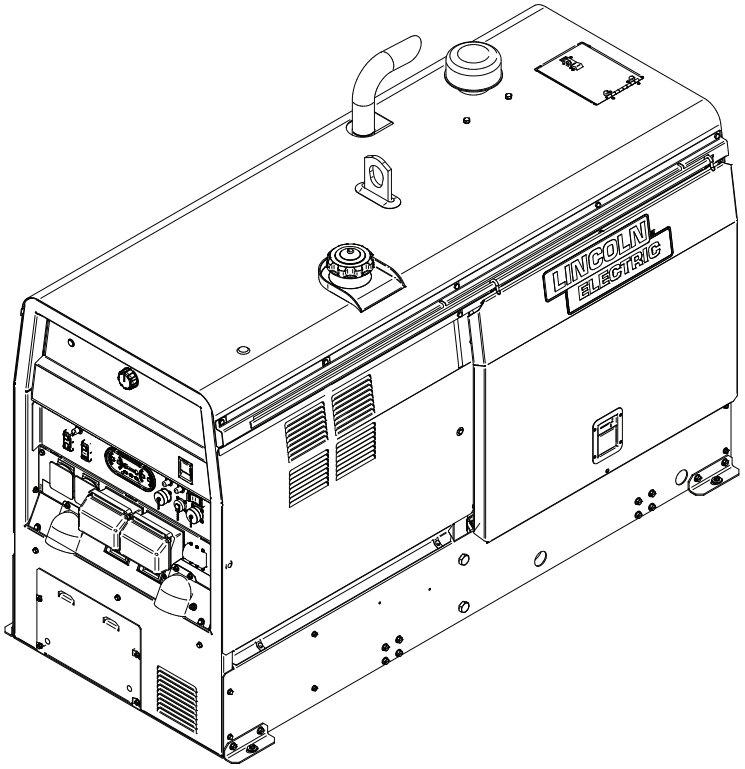
LINCOLN ELECTRIC

Service Manual

Vantage® 441X/LE500X



For use with machines having Code Numbers:

12883, 12890, 13195, 13196

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.

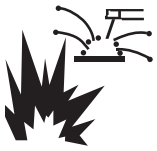
5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

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.

Vantage® 441X

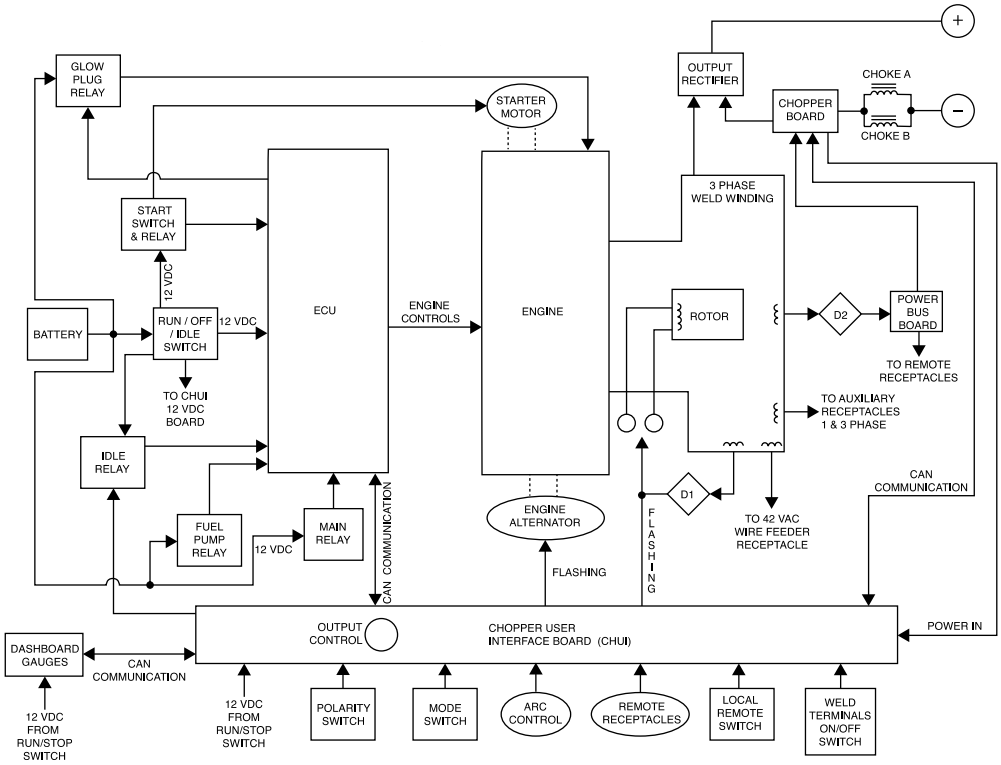
Service Manual

Last update:

2023/08/01

Theory of Operation

Figure E.1 – Functional Design



Functional Design

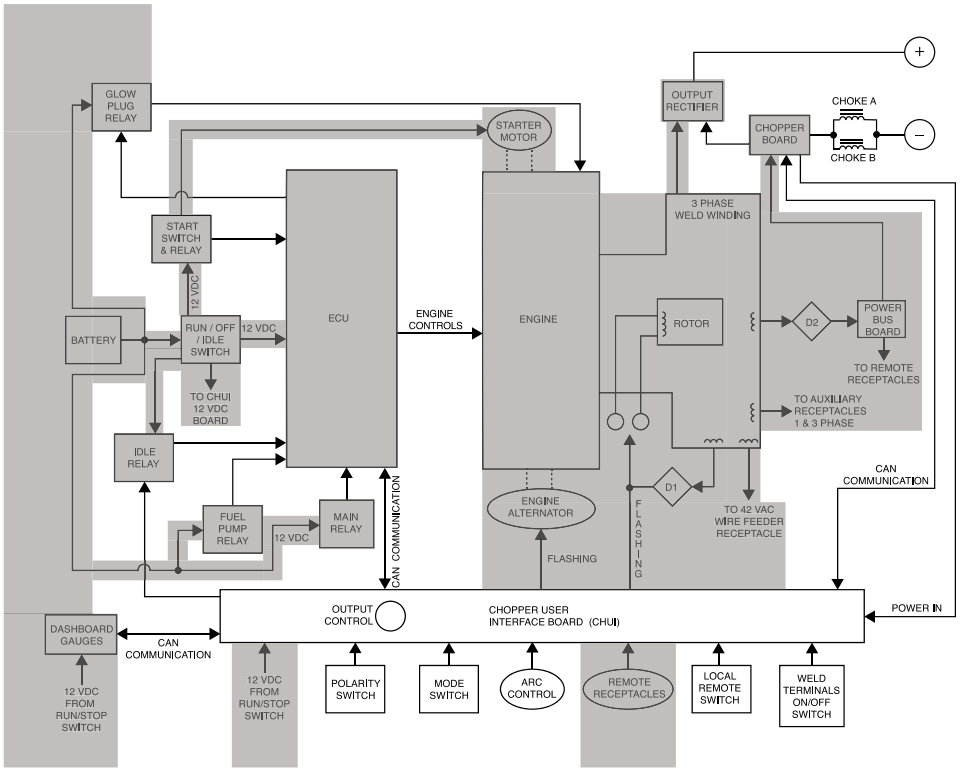
The VANTAGE® 441X is a diesel engine-driven welding power source capable of producing 400 amps at 36 VDC at a 100% duty cycle. The engine is coupled to a brush-type alternating current generator. This AC output is rectified and controlled by Chopper Technology operating at 40 Khz. to produce DC current for multi-purpose welding applications. The VANTAGE® 441X is also capable of producing 11,000 watts of AC single phase auxiliary power at 100% duty cycle or 17,000 watts of three phase 240 VAC @ 100% duty cycle.

The machine is equipped with Crosslinc technology to provide remote voltage control via weld cable communications. It also has VRD (Voltage Reduction Technology) for lower OCV applications.

The Vantage 441X is made up of eight main components. They are as follows:

- Engine
- Rotor and Stator
- Output Rectifier
- Chopper Board
- Output Chokes
- Chopper User Interface Board (CHUI)
- Power Bus Board
- Engine Control Unit (ECU)

Figure E.2 – Power Up



Power Up

BATTERY, RUN / STOP / IDLE SWITCH, ENGINE CONTROL UNIT (ECU), RELAYS, ENGINE ALTERNATOR, ROTOR, STATOR, AND POWER BUS BOARD.

The battery supplies voltage directly to the run / stop / idle switch, the fuel pump relay, the glow plug relay, and the main relay. It also supplies voltage, via the run / stop / idle switch, to the starter switch / relay, to the chopper user interface board (CHUI), the engine control unit (ECU), the idle relay, and the dashboard gauge board. The battery also supplies flashing voltage to the engine's battery charging alternator via the CHUI board.

When the run / stop / idle switch is turned ON and the start relay is activated the starter motor cranks the engine and the ECU activates the fuel relay that then activates the fuel pump and fuel flows to the engine.

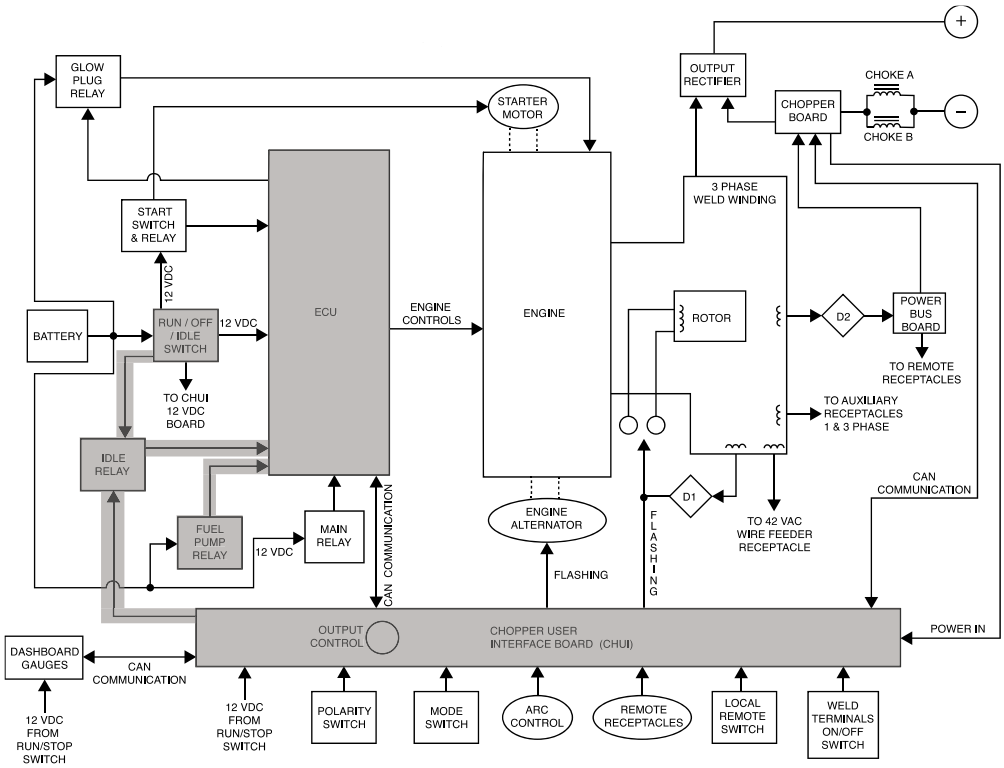
When the engine, that is mechanically coupled to the rotor, located within the stator assembly, is started up and running a 'flashing voltage' is sent to the rotor coils through a brush and slip ring configuration. This 'flashing voltage' originates from the CHUI board. The rotating field (rotor) induces 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
• 42 VAC winding for external wire feeder power
• 42 VAC winding for the power board

The three phase welding windings are connected to the output rectifier. The auxiliary windings are connected through circuit breakers and ground fault circuit interrupters (GFCI) to the appropriate receptacles. (120 / 240 VAC single phase and 240 VAC 3-phase). One portion of the auxiliary power winding is also connected to the D1 bridge rectifier. This resultant DC voltage is filtered and applied to the rotor (exciter feedback). The 42 VAC winding is connected to the wire feeder receptacle. The other 42 VAC winding is applied to the D2 bridge

rectifier. This resultant DC voltage is filtered and applied to the power bus board. The power bus board supplies 40 VDC to the chopper board and to the remote receptacles.

Figure E.3 – ECU, Run / Stop / Idle Switch, CHUI Board



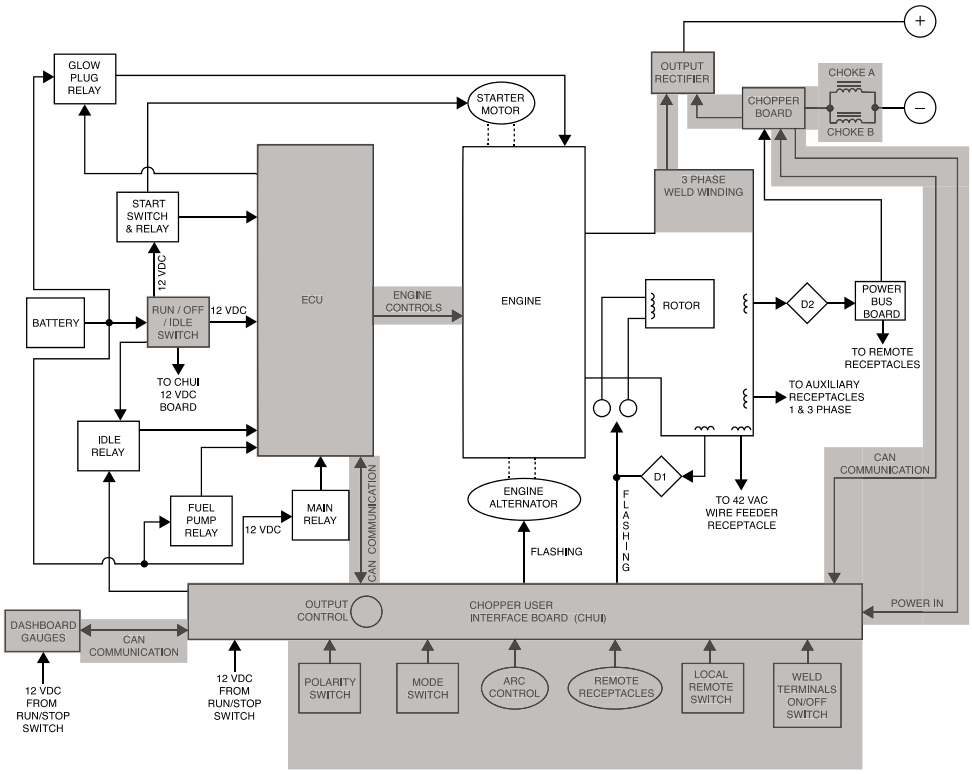
ECU, Run / Stop / Idle Switch, CHUI Board

The engine sensors are connected to the ECU, and in the case of an engine fault condition the ECU will shut off the engine by deactivating the fuel pump relay.

If no welding or auxiliary current is being drawn, and the run / stop / idle switch is in the ‘auto’ position, the CHUI board will signal the ECU board to take the engine to low speed and the engine’s speed will be reduced to 1500 RPM. When output current is sensed, either weld or auxiliary, upon a signal from the CHUI board the ECU board will deactivate the idle relay and the engine’s RPM will increase to high speed (1800 RPM loaded).

When the run / stop / idle switch is in the ‘high’ position the engine will stay at high speed even if there is no load (weld or auxiliary) on the machine.

Figure E.4 – Welding Output and Control



Welding Output and Control

THREE PHASE OUTPUT RECTIFIER, CHOPPER BOARD, OUTPUT CHOKES, OUTPUT SHUNT, AND CHOPPER USER INTERFACE BOARD (CHUI).

The three phase weld windings in the stator are connected to the three-phase output rectifier. The resultant DC voltage is applied to the chopper board. The capacitors, that are incorporated within the chopper board, function as filters, and power supplies for the chopper IGBTs. See ***IGBT operation*** in this section. The IGBTs are high speed switches operating at 40 KHZ. These devices are switched on and off dependent upon C.A.N. communications between the CHUI board and the chopper board. See ***Pulse Width Modulation*** in this 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.

Current feedback (from the shunt) is sent to the chopper board for processing and control purposes. Voltage feedback is sent directly to the CHUI board for processing and control purposes.

The CHUI board has many functions as follows:
• Receives input power from the chopper board
• Interfaces with the chopper board and sends C.A.N. communication signals
• Communicates with the ECU module
• Communicates with the dashboard gauges
• Interfaces with the remote receptacles
• Receives commands from the mode selector switch, the on / off / idle switch, the weld terminal switch, the arc control potentiometer, the polarity switch, and the local remote switch.

The CHUI board monitors the operator controls. It compares these commands to the current and voltage feedback information it receives from the chopper board. The circuitry on the CHUI board determines how the output should be controlled to optimize welding results, and it sends the correct C.A.N. signals to the chopper board IGBT driver circuits.

VRD (Voltage Reduction Device)

The VRD feature provides additional safety in the 'CC-Stick' mode especially in an environment with a higher risk of electric shock such as wet areas and hot humid sweaty conditions.

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

The machine is shipped with the VRD switch in the 'Off' position. With the VRD switch in the 'on' position, the red and green VRD lights are enabled. In the 'off' position, both lights will be OFF.
These lights, monitor the OCV (Open Circuit Voltage) and weld voltage at all times. In the 'CC-Stick' mode when not welding the green light will illuminate indicating that the VRD has reduced the OCV to less than 32V. During welding the red light will illuminate whenever the arc voltage is equal to or greater than 32V. This means that the red and green light may alternate depending on the weld voltage. This is normal operation. See the ***VRD INDICATOR LIGHT*** information in the ***Operation Section*** for further details.

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.

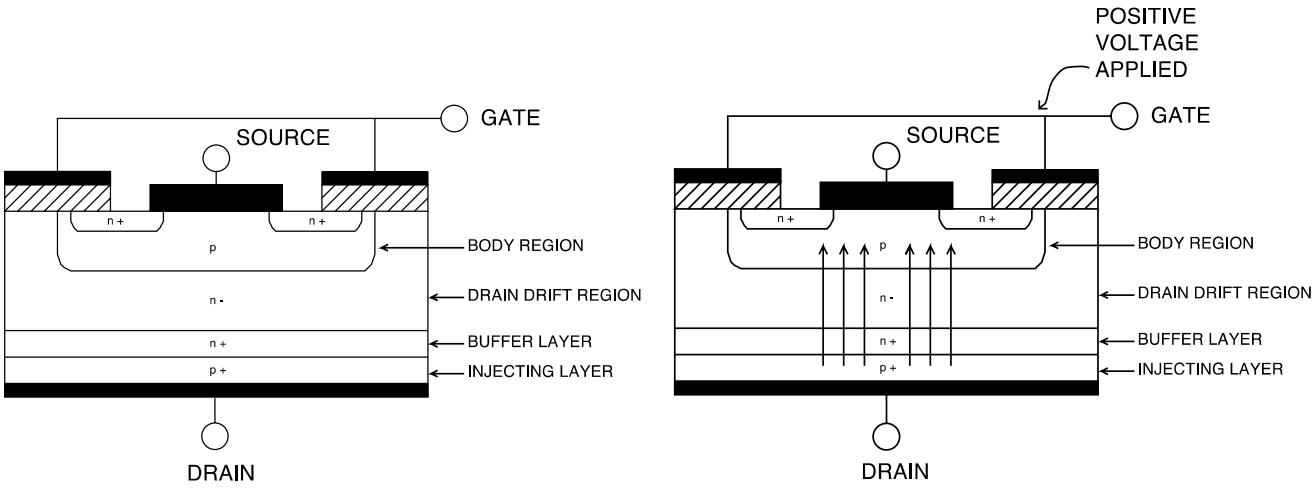
Welding Current

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.

Figure E.5 – Insulated Gate Bipolar Transistor (IGBT) Operation



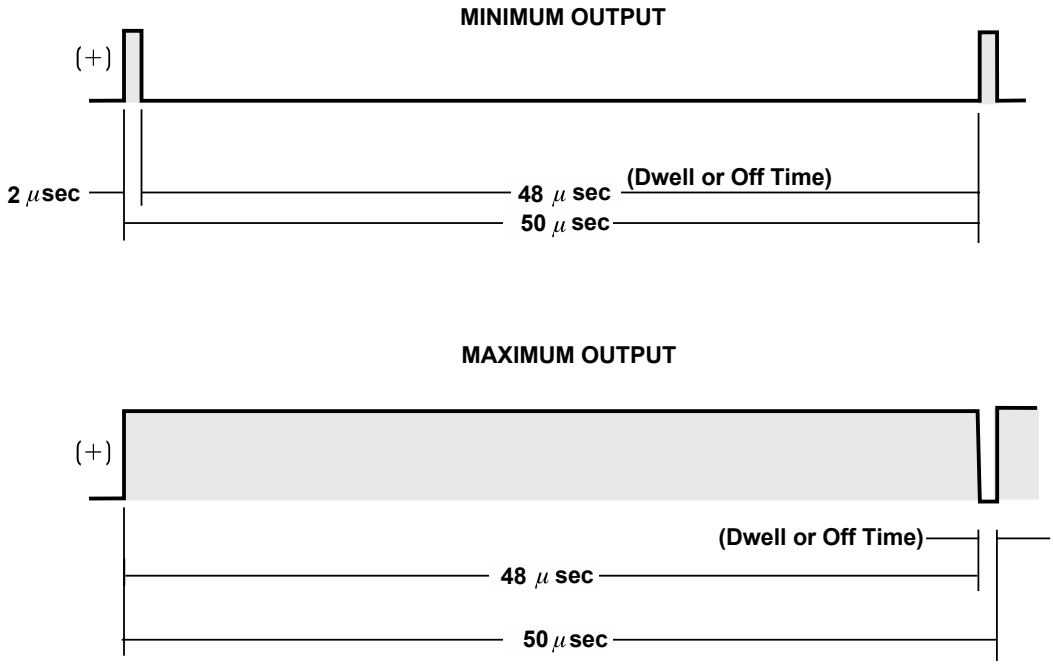
Insulated Gate Bipolar Transistor (IGBT) Operation

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.

Figure E.6 – Pulse Width Modulation



Pulse Width Modulation

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

MINIMUM OUTPUT

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

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

MAXIMUM OUTPUT

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

Troubleshooting & Repair

HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

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

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

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

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

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

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

⚠ CAUTION

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

PC BOARD TROUBLESHOOTING PROCEDURES

⚠ WARNING

ELECTRIC SHOCK can kill.

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

⚠ CAUTION

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

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

PC board can be damaged by static electricity.

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

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

Reusable Container
Do Not Destroy

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

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

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

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

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

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

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

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

5. Remove the replacement PC board and substitute it with the original PC board to recreate the original problem.

a. If the original problem does not reappear by substituting the original board, then the PC board was not the problem. Continue to look for bad connections in the control wiring harness, junction blocks and terminal strips.

b. If the original problem is recreated by the substitution of the original board, then the PC board was the problem. Reinstall the replacement PC board and test the machine.

6. Always indicate that this procedure was followed when warranty reports are to be submitted.

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

Troubleshooting guide

Observe Safety Guidelines detailed in the beginning of this manual.		**TROUBLESHOOTING GUIDE**
PROBLEMS (SYMPTOMS)	**POSSIBLE AREAS OF MISADJUSTMENT(S)**	**RECOMMENDED COURSE OF ACTION**
OUTPUT PROBLEMS		
Major physical or electrical damage is evident.	1. N/A.	1. Contact the Lincoln Electric Service Department at 1-888-935-3877.
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. Ensure the weld terminals ON switch is in the “ON” position.	1. Perform the ***Output Rectifier Test Procedure***. 2. Perform the ***Chopper Module Board Test Procedure***. 3. Perform the ***D2 Rectifier Test Procedure***. 4. Perform the ***Chopper User Interface Board Test Procedure***. 5. Perform the ***Stator Test Procedure***. 6. Perform the ***Output Choke(s) Test Procedure***. 7. Check the internal connections between the positive output terminal and the output rectifier. See Wiring Diagram. 8. Check the internal connections between the output choke(s) and the negative output terminal. See Wiring Diagram.
There is no welding output or auxiliary output. The engine runs normally.	1. Ensure the weld terminals ON switch is in the “ON” position. 2. Check the circuit breakers and GFCI devices. Reset if tripped.	1. Perform the ***Rotor Test Procedure***. 2. Perform the ***D1 Rectifier Test Procedure***. 3. Check the R1 Resistor. See Wiring Diagram. 4. Perform the ***Chopper User Interface Board Test Procedure***. 5. Perform the ***Stator Test Procedure***.
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 GFCI’s for proper operation.	1. Perform the ***Circuit Breaker (CB1) Test Procedure, Circuit Breaker (CB2) Test Procedure, and Circuit Breaker (CB3) Test Procedure***. 2. Perform the ***Auxiliary Receptacles Test Procedure***. 3. Perform the ***Stator Test Procedure***.
There is no control of the welding output. The auxiliary output is normal, and the engine runs normally.	1. Ensure the local remote switch is in the “local” position.	1. Perform the ***Chopper User Interface Board Test Procedure***. 2. Perform the ***Chopper Module Board Test Procedure***.

		3. Perform the ***Current Shunt Test Procedure***.
The machine has low welding output and low auxiliary voltage output. The engine runs normally.	1. Ensure the engine is running at 1800rpm when in the high idle mode.	1. Perform the ***Rotor Test Procedure***. 2. Perform the ***D1 Rectifier Test Procedure***. 3. Check the field capacitor. See Wiring Diagram. 4. Perform the ***Stator Test Procedure***.

⚠ CAUTION

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

Observe Safety Guidelines detailed in the beginning of this manual.		**TROUBLESHOOTING GUIDE**
PROBLEMS (SYMPTOMS)	**POSSIBLE AREAS OF MISADJUSTMENT(S)**	**RECOMMENDED COURSE OF ACTION**
ENGINE PROBLEMS		
Engine won't crank when start / glow plug button is activated.	1. The battery or battery connections may be faulty. 2. Ensure the run /stop / idle switch is set to "run".	1. Perform the ***Run / Stop / Idle Switch Test Procedure***. 2. Perform the ***Start / Glow Plug Switch Test Procedure***. 3. Perform the ***ECU Test Procedure***. 4. Perform the ***Starter Test Procedure***.
Engine will crank but not start when start / glow plug button is activated.	1. Ensure there is adequate fuel in the fuel tank. 2. Check circuit breaker(s) (CB5) and (CB6). Reset if tripped. See Wiring Diagram.	1. Perform the ***Circuit Breaker (CB5) Test Procedure and Circuit Breaker (CB6) Test Procedure***. 2. Perform the ***Run / Stop / Idle Switch Test Procedure***. 3. Perform the ***Main Relay Test Procedure***. 4. Perform the ***Fuel Relay Test Procedure***. 5. Perform the ***Glow Relay Test Procedure***. 6. Perform the ***ECU Test Procedure***. 7. The fuel pump may be faulty. 8. The engine may need repair.
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. Ensure there is sufficient fuel in fuel tank.	1. Perform the ***ECU Test Procedure***. 2. Perform the ***Fuel Relay Test Procedure***. 3. The fuel pump may be faulty. 4. The engine may need repair.
Engine will not shut off.	1. Ensure the run /stop / idle switch is set to the OFF position.	1. Perform the ***Run / Stop / Idle Switch Test Procedure***. 2. Perform the ***Fuel Relay Test Procedure***. 3. Perform the ***ECU Test Procedure***.
Engine will not go to low idle mode (1500 rpm).	1. Ensure the run /stop / idle switch is in the AUTO position. 2. Ensure there is not a load on the welding terminals or any of the auxiliary power receptacles.	1. Perform the ***Run / Stop / Idle Switch Test Procedure***. 2. Perform the ***Idle Relay Test Procedure***. 3. Perform the ***ECU Test Procedure***. 4. Perform the ***Chopper User Interface Board Test Procedure***.
Engine will not go to high speed when a load is applied to the auxiliary power receptacles and the run /stop / idle switch is set to the AUTO position. The	1. Ensure the load is above 100 watts.	1. The auxiliary power sensor toroid or associated wiring may be faulty. See Wiring Diagram. 2. Perform the ***ECU Test Procedure***.

auxiliary output voltage is normal when the machine is set to high speed (1800 rpm). The machine does go to high speed when a load is applied to the welding terminals.		3. Perform the ***Chopper User Interface Board Test Procedure***.
Engine will not go to high speed when a load is applied to the welding terminals and the run /stop / idle switch is set to the AUTO position. The welding open circuit voltage is normal when the machine is set to high speed (1800 rpm).	1. Ensure the weld terminal switch is in the ON position.	1. Perform the ***Run / Stop / Idle Switch Test Procedure***. 2. Perform the ***ECU Test Procedure***. 3. Perform the ***Chopper User Interface Board Test Procedure***. 4. Perform the ***Idle Relay Test Procedure***.

⚠ CAUTION

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Observe Safety Guidelines detailed in the beginning of this manual.	TROUBLESHOOTING GUIDE	
PROBLEMS (SYMPTOMS)	**POSSIBLE AREAS OF MISADJUSTMENT(S)**	**RECOMMENDED COURSE OF ACTION**
FUNCTION PROBLEMS		
The 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 ***Starter Test Procedure***. 2. Ensure the engine alternator is getting “flashed” from the chopper user interface board. See Wiring Diagram.
The dashboard gauge board does not illuminate or does not function correctly.	1. Ensure the run /stop / idle switch is in the RUN position.	1. Ensure the dashboard gauge board is receiving 12 VDC and communication. See Wiring Diagram.
There is no control of weld output at the machine’s front panel.	1. Ensure the local remote switch is in the LOCAL position.	1. Perform the ***Chopper User Interface Board Test Procedure***.
An external wire feeder will not function correctly.	1. Ensure the local remote switch is in the REMOTE position. 2. Ensure the 42V / 120V switch is in the correct position for the wire feeder being used.	1. Perform the ***42V / 120V Wire Feeder Voltmeter Switch Test Procedure***. 2. Perform the ***Bus Board Test Procedure***. 3. Perform the ***D2 Rectifier Test Procedure***. 4. Check the leads between the remote receptacles and the chopper user interface board. See Wiring Diagram.
The machine will not change welding modes when the mode switch is changed.	1. Ensure the local remote switch is in the LOCAL position.	1. Perform the ***Mode Selector Board Test Procedure***. 2. Perform the ***Chopper User Interface Board Test Procedure***.
The 42 VAC is not present at the 14-pin remote receptacle.	1. Ensure the 42V / 120V switch is in the correct (42V) position. 2. Check circuit breaker (CB4). Reset if tripped. See Wiring Diagram.	1. Perform the ***42V / 120V Wire Feeder Voltmeter Switch Test Procedure***. 2. Perform the ***Circuit Breaker (CB4) Test Procedure***. 3. Perform the ***Stator Test Procedure***.
The 120 VAC is not present at the 14-pin remote receptacle.	1. Ensure the 42V / 120V switch is in the correct (120V) position. 2. Check circuit breaker (CB2). Reset if tripped. See Wiring Diagram.	1. Perform the ***42V / 120V Wire Feeder Voltmeter Switch Test Procedure***. 2. Perform the ***Circuit Breaker (CB2) Test Procedure***. 3. Perform the ***Stator Test Procedure***.
The VRD function will not work correctly.	1. Ensure the machine is in the correct welding mode (CC-stick). 2. Ensure the VRD switch is in the ON position.	1. Perform the ***Chopper User Interface Board Test Procedure***.
The welding output is limited when using a remote-control device.	1. In some welding modes the maximum output is limited by the output control on the machine. 2. Ensure the maximum welding output is normal when nothing is	1. Perform the ***Chopper User Interface Board Test Procedure***.

	connected to the remote receptacles.	

⚠ CAUTION

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

Test Procedures

HOW TO USE THE TEST REFFERENCE 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.

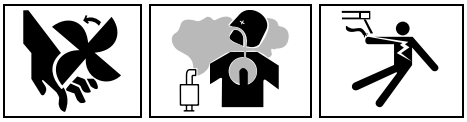
Step 1. IDENTIFY MACHINE FUNCTION
There will be three columns with a "MACHINE FUNCTION" listed at the top. You can choose from "POWER UP", "PRIMARY OUTPUT" or “AUXILIARY OUTPUT". Choose the column that best describes the symptom that the machine is exhibiting a problem with.
Examples are as follows:
• POWER UP - machine won’t turn on, blows fuses, no display.
• PRIMARY 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.

MACHINE FUNCTION VANTAGE 441X			
RELATED COMPONENT LIST	POWER UP	WELDING OUTPUT	AUXILIARY OUTPUT
D1 RECTIFIER		X	X
D2 RECTIFIER			X
ROTOR		X	X
STATOR		X	X
AUXILIARY RECEPTACLES			X
DC BUS BOARD		X	X
ARC CONTROL POT		X	
OUTPUT RECTIFIER		X	
IDLE RELAY			X
FUEL RELAY	X	X	X
MAIN RELAY	X	X	
START 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		
CB9		X	X
CB10	X		
CB11	X		
CB12	X		
STARTER	X		
ALTERNATOR	X		
CHOPPER BOARD		X	
CHUI BOARD	X	X	
SHUNT		X	
START / GLOW SWITCH	X		
CHOKE A		X	
CHOKE B		X	
MODE SELECT BOARD		X	
POLARITY SWITCH		X	
FUEL PUMP	X	X	X
42V / 115V SWITCH			X
ECU MODULE	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
1/2” Nutdriver
1/2” Open-End Wrench
Wiring Diagram

REMOVAL PROCEDURE

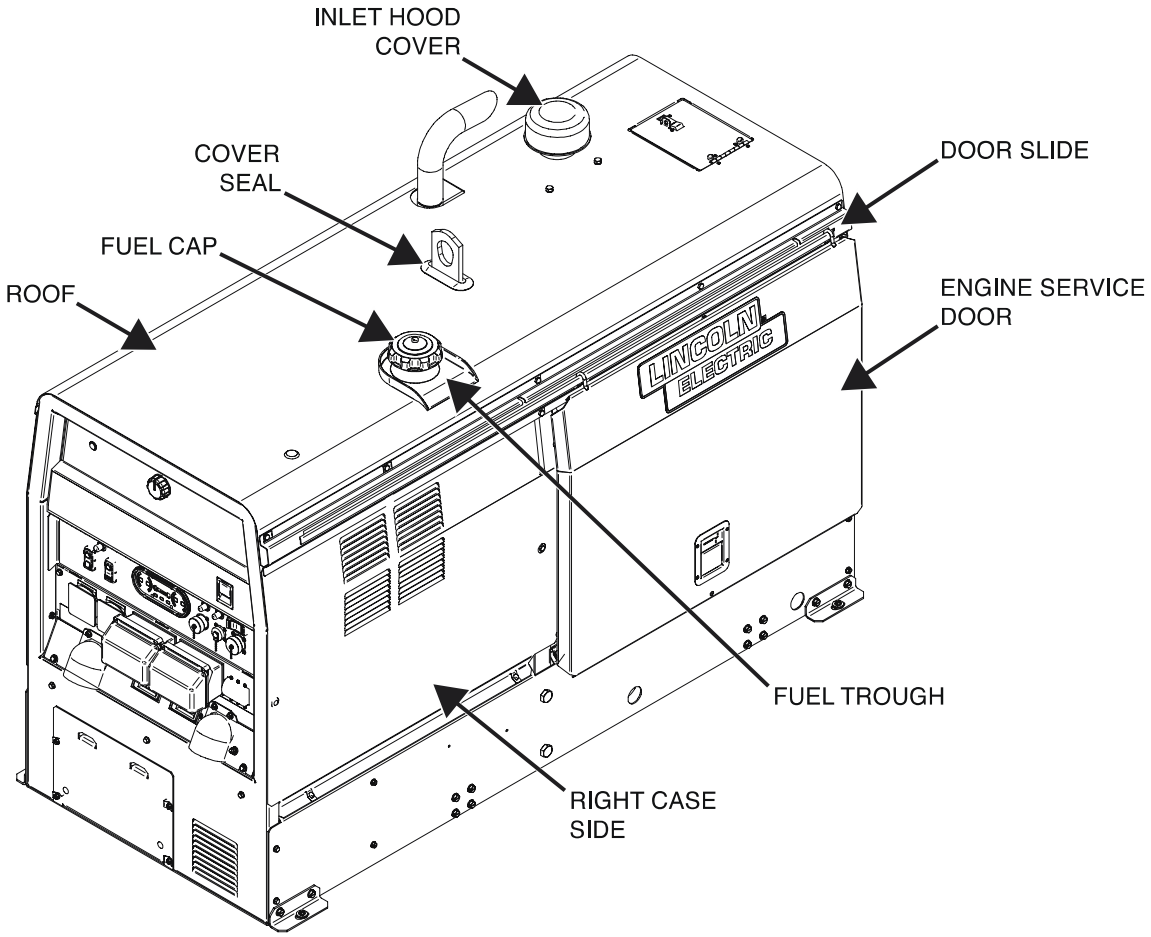
1. Turn off the engine of the Vantage 441X machine.
2. Carefully remove the engine service door. See ***Figure F.1***.
3. Using a 3/8” nutdriver, remove the nine screws securing the door slide to the machine. See ***Figure F.1***.
4. Carefully remove the door slide from the machine.
5. Using a 3/8” nutdriver, loosen the two screws securing the right case side to the machine. See ***Figure F.1***.
6. Using a 3/8” nutdriver, remove the six screws securing the right case side to the machine. See ***Figure F.1***.
7. Carefully remove the right case side from the machine.
8. Carefully remove the inlet hood from the air cleaner. See ***Figure F.1***.
9. Using a 3/8” nutdriver, remove the eighteen screws securing the roof to the machine. See ***Figure F.1***.
10. Using a 1/2” nutdriver and a 1/2” open-end wrench, remove the two bolts, two nuts, two lock washers, and four flat washers securing the air cleaner to the roof. See ***Figure F.1***.
11. Carefully remove the cover seal, fuel trough, and fuel cap from the machine. See ***Figure F.1***. Retain fuel cap for replacement.
12. With the help of an assistant, carefully remove the roof from the machine. See ***Figure F.1***.
13. Carefully attach the fuel cap to the machine.
14. Using a 3/8” nutdriver, loosen the two screws securing the left case side to the machine.
15. Using a 3/8” nutdriver, remove the six screws securing the left case side to the machine.
16. Carefully remove the left case side from the machine.
17. Using a 3/8” nutdriver, loosen the two screws securing the left engine cover to the machine.
18. Using a 3/8” nutdriver, remove the two screws securing the left engine cover to the machine.
19. Carefully remove the left engine cover from the machine.
20. Perform any tests / replacement procedures.

REPLACEMENT PROCEDURE

1. Carefully position the left engine cover onto the machine.
2. Using a 3/8” nutdriver, attach the two screws securing the left engine cover to the machine.
3. Using a 3/8” nutdriver, tighten the two screws securing the left engine cover to the machine.
4. Carefully attach the left case side to the machine.
5. Using a 3/8” nutdriver, attach the six screws securing the left case side to the machine.
6. Using a 3/8” nutdriver, tighten the two screws securing the left case side to the machine.

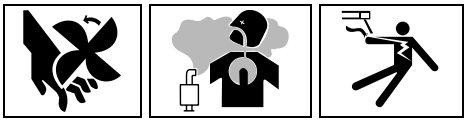
7. Carefully remove the fuel cap from the machine.
8. With the help of an assistant, carefully position the roof on the machine.
9. Carefully attach the cover seal, fuel trough, and fuel cap to the machine.
10. Using a 1/2” nutdriver and a 1/2” open-end wrench, attach the two bolts, two nuts, two lock washers, and four flat washers securing the air cleaner to the roof.
11. Using a 3/8” nutdriver, attach the eighteen screws securing the roof to the machine.
12. Carefully attach the inlet hood to the air cleaner.
13. Carefully attach the right case side to the machine.
14. Using a 3/8” nutdriver, attach the six screws securing the right case side to the machine.
15. Using a 3/8” nutdriver, tighten the two screws securing the right case side to the machine.
16. Carefully position the door slide onto the machine.
17. Using a 3/8” nutdriver, attach the nine screws securing the door slide to the machine.
18. Carefully position the engine service door assembly into the door slide.

Figure F.1 – Case cover part locations



CAPACITOR DISCHARGE PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

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

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 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Locate the chopper module board. See ***Figure F.1***. The chopper module board is located on the power module panel. 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 module board terminals B1 to B2 and B4 to B5. **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 module board. See ***Figure 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.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. See ***Figure F.3***. The field capacitor is located on the fan baffle on the right side of the machine. See Wiring Diagram.
8. If the Lincoln recommended resistor or an equivalent resistor is used, the capacitor 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.4***. See Wiring Diagram.
9. Using a volt/ohmmeter, check the voltage across the capacitor terminals. See ***Figure F.4***. See Wiring Diagram. Voltage should be zero.
10. If any voltage is present, repeat the discharge procedure until reading is zero volts.
11. Locate the 42V capacitor. See ***Figure F.5***. The 42V capacitor is located inside the inner control panel on the left side of the machine. See Wiring Diagram.
12. If the Lincoln recommended resistor or an equivalent resistor is used, the capacitor 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.6***. See Wiring Diagram.

13. Using a volt/ohmmeter, check the voltage across the capacitor terminals. See ***Figure F.6***. See Wiring Diagram. Voltage should be zero.
14. If any voltage is present, repeat the discharge procedure until reading is zero volts.
15. Perform the necessary tests and/or replacement procedures.

Figure F.1 – Chopper module board location

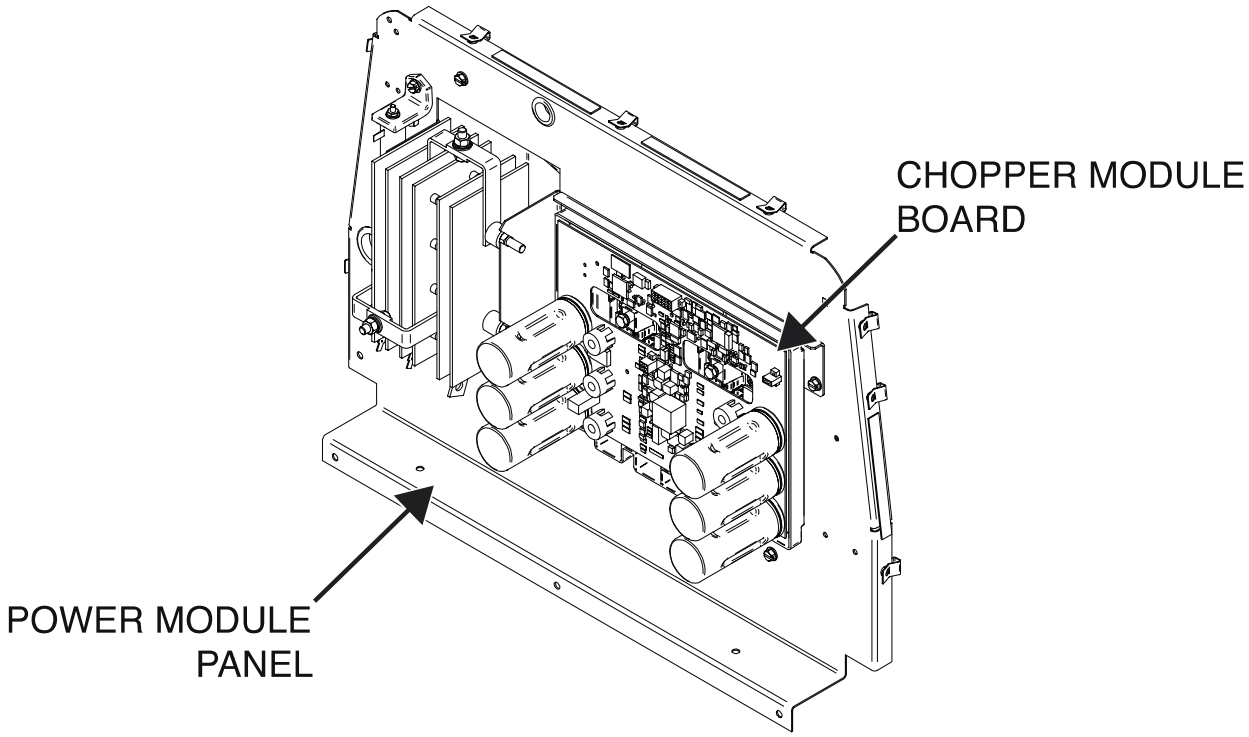


Figure F.2 – Chopper module board discharge

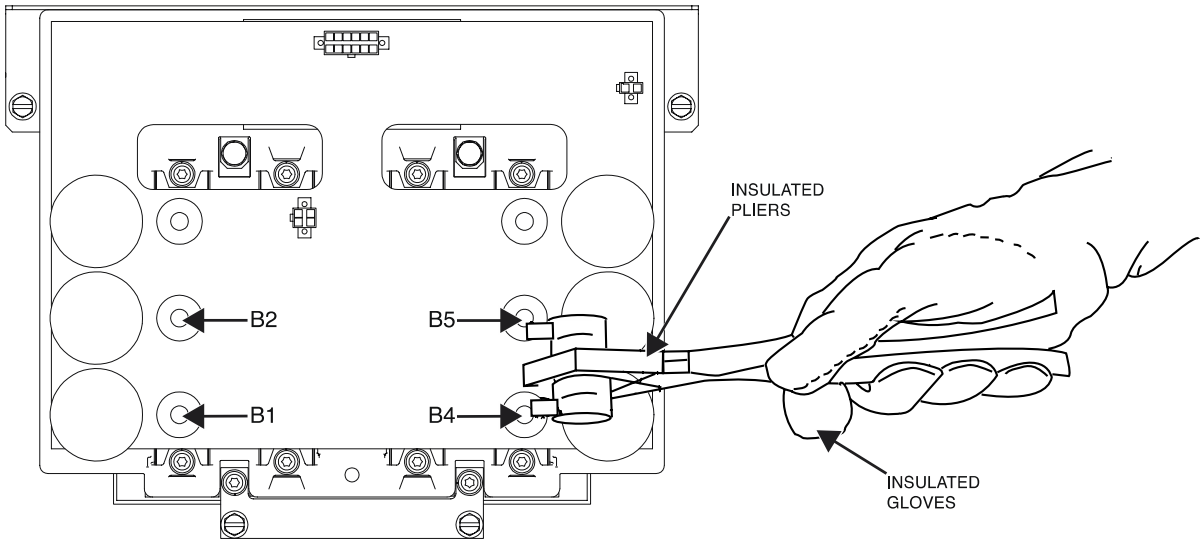


Figure F.3 – Field capacitor location

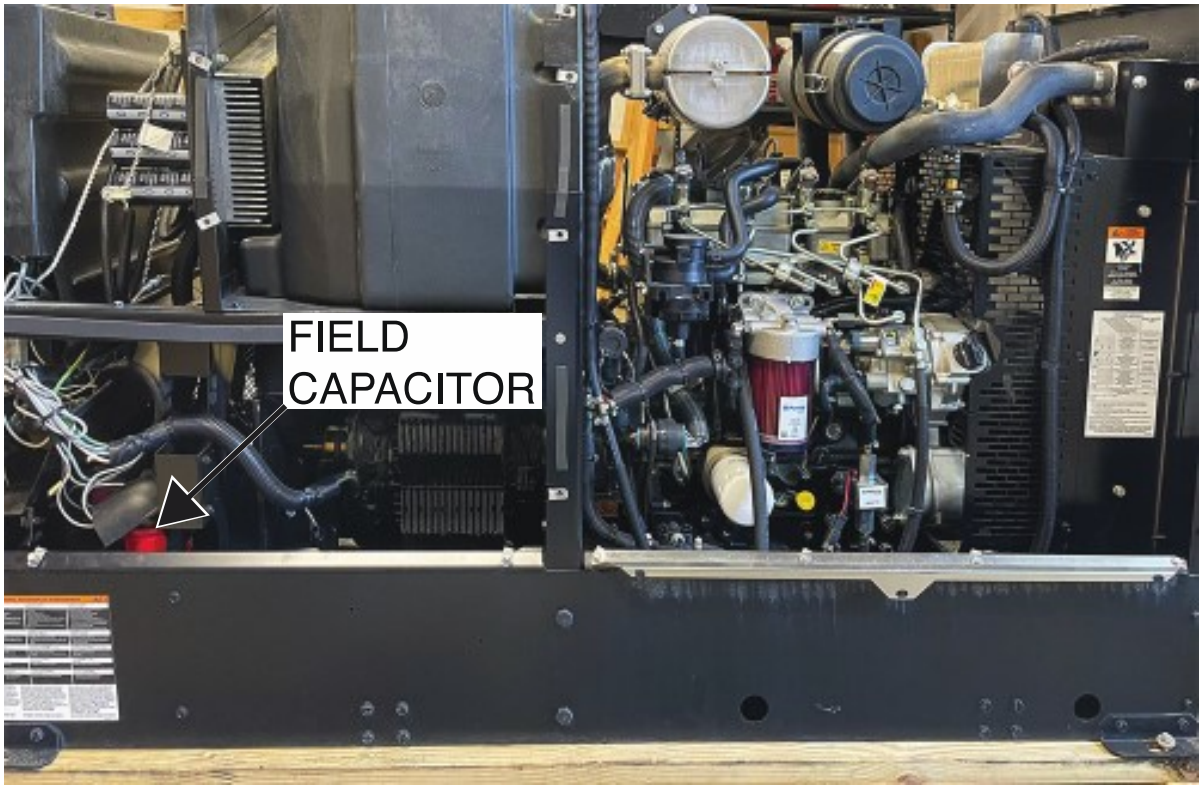


Figure F.4 – Field capacitor discharge

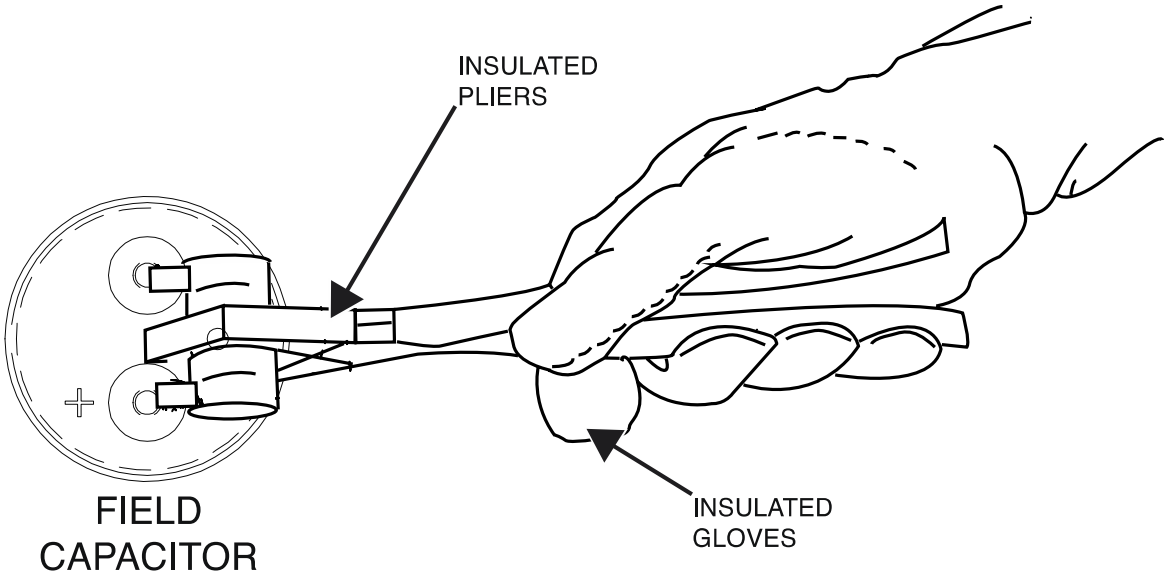


Figure F.5 – 42V capacitor location

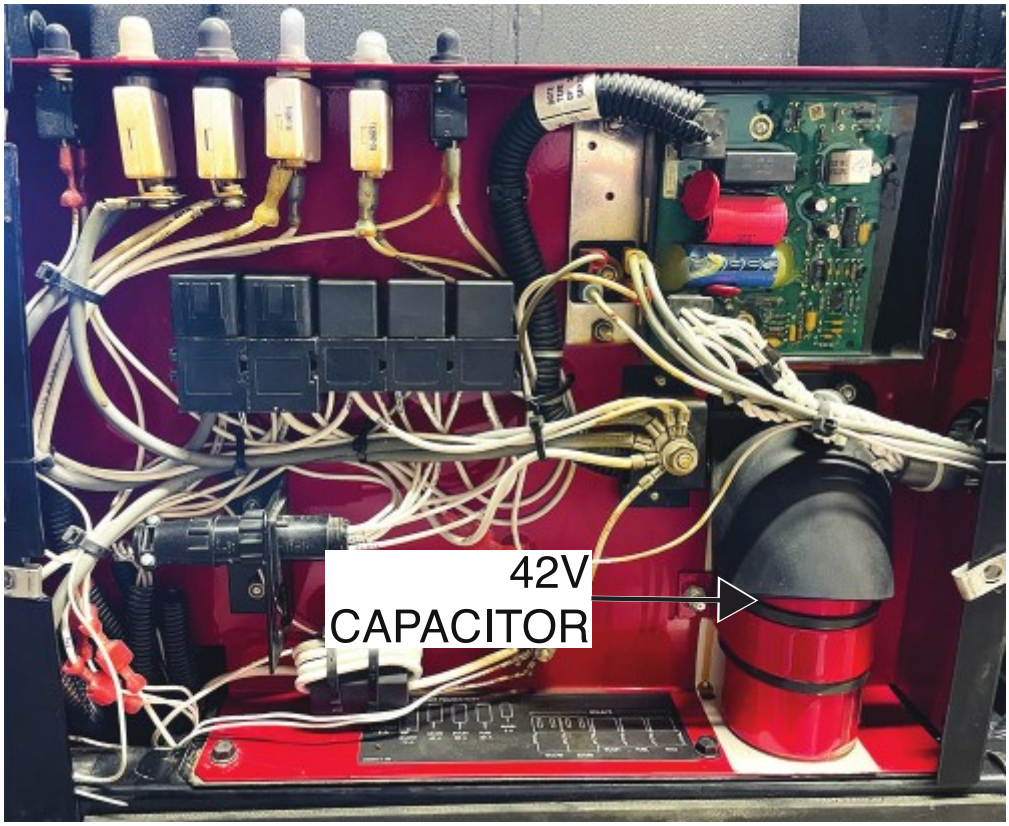
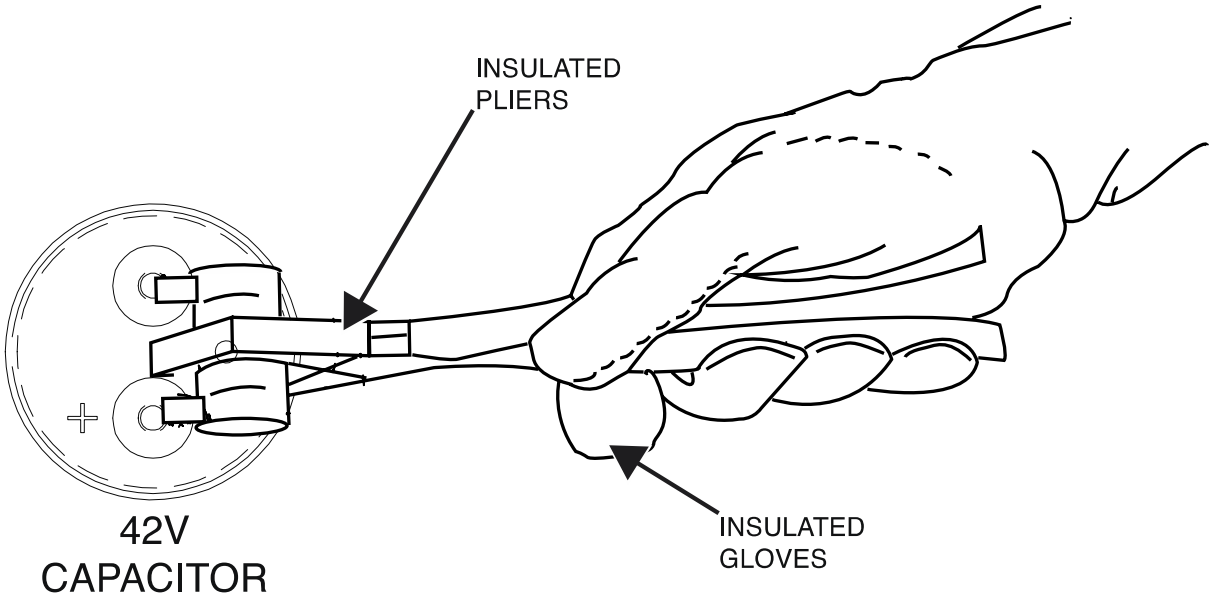
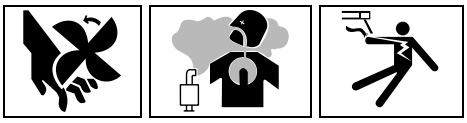


Figure F.6 – 42V capacitor discharge



42V / 120V WIRE FEEDER VOLTMETER SWITCH TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the 42V / 120V Wire Feeder Voltmeter Switch is functioning properly.

MATERIALS NEEDED

3/8” Nutdriver
Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the 42V / 120V wire feeder voltmeter switch. The 42V / 120V wire feeder voltmeter switch is located on the control panel. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.2***.
6. Carefully lower the control panel to gain access to the rear of the 42V / 120V wire feeder voltmeter switch.
7. Carefully remove the shield from the machine.
8. Label and disconnect leads 42B, 32, 32A, and 42A from the 42V / 120V wire feeder voltmeter switch. See ***Figure F.3***. See Wiring Diagram.
9. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.3***. See Wiring Diagram.
10. If any of the tests fail, the 42V / 120V wire feeder voltmeter switch may be faulty.
11. If faulty, perform the ***42V / 120V Wire Feeder Voltmeter Switch Removal And Replacement Procedure***.
12. If all tests pass, proceed to the ***Test Reference Chart***.
13. Connect previously disconnected leads 42B, 32, 32A, and 42A to the 42V / 120V wire feeder voltmeter switch. See Wiring Diagram.
14. Carefully raise the control panel into the upright position.
15. Carefully position the shield into the machine.
16. Using a 3/8” nutdriver, attach the four screws securing the control panel into the upright position.
17. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – 42V / 120V wire feeder voltmeter switch resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
120V POSITION	ENGINE NOT RUNNING. SWITCH SET TO 120V. REMOVE ALL LEADS.	TERMINAL 2 (LEAD 32)	TERMINAL 3 (LEAD 32A)	< 1 OHM
42V POSITION	ENGINE NOT RUNNING. SWITCH SET TO 42V. REMOVE ALL LEADS.	TERMINAL 2 (LEAD 32)	TERMINAL 3 (LEAD 32A)	> 500 OHMS
42V POSITION	ENGINE NOT RUNNING. SWITCH SET TO 42V. REMOVE ALL LEADS.	TERMINAL 4 (LEAD 42B)	TERMINAL 5 (LEAD 42A)	< 1 OHM
120V POSITION	ENGINE NOT RUNNING. SWITCH SET TO 120V. REMOVE ALL LEADS.	TERMINAL 4 (LEAD 42B)	TERMINAL 5 (LEAD 42A)	> 500 OHMS

Figure F.1 – 42V / 120V wire feeder voltmeter switch location

Figure F.2 – Control panel mounting screw locations

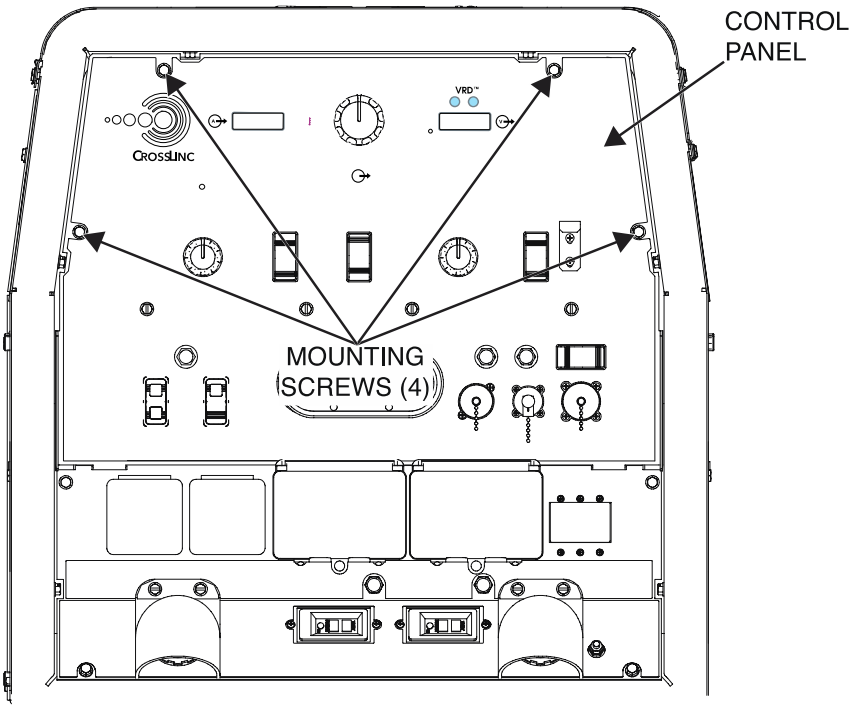
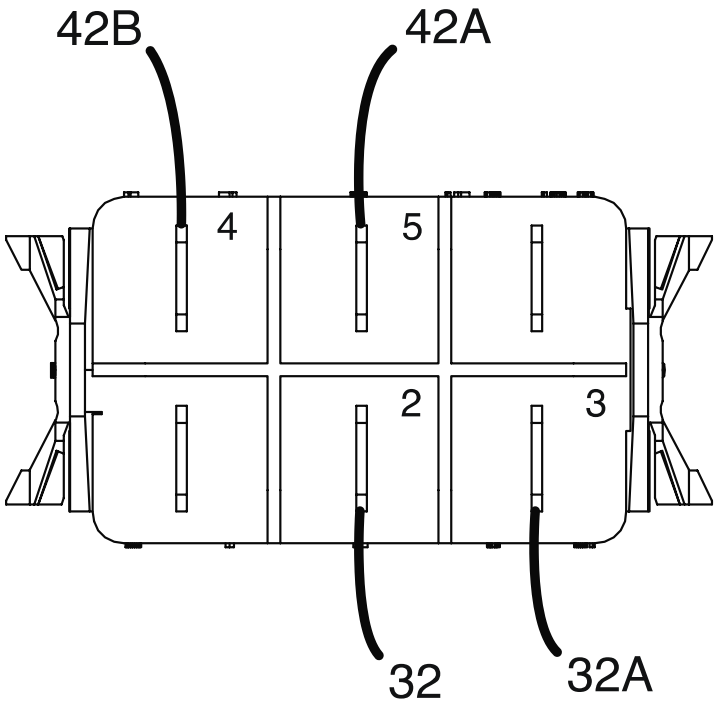


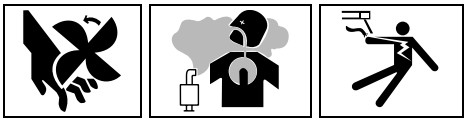
Figure F.3 – 42V / 120V wire feeder voltmeter switch terminal and lead locations



42V / 120V WIRE FEEDER
VOLTMETER SWITCH
(VIEWED FROM THE REAR)

ALTERNATOR TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Alternator is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the alternator. The alternator is located on the left side of the engine. See ***Figure F.1***. See Wiring Diagram.
5. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
6. If any of the tests fail, the alternator may be faulty.
7. If faulty, perform the ***Alternator Removal And Replacement Procedure***.
8. If all tests pass, proceed to the ***Test Reference Chart***.
9. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Alternator voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
BATTERY	ENGINE NOT RUNNING. BATTERY TERMINALS CONNECTED.	BATTERY POSITIVE TERMINAL	BATTERY NEGATIVE TERMINAL	~ 12.6 VDC
ALTERNATOR CHARGING	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH IDLE. BATTERY TERMINALS CONNECTED.	BATTERY POSITIVE TERMINAL	BATTERY NEGATIVE TERMINAL	~ 13.7 VDC - 14.2 VDC
ALTERNATOR CHARGING	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH IDLE. BATTERY TERMINALS CONNECTED.	LEAD 238 ALT (B+)	BATTERY NEGATIVE TERMINAL	~ 13.7 VDC - 14.2 VDC
ALTERNATOR FLASHING FROM CHUI	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH IDLE. BATTERY TERMINALS CONNECTED.	LEAD 202	BATTERY NEGATIVE TERMINAL	~ 1.6 VDC - 12.6 VDC

Figure F.1 – Alternator location

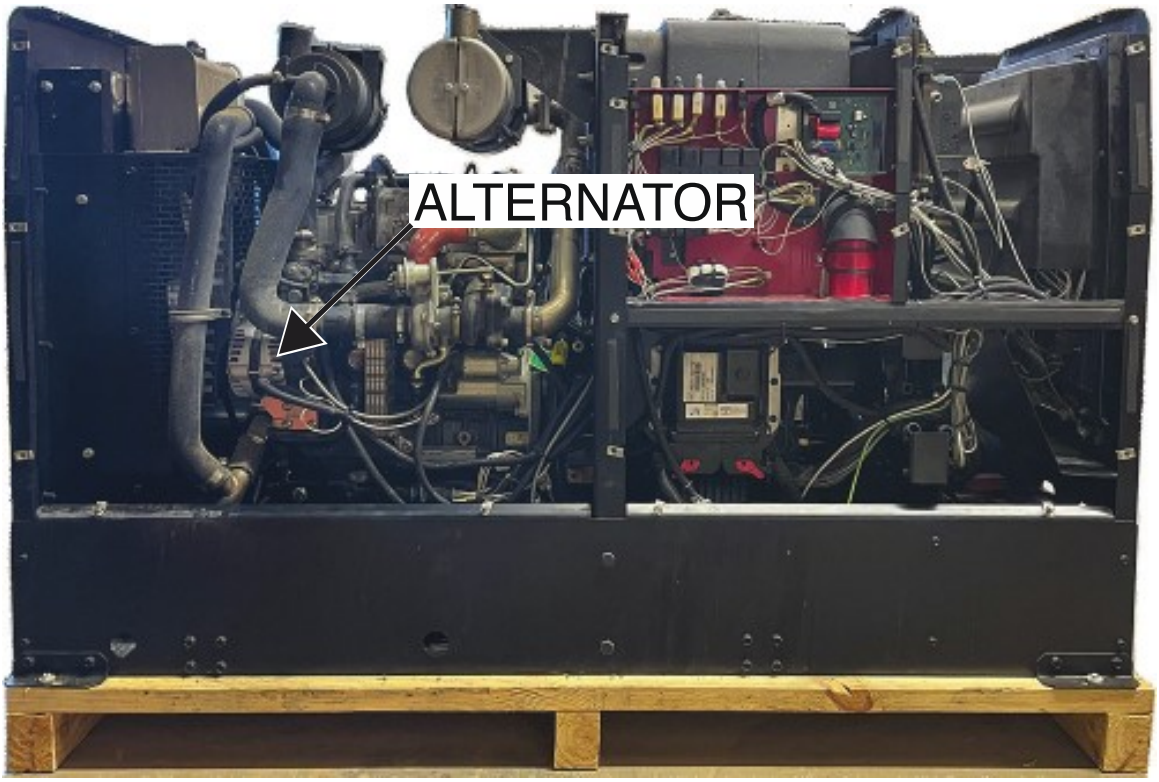
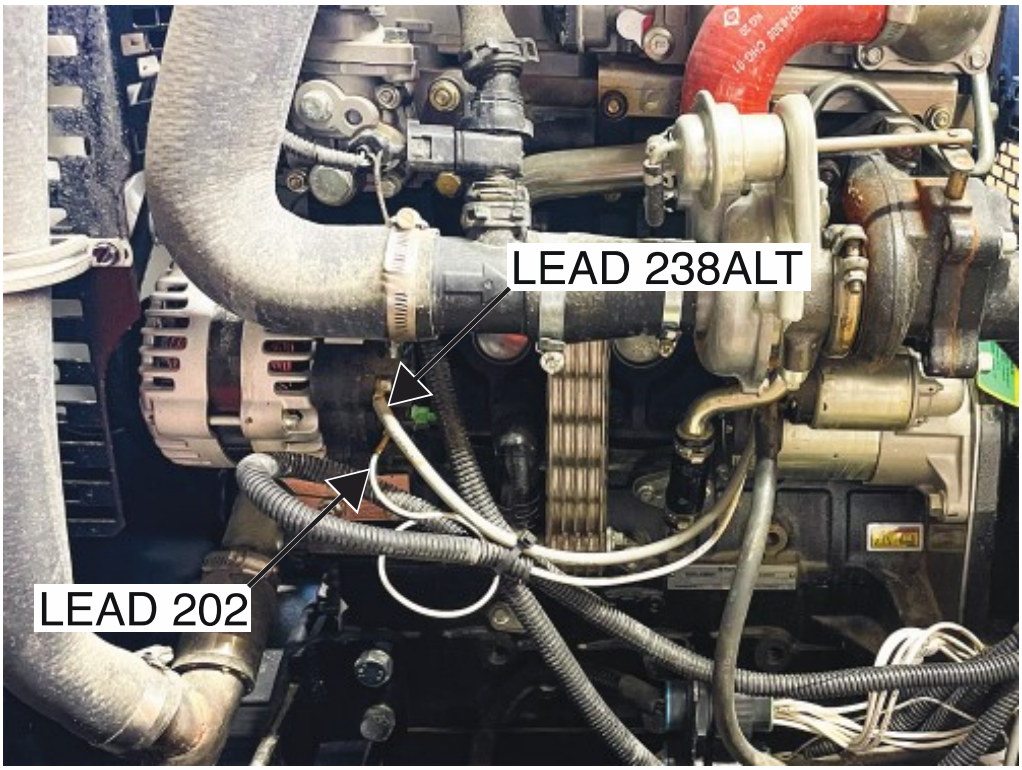
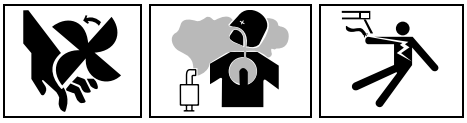


Figure F.2 – Alternator lead locations



ARC CONTROL POTENTIOMETER TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Arc Control Potentiometer is functioning properly.

MATERIALS NEEDED

3/8” Nutdriver
Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the arc control potentiometer. The arc control potentiometer is located on the control panel. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.2***.
6. Carefully lower the control panel to gain access to the arc control potentiometer.
7. Carefully remove the shield from the machine.
8. Label and disconnect plug J32 from the chopper user interface board. See ***Figure F.3***. See Wiring Diagram.
9. Using a volt/ohmmeter, perform the resistance test outlined in ***Table F.1***. See ***Figure F.3***. See Wiring Diagram.
10. If the test fails, the arc control potentiometer may be faulty.
11. If faulty, perform the ***Arc Control Potentiometer Removal And Replacement Procedure***.
12. If the test passes, proceed to the ***Test Reference Chart***.
13. Connect previously disconnected plug J32 to the chopper user interface board. See Wiring Diagram.
14. Carefully raise the control panel into the upright position.
15. Carefully position the shield into the machine.
16. Using a 3/8” nutdriver, attach the four screws securing the control panel into the upright position.
17. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Arc control potentiometer resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
ARC CONTROL POTENTIOMETER	ENGINE NOT RUNNING. PLUG J32 DISCONNECTED.	PLUG J32 PIN 2 (LEAD 279)	PLUG J32 PIN 5 (LEAD 277)	9.5K OHM
	ENGINE NOT RUNNING. PLUG J32 DISCONNECTED. ROTATE KNOB FROM MIN TO MAX.	PLUG J32 PIN 2 (LEAD 279)	PLUG J32 PIN 3 (LEAD 278)	1 OHM - 9.5K OHM

Figure F.1 – Arc control potentiometer location

Figure F.2 – Control panel mounting screw locations

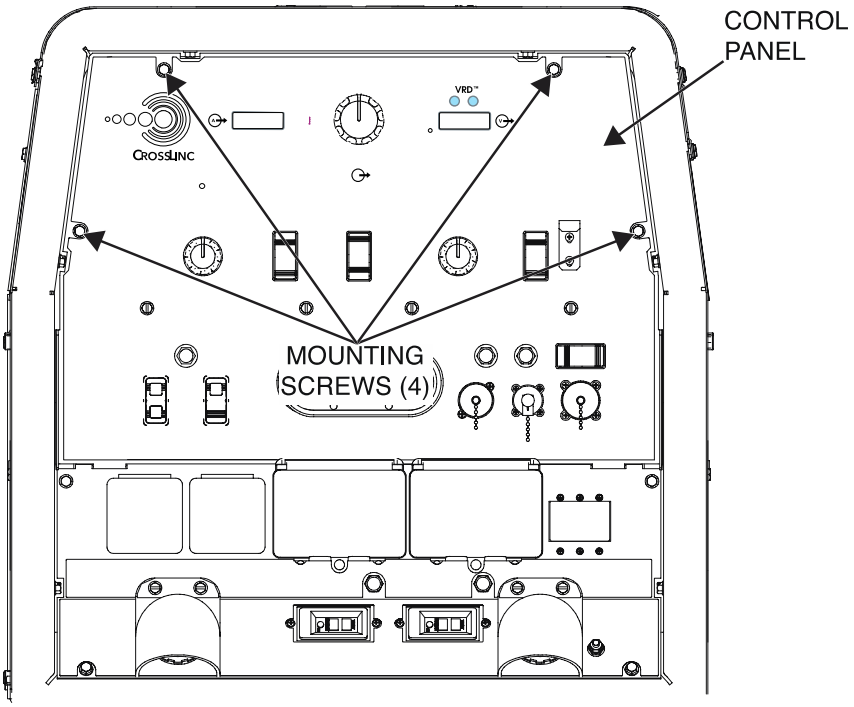
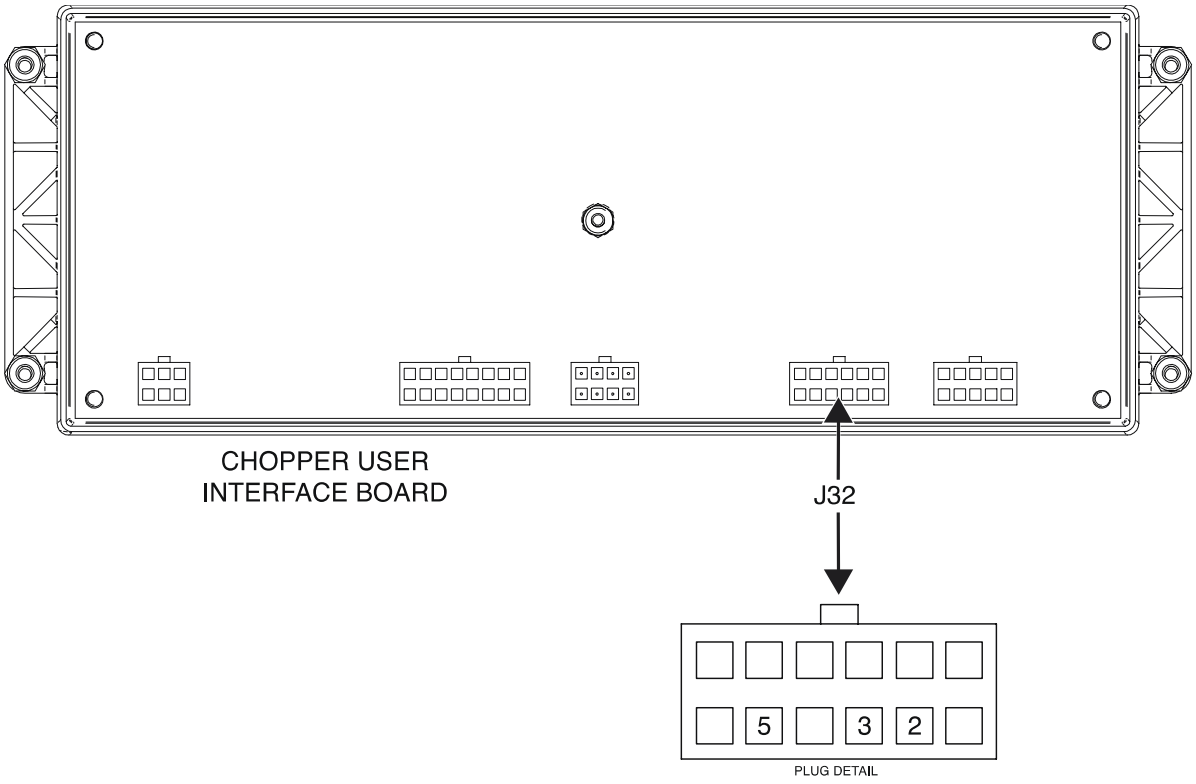
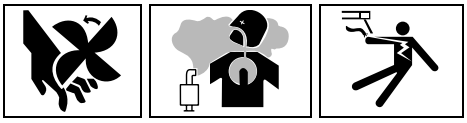


Figure F.3 – Arc control potentiometer plug J32 and terminal locations



AUXILIARY RECEPTACLES TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Auxiliary Receptacles are functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the auxiliary receptacles. The auxiliary receptacles are located on the output panel. See ***Figure F.1***. See Wiring Diagram.
5. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
6. If the tests for either the 240 VAC 3-phase receptacle (J13) or 120 / 240 VAC single phase receptacle (J10) fail, circuit breaker (CB1) may be faulty. Perform the ***Circuit Breaker (CB1) Test Procedure***.
7. If the tests for 120 VAC receptacle right side (J12) fail, circuit breaker (CB2) may be faulty. Perform the ***Circuit Breaker (CB2) Test Procedure***.
8. If the tests for 120 VAC receptacle left side (J12) fail, circuit breaker (CB3) may be faulty. Perform the ***Circuit Breaker (CB3) Test Procedure***.
9. If all tests pass, proceed to the ***Test Reference Chart***.
10. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Auxiliary receptacles voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
240 VAC 3-PHASE RECEPTACLE J13	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH.	X LEAD 3B	Y LEAD 6C	240 VAC
		Y LEAD 6C	Z LEAD 4A	240 VAC
		Z LEAD 4A	X LEAD 3B	240 VAC
120 / 240 VAC SINGLE PHASE RECEPTACLE J10	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH.	X LEAD 3C	Y LEAD 6D	240 VAC
		X LEAD 3C	W LEAD 5D	120 VAC
		Y LEAD 6D	W LEAD 5D	120 VAC
120 VAC RECEPTACLE (RIGHT SIDE) J12	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH.	HOT LEAD 3F	NEUTRAL LEAD 5B	120 VAC
120 VAC RECEPTACLE (LEFT SIDE) J11	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH.	HOT LEAD 6G	NEUTRAL LEAD 5E	120 VAC

Figure F.1 – Auxiliary receptacles locations

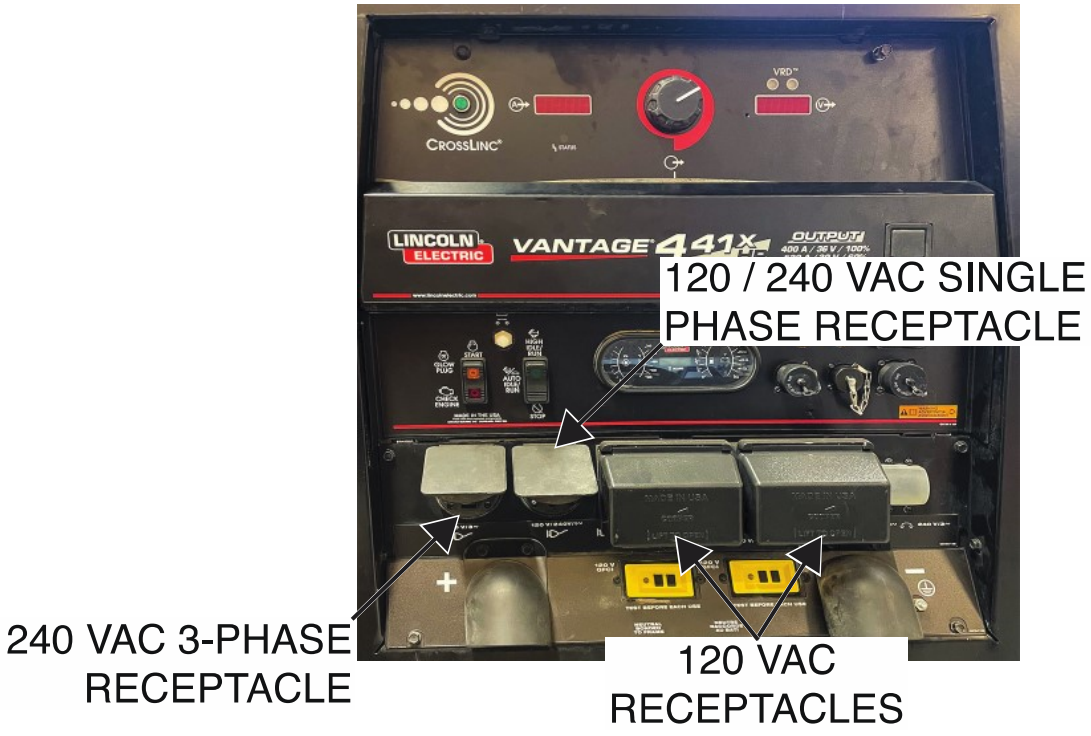
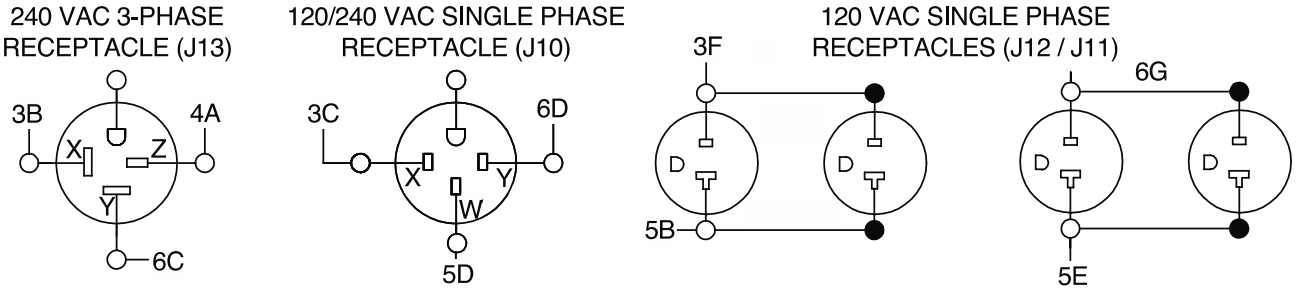
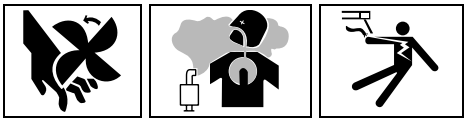


