nut driver
- 1/2" wrench
- 10mm wrench
- 7/16" wrench
- Strobe-tach, frequency counter, or oscilloscope
- Chalk

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ENGINE THROTTLE ADJUSTMENT TEST (*continued*)

FIGURE F.8 – MARK LOCATION, STROBE/TACH METHOD

**TEST PROCEDURE**

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

Strobe-tach Method:

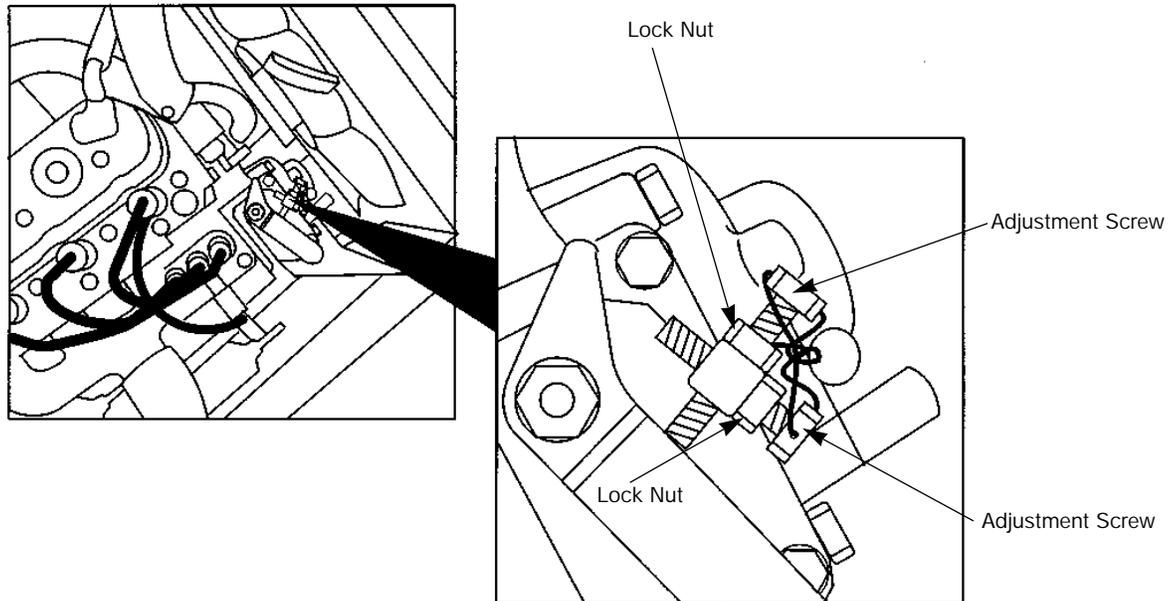
1. With the 5/16" nut drivers, remove the sheet metal screws from the right case side.
2. Carefully remove the right case side.
3. Carefully lift the double door assembly to gain access to the engine compartment.
4. With the chalk, mark one of the flywheel bolts. See Figure F.8 for location. Conduct this procedure with the engine OFF.
5. Connect the strobe-tach according to the manufacturer's instructions.
6. Start the engine and direct the strobe-tach light on the flywheel and synchronize it to the rotating mark.
7. 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.
8. If any of the readings is incorrect, adjust the throttle as follows.

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ENGINE THROTTLE ADJUSTMENT TEST (*continued*)

FIGURE F.9 – HIGH IDLE ADJUSTMENT NUT



Adjust HIGH IDLE: First make sure there is NOT a load on the machine. Use the 10mm wrench to loosen the lock nut. See Figure F.9 for location of adjustment screw and lock nut. With the 10mm wrench turn the adjustment screw counterclockwise to increase the high idle RPM. Note: It is usually NOT necessary to cut or remove the wire and seal. Adjust the speed until the tach reads between 3650 and 3700 RPM.

Adjust LOW IDLE: First make sure there is NOT a load on the machine. Set the IDLE switch to AUTO and wait for the engine to change to low idle speed. Use the 7/16" wrench to loosen the lock nut. See **Figure F.10** for location. Use the 1/2" wrench to adjust the solenoid, which changes the amount of throw in the throttle lever arm. Adjust the nut until the tach reads between 2150 and 2220 RPM.

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 (2200 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. Use the 10mm wrench to loosen the lock nut. See Figure F.9 for location of adjustment screw and lock nut. With the 10mm wrench, turn the adjustment screw counterclockwise to increase the high idle RPM. Note: It is usually NOT necessary to cut or remove the wire and seal. Adjust the speed until the frequency is 63 Hz.

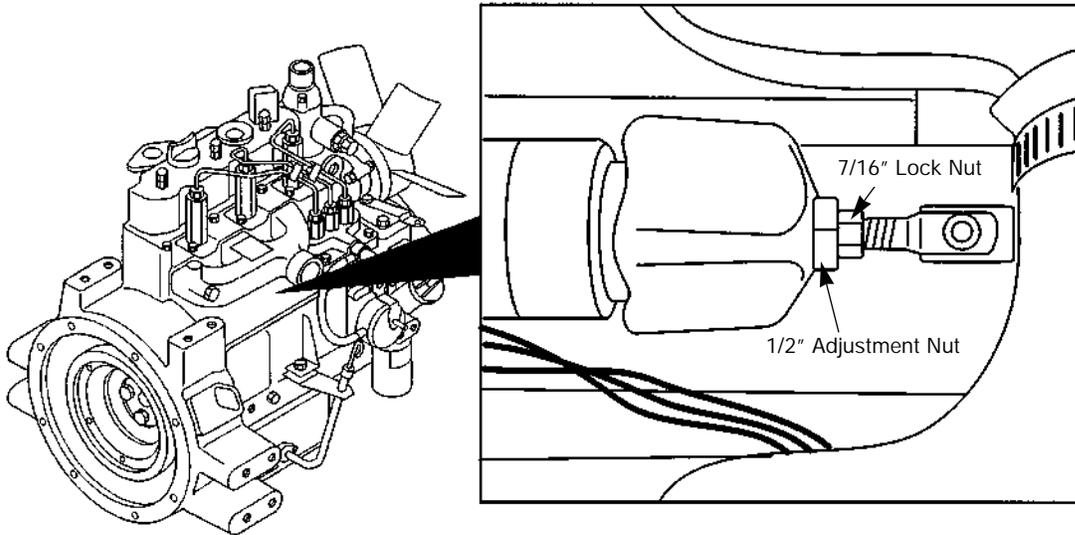
Adjust LOW IDLE: First make sure there is NOT a load on the machine. Set the IDLE switch to AUTO and wait for the engine to change to low idle speed. Use the 7/16" wrench to loosen the lock nut. See **Figure F.10** for location. Use the 1/2" wrench to adjust the solenoid, which changes the amount of throw in the throttle lever arm. Adjust the nut until the frequency is 37 Hz.

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ENGINE THROTTLE ADJUSTMENT TEST (continued)

FIGURE F.10 – LOW IDLE ADJUSTMENT NUT

**Oscilloscope Method:**

1. Connect the oscilloscope to the 115 VAC receptacle, according to the manufacturer's instructions. At 3700 RPM, the waveform should exhibit a period of 15.8 milliseconds. At 2200 RPM, the waveform should exhibit a period of 27.02 milliseconds. Refer to NORMAL OPEN CIRCUIT VOLTAGE WAVEFORM (115 VAC SUPPLY) HIGH IDLE – NO LOAD in this section of the manual.
2. If either waveform periods is incorrect, adjust the throttle as follows:

Adjust HIGH IDLE: First make sure there is NOT a load on the machine. Use the 10mm wrench to loosen the lock nut. See **Figure F.9** for location of the adjustment screw and lock nut. With the 10mm wrench, turn the adjustment screw counterclockwise to increase the high idle RPM. Note: It is usually NOT necessary to cut or remove the wire and seal. Adjust the speed until the period is 15.8 milliseconds.

Adjust LOW IDLE: First make sure there is NOT a load on the machine. Set the IDLE switch to AUTO and wait for the engine to change to low idle speed. Use the 7/16" wrench to loosen the lock nut. See Figure F.10 for location. Use the 1/2" wrench to adjust the solenoid, which changes the amount of throw in the throttle lever arm. Adjust the nut until the period is 27.02 milliseconds.

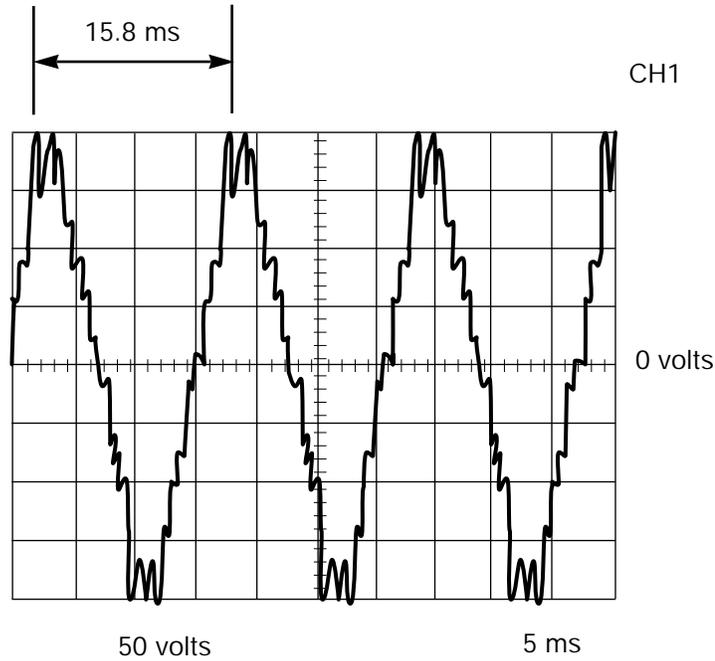
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TROUBLESHOOTING & REPAIR

