

**EXCEL-ARC[®] 500 and 6045
Transformer-Rectifier DC
Welding Machine**

For the Following Specs:

- 500015-1 500 CC, 60 Hz
- 500015-2 6045 CV, 60 Hz
- 500015-3 6045 CC/CV, 60 Hz
- 500015A-1 500 CC, 60 Hz
- 500015A-2 6045 CV, 60 Hz
- 500015A-3 6045 CC/CV, 60 Hz



OWNER'S MANUAL Number **430429-147**
Revised December 1, 1997

IMPORTANT: Read these instructions before installing, operating, or servicing this system.

THERMAL ARC INC., TROY, OHIO 45373-1085, U.S.A.

INTRODUCTION	1
How To Use This Manual	1-1
Equipment Identification	1-1
Receipt Of Equipment	1-1
SAFETY INSTRUCTIONS AND WARNINGS	2
DESCRIPTION OF EQUIPMENT	3
General	3-1
Recommended Unit Applications	3-1
Wire Feeder Compatibility	3-1
Controls and Outlets	3-1
Duty Cycle	3-5
INSTALLATION	4
Location	4-1
Grounding	4-1
Internal Wiring Check	4-2
Connecting Welding Machine to Line Voltage	4-2
Welding Leads	4-3
OPERATION	5
General	5-1
Preweld Operation	5-1
SMAW (Stick) Welding, Carbon Arc Gouging	5-1
Welding, Semiautomatic or Automatic	5-1
MAINTENANCE	6
Replacing SCRs	6-1
Lubrication	6-1
Inspection and Cleaning	6-1
TROUBLESHOOTING	7
General	7-1
Detailed Troubleshooting Instructions	7-5
PARTS LIST	8
Equipment Identification	8-1
How To Use This Parts List	8-1
How To Select Recommended Spares	8-1
DIAGRAMS	

INTRODUCTION

How To Use This Manual

This Owner's Manual usually applies to just the underlined specification or part numbers listed on the cover. If none are underlined, they are all covered by this manual.

To ensure safe operation, read the entire manual, including the chapter on Safety Instructions and Warnings.

Throughout this manual, the words **WARNING**, **CAUTION**, and **NOTE** may appear. Pay particular attention to the information provided under these headings. These special annotations are easily recognized as follows:

WARNING gives information regarding possible personal injury. Warnings will be enclosed in a box such as this.

CAUTION refers to possible equipment damage. Cautions will be shown in bold type.

NOTE offers helpful information concerning certain operating procedures. Notes will be shown in italics.

Equipment Identification

The unit's identification number (specification or part number), model, and serial number usually appear on a nameplate attached to the control panel. In some cases, the nameplate may be attached to the rear panel. Equipment which does not have a control panel such as gun and cable assemblies are identified only by the specification or part number printed on the shipping container. Record these numbers for future reference.

Receipt Of Equipment

When you receive the equipment, check it against the invoice to make sure it is complete and inspect the equipment for possible damage due to shipping. If there is any damage, notify the carrier immediately to file a claim. Furnish complete information concerning damage claims or shipping errors to Thermal Arc, Order Department, 2200 Corporate Drive, Troy, Ohio 45373-1085. Include all equipment identification numbers as described above along with a full description of the parts in error.

Move the equipment to the installation site before uncrating the unit. A lifting eye on the top of the case has been provided so that the equipment may be carried or lifted with a crane or hoist. Use care to avoid damaging the equipment when using bars, hammers, etc., to uncrate the unit.

WARNING: Falling machine due to lifting eye failure may cause death or serious injury.

- Lifting device may fail when overloaded.
- This lifting device is designed to lift the power source **ONLY**. If the machine is equipped with a trailer or accessories over 100 pounds, **DO NOT LIFT** by lifting eyes.
- Avoid sudden jerks, drops, or swinging.
- Check lifting device components visually for looseness and signs of metal fatigue.
- Before changing any hardware, check grade and size of bolts, and replace with bolts of equal or higher size and grade.

Additional copies of this manual may be purchased by contacting Thermal Arc at the address given above. Include the Owner's Manual number and equipment identification numbers.

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DESCRIPTION OF EQUIPMENT

General

There are three basic units of the EXCEL-ARC[®]. The EXCEL-ARC[®] 500 (CC), Part Number 500015-1 & 500015A-1, is a constant-current transformer-rectifier type DC welding machine that provides volt-ampere characteristic curves that are basically drooping with a slight slope.

The EXCEL-ARC[®] 6045 (CV), Part Number 500015-2 & 500015A-2, is a constant-voltage transformer-rectifier type DC welding machine that provides volt-ampere characteristic curves that are basically flat.

The EXCEL-ARC[®] 6045 (CC/CV), Part Number 500015-3 & 500015A-3, is a combination constant-current and constant-voltage transformer-rectifier type DC welding machine that provides volt-ampere characteristic curves for each mode of operation.

Table 3-1 gives input voltage and amperage data for all part numbers covered by this manual.

Recommended Unit Applications

1. Gas metal arc welding (MIG)
2. Flux cored arc welding (with or without *gas shielding*)
3. Submerged arc welding
4. Electro-slag welding
5. Carbon arc gouging
6. SMAW (Stick welding)
7. GTAW (TIG welding)

Wire Feeder Compatibility

Some models of wire feeders will connect onto this unit with no special preparation. In some cases, however, an interface must be used and in other instances, some rewiring must be accomplished. Complete details for these exceptions will be found in the instruction manual supplied with the wire feeder.

ITEM	PART NO. 500015-1 & 500015A-1 EXCEL-ARC [®] CC	PART NO. 500015-2 & 500015A-2 EXCEL-ARC [®] CV	PART NO. 500015-3 & 500015A-3 EXCEL-ARC [®] CC/CV	
			CC	CV
Rated Output Amperage	400 Amps	450 Amps	400 Amps	450 Amps
Rated Output Voltage	36 Volts	38 Volts	36 Volts	38 Volts
Rated Duty Cycle	60% Duty	100% Duty	60% Duty	100% Duty
Minimum Output	40 Amps	50 Amps @ 13 Volts	40 Amps	50 Amps @ 13 Volts
Maximum Output	500 Amps	600 Amps @ 40 Volts	500 Amps	600 Amps @ 40 Volts
Rated Input Voltage	200/230/460/575	200/230/460/575	200/230/460/575	
Rated Input Amperage	76/66/33/26	87/76/38/30	87/76/38/30	
Input kW	20 kW	22.5 kW	22.5 kW	
Input kVA	26.3 kVA	30.1 kVA	30.1 kVA	
Input Frequency	60 Hz	60 Hz	60 Hz	
Input Phase	3 Phase	3 Phase	3 Phase	
Maximum Open Circuit Voltage	58	58	58	
Auxiliary Power	1 kVA – 115V, 9 A	1 kVA – 115V, 9 A	1 kVA – 115V, 9 A	
No Load Input Voltage	200/230/460/575	200/230/460/575	200/230/460/575	
No Load Input Amperage	5.6/4.9/2.45/1.9	6.9/6.0/3.0/2.4	6.9/6.0/3.0/2.4	
No Load kW	.9 kW	1.6 kW	1.6 kW	
No Load kVA	1.94 kVA	2.4 kVA	2.4 kVA	
Power Factor	.76	.75	.75	
Efficiency	72%	76%	76%	

Table 3-1 Input Voltage/Amperage Data

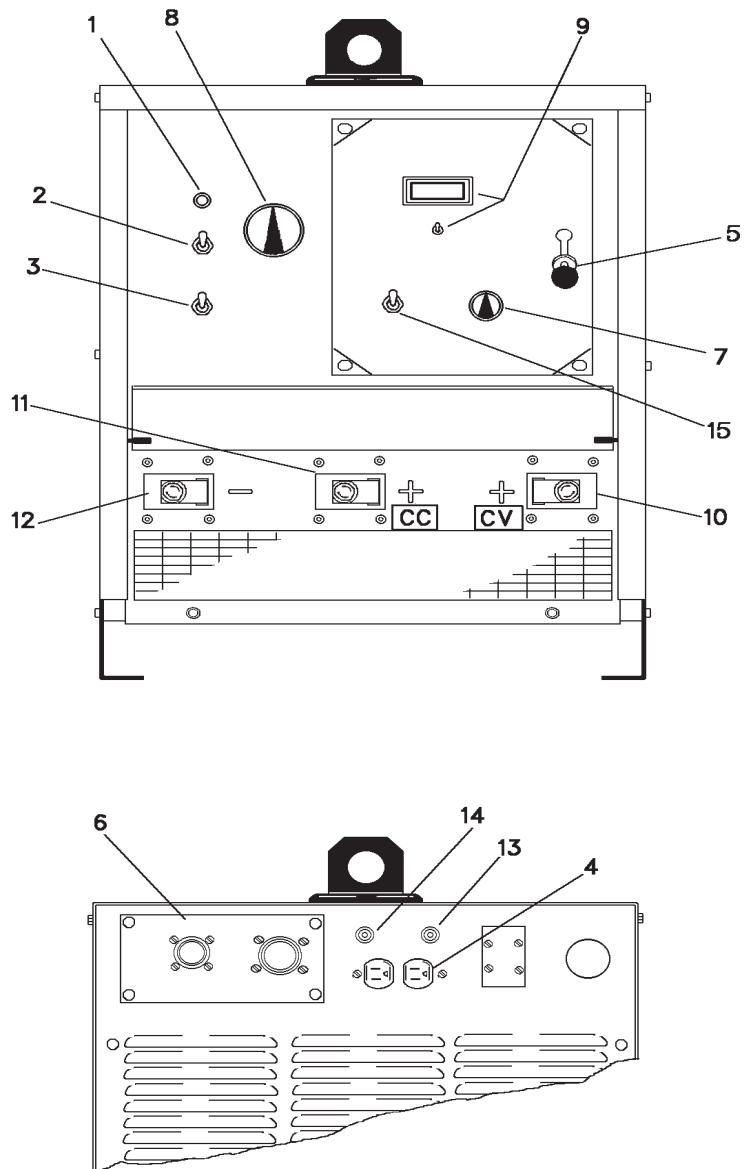


Figure 3-1 Front and Rear Panel

Controls and Outlets

See callouts on Figure 3-1.

