LINCOLN ELECTRIC

GENUINE LINCOLN PARTS™

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

SAE-300®

For use with machines having Code Numbers:

11645, 11916, 12090, 11906, 12162, 12683

SERVICE MANUAL

Need Help? Call 1.888.935.3877
to talk to a Service Representative

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

After hours?
Use “Ask the Experts” at lincolnelectric.com
A Lincoln Service Representative will contact you no later than the following business day.

For Service outside the USA:
Email: globalservice@lincolnelectric.com

SVM218-A | Issue Date 12-Apr

THE LINCOLN ELECTRIC COMPANY
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Phone: +1.216.481.8100 • www.lincolnelectric.com

⚠ WARNING

⚠ CALIFORNIA PROPOSITION 65 WARNINGS ⚠

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

The Above For Diesel Engines

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

The Above For Gasoline Engines

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

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

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.

FOR ENGINE powered equipment.

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

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

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

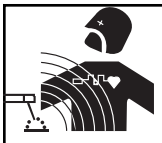
1.d. Keep all equipment safety guards, covers and devices in position and in good repair.Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

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

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

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

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



ELECTRIC AND MAGNETIC FIELDS may be dangerous

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

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

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

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

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

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

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

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

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

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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. I standards.

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

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

FUMES AND GASES can be dangerous.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases.When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.**

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

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

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

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

5.f. Also see item 1.b.

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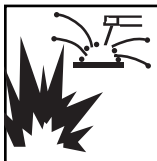

WELDING and CUTTING SPARKS can cause fire or explosion.

6.a. Remove fire hazards from the welding area.If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.

6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to “Safety in Welding and Cutting” (ANSI Standard Z49.1) and the operating information for the equipment being used.

6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.

6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been “cleaned”. For information, purchase “Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances”, AWS F4.1 from the American Welding Society (see address above).

6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.

6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.

6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.

6.h. Also see item 1.c.

6.I. Read and follow NFPA 51B “ Standard for Fire Prevention During Welding, Cutting and Other Hot Work”, available from NFPA, 1 Batterymarch Park,PO box 9101, Quincy, Ma 022690-9101.

6.j. Do not use a welding power source for pipe thawing.

CYLINDER may explode if damaged.

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

7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.

7.c. Cylinders should be located:

- Away from areas where they may be struck or subjected to physical damage.
- A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.

7.d. Never allow the electrode, electrode holder or any other electrically “hot” parts to touch a cylinder.

7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.

7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.

7.g. Read and follow the instructions on compressed gas cylinders, associated equipment and CGA publication P-I, “Precautions for Safe Handling of Compressed Gases in Cylinders,” available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.

FOR ELECTRICALLY powered equipment.

8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.

8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer’s recommendations.

8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer’s recommendations.

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

PRÉCAUTIONS DE SÛRETÉ

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

Sûreté Pour Soudage A L'Arc

1. Protegez-vous contre la secousse électrique:

   a. Les circuits à l'électrode et à la piéce 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 vétements mouillés. Porter des gants secs et sans trous pour isoler les mains.
   b. Faire trés attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher metallique ou des grilles metalliques, 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 defonctionnement.
   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 precautions pour le porte-électrode s'applicuent 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 ou on recoit un choc. Ne jamais enrouler le câble-électrode autour de n'importe quelle partie du corps.

3. Un coup d'arc peut être plus sévère qu'un coup de soliel, donc:

   a. Utiliser un bon masque avec un verre filtrant approprié ainsi qu'un verre blanc afin de se protéger les yeux du rayonnement de l'arc et des projections quand on soude ou quand on regarde l'arc.
   b. Porter des vêtements convenables afin de protéger la peau de soudeur et des aides contre le rayonnement de l'arc.
   c. Protéger l'autre personnel travaillant à proximité au soudage à l'aide d'écrans appropriés et non-inflammables.

4. Des gouttes de laitier en fusion sont émises de l'arc de soudage. Se protéger avec des vêtements de protection libres de l'huile, tels que les gants en cuir, chemise épaisse, pantalons sans revers, et chaussures montantes.

5. Toujours porter des lunettes de sécurité dans la zone de soudage. Utiliser des lunettes avec écrans lateraux 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 une endroit isolé de la masse. Un court-circuit accidental peut provoquer un échauffement et un risque d'incendie.

8. S'assurer que la masse est connectée le plus prés 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 chaines de levage, câbles de grue, ou autres circuits. Cela peut provoquer des risques d'incendie ou d'echauffement des chaines et des câbles jusqu'à ce qu'ils se rompent.

9. Assurer une ventilation suffisante dans la zone de soudage. Ceci est particuliérement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumeés toxiques.

10. Ne pas souder en présence de vapeurs de chlore provenant d'opérations de dégraissage, nettoyage ou pistolage. La chaleur ou les rayons de l'arc peuvent réagir avec les vapeurs du solvant pour produire du phosgéne (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 chassis du poste conformement au code de l'électricité et aux recommendations du fabricant. Le dispositif de montage ou la piece 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 faires des travaux à l'interieur de poste, la debrancher à l'interrupteur à la boite de fusibles.

4. Garder tous les couvercles et dispositifs de sûreté à leur place.

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Electromagnetic Compatibility (EMC)

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

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

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

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

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

a) other supply cables, control cables, signaling and telephone cables; above, below and adjacent to the welding equipment;

b) radio and television transmitters and receivers;

c) computer and other control equipment;

d) safety critical equipment, e.g., guarding of industrial equipment;

e) the health of the people around, e.g., the use of pacemakers and hearing aids;

f) equipment used for calibration or measurement

g) the immunity of other equipment in the environment. The user shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures;

h) the time of day that welding or other activities are to be carried out.

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Electromagnetic Compatibility (EMC)

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

Methods of Reducing Emissions

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

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

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

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

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

Screening and Shielding
Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire welding installation may be considered for special applications. [1]

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

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TECHNICAL SPECIFICATIONS - SAE-300®

INPUT - DIESEL ENGINE					
Make/Model	**Description**	**Speed (RPM)**	**Displacement**	**Starting System**	**Dry Capacities**
Perkins 404D-22 EPA Tier 4 interim Compliant	4 Cylinder 4 Cycle Naturally Aspirated Water-Cooled Diesel Engine Cast Iron Cylinder, Block/Crankcase	High Idle 1800 Low Idle 1400 Full Load 1725	135 cu. in (2.2 ltrs) **Bore x Stroke** 3.3" x 3.9" (84mm x 100mm) 32.7HP @1800 RPM	12VDC battery (Group 24, 650 cold crank amps) 2.0 KW Starter 65 A. Alternator w/ built in reg.	Fuel: 16 gal. 60.6 L. Oil: 11.2 Qts. 10.6 L. Coolant: 9.5 Qts. 9.0 L.

RATED OUTPUT @ 104°F(40°C) - WELDER		
DESCRIPTION	**RATED DC OUTPUT * VOLTS @ RATED AMPS**	**Duty CYCLE**
300 Amp DC Welder All Copper Windings Pure DC Power Generator	30V @ 250A 32V @ 300A 98V DC Max. OCV @ 1800RPM	100% 60%

RATED OUTPUT @ 104°F(40°C) - GENERATOR
Auxiliary Power (1)
3,000 Watts Continuous, 60 Hz AC 26 Amps @ 115V 13 Amps @ 230V

PHYSICAL DIMENSIONS (2)				
MODEL	**HEIGHT**	**WIDTH**	**DEPTH**	**WEIGHT**
K3003-1 CSA w/o Wire Feed Module	45.5 in. (1156 mm)	24.00 in. (610 mm)	65.0 in. (1651 mm)	1453 lbs. (659 kg.)

* Based on a 10 min. period.

(1) Output rating in watts is equivalent to volt-amperes at unity power factor. Output voltage is within ± 10% at all loads up to rated capacity. When welding, available auxiliary power will be reduced.

(2) Height to top of exhaust elbow.

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GENERAL DESCRIPTION

The SAE-300® is a heavy duty, engine driven, DC arc welding power source, capable of providing constant current output for stick welding or DC TIG welding. This welder is wound with all copper coils, rated at 300 amps/32 Volts and provides other Classic® features such as improved door latches and stainless hinges. With the addition of the optional K623-1 Wire Feed Module™, the SAE-300® will provide constant voltage output for running the LN-7, LN-23P, or LN-25 wire feeders. (The Wire Feed Module is factory installed on the K1643-8). The optional K924-5 Remote Control Kit, provides a remote control rheostat for remote fine current and open circuit voltage adjustment. See Section C for description.

The SAE-300® has an Electronic Engine Protection System. In the event of sudden low oil pressure or high coolant temperature, the engine immediately shuts down. The SAE-300® has a current range of 40-350 DC amps with output ratings as follows:

These units are also capable of providing 3 KVA of 115/230 volts of 60 cycle AC auxiliary power.

The SAE-300® uses the Perkins 404D-22 industrial water-cooled diesel engine.

RATED OUTPUT	DUTY CYCLE
250A @ 30V	100%
300A @ 32V	60%

DESIGN FEATURES

CONTROL PANEL

The welder controls consist of a “Course Current Control” Reactor and a “Fine Current Adjustment” rheostat located on the upper control panel at the exciter end of the machine. The lower control panel welder is equipped with a “Start” button, an “Ignition” switch, an “Idler” control switch and a “Glow Plug” button for easier cold weather starting.

The lower control panel also contains an engine temperature gauge, a battery charging ammeter, an oil pressure gauge, for auxiliary power there is one 20 amp, 120VAC (5-20R) duplex receptacle with GFCI protection and one 15 amp, 250VAC (6-15R) receptacle, protected by 2 pole, 15 Amp breaker.

The lower control panel also has a remote/local switch and a twist-lock receptacle (NEMA L14-20R) for the optional Constant Current remote control unit (K924-4).

All Copper Windings - For long life and dependable operation.

Engine Idler - The SAE-300® is equipped with an electronic automatic engine idler. It automatically increases and decreases engine speed **when starting and stopping welding or using auxiliary power**.

A built-in time delay permits changing electrodes before the engine slows to its low idle speed.

The “Idler” control switch on the panel locks the idler in high idle position when desired.

Auxiliary Power - 3.0 kVA of nominal 115/230V, 60Hz, AC. Output voltage is maintained within ± 10% at all loads up to rated capacity. (See ***Optional Features Section*** C for Power Plug Kit.)

GFCI - Protects the 20 amp, 120V duplex receptacle. See the ***Maintenance Section*** for detailed information on testing and resetting of the GFCI.

120 V DUPLEX RECEPTACLE AND GFCI

A GFCI protects the 120V auxiliary power receptacle.

A GFCI (Ground Fault Circuit Interrupter) is a device to protect against electric shock should a piece of defective equipment connected to it develop a ground fault. If this situation should occur, the GFCI will trip, removing voltage from the output of the receptacle. If a GFCI is tripped see the ***MAINTENANCE section*** for detailed information on testing and resetting it. A GFCI should be properly tested at least once every month.

The 120 V auxiliary power receptacle should only be used with three wire grounded type plugs or approved double insulated tools with two wire plugs. The current rating of any plug used with the system must be at least equal to the current capacity of the associated receptacle.

Welder Enclosure - The complete welder is rubber mounted on a rugged steel “C” channel base.

The output terminals are placed at the side of the machines so that they are protected by the door. The output terminals are labeled (+) and (-).

Cranking System - A 12 volt electric starter is standard.

Air Cleaner - Heavy duty two stage dry type.

Muffler - A muffler and stainless steel exhaust outlet elbow are standard.

Engine Hour Meter - A meter to record hours of operation.

Engine Protection - The system shuts the engine down in the event of sudden low oil pressure or high coolant temperature. A warning light on the control panel will indicate such a fault. To reset the engine for restarting, turn the ignition switch off then on.

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Oil Drain Valve - A ball valve, hose and clamp are standard.

Remote Control - The Remote / Local Switch and Receptacle are standard.

PRE-OPERATION INSTALLATION

⚠ WARNING

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

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

ENGINE EXHAUST can kill.
- **Use in open, well ventilated areas or vent exhaust outside.**

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

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

EXHAUST SPARK ARRESTER

Some federal, state or local laws may require that engines be equipped with exhaust spark arresters when they are operated in certain locations where unarrested sparks may present a fire hazard. The standard muffler included with this welder does not qualify as a spark arrester. When required by local regulations, a suitable spark arrester must be installed and properly maintained.

⚠ CAUTION

Use of an incorrect arrester may lead to engine damage or performance loss. Contact the engine manufacturer for specific recommendations.

LOCATION / VENTILATION

Always operate the welder with the doors closed. Leaving the doors open changes the designed air flow and may cause overheating.

The welder should be located to provide an unrestricted flow of clean, cool air. Also, locate the welder so that engine exhaust fumes are properly vented to an outside area.

⚠ CAUTION

DO NOT MOUNT OVER COMBUSTIBLE SURFACES.
Where there is a combustible surface directly under stationary or fixed electrical equipment, the surface shall be covered with a steel plate at least .06"(1.6mm) thick, which shall extend not more than 5.90"(150mm) beyond the equipment on all sides.

MACHINE GROUNDING

According to the United States National Electrical Code, the frame of this portable generator is not required to be grounded and is permitted to serve as the grounding means for cord connected equipment plugged into its receptacle.

Some state, local, or other codes or unusual operating circumstances may require the machine frame to be grounded. It is recommended that you determine the extent to which such requirements may apply to your particular situation and follow them explicitly. A machine grounding stud marked with the symbol ⏚ is provided on the welding generator frame foot. In general, if the machine is to be grounded, it should be connected with a #8 or larger copper wire to a solid earth ground such as a metal water pipe going into the ground for at least ten feet and having no insulated joints, or to the metal framework of a building which has been effectively grounded. The U.S. National Code lists a number of alternate means of grounding electrical equipment.

LIFT BAIL

A lift bail is provided for lifting with a hoist.

⚠ WARNING

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

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TRAILER (SEE OPTIONAL FEATURES)

If the user adapts a non-Lincoln trailer, he must assume responsibility that the method of attachment and usage does not result in a safety hazard nor damage the welding equipment. Some of the factors to be considered are as follows:

1. Design capacity of trailer vs. weight of Lincoln equipment and likely additional attachments.
2. Proper support of and attachment to, the base of the welding equipment so there will be no undue stress to the framework.
3. Proper placement of the equipment on the trailer to ensure stability side to side and front to back when being moved and when standing by itself while being operated or serviced.
4. Typical conditions of use, i.e., travel speed, roughness of surface on which the trailer will be operated; environmental conditions, likely maintenance.
5. Conformance with federal, state and local laws. (1)

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

VEHICLE MOUNTING

⚠ WARNING

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

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

POLARITY CONTROL AND CABLE SIZES

With the engine off, route the electrode and work cables through the strain relief bracket on the base and connect to the studs located below the fuel tank mounting rail. (See size recommendations below.) For positive polarity, connect the electrode cable to the terminal marked "+". For Negative polarity, connect the electrode cable to the "-" stud. These connections should be checked periodically and tightened if necessary.

When welding at a considerable distance from the welder, be sure you use ample sized welding cables.

RECOMMENDED COPPER CABLE SIZES			
		Cables Sizes for Combined Length of Electrode Plus Work Cable	
Amps	Duty Cycle	Up to 200ft.(61m)	200 to 250ft. (61 to 76m)
250	100%	1	1/0
300	60%	1/0	2/0

PRE-OPERATION SERVICE

⚠ CAUTION

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

⚠ WARNING

- **Stop engine while fueling.**
- **Do not smoke when fueling.**
- **Keep sparks and flame away from tank.**
- **Do not leave unattended while fueling.**
- **Wipe up spilled fuel and allow fumes to clear before starting engine.**
- **Do not overfill tank, fuel expansion may cause overflow.**

DIESEL FUEL can cause fire

DIESEL FUEL ONLY-Low sulphur fuel or ultra low sulphur fuel in U.S.A. and Canada.

OIL

This unit is supplied from the factory with the engine crankcase filled with a high quality SAE 10W/30 oil. This oil should be acceptable for most typical ambient temperatures. Consult the engine operation manual for specific engine manufacturer's recommendations. Upon receipt of the welder, check the engine dipstick to be sure the oil is at the "full" mark. DO NOT overfill.

FUEL

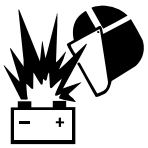
Fill the fuel tank with the grade of fuel recommended in the Engine Operator's manual. Make sure the fuel valve on the water separator is in the open position.

COOLING SYSTEM

The radiator has been filled at the factory with a 50-50 mixture of ethylene glycol antifreeze and water. Check the radiator level and add a 50-50 solution as needed (see engine manual or antifreeze container for alternate antifreeze recommendations).

BATTERY CHARGING

⚠ WARNING



GASES FROM BATTERY can explode.
- **Keep sparks, flame and cigarettes away.**

BATTERY ACID can burn eyes and skin.
- **Wear gloves and eye protection and be careful when boosting, charging or working near battery.**

To prevent EXPLOSION when:

a) Installing a new battery - disconnect the negative cable from the old battery first and connect the negative cable to the new battery last.

b) 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.

c) Using a booster - connect the positive lead to the battery first, then connect the negative lead to the ground lead on the base.

To prevent ELECTRICAL DAMAGE when:

a) Installing a new battery.

b) Using a booster.

Use correct polarity - Negative Ground.

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

- **To prevent BATTERY BUCKLING, tighten nuts on battery clamp until snug.**

The SAE-300® is equipped with a wet charged battery. The charging current is automatically regulated when the battery is low (after starting the engine) to a trickle current when the battery is fully charged.

When replacing, jumping or otherwise connecting the battery to the battery cables, the proper polarity must be observed. This system is NEGATIVE GROUND.

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ENGINE OPERATION

⚠ WARNING

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

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

ENGINE EXHAUST can kill.
- **Use in open, well ventilated areas or vent exhaust outside.**

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

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

Operate the welder with the doors closed. Leaving the doors open changes the designed air flow and can cause overheating.

STARTING THE SAE-300® 404D-22 DIESEL ENGINE

1. Turn the "IDLER" switch to "HIGH".
2. Turn the "IGNITION" switch to "ON".
3. Press the Glow Plug button for 20 to 30 seconds. (maximum 60 seconds).
4. Press the Start button. When the engine starts running, release both buttons. If the engine fails to start in 20 seconds, wait 30 seconds and repeat the above procedure.
5. Observe the oil pressure. If no pressure shows within 30 seconds, stop the engine and consult the engine operating manual. To stop the engine, turn the "IGNITION" switch to "OFF".
6. If the engine protection warning light comes on during cranking or after start up, the "IGNITION" switch must be turned "OFF" to reset the engine protection system.
7. Allow the engine to run at high idle speed for several minutes to warm the engine. Stop the engine and recheck the oil level, after allowing sufficient time for the oil to drain into the pan. If the level is down, fill it to the full mark again. The engine controls were properly set at the factory and should require no adjusting when received.

COLD WEATHER STARTING

With a fully charged battery and the proper weight oil, the engine should start satisfactorily even down to about -15°F (-26°C), it maybe desirable to install cold-starting aides.

NOTE: Extreme cold weather starting may require longer glow plug operation.

⚠ WARNING

Under NO conditions should ether or other starting fluids be used!

HIGH ALTITUDE OPERATION

The engine will run correctly up to an altitude of 600m (2000ft.). If the engine is to be operated permanently at an altitude above this, the fuel consumption and exhaust emissions may be excessive.

Contact the Perkins Application Department for any engine adjustments that may be required.

STOPPING THE ENGINE

1. Turn the "IGNITION" switch to "OFF"

At the end of each day's welding, check the crankcase oil level, drain accumulated dirt and water from the water separator located on the fuel rail. Refill the fuel tank to minimize moisture condensation in the tank. Also, running out of fuel tends to draw dirt into the fuel system.

When hauling the welder between job sites, close the fuel feed valve on the separator located on the fuel rail.

If the fuel supply is cut off or runs out while the fuel pump is operating, air may be entrapped in the fuel distribution system. If this happens, bleeding of the fuel system may be necessary. Use qualified personnel to do this per the instructions in the ***MAINTENANCE section*** of this manual.

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ENGINE BREAK-IN

Lincoln Electric selects high quality, heavy-duty industrial engines for the portable welding machines we offer. While it is normal to see a small amount of crankcase oil consumption during initial operation, excessive oil use, wet stacking (oil or tar like substance at the exhaust port), or excessive smoke is not normal.

Larger machines with a capacity of 350 amperes and higher, which are operated at low or no-load conditions for extended periods of time are especially susceptible to the conditions described above. To accomplish successful engine break-in, most diesel-powered equipment needs only to be run at a reasonably heavy load within the rating of the welder for some period of time during the engine's early life. However, if the welder is subjected to extensive light loading, occasional moderate to heavy loading of the engine may sometimes be necessary. Caution must be observed in correctly loading a diesel/generator unit.

1. Connect the welder output studs to a suitable resistive load bank. Note that any attempt to short the output studs by connecting the welding leads together, direct shorting of the output studs, or connecting the output leads to a length of steel will result in catastrophic damage to the generator and voids the warranty.
2. Set the welder controls for an output current and voltage within the welder rating and duty cycle. Note that any attempt to exceed the welder rating or duty cycle for any period of time will result in catastrophic damage to the generator and voids the warranty.
3. Periodically shut off the engine and check the crankcase oil level.

WELDER OPERATION

⚠ WARNING

ELECTRIC SHOCK can kill.
- **Do not touch electrically live parts or electrode with skin or wet clothing.**
- **Insulate yourself from work and ground.**

FUMES & GASES can be dangerous.
- **Keep your head out of the fumes.**
- **Use ventilation or exhaust to remove fumes from breathing zone.**

WELDING SPARKS can cause fire or explosion.
- **Keep flammable material away.**

ARC RAYS can burn.
- **Wear eye, ear and body protection.**

DUTY CYCLE

The NEMA output rating of the SAE-300® is 300 amperes at 32 arc volts on a 60% duty cycle (consult Specifications in this manual for alternate ratings). Duty cycle is based on a ten minute period; thus, the welder can be loaded at rated output for six minutes out of every ten minute period.

CURRENT CONTROL

⚠ CAUTION

Do not adjust the "Current Control" while welding because this can damage the control.

The "Coarse Current Control" is the main Current Adjuster. The "Fine Current Control" adjusts the current from minimum to maximum. Open circuit voltage is also controlled by the "Fine Current Control" permitting control of the arc characteristics.

A high open circuit voltage setting provides the soft "buttering" arc with best resistance to pop-outs preferred for most welding. To get this characteristic, set the "Coarse Current Control" to the lowest setting that still provides the current you need and set the "Fine Current Control" near maximum.

When a forceful "digging" arc is required, usually for vertical and overhead welding, use a higher "Coarse Current Control" setting and lower open circuit voltage.

Some arc instability may be experienced with EXX10 electrodes when trying to operate with long arc techniques at settings at the lower end of the open circuit voltage range.

STICK / TIG WELDING

Start by setting the right-side Fine Current and OCV control dial to 60, then set the left-side Coarse Current control dial to the desired current using the dial markings as an approximate guideline. Arc characteristics and small changes in output can then be adjusted using the Fine Current and OCV control dial. A K924-4 Remote Control unit can also be used as the Fine Control and OCV control dial.

SELF-SHIELDED FLUX-CORED WELDING

(with a K623-1 Wire Feed Module installed)

Start by setting the Wire (CV) / Stick (CC) toggle switch to the Wire (CV) position. Then set the left-side Coarse Current control dial to 270. Now move the Voltage Adjustment dial to the desired voltage. Move the Coarse Current control to the left for a softer arc and to the right for a crisper arc.

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GAS-SHIELDED FLUX-CORED WELDING

(with a K623-1 Wire Feed Module installed)

Start by setting the Wire (CV) / Stick (CC) toggle switch to the Wire (CV) position. Then set the left-side Coarse Current control dial to 150. Now move the Voltage Adjustment dial to the desired voltage. Move the Coarse Current control to the left for a softer arc and to the right for a crisper arc.

MIG WELDING

(with a K623-1 Wire Feed Module Installed)

Start by setting the Wire (CV) / Stick (CC) toggle switch to the Wire (CV) position. Then set the left-side Coarse Current control dial to 150. Now move the Voltage Adjustment dial to the desired voltage. Move the Coarse Current control to the left for a softer arc and to the right for a crisper arc.

CARBON ARC GOUGING

Set both the Coarse Current and Fine Current O.C.V controls to maximum for carbon arc gouging in the CC (constant current) mode. If a K623-1 Wire Feed Module is installed and the CV (constant voltage) mode is desired, set the Wire (CV) / Stick (CC) toggle switch to the Wire (CV) position. Then set the left-side Coarse Current control to maximum output and the Voltage Adjustment dial to maximum output.

IDLER OPERATION

Start the engine with the “Idler” switch in the “High” position. Allow it to run at high idle speed for several minutes to warm the engine. See Specifications for operating speeds.

The idler is controlled by the “Idler” toggle switch on the welder control panel. The switch has two positions as follows:

1. In the “High”  position, the idler solenoid deactivates and the engine goes to high idle speed. The speed is controlled by the governor.
2. In the “Auto”  /  position, the idler operates as follows:
   a. When welding or drawing power for lights or tools (approximately 100 watts minimum) from the receptacles, the idler solenoid deactivates and the engine operates at high idle speed.
   b. When welding ceases or the power load is turned off, a preset time delay of about 15 seconds starts. This time delay cannot be adjusted.
   c. If the welding or power load is not re-started before the end of the time delay, the idler solenoid activates and reduces the engine to low idle speed.

AUXILIARY POWER

If GFCI is tripped, See the ***MAINTENANCE section*** for detailed information on testing and resetting the GFCI.

The AC auxiliary power, supplied as a standard, has a rating of 3.0 KVA of 115/230 VAC (60 hertz).

With the 3.0 KVA, 115/230 VAC auxiliary power, one 120V duplex protected by GFCI and one 230V duplex, grounding type receptacle with 2 pole, 15 amp circuit breaker.

The rating of 3.0 KVA permits a maximum continuous current of 13 amps to be drawn from the 230 volt duplex receptacle. 20 amps can be drawn from the 120 volt duplex receptacle. The total combined load of all receptacles is not to exceed 3.0 KVA.

An optional power plug kit is available. When this kit is specified, the customer is supplied with a plug for each receptacle.

SAE-300® WITH PERKINS 404D-22 DIESEL ENGINE
TYPICAL FUEL CONSUMPTION DATA

Low Idle (1375 RPM)-No Load @ 45 Volts	0.28 gal/hr (1.06 ltrs/hr)
High Idle (1800 RPM)-No Load @ 96.6 Volts	0.42 gal/hr (1.59 ltrs/hr)
3000 Watts	0.59 gal/hr (2.23 ltrs/hr)
250 Amps @ 30 Volts	1.03 gal/hr (3.90 ltrs/hr)
300 Amps @ 32 Volts	1.37 gal/hr (5.19 ltrs/hr)

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OPTIONAL FEATURES

(FIELD INSTALLED)

GENERAL OPTIONS

⚠ WARNING

Pipe Thawing with an arc welder can cause fire, explosion, damage to electric wiring or to the arc welder if done improperly. The use of an arc welder for pipe thawing is not approved by the CSA, nor is it recommended or supported by Lincoln Electric.

Power Plug Kit K802D

A power plug kit for the auxiliary power receptacles is available. (Provides a plug for each receptacle.)

Spark Arrestor Kit K903-1

Includes a heavy gage steel, approved spark arrestor, clamp and adapter for mounting to the muffler exhaust pipe.

