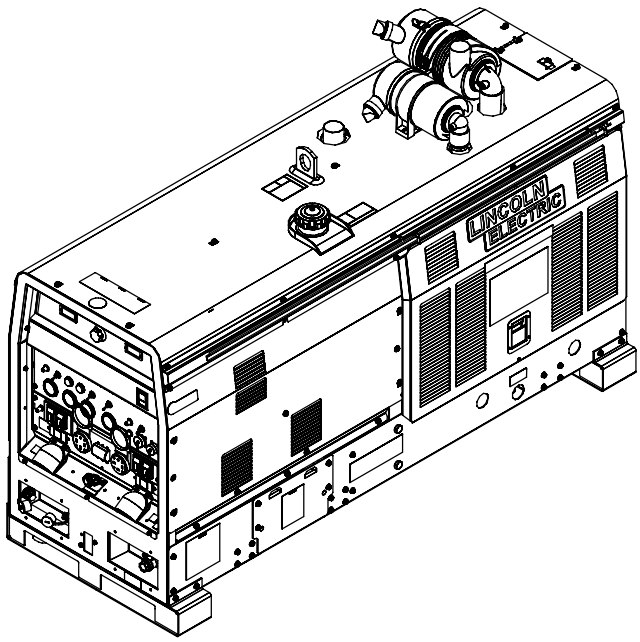
NOTE: This manual will cover most of the troubleshooting and repair procedures for the code numbers listed. Some variances may exist when troubleshooting/repairing later code numbers.

AIR VANTAGE® 650 CUMMINS

For use with machines having Code Numbers:

11654, 12378, 11655, 12379, 12557, 12582

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

SVM253-A | Issue Date 14-Aug

THE LINCOLN ELECTRIC COMPANY
22801 St. Clair Avenue • Cleveland, OH • 44117-1199 • U.S.A.
Phone: +1.216.481.8100 • www.lincolnelectric.com

SAFETY DEPENDS ON YOU

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

⚠ WARNING

This statement appears where the information must be followed exactly to avoid serious personal injury or loss of life.

⚠ CAUTION

This statement appears where the information must be followed to avoid minor personal injury or damage to this equipment.

KEEP YOUR HEAD OUT OF THE FUMES.

DON'T get too close to the arc. Use corrective lenses if necessary to stay a reasonable distance away from the arc.

READ and obey the Material Safety Data Sheet (MSDS) and the warning label that appears on all containers of welding materials.

USE ENOUGH VENTILATION or exhaust at the arc, or both, to keep the fumes and gases from your breathing zone and the general area.

IN A LARGE ROOM OR OUTDOORS, natural ventilation may be adequate if you keep your head out of the fumes (See below).

USE NATURAL DRAFTS or fans to keep the fumes away from your face.

If you develop unusual symptoms, see your supervisor. Perhaps the welding atmosphere and ventilation system should be checked.

WEAR CORRECT EYE, EAR & BODY PROTECTION

PROTECT your eyes and face with welding helmet properly fitted and with proper grade of filter plate (See ANSI Z49.1).

PROTECT your body from welding spatter and arc flash with protective clothing including woolen clothing, flame-proof apron and gloves, leather leggings, and high boots.

PROTECT others from splatter, flash, and glare with protective screens or barriers.

IN SOME AREAS, protection from noise may be appropriate.

BE SURE protective equipment is in good condition.

Also, wear safety glasses in work area AT ALL TIMES.

SPECIAL SITUATIONS

DO NOT WELD OR CUT containers or materials which previously had been in contact with hazardous substances unless they are properly cleaned. This is extremely dangerous.

DO NOT WELD OR CUT painted or plated parts unless special precautions with ventilation have been taken. They can release highly toxic fumes or gases.

Additional precautionary measures

PROTECT compressed gas cylinders from excessive heat, mechanical shocks, and arcs; fasten cylinders so they cannot fall.

BE SURE cylinders are never grounded or part of an electrical circuit.

REMOVE all potential fire hazards from welding area.

ALWAYS HAVE FIRE FIGHTING EQUIPMENT READY FOR IMMEDIATE USE AND KNOW HOW TO USE IT.

SECTION A: WARNINGS

CALIFORNIA PROPOSITION 65 WARNINGS

Diesel Engines

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

Gasoline Engines

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

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

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

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

FOR ENGINE POWERED EQUIPMENT.

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

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

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

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

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

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

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

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

ELECTRIC AND MAGNETIC FIELDS MAY BE DANGEROUS

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

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

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

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

- 2.d.1. Route the electrode and work cables together - Secure them with tape when possible.
- 2.d.2. Never coil the electrode lead around your body.
- 2.d.3. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.
- 2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.
- 2.d.5. Do not work next to welding power source.

ELECTRIC SHOCK CAN KILL.

3.a. The electrode and work (or ground) circuits are electrically "hot" when the welder is on. Do not touch these "hot" parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.

3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:

- Semiautomatic DC Constant Voltage (Wire) Welder.
- DC Manual (Stick) Welder.
- AC Welder with Reduced Voltage Control.

3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically "hot".

3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.

3.e. Ground the work or metal to be welded to a good electrical (earth) ground.

3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.

3.g. Never dip the electrode in water for cooling.

3.h. Never simultaneously touch electrically "hot" parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.

3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.

3.j. Also see Items 6.c. and 8.

ARC RAYS CAN BURN.

4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87. 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.

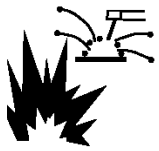
5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

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.

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.

Welding Safety Interactive Web Guide for mobile devices

ELECTROMAGNETIC COMPATABILITY (EMC)

CONFORMANCE

Products displaying the CE mark are in conformity with European Community Council Directive of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (89/336/EEC). 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.

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

As a rule of thumb, for many mild steel electrode, if the air is visibly clear and you are comfortable, then the ventilation is generally adequate for your work. The most accurate way to determine if the worker exposure does not exceed the applicable exposure limit for compounds in the fumes and gases is to have an industrial hygienist take and analyze a sample of the air you are breathing. This is particularly important if you are welding with stainless, hardfacing or Special Ventilation products. All Lincoln MSDS have a maximum fume guideline number. If exposure to total fume is kept below that number, exposure to all fume from the electrode (not coatings or plating on the work) will be below the TLV.

There are steps that you can take to identify hazardous substances in your welding environment. Read the product label and material safety data sheet for the electrode posted in the work place or in the electrode or flux container to see what fumes can be reasonably expected from use of the product and to determine if special ventilation is needed. Secondly, know what the base metal is and determine if there is any paint, plating, or coating that could expose you to toxic fumes and/or gases. Remove it from the metal being welded, if possible. If you start to feel uncomfortable, dizzy or nauseous, there is a possibility that you are being overexposed to fumes and gases, or suffering from oxygen deficiency. Stop welding and get some fresh air immediately. Notify your supervisor and co-workers so the situation can be corrected and other workers can avoid the hazard. Be sure you are following these safe practices, the consumable labeling and MSDS to improve the ventilation in your area. Do not continue welding until the situation has been corrected.

NOTE: The MSDS for all Lincoln consumables is available on Lincoln's web-site: www.lincolnelectric.com

Before we turn to the methods available to control welding fume exposure, you should understand a few basic terms:

Natural Ventilation is the movement of air through the workplace caused by natural forces. Outside, this is usually the wind. Inside, this may be the flow of air through open windows and doors.

Mechanical Ventilation is the movement of air through the workplace caused by an electrical device such as a portable fan or permanently mounted fan in the ceiling or wall.

Source Extraction (Local Exhaust) is a mechanical device used to capture welding fume at or near the arc and filter contaminants out of the air.

The ventilation or exhaust needed for your application depends upon many factors such as:

- Workspace volume
- Workspace configuration
- Number of welders
- Welding process and current
- Consumables used (mild steel, hardfacing, stainless, etc.)
- Allowable levels (TLV, PEL, etc.)
- Material welded (including paint or plating)
- Natural airflow

Your work area has adequate ventilation when there is enough ventilation and/or exhaust to control worker exposure to hazardous materials in the welding fumes and gases so the applicable limits for those materials is not exceeded. See chart of TLV and PEL for Typical Electrode Ingredients, the OSHA PEL (Permissible Exposure Limit), and the recommended guideline, the ACGIH TLV (Threshold Limit Value), for many compounds found in welding fume.

Ventilation

There are many methods which can be selected by the user to provide adequate ventilation for the specific application. The following section provides general information which may be helpful in evaluating what type of ventilation equipment may be suitable for your application. When ventilation equipment is installed, you should confirm worker exposure is controlled within applicable OSHA PEL and/or ACGIH TLV. According to OSHA regulations, when welding and cutting (mild steels), natural ventilation is usually considered sufficient to meet requirements, provided that:

1. The room or welding area contains at least 10,000 cubic feet (about 22' x 22' x 22') for each welder.
2. The ceiling height is not less than 16 feet.
3. Cross ventilation is not blocked by partitions, equipment, or other structural barriers.
4. Welding is not done in a conned space.

Spaces that do not meet these requirements should be equipped with mechanical ventilating equipment that exhausts at least 2000 CFM of air for each welder, except where local exhaust hoods or booths, or air-line respirators are used.

Important Safety Note:

When welding with electrodes which require special ventilation such as stainless or hardfacing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce hazardous fumes, keep exposure as low as possible and below exposure limit values (PEL and TLV) for materials in the fume using local exhaust or mechanical ventilation. In conned spaces or in some circumstances, for example outdoors, a respirator may be required if exposure cannot be controlled to the PEL or TLV. (See MSDS and chart of TLV and PEL for Typical Electrode Ingredients.) Additional precautions are also required when welding on galvanized steel.

BIBLIOGRAPHY AND SUGGESTED READING

ANSI Z87.1, Practice for Occupational and Educational Eye and Face Protection, American National Standards Institute, 11 West 42nd Street, New York, NY 10036.

Arc Welding and Your Health: A Handbook of Health Information for Welding. Published by The American Industrial Hygiene Association, 2700 Prosperity Avenue, Suite 250, Fairfax, VA 22031-4319.

NFPA Standard 51B, Cutting and Welding Processes, National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9146, Quincy, MA 02269-9959.

OSHA General Industry Standard 29 CFR 1910 Subpart Q. OSHA Hazard Communication Standard 29 CFR 1910.1200. Available from the Occupational Safety and Health Administration at http://www.osha.org or contact your local OSHA office.

The following publications are published by The American Welding Society, P.O. Box 351040, Miami, Florida 33135. AWS publications may be purchased from the American Welding society at http://www.aws.org or by contacting the AWS at 800-443-9353.

ANSI, Standard Z49.1, Safety in Welding, Cutting and Allied Processes. Z49.1 is now available for download at no charge at http://www.lincolnelectric.com/community/safety/ or at the AWS website http://www.aws.org.

AWS F1.1, Method for Sampling Airborne Particulates Generated by Welding and Allied Processes.

AWS F1.2, Laboratory Method for Measuring Fume Generation Rates and Total Fume Emission of Welding and Allied Processes.

AWS F1.3, Evaluating Contaminants in the Welding Environment: A Strategic Sampling Guide.

AWS F1.5, Methods for Sampling and Analyzing Gases from Welding and Allied Processes.

AWS F3.2, Ventilation Guide for Welding Fume Control.

AWS F4.1, Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances.

AWS SHF, Safety and Health Facts Sheets. Available free of charge from the AWS website at http://www.aws.org.

LISTED BELOW ARE SOME TYPICAL INGREDIENTS IN WELDING ELECTRODES AND THEIR TLV (ACGIH) GUIDELINES AND PEL (OSHA) EXPOSURE LIMITS

INGREDIENTS	CAS No.	TLV mg/m3	PEL mg/m3
Aluminum and/or aluminum alloys (as Al)*****	7429-90-5	10	15
Aluminum oxide and/or Bauxite*****	1344-28-1	10	5**
Barium compounds (as Ba)*****	513-77-9	****	****
Chromium and chromium alloys or compounds (as Cr)*****	7440-47-3	0.5(b)	.005(b)
Fluorides (as F)	7789-75-5	2.5	2.5
Iron	7439-89-6	10*	10*
Limestone and/or calcium carbonate	1317-65-3	10	15
Lithium compounds (as Li)	554-13-2	10*	10*
Magnesite	1309-48-4	10	15
Magnesium and/or magnesium alloys and compounds (as Mg)	7439-95-4	10*	10*
Manganese and/or manganese alloys and compounds (as Mn)*****	7439-96-5	0.2	5.0(c)
Mineral silicates	1332-58-7	5**	5**
Molybdenum alloys (as Mo)	7439-98-7	10	10
Nickel*****	7440-02-0	1.5	1
Silicates and other binders	1344-09-8	10*	10*
Silicon and/or silicon alloys and compounds (as Si)	7440-21-3	10*	10*
Strontium compounds (as Sr)	1633-05-2	10*	10*
Zirconium alloys and compounds (as Zr)	12004-83-0	5	5

Supplemental Information:

(*) Not listed. Nuisance value maximum is 10 milligrams per cubic meter. PEL value for iron oxide is 10 milligrams per cubic meter. TLV value for iron oxide is 5 milligrams per cubic meter.

(**) As respirable dust.

(*****) Subject to the reporting requirements of Sections 311, 312, and 313 of the Emergency Planning and Community Right-to-Know Act of 1986 and of 40CFR 370 and 372.

(b) The PEL for chromium (VI) is .005 milligrams per cubic meter as an 8 hour time weighted average. The TLV for water-soluble chromium (VI) is 0.05 milligrams per cubic meter. The TLV for insoluble chromium (VI) is 0.01 milligrams per cubic meter.

c) Values are for manganese fume. STEL (Short Term Exposure Limit) is 3.0 milligrams per cubic meter. OSHA PEL is a ceiling value.

(****) There is no listed value for insoluble barium compounds. The TLV for soluble barium compounds is 0.5 mg/m3.

TLV and PEL values are as of April 2006. Always check Material Safety Data Sheet (MSDS) with product or on the Lincoln Electric website at http://www.lincolnelectric.com

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Figure E.1 - Block logic diagram

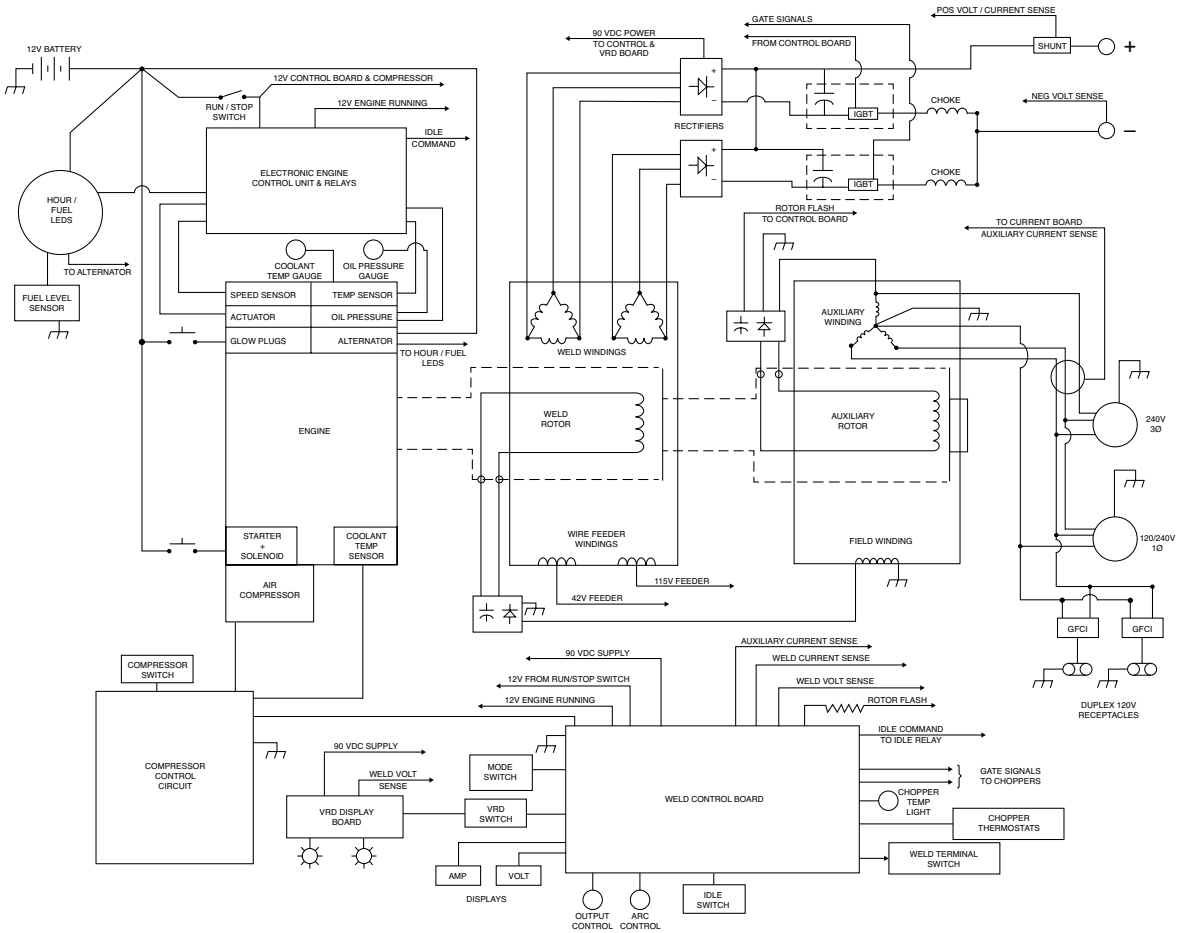
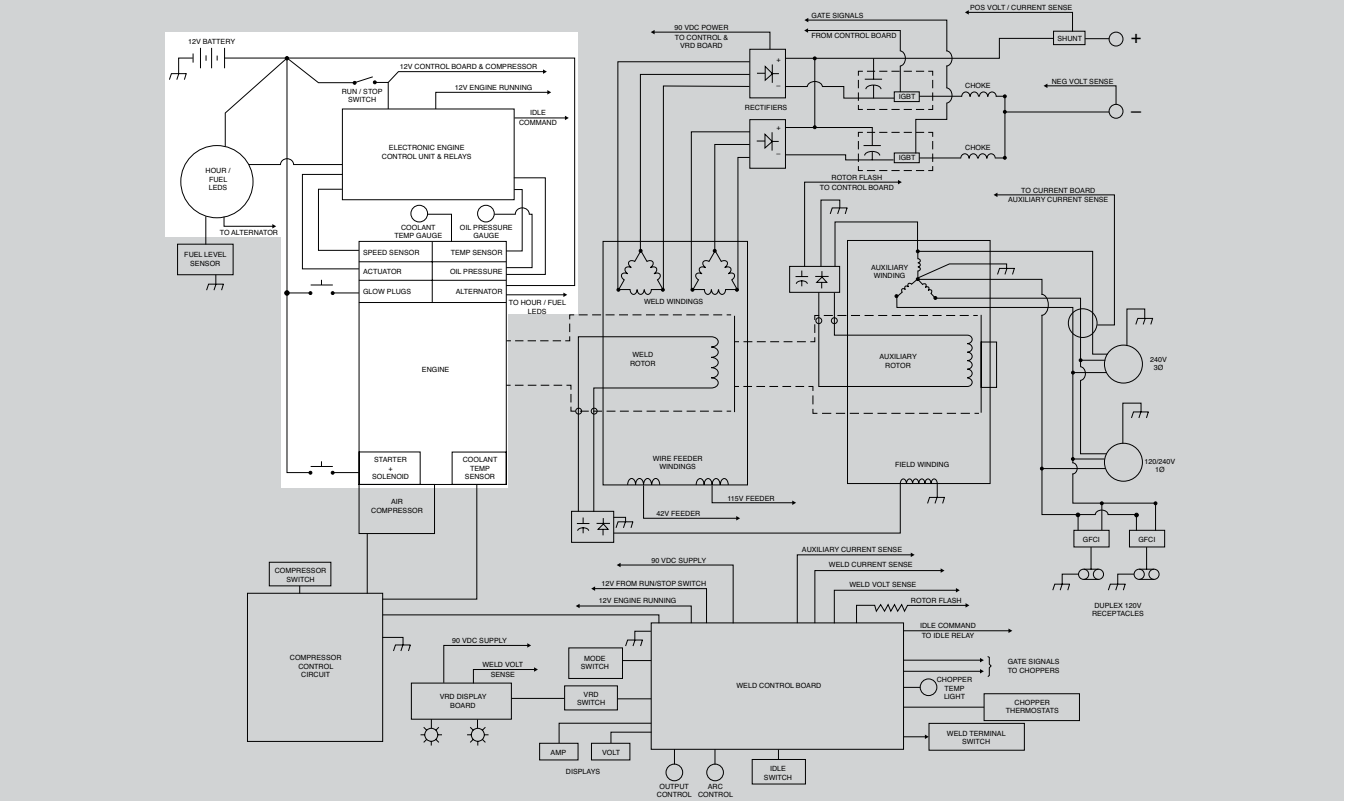


Figure E.2 - Battery, engine, engine control and protection and multifunction indicator device

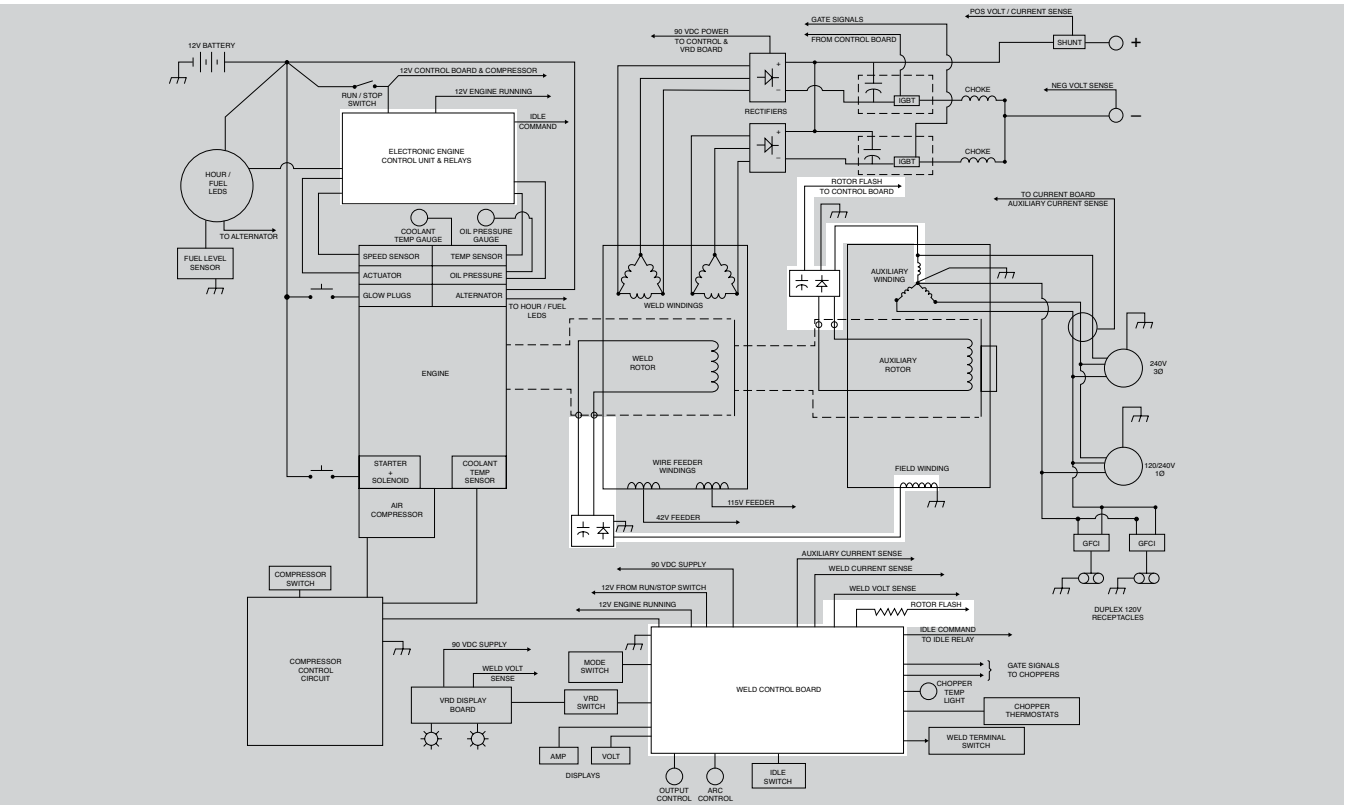


BATTERY, ENGINE, ENGINE CONTROL AND PROTECTION AND MULTIFUNCTION INDICATOR DEVICE (FUEL GAUGE, HOUR METER AND LEDS)

The 12 Volt DC battery powers the engine starter motor and also supplies power to the electronic engine control unit and other associated circuitry. When the start button is depressed, the engine rotates. When this rotation is detected, the engine control unit actuator supplies fuel and the engine begins to run. A sensor in the engine detects the engine RPM and the engine control unit controls the actuator to maintain a pre-programmed engine RPM. Temperature and oil pressure sensors also send information to the engine control unit. If high temperature or low oil pressure is detected, the engine will be shut down to prevent damage and an engine protection LED on the multifunction indicator device will be illuminated. The engine also drives an alternator that charges the battery. If this alternator should fail to charge the battery, an LED will light in the multifunction indicator device.

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

Figure E.3 - Rotor flashing and power generation

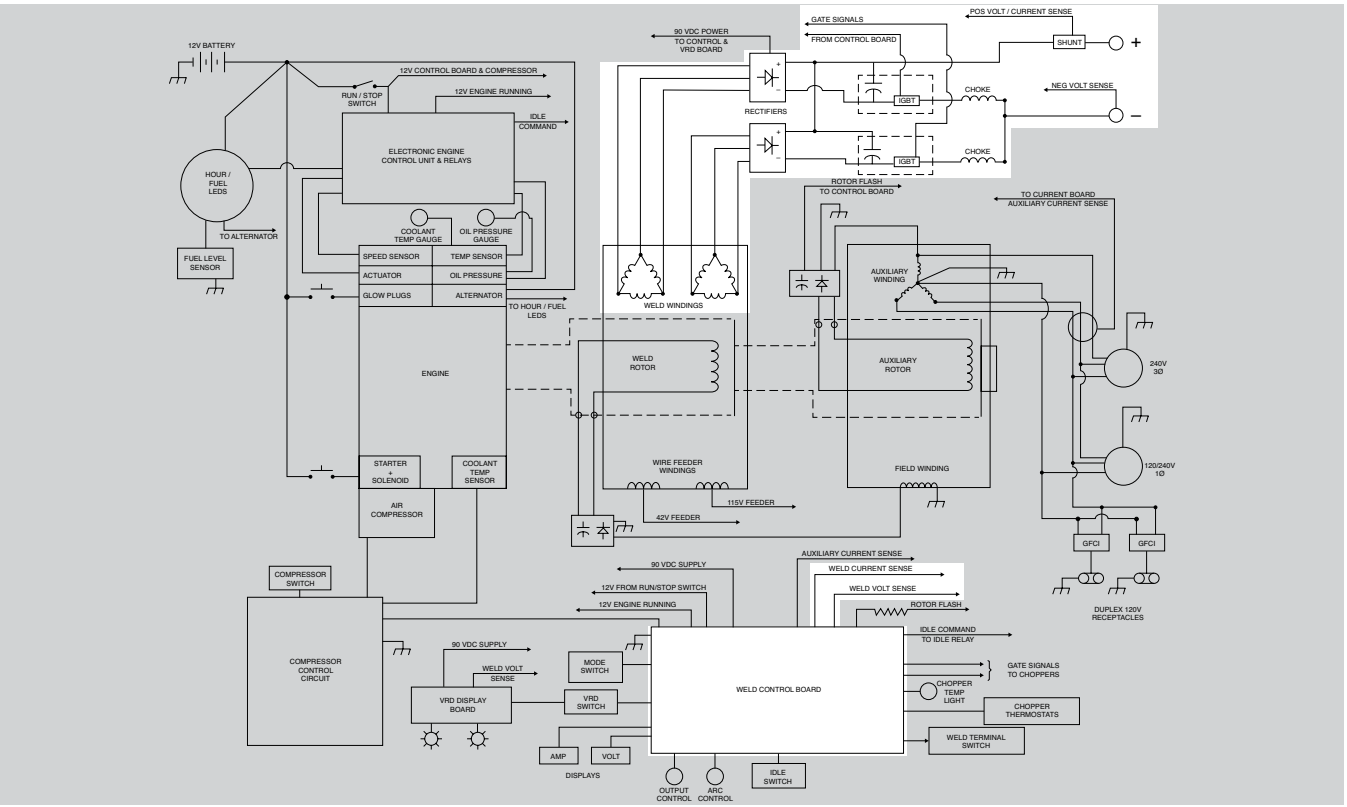


ROTOR FLASHING AND POWER GENERATION

After the engine is running, the engine control unit sends battery voltage signal to the weld control board. When this happens, “Flashing” voltage is applied to the auxiliary rotor slip rings. This low flashing voltage magnetizes the rotor. The rotation of the engine causes the magnetic field to rotate inducing current in the stator windings of the auxiliary power AC generator. Some of this power is routed through a rectifier and filtered by a capacitor then applied back to the rotor. This feedback system causes the output of the AC auxiliary generator to rapidly rise to the voltage at which it is designed to operate. A separate field winding in the auxiliary power stator also produces output which is routed through a rectifier, then filtered by a capacitor and applied to the brushes of the weld rotor. The weld rotor and stator are now energized.

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

Figure E.4 - Weld windings, rectifiers, choppers, choke and feedback



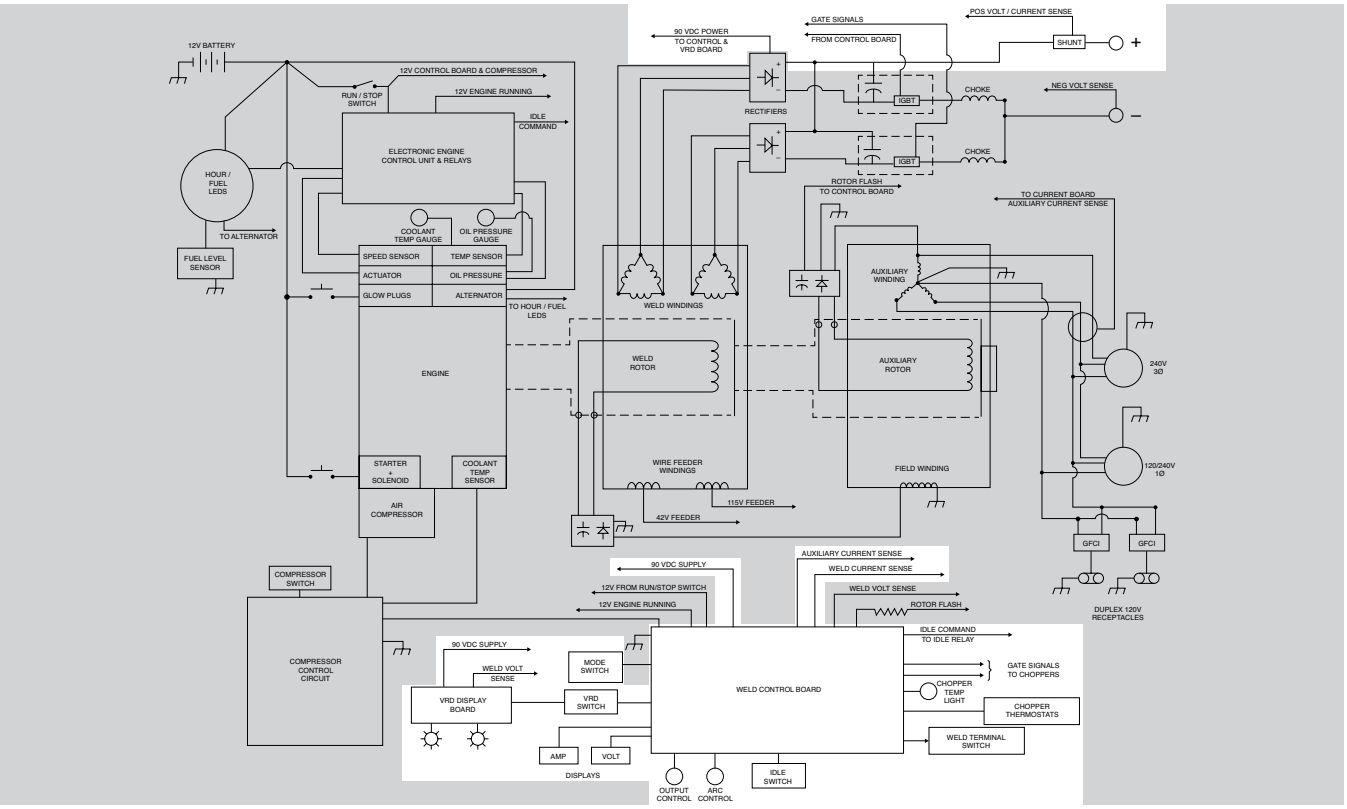
WELD WINDINGS, RECTIFIERS, CHOPPERS, CHOKE AND FEEDBACK

The weld power AC generator contains two 3 phase weld windings. The output of each of these windings is rectified by a three phase rectifier bridge and then filtered by a bank of capacitors incorporated into each of the chopper modules. This filtered DC power is used to supply 90 VDC to the control PC board, the VRD PC board and the IGBT's. (See ***IGBT operation*** later in this section for a more detailed description of IGBT operation). IGBT's are high speed switches that operate from a 20 KHZ Pulse Width Modulated gate signal created at the weld control board. The "Chopped" DC output from the IGBT's flows through a choke and a shunt before being applied to the weld output terminals. The choke stores electrical energy and works in conjunction with the Free-Wheeling diodes incorporated into the chopper modules to filter the weld output and help balance the outputs from the two choppers.

Output voltage feedback from the output terminals and current feedback from the shunt are fed back to the weld control board as a means of controlling weld output.

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

Figure E.5 - Weld control and VRD boards



WELD CONTROL AND VRD BOARDS

The weld control circuitry of the weld control board is powered by the 90 VDC that also powers the weld control IGBT's. It receives operator commands from the control devices on the welder control panel. The output control, arc control, mode switch and idle switch are located on the weld control panel. The microprocessor on the board compares the voltage and current feedback to the operator settings and adjusts the IGBT gate signals to provide the weld output desired. Amp and volt displays are driven by the board and will display user preset values when no current is flowing and actual current and voltage while welding.

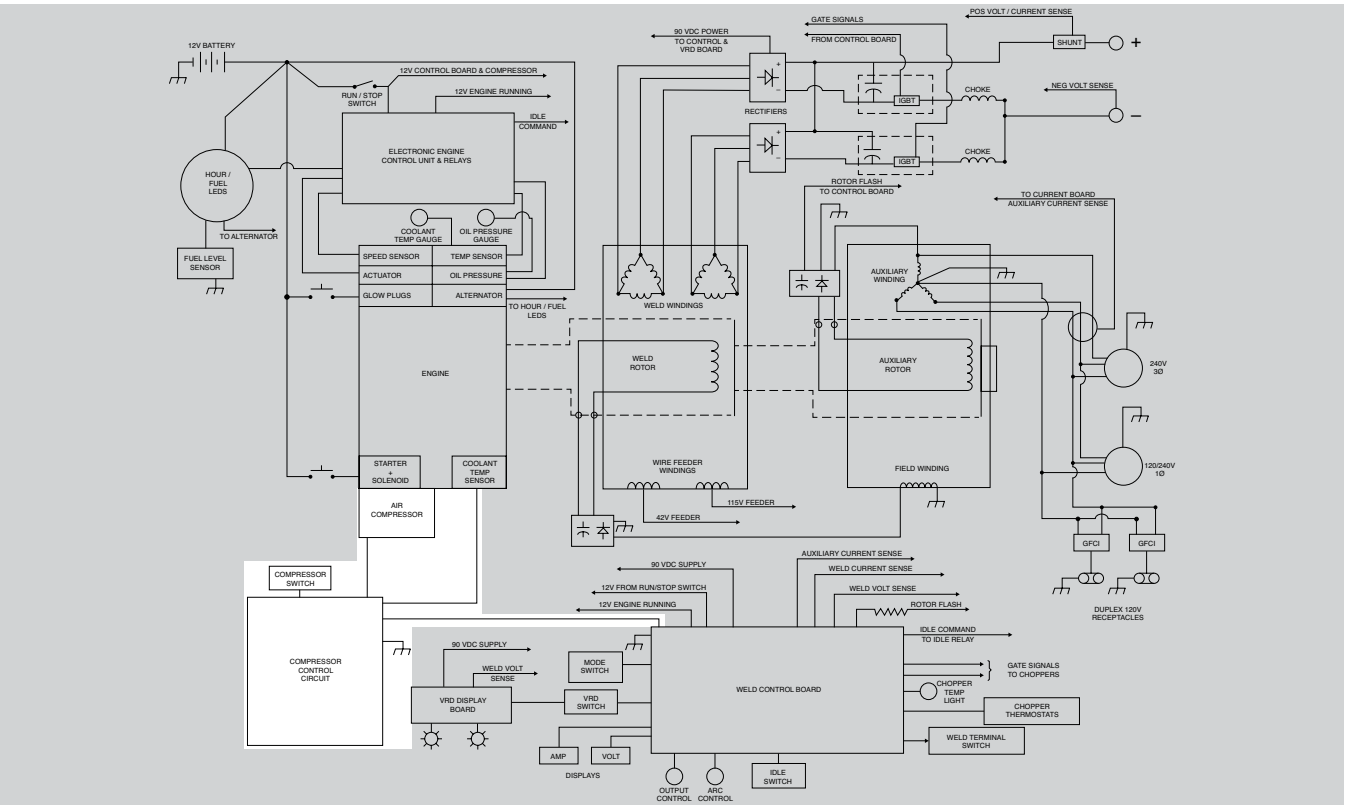
The weld control board also monitors both weld and auxiliary current and signals the engine control unit to change from low to high RPM as required.

This board also monitors the temperature of the chopper heat sinks and will shut down weld output and illuminate an indicator light in the event of a chopper over temperature condition.

The VRD (Voltage Reduction Device) board is also powered by the same 90 VDC supply that powers the weld control board. This board is active only when the internal VRD switch is in the ON position. The board monitors the weld terminal voltage and will illuminate the red light whenever the voltage at the weld terminals is equal to or higher than 30 VDC. The green light will illuminate when the voltage is below 30 VDC. In the CC Stick mode the VRD system will lower the weld terminal voltage to less than 30 VDC when not welding. While welding, it is common for the lights to alternate between red and green.

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

Figure E.6 - VMAC belt-driven air compressor

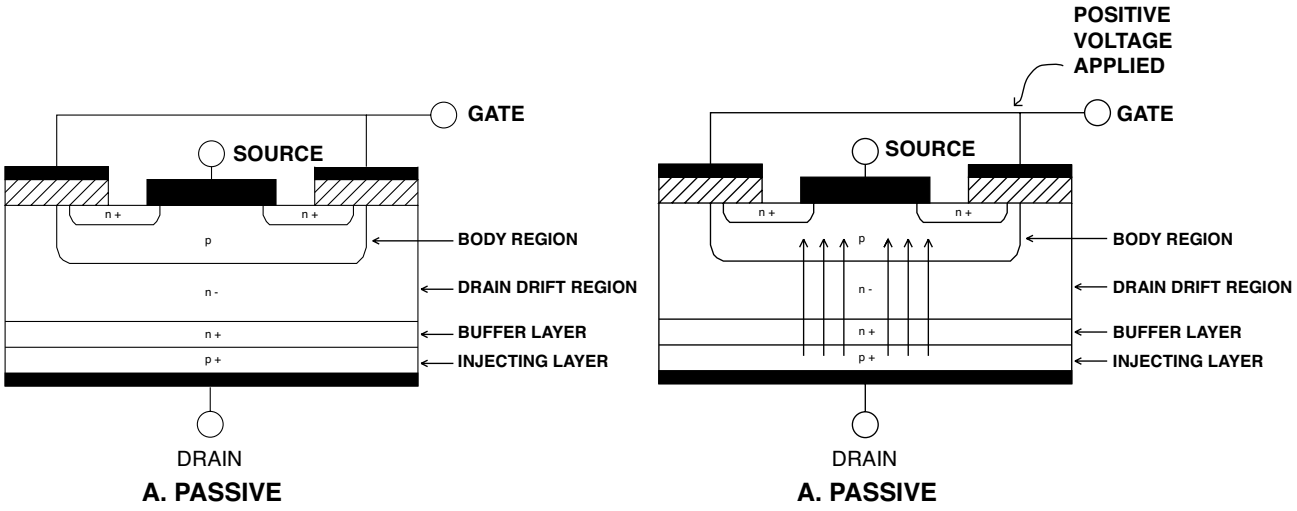


VMAC BELT-DRIVEN AIR COMPRESSOR

The Air Vantage 650 is equipped with a belt driven rotary screw compressor. The compressor is activated by an electric clutch pulley. A control circuit monitors compressor oil temperature, engine coolant temperature and pressures within the air compressor system. The control circuitry will shut down the compressor in the event of a fault and not permit the compressor to start if there is a problem.

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

Figure E.7 - Insulated gate bipolar transistor (IGBT) operation



INSULATED GATE BIPOLAR TRANSISTOR (IGBT) OPERATION

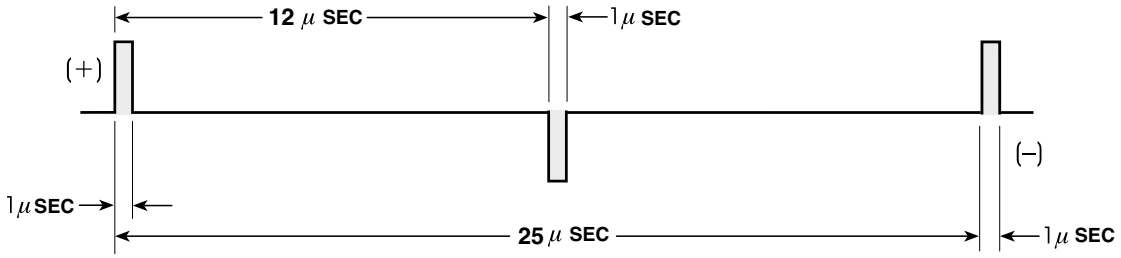
The IGBT is a type of transistor. IGBT's are semiconductors well suited for high frequency switching and high current applications.

Drawing A in Figure E.7 shows an IGBT in a passive mode. There is no gate signal, zero volts relative to the source and therefore, no current flow. The drain terminal of the IGBT may be connected to a voltage supply; but since there is no conduction the circuit will not supply current to components connected to the source. The circuit is turned off like a light switch.

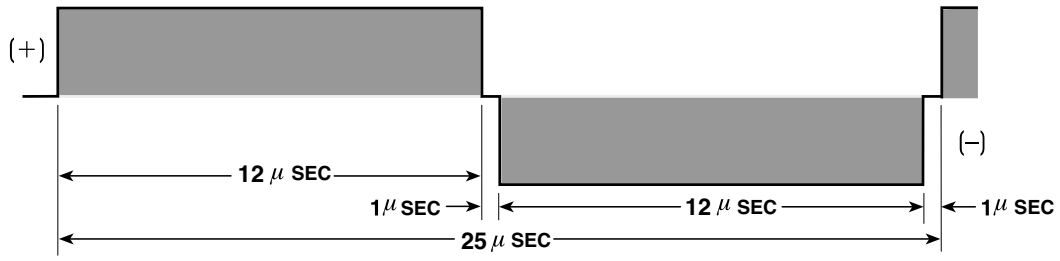
Drawing B shows the IGBT in an active mode. When the gate signal, a positive DC voltage relative to the source, is applied to the gate terminal of the IGBT, the device is capable of conducting current. A voltage supply connected to the drain terminal will allow the IGBT to conduct and supply current to circuit components coupled to the source. Current will flow through the conducting IGBT to downstream components as long as the positive gate signal is present. This is similar to turning ON a light switch.

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

Figure E.8 - Pulse width modulation



MINIMUM OUTPUT



MAXIMUM OUTPUT

PULSE WIDTH MODULATION

The term PULSE WIDTH MODULATION is used to describe how much time is devoted to conduction in the cycle. Changing the pulse width is known as MODULATION. Pulse Width Modulation (PWM) is the varying of the pulse width over the allowed range of a cycle to affect the output of the machine.

MINIMUM OUTPUT

By controlling the duration of the gate signal, the IGBT is turned on and off for different durations during a cycle. The top drawing shows the minimum output signal possible over a 50-microsecond time period.

The positive portion of the signal represents one IGBT group conducting for 2 microsecond. The dwell time (off time) is 48 microseconds. Since only 2 microseconds of the 50-microsecond time period is devoted to conducting, the output power is minimized.

MAXIMUM OUTPUT

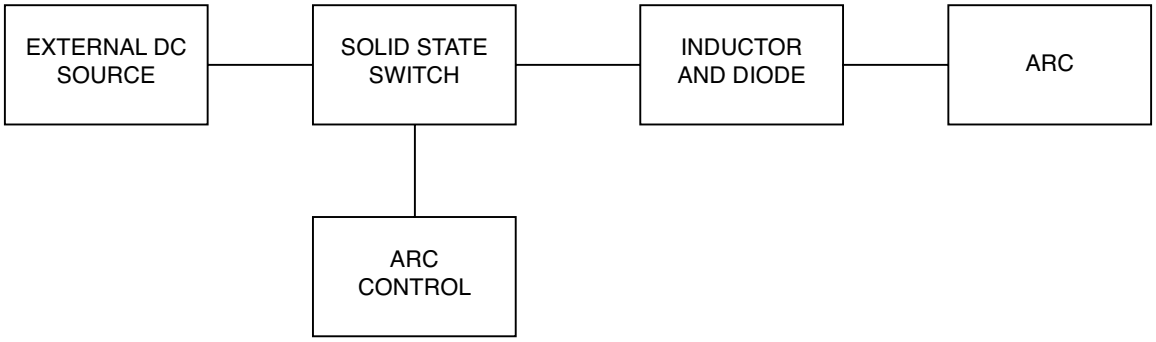
By holding the gate signals on the 48 microseconds and allowing only 2 microseconds of dwell time (off time) during the 50-microsecond cycle, the output is maximized. The darkened area under the top curve can be compared to the area under the bottom curve. The more darkened area under the curve, the more power is present.

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

CHOPPER TECHNOLOGY FUNDAMENTALS

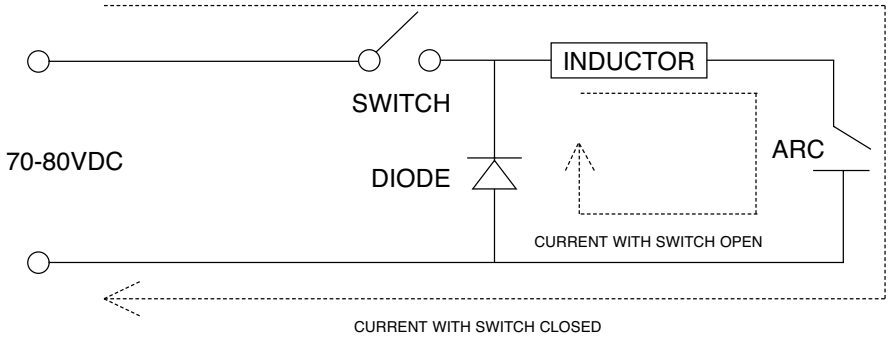
The new era of welding machines such as the Air Vantage 650, employ a technology whereby a DC source is turned on and off (chopped up) at high speed, then smoothed through an inductor to control an arc.

Hence the name “Chopper”. The biggest advantage of chopper technology is the high-speed control of the arc, similar to the inverter machines. A block diagram for this is as follows:



In this system, the engine drives a three-phase alternator, which generates power that is rectified and filtered to produce about 80 VDC. The current is applied through a solid state switch (IGBT) to an inductor.

By turning the switch on and off, current in the inductor and the arc can be controlled. The following diagram depicts the current flow in the system when switch is open and closed.



When the switch is closed, current is applied through the inductor to the arc. When the switch opens, current stored in the inductor sustains flow in the arc and through the diode. The repetition rate of switch closure is 20Khz, which allows ultra-fast control of the arc.

By varying the ratio of on time versus off time of the switch (Duty Cycle), the current applied to the arc is controlled. This is the basis for Chopper Technology: Controlling the switch in such a way as to produce superior welding.

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

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- TROUBLESHOOTING AND REPAIR SECTION -

HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

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

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

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

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

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

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

⚠ CAUTION

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

PC BOARD TROUBLESHOOTING PROCEDURES

⚠ WARNING

ELECTRIC SHOCK can kill.

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

⚠ CAUTION

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

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

PC board can be damaged by static electricity.

- Remove your body's static charge before opening the static-shielding bag. Wear an anti-static wrist strap. For safety, use a 1 Meg ohm resistive cord connected to a grounded part of the equipment frame.
- If you don't have a wrist strap, touch an un-painted, grounded, part of the equipment frame. Keep touching the frame to prevent static build-up. Be sure not to touch any electrically live parts at the same time.

ATTENTION

Static-Sensitive Devices Handle only at Static-Safe Workstations

Reusable Container Do Not Destroy

- Tools which come in contact with the PC board must be either conductive, anti-static or static-dissipative.
- Remove the PC board from the static-shielding bag and place it directly into the equipment. Don't set the PC board on or near paper, plastic or cloth which could have a static charge. If the PC board can't be installed immediately, put it back in the static-shielding bag.
- If the PC board uses protective shorting jumpers, don't remove them until installation is complete.
- If you return a PC board to The Lincoln Electric Company for credit, it must be in the static-shielding bag. This will prevent further damage and allow proper failure analysis.

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

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

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

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

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

Observe Safety Guidelines detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Major physical and electrical damage is evident.	1. Contact the Lincoln Electric Service Department at 1-888-935-3877.	1. Contact the Lincoln Electric Service Department at 1-888-935-3877.
No welding output in either Stick or CV modes. The engine operates normally. The auxiliary output is normal.	1. Place the welding terminals switch in the "ALWAYS ON" position. If the problem is solved, the fault may be in the external control cable (if used), leads #2 and #4. See the Wiring Diagram. 2. With the engine at high idle 1860 RPM, the machine in the stick mode and the OUTPUT CONTROL at maximum, check for the presence of approximately 87 VDC (open circuit voltage) at the output terminals. 3. If the correct OCV is present at the welding output terminals check the welding cables, clamps and electrode holder for loose or faulty connections.	1. Check for loose or faulty connections on the heavy current carrying leads between the output bridge, the power modules, the choke and the output terminals. 2. Check the welding terminals switch and associated leads. See the Wiring Diagram. 3. Check gate leads #23, #23A, #25 and 25A for loose or faulty connections. See the Wiring Diagram. 4. Perform the ***Weld Rotor Voltage Test Procedure***. 5. Perform the ***Weld Rotor Resistance Test Procedures (Static and Dynamic)***. 6. Perform the ***Weld Stator Voltage Test Procedure***. 7. Perform the ***Output Rectifier Bridge Test Procedure***. 8. Perform the ***Chopper Module LED's And Test Procedure***. 9. The weld control board may be faulty. Perform the ***Weld Control Board Test Procedure***.

⚠ CAUTION

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

Observe Safety Guidelines detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
No welding output in either Stick or CV modes. Also no auxiliary power. The engine operates normally.	1. Check the brushes for wear and proper contact to the rotor slip rings. 2. Make sure the engine is operating at the correct high idle speed 1860 RPM. 3. Check for loose or faulty connections or leads on the auxiliary power studs in the control box. See the Wiring Diagram.	1. Perform the ***Auxiliary Rotor Voltage Test Procedure***. 2. Perform the ***Auxiliary Rotor Resistance Test Procedures (Static And Dynamic)***. 3. Perform the ***Auxiliary Rotor Flashing Voltage Test Procedure***. If the "flashing" voltage is not present, leads 6, 5H, 200B, #201 or #200 may be faulty. See the Wiring Diagram. 4. Check the auxiliary rotor field diode bridge and capacitor. Replace if necessary. 5. Perform the ***Auxiliary Stator Voltage Test Procedure***.
No auxiliary power at the receptacles. The welding output is normal and the engine operates normally.	1. The circuit breakers may be tripped. Reset if necessary. 2. Check for loose or faulty connections at the auxiliary receptacles.	1. Check the wiring between the auxiliary receptacles, the connection studs in the control box and the main stator. See the Wiring Diagram. 2. Perform the ***Auxiliary Stator Voltage Test Procedure***. 3. Check GFCI receptacles. **NOTE:** The machine must be at high idle to reset the GFCI receptacles.

⚠ CAUTION

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

Observe Safety Guidelines detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The machine has welding output but no control of output. The auxiliary power is normal.	1. If a remote control unit is connected to the machine, check the remote control and related cable. 2. Check the welding and work cables for loose or faulty connections.	1. Check the OUTPUT control potentiometer and related leads. See the Wiring Diagram. 2. Check the shunt and associated feedback leads. See the Wiring Diagram. 3. Check the voltage feedback leads for loose or faulty connections. See the Wiring Diagram. 4. Perform the ***Chopper Module LED's And Test Procedure***. 5. The weld control board may be faulty. Perform the ***Weld Control Board Test Procedure***.
The machine has low welding output and low auxiliary output.	1. Check both sets of brushes for wear and proper contact with slip rings. 2. The engine RPM may be too low. 3. If the engine high idle RPM is OK, then the engine may have lost horsepower and be in need of major repair.	1. If the engine high idle speed is low, perform the ***Engine RPM Test Procedure***. 2. Perform the ***Auxiliary Rotor Voltage Test Procedure***. 3. Perform the ***Auxiliary Stator Voltage Test Procedure***.

⚠ CAUTION

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

Observe Safety Guidelines detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
The weld output control is still active when the remote control unit is attached.	1. This is normal when in TIG, CC Stick or Downhill Pipe modes. 2. The remote control unit may be defective. 3. Check the amphenol connections and associated wiring.	1. Check Plug J1 on the weld control board for loose or faulty connections. 2. The weld control board may be faulty. Perform the ***Weld Control Board Test Procedure***.
The machine seems locked into the CC mode of operation (Stick mode).	1. Check the position of the MODE SELECTOR switch. It must be in the correct position for the process being used.	1. Check the MODE SELECTOR switch and associated leads. See the Wiring Diagram. 2. The weld control board may be faulty. Perform the ***Weld Control Board Test Procedure***.

⚠ CAUTION

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

Observe Safety Guidelines detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
The wire feeder does not work when connected to the welder amphenol.	1. Check the position of the 42 V / 115 V wire feed voltage switch. 2. Check the appropriate circuit breaker (CB6 or CB7). Reset if tripped. 3. The wire feeder control cable may be faulty. 4. The wire feeder may be faulty.	1. With the wire feeder voltage switch in the desired position, check for the appropriate source voltage at the 14 pin amphenol receptacle (42 VAC at pins I and K) (115 VAC at pins A and J). 2. If the needed voltage is not present, check wiring, switch and circuit breakers. See the Wiring Diagram. 3. Perform the ***Weld Stator Voltage Test Procedures***.
The battery does not stay charged.	1. Check for loose or faulty connections at the battery and engine charging system. 2. The battery may be faulty. Check or replace. 3. The fan belt may be loose.	1. The battery charging circuit may be faulty. Perform the ***Battery Charging Circuit Test Procedure***.

⚠ CAUTION

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

Observe Safety Guidelines detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
The engine will not crank when the start button is pushed.	1. Check that the battery lockout switch is in the ON position. 2. Check for loose or faulty battery cable connections. 3. Check for a faulty start button and for faulty connections in the start button wiring. See the Wiring Diagram. 4. The battery may be low or faulty.	1. The starter motor or starter solenoid may be faulty. 2. The engine may be hard to crank due to a mechanical failure in the engine.
The engine cranks but will not start.	1. Check for adequate fuel supply (check fuel filters). 2. Make sure the fuel shut off valve is in the open position. 3. ON/OFF switch has been on for more than 60 seconds before starting (cycle switch OFF then ON).	1. Check that the engine governor control unit is getting 12 VDC battery voltage. See the Wiring Diagram. 2. There may be a faulty connection between the engine governor control unit and the magnetic pickup speed sensor or the fuel actuator. See the Wiring Diagram. 3. There may be a failure in the engine or engine control system. Contact the engine manufacturer for testing and service engine components.

⚠ CAUTION

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

Observe Safety Guidelines detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
The engine shuts down shortly after starting.	1. Check for adequate fuel supply. 2. Be certain the engine is not overheated. Check coolant level. CAUTION hot coolant under pressure can be very dangerous. Do not remove radiator cap until the engine has cooled. 3. Oil pressure may be low. Check oil level.	1. Check the RUN/STOP switch and associated leads for loose or faulty connections. 2. There may be a grounded wire between the engine governor control unit and the coolant temperature switch or the oil pressure switch. See the Wiring Diagram. 3. The coolant temperature switch or the oil pressure switch may be faulty. 4. The engine oil pressure may be low due to a failure within the engine. 5. The engine governor control unit may be faulty. Perform the ***Electronic Engine Governor Module Test Procedure***.

⚠ CAUTION

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

Observe Safety Guidelines detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
The engine will not idle down to low speed. The machine has normal weld output and auxiliary power.	1. Make sure the IDLER switch is in the "AUTO" position. 2. Make sure there is NOT an external load on the weld terminals nor the auxiliary power receptacles.	1. Check the CR3 idle relay and associated wiring. Make sure the relay is getting 12 VDC battery voltage at lead 232L. See the Wiring Diagram. 2. Check for faulty idle switch or associated wiring. 3. Unplug the shunt, plug J6. If the engine idles down after about 12 seconds current is being detected in the weld output. Check for dirt buildup around weld output terminals or a very dirty or defective bypass assembly. 4. With the idle switch in the high position lead #405 should measure 12 VDC battery voltage all the time. If 12 VDC battery voltage is not present, check for faulty connections in lead #405. 5. With idle switch in the auto idle position, voltage on lead #405 should drop to zero after about 12 seconds. 6. If the voltage on lead #405 does drop to zero but the engine does not go to low idle, the CR3 relay or the engine governor control unit is likely defective. Perform the ***Electronic Engine Governor Module Test Procedure***. 7. If the voltage on lead #405 does not drop to zero, the weld control board is likely bad. Perform the ***Weld Control Board Test Procedure***.