1. Pilot Light (500015-1, -2, -3 & 500015A-1, -2, -3) — When lighted, indicates that the input contactor (power) is ON.

2. Input Contactor Control (500015-1, -2, -3 & 500015A-1, -2, -3) — This toggle switch is the master power switch for the welding machine, and must be in the ON position before any other section will operate. The primary circuit of the control transformer is energized whenever line voltage is present at the input terminals. This switch closes the secondary circuit of the control transformer, energizing the contactor, which energizes the power transformer. Do not use this switch to start or stop arc. Start arc with switch ON, break arc, then turn switch OFF.

3. Local/Remote Output Control Volts/Amperes Selector Switch (500015-1, -2, -3 & 500015A-1, -2, -3) — Selects either the output control (Local) or some remote control device (Remote) to control welding output.

4. 115-V AC Receptacles (500015-1, -2, -3 & 500015A-1, -2, -3) — Provides auxiliary power for lights, wire feeders, water pumps, etc. — 15 amps maximum.

5. CC/CV Selector Switch (CC/CV) (500015-3 & 500015A-3) — Selects the welding mode of operation.

6. Feeder Control Receptacle Panel (Automatic) (CV units) (500015-2, -3 & 500015A-2, -3) —

Amphenol (19-pin) connector for a remote voltage control type wire feeder. (Semiautomatic) (5-pin) connector for the control cable from semiautomatic wire feeder only.

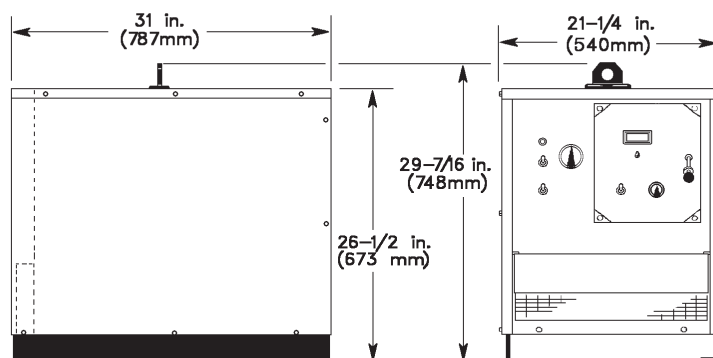
NOTE: Only one feeder control receptacle is used at any one time.

7. Arc Force Control (CC/CV Units) (500015-1, -3 & 500015A-1, -3) — This potentiometer controls short circuit (welding) current to produce an increase in current as the arc length is shortened. The control is present to provide the degree of "hard start" required, and the additional dynamic change for welding tight grooves, etc. Turn clockwise to increase "hard start" characteristics, counterclockwise to obtain a soft-start, smooth arc.

8. Welding Voltage/Amperes Control (CV Units) (500015-2, -3 & 500015A-2, -3) — Adjusts arc welding output and open circuit voltage. Open-circuit voltage is approximately 1.5 times the welding voltage for constant voltage welding. On 500015-1, -3 & 500015A-1, -3 (CC units) — Adjusts the welding current.

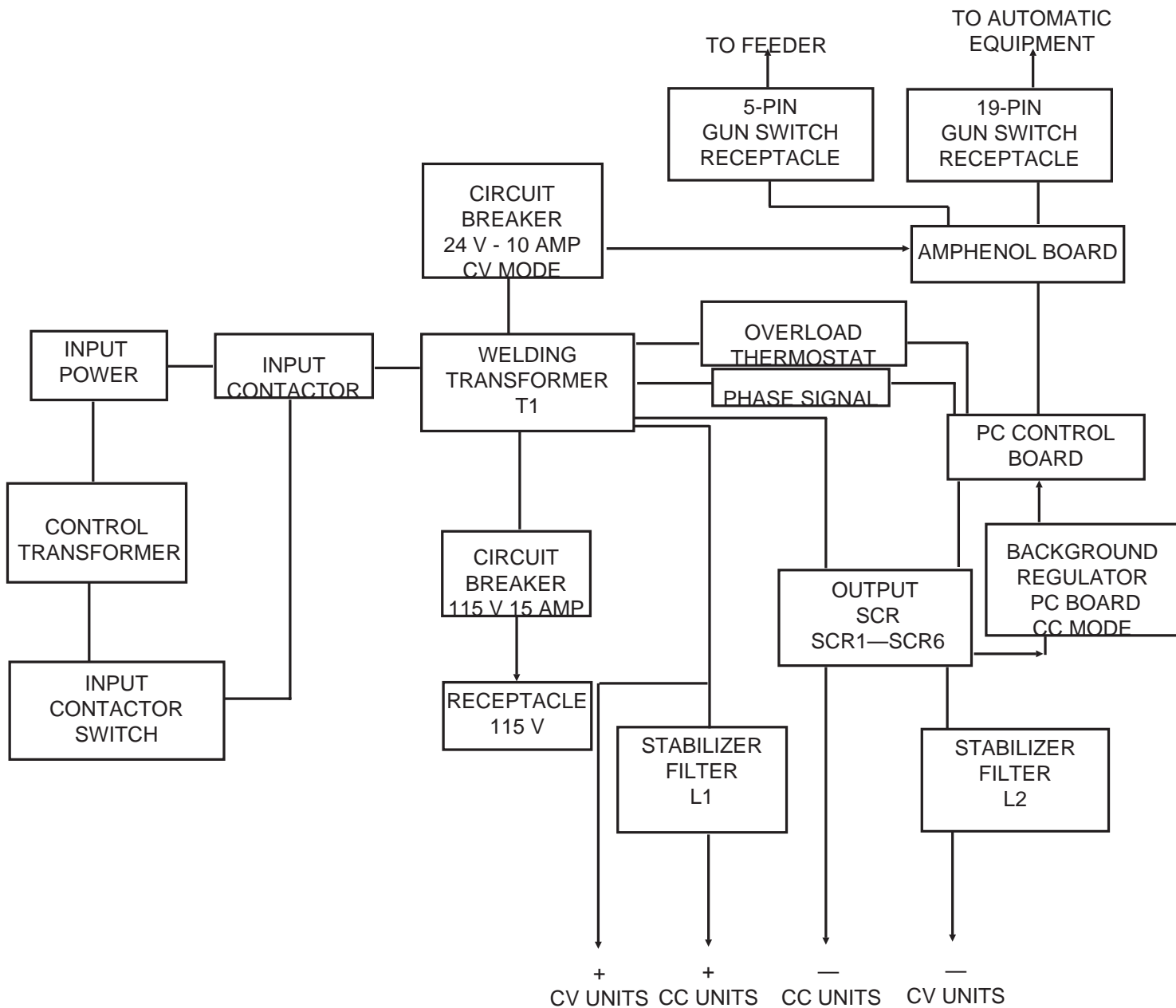
9. Volt/Amp Meter and Switch (CV Units) (500015-2, -3 & 500015A-2, -3) — A single meter with switch that will read DC volts when in the V. position or read DC amps in the A. position.

10. Positive Terminal (+) (CV mode) (500015-2, -3 & 500015A-2, -3) — Serves as a connection point for the lead to the wire feeder when reverse polarity is desired.



Weight (CC/CV) — 510 Lbs. (231 kg)
 (CC) — 460 Lbs. (209 kg)
 (CV) — 455 Lbs. (206 kg)

Figure 3-2 EXCEL-ARC[®] 500 and 6045
 Dimensions and Weight



Functional Block Diagram for EXCEL-ARC[®] 500
 and 6045

11. Positive Terminal (+) (CC mode) (500015-1, -3 & 500015A-1, -3) — Serves as a connection point for the lead to the electrode holder lead for SMAW (stick) or arc gouging mode of operation when reverse polarity is desired.

NOTE: To obtain opposite welding polarity, simply reverse the connections to the positive and negative terminals.

12. Negative Terminal (—) — Serves as a connection point for the lead to the workpiece when reverse polarity is desired.

13. Circuit Breaker — Rated at 15 amps — provides protection to the 115-volt circuit which includes the fan and the 115-volt AC power receptacle.

14. Circuit Breaker — Rated at 10 amps — provides protection to the 24-volt circuit for the wire feeder and automatic equipment.

15. Stick/Tig Selector Switch (CC Units) (500015-1, -3 & 500015A-1, -3) — Selects a reduced current start in the TIG mode.

Duty Cycle

(Figure 3-3)

Duty cycle is the percentage of each ten-minute period of time that the welding machine may be operated under rated load conditions. For example, a duty cycle of 60% means that the machine can be operated at rated load for an average of 6 minutes of each 10 minute period of operation. During the remaining 4 minutes, the machine must idle to permit proper cooling. Figure 3-3 enables the operator to determine the duty cycle at various welding amperages.