Figure F.2 – Auxiliary receptacles lead locations



CIRCUIT BREAKER (CB1) TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Circuit Breaker (CB1) is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the circuit breaker (CB1). The circuit breaker (CB1) is located on the output panel. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads 3, 4, 6, 3B, 3C, 4A, 6C, and 6D from the circuit breaker (CB1). See ***Figure F.2.*** See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance test outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If the test fails, the circuit breaker (CB1) may be faulty.
8. If faulty, perform the ***Circuit Breaker (CB1) Removal And Replacement Procedure***.
9. If the test passes, proceed to the ***Test Reference Chart***.
10. Connect previously disconnected leads 3, 4, 6, 3B, 3C, 4A, 6C, and 6D from the circuit breaker (CB1). See Wiring Diagram.
11. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Circuit breaker (CB1) resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
CIRCUIT BREAKER (CB1)	ENGINE NOT RUNNING. CIRCUIT BREAKER (CB1) NOT TRIPPED. LEADS 3, 3B, 3C, 4, 4A, 6, 6C, AND 6D DISCONNECTED.	TERMINAL (LEAD 3)	TERMINAL (LEAD 3B)	< 1 OHMS
		TERMINAL (LEAD 4)	TERMINAL (LEAD 4A)	< 1 OHMS
		TERMINAL (LEAD 6)	TERMINAL (LEAD 6C)	< 1 OHMS
	ENGINE NOT RUNNING. CIRCUIT BREAKER (CB1) TRIPPED. LEADS 3, 3B, 3C, 4, 4A, 6, 6C, AND 6D DISCONNECTED.	TERMINAL (LEAD 3)	TERMINAL (LEAD 3B)	< 500K OHMS
		TERMINAL (LEAD 4)	TERMINAL (LEAD 4A)	< 500K OHMS
		TERMINAL (LEAD 6)	TERMINAL (LEAD 6C)	< 500K OHMS

Figure F.1 – Circuit breaker (CB1) location

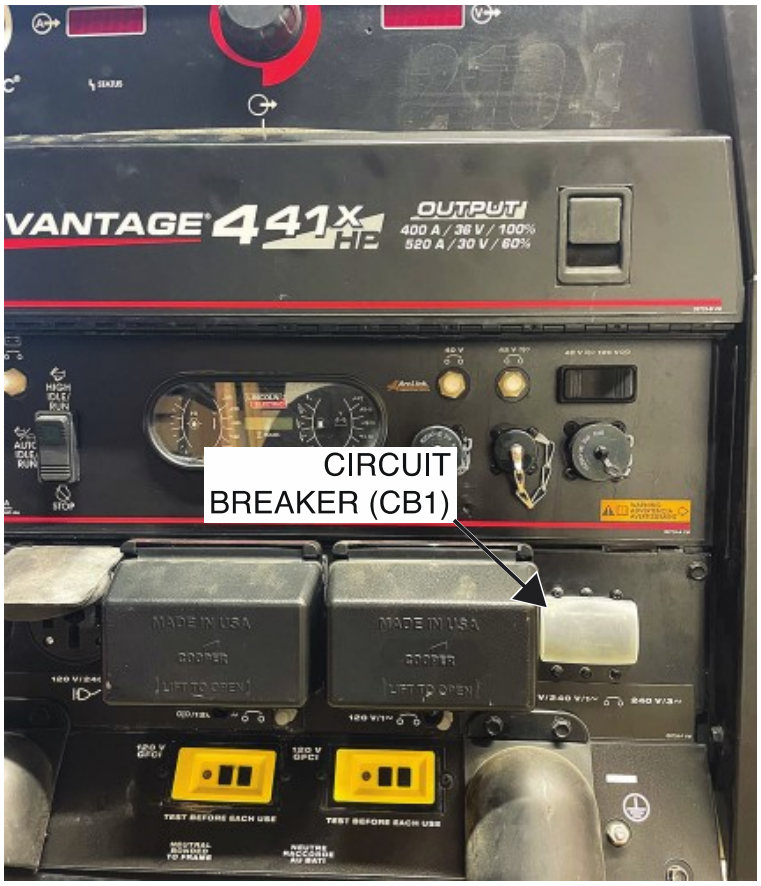
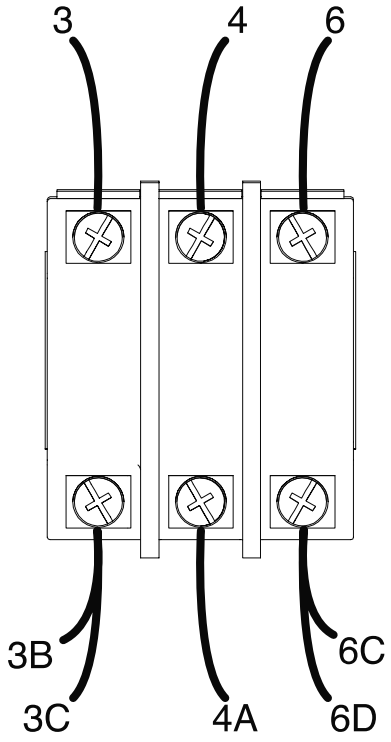
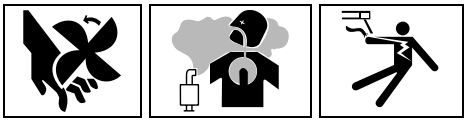


Figure F.2 – Circuit breaker (CB1) lead locations



CIRCUIT BREAKER (CB2) TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Circuit Breaker (CB2) is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the circuit breaker (CB2). The circuit breaker (CB2) is located on the output panel. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads 32A, 3E, and 3D from the circuit breaker (CB2). See ***Figure F.2***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance test outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If the test fails, the circuit breaker (CB2) may be faulty.
8. If faulty, perform the ***Circuit Breaker (CB2) Removal And Replacement Procedure***.
9. If the test passes, proceed to the ***Test Reference Chart***.
10. Connect previously disconnected leads 32A, 3E, and 3D from the circuit breaker (CB2). See Wiring Diagram.
11. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Circuit breaker (CB2) resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
CIRCUIT BREAKER (CB2)	ENGINE NOT RUNNING. CIRCUIT BREAKER (CB2) NOT TRIPPED. LEADS 3D, 3E, AND 32A DISCONNECTED.	RIGHT TERMINAL (LEAD 3D)	LEFT TERMINAL (LEAD 32A)	< 1 OHMS

Figure F.1 – Circuit breaker (CB2) location

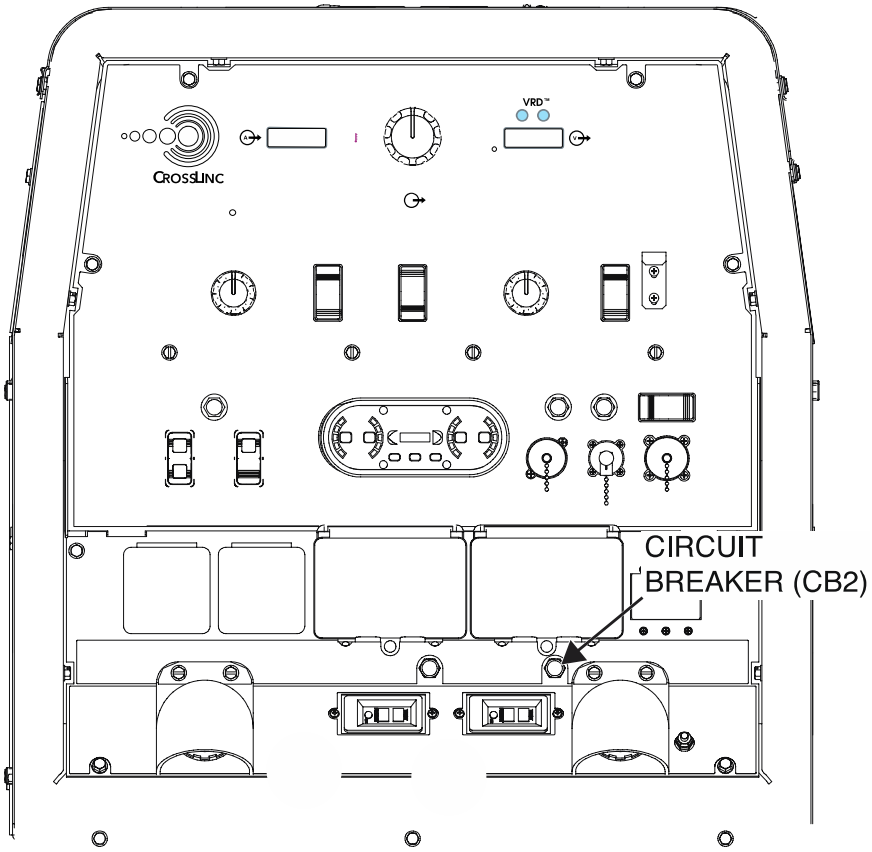
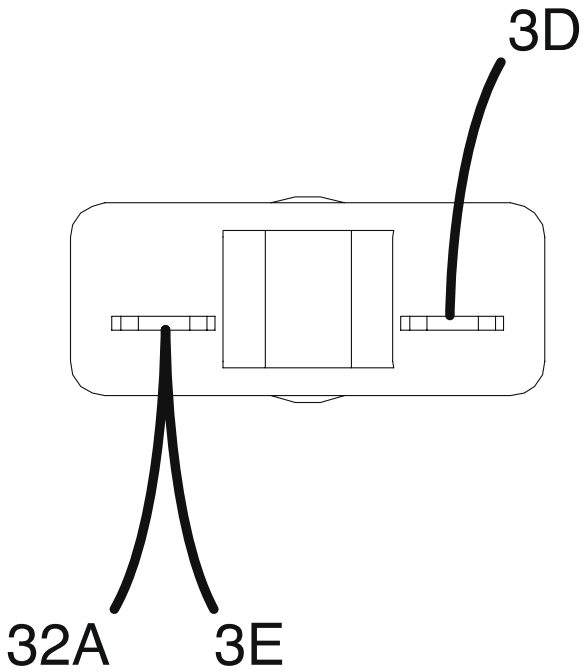
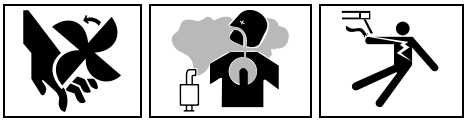


Figure F.2 – Circuit breaker (CB2) lead locations



CIRCUIT BREAKER (CB3) TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Circuit Breaker (CB3) is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the circuit breaker (CB3). The circuit breaker (CB3) is located on the output panel. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads 6F, and 6E from the circuit breaker (CB3). See ***Figure F.2***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance test outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If the test fails, the circuit breaker (CB3) may be faulty.
8. If faulty, perform the ***Circuit Breaker (CB3) Removal And Replacement Procedure***.
9. If the test passes, proceed to the ***Test Reference Chart***.
10. Connect previously disconnected leads 6F, and 6E from the circuit breaker (CB3). See Wiring Diagram.
11. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Circuit breaker (CB3) resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
CIRCUIT BREAKER (CB3)	ENGINE NOT RUNNING. CIRCUIT BREAKER (CB3) NOT TRIPPED. LEADS 6E AND 6F DISCONNECTED.	RIGHT TERMINAL (LEAD 6E)	LEFT TERMINAL (LEAD 6F)	< 1 OHMS

Figure F.1 – Circuit breaker (CB3) location

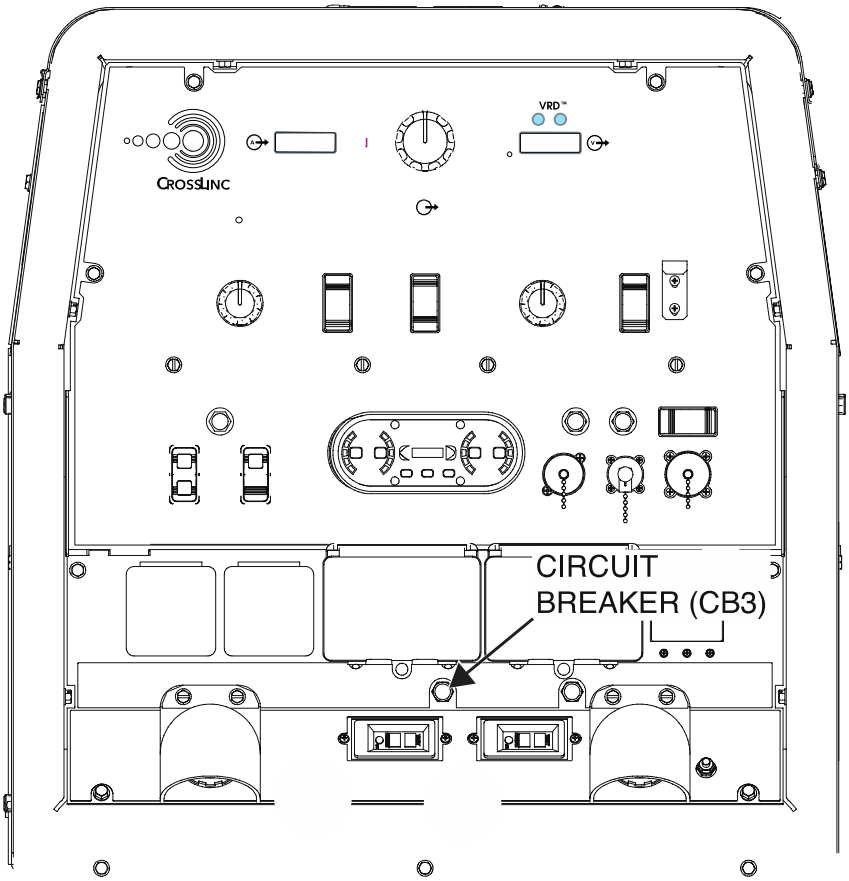
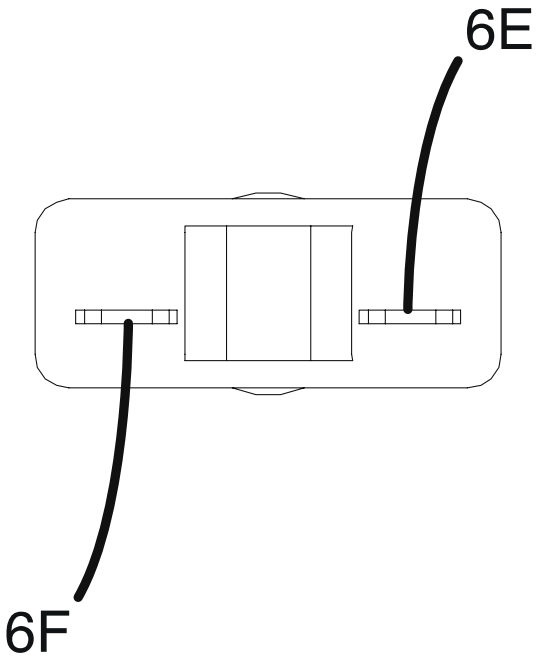
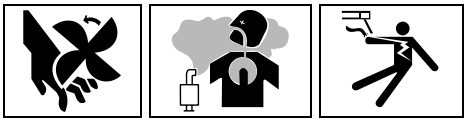


Figure F.2 – Circuit breaker (CB3) lead locations



CIRCUIT BREAKER (CB4) TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Circuit Breaker (CB4) is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the circuit breaker (CB4). The circuit breaker (CB4) is located on the control panel. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads 42 and 42B from the circuit breaker (CB4). See ***Figure F.2***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance test outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If the test fails, the circuit breaker (CB4) may be faulty.
8. If faulty, perform the ***Circuit Breaker (CB4) Removal And Replacement Procedure***.
9. If the test passes, proceed to the ***Test Reference Chart***.
10. Connect previously disconnected leads 42 and 42B from the circuit breaker (CB4). See Wiring Diagram.
11. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Circuit breaker (CB4) resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
CIRCUIT BREAKER (CB4)	ENGINE NOT RUNNING. CIRCUIT BREAKER (CB4) NOT TRIPPED. LEADS 42 AND 42B DISCONNECTED.	TOP TERMINAL (LEAD 42)	BOTTOM TERMINAL (LEAD 42B)	< 1 OHMS

Figure F.1 – Circuit breaker (CB4) location

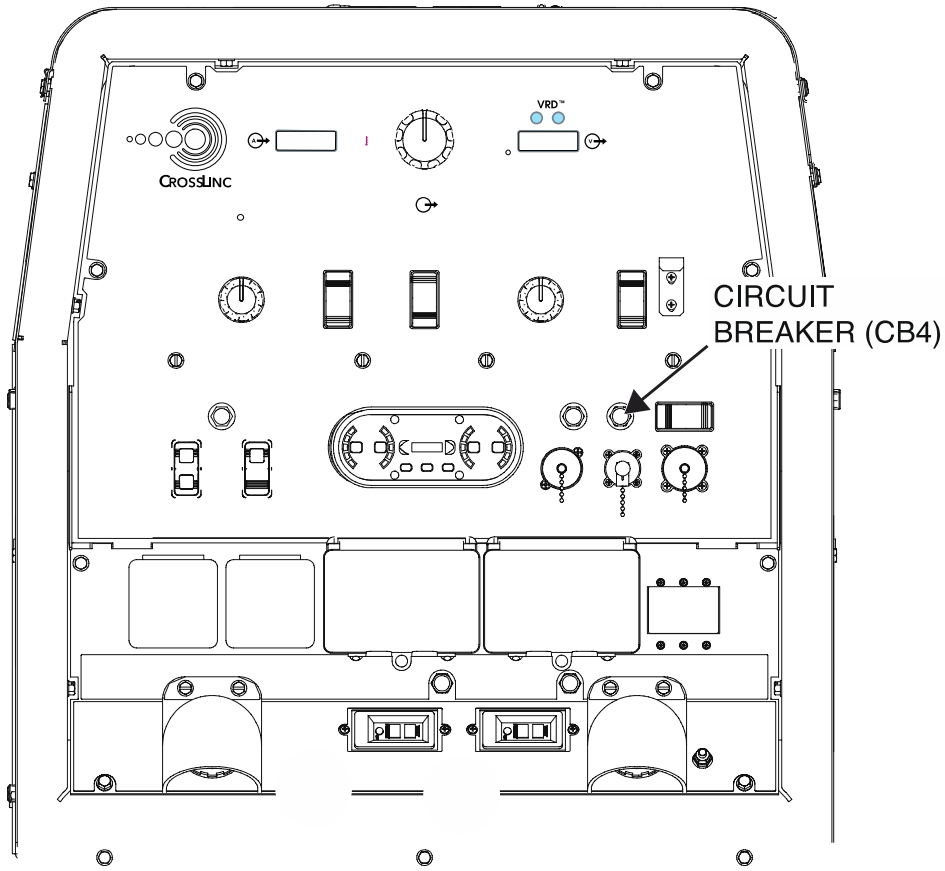
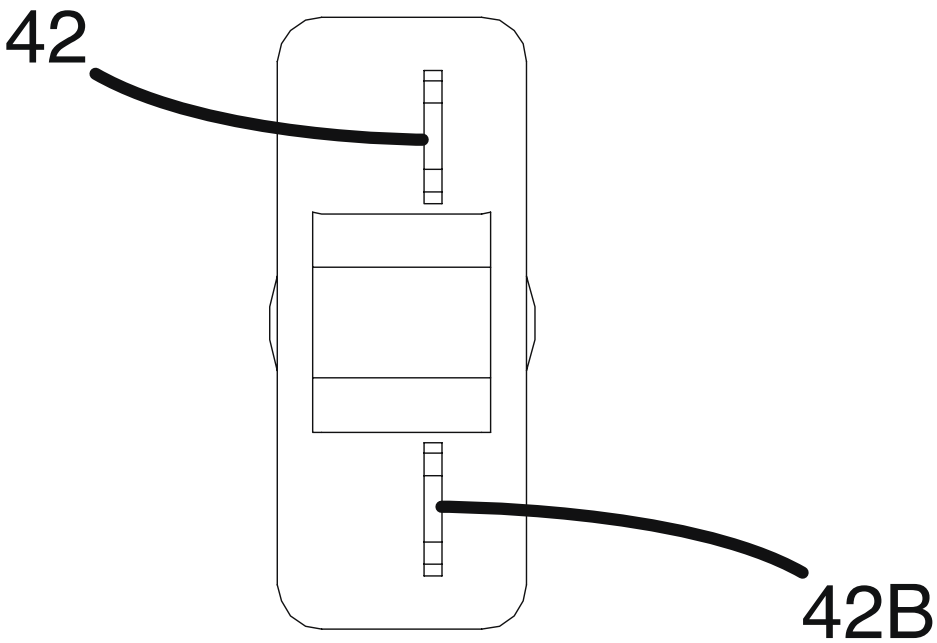
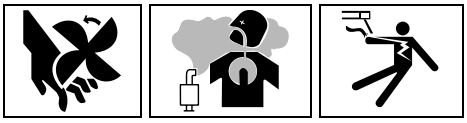


Figure F.2 – Circuit breaker (CB4) lead locations



CIRCUIT BREAKER (CB5) TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Circuit Breaker (CB5) is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

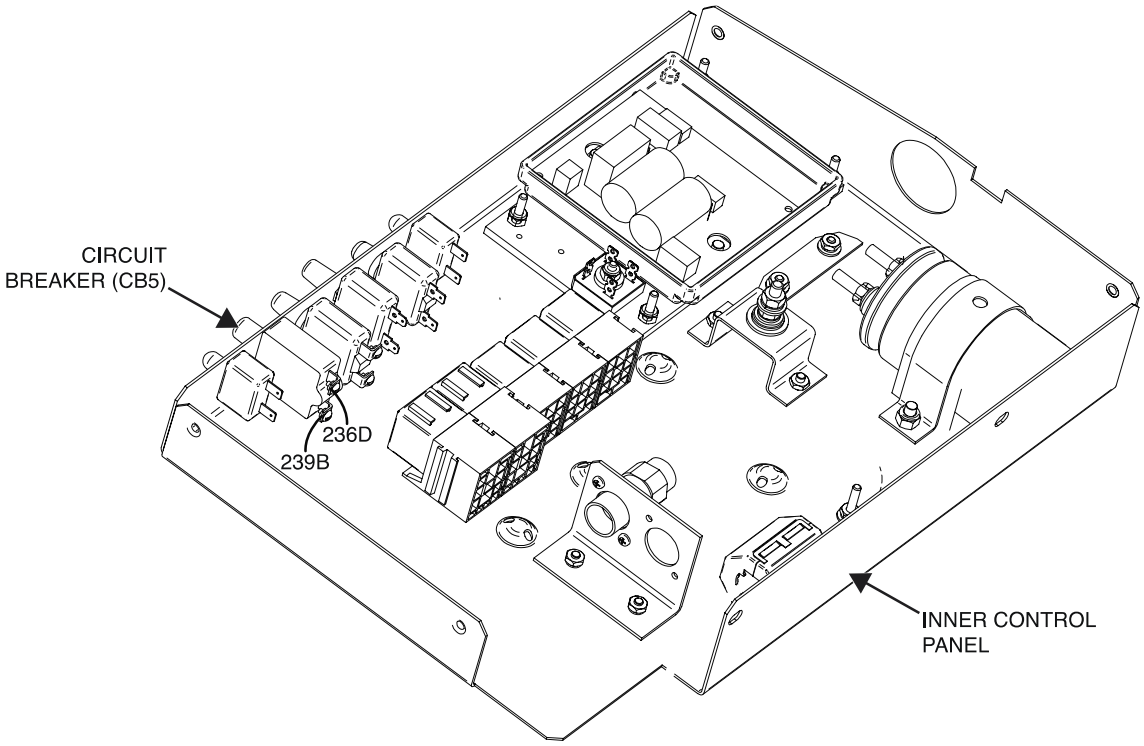
TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the circuit breaker (CB5). The circuit breaker (CB5) is located on the inner control panel. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads 236D and 239B from the circuit breaker (CB5). See ***Figure F.1***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance test outlined in ***Table F.1***. See ***Figure F.1***. See Wiring Diagram.
7. If the test fails, the circuit breaker (CB5) may be faulty.
8. If faulty, perform the ***Circuit Breaker (CB5) Removal And Replacement Procedure***.
9. If the test passes, proceed to the ***Test Reference Chart***.
10. Connect previously disconnected leads 236D and 239B from the circuit breaker (CB5). See Wiring Diagram.
11. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Circuit breaker (CB5) resistance tests

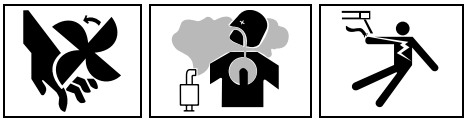
COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
CIRCUIT BREAKER (CB5)	ENGINE NOT RUNNING. CIRCUIT BREAKER (CB5) NOT TRIPPED. LEADS 239B AND 236D DISCONNECTED.	OUTER TERMINAL (LEAD 239B)	INNER TERMINAL (LEAD 236D)	< 1 OHMS

Figure F.1 – Circuit breaker (CB5) lead locations



CIRCUIT BREAKER (CB6) TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Circuit Breaker (CB6) is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

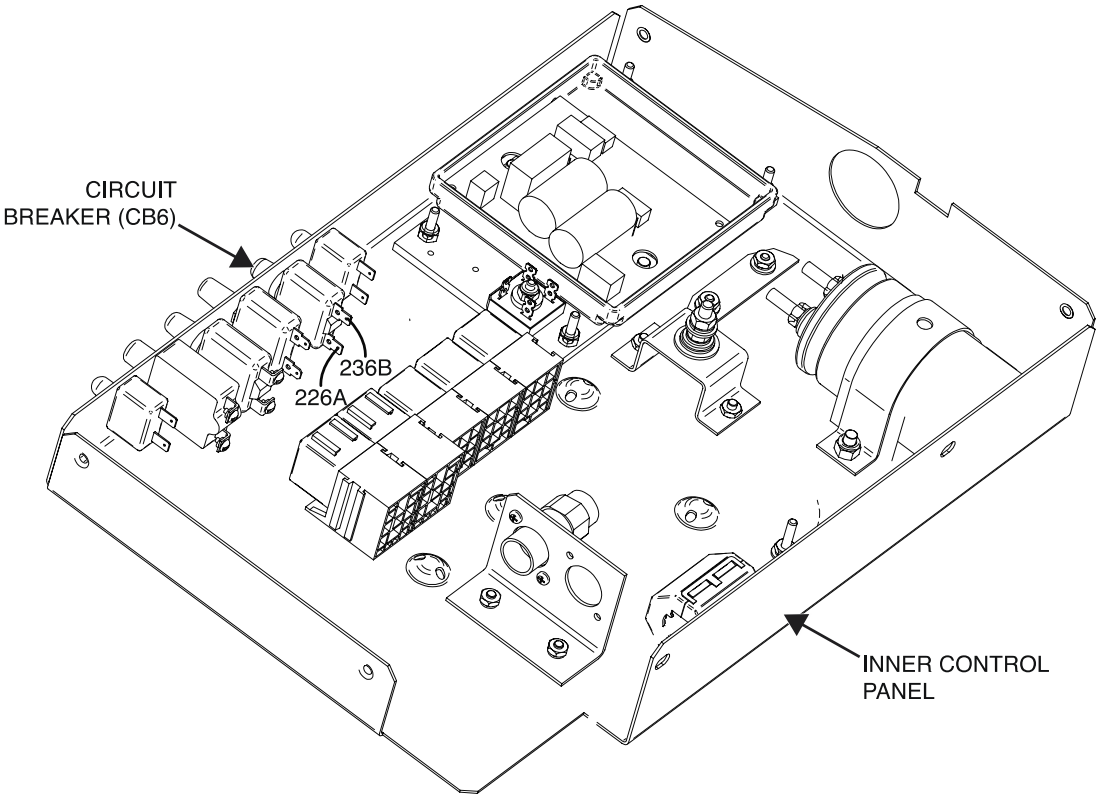
TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the circuit breaker (CB6). The circuit breaker (CB6) is located on the inner control panel. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads 236B and 226A from the circuit breaker (CB6). See ***Figure F.1***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance test outlined in ***Table F.1***. See ***Figure F.1***. See Wiring Diagram.
7. If the test fails, the circuit breaker (CB6) may be faulty.
8. If faulty, perform the ***Circuit Breaker (CB6) Removal And Replacement Procedure***.
9. If the test passes, proceed to the ***Test Reference Chart***.
10. Connect previously disconnected leads 236B and 226A from the circuit breaker (CB6). See Wiring Diagram.
11. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Circuit breaker (CB6) resistance tests

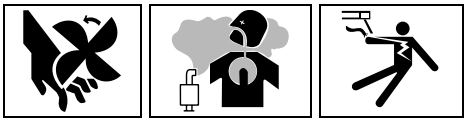
COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
CIRCUIT BREAKER (CB6)	ENGINE NOT RUNNING. CIRCUIT BREAKER (CB6) NOT TRIPPED. LEADS 226A AND 236B DISCONNECTED.	OUTER TERMINAL (LEAD 226A)	INNER TERMINAL (LEAD 236B)	< 1 OHMS

Figure F.1 – Circuit breaker (CB6) lead locations



CIRCUIT BREAKER (CB7) TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Circuit Breaker (CB7) is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

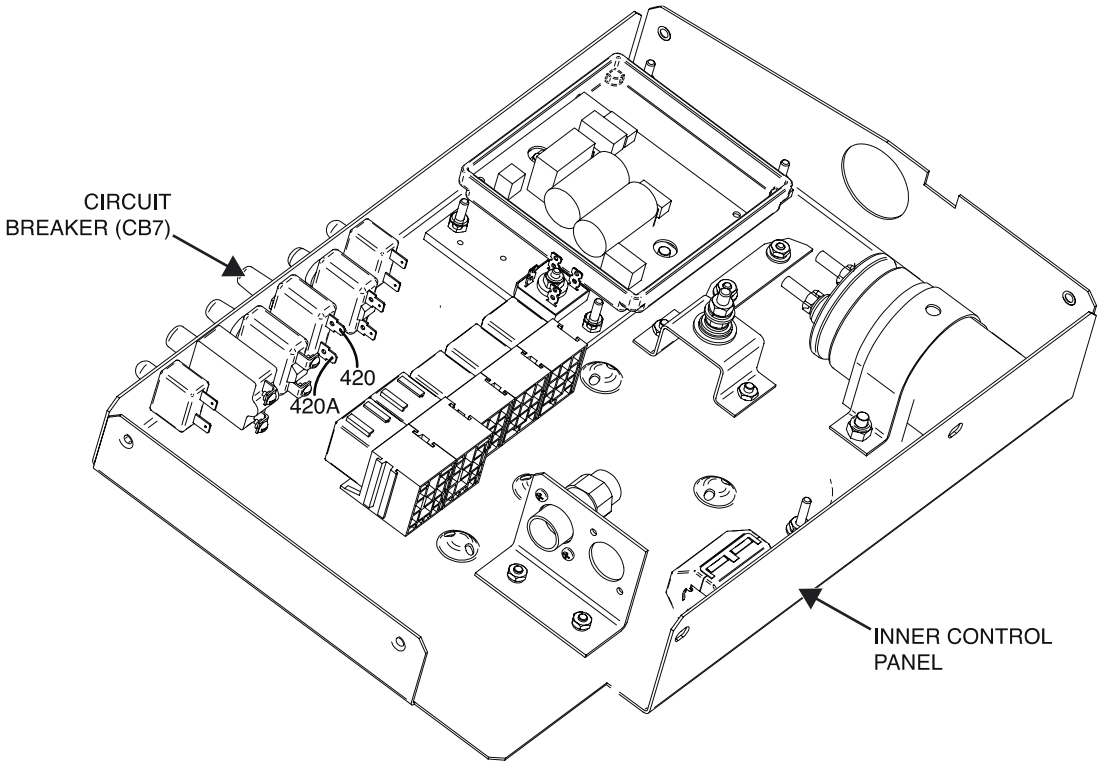
TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the circuit breaker (CB7). The circuit breaker (CB7) is located on the inner control panel. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads 420 and 420A from the circuit breaker (CB7). See ***Figure F.1***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance test outlined in ***Table F.1***. See ***Figure F.1***. See Wiring Diagram.
7. If the test fails, the circuit breaker (CB7) may be faulty.
8. If faulty, perform the ***Circuit Breaker (CB7) Removal And Replacement Procedure***.
9. If the test passes, proceed to the ***Test Reference Chart***.
10. Connect previously disconnected leads 420 and 420A from the circuit breaker (CB7). See Wiring Diagram.
11. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Circuit breaker (CB7) resistance tests

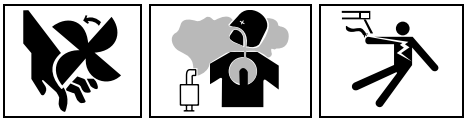
COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
CIRCUIT BREAKER (CB7)	ENGINE NOT RUNNING. CIRCUIT BREAKER (CB7) NOT TRIPPED. LEADS 420 AND 420A DISCONNECTED.	INNER TERMINAL (LEAD 420)	OUTER TERMINAL (LEAD 420A)	< 1 OHMS

Figure F.1 – Circuit breaker (CB7) lead locations



CIRCUIT BREAKER (CB8) TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Circuit Breaker (CB8) is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

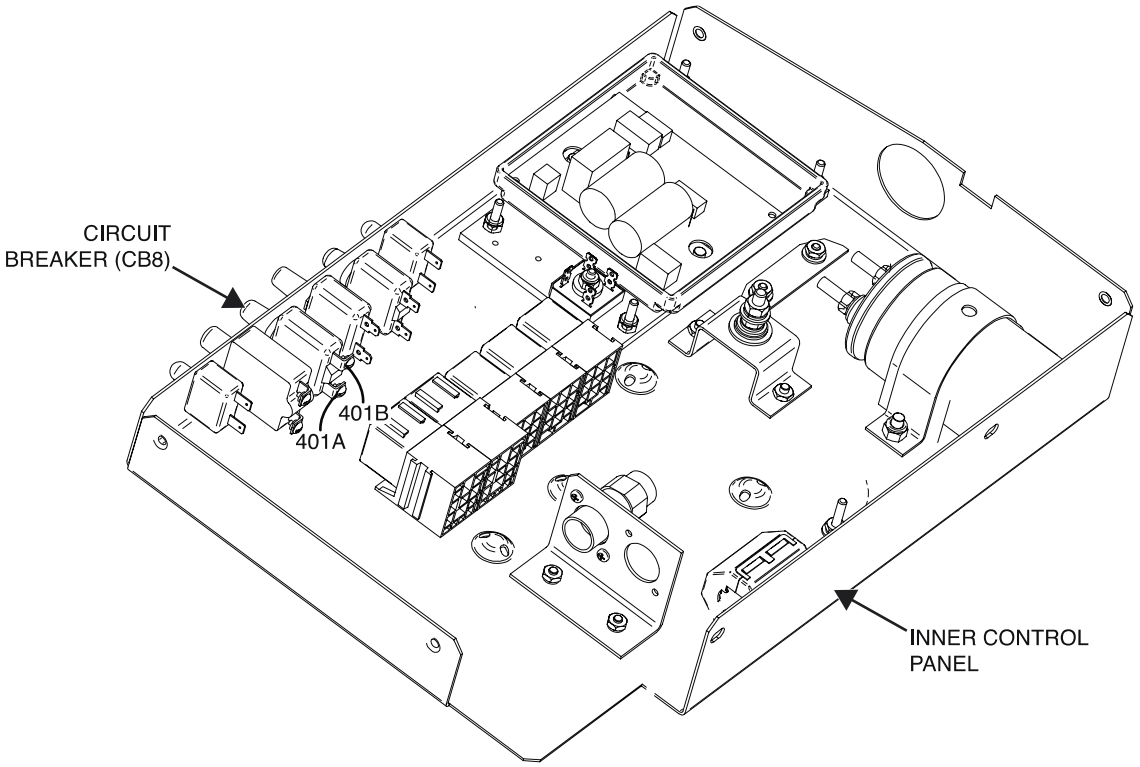
TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the circuit breaker (CB8). The circuit breaker (CB8) is located on the inner control panel. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads 401A and 401B from the circuit breaker (CB8). See ***Figure F.1***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance test outlined in ***Table F.1***. See ***Figure F.1***. See Wiring Diagram.
7. If the test fails, the circuit breaker (CB8) may be faulty.
8. If faulty, perform the ***Circuit Breaker (CB8) Removal And Replacement Procedure***.
9. If the test passes, proceed to the ***Test Reference Chart***.
10. Connect previously disconnected leads 401A and 401B from the circuit breaker (CB8). See Wiring Diagram.
11. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Circuit breaker (CB8) resistance tests

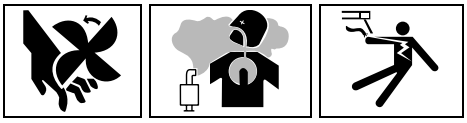
COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
CIRCUIT BREAKER (CB8)	ENGINE NOT RUNNING. CIRCUIT BREAKER (CB8) NOT TRIPPED. LEADS 401A AND 401B DISCONNECTED.	OUTER TERMINAL (LEAD 401A)	INNER TERMINAL (LEAD 401B)	< 1 OHMS

Figure F.1 – Circuit breaker (CB8) lead locations



CIRCUIT BREAKER (CB9) TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Circuit Breaker (CB9) is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the circuit breaker (CB9). The circuit breaker (CB9) is located on the control panel. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads 46 and 46A from the circuit breaker (CB9). See ***Figure F.2***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance test outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If the test fails, the circuit breaker (CB9) may be faulty.
8. If faulty, perform the ***Circuit Breaker (CB9) Removal And Replacement Procedure***.
9. If the test passes, proceed to the ***Test Reference Chart***.
10. Connect previously disconnected leads 46 and 46A from the circuit breaker (CB9). See Wiring Diagram.
11. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Circuit breaker (CB9) resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
CIRCUIT BREAKER (CB9)	ENGINE NOT RUNNING. CIRCUIT BREAKER (CB9) NOT TRIPPED. LEADS 46 AND 46A DISCONNECTED.	TOP TERMINAL (LEAD 46)	BOTTOM TERMINAL (LEAD 46A)	< 1 OHMS

Figure F.1 – Circuit breaker (CB9) location

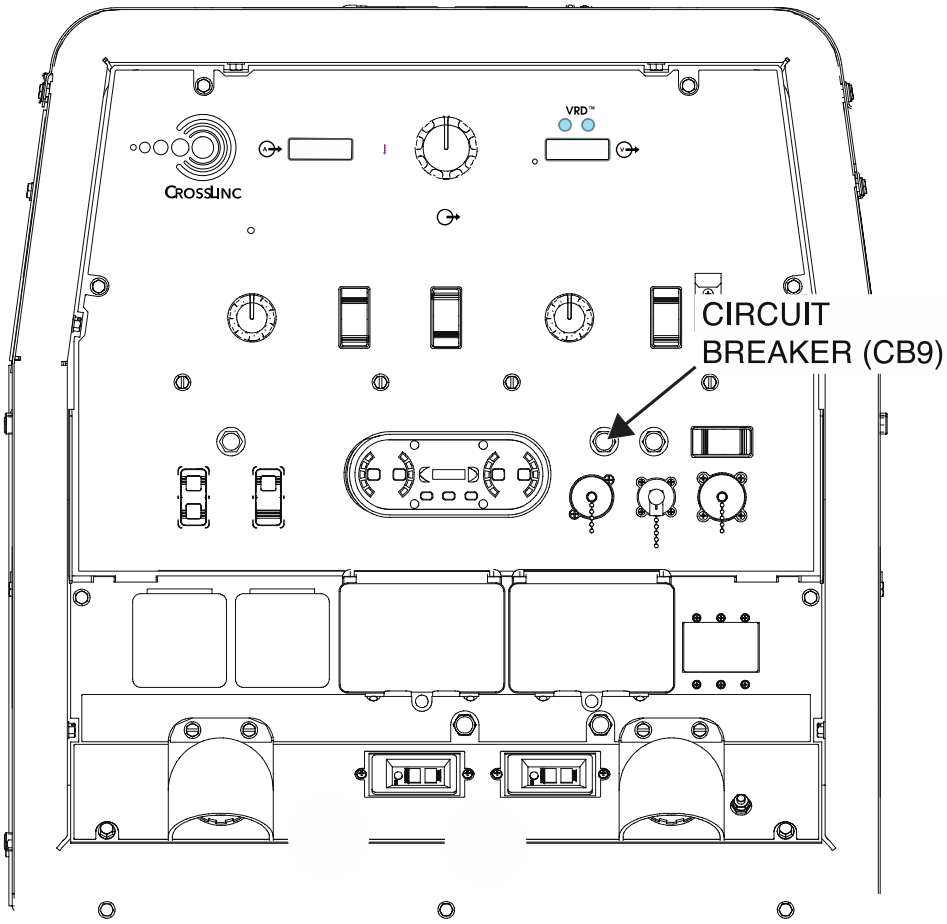
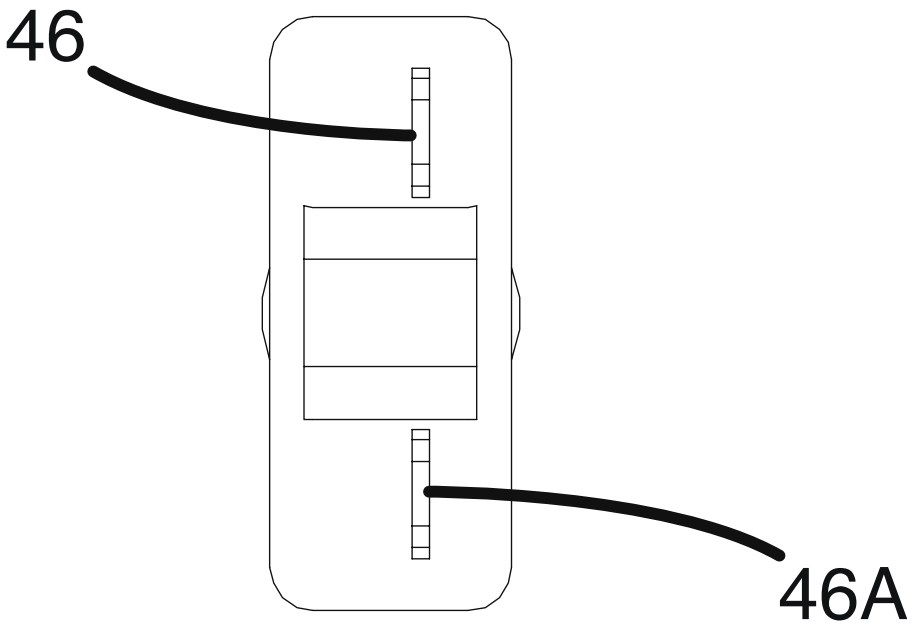
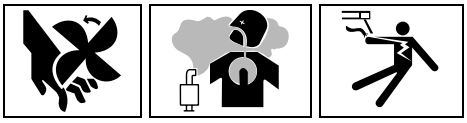


Figure F.2 – Circuit breaker (CB9) lead locations



CIRCUIT BREAKER (CB10) TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Circuit Breaker (CB10) is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the circuit breaker (CB10). The circuit breaker (CB10) is located on the control panel. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads 238A and 236A from the circuit breaker (CB10). See ***Figure F.2***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance test outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If the test fails, the circuit breaker (CB10) may be faulty.
8. If faulty, perform the ***Circuit Breaker (CB10) Removal And Replacement Procedure***.
9. If the test passes, proceed to the ***Test Reference Chart***.
10. Connect previously disconnected leads 238A and 236A from the circuit breaker (CB10). See Wiring Diagram.
11. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Circuit breaker (CB10) resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
CIRCUIT BREAKER (CB10)	ENGINE NOT RUNNING. CIRCUIT BREAKER (CB10) NOT TRIPPED. LEADS 238A AND 236A DISCONNECTED.	TOP TERMINAL (LEAD 238A)	BOTTOM TERMINAL (LEAD 236A)	< 1 OHMS

Figure F.1 – Circuit breaker (CB10) location

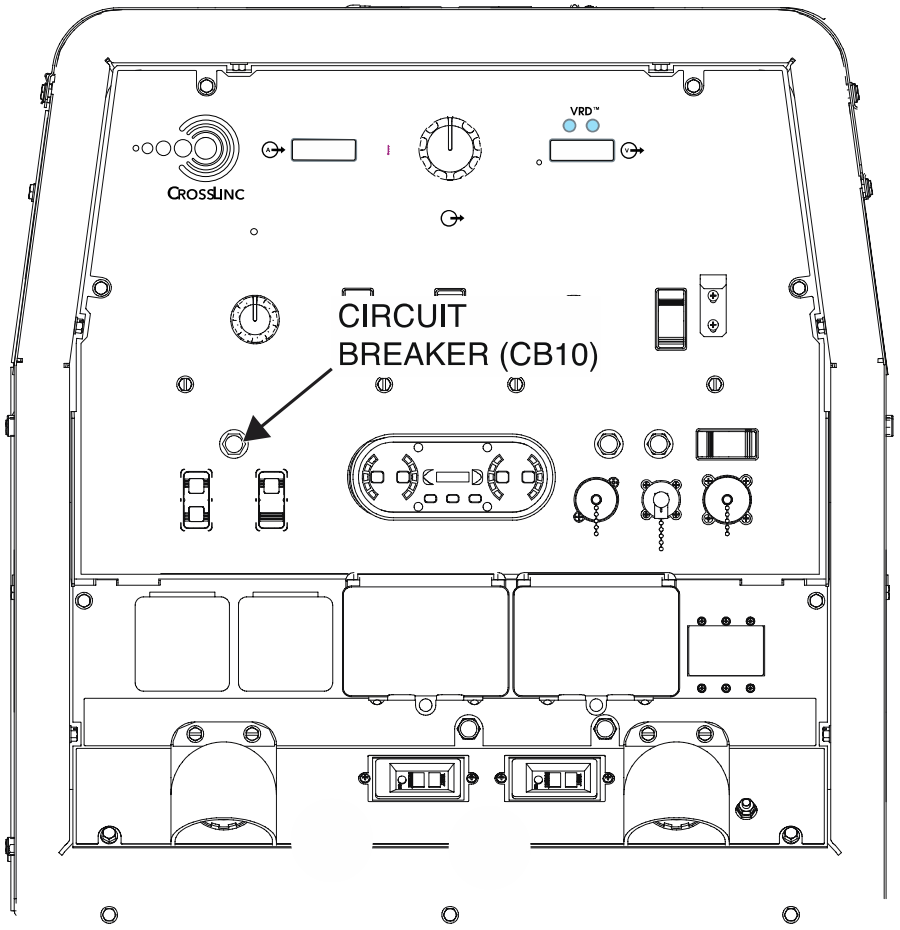
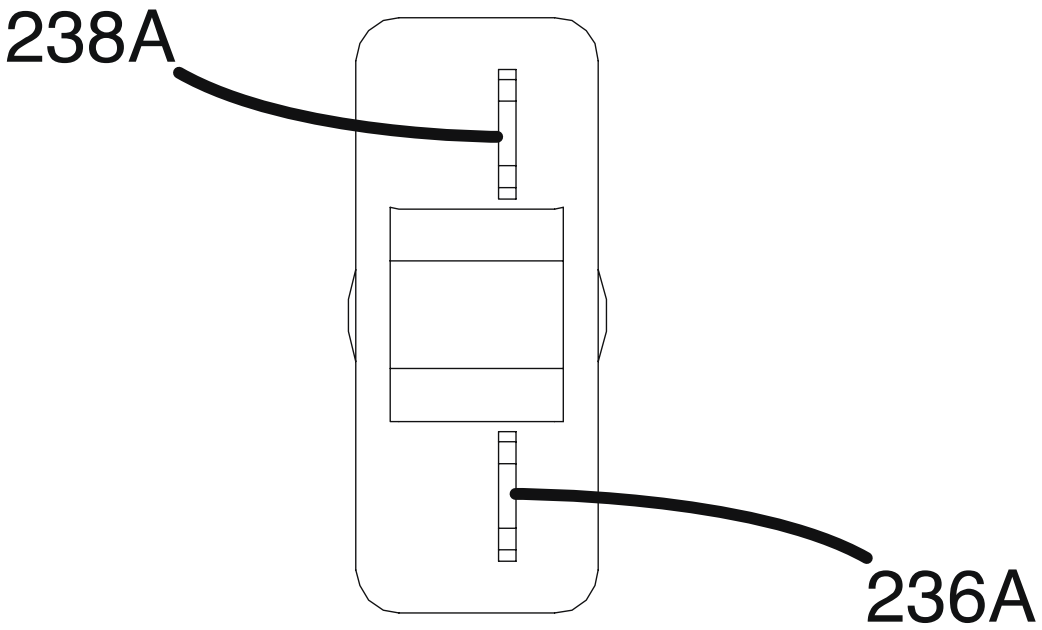
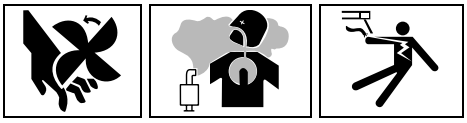


Figure F.2 – Circuit breaker (CB10) lead locations



CIRCUIT BREAKER (CB11) TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Circuit Breaker (CB11) is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

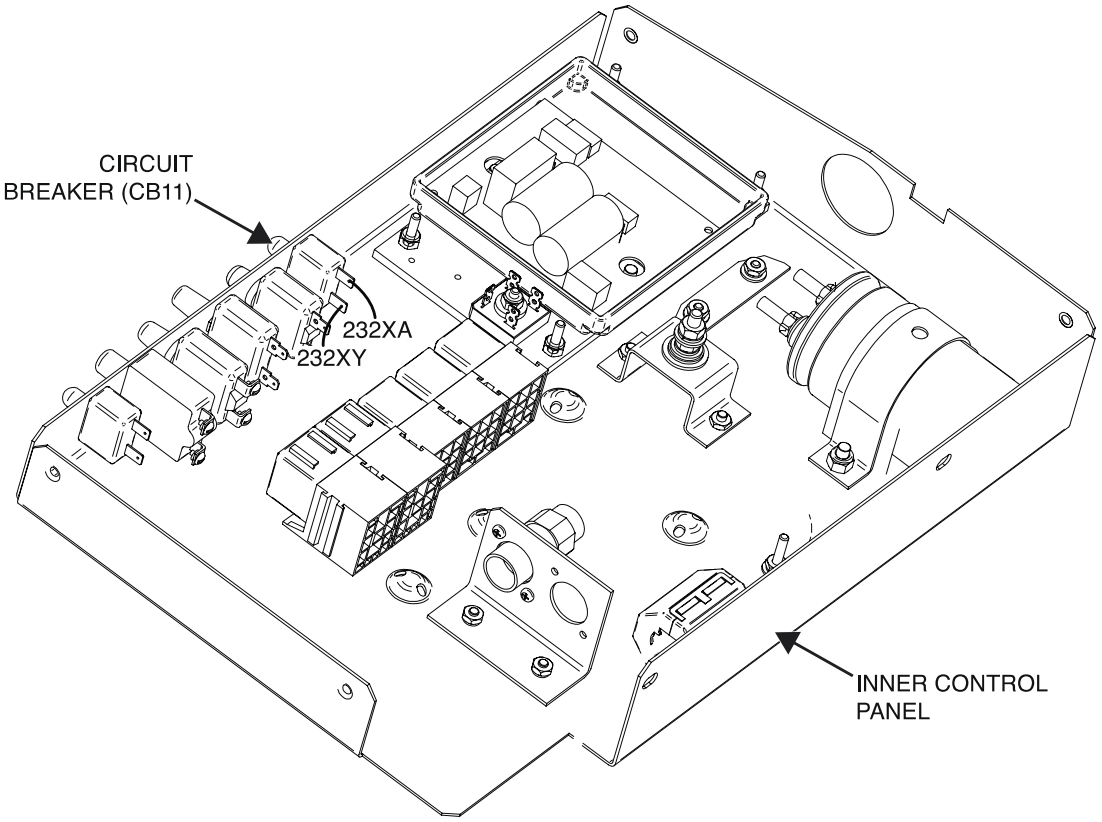
TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the circuit breaker (CB11). The circuit breaker (CB11) is located on the inner control panel. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads 232XA and 232XY from the circuit breaker (CB11). See ***Figure F.1***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance test outlined in ***Table F.1***. See ***Figure F.1***. See Wiring Diagram.
7. If the test fails, the circuit breaker (CB11) may be faulty.
8. If faulty, perform the ***Circuit Breaker (CB11) Removal And Replacement Procedure***.
9. If the test passes, proceed to the ***Test Reference Chart***.
10. Connect previously disconnected leads 232XA and 232XY from the circuit breaker (CB11). See Wiring Diagram.
11. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Circuit breaker (CB11) resistance tests

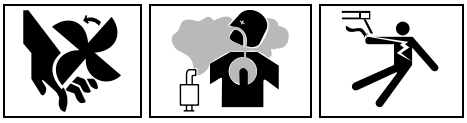
COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
CIRCUIT BREAKER (CB11)	ENGINE NOT RUNNING. CIRCUIT BREAKER (CB11) NOT TRIPPED. LEADS 232XA AND 232XY DISCONNECTED.	INNER TERMINAL (LEAD 232XA)	OUTER TERMINAL (LEAD 232XY)	< 1 OHMS

Figure F.1 – Circuit breaker (CB11) lead locations



CIRCUIT BREAKER (CB12) TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Circuit Breaker (CB12) is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

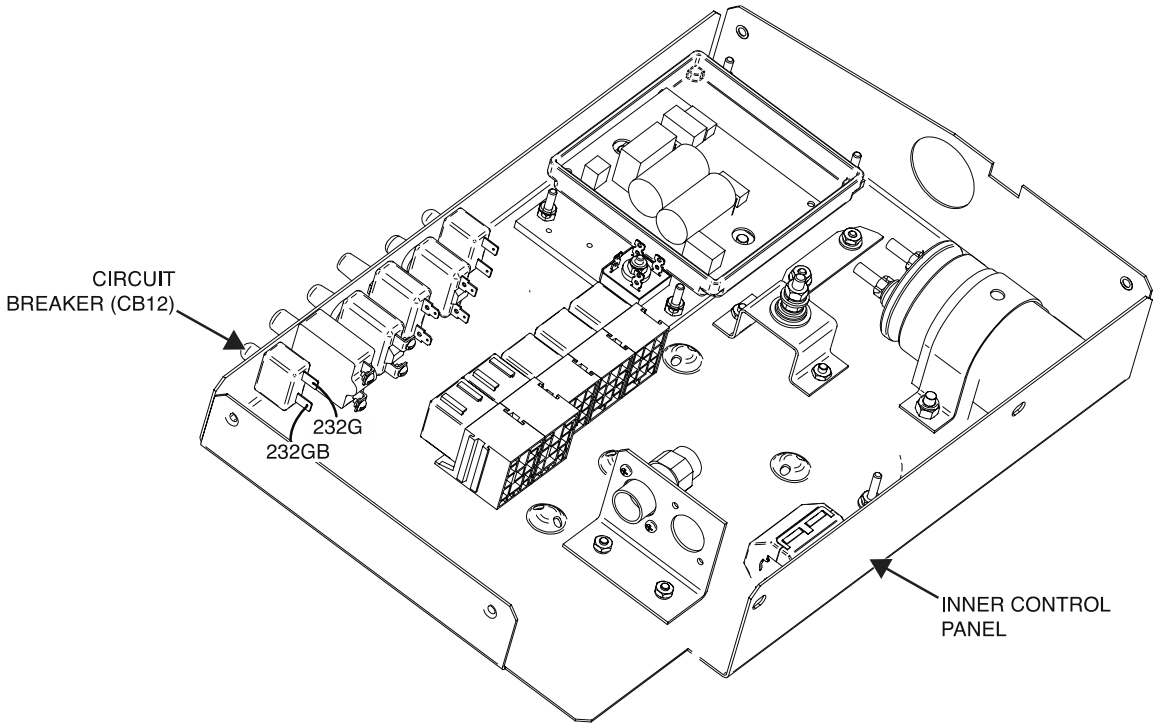
TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the circuit breaker (CB12). The circuit breaker (CB12) is located on the inner control panel. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads 232G and 232GB from the circuit breaker (CB12). See ***Figure F.1***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance test outlined in ***Table F.1***. See ***Figure F.1***. See Wiring Diagram.
7. If the test fails, the circuit breaker (CB12) may be faulty.
8. If faulty, perform the ***Circuit Breaker (CB12) Removal And Replacement Procedure***.
9. If the test passes, proceed to the ***Test Reference Chart***.
10. Connect previously disconnected leads 232G and 232GB from the circuit breaker (CB12). See Wiring Diagram.
11. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Circuit breaker (CB12) resistance tests

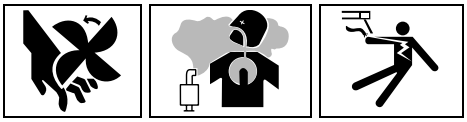
COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
CIRCUIT BREAKER (CB12)	ENGINE NOT RUNNING. CIRCUIT BREAKER (CB12) NOT TRIPPED. LEADS 232G AND 232GB DISCONNECTED.	INNER TERMINAL (LEAD 232G)	OUTER TERMINAL (LEAD 232GB)	< 1 OHMS

Figure F.1 – Circuit breaker (CB12) lead locations



OUTPUT CHOKE A TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Output Choke A (Right) is functioning properly.

MATERIALS NEEDED

3/8” Nutdriver
1/2” Nutdriver
1/2” Open-End Wrench
Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the output choke A (right). The output choke A (right) is located behind the output panel. See ***Figure F.1***. See Wiring Diagram.
5. Using a 1/2" nutdriver and a 1/2” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads W9/W10 to the top terminal of output choke B (left). See ***Figure F.2***. See Wiring Diagram. Label and disconnect leads.
6. Using a 1/2" nutdriver and a 1/2” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads 208C and NEG-choke to the lower terminals of the output choke(s). See Wiring Diagram. Label and disconnect leads.
7. Using a 1/2" nutdriver and a 1/2” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing the choke jumper lead to the top terminal of the output choke A (right). See Wiring Diagram. Label and disconnect leads.
8. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
9. If any of the tests fail, the output choke A (right) may be faulty.
10. If faulty, perform the ***Output Choke(s) Removal And Replacement Procedure***.
11. If all tests pass, proceed to the ***Test Reference Chart***.
12. Using a 1/2" nutdriver and a 1/2” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing the choke jumper lead to the top terminal of output choke A (right). See Wiring Diagram.
13. Using a 1/2" nutdriver and a 1/2” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads 208C and NEG-choke to the lower terminals of the output choke(s). See Wiring Diagram.
14. Using a 1/2" nutdriver and a 1/2” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads W9/W10 to the top terminal of output choke B (left). See Wiring Diagram.
15. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Output choke A (right) resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
OUTPUT CHOKE A (RIGHT)	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO STOP. TERMINALS W9, W10, AND NEG DISCONNECTED.	TERMINALS W9 AND W10	TERMINAL NEG	< 1 OHMS
		TERMINALS W9 AND W10	CASE GROUND	< 500K OHMS

Figure F.1 – Output choke locations

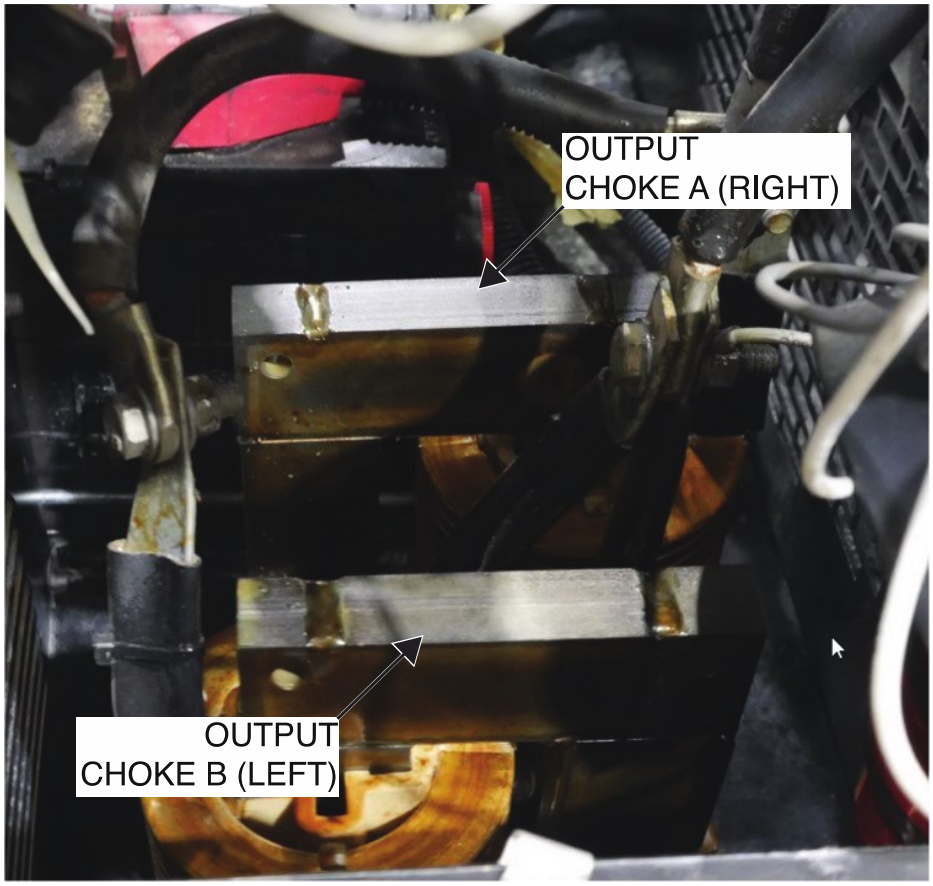
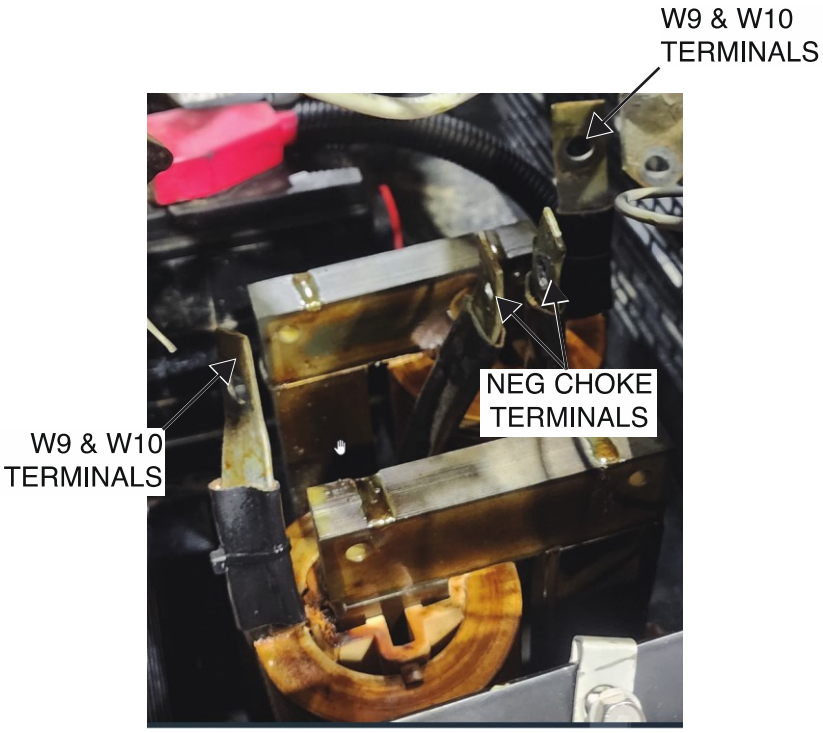
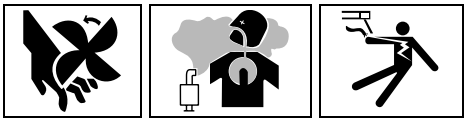


Figure F.2 – Output choke lead locations



OUTPUT CHOKE B TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Output Choke B (Left) is functioning properly.

MATERIALS NEEDED

1/2” Nutdriver
1/2” Open-End Wrench
Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the output choke B (left). The output choke B (left) is located behind the output panel. See ***Figure F.1***. See Wiring Diagram.
5. Using a 1/2" nutdriver and a 1/2” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads W9/W10 to the top terminal of output choke B (left). See ***Figure F.2***. See Wiring Diagram. Label and disconnect leads.
6. Using a 1/2" nutdriver and a 1/2” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads 208C and NEG-choke to the lower terminals of the output choke(s). See Wiring Diagram. Label and disconnect leads.
7. Using a 1/2" nutdriver and a 1/2” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing the choke jumper lead to the top terminal of output choke A (right). See Wiring Diagram. Label and disconnect leads.
8. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
9. If any of the tests fail, the output choke B (left) may be faulty.
10. If faulty, perform the ***Output Choke(s) Removal And Replacement Procedure***.
11. If all tests pass, proceed to the ***Test Reference Chart***.
12. Using a 1/2" nutdriver and a 1/2” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing the choke jumper lead to the top terminal of output choke A (right). See Wiring Diagram.
13. Using a 1/2" nutdriver and a 1/2” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads 208C and NEG-choke to the lower terminals of the output choke(s). See Wiring Diagram.
14. Using a 1/2" nutdriver and a 1/2” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads W9/W10 to the top terminal of output choke B (left). See Wiring Diagram.
15. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Output choke B (left) resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
OUTPUT CHOKE B (LEFT)	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO STOP. TERMINALS W9 AND W10 DISCONNECTED.	TERMINALS W9 AND W10	TERMINAL NEG	< 1 OHMS
		TERMINALS W9 AND W10	CASE GROUND	< 500K OHMS

Figure F.1 – Output choke locations

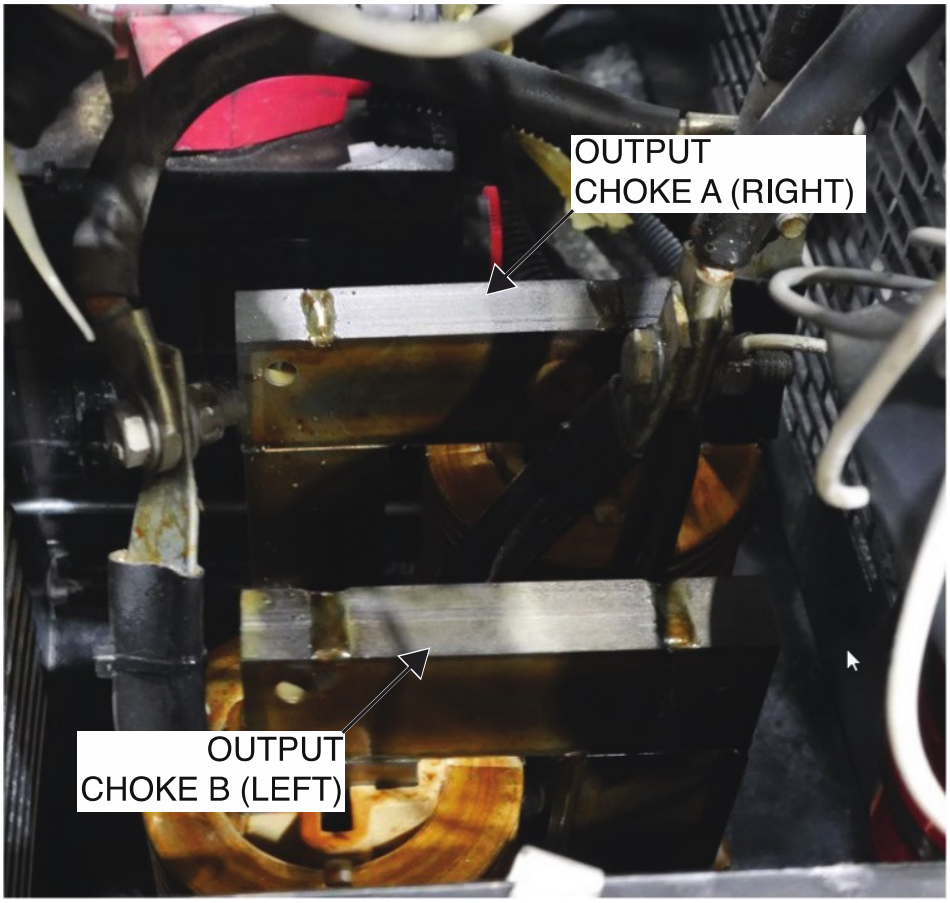
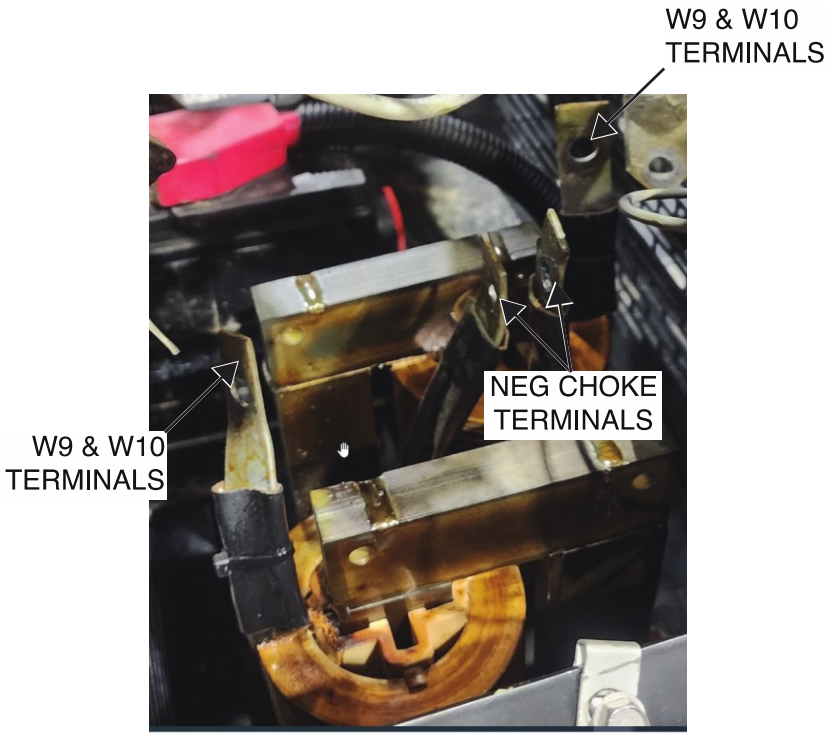
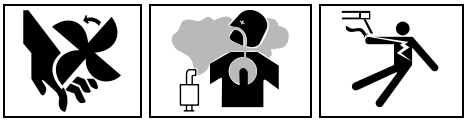


Figure F.2 – Output choke lead locations



CHOPPER MODULE BOARD TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Chopper Module Board is functioning properly. This test will NOT test all of the circuitry on this component.

MATERIALS NEEDED

3/8” Nutdriver
7/16” Nutdriver
Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the chopper module board. The chopper module board is located on the power module panel. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.2***.
6. Carefully lower the control panel to gain access to the chopper module board.
7. Carefully remove the shield from the machine.
8. Using a 7/16” nutdriver, remove the bolt, lock washer, and flat washer securing lead B1-NEG to terminal B1 on the chopper module board. See ***Figure F.3***. See Wiring Diagram.
9. Using a 7/16” nutdriver, remove the bolt, lock washer, and flat washer securing lead B2-POS to terminal B2 on the chopper module board. See ***Figure F.3***. See Wiring Diagram.
10. Using a 7/16” nutdriver, remove the bolt, lock washer, and flat washer securing lead W10 to terminal B3 on the chopper module board. See ***Figure F.3***. See Wiring Diagram.
11. Using a 7/16” nutdriver, remove the bolt, lock washer, and flat washer securing lead B4-NEG to terminal B4 on the chopper module board. See ***Figure F.3***. See Wiring Diagram.
12. Using a 7/16” nutdriver, remove the bolt, lock washer, and flat washer securing lead B5-POS to terminal B5 on the chopper module board. See ***Figure F.3***. See Wiring Diagram.
13. Using a 7/16” nutdriver, remove the bolt, lock washer, and flat washer securing lead W9 to terminal B6 on the chopper module board. See ***Figure F.3***. See Wiring Diagram.
14. Using a volt/ohmmeter, perform the wide diode tests outlined in ***Table F.1***. See ***Figure F.3***. See Wiring Diagram.
15. If any of the tests fail, the chopper module board may be faulty.
16. If faulty, perform the ***Chopper Module Board Removal And Replacement Procedure***.
17. If all tests pass, proceed with active testing.
18. Using a 7/16” nutdriver, attach the bolt, lock washer, and flat washer securing lead W9 to terminal B6 on the chopper module board. See Wiring Diagram.
19. Using a 7/16” nutdriver, attach the bolt, lock washer, and flat washer securing lead B5-POS to terminal B5 on the chopper module board. See Wiring Diagram.
20. Using a 7/16” nutdriver, attach the bolt, lock washer, and flat washer securing lead B4-NEG to terminal B4 on the chopper module board. See Wiring Diagram.

21. Using a 7/16” nutdriver, attach the bolt, lock washer, and flat washer securing lead W10 to terminal B3 on the chopper module board. See Wiring Diagram.
22. Using a 7/16” nutdriver, attach the bolt, lock washer, and flat washer securing lead B2-POS to terminal B2 on the chopper module board. See Wiring Diagram.
23. Using a 7/16” nutdriver, attach the bolt, lock washer, and flat washer securing lead B1-NEG to terminal B1 on the chopper module board. See Wiring Diagram.
24. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.2***. See ***Figure F.3***. See Wiring Diagram.
25. If any of the tests fail, the chopper module board may be faulty.
26. If faulty, perform the ***Chopper Module Board Removal And Replacement Procedure***.
27. If all tests pass, proceed to the ***Test Reference Chart***.
28. Carefully raise the control panel into the upright position.
29. Carefully position the shield into the machine.
30. Using a 3/8” nutdriver, attach the four screws securing the control panel into the upright position.
31. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Chopper module board wide diode tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
CHOPPER BOARD	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO STOP. TERMINALS B1, B2, B3, B4, B5, AND B6 DISCONNECTED.	TERMINAL B3	TERMINAL B2	0.3 VDC – 0.7 VDC
		TERMINAL B1	TERMINAL B3	0.3 VDC – 0.7 VDC
		TERMINAL B6	TERMINAL B5	0.3 VDC – 0.7 VDC
		TERMINAL B4	TERMINAL B6	0.3 VDC – 0.7 VDC

Table F.2 – Chopper module board voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
CHOPPER MODULE (INPUT)	ENGINE RUNNING. AT HIGH IDLE. RUN / STOP / IDLE SWITCH SET TO HIGH. RECONNECTED TERMINALS B1, B2, B3, B4, B5, AND B6 SET TO CC – STICK MODE.	TERMINAL B2	TERMINAL B1	~ 90 VDC
		TERMINAL B5	TERMINAL B4	~ 90 VDC
CHOPPER MODULE (OUTPUT)		TERMINAL B2	TERMINAL B3	~ 60 VDC
		TERMINAL B5	TERMINAL B6	~ 60 VDC

Figure F.1 – Chopper module board location

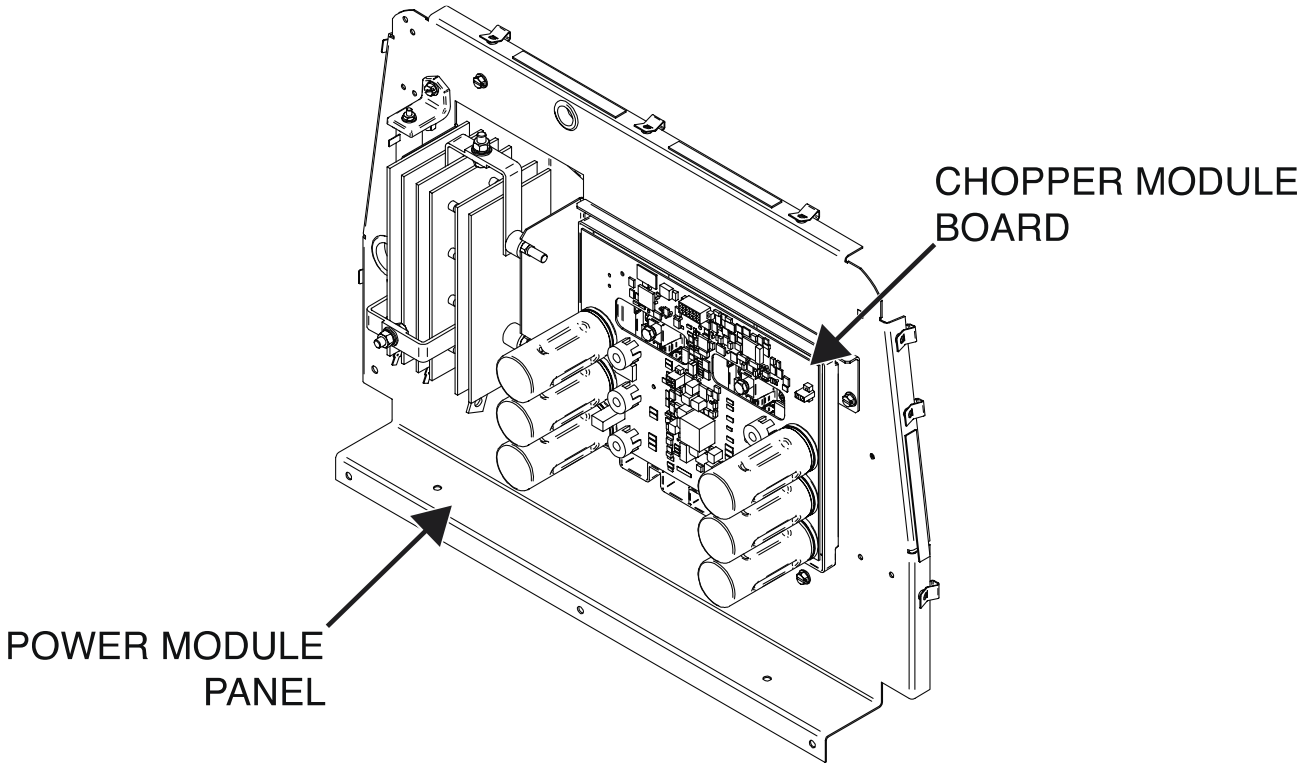


Figure F.2 – Control panel mounting screw locations

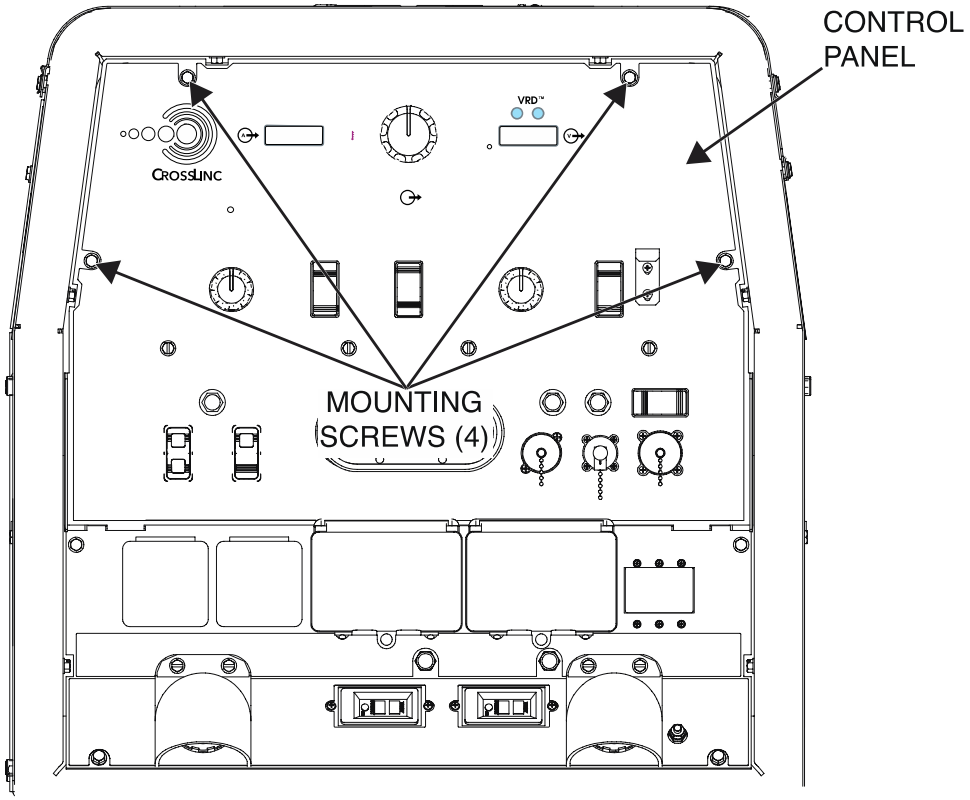
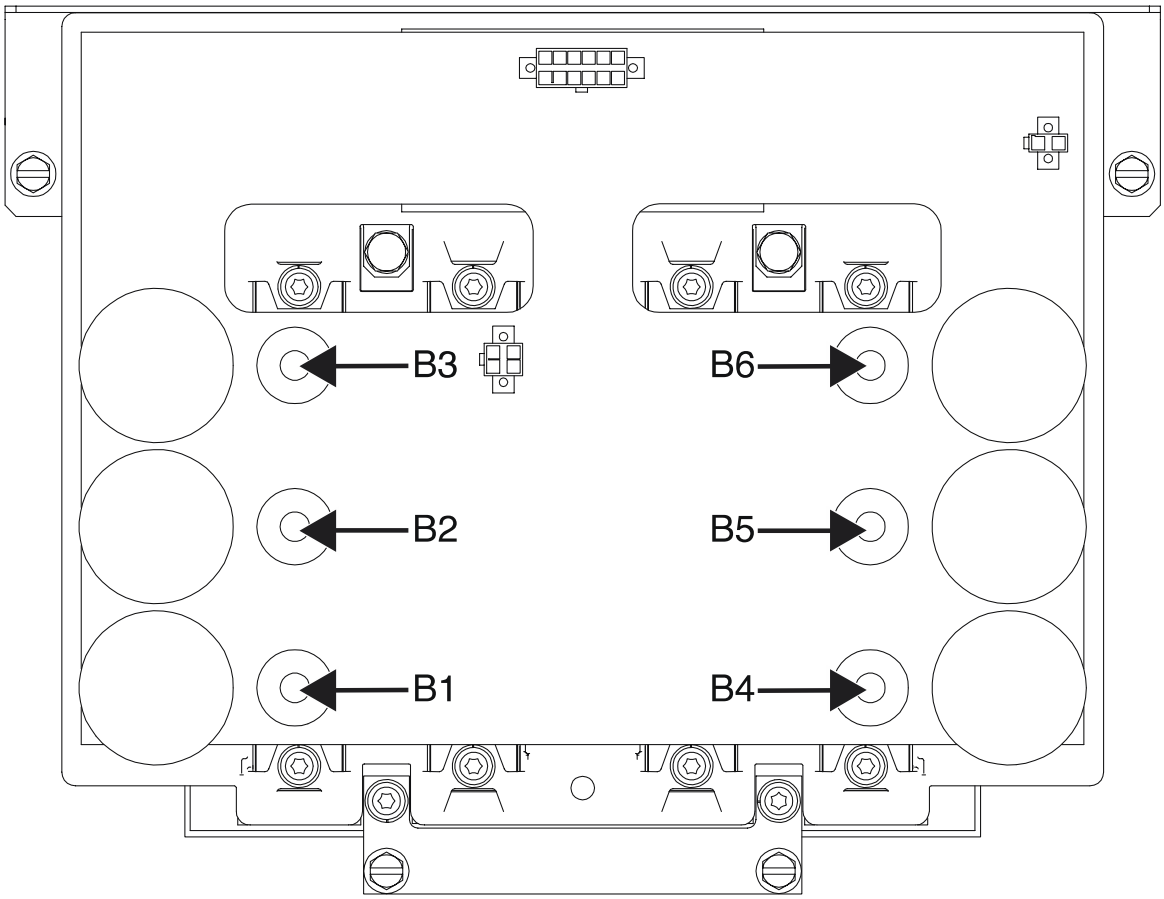
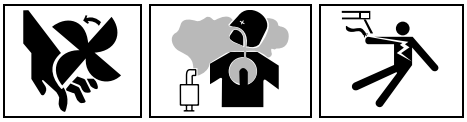


Figure F.3 – Chopper module board terminal locations



CHOPPER USER INTERFACE BOARD TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Chopper User Interface Board is functioning properly. This test will NOT test all of the circuitry on this component.