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 10-LX



Return to Section TOC

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TROUBLESHOOTING & REPAIR

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

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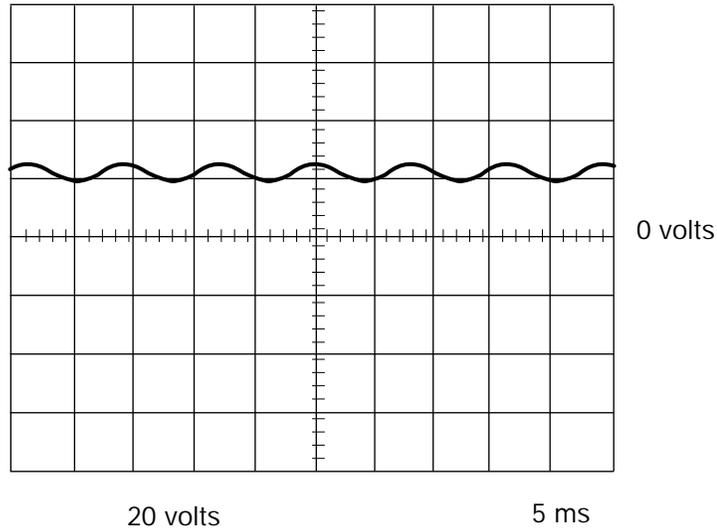
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CH1



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

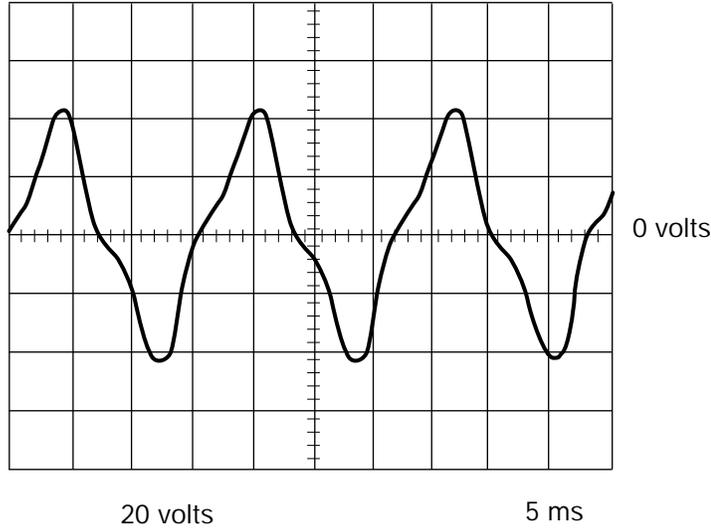
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TROUBLESHOOTING & REPAIR

TYPICAL AC WELD OUTPUT VOLTAGE WAVEFORM MACHINE LOADED

CH1



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 10-LX



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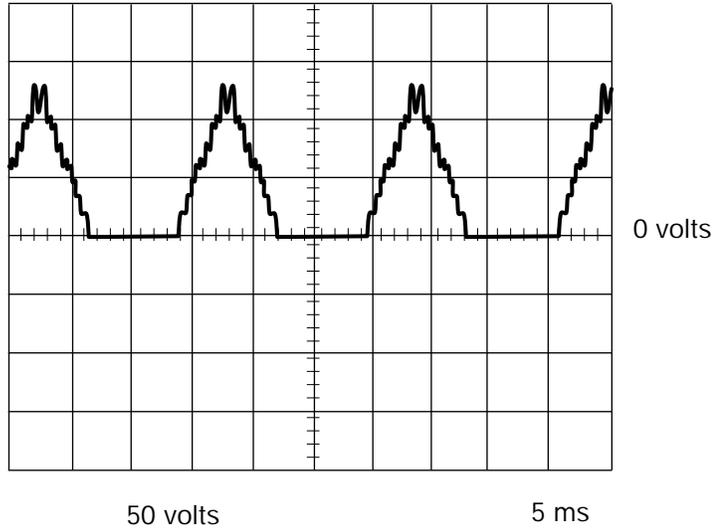
Return to Master TOC

TROUBLESHOOTING & REPAIR

ABNORMAL OPEN CIRCUIT DC WELD VOLTAGE WAVEFORM

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

CH1



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 10-LX



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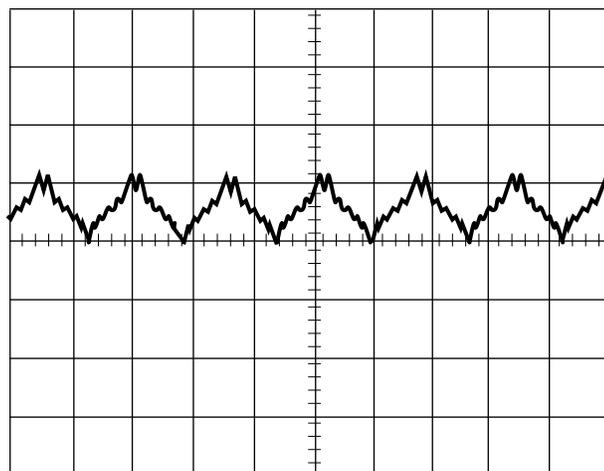
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TROUBLESHOOTING & REPAIR

ABNORMAL OPEN CIRCUIT WELD VOLTAGE WAVEFORM (HIGH CV MODE)

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

CH1



0 volts

50 volts

5 ms

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 10-LX



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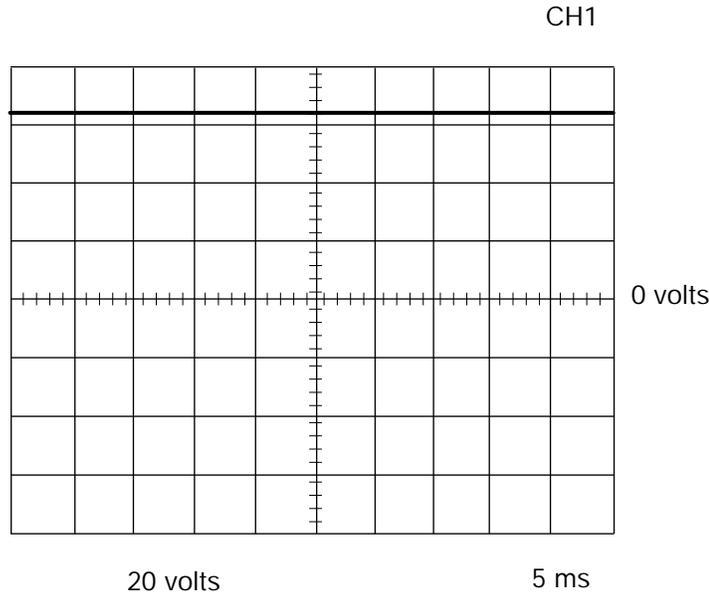
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TROUBLESHOOTING & REPAIR

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 10-LX



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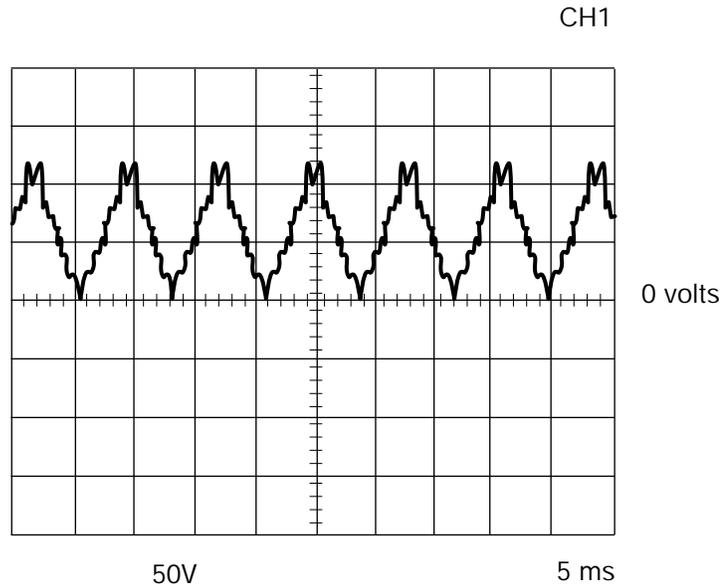
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TROUBLESHOOTING & REPAIR

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 10-LX



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TROUBLESHOOTING & REPAIR

NORMAL OPEN CIRCUIT AC WELD VOLTAGE WAVEFORM HIGH IDLE – NO LOAD – OUTPUT CONTROL AT MAXIMUM

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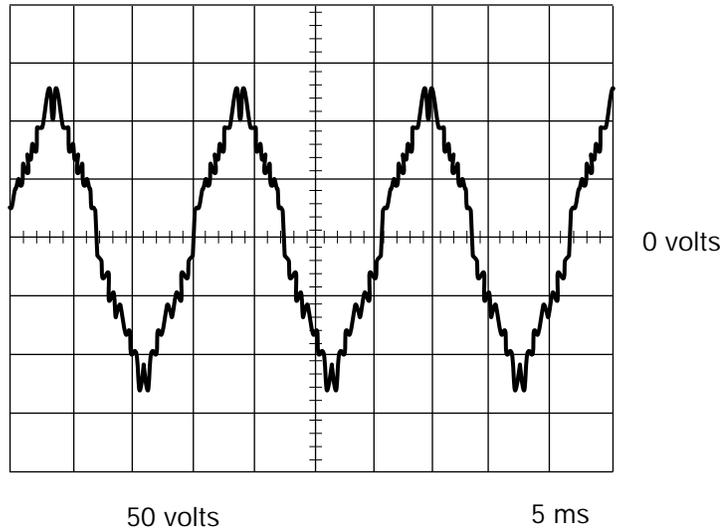
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CH1



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

Note: Scope probes connected at machine output terminals.