Trailer K2636-1

For heavy-duty road, off-road, plant and yard use. Includes pivoting jack stand, safety chains and 13 in. (330.2 mm) wheels. Stiff .120 in. (3.0 mm) welded rectangular steel tube frame construction is phosphate etched and powder coat painted for superior rust and corrosion resistance. Low sway suspension gives outstanding stability with manageable tongue weight. Wheel bearings are packed with high viscosity, high pressure, low washout Lubriplate® grease.

Includes a Duo-Hitch™– a 2 in. (50.8 mm) Ball/Lunette

Eye combination hitch. Overall width: 60 in. (1.5 m)

K2639-1 Fender & Light Kit

K2640-1 Cable Rack

Stainless Steel Sheet Metal Kit K2423-1

Stainless steel roof and doors. Also includes decals (mounted), door latches, door hooks, bumpers and all required mounting hardware. Fits K6090-9 and -10 Pipeliner® 200D and K1643-1 thru -10 Classic® 300D

STICK OPTIONS

ACCESSORY SET K704

Includes 35 feet (10 m) of electrode cable and 30 feet (9 m) of work cable, headshield, work clamp and electrode holder. Cable is rated at 500 amps, 60% duty cycle.

Remote Control Kit K924-4

Contains remote control rheostat and 100 ft. (30.5 m) cable for adjusting the OCV at the welding site.

TIG OPTIONS

TIG Module K930-2

Provides high frequency and shielding gas control for AC and DC GTAW (TIG) welding applications. Its compact case is designed for easy carrying, complete with a handle. High frequency bypass is built in. Additionally, the K936-3 control cable is required if remote control is used. If remote control is not used the K936-4 control cable is required.

PTA-26V TIG Torch K1783-9

Air cooled 200 amp torch equipped with valve for gas flow control. 25Ft. length.

Magnum Parts Kit For PTA-26V TIG Torch KP509

Control Cable K936-4 (required for TIG Module)

Control cable for connecting the K930-2 TIG Module.

Arc Start Switch K814 (required for TIG Module)

Comes with a 25ft.(7.6m) cable.

Attaches to the TIG torch for convenient finger control.

Contactor Kit K938-1 (required for TIG Module)

Provide “Cold” tungsten Tip when welding with the TIG Module.

Control Cable Extension K937-45

Allows the TIG Module to be operated at distances up to 200 ft. from the power source.Available in 45 ft. (13.7m).

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WIRE FEEDER OPTIONS

Wire Feed Module K623-1

Provides constant voltage (CV) output with improved arc stability for Innershield welding. Excellent for MIG welding. Recommended wire feeders are the LN-7, LN-23P and LN-25.

Remote Control Kit K2464-1

(Stick & Wire)

For machines that have the wire feed module. Contains a rheostat for stick output, a potentiometer for wire output and 100 ft. (30 m) of control cable.

LN-25 PRO Wire Feeder K2613-1

Portable CC/CV unit for flux-cored and MIG welding with MAXTRAC® wire drive system. Includes Gas Solenoid & Internal Contactor. Requires Wire Feed Module.

Magnum® 350 Innershield Gun for LN-25 K126-12

For self-shielded wire with 15 ft. (4.5m) cable. For .072"(1.9mm) (5/64" (2.0mm) wire.

Magnum® PRO 350 Ready-Pak® K2652-2-10-45

15 ft., .035-5/64 in.

Magnum® PRO MIG/flux-cored welding guns are rated 100% duty cycle. The guns are designed for high amperage, high duty cycle applications in extreme environments where heat-resistance and fast service-ability are key.

Drive Roll and Guide Tube Kit (for LN-25 PRO)

KP1697-068 for .068-.072 in. (1.8 mm)

KP1697-5/64 for 5/64 in. (2.0 mm)

For cored or solid steel wire.

Magnum® 300 MIG Gun and Cable Package LN-25 PRO K1802-1 (includes K466-1 Connector Kit)

For .035-.045 in. (0.9-1.2 mm) gas-shielded wire with 15 ft. (4.5 m) cable.

Drive Roll and Guide Tube Kit (for LN-25 PRO) KP1696-1

For .035 in. and .045 in. (0.9 mm and 1.1 mm) solid steel wire.

Magnum Spool Gun K487-25

Hand held semiautomatic wire feeder requires SG Control Module. 25 ft. length.

SG Control Module K488 (For Magnum Spool Gun)

The interface between the power source and the spool gun. Provides control of wire speed and gas flow.

Input Cable K691-10 (For SG Control Module)

For Lincoln engine drives with 14-pin MS-type connection, separate 115V NEMA receptacle and output stud connections. 10 ft. length.

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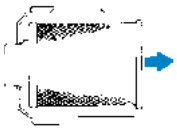
Service Instructions

Single- and Two-Stage Engine Air Cleaners

1 Remove the Filter



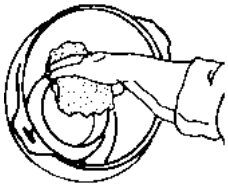
Rotate the filter while pulling straight out.

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

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

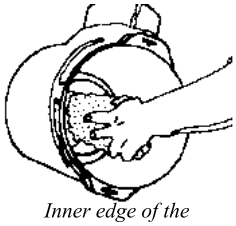
2 Clean Both Surfaces of the Outlet Tube and Check the Vacuator™ Valve

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



Outer edge of the outlet tube

Wipe both sides of the outlet tube clean.

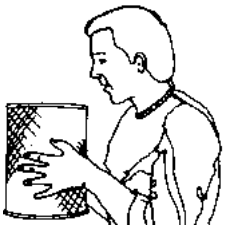


Inner edge of the outlet tube

If your air cleaner is equipped with a Vacuator Valve
Visually check and physically squeeze to make sure the valve is flexible and not inverted, damaged or plugged.

3 Inspect the Old Filter for Leak Clues

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



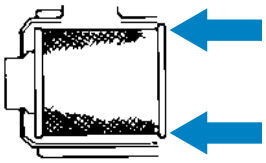
4 Inspect the New Filter for Damage

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

5 Insert the New Radial Seal Filter Properly

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

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



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

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

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

Caution

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

6 Check Connectors for Tight Fit

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

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SAFETY PRECAUTIONS

⚠ WARNING

Have qualified personnel do the maintenance work. Turn the engine off before working inside the machine. In some cases, it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.

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

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

ENGINE EXHAUST can kill.
- **Use in open, well ventilated areas or vent exhaust outside.**

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

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

GENERAL INSTRUCTIONS

1. Blow out the welder and controls with an air hose at least once every two months. In particularly dirty locations, this cleaning may be necessary once a week. Use low pressure air to avoid driving dirt into the insulation.
2. Follow the engine service schedule in this manual and the detailed maintenance and troubleshooting in the engine manufacturer's manual.

COOLING SYSTEM

The SAE-300® is equipped with a pressure radiator. Keep the radiator cap tight to prevent loss of coolant. Clean and flush the cooling system periodically to prevent clogging the passage and overheating the engine. When antifreeze is needed, always use the permanent type.

BEARINGS

This welder is equipped with a double synthetic sealed ball bearing having sufficient grease to last indefinitely under normal service.

COMMUTATOR AND BRUSHES

⚠ WARNING

Uncovered rotating equipment can be dangerous. Use care so your hands, hair, clothing or tools do not catch in the rotating parts. Protect yourself from particles that may be thrown out by the rotating armature when stoning the commutator.

Shifting of the commutator brushes may result in:

- Change in machine output
- Commutator damage
- Excessive brush wear

Periodically inspect the commutator, slip rings and brushes by removing the covers. DO NOT remove or replace these covers while the machine is running.

Commutators and slip rings require little attention. However, if they are black or appear uneven, have them cleaned by an experienced maintenance man

using fine sandpaper or a commutator stone. Never use emery cloth or paper for this purpose.

Replace brushes when they wear within 1/4" of the pigtail. A complete set of replacement brushes should be kept on hand. Lincoln brushes have a curved face to fit the commutator. Have an experienced maintenance man seat these brushes by lightly stoning the commutator as the armature rotates at full speed until contact is made across the full face of the brushes. After stoning, blow out the dust with low pressure air.

To seat slip ring brushes, position the brushes in place. Then slide one end of a piece of fine sandpaper between slip rings and brushes with the coarse side against the brushes. Pull the sandpaper around the circumference of the rings - in direction of rotation only - until brushes seat properly. In addition, stone slip ring with a fine stone. Brushes must be seated 100%.

Arcing or excessive exciter brush wear indicates a possible misaligned shaft. Have an authorized Field Service Shop check and realign the shaft.

IDLER MAINTENANCE

⚠ CAUTION

Before doing electrical work on the idler printed circuit board, disconnect the battery.

When installing a new battery or using a jumper battery to start the engine, be sure the battery polarity is connected properly. The correct polarity is negative ground. Damage to the engine alternator and the printed circuit board can result from incorrect connection.

1. Proper operation of the idler requires good grounding of the printed circuit board, reed switch and battery.
2. Idler solenoid is activated for low idle.
3. If desired, the welder can be used without automatic idling by setting the "Idler" switch to the "High" position.

NAMEPLATES

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

PURGING AIR FROM FUEL SYSTEM

(Perkins 404D-22 Engine)

⚠ WARNING

Keep fuel clear of open flames or arcs, allow engine to cool before working on the fuel system. Wipe up any spilled fuel and do not start engine until fumes clear.

If the engine is running rough and you suspect air has been trapped in the fuel system, (e.g. the engine was allowed to run out of fuel) perform the following steps using qualified personnel:

1. Loosen by two or three turns, the vent screw (Figure D.1) on the fuel inlet connection.

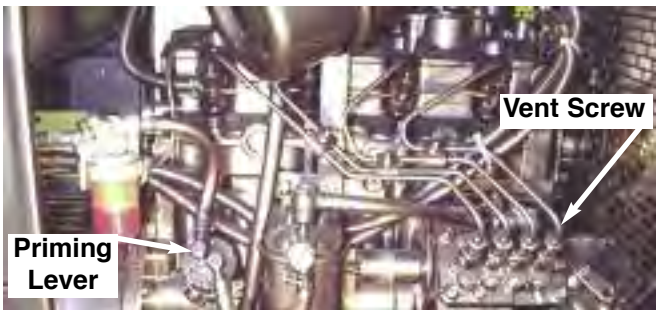

FIGURE D.1

2. Operate the electric fuel pump by turning the "Ignition" switch "ON" until fuel, free of air, flows from the vent point. Tighten the vent screw.
3. Contact your Perkins Engine repair facility if problems persist.

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ENGINE SERVICE

EVERY DAY OR EVERY 8 HOURS	FIRST SERVICE - (20 / 50 HOURS)	EVERY 100 HOURS OR 3 MONTHS	EVERY 250 HOURS OR 6 MONTHS	EVERY 500 HOURS OR 12 MONTHS	EVERY 1000 HOURS	ENGINE SERVICE (NOTE 2)	
						MAINTENANCE ITEM	TYPE OR QUANTITY
I						Coolant level	
			I			Concentration of antifreeze	50/50 Water/Ethylene Glycol
					R	Coolant (NOTE 3)	9.5qt., 9.0L
I						Engine oil level (NOTE 1)	
	R			R		Engine oil (NOTE 1 & 3)	8.45qt., 8L (refill amount)
	R			R		Engine oil filter	Perkins #140517050
C						Drain water separator & fuel strainer	
				R		Water separator element	Lincoln #M20840-A
				R		Fuel filter canister	Perkins #130366120
			I			Tension of alternator drive belt	
			I			Alternator drive belt wear	
					R	Alternator drive belt	Perkins #080109107
C						Air filter (earlier check may be req'd)	
				R		Air filter element	Donaldson #P821575
					R	Renew the engine breather	
					I	Tighten cylinder head	
					I	Valve clearances	Intake .008", exhaust .008"
					I	Electrical systems	
					I	All nuts and bolts for tightness	
				I		Injector performance	Contact P erkins
I						Leaks or engine damage	
				I		Battery	

I = Inspect C = Clean R = Replace

Notes:

(1) Consult Engine Operators Manual for oil recommendations.
(2) Consult Engine Operators Manual for additional maintenance schedule information.
(3) Fill slowly! Ensure correct quantity is used.

Above operations to be carried out by trained personnel with reference to the workshop manual where necessary .

These preventative maintenance periods apply to average conditions of operation. If necessary use shorter periods.

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GFCI TESTING AND RESETTING PROCEDURE

The GFCI should be properly tested at least once every month or whenever it is tripped. To properly test and reset the GFCI :

- If the GFCI has tripped, first carefully remove any load and check it for damage.
- If the equipment has been shut down, it must be restarted.
- The equipment needs to be operating at high idle speed and any necessary adjustments made on the control panel so that the equipment is providing at least 80 volts to the receptacle input terminals.
- The circuit breaker for this receptacle must not be tripped. Reset if necessary.
- Push the "Reset" button located on the GFCI. This will assure normal GFCI operation.
- Plug a night-light (with an "ON/OFF" switch) or other product (such as a lamp) into the Duplex receptacle and turn the product "ON".
- Push the "Test" button located on the GFCI. The night-light or other product should go "OFF".
- Push the "Reset" button, again. The light or other product should go "ON" again.

If the light or other product remains "ON" when the "Test" button is pushed, the GFCI is not working properly or has been incorrectly installed (miswired). If your GFCI is not working properly, contact a qualified, certified electrician who can assess the situation, rewire the GFCI if necessary or replace the device.

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FIGURE E.1 BLOCK LOGIC DIAGRAM

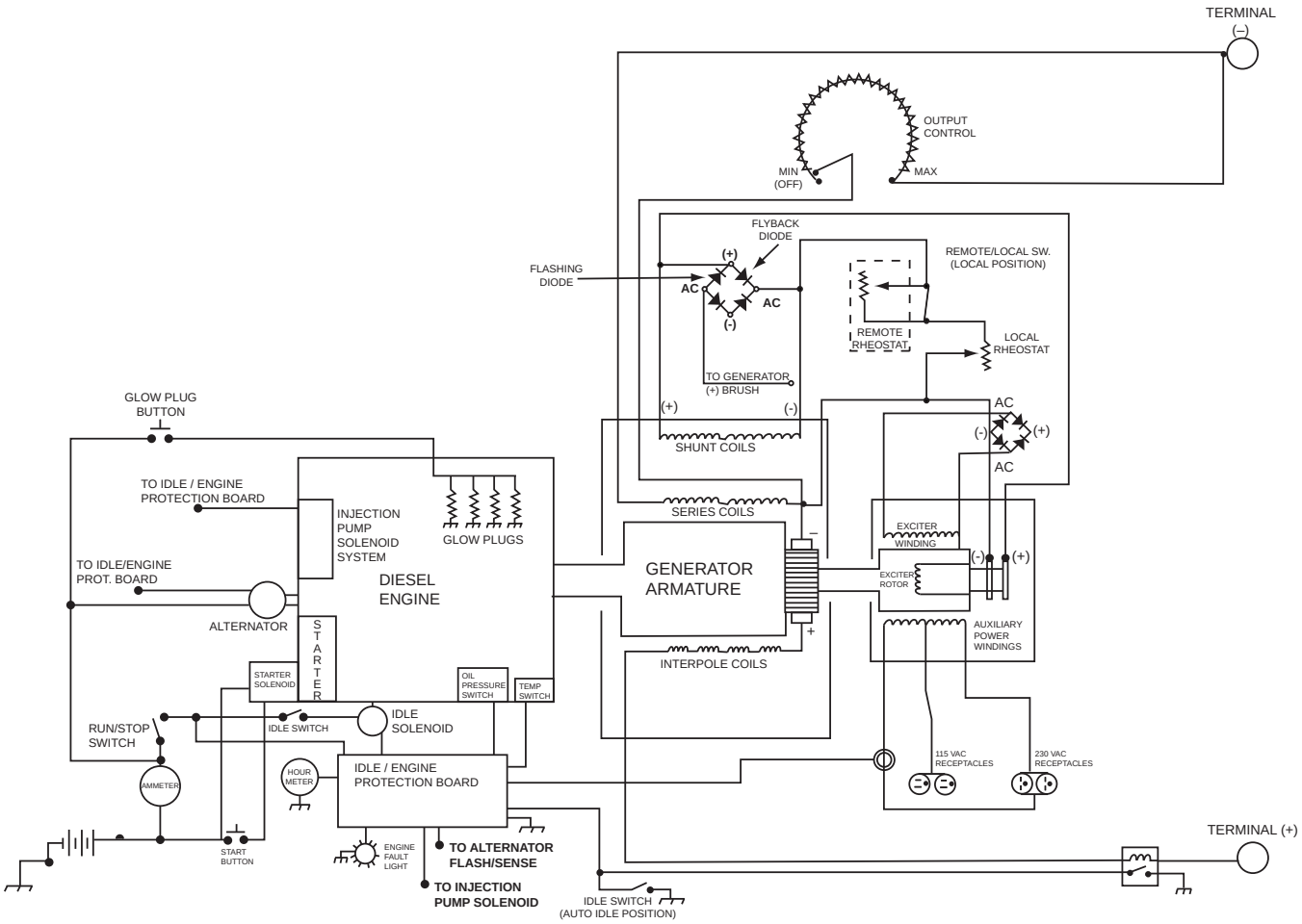
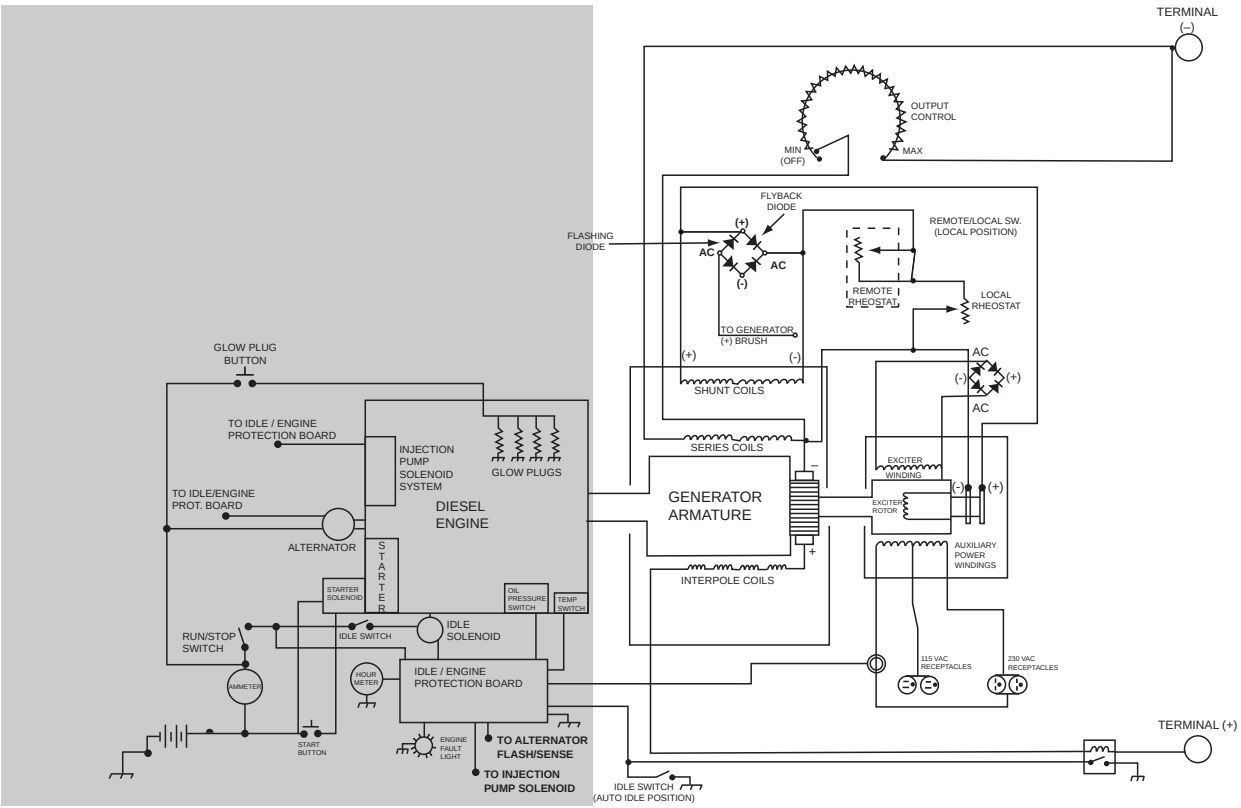


FIGURE E.2 - ENGINE START AND PROTECTION



ENGINE STARTING AND PROTECTION

Turning on the run/stop switch supplies 12VDC power to idler/engine protection PC board and idle solenoid. During the first minute after the switch is placed in the on position, power is supplied to the Fuel solenoid, the hour meter and the flashing circuit for the engine alternator. The engine should be started during this first minute.

After one minute, the PC board will begin to monitor the oil pressure switch, cooling system temp switch and the engine alternator. If a fault is detected in any of these systems, the engine fault light will come on and the engine will be shut down by shutting off the power to the fuel solenoid. These systems signal a fault by connecting the sense lead to chassis ground.

If the engine fault light turns on, the engine protection system must be reset by turning the run/stop switch off, then on again before attempting to restart the engine.

The machine is equipped with a glow plug starting system that is used for cold weather starting. Pressing the Glow Plug button activates this system. See the machine nameplate and engine manual for operating instructions and service information.

Pressing the start button activates the starter motor which cranks the engine. The start button is a momentary contact switch that routes power from the battery to the starting terminal of the starter solenoid. The starter will crank the engine even if the run/stop switch is in the off position.

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

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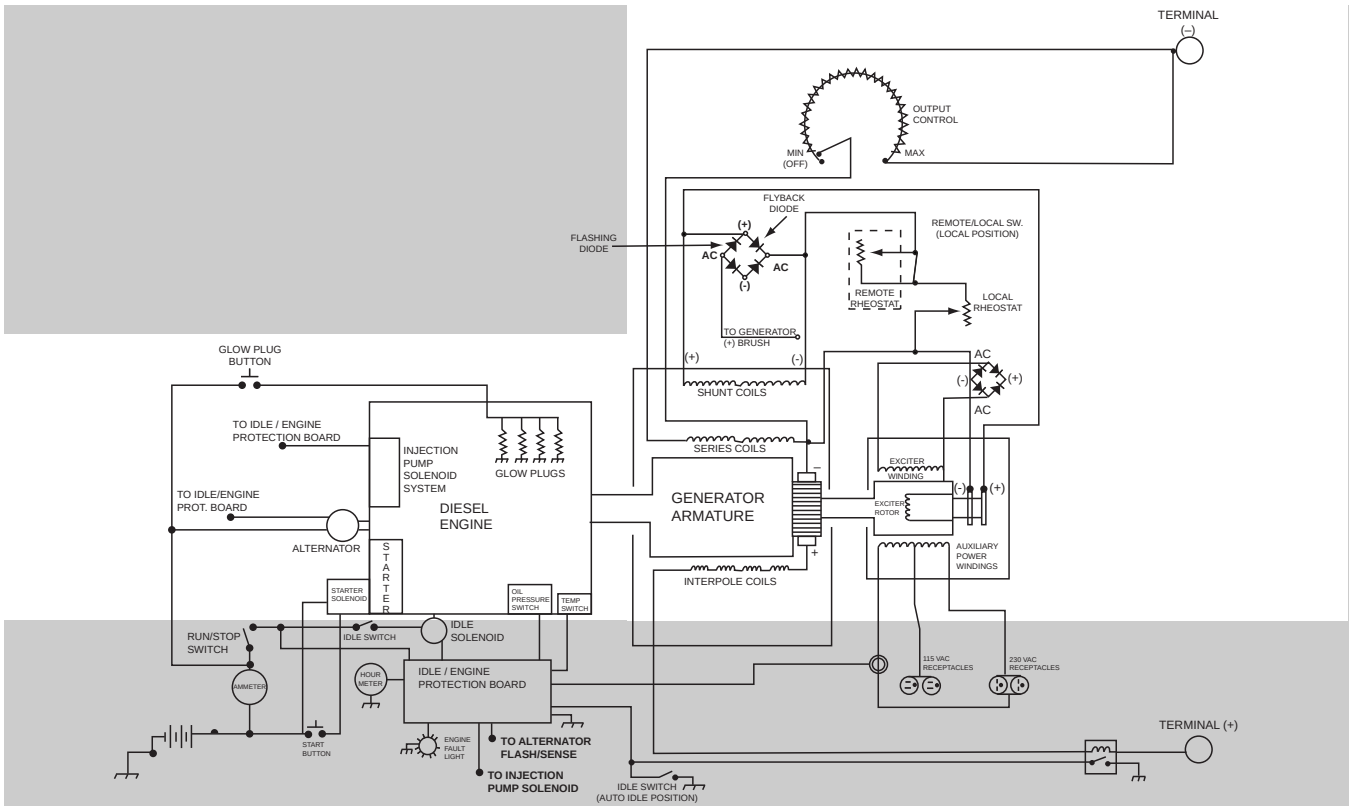
FIGURE E.3 - AUTOMATIC ENGINE IDLE SYSTEM



AUTOMATIC ENGINE IDLE SYSTEM

The automatic idle system reduces the engine RPM when there is no electrical demand on the machine. When an arc is struck, or a load of 100 Watts or greater is applied to the auxiliary output, the engine speed will immediately increase to high RPM. When the load is released, the engine continues to run at high RPM for about 12 seconds. If a load is re-applied during this time, the machine will continue to operate at high RPM. If no load is applied, the engine RPM is reduced to idle speed.

The automatic idle system functions by energizing a solenoid, which pulls the engine speed control to a preset low idle RPM position. When this solenoid is de-energized, the engine speed is controlled by the governor which maintains the engine RPM at the specified high RPM setting. The solenoid is supplied with +12VDC power and is activated when circuitry on the Idler/engine shutdown PC board completes the solenoid's path to chassis ground.

The automatic idle circuitry on the PC board uses a magnetic reed switch to sense weld current and a toroidal current transformer to sense auxiliary current. When weld current flows the reed switch closes, connecting the sense lead to chassis ground. When sufficient AC current flows, the toroidal current transformer sends a signal to the PC board.

When the idle switch is in the "high" position, the sense lead connecting the reed switch to the idler/engine protection PC board is connected to chassis ground. The **SAE-300®** will continuously run at high RPM.

If the machine had been operating at low idle and the idle switch is moved from auto to high, the engine RPM will increase immediately. If the switch is moved from "high" to "auto" and if there is no electrical demand from either the weld or the auxiliary circuits, the RPM will be reduced after a 12 second delay.

