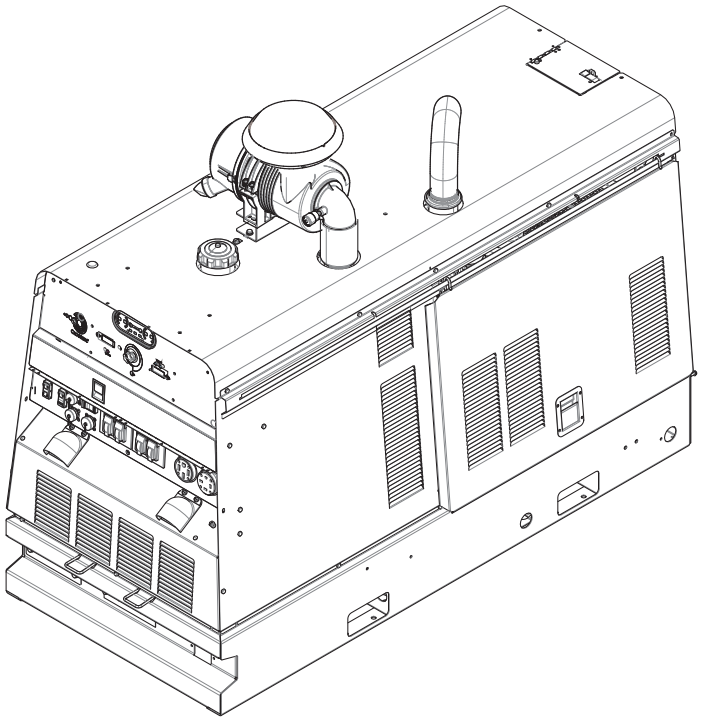
LINCOLN ELECTRIC

Service Manual

Vantage® 549X



For use with machines having Code Numbers:

13191, 13192, 13413, 13440, 13441, 13493

GENUINE LINCOLN PARTS™

Register your machine:
www.lincolnelectric.com/register

Authorized Service and Distributor Locator:
www.lincolnelectric.com/locator

Save for future reference

Date Purchased

Code: (ex: 10859)

Serial: (ex: U1060512345)

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

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

THANK YOU FOR SELECTING A QUALITY PRODUCT BY LINCOLN ELECTRIC.

PLEASE EXAMINE CARTON AND EQUIPMENT FOR DAMAGE IMMEDIATELY

When this equipment is shipped, title passes to the purchaser upon receipt by the carrier. Consequently, claims for material damaged in shipment must be made by the purchaser against the transportation company at the time the shipment is received.

SAFETY DEPENDS ON YOU

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

⚠ 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 Safety Data Sheet (SDS) 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

WARNING: Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects, or other reproductive harm.

- Always start and operate the engine in a well-ventilated area.
- If in an exposed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information go to www.P65 warnings.ca.gov/diesel

WARNING: This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code § 25249.5 *et seq.)*

WARNING: Cancer and Reproductive Harm www.P65warnings.ca.gov

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. 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.

1.i. Using a generator indoors CAN KILL YOU IN MINUTES.

1.j. Generator exhaust contains carbon monoxide. This is a poison you cannot see or smell.

1.k. NEVER use inside a home or garage, EVEN IF doors and windows are open.

1.l. Only use OUTSIDE and far away from windows, doors and vents.

1.m. Avoid other generator hazards. READ MANUAL BEFORE USE.

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 hardfacing (see instructions on container or SDS) 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 unless exposure assessments indicate otherwise. In confined spaces or in some circumstances, outdoors, a respirator may also 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.

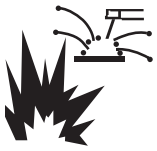
5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

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 Safety Data Sheet (SDS) and follow your employer’s safety practices. SDS 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, 14501 George Carter Way Chantilly, VA 20151.

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.

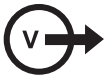
8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

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

CONTENT/DETAILS MAY BE CHANGED OR UPDATED WITHOUT NOTICE. FOR MOST CURRENT INSTRUCTION MANUALS, GO TO PARTS.LINCOLNELECTRIC.COM.

GRAPHIC SYMBOLS

The following graphics appear on the machine or in the manual.

	Warning or Caution		Engine		Downhill Pipe welding
	Instructions		Oil		Remote
	Fumes and Gases		Oil Pressure		Arc Control
	Explosion		Engine Temperature		Pulse
	Arc Rays		Engine Hours		Voltmeter Polarity
	Moving Parts		Fuel		
	Falling Equipment		Battery		Stop
	Electric Shock		Welder Output		Auto Idle
	Fire or explosion		Voltage Output		High Idle
	Battery explosion		Amperage Output		Start
	Battery acid	A	Welding Amperage		Glow Plug
U_r	Reduced Open Circuit Voltage	V	Welding Voltage		Protective Ground
U0	Open Circuit Voltage		CrossLinc		Circuit Breaker
I2	Output Current		Status Indicator		Wire Feeder
U2	Output Voltage		Mode Select		Receptacle
X	Duty Cycle		SMAW welding	+	Positive Output
	Phase		GMAW/FCAW welding	−	Negative Output
	3 phase alternator		GTAW welding		
	Direct current		Carbon Arc Gouging		

GENERAL DESCRIPTION

The Vantage® 549X is a diesel engine-driven welding power source. The machine uses a brush type alternating current generator for DC multi-purpose welding, for 120/240 VAC single phase and 240 VAC three phase auxiliary standby power. The welding control system uses state of the art Chopper Technology®.

The machine has been equipped with CrossLinc® Technology to provide weld cable communication for voltage control at the arc without the need for a control cable.

TECHNICAL SPECIFICATIONS

INPUT - DIESEL ENGINE	
Make /Model	Description
(K3534-2, K3534-20, K3534-12) Deutz® TD2.9L4 EPA Tier 4 Final Compliant	4 Cylinder 49.4 HP (37 kW) Turbocharged Water Cooled Diesel Engine
Speed (RPM)	Displacement
High Idle 1800 Low Idle 1525 Full Load	178 cu. in. (2.9L) Bore x Stroke 3.62" x 4.33" 92mm x 110mm
Starting System	Capacities
12 VDC Battery and Starter with Automatic Glow Plugs	Fuel: 25 US gal. (94.6L) Oil: 2.25 US gal. (8.5L) Cooling System: 4.1 US gal. (15.6L)
Battery Size	
BCI Group Size 34 800 Cold Crank Amps	

RATED OUTPUT @ 104°F(40°C) - WELDER		
Duty Cycle	Welding Output	Volts at Rated Amps
100%	500 Amps (DC multi-purpose)	40 Volts
60%	575 Amps (DC multi-purpose)	35 Volts

IEC 60974-1; IP23 Rated

OUTPUT @ 104°F(40°C) - WELDER AND GENERATOR	
Welding Mode	Output Range
CC-Stick	30-575 Amps
Downhill Pipe (CC)	40-350 Amps
Touch Start TIG	20-350 Amps
CV-Wire	10-45 Volts
Arc Gouging	60-575 Amps
Open Circuit Voltage 60V Avg @ 1800 RPM 66V Peak @ 1800 RPM	
Auxiliary Power(1) 120/240 VAC 11,000 Watts, 60 Hz., Single Phase 19,000 Watts, 60 Hz., Three Phase	

RECEPTACLES	
Receptacle	Circuit Breaker
120 VAC Duplex (5-20R) GFCI Protected	20 Amps
240 VAC Three Phase (15-50R)	50 Amps
120/240 VAC Single Phase (14-50R)	50 Amps

PHYSICAL DIMENSIONS	
Height (2)	42.0 in. (1066.8 mm)
Width (3)	32.9 in. (835.7 mm)
Depth	69.0 in. (1753 mm)
Weight (4)	1662 lbs. (753 kg)

(1) Output rating in watts is equivalent to volt-amperes at unity power factor. Output voltage is within +/- 10% at all loads up to rated capacity. When welding, available auxiliary power will be reduced.
(2) Top of Enclosure. Add 16.1" (409 mm) for exhaust and air cleaner.
(3) Includes Door. Base is 31.6" (803 mm) wide.
(4) Approximate weight less fuel.

INSTALLATION

SAFETY PRECAUTIONS

⚠ WARNING

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

ELECTRIC SHOCK can kill.

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

ENGINE EXHAUST can kill.

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

MOVING PARTS can injure.

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

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

VRD (VOLTAGE REDUCTION DEVICE)

The VRD reduces the OCV (Open Circuit Voltage) at the welding output terminals while not welding to less than 30 VDC when the resistance of the output circuit is above 200Ω (ohms).

The VRD requires that the welding cable connections be kept in good electrical condition because poor connections will contribute to poor starting. Having good electrical connections also limits the possibility of other safety issues such as heat-generated damage, burns and fires.

The machine is shipped with the VRD switch in the “OFF” position.

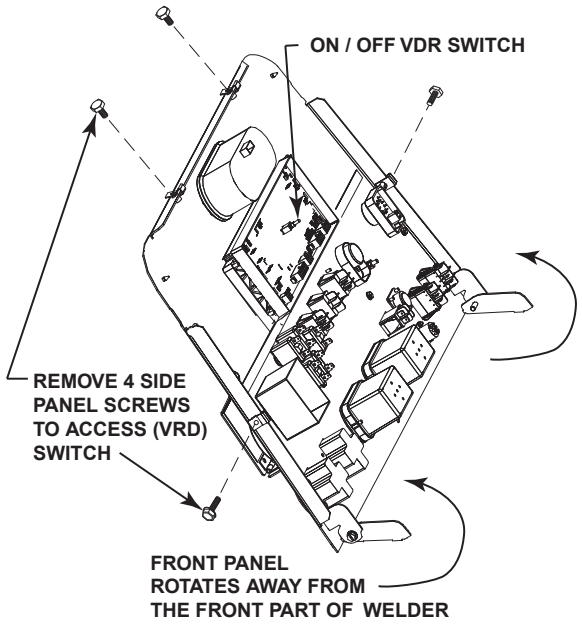
To utilize the CrossLinc feature on this product, the VRD needs to remain in the “OFF” position.

Alternatively, if VRD is in the "ON" position, the operator can turn on CrossLinc for CV modes (VRD will be disabled for CV modes) by using the tool provided to access the hidden menu screen. Refer the CONTROLS AND SETTING section for making changes.

To turn VRD “ON” or “OFF”:

- Turn the engine “OFF”
- Diconnect the negative battery cable
- Lower the front panel by removing 4 side panel screws (See Figure A.1)
- Place the VRD switch in the “ON” or “OFF” position (See Figure A.1)

FIGURE A.1



With the VRD switch in the “OFF” position, the VRD lights are non activated.

LOCATION AND VENTILATION

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

⚠ WARNING

Air to cool the engine is drawn in the side and exhausted through radiator and case back. It is important that the intake and exhaust air is not restricted. Allow a minimum clearance of 1ft. (0.6m) from the case back and 16 in. (406mm) from either side of the base to a vertical surface. (Failure to resolve these guidelines may result in an overtemp condition resulting in engine shut down).

⚠ WARNING

DO NOT MOUNT OVER COMBUSTIBLE SURFACES

Where there is a combustible surface directly under stationary or fixed electrical equipment, that surface should be covered with a steel plate at least .06”(1.6mm) thick, which should extend not less than 5.90”(150mm) beyond the equipment on all sides.

STORING

1. Store the machine in a cool, dry place when it is not in use. Protect it from dust and dirt. Keep it where it can't be accidentally damaged from construction activities, moving vehicles, and other hazards.
2. Drain the engine oil and refill with fresh oil. Run the engine for about five minutes to circulate oil to all the parts. See the ENGINE OPERATION section manual for details on changing oil.
3. Remove the battery, recharge it, and adjust the electrolyte level. Store the battery in a dry, dark place.

STACKING

Vantage® 549X machines cannot be stacked.

ANGLE OF OPERATION

To achieve optimum engine performance the Vantage® 549X should be run in a level position. The maximum angle of operation for the Deutz® engine is 30 degrees in all directions. When operating the welder at an angle, provisions must be made for checking and maintaining the oil level at the normal (FULL) oil capacity. Also the effective fuel capacity will be slightly less than the specified 25 gal. (94.6L).

LIFTING

The Vantage® 549X weighs approximately 1836 lbs. (832kg) with a full tank of fuel and 1662 lbs. (753kg) less fuel. A lift bale is mounted to the machine and should always be used when lifting the machine.

⚠ WARNING

FALLING EQUIPMENT can cause injury.

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

ENVIRONMENTAL LIMITATIONS

This machine is IP23 rated for use in an outdoor environment. The machine should not be subjected to falling water during use nor should any parts of it be submerged in water. Doing so may cause improper operation as well as pose a safety hazard. The best practice is to keep the machine in a dry, sheltered area.

HIGH ALTITUDE OPERATION

At higher altitudes, output derating may be necessary. For maximum rating, derate the welder output in accordance with the guidelines in Table A.1 below for this engine model from the manufacturer:

TABLE A.1 DEUTZ TD2.9L4

Altitude		Power Derating Factor (%)
Meters	Feet	
0	0	100%
500	1,640	100%
1000	3,281	100%
1500	4,921	100%
1680	5,512	100%
2000	6,562	100%
2500	8,202	100%
3000	9,843	100%
3500	11,483	100%
4000	13,123	100%
4500	14,764	100%
5000	16,404	100%
5500	18,045	97%
6000	19,685	92%

HIGH TEMPERATURE OPERATION

At temperatures above 104°F (40°C), output voltage derating may be necessary. For maximum output current ratings, derate welder voltage rating 2 volts for every 21°F (10°C) above 104°F (40°C).

COLD WEATHER STARTING:

With a fully charged battery and OW40 oil, the engine should start satisfactorily down to -20°F (-29C°). If the engine must be frequently started at or below 0°F (-18°C), it may be desirable to install cold-starting aides. For engines with common rail injection, the mixing of petroleum or kerosene and adding of extra low additives is not permissible. Fuels in accordance with ASTM S975 Grade 1D or DIN EN590-Arctic-Diesel may have no petroleum added. Allow the engine to warm up before applying a load or switching to high idle.

⚠ WARNING

Under no conditions should ether or other starting fluids be used with this engine!

TOWING

Use a recommended trailer for use with this equipment for road, in-plant and yard towing by a vehicle(1). If the user adapts a non-Lincoln trailer, they must assume responsibility that the method of attachment and usage does not result in a safety hazard or damage the welding equipment. Some of the factors to be considered are as follows:

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

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

SERVICE TRUCK AND TRAILER INSTALLATION

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

⚠ WARNING

- **Improperly mounted concentrated loads may cause unstable vehicle handling and tires or other components to fail.**
- **Only transport this welding equipment on serviceable vehicles which are rated and designed for such loads.**
- **Distribute, balance and secure loads so vehicle is stable under conditions of use.**
- **Do not exceed maximum rated loads for components such as suspension, axles and tires.**
- **Mount equipment base to metal bed or frame of vehicle. Do not mount the welder using rubber mounts.**
- **Follow vehicle manufacturer's instructions.**
- **Do not install equipment where air flow is restricted. Equipment or the engine may overheat.**
- **Do not weld on the base. Welding on the base may cause fuel tank explosion or fire.**
- **Always ground the equipment frame to the vehicle frame to prevent electric shock and static electricity hazards.**
- **Do not place propane or shielding gas tanks near hot air or exhaust.**

PRE-OPERATION ENGINE SERVICE

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

⚠ WARNING

- **Stop engine and allow to cool before fueling.**
- **Do not smoke when fueling.**
- **Fill fuel tank at a moderate rate and do not overfill.**
- **Wipe up spilled fuel and allow fumes to clear before starting engine.**
- **Keep sparks and flame away from tank.**

OIL

The Vantage® 549X is shipped with the engine crankcase filled with high quality SAE 10W-30 Oil that meets (API class CJ-4 or better) for diesel engines. Check the oil level before starting the engine. If it is not up to the full mark on the dip stick, add oil as required. Check the oil level every four hours of running time during the first 50 running hours. The oil change interval is dependent on the quality of the oil and the operating environment. Refer to the Engine Operator's Manual for more details on specific oil recommendations, break-in information, and proper service and maintenance intervals.

FUEL

⚠ WARNING

USE ULTRA-LOW SULFUR DIESEL FUEL ONLY

Fill the fuel tank with clean, fresh fuel. The capacity of the tank is 25 gal. (94.6L). When the fuel gauge reads empty the tank contains approximately 2 gal. (7.6L) of reserve fuel.

NOTE: A fuel shut off valve is located just before the pre-filter/sediment filter. Place the valve in the closed position when the welder is not used for extended periods of time.

ENGINE COOLING SYSTEM

⚠ WARNING

HOT COOLANT can burn skin.
Do not remove cap if radiator is hot.

The welder is shipped with the engine and radiator filled with a 50% mixture of ethylene glycol and water. See the MAINTENANCE section and the engine Operator's Manual for more information on coolant.

BATTERY CONNECTION

⚠ CAUTION

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

The Vantage® 549X is shipped with the negative battery cable disconnected. Make certain that the RUN/STOP/IDLE switch is in the STOP position. Remove the four screws from the battery tray using a screwdriver or a 3/8"(10mm) socket. Attach the negative battery cable to the negative battery terminal and tighten using a 1/2"(13mm) socket or wrench.

NOTE: This machine is furnished with a wet charged battery; if unused for several months, the battery may require a booster charge. Be careful to charge the battery with the correct polarity. (See Battery in MAINTENANCE section)

⚠ WARNING

GASES FROM BATTERY can explode.

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

To prevent EXPLOSION when:

- **INSTALLING A NEW BATTERY — disconnect negative cable from old battery first and connect to new battery last.**
- **CONNECTING A BATTERY CHARGER — remove battery from welder by disconnecting negative cable first, then positive cable and battery clamp. When reinstalling, connect negative cable last. Keep well ventilated.**
- **USING A BOOSTER — connect positive lead to battery first then connect negative lead to negative battery lead at engine foot.**

BATTERY ACID can burn eyes and skin.

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

IMPORTANT: To prevent ELECTRICAL DAMAGE WHEN:

a) Installing new batteries.

b) Using a booster.

Use correct polarity — **Negative Ground.**

EXHAUST OUTLET PIPE

Remove cap from DOC pipe protruding from roof.

Using the clamp provided secure the outlet pipe to the outlet tube with the pipe positioned such that it will direct the exhaust in the desired direction away from the air intake. Tighten using an internal socket or allen wrench.

SPARK ARRESTOR

Some federal, state or local laws may require that gasoline or diesel engines be equipped with exhaust spark arrestors when they are operated in certain locations where unarrested sparks may present a fire hazard.

The DOC (Diesel Oxidation Catalyst) unit included with this welder does not qualify as a spark arrestor. When required by local regulations, a suitable spark arrestor, such as the K3985-1 must be installed and properly maintained.

⚠ WARNING

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

AIR CLEANER INSTALL

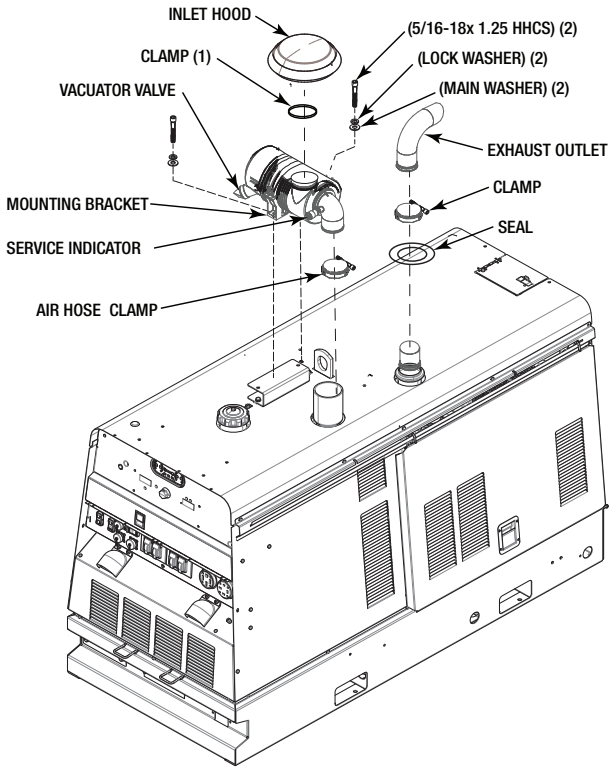
All parts below are shipped with the machine in a separate box attached to the crate. (see Figure A.2)

- Remove cap from air intake hose and DOC exhaust attached on machine. Insert air cleaner into bracket between the two ridges of a larger diameter. Position the vacuator 6 o'clock.
- Tighten air hose clamp just below service indicator to hold clamp while pushing air cleaner onto hose, once hose is in place loosen air hose clamp slide down and tighten clamp.
- Install 2 hex head screws, washers and nuts to mounting bracket securing air cleaner.
- Install Inlet Hood to Air Cleaner, tighten clamp securely.

SERVICE INDICATOR

Air cleaner service indicator provides a Go/No-Go visual indication of useful filter service life.

FIGURE A.2



MACHINE GROUNDING

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

To prevent dangerous electric shock, other equipment powered by this engine driven welder must:

a) be grounded to the frame of the welder using a grounded type plug, or

b) be double insulated.

When this welder is mounted on a truck or trailer, its frame must be securely connected to the metal frame of the vehicle. When this engine driven welder is connected to premises wiring such as that in a home or shop, its frame must be connected to the system earth ground. See further connection instructions in the section entitled STANDBY POWER CONNECTIONS as well as the article on grounding in the latest National Electrical Code and the local codes.

In general, if the machine is to be grounded, it should be connected with a #8 or larger copper wire to a solid earth ground such as a metal ground stake going into the ground for at least 10 ft. (3.1m) or to the metal framework of a building which has been effectively grounded. The National Electric Code lists a number of alternate means of grounding electrical equipment. A machine grounding stud marked with the symbol is ⏚ provided on the front of the welder.

AUXILIARY POWER RECEPTACLES

Start the engine and set the RUN/STOP/IDLE control switch to the "High Idle" position. Voltage is now correct at the receptacles for auxiliary power. This must be done before a tripped GFCI can be reset properly. See the MAINTENANCE section for more detailed information on testing and resetting the GFCI.

The auxiliary power of the Vantage® 549X consists of two 20 Amp 120 VAC (5-20R) duplex receptacles with GFCI protection, one 50 Amp 120/240 VAC single phase (14-50R) receptacle and one 50 Amp 240 VAC three phase (15-50R) receptacle.

The auxiliary power capacity is 11,000 watts continuous of 60 Hz, single phase power. The auxiliary power capacity rating in watts is equivalent to volt-amperes at unity power factor.

The 240 VAC output can be split to provide two separate 120 VAC outputs with a max permissible current of 50 amps per output to two separate 120 VAC branch circuits NOTE: These circuits are opposite polarities and cannot be paralleled. Output voltage is within ± 10% at all loads up to rated capacity.

The three phase auxiliary power capacity is 19,000 watts continuous at 60 Hz.

120 VAC DUPLEX RECEPTACLES AND GFCI

A GFCI protects the two 120 VAC auxiliary power receptacles.

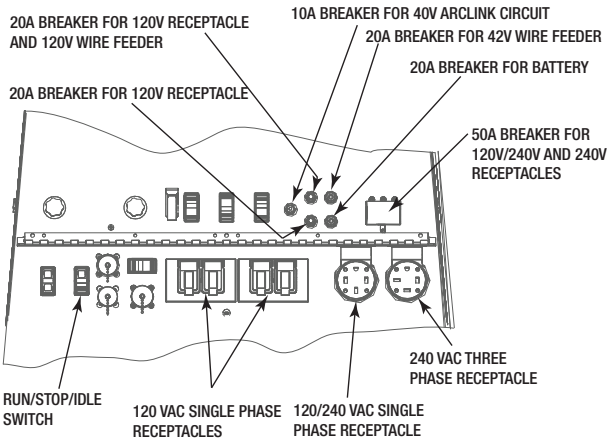
A GFCI (Ground Fault Circuit Interrupter) is a device to protect against electric shock should a piece of defective equipment connected to it develop a ground fault. If this situation should occur, the GFCI will trip, removing voltage from the output of the receptacle. If a GFCI is tripped see the MAINTENANCE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

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

CIRCUIT BREAKERS

All auxiliary power is protected by circuit breakers. The 120 VAC duplex receptacles have 20 amp circuit breakers for each receptacle. The 120/240V single phase and the 240V three phase receptacles have a 50 amp 3-pole circuit breaker that disconnects both hot leads and all three phases simultaneously. (See Figure A.3)

FIGURE A.3 - AUXILIARY POWER RECEPTACLES



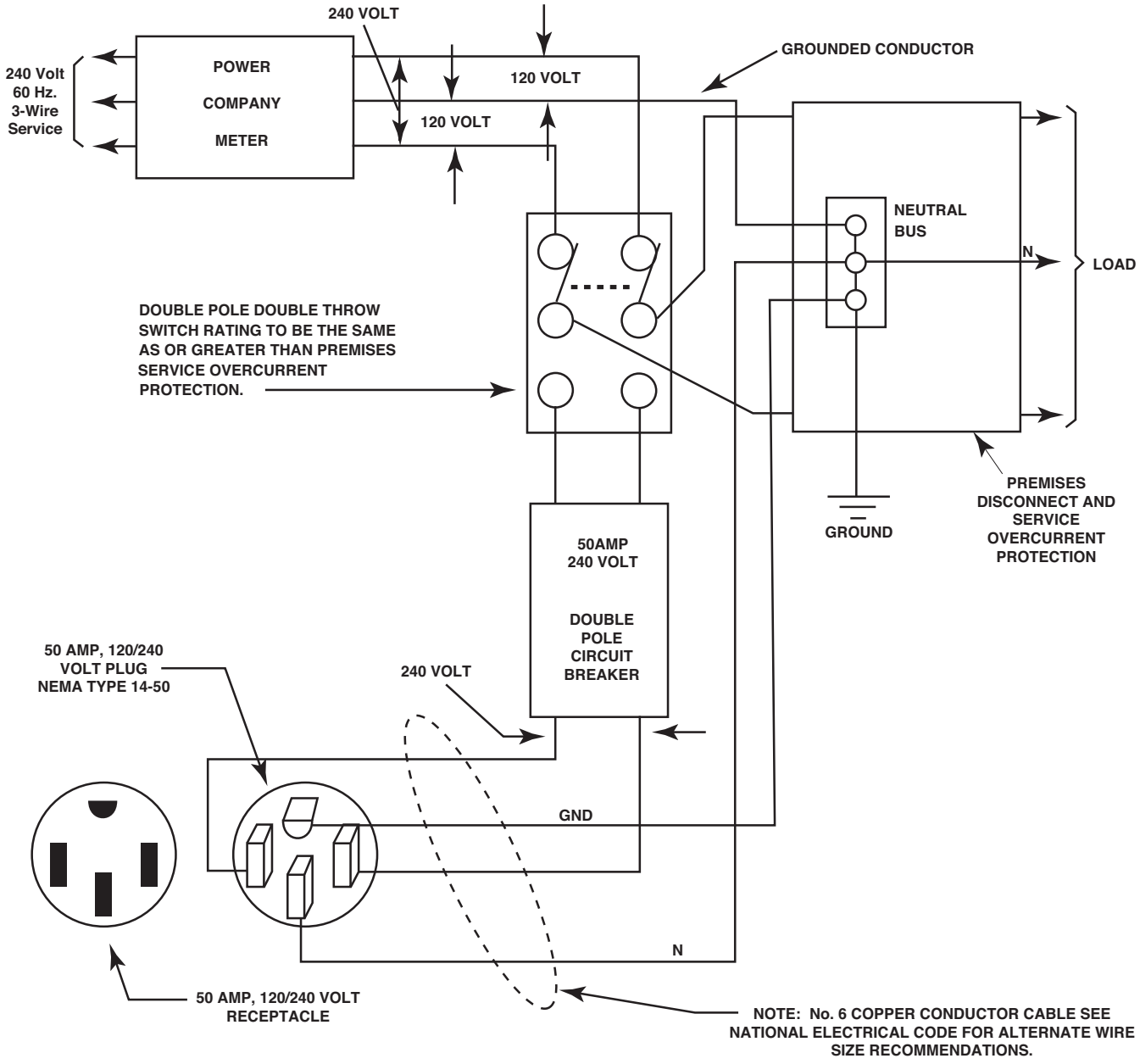
STANDBY POWER CONNECTIONS

The Vantage® 549X is suitable for temporary, standby or emergency power using the engine manufacturer's recommended maintenance schedule.

The Vantage® 549X can be permanently installed as a standby power unit for 240 VAC, 3 wire, 50 amp service. Connections must be made by a licensed electrician who can determine how the 120/240 VAC power can be adapted to the particular installation and comply with all applicable electrical codes. Refer to the connection diagram shown in Figure A.4.

1. Install the double-pole, double-throw switch between the power company meter and the premises disconnect. Switch rating must be the same or greater than the customer's premises disconnect and service over current protection.
2. Take necessary steps to assure load is limited to the capacity of the Vantage® 549X by installing a 50 amp, 240 VAC double pole circuit breaker. Maximum rated load for each leg of the 240 VAC auxiliary is 50 amps. Loading above the rated output will reduce output voltage below the allowable -10% of rated voltage which may damage appliances or other motor-driven equipment and may result in overheating of the engine and / or alternate windings.
3. Install a 50 amp 120/240 VAC plug (NEMA Type 14-50P) to the double-pole circuit breaker using No. 6, 4 conductor cable of the desired length.
4. Plug this cable into the 50 Amp 120/240 Volt receptacle on the Vantage® 549X case front.

FIGURE A.4 Connection of the Vantage® 549X to Premises Wiring



WELDING OUTPUT CABLES

With the engine off, route the electrode and work cables through the strain relief bracket provided on the front of the base and connect to the terminals provided. These connections should be checked periodically and tightened if necessary.

Listed in Table A.2 are copper cable sizes recommended for the rated current and duty cycle. Lengths stipulated are the distance from the welder to work and back to the welder again. Cable sizes are increased for greater lengths primarily for the purpose of minimizing cable voltage drop.

TABLE A.2

OUTPUT CABLE GUIDELINES						
Amperes	Percent Duty Cycle	CABLE SIZES FOR COMBINED LENGTHS OF ELECTRODE AND WORK CABLES [RUBBER COVERED COPPER - RATED 167°F (75°C)]**				
		0 to 50 Ft.	50 to 100 Ft.	100 to 150 Ft.	150 to 200 Ft.	200 to 250 Ft.
200	60	2	2	2	1	1/0
200	100	2	2	2	1	1/0
250	30	3	3	2	1	1/0
250	40	2	2	1	1	1/0
250	60	1	1	1	1	1/0
250	100	1	1	1	1	1/0
300	60	1	1	1	1/0	2/0
300	100	2/0	2/0	2/0	2/0	3/0
350	40	1/0	1/0	2/0	2/0	3/0
400	60	2/0	2/0	2/0	3/0	4/0
400	100	3/0	3/0	3/0	3/0	4/0
500	60	2/0	2/0	3/0	3/0	4/0
600	60	3/0	3/0	3/0	4/0	2-3/0
600	80	2-1/0	2-1/0	2-1/0	2-2/0	2-3/0
600	100	2-1/0	2-1/0	2-1/0	2-2/0	2-3/0

** Tabled values are for operation at ambient temperatures of 104°F (40°C) and below. Applications above 104°F (40°C) may require cables larger than recommended, or cables rated higher than 167°F (75°C).

PULSE WELDING

When pulse welding, always use 4/0 cable. The cables must be sized based upon the peak current of the pulse waveform, not the average current. Do not coil the electrode or work cable. Limit the combined length of the electrode and work cable to 60 feet. Undersized cables, coiled cables and long lengths all increase cable inductance and lower pulse welding performance.

CABLE INSTALLATION

Install the welding cables to your Vantage® 549X as follows.

⚠ WARNING

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

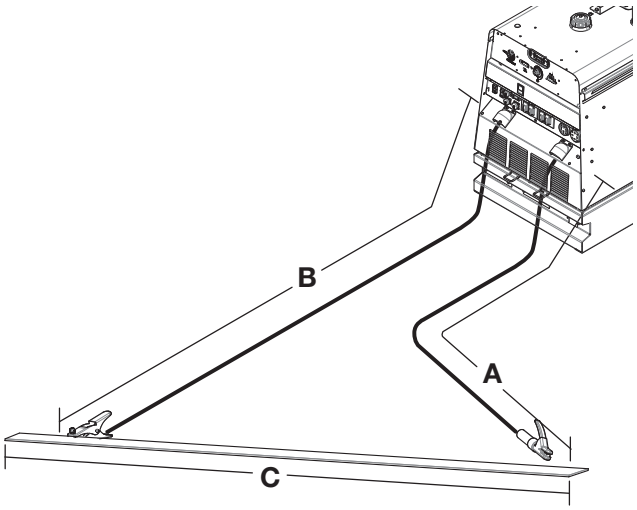
⚠ CAUTION

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

CABLE INDUCTANCE AND ITS EFFECTS ON WELDING

Excessive cable inductance will cause the welding performance to degrade. There are several factors that contribute to the overall inductance of the cabling system including cable size and loop area. The loop area is defined by the separation distance between the electrode and work cables and the overall welding loop length. The welding loop length is defined as the total of length of the electrode cable (A) + work cable (B) + work path (C) (See Figure A.5).

FIGURE A.5



To minimize inductance always use the appropriate size cables, and whenever possible, run the electrode and work cables in close proximity to one another to minimize the loop area. Since the most significant factor in cable inductance is the welding loop length, avoid excessive lengths and do not coil excess cable. For long work piece lengths, a sliding ground should be considered to keep the total welding loop length as short as possible.

Electrode Voltage Sensing

The remote electrode sense lead (67) is built into the 5-pin ArcLink control cable and is always connected to the wire drive feed plate when an ArcLink wire feeder is present. Enabling or disabling electrode voltage sensing is application specific, and automatically configured by the active weld mode.

Voltage sense leads requirements are based on the weld process (See Table A.3)

TABLE A.3

Process	Electrode Voltage Sensing (1)
GMAW	67 lead
FCAW	67 lead
GTAW	Voltage sense at studs
SMAW	Voltage sense at studs

(1) The electrode voltage sense lead (67) is automatically enabled by the weld process, and integral to the 5 pin ArkLink control cable.

CONTROL CABLE CONNECTIONS

General Guidelines

Genuine Lincoln control cables should be used at all times (except where noted otherwise). Lincoln cables are specifically designed for the communication and power needs of the engine driven welder and Power Feed® systems. Most are designed to be connected end to end for ease of extension. Generally, it is recommended that the total length not exceed 200 ft (61 m). The use of non-standard cables, especially in lengths greater than 25 feet, can lead to communication problems (system shutdowns), poor motor acceleration (poor arc starting), and low wire driving force (wire feeding problems). Always use the shortest length of control cable possible, and **DO NOT coil excess cable.**

Regarding cable placement, best results will be obtained when control cables are routed separate from the weld cables. This minimizes the possibility of interference between the high currents flowing through the weld cables, and the low level signals in the control cables.

Connection Between Vantage® 549X and ArcLink® Compatible Wire Feeders

The 5-pin ArcLink® control cable connects the Vantage® 549X to the wire feeder. The control cable consists of two power leads, one twisted pair for digital communication, and one lead for voltage sensing. The 5-pin ArcLink® connection on the Vantage® 549X is located on control panel. The control cable is keyed and polarized to prevent improper connection. Best results will be obtained when control cables are routed separate from the weld cables, especially in long distance applications. The recommended combined length of the ArcLink® control cable network should not exceed 200 ft (61 m).

CROSSLINC TECHNOLOGY

This machine features CrossLinc technology, which allows for remote control of the welding output via the weld cables rather than a control cable. As result, the control cable is no longer needed when connected to a CrossLinc compatible wire feeder or remote control.

This machine will function with all CrossLinc compatible wire feeders except for the oldest LN-25X models. Incompatible models include:

Code # 12432

Code # 12504

REMOTE CONTROL CONNECTIONS

The Vantage® 549X is equipped with a 12-pin and a 14-pin connector. To enable remote control capabilities, the LOCAL/REMOTE switch must be in the REMOTE position.

CONSTANT CURRENT WELD MODES

For the **DOWNHILL PIPE** or **CC-STICK** weld mode selector switch positions, remote setting of the preset arc current is set through the 12 pin connector or the 14 pin connector depending on the setup menu setting (12 pin connector is the factory default setting). The OUTPUT CONTROL knob is used to set the maximum arc current preset range for the remote input. The left digital output display will show the maximum setting for the arc current preset range as set by the OUTPUT CONTROL knob.

For the **TOUCH START TIG** weld mode selector switch position, remote setting of the preset arc current is set through the 12 pin connector (typically using a foot amptrol). The OUTPUT CONTROL knob is used to set the maximum arc current preset range for the remote input. The left digital output display will show the maximum setting for the arc current preset range as set by the OUTPUT CONTROL knob.

EXAMPLE: When the OUTPUT CONTROL on the welder is set to 200 amps, the arc current preset range on the remote control will preset over the range from minimum to 200 amps, rather than the full minimum to maximum preset arc current range. Any preset arc current range that is less than the full range provides finer arc current preset resolution for more fine tuning of the output.

For the **ARC GOUGING** weld mode selector switch position, remote setting of the preset arc current is set through the 12 pin connector. The remote input sets the arc current preset over the full range from minimum to maximum. The left digital output display will show the maximum setting for the arc current preset range as set by the OUTPUT CONTROL knob.

CONSTANT VOLTAGE WELD MODES

For operation with a control cable wire feeder:

With the **CV-WIRE** weld mode selector switch position **and the WELD TERMINALS ON switch in the REMOTE position**, remote setting of the preset arc voltage is set through the 14 pin connector. The remote input sets the arc voltage preset range from 10.0V to 45.0V. The right digital output display will show the arc voltage preset.

For operation with an across the arc wire feeder:

With the **CV-WIRE** weld mode selector switch position **and the WELD TERMINALS ON switch in the ON position**, remote setting of the preset arc voltage is set through the 12 pin connector. The remote input sets the arc voltage preset range from 10.0V to 45.0V. The right digital output display will show the arc voltage preset.

When a CrossLinc device is connected, the remote control is ignored. The CrossLinc device provides the remote output control to set values.

For the **ARCLINK** weld mode selector switch position, remote capability is possible only with an ArcLink compatible digital remote control through the 5 pin connector.

NOTE: To connect accessories with a 6 pin connector, use the included 12-pin to 6-pin adaptor (K2909-1).

WELDING TERMINALS

The Vantage® 549X is equipped with a toggle switch for selecting "hot" welding terminals when in the WELD TERMINALS ON position or "cold" welding terminals when in the REMOTELY CONTROLLED position. When in ArcLink, the output of the weld terminals is controlled by the mode selected.

ACCESSORY CONNECTION DIAGRAMS

⚠ WARNING

Shut off welder before making or removing any electrical connections.

When connecting an accessory to the Vantage® 549X, the following steps should be taken:

- Shut off the welder.
- Connect your leads for the desired accessory. For electrode positive, connect the electrode cable to the "+" terminal of the welder and work cable to the "-" terminal of the welder. For electrode negative, connect the electrode cable "-" terminal of the welder and work cable to the "+" terminal of the welder. Installation diagrams for common setups are included on the following pages.
- Set the WIRE FEEDER VOLTMETER switch to either "+" or "-" as required by the electrode type (See Figure A.6).
- The switch positions on the Vantage® 549X will be dependent on the type of accessory chosen. Reference Table A.4 and Figure A.6 for guidance on how to properly set up each accessory.

FIGURE A.6

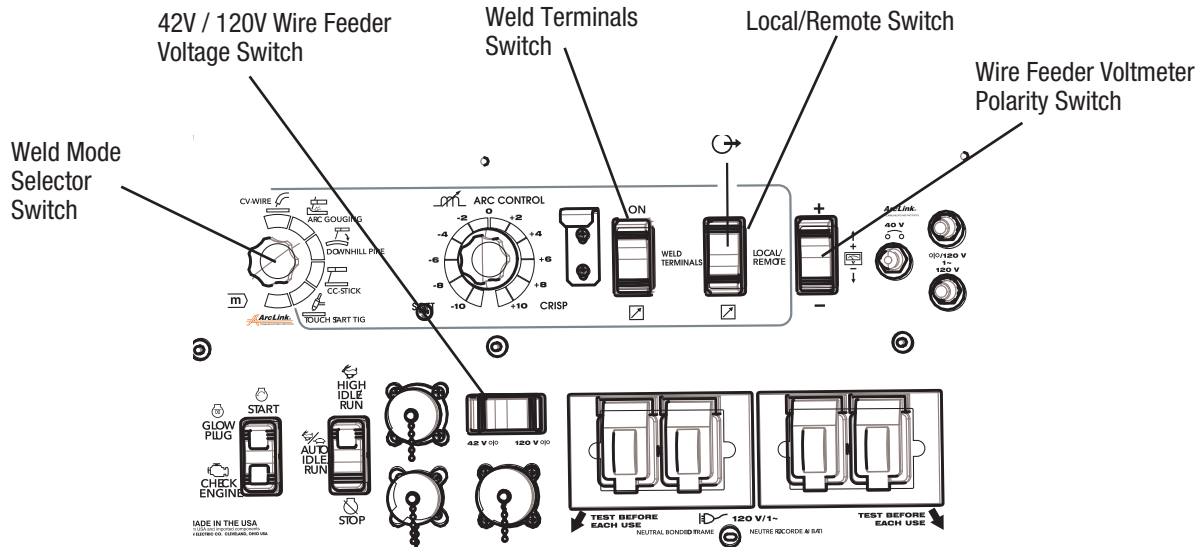
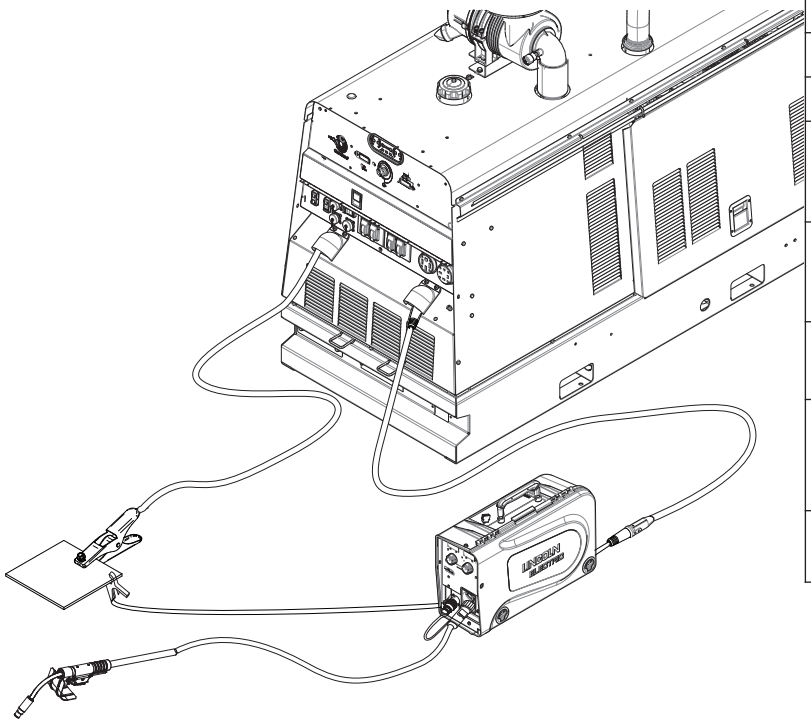


TABLE A.4

ACCESSORY	WELD MODE SWITCH	WELD TERMINALS SWITCH	LOCAL/REMOTE SWITCH	115/42VAC SWITCH
CrossLinc Feeder	CV	ON	REMOTE	N/A
CrossLinc Remote	Stick, Tig, Gouging	ON	REMOTE	N/A
Across The Arc Feeder (Non CrossLinc)	CV	ON	LOCAL	N/A
42VAC Bench Feeder w/Voltage Control (Flex Feeds, LN-25 Dual)	CV	REMOTE	REMOTE	42VAC
42VAC Bench Feeder w/o Voltage Control (LF Feeders)	CV	REMOTE	REMOTE	42VAC
Submerged Arc Controllers (NA-3, LT-7)	CV/CC	REMOTE	REMOTE	115VAC
ArcLink Feeders (Power Feed)	ArcLink	N/A	N/A	N/A
TIG Module	TIG	REMOTE	REMOTE	N/A
Spool Gun Module	CV	ON	LOCAL	N/A

CROSSLINC SETUP CV

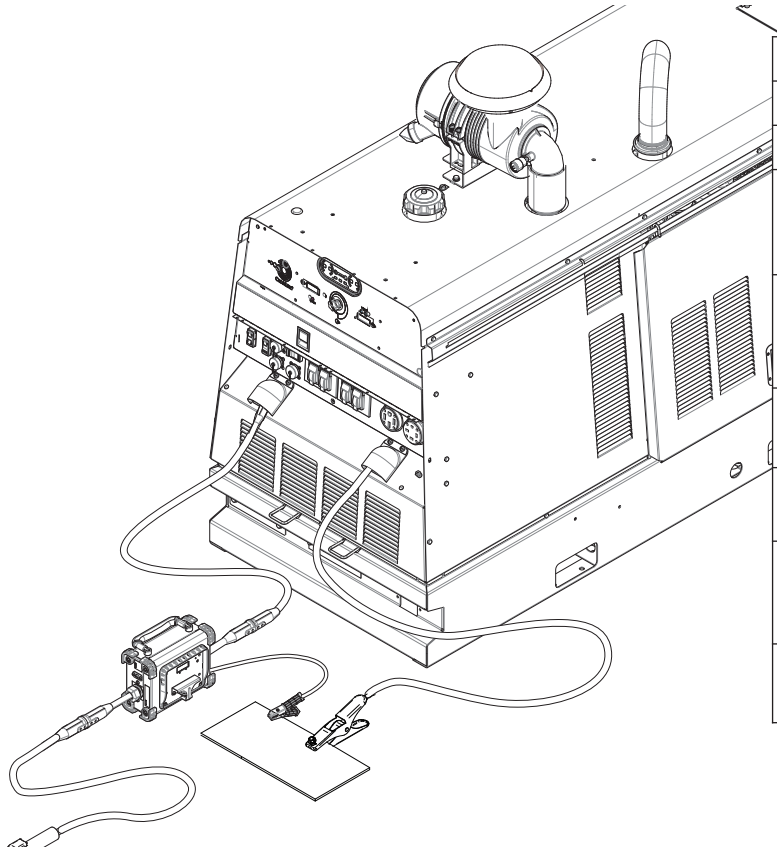
FIGURE A.7



Item	Desc.	K#
Machine	Vantage® 549X	K3534-2
Feeder	LN-25X w/TVT	K4267-2
Gun	K126® PRO Innershield® 350A FCAW-SS Welding Gun 15 ft 1/16-5/64	K126-12
Work Cable	Weld Power Cable - Lug to Lug (3/0, 600A, 60%) - 35 ft (10.6 m)	K1842-35
Work Clamp	GC-500 Work Clamp - 500A, 60% Duty Cycle	K910-2
Weld Power Cable	Weld Cable - Tweco® Plug & Receptacle (3/0, 600A, 60%) - 50 ft (15.3 m)	K2485-3
Adapter	Lug to Tweco Style Receptacle Adapter	K2487-1

CROSSLINC SETUP CC

FIGURE A.8

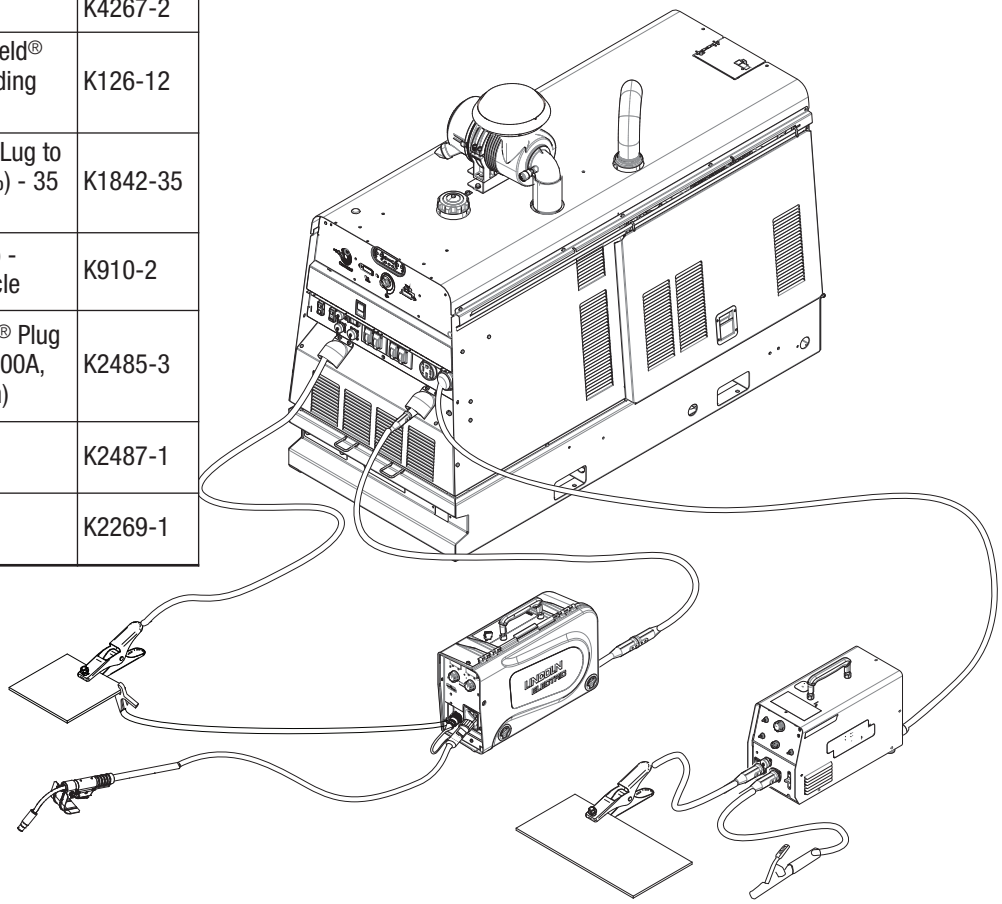


Item	Desc.	K#
Machine	Vantage® 549X	K3534-2
Remote	CrossLinc® Remote	K4345-1
Weld Power Cable	Weld Cable - Tweco® Plug & Receptacle (3/0, 600A, 60%) - 50 ft (15.3 m)	K2485-3
Weld Power Cable	Weld Cable - Tweco® Male & Open End (3/0, 600A, 60%)- 10 ft (3 m)	K2483-3
Electrode Holder	EH-405HD Electrode Holder - 400A, 60% Duty Cycle	K909-8
Adapter	Lug to Tweco Style Receptacle Adapter.	K2487-1
Work Cable	Weld Power Cable - Lug to Lug (3/0, 600A, 60%) - 35 ft (10.6 m)	K1842-35
Work Clamp	GC-500 Work Clamp - 500A, 60% Duty Cycle	K910-2

DUAL ARC SETUP

Item	Desc.	K#
Machine	Vantage® 549X	K3534-2
Feeder	LN-25X w/TVT	K4267-2
Gun	K126® PRO Innershield® 350A FCAW-SS Welding Gun 15 ft 1/16-5/64	K126-12
Work Cable	Weld Power Cable - Lug to Lug (3/0, 600A, 60%) - 35 ft (10.6 m)	K1842-35
Work Clamp	GC-500 Work Clamp - 500A, 60% Duty Cycle	K910-2
Weld Power Cable	Weld Cable - Tweco® Plug & Receptacle (3/0, 600A, 60%) - 50 ft (15.3 m)	K2485-3
Adapter	Lug to Tweco Style Receptacle Adapter	K2487-1
Machine	Invertec V275-S	K2269-1

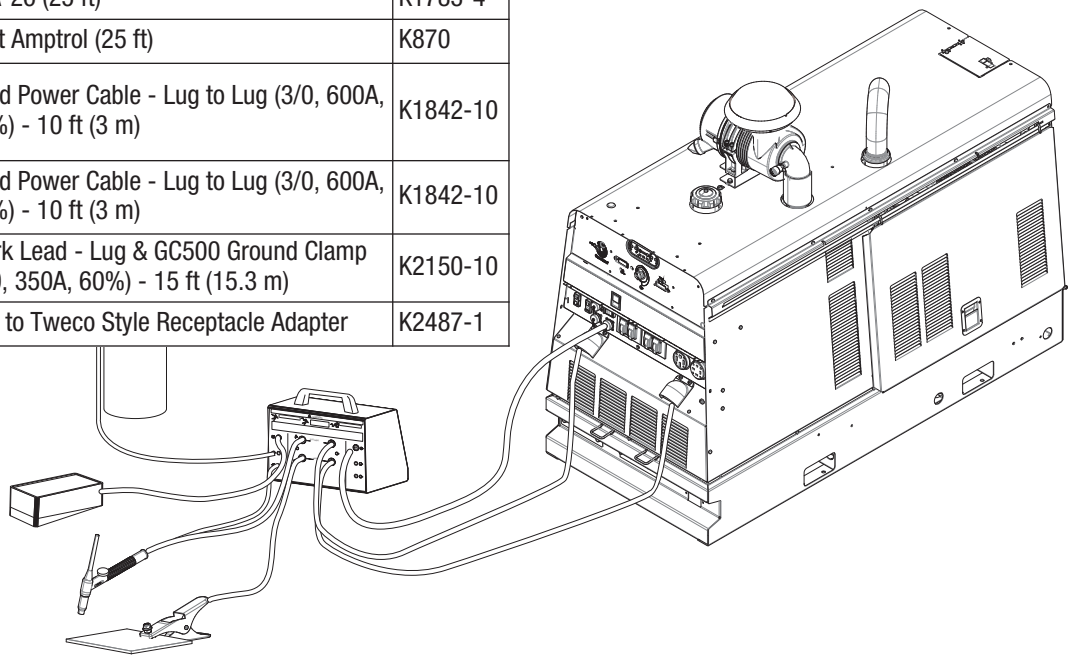
FIGURE A.9



TIG MODULE

Item	Desc.	K#
Machine	Vantage 549X	K3534-2
Accessory	TIG Module	K930-2
Control Cable	9 - 14 Pin Cable	K936-1
Torch	PTA-26 (25 ft)	K1783-4
Foot Pedal	Foot Amptrol (25 ft)	K870
Electrode Cable (Power Source to Module)	Weld Power Cable - Lug to Lug (3/0, 600A, 60%) - 10 ft (3 m)	K1842-10
Work Cable (Power Source to Module)	Weld Power Cable - Lug to Lug (3/0, 600A, 60%) - 10 ft (3 m)	K1842-10
Work Lead	Work Lead - Lug & GC500 Ground Clamp (2/0, 350A, 60%) - 15 ft (15.3 m)	K2150-10
Adapter	Lug to Tweco Style Receptacle Adapter	K2487-1

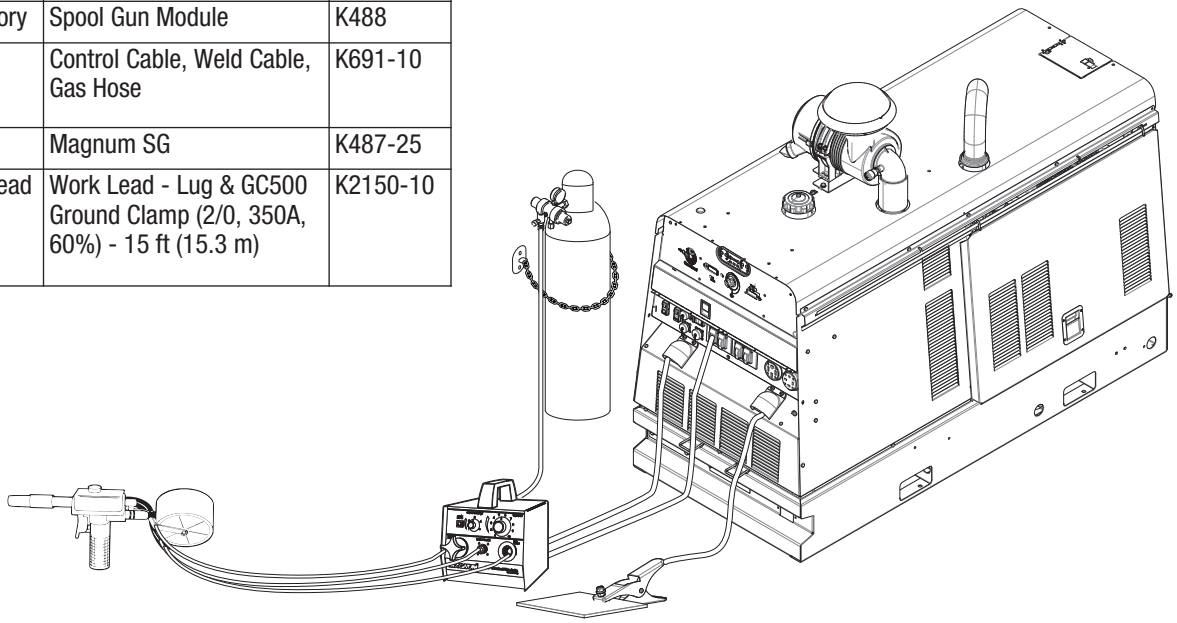
FIGURE A.10



SPOOL GUN MODULE

Item	Description	K#
Machine	Vantage 549X	K3534-2
Accessory	Spool Gun Module	K488
Control Cable	Control Cable, Weld Cable, Gas Hose	K691-10
Gun	Magnum SG	K487-25
Work Lead	Work Lead - Lug & GC500 Ground Clamp (2/0, 350A, 60%) - 15 ft (15.3 m)	K2150-10

FIGURE A.11



OPERATION

SAFETY INSTRUCTIONS

Read and understand this entire section before operating your machine.

⚠ WARNING

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

ELECTRIC SHOCK can kill.

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

ENGINE EXHAUST can kill.

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

MOVING PARTS can injure.

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

Only qualified personnel should operate this equipment.

ADDITIONAL SAFETY PRECAUTIONS

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

RECOMMENDED APPLICATIONS

WELDER - The Vantage® 549X provides excellent constant current DC welding output for stick (SMAW) and TIG (GTAW) welding. The Vantage® 549X also provides excellent constant voltage DC welding output for MIG (GMAW), Innershield (FCAW), Outershield (FCAW-G) and Metal Core (GMAW-C) welding. In addition the Vantage® 549X can be used for Arc Gouging with carbons up to 3/8”(9.5mm) in diameter.

The Vantage® 549X is **NOT RECOMMENDED** for pipe thawing.

⚠ WARNING

Pipe Thawing with an arc welder can cause fire, explosion, damage to electric wiring or to the arc welder if done improperly.

The use of an arc welder for pipe thawing is not approved by the CSA, nor is it recommended or supported by Lincoln Electric.

GENERATOR -The Vantage® 549X provides smooth 120/240 VAC single phase and 240V three phase output for auxiliary power and emergency standby power.

ADD FUEL

⚠ WARNING

DIESEL FUEL can cause fire.

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

USE ULTRA-LOW SULFUR DIESEL FUEL ONLY

- **Remove the fuel tank cap.**
- **Fill the tank. DO NOT FILL THE TANK TO THE POINT OF OVERFLOW.**
- **Replace the fuel cap and tighten securely.**
- **See Engine Owner's Manual for specific fuel recommendations.**

BREAK-IN PERIOD

The engine will use a small amount of oil during its "break-in" period. The break-in period is about 50 running hours. Check the oil every four hours during break-in. Change the oil after the first 50 hours of operation. Thereafter, follow the engine service and maintenance schedule located in the Engine Operator's Manual.

⚠ CAUTION

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

ENGINE OPERATION

Before starting the engine:

- Be sure the machine is on a level surface.
- Open side engine door and remove the engine oil dipstick and wipe it with a clean cloth. Reinsert the dipstick and check the level on the dipstick.
- Add oil (if necessary) to bring the level up to the full mark. Do not overfill. Close engine door.
- Check radiator for proper coolant level. (Fill if necessary).
- See Engine Owner's Manual for specific oil and coolant recommendations.

STARTING THE ENGINE

1. Remove all plugs connected to the AC power receptacles.
2. Set RUN / STOP / IDLE switch to AUTO IDLE / RUN position.
3. Press START / GLOW PLUG switch and hold until machine turns overs
4. Release the engine START / GLOW PLUG switch immediately when the engine starts.
5. The engine will run at high idle speed for approximately 12 seconds and then drop to low idle speed. Allow the engine to warm up at low idle for several minutes before applying a load and/or switching to high idle.

NOTE: Allow a longer warm up time in cold weather.

⚠ CAUTION

- **Do not allow the starter motor to run continuously for more than 20 seconds.**
- **Do not push the START button while the engine is running because this can damage the ring gear and/or the starter motor.**
- **If the Engine Protection or Battery Charging Lights do "not" turn off shortly after starting the engine shut off the engine immediately and determine the cause.**

STOPPING THE ENGINE

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

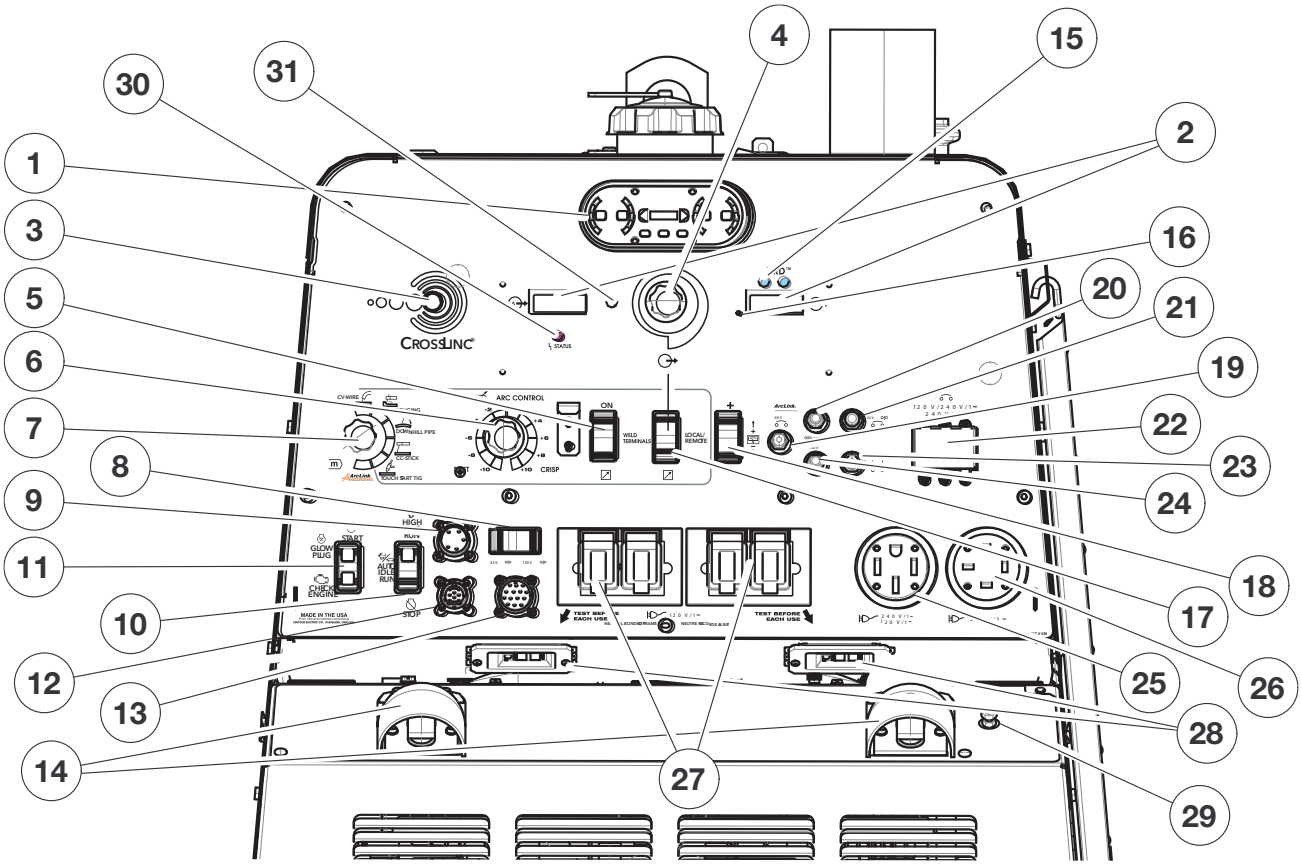
Turn off the engine by placing the RUN / STOP / IDLE switch in the STOP position.

NOTE: A fuel shut off valve is located on the fuel pre-filter.

CONTROLS AND SETTINGS

All welder and engine controls are located on the case front panel. Refer to Figure B.1 and the explanations that follow.

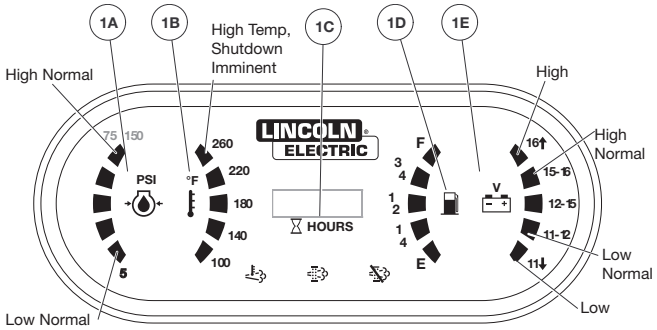
FIGURE B.1 CASE FRONT PANEL CONTROLS



SYSTEM CONTROLS

1. DASHBOARD GAUGE - The dash board gauge displays 5 gauges (Figure B.2):

FIGURE B.2



1A. OIL PRESSURE - The gauge displays the engine oil pressure when the engine is running.

1B. ENGINE TEMPERATURE - The gauge displays the engine coolant temperature.

1C. HOUR METER - The hour meter displays the total time that the engine has been running. This meter is a useful indicator for scheduling preventive maintenance.

1D. FUEL LEVEL - Displays the level of diesel fuel in the fuel tank.

The operator must watch the fuel level closely to prevent running out of fuel.

1E. BATTERY VOLTAGE INDICATOR - Displays the battery voltage and indicates that the charging system is functioning properly

NOTE: The respective icons for oil pressure, coolant temperature, fuel level and battery voltage are white. They will turn red when outside normal operating ranges.

2. DIGITAL OUTPUT METERS - The digital meters allow the preset arc output voltage (CV-WIRE mode) or preset arc current (CC-STICK, DOWNHILL PIPE, ARC GOUGING and TIG modes) to be set prior to welding using the OUTPUT CONTROL dial. During welding, the meters will display the actual output voltage (VOLTS) and current (AMPS). A memory feature holds the display of both meters on for seven seconds after welding is stopped. This allows the operator to read the actual current and voltage just prior to when welding was ceased.

While the display is being held the left-most decimal point in each display will be flashing. The accuracy of the meters is +/- 3%.

The meters will display all dashes for preset when ArcLink® mode is selected.

3. CROSSLINC INDICATOR LIGHT - When a CrossLinc enabled device is connected with the machine using the standard weld power cable and the device's sense lead is attached to the work piece, the CrossLinc light will automatically illuminate on both the machine and the device. No additional pairing of the machine to the device is needed. This light indicates the CrossLinc connection is active and that control of the voltage and current can be made at the device.

4. OUTPUT CONTROL - The OUTPUT CONTROL knob is used to preset the output voltage or current as displayed on the digital meters for the five welding modes.

5. WELD TERMINALS ON SWITCH - Output is enabled when in the ON position. Output is remotely controlled when in the REMOTE position. This control is not active in ArcLink® modes.

6. ARC CONTROL - The ARC CONTROL knob is active in the CC-STICK, DOWNHILL PIPE, and CV-WIRE modes, and has different functions in these modes. This control is not active in the TOUCH START TIG, ARC GOUGING, or ArcLink modes.

CC-STICK mode: In this mode, the ARC CONTROL knob sets the short circuit current (arc force) during stick welding. Increasing the number from -10 (Soft) to +10 (Crisp) increases the short circuit current and prevents sticking of the electrode to the plate while welding.

This can also increase spatter. It is recommended that the ARC CONTROL be set to the minimum number without electrode sticking. Start with a setting at 0.

DOWNHILL PIPE mode: In this mode, the ARC CONTROL knob sets the short circuit current (arc force) during stick welding to adjust for a soft or a more forceful digging arc (Crisp).

Increasing the number from -10 (Soft) to +10 (Crisp) increases the short circuit current which results in a more forceful digging arc. Typically a forceful digging arc is preferred for root and hot passes. A softer arc is preferred for fill and cap passes where weld puddle control and deposition ("stacking" of iron) are key to fast travel speeds. It is recommended that the ARC CONTROL be set initially at 0.

CV-WIRE mode: In this mode, the ARC CONTROL knob changes the inductance ("pinch") of the current. By adjusting the pinch, the the rate of current rise will change when the electrode short circuits to the work.

Increasing the pinch from -10 to +10 may reduce spatter, while decreasing the pinch will make the puddle more fluid, resulting in a flatter and smoother weld bead.

7. WELD MODE SELECTOR SWITCH

Provides six selectable welding modes:

CV-WIRE

DOWNHILL PIPE

CC-STICK

TOUCH START TIG

ARC GOUGING

ARCLINK

8. 42V / 120V WIRE FEEDER VOLTAGE SWITCH Toggles output of 14-pin connector to voltage requirement of wire feeder. (Located above 14-pin connector.)

9. 5-PIN CONNECTOR - For attaching an ArcLink® wire feeder control cable.

10. RUN / STOP / IDLE SWITCH - Toggling the switch to the RUN position energizes the fuel solenoid for approximately 30 seconds. The engine must be started within that time or the fuel solenoid will degenerize, and the switch must be toggled to reset the timer.

Has two positions as follows:

1) In the "HIGH IDLE" position  , the engine runs at the high idle speed controlled by the governor.

2) In the "AUTO IDLE"  /  position, the idler operates as follows:

- When switched from "High" to "Auto" or after starting the engine, the engine will operate at full speed for approximately 12 seconds and then go to low idle speed.
- When the electrode touches the work or power is drawn for lights or tools (approximately 100 watts minimum) the engine accelerates and operates at full speed.
- When welding ceases and the auxiliary power load is turned off, a fixed time delay of approximately 12 seconds starts.
- If the welding or auxiliary power load is not restarted before the end of the time delay, the idler reduces the engine speed to low idle speed.
- The engine will automatically return to high idle speed when the welding load or auxiliary power load is reapplied.

Idler Operational Exceptions - When the WELDING TERMINALS switch is in the REMOTELY CONTROLLED position or the MODE SELECTION switch is in the ArcLink® position the idler will operate as follows:

- When the triggering device (amptrol, arc start switch, etc.) is pressed, the engine will accelerate and operate at full speed, provided a welding load is applied within approximately 12 seconds.
- If the triggering device remains pressed but no welding load is applied within approximately 12 seconds, the engine may return to low idle speed.
- If the triggering device is released or welding ceases, the engine will return to low idle speed after approximately 12 seconds.

11. START / GLOW PLUG SWITCH - Energizes the starter motor to crank the engine. With the engine RUN /STOP / IDLE switch in the "RUN" position, push and release the START button to start the engine:

- This switch has an amber light (top of switch) to indicate glow light, this engine will automatically apply power to the glow circuit and indicator light will turn off when glow is completed. (Engine will crank but will not start until glow cycle is completed)
- This switch also has a red light (bottom of switch) it will light up when there are faults with the engine. (Check engine light comes on) Field Service Shop will need to connect to diagnostic plug to read error codes.

12. 12-PIN CONNECTOR - For attaching optional remote control equipment. The K2909-1 (12-pin to 6-pin) adapter cable is included for attaching to accessories requiring the 6-pin connector.

13. 14-PIN CONNECTOR - For attaching wire feeder control cables. Includes contactor closure circuit, work sense lead remote control circuit, and 120V and 42V power.

14. WELD OUTPUT TERMINALS - These 1/2" - 13 studs with flange nuts provide welding connection points for the electrode and work cables. For positive polarity welding the electrode cable connects to the "+" positive terminal and the work cable connects to this "-" negative terminal. For nega-tive polarity welding the work cable connects to the "+" posi-tive terminal and the electrode cable connects to this "-" neg-ative terminal.

15. VRD (VOLTAGE REDUCTION DEVICE) INDICATOR LIGHTS - On the front panel of the Vantage® 549X are two indicator lights. A red light when lit indicates OCV (Open Circuit Voltage) is equal to or greater than 30V and a green light when lit indicates OCV is less than 30V.

The VRD must be active for the lights to be enabled. When the machine is first started with VRD enabled, both lights will illuminate for 5 seconds.

These lights monitor the OCV and weld voltage at all times. When not welding the green light will illuminate indicating that the VRD has reduced the OCV to less than 30V. During welding the red light will illuminate whenever the arc voltage is equal to or greater than 30V. This means that the red and green light may alternate depending on the weld voltage. This is normal operation.

If the red light remains illuminated or both VRD lights flash when not welding, the VRD is not functioning properly. Please refer to your local field service shop for service.

If VRD is turned ON, but no lights are illuminated, refer to the trouble shooting section.

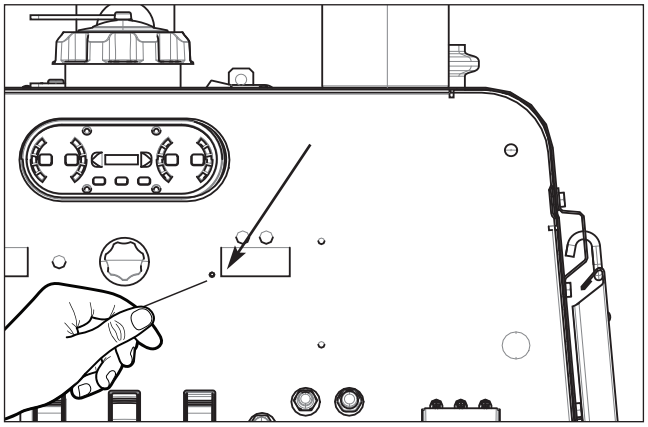
NOTE: See page A-2 to change the on/off position of the VRD switch.

16. HIDDEN MENU BUTTON - The hidden setup menu can be accessed any time the machine is on with the engine running and not in a welding arc (arc off or OCV). To access, press the HIDDEN MENU push button (Figure B.3 - functions are listed in following section) with the appropriate tool provided with the machine.

NOTE: The menu system will exit automatically if any of the following conditions are met:

- If no settings are changed for 10 seconds.
- If the mode selection switch position is changed.
- If the arc status changes to arc or short.
- If the entire setup menu sequence is cycled through.

FIGURE B.3



17. LOCAL/REMOTE SWITCH - In the LOCAL position, machine output control is set by the OUTPUT CONTROL knob on the front of the machine. In the REMOTE position, the machine output control is set by the remote inputs. This control is not active in ArcLink® modes.

18. WIRE FEEDER VOLTMETER POLARITY SWITCH Matches the polarity of the wire feeder voltmeter to the polarity of the electrode.

19. 10A BREAKER FOR 40V ARCLINK CIRCUIT

20. 20A BREAKER FOR 120V RECEPTACLE AND 120V WIRE FEEDER

21. 20A BREAKER FOR 42V WIRE FEEDER

22. 50A BREAKER FOR 120V/240V AND 240V RECPTACLES

23. 20A BREAKER FOR BATTERY

24. 20A BREAKER FOR 120V RECEPTACLE

25. 120/240 VAC SINGLE PHASE RECEPTACLE This is a 120/240 VAC (14-50R) receptacle that provides 240 VAC or can be split for 120 VAC single phase auxiliary power. This receptacle has a 50 amp rating. Refer to the AUXILIARY POWER RECEPTACLES section in the INSTALLATION chapter for further information about this receptacle. Also refer to the AUXILIARY POWER OPERATION section later in this chapter.

26. 240 VAC THREE PHASE RECEPTACLE - This is a 240 VAC (15-50R) receptacle that provides 240 VAC three phase auxiliary power. This receptacle has a 50 amp rating.

27. 120 VAC SINGLE PHASE RECEPTACLES - These are 120 VAC (5-20R) receptacles that provides 120 VAC single phase auxiliary power. Each receptacle has a 20 amp rating.

28. GFCI MODULES - Protects the 120 VAC duplex receptacles.

29. GROUND STUD - Provides a connection point for connecting the machine case to earth ground. Refer to MACHINE GROUNDING in the INSTALLATION section for proper machine grounding information.

30. LED STATUS LIGHT - The status LED indicates system status. Normal operation is a steady green light. (See Table B.1)

NOTE: During normal power-up, the LED may flash red and/or green as the equipment performs self tests.

TABLE B.1

LED CONDITION	DEFINITION
Steady Green	System is communicating normally.
Blinking Green	Occurs during a reset and indicates the power source is identifying each component in the system. This is normal for up to 15 seconds after power-up, or if the system configuration is changed during operation.
Fast Blinking Green	Indicates that one or more pieces of ArcLink equipment are not mapping properly.
Combination of Blinking Green and Red	Non-recoverable system fault. If the power source or wire feeder status LED is flashing any combination of red and green, errors are present in the system. Read the error code before the machine is turned off. Instructions for reading the error code are detailed in the Service Manual. Individual code digits are flashed in red with a long pause between digits. If more than one code is present, the codes will be separated by a green light. To clear the error, turn the power source OFF, and then back ON to reset.

31. THERMAL LIGHT - This status light indicates when the power source has been driven into thermal overload. If the output terminals were ON, the output will be turned back on once the unit cools down to an acceptable temperature level. If the unit was operating in the REMOTE mode, the trigger will need to be opened before or after the thermal has cleared and closed after the machine has cooled down to an acceptable temperature to reestablish output.