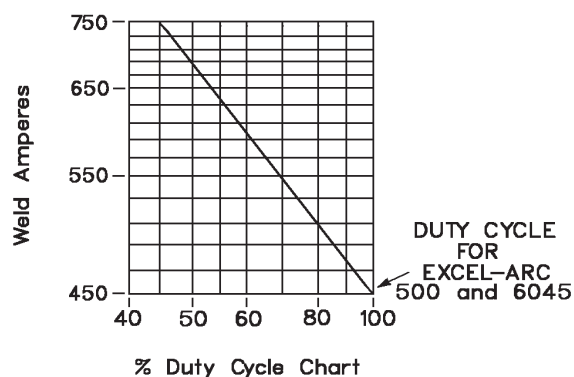
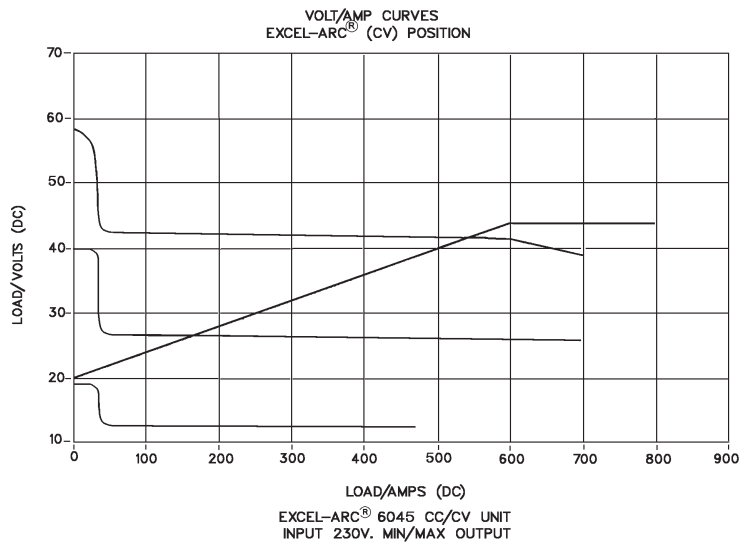
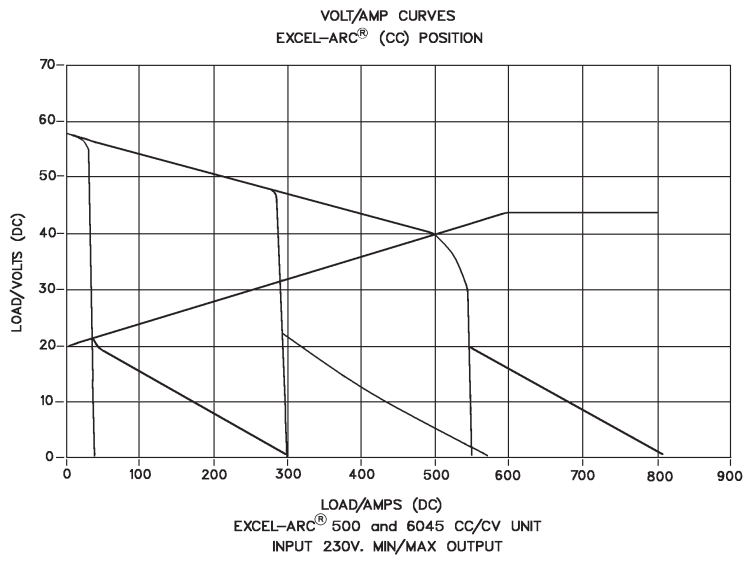


Figure 3-3 Duty Cycle Chart



Volt/Ampere Characteristic Curves

INSTALLATION

Location

For best operating characteristics and longest unit life, take care in selecting an installation site. Avoid locations exposed to high humidity, dust, high ambient temperature, or corrosive fumes. Moisture can condense on electrical components, causing corrosion or shorting of circuits. Dirt on components helps retain this moisture.

Adequate air circulation is needed at all times in order to assure proper operation. Provide a minimum of 12 inches (305 mm) of free air space at both front and rear of the unit. Make sure that the ventilator openings are not obstructed.

Grounding

The frame of this welding machine should be grounded for personnel safety, and to assure oper-

ation of the overcurrent protection. The grounding method, and the equipment grounding conductor size and type shall conform to local and national codes.

For the National Electrical Code, the equipment grounding conductor shall be green, green with a yellow stripe, or bare.

If flexible power cable is used, use a cable assembly which includes the equipment grounding conductor. If metallic armored cable or conduit is used, the metal sheathing or conduit must be effectively grounded per local and national codes.

Rubber-tire mounted equipment shall be grounded to conform to local and national codes. The grounding assists in providing protection against line voltage electrical shock and static shock. The grounding serves to discharge the static electric charge which tends to build up on rubber-

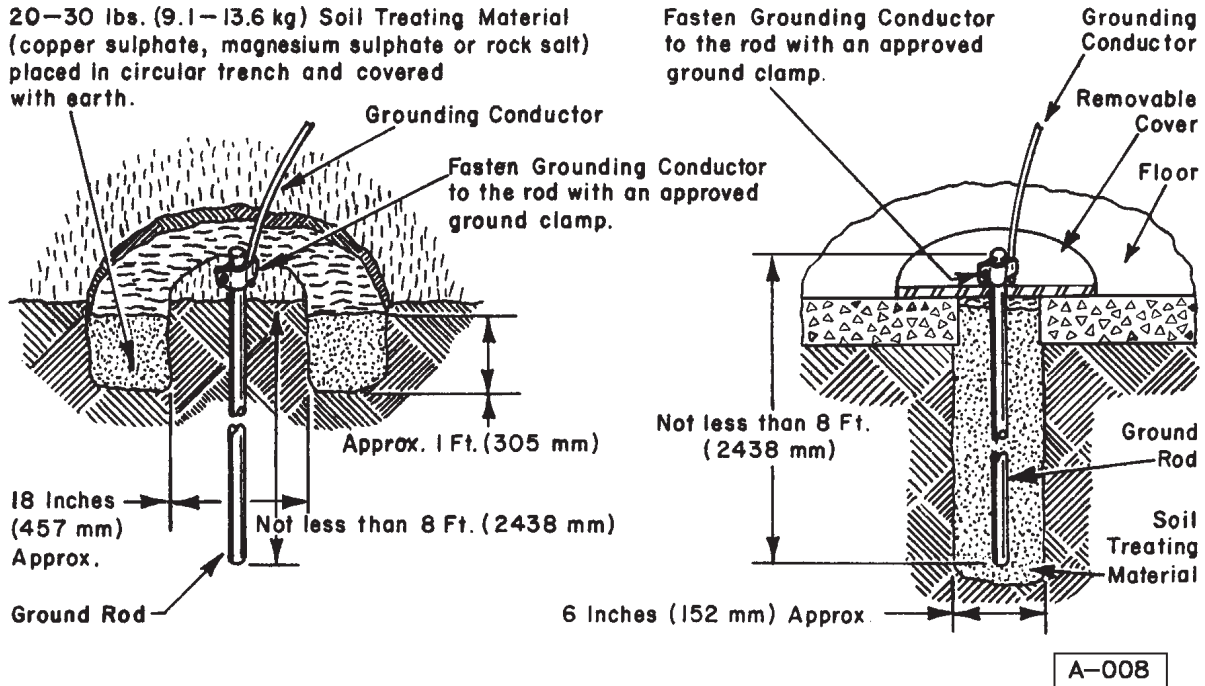


Figure 4-1

LINE VOLTS	RATED LOAD AMPS	APPROX. LINE FUSE SIZE	COPPER LINE WIRE SIZE*		COPPER GROUNDING CONDUCTOR MIN. SIZE
			IN CONDUIT	FLEXIBLE CABLE	
200	81	100	No. 4	No. 2	No. 8
230	71	100	No. 6	No. 6	No. 8
460	35.5	40	No. 8	No. 6	No. 10
575	28	40	No. 10	No. 8	No. 10

**Conductor size shall be modified as required for line voltage drop and ambient temperature. Sizes listed for conduit installation are based on 90° C conductor insulation, designated as FEP, FEPB, RHH, and THHN.*

Table 4-1 Recommended Wire and Fuse Size Table

tire mounted equipment. This static charge can cause painful shock and lead to the erroneous conclusion that an electrical fault exists in the equipment.

If a system ground is not available, consult the electrical code enforcement body for instructions. The welding machine should be connected to an adequate driven ground rod, or to a water pipe that enters the ground not more than 10 feet (30 meters) from the machine.

The equipment grounding conductor size is listed in Table 4-1 as a guide, if no local or national code is applicable.

Attach the equipment grounding conductor to the stud provided on the yoke. Determine that the ground wire size is adequate before the machine is operated.

CAUTION: Be sure to replace the cabinet top to assure adequate internal ventilation and prevent component failure.

Internal Wiring Check

Refer to the product identification plate (nameplate) on the welding machine's rear panel to determine the power input voltages and frequency at which it will be operated.

Remove left side panel for access to Line Voltage Changeover circuitry. Check line voltage connections against instructions on Voltage Changeover Diagram supplied with this manual. If necessary, rearrange internal wiring and/or link connections.

Connecting Welding Machine to Line Voltage

The input power should be connected to the unit through a fused disconnect switch, or other suitable disconnecting means furnished by the user. A hole is provided in the rear panel of the machine, near to the input connections, for the entry of the input conductors.