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

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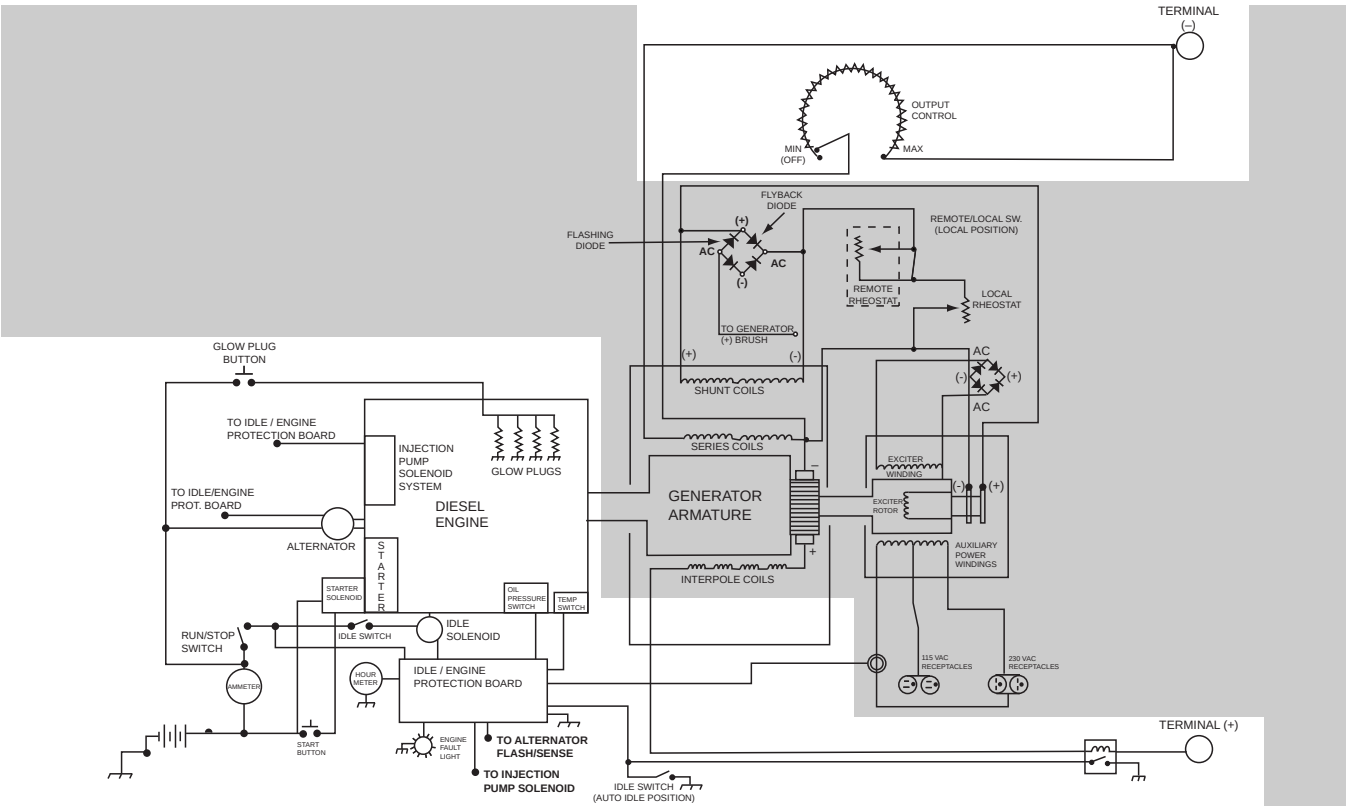
FIGURE E.4 - EXCITER / AUXILIARY OPERATION



EXCITER / AUXILIARY ALTERNATOR OPERATION

The exciter alternator is the smaller power generator that is located at the end of the main welding generator. It provides power to energize the rotor, the shunt fields of the main welding generator and about 3 KVA of 120/230 volts, 60 Hz. for auxiliary power.

Flashing:

The exciter alternator requires that DC power be applied to the slip rings to start the power generation process. This DC power is often referred to as “Flashing” voltage.

Flashing voltage is low voltage (about 4 to 6 VDC) generated by the main armature spinning in a weak magnetic field. This magnetic field is caused by residual magnetism in the iron poles of the generator.

Flashing current passes through a flashing diode and is applied to the rotor field winding through the exciter brushes and slip rings.

Building output:

The flashing current produces a weak magnetic field in the rotor, which is coupled to the now running engine. This rotating magnetic field begins to generate AC output from all of the stator windings. Output from the exciter winding is rectified by a diode bridge and then fed back into the rotating field winding, through the brushes, making the magnetic field stronger. This stronger magnetic field then produces higher voltage from the stator windings, which feeds back to the rotor, making its magnetic field even stronger.

This process of strengthening the magnetic field through feedback from the exciter winding continues to increase the output of the alternator until the design voltage is reached.

The field voltage is now higher than the voltage produced by the welding generator. The flashing diode will now block the higher voltage from intruding into the weld circuit.

(continued on next page)

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

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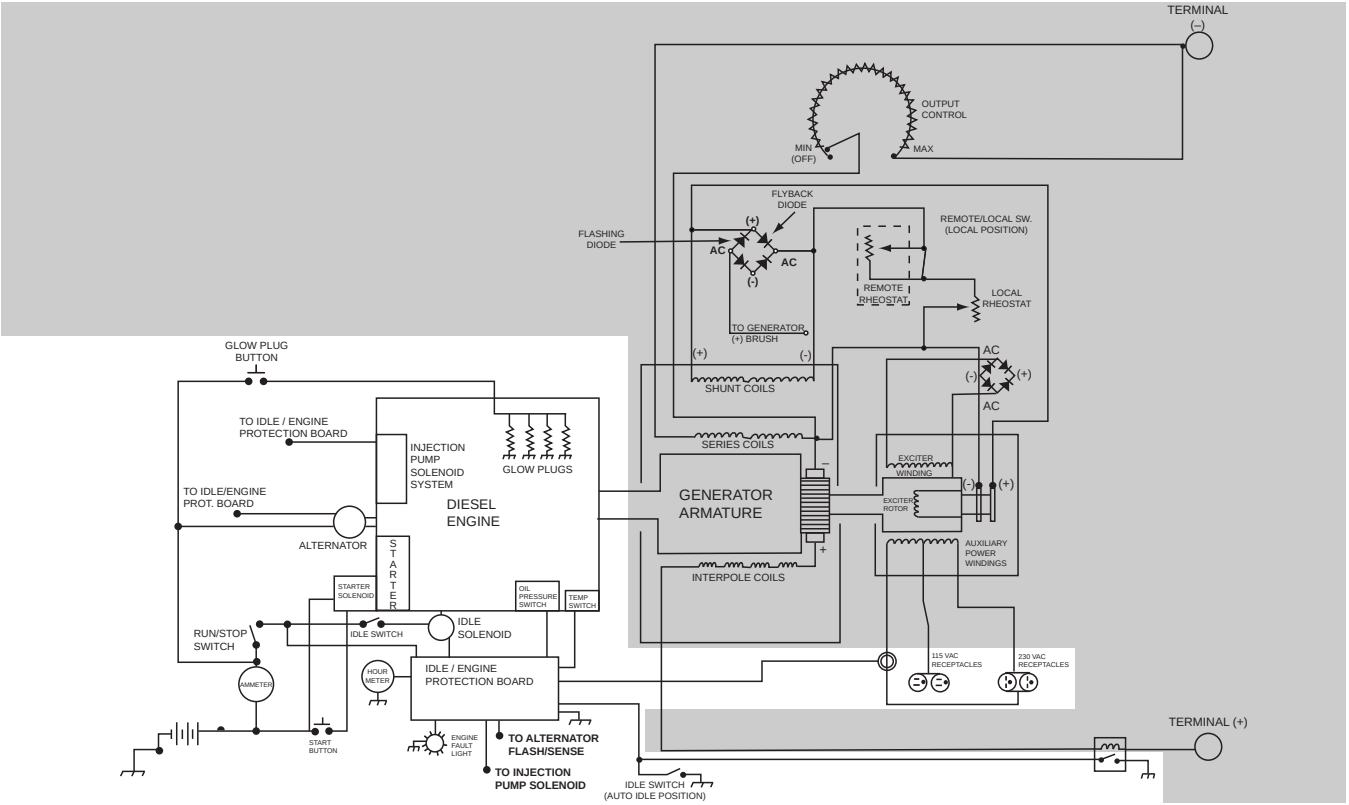
EXCITER / AUXILIARY ALTERNATOR OPERATION (Continued)

AC Auxiliary Output:
The exciter alternator is now producing sufficient AC power from both the exciter winding and the 115/230 VAC auxiliary power winding. This 115/230 VAC, 60 Hz. auxiliary power is made available for use through the receptacles on the front panel of the machine, after passing through circuit breakers and the automatic idle system's current sensor.

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

FIGURE E.5 - WELDING GENERATOR AND EXCITER



WELDING GENERATOR AND EXCITOR

Overview:

The welding generator is coupled directly to the engine and produces the DC current required for welding and arc gouging. The welding power is induced in the windings of the armature when it spins in a magnetic field. The power produced in the armature is converted to direct current (DC) by a commutator and a set of carbon brushes, which are then connected to the interpole coils, the series coils and the reactor assembly. The weld current is controlled by varying the field (Fine Current and O.C.V. Control) and the reactor (Coarse Current Control) setting, using the front panel control knobs.

EXCITATION AND FIELD CONTROL:

Before any welding current can be produced, there must be a strong magnetic field in which the armature can spin. Creating this magnetic field is often described as exciting the generator and is accomplished by passing controlled DC current through two shunt coils in the generator stator.

The power used to excite the main welding generator is the same rectified DC current used to power the rotating field of the exciter alternator. (See the section ***EXCITER/AUXILIARY ALTERNATOR OPERATION***). This DC current passes through the remote / local switch and then through either the panel mounted rheostat (Fine Current and O.C.V. control), or a remote fine current control rheostat. The controlled DC current then passes through the two series connected shunt field coils in the welding generator stator.

When the remote/local switch is moved from one position to another, there is a brief period of time when the coils are disconnected. When this happens, the magnetic field around the shunt field coils collapses causing a very high induced voltage spike in the shunt coil circuit. A flyback spike without damaging insulation or the remote/local switch.

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

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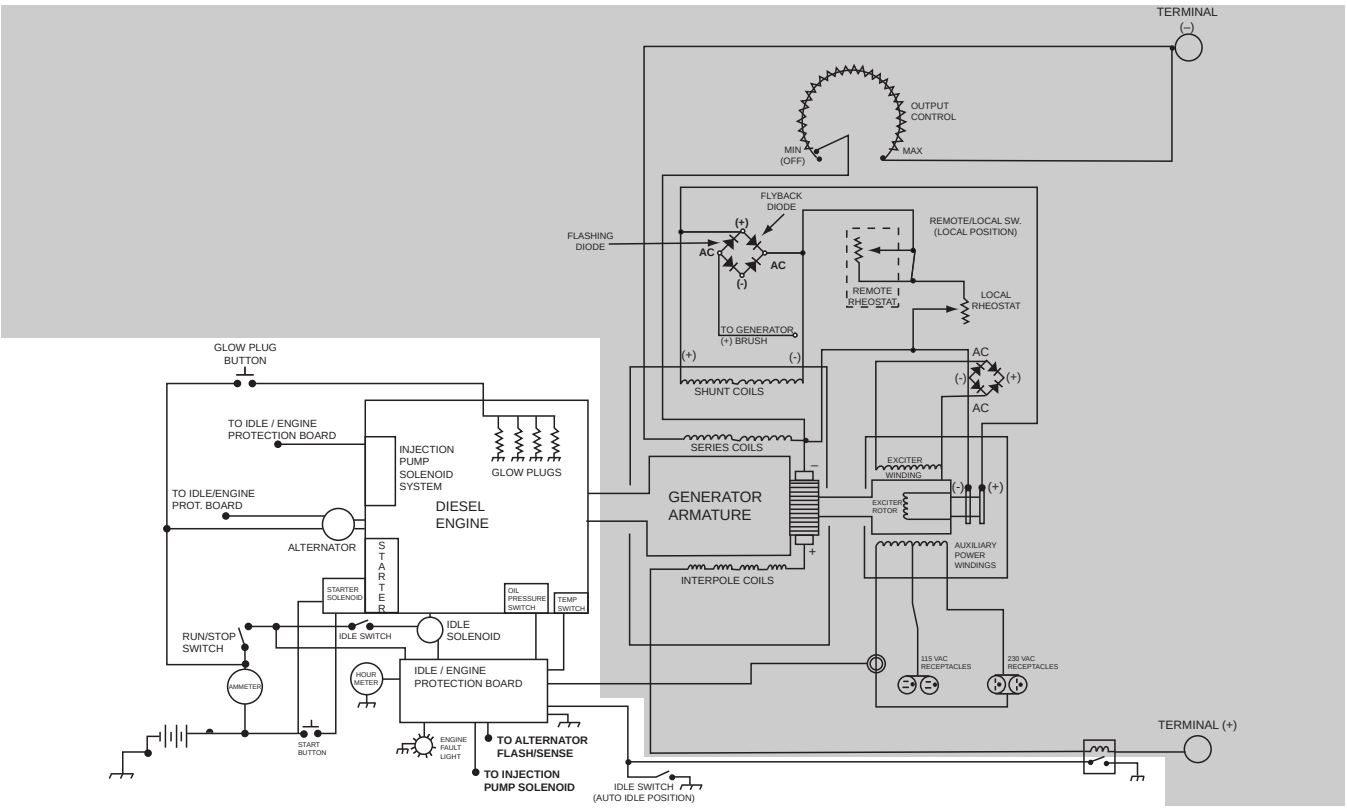
FIGURE E.6 - WELDING GENERATOR



WELDING GENERATOR OPERATION (Continued)

Producing weld current:

Weld current is produced in the armature windings when it spins in the magnetic field produced by the excitation process described above. The 64 Ohm rheostat in the excitation circuit varies the strength of the field. A stronger field will produce greater weld output; a weaker field will produce less.

As the windings in the armature pass through the magnetic field, current flows, first in one direction, then the other. This alternating current flow is converted to direct current (DC) and connected to the remaining generator circuitry through a commutator and a system of brushes.

The commutator is a cylindrical structure made up of copper conductor bars and insulating materials that keep each bar isolated from the other bars and from the armature shaft. Each bar is connected to the end of an armature winding.

The brushes contact the commutator at precise points around its circumference and are positioned so that they will conduct current only from windings that are producing maximum output at the correct polarity.

With the armature spinning at about 1800 RPM, windings are coming in contact with the brushes many times per second, producing a continuous flow of DC current at the generator brushes.

Controlling the weld output:

The **SAE-300®** utilizes a dual continuous control system for weld output. These controls are the Fine Current and O.C.V. control and the Coarse Current Control dials on the control panel.

Fine Current And O.C.V. Control:

The fine current and O.C.V. control handle manipulates the 64 Ohm rheostat in the weld generator excitation circuit. This rheostat controls the current passing through the shunt field coils in the weld generator. Changing the current in these coils changes the current output of the weld generator and has a significant affect on the open circuit voltage (O.C.V.)

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

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WELDING GENERATOR OPERATION (Continued)

Interpole coils:

Armature current from the positive brushes are routed through four interpole coils, before being connected to the weld output terminal. These coils are narrower than the shunt and series coils and are located in the generator stator between them. Their purpose is to reduce distortion of the magnetic field.

The magnetic field generated by the shunt coils will become distorted when current is drawn from the armature. This distortion will increase as the current flow increases. The interpole coils are connected and arranged to counteract this magnetic distortion. If not corrected, the distortion would cause reduced output and excessive sparking on the commutator.

Current Control:

The Coarse Current Control handle turns a rotor inside the reactor assembly. This reactor assembly functions together with the generator's series coils to regulate the output current and produce the drooping volt/amp curve that is so important to a constant current welding source. This current control has almost no effect on the OCV.

Series coils and reactor:

Current from the negative brushes is routed through the generator's series coils and the reactor assembly before being connected to the negative weld output terminal. These series coils are wound and arranged in such a way as to reduce or buck the current flowing from the armature. Because the series coils do not reduce the weld output until current is flowing, OCV is not reduced and starting the arc is easier.

Reactor Assembly:

The reactor assembly functions like a specialized, high current rheostat and is connected in parallel with the series coils of the generator. At the very minimum setting the reactor is electrically open, forcing all of the current flowing from the armature to pass through the series coils. This setting will produce the lowest weld current that can be set with this control.

Moving the current control off of the minimum setting closes the circuit in the reactor and allows some of the current to bypass the series coils. Continuing to move the control to the higher settings reduces the resistance of the reactor and causes even more current to bypass the series coils. When the current control is set to maximum, the reactor resistance is at minimum and nearly all of the current passes through the reactor. Because the current passing through the reactor is not reduced by the bucking action of the series coils, weld current is increased.

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

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HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

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

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

Step 1. LOCATE PROBLEM (SYMPTOM).
Look under the column labeled "PROBLEM (SYMPTOMS)". This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. Symptoms are grouped into the following categories: output problems, function problems, wire feeding problems and welding problems.

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

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

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

⚠ CAUTION

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

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PC BOARD TROUBLESHOOTING PROCEDURES

⚠ WARNING

ELECTRIC SHOCK can kill.

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

⚠ CAUTION

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

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

PC board can be damaged by static electricity.

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

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

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

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

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

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

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

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

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

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

5. Remove the replacement PC board and substitute it with the original PC board to recreate the original problem.
   a. If the original problem does not reappear by substituting the original board, then the PC board was not the problem. Continue to look for bad connections in the control wiring harness, junction blocks and terminal strips.
   b. If the original problem is recreated by the substitution of the original board, then the PC board was the problem. Reinstall the replacement PC board and test the machine.
6. Always indicate that this procedure was followed when warranty reports are to be submitted.

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

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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		
Both the weld and auxiliary output voltages are low	1. Make sure the engine is operating at the correct high idle speed. 2. Make sure that no load is connected to either the weld or auxiliary outputs.	1. Perform the ***Engine RPM Adjustment Test***. 2. Perform the ***Brush and Slip Ring Service Procedure.*** 3. Perform the ***Exciter Rotor Voltage Test***. 4. Perform ***Exciter Rotor Resistance and Ground Test***.
There is no, or very low weld output and no auxiliary output.	1. Check that the remote/local switch is in the local control position. Check that the auxiliary power circuit breakers and GFCIs (if so equipped) are not tripped. **NOTE:** GFCIs will not reliably reset, unless engine is operating at high idle RPM. 2. Check all leads and cables for damaged or poor connections.	1. Perform the ***Brush and Slip Ring Service Procedure***. 2. Perform the ***Exciter Rotor Voltage Test***. 3. Perform the ***Exciter Rotor Resistance and Ground Test***.
There is no, or very low weld output voltage. The auxiliary output is normal.	1. Check that the remote/local switch is positioned correctly. 2. If a remote current control is being used, try switching to local control. The remote current control may be faulty. 3. Check all leads and cables for damaged or poor connections.	1. Perform the ***Shunt Field Coil Resistance and Ground Test***. 2. Perform the ***Shunt Field Circuit Voltage Test.*** 3. Perform the ***Welding Generator Brush and Commutator Inspection and Service Procedure.*** 4. Check for damaged or poor connections at the brush holders, series and interpole coils, course current control unit, weld output terminals and all the conductors connecting these components. 5. The Armature may be faulty.

⚠ CAUTION

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
There is no auxiliary voltage, weld output is normal.	1. Check that the auxiliary power circuit breakers are not tripped. 2. If the machine is equipped with a ground fault circuit interrupter (GFCI), it may be tripped or defective. **NOTE:** GFCIs will not reliably reset, unless engine is operating at high idle RPM. 3. Check all leads and cables for damaged or poor connections.	1. Check for auxiliary voltage at the receptacle input terminals, if normal voltage is present, replace receptacle. 2. Check for auxiliary voltage at the connections closest to the exciter stator windings. See Wiring Diagram. • If normal voltage is present, check the wiring and circuit breakers between the test points and the receptacle. Repair or replace any defective parts or wiring. • If normal voltage is not present, check for damaged conductors between the test points and the winding. If the conductors are good, the stator is defective.

⚠ CAUTION

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The weld output varies abnormally. Auxiliary voltage is normal.	1. Check welding cables for damaged or poor connections. 2. Welding cable may be excessively long, too small, or coiled. Try using a set of short test cables of adequate size. 3. If a remote current control is being used, try switching to local control. The remote current control may be faulty. 4. The engine may not be maintaining steady RPM. Make sure there is an adequate supply of clean, fresh fuel. Replace fuel filters if necessary. Have engine serviced by a qualified engine technician.	1. Check and, if necessary, perform the ***Brush and Slip Ring Service Procedure.*** 2. Perform the ***Welding Generator Brush and Commutator Inspection and Service Procedure.*** 3. Perform the ***Engine RPM Adjustment Test.*** 4. Check all the large weld current carrying leads inside the machine for damaged conductors, insulation and poor connections. 5. Perform the ***Course Current Control Unit Inspection and Service Procedure***. 6. Check the wiring that connects the exciter, diode bridges, rheostat, remote/local switch and the shunt coils. Check for damaged conductors, insulation and connections. 7. Check Fine Current / OCV Control rheostat, replace if necessary. 8. Check remote/local switch. Replace if necessary. 9. Perform the ***Exciter Rotor Resistance and Ground Test***. 10. Perform the ***Shunt Field Coil Resistance and Ground Test***. 11. Check the Generator brush rocker position; perform the ***Rocker Adjustment Procedure*** if necessary.

⚠ CAUTION

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

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The weld output is considerably less than indicated on the dials. Auxiliary voltage is normal.	1. Check welding cables for damaged or poor connections. 2. Welding cable may be excessively long, too small, or coiled. Try using a set of short test cables of adequate size. 3. If a remote current control is being used, try switching to local control. The remote current control may be faulty. 4. The engine RPM may be low. Make sure there is an adequate supply of clean, fresh fuel. Replace fuel filters if necessary. Have engine serviced by a qualified engine technician.	1. Perform the ***Engine RPM Adjustment Test***. 2. Perform the ***Welding Generator Brush and Commutator Inspection and Service Procedure.*** 3. Perform the ***Brush and Slip Ring Service Procedure.*** 4. Perform the ***Shunt Field Coil Resistance and Ground Test.*** 5. Perform the ***"Dead Short", "First Step" and "Open Reactor" Tests***. If necessary, perform the ***Course Current Control Unit Inspection and Service Procedure.*** 6. Perform the ***Exciter Rotor Resistance and Ground Test***. 7. Check all the large weld current carrying leads inside the machine for damaged conductors, damaged insulation and poor connections. 8. Check the wiring that connects the exciter, diode bridges, rheostat, remote/local switch and the shunt coils. Check for damaged conductors, insulation and connections. 9. Check Fine Current / OCV Control rheostat, replace if necessary. 10. Check remote / local switch. Replace if necessary. 11. Verify that the rocker is positioned correctly, according to the factory drill mark. If necessary, perform the ***Rocker Adjustment Procedure.***

⚠ CAUTION

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

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The weld output is considerably higher than indicated on the dials. Auxiliary voltage is normal.	1. If a remote current control is being used, try switching to local control. The remote current control may be faulty.	1. Verify that the rocker is positioned correctly, according to the factory drill mark. 2. Perform the ***Dead Short, First Step and Open Reactor Tests.*** 3. Perform the ***Exciter Rotor Resistance and Ground Test***. 4. Perform the ***Shunt Field Coil Resistance and Ground Test.*** 5. Perform the ***Rocker Adjustment Procedure.***
The welding arc is loud and spatters excessively.	1. The weld current or voltage settings may be incorrect. 2. The polarity may be incorrect for the process in use. 3. If a remote current control is being used, try switching to local control. The remote current control may be faulty.	1. The engine RPM may be incorrect; perform the ***Engine RPM Adjustment Test***. 2. Perform the ***Brush and Slip Ring Service Procedure.*** 3. Perform the ***Welding generator Brush and Commutator Inspection and Service Procedure***. 4. Perform the ***Dead Short, First Step and Open Reactor Tests.*** 5. Perform the ***Exciter Rotor Resistance and Ground Test.*** 6. Perform the ***Shunt Field Coil Resistance and Ground Test.*** 7. Check that the rocker is aligned to the factory drill mark and perform the ***Rocker Adjustment Procedure*** if necessary.

⚠ CAUTION

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

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The welding arc frequently "pops out". Welding seems otherwise normal and auxiliary output voltage appears normal.	1. Fine Current / OCV Control rheostat may be set too low. 2. If a remote control is being used, try switching to local control. The remote control unit may be faulty. 3. Check welding cables for damaged or poor connections. 4. Welding cable may be excessively long, too small, or coiled. Try using a set of short test cables of adequate size.	1. The engine RPM may be incorrect; perform the ***Engine RPM Adjustment Test***. 2. Perform the ***Brush and Slip Ring Service Procedure.*** 3. Perform the ***Welding Generator Brush and Commutator Inspection and Service Procedure***. 4. Perform the ***Coarse Current Control Unit Inspection and Service Procedure***. 5. Perform the ***Exciter Rotor Voltage Test***. 6. Perform the ***Shunt Field Circuit Voltage Test***. 7. Check that the rocker is aligned to the factory drill mark and perform the ***Rocker Adjustment Procedure*** if necessary.
The engine will not crank when the start button is pressed.	1. The batteries may be discharged. Check and if necessary, charge or replace the batteries. 2. The battery cables or battery connections may be loose or corroded. Service the battery terminals.	1. Check for battery voltage where lead 52 connects to the starter solenoid, while holding in the start button. • If no voltage is present, check the connections and wiring connecting the starter solenoid, the ammeter and the start push button switch. (See the Wiring Diagram) If the wiring and connections are good, replace the push button switch. • If voltage is present, check that the negative battery terminal is properly connected to the engine block. If the battery is properly connected, the starter/solenoid is defective and should be serviced or replaced.

⚠ CAUTION

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

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The engine cranks when the start button is pressed, but will not start.	1. Make sure the run/stop switch is in the run position. 2. The run/stop switch may have been left in the run position for more that 30 seconds (60 seconds for some models). Move switch to the stop position, then after a few seconds, move it back to the run position. 3. If the machine is being used in a cold climate, the thermostart or glow plug system may need to be used. See the welder operators' manual and the engine operator's manual for detailed instructions. 4. Check that there is an adequate supply of fresh clean fuel and that the fuel shut-off valve is open. 5. Check and if necessary, replace the fuel filter. 6. There may be air in the fuel system. See the engine manufacturer's manual and bleed all air from the fuel system.	1. Perform the ***Engine Fuel System Voltage Tests***.

⚠ CAUTION

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

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The engine starts normally, but shuts down after running for several seconds.	1. The oil pressure may be low. Check the oil level and add oil as needed. If necessary, contact the engine manufacturer, or a qualified engine specialist to determine the cause of the low oil pressure condition and make any required adjustments or repairs. 2. The engine alternator belt may be loose or broken. Replace the belt and/or adjust the belt tension. 3. The engine may be overheated. Contact the engine manufacturer, or a qualified engine specialist to determine the cause of the overheat condition and make any required adjustments or repairs.	1. The idle/engine protection PC board, alternator, oil pressure switch, or engine coolant temperature switch may be faulty. Perform the ***Engine Protection System Test***.
The engine will not develop full power.	1. Check that there is an adequate supply of fresh clean fuel and that the fuel shut-off valve is fully open. 2. Check the fuel and air filters, replace if necessary.	1. Perform the ***Engine RPM Adjustment Test***. 2. There may be internal problems with the engine. Contact the engine manufacturer or a qualified engine repair technician.
The engine will not shut down when the run/stop switch is moved to the stop position.		1. Check the voltage at the fuel solenoid. If the voltage drops to zero when the switch is turned off and the engine continues to run, there is likely a failure in the fuel system. Contact the engine manufacturer or a qualified engine technician. 2. If the voltage remains at the solenoid after the switch is moved to the stop position, the run/stop switch has most likely failed.