SCOPE SETTINGS

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

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TROUBLESHOOTING & REPAIR

BRUSH REMOVAL AND REPLACEMENT

⚠ WARNING

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353 (WELD).

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
- 7/16" Wrench
- 5/16" Wrench
- Slot head screwdriver
- Needle nose pliers

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Return to Section TOC
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Return to Master TOC

BRUSH REMOVAL AND REPLACEMENT (*continued*)

PROCEDURE

1. Perform this procedure with the engine OFF.
2. With the 5/16" and 3/8" nut drivers, remove the sheet metal screws from the right case side.
3. Carefully remove the right case side.
4. Using the needle nose pliers, gently remove the red and white wires from the brush holder. Note lead placement. See **Figure F.11**.
5. With the 7/16" wrench, remove the brush holder assembly bracket from the stator frame.
6. 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.
7. To change the brushes, use the slot head screw driver to pop off the plastic retainer on the back of the brush holder assembly.
8. 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.
9. 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.
10. 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.
11. Slide the brush holder assembly back into the bracket and, with the 5/16" wrench, install the two screws that hold it in place.
12. With the 7/16" wrench, install the brush holder assembly bracket to the stator frame.,
13. Slowly remove the non-metallic retainer from the brush holder and let the brushes snap back against the slip rings.
14. With the needle nose pliers, connect the red and white wires to the appropriate terminals on the brushes. The red wire is nearest to the rotor lamination.
15. Check the wire connections for clearance and tightness.
16. Install the right case side using the sheet metal screws and 5/16" and 3/8" nut drivers.

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 216-383-2531 or 1-800-833-9353 (WELD).

DESCRIPTION

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

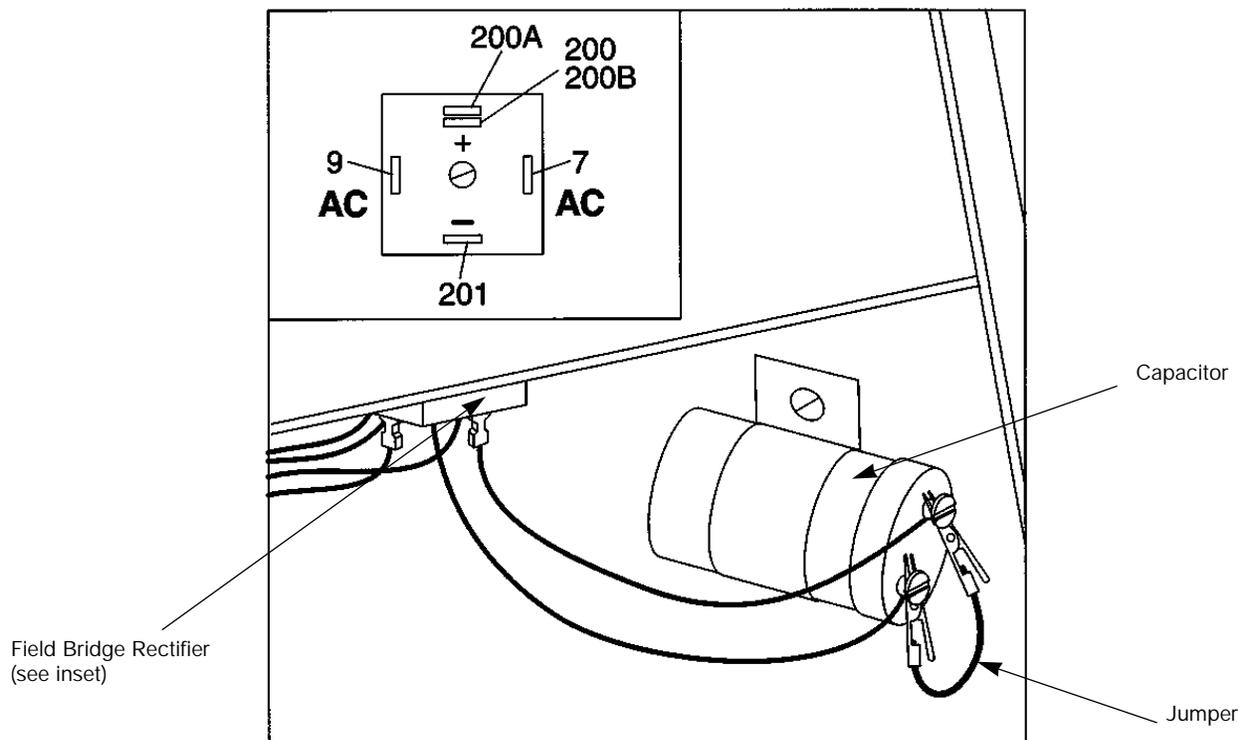
MATERIALS NEEDED

- 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
- Wiring Diagram

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TROUBLESHOOTING & REPAIR

FIELD CAPACITOR AND/OR RECTIFIER BRIDGE REMOVAL
AND REPLACEMENT *(continued)*FIGURE F.12
RECTIFIER BRIDGE LOCATION AND DISCHARGING THE FIELD CAPACITOR**PROCEDURE**

1. Perform this procedure with the engine OFF.
2. With the 5/16" and 3/8" nut drivers, remove the sheet metal screws from the right case side.
3. Carefully remove the right case side.
4. Discharge the field capacitor by connecting the jumper wire clips on the white and red wire terminals on the top of the capacitor. See Figure F.12. Leave the clips on for at least 5 seconds, then remove.
5. Loosen the two screws on the top of the capacitor. Lead #200 attaches to the positive (+) terminal. Lead #201A attaches to the negative (-) terminal.
6. With the 5/16" nut driver, remove the sheet metal screw that holds the capacitor mounting bracket to the fuel tank support bracket. Remove the field capacitor.
7. To install the capacitor, reattach the leads to their respective terminals [#200 to positive (+); #201A to negative (-)] and tighten the screws.
8. Using the 5/16" nut driver, assemble the capacitor and mounting bracket to the fuel tank support bracket.
9. Check that the leads are not grounded and also for clearance and tightness.
10. Install the right case side using the sheet metal screws and 5/16" and 1/8" nut drivers.

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

PROCEDURE - RECTIFIER BRIDGE REMOVAL AND REPLACEMENT

1. Perform this procedure with the engine OFF.
2. With the 5/16" and 3/8" nut drivers, remove the sheet metal screws from the right case side.
3. Carefully remove the right case side.
4. Discharge the field capacitor by connecting the jumper wire clips on the white and red wire terminals on the top of the capacitor. See **Figure F.12**. Leave the clips on for at least 5 seconds, then remove.
5. With the needle nose pliers, gently remove the six wires from the field rectifier bridge.
6. With the slot head screw driver remove the rectifier mounting screw, nut, and washers that hold the rectifier to either the vertical baffle or the fuel tank support bracket. Remove the field rectifier bridge.
7. Install the new rectifier using the mounting screw and associated hardware. Place the flat washer under the screw head and the lock washer under the nut.
8. Replace the wires to their appropriate locations on the new rectifier bridge. (See 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.

Lead #201 is 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 for clearance and tightness.
10. Install the right case side using the sheet metal screws and 5/16" and 1/8" nut drivers.

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 216-383-2531 or 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
- Diagonal cutters
- 1/2" wrench
- Wiring Diagram

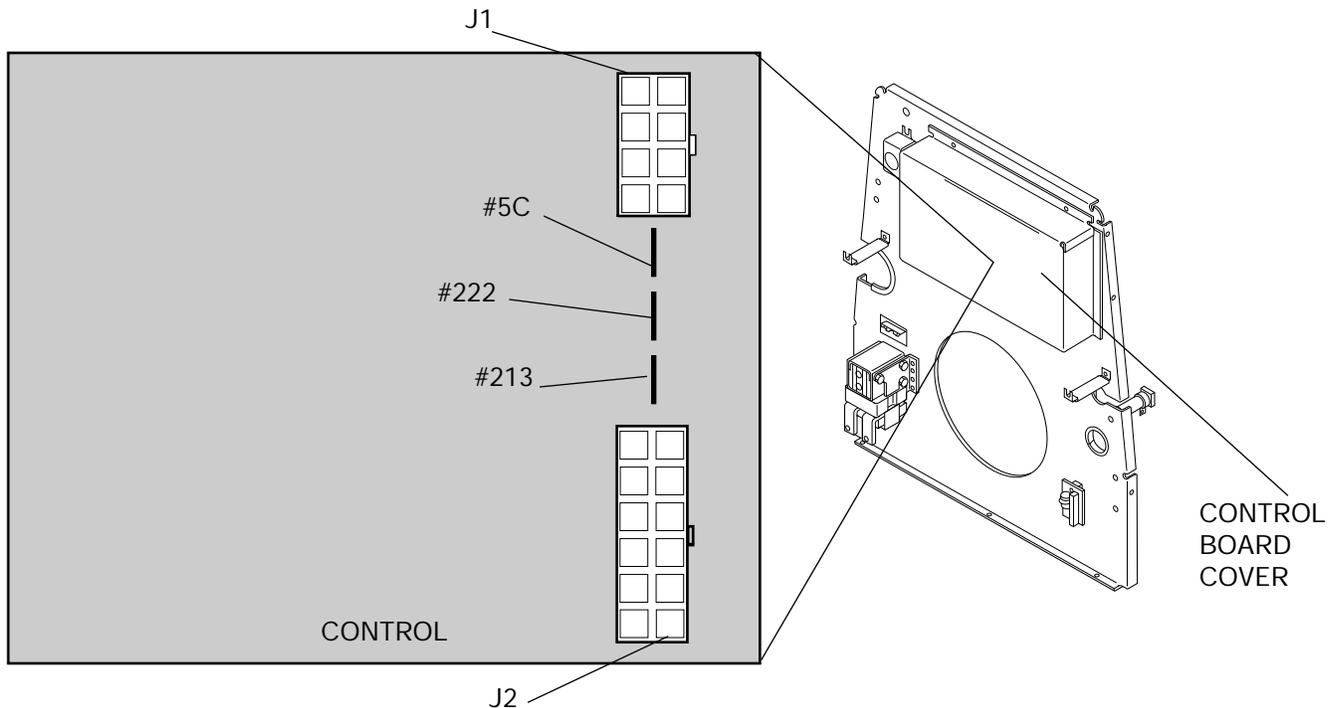
RANGER 10-LX



TROUBLESHOOTING & REPAIR

CONTROL BOARD REMOVAL AND REPLACEMENT (continued)