DANGER: ELECTRIC SHOCK CAN KILL. Open the disconnect switch, or breaker, and determine that no voltage is present, before connecting wires between welding machine and power supply.

CAUTION: The method of installation, conductor size, and overcurrent protection shall conform to the requirements of the local electrical code, the National Electrical Code, or other national codes, as applicable. All installation wiring and machine reconnections shall be done by qualified persons.

Table 4-1 provides minimal information for selection of line conductors, fuses, and the equipment grounding conductor. This information is from the National Electrical Code NFPA 70-1981 Edition. Install this equipment per the latest edition, avail-

Place links in proper position based on input voltage value.

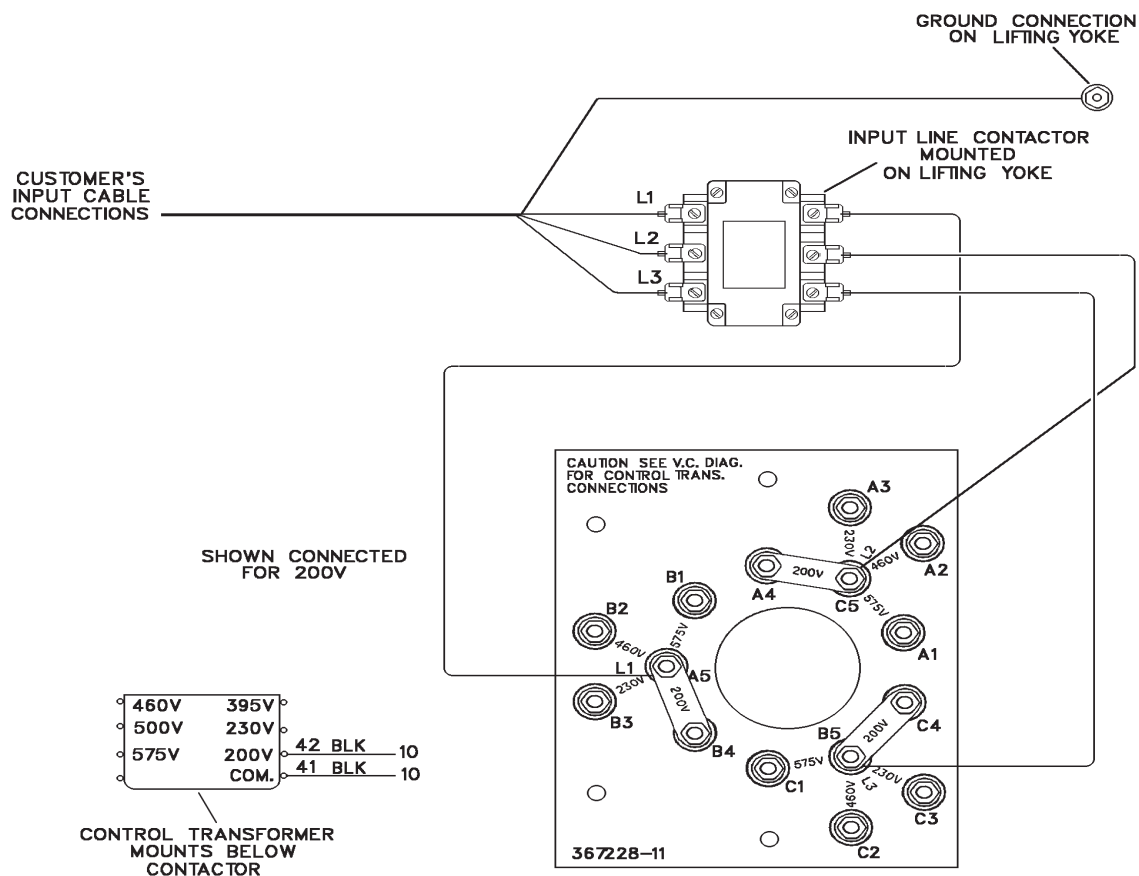


Figure 4-2 Input Voltage Connection & Changeover

able from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.

Connect the three-phase line leads to terminals L1, L2, and L3 on the line contactor inside the welding machine cabinet.

Welding Leads

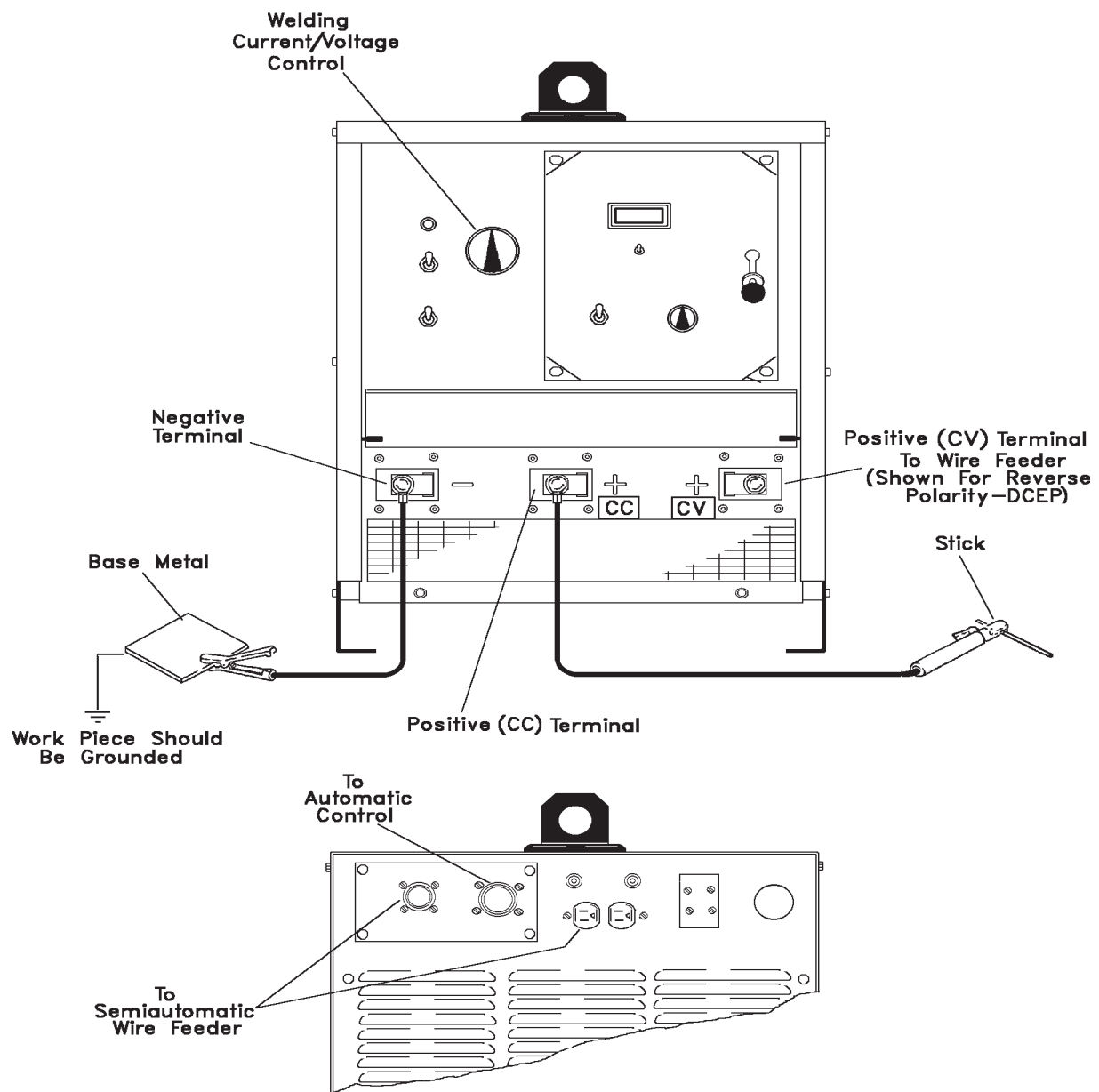
Use Table 4-2 for selection of the proper size copper welding leads.

Welding Current Amperes	TOTAL LENGTH OF LEAD CIRCUIT IN FEET (AND METERS) (ELECTRODE LEAD PLUS WORK LEAD)				
	50 Feet (15.2 M)	100 Feet (30.5 M)	150 Feet (45.7 M)	200 Feet (61.0 M)	250 Feet (76.2 M)
100	#4	#4	#4	#3	#2
150	#3	#3	#2	#1	#1/0
200	#2	#2	#1	#1/0	#2/0
250	#1	#1	#1/0	#2/0	#3/0
300	#1/0	#1/0	#2/0	#3/0	#4/0
350	#1/0	#1/0	#3/0	#4/0	#4/0
400	#2/0	#2/0	#3/0	#4/0	2 — #2/0
450	#2/0	#2/0	#4/0	2 — #2/0	2 — #3/0
500	#3/0	#3/0	#4/0	2 — #2/0	2 — #3/0

For 60% duty cycle

NOTE: Lead size shown is for 90°C cable insulation, 30°C (86°F) ambient, and not over 4.5 volts lead drop.

Table 4-2



NOTE: To change polarity, reverse connections on power output terminals on power source.

Figure 4-3 Installation Diagram

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OPERATION

General

Before operating this system, be sure that all installation instructions have been accomplished. When operating this system, observe all applicable Safety Warnings listed in this and related system manuals.

The operating instructions in this manual pertain only to the EXCEL-ARC® 500 and 6045 welding machines. Consult operating instructions for components used with this system before operating.

