



TM-180 670B September 2001
Eff. w/Serial Number KG139511

Processes



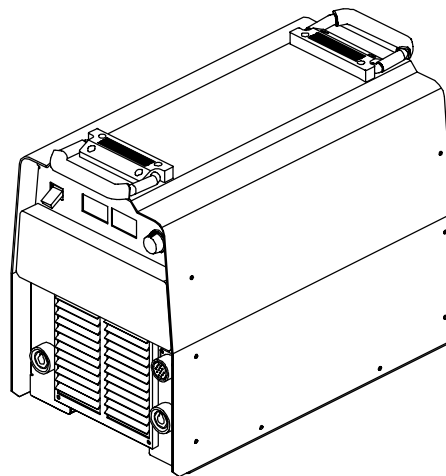
Description



Arc Welding Power Source



XMT[®] 304 (400 Volt Models)



TECHNICAL MANUAL



Visit our website at
www.MillerWelds.com

Declaration of Conformity For European Community (CE) Products

Manufacturer's Name: Miller Electric Mfg. Co.
Manufacturer's Address: 1635 W. Spencer Street
Appleton, WI 54914 USA

Declares that the product: **XMT® 304**

conforms to the following Directives and Standards:

Directives

Electromagnetic compatibility Directives: 89/336/EEC, 92/31/EEC

Low Voltage Directive: 73/23/EEC

Machinery Directives: 89/392/EEC, 91/368/EEC, 93/C 133/04, 93/68/EEC

Standards

*Electromagnetic compatibility (EMC) Product standard for arc welding equipment:
EN50199: December 1995*

Safety Requirements for Arc Welding Equipment part 1: EN 60974-1: 1989

Degrees of Protection provided by Enclosures (IP code): IEC 529: 1989

*Insulation coordination for equipment within low-voltage systems:
Part 1: Principles, requirements and tests: IEC 664-1: 1992*

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TABLE OF CONTENTS

SECTION 1 – SAFETY PRECAUTIONS FOR SERVICING	1
1-1. Symbol Usage	1
1-2. Servicing Hazards	1
1-3. EMF Information	2
SECTION 2 – DEFINITIONS	3
2-1. Manufacturer's Warning Label Definitions	3
2-2. Manufacturer's Rating Labels	5
2-3. Symbols And Definitions	6
SECTION 3 – INSTALLATION	7
3-1. Specifications	7
3-2. Duty Cycle And Overheating	7
3-3. Volt-Ampere Curves	8
3-4. Selecting A Location	9
3-5. Weld Output Terminals And Selecting Cable Sizes	10
3-6. Remote 14 Receptacle Information	11
3-7. 110 Volt AC Duplex Receptacle	11
3-8. Electrical Service Guide	12
3-9. Connecting Input Power	12
SECTION 4 – OPERATION	13
4-1. Front Panel Controls	13
4-2. Meter Functions	14
4-3. Mode Switch Settings	15
4-4. Lift-Arc Trigger Hold TIG	16
SECTION 5 – THEORY OF OPERATION	18
SECTION 6 – EXPLANATION OF ELECTRICAL PARTS	20
SECTION 7 – PRE-POWER CHECKLIST	24
7-1. Checking Unit Before Applying Power	24
7-2. Output Diodes D1, D2	24
7-3. Input Rectifier SR1	25
7-4. Tank Capacitor C1 and Input Capacitors C3, C4	25
7-5. IGBT Modules PM1, PM2	26
7-6. Diodes D1, D2, D3, D4	27
SECTION 8 – TROUBLESHOOTING	28
8-1. Troubleshooting Table	28
8-2. Voltmeter/Ammeter Help Displays Prior To Serial No. KG150087	30
8-3. Voltmeter/Ammeter Help Displays Effective With KG150087	31
8-4. Troubleshooting Circuit Diagram For Welding Power Source Prior To KK104771	32
8-5. Troubleshooting Circuit Diagram For Welding Power Source Eff. With KK104771	34
8-6. Waveforms For Sections 8-4 And 8-5	36
8-7. Control Board PC1 Testing Information (All Models – Use With Section 8-8)	37
8-8. Control Board PC1 Test Point Values (All Models)	38
8-9. Display Board PC3 Testing Information (All Models – Use With Section 8-10)	40
8-10. Display Board PC3 Test Point Values (All Models)	41
8-11. Interconnecting Board PC2 Testing Information (All Models)	42
SECTION 9 – MAINTENANCE	43
9-1. Routine Maintenance	43
9-2. Blowing Out Inside Of Unit	43
9-3. Measuring Input Capacitor Voltage	44
9-4. Checking Bus Voltage Imbalance	45
SECTION 10 – ELECTRICAL DIAGRAMS	46
SECTION 11 – PARTS LIST FOR KG139511 AND FOLLOWING	68

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 Section 25249.5 et seq.)