FIGURE F.13 - CONTROL BOARD LOCATION



PROCEDURE

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

1. Perform this procedure with the engine OFF.
2. With the 5/16" and 3/8" nut drivers, remove the sheet metal screws from the top and right case side.
3. If necessary, use the 1/2" wrench to remove the exhaust pipe from the muffler.
4. Carefully remove the right case side.
5. Remove the rubber gasket (cover seal) from the lift bail.
6. Remove the fuel cap and the rubber gasket from the fill tube.
7. Unlatch the double door assembly and use the slot head screwdriver and 3/8" wrench to remove the door support rod from the door assembly.
8. Remove the case top, **then reinstall the fuel cap.**
9. With the 5/16" nut driver, remove the control board cover. See Figure F.13.
10. Remove the two molex plugs from the control board. Also remove the three individual leads #213, #222 and #5C. (Note lead placement.)
11. Detach the two in-line connectors from the current sensing leads (#254 and #254A). See the Wiring Diagram. These leads attach to the current sensor located on the control board.
12. Remove lead #3 from the 115VAC receptacle. Thread the lead through the hole in the current sensor in order to separate it from the control board. It will probably be necessary to cut any cable ties restraining the wiring. Use the diagonal cutters.
13. With the 1/4" nut driver, remove the screws holding the control board.
14. Replace the old control board with a new one.
15. Thread lead #3 back through the current sensor on the control board and reattach the lead to the 115VAC receptacle.

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TROUBLESHOOTING & REPAIR

CONTROL BOARD REMOVAL AND REPLACEMENT *(continued)*

16. Connect current sensing leads #254 and #254A. See the Wiring Diagram for the proper connections.
17. Connect the two molex plugs.
18. Connect the three individual leads #213, #222 and #5C.
19. Replace any cable ties that were cut during the removal procedure.
20. With the 5/16" nut driver, install the control board cover.
21. Install the right case side, top, gaskets and double door support rod.

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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 216-383-2531 or 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
- 7/16" Nut driver
- Dow Corning 340
- Wiring Diagram

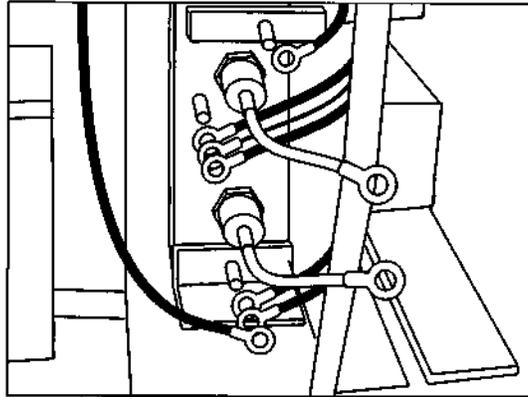
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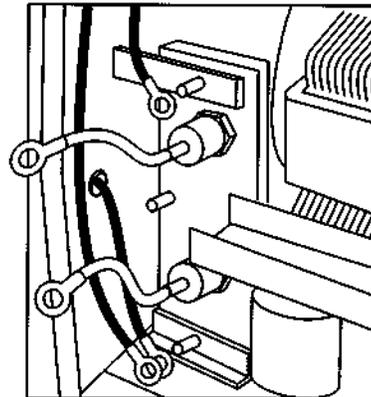
TROUBLESHOOTING & REPAIR

OUTPUT RECTIFIER BRIDGE REMOVAL AND REPLACEMENT *(continued)*

FIGURE F.14 - OUTPUT RECTIFIER CONNECTIONS



Left Side (-)



Right Side (+)

PROCEDURE

1. Perform this procedure with the engine OFF.
2. With the 5/16" and 3/8" nut drivers, remove the sheet metal screws from the left and right case sides.
3. 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.
4. 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 wiring diagram.
5. 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.)
6. With the 7/16" wrench, remove the nut and washers holding the top stud assembly to the rectifier mounting bolts.
7. With the 7/16" wrench, remove the nuts, lock washers, and flat washers from the two top mounting bolts. **(Note insulator placement.)**
8. With the 3/8" nut driver, remove the two bottom mounting sheet metal screws. (Note insulator placement - upon reassembly the heat sink must be electrically insulated from the frame of the Ranger 10-LX.)

For the remaining steps refer to Figure F.14.

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TROUBLESHOOTING & REPAIR

OUTPUT RECTIFIER BRIDGE REMOVAL AND REPLACEMENT *(continued)*

9. Clear the leads and carefully remove the heat sink assembly.
10. Repeat the above procedure to remove the other half of the output rectifier.

REASSEMBLY:

When reassembling, use Dow Corning 340 on all aluminum electrical connection surfaces.

1. With the 3/8" nut driver, mount the heat sink assemblies at the bottom using the sheet metal mounting screws. Be sure to place the insulators properly so that the heat sinks are electrically insulated from the machine frame.
2. With the 1/2" wrench, reattach the two heavy leads and one small lead to the heat sink plate. (Small lead goes on top.)
3. With the 7/16" wrench, fit the flat washers, lock washers, and nuts to the two top mounting bolts.
4. With the 7/16" wrench, fit the washers and nut to hold the top stud assembly to the rectifier mounting bolts.
5. With the 1/2" wrench, reattach the diode pigtails and heavy leads to the terminal studs. Placement is: leads, flat washer, split washer, nut.
6. With the 5/16" and 3/8" nut drivers, replace the machine case sides and top.

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TROUBLESHOOTING & REPAIR

OUTPUT CAPACITOR BANK REMOVAL AND REPLACEMENT

⚠ WARNING

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353 (WELD).

DESCRIPTION

The following procedure will aid the technician in removing the output capacitor bank of four capacitors for maintenance or replacement.

MATERIALS NEEDED

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

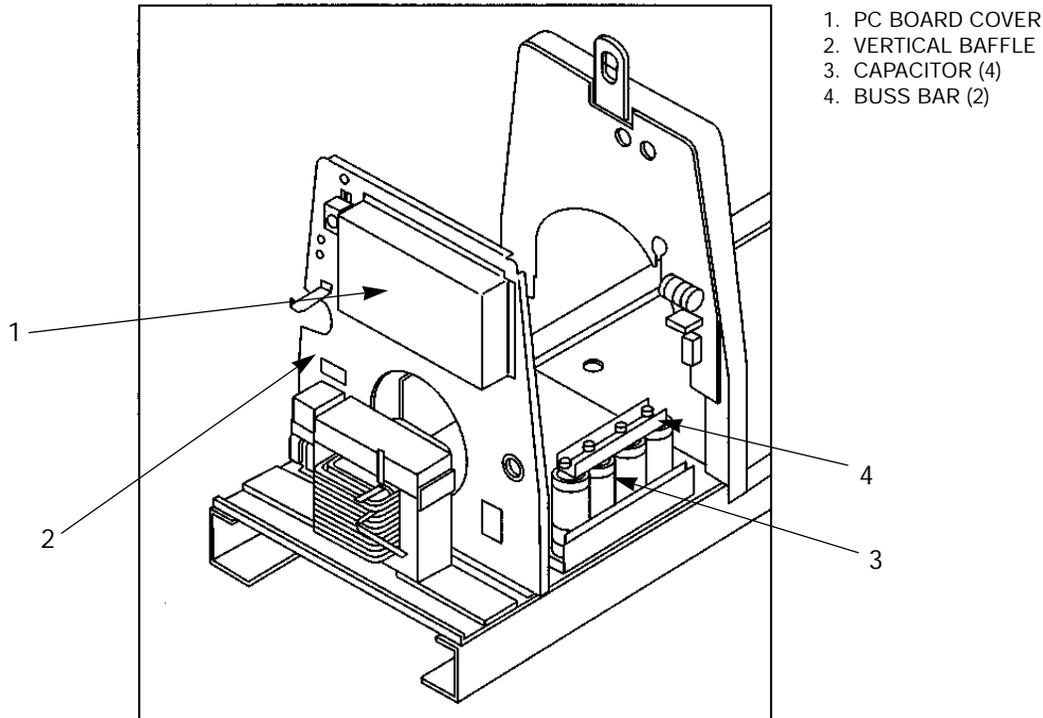
RANGER 10-LX



TROUBLESHOOTING & REPAIR

OUTPUT CAPACITOR BANK EMOVAL AND REPLACEMENT *(continued)*

FIGURE F.15 - OUTPUT CAPACITOR BANK/PRINTED CIRCUIT BOARD LOCATION



1. PC BOARD COVER
2. VERTICAL BAFFLE
3. CAPACITOR (4)
4. BUSS BAR (2)

PROCEDURE

1. Perform this procedure with the engine OFF.
2. With the 5/16" and 3/8" nut drivers, remove the sheet metal screws from the right case side.
3. Carefully remove the right case side.
4. 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.15.
5. With the 1/2" wrench, remove the two nuts, bolts, and associated washers holding the two heavy leads and two small leads (#242B negative and #240A positive) to the capacitor bank buss bars. Note lead placement.
6. With the 3/8" nut driver, remove the four mounting screws holding the capacitor bank assembly to the base of the RANGER 10-LX.
7. Carefully remove the capacitor bank assembly.
8. To replace the capacitor bank assembly, mount the assembly to the base of the machine using the four screws and the 3/8" nut driver.
9. With the 1/2" wrench, attach the two heavy leads, the two small leads, and associated fasteners to the positive and negative capacitor buss bars. Observe capacitor polarity.
10. Install the right case side using the 5/16" and 3/8" nut drivers.