A thermostatically controlled fan motor is standard on this unit. The fan motor starts and stops automatically when a predetermined temperature has been reached.

Preweld Operation

1. Connect welding leads to terminals on front panel.

WARNING: Disconnect line voltage from the unit before making any connections inside unit. Turn off fused disconnect switch that supplies power to welding machine, and remove its fuse.

ELECTRIC SHOCK can kill!

- Do not touch live electrical parts, including the output terminals and electrode.

2. If used, connect remote control wire assembly and gun switch to welding machine. Connect feeder receptacle to wire electrode feeder system.
3. Refer to other manuals for component connections.
4. Set Output Control to desired value.
5. Set the remote/local control switch in the desired mode.
6. Set the stick/Tig switch (500015-1 and -3 & 500015A-1 and -3) in the desired mode.

7. Place the voltage sensing jumpers (500015-2 and -3 & 500015A-2 and -3) on the main P.C. control board to the desired mode. Local (voltage sensing from the power source which comes from the factory), Jumper JP-2 (–) and JP-4 (⚡). For remote voltage sensing, going out to the optional terminal strip – H.B. P/N 204248 Jumper JP-3 (–) and JP-5 (⚡).

SMAW (Stick) Welding, Carbon Arc Gouging

(500015-1 and -3 & 500015A-1 and -3)

Refer to Figure 3-1 for controls (numbers in parenthesis refer to callouts on Figure 3-1).

1. On 500015-3 & 500015A-3 set the CC/CV selector switch to CC position.
2. Hold electrode clear of work, and set Stick/Tig Switch (15) to STICK position. Be sure the Remote-Local Switch (3) is set to LOCAL position.
3. Turn Input Contactor Control Switch (2) to ON position.
4. Strike arc. Adjust Welding Output Control (8) if required. Adjust Arc Force Control (7) to desired level.
5. At the conclusion of welding, break arc, and turn Input Contactor Control Switch (2) to OFF position.

Welding, Semiautomatic or Automatic

Refer to Figure 3-1 for controls.

1. On 500015-2 and -3 & 500015A-2 and -3 set Remote/Local Output Control Switch (3) and Voltage Sensing Jumpers to LOCAL — JP-2 and JP-4.

NOTE: Set Output Control Switch (3) to REMOTE when using a feeder which controls the voltage, and remote voltage control is desired. Set Voltage Sensing Jumpers to JP-3 and JP-5 to REMOTE when using a feeder which provides voltage sensing at the actual welding location. If the Voltage Sensing Jumpers are placed in the REMOTE position, and the voltage sensing leads are not connected at the welding location, the output of the welding machine will go to maximum amperage.

430429-147
OPERATION

2. On 500015-3 & 500015A-3 set the CC/CV Selector Switch to CV position.

3. Place Input Contactor Control Switch (2) in ON position (Power ON).

4. Inch wire electrode to position over work; see related owner's manuals.

5. Depress gun switch trigger and strike arc.

6. The Excel-Arc[®] weld termination sequence is fully adjustable. Three simple jumper changes on the main circuit board allow the following weld termination treatments.

A.) Burnback Delay (JP-1)

B.) "Wire Sharpening"[™] (JP-9)

A. Burnback Delay — When JP-1 jumper block is in the enable position, the Excel-Arc[®] will maintain a contactor closure for approximately .25 seconds after the gun trigger has been released.

The primary function of this feature is the prevention of wire sticking to the weld puddle upon completion of a weld. Another term commonly used to describe burnback is the term anti-stick.

The burnback option is preferred in the following situations.

– When the Excel-Arc[®] power source is used with older model wire feeders which do not have solid state motor controls and which have a tendency for wire coasting.

– When the Excel-Arc[®] is used on high cycle, short weld applications or if a great deal of tack welding is done.

The Excel-Arc[®] power source is shipped from the factory with the burnback delay (JP-1) enabled.

B. "Wire Sharpening"[™] — In order to use this feature, Jumper JP-1 ("Burnback Delay") must be in the enable position.

"Wire Sharpening"[™] serves the same function as burnback delay. However, in addition to maintaining contactor closure for approximately .25 seconds, the Excel-Arc[®] power source also lowers the weld voltage to a value too low to maintain an arc but sufficient enough to burn off the remaining wire. The effect is a significant reduction in the ball size of the end of the wire.

CAUTION: In order for this circuit to work properly, the MIG gun must remain stationary for the complete "Wire Sharpening"[™] time period.

"Wire Sharpening"[™] is preferred in the following applications.

– Automatic welding operations & Robotic applications.

The Excel-Arc[®] is shipped from the factory with the "Wire Sharpening"[™] feature (JP-9) disabled.

MAINTENANCE

Replacing SCRs

Replacing a SCR is a critical task but it can be accomplished in the field by following the instructions in the Detailed Troubleshooting section of the Troubleshooting chapter of this manual.

Lubrication

The fan motor incorporates a sleeve bearing and therefore will need periodic lubrication. The following table will furnish a recommended guide to the frequency of this lubrication.

Type of Duty	Lubrication Interval
Light (up to 6 hrs./day)	Every 12 months
Moderate (7 to 15 hrs./day)	Every 6 months
Heavy (16 to 24 hrs./day)	Every 3 months

NOTE: Apply 1-12 drops of 20W non-detergent oil at each end of bearing.

Inspection and Cleaning

For uninterrupted, satisfactory service from this welding machine, it is necessary to keep the machine clean, dry, and well ventilated. At least every three months, or more often as necessary, wipe and blow out all dirt from the machine's internal components, with air pressure of not over 25 psi (172 kPa). Be sure to wipe the fan blades clean.

Check and tighten all electrical connections as necessary to eliminate unnecessary losses and to avoid subsequent trouble from overheating or open circuits. Check for broken wiring or damaged insulation on wiring.

CAUTION: The flow of air through the welding machine is carefully directed by baffles. Never operate the welding machine with any of the side or top panels removed or open, as serious damage to the rectifiers might result.

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TROUBLESHOOTING

General

(Also refer to Troubleshooting in wire feeder and gun manuals.)

Troubleshooting Guide

Welding machine will not start.

Power switch OFF

Place power switch in ON position.

Power lines dead

Check voltage.

Broken power lead

Repair.

Wrong line voltage

Check power supply.

Incorrect input power connections at welding machine

Check connections against wiring diagram.

Open circuit to power switch or control transformer

Repair. Check for broken wire or loose connections at terminals.

Fuse on control transformer blown

Remedy cause. Replace fuse.

Line contactor fails to close.

Defective NVR coil

Replace.

Mechanical obstruction on contactor

Remove.

Broken leads at line contactor

Repair.

Contactor chatters.

Line leads too small

Use larger leads.

Low line voltage

Check line voltage.

Contactors operate and blows link fuses.

Wrong line voltage

Check nameplate of welding machine for line voltage to use; check line voltage.

Links on voltage changeover board incorrectly connected

Check Voltage Changeover diagrams for link positions; connect links correctly. See Diagrams chapter.

Line fuse too small

Install proper size fuse.

SCR failure or shorted flyback diode

Refer to Detailed Troubleshooting Instructions.

Short circuit in primary connections

Remove short circuit.

Transformer failed

Repair or replace.

Unit delivers welding current but soon shuts down (Thermal overload trips)

Welding machine overloaded

Reduce load, overload can be carried only for a short time.

Duty cycle too high

Do not operate continually at overload currents.

Power leads too long or too small in cross section

Replace with larger diameter cable.

Ambient temperature too high

Operate at reduced loads when temperature exceeds 104° F (40° C).

Ventilation blocked

Check air intake and exhaust openings to be unobstructed.

Fan not operating after machine is loaded down

Check fan thermostat. Check bearings, disconnect leads and apply motor nameplate voltage to test.

Solid-state contactor operates, but welding machine will not deliver welding current, and open circuit voltage is present at the output when gun switch is depressed.

No ground connections at work

Make connections.

Welding cables not connected

Make connections.

Voltage/amps dial does not control welding voltage.

Potentiometer burned out

Replace.

Loose connections in voltage control circuit

Check connections.

Control circuit board failure

Replace control board.

Fan not operating (also see causes and remedies under “Welding machine will not start”)

NOTE: Fan will not operate until rectifier heats up.

Motor failed

Replace or repair.

Broken lead or connection to fan motor

Repair wiring.

Blown circuit breaker on rear panel of welding machine

Reset circuit breaker. 115-volt receptacle may be overloaded.

Operator gets shock when welding machine case, ground cable, work, or work table is touched.

Case of welding machine not grounded

Ground welding machine case.

Work table and work not grounded

Ground work and work table to plant ground.

Abnormal current fluctuation, voltage nearly constant

Irregular wire feed speed

See welding head manual.

Inadequate shielding of arc by flux or gas

Increase shielding by trial and error. See welding head manual.

Wire feed rate too slow

Increase wire feed. See wire burn-off rate charts.

Too much shielding gas

Decrease by trial and error. See welding head manual.

Loose cable connections

Check for overheated connections and tighten.

Welding contact tube (tip) on wire feeder makes poor contact with electrode

Check contact tube hole size and replace with proper tube.

Contactor fails to open.

Contactor contacts sticking

Clean contacts.

Very noticeable, rough, sputtering arc. Loss of control and burnback. Minor starting problems.

Control circuit board failure

Replace Control P.C. Board.

Output of welding machines goes to maximum and there is no control.

Voltage sensing lead not connected

Connect lead.