32. DIAGNOSTIC PLUG - This is used by field service shops to connect and troubleshoot engine error codes, found on the firewall inside the machine. (Figure B.4)

FIGURE B.4

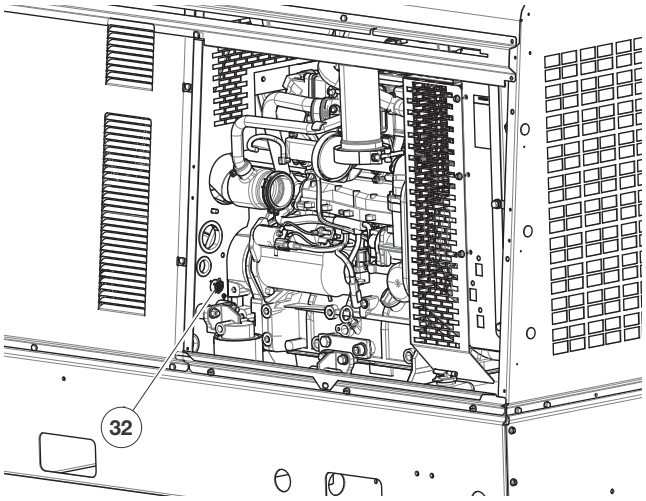
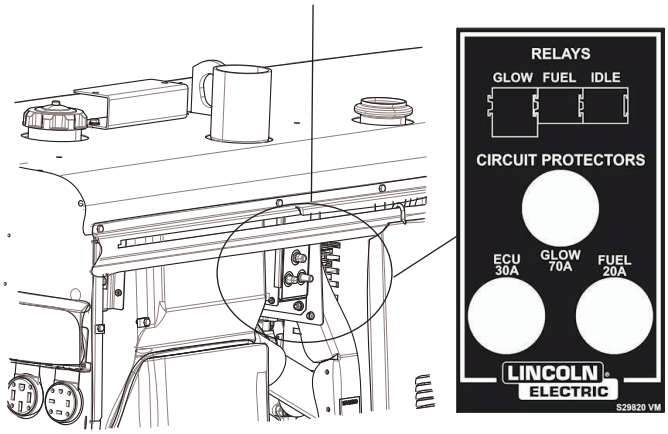


FIGURE B.5 - LOCATION OF ITEMS 33 - 36



ITEMS 33 - 36 ARE LOCATED BEHIND THE RIGHT FRONT SHEET METAL PANEL - FIGURE B.5

33. GLOW RELAY / BREAKER (70A)

34. FUEL RELAY / BREAKER (20A)

35. IDLE RELAY

36. ECU (ELECTRONIC CONTROL UNIT) BREAKER (30A)

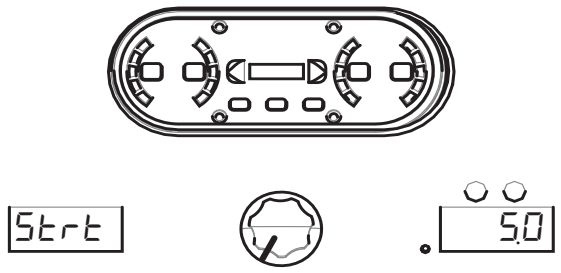
HIDDEN SETUP MENU FUNCTIONS

HOT START CONTROL

Hot start can be set based off weld mode. Non-applicable weld modes will not display hot start.

The left display will show “Hot” and “Strt” alternately at 0.5 second intervals. The right display will show a number from 0.0 to 10.0. The default value will be 5, (Figure B.6). This setting will be stored in system memory and will be remembered between machine power cycles.

FIGURE B.6



CV MODE SELECTION

Default CV mode will be non-synergic FCAW-SS (mode 6). Alternate settings will be non-synergic GMAW (mode 5) and non-synergic FCAW-GS (mode 7). The left display will show “CV” and “type” alternately at 0.5 second intervals. The right display will show “FC.SS”(Figure B.7), “FC.gS”(Figure B.8) or “MIG”(Figure B.9). This setting will be stored in system memory and will be remembered between machine power cycles. This setting will only be visible if the process selection switch is in the CV Wire position.

FIGURE B.7

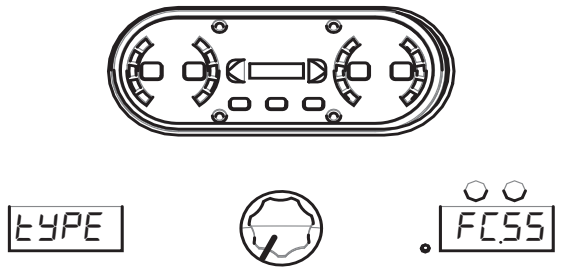


FIGURE B.8

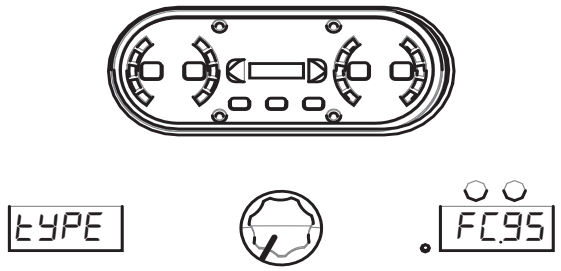
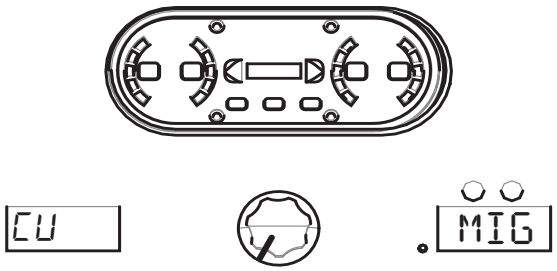


FIGURE B.9



REMOTE CONNECTOR SELECTION FOR STICK AND DOWNHILL PIPE MODES.

Select between the 12-pin or 14-pin connector for remote potentiometer input for STICK or DOWNHILL PIPE modes when in the REMOTE position. The default from the factory will be the 12-pin connector. The left display will show “Pot” and the right display will show “12P” (Figure B.10) or “14P” (Figure B.11) based off selection. This setting is stored in system memory and will be remembered between machine power cycles. This selection will only be visible for STICK and DOWNHILL PIPE modes.

FIGURE B.10

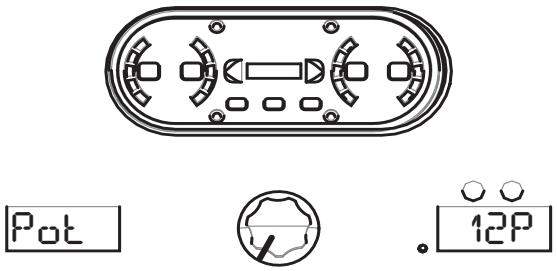
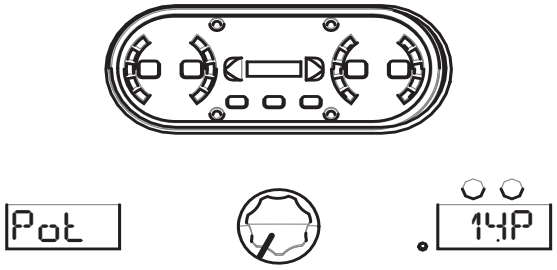


FIGURE B.11



CROSSLINC IN CV MODES

CrossLinc can be enabled for CV modes (VRD will be off in CV modes). The left display will show "CUC" and the right display will show "On" when enabled (Figure B.12) or "OFF" when not enabled (Figure B.13). This setting will be stored in system memory and will be remembered between machine power cycles.

FIGURE B.12

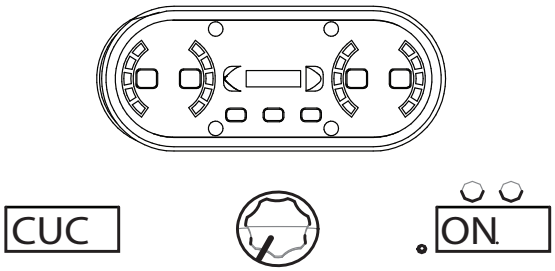
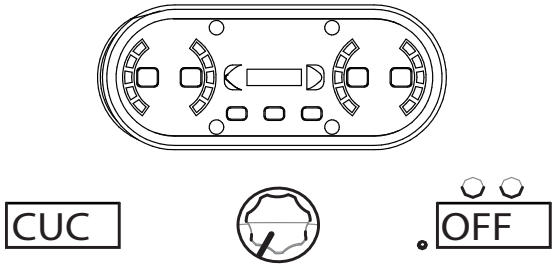


FIGURE B.13



TEST MODES FOR GRID LOAD TESTING

The left display will show **"tESt"** and **"LoAd"** alternately at 0.5 second intervals. The right display will show **"CC" (mode 200)** (Figure B.14), **"CV" (mode 201)**(Figure B.15) or **"OFF" (normal operation)**(Figure B.16). This setting is not remembered between machine power cycles and will default to **OFF** at each power on. Moving the position of the weld mode selector switch will reset the setting back to **OFF**.

FIGURE B.14

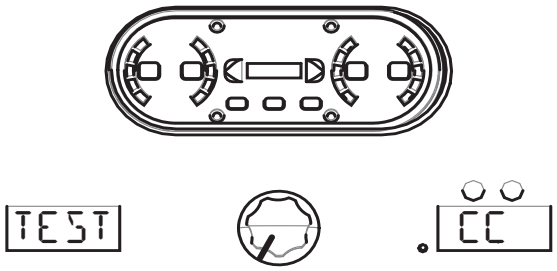


FIGURE B.15

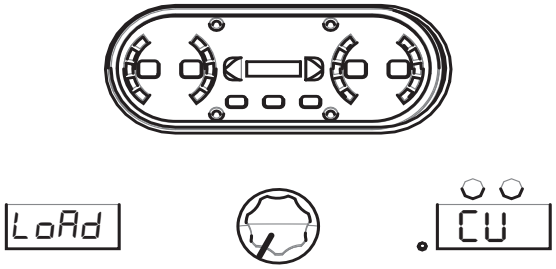
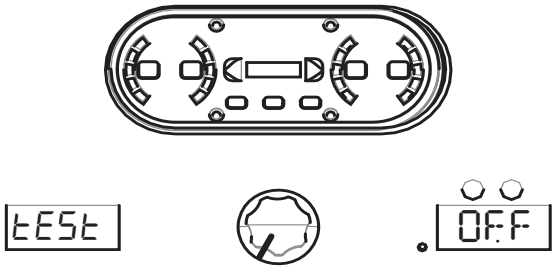


FIGURE B.16



RESET BACK TO DEFAULT SETTINGS

Pressing and holding the hidden reset push button for 5 seconds will cause certain stored values to be reset to defaults. The stored hot start values will return to a default setting of 5 on the display (0 at the attribute). The work point values will all be reset to the minimum from the weld table for each respective weld mode. The alternate CV mode selection will revert back to the Flux-Cored Arc Welding-Self Shielding (FCAW-SS) setting. The remote pot connector choice will revert back to the 12-pin connector. When the reset occurs, the left display will show **" deF"**, and the right display will show **"AuLt"** for 3 seconds until the machine exits the menu system.

MAKING A WELD

SAFETY INSTRUCTIONS
Read and understand this entire section before operating your machine.

⚠ WARNING

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

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

ENGINE EXHAUST can kill.
- **Use in open, well ventilated areas or vent exhaust outside**
- **Do not stack anything near the engine.**

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

Only qualified personnel should operate this equipment.

⚠ WARNING

The serviceability of a product or structure utilizing the welding programs is and must be the sole responsibility of the builder/user. Many variables beyond the control of The Lincoln Electric Company affect the results obtained in applying these programs. These variables include, but are not limited to, welding procedure, plate chemistry and temperature, weldment design, fabrication methods and service requirements. The available range of a welding program may not be suitable for all applications, and the build/user is and must be solely responsible for welding program selection.

Choose the electrode material, electrode size, shielding gas, and process (GMAW, GMAW-P etc.) appropriate for the material to be welded.

Select the weld mode that best matches the desired welding process. The standard weld set shipped with the Vantage® 549X encompasses a wide range of common processes that will meet most needs. If a special weld mode is desired, contact your local Lincoln Electric sales representative.

All adjustments are made through the user interface. Because of the different configuration options, your system may not have all of the following adjustments.

See ACCESSORIES section for kits and options available to use with the Vantage® 549X, visit lincolnelectric.com, or contact your local Lincoln Electric sales representatives.

DUTY CYCLE

Duty cycle is the percentage of time the load is being applied in a 10 minute period. For example, a 60% duty cycle represents 6 minutes of load and 4 minutes of no load in a 10 minute period.

NOTE: The duty cycles for the IEC rated output and max output are listed on the front nameplate of the Vantage 549X.

DEFINITION OF WELDING MODES

Non-Synergic Welding Modes

- A **non-synergic welding** mode requires all welding process variables to be set by the operator.

Synergic Welding Modes

- A **synergic welding** mode offers the simplicity of single knob control. The machine will select the correct voltage and amperage based on the Wire Feed Speed (WFS) set by the operator.

BASIC WELDING CONTROLS

Weld Mode

Selecting a weld mode determines the output characteristics of the Vantage® 549X power source. Weld modes are developed with a specific electrode material, electrode size, and shielding gas. Refer to the WELDER OPERATION section for a more completed description of the weld modes programmed into the machine at the factory.

Wire Feed Speed (WFS)

In synergic welding modes (synergic CV, GMAW-P), WFS is the dominant control parameter. The user adjusts WFS according to factors such as wire size, penetration requirements, heat input, etc. The Vantage® 549X then uses the WFS setting to adjust the voltage and current according to settings contained in the Vantage® 549X .

In non-synergic modes, the WFS control behaves like a conventional power source where WFS and voltage are independent adjustments. Therefore, to maintain proper arc characteristics, the operator must adjust the voltage to compensate for any changes made to the WFS.

Amps

In constant current modes, the OUTPUT CONTROL knob adjusts the welding amperage.

Volts

In constant voltage modes, the OUTPUT CONTROL knob adjusts the welding voltage.

WELDER OPERATION

CC-STICK MODE

The Vantage® 549X can be used with a broad range of DC stick electrodes.

The CC-STICK position of the MODE switch is designed for horizontal, vertical-up and over head welding with all types of stick electrodes, especially low hydrogen. The OUTPUT CONTROL knob adjusts the full output range for stick welding.

The ARC CONTROL knob sets the short circuit (arc force) current during stick welding. Increasing the number from -10 (Soft) to +10 (Crisp) increases the short circuit current and prevents sticking of the electrode to the plate while welding. This can also increase spatter. It is recommended that the ARC CONTROL be set to the minimum number without electrode sticking. Start with the knob set at 0.

DOWNHILL PIPE MODE

This slope controlled setting is intended for “out-of-position” and “down hill” pipe welding where the operator would like to control the current level by changing the arc length. The OUTPUT CONTROL knob adjusts the full output range for pipe welding.

The ARC CONTROL knob sets the short circuit current (arc force) during stick welding to adjust for a soft or a more forceful digging arc (Crisp). Increasing the number from -10 (Soft) to +10 (Crisp) increases the short circuit current which results in a more forceful digging arc. Typically a forceful digging arc is preferred for root and hot passes. A softer arc is preferred for fill and cap passes where weld puddle control and deposition (“stacking” of iron) are key to fast travel speeds. It is recommended that the ARC CONTROL be set initially at 0.

TOUCH START TIG MODE

The Vantage® 549X can be used in a wide variety of DC TIG welding applications.

The TOUCH START TIG setting of the MODE switch is for DC TIG welding. To initiate a weld, the OUTPUT CONTROL knob is first set to the desired current and the tungsten is touched to the work. During the time the tungsten is touching the work, there is very little voltage or current and, in general, this avoids tungsten contamination. Then, the tungsten is gently lifted off the work in a rocking motion, which establishes the arc.

To stop the arc, simply lift the TIG torch away from the work piece. When the arc voltage reaches approximately 30 volts, the arc will go out and the machine will automatically reset to the touch start current level. The tungsten may then be retouched to the work piece to restrike the arc. The arc may also be started and stopped with an amptrol or arc start switch.

NOTE: While using TOUCH START TIG mode, it is important to use the proper welding cable size to ensure expected performance levels.

The ARC CONTROL is not active in the TIG mode.

HIGH FREQUENCY TIG OPTIONS

In general the ‘Touch Start’ feature avoids tungsten contamination without the use of a high frequency unit. If the use of a high frequency generator is desired, the K930-2 TIG Module can be used with the Vantage® 549X.

The Vantage® 549X is equipped with the required radio frequency bypass circuitry for the connection of high frequency generating equipment.

The Vantage® 549X and any high frequency generating equipment must be properly grounded. See the K930-2 TIG Module operating manuals for complete instructions on installation, operation, and maintenance.

When using the TIG Module, the OUTPUT CONTROL knob on the Vantage® 549X is used to set the maximum range of the CURRENT CONTROL on the TIG Module amptrol.

For high frequency AC TIG, utilize the auxiliary output to power a Square Wave TIG 200.

SETTINGS WHEN USING THE K930-2 TIG MODULE

- Set the WELD MODE switch to the TOUCH START TIG setting.
- Set the RUN / STOP / IDLE switch to the AUTO IDLE / RUN position.
- Set the WELDING TERMINALS switch to the REMOTELY CONTROLLED position. This will keep the solid state contactor open and provide a “cold” electrode until the triggering device (amptrol or arc start switch) is pressed.

Table B.2 TYPICAL CURRENT RANGES [1] FOR TUNGSTEN ELECTRODES [2]

Tungsten Electrode Diameter mm (in)	DCEN (-)	DCEP (+)	Approximate Argon Gas Flow Rate L/min (cfm)		TIG TORCH Nozzle Size [4] [5]
	1%, 2% Thoriated Tungsten	1%, 2% Thoriated Tungsten	Aluminum	Stainless Steel	
.25 (0.010)	2-15	(3)	2-4 (3-8)	2-4 (3-8)	#4, #5, #6
.50 (0.020)	5-20	(3)	3-5 (5-10)	3-5 (5-10)	
1.0 (0.040)	15-80	(3)	3-5 (5-10)	3-5 (5-10)	
1.6 (1/16)	70-150	10-20	3-5 (5-10)	4-6 (9-13)	#5, #6
2.4 (3/32)	150-250	15-30	6-8 (13-17)	5-7 (11-15)	#6, #7, #8
3.2 (1/8)	250-400	25-40	7-11 (15-23)	5-7 (11-15)	
4.0 (5/32)	400-500	40-55	10-12 (21-25)	6-8 (13-17)	#8, #10
4.8 (3/16)	500-750	55-80	11-13 (23-27)	8-10 (18-22)	
6.4 (1/4)	750-1000	80-125	13-15 (28-32)	11-13 (23-27)	

(1) When used with argon gas. The current ranges shown must be reduced when using argon/helium or pure helium shielding gases.

(2) Tungsten electrodes are classified as follows by the American Welding Society (AWS):

Pure	EWP
1% Thoriated	EWTh-1
2% Thoriated	EWTh-2

Though not yet recognized by the AWS, Ceriated Tungsten is now widely accepted as a substitute for 2% Thoriated Tungsten in AC and DC applications.

(3) DCEP is not commonly used in these sizes.

(4) TIG torch nozzle “sizes” are in multiples of 1/16ths of an inch:

# 4 =	1/4 in.	6 mm
# 5 =	5/16 in.	8 mm
# 6 =	3/8 in.	10 mm
# 7 =	7/16 in.	11 mm
# 8 =	1/2 in.	12.5 mm
#10 =	5/8 in.	16 mm

(5) TIG torch nozzles are typically made from alumina ceramic. Special applications may require lava nozzles, which are less prone to breakage, but cannot withstand high temperatures and high duty cycles.

CV-WIRE MODE

Connect a wire feeder to the Vantage® 549X and set welder controls according to the instructions listed earlier in this section.

The Vantage® 549X in the CV-WIRE position, permits it to be used with a broad range of flux cored wire (Innershield® and Outershield®) electrodes and solid wires for GMAW (MIG) welding. Welding can be finely tuned using the ARC CONTROL. Turning the ARC CONTROL clockwise from -10 (soft) to +10 (crisp) changes the arc from soft and washed-in to crisp and narrow. It acts as an inductance/pinch control. The proper setting depends on the procedure and operator preference. Start with the knob set at 0.

For any electrodes, including the above recommendations, the procedures should be kept within the rating of the machine. For additional electrode information, see www.lincolnelectric.com or the appropriate Lincoln publication.

Synergic CV

For each wire feed speed, a corresponding voltage is preprogrammed into the machine through special software at the factory.

The nominal preprogrammed voltage is the best average voltage for a given wire feed speed, but may be adjusted to preference. When the wire feed speed changes, the Vantage® 549X automatically adjusts the voltage level correspondingly to maintain similar arc characteristics throughout the WFS range. See Table B.4 for the available synergy modes accessible via ARCLINK mode.

Non-Synergic CV

In non-synergic modes, the WFS control behaves more like a conventional CV power source where WFS and voltage are independent adjustments. Therefore to maintain the arc characteristics, the operator must adjust the voltage to compensate for any changes made to the WFS.

ARC GOUGING MODE

For optimal performance when arc gouging, set the Vantage® 549X WELD MODE SELECTOR knob to the ARC GOUGING position.

Set the OUTPUT CONTROL knob to adjust output current to the desired level for the gouging electrode being used according to the ratings in Table B.3 below.

If gouging above 450 amps, it is recommended to set the machine to HIGH IDLE.

*Maximum current setting is limited to the Vantage® 549X maximum of 575 amps.

TABLE B.3

ELECTRODE DIAMETER	CURRENT RANGE DCEP (+)
1/8" (3.2 mm)	30-60 Amps
5/32" (4.0 mm)	90-150 Amps
3/16" (4.8 mm)	200-250 Amps
1/4" (6.4 mm)	300-400 Amps
5/16" (7.9 mm)	350-450 Amps
3/8" (9.5 mm)	450-575 Amps

NOTE: If desired the CV-WIRE mode can be used for arc gouging applications.

ARCLINK MODE

This weld mode is intended to unlock basic non-synergic and synergic modes intended for use with compatible ArcLink wire feeders. All of the Vantage® 549X user interface controls are disabled in this mode and controlling the power source is accomplished from the wire feeder user interface.

Hot Start – Not used for this welding process.

Arc Control – Not used for this welding process.

Weld Terminals On/Remote – Not used for this welding process.

Amperage Display – This display will display three dashed lines when the machine is in the idle state. This indicates that amperage is not settable in this weld mode. While output is enabled, the actual welding amperage will be displayed. After welding, the meter holds the actual amperage value for 5 seconds. Output adjustment while in the "hold" period results in the "prior to operation" characteristics stated above. The displays blink indicating that the machine is in the "Hold" period.

Voltage Display – This display will display the pre-set welding voltage when the machine is in the idle state. After welding, the meter holds the actual voltage value for 5 seconds. Output adjustment while in the "hold" period results in the "prior to operation" characteristics stated above. The displays blink indicating that the machine is in the "Hold" period.

Output Control Local/Remote – Not used for this welding process

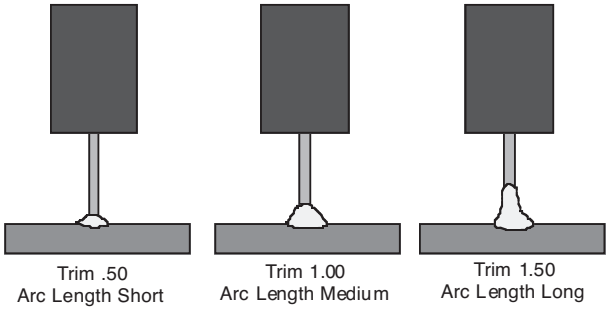
Output Control – Not used for this welding process

PULSE WELDING

Pulse welding procedures are set by controlling an overall "arc length" variable. When pulse welding, the arc voltage is highly dependent upon the waveform. The peak current, back ground current, rise time, fall time and pulse frequency all affect the voltage. The exact voltage for a given wire feed speed can only be predicted when all the pulsing waveform parameters are known. Voltage or Trim can be adjusted.

Trim adjusts the arc length and ranges from 0.50 to 1.50 with a nominal value of 1.00. Trim values greater than 1.00 increase the arc length, while values less than 1.00 decrease the arc length. 1.00 is a good starting point for most conditions. (See Figure B.17)

FIGURE B.17



Most pulse welding programs are synergic. As the wire feed speed is adjusted, the Vantage® 549X will automatically recalculate the waveform parameters to maintain similar arc properties.

The Vantage® 549X utilizes "adaptive control" to compensate for changes in the electrical stick-out while welding. (Electrical stick-out is the distance from the contact tip to the work piece.) The Vantage® 549X waveforms are optimized for a 0.75" stick-out. The adaptive behavior supports a range of stick-outs from 0.50 to 1.25". At very low or high wire feed speeds, the adaptive range may be less due to reaching physical limitations of the welding process.

UltimArc™ Control

UltimArc™ Control adjusts the focus or shape of the arc. UltimArc™ Control is adjustable from -10.0 to +10.0 with a nominal setting of 0.0. Increasing the UltimArc™ Control increases the pulse frequency and background current while decreasing the peak current. This results in a tight, stiff arc used for high speed sheet metal welding. Decreasing the UltimArc™ Control decreases the pulse frequency and background current while increasing the peak current. This results in a soft arc good for out of position welding. (See Figure B.18)

FIGURE B.18

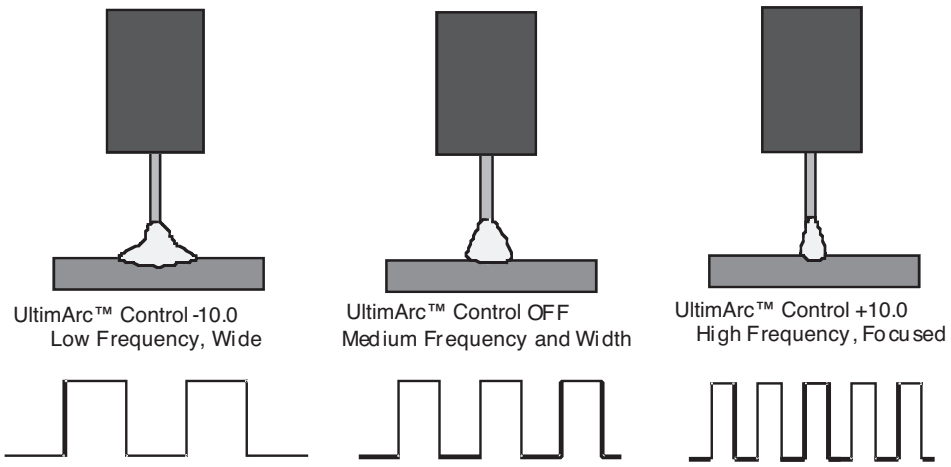


TABLE B.4

The following modes can be accessed via an ArcLink feeder:

Synergic CV Modes									
Diameter	Steel		Stainless		Metal-Cored	Flux Core		Aluminum	
	CO 2	Argon Mix	Argon Mix	Tri-Mix	Argon Mix	Argon Mix	CO2	4043	5356
.030	•	•	•	•					
.035	•	•	•	•				•	•
.040	•	•							
.045	•	•	•	•	•	•	•		
3/64								•	•
.052	•	•			•	•	•		
1/16		•	•		•	•	•	•	•

Pulse Modes					
Diameter	Steel	Stainless	Metal-Cored	Aluminum	
	Argon Mix	Argon Mix	Argon Mix	4043	5356
.035	•	•		•	•
.040	•				
.045	•	•	•		
3/64				•	•
.052	•		•		
1/16	•	•	•	•	•

CROSSLINC

CrossLinc provides the benefits of remote control without a cable. The accessory or wire feeder talks to the power source by sending a signal through the electrode cable.

To start CrossLinc, simply connect the weld cables and sense lead per the CrossLinc device's instructions. Select the desired weld mode with the machine. When weld output is ON, the CrossLinc device will automatically link to the machine. The CrossLinc light will be on to show active communication.

When CrossLinc is active, the remote control is disabled.

CrossLinc technology uses a communication protocol coupled in the electrode and work cables. For best performance the total voltage drop in the system should be kept under 10V.

CrossLinc is not compatible with High Frequency TIG. If high frequency is in the area, the cables need to routed as far as possible from each other. Also, follow all high frequency best practices, including an driven earth ground.

For Touch Start TIG applications, the machine should be placed on HIGH idle to ensure the most robust CrossLinc connection.

PARALLELING

When paralleling machines in order to combine their outputs, all units must be operated in the CC-STICK mode at the same output settings. To achieve this, turn the WELD MODE switch to the CC-STICK position. Operation in other modes may produce erratic outputs, and large output imbalances between the units.

AUXILIARY POWER OPERATION

Start the engine and set the RUN / STOP / IDLE switch to the desired operating mode. Full power is available regardless of the welding control settings, if no welding current is being drawn.

The auxiliary power of the Vantage® 549X consists of two 20 amp 120 VAC (5-20R) duplex receptacles with GFCI protection, one 50 amp 120/240 VAC single phase (14-50R) receptacle and one 50 amp 240 VAC three phase (15-50R) receptacle.

The auxiliary power capacity is 11,000 watts of 60 Hz, single phase power or 19,000 watts of 60 Hz, three phase power. The auxiliary power capacity rating in watts is equivalent to volt-amperes at unity power factor. The maximum permissible current of the 240 VAC output is 50 A. The 240 VAC single phase output can be split to provide two separate 120 VAC outputs with a maximum permissible current of 50 A per output to two separate 120 VAC branch circuits. Output voltage is within ± 10% at all loads up to rated capacity.

NOTE: The two 120V GFCI receptacles and the two 120V circuits of the 120/240V receptacle are connected to different phases and cannot be paralleled.

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

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

SIMULTANEOUS WELDING AND AUXILIARY POWER LOADS

The auxiliary power capacity previously stated is maintained without any welding load. If a welding load is present, the available auxiliary power will decrease.

Simultaneous welding and power loads are specified in Table B.5. The permissible currents shown assume that current is being drawn from either the 120 VAC or 240 VAC supply (not both at the same time).

TABLE B.5 VANTAGE 549X SIMULTANEOUS WELDING AND POWER LOADS

WELD AMPS		1 PHASE WATTS	1 PHASE AMPS		3 PHASE WATTS	3 PHASE AMPS		BOTH 1 AND 3 PHASE WATTS	BOTH 1 AND 3 PHASE AMPS
0		11,000	46		19,000	46		------	46
100		11,000	46		16,600	40		------	46
200	PLUS	11,000	46	OR	13,400	32	OR	------	46
250		11,000	46		11,500	28		11,000	------
300		9,400	39		9,400	23		9,400	------
400		4,600	19		4,600	11		4,600	------
up to 575		0	0		0	0		0	0

TABLE B.6 VANTAGE® 549X EXTENSION CORD LENGTH RECOMMENDATIONS

Current (Amps)	Voltage (Volts)	Load (Watts)	Maximum Allowable Cord Length in ft. (m) for Conductor Size											
			14 AWG		12 AWG		10 AWG		8 AWG		6 AWG		4 AWG	
15	120	1800	30	(9)	40	(12)	75	(23)	125	(38)	175	(53)	300	(91)
15	240	3600	60	(18)	75	(23)	150	(46)	225	(69)	350	(107)	600	(183)
20	120	2400			30	(9)	50	(15)	88	(27)	138	(42)	225	(69)
20	240	4800			60	(18)	100	(30)	175	(53)	275	(84)	450	(137)
25	240	6000					90	(27)	150	(46)	225	(69)	250	(76)
30	240	7200					75	(23)	120	(37)	175	(53)	300	(91)
38	240	9000							100	(30)	150	(46)	250	(76)
50	240	12000									125	(38)	200	(61)

Conductor size is based on maximum 2.0% voltage drop.

GFCI MODULE

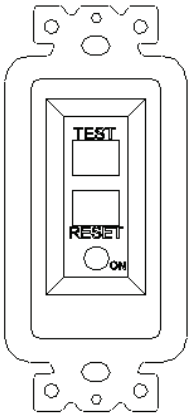
⚠ WARNING

- **An electric shock can result in serious injury or death.**
- **Always perform the GFCI test before using the generator. If the GFCI system fails the test, the machine must be repaired by an authorized service center.**
- **If the GFCI fails to trip when the test button is pressed (“ON” light does not go off or "STATUS light is RED) or fails to reset (“ON” light does not go on or "STATUS light is blinking) the device is inoperative and should be replaced immediately.**
- **If the GFCI tests properly without any appliance connected to it but trips each time an appliance is connected to it, the appliance has a ground fault and needs to be repaired or replaced. DO NOT USE THE APPLIANCE IF THIS CONDITION OCCURS: A REAL SHOCK HAZARD MAY EXIST.**
- **Due to the risk of power interruption, do not power life support equipment from this machine.**
- **GFCI’s do not protect against short circuits or overloads.**
- **Unplug accessories and tools before attempting service.**
- **Close the front service doors protecting the receptacles when operating the machine.**
- **Do not test or reset the GFCI while at idle speed.**
- **If the LED blinks, stop using the GFCI receptacle and have it replaced by an authorized service center.**
- **Long extension cords or cords with poor insulation may allow enough leakage current to trip the GFCI.**

The GFCI modules protect the (2) 120 VAC duplex receptacles. Two different types of modules are used in the machines.

Machines manufactured approximately September 2021 or earlier

The GFCI is an auto reset GFCI. It is identified by the “ON” LED located below the buttons.

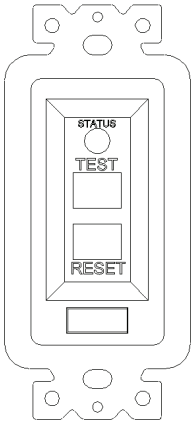


- Auto Reset: Immediately supplies power to the load when power is applied to the line.
- “ON” LED illuminates red when the load has power.

To test this GFCI, press the "TEST" button. The "ON" red LED should turn off. Then press the "RESET" button. The "ON" red LED should turn on. If the "ON" red LED does not turn off and on as indicated, the GFCI failed the test and should be replaced.

Machines manufactured approximately October 2021 or later

The GFCI is an auto reset, self-testing GFCI. It is identified by the “STATUS” LED located above the buttons.



- Auto Reset: Immediately supplies power to the load when power is applied to the line.
- “STATUS” LED illuminates Green when the GFCI is functioning properly.
- “STATUS” LED illuminates Red when the GFCI has “tripped”. Press the reset button.
- “STATUS” LED illuminates flashing Red when the GFCI has failed and needs replaced.

While this GFCI has a self-testing feature, to manually test this GFCI, press the "TEST button. The “STATUS” LED should turn red. Then press the "RESET" button. The “STATUS” LED should turn green. If the “STATUS” LED does not turn red and green as indicated, or flashes red, the GFCI failed the test and should be replaced.”

TYPICAL FUEL CONSUMPTION

Refer to Table B.7 for typical fuel consumption of the Vantage® 549X Engine for various operating scenarios.

TABLE B.7
(Deutz TD2.9L4) Fuel Consumption

	GAL. / HR.	L / HR.	RUN TIME (HRS.) WITH FULL TANK*
High Idle	0.71	2.69	35.2
Low Idle	0.36	1.37	68.9
100A 24V	0.83	3.15	30.0
200A 28V	1.02	3.87	24.4
300A 32V	1.27	4.81	19.7
400A 36V	1.59	6.03	15.7
500A 40V	2.01	7.59	12.5
525A 41V	2.14	8.09	11.7
11kW Single Phase Power	1.30	4.94	19.2
19kW Three Phase Power	1.78	6.75	14.0

*Full Tank equals 25 gal. (94.6L)

ACCESSORIES

CROSSLINC ACCESSORIES

LN-25X

True Voltage Technology (TVT) is now included with the LN-25X portable wire feeder. When used with a CrossLinc compatible power source, control cables are eliminated and voltage can be controlled right at the feeder. TVT compensates for voltage drop when using long welding power cables.

Order: K4267-2

Activ8X

Rugged, light-weight, portable across-the-arc wire feeder that fits up to an 8" dia. spool. Includes CrossLinc and TVT capability to remotely set voltage from the feeder without a control cable and to ensure the set voltage regardless of power cable lengths.

Order: K3519-1

CrossLinc Remote

Utilize with CrossLinc compatible equipment to control output for CC processes like stick or TIG welding. Remote control is added in-line with the welding power cable to allow for remote output control of the power source through the weld cable without additional control cables.

Order: K4345-1

GENERAL ACCESSORIES

Large Welder Trailer

Two-wheeled trailer with a standard Duo-Hitch™ (2" Ball and Lunette Eye combination hitch) for heavy-duty road, off-road, plant, and yard use. For highway use, consult applicable federal, state, and local laws regarding possible additional requirements. Optional fender and light package available.

Order: K2637-2 Large Trailer
K2639-1 Fender & Light Kit
K2640-1 Cable Rack

Four-Wheeled Steerable Trailer

Four-wheeled trailer with a standard Duo-Hitch™ (2" Ball and Lunette Eye combination hitch) for plant and yard towing. Includes 13" wheels and an automatically engaging drawbar lock.

Order: K2641-2

Full KVA Power Plug Kit

Provides four 115V plugs rated at 20 amps each, and one dual voltage, full KVA plug rated at 115/230V, 50 amps.

Order: K802N

Polarity/Multi-Process Switch

Offers easy polarity switching and process changes for all Lincoln® Chopper Technology® engine-driven welders.

Order: K2642-1 Polarity/Multi-Process Switch

Air Filter Guard Kit

Placed around the air filter to provide additional protection from incidental damage.

Order: K4698-1

Spark Arrestor

Mounts to exhaust tube to significantly reduce spark emissions.

Order K3985-1

Deutz® Engine Service Kit

One easy-to-purchase kit including all the needed engine filters to maintain peak welder performance. Includes air filter, fuel filter, oil filter, and fuel water separator.

Order: K3558-5

Remote Output Control

Portable control provides same dial range as the output control on the welder. The remote features a convenient 12-pin plug for easy connection to the welder.

Order: K857-2 25 ft (7.6 m)
K857-3 100 ft (30.4 m)

Remote Output Control with Min Setting

125 ft. (38.0 m) portable control provides same dial range as the output control on the welder. Second adjustment knob sets the low end setpoint for increased resolution. Remote comes standard with a 6-pin plug. 12-pin to 6-pin Adaptor (K2909-1) needed. Optional built-in 120 VAC receptacles available.

Order: K4330-1
K4268-1 With 120V AC Receptacles
K2909-1 12-pin to 6-pin Adaptor

TIG ACCESSORIES

Pro-Torch PTA-26 TIG Torch

Air-cooled 200 amp torch (2 piece) equipped with valve for gas flow control with 25 ft. (7.6 m) of cable length. Expendables parts kit available.

Order: K1783-9 PTA-26 TIG Torch
KP509 Magnum Parts Kit for PTA-26 TIG Torch

Foot Amptrol

Remote output control foot pedal for TIG welding with a 25 ft. (7.6 m) cable featuring a 12-pin connector.

Order: K870-2

Hand Amptrol

Remote output control hand control for TIG welding with a 25 ft. (7.6 m) cable featuring a 12-pin connector. Includes hook and loop straps to secure torch. (One size fits all Pro-Torch TIG Torches.)

Order: K963-4

TIG Module

Supplies high frequency for superior starting, contactor control, remote control capability, and a gas valve for AC or DC TIG welding.

Order: K930-2 TIG Module
K936-1 TIG Module Cable, 9 pin to 14 pin

WIRE FEEDERS & GUNS

K126 Pro Innershield® Gun

Feature replaceable liners, interchangeable backend, long life Magnum® PRO contact tips, improved heat resistant gun tubes, and better trigger lead protection. For self-shielded .062-5/64 in. (1.6-2.0 mm) wire with 15 ft. (4.5 m) cable. Includes K466-10 Connector Kit.

Order: K126-12

Magnum SG Spool Gun

25.ft (7.6m) handheld semiautomatic wire feeder large easy-grip handle and remote control wire speed. Requires Control Module and Input Cable.

Order: K487-25 Magnum SG
K488 Magnum Control Module
K691-10 Input Cable

Power Feed 25M

Compact wire feeder offers push-pull capable for premium aluminum welding. Features the MAXTRAC® drive system, full controls, and procedural memory presets to support the advanced process welding on almost any application. Plastic and aluminum case available. ArcLink control cable needed.

Order: K2536-5 Plastic Case
K2536-4 Aluminum Case
K2683-25 Heavy Duty ArcLink Control Cable - 25 ft. (7.6 m)
K2683-50 Heavy Duty ArcLink Control Cable - 50 ft. (15.2 m)
K2683-100 Heavy Duty ArcLink Control Cable - 100 ft. (30.4 m)
K2429-1 ArcLink® "T" Connector Kit

CABLE ACCESSORIES

Tweco® Adaptors

Allows for quick cable changeovers on the jobsite.

Order: K2487-1 Stud to Tweco Female Adapter – LENCO (CT-40FS)
K2946-1 Tweco Style Cam-Lock Adapter Plug for 2/0 (50 mm^2) cable
K3416-70 Tweco Style Plug (Male, 1/0 thru 2/0)
K3416-90 Tweco Style Plug (Male, 3/0 thru 4/0)
K3417-70 Tweco Style Receptacle (Female, 1/0 thru 2/0)
K3417-90 Tweco Style Receptacle (Female, 3/0 thru 4/0)

POWER SOURCES

Square Wave TIG 200

Portable TIG and stick welding machine that provides smooth and stable AC TIG welding on aluminum and DC TIG welding on steel, stainless steel and chrome-moly.

Order: K5126-1

PowerMIG 210MP

Multi-process welder with MIG, stick, TIG, and flux-cored welding. The push-and-turn digital controls and color display screen make setup and operation intuitive and easy, while the all-metal wire drive and sturdy sheet-metal construction make it rugged and ready for any job. Runs off auxiliary power to provide an additional welding arc.

Order: K3963-1

Tomahawk 1000 Plasma Cutter

Cuts metal using the AC generator power from the engine-driven welder. Requires the T12153-10 Full-KVA Power Plug (NEMA 15-50P).

Order: K2808-1

Multi-Weld 350

Small and portable welder to provide additional welding arcs. Multiple machines can be powered off the welding power cable of one main power supply. Excellent option to provide control at the welding arc for DC+ stick or wire processes.

Order: K1735-1

Invertec V350 PRO

Efficient, lightweight, and portable multi-process welder. Runs off the auxiliary power to provide an additional welding arc.

Order: K1728-6

Invertec V275-S

Proven, portable CC power source for Stick or TIG welding. Runs off the auxiliary power to provide an additional welding arc.

Order: K2269-1

Flextec 350X PowerConnect

Reliable, multi-process welder designed for use in construction, fabrication, shipbuilding, and other heavy-duty applications. Features PowerConnect Technology to allow for automatic connecting to any incoming voltage including 200-575 VAC, single or three-phase, 50 or 60 Hz

Order: K4273-1

MAINTENANCE

SAFETY PRECAUTIONS

READ AND UNDERSTAND ENTIRE SECTION BEFORE OPERATING MACHINE.

⚠ WARNING

- **Have a qualified technician do the maintenance and troubleshooting work.**
- **Turn the engine off before working inside the machine.**
- **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.**

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

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

⚠ WARNING

HOT PARTS AND FLUID can burn or cause fire.

- **Do not touch hot parts with bare hands or allow hot fluid to contact skin.**
- **Allow equipment to completely cool before servicing.**
- **Handle hot parts using proper tools and wear heavy insulated welding gloves and clothing to prevent burns.**
- **Do not place unit on, over, or near combustible surfaces.**
- **Keep all flammable material away from unit**

⚠ WARNING

Before carrying out service, maintenance and/or repair jobs, fully disconnect power to the machine.

Use Personal Protective Equipment (PPE), including safety glasses, dust mask and gloves to avoid injury. This also applies to persons who enter the work area.

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

Have qualified personnel do all maintenance and troubleshooting work.

ROUTINE AND PERIODIC MAINTENANCE

DAILY

- Check the engine oil level.
- Refill the fuel tank to minimize moisture condensation in the tank.
- Open the water drain valve located on the bottom of the water separator element 1 or 2 turns and allow to drain into a container suitable for diesel fuel for 2 to 3 seconds. Repeat the above drainage procedure until diesel fuel is detected in the container.
- Clean interior of machine with a low pressure air stream. Make a thorough inspection of all components.
- Look for signs of overheating, broken leads, or other obvious problems. Many problems can be uncovered with a good visiual inspection.

PERIODIC

Blow out the machine with low pressure air periodically. In particularly dirty locations, this may be required once a week.

BRUSH REMOVAL AND REPLACEMENT

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

⚠ WARNING

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

ENGINE MAINTENANCE

Refer to the SERVICE PLAN section of the Engine Operator's Manual for the recommended maintenance schedule of the following:

a) Engine Oil and Filter

b) Air Cleaner

c) Fuel Filter and Delivery System

d) Alternator Belt

e) Battery

f) Cooling System

Refer to Table D.1 at the end of this section for various engine maintenance components.

AIR FILTER

⚠ WARNING

- **Excessive air filter restriction will result in reduced engine life.**
- **Never use gasoline or low flash point solvents for cleaning the air cleaner element. A fire or explosion could result.**
- **Never run the engine without the air cleaner. Rapid engine wear will result from contaminants, such as dust and dirt being drawn into the engine.**

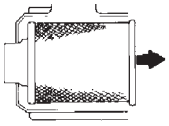
The diesel engine is equipped with a dry type air filter. Never apply oil to it. Service the air cleaner per instructions on page D-3

Replace the air filter element as needed per the service indicator. If no indicator is present, clean as needed and replace every 200 hours of operation. Under dusty conditions, replace sooner.

Service Instructions

Single- and Two-Stage Engine Air Cleaners

1 Remove the Filter



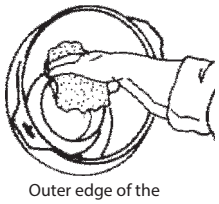
Rotate the filter while pulling straight out.

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

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

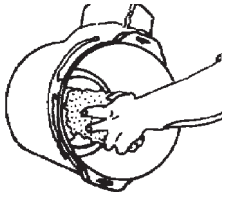
2 Clean Both Surfaces of the Outlet Tube and Check the Vacuator™ Valve

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



Outer edge of the outlet tube

Wipe both sides of the outlet tube clean.

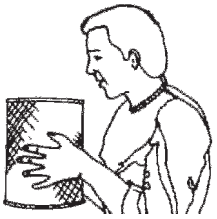


Inner edge of the outlet tube

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

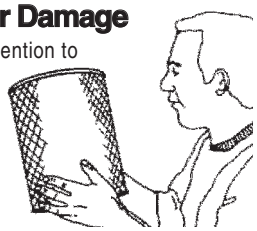
3 Inspect the Old Filter for Leak Clues

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



4 Inspect the New Filter for Damage

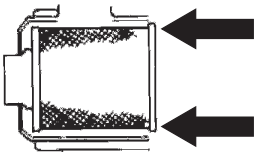
Inspect the new filter carefully, paying attention to the inside of the open end, which is the sealing area. NEVER install a damaged filter. A new Donaldson radial seal filter may have a dry lubricant on the seal to aid installation.



5 Insert the New Radial Seal Filter Properly

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

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



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

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

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

Caution

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

6 Check Connectors for Tight Fit

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

FUEL FILTERS

⚠ WARNING

When working on the fuel system

- **Keep naked lights away, do not smoke!**
- **Do not spill fuel!**

The Vantage® 549X is equipped with a fuel pre-filter / water separator before the electric lift pump and a fuel filter after the lift pump and before the injectors. Open the drain on the fuel pre-filter / water separator and drain out any water daily. Close drain when diesel fuel starts to come out. If excessive water is in the fuel, the engine will not start. The procedure for changing the filter is as follows.

1. Close the fuel shutoff valve.
2. Clean the area around the fuel filter head. Remove the filter. Clean the gasket surface of the filter head and replace the o-ring.
3. Fill the clean filter with clean fuel, and lubricate the o-ring seal with clean lubricating oil.
4. Install the filter as specified by the filter manufacturer.

⚠ WARNING

Mechanical over tightened will distort the threads, filter element seal or filter can.

COOLING SYSTEM

The cooling system of the Deutz engine needs to be checked and cleaned periodically. (Consult the Engine Owner's Manual for the proper procedures and frequency).

Coolant needs to be added at the radiator filler neck after removing cap when system is cool. Fill to top of filler neck. Engine will not start if coolant level is too low.

The coolant system is equipped with an internal expansion tank located inside the top radiator tank. This allows for normal thermal expansion and contraction of the engine coolant. The system is fitted with a “catch only” reservoir to keep any rejected or excess coolant from entering the environment. Check periodically and empty as required. **Do not fill with coolant**.

CHECKING AND REPLACING COOLANT

⚠ WARNING

HOT COOLANT can burn skin. Do not remove cap if radiator is hot.

Check the coolant level by observing the level in the radiator. Add 50/50 antifreeze / water solution if the level is low by removing the radiator cap and adding coolant into the radiator. Fill up to the tube in the radiator filler neck.

To drain the coolant, open the valve at the bottom of the radiator. Open the radiator cap to allow complete drainage. (Tighten the valve and refill with a 50/50 antifreeze/water solution.) Use an automotive grade (low silicate) ethylene glycol antifreeze. The cooling system capacity is 4.1 US gal. (15.6L). Squeeze upper and lower radiator hoses while filling to bleed air from system coolant. Replace and tighten the radiator cap.

Periodically remove the dirt from the radiator fins.

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

⚠ CAUTION

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

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

BATTERY HANDLING

⚠ WARNING

GASES FROM BATTERY can explode.

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

To prevent EXPLOSION when:

- **INSTALLING A NEW BATTERY - disconnect negative cable from old battery first and connect to new battery last.**
- **CONNECTING A BATTERY CHARGER - Remove battery from welder by disconnecting negative cable first, then positive cable and battery clamp. When reinstalling, connect negative cable last. Keep well ventilated.**
- **USING A BOOSTER - connect positive lead to battery first then connect negative lead to engine foot.**

BATTERY ACID CAN BURN EYES AND SKIN.

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

PREVENTING ELECTRICAL DAMAGE

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

PREVENTING BATTERY DISCHARGE - Turn the RUN/STOP switch to stop when engine is not running.

PREVENTING BATTERY BUCKLING - Tighten nuts on battery clamp until snug.

CHARGING THE BATTERY -When you charge, jump, replace, or otherwise connect battery cables to the battery, be sure the polarity is correct. Improper polarity can damage the charging circuit. The Vantage® 549X positive (+) battery terminal has a red terminal cover.

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

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

ENGINE OIL CHANGE

Drain the engine oil while the engine is warm to assure rapid and complete draining. It is recommended that each time the oil is changed the oil filter be changed as well.

- Be sure the unit is off. Disconnect the negative battery cable to ensure safety.
- Locate oil drain hose and valve in bottom of base and pull through the hole in the battery access panel on the welder.
- Remove the cap from the drain valve. Push valve in and twist counterclockwise. Pull to open and drain the oil into a suitable container for disposal.
- Close the drain valve by pushing in and twisting clockwise. Replace the cap.
- Re-fill the crankcase to the upper limit mark on the dipstick with the recommended oil. Replace and tighten the oil filler cap securely.
- Push oil drain hose and valve back into unit, re-connect negative battery cable, and close doors and engine top cover before restarting unit.Wash your hands with soap and water after handling used motor oil. Please dispose of used motor oil in a manner that is compatible with the environment. We suggest you take it in a sealed container to your local service station or recycling center for reclamation. DO NOT throw it in the trash, pour it on the ground, or down a drain.

SAE 10W-30 oil that meets API class CJ-4 or better is recommended for general, all temperature use, 5F to 104F (-15C to 40C).

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

Oil Filter Change

- Drain the oil.
- Remove the oil filter with an oil filter wrench and drain the oil into a suitable container. Discard the used filter. Note: Care should be taken during filter removal to not disrupt or damage in any way the fuel lines.
- Clean the filter mounting base and coat the gasket of the new filter with clean engine oil.
- Screw the new filter on by hand until the gasket contacts the mounting base. Using an oil filter wrench, tighten the filter an additional 1/2 to 7/8 of a turn.
- Refill the crankcase with the specified amount of the recommended engine oil. Reinstall the oil filler cap and tighten securely.
- Start the engine and check for oil filter leaks.
- Stop the engine and check the oil level. If necessary, add oil to the upper limit mark on the dipstick.

TIGHTENING THE FAN BELT

If the fan belt is loose, the engine can overheat and the battery lose its charge. Check tightness by pressing on the belt midway between the pulleys. For tightness requirements, please refer to the Engine Owner's Manual.

NAMEPLATES / WARNING DECALS MAINTENANCE

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

STORAGE

Store the Vantage® 549X in a clean, dry protected areas.

TABLE D.1

REPLACEMENT SERVICE ITEMS

ITEM	MAKE	PART NUMBER	SERVICE INTERVAL
AIR CLEANER ELEMENT	DONALDSON FLEETGUARD	P828889 AF25557	(WITH SERVICE INDICATOR) CLEAN AS NEEDED, REPLACE AS INDICATED BY THE SERVICE INDICATOR (WITHOUT SERVICE INDICATOR) CLEAN AS NEEDED, REPLACE EVERY 200 HOURS.
OIL FILTER	DEUTZ	01174416	REPLACE EVERY 500 HOURS OR 12 MONTHS, WHICHEVER IS LESS
FAN BELT	DEUTZ	04131488	REPLACE EVERY 1500 HOURS
FUEL FILTER	DEUTZ	04137456	REPLACE EVERY 500 HOURS OR 24 MONTHS, WHICHEVER IS LESS
FUEL FILTER/ WATER SEPARATOR	DEUTZ	04130241	CLEAN AS NEEDED, REPLACE EVERY 1000 HOURS
BATTERY	——	BCI GROUP 34	INSPECT EVERY 500 HOURS
ENGINE OIL CHANGE	SEE MANUAL	——	CHANGE EVERY 500 HOURS OR 6 MONTHS, WHICHEVER IS LESS. CHECK DAILY.

S29926

GFCI MAINTENANCE

⚠ WARNING

- **An electric shock can result in serious injury or death.**
- **Always perform the GFCI test before using the generator. If the GFCI system fails the test, the machine must be repaired by an authorized service center.**
- **If the GFCI fails to trip when the test button is pressed (power "ON" light does not go off) or fails to reset (power "ON" light does not go on) the device is inoperative and should be replaced immediately.**
- **If the GFCI tests properly without any appliance connected to it but trips each time an appliance is connected to it, the appliance has a ground fault and needs to be repaired or replaced. DO NOT USE THE APPLIANCE IF THIS CONDITION OCCURS: A REAL SHOCK HAZARD MAY EXIST.**
- **Due to the risk of power interruption, do not power life support equipment from this machine.**
- **GFCI's do not protect against short circuits or overloads.**
- **Unplug accessories and tools before attempting service.**
- **Do not test or reset the GFCI while at low idle speed.**
- **If the LED blinks, stop using the GFCI receptacle and have it replaced by an authorized service center.**
- **Long extension cords or cords with poor insulation may allow enough leakage current to trip the GFCI.**

FUNCTIONAL DESCRIPTION

The Vantage 549X is a diesel engine-driven welding power source. The machine uses a brush type alternating current generator for DC multi-purpose welding, for 120/240 VAC single phase and 240 VAC three phase auxiliary standby power. The welding control system uses state of the art Chopper Technology. The machine has been equipped with CrossLinc Technology to provide weld cable communication for voltage control at the arc without the need for a control cable.

The Vantage 549X is make up of eight main components. They are as follows:

- The Engine
- Engine Control Unit (ECU)
- Stator and Rotor
- Chopper User Interface Board (CHUI)
- Output Rectifier
- Chopper Modules (2)
- Dashboard Gauges Module
- Power Bus Board

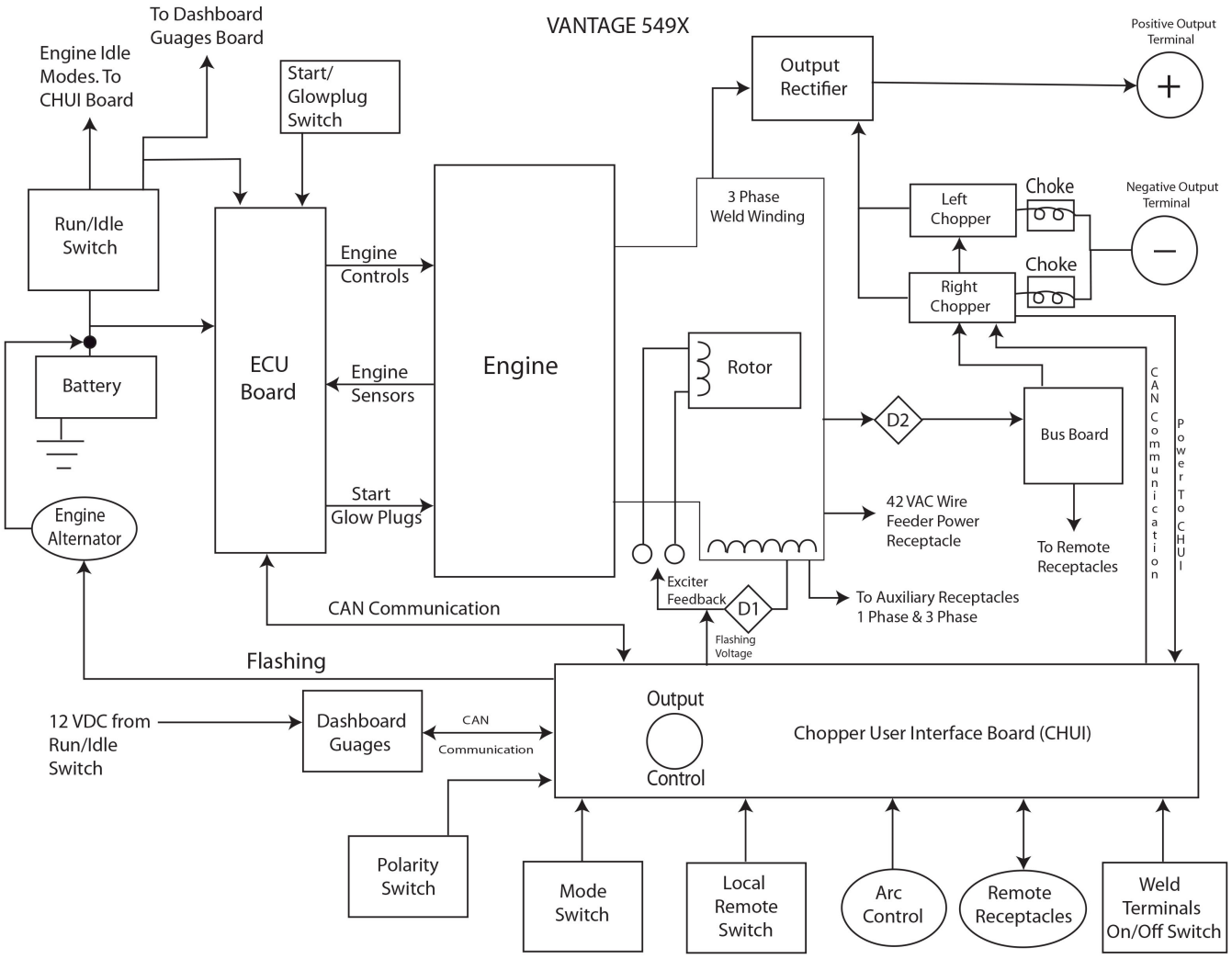


Figure E.1

POWER UP

BATTERY, RUN/IDLE SWITCH, START/GLOW PLUG SWITCH, ECU Module, ROTOR, AND STATOR

The Battery supplies voltage directly to the ECU Module. It also supplies voltage, via the Run/Idle Switch, to the Dashboard Gauge Board and to the ECU Module. The Run/Idle Switch also signals the Chopper User Interface Board to control the Engine's RPM, via the ECU Module, in the Automatic Idle or High Idle Modes. The Engine Alternator is flashed by the Chopper User Interface Board.

When the Start/Glow Plug Switch is activated the ECU Module energizes the Engine's Glow Plugs and also energizes the Starter Motor.

When the Engine, that is mechanically coupled to the Rotor, located within the Stator assembly, is started up and running a "flashing voltage" is sent to the Rotor coils through a brush and slip ring configuration. This "flashing voltage" originates from the Chopper User Interface Board. This rotating field (Rotor) induces AC voltages on the stationary windings housed in the Stator frame.

The Stator houses several separate windings. They are as follows:

- Three phase windings for welding
- Single and three phase windings for auxiliary power and exciter feedback voltage
- A 42VAC winding for external wire feeder power.
- Another 42VAC winding that is connected to the D2 rectifier.

The three phase welding windings are connect to the Output Rectifier. The Auxiliary windings are connected through circuit breakers and ground fault circuit interrupters (GFCI) to the appropriate receptacles. (120/240VAC single phase and 240VAC three phase). One portion of the Auxiliary power winding is also connected to the D1 rectifier bridge and the resultant DC voltage is applied to the Rotor (exciter feedback). The 42VAC winding is connected to the 14 pin remoted receptacle. An additional 42VAC winding is connected to the D2 rectifier bridge and the resultant DC voltage is applied to the Bus Board.

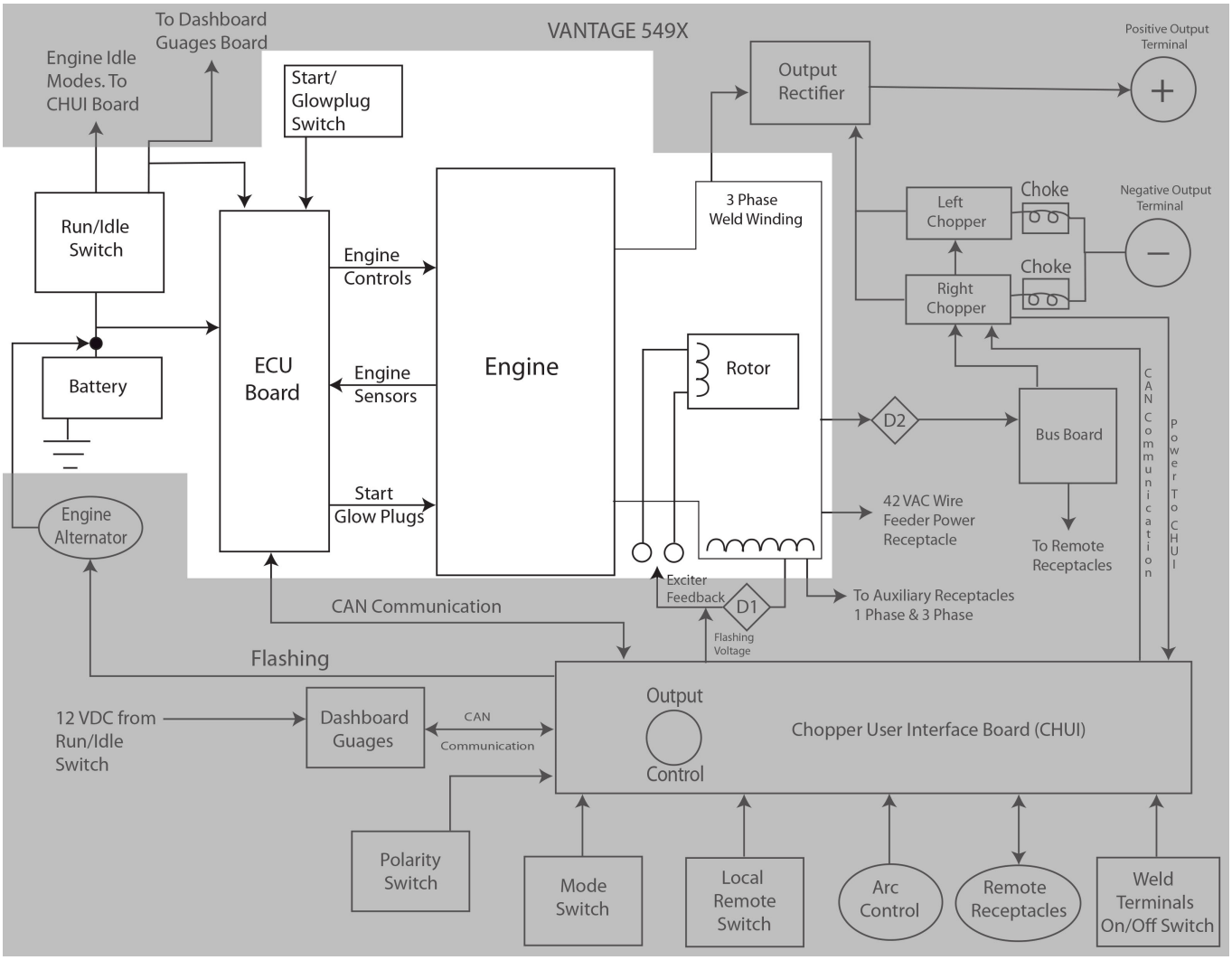


Figure E.2

ENGINE COMPONENTS

ENGINE CONTROLS, SENSORS, PROTECTION AND ENGINE CONTROL MODULE (ECU)

The following engine sensors are connected to the ECU Module and in the case of a faulty condition the ECU will shut off the engine by deactivating the fuel pump.

- Low oil pressure
- High coolant temperature

The ECU controls the engine speed dependent upon signals from the crankshaft and camshaft speed sensors. The Engine speed is regulated by the commands from the ECU to the Engine's fuel injectors.
If no welding or auxiliary current is being drawn, and the ON/OFF Idler Switch in the Auto position, the CHUI board will signal the ECU board, via CAN communications, to reduce the Engine's RPM to low idle speed (1525 RPM). When output current is sensed, either weld or auxiliary, the CHUI board will signal the ECU board to increase the Engine's RPM to high idle speed (1800RPM).

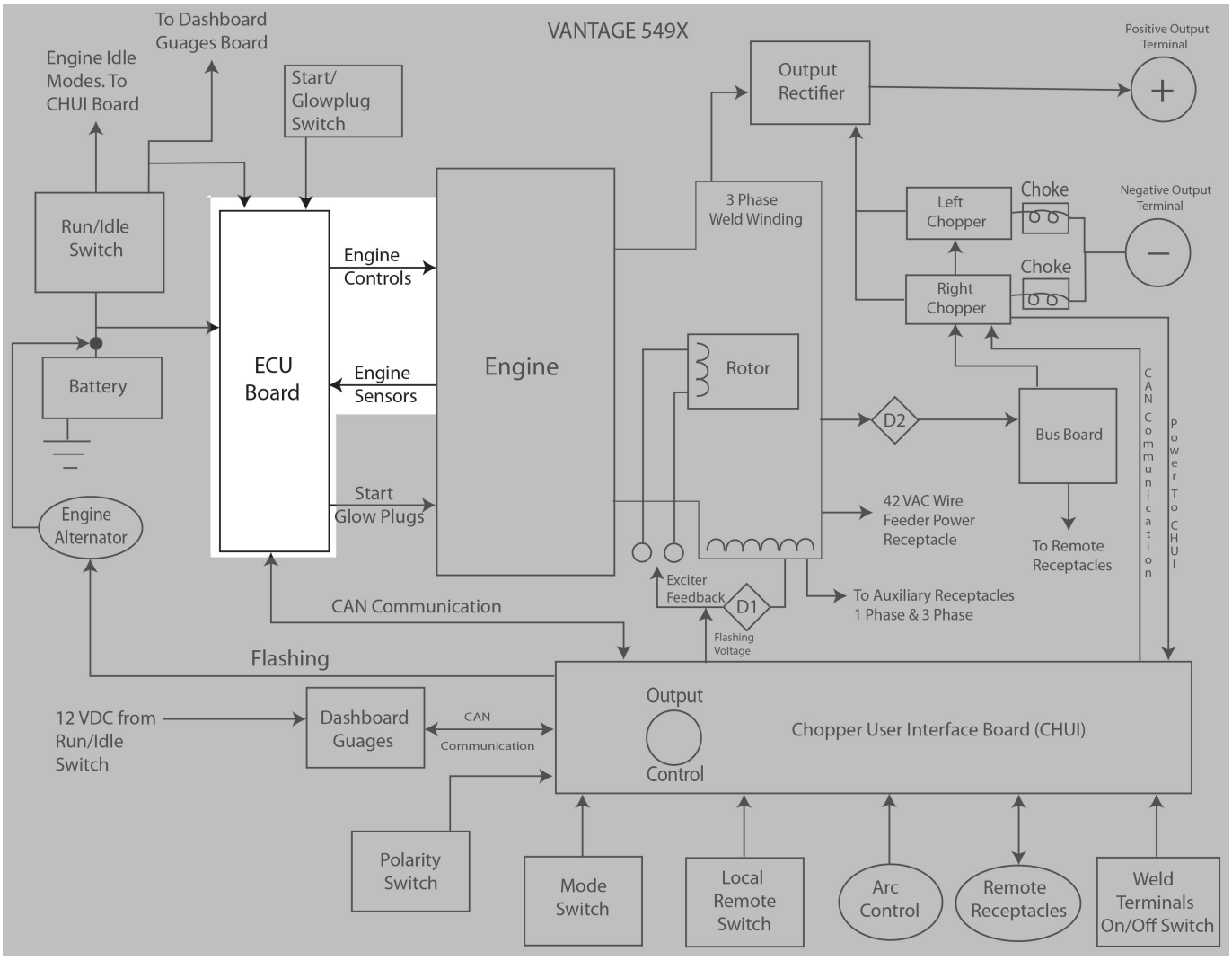


Figure E.3

WELDING OUTPUT AND CONTROL

THREE PHASE OUTPUT RECTIFIER, CHOPPER BOARDS, OUTPUT CHOKES, POWER BUS BOARD, DASHBOARD GAUGE BOARD, AND CHOPPER USER INTERFACE BOARD

The three phase weld windings in the Stator are connected to the Three Phase Output Rectifier. The resultant DC voltage is applied to the capacitor/chopper circuitry that is incorporated within the two parallel Chopper Boards. The capacitors function as filters and also power supplies for the chopper IGBTs. See IGBT Operation in this section. The IGBTs are high speed switches operating at 40KHZ. These devices are switched on and off by the gate signals generated within the Right Side Chopper Board after receiving commands from Chopper User Interface Board via CAN communications. See Pulse Width Modulation in the section. Free-wheeling diodes are incorporated in the Chopper Board circuitry to provide a current path for the stored energy in the Output Chokes when the IGBTs are in the OFF state. Voltage and current feedback is sent to the right side chopper board for processing and control purposes.

The Chopper User Interface Board (CHUI) has many functions as follows:

- Receives input power from the Right Side Chopper Board.
- Interfaces with the Right Side Chopper Board via CAN communication signals.
- Communicates and interfaces with both the Dashboard Gauges Board and the Engine Control Board (EUC) via CAN communications.
- Interfaces with the Remote Receptacles.
- Receives commands from the Weld Terminals Switch, the Mode Selector Switch, the Local Remote Switch, Polarity Switch and the Arc Control Potentiometer
- Receives welding output and process commands from the Output Control Encoder located within the CHUI board.

The Bus Board supplies 40DC to the Right Side Chopper Board and also to the Remote Receptacles.
The Dashboard Gauge Board is powered by 12VDC battery circuit voltage and interfaces with the CHUI board via CAN communications

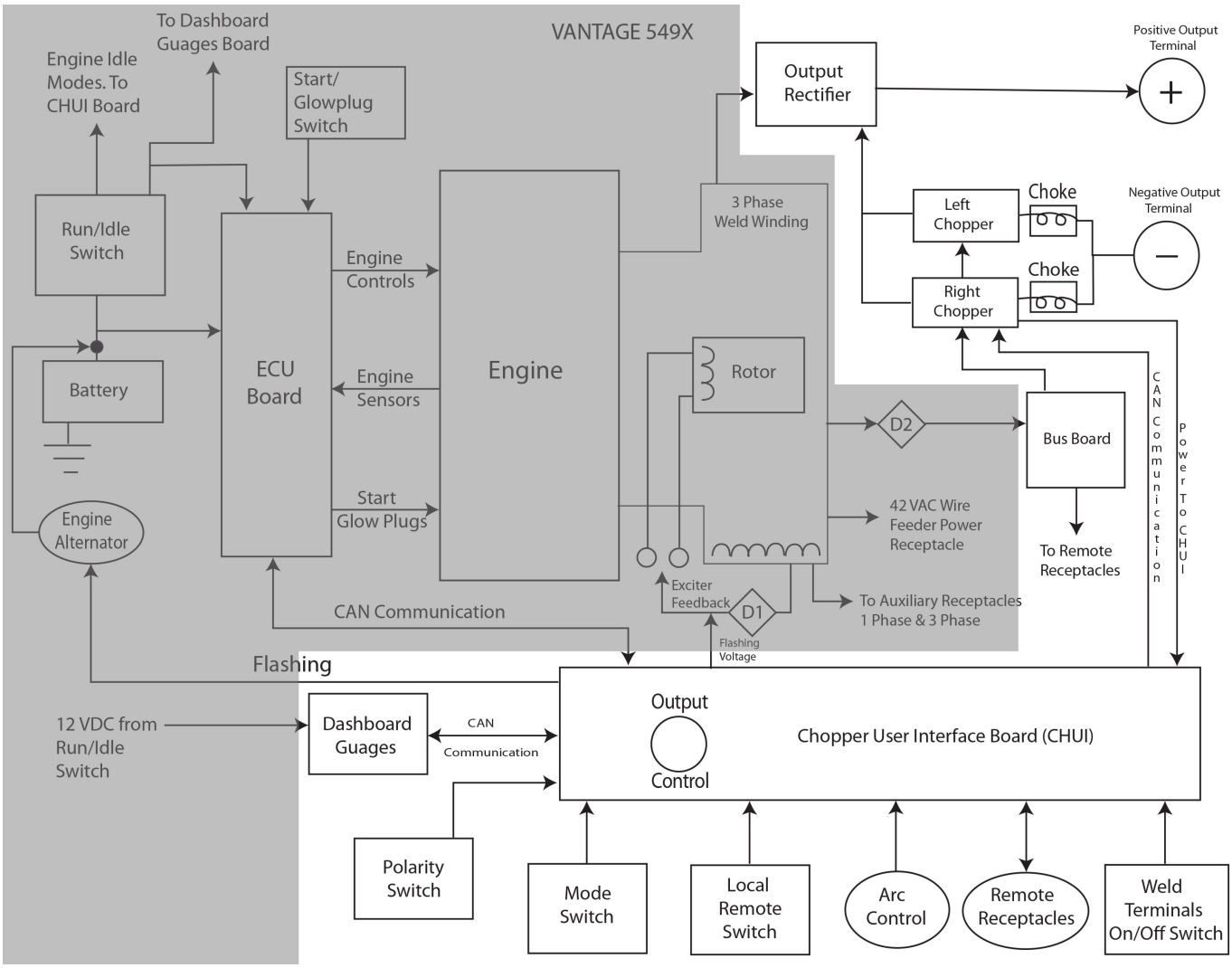


Figure E.4

PROTECTION

Auxiliary Power
The auxiliary power circuits are protected from over current conditions by the following:

- One three pole 50 Amp circuit breaker-(CB1)
- Two single pole 20 Amp circuit breakers – (CB2 and CB3)

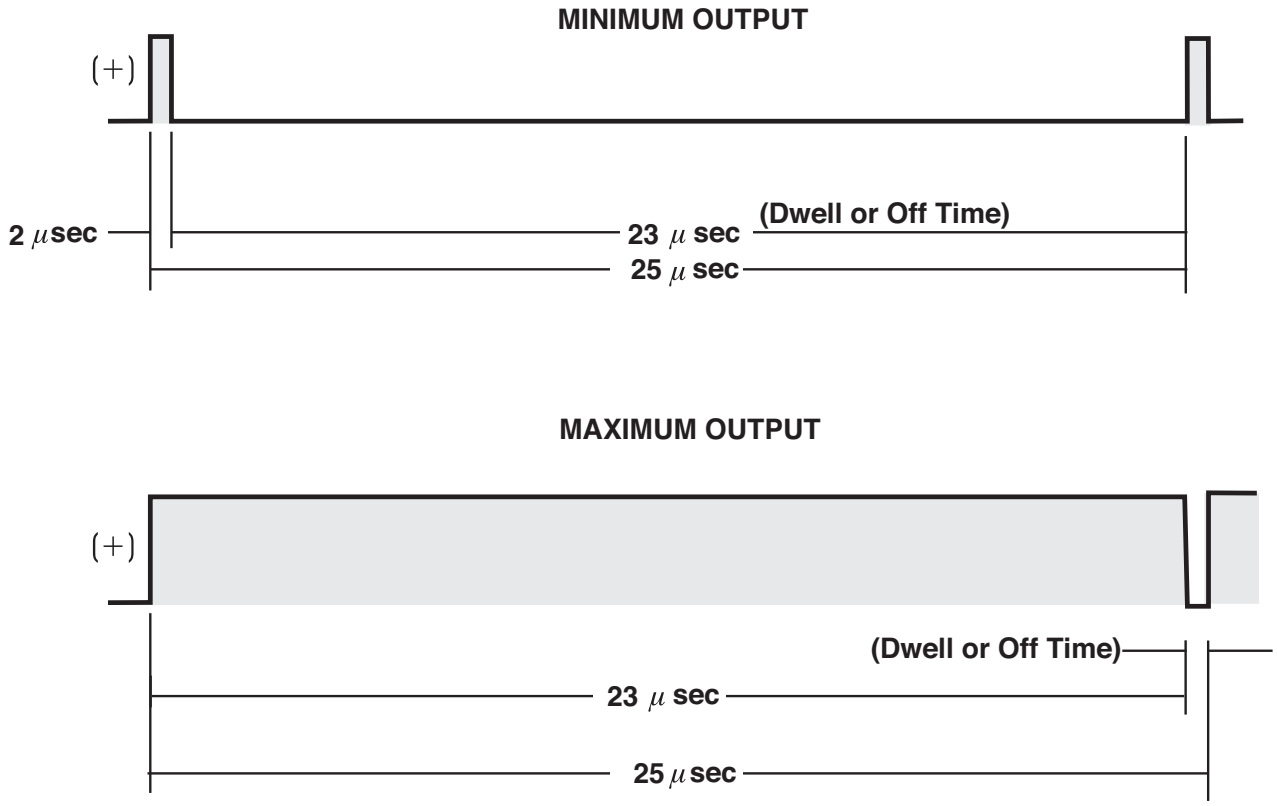
There are also two Ground Fault Circuit Interrupters (GFCI) to protect the circuits from ground faults.