MATERIALS NEEDED

3/8” Nutdriver
Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the chopper user interface board. The chopper user interface board is located on the control panel. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.2***.
6. Carefully lower the control panel to gain access to the rear of the chopper user interface board.
7. Carefully remove the shield from the machine.
8. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.1***. See ***Figures F.3*** and ***F.4***. See Wiring Diagram.
9. If any of the tests fail, the chopper user interface board may be faulty.
10. If faulty, perform the ***Chopper User Interface Board Removal And Replacement Procedure***.
11. If all tests pass, proceed to the ***Test Reference Chart***.
12. Carefully raise the control panel into the upright position.
13. Carefully position the shield into the machine.
14. Using a 3/8” nutdriver, attach the four screws securing the control panel into the upright position.
15. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Chopper user interface board voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
DISPLAY CAN SIGNAL	ENGINE RUNNING AT HIGH IDLE. RUN / STOP / IDLE SWITCH SET TO HIGH. ENGINE RUNNING AT HIGH IDLE. RUN / STOP / IDLE SWITCH SET TO HIGH. SET MODE TO CC. SET TO LOCAL WELD TERMINALS ON.	PLUG J34 PIN 4 (LEAD 287)	PLUG J34 PIN 7 (LEAD 288)	~ 2 VDC
ECU CAN SIGNAL		PLUG J34 PIN 6 (LEAD ECB54B)	PLUG J34 PIN 3 (LEAD ECB76B)	~ 15 VDC
ARCLINK CAN TO CHOPPER USER INTERFACE BOARD		PLUG J31 PIN 3 (LEAD 284)	PLUG J31 PIN 1 (LEAD 283)	~ 15 VDC
ARCLINK CAN TO 5 PIN RECEPTACLES		PLUG J31 PIN 4 (LEAD 54)	PLUG J31 PIN 2 (LEAD 53)	~ 2 VDC
BATTERY VOLTAGE FROM RUN / STOP / IDLE SWITCH		PLUG J34 PIN 9 (LEAD 232C)	PLUG J34 PIN 1 (LEAD 5K)	12 VDC
ALTERNATOR FLASHING		PLUG J34 PIN 16 (LEAD 281)	PLUG J34 PIN 1 (LEAD 5K)	10.6 VDC
ROTOR FLASHING AND EXCITATION		PLUG J34 PIN 15 (LEAD 200N)	PLUG J34 PIN 1 (LEAD 5K)	10.6 VDC – 161.1 VDC
LOCAL SWITCH SUPPLY		PLUG J32 PIN 1 (LEAD 256)	PLUG J32 PIN 2 (LEAD 279)	15 VDC
ARC CONTROL POTENTIOMETER SUPPLY		PLUG J32 PIN 5 (LEAD 277)	PLUG J32 PIN 2 (LEAD 279)	9.93 VDC
INPUT POWER FROM CHOPPER BOARD		PLUG J31 PIN 6 (LEAD 13)	PLUG J31 PIN 5 (LEAD 14)	89 VDC
REMOTE POTENTIOMETER SUPPLY		PLUG J33 PIN 4 (LEAD 77A)	PLUG J33 PIN 1 (LEAD 75A)	9.93 VDC
REMOTE TRIGGER SUPPLY		PLUG J33 PIN 5 (LEAD 2)	PLUG J33 PIN 6 (LEAD 4)	15 VDC
VOLTAGE FEEDBACK		PLUG J35 PIN 1 (LEAD 206F)	PLUG J35 PIN 2 (LEAD 208F)	59.7 VDC
MODE SELECTION		PLUG J32 PIN 5 (LEAD 277)	PLUG J32 PIN 6 (LEAD 222)	3.9 VDC

Figure F.1 – Chopper user interface board location

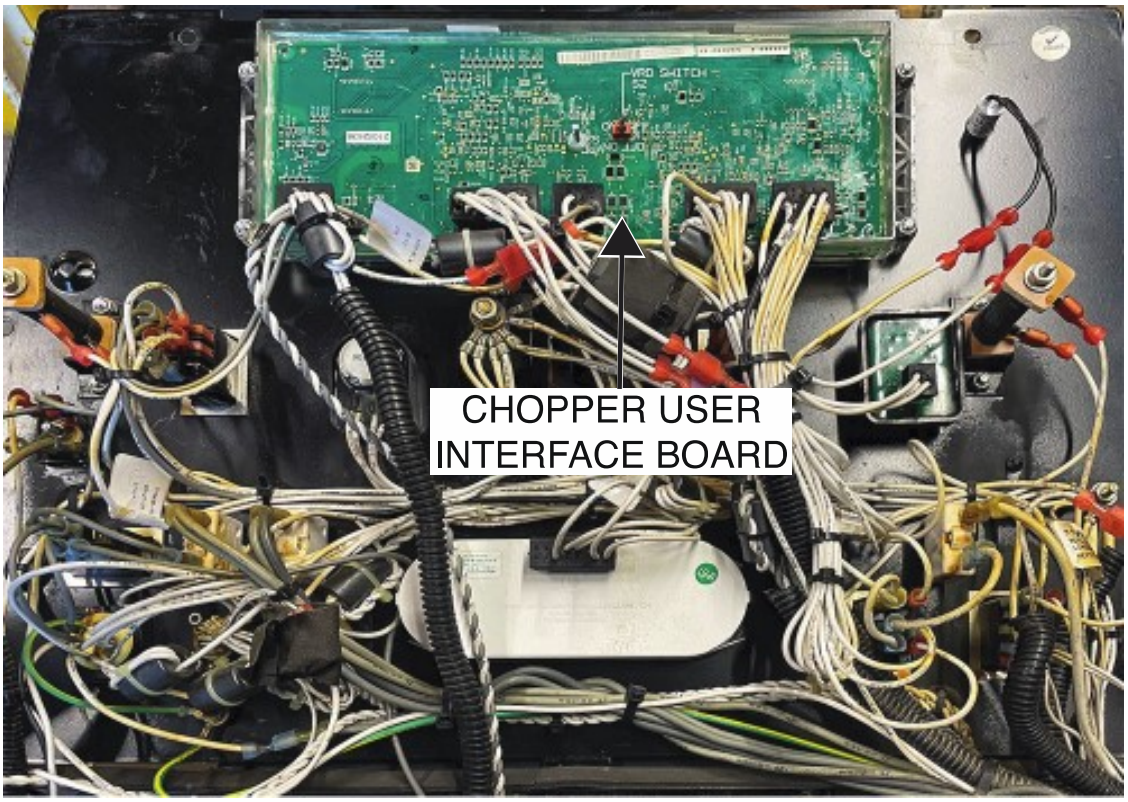


Figure F.2 – Control panel mounting screw locations

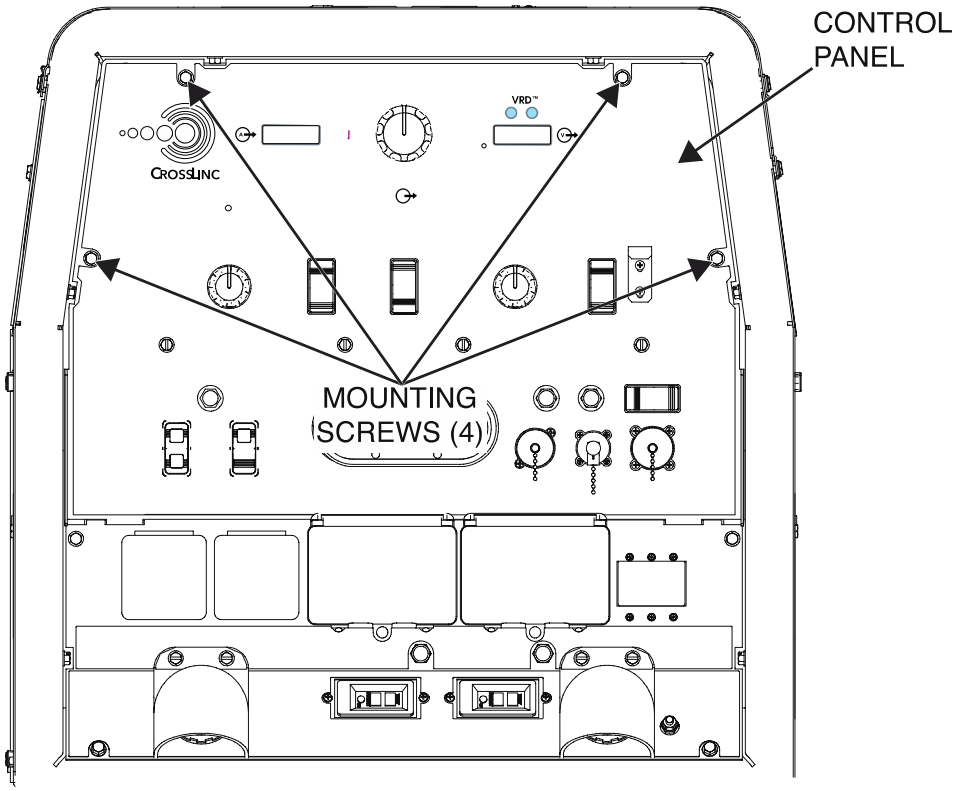


Figure F.3 – Chopper user interface board plug locations

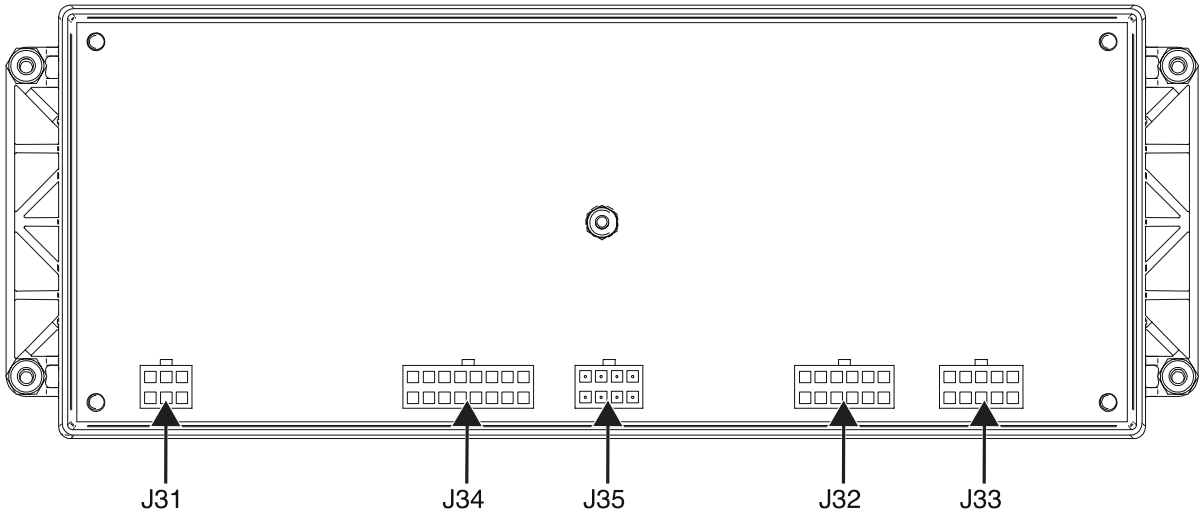
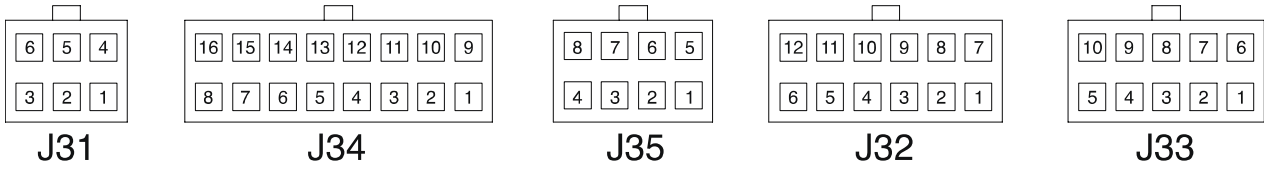
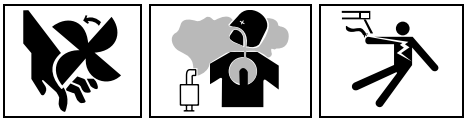


Figure F.4 – Chopper user interface board plug and terminal locations



CURRENT SHUNT TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Current Shunt is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Resistive Load Bank
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the current shunt. The current shunt is located on the rear of the positive output terminal. See ***Figure F.1***. See Wiring Diagram.
5. Properly connect a resistive load bank to the output studs of the machine. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the feedback voltage test outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If the test fails, the current shunt may be faulty.
8. If faulty, perform the ***Current Shunt Removal And Replacement Procedure***.
9. If the test passes, proceed to the ***Test Reference Chart***.
10. Carefully disconnect the resistive load bank from the machine.
11. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Current shunt feedback voltage test

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
SHUNT FEEDBACK	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH. SET TO CC MODE. CURRENT SET TO 200A. USING A LOAD BANK.	LEAD 204S (WHITE LEAD)	LEAD 206S (BLACK LEAD)	25M VDC

Figure F.1 – Current shunt location

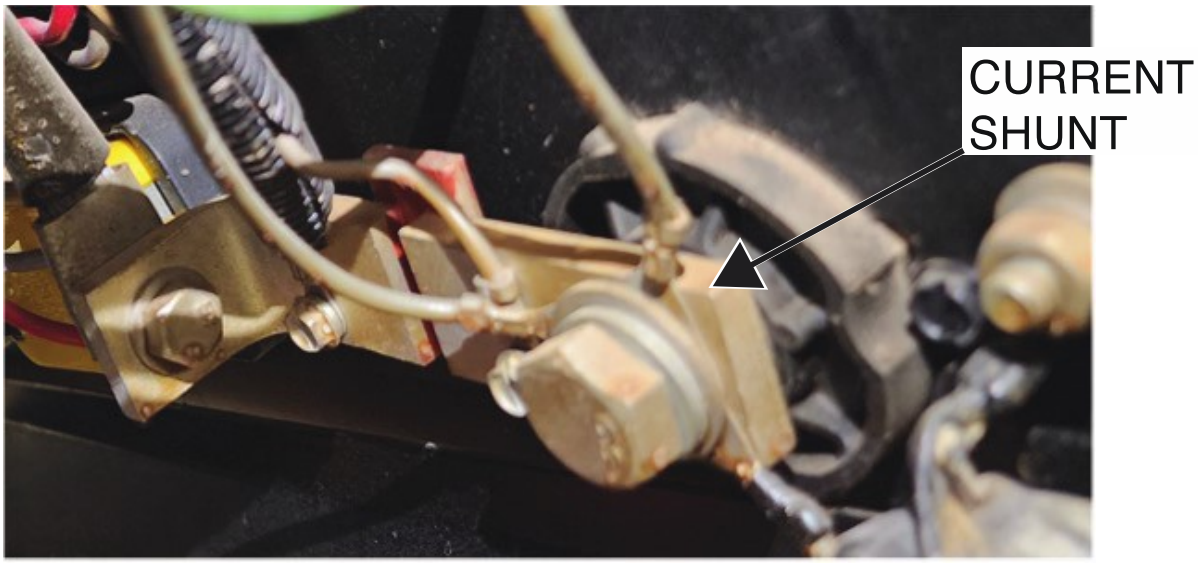
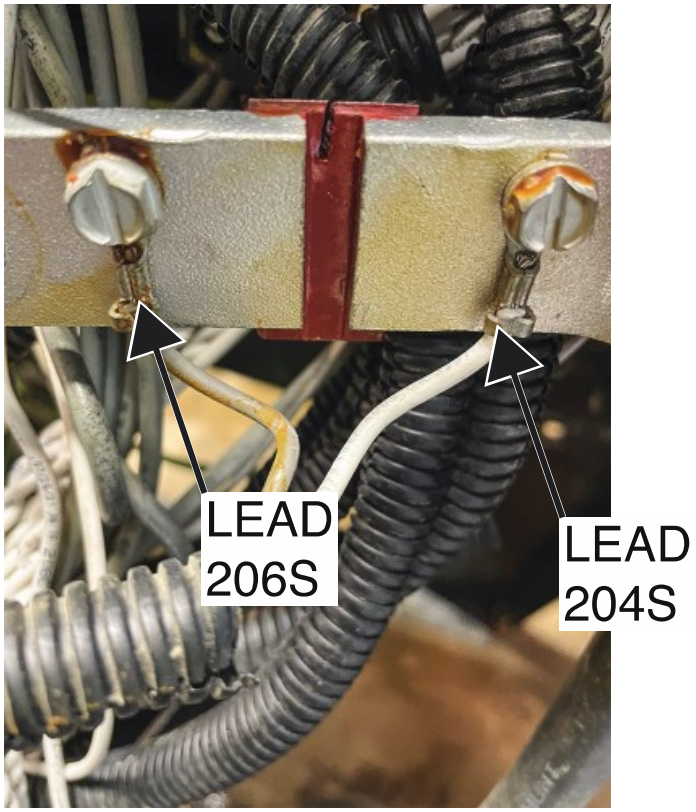
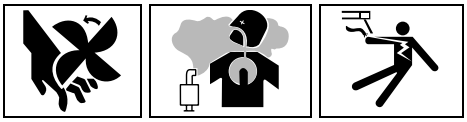


Figure F.2 – Current shunt lead locations



D1 RECTIFIER TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the D1 Rectifier is functioning properly.

MATERIALS NEEDED

3/8” Nutdriver
Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the D1 rectifier. The D1 rectifier is located on the control panel. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.2***.
6. Carefully lower the control panel to gain access to the rear of the D1 rectifier.
7. Carefully remove the shield from the machine.
8. Label and disconnect leads 5H, 201A, 200, 200A, and 6A from the D1 rectifier. See ***Figure F.3***. See Wiring Diagram.
9. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.3***. See Wiring Diagram.
10. If any of the tests fail, the D1 rectifier may be faulty.
11. If faulty, perform the ***D1 Rectifier Removal And Replacement Procedure***.
12. If all tests pass, proceed with active testing.
13. Connect previously disconnected leads 5H, 201A, 200, 200A, and 6A to the D1 rectifier. See Wiring Diagram.
14. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.2***. See ***Figure F.3***. See Wiring Diagram.
15. If any of the tests fail, the D1 rectifier may be faulty.
16. If faulty, perform the ***D1 Rectifier Removal And Replacement Procedure***.
17. If all tests pass, proceed to the ***Test Reference Chart***.
18. Carefully raise the control panel into the upright position.
19. Carefully position the shield into the machine.
20. Using a 3/8” nutdriver, attach the four screws securing the control panel into the upright position.
21. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – D1 rectifier wide diode tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
D1 RECTIFIER	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO STOP. LEADS 5H, 6A, 200, 200A, AND 201A DISCONNECTED	AC TERMINAL (LEAD 5H)	POSITIVE TERMINAL (LEAD 200A)	0.3 VDC - 0.7 VDC
		AC TERMINAL (LEAD 6A)	POSITIVE TERMINAL (LEAD 200A)	0.3 VDC - 0.7 VDC
		NEGATIVE TERMINAL (LEAD 201A)	AC TERMINAL (LEAD 5H)	0.3 VDC - 0.7 VDC
		NEGATIVE TERMINAL (LEAD 201A)	AC TERMINAL (LEAD 6A)	0.3 VDC - 0.7 VDC

Table F.2 – D1 rectifier voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
D1 RECTIFIER AC INPUT	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH. LEADS 5H, 6A, 200, 200A, AND 201A RECONNECTED	AC TERMINAL (LEAD 5H)	AC TERMINAL (LEAD 6A)	~ 112 VAC
D1 RECTIFIER DC OUTPUT		POSITIVE TERMINAL (LEAD 200A)	NEGATIVE TERMINAL (LEAD 201A)	~ 159 VAC

Figure F.1 – D1 rectifier location

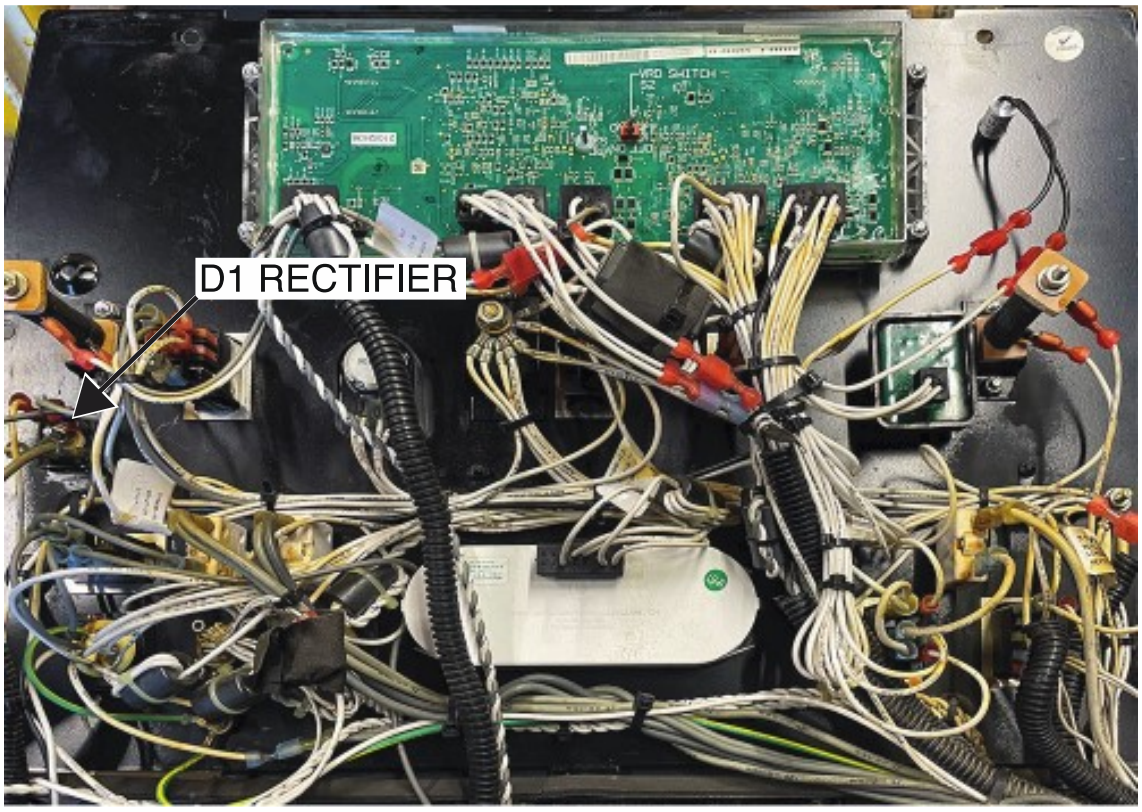


Figure F.2 – Control panel mounting screw locations

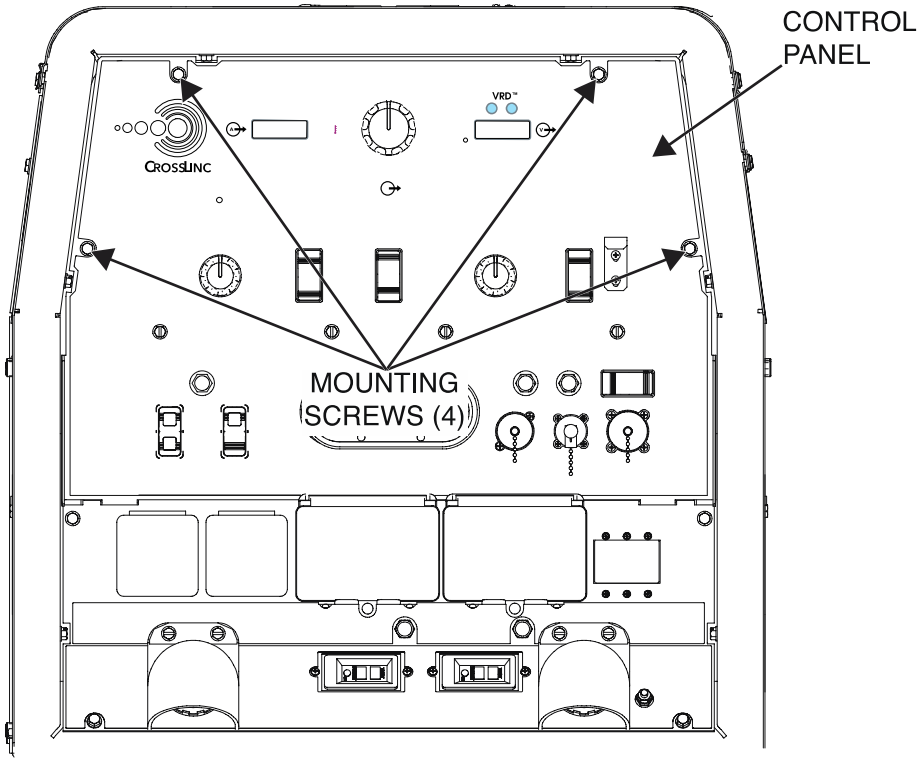
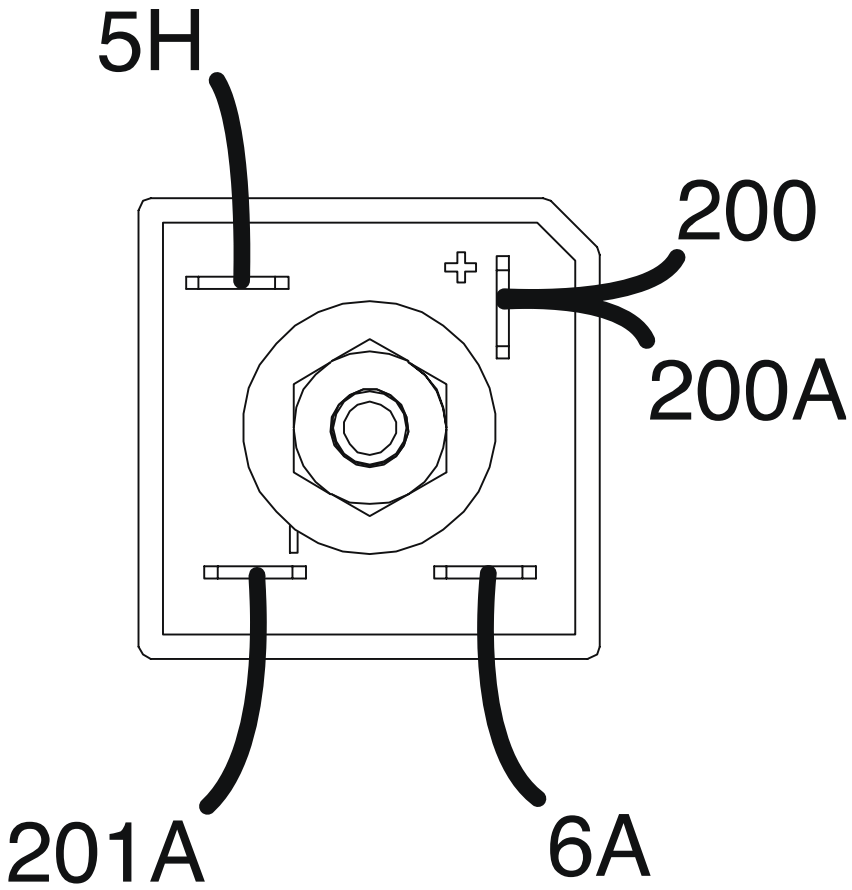
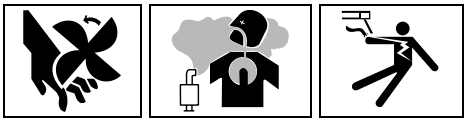


Figure F.3 – D1 rectifier lead locations



D2 RECTIFIER TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the D2 Rectifier is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the D2 rectifier. The D2 rectifier is located on the inner control panel. See ***Figure F.1***. See Wiring Diagram.
5. Label and disconnect leads 65A, 46A, 45, and 66A from the D2 rectifier. See ***Figure F.2***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If any of the tests fail, the D2 rectifier may be faulty.
8. If faulty, perform the ***D2 Rectifier Removal And Replacement Procedure***.
9. If all tests pass, proceed with active testing.
10. Connect previously disconnected leads 65A, 46A, 45, and 66A to the D2 rectifier. See Wiring Diagram.
11. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.2***. See ***Figure F.2***. See Wiring Diagram.
12. If any of the tests fail, the D2 rectifier may be faulty.
13. If faulty, perform the ***D2 Rectifier Removal And Replacement Procedure***.
14. If all tests pass, proceed to the ***Test Reference Chart***.
15. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – D2 rectifier wide diode tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
D2 RECTIFIER	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO STOP. LEADS 45, 46A, 65A, AND 66A DISCONNECTED	AC TERMINAL (LEAD 45)	POSITIVE TERMINAL (LEAD 65A)	0.3 VDC - 0.7 VDC
		AC TERMINAL (LEAD 46A)	POSITIVE TERMINAL (LEAD 65A)	0.3 VDC - 0.7 VDC
		NEGATIVE TERMINAL (LEAD 66A)	AC TERMINAL (LEAD 45)	0.3 VDC - 0.7 VDC
		NEGATIVE TERMINAL (LEAD 66A)	AC TERMINAL (LEAD 46A)	0.3 VDC - 0.7 VDC

Table F.2 – D2 rectifier voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
D2 RECTIFIER INPUT	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH. LEADS 45, 46A, 65A, AND 66A RECONNECTED	AC TERMINAL (LEAD 45)	AC TERMINAL (LEAD 46A)	~ 42 VAC
D2 RECTIFIER OUTPUT		POSITIVE TERMINAL (LEAD 65A)	NEGATIVE TERMINAL (LEAD 66A)	~ 59 VDC

Figure F.1 – D2 rectifier location

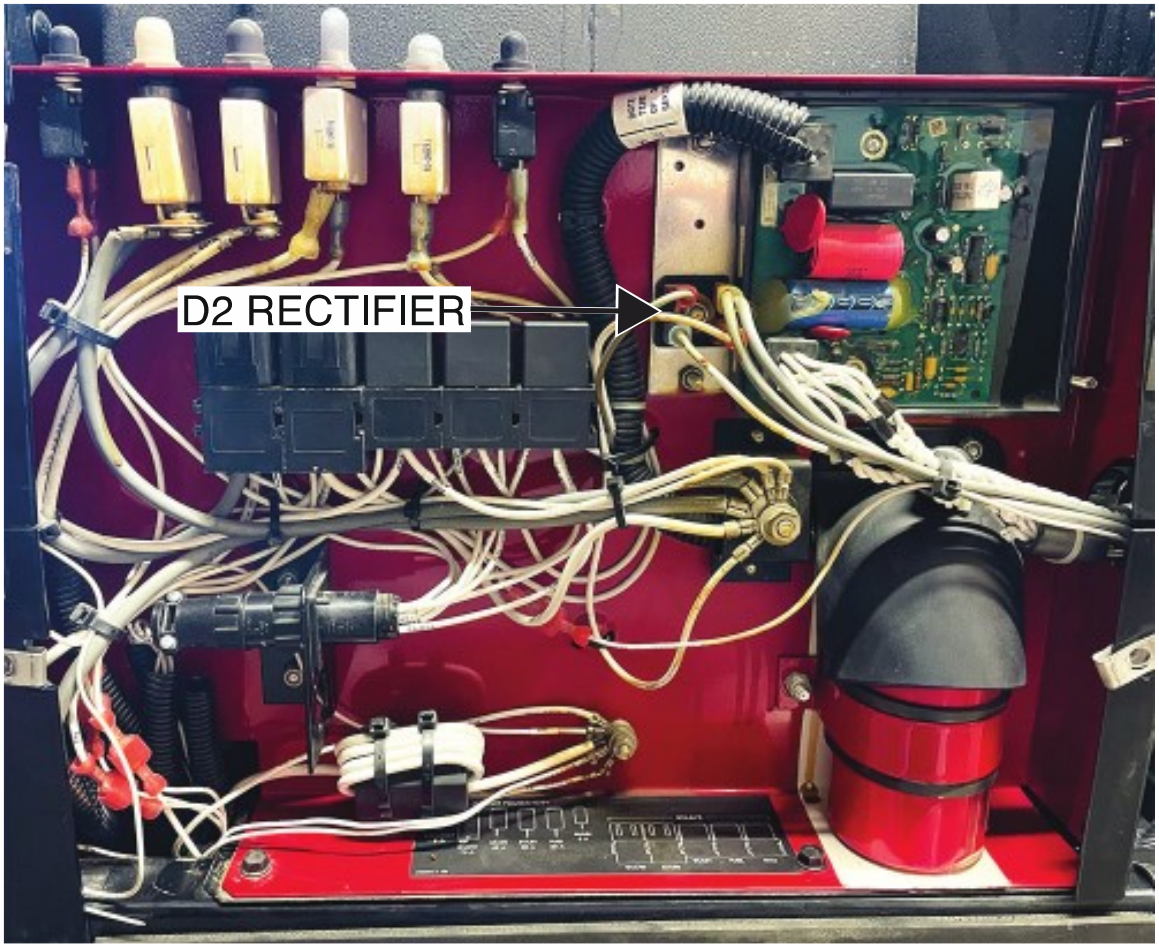
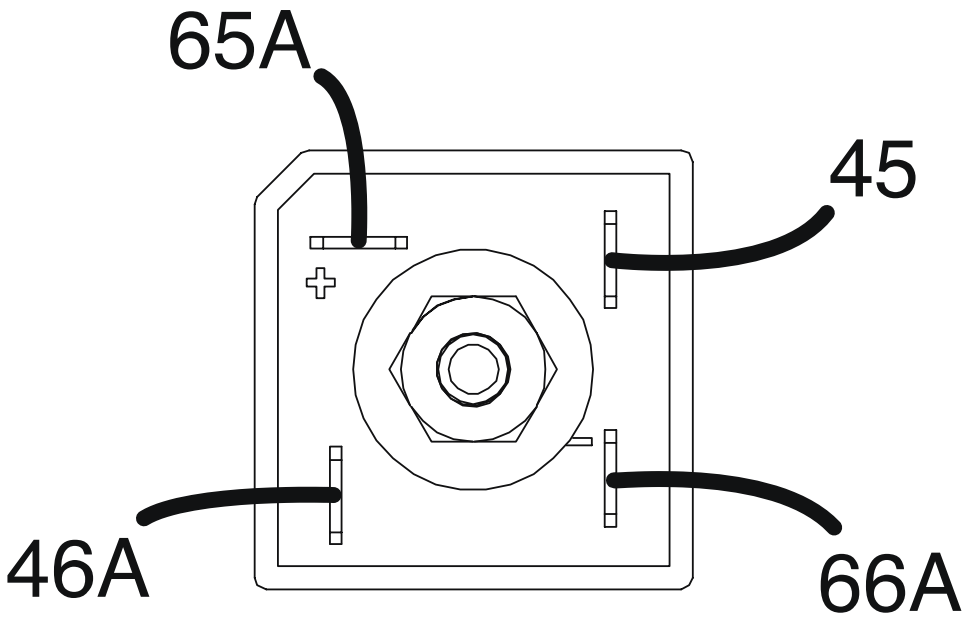
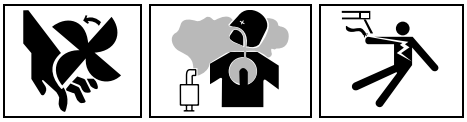


Figure F.2 – D2 rectifier lead locations



BUS BOARD TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Bus Board is functioning properly. This test will NOT test all of the circuitry on this component.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the bus board. The bus board is located on the inner control panel. See ***Figure F.1***. See Wiring Diagram.
5. Remove any accessories plugged into the 5-pin and the 12-pin Amphenol's.
6. Start the engine and run at high idle (1800 RPM).
7. Visually verify that LED 1 is red and illuminated. This indicates there is output from the bus board.
8. If LED 1 is illuminated, the bus board should be functioning properly.
9. If the bus board is functioning properly, proceed to the ***Test Reference Chart***.
10. If LED 1 is not red and illuminated, continue with active testing.
11. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.1***. See ***Figures F.2*** and ***F.3***. See Wiring Diagram.
12. If any of the tests fail, the bus board may be faulty.
13. If faulty, perform the ***Bus Board Removal And Replacement Procedure***.
14. If all tests pass, proceed to the ***Test Reference Chart***.
15. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Bus board voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
POWER BUS BOARD INPUT	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH.	PLUG J46 PIN 2 (LEAD 65)	PLUG J46 PIN 3 (LEAD 66)	~ 58 VDC
		PLUG J47 PIN 3 (LEAD 52)	PLUG J47 PIN 1 (LEAD 51)	~ 40 VDC
POWER BUS BOARD OUTPUT		PLUG J47 PIN 4 (LEAD 52A)	PLUG J47 PIN 5 (LEAD 51A)	~ 40 VDC
		PLUG J47 PIN 8 (LEAD 52B)	PLUG J47 PIN 6 (LEAD 51B)	~ 40 VDC

Figure F.1 – Bus board location

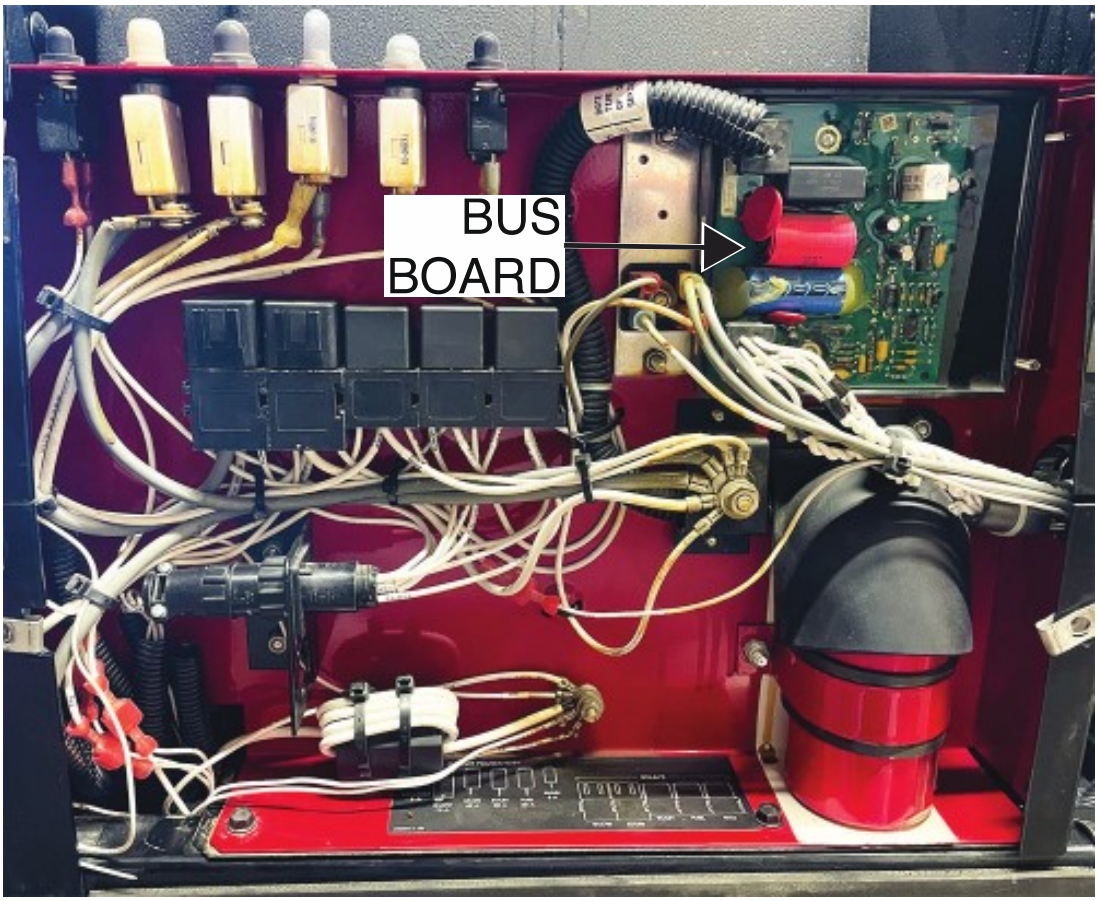


Figure F.2 – Bus board plug locations

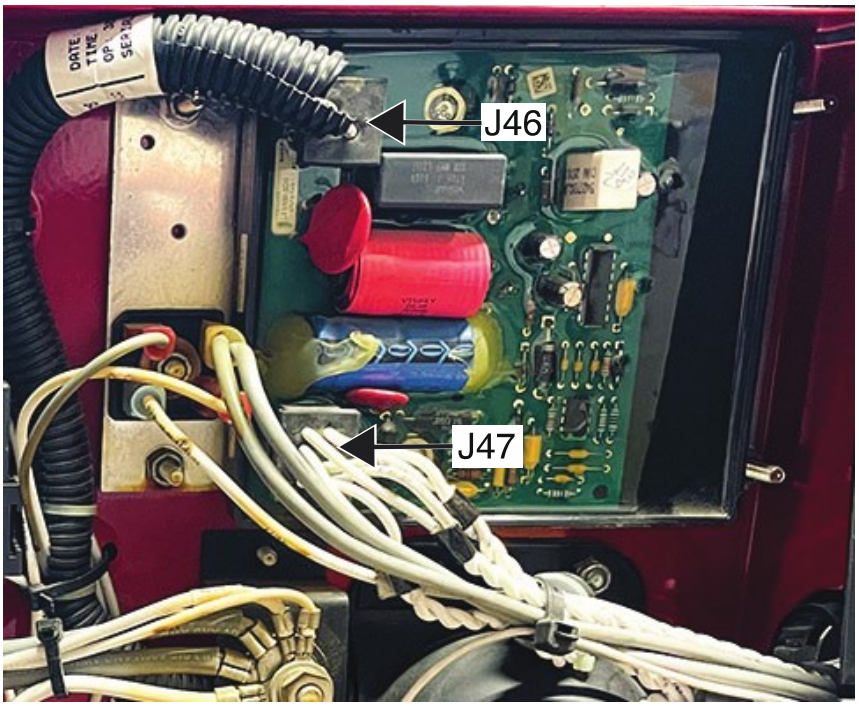
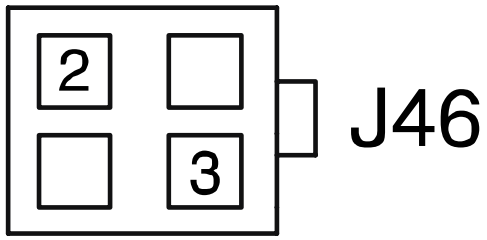
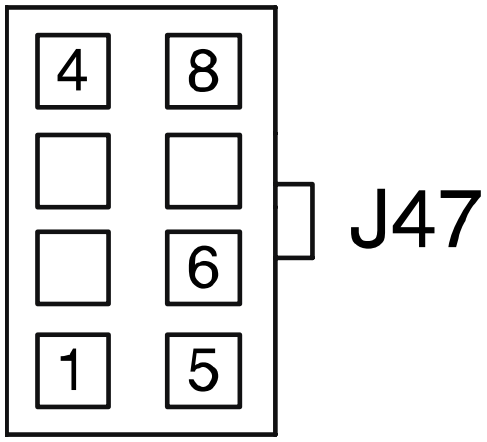


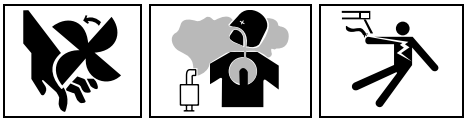
Figure F.3 – Bus board plug terminal locations





ECU TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the ECU is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the ECU. The ECU is located on the left side of the stator frame. See ***Figure F.1***. See Wiring Diagram.
5. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.1***. See ***Figures F.2*** and ***F.3***. See Wiring Diagram.
6. If any of the tests fail, the ECU may be faulty.
7. If faulty, perform the ***ECU Removal And Replacement Procedure***.
8. If all tests pass, proceed to the ***Test Reference Chart***.
9. Attach all relays disconnected during testing. See Wiring Diagram.
10. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – ECU voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
ECU CAN SIGNAL	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH.	LEAD ECB54A	LEAD ECB76A	~ .15 VDC
START / GLOW PLUG	STARTER RELAY REMOVED. ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH. PRESSING START BUTTON.	LEAD ECB45A	GROUND STUD	12 VDC
AUTO IDLE SWITCH	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO AUTO.	LEAD ECB80A	GROUND STUD	12 VDC
STARTER RELAY	MAIN FUEL AND IDLE RELAYS REMOVED. ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH.	12 VDC INSULATED STUD	LEAD 411	12 VDC
FUEL PUMP RELAY		12 VDC INSULATED STUD	LEAD ECB26A	12 VDC
MAIN RELAY		12 VDC INSULATED STUD	LEAD 424A	12 VDC
SWITCHED BATTERY		12 VDC INSULATED STUD	LEAD 402A	12 VDC
SHUTDOWN / WARNING LAMP		12 VDC INSULATED STUD	LEAD 408A	12 VDC
START INPUT		12 VDC INSULATED STUD	LEAD 405C	12 VDC
WAIT TO START LAMP		12 VDC INSULATED STUD	LEAD 409A	12 VDC

Figure F.1 – ECU location

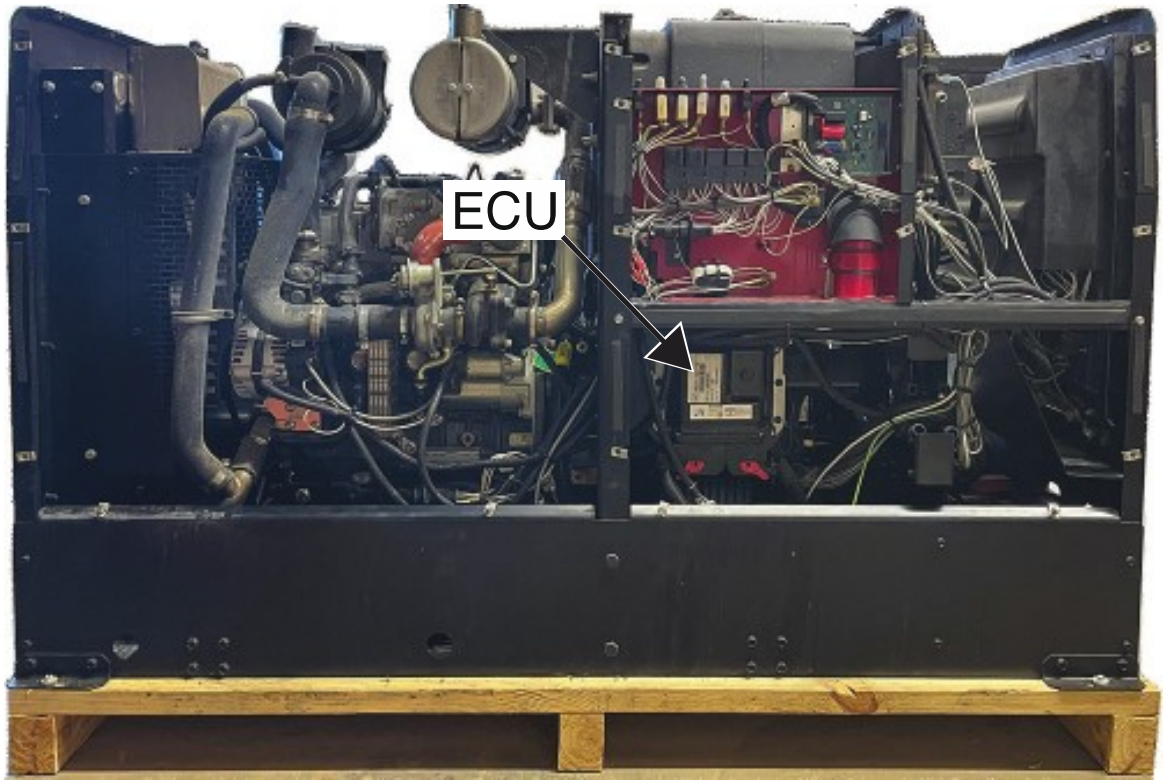


Figure F.2 – Ground stud and 12 VDC insulated stud locations

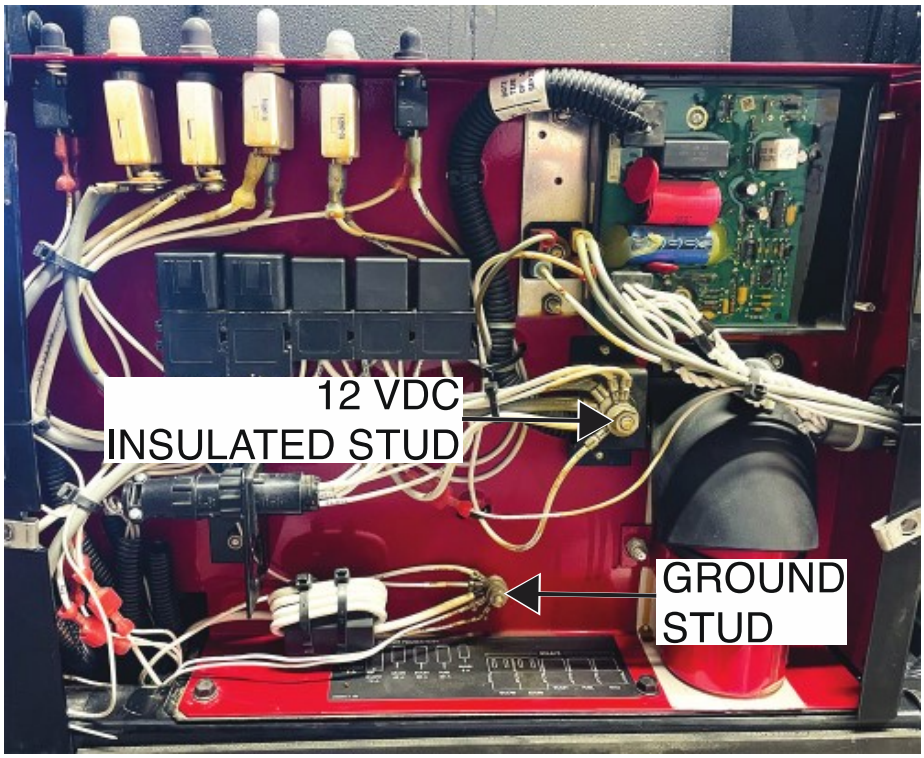
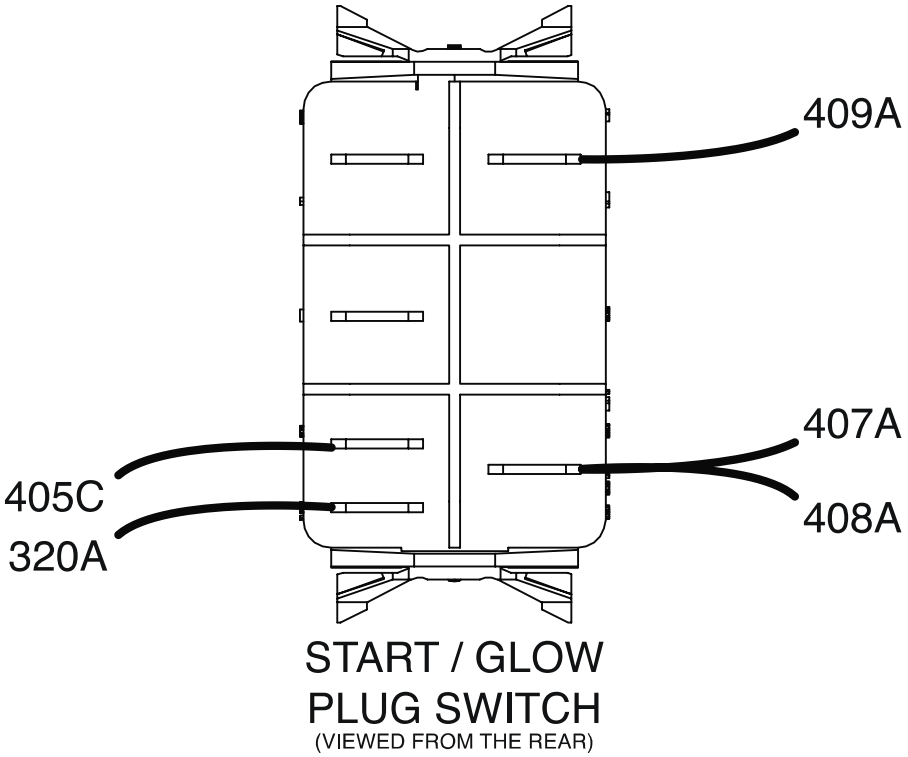
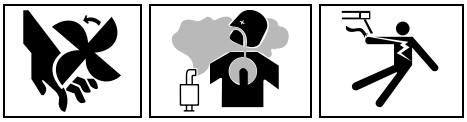


Figure F.3 – Start / glow plug switch lead locations



STARTER TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Starter is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Battery Tester
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the starter. The starter is located on the left side of the engine. See ***Figure F.1***. See Wiring Diagram.
5. Using a volt/ohmmeter, perform the first three voltage tests outlined in ***Table F.1***. See ***Figures F.2*** and ***F.3***. See Wiring Diagram.
6. If no or low voltage, check the battery and harness for faults.
7. If the first three voltage tests pass, proceed with the fourth test.
8. If no voltage is present during the fourth test, check the starter solenoid.
9. If faulty, perform the ***Starter Removal And Replacement Procedure***.
10. If all tests pass, proceed to the ***Test Reference Chart***.
11. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure.***

Table F.1 – Starter voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
STARTER MOTOR SOLENOID INPUT FROM BATTERY	ENGINE NOT RUNNING.	TERMINAL B (POSITIVE LEAD 238S)	CHASSIS GROUND	~ 12.6 VDC
STARTER MOTOR SOLENOID OUTPUT TO RUN / STOP / IDLE SWITCH	ENGINE NOT RUNNING.	LEAD 236A RUN / STOP / IDLE SWITCH	CHASSIS GROUND	~ 12.6 VDC
STARTER MOTOR SOLENOID INPUT	RUN / STOP / IDLE SWITCH SET TO HIGH IDLE. PRESSING START BUTTON.	LEAD 420	CHASSIS GROUND	~ 12.6 VDC
STARTER MOTOR SOLENOID OUTPUT TO STARTER MOTOR	RUN / STOP / IDLE SWITCH SET TO HIGH IDLE. PRESSING START BUTTON.	TERMINAL S	CHASSIS GROUND	~ 12.6 VDC

Figure F.1 – Starter location

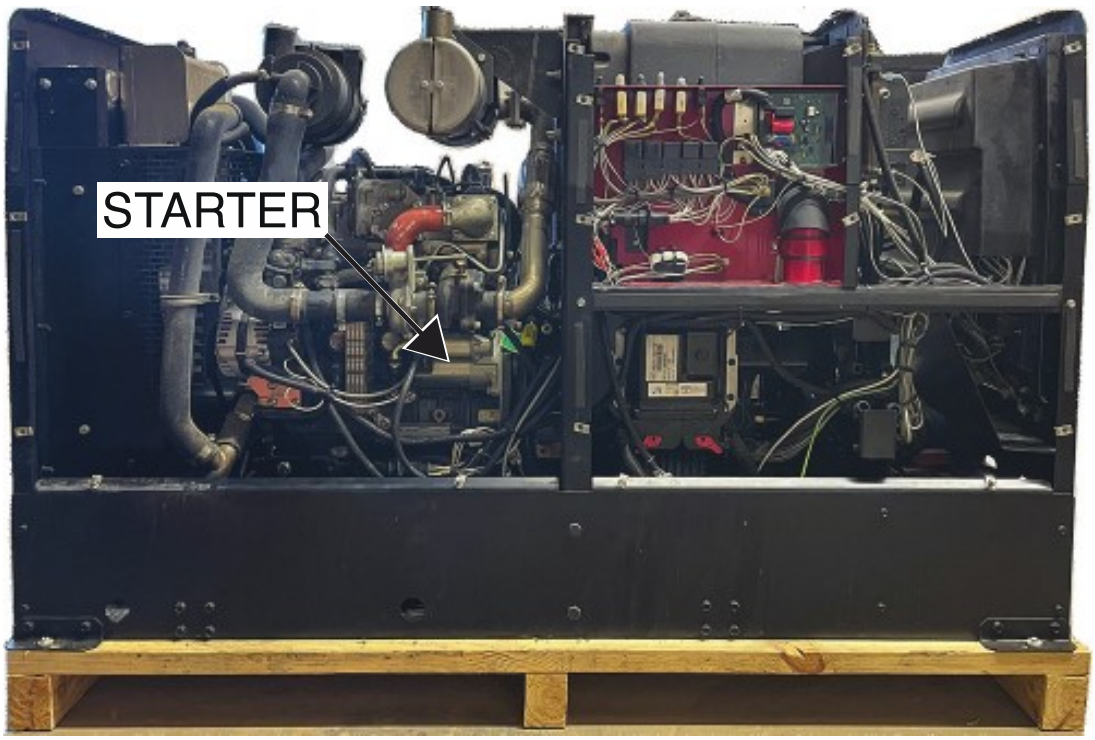


Figure F.2 – Starter terminal and lead locations

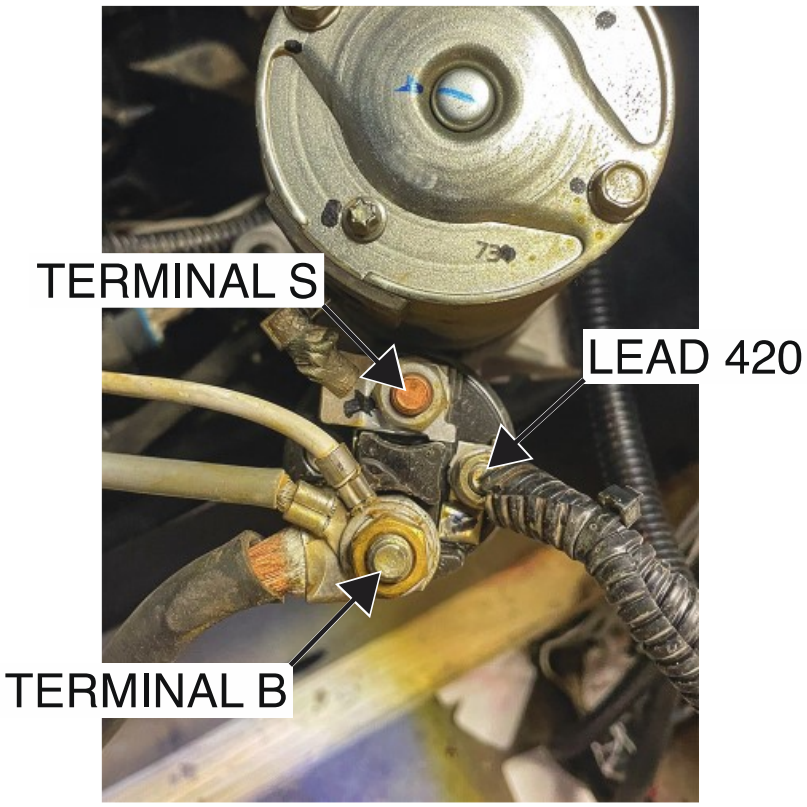
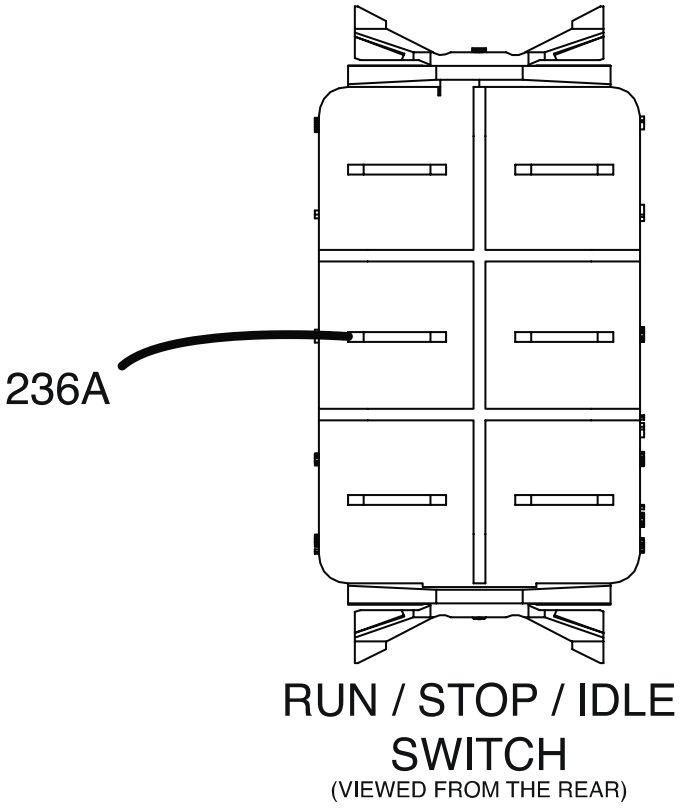
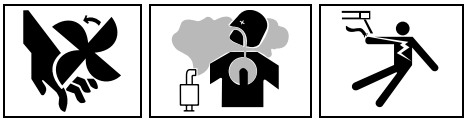


Figure F.3 – Run / stop / idle switch lead 236A location



FUEL PUMP TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Fuel Pump is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the fuel pump. The fuel pump is located on the right side of the engine. See ***Figure F.1***. See Wiring Diagram.
5. Using a volt/ohmmeter, perform the voltage test outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
6. If the test fails, the fuel pump may be faulty.
7. If faulty, perform the ***Fuel Pump Removal And Replacement Procedure***.
8. If the test passes, proceed to the ***Test Reference Chart***.
9. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Fuel pump voltage test

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
FUEL PUMP	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO AUTO.	LEAD 226	LEAD 5M	~ 12 VDC

Figure F.1 – Fuel pump location

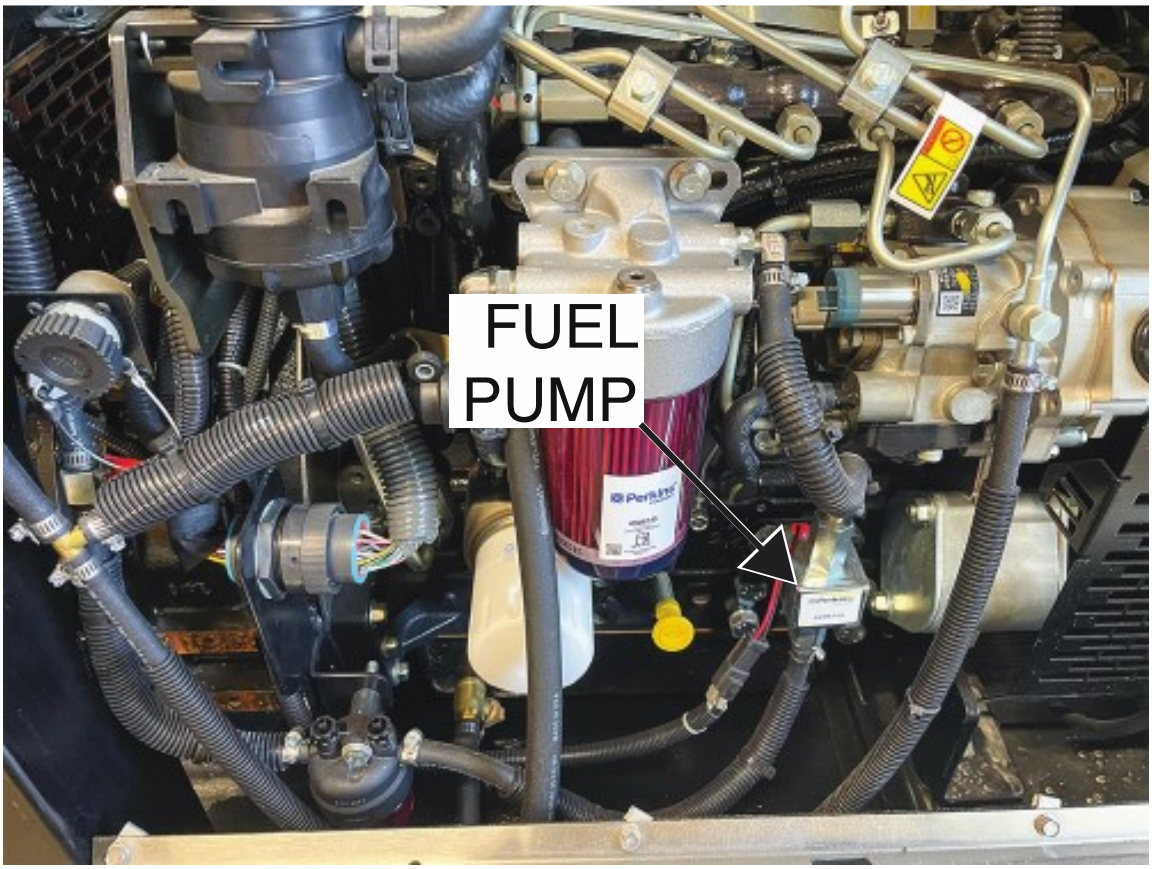
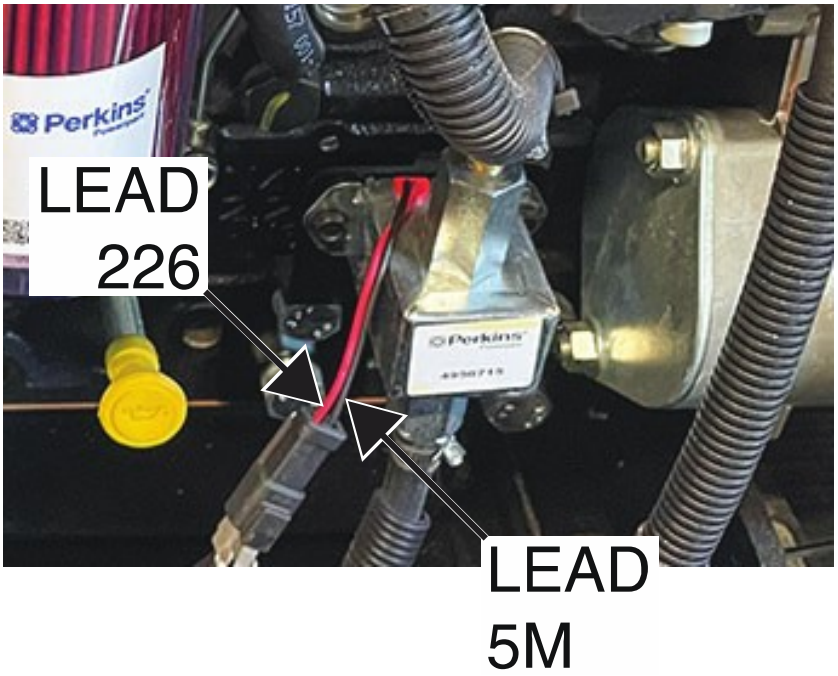
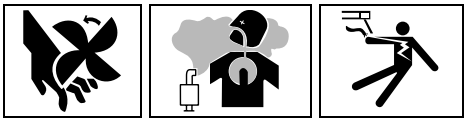


Figure F.2 – Fuel pump lead locations



FUEL RELAY TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Fuel Relay is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the fuel relay. The fuel relay is located on the inner control panel. See ***Figure F.1***. See Wiring Diagram.
5. Carefully unplug the fuel relay from its socket. See ***Figure F.1***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If any of the tests fail, the fuel relay may be faulty.
8. If faulty, perform the ***Fuel Relay Removal And Replacement Procedure***.
9. If all tests pass, proceed with active testing.
10. Carefully position the fuel relay into its socket. See ***Figure F.1***. See Wiring Diagram.
11. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.2***. See ***Figure F.2***. See Wiring Diagram.
12. If any of the tests fail, the fuel relay may be faulty.
13. If faulty, perform the ***Fuel Relay Removal And Replacement Procedure***.
14. If all tests pass, proceed to the ***Test Reference Chart***.
15. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Fuel relay resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
FUEL RELAY	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO STOP. FUEL RELAY REMOVED FROM SOCKET	TERMINAL 86	TERMINAL 85	90 OHMS
		TERMINAL 30	TERMINAL 87	> 500K OHMS
		TERMINAL 30	TERMINAL 87A	< 1 OHMS

Table F.2 – Fuel relay voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
FUEL RELAY COIL	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO AUTO. FUEL RELAY INSTALLED	TERMINAL 86 PLUG J87 PIN 9 (LEAD ECB90A)	TERMINAL 85 PLUG J87 PIN 4 (LEAD ECB26A)	12.1 VDC
FUEL RELAY CONTACT		TERMINAL 30 (LEAD 226A)	TERMINAL 87 (LEAD 226)	0 VDC
	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO OFF.	TERMINAL 30 (LEAD 226A)	TERMINAL 87 (LEAD 226)	11.7 VDC

Figure F.1 – Fuel relay location

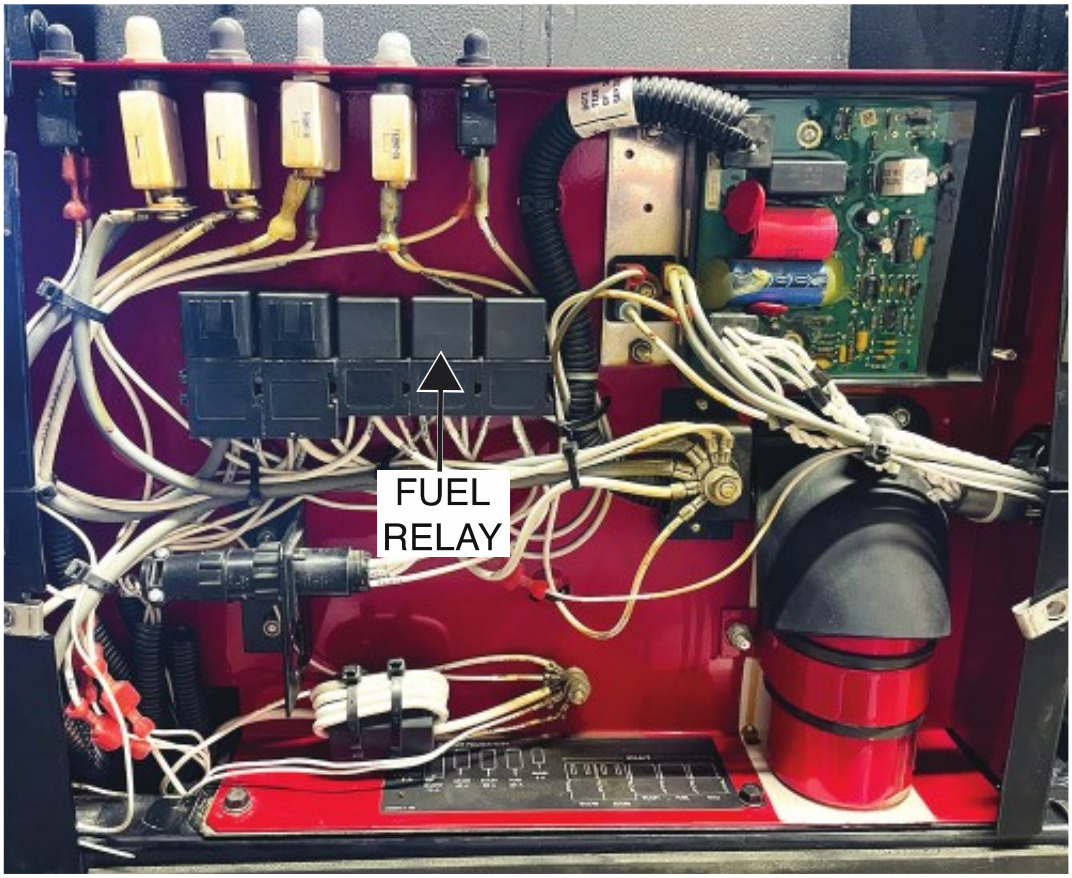
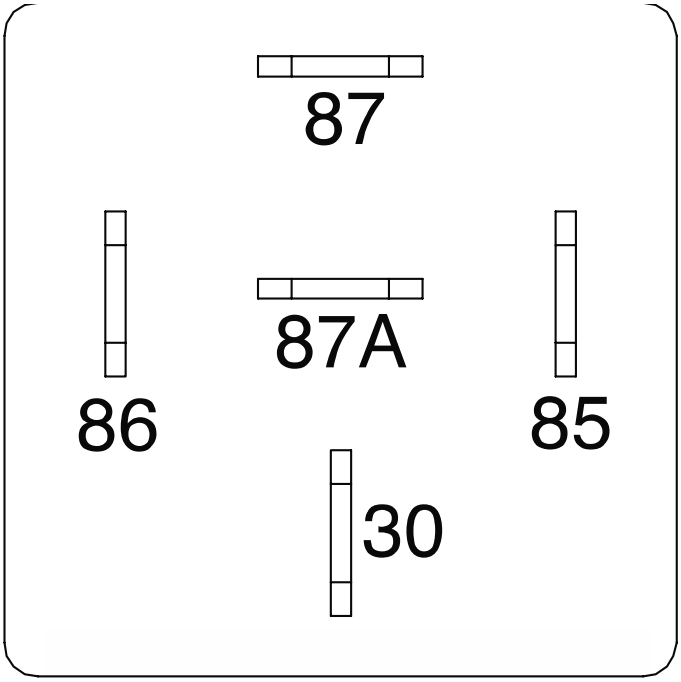
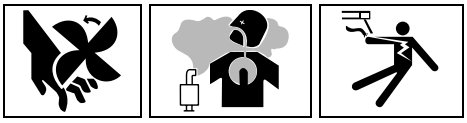


Figure F.2 – Fuel relay lead locations



GLOW RELAY TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Glow Relay is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the glow relay. The glow relay is located on the inner control panel. See ***Figure F.1***. See Wiring Diagram.
5. Carefully unplug the glow relay from its socket. See ***Figure F.1***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If any of the tests fail, the glow relay may be faulty.
8. If faulty, perform the ***Glow Relay Removal And Replacement Procedure***.
9. If all tests pass, proceed with active testing.
10. Carefully position the glow relay into its socket. See ***Figure F.1***. See Wiring Diagram.
11. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.2***. See ***Figure F.2***. See Wiring Diagram.
12. If any of the tests fail, the glow relay may be faulty.
13. If faulty, perform the ***Glow Relay Removal And Replacement Procedure***.
14. If all tests pass, proceed to the ***Test Reference Chart***.
15. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Glow relay resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
GLOW RELAY	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO STOP. GLOW RELAY REMOVED FROM SOCKET.	TERMINAL 86	TERMINAL 85	~ 90 OHMS
		TERMINAL 30	TERMINAL 87	> 500K OHMS
		TERMINAL 30	TERMINAL 87A	< 1 OHMS

Table F.2 – Glow relay voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
GLOW RELAY COIL	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO AUTO. STARTER RELAY REMOVED. GLOW RELAY IN SOCKET. START BUTTON PRESSED.	TERMINAL 86 PLUG J87 PIN 5 (LEAD ECA45A)	TERMINAL 85 PLUG J87 PIN 6 (LEAD ECA35A)	11.44 VDC
GLOW RELAY CONTACT	START BUTTON NOT PRESSED.	TERMINAL 30 (LEAD 239B)	TERMINAL 87 (LEAD 239)	0 VDC
		TERMINAL 30 (LEAD 239B)	TERMINAL 87 (LEAD 239)	12.1 VDC

Figure F.1 – Glow relay location

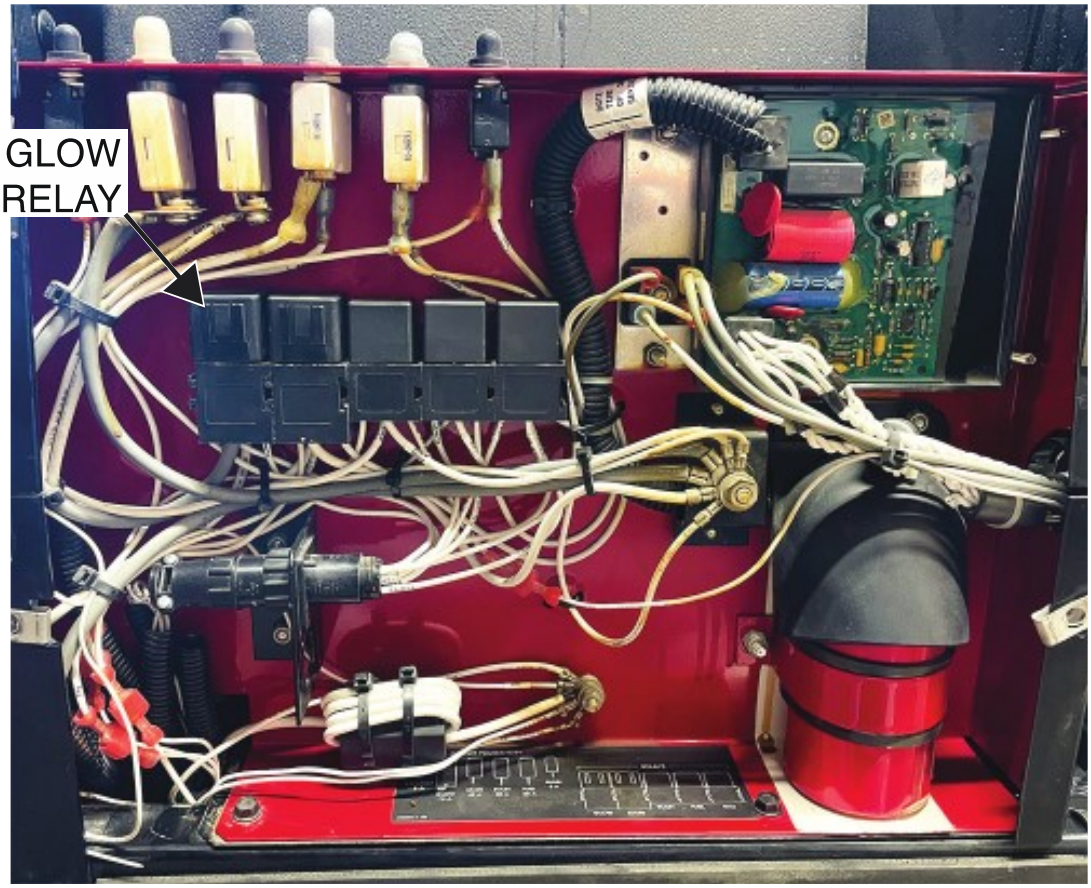
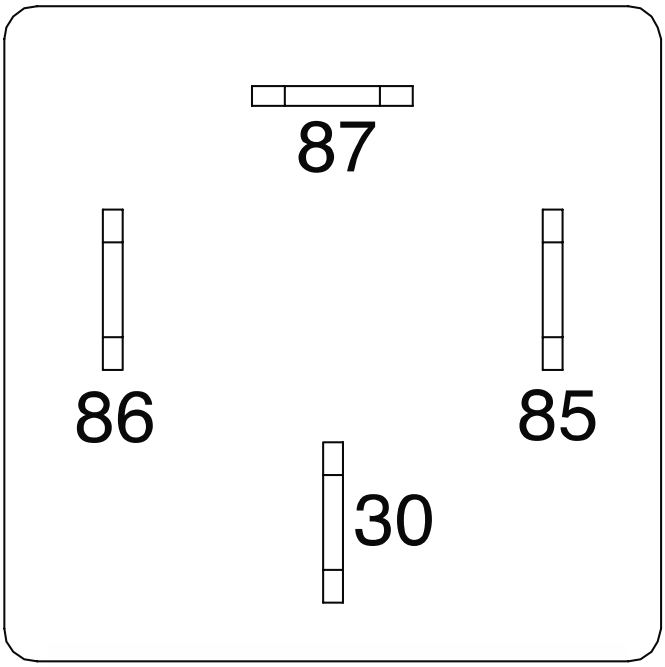
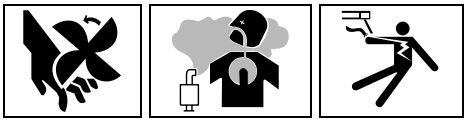


Figure F.2 – Glow relay lead locations



IDLE RELAY TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Idle Relay is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the idle relay. The idle relay is located on the inner control panel. See ***Figure F.1***. See Wiring Diagram.
5. Carefully unplug the idle relay from its socket. See ***Figure F.1***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If any of the tests fail, the idle relay may be faulty.
8. If faulty, perform the ***Idle Relay Removal And Replacement Procedure***.
9. If all tests pass, proceed with active testing.
10. Carefully position the idle relay into its socket. See ***Figure F.1***. See Wiring Diagram.
11. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.2***. See ***Figure F.2***. See Wiring Diagram.
12. If any of the tests fail, the idle relay may be faulty.
13. If faulty, perform the ***Idle Relay Removal And Replacement Procedure***.
14. If all tests pass, proceed to the ***Test Reference Chart***.
15. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Idle relay resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
IDLE RELAY	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO STOP. IDLE RELAY REMOVED FROM SOCKET.	TERMINAL 86	TERMINAL 85	90 OHMS
		TERMINAL 30	TERMINAL 87	> 500K OHMS
		TERMINAL 30	TERMINAL 87A	< 1 OHMS

Table F.2 – Idle relay voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
IDLE RELAY COIL	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO AUTO. WAIT TWENTY SECONDS AFTER START. IDLE RELAY INSTALLED.	TERMINAL 86 PLUG J87 PIN 2 (LEAD 232DA)	TERMINAL 85 PLUG J87 PIN 1 (LEAD 405A)	13.2 VDC
IDLE RELAY CONTACT	BEFORE TWENTY SECONDS.	TERMINAL 30 PLUG J87 PIN 8 (LEAD ECB80A)	TERMINAL 87 PLUG J87 PIN 7 (LEAD ECB74A)	0 VDC
		TERMINAL 30 PLUG J87 PIN 8 (LEAD ECB80A)	TERMINAL 87 PLUG J87 PIN 7 (LEAD ECB74A)	12.32 VDC

Figure F.1 – Idle relay location

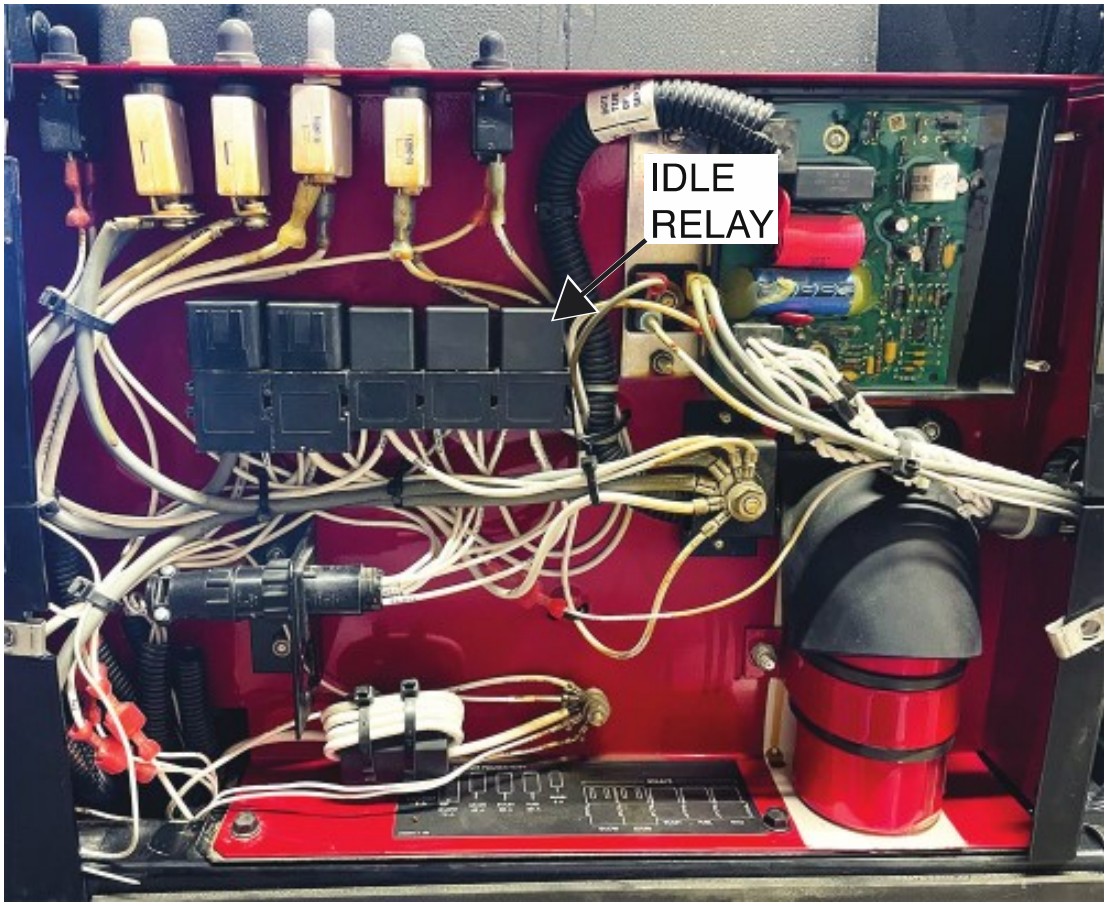
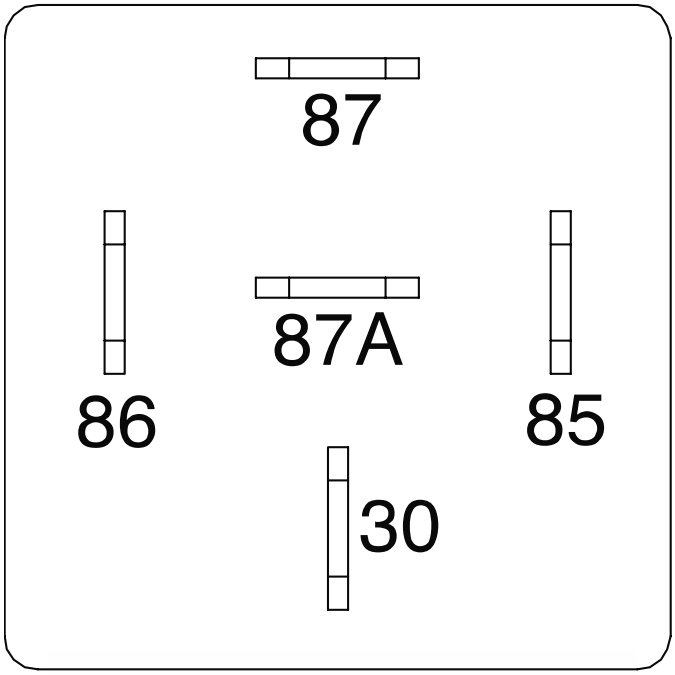
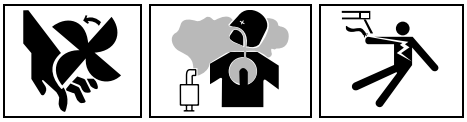


Figure F.2 – Idle relay lead locations



MAIN RELAY TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Main Relay is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the main relay. The main relay is located on the inner control panel. See ***Figure F.1***. See Wiring Diagram.
5. Carefully unplug the main relay from its socket. See ***Figure F.1***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If any of the tests fail, the main relay may be faulty.
8. If faulty, perform the ***Main Relay Removal And Replacement Procedure***.
9. If all tests pass, proceed with active testing.
10. Carefully position the main relay into its socket. See ***Figure F.1***. See Wiring Diagram.
11. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.2***. See ***Figure F.2***. See Wiring Diagram.
12. If any of the tests fail, the main relay may be faulty.
13. If faulty, perform the ***Main Relay Removal And Replacement Procedure***.
14. If all tests pass, proceed to the ***Test Reference Chart***.
15. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Main relay resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
MAIN RELAY	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO STOP. MAIN RELAY REMOVED FROM SOCKET.	TERMINAL 86	TERMINAL 85	90 OHMS
		TERMINAL 30	TERMINAL 87	> 500K OHMS
		TERMINAL 30	TERMINAL 87A	< 1 OHMS

Table F.2 – Main relay voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
MAIN RELAY COIL	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO AUTO. MAIN RELAY IN SOCKET.	TERMINAL 86 (LEAD 232XA)	TERMINAL 85 (LEAD 424)	10.9 VDC
MAIN RELAY CONTACT	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO OFF.	TERMINAL 30 (LEAD 406A)	TERMINAL 87 (LEAD 402)	0 VDC
		TERMINAL 30 (LEAD 406A)	TERMINAL 87 (LEAD 402)	12.32 VDC

Figure F.1 – Main relay location

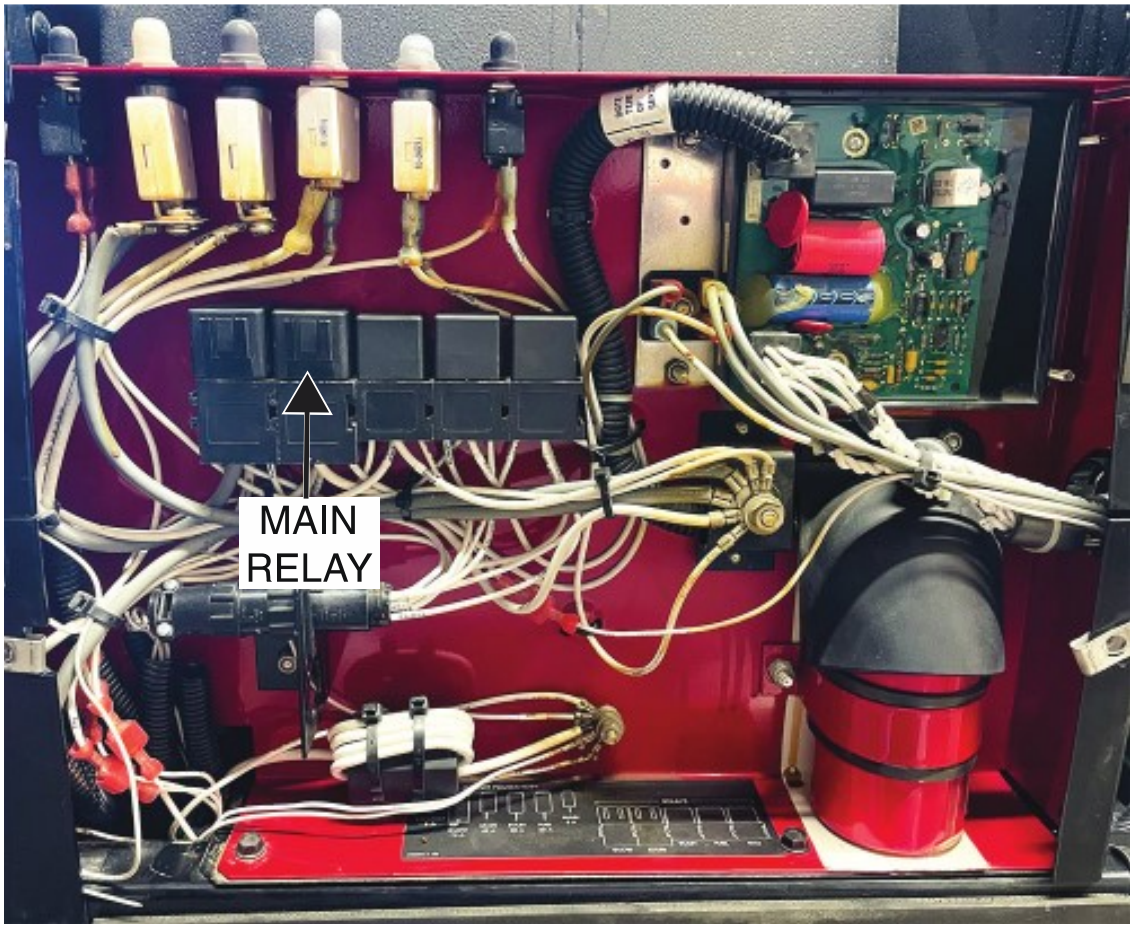
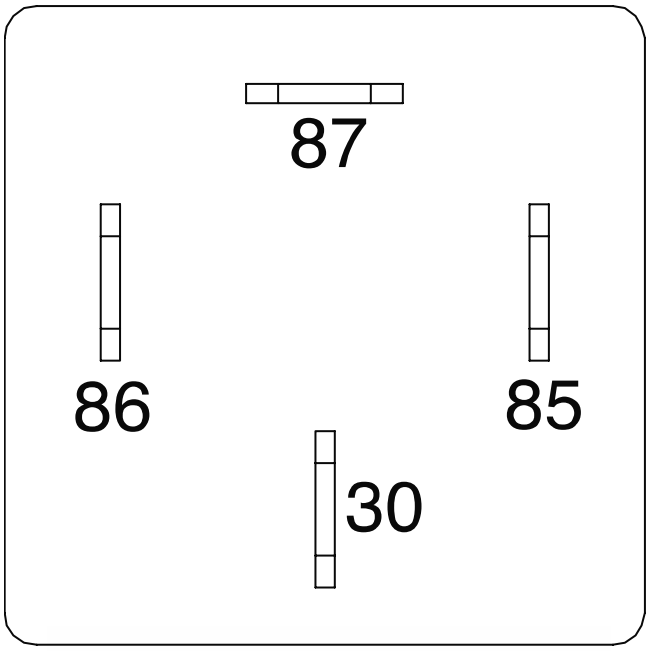
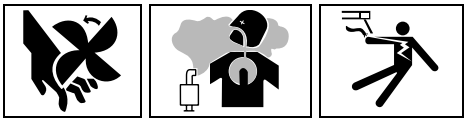


Figure F.2 – Main relay lead locations



MODE SELECTOR BOARD TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Mode Selector Board is functioning properly. This test will NOT test all of the circuitry on this component.