Jumper JP-2 and JP-4 on Control P.C. Board not connected

Add jumpers JP-2 and JP-4 on Control P.C. Board.

Detailed Troubleshooting Instructions

The EXCEL-ARC[®] 500 and 6045 are solid-state welding machines. The method of troubleshooting is different, but is not more difficult than troubleshooting a conventional unit. Do not overlook the obvious. As in the case of all electrical equipment, loose connections are the primary cause of malfunction both internal and external to the welding machine. Do not overlook bad grounds, worn contact tubes (tips), dirty cable liners, shorted control cables, wrong settings, blown fuses, worn contactors, misconnections from feeding equipment, misapplication, etc. To check the Control P.C. Board, take control module panel off the front panel. Check the control board for loose connectors, broken or loose wires. Inspect the P.C. Board for broken components, scorched or burned components. The only equipment needed to properly detect a problem on this welding machine is a simple voltohmmeter, although an oscilloscope is the best method to quickly "see" the problem.

Voltages of Interest — Refer to Connection Diagram.

1. Across the secondary on all three phases — 88.0 V AC \pm 10%.
2. From the center bus bar on secondaries to the top or bottom of the secondary — 44.0 V AC \pm 10%.

NOTE: The \pm 10% refers to the possibility of having a high or low input line voltage.

3. 115 V Receptacles — 115 V AC \pm 10%.
4. AC Input Voltage — Test Points R206 to R207 — 36 V AC voltage reading — AC voltage input to P.C. Board; Test Points R208 to R209 — 36 V AC voltage reading — AC voltage input to P.C. Board; Test Points R210 to R211 — 36 V AC voltage reading — AC voltage input to P.C. Board.
5. Power Supply Checks — Test Points TP16 to TP18 — +22 V DC meter reading — power supply reading; Test Points TP16 to TP17 — +15 V DC meter reading — power supply reading; Test Points TP16 to TP19 — -15V DC meter reading — power supply reading.
6. Output Contactor Checks — Test Point TP16 to Anode L9 — +16 V DC meter reading (for CC Mode); Test Point TP16 to L8 — +16V DC meter reading (for CV Mode) — output switch to local pins A and B on Amphenol shorted together; Test Point TP16 to R22 — +16V DC meter reading (for Tig position).
7. Output Reference Circuits — Test Point TP16 to TP9 — +10 V DC meter reading — reference

voltage supply; Test Point TP16 to L10 — -9.50 meter reading for Excel-Arc[®] 6045 Models, -10 V DC meter reading for Excel-Arc[®] CC and 8065 Models — Voltage reference supply to output pots.

8. SCR Firing Circuits — Test Point TP16 to TPE — 4.3 V DC meter reading — Checks ramp circuits; Test Point TP16 to TPD — 4.3 V DC meter reading — All readings should be very close for balance; Test Point TP16 to TPB — 4.3 V DC meter reading — All readings should be very close for balance; Test Point TP16 to +C69 — 17-19 V DC meter reading — Checks SCR Gate; Test Point TP16 to +C70 — 17-19 V DC meter reading — Generator Circuits; Test Point TP16 to +C71 — 17-19 V DC meter reading — All should be equal.

Control Circuit Board Malfunction — If a board malfunction occurs, the following situations will probably result:

1. Loss of arc completely.
2. Very noticeable, rough, sputtering arc.
3. Loss of control and burnback.
4. Minor starting problems.

SCR Malfunction — If one or more SCRs malfunction, the following situations will probably result:

1. Blown line fuses as the result of a shorted SCR (similar to a shorted diode). A shorted flyback diode will also produce this situation.
2. If one SCR does not turn on [either it is open or the gate signal is not being received by the SCR (gate circuit open)], a very small change will occur at the arc and will be difficult to notice by the average operator. Generally when this happens, it will be necessary to adjust the voltage control on the front of the welding machine (turn it up) to obtain the same arc that was being produced before the defect occurred.
3. If two SCRs do not turn on, the arc becomes more erratic and unstable.

Component Testing

1. In the case of a severe malfunction, such as a shorted SCR or diode, do not turn on the unit. Disconnect the leads from the transformer to the heat sink assembly and check with a VOM for shorted SCRs or a shorted flyback diode.
2. If the welding machine is suspected, a very simple test can tell you a great deal about it. Simulate gun switch closing and observe the open circuit voltage. This can be done by putting the Process Selection Switch (Fig. 3-1, item 5) in the CV position and shorting terminals A and B together on the 5-pin

connector on the rear panel. This voltage should vary from 19V DC to 57V DC \pm 10%, as the voltage control is rotated from min. to max. slowly. If this voltage varies smoothly, there is a strong possibility that nothing has malfunctioned in the welding machine. If the voltage varies erratically and does not come close to the values listed, you probably have a control circuit board problem. If the voltage variation is somewhat smooth, but does not reach the maximum value (remember the \pm 10% refers to a high or low line voltage), you probably have an SCR problem.

3. The next step is to go inside the unit and check the control circuit board. See the instructions provided for this test. It is important to run through the tests in the order they are listed. If an interface box is being used, it will be necessary to switch the welding machine local-remote switch to the local position.

4. If nothing is found defective on the board, the next step is to go to the SCRs. First of all an open gate or an open SCR *cannot* be checked with a VOM. If an SCR is not firing, the open circuit voltage (OCV) will shift down. Check the following table for typical values:

Disconnect cable #103 from the capacitor bank assembly. Insulate the lug end of cable #103 to prevent it from touching chassis or any other surface.

- a. All SCRs firing properly — max. OCV = 57V DC.
- b. 1 SCR not firing — max. OCV = 51V DC.
- c. 2 SCRs not firing — max. OCV = 45V DC.
- d. 3 SCRs not firing — max. OCV = 39V DC.

NOTE: These voltages were recorded at nominal line voltage with voltage control adjustment at MAXIMUM setting (unit adjusted for high open-circuit voltage).

The best way to isolate the particular SCR which is malfunctioning is as follows. Refer to Connection

Diagram while inspecting the unit. On the output rectifier there are gate leads coming off of the SCRs. Each of these leads are connected to a quick-disconnect terminal on the suppressor board. Turn the voltage control pot to maximum. Disconnect one lead to one SCR and observe the OCV. If the OCV drops to a lower value, this indicates that this particular SCR is working properly. *Reconnect this lead* and do the same thing with the remaining leads until you discover which disconnection does *not* cause the OCV to drop to a lower level. This is the malfunctioning SCR. See Mounting Procedures for SCRs which follows.

Mounting Procedure for SCRs

1. Thoroughly clean heat sink surface to eliminate any dirt or contamination.

2. Apply a thin coat of Alcoa #2 compound to cleaned surface. Alcoa #2 is available from Thermal Arc, part number 903870.

3. Positively locate the SCR in place in the heat sink. A small spring pin in the extruded heat sink will locate the SCR.

4. Place the clamp in position with the bolts through the holes in the heat sink, and proceed in following manner.

5. Tighten the nuts evenly until finger tight.

6. Tighten each bolt in 1/4 turn increments using correct size hex key.

7. Place the Force Indicator Gauge (903878) firmly against the springs as shown. Be sure both ends and the center are in firm contact with the springs. The gauge notch location will indicate the spring deflection or force. Correct mounting force is indicated as shown below.

8. Spring deflection over 2-1/4 inches of spring is .037" \pm .002" for all clamps.

9. All clamps to be set at 4° mark. This corresponds to the VE3000-VE2500 section on the gauge label.

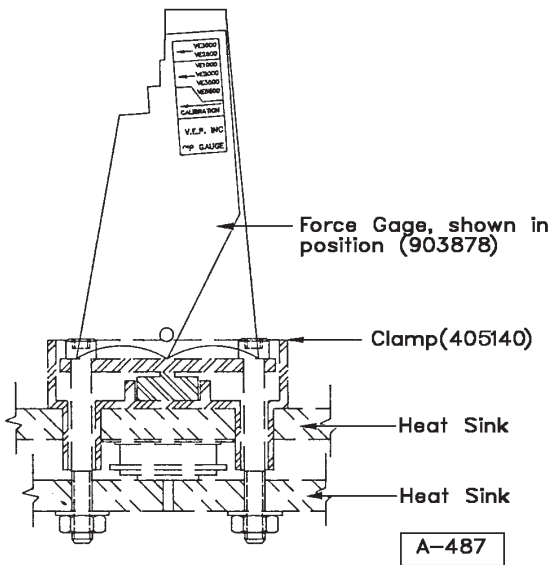
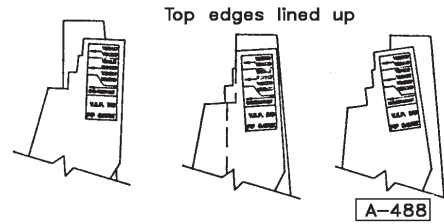


Figure 7-1

Examples:



Less than rated force. Tighten nuts alternately 1/4 turn at a time until points coincide.

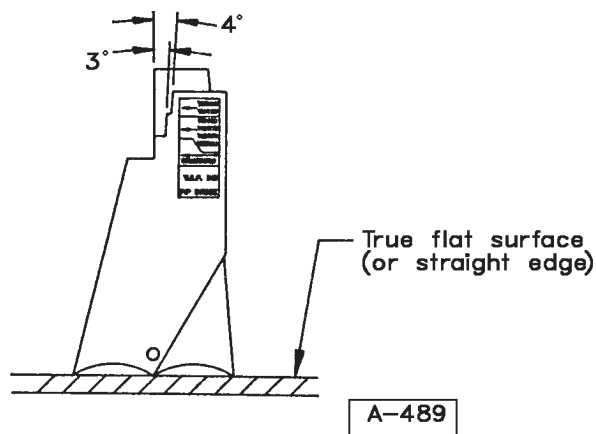
Correct rated force.