SECTION 1 – SAFETY PRECAUTIONS FOR SERVICING

1-1. Symbol Usage

OM-180 670M - 1/00, safety_stm 5/97



Means Warning! Watch Out! There are possible hazards with this procedure! The possible hazards are shown in the adjoining symbols.

▲ Marks a special safety message.

☞ Means "Note"; not safety related.



This group of symbols means Warning! Watch Out! possible ELECTRIC SHOCK, MOVING PARTS, and HOT PARTS hazards. Consult symbols and related instructions below for necessary actions to avoid the hazards.

1-2. Servicing Hazards

- ▲ The symbols shown below are used throughout this manual to call attention to and identify possible hazards. When you see the symbol, watch out, and follow the related instructions to avoid the hazard.
- ▲ Only qualified persons should service, test, maintain, and repair this unit.
- ▲ During servicing, keep everybody, especially children, away.



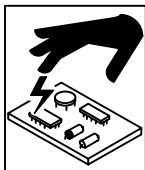
ELECTRIC SHOCK can kill.

- Do not touch live electrical parts.
- Turn Off welding power source and wire feeder and disconnect and lockout input power using line disconnect switch, circuit breakers, or by removing plug from receptacle, or stop engine before servicing unless the procedure specifically requires an energized unit.

- Insulate yourself from ground by standing or working on dry insulating mats big enough to prevent contact with the ground.
- Do not leave live unit unattended.
- If this procedure requires an energized unit, have only personnel familiar with and following standard safety practices do the job.
- When testing a live unit, use the one-hand method. Do not put both hands inside unit. Keep one hand free.
- Disconnect input power conductors from deenergized supply line BEFORE moving a welding power source.

SIGNIFICANT DC VOLTAGE exists after removal of input power on inverters.

- Turn Off inverter, disconnect input power, and discharge input capacitors according to instructions in Maintenance Section before touching any parts.



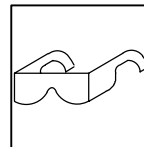
STATIC (ESD) can damage PC boards.

- Put on grounded wrist strap BEFORE handling boards or parts.
- Use proper static-proof bags and boxes to store, move, or ship PC boards.



FIRE OR EXPLOSION hazard.

- Do not place unit on, over, or near combustible surfaces.
- Do not service unit near flammables.



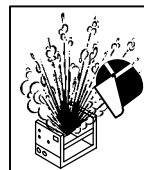
FLYING METAL can injure eyes.

- Wear safety glasses with side shields or face shield during servicing.
- Be careful not to short metal tools, parts, or wires together during testing and servicing.



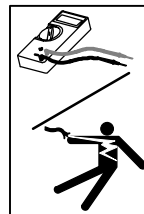
HOT PARTS can cause severe burns.

- Do not touch hot parts bare handed.
- Allow cooling period before working on welding gun or torch.



EXPLODING PARTS can cause injury.

- Failed parts can explode or cause other parts to explode when power is applied to inverters.
- Always wear a face shield and long sleeves when servicing inverters.



SHOCK HAZARD from testing.

- Turn Off welding power source and wire feeder or stop engine before making or changing meter lead connections.
- Use at least one meter lead that has a self-retaining spring clip such as an alligator clip.
- Read instructions for test equipment.



FALLING UNIT can cause injury.

- Use lifting eye to lift unit only, NOT running gear, gas cylinders, or any other accessories.
- Use equipment of adequate capacity to lift and support unit.
- If using lift forks to move unit, be sure forks are long enough to extend beyond opposite side of unit.



MOVING PARTS can cause injury.

- Keep away from moving parts such as fans.
- Keep all doors, panels, covers, and guards closed and securely in place.



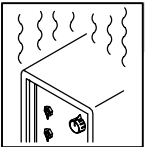
MOVING PARTS can cause injury.

- Keep away from moving parts.
- Keep away from pinch points such as drive rolls.