⚠ CAUTION

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

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The battery does not stay charged.	1. The battery may be faulty. Recharge and test the battery. Replace it if necessary. 2. The engine alternator drive belt may be loose. Replace and/or adjust the belt tension.	1. Perform the ***Engine Alternator Test.***
The machine will not idle down to low RPM when weld and auxiliary loads are removed. The machine has normal weld and auxiliary output. The engine starts and shuts down normally.	1. Make sure the idle switch is in the "AUTO IDLE" position. 2. Make sure there is no external load on the weld terminals or the auxiliary power receptacles. Disconnect the weld cables and unplug anything that may be connected to the auxiliary receptacles. 3. Check for mechanical restrictions in the idler solenoid linkage.	1. Perform the ***Idle Solenoid Test***. 2. Perform the ***Engine RPM Adjustment Test***. *3.* The Reed Switch may be faulty. The reed switch should be electrically open if no current is flowing in the weld circuit. If there is continuity through the reed switch when the machine is off, it is defective and should be replaced. 4. There may be voltage in the toroidal current sensor circuit. Unplug the J32 current sensor from the idle / engine protection P.C. board. 5. If the machine idles down after the sensor is unplugged, check the wiring between the PC board and toroidal current sensor for damaged insulation and electrical contact with other electrically live components. (See the Wiring Diagram) If the wiring is good, there is likely a load on the auxiliary circuit. Check all wiring and components in the AC auxiliary circuit. See Wiring Diagram. 6. If the machine still will not idle down, check all wiring connected to the solenoid. See the Wiring Diagram. Look for damaged wiring, poor connections, dirty or corroded terminals, etc. If all of the wiring is good, replace the PC board.

⚠ CAUTION

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

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The engine goes to low idle, but will not stay at low idle. The machine has normal weld and auxiliary output. The engine starts and shuts down normally.	1. Make sure there are no external loads on the weld terminals or the auxiliary power receptacles. Disconnect the weld cables and unplug anything that may be connected to the auxiliary receptacles.	1. The low idle RPM may be too low. Perform the ***Engine RPM Adjustment Procedure.*** 2. The idle solenoid linkage may be out of adjustment. Check that the linkage moves freely and that the plunger is not binding in any way. Check that the solenoid can freely pull in and solidly seat against its internal stop. 3. Perform the ***Idle Solenoid Test***. 4. There may be a poor or intermittent connection in the solenoid wiring, or a component may be opening while under load. Repair or replace any poor connections, damaged wiring, or faulty components. See Wiring Diagram. 5. The idle/engine protection PC board may be faulty.

⚠ CAUTION

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

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The engine will not go to high idle when the idle switch is moved to the "High" position. The idle system functions normally while welding or using auxiliary power. The engine starts and shuts down normally.		The idle switch may be defective, or there may be a faulty connection between the PC board, the idle switch and the chassis ground connection.
The engine will not go to high idle when striking an arc. The automatic idle system functions normally when using auxiliary power. Weld and auxiliary power are normal when the idle switch is in the "High Idle" position. The engine starts, runs and shuts down normally.	1. Check that the welding cables, electrode holder and work clamp are tight and in good condition.	1. The Reed Switch, or the wiring that connects it to the PC board and chassis ground may be faulty. The Reed Switch should close when sufficient current is drawn from the weld output terminals.

⚠ CAUTION

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The engine will not go to high idle when using auxiliary power. The automatic idle system functions normally when welding. Weld and auxiliary power is normal when the idle switch is in the “High Idle” position. The engine starts, runs and shuts down normally.	1. The load applied to the auxiliary receptacles may be too low. A load of 100 Watts minimum is required for the idle system to operate reliably. 2. Check that any power cords are in good condition and properly connected. 3. Verify that any devices operating from the auxiliary AC power are operating correctly and are in good condition. Try plugging the device into another source of AC power to be sure it is functioning properly. 4. Some devices may test the input power for correct voltage and frequency before they will operate. If such a device is being used, the idle switch will need to be placed in the “High” position. The current drawn by many of these devices, when testing the power, is too low to reliably activate the automatic idle system.	1. The Toroidal Current Transformer or the wiring connecting it to the idler/engine protection PC board may be faulty. Check the resistance of the toroidal current transformer. The resistance should measure 10 to 14 Ohms. 2. The Idler/Engine Protection PC board may be faulty.

⚠ CAUTION

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

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ENGINE RPM ADJUSTMENT TEST PROCEDURE

⚠ WARNING

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

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

TEST DESCRIPTION

This test will determine if the Engine is operating at the correct RPM, for both high and low idle positions.

MATERIALS NEEDED

Miscellaneous Hand Tools
Strobe Tachometer
Frequency Counter Or Multimeter With Frequency Counter Function
Bright Colored Marking Pencil Or Marker

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ENGINE RPM ADJUSTMENT TEST PROCEDURE (continued)

PROCEDURE

1. Turn the engine off.
2. Open the side door.

NOTE: Secure the door in the open position using the door restraint system.

Check that the linkage attaching the solenoid to the engine speed control lever is properly aligned and in good condition.

Strobe-Tach Method:

Place a highly visible mark on the engine crankshaft pulley, or another rotating component connected to the engine crankshaft.

Connect the strobe-tach according to the manufacturer's instructions.

Start the engine and place the idle switch in the "HIGH IDLE" position. Make sure that there is no load on the machine and allow the engine RPM to stabilize.

Direct the strobe-tach light on the highly visible mark that had been applied earlier and synchronize the light with the rotating mark. See the strobe-tach manufacturer's instructions.

The tach should read between 1790 and 1810 RPM

Move the idle switch to the "AUTO IDLE" position and wait for the engine RPM to drop and stabilize at the low idle RPM.

Synchronize the strobe-tach to read the low idle RPM.

The tach should read 1350 to 1450 RPM.

If either of the readings is incorrect, proceed to the "ENGINE RPM ADJUSTMENT PROCEDURE" later in this section.

Frequency counter method:

NOTE: A dedicated frequency counter can be used for this test, but many high quality digital multimeters also have this function and can be easily utilized. See the manufacturer's instructions for your frequency counter or multimeter.

Set your frequency counter per the meter manufacturer's instructions and plug the probes into one of the 120VAC auxiliary receptacles.

Start the engine and place the idle switch in the "HIGH IDLE" position. Make sure that there is no load on the machine and allow the engine RPM to stabilize.

The frequency should read between 59.7 and 60.3 Hz.

Move the idle switch to the "AUTO IDLE" position and wait for the engine RPM to drop and stabilize at the low idle RPM.

The frequency counter should read 45 to 48.3 Hz.

If either of the readings is incorrect, proceed to the "ENGINE RPM ADJUSTMENT PROCEDURE" later in this section.

NOTE: For Lincoln Electric 1800 RPM (4 Pole) machines, that have 60 Hz AC auxiliary power; the engine RPM can be determined by multiplying the frequency of the auxiliary power output, in Hz. By 30. (Example: 60 Hz. * 30 = 1800 RPM)

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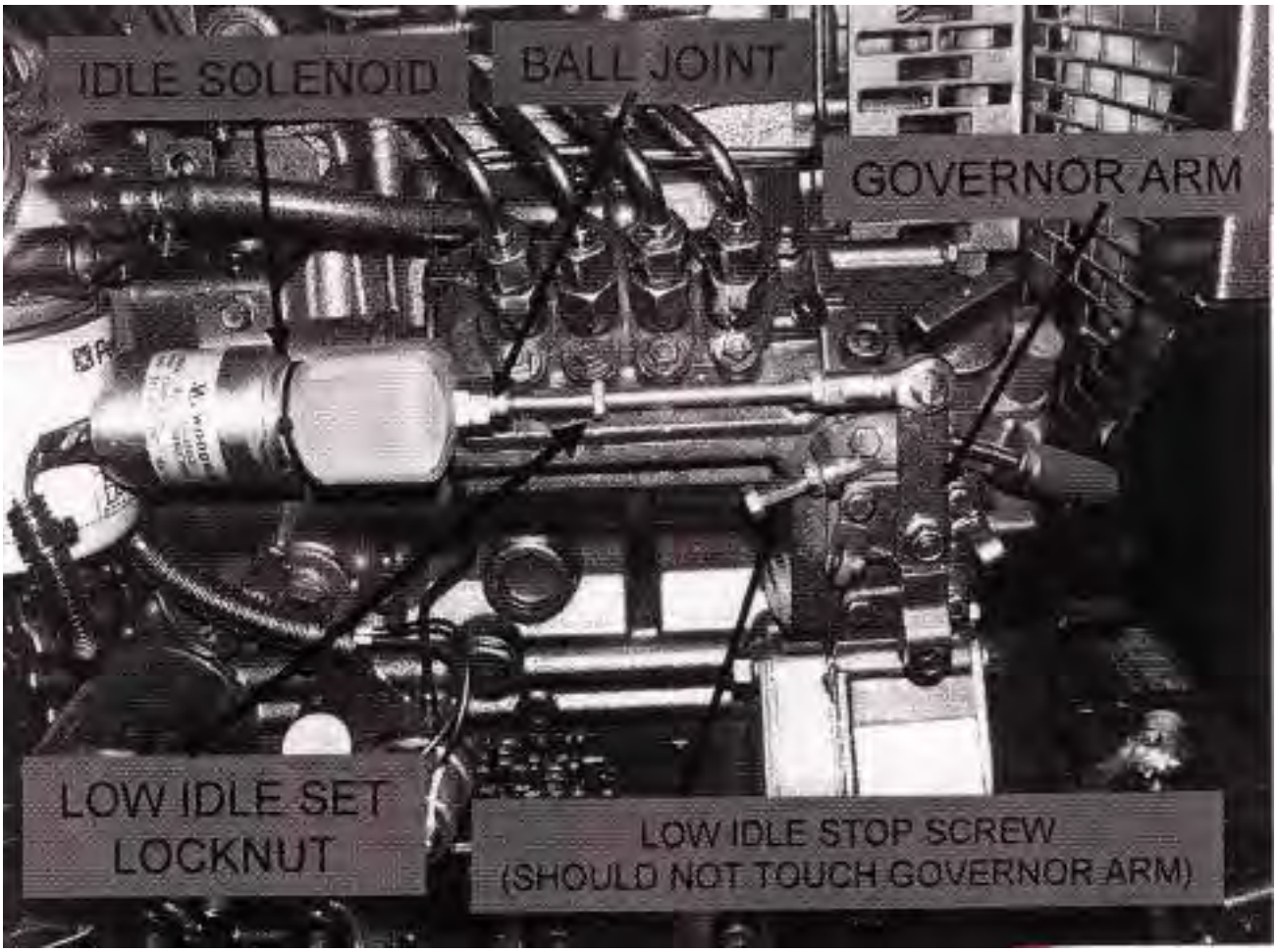
ENGINE RPM ADJUSTMENT TEST PROCEDURE (continued)

FIGURE F.1 – ENGINE RPM ADJUSTMENT PROCEDURE



HIGH IDLE ADJUSTMENT

IMPORTANT: The high idle RPM is set by the engine manufacturer and should not be changed. If the high idle RPM is not within the specified range, the engine should be serviced by a qualified engine technician.

LOW IDLE ADJUSTMENT:

Put the idler switch in AUTO and allow the engine speed to drop to the low idle RPM. Set the low idle RPM between 1350 and 1450 RPM by adjusting the length of the idler rod by turning it into or out of the ball joint. Ensure that there is no contact between the engine's low speed stop screw and the governor arm when the idle solenoid is energized. Tighten the lock nut at the ball joint.

IMPORTANT: The solenoid plunger must seat firmly against its internal stop and the engine's low speed stop screw must not contact the governor arm.

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IDLE SOLENOID TEST

⚠ WARNING

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

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

TEST DESCRIPTION

This test will help determine if the Idle Solenoid and linkage are faulty. This test should be performed if the automatic idle system fails to function properly.

MATERIALS NEEDED

Miscellaneous Hand Tools
Multimeter
Wiring Diagram

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IDLE SOLENOID TEST (continued)

PROCEDURE

1. Examine the idle linkage for damage, binding, or mis-alignment.
2. Check to be sure that the solenoid plunger can fully bottom-out in the solenoid coil housing.

NOTE: When in the low idle position, the low idle stop screw on the injection pump should not come in contact with the engine speed control arm.

3. Check solenoid coil resistance. Unplug the solenoid and check the resistance between the following points:
   A. Black wire to white wire should measure about 0.3 Ohms.
   B. Black wire to red wire should measure about 11 Ohms.
   C. Any wire to the metal solenoid body should measure very high resistance. 500,000 (500k) Ohms or higher is acceptable.

With the solenoid still unplugged, check the solenoid function by applying battery voltage as described below:

- Apply positive (+) battery voltage to the black wire and for a very brief moment, (less than 1 second) connect negative (-) battery voltage to the white wire. The solenoid should activate immediately.

WARNING: Do not allow the battery power to remain connected to the black and white leads. Serious damage would result.

- Apply positive (+) battery voltage to the black wire and negative voltage to the red wire. Manually move the solenoid plunger into the solenoid. Once the plunger has seated, it should hold tightly until the battery voltage is removed.

BRUSH AND SLIP RING SERVICE PROCEDURE (Exciter / Auxiliary Power Alternator)

⚠ WARNING

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

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

TEST DESCRIPTION

This procedure provides guidance in testing and maintaining the Brush and Slip Ring System of the Exciter / Auxiliary Power Alternator.

MATERIALS NEEDED

500 Or 600 Grit Emery Cloth.
180 Grit Sand Paper
220 Or 320 Grit Commutator Stone (Optional)

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BRUSH AND SLIP RING SERVICE PROCEDURE (Exciter / Auxiliary Power Alternator) (continued)

PROCEDURE

1. Remove the covers from the exciter / auxiliary power alternator by removing the screws securing it.
2. Examine brushes, slip rings and brush holder.
   - Brushes should be clean and free from oil or grease.
   - The brushes should be of sufficient length and have adequate spring tension.
   - Brushes should be making good, continuous contact with the slip rings and should be riding near the center of the slip rings. (The brush holder bracket may need to be slightly bent to achieve acceptable alignment.)

   (Generally, the brushes should be replaced if either brush has less than 1/4" remaining before it reaches the end of its travel.)
3. If the slip rings are very dark in color, display evidence of excessive arcing, or have worn prematurely, these may be signs of a grounded or shorted rotor. Perform the ***Exciter Rotor Resistance and Ground Test***.

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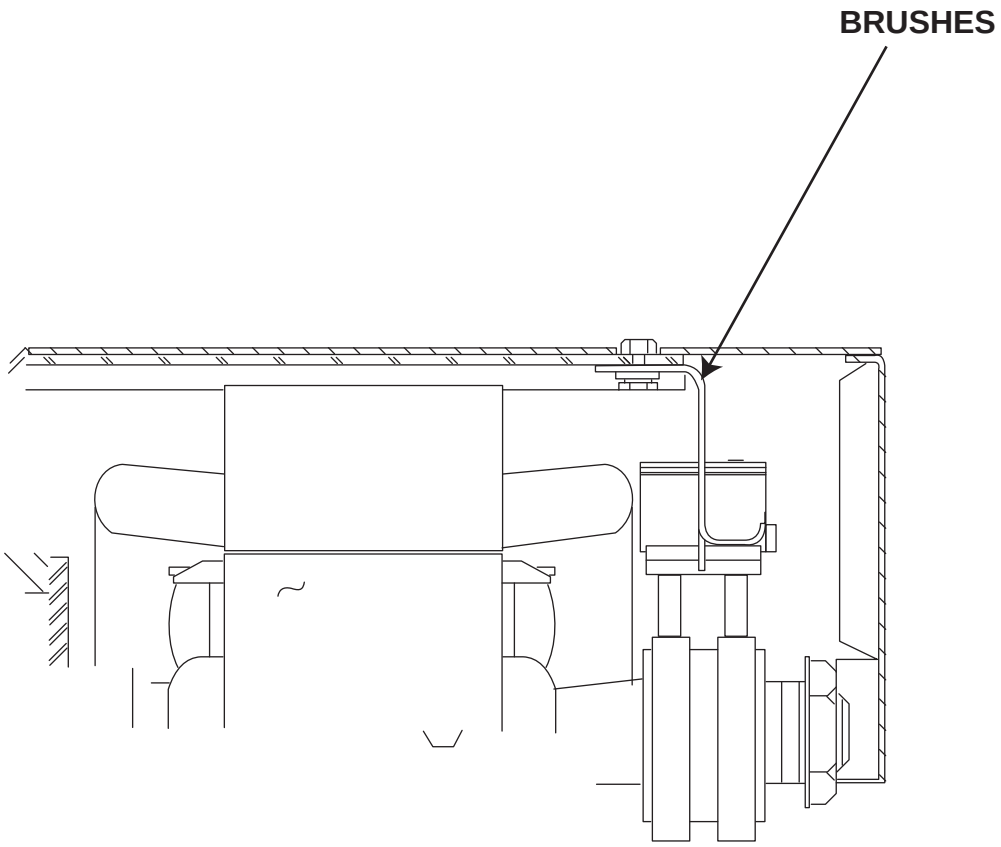
BRUSH AND SLIP RING SERVICE PROCEDURE (Exciter / Auxiliary Power Alternator) (continued)

FIGURE F.2 – BRUSH LOCATIONS



4. Check for evidence of sticking brushes. Sticking brushes will normally result in the slip rings being pitted and discolored from excessive arcing. Another sign of sticking brushes is instability or loss of both weld and auxiliary output, but the machine may begin to work properly, for a short time, after being jarred or moved.
5. If there is any evidence that the brushes may have been sticking in the brush holders, a new brush holder and brush assembly should be installed.

Cleaning slip rings:

In the event that the slip rings have become dirty, discolored or mildly pitted, it will be necessary to clean them, using very fine (500 or 600 grit) emery cloth, or a 220 or 320 grit commutator stone.

⚠ CAUTION

Commutator stones should only be used by experienced technicians who have the knowledge and equipment necessary to use them safely.

Seating brushes:

If brushes have been replaced, repositioned, or are not making full contact with the slip rings, it will be necessary to re-seat them. This can be done by placing a strip of 180 grit sandpaper between the slip rings and the brushes, with the abrasive side against the brushes. Pull the sandpaper strip around the circumference of the slip rings in the direction of rotor rotation only. Repeat this procedure until the surface of each brush is in full contact with its matching slip ring.

Use low pressure compressed air to thoroughly blow the carbon, commutator stone and sandpaper dust from the machine before operating.

Securely connect the leads to the brush terminals (See Wiring Diagram) and replace the alternator cover if testing and service is complete.

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EXCITER ROTOR VOLTAGE TEST

⚠ WARNING

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

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

TEST DESCRIPTION

This test will determine if the Exciter Rotor Winding is operating at normal voltage.

MATERIALS NEEDED

Miscellaneous Hand Tools
Voltmeter
Wiring Diagram

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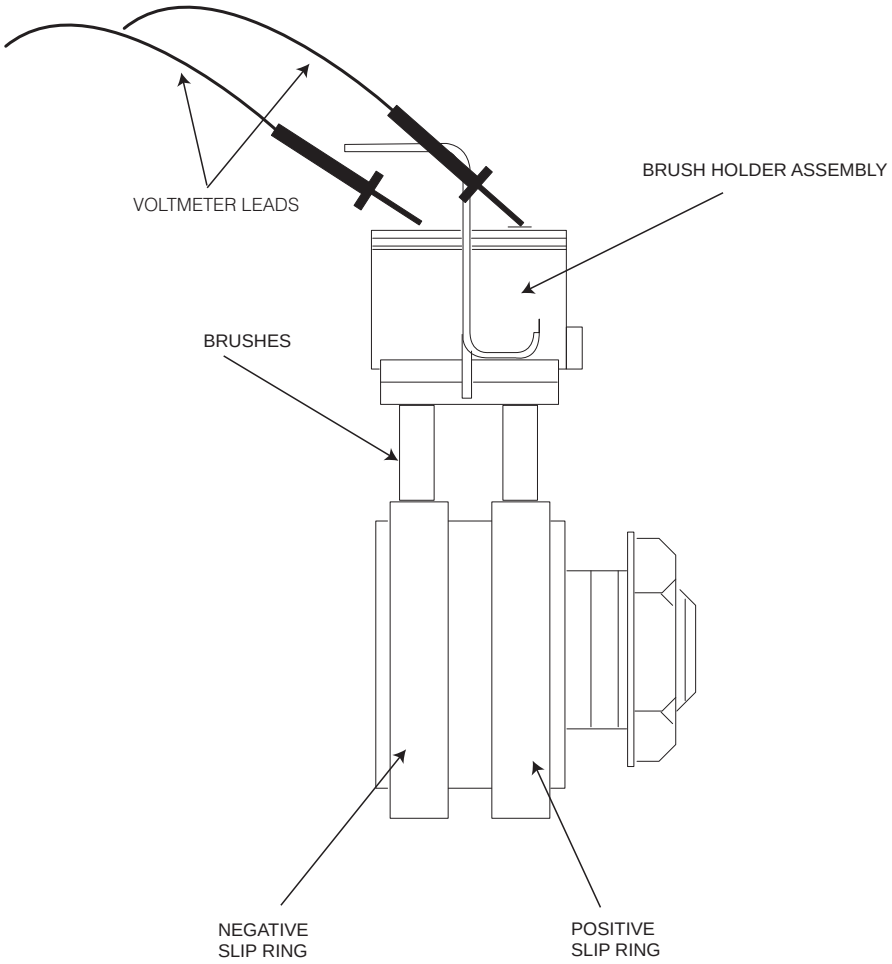
EXCITER ROTOR VOLTAGE TEST (continued)

FIGURE F.3 – EXCITER ROTOR VOLTAGE TEST



PROCEDURE

1. Turn engine off.

The Engine and generator should be at normal operating temperature for this test. If the machine is cold, the voltage readings may be slightly higher than specified.

2. Remove the covers from the exciter/auxiliary power alternator by removing the screws securing it.

3. Connect the volt meter probes to the brush terminals. See Wiring Diagram and Figure F.3

NOTE: On this machine and all other Lincoln Electric DC generator machines, the black exciter lead is positive and the red lead is negative.

4. Start the engine and place the idle switch in the "HIGH" position. Read the voltage at the brush terminals.

The voltage should be 123 to 133 VDC*.

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EXCITER ROTOR VOLTAGE TEST (continued)

5. Set the RUN/STOP switch to “STOP”

If the meter reading is normal, this test is complete.

If the voltage measures zero or very near zero, Perform the ***Flashing Voltage Tests*** and the ***Exciter Rotor Resistance and Ground Test***.

If voltage is higher than specified, the engine RPM may be too high, or there may be voltage intrusion from one of the higher voltage stator windings to the stator exciter winding. Perform the ***Engine RPM Adjustment Test*** and the ***Exciter Stator Short Circuit and Ground Test***.

If the voltage is lower than 124, but higher than 6, the engine RPM may be too low, or there may be problems in the windings or other exciter circuit components or connections. Perform the ***Engine RPM Adjustment Test*** and then perform the testing described below, under the heading “If the voltage measures about 2 to 4 VDC”

If the voltage measures about 2 to 4 VDC, the generator is not building-up to normal output even though the flashing circuit appears to be functioning normally. This condition could be caused by one of several failed components or connections. Continue with the following tests.

6. Test the field bridge rectifier.
7. Check the wiring, fuse and terminals connecting the field bridge rectifier to the Exciter stator winding. See Wiring Diagram.
8. Perform the ***Exciter Stator Short Circuit and Ground Test***.
9. Perform the ***Exciter Rotor Resistance And Ground Tests***.

When the ***Stator Short Circuit and Ground Tests*** have been completed, reconnect the leads to the AC terminals of the field bridge rectifier.

Be sure that there are no loads of any kind across any of the stator windings. The exciter winding should be the only stator winding connected at this time. Examine stator wiring for damage, pinched leads, chafed insulation, etc. If necessary, disconnect and insulate the stator output leads as close to the stator winding as possible. If any leads were disconnected, secure them so they cannot be damaged by moving parts. See Wiring Diagram.

10. Re-start the machine and measure the rotor voltage.

If the rotor voltage continues to read significantly lower than 124VDC, the Stator is probably defective and should be replaced.

NOTE: The field bridge rectifier may appear to function normally when tested independently, but may malfunction when placed under the stress of normal operation. For this reason, it is recommended that the bridge rectifier be replaced with a known good component before replacing the stator.

* Voltages shown in this document are for a machine operating at normal temperature. Voltage readings may be slightly higher if the machine is cold.

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EXCITER ROTOR RESISTANCE AND GROUND TEST (Exciter / Auxiliary Power Alternator)

⚠ WARNING

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

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

TEST DESCRIPTION

This test will determine if the Exciter / Auxiliary Power Alternator Rotor Winding is open, shorted, or grounded.

MATERIALS NEEDED

Miscellaneous Hand Tools
Ohmmeter (Analog Type Meter Required For Dynamic Resistance Test.)
Wiring Diagram

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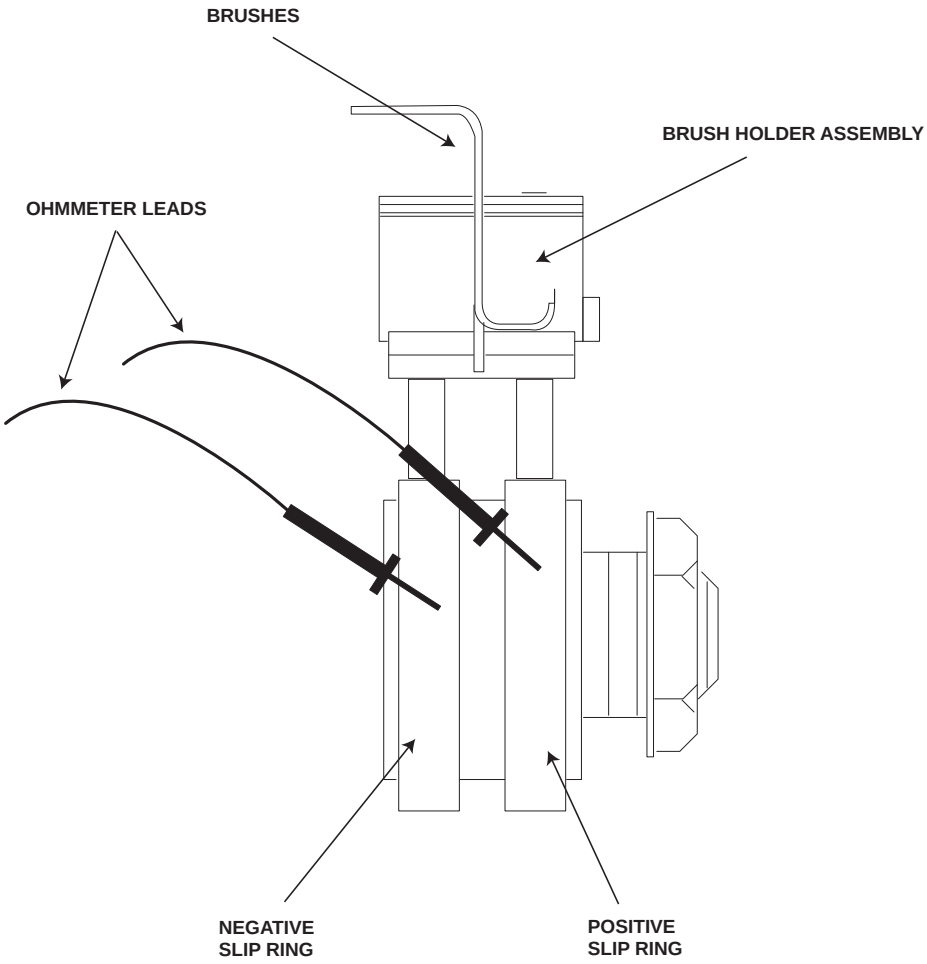
EXCITER ROTOR RESISTANCE AND GROUND TEST (Exciter / Auxiliary Power Alternator) (continued)

FIGURE F.4 – SLIP RING LOCATIONS



PROCEDURE

"Static" Tests:

1. Turn the engine off.
2. Remove the cover from the Exciter / Auxiliary Power Alternator by removing the screws securing it.
3. Locate and label the leads connected to the rotor brush holder assembly. Remove the leads to electrically isolate the rotor windings.
4. Using the ohmmeter, check the rotor winding resistance across the slip rings. Normal resistance is approximately 41.5* ohms, at 77°F. (25° C.) See Figure F.4.
5. Measure the resistance to ground. Place one meter probe on either of the slip rings. Place the other probe on any good, unpainted chassis ground. The resistance should be very high, at least 500,000 (500k) ohms.