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TROUBLESHOOTING & REPAIR

OUTPUT CONTACTOR REMOVAL AND REPLACEMENT

⚠ WARNING

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

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 216-383-2531 or 1-800-833-9353 (WELD).

DESCRIPTION

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

MATERIALS NEEDED

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

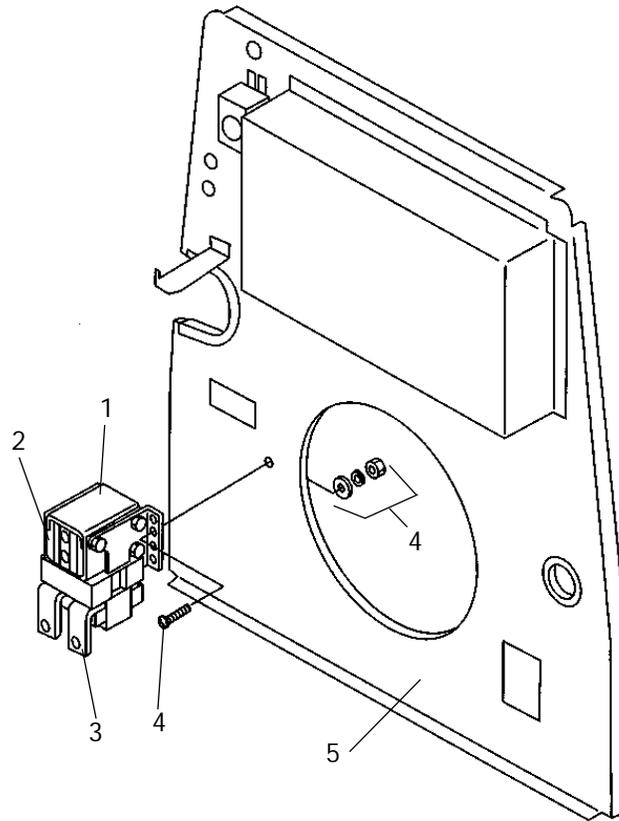
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TROUBLESHOOTING & REPAIR

OUTPUT CAPACITOR REMOVAL
AND REPLACEMENT *(continued)*

FIGURE F.16 - OUTPUT CONTACTOR LOCATION



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

PROCEDURE

1. Perform this procedure with the engine OFF.
2. With the 5/16" and 3/8" nut drivers, remove the sheet metal screws from the left case side.
3. Carefully remove the left case side.
4. With the needle nose pliers, remove the five small leads connected to the output contactor coil (leads #224F, #224K, #14B, #2C and #2D). **Note lead placement.** See **Figure F.17**.
5. With the 1/2" wrench, remove the nut, bolt, and associated washers holding the heavy lead and two small leads (#241 and #241A) to the output contactor. Also remove the heavy copper strap connected to the contactor.
6. With the slot head screw driver and 3/8" nut driver, remove the three mounting screws, nuts, and associated washers from the contactor. The contactor can now be removed.
7. To reinstall the output contactor, use the slot head screw driver and 3/8" nut driver to attach the three mounting screws, nuts and associated washers that hold the contactor to the vertical baffle.
8. With the 1/2" wrench and the two nuts, bolts and associated washers, attach the heavy lead and two small leads to the output contactor. Also attach the copper strap to the contactor.
9. With the needle nose pliers, carefully attach the five small leads to the contactor coil. See Wiring Diagram and **Figure F.17**.
10. Install the left case side using the sheet metal screws and 5/16" and 3/8" nut drivers.

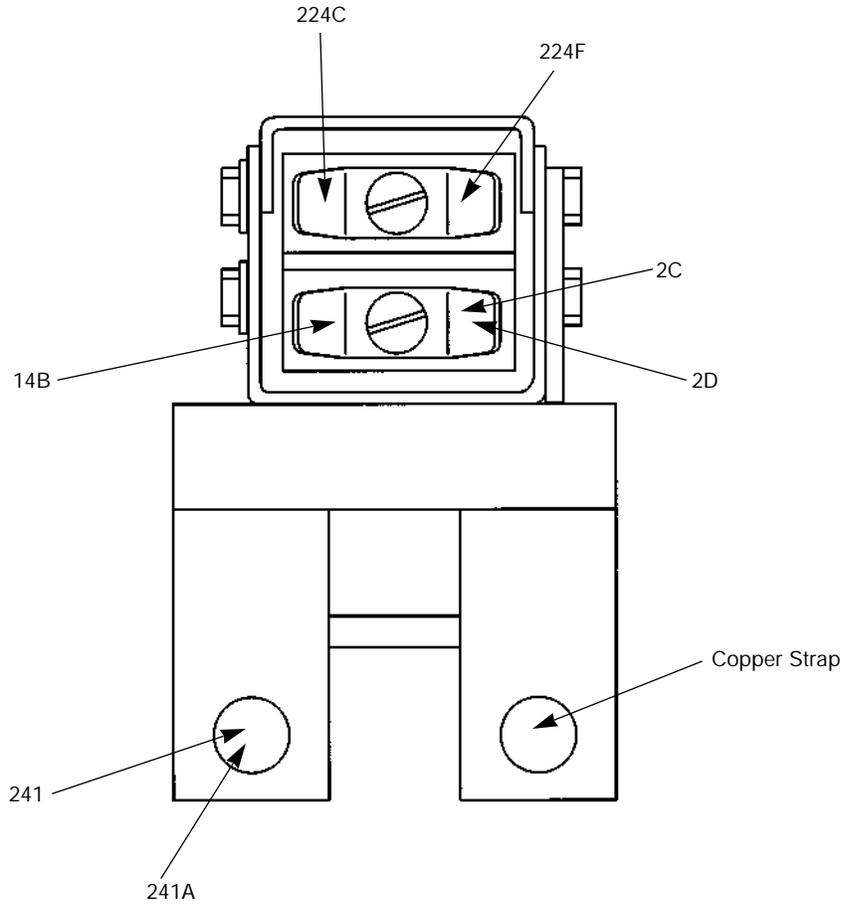
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TROUBLESHOOTING & REPAIRS

OUTPUT CAPACITOR REMOVAL AND REPLACEMENT *(continued)*

FIGURE F.17 - CONTACTOR COIL LEAD PLACEMENT



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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 216-383-2531 or 1-800-833-9353 (WELD).

DESCRIPTION

The following procedure will aid the technician in removing the stator and/or 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
- 3/8" Nut driver
- Feeler gauges
- Needle nose pliers
- Diagonal cutters
- Slot head screw driver
- 7/16" Wrench
- 1/2" Wrench
- Gear puller
- Socket wrench extension (8")

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TROUBLESHOOTING & REPAIR

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

PROCEDURE (Stator Removal)

1. Perform this procedure with the engine OFF.
 2. With the 5/16" and 3/8" nut drivers, remove the sheet metal screws from the case top and left and right case sides.
 3. If necessary, use the 1/2" wrench to remove the exhaust pipe from the muffler.
 4. Carefully remove the left and right case sides, then remove the positive (+) lead from the battery.
 5. Remove the rubber gasket (cover seal) from the lift bail.
 6. Remove the fuel cap and the rubber gasket from the fill tube.
 7. 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.
 8. Remove the case top, then reinstall the fuel cap.
 9. With the 1/2" socket wrench, remove the fuel tank. (Four bolts hold the fuel tank.) With the 3/8" nut driver, remove lead #226 from the fuel gauge.
 10. With the slot head screw driver, remove the field bridge rectifier. Leave the leads attached. Cut any necessary cable ties.
 11. Perform the **Output Capacitor Bank** Removal procedure.
 12. Perform the **Brush Removal** procedure.
 13. Cut the cable ties from the reactor to the range switch.
 14. Remove the four stator leads connected to the range switch. Use care. Excessive torque will break the terminals away from the rivets.
 15. Remove all stator leads from connection points on the front panel:

Remove lead #31 from circuit breaker CB2.

Disconnect the in-line connector on leads #42 and #32 located between the stator and the 14-pin amphenol.
- Remove the PC board cover.
- Disconnect lead #3 from the 115VAC receptacle and remove it from the current sensor located on the control board. It may be necessary to remove the receptacles.
- Disconnect lead #5 from the 115 VAC receptacle.
- Disconnect lead #5D from the common ground screw.
- Disconnect lead #6 from the 115/230 VAC receptacle.
- Disconnect leads #7 and #9 from the field rectifier bridge (D2). You may have already done this step when you removed the fuel tank. Cut any necessary cable ties to free leads #7 and #9 from the cable bundle.
- Remove lead W1 (heavy stator lead) from the left side output rectifier assembly.
- Remove lead S2 (heavy stator lead) from the left side output rectifier assembly.
- Untape and disconnect W2 from S1 to separate the stator from the reactor.
16. Using the 3/8" wrench, 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. Perform the **Output Contactor Removal procedure**.
 19. Remove the heavy lead from the choke to the bottom of the positive output rectifier.
 20. Slide the choke assembly out.
 21. Using the 1/2" wrench, remove the three reactor mounting bolts from the base of the machine.
 22. Using the 5/16" wrench, remove the three sheet metal screws holding the front vertical baffle.