MATERIALS NEEDED

3/8” Nutdriver
Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the mode selector board. The mode selector board is located on the control panel. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.2***.
6. Carefully lower the control panel to gain access to the rear of the mode selector board.
7. Carefully remove the shield from the machine.
8. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.1***. See ***Figure F.3***. See Wiring Diagram.
9. If any of the tests fail, the mode selector board may be faulty.
10. If faulty, perform the ***Mode Selector Board Removal And Replacement Procedure***.
11. If all tests pass, proceed to the ***Test Reference Chart***.
12. Carefully raise the control panel into the upright position.
13. Carefully position the shield into the machine.
14. Using a 3/8” nutdriver, attach the four screws securing the control panel into the upright position.
15. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Mode selector voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
MODE SELECTOR BOARD	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH. MODE CC.	PLUG J81 PIN 4 (LEAD 277A)	PLUG J81 PIN 1 (LEAD 222)	3.9 VDC
	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH. MODE PIPE.	PLUG J81 PIN 4 (LEAD 277A)	PLUG J81 PIN 1 (LEAD 222)	5.9 VDC
	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH. MODE CV.	PLUG J81 PIN 4 (LEAD 277A)	PLUG J81 PIN 1 (LEAD 222)	7.9 VDC
	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH. MODE GOUGE.	PLUG J81 PIN 4 (LEAD 277A)	PLUG J81 PIN 1 (LEAD 222)	9.9 VDC
	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH. MODE TIG.	PLUG J81 PIN 4 (LEAD 277A)	PLUG J81 PIN 1 (LEAD 222)	1.9 VDC
	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH. MODE ARCLINK.	PLUG J81 PIN 4 (LEAD 277A)	PLUG J81 PIN 1 (LEAD 222)	.9 VDC

Figure F.1 – Mode selector board location

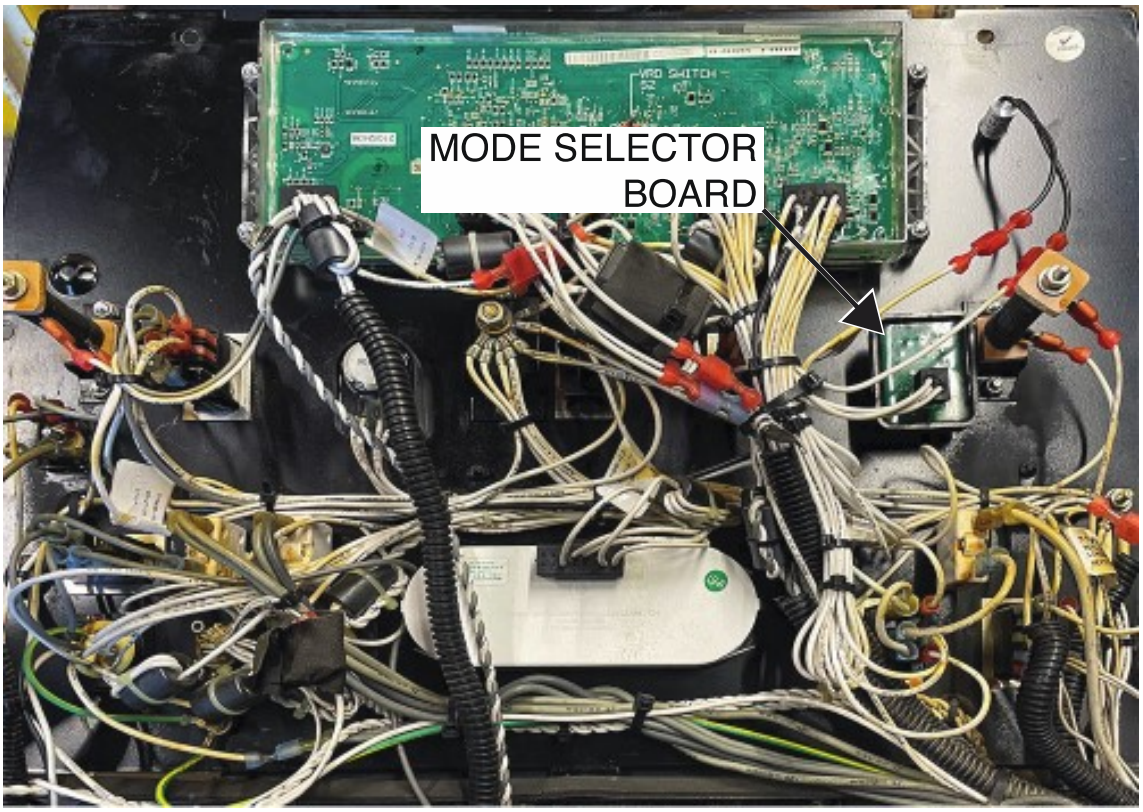


Figure F.2 – Control panel mounting screw locations

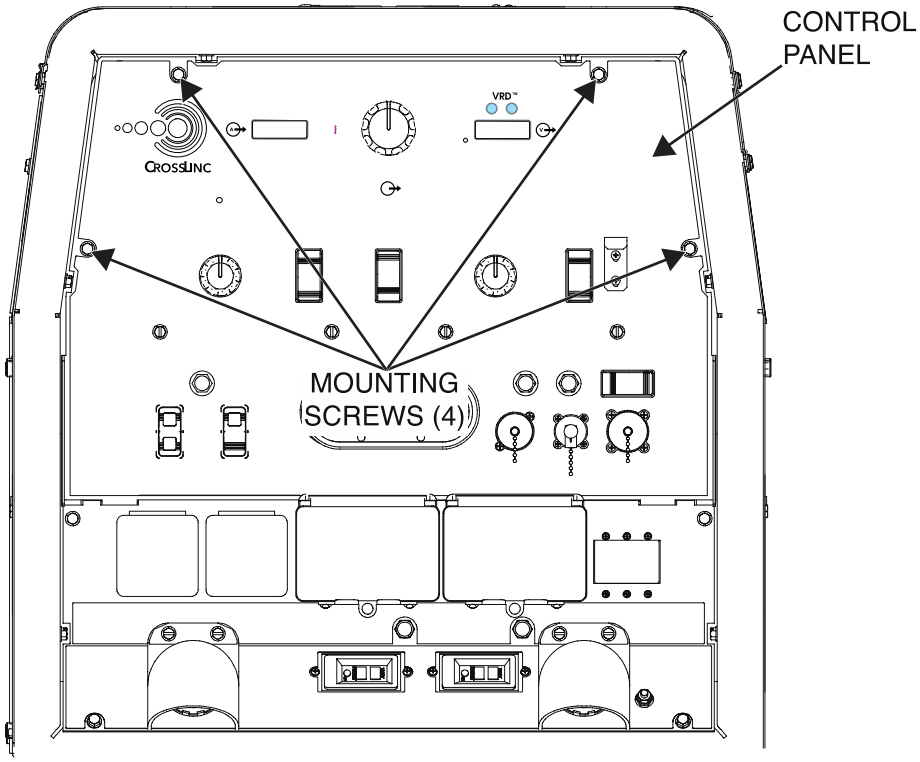
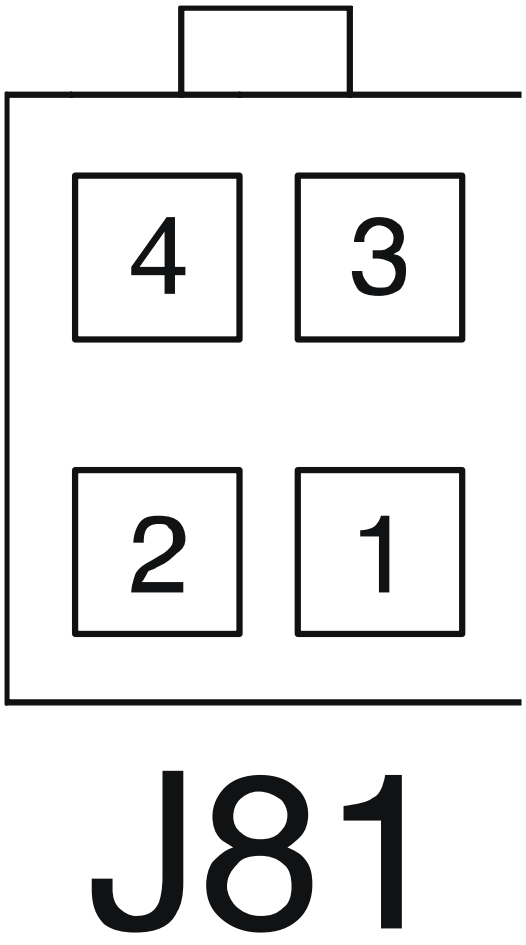
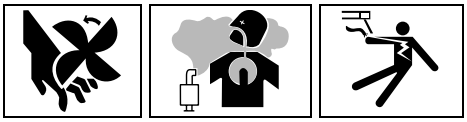


Figure F.3 – Mode selector board plug J81 terminal locations



OUTPUT RECTIFIER TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Output Rectifier is functioning properly.

MATERIALS NEEDED

3/8” Nutdriver
7/16” Nutdriver
7/16” Open-End Wrench
1/2” Nutdriver
1/2” Open-End Wrench
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the output rectifier. The output rectifier is located on the power module panel. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.2***.
6. Carefully lower the control panel to gain access to the output rectifier.
7. Carefully remove the shield from the machine.
8. Using a 7/16” nutdriver and a 7/16” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads W1/W6 to the left AC terminal of the output rectifier. See ***Figure F.3***. See Wiring Diagram.
9. Using a 7/16” nutdriver and a 7/16” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads W2/W3 to the middle AC terminal of the output rectifier. See ***Figure F.3***. See Wiring Diagram.
10. Using a 7/16” nutdriver and a 7/16” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads W4/W5 to the right AC terminal of the output rectifier. See ***Figure F.3***. See Wiring Diagram.
11. Using a 1/2” nutdriver and a 1/2” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads B1-NEG and B4-NEG to the negative terminal of the output rectifier. See ***Figure F.3***. See Wiring Diagram.
12. Using a 1/2” nutdriver and a 1/2” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads 206C, B2-POS, B5-POS, and POS-SHUNT to the positive terminal of the output rectifier. See ***Figure F.3***. See Wiring Diagram.
13. Using a volt/ohmmeter, perform the wide diode tests outlined in ***Table F.1***. See ***Figure F.3***. See Wiring Diagram.
14. If any of the tests fail, the output rectifier may be faulty.
15. If faulty, perform the ***Output Rectifier Removal And Replacement Procedure***.
16. If all tests pass, proceed with active testing.
17. Using a 1/2” nutdriver and a 1/2” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads 206C, B2-POS, B5-POS, and POS-SHUNT to the positive terminal of the output rectifier. See Wiring Diagram.

18. Using a 1/2” nutdriver and a 1/2” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads B1-NEG and B4-NEG to the negative terminal of the output rectifier. See Wiring Diagram.
19. Using a 7/16” nutdriver and a 7/16” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads W4/W5 to the right AC terminal of the output rectifier. See Wiring Diagram.
20. Using a 7/16” nutdriver and a 7/16” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads W2/W3 to the middle AC terminal of the output rectifier. See Wiring Diagram.
21. Using a 7/16” nutdriver and a 7/16” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads W1/W6 to the left AC terminal of the output rectifier. See Wiring Diagram.
22. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.2***. See ***Figure F.3***. See Wiring Diagram.
23. If any of the tests fail, the output rectifier may be faulty.
24. If faulty, perform the ***Output Rectifier Removal And Replacement Procedure***.
25. If all tests pass, proceed to the ***Test Reference Chart***.
26. Carefully raise the control panel into the upright position.
27. Carefully position the shield into the machine.
28. Using a 3/8” nutdriver, attach the four screws securing the control panel into the upright position.
29. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Output rectifier wide diode tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
3 PHASE RECTIFIER DIODES	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO STOP. TERMINALS W1/W6, W2/W3, W4/W5, POSITIVE, AND NEGATIVE FROM CHOPPER BD DISCONNECTED.	TERMINAL W1/W6	POSITIVE TERMINAL	0.3 VDC - 0.7 VDC
		TERMINAL W2/W3	POSITIVE TERMINAL	0.3 VDC - 0.7 VDC
		TERMINAL W4/W5	POSITIVE TERMINAL	0.3 VDC - 0.7 VDC
		NEGATIVE TERMINAL	TERMINAL W1/W6	0.3 VDC - 0.7 VDC
		NEGATIVE TERMINAL	TERMINAL W2/W3	0.3 VDC - 0.7 VDC
		NEGATIVE TERMINAL	TERMINAL W4/W5	0.3 VDC - 0.7 VDC

Table F.2 – Output rectifier voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
PHASE 1 AC INPUT	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH IDLE.	TERMINAL W1/W6	TERMINAL W2/W3	~ 66 VAC
PHASE 2 AC INPUT		TERMINAL W2/W3	TERMINAL W4/W5	~ 67 VAC
PHASE 3 AC INPUT		TERMINAL W4/W5	TERMINAL W1/W6	~ 66 VAC
3 PHASE RECTIFIER OUTPUT		POSITIVE TERMINAL	NEGATIVE TERMINAL	~ 88 VDC

Figure F.1 – Output rectifier panel location

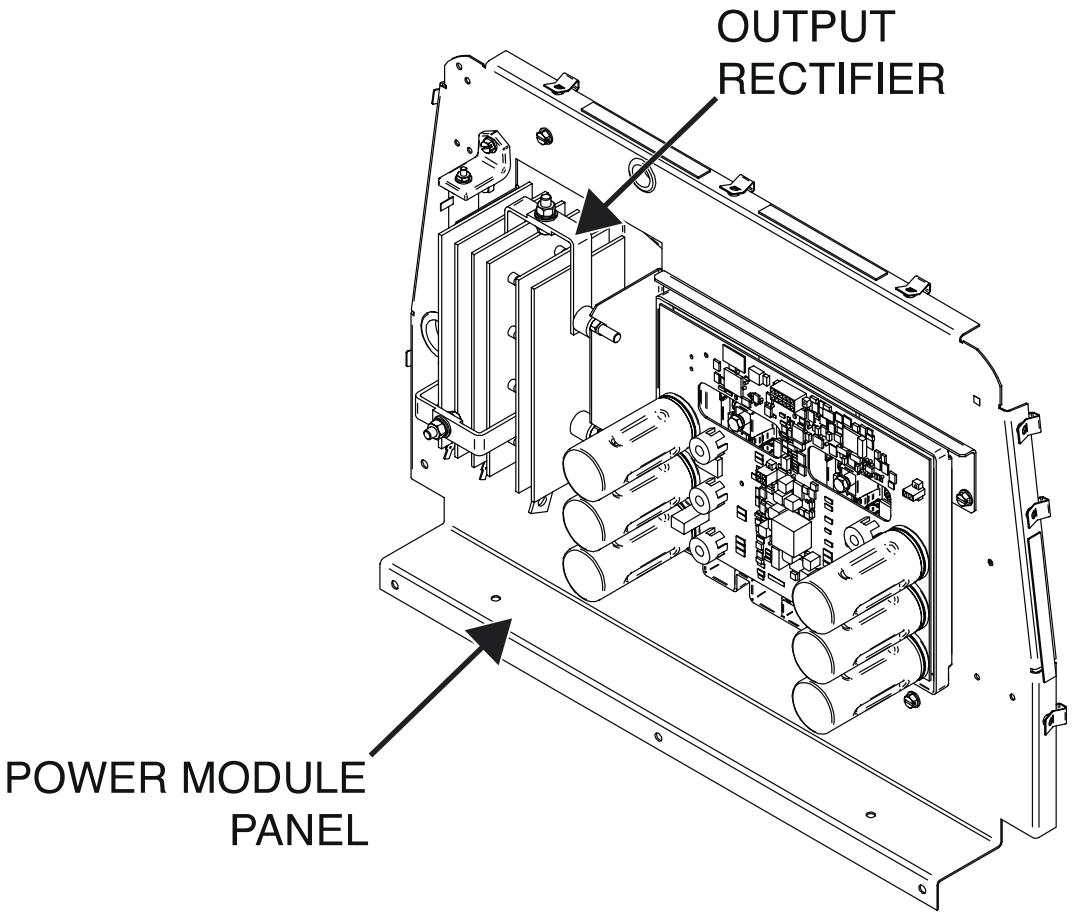


Figure F.2 – Control panel mounting screw lead locations

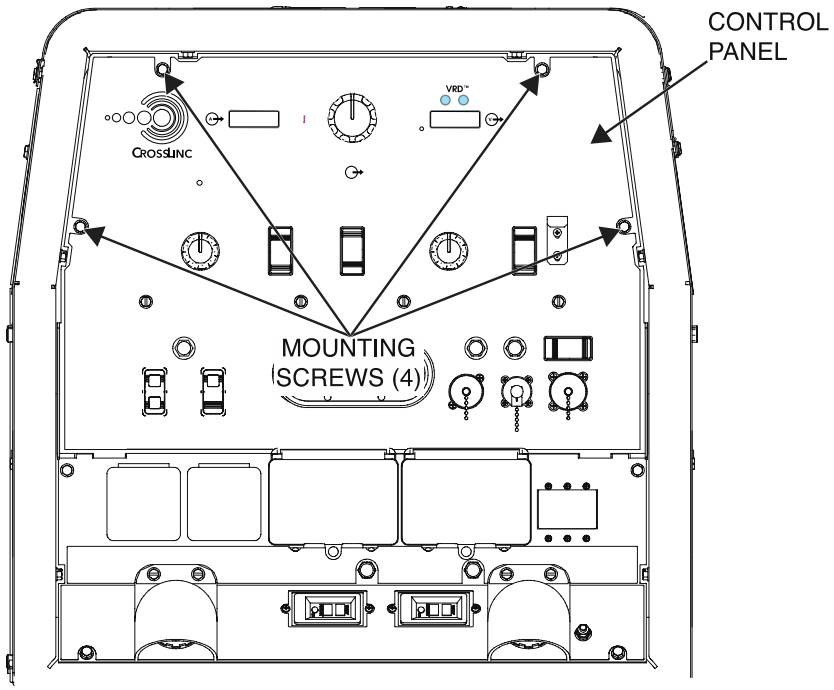
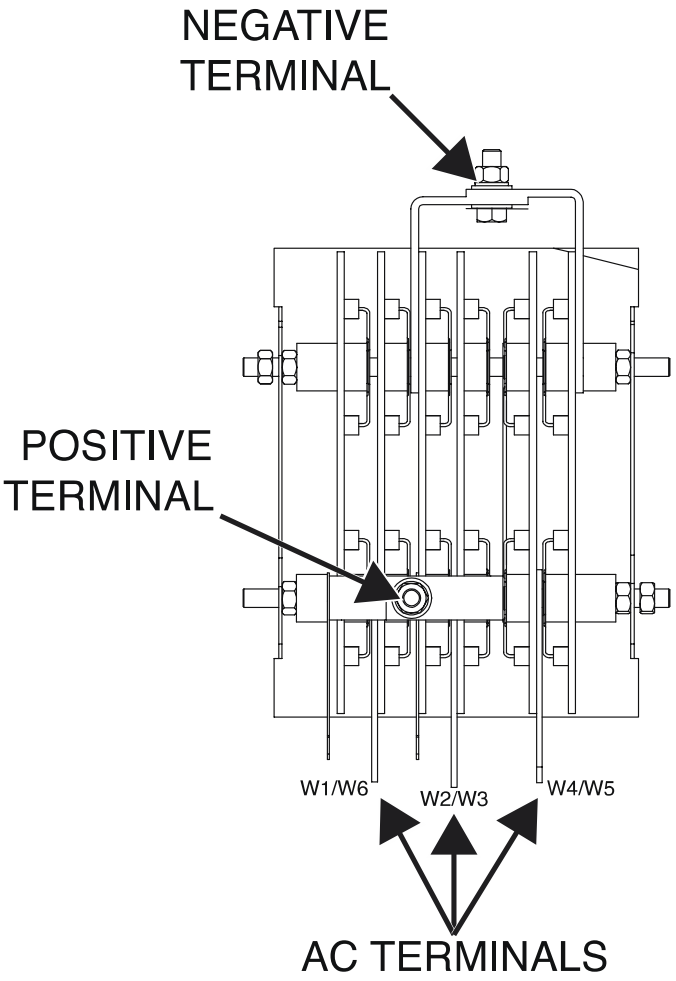
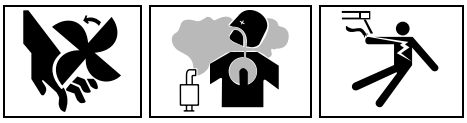


Figure F.3 – Output rectifier terminal locations



WIRE FEEDER VOLTMETER POLARITY SWITCH TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Wire feeder Voltmeter Polarity Switch is functioning properly.

MATERIALS NEEDED

3/8” Nutdriver
Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the wire feeder voltmeter polarity switch. The wire feeder voltmeter polarity switch is located on the control panel. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.2***.
6. Carefully lower the control panel to gain access to the rear of the wire feeder voltmeter polarity switch.
7. Carefully remove the shield from the machine.
8. Label and disconnect leads 206A, 21, 208A, 256C, and 258 from the wire feeder voltmeter polarity switch. See ***Figure F.3***. See Wiring Diagram.
9. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.3***. See Wiring Diagram.
10. If any of the tests fail, the wire feeder voltmeter polarity switch may be faulty.
11. If faulty, perform the ***Wire Feeder Voltmeter Polarity Switch Removal And Replacement Procedure***.
12. If all tests pass, proceed to the ***Test Reference Chart***.
13. Connect previously disconnected leads 206A, 21, 208A, 256C, and 258 to the wire feeder voltmeter polarity switch. See Wiring Diagram.
14. Carefully raise the control panel into the upright position.
15. Carefully position the shield into the machine.
16. Using a 3/8” nutdriver, attach the four screws securing the control panel into the upright position.
17. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Wire feeder voltmeter polarity switch resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
POSITIVE POLARITY	ENGINE NOT RUNNING. SWITCH SET TO POSITIVE POLARITY. REMOVE ALL LEADS.	TERMINAL 2 (LEAD 21)	TERMINAL 3 (LEAD 208A)	< 1 OHM
		TERMINAL 5 (LEAD 258)	TERMINAL 6	< 1 OHM
POSITIVE POLARITY	ENGINE NOT RUNNING. SWITCH SET TO POSITIVE POLARITY. REMOVE ALL LEADS.	TERMINAL 2 (LEAD 21)	TERMINAL 1 (LEAD 206A)	< 500 OHM
		TERMINAL 5 (LEAD 258)	TERMINAL 4 (LEAD 256C)	< 500 OHM
NEGATIVE POLARITY	ENGINE NOT RUNNING. SWITCH SET TO NEGATIVE POLARITY. REMOVE ALL LEADS.	TERMINAL 2 (LEAD 21)	TERMINAL 3 (LEAD 208A)	< 500 OHM
		TERMINAL 5 (LEAD 258)	TERMINAL 6	< 500 OHM
NEGATIVE POLARITY	ENGINE NOT RUNNING. SWITCH SET TO NEGATIVE POLARITY. REMOVE ALL LEADS.	TERMINAL 2 (LEAD 21)	TERMINAL 1 (LEAD 206A)	< 1 OHM
		TERMINAL 5 (LEAD 258)	TERMINAL 4 (LEAD 256C)	< 1 OHM

Figure F.1 – Wire feeder voltmeter polarity switch location

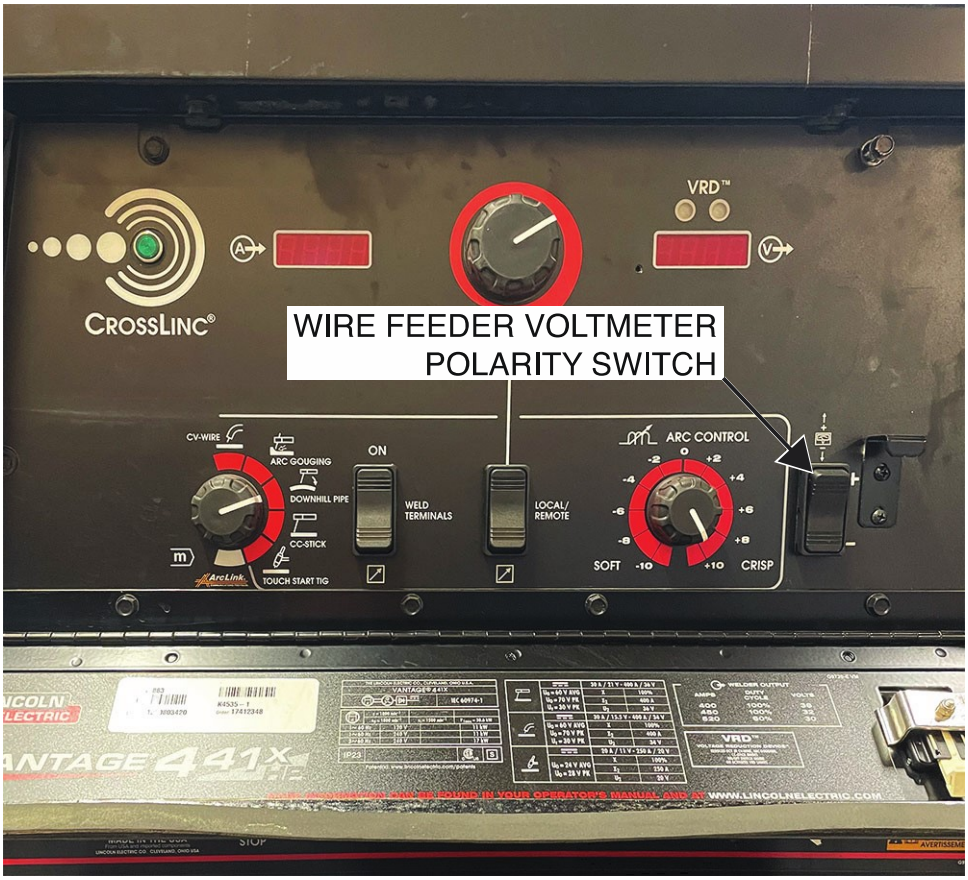


Figure F.2 – Control panel mounting screw locations

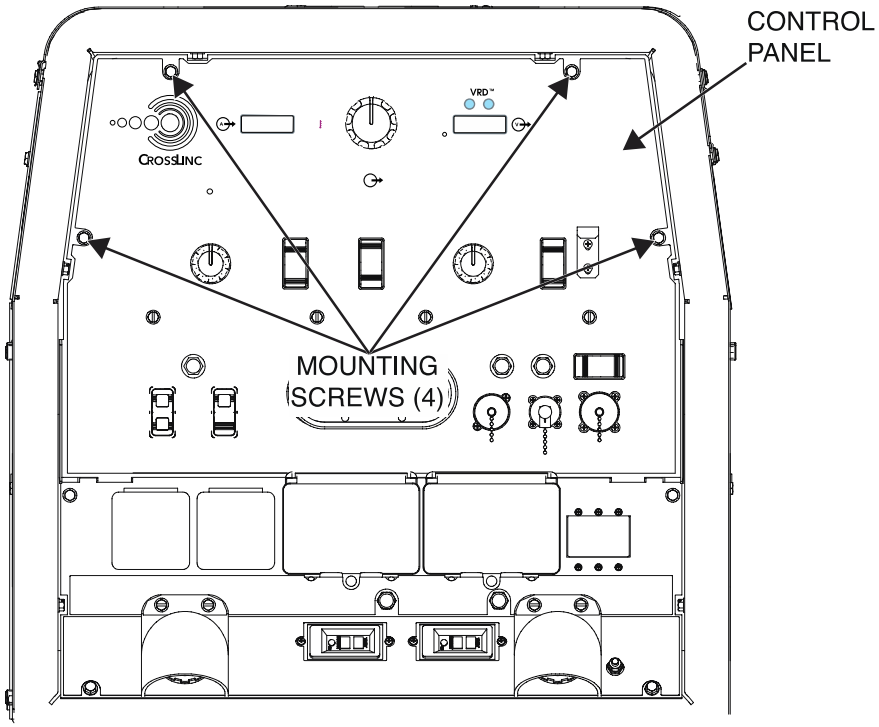
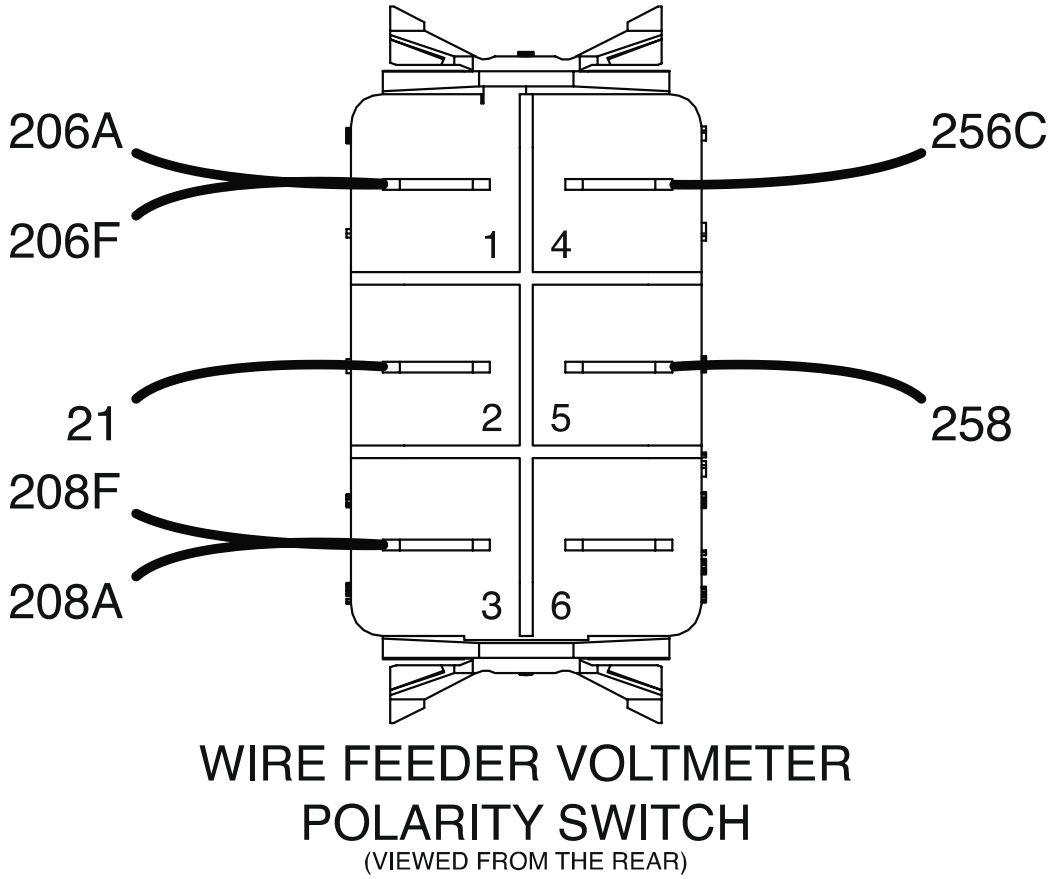
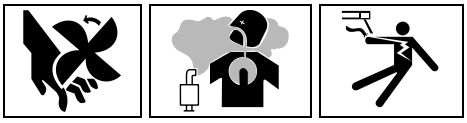


Figure F.3 – Wire feeder voltmeter polarity switch lead and terminal locations



ROTOR TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Rotor is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
7/16” Nutdriver
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the rotor. The rotor is connected to the engine. See ***Figure F.1***. See Wiring Diagram.
5. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.1***. See Wiring Diagram.
6. If any of the tests fail, the rotor may be faulty.
7. If faulty, perform the ***Stator And Rotor Removal And Replacement Procedure***.
8. If all tests pass, proceed with active testing.
9. Using a 7/16” nutdriver, remove the nut, lock washer, and flat washer securing lead 200B to the positive terminal of the field capacitor. See ***Figure F.2***. See Wiring Diagram. Label and disconnect the lead.
10. Using a 7/16” nutdriver, remove the nut, lock washer, and flat washer securing lead 201 to the negative terminal of the field capacitor. See ***Figure F.2***. See Wiring Diagram. Label and disconnect the lead.
11. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.2***. See ***Figure F.2***. See Wiring Diagram.
12. If any of the tests fail, the rotor may be faulty.
13. If faulty, perform the ***Stator And Rotor Removal And Replacement Procedure***.
14. If all tests pass, proceed to the ***Test Reference Chart***.
15. Using a 7/16” nutdriver, attach the nut, lock washer, and flat washer securing lead 201 to the negative terminal of the field capacitor. See Wiring Diagram.
16. Using a 7/16” nutdriver, attach the nut, lock washer, and flat washer securing lead 200B to the positive terminal of the field capacitor. See Wiring Diagram.
17. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Rotor resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
ROTOR	ENGINE NOT RUNNING.	ONE SLIP RING	OTHER SLIP RING	~ 25 OHMS
ROTOR	ENGINE NOT RUNNING.	ONE SLIP RING	GROUND	> 500K OHMS

Table F.2 – Rotor resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
ROTOR	ENGINE RUNNING. LEADS 200B AND 201 DISCONNECTED.	LEAD 200B	LEAD 201	> 500K OHMS
ROTOR	ENGINE RUNNING. LEADS 200B AND 201 DISCONNECTED.	LEAD 200B	GROUND	> 500K OHMS

Figure F.1 – Rotor location

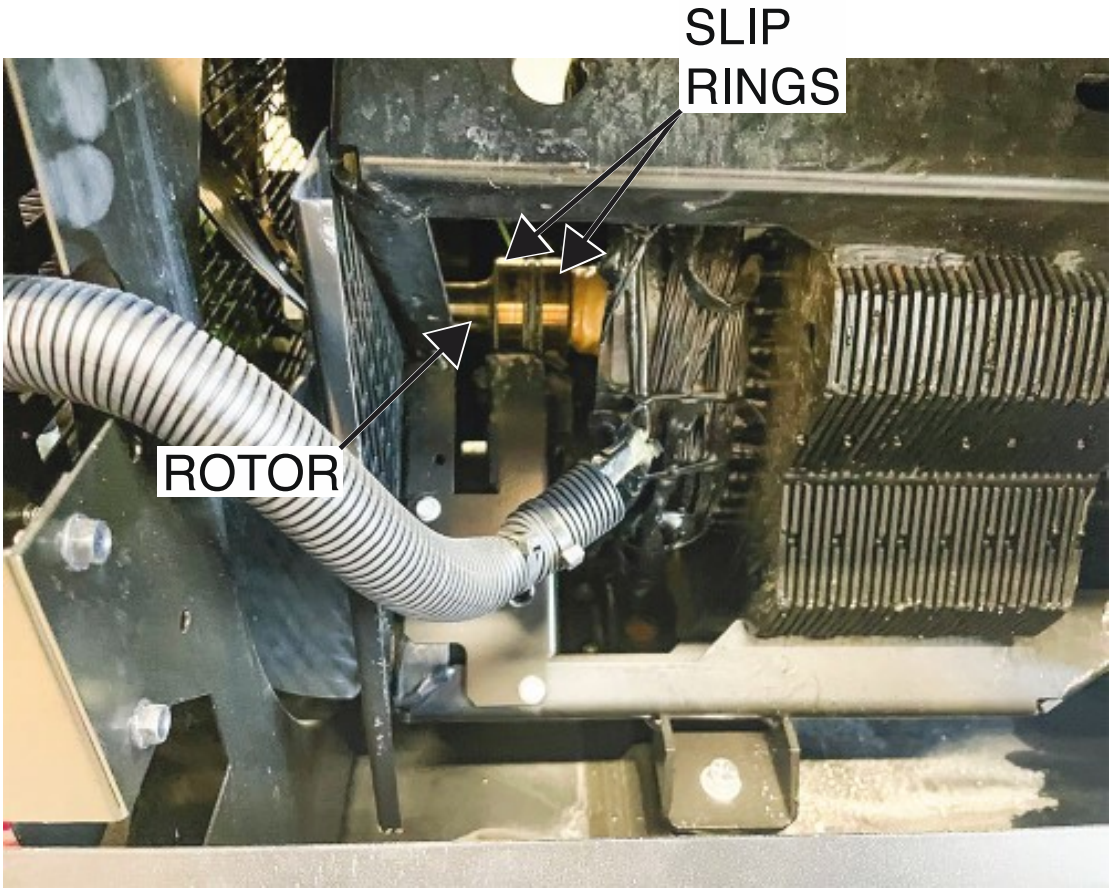
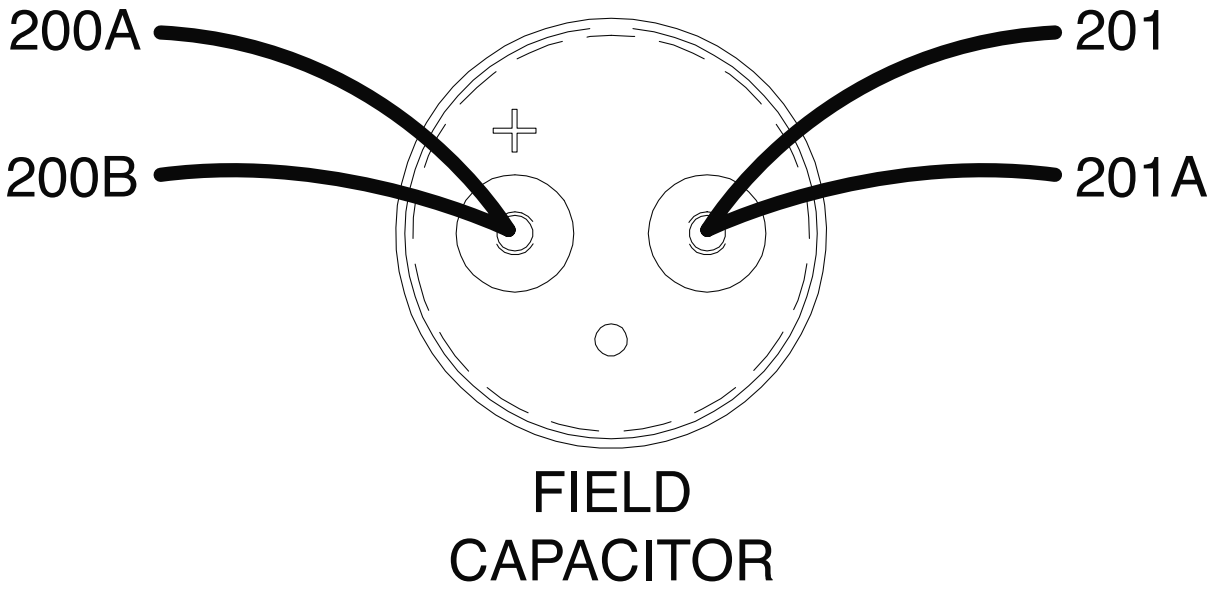
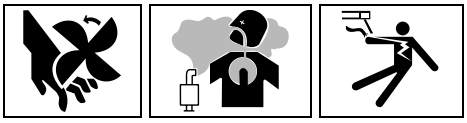


Figure F.2 – Field capacitor lead locations



RUN / STOP / IDLE SWITCH TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Run / Stop / Idle Switch is functioning properly.

MATERIALS NEEDED

3/8” Nutdriver
Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the run / stop / idle switch. The run / stop / idle switch is located on the control panel. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.2***.
6. Carefully lower the control panel to gain access to the rear of the run / stop / idle switch.
7. Carefully remove the shield from the machine.
8. Label and disconnect leads 232, 232A, 236A, 5S, 256, 256A, and 257 from the run / stop / idle switch. See ***Figure F.3***. See Wiring Diagram.
9. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.3***. See Wiring Diagram.
10. If any of the tests fail, the run / stop / idle switch may be faulty.
11. If faulty, perform the ***Run / Stop / Idle Switch Removal And Replacement Procedure***.
12. If all tests pass, proceed with active testing.
13. Connect previously disconnected leads 232, 232A, 236A, 5S, 256, 256A, and 257 to the run / stop / idle switch. See Wiring Diagram.
14. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.2***. See ***Figure F.3***. See Wiring Diagram.
15. If any of the tests fail, the run / stop / idle switch may be faulty.
16. If faulty, perform the ***Run / Stop / Idle Switch Removal And Replacement Procedure***.
17. If all tests pass, proceed to the ***Test Reference Chart***.
18. Carefully raise the control panel into the upright position.
19. Carefully position the shield into the machine.
20. Using a 3/8” nutdriver, attach the four screws securing the control panel into the upright position.
21. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Run / stop / idle switch resistance tests (with all leads disconnected from switch)

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
RUN / STOP / IDLE SWITCH	BATTERY DISCONNECTED. RUN / STOP / IDLE SWITCH IN HIGH IDLE (POS. 1).	TERMINAL 2 (LEAD 236A)	TERMINAL 3 (LEAD 232A)	0 OHMS
	BATTERY DISCONNECTED. RUN / STOP / IDLE SWITCH IN HIGH IDLE (POS. 2).	TERMINAL 2 (LEAD 236A)	TERMINAL 3 (LEAD 232A)	0 OHMS
	BATTERY DISCONNECTED. RUN / STOP / IDLE SWITCH IN HIGH IDLE (POS. 1).	TERMINAL 5 (LEAD 256)	TERMINAL 6 (LEAD 257)	0 OHMS
	BATTERY DISCONNECTED. RUN / STOP / IDLE SWITCH IN HIGH IDLE (POS. 2).	TERMINAL 5 (LEAD 256)	TERMINAL 6 (LEAD 257)	OL
	BATTERY DISCONNECTED. RUN / STOP / IDLE SWITCH IN STOP (POS. 3).	TERMINAL 2 (LEAD 236A)	TERMINAL 3 (LEAD 232A)	OL
	BATTERY DISCONNECTED. RUN / STOP / IDLE SWITCH IN STOP (POS. 3).	TERMINAL 5 (LEAD 256)	TERMINAL 6 (LEAD 257)	OL

Table F.2 – Run / stop / idle switch voltage tests (with all leads reconnected to switch)

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
RUN / STOP / IDLE SWITCH	BATTERY CONNECTED. RUN / STOP / IDLE SWITCH IN HIGH IDLE (POS. 1).	TERMINAL 2 (LEAD 236A)	TERMINAL 3 (LEAD 232A)	0 VDC
	BATTERY CONNECTED. RUN / STOP / IDLE SWITCH IN AUTO (POS. 2).	TERMINAL 2 (LEAD 236A)	TERMINAL 3 (LEAD 232A)	0 VDC
	BATTERY CONNECTED. RUN / STOP / IDLE SWITCH IN STOP (POS. 3).	TERMINAL 2 (LEAD 236A)	TERMINAL 3 (LEAD 232A)	12.2 VDC
	ENGINE RUNNING. BATTERY CONNECTED. RUN / STOP / IDLE SWITCH IN HIGH IDLE (POS. 1).	TERMINAL 5 (LEAD 256)	TERMINAL 6 (LEAD 257)	0 VDC
	ENGINE RUNNING. BATTERY CONNECTED. RUN / STOP / IDLE SWITCH IN AUTO (POS. 2).	TERMINAL 5 (LEAD 256)	TERMINAL 6 (LEAD 257)	15 VDC
	ENGINE RUNNING. BATTERY CONNECTED. RUN / STOP / IDLE SWITCH IN STOP (POS. 3).	TERMINAL 5 (LEAD 256)	TERMINAL 6 (LEAD 257)	0 VDC

Figure F.1 – Run / stop / idle switch location

Figure F.2 – Control panel mounting screw locations

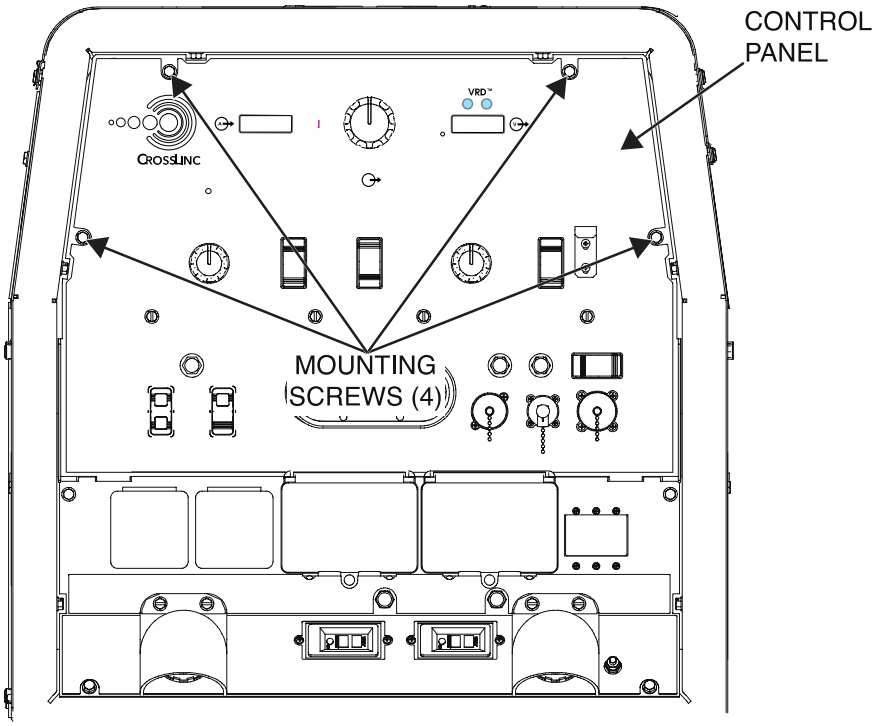
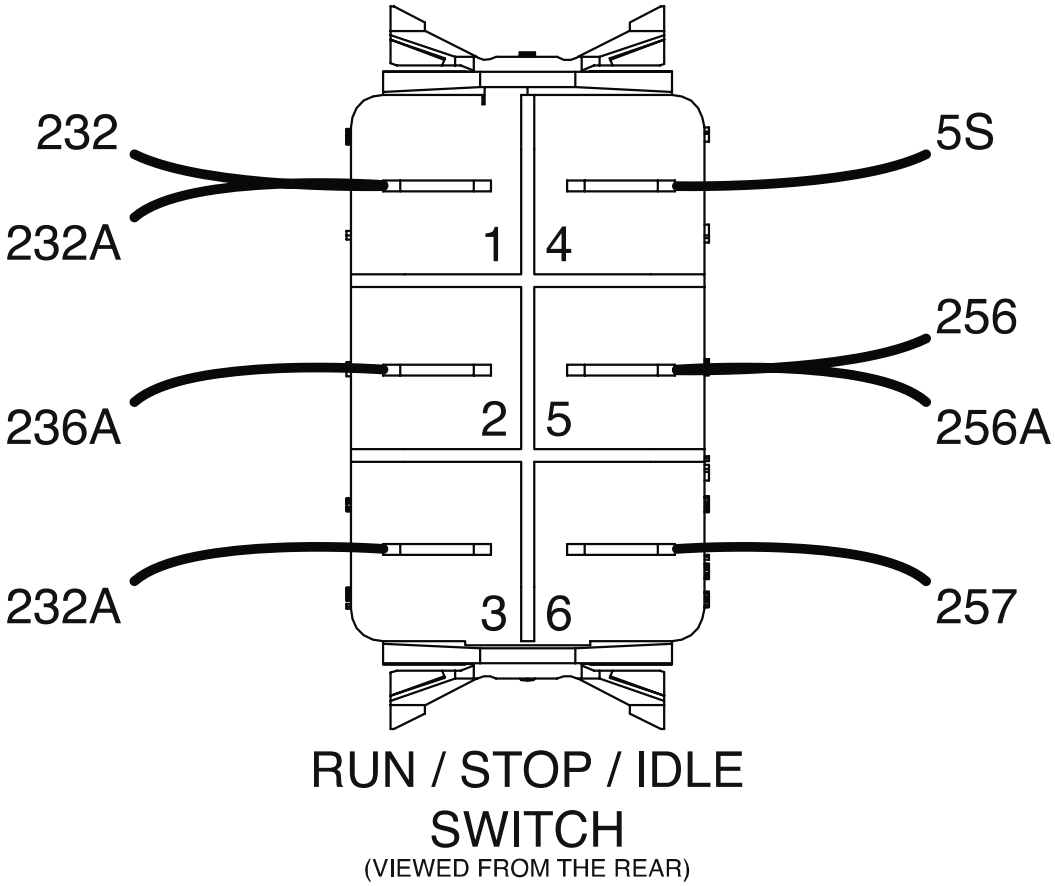
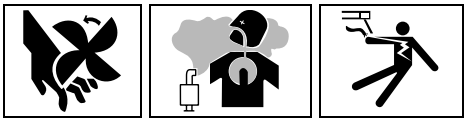


Figure F.3 – Run / stop / idle switch lead and terminal locations



START / GLOW PLUG SWITCH TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Start / Glow Plug Switch is functioning properly.

MATERIALS NEEDED

3/8” Nutdriver
Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the start / glow plug switch. The start / glow plug switch is located on the control panel. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.2***.
6. Carefully lower the control panel to gain access to the rear of the start / glow plug switch.
7. Carefully remove the shield from the machine.
8. Label and disconnect leads 232NA, 232NB, 414A, 405C, 320A, 232L, 408A, 407A, and 409A from the start / glow plug switch. See ***Figure F.3***. See Wiring Diagram.
9. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.3***. See Wiring Diagram.
10. If any of the tests fail, the start / glow plug switch may be faulty.
11. If faulty, perform the ***Start / Glow Plug Switch Removal And Replacement Procedure***.
12. If all tests pass, proceed with active testing.
13. Connect previously disconnected leads 232NA, 232NB, 414A, 405C, 320A, 232L, 408A, 407A, and 409A to the start / glow plug switch. See Wiring Diagram.
14. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.2***. See ***Figure F.3***. See Wiring Diagram.
15. If any of the tests fail, the start / glow plug switch may be faulty.
16. If faulty, perform the ***Start / Glow Plug Switch Removal And Replacement Procedure***.
17. If all tests pass, proceed to the ***Test Reference Chart***.
18. Carefully raise the control panel into the upright position.
19. Carefully position the shield into the machine.
20. Using a 3/8” nutdriver, attach the four screws securing the control panel into the upright position.
21. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Start / glow plug switch resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
START / GLOW SWITCH	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO STOP. LEADS DISCONNECTED. START BUTTON NOT PRESSED.	TERMINAL 2 (LEAD 414A)	TERMINAL 3 (LEAD 320A)	OL
	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO STOP. LEADS DISCONNECTED. START BUTTON PRESSED.	TERMINAL 2 (LEAD 414A)	TERMINAL 3 (LEAD 320A)	0.1 OHMS

Table F.2 – Start / glow plug switch voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
START / GLOW SWITCH	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO AUTO. START BUTTON NOT PRESSED.	TERMINAL 2 (LEAD 414A)	TERMINAL 3 (LEAD 320A)	12.1 VDC
	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO AUTO. STARTER RELAY REMOVED. START BUTTON PRESSED.	TERMINAL 2 (LEAD 414A)	TERMINAL 3 (LEAD 320A)	0 VDC

Figure F.1 – Start / glow plug switch location

Figure F.2 – Control panel mounting screw locations

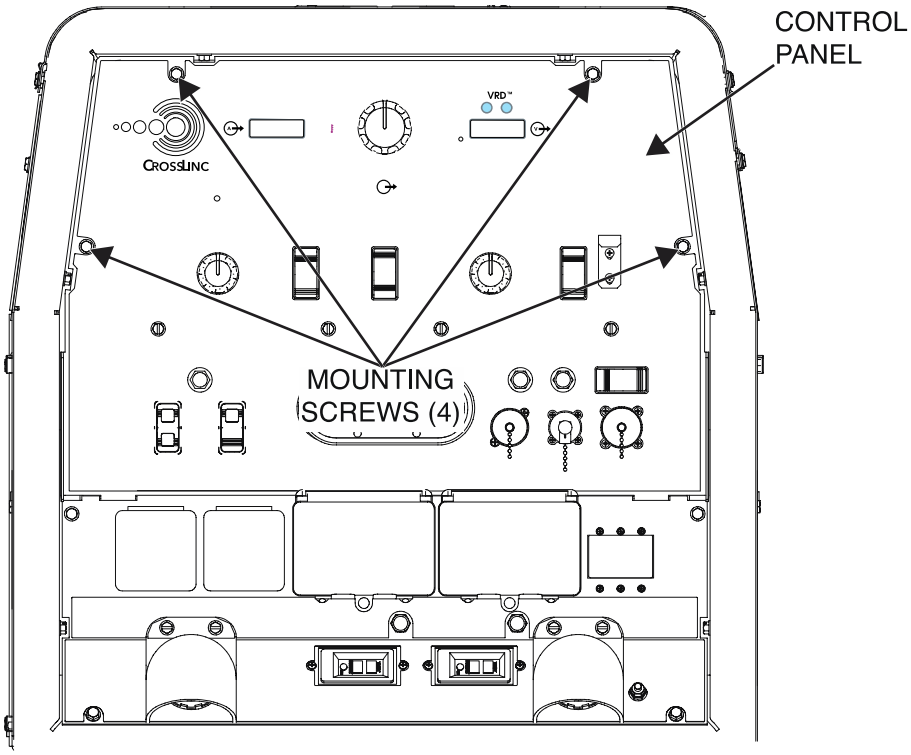
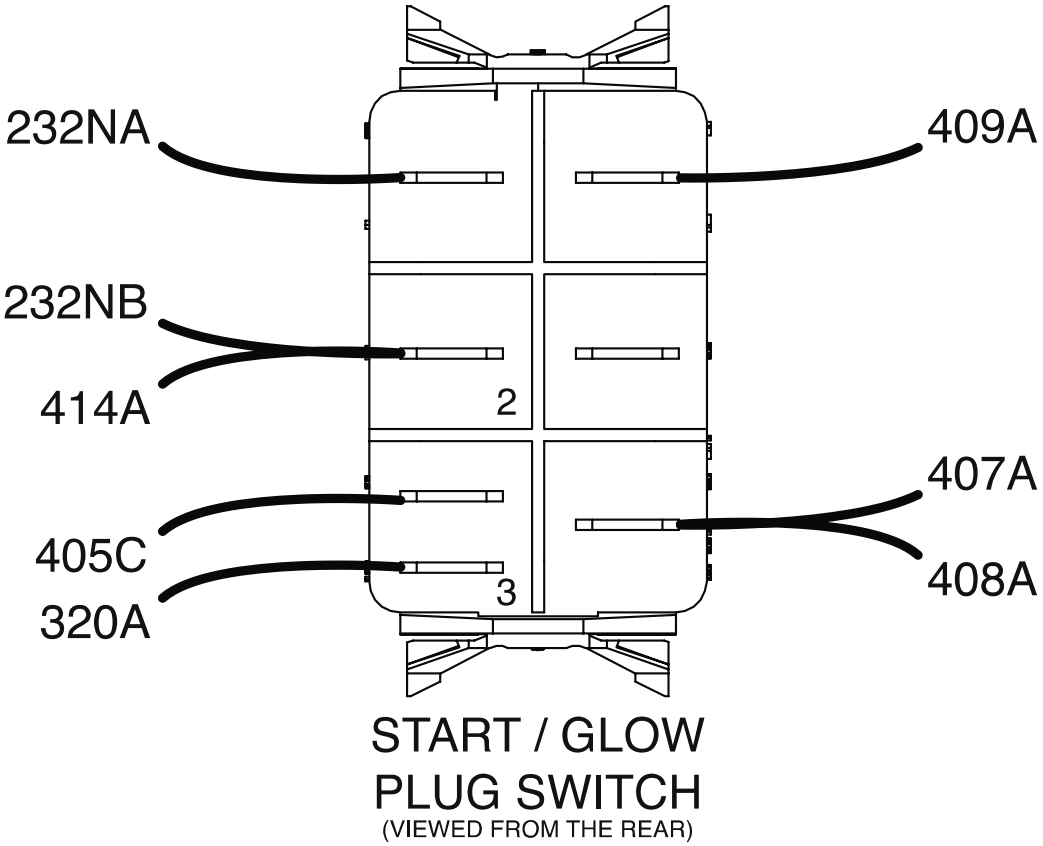
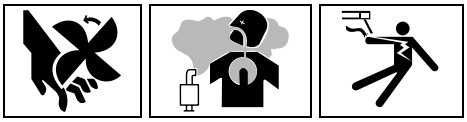


Figure F.3 – Start / glow plug switch lead and terminal locations



STARTER RELAY TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Starter Relay is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the starter relay. The starter relay is located on the inner control panel. See ***Figure F.1***. See Wiring Diagram.
5. Carefully unplug the starter relay from its socket. See ***Figure F.1***. See Wiring Diagram.
6. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figure F.2***. See Wiring Diagram.
7. If any of the tests fail, the starter relay may be faulty.
8. If faulty, perform the ***Starter Relay Removal And Replacement Procedure***.
9. If all tests pass, proceed with active testing.
10. Carefully position the starter relay into its socket. See ***Figure F.1***. See Wiring Diagram.
11. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.2***. See ***Figure F.2***. See Wiring Diagram.
12. If any of the tests fail, the starter relay may be faulty.
13. If faulty, perform the ***Starter Relay Removal And Replacement Procedure***.
14. If all tests pass, proceed to the ***Test Reference Chart***.
15. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Starter relay resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
STARTER RELAY	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO STOP. STARTER RELAY REMOVED FROM SOCKET.	TERMINAL 86	TERMINAL 85	90 OHMS
		TERMINAL 30	TERMINAL 87	> 500K OHMS
		TERMINAL 30	TERMINAL 87A	< 1 OHMS

Table F.2 – Starter relay voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
STARTER RELAY COIL	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO AUTO. STARTER RELAY IN SOCKET. START BUTTON PRESSED FOR ONE SECOND.	TERMINAL 86 (LEAD 320B)	TERMINAL 85 (LEAD 411)	10.9 VDC
		TERMINAL 30 (LEAD 420B)	TERMINAL 87 (LEAD 420A)	0 VDC
STARTER RELAY CONTACT	RUN / STOP / IDLE SWITCH SET TO OFF. STARTER RELAY IN SOCKET.	TERMINAL 30 (LEAD 420B)	TERMINAL 87 (LEAD 420A)	12.32 VDC

Figure F.1 – Starter relay location

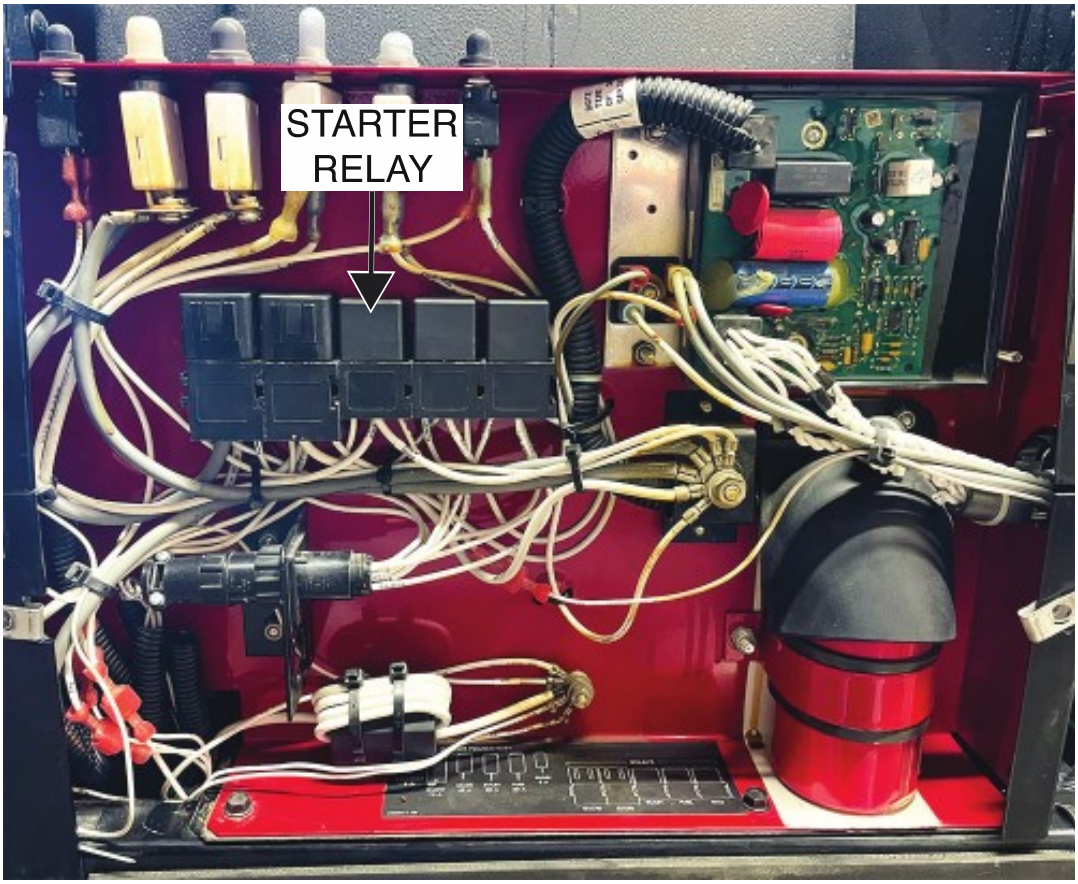
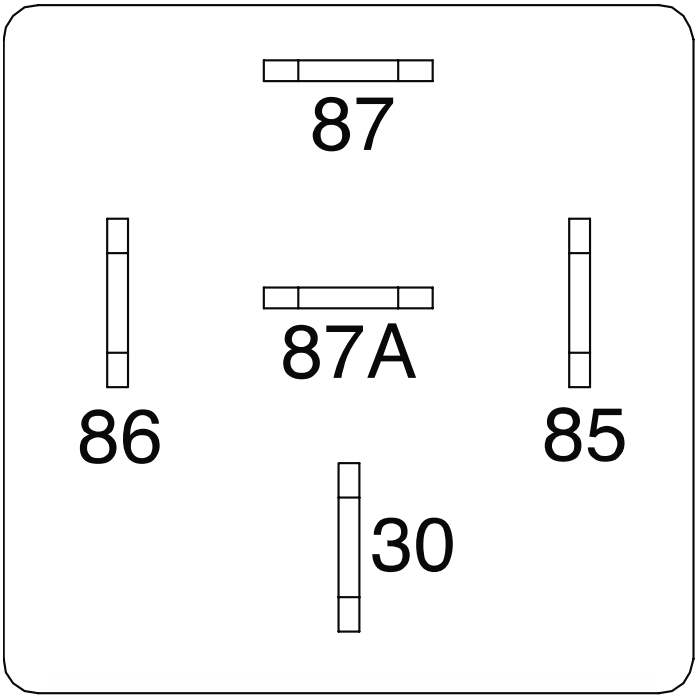
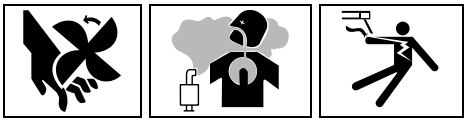


Figure F.2 – Starter relay lead locations



STATOR TEST PROCEDURE

Refer to Safety pages for explanation of hazards:



TEST DESCRIPTION

This test will determine if the Stator is functioning properly.

MATERIALS NEEDED

3/8” Nutdriver
7/16” Nutdriver
7/16” Open-End Wrench
Volt/Ohmmeter
Wiring Diagram
All Required P.P.E.

TEST PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the stator. The stator is attached to the engine. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.2***.
6. Carefully lower the control panel to gain access to the output rectifier.
7. Carefully remove the shield from the machine.
8. Using a 7/16” nutdriver and a 7/16” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads W1/W6 to the left AC terminal of the output rectifier. See ***Figure F.3***. See Wiring Diagram.
9. Using a 7/16” nutdriver and a 7/16” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads W2/W3 to the middle AC terminal of the output rectifier. See ***Figure F.3***. See Wiring Diagram.
10. Using a 7/16” nutdriver and a 7/16” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads W4/W5 to the right AC terminal of the output rectifier. See ***Figure F.3***. See Wiring Diagram.
11. Using a slotted screwdriver, loosen the three screws securing leads 3, 4, and 6, to the circuit breaker (CB1). See ***Figure F.4***. See Wiring Diagram. Label and disconnect the leads.
12. Using a 3/8” nutdriver remove the nut and lock washer securing lead 5 to the ground stud on the output panel. See ***Figure F.5***. See Wiring Diagram.
13. Label and disconnect lead 46 from the circuit breaker (CB9). See ***Figure F.6***. See Wiring Diagram.
14. Label and disconnect lead 45 from the D2 rectifier. See ***Figure F.7***. See Wiring Diagram.
15. Label and disconnect lead 42 from the circuit breaker (CB4). See ***Figure F.8***. See Wiring Diagram.
16. Label and disconnect lead 41 from lead 41A quick-connect. See Wiring Diagram.
17. Using a volt/ohmmeter, perform the resistance tests outlined in ***Table F.1***. See ***Figures F.3***, ***F.4***, ***F.5***, ***F.6***, ***F.7***, and ***F.8***. See Wiring Diagram.
18. If any of the tests fail, the stator may be faulty.
19. If faulty, perform the ***Stator And Rotor Removal And Replacement Procedure***.
20. If all tests pass, proceed with active testing.
21. Connect previously disconnected lead 41 to lead 41A quick-connect. See Wiring Diagram.
22. Connect previously disconnected lead 42 to the circuit breaker (CB4). See Wiring Diagram.
23. Connect previously disconnected lead 45 to the D2 rectifier. See Wiring Diagram.

24. Connect previously disconnected lead 46 to the circuit breaker (CB9). See Wiring Diagram.
25. Using a 3/8” nutdriver attach the nut and lock washer securing lead 5 to the ground stud on the output panel. See Wiring Diagram.
26. Using a slotted screwdriver, tighten the three screws securing leads 3, 4, and 6, to the circuit breaker (CB1). See Wiring Diagram.
27. Using a 7/16” nutdriver and a 7/16” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads W4/W5 to the right AC terminal of the output rectifier. See Wiring Diagram.
28. Using a 7/16” nutdriver and a 7/16” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads W2/W3 to the middle AC terminal of the output rectifier. See Wiring Diagram.
29. Using a 7/16” nutdriver and a 7/16” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads W1/W6 to the left AC terminal of the output rectifier. See Wiring Diagram.
30. Using a volt/ohmmeter, perform the voltage tests outlined in ***Table F.2***. See ***Figures F.3***, ***F.4***, ***F.5***, ***F.6***, ***F.7***, and ***F.8***. See Wiring Diagram.
31. If any of the tests fail, the stator may be faulty.
32. If faulty, perform the ***Stator And Rotor Removal And Replacement Procedure***.
33. If all tests pass, proceed to the ***Test Reference Chart***.
34. Carefully raise the control panel into the upright position.
35. Carefully position the shield into the machine.
36. Using a 3/8” nutdriver, attach the four screws securing the control panel into the upright position.
37. When all testing and repair procedures are complete, perform the ***Retest After Repair Procedure***.