⚠ CAUTION

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

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TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
The engine will not go to high idle when using the auxiliary power. Auxiliary power is normal when the IDLER switch is in the "HIGH" position. Automatic idle function works properly when the welding terminals are loaded.	1. Make sure the auxiliary power leads are tight. 2. The automatic idler may not function if the auxiliary power is loaded to less than 150 watts.	1. Check the current sensing toroid for loose or faulty connections. See the Wiring Diagram. 2. Check that the lead wires are passing through the toroidal current sensor in the proper direction and have the correct number of turns. See the Wiring Diagram. 3. The current sensing toroid may be faulty. 4. The weld control board may be faulty. Perform the ***Weld Control Board Test Procedure***.
The engine will not go to high idle when attempting to weld or when the auxiliary power is loaded. Welding output and auxiliary power outputs are normal when IDLER switch is in the "HIGH" position.	1. Make sure the welding cables and auxiliary power lead connections are tight.	1. The weld control board may be faulty. Perform the ***Weld Control Board Test Procedure***.
The machine goes to low idle but does not stay at low idle.	1. Make sure there is NOT an external load (auxiliary or weld) connected to the Air Vantage 650.	1. The CR3 idle relay may be defective. 2. There may be faulty electrical connections at the CR3 relay or the wiring connected to that relay. 3. The engine governor control unit may be defective. Perform the ***Electronic Engine Governor Module Test Procedure***. 4. The weld control board may be faulty. Perform the ***Weld Control Board Test Procedure***.

⚠ CAUTION

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

Observe Safety Guidelines detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
WELDING PROBLEMS		
The welding arc is "cold". The engine runs normally. The auxiliary power is normal.	1. Check for loose or faulty connections at the weld output terminals and welding cable connections. 2. The welding cable may be too long or coiled, causing an excessive voltage drop. 3. Make sure the electrode (wire, gas, voltage, current etc.) is correct for the process being used.	1. Check for the correct OCV at the welding output terminals. If the correct voltage is present at the output terminals, check for loose connection on the heavy current carrying leads inside the Air Vantage 650. See the Wiring Diagram. 2. If the OCV is low at the welder output terminals, perform the ***Engine RPM Test Procedure***. 3. Test the potentiometers and mode switch for correct function and be certain that these components are not grounded. 4. Perform the ***Output Rectifier Bridge Test Procedure***. 5. Perform the ***Weld Rotor Voltage Test***. 6. Perform the ***Weld Rotor Resistance Test Procedures (Static and Dynamic)***. 7. Perform the ***Weld Stator Voltage Test Procedure***. 8. Perform the ***Chopper Module LED's And Test Procedure***. 9. The weld control board may be faulty. Perform the ***Weld Control Board Test Procedure***.

⚠ CAUTION

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

Observe Safety Guidelines detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
WELDING PROBLEMS		
The air compressor blows out oil when engaged.	1. The air outlet valve may be open. The compressor should not be operated with a wide open air outlet. 2. The air compressor oil tank may be overfilled. Check oil and add only Vmac compressor oil.	1. There may be a fault in the air compressor system. Contact Vmac to locate an authorized repair facility.
The air compressor clutch does not engage when the switch is turned on.	1. The engine or air compressor system may be overheated. Try again when the machine has cooled.	1. The system may have been turned off, then on again. The system will not start before the internal pressure has dropped to a safe level. There will be a delay while the blow down solenoid vents the pressure in the system. 2. Perform the ***Air Compressor Electrical Test Procedure***. 3. The blow down solenoid may be defective. 4. The compressor clutch relay may be defective. 5. There may be a fault in the air compressor system. Contact VMAC to locate an authorized repair facility. VMAC (Vehicle Mounted Air Compressors) 1333 Kipp Rd. Nanaimo, B.C. V9X 1R3 Canada Telephone: (250) 740-3200 FAX: (250) 740-3201 Toll Free: (800) 738-8622 Web Site: www.vmacair.com

⚠ CAUTION

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

CASE COVER 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

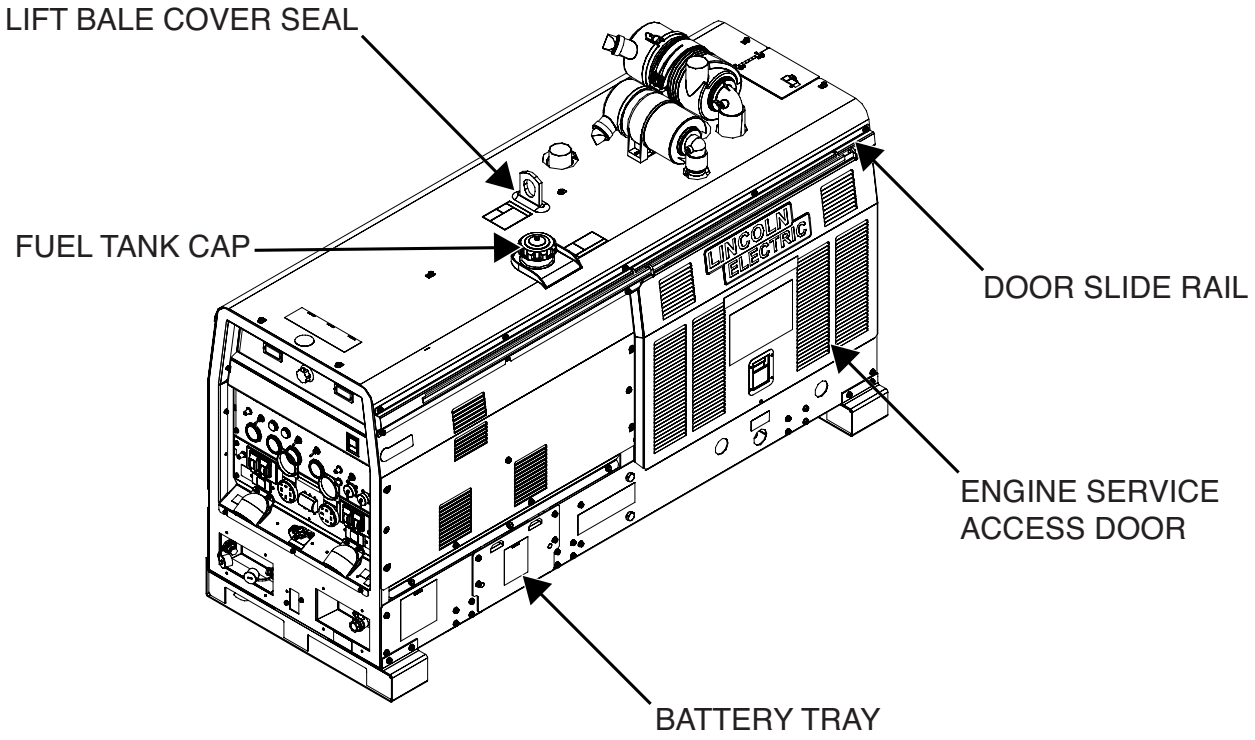
This procedure will aid the technician in the removal and replacement of the Case Covers.

MATERIALS NEEDED

1/2” Nutdriver
Slotted Screwdriver
5/16” Nutdriver
1/2” Wrench
3/8” Nutdriver
Wiring Diagram

CASE COVER REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.1 – Battery tray mounting bolt location



REMOVAL PROCEDURE

1. Turn off the Air Vantage 650 machine.
2. Using a 1/2” nutdriver, remove the four bolts securing the battery tray to the machine. See Figure F.1.
3. Slide out battery tray and using a 1/2” nutdriver, disconnect the negative battery cable. See Wiring Diagram.

NOTE: Be sure to electrically isolate the negative battery cable.

AIR CLEANERS AND ENGINE EXHAUST PIPE REMOVAL

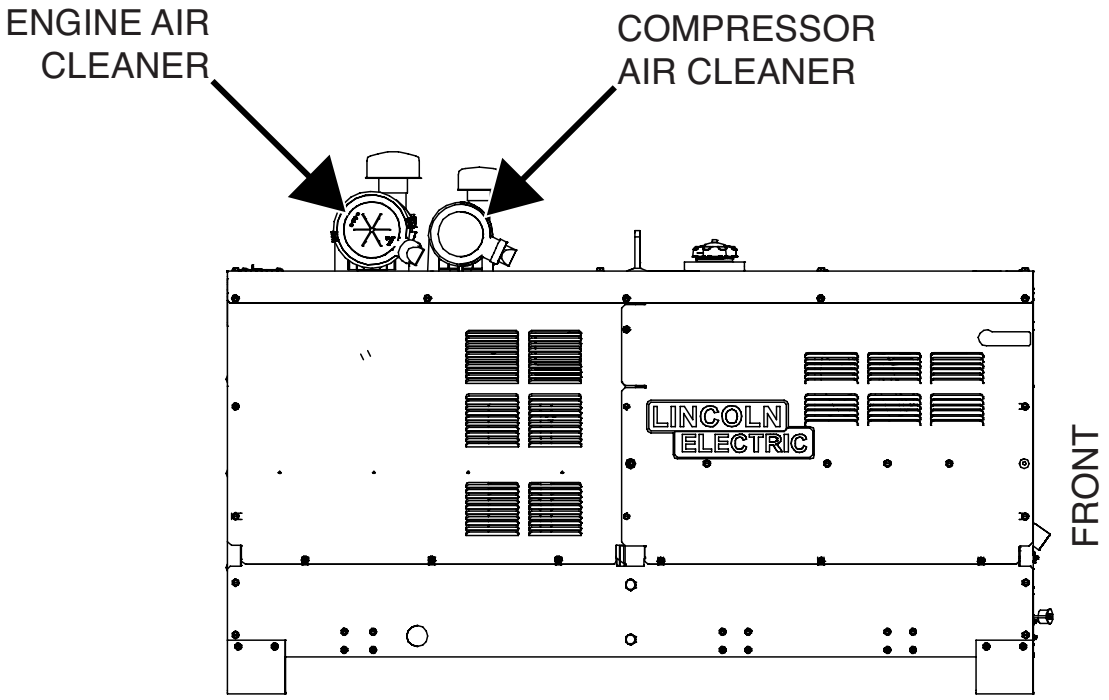
1. Locate the engine air cleaner and compressor air cleaner. See ***Figure F.2***.
2. Using a slotted screwdriver, loosen the hose clamp securing the engine air cleaner to the hose. See ***Figure F.3***. Repeat this step to remove the compressor air cleaner.
3. Using a 5/16” nutdriver, remove the two mounting screws securing the engine air cleaner to the machine. Note washer placement for reassembly. See ***Figure F.3***. Repeat this step to remove the compressor air cleaner.
4. The engine air cleaner and compressor air cleaner can now be removed.
5. Using a 1/2” nutdriver and a 1/2” wrench, loosen the clamp securing the engine exhaust outlet pipe and remove the engine exhaust pipe. See ***Figure F.4***.

RIGHT SIDE PANEL REMOVAL

1. Unlatch and open the engine service access door. Align the hooks at the top of the door with the notches in the door slide rail. Lift the door up and out to remove. See Figure F.1.
2. Using a 1/2” nutdriver, remove the nine bolts securing the door slide rail and carefully remove the door slide rail. See Figure F.1.
3. Using a 1/2” nutdriver, loosen the three bolts on the bottom of the right front side panel. The panel is slotted therefore it is not necessary to completely remove the bottom bolts. See ***Figure F.4***.
4. Using a 1/2” nutdriver, remove the eight bolts securing the right front side panel. Lift the panel up and away from the machine to remove the panel. See ***Figure F.4***.

CASE COVER REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.2 – Air cleaner locations



ROOF PANEL REMOVAL

1. Remove the fuel tank cap. See ***Figure F.1***.
2. Remove the lift bale cover seal. See ***Figure F.1***.
3. Using a 1/2" nutdriver, remove the thirteen bolts securing the roof panel to the machine. Note placement of the air cleaner bracket (attached to the bottom of roof panel) for reassembly. See ***Figure F.5***.
4. With the help of an assistant carefully lift the roof panel off of the machine.

NOTE: The fuel tank filler gasket fits snugly around the tank fill tube and may need to be worked a bit to allow the roof panel to be removed.

5. Replace the previously removed fuel tank cap.

LEFT SIDE PANEL REMOVAL

1. Using a 1/2" nutdriver, loosen the six bolts on the bottom of the left case side panels. The panel is slotted therefore it is not necessary to completely remove the bottom bolts. See ***Figure F.6***.
2. Using a 1/2" nutdriver, remove the nine bolts securing the left front side panel. Lift the panel up and away from the machine to remove the panel. See ***Figure F.6***.
3. Using a 1/2" nutdriver, remove the two bolts securing the left rear side panel. Lift the panel up and away from the machine to remove the panel. See ***Figure F.6***.

CONTROL PANEL ASSEMBLY REMOVAL

1. Using a 3/8" nutdriver, remove the six bolts securing the control panel assembly. The front panel hinged cover will need to be open to access two of the bolts. Note shield placement for reassembly. See ***Figure F.7***.
2. The control panel can now be tilted forward to gain access to internal components.

CASE COVER REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.3 – Air cleaner removal

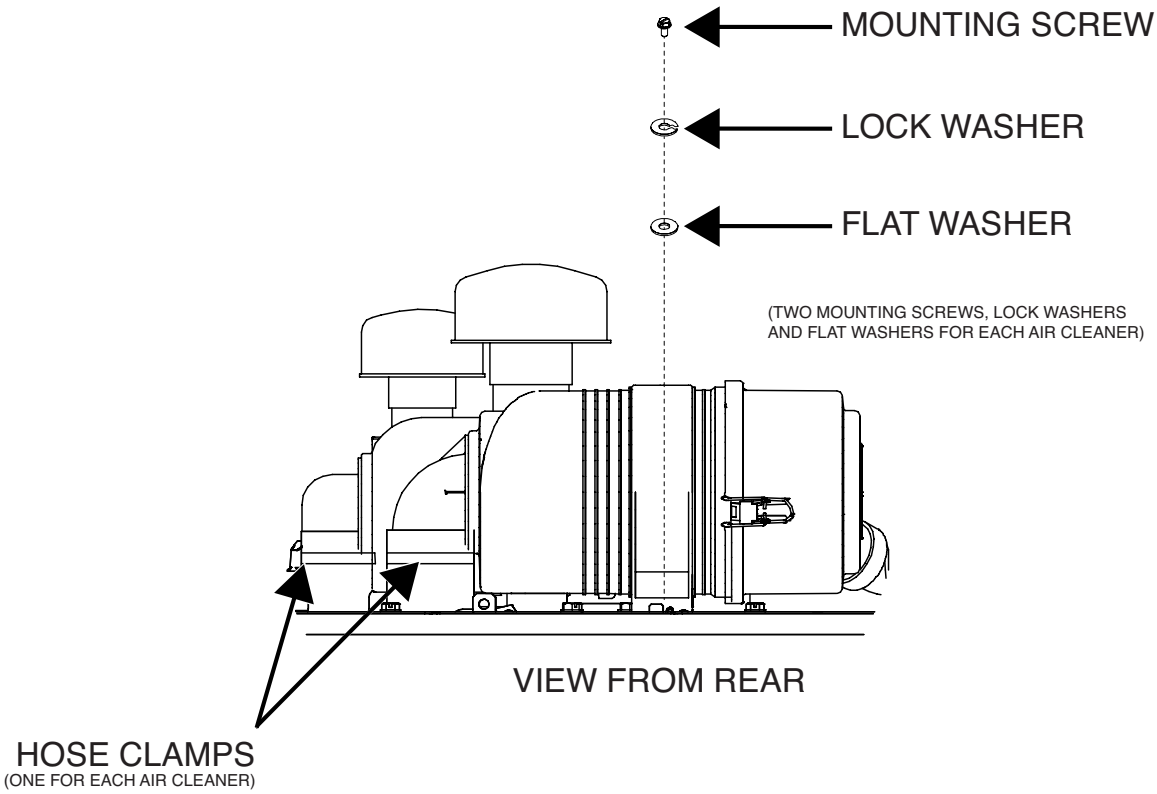
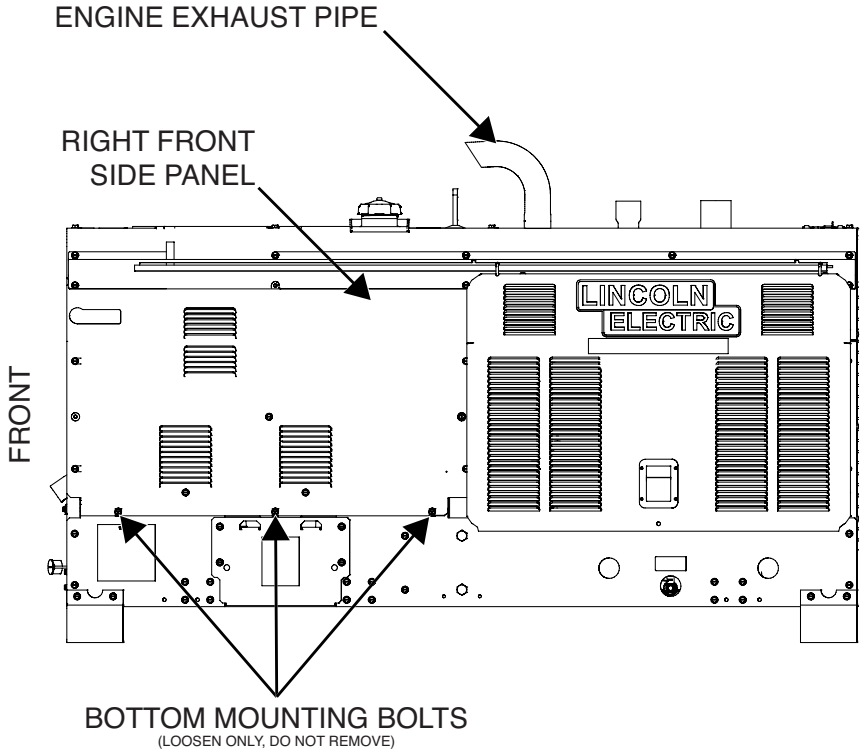


Figure F.4 – Right side panel removal



CASE COVER REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.5 – Roof removal

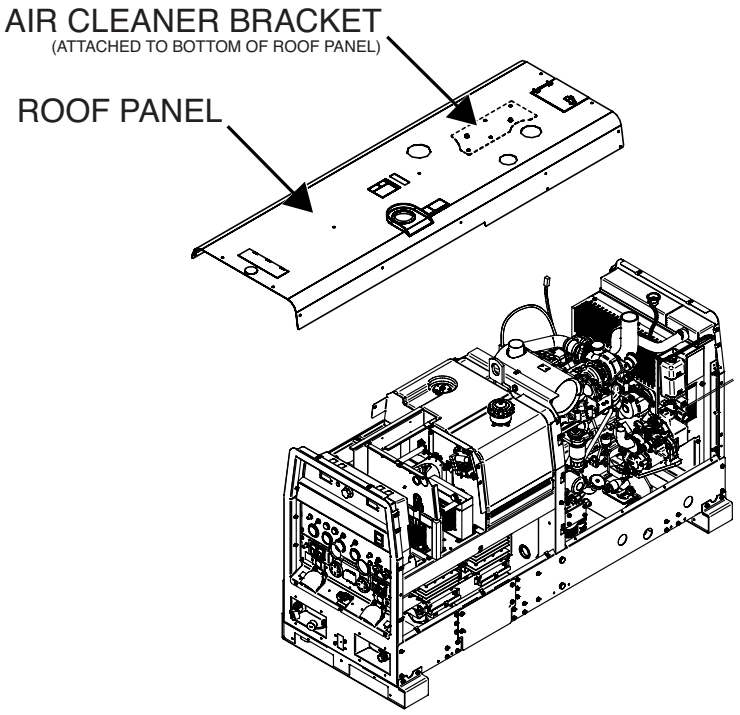
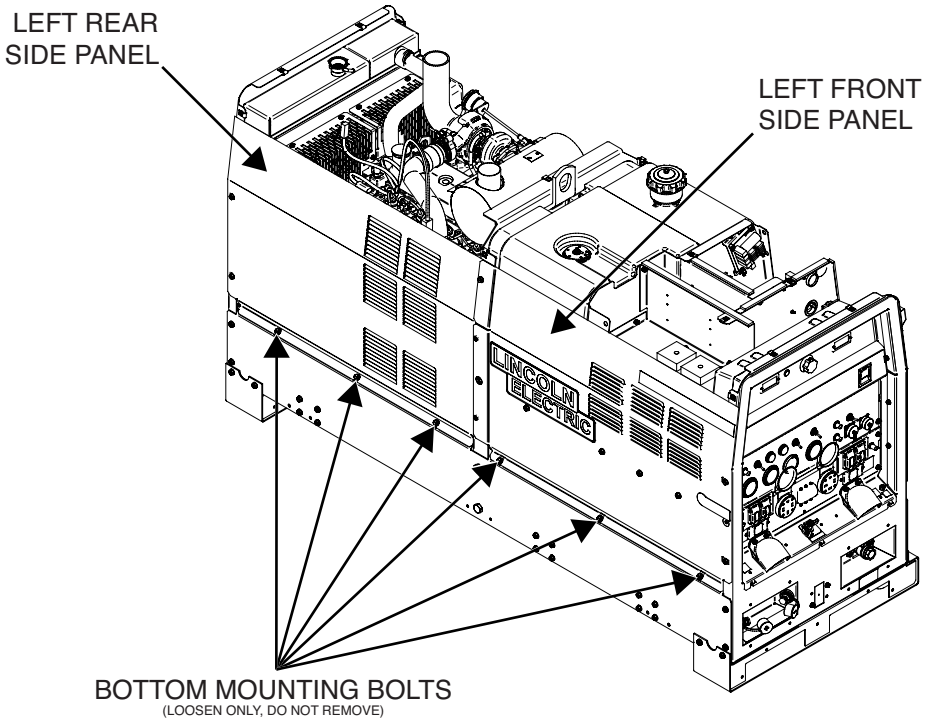


Figure F.6 – Left side panel removal



CASE COVER REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.7 – Control panel assembly removal

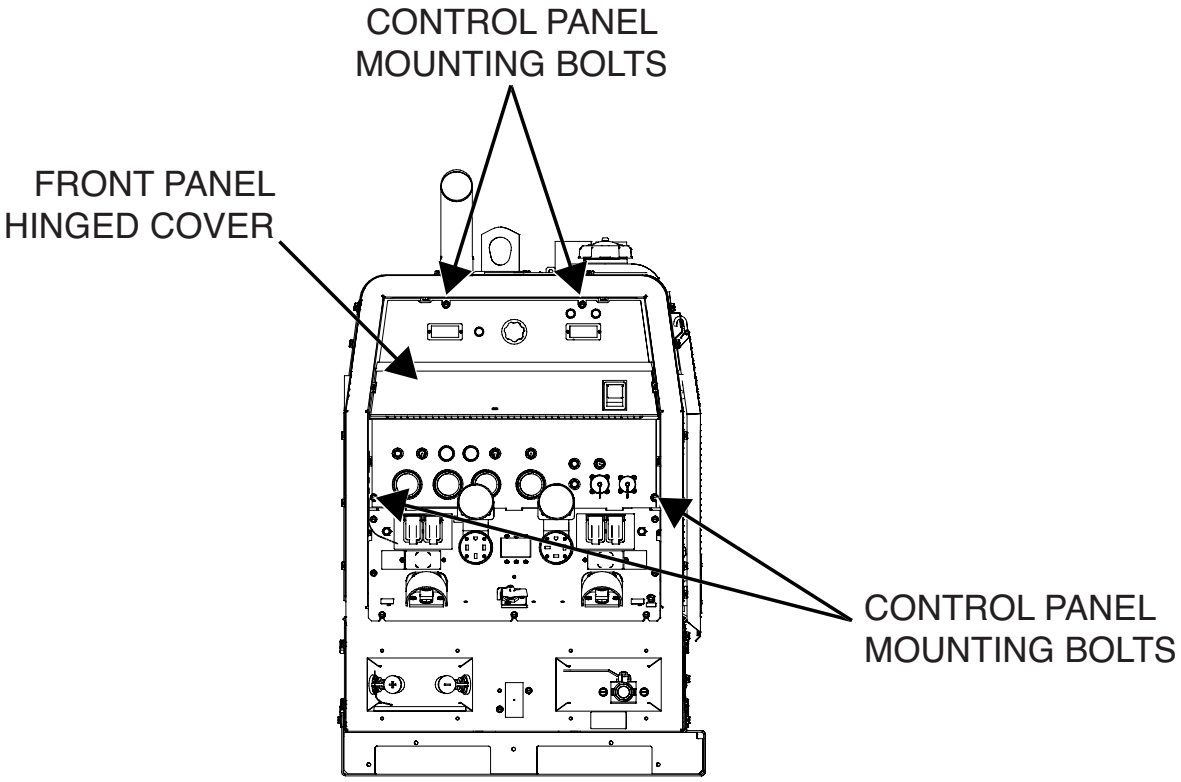
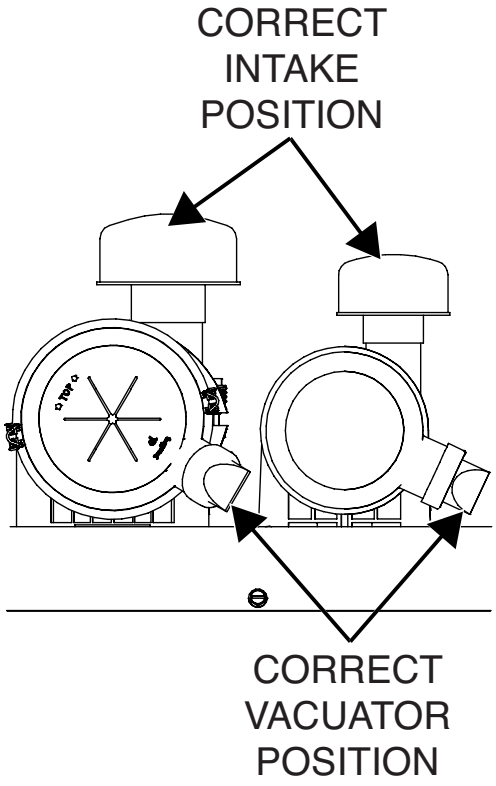


Figure F.8 – Air cleaner replacement



CASE COVER REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

REPLACEMENT PROCEDURE

CONTROL PANEL ASSEMBLY REPLACEMENT

1. Carefully place the control panel in the closed position.
2. Using a 3/8" nutdriver, attach the six bolts securing the control panel assembly. The front panel hinged cover will need to be open to access two of the bolts. Note shield placement for reassembly.

LEFT SIDE PANEL REPLACEMENT

1. Carefully position the left rear side panel onto the previously loosened bolts.
2. Using a 1/2" nutdriver, attach the two bolts securing the left rear side panel.
3. Carefully position the left front side panel onto the previously loosened bolts.
4. Using a 1/2" nutdriver, attach the nine bolts securing the left front side panel.
5. Using a 1/2" nutdriver, tighten the six bolts on the bottom of the left case side panels.

ROOF PANEL REPLACEMENT

1. Remove the fuel tank cap.
2. With the help of an assistant carefully lower the roof panel onto the machine.

NOTE: The fuel tank filler gasket fits snugly around the tank fill tube and may need to be worked a bit to allow the roof panel to be replaced.

3. Using a 1/2" nutdriver, attach the thirteen bolts securing the roof panel to the machine. Note placement of the air cleaner bracket (attached to the bottom of roof panel) for reassembly.
4. Attach the lift bale cover seal.
5. Attach the fuel tank cap.

RIGHT SIDE PANEL REPLACEMENT

1. Carefully position the right side front panel onto the previously loosened bolts.
2. Using a 1/2" nutdriver, attach the eight bolts securing the right side front panel.
3. Using a 1/2" nutdriver, tighten the three bolts on the bottom of the right side front panel.
4. Carefully position the door slide rail on the machine.
5. Using a 1/2" nutdriver, attach the nine bolts securing the door slide rail.
6. Align the hooks at the top of the service door with the notches in the door slide rail. Lower the door and secure it closed with the latch.

AIR CLEANERS AND ENGINE EXHAUST PIPE REPLACEMENT

1. Carefully position the engine exhaust pipe onto the machine.
2. Using a 1/2" nutdriver and a 1/2" wrench, tighten the clamp securing the engine exhaust outlet pipe.
3. Properly position the engine air cleaner and compressor air cleaner onto the machine. See ***Figure F.8***.
4. Using a 5/16" nutdriver, attach the two mounting screws and washers securing the engine air cleaner to the machine. Repeat this step for the compressor air cleaner.
5. Using a slotted screwdriver, tighten the hose clamp securing the engine air cleaner to the hose. Repeat this step for the compressor air cleaner.

BATTERY RECONNECTION

1. Using a 1/2" nutdriver, connect the negative battery cable. See Wiring Diagram.
2. Carefully position the battery tray into the machine.
3. Using a 1/2" nutdriver, attach the four bolts securing the battery tray to the machine.

CHOPPER MODULE CAPACITOR DISCHARGE PROCEDURE

⚠ WARNING

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

TEST DESCRIPTION

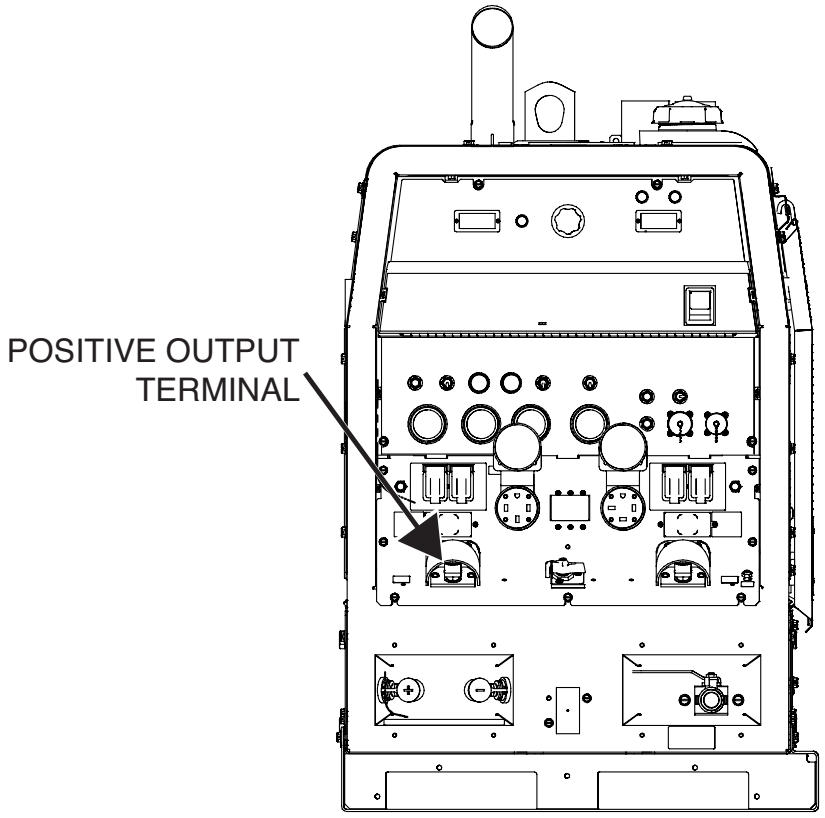
This test procedure will insure that the large Capacitors in the Chopper Modules have been discharged. This procedure should be performed whenever work is to be attempted on any internal components.

MATERIALS NEEDED

Volt/Ohmmeter
Resistor (25 - 1000 Ohms And 25 Watt Minimum)
Jumper Leads
Wiring Diagram

CHOPPER MODULE CAPACITOR DISCHARGE PROCEDURE *(continued)*

Figure F.9 – Positive output terminal location



PROCEDURE

1. Turn off the Air Vantage 650.
2. Perform the ***Case Cover Removal Procedure***.
3. Locate the positive output terminal on the front of the machine. See Figure F.9.
4. Locate the negative output rectifier terminal. See ***Figure F.10*** and ***Figure F.11***. See Wiring Diagram.
5. Using a voltmeter, test for DC voltage between the positive output terminal and the negative output rectifier terminal. See ***Figure F.11***. See Wiring Diagram. If the voltage is zero, the capacitors are discharged and no further action is required.

NOTE: Chopper modules are designed to discharge the capacitors on their own but should be manually discharged if voltage is present.

6. If voltage is present, discharge the capacitors by carefully placing a resistor (25-1000 Ohms and 25 watt minimum) between the positive output terminal and negative output rectifier terminal. Jumper leads may be necessary. Apply resistor for at least 10 seconds.
7. Check for presence of DC voltage. If voltage is present, repeat previous step until no voltage remains.
8. Perform desired test(s) / repair procedure(s).
9. When testing is complete, perform the ***Case Cover Replacement Procedure***.

CHOPPER MODULE CAPACITOR DISCHARGE PROCEDURE *(continued)*

Figure F.10 – Output rectifier locations

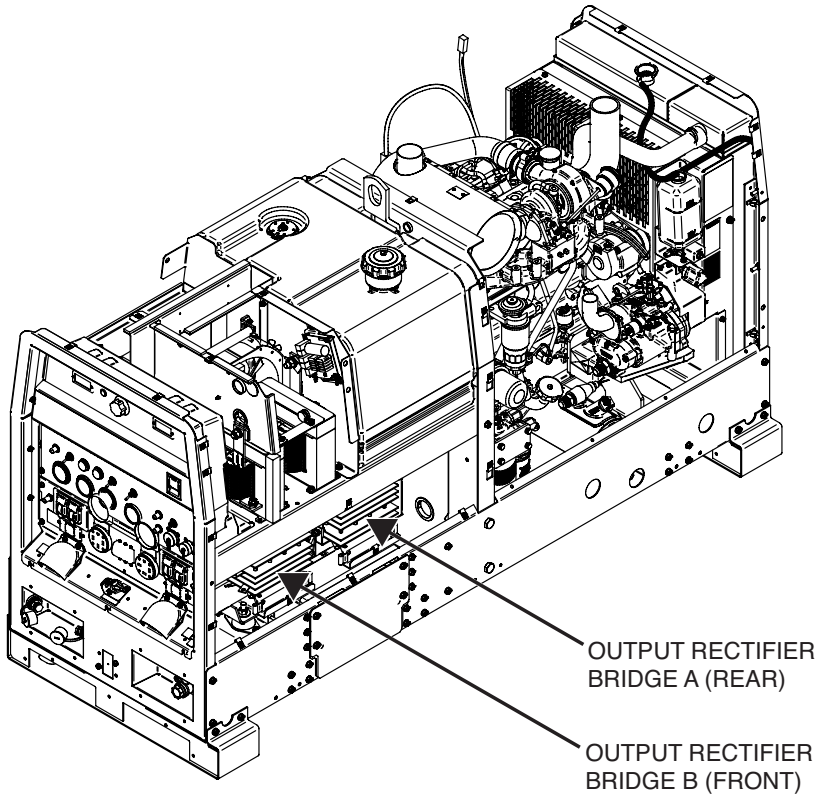
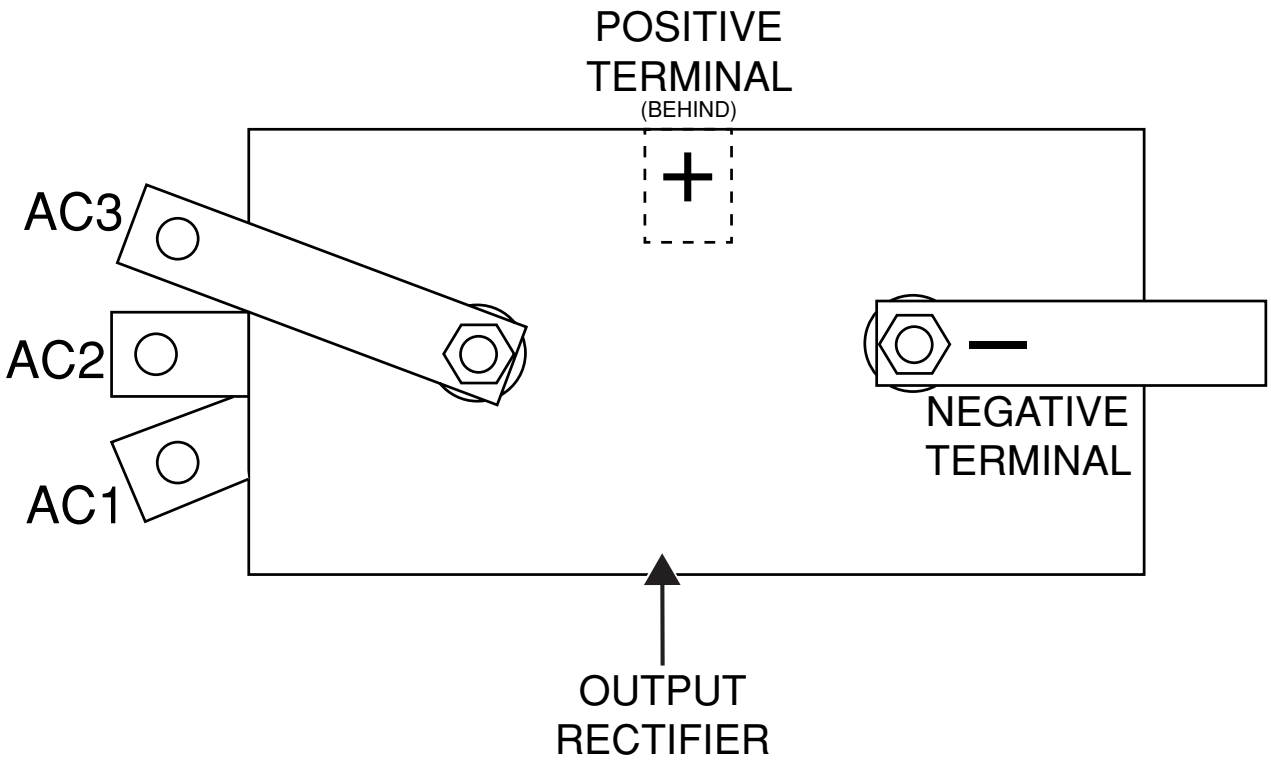


Figure F.11 – Negative output rectifier connection location



CHOPPER MODULE LED's AND 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

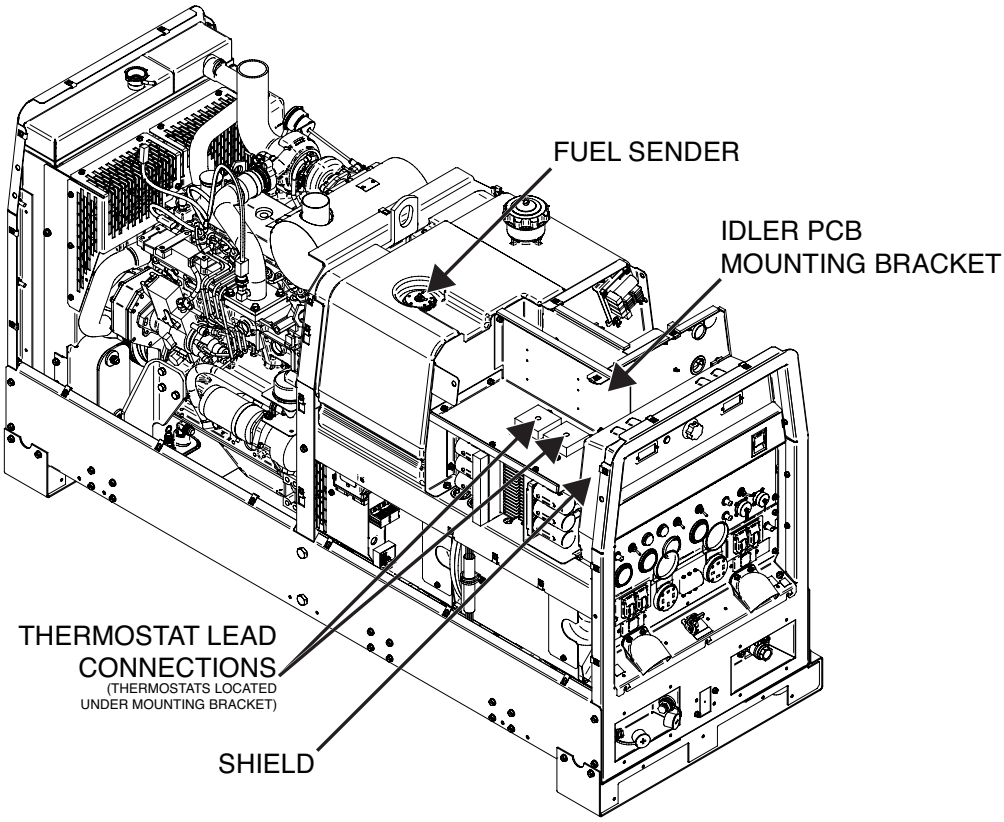
This test will help determine if the Chopper Module is receiving correct input voltage and gate signals and is able to supply power to the Weld Circuit.

MATERIALS NEEDED

3/8" Nutdriver
7/16" Nutdriver
Volt/Ohmmeter
Wiring Diagram

CHOPPER MODULE LED's AND TEST PROCEDURE *(continued)*

Figure F.12 – Fuel sender location and idler PCB mounting bracket removal

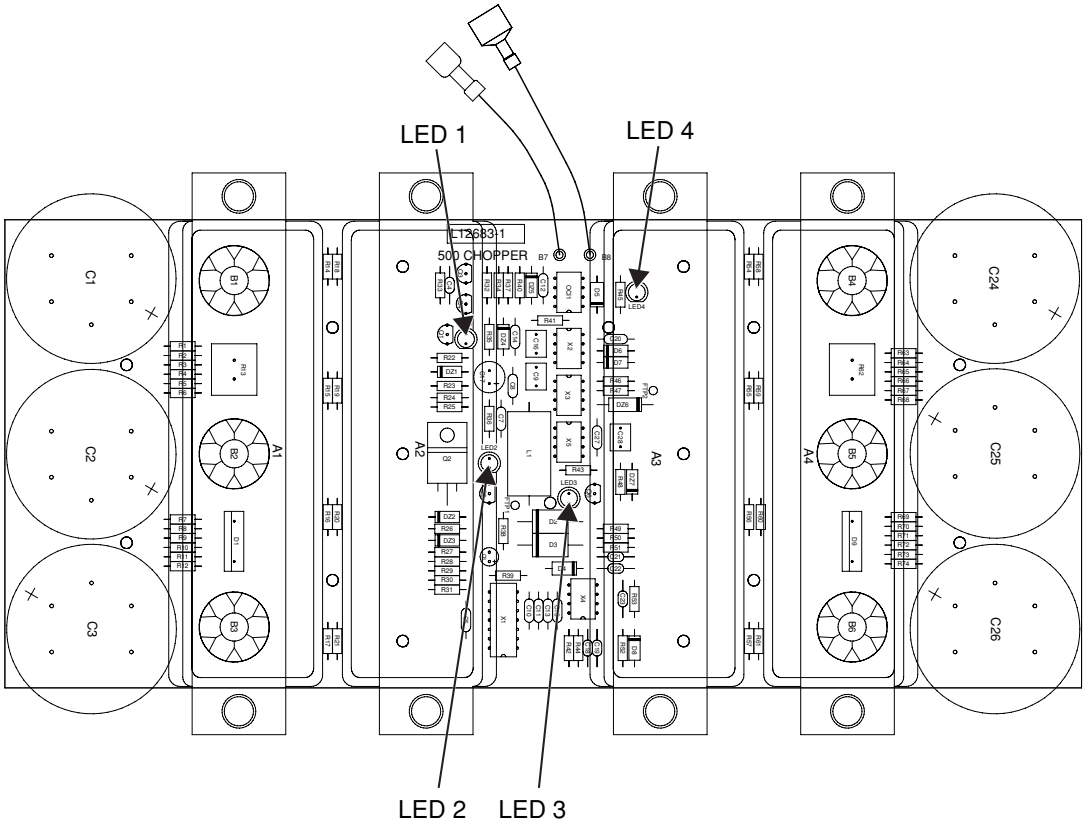


PROCEDURE

1. Turn off the Air Vantage 650.
2. Perform the ***Case Cover Removal Procedure***.
3. Label and disconnect leads 250, 250A and 250B from the thermostats. See Wiring Diagram.
4. Label and disconnect leads 229 and 5J from the fuel sender. See Figure F.12. See Wiring Diagram.
5. Using a 3/8" nutdriver, remove the four screws from the idler PCB mounting bracket. See Figure F.12.
6. Using a 7/16" nutdriver, remove the three nuts and washers from idler PCB mounting bracket. See Figure F.12.
7. Lower the control panel, see the ***Case Cover Removal Procedure***.
8. Remove the shield, located behind the control panel. See Figure F.12.
9. Visually examine chopper modules for damage.
10. Place idler switch in the high idle position.
11. Place the weld mode switch in the SMAW stick position.
12. Place the weld terminals switch in the always on position.
13. Turn off the VRD switch.
14. Reconnect the leads to the fuel sender and chopper module thermostats. See Wiring Diagram.
15. Start the engine and observe the lights on each chopper PC board. All four LEDs should be illuminated. See ***Figure F.13***.
16. LED 1 indicates output is present from B2 to B3. See ***Figure F.13***.
17. LED 2 indicates that the chopper module is receiving power from the output rectifier through terminals B1 to B2 and through terminals B4 to B5. See ***Figure F.13***.
18. LED 3 indicates output is present from terminals B5 to B6. See ***Figure F.13***.
19. LED 4 indicates that a gate signal is being received from the weld control board through flex leads B7 and B8. See ***Figure F.13***.
20. Move the weld terminal switch to the remote control position and observe that LEDs 1, 3 and 4 turn off. Return the weld terminal switch to the always on position.

CHOPPER MODULE LED's AND TEST PROCEDURE *(continued)*

Figure F.13 – Chopper module LED locations



21. If the chopper is getting proper input voltage from the rectifier and a gate signal from the weld control board but does not have output, the chopper is defective and should be replaced.

NOTE: The LEDs will indicate that a voltage or gate signal is present but these values can be measured to determine if the values are correct. See the following list of test points and expected measurements.

- Input voltage from rectifier – (LED 2) Measured from B1 to B2 and B4 to B5. Should measure 80 to 100 Volts DC when engine is operating at high idle.
- Gate signal from weld control board – (LED 4) Pulse Width Modulated (PWM) signal. Measured between B7 and B8 Flex leads - 15 Volts DC square wave pulsing at approximately 20 kHz. It is best to use the Hz function of the meter to check frequency rather than voltage.

  NOTE: Due to the on/off pulsing of the PWM signal, a typical volt meter will always read less than 15 VDC.

- Chopper output from terminals B2 to B3 (LED 1) and from terminals B5 to B6 (LED 3). Measurement should be about 58 Volts DC with mode switch in CC stick position and VRD turned off.

22. Label and disconnect leads 250, 250A and 250B from the thermostats. See Wiring Diagram.
23. Label and disconnect leads 229 and 5J from the fuel sender. See Wiring Diagram.
24. Using a 3/8" nutdriver, attach the four screws securing the idler PCB mounting bracket to the power module assembly.
25. Using a 7/16" nutdriver, attach the three nuts and washers securing the idler PCB mounting bracket to the power module assembly. See ***Figure F.12***.
26. Reconnect the leads to the fuel sender and chopper module thermostats. See Wiring Diagram.
27. Attach the shield to the rear of the control panel.
28. Perform the ***Case Cover Replacement Procedure***.

ENGINE RPM TEST PROCEDURE

⚠ WARNING

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

TEST DESCRIPTION

This test will determine whether the Engine is operating at the correct speed (RPM) during both high and low idle conditions.

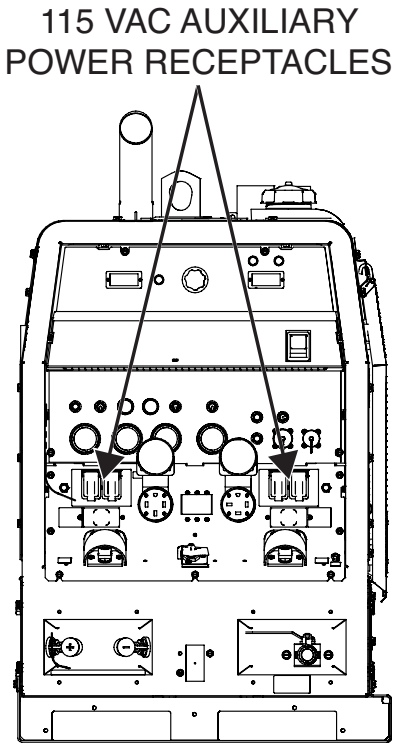
NOTE: This test can only determine if the RPM is within specifications. **The RPM is programmed into the Electronic Engine Governor Module and cannot be adjusted**.

MATERIALS NEEDED

High visibility marking pencil (For strobe-tach method only)
Strobe tach, frequency counter or multi-meter with HZ function

ENGINE RPM TEST PROCEDURE *(continued)*

Figure F.14 – 115VAC Auxiliary Power Receptacles



PROCEDURE

STROBE-TACH METHOD

1. Turn off the Air Vantage 650.
2. Be certain there is no load on either the weld or auxiliary outputs.
3. Remove the side cover from the non-service side of the engine. See the ***Case Cover Removal Procedure***. This only needs to be removed for the strobe-tach method.
4. Place a mark on the engine crank shaft pulley or on the rotating ring between engine crankshaft pulley and the engine block.
5. Connect the strobe-tach according to the manufacturer's instructions.
6. Place the idle switch in the high idle position.
7. Start the engine and direct the strobe-tach light to the mark placed in step 4. Synchronize the light to the rotating mark.
8. The tach should read between 1840 and 1870 RPM.
9. Place the idle switch in the auto idle position and wait for the engine RPM to drop and stabilize. This may take about 12 to 15 seconds. Synchronize the strobe-tach light with the rotating mark.
10. The tach should read between 1490 and 1540 RPM.
11. If either of the readings are incorrect, a problem exists with the electronic governor control system. An authorized engine technician should be contacted to repair, replace or reprogram the electronic governor system.
12. When testing is complete, perform the ***Case Cover Replacement Procedure***.

FREQUENCY METER / MULTI-METER METHOD

1. If using a frequency counter or a multi-meter, set it to the AC HZ function. Plug the frequency counter or multi-meter into one of the 115 VAC auxiliary power receptacles. See Figure F.14.
2. Place the idle switch in the high idle position.
3. Start the engine, allow the engine RPM to stabilize, then observe the frequency. The frequency should measure between 61.3 and 62.3 HZ (1869 and 1840 RPM).
4. Place the idle switch in the "Auto" position and wait for the RPM to drop and stabilize.
5. The frequency should measure between 49.7 and 51.3 HZ (1490 and 1540 RPM).

NOTE: RPM can be calculated from the frequency by multiplying the frequency by 30. (Example : 62 HZ X 30 = 1860 RPM).

This formula works for any 4 pole Lincoln Electric welding machine with AC auxiliary power.

ELECTRONIC ENGINE GOVERNOR MODULE TEST PROCEDURE (ENGINE SPEED CONTROL)

⚠ WARNING

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

TEST DESCRIPTION

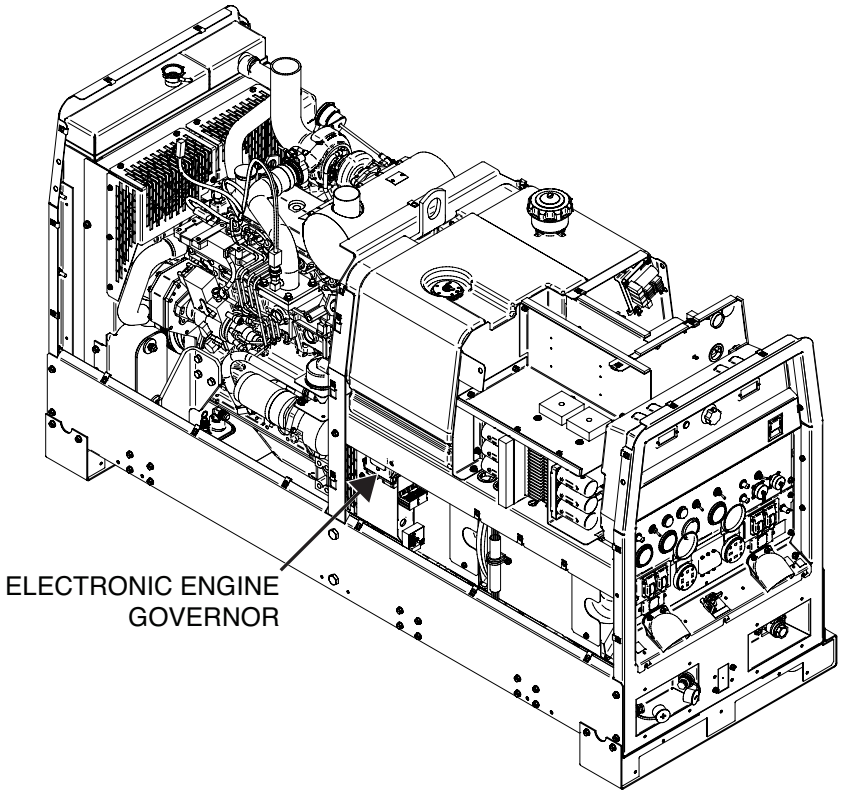
This test will help determine if the Electronic Engine Governor System is working properly. It should be performed if the Engine will not start and it has been determined that there is no air in the Diesel Fuel System. See the Engine Operators Manual for fuel system bleeding instructions.

MATERIALS NEEDED

RMS Volt/Ohmmeter
Wiring Diagram

ELECTRONIC ENGINE GOVERNOR MODULE TEST PROCEDURE (ENGINE SPEED CONTROL) *(continued)*

Figure F.15 – Electronic engine governor location



PROCEDURE

1. Turn off the Air Vantage 650.
2. Perform the ***Case Cover Removal Procedure***, for the case sides on the left side of machine (operators left when facing the control panel).
3. Locate the electronic engine governor module. See Figure F.15.
4. Turn on the run/stop switch and observe that the light on the electronic engine governor module is illuminated. See ***Figure F.16***.
5. If the light is not illuminated, using an volt/ohmmeter check for battery voltage between pins 9 and 4 on plug J31 (leads #232N and lead 5S). See ***Figure F.16*** and ***Figure F.17***. See the Wiring Diagram.
6. If battery voltage is present, perform the ***Electronic Engine Governor Module Removal And Replacement Procedure***.
7. Locate the fuel actuator. It is mounted on the injection pump which is on the non-service side of the engine. See ***Figure F.18***.
8. Disconnect one of the leads from the fuel actuator. See Wiring Diagram.
9. Using a volt/ohmmeter, test the resistance of the fuel actuator. It should measure about 2.0 Ohms. See Wiring Diagram.
10. If the resistance reading is significantly different from 2.0 Ohms, the fuel actuator may be faulty. See the Engine manufacturers service manual.
11. Locate the magnetic pickup sensor. It is located on the service side of the engine. See ***Figure F.19***.
12. Unplug the magnetic sensor leads. See Wiring Diagram.
13. Using an volt/ohmmeter, test the resistance of the magnetic pickup sensor. The sensor resistance should be 180 to 210 Ohms.
14. If the resistance reading is significantly different than expected, the magnetic pickup sensor is faulty, perform the ***Magnetic Pickup Sensor Replacement And Adjustment Procedure***.
15. Connect the RMS AC volt meter to the magnetic pickup leads. Crank the engine and check for at least 2 volts RMS. See Wiring Diagram.
16. If the expected voltage is not present, perform the ***Magnetic Pickup Sensor Replacement and Adjustment Procedure***.
17. If the voltage is low, adjust the magnetic pickup. See the ***Magnetic Pickup Sensor Replacement and Adjustment Procedure*** and retest.
18. Check the appropriate leads for loose or faulty connections. See Wiring Diagram.
19. If the electronic governor module is getting power and the magnetic pickup and actuator test good, perform the ***Electronic Engine Governor Module Removal And Replacement Procedure***.
20. Connect any previously disconnected leads and plugs.
21. Perform the ***Case Cover Replacement Procedure***.