WELDING CURRENT
Based on the feedback from the output shunt (located in the positive welding circuit) the welding current is limited to a maximum output level.

ENGINE PROTECTION
In the case of low oil pressure, or high coolant temperature, the engine will shut down. The engine is also protected from excessive low or high RPM.

THEORY OF OPERATION

TYPICAL IGBT OUTPUTS



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 25-microsecond time period.

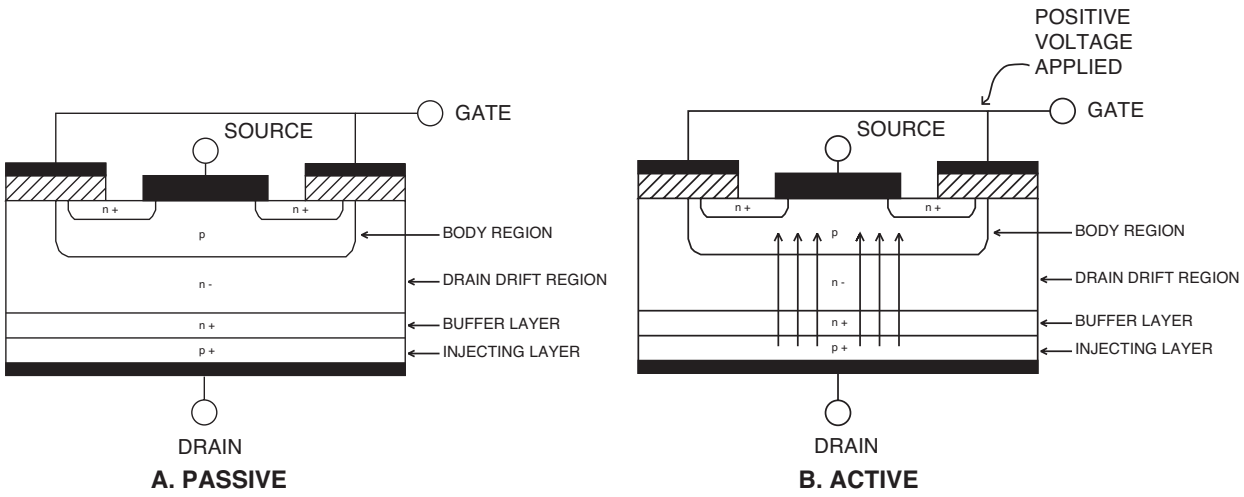
The positive portion of the signal represents one IGBT group conducting for 2 microsecond. The dwell time (off time) is 23 microseconds. Since only 2 microseconds of the 25-microsecond time period is devoted to conducting, the output power is minimized.

MAXIMUM OUTPUT

By holding the gate signals on for 23 microseconds and allowing only 2 microseconds of dwell time (off time) during the 25-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.

THEORY OF OPERATION

IGBT OPERATION



A. PASSIVE **B. ACTIVE**

INSULATED GATE BIPOLAR TRANSISTOR (IGBT) OPERATION

An IGBT is a type of transistor. IGBTs are semiconductors well suited for high frequency switching and high current applications.

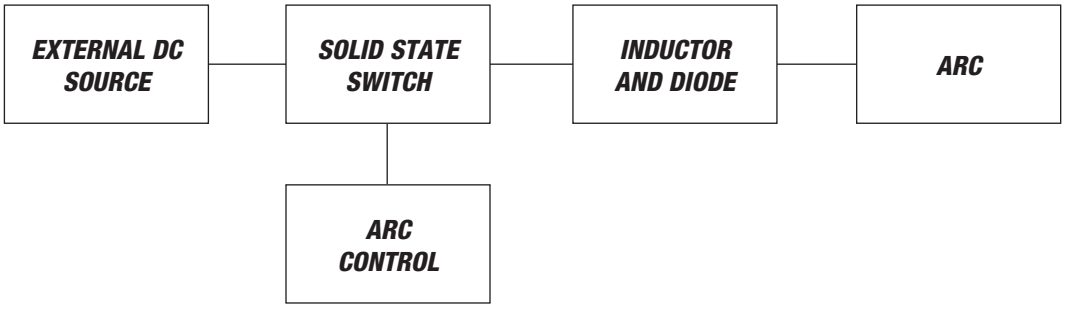
Drawing A shows an IGBT in a passive mode. There is no gate signal, (zero volts relative to the source) and therefore, no current flow. The drain terminal of the IGBT may be connected to a voltage supply; but since there is no conduction the circuit will not supply current to components connected to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

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, it 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.

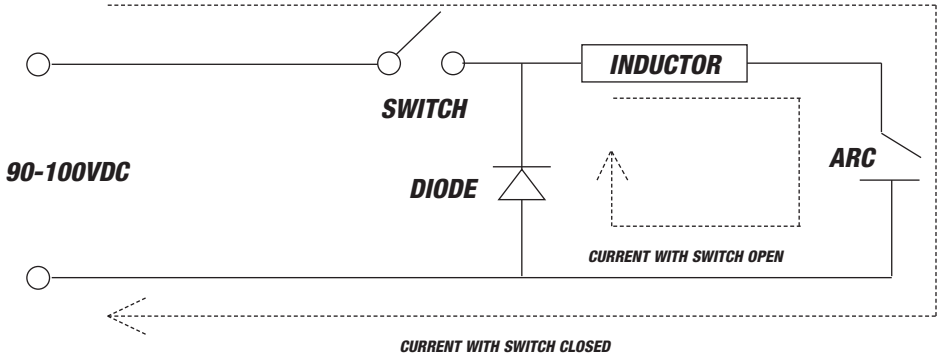
THEORY OF OPERATION

CHOPPER TECHNOLOGY FUNDAMENTALS

The new era of welding machines such as the Frontier 400X, 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 approximately 90-100VDC. The current is applied through a solid state switch 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 the 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 40Khz, 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.

TROUBLESHOOTING

How to Use Troubleshooting Guide

⚠ WARNING

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

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

Step 1. LOCATE PROBLEM (SYMPTOM).

Look under the column labeled "PROBLEM (SYMPTOMS)." This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting.

Step 2. POSSIBLE CAUSE.

The second column labeled "POSSIBLE CAUSE" lists the obvious external possibilities that may contribute to the machine symptom.

Step 3. RECOMMENDED COURSE OF ACTION.

This column provides a course of action for the Possible Cause, generally it states to contact your local Lincoln Authorized Field Service Facility.

If you do not understand or are unable to perform the Recommended Course of Action safely, contact your local Lincoln Authorized Field Service Facility.

⚠ WARNING

ELECTRIC SHOCK can kill.

- **Turn off machine at the disconnect switch on the rear of the machine and remove main power supply connections before doing any troubleshooting.**

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your Lincoln Authorized Service Facility for technical troubleshooting assistance before you proceed.

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PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Major mechanical or electrical damage is evident.	1. Contact your local Lincoln Authorized Field Service Facility.	1. Contact the Lincoln Electric Service Department at 1-888-3877.
There is no welding output. The engine runs normally. The auxiliary output is normal (120/240V).	1. Check for loose or faulty connections at the welding terminals and cables. 2. Make sure the weld terminals switch is in the "ON" position.	1. Perform the ***Output Rectifier Test.*** 2. Perform the ***Right Chopper Board Test.*** 3. Perform the ***D2 Rectifier Test.*** 4. Perform the ***Power Bus Board Test.*** 5. Perform the ***Chopper User Interface Board Test.*** 6. Perform the ***Stator Test.*** 7. Perform the ***Output Chokes Tests.*** 8. Check the internal connections between the Positive Output Terminal and the Output Rectifier. See the wiring diagram. 9. Check the internal connections between the output chokes and the Negative Output Terminal. See the wiring diagram.
There is no welding output or auxiliary output. The engine runs normally.	1. Make sure the weld terminals switch is in the "ON" position. 2. Check the Circuit Breakers and GFCI devices. Reset if tripped.	1. Perform ***the Rotor Test.*** 2. Perform the ***D1 Rectifier Test.*** 3. Check the R1 Resistor. See the Wiring Diagram. 4. Perform the ***Chopper User Interface Board Test.*** 5. Perform the ***Stator Test.***
There is no auxiliary output. (120/240V). The engine runs normally. The welding output is normal.	1. Check the Circuit Breakers and GFCI devices. Reset if tripped. 2. Check the GFCIs for proper operation.	1. Perform the ***Circuit Breaker Tests CB1, CB2, and CB3.*** 2. Perform the ***Auxiliary Power Receptacles Tests.*** 3. Perform the ***Stator Test.***
There is no control of the welding output. The auxiliary output is normal and the engine runs normally.	1. Make sure the Local/Remote Switch is in the "Local" position.	1. Perform the ***Chopper User Interface Board Test.*** 2. Perform the ***Right Chopper Board Test.*** 3. Perform the ***Left Chopper Board Test.*** 4. Perform the ***Output Shunt Test.***
The machine has low welding output and low auxiliary voltage output. The engine runs normally.	1. Make sure the engine is running at 1800RPM when in the high idle mode.	1. Perform ***the Rotor Test.*** 2. Perform the ***D1 Rectifier Test.*** 3. Check the Capacitor that is across the D1 Rectifier. See the Wiring Diagram. 4. Perform the ***Stator Test.***

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your Lincoln Authorized Service Facility for technical troubleshooting assistance before you proceed.

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PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
Engine wont crank when start/glow button is activated.	1. The battery or battery connections may be faulty. 2. Make sure the Run/Idle Switch is set to “Run”.	1. Perform the ***Run/Idle Switch Test.*** 2. Perform the ***Start/Glow Switch Test.*** 3. Perform the ***ECU Board Test.*** 4. The Engine Starter Motor Assembly may be faulty.
Engine will crank but not start when start/glow button is activated.	1. Make sure there is adequate fuel in fuel the tank. 2. Check circuit breaker CB6. Reset if tripped. See the wiring diagram.	1. Perform the ***Run/Idle Switch Test.*** 2. Perform the ***Fuel Relay Test.*** 3. Perform the ***Glow Plug Relay Test.*** 4. Perform the ***ECU Board Test.*** 5. The Fuel Pump may be faulty. 6. The Engine may be in need of repair.
The Engine shuts down shortly after starting.	1. Check the coolant level in the radiator. 2. The coolant temperature may be too high. 3. The engine’s oil level or oil pressure may be low. 4. Make sure there is sufficient fuel in fuel tank.	1. Perform the ***ECU Board Test.*** 2. The Fuel Pump may be faulty. 3. The Engine may be in need of repair.
The Engine will not shut off.	1. Make sure the Run/Idle switch is in the OFF position.	1. Perform the ***Run/Idle Switch Test.*** 2. Perform the ***Fuel Relay Test.*** 3. Perform the ***ECU Board Test.***
The Engine will not go to low idle mode. (1525 RPM)	1. Make sure the Run/Idle switch is in the Auto position. 2. Make sure there is not a load on the welding terminals or any of the auxiliary power receptacles.	1. Perform the ***Run/Idle Switch Test.*** 2. Perform the ***Idle Relay Test.*** 3. Perform the ***ECU Board Test.*** 4. Perform the ***Chopper User Interface Board Test.***
The Engine will not go to high speed when a load is applied to the auxiliary power receptacles and the Run Idle switch is set to the Auto position. The auxiliary output voltage is normal when the machine is at high speed. (1800 RPM)	1. Make sure the load is above 100 Watts.	1. The auxiliary power sensor toroid or associated wiring may be faulty. See the wiring diagram. 2. Perform the ***ECU Board Test.*** 3. Perform the ***Chopper User Interface Board Test.*** 4. Perform the ***Idle Relay Test.***

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your Lincoln Authorized Service Facility for technical troubleshooting assistance before you proceed.

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PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS (CONT)		
The Engine will not go to high speed when a load is applied to the welding terminals and the Run Idle switch is set to the Auto position. The welding open circuit voltage is normal when the machine is at high speed (1800 RPM).	1. Make sure the Weld Terminals Switch is in the ON position.	1. Perform ***the Output Shunt Test.*** 2. Perform the ***ECU Board Test.*** 3. Perform the ***Chopper User Interface Board Test.*** 4. Perform the ***Idle Relay Test.***
FUNCTION PROBLEMS		
The Battery does not stay charged.	1. Check for loose or faulty connections at the battery. 2. The fan belt may be loose. 3. The battery may be faulty.	1. Perform ***the Engine Alternator Test.*** 2. Make sure the engine alternator is getting "flashed" from the Chopper User Interface Board. See the wiring diagram.
The Dashboard Gauge Board does not light or does not function correctly.	1. Make sure the Run/Idle switch is in the RUN position.	1. Make sure the Dashboard Gauge Board is receiving 12VDC. See the wiring diagram.
There is no control of weld output at the machine's front panel.	1. Make sure the Local/Remote Switch is in the LOCAL position.	1. Perform the ***Chopper User Interface Board Test.***
An external wirefeeder will not function correctly.	1. Make sure the Local/Remote Switch is in the REMOTE position. 2. Make sure the 42/115 switch is in the correct position for the wirefeeder being used.	1. Perform the ***42/115V Switch Test.*** 2. Perform the ***Power Bus Board Test.*** 3. Check the leads between the remote receptacles and the Chopper User Interface Board. See the wiring diagram.
The machine will not change welding modes when the mode switch is changed.	1. Make sure the Local/Remote switch is in the LOCAL position.	1. Perform the ***Mode Switch Board Test.*** 2. Perform the ***Chopper User Interface Board Test.*** 3. Make sure the Dashboard Gauge Board is receiving 12VDC. See the wiring diagram.
The 42VAC is not present at the 14 pin remote receptacle.	1. Make sure the 42/115 switch is in the correct (42V) position. 2. Check circuit breaker CB4. Reset if tripped. See the wiring diagram.	1. Perform ***the 42/115V Switch Test.*** 2. Perform the ***Stator Test.***
The 115VAC is not present at the 14 pin remote receptacle.	1. Make sure the 42/115 switch is in the correct (115V) position. 2. Check circuit breaker CB2. Reset if tripped. See the wiring diagram.	1. Perform the ***42/115V Switch Test.*** 2. Perform the ***Stator Test.***

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your Lincoln Authorized Service Facility for technical troubleshooting assistance before you proceed.

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TEST PROCEDURES

HOW TO USE THE TEST REFERENCE CHART

⚠ WARNING

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

The Test Reference Chart is a nonspecific, operations based troubleshooting aide intended to identify components involved in a particular machine function. The left side of the chart consists of a listing of all major components in the machine. Across the top of the chart the three main machine functions are listed. This chart is provided to help you quickly identify possible faulty components, simply identify the particular function and refer to its specified column for a list of its related components. Simply follow the steps below.

Step 1. IDENTIFY MACHINE FUNCTION

There will be three columns with a "MACHINE FUNCTION" listed at the top. You can choose from "POWER UP", "PRIMARY OUTPUT" or 'AUXILIARY OUTPUT". Choose the column that best describes the symptom that the machine is exhibiting a problem with. Examples are as follows:

- POWER UP - machine wont turn on, blows fuses, no display
- WELDING OUTPUT - no welding output, no wire feed, cannot control output, poor welding characteristics
- AUXILIARY OUTPUT - does not power feeder, no power from 120V receptacle,

Step 2. IDENTIFY RELATED COMPONENTS

If a component is used in a particular "MACHINE FUNCTION" it will be marked in the corresponding column. These components serve a purpose for the identified "MACHINE FUNCTION" and could be related to the symptom identified as a possible faulty component.

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your Lincoln Authorized Service Facility for technical troubleshooting a ssistance before you proceed.

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RELATED COMPONENT LIST	MACHINE FUNCTION VANTAGE 549X		
	POWER UP	WELDING OUTPUT	AUXILIARY OUTPUT
D1	X	X	X
D2		X	X
Rotor	X	X	X
Stator	X	X	X
Auxiliary Receptacles			X
DC Bus Board		X	
D3		X	
Idle Relay	X		
Fuel Relay	X		
Glow Relay	X		
Run/Stop/Idle Switch	X		
CB1			X
CB2			X
CB3			X
CB4			X
CB5	X		
CB6	X		
CB7	X		
CB8	X		
Engine Starter	X		
Engine Altenator	X		
Left Chopper Board		X	
Right Chopper Board		X	
CHUI Board	X	X	
Shunt		X	
Start/Glow Switch	X		
Choke		X	
Mode Select Board		X	
Polarity Switch			X
42/115V Switch			X

CASE COVER REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

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

MATERIALS NEEDED

3/8” Nutdriver
7/16” Open-End Wrench
1/2” Nutdriver
Wiring Diagram

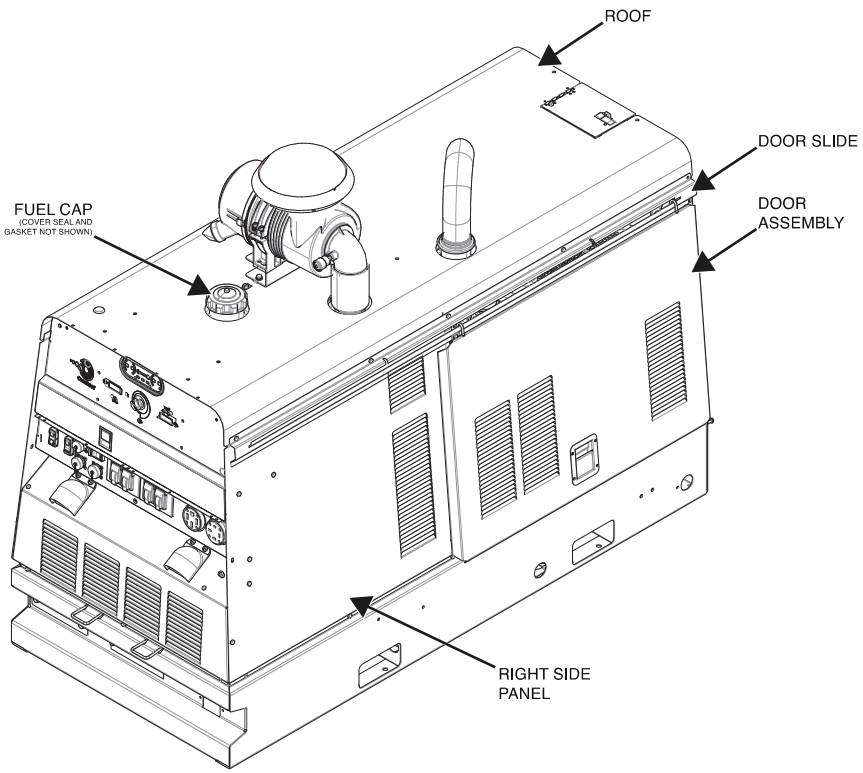
REMOVAL PROCEDURE

1. Turn off the engine of the Vantage 549X machine.
2. Carefully slide the door assembly off the door slide. See ***Figure F.1***.
3. Using a 3/8” nutdriver, remove six of the screws securing the door slide to the machine. See ***Figure F.1***.
4. Using a 3/8” nutdriver and a 7/16” nutdriver, remove the screw and nut securing the door slide to the machine. See ***Figure F.1***. The door slide can be removed.
5. Remove the protective trim from around the front edge of the case covers.
6. Using a 3/8” nutdriver, remove the 13 screws securing the roof to the machine. See ***Figure F.1***.
7. Remove the cover seal, gasket, and fuel cap from the machine. See ***Figure F.1***. Do not discard any of these components.
8. With the help of an assistant, carefully remove the roof from the machine.
9. Carefully attach the fuel cap to the fuel tank.
10. Using a 3/8” nutdriver, remove the eight screws securing the right-side panel to the machine. See ***Figure F.1***.
11. Using a 3/8” nutdriver, loosen the two screws securing the right-side panel to the machine. See ***Figure F.1***.
12. Using a 1/2” nutdriver, remove the two screws securing the right-side panel to the machine. See ***Figure F.1***.
13. The right-side panel can now be removed.
14. Using a 3/8” nutdriver, remove the eight screws securing the left-side panel to the machine.
15. Using a 3/8” nutdriver, loosen the two screws securing the left-side panel to the machine.
16. Using a 1/2” nutdriver, remove the two screws securing the left-side panel to the machine.
17. The left-side panel can now be removed.
18. Using a 3/8” nutdriver, remove the five screws securing the engine case side assembly to the machine.
19. Using a 3/8” nutdriver, loosen the two screws securing the engine case side panel assembly to the machine.
20. The engine case side panel assembly can now be removed.
21. Perform any tests / replacement procedures.

REPLACEMENT PROCEDURE

1. Carefully position the engine case side panel assembly onto the machine.
2. Using a 3/8” nutdriver, tighten the two screws securing the engine case side panel assembly to the machine.
3. Using a 3/8” nutdriver, attach the five screws securing the engine case side assembly to the machine.
4. Carefully position the left-side panel onto the machine.
5. Using a 1/2” nutdriver, attach the two screws securing the left-side panel to the machine.
6. Using a 3/8” nutdriver, tighten the two screws securing the left-side panel to the machine.
7. Using a 3/8” nutdriver, attach the eight screws securing the left-side panel to the machine.
8. Carefully position the right-side panel onto the machine.
9. Using a 1/2” nutdriver, attach the two screws securing the right-side panel to the machine.
10. Using a 3/8” nutdriver, tighten the two screws securing the right-side panel to the machine.
11. Using a 3/8” nutdriver, attach the eight screws securing the right-side panel to the machine.
12. Remove the fuel cap from the fuel tank.
13. With the help of an assistant, carefully position the roof onto the machine.
14. Attach the cover seal, gasket, and fuel cap to the machine.
15. Using a 3/8” nutdriver, attach the 13 screws securing the roof to the machine.
16. Attach the protective trim around the front edge of the case covers.
17. Carefully position the door slide onto the machine.
18. Using a 3/8” nutdriver and a 7/16” nutdriver, attach the screw and nut securing the door slide to the machine.
19. Using a 3/8” nutdriver, attach six of the screws securing the door slide to the machine.
20. Carefully slide the door assembly onto the door slide.

Figure F.1 – Case cover components



CAPACITOR DISCHARGE PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will ensure that the large Capacitors on each of the Chopper Boards, the Field Capacitor, and the 42V Capacitor have been discharged. This procedure should be performed whenever work is to be attempted.

MATERIALS NEEDED

Volt/Ohmmeter
Resistor (25-1000 ohms and 25 watts minimum)
Electrically Insulated Gloves
Electrically Insulated Pliers
Jumper Leads
Wiring Diagram

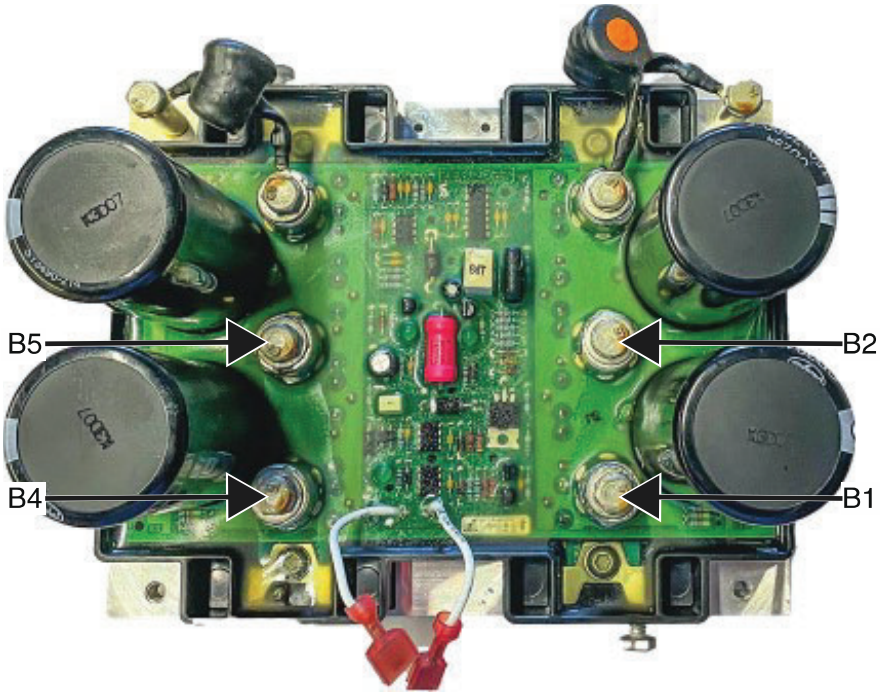
TEST PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Locate the chopper boards on either side of the machine. See Wiring Diagram.
4. If the Lincoln recommended resistor or an equivalent resistor is used, the capacitors can be discharged by holding the resistor with insulated gloves and insulated pliers and using the resistor terminals to bridge the chopper board terminals B1 to B2 and B4 to B5 on each chopper board. **DO NOT TOUCH THE TERMINALS OR METAL PARTS OF THE PLIERS WITH YOUR BARE HANDS**. Hold the resistor in place for about ten seconds. If another type of resistor is used, jumper leads may need to be attached to the resistor. The leads can then be used to connect terminals B1 to B2 and B4 to B5 on the chopper boards. See ***Figures F.1*** and ***F.2***. See Wiring Diagram.
5. Using a volt/ohmmeter, check the voltage across terminals B1 and B2 then across terminals B4 and B5. See ***Figures F.1*** and ***F.2***. See Wiring Diagram. Voltage should be zero.
6. If any voltage is present, repeat discharge procedure until reading is zero volts.
7. Locate the field capacitor and 42V capacitor. The field capacitor is located on the fan baffle on the right side of the machine, the bus capacitor is located inside the control box. See Wiring Diagram.
8. If the Lincoln recommended resistor or an equivalent resistor is used, the capacitors can be discharged by holding the resistor with insulated gloves and insulated pliers and using the resistor terminals to bridge the capacitor terminals. **DO NOT TOUCH THE TERMINALS OR METAL PARTS OF THE PLIERS WITH YOUR BARE HANDS**. Hold the resistor in place for about ten seconds. If another type of resistor is used, jumper leads may need to be attached to the resistor. The leads can then be used to connect the capacitor terminals. See ***Figure F.3***. See Wiring Diagram.
9. Using a volt/ohmmeter, check the voltage across the capacitor terminals. See ***Figure F.3***. See Wiring Diagram. Voltage should be zero.
10. If any voltage is present, repeat the discharge procedure until reading is zero volts.
11. Perform the necessary test and/or replacement procedures.

Figure F.1 – Right-side chopper board terminal locations

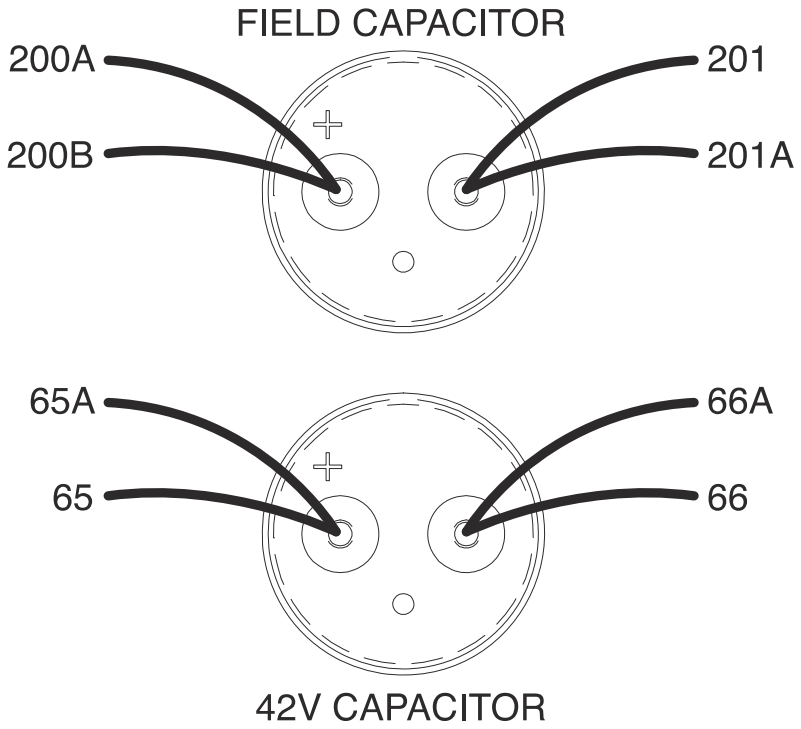
RIGHT-SIDE CHOPPER BOARD

Figure F.2 – Left-side chopper board terminal locations



LEFT-SIDE CHOPPER BOARD

Figure F.3 – Field capacitor and 42V capacitor terminal locations



CONTROL PANEL ACCESS PROCEDURE

Refer to Safety pages for explanation of hazards:

PROCEDURE DESCRIPTION

This procedure will aid the technician in accessing components behind the Control Panel.

MATERIALS NEEDED

5/16” Nutdriver
3/8” Nutdriver
Wiring Diagram

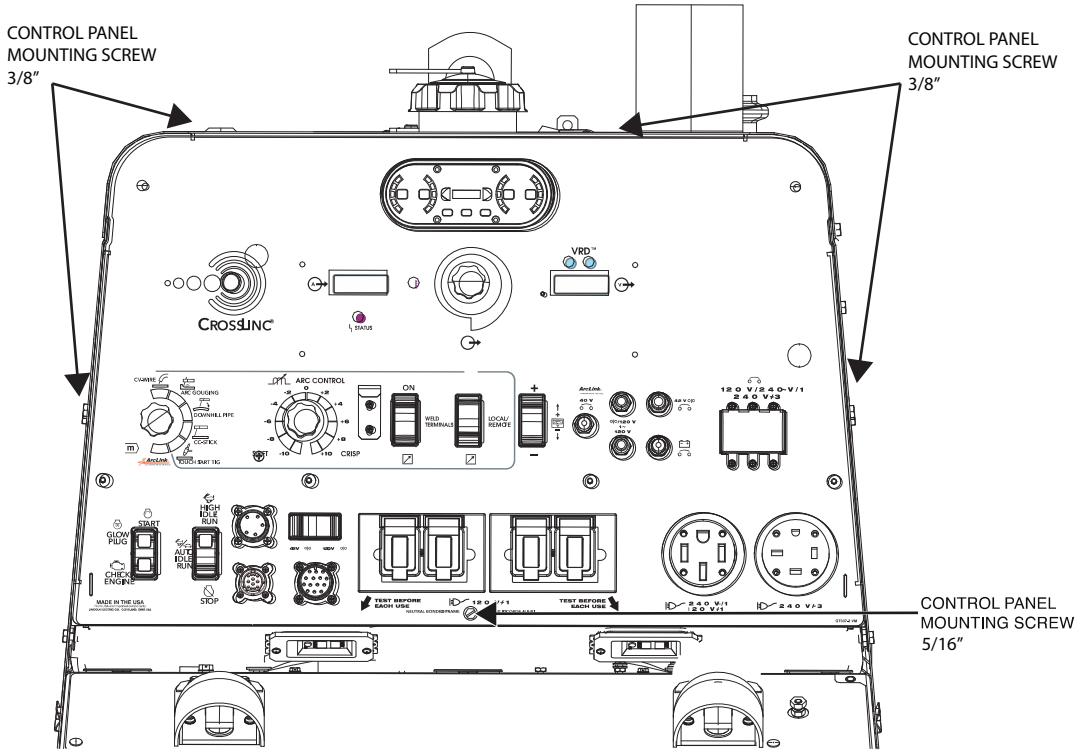
ACCESS PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Capacitor Discharge Procedure***.
3. Using a 3/8” nutdriver, remove the four screws securing the control panel from the sides and top. See ***Figure F.1***.
4. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
5. The control panel can now be lowered for access.

REPLACEMENT PROCEDURE

1. Using a 5/16” nutdriver, replace the screw securing the control panel into the upright position. See ***Figure F.1***.
2. Using a 3/8” nutdriver, replace the four screws securing the control panel from the sides and top. See ***Figure F.1***.
3. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw location



Refer to Safety pages for explanation of hazards:

40VDC BUS BOARD TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of the 40VDC Bus Board using Active tests.

MATERIALS NEEDED:
3/8” nut driver
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of the 40VDC Bus Board refer to Figure F.1.

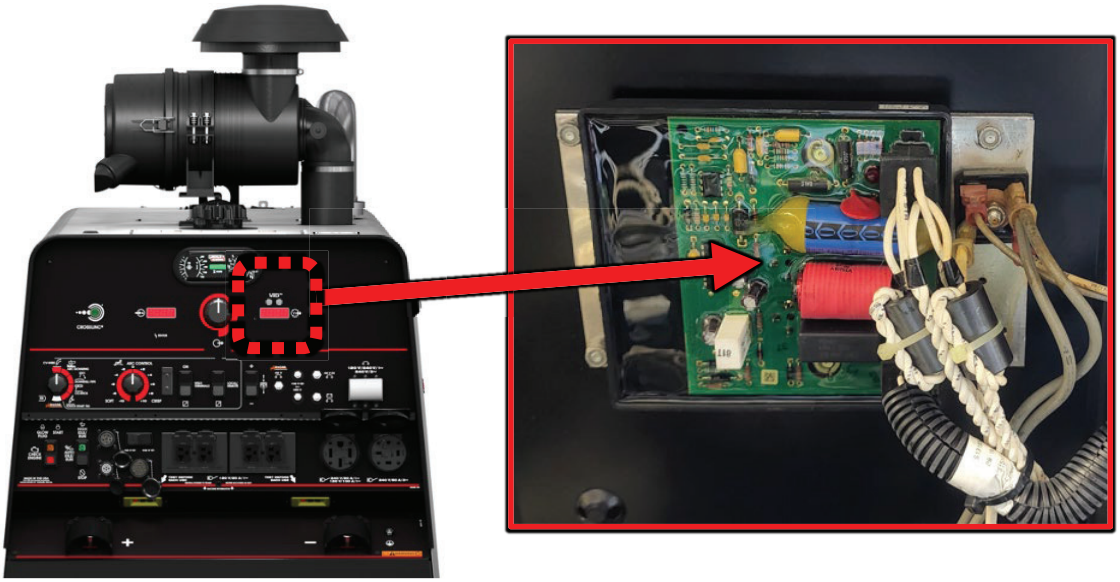


Figure F.1

2. Perform the “Control Panel Access Procedure” to gain access for testing.

3. Perform the Active Testing.

A. ACTIVE TESTING

A.1. Ensure the engine is running, the On/Idle/Stop switch set to HIGH and LED1 is illuminated. If there is NO illumination this component may be faulty.

A.2. Perform the measurements identified in Test Table 1 below, refer to Figure F.2 for test point locations.

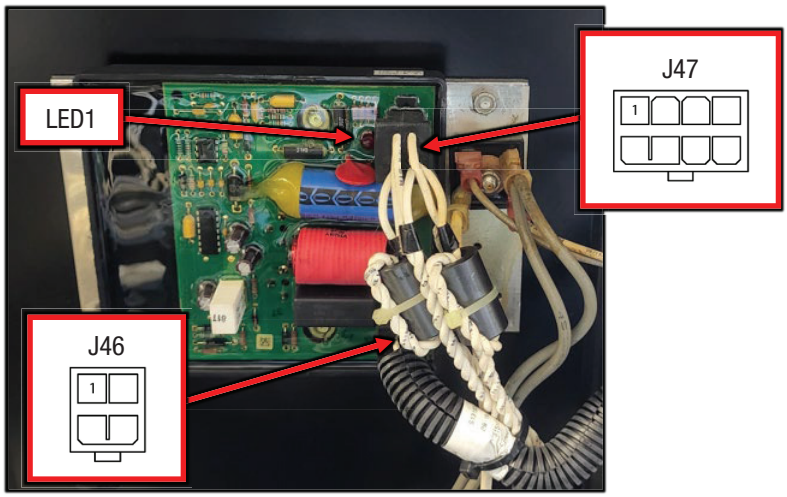


Figure F.2

40VDC Bus Board Active Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Bus Board Input	Engine running, Run/Stop/Idle switch set to HIGH, LED1 is illuminated	J46 pin 2	J46 pin 3	~59.3VDC
Bus Board Output		J47 pin 1	J47 pin 3	~40VDC
		J47 pin 5	J47 pin 4	~40VDC
		J47 pin 8	J47 pin 6	~40VDC

Table 1

A.3. If the output measurements are not correct this component may be faulty.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

42/115V SWITCH TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of the 42/115V Switch using Static tests.

MATERIALS NEEDED:
3/8” nut driver
Needle nose pliers
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of the 42/115V Switch refer to Figure F.1.

Figure F.1

2. Perform the “Control Panel Access Procedure” to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the following connections, refer to Figure F.2..

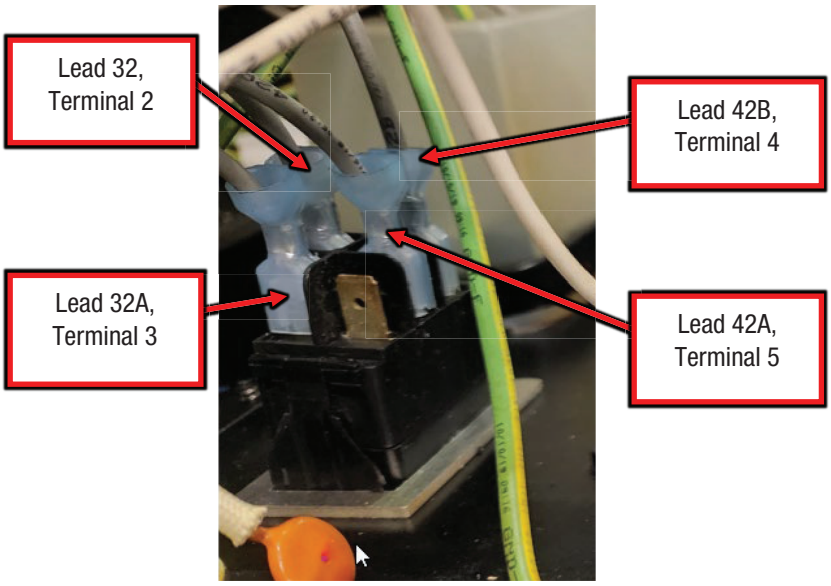


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.2 for test point locations. NOTE: LEADS ARE REMOVED FOR TESTING, MEASUREMENTS ARE MADE ON THE SWITCH TERMINALS.

42/115V Switch Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
115V Position	Run/Stop/Idle switch set to STOP, set to 115V	Terminal 2	Terminal 3	< 1Ω
42V Position	Run/Stop/Idle switch set to STOP, set to 42V	Terminal 4	Terminal 5	< 1Ω

Table 1

A.4. If measurements are correct reconnect all connections removed in step A.2 and proceed to step 4.

A.5. Any failed measurement indicates a defective component.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

ARC CONTROL SWITCH TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of the Arc Control Switch using Static tests.

MATERIALS NEEDED:
5/16” nut driver
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of the Arc Control Switch refer to Figure F.1.

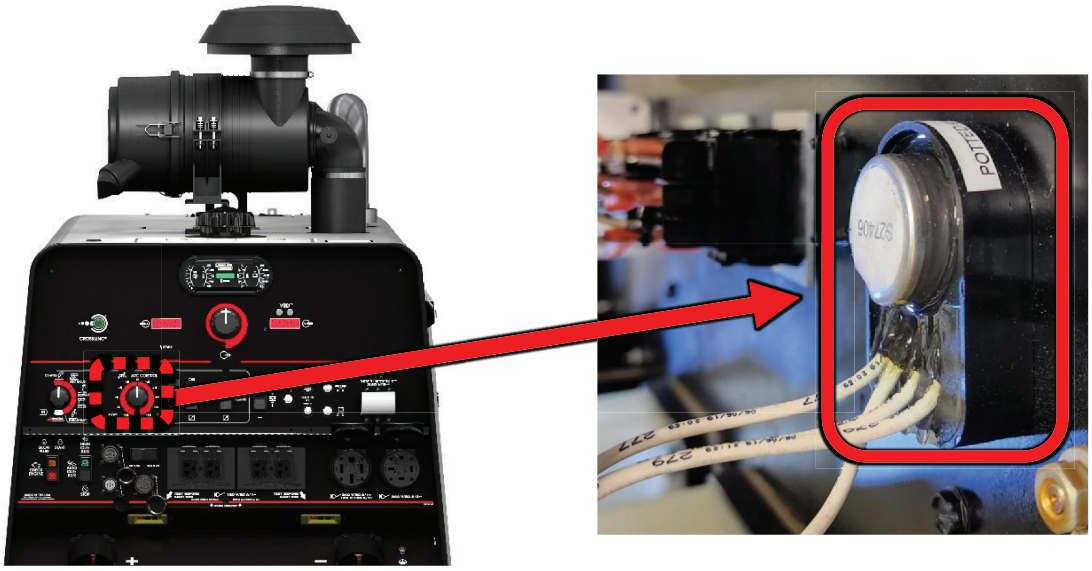


Figure F.1

2. Perform the “Control Panel Access Procedure” to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to OFF.

A.2. Label and disconnect the following connections on the Chopper User Interface board (behind front panel), refer to Figure F.2..

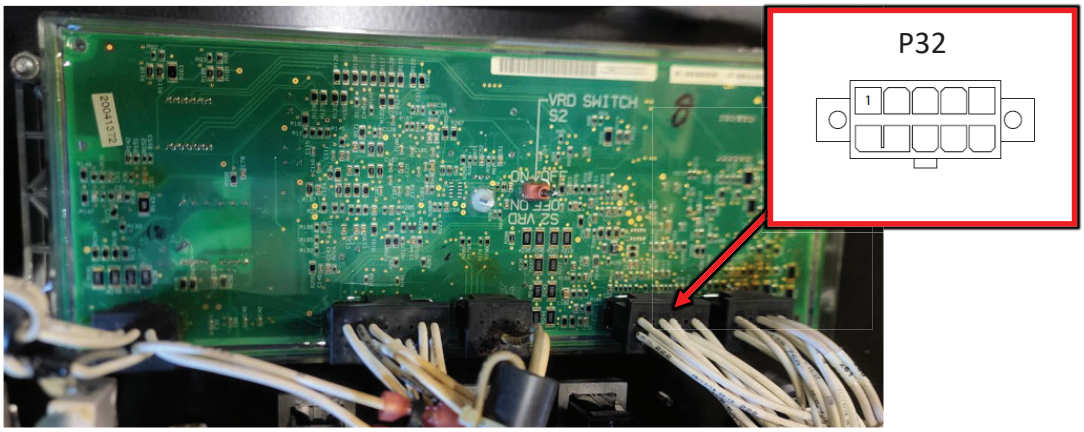


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.2 for test point locations. NOTE: MEASUREMENTS ARE MADE ON THE P32 PLUG REMOVED ABOVE.

Arc Control Switch Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Arc Control Switch	P32 disconnected	P32 pin 2 Lead 279	P32 pin 5 Lead 277	9.5KΩ
	P32 disconnected, Arc Control Switch rotated from Min to Max	P32 pin 2 Lead 279	P32 pin 3 Lead 278	1Ω – 9.5KΩ

Table 1

A.4. If measurements are correct reconnect all connections removed in step A.2 and proceed to step 4.

A.5. Any failed measurement indicates a defective component.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

AUXILIARY RECEPTACLES TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of the Auxiliary Receptacles using Active tests.

MATERIALS NEEDED:
3/8" nut driver
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of the Auxiliary Receptacles refer to Figure F.1.

Figure F.1

2. Perform the “Control Panel Access Procedure” to gain access for testing.

3. Perform the Active Testing.

A. ACTIVE TESTING

A.1. Ensure the engine is running and On/Idle/Stop switch set to HIGH and that CB1, CB2 and CB3 are not tripped.

A.2. Perform the measurements identified in Test Table 1 below, refer to Figure F.2 for test point locations.

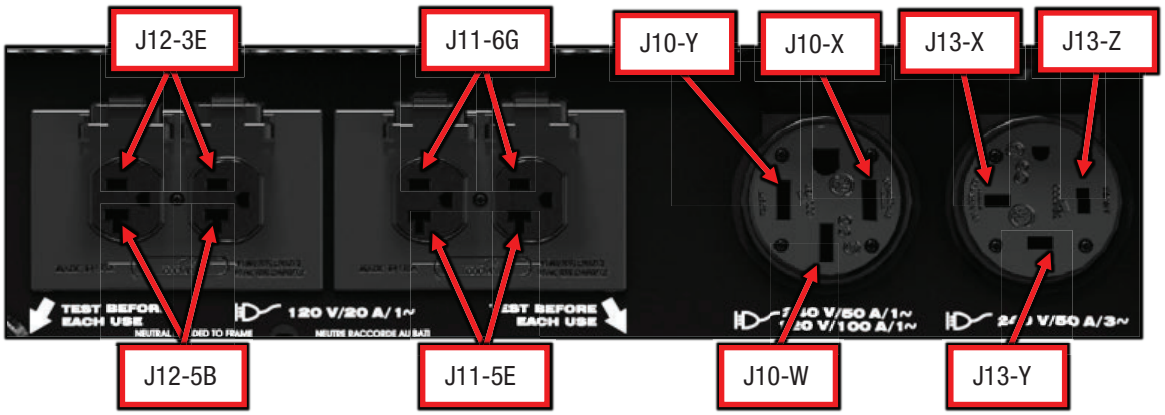


Figure F.2

Auxiliary Receptacles Active Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
240 VAC 3 Phase Receptacle (J13)	Engine running, Run/Stop/Idle switch set to HIGH	J13-X	J13-Y	~240VAC
		J13-Y	J13-Z	~240VAC
		J13-Z	J13-	~240VAC
120 / 240 VAC Single Phase Receptacle (J10)	Engine running, Run/Stop/Idle switch set to HIGH	J10-X	J10-Y	~240VAC
		J10-X	J10-W	~120VAC
		J10-Y	J10-W	~120VAC
120VAC Receptacle (Left Side) (J12)	Engine running, Run/Stop/Idle switch set to HIGH	J12-3E	J12-5B	~120VAC
120VAC Receptacle (Right Side) (J11)	Engine running, Run/Stop/Idle switch set to HIGH	J11-6G	J11-5E	~120VAC

Table 1

A.3. If the output measurements are not correct this component may be faulty.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

CB1 TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of CB1 using Static tests.

MATERIALS NEEDED:
3/8" nut driver
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of CB1 refer to Figure F.1.

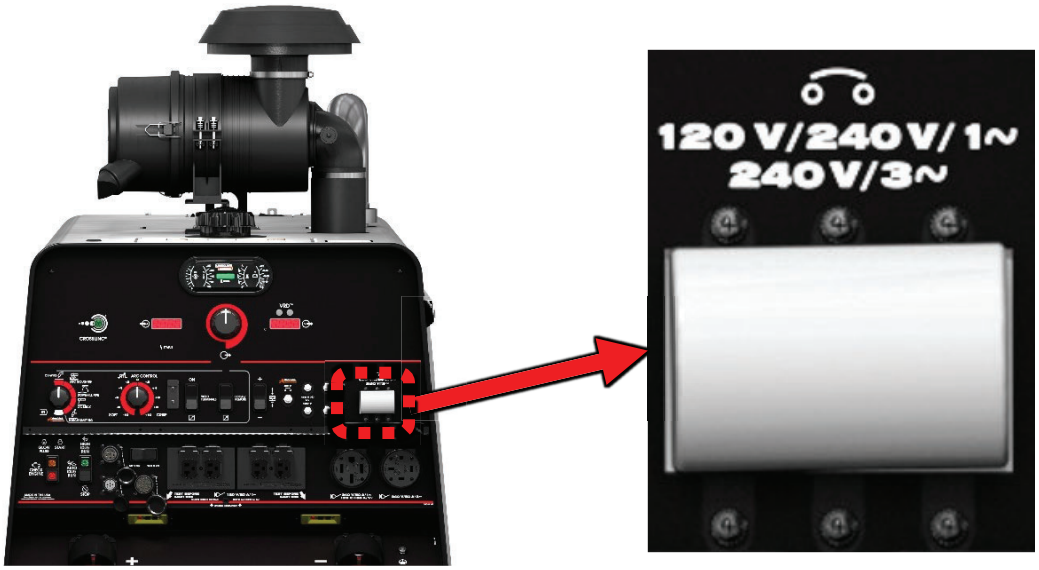


Figure F.1

2. Perform the "Control Panel Access Procedure" to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the following connections on CB1, refer to Figure F.2.

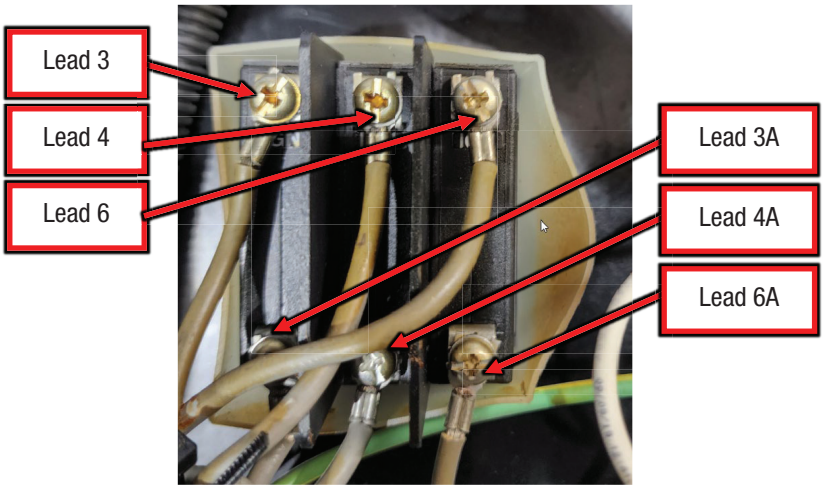


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations. NOTE: MEASUREMENTS ARE MADE ON CB1 WITH THE LEADS REMOVED.

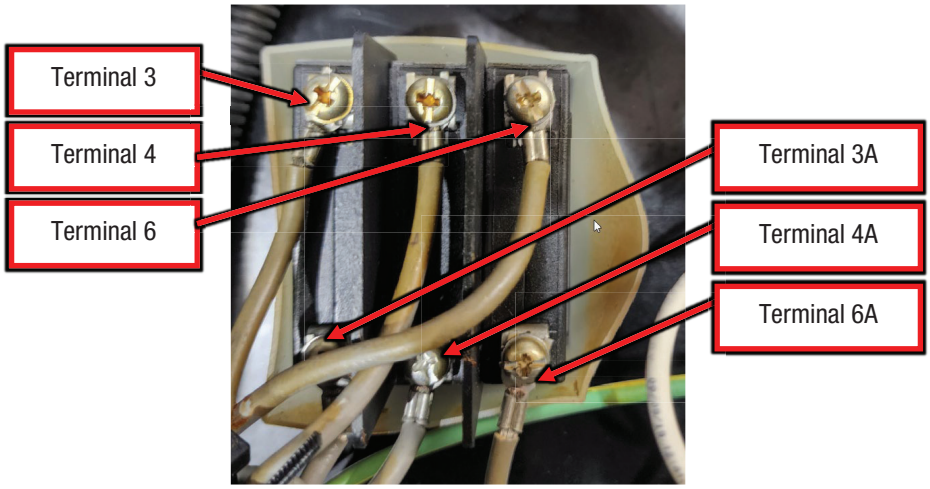


Figure F.3

CB1 Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
CB1	Engine not running, CB1 not tripped	Terminal 3	Terminal 3B	<1Ω
		Terminal 4	Terminal 4A	<1Ω
		Terminal 6	Terminal 6C	<1Ω

Table 1

A.4. If measurements are correct reconnect all connections removed in step A.2 and proceed to step 4.

A.5. Any failed measurement indicates a defective component.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

CB2 TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of CB2 using Static tests.

MATERIALS NEEDED:
3/8” nut driver
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of CB2 refer to Figure F.1.

Figure F.1

2. Perform the “Control Panel Access Procedure” to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the following connections on CB2, refer to Figure F.2.

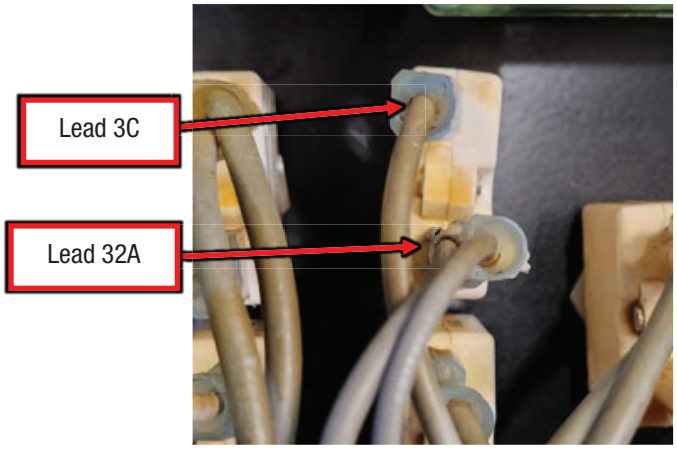


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations. NOTE: MEASUREMENTS ARE MADE ON CB2 WITH THE LEADS REMOVED.

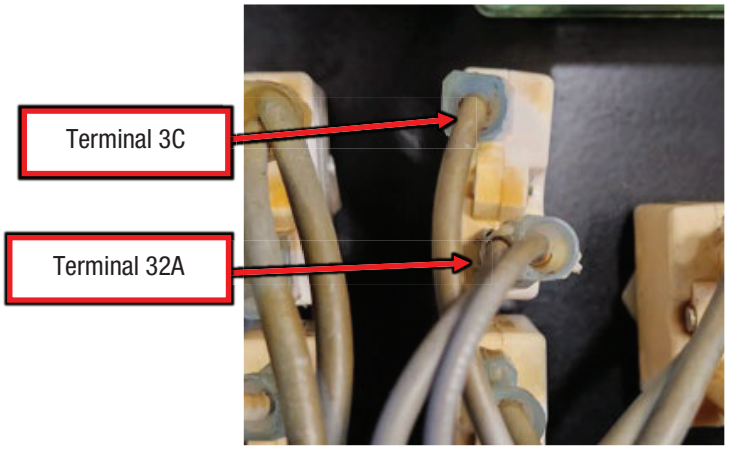


Figure F.3

CB2 Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
CB2	Engine not running, CB2 not Tripped	Terminal 3C	Terminal 32A	<1Ω

Table 1

A.4. If measurements are correct reconnect all connections removed in step A.2 and proceed to step 4.

A.5. Any failed measurement indicates a defective component.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

CB3 TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of CB3 using Static tests.

MATERIALS NEEDED:
3/8” nut driver
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of CB3 refer to Figure F.1.

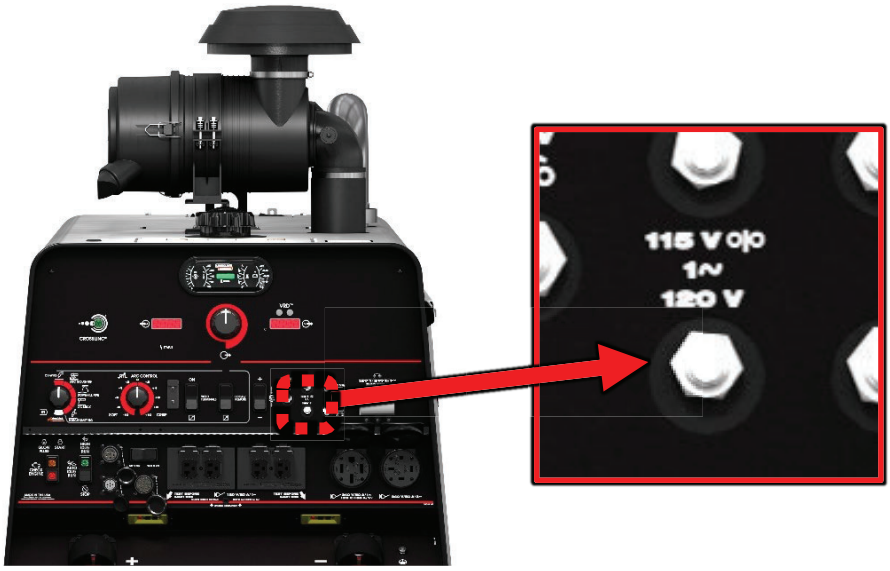


Figure F.1

2. Perform the “Control Panel Access Procedure” to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the following connections on CB3, refer to Figure F.2.

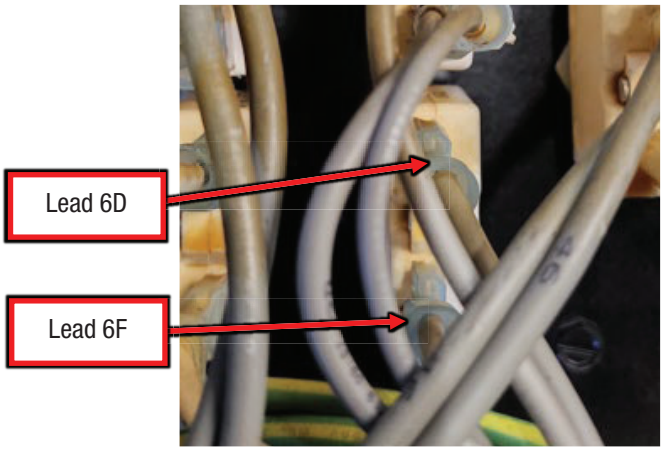


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations. NOTE: MEASUREMENTS ARE MADE ON CB3 WITH THE LEADS REMOVED.

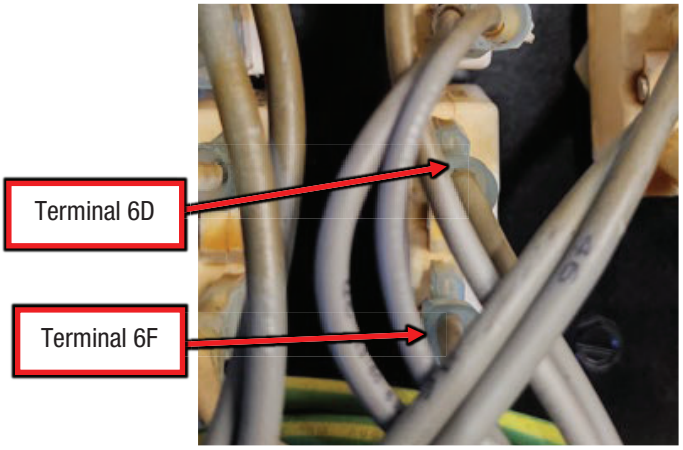


Figure F.3

CB3 Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
CB3	Engine not running, CB3 not Tripped	Terminal 6D	Terminal 6F	<1Ω

Table 1

A.4. If measurements are correct reconnect all connections removed in step A.2 and proceed to step 4.

A.5. Any failed measurement indicates a defective component.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

CB4 TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of CB4 using Static tests.

MATERIALS NEEDED:
3/8” nut driver
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of CB4 refer to Figure F.1.

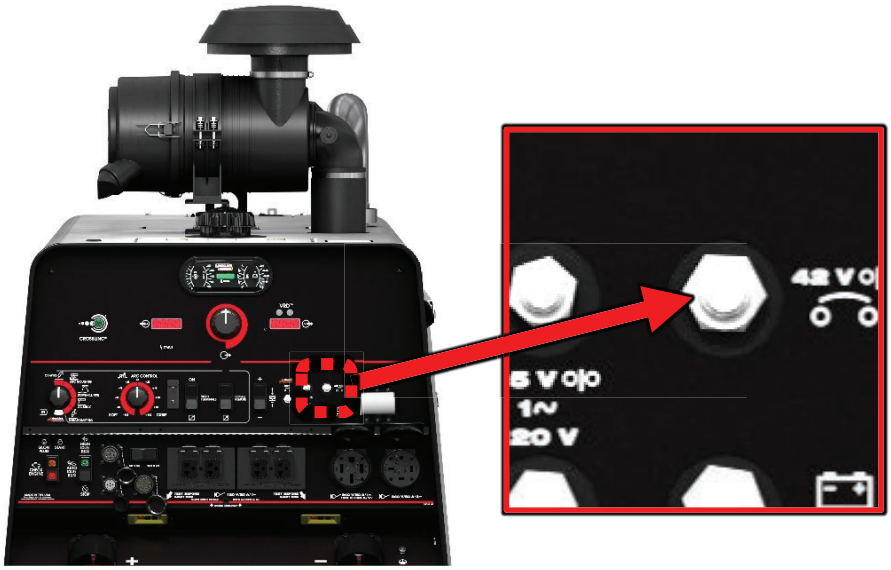


Figure F.1

2. Perform the “Control Panel Access Procedure” to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the following connections on CB4, refer to Figure F.2.

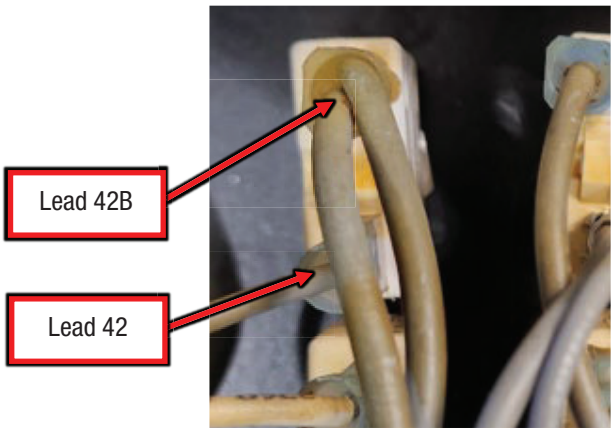


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations. NOTE: MEASUREMENTS ARE MADE ON CB4 WITH THE LEADS REMOVED.

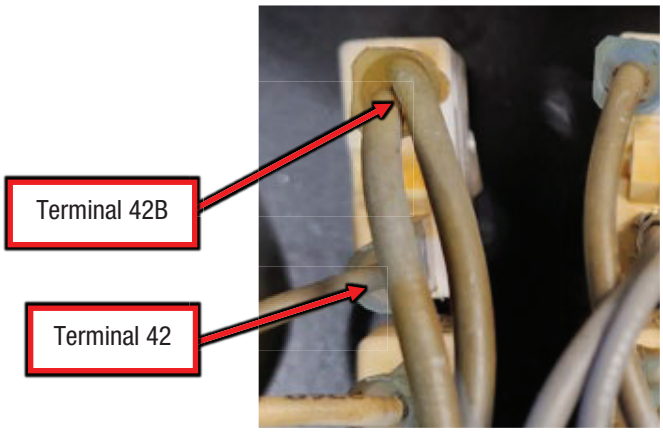


Figure F.3

CB4 Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
CB4	Engine not running, CB4 not Tripped	Terminal 42	Terminal 42B	<1Ω

Table 1

A.4. If measurements are correct reconnect all connections removed in step A.2 and proceed to step 4.

A.5. Any failed measurement indicates a defective component.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

CB5 TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of CB5 using Static tests.

MATERIALS NEEDED:
3/8” nut driver
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of CB5 refer to Figure F.1.

Figure F.1

2. Perform the “Case Cover Removal” to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the following connections on CB5, refer to Figure F.2.

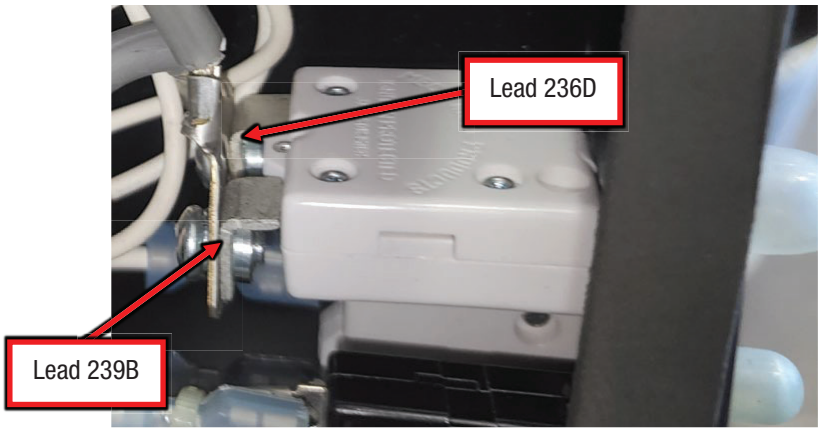


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations. NOTE: MEASUREMENTS ARE MADE ON CB5 WITH THE LEADS REMOVED.

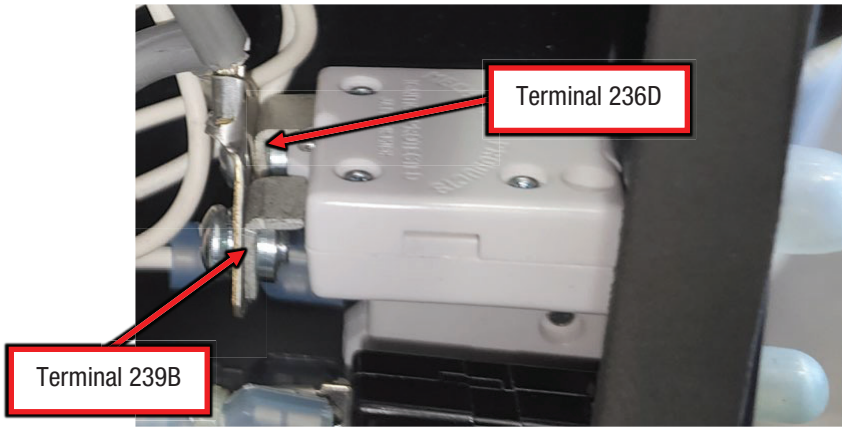


Figure F.3

CB5 Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
CB5	Engine not running, CB5 not Tripped	Terminal 236D	Terminal 239B	<1Ω

Table 1

A.4. If measurements are correct reconnect all connections removed in step A.2 and proceed to step 4.

A.5. Any failed measurement indicates a defective component.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

CB6 TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of CB6 using Static tests.

MATERIALS NEEDED:
3/8" nut driver
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of CB6 refer to Figure F.1.

Figure F.1

2. Perform the "Case Cover Removal" to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the following connections on CB6, refer to Figure F.2.

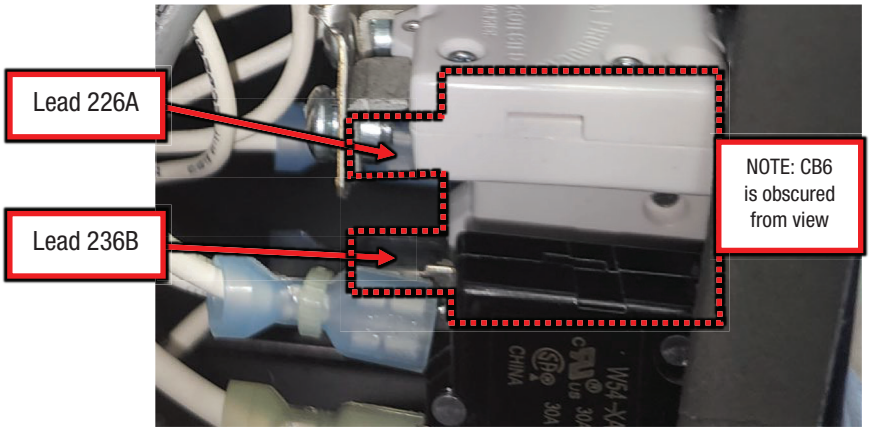


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations. NOTE: MEASUREMENTS ARE MADE ON CB6 WITH THE LEADS REMOVED.

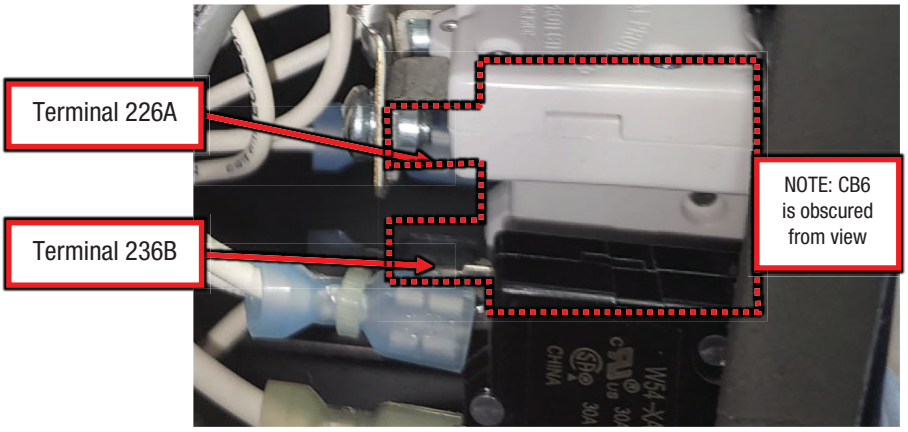


Figure F.3

CB6 Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
CB6	Engine not running, CB6 not Tripped	Terminal 226A	Terminal 236B	<1Ω

Table 1

A.4. If measurements are correct reconnect all connections removed in step A.2 and proceed to step 4.

A.5. Any failed measurement indicates a defective component.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

CB7 TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of CB7 using Static tests.

MATERIALS NEEDED:
3/8” nut driver
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of CB7 refer to Figure F.1.

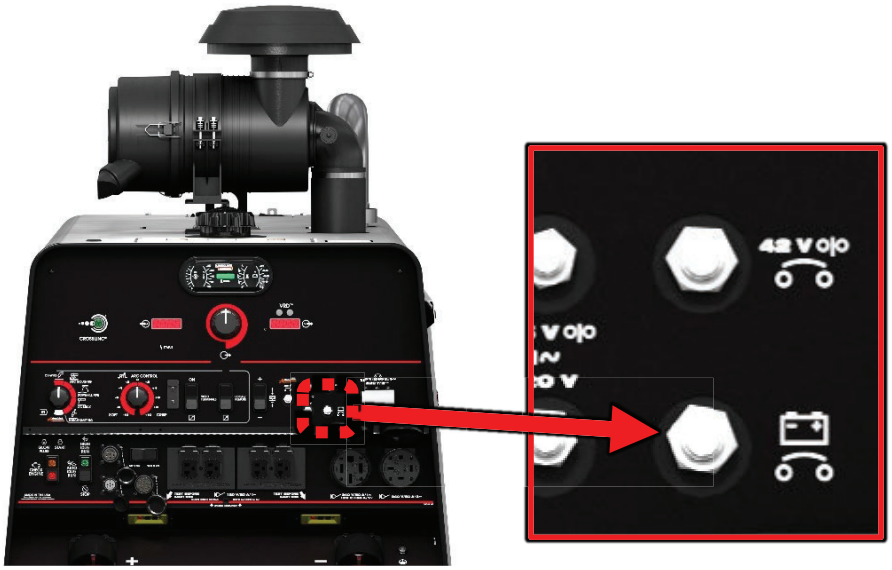


Figure F.1

2. Perform the “Control Panel Access Procedure” to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the following connections on CB7, refer to Figure F.2.

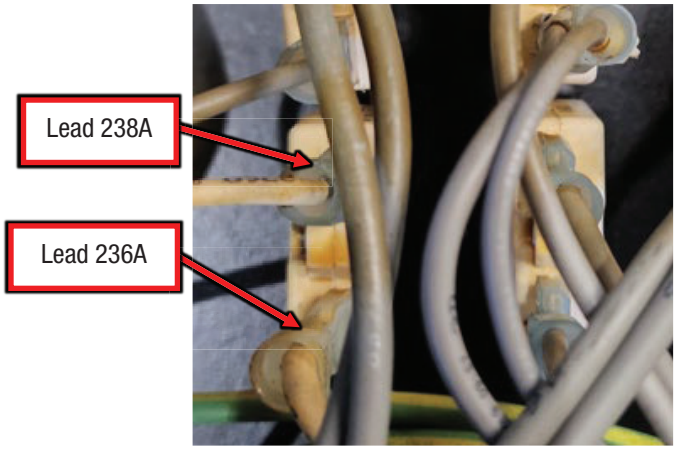


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations. NOTE: MEASUREMENTS ARE MADE ON CB7 WITH THE LEADS REMOVED.

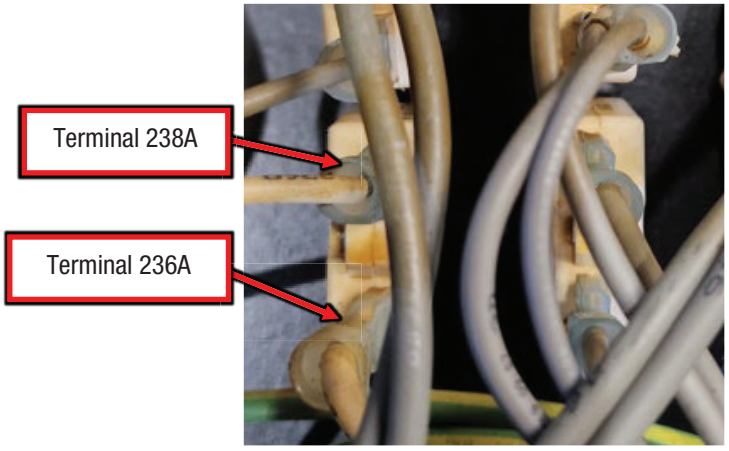


Figure F.3

CB7 Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
CB7	Engine not running, CB7 not Tripped	Terminal 238A	Terminal 236A	<1Ω

Table 1

A.4. If measurements are correct reconnect all connections removed in step A.2 and proceed to step 4.

A.5. Any failed measurement indicates a defective component.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

CB8 TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of CB8 using Static tests.

MATERIALS NEEDED:
3/8”, 1/2" nut driver
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of CB8 refer to Figure F.1.

Figure F.1

2. Perform the “Case Cover Removal” to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to OFF.

A.2. Label and disconnect the following connections on CB8, refer to Figure F.2.

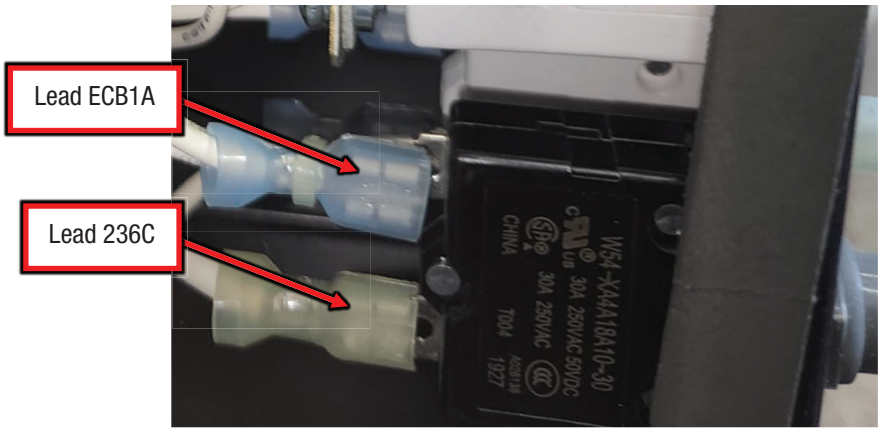


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations. NOTE: MEASUREMENTS ARE MADE ON CB8 WITH THE LEADS REMOVED.

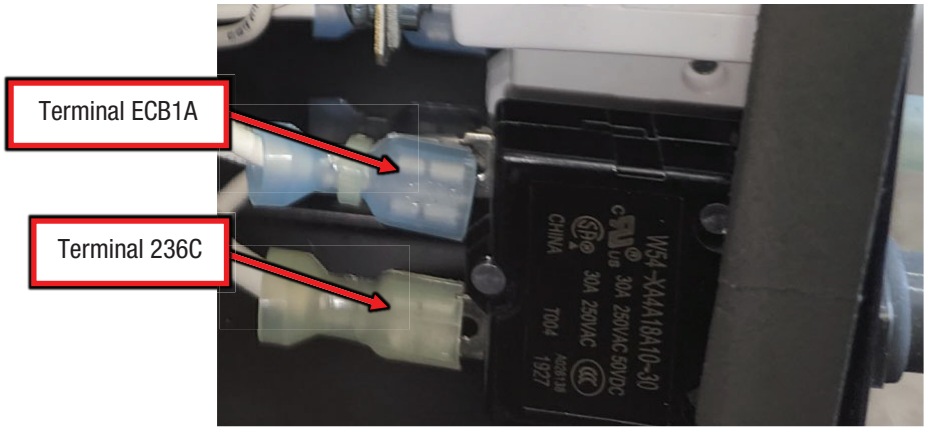


Figure F.3

CB8 Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
CB8	Engine not running, CB8 not Tripped	Terminal 236A	Terminal ECB1A	<1Ω

Table 1

A.4. If measurements are correct reconnect all connections removed in step A.2 and proceed to step 4.

A.5. Any failed measurement indicates a defective component.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

CB9 TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of CB9 using Static tests.

MATERIALS NEEDED:
3/8” nut driver
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of CB9 refer to Figure F.1.

Figure F.1

2. Perform the “Control Panel Access Procedure” to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the following connections on CB9, refer to Figure F.2.