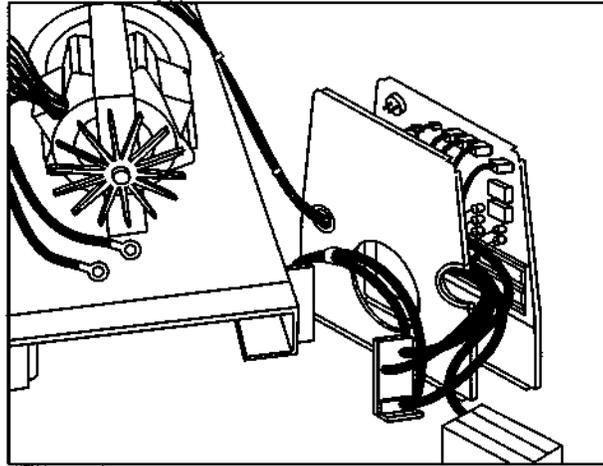
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TROUBLESHOOTING & REPAIR

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

FIGURE F.19- ENGINE AND ROTOR REMOVED FROM STATOR



23. Using the 5/16" wrench, remove the three sheet metal screws holding the front vertical baffle to the base of the machine.
24. 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. Support the unit with a box or large pan. See Figure F.19.
26. Remove the two 3/8" nuts and bolts that hold the stator mounting bracket to the base of the machine. See **Figure F.18**.
27. Remove the 1/2" blower (fan) bolt the blower, and the two 3/8" screws that hold the rotor bearing in place. You will need to use a gear puller to remove the blower.
28. Support the engine. See **Figure F.18**.
29. 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.18**.
2. Remove the six 1/2" rotor bolts and spacers. Caution: The rotor will be free to fall when the bolts are removed.
3. Rotor bearing must be removed before stator is reinstalled. (Install bearing after stator is reinstalled).
4. Install bearing tolerance ring.
5. Carefully install stator and check air gap .015" (minimum).

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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).

LEAD RECONNECTION CHECKLIST

Engine

- Lead #226 to fuel gauge

Front Panel/PC Board

- 4 stator leads to Range switch
- Lead #31 from CB2
- Leads #42 and #32 between stator and 14-pin amphenol
- Lead #3 to 115 VAC receptacle
- Lead #5 to 115 VAC receptacle
- Lead #5D to common ground screw
- Lead #6 to 115/230 VAC receptacle
- Leads #7 and #9 to field bridge rectifier
- Lead W1 (heavy lead) to left side output rectifier assembly
- Lead S2 (heavy lead) to left side output rectifier assembly
- Lead W2 to S1

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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	2150-2250	NA
High Idle	3650-3700	3400-3650

WELDER DC OUTPUT¹

Output Control	Range Switch	Open Circuit Volts	Load Volts	Load Amps
Maximum	Maximum	61 - 68	25 - 35	250 - 285

WELDER AC OUTPUT¹

Output Control	Range Switch	Open Circuit Volts	Load Volts	Load Amps
Maximum	Maximum	70 - 76	25 - 35	250 - 305

WELDER CV OUTPUT¹

Output Control	Range Switch	Open Circuit Volts	Load Volts	Load Amps
Maximum	Wire Feed CV High	59 - 62	30 - 34	250 - 280
Maximum	Wire Feed CV Med HI	42 - 45	23 - 26	220 - 240
Maximum	Wire Feed CV Med LO	33.5 - 36	19 - 21	155 - 170
Maximum	Wire Feed CV Low	25 - 27	14.5 - 16	135 - 155

AUXILIARY POWER OUTPUT

230 Volt Receptacle			115 Volt Receptacle ²		
Open Circuit Voltage	Load Volts	Load Amps	Open Circuit Voltage	Load Volts	Load Amps
245 - 253	210 - 240	43 - 48	120 - 127	106 - 121	78 - 83

AMPHENOL AUXILIARY OUTPUT

42 Volt Auxiliary		115 Volt Receptacle ²	
Open Circuit Voltage	Load Volts	Open Circuit Voltage	Load Volts
43 - 50	40 - 48	115 - 126	110 - 126

FIELD AMPS AND VOLTS

Slip Ring Volts	Field Amps
37 - 47 VDC	6 - 6.8 Amps DC

¹ OUTPUT CONTROL switch set at MAXIMUM (position 10).

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

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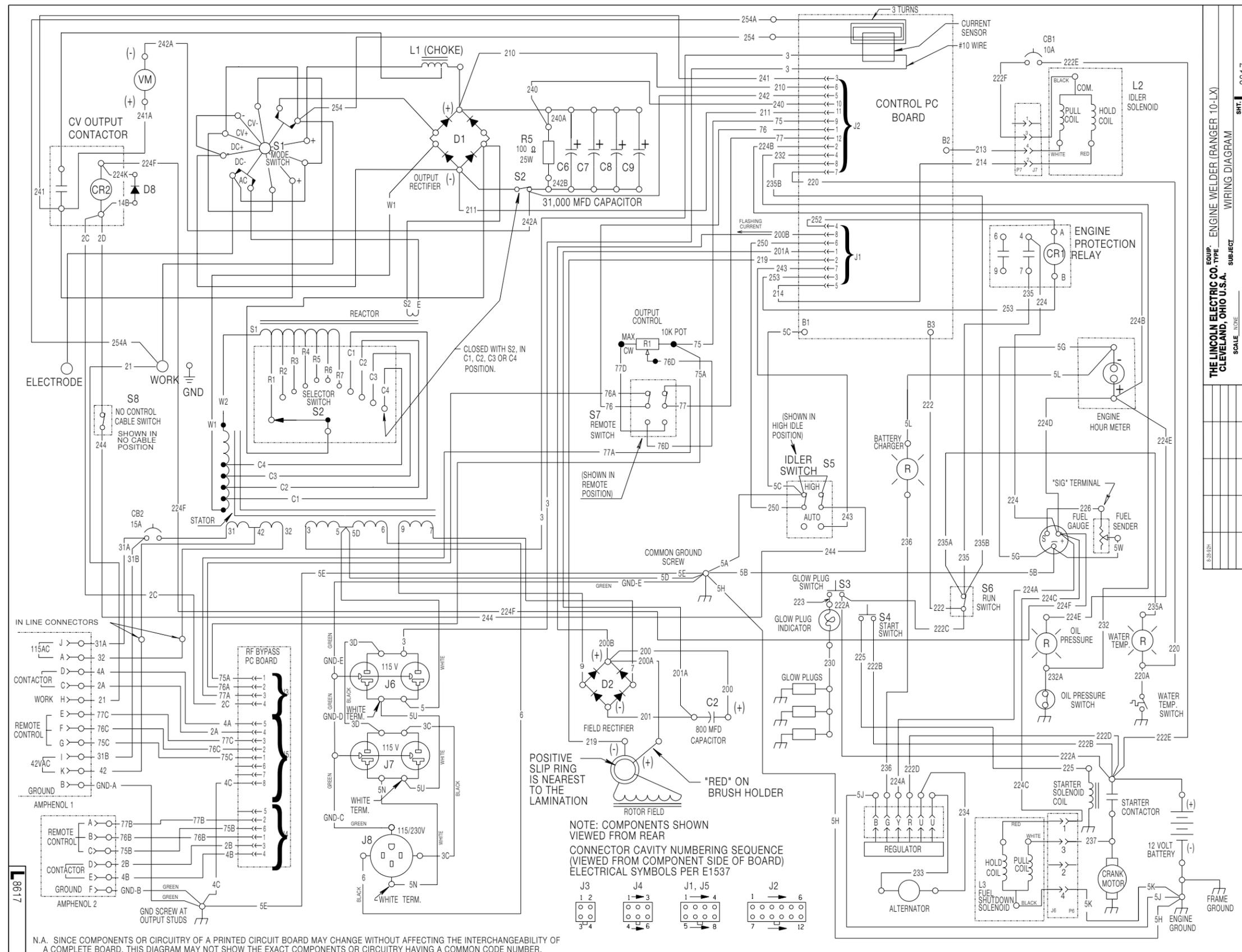
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Wiring Diagram Ranger 10LX Code 9816



N.A. SINCE COMPONENTS OR CIRCUITRY OF A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGEABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY HAVING A COMMON CODE NUMBER.