ELECTRONIC ENGINE GOVERNOR MODULE TEST PROCEDURE (ENGINE SPEED CONTROL) *(continued)*

Figure F.16 – Electronic engine governor light and plug J31 locations

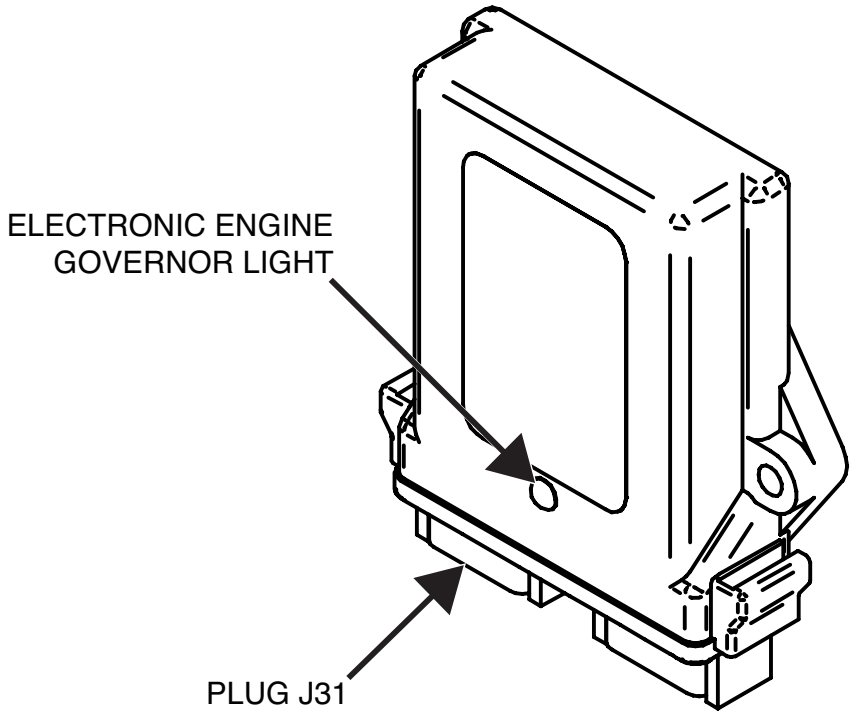
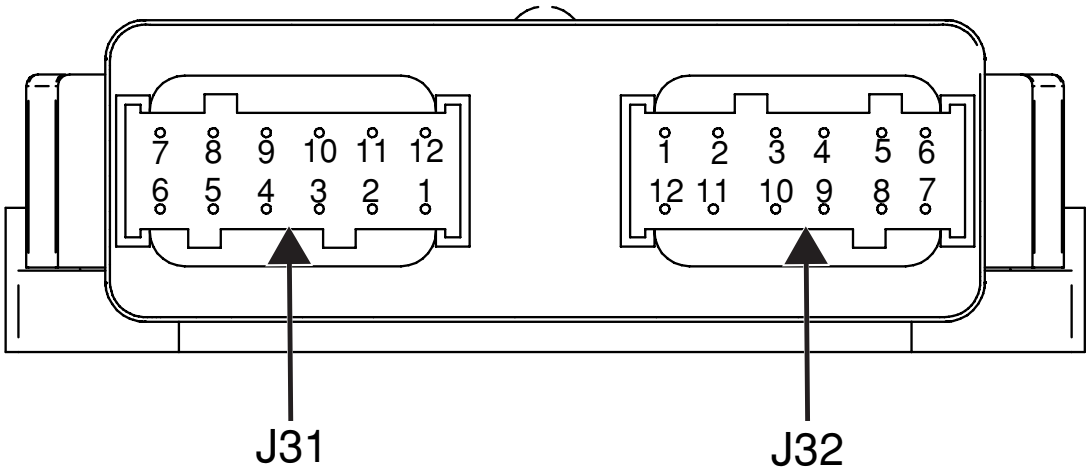


Figure F.17 – Plug J31 pin locations



ELECTRONIC ENGINE GOVERNOR MODULE TEST PROCEDURE (ENGINE SPEED CONTROL) *(continued)*

Figure F.18 – Fuel actuator location

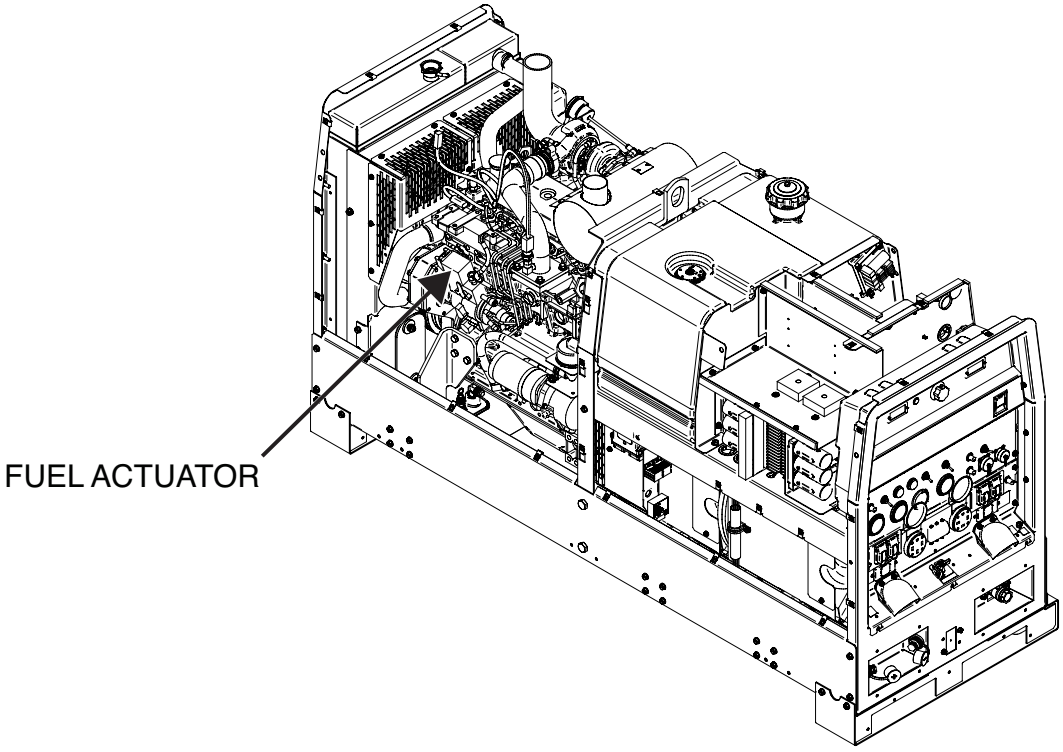
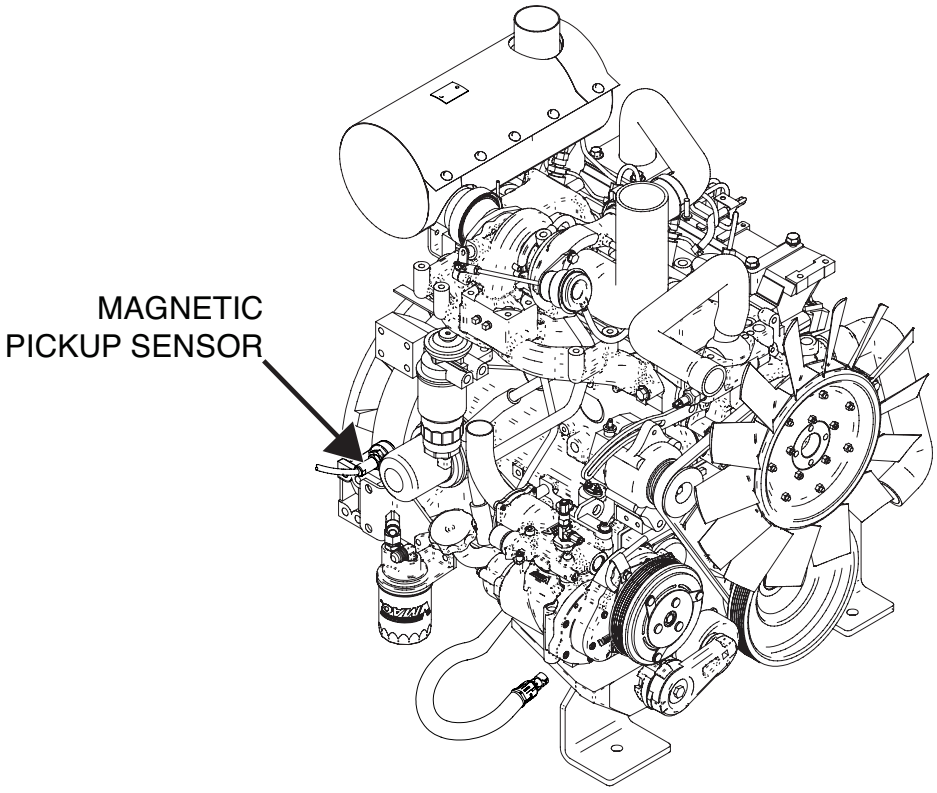


Figure F.19 – Magnetic pickup sensor location



BATTERY CHARGING CIRCUIT 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

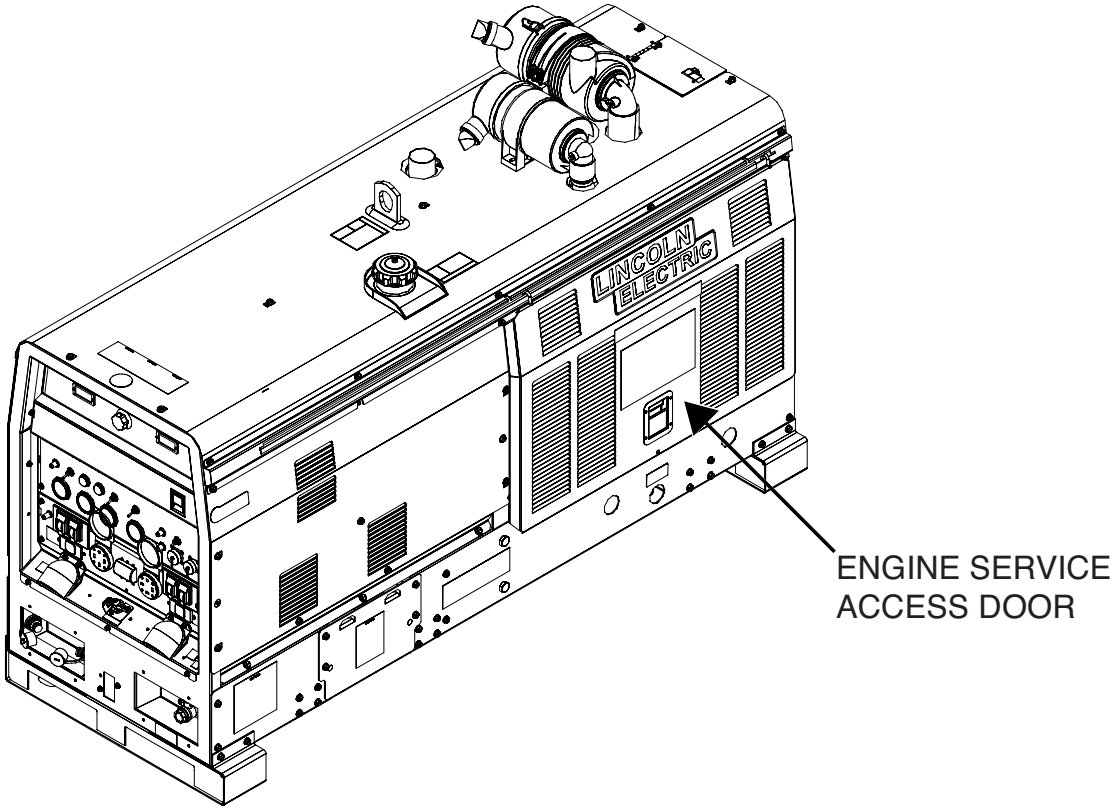
This test will determine if the Engine Battery Charging Alternator and supporting Circuitry is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

BATTERY CHARGING CIRCUIT TEST PROCEDURE *(continued)*

Figure F.20 – Engine service access door location



PROCEDURE

1. Turn off the Air Vantage 650.
2. Open the engine service access door. See Figure F.20.
3. Locate the engine alternator. See ***Figure F.21***.
4. Examine the alternator drive belt and verify that the belt is tight and in good condition.
5. Start the engine and place the idle switch in the high position.
6. Using a volt/ohmmeter, test for DC voltage between lead #238 and chassis ground. Voltage should be 13.2 to 14.5 VDC. See ***Figure F.22***. See Wiring Diagram.
7. Using a volt/ohmmeter, test for DC voltage between lead #232 and chassis ground. Voltage should be 13.2 to 14.5 VDC. See ***Figure F.22***. See Wiring Diagram.
8. When the engine is running, if battery voltage is present at lead #232 and the voltage at lead #238 is significantly lower than expected, the alternator may be faulty. See the Engine manufacturers service manual.
9. Close and secure the engine service access door.

BATTERY CHARGING CIRCUIT TEST PROCEDURE *(continued)*

Figure F.21 – Alternator location

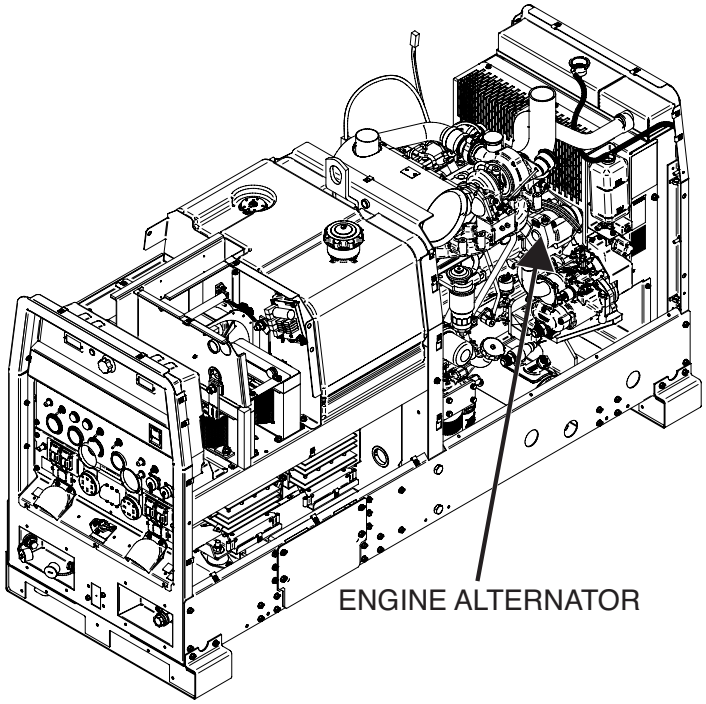
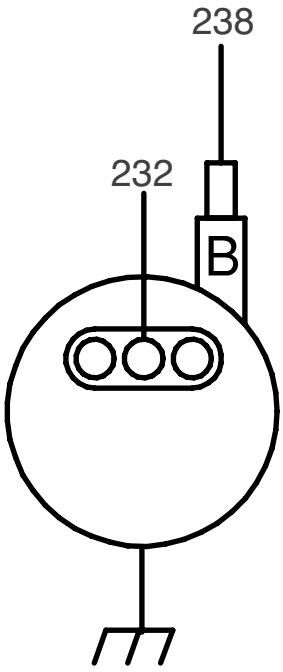


Figure F.22 – Alternator lead locations



AIR COMPRESSOR ELECTRICAL 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

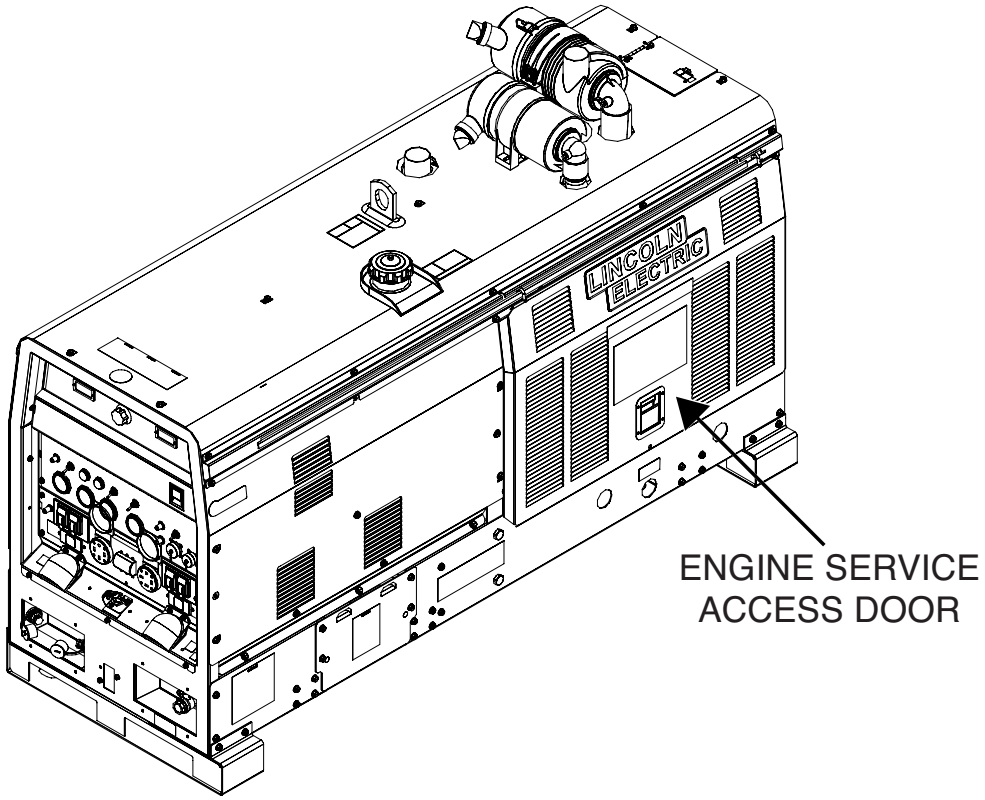
This test will help to determine if the Electrical Control Circuitry is functioning normally. Perform this test if the Compressor Clutch does not engage when the switch is turned on. If the Compressor System has a problem that is not related to the Electrical Control System, a qualified VMAC repair technician should be contacted to troubleshoot and repair the system.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

AIR COMPRESSOR ELECTRICAL TEST PROCEDURE *(continued)*

Figure F.23 – Engine service access door location



PROCEDURE

1. Turn off the Air Vantage 650.
2. Open the engine service access door. See Figure F.23.
3. Locate the compressor. See ***Figure F.24***.
4. Verify that the compressor drive belt is present, tight and in good condition.
5. Close the air outlet valve, located on the front of the machine. See ***Figure F.25***.
6. Start the engine and turn on the compressor switch.
7. Check to see if the compressor protection/temp light is on. See ***Figure F.25***.
8. If the protection light is ON:
   - A. Internal pressures in the system may be too high. Allow more time for internal pressure to drop.
   - B. The compressor system or engine may be overheated or there may be damaged wire or terminal in the temp sensor circuit. See Wiring Diagram.
   - C. The blow down solenoid or the pressure switch may be defective. (The blow down solenoid and pressure switch are located on the engine service side just below the coolant recovery tank. See ***Figure F.26***. The blow down solenoid coil should measure 31 Ohms. The pressure switch should read 0 Ohms with less than 15 PSI. See Wiring Diagram.
9. If the protection light is OFF:
   - A. The compressor relay may be defective. (Relay is located behind the control panel on the right side of the machine). See ***Figure F.27***.
   - B. The compressor electric clutch may be defective. (resistance of clutch coil should be about 3.5 Ohms).
   - C. The compressor switch or 12 volt supply wiring may be faulty. See the Wiring Diagram.
10. When testing is complete, close and secure the engine service access door.
11. Open the air outlet, located on the front of the machine.

AIR COMPRESSOR ELECTRICAL TEST PROCEDURE *(continued)*

Figure F.24 – Compressor location

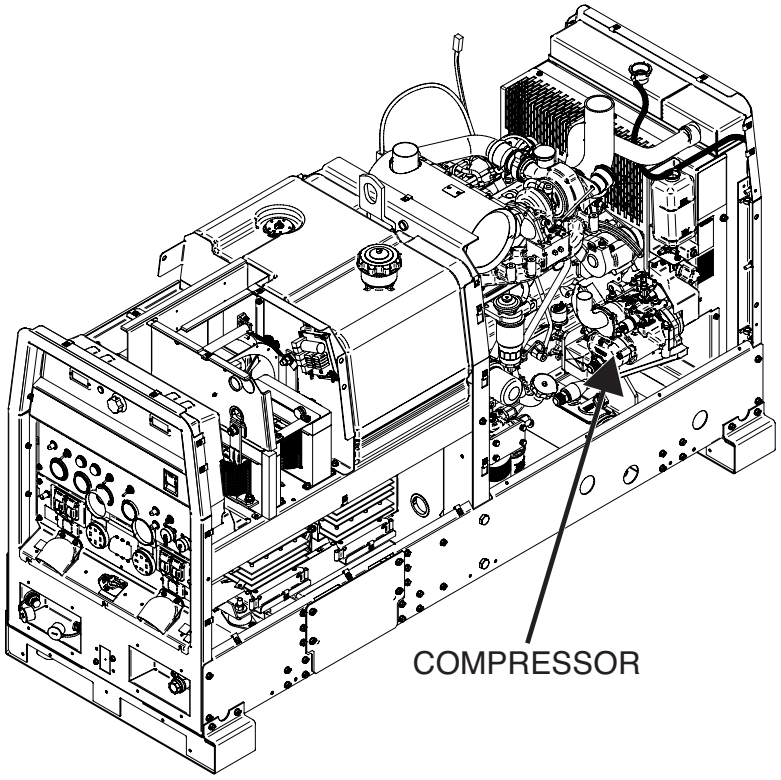
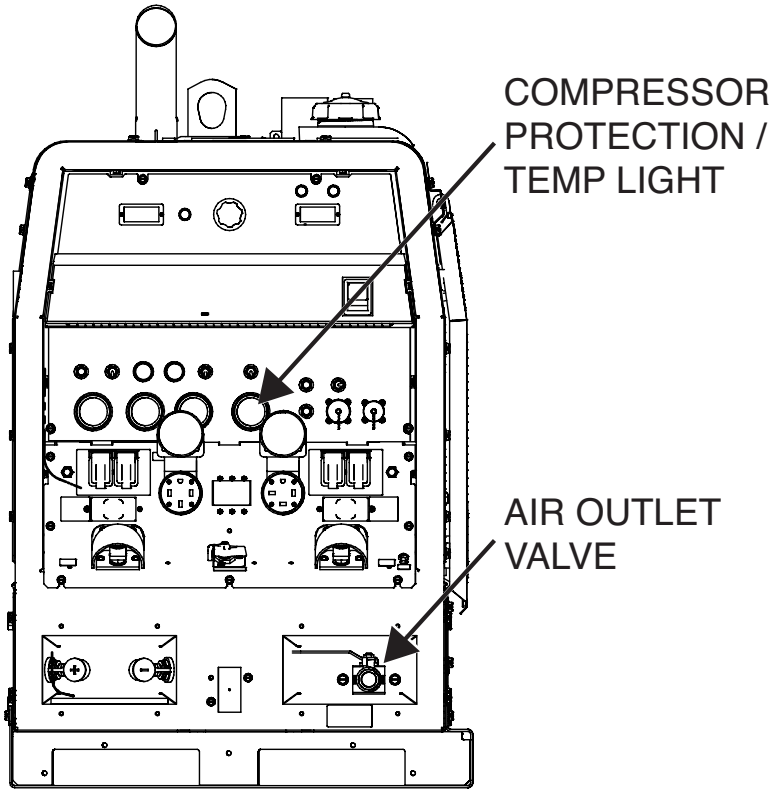


Figure F.25 – Compressor protection/temp light location



AIR COMPRESSOR ELECTRICAL TEST PROCEDURE *(continued)*

Figure F.26 – Blow down solenoid and pressure switch locations

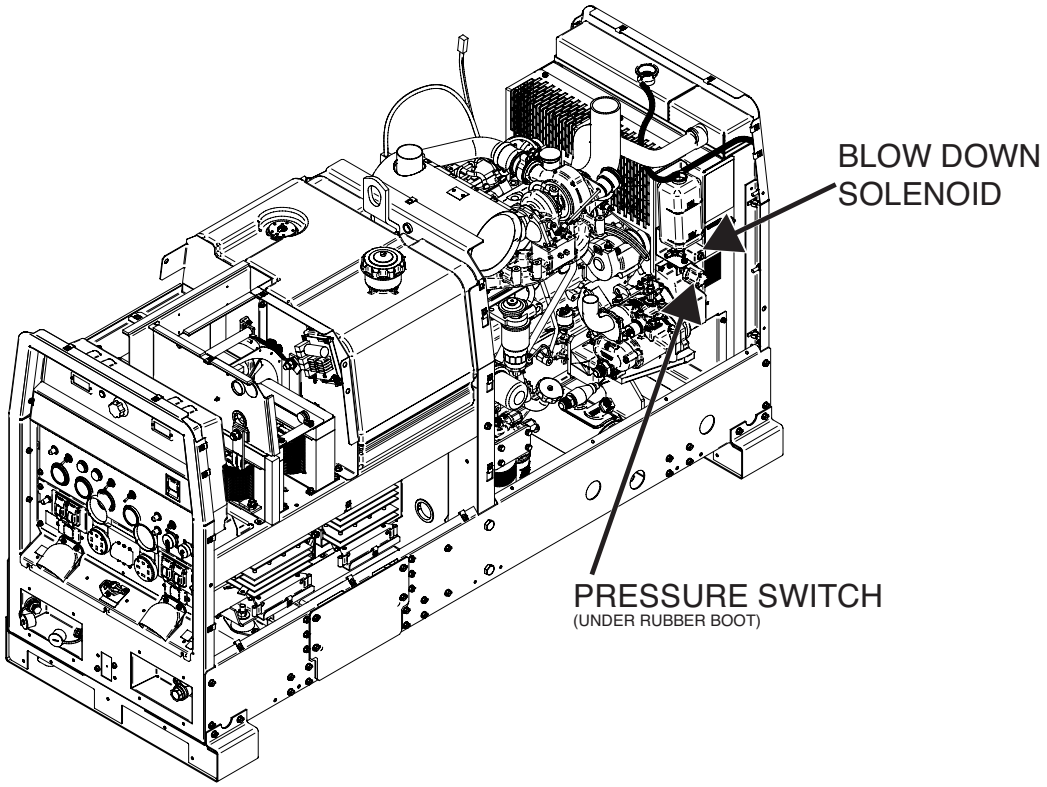
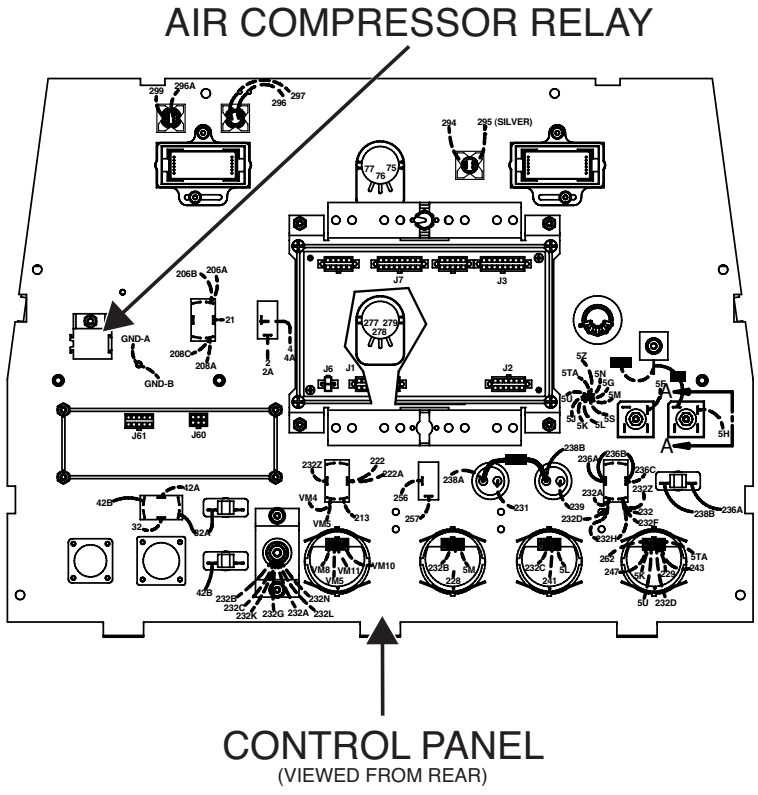


Figure F.27 – Compressor relay location



WELD CONTROL BOARD 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

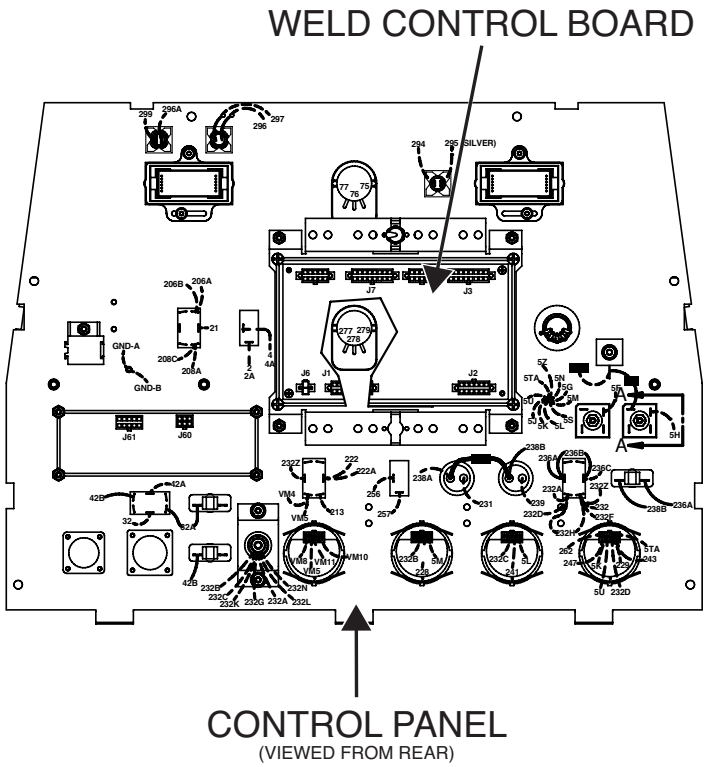
This test will help determine if the Weld Control Board is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

WELD CONTROL BOARD TEST PROCEDURE *(continued)*

Figure F.28 – Weld control board location



PROCEDURE

1. Turn off the Air Vantage 650.
2. Lower the control panel. See the ***Case Cover Removal Procedure***.
3. Locate the weld control board attached to the bracket on the back of the control panel. See Figure F.28.
4. Using a volt/ohmmeter, perform the tests outlined in ***Table F.1*** and ***F.2***. See ***Figure F.29***. See Wiring Diagram.
5. If any of the tests fail the weld control board may be faulty.
6. If faulty, perform the ***Weld Control Board Removal And Replacement Procedure***.
7. Perform the ***Case Cover Replacement Procedure***.

WELD CONTROL BOARD TEST PROCEDURE *(continued)*

Figure F.29 – Weld control board lead locations

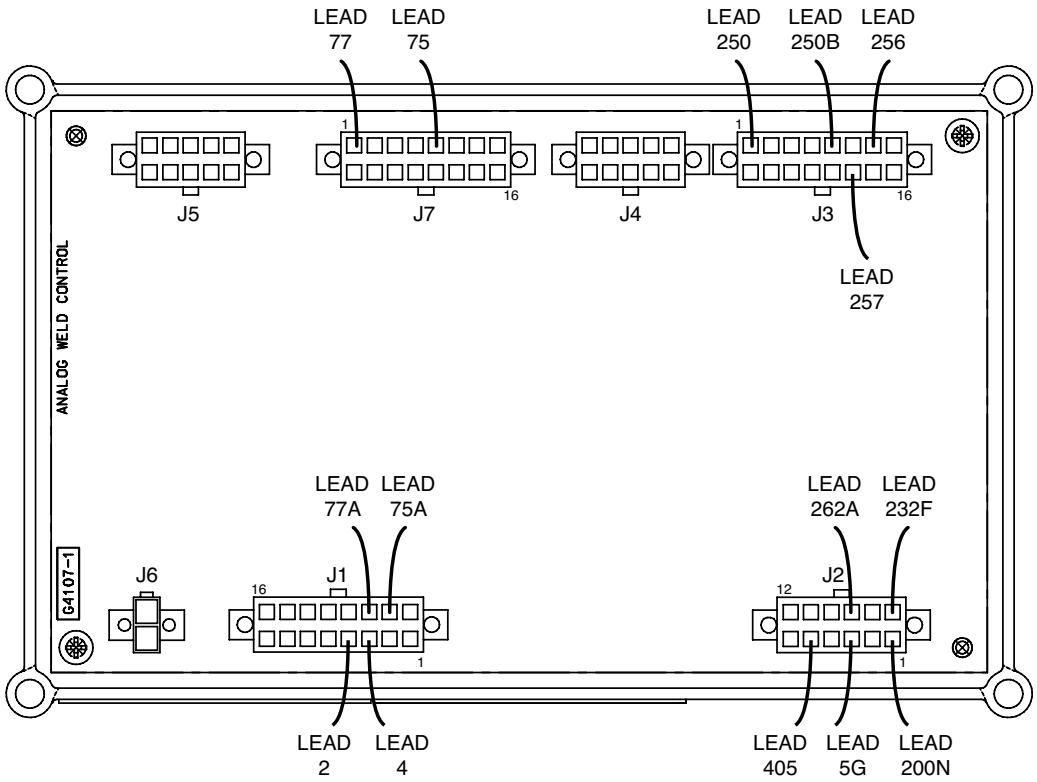


Table F.1 – Weld control board voltage tests

DESCRIPTION	TEST POINTS (+)	TEST POINTS (–)	EXPECTED READING	CONDITIONS
BATTERY VOLTAGE APPLIED TO BOARD	PLUG J2 PIN 7 (LEAD 232F)	PLUG J2 PIN 3 (LEAD 5G)	12 - 13 VDC	RUN STOP SWITCH IN 'RUN' POSITION. ENGINE NOT RUNNING.
REMOTE CONTROL CIRCUIT	PLUG J1 PIN 11 (LEAD 77A)	PLUG J1 PIN 10 (LEAD 75A)	10 VDC	ENGINE RUNNING.
OUTPUT CONTROL CIRCUIT	PLUG J7 PIN 1 (LEAD 77)	PLUG J7 PIN 5 (LEAD 75)	10 VDC	ENGINE RUNNING.
FLASHING VOLTAGE	PLUG J2 PIN 1 (LEAD 200N)	PLUG J2 PIN 3 (LEAD 5G)	12 VDC	DURING FLASHING.
LOW ENGINE IDLE COMMAND	PLUG J2 PIN 5 (LEAD 405)	PLUG J2 PIN 3 (LEAD 5G)	12 - 13 VDC	ENGINE RUNNING AT HIGH SPEED.
LOW ENGINE IDLE COMMAND	PLUG J2 PIN 5 (LEAD 405)	PLUG J2 PIN 3 (LEAD 5G)	0 VDC	ENGINE AT LOW IDLE RPM.
WELD TERMINAL SWITCH CIRCUIT	PLUG J1 PIN 4 (LEAD 2)	PLUG J1 PIN 3 (LEAD 4)	15 VDC	WELD TERMINAL SWITCH OPEN. ENGINE RUNNING.
IDLER SWITCH	PLUG J3 PIN 7 (LEAD 256)	PLUG J3 PIN 14 (LEAD 257)	15 VDC	IDLER SWITCH OPEN. ENGINE RUNNING.

WELD CONTROL BOARD TEST PROCEDURE *(continued)*

Table F.2 – Weld control board resistance tests

DESCRIPTION	TEST POINTS (+)	TEST POINTS (–)	EXPECTED READING	CONDITIONS
CHECKING NORMALLY CLOSED CHOPPER HEAT SINK THERMOSTATS	PLUG J3 PIN 5 (LEAD 250B)	PLUG J3 PIN 1 (LEAD 250)	0 OHMS	ENGINE NOT RUNNING.
WELD TERMINAL SWITCH CIRCUIT	PLUG J1 PIN 4 (LEAD 2)	PLUG J1 PIN 3 (LEAD 4)	LESS THAN 1 OHM	WELD TERMINAL SWITCH CLOSED.
IDLER SWITCH	PLUG J3 PIN 7 (LEAD 256)	PLUG J3 PIN 14 (LEAD 257)	LESS THAN 1 OHM	IDLER SWITCH CLOSED.

OUTPUT RECTIFIER BRIDGE TEST PROCEDURE

⚠ WARNING

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

TEST DESCRIPTION

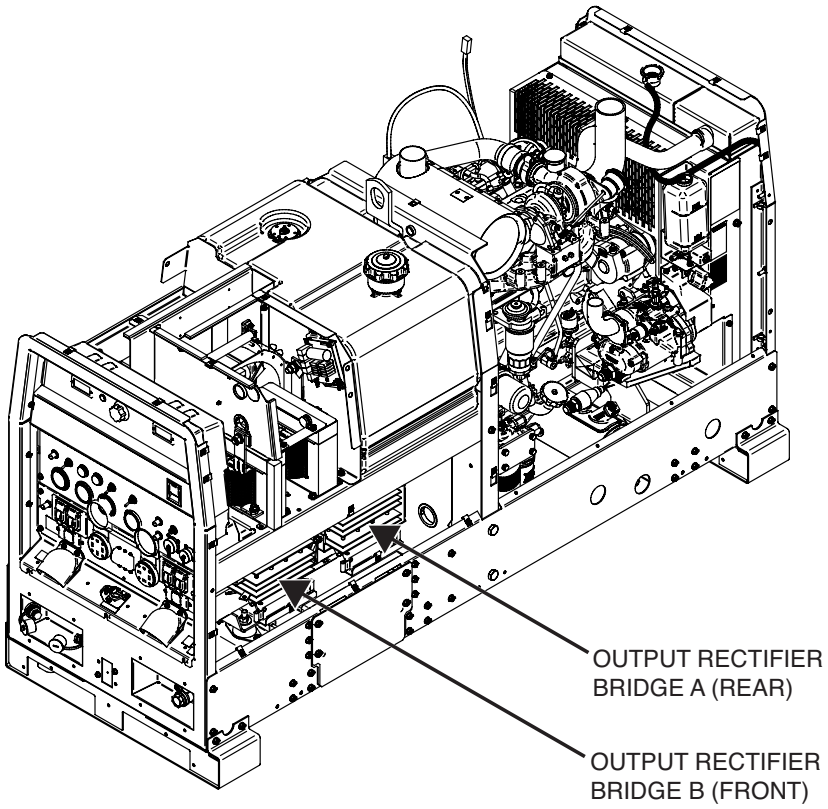
This test will help determine if one or more of the Diode Sets in the Weld Output Rectifiers is shorted or open. This test cannot determine if a Single Diode within a set is open.

MATERIALS NEEDED

7/16” Wrench
1/2” Open End Wrench
Volt/Ohmmeter
Wiring Diagram

OUTPUT RECTIFIER BRIDGE TEST PROCEDURE *(continued)*

Figure F.30 – Output rectifier bridge locations



PROCEDURE

1. Turn off the engine.
2. Perform the ***Case Cover Removal Procedure***.
3. Locate the two output rectifiers on the right side of the machine below the fuel tank and output chokes. (Operator right when facing control panel). See Figure F.30.

OUTPUT RECTIFIER BRIDGE B

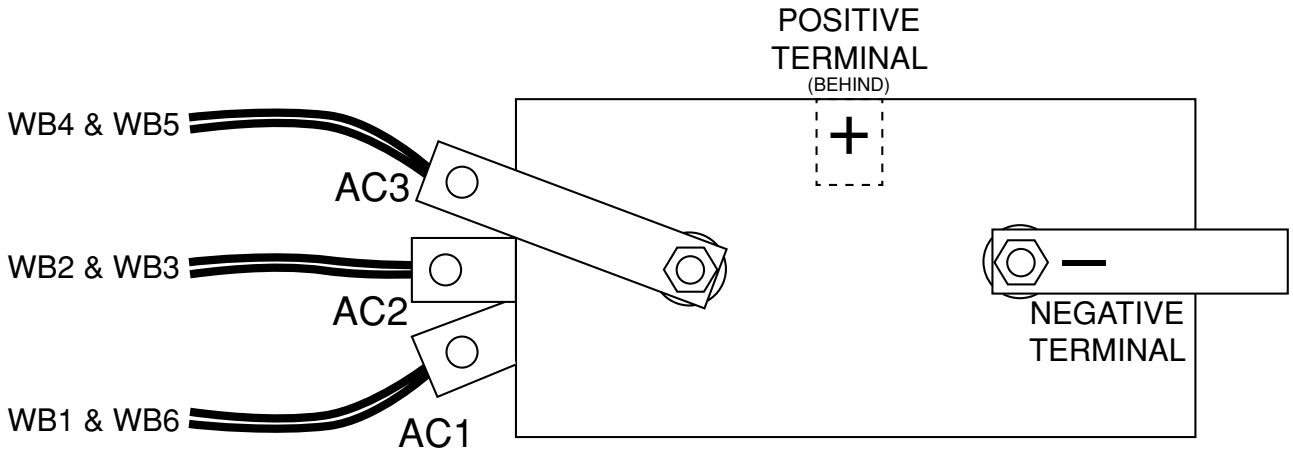
4. Using a 7/16” wrench, label and disconnect the WB2 and WB3 cables from the rectifier terminal. See ***Figure F.31***. See Wiring Diagram.
5. Using a 7/16” wrench, label and disconnect the WB1 and WB6 cables from the rectifier terminal. See ***Figure F.31***. See Wiring Diagram.
6. Using a 7/16” wrench, label and disconnect the WB4 and WB5 cables from the rectifier terminal. See ***Figure F.31***. See Wiring Diagram.
7. Using a 1/2” wrench, label and disconnect the cable and the jumper cable from the negative terminal of the rectifier. See ***Figure F.31***. See Wiring Diagram.
8. Using an ohmmeter, perform the tests in ***Table F.3***.

NOTE: The positive terminal of the rectifier is located between the rectifier and the generator. There is no need to disconnect the leads from this terminal. It can be accessed by using a probe inserted between the rectifier plates. When inserting the probe, be careful not to damage the thin diodes leads.

9. If the Ohm readings are significantly higher or lower than specified in ***Table F.3***, the rectifier is faulty.
10. If faulty, perform the ***Output Rectifier Bridge Removal And Replacement Procedure***.
11. Using a 7/16” wrench, connect the WB2 and WB3 cables to the rectifier terminal. See Wiring Diagram.
12. Using a 7/16” wrench, connect the WB1 and WB6 cables to the rectifier terminal. See Wiring Diagram.
13. Using a 7/16” wrench, connect the WB4 and WB5 cables to the rectifier terminal. See Wiring Diagram.
14. Using a 1/2” wrench, connect the cable and the jumper cable to the negative terminal of the rectifier. See Wiring Diagram.

OUTPUT RECTIFIER BRIDGE TEST PROCEDURE *(continued)*

Figure F.31 – Output rectifier bridge B lead locations



OUTPUT RECTIFIER BRIDGE A

15. Using a 7/16” wrench, label and disconnect the WA2 and WA3 cables from the rectifier terminal. See ***Figure F.32***. See Wiring Diagram.
16. Using a 7/16” wrench, label and disconnect the WA1 and WA6 cables from the rectifier terminal. See ***Figure F.32***. See Wiring Diagram.
17. Using a 7/16” wrench, label and disconnect the WA4 and WA5 cables from the rectifier terminal. See ***Figure F.32***. See Wiring Diagram.
18. Using a 1/2” wrench, label and disconnect the cable and the jumper cable from the negative terminal of the rectifier. See ***Figure F.32***. See Wiring Diagram.
19. Using an ohmmeter, perform the tests in ***Table F.3***.

NOTE: The positive terminal of the rectifier is located between the rectifier and the generator. There is no need to disconnect the leads from this terminal. It can be accessed by using an probe inserted between the rectifier plates. When inserting the probe, be careful not to damage the thin diodes leads.

20. If the Ohm readings are significantly higher or lower than specified in ***Table F.3***, the rectifier is faulty.
21. If faulty, perform the ***Output Rectifier Bridge Removal And Replacement Procedure***.
22. Using a 7/16” wrench, connect the WA2 and WA3 cables to the rectifier terminal. See Wiring Diagram.
23. Using a 7/16” wrench, connect the WA1 and WA6 cables to the rectifier terminal. See Wiring Diagram.
24. Using a 7/16” wrench, connect the WA4 and WA5 cables to the rectifier terminal. See Wiring Diagram.
25. Using a 1/2” wrench, connect the cable and the jumper cable to the negative terminal of the rectifier. See Wiring Diagram.
26. Perform the ***Case Cover Replacement Procedure***.

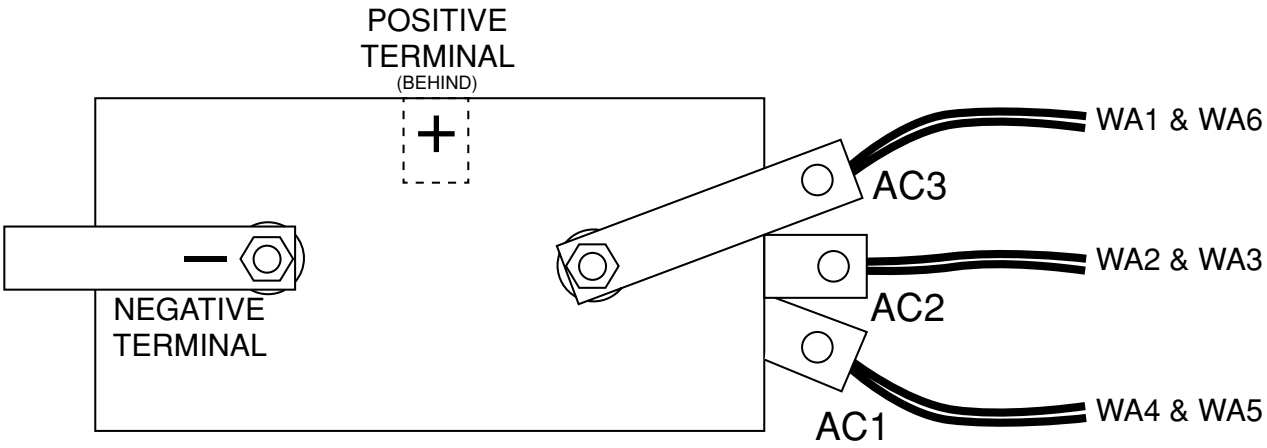
OUTPUT RECTIFIER BRIDGE TEST PROCEDURE *(continued)*

Table F.3 – Output rectifier bridge tests

DIODE TEST RECTIFIER TERMINAL CONNECTIONS		DIODE BIAS & EXPECTED TEST RESULT
TEST INSTRUMENT (+) LEAD	TEST INSTRUMENT (–) LEAD	
NEGATIVE TERMINAL	AC1	FORWARD BIAS (LOW RESISTANCE)
NEGATIVE TERMINAL	AC2	FORWARD BIAS (LOW RESISTANCE)
NEGATIVE TERMINAL	AC3	FORWARD BIAS (LOW RESISTANCE)
AC1	NEGATIVE TERMINAL	FORWARD BIAS (HIGH RESISTANCE)
AC2	NEGATIVE TERMINAL	FORWARD BIAS (HIGH RESISTANCE)
AC3	NEGATIVE TERMINAL	FORWARD BIAS (HIGH RESISTANCE)
AC1	POSITIVE TERMINAL	REVERSE BIAS (LOW RESISTANCE)
AC2	POSITIVE TERMINAL	REVERSE BIAS (LOW RESISTANCE)
AC3	POSITIVE TERMINAL	REVERSE BIAS (LOW RESISTANCE)
DC(+)	AC1	REVERSE BIAS (HIGH RESISTANCE)
DC(+)	AC2	REVERSE BIAS (LOW RESISTANCE)
DC(+)	AC3	REVERSE BIAS (LOW RESISTANCE)

OUTPUT RECTIFIER BRIDGE TEST PROCEDURE *(continued)*

Figure F.32 – Output rectifier bridge A lead locations



AUXILIARY ROTOR VOLTAGE TEST PROCEDURE

⚠ WARNING

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TEST DESCRIPTION

This test will determine if the correct DC voltage is being applied to the Auxiliary Rotor.

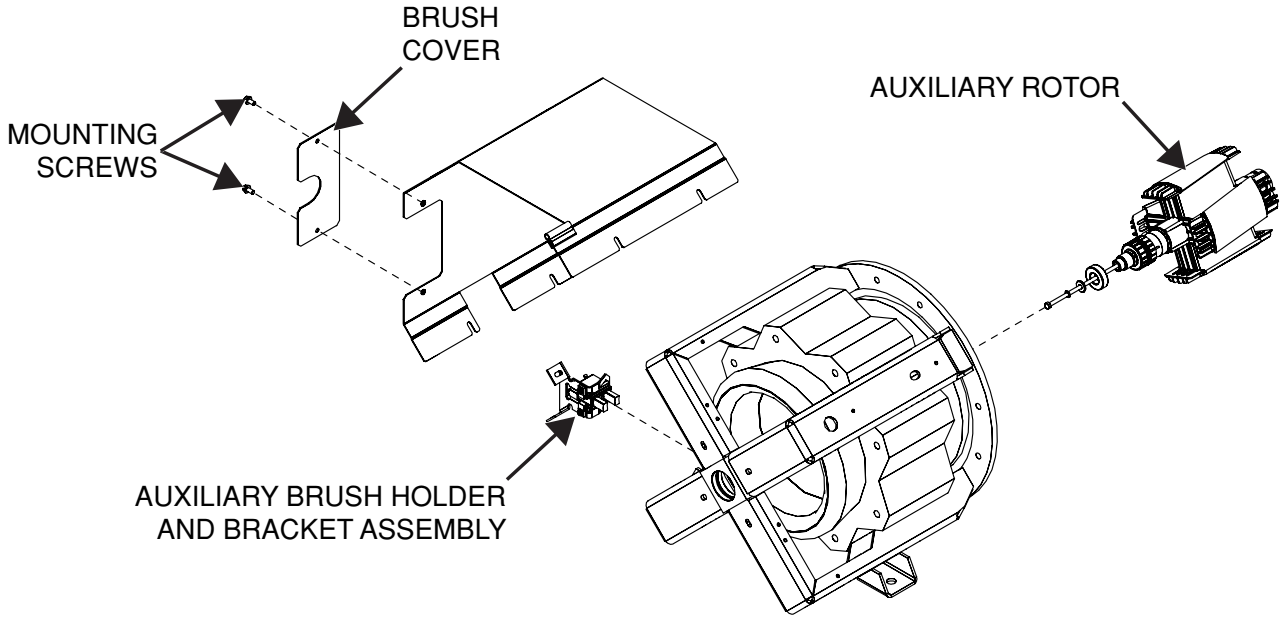
NOTE: The Auxiliary Rotor is the one farthest from the Engine and closest to the case front.

MATERIALS NEEDED

3/8” Nutdriver
Volt/Ohmmeter
Wiring Diagram

AUXILIARY ROTOR VOLTAGE TEST PROCEDURE *(continued)*

Figure F.33 – Auxiliary rotor brush cover removal

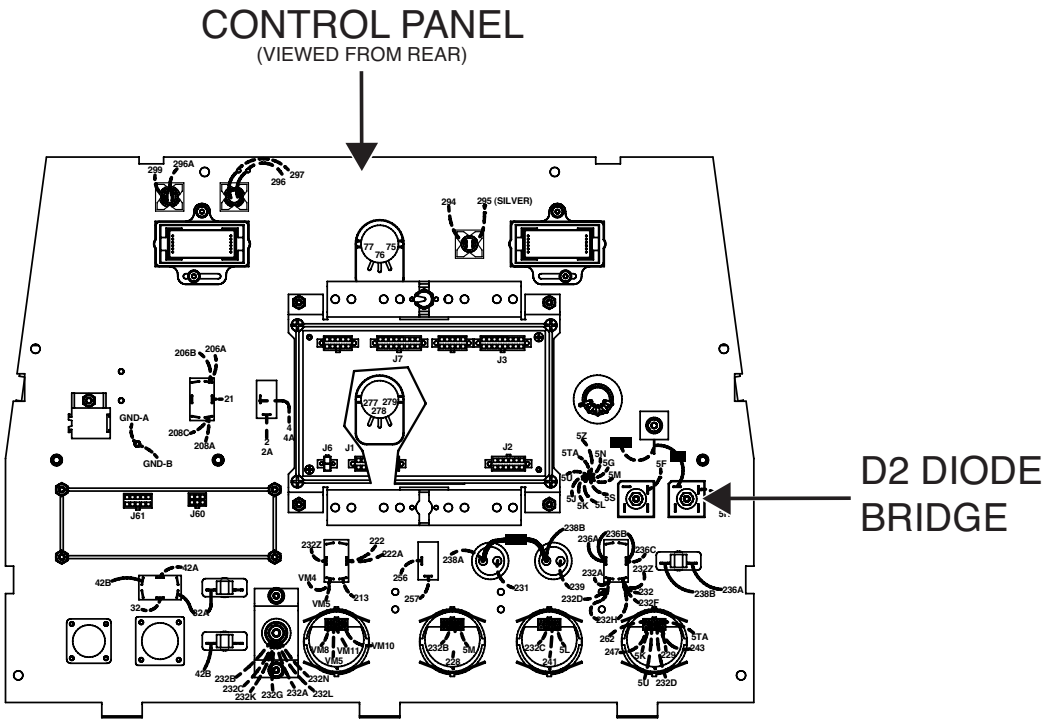


PROCEDURE

1. Turn off the Air Vantage 650.
2. Perform the ***Case Cover Removal Procedure***, for left side of machine.
3. Using a 3/8" nutdriver, remove the two screws securing the brush cover to the auxiliary rotor (the brush cover farthest from the engine). See Figure F.33.
4. Using a volt/ohmmeter, set the meter for DC volts and attach the probes to the brush leads of the auxiliary rotor. Start the engine and operate it at high RPM. See Wiring Diagram.
5. Observe the voltage on the meter. Normal voltage is about 160 VDC.
6. If the voltage is normal, this test is complete.
7. If the voltage is low, check the C2 capacitor.
8. If the voltage is zero or very near zero, perform the ***Auxiliary Rotor Resistance Test Procedures (Static And Dynamic)***.
9. If the rotor resistance is normal, proceed to the ***Auxiliary Rotor Flashing Voltage Test Procedure***.
10. If the voltage is between 3 and 5 Volts DC:
    - Test or replace the D2 field bridge rectifier, it may be defective. See ***Figure F.34***.
    - Check for damaged leads or a faulty connection at leads 5H, 5X, 5, 6A, the insulated neutral stud on the bottom right of the output panel and the ground stud on the control panel. See the Wiring Diagram.
    - The auxiliary alternator may be under a heavy electrical load. Disconnect any loads from the machines receptacles and shut off the 3 pole circuit breaker CB1.
    - The auxiliary stator may be defective.
11. If the voltage measures about 11 to 14 VDC, check for dirty or defective brushes or slip rings and perform the ***Auxiliary Rotor Resistance Test Procedures (Static And Dynamic)***.
12. Using a 3/8" nutdriver, attach the two screws securing the brush cover.
13. Perform the ***Case Cover Replacement Procedure***.

AUXILIARY ROTOR VOLTAGE TEST PROCEDURE *(continued)*

Figure F.34 – D2 field bridge rectifier location



AUXILIARY ROTOR FLASHING VOLTAGE 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

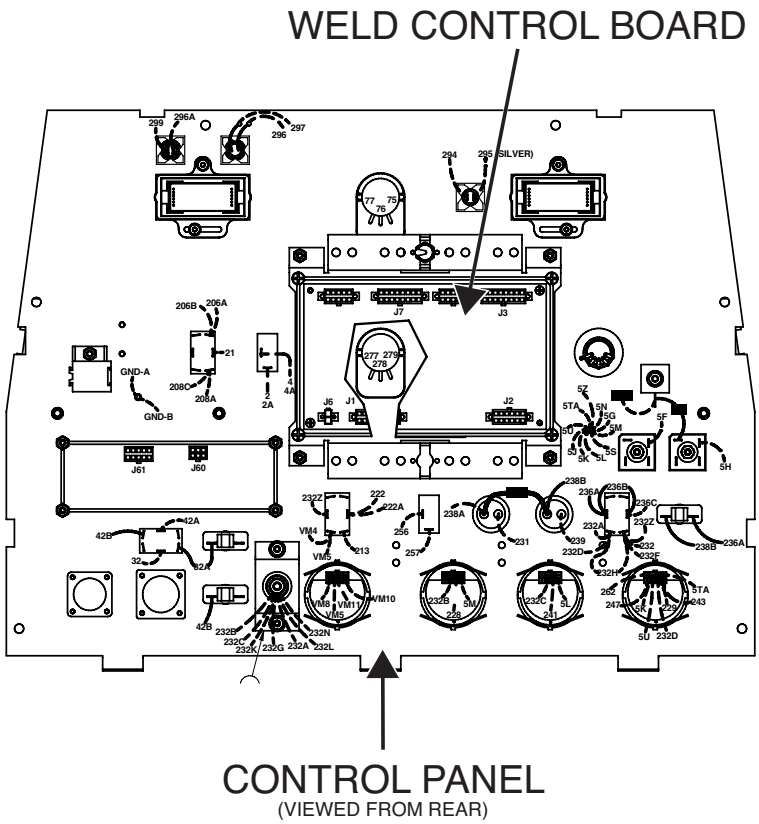
This test will help determine if the Auxiliary Rotor is receiving "FLASHING" voltage. This test should be performed if no voltage is detected when performing the ***Auxiliary Rotor Voltage Test***.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

AUXILIARY ROTOR FLASHING VOLTAGE TEST PROCEDURE *(continued)*

Figure F.35 – Weld control board location



PROCEDURE

1. Turn off the Air Vantage 650.
2. Lower the control panel. See the ***Case Cover Removal Procedure***.
3. Locate the weld control board attached to the bracket on the back of the control panel. See Figure F.35.
4. Locate leads 5G (J2-3) and 200N (J2-1). See ***Figure F.36***. See Wiring Diagram.
5. Start the engine.
6. Using a voltmeter, test for battery voltage (12 - 13.5VDC) between leads 5G (J2-3) and 200N (J2-1). See ***Figure F.36***. See Wiring Diagram.
7. If battery voltage is present:
   - Check for defective R5 resistor. See ***Figure F.37***.
   - Check for damaged leads or connections at leads #200 and #200N. See Wiring Diagram.
   - Test or replace the D2 bridge rectifier. See ***Figure F.37***.
   - Check that lead 5H is making good connection with chassis ground.
8. If battery voltage is not present:
   - Check that the 5H lead is getting good connection with the negative battery terminal. See Wiring Diagram.
   - Using a voltmeter, test for battery voltage between leads 5G (J2-3) and lead #232F (J2-7). See ***Figure F.36***. See Wiring Diagram.
   - If battery voltage is not present, check lead #232F between the weld control board and the run/stop switch. See Wiring Diagram.
   - Using a voltmeter, test for battery voltage between lead 5G (J2-3) and lead #262A (J2-9). See ***Figure F.36***. See Wiring Diagram. If battery voltage is not present, check lead #262A and the CR-4 engine protection relay. Check that the relay is getting 12 Volt DC power and is being activated by the engine governor control module.
   - The CR-4 engine protection relay may be defective.
   - The engine governor control module may be defective.
9. If battery voltage is present between leads 5G (J2-3) and lead #232F (J2-7) and between 5G (J2-3) and lead #262A (J2-9), but voltage is not present between leads 5G (J2-3) and lead #200N (J2-1) the weld control board may be defective.
10. Perform the ***Case Cover Replacement Procedure***.