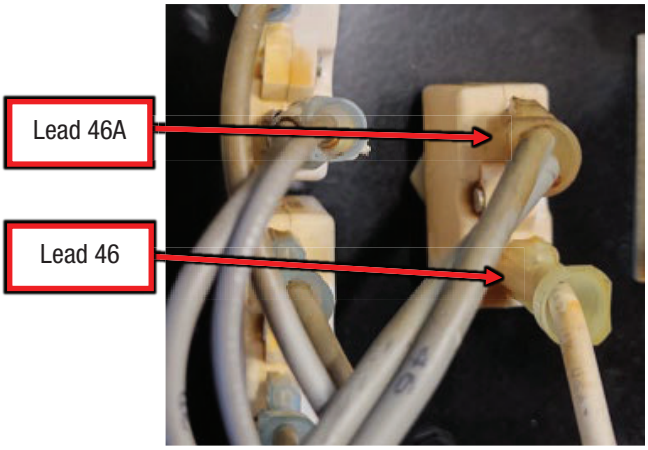


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations. NOTE: MEASUREMENTS ARE MADE ON CB9 WITH THE LEADS REMOVED.

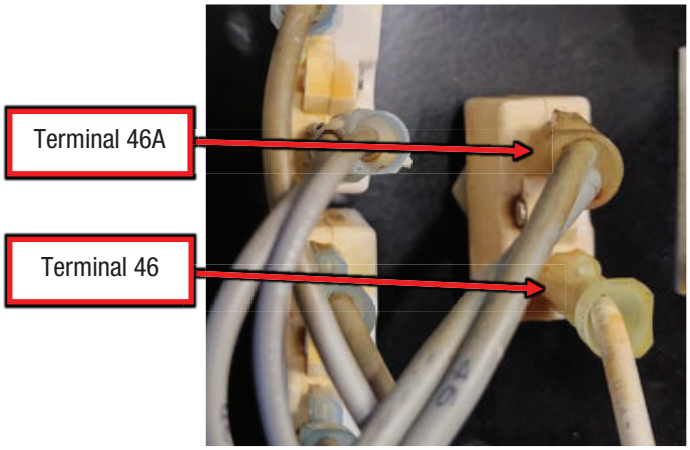


Figure F.3

CB9 Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
CB9	Engine not running, CB9 not Tripped	Terminal 46A	Terminal 46	<1Ω

Table 1

A.4. If measurements are correct reconnect all connections removed in step A.2 and proceed to step 4.

A.5. Any failed measurement indicates a defective component.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

CHOKE A TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of Choke A using Static tests.

MATERIALS NEEDED:
3/8”, 7/16”, 1/2” nut drivers
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of Choke A refer to Figure F.1.

Figure F.1

2. Perform the “Control Panel Access Procedure” to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the leads from the following terminals on Choke A, refer to Figure F.2.

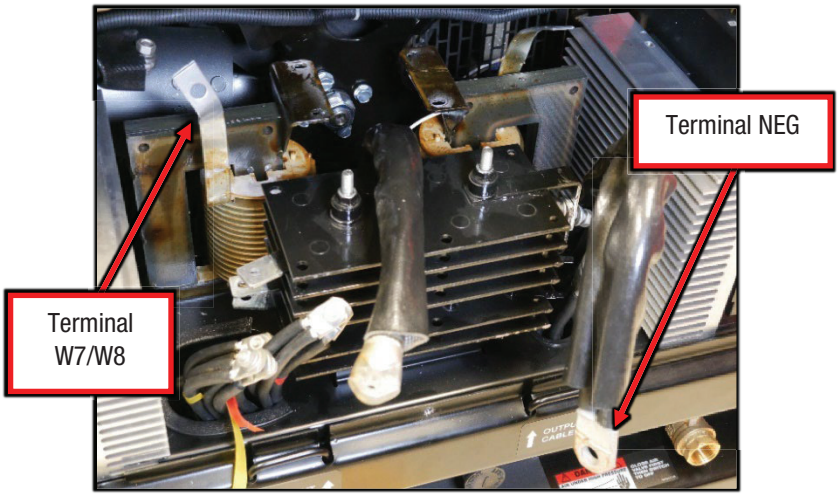


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.2 for test point locations. NOTE: MEASUREMENTS ARE MADE ON CHOKE A WITH THE LEADS REMOVED.

Choke A Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Choke A	Engine not running, Run/Stop/Idle switch set to STOP	Terminal W7/W8	Terminal NEG	<1Ω
		Terminal W7/W8	Chassis Ground	OL

Table 1

A.4. If measurements are correct reconnect all connections removed in step A.2 and proceed to step 4.

A.5. Any failed measurement indicates a defective component.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

CHOKE B TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of Choke B using Static tests.

MATERIALS NEEDED:
3/8", 7/16", 1/2" nut drivers
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of Choke B refer to Figure F.1.

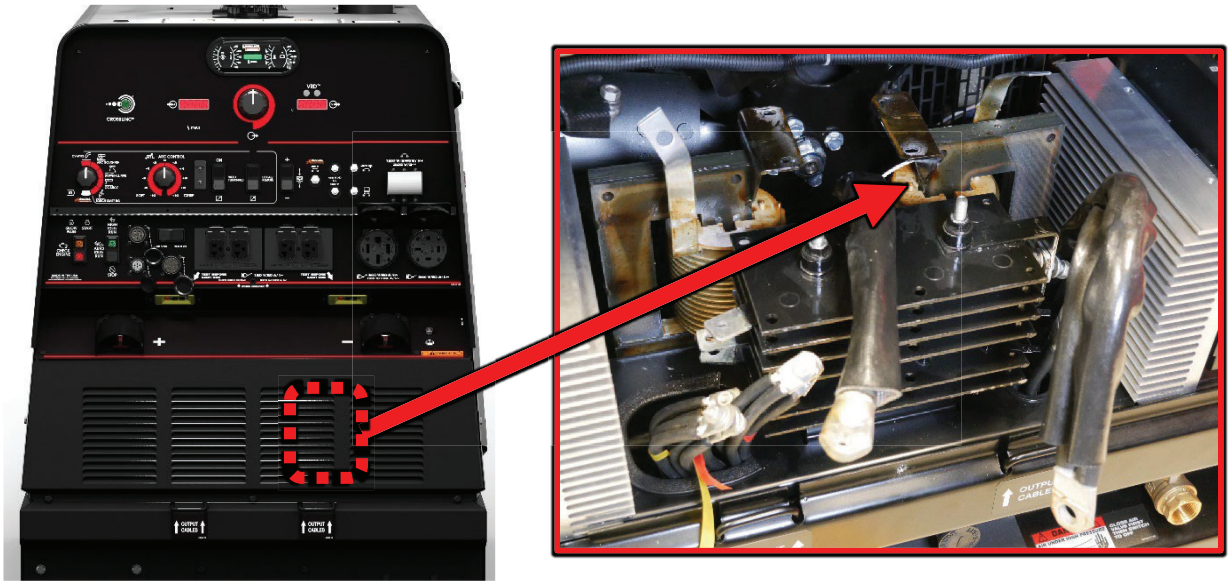


Figure F.1

2. Perform the "Control Panel Access Procedure" to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the leads from the following terminals on Choke B, refer to Figure F.2.

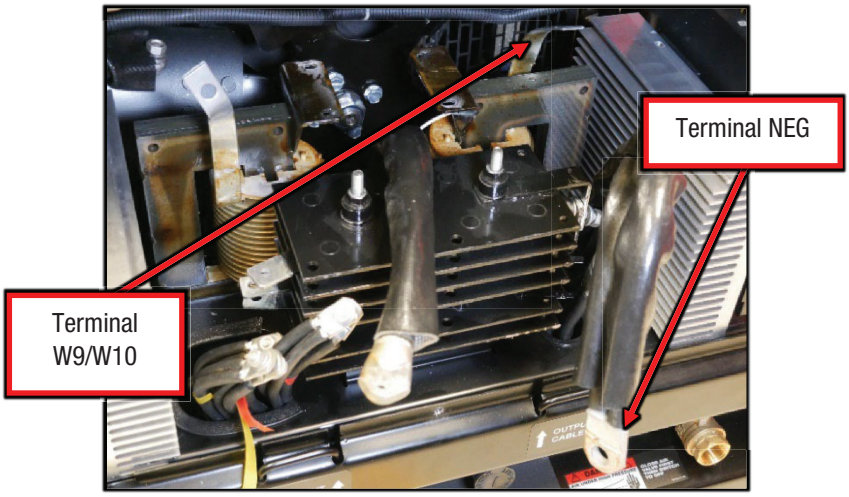


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.2 for test point locations. NOTE: MEASUREMENTS ARE MADE ON CHOKE B WITH THE LEADS REMOVED.

Choke B Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Choke B	Engine not running, Run/Stop/Idle switch set to STOP	Terminal W9/W10	Terminal NEG	<1Ω
		Terminal W9/W10	Chassis Ground	OL

Table 1

A.4. If measurements are correct reconnect all connections removed in step A.2 and proceed to step 4.

A.5. Any failed measurement indicates a defective component.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

CHOPPER USER INTERFACE (CHUI) BOARD TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of the CHUI Board using Active tests.

MATERIALS NEEDED:
1/2” nut driver
7/16” nut driver
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of the CHUI Board refer to Figure F.1.

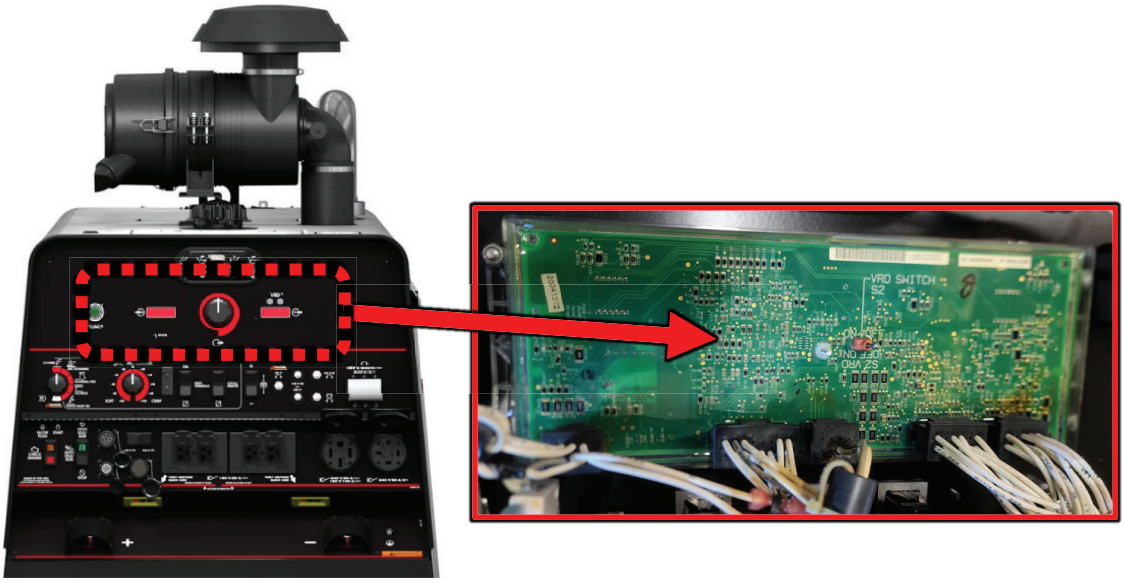


Figure F.1

2. Perform the “Control Panel Access Procedure” to gain access for testing.

3. Perform the Static Testing.

A. ACTIVE TESTING

A.1. Ensure the engine is running and On/Idle/Stop switch set to HIGH.

A.2. Perform the measurements identified in Test Table 1 below, refer to Figure F.2 for test point locations.

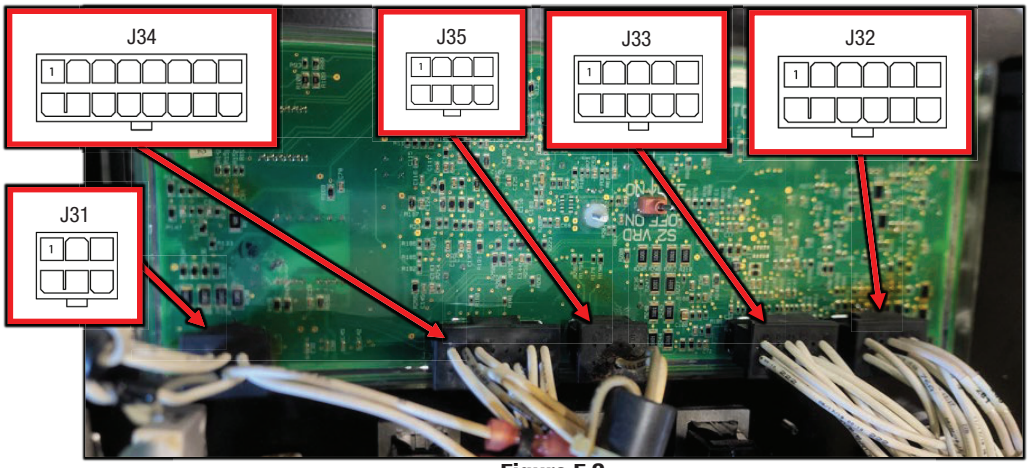


Figure F.2

CHUI Board Active Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Display CAN signal	Engine running, Run/Stop/Idle switch set to HIGH	J34 pin 4	J34 pin 7	~2 VDC
ECU CAN signal		J34 pin 6	J34 pin 3	~2 VDC
Arclink CAN to Chopper		J31 pin 3	J31 pin 1	~2 VDC
Arclink CAN to 5 pin		J31 pin 4	J31 pin 2	~2 VDC
Input voltage from Battery		J34 pin 9	J34 pin 1	12 VDC
Alternator Flashing		J34 pin 16	J34 pin 1	12 VDC
Rotor Flashing		J34 pin 15	J34 pin 1	12 VDC
Local Switch Supply		J32 pin 1	J32 pin 2	15 VDC
Arc Control Pot Supply		J32 pin 5	J32 pin 2	10 VDC
Input Power From Chopper		J31 pin 6	J31 pin 5	104 VDC
Remote Pot Supply		J33 pin 4	J33 pin 1	10 VDC
Remote Trigger Supply		J33 pin 6	J33 pin 5	15 VDC
Machine Selection		J32 pin 5	J32 pin 12	3 VDC
Voltage Feedback		J35 pin 1	J35 pin 2	OCV
Mode Selection		J32 pin 5	J32 pin 6	3.5 VDC

Table 1

A.3. If the input measurements are correct and the output measurements are not correct this component may be faulty.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

CURRENT SHUNT TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of the Current Shunt using Active tests.

MATERIALS NEEDED:
3/8", 1/2" nut driver
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of the Current Shunt refer to Figure F.1.

Figure F.1

2. Perform the "Case Cover Removal" to gain access for testing.

3. Perform the Active Testing.

A. ACTIVE TESTING

A.1. Ensure the engine is running, On/Idle/Stop switch set to HIGH, Mode set to CC at 200A and properly connected to a load bank.

A.2. Perform the measurements identified in Test Table 1 below, refer to Figure F.2 for test point locations.

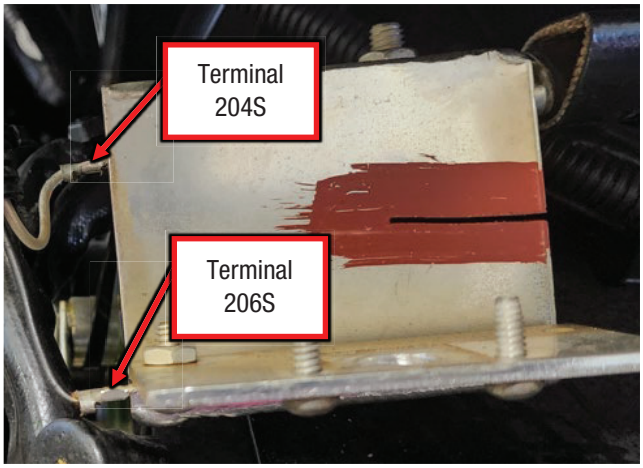


Figure F.2

Current Shunt Active Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Current Shunt feedback	Engine running, Run/Stop/Idle switch set to HIGH, set to CC Mode, current set to 200A, connected to Load Bank	Terminal 204S	Terminal 206S	~25m VDC

Table 1

A.3. If the measurements are not correct this component may be faulty.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

D1 TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of D1 using Static and Active tests.

MATERIALS NEEDED:
3/8", 1/2" nut driver
Needle nose pliers
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of D1 refer to Figure F.1.

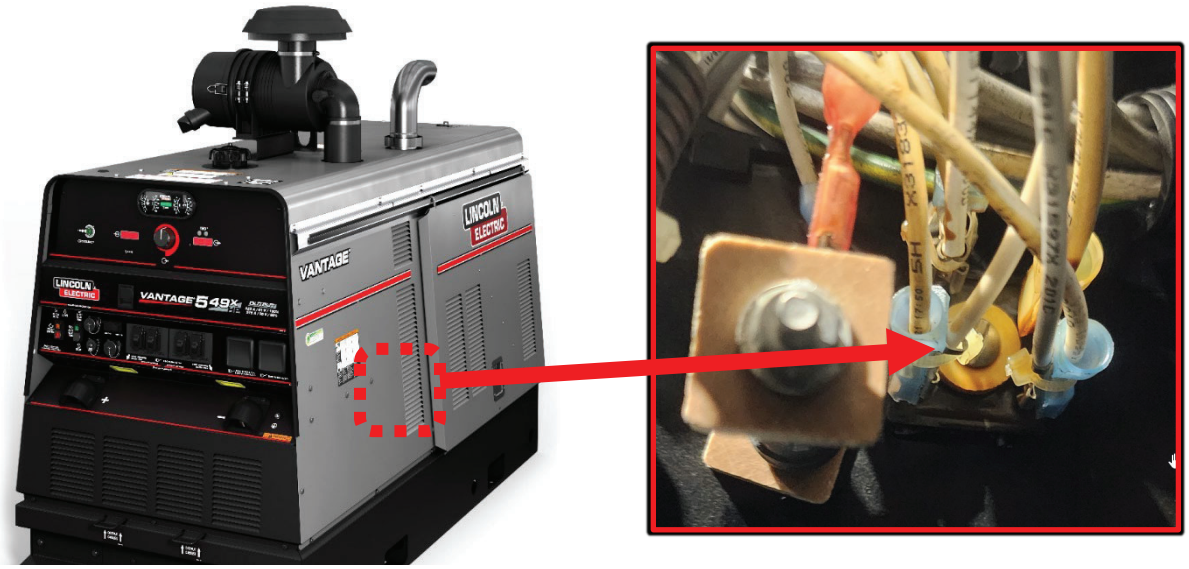


Figure F.1

2. Perform the "Case Cover Removal" to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the following connections, refer to Figure F.2.

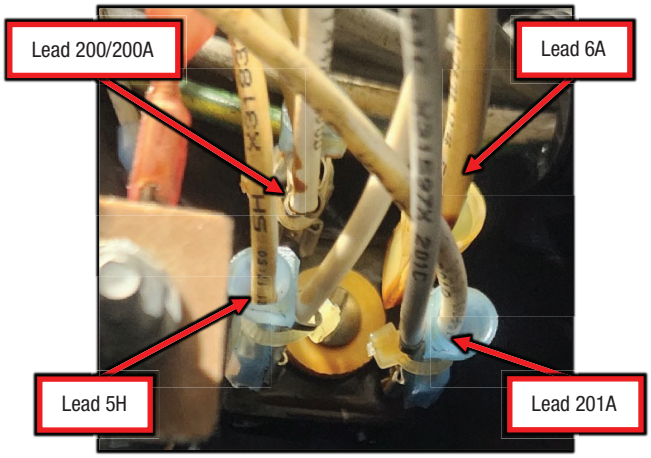
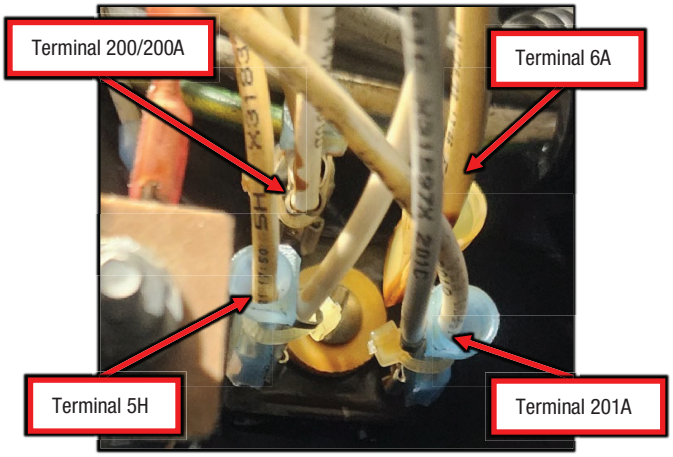


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations. NOTE: MEASUREMENTS ARE MADE ON D1 WITH THE LEADS REMOVED.



D1 Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
D1 Rectifier	Engine not running, Run/Stop/Idle switch set to STOP, Meter set to Diode mode	Terminal 6A	Terminal 200A	0.3 – 0.7VDC
		Terminal 5H	Terminal 200A	0.3 – 0.7VDC
		Terminal 201A	Terminal 6A	0.3 – 0.7VDC
		Terminal 201A	Terminal 5H	0.3 – 0.7VDC

Table 1

A.4 If measurements are correct reconnect anything disconnected in previous steps and proceed to “B. ACTIVE TESTING”.

A.5. Any failed measurement indicates a defective component.

B. ACTIVE TESTING

B.1. Ensure the engine is running and the Run/Stop/Idle switch is set to HIGH.

B.2. Perform the measurements in Test Table 2 below, refer to Figure F.4 for test point locations.

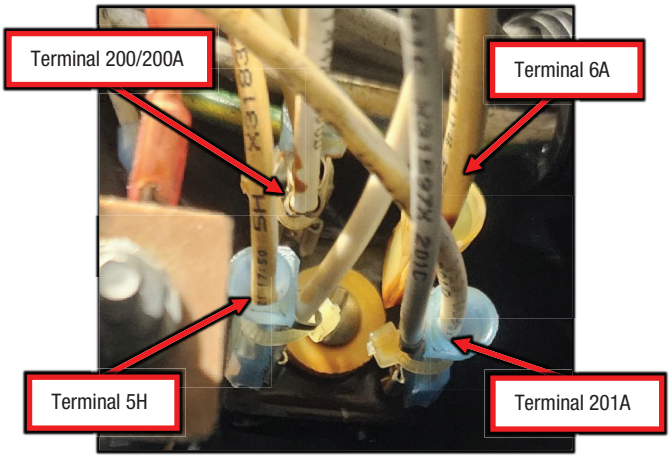


Figure F.4

D1 Active Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
D1 Input	Engine running, Run/Stop/Idle switch set to HIGH	Terminal 6A	Terminal 5H	~140VAC
D1 Output		Terminal 200A	Terminal 201A	~200VDC

Table 2

B.3. If the input measurements are correct and the output measurements are not correct this component may be faulty.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

D2 TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of D2 using Static and Active tests.

MATERIALS NEEDED:
3/8” nut driver
Needle nose pliers
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of D2 refer to Figure F.1.

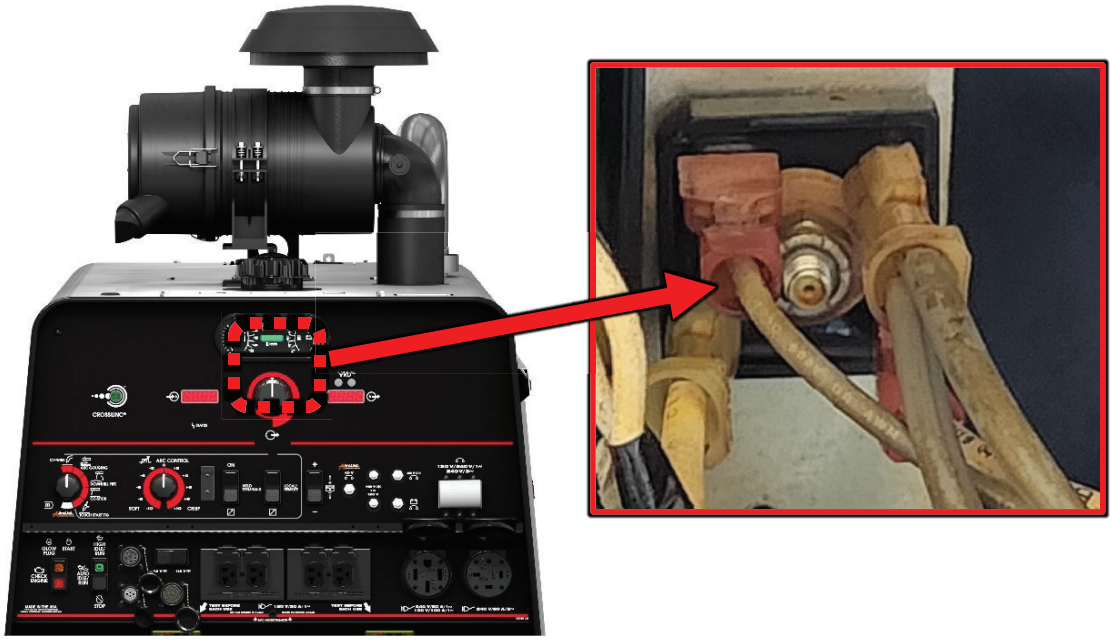


Figure F.1

2. Perform the “Control Panel Access Procedure” to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the following connections, refer to Figure F.2.

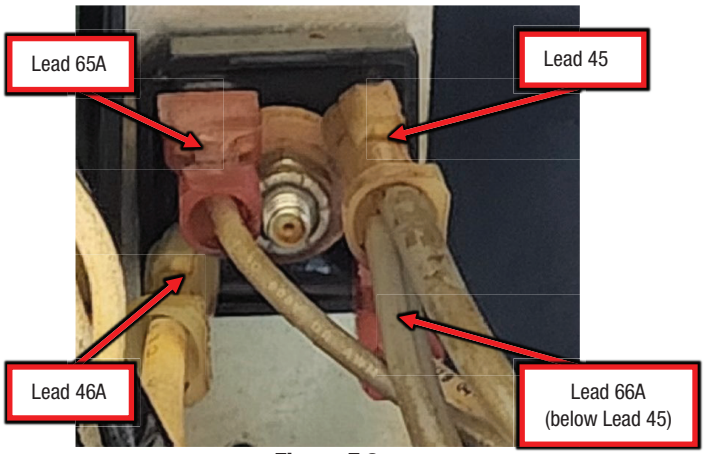


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations. NOTE: MEASUREMENTS ARE MADE ON D2 TERMINALS WITH THE LEADS REMOVED.

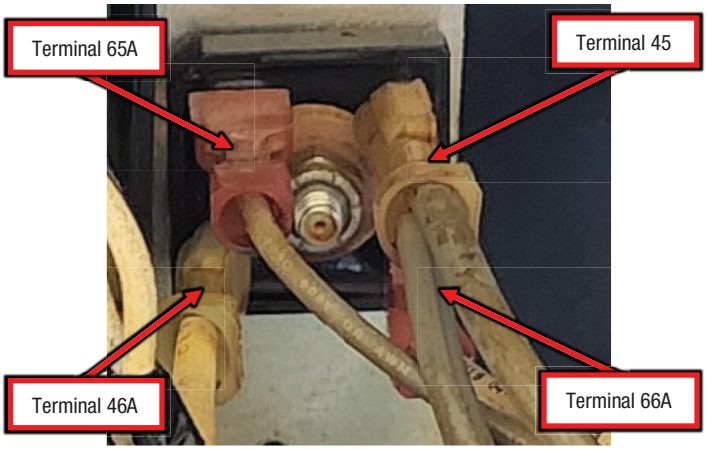


Figure F.3

D2 Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
D2 Rectifier	Engine not running, Run/Stop/Idle switch set to STOP, Meter set to Diode mode	Terminal 45	Terminal 65A	0.3–0.7VDC
		Terminal 46A	Terminal 65A	0.3–0.7VDC
		Terminal 66A	Terminal 45	0.3–0.7VDC
		Terminal 66A	Terminal 46A	0.3–0.7VDC

Table 1

A.4 If measurements are correct reconnect anything disconnected in previous steps and proceed to “B. ACTIVE TESTING”.

A.5. Any failed measurement indicates a defective component.

B. ACTIVE TESTING

B.1. Ensure the engine is running and On/Idle/Stop switch set to HIGH.

B.2. Perform the measurements in Test Table 2 below, refer to Figure F.4 for test point locations.

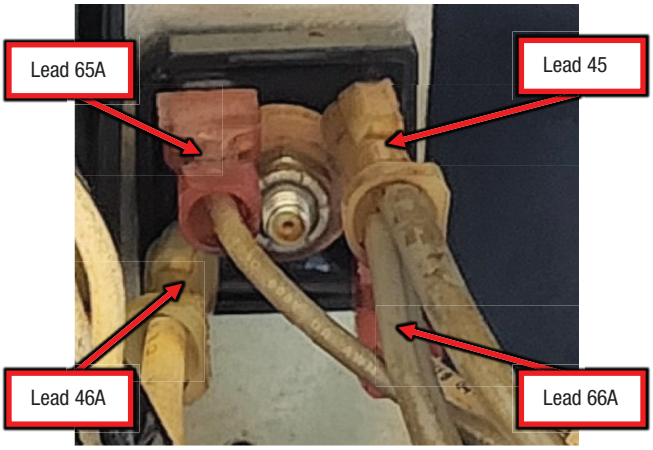


Figure F.4

D2 Active Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
D2 Rectifier Input	Engine running, Run/Stop/Idle switch set to STOP	Lead 45	Lead 46A	~42VAC
D2 Rectifier Output		Lead 65A	Lead 66A	~59VDC

Table 2

B.3. If the input measurements are correct and the output measurements are not correct this component may be faulty.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

D3 TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of D3 using Static and Active tests.

MATERIALS NEEDED:
3/8", 7/16", 3/4" nut driver
Needle nose pliers
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of D3 refer to Figure F.1.

Figure F.1

2. Perform the "Control Panel Access Procedure" to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the following connections, refer to Figure F.2.

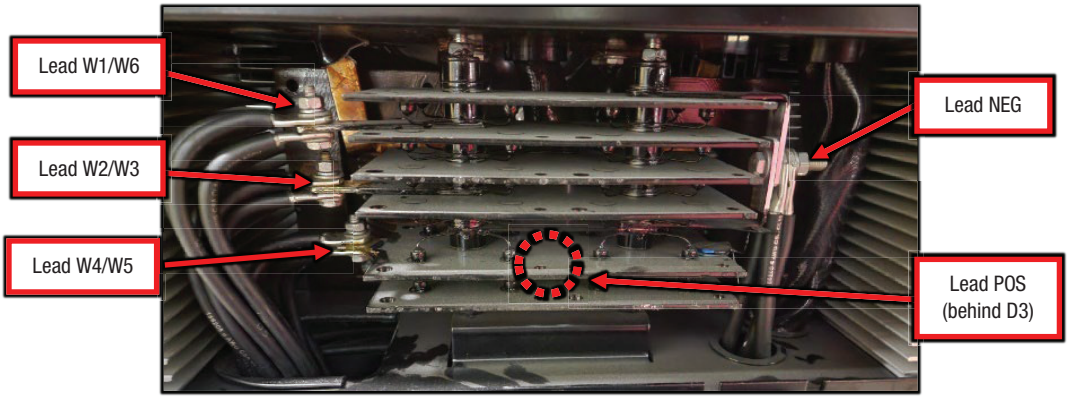


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations. NOTE: MEASUREMENTS ARE MADE ON D3 TERMINALS WITH THE LEADS REMOVED.

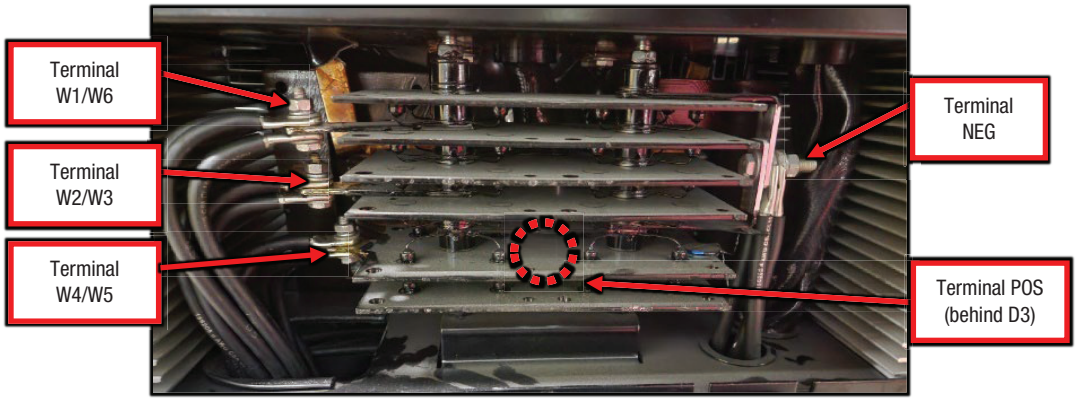


Figure F.3

D3 Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
D3 Rectifier	Engine not running, Run/Stop/Idle switch set to STOP, Meter set to Diode mode	Terminal W1/W6	Positive Terminal	0.3–0.7VDC
		Terminal W2/W3	Positive Terminal	0.3–0.7VDC
		Terminal W4/W5	Positive Terminal	0.3–0.7VDC
		Negative Terminal	Terminal W1/W6	0.3–0.7VDC
		Negative Terminal	Terminal W2/W3	0.3–0.7VDC
		Negative Terminal	Terminal W4/W5	0.3–0.7VDC

Table 1

A.4 If measurements are correct reconnect anything disconnected in previous steps and proceed to “B. ACTIVE TESTING”.

A.5. Any failed measurement indicates a defective component.

B. ACTIVE TESTING

B.1. Ensure the engine is running and On/Idle/Stop switch set to HIGH.

B.2. Perform the measurements in Test Table 2 below, refer to Figure F.4 for test point locations.

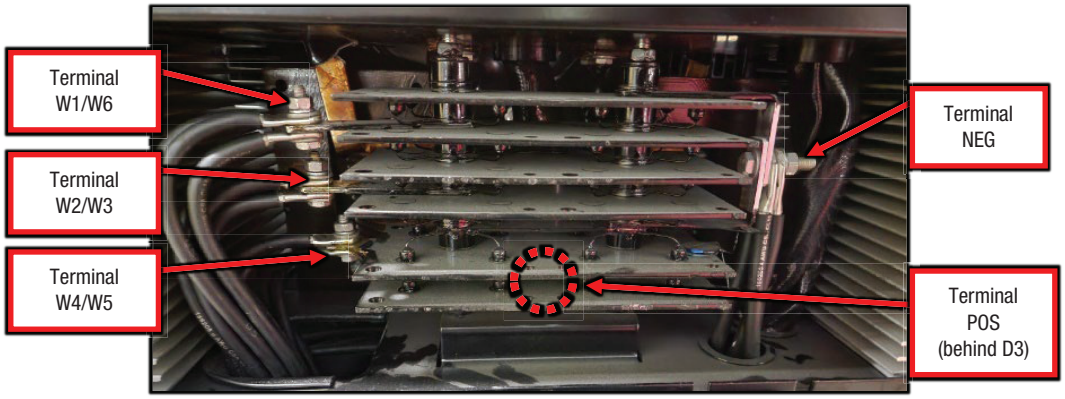


Figure F.4

D3 Active Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
D3 Phase 1 AC input	Engine running, Run/Stop/Idle switch set to HIGH	Terminal W1/W6	Terminal W2/W3	~66VAC
D3 Phase 2 AC input		Terminal W2/W3	Terminal W4/W5	~67VAC
D3 Phase 3 AC input		Terminal W4/W5	Terminal W1/W6	~66VAC
D3 3 Phase Output		Positive Terminal	Negative Terminal	~88VDC

Table 2

B.3. If the input measurements are correct and the output measurements are not correct this component may be faulty.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

FUEL RELAY TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of the Fuel Relay using Static and Active tests.

MATERIALS NEEDED:
3/8", 1/2" nut driver
Needle nose pliers
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of the Fuel Relay refer to Figure F.1.

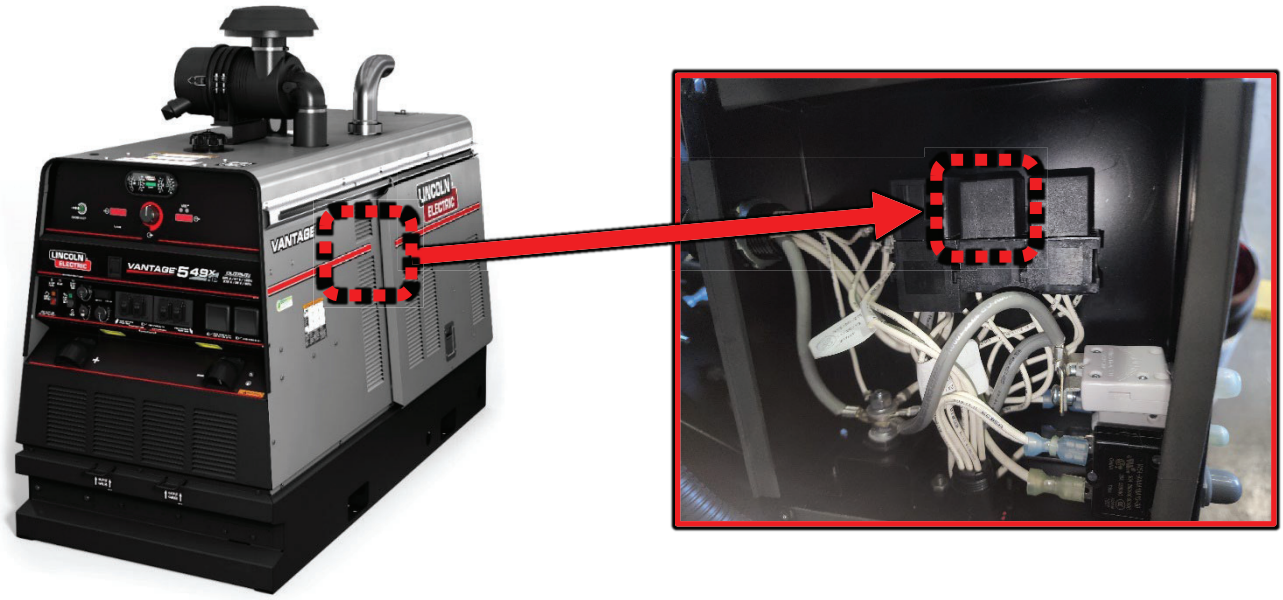


Figure F.1

2. Perform the "Case Cover Removal" to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the Fuel Relay from its socket, refer to Figure F.2.

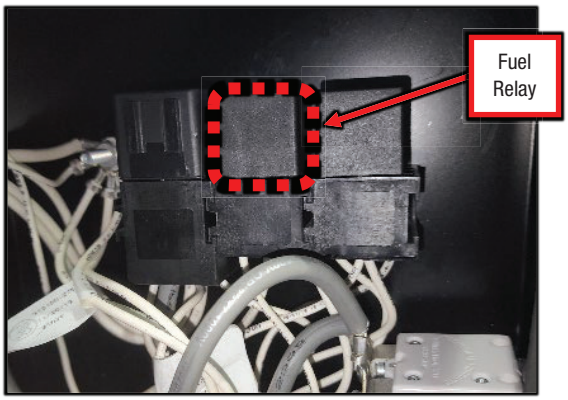


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations.

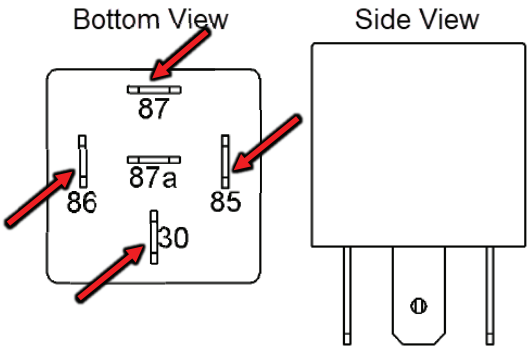


Figure F.3

Fuel Relay Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Fuel Relay	Engine not running, Run/Stop/Idle switch set to STOP, Relay removed from socket	Terminal 86	Terminal 85	90Ω
		Terminal 30	Terminal 87	OL
		Terminal 30	Terminal 87A	<1Ω

Table 1

A.4 If measurements are correct reconnect anything disconnected in previous steps and proceed to “B. ACTIVE TESTING”.

A.5. Any failed measurement indicates a defective component.

B. ACTIVE TESTING

B.1. Ensure the engine is NOT running and On/Idle/Stop switch set to AUTO.

B.2. Perform the measurements in Test Table 2 below, refer to Figure F.4 for test point locations.

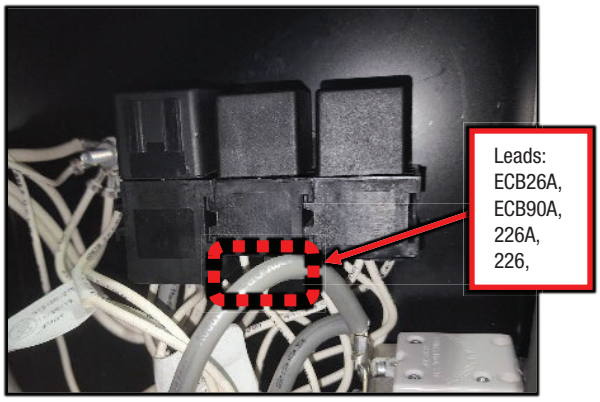


Figure F.4

Fuel Relay Active Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Fuel Relay coil input	Engine NOT running, Run/Stop/Idle switch set to AUTO	Lead ECB26A	Lead ECB90A	~12VDC
Fuel Relay output		Lead 226A	Lead 226	<1VDC

Table 2

B.3. If the input measurements are correct and the output measurements are not correct this component may be faulty.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

GLOW RELAY TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of the Glow Relay using Static and Active tests.

MATERIALS NEEDED:
3/8", 1/2" nut driver
Needle nose pliers
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of the Glow Relay refer to Figure F.1.

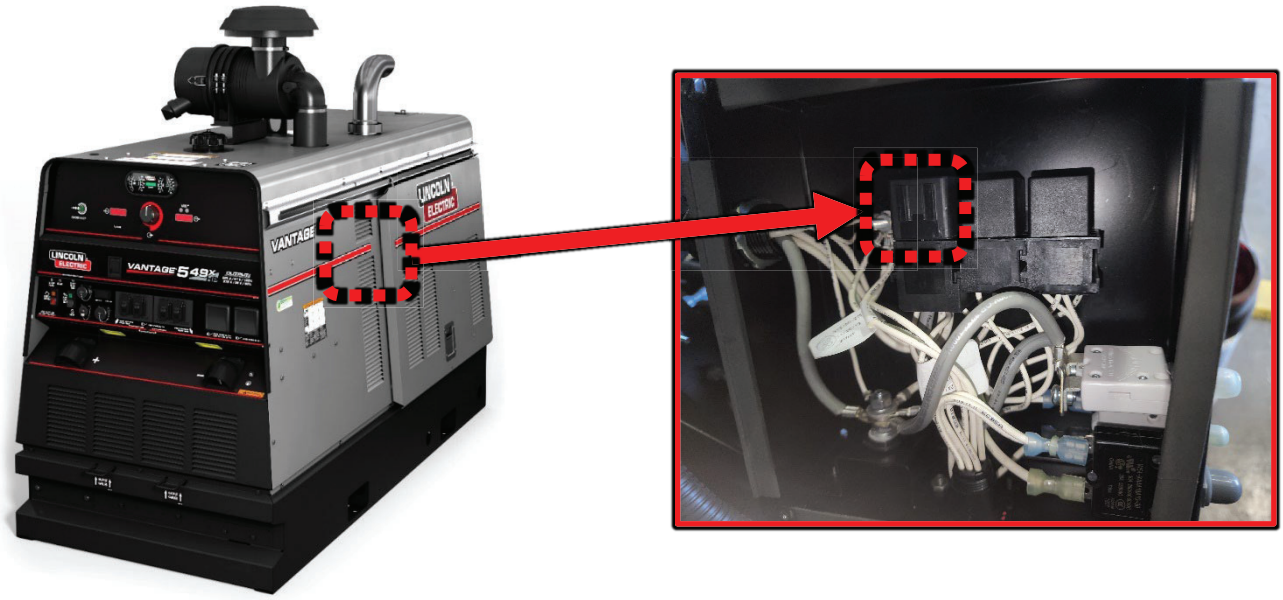


Figure F.1

2. Perform the "Case Cover Removal" to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the Glow Relay from its socket, refer to Figure F.2.

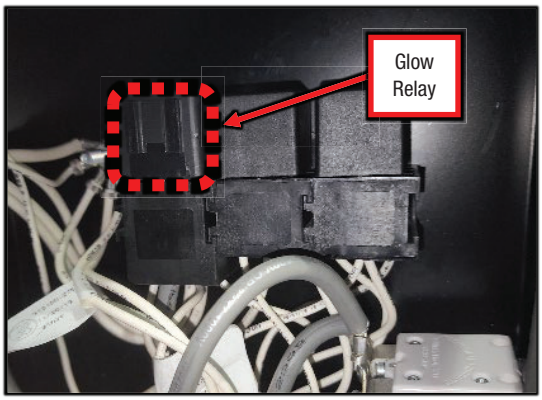


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations.

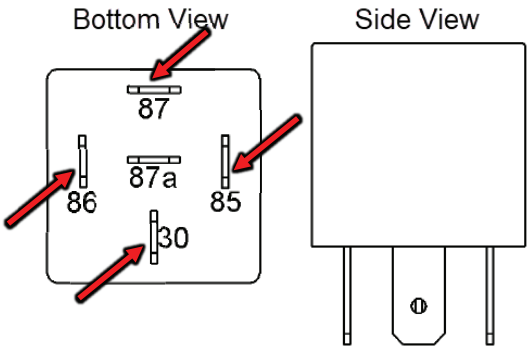


Figure F.3

Glow Relay Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Glow Relay	Engine not running, Run/Stop/Idle switch set to STOP, Relay removed from socket	Terminal 86	Terminal 85	90Ω
		Terminal 30	Terminal 87	OL
		Terminal 30	Terminal 87A	<1Ω

Table 1

A.4 If measurements are correct reconnect anything disconnected in previous steps and proceed to “B. ACTIVE TESTING”.

A.5. Any failed measurement indicates a defective component.

B. ACTIVE TESTING

B.1. Ensure the engine is running and On/Idle/Stop switch set to AUTO, depress the START button when directed during measurements.

B.2. Perform the measurements in Test Table 2 below, refer to Figure F.4 for test point locations.

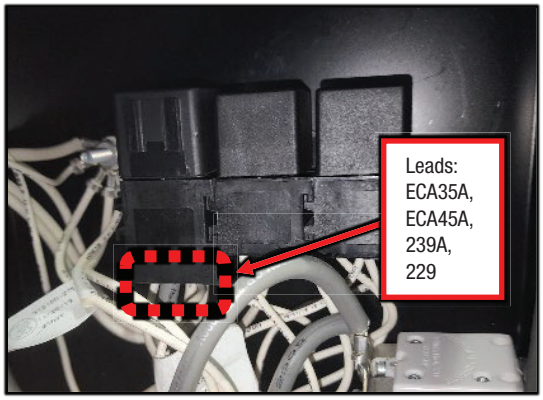


Figure F.4

Glow Relay Active Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Glow Relay coil input	Engine running, Run/Stop/Idle switch set to AUTO, Start Button depressed	Lead ECA35A	Lead ECA45A	~12VDC
Glow Relay output		Lead 239A	Lead 229	<1VDC

Table 2

B.3. If the input measurements are correct and the output measurements are not correct this component may be faulty.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

IDLE RELAY TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of the Idle Relay using Static and Active tests.

MATERIALS NEEDED:
3/8", 1/2" nut driver
Needle nose pliers
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of the Idle Relay refer to Figure F.1.

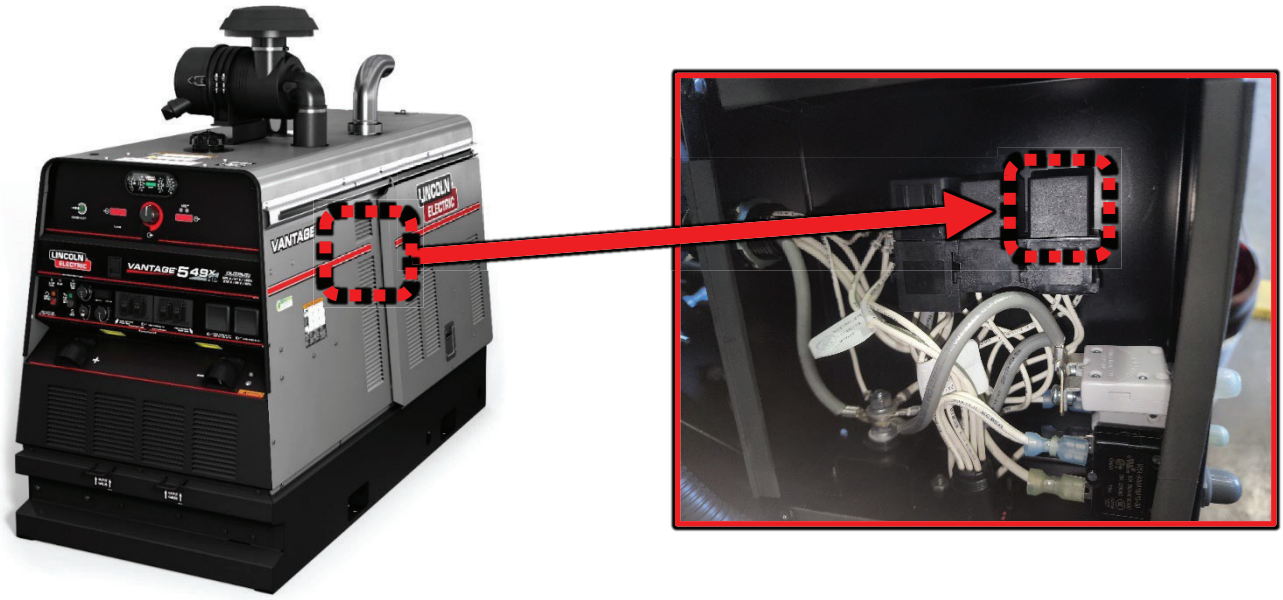


Figure F.1

2. Perform the "Case Cover Removal" to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the Idle Relay from its socket, refer to Figure F.2.

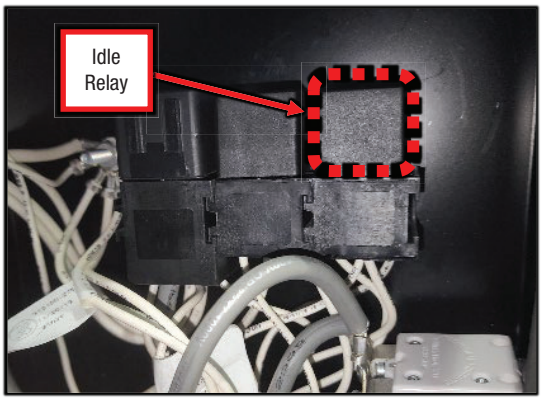


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations.

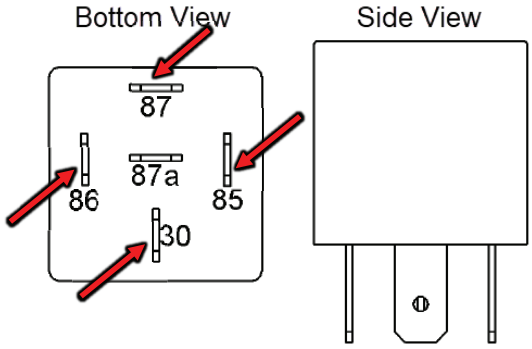


Figure F.3

Idle Relay Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Idle Relay	Engine not running, Run/Stop/Idle switch set to STOP, Relay removed from socket	Terminal 86	Terminal 85	90Ω
		Terminal 30	Terminal 87	OL
		Terminal 30	Terminal 87A	<1Ω

Table 1

A.4 If measurements are correct reconnect anything disconnected in previous steps and proceed to “B. ACTIVE TESTING”.

A.5. Any failed measurement indicates a defective component.

B. ACTIVE TESTING

B.1. Ensure the engine is running and On/Idle/Stop switch set to AUTO, wait 20 seconds after engine starts before taking any measurements.

B.2. Perform the measurements in Test Table 2 below, refer to Figure F.4 for test point locations.

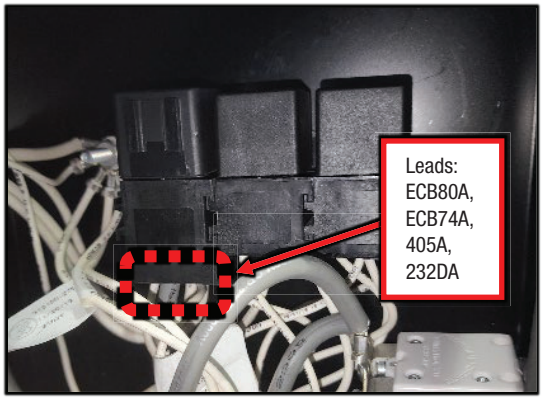


Figure F.4

Idle Relay Active Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Idle Relay coil input	Engine running, Run/Stop/Idle switch set to AUTO, Wait 20 seconds before measuring	Lead 405A	Lead 232DA	~12VDC
Idle Relay output		Lead ECB80A	Lead ECB74A	<1VDC

Table 2

B.3. If the input measurements are correct and the output measurements are not correct this component may be faulty.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

CHOPPER BOARD (LEFT) TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of the Left Chopper Board using Static and Active tests.

MATERIALS NEEDED:
3/8", 1/2" and 7/16" nut driver
Needle nose pliers
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of the Left Chopper Board refer to Figure F.1.

Figure F.1

2. Perform the "Case Cover Removal" to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the following connections, refer to Figure F.2.

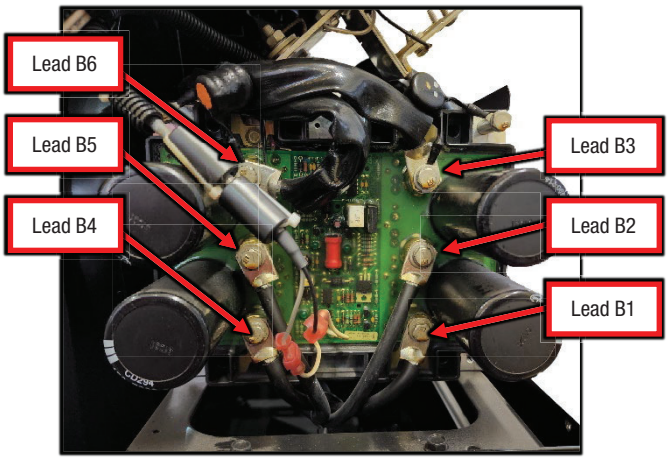


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations. NOTE: MEASUREMENTS ARE MADE ON THE LEFT CHOPPER BOARD TERMINALS WITH THE LEADS REMOVED.

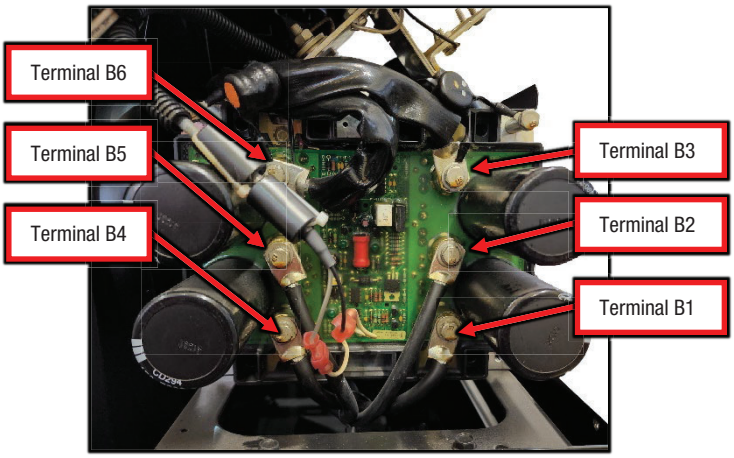


Figure F.3

Left Chopper Board Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Left Chopper Board	Engine not running, Run/Stop/Idle switch set to STOP, Meter set to DIODE mode	Terminal B3	Terminal B2	~0.334VDC
		Terminal B1	Terminal B3	~0.338VDC
		Terminal B6	Terminal B5	~0.334VDC
		Terminal B4	Terminal B6	OL

Table 1

A.4 If measurements are correct reconnect anything disconnected in previous steps and proceed to “B. ACTIVE TESTING”.

A.5. Any failed measurement indicates a defective component.

B. ACTIVE TESTING

B.1. Ensure the engine is running and On/Idle/Stop switch set to HIGH with the machine set to CC-Stick mode.
NOTE: ENSURE ALL LEADS ON THE LEFT CHOPPER BOARD ARE RECONNECTED PRIOR TO TESTING.

B.2. Perform the measurements in Test Table 2 below, refer to Figure F.4 for test point locations.

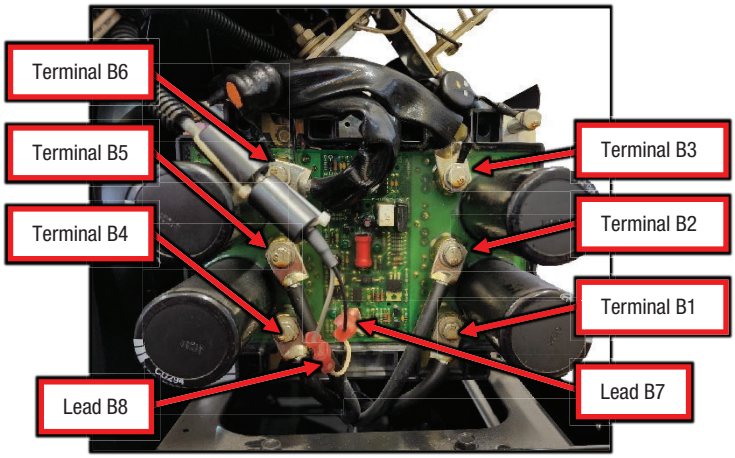


Figure F.4

Left Chopper Board Active Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Voltage Input	Engine running at HIGH, Run/Stop/Idle switch set to HIGH, Mode set to CC–Stick	Terminal B2	Terminal B1	~89.3VDC
		Terminal B5	Terminal B4	~89.3VDC
Voltage Output		Terminal B2	Terminal B3	~60.2 VDC
		Terminal B5	Terminal B6	~60.2VDC
Gate Drive Input		Lead B8	Lead B7	~40KHz

B.3. If the input measurements are correct and the output measurements are not correct this component may be faulty.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

CHOPPER BOARD (RIGHT) TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of the Right Chopper Board using Static and Active tests.

MATERIALS NEEDED:
3/8”, 7/16”, 1/2" nut driver
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of the Right Chopper Board refer to Figure F.1.

Figure F.1

2. Perform the “Case Cover Removal” to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the following connections, refer to Figure F.2.

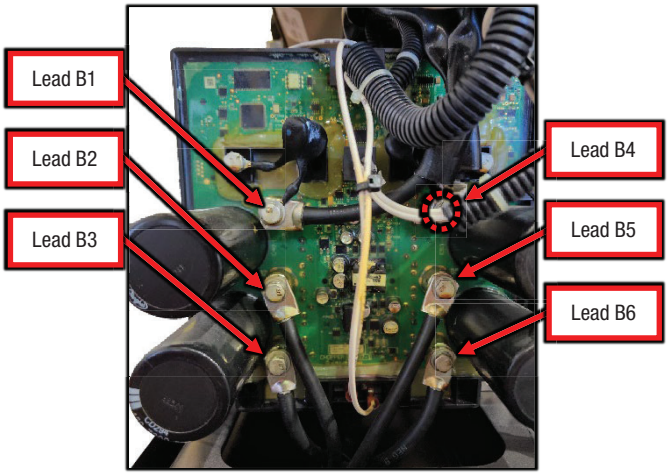


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations. NOTE: MEASUREMENTS ARE MADE ON THE RIGHT CHOPPER BOARD TERMINALS WITH THE LEADS REMOVED.

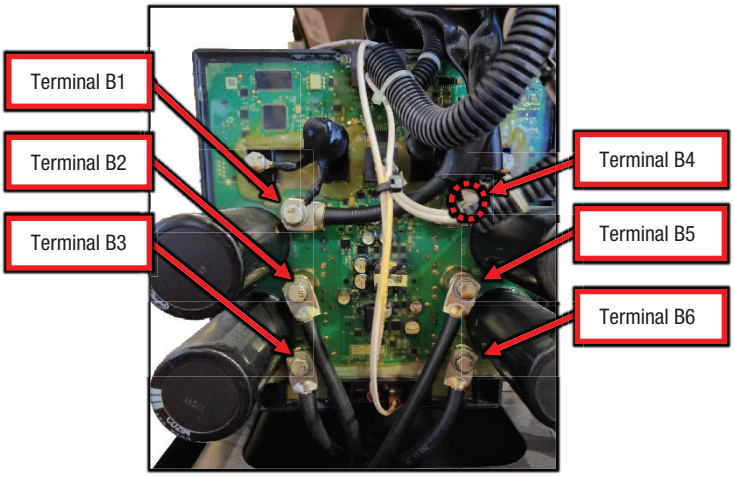


Figure F.3

Right Chopper Board Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Right Chopper Board	Engine not running, Run/Stop/Idle switch set to STOP, Meter set to DIODE mode	Terminal B3	Terminal B2	~0.334VDC
		Terminal B1	Terminal B3	~0.336VDC
		Terminal B6	Terminal B5	~0.334VDC
		Terminal B4	Terminal B6	OL

Table 1

A.4 If measurements are correct reconnect anything disconnected in previous steps and proceed to “B. ACTIVE TESTING”.

A.5. Any failed measurement indicates a defective component.

B. ACTIVE TESTING

B.1. Ensure the engine is running and On/Idle/Stop switch set to HIGH with the machine set to CC-Stick mode.
NOTE: ENSURE ALL LEADS ON THE RIGHT CHOPPER BOARD ARE RECONNECTED PRIOR TO TESTING.

B.2. Perform the measurements in Test Table 2 below, refer to Figure F.4 for test point locations.

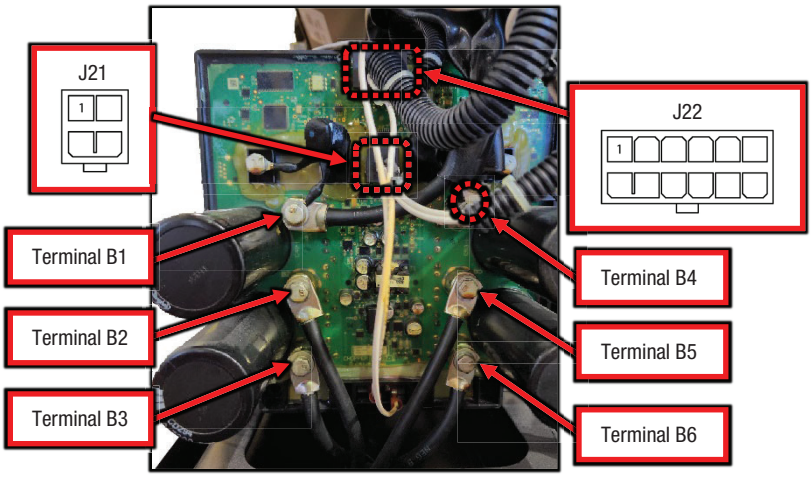


Figure F.4

Right Chopper Board Active Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Voltage Input	Engine running at HIGH, Run/Stop/Idle switch set to HIGH, Mode set to CC–Stick	Terminal B2	Terminal B1	~89.3VDC
		Terminal B5	Terminal B4	~89.3VDC
Voltage Output		Terminal B2	Terminal B3	~60.2 VDC
		Terminal B5	Terminal B6	~60.2VDC
CAN Communication		J21 pin 1	J21 pin 2	~2VDC
Input Power		J22 pin 3	J22 pin 2	~40VDC
Output Power to CHUI		J21 pin 4	J21 pin 3	~89.3VDC
Gate Drive Output to Left Chopper		J22 pin 9	J22 pin 10	~40KHz

B.3. If the input measurements are correct and the output measurements are not correct this component may be faulty.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

MODE SELECT BOARD TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of the Mode Select Board using Active tests.

MATERIALS NEEDED:
3/8” nut driver
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of the Mode Select Board refer to Figure F.1.

Figure F.1

2. Perform the “Control Panel Access Procedure” to gain access for testing.

3. Perform the Static Testing.

A. ACTIVE TESTING

A.1. Ensure the engine is running and the Run/Stop/Idle switch is set to HIGH, rotate the Mode Select dial as directed.

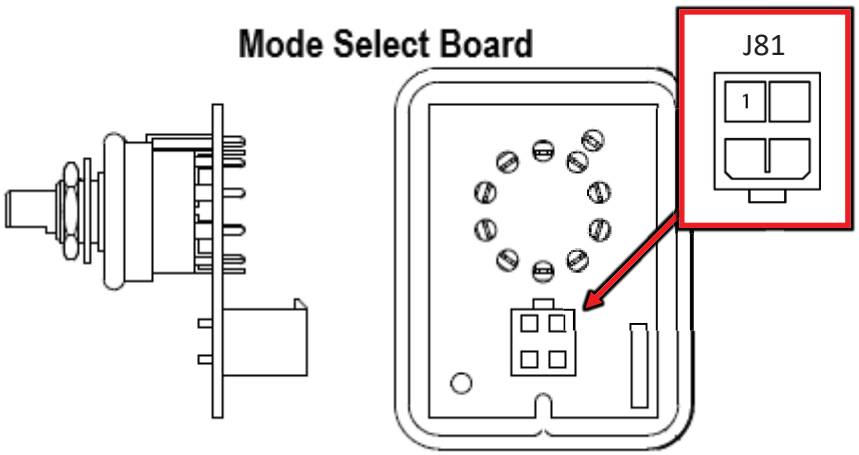


Figure F.2

A.3. Perform the active measurements in Test Table 1, refer to Figure F.2 for test point locations.

Mode Select Board Active Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Mode Select Board	Mode Switch set to CC	J81 pin 4	J81 pin 1	~3.9VDC
	Mode Switch set to PIPE	J81 pin 4	J81 pin 1	~5.9VDC
	Mode Switch set to CV	J81 pin 4	J81 pin 1	~7.9VDC
	Mode Switch set to GOUGE	J81 pin 4	J81 pin 1	~9.9VDC
	Mode Switch set to TIG	J81 pin 4	J81 pin 1	~1.9VDC
	Mode Switch set to ARCLINK	J81 pin 4	J81 pin 1	~.98VDC

Table 1

A.4. If measurements are correct reconnect all connections removed in step A.2 and proceed to step 4.

A.5. Any failed measurement indicates a defective component.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

POLARITY SWITCH TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of the Polarity Switch using Static tests.

MATERIALS NEEDED:
3/8” nut driver
Needle nose pliers
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of the Polarity Switch refer to Figure F.1.

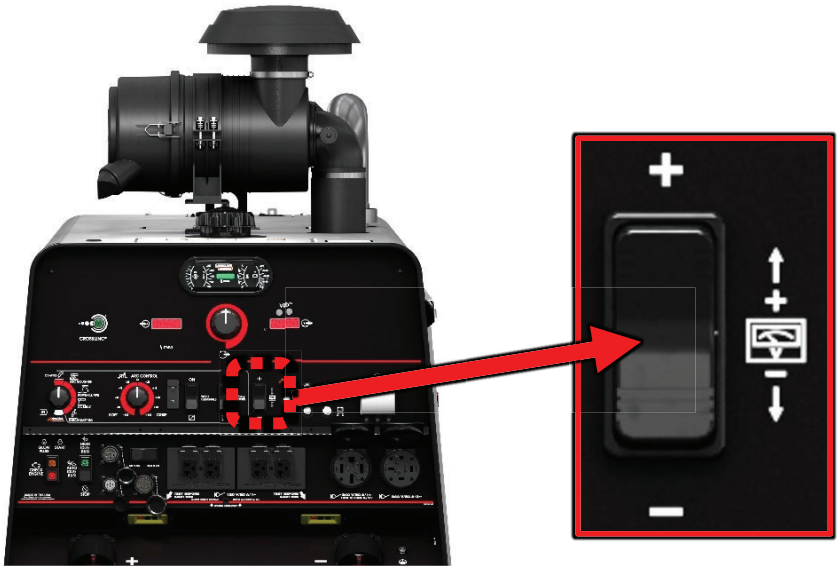


Figure F.1

2. Perform the “Control Panel Access Procedure” to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP, set the Polarity Switch as directed.

A.2. Label and disconnect the following connections on the Polarity Switch, refer to Figure F.2..

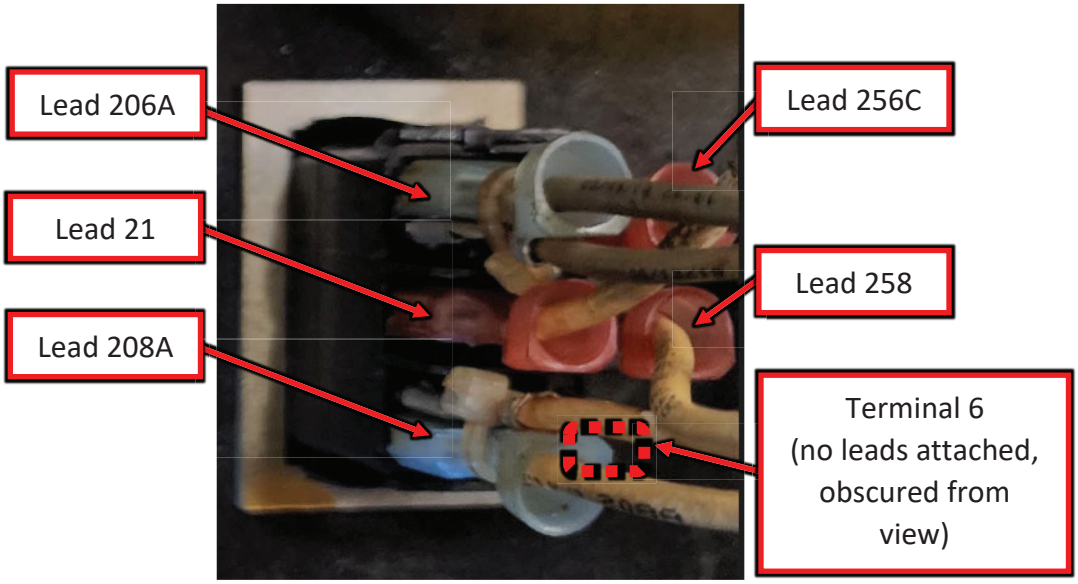


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.2 for test point locations. NOTE: MEASUREMENTS ARE MADE ON THE POLARITY SWITCH TERMINALS WITH THE LEADS REMOVED.

Polarity Switch Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Polarity Switch	Polarity Switch set to POSITIVE	Terminal 21	Terminal 208A	< 1Ω
		Terminal 258	Terminal 6	< 1Ω
	Polarity Switch set to NEGATIVE	Terminal 21	Terminal 206A	< 1Ω
		Terminal 258	Terminal 256C	< 1Ω

Table 1

A.4. If measurements are correct reconnect all connections removed in step A.2 and proceed to step 4.

A.5. Any failed measurement indicates a defective component.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

ROTOR TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of the Rotor using Static tests.

MATERIALS NEEDED:
3/8”, 1/2" nut driver
Needle nose pliers
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of the Rotor refer to Figure F.1.

Figure F.1

2. Perform the “Case Cover Removal” to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle switch is set to STOP.

A.2. Label and disconnect the following connections, refer to Figure F.2.

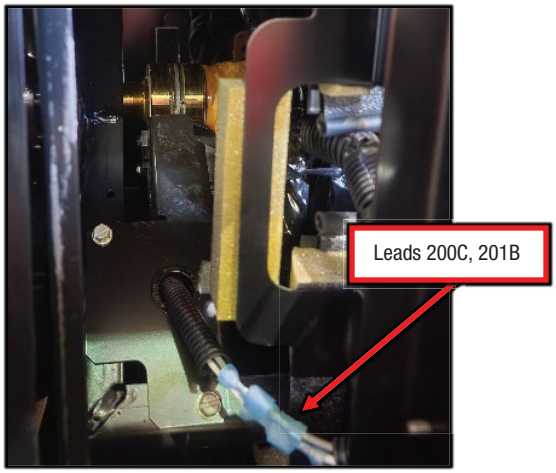


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations. NOTE: MEASUREMENTS ARE MADE ON THE SLIP RINGS WITH LEADS 200C AND 201B REMOVED.

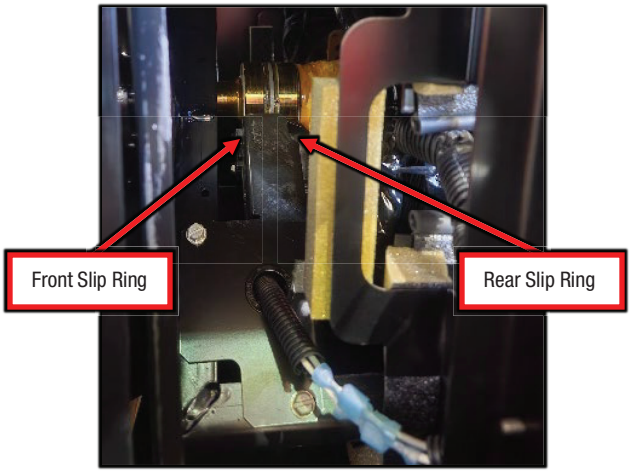


Figure F.3

Rotor Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Rotor	Leads 200C and 201B Disconnected	Front Slip Ring	Rear Slip Ring	~27Ω
		Front Slip Ring	Chassis Ground	>100MΩ

Table 1

A.4. If measurements are correct reconnect all connections removed in step A.2 and proceed to step 4.

A.5. Any failed measurement indicates a defective component.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

RUN/STOP/IDLE SWITCH TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of the Run/Stop/Idle Switch using Static and Active tests.

MATERIALS NEEDED:
3/8” nut driver
Needle nose pliers
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of the Run/Stop/Idle Switch refer to Figure F.1.

Figure F.1

2. Perform the “Control Panel Access Procedure” to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle Switch is set as directed and the Battery is NOT connected.

A.2. Perform the static measurements in Test Table 1, refer to Figure F.2 for test point locations. NOTE: ENSURE THE BATTERY IS NOT CONNECTED BEFORE TAKING ANY MEASUREMENTS.

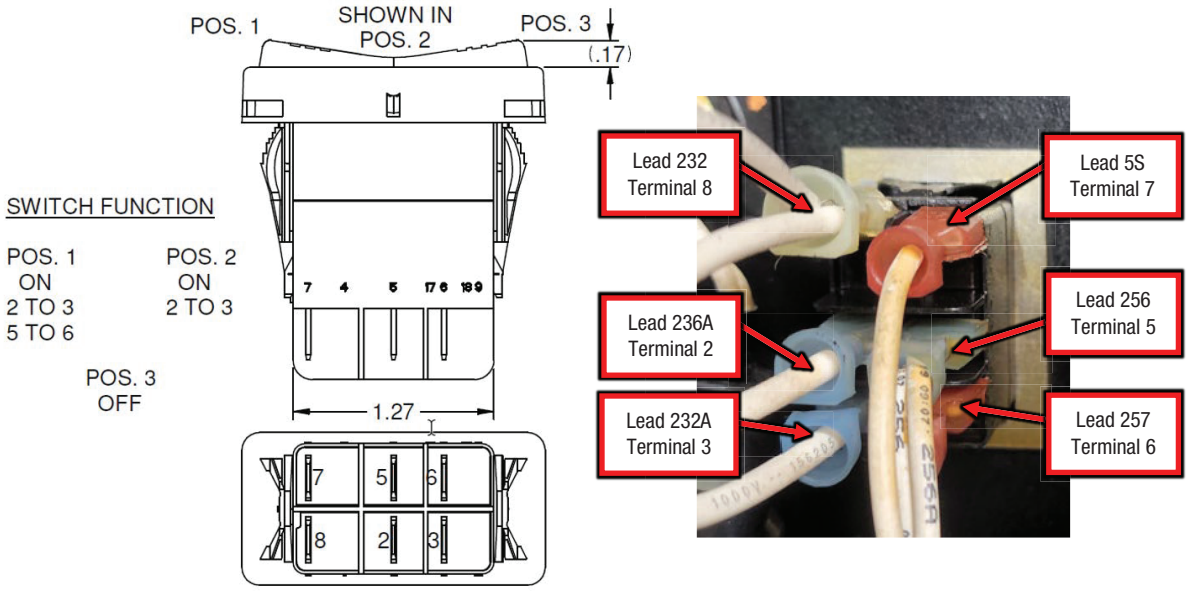


Figure F.2

Run/Stop/Idle Switch Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Run/Stop/Idle Switch	Run/ Stop Switch in High Idle (POS. 1)	Lead 236A (Terminal 2)	Lead 232A (Terminal 3)	<1Ω
	Run/ Stop Switch in Auto (POS. 2)	Lead 236A (Terminal 2)	Lead 232A (Terminal 3)	<1Ω
	Run/ Stop Switch in High Idle (POS. 1)	Lead 256 (Terminal 5)	Lead 257 (Terminal 6)	<1Ω
	Run/ Stop Switch in High Idle (POS. 2)	Lead 256 (Terminal 5)	Lead 257 (Terminal 6)	OL
	Run/ Stop Switch in Stop (POS. 3)	Lead 236A (Terminal 2)	Lead 232A (Terminal 3)	OL
	Run/ Stop Switch in Stop (POS. 3)	Lead 256 (Terminal 5)	Lead 257 (Terminal 6)	OL

Table 1

A.4 If measurements are correct reconnect anything disconnected in previous steps and proceed to “B. ACTIVE TESTING”.