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

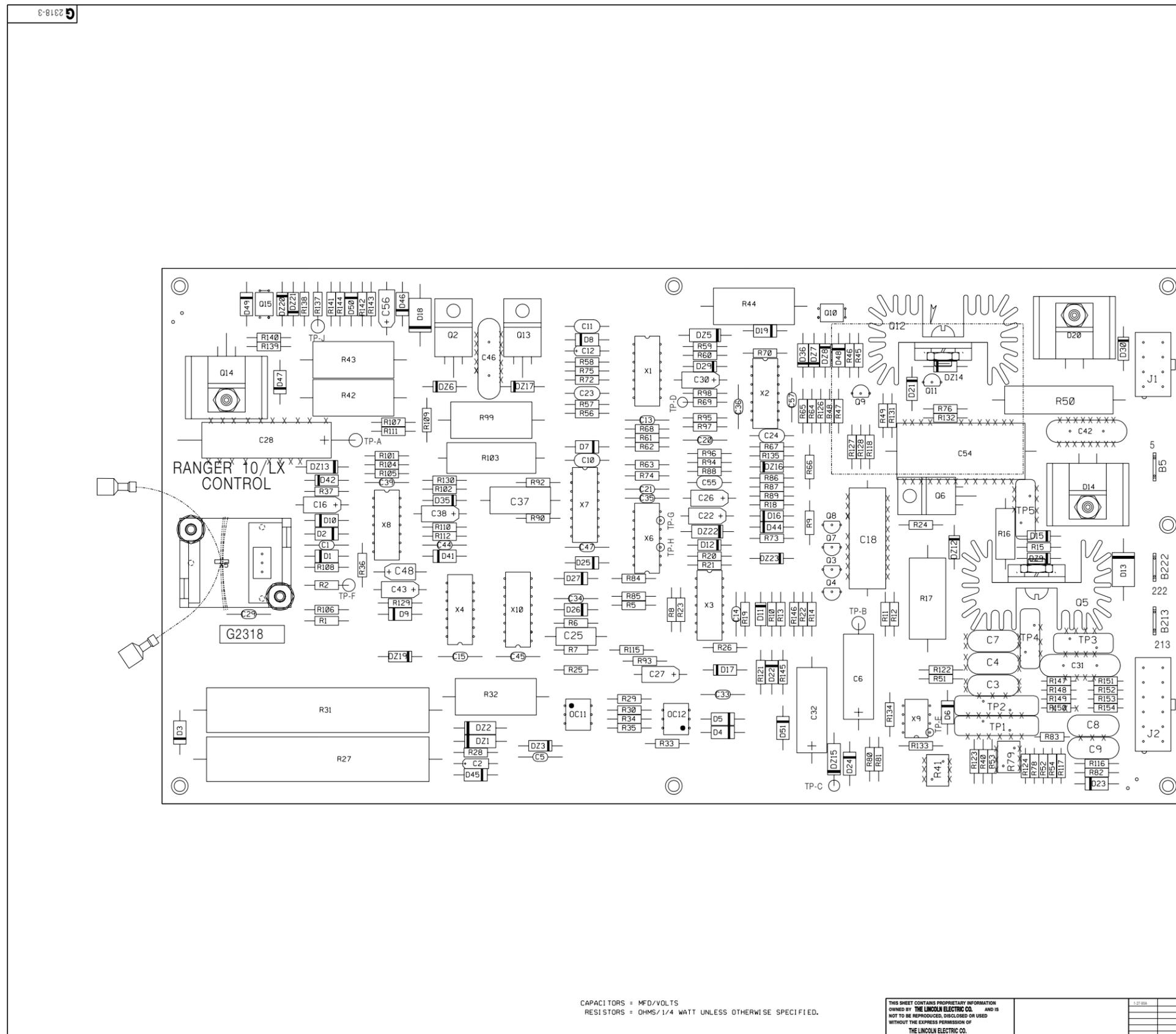
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THE LINCOLN ELECTRIC CO. EQUIP. TYPE ENGINE WELDER (RANGER 10-LX)
 CLEVELAND, OHIO U.S.A. SUBJECT WIRING DIAGRAM
 SCALE NONE REF. L 8617
 DR. E. G. B. DATE 10/91 CHK SUBSPDQ

Control PC Board (G2318) Layout

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ITEM	REQ'D.	PART No.	IDENTIFICATION
B5, B213, B222	3	T 13157-14	TAB TERMINAL
C1, C5, C13, C14, C15, C20, C21, C29, C33, C34, C35, C36, C39, C44, C45, C47	16	S 16668-5	.022/50
C2	1	S 13490-42	1.0/35
C3, C4, C7, C8, C9	5	T 11577-52	.0047 or .005/1400
C6, C32	2	S 13490-15	.05/600V
C10, C11, C23, C24, C55	5	S 16668-11	.1/50
C12	1	S 13490-19	1.8/20
C16, C22, C26, C27, C30, C38, C43	7	S 13490-39	.47/50
C18	1	S 13490-102	.047/100
C25	1	S 13490-71	.05/600V
C28	3	T 11577-46	.022/200
C31, C42, C46	1	S 13490-4	4.7/35
C37	1	S 13490-25	.22MFD, 400VDC CAPACITOR
C48	1	T 11577-33	820pF/50
C54	1	S 13490-30	IN4004
C56	1	T 12199-1	IN4007
D1, D2, D7, D8, D9, D10, D19, D22, D24, D25, D26, D27, D41, D45, D46, D47, D48, D49, D50, D51	20	T 12199-2	IN4936
D3, D4, D5, D6, D23	5	T 12705-29	DIODE
D11, D12, D15, D16, D17, D21, D29, D30, D35, D36, D42, D44	12	T 12705-34	IN4746A
D13	1	T 12705-32	IN4740
D14, D20	2	T 12705-14	IN5347B
D18	1	T 12702-33	IN4728A
DZ1, DZ2, DZ5, DZ15, DZ22	5	T 12702-29	IN4744A
DZ3	1	T 12702-46	IN4761A
DZ6, DZ7, DZ9, DZ12, DZ14, DZ17, DZ21	7	T 12702-25	IN5357B
DZ8, DZ20	2	T 12702-40	IN4735
DZ13	1	T 12702-27	IN4740
DZ16	1	T 12702-45	IN4746A
DZ19	1	S 18248-8	CONNECTOR
DZ23	1	S 18248-12	HEADER
J1	1	S 15000-10	OPTO ISOLATOR
J2	2	T 12704-61	18A 200V MOSFET (SS)
OC11, OC12	3	T 12704-68	2N4401
Q2, Q6, Q13	3	T 12704-69	2N4403
Q3, Q7	2	S 20106-1	HEXFET W/ H. S. ASBLY (SS)
Q4, Q8, Q11	3	T 12704-47	.5AMP / 300 VOLT PNP
Q5, Q12	2	T 12704-73	1C PKG MOSFET (SS)
Q9	1	T 12704-49	100 1/4W
Q10, Q15	2	S 19400-1000	4.75K
Q14	1	S 19400-4751	13.7K 1/4W
R1, R14, R15, R22, R24, R33, R84, R85	8	S 19400-1002	10K 1/4W
R2, R52, R53, R61, R74, R116, R117, R131, R132	9	S 19400-1372	33.2K 1/4W
R5, R8, R13, R62, R64, R75, R80, R81, R89, R94, R107, R109, R110, R111, R126, R130, R133, R138, R141, R144, R147, R148, R149, R150, R151, R152, R153, R154	28	S 19400-1821	1.82K 1/4W
R6	1	S 19400-3322	33.2K 1/4W
R7, R30, R34, R92	4	S 19400-1821	1.82K 1/4W
R9	2	S 19400-4753	47.5K 1/4W
R10, R129	2	S 19400-3922	39.2K 1/4W
R11, R66	2	S 19400-2212	22.1K 1/4W
R12, R68, R106, R108, R112	5	T 12300-86	.05/3W
R16	1	T 14648-24	0.5 OHM 5 WATT RESISTOR
R17, R99	2	S 19400-2672	26.7K 1/4W
R18, R26, R73, R98, R102	5	S 19400-4752	47.5K 1/4W
R19, R25, R37, R86, R96, R104	6	S 19400-6191	6.19K 1/4W
R20, R93, R97, R101	4	S 19400-1333	133K 1/4W
R21, R23, R95, R105, R143	5	T 12300-74	475 1/4W
R27	1	S 19400-6813	681K 1/4W
R28, R45, R47, R48, R56, R57, R58, R59, R60	2	T 12300-73	20 WATT 250 OHM RESISTOR
R29, R35	1	T 14648-18	68.5W
R31	1	S 19400-2211	2.21K 1/4W
R32	4	S 19400-68R1	68.1 1/4W
R36	1	S 18380-1	PTC THERMISTOR
R40, R78, R123, R124	4	T 14648-21	2.7 OHM 5W
R41, R79	2	T 14648-14	390 5W
R42, R43	2	S 19400-3320	332 1/4W
R44	1	S 19400-1001	1K 1/4W
R49, R69, R82, R83	4	T 12300-77	0.1 OHMS/7WATT WIRE WOUND
R50	1	S 19400-47R5	47.5 1/4W
R51, R54, R121, R122	4	S 19400-3011	3.01K 1/4W
R53	1	S 19400-5232	52.3K 1/4W
R65	1	S 19400-8251	8.25K 1/4W
R67	1	S 19400-3323	332K 1/4W
R70	2	S 19400-1003	100K 1/4W
R72, R115	2	S 19400-6811	6.81K 1/4W
R76, R142	2	S 19400-6812	68.1K 1/4W
R87	1	S 19400-2213	221K 1/4W
R88	1	S 19400-1822	18.2K 1/4W
R90	1	T 12300-80	5 WATT 0.5 OHM RESISTOR
R103	3	S 19400-3321	3.32K 1/4W
R118, R127, R128	3	S 19400-2001	2.0K 1/4W
R134, R145, R146	2	S 19400-75R0	75 1/4W
R135, R137	2	T 13640-18	16DJ
R139, R140	2	T 13640-12	38J
TP1, TP2	2	T 13640-15	15J
TP3	1	S 15128-4	LM224 OP-AMP
TP4, TP5	2	S 15128-11	14 PIN QUAD COMPARATOR
X1	1	S 15018-15	14 PIN I.C. (SS)
X2, X3, X8	3	S 18504	16 PIN I.C. (SS)
X4, X6	2	T 15128-10	VOLTAGE REF.
X5	1		
X7, X10	2		
X9	1		