Table F.1 – Stator resistance tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
STATOR WELD WINDINGS	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO STOP. TERMINALS W1/W6, W2/W3, AND W4/W5 DISCONNECTED.	TERMINAL W1	TERMINAL W2	< 1 OHMS
		TERMINAL W3	TERMINAL W4	< 1 OHMS
		TERMINAL W5	TERMINAL W6	< 1 OHMS
		TERMINAL W1	GROUND	> 500K OHMS
		TERMINAL W3	GROUND	> 500K OHMS
		TERMINAL W5	GROUND	> 500K OHMS
STATOR AUXILIARY WINDINGS	ENGINE NOT RUNNING. RUN / STOP / IDLE SWITCH SET TO STOP. TERMINALS 3, 4, 5, 6, 41, 42, 45, AND 46 DISCONNECTED.	LEAD 3 (CB1)	LEAD 5	< 1 OHMS
		LEAD 4 (CB1)	LEAD 5	< 1 OHMS
		LEAD 6 (CB1)	LEAD 5	< 1 OHMS
		LEAD 41	LEAD 42 (CB4)	< 1 OHMS
		LEAD 41	GROUND	> 500K OHMS
		LEAD 45 (D2)	LEAD 46 (CB9)	< 1 OHMS
		LEAD 45 (D2)	GROUND	> 500K OHMS

Table F.2 – Stator voltage tests

COMPONENT / CIRCUIT TESTED	CONDITION(S)	+ METER LEAD	-METER LEAD	EXPECTED READING
PHASE 1 AC INPUT	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH.	LEAD W1/W6	LEAD W2/W3	65 VAC
PHASE 2 AC INPUT		LEAD W2/W3	LEAD W4 W5	65 VAC
PHASE 3 AC INPUT		LEAD W4/W5	LEAD W1/W6	65 VAC
STATOR AUXILIARY WINDINGS	ENGINE RUNNING. RUN / STOP / IDLE SWITCH SET TO HIGH.	J54 PIN 1 (LEAD 41A)	LEAD 42 (CB4)	42 VAC
		LEAD 3 (CB1)	LEAD 5	120 VAC
		LEAD 4 (CB1)	LEAD 5	218 VAC
		LEAD 6 (CB1)	LEAD 5	120 VAC
		LEAD 45 (D2)	LEAD 46 (CB9)	42 VAC

Figure F.1 – Stator location

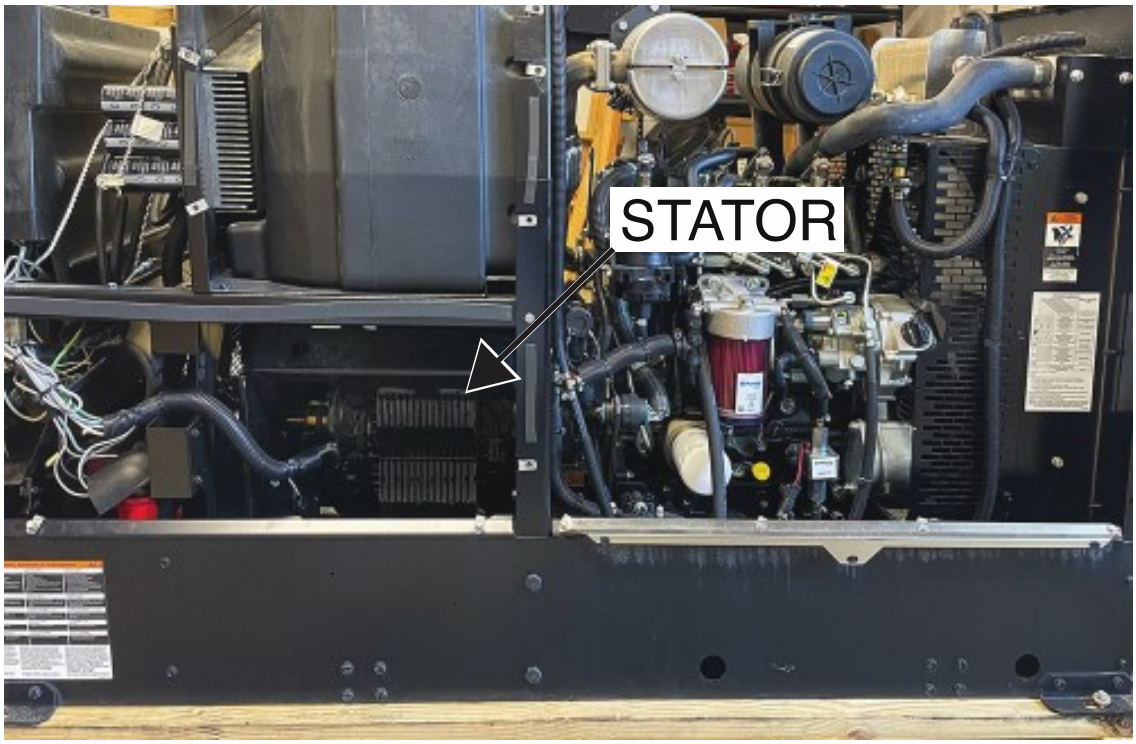


Figure F.2 – Control panel mounting screw locations

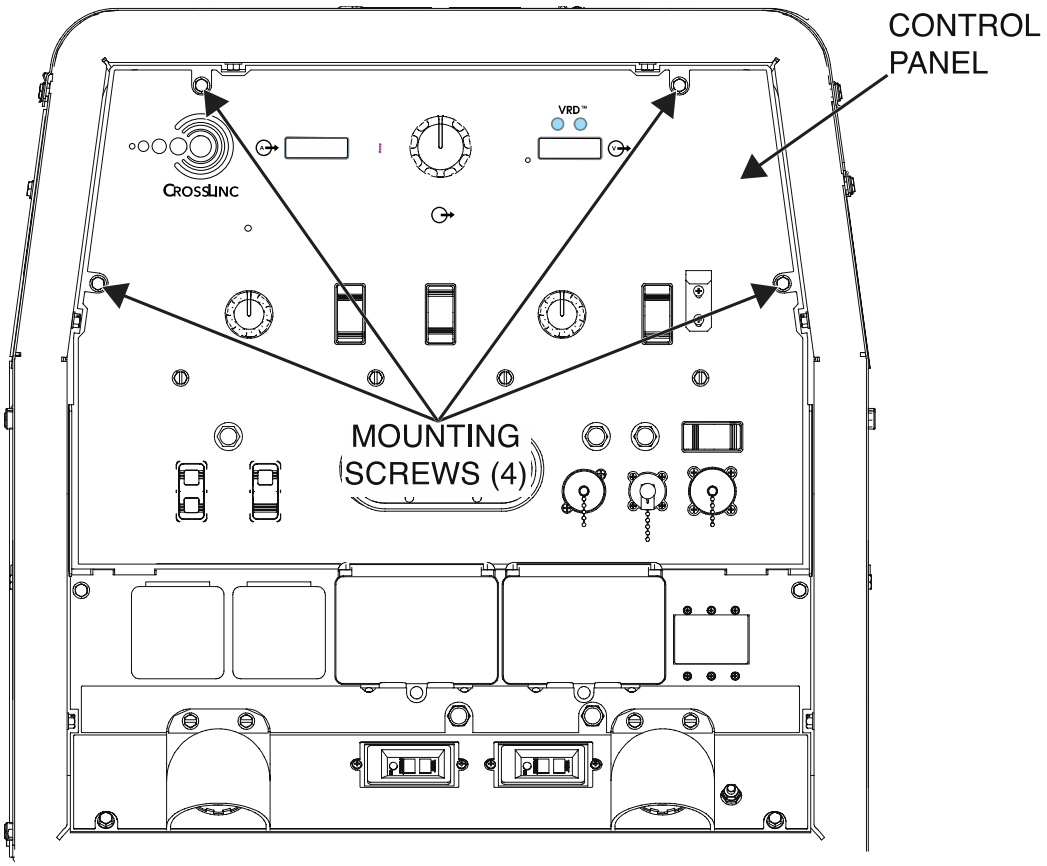


Figure F.3 – Output rectifier lead and terminal locations

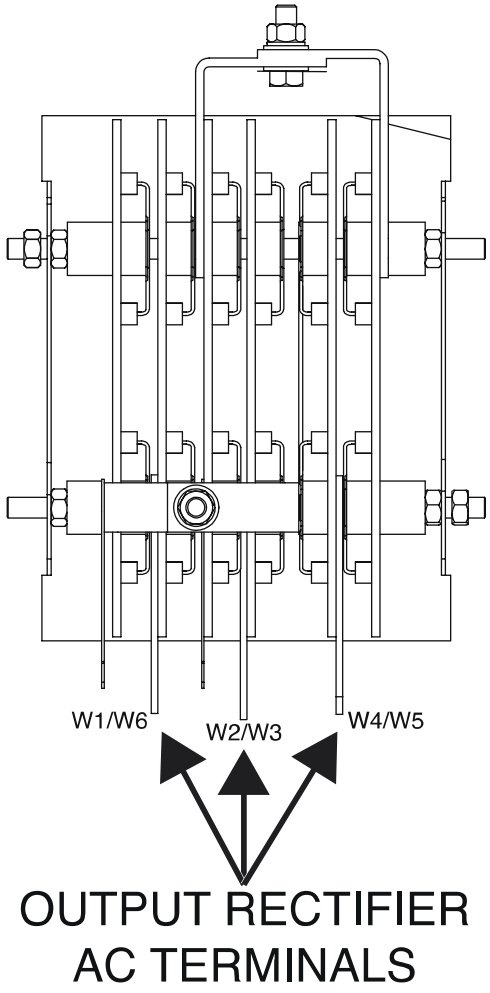


Figure F.4 – Circuit breaker (CB1) lead locations

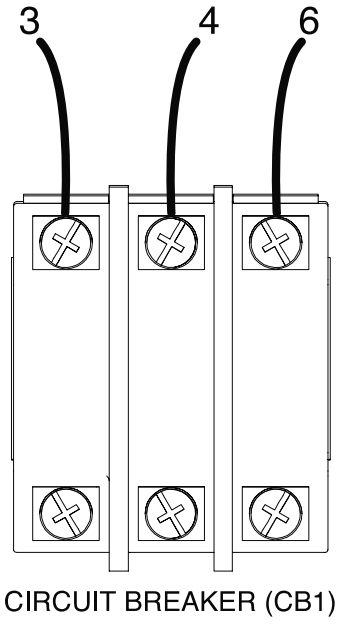


Figure F.5 – Output panel ground stud and lead 5 locations

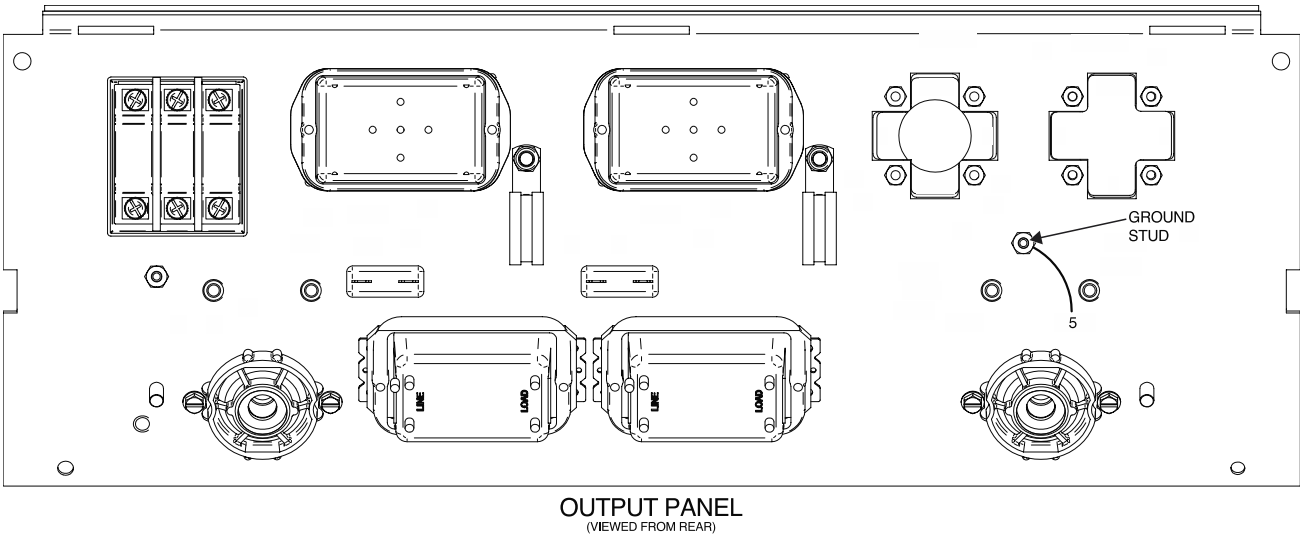
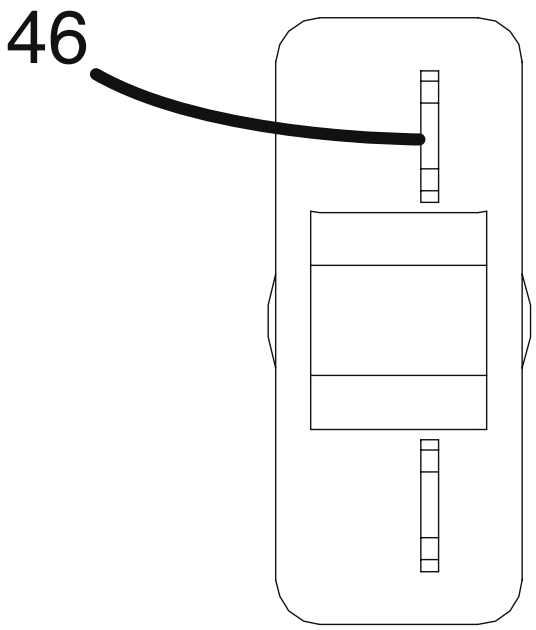


Figure F.6 – Circuit breaker (CB9) lead 46 location



CIRCUIT
BREAKER (CB9)

Figure F.7 – D2 rectifier lead 45 location

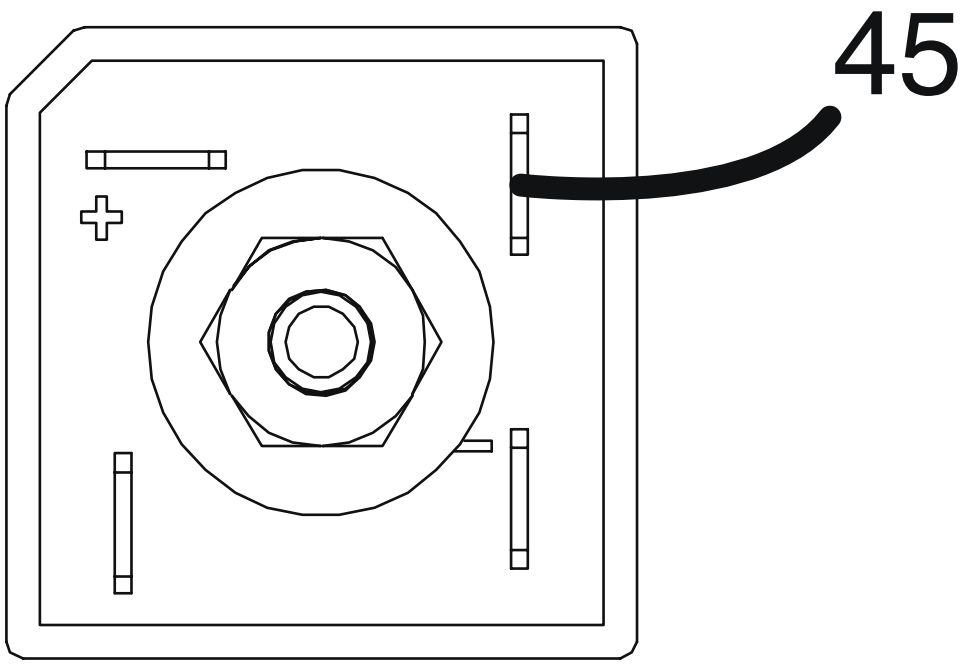
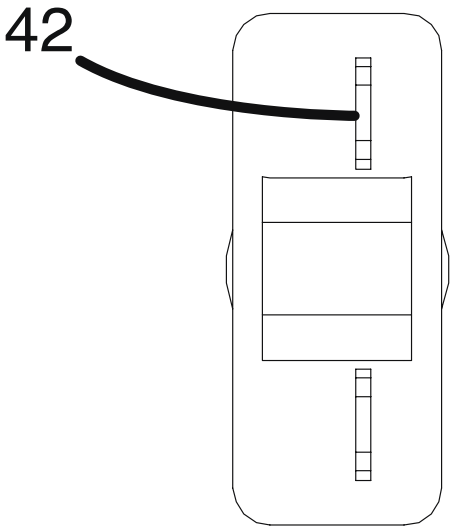


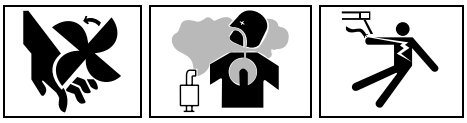
Figure F.8 – Circuit breaker (CB4) lead 42 location



Removal And Replacement Procedures

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

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the rear of the wire feeder voltmeter polarity switch.
6. Carefully remove the shield from the machine.
7. Label and disconnect leads 206A, 206F, 21, 208F, 208A, 256C, and 258 from the wire feeder voltmeter polarity switch. See ***Figure F.2***. See Wiring Diagram.
8. Carefully depress the tabs at the top and bottom of the rear side of the wire feeder voltmeter polarity switch. See ***Figure F.2***.
9. Carefully maneuver the wire feeder voltmeter polarity switch through the front panel of the machine. Retain the switch backing plate for reassembly.
10. The wire feeder voltmeter polarity switch can now be removed and 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, 208F, 208A, 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. Carefully position the shield into the machine.
5. Using a 3/8” nutdriver, attach the four screws 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 locations

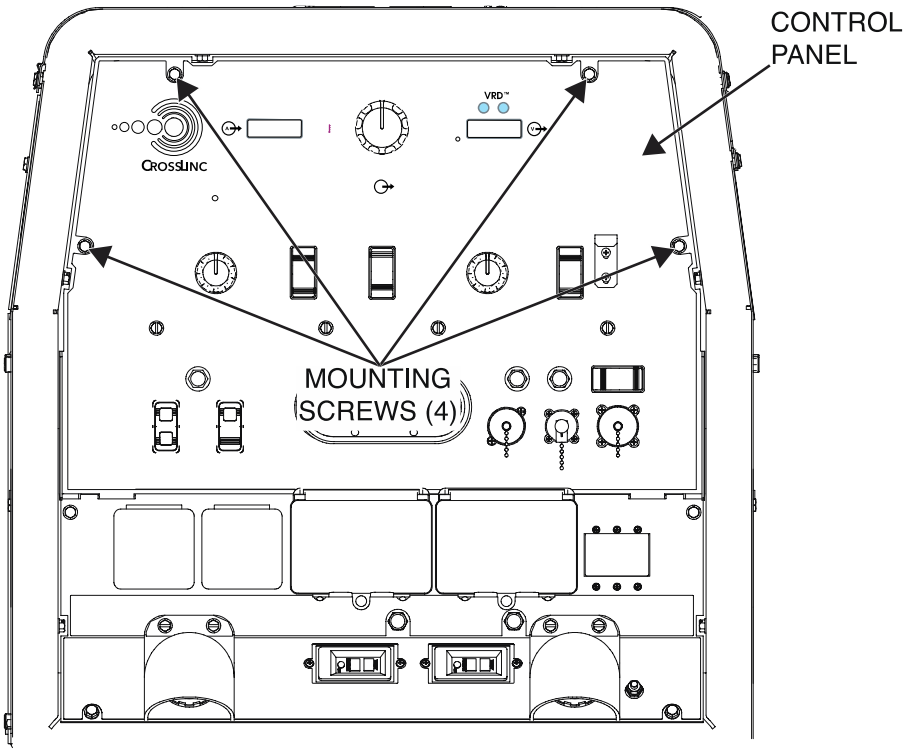
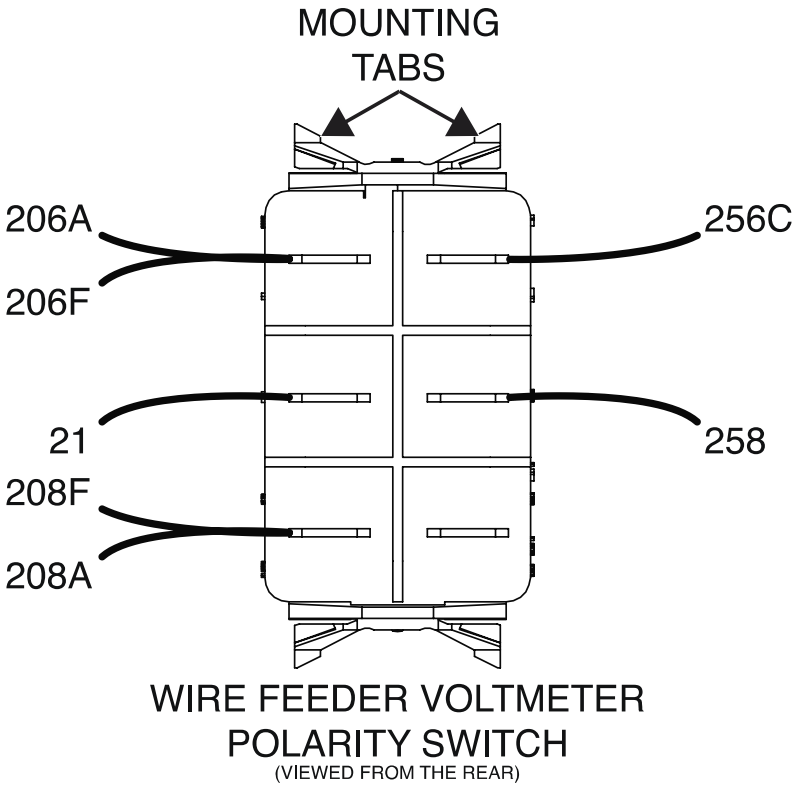
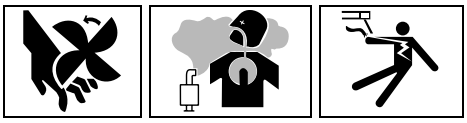


Figure F.2 – Wire feeder voltmeter polarity switch lead and mounting tab locations



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

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the rear of the local remote switch.
6. Carefully remove the shield from the machine.
7. Label and disconnect leads 256B, 256C, and 254 from the local remote switch. See ***Figure F.2***. See Wiring Diagram.
8. Carefully depress the tabs at the top and bottom of the rear side of the local remote switch. See ***Figure F.2***.
9. Carefully maneuver the local remote switch through the front panel of the machine. Retain the switch backing plate for reassembly.
10. The local remote switch can now be removed and 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 256B, 256C, and 254 to the rear of the local remote switch. See Wiring Diagram.
3. Carefully raise the control panel into the upright position.
4. Carefully position the shield into the machine.
5. Using a 3/8” nutdriver, attach the four screws 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 locations

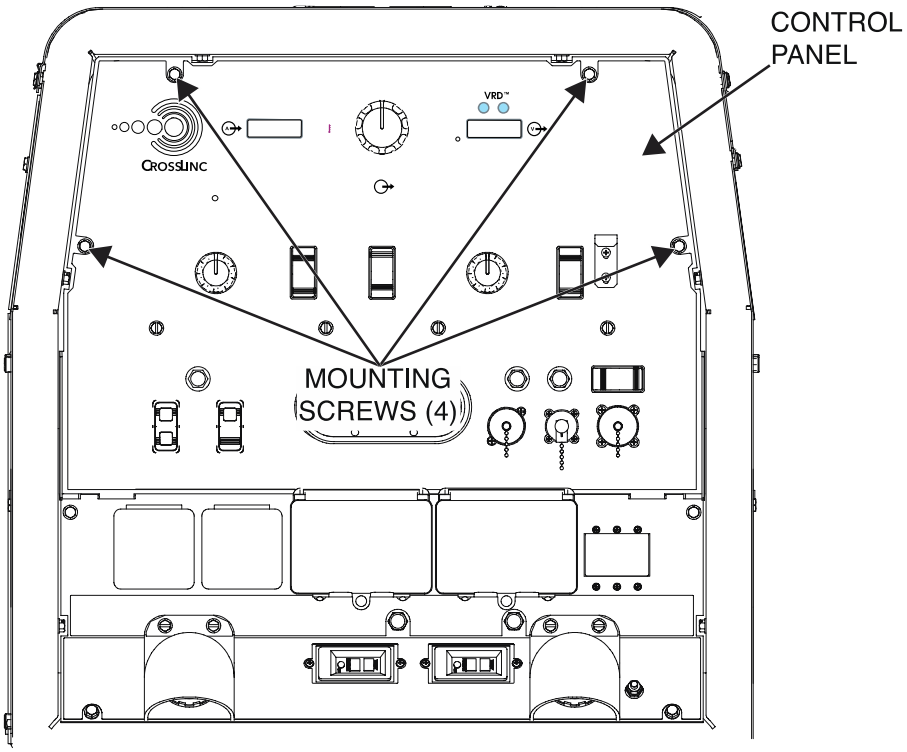
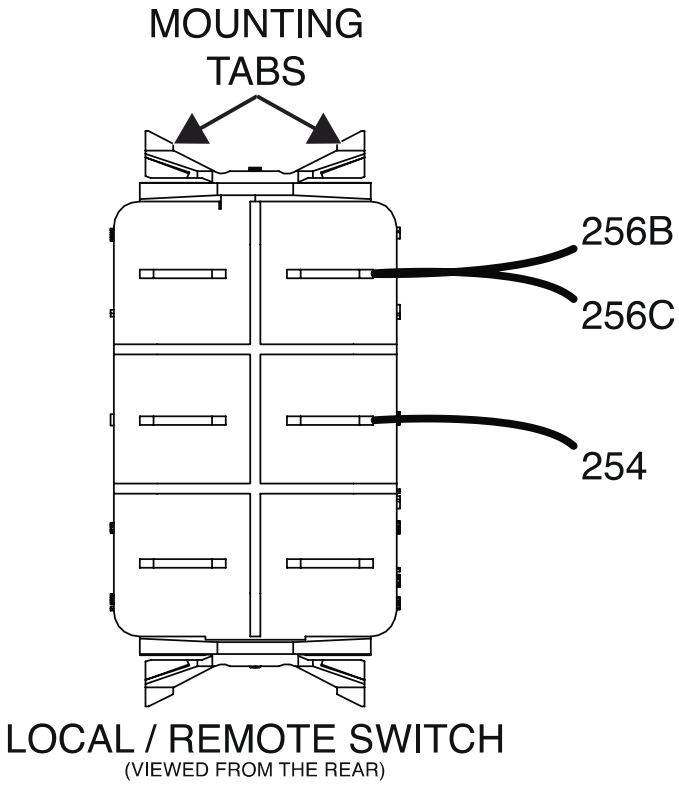
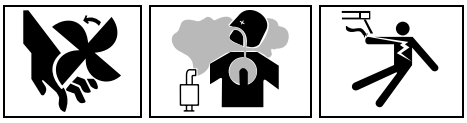


Figure F.2 – Local remote switch lead and mounting tab locations



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

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the rear of the weld terminals on switch.
6. Carefully remove the shield from the machine.
7. Label and disconnect leads 255, 256B, and 256A from the weld terminals on switch. See ***Figure F.2***. See Wiring Diagram.
8. Carefully depress the tabs at the top and bottom of the rear side of the weld terminals on switch. See ***Figure F.2***.
9. Carefully maneuver the weld terminals on switch through the front panel of the machine. Retain the switch backing plate for reassembly.
10. The weld terminals on switch can now be removed and 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 terminals on switch. See Wiring Diagram.
3. Carefully raise the control panel into the upright position.
4. Carefully position the shield into the machine.
5. Using a 3/8” nutdriver, attach the four screws 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 locations

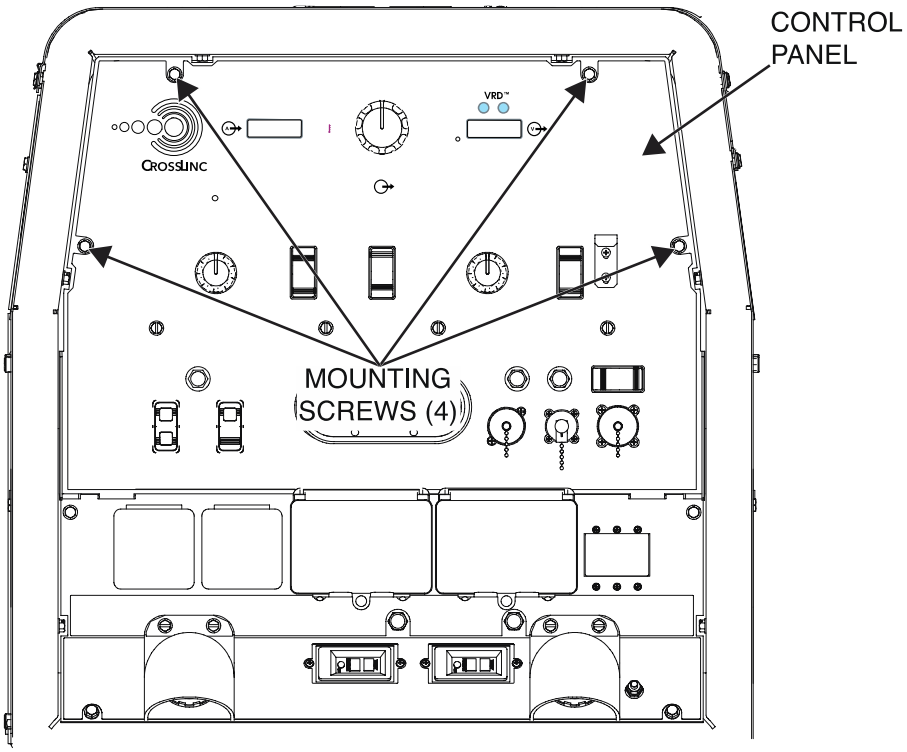
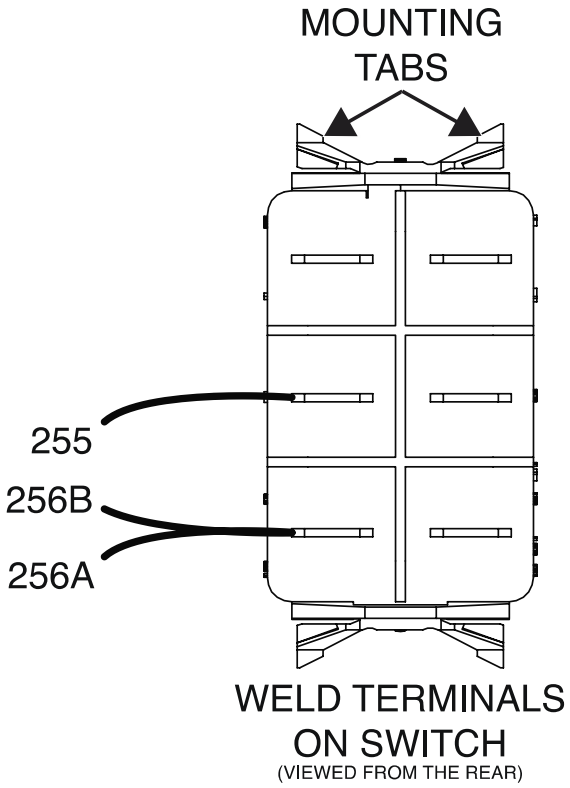
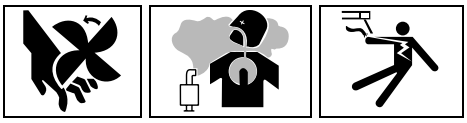


Figure F.2 – Weld terminals on switch lead and mounting tab locations



42V / 120V WIRE FEEDER VOLTMETER 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 Voltmeter Switch.

MATERIALS NEEDED

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the rear of the 42V / 120V wire feeder voltmeter switch.
6. Carefully remove the shield from the machine.
7. Label and disconnect leads 42B, 32, 32A, and 42A from the 42V / 120V wire feeder voltmeter switch. See ***Figure F.2***. See Wiring Diagram.
8. Carefully depress the tabs at the top and bottom of the rear side of the 42V / 120V wire feeder voltmeter switch. See ***Figure F.2***.
9. Carefully maneuver the 42V / 120V wire feeder voltmeter switch through the front panel of the machine. Retain the switch backing plate for reassembly.
10. The 42V / 120V wire feeder voltmeter switch can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new 42V / 120V wire feeder voltmeter switch into the control panel and press firmly to seat the switch into the switch backing plate.
2. Connect leads 42B, 32, 32A, and 42A to the rear of the 42V / 120V wire feeder voltmeter switch. See Wiring Diagram.
3. Carefully raise the control panel into the upright position.
4. Carefully position the shield into the machine.
5. Using a 3/8” nutdriver, attach the four screws 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 locations

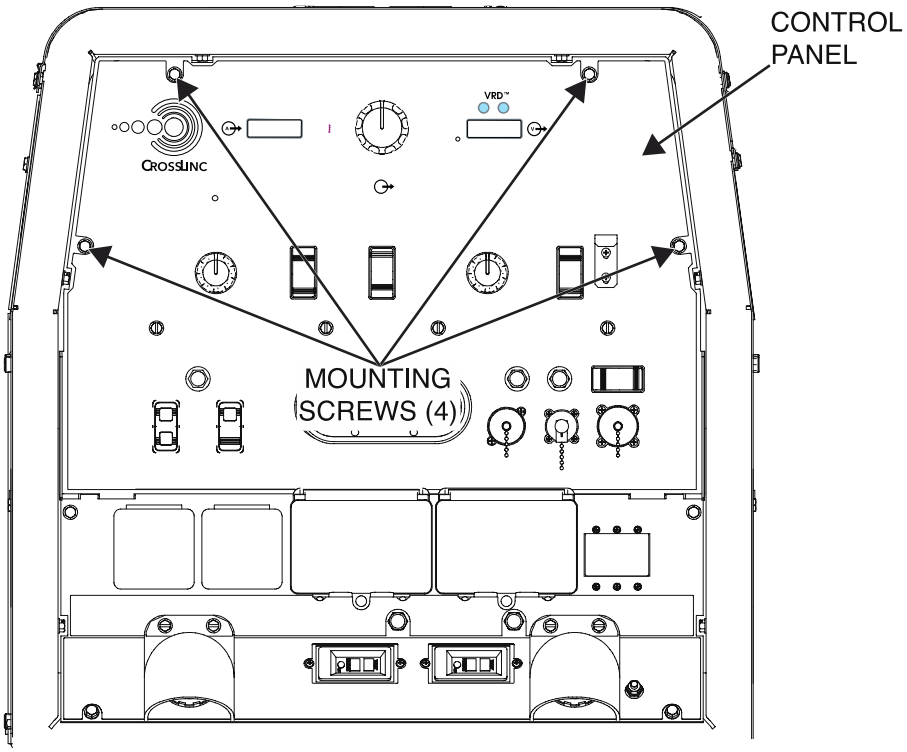
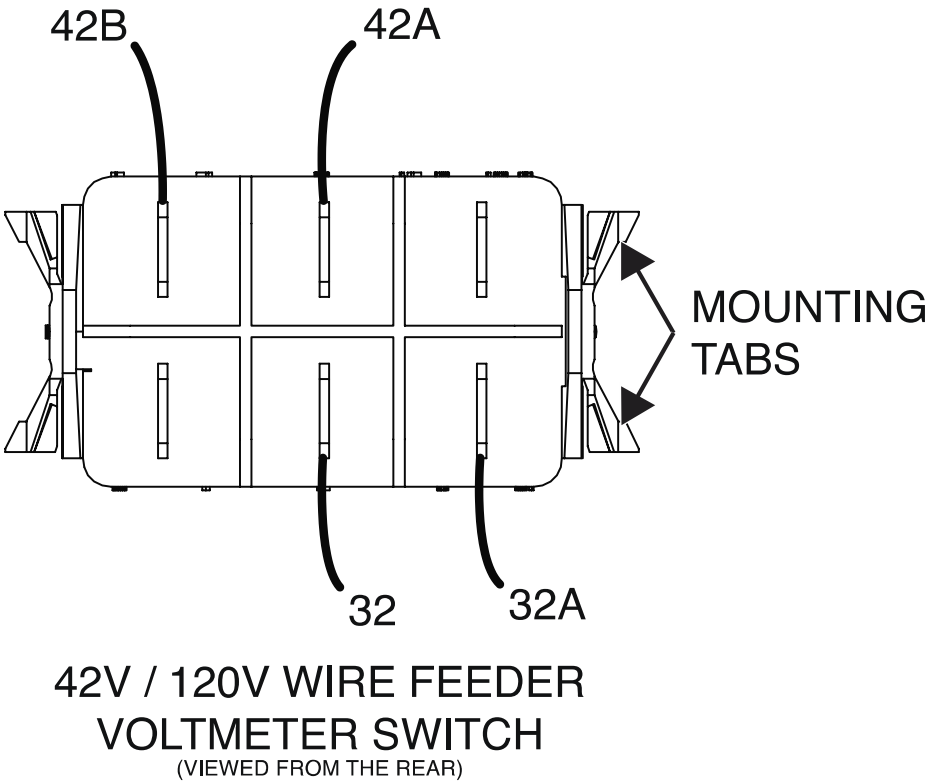
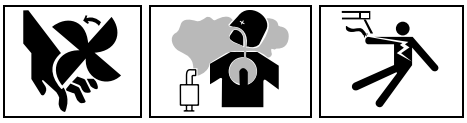


Figure F.2 – 42V / 120V wire feeder voltmeter switch lead and mounting tab locations



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

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the rear of the run / stop / idle switch.
6. Carefully remove the shield from the machine.
7. Label and disconnect leads 232, 232A, 236A, 5S, 256, 256A, and 257 from the run / stop / idle switch. See ***Figure F.2***. See Wiring Diagram.
8. Carefully depress the tabs at the top and bottom of the rear side of the run / stop / idle switch. See ***Figure F.2***.
9. Carefully maneuver the run / stop / idle switch through the front panel of the machine. Retain the switch backing plate for reassembly.
10. The run / stop / idle switch can now be removed and 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, 5S, 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. Carefully position the shield into the machine.
5. Using a 3/8” nutdriver, attach the four screws 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 locations

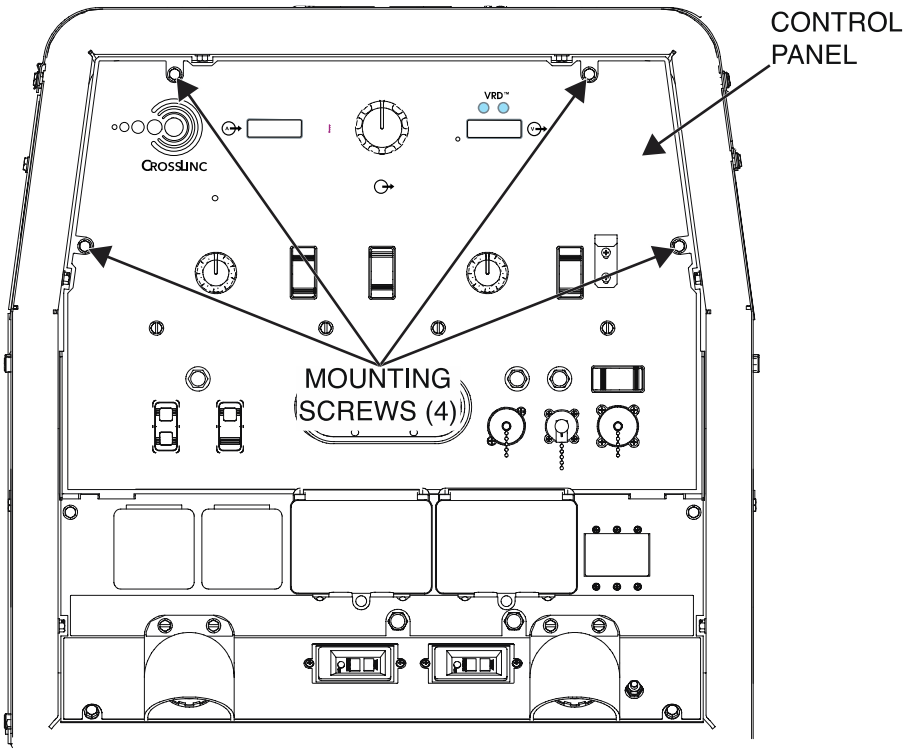
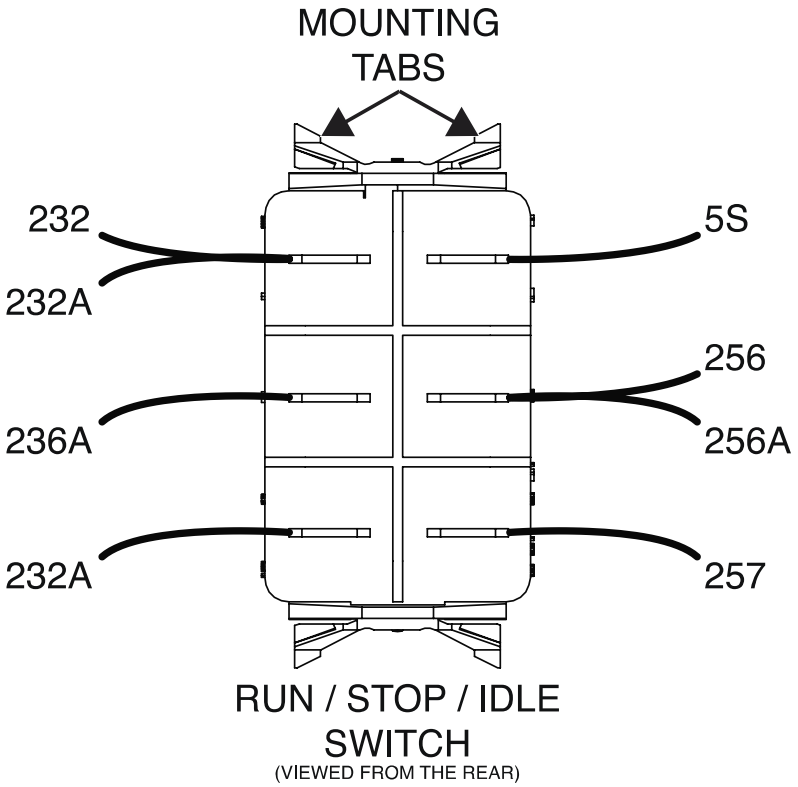
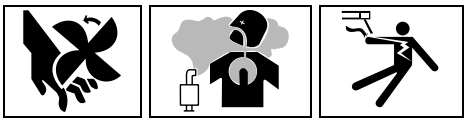


Figure F.2 – Run / stop / idle switch lead and mounting tab locations



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

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the rear of the start / glow plug switch.
6. Carefully remove the shield from the machine.
7. Label and disconnect leads 232NA, 232NB, 414A, 405C, 320A, 232L, 408A, 407A, and 409A from the start / glow plug switch. See ***Figure F.2***. See Wiring Diagram.
8. Carefully depress the tabs at the top and bottom of the rear side of the start / glow plug switch. See ***Figure F.2***.
9. Carefully maneuver the start / glow plug switch through the front panel of the machine. Retain the switch backing plate for reassembly.
10. The start / glow plug switch can now be removed and 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 232NA, 232NB, 414A, 405C, 320A, 232L, 408A, 407A, and 409A to the rear of the start / glow plug switch. See Wiring Diagram.
3. Carefully raise the control panel into the upright position.
4. Carefully position the shield into the machine.
5. Using a 3/8” nutdriver, attach the four screws 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 locations

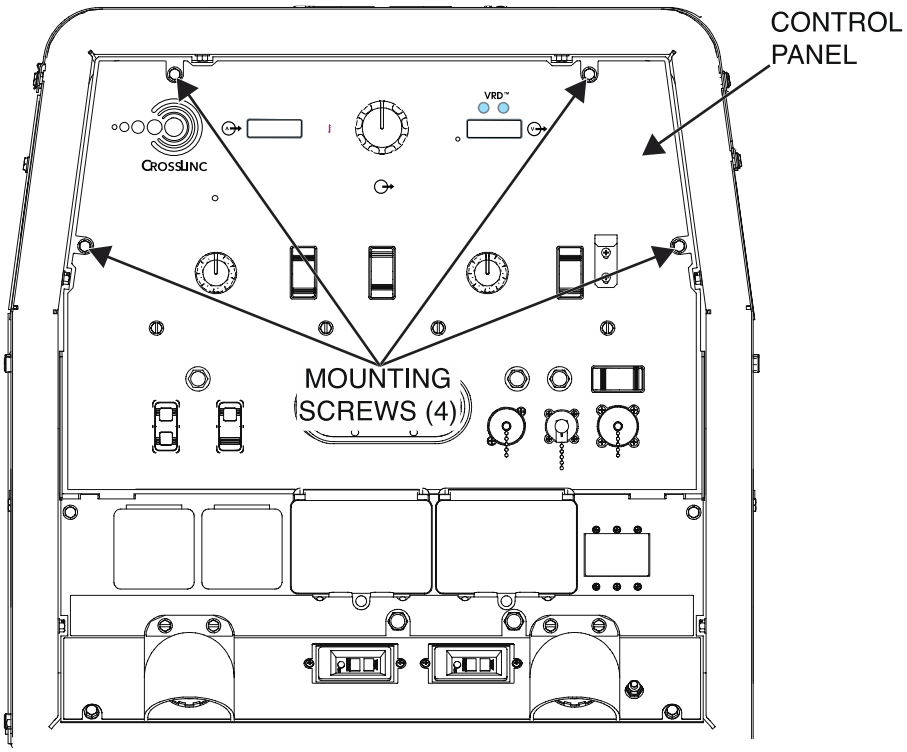
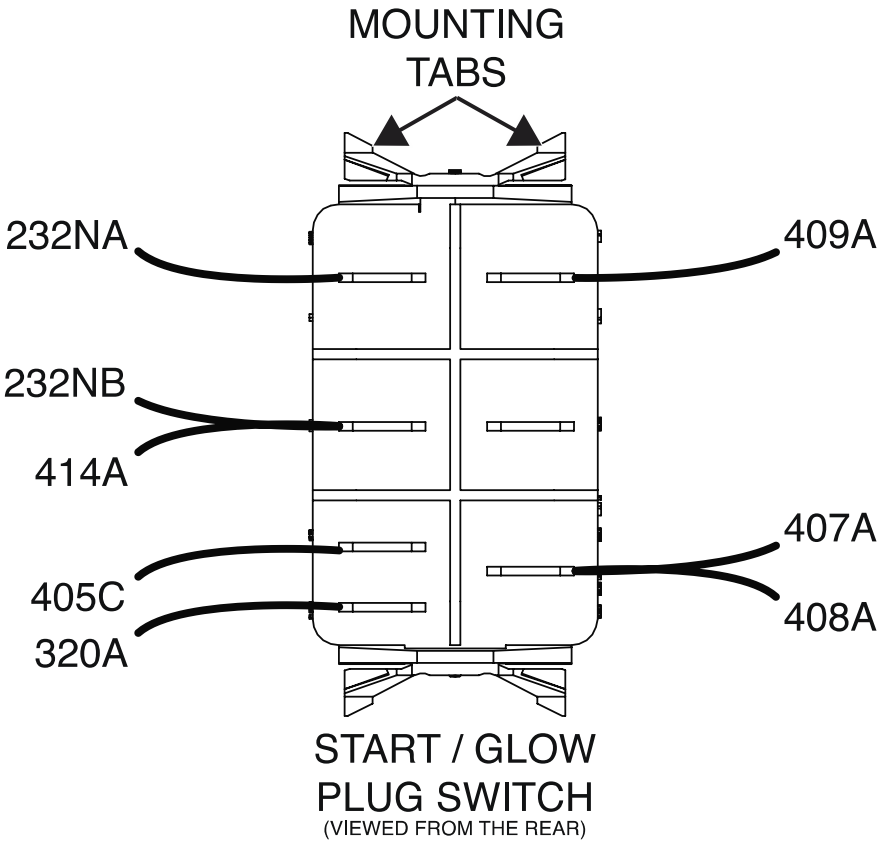
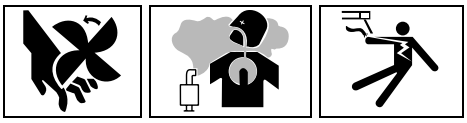


Figure F.2 – Start / glow plug switch lead and mounting tab locations



CIRCUIT BREAKER (CB1) 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 Circuit Breaker (CB1).

MATERIALS NEEDED

Slotted Screwdriver
Phillips Screwdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a slotted screwdriver, loosen the six screws securing leads 3, 4, 6, 3B, 3C, 4A, 6C, and 6D to the circuit breaker (CB1). See ***Figure F.1***. See Wiring Diagram. Label and disconnect the leads.
5. Using a Phillips screwdriver, remove the six screws and lock washers securing the circuit breaker (CB1) to the output panel. See ***Figure F.2***.
6. Carefully slide the circuit breaker (CB1) out of the output panel and separate the circuit breaker cover from the circuit breaker (CB1). Retain circuit breaker cover for replacement.
7. The circuit breaker (CB1) can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new circuit breaker (CB1) into the circuit breaker cover.
2. Carefully slide the circuit breaker (CB1) into the output panel.
3. Using a Phillips screwdriver, attach the six screws and lock washers securing the circuit breaker (CB1) to the output panel.
4. Using a slotted screwdriver, tighten the six screws securing leads 3, 4, 6, 3B, 3C, 4A, 6C, and 6D to the circuit breaker (CB1). See Wiring Diagram.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Circuit breaker (CB1) lead locations

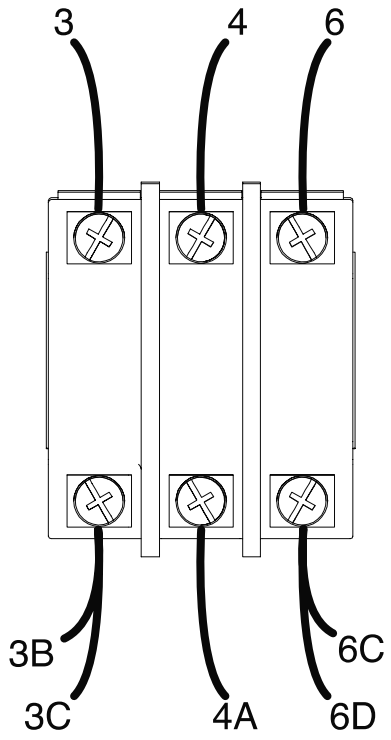
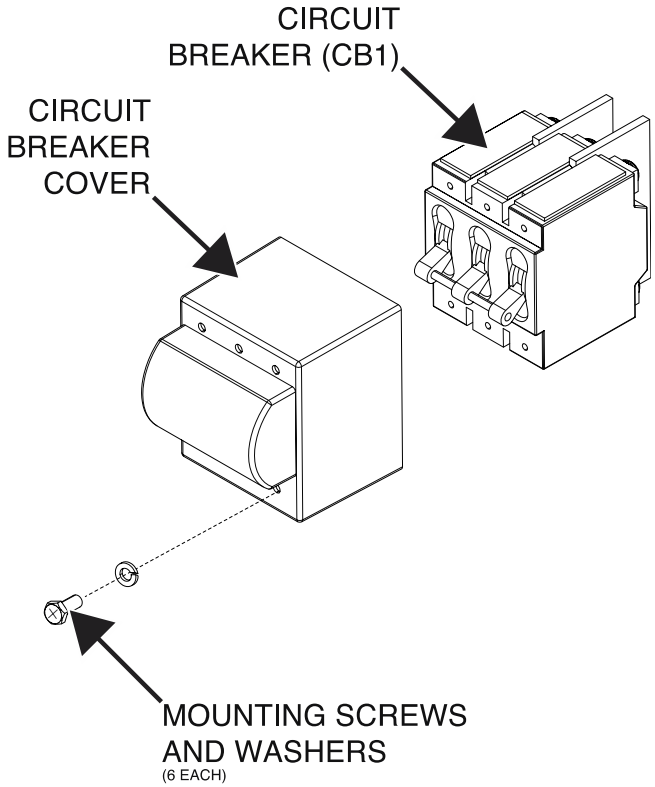
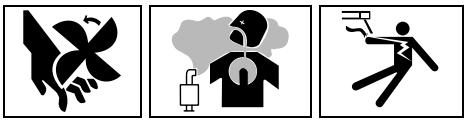


Figure F.2 – Circuit breaker (CB1) mounting hardware locations



CIRCUIT BREAKER (CB2) 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 Circuit Breaker (CB2).

MATERIALS NEEDED

1/2” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect leads 32A, 3E, and 3D from the circuit breaker (CB2). See ***Figure F.1***. See Wiring Diagram.
5. Using a 1/2” nutdriver, remove the sealing boot securing the circuit breaker (CB2) to the output panel. See ***Figure F.2***.
6. The circuit breaker (CB2) can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new circuit breaker (CB2) into the machine.
2. Using a 1/2” nutdriver, attach the sealing boot securing the circuit breaker (CB2) to the output panel.
3. Connect leads 32A, 3E, and 3D to the terminals of the circuit breaker (CB2). See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Circuit breaker (CB2) lead locations

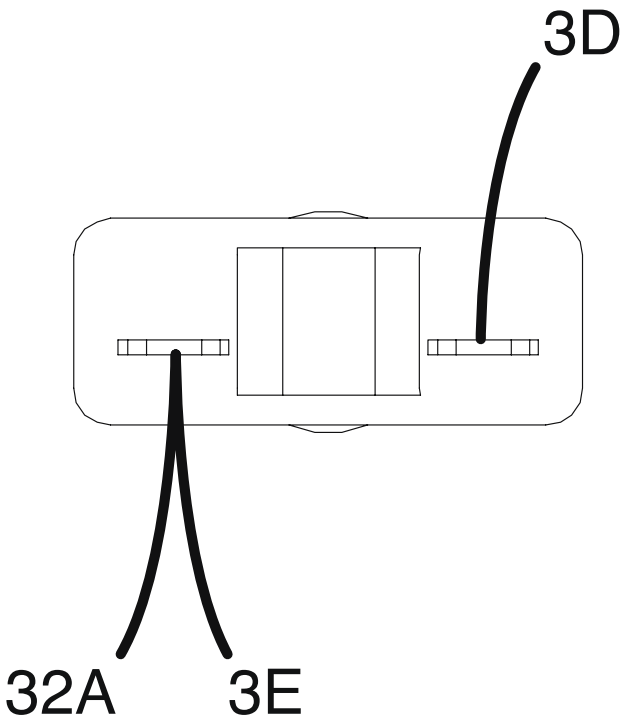
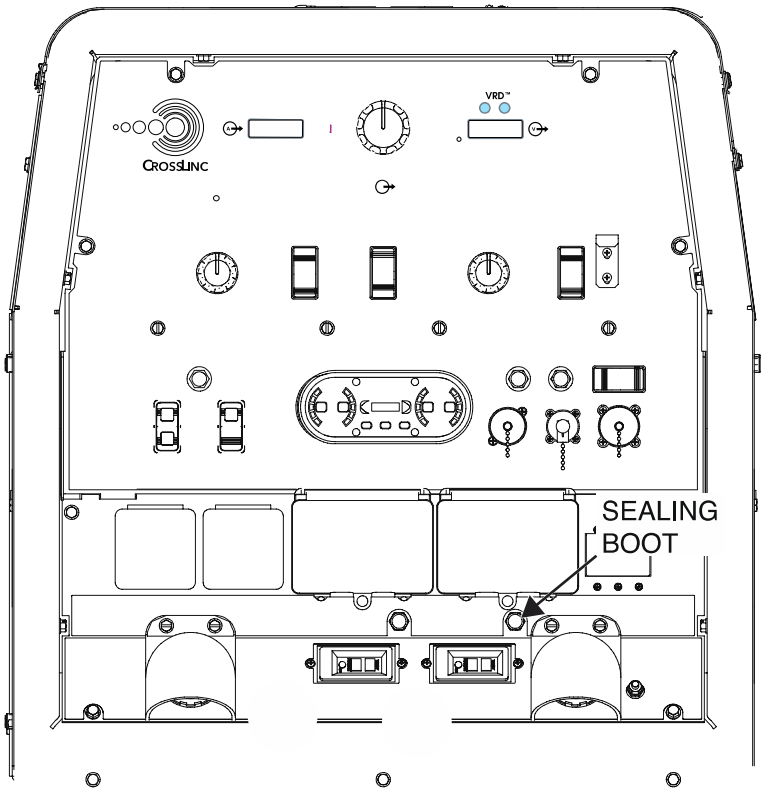
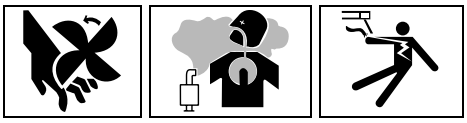


Figure F.2 – Circuit breaker (CB2) sealing boot location



CIRCUIT BREAKER (CB3) 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 Circuit Breaker (CB3).

MATERIALS NEEDED

1/2” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect leads 6F and 6E from the circuit breaker (CB3). See ***Figure F.1***. See Wiring Diagram.
5. Using a 1/2” nutdriver, remove the sealing boot securing the circuit breaker (CB3) to the output panel. See ***Figure F.2***.
6. The circuit breaker (CB3) can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new circuit breaker (CB3) into the machine.
2. Using a 1/2” nutdriver, attach the sealing boot securing the circuit breaker (CB3) to the output panel.
3. Connect leads 6F and 6E to the circuit breaker (CB3). See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Circuit breaker (CB3) lead locations

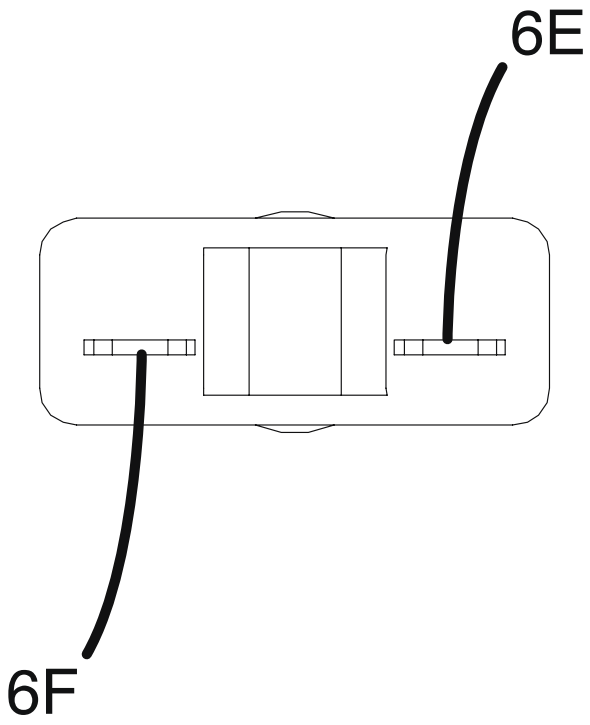
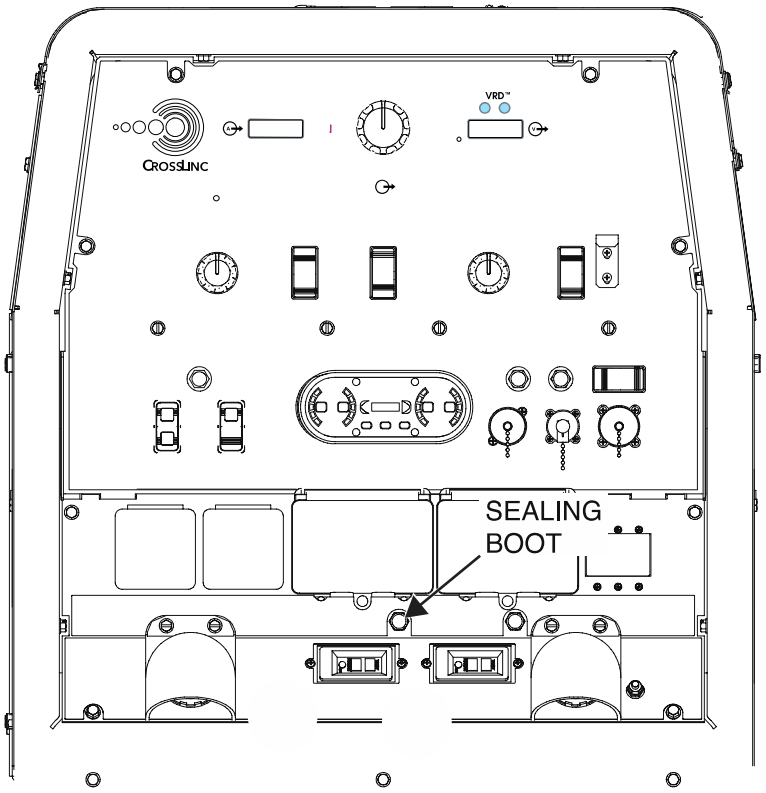
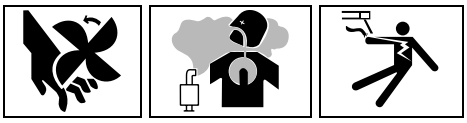


Figure F.2 – Circuit breaker (CB3) sealing boot location



CIRCUIT BREAKER (CB4) 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 Circuit Breaker (CB4).

MATERIALS NEEDED

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

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the rear of circuit breaker (CB4).
6. Carefully remove the shield from the machine.
7. Label and disconnect leads 42 and 42B from the circuit breaker (CB4). See ***Figure F.2***. See Wiring Diagram.
8. Using a 5/8” nutdriver, remove the sealing boot securing the circuit breaker (CB4) to the control panel. See ***Figure F.3***.
9. The circuit breaker (CB4) can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new circuit breaker (CB4) into the control panel.
2. Using a 5/8” nutdriver, attach the sealing boot securing the circuit breaker (CB4) to the control panel.
3. Connect leads 42 and 42B to the circuit breaker (CB4). See Wiring Diagram.
4. Carefully raise the control panel into the upright position.
5. Carefully position the shield into the machine.
6. Using a 3/8” nutdriver, attach the four screws 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 locations

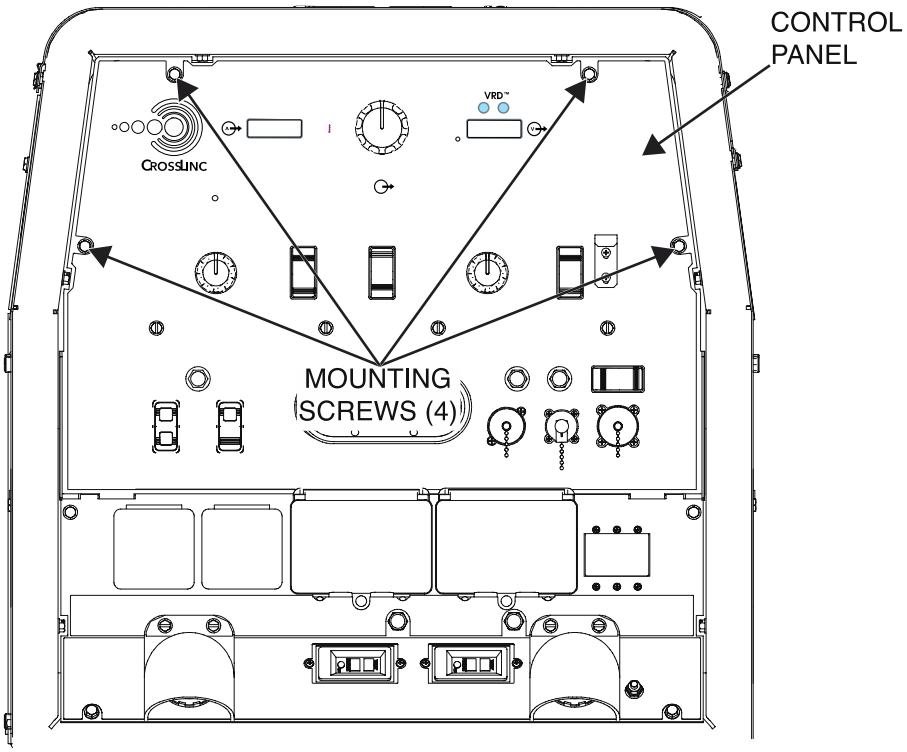


Figure F.2 – Circuit breaker (CB4) lead locations

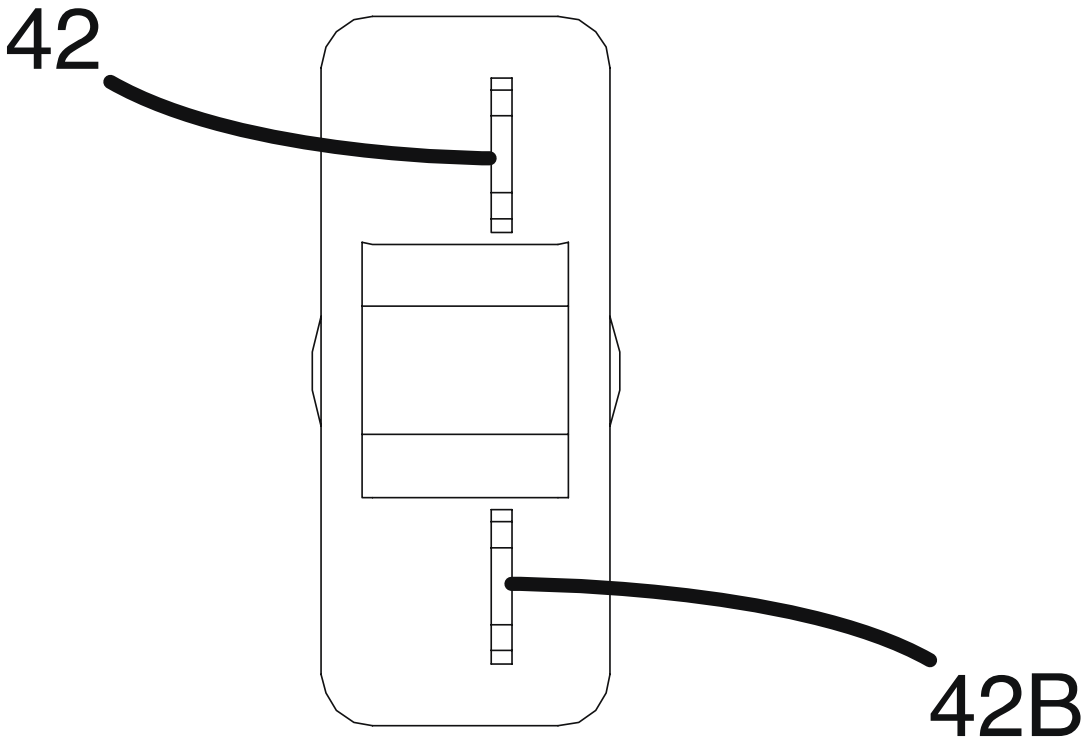
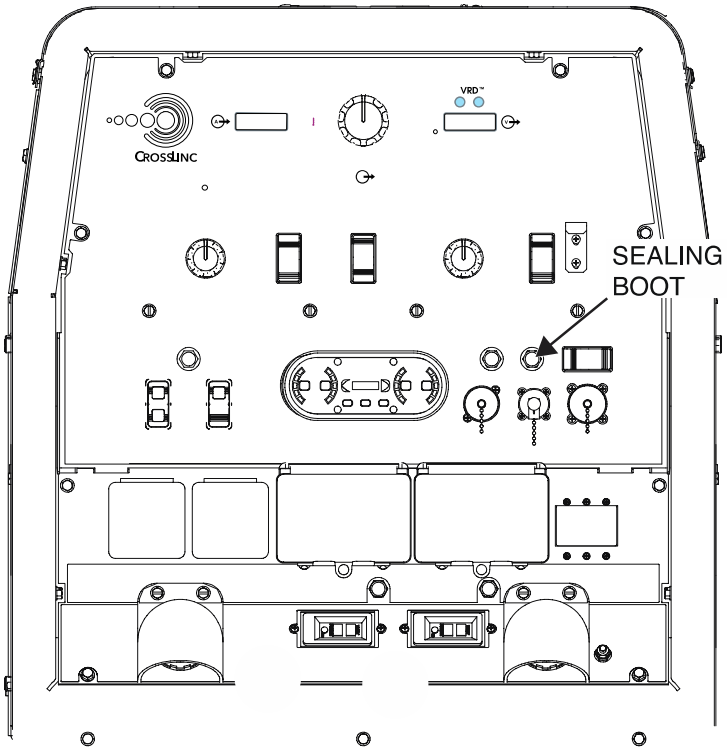
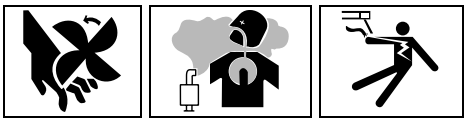


Figure F.3 – Circuit breaker (CB4) sealing boot location



CIRCUIT BREAKER (CB5) 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 Circuit Breaker (CB5).

MATERIALS NEEDED

Phillips Screwdriver
5/8” Nutdriver
Wiring Diagram

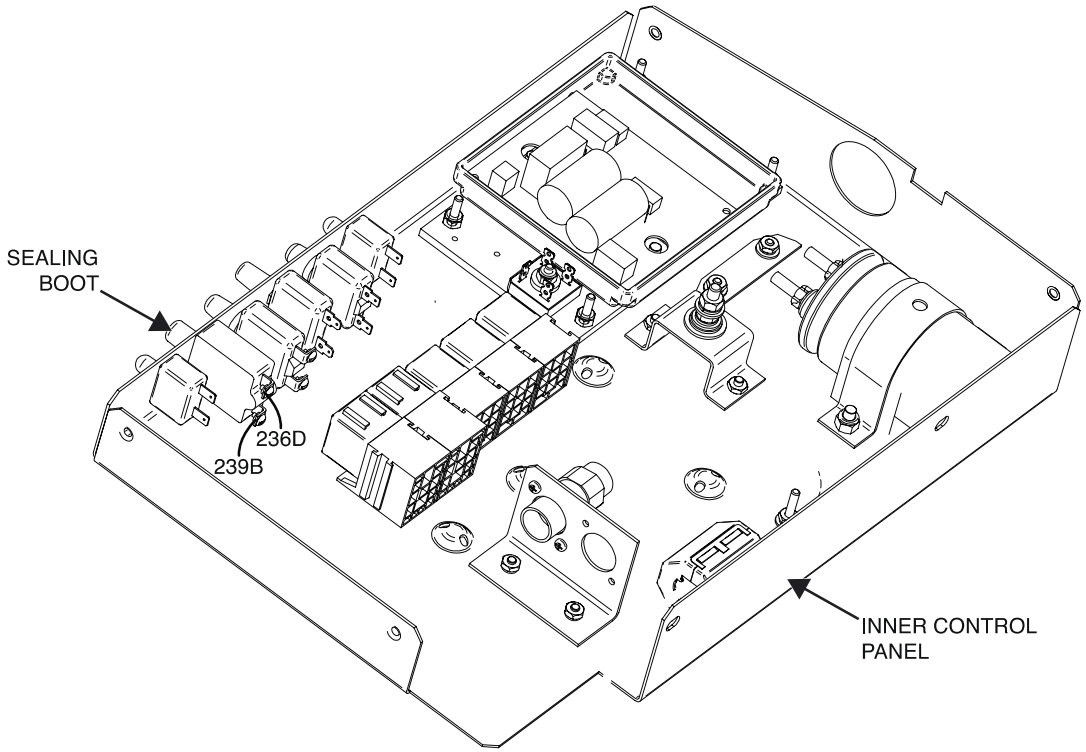
REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a Phillips screwdriver, remove the two screws and two lock washers securing leads 236D and 239B to circuit breaker (CB5). See ***Figure F.1***. See Wiring Diagram. Label and disconnect leads.
5. Using a 5/8” nutdriver, remove the sealing boot securing the circuit breaker (CB5) to the inner control panel. See ***Figure F.1***.
6. The circuit breaker (CB5) can now be removed and replaced.

REPLACEMENT PROCEDURE

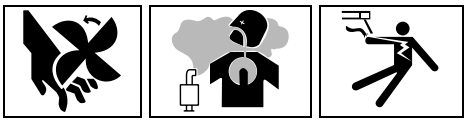
1. Carefully position the new circuit breaker (CB5) into the inner control panel.
2. Using a 5/8” nutdriver, attach the sealing boot securing the circuit breaker (CB5) to the inner control panel.
3. Using a Phillips screwdriver, attach the two screws and two lock washers securing leads 236D and 239B to circuit breaker (CB5). See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Circuit breaker (CB5) lead and sealing boot locations



CIRCUIT BREAKER (CB6) 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 Circuit Breaker (CB6).

MATERIALS NEEDED

5/8” Nutdriver
Wiring Diagram

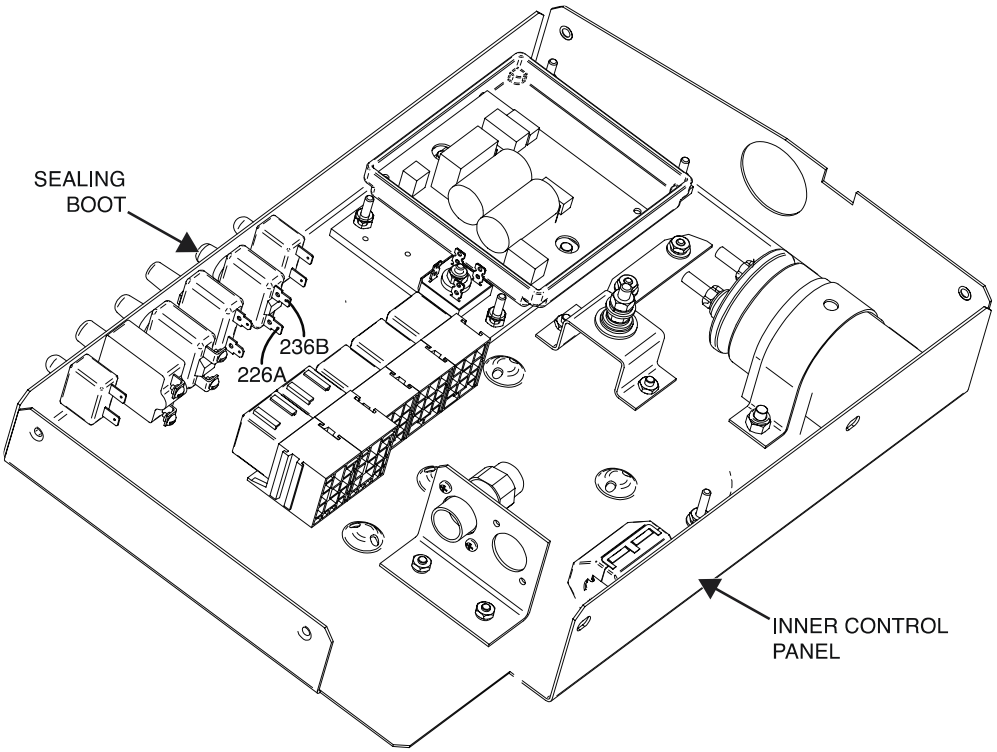
REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect leads 236B and 226A from the circuit breaker (CB6). See ***Figure F.1***. See Wiring Diagram.
5. Using a 5/8” nutdriver, remove the sealing boot securing the circuit breaker (CB6) to the inner control panel. See ***Figure F.1***.
6. The circuit breaker (CB6) can now be removed and replaced.

REPLACEMENT PROCEDURE

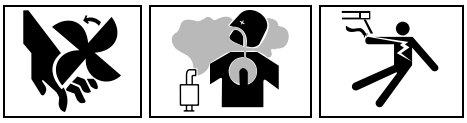
1. Carefully position the new circuit breaker (CB6) to the inner control panel.
2. Using a 5/8” nutdriver, attach the sealing boot securing the circuit breaker (CB6) to the inner control panel.
3. Connect leads 236B and 226A to the circuit breaker (CB6). See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Circuit breaker (CB6) lead and sealing boot locations



CIRCUIT BREAKER (CB7) 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 Circuit Breaker (CB7).

MATERIALS NEEDED

1/2” Nutdriver
Wiring Diagram

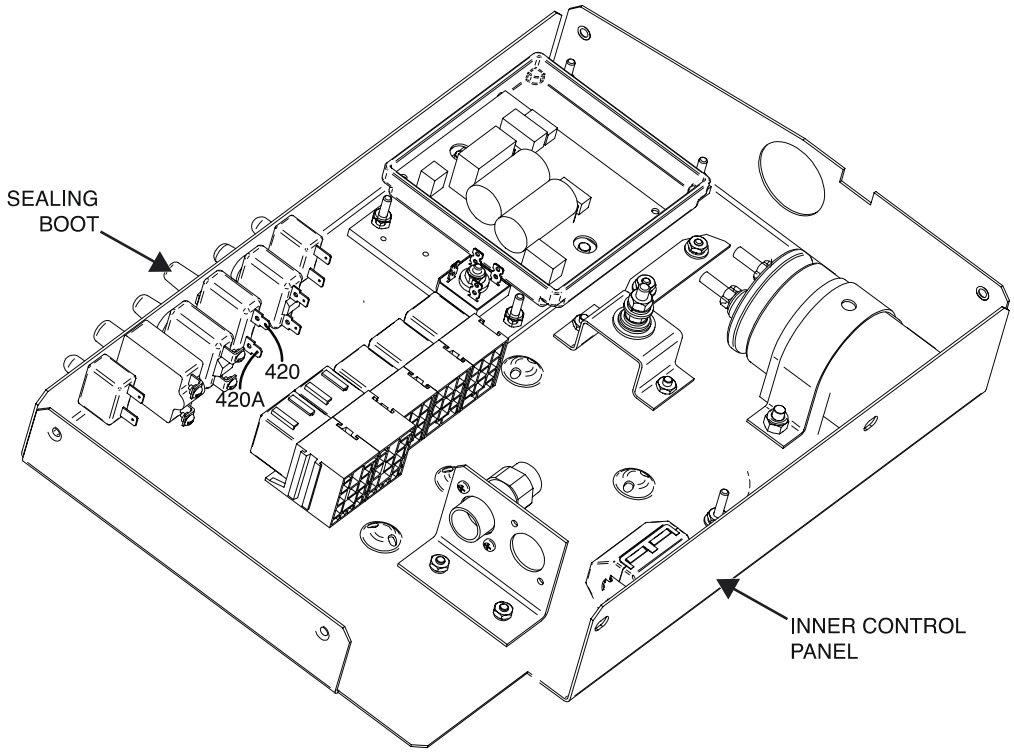
REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect leads 420 and 420A from the circuit breaker (CB7). See ***Figure F.1***. See Wiring Diagram.
5. Using a 1/2” nutdriver, remove the sealing boot securing the circuit breaker (CB7) to the inner control panel. See ***Figure F.1***.
6. The circuit breaker (CB7) can now be removed and replaced.

REPLACEMENT PROCEDURE

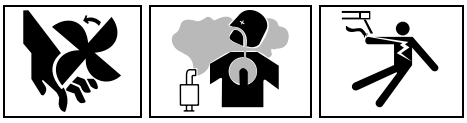
1. Carefully position the new circuit breaker (CB7) to the inner control panel.
2. Using a 1/2” nutdriver, attach the sealing boot securing the circuit breaker (CB7) to the inner control panel.
3. Connect leads 420 and 420A to the circuit breaker (CB7). See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Circuit breaker (CB7) lead and sealing boot locations



CIRCUIT BREAKER (CB8) 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 Circuit Breaker (CB8).

MATERIALS NEEDED

Phillips Screwdriver
5/8” Nutdriver
Wiring Diagram

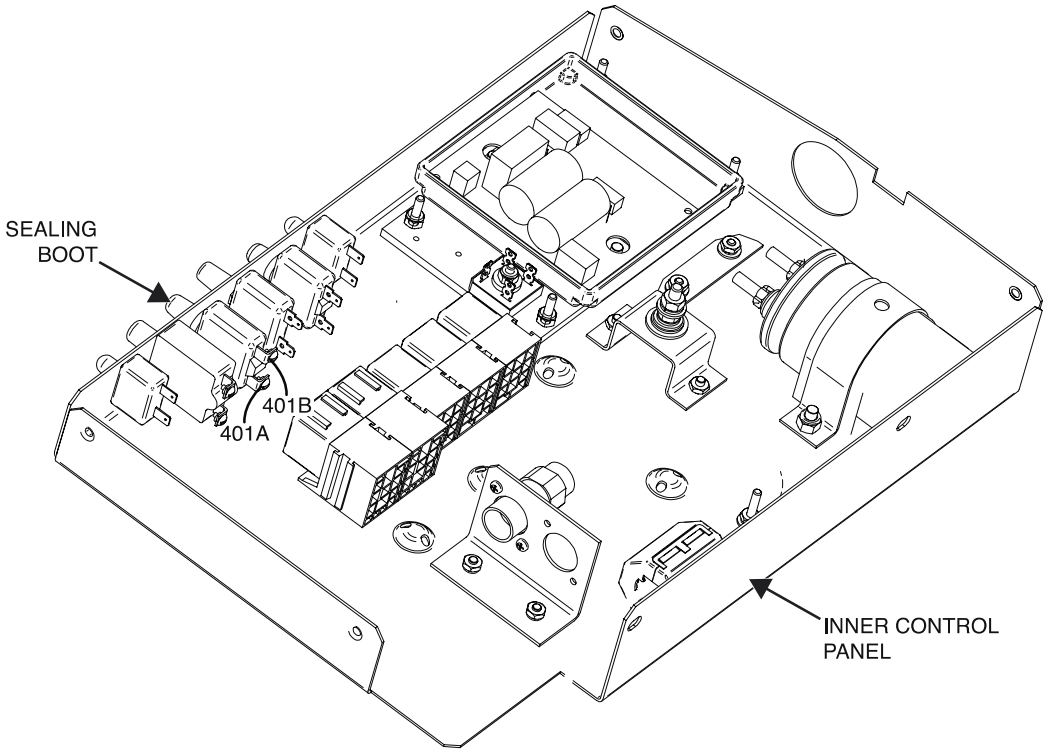
REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a Phillips screwdriver, remove the two screws and two lock washers securing leads 401A and 401B to circuit breaker (CB8). See ***Figure F.1***. See Wiring Diagram.
5. Using a 5/8” nutdriver, remove the sealing boot securing the circuit breaker (CB8) to the inner control panel. See ***Figure F.1***.
6. The circuit breaker (CB8) can now be removed and replaced.

REPLACEMENT PROCEDURE

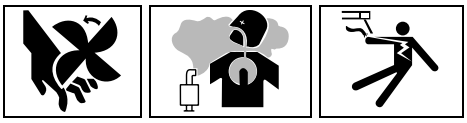
1. Carefully position the new circuit breaker (CB8) to the inner control panel.
2. Using a 5/8” nutdriver, attach the sealing boot securing the circuit breaker (CB8) to the inner control panel.
3. Connect leads 401A and 401B to the terminals of the circuit breaker (CB8). See Wiring Diagram.
4. Using a Phillips screwdriver, attach the two screws and two lock washers securing leads 401A and 401B to circuit breaker (CB8). See Wiring Diagram.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Circuit breaker (CB8) lead and sealing boot locations



CIRCUIT BREAKER (CB9) 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 Circuit Breaker (CB9).

MATERIALS NEEDED

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

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the rear of circuit breaker (CB9).
6. Carefully remove the shield from the machine.
7. Label and disconnect leads 46 and 46A from the circuit breaker (CB9). See ***Figure F.2***. See Wiring Diagram.
8. Using a 5/8” nutdriver, remove the sealing boot securing the circuit breaker (CB9) to the control panel. See ***Figure F.3***.
9. The circuit breaker (CB9) can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new circuit breaker (CB9) into the control panel.
2. Using a 5/8” nutdriver, attach the sealing boot securing the circuit breaker (CB9) to the control panel.
3. Connect leads 46 and 46A to the circuit breaker (CB9). See Wiring Diagram.
4. Carefully raise the control panel into the upright position.
5. Carefully position the shield into the machine.
6. Using a 3/8” nutdriver, attach the four screws 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 locations

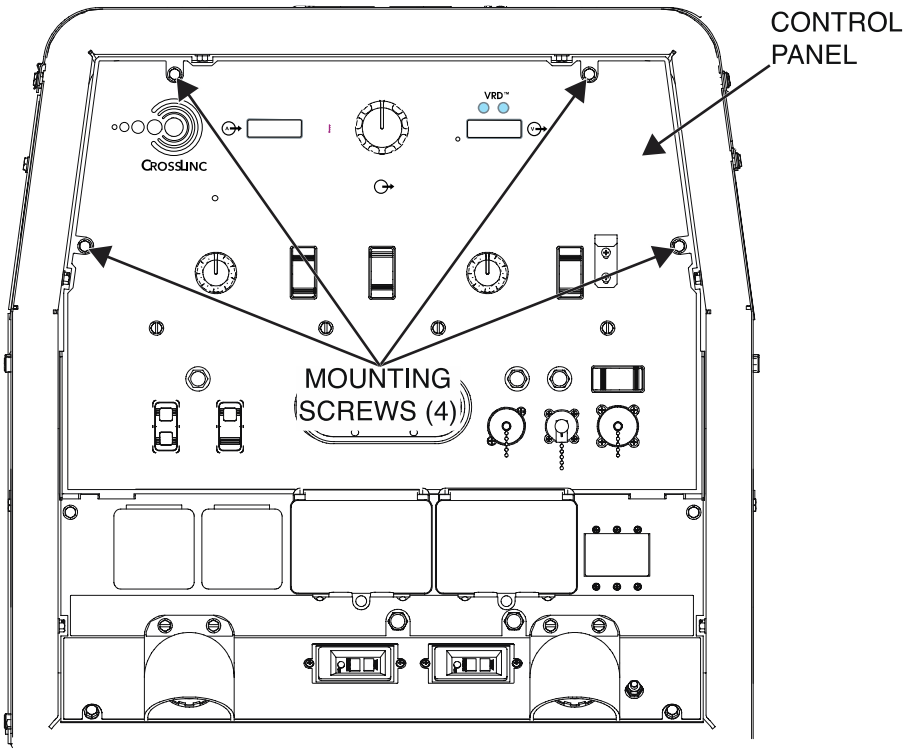


Figure F.2 – Circuit breaker (CB9) lead locations

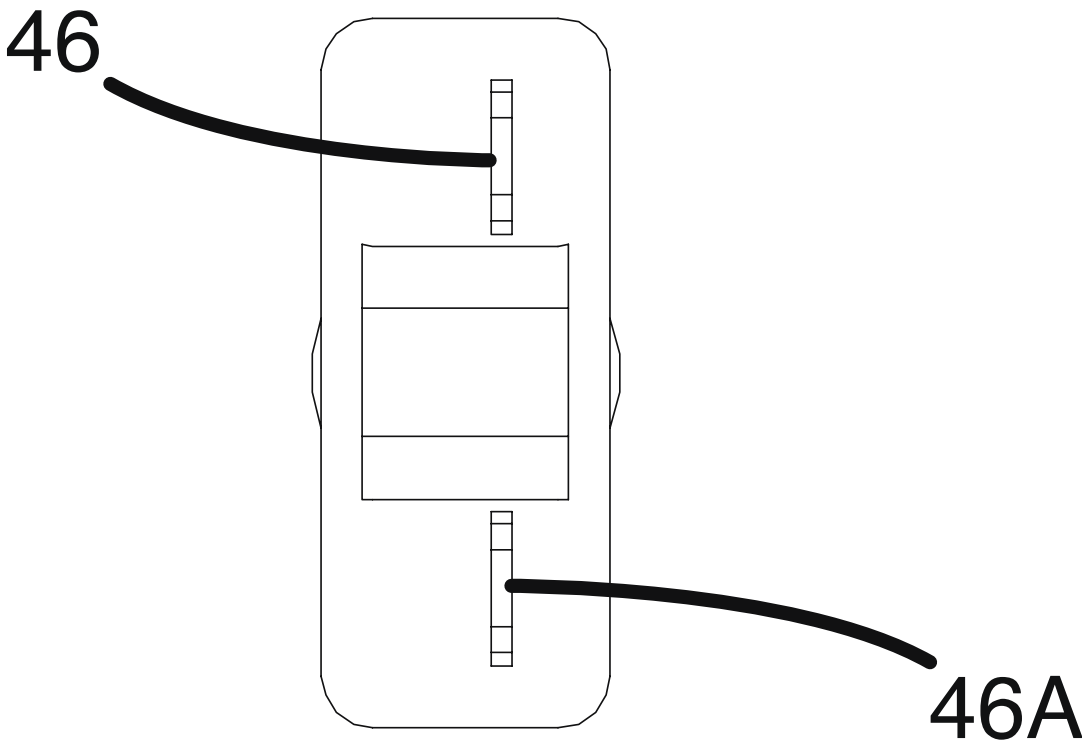
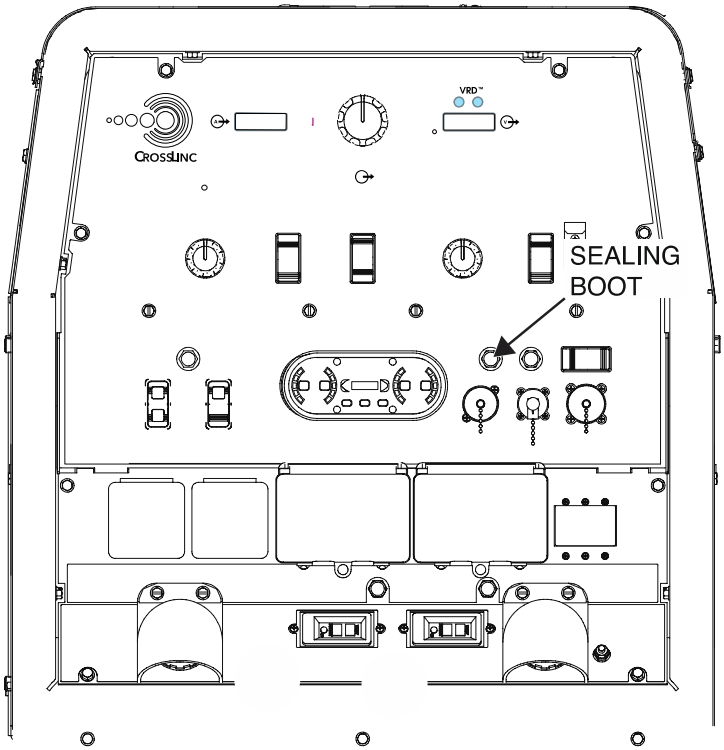
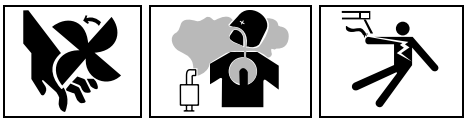


Figure F.3 – Circuit breaker (CB9) sealing boot location



CIRCUIT BREAKER (CB10) 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 Circuit Breaker (CB10).