A.5. Any failed measurement indicates a defective component.

B. ACTIVE TESTING

B.1. Ensure the engine is NOT running and On/Idle/Stop switch set as directed.

B.2. Perform the measurements in Test Table 2 below, refer to Figure F.3 for test point locations.

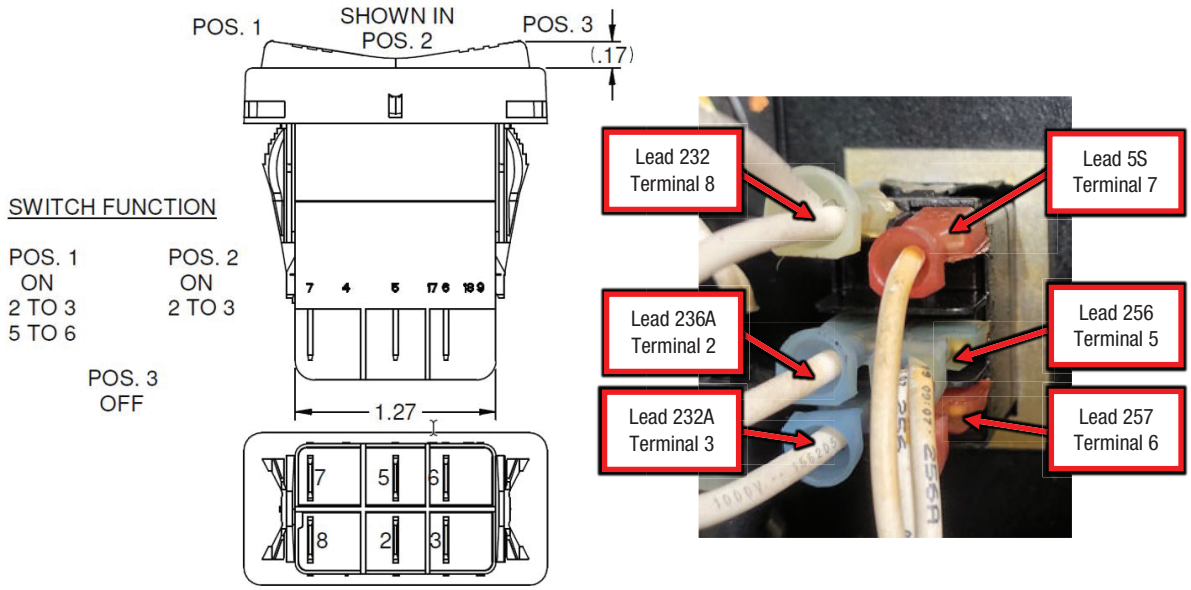


Figure F.3

Run/Stop/Idle Switch Active Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Run/Stop/Idle Switch	Run/ Stop Switch in High Idle (POS. 1)	Lead 236A (Terminal 2)	Lead 232A (Terminal 3)	<1VDC
	Run/ Stop Switch in Auto (POS. 2)	Lead 236A (Terminal 2)	Lead 232A (Terminal 3)	<1VDC
	Run/ Stop Switch in High Idle (POS. 1)	Lead 256 (Terminal 5)	Lead 257 (Terminal 6)	<1VDC
	Run/ Stop Switch in High Idle (POS. 2)	Lead 256 (Terminal 5)	Lead 257 (Terminal 6)	~12VDC
	Run/ Stop Switch in Stop (POS. 3)	Lead 236A (Terminal 2)	Lead 232A (Terminal 3)	~12VDC
	Run/ Stop Switch in Stop (POS. 3)	Lead 256 (Terminal 5)	Lead 257 (Terminal 6)	~12VDC

Table 2

B.3. If the input measurements not correct this component may be faulty.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

START/GLOW SWITCH TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of the Start/Glow Switch using Static and Active tests.

MATERIALS NEEDED:
3/8” nut driver
Needle nose pliers
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of the Start/Glow Switch refer to Figure F.1.

Figure F.1

2. Perform the “Control Panel Access Procedure” to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle Switch is set to STOP and the Battery is NOT connected.

A.2. Perform the static measurements in Test Table 1, refer to Figure F.2 for test point locations. NOTE: ENSURE THE BATTERY IS NOT CONNECTED BEFORE TAKING ANY MEASUREMENTS.

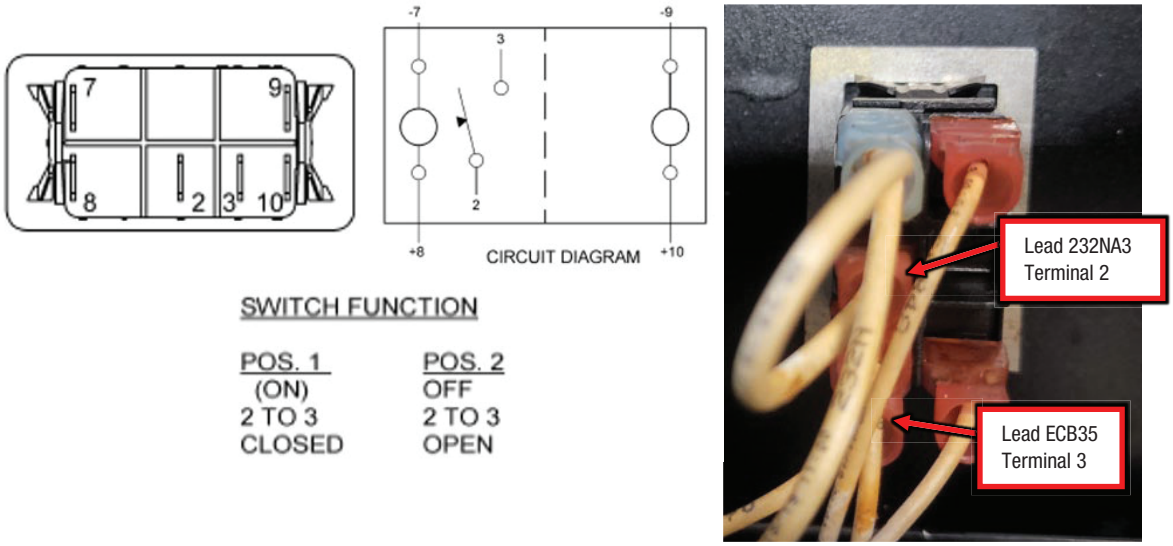


Figure F.2

Start/Glow Switch Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Start/Glow Switch	Start button depressed	Lead ECB35 (Terminal 3)	Lead 232NA (Terminal 2)	<1Ω
	Start button not depressed	Lead ECB35 (Terminal 3)	Lead 232NA (Terminal 2)	OL

Table 1

A.4 If measurements are correct reconnect anything disconnected in previous steps and proceed to “B. ACTIVE TESTING”.

A.5. Any failed measurement indicates a defective component.

B. ACTIVE TESTING

B.1. Ensure the engine is NOT running, the On/Idle/Stop switch is set to AUTO, the Fuel Relay is removed from its socket and the Start/Glow button depressed as directed, refer to Figure F.3.

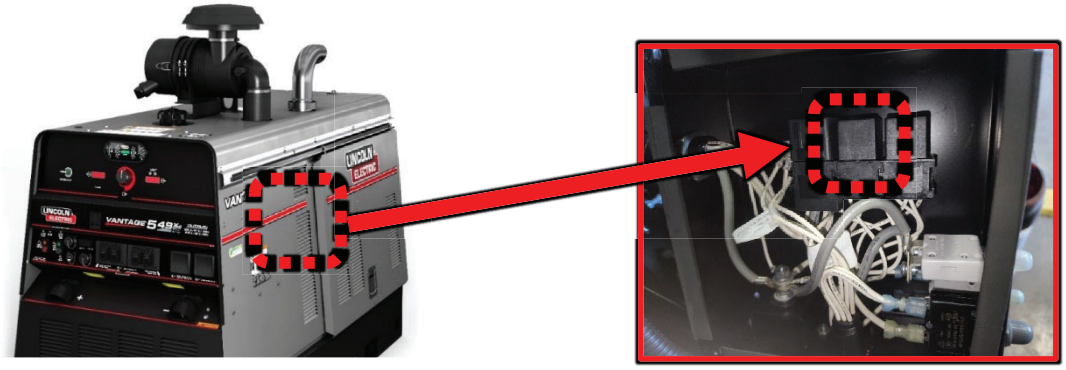


Figure F.3

B.2. Perform the measurements in Test Table 2 below, refer to Figure F.4 for test point locations.

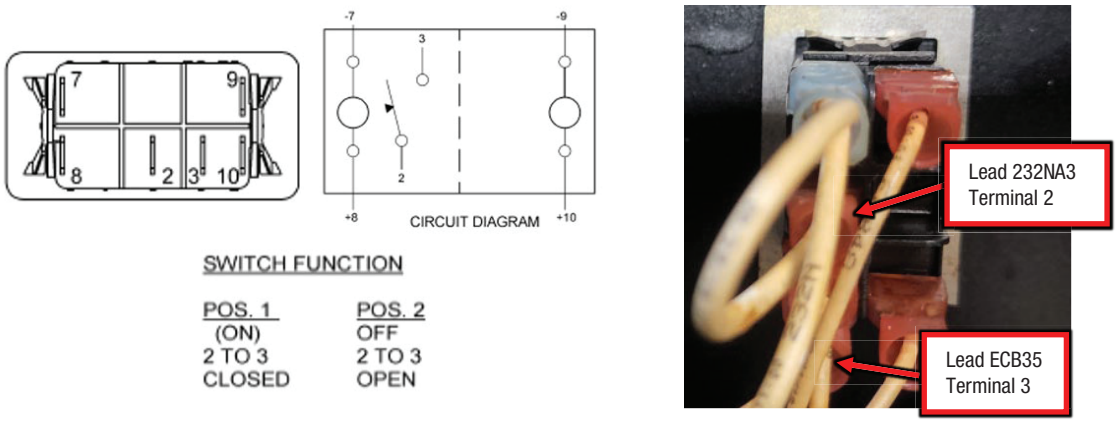


Figure F.4

Start/Glow Switch Active Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Start/Glow Switch	Start button depressed	Lead ECB35 (Terminal 3)	Lead 232NA (Terminal 2)	<1VDC
	Start button not depressed	Lead ECB35 (Terminal 3)	Lead 232NA (Terminal 2)	~12VDC

Table 2

B.3. If the measurements not correct this component may be faulty.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Refer to Safety pages for explanation of hazards:

STATOR TEST PROCEDURE

TEST DESCRIPTION:
This procedure will determine the proper function of the Stator using Static and Active tests.

MATERIALS NEEDED:
3/8", 7/16" nut driver
Needle nose pliers
Digital Multi-Meter
Wiring Diagram
Machine Schematic
Required P.P.E.

TEST PROCEDURE:
1. For location of the Stator refer to Figure F.1.

Figure F.1

2. Perform the "Case Cover Removal" to gain access for testing.

3. Perform the Static Testing.

A. STATIC TESTING

A.1. Ensure the engine is not running and the Run/Stop/Idle Switch is set to STOP.

A.2. Label and disconnect the following connections, refer to Figure F.2.

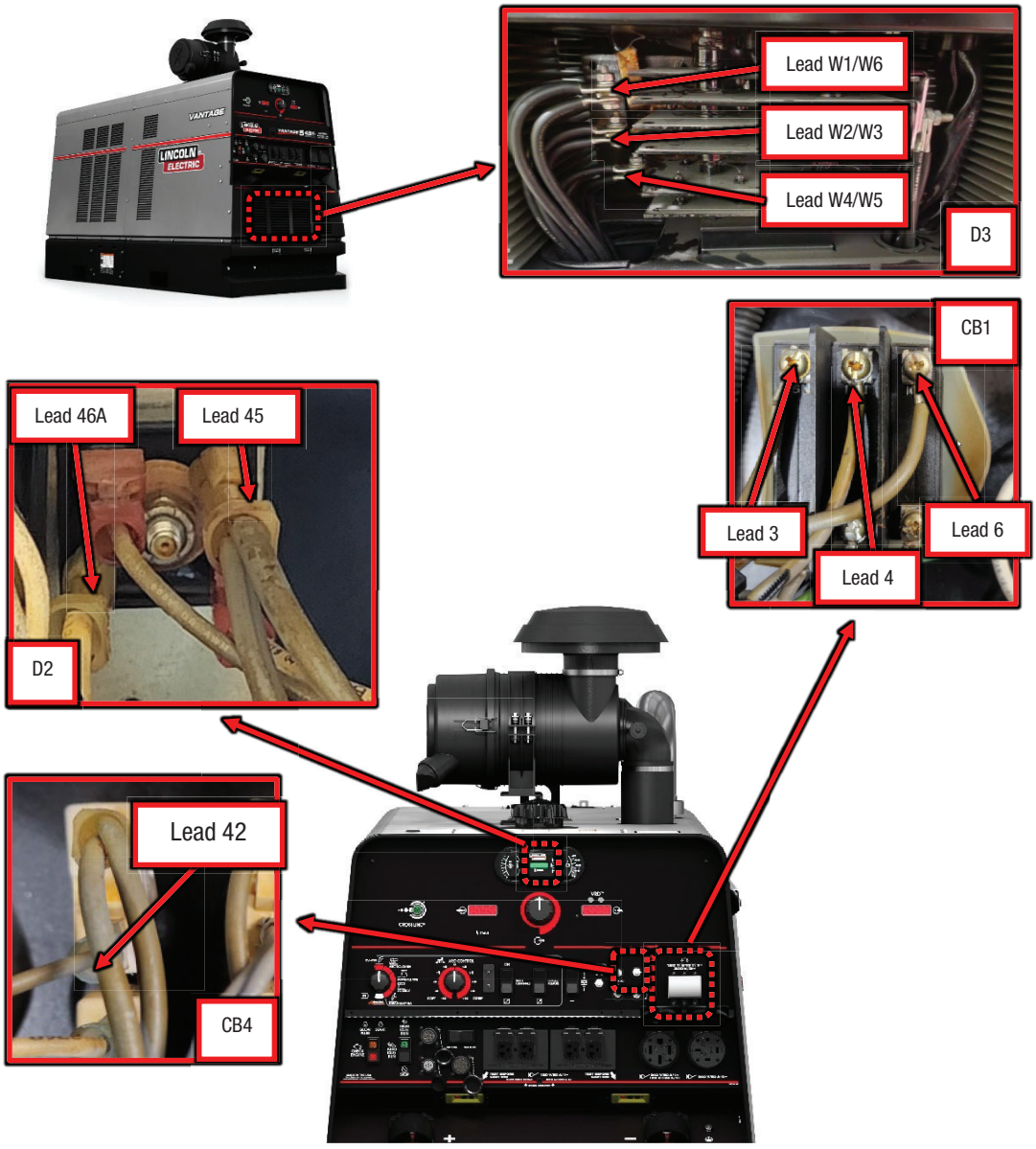


Figure F.2

A.3. Perform the static measurements in Test Table 1, refer to Figure F.3 for test point locations.

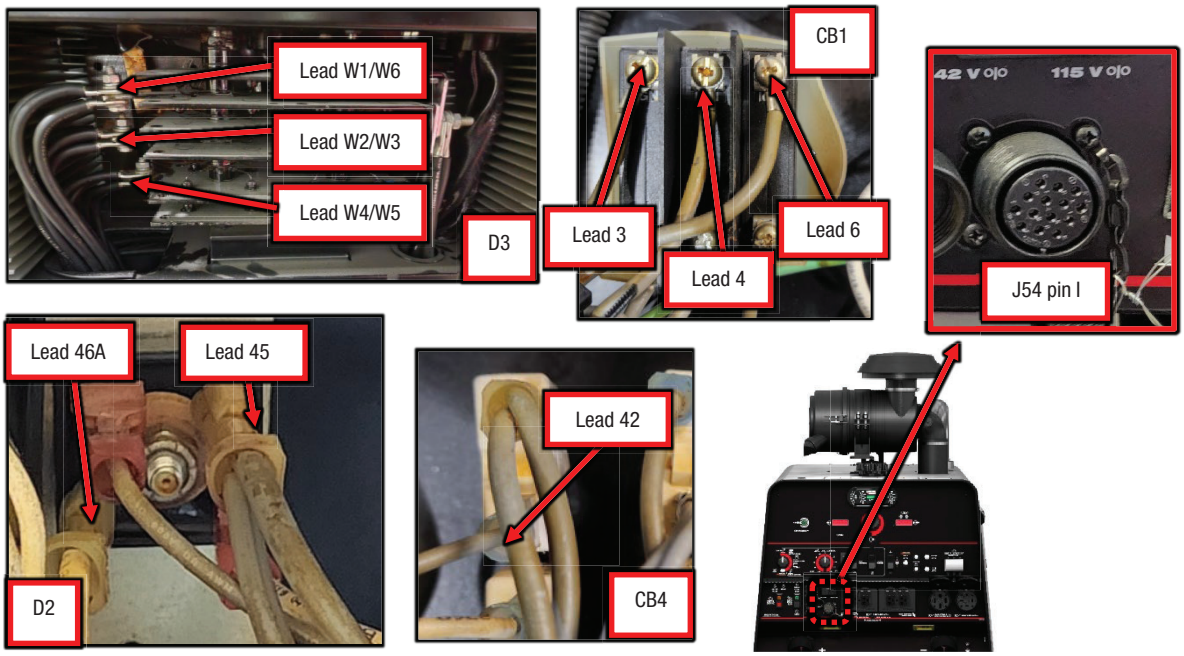


Figure F.3

Stator Static Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Weld Windings	Engine not running, Run/Stop/Idle switch set to STOP	Lead W1	Lead W2	<1Ω
		Lead W3	Lead W4	<1Ω
		Lead W5	Lead W6	<1Ω
		Lead W1	Chassis Ground	OL
		Lead W3	Chassis Ground	OL
		Lead W5	Chassis Ground	OL
Auxiliary Windings		Lead 3 (CB1)	Chassis Ground	<1Ω
		Lead 4 (CB1)	Chassis Ground	<1Ω
		Lead 6 (CB1)	Chassis Ground	<1Ω
		J54 pin I	Lead 42 (CB4)	<1Ω
		J54 pin I	Chassis Ground	OL
		Lead 45 (D2)	Lead 46A (D2)	<1Ω
		Lead 45 (D2)	Chassis Ground	OL

Table 1

A.4 If measurements are correct reconnect anything disconnected in previous steps and proceed to “B. ACTIVE TESTING”.

A.5. Any failed measurement indicates a defective component.

B. ACTIVE TESTING

B.1. Ensure the engine is running, the On/Idle/Stop switch is set to HIGH.

B.2. Perform the measurements in Test Table 2 below, refer to Figure F.3 for test point locations.

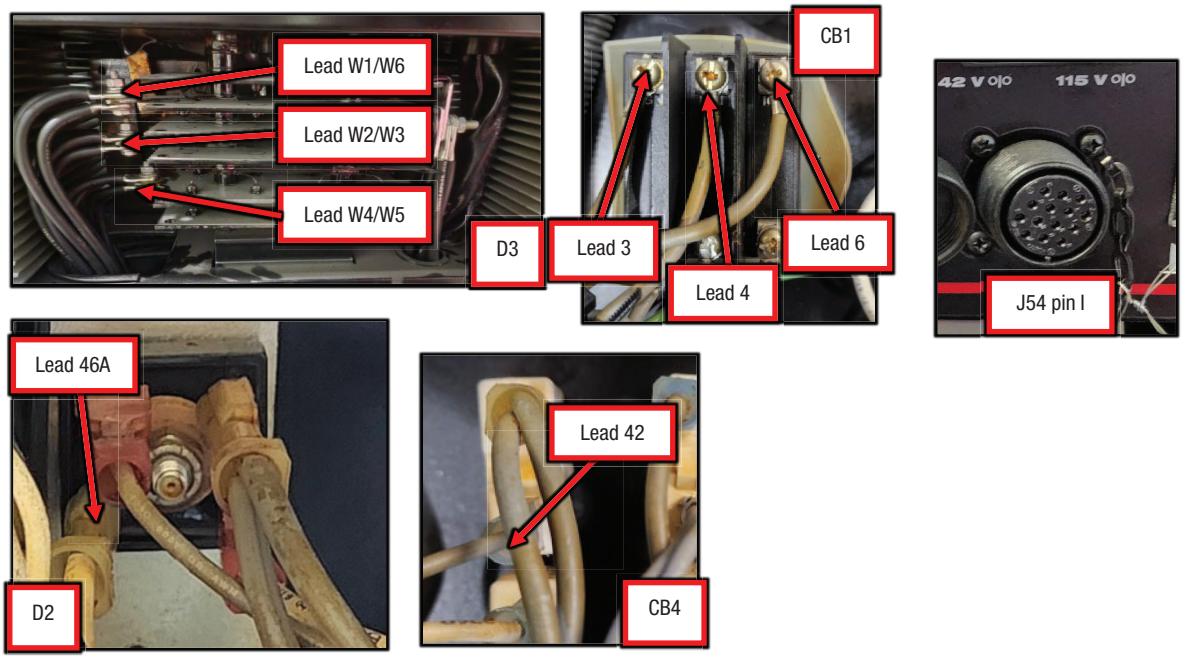


Figure F.3

Stator Active Test				
Component/Circuit Tested	Condition(s)	+Meter Lead	-Meter Lead	Expected Value
Weld Winding Outputs	Engine running, Run/Stop/Idle switch set to HIGH	Terminal W1/W6	Terminal W2/W3	~80 VAC
		Terminal W2/W3	Terminal W4/W5	~80 VAC
		Terminal W4/W5	Terminal W1/W6	~80 VAC
Aux Winding Outputs		J54 pin I	Lead 42 (CB4)	~42VAC
		Lead 3 (CB1)	Chassis Ground	~120VAC
		Lead 4 (CB1)	Chassis Ground	~120VAC
		Lead 6 (CB1)	Chassis Ground	~120VAC
		Lead 45 (D2)	Lead 46A (D2)	~42VAC

Table 2

B.3. If the input measurements are correct and the output measurements are not correct this component may be faulty.

4. If problems with the machine persist, refer to the “Test Reference” chart for other possible faulty components. Reconnect anything disconnected in previous steps.

Removal And Replacement Procedures

ARC CONTROL POTENTIOMETER REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Arc Control Potentiometer.

MATERIALS NEEDED

5/64” Allen Wrench
1/2” Nutdriver
5/16” Nutdriver
Molex Removal Tool
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/64” Allen wrench, loosen the set screw securing the knob to the shaft. See ***Figure F.1***.
5. Remove the knob and the rubber washer. Retain both for reassembly.
6. Using a 1/2” nutdriver, remove the nut and washer securing the arc control potentiometer to the control panel.
7. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
8. Carefully lower the control panel to gain access to the chopper user interface board. See Wiring Diagram.
9. Label and disconnect plug J32 from the chopper user interface board. See ***Figure F.2***. See Wiring Diagram.
10. Using a Molex removal tool, remove leads 279, 278 and 277 from plug J32. See Wiring Diagram. Label leads for reassembly.
11. Label and disconnect plug J81 from the mode select switch. See ***Figure F.3***. See Wiring Diagram.
12. Using a Molex removal tool, remove lead 277A from plug J81. See Wiring Diagram. Label leads for reassembly.
13. The arc control potentiometer can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new arc control potentiometer into the control panel.
2. Attach lead 277A to plug J81. See Wiring Diagram.
3. Connect plug J81 to the mode select switch. See Wiring Diagram.
4. Attach leads 279, 278 and 277 to plug J32. See Wiring Diagram.
5. Connect plug J32 to the chopper user interface board. See Wiring Diagram.
6. Carefully raise the control panel into the upright position.
7. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position.

8. Using a 1/2” nutdriver, attach the nut and washer securing the arc control potentiometer to the control panel.
9. Attach the knob and the rubber washer to the shaft.
10. Using a 5/64” Allen wrench, tighten the set screw securing the knob to the shaft.
11. Perform the ***Case Cover Replacement Procedure***.
12. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Arc control potentiometer and control panel mounting screw locations

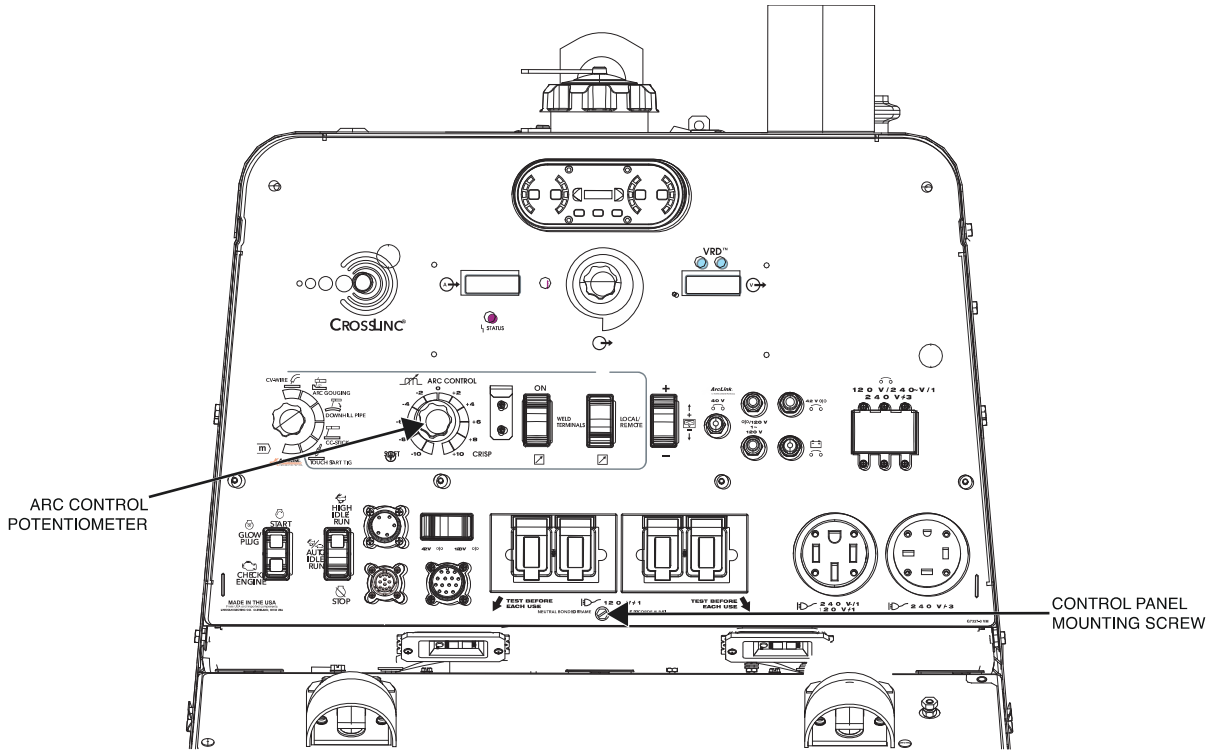


Figure F.2 – Chopper user interface board plug J32 location

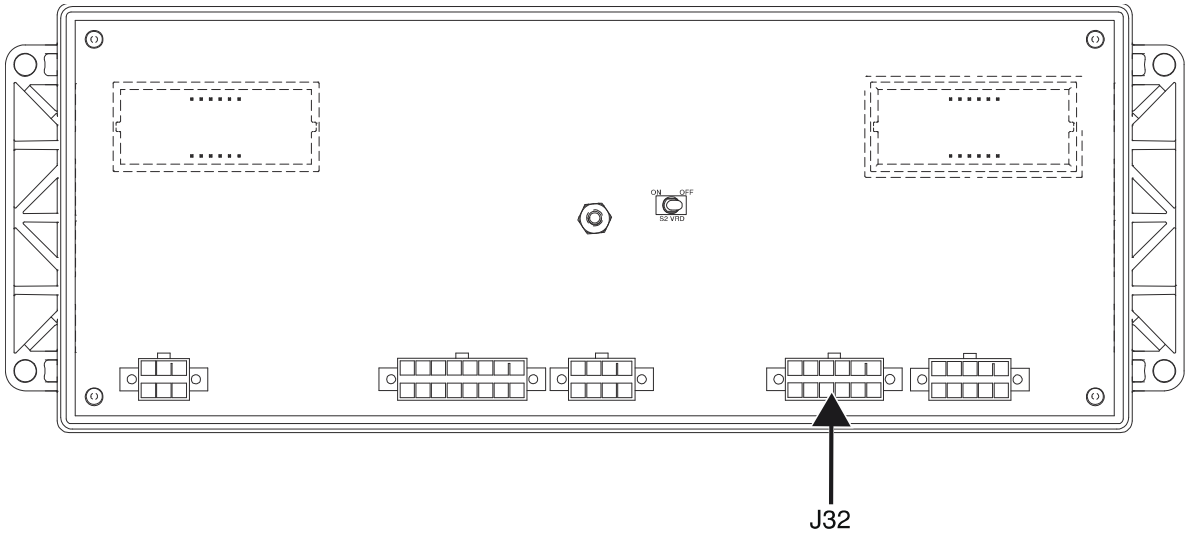
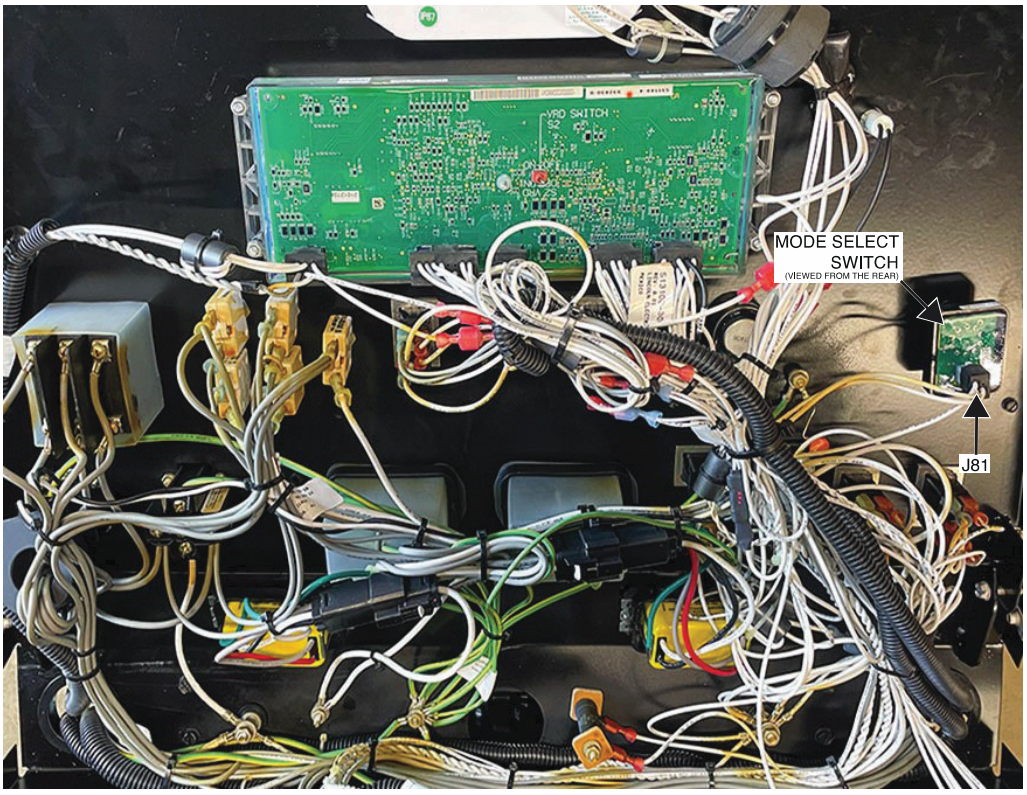


Figure F.3 – Mode select switch plug J81 location



WELD TERMINALS ON SWITCH REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Weld Terminals ON Switch.

MATERIALS NEEDED

5/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the rear of the weld terminals ON switch. See Wiring Diagram.
6. Label and disconnect leads 255, 256B and 256A from the rear of the weld terminal ON switch. See ***Figure F.2***. See Wiring Diagram.
7. Squeeze the mounting tabs of the switch and push the switch outward and away from the machine. See ***Figure F.2***. Retain the switch backing plate for reassembly.
8. The weld terminal ON switch can now be replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new weld terminals ON switch into the control panel and press firmly to seat the switch into the switch backing plate.
2. Connect leads 255, 256B and 256A to the rear of the weld terminal ON switch. See Wiring Diagram.
3. Carefully raise the control panel into the upright position.
4. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw location

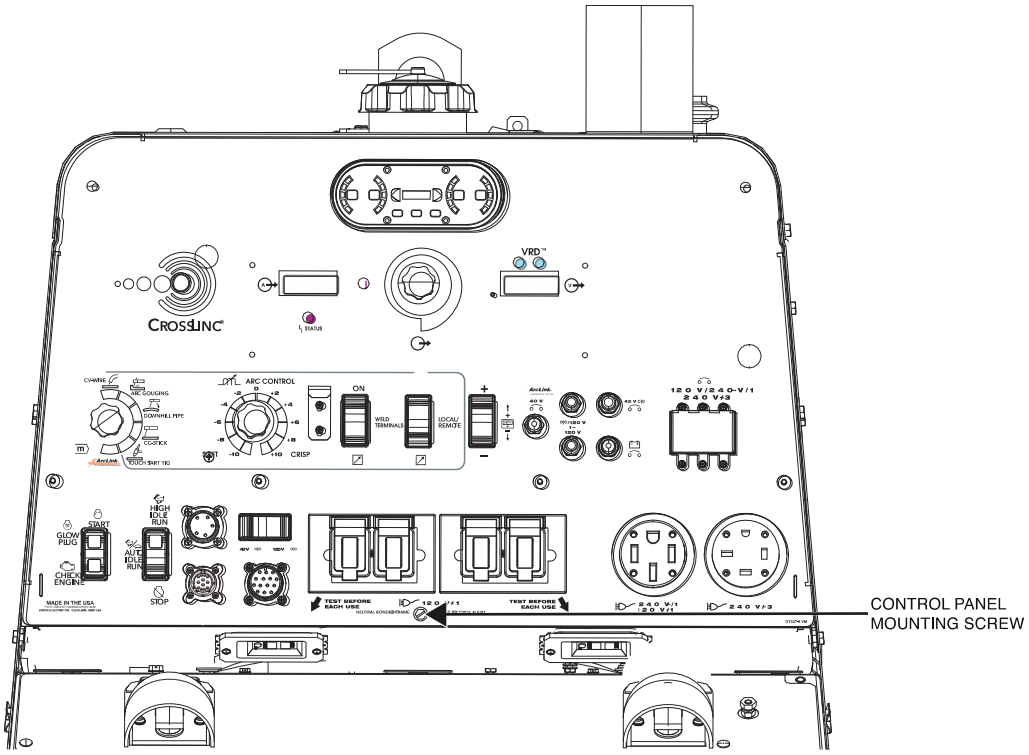
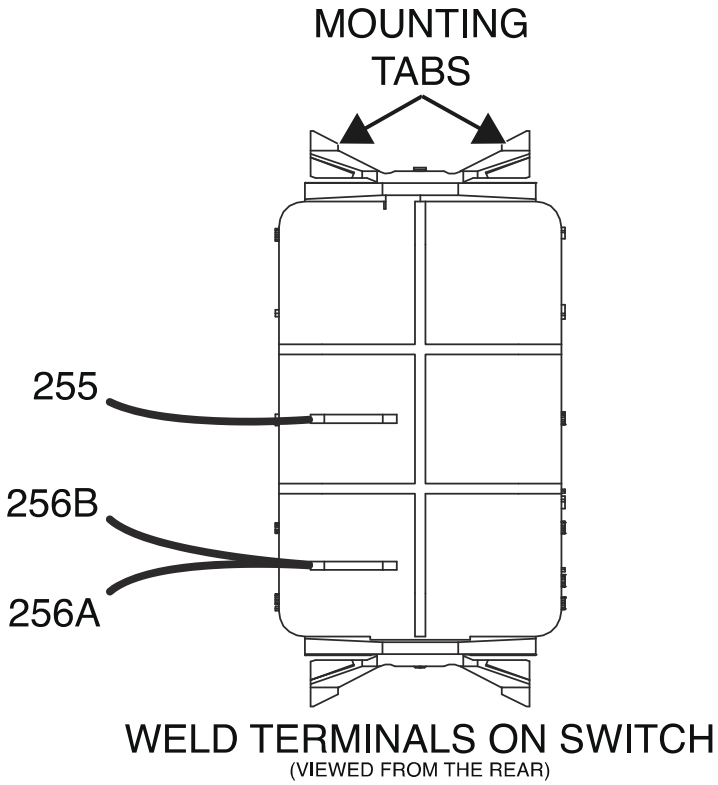


Figure F.2 – Weld terminals ON switch leads and mounting tabs location



LOCAL / REMOTE SWITCH REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Local / Remote Switch.

MATERIALS NEEDED

5/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the rear of the local / remote switch. See Wiring Diagram.
6. Label and disconnect leads 255, 256B and 256C from the rear of the local / remote switch. See ***Figure F.2***. See Wiring Diagram.
7. Squeeze the mounting tabs of the switch and push the switch outward and away from the machine. See ***Figure F.2***. Retain the switch backing plate for reassembly.
8. The local / remote switch can now be replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new local / remote switch into the control panel and press firmly to seat the switch into the switch backing plate.
2. Connect leads 255, 256B and 256C to the rear of the local / remote switch. See Wiring Diagram.
3. Carefully raise the control panel into the upright position.
4. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw location

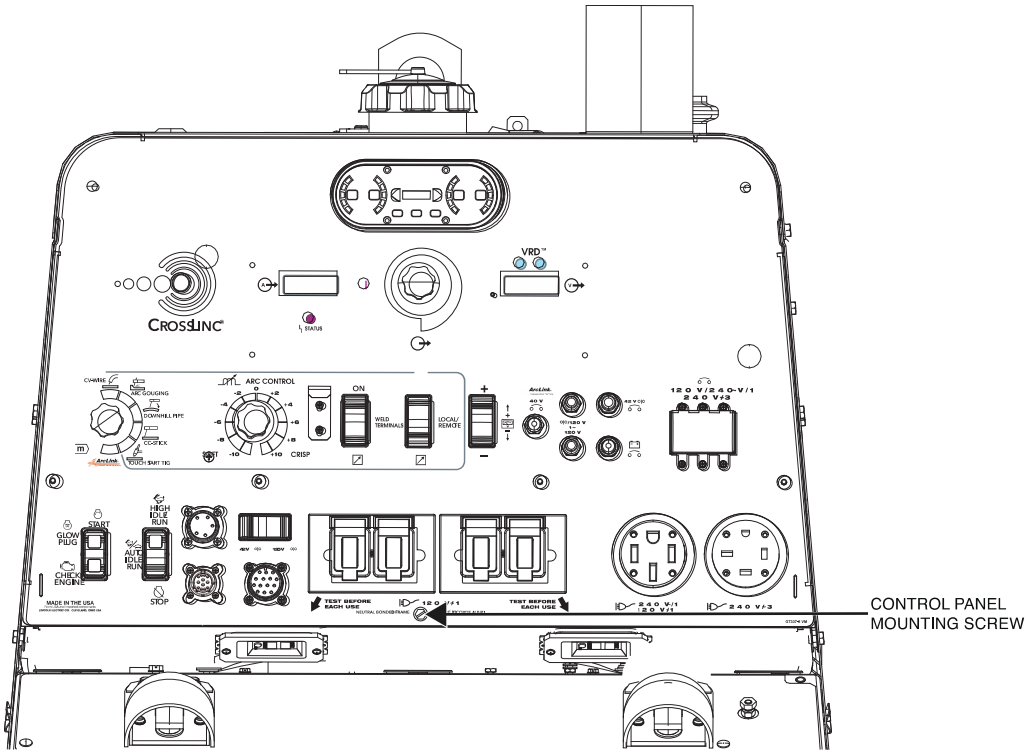
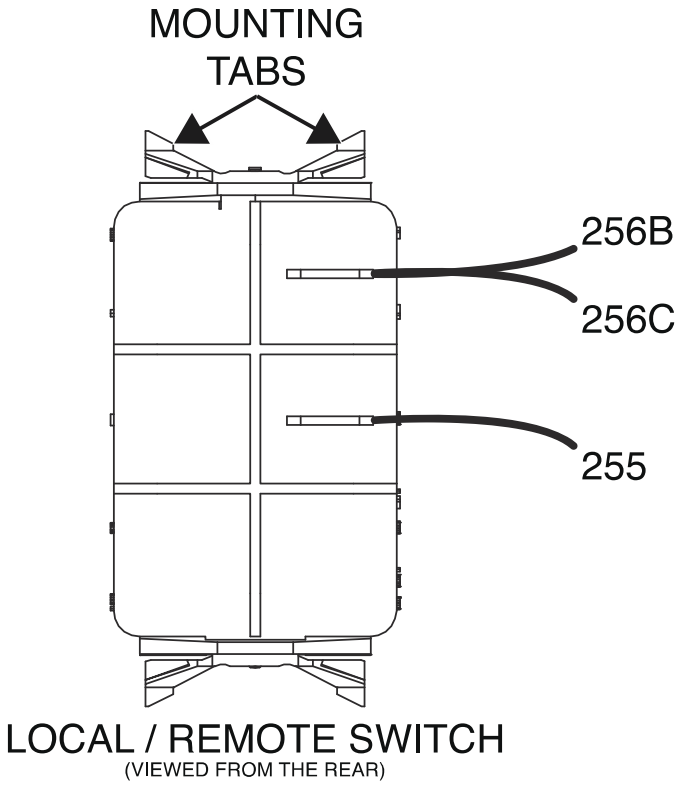


Figure F.2 – Local / remote switch leads and mounting tabs location



WIRE FEEDER VOLTMETER POLARITY SWITCH REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Wire Feeder Voltmeter Polarity Switch.

MATERIALS NEEDED

5/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the rear of the wire feeder voltmeter polarity switch. See Wiring Diagram.
6. Label and disconnect leads 206A, 206F, 21, 208A, 208F, 256C and 258 from the rear of the wire feeder voltmeter polarity switch. See ***Figure F.2***. See Wiring Diagram.
7. Squeeze the side tabs of the switch and push the switch outward and away from the machine. See ***Figure F.2***. Retain the switch backing plate for reassembly.
8. The wire feeder voltmeter polarity switch can now be replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new wire feeder voltmeter polarity switch into the control panel and press firmly to seat the switch into the switch backing plate.
2. Connect leads 206A, 206F, 21, 208A, 208F, 256C and 258 to the rear of the wire feeder voltmeter polarity switch. See Wiring Diagram.
3. Carefully raise the control panel into the upright position.
4. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw location

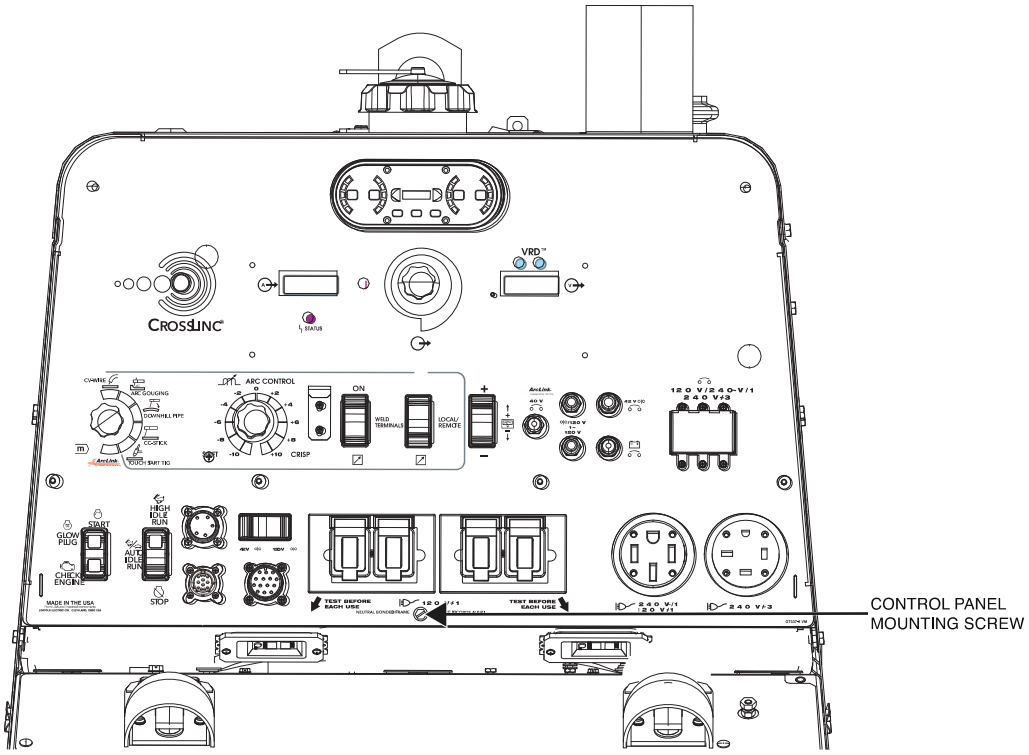
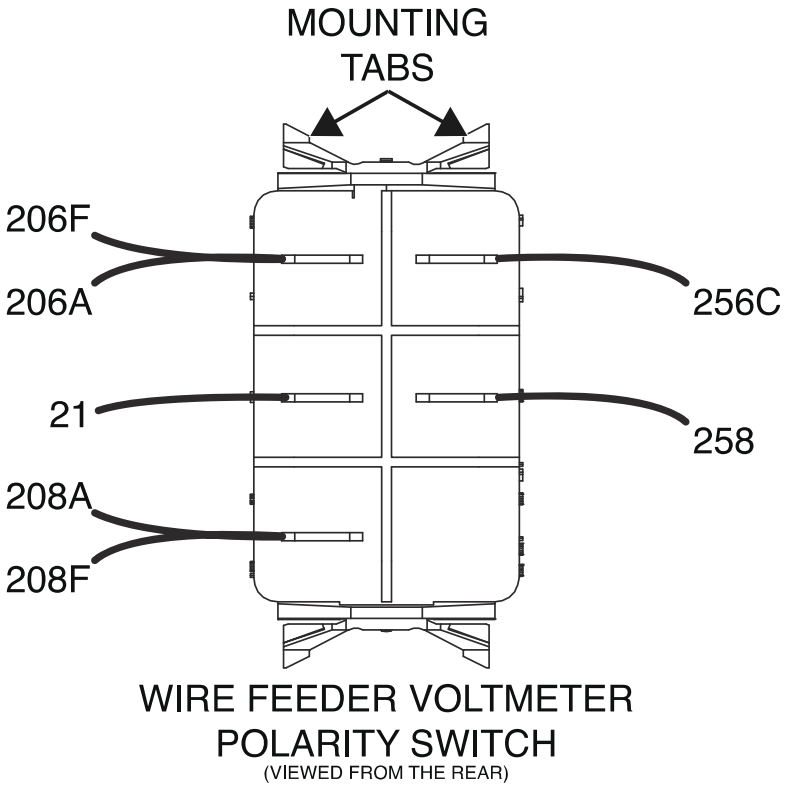


Figure F.2 – Wire feeder voltmeter polarity switch leads and mounting tabs location



42V / 120V WIRE FEEDER VOLTAGE SWITCH REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the 42V / 120V Wire Feeder Voltage Switch.

MATERIALS NEEDED

5/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the rear of the 42V / 120V wire feeder voltage switch. See Wiring Diagram.
6. Label and disconnect leads 42B, 42A, 32, and 32A from the rear of the 42V / 120V wire feeder voltage switch. See ***Figure F.2***. See Wiring Diagram.
7. Squeeze the side tabs of the switch and push the switch outward and away from the machine. See ***Figure F.2***. Retain the switch backing plate for reassembly.
8. The 42V / 120V wire feeder voltage switch can now be replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new 42V / 120V wire feeder voltage switch into the control panel and press firmly to seat the switch into the switch backing plate.
2. Connect leads 42B, 42A, 32, and 32A to the rear of the 42V / 120V wire feeder voltage switch. See Wiring Diagram.
3. Carefully raise the control panel into the upright position.
4. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw location

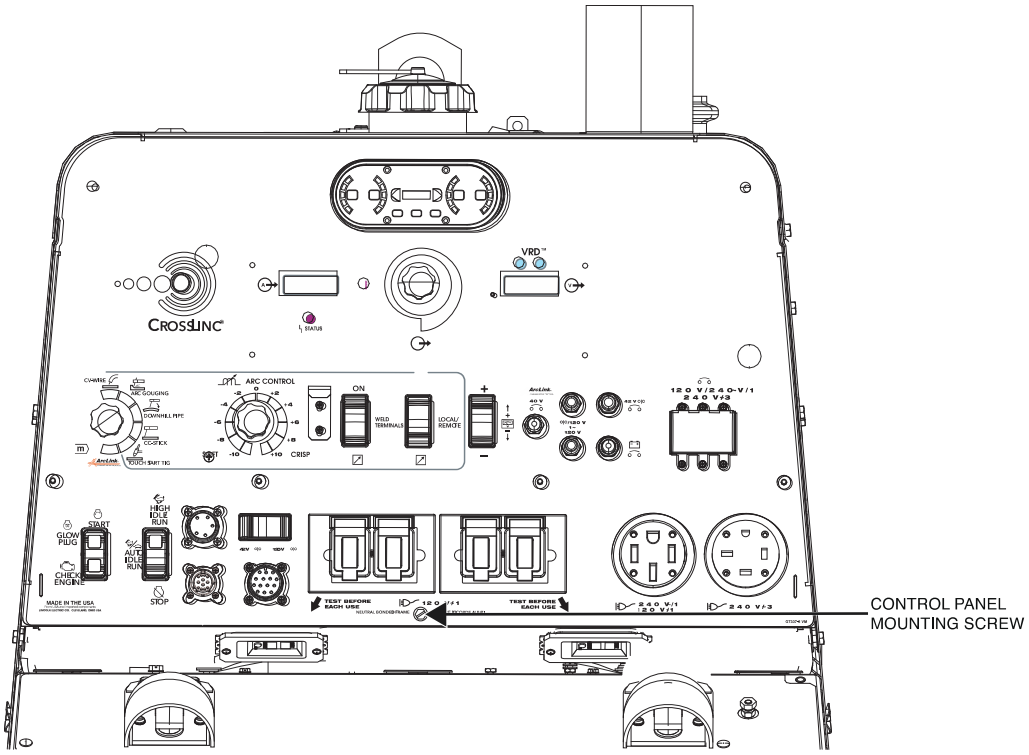
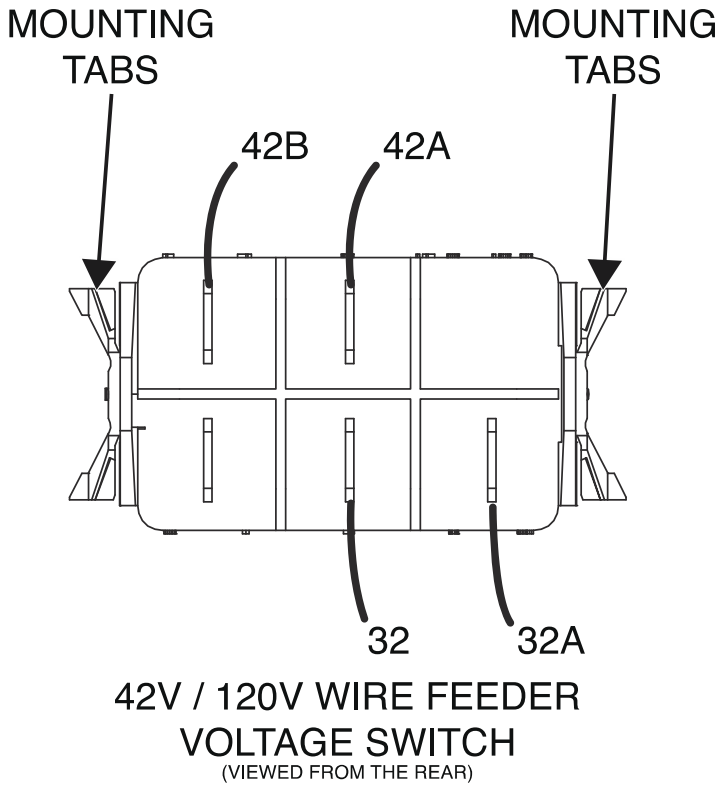


Figure F.2 – 42V / 120V wire feeder voltage switch leads and mounting tabs location



RUN / STOP / IDLE SWITCH REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Run / Stop / Idle Switch.

MATERIALS NEEDED

5/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the rear of the run / stop / idle switch. See Wiring Diagram.
6. Label and disconnect leads 232, 232A, 236A, 55, 256, 256A, and 257 from the rear of the run / stop / idle switch. See ***Figure F.2***. See Wiring Diagram.
7. Squeeze the side tabs of the switch and push the switch outward and away from the machine. See ***Figure F.2***. Retain the switch backing plate for reassembly.
8. The run / stop / idle switch can now be replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new run / stop / idle switch into the control panel and press firmly to seat the switch into the switch backing plate.
2. Connect leads 232, 232A, 236A, 55, 256, 256A, and 257 to the rear of the run / stop / idle switch. See Wiring Diagram.
3. Carefully raise the control panel into the upright position.
4. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw location

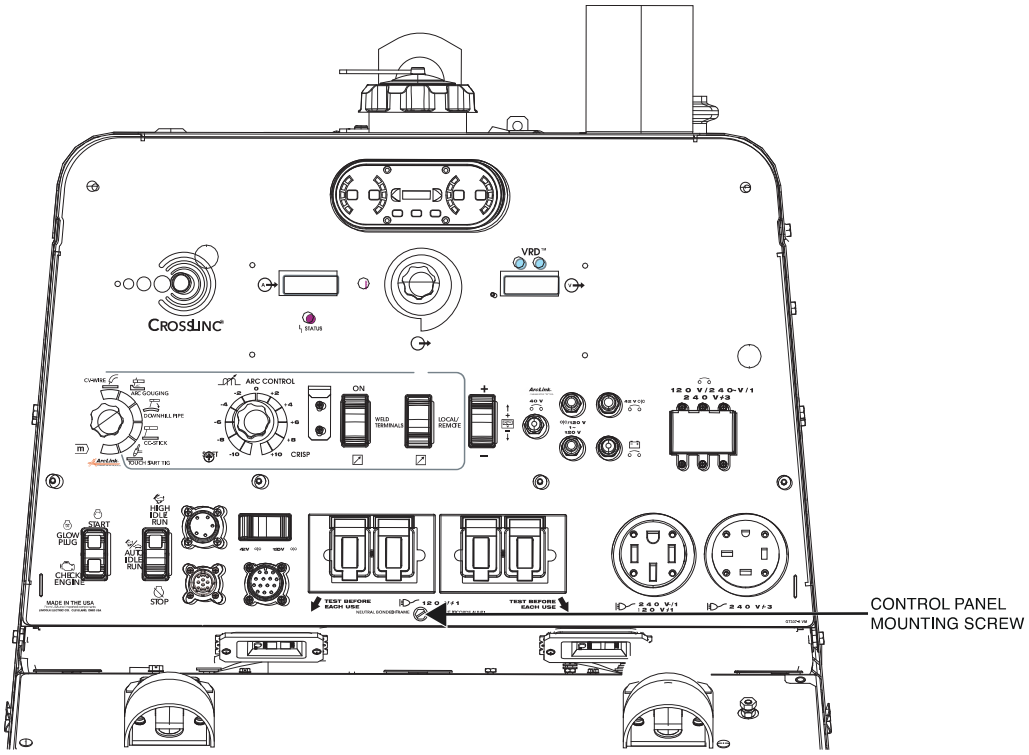
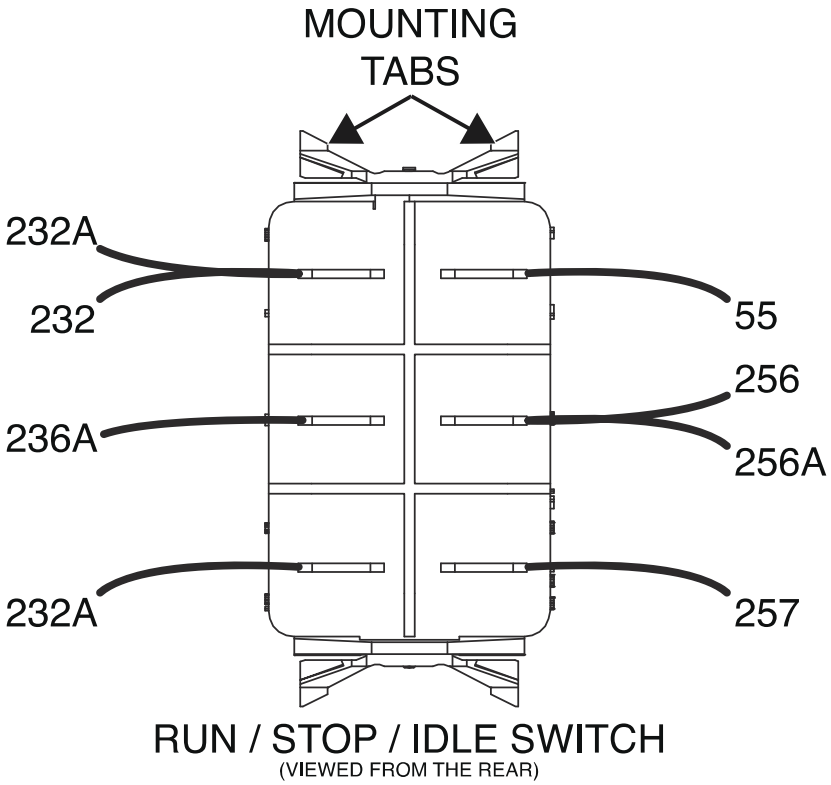


Figure F.2 – Run / stop / idle switch leads and mounting tabs location



START / GLOW PLUG SWITCH REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Start / Glow Plug Switch.

MATERIALS NEEDED

5/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the rear of the start / glow plug switch. See Wiring Diagram.
6. Label and disconnect leads 232N, 232NA, ECB35, ECB70, ECB48, and ECB65 from the rear of the start / glow plug switch. See ***Figure F.2***. See Wiring Diagram.
7. Squeeze the side tabs of the switch and push the switch outward and away from the machine. See ***Figure F.2***. Retain the switch backing plate for reassembly.
8. The start / glow plug switch can now be replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new start / glow plug switch into the control panel and press firmly to seat the switch into the switch backing plate.
2. Connect leads 232N, 232NA, ECB35, ECB70, ECB48, and ECB65 to the rear of the start / glow plug switch. See Wiring Diagram.
3. Carefully raise the control panel into the upright position.
4. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw location

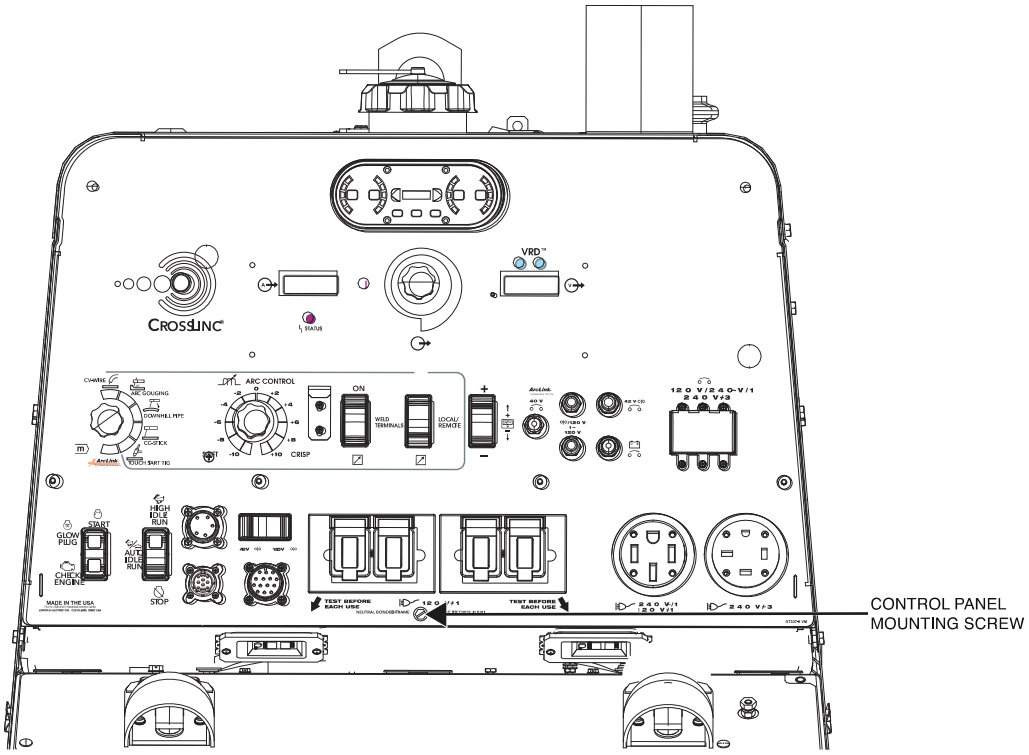
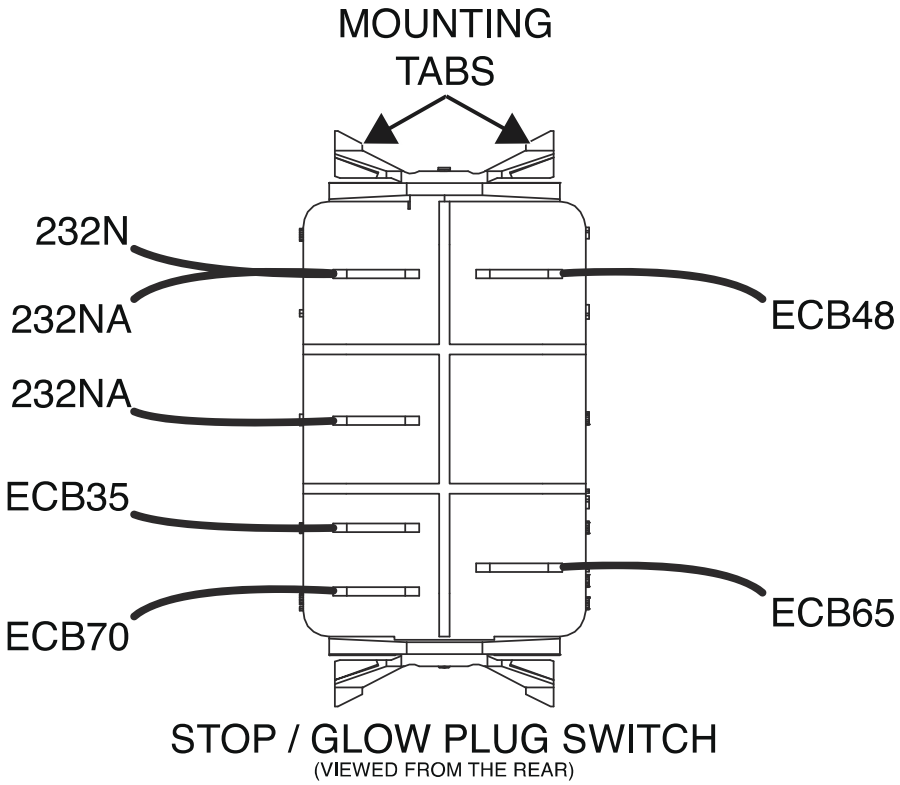


Figure F.2 – Start / glow plug leads and mounting tabs location



GLOW RELAY REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Glow Relay.

MATERIALS NEEDED

5/16” Nutdriver
3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the four screws securing the circuit breaker box cover to the circuit breaker box. See ***Figure F.1***.
5. Carefully unplug the glow relay from the mounting socket. See ***Figure F.2***. See Wiring Diagram.
6. Using a 3/8” nutdriver, remove the nut securing the mounting socket to the circuit breaker box. See ***Figure F.2***.
7. Carefully disconnect leads ECA35A, ECA45A, ECA23A, 239, 239A, and 239B from the mounting socket. See Wiring Diagram.
8. The glow relay can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Connect leads ECA35A, ECA45A, ECA23A, 239, 239A, and 239B to the mounting socket. See Wiring Diagram.
2. Using a 3/8” nutdriver, attach the nut securing the mounting socket to the circuit breaker box.
3. Plug the glow relay into the mounting socket. See Wiring Diagram.
4. Using a 5/16” nutdriver, attach the four screws securing the circuit breaker box cover to the circuit breaker box.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Circuit breaker box and circuit breaker box cover location

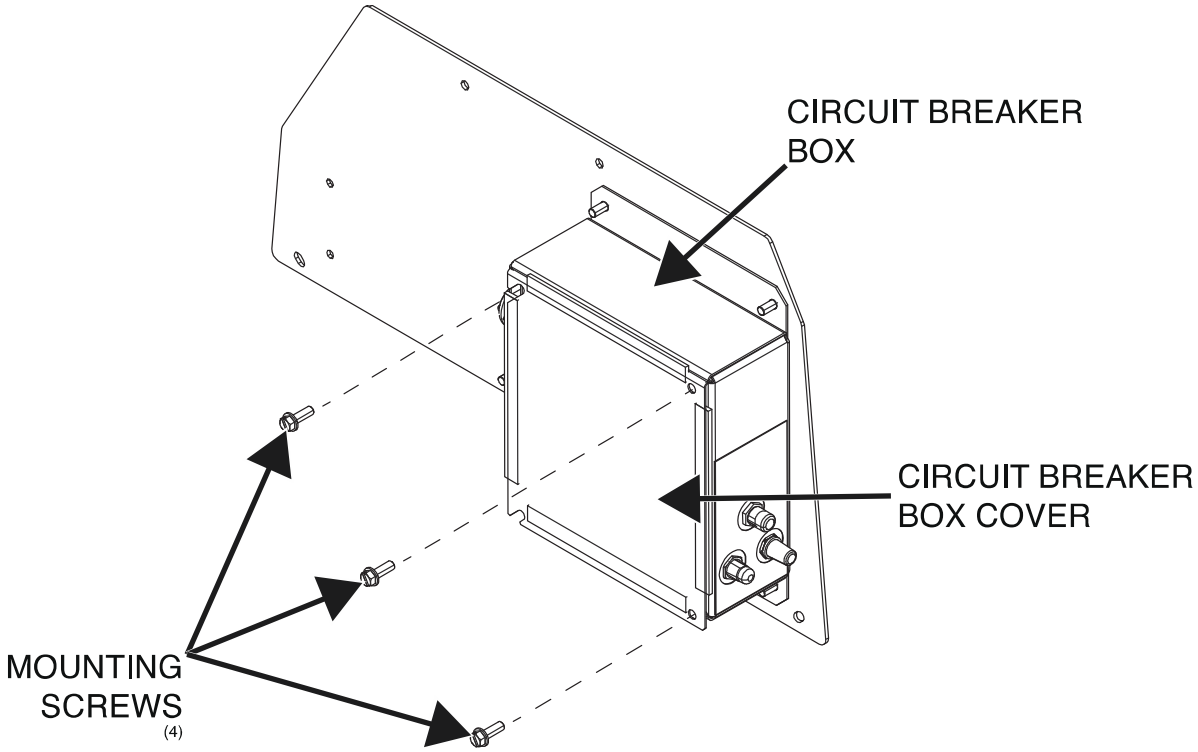
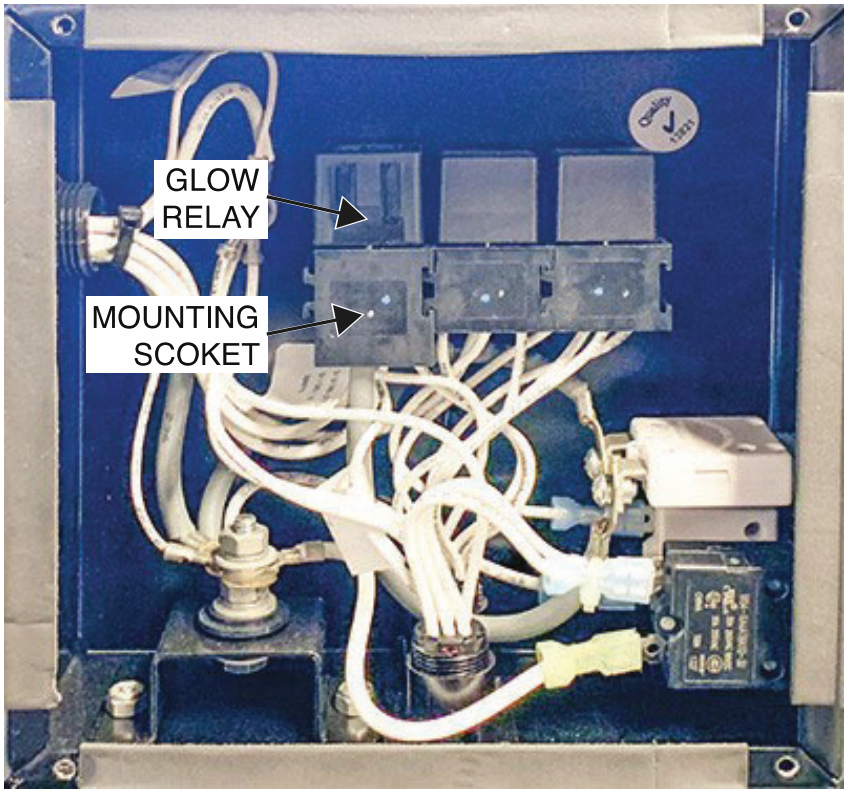


Figure F.2 – Glow relay and glow relay mounting socket location



FUEL RELAY REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Fuel Relay.

MATERIALS NEEDED

5/16” Nutdriver
3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the four screws securing the circuit breaker box cover to the circuit breaker box. See ***Figure F.1***.
5. Carefully unplug the fuel relay from the mounting socket. See ***Figure F.2***. See Wiring Diagram.
6. Using a 3/8” nutdriver, remove the nut securing the mounting socket to the circuit breaker box. See ***Figure F.2***.
7. Carefully disconnect leads ECB26A, 226, 226A, and ECB90A from the mounting socket. See Wiring Diagram.
8. The fuel relay can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Connect leads ECB26A, 226, 226A, and ECB90A to the mounting socket. See Wiring Diagram.
2. Using a 3/8” nutdriver, attach the nut securing the mounting socket to the circuit breaker box.
3. Plug the fuel relay into the mounting socket. See Wiring Diagram.
4. Using a 5/16” nutdriver, attach the four screws securing the circuit breaker box cover to the circuit breaker box.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Circuit breaker box and circuit breaker box cover location

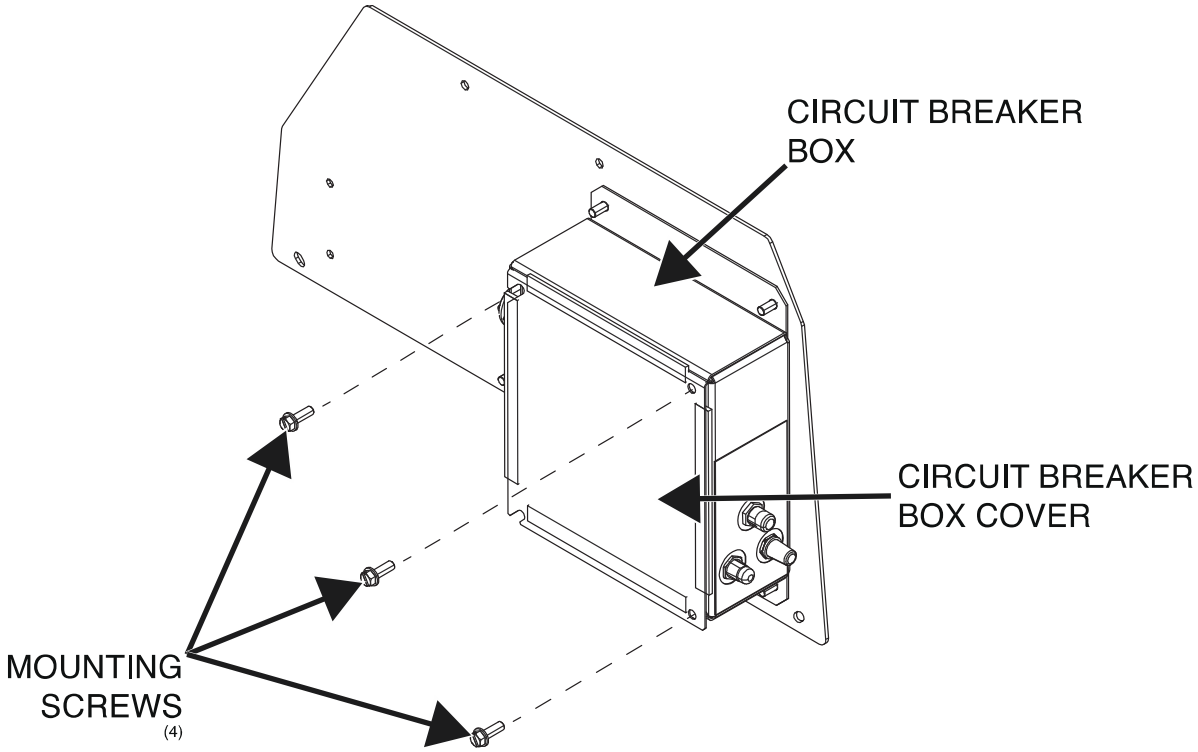
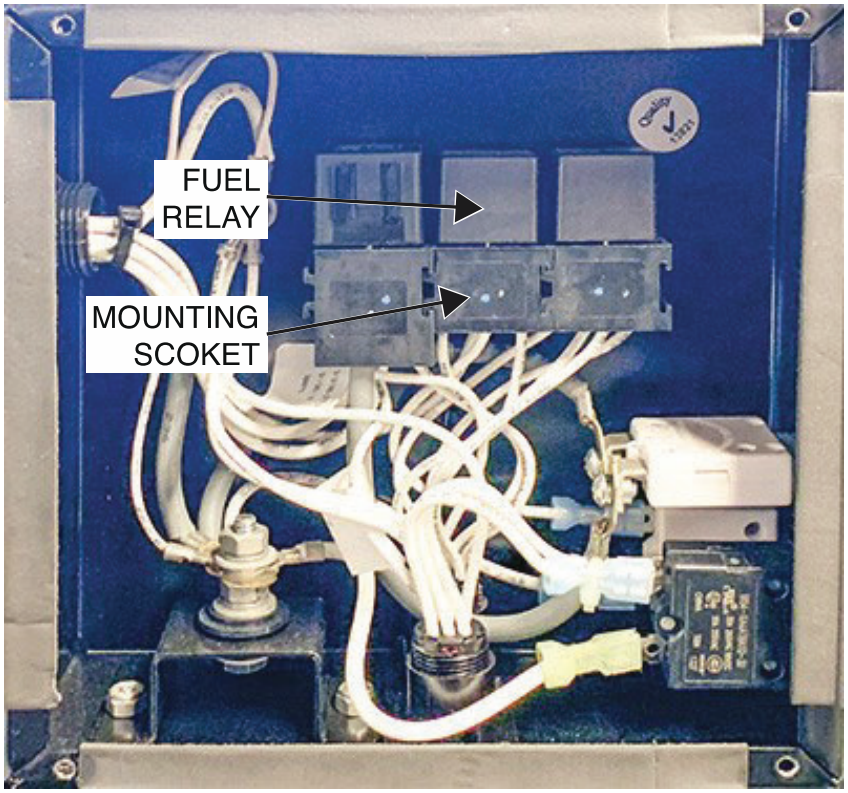


Figure F.2 – Fuel relay and fuel relay mounting socket location



IDLE RELAY REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Idle Relay.