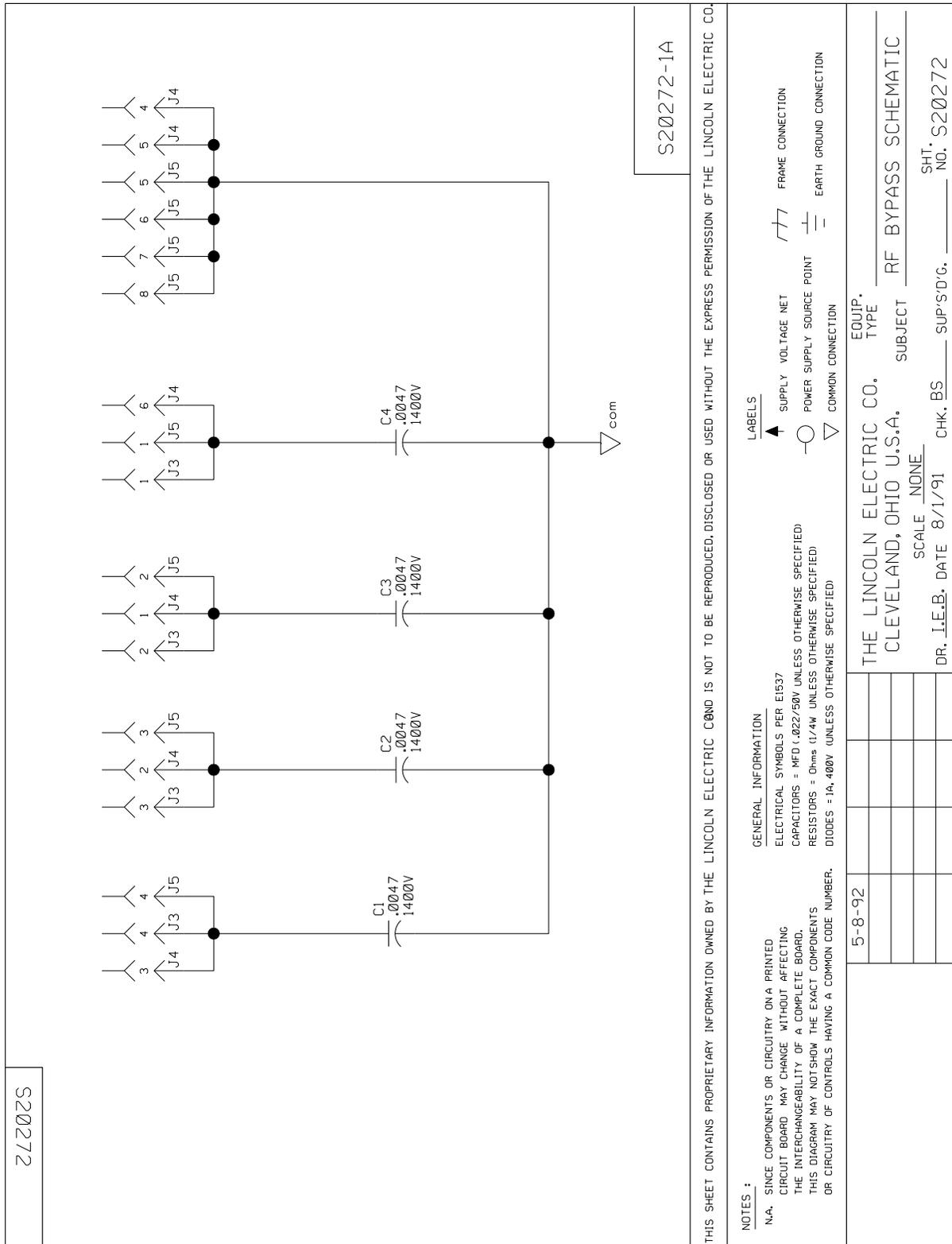
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THE LINCOLN ELECTRIC CO. CLEVELAND, OHIO U.S.A.
EQUIP. TYPE: ENGINE WELDER
SUBJECT: CONTROL P.C. BOARD ASSEMBLY
SCALE: REF. DATE: CHK. REF. SUPP'D. G.2318

NOTE: Lincoln Electric assumes no responsibility for liabilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.



RF BYPASS BOARD SCHEMATIC



S20272

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NOTES :

N/A. SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGEABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1637

CAPACITORS = MFD (.0022/50V UNLESS OTHERWISE SPECIFIED)

RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)

DIODES = 1A, 400V (UNLESS OTHERWISE SPECIFIED)

LABELS

▲ SUPPLY VOLTAGE NET

□ FRAME CONNECTION

○ POWER SUPPLY SOURCE POINT

▽ COMMON CONNECTION

△ com

EQUIP. TYPE
THE LINCOLN ELECTRIC CO.
CLEVELAND, OHIO U.S.A.

SUBJECT
RF BYPASS SCHEMATIC

SCALE NONE

DATE 8/1/91

CHK. BS _____

SUP'D/G. _____

SHT. NO. S20272

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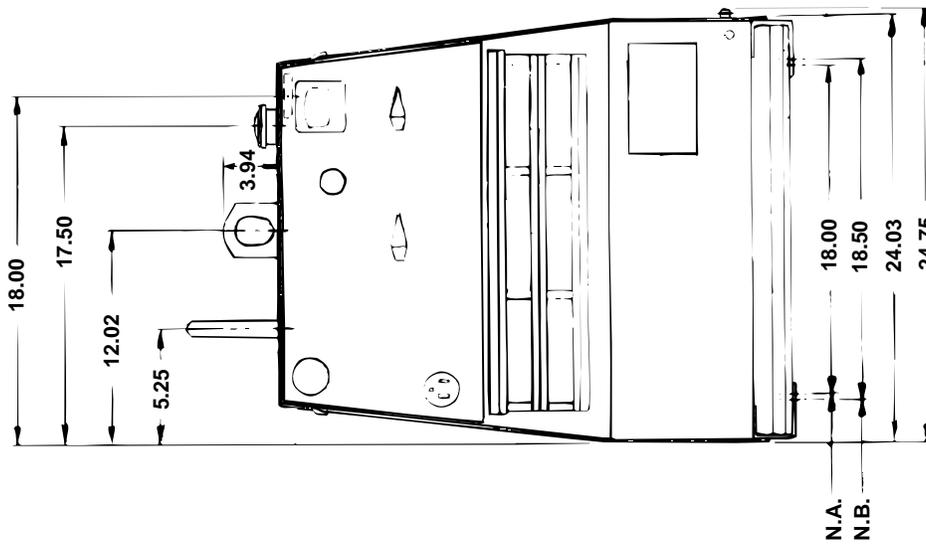
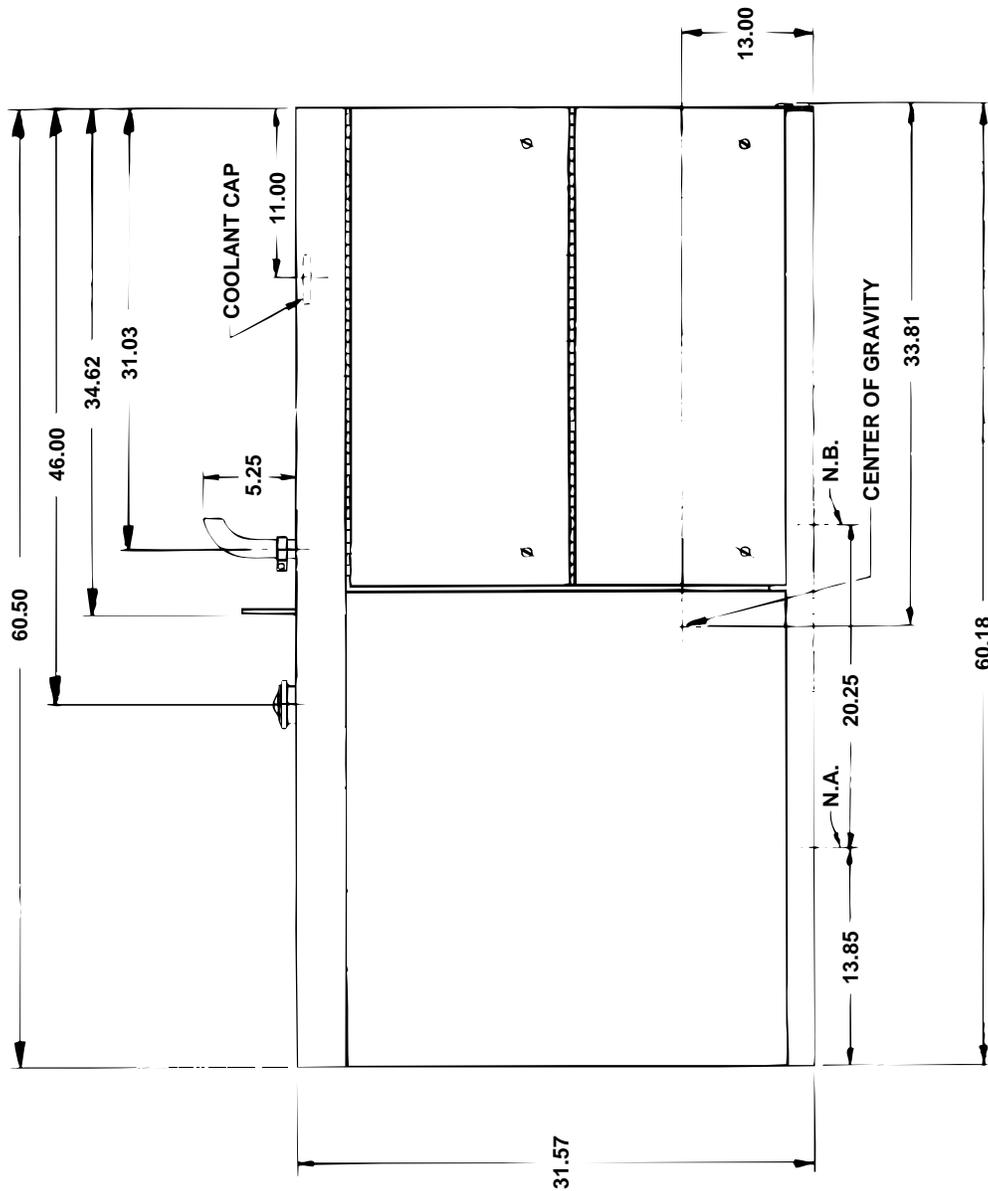
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RANGER 10LX



M16706
3-24-95E