If the resistance measurements are not as specified the rotor may be faulty and should be replaced.

If these resistance values are normal, continue testing, using the dynamic rotor resistance and ground test in this section.

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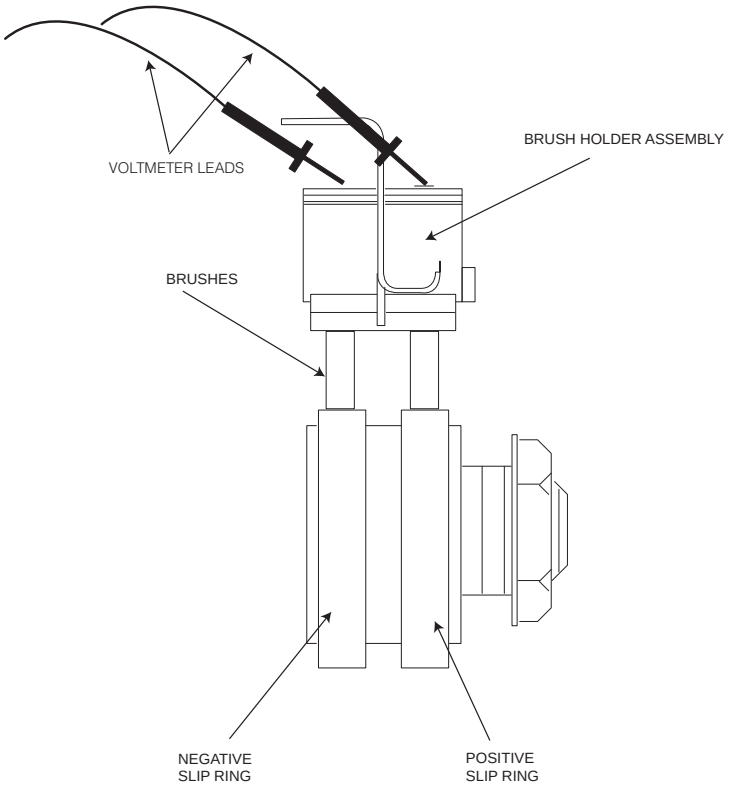
EXCITER ROTOR RESISTANCE AND GROUND TEST (Exciter / Auxiliary Power Alternator) (continued)

FIGURE F.5 – SLIP RING LOCATIONS



"Dynamic" Tests:

(Also referred to as flying resistance test)

This test checks for faults in the rotor winding, while these windings are being stressed by the mechanical forces encountered during normal operation.

NOTE: This test is best performed with a good quality analog type ohmmeter. Many digital meters will not provide stable or accurate resistance readings while the rotor is spinning.

This test requires that the brushes and slip rings are clean, in good condition and are properly seated.

Perform the ***Brush and Slip Ring Service Procedure***.

1. Insulate the lead wires that had been disconnected from the brushes during the static rotor resistance test. Position and secure them so they cannot become damaged by the spinning rotor.

It is recommended that the ohmmeter leads be securely attached to the brush terminals, using clips or terminals BEFORE starting the engine. See Figure F.5.

2. Start the engine and run it at high idle speed (1800 RPM). The resistance should read approximately 42 ohms* at 77 deg. F. (25 deg. C).
3. Shut off engine and move one of the ohmmeter leads to a good clean chassis ground connection.
4. Restart the engine and run it at high idle speed (1800 RPM). The resistance should be very high, at least 500,000 (500k) ohms.
5. If the resistance readings differ significantly from the values indicated, re-check the brushes and the brush spring tension. If the brushes and slip rings are good, replace the rotor.
6. Securely connect the leads to the brush terminals (See Wiring Diagram) and replace the alternator cover if testing and service is complete.

***NOTE:** The resistance of the copper windings will change with temperature. Higher temperatures will produce higher resistance and lower temperatures will produce lower resistance.

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FLASHING VOLTAGE TEST

⚠ WARNING

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

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

TEST DESCRIPTION

This test checks the Exciter Rotor Flashing Voltage.

MATERIALS NEEDED

Miscellaneous Hand Tools
Voltmeter
Wiring Diagram

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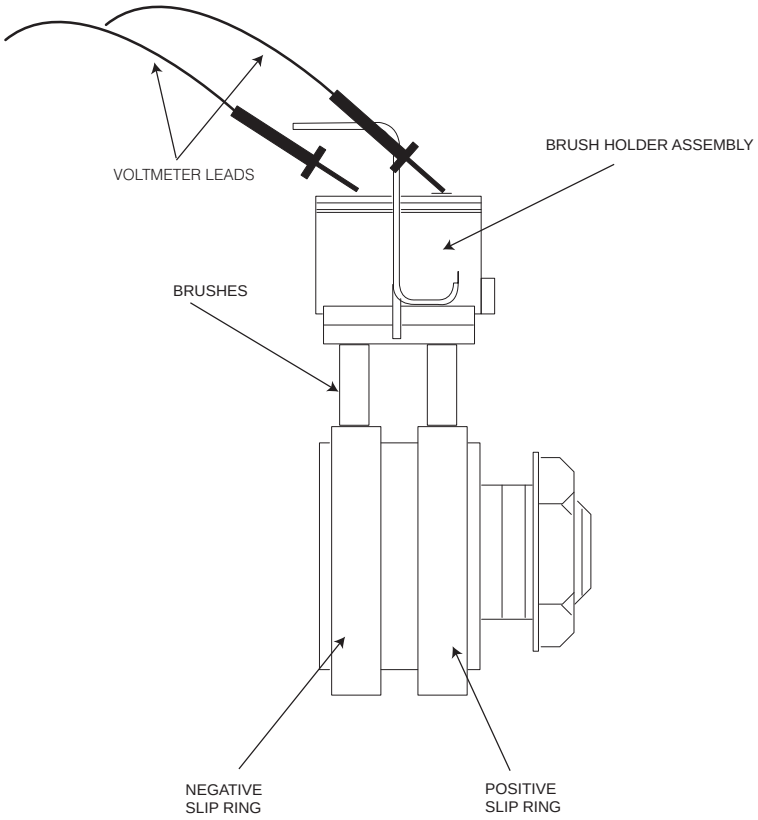
FLASHING VOLTAGE TEST (continued)

FIGURE F.6 – FLASHING VOLTAGE TEST



PROCEDURE

1. Lift the left and right side covers and secure them with the hooks provided.
2. Remove the 15 Amp fuse from the fuse holder located on the back of the control panel on the right side. (Operator's right when facing the control panel.)
3. Remove the cover from the exciter / auxiliary power alternator.
4. Disconnect any weld cables or power cords.
5. Set the meter for DC volts and attach the leads to the brush terminals. See Figure F.6.

NOTE: The negative brush is the one closest to the winding of the exciter and normally has a red wire attached.

6. Place the idle switch in the "High" idle position, start the engine and read the voltage.
7. If the voltage measures between 3 and 6 volts, the flashing is normal and the test is complete.
8. If the meter measures zero or very near zero, move the meter leads to the weld output terminals. Measure the voltage and observe the polarity of the DC voltage.
9. If the voltage measures between 3 and 6 volts DC and the polarity is the same as indicated on the weld output terminals, do the following: Check for a faulty flashing/flywheel bridge rectifier. Check for a poor connection between the welding generator brush holders, the flashing/flywheel rectifier, the field bridge rectifier and slip rings. See Wiring Diagram.
10. If the voltage is zero or very near zero, or if the polarity does not match the polarity indicated at the weld terminals, perform the Field Flashing Procedure. Connect a 12 volt battery to the proper polarity at the brushholder for a few seconds with the engine running at low idle. Disconnect jumper leads and repeat the above steps.
11. If the Field Flashing Procedure does not correct the problem, replace the fuse removed in step 2 and perform the ***Welding Generator Brush And Commutator Inspection And Service Procedure***, the ***Weld Circuit Ground And Short Circuit Test*** and The ***Shunt Field Coil Resistance Ground Test***.

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EXCITER STATOR SHORT CIRCUIT & GROUND TEST

⚠ WARNING

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

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

TEST DESCRIPTION

This test will determine if there are undesirable electrical connections between the Exciter Stator Windings and Chassis Ground, or between individual Windings within the Exciter Stator.

This test should be performed if flashing voltage is present at the Rotor Slip Rings, Rotor Resistance, the Field Bridge Rectifier and all associated wiring are proven to be good, but the Exciter Stator output voltage fails to build-up to normal levels, or is too high in one or more of the Windings.

MATERIALS NEEDED

Miscellaneous Hand Tools
Ohmmeter

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EXCITER STATOR SHORT CIRCUIT & GROUND TEST (continued)

PROCEDURE

1. Open either, or both of the doors.
2. Make sure that nothing is plugged into the auxiliary receptacles.
3. Disconnect and isolate the ground lead, (GNDT), connected to the neutral side of the 115 VAC auxiliary receptacle. See the Wiring Diagram.
4. Disconnect and isolate the exciter winding leads. Leads #214 and #215.
5. Using an ohmmeter; check the resistance between the following points. Resistance should read very high, 500,000 (500k) ohms minimum.

- From chassis ground and one of the exciter winding leads.
- From chassis ground and one of the neutral terminals of the 115 VAC receptacle. (The neutral terminal is the larger of the two slots).
- From one of the neutral terminals of the 115 VAC receptacle to one of the exciter leads.

If any of these readings are less than 500,000 (500k) ohms, be certain that the windings are completely dry and check for grounded components or wiring that remain connected to the stator, such as circuit breakers, receptacles, etc. See Wiring Diagram. If necessary, disconnect and isolate the stator leads as close to the stator winding as possible.

If the low resistance to ground, or between individual stator windings is determined to be within the stator, the stator is defective and should be replaced.

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WELDING GENERATOR BRUSH AND COMMUTATOR INSPECTION AND SERVICE

⚠ WARNING

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

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

TEST DESCRIPTION

This procedure provides guidelines for checking and servicing the Welding Generator Commutator and Brushes.

MATERIALS NEEDED

Miscellaneous Hand Tools
120-150 Grit Commutator Stone
220-320 Grit Commutator Stone

IMPORTANT: Do not use emery cloth or paper to clean the commutator. Use only sand paper or a commutator stone.

CAUTION: Stoning the commutator involves pressing an abrasive stone against a spinning commutator. This procedure can be hazardous if done without proper training, tools and protective equipment. Consult the commutator stone manufacturer's instructions before attempting this procedure.

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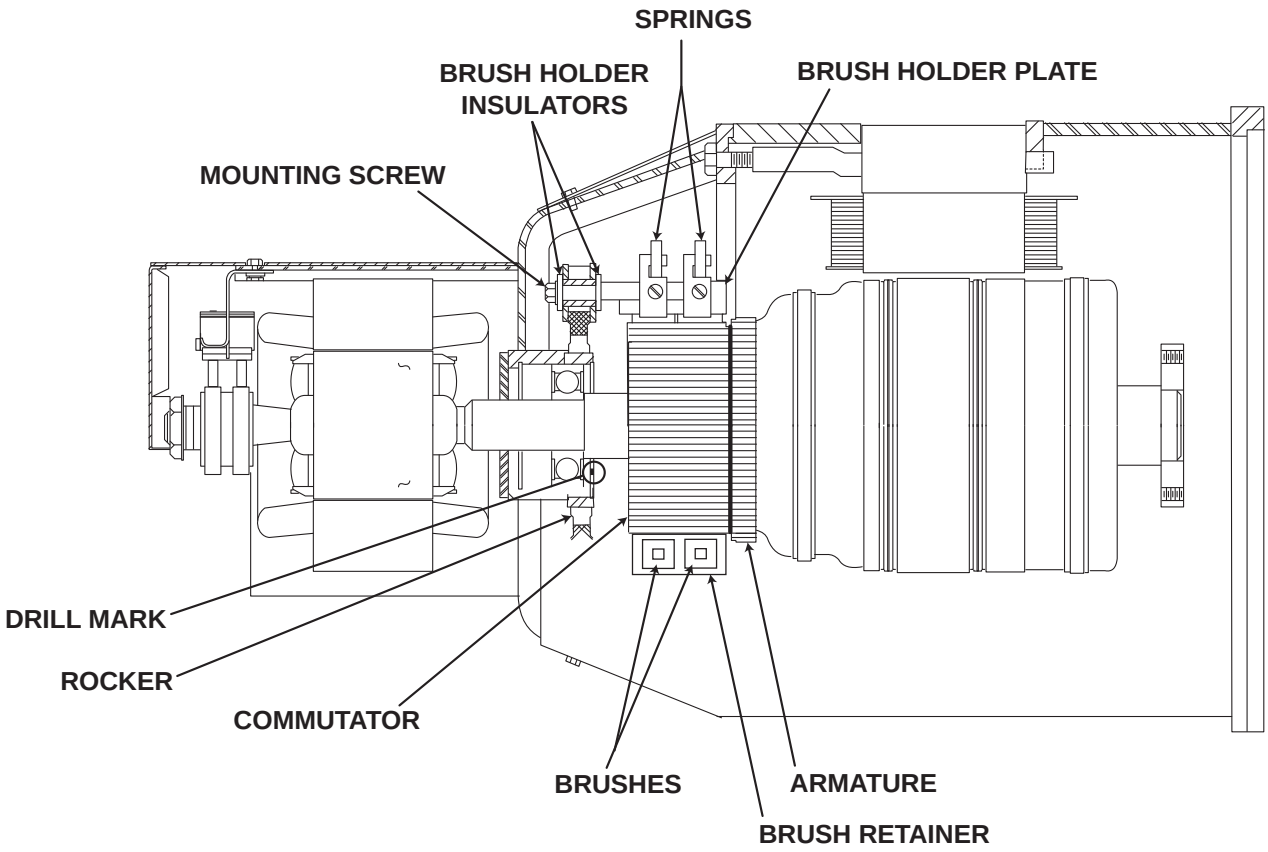
WELDING GENERATOR BRUSH AND COMMUTATOR INSPECTION AND SERVICE (continued)

FIGURE F.7 – GENERATOR COMPONENTS



PROCEDURE

1. Shut off the engine.
2. Open either, or both of the doors and secure them with the hooks provided.
3. Disconnect the negative battery cable.
4. Remove the sheet metal cover protecting the welder generator brushes.
5. Examine the Commutator.

Normal appearance:

The commutator should appear smooth and have an even brown color where the brushes ride.

Blackened Commutator:

A commutator that appears to have an even black color all around may indicate a grounded armature, shorted weld circuit, a serious overload condition, or out-of-adjustment rocker. It could also indicate the use of poor quality brushes, or brushes that have been contaminated with oil or some other foreign substance.

- Check the rocker position. Be certain that it is aligned with or very close to the factory drill mark. See Figure F.7. IMPORTANT: If the rocker position requires adjustment, do not over tighten the rocker clamping screw. This screw should be tightened to a torque of 70 to 75 Inch-Lbs. Over tightening can destroy the rocker.
- Perform the ***Weld Circuit Ground and Short Circuit Test***.
- If the weld circuit is not grounded or shorted and poor brush quality or contamination is suspected, replace the brushes and seat them with a commutator stone or sand paper.
- If brush quality or contamination is not suspected, clean the commutator by lightly stoning the surface.

⚠ CAUTION

Stoning the commutator involves pressing an abrasive stone against a spinning commutator. This procedure can be hazardous if done without proper training, tools and protective equipment. Consult the commutator stone manufacturer's instructions before attempting this procedure.

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WELDING GENERATOR BRUSH AND COMMUTATOR INSPECTION AND SERVICE (continued)

Pitted and Arc Damaged Commutator:

If pitting and arc damage to the commutator is evident, the machine may have been used with badly worn brushes. The brush spring tension may have been too low, or the brushes may have been sticking in the holders. An out-of-adjustment rocker or a serious overload may also cause this condition.

- Examine the inside of the brush covers and other parts that are close to the commutator. If there is a significant amount of solder and debris that has been thrown from the commutator, the armature will need to be replaced and the stator coils must be carefully examined and tested for damage.
- Perform the ***Weld Circuit Ground and Short Circuit Test***.
- If the brushes are worn out, replace them and resurface or clean the commutator as needed. If the brush springs appear weak, discolored or damaged in any way, replace them as well. The brush holder plates and retainers should be clean, smooth and undamaged so the brushes can move freely as they wear.
- Check the rocker position. Be certain that it is aligned with or very close to the factory drill mark. ***See Figure F.7***. IMPORTANT: If the rocker position requires adjustment, do not over tighten the rocker clamping screw. This screw should be tightened to a torque of 70 to 75 Inch-Lbs. Over tightening can destroy the rocker.

Uneven Commutator appearance:

If the commutator appears to have some normal colored bars and some blackened bars, the armature may be shorted.

- If excessive sparking is observed and/or the weld output is abnormal, the armature should be replaced.
- If the commutator has uneven color, but there is no sign of serious generator performance problems, the commutator may only need to be cleaned by lightly stoning the surface. See caution note on commutator stone usage.

Examine the brushes:

The brushes and springs should all be in place and not be excessively worn. Brushes should be replaced if they are worn to within ¼" of the pigtail lead.

The pigtail lead of each brush should be positioned so it allows free movement of the brush while it wears.

The brushes should be seated so that the face of each brush makes 95% minimum contact with the commutator. Lightly stone the commutator to seat the brushes. See caution note on commutator stone usage.

Examine the brush holders:

The brush holder insulators must be clean and in good condition and all of the hardware must be in place. ***See Figure F.7***. Replace any insulators that are cracked or damaged in any way.

When installing the brush holders, they should be rotated toward the brush retainer (clockwise rotation when facing the brush holder mounting screw.) until they stop. The edge of the brush holder plate should be parallel with the surface of the commutator and positioned .030 to .090 from the surface of the commutator. The brush holder mounting screw should be tightened to a torque of 24 to 28 Ft Lbs.

The brush holder plate and retainer assembly must be clean and smooth; nothing should prevent free movement of the brushes. All electrical connections to the brush holders must be clean and tight. The recommended torque for 5/16-18 brush holder connection screws is 8 Ft.-Lbs.

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WELD CIRCUIT GROUND AND SHORT CIRCUIT TEST

⚠ WARNING

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

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

TEST DESCRIPTION

This procedure checks for grounded components in the Weld Circuit. It also checks for a Short Circuit condition between the positive and negative components of the Weld Circuit. This test cannot detect a Short Circuit within the Armature or a turn to turn Short Circuit within a Coil or Coil Set.

IMPORTANT: The machine must be clean and completely dry before this test is done.

MATERIALS NEEDED

Miscellaneous Hand Tools
Ohmmeter or Multimeter
Wiring Diagram

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WELD CIRCUIT GROUND AND SHORT CIRCUIT TEST (continued)

PROCEDURE

1. Turn the engine off.

Weld circuit ground test:

1. Rotate the coarse current control to the minimum output position.
2. Measure the resistance between either of the two weld output terminals and a clean chassis ground connection.
3. The resistance measurement should be very high 500,000 (500k) Ohms minimum.

If the resistance is lower than 500k Ohms:

4. Move the output control away from the minimum position and recheck the resistance. If the resistance is now 500k Ohms or greater; check for a damaged or missing insulator bushing at the output control unit.
5. If the resistance is still less than 500k Ohms, Remove the welding generator brushes, or pull them away from the commutator and isolate them so they cannot come in contact with anything except the brush holder where they are attached.
6. Disconnect Plug #P10 from the receptacle #J5 and be certain none of the conductors can come in contact with chassis ground or any other wiring.
7. Check the resistance between chassis ground and each output terminal and between chassis ground and the commutator.

If the commutator has low resistance to chassis ground, the armature is defective.

8. If the resistance measured at the positive terminal is low, carefully examine the interpole coils and the heavy leads and the brush holders connected to the interpole coils. Check for damaged, dirty or missing brush holder insulators. Check for a damaged or dirty weld output positive terminal.
9. If the resistance measured at the negative terminal is low, examine the coarse current control unit, the series coils and the heavy leads and brush holders connected to them. Check for damaged, dirty or missing brush holder insulators. Check for a damaged or dirty weld output negative terminal. If necessary, disconnect the coarse current control unit and test it separately. ***See the Coarse Current Control Unit (Variable Reactor) Inspection and Service Procedure***.
10. Test for a short circuit condition between the positive and negative circuits.
11. With the brushes still isolated as described above, check the resistance between the two weld terminals. The resistance should be very high, 500,000 (500k) Ohms minimum.
12. If the resistance measurement is too low, check the heavy weld current carrying leads and connections for damaged insulation or dirt buildup between the negative (Series Coils) and positive (Interpole Coils) circuits. If the low resistance point is between the stator coils, the coils will require replacement or repair.

Field Flashing Procedure:

This procedure restores or corrects the residual magnetism in the welding generator. This procedure should be performed if there is no residual voltage output or if the polarity of the residual output is reversed.

1. Turn off the engine and remove the cover from the exciter / auxiliary power alternator.
2. Place the fine current / OCV control to the maximum setting.
3. Connect a DC power source of about 12 Volts to the exciter brush terminals. (The battery works well for this purpose.) Connect the positive lead to the positive brush terminal and the negative lead to the negative terminal and apply the voltage for about 3 to 5 seconds.

NOTE: If the residual output was present but the polarity was reversed, the above procedure should be used but the voltage used to flash the fields must be at least 24 Volts DC.

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SHUNT FIELD COIL RESISTANCE AND GROUND TEST

⚠ WARNING

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

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

TEST DESCRIPTION

This procedure will determine if the Welding Generator Shunt Field Coils are open, shorted or grounded

IMPORTANT: The machine should be clean and windings must be completely dry before this test is done.

MATERIALS NEEDED

Miscellaneous Hand Tools
Ohmmeter or Multimeter
Wiring Diagram

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SHUNT FIELD COIL RESISTANCE AND GROUND TEST (continued)

PROCEDURE

1. Turn off the engine.
2. Open one of the side doors and secure it with the hook provided.
3, Locate the brown and blue wires in the lead bundle exiting at the top of the welding generator frame and disconnect them.
4. Measure the resistance between the brown and blue wires that connect the shunt coils inside the generator frame. The resistance should measure about 50 to 54 Ohms* at 77º F (25º C)
5. If the resistance reading is correct, proceed to the Shunt Coil Ground Test.
6. If the resistance is significantly higher or lower than specified, examine the leads connecting the shunt coils and the jumper lead connecting the two coils together. If the leads and connections are undamaged, the shunt coils should be replaced.

Shunt Coil Ground Test:

1. Measure the resistance between either the brown or blue wires and a good clean chassis ground. The resistance should be very high. 500,00 (550k) Ohms Minimum.
2. If the resistance is low, check the lead wires connected to the shunt coils and the jumper lead wire connecting the two coils together. If these leads are in good condition and the low resistance is determined to be defective coil. The shunt coils should be replaced.
3. Reconnect the wires and replace any covers that have been removed.

***NOTE:** The resistance of the copper windings will change with temperature. Higher temperatures will produce slightly higher resistance and lower temperatures will produce slightly lower resistance.

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SHUNT FIELD CIRCUIT VOLTAGE TEST

⚠ WARNING

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

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

TEST DESCRIPTION

This procedure will determine if the Shunt Field Coils are receiving the necessary power to operate correctly.

This test should be done if there is little or no output from the welding generator, but auxiliary output is normal.

MATERIALS NEEDED

Miscellaneous Hand Tools
Voltmeter Or Multimeter
Wiring Diagram

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SHUNT FIELD CIRCUIT VOLTAGE TEST (continued)

PROCEDURE

1. Turn the engine off.
2. Locate the 12 pin molex connector in the wire bundle that exits the welding generator fame. See the Wiring Diagram.
3. Set the voltmeter for DC voltage and back-probe pins #3 and #5, (Blue and brown wires) of the 12 pin Molex connector.
4. Set the fine current / OCV control to maximum, set the idle switch to “High” and set the remote/local switch to local position.
5. Start the engine.
6. The voltage should read about 123 to 133 Volts DC. (Voltage will be a bit higher if machine is not warmed to normal operating temperature.)

If normal DC voltage is present, perform the ***Shunt Field Coil Resistance and Ground Test***.

If voltage is not present, check the rheostat, the remote/local switch, the J5 and P10 Molex connectors. Check all the wiring and terminals connecting the field bridge rectifier, the remote / local switch, the Flashing/Flywheel rectifier and the J5-P10 connectors.

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DEAD SHORT, 1ST STEP AND OPEN REACTOR TESTS

⚠ WARNING

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

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

TEST DESCRIPTION

This procedure tests the operation of the Coarse Output Control Unit (Variable Reactor) and the Series Field Coils in the Welding Generator.

This procedure should be done if the low end weld output too low, too high, or varies abnormally and the auxiliary output is normal.

MATERIALS NEEDED

Miscellaneous Hand tools
Ohmmeter
Resistive Load Bank
A Short Length Of Heavy Cable To Short The Output, Or Load Bank With Shorting Contactor

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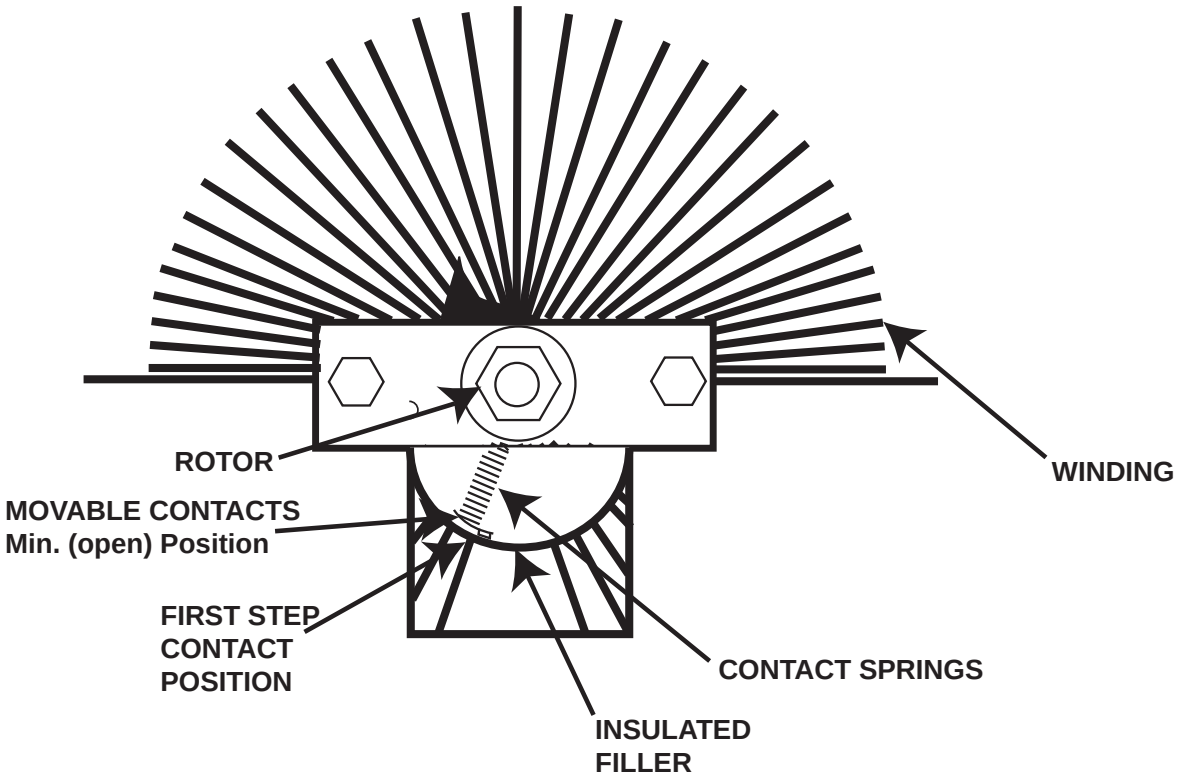
DEAD SHORT, 1ST STEP AND OPEN REACTOR TESTS (continued)

FIGURE F.8 – COARSE CONTROL UNIT



PROCEDURE

1. If possible, bring the machine to normal temperature by connecting a load bank and operating the machine at 100% output (250 amps @ 30 volts) for about 30 minutes.
2. Remove the load; turn the Fine Current / O.C.V. Rheostat to MAXIMUM and the Coarse Current Control to MINIMUM (Contacts on the insulated steel filler or “Open Reactor”).
3. Short the output terminals and check that the machine output is 92 to 117 Amps, at 0.2 to 4 Volts DC*.