MATERIALS NEEDED

5/16” Nutdriver
3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the four screws securing the circuit breaker box cover to the circuit breaker box. See ***Figure F.1***.
5. Carefully unplug the idle relay from the mounting socket. See ***Figure F.2***. See Wiring Diagram.
6. Using a 3/8” nutdriver, remove the nut securing the mounting socket to the circuit breaker box. See ***Figure F.2***.
7. Carefully disconnect leads ECB80A, 405A, 232DA, and ECB74A from the mounting socket. See Wiring Diagram.
8. The idle relay can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Connect leads ECB80A, 405A, 232DA, and ECB74A to the mounting socket. See Wiring Diagram.
2. Using a 3/8” nutdriver, attach the nut securing the mounting socket to the circuit breaker box.
3. Plug the idle relay into the mounting socket. See Wiring Diagram.
4. Using a 5/16” nutdriver, attach the four screws securing the circuit breaker box cover to the circuit breaker box.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Circuit breaker box and circuit breaker box cover location

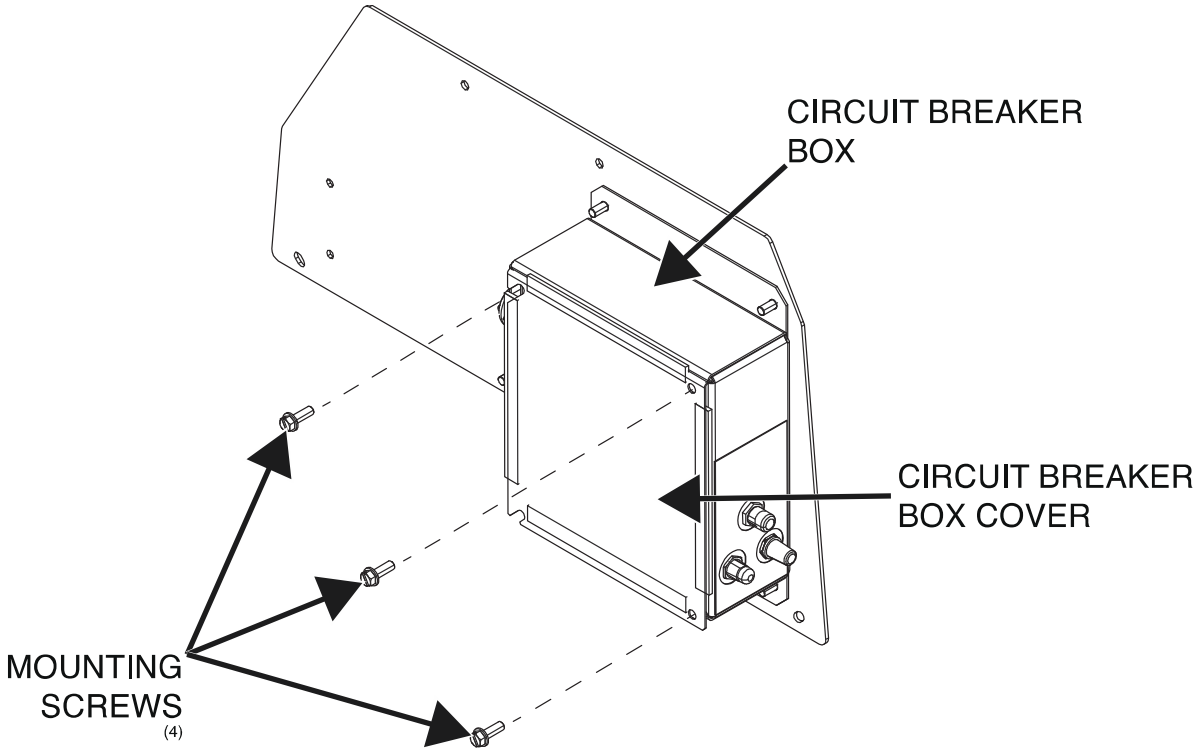
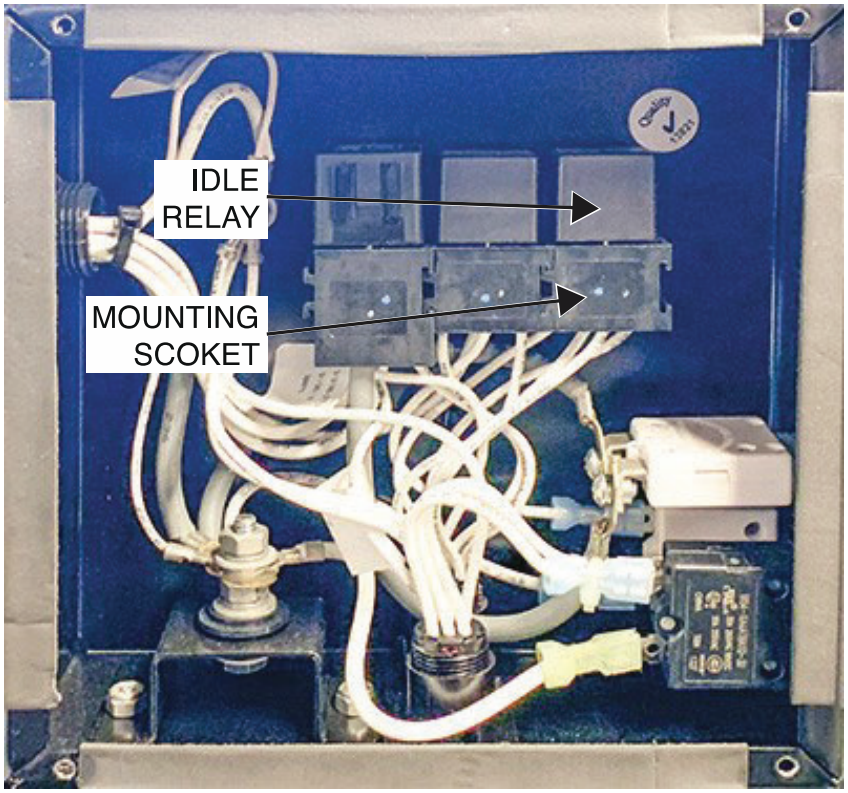


Figure F.2 – Idle relay and idle relay mounting socket location



BOOST RELAY REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Boost Relay.

MATERIALS NEEDED

Phillips Screwdriver
3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a Phillips screwdriver, loosen the four screws securing leads F1, F1A, 232P, and 271 to terminals 1, 2, 3, and 4 of the boost relay. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the two nuts, lock washers, flat washers, spacers, and screws securing the boost relay to the fan baffle. See ***Figure F.2***.
6. The boost relay can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new boost relay onto the fan baffle.
2. Using a 3/8” nutdriver, attach the two nuts, lock washers, flat washers, spacers, and screws securing the boost relay to the fan baffle.
3. Using a Phillips screwdriver, tighten the four screws securing leads F1, F1A, 232P, and 271 to terminals 1, 2, 3, and 4 of the boost relay. See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Boost relay lead locations

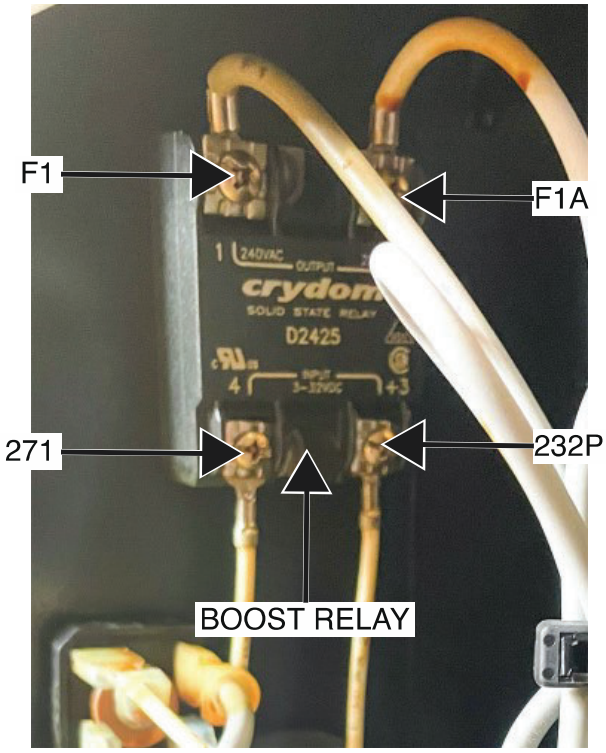
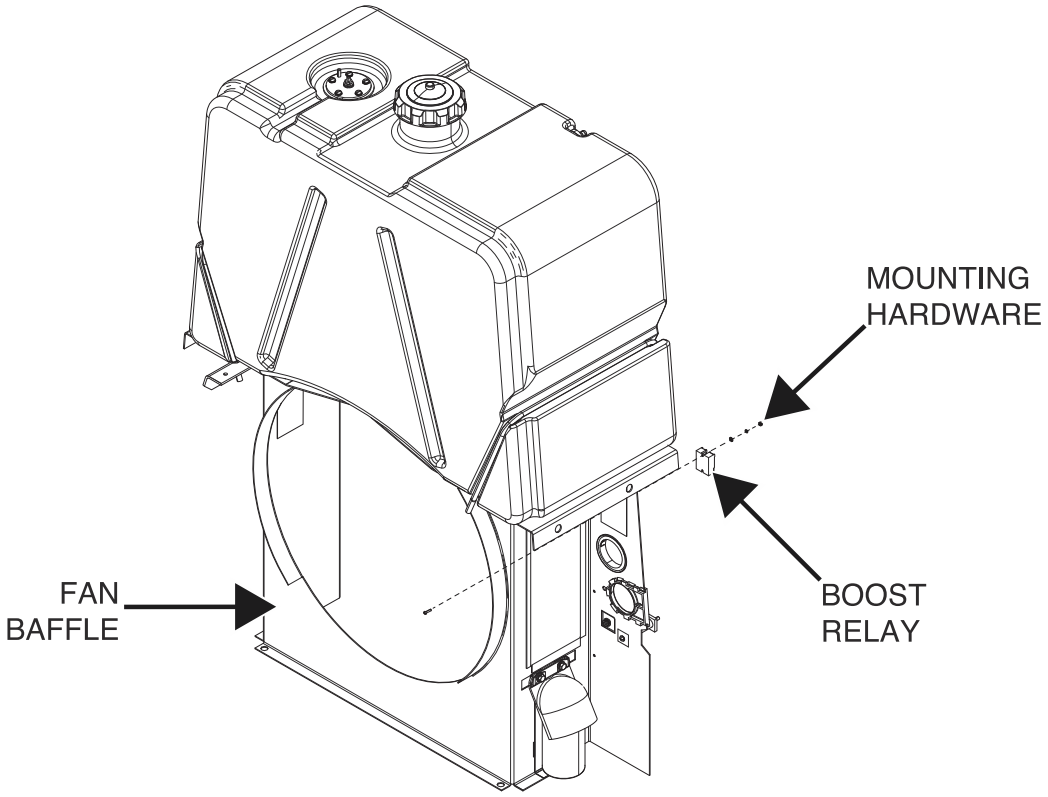


Figure F.2 – Boost relay mounting hardware locations



D1 RECTIFIER REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the D1 Rectifier.

MATERIALS NEEDED

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

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect leads 200, 200A, 200D, F1A, 201A, 201C, 5H, and 5R from the D1 rectifier. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the nut, lock washer, flat washer, spacer, and screw securing the D1 rectifier to the fan baffle. See ***Figure F.2***.
6. The D1 rectifier can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Apply a thin coating of Dow Corning 340 heat sink compound to the rear of the diode.
2. Carefully position the new D1 rectifier to the fan baffle.
3. Using a 3/8” nutdriver, attach the nut, lock washer, flat washer, spacer, and screw securing the D1 rectifier to the fan baffle.
4. Connect leads 200, 200A, 200D, F1A, 201A, 201C, 5H, and 5R to the D1 rectifier. See Wiring Diagram.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – D1 rectifier lead locations

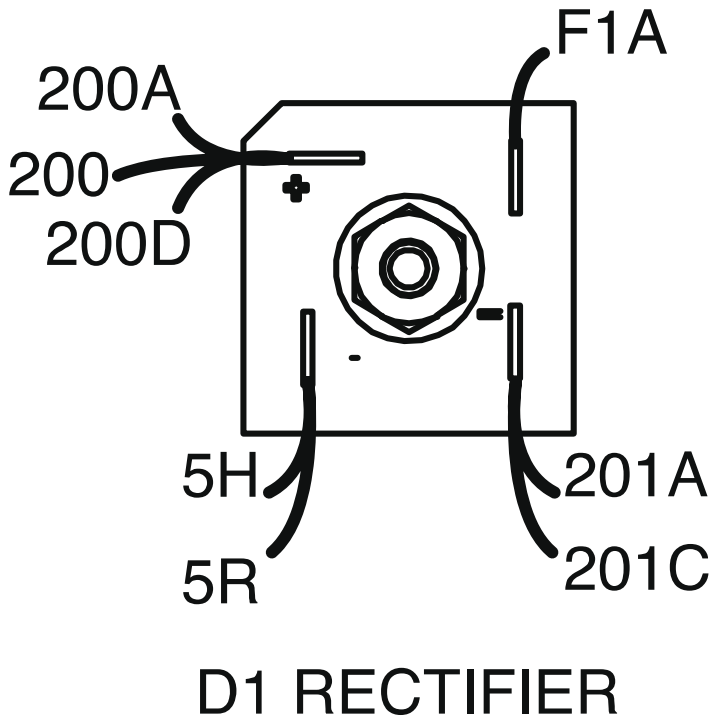
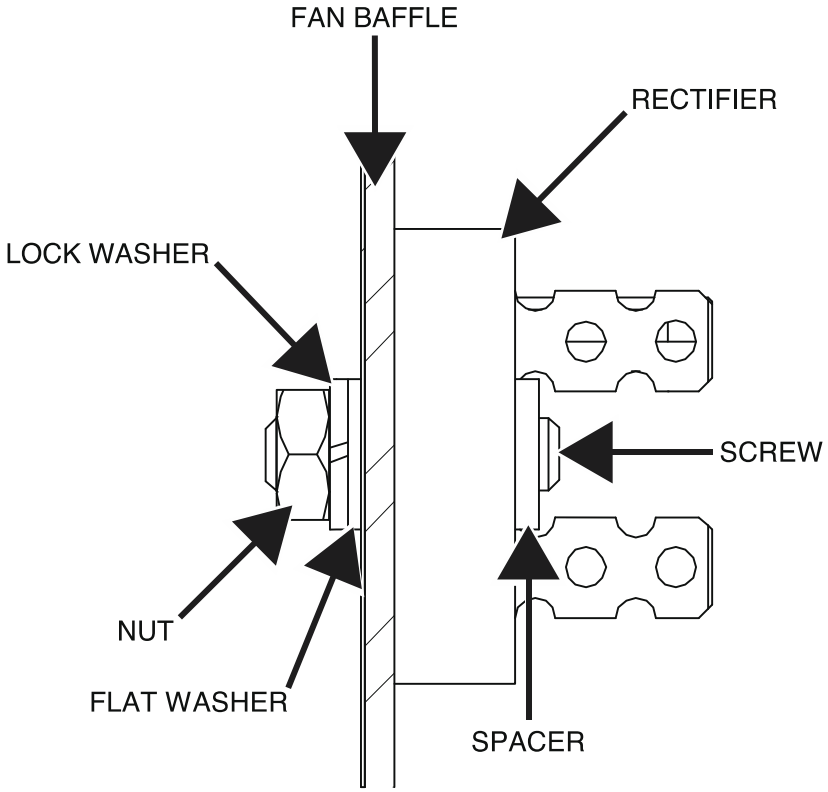


Figure F.2 – D1 rectifier mounting hardware locations



D2 RECTIFIER REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the D2 Rectifier.

MATERIALS NEEDED

5/16” Nutdriver
3/8” Nutdriver
Dow Corning 340 Heat Sink Compound (Lincoln Part #T12837)
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the D2 rectifier. See Wiring Diagram.
6. Label and disconnect leads 65A, 45, 66A, and 46A from the D2 rectifier. See ***Figure F.2***. See Wiring Diagram.
7. Using a 3/8” nutdriver, remove the nut, lock washer, flat washer, and spacer securing the D2 rectifier to the 40V bus board mounting plate. See ***Figure F.3***. See Wiring Diagram.
8. The D2 rectifier can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Apply a thin coating of Dow Corning 340 heat sink compound to the rear of the diode.
2. Carefully position the new D2 rectifier onto the 42V bus board mounting plate.
3. Using a 3/8” nutdriver, attach the nut, lock washer, flat washer, and spacer securing the D2 rectifier to the 40V bus board mounting plate.
4. Connect leads 65A, 45, 66A, and 46A to the D2 rectifier. See Wiring Diagram.
5. Carefully raise the control panel into the upright position.
6. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position.
7. Perform the ***Case Cover Replacement Procedure***.
8. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw location

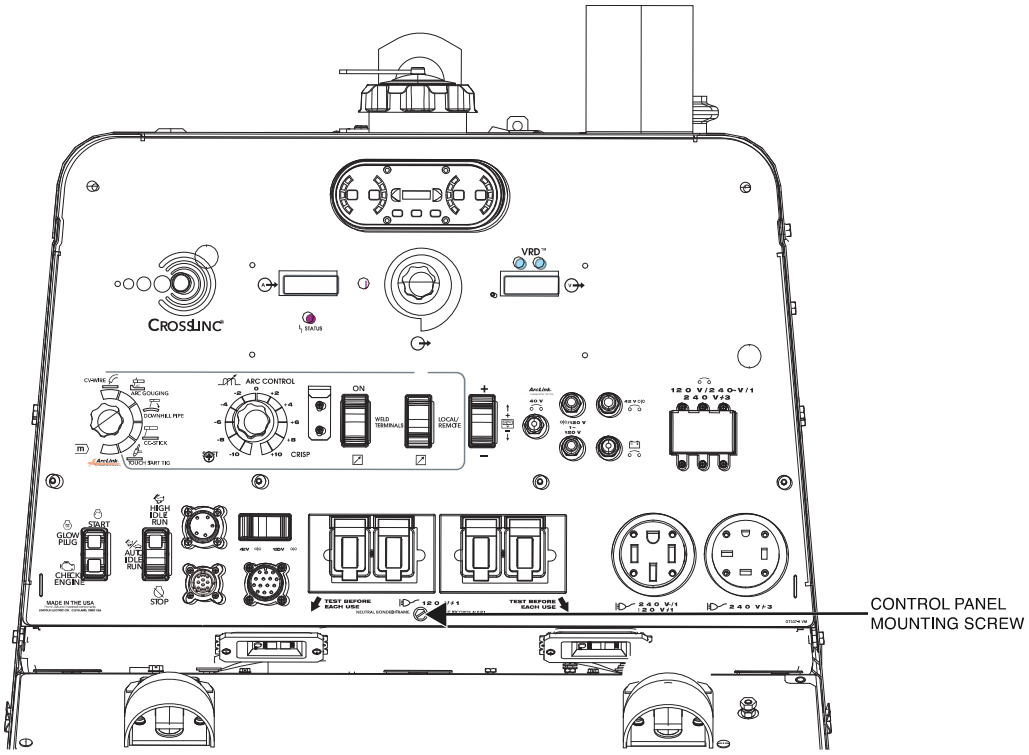


Figure F.2 – D2 rectifier lead locations

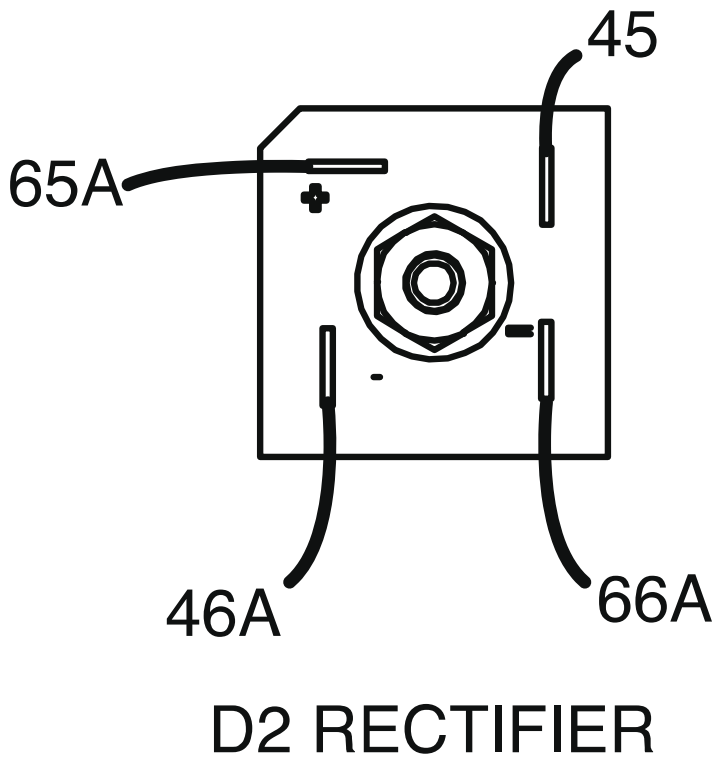
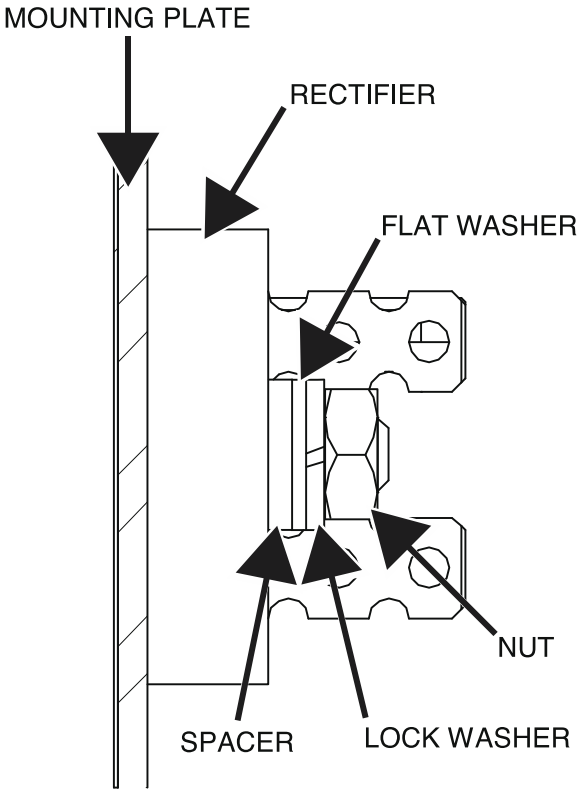


Figure F.3 – D2 rectifier mounting hardware locations



D3 RECTIFIER REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the D3 Rectifier.

MATERIALS NEEDED

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

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect leads 200D, F2, 201C, and 5R from the D3 rectifier. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the nut, lock washer, flat washer, spacer, and screw securing the D3 rectifier to the fan baffle. See ***Figure F.2***.
6. The D1 rectifier can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Apply a thin coating of Dow Corning 340 heat sink compound to the rear of the diode.
2. Carefully position the new D3 rectifier onto the fan baffle.
3. Using a 3/8” nutdriver, attach the nut, lock washer, flat washer, spacer, and screw securing the D3 rectifier to the fan baffle.
4. Connect leads 200D, F2, 201C, and 5R to the D3 rectifier. See Wiring Diagram.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – D3 rectifier lead locations

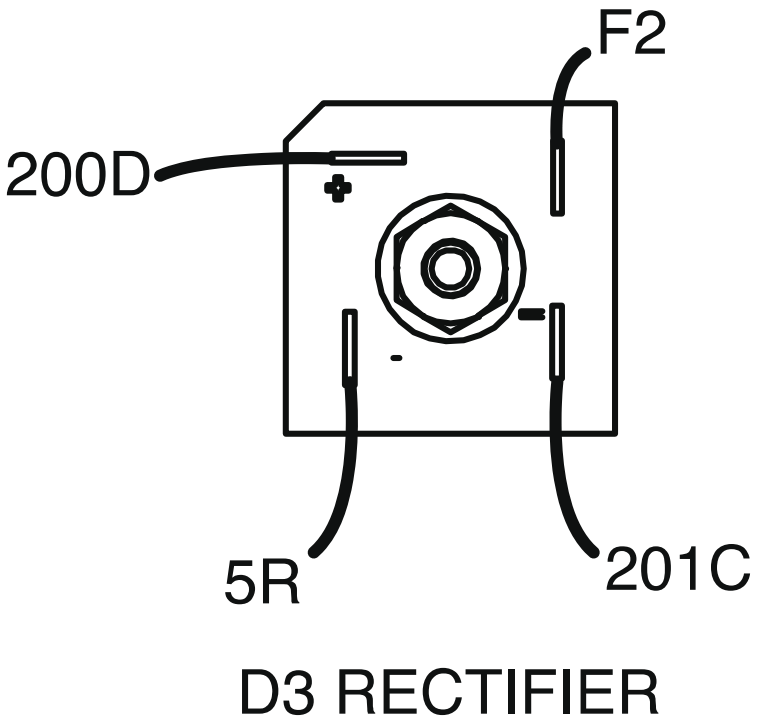
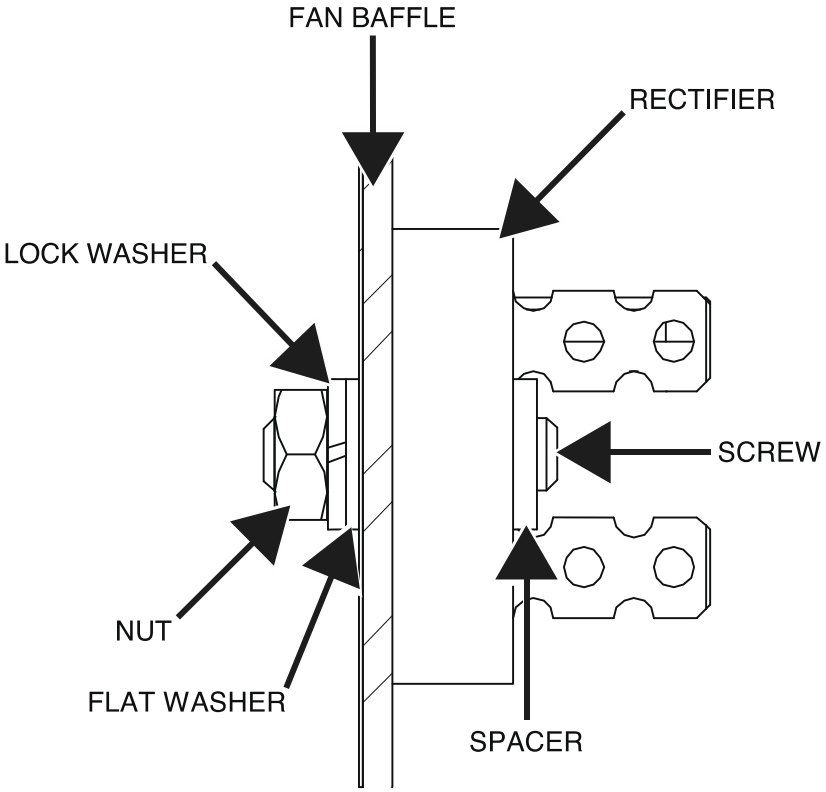


Figure F.2 – D3 rectifier mounting hardware locations



CB1 CIRCUIT BREAKER REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the CB1 Circuit Breaker.

MATERIALS NEEDED

5/16” Nutdriver
Slotted Screwdriver
Phillips Screwdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the CB1 circuit breaker. See Wiring Diagram.
6. Using a slotted screwdriver, loosen the 6 screws securing leads 6, 4, 3, 6B, 4A, and 3A to the CB1 circuit breaker. See ***Figure F.2***. See Wiring Diagram. Label and disconnect leads.
7. Using a Phillips screwdriver, remove the six screws and washers securing the CB1 circuit breaker to the control panel. See ***Figure F.3***.
8. Carefully slide the CB1 circuit breaker out of the control panel and separate the circuit breaker cover form the CB1 circuit breaker. See ***Figure F.3***.
9. The CB1 circuit breaker can now be replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new CB1 circuit breaker into the circuit breaker cover.
2. Using a Phillips screwdriver, attach the six screws and washers securing the CB1 circuit breaker to the control panel.
3. Using a slotted screwdriver, tighten the 6 screws securing leads 6, 4, 3, 6B, 4A, and 3A to the CB1 circuit breaker.
4. Carefully raise the control panel into the upright position.
5. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw location

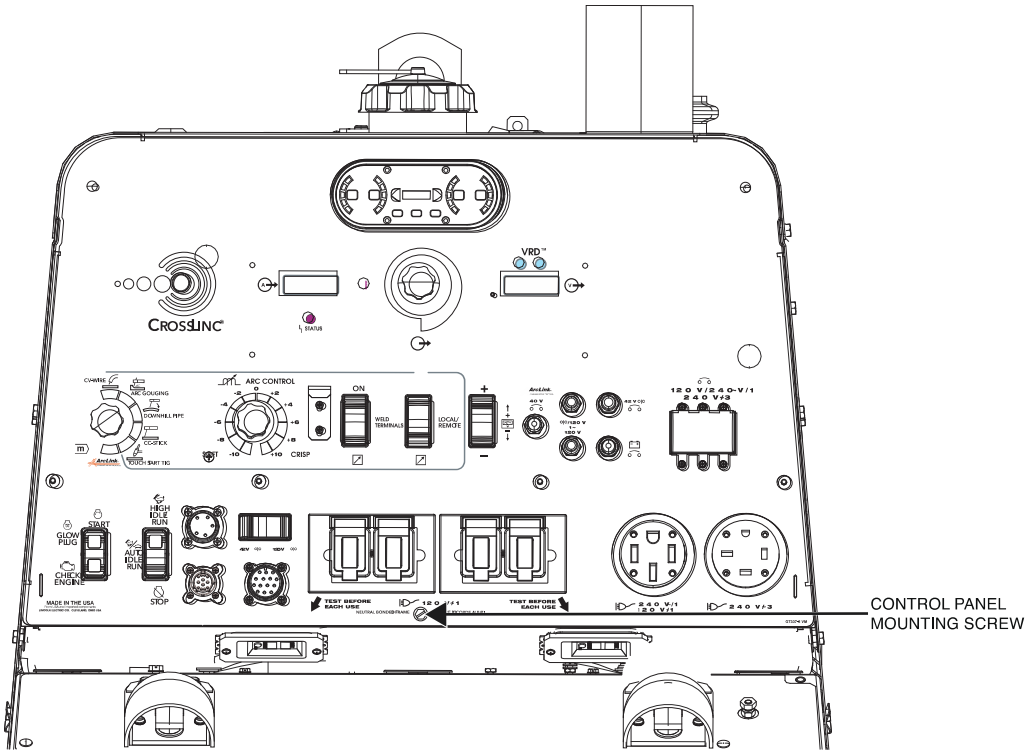


Figure F.2 – CB1 circuit breaker lead locations

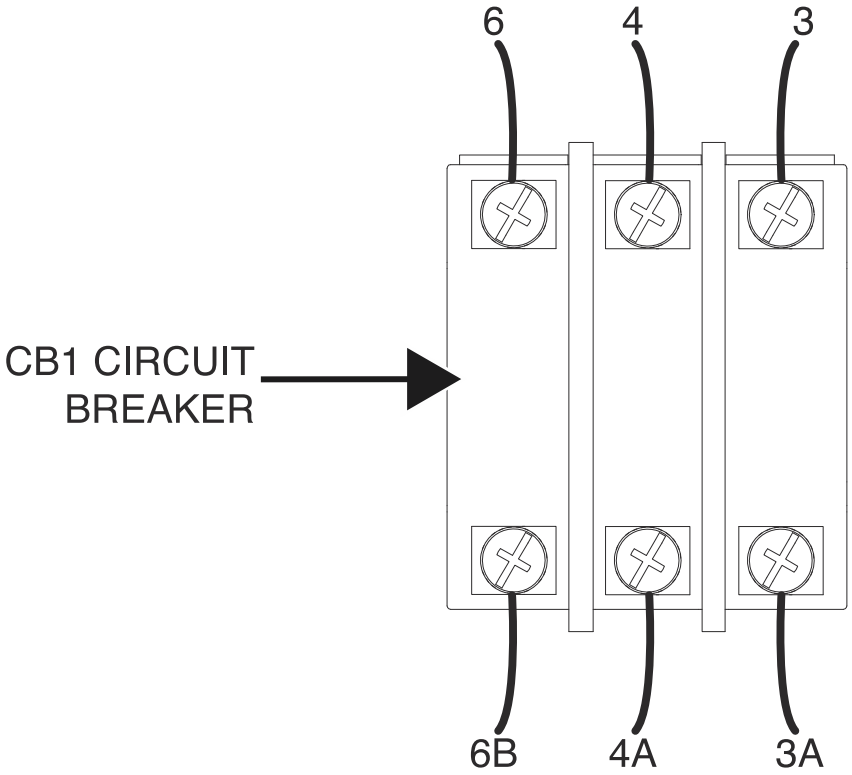
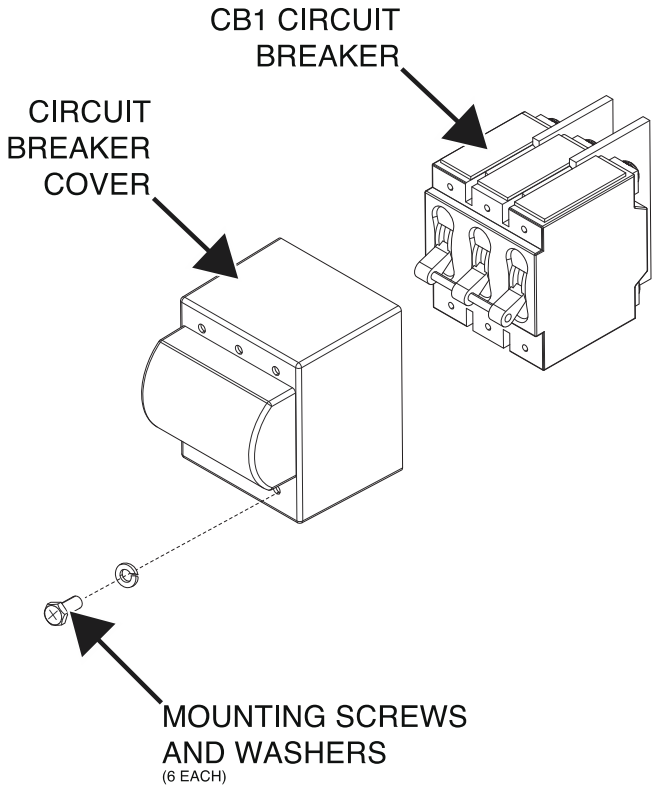


Figure F.3 – CB1 circuit breaker cover and mounting hardware locations



CB2 AND CB3 CIRCUIT BREAKERS REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the CB2 and CB3 Circuit Breakers.

MATERIALS NEEDED

5/16” Nutdriver
1/2” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the CB2 and CB3 circuit breakers. See Wiring Diagram.
6. Label and disconnect leads 3C, 32A, and 3E from the CB2 circuit breaker or leads 6D and 6F from the CB3 circuit breaker. See ***Figure F.2***. See Wiring Diagram.
7. Using a 1/2” nutdriver, remove the sealing boot securing the circuit breaker to the control panel. See ***Figure F.2***.
8. The CB2 or CB3 circuit breaker can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new CB2 or CB3 circuit breaker into the control panel.
2. Using a 1/2” nutdriver, attach the sealing boot securing the circuit breaker to the control panel.
3. Connect leads 3C, 32A, and 3E to the CB2 circuit breaker or leads 6D and 6F to the CB3 circuit breaker. See Wiring Diagram.
4. Carefully raise the control panel into the upright position.
5. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw location

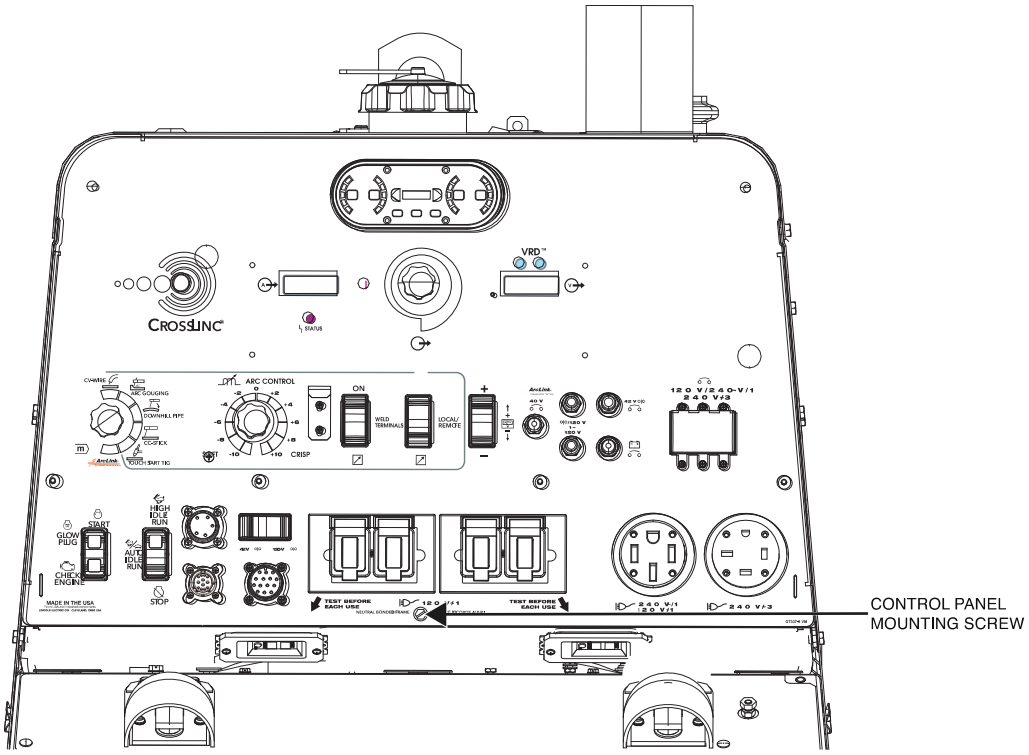
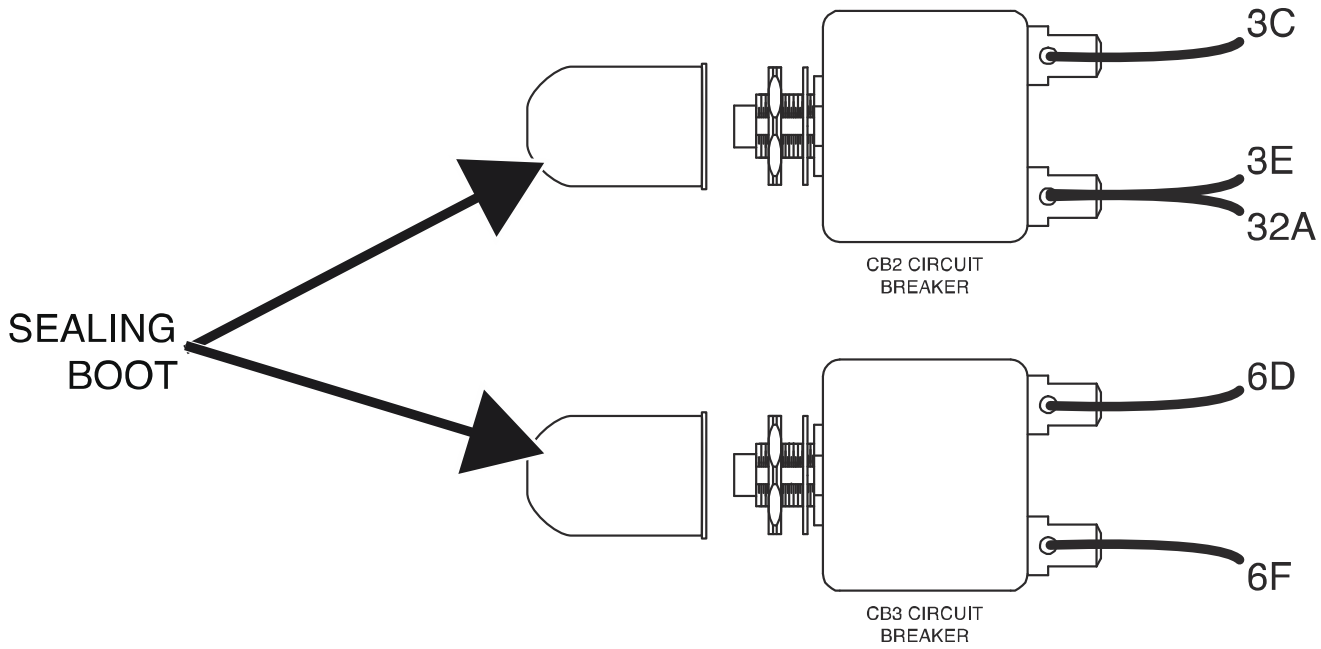


Figure F.2 – CB2 and CB3 circuit breaker leads and sealing boot locations



CB4, CB7 AND CB9 CIRCUIT BREAKERS REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the CB4, CB7, and CB9 Circuit Breakers.

MATERIALS NEEDED

5/16” Nutdriver
5/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the CB4, CB7, and CB9 circuit breakers. See Wiring Diagram.
6. Label and disconnect leads 42 and 42B from the CB4 circuit breaker or leads 236A and 238A from the CB7 circuit breaker or leads 46 and 46A from the CB9 circuit breaker. See ***Figure F.2***. See Wiring Diagram.
7. Using a 5/8” nutdriver, remove the sealing boot securing the circuit breaker to the control panel. See ***Figure F.2***.
8. The CB4, CB7, or CB9 circuit breaker can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new CB4, CB7, or CB9 circuit breaker into the control panel.
2. Using a 5/8” nutdriver, attach the sealing boot securing the circuit breaker to the control panel.
3. Connect leads 42 and 42B to the CB4 circuit breaker or leads 236A and 238A to the CB7 circuit breaker or leads 46 and 46A to the CB9 circuit breaker. See Wiring Diagram.
4. Carefully raise the control panel into the upright position.
5. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw location

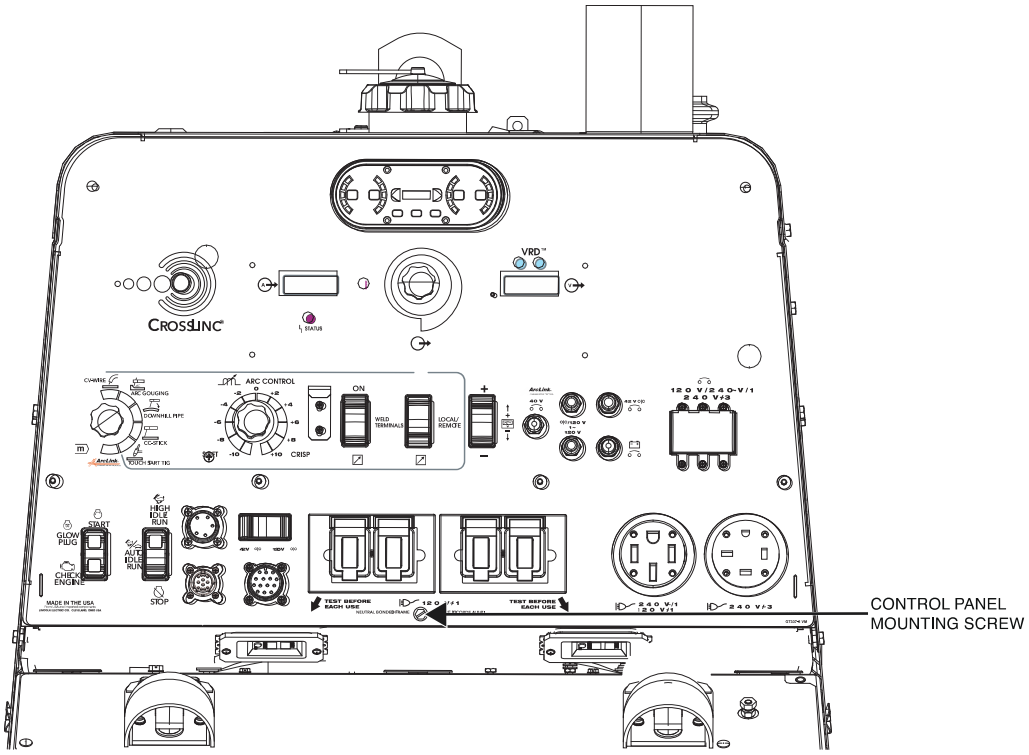
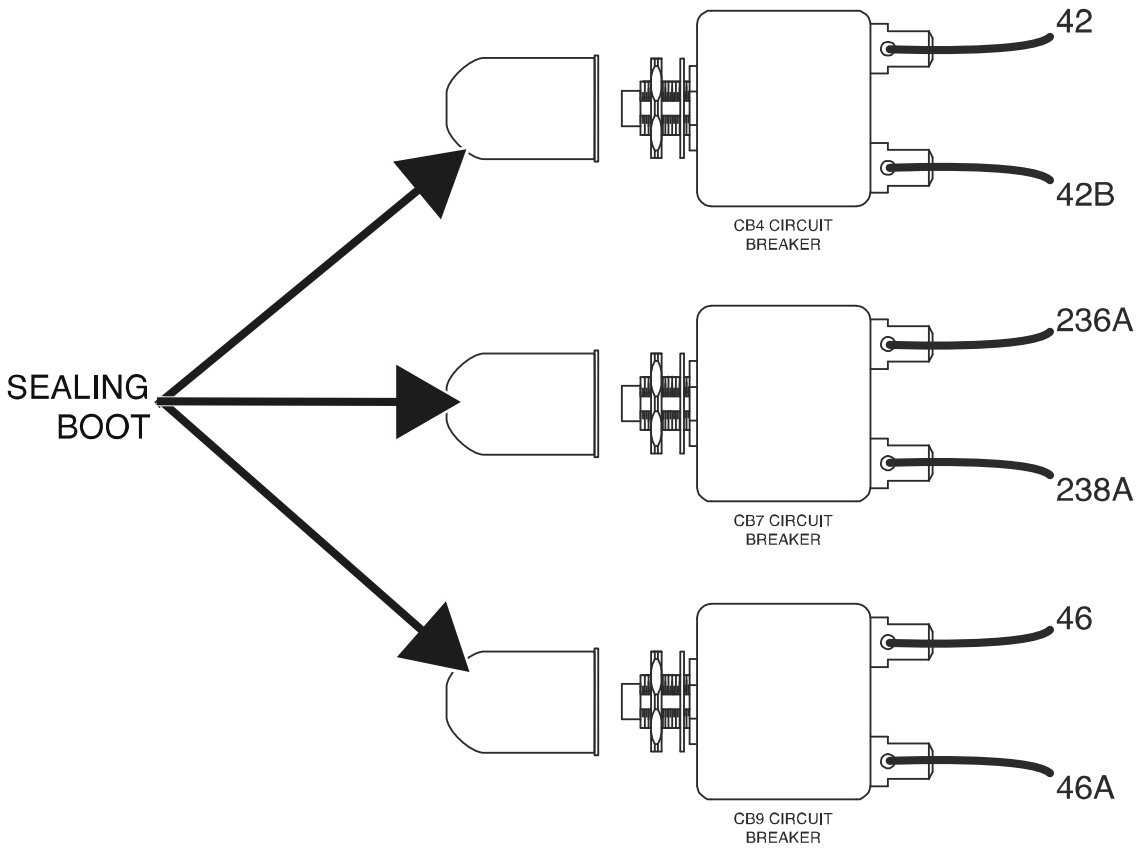


Figure F.2 – CB4, CB7 and CB9 circuit breaker leads and sealing boot locations



CB5 (GLOW) CIRCUIT BREAKERS REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the CB5 (glow) circuit breaker.

MATERIALS NEEDED

5/16” Nutdriver
5/8” Nutdriver
Phillips Screwdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the four screws securing the circuit breaker box cover to the circuit breaker box. See ***Figure F.1***.
5. Using a 5/8” nutdriver, remove the sealing boot securing the CB5 (glow) circuit breaker to the circuit breaker box. See ***Figure F.1***.
6. Using a Phillips screwdriver, remove the two screws and washers securing leads 236D and 239B to the CB5 (glow) circuit breaker. See ***Figure F.2***. See Wiring Diagram. Label leads for reassembly.
7. The CB5 (glow) circuit breaker can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new CB5 (glow) circuit breaker into the circuit breaker box.
2. Using a Phillips screwdriver, attach the two screws and washers securing leads 236D and 239B to the CB5 (glow) circuit breaker. See Wiring Diagram.
3. Using a 5/8” nutdriver, attach the sealing boot securing the CB5 (glow) circuit breaker to the circuit breaker box.
4. Using a 5/16” nutdriver, attach the four screws securing the circuit breaker box cover to the circuit breaker box.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Circuit breaker box, circuit breaker box cover, and sealing boot locations

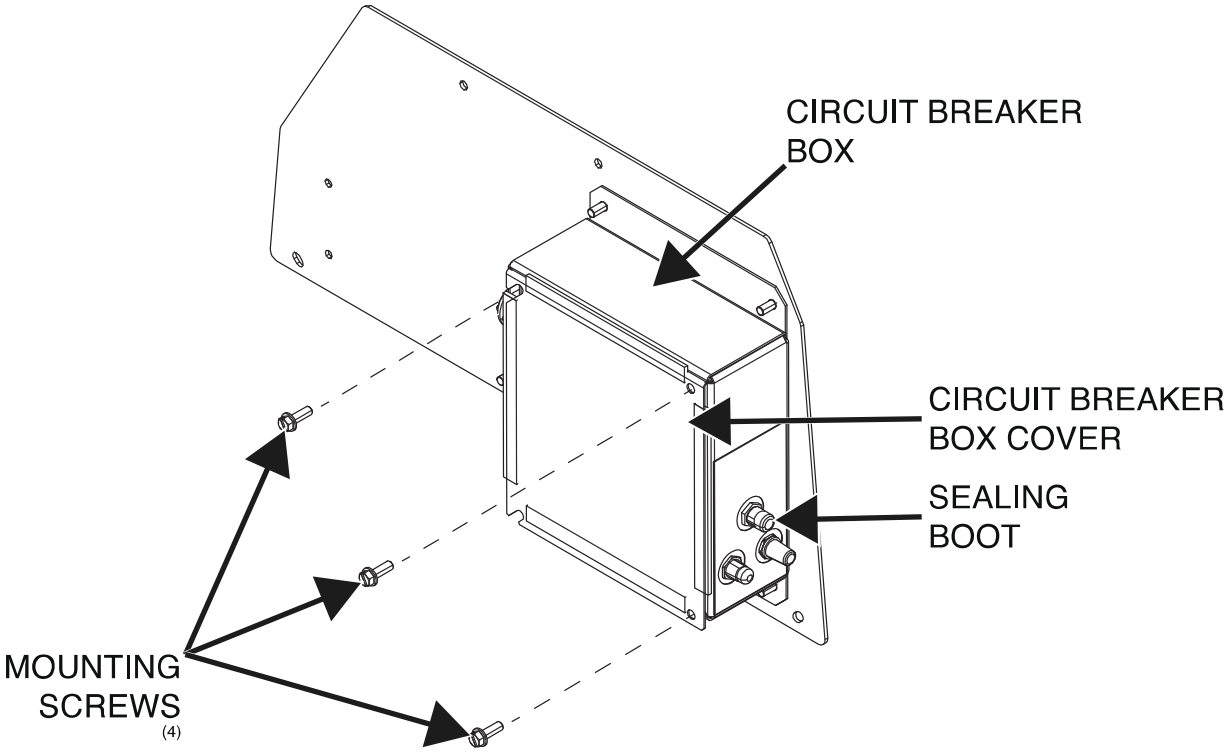
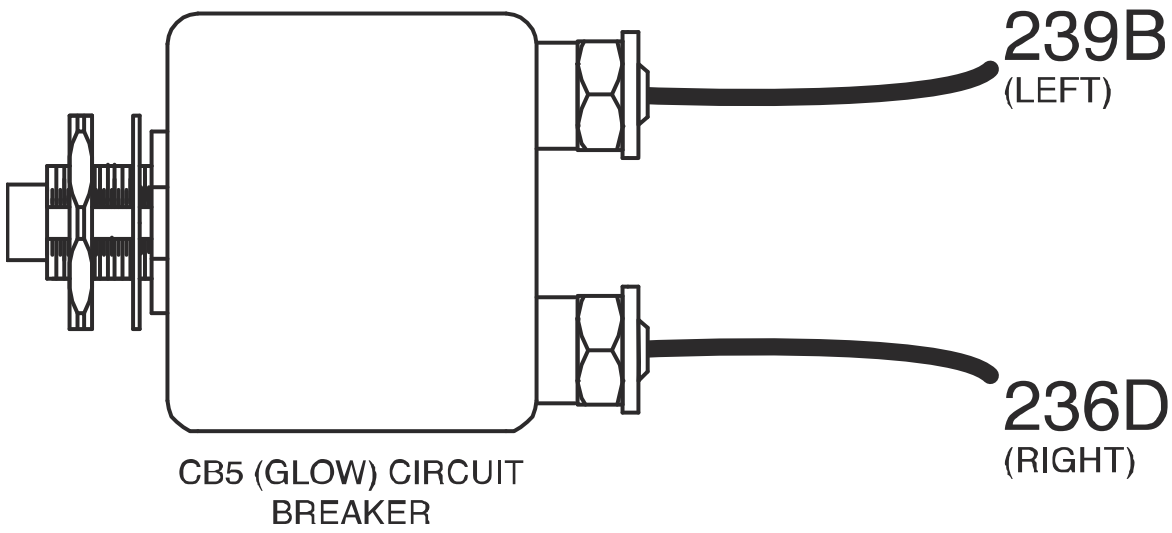


Figure F.2 – CB5 (glow) circuit breaker lead locations



CB6 (FUEL) CIRCUIT BREAKERS REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the CB6 (Fuel) Circuit Breaker.

MATERIALS NEEDED

5/16” Nutdriver
1/2” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the four screws securing the circuit breaker box cover to the circuit breaker box. See ***Figure F.1***.
5. Using a 1/2” nutdriver, remove the sealing boot securing the CB6 (fuel) circuit breaker to the circuit breaker box. See ***Figure F.1***.
6. Label and disconnect leads 226A and 236B from the CB6 (fuel) circuit breaker. See ***Figure F.2***. See Wiring Diagram.
7. The CB6 (fuel) circuit breaker can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new CB6 (fuel) circuit breaker into the circuit breaker box.
2. Connect leads 226A and 236B to the CB6 (fuel) circuit breaker. See Wiring Diagram.
3. Using a 1/2” nutdriver, attach the sealing boot securing the CB6 (fuel) circuit breaker to the circuit breaker box.
4. Using a 5/16” nutdriver, attach the four screws securing the circuit breaker box cover to the circuit breaker box.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Circuit breaker box, circuit breaker box cover, and sealing boot locations

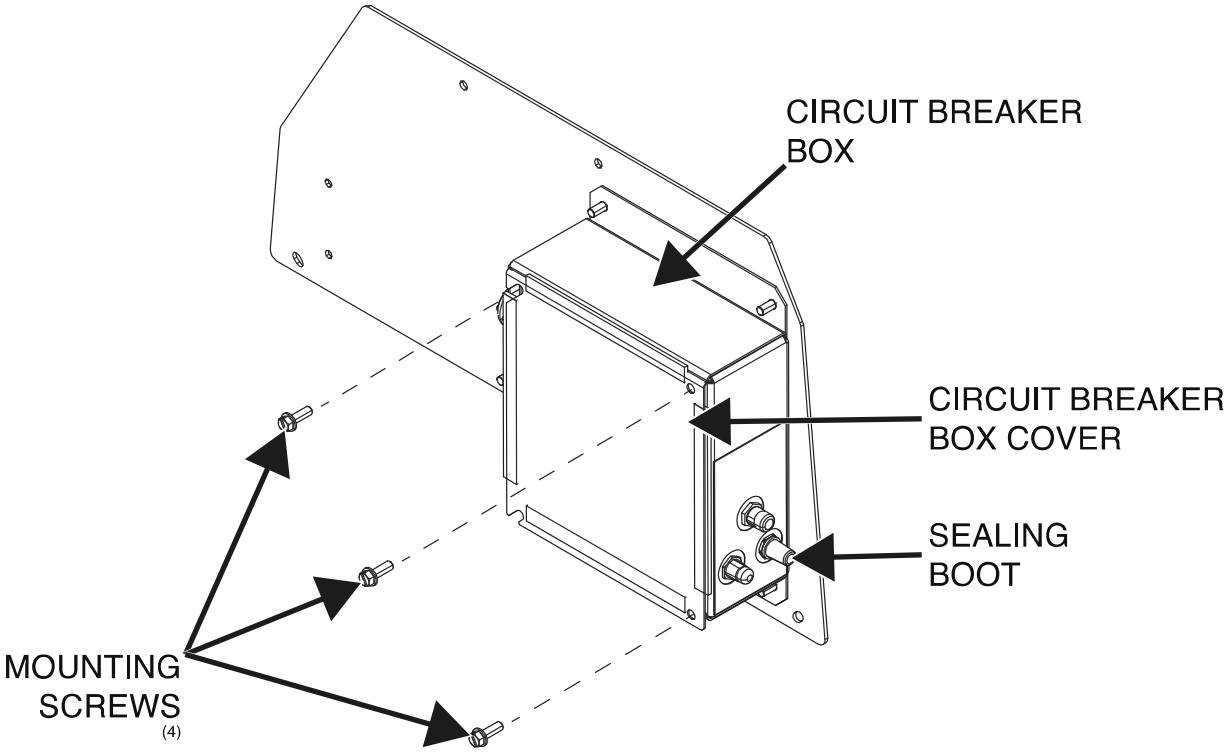
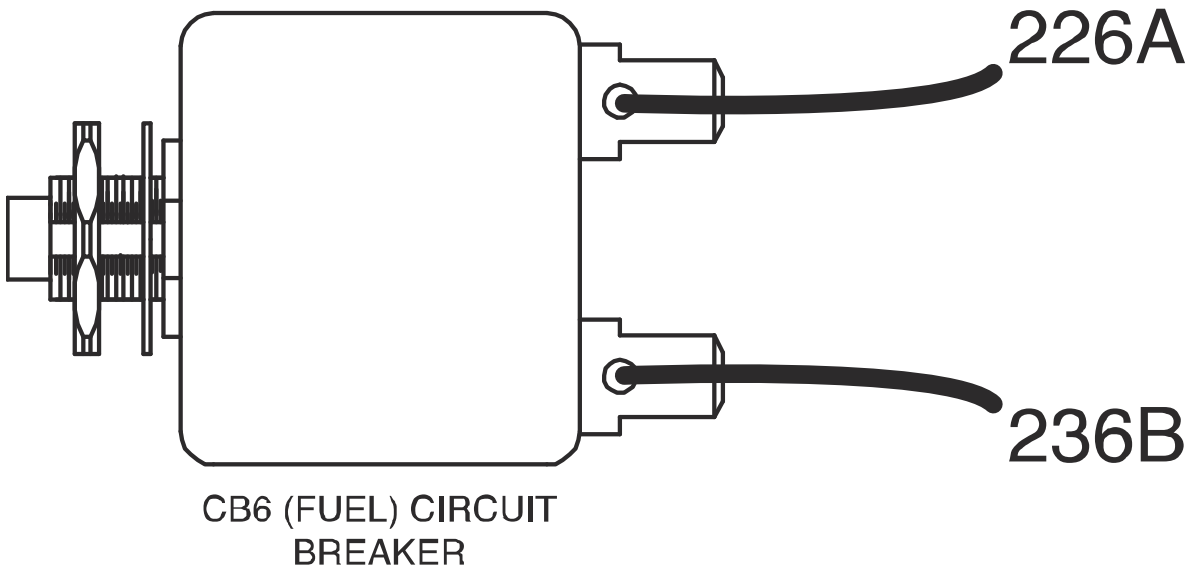


Figure F.2 – CB6 (fuel) circuit breaker lead locations



CB8 (ECU) CIRCUIT BREAKERS REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the CB8 (ECU) Circuit Breaker.

MATERIALS NEEDED

5/16” Nutdriver
5/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the four screws securing the circuit breaker box cover to the circuit breaker box. See ***Figure F.1***.
5. Using a 5/8” nutdriver, remove the sealing boot securing the CB8 (ECU) circuit breaker to the circuit breaker box. See ***Figure F.1***.
6. Label and disconnect leads ECB1A, ECB3A, ECB5A and 236C from the CB8 (ECU) circuit breaker. See ***Figure F.2***. See Wiring Diagram.
7. The CB8 (ECU) circuit breaker can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new CB8 (ECU) circuit breaker into the circuit breaker box.
2. Connect leads ECB1A, ECB3A, ECB5A and 236C to the CB8 (ECU) circuit breaker. See Wiring Diagram.
3. Using a 5/8” nutdriver, attach the sealing boot securing the CB8 (ECU) circuit breaker to the circuit breaker box.
4. Using a 5/16” nutdriver, attach the four screws securing the circuit breaker box cover to the circuit breaker box.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Circuit breaker box, circuit breaker box cover, and sealing boot locations

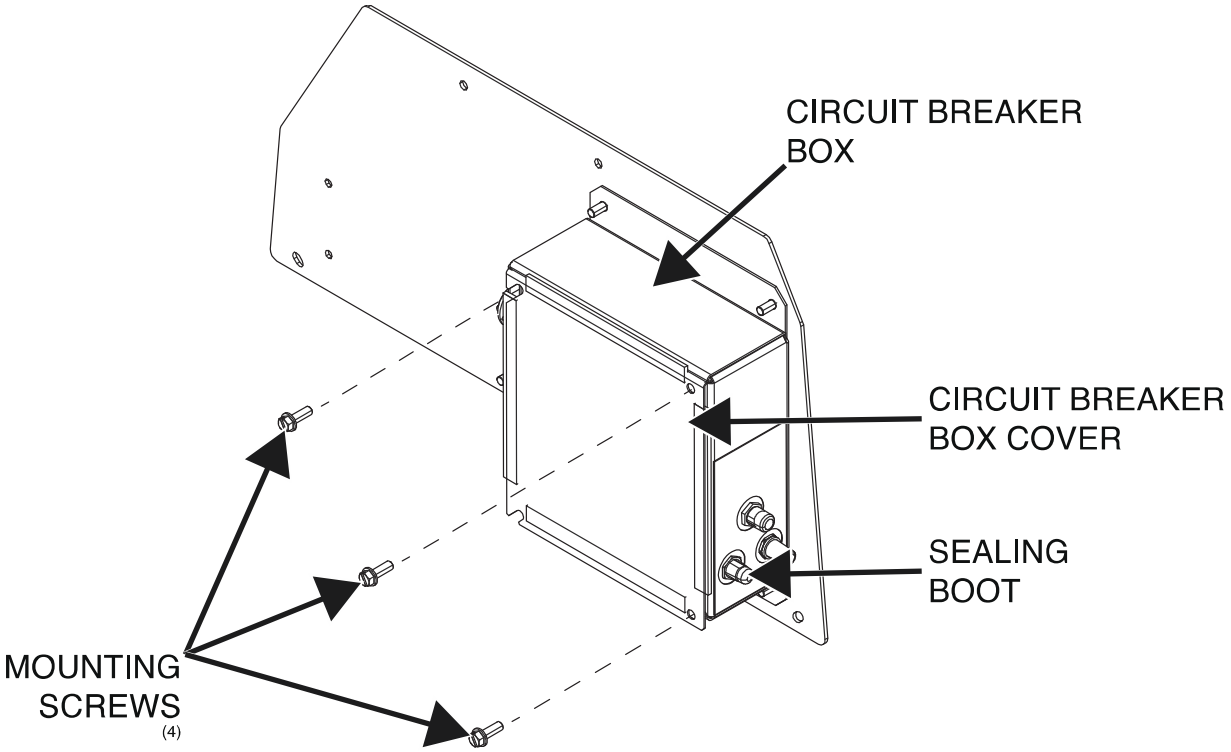
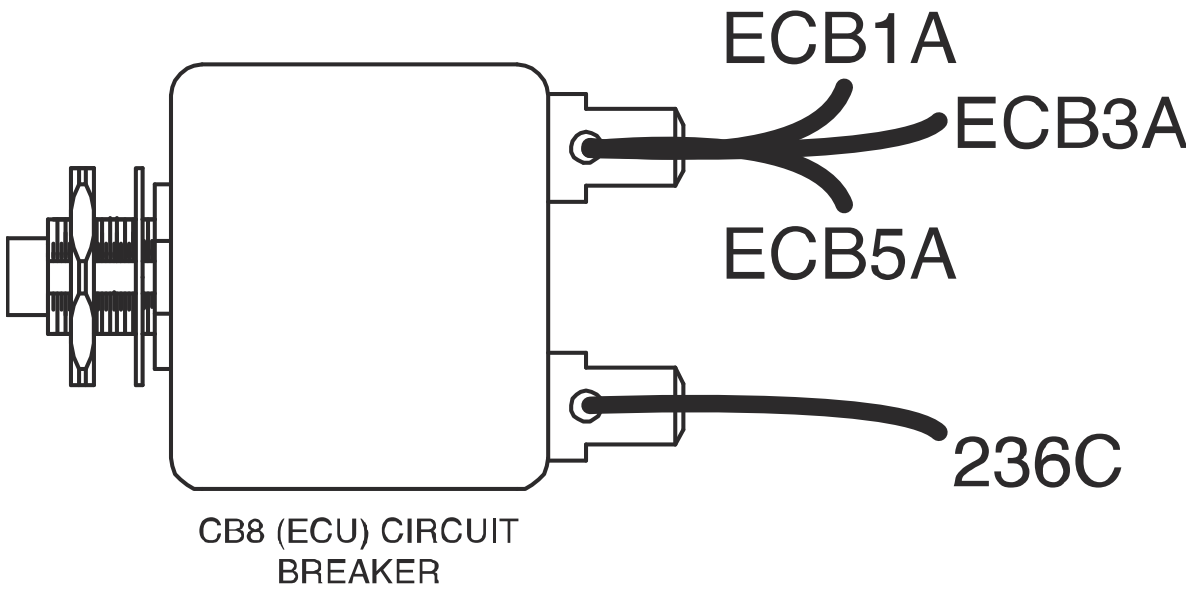


Figure F.2 – CB8 (ECU) circuit breaker lead locations



120V GFCI REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the 120V GFCI's.

MATERIALS NEEDED

5/16" Nutdriver
Phillips Screwdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16" nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the 120V GFCI's. See Wiring Diagram.
6. Label and disconnect the green lead from lead GND-H (left) or GND-G (right). See Wiring Diagram. Cut cable ties as necessary.
7. Label and disconnect plug P70AB from plug J70A (left) or J70B (right). See ***Figure F.2***. See Wiring Diagram. Cut cable ties as necessary.
8. Using a Phillips screwdriver, remove the two screws securing the GFCI cover to the control panel. See ***Figure F.3***. Remove the GFCI cover. Retain the GFCI cover for reassembly.
9. Cut cable ties as necessary to allow for the removal of the GFCI.
10. The GFCI can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new GFCI into the control panel.
2. Using a Phillips screwdriver, attach the two screws securing the GFCI cover to the control panel.
3. Connect plug P70AB to plug J70A (left) or J70B (right). See Wiring Diagram.
4. Connect the green lead to lead GND-H (left) or GND-G (right). See Wiring Diagram.
5. Carefully raise the control panel into the upright position.
6. Using a 5/16" nutdriver, attach the screw securing the control panel into the upright position.
7. Perform the ***Case Cover Replacement Procedure***.
8. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw location

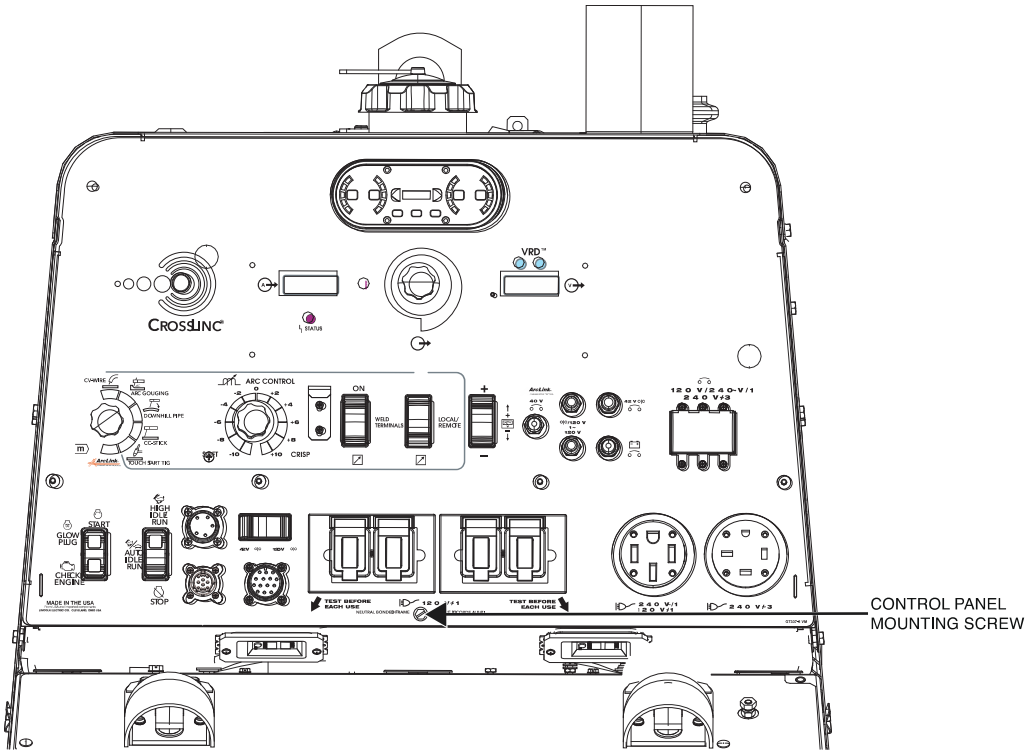


Figure F.2 – Mode select switch and GFCI plug locations

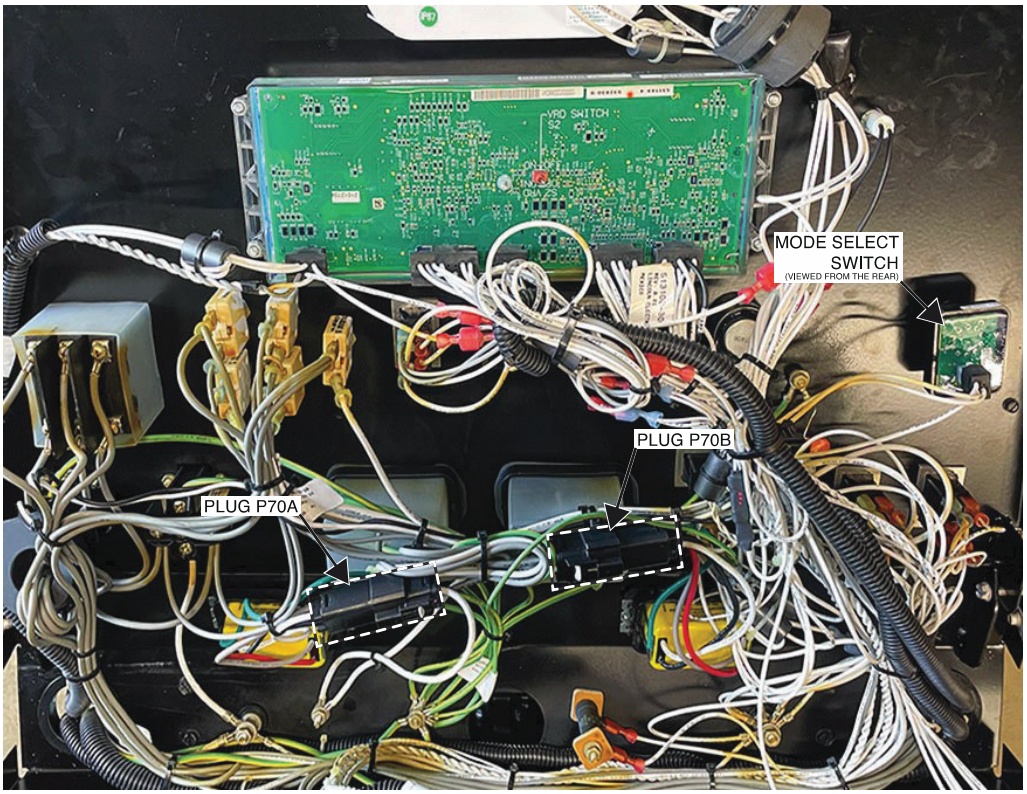
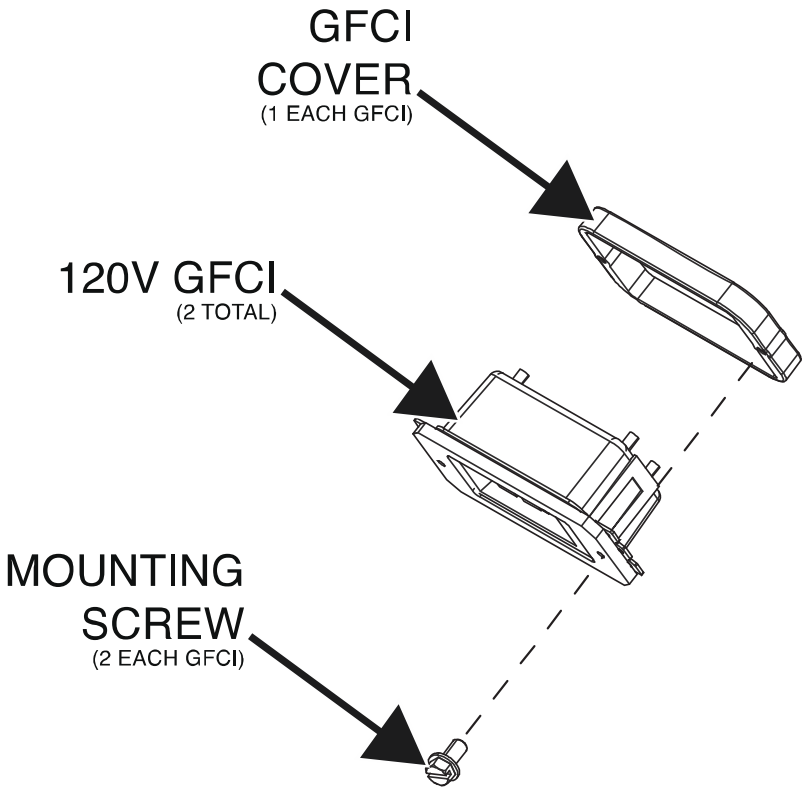


Figure F.3 – GFCI cover and mounting hardware locations



120 / 240 VAC SINGLE PHASE RECEPTACLE REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the 120 / 240 VAC Single Phase Receptacle.