MATERIALS NEEDED

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

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the rear of circuit breaker (CB10).
6. Carefully remove the shield from the machine.
7. Label and disconnect leads 238A and 236A from the circuit breaker (CB10). See ***Figure F.2***. See Wiring Diagram.
8. Using a 5/8” nutdriver, remove the sealing boot securing the circuit breaker (CB10) to the control panel. See ***Figure F.3***.
9. The circuit breaker (CB10) can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new circuit breaker (CB10) into the control panel.
2. Using a 5/8” nutdriver, attach the sealing boot securing the circuit breaker (CB10) to the control panel.
3. Connect leads 238A and 236A to the circuit breaker (CB10). See Wiring Diagram.
4. Carefully raise the control panel into the upright position.
5. Carefully position the shield into the machine.
6. Using a 3/8” nutdriver, attach the four screws 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 locations

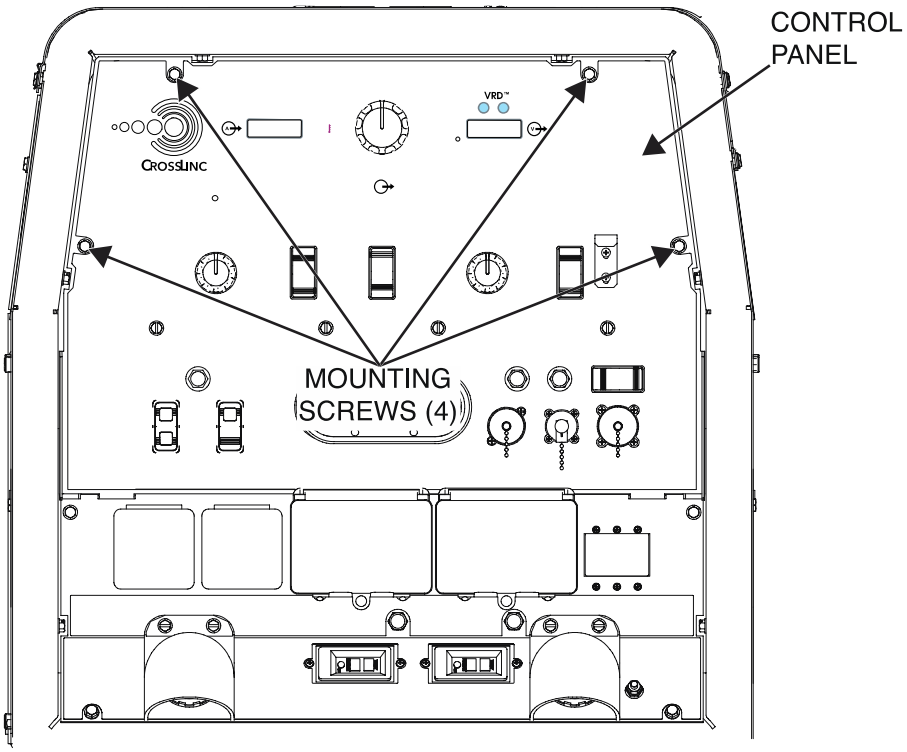


Figure F.2 – Circuit breaker (CB10) lead locations

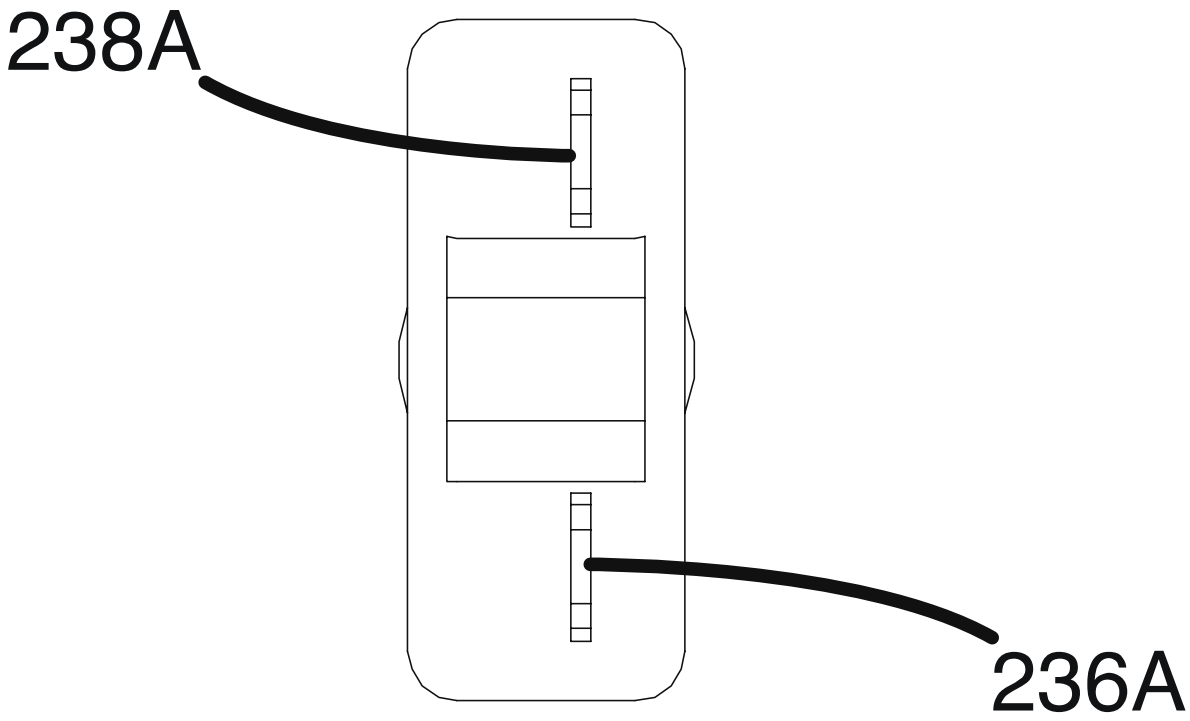
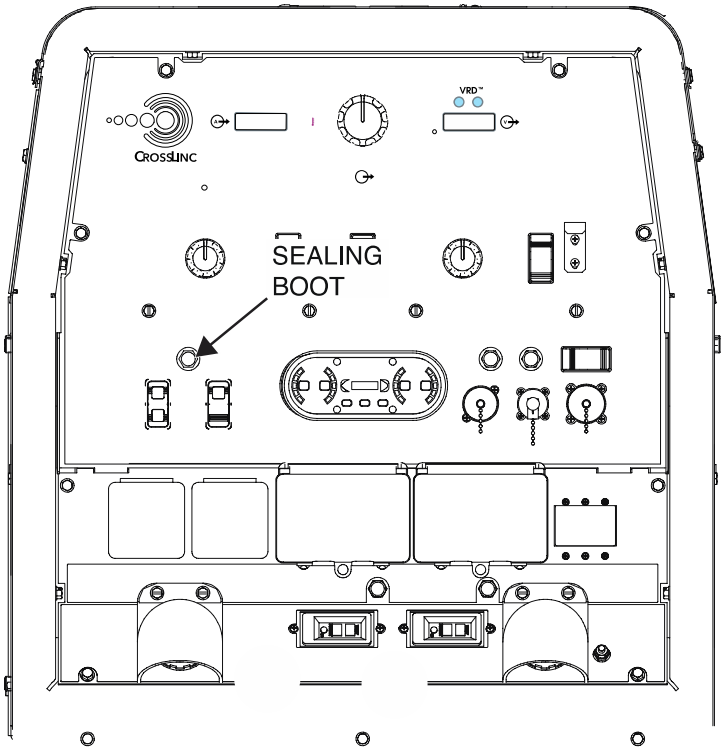
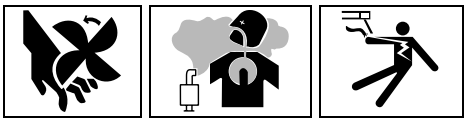


Figure F.3 – Circuit breaker (CB10) sealing boot location



CIRCUIT BREAKER (CB11) 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 Circuit Breaker (CB11).

MATERIALS NEEDED

Wiring Diagram

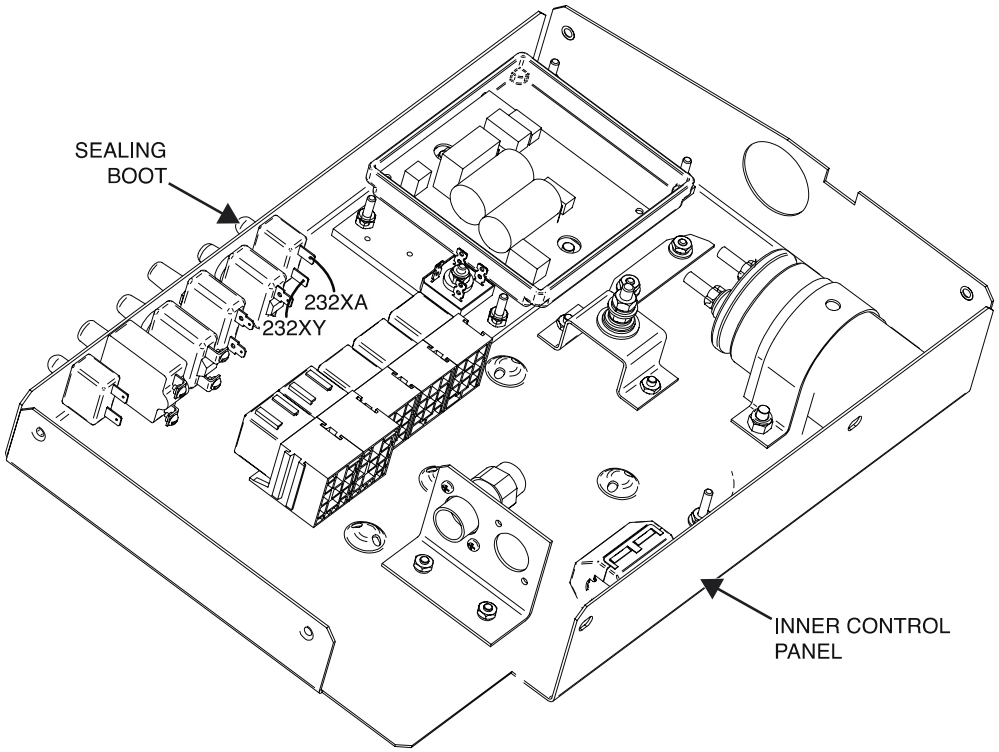
REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect leads 232XA and 232XY from the circuit breaker (CB11). See ***Figure F.1***. See Wiring Diagram.
5. Carefully twist the sealing boot counterclockwise to remove the circuit breaker (CB11) from the inner control panel. See ***Figure F.1***. Cut cable ties as necessary.
6. The circuit breaker (CB11) can now be removed and replaced.

REPLACEMENT PROCEDURE

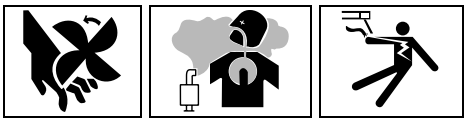
1. Carefully position the new circuit breaker (CB11) to the inner control panel.
2. Carefully twist the sealing boot clockwise to attach the circuit breaker (CB11). Replace cable ties as necessary.
3. Connect leads 232XA and 232XY to the circuit breaker (CB11). See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Circuit breaker (CB11) lead and sealing boot locations



CIRCUIT BREAKER (CB12) 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 Circuit Breaker (CB12).

MATERIALS NEEDED

Wiring Diagram

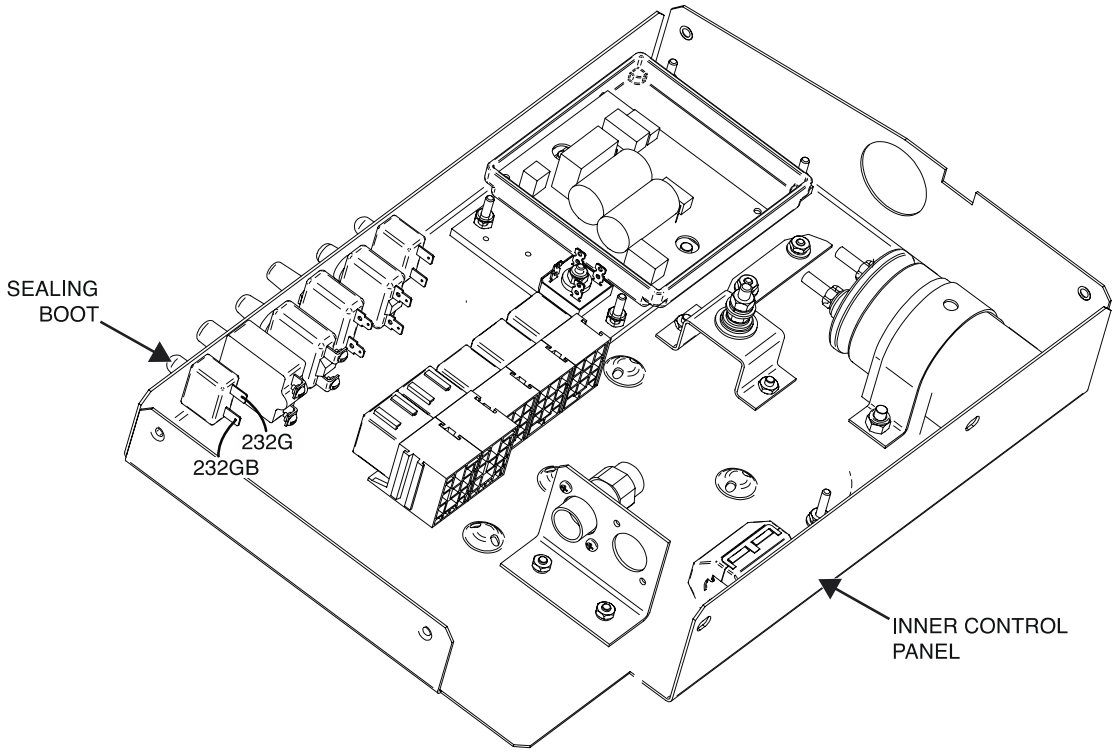
REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect leads 232G and 232GB from the circuit breaker (CB12). See ***Figure F.1***. See Wiring Diagram.
5. Carefully twist the sealing boot counterclockwise to remove the circuit breaker (CB12) from the inner control panel. See ***Figure F.1***. Cut cable ties as necessary.
6. The circuit breaker (CB12) can now be removed and replaced.

REPLACEMENT PROCEDURE

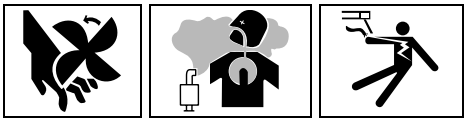
1. Carefully position the new circuit breaker (CB12) to the inner control panel.
2. Carefully twist the sealing boot clockwise to attach the circuit breaker (CB12) to the inner control panel. Replace cable ties as necessary.
3. Connect leads 232G and 232GB to the circuit breaker (CB12). See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Circuit breaker (CB12) lead and sealing boot locations



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

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Carefully unplug the glow relay, starter relay, and idle relay from their mounting sockets. See ***Figure F.1***.
5. Using a 3/8” nutdriver, remove the three nuts securing all five mounting sockets to the inner control panel. See ***Figure F.2***.
6. Carefully maneuver the mounting sockets off the mounting posts (all five mounting sockets are interconnected). Cut cable ties as necessary.
7. Carefully separate the glow relay mounting socket from the adjacent mounting socket(s).
8. Label and disconnect leads ECA35A, ECA45A, 239, and 239B from the glow relay mounting socket. See Wiring Diagram.
9. The glow relay can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Connect leads ECA35A, ECA45A, 239, and 239B to the glow relay mounting socket. See Wiring Diagram.
2. Carefully attach the glow relay mounting socket to the adjacent mounting socket(s).
3. Carefully position the mounting sockets onto the mounting posts. Replace cable ties as necessary.
4. Using a 3/8” nutdriver, attach the three nuts securing all five mounting sockets to the inner control panel.
5. Carefully plug the glow relay, starter relay, and idle relay to their mounting sockets.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Glow relay, starter relay, and idle relay locations

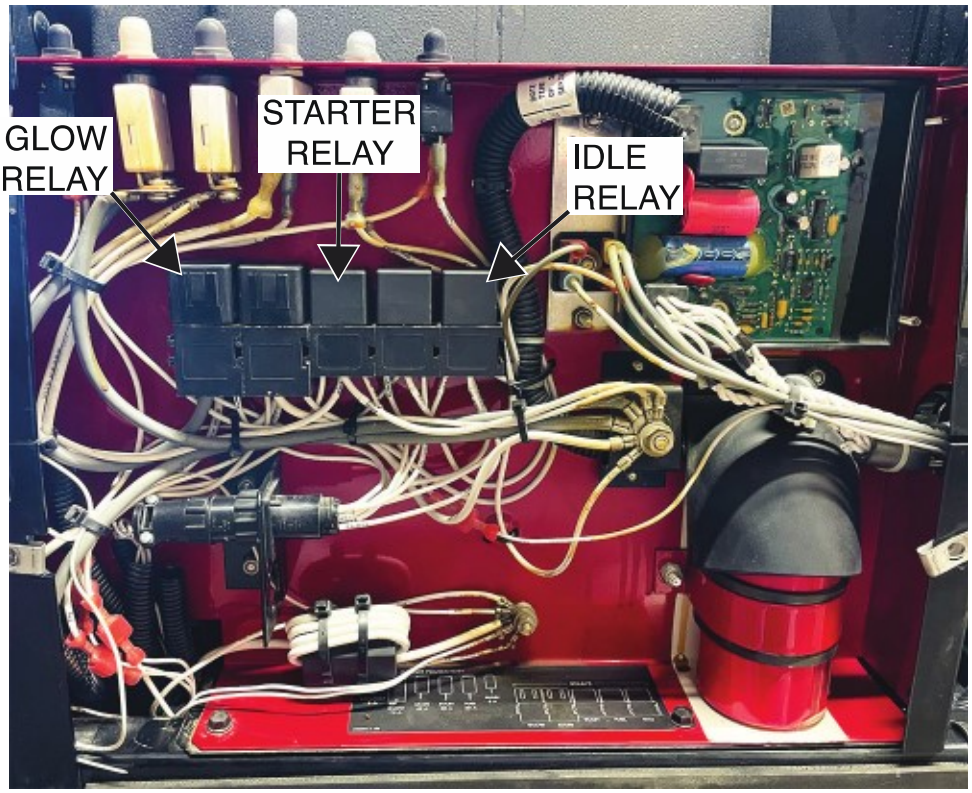
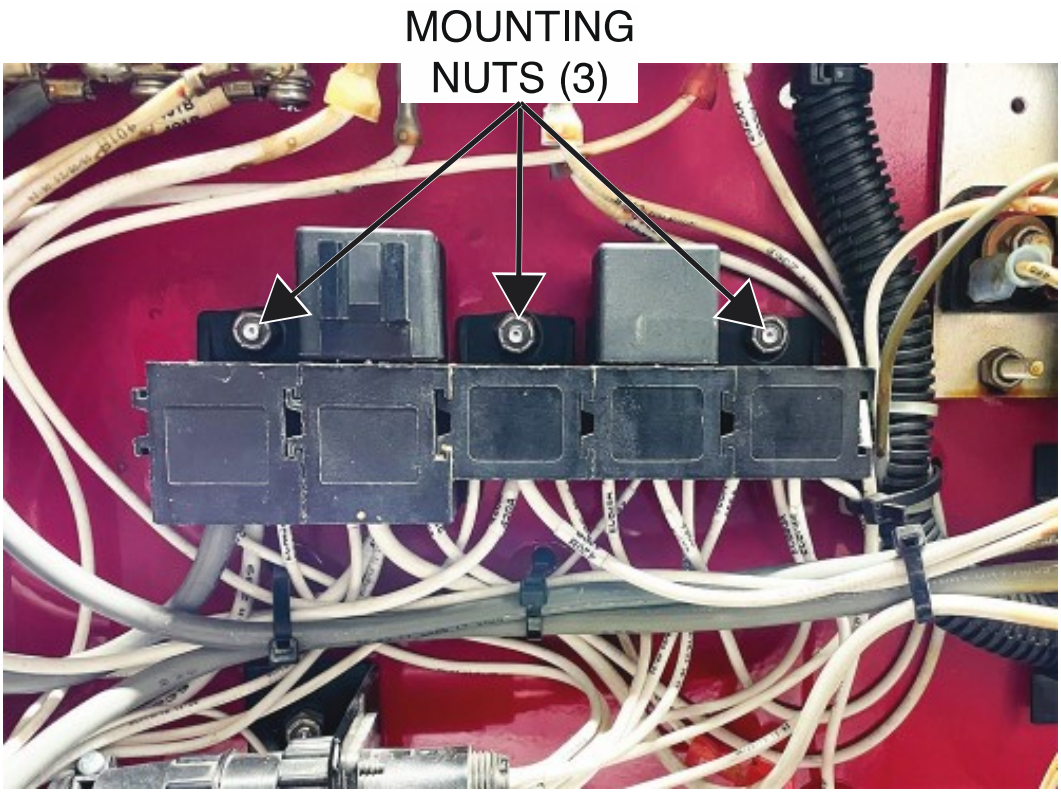
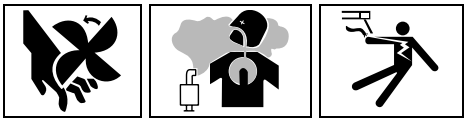


Figure F.2 – Glow relay, starter relay, and idle relay mounting nut locations



MAIN 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 Main Relay.

MATERIALS NEEDED

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Carefully unplug the glow relay, starter relay, and idle relay from their mounting sockets. See ***Figure F.1***.
5. Using a 3/8” nutdriver, remove the three nuts securing all five mounting sockets to the inner control panel. See ***Figure F.2***.
6. Carefully maneuver the mounting sockets off the mounting post (all five mounting sockets are interconnected). Cut cable ties as necessary.
7. Carefully separate the main relay mounting socket from the adjacent mounting socket(s).
8. Label and disconnect leads 424, 402, 401B, 232XA, and 406A from the main relay mounting socket. See Wiring Diagram.
9. The main relay can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Connect leads 424, 402, 401B, 232XA, and 406A to the glow relay mounting socket. See Wiring Diagram.
2. Carefully attach the main relay mounting socket to the adjacent mounting socket(s).
3. Carefully position the mounting sockets onto the mounting posts. Replace cable ties as necessary.
4. Using a 3/8” nutdriver, attach the three nuts securing all five mounting sockets to the inner control panel.
5. Carefully plug the glow relay, starter relay, and idle relay to their mounting sockets.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Glow relay, starter relay, idle relay, and main relay locations

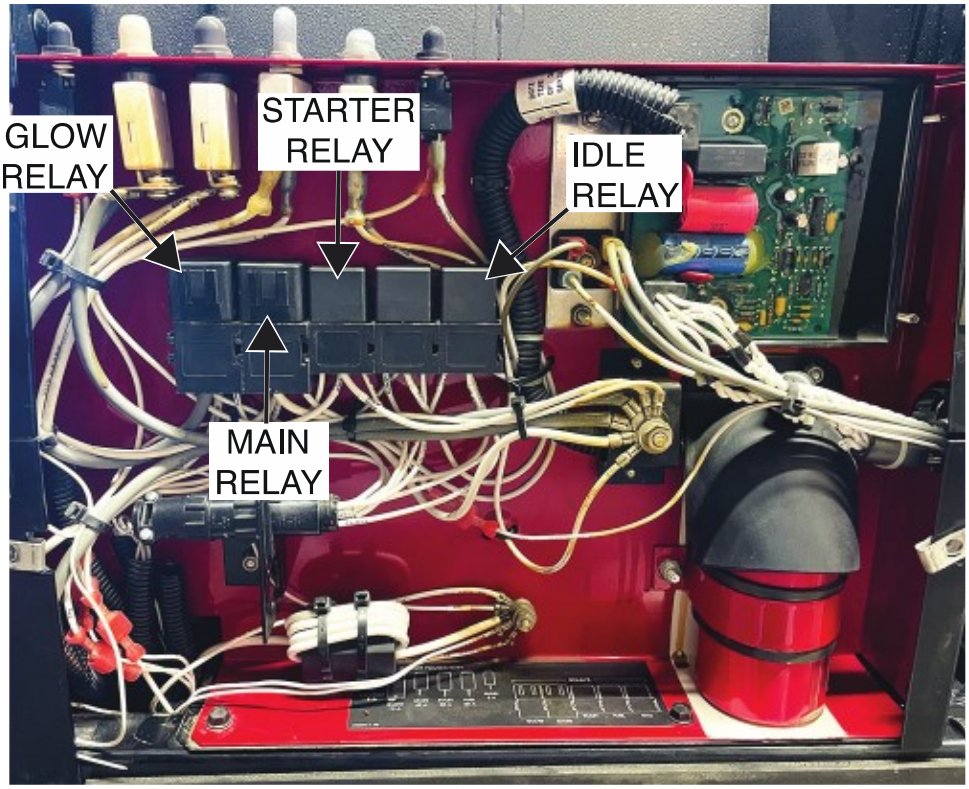
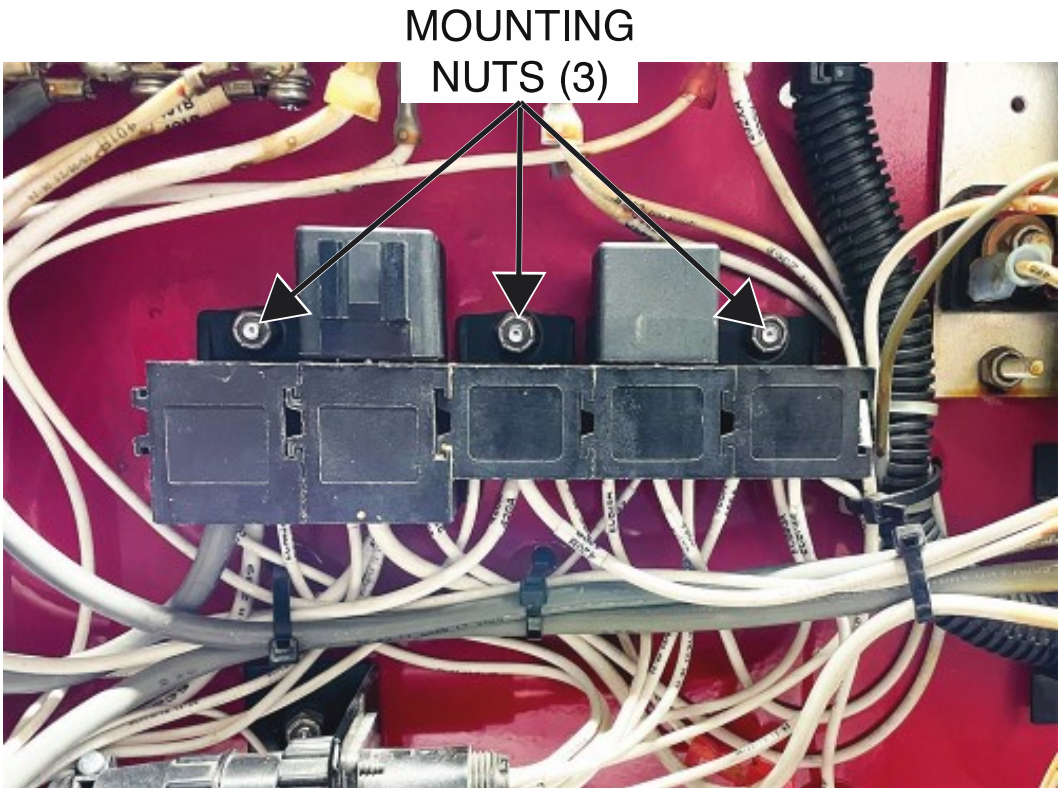
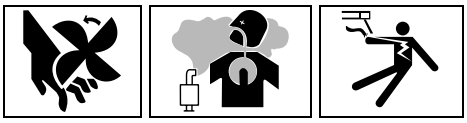


Figure F.2 – Glow relay, starter relay, idle relay and main relay mounting nut locations



STARTER 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 Starter Relay.

MATERIALS NEEDED

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Carefully unplug the glow relay, starter relay, and idle relay from their mounting sockets. See ***Figure F.1***.
5. Using a 3/8” nutdriver, remove the three nuts securing all five mounting sockets to the inner control panel. See ***Figure F.2***.
6. Carefully maneuver the mounting sockets off the mounting post (all five mounting sockets are interconnected). Cut cable ties as necessary.
7. Carefully separate the starter relay mounting socket from the adjacent mounting socket(s).
8. Label and disconnect leads 411, 302B, 420A, and 420B from the starter relay mounting socket. See Wiring Diagram.
9. The starter relay can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Connect leads 411, 302B, 420A, and 420B to the starter relay mounting socket. See Wiring Diagram.
2. Carefully attach the starter relay mounting socket to the adjacent mounting socket(s).
3. Carefully position the mounting sockets onto the mounting posts. Replace cable ties as necessary.
4. Using a 3/8” nutdriver, attach the three nuts securing all five mounting sockets to the inner control panel.
5. Carefully plug the glow relay, starter relay, and idle relay to their mounting sockets.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Glow relay, starter relay, and idle relay locations

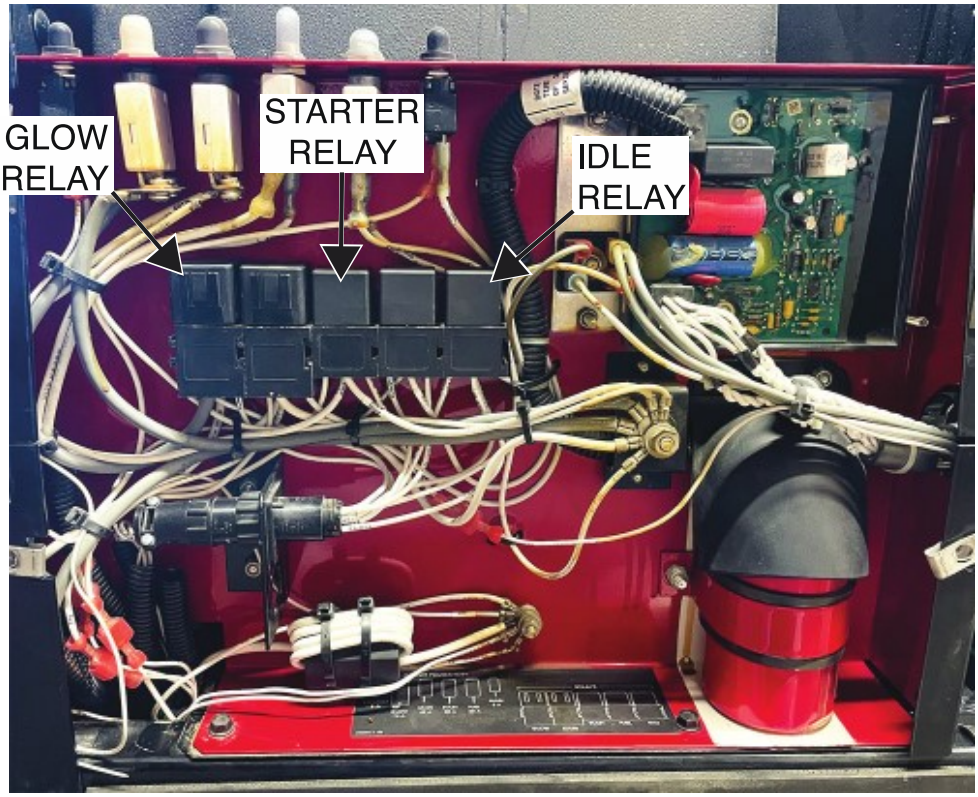
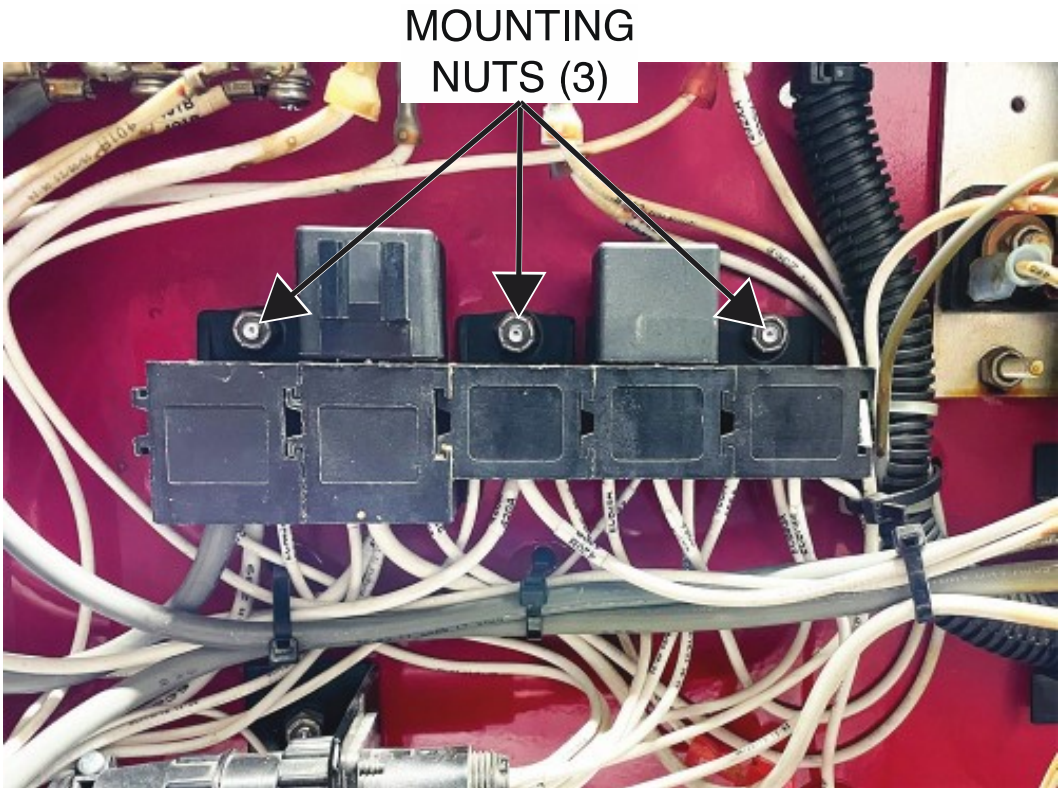
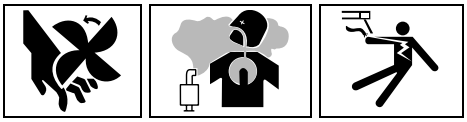


Figure F.2 – Glow relay, starter relay, and idle relay mounting nut locations



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

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Carefully unplug the glow relay, starter relay, and idle relay from their mounting sockets. See ***Figure F.1***.
5. Using a 3/8” nutdriver, remove the three nuts securing all five mounting sockets to the inner control panel. See ***Figure F.2***.
6. Carefully maneuver the mounting sockets off the mounting post (all five mounting sockets are interconnected). Cut cable ties as necessary.
7. Carefully separate the fuel relay mounting socket from the adjacent mounting socket(s).
8. Label and disconnect leads 226, 226A, ECB26A, and ECB90A from the fuel relay mounting socket. See Wiring Diagram.
9. The fuel relay can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Connect leads 226, 226A, ECB26A, and ECB90A to the fuel relay mounting socket. See Wiring Diagram.
2. Carefully attach the fuel relay mounting socket to the adjacent mounting socket(s).
3. Carefully position the mounting sockets onto the mounting posts. Replace cable ties as necessary.
4. Using a 3/8” nutdriver, attach the three nuts securing all five mounting sockets to the inner control panel.
5. Carefully plug the glow relay, starter relay, and idle relay to their mounting sockets.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Glow relay, starter relay, idle relay, and fuel relay locations

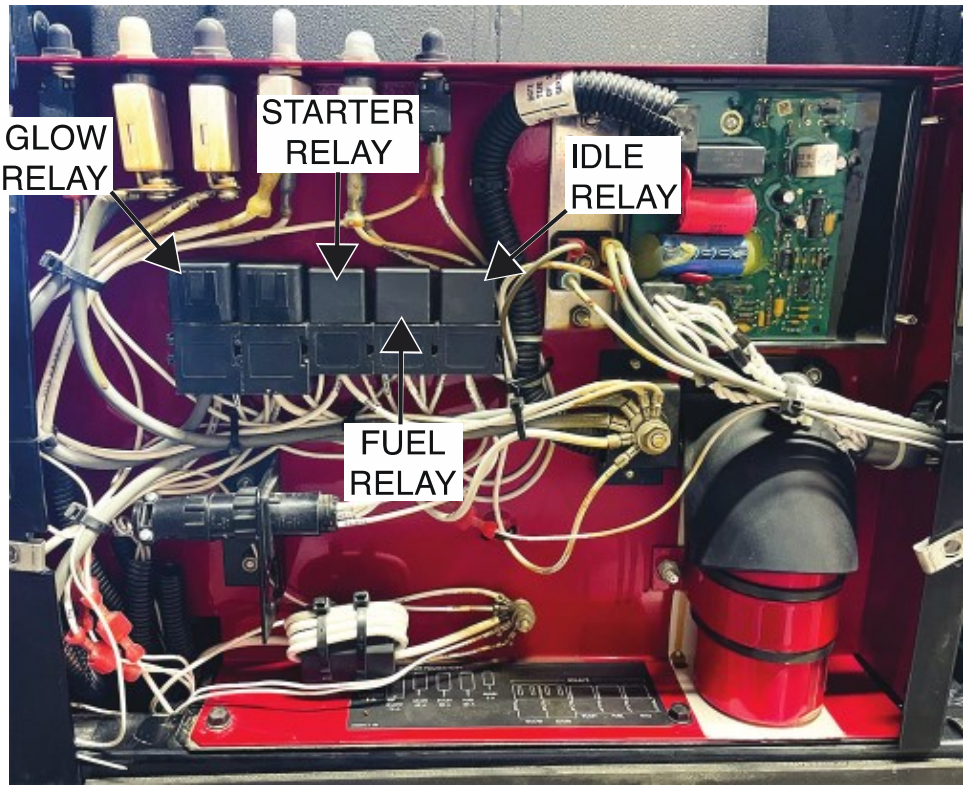
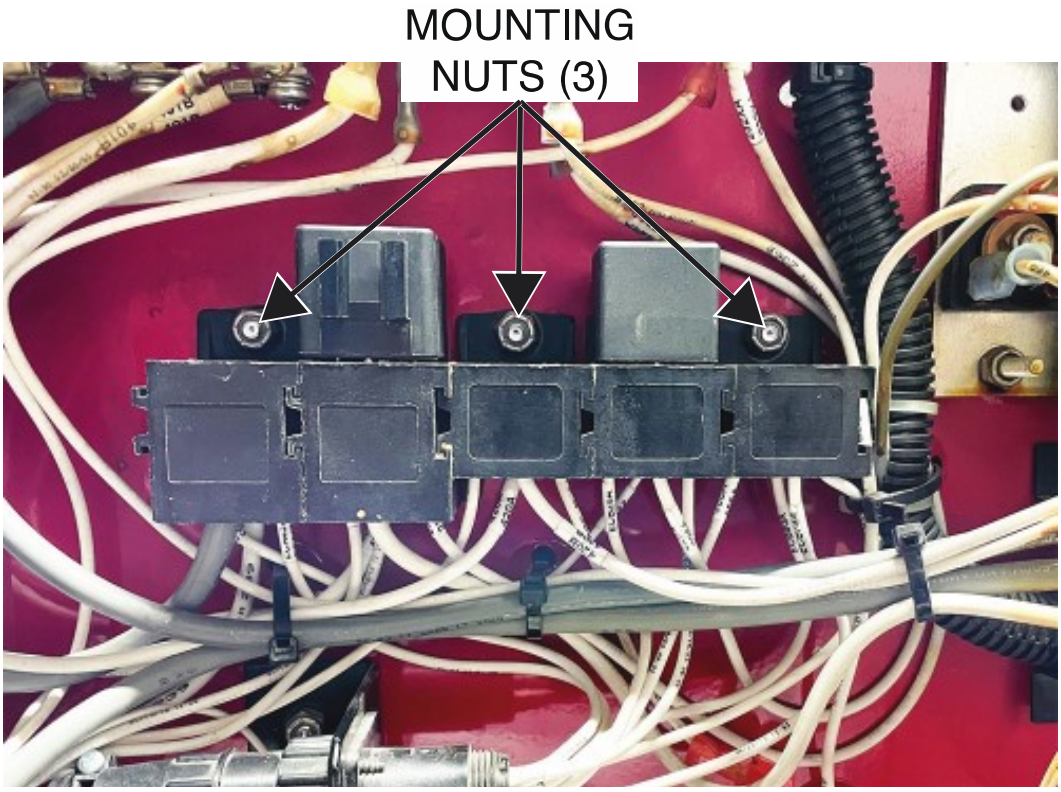
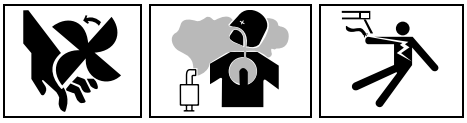


Figure F.2 – Glow relay, starter relay, idle relay, and fuel relay mounting nut locations



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

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Carefully unplug the glow relay, starter relay, and idle relay from their mounting sockets. See ***Figure F.1***.
5. Using a 3/8” nutdriver, remove the three nuts securing all five mounting sockets to the inner control panel. See ***Figure F.2***.
6. Carefully maneuver the mounting sockets off the mounting post (all five mounting sockets are interconnected). Cut cable ties as necessary.
7. Carefully separate the idle relay mounting socket from the adjacent mounting socket(s).
8. Label and disconnect leads 405A, 332DA, ECB80A, and ECB74A from the idle relay mounting socket. See Wiring Diagram.
9. The idle relay can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Connect leads 405A, 332DA, ECB80A, and ECB74A to the idle relay mounting socket. See Wiring Diagram.
2. Carefully attach the idle relay mounting socket to the adjacent mounting socket(s).
3. Carefully position the mounting sockets onto the mounting posts. Replace cable ties as necessary.
4. Using a 3/8” nutdriver, attach the three nuts securing all five mounting sockets to the inner control panel.
5. Carefully plug the glow relay, starter relay, and idle relay to their mounting sockets.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Glow relay, starter relay, and idle relay locations

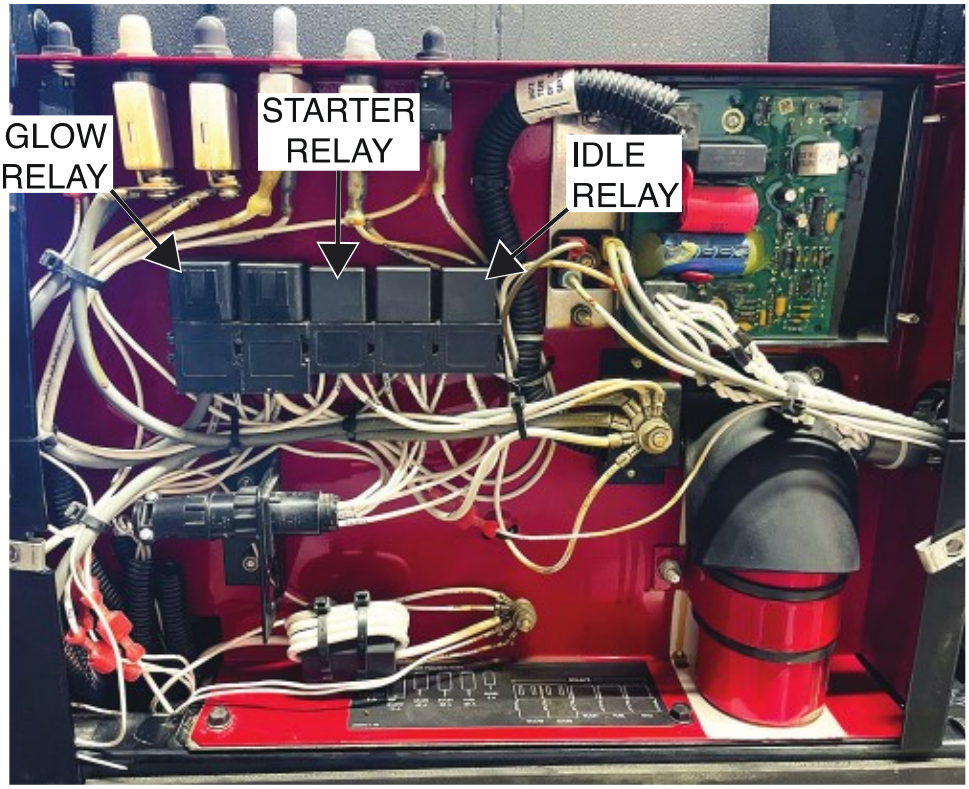
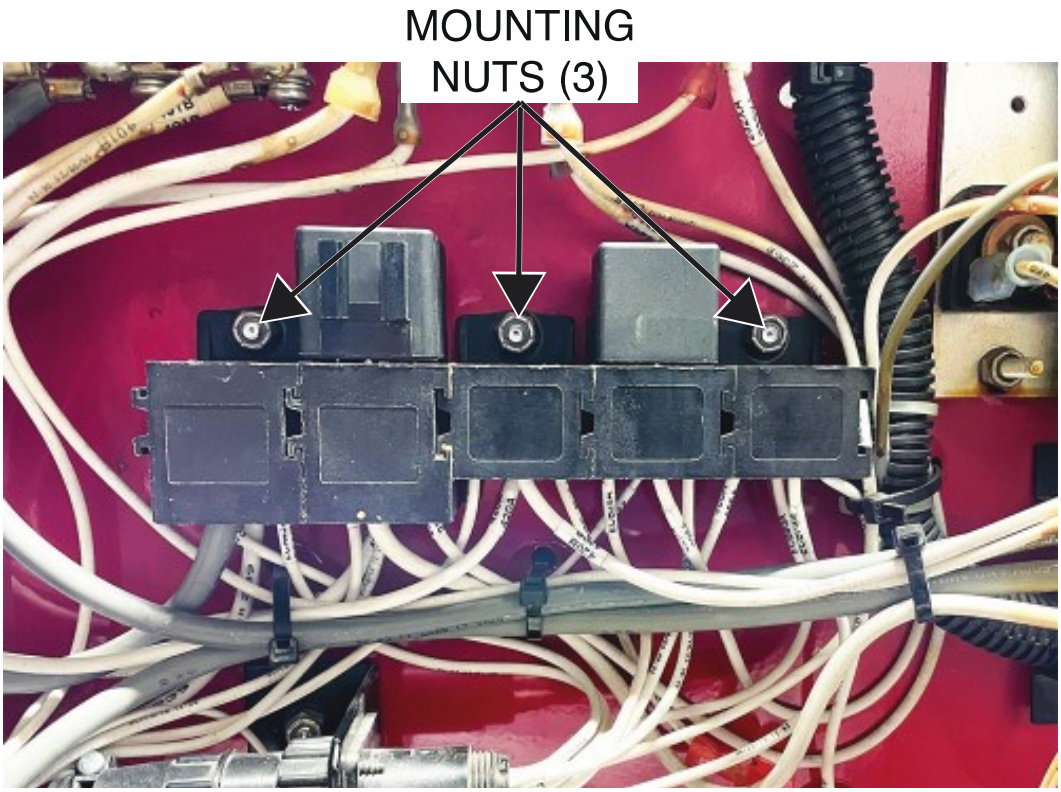
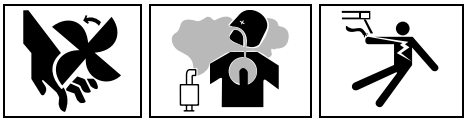


Figure F.2 – Glow relay, starter relay, and idle relay mounting nut locations



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 Bus Board.

MATERIALS NEEDED

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Perform the ***D2 Rectifier Removal Procedure***.
5. Label and disconnect plugs J46 and J47 from the bus board. See ***Figure F.1***. See Wiring Diagram.
6. Using a 3/8” nutdriver, remove the six screws securing the inner control panel to the machine. See ***Figure F.2***.
7. Carefully adjust the position of the inner control panel to access the bus board mounting nuts.
8. Using a 3/8” nutdriver, remove the four nuts securing the bus board to the mounting posts. See ***Figure F.2***.
9. Carefully remove the bus board from the mounting posts.
10. The bus board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new bus board onto the mounting posts.
2. Carefully adjust the position of the inner control panel to access the bus board mounting nuts.
3. Using a 3/8” nutdriver, attach the four nuts securing the bus board to the mounting posts.
4. Using a 3/8” nutdriver, attach the six screws securing the inner control panel to the machine.
5. Connect plugs J46 and J47 to the bus board. See Wiring Diagram.
6. Perform the ***D2 Rectifier Removal Procedure***.
7. Perform the ***Case Cover Replacement Procedure***.
8. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Bus board plug and D2 rectifier locations

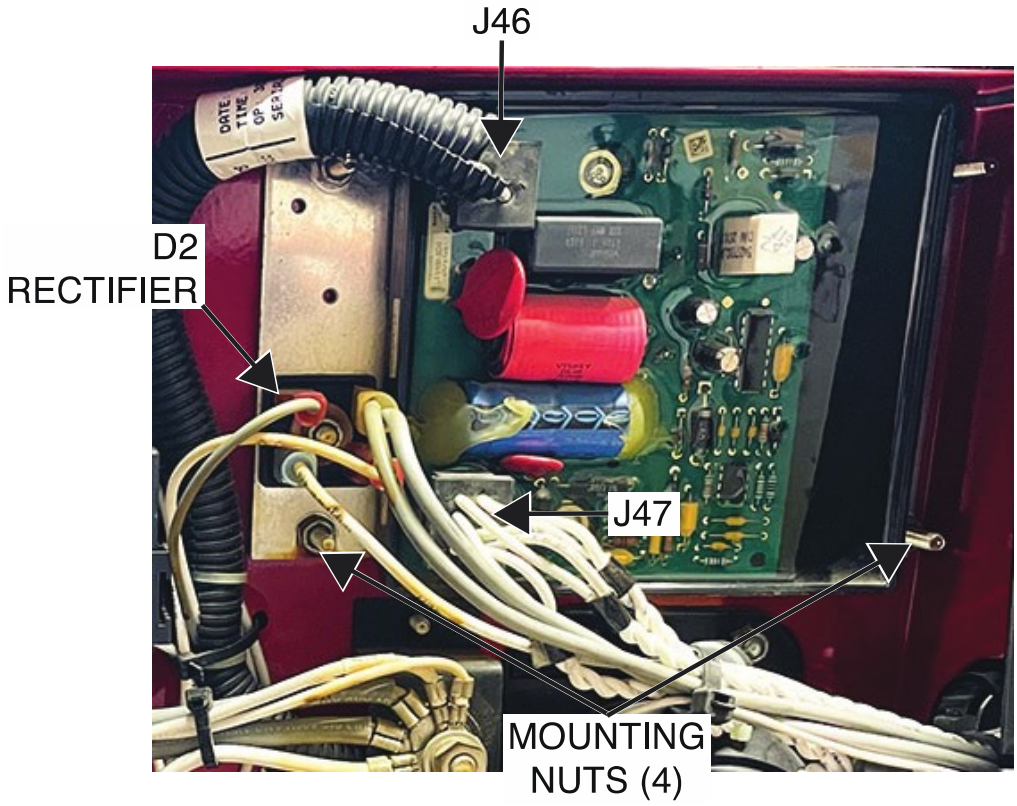
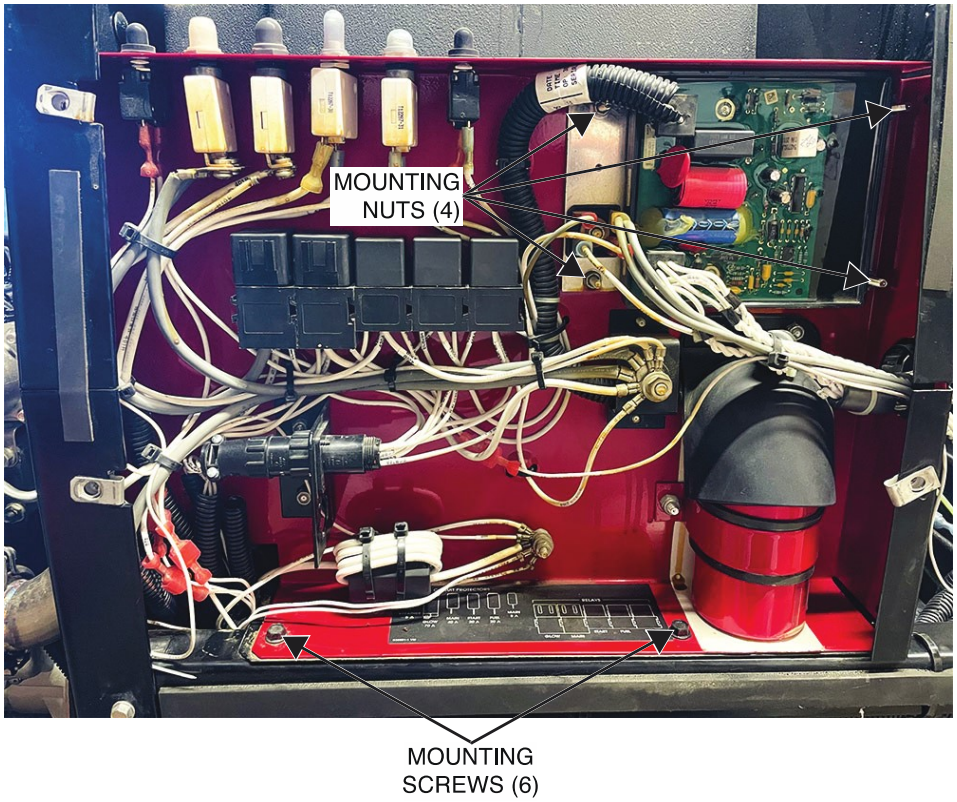
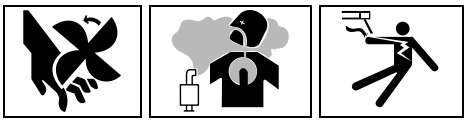


Figure F.2 – Bus board mounting hardware locations



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 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the two nuts securing the output stud cover plate to the output stud cover. See ***Figure F.1***. Remove the output stud cover. Retain for reassembly.
5. 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.2***. See Wiring Diagram.
6. 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.2***. See Wiring Diagram.
7. Using a 7/16” nutdriver, remove the nut securing the 42V capacitor bracket to the inner control panel assembly. See ***Figure F.1***.
8. 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 7/16” nutdriver, attach the nut securing the 42V capacitor bracket to the inner control panel assembly.
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 nuts 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 – 42V capacitor mounting hardware locations

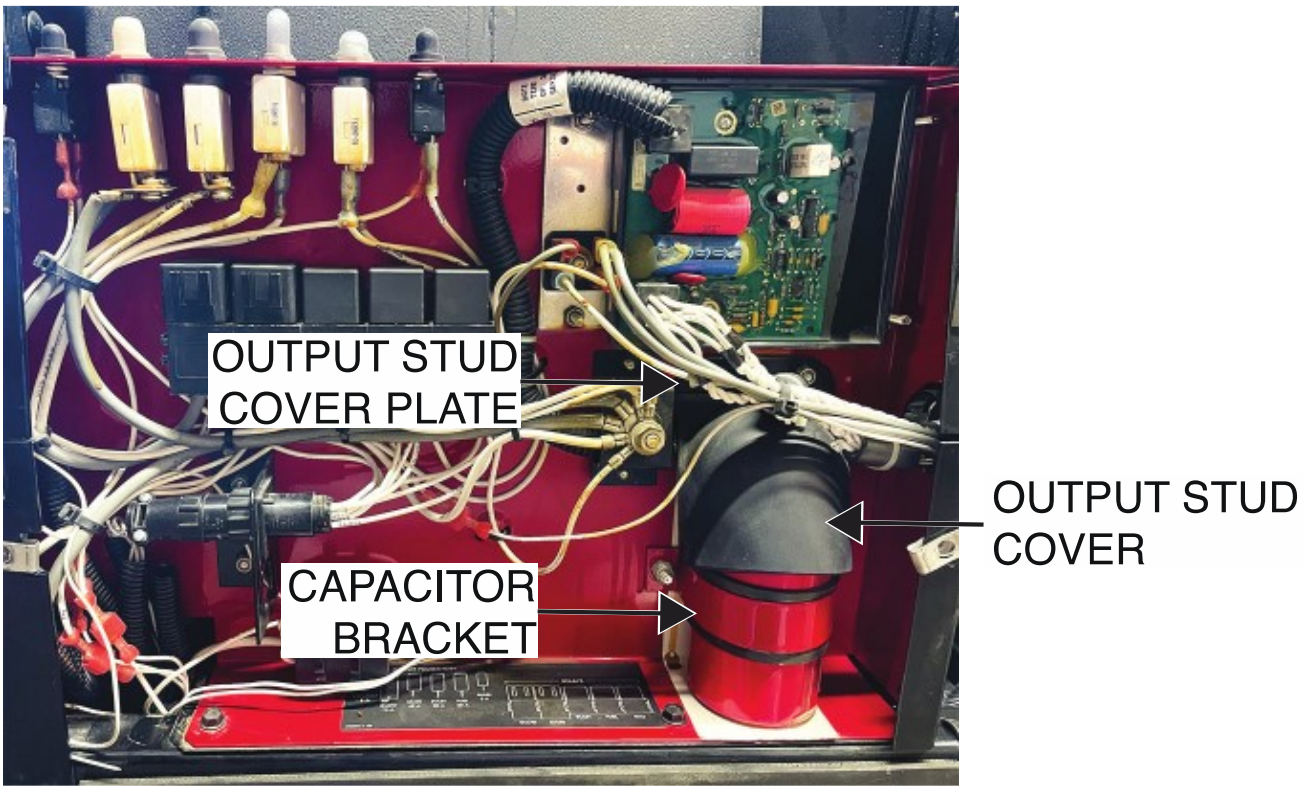
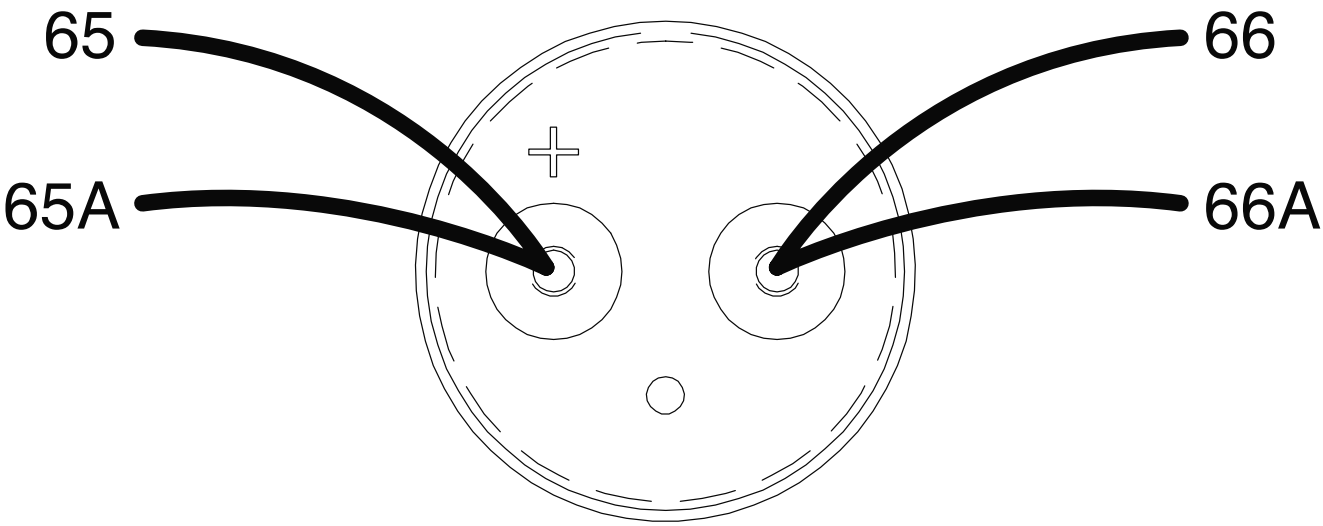
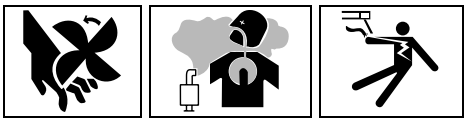


Figure F.2 – 42V capacitor lead locations



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
3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X 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***.
5. Carefully remove the output control knob. Retain the output control knob for reassembly.
6. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.1***.
7. Carefully lower the control panel to gain access to the chopper user interface board.
8. Carefully remove the shield from the machine.
9. Label and disconnect plugs J31, J34, J35, J32, and J33 from the chopper user interface board. See ***Figure F.2***. See Wiring Diagram.
9. Using a 3/8” nutdriver, remove the four nuts securing the chopper user interface board to the control board. See ***Figure F.2***.
10. Carefully remove the chopper user interface board from the mounting posts.
11. The chopper user interface board can now be removed and 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 board.
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. Carefully position the shield into the machine.
6. Using a 3/8” nutdriver, attach the four screws securing the control panel into the upright position.
7. Carefully position the output control knob onto the shaft.
8. Using a 5/64” Allen wrench, tighten the set screw securing the output control knob to the shaft.
9. Perform the ***Case Cover Replacement Procedure***.
10. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Output control knob and control panel mounting screw locations

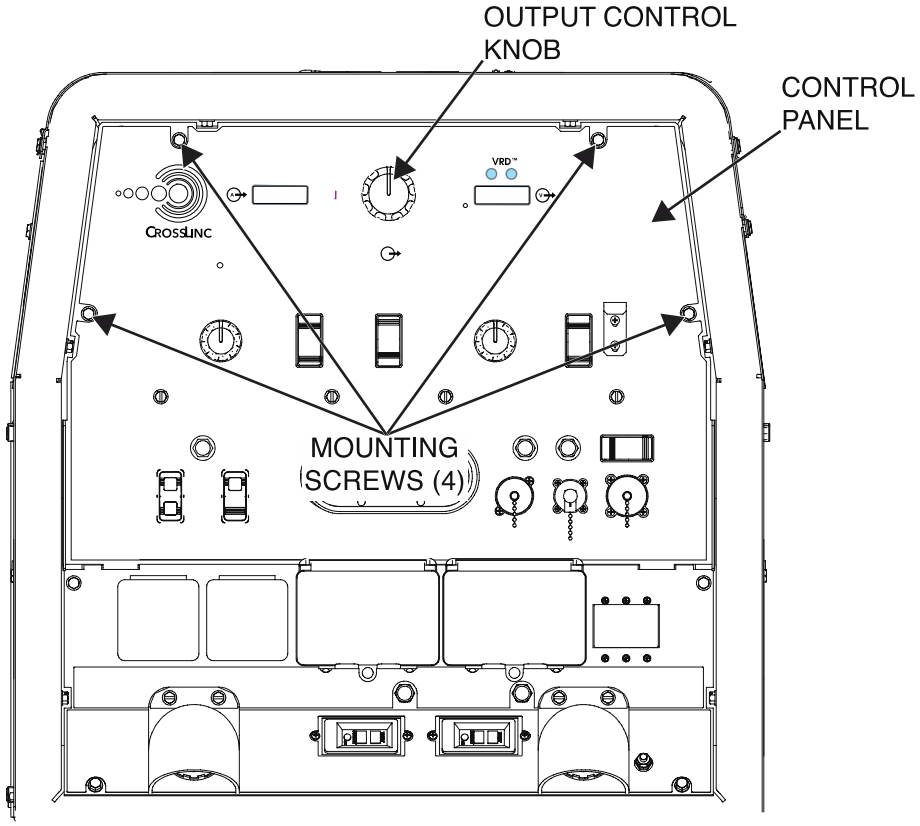
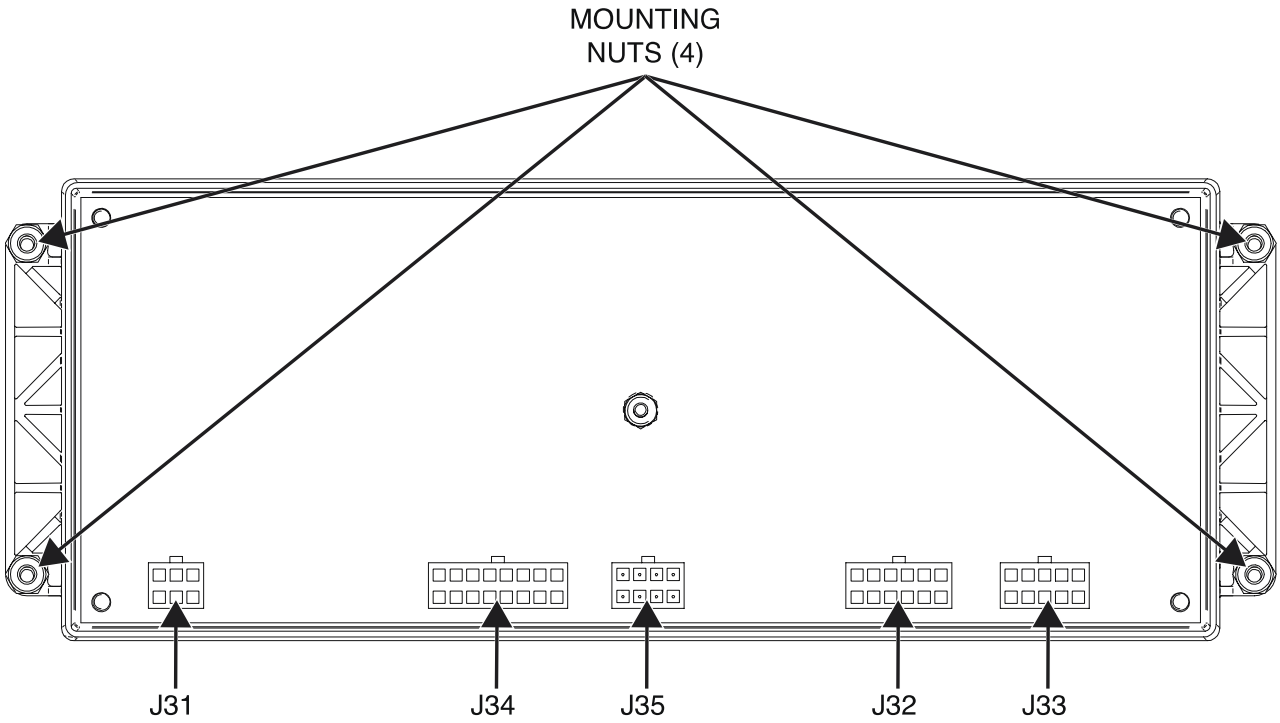
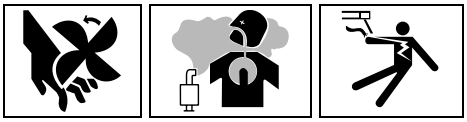


Figure F.2 – Chopper user interface board plug and mounting nut locations



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 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the D1 rectifier.
6. Carefully remove the shield from the machine.
7. Label and disconnect leads 5H, 201A, 200, 200A, and 6A from the D1 rectifier. See ***Figure F.2***. See Wiring Diagram.
8. Using a 3/8” nutdriver, remove the nut, lock washer, flat washer, and insulating washer securing the D1 rectifier to the control panel. See ***Figure F.3***. See Wiring Diagram.
9. 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 onto the control panel.
3. Using a 3/8” nutdriver, attach the nut, lock washer, flat washer, and insulating washer securing the D1 rectifier to the control panel. See Wiring Diagram.
4. Connect leads 5H, 201A, 200, 200A, and 6A to the D1 rectifier. See Wiring Diagram.
5. Carefully raise the control panel into the upright position.
6. Carefully position the shield into the machine.
7. Using a 3/8” nutdriver, attach the four screws 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 locations

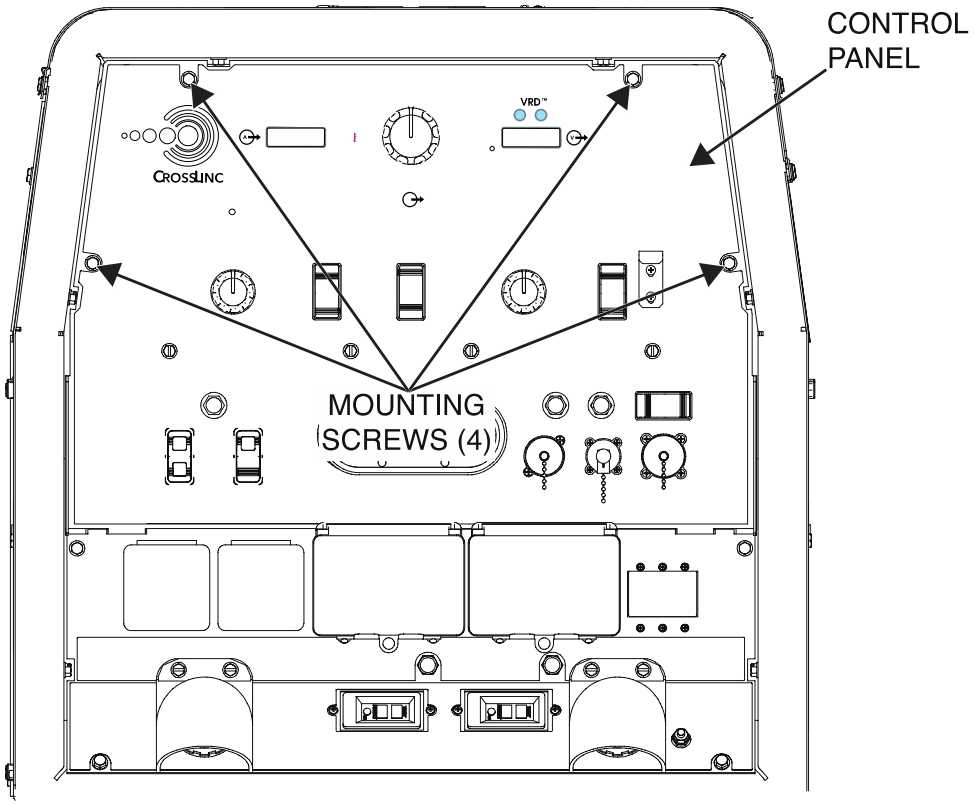


Figure F.2 – D1 rectifier lead locations

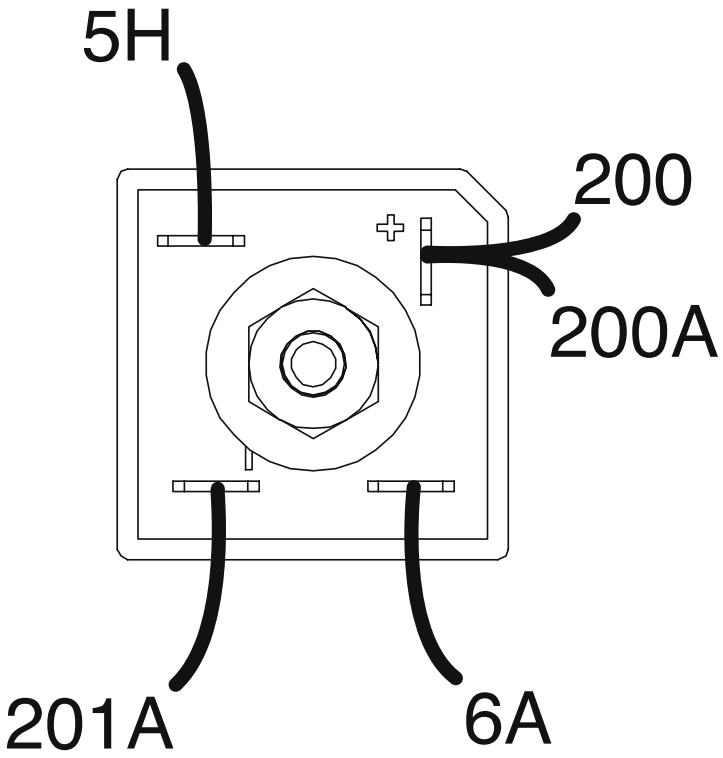
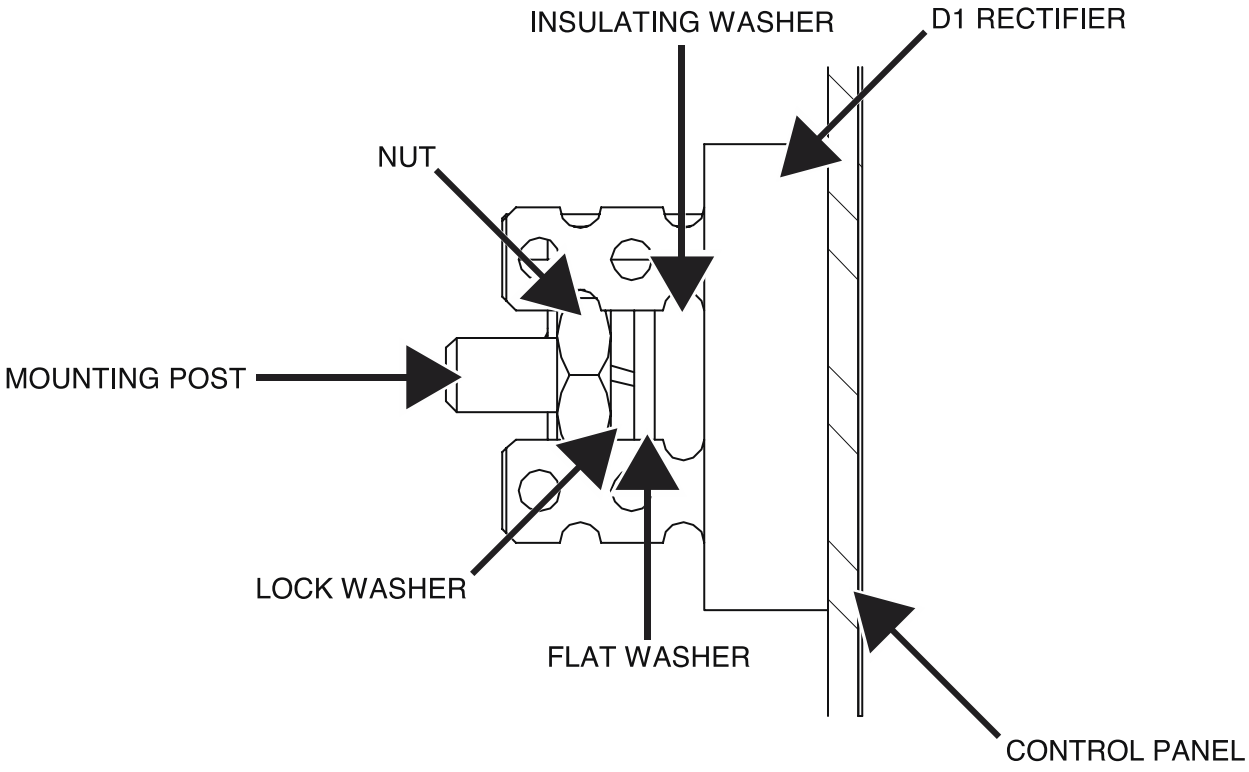
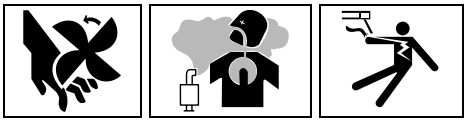


Figure F.3 – D1 rectifier mounting hardware locations



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

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

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect leads 65A, 46A, 45, and 66A from the D2 rectifier. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the nut and insulating washer securing the D2 rectifier to the bus board mounting plate. See ***Figure F.2***. See Wiring Diagram.
6. 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 bus board mounting plate. See Wiring Diagram.
3. Using a 3/8” nutdriver, attach the nut and insulating washer securing the D2 rectifier to the bus board mounting plate.
4. Connect leads 65A, 46A, 45, and 66A to the D2 rectifier. See Wiring Diagram.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – D2 rectifier lead locations

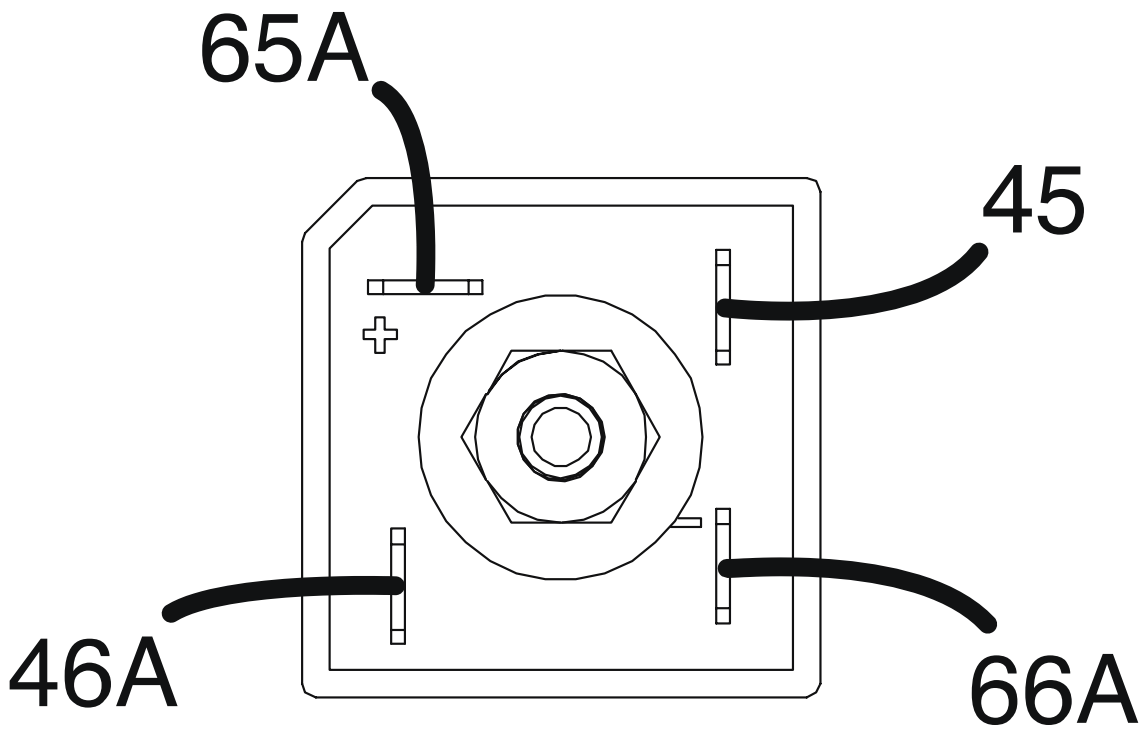
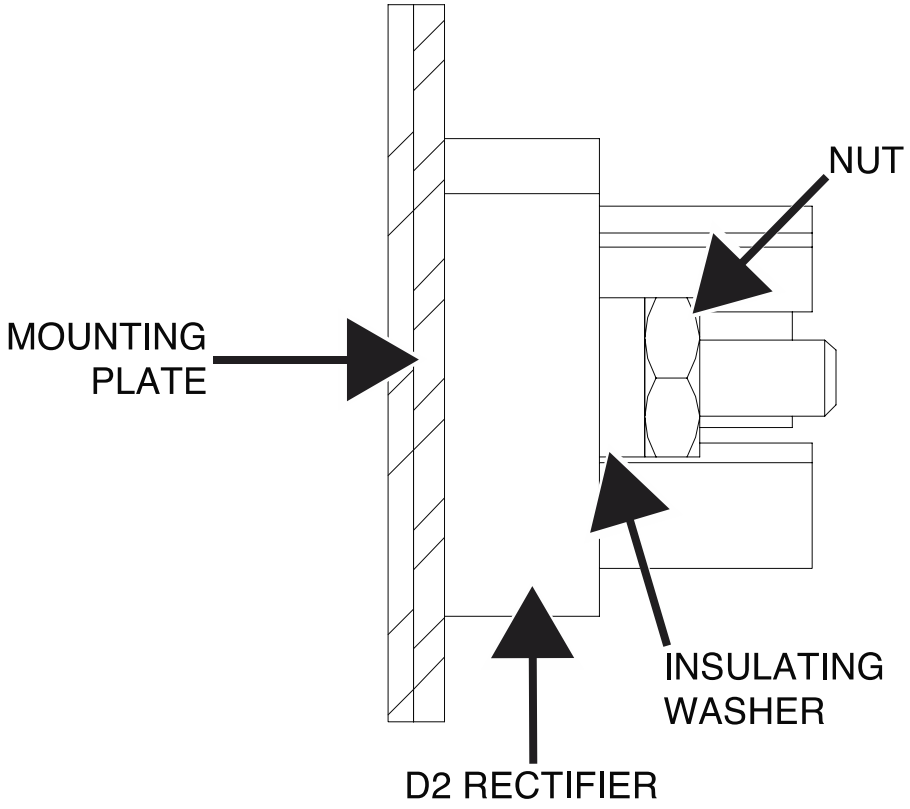
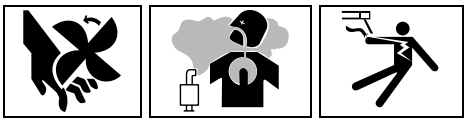


Figure F.2 – D2 rectifier mounting hardware locations



MODE SELECTOR 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 Selector Board.