AUXILIARY ROTOR FLASHING VOLTAGE TEST PROCEDURE *(continued)*

Figure F.36 – Lead 5G, 200N, 262A and 232F locations

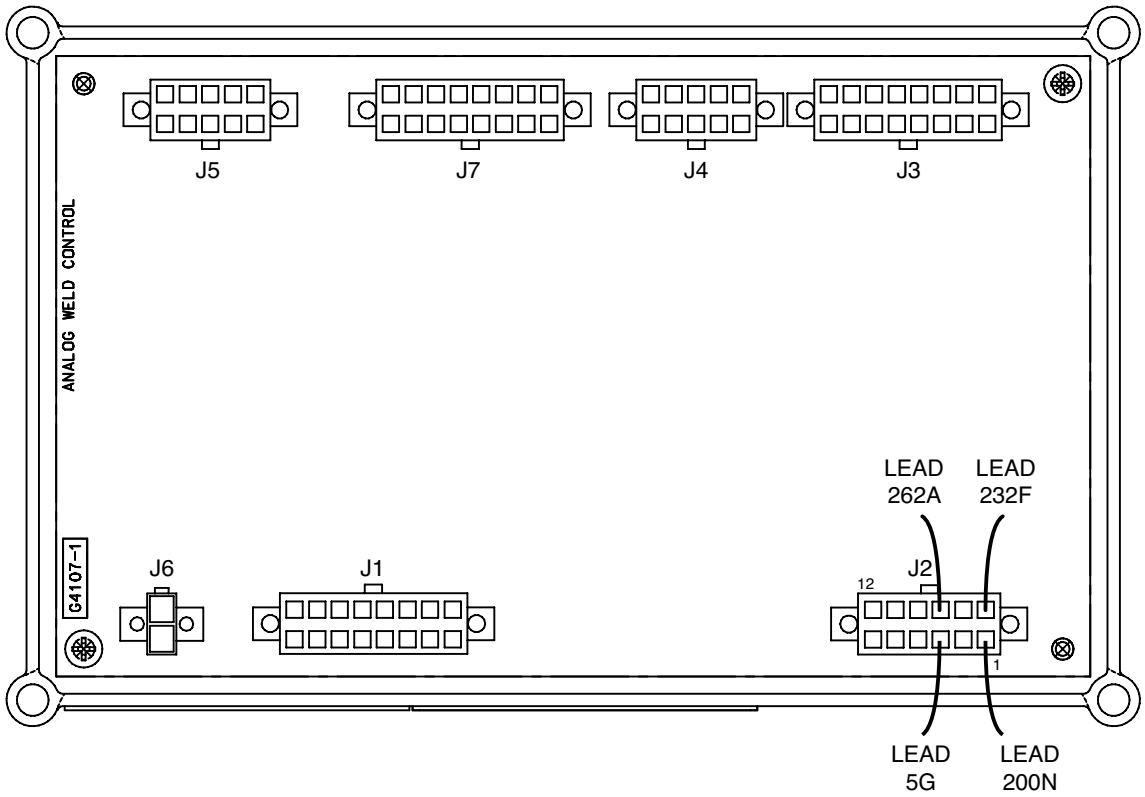
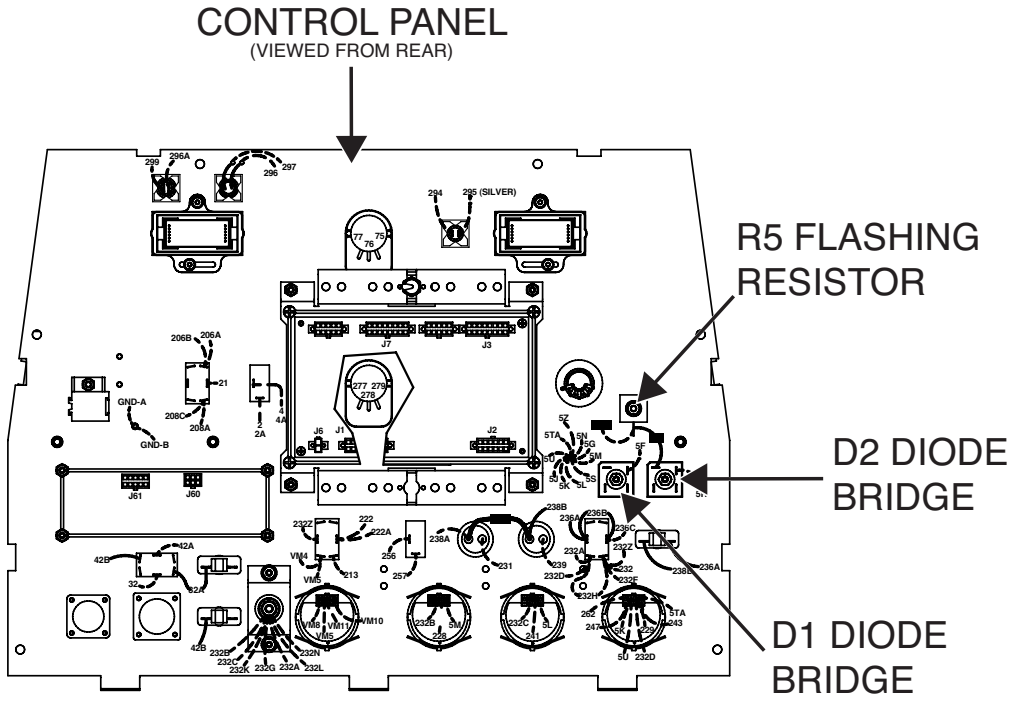


Figure F.37 – R5 resistor and diode bridge locations



AUXILIARY STATOR VOLTAGE 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

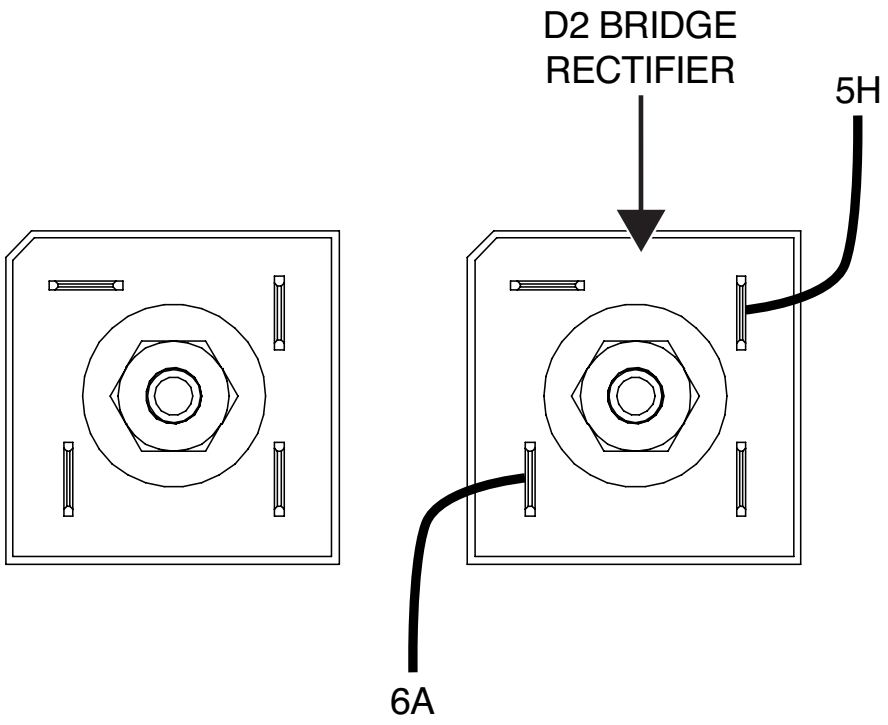
This test will determine if the Auxiliary Stator is putting out the required voltages. This test should be done if it has been established that the Auxiliary Rotor voltage is normal.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

AUXILIARY STATOR VOLTAGE TEST PROCEDURE *(continued)*

Figure F.38 – D2 diode bridge lead locations



PROCEDURE

1. Turn off the Air Vantage 650.
2. Lower the control panel. See the ***Case Cover Removal Procedure***.
3. Place the idle switch in the high idle position.
4. Place the three pole CB-1 circuit breaker in the on position.
5. Locate leads 5H and 6A on the AC terminals of the D2 bridge rectifier. See Figure F.38.
6. Start the engine and using an volt/ohmmeter, measure the AC voltage between leads 5H and 6A. Voltage should be approximately 140 VAC. See Figure F.38. See Wiring Diagram.
7. Locate the 240 Volt three phase receptacle and the 120/240 Volt receptacle on the output panel. See ***Figure F.39***.
8. Using an volt/ohmmeter, test the AC voltage between terminals X to Y, X to Z and Y to Z. Voltage should be approximately 240 VAC. See ***Figure F.40***. See the Wiring Diagram.
9. Using an volt/ohmmeter, test for AC voltage at 120/240 VAC receptacle. Terminals X to Y should measure about 240 VAC. Terminals X to W and Y to W should measure about 120 VAC. See ***Figure F.40***. See Wiring Diagram.
10. If the expected voltage is not present at the above test points, check for faulty wiring between the receptacle terminals, circuit breakers and the stator windings. See the Wiring Diagram.
11. If any of the voltages are missing perform the ***Auxiliary Rotor Voltage Test Procedure***, ***Auxiliary Rotor Flashing Voltage Test Procedure*** and the ***Auxiliary Rotor Resistance Test Procedures (Static and Dynamic)***.
12. The auxiliary stator may be defective.
13. Perform the ***Case Cover Replacement Procedure***.

AUXILIARY STATOR VOLTAGE TEST PROCEDURE *(continued)*

Figure F.39 – 240 volt three phase receptacle and 120/240 volt receptacle location

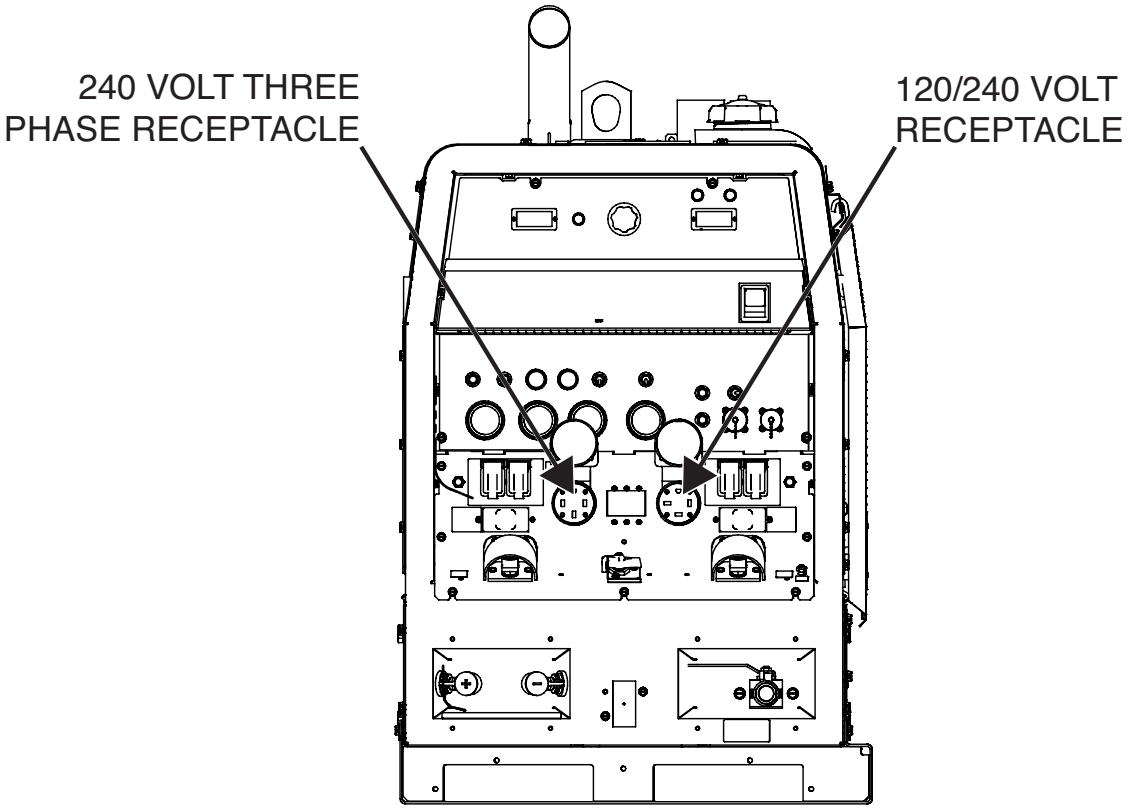
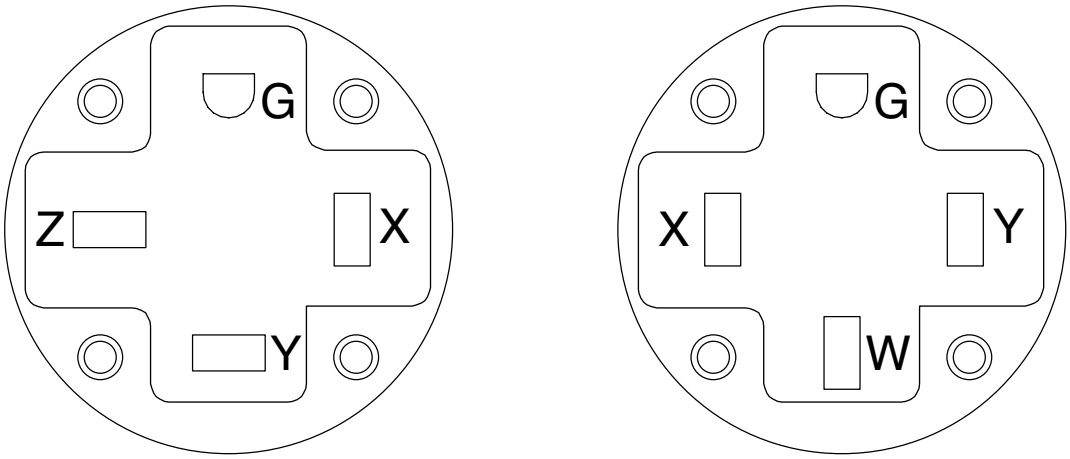


Figure F.40 – 240 volt three phase receptacle and 120/240 volt receptacle terminal location



AUXILIARY ROTOR RESISTANCE TEST PROCEDURE (STATIC)

⚠ WARNING

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

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

TEST DESCRIPTION

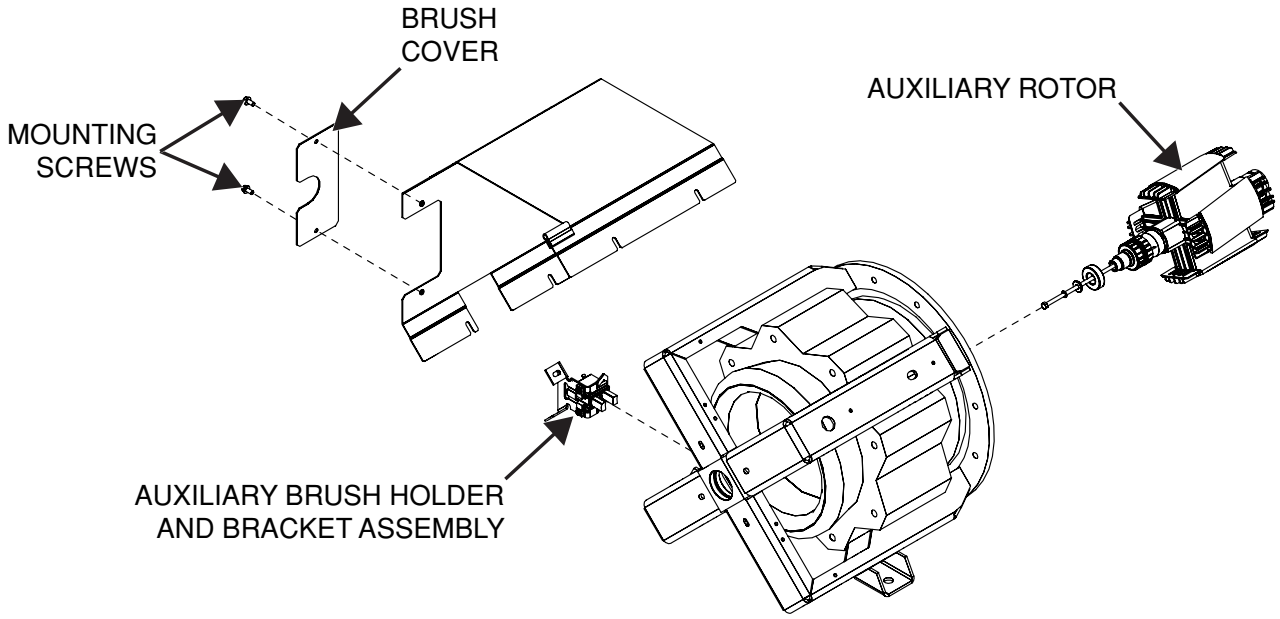
This test will determine if there is a shorted, open or grounded Winding in the Auxiliary Rotor.

MATERIALS NEEDED

Ohmmeter
3/8” Nutdriver
Wiring Diagram

AUXILIARY ROTOR RESISTANCE TEST PROCEDURE (STATIC) *(continued)*

Figure F.41 – Auxiliary rotor brush cover removal



PROCEDURE

1. Turn off the Air Vantage 650.
2. Perform the ***Case Cover Removal Procedure***, for left side of machine.

NOTE: This test will be performed with the engine OFF and the battery disconnected.

3. Using a 3/8" nutdriver, remove the two screws securing the brush cover. See Figure F.41.
4. Using a 3/8" nutdriver, remove the brush holder and bracket assembly. See Figure F.41.
5. Using an ohmmeter, measure the resistance across the slip rings of the auxiliary rotor. The auxiliary rotor resistance should measure about 36 Ohms at 75 deg. F*.

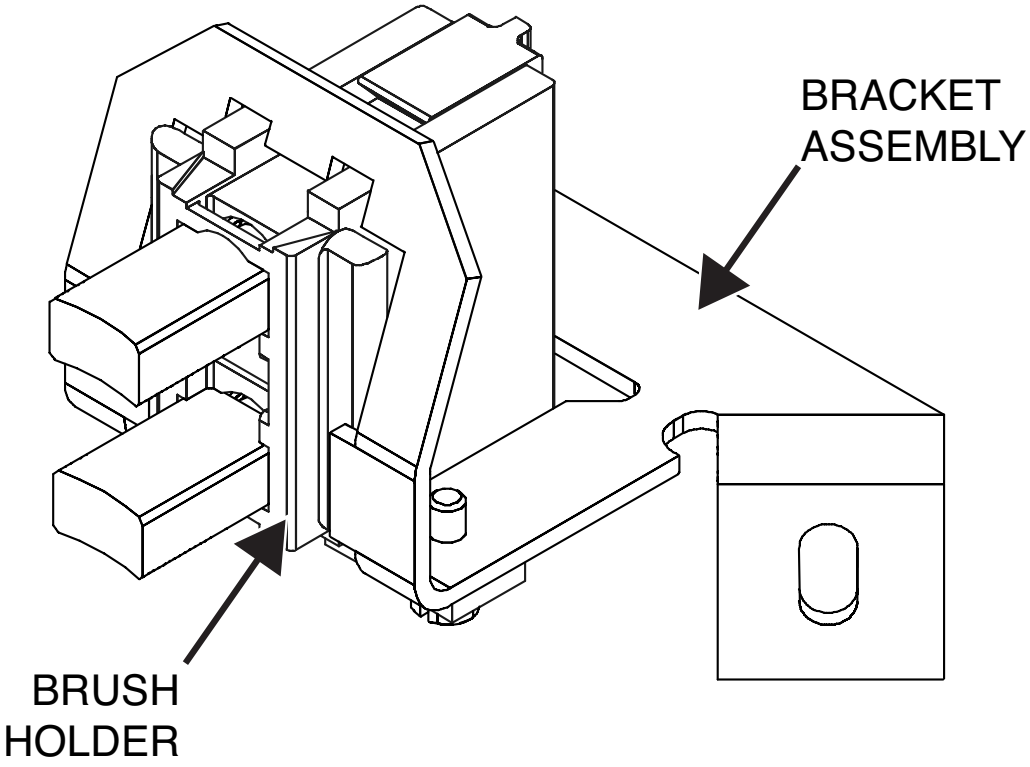
   A. If the rotor resistance is significantly higher or lower than specified above, the rotor is defective and should be replaced.

* **NOTE:** The resistance of the copper windings changes with temperature. Higher temperatures will slightly increase resistance while cooler temperatures will decrease resistance.

6. Using an ohmmeter, measure the resistance from one of the slip rings of the auxiliary rotor to a good, clean chassis ground. The resistance should be very high. Normal resistance to ground should be at least 500,000 ohms.
7. Examine the brushes and brush holders. See ***Figure F.42***. Replace the brushes if they exhibit excessive wear or visible damage of any kind.
8. When testing is complete, using a 3/8" nutdriver, attach the brush holder and bracket assemblies. Make sure the brushes and holders are in good condition and centered on the slip rings.
9. Connect the brush leads and replace any wire ties that had been removed. See Wiring Diagram.
10. Using a 3/8" nutdriver, attach the two screws securing the brush cover.
11. Perform the ***Case Cover Replacement Procedure***.

AUXILIARY ROTOR RESISTANCE TEST PROCEDURE (STATIC) *(continued)*

Figure F.42 – Auxiliary brush holder and bracket assembly



AUXILIARY ROTOR RESISTANCE TEST PROCEDURE (DYNAMIC)

⚠ 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

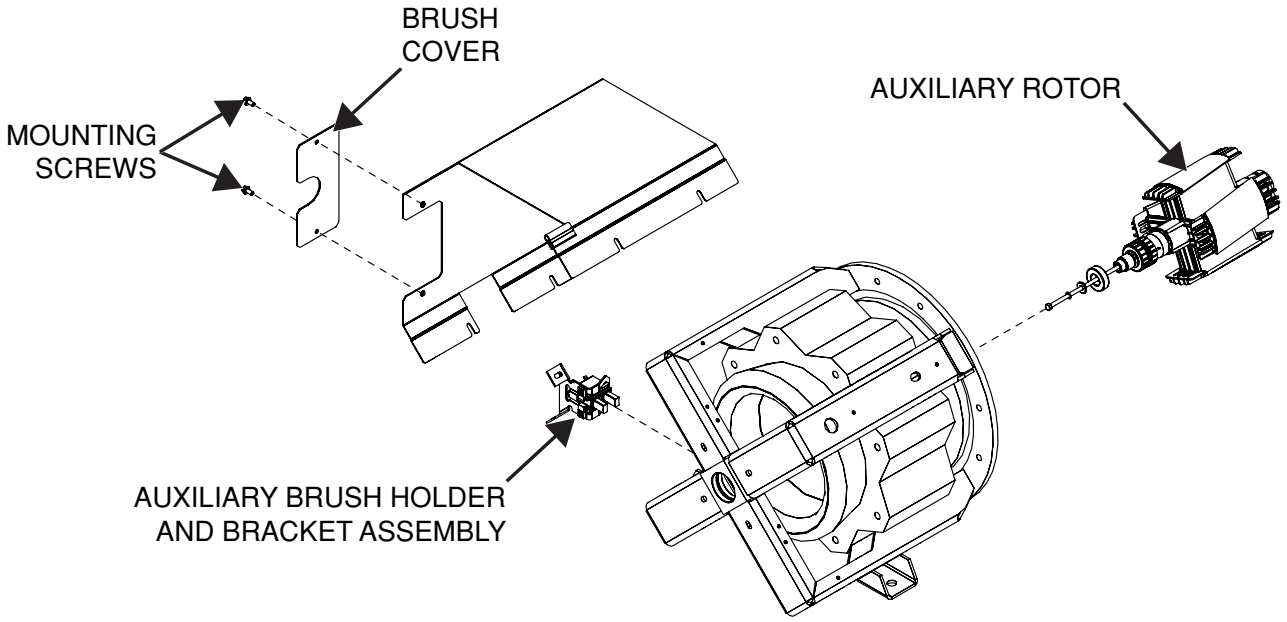
This test will help determine if the Auxiliary Rotor Winding is shorted, open or grounded while under the stress of centrifugal force.

MATERIALS NEEDED

3/8” Nutdriver
Analog Ohmmeter (digital meters typically will not perform properly for this test)
Wiring Diagram

AUXILIARY ROTOR RESISTANCE TEST PROCEDURE (DYNAMIC) *(continued)*

Figure F.43 – Auxiliary rotor brush cover removal

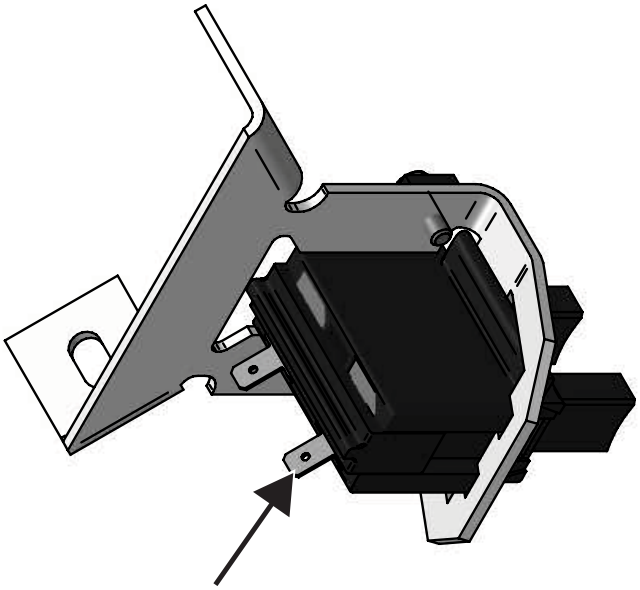


PROCEDURE

1. Turn off the Air Vantage 650.
2. Perform the ***Case Cover Removal Procedure***, for left side of machine.
3. Using a 3/8" nutdriver, remove the two screws securing the brush cover. See Figure F.43.
4. Label, disconnect and insulate the wires from both sets of brushes. See Wiring Diagram.
5. Check that the slip rings are clean and the brushes are in good condition, properly centered and seated on the rings.
6. Use an analog ohmmeter fitted with clips or terminals. Attach them to the brush terminals on the auxiliary rotor. See ***Figure F.44***.
7. Place the idle switch in the high position and start the engine.
8. The ohmmeter should read approximately 36 ohms.
9. Turn off the engine.
10. Remove one of the ohmmeter leads and attach it to a good clean chassis ground connection.
11. Start the engine and read the ohms. The resistance should be very high. 500,000 Ohms or higher is acceptable.
12. If ohmmeter reading is significantly different the rotor may be faulty. Perform the ***Rotors And Stators Removal And Replacement Procedure***, for the auxiliary rotor.
13. Turn off the Air Vantage 650.
14. Connect the brush leads and replace any cable ties that had been removed. See Wiring Diagram.
15. Using a 3/8" nutdriver, attach the two screws securing the brush cover.
16. Perform the ***Case Cover Replacement Procedure***.

AUXILIARY ROTOR RESISTANCE TEST PROCEDURE (DYNAMIC) *(continued)*

Figure F.44 – Auxiliary brush terminals location



WELD ROTOR VOLTAGE 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

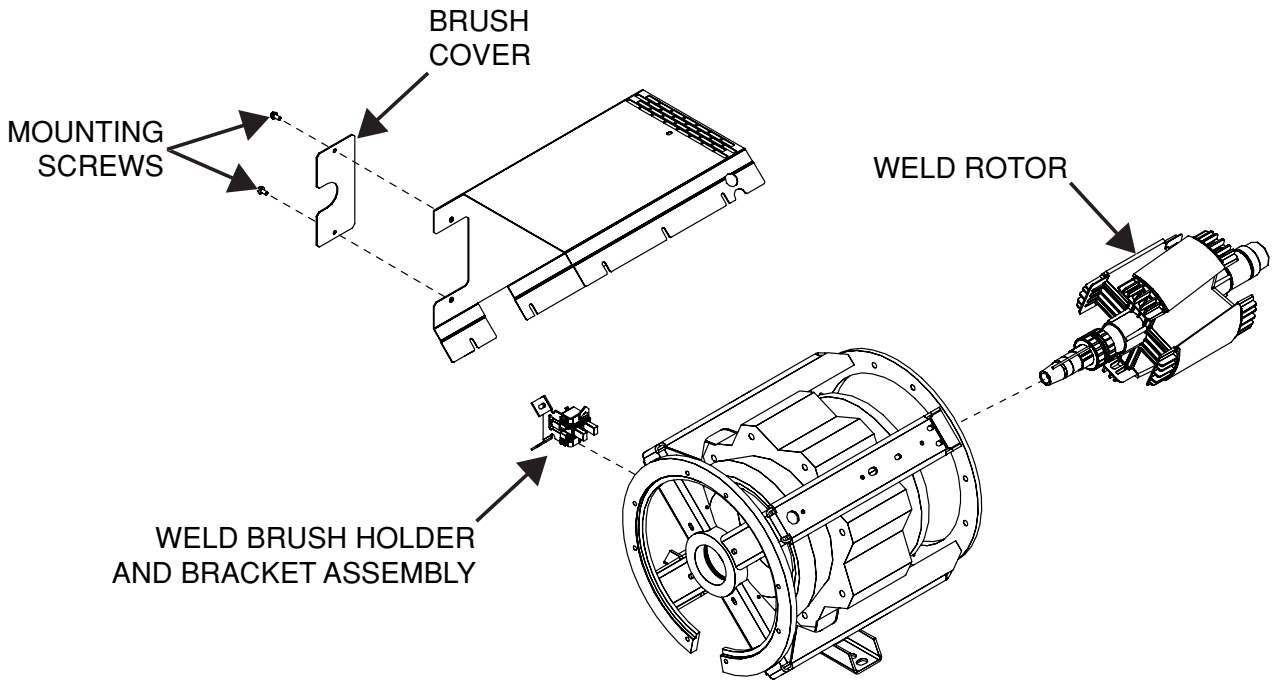
This test will help determine if the Weld Rotor (The Rotor closest to the Engine) is receiving the correct voltage from the Auxiliary Alternator.

MATERIALS NEEDED

3/8” Nutdriver
Volt/Ohmmeter
Wiring Diagram

WELD ROTOR VOLTAGE TEST PROCEDURE *(continued)*

Figure F.45 – Weld rotor brush cover removal



PROCEDURE

1. Turn off the Air Vantage 650.
2. Remove the side panels from the left side of the machine. See the ***Case Cover Removal Procedure***.
3. Using a 3/8" nutdriver, remove the two screws securing the brush cover from the alternator closest to the engine. See Figure F.45.
4. Using a volt/ohmmeter set for DC volts, attach the probes to the brush leads of the weld rotor. (The brush set closest to the engine). See ***Figure F.46***. See Wiring Diagram.
5. Start the engine and operate it at high RPM.
6. Observe the voltage on the meter. Normal voltage is about 170 VDC.
7. If normal voltage is not present:
   - The D1 field bridge rectifier may be defective.
   - Check for damaged leads or poor connections at leads #200C, 5F, #201C and F1. See ***Figure F.47***. See Wiring Diagram.
   - Check connections at D1 diode bridge. See ***Figure F.47***. See Wiring Diagram. Make certain lead 5F has continuity to frame ground.
   - Check connections at C1 capacitor. See ***Figure F.48***. See Wiring Diagram.
   - If voltage is low, perform the ***Engine RPM Test Procedure***, check or replace D1 diode bridge, check capacitor C1.
8. Using a 3/8" nutdriver, attach the two screws securing the brush cover. See Figure F.45.
9. Perform the ***Case Cover Replacement Procedure***.

WELD ROTOR VOLTAGE TEST PROCEDURE *(continued)*

Figure F.46 – Weld brush terminal locations

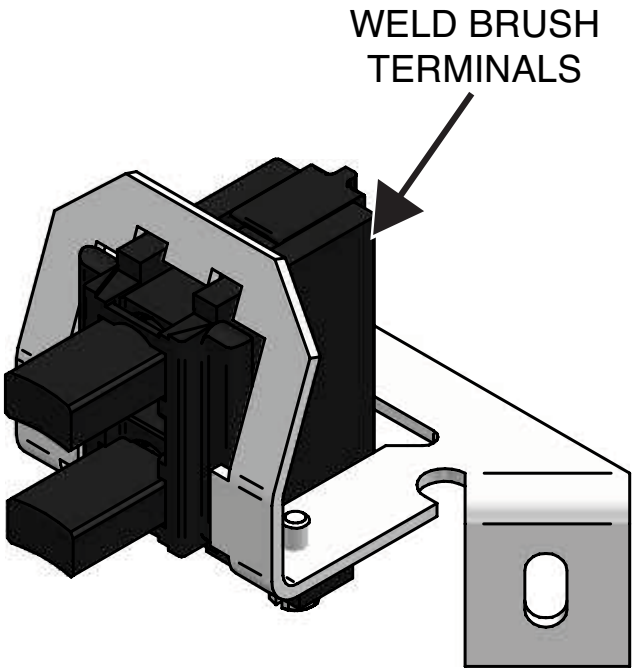
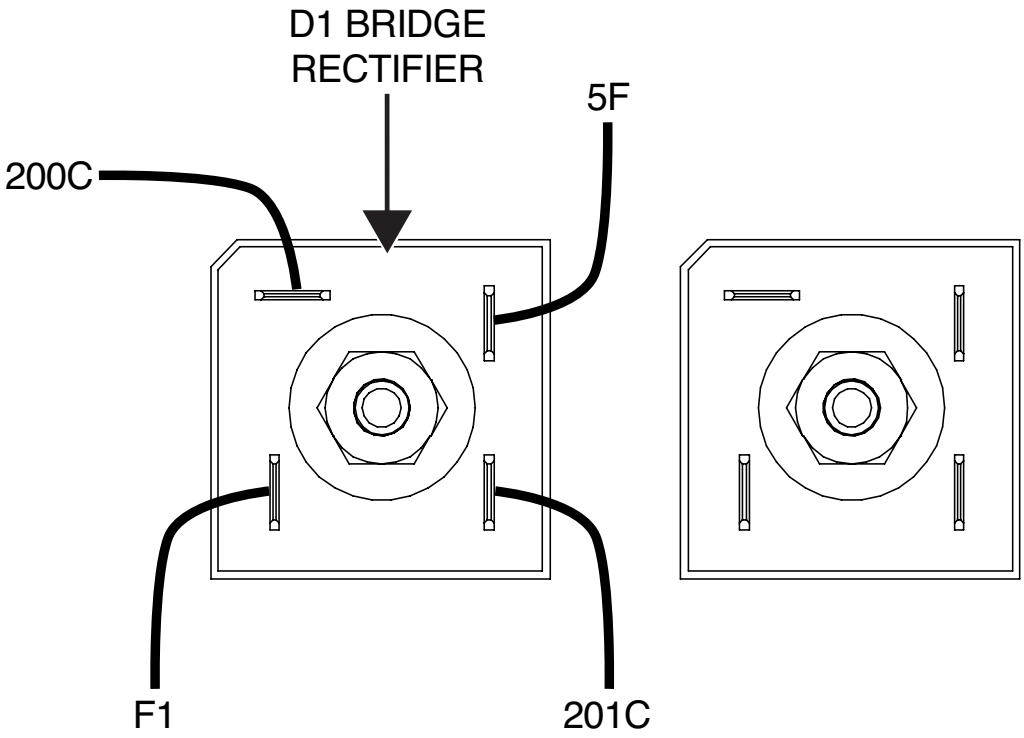
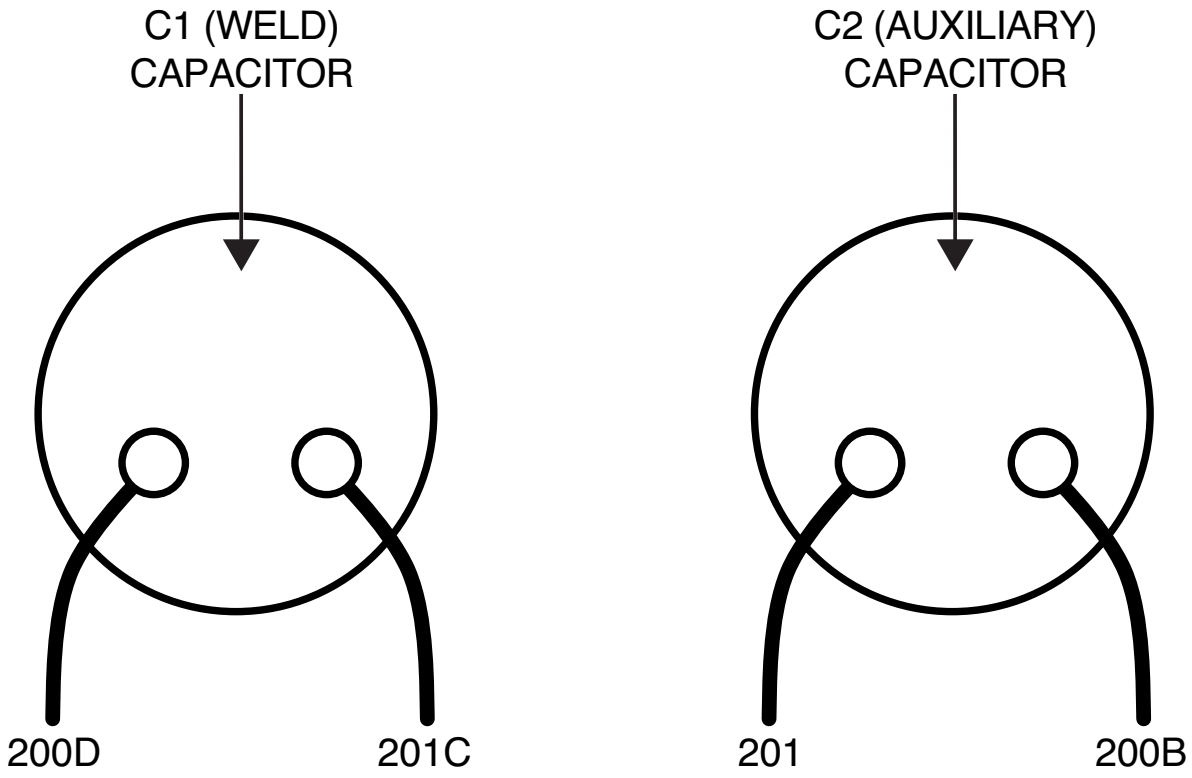


Figure F.47 – D1 diode bridge lead locations



WELD ROTOR VOLTAGE TEST PROCEDURE *(continued)*

Figure F.48 – C1 capacitor lead locations



WELD STATOR VOLTAGE 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

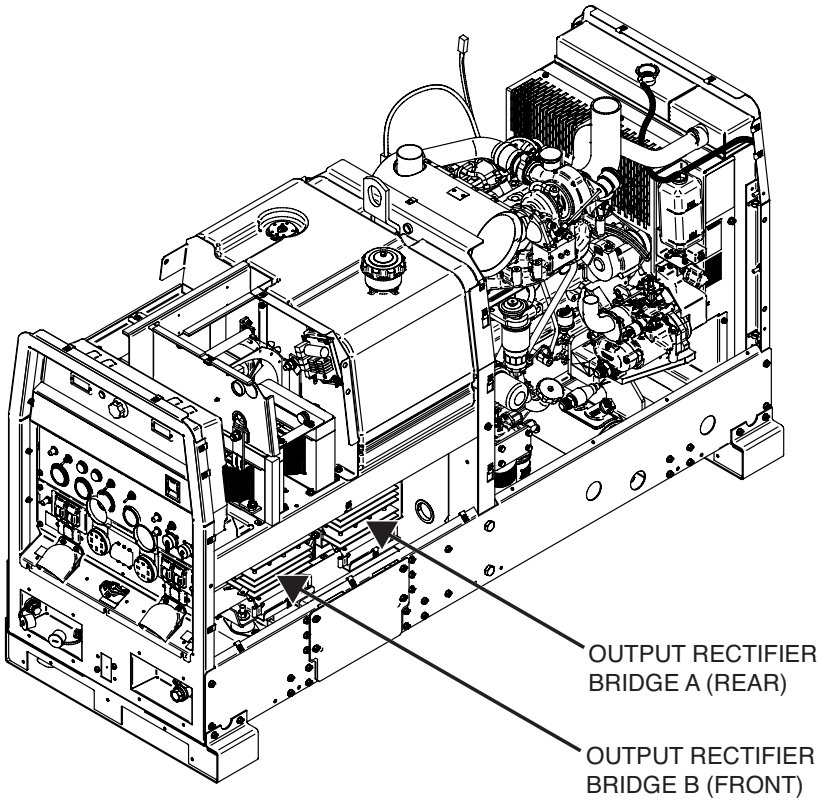
This test will determine if the correct AC voltages are being generated from the Weld Stator Windings. This test should only be done after it has been determined that Rotor voltages are normal for both Rotors.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

WELD STATOR VOLTAGE TEST PROCEDURE *(continued)*

Figure F.49 – Output rectifier locations



PROCEDURE

1. Turn off the Air Vantage 650.
2. Perform the ***Case Cover Removal Procedure***.
3. Locate the weld output rectifiers on the right side of the machine below fuel tank and output chokes. (operators right when facing the control panel). See Figure F.49.
4. Start the engine and place the idle switch in the high idle position.
5. Test for AC voltage at the AC input terminals (AC1, AC2, AC3) of one of the output rectifiers. Voltage should be 60 to 65 VAC for each of the three phases. Repeat the test for the other rectifier. See ***Figure F.50***. See Wiring Diagram.
6. Locate the 14 pin amphenol receptacle on the right side of the control panel. See ***Figure F.51***.
7. Place the wire feeder supply voltage switch in the 115 Volt position.
8. Using an volt/ohmmeter, test for approximately 120 VAC between pins “A” and “J”. See ***Figure F.52***.
9. Move switch to the 42 Volt position.
10. Using an volt/ohmmeter, test for approximately 42 VAC between pins “I” and “K”. See ***Figure F.52***.
11. If voltage is not present at any of these locations, make sure the weld rotor voltage and resistance is normal. Perform the ***Weld Rotor Voltage Test Procedure*** and ***Weld Rotor Resistance Test Procedures (Static And Dynamic)***.
12. If the rotor voltage and resistance values are normal and correct voltage is not present at one or more test points on the stator, check wiring, switches and circuit breakers between the windings and the test points. See Wiring Diagram.
13. If wiring, switches and breakers are all good, the weld stator may be faulty.
14. Perform the ***Case Cover Replacement Procedure***.

WELD STATOR VOLTAGE TEST PROCEDURE *(continued)*

Figure F.50 – Output rectifier bridge terminal locations

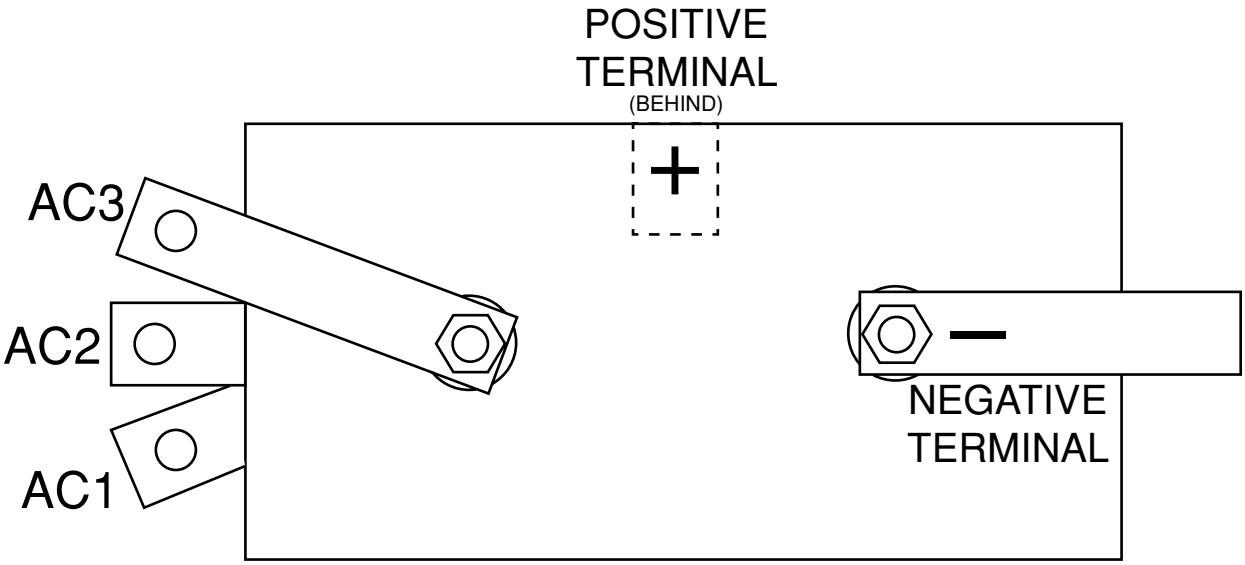
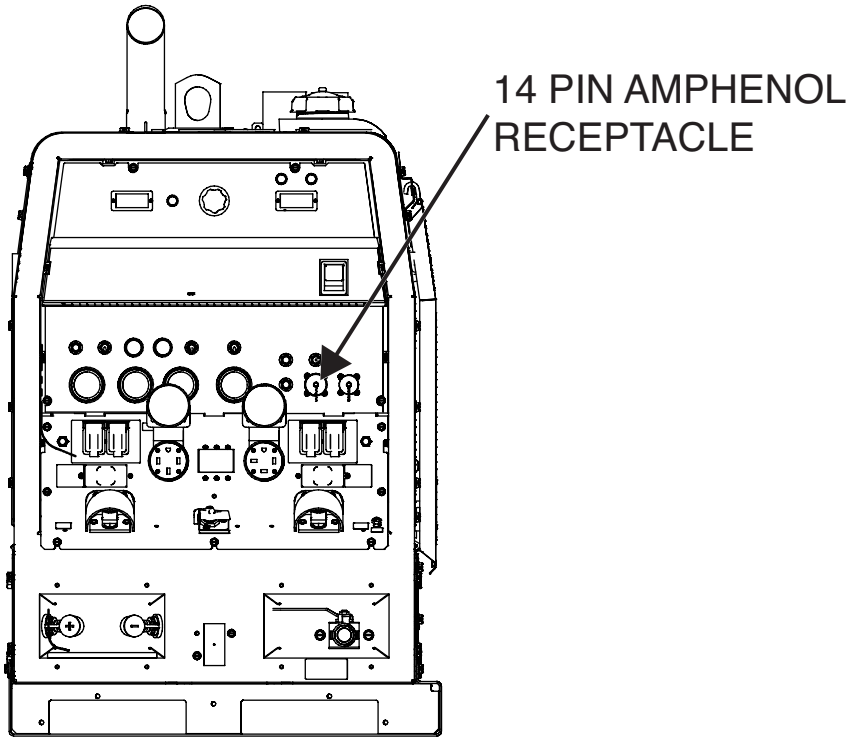
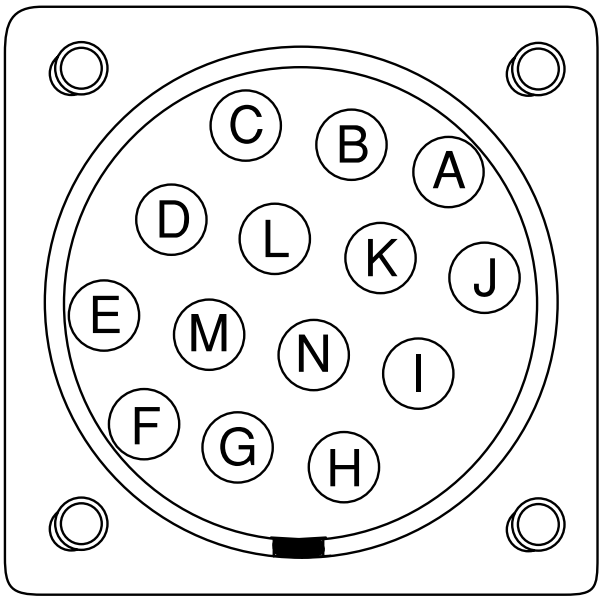


Figure F.51 – 14 pin amphenol receptacle location



WELD STATOR VOLTAGE TEST PROCEDURE *(continued)*

Figure F.52 – 14 pin amphenol receptacle test points



WELD ROTOR RESISTANCE TEST PROCEDURE (STATIC)

⚠ WARNING

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

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

TEST DESCRIPTION

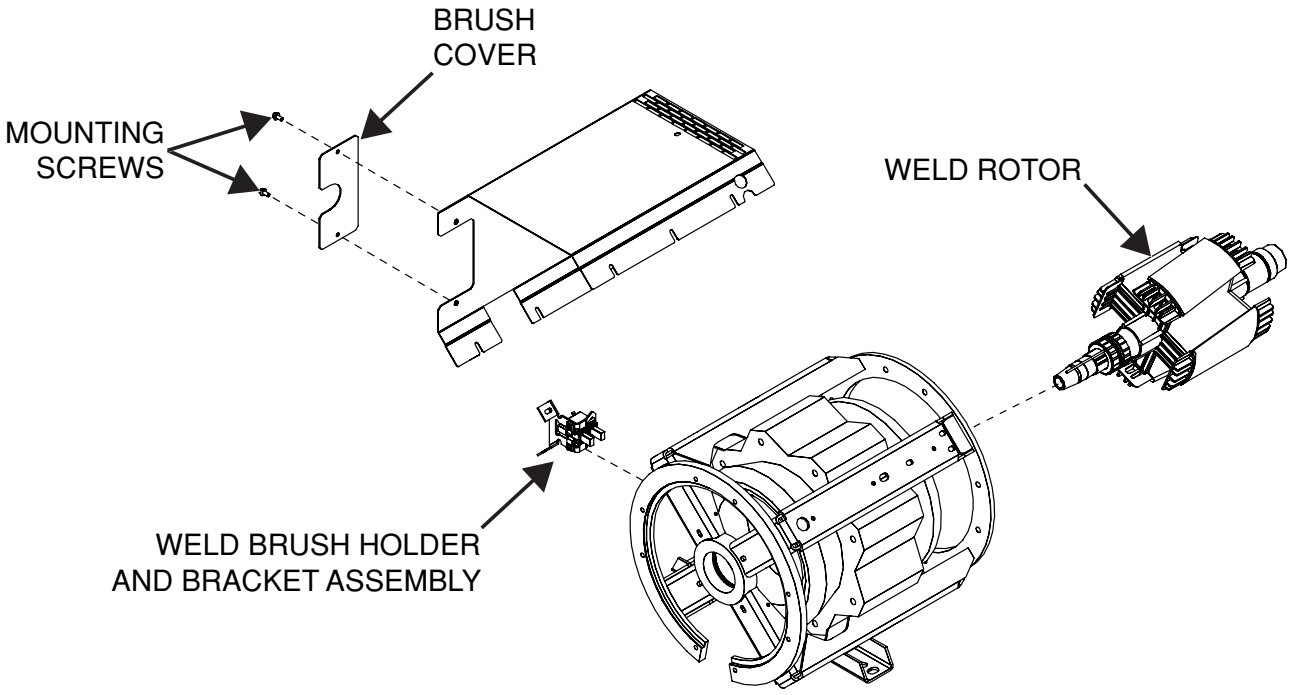
This test will determine if there is a shorted, open or grounded Winding in the Weld Rotor.

MATERIALS NEEDED

Ohmmeter
3/8” Nutdriver
Wiring Diagram

WELD ROTOR RESISTANCE TEST PROCEDURE (STATIC) *(continued)*

Figure F.53 – Weld rotor brush holder removal



PROCEDURE

1. Turn off the Air Vantage 650.
2. Perform the ***Case Cover Removal Procedure***, for left side of machine.

NOTE: This test will be performed with the engine OFF and the battery disconnected.

3. Using a 3/8” nutdriver, remove the two screws securing the brush cover. See Figure F.53.
4. Using a 3/8” nutdriver, remove the brush holder and bracket assembly. See Figure F.53.
5. Using an ohmmeter, measure the resistance across the slip rings of the weld rotor. The weld rotor resistance should measure about 25 Ohms at 75 deg. F*.

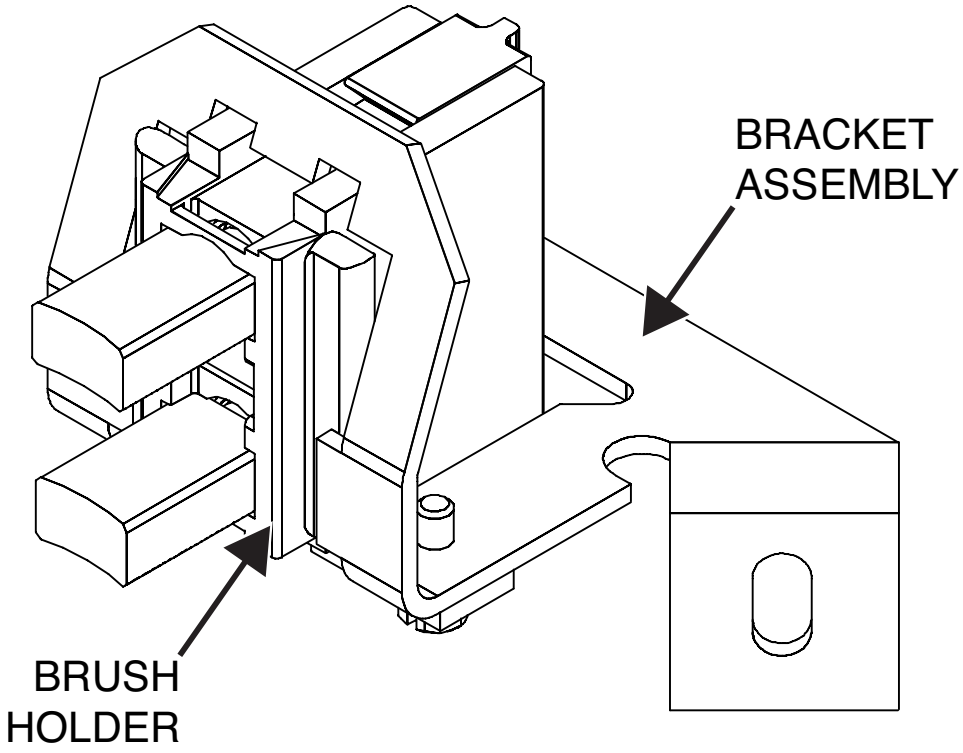
   A. If the rotor resistance is significantly higher or lower than specified above, the rotor is defective and should be replaced.

* **NOTE:** The resistance of the copper windings changes with temperature. Higher temperatures will slightly increase resistance while cooler temperatures will decrease resistance.

6. Using an ohmmeter, measure the resistance from one of the slip rings of the weld rotor to a good, clean chassis ground. The resistance should be very high. Normal resistance to ground should be at least 500,000 ohms.
7. Examine the brushes and brush holders. See ***Figure F.54***. Replace the brushes if they exhibit excessive wear or visible damage of any kind.
8. When testing is complete, using a 3/8” nutdriver, attach the brush holder and bracket assemblies. Make sure the brushes and holders are in good condition and centered on the slip rings.
9. Connect the brush leads and replace any cable ties that had been removed. See Wiring Diagram.
10. Using a 3/8” nutdriver, attach the two screws securing the brush cover.
11. Perform the ***Case Cover Replacement Procedure***.

WELD ROTOR RESISTANCE TEST PROCEDURE (STATIC) *(continued)*

Figure F.54 – Weld brush holder and bracket assembly



WELD ROTOR RESISTANCE TEST PROCEDURE (DYNAMIC)

⚠ 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

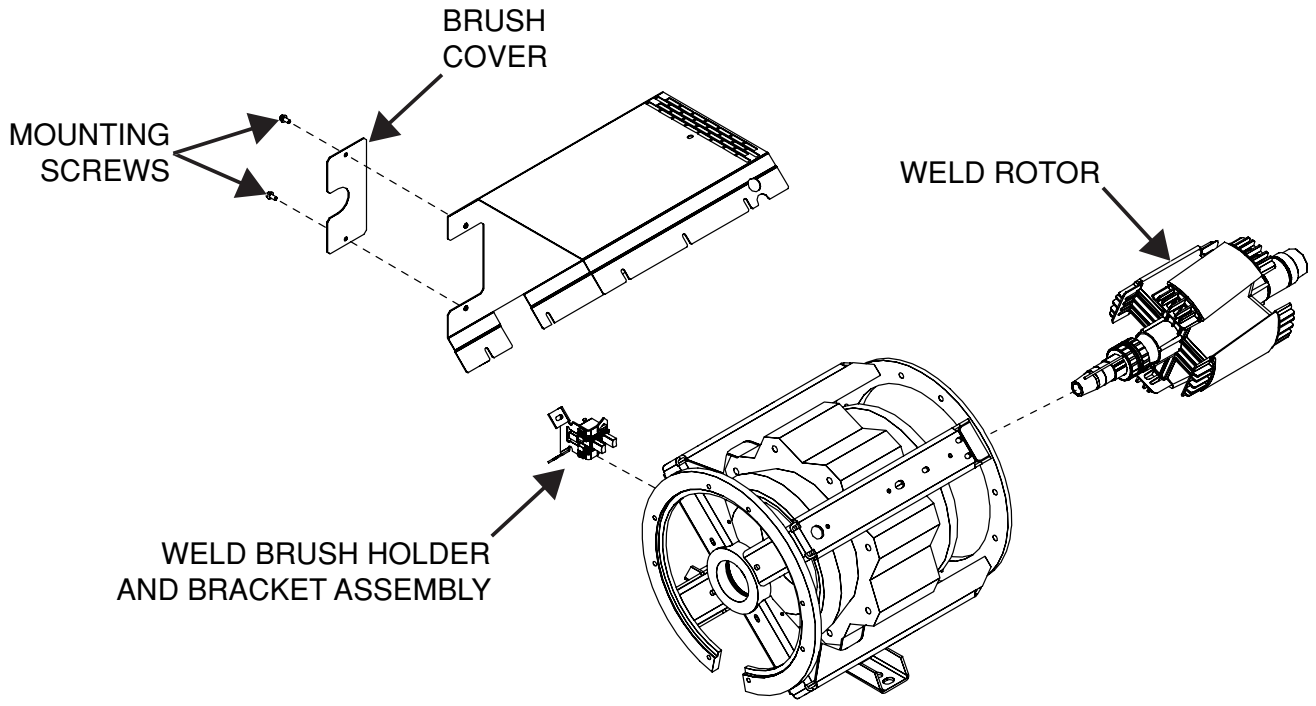
This test will help determine if the Weld Rotor Winding is shorted, open or grounded while under the stress of centrifugal force.