MATERIALS NEEDED

5/16” Nutdriver
Slotted Screwdriver
11/32” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the rear of the 120 / 240 VAC single phase receptacle. See Wiring Diagram.
6. Using a slotted screwdriver, loosen the four screws securing leads GND-C, 3B, 3C, 5D, 6C, and 6D to the receptacle terminals. See ***Figure F.2***. See Wiring Diagram.
7. Using a 11/32” nutdriver and a slotted screwdriver, remove the four screws and nuts securing the receptacle and receptacle cover to the control panel. See ***Figure F.3***.
8. The 120 / 240 VAC single phase receptacle can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new 120 / 240 VAC single phase receptacle and receptacle cover into the control panel.
2. Using a 11/32” nutdriver and a slotted screwdriver, attach the four screws and nuts securing the receptacle and receptacle cover to the control panel.
3. Using a slotted screwdriver, tighten the four screws securing leads GND-C, 3B, 3C, 5D, 6C, and 6D to the receptacle terminals. See Wiring Diagram.
4. Carefully raise the control panel into the upright position.
5. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw location

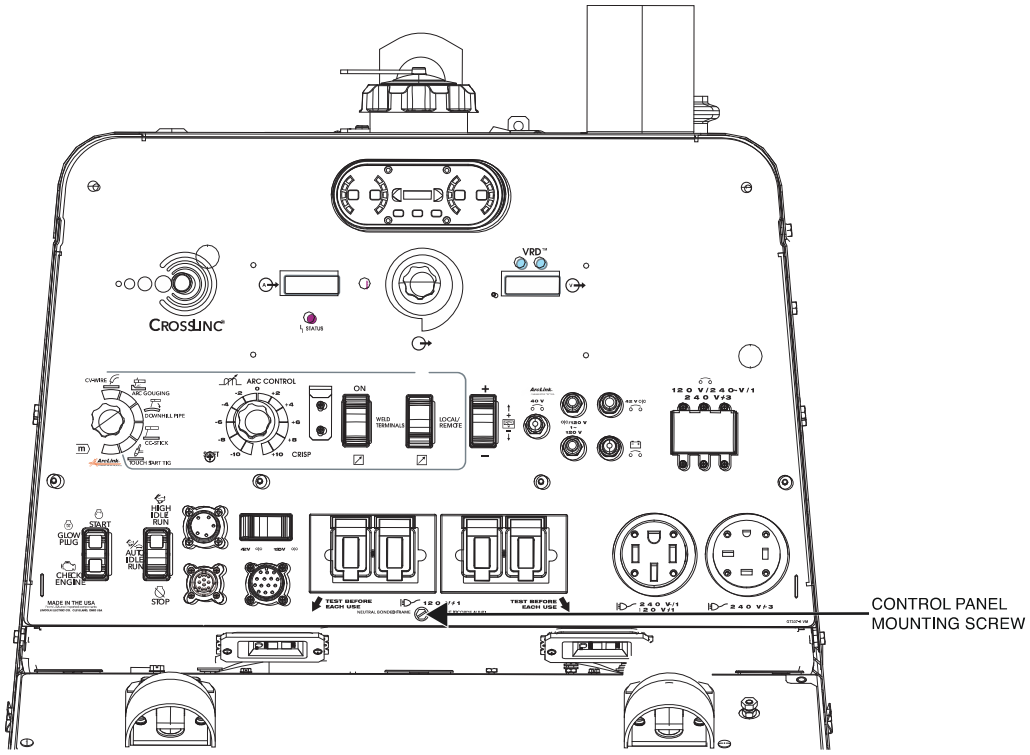


Figure F.2 – 120 / 240 VAC single phase receptacle lead locations

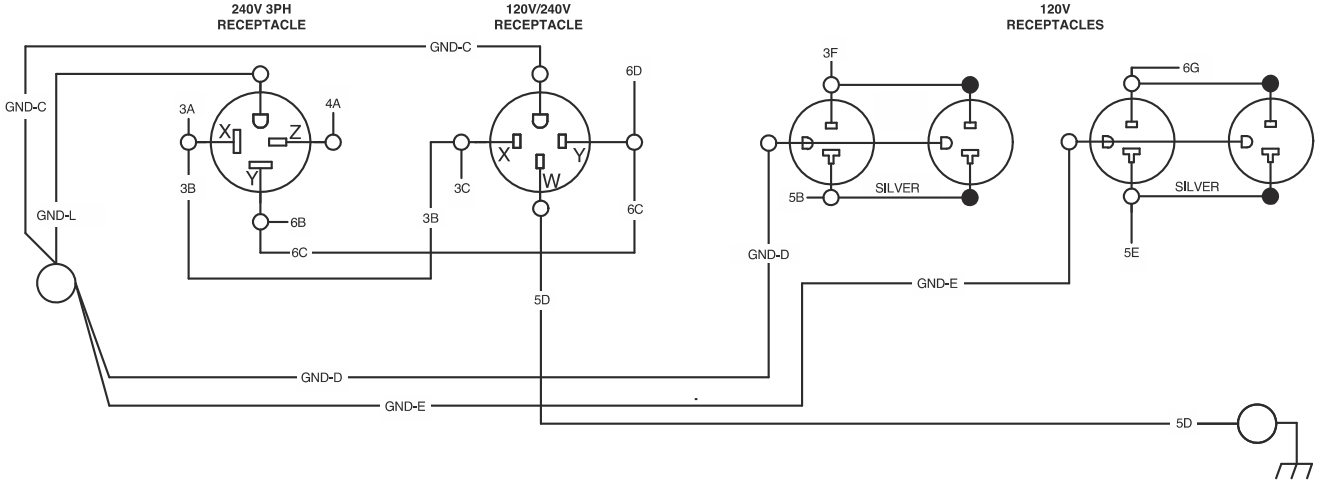
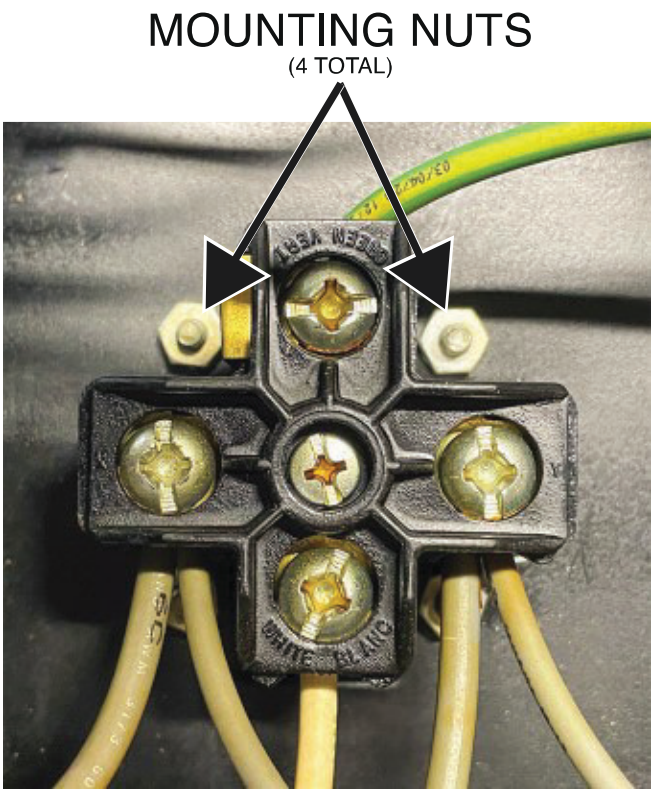


Figure F.3 – 120 / 240 VAC single phase receptacle mounting nut locations



240 VAC 3 PHASE RECEPTACLE REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the 240 VAC 3 Phase Receptacle.

MATERIALS NEEDED

5/16” Nutdriver
Slotted Screwdriver
11/32” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the rear of the 240 VAC 3 phase receptacle. See Wiring Diagram.
6. Using a slotted screwdriver, loosen the four screws securing leads GND-L, 3A, 3B, 6B, 6C, and 4A to the 240 VAC 3 phase receptacle. See ***Figure F.2***. See Wiring Diagram.
7. Using a 11/32” nutdriver and a slotted screwdriver, remove the four nuts securing the receptacle and receptacle cover to the control panel. See ***Figure F.3***.
8. The 240 VAC 3 phase receptacle can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new 240 VAC 3 phase receptacle and receptacle cover into the control panel.
2. Using a 11/32” nutdriver and a slotted screwdriver, attach the four screws and nuts securing the receptacle and receptacle cover to the control panel.
3. Using a slotted screwdriver, tighten the four screws securing leads GND-L, 3A, 3B, 6B, 6C, and 4A to the 240 VAC 3 phase receptacle. See Wiring Diagram.
4. Carefully raise the control panel into the upright position.
5. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw location

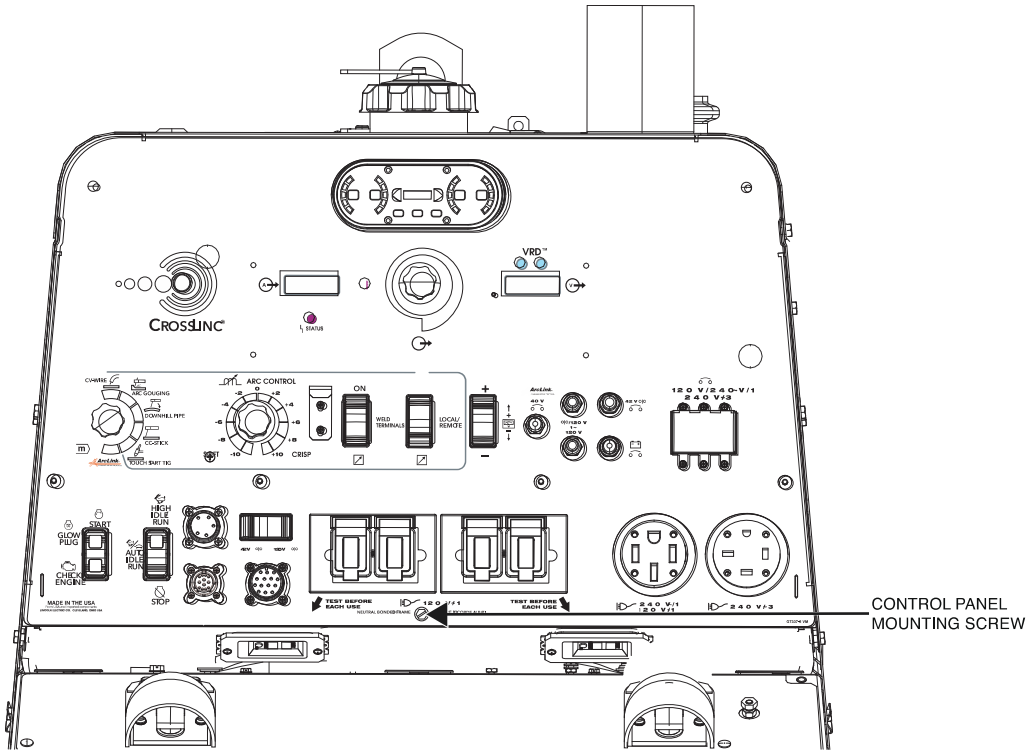


Figure F.2 – 240 VAC 3 phase receptacle lead locations

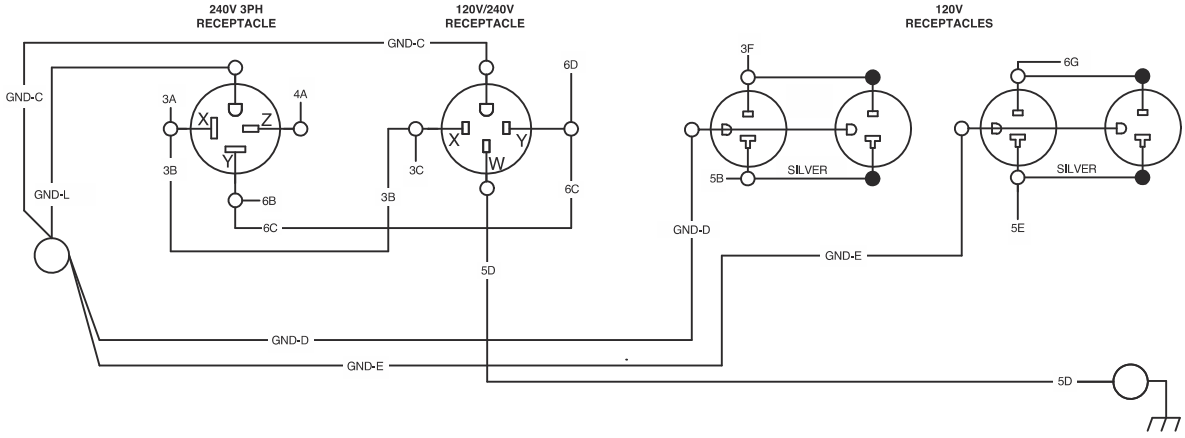
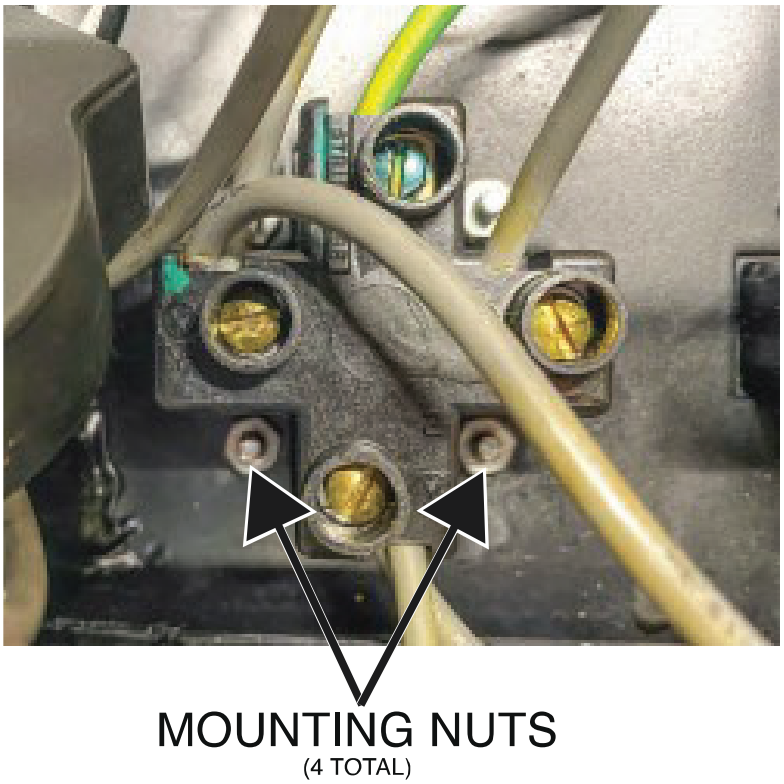


Figure F.3 – 240 VAC 3 phase receptacle mounting nut locations



120 VAC SINGLE PHASE RECEPTACLES REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the 120 VAC Single Phase Receptacles.

MATERIALS NEEDED

Slotted Screwdriver
Phillips Screwdriver
Wiring Diagram

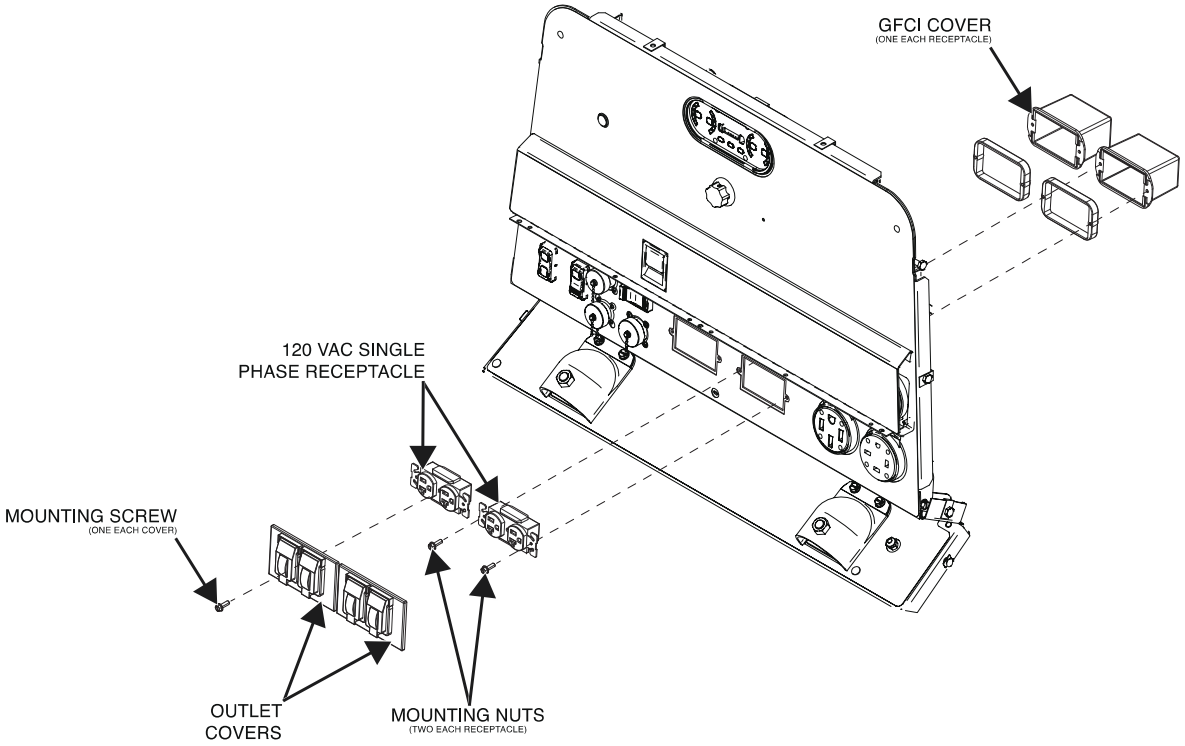
REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a slotted screwdriver, remove the screw securing the outlet cover to the 120 VAC receptacle. See ***Figure F.1***. Remove the outlet cover. Retain outlet cover for reassembly.
5. Using a Phillips screwdriver, remove the two screws securing the receptacle to the control panel and the GFCI cover. See ***Figure F.1***.
6. Carefully remove the GFCI covers.
7. Using a slotted screwdriver, loosen the four screws securing the leads to the terminals of the outlet to be replaced. See Wiring Diagram.
8. The 120 VAC receptacle can now be removed and replaced. Retain the GFCI cover for reassembly.

REPLACEMENT PROCEDURE

1. Carefully position the new 120 VAC receptacle into the control panel.
2. Using a slotted screwdriver, tighten the four screws securing the previously disconnected leads to the terminals of the outlet. See Wiring Diagram.
3. Carefully attach the GFCI covers.
4. Using a Phillips screwdriver, attach the two screws securing the receptacle to the control panel and the GFCI cover.
5. Using a slotted screwdriver, attach the screw securing the outlet cover to the 120 VAC receptacle.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – 120 VAC single phase receptacle mounting hardware locations



FIELD CAPACITOR REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Field Capacitor.

MATERIALS NEEDED

3/8” Nutdriver
7/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the two screws securing the output stud cover plate to the output stud cover. See ***Figure F.1***. Remove the outlet cover. Retain for reassembly.
5. Using a 7/16” nutdriver, remove the nut, lock washer, and flat washer securing leads 201 and 201A to the negative terminal of the field capacitor. See ***Figure F.2***. See Wiring Diagram.
6. Using a 7/16” nutdriver, remove the nut, lock washer, and flat washer securing leads 200A and 200B to the positive terminal of the field capacitor. See ***Figure F.2***. See Wiring Diagram.
7. Using a 3/8” nutdriver, remove the screw securing the capacitor bracket to the fan baffle. See ***Figure F.1***.
8. The field capacitor can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new field capacitor into the capacitor bracket.
2. Using a 3/8” nutdriver, attach the screw securing the capacitor bracket to the fan baffle.
3. Using a 7/16” nutdriver, attach the nut, lock washer, and flat washer securing leads 200A and 200B to the positive terminal of the field capacitor. See Wiring Diagram.
4. Using a 7/16” nutdriver, attach the nut, lock washer, and flat washer securing leads 201 and 201A to the negative terminal of the field capacitor. See Wiring Diagram.
5. Using a 3/8” nutdriver, attach the two screws securing the output stud cover plate to the output stud cover.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Field capacitor removal

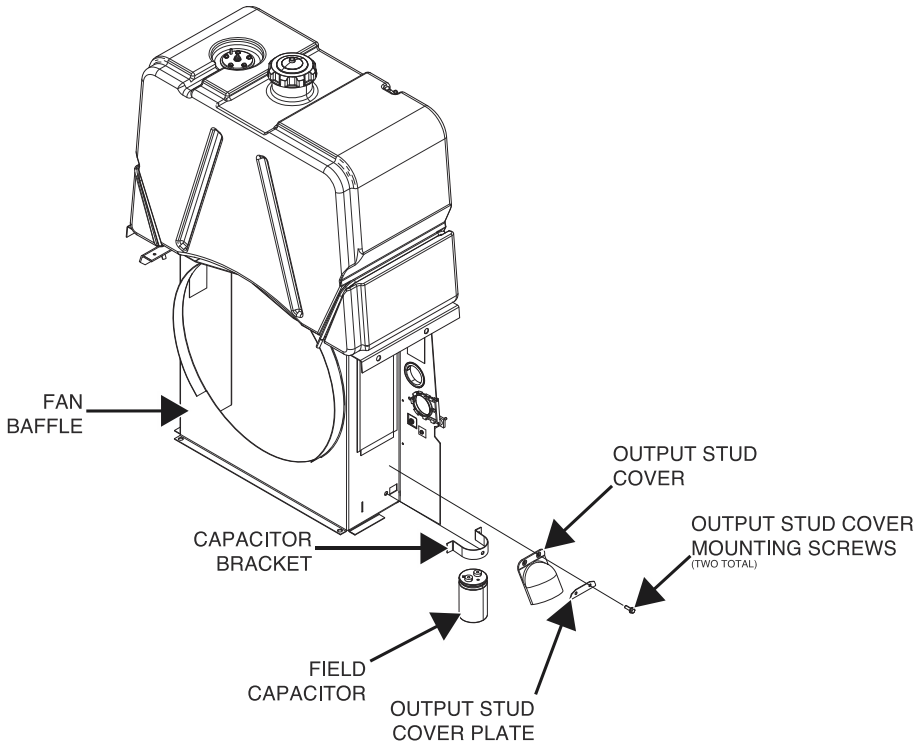
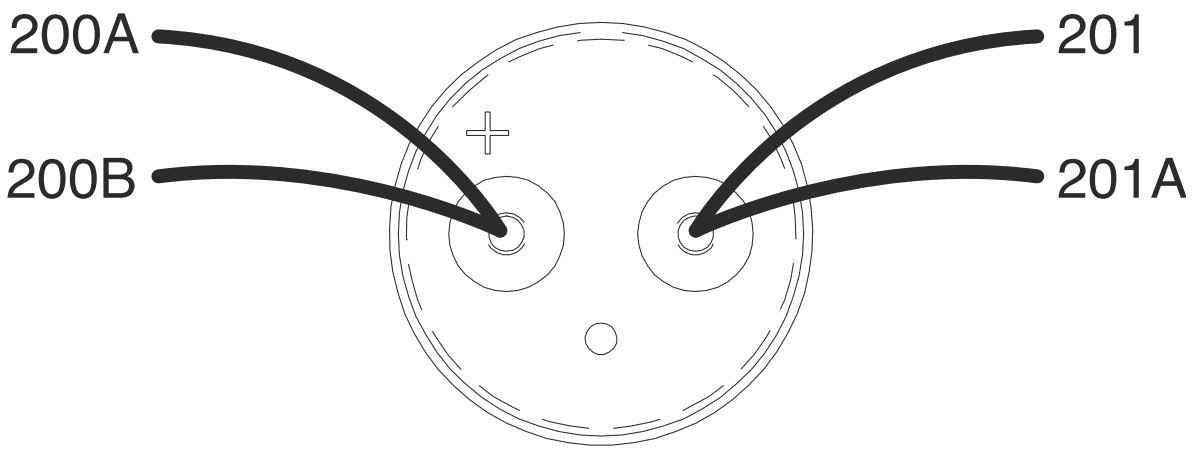


Figure F.2 – Field capacitor lead locations



42V CAPACITOR REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the 42V Capacitor.

MATERIALS NEEDED

3/8” Nutdriver
7/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the 42V capacitor. See Wiring Diagram.
6. Using a 3/8” nutdriver, remove the two screws securing the output stud cover plate to the output stud cover. See ***Figure F.2***. Remove the outlet cover. Retain for reassembly.
7. Using a 7/16” nutdriver, remove the nut, lock washer, and flat washer securing leads 66 and 66A to the negative terminal of the 42V capacitor. See ***Figure F.3***. See Wiring Diagram.
8. Using a 7/16” nutdriver, remove the nut, lock washer, and flat washer securing leads 65 and 65A to the positive terminal of the 42V capacitor. See ***Figure F.3***. See Wiring Diagram.
9. Using a 3/8” nutdriver, remove the screw securing the capacitor bracket to the control box. See ***Figure F.2***.
10. The 42V capacitor can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new 42V capacitor into the capacitor bracket.
2. Using a 3/8” nutdriver, attach the screw securing the capacitor bracket to the control box.
3. Using a 7/16” nutdriver, attach the nut, lock washer, and flat washer securing leads 65 and 65A to the positive terminal of the 42V capacitor. See Wiring Diagram.
4. Using a 7/16” nutdriver, attach the nut, lock washer, and flat washer securing leads 66 and 66A to the negative terminal of the 42V capacitor. See Wiring Diagram.
5. Using a 3/8” nutdriver, attach the two screws securing the output stud cover plate to the output stud cover.
6. Carefully raise the control panel into the upright position.
7. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position.
8. Perform the ***Case Cover Replacement Procedure***.
9. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw location

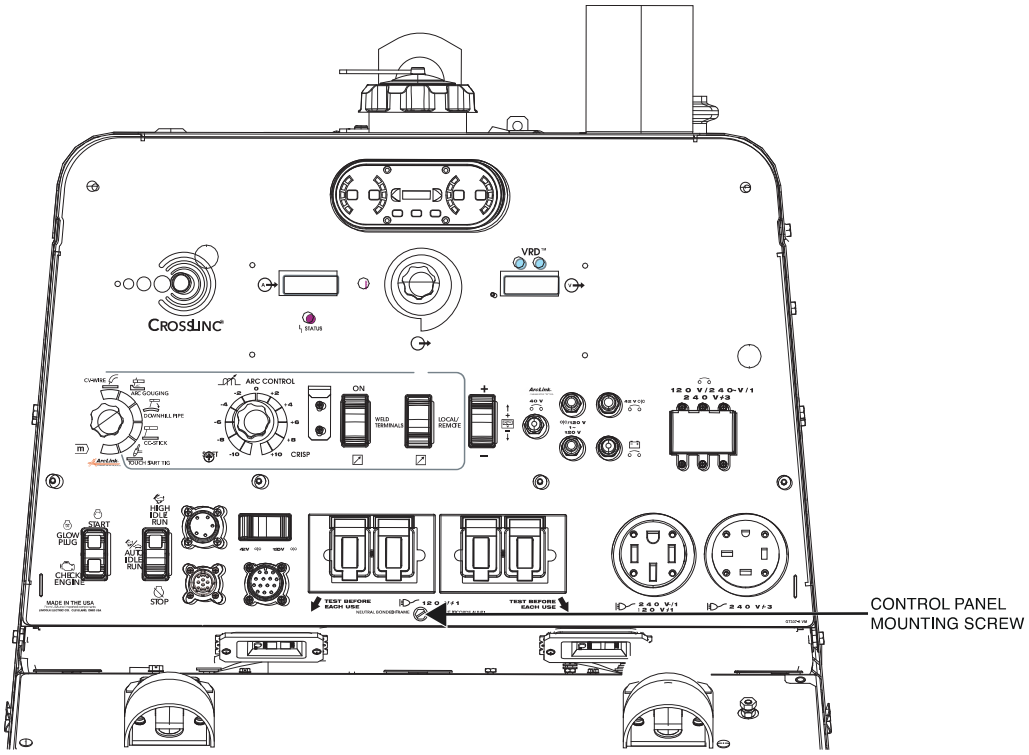


Figure F.2 – 42V capacitor mounting hardware locations

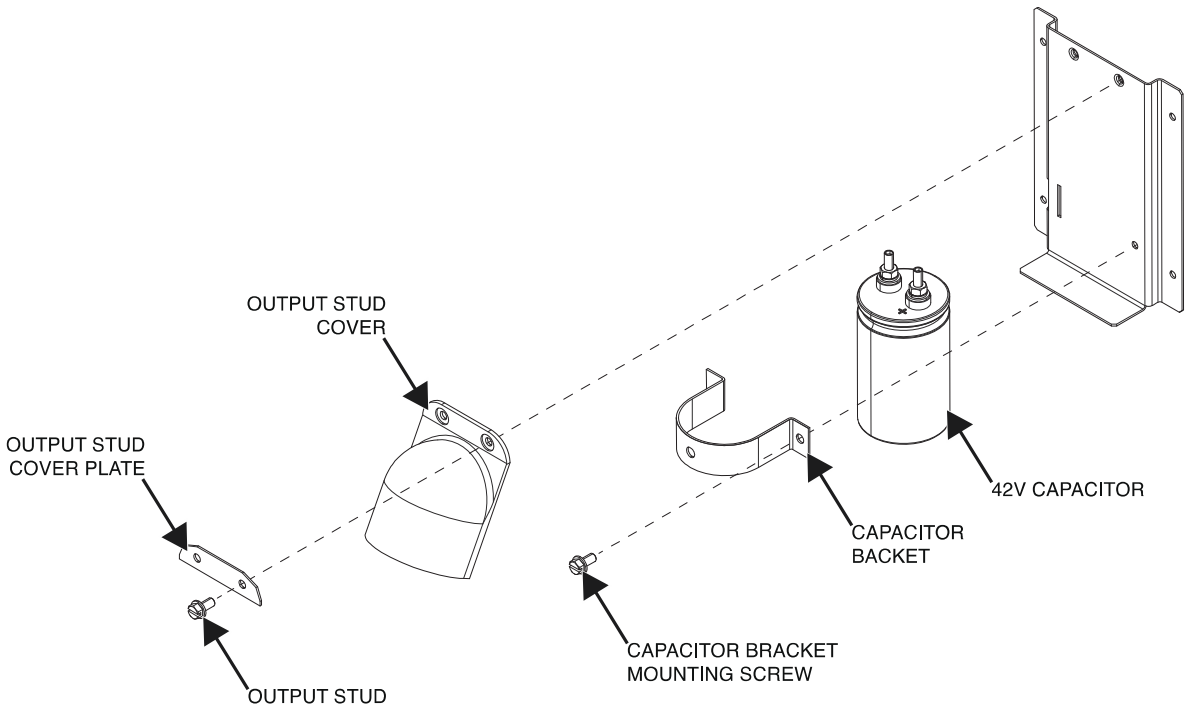
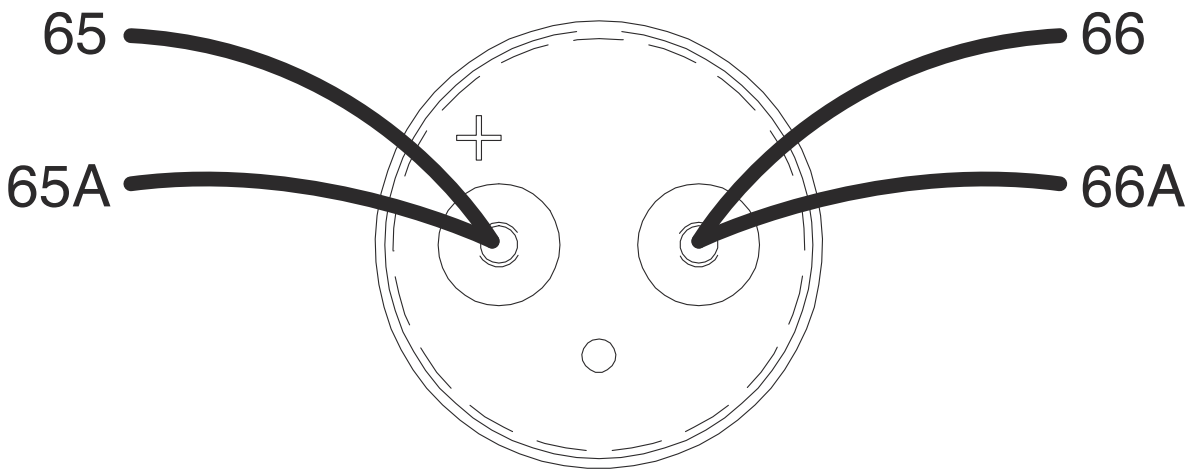


Figure F.3 – 42V capacitor lead locations



BATTERY REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

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

MATERIALS NEEDED

3/8” Nutdriver
1/2” Nutdriver
7/16” Nutdriver
Wiring Diagram

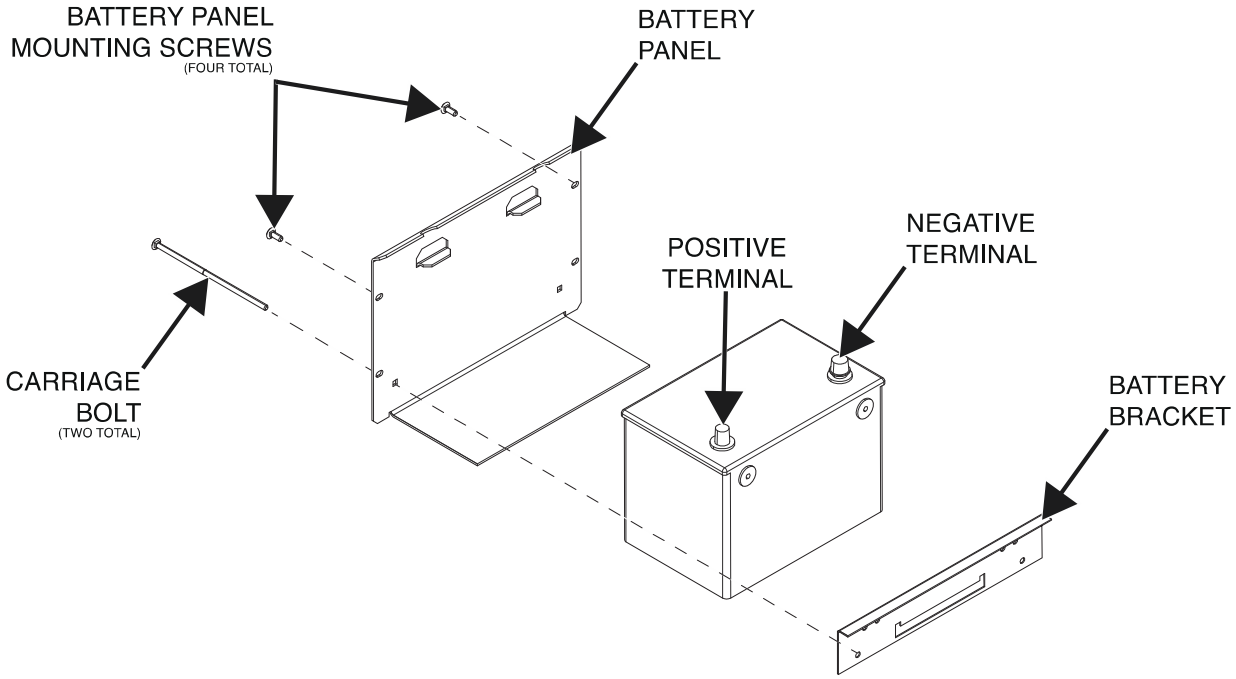
REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the four screws, lock washers and flat washers securing the battery panel to the machine. See ***Figure F.1***.
5. Carefully slide the battery panel out to gain access to the battery terminals and battery bracket.
6. Using a 1/2” nutdriver, loosen the terminal clamps securing the leads to the positive and negative battery terminals. See ***Figure F.1***. See Wiring Diagram.
7. Using a 7/16” nutdriver, remove the two nuts and carriage bolts securing the battery bracket to the battery panel. See ***Figure F.1***.
8. The battery can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new battery into the battery panel.
2. Using a 7/16” nutdriver, attach the two nuts and carriage bolts securing the battery bracket to the battery panel.
3. Using a 1/2” nutdriver, tighten the terminal clamps securing the leads to the positive and negative battery terminals. See Wiring Diagram.
4. Using a 3/8” nutdriver, attach the four screws, lock washers and flat washers securing the battery panel to the machine.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Battery mounting hardware locations



ENGINE ECU REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Engine ECU.

MATERIALS NEEDED

7/16” Nutdriver
Wiring Diagram

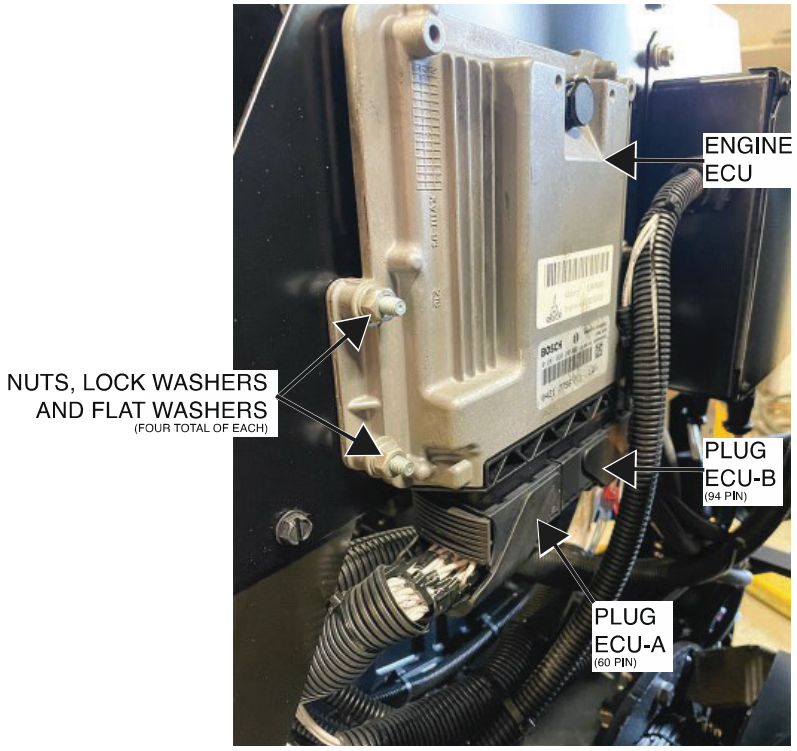
REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plugs ECU-A (60-pin connector) and ECU-B (94-pin connector) from the engine ECU. See ***Figure F.1***. See Wiring Diagram.
5. Using a 7/16” nutdriver, remove the four nuts, lock washers and flat washers securing the ECU to the ECU mounting bracket. See ***Figure F.1***.
6. Carefully remove the engine ECU from its mounting posts.
7. The engine ECU can now be replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new engine ECU onto the mounting posts.
2. Using a 7/16” nutdriver, attach the four nuts, lock washers and flat washers securing the ECU to the ECU mounting bracket.
3. Connect plugs ECU-A (60-pin connector) and ECU-B (94-pin connector) to the engine ECU. See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Engine ECU plug and mounting hardware locations



CHOPPER USER INTERFACE BOARD REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Chopper User Interface Board.

MATERIALS NEEDED

5/64” Allen Wrench
5/16” Nutdriver
3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/64” Allen wrench, loosen the set screw securing the output control knob to the shaft. See ***Figure F.1***. Remove the output control knob. Retain the output control knob for reassembly.
5. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
6. Carefully lower the control panel to gain access to the rear of the chopper user interface board. See Wiring Diagram.
7. Label and disconnect plugs J31, J34, J35, J32 and J33 from the chopper user interface board. See ***Figure F.2***. See Wiring Diagram.
8. Using a 3/8” nutdriver, remove the four nuts securing the chopper user interface board to the control panel. See ***Figure F.2***.
9. Carefully remove the chopper user interface board from the mounting posts.
10. The chopper user interface board can now be replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new chopper user interface board onto the mounting posts.
2. Using a 3/8” nutdriver, attach the four nuts securing the chopper user interface board to the control panel.
3. Connect plugs J31, J34, J35, J32 and J33 to the chopper user interface board. See Wiring Diagram.
4. Carefully raise the control panel into the upright position.
5. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position.
6. Using a 5/64” Allen wrench, tighten the set screw securing the output control knob to the shaft.
7. Perform the ***Case Cover Replacement Procedure***.
8. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Output control knob and control panel mounting screw location

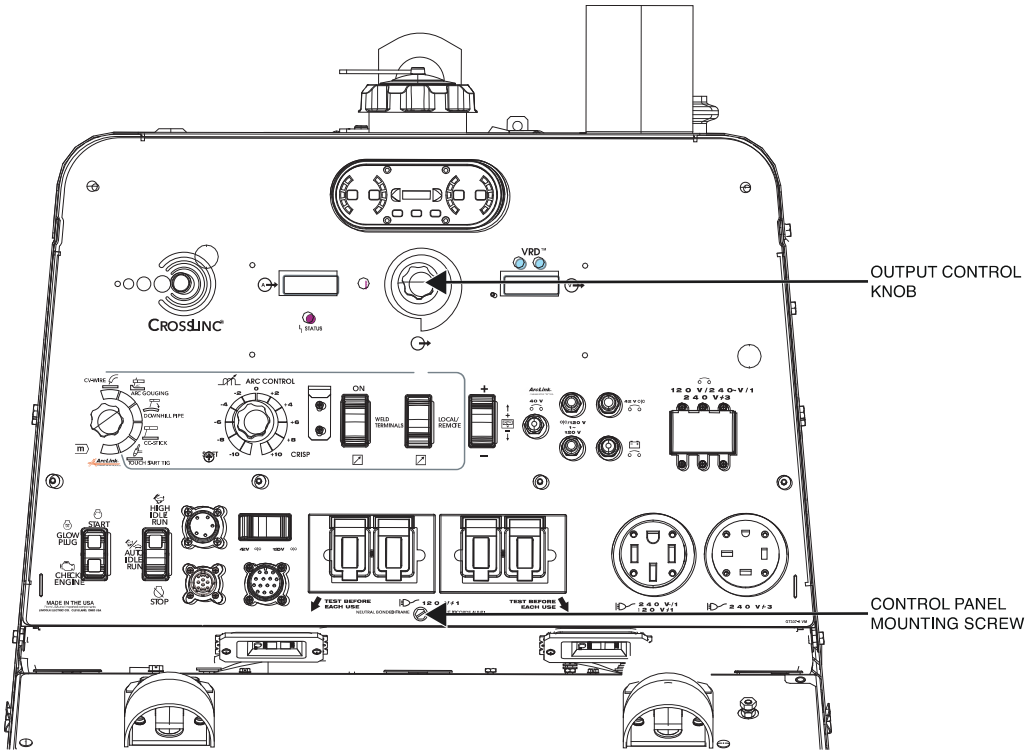
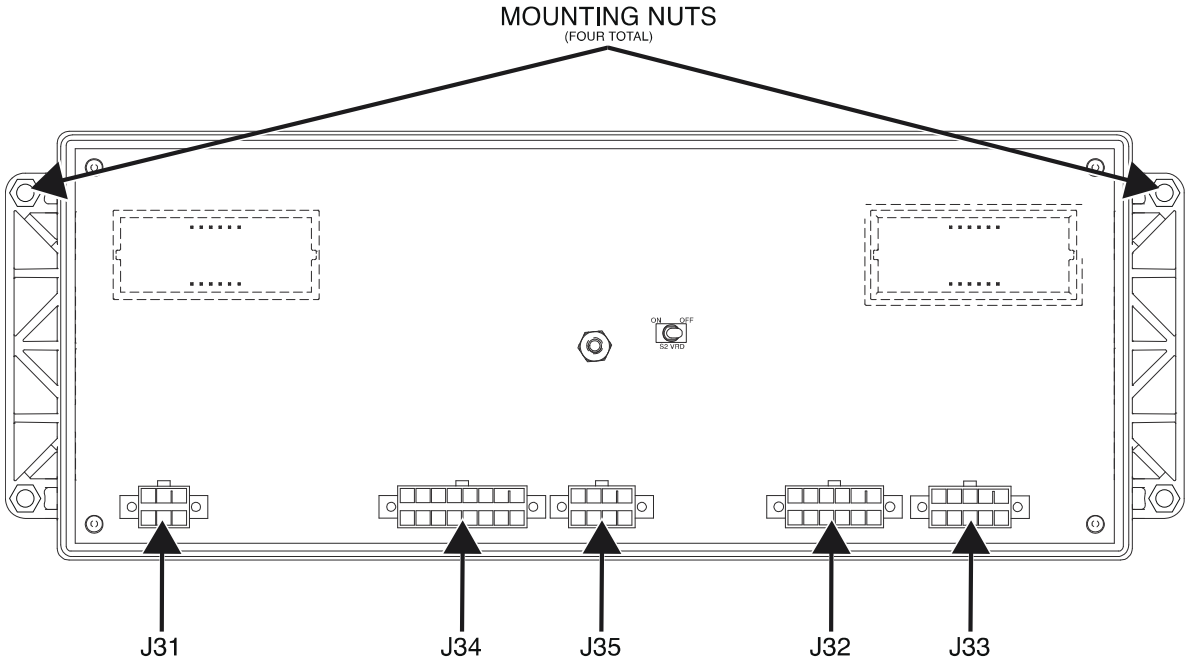


Figure F.2 – Chopper user interface board plug and mounting nut locations



40 VDC BUS BOARD REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the 40 VDC Bus Board.

MATERIALS NEEDED

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Perform the ***D2 Rectifier Removal Procedure***.
5. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
6. Carefully lower the control panel to gain access to the 40 VDC bus board. See Wiring Diagram
7. Label and disconnect plugs J46 and J47 from the 40 VDC bus board. See ***Figure F.2***. See Wiring Diagram.
8. Using a 3/8” nutdriver, remove the four nuts securing the 40 VDC bus board mounting plate to the control box. See ***Figure F.2***.
9. The 40 VDC bus board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new 40 VDC bus board assembly into the machine.
2. Using a 3/8” nutdriver, attach the four nuts securing the 40 VDC bus board mounting plate to the control box.
3. Connect plugs J46 and J47 to the 40 VDC bus board. See Wiring Diagram.
4. Carefully raise the control panel into the upright position.
5. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position.
6. Perform the ***D2 Rectifier Replacement Procedure***.
7. Perform the ***Case Cover Replacement Procedure***.
8. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw location

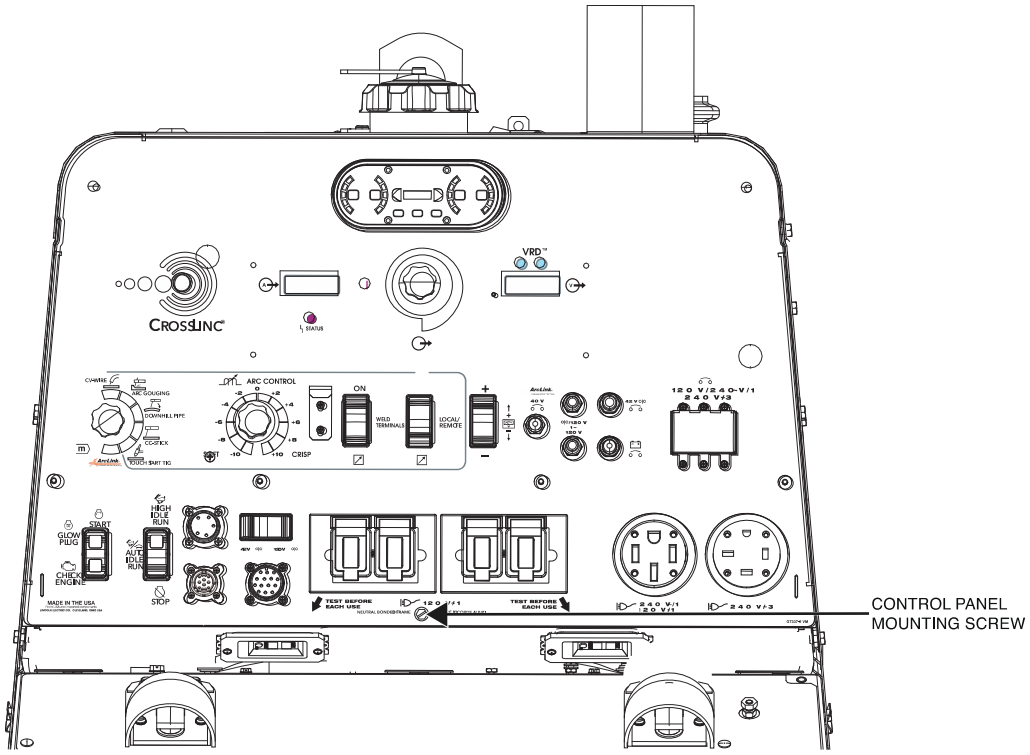


Figure F.2 – 40 VDC bus board plug and mounting hardware locations

FUEL TANK REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Fuel Tank.

MATERIALS NEEDED

3/8” Nutdriver
Slotted Screwdriver
Paper Towels
Fuel Siphon
Fuel Storage Container
9/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Place the fuel shutoff switch into the OFF position.
5. Using a 3/8” nutdriver, remove the two nuts and lock washers securing leads 229 and 5J to the fuel level sensor. See ***Figure F.1***. See Wiring Diagram.
6. Using a slotted screwdriver, loosen the hose clamp securing the fuel line to the top of the fuel tank. See ***Figure F.2***. Wrap fuel line in paper towels to prevent spills.
7. Using a fuel siphon, drain the fuel into a fuel storage container.
8. Using a 9/16” nutdriver, remove the two nuts, flat washers and rubber washers securing each of the two fuel tank straps to the machine. See ***Figure F.2***.
9. Using a slotted screwdriver, loosen the hose clamp securing the lower fuel line to the fuel tank. See ***Figure F.2***. Wrap fuel line in paper towels to prevent spills.
10. The fuel tank can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new fuel tank into the machine.
2. Using a slotted screwdriver, tighten the hose clamp securing the lower fuel line to the fuel tank.
3. Using a 9/16” nutdriver, attach the two nuts, flat washers and rubber washers securing each of the two fuel tank straps to the machine.
4. Using a slotted screwdriver, tighten the hose clamp securing the fuel line to the top of the fuel tank.
5. Using a 3/8” nutdriver, attach the two nuts and lock washers securing leads 229 and 5J to the fuel level sensor. See Wiring Diagram.
6. Place the fuel shutoff switch into the ON position.
7. Perform the ***Case Cover Replacement Procedure***.
8. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Fuel sender lead locations

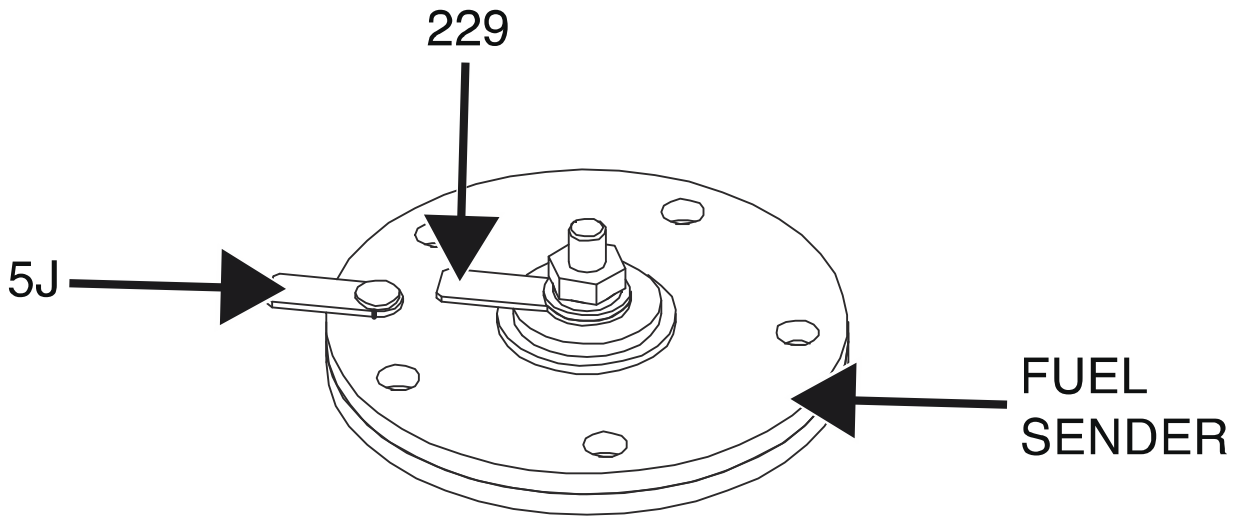
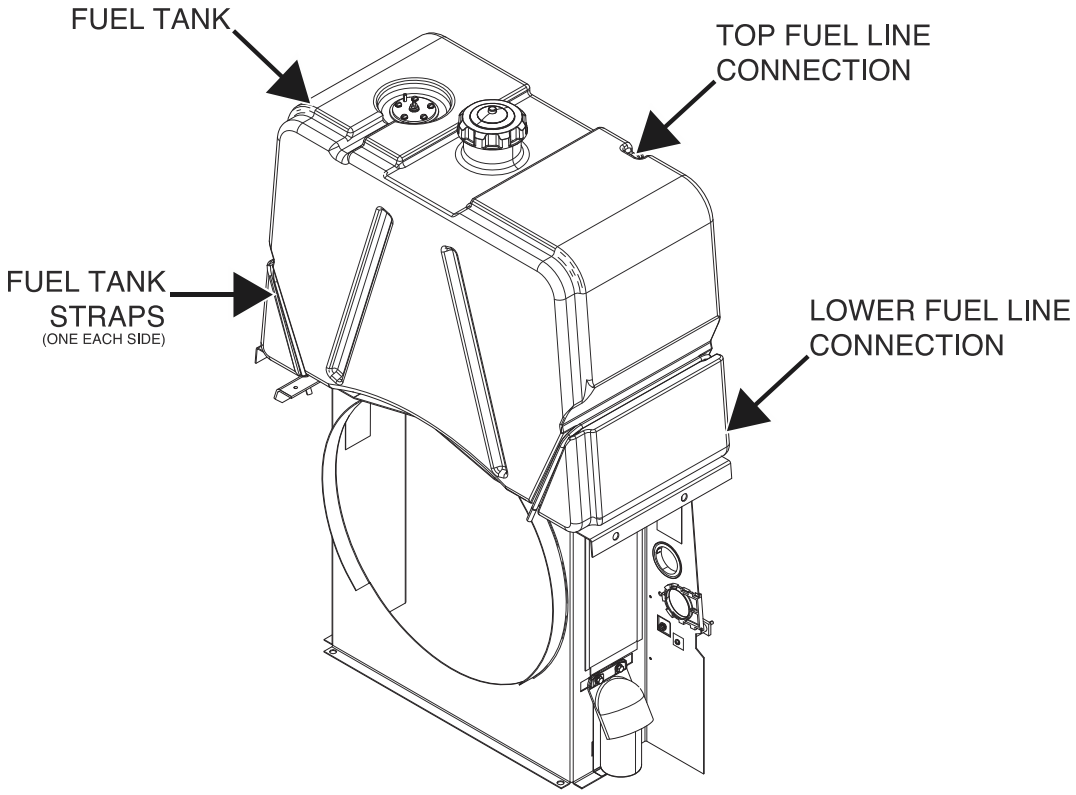


Figure F.2 – Fuel line connection and fuel tank strap locations



BRUSH AND BRUSH HOLDER ASSEMBLY REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Brush and Brush Holder Assembly.

MATERIALS NEEDED

3/8” Nutdriver
5/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the screw securing the brush cover to the fan baffle. See ***Figure F.1***.
5. Label and disconnect leads 200C and 201B from the quick connect terminals. See Wiring Diagram.
6. Using a 3/8” nutdriver, remove the two screws securing the brush holder bracket to the stator frame. See ***Figure F.2***.
7. Carefully remove the brush holder bracket.
8. Label and disconnect leads 200C and 201B from the brush terminals. See ***Figure F.2***. See Wiring Diagram.
9. Using a 5/16” nutdriver, remove the two screws securing the brush holder to the brush holder bracket. See ***Figure F.2***.
10. The brushes can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new brush holder into the brush holder bracket.
2. Using a 5/16” nutdriver, attach the two screws securing the brush holder to the brush holder bracket.
3. Connect leads 200C and 201B to the brush terminals. See Wiring Diagram.
4. Using a 3/8” nutdriver, attach the two screws securing the brush holder bracket to the stator frame.
5. Connect leads 200C and 201B to the quick connect terminals. See Wiring Diagram.
6. Using a 3/8” nutdriver, attach the screw securing the brush cover to the fan baffle.
7. Perform the ***Case Cover Replacement Procedure***.
8. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Brush cover and fan baffle locations

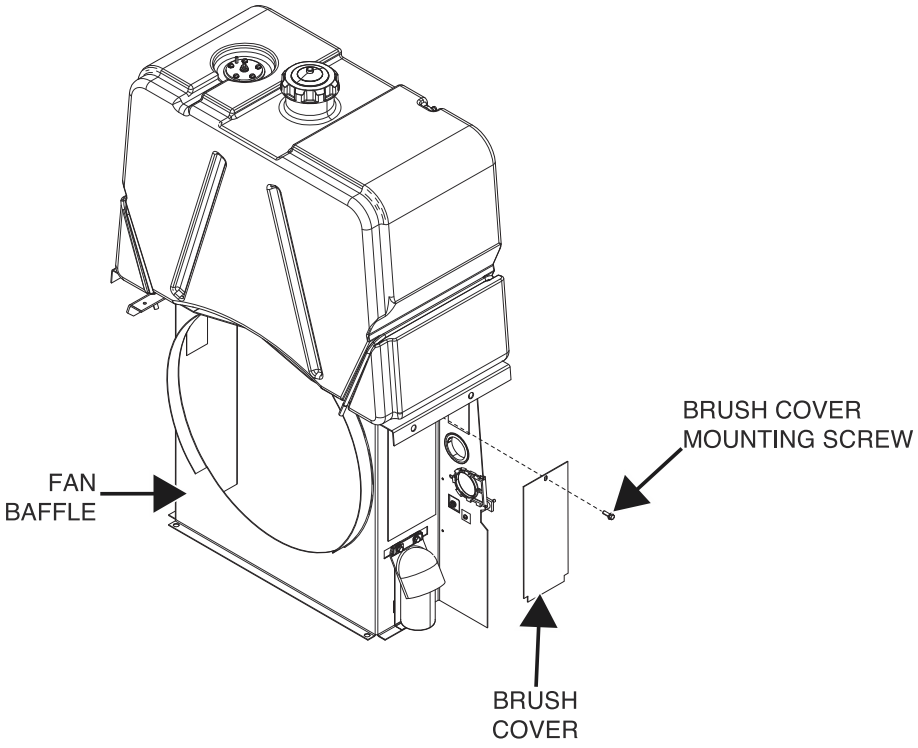
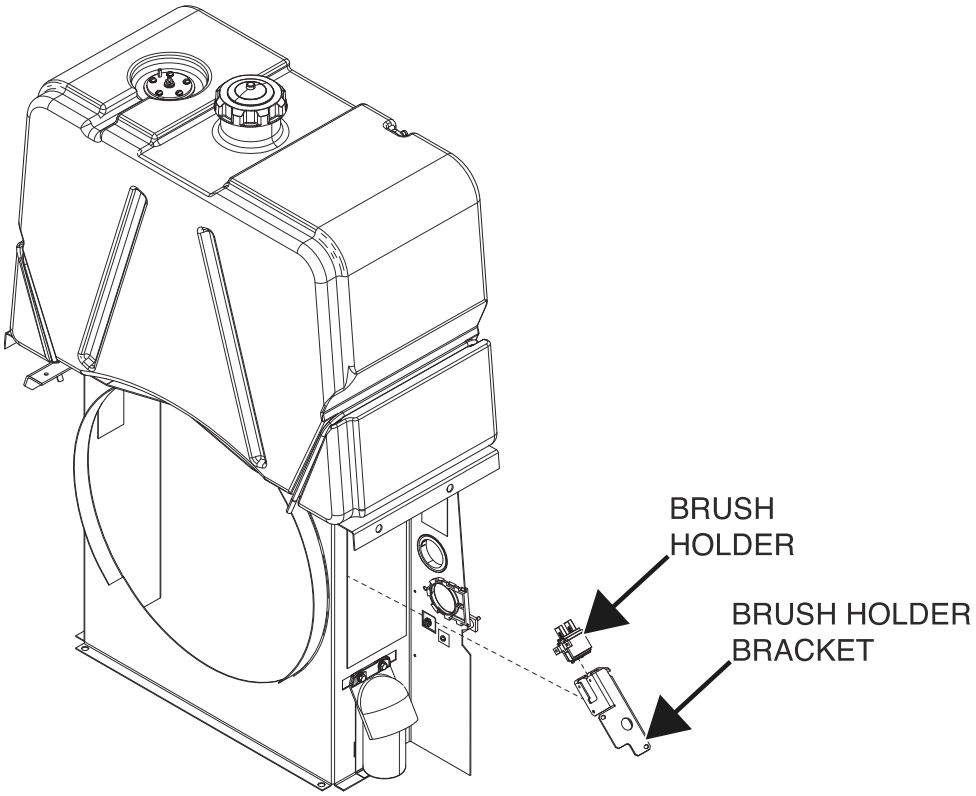


Figure F.2 – Brush holder and brush holder bracket locations



MODE SELECT BOARD REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Mode Select Board.

MATERIALS NEEDED

5/46” Allen Wrench
9/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plug J81 from the rear of the mode select board. See ***Figure F.1***. See Wiring Diagram.
5. Using a 5/64” Allen wrench, loosen the set screw securing the knob to the shaft. See ***Figure F.2***.
6. Using a 9/16” nutdriver, remove the nut securing the board to the control panel. See ***Figure F.2***. See Wiring Diagram.
7. Carefully maneuver the mode select board out of the front panel.
8. The mode select board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new mode select board into the front panel.
2. Using a 9/16” nutdriver, attach the nut securing the board to the control panel.
3. Using a 5/64” Allen wrench, tighten the set screw securing the knob to the shaft.
4. Connect plug J81 to the rear of the mode select board. See Wiring Diagram.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Mode select board plug J81 locations

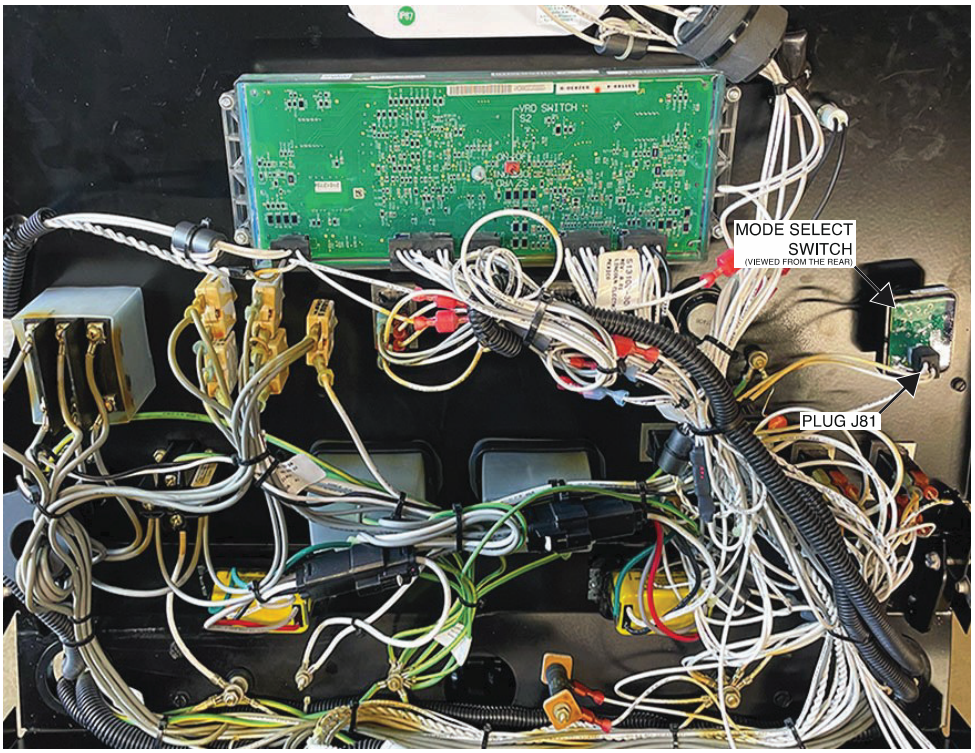
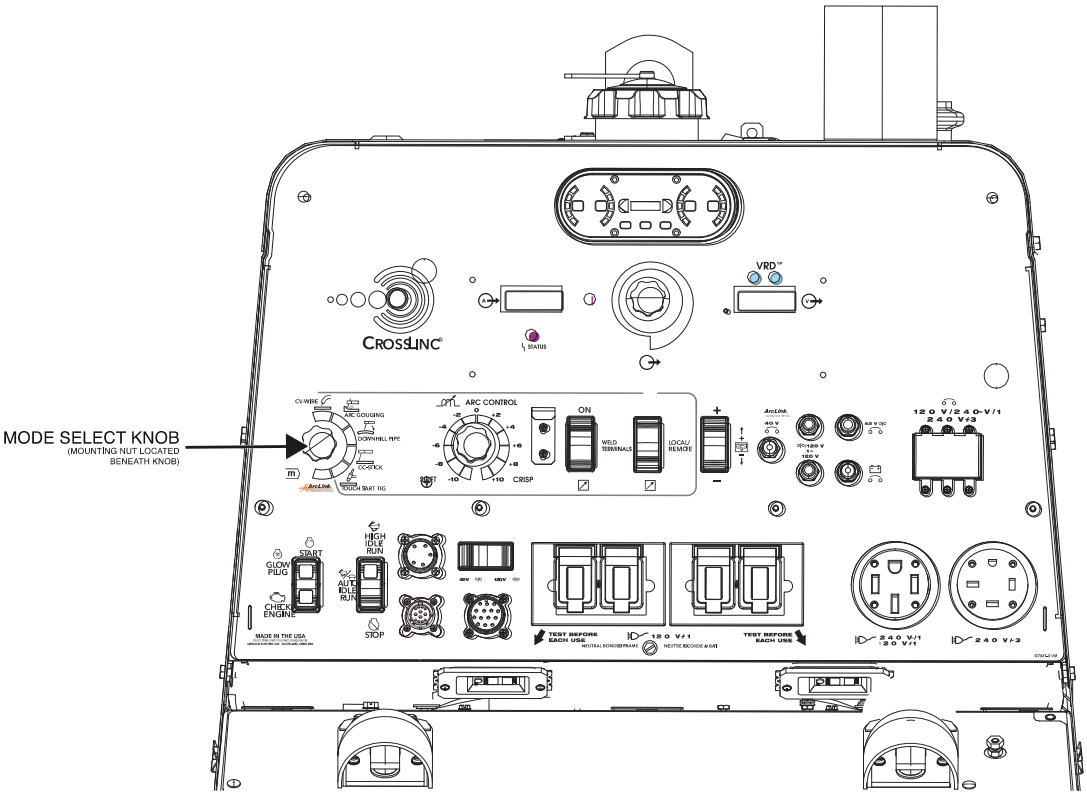


Figure F.2 – Mode select board knob location



OUTPUT PANEL REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Output Panel.

MATERIALS NEEDED

5/16” Nutdriver
3/8” Nutdriver
7/16” Nutdriver
Two 3/4” Open-End Wrenches
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the output panel mounting screws.
6. Using a 3/8” nutdriver, remove the two screws securing the output panel to the control box.
7. Carefully raise the control panel into the upright position.
8. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position. See ***Figure F.1***.
9. Using a 3/8” nutdriver, remove the three screws securing the output panel to the machine. See ***Figure F.2***.
10. Using a 7/16” nutdriver, remove the nut securing lead GND-J to the ground stud on the output panel. See Wiring Diagram.
11. Using two 3/4” open-end wrenches, remove the nut and bolt securing the leads to the negative output terminal. See ***Figure F.2***. See Wiring Diagram.
12. Using two 3/4” open-end wrenches, remove the nut and bolt securing the leads to the positive output terminal. See ***Figure F.2***. See Wiring Diagram.
13. Cut cable ties as necessary to allow for the removal of the output panel.
14. The output panel can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the output panel to allow for the reconnection of leads.
2. Using two 3/4” open-end wrenches, attach the nut and bolt securing the previously removed leads to the positive output terminal. See Wiring Diagram.
3. Using two 3/4” open-end wrenches, attach the nut and bolt securing the previously removed leads to the negative output terminal. See Wiring Diagram.
4. Using a 7/16” nutdriver, attach the nut securing lead GND-J to the ground stud on the output panel. See Wiring Diagram.
5. Using a 3/8” nutdriver, attach the three screws securing the output panel to the machine.
6. Using a 5/16” nutdriver, remove the screw securing the control panel into the upright position.

7. Carefully lower the control panel.
8. Using a 3/8” nutdriver, attach the two screws securing the output panel to the control box.
9. Carefully raise the control panel into the upright position.
10. Using a 5/16” nutdriver, attach the screw securing the control panel into the upright position.
11. Perform the ***Case Cover Replacement Procedure***.
12. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw location

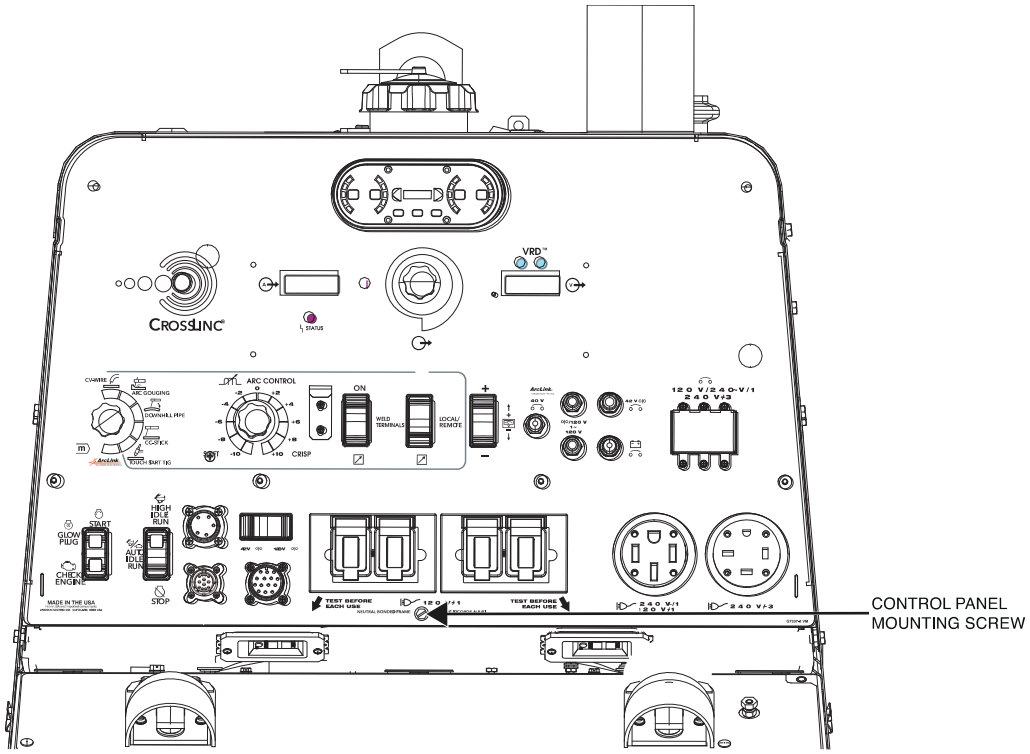
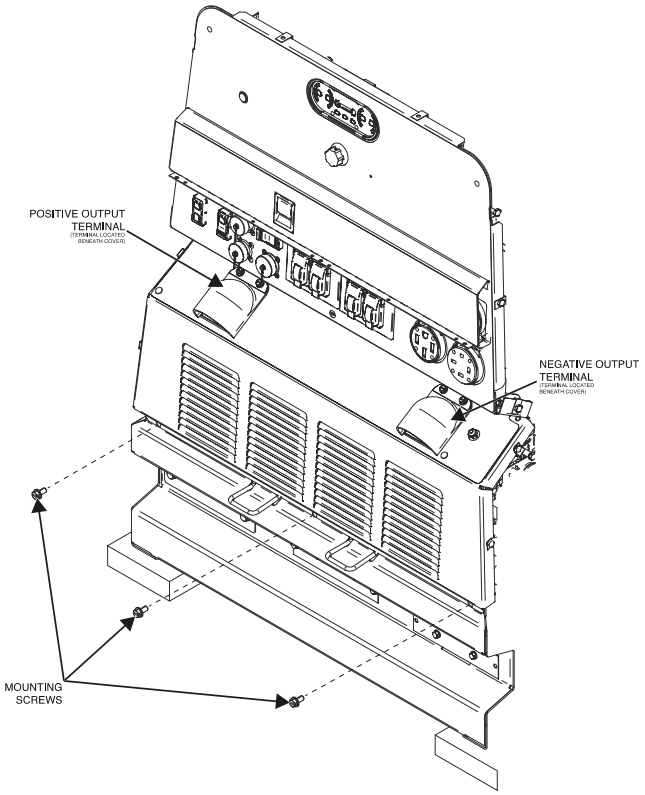


Figure F.2 – Output panel mounting screw, positive and negative output terminal locations



POWER MODULE REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Power Module and most of its components.

MATERIALS NEEDED

7/16” Nutdriver
Two 1/2” Open-End Wrenches
Two 7/16” Open-End Wrenches
3/8” Nutdriver
1/2” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Perform the ***Output Panel Removal Procedure***.
5. Label and disconnect plugs J20, J21, and J22 from the right-side chopper board. See ***Figure F.1***. See Wiring Diagram.
6. Label and disconnect leads 250A and 250B from the right-side chopper board thermostat terminals. See ***Figure F.1***. See Wiring Diagram.
7. Using a 7/16” nutdriver, remove the screw, lock washer, and flat washer securing lead W10 to terminal B3 of the right-side chopper board. See ***Figure F.1***. See Wiring Diagram.
8. Using a 7/16” nutdriver, remove the screw, lock washer, and flat washer securing lead POSB to terminal B2 of the right-side chopper board. See ***Figure F.1***. See Wiring Diagram.
9. Using a 7/16” nutdriver, remove the screw, lock washer, and flat washer securing lead NEGB to terminal B1 of the right-side chopper board. See ***Figure F.1***. See Wiring Diagram.
10. Using a 7/16” nutdriver, remove the screw, lock washer, and flat washer securing lead W9 to terminal B6 of the right-side chopper board. See ***Figure F.1***. See Wiring Diagram.
11. Using a 7/16” nutdriver, remove the screw, lock washer, and flat washer securing lead POSB to terminal B5 of the right-side chopper board. See ***Figure F.1***. See Wiring Diagram.
12. Using a 7/16” nutdriver, remove the screw, lock washer, and flat washer securing lead NEGB to terminal B4 of the right-side chopper board. See ***Figure F.1***. See Wiring Diagram.
13. Using a 7/16” nutdriver, remove the two screws and lock washers securing the power module top bracket to the right-side chopper board heat sink. See ***Figure F.1***.
14. Label and disconnect leads 23 and 25 from the left-side chopper board thermostat terminals. See ***Figure F.2***. See Wiring Diagram.
15. Using a 7/16” nutdriver, remove the screw, lock washer, and flat washer securing lead W8 to terminal B6 of the left-side chopper board. See ***Figure F.2***. See Wiring Diagram.
16. Using a 7/16” nutdriver, remove the screw, lock washer, and flat washer securing lead POSA to terminal B5 of the left-side chopper board. See ***Figure F.2***. See Wiring Diagram.
17. Using a 7/16” nutdriver, remove the screw, lock washer, and flat washer securing lead NEGA to terminal B4 of the left-side chopper board. See ***Figure F.2***. See Wiring Diagram.

18. Using a 7/16” nutdriver, remove the screw, lock washer, and flat washer securing lead W7 to terminal B3 of the left-side chopper board. See ***Figure F.2***. See Wiring Diagram.
19. Using a 7/16” nutdriver, remove the screw, lock washer, and flat washer securing lead POSA to terminal B2 of the left-side chopper board. See ***Figure F.2***. See Wiring Diagram.
20. Using a 7/16” nutdriver, remove the screw, lock washer, and flat washer securing lead NEGA to terminal B1 of the left-side chopper board. See ***Figure F.2***. See Wiring Diagram.
21. Using a 7/16” nutdriver, remove the two screws and lock washers securing the power module top bracket to the left-side chopper board heat sink. See ***Figure F.3***.
22. Using two 1/2” open-end wrenches, remove the bolt, nut, lock washer and two flat washers securing the heavy lead to the shunt. See Wiring Diagram.
23. Using two 7/16” open-end wrenches, remove the four bolts, nuts, lock washers, and eight flat washers securing the chokes to the power module top bracket. See ***Figure F.3***.
24. Using a 3/8” nutdriver, remove the four screws securing the power module bracket to the base of the machine.
25. Cut cable ties as necessary to allow for the removal of the power module bracket.
26. Carefully lift the power module bracket out of the machine to gain access to the remaining connections.
27. Using two 1/2” open-end wrenches, remove the two bolts, nuts, lock washers and two flat washers securing leads POSA, POSB, 206C and the heavy black lead to the positive output terminal of the output rectifier. See ***Figure F.3***. See Wiring Diagram.
28. Using a 7/16” nutdriver, remove the two bolts, lock washers and flat washers securing the left choke to the power module bracket. See ***Figure F.3***.
29. Using two 1/2” open-end wrenches, remove the bolt, nut, lock washer, and flat washer securing the lead to the bottom terminal of the left choke. See ***Figure F.3***. See Wiring Diagram.
30. The left choke can now be removed and replaced.
31. Using a 7/16” nutdriver, remove the two bolts, lock washers and flat washers securing the right choke to the power module bracket. See ***Figure F.3***.
32. Using two 1/2” open-end wrenches, remove the bolt, nut, lock washer, and flat washer securing the lead to the bottom terminal of the right choke. See ***Figure F.3***. See Wiring Diagram.
33. The right choke can now be removed and replaced.
34. Using a 7/16” nutdriver, remove the two screws and lock washers securing the right-side chopper board heat sink to the power module bracket. See ***Figure F.3***.
35. The right-side chopper board can now be removed and replaced.
36. Using a 7/16” nutdriver, remove the two screws and lock washers securing the left-side chopper board heat sink to the power module bracket. See ***Figure F.3***.
37. The left-side chopper board can now be removed and replaced.
38. Using a 1/2” nutdriver, remove the two nuts securing the output rectifier to the power module bracket. See ***Figure F.3***.
39. The output rectifier can be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new output rectifier into the power module bracket.
2. Using a 1/2” nutdriver, attach the two nuts securing the output rectifier to the power module bracket.
3. Carefully position the new left-side-chopper board onto the power module bracket.
4. Using a 7/16” nutdriver, attach the two screws and lock washers securing the left-side chopper board heat sink to the power module bracket.
5. Carefully position the new right-side-chopper board onto the power module bracket.
6. Using a 7/16” nutdriver, attach the two screws and lock washers securing the right-side chopper board heat sink to the power module bracket.
7. Carefully position the right choke onto the power module bracket.
8. Using two 1/2” open-end wrenches, attach the bolt, nut, lock washer, and flat washer securing the lead to the bottom terminal of the right choke. See Wiring Diagram.
9. Using a 7/16” nutdriver, attach the two bolts, lock washers and flat washers securing the right choke to the power module bracket.
10. Carefully position the left choke onto the power module bracket.