Excessive force. Loosen both nuts and start over. Never adjust force by backing off the nuts. Friction will produce a false reading. Always start from Step 1.

Figure 7-2

To Calibrate Force Gauge:

If the gauge is suspected of being out of calibration due to wear or damage, check it on a flat surface as shown below.



If the calibration edges do not line up, calibrate the gauge by filing the bottom contact points.

Figure 7-3

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PARTS LIST

Equipment Identification

All identification numbers as described in the Introduction chapter must be furnished when ordering parts or making inquiries. This information is usually found on the nameplate attached to the equipment. Be sure to include any dash numbers following the Specification or Assembly numbers.

How To Use This Parts List

The Parts List is a combination of an illustration (Figure Number) and a corresponding list of parts which contains a breakdown of the equipment into assemblies, subassemblies, and detail parts. All parts of the equipment are listed except for commercially available hardware, bulk items such as wire, cable, sleeving, tubing, etc., and permanently attached items which are soldered, riveted, or welded to another part. The part descriptions may be indented to show part relationships.

To determine the part number, description, quantity, or application of an item, simply locate the item in question from the illustration and refer to that item number in the corresponding Parts List.

An "Application Code" is used to distinguish parts that are applicable only to certain Specifications and/or Assemblies. This code is found in the rightmost column of the Parts List. If an item in the Parts

List applies to all Specifications or Assemblies, the word "ALL" will be in the Application Code column. Refer to the following list to determine the appropriate Application Codes for the Specifications or Assemblies covered by this manual. If only the assembly or specification number is listed, the use of an Application Code does not apply to this manual.

How To Select Recommended Spares

The first two columns of the Parts List are used to show the recommended quantity of parts which are typically required for spares or replacement purposes. The quantities under Class 1 are for parts that are consumed or that may need replacement in two years or less depending on operating hours. Class 2 quantities are for parts that may need replacement under unusual service conditions or additional operating hours. These are suggested quantities based on expected usage or the minimum package quantity. Class 1 spares are repeated under Class 2 but the quantities may be larger to allow for additional operating hours. Contact your equipment dealer for assistance in establishing the spare parts program best suited for your needs.

PART NUMBER

500015-1
500015-2
500015-3
500015A-1
500015A-2
500015A-3

APPLICATION CODE

A
B
C
D
E
F

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PARTS LIST

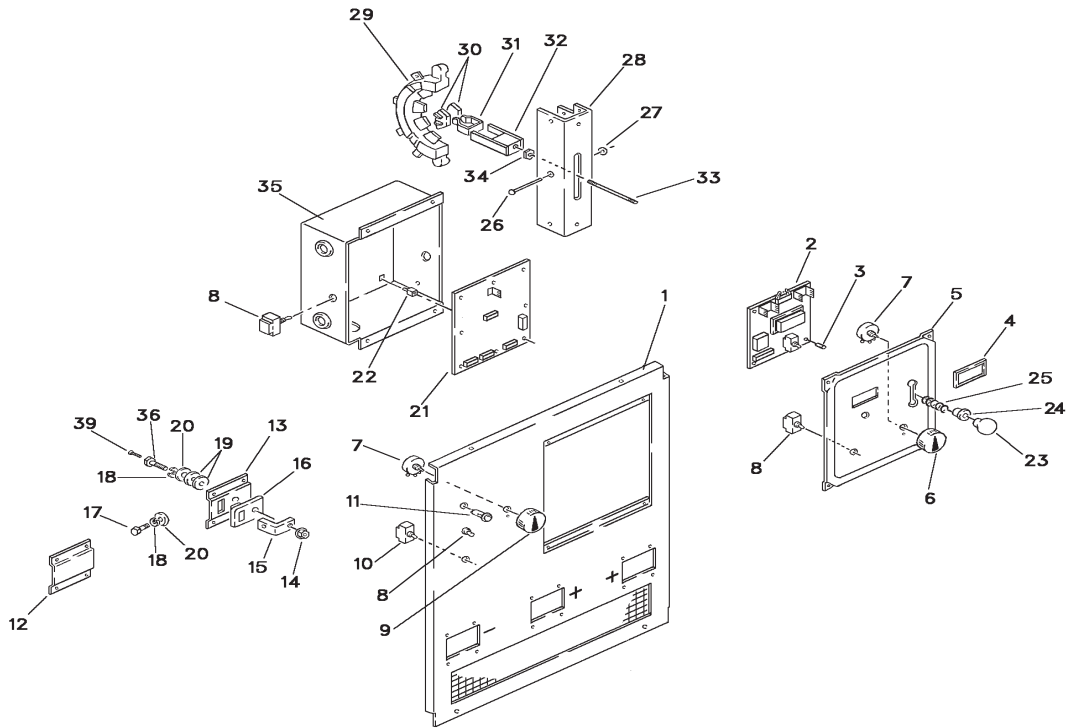


Figure 8-1 EXCEL-ARC® Control Panel Group

Parts List for Figure 8-1

Quantity Recomm. Spares Class 1	Item No	Part Number	Description	Qty per Assy	Application Code
		500015-1	Excel-Arc Welder [®] - 500 CC, 60 Hz	1	A
		500015-2	Excel-Arc Welder [®] - 6045 CV, 60 Hz	1	B
		500015-3	Excel-Arc Welder [®] - 6045 CC/CV, 60 Hz	1	C
		500015A-1	Excel-Arc Welder [®] - 500 CC, 60 Hz	1	D
		500015A-2	Excel-Arc Welder [®] - 6045 CV, 60 Hz	1	E
		500015A-3	Excel-Arc Welder [®] - 6045 CC/CV, 60 Hz	1	F
	1	204055-1	. Panel - Control	1	ABC
		204055A-1	. Panel - Control	1	DEF
1	2	204212	. Board - PC, Digital Display	1	BCEF
	3	204600-2	. Spacer	4	BCEF
	4	409000-1	. Bezel - Meter	1	BCEF
	5	204053-1	. Panel - Control Module	1	A
		204053-7	. Panel - Control Module	1	D
		204053-2	. Panel - Control Module	1	B
		204053-8	. Panel - Control Module	1	E
		204053-3	. Panel - Control Module	1	C
		204053-9	. Panel - Control Module	1	F
	6	406806-1	. Knob - Control	1	AC
		406806-3	. Knob - Control	1	DF
1	7	401428-8	. Potentiometer - Volt/Amp Ctl, Arc Force	2	ACDF
		401428-8	. Potentiometer - Volt/Amp Ctl, Arc Force	1	BE
	8	405365-1	. Switch - Toggle, ON/OFF, Tig Stick	2	ACDF
		405365-1	. Switch - Toggle, ON/OFF, Tig Stick	1	BE
	9	408850-2	. Knob - Black	1	ABC
		408850-5	. Knob - Black	1	DEF
	10	402682	. Switch - Toggle, RMT/LC1	1	All
1	11	402421-2	. Light - Indicator	1	All
	12	204052-2	. Panel - Output, Blank	1	AB
		204052-6	. Panel - Output, Blank	1	DE
	13	204052-1	. Panel - Output, Terminal	2	AB
		204052-5	. Panel - Output, Terminal	2	DE
		204052-1	. Panel - Output, Terminal	3	C
		204052-5	. Panel - Output, Terminal	3	F
	14	400614-1	. Nut - 1/2-13, Hex, Flanged	2	ABDE
		400614-1	. Nut - 1/2-13, Hex, Flanged	3	CF
	15	5CW-974	. Bus - Cable Stud	2	ABDE
		5CW-974	. Bus - Cable Stud	3	CF

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Parts List for Figure 8-1

Quantity	Recomm.	Item	Part	Description	Qty	Application
Spares		No	Number		per	Code
Class 1	Class 2				Assy	
		16	5CW-975	. Bushing - Insulator	2	ABDE
			5CW-975	. Bushing - Insulator	3	CF
		17	No Number	. Screw - 1/2-13 x 3/4, HHC, ST.	2	ABDE
			No Number	. Screw - 1/2-13 x 3/4, HHC, ST.	3	CF
		18	No Number	. Washer - LK, Std, ST. 1/2	4	ABDE
			No Number	. Washer - LK, Std, ST. 1/2	6	CF
		19	5CW-976A	. Washer - Insulator Stud	4	ABDE
			5CW-976A	. Washer - Insulator Stud	6	CF
		20	No Number	. Washer - FL, ST. 1/2	4	ABDE
			No Number	. Washer - FL, ST. 1/2	6	CF
	1	21	204207B	. Board - PC, Control	1	All
		22	171086-1	. Stand-off - PC Board	8	All
		23	W-9956	. Knob - Switch, Range	1	CF
		24	367880	. Sleeve - Sw.	1	CF
		25	400562-24	. Spring - Compression	1	CF
			367260	. Switch - Range	1	C
			367260-1	. Switch - Range	1	F
		26	405478	. . Rivet	1	CF
		27	W-11291-3	. . Nut - Speed, Push on	1	CF
		28	410602	. . Bracket	1	C
			410602-1	. . Bracket	1	F
		29	410589	. . Contact - Stationary	1	CF
		30	12RT-238	. . Contact - Movable	2	CF
		31	410541	. . Spring	1	CF
		32	910061	. . Guide	1	CF
		33	W-9549-21	. . Rod - Threaded, 1/4 Dia.	1	CF
		34	No Number	. . Nut - 1/4-20 SCR, MH, Hex, ST.	1	CF
		35	204055-7	. Box - Control Board	1	ABC
			204055A-7	. Box - Control Board	1	DEF
		—	204247-1	. Cable - Ribbon, Meter	1	BCEF
		36	351505	. Screw - 1/2-13 x 1-3/4, HHC, ST.	2	ABDE
			351505	. Screw - 1/2-13 x 1-3/4, HHC, ST.	3	CF
		37		. Delete		
		38		. Delete		
		39	No Number	. Screw - #6-32 x 1/4 Rd. Hd. MH. ST.	2	ABDE
			No Number	. Screw - #6-32 x 1/4 Rd. Hd. MH. ST.	3	CF
		—		Not Illustrated		