MATERIALS NEEDED

3/8" Nutdriver
Analog Ohmmeter (digital meters typically will not perform properly for this test)
Wiring Diagram

WELD ROTOR RESISTANCE TEST PROCEDURE (DYNAMIC) *(continued)*

Figure F.55 – Weld rotor brush cover removal

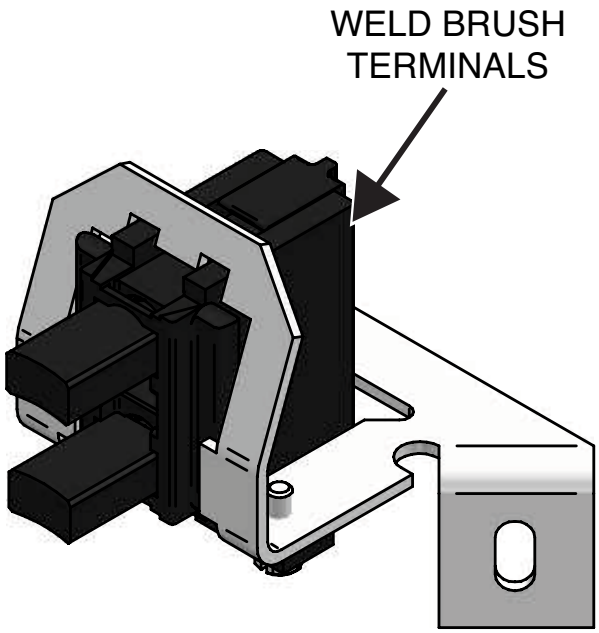


PROCEDURE

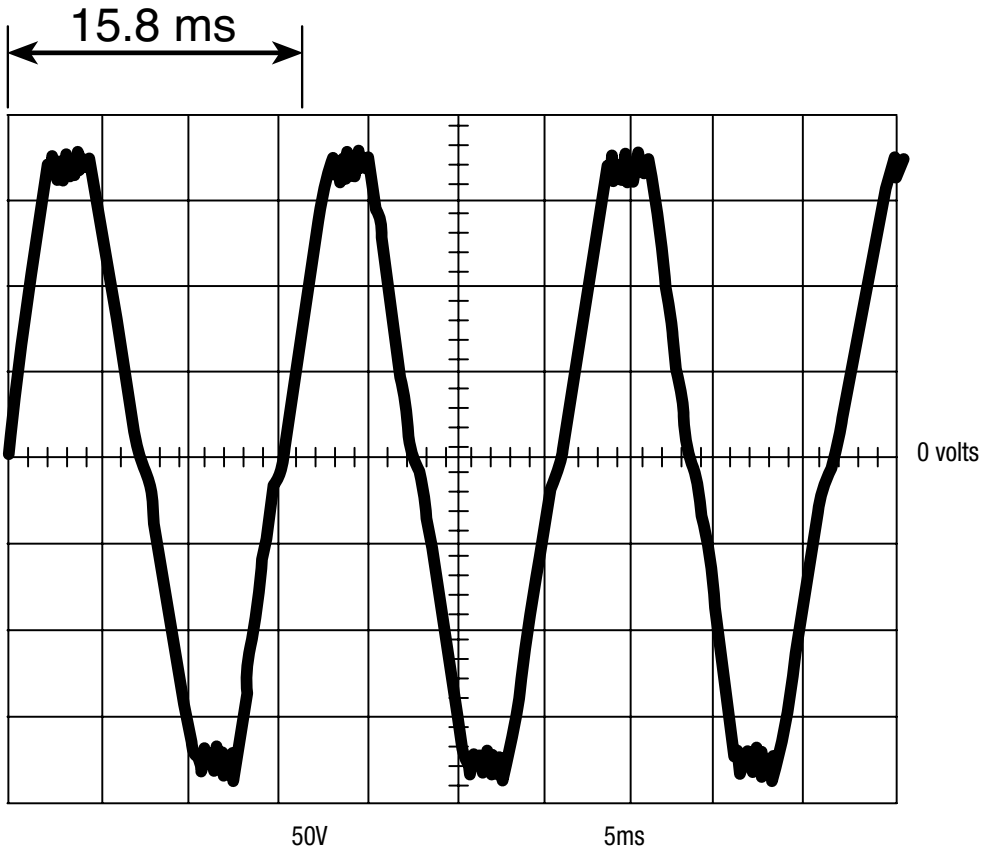
1. Turn off the Air Vantage 650.
2. Perform the ***Case Cover Removal Procedure***, for left side of machine.
3. Using a 3/8” nutdriver, remove the two screws securing the brush covers. See Figure F.55.
4. Label, disconnect and insulate the wires from both sets of brushes. See Wiring Diagram.
5. Check that the slip rings are clean and the brushes are in good condition, properly centered and seated on the rings.
6. Use an analog ohmmeter fitted with clips or terminals. Attach them to the brush terminals on the weld rotor. See ***Figure F.56***.
7. Place the idle switch in the high position and start the engine.
8. The ohmmeter should read approximately 25 ohms.
9. Turn off the engine.
10. Remove one of the ohmmeter leads and attach it to a good clean chassis ground connection.
11. Start the engine and read the ohms. The resistance should be very high. 500,000 Ohms or higher is acceptable.
12. If ohmmeter reading is significantly different the rotor may be faulty. Perform the ***Rotors And Stators Removal And Replacement Procedure***, for the weld rotor.
13. Turn off the Air Vantage 650.
14. Connect the brush leads and replace any cable ties that had been removed. See Wiring Diagram.
15. Using a 3/8” nutdriver, attach the two screws securing the brush cover.
16. Perform the ***Case Cover Replacement Procedure***.

WELD ROTOR RESISTANCE TEST PROCEDURE (DYNAMIC) *(continued)*

Figure F.56 – Weld brush terminal locations



NORMAL OPEN CIRCUIT VOLTAGE WAVEFORM (115VAC SUPPLY) HIGH IDLE – NO LOAD

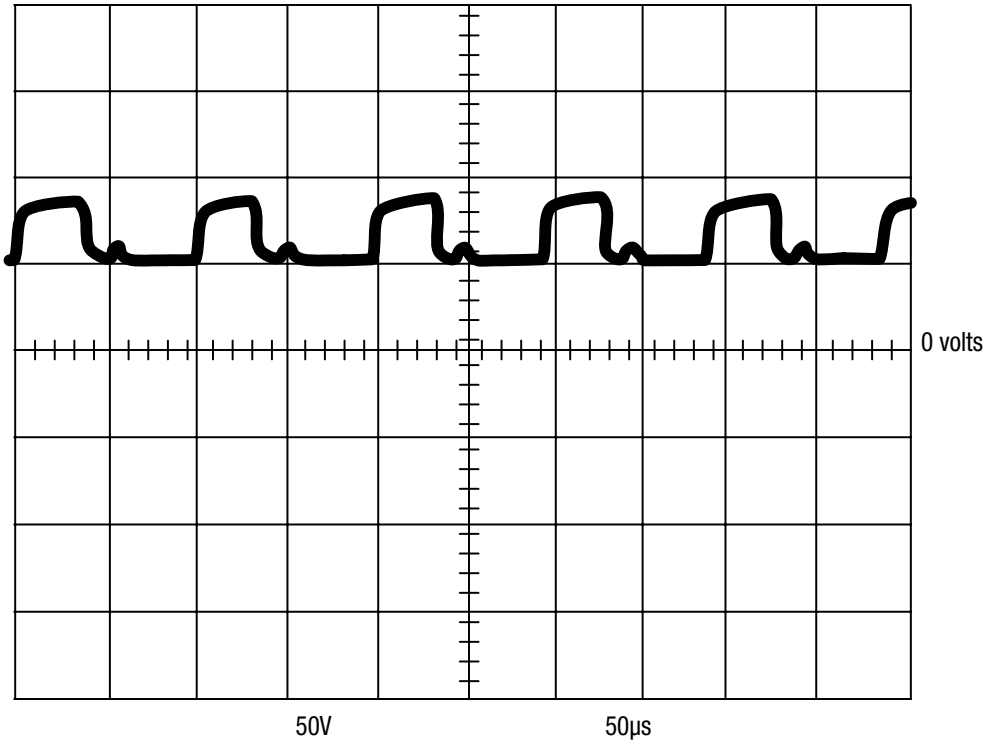


This is the typical auxiliary output voltage generated from a properly operating machine. Note that each vertical division represents 50 volts and that each horizontal division represents 5 milliseconds in time.

NOTE: Scope probes are connected at 115VAC receptacle.

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

NORMAL OPEN CIRCUIT VOLTAGE WAVEFORM (STICK) MAX CONTROL POT – HIGH IDLE – NO LOAD

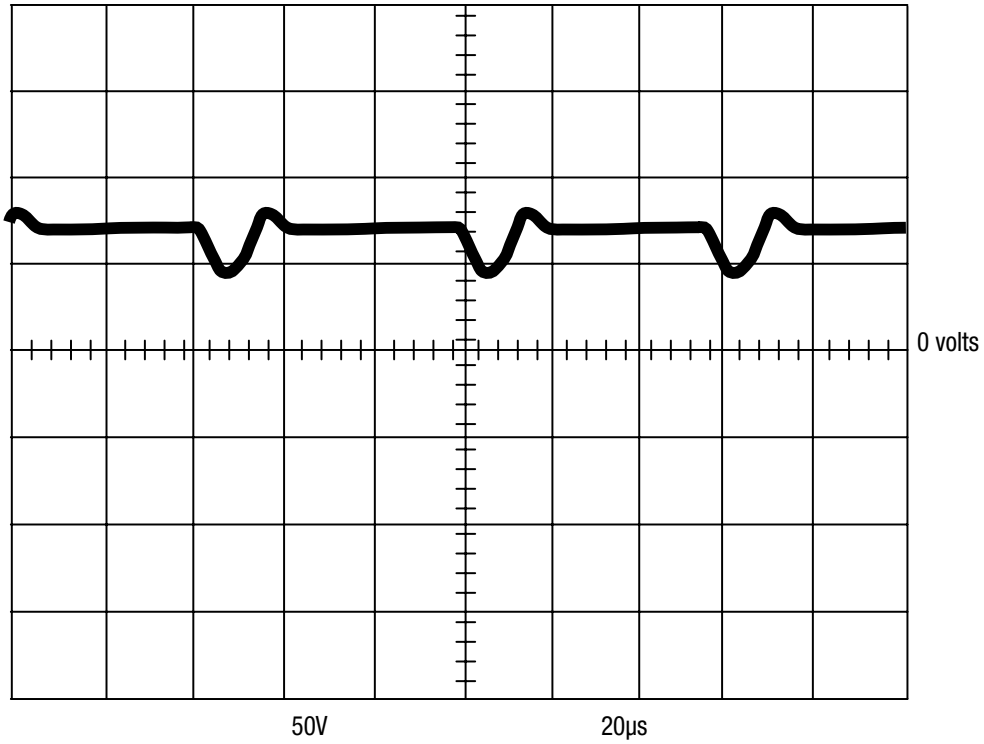


This is the typical DC open circuit output voltage generated from a properly operating machine in the Constant Current (CC) mode.

Note that each vertical division represents 50 volts and that each horizontal division represents 50 milliseconds in time.

SCOPE SETTINGS	
Volts/Div	50V/Div.
Horizontal Sweep	50 µs/Div.
Coupling	DC
Trigger	Internal

NORMAL WELD VOLTAGE WAVEFORM (STICK CC) MACHINE LOADED TO 175 AMPS AT 66 VOLTS



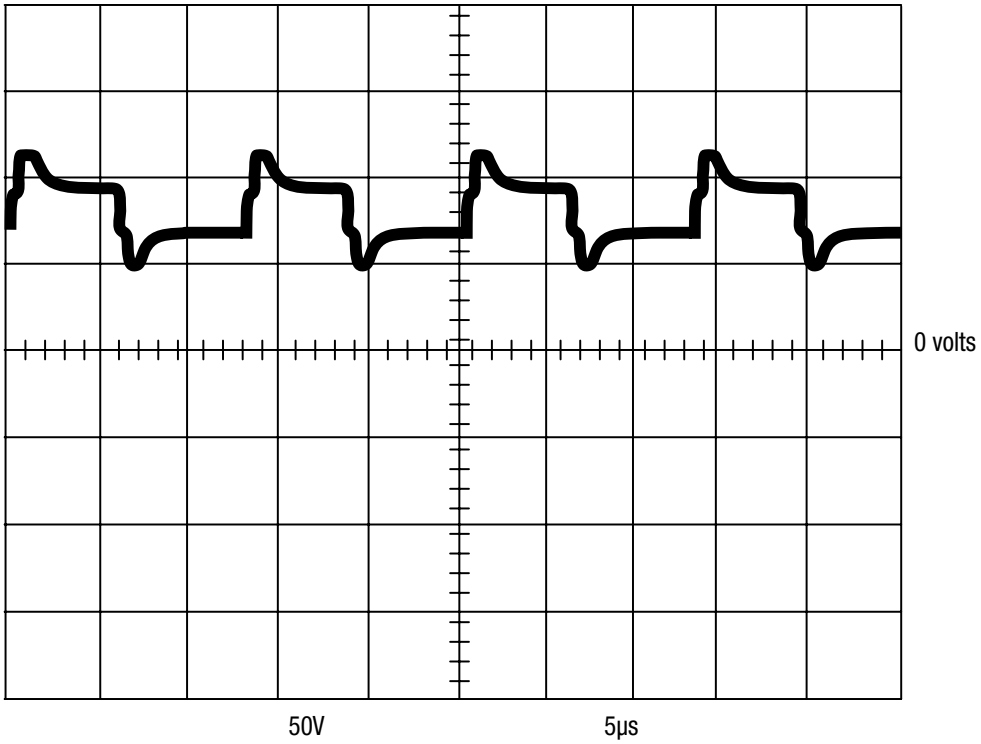
This is the typical DC output voltage generated from a properly operating machine in the Constant Current (CC) mode.

Note that each vertical division represents 20 volts and that each horizontal division represents 20 milliseconds in time.

The machine was loaded with a resistance grid bank to 175 amps at 66 volts.

SCOPE SETTINGS	
Volts/Div	50V/Div.
Horizontal Sweep	20 µs/Div.
Coupling	DC
Trigger	Internal

NORMAL WELD VOLTAGE WAVEFORM (WIRE CV) MACHINE LOADED TO 100 AMPS AT 36 VOLTS



This is the typical DC output voltage generated from a properly operating machine in the Constant Voltage (CV) mode.

Note that each vertical division represents 20 volts and that each horizontal division represents 20 milliseconds in time.

The machine was loaded with a resistance grid bank to 100 amps at 36 volts.

SCOPE SETTINGS	
Volts/Div	20V/Div.
Horizontal Sweep	20 µs/Div.
Coupling	DC
Trigger	Internal

DIODE BRIDGE RECTIFIER
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 D1 and D2 Diode Bridge Rectifiers.

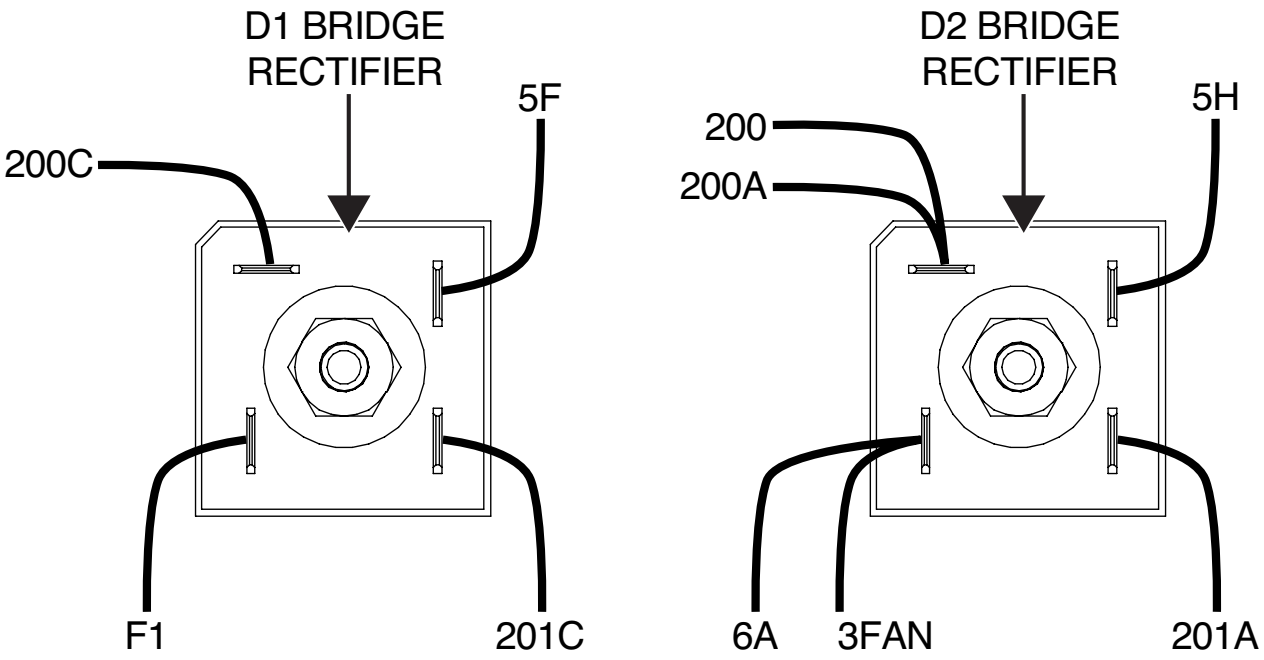
MATERIALS NEEDED

3/8” Nutdriver
Wiring Diagram
Dow Corning 340 Heat Sink Compound (Lincoln T12837)

DIODE BRIDGE RECTIFIER

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.57 – Diode bridge rectifier leads



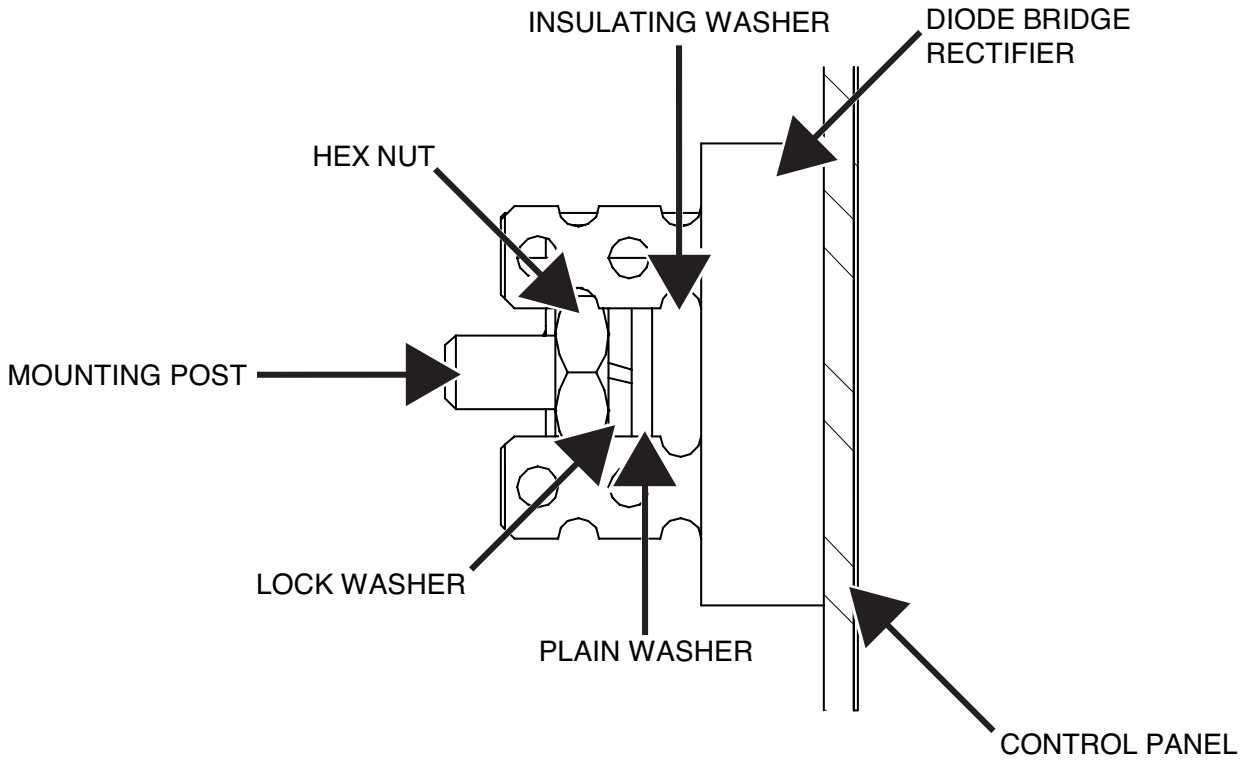
REMOVAL PROCEDURE

1. Turn off the Air Vantage 650.
2. Lower the control panel. See the ***Case Cover Removal Procedure***.
3. Label and disconnect leads 200C, 5F, F1 and 201C from D1 diode bridge rectifier or leads 200, 200A, 5H, 6A, 3FAN and 201A from D2 diode bridge rectifier. See Figure F.57. See Wiring Diagram.
4. Using a 3/8" nutdriver, remove the hex nut, lock washer, plain washer and insulating washer securing the diode bridge rectifier to the control panel. See ***Figure F.58***. Note washer placement for reassembly.
5. The diode bridge rectifier can now be removed and replaced.

DIODE BRIDGE RECTIFIER

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.58 – Diode bridge rectifier removal



REPLACEMENT PROCEDURE

1. Apply a thin coating of Dow Corning 340 heat sink compound (Lincoln T12837) to the rear of the new diode bridge rectifier.
2. Carefully position the new diode bridge rectifier on to the mounting post on the rear of the control panel.
3. Using a 3/8" nutdriver, attach the insulating washer, plain washer, lock washer and hex nut securing the diode bridge rectifier to the machine.
4. Connect leads 200C, 5F, F1 and 201C to D1 diode bridge rectifier and/or leads 200, 200A, 5H, 6A, 3FAN and 201A to D2 diode bridge rectifier. See Wiring Diagram.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

ELECTRONIC ENGINE GOVERNOR MODULE 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 Electronic Engine Governor Module (Engine Speed Control).

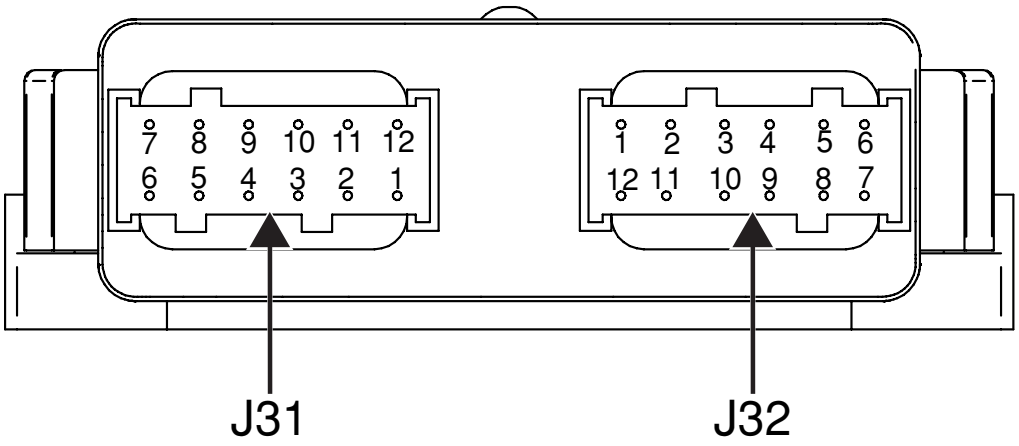
MATERIALS NEEDED

3/8” Nutdriver
Wiring Diagram

ELECTRONIC ENGINE GOVERNOR MODULE

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.59 – Electronic engine governor plugs

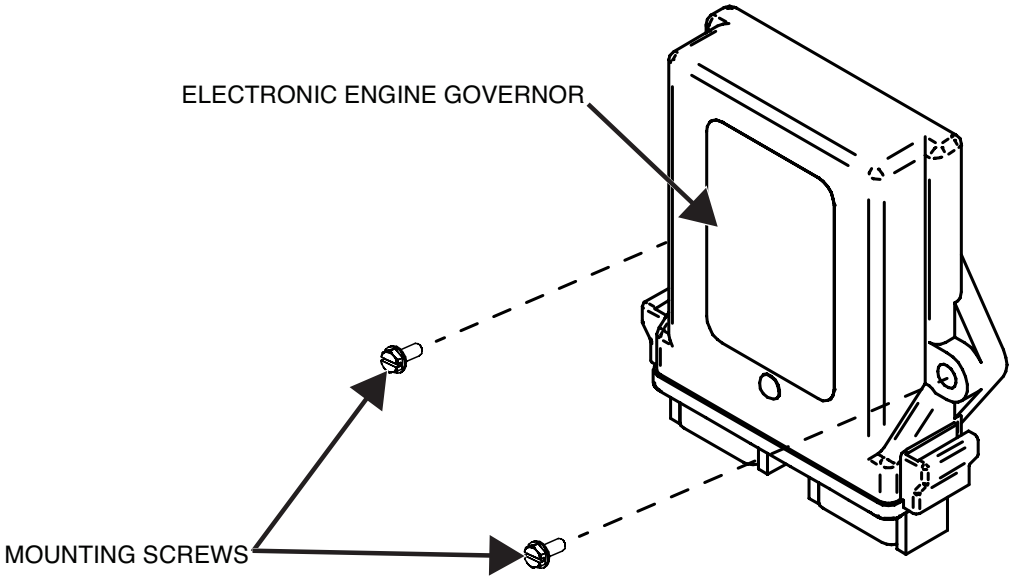


REMOVAL PROCEDURE

1. Turn off the Air Vantage 650.
2. Perform the ***Case Cover Removal Procedure***.
3. Label and disconnect plugs from J31 and J32 on the electronic engine governor. See Figure F.59. See Wiring Diagram.
4. Using a 3/8” nutdriver, remove the two screws securing the electronic engine governor to the machine. See ***Figure F.60***.
5. The electronic engine governor can now be removed and replaced.

ELECTRONIC ENGINE GOVERNOR MODULE
REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.60 – Mounting screw locations



REPLACEMENT PROCEDURE

1. Carefully position new electronic engine governor module onto the machine.
2. Using a 3/8” nutdriver, attach the two screws securing the electronic engine governor to the machine.
3. Connect the previously removed plugs to J31 and J32 on the electronic engine governor. See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

BLOW DOWN SOLENOID AND PRESSURE SWITCH 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

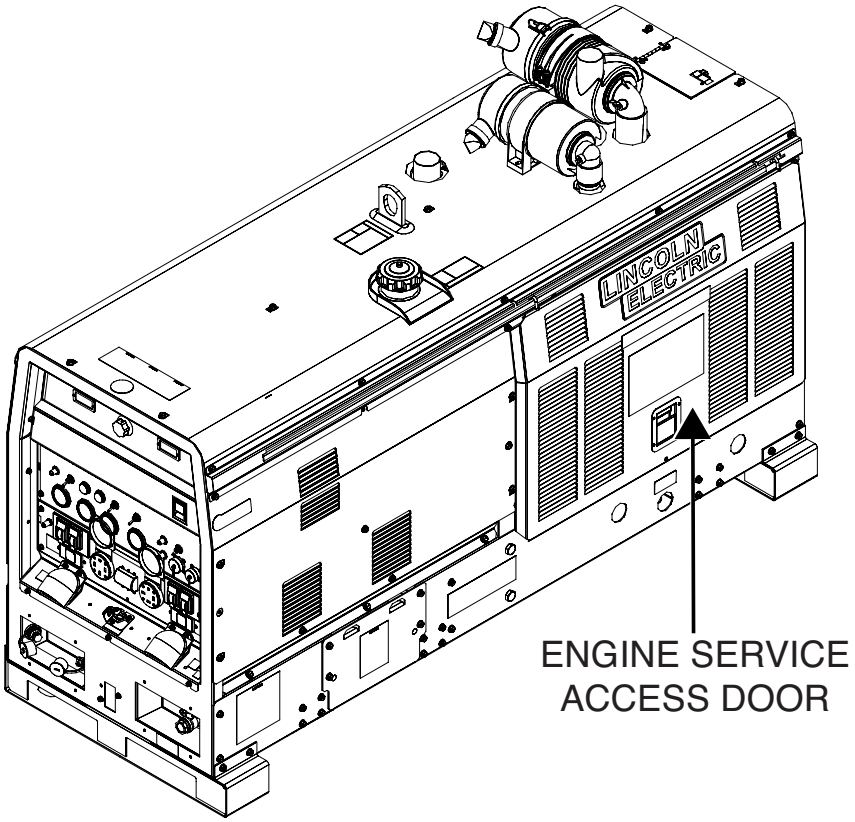
This procedure will aid the technician in the removal and replacement of the Blow Down Solenoid and the Pressure Switch.

MATERIALS NEEDED

Phillips Screwdriver
Needle Nose Pliers
Two 7/16” Open End Wrenches
3/8” Nutdriver
Wiring Diagram

BLOW DOWN SOLENOID AND PRESSURE SWITCH REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.61 – Engine Service Access Door location



REMOVAL PROCEDURE

1. Turn off the Air Vantage 650.
2. Open the engine service access door. See Figure F.61.
3. Remove the rubber boot covering the pressure switch.
4. Using a phillips screwdriver, loosen the two screws securing leads VM6 and VM7 to the pressure switch. Label and disconnect the leads. See ***Figure F.62***. See Wiring Diagram.
5. Using needle nose pliers, disconnect the air hose from the pressure switch. See ***Figure F.63***.
6. Using two open end 7/16" wrenches, remove the nut and washer securing the pressure switch to the bottle bracket. See ***Figure F.64***. The pressure switch can now be removed form the machine.
7. Label and disconnect the plug (leads VM12 and VM13) from the solenoid. See Wiring Diagram. Cut cable ties as necessary.
8. Using needle nose pliers, disconnect air hoses from the rear of the solenoid assembly. See ***Figure F.63***.
9. Carefully slide the coolant bottle up and off of the bottle bracket. This will allow access to the solenoid mounting screw. See ***Figure F.65***.
10. Using a 3/8" nutdriver, remove the mounting screw securing the solenoid assembly to the bottle bracket. See ***Figure F.66***.

BLOW DOWN SOLENOID AND PRESSURE SWITCH REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.62 – Pressure switch lead locations

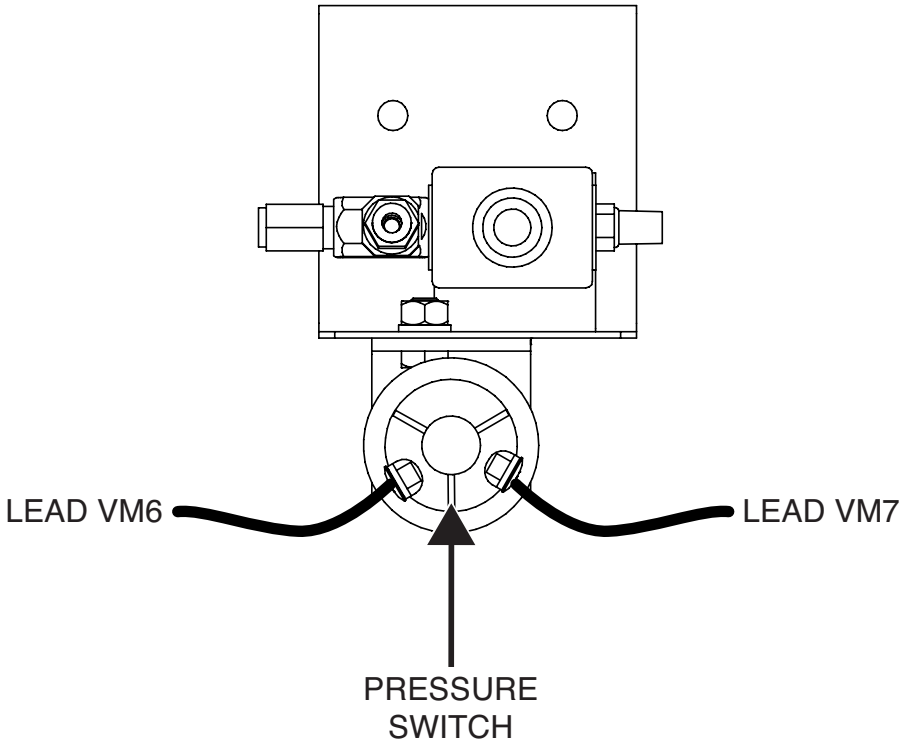
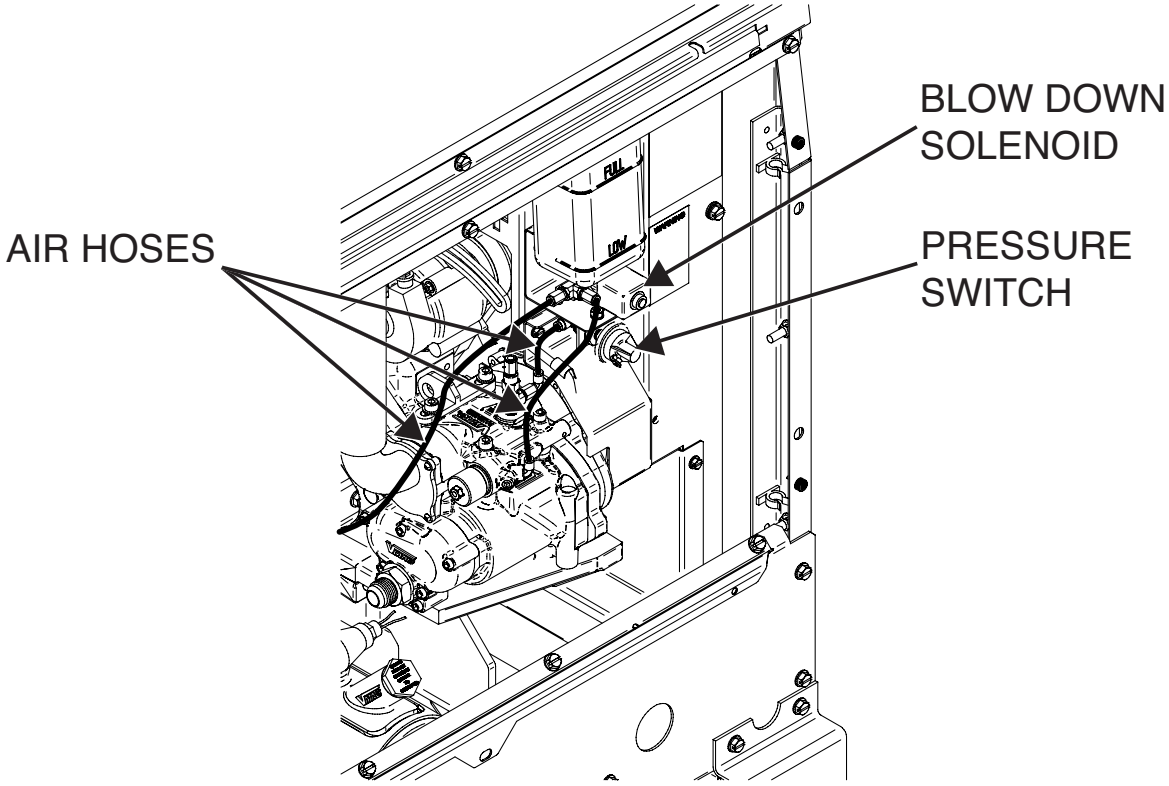


Figure F.63 – Air hose locations



BLOW DOWN SOLENOID AND PRESSURE SWITCH REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.64 – Pressure switch removal

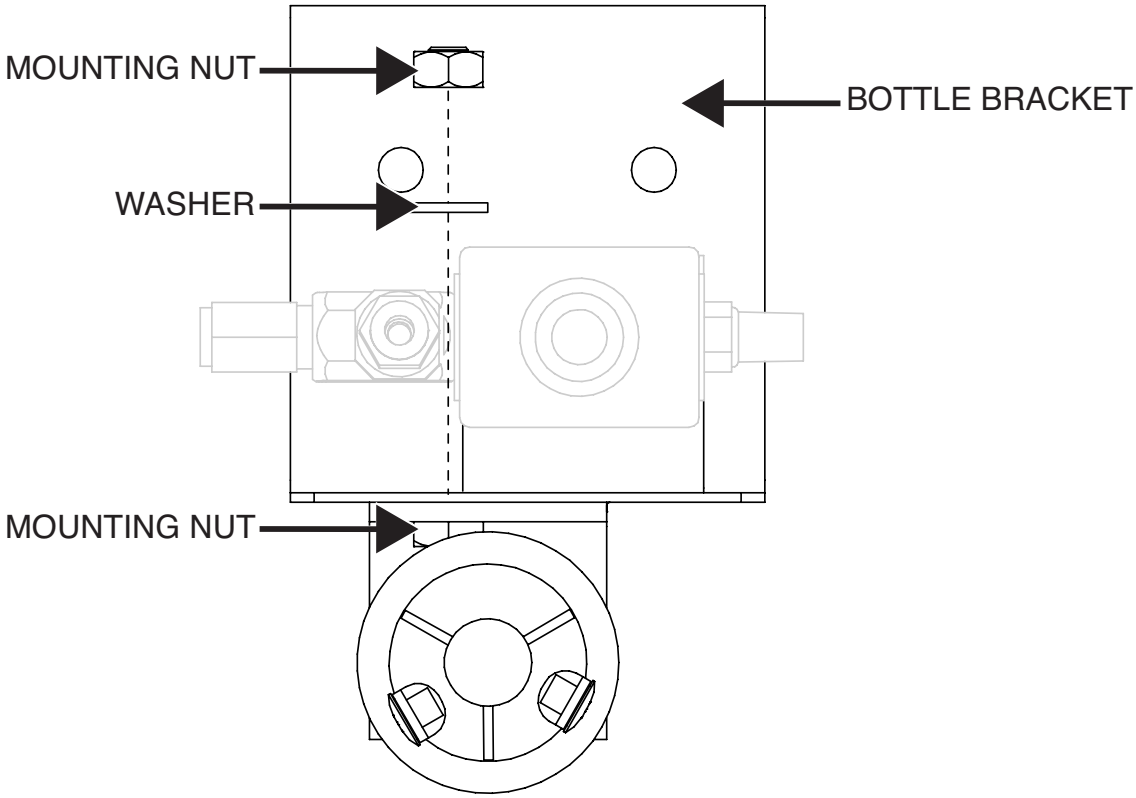
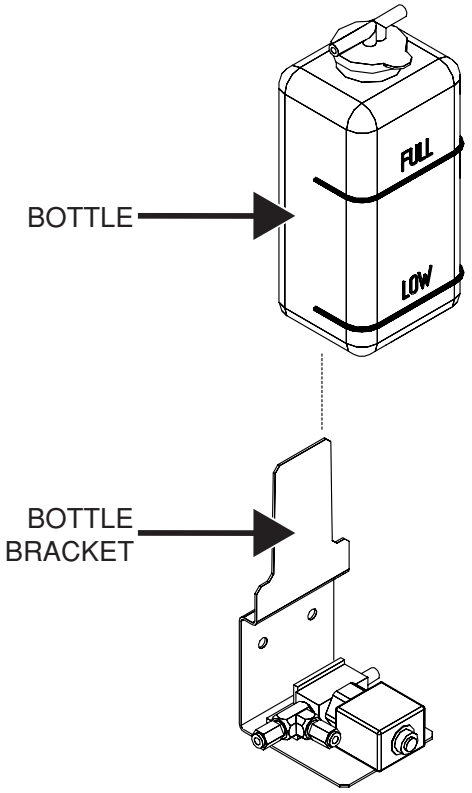
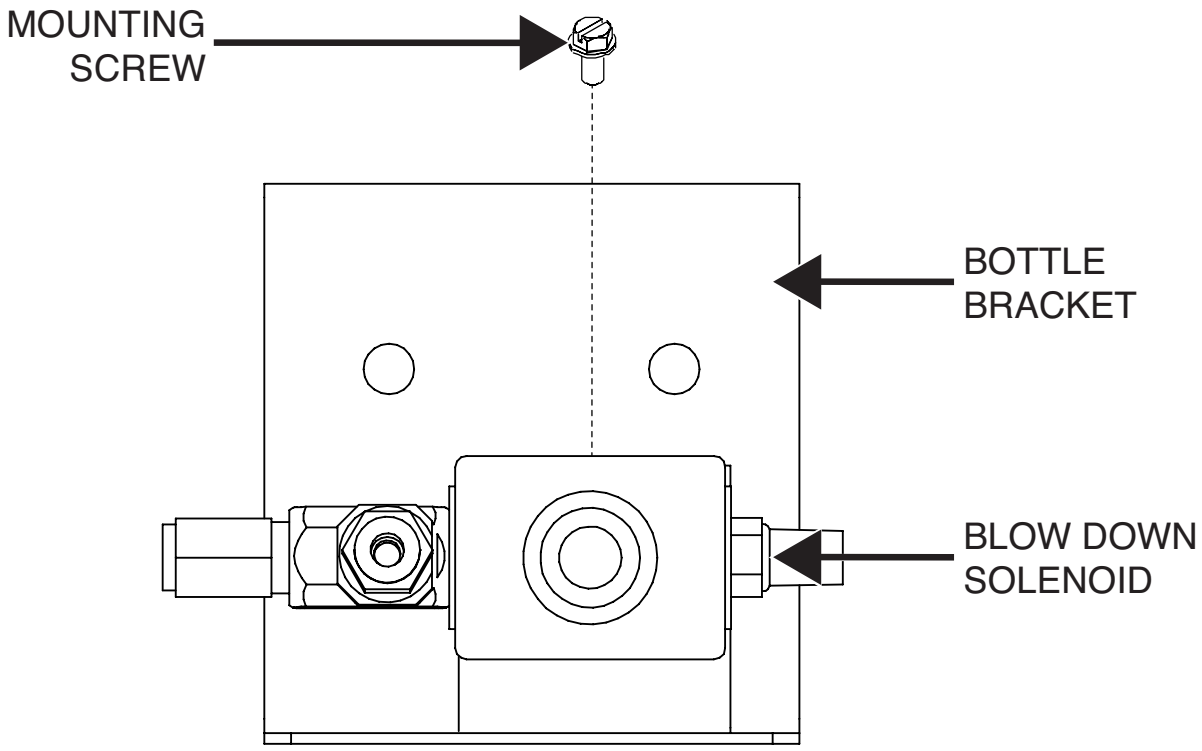


Figure F.65 – Bottle removal



BLOW DOWN SOLENOID AND PRESSURE SWITCH REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.66 – Solenoid removal



REPLACEMENT PROCEDURE

1. Using two open end 7/16” wrenches, attach the nut and washer securing the pressure switch to the bottle bracket.
2. Using needle nose pliers, connect the air hose to the pressure switch.
3. Using a phillips screwdriver, tighten the two screws connecting leads VM6 and VM7 to the pressure switch. See Wiring Diagram.
4. Attach the rubber boot covering the pressure switch.
5. Carefully slide the coolant bottle up and off of the bottle bracket. This will provide access to mount the solenoid.
6. Using a 3/8” nutdriver, attach the mounting screw securing the solenoid assembly to the bottle bracket.
7. Using needle nose pliers, connect air hoses to the rear of the solenoid assembly.
8. Connect the solenoid plug (leads VM12 and VM13). See Wiring Diagram. Attach cable ties as necessary.
9. Close and secure the engine service door.
10. Perform the ***Retest After Repair Procedure***.

WELD CONTROL BOARD
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 Weld Control Board.

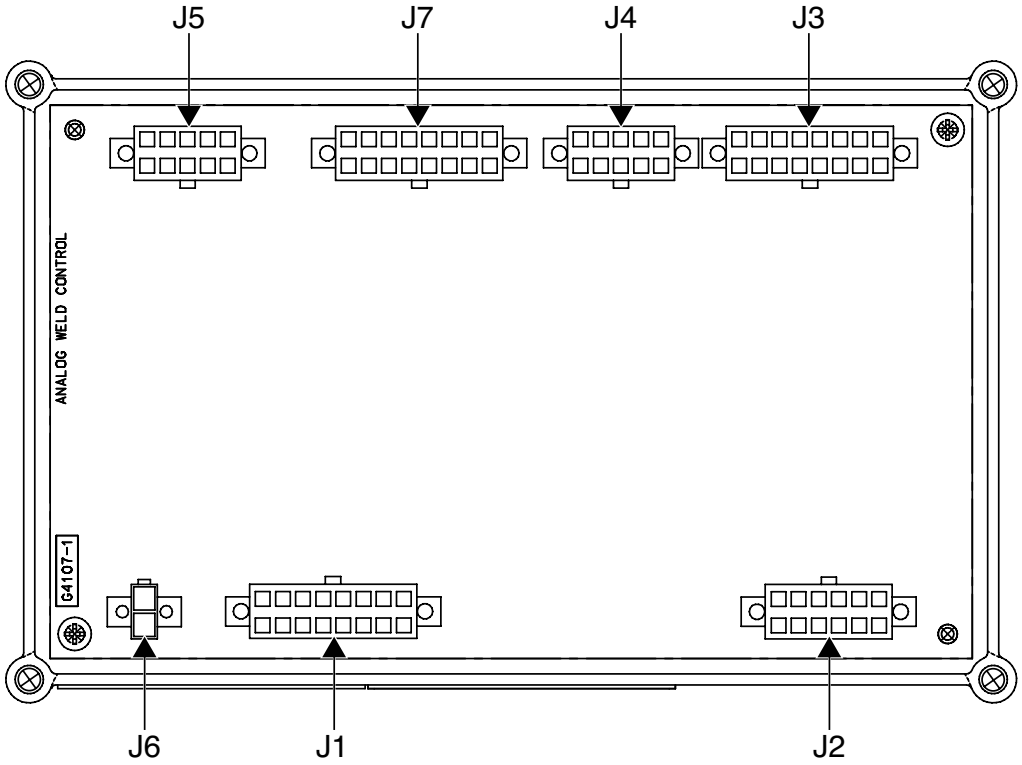
MATERIALS NEEDED

Phillips Screwdriver
Wiring Diagram

WELD CONTROL BOARD

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.67 – Weld control board plug locations



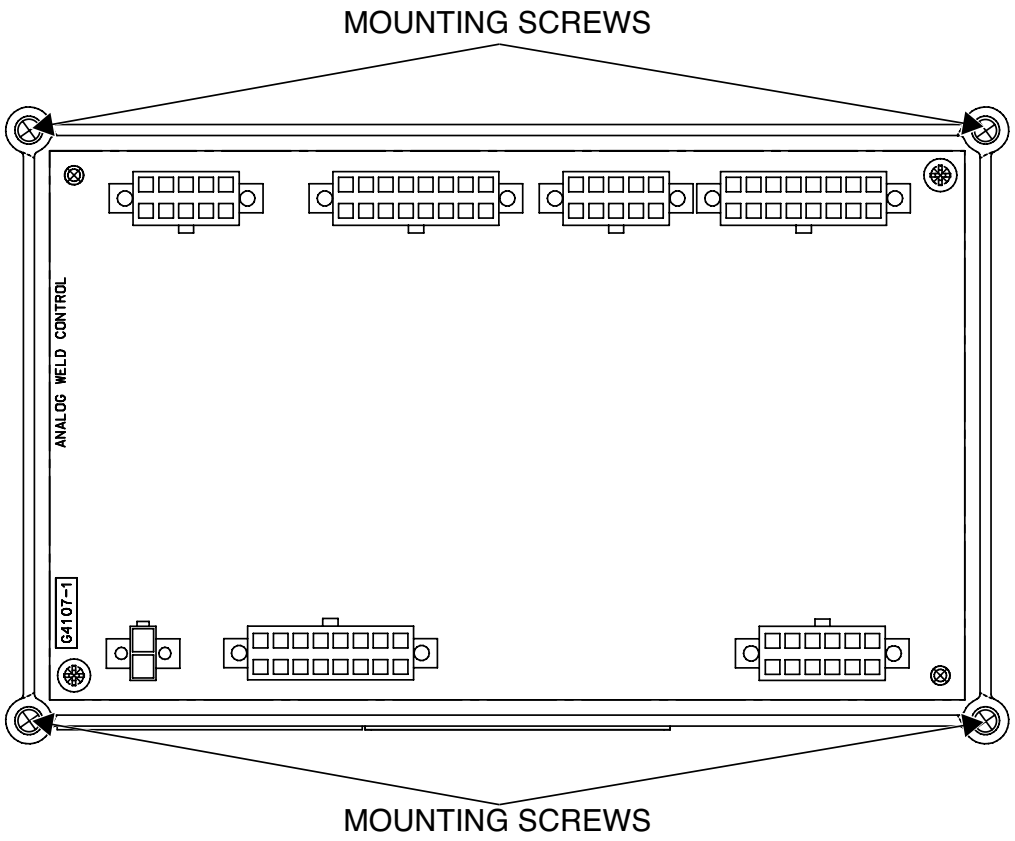
REMOVAL PROCEDURE

1. Turn off the Air Vantage 650.
2. Lower the control panel, see the ***Case Cover Removal Procedure***.
3. Label and disconnect plugs J1, J2, J3, J4, J5, J6 and J7 from the weld control board. See Figure F.67. See Wiring Diagram.
4. Using a phillips screwdriver, remove the four screws securing the weld control board to the PC board mounting bracket. See ***Figure F.68***.
5. The weld control board can now be removed and replaced.

WELD CONTROL BOARD

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.68 – Weld control board mounting screws



REPLACEMENT PROCEDURE

1. Carefully position the new weld control board onto the PC board mounting bracket.
2. Using a phillips screwdriver, attach the four screws securing the weld control board to the machine.
3. Connect plugs J1, J2, J3, J4, J5, J6 and J7 to the weld control board. See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

AIR COMPRESSOR
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 Air Compressor.

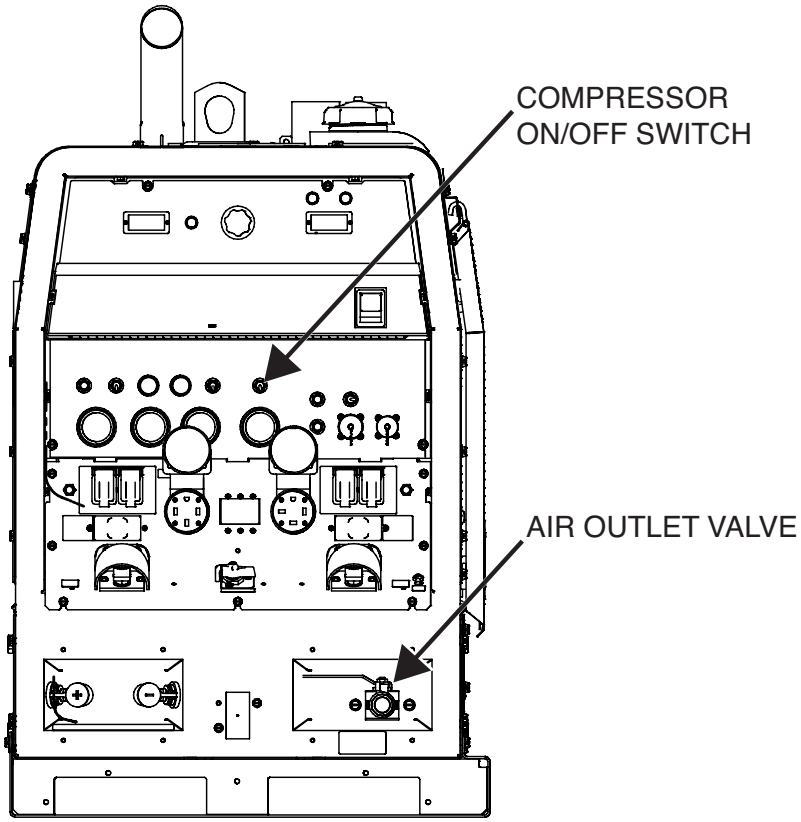
MATERIALS NEEDED

Two 1-1/4” Open End Wrenches
Two 7/8” Open End Wrenches
Slotted Screwdriver
3/8” Socket With Extension
3/8” Drive Ratchet or Similar Tool
1/2” Socket

AIR COMPRESSOR

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.69 – Compressor ON/OFF switch and air outlet valve locations



REMOVAL PROCEDURE

1. Turn off the compressor switch and wait for system to depressurize through the blow down solenoid. See Figure F.69.
2. Turn off the Air Vantage 650.
3. Perform the ***Case Cover Removal Procedure***.
4. After the pressure has dissipated, open the air outlet valve at the front of the Air Vantage 650. See Figure F.69.
5. Label and disconnect the air and oil lines from the compressor. See ***Figure F.70***.
   A. To disconnect the small plastic lines, peel back the corrugated sleeving from the plastic line. Push the line into the fitting, then press and hold down the release collar. The plastic line can now be pulled straight out.
   B. The large lines can be removed using appropriate sized open end wrenches. When tightening these fittings a second wrench should be used to hold the portion of the fitting on the compressor pump to avoid damaging the pump. Use two 1-1/4” open end wrenches for the large air hose on the side of the compressor. Use two 7/8” open end wrenches for the large air hose on the bottom of the compressor.
6. Using a slotted screwdriver, loosen the hose clamp securing the air intake hose to the air compressor and remove the air intake hose. See ***Figure F.71***.
7. Using a 3/8” socket with extension, remove the two screws securing the belt guard and remove the belt guard. See ***Figure F.72***.
8. Using a 3/8” drive ratchet or a similar tool, use an upward motion to relieve the tension on the compressor drive belt and remove the compressor drive belt. See ***Figure F.73***.
9. Label and disconnect the wires from the electric clutch pulley of the compressor. See Wiring Diagram. Cut any cable ties as necessary.
10. Using a 1/2” socket, remove the three bolts, lock washers and flat washers securing the compressor to the compressor mounting bracket. See ***Figure F.74***.
11. To separate the air compressor from the engine assembly it is necessary to slide the compressor bracket off the threaded stud on the rear of the alternator.
12. The air compressor can now be removed and replaced.