11. Using two 1/2” open-end wrenches, attach the bolt, nut, lock washer, and flat washer securing the lead to the bottom terminal of the left choke. See Wiring Diagram.
12. Using a 7/16” nutdriver, attach the two bolts, lock washers and flat washers securing the left choke to the power module bracket.
13. Using two 1/2” open-end wrenches, attach the two bolts, nuts, lock washers and two flat washers securing leads POSA, POSB, 206C and the heavy black lead to the positive output terminal of the output rectifier. See Wiring Diagram.
14. Carefully position the power module bracket into the machine.
15. Replace cable ties as necessary.
16. Using a 3/8” nutdriver, attach the four screws securing the power module bracket to the base of the machine.
17. Using two 7/16” open-end wrenches, attach the four bolts, nuts, lock washers, and eight flat washers securing the chokes to the power module top bracket.
18. Using two 1/2” open-end wrenches, attach the bolt, nut, lock washer and two flat washers securing the heavy lead to the shunt. See Wiring Diagram.
19. Using a 7/16” nutdriver, attach the two screws and lock washers securing the power module top bracket to the left-side chopper board heat sink.
20. Using a 7/16” nutdriver, attach the screw, lock washer, and flat washer securing lead NEGA to terminal B1 of the left-side chopper board. See Wiring Diagram.
21. Using a 7/16” nutdriver, attach the screw, lock washer, and flat washer securing lead POSA to terminal B2 of the left-side chopper board. See Wiring Diagram.
22. Using a 7/16” nutdriver, attach the screw, lock washer, and flat washer securing lead W7 to terminal B3 of the left-side chopper board. See Wiring Diagram.
23. Using a 7/16” nutdriver, attach the screw, lock washer, and flat washer securing lead NEGA to terminal B4 of the left-side chopper board. See Wiring Diagram.
24. Using a 7/16” nutdriver, attach the screw, lock washer, and flat washer securing lead POSA to terminal B5 of the left-side chopper board. See Wiring Diagram.
25. Using a 7/16” nutdriver, attach the screw, lock washer, and flat washer securing lead W8 to terminal B6 of the left-side chopper board. See Wiring Diagram.
26. Connect leads 23 and 25 to the left-side chopper board thermostat terminals. See Wiring Diagram.
27. Using a 7/16” nutdriver, attach the two screws and lock washers securing the power module top bracket to the right-side chopper board heat sink.
28. Using a 7/16” nutdriver, attach the screw, lock washer, and flat washer securing lead NEGB to terminal B4 of the right-side chopper board. See Wiring Diagram.
29. Using a 7/16” nutdriver, attach the screw, lock washer, and flat washer securing lead POSB to terminal B5 of the right-side chopper board. See Wiring Diagram.
30. Using a 7/16” nutdriver, attach the screw, lock washer, and flat washer securing lead W9 to terminal B6 of the right-side chopper board. See Wiring Diagram.
31. Using a 7/16” nutdriver, attach the screw, lock washer, and flat washer securing lead NEGB to terminal B1 of the right-side chopper board. See Wiring Diagram.
32. Using a 7/16” nutdriver, attach the screw, lock washer, and flat washer securing lead POSB to terminal B2 of the right-side chopper board. See Wiring Diagram.
33. Using a 7/16” nutdriver, attach the screw, lock washer, and flat washer securing lead W10 to terminal B3 of the right-side chopper board. See Wiring Diagram.
34. Connect leads 250A and 250B to the right-side chopper board thermostat terminals. See Wiring Diagram.
35. Connect plugs J20, J21, and J22 to the right-side chopper board. See Wiring Diagram.
36. Perform the ***Output Panel Replacement Procedure***.
37. Perform the ***Case Cover Replacement Procedure***.
38. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Right-side chopper board plug and terminal locations

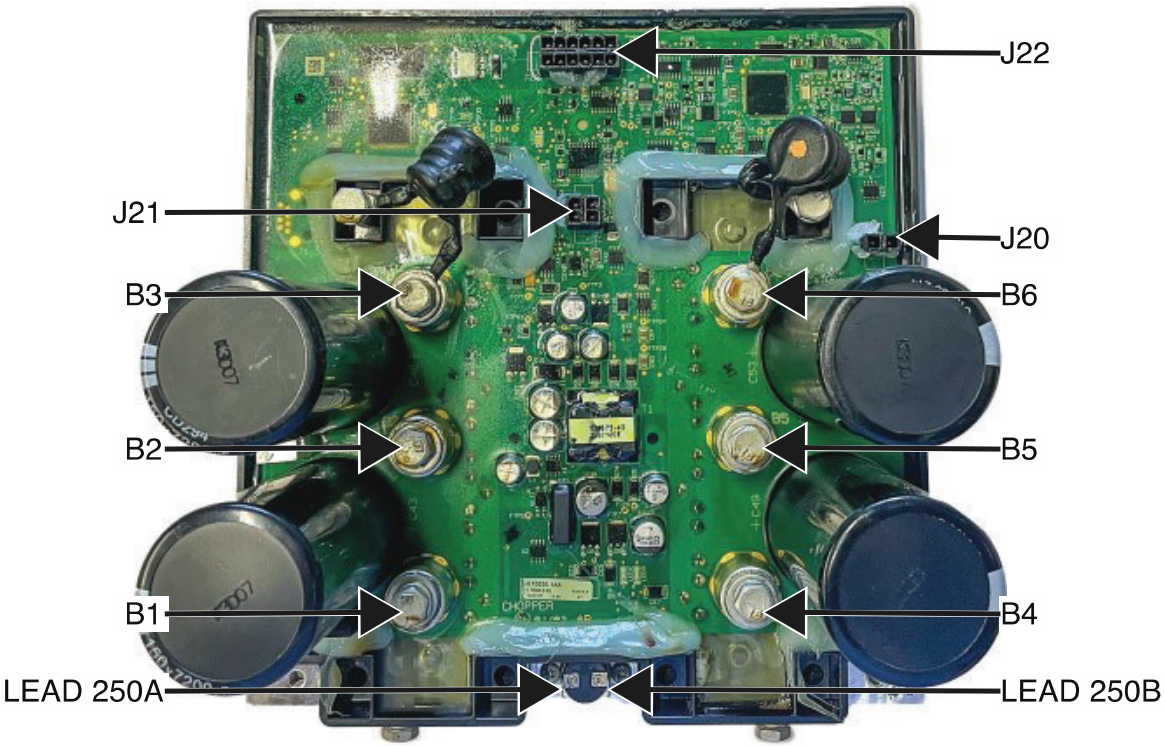


Figure F.2 – Left-side chopper board terminal locations

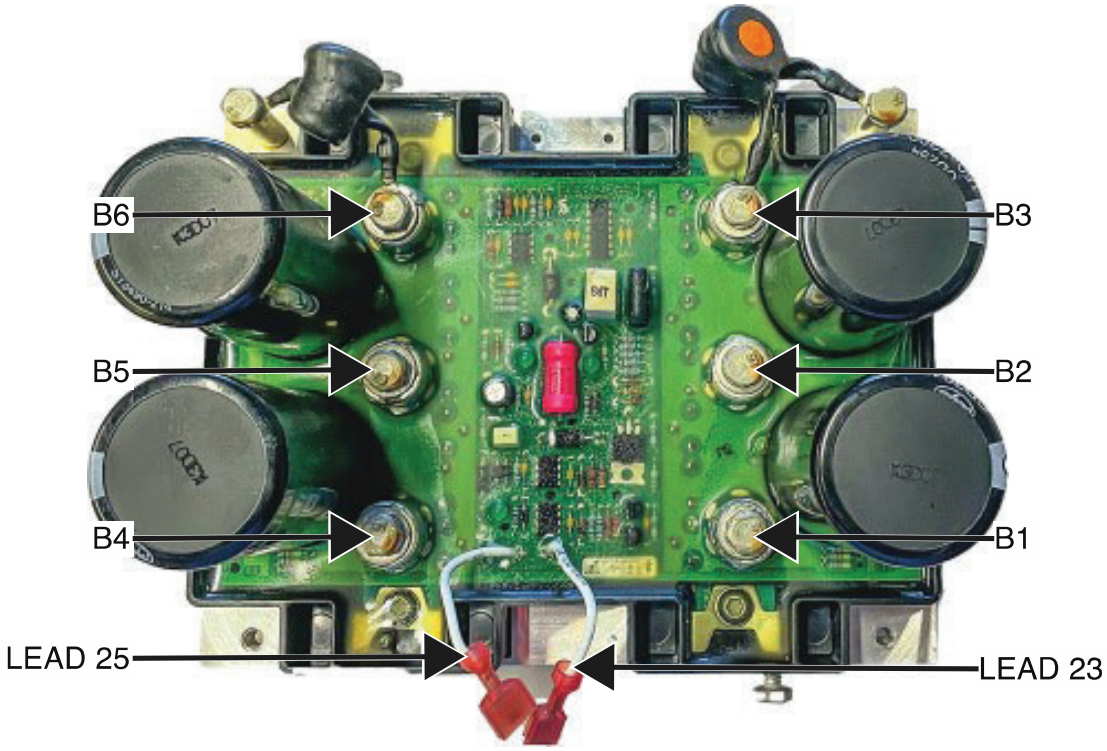
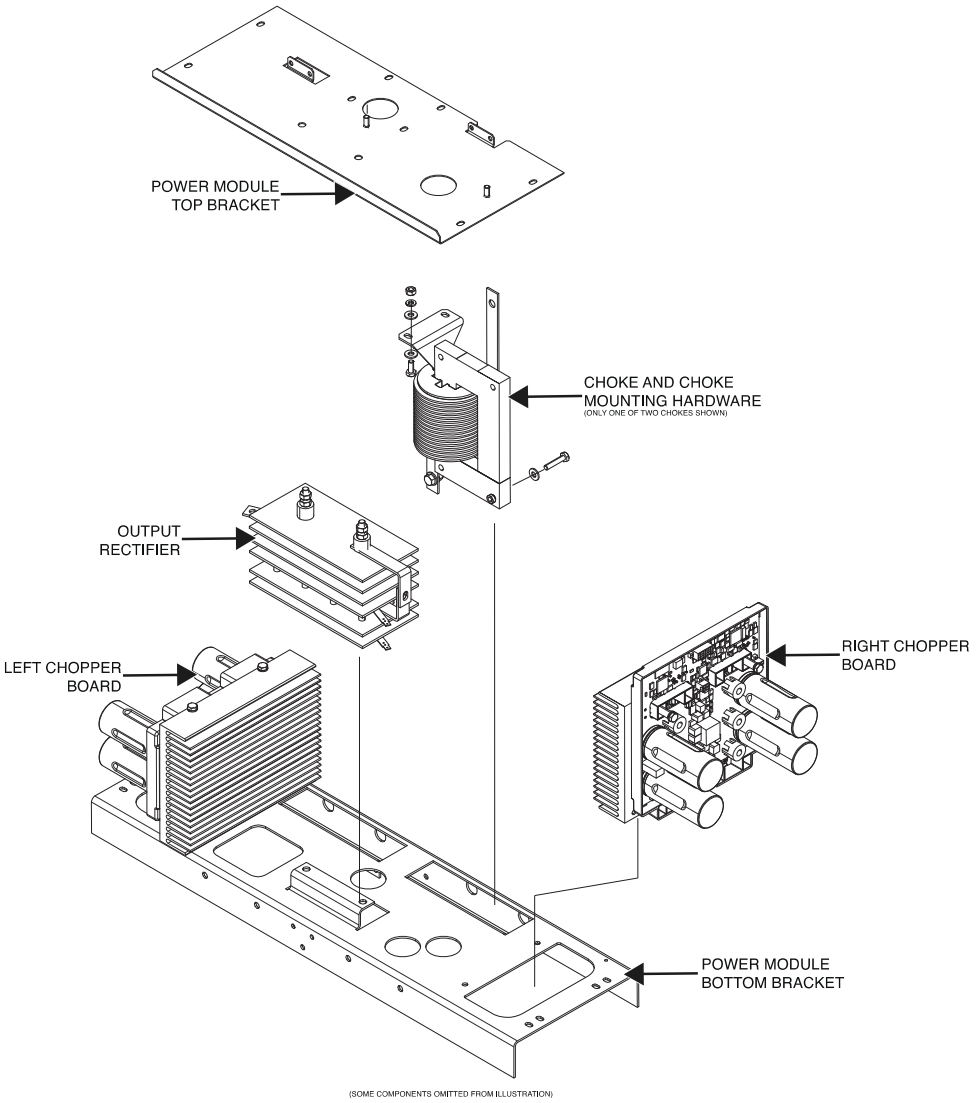


Figure F.3 – Power module components and mounting hardware locations



STATOR AND ROTOR ASSEMBLY REMOVAL AND REPLACEMENT PROCEDURE

Refer to Safety pages for explanation of hazards:

TEST DESCRIPTION

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

MATERIALS NEEDED

Slotted Screwdriver
3/8” Nutdriver
7/16” Nutdriver
Phillips Screwdriver
5/16” Nutdriver
1/2” Nutdriver
Small Piece Of Wood
Large Crescent Wrench
3/4” Open-End Wrench
3/4” Socket
Hoist And Appropriate Rigging
11/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 549X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Perform the ***Power Module Removal Procedure***.
5. Perform the ***Fuel Tank Removal Procedure***.
6. Perform the ***Field Capacitor Removal Procedure***.
7. Perform the ***Brush And Brush Holder Removal Procedure***.
8. Label and disconnect lead 46 from the CB9 circuit breaker. See ***Figure F.1***. See Wiring Diagram.
9. Label and disconnect lead 45 from the D2 diode bridge. See ***Figure F.2***. See Wiring Diagram.
10. Label and disconnect lead 42 from the CB4 circuit breaker. See ***Figure F.3***. See Wiring Diagram.
11. Label and disconnect lead 41 from 41A quick-connect terminal. See Wiring Diagram.
12. Using a slotted screwdriver, loosen the two screws securing leads 3 and 6 to the CB1 circuit breaker. See ***Figure F.4***. See Wiring Diagram. Label and disconnect leads. Note turns and direction thru toroid for reassembly.
13. Using a slotted screwdriver, loosen the screw securing lead 4 to the CB1 circuit breaker. See ***Figure F.4***. See Wiring Diagram. Label and disconnect lead.
14. Using a 3/8” nutdriver, remove the nut, lock washer, and flat washer securing lead 5 to the ground stud on the control panel. See Wiring Diagram.
15. Using a 7/16” nutdriver, remove the nut, lock washer, and flat washer securing lead 5A to the auxiliary stud on the control panel. See Wiring Diagram.
16. Label and disconnect lead F2 from the D3 diode bridge. See ***Figure F.5***. See Wiring Diagram.
17. Using a Phillips screwdriver, loosen the screw securing lead F1 to the boost relay. See ***Figure F.6***. See Wiring Diagram.

18. Using a 5/16” nutdriver, remove the two screws securing the fuel tank guard to the fan baffle. See ***Figure F.7***.
19. Using a Phillips screwdriver, loosen the three screws securing leads F1A, 271, and 232P to the boost relay. See ***Figure F.6***. See Wiring Diagram.
20. Label and disconnect leads 200 and 200N from the R1 resistor. See Wiring Diagram.
21. Label and disconnect leads 200A, 200D, 200, F1A, 5H, 5R, 201A, and 201C from the D1 diode bridge. See ***Figure F.8***. See Wiring Diagram.
22. Label and disconnect leads 200D, 5R, and 201C from the D3 diode bridge. See ***Figure F.5***. See Wiring Diagram.
23. Using a 7/16” nutdriver, remove the two nuts, lock washers, and flat washers securing the fan baffle to the machine base. See ***Figure F.7***.
24. Using a 1/2” nutdriver, remove the two screws securing the fan baffle to the fuel tank supports. See ***Figure F.9***.
25. Using a 5/16” nutdriver, remove the four screws securing the fan baffle to the upper stator baffle. See ***Figure F.9***.
26. Using a 5/16” nutdriver, remove the two screws securing the fan baffle to the lower stator baffle. See ***Figure F.9***.
27. Label and disconnect any remaining leads to allow for the removal of the control box. See Wiring Diagram.
28. Using a 3/8” nutdriver, remove the two screws securing the control box to the fuel tank supports.
29. Carefully maneuver the control box away from the machine to allow for the removal of the stator.
30. Carefully maneuver the fan baffle out of the machine.
31. Using a 1/2” nutdriver, remove the two screws securing the fuel tank supports to the machine. See ***Figure F.9***.
32. Carefully remove the upper and lower stator baffles.
33. Carefully remove the acoustical foam. See ***Figure F.10***.
34. Using a 3/8” nutdriver, remove the eight screws securing the two stator cowlings to the machine. See ***Figure F.10***.
35. Use a small piece of wood to prevent the fan blades from turning during removal.
36. Using a large crescent wrench, remove the nut and washer securing the fan to the rotor shaft. See ***Figure F.10***.
37. Carefully slide the fan off the rotor shaft.
38. Using a 3/4” open-end wrench and a 3/4” socket, remove the two bolts, nuts, flat washers, and engine support washers securing the stator frame to the engine mounts. See ***Figure F.10***.
39. Using a hoist and appropriate rigging, slightly lift the stator frame off its mount.
40. Place a piece of wood or steel blocking under the flywheel housing to support the engine.
41. Using a 11/16” nutdriver, remove the eight screws and washers securing the stator frame to the engine.
42. Using a hoist and appropriate rigging, carefully remove the stator frame from the engine.
43. Using a hoist and appropriate rigging, support the rotor and shaft assembly.
44. Remove the eight screws securing the rotor coupling disc to the engine.
45. The rotor assembly can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Using a hoist and appropriate rigging, carefully mate the rotor and shaft assembly with the engine.
2. Attach the eight screws securing the rotor coupling disc to the engine.
3. Using a hoist and appropriate rigging, carefully mate the stator frame to the engine.
4. Using a 11/16” nutdriver, remove the eight screws and washers securing the stator frame to the engine.
5. Using a hoist and appropriate rigging, slightly lift the stator frame off its mount.
6. Carefully remove the piece of wood or steel blocking from under the flywheel housing to support the engine.
7. Using a hoist and appropriate rigging, carefully lower the stator frame onto its mount.
8. Using a 3/4” open-end wrench and a 3/4” socket, attach the two bolts, nuts, flat washers, and engine support washers securing the stator frame to the engine mounts.

9. Carefully slide the fan onto the rotor shaft.
10. Use a small piece of wood to prevent the fan blades from turning during replacement.
11. Using a large crescent wrench, attach the nut and washer securing the fan to the rotor shaft.
12. Remove the piece of wood from the fan blades.
13. Using a 3/8” nutdriver, attach the eight screws securing the two stator cowlings to the machine.
14. Carefully attach the acoustical foam.
15. Carefully position the upper and lower stator baffles.
16. Using a 1/2” nutdriver, attach the two screws securing the fuel tank supports to the machine.
17. Carefully position the fan baffle into the machine.
18. Carefully maneuver the control box onto the fuel tank supports.
19. Using a 3/8” nutdriver, attach the two screws securing the control box to the fuel tank supports.
20. Connect any previously disconnected leads to the control box. See Wiring Diagram.
21. Using a 5/16” nutdriver, attach the two screws securing the fan baffle to the lower stator baffle.
22. Using a 5/16” nutdriver, attach the four screws securing the fan baffle to the upper stator baffle.
23. Using a 1/2” nutdriver, attach the two screws securing the fan baffle to the fuel tank supports.
24. Using a 7/16” nutdriver, attach the two nuts, lock washers, and flat washers securing the fan baffle to the machine base.
25. Connect leads 200D, 5R, and 201C to the D3 diode bridge. See Wiring Diagram.
26. Connect leads 200A, 200D, 200, F1A, 5H, 5R, 201A, and 201C to the D1 diode bridge. See Wiring Diagram.
27. Connect leads 200 and 200N to the R1 resistor. See Wiring Diagram.
28. Using a Phillips screwdriver, tighten the three screws securing leads F1A, 271, and 232P to the boost relay. See Wiring Diagram.
29. Using a 5/16” nutdriver, attach the two screws securing the fuel tank guard to the fan baffle.
30. Using a Phillips screwdriver, tighten the screw securing lead F1 to the boost relay. See Wiring Diagram.
31. Connect lead F2 to the D3 diode bridge. See Wiring Diagram.
32. Using a 7/16” nutdriver, attach the nut, lock washer, and flat washer securing lead 5A to the auxiliary stud on the control panel. See Wiring Diagram.
33. Using a 3/8” nutdriver, attach the nut, lock washer, and flat washer securing lead 5 to the ground stud on the control panel. See Wiring Diagram.
34. Using a slotted screwdriver, tighten the screw securing lead 4 to the CB1 circuit breaker. See Wiring Diagram.
35. Using a slotted screwdriver, tighten the two screws securing leads 3 and 6 to the CB1 circuit breaker. See Wiring Diagram. Ensure the correct direction and number of turns thru the toroid.
36. Connect lead 41 to 41A quick-connect terminal. See Wiring Diagram.
37. Connect lead 42 to the CB4 circuit breaker. See Wiring Diagram.
38. Connect lead 45 to the D2 diode bridge. See Wiring Diagram.
39. Connect lead 46 to the CB9 circuit breaker. See Wiring Diagram.
40. Perform the ***Brush And Brush Holder Replacement Procedure***.
41. Perform the ***Field Capacitor Replacement Procedure***.
42. Perform the ***Fuel Tank Replacement Procedure***.
43. Perform the ***Power Module Replacement Procedure***.
44. Perform the ***Case Cover Replacement Procedure***.
45. Perform the ***Retest After Repair Procedure***.

Figure F.1 – CB9 circuit breaker lead locations

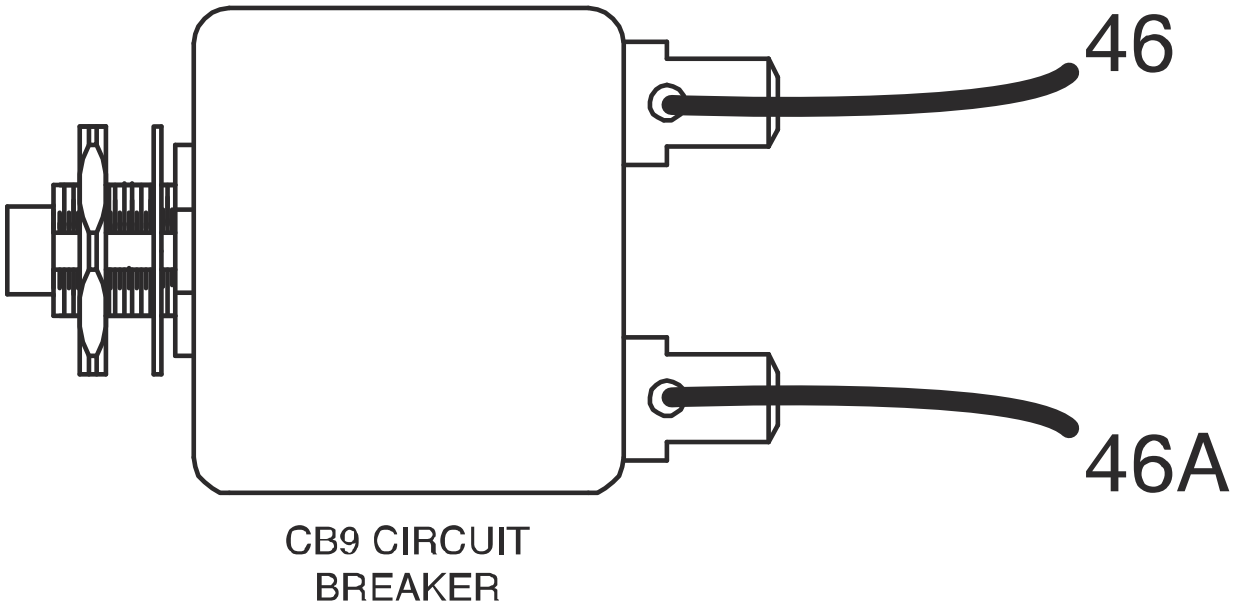


Figure F.2 – D2 rectifier lead locations

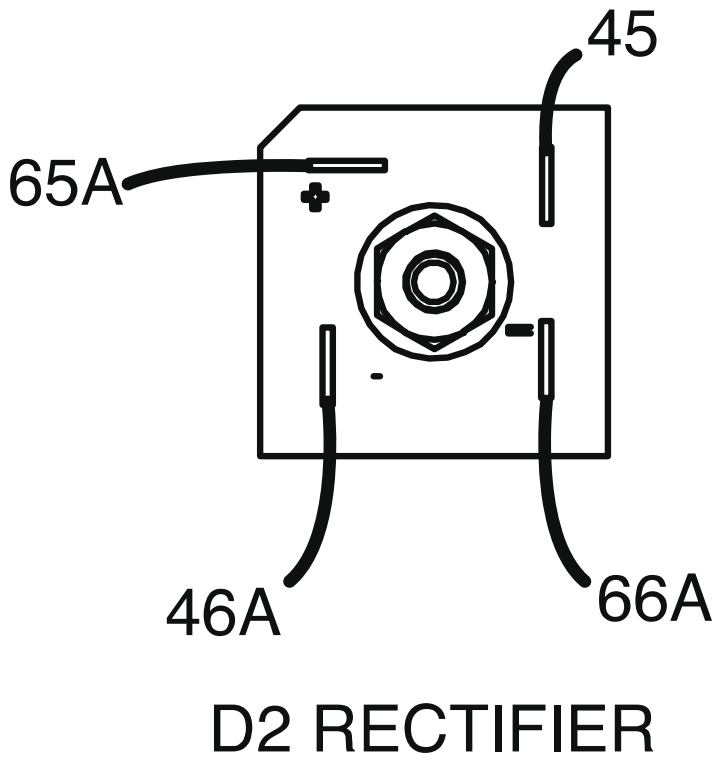


Figure F.3 – CB4 circuit breaker lead locations

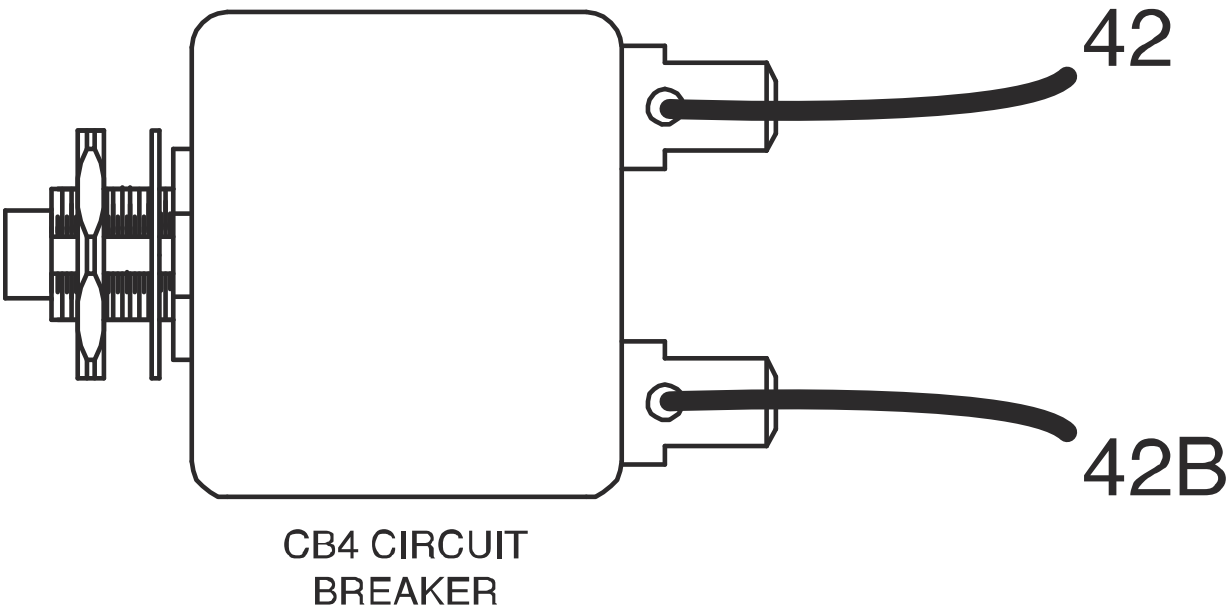


Figure F.4 – CB1 circuit breaker lead locations

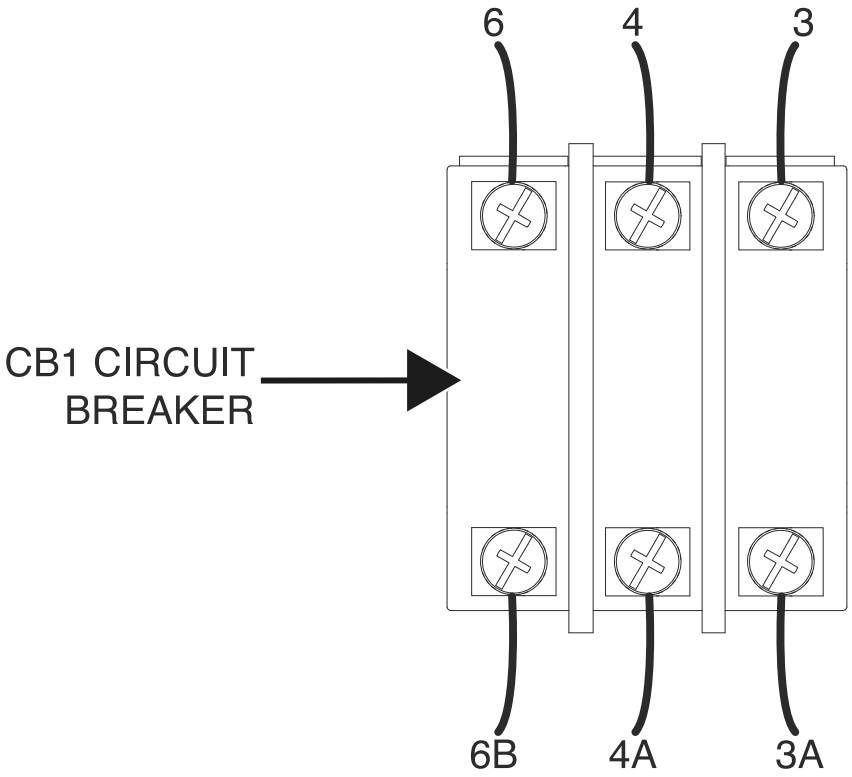


Figure F.5 – D3 rectifier lead locations

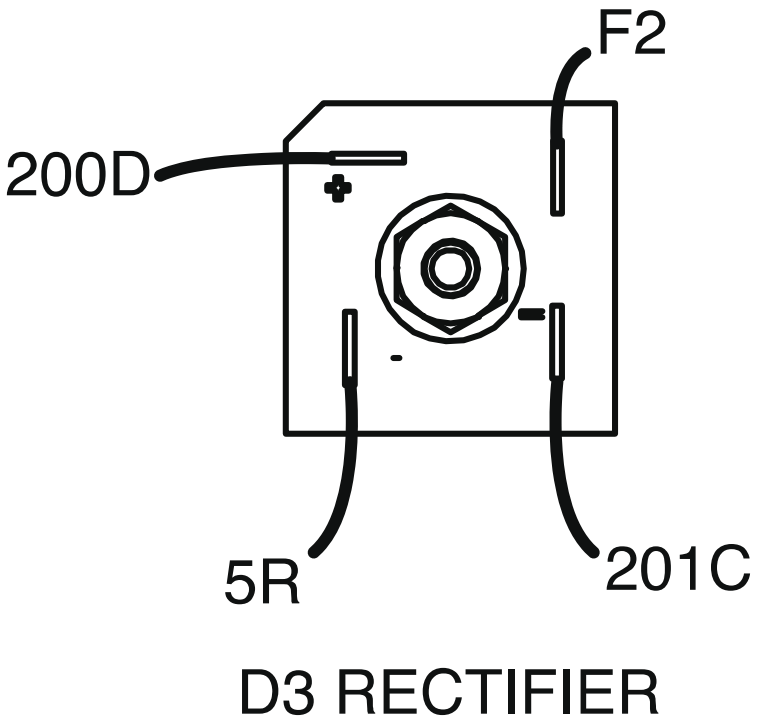


Figure F.6 – Boost relay lead locations

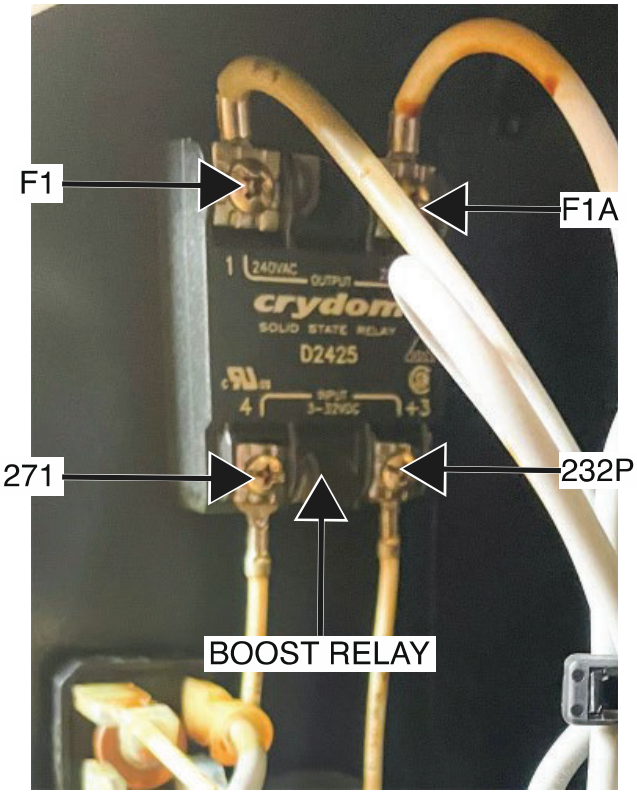


Figure F.7 – Fan baffle and fuel tank guard locations

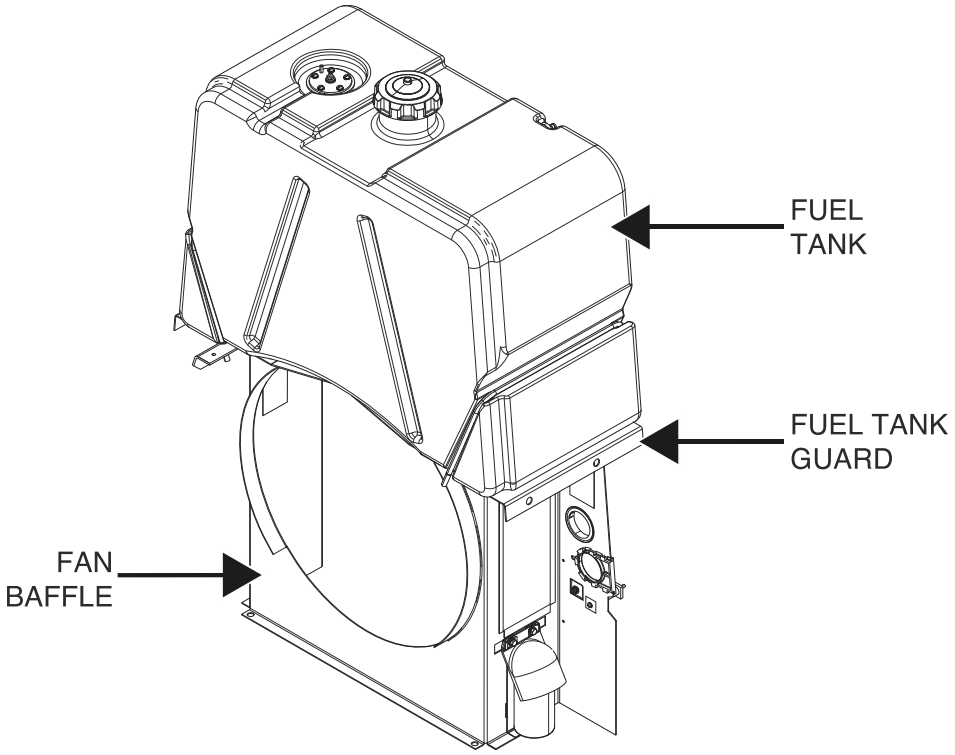


Figure F.8 – D1 rectifier lead locations

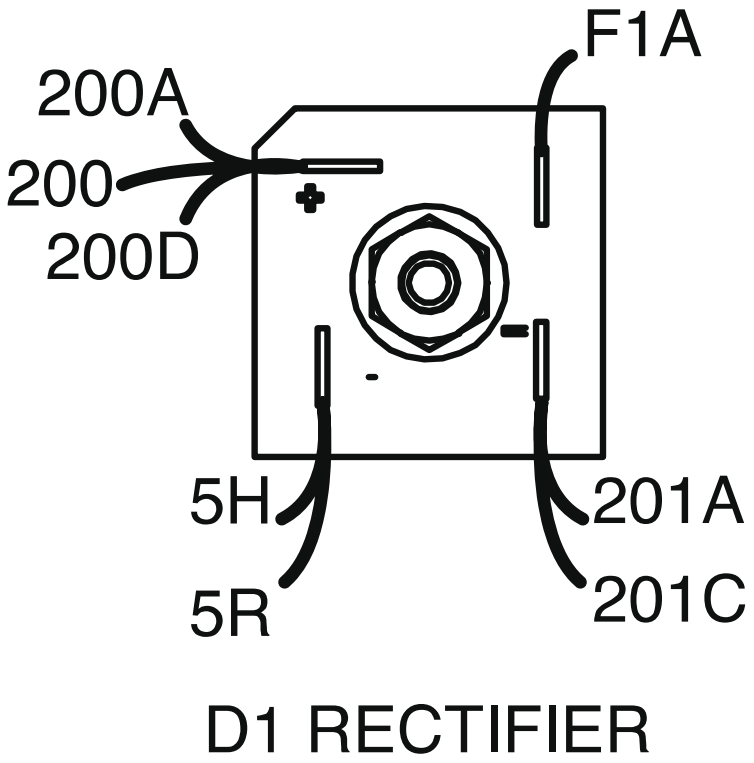


Figure F.9 – Fuel tank support, upper stator baffle, and lower stator baffle locations

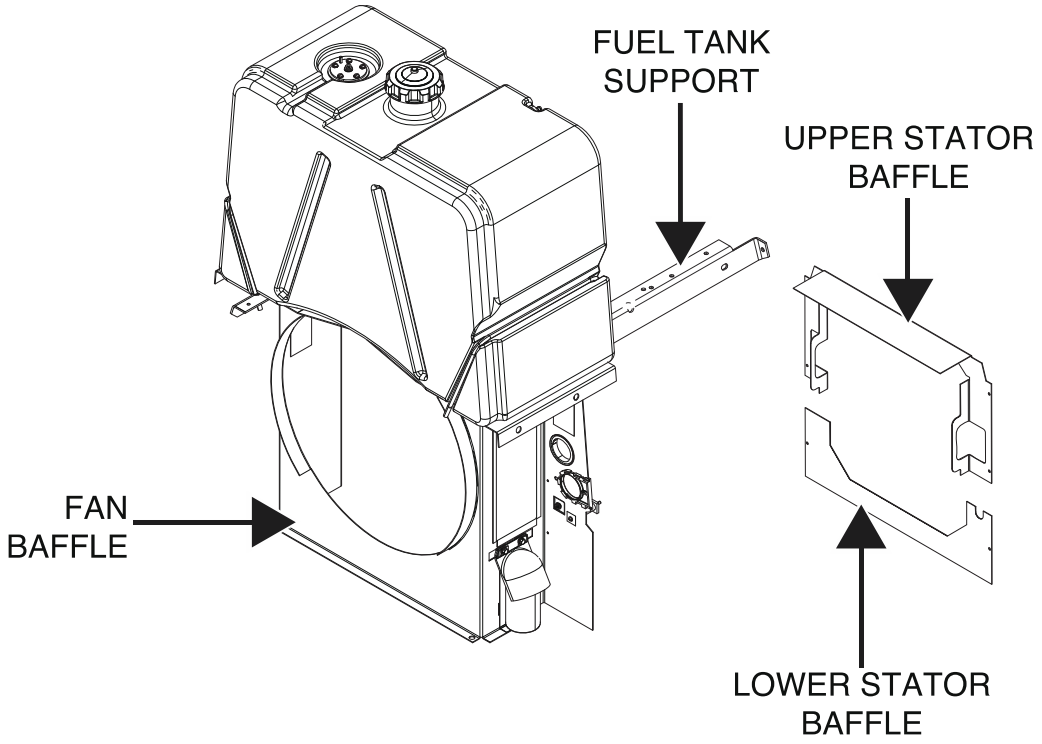
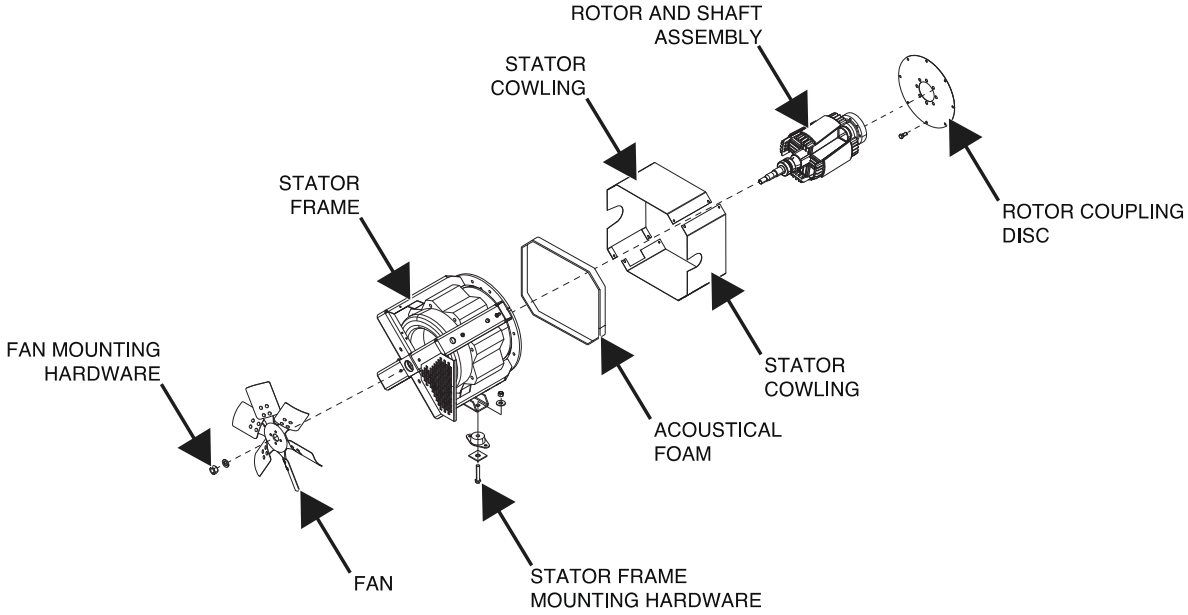


Figure F.10 – Stator and rotor removal component locations



RETEST AFTER REPAIR

Retest a machine:

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

OR

• If you repair or replace any electrical components.

ENGINE OUTPUT

Mode	No Load RPM	Load RPM
Low Idle	1525 RPM	N/A
High Idle	1800 RPM	1800 RPM

MAXIMUM WELDER OUTPUT

Output Control	Output Mode	Open Circuit Voltage	Load Volts	Load Amps
Maximum	CC-Stick	60 VDC(AVG)	41 VDC	525 Amps

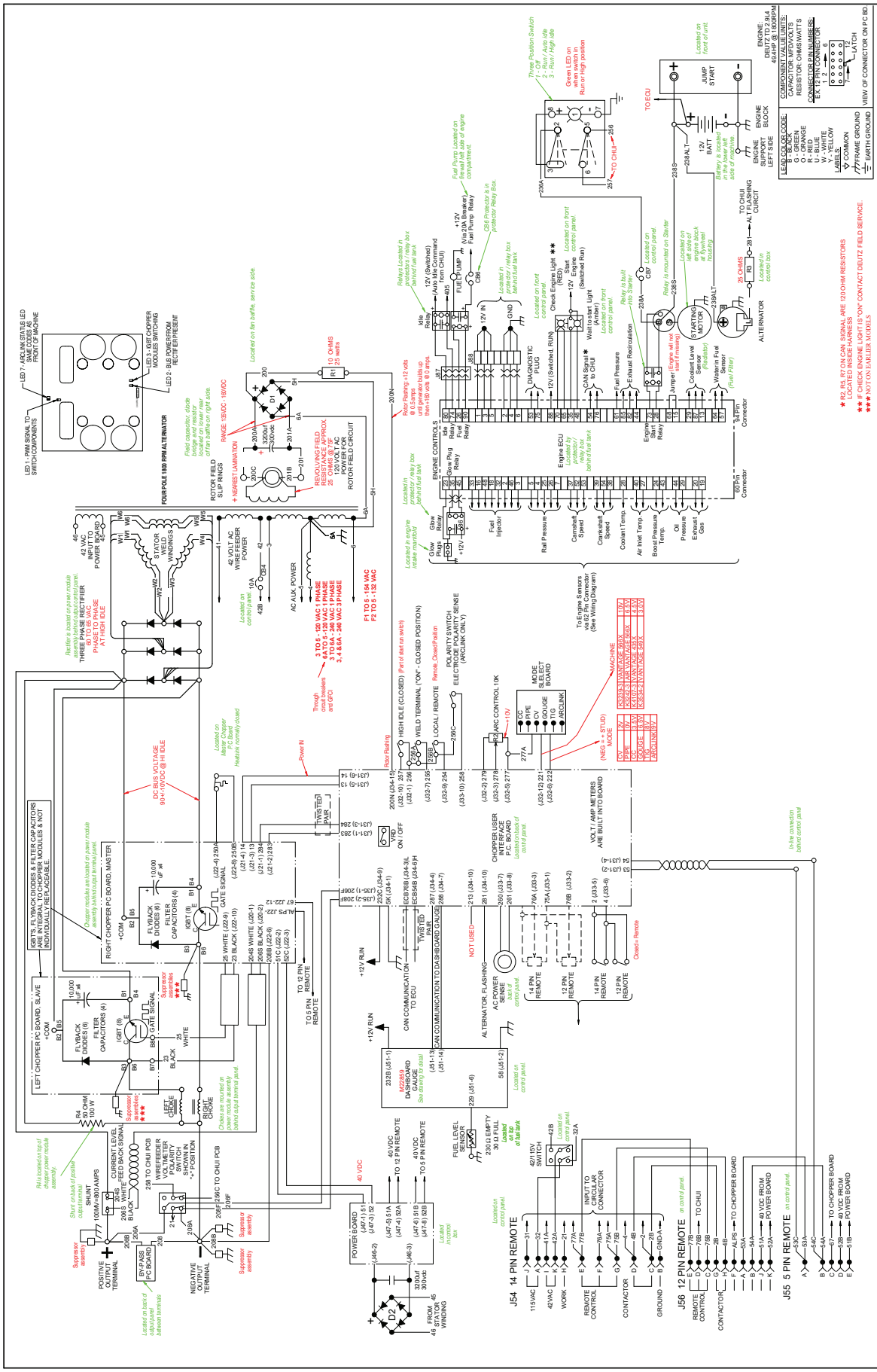
WELDER MODES OUTPUT

WELDING MODE	OUTPUT RANGE
CC-Stick	30-575 Amps
Downhill Pipe (CC)	40-350 Amps
Touch Start TIG	20-350 Amps
CV-Wire	10-45 Volts
Arc Gouging	60-575 Amps

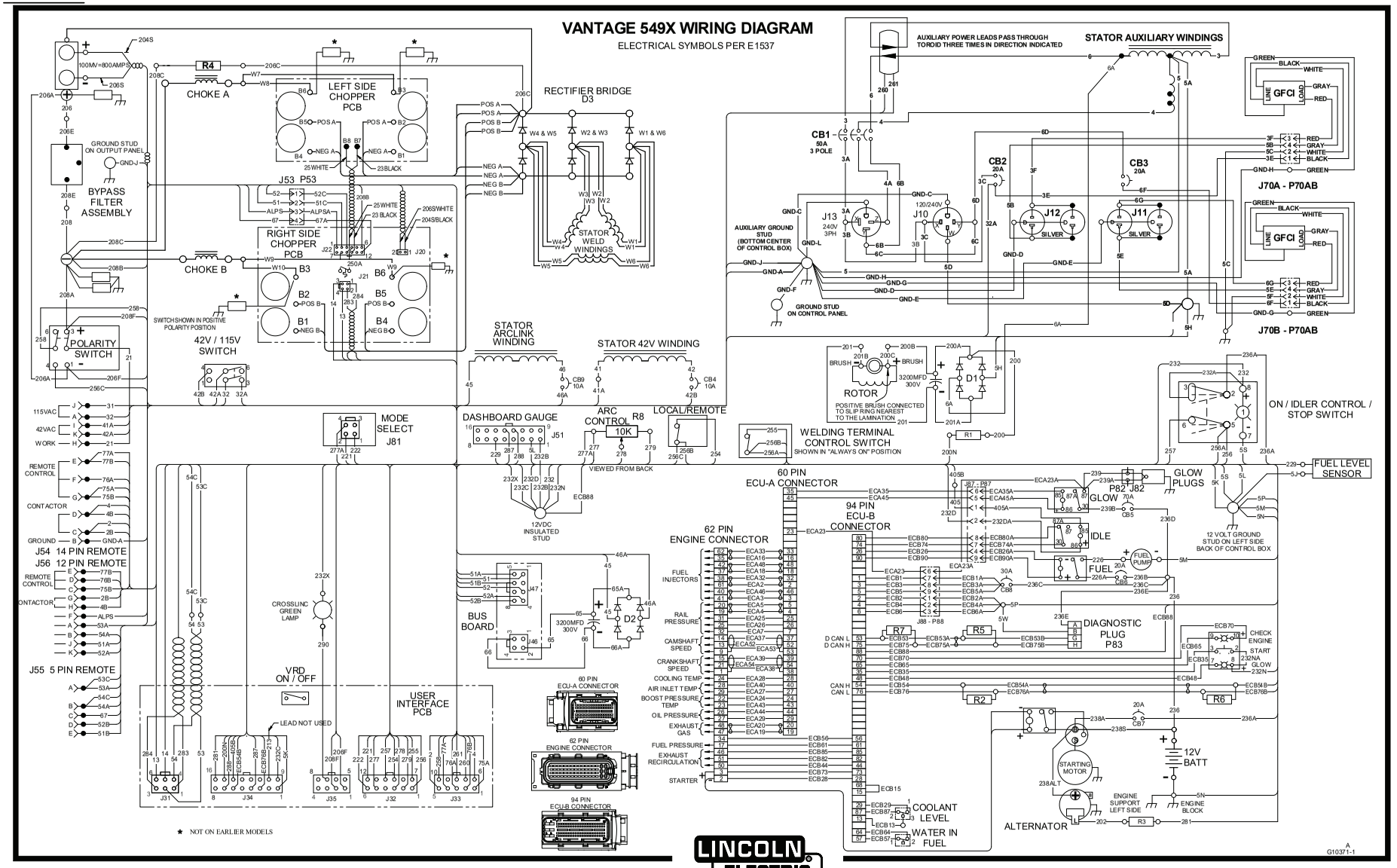
AUXILIARY POWER RECEPTACLES OUTPUT

120VAC Receptacle (Single Phase)			240VAC Receptacle (Three Phase)		
Open Circuit Voltage	Load Voltage	Watts	Open Circuit Voltage	Load Voltage	Watts
120 VAC	110-120 VAC	11,000	240 VAC	210-240 VAC	19,000

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

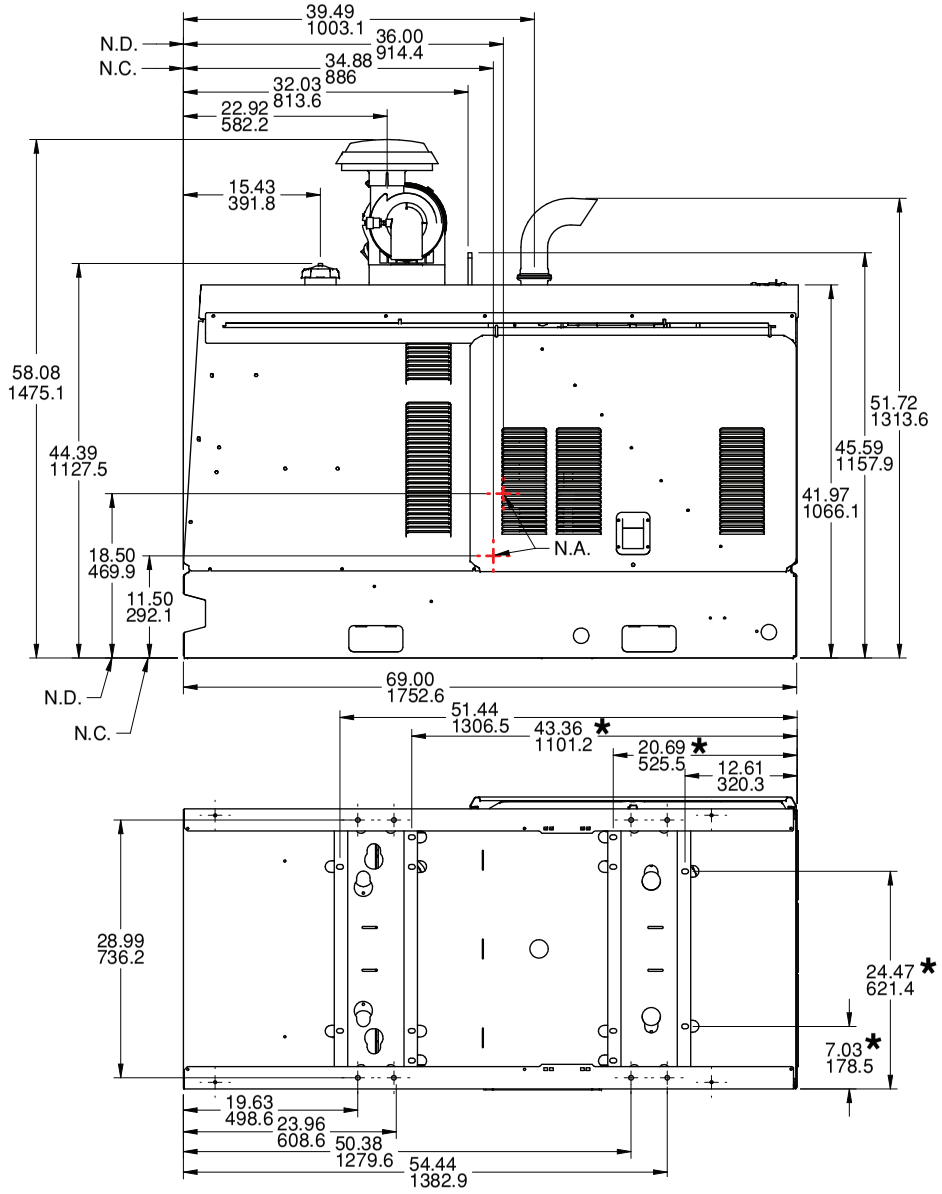


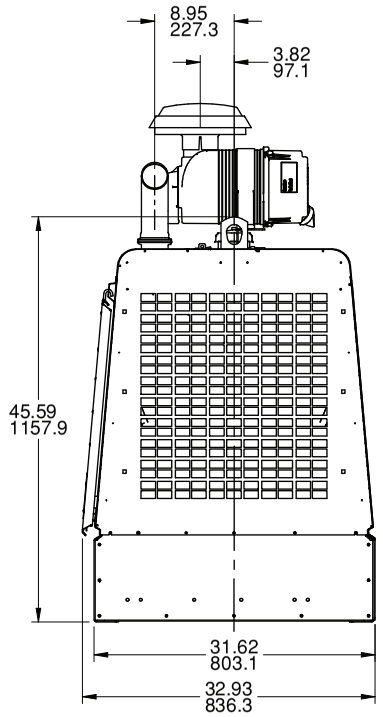
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The specific diagram for a particular code is located in the literature container supplied with the machine. If the diagram is illegible, contact the Service Department for a replacement. Give the equipment code number.



LINCOLN ELECTRIC
CLEVELAND, OHIO, U.S.A.

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 located in the literature container supplied with the machine. If the diagram is illegible, contact the Service Department for a replacement. Give the equipment code number.





N.A. CENTER OF GRAVITY WITH OIL IN ENGINE, OIL IN COMPRESSOR, IF PRESENT, COO & EMPTY FUEL TANK.
N.B. AIR CLEANER INSTALLED BY END USER.
N.C. VANTAGE 600, VANTAGE 549, VANTAGE 566.
N.D. AIR VANTAGE 600, AIR VANTAGE 566.

* TRAILER MOUNTING HOLE LOCATIONS.

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

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2 Step – When the gun trigger is pulled, the welding system cycles through the arc starting sequence and into the main welding parameters. The welding system will continue to weld as long as the gun trigger is activated. Once the trigger is released, the welding system cycles through the arc ending steps.

3 Phase voltage – Three AC voltage sources that are phase shifted 120° with respect to each other.

4 Step – The 4 step trigger adds to the welder's comfort when making long welds by allowing the trigger to be released after an initial trigger pull. When the gun trigger is pulled, the welding system cycles through the arc starting sequence and into the main welding parameters. Welding stops when the trigger is pulled a second time and then released and the welding system cycles through the arc ending steps.

A-lead – The single wire used to configure the machine reconnect for various input Voltages.

AC (Alternating Current) – Voltage or current that changes polarity or direction, respectively, over time.

Active Condition – The machine is energized either by connection to a power source or has some kind of mechanical motion within the unit.

Alternator – An electric generator that produces alternating current. The main function of this device is to change mechanical energy into electrical energy. The mechanical energy can be supplied by either a motor or engine.

Ampere (Amp) – The standard measurement unit of current flow. Symbol: A

Anode – The positively charged electrode of a device.

Arc Control (Pinch) – Adjusts how quickly the current will rise when the wire is shorted to the work resulting in a soft or crisp arc.

Arc Force – A temporary increase of the output current during SMAW welding when the arc is too short.

Arc Length – The physical gap between the end of the electrode and the weld puddle.

Across the Arc – The device is electrically connected to the welding terminals. This device is powered by the same voltage that is used for welding.

Arc-link cable – Used between the power source and wire feeder in a bench system and between the power source, control box and wire drive in a boom system. This 5 pin cable supplies voltage from the power source to power the feeder and also transmits digital signals between the two.

Armature – The part of an electric device that includes the main current-carrying winding and in which the electromotive force is induced.

Armature Reaction – A force set up by the current induced in the armature of a generator that results in altering as to both magnitude and direction the flux due to the field magnet.

Asynchronous Welder Generator – An alternator that utilizes an air-gap rotating magnetic-field between a stator and a rotor to interact with an induced current in a rotor winding. It is sometimes called an induction generator.

Auxiliary Windings – Stator winding used to power the auxiliary connections.

Battery – A combination of two or more cells electrically connected to work together to produce electric energy.

Block Diagram – visual representation of a machine that utilizes simplified blocks to represent the principal parts or functions of the machine.

Boost Converter – The boost converter increases applied voltage to a higher level. This circuitry only applies to DC voltage and is only active if the applied voltage is below a predetermined value.

Bridge Rectifier – A type of full wave rectifier which uses four or more diodes in a bridge circuit configuration to efficiently convert the Alternating Current (AC) into Direct Current (DC).

Brushes – An electrical contact which conducts current between stationary wires and moving parts, most commonly in a rotating shaft.

Buck Converter – The buck converter decreases applied voltage to a lower level. This circuitry only applies to DC voltage and is only active if the applied voltage is above a predetermined value.

Buck/Boost Converter – The combined buck/boost circuitry is utilized to increase or decrease an applied voltage to a predetermined value.

CAN communication – Controller Area Network (CAN bus) is a robust vehicle bus standard designed to allow microcontrollers and devices to communicate with each other's applications without a host computer. It broadcasts messages to the nodes presented in a network.

Cathode – The negatively charged electrode of a device.

Capacitance – The ability of a body to store an electrical charge.

Capacitor – A device used to store an electric charge, consisting of one or more pairs of conductors separated by an insulator. Capacitance is measured in Farad's (F) and some capacitors are polarity sensitive which is typically noted on the device as such.

Circuit Breaker – A device to prevent excessive current flow in a circuit that may be caused by a short circuit or heavy loads. The circuit breaker will stop the flow of current (open) if such a situation occurs.

Collector – The positively charged electrode of a transistor device.

Commutator – A cylindrical ring or disk assembly of conducting members, individually insulated in a supporting structure with an exposed surface for contact with current-collecting brushes and mounted on the armature shaft, for changing the frequency or direction of the current in the armature windings.

Conductor – A type of material that allows the flow of charge (**electrical** current) in one or more directions

Connectors – Various devices for connecting one object to another.

Constant Current – A process where the power source keeps the current as constant as possible even when the operator varies the arc length. The voltage varies, formerly known as "variable voltage". Mainly used for Stick and TIG welding.

Constant Voltage – A process where the power source keeps the voltage as constant as possible and allows amperage to vary considerably. Mainly used for MIG and Flux core welding using wire feeders.

Contactor – A mechanically or electrically operated switch used in high current applications.

Control cable – A multistrand cable used for transmission of power, command and feedback information.

Crosslinc – A welding system communication technology. When using a Crosslinc enabled power source and wire feeder, welding voltage can be controlled remotely, through the welding cable without the use of an additional control cable.

Current – The flow of electrons through a conductor.

Current Transducer – A device used to detect DC current flow.

Cycle – One complete wave of alternating current or voltage.

DC (Direct Current) – A voltage or current that never crosses zero and maintains current flow in one direction.

Diode – A device used in a circuit that allows current to flow in one direction only. Typically current flow will occur if the diode's anode is more positive than its cathode. Typical configurations used can be: blocking, flashing, free-wheeling, full wave bridge rectifier, half wave rectifier.

Display – An electronic device with a screen used for displaying information.

Duty Cycle – The percentage of a ten (10) minute period that a power source can operate its rated load before exceeding its thermal limit.

Efficiency – The ratio of the output power divided by the input power.

Electrical Interference (noise) – Unwanted noise or other effects from electromagnetic radiation.

Electricity – The flow of electrons through a conductor from the source to a ground.

Electrode Negative – When the electrode is connected to the negative output terminal.

Electrode Positive – When the electrode is connected to the positive output terminal.

Electromagnetism – Magnetism developed by a current of electricity.

Emitter – The negatively charged electrode of a transistor device.

Encoder – An electro-mechanical device that converts the angular position or motion of a shaft or axle to digital output signals.

Excitation – The process of generating a magnetic field by means of an electric current. The source of this can be from a magnet or an external voltage source.

Excitation Windings – Stator winding that powers the excitation process in an alternator or generator.

Farads – The standard measurement unit of capacitance. Symbol: f

Feedback – To provide actual output information to a control circuit so as to maintain a constant output.

Feeder Winding – Stator winding that powers the wire feeders.

Field Windings – The stationary windings of a generator.

Field Current – The current flow through the Field Windings

Light Emitting Diode (LED) – A semiconductor device that emits light when an electric current passes through it.

Flashing – A generic term referring to the initial excitation of an electrical magnetic field.

Forward Biased – When voltage is applied to a semiconductor device in the direction that allows current to flow.

Frequency – The number of occurrences of a repeating event (cycles) per unit of Time.

Full Wave – A rectifier that converts alternating current into continuous current and that utilizes both halves of each cycle of the alternating current.

Fuse – An electrical safety device that operates to provide overcurrent protection of an electrical circuit. Its essential component is a metal wire or strip that melts when too much current flows through it, thereby interrupting current flow.

Gate – Is the control terminal in a semiconductor device. Typically a small voltage is applied to the Gate to trigger or latch the device.

Generator – An electric generator that produces direct current. The main function of this device is to change mechanical energy into electrical energy. The mechanical energy can be supplied by either a motor or engine.

GFCI (Ground Fault Circuit Interrupter) – A device which interrupts current flow when it senses an imbalance between the outgoing and incoming current.

Ground Connection – A safety connection from a welding machine frame to an earth ground.

Half Wave - A rectifier that utilizes one half cycle of alternating current and suppresses the other.

Henry – The standard measurement unit of inductance. Symbol: H

Hertz – The standard measurement unit of electrical frequency. Symbol: Hz

High Frequency – A high frequency used for arc ignition and stabilization when TIG welding.

Hot Start – Increases the output amperage for a designated amount of time at the start of a weld.

Insulated Gate Bipolar Transistor (IGBT) – A high speed solid state switching device that can be turned on by applying a voltage signal to the gate. When the gate signal is removed the IGBT will turn off. An IGBT will operate on DC voltage only.

Inductance – The tendency of an electrical conductor to oppose a change in the electric current flowing through it.

Inductor – A passive component which stores the electrical energy in a magnetic field when the electric current passes through it.

Interpole Coils – Utilized in generators. They counteract the effects of armature reaction.

Inverter – circuitry that changes direct current (DC) to alternating current (AC).

Life Cycle – The length of time a product is introduced to consumers until it's removal from the shelves.

Motor – An electrical device that converts electrical energy into mechanical energy.

Magnetic Field – The area around a magnet or coil in which there is magnetic force.

Magnetic Flux – The measurement of the total magnetic field lines that pass throug a given surface area.

Magnetism – The force that arises from the motion of electric charges.

MOLEX – Is the vernacular term for a two-piece pin and socket interconnection that was pioneered by Molex Connector Company.

Negative Temperature Co-efficient (NTC) – A type of thermistor in which the resistance decreases in relation to a rise in temperature.

OCV (Open Circuit Voltage) –The potential voltage in the welding circuit before the arc is initiated or a load applied; measured in volts.

Ohms – The standard measurement unit of electrical resistance. Symbol: Ω

Ohm's Law – current passing through a conductor is proportional to the voltage over the resistance. I = V / R.

Parallel Circuit – a circuit that has multiple current paths.

Peak Value – The maximum value attained by the current during one cycle. There is a positive and negative peak.

Peak to Peak Value – The maximum value attained by both peaks during one cycle.

Phase – A relative variation or change of state or a cycle.

Phaseback (foldback) – A current limiting feature (a type of overload protection).

Pilot Arc – The electrical pathway between the torch nozzle and electrode tip. This function aids in the transfer of current from the electrode tip to the work piece.

Polarity – The polarity of the electrode as compared to the polarity of the work piece.

Positive Temperature Co-efficient (PTC) – A type of thermistor in which the resistance increases in relation to a rise in temperature.

Potentiometer – It is a variable resistor with three terminals. The middle terminal is adjustable. The potential at the third terminal can be adjusted to give any fraction of the potential voltage across the two outer terminals.

Power – The rate, over time, in which electrical energy is transferred within an electrical circuit.

Power Factor – The ratio of the real power that is used to do work to the apparent power that is supplied to the circuit.

Printed Circuit Boards – A physical device that houses one or more electrical circuits.

Pulsating DC – A periodic current which changes in value but never changes direction.

Rated Load – The average amperage and voltage the power source is designed to produce for a given specific duty cycle time period. For example, 400 amps, 36 load volts, at 60 percent duty cycle.

RCBO (Residual Current Breaker with Over-current) – A combination of a RCD and Circuit Breaker.

RCD (Residual Current Device) – Detects imbalance in the currents of the supply and return conductors of a circuit. Does not protect against shorts.

Reactor – An electrical magnetic component used to maintain current at constant levels by resisting any changes in the current.

Reconnect Panel – Used to configure the machine's internal components for various input power voltages

Rectification – The process of converting alternating current to direct current.

Relay – An electrically operated switch used in low current applications.

Resistance – The opposition to the passage of an electric current through a conductor. Measured in Ohms (Ω) and is not polarity sensitive.

Resistor – Used to regulate voltage and current levels in a circuit.

Reverse Biased – When voltage is applied to a semiconductor device in the direction that does not allows current to flow.

Rheostat – A two terminal adjustable resistor that may have its resistance value changed without opening the circuit in which it is connected, thereby controlling the current through the circuit.

Ripple – The residual periodic variation of the DC voltage within a power supply which has been derived from an alternating current source.

RMS (Root Means Squared) – The same amount of heat dissipation across a resistor as Direct Current.

Rotor – A rotating component of an electromagnetic system in an electric motor, or alternator.

RPM (Revolutions per minute) – A unit of rotational speed or the frequency of rotation around a fixed axis.

Saturation – The state reached when an increase in applied external magnetic field cannot increase the magnetization of the material further.

Saw Tooth Wave Form – A non-sinusoidal waveform. It is so named based on its resemblance to the teeth of a plain-toothed saw.

Schematic Diagram – A representation of the electronic components of a machine utilizing graphic symbols rather than realistic pictures.

Schematic Symbols – A standardized pictogram used to represent various electrical and electronic devices or function.

Series Circuit – a circuit that has only one current path.

Series - Parallel Circuit – a circuit that has both a single current path and multiple current paths.

Silicon Controlled Rectifier (SCR) – Very similar to a Diode in which it allows current to flow when the anode is more positive than the cathode. However, current flow will occur only if a small signal is applied to its Gate and will stop flowing when the voltage drops to zero or goes negative.

Shunt – A type of low value resistance used to detect circuit current.

Sinusoidal Wave Form – A curve that describes a smooth repetitive oscillation of a waveform.

Slip Rings – An electromechanical device that allows the transmission of electrical power from a stationary to a rotating structure. Normally a copper or brass circular device attached to a rotating member.

Solenoid – An electromechanical device that when energized acts like a magnet so that a movable core is drawn into the coil when a current flows and that is used especially as a switch or control for a mechanical device (such as a valve).

Source – Provides the electrical potential that is required for electricity to flow.

Spark Gap Generator – Used to initiate and maintain the arc in a TIG machine.

Square Wave Form – A type of waveform where the signal has only two levels. The signal transitions between these levels at regular intervals and the switching time is very rapid.

Standard Units of Measurement – Is a quantifiable language that helps everyone understand the association of the object with the measurement.

Static Condition – The machine is not connection to a power source and has no mechanical motion.

Stator – The stationary part of a rotary system, found in electric alternators, generators and electric motors.

Switch – A mechanical device used to interrupt the flow of current in a circuit. Switches are essentially binary devices: they are either completely on (closed) or completely off (open).

Tachometer – A device or circuit used to measure the rotations of a mechanical device.

Thermistor – A type of resistor in which resistance changes due to temperature, two main types: Positive Temperature Co-efficient (PTC), Negative Temperature Co-efficient (NTC).

Thermostat – A mechanical device that interrupts or closes a circuit when a pre-determined temperature limit is reached.

Toroid – A device used to filter unwanted electrical noise.

Trigger Interlock – The gun trigger will stay closed (activated) as long as welding current is flowing and will open (deactivate) when welding current stops.

Transformer – A device with a group of mutually-inductive coils used to magnetically induce AC power from one coil to the other. Typical examples are as follows:

> ***Isolation Transformer*** – A transformer usually used for circuit protection.
>
> ***Step Down Transformer*** – A transformer where the secondary voltage is lower than the primary voltage.
>
> ***Step Up Transformer*** – A transformer where the secondary voltage is higher than the primary voltage.
>
> ***Current Transformer*** – A type of transformer used as a current monitoring device.
>
> ***Power Transformer*** – A transformer that contains multiple primary windings to accommodate a variety of input voltages.

Twisted Pair – A cable consisting of two wires of a single circuit twisted around each other for the purposes of improving electromagnetic compatibility.

Voltage – The pressure or difference in electrical potential between two points in a circuit that causes current to flow.

Volts – The standard unit of measurement for Voltage. Symbol: V

User Interface – A device where interactions between operators and machines occur.

Watts – The standard measurement unit of electrical power. Symbol: W

Watts Law – power of an electrical circuit is the product of its voltage and current. P = I x V.

Weld Winding – Stator winding that provides the power for the welding components.

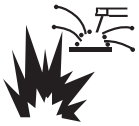
Welding Electrode – A consumable component of the welding circuit through which current is conducted between the electrode holder and the arc that becomes part of the weldment.

Welding Gun – In semi-automatic or automatic welding, a device to transfer current and guide the electrode wire into the arc puddle.

Wire Harness – A system of insulated conducting wires bound together with insulating materials.

Wiring Diagram – a simple visual representation of the physical connections and physical layout of the electrical system of the machine.

WFS (Wire Feed Speed) – The speed at which the consumable wire is fed into the weld joint puddle.

			
WARNING	● Do not touch electrically live parts or electrode with skin or wet clothing. ● Insulate yourself from work and ground.	● Keep flammable materials away.	● Wear eye, ear and body protection.
Spanish **AVISO DE PRECAUCION**	● No toque las partes o los electrodos bajo carga con la piel o ropa mojada. ● Aislese del trabajo y de la tierra.	● Mantenga el material combustible fuera del área de trabajo.	● Protéjase los ojos, los oídos y el cuerpo.
French **ATTENTION**	● Ne laissez ni la peau ni des vêtements mouillés entrer en contact avec des pièces sous tension. ● Isolez-vous du travail et de la terre.	● Gardez à l'écart de tout matériel inflammable.	● Protégez vos yeux, vos oreilles et votre corps.
German **WARNUNG**	● Berühren Sie keine stromführenden Teile oder Elektroden mit Ihrem Körper oder feuchter Kleidung! ● Isolieren Sie sich von den Elektroden und dem Erdboden!	● Entfernen Sie brennbarres Material!	● Tragen Sie Augen-, Ohren- und Körperschutz!
Portuguese **ATENÇÃO**	● Não toque partes elétricas e electrodos com a pele ou roupa molhada. ● Isole-se da peça e terra.	● Mantenha inflamáveis bem guardados.	● Use proteção para a vista, ouvido e corpo.
Japanese **注意事項**	● 通電中の電気部品、又は溶材にヒフやぬれた布で触れないこと。 ● 施工物やアースから身体が絶縁されている様にして下さい。	● 燃えやすいものの側での溶接作業は絶対にしてはなりません。	● 目、耳及び身体に保護具をして下さい。
Chinese **警 告**	● 皮肤或濕衣物切勿接觸帶電部件及銲條。 ● 使你自己與地面和工件絕緣。	● 把一切易燃物品移離工作場所。	● 佩戴眼、耳及身體勞動保護用具。
Korean **위 험**	● 전도체나 용접봉을 젖은 헝겁 또는 피부로 절대 접촉치 마십시요. ● 모재와 접지를 접촉치 마십시요.	● 인화성 물질을 접근 시키지 마시요.	● 눈, 귀와 몸에 보호장구를 착용하십시요.
Arabic **تحذير**	● لا تلمس الاجزاء التي يسري فيها التيار الكهربائي أو الالكترود بجلد الجسم أو بالملابس المبللة بالماء. ● ضع عازلا على جسمك خلال العمل.	● ضع المواد القابلة للاشتعال في مكان بعيد.	● ضع أدوات وملابس واقية على عينيك وأذنيك وجسمك.

READ AND UNDERSTAND THE MANUFACTURER'S INSTRUCTION FOR THIS EQUIPMENT AND THE CONSUMABLES TO BE USED AND FOLLOW YOUR EMPLOYER'S SAFETY PRACTICES.

SE RECOMIENDA LEER Y ENTENDER LAS INSTRUCCIONES DEL FABRICANTE PARA EL USO DE ESTE EQUIPO Y LOS CONSUMIBLES QUE VA A UTILIZAR, SIGA LAS MEDIDAS DE SEGURIDAD DE SU SUPERVISOR.

LISEZ ET COMPRENEZ LES INSTRUCTIONS DU FABRICANT EN CE QUI REGARDE CET EQUIPMENT ET LES PRODUITS A ETRE EMPLOYES ET SUIVEZ LES PROCEDURES DE SECURITE DE VOTRE EMPLOYEUR.

LESEN SIE UND BEFOLGEN SIE DIE BETRIEBSANLEITUNG DER ANLAGE UND DEN ELEKTRODENEINSATZ DES HERSTELLERS. DIE UNFALLVERHÜTUNGSVORSCHRIFTEN DES ARBEITGEBERS SIND EBENFALLS ZU BEACHTEN.

			
● Keep your head out of fumes. ● Use ventilation or exhaust to remove fumes from breathing zone.	● Turn power off before servicing.	● Do not operate with panel open or guards off.	**WARNING**
● Los humos fuera de la zona de respiración. ● Mantenga la cabeza fuera de los humos. Utilice ventilación o aspiración para gases.	● Desconectar el cable de alimentación de poder de la máquina antes de iniciar cualquier servicio.	● No operar con panel abierto o guardas quitadas.	Spanish **AVISO DE PRECAUCION**
● Gardez la tête à l'écart des fumées. ● Utilisez un ventilateur ou un aspirateur pour ôter les fumées des zones de travail.	● Débranchez le courant avant l'entretien.	● N'opérez pas avec les panneaux ouverts ou avec les dispositifs de protection enlevés.	French **ATTENTION**
● Vermeiden Sie das Einatmen von Schweibrauch! ● Sorgen Sie für gute Be- und Entlüftung des Arbeitsplatzes!	● Strom vor Wartungsarbeiten abschalten! (Netzstrom völlig öffnen; Maschine anhalten!)	● Anlage nie ohne Schutzgehäuse oder Innenschutzverkleidung in Betrieb setzen!	German **WARNUNG**
● Mantenha seu rosto da fumaça. ● Use ventilação e exhaustão para remover fumo da zona respiratória.	● Não opere com as tampas removidas. ● Desligue a corrente antes de fazer serviço. ● Não toque as partes elétricas nuas.	● Mantenha-se afastado das partes moventes. ● Não opere com os paineis abertos ou guardas removidas.	Portuguese **ATENÇÃO**
● ヒュームから頭を離すようにして下さい。 ● 換気や排煙に十分留意して下さい。	● メンテナンス・サービスに取りかかる際には、まず電源スイッチを必ず切って下さい。	● パネルやカバーを取り外したままで機械操作をしないで下さい。	Japanese **注意事項**
●頭部遠離煙霧。 ●在呼吸區使用通風或排風器除煙。	●維修前切斷電源。	●儀表板打開或沒有安全罩時不準作業。	Chinese **警 告**
● 얼굴로부터 용접가스를 멀리하십시요. ● 호흡지역으로부터 용접가스를 제거하기 위해 가스제거기나 통풍기를 사용하십시요.	● 보수전에 전원을 차단하십시요.	● 판넬이 열린 상태로 작동치 마십시요.	Korean **위 험**
● ابعد رأسك بعيداً عن الدخان. ● استعمل التهوية أو جهاز ضغط الدخان للخارج لكي تبعد الدخان عن المنطقة التي تتنفس فيها.	● اقطع التيار الكهربائي قبل القيام بأية صيانة.	● لا تشغل هذا الجهاز اذا كانت الاغطية الحديدية الواقية ليست عليه.	Arabic **تحذير**

LEIA E COMPREENDA AS INSTRUÇÕES DO FABRICANTE PARA ESTE EQUIPAMENTO E AS PARTES DE USO, E SIGA AS PRÁTICAS DE SEGURANÇA DO EMPREGADOR.

使う機械や溶材のメーカーの指示書をよく読み、まず理解して下さい。そして貴社の安全規定に従って下さい。

請詳細閱讀並理解製造廠提供的説明以及應該使用的銀焊材料，並請遵守貴方的有関勞動保護規定。

이 제품에 동봉된 작업지침서를 숙지하시고 귀사의 작업자 안전수칙을 준수하시기 바랍니다.

اقرأ بتمعن وافهم تعليمات المصنع المنتج لهذه المعدات والمواد قبل استعمالها واتبع تعليمات الوقاية لصاحب العمل.

CUSTOMER ASSISTANCE POLICY

The business of Lincoln Electric is manufacturing and selling high quality welding equipment, automated welding systems, consumables, and cutting equipment. Our challenge is to meet the needs of our customers, who are experts in their fields, and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for information or technical information about their use of our products. Our employees respond to inquiries to the best of their ability based on information and specifications provided to them by the customers and the knowledge they may have concerning the application. Our employees, however, are not in a position to verify the information provided or to evaluate the engineering requirements for the particular weldment, or to provide engineering advice in relation to a specific situation or application. Accordingly, Lincoln Electric does not warrant or guarantee or assume any liability with respect to such information or communications. Moreover, the provision of such information or technical information does not create, expand, or alter any warranty on our products. Any express or implied warranty that might arise from the information or technical information, including any implied warranty of merchantability or any warranty of fitness for any customers' particular purpose or any other equivalent or similar warranty is specifically disclaimed.

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WELD FUME CONTROL EQUIPMENT

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.

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