MATERIALS NEEDED

5/64” Allen Wrench
9/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X 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 and rubber washer securing the board to the control panel. See ***Figure F.3***. See Wiring Diagram.
7. Carefully maneuver the mode select board out of the control 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 and rubber washer securing the board to the control panel. See Wiring Diagram.
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 selector board plug J81 location

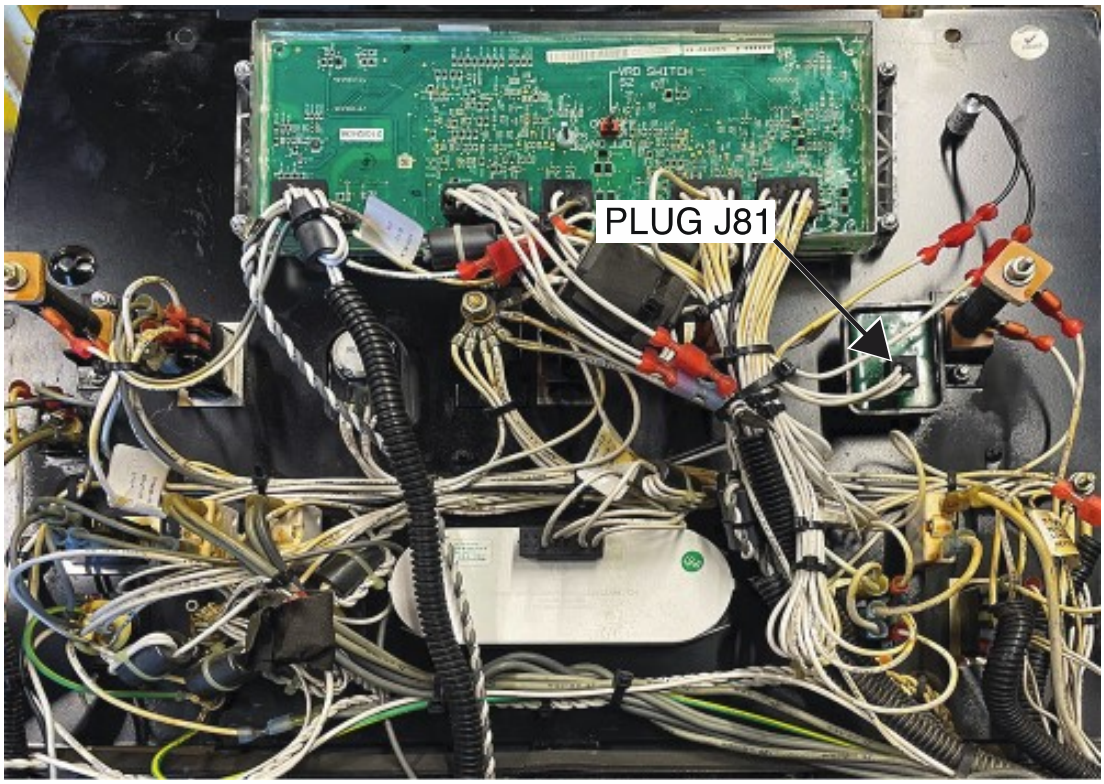


Figure F.2 – Mode selector board knob location

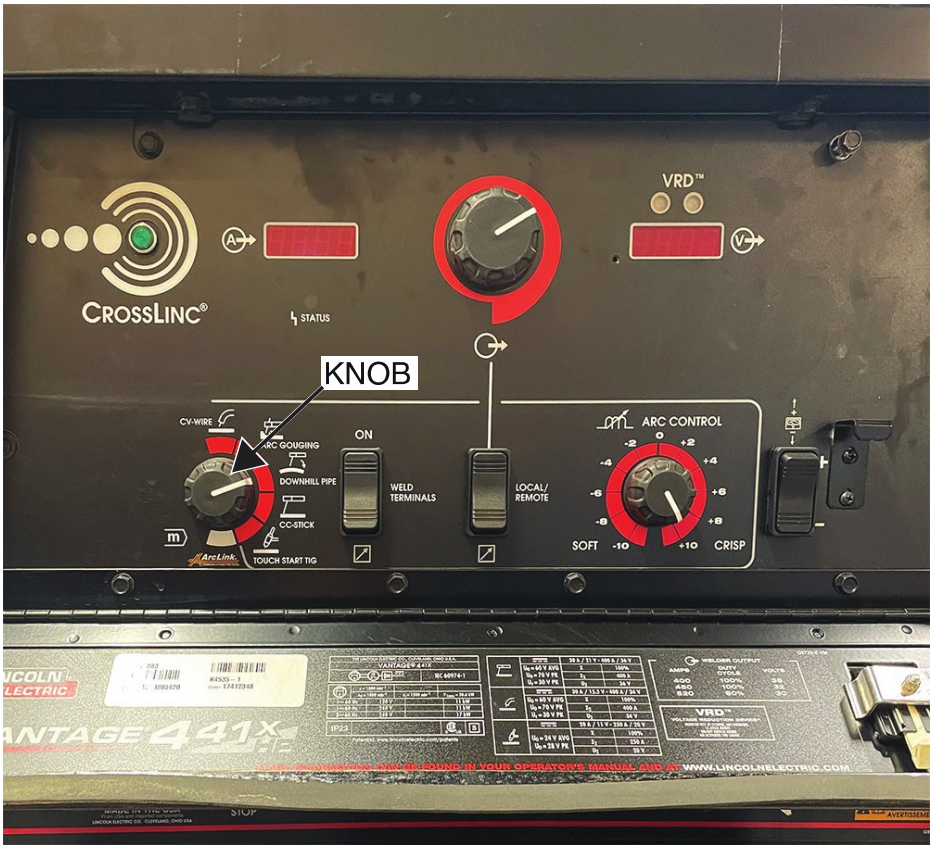
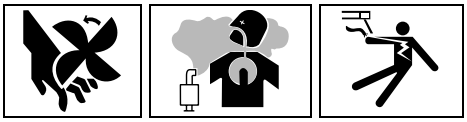


Figure F.3 – Mode selector board mounting hardware locations

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

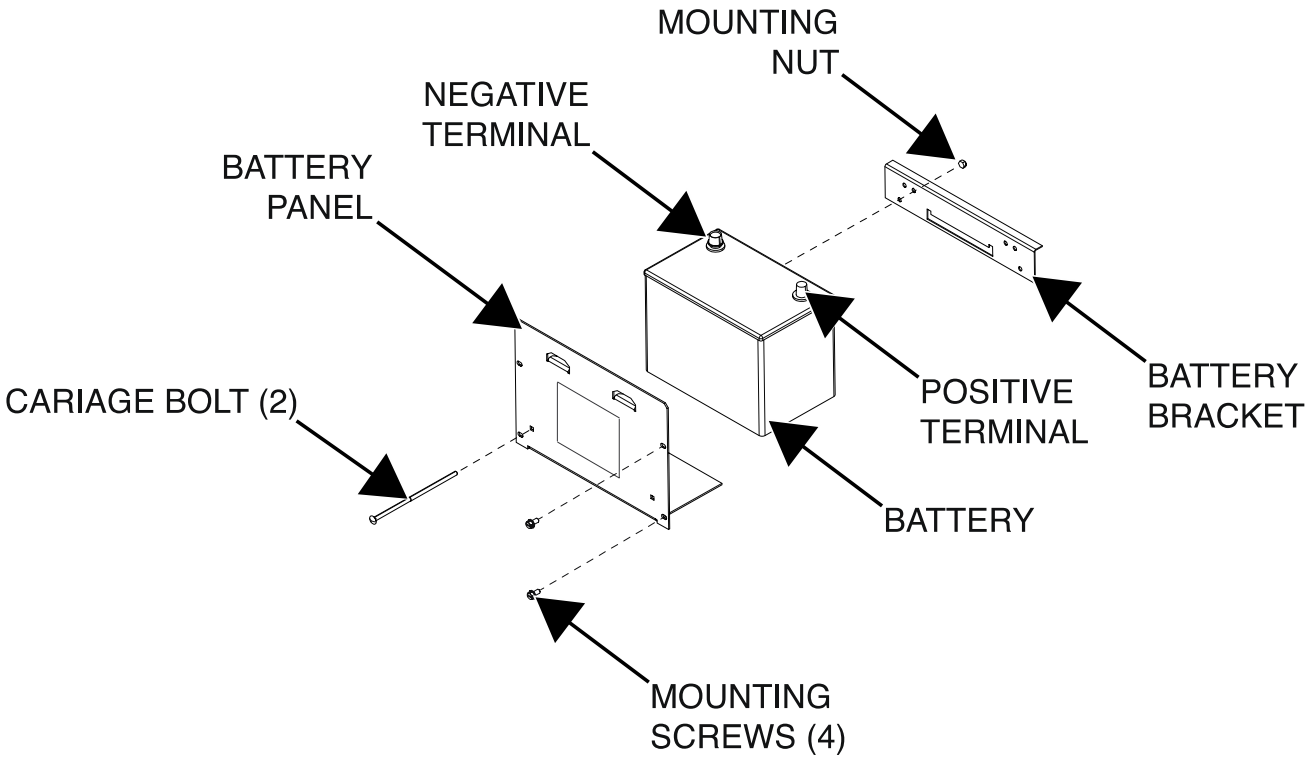
REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the four screws 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

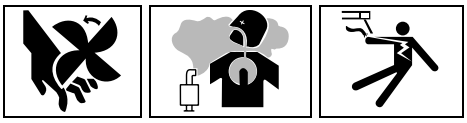
1. Carefully position the new battery into the battery panel.
2. Using a 7/16” nutdriver, attach the two nuts and carriage bolts securing the battery bracket to the battery panel.
3. Carefully position the battery panel into the machine.
4. Using a 1/2” nutdriver, tighten the terminal clamps securing the leads to the positive and negative battery terminals. See Wiring Diagram.
5. Using a 3/8” nutdriver, attach the four screws securing the battery panel to the machine.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Battery mounting hardware locations



BRUSH AND BRUSH HOLDER 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

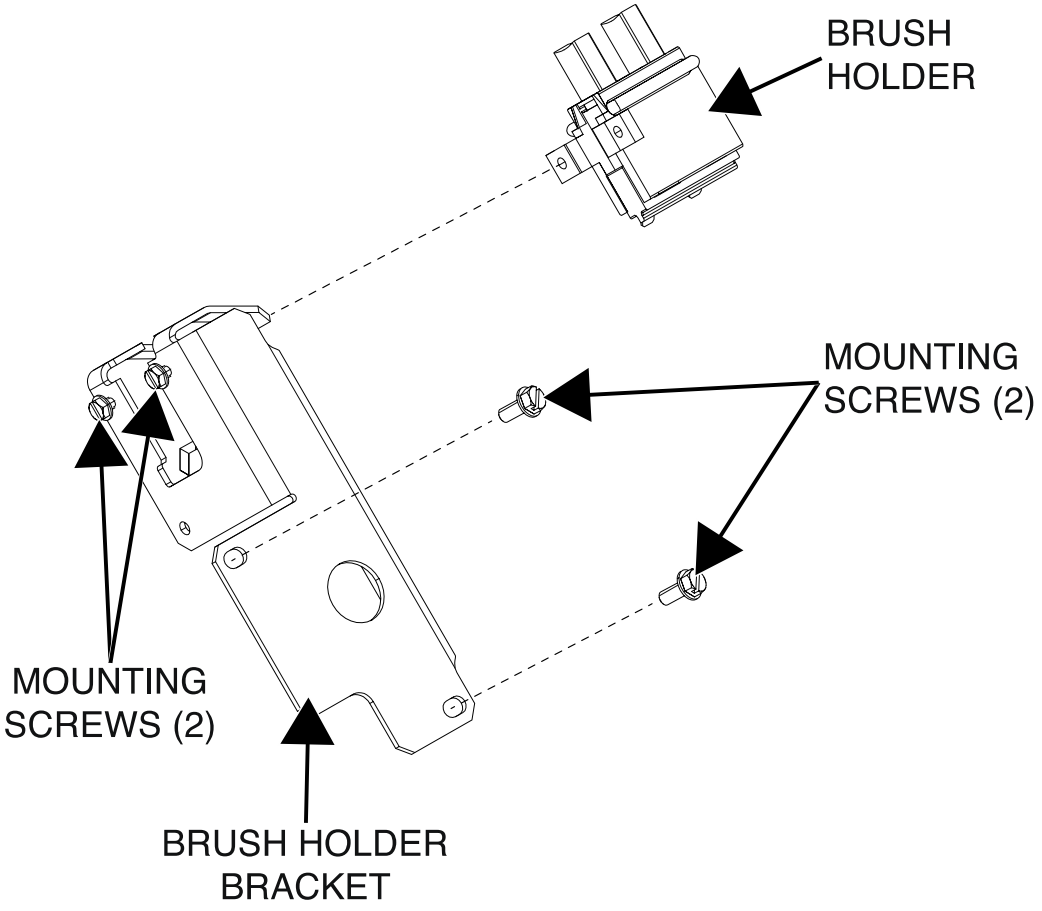
REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X 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 brush holder bracket to the machine. See ***Figure F.1***.
5. Carefully maneuver the brush holder bracket out of the machine.
6. Label and disconnect leads 201 and 200B from the terminals of the brush holder. See Wiring Diagram. Cut cable ties as necessary.
7. Route the leads through the brush holder bracket.
8. Using a 5/16” nutdriver, remove the two screws securing the brush holder to the brush holder bracket. See ***Figure F.1***.
9. The brush and brush holder can now be removed and replaced.

REPLACEMENT PROCEDURE

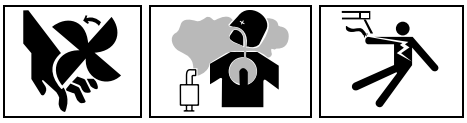
1. Carefully position the new brush holder into the brush holder bracket.
2. Using a 5/16” nutdriver, attach the two screws securing the brush holder to the brush holder bracket.
3. Route the leads through the brush holder bracket.
4. Connect leads 201 and 200B to the terminals of the brush holder. See Wiring Diagram. Replace cable ties as necessary.
5. Carefully position the brush holder bracket into the machine.
6. Using a 3/8” nutdriver, attach the two screws securing the brush holder bracket to the machine.
7. Perform the ***Case Cover Replacement Procedure***.
8. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Brush holder mounting hardware locations



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
3/8” Nutdriver
Molex Removal Tool
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X 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 arc control knob to the shaft. See ***Figure F.1***.
5. Remove the arc control potentiometer knob and rubber washer. Retain the arc control potentiometer knob and rubber washer for reassembly.
6. Using a 1/2” nutdriver, remove the nut and washer securing the arc control potentiometer to the control panel. See ***Figure F.2***.
7. Carefully remove the arc control potentiometer from the control panel.
8. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.3***.
9. Carefully lower the control panel to gain access to the arc control potentiometer.
10. Carefully remove the shield from the machine.
11. Using a Molex removal tool, remove the lead 277A from plug J81 of the mode select board. See ***Figure F.4***. See Wiring Diagram. Cut cable ties as necessary.
12. Using a Molex removal tool, remove the leads 277, 278, and 279 from plug J32 of the chopper user interface board. See ***Figure F.5***. See Wiring Diagram. Cut cable ties as necessary.
13. The arc control potentiometer can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new arc control potentiometer into the machine.
2. Using a Molex removal tool, attach the leads 277, 278, and 279 to plug J32 of the chopper user interface board. See Wiring Diagram. Replace cable ties as necessary.
3. Using a Molex removal tool, attach the lead 277A to plug J81 of the mode select board. See Wiring Diagram. Replace cable ties as necessary.
4. Carefully raise the control panel into the upright position.
5. Carefully position the shield into the machine.
6. Using a 3/8” nutdriver, attach the four screws securing the control panel into the upright position.
7. Carefully attach the arc control potentiometer to the control panel.

8. Using a 1/2” nutdriver, attach the nut and washer securing the arc control potentiometer to the control panel.
9. Attach the arc control potentiometer knob and rubber washer.
10. Using a 5/64” Allen wrench, tighten the set screw securing the arc control knob to the shaft.
11. Perform the ***Case Cover Replacement Procedure***.
12. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Arc control potentiometer knob locations

Figure F.2 – Arc control potentiometer mounting hardware locations

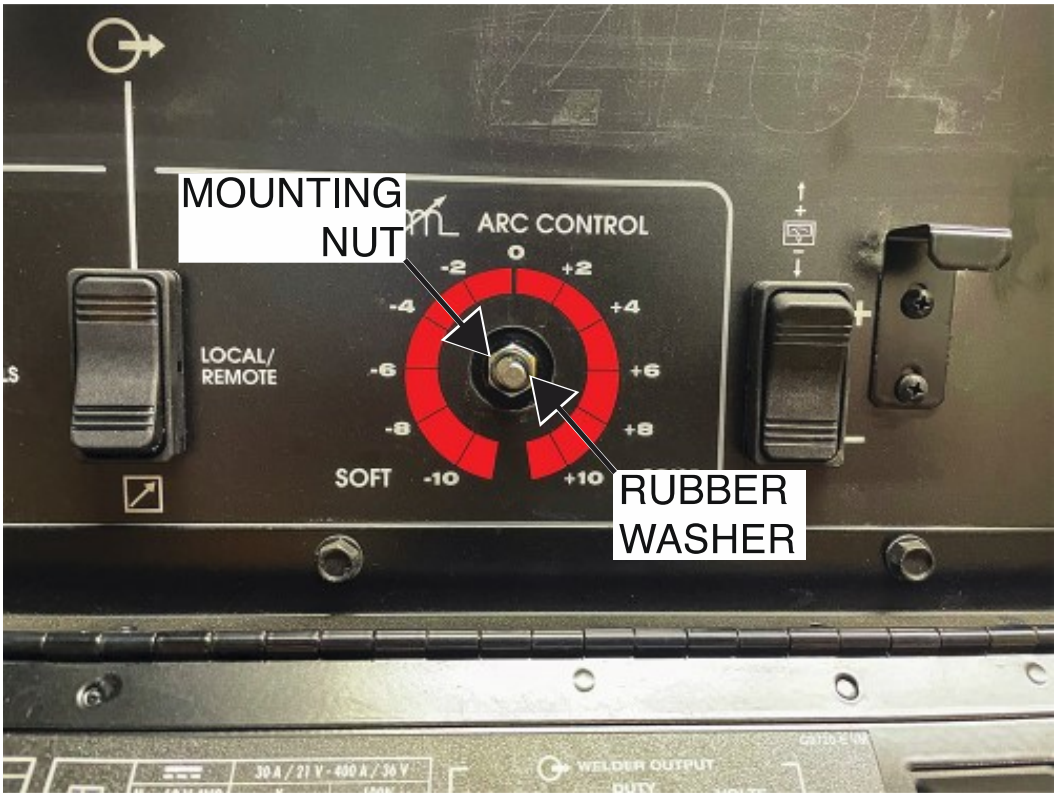


Figure F.3 – Control panel mounting screw locations

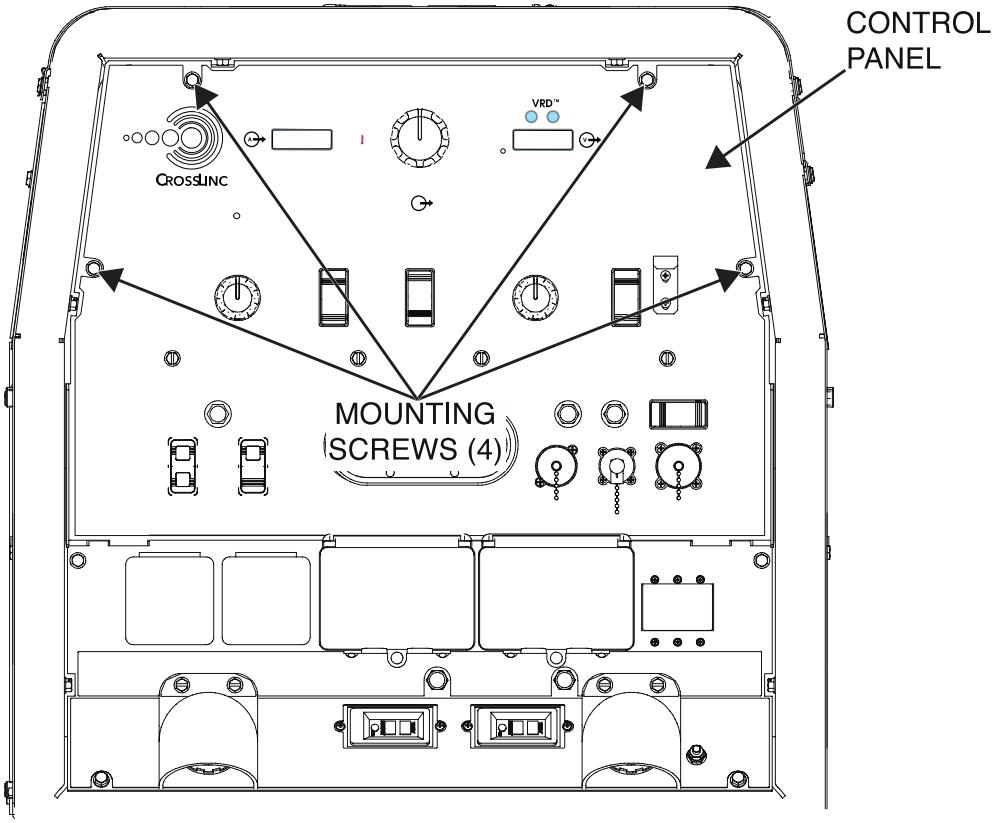


Figure F.4 – Mode selector board plug J81 and lead 277A locations

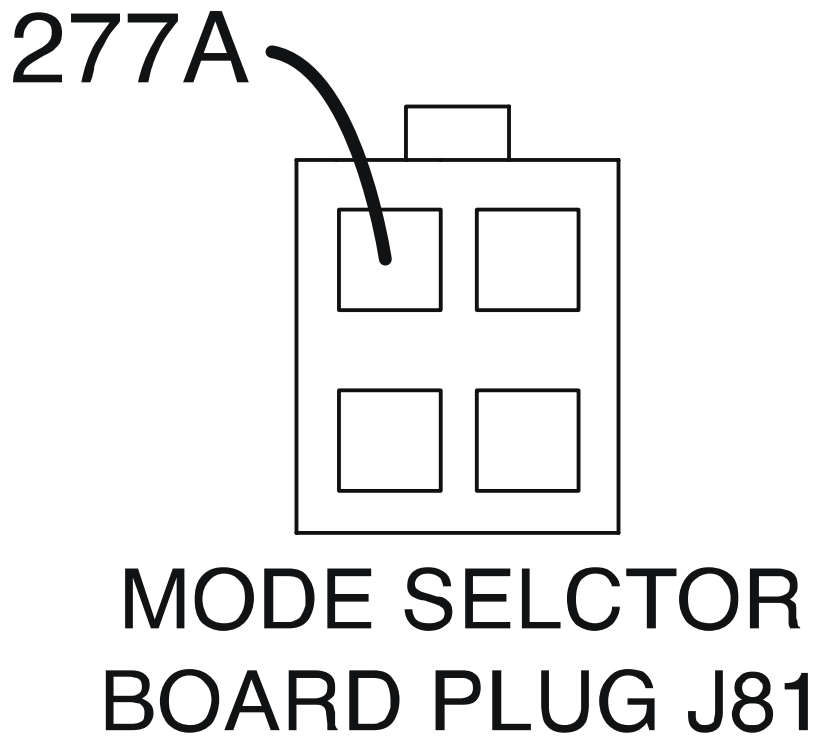
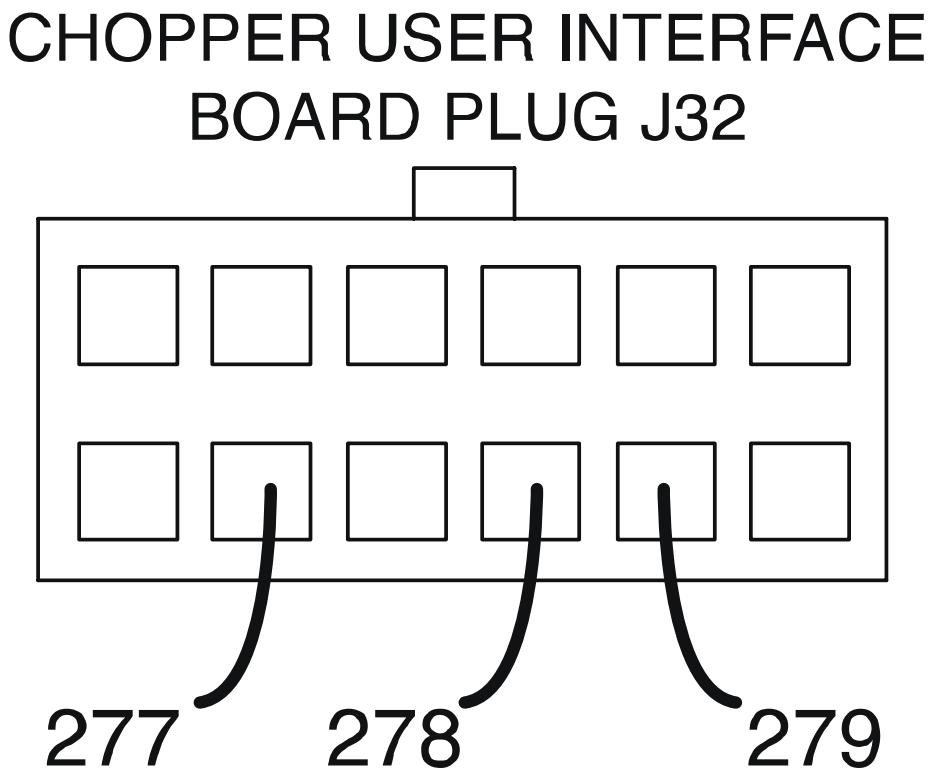
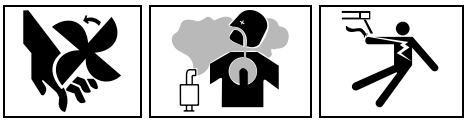


Figure F.5 – Chopper user interface board plug J32 and leads 277, 278, and 279 locations



CHOPPER MODULE 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 Module Board.

MATERIALS NEEDED

7/16” Nutdriver
3/8” Nutdriver
Torx Nutdriver (Size T-25)
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plugs J20, J21, and J22 from the chopper module board. See ***Figure F.1***. See Wiring Diagram.
5. Using a 7/16” nutdriver, remove the bolt, lock washer, and flat washer securing lead B1-NEG to terminal B1 on the chopper module board. See ***Figure F.1***. See Wiring Diagram.
6. Using a 7/16” nutdriver, remove the bolt, lock washer, and flat washer securing lead B2-POS to terminal B2 on the chopper module board. See ***Figure F.1***. See Wiring Diagram.
7. Using a 7/16” nutdriver, remove the bolt, lock washer, and flat washer securing lead W10 to terminal B3 on the chopper module board. See ***Figure F.1***. See Wiring Diagram.
8. Using a 7/16” nutdriver, remove the bolt, lock washer, and flat washer securing lead B4-NEG to terminal B4 on the chopper module board. See ***Figure F.1***. See Wiring Diagram.
9. Using a 7/16” nutdriver, remove the bolt, lock washer, and flat washer securing lead B5-POS to terminal B5 on the chopper module board. See ***Figure F.1***. See Wiring Diagram.
10. Using a 7/16” nutdriver, remove the bolt, lock washer, and flat washer securing lead W9 to terminal B6 on the chopper module board. See ***Figure F.1***. See Wiring Diagram.
11. Using a 3/8” nutdriver, remove the four screws securing the chopper brackets to the power module panel. See ***Figure F.2***.
12. Carefully maneuver the chopper module board assembly out of the machine.
13. Using a Torx nutdriver (Size T-25), remove the two screws and lock washers securing the lower chopper bracket to the heat sink. See ***Figure F.3***. Retain the lower chopper bracket for assembly.
14. Using a 7/16” nutdriver, remove the two bolts, lock washers, and spacers securing the upper chopper bracket to the chopper module board assembly. See ***Figure F.3***. Retain the upper chopper bracket for assembly.
15. The chopper module board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Using a 7/16” nutdriver, attach the two bolts, lock washers, and spacers securing the upper chopper bracket to the chopper module board assembly.
2. Using a Torx nutdriver (Size T-25), attach the two screws and lock washers securing the lower chopper bracket to the heat sink.

3. Carefully position the new chopper module board assembly into the machine.
4. Using a 3/8” nutdriver, attach the four screws securing the chopper brackets to the power module panel.
5. Using a 7/16” nutdriver, attach the bolt, lock washer, and flat washer securing lead W9 to terminal B6 on the chopper module board. See Wiring Diagram.
6. Using a 7/16” nutdriver, attach the bolt, lock washer, and flat washer securing lead B5-POS to terminal B5 on the chopper module board. See Wiring Diagram.
7. Using a 7/16” nutdriver, attach the bolt, lock washer, and flat washer securing lead B4-NEG to terminal B4 on the chopper module board. See Wiring Diagram.
8. Using a 7/16” nutdriver, attach the bolt, lock washer, and flat washer securing lead W10 to terminal B3 on the chopper module board. See Wiring Diagram.
9. Using a 7/16” nutdriver, attach the bolt, lock washer, and flat washer securing lead B2-POS to terminal B2 on the chopper module board. See Wiring Diagram.
10. Using a 7/16” nutdriver, attach the bolt, lock washer, and flat washer securing lead B1-NEG to terminal B1 on the chopper module board. See Wiring Diagram.
11. Connect plugs J20, J21, and J22 to the chopper module board. See Wiring Diagram.
12. Perform the ***Case Cover Replacement Procedure***.
13. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Chopper module board plug and terminal locations

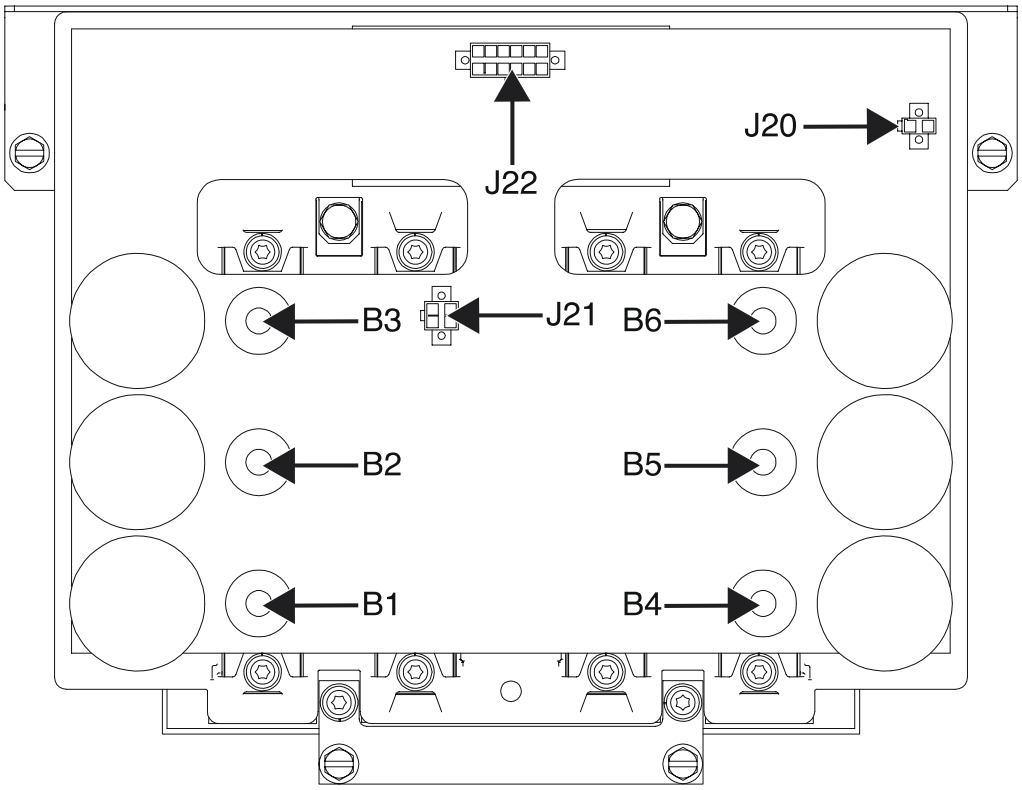


Figure F.2 – Chopper module board bracket and bracket mounting hardware locations

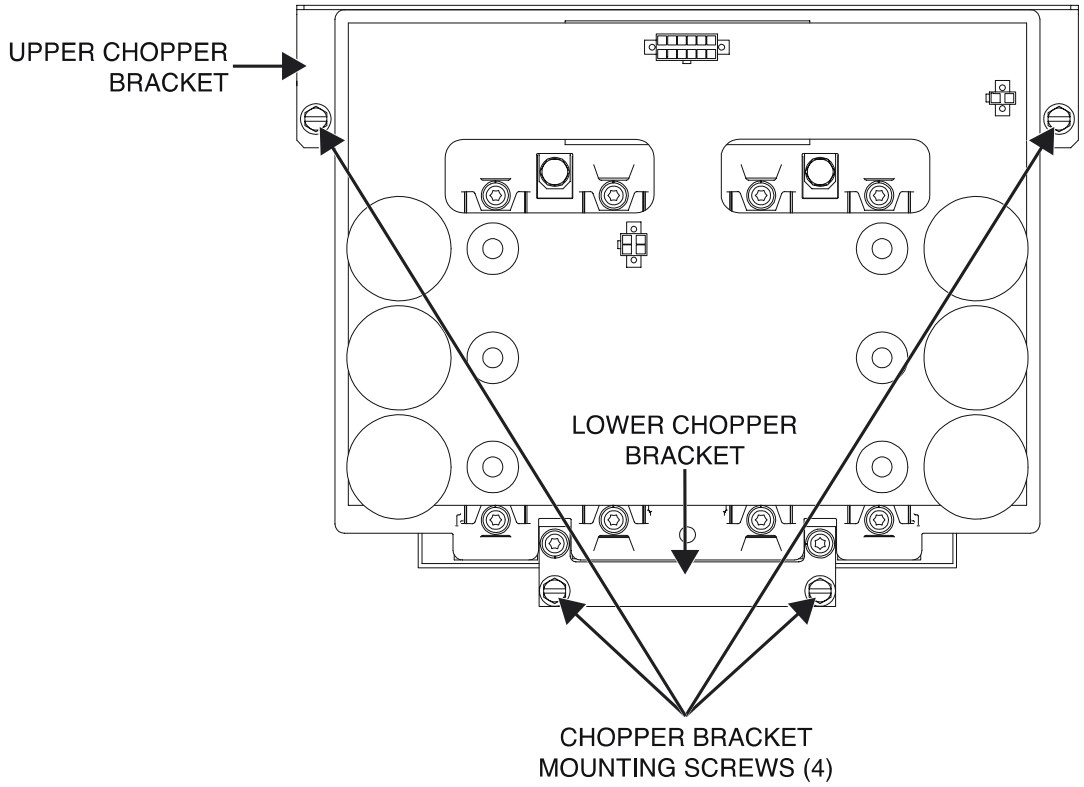
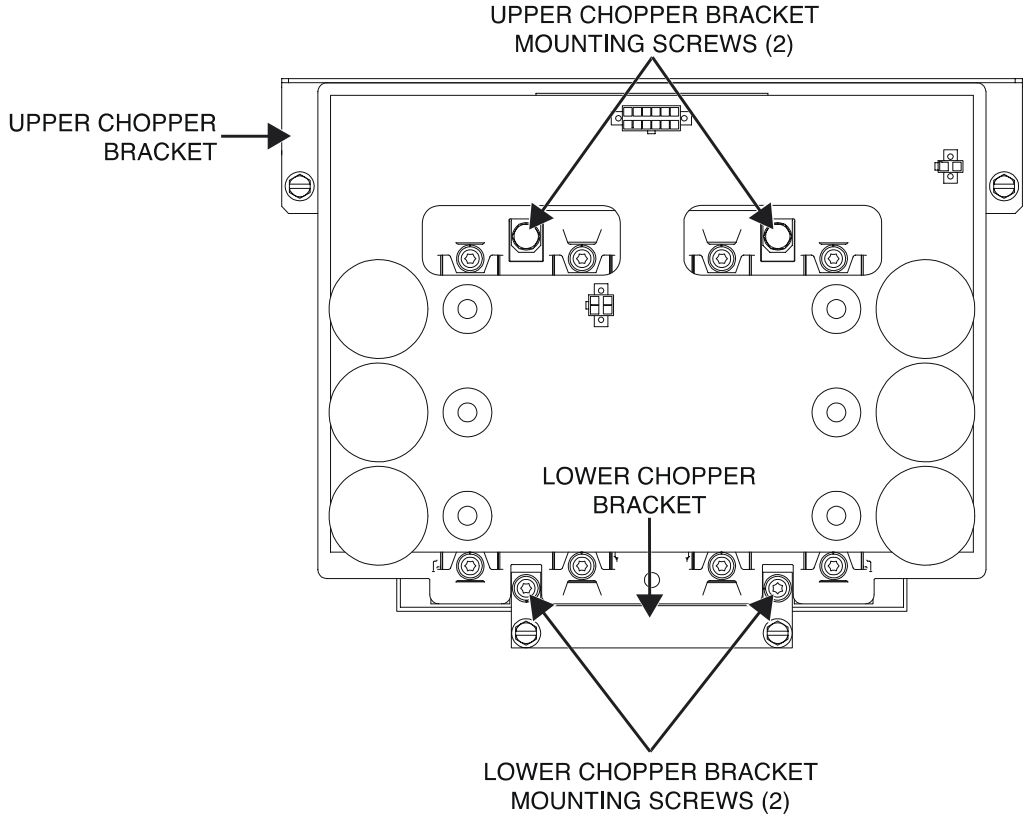
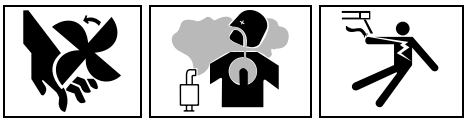


Figure F.3 – Chopper module board upper and lower bracket mounting hardware locations



OUTPUT 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 Output Rectifier.

MATERIALS NEEDED

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

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the output rectifier.
6. Carefully remove the shield from the machine.
7. Using a 7/16” nutdriver and a 7/16” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads W1/W6 to the left AC terminal of the output rectifier. See ***Figure F.2***. See Wiring Diagram.
8. Using a 7/16” nutdriver and a 7/16” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads W2/W3 to the middle AC terminal of the output rectifier. See ***Figure F.2***. See Wiring Diagram.
9. Using a 7/16” nutdriver and a 7/16” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads W4/W5 to the right AC terminal of the output rectifier. See ***Figure F.2***. See Wiring Diagram.
10. Using a 1/2” nutdriver and a 1/2” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads B1-NEG and B4-NEG to the negative terminal of the output rectifier. See ***Figure F.2***. See Wiring Diagram.
11. Using a 1/2” nutdriver and a 1/2” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads 206C, B2-POS, B5-POS, and POS-SHUNT to the positive terminal of the output rectifier. See ***Figure F.2***. See Wiring Diagram.
12. Using a 1/2” nutdriver, remove the two nuts, lock washers, and flat washers securing the output rectifier to the power module panel. See ***Figure F.3***.
13. The output rectifier can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new output rectifier into the power module panel.
2. Using a 1/2” nutdriver, attach the two nuts, lock washers, and flat washers securing the output rectifier to the power module panel.

3. Using a 1/2” nutdriver and a 1/2” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads 206C, B2-POS, B5-POS, and POS-SHUNT to the positive terminal of the output rectifier. See Wiring Diagram.
4. Using a 1/2” nutdriver and a 1/2” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads B1-NEG and B4-NEG to the negative terminal of the output rectifier. See Wiring Diagram.
5. Using a 7/16” nutdriver and a 7/16” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads W4/W5 to the right AC terminal of the output rectifier. See Wiring Diagram.
6. Using a 7/16” nutdriver and a 7/16” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads W2/W3 to the middle AC terminal of the output rectifier. See Wiring Diagram.
7. Using a 7/16” nutdriver and a 7/16” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads W1/W6 to the left AC terminal of the output rectifier. See Wiring Diagram.
8. Carefully raise the control panel into the upright position.
9. Carefully position the shield into the machine.
10. Using a 3/8” nutdriver, attach the four screws securing the control panel into the upright position. See Wiring Diagram.
11. Perform the ***Case Cover Replacement Procedure***.
12. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw locations

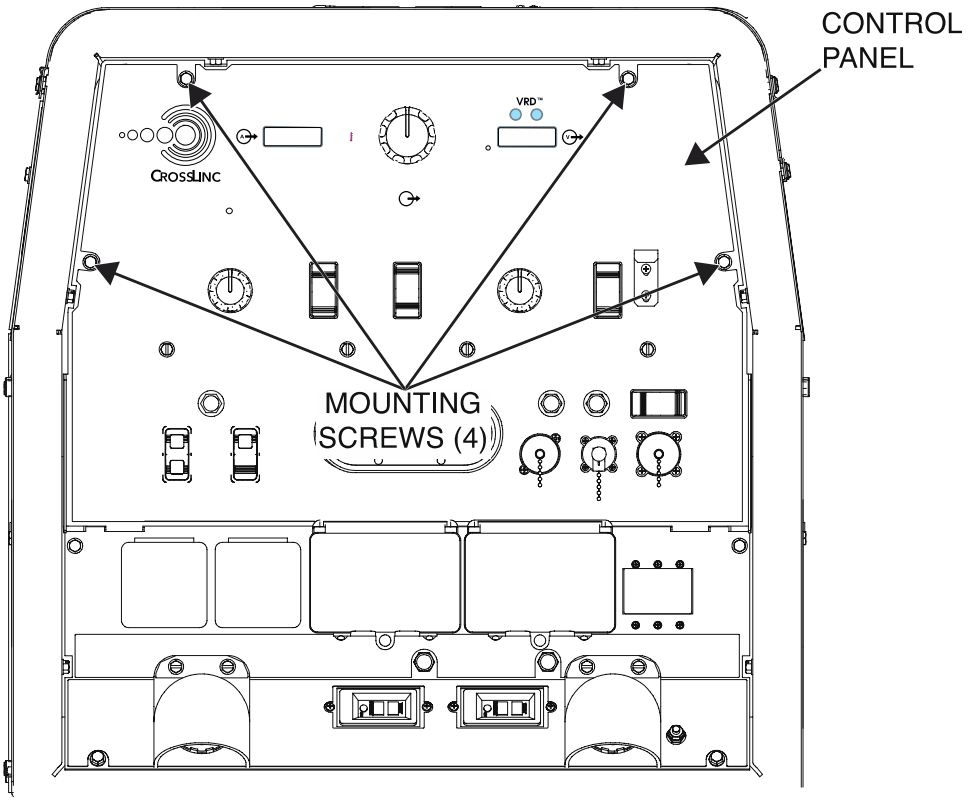


Figure F.2 – Output rectifier terminal locations

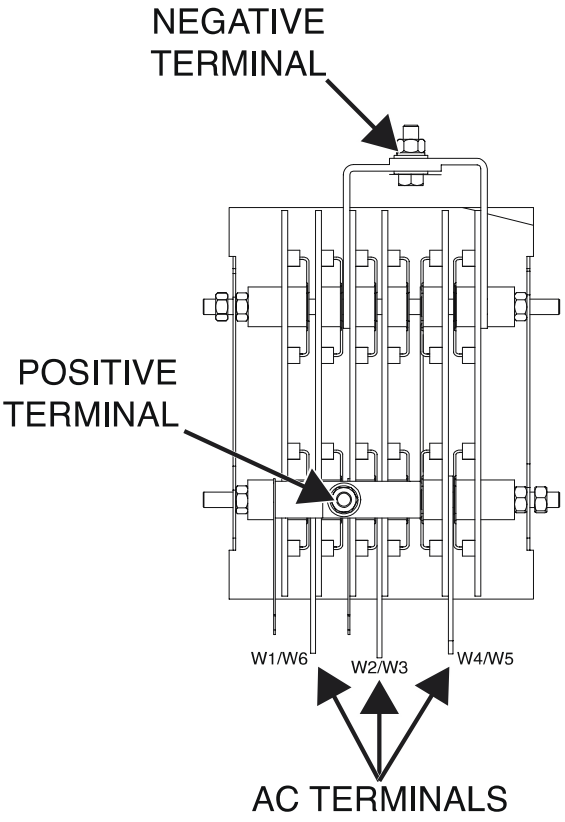
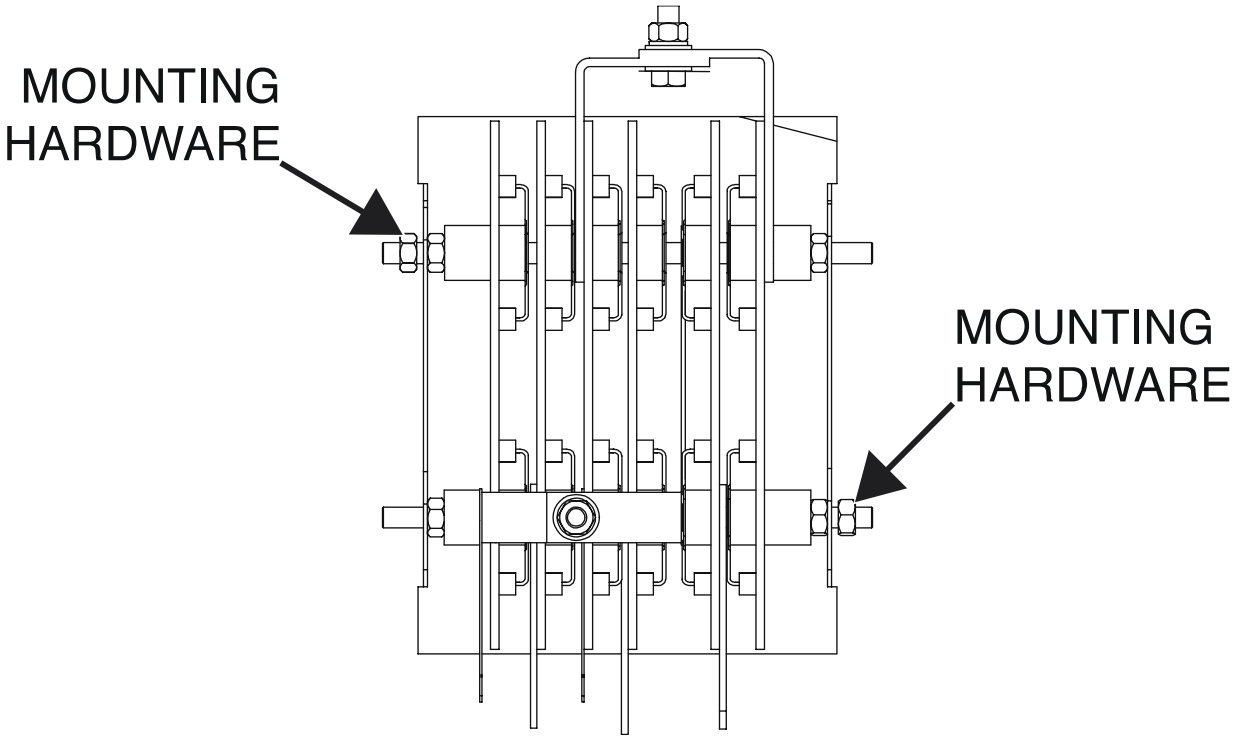
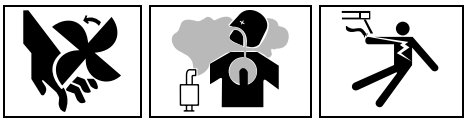


Figure F.3 – Output rectifier mounting hardware locations



120 VAC SINGLE PHASE RECEPTACLE(S) 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 Receptacle(s).

MATERIALS NEEDED

Phillips Screwdriver
Wiring Diagram

REMOVAL PROCEDURE

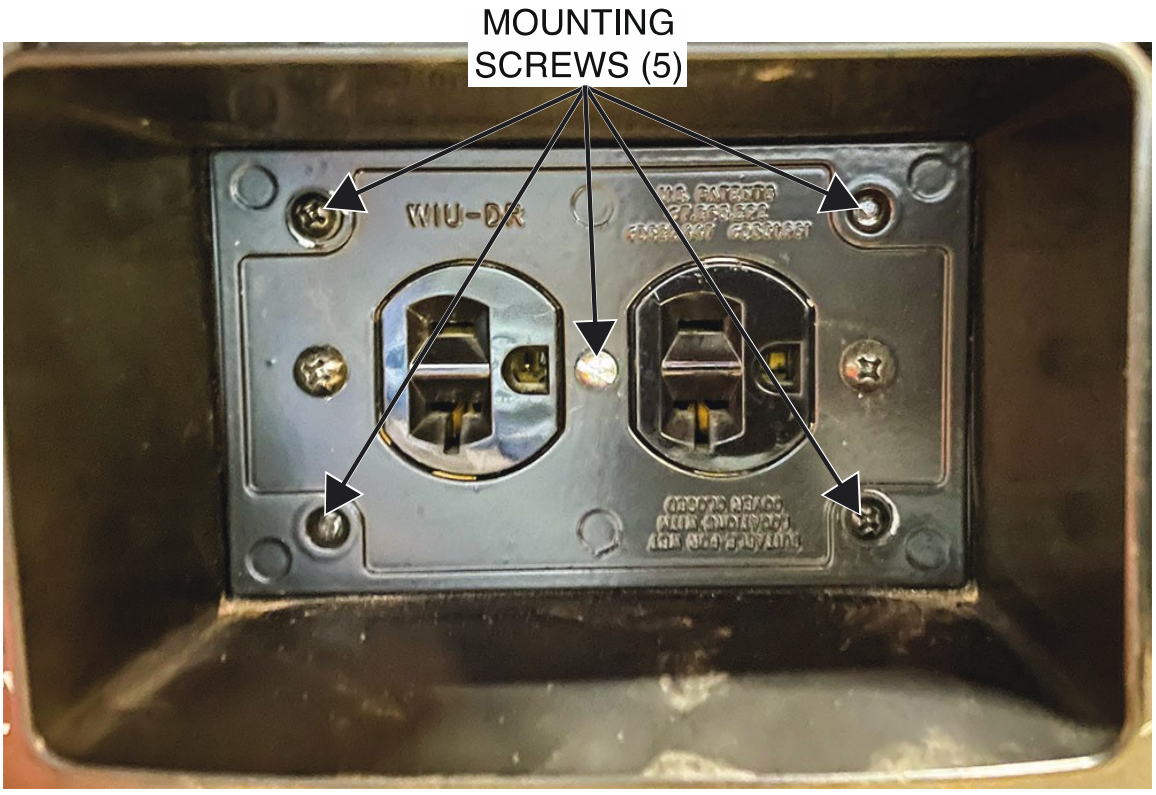
1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Open the outlet cover to gain access to the mounting screws. See ***Figure F.1***.
5. Using a Phillips screwdriver, remove the five screws securing the receptacle, receptacle box, mounting bracket, and rubber cover to the output panel. See ***Figure F.2***.
6. Using a Phillips screwdriver, loosen the screw securing each lead (GND-D, 5B, and 3F on left receptacle and GND-E, 5E, and 6G on right receptacle) to the 120 VAC single phase receptacle(s). See ***Figure F.2***. See Wiring Diagram.
7. The 120 VAC single phase receptacle(s) can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new 120 VAC single phase receptacle(s) in the machine.
2. Using a Phillips screwdriver, tighten the screw securing each lead (GND-D, 5B, and 3F on left receptacle and GND-E, 5E, and 6G on right receptacle) to the 120 VAC single phase receptacle(s). See Wiring Diagram.
3. Using a Phillips screwdriver, attach the five screws securing the receptacle, receptacle box, mounting bracket, and rubber cover to the output panel.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

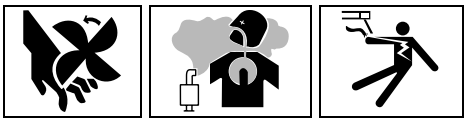
Figure F.1 – 120 VAC single phase receptacle locations

Figure F.2 – 120 VAC single phase receptacle mounting screw 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

Slotted Screwdriver
11/32” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a slotted screwdriver, loosen the four screws securing the leads GND-C, 6D, 6E, 5D, 3C, and 3D to the receptacle terminals. See ***Figure F.1***. See Wiring Diagram.
5. Using a 11/32” nutdriver and a slotted screwdriver, remove the four screws, lock washers, and nuts securing the receptacle and receptacle cover to the output panel. See ***Figure F.2***.
6. 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 output panel.
2. Using a 11/32” nutdriver and a slotted screwdriver, attach the four screws, lock washers, and nuts securing the receptacle and receptacle cover to the output panel.
3. Using a slotted screwdriver, tighten the four screws securing the leads GND-C, 6D, 6E, 5D, 3C, and 3D to the receptacle terminals. See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – 120 / 240 VAC single phase receptacle lead locations

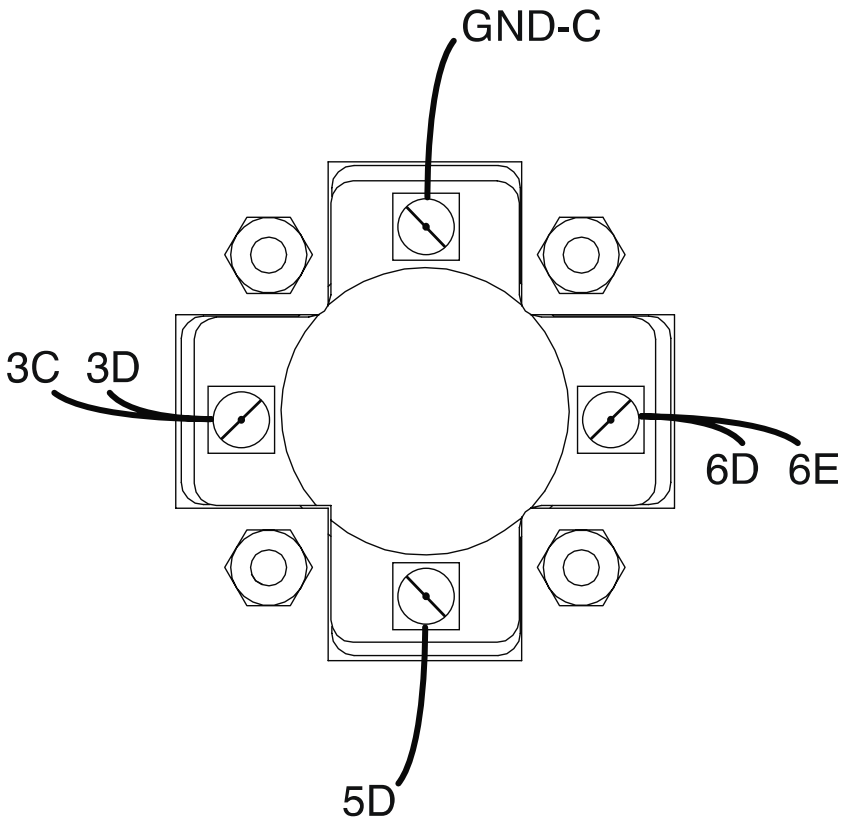
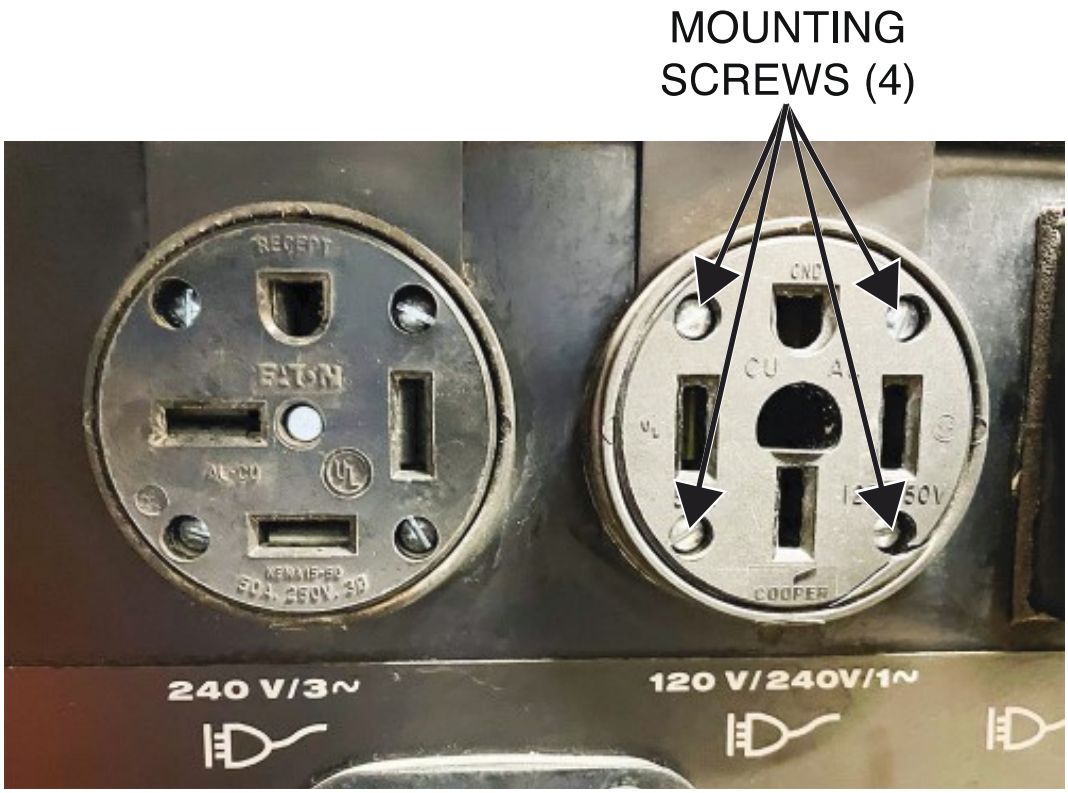
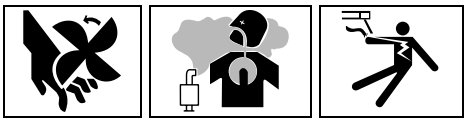


Figure F.2 – 120 / 240 VAC single phase receptacle mounting screw locations



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

Slotted Screwdriver
11/32” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a slotted screwdriver, loosen the four screws securing the leads GND-L, 4A, 6C, and 3B to the 240 VAC 3-phase receptacle. See ***Figure F.1***. See Wiring Diagram.
5. Using a 11/32” nutdriver and slotted screwdriver, remove the four nuts securing the receptacle and receptacle cover to the output panel. See ***Figure F.2***.
6. 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 output panel.
2. Using a 11/32” nutdriver and slotted screwdriver, attach the four screws and nuts securing the receptacle and receptacle cover to the output panel.
3. Using a slotted screwdriver, tighten the four screws securing the leads GND-L, 4A, 6C, and 3B to the 240 VAC 3-phase receptacle. See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.1 – 240 VAC 3-phase receptacle lead locations

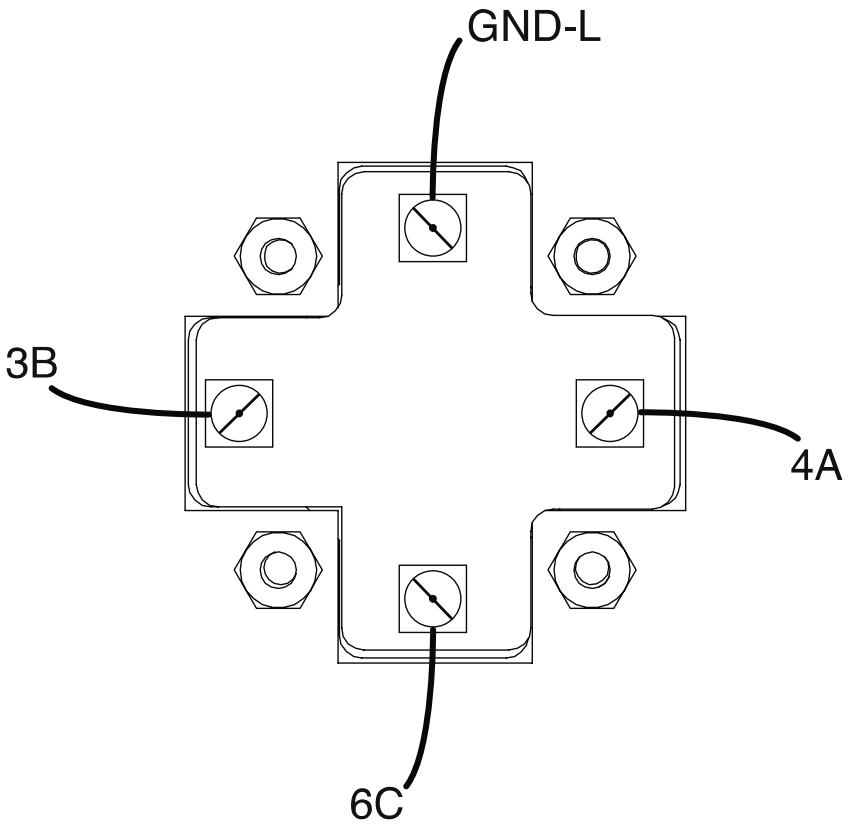
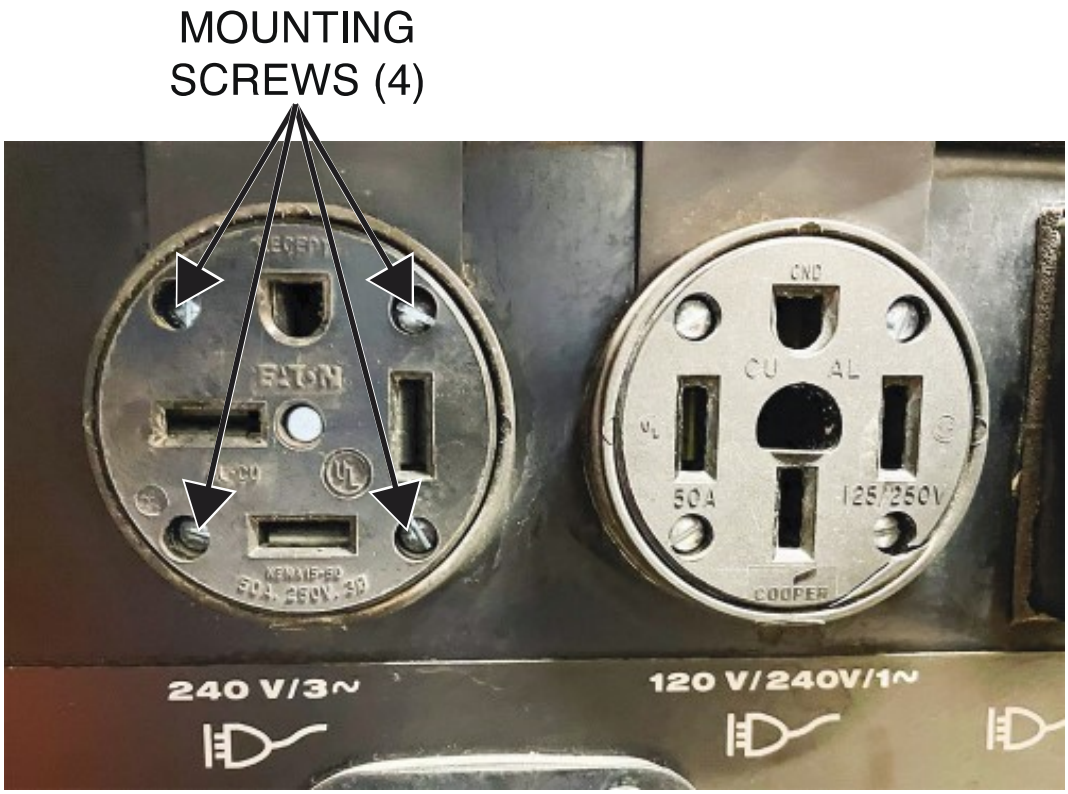
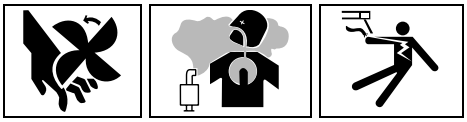


Figure F.2 – 240 VAC 3-phase receptacle mounting screw locations



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.

MATERIALS NEEDED

3/8” Nutdriver
Phillips Screwdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the four screws securing the control panel to the machine. See ***Figure F.1***.
5. Carefully lower the control panel to gain access to the 120V GFCI.
6. Carefully remove the shield from the machine.
7. Label and disconnect the green lead from lead GND-H (left) or GND-G (right). See Wiring Diagram. Cut cable ties as necessary.
8. Label and disconnect plug P70AB from plug J70A (left) or J70B (right). See ***Figure F.2***. See Wiring Diagram. Cut cable ties as necessary.
9. Using a Phillips screwdriver, remove the two screws securing the 120V GFCI to the output panel. Remove the bracket. See ***Figure F.3***. Retain the bracket for reassembly.
10. Cut cable ties as necessary to allow the removal of the 120V GFCI.
11. The 120V GFCI can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new 120V GFCI into the output panel.
2. Using a Phillips screwdriver, attach the two screws securing the 120V GFCI and the bracket to the output panel.
3. Connect plug P70AB to plug J70A (left) or J70B (right). See Wiring Diagram. Replace cable ties as necessary.
4. Connect the green lead to lead GND-H (left) or GND-G (right). See Wiring Diagram. Replace cable ties as necessary.
5. Carefully raise the control panel into the upright position.
6. Carefully position the shield into the machine.
7. Using a 3/8” nutdriver, attach the four screws securing the control panel into the upright position. See Wiring Diagram.
8. Perform the ***Case Cover Replacement Procedure***.
9. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Control panel mounting screw locations

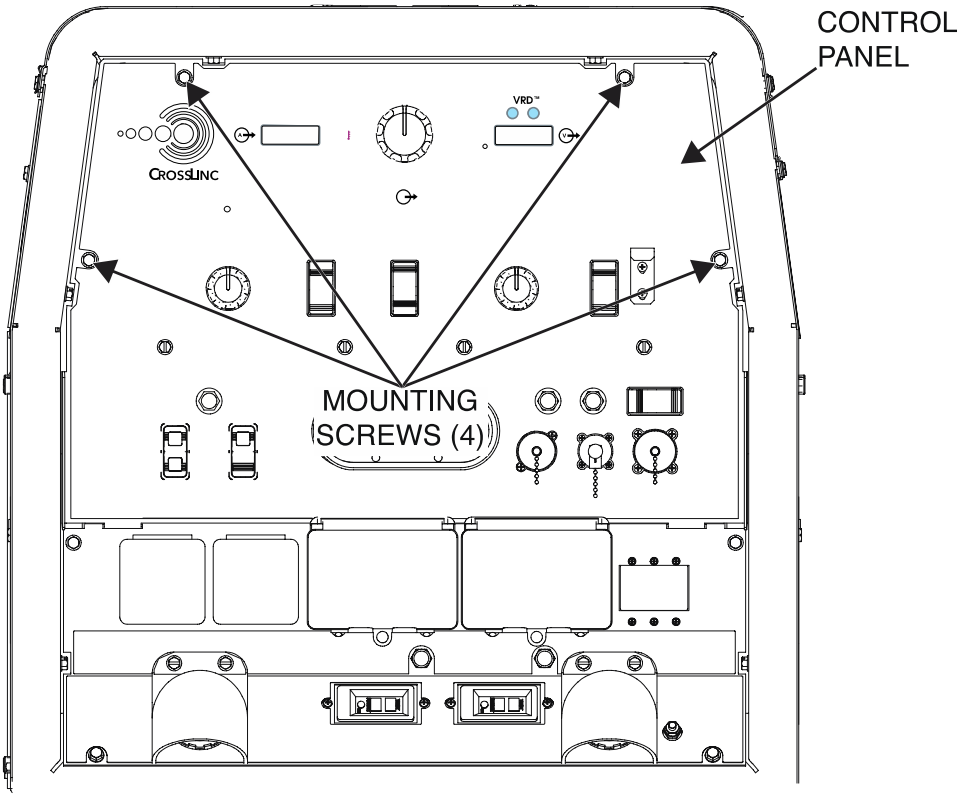


Figure F.2 – 120V GFCI ground lead and plug locations

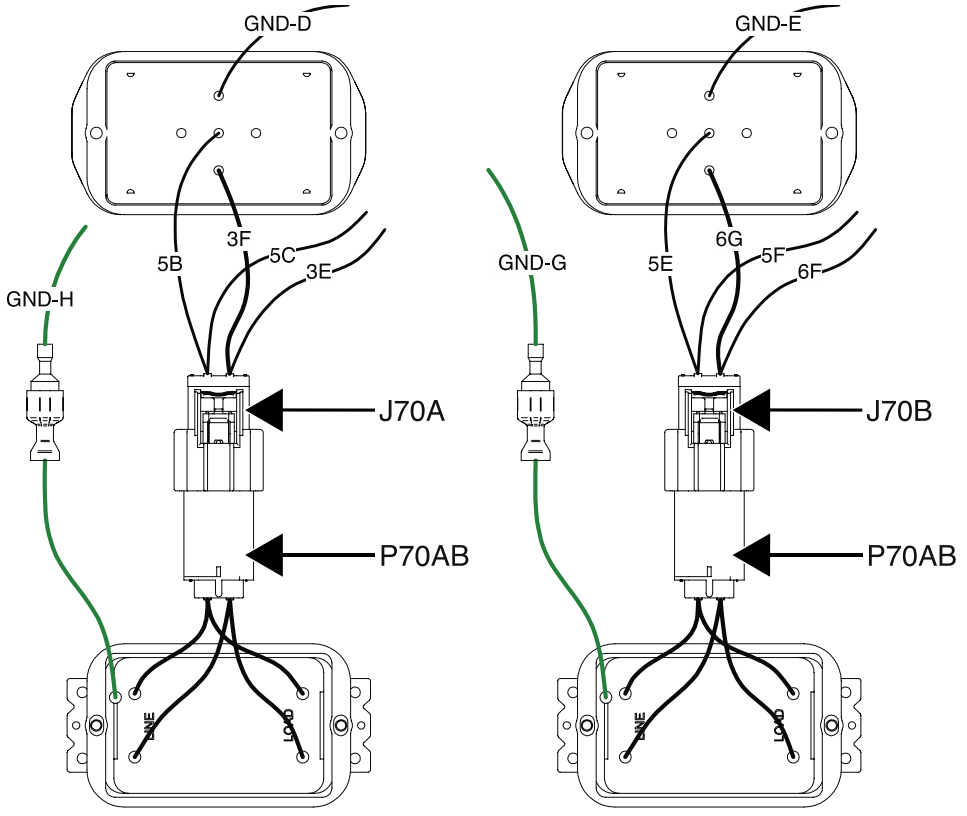
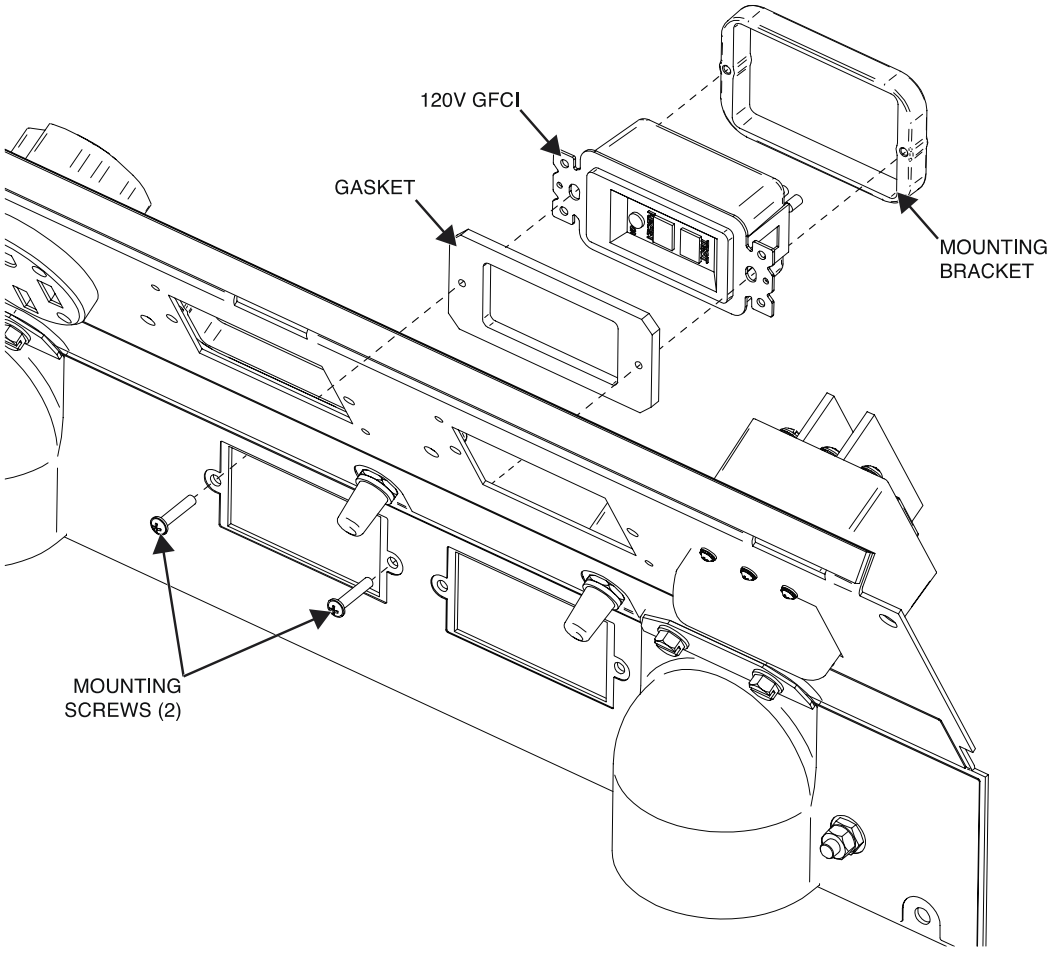
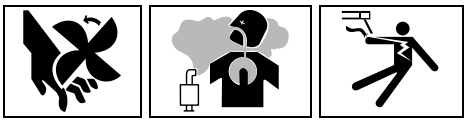


Figure F.3 – 120V GFCI mounting hardware locations



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

7/16” Nutdriver
3/8” Nutdriver With Extension
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the two nuts securing the output stud cover plate to the output stud cover. See ***Figure F.1***. Remove the output stud cover. Retain for reassembly.
5. 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. Label and disconnect the leads.
6. 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. Label and disconnect the leads.
7. Using a 3/8” nutdriver with extension, remove the screw securing the field capacitor bracket to the stator fan guard. 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 machine.
2. Using a 3/8” nutdriver with extension, attach the screw securing the field capacitor bracket to the stator fan guard.
3. 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.
4. 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.
5. Using a 3/8” nutdriver, attach the two nuts 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 mounting hardware locations

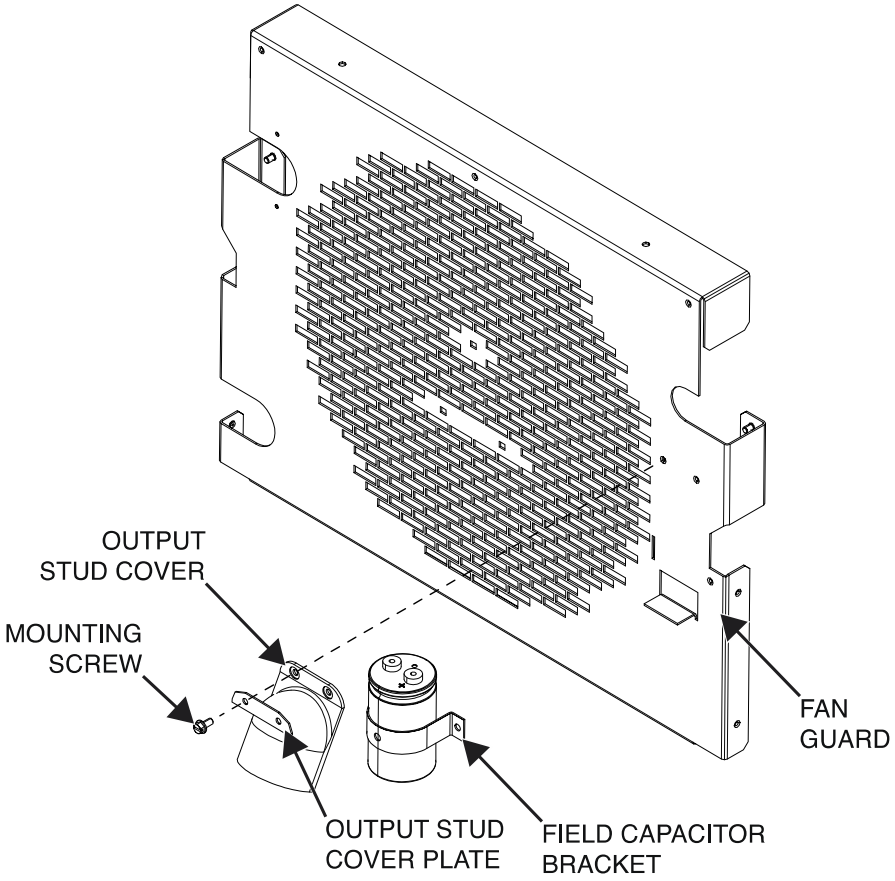
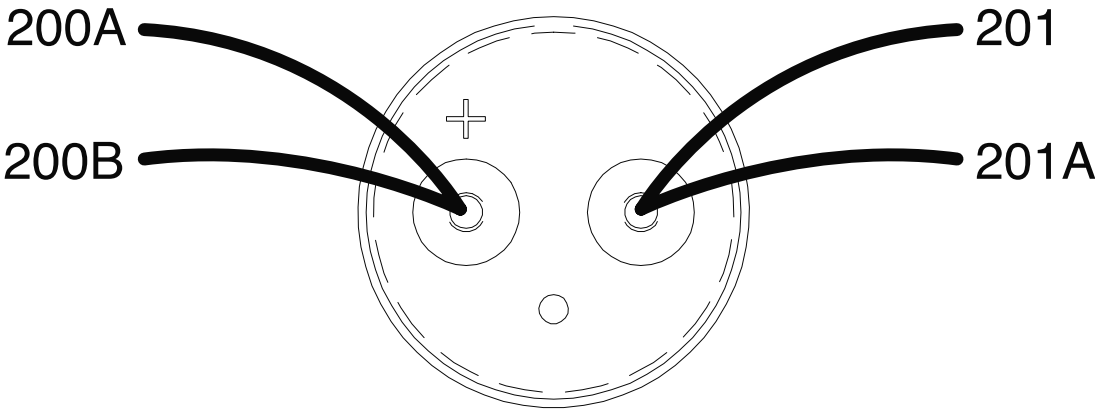
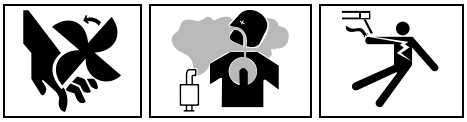


Figure F.2 – Field capacitor lead locations



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 ECU.

MATERIALS NEEDED

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect the 36-pin machine interface and the 8-pin machine interface from the ECU. See ***Figure F.1***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the screw securing the lead 5R to the ECU. See ***Figure F.2***.
6. Using a 3/8” nutdriver, remove the three screws securing the ECU to the machine. See ***Figure F.2***.
7. The ECU can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new ECU into the machine.
2. Using a 3/8” nutdriver, attach the three screws securing the ECU to the machine.
3. Using a 3/8” nutdriver, attach the screw securing the lead 5R to the ECU.
4. Connect the 36-pin machine interface and the 8-pin machine interface to the ECU. See Wiring Diagram.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – 36-pin and 8-pin machine interface locations

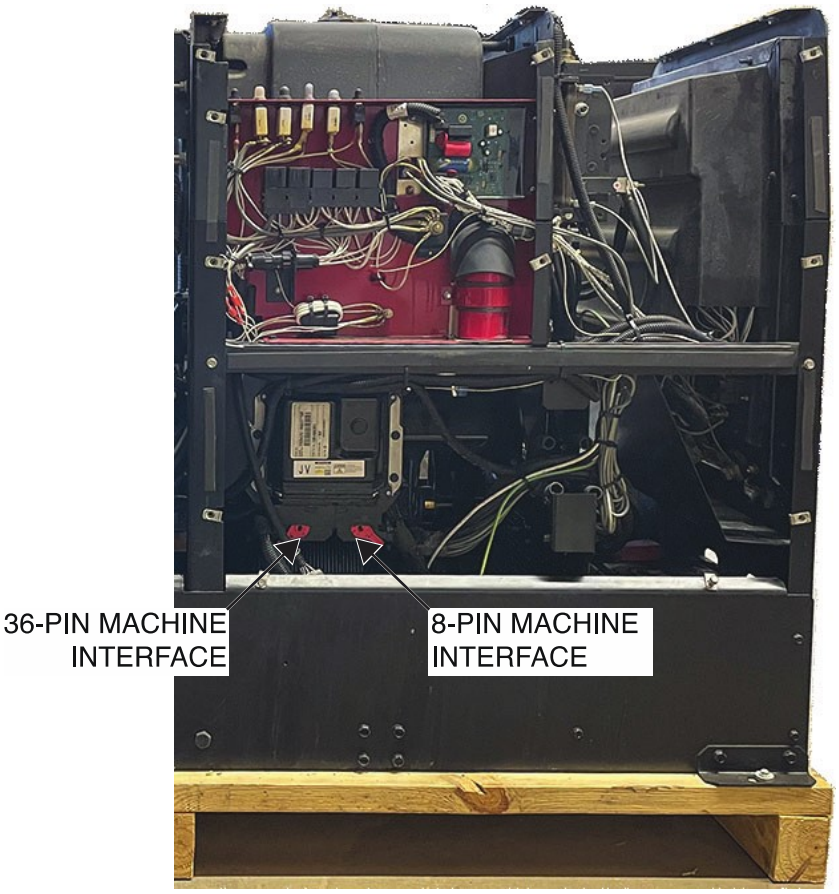
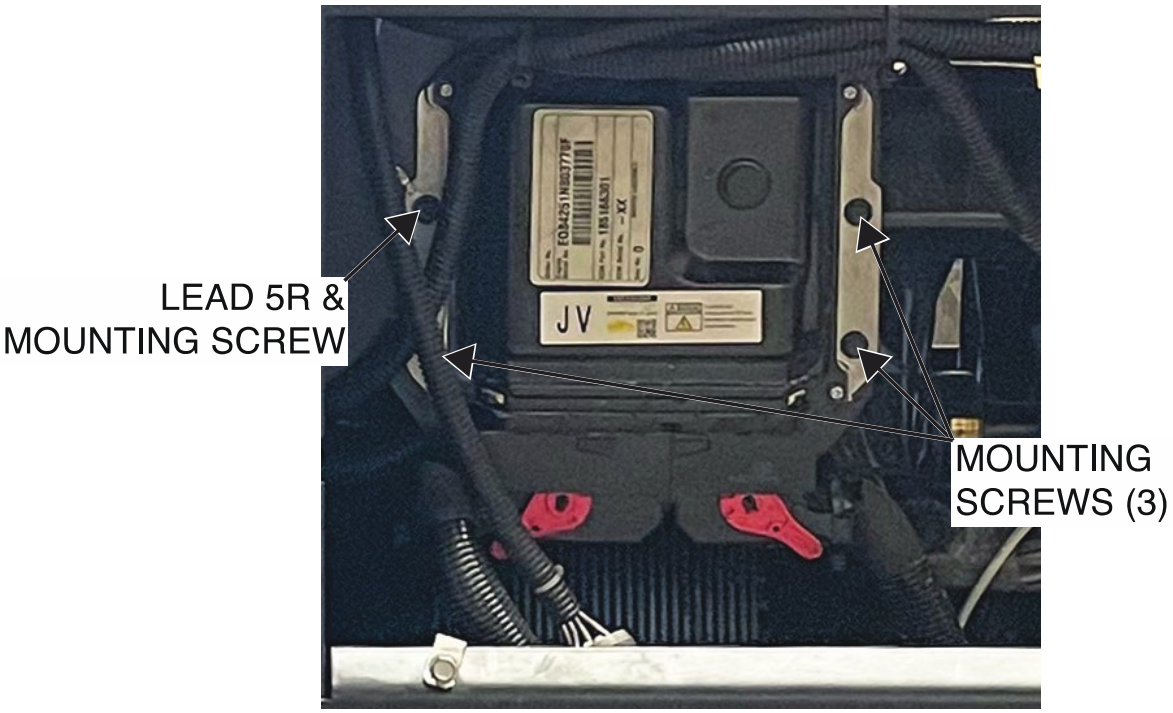
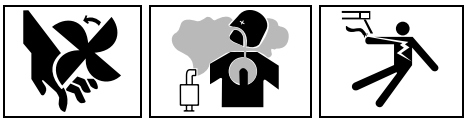


Figure F.2 – ECU lead 5R and mounting screw locations



OUTPUT CHOKE(S) 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 Choke(s).

MATERIALS NEEDED

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

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X 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 metal shield to the support rail. See ***Figure F.1***.
5. Using a 3/8” nutdriver, remove the two screws securing the metal shield to the front panel. See ***Figure F.1***.
6. Carefully maneuver the metal shield out of the machine to gain access to the output choke(s). Retain the metal shield for reassembly.
7. Using a 1/2" nutdriver and a 1/2” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads W9/W10 to the top terminal of the left (B) output choke. See ***Figure F.2***. See Wiring Diagram. Label and disconnect leads.
8. Using a 1/2" nutdriver and a 1/2” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing leads 208C and NEG-choke to the lower terminals of the output choke(s). See ***Figure F.2***. See Wiring Diagram. Label and disconnect leads.
9. Using a 1/2" nutdriver and a 1/2” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing the choke jumper lead to the top terminal of the right (A) output choke. See ***Figure F.2***. See Wiring Diagram. Label and disconnect leads.
10. Using a 7/16” nutdriver, remove the four nuts, lock washers, and flat washers securing each of the output choke(s) to the machine. See ***Figure F.1***.
11. Carefully remove the output choke(s) from the mounting posts.
12. The output choke(s) can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new output choke(s) into the machine.
2. Using a 7/16” nutdriver, attach the four nuts, lock washers, and flat washers securing each of the output choke(s) to the machine.
3. Using a 1/2" nutdriver and a 1/2” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing the choke jumper lead to the top terminal of the right (A) output choke. See Wiring Diagram.