AIR COMPRESSOR

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.70 – Air and oil hose location and connection points

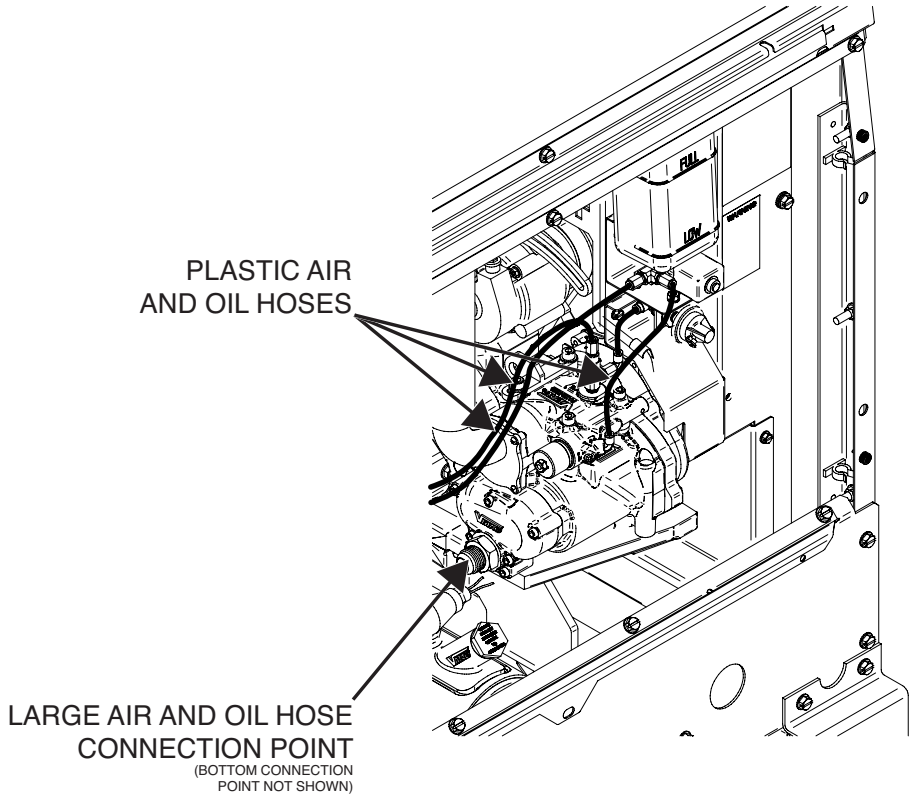
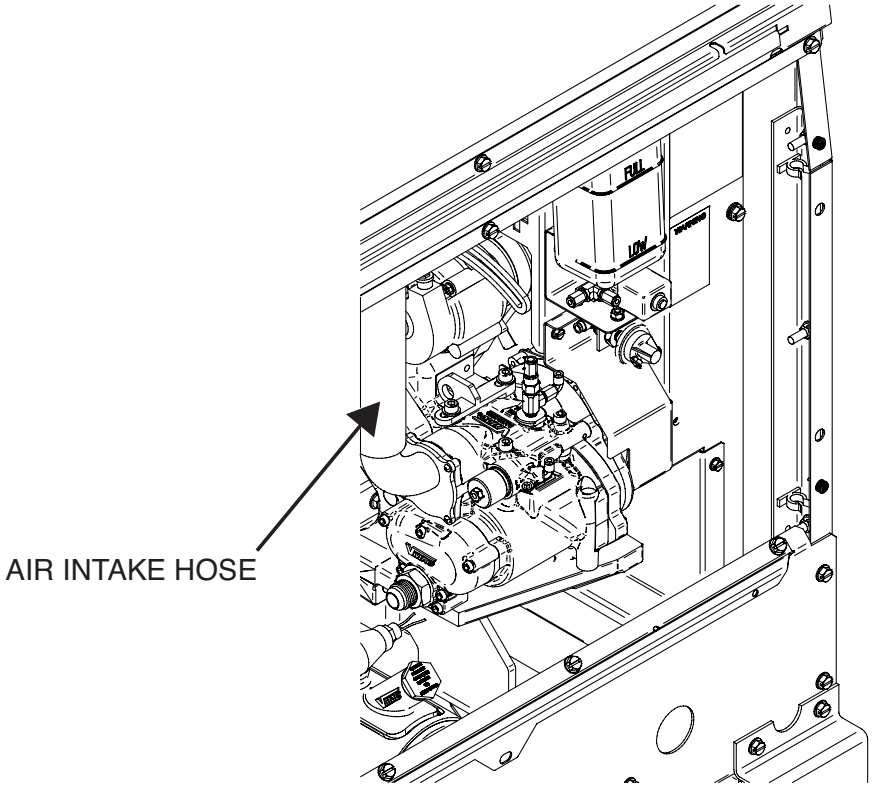


Figure F.71 – Air intake hose location



AIR COMPRESSOR

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.72 – Belt guard location and mounting screws

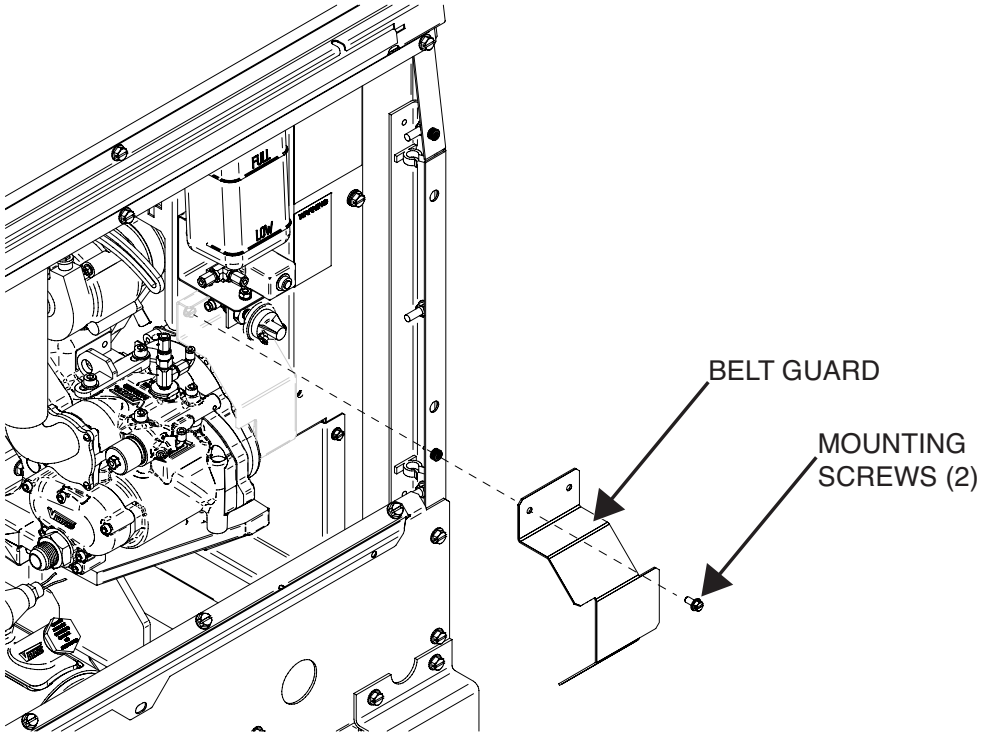
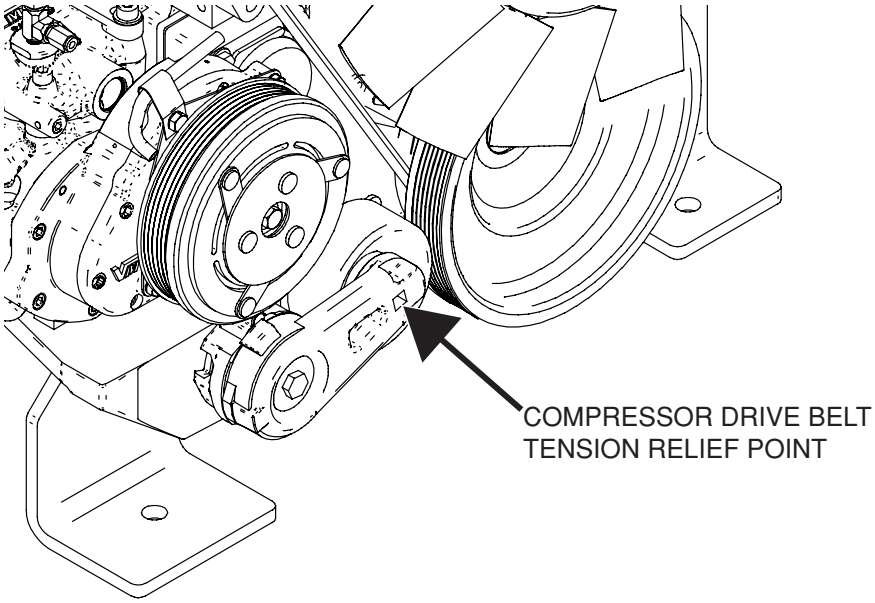


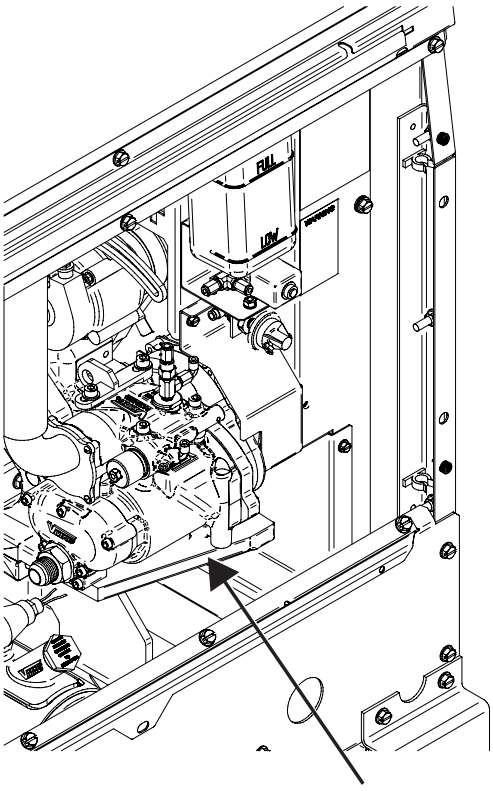
Figure F.73 – Compressor drive belt tension relief point



AIR COMPRESSOR

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.74 – Air compressor mounting bracket



REPLACEMENT PROCEDURE

1. Carefully position the new compressor bracket onto the threaded stud on the rear of the alternator.
2. Using a 1/2" socket, attach three bolts, lock washers and flat washers securing the compressor to the compressor mounting bracket.
3. Connect the wires to the electric clutch pulley of the compressor. See Wiring Diagram. Replace any cable ties as necessary.
4. Using a 3/8" drive ratchet or a similar tool, use an upward motion to relieve the tension on the compressor drive and attach the compressor drive belt.
5. Using a 3/8" socket with extension, attach the two screws securing the belt guard.
6. Using a slotted screwdriver, tighten the hose clamp securing the air intake hose to the air compressor.
7. Connect the air and oil lines to the compressor.
   A. To connect the small plastic lines, peel back the corrugated sleeving from the plastic line. Push the line into the fitting, then press and hold down the release collar.
   B. The large lines can be attached using appropriate sized open end wrenches. When tightening these fittings a second wrench should be used to hold the portion of the fitting on the compressor pump to avoid damaging the pump. Use two 1-1/4" open end wrenches for the large air hose on the side of the compressor. Use two 7/8" open end wrenches for the large air hose on the bottom of the compressor.
8. Close the air outlet valve at the front of the Air Vantage 650.
9. Perform the ***Case Cover Replacement Procedure***.
10. Perform the ***Retest After Repair Procedure***.

MAGNETIC PICKUP SENSOR REPLACEMENT AND ADJUSTMENT PROCEDURE

⚠ WARNING

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TEST DESCRIPTION

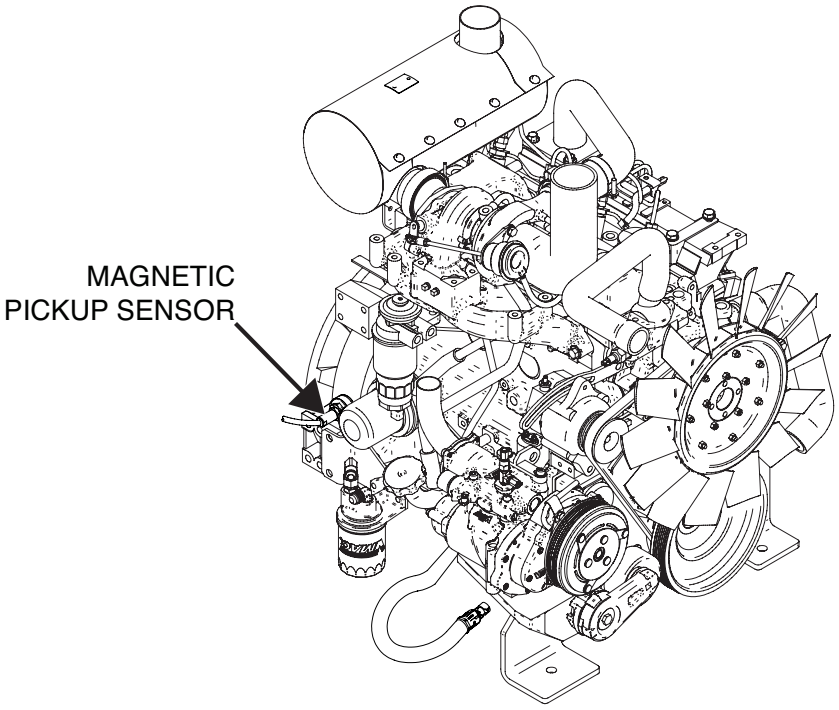
This procedure should be followed if a new Magnetic Pickup Sensor is installed or if the existing Magnetic Pickup Sensor requires adjustment.

MATERIALS NEEDED

3/4" Open End Wrench
1" Open End Wrench
Adjustable Wrench
Thread Locking Compound (Loctite #242 or equivalent)
Wiring Diagram

MAGNETIC PICKUP SENSOR
REPLACEMENT AND ADJUSTMENT PROCEDURE *(continued)*

Figure F.75 – Magnetic pickup sensor location



REMOVAL PROCEDURE

1. Turn off the Air Vantage 650.
2. Open the engine service door. See ***Case Cover Removal Procedure***.
3. Locate the magnetic pickup sensor, in the flywheel housing of the engine. See Figure F.75.
4. Label and disconnect the two wires coming out of the rear of the magnetic pickup sensor. See ***Figure F.76***. See Wiring Diagram.
5. Using a 3/4" open end wrench and a 1" open end wrench to hold the bushing in place, loosen the jam nut on the magnetic pickup sensor. See ***Figure F.77***.
6. Using a 1" open end wrench, remove the bushing from the flywheel housing. See ***Figure F.77***.
7. The magnetic pickup sensor and bushing can now be removed from the machine.

MAGNETIC PICKUP SENSOR
REPLACEMENT AND ADJUSTMENT PROCEDURE *(continued)*

Figure F.76 – Magnetic pickup sensor leads

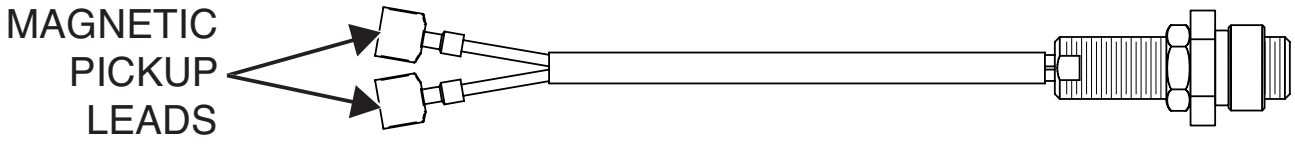
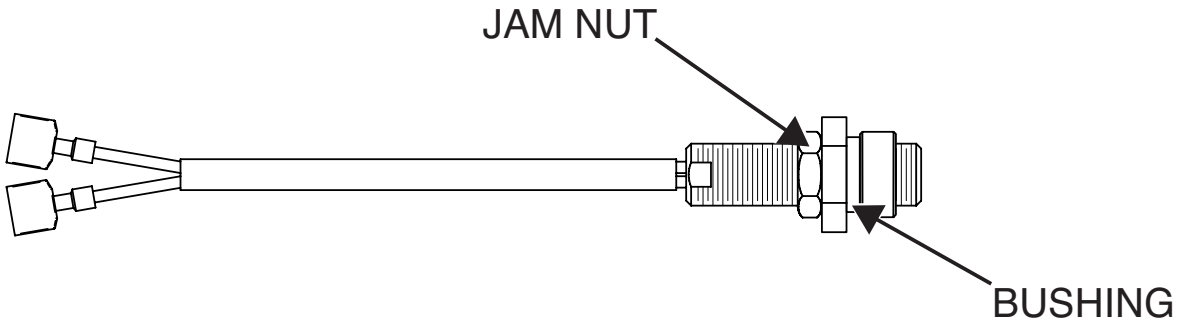


Figure F.77 – Jam nut and bushing location



MAGNETIC PICKUP SENSOR
REPLACEMENT AND ADJUSTMENT PROCEDURE *(continued)*

REPLACEMENT PROCEDURE

1. Before installing a new magnetic pickup sensor, clean the threads thoroughly so the magnetic pickup sensor and bushing can be screwed in easily by hand.
2. Carefully apply thread locking compound (Loctite #242 or equivalent) to the bushing and tighten it securely into the flywheel housing opening.
3. Carefully apply thread locking compound (Loctite #242 or equivalent) on the threads of the pickup and place the jam nut on the pickup body, positioning it near the end where the leads exit.
4. Carefully thread the magnetic pickup sensor body into the bushing by hand. Keep turning the magnetic pickup sensor clockwise until it just touches the flywheel.
5. Back the magnetic pickup sensor out 1/4 turn.
6. Using an adjustable wrench, hold the magnetic pickup sensor in place.
7. Using a 3/4” open end wrench, tighten the jam nut.
8. Connect the two lead wires on the magnetic pickup sensor and replace any cable ties as necessary. See Wiring Diagram.
9. Secure the engine service door. See the ***Case Cover Replacement Procedure***.
10. Perform the ***Retest After Repair Procedure***.

CHOPPER MODULE(S)
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 Chopper Module(s).

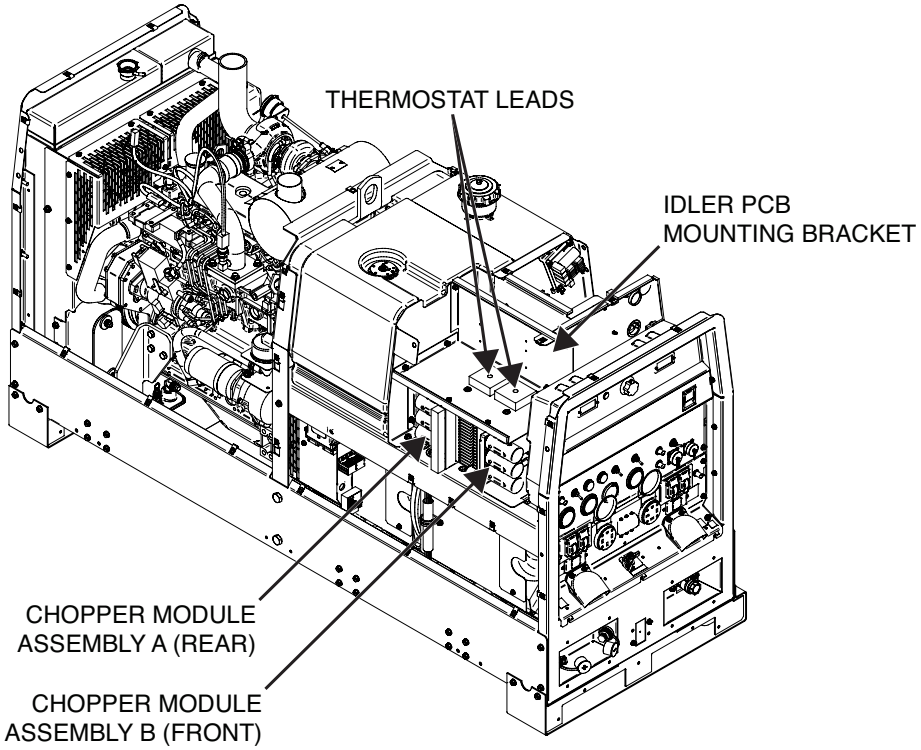
MATERIALS NEEDED

3/8” Nutdriver
7/16” Nutdriver
1/2” Nutdriver
7/16” Socket
1/2” Socket with Extension
Phillips Screwdriver
Torque Wrench (in./lbs.)
Dow Corning 340 Heat Sink Compound (Lincoln T12837)
Wiring Diagram

CHOPPER MODULE(S)

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.78 – Idler PCB bracket removal



REMOVAL PROCEDURE

1. Turn off the Air Vantage 650.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Chopper Module Discharge Procedure***.
4. Label and disconnect leads 250, 250A and 250B from the thermostats. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the four screws from the idler PCB mounting bracket. See Figure F.78.
6. Using a 7/16” nutdriver, remove the three nuts and washers from idler PCB mounting bracket. See Figure F.78.
7. The idler PCB mounting bracket can now be removed and set aside.
8. Using a 7/16” socket, label and disconnect all leads from chopper A (rear). See Figure F.78 and ***Figure F.79***. See Wiring Diagram.
9. Using a 7/16” socket, label and disconnect all leads from chopper B (front). See Figure F.78 and ***Figure F.80***. See Wiring Diagram.
10. Using a 1/2” socket with an extension, remove the two mounting bolts securing the chopper PC board mount to the fuel tank shelf. Repeat this step for the other chopper module assembly. See ***Figure F.81***. The chopper module assemblies can now be removed from the machine.
11. Using a phillips screwdriver, remove the two screws securing the thermostat to the chopper module assembly. Repeat this step for the other chopper module assembly. See ***Figure F.81***.
12. Using a 3/8” nutdriver, remove the four bolts securing the chopper PC board mount to the chopper module assembly. See ***Figure F.81***. Repeat this step for each chopper module assembly.
13. The chopper module(s) can now be removed and replaced.

CHOPPER MODULE

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.79 – Chopper module A lead locations

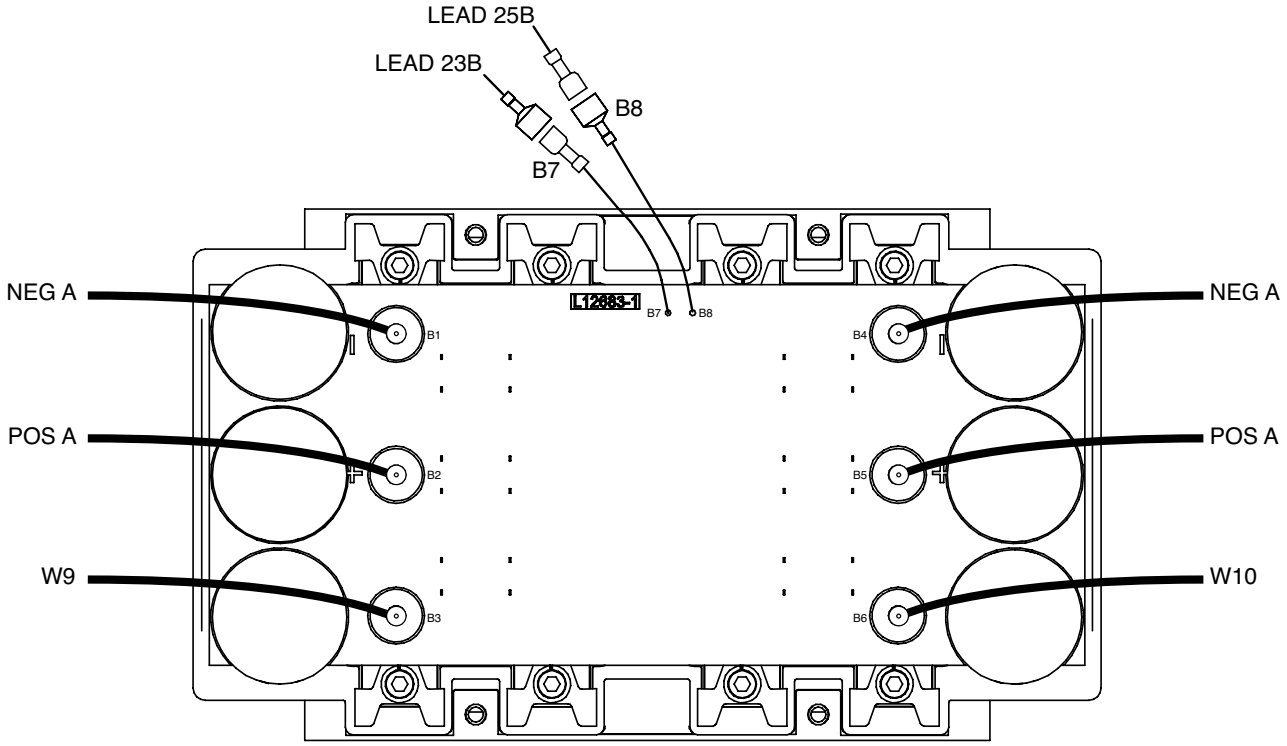
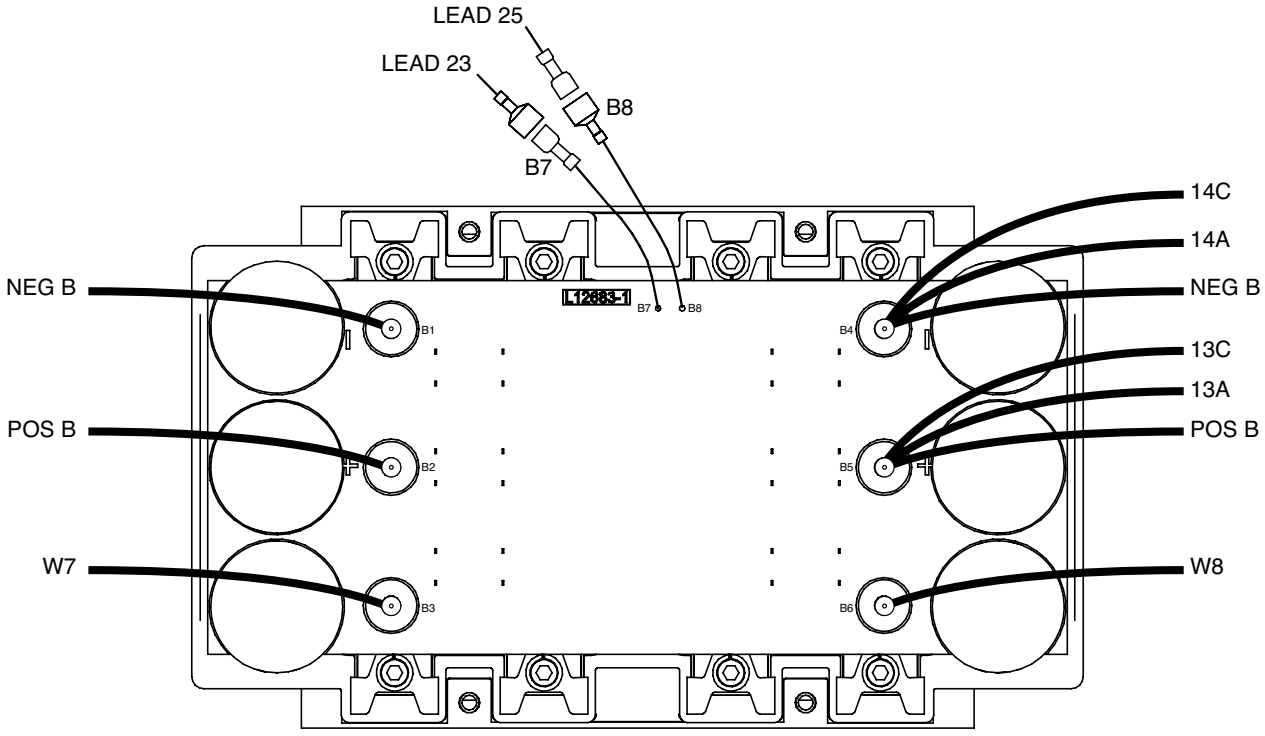


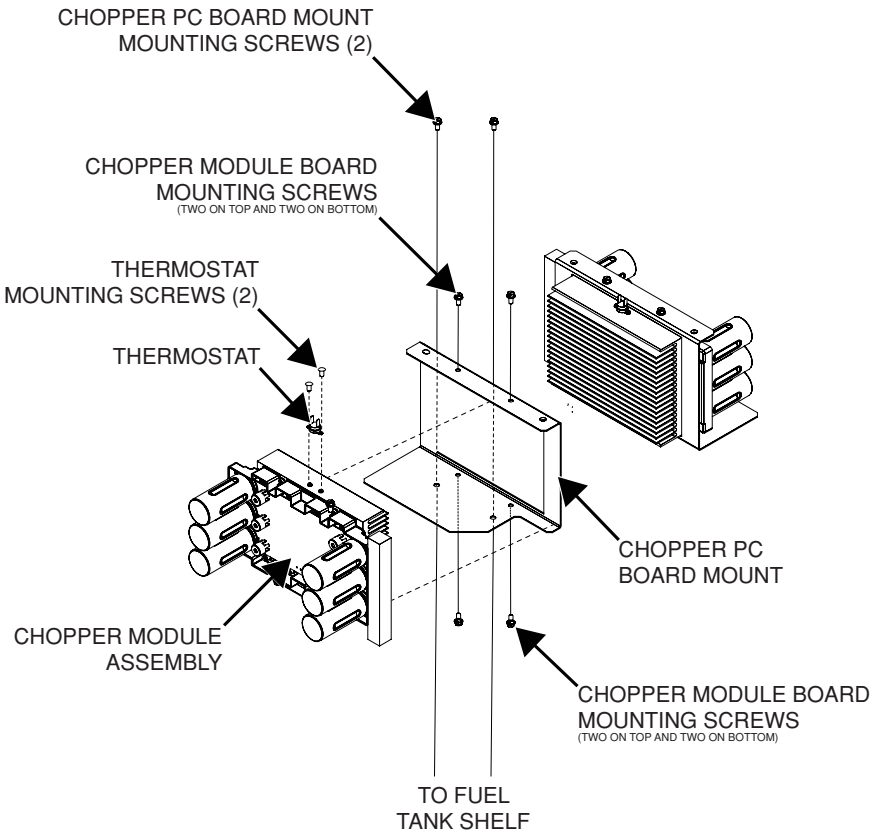
Figure F.80 – Chopper module B lead locations



CHOPPER MODULE

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.81 – Chopper module assembly mounting screw locations



REPLACEMENT PROCEDURE

1. Carefully position the new chopper module board assembly in to the chopper PC board mount.
2. Using a 3/8” nutdriver, attach the four bolts securing the chopper PC board mount to the chopper module board assembly. Repeat this step for each chopper module assembly.
3. Apply a thin coating of Dow Corning 340 heat sink compound (Lincoln T12837) to the rear of the thermostats.
4. Using a phillips screwdriver, attach the two screws securing the thermostats to each chopper module assembly.
5. Using a 1/2” socket with an extension, attach the two mounting bolts securing each chopper PC board mount to the fuel tank shelf (four bolts total).
6. Using a 7/16” socket, connect all previously removed leads to chopper A and B. See Wiring Diagram. When connecting leads to the chopper modules be sure to adhere to the following directions:
    A. Apply a thin coat of electrical joint compound to the six large terminals of the chopper module(s).
    B. Be certain the wires are connected and arranged exactly as they had been on the original chopper module(s).
    C. Be certain each connection screw has a lock washer and flat washer.
    D. **Torque the chopper connection screws to 50 to 60 in./lbs**.
7. Carefully position the idler PCB bracket into the machine.
8. Using a 7/16” nutdriver, attach the three nuts and washers to the idler PCB mounting bracket.
9. Using a 3/8” nutdriver, attach the four screws to the idler PCB mounting bracket.
10. Connect leads 250, 250A and 250B to the thermostats. See Wiring Diagram.
11. Perform the ***Case Cover Replacement Procedure***.
12. Perform the ***Retest After Repair Procedure***.

POWER MODULE FAN
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

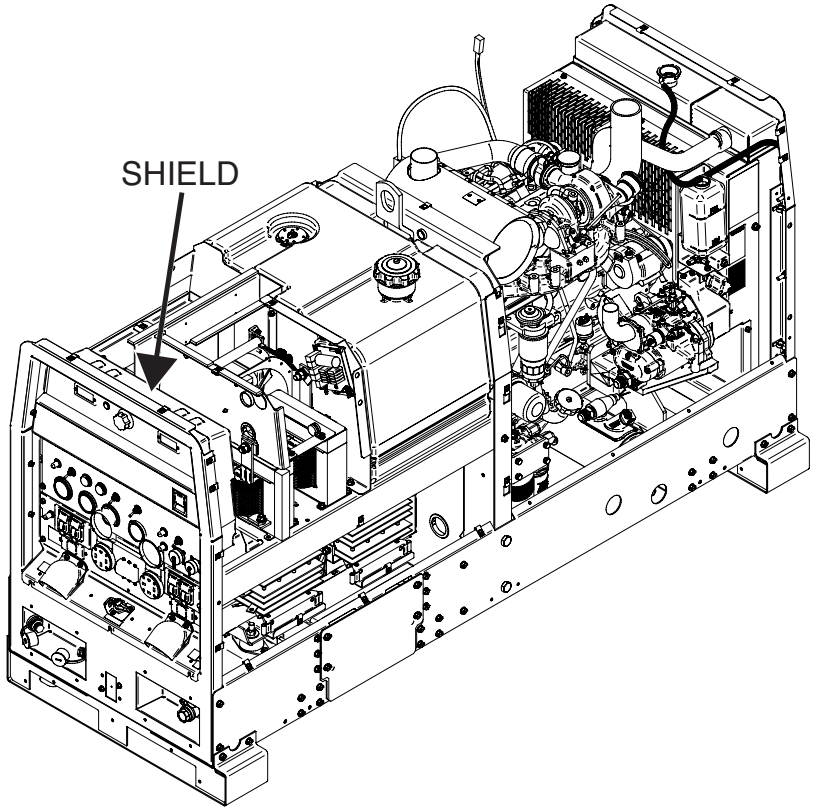
This procedure will aid the technician in the removal and replacement of the Power Module Fan.

MATERIALS NEEDED

Small Slotted Screwdriver
1/2” Nutdriver
3/8” Nutdriver
7/16” Nutdriver
Wiring Diagram

POWER MODULE FAN
REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.82 – Shield location



REMOVAL PROCEDURE

1. Turn off the Air Vantage 650.
2. Perform the ***Case Cover Removal Procedure***, including lowering the control panel.
3. Remove the shield from behind the control panel to gain access to power module fan components. See Figure F.82.
4. Using a small slotted screwdriver, label and disconnect lead 3FAN and lead 5FAN from the fan terminal strip. See ***Figure F.83***. See Wiring Diagram.
5. Label and disconnect the leads 206D (left) and 208D (right) from the R4 resistor. See ***Figure F.84***. See Wiring Diagram.
6. Using a 1/2" nutdriver, remove the two screws securing the fan mounting bracket to the fuel tank shelf. See ***Figure F.84***.
7. Using a 3/8" nutdriver, remove the two screws securing the bypass PC board bracket assembly to the fan mounting bracket. See ***Figure F.85***.
8. Using a 3/8" nutdriver, remove the two screws securing the bypass PC board bracket to the module adapter plate. See ***Figure F.85***.
9. Using a 7/16" nutdriver, remove the hex nut and crush washer securing the fan bracket to the fuel tank baffle. See ***Figure F.86***. Note washer placement for reassembly.
10. Carefully slide the bypass PC board bracket assembly free of the fan mounting bracket.
11. Carefully slide the fan mounting bracket away from the fuel tank baffle and out of the machine.
12. Using a 3/8" nutdriver, remove the four screws securing the fan to the fan mounting bracket. See ***Figure F.87***.
13. The fan can now be removed and replaced.

POWER MODULE FAN

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.83 – Fan lead locations

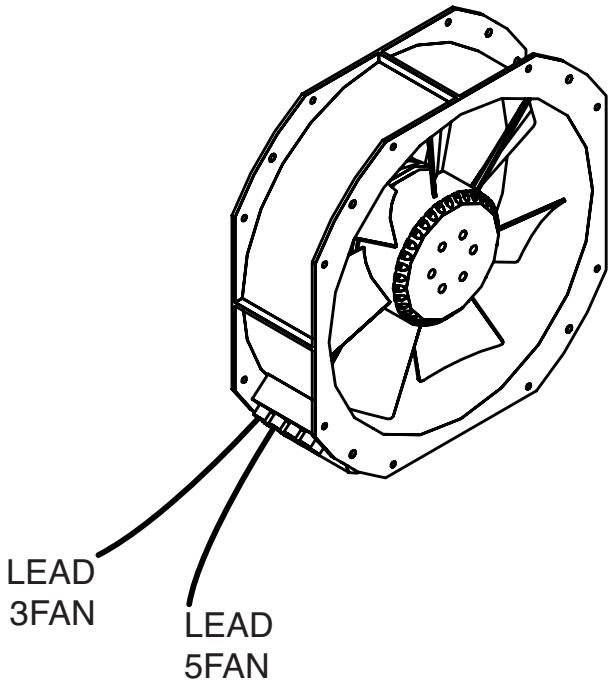
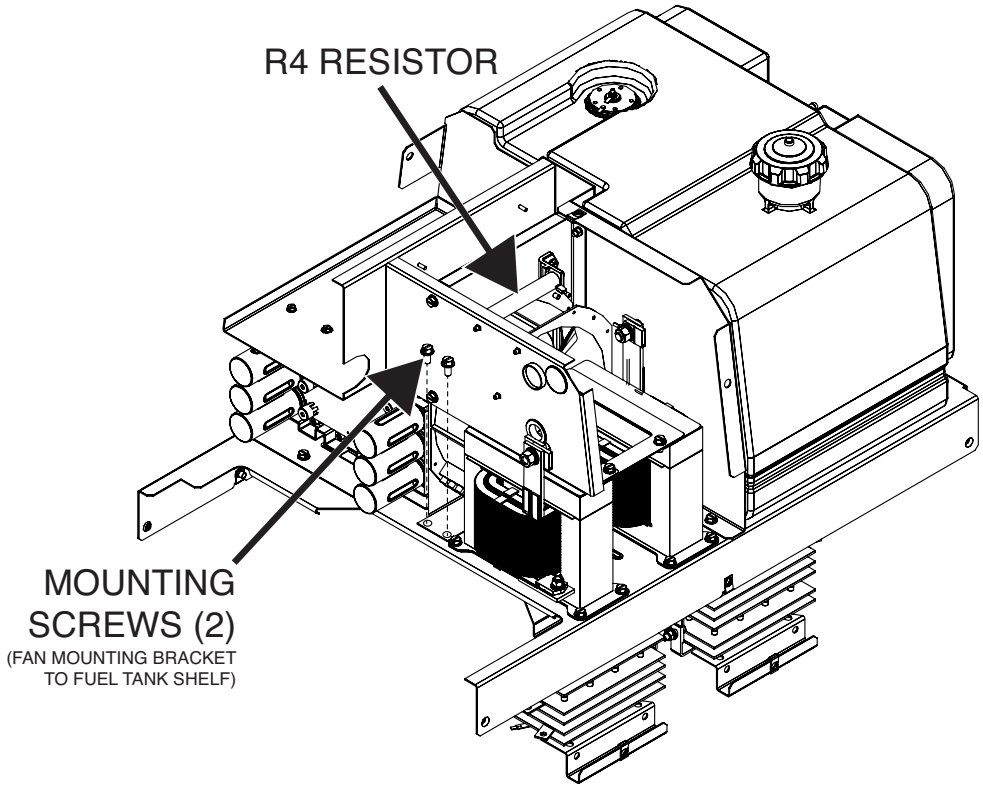


Figure F.84 – R4 resistor



POWER MODULE FAN

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.85 – Power module fan removal

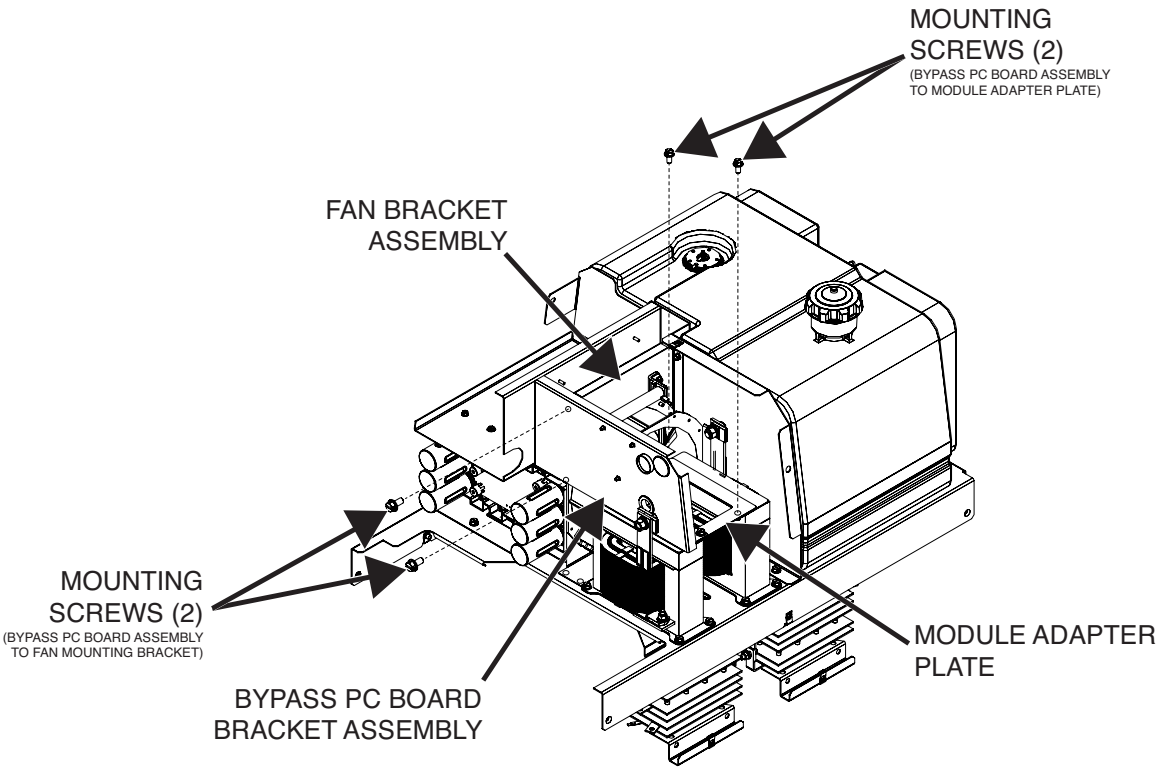
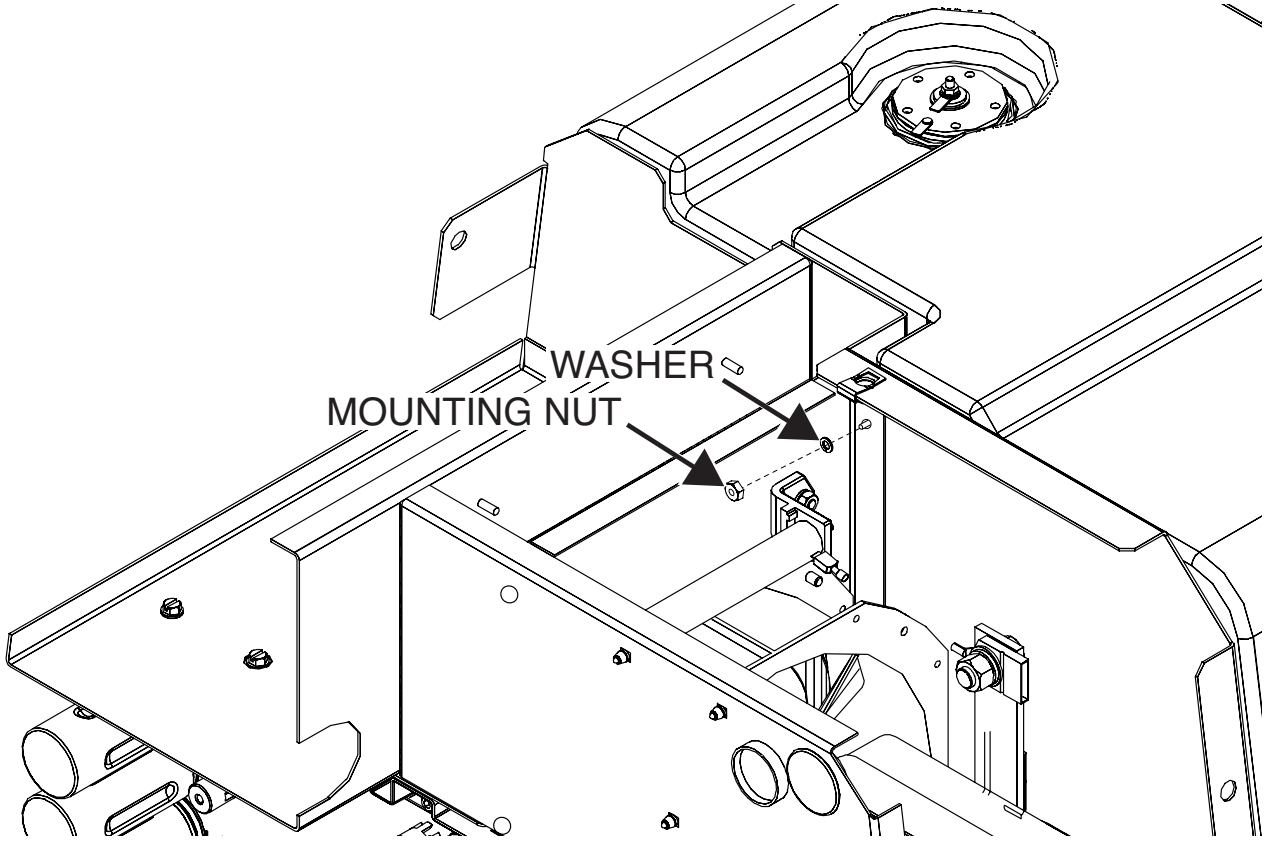


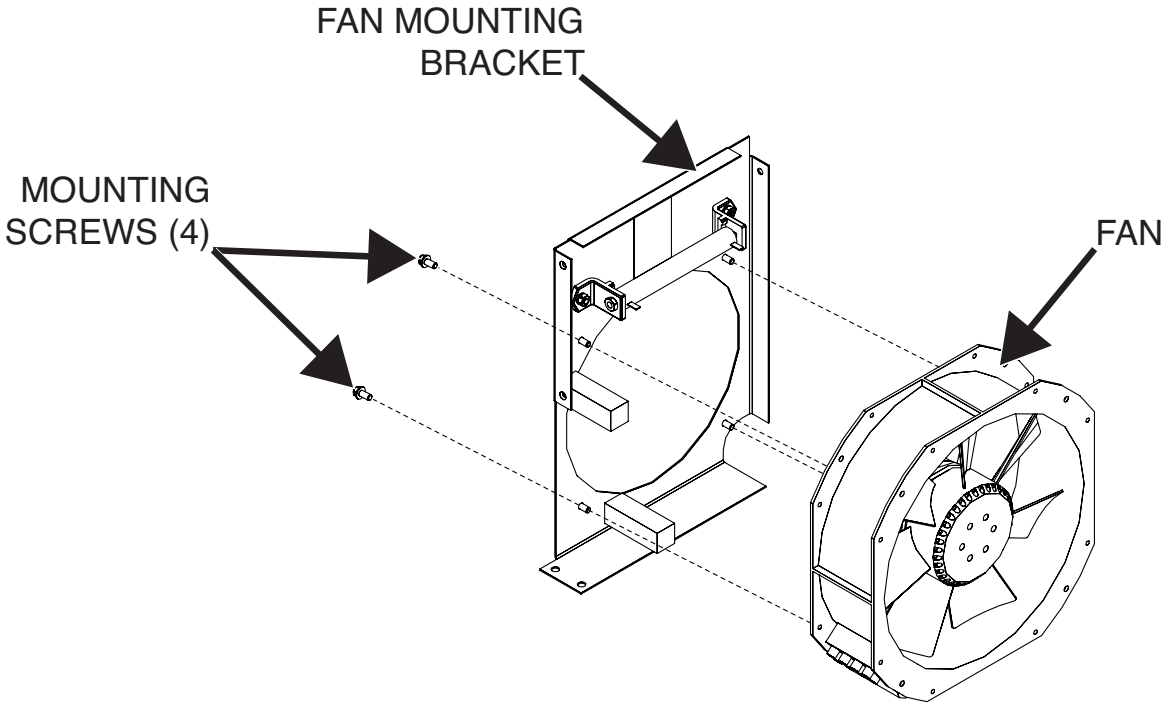
Figure F.86 – Mounting nut location



POWER MODULE FAN

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.87 – Fan removal



REPLACEMENT PROCEDURE

1. Position new fan in fan mounting bracket.
2. Using a 3/8” nutdriver, attach the four screws securing the fan to the fan mounting bracket.
3. Carefully position fan assembly into the machine.
4. Carefully slide the bypass PC board bracket assembly towards the fan mounting bracket.
5. Using a 7/16” nutdriver, attach the hex nut and crush washer securing the fan bracket to the fuel tank baffle.
6. Using a 3/8” nutdriver, attach the two screws securing the bypass PC board bracket to the module adapter plate.
7. Using a 3/8” nutdriver, attach the two screws securing the bypass PC board bracket assembly to the fan mounting bracket.
8. Using a 1/2” nutdriver, attach the two screws securing the fan mounting bracket to the fuel tank shelf.
9. Connect leads 206D (left) and 208D (right) to the large R4 resistor. See Wiring Diagram.
10. Using a small slotted screwdriver, connect lead 3FAN and lead 5FAN to the fan terminal strip. See Wiring Diagram.
11. Place the previously removed shield into position behind the control panel.
12. Perform the ***Case Cover Replacement Procedure***.
13. Perform the ***Retest After Repair Procedure.***

FUEL TANK
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 Fuel Tank.

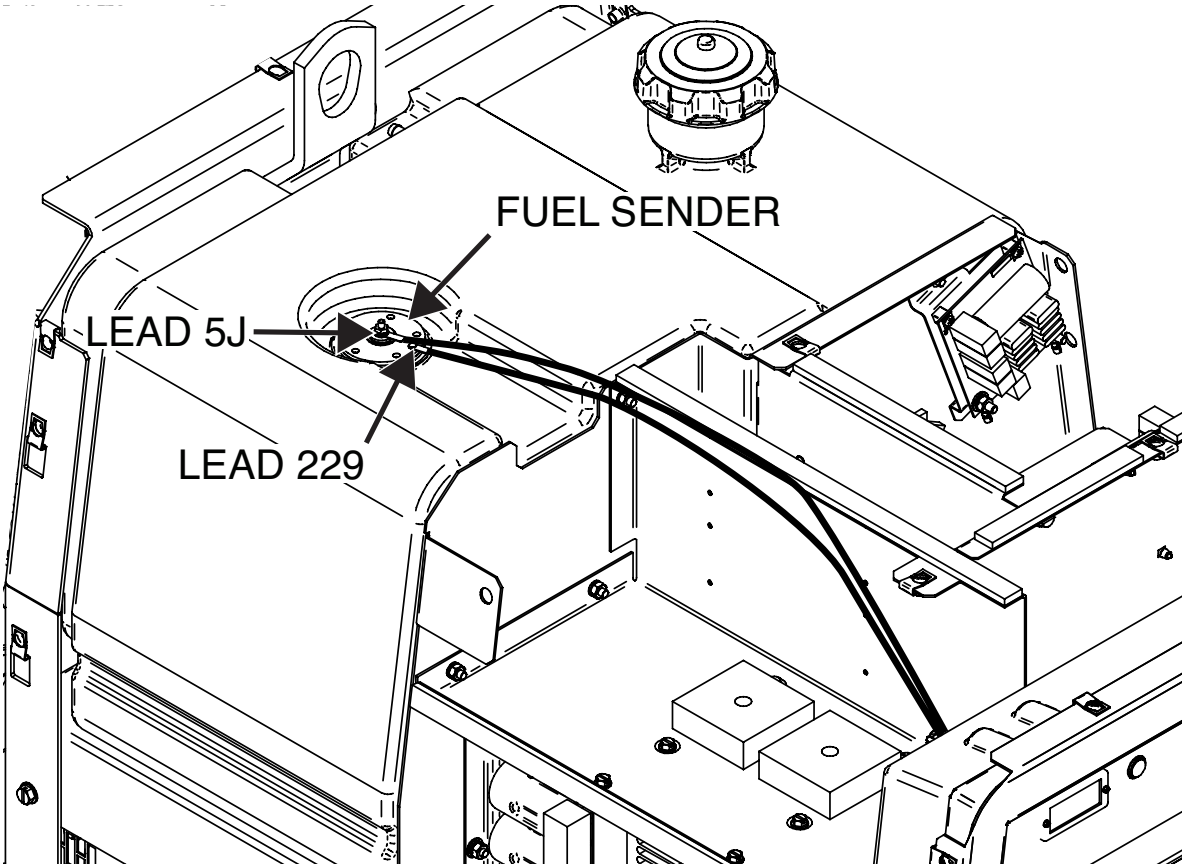
MATERIALS NEEDED

Slotted Screwdriver
Two 3/4” Wrenches
Needle Nose Pliers
Container Suitable To Catch Fuel From Lines
Approved Fuel Storage Container(s)
Length of 3/8” Fuel Tubing
Wiring Diagram

FUEL TANK

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.88 – Fuel level sending unit lead locations



REMOVAL PROCEDURE

1. Turn off the Air Vantage 650 and wait for the engine to cool.
2. Perform the ***Case Cover Removal Procedure***.
3. Label and disconnect leads 5J and 229 from the fuel level sending unit. See Figure F.88. See Wiring Diagram.
4. Turn off the red fuel shutoff valve. The fuel shutoff valve is located on the fuel outlet line at the bottom of the fuel tank and is accessed on the service side (right) of the machine.
5. Using a slotted screwdriver or an 1/4" nutdriver, loosen the hose clamp securing the fuel line and remove the fuel line from the outlet end of the fuel shutoff valve. Catch any fuel that may spill when the line is disconnected and deposit this fuel in an approved container.
6. Obtain a length of 3/8" fuel tubing and connect one end to the valve. Place the other end into an approved fuel container and open the valve to drain the tank.
7. After tank is empty, disconnect the fuel outlet line from the elbow nearest to the fuel tank.
8. Using two 3/4" wrenches, remove the four nuts and washers securing the lift bale to the lift frame assembly and remove the lift bale. See ***Figure F.89***.
9. Using needle nose pliers, label and disconnect the fuel tank vent line from the top of the fuel tank. See ***Figure F.90***.
10. With the help of an assistant, the fuel tank can now be lifted straight up and out of the machine.

FUEL TANK

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.89 – Lift bale removal

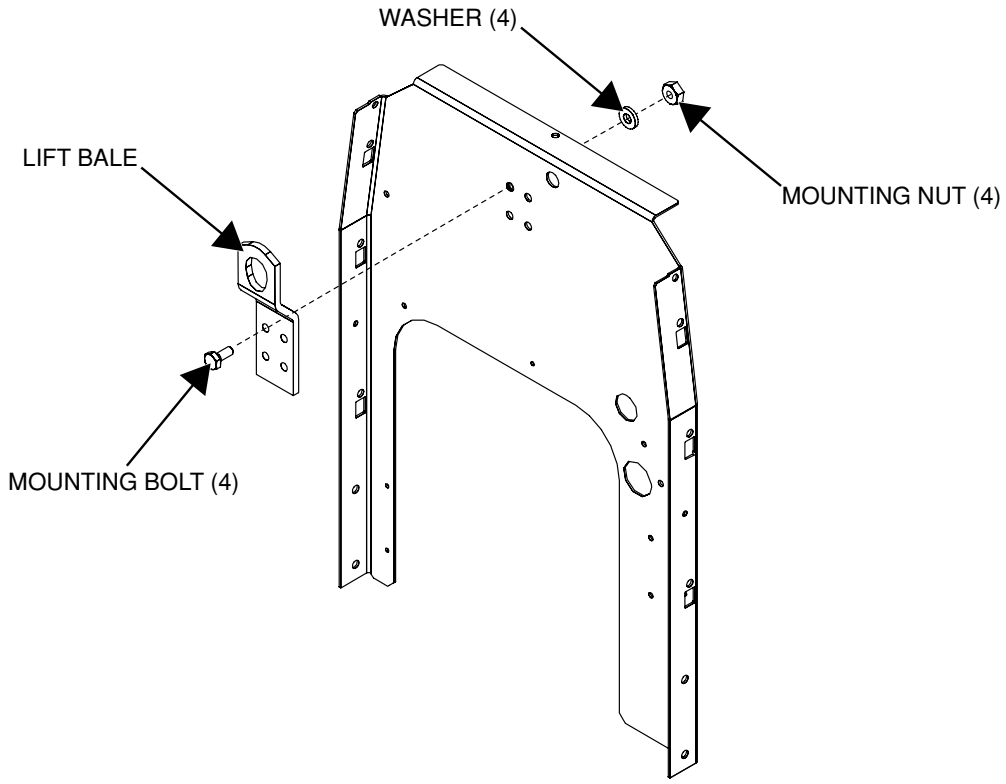
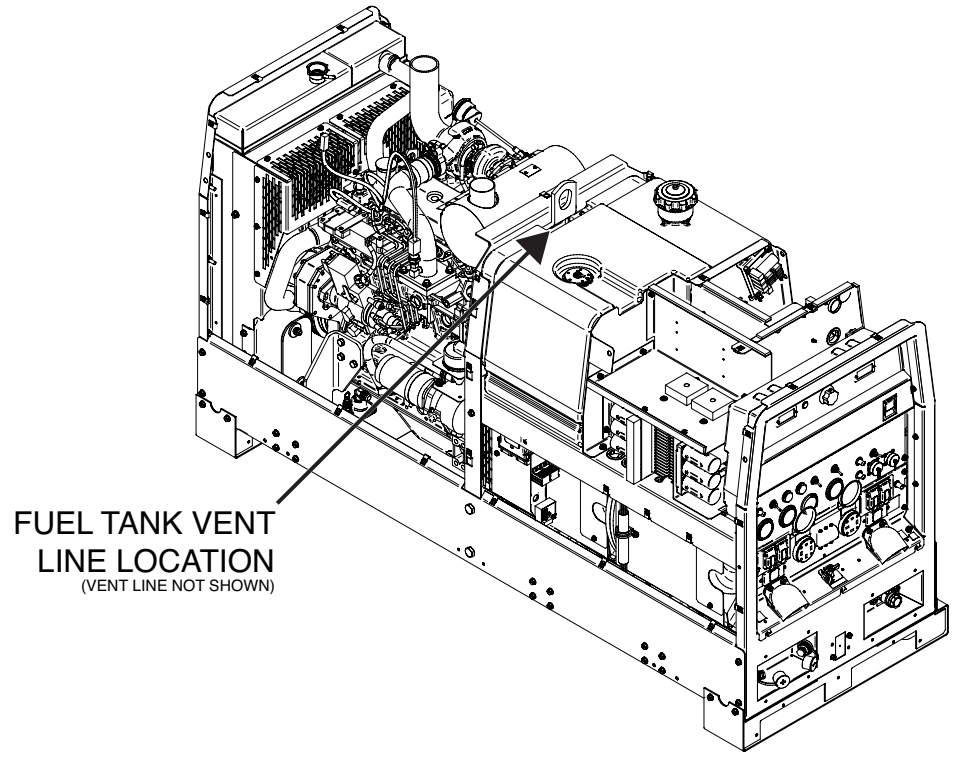


Figure F.90 – Fuel tank vent line location



FUEL TANK
REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

REPLACEMENT PROCEDURE

1. Carefully position the new fuel tank into the machine.
2. When replacing the fuel tank be sure the fuel outlet line is securely attached to the tank and is protruding through the hole in the lift frame.
3. Using needle nose pliers, tighten hose clamp securing the vent line.
4. Using two 3/4" wrenches, attach the four nuts and washers securing the lift bale.
5. Using a slotted screwdriver or 1/4" nutdriver, attach the previously removed fuel lines.
6. Attach leads 5J and 229 to the fuel level sender. See Wiring Diagram.
7. Refill the fuel tank and check for any leakage.
8. Open the fuel shutoff valve.
9. Perform the ***Case Cover Replacement Procedure***.
10. Perform the ***Retest After Repair Procedure***.

POWER MODULE / OUTPUT RECTIFIER 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 Power Module and Output Rectifier.

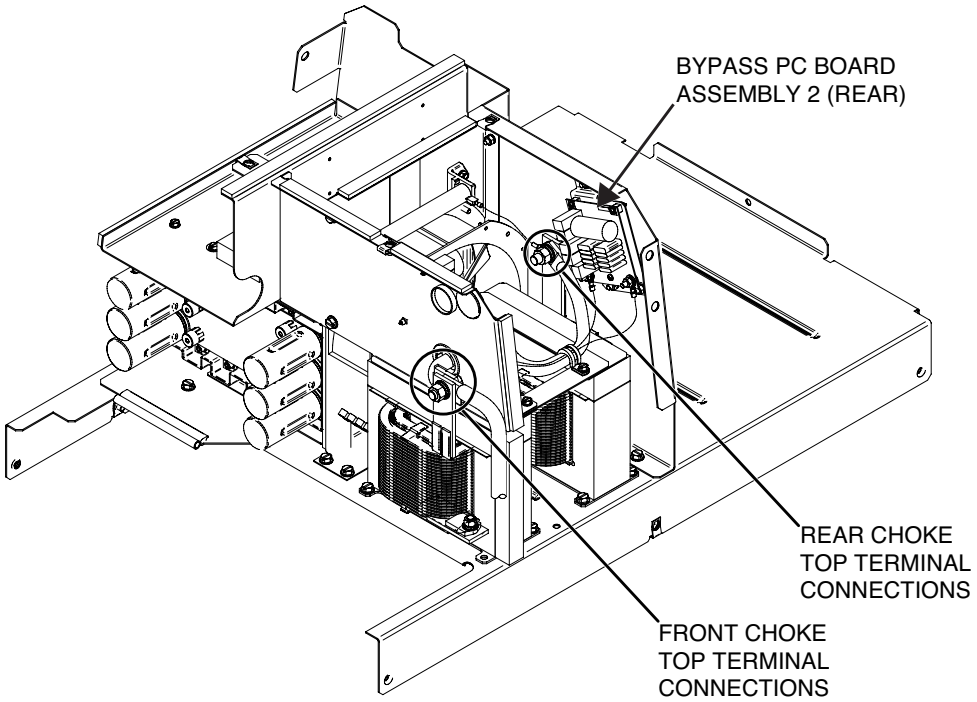
NOTE: A number of wires will need to be disconnected and several cable ties will need to be cut to preform this procedure. Carefully check that all wires are clearly marked so they can be correctly reconnected and replace all cable ties when reassembling the machine.