If there is no output at the Min. setting of the output control, there is probably an open circuit in the Series coils or the conductors connecting them. See the Internal generator diagram and the Wiring Diagram.

A high output when the reactor is set to Min. would indicate a possible short in the series coils. See the internal generator diagram.

4. Begin rotating the coarse output control until the output current changes, this is the first step or first turn of the reactor coil. See Figure F.8. The output should measure 140 to 185 Amps, at 0.2 to 4 Volts DC*.

A slightly high reading in the Min. position, with no clear first step jump in output could indicate that the contacts are badly worn and the contact fingers, rather than the contacts themselves, may be making contact with the output control winding. Perform the ***Coarse Current Control Unit Inspection and Service Procedure.***

No change in the output as the coarse output control is slowly increased to the first step would indicate an open Output Control Unit, or an open in the cables connecting to it. See Wiring Diagram and perform the ***Coarse Current Control Unit Inspection and Service Procedure.***

* These values will be accurate if machine is operating at normal temperature. If the machine is cold, the values will be higher.

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ROCKER ADJUSTMENT PROCEDURE

⚠ WARNING

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

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

TEST DESCRIPTION

The Rocker is the part of the Welding Generator that supports and positions the 4 sets of Brushes. Its position can be adjusted to fine tune the weld output and influence the weld characteristics.

IMPORTANT: The Rocker is set at the factory for the best overall performance and long Generator and Brush life. Altering this adjustment is normally not recommended unless one or more of the Welding Generator components affecting this setting have been replaced. In very unusual situations, very small adjustments of the Rocker may be beneficial if the machine is operating within the specified limits, but the arc characteristics are unsatisfactory for the desired application.

CAUTION: Improper Rocker adjustment can result in poor performance, reduced Brush life and damage to the Welding Generator. This adjustment should only be attempted by an experienced professional.

MATERIALS NEEDED

Resistive Load Bank, Capable Of Absorbing At Least A 300 Amp load
Voltmeter
Ammeter, Able To Read At Least 300 Amps
Miscellaneous Hand Tools
Drill With 1/8” Bit
Tachometer Or Frequency Meter

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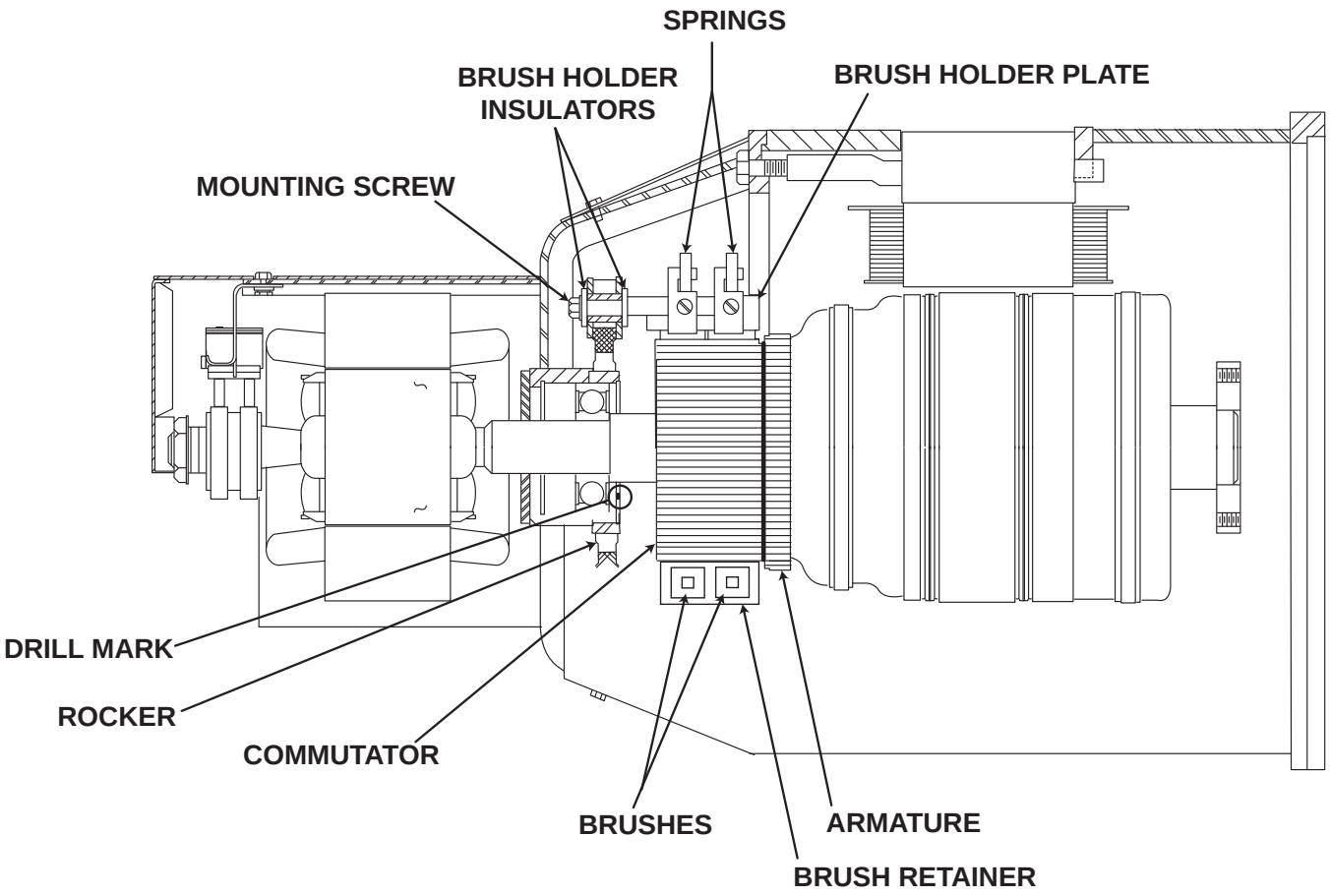
ROCKER ADJUSTMENT PROCEDURE (continued)

FIGURE F.9 – ROCKER W/MARKS



PROCEDURE

The factory set point drill marks:

1. When the rocker is set for the first time at the factory, a 1/8" drill is used to mark the position of both the rocker and the exciter bracket. See Figure F.9.

If a machine is not operating within the specified limits and nothing else appears to be faulty, the rocker position should be checked. If the drill marks are not aligned, the rocker and/or the exciter bracket should be reset to the original factory position.

If it has been determined that a rocker adjustment is necessary on an unaltered machine; the rocker should only be moved in very small increments and the total movement should be no more than ½ the diameter of the drill mark.

Setting the Rocker - if the factory drill mark is missing or invalid due to component replacement.

IMPORTANT: The following procedures should only be attempted if all the other systems have been thoroughly checked and are functioning normally.

A tachometer will be required for this phase of the test. ***See the Engine RPM Adjustment Test*** for details about measuring engine RPM.

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ROCKER ADJUSTMENT PROCEDURE (continued)

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PROCEDURE

Initial rocker placement:

1. The rocker should be initially positioned so the center of brushes visually lines up with the center of the main poles. Lining up the four brush holder studs with the four exciter bracket mounting bolts is acceptable for initial placement. The rocker should be tight against the shoulder of the hub and the clamping screw should be tightened only enough to assure the rocker cannot move.

IMPORTANT: DO NOT OVER TIGHTEN. Over tightening the rocker clamp screw can destroy the rocker.

2. Check that the brush holders are properly installed and positioned correctly. ***See the Welding generator Brush and Commutator Inspection and Service Procedure.***

3. Start the engine, place the idle switch in the high idle position and seat the brushes using a commutator stone. ***See the Welding generator Brush and Commutator Inspection and Service Procedure.***

4. Use a load bank to apply a 100% duty cycle load (250 amps @ 30 volts). Look at the brushes while the load is applied. If excessive sparking is observed, adjust the rocker position to minimize sparking. Generally, moving the rocker slightly in the direction of the armature rotation will reduce sparking.

5. Continue running the machine under load for at least 30 minutes to bring the machine up to normal operating temperature and to fully seat the brushes.

Check for Max output.

6. Remove the load, set the output control and rheostat to maximum, re-apply the load and adjust the load bank to apply a 300 Amp load to the machine.

WARNING: Do not move the Coarse Current Control while the machine is under load.

7. Measure the output voltage, it should read between 36 and 46 Volts DC

8. Measure the engine RPM, it should measure between 1650 and 1750 RPM.

If the engine RPM is not within specification, Perform the ***Engine RPM Adjustment Test***, if the engine high idle RPM is normal, but the load RPM is significantly less than specified above, the engine or governor may be malfunctioning. See the engine troubleshooting procedures in this manual and/or have the engine serviced or repaired by a qualified engine technician.

If the weld output voltage is lower than specified above, the rocker position will need to be adjusted. Generally, moving the rocker opposite the armature rotation direction will increase output voltage. When making this adjustment, the rocker should only be moved in very small increments. The adjustment may need to be repeated several times to achieve the desired result.

9. Remove the load and check the voltage at the output studs (OCV). The voltage should measure 94 to 99 Volts DC.

After the rocker has been adjusted and the machine is operating normally, the rocker locking screw should be tightened to 70-75 Inch-Lbs.

If new parts had been installed, the new rocker and/or exciter bracket location should be marked with a 1/8” drill mark. ***See Figure F.9***.

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COARSE CURRENT CONTROL UNIT (VARIABLE REACTOR) INSPECTION AND SERVICE PROCEDURE

⚠ WARNING

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

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

TEST DESCRIPTION

The Coarse Current Control unit, also known as a Variable Reactor, functions like a very high current, highly specialized rheostat. It works together with the Series Coils in the Generator to regulate the weld output and the weld output volt/amp curve. See the Theory Of Operation section of this manual for a more complete description.

This procedure should be performed if a visual inspection of the unit indicates excessive wear, dirt, or damage. It should also be performed if the Coarse Current control unit fails a ground test, or if called for in the dead short, first step, or open reactor tests. It should also be done if the weld output is low or erratic and the auxiliary output is normal.

MATERIALS NEEDED

Miscellaneous Hand Tools
400 To 600 Grit Sand Paper
Ohmmeter

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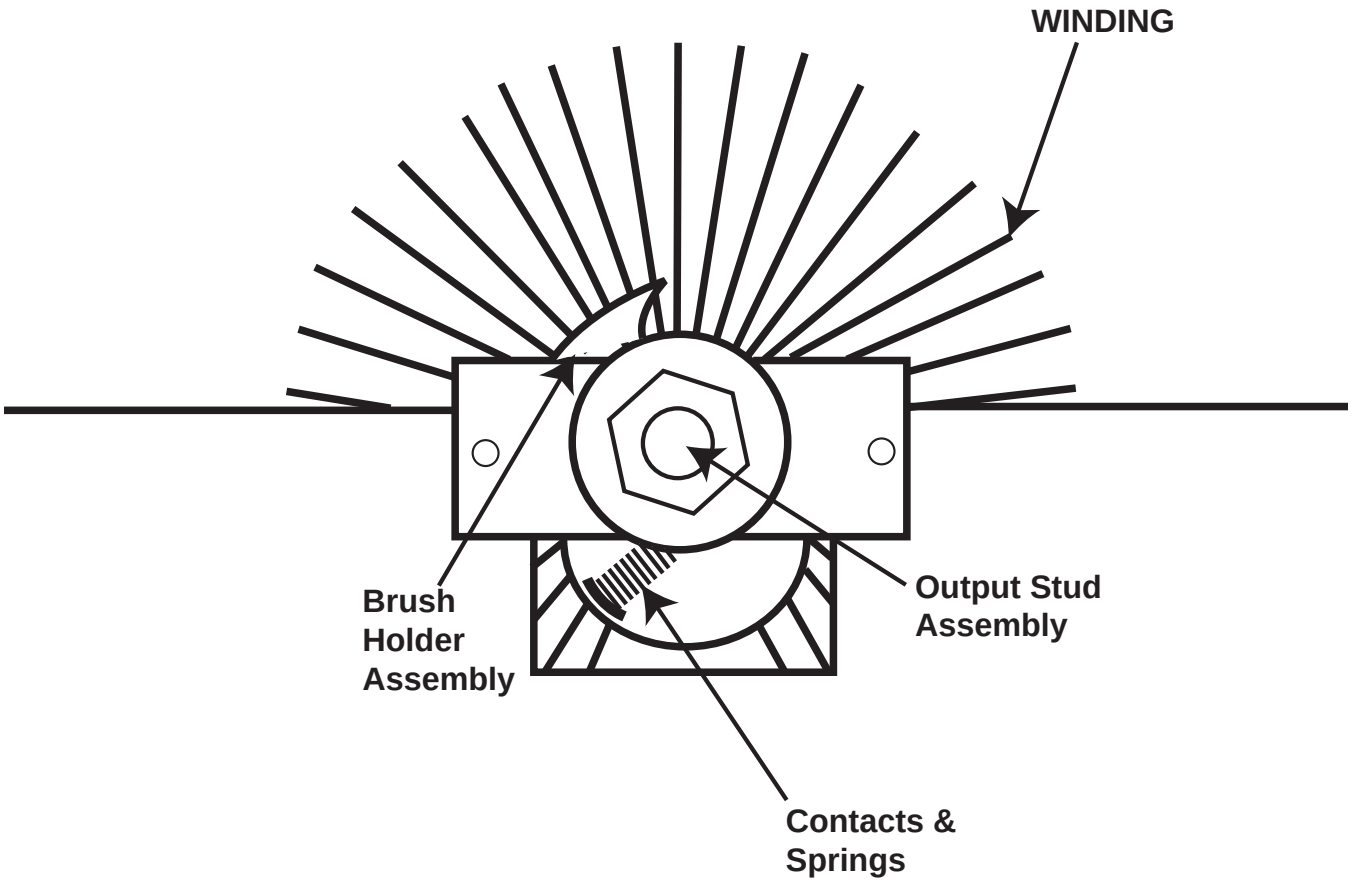
COARSE CURRENT CONTROL UNIT (VARIABLE REACTOR) INSPECTION AND SERVICE PROCEDURE (continued)

FIGURE F.10 – BRUSH & SPRING



PROCEDURE

1. Turn the engine off, open the doors and disconnect the negative battery cable. The doors must be secured while disconnecting the battery cable.
2. Remove the roof and doors.
3. Inspect the output control unit:
4. Carefully examine the unit. Check for arc damage, missing or broken springs, burned and/or badly worn contacts. Also look for missing or damaged insulators, poor lead connections and damaged lead insulation. If there is serious damage to the inside diameter of the winding, the Output Control Unit should be replaced. See Figure F.10 and ***Figure F.11***.
5. Disassemble the continuous control unit:

If service is necessary, remove the fuel tank and disconnect the heavy cable attached to the output stud, at the center back on the output control.

6. Remove the Output control handle.
7. Remove the two screws holding the Brush holder stud assembly. Use caution, the shaft is under spring tension. The stud assembly and the rotating brush holder/contact assembly can now be removed through the back of the unit. See Figure F.10 and ***Figure F.11***.

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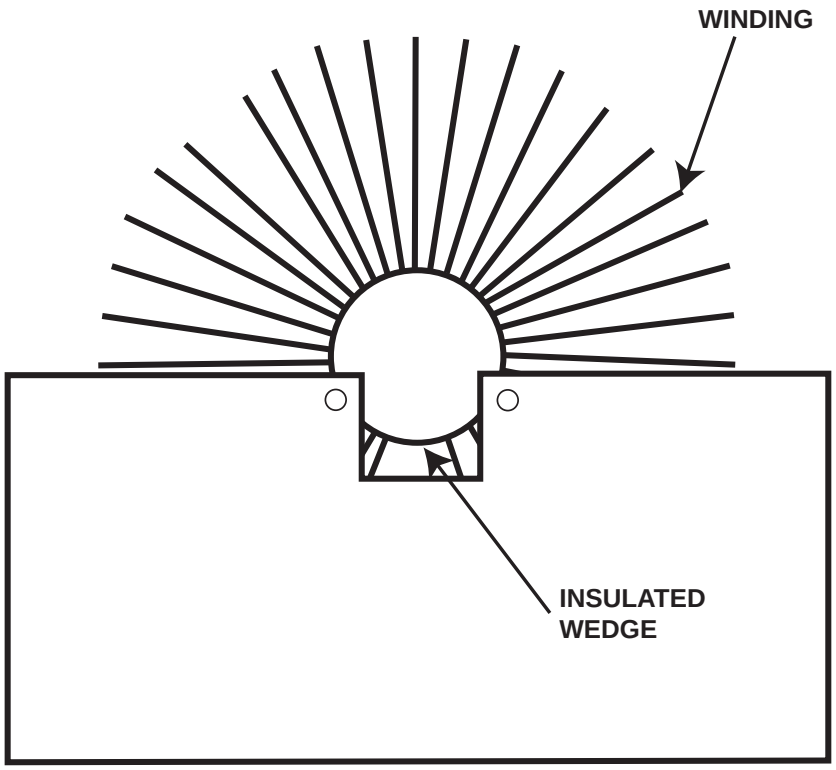
COARSE CURRENT CONTROL UNIT (VARIABLE REACTOR) INSPECTION AND SERVICE PROCEDURE (continued)

FIGURE F.11 – BRUSH & SPRING



Servicing the continuous control unit:

8. Clean the continuous output control unit by using low pressure air to remove any excess dust and dirt. If the unit is greasy or oily, a more thorough cleaning will be required. The unit must be clean and completely dry before continuing.
9. Ground test the unit by testing the resistance between the following points:
   - Chassis ground to winding
   - Chassis ground to the insulated steel wedge (at the bottom of continuous output control inside diameter)
   - Insulated steel wedge to the winding. See Figure F.11.

The resistance should be very high, 500,000 (500k) Ohms min.

If the resistance is too low, disconnect the remaining connection cable and look for any connection with chassis ground, including any buildup of conductive dirt contacting the winding. Repeat the above resistance tests. If the low resistance is determined to be within the continuous output control unit, it will need to be replaced.

Use very fine, 400 to 600 grit sand paper or a cylinder hone to clean away any dirt, oxidation, or minor arc pitting from the output control bore.

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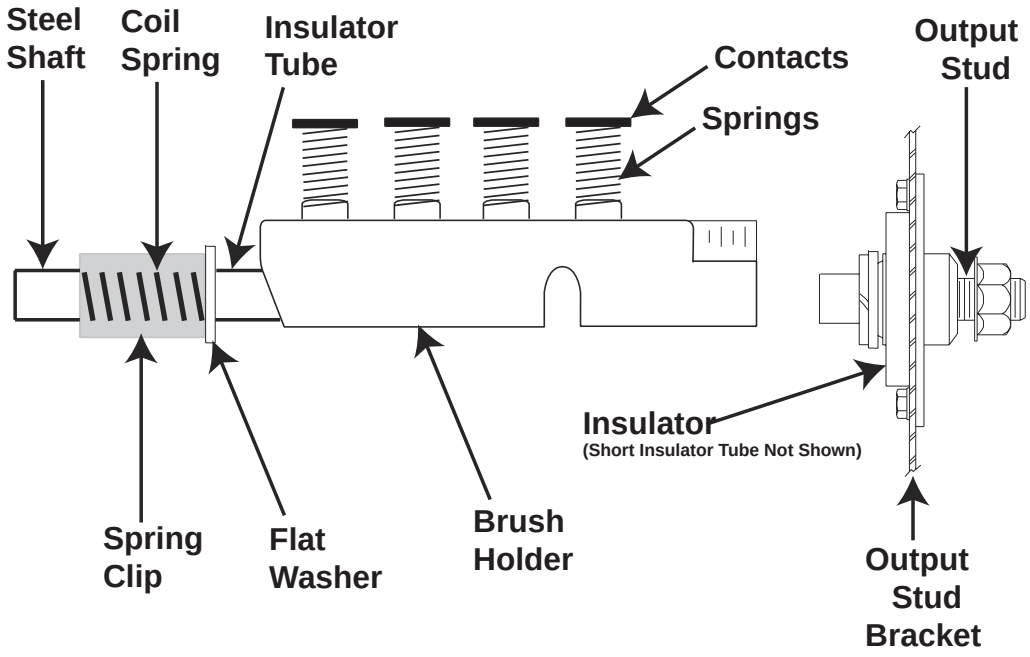
COARSE CURRENT CONTROL UNIT (VARIABLE REACTOR) INSPECTION AND SERVICE PROCEDURE (continued)

FIGURE F.12 – INSULATOR & SPRING LOCATIONS



Servicing the rotating brush holder and output stud assembly:

Thoroughly clean and inspect the rotating brush holder assembly and the output stud assembly.

10. Examine the insulators on both assemblies. See Figure F.12. Replace any that are worn, damaged or missing. If the shaft insulation tube requires replacement, position the shaft and tube per ***Figure F.13*** and torque the two 5/16-18 Hex head screws to 8 Ft-Lbs.

11. Disassemble the output stud assembly and check the insulating washers and tube. Replace them if they are damaged or worn and re-assemble the output stud assembly. See Figure F.12.

12. Check for grounded output stud and brush holder assemblies by measuring the resistance as follows:

From the steel shaft to the rotating brush holder

From the copper output stud to the output stud bracket

The resistance should be very high, 500,000 (500k) Ohms min.

If any of the contacts on the brush holder assembly are damaged, install all new contacts and new springs.

13. Assemble the flat washer, spring clip and coil spring to the shaft. See figure F.12.

14. Apply a thin layer of grease to both the output stud and the inside of the brush holder that mates to the output stud. Grease should also be applied to the area around the hole where the shaft passes through the front panel.

15. Insert the brush holder and output stud assembly through the output control unit and through the hole in the front panel. Be sure the output stud bracket is positioned correctly. The insulated stop should be on the left when facing the back on the output control unit.

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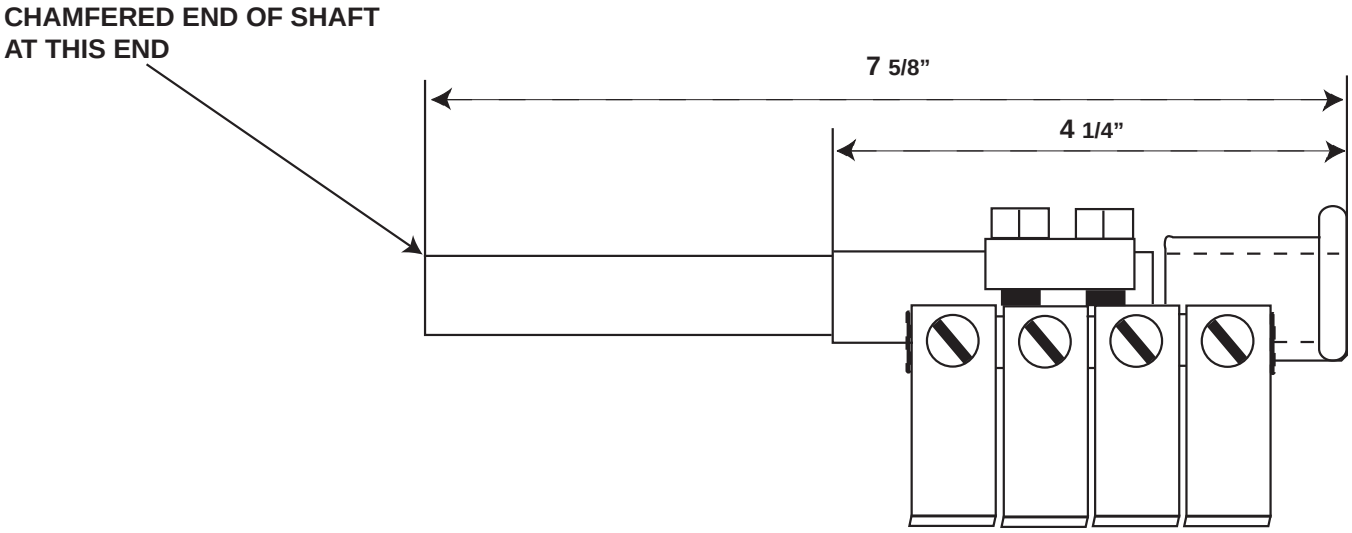
COARSE CURRENT CONTROL UNIT (VARIABLE REACTOR) INSPECTION AND SERVICE PROCEDURE (continued)

FIGURE F.13 – SHAFT & TUBE



The shaft spring will need to be compressed and the bracket drawn close to the back of the output control before the screws can be started and tightened. Locking type pliers and a drift punch can be used to maneuver the bracket into position. Tighten the screws.

16. Connect any cables that had been removed. Install fuel tank, roof and doors. Reconnect the battery cable.

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ENGINE PROTECTION SYSTEM CIRCUIT TEST

⚠ WARNING

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

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

TEST DESCRIPTION

This test will help pinpoint a failure of the Engine Protection System and should be done if the engine fault light turns on and the Engine shuts down shortly after startup and the Engine is not actually in a fault condition.

MATERIALS NEEDED

Miscellaneous Hand Tools
Voltmeter
Wiring Diagram

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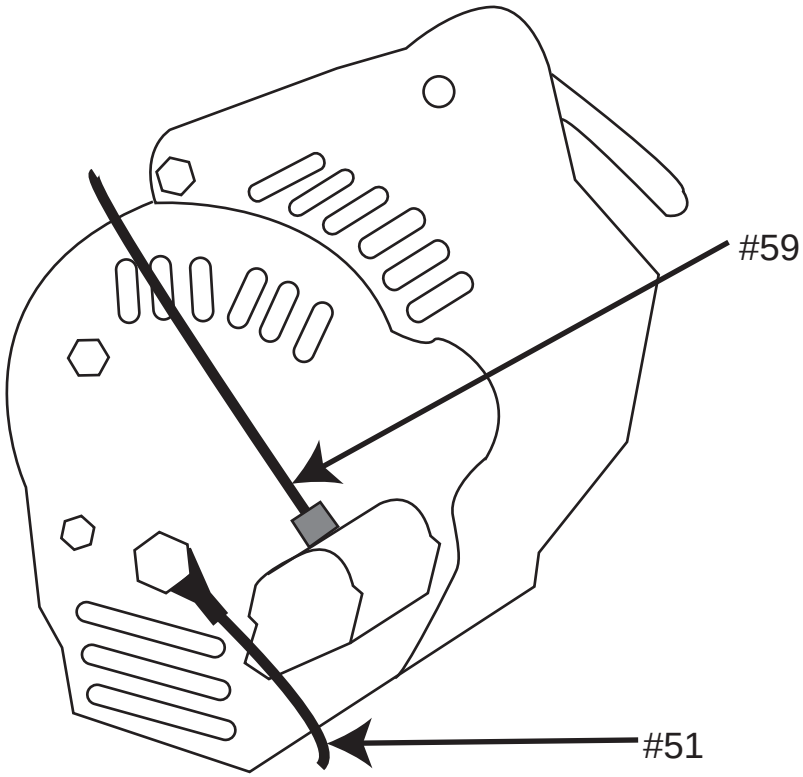
ENGINE PROTECTION SYSTEM CIRCUIT TEST (continued)

FIGURE F.14 – ENGINE ALTERNATOR



PROCEDURE

IMPORTANT: Before proceeding with this test, verify that the engine has normal oil pressure, is not overheated and the alternator drive belt is in place and properly tensioned.