4. Using a 1/2" nutdriver and a 1/2” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads 208C and NEG-choke to the lower terminals of the output choke(s). See Wiring Diagram.
5. Using a 1/2" nutdriver and a 1/2” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing leads W9/W10 to the top terminal of the left (B) output choke. See Wiring Diagram.
6. Carefully position the metal shield into the machine.
7. Using a 3/8” nutdriver, attach the two screws securing the metal shield to the front panel.
8. Using a 3/8” nutdriver, attach the two screws securing the metal shield to the support rail.
9. Perform the ***Case Cover Replacement Procedure***.
10. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Metal shield and mounting screw locations

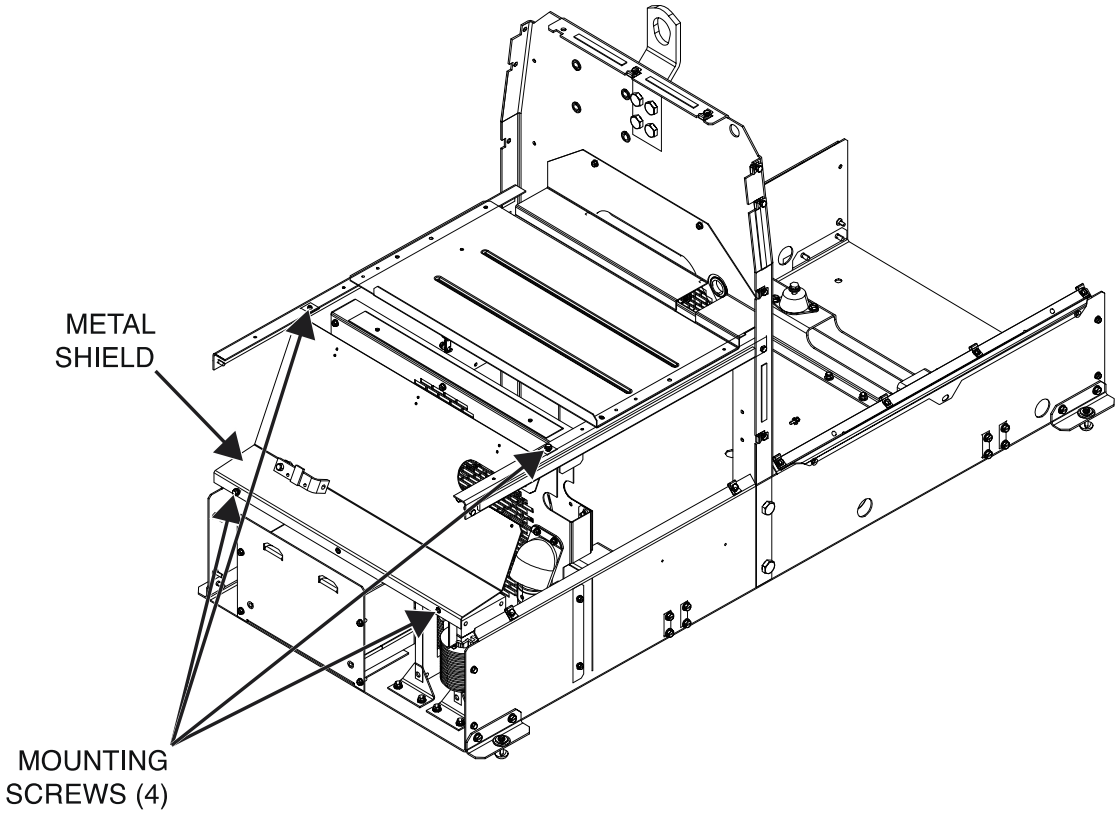
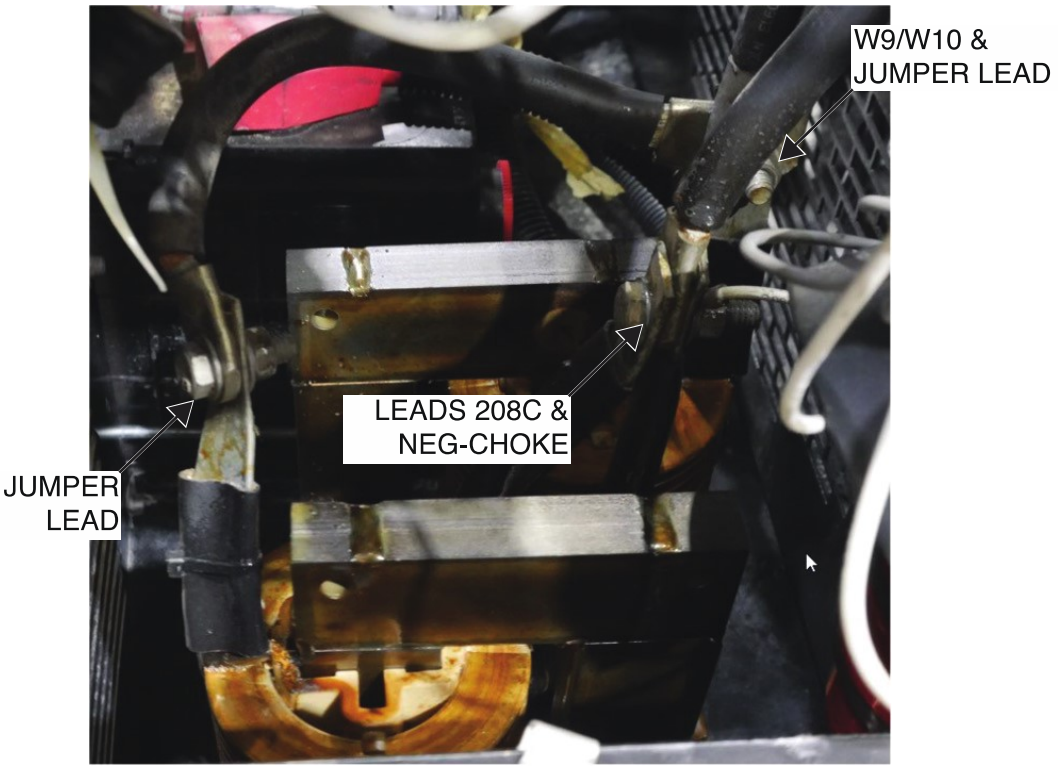
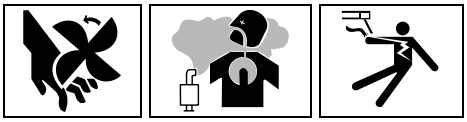


Figure F.2 – Output choke lead locations



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

Fuel Siphon
Fuel Storage Container
Slotted Screwdriver
3/8” Nutdriver
7/16” Nutdriver
Locking Wrench
Paper Towels
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a fuel siphon, remove the fuel from the fuel tank and store it in an appropriate fuel storage container.
5. Label and disconnect leads 5J and 229 from the fuel sender. See ***Figure F.1***. See Wiring Diagram. Cut cable ties as necessary.
6. Carefully route the fuel sender leads through the power module panel. See Wiring Diagram.
7. Using a slotted screwdriver, loosen the hose clamp securing the top fuel line to the fuel tank. Label and disconnect the fuel line.
8. Using a 3/8” nutdriver, remove the two screws securing the fuel tank front panel to the power module panel. See ***Figure F.2***.
9. Using a 7/16” nutdriver, remove the nut, lock washer, and flat washer securing the fuel tank front panel to the power module panel. See ***Figure F.3***.
10. Using a 3/8” nutdriver, remove the two screws securing the two R4 resistor mounting brackets to the power module panel. See ***Figure F.2***.
11. Using a 3/8” nutdriver, remove the four screws securing the chopper brackets to the power module panel. See ***Figure F.4***.
12. Carefully remove the chopper module board partially out of the power module panel to allow for removal of the fuel tank front panel.
13. Carefully remove the fuel tank front panel from the machine.
14. Using slotted screwdriver, loosen the hose clamp securing the lower fuel line to the fuel shutoff. **NOTE:** To avoid fuel spills, temporarily wrap the fuel hoses with paper towels to absorb any residual fuel. If there is any fuel left in the fuel tank, drain it into an appropriate fuel storage container.
15. Using a locking wrench, clamp the fuel line to prevent any fuel spills during the removal of the fuel tank.
16. Carefully maneuver the fuel tank out of the machine.
17. The fuel tank can now be replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new fuel tank into the machine.
2. Carefully attach the lower fuel line to the fuel shutoff.
3. Using slotted screwdriver, tighten the hose clamp securing the lower fuel line to the fuel shutoff.
4. Carefully position the fuel tank front panel into the machine.
5. Using a 3/8” nutdriver, attach the four screws securing the chopper brackets to the power module panel.
6. Using a 3/8” nutdriver, attach the two screws securing the two R4 resistor mounting brackets to the power module panel.
7. Using a 7/16” nutdriver, attach the nut, lock washer, and flat washer securing the fuel tank front panel to the power module panel.
8. Using a 3/8” nutdriver, attach the two screws securing the fuel tank front panel to the power module panel.
9. Using a slotted screwdriver, tighten the hose clamp securing the top fuel line to the fuel tank.
10. Carefully route the fuel sender leads through the power module panel. See Wiring Diagram.
11. Connect leads 5J and 229 to the fuel sender. See Wiring Diagram. Replace cable ties as necessary.
12. Perform the ***Case Cover Replacement Procedure***.
13. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Fuel sender lead locations

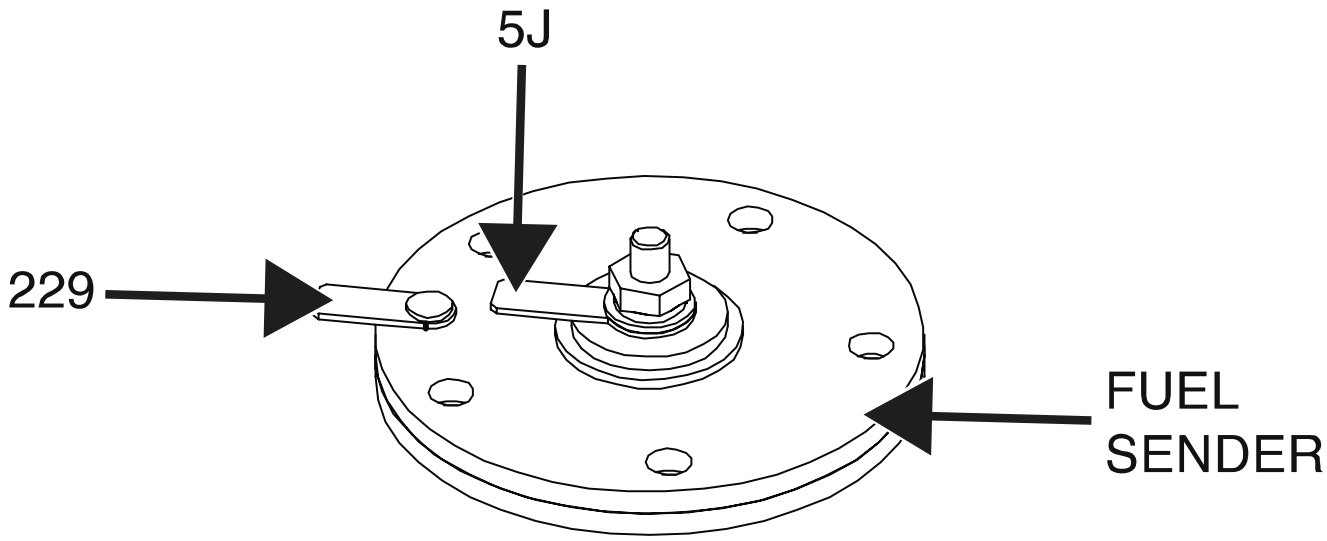


Figure F.2 – Fuel tank front panel and R4 resistor mounting bracket locations

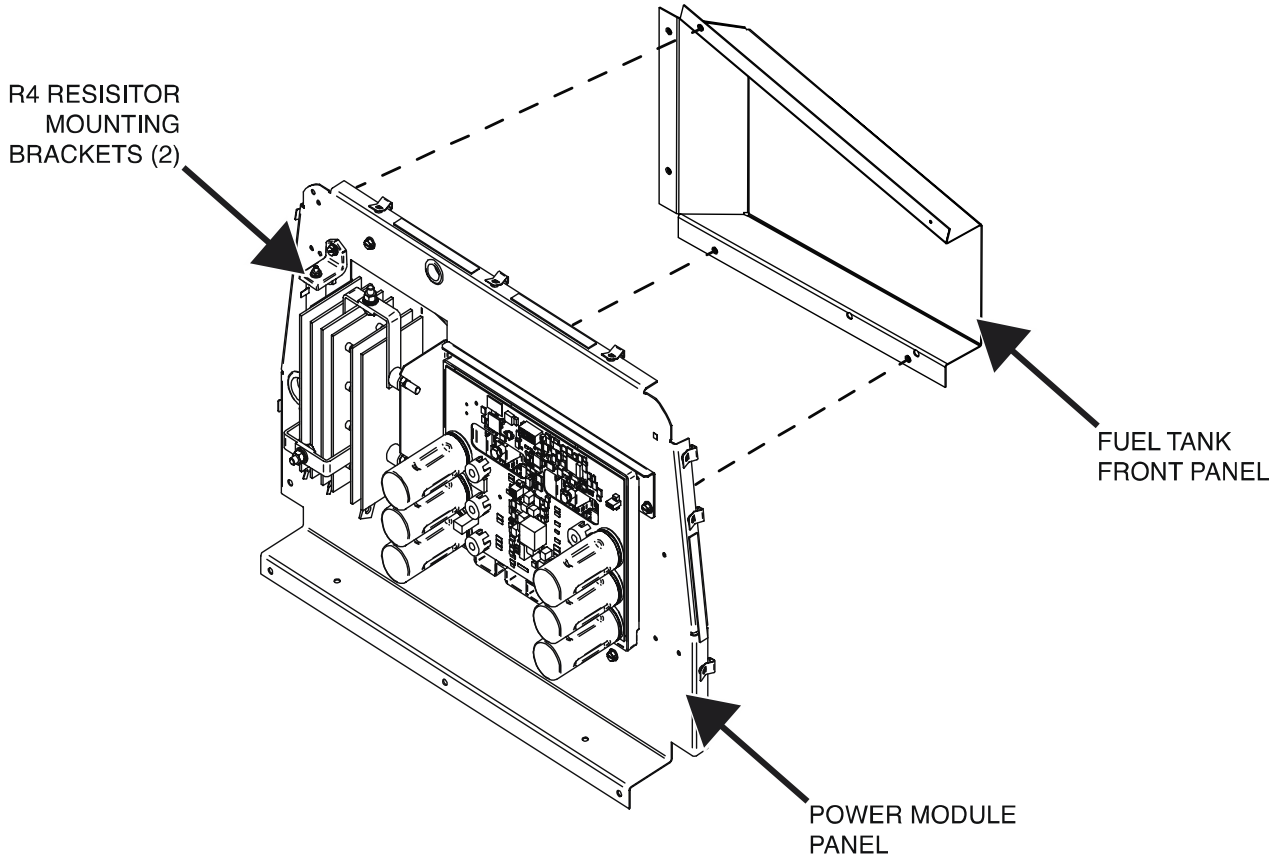


Figure F.3 – Fuel tank front panel mounting hardware locations

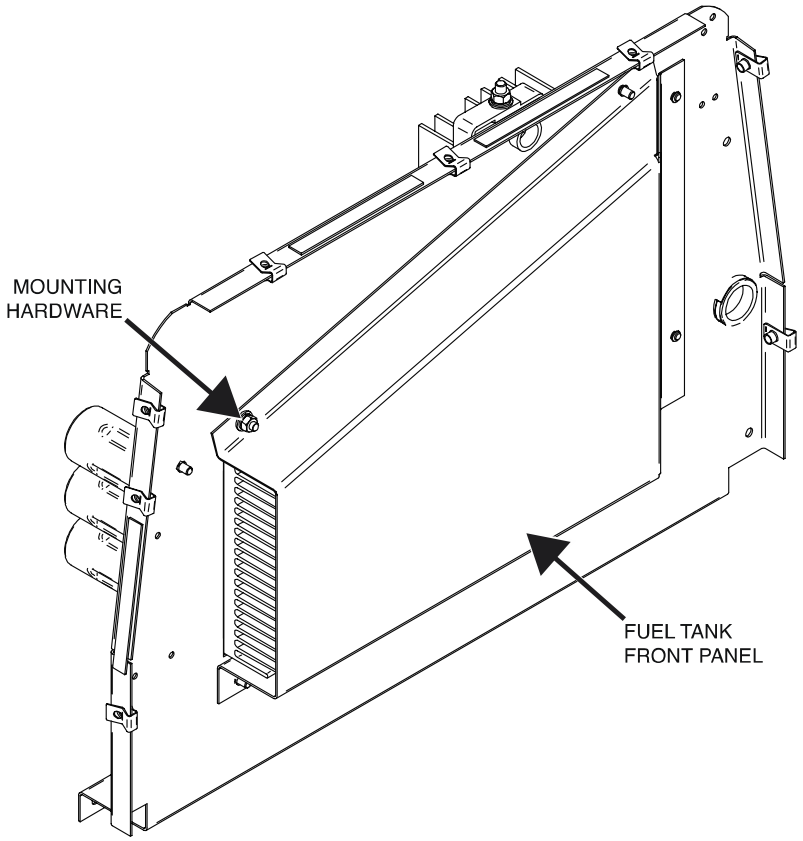
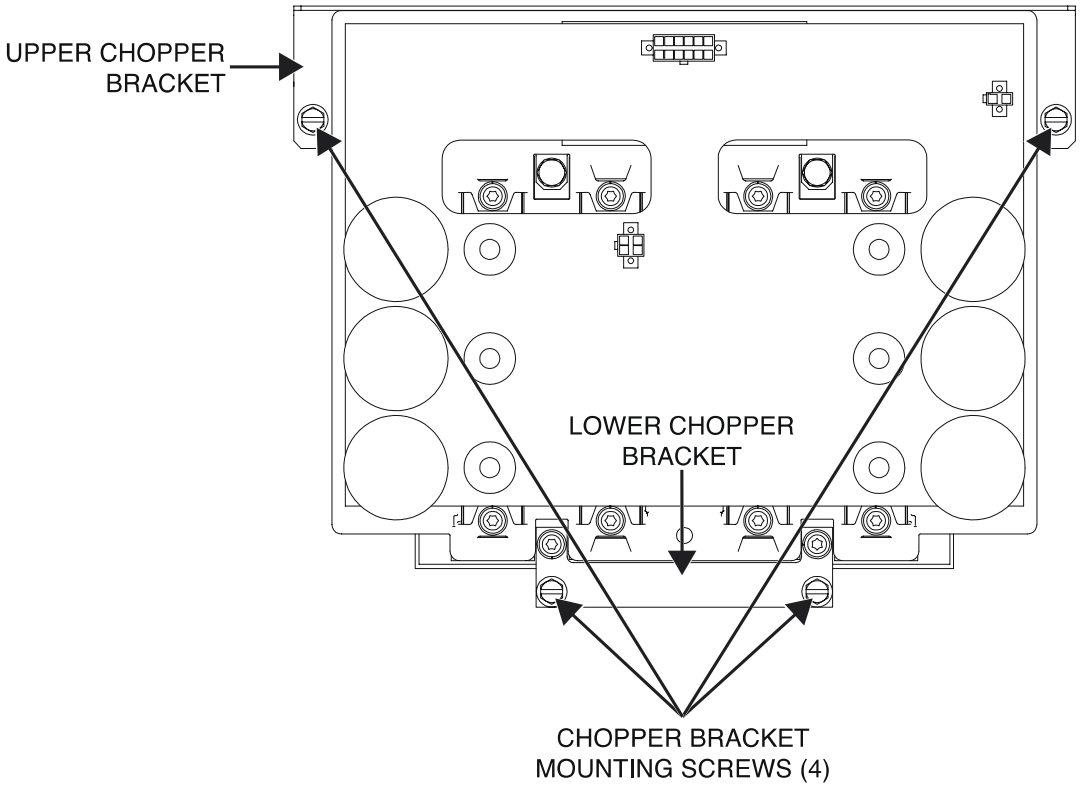
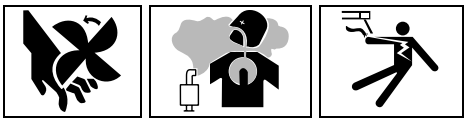


Figure F.4 – Upper and lower chopper bracket screw locations



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 Stator and Rotor Assemblies.

MATERIALS NEEDED

Slotted Screwdriver
3/8” Nutdriver
7/16” Nutdriver
Small Piece Of Wood
Large Crescent Wrench
9/16” Nutdriver
Hoist And Appropriate Rigging
Piece Of Wood Or Steel Blocking
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Perform the ***Fuel Tank Removal Procedure***.
5. Perform the ***Field Capacitor Removal Procedure***.
6. Perform the ***Brush and Brush Holder Removal Procedure***.
7. Perform the ***Output Rectifier Removal Procedure***.
8. Perform the ***Chopper Module Board Removal Procedure***.
9. Perform the ***Output Choke Removal Procedure***.
10. Perform the ***Battery Removal Procedure***.
11. Label and disconnect lead 46 from circuit breaker (CB9). See ***Figure F.1***. See Wiring Diagram.
12. Label and disconnect lead 45 from the D2 rectifier. See ***Figure F.2***. See Wiring Diagram.
13. Label and disconnect lead 41 from lead 41A quick-connect terminal. See Wiring Diagram.
14. Label and disconnect lead 42 from circuit breaker (CB4). See ***Figure F.3***. See Wiring Diagram.
15. Label and disconnect lead 6A from the D1 rectifier. See ***Figure F.4***. See Wiring Diagram.
16. Using a slotted screwdriver, loosen the three screws securing leads 3, 4, and 6 to circuit breaker (CB1). See ***Figure F.5***. See Wiring Diagram. Label and disconnect the leads.
17. Using a 3/8” nutdriver, remove the nut, lock washer, and flat washer securing lead 5 to the ground stud on the output panel. See ***Figure F.6***. See Wiring Diagram.
18. Using a 3/8” nutdriver, remove the nut, lock washer, and flat washer securing lead 5A to the neutral stud on the output panel. See ***Figure F.6***. See Wiring Diagram.
19. Using a 3/8” nutdriver, remove the four screws securing the front panel to the base of the machine. See ***Figure F.7***.
20. Using a 3/8” nutdriver, remove the two screws securing the two support rails to the front panel. See ***Figure F.7***.
21. Carefully maneuver the front panel to gain access to any remaining leads. See Wiring Diagram.
22. Label and disconnect any remaining leads to allow the front panel to be moved to the side. See Wiring Diagram. Cut cable ties as necessary.

23. Carefully maneuver the front panel to the side of the machine.
24. Using a 3/8” nutdriver, remove the five screws securing the power module panel to the fan baffle. See ***Figure F.8***.
25. Using a 3/8” nutdriver, remove the two screws securing the inner control panel to the power module panel. See ***Figure F.9***.
26. Carefully remove the power module panel.
27. Using a 3/8” nutdriver, remove the screw securing the fuel tank tray to the right support rail. See ***Figure F.8***.
28. Using a 3/8” nutdriver, remove the two screws securing the inner control panel and fuel tank tray to the left support rail. See ***Figure F.9***.
29. Using a 3/8” nutdriver, remove the two screws securing the fuel tank tray to the lift bale frame. See ***Figure F.8***.
30. Using a 7/16” nutdriver, remove the nut, lock washer, and flat washer securing the fuel tank tray to the ECU mounting bracket. See ***Figure F.9***.
31. Carefully maneuver the fuel tank tray out of the machine.
32. Using a 3/8” nutdriver, remove the screw securing each support rail to the machine. See ***Figure F.8***.
33. Using a 3/8” nutdriver, remove the four screws securing the fan baffle to the machine. See ***Figure F.8***.
34. Carefully maneuver the fan baffle out of the machine.
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 from the rotor shaft. See ***Figure F.10***.
38. Using a 9/16” nutdriver, remove the two bolts, lock washers, and flat 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 hoist and appropriate rigging, lower the stator frame and engine onto the blocking.
42. Using a 9/16” nutdriver, remove the eight screws and lock washers securing the stator frame to the engine.
43. Using a hoist and appropriate rigging, carefully remove the stator frame from the engine.
44. Using a hoist and appropriate rigging, support the rotor and shaft assembly.
45. Remove the eight screws and lock washers securing the rotor coupling disk to the engine.
46. The rotor assembly can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Using a hoist and appropriate rigging, carefully mate the new rotor and shaft assembly with the engine.
2. Attach the eight screws and lock washers securing the rotor coupling disk to the engine.
3. Using a hoist and appropriate rigging, carefully mate the stator frame to the engine.
4. Using a 9/16” nutdriver, attach the eight screws and lock 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.
7. Using a hoist and appropriate rigging, carefully lower the stator frame onto its mounts.
8. Using a 9/16” nutdriver, attach the two bolts, lock washers, and flat washers securing the stator frame to the engine mounts.
9. Carefully slide the fan back 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. Carefully position the fan baffle into the machine.
13. Using a 3/8” nutdriver, attach the four screws securing the fan baffle to the machine.
14. Using a 3/8” nutdriver, attach the screw securing each support rail to the machine.
15. Carefully position the fuel tank tray into the machine.

16. Using a 7/16” nutdriver, attach the nut, lock washer, and flat washer securing the fuel tank tray to the ECU mounting bracket.
17. Using a 3/8” nutdriver, attach the two screws securing the fuel tank tray to the lift bale frame.
18. Using a 3/8” nutdriver, attach the two screws securing the inner control panel and fuel tank tray to the left support rail.
19. Using a 3/8” nutdriver, attach the screw securing the fuel tank tray to the right support rail.
20. Carefully position the power module panel into the machine.
21. Using a 3/8” nutdriver, attach the two screws securing the inner control panel to the power module panel.
22. Using a 3/8” nutdriver, attach the five screws securing the power module panel to the fan baffle.
23. Carefully position the front panel at the front of the machine.
24. Connect any previously disconnected leads to the front panel. See Wiring Diagram. Attach cable ties as necessary.
25. Using a 3/8” nutdriver, attach the two screws securing the two support rails to the front panel.
26. Using a 3/8” nutdriver, attach the four screws securing the front panel to the base of the machine.
27. Using a 3/8” nutdriver, attach the nut, lock washer, and flat washer securing lead 5A to the neutral stud on the output panel. See Wiring Diagram.
28. Using a 3/8” nutdriver, attach the nut, lock washer, and flat washer securing lead 5 to the ground stud on the output panel. See Wiring Diagram.
29. Using a slotted screwdriver, tighten the three screws securing leads 3, 4, and 6 to circuit breaker (CB1). See Wiring Diagram.
30. Connect lead 6A to the D1 rectifier. See Wiring Diagram.
31. Connect lead 42 to circuit breaker (CB4). See Wiring Diagram.
32. Connect lead 41 to lead 41A quick-connect terminal. See Wiring Diagram.
33. Connect lead 45 to the D2 rectifier. See Wiring Diagram.
34. Connect lead 46 to circuit breaker (CB9). See Wiring Diagram.
35. Perform the ***Battery Replacement Procedure***.
36. Perform the ***Output Choke Replacement Procedure***.
37. Perform the ***Chopper Module Board Replacement Procedure***.
38. Perform the ***Output Rectifier Replacement Procedure***.
39. Perform the ***Brush and Brush Holder Replacement Procedure***.
40. Perform the ***Field Capacitor Replacement Procedure***.
41. Perform the ***Fuel Tank Replacement Procedure***.
42. Perform the ***Case Cover Replacement Procedure***.
43. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Circuit breaker (CB9) lead 46 location

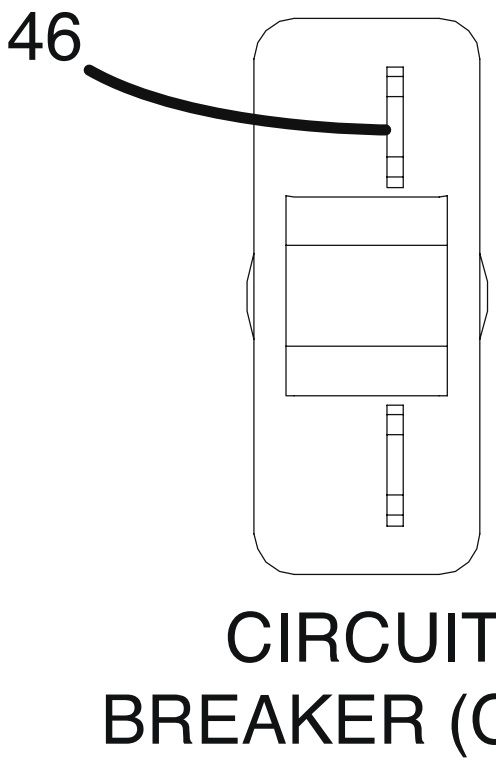


Figure F.2 – D2 rectifier lead 45 location

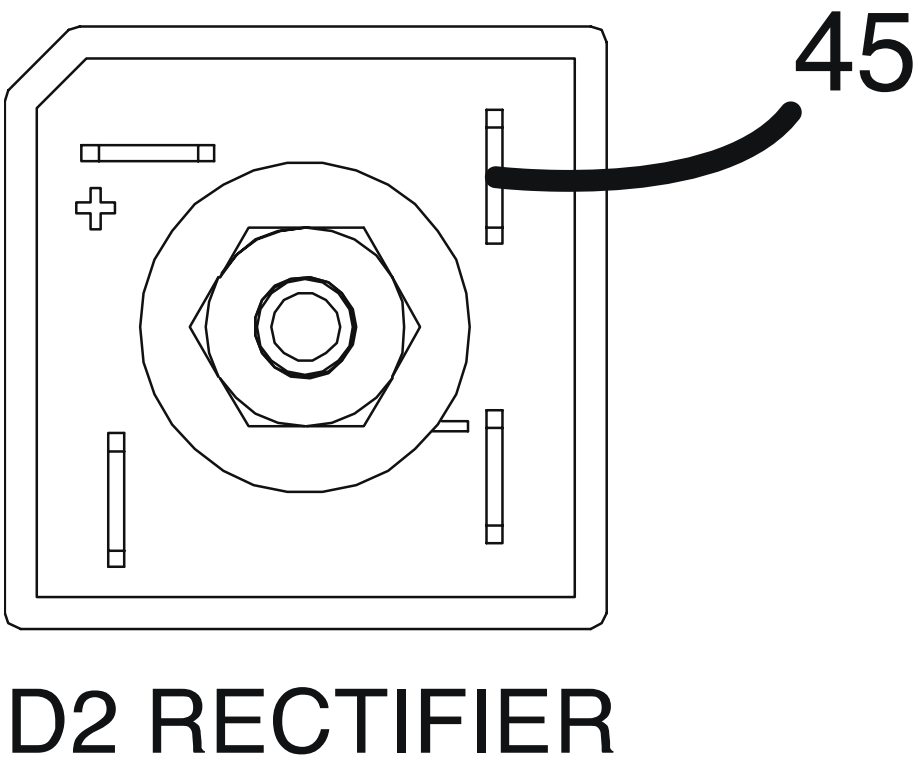


Figure F.3 – Circuit breaker (CB4) lead 42 location

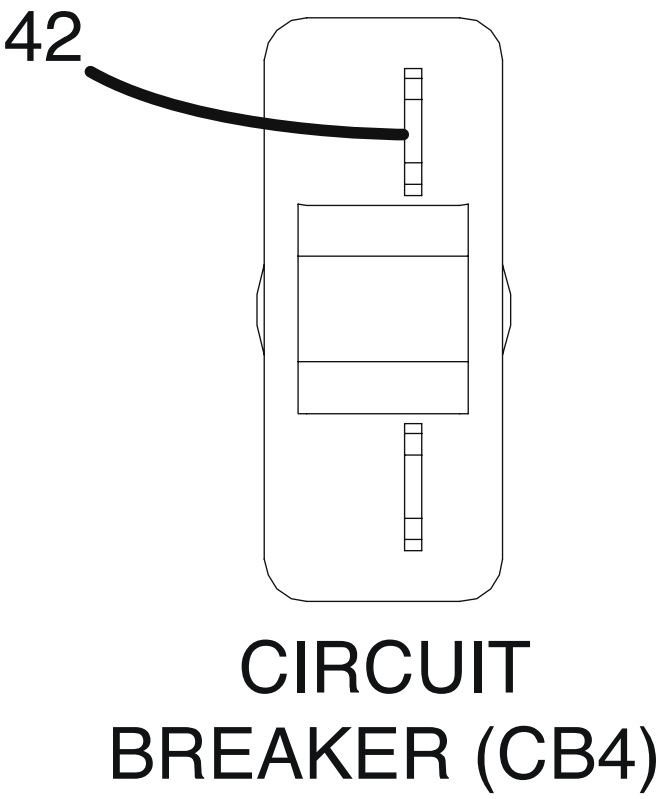


Figure F.4 – D1 rectifier lead 6A location

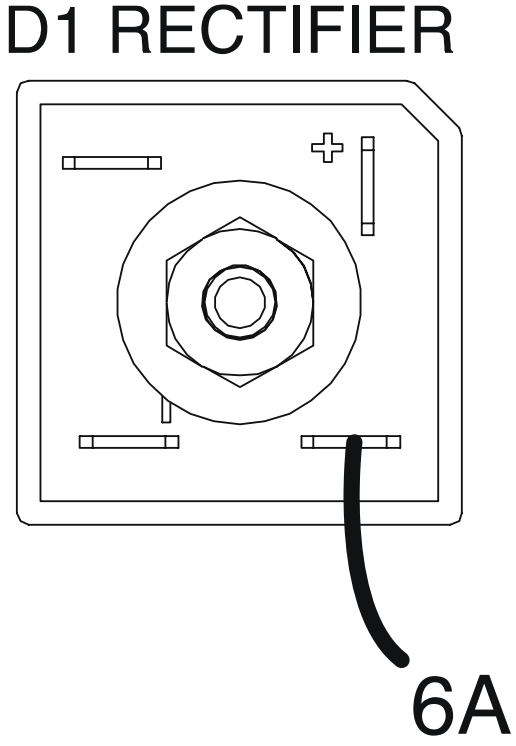


Figure F.5 – Circuit breaker (CB1) lead locations

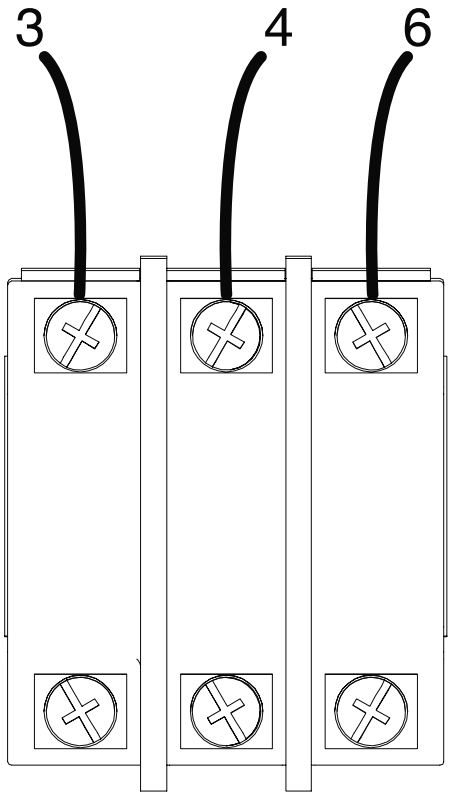


Figure F.6 – Ground stud, neutral stud, lead 5A, and lead 5 locations

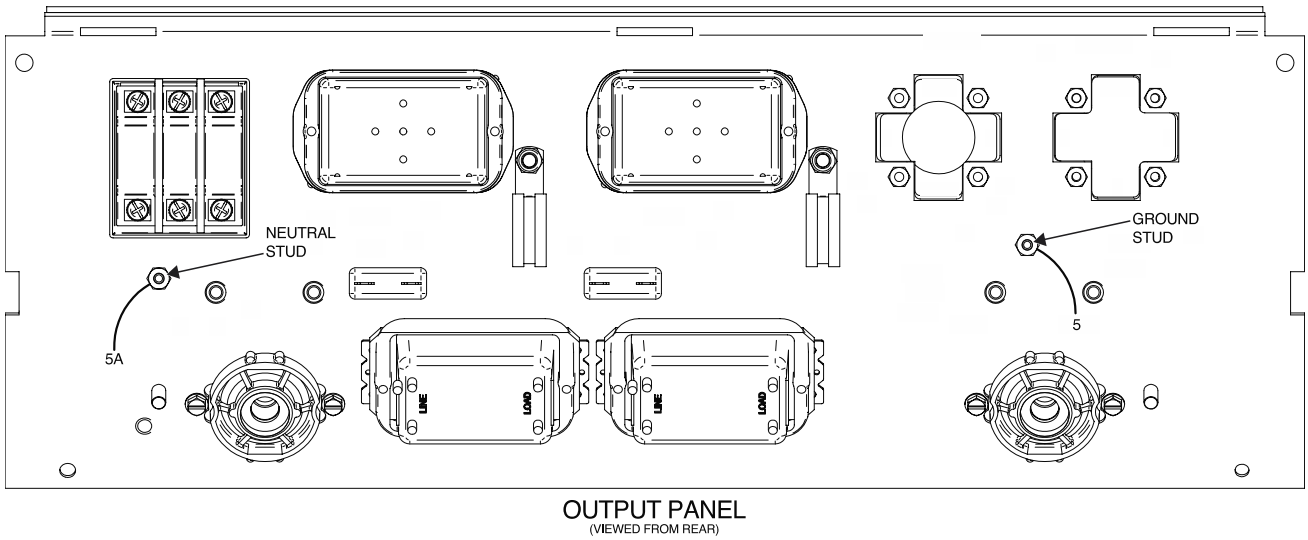


Figure F.7 – Front panel mounting screw locations

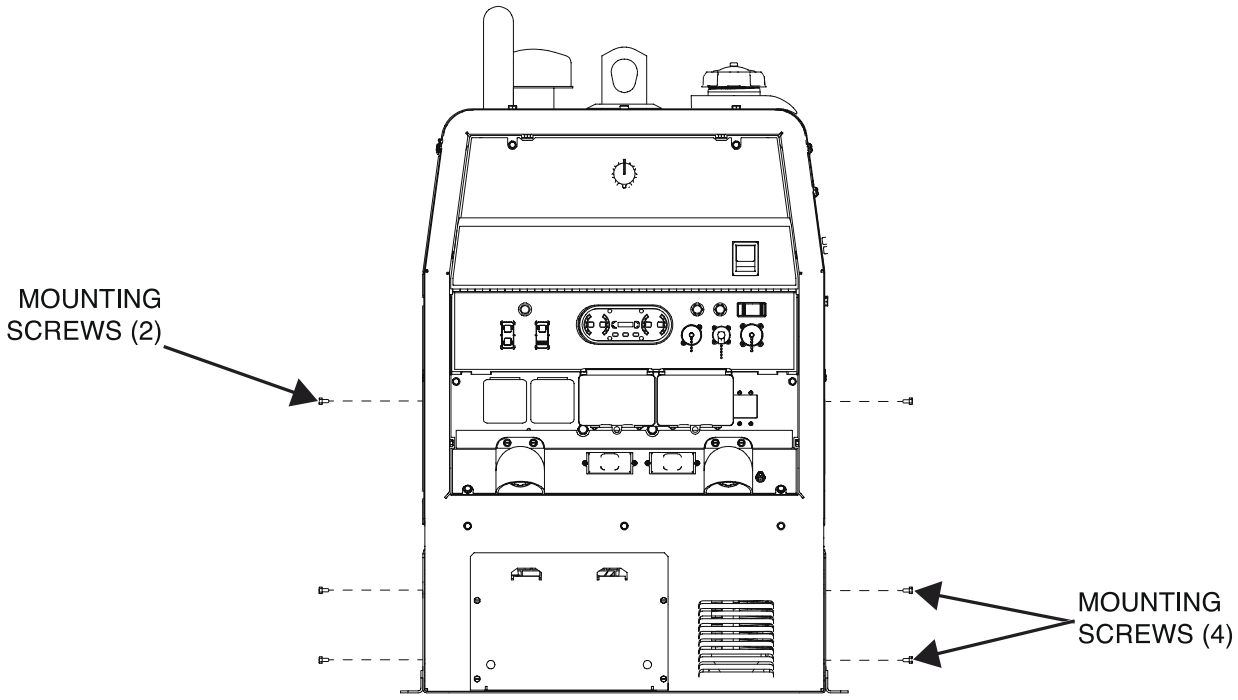


Figure F.8 – Component locations

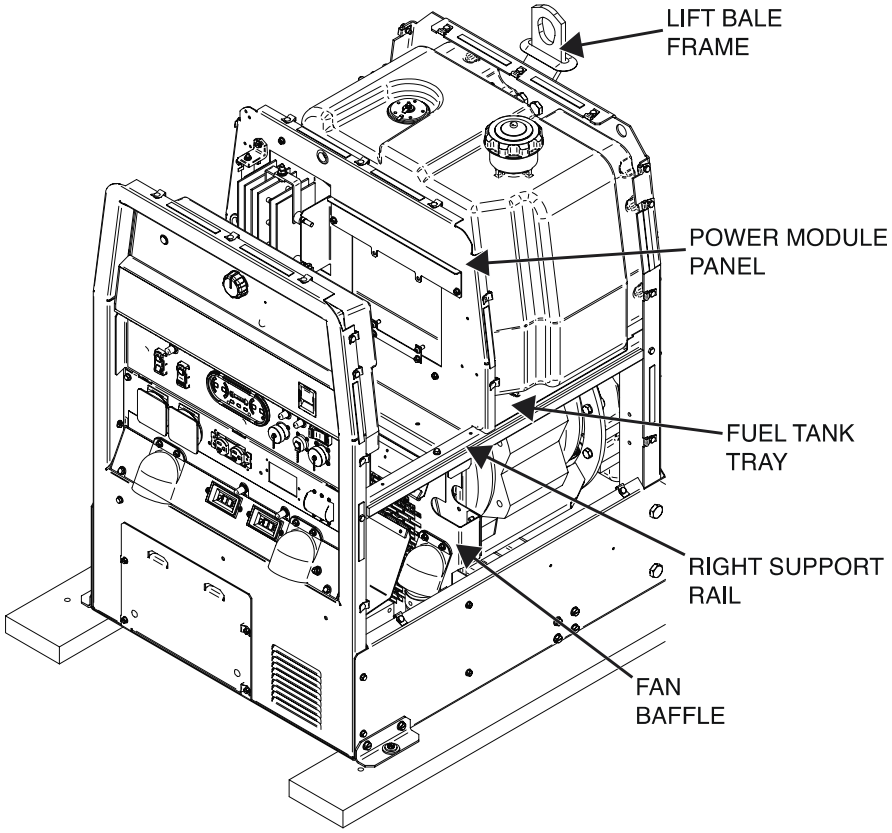


Figure F.9 – Inner control panel and ECU bracket locations

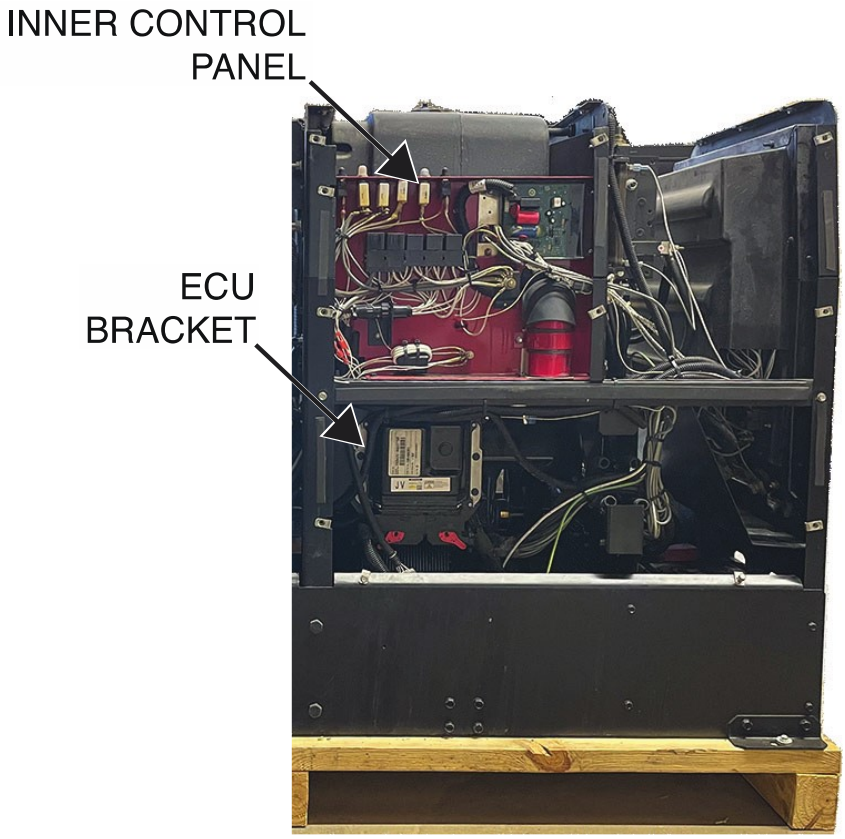
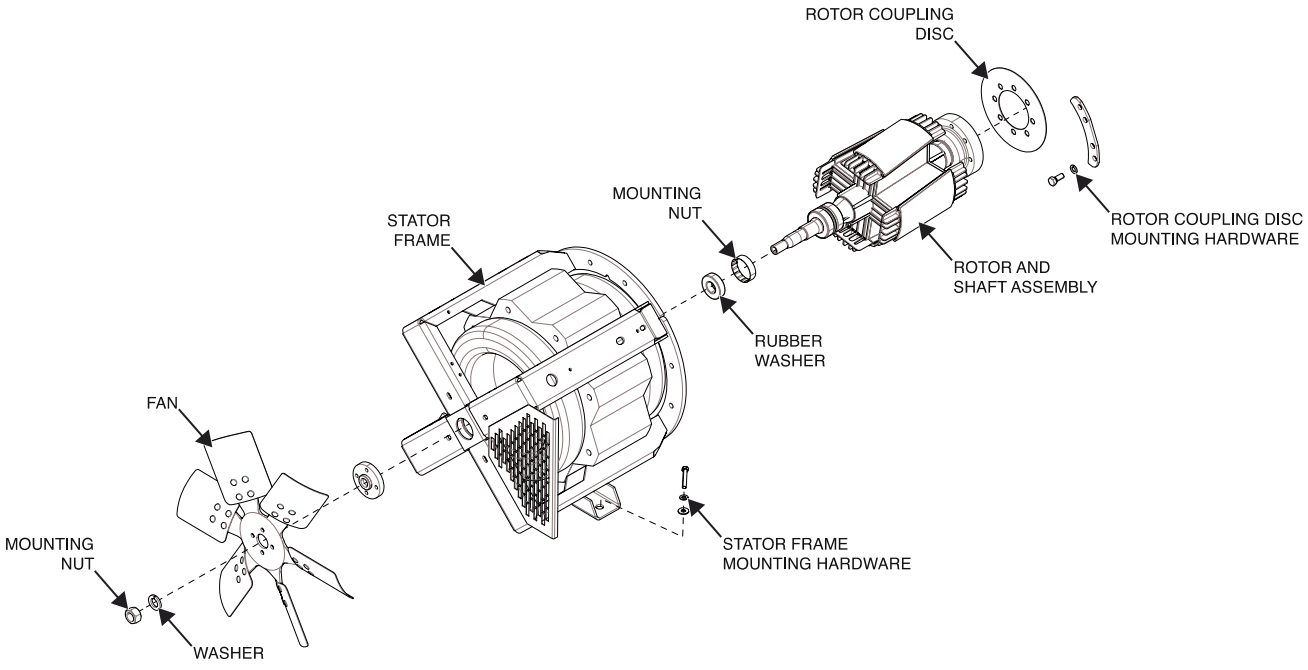
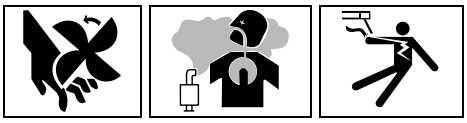


Figure F.10 – Stator and rotor mounting hardware and component locations



CURRENT SHUNT 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 Current Shunt.

MATERIALS NEEDED

1/2” Nutdriver
1/2” Open-End Wrench
3/4” Nutdriver
Slotted Screwdriver
3/8” Open-End Wrench
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 1/2” nutdriver and a 1/2” open-end wrench, remove the bolt, nut, lock washer, and two flat washers securing lead POS-Shunt to the current shunt. See ***Figure F.1***. See Wiring Diagram. Label and disconnect the lead.
5. Using a 3/4” nutdriver, remove the bolt, lock washer, and flat washer securing leads 206, 206A, ground lead and current shunt to the rear of the positive output terminal. See ***Figure F.2***. See Wiring Diagram. Label and disconnect the leads.
6. Using a slotted screwdriver and a 3/8” open-end wrench, remove the screw, nut, and lock washer securing lead 204S to the current shunt. See ***Figure F.3***. See Wiring Diagram. Label and disconnect the lead.
7. Using a slotted screwdriver and a 3/8” open-end wrench, remove the screw, nut, and lock washer securing lead 206S to the current shunt. See ***Figure F.3***. See Wiring Diagram. Label and disconnect the lead.
8. The current shunt can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new current shunt into the machine.
2. Using a slotted screwdriver and a 3/8” open-end wrench, attach the screw, nut, and lock washer securing lead 206S to the current shunt. See Wiring Diagram.
3. Using a slotted screwdriver and a 3/8” open-end wrench, attach the screw, nut, and lock washer securing lead 204S to the current shunt. See Wiring Diagram.
4. Using a 3/4” nutdriver, attach the bolt, lock washer, and flat washer securing leads 206, 206A, ground lead, and current shunt to the rear of the positive output terminal. See Wiring Diagram.
5. Using a 1/2” nutdriver and a 1/2” open-end wrench, attach the bolt, nut, lock washer, and two flat washers securing lead POS-Shunt to the current shunt. See Wiring Diagram.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Lead POS-shunt mounting hardware location

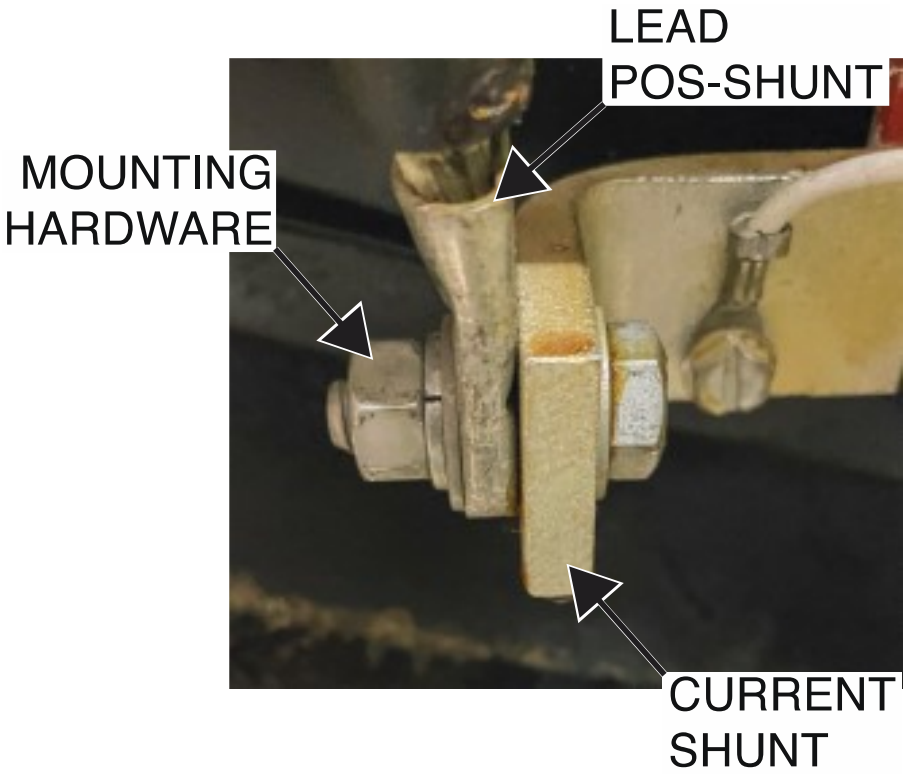


Figure F.2 – Current shunt mounting hardware location

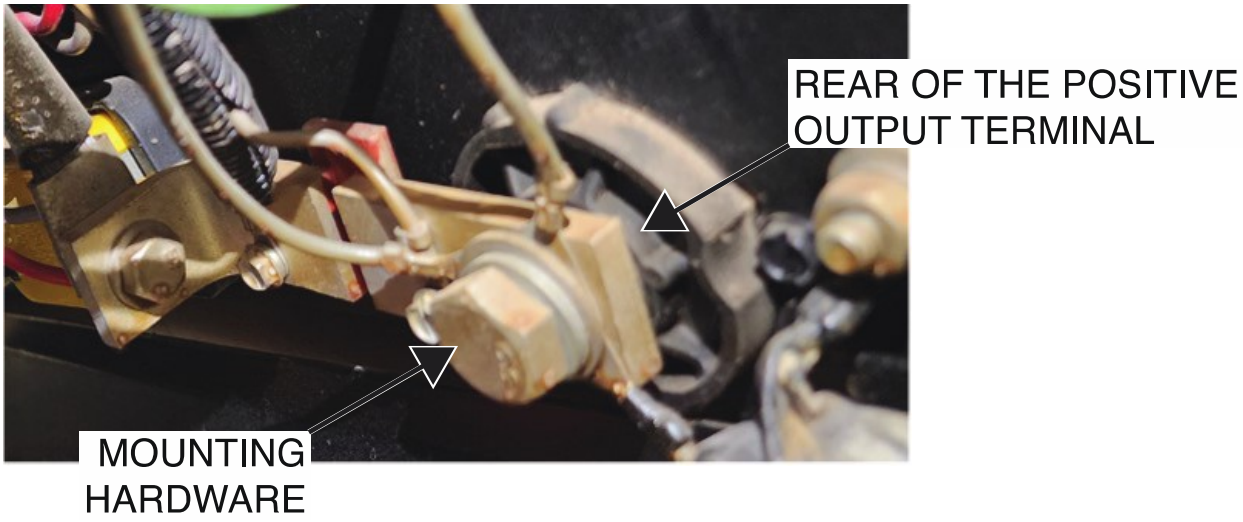
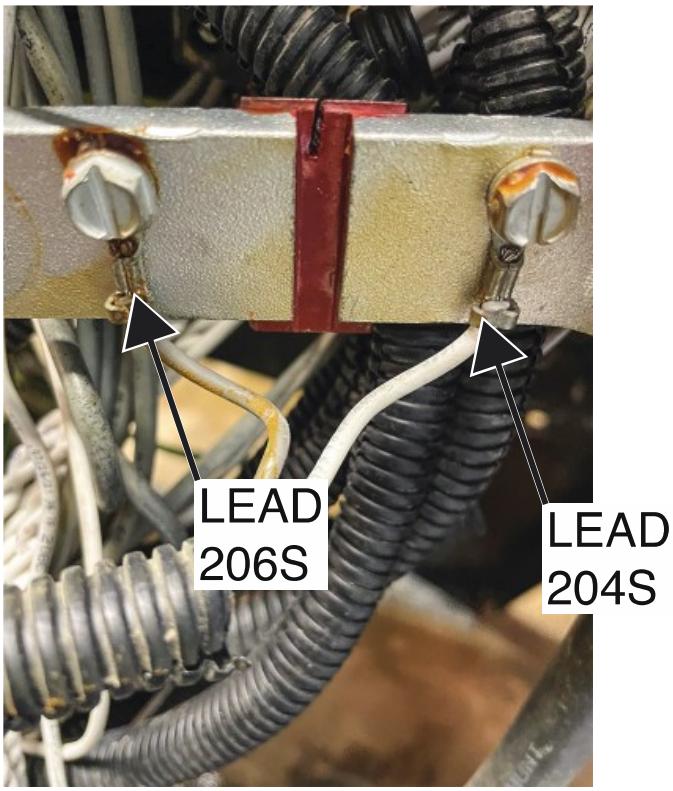
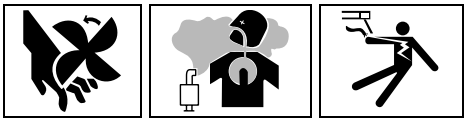


Figure F.3 – Leads 204S and 206S mounting hardware locations



ALTERNATOR 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 Alternator.

MATERIALS NEEDED

3/8” Nutdriver
1/2” Nutdriver
10mm Nutdriver
8mm Nutdriver
12mm Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X 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 radiator hose clamp to the left fan guard. See ***Figure F.1***.
5. Using a 1/2” nutdriver, remove the four screws securing the coolant expansion tank to the machine. See ***Figure F.1***.
6. Carefully maneuver the coolant expansion tank to gain access to the left fan guard.
7. Using a 3/8” nutdriver, remove the five screws securing the left fan guard to the machine. See ***Figure F.1***.
8. Carefully maneuver the left fan guard out of the machine.
9. Using a 10mm nutdriver, remove the nut securing lead 238ALT to the alternator. See ***Figure F.2***. See Wiring Diagram. Label and disconnect the lead.
10. Using an 8mm nutdriver, remove the nut and lock washer securing lead 202 to the alternator. See ***Figure F.2***. See Wiring Diagram. Label and disconnect the lead.
11. Using a 12mm nutdriver, remove the bolt, nut, lock washer, and flat washer securing the alternator to the machine. See ***Figure F.3***.
12. Using a 10mm nutdriver, loosen the bolt and flat washer securing the alternator to the machine. See ***Figure F.4***.
13. Carefully adjust the alternator to release tension on the belt.
14. Remove the belt from the alternator flywheel. Retain belt for replacement.
15. The alternator can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new alternator into the machine.
2. Attach the belt to the alternator flywheel.
3. Carefully adjust the alternator to apply tension on the belt.
4. Using a 10mm nutdriver, tighten the bolt and flat washer securing the alternator to the machine.
5. Using a 12mm nutdriver, attach the bolt, nut, lock washer, and flat washer securing the alternator to the machine.

6. Using an 8mm nutdriver, attach the nut and lock washer securing lead 202 to the alternator. See Wiring Diagram.
7. Using a 10mm nutdriver, attach the nut securing lead 238ALT to the alternator. See Wiring Diagram.
8. Carefully position the left fan guard into the machine.
9. Using a 3/8” nutdriver, attach the five screws securing the left fan guard to the machine.
10. Using a 1/2” nutdriver, attach the four screws securing the coolant expansion tank to the machine.
11. Using a 3/8” nutdriver, attach the screw securing the radiator hose clamp to the left fan guard.
12. Perform the ***Case Cover Replacement Procedure***.
13. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Left fan guard, coolant expansion tank, and radiator hose clamp locations

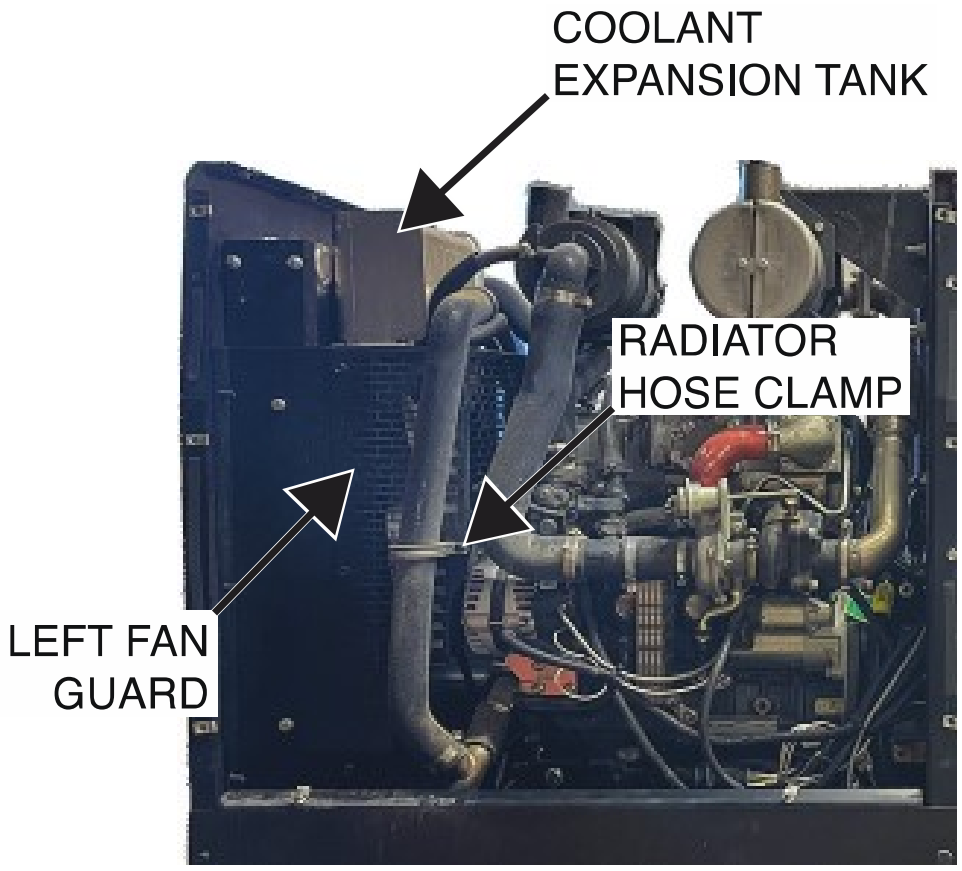


Figure F.2 – Alternator lead locations

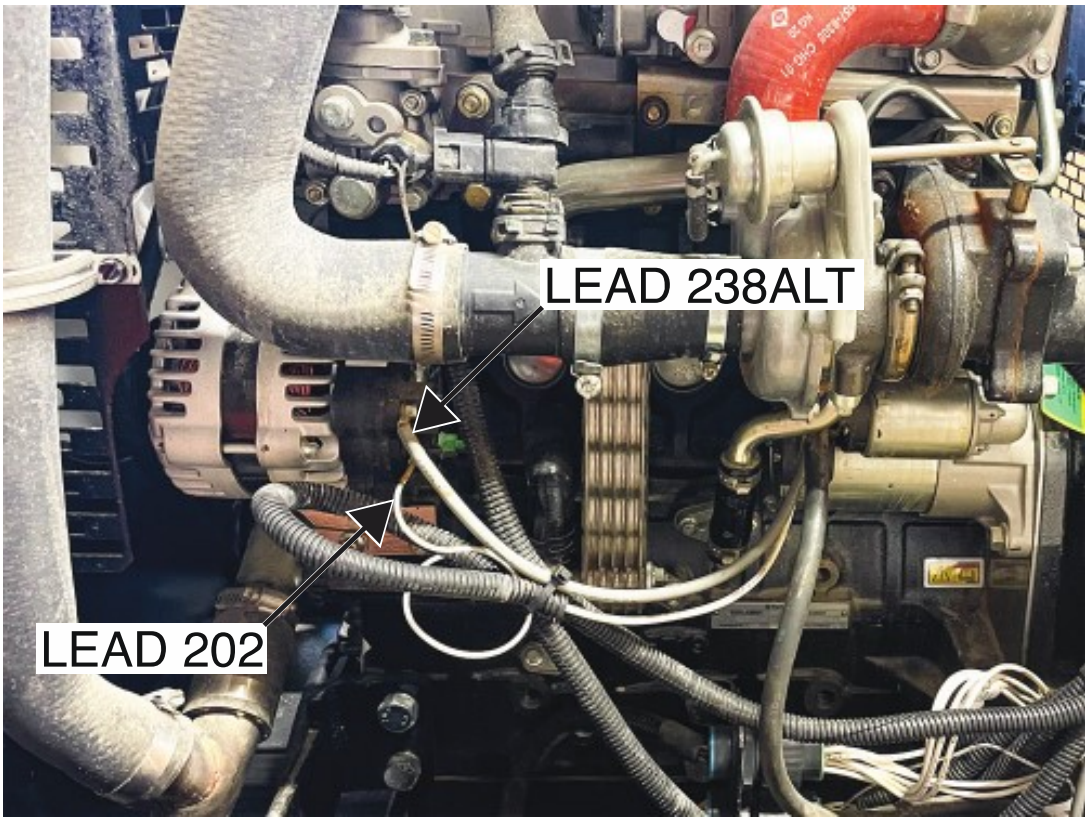


Figure F.3 – Alternator mounting hardware location

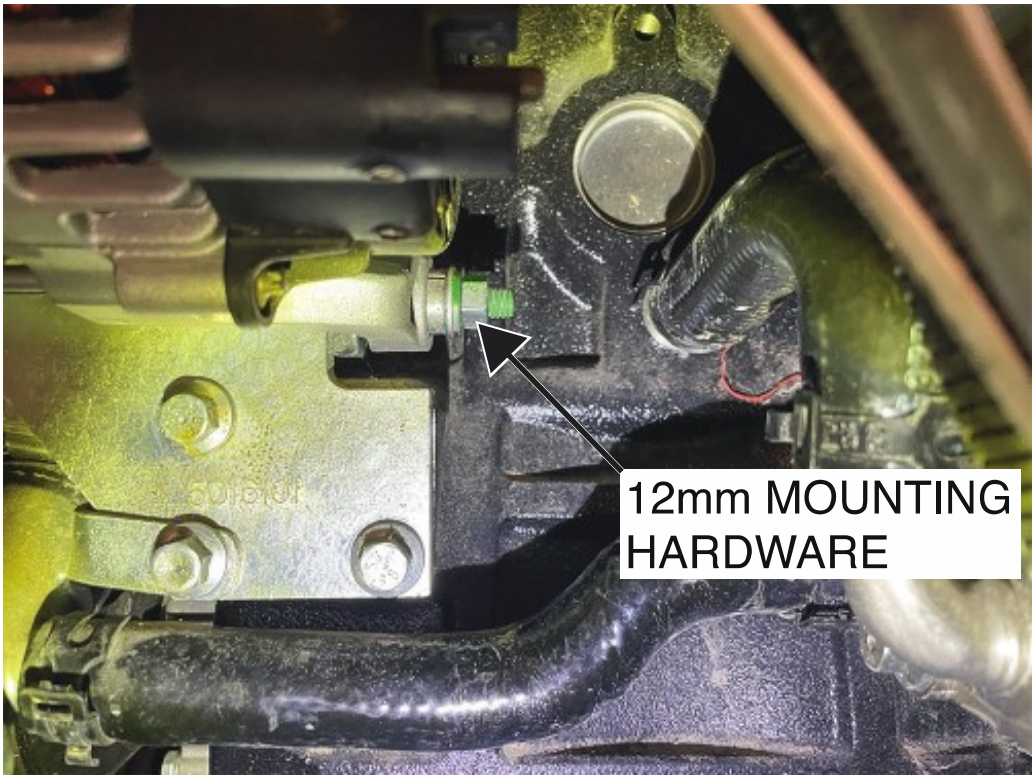
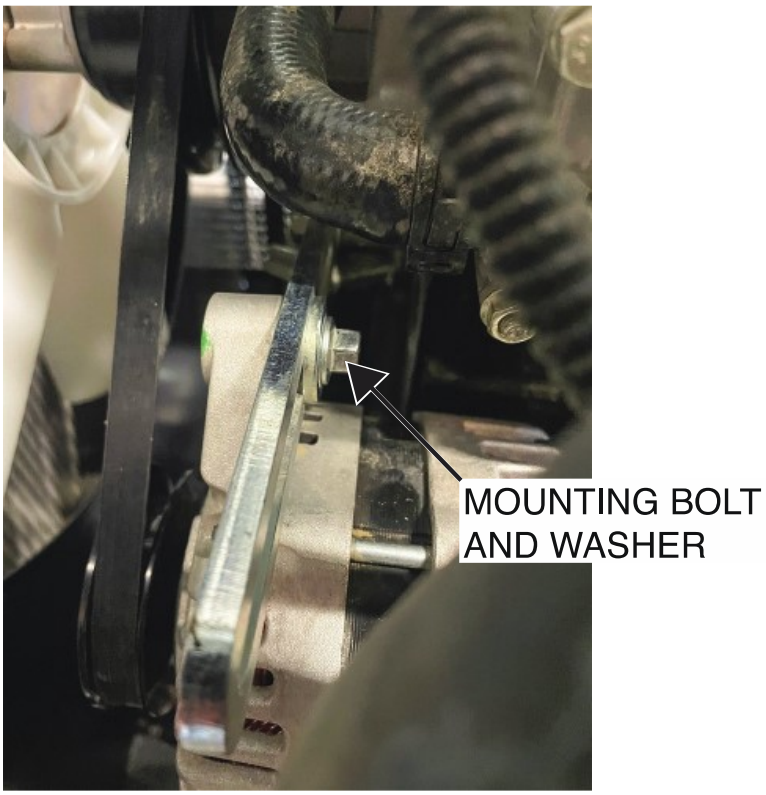
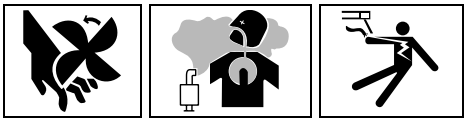


Figure F.4 – Alternator mounting bolt and washer location



STARTER 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 Starter.

MATERIALS NEEDED

13mm Nutdriver
10mm Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 13mm nutdriver, remove the two bolts securing the starter to the engine. See ***Figure F.1***.
5. Carefully maneuver the starter out of the machine to gain access to the leads 238S, 238A, 420, and 238ALT. See Wiring Diagram.
6. Using a 13mm nutdriver, remove the nut, lock washer, and flat washer securing leads 238S, 238A, and 238ALT to the terminal B of the starter. See ***Figure F.2***. See Wiring Diagram. Label and disconnect the leads.
7. Using a 10mm nutdriver, remove the nut and lock washer securing the lead 420 to the starter. See ***Figure F.2***. See Wiring Diagram. Label and disconnect the lead.
8. The starter can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new starter into the machine.
2. Using a 10mm nutdriver, attach the nut and lock washer securing the lead 420 to the starter. See Wiring Diagram.
3. Using a 13mm nutdriver, attach the nut, lock washer, and flat washer securing leads 238S, 238A, and 238ALT to terminal B of the starter. See Wiring Diagram.
4. Using a 13mm nutdriver, attach the two bolts securing the starter to the engine.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Starter mounting bolt location

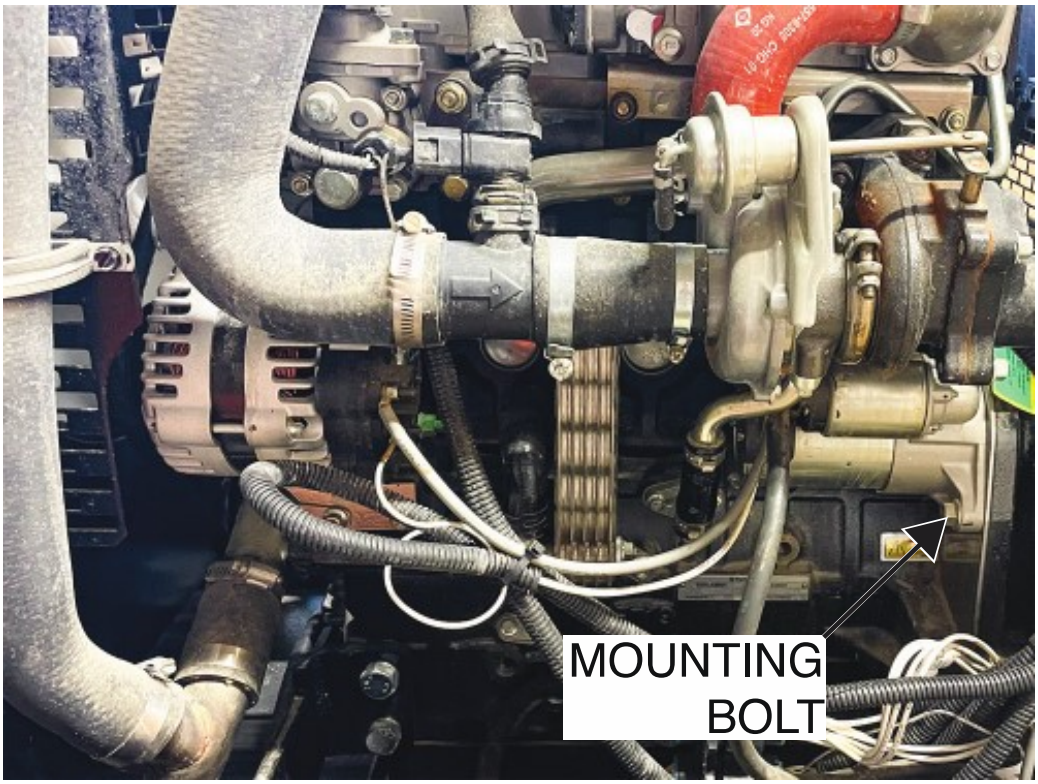
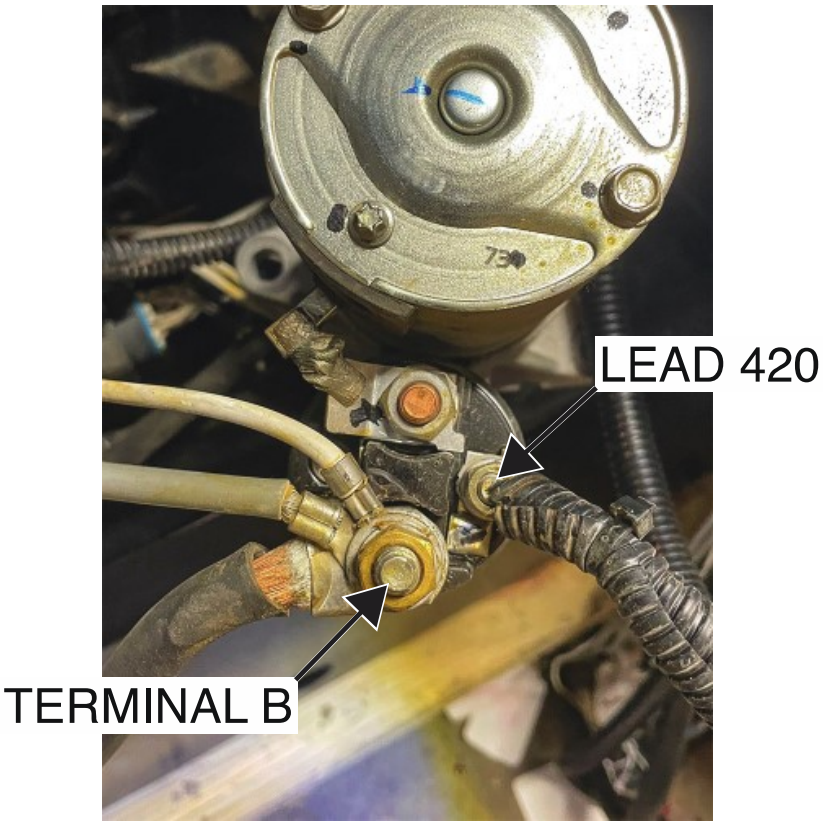
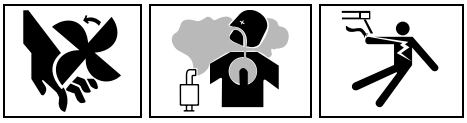


Figure F.2 – Starter lead 420 and terminal B locations



FUEL PUMP 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 Pump.

MATERIALS NEEDED

Slotted Screwdriver
Paper Towels
3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Turn off the engine on the Vantage 441X machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Carefully close the fuel shutoff. See ***Figure F.1***.
5. Label and disconnect the fuel pump plug from the quick-connect terminal. See ***Figure F.2***. See Wiring Diagram.
6. Using a slotted screwdriver, loosen the hose clamp securing the fuel line to the top of the fuel pump. See ***Figure F.2***. **NOTE:** To avoid fuel spills, temporarily wrap the fuel hose with paper towels to absorb any residual fuel.
7. Using a slotted screwdriver, loosen the hose clamp securing the fuel line to the bottom of the fuel pump. See ***Figure F.2***. **NOTE:** To avoid fuel spills, temporarily wrap the fuel hose with paper towels to absorb any residual fuel.
8. Using a 3/8” nutdriver, remove the two screws securing the fuel pump to the engine. See ***Figure F.3***.
9. The fuel pump can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new fuel pump into the machine.
2. Using a 3/8” nutdriver, attach the two screws securing the fuel pump to the engine.
3. Using a slotted screwdriver, tighten the hose clamp securing the fuel line to the bottom of the fuel pump.
4. Using a slotted screwdriver, tighten the hose clamp securing the fuel line to the top of the fuel pump.
5. Connect the fuel pump plug to the quick connect terminal. See Wiring Diagram.
6. Carefully open the fuel shutoff.
7. Perform the ***Case Cover Replacement Procedure***.
8. Perform the ***Retest After Repair Procedure***.

Figure F.1 – Fuel shutoff location

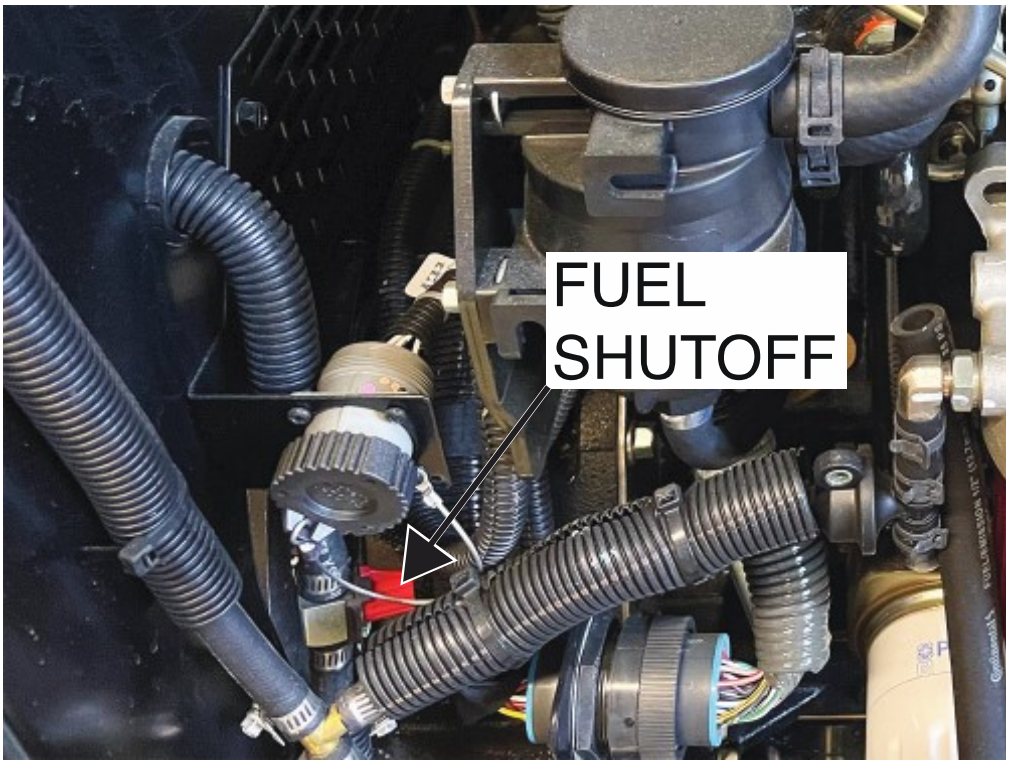


Figure F.2 – Fuel pump plug and hose clamp locations

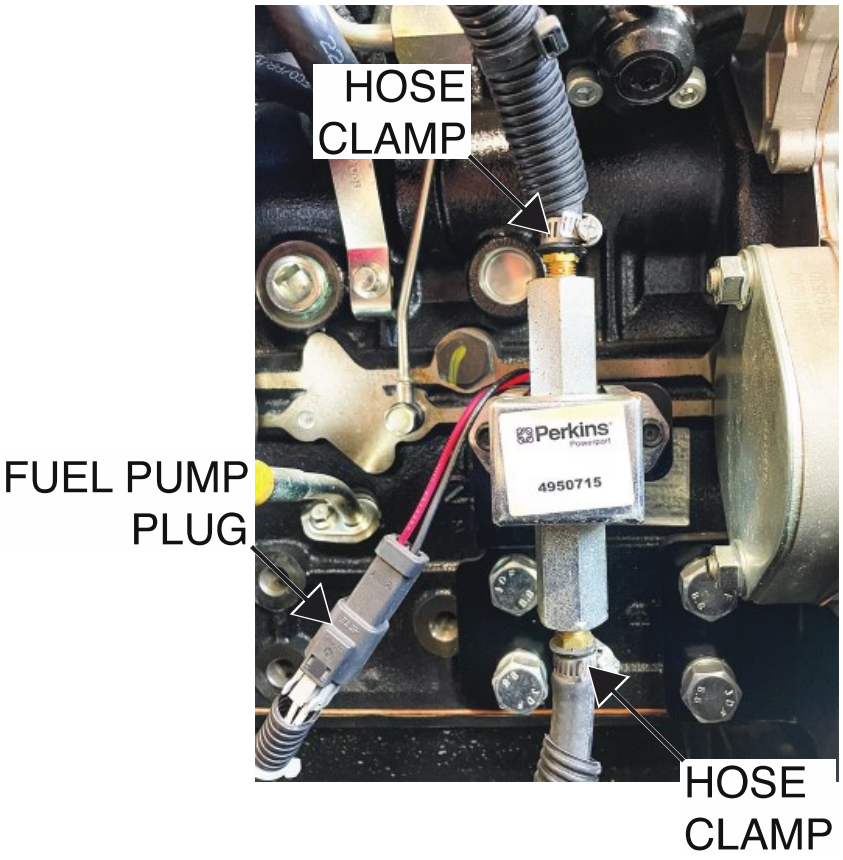
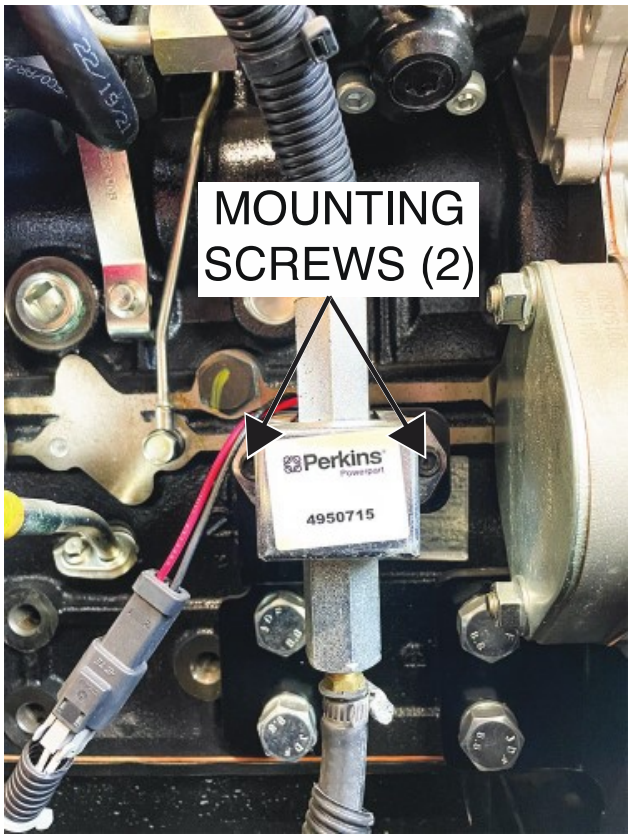


Figure F.3 – Fuel pump mounting screw locations



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	FULL LOAD RPM
LOW IDLE	1500 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)	30 VDC	525 AMPS

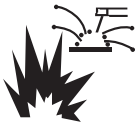
WELDER MODES OUTPUT

WELDING MODE	OUTPUT RANGE
CC-STICK	30-525 AMPS
DOWNHILL PIPE (CC)	40-350 AMPS
TOUCH START TIG	20-350 AMPS
CV-WIRE	10-45 VOLTS
ARC GOUGING	60-525 AMPS

AUXILLIARY POWER RECEPTACLES OUTPUT

120 VAC RECEPTICAL (SINGLE PHASE)			240 VAC RECEPTICAL (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	17,000

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

			
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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