MATERIALS NEEDED

Two 3/4” Open End Wrenches
7/16” Nutdriver
3/8” Nutdriver
Two 9/16” Open End Wrenches
Utility Knife
1/2” Nutdriver / Wrench
Slotted Screwdriver
Two 1/2” Open End Wrenches
Two 7/16” Open End Wrenches
Phillips Screwdriver
Heat Shrink Wrapping
Cable Ties

POWER MODULE / OUTPUT RECTIFIER
REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.91 – Choke terminal locations



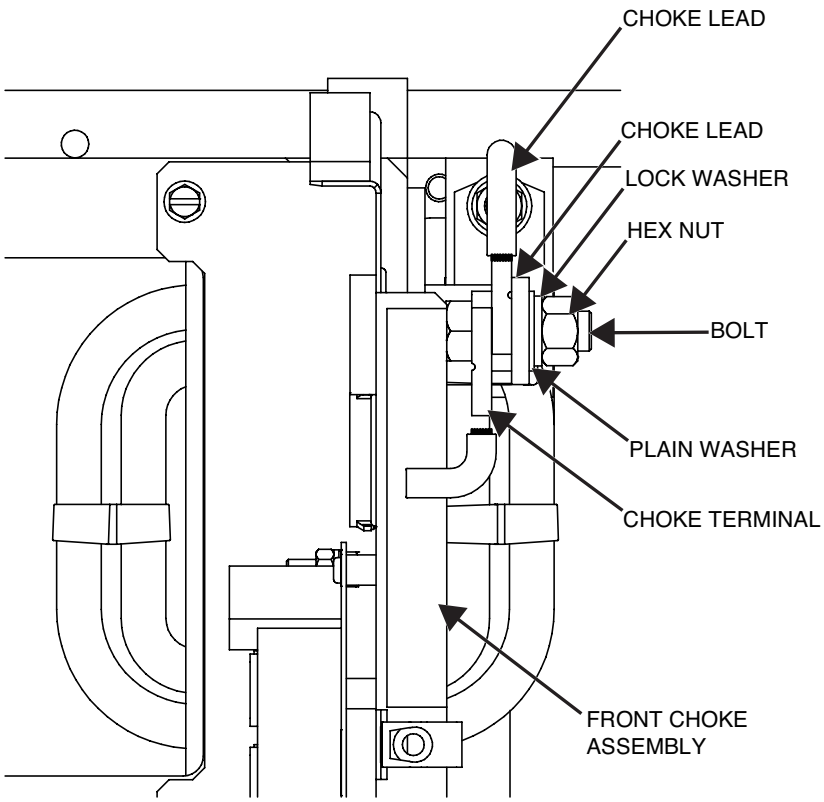
REMOVAL PROCEDURE

1. Turn off the Air Vantage 650.
2. Perform the ***Case Cover Removal Procedure***.
3. Remove the battery tray and battery from the machine.
4. Perform the ***Chopper Module Capacitor Discharge Procedure***.
5. Perform the ***Chopper Module Removal Procedure***, to remove the two chopper module board assemblies.
6. Perform the ***Fuel Tank Removal Procedure***.
7. Using two 3/4" open end wrenches, label and disconnect the two heavy leads from the top terminal of the front choke assembly. See Figure F.91 and ***Figure F.92***. See Wiring Diagram. Note washer placement for reassembly.
8. Using two 3/4" open end wrenches, label and disconnect lead 208D and the heavy lead from the top terminal of the rear choke assembly. See Figure F.91 and ***Figure F.93***. See Wiring Diagram. Note washer placement for reassembly.
9. Using two 7/16" open end wrenches, remove leads 206E and 208E from the bypass PC board assembly 1 (front). See ***Figure F.94*** and ***Figure F.95***. See Wiring Diagram. Note washer placement for reassembly (nut, lead, nut, lock washer, flat washer, lead).
10. Using a phillips screwdriver, remove the ground lead (GND-J) from the bypass PC board assembly 1 (front). See ***Figure F.94*** and ***Figure F.95***. See Wiring Diagram.
11. Using two 7/16" open end wrenches, remove leads 206F and 208F from the bypass PC board assembly 2 (rear). See ***Figure F.91*** and ***Figure F.95***. See Wiring Diagram. Note washer placement for reassembly (nut, lock washer, flat washer).
12. Perform the ***Power Module Fan Removal Procedure***.
13. Using a 3/8" nutdriver, remove the four screws securing the module adapter plate from the top of the choke assemblies. See ***Figure F.96***.
14. Using a utility knife, cut away the heat shrink wrapping around the heavy leads at the lower terminals of each choke. See ***Figure F.97***. See Wiring Diagram.
15. Using two 9/16" open end wrenches, label and disconnect the heavy leads connected to the lower terminal of each choke assembly. See ***Figure F.97***. See Wiring Diagram. Note washer placement for reassembly (bolt, lead, terminal, flat washer, lock washer, nut).
16. Due to variations in design, additional wiring may need to be disconnected and cleared. Carefully check for any additional leads that connect to or run through the power module. Label, disconnect and clear them. See Wiring Diagram.
17. Using a 1/2" nutdriver, remove the three screws securing each choke assembly to the fuel tank shelf. See ***Figure F.98***.

POWER MODULE / OUTPUT RECTIFIER

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.92 – Front top choke terminal lead and washer placement



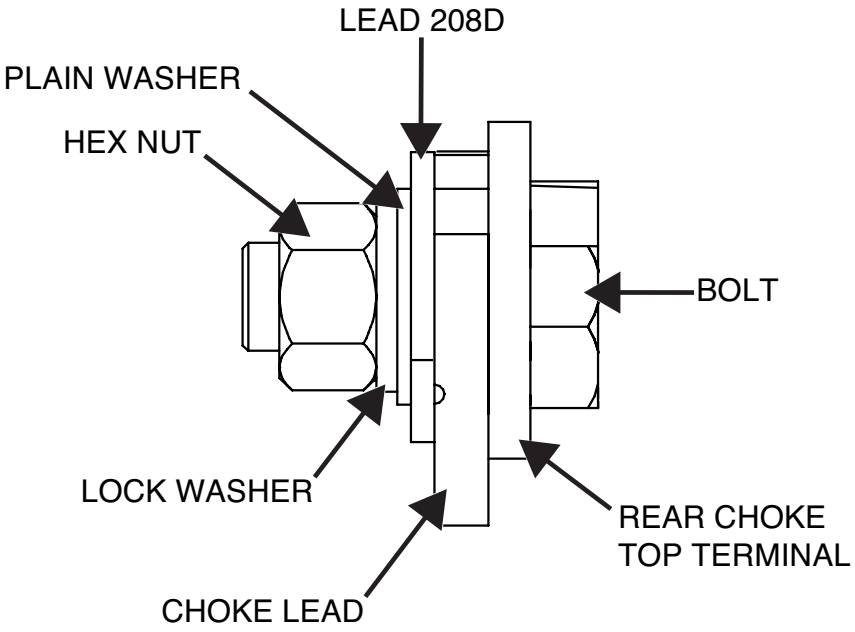
18. The choke assemblies can now be removed from the fuel tank shelf.

NOTE: The choke assemblies are heavy, use caution when lifting and moving.

19. Using a 7/16” nutdriver, label and disconnect leads 200D and 201C from the C1 (Weld) capacitor. See ***Figure F.99***. See Wiring Diagram. Note washer placement for reassembly (nut, lock washer, flat washer, lead).
20. Using a 7/16” nutdriver, label and disconnect leads 201 and 200B from the C2 (Auxiliary) capacitor. See ***Figure F.99***. See Wiring Diagram. Note washer placement for reassembly (nut, lock washer, flat washer, lead).
21. Using a 1/2” nutdriver, remove the three screws securing the fuel tank baffle to the fuel tank shelf and remove fuel tank baffle. See ***Figure F.98***.
22. Carefully route all wiring through the bottom of the fuel tank shelf to allow for removal of the fuel tank shelf.
23. Cut cable ties as necessary to clear all wiring from the bottom of the fuel tank shelf.
24. Using a slotted screwdriver, remove speed nuts as necessary to allow clearance for the removal of the fuel tank shelf.
25. Using a 1/2” nutdriver, remove the nine screws securing the fuel tank shelf to the machine. See ***Figure F.100***.
26. Remove the fuel tank shelf by lifting the front end upwards and out of the machine.
27. Using a 3/8” socket, remove the two screws securing the upper rectifier mounting bracket to the right baffle. See ***Figure F.103***.
28. Cut any cable ties attached to the rectifier wiring.
29. Using a 7/16” wrench, label and disconnect leads WB4, WB5, WB2, WB3, WB1 and WB6 from the terminals of output rectifier B (front). See ***Figure F.101***. See Wiring Diagram.
30. Using a 1/2” wrench, label and disconnect NEG B lead and the jumper cable from the negative terminal of the output rectifier B (front). See ***Figure F.101***. See Wiring Diagram.
31. Using two 1/2” open end wrenches, label and disconnect lead 206D, POS B and POS B shunt from the positive terminal of output rectifier B (front). See ***Figure F.101***. See Wiring Diagram. Note washer placement for reassembly (nut, lock washer, flat washer, leads, terminal, bolt).
32. Using a 7/16” wrench, label and disconnect leads WA1, WA6, WA2, WA3, WA4 and WA5 from the terminals of output rectifier A (rear). See ***Figure F.102***. See Wiring Diagram.
33. Using a 1/2” wrench, label and disconnect NEG A lead and the jumper cable from the negative terminal of the output rectifier A (rear). See ***Figure F.102***. See Wiring Diagram.
33. Using two 1/2” open end wrenches, label and disconnect lead POS A and POS A shunt from the positive terminal of output rectifier A (rear). See ***Figure F.102***. See Wiring Diagram. Note washer placement for reassembly (nut, lock washer, flat washer, leads, terminal, bolt).

POWER MODULE / OUTPUT RECTIFIER
REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.93 – Rear top choke lead and washer placement



35. Carefully remove the output rectifier assemblies from the machine.
36. Using a 1/2” nutdriver, remove the two nuts and lock washers securing the output rectifier assemblies to the rectifier mounting bracket. See ***Figure F.103***.
37. The output rectifier assemblies can now be removed and replaced.

POWER MODULE / OUTPUT RECTIFIER
REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.94 – Bypass PC board assembly 1 location

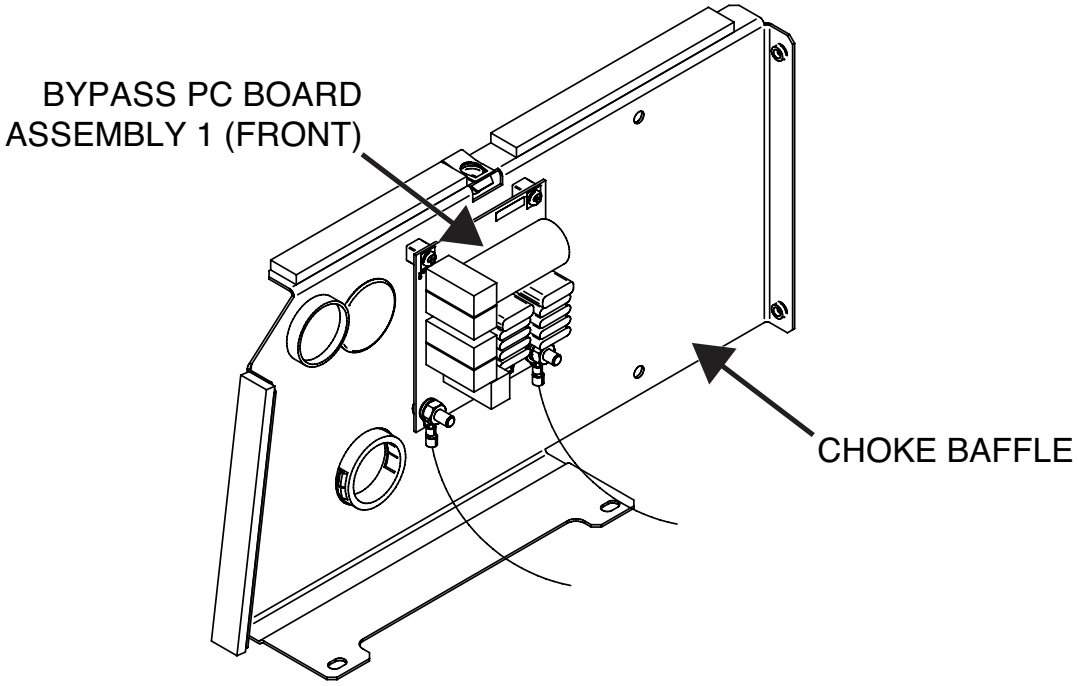
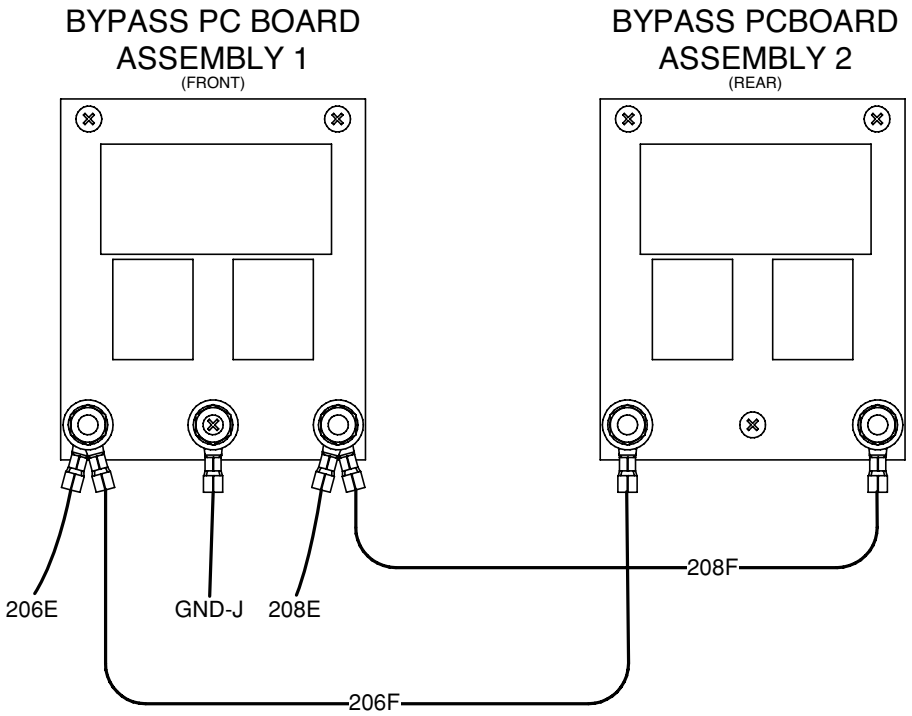


Figure F.95 – Bypass PC board lead locations



POWER MODULE / OUTPUT RECTIFIER
REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.96 – Module adapter plate removal

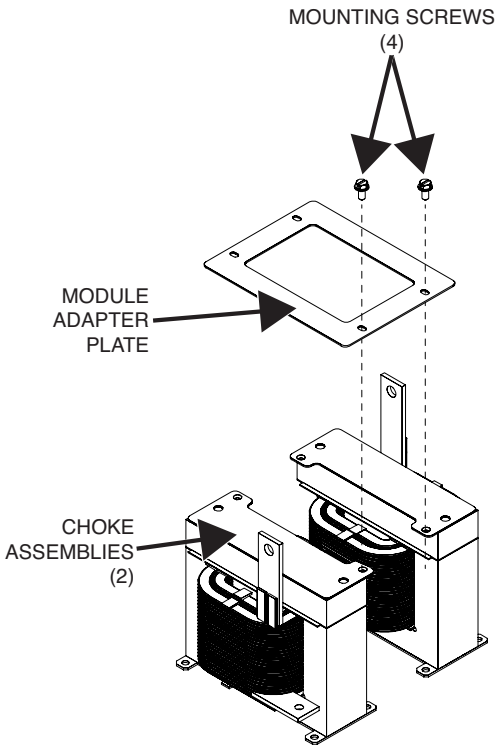
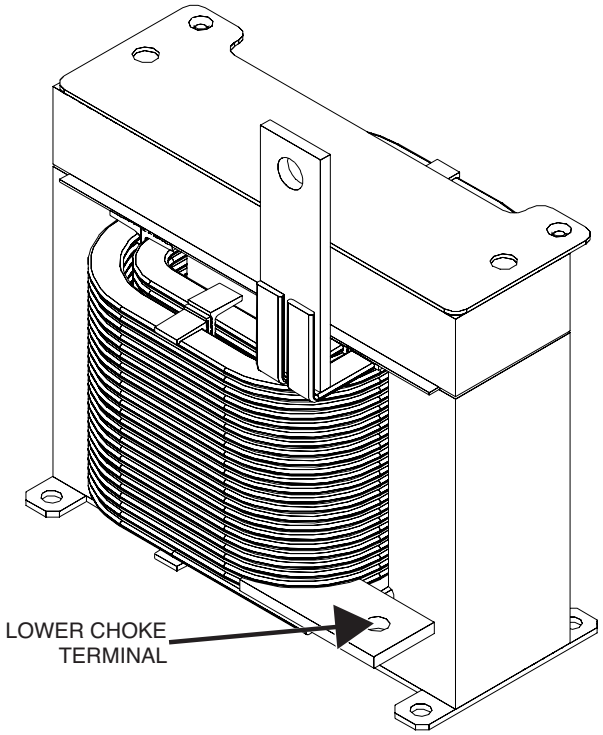


Figure F.97 – Lower choke terminal location



POWER MODULE / OUTPUT RECTIFIER
REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.98 – Choke and fuel tank baffle removal

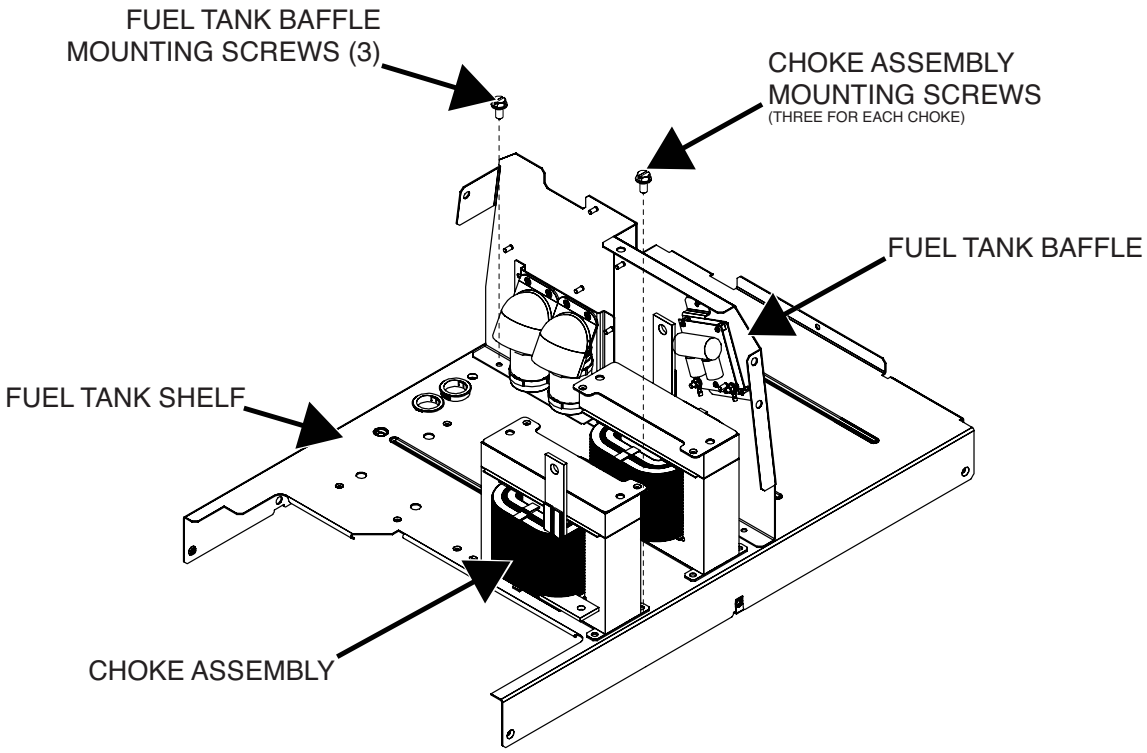
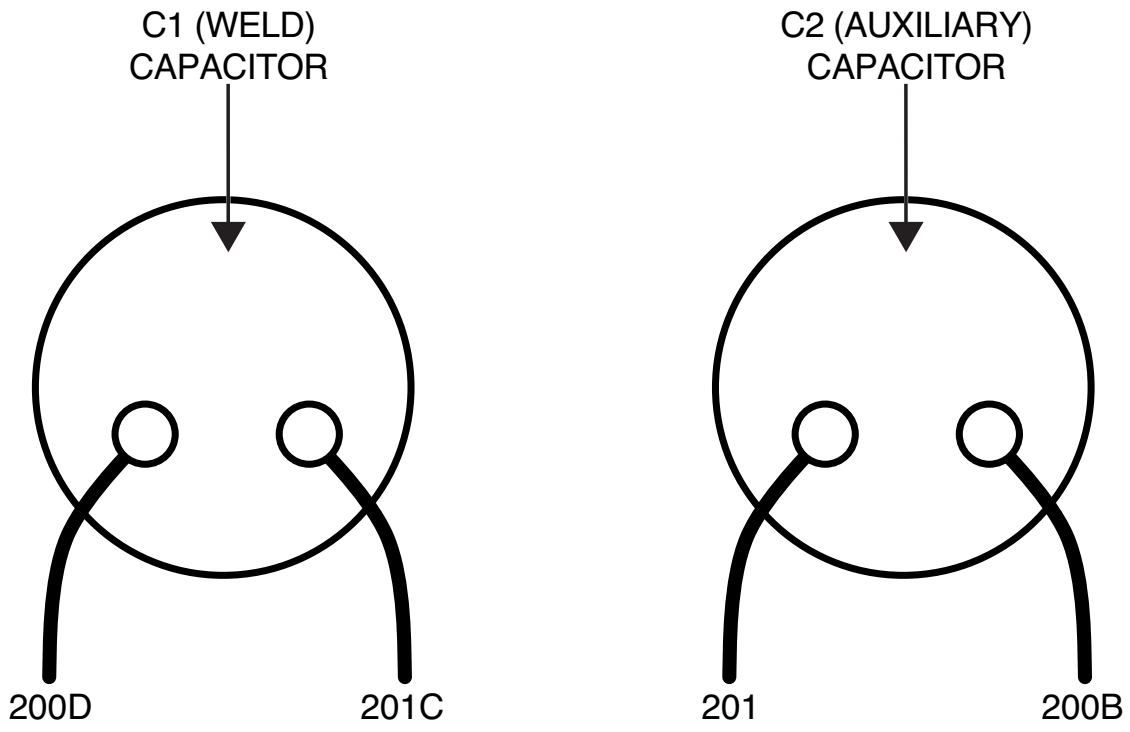


Figure F.99 – Capacitor lead locations



POWER MODULE / OUTPUT RECTIFIER
REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.100 – Fuel tank shelf

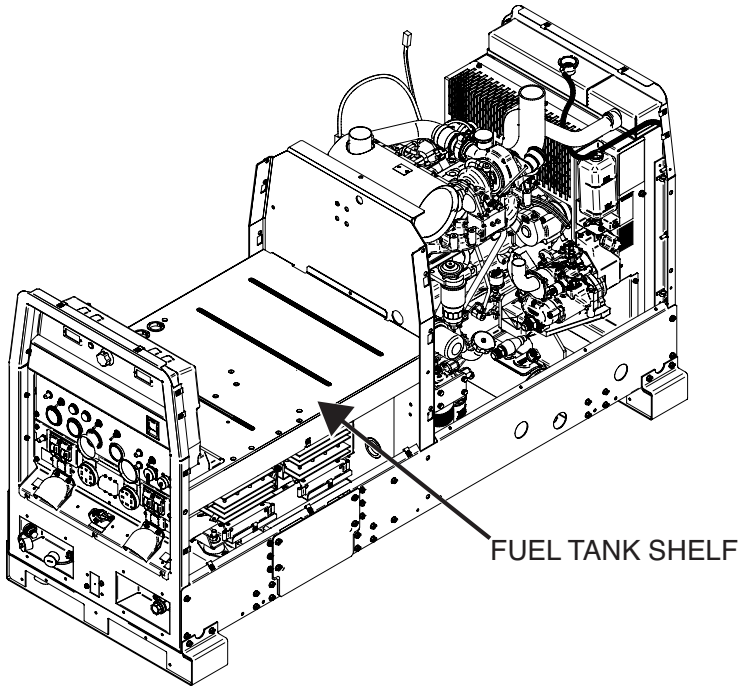
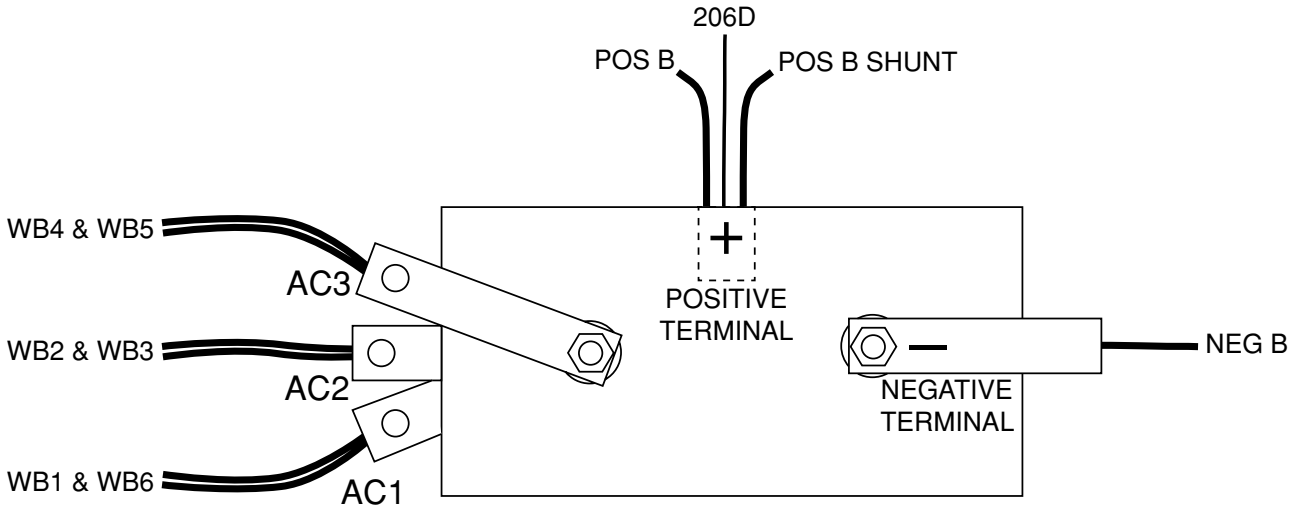


Figure F.101 – Output rectifier B lead locations



POWER MODULE / OUTPUT RECTIFIER
REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.102 – Output rectifier A lead locations

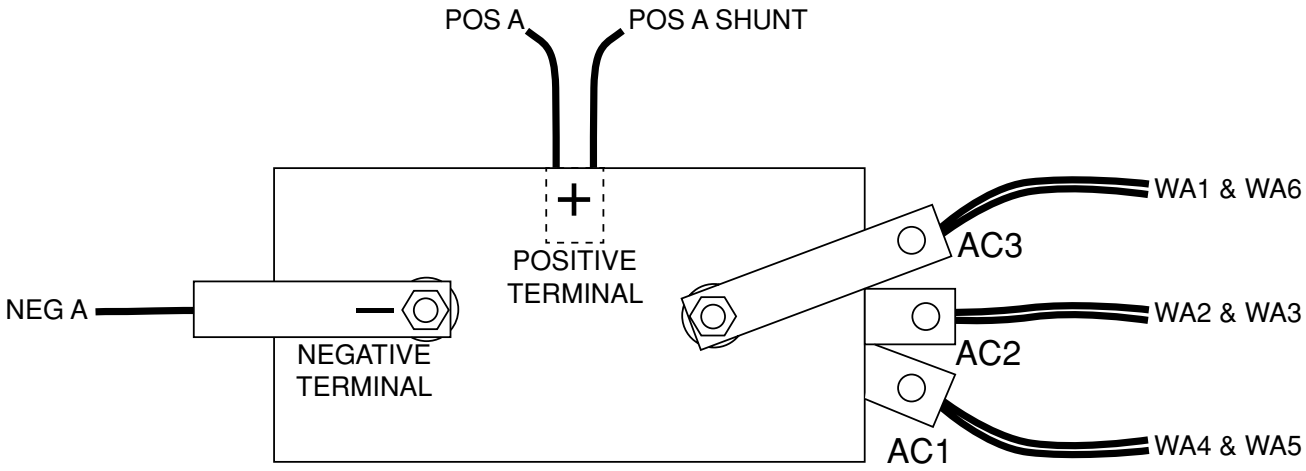
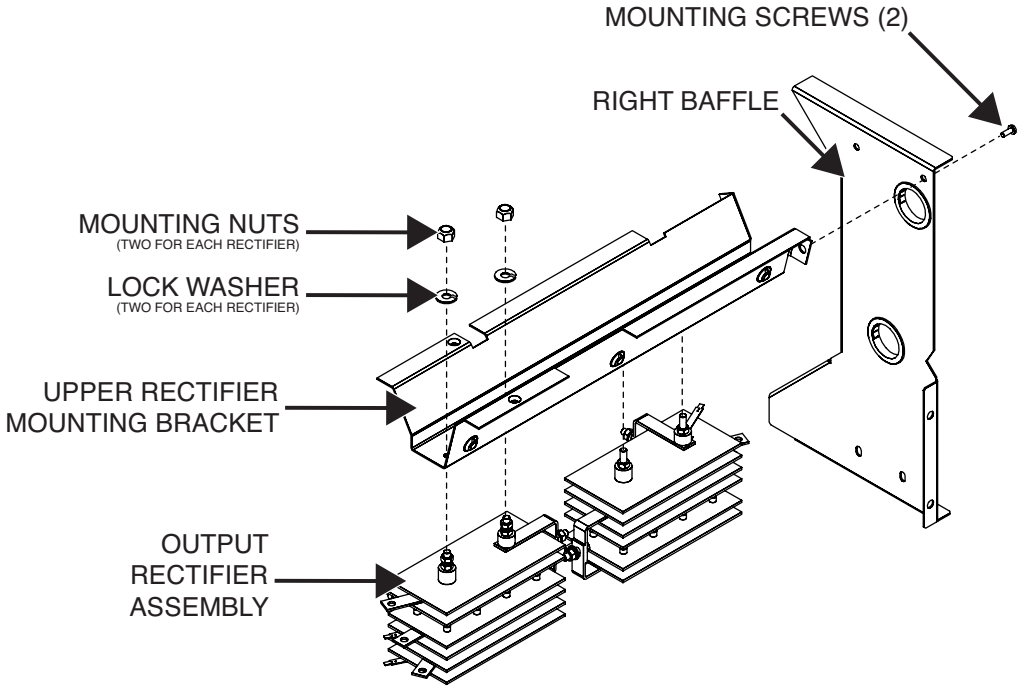


Figure F.103 – Output rectifier removal



POWER MODULE / OUTPUT RECTIFIER REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

REPLACEMENT PROCEDURE

1. Using a 1/2" nutdriver, attach the two nuts and lock washers securing each of the output rectifier assemblies to the upper rectifier mounting bracket.
2. Carefully position the rectifier assembly in the machine.
3. Using two 1/2" open end wrenches, connect leads POS A and POS A shunt to the positive terminal of output rectifier A (rear). See Wiring Diagram. Note washer placement for reassembly (nut, lock washer, flat washer, leads, terminal, bolt).
4. Using a 1/2" wrench, connect NEG A lead and the jumper cable to the negative terminal of the output rectifier A (rear). See Wiring Diagram.
5. Using a 7/16" wrench, connect leads WA1, WA6, WA2, WA3, WA4 and WA5 to the terminals of output rectifier A (rear). See Wiring Diagram.
6. Using two 1/2" open end wrenches, connect leads 206D, POS B and POS B shunt to the positive terminal of the output rectifier B (front). See Wiring Diagram. Note washer placement for reassembly (nut, lock washer, flat washer, leads, terminal, bolt).
7. Using a 1/2" wrench, connect NEG B lead and jumper cable to the negative terminal of the output rectifier B (front). See Wiring Diagram.
8. Using a 7/16" wrench, connect leads WB4, WB5, WB2, WB3, WB1 and WB6 to the terminals of output rectifier B (front). See Wiring Diagram.
9. Replace cable ties as necessary to the rectifier wiring.
10. Using a 3/8" socket, attach the two screws securing the upper rectifier mounting bracket to the right baffle.
11. Carefully position the fuel tank shelf into the machine.
12. Using a 1/2" nutdriver, attach the nine screws securing the fuel tank shelf to the machine.
13. Using a slotted screwdriver, attach the previously removed speed nuts.
14. Carefully route all wiring through the bottom of the fuel tank shelf.
15. Replace cable ties as necessary to secure the wiring to the fuel tank shelf.
16. Carefully position the fuel tank baffle onto the fuel tank shelf.
17. Using a 1/2" nutdriver, attach the three screws securing the fuel tank baffle to the fuel tank shelf.
18. Using a 7/16" nutdriver, connect leads 201 and 200B to the C2 (Auxiliary) capacitor. See Wiring Diagram. Note washer placement for reassembly (nut, lock washer, flat washer, lead).
19. Using a 7/16" nutdriver, connect leads 200D and 201C to the C1 (Weld) capacitor. See Wiring Diagram. Note washer placement for reassembly (nut, lock washer, flat washer, lead).
20. Carefully position the choke assemblies onto the fuel tank shelf.

NOTE: The choke assemblies are heavy, use caution when lifting and moving.

21. Using a 1/2" nutdriver, attach the three screws securing each choke assembly to the fuel tank shelf.
22. Using two 9/16" open end wrenches, connect the heavy leads to the lower terminal of each choke assembly. See Wiring Diagram. Note washer placement for reassembly (bolt, lead, terminal, flat washer, lock washer, nut).
23. Replace the heat shrink wrapping around the heavy leads at the lower terminals of each choke. See Wiring Diagram.
24. Using a 3/8" nutdriver, attach the four screws securing the module adapter plate to the top of the choke assemblies.
25. Perform the ***Power Module Fan Replacement Procedure***.
26. Using two 7/16" open end wrenches, attach leads 206F and 208F to the bypass PC board assembly 2 (rear). See Wiring Diagram. Note washer placement for reassembly (nut, lock washer, flat washer).
27. Using a phillips screwdriver, attach the ground lead (GND-J) to the bypass PC board assembly 1 (front). See Wiring Diagram.
28. Using two 7/16" open end wrenches, attach leads 206E and 208E to the bypass PC board assembly 1 (front). See Wiring Diagram. Note washer placement for reassembly (nut, lead, nut, lock washer, flat washer, lead).
29. Using two 3/4" open end wrenches, connect lead 208D and the heavy lead to the top terminal of the rear choke assembly. See Wiring Diagram. Note washer placement for reassembly.
30. Using two 3/4" open end wrenches, connect the two heavy leads to the top terminal of the front choke assembly. See Wiring Diagram. Note washer placement for reassembly.
31. Due to variations in design, additional wiring may need to be connected. Carefully check for any additional leads previously removed that connect to or run through the power module and connect them to the appropriate locations. See Wiring Diagram.
32. Perform the ***Fuel Tank Replacement Procedure***.
33. Perform the ***Chopper Module Replacement Procedure***, to replace the two chopper module boards assemblies.
34. Place the battery tray and battery into the machine.
35. Perform the ***Case Cover Replacement Procedure***.
36. Perform the ***Retest After Repair Procedure***.

ROTORS AND STATORS
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 Rotors and Stators. This procedure requires that a substantial number of wires and cables be removed. Be certain all leads and cables are clearly marked before removal so they can be quickly and accurately reconnected. Also note the arrangement of the hardware and cables. The heavy cables and hardware will need to be arranged exactly as they were before they were disconnected.

Torque Specifications:

Screws for the blower paddle assemblies, coupling to engine flywheel, weld stator to engine and auxiliary stator to weld stator: 28 Ft Lbs (Tighten bolts in an alternating pattern).

Auxiliary rotor through bolt: 58 to 62 ft-lbs (use high strength thread locking compound).

Shaft coupling to weld rotor shaft: 201 to 210 ft-lbs (use high strength thread locking compound).

Stator and engine mounting nuts (1/2-13): 38 ft-lbs.

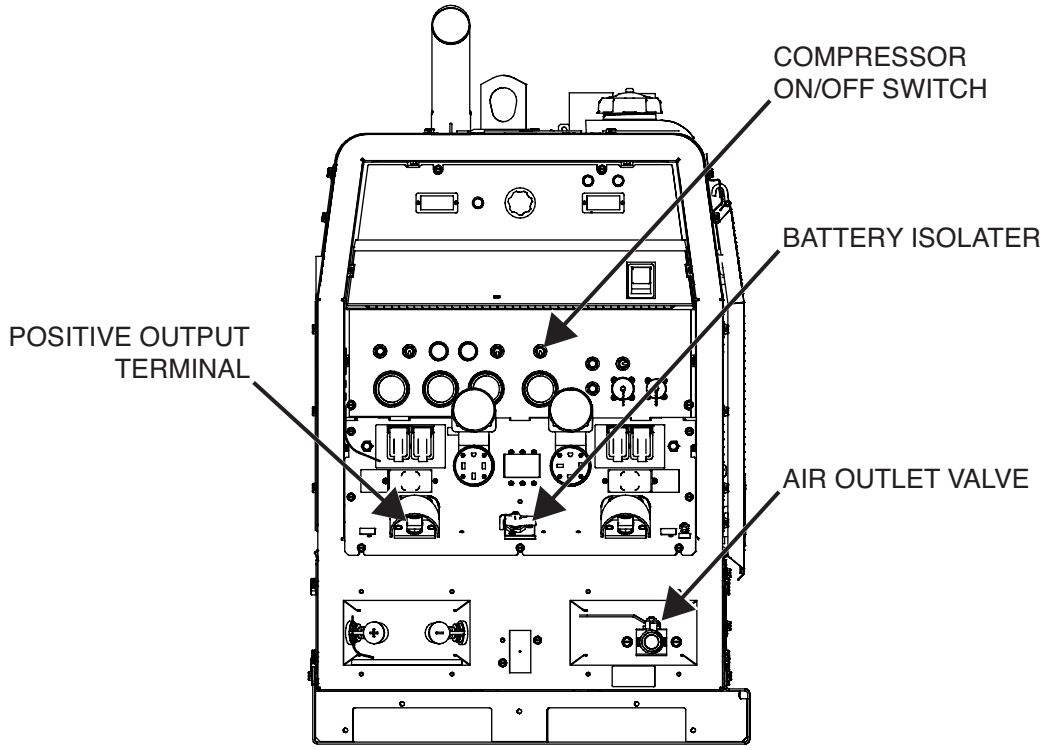
MATERIALS NEEDED

7/16” Nutdriver
1/2” Nutdriver
3/8” Nutdriver
1-1/4” Open End Wrench
Two 1/2” Open End Wrenches
9/16” Nutdriver
5/16” Nutdriver
Two 3/4” Open End Wrenches
3/4” Socket
11/16” Socket
Torque Wrench
Grease (Chevron SRI or Equivalent)
Adjustable Wrench
Hoist and rigging
Two jaw or bolt on type gear puller
Rotor removal tool, Lincoln Electric part number: S20925
Heavy duty snap ring tool with 90 deg. tips.
High Strength Thread Locking Compound
Feeler gage .010” thick, .50” wide, 12” long (for checking rotor/stator air gap)

ROTORS AND STATORS

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.104 – Compressor ON/OFF switch and air outlet valve locations



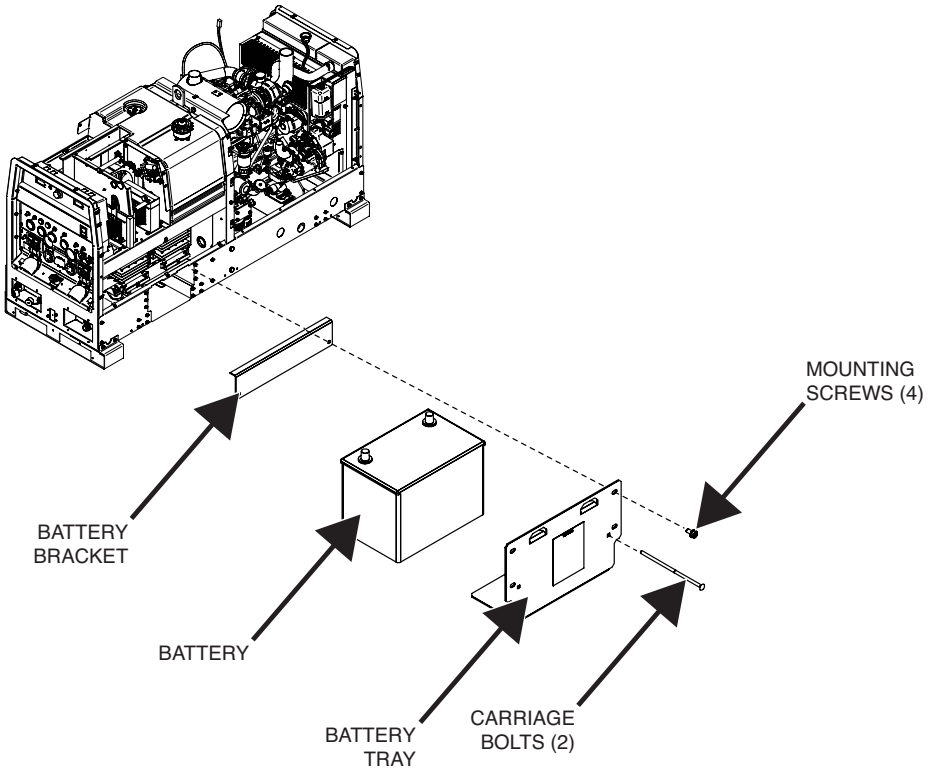
REMOVAL PROCEDURE

1. Turn off the compressor switch and wait for system to depressurize through the blow down solenoid. See Figure F.104.
2. Turn off the Air Vantage 650.
3. After the pressure has dissipated, open the air outlet valve at the front of the Air Vantage 650. See Figure F.104.
4. Place the machine on a flat surface and use wood or metal blocks to fully and evenly support the base and permit access to the large holes in the bottom of the base, just below the alternator rubber mounts.
5. Perform the ***Case Cover Removal Procedure***.
6. Remove the battery assembly out of the machine.
7. Using a 7/16” nutdriver, remove the two nuts from the carriage bolts securing the battery bracket. See ***Figure F.105***.
8. Using a 1/2” nutdriver, label and disconnect the positive battery leads from the positive battery terminals. See ***Figure F.105***. See Wiring Diagram.
9. Remove the battery from the battery tray. See ***Figure F.105***.
10. Using a 1/2” nutdriver, attach the four screws securing the battery tray to the machine. See ***Figure F.105***. The battery tray provides additional support to the machine base.
11. Perform the ***Chopper Module Capacitor Discharge Procedure***.
12. Perform the ***Fuel Tank Removal Procedure***.
13. Perform the ***Power Module / Output Rectifier Removal Procedure***.
14. Using a 3/8” nutdriver, remove the two screws securing the brush cover from the weld alternator rotor (closest to the engine). See ***Figure F.106***.
15. Using a 3/8” nutdriver, remove the two screws securing the brush cover from the auxiliary alternator rotor (farthest from the engine). See ***Figure F.107***.
16. To allow for the removal of the stator and rotor assemblies the case front assembly must be removed from the machine. See Figure F.104.
17. Using a 1-1/4” open end wrench, label and disconnect the air line from the rear of the air outlet valve. See Figure F.104.
18. Using two 1/2” open end wrenches, label and disconnect leads POS B shunt and POS A shunt from the shunt on the rear of the positive output terminal. See Figure F.104. See Wiring Diagram. Note washer placement for reassembly (nut, lock washer, flat washer, lead, mounting point, bolt).
19. Using a 9/16” nutdriver, remove the nut and lock washer securing the battery isolator lead to the switch on the rear of the battery isolator. See Figure F.104. See Wiring Diagram.

ROTORS AND STATORS

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.105 – Battery removal



20. Using a 9/16” nutdriver, label and disconnect lead 238 and the two positive battery leads from the rear of the battery isolator. See ***Figure F.104***. Note washer placement for reassembly (nut, lock washer, lead 238, lead, lead). See Wiring Diagram.
21. Label and disconnect leads connected to the control panel and case front assembly to allow for the removal of the case front assembly. Cut cable ties as necessary. See Wiring Diagram. There are a large number of leads and it is crucial that all leads are reconnected and routed in the same manner as they were originally installed.

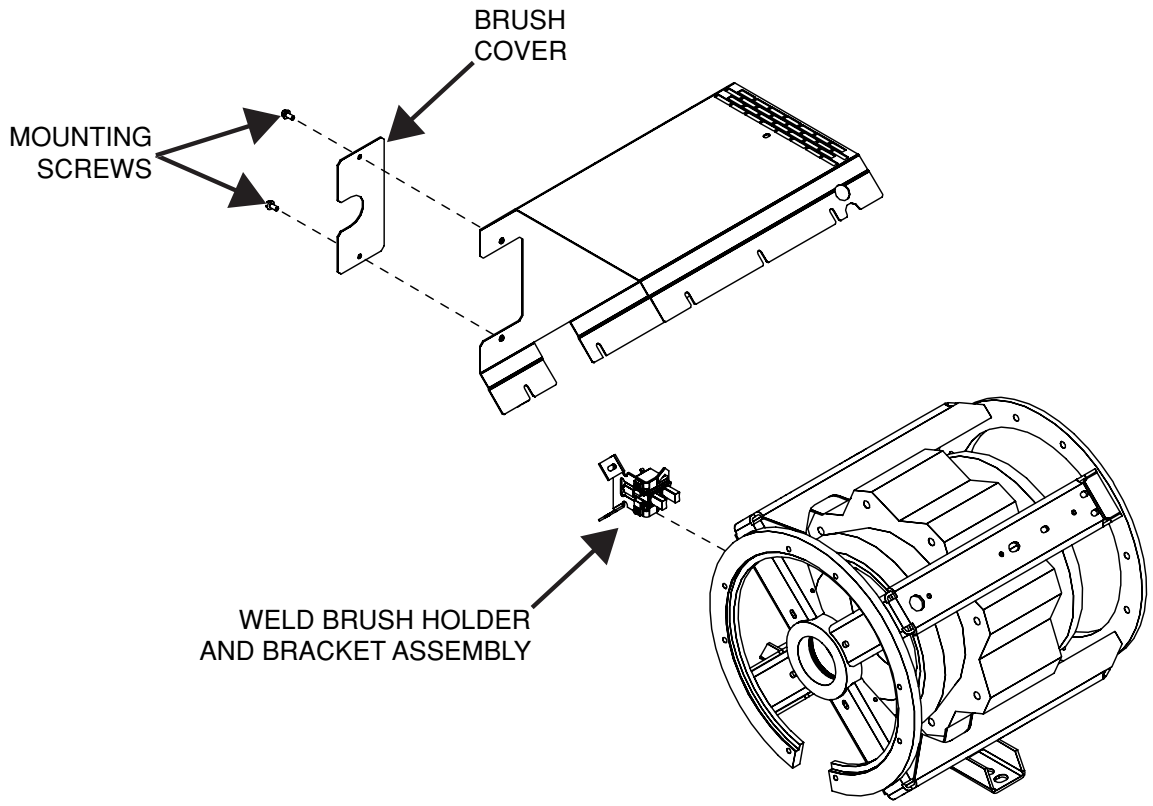
NOTE: Leads mounted to the posts on the rear of the control panel must be reattached in the same order as they were removed.

22. Using a 1/2” nutdriver, remove the four screws securing the case front assembly. See ***Figure F.108***.
23. Using a 1/2” nutdriver, loosen the bottom locknut and washer securing the bottom of the case front assembly to the plate on the bottom of the machine. The locknut and washer are located behind the cover plate on the case front assembly. See ***Figure F.108***.
24. The case front assembly can now be carefully removed and set aside.
25. Carefully route all wiring to the sides of the machine so it does not get damaged when removing components from the machine.
26. Unplug the CR3 idle relay to gain access to the mounting screw. See ***Figure F.109***. See Wiring Diagram.
27. Using a 5/16” nutdriver, remove the screw securing the CR3 idle relay to the left baffle. See ***Figure F.109***.
28. Plug the CR3 idle relay back into the mounting harness.
29. Unplug the CR4 engine protection relay to gain access to the mounting screw. See ***Figure F.109***. See Wiring Diagram.
30. Using a 5/16” nutdriver, remove the screw securing the CR4 engine protection relay to the left baffle. See ***Figure F.109***.
31. Plug the CR4 engine protection relay back into the mounting harness.
32. Label and disconnect leads 262, 232S, 234R, 232P, 232R and 232S from the timer delay relay. See ***Figure F.109*** and ***F.110***. See Wiring Diagram.
33. Route any wiring running through the left and right baffles to allow the baffles to be removed. Cut cable ties as necessary.
34. Using a 1/2” nutdriver, remove the four screws securing the left baffle to the machine. See ***Figure F.111***.
35. Using a 1/2” nutdriver, remove the two screws securing the right baffle to the machine. See ***Figure F.111***.
36. The left and right baffles can now be removed and set aside.
37. Label and disconnect the two small plastic hoses from the coalescer. See ***Figure F.112***. The coalescer is attached to the rear of the lift frame assembly.

ROTORS AND STATORS

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.106 – Weld brush cover removal

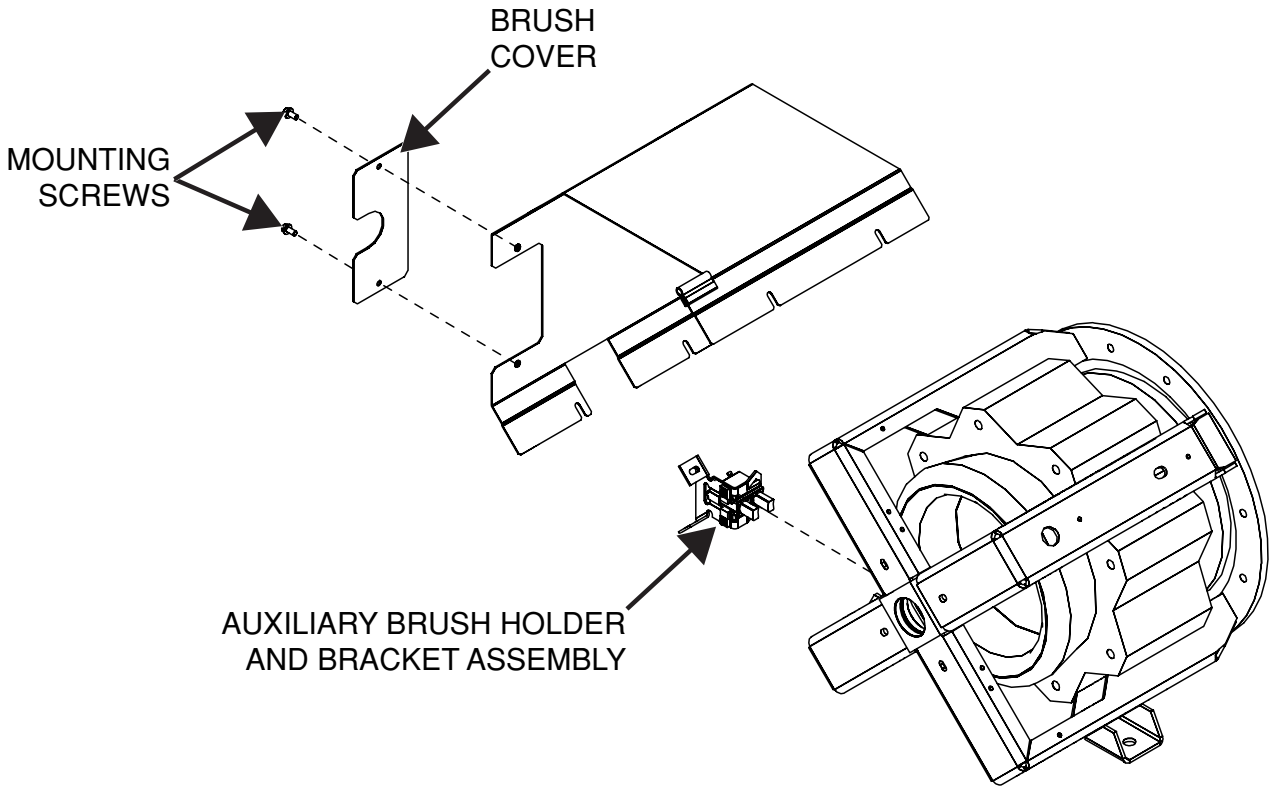


38. Using a 1-1/4” open end wrench and an adjustable wrench, label and disconnect the two large hoses from the coalescer. See ***Figure F.112***.
39. Route any cables and wiring through the lift frame assembly to allow for removal of the lift frame assembly.
40. Using two 3/4” open end wrenches, remove the four bolts securing the lift frame assembly to the machine. See ***Figure F.111***. Note washer placement for reassembly (nut, lock washer, panel, bolt).
41. The lift frame assembly can now be carefully removed and set aside.
42. Label and disconnect plugs J31 and J32 from the electronic engine speed governor. See ***Figure F.113***. See Wiring Diagram.
43. Using a 3/8” nutdriver, remove the two screws securing the electronic engine speed governor to the machine and remove the electronic engine speed governor. See ***Figure F.113***.
44. Label and disconnect leads 200D and 201B from the weld brush terminals. See ***Figure F.114***. See Wiring Diagram.
45. Label and disconnect leads 200B and 201 from the auxiliary brush terminals. See ***Figure F.115***. See Wiring Diagram.
46. Using a 3/8” nutdriver, remove the two screws securing the weld brush holder to the machine. See ***Figure F.116***.
47. Using a 3/8” nutdriver, remove the two screws securing the auxiliary brush holder to the machine. See ***Figure F.116***.
48. Using a 3/8” nutdriver, remove the seven screws securing the top auxiliary stator cowling. See ***Figure F.117***.
49. Carefully move any cables or wiring as necessary to allow for the removal of the top auxiliary stator cowling.
50. Carefully remove the top auxiliary stator cowling and set aside.
51. Using a 1/2” nutdriver, remove the nine screws securing the top weld stator cowling. See ***Figure F.117***.
52. Using a 3/8” nutdriver, remove the three screws securing the top weld stator cowling. See ***Figure F.117***.
53. Carefully move any cables or wiring as necessary to allow for the removal of the top weld stator cowling.
54. Carefully remove the top weld stator cowling and set aside.
55. Using a 3/8” nutdriver, remove the two screws securing the bottom auxiliary stator cowling. See ***Figure F.117***.
56. Using a 1/2” nutdriver, remove the three screws securing the bottom weld stator cowling. See ***Figure F.117***.
57. Using a 3/8” nutdriver, remove the three screws securing the bottom weld stator cowling. See ***Figure F.117***.
58. Using a 3/4” socket and a 3/4” open end wrench, remove the four lock nuts, bolts, flat washers and engine support washers securing the generator assembly to the rubber mounts. See ***Figure F.118***. These bolts can be accessed through the large holes in the base of the machine. Note washer placement for reassembly.

ROTORS AND STATORS

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.107 – Auxiliary brush cover removal



59. Using a hoist and appropriate rigging, carefully lift the generator assembly slightly above the rubber mounts to allow for the removal of the bottom stator cowling's. See ***Figure F.117***.

NOTE: When lifting the generator assembly do not lift any higher than necessary as this may cause damage to the components on the rear of the engine assembly.

60. With the generator assembly lifted, carefully route any cables and/or wiring to allow for the removal of the bottom stator cowling's.
61. Carefully remove the auxiliary and weld bottom stator cowling's and set aside.
62. Using wood or metal blocks, support the end of the engine. The blocks only need to be high enough to take the weight off of the rubber mounts.
63. Using a hoist and appropriate rigging, carefully lower the generator assembly so it is resting just above the rubber mounts.

AUXILIARY STATOR REMOVAL

64. Using a hoist and appropriate rigging, securely support the auxiliary stator tie bar assembly.
65. Using a 11/16" socket, remove the eight bolts and lock washers securing the auxiliary stator tie bar assembly mounting flange to mating flange on the weld stator tie bar assembly. See ***Figure F.119***.
66. Using the hoist adjusted to support the weight of the auxiliary stator tie bar assembly, use a gear puller to remove the auxiliary stator tie bar assembly off of the auxiliary rotor bearing. See ***Figure F.119***.
67. Using the hoist, raise or lower the stator tie bar assembly as necessary while gently pulling it off of the auxiliary rotor assembly and away from the weld stator tie bar assembly. Be very careful not to damage either the stator or rotor windings while separating the two parts. See ***Figure F.119***.
68. Using the hoist, carefully place the auxiliary stator tie bar assembly in a safe location.