Secure the doors in the open position using the door restraint system.

⚠ CAUTION

The following procedure will temporarily disable the engine protection system. Be absolutely certain that engine temperature and oil pressure are within the normal range. If the engine is permitted to run while overheated or with low oil pressure, severe engine damage will likely result and the engine warranty will not cover the damage. Be absolutely certain that all wires are connected when the test is completed.

1. Disconnect the lead from the engine coolant temperature switch, lead #44.
2. Disconnect the lead from the engine oil pressure switch, lead #54.
3. Disconnect the flash/sense lead from the engine alternator, lead 59.

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ENGINE PROTECTION SYSTEM CIRCUIT TEST (continued)

4. Insulate and/or position these leads so they cannot touch chassis ground, any other electrical conductor, or be damaged by any moving parts.
5. Start the engine and allow it to run.
6. If the engine still shuts down, thoroughly check the three wires that had been disconnected in steps 1 through 3. Be particularly aware of damaged insulation, or anything that may cause one of these conductors to come in contact with chassis ground.
7. If no problems are discovered with the wiring or insulation, the Idler/Engine shutdown PC board is faulty and should be replaced.
8. If the engine continues to run with these wires disconnected, one of the engine protection switches is faulty or the engine alternator is faulty.
9. Shut off the engine and reconnect any one of the three leads that had been disconnected in steps 1 through 3, then start the engine and allow it to run. If the engine shuts down, the component that had just been connected is faulty and should be repaired or replaced.
10. If the engine continues to run after reconnecting one of the wires, repeat step #9, connecting one of the two remaining wires, then repeat step #9 again connecting the last wire. Repair or replace any faulty component.

Be certain to reconnect all lead wires and close the doors when testing and service is complete.

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ENGINE ALTERNATOR TEST

⚠ WARNING

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

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

TEST DESCRIPTION

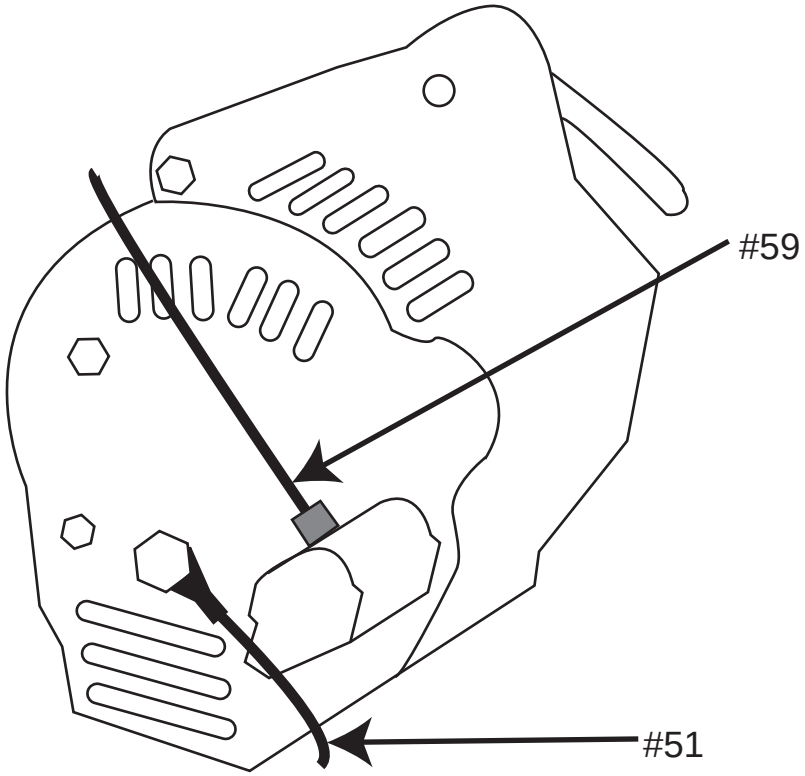
This test will determine if the Engine Alternator is operating normally.

MATERIALS NEEDED

Voltmeter Or Multimeter
Miscellaneous Hand Tools
Wiring Diagram

ENGINE ALTERNATOR TEST (continued)

FIGURE F.15 – ENGINE ALTERNATOR



PROCEDURE

1. Locate the engine alternator (See Figure F.15)
2. Check voltage as follows:
3. Run/stop switch off:
   - Chassis ground to the B+ terminal of the alternator, (Lead #51) the meter should read battery voltage.
   - Chassis ground to the alternator flash/sense lead, (Lead #59). The meter should read 0 volts.

Run/stop switch on:

- Chassis ground to the flash/sense lead, (Lead #59) the meter should read 11.5 to 12.9 Volts DC during first 30 seconds of operation. (This time may be 60 seconds on some models.)

Engine running:

- Chassis ground to the B+ terminal of the alternator, (Lead #51). The meter should read about 13.5 to 14.2 VDC.
- Chassis ground to the alternator flash/sense lead, (Lead #59). The meter should read about 10 Volts DC.

NOTE: A closed temperature switch or oil pressure switch can also cause the flash/sense voltage to measure low; perform the ***Engine Protection System Test*** before replacing the alternator.

If the voltages are significantly different from those shown above, check the wiring connected to the alternator for faulty connections or bad insulation. If the wiring is good, the alternator is probably faulty and should be serviced or replaced.

ENGINE FUEL SYSTEM VOLTAGE TESTS

⚠ WARNING

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

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

TEST DESCRIPTION

This test will determine if the Fuel System is getting the electrical power needed to function correctly.

MATERIALS NEEDED

Miscellaneous Hand Tools
Multimeter, Or A Voltmeter And Ohmmeter

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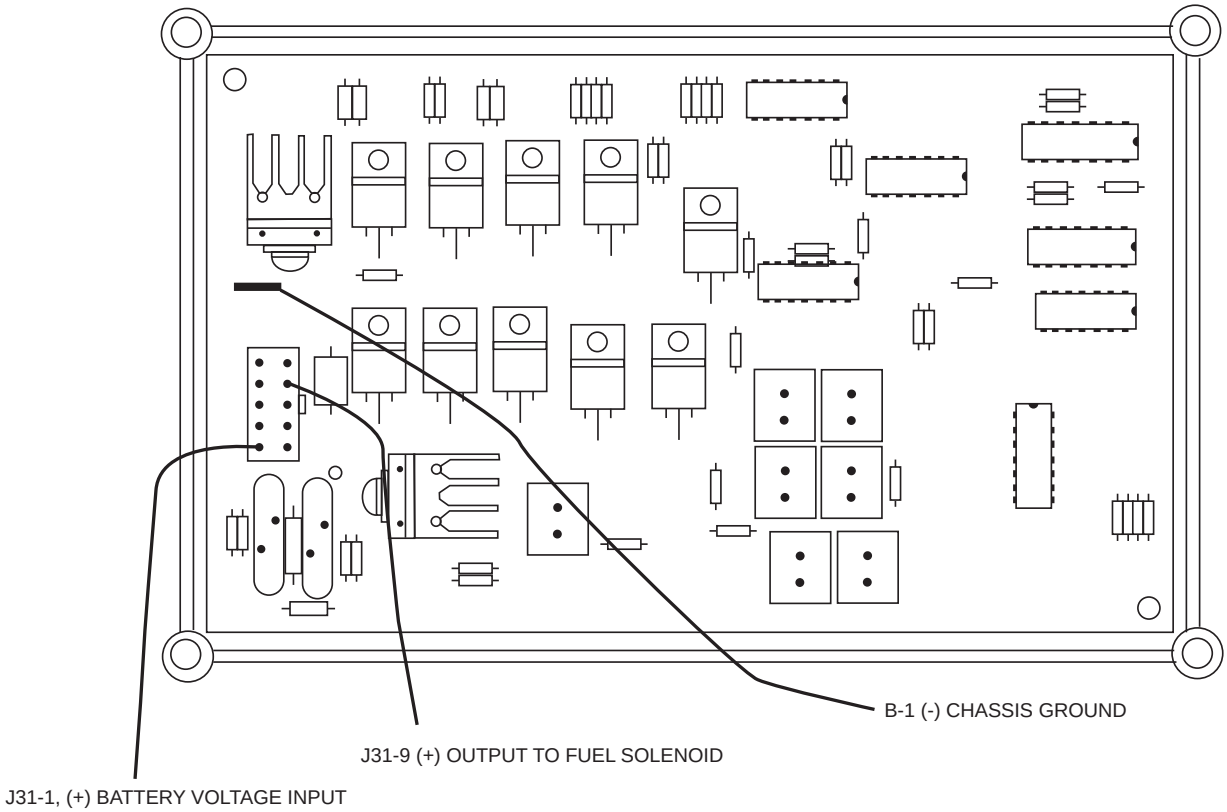
ENGINE FUEL SYSTEM VOLTAGE TESTS (continued)

FIGURE F.16 – PC BOARD



PROCEDURE

1. Open the doors on the **SAE-300®** machine and secure them using the hooks provided.
2. Check the wiring and connections on the Idle/Engine protection PC board, the engine fuel system injection pump solenoid and chassis ground. Look for dirty, corroded, or damaged terminals, including the Molex terminals connecting the wiring to the PC board. Look for poor crimp connections and damaged wiring.
3. Make sure the battery is in good condition and is fully charged, then place the run/stop switch in the run position. Within 30 seconds, check for battery voltage (11 to 13 VDC), across fuel solenoid. See the Wiring Diagram.

NOTE: The secondary solenoid will only have voltage if the fuel system temperature switch is closed. Consult a Perkins engine service facility for precise information about the temperature switch and other fuel system electrical components.

If battery voltage is present at the solenoids and the fuel pump (If equipped) and the starter motor is cranking the engine normally, the problem is likely in the engine. Engine problems should be diagnosed and repaired by a qualified Perkins engine technician.

If battery voltage is not present at the solenoids and fuel pump (if equipped) follow the procedures below.

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ENGINE FUEL SYSTEM VOLTAGE TESTS (continued)

1. Place the run/stop switch in the “RUN” position and within 30 seconds, check for 11 to 13 VDC between terminal J31-9(+) and terminal B-1(-).
2. Check for battery voltage between terminal J31-1(+) and terminal B-1(-).

If the correct voltage is present for tests #1 and #2, check the wiring and connections between the PC board and the solenoid. See Wiring Diagram.

If no voltage is present for tests #1 and #2, check the run/stop switch and all wiring and connections between terminal J31-1 and the positive battery terminal. Check all the wiring and connections between Terminal B-1 and the negative battery terminal. See Wiring Diagram.

If the correct voltage is present for test #2, but not for test #1 and the voltage reading was taken within 30 seconds of placing the run/stop switch in the “run” position, The PC board is faulty and should be replaced.

NOTE: The fuel solenoids is part of the Perkins engine and should be tested and, if necessary, repaired or replaced by a qualified Perkins engine technician. To help in precisely identifying a fuel system failure, approximate solenoid resistance values are included on the machine schematic.

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ALTERNATOR ROTOR REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

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

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

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Alternator Rotor.

MATERIALS NEEDED

Large Slot Head Screwdriver
Small Gear Puller
Miscellaneous Hand Tools

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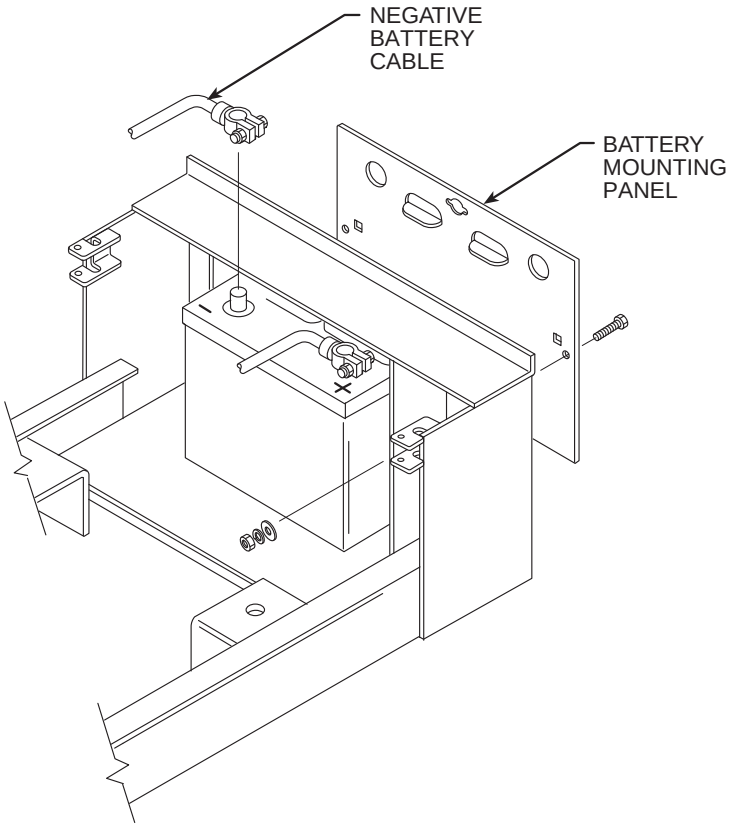
ALTERNATOR ROTOR
REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.17 – BATTERY PANEL REMOVAL



PROCEDURE

1. Turn the engine off.
2. Using the 7/16” wrench, remove the two bolts and washers and partially slide out the battery mounting panel. See Figure F.17.
3. With the 1/2" wrench, disconnect the negative battery cable.

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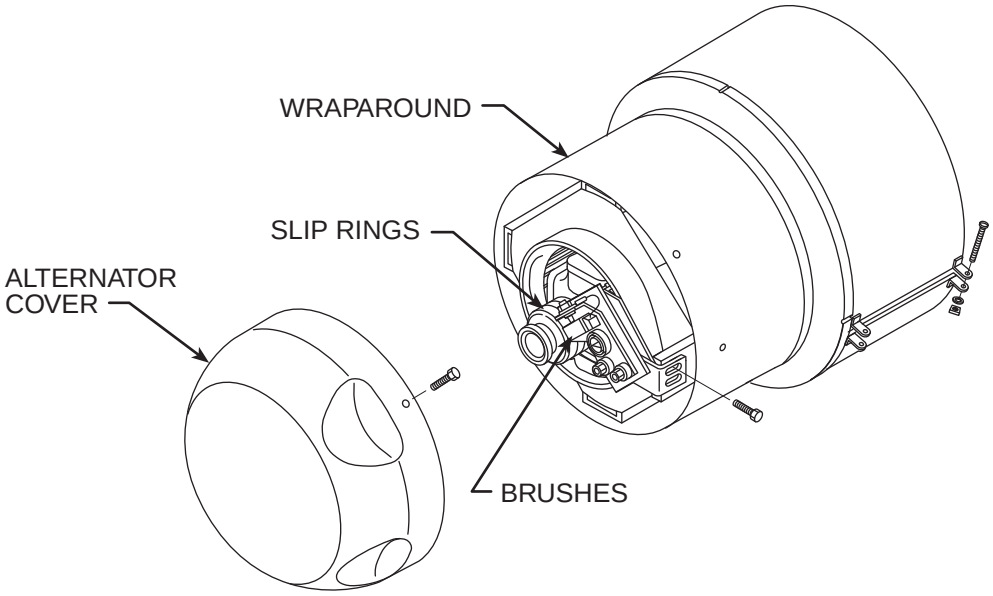
ALTERNATOR ROTOR
REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.18 – ALTERNATOR COVER AND WRAPAROUND REMOVAL



See Figure F.18 for steps 3 - 5.

3. With the 3/8" wrench, loosen the screws on the left and right sides and bottom of the alternator wrap-around.
4. With the 5/16" wrench, remove the 4 screws from the alternator cover.
5. Remove the alternator cover and wrap-around. Be careful to clear the leads.

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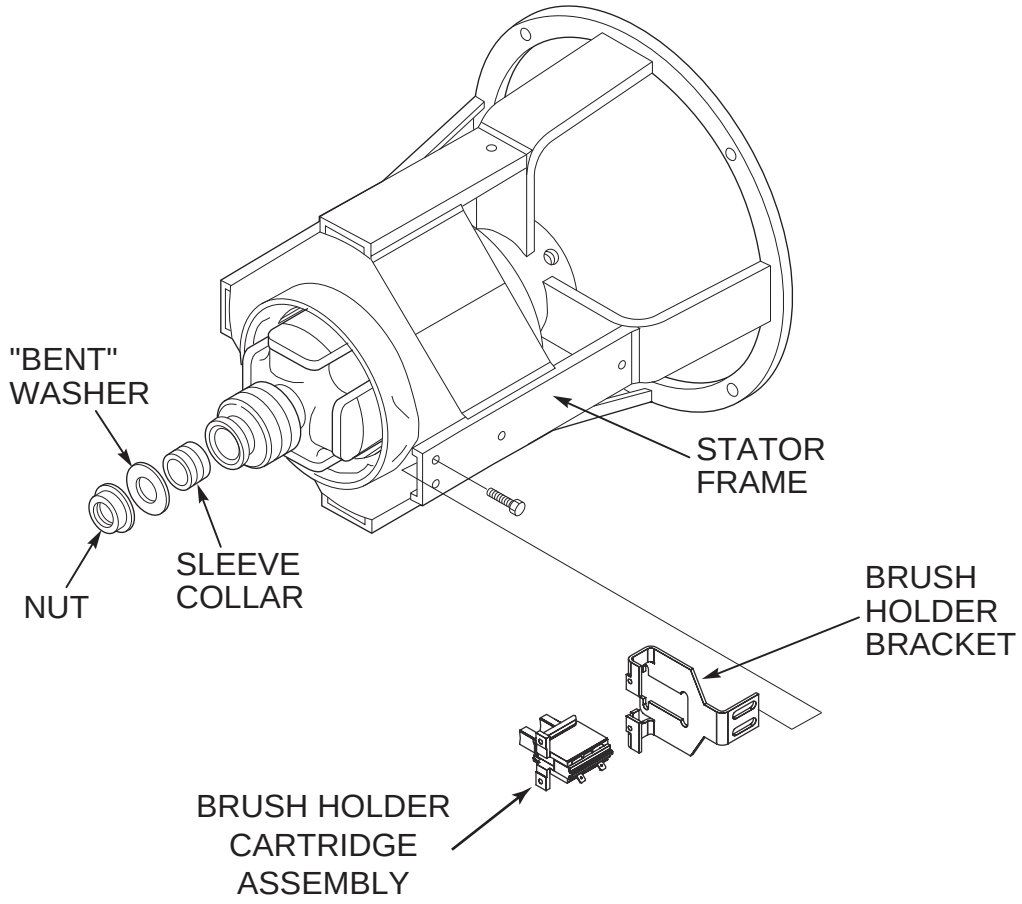
ALTERNATOR ROTOR
REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.19 – ROTOR REMOVAL



See Figure F.19 for steps 6 - 8.

6. With the 7/16" wrench, remove the two bolts, nuts and washers mounting the brush holder assembly to the stator frame.
7. Bend the flat washer away from the rotor locking nut.
8. With the 1-5/8" socket wrench, remove the rotor locking nut, washer and sleeve collar.

NOTE: The sleeve collar will have to be removed with a gear puller. Be careful not to damage the rotor slip ring assembly. Remove the rotor by pulling it free of the generator shaft.

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ALTERNATOR ROTOR
REMOVAL AND REPLACEMENT PROCEDURE (continued)

Replacement

9. Carefully mount the rotor onto the generator shaft. Install a new sleeve collar (part number T14337), washer and rotor locking nut.

   NOTE: Be careful not to damage or deform the new sleeve collar. Carefully tap the new sleeve collar into position. The rotor locking nut should be torqued to 175 ft.-lbs.

   After the rotor locking nut is properly torqued, bend the washer down over the locking nut.

   Check rotor air gap. .017" minimum is allowed.

10. Mount the brush holder assembly to the stator frame using two bolts, washers and nuts.

Installing and Seating Exciter Slip Ring Brushes

a. Make sure the slip rings are clean and free from oil and grease.

b. With the brushes in place, insert one end of a minimum 24" long piece of 180 grit sandpaper between the slip rings and brushes (abrasive against brushes). Pull the paper around the circumference of the rings in the direction of rotation only. Repeat this procedure until the entire face of the brush is contoured to the radius of the slip ring.

c. Check the brushes to be certain that there is spring tension holding them firmly against the slip rings.

11. Install the alternator cover and wrap-around.

12. Connect the negative battery cable.

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ALTERNATOR STATOR REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

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

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

TEST DESCRIPTION

This procedure will aid the repair technician in removal and replacement of the Exciter Alternator Stator.

MATERIALS NEEDED

Miscellaneous Hand Tools
Pry Bar
Wiring Diagram

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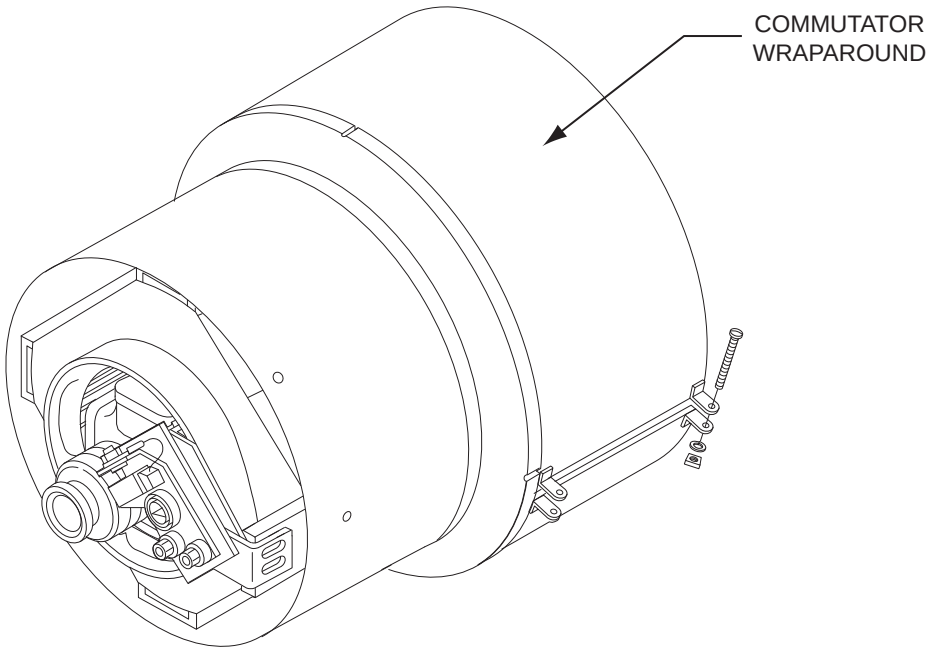
ALTERNATOR STATOR
REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.20 – GENERATOR COVER REMOVAL



PROCEDURE

1. Turn off the engine.
2. Perform the ***Alternator Rotor Removal Procedure.***
3. Remove the roof and doors.
4. Using a screwdriver, remove the wrap-around cover protecting the welding generator brushes and commutator. See Figure F.20.
5. Use the wiring diagram to identify all of the wires connected to the alternator stator winding. Carefully mark these leads, for later reassembly and then disconnect them. Cut cable ties as needed.
6. Lift the eight welding generator brushes from the commutator. Note the position of the brushes for later reassembly.
7. To assure accurate reconnection, carefully mark the heavy leads connected to the brush holders and then disconnect them. To aid in reassembly, note the way these leads are connected, routed and positioned.
8. The front panel of the machine can be unbolted and moved to the side to provide the clearance necessary to remove the exciter stator. This can normally be done by disconnecting only the wires and cutting only the cable ties necessary to allow the front panel to be moved. Most wiring can remain connected. Be sure to carefully mark all of the wires that were disconnected to aid in reassembly.

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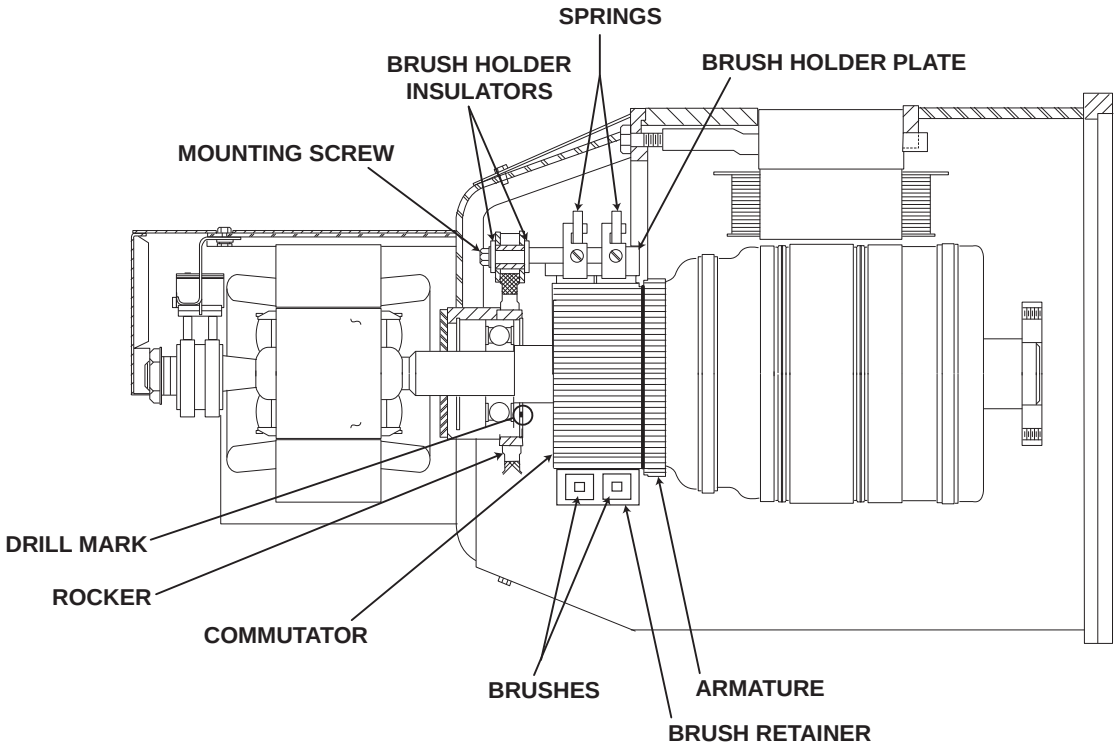
ALTERNATOR STATOR
REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.21 – ROCKER & MARK LOCATIONS



9. Drain the fuel and store it in an approved container. Disconnect the fuel line from the bottom of the tank and plug the line to avoid getting dirt or other contaminants into the fuel system. Remove the fuel tank and the tank mounting rails.