Parts List for Figure 8-2

Quantity		Item No	Part Number	Description	Qty per Assy	Application Code
Recomm. Spares	Class 2					
		1	204054	. Base - Welder	1	ABC
			204054-1	. Base - Welder	1	DEF
		2	204124	. Transformer - Power	1	All
		3	367228-11	. . Board - Voltage Changeover	1	All
		4	CW-811	. Link - Voltage Changeover	3	All
		5	204301	. Bracket - Mtg.	2	ABC
			204301-1	. Bracket - Mtg.	2	DEF
		6	204194	. Choke - Filter, CC	1	ACDF
		7	204193	. Choke - Filter, CV	1	BCEF
		8	204061-1	. Door	1	ABC
			204061-2	. Door	1	DEF
		9	203453	. Hinge - Door	2	All
		10	204055-5	. Panel - Side, Left	1	ABC
			204055A-5	. Panel - Side, Left	1	DEF
1		11	406358-4	. Resistor - Fixed, 175 W	1	BCEF
1		12	406358-1	. Resistor - 25 Ohm, 175 W	1	All
		13	204060	. Yoke - Lifting	1	ABC
			204060-1	. Yoke - Lifting	1	DEF
		14	402037-33	. Grommet - Rubber	2	All
		15	402037-11	. Grommet - Rubber	3	All
		16	375426-4	. Standoff	5	ACDF
		17	204182	. Board - Current Booster	1	ACDF
		18	204055-4	. Panel - Side, Right	1	ABC
			204055A-4	. Panel - Side, Right	1	DEF
			204099	. Capacitor - Assembly	1	BC
			204099-1	. Capacitor - Assembly	1	EF
		19	204152	. . Bus - Capacitor	2	BCEF
		20	405278-15	. . Capacitor	5	BCEF
		21	204301	. . Bracket - Mtg.	2	BC
			204301-1	. . Bracket - Mtg.	2	EF
		22	409870	. . Washer - Insulating	4	BCEF
		23	409869	. . Bushing - Insulating	4	BCEF
		24	204055-6	. Box - Contactor	1	ABC
			204055A-6	. Box - Contactor	1	DEF
		25	405402	. Contactor	1	All
		26	406392-2	. Transformer - Control	1	All
		27	W-11166-11	. Fuse - 1/2 Amp	1	All
		28	204055-3	. Panel - Top	1	ABC
			204055A-3	. Panel - Top	1	DEF
		29	12CW-2170	. Boot - Lifting Eye	1	All
		30	204036	. Label - Precautionary	1	All

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Parts List for Figure 8-2

Quantity		Item	Part	Description	Qty	Application
Recomm.	Spares					
Class 1	Class 2	No	Number		per	Code
					Assy	
		31	402900	. Terminal - Quick Connect	2	ABDE
			402900	. Terminal - Quick Connect	3	CF
		32	368705-36	. Capacitor - W/Leads	2	ABDE
			368705-36	. Capacitor - W/Leads	3	CF
		33	830116	. Label - Frame Ground	2	All
		34	408891	. Label - Warning	1	All
		—	204204	. Label - Voltage Changeover	1	All
		—	406484	. Label - Fuse	1	All

— Not Illustrated

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PARTS LIST

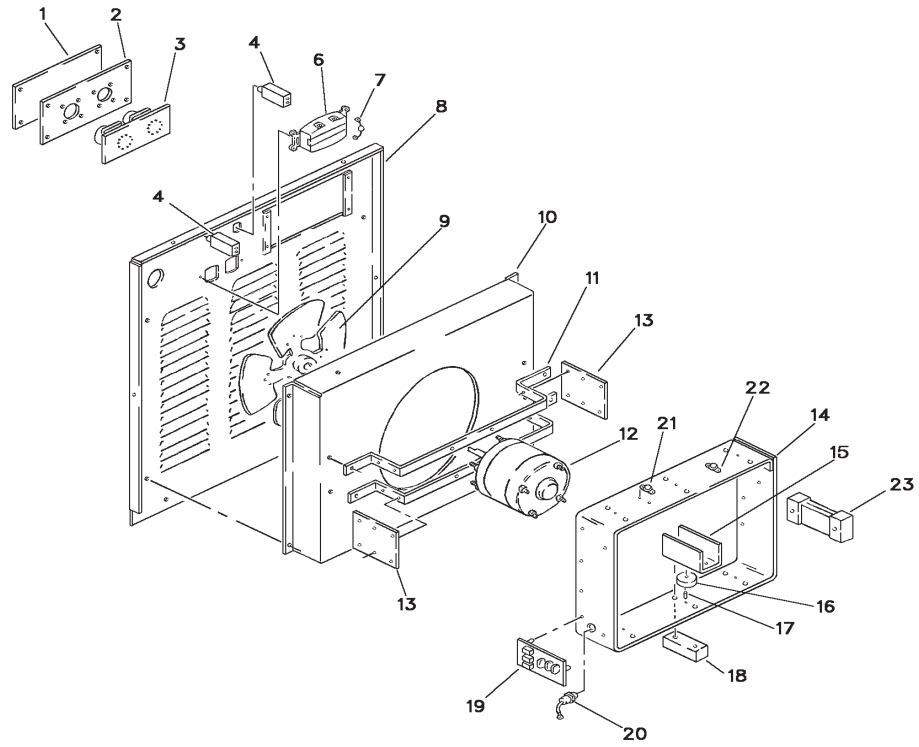


Figure 8-3 Rear Panel Group

Parts List for Figure 8-3

Quantity	Item	Part	Description	Qty	Application
Recomm.	No	Number		per	Code
Spares				Assy	
Class 1	Class 2				
	1	204109-2	. Panel - Amphenol, Blank	1	A
		204109-4	. Panel - Amphenol, Blank	1	D
	2	204109-1	. Panel - Amphenol	1	BC
		204109-3	. Panel - Amphenol	1	EF
	3	204184A	. Board - P.C. Amphenol	1	BCEF
	4	203627-7	. Breaker - Circuit, 10 A	1	AD
		203627-1	. Breaker - Circuit, 10 A	2	BCEF
	5		. Delete		
	6	402670	. Receptacle - 115 V.	1	All
	7	366826-1	. Suppressor - Assembly	1	All
	8	204055-2	. Panel - Rear	1	ABC
		204055A-2	. Panel - Rear	1	DEF
	9	8RT-609	. Blade - Fan	1	All
	10	204055-8	. Shroud - Fan	1	ABC
		369650-1	. Shroud - Fan	1	DEF
	11	369640	. Bracket - Mtg. Fan	2	ABC
		369640-1	. Bracket - Mtg. Fan	2	DEF
	12	12TW-595-1	. Motor - Fan	1	All
	13	369641	. Insulator - Mtg.	2	All
	14	369639	. Heat Sink - Rectifier	1	All
	15	369642	. Heat Sink - SCR	6	All
	16	405139	. Rectifier - Silicon	6	All
	17	16DA-954-12	. Pin - Spring	6	All
	18	405140-1	. Clamp - Mtg.	6	All
	19	204210	. Board - Suppressor	2	All
	20	402832-3	. Diode - Flyback	1	All
	21	404044-6	. Thermostat - Fan	1	All
	22	404044-3	. Thermostat - Overload	1	All
	23	367732	. Shunt	1	All
	—	204038-1	. Cable - Ribbon, Amphenol	1	BCEF
	—	903914-1	. Cap - Protective	1	BCEF
	—	903914-2	. Cap - Protective	1	BCEF
	—	403091-14	. Plug - Hole	1	All
	—	170919-2	. Plug - Hole	1	AD
	—		Not Illustrated		

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DIAGRAMS

- Note the model and part number shown on the equipment nameplate.
- Locate these numbers in the model and part number columns below.
- Use only those diagrams and instructions that are applicable.

MODEL NO.	PART NUMBER	CONNECTION DIAGRAM	SCHEMATIC DIAGRAM	VOLTAGE CHANGEOVER DIAGRAM
EXCEL-ARC[®] 500	500015-1	204202 Sheet 1 & 2	204202 Sheet 3	204203
	500015A-1	204202 Sheet 1 & 2	204202 Sheet 3	204203
EXCEL-ARC[®] 6045	500015-2	204202 Sheet 4 & 5	204202 Sheet 6	204203
	500015-3	204202 Sheet 7 & 8	204202 Sheet 9	204203
	500015A-2	204202 Sheet 4 & 5	204202 Sheet 6	204203
	500015A-3	204202 Sheet 7 & 8	204202 Sheet 9	204203