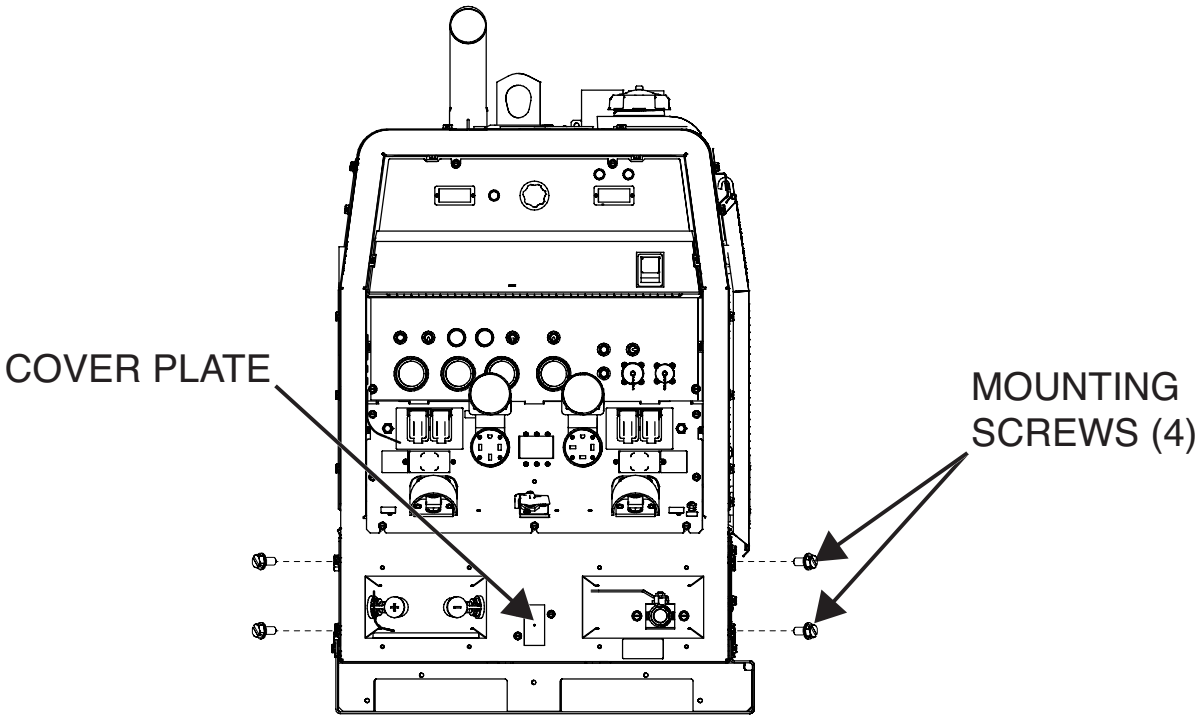
AUXILIARY ROTOR REMOVAL

69. Using the hoist and appropriate rigging, support the auxiliary rotor assembly. See ***Figure F.120***.
70. Using a 9/16" socket, remove the through bolt, lock washer and centering washer from the auxiliary rotor. See ***Figure F.120***.
71. Using the rotor removal tool, following the instructions supplied with the rotor removal tool, separate the auxiliary rotor shaft from the weld rotor shaft. See ***Figure F.120***.
72. Using the hoist, place the auxiliary rotor assembly in a safe location.

ROTORS AND STATORS

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.108 – Case front assembly removal



WELD STATOR REMOVAL

73. Using the hoist and appropriate rigging, support the weight of the weld stator tie bar assembly. See ***Figure F.121***.
74. Using an heavy duty angled snap ring tool, remove the retaining ring from the rear side (closest to the engine) of the weld stator bearing housing. The retaining ring will remain on the shaft of the weld alternator rotor. See ***Figure F.121***.
75. Using a 11/16" socket, loosen the eight bolts and washers securing the weld stator tie bar assembly to the engine mounting flange. Do not fully remove the mounting bolt at this point. See ***Figure F.121***.
76. Using a gear puller, carefully pull the weld alternator stator tie bar assembly off of the bearing. See ***Figure F.121***.
77. Using a hoist, raise or lower the weld stator tie bar assembly while gently pulling it off of the weld rotor assembly and away from the engine. Be very careful not to damage either the stator or rotor windings while separating the two parts. See ***Figure F.121***.
78. Using the hoist, place the weld stator tie bar assembly in a safe location.

WELD ROTOR REMOVAL

79. Using the hoist and appropriate rigging, securely support the weld rotor assembly. See ***Figure F.122***.
80. Using the hoist, carefully pull the weld rotor and shaft hub assembly out of the shaft coupling. See ***Figure F.122***.

COUPLING REMOVAL

81. Using a 11/16" socket, remove the eight bolts and lock washers securing the four blower paddle assemblies and shaft coupling to the engine flywheel. See ***Figure F.122***.
82. Carefully secure the rotor so it cannot turn.
83. Using a 1/2" allen wrench, remove the large allen bolt securing the coupling hub to the rotor. The hub can now be pulled off of the rotor shaft. See ***Figure F.122***.

ROTORS AND STATORS

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.109 – Left baffle components

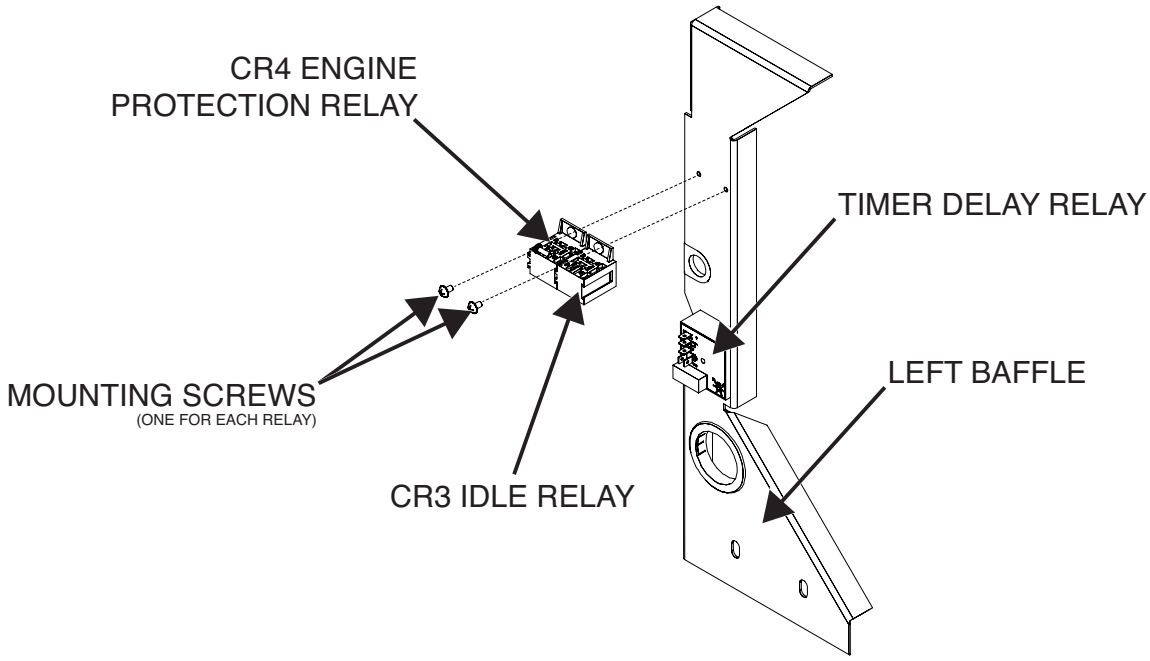
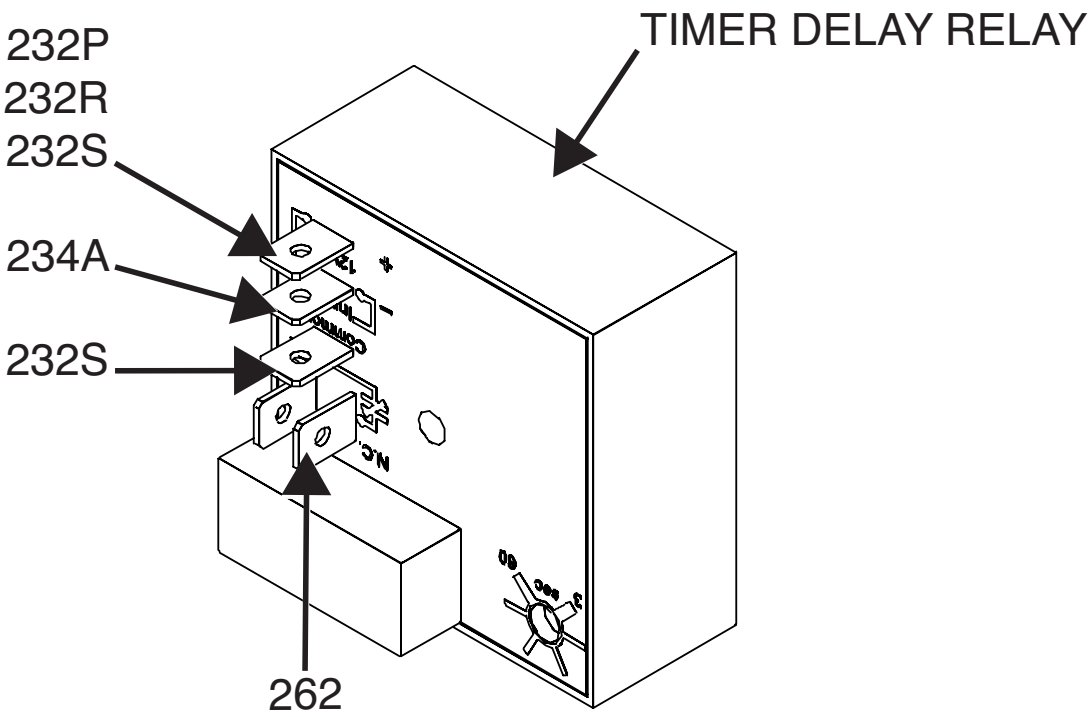


Figure F.110 – Timer delay relay lead locations



ROTORS AND STATORS

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.111 – Lift frame assembly, left baffle and right baffle removal

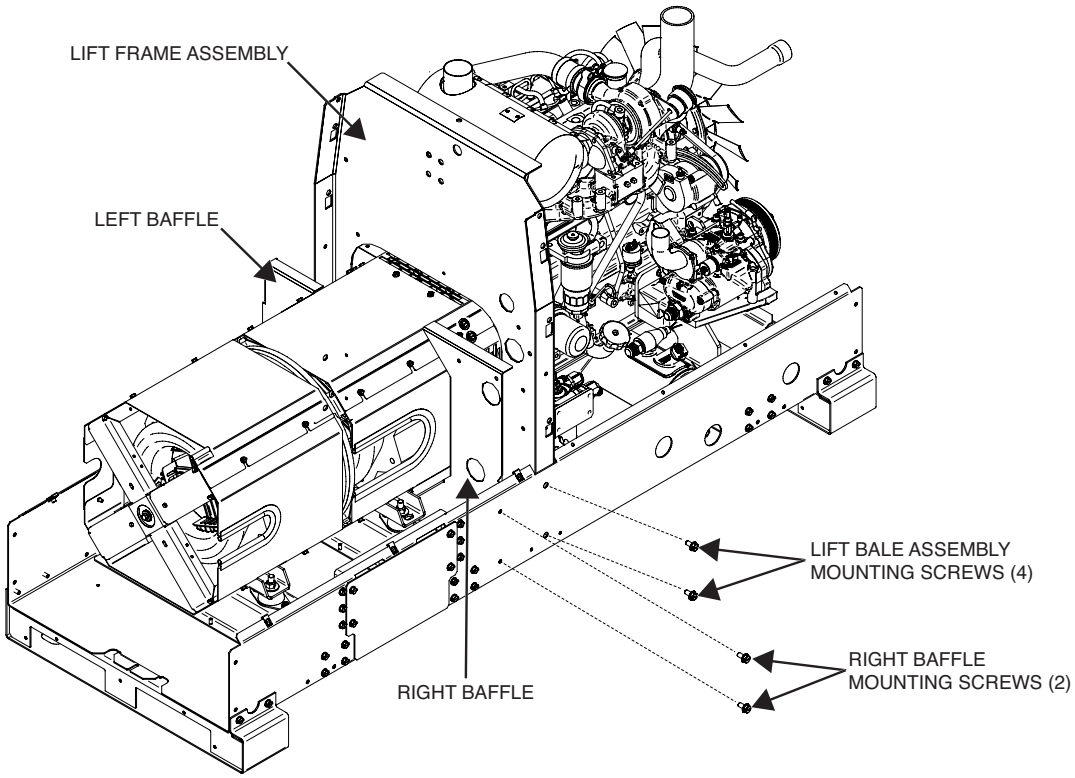
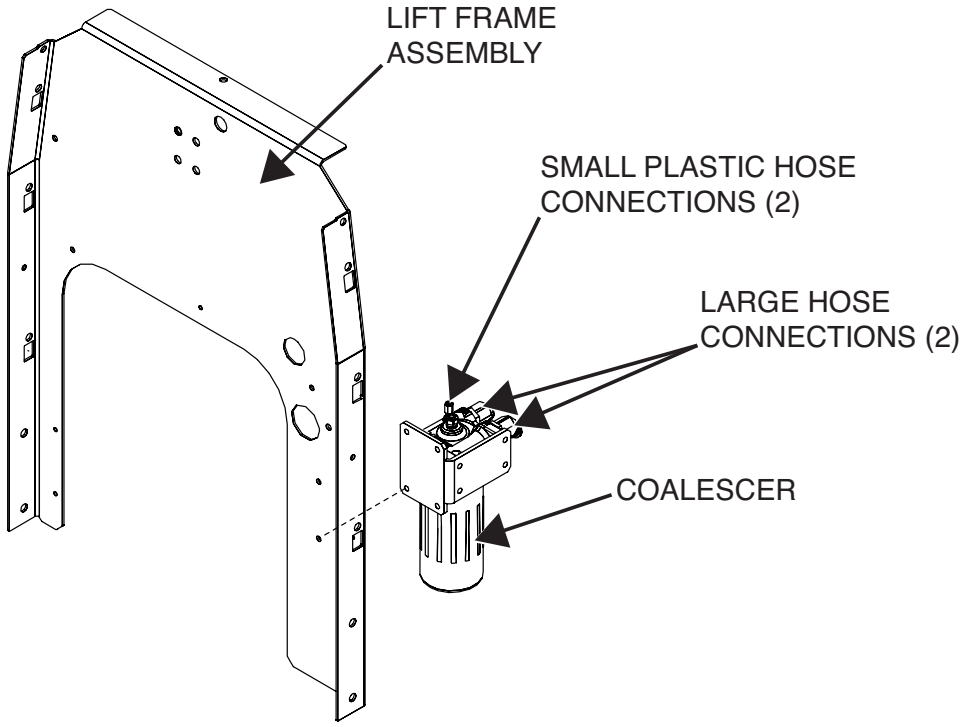


Figure F.112 – Coalescer location and hose connections



ROTORS AND STATORS

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.113 – Electronic engine governor plugs and mounting screws

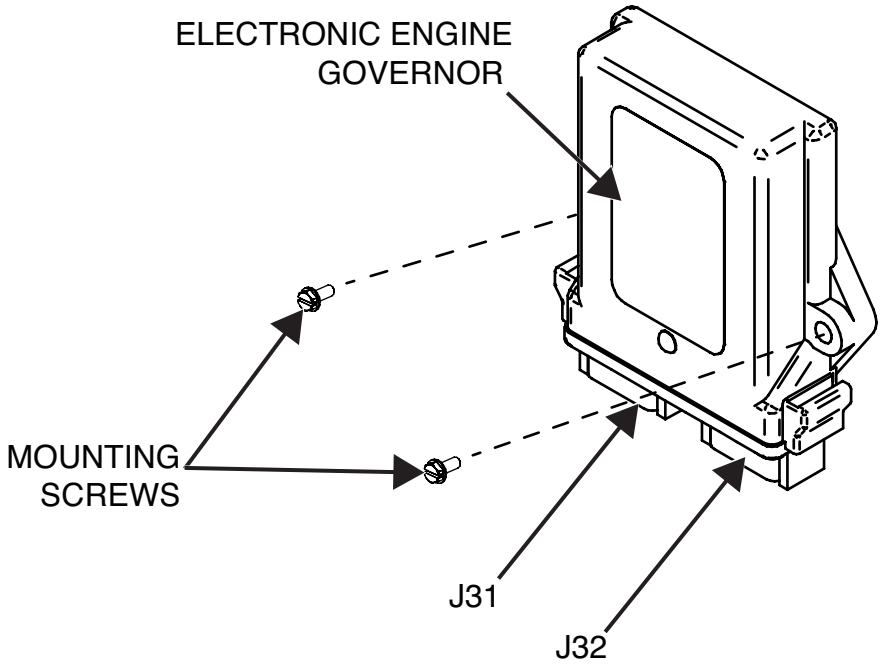
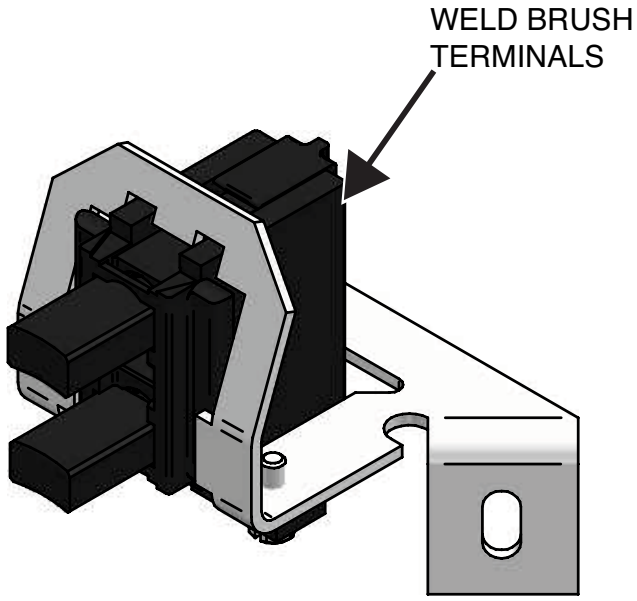


Figure F.114 – Weld brush terminal location



ROTORS AND STATORS

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.115 – Auxiliary brush terminal location

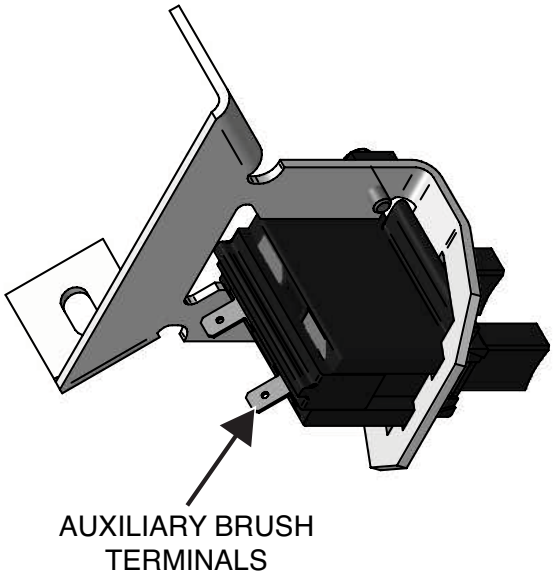
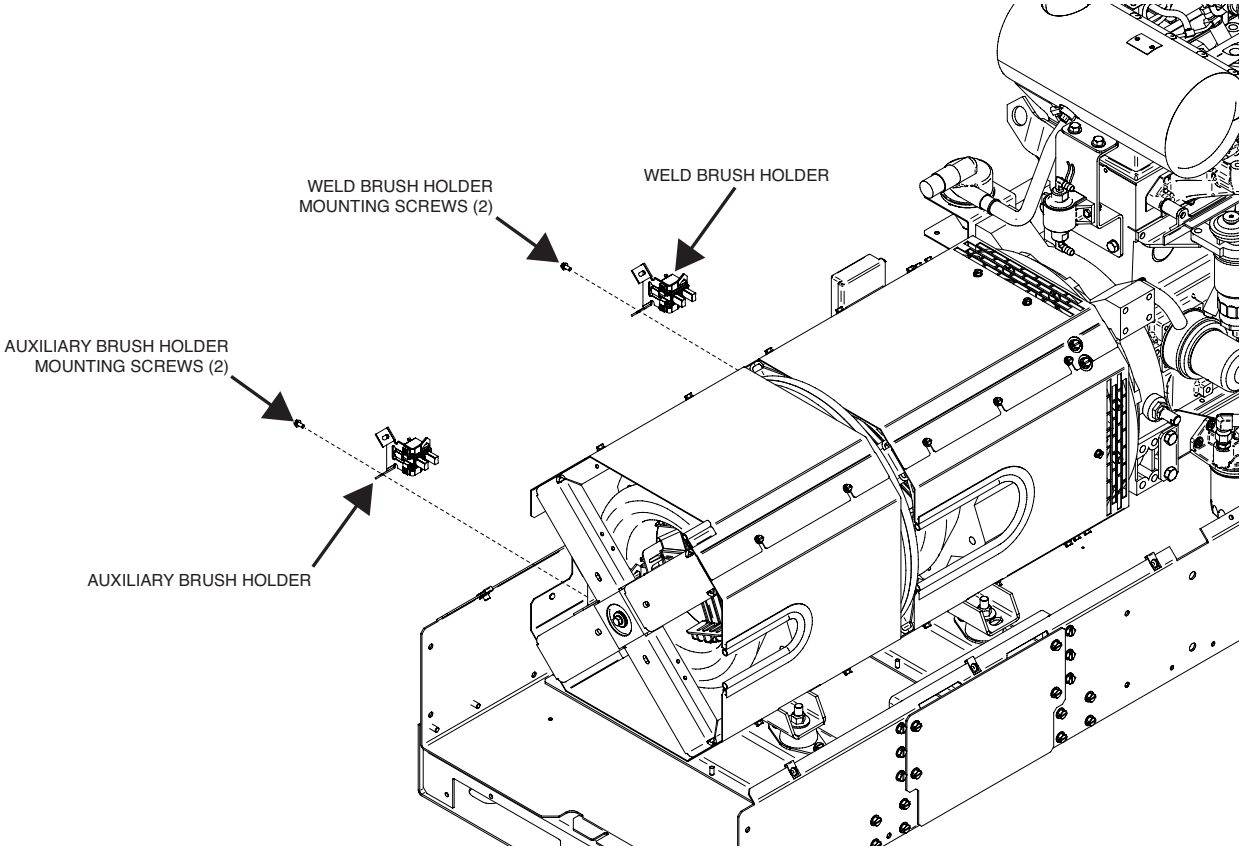


Figure F.116 – Auxiliary and weld brush holder removal



ROTORS AND STATORS

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.117 – Stator cowling locations

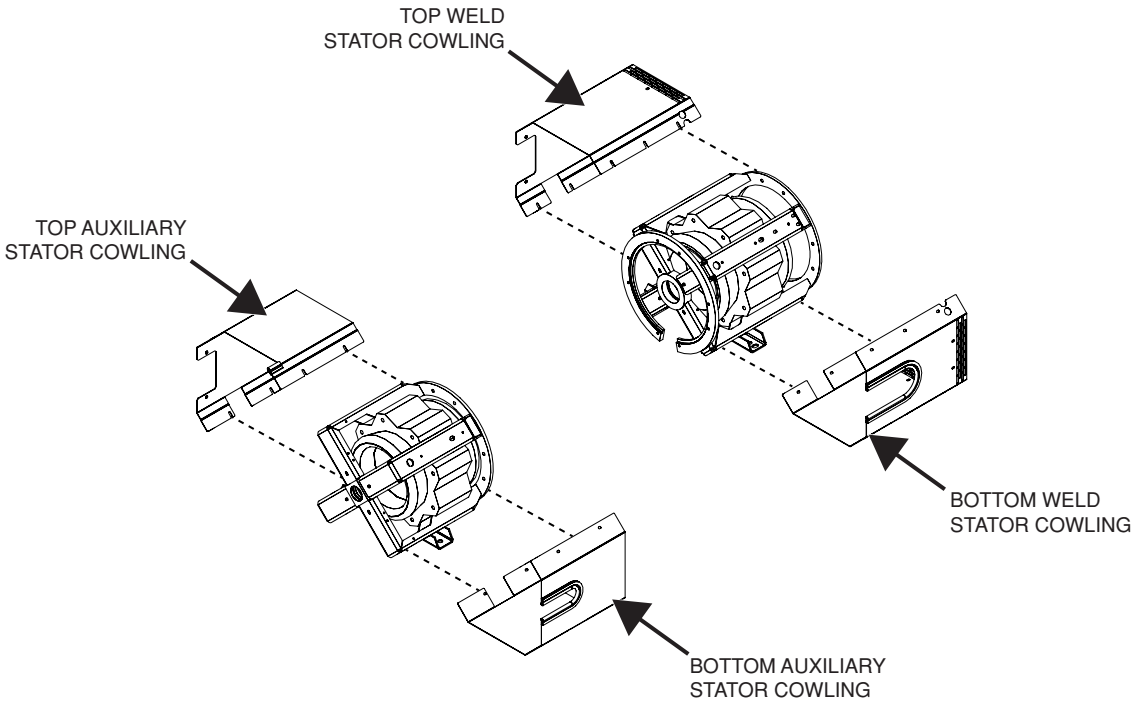
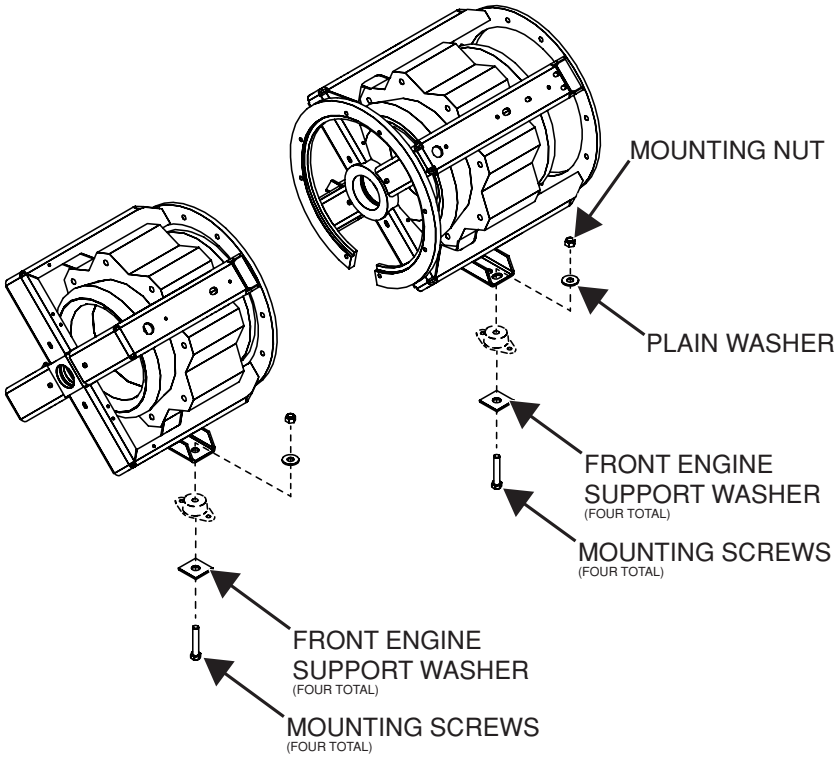


Figure F.118 – Generator assembly mounting bolts



ROTORS AND STATORS

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.119 – Auxiliary stator tie bar assembly removal

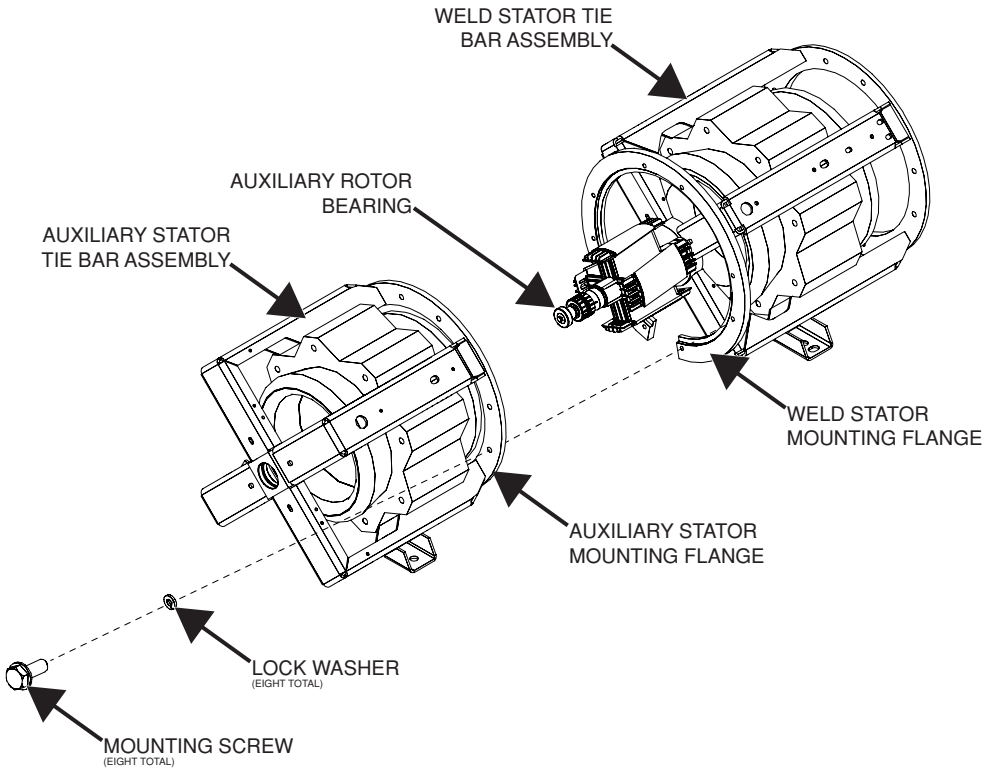
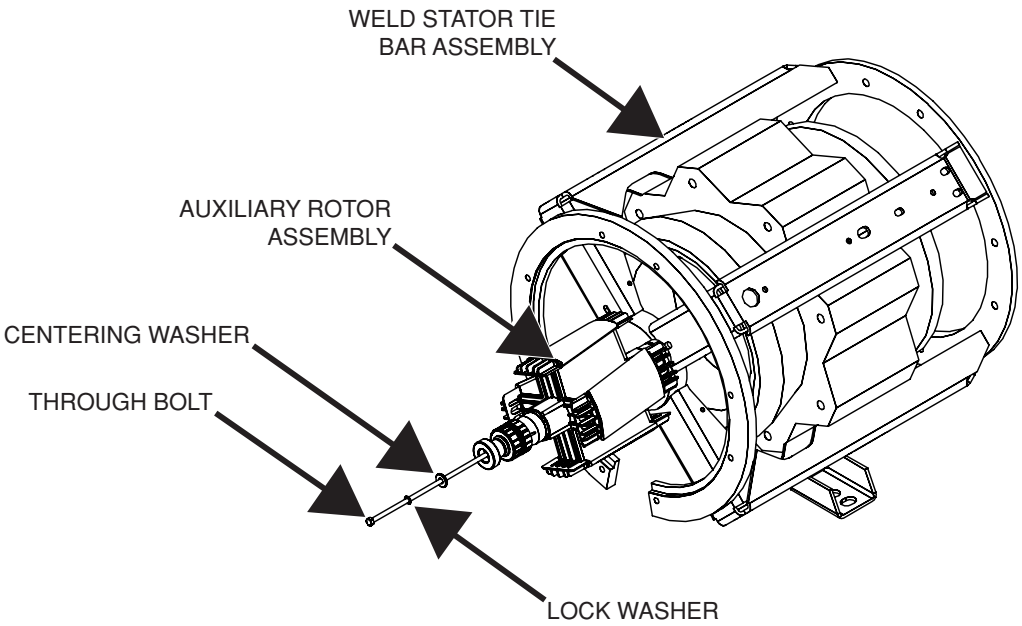


Figure F.120 – Auxiliary rotor removal



ROTORS AND STATORS

REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

Figure F.121 – Weld stator tie bar assembly removal

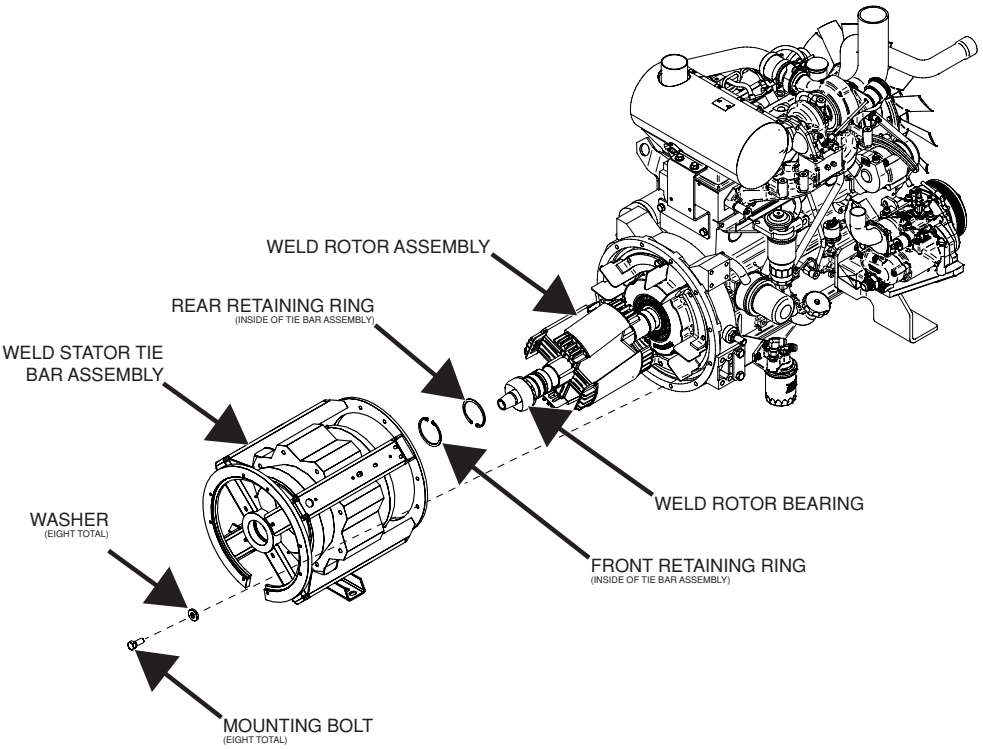
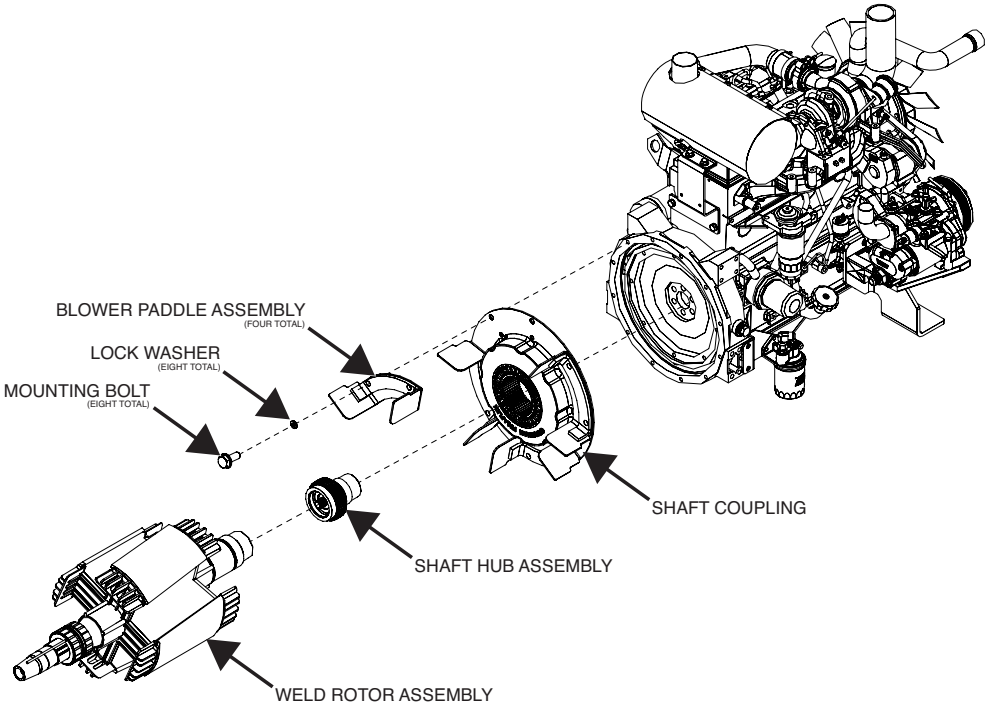


Figure F.122 – Weld rotor and shaft coupling removal



ROTORS AND STATORS
REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

REPLACEMENT PROCEDURE

INSTALLING SHAFT COUPLING TO THE ENGINE FLYWHEEL

1. Thoroughly clean and inspect the surfaces of the engine flywheel and the shaft coupling. There should be no dirt or imperfections on the mating surfaces that could prevent proper seating and alignment of the shaft coupling to the engine flywheel.
2. Carefully place the shaft coupling on the engine flywheel, being certain that it is fully seated in the machined recess area.
3. Using a 11/16" torque wrench, attach the eight bolts and lock washers securing the four blower paddle assemblies to the shaft coupling and the engine flywheel. Tighten these eight bolts and lock washers evenly and in an alternating pattern. Torque to 28 ft./lbs. as specified in the ***Torque Specifications*** at the beginning of this procedure.

INSTALLING THE SHAFT HUB TO THE WELD ALTERNATOR ROTOR

4. Thoroughly clean and inspect the mating surfaces of the rotor shaft and the shaft hub assembly.
5. Secure the rotor assembly so it cannot turn when the mounting screw is tightened.
6. Carefully place the shaft hub on the end of the weld rotor shaft.
7. Carefully apply high strength thread locking compound to the threads of the mounting screw.
8. Using a 1/2" allen wrench, attach the bolt and lock washer securing the shaft hub to the weld rotor assembly. Using a 1/2" torque wrench, torque the screw to between 201 and 210 ft./lbs. as specified in the ***Torque Specifications*** at the beginning of this procedure.

INSTALLING THE WELD ROTOR

9. It is highly recommended that a new bearing be installed whenever the rotor or stator is disassembled. When installing the new bearing be certain the bearing retaining ring is placed on the shaft before the bearing is installed.
10. Apply a thin coating grease (Chevron SRI or equivalent) to the end of the shaft hub.
11. Using a hoist and appropriate rigging, carefully position the weld rotor and shaft hub assembly fully into the flywheel mounted portion of the shaft coupling.

INSTALLING THE WELD STATOR

12. Prepare the weld stator by thoroughly cleaning and inspecting the machined surfaces on the engine and stator mounting flanged. These surfaces should be free of dirt and defects that could prevent proper seating and alignment.
13. Clean the bearing seat in the stator. Be certain the "O" ring and retaining ring grooves are clean and undamaged. Install a new "O" ring and install the outboard retaining ring.
14. Apply a thin coating of grease (Chevron SRI or equivalent) to the inside diameter of the bearing bore.
15. Using the hoist and appropriate rigging, carefully position the weld stator tie bar assembly over the rotor and onto the bearing. Be careful not to damage the rotor or stator windings.
16. Make certain the flange is fully seated and bolt holes are properly aligned.
17. Attach the eight mounting bolts and lock washers securing the stator tie bar assembly to the engine mounting flange. Hand-tighten these screws at this time.
18. Using the hoist and appropriate rigging, carefully lift the weld stator assembly enough to remove the blocks supporting the engine and then lower the weld stator onto the rubber mounts. Be certain the stator mounting feet are resting evenly on both mounts.
19. Using a 11/16" torque wrench, tighten the eights screws and lock washers evenly in an alternating pattern. Torque to 28 ft./lbs. as specified in the ***Torque Specifications*** at the beginning of this procedure.
20. Carefully move the rotor away from the engine so the bearing is firmly against the outer retaining ring.
21. Using a heavy duty angled snap ring tool, install the inner retaining ring being certain that it is fully seated in the groove.
22. Using the feeler gage, check the air gap between the rotor and stator. The feeler gage dimensions are shown in the ***Materials Needed*** list in the beginning of this procedure.
    - The rotor should be positioned so the gap between the rotor poles and the stator can be checked at four locations 90 degrees apart without turning the rotor.
    - The gage should pass completely through the gap between the rotor and stator at all four locations.
    - The edges of the gage must not fall into the stator slots.

ROTORS AND STATORS
REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

INSTALLING THE AUXILIARY ROTOR

23. Thoroughly clean and inspect the tapered area and the threaded hole in the end of the weld rotor shaft. Clean and inspect the internal tapered area of the auxiliary rotor. These mating tapers must be clean, dry and be free of any scratches and imperfections.
24. It is recommended that a new bearing be installed on the auxiliary rotor.
25. Using the hoist and appropriate rigging, carefully position the auxiliary rotor onto the tapered end of the weld rotor.
26. Place the lock washer and centering washer onto the through bolt.
27. Carefully apply high strength thread locking compound to the through bolt threads.
28. Using a 9/16" torque wrench, torque the through bolt to between 50 to 62 ft./lbs. as specified in the ***Torque Specifications*** at the beginning of this procedure.

INSTALLING THE AUXILIARY STATOR

29. Prepare the bearing surface and mounting flanges by thoroughly cleaning and inspecting the machined mating surfaces on the auxiliary and weld stator mounting flanges. These surfaces should be free of dirt and defects that could prevent proper seating and alignment.
30. Clean the bearing seat in the stator. Be certain the "O" ring is clean and undamaged. Install a new "O" ring.
31. Apply a thin coating of grease (Chevron SRI or equivalent) to the inside diameter of the bearing bore.
32. Use the hoist and appropriate rigging, carefully place the stator tie bar assembly over the auxiliary rotor. Be sure the mating flanges are properly aligned and fully seated. The feet should be resting evenly on the rubber mounts.
33. Using a 11/16" torque wrench, attach the eight screws and lock washers securing the auxiliary stator assembly to the weld stator assembly. Tighten these screws evenly and in an alternating pattern. Torque to 28 ft./lbs. as specified in the ***Torque Specifications*** at the beginning of this procedure.
34. Using the feeler gage, check the air gap between the rotor and stator. The feeler gage dimensions are shown in the ***Materials Needed*** list in the beginning of this procedure.
    - The rotor should be positioned so the gap between the rotor poles and the stator can be checked at four locations 90 degrees apart without turning the rotor.
    - The gage should pass completely through the gap between the rotor and stator at all four locations.
    - The edges of the gage must not fall into the stator slots.

COMPLETING THE REASSEMBLY

35. Using the hoist and appropriate rigging, lift the stator assemblies off of the rubber mounts and place the bottom sheet metal cowling's on both stators.
36. Lower the weld and auxiliary stator assemblies down onto the rubber mounts and align the holes.
37. Using a 3/4" socket and a 3/4" open end wrench, secure the four lock nuts, bolts, flat washers and engine support washers securing the generator assembly to the rubber mounts.
38. Using a 3/8" nutdriver, attach the three screws securing the bottom weld stator cowling.
39. Using a 1/2" nutdriver, attach the three screws securing the bottom weld stator cowling.
40. Using a 3/8" nutdriver, attach the two screws securing the bottom auxiliary stator cowling.
41. Carefully route any cables and wiring to allow for the proper installation of the top weld stator cowling.
42. Carefully position the top weld stator cowling onto the weld stator tie bar assembly.
43. Using a 3/8" nutdriver, attach the three screws securing the top weld stator cowling.
44. Using a 1/2" nutdriver, attach the nine screws securing the top weld stator cowling.
45. Carefully route any cables and wiring to allow for the proper installation of the top auxiliary stator cowling.
46. Carefully position the top auxiliary stator cowling onto the auxiliary stator tie bar assembly.
47. Using a 3/8" nutdriver, attach the seven screws securing the top auxiliary stator cowling.
48. Using a 3/8" nutdriver, attach the two screws securing the auxiliary brush holder to the machine.
49. Using a 3/8" nutdriver, attach the two screws securing the weld brush holder to the machine.
50. Connect leads 200B and 201 to the auxiliary brush terminals. See Wiring Diagram.
51. Connect leads 200D and 201B to the weld brush terminals. See Wiring Diagram.
52. Using a 3/8" nutdriver, attach the two screws securing the electronic engine speed governor to the machine.
53. Connect plugs J31 and J32 to the electronic engine speed governor. See Wiring Diagram.
54. Carefully position the lift frame assembly into the machine.
55. Using two 3/4" open end wrenches, attach the four bolts, lock washers and nuts securing the lift frame assembly to the machine.

ROTORS AND STATORS
REMOVAL AND REPLACEMENT PROCEDURE *(continued)*

56. Carefully route any cables and wiring through the lift frame assembly as necessary.
57. Using a 1-1/4” open end wrench and an adjustable wrench, connect the two large hoses to the coalescer on the rear of the lift frame assembly.
58. Connect the two small plastic hoses to the coalescer.
59. Carefully position the right baffle into the machine.
60. Using a 1/2” nutdriver, attach the two screws securing the right baffle to the machine.
61. Carefully position the left baffle to the machine.
62. Using a 1/2” nutdriver, attach the four screws securing the left baffle to the machine.
63. Carefully route any wiring running through the left and right baffles. Replace any cable ties as necessary.
64. Connect leads 262, 232S, 234R, 232P, 232R and 232S to the timer delay relay on the left baffle. See Wiring Diagram.
65. Unplug the CR4 engine protection relay from the mounting harness. See Wiring Diagram.
66. Using a 5/16” nutdriver, attach the screw securing the CR4 engine protection relay to the left baffle.
67. Plug the CR4 engine protection relay back into the mounting harness.
68. Unplug the CR3 idle relay from the mounting harness.
69. Using a 5/16” nutdriver, attach the screw securing the CR3 idle relay to the left baffle.
70. Plug the CR3 idle relay back into the mounting harness.
71. Carefully position the case front assembly at the front of the machine.
72. Using a 7/16” nutdriver, attach the bottom locknut and washer securing the bottom of the case front assembly to the plate on the bottom of the machine base. The locknut and washer are located behind the cover plate on the case front assembly.
73. Using a 1/2” nutdriver, attach the four screws securing the case front assembly.
74. Connect all previously removed leads to the control panel and case front assembly. Replace any cable ties as necessary. See Wiring Diagram. There are a large number of leads and it is crucial that all leads are reconnected and routed in the same manner as they were originally installed.

NOTE: Leads mounted to the posts on the rear of the control panel must be reattached in the same order as they were removed.

75. Using a 9/16” nutdriver, connect lead 238 and the two positive battery leads to the switch on the rear of the battery isolator. See Wiring Diagram.
76. Using a 9/16” nutdriver, attach the nut and lock washer securing the battery isolator lead to the switch on the rear of the battery isolator. See Wiring Diagram.
77. Using two 1/2” open end wrenches, connect leads POS B shunt and POS A shunt to the shunt on the rear of the positive output terminal. See Wiring Diagram. Note washer placement for reassembly (nut, lock washer, flat washer, lead, mounting point, bolt).
78. Using a 1-1/4” open end wrench, connect the air line to the rear of the outlet valve.
79. Using a 3/8” nutdriver, attach the two screws securing the brush cover to the auxiliary alternator rotor (farthest from the engine).
80. Using a 3/8” nutdriver, attach the two screws securing the brush cover to the weld alternator rotor (closest to the engine).
81. Perform the ***Power Module / Output Rectifier Replacement Procedure***.
82. Perform the ***Fuel Tank Replacement Procedure***.
83. Using a 1/2” nutdriver, remove the four screws securing the battery tray to the machine and remove the battery tray from the machine.
84. Carefully place the battery into the battery tray.
85. Using a 7/16” nutdriver, attach the two nuts to the two carriage bolts securing the battery bracket to the battery tray.
86. Using a 1/2” nutdriver, connect the positive battery lead to the positive battery terminal. See Wiring Diagram. Do not connect the negative battery terminal at this time.
87. Carefully place the battery tray into the machine.
88. Using a 1/2” nutdriver, attach the four screws securing the battery tray to the machine.
89. Perform the ***Case Cover Replacement Procedure***.
90. Using the hoist and appropriate rigging, lift the machine, remove the wood blocks and place the machine on a flat surface.
91. Close the air outlet valve at the front of the Air Vantage 650.
92. Turn the compressor switch to the ON position.
93. Perform the ***Retest After Repair Procedure***.

RETEST AFTER REPAIR

ENGINE RPM		
MODE	**NO LOAD RPM**	**LOAD RPM (600 AMPS 44 VOLTS)**
LOW IDLE	1490 / 1540	N/A
HIGH IDLE	1840 / 1870	1750 MIN.

OUTPUT TESTS (CONSTANT CURRENT) CC STICK MODE		
OCV (OPEN CIRCUIT VOLTAGE)	55 / 60 VDC	
WELD OUTPUT LOAD TEST		
PRESET AMPS TO 600, ADJUST LOAD BANK TO OBTAIN VOLTAGE SHOWN		
VOLTS	**AMPS**	**RPM**
43.5 / 45	590 / 610	1750 MIN.
ARC CONTROL TEST		
PRESET AMPS TO 150 AND SHORT CIRCUIT WELD OUTPUT TERMINALS		
ARC CONTROL MINIMUM	**ARC CONTROL MAXIMUM**	
140 / 165 AMPS	225 / 255 AMPS	

OUTPUT TESTS (CONSTANT VOLTAGE) CV WIRE MODE		
OCV (OPEN CIRCUIT VOLTAGE)		
OUTPUT CONTROL MINIMUM	**OUTPUT CONTROL MAXIMUM**	
55 / 60 VDC	55 / 60 AMPS	
WELD OUTPUT LOAD TEST		
OUTPUT CONTROL SET TO MAXIMUM, LOAD BANK SET TO OBTAIN 590 / 610 AMPS		
44 / 46 VOLTS		

TOUCH START TIG TESTS		
OCV (OPEN CIRCUIT VOLTAGE)	**SHORT CIRCUIT AMPS**	
MIN OR MAX: 10 / 15 VDC	MIN OR MAX: 18 / 28 AMPS	

AUXILIARY POWER (WELD/AUXILIARY ALTERNATOR AT NORMAL OPERATING TEMPERATURE)		
240 VOLT SINGLE PHASE RECEPTACLE		
OCV (OPEN CIRCUIT VOLTAGE)	**VOLTS @ 45 / 50 AMP LOAD**	
230 / 264	216 / 252	
240 VOLT THREE PHASE RECEPTACLE		
OCV (OPEN CIRCUIT VOLTAGE)	**VOLTS @ 40 / 46 AMPS (PHASE TO PHASE)**	
230 / 264	216 / 252	
120 VOLT RECEPTACLES		
OCV (OPEN CIRCUIT VOLTAGE)	**VOLTS @ 20 AMP LOAD**	
115 / 132	108 / 126	

COMPRESSOR OUTPUT
PSI @ NO LOAD (0 CFM)
145 / 155

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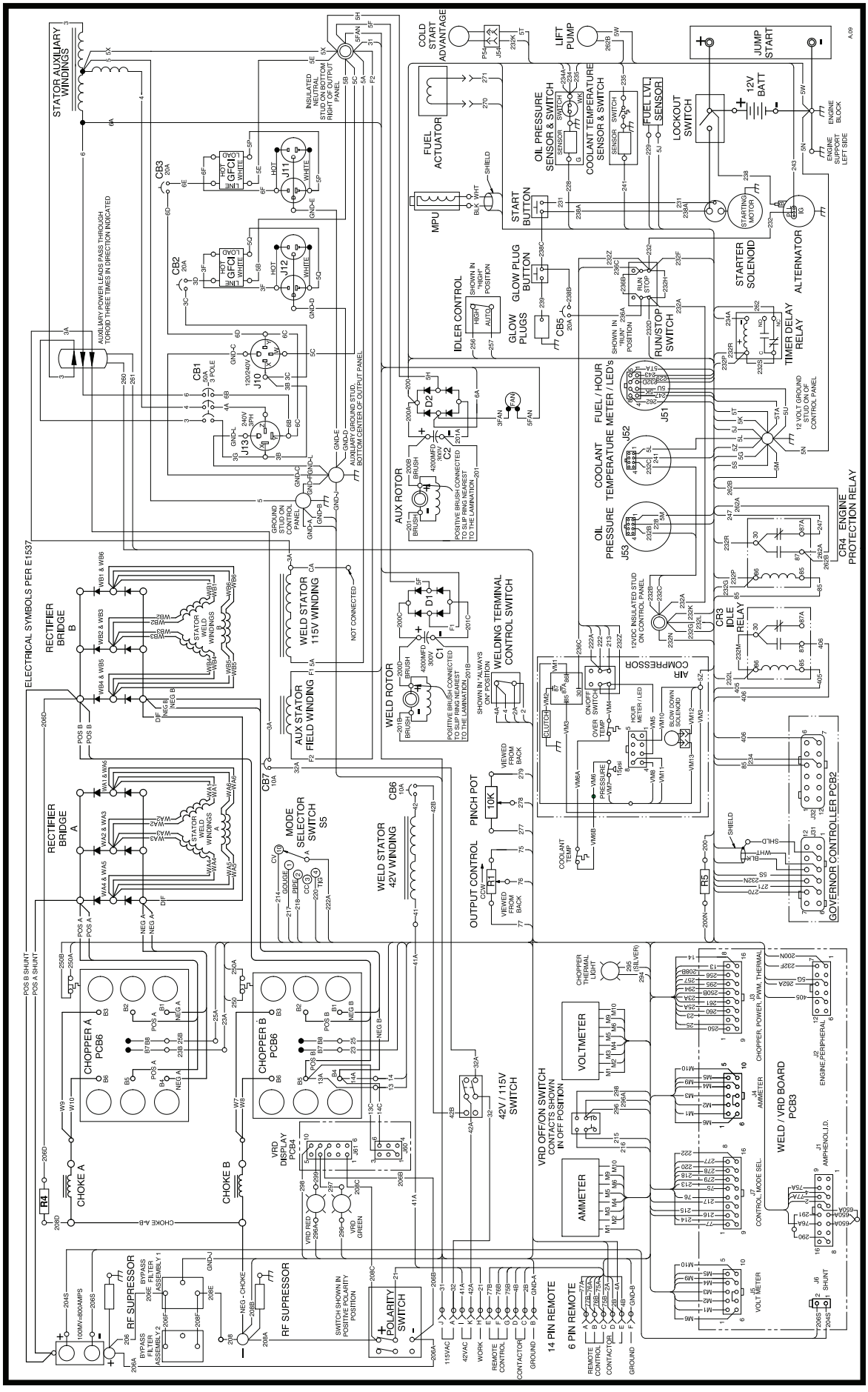
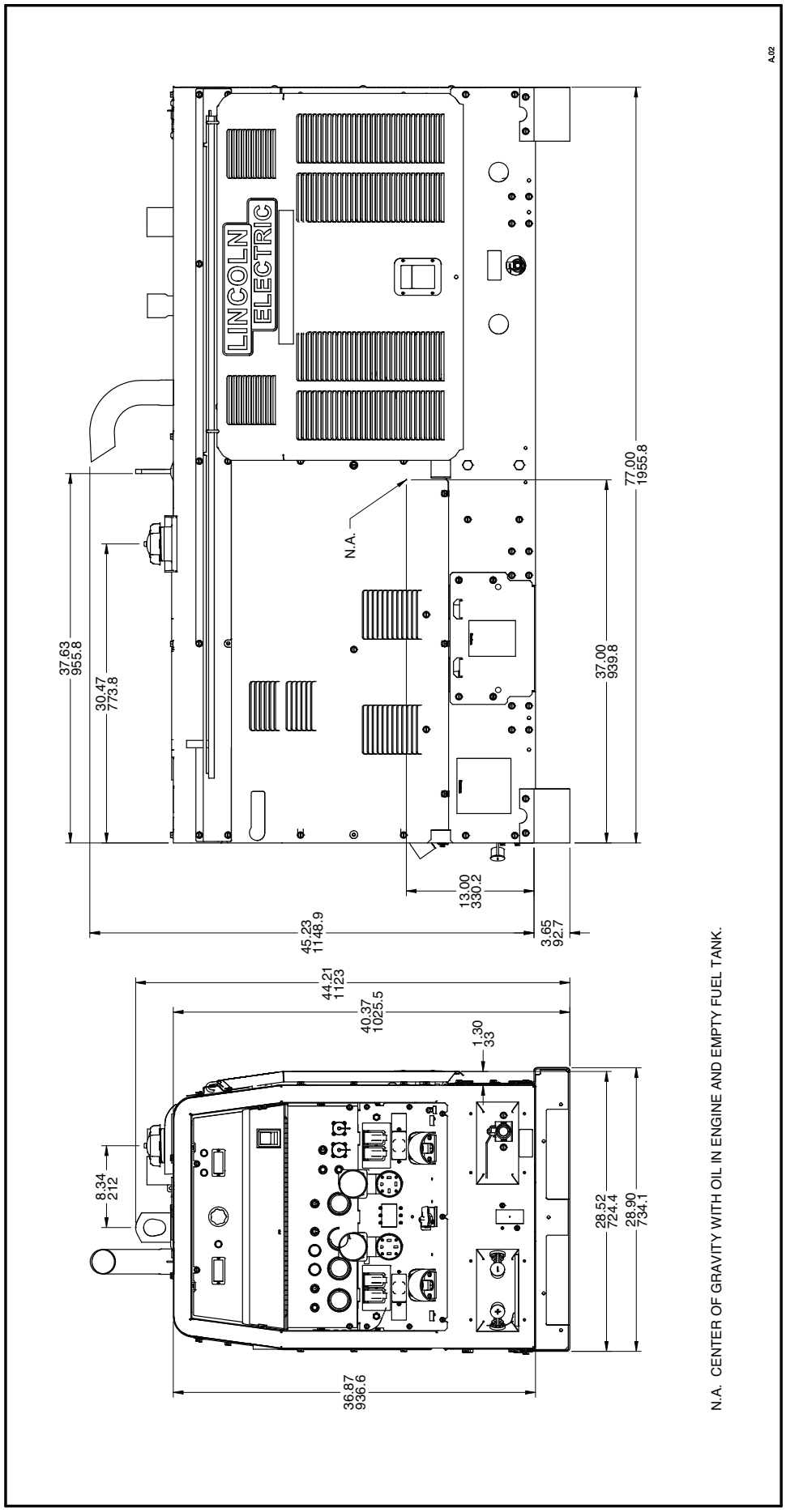
- DIAGRAMS SECTION -

AIR VANTAGE 650 K2961-1 WIRING DIAGRAM



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The specific diagram for a particular code is included with the machine. If the diagram is illegible, write to the Service Department for a replacement. Give the equipment code number.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13.00
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1148.9
3.65
92.7
44.21
1123
40.37
1025.5
1.30
33
8.34
212
28.52
724.4
28.90
734.1
36.87
936.6
N.A. CENTER OF GRAVITY WITH OIL IN ENGINE AND EMPTY FUEL TANK.