Note the drill spots marking the position of the exciter bracket and the rocker. It is very important that these marks be precisely aligned during reassembly. See Figure F.21.

NOTE: If these drill marks cannot be found, the positions of the rocker and exciter bracket should be clearly marked so these parts can be precisely aligned when the machine is reassembled.

10. Loosen the rocker clamping screw, but do not remove it.
11. Use a hoist, or other appropriate means to support the weight of the exciter frame assembly.
12. Remove the four screws securing the exciter end bracket to the generator frame.
13. Carefully pry the exciter stator/end bracket assembly away from the generator frame.

NOTE: The welding generator brush holder and rocker assembly will also be removed.

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ALTERNATOR STATOR
REMOVAL AND REPLACEMENT PROCEDURE (continued)

Replacing the Exciter Alternator Stator:

1. During reassembly, anti-seize compound should be applied to the screw threads.
2. Inspect the mating surfaces of the generator frame and the exciter bracket assembly. These surfaces must mate together completely so it is very important that the surfaces are completely clean and undamaged. The bearing and bearing housing should also be clean and undamaged.

Be sure that the rocker assembly is placed on the bearing housing with the locking screw positioned on top.

3. Place some bearing grease in the bearing housing. Chevron SRI or equivalent is recommended.
4. Mount the exciter stator/end bracket assembly to the welding generator frame. Carefully line up the drill spot between the two mating parts. Carefully and evenly tighten the four mounting bolts. ***See Figure F.21***.
5. Check the armature air gap. At the smallest point, the gap should be wide enough to allow a .035" thick ½" wide feeler gage to fit between the armature and stator through the entire length.
6. Position the rocker tightly against the hub, align the drill mark and tighten the rocker lock screw to 70 to 75 Inch-Lbs. DO NOT OVERTIGHTEN.
7. Be certain that the brush holders are properly positioned and parallel with the commutator. See the commutator and brush service procedure.
8. Re-attach the heavy generator leads to the brush holders. Use the notes made during disassembly to assure that the leads are connected and routed correctly.
9. If the original brushes are used, install them in the same positions that they had been. Form the braided brush leads so they will not interfere with the travel of the brushes as they wear.
10. Reverse the removal procedure to finish reassembling the machine.
11. Replace all the tie wraps that had been removed during disassembly.
12. Replace and connect the battery. Connect the positive cables first, followed by the negative cables.
13. Connect the fuel line and fill the tank. The fuel system may require bleeding. See the engine instruction manual for more information on the fuel system bleeding procedure.
14. Start the engine and seat the brushes using a commutator stone. ***See the Commutator and Brush Service Procedure***.
15. Replace the brush and exciter sheet metal covers.
16. Replace the roof and doors.

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GENERATOR FRAME
REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

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

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

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Case Sheet Metal Covers.

MATERIALS NEEDED

Miscellaneous Hand Tools

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GENERATOR FRAME
REMOVAL AND REPLACEMENT PROCEDURE (continued)

Remove the generator frame

1. Turn off Engine.
2. Perform the ***Alternator Rotor Removal Procedure***.
3. Perform the ***Alternator Stator Removal Procedure.***
4. Disconnect all of the wires and cables that connect to the stator/frame assembly. Carefully mark them for reassembly.
5. Remove the mounting bolts from the generator feet.
6. Using a hoist and sling, very carefully lift the generator only enough so the generator frame will clear the welder frame and can be removed. The sling should be positioned near the center of the generator frame.

Carefully watch the clearance between the engine and any other components while hoisting, especially the clearance between the engine fan, the fan shroud and radiator. Loosen or remove the radiator if necessary.

7. Support the engine at the generator adapter plate end.
8. With the generator frame still supported by the sling, (Be certain the sling is positioned at the center of gravity of the generator frame.) and the weight of the engine resting on the supports that were placed in the previous step, remove the screws securing the generator frame to the engine adapter plate.
9. Carefully pry and wiggle the generator frame to free it from the adapter plate and then slide the generator frame off of the armature. Adjust the height of the stator frame as needed to assure that it can slide off the armature without damage to any of the armature or stator windings.

Replacing the Generator Frame

1. During reassembly, anti-seize compound should be applied to the screw threads.
2. Carefully inspect the mating surfaces of the engine adapter plate and the generator frame. The mating surfaces must be clean and undamaged.
3. Lift the generator frame with the rope sling and very carefully slide it over the armature. Be very careful that the armature and stator windings are not damaged.
4. Align the bolt holes and install the screws that had been removed earlier. Carefully and evenly tighten them, making sure that the mating surfaces come together cleanly all the way around. Tighten the screws.
5. Remove the supports from the engine and carefully lower the generator frame. Install the rubber mounts.
6. Reverse the removal procedure to reassemble the machine. Be sure to secure all cables and wires. Replace all cable ties that had been removed during disassembly.
7. Perform the ***Alternator Stator Replacement Procedure***.
8. Perform the ***Alternator Rotor Replacement Procedure***.

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GENERATOR ARMATURE REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

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

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

TEST DESCRIPTION

This procedure will guide the technician in removing and replacing the Welding Generator Armature.

MATERIALS NEEDED

Rope Sling
Miscellaneous Hand Tools

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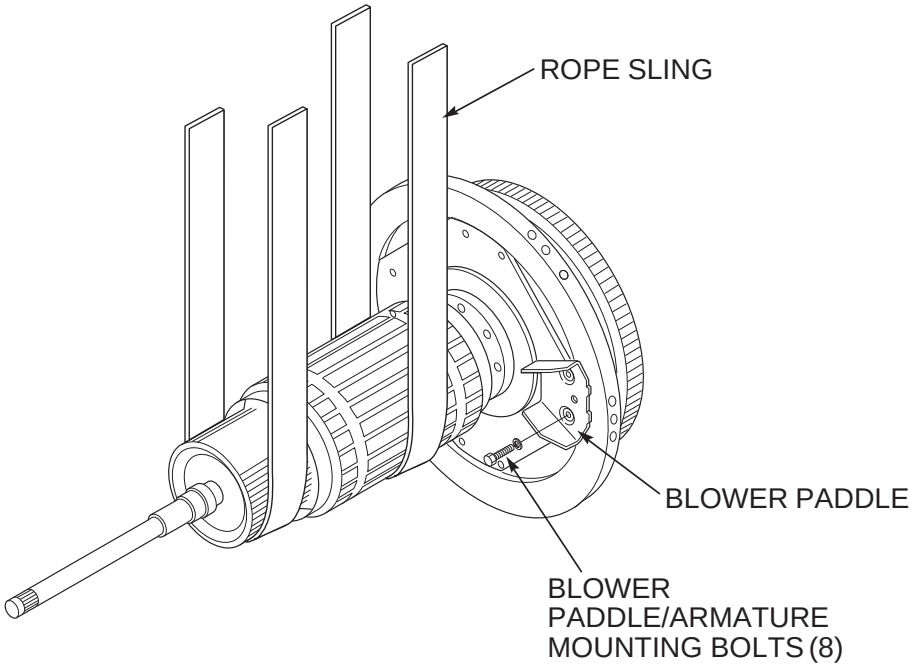
GENERATOR ARMATURE
REMOVAL AND REPLACEMENT PROCEDURE (continued)

FIGURE F.22 – SLING LIFT



PROCEDURE

Removing the Armature

1. Turn off the engine
2. Perform the ***Alternator Rotor Removal Procedure.***
3. Perform the ***Alternator Stator Removal Procedure***.
4. Perform the ***Generator Frame Removal Procedure.***
5. Using the rope sling, support the armature. Position the sling at the center of gravity of the armature assembly. See Figure F.22.
6. Remove the eight screws securing the blower paddle segments and the outer diameter of the flexible coupling disk to the flywheel.
7. With the armature securely supported in the sling, unlock it from the flywheel by carefully rotating it 1/8 of a turn in either direction.

Replacing the armature

1. Carefully inspect the mating surfaces of the flywheel and armature coupling parts. These surfaces must be clean and undamaged.
2. Support the armature in a rope sling and carefully move it into position and align it to the flywheel.
3. Rotate the armature 1/8 of a turn, in either direction, to engage the locking mechanism and line up the bolt holes. Be certain that the coupling plate is fully and cleanly seated in the flywheel.
4. Replace the eight screws and four blower segments. Tighten the screws.
5. Perform the ***Generator Frame Replacement Procedure.***
6. Perform the ***Alternator Stator Replacement Procedure***.
7. Perform the ***Alternator Rotor Replacement Procedure***.

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Retest after repair

The machine should be retested if any parts are replaced that could affect the machine's electrical characteristics.

Engine output:

Perform the ***Engine RPM Adjustment Test***

Welder DC Output:

Maximum Output:
Bring the machine to normal temperature by connecting a load bank and operating the machine at 100% output (250 amps @ 30 volts) for about 30 minutes.

Remove the load and set the output control and job selector rheostat to the maximum position.

IMPORTANT: Do not move the output control while a load is applied to the weld output terminals. Damage to the output control unit may result.

Read the open circuit voltage (OCV) at the weld output terminals. The voltage should measure 94 to 99 DC Volts.

Set the coarse and fine current controls to maximum and apply a 300 Amp load to the machine using the resistive load bank. Check the engine RPM and weld terminal voltage.
The Engine RPM should be 1650 to 1750
The weld output volts should be 36 to 46 VDC.

AC Auxiliary Output:

Machine should be operating at normal operating temperature.
Place the idle switch in the high idle position.
230 Volt receptacles should read 240 to 254 AC volts.
115 Volt receptacles should read 118 to 130 AC Volts.

Field amps and volts:

Place the fine current / O.C.V. rheostat to Maximum. (The machine should still be at normal operating temperature.)

Exciter volts, Measured at slip rings: 123 to 133 DC Volts
Exciter rotor amps: 2.2 to 2.6
Shunt field amps: 1.9 to 2.4
(Measure the Shunt Field current at either the blue or brown wires between the generator and the J5 Molex connector. See Wiring Diagram.)

NOTES

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TABLE OF CONTENTS - DIAGRAM SECTION

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

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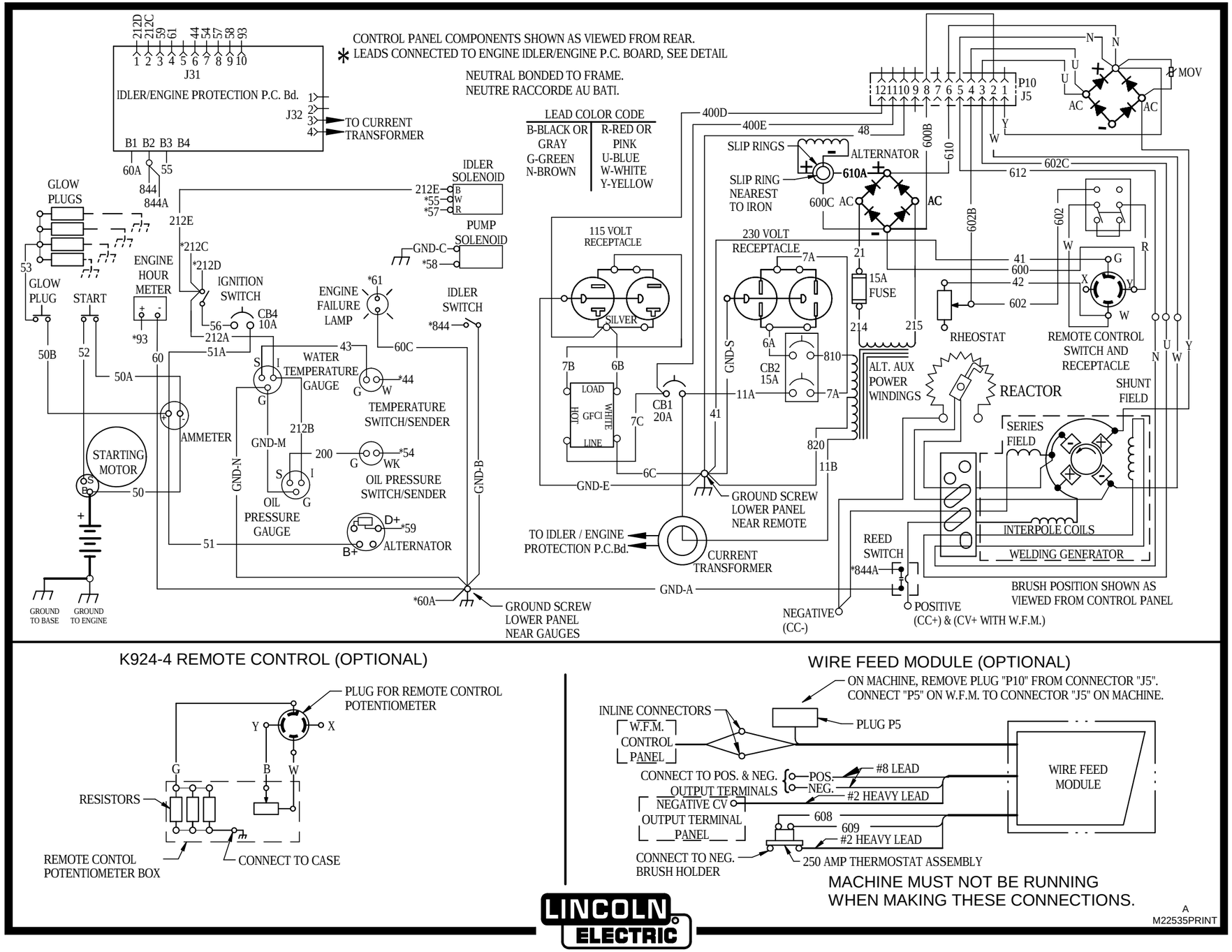
WIRING DIAGRAM - (M22535)

SAE-300 - PERKINS WIRING DIAGRAM



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

SCHEMATIC - COMPLETE MACHINE (L15879)

L15879 | ENGINEERING CONTROLLED MANUFACTURER: No | CHANGE DETAIL: CHANGED DC EXCITER TO AC EXCITER

IDLER / ENGINE PROTECTION PC BOARD (LOCATED BEHIND LOWER CONTROL PANEL)

CENTER OF CONTROL PANEL
12 VOLT - NORMALLY OFF
RED ENGINE PROTECTION LIGHT
60C — 61 — J1-4
ENGINE SHUTDOWN
N.C.
N.O.
ENGINE RUNNING
SCHEMATIC G4828-1
FLYBACK DIODES
ENGINE PROTECTION CIRCUITS (SEE BELOW FOR LOGIC)

INJECTION PUMP SOLENOID
GND-C — 58 — J1-9
RIGHT SIDE OF ENGINE BY INJECTION PUMP
APPROXIMATE RESISTANCE: 3.3 OHMS
TYPICAL CURRENT DRAW: 3.3A

CENTER OF CONTROL PANEL
HOUR METER
60 — 93 — J1-10

UNUSED
J1-5
J2-1
J2-2

B1 — 60A — REVERSE VOLTAGE PROTECTION DIODE

AUX LOAD SENSING
WELD LOAD SENSING
IDLE SOLENOID CIRUITS (SEE BELOW FOR LOGIC)
J2-3 J2-4 B2

J1-3 — 59 — THIS LEAD PROVIDES FLASH FOR ALTERNATOR AND SENSES ALTERNATOR OUTPUT

BACK, LEFT SIDE OF ENGINE
65 AMP / 12 VOLT ALTERNATOR
D+ B+

BACK, RIGHT SIDE OF ENGINE
IDLE SOLENOID
TYPICAL CURRENT DRAW AND RESISTANCE:
HOLD COIL: 1A, 10-15 OHMS
PULL COIL: 40A, LESS THAN .1 OHM

B3 — 55 — WHITE — PULL COIL
J1-8 — 57 — RED — HOLD COIL
BLACK
212E

J1-2 — 212C
J1-1 — 212D

IGNITION SWITCH
56 — 10A CB4 — LOWER LEFT OF CONTROL PANEL — 51 — 51A

GLOW PLUG SWITCH — 53
AMMETER SHOWS FULL DISCHARGE WHILE PRESSING GLOW PLUG SWITCH
GLOW PLUGS
TYPICAL CURRENT DRAW IS 40 +/- 3 AMPS

51C — -40 TO 40 AMPS — AMMETER — 50A — 50

START SWITCH — 52

STARTER SOLENOID
STARTER MOTOR
BACK, BOTTOM OF MACHINE
BATTERY
12.6 VOLTS MIN AT REST
14-14.5 VOLTS WHILE RUNNING

J1-6 — 44 — 43 — BACK, LEFT SIDE OF ENGINE — |W G|
TEMPERATURE SWITCH / SENDER
SWITCH CLOSES AT 230ºF +/-6ºF
212A — S I G — SHOWN IN "OFF" POSITION
212B
TEMPERATURE GAUGE
LOWER LEFT OF CONTROL PANEL
SENDER OPERATION:
140ºF -> 134+/-13.5 OHMS
194ºF -> 51.2+/-4.3 OHMS
212ºF -> 38.5+/-3 OHMS
SENDER IS APPROX. 500 OHMS AT 70ºF

J1-7 — 54 — 200 — BACK, TOP OF ENGINE — |W G|
S I G
OIL PRESSURE GAUGE
LOWER LEFT OF CONTROL PANEL
OIL PRESSURE SWITCH / SENDER
SWITCH CLOSES AT 6+/-2 PSI
SENDER OPERATION:
0 PSI -> 10+/-5 OHMS
40PSI -> 105+/-5 OHMS
80 PSI -> 187+/-5 OHMS

B4
B5 — UNUSED
B6
ON NEWER BOARDS, J1 BECOMES J31, J2 BECOMES J32, B5 AND B6 TERMINALS ARE DELETED.

844 — GND-B — IDLER SWITCH — SHOWN IN "AUTO IDLE" POSITION
844A
400D
400E

K924-4 REMOTE CONTROL (OPTIONAL)
REMOTE CONTROL PLUG
G Y X W
25+/-1.25 OHMS EACH
64+/-6.4 OHMS MAX
CCW
RHEOSTAT
REMOTE CONTROL BOX

PLUG IS LOCATED BEHIND LOCAL / REMOTE SWITCH ON RIGHT SIDE OF MACHINE (AS VIEWED FROM CONTROL PANEL)
THIS DIODE ALLOWS THE RESIDUAL MAGNETISM OF THE GENERATOR TO FLASH THE EXCITER ROTOR WHICH IN TURN PROVIDES THE EXCITATION FOR THE GENERATOR
P10 PLUG IS REMOVED FOR WIRE FEED MODULE CONNECTION
P10
12 11 10 9 8 7 6 5 4 3 2 1
J5 — 48
N N U U
AC AC MOV
BRIDGE AND MOV LOCATED ON RIGHT OUTEF SIDE OF REACTOR SHEET METAL.
FLYBACK DIODE PREVENTS VOLTAGE SPIKES IN SHUNT FIELD FROM DAMAGING LOCAL/REMOTE TOGGLE SWITCH WHEN SWITCHED

AC EXCITER
WINDING SPEC: ALT-241-3A
40.5 - 42.5 OHMS AT 25C
EXCITER REVOLVING FIELD (ROTOR)
SLIP RINGS
POSITIVE SLIP RING IS NEAREST TO IRON
610A — 610 — 600C — 600B — 600
AC AC DIODE — LOWER, RIGHT SIDE OF CONTROL PANEL
21 — FUSE 15A — 215 — 214
LOWER, RIGHT OF CONTROL PANEL

20A CB1 — 11A — 15A CB2 — 7A — 6A — 810
7C — LOAD — GFCI — LINE — 7B — 115 VOLT RECEPTACLE — 6B — 6C — SILVER
GND-S — 6A — 230 VOLT RECEPTACLE
GND-E — 820 — 11B

EXCITER CIRCUIT
LEAD 21A TO 21B
WINDING SPEC: ALT-214-2B
.488 OHMS MAX AT 25C
115 VOLT CIRCUIT
LEAD 810 TO 820
WINDING SPEC: ALT-214-2C
.230 OHMS MAX AT 25C
115 VOLT CIRCUIT
LEAD 820 TO 830
WINDING SPEC: ALT-214-2D
.424 OHMS MAX AT 25C

EXCITER STATOR (ALTERNATOR)
GENERATOR LEAD BLOCK SHOWN AS VIEWED WITH ENGINE IN THIS DIRECTION

TOP, RIGHT PORTION OF CONTROL PANEL
CCW RHEOSTAT 64+/-6.4 OHMS MAX
602B — 42 — 602 — 41 — 600 — G X Y W
REMOTE RECEPTACLE
LOCAL / REMOTE SWITCH
SHOWN IN LOCAL POSITION
612 — 602C W — W Y — N — U

IDLE SOLENOID CIRUIT LOGIC
1. WHEN THE ENGINE IS RUNNING IN HIGH IDLE OR UNDER LOAD, THE SOLENOID IS NOT ENERGIZED.
2. IF NO AUXILIARY CURRENT DRAW OR WELD LOAD IS SENSED FOR 15 SECONDS AND THE IDLER SWITCH IS OPEN (AUTO), THE PULL AND HOLD COIL OF THE IDLER SOLENOID ARE ENERGIZED. THE PULL COIL IS DE-ENERGIZED AFTER HALF A SECOND.
3. IF AN AUXILIARY CURRENT DRAW OR WELD LOAD IS SENSED OR THE IDLER SWITCH IS CLOSED (HIGH), THE IDLE SOLENOID IS DE-ENERGIZED.

TOP, LEFT PORTION OF CONTROL PANEL
MAX OUTPUT — REACTOR — MIN. OUTPUT

SERIES FIELD
INTERPOLE COILS
SHUNT FIELD
FJW-5AP COIL PAIR: 25.2 - 26.7 OHMS EACH
BRUSH POSITION SHOWN AS VIEWED FROM CONTROL PANEL
WELDING GENERATOR

*844A — GND-A
NEGATIVE OUTPUT TERMINAL
POSITIVE OUTPUT TERMINAL
BACK OF OUTPUT STUD
REED SWITCH SWITCH CLOSES WITH FLOW OF WELDING CURRENT
TYPICAL OCV (WARM MACHINE):
94-99.0 VOLTS AT MAX RHEOSTAT
44-54.5 VOLTS AT MIN RHEOSTAT
UNDER LEFT DOOR

COMPONENT VALUE UNITS:
CAPACITOR: MFD/VOLTS
RESISTOR: OHMS/WATTS

CONNECTOR PIN NUMBERS:
EX. 12 PIN CONNECTOR
1 2 — 6 — 7 — 12 — LATCH
VIEW OF CONNECTOR ON PC BOARD

LEAD COLOR CODE:
B-BLACK OR GRAY
G-GREEN
R-RED OR PINK
U-BLUE
W-WHITE
Y-YELLOW
N-BROWN

LABELS:
COMMON
FRAME GROUND
EARTH GROUND

MANUFACTURING TOLERANCE PER E2056 UNLESS OTHERWISE SPECIFIED TOLERANCE ON 2 PLACE DECIMALS IS ± .02 in. (± 0.5 mm) ON 3 PLACE DECIMALS IS ± .002 in. (± 0.05 mm) ON ALL ANGLES IS ± .5 OF A DEGREE MATERIAL TOLERANCE ("t") TO AGREE WITH PUBLISHED STANDARDS.
DO NOT SCALE THIS DRAWING

CONTROL:	CLEVELAND
DRAWN BY:	tsado
ENGINEER:	DJB
APPROVED:	GWM
SCALE:	NONE
IF PRINTED @ A2 SIZE:	
UNITS:	INCH
EQUIPMENT TYPE:	SAE-300
SUBJECT:	MACHINE SCHEMATIC
MATERIAL DISPOSITION:	UF
APPROVAL DATE:	9-23-2011
PROJECT NUMBER:	CRM42466
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DOCUMENT REVISION:	B

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

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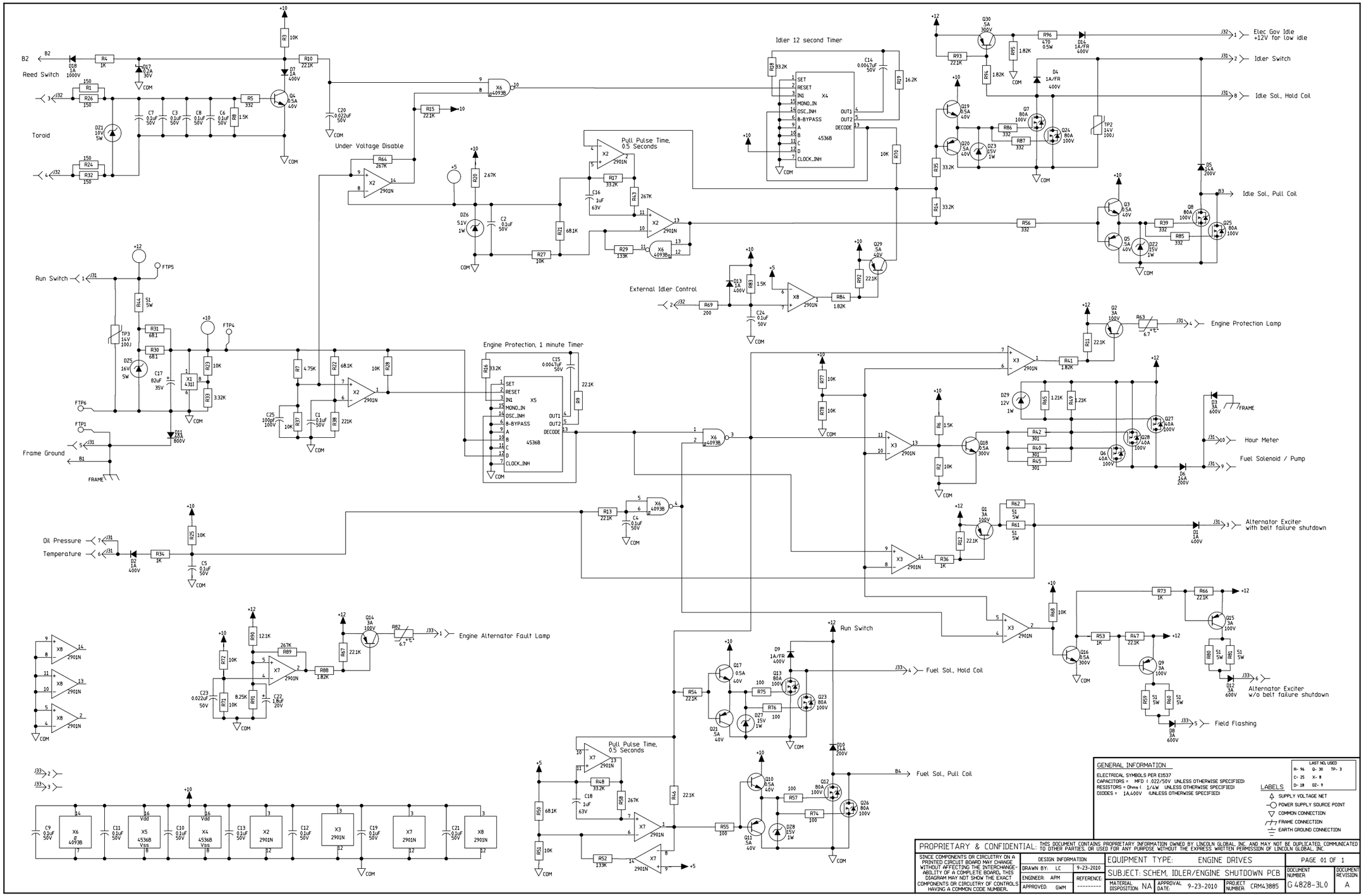
SCHEMATIC - IDLER PC BOARD (G4828)



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

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