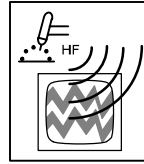
MAGNETIC FIELDS can affect pacemakers.

- Pacemaker wearers keep away from servicing areas until consulting your doctor.



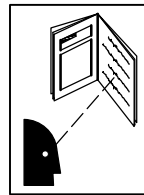
OVERUSE can cause OVERHEATING.

- Allow cooling period; follow rated duty cycle.
- Reduce current or reduce duty cycle before starting to weld again.
- Do not block or filter airflow to unit.



H.F. RADIATION can cause interference.

- High-frequency (H.F.) can interfere with radio navigation, safety services, computers, and communications equipment.
- Have only qualified persons familiar with electronic equipment install, test, and service H.F. producing units.
- The user is responsible for having a qualified electrician promptly correct any interference problem resulting from the installation.
- If notified by the FCC about interference, stop using the equipment at once.
- Have the installation regularly checked and maintained.
- Keep high-frequency source doors and panels tightly shut, keep spark gaps at correct setting, and use grounding and shielding to minimize the possibility of interference.



READ INSTRUCTIONS.

- Use MILLER Testing Booklet (Part No. 150 853) when servicing this unit.
- Consult the Owner's Manual for welding safety precautions.
- Use only genuine MILLER replacement parts.

1-3. EMF Information

Considerations About Welding And The Effects Of Low Frequency Electric And Magnetic Fields

Welding current, as it flows through welding cables, will cause electromagnetic fields. There has been and still is some concern about such fields. However, after examining more than 500 studies spanning 17 years of research, a special blue ribbon committee of the National Research Council concluded that: "The body of evidence, in the committee's judgment, has not demonstrated that exposure to power-frequency electric and magnetic fields is a human-health hazard." However, studies are still going forth and evidence continues to be examined. Until the final conclusions of the research are reached, you may wish to minimize your exposure to electromagnetic fields when welding or cutting.

To reduce magnetic fields in the workplace, use the following procedures:

1. Keep cables close together by twisting or taping them.
2. Arrange cables to one side and away from the operator.
3. Do not coil or drape cables around your body.
4. Keep welding power source and cables as far away from operator as practical.
5. Connect work clamp to workpiece as close to the weld as possible.

About Pacemakers:

Pacemaker wearers consult your doctor first. If cleared by your doctor, then following the above procedures is recommended.

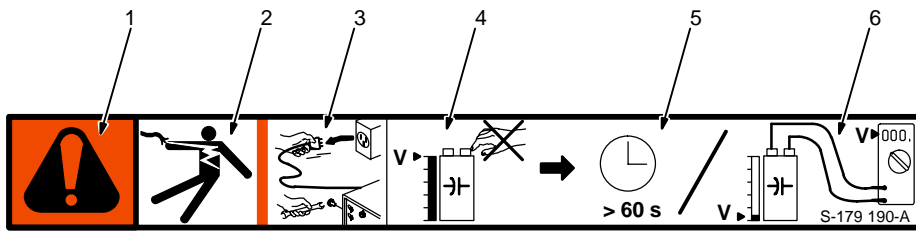
SECTION 2 – DEFINITIONS

2-1. Manufacturer's Warning Label Definitions



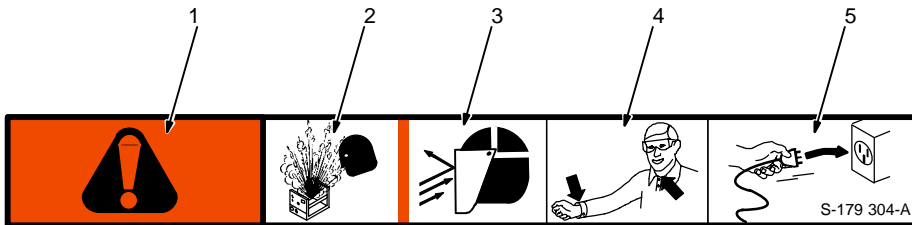
Warning! Watch Out! There are possible hazards as shown by the symbols.

- 1 Electric shock from welding electrode or wiring can kill.
 - 1.1 Wear dry insulating gloves. Do not touch electrode with bare hand. Do not wear wet or damaged gloves.
 - 1.2 Protect yourself from electric shock by insulating yourself from work and ground.
 - 1.3 Disconnect input plug or power before working on machine.
- 2 Breathing welding fumes can be hazardous to your health.
 - 2.1 Keep your head out of the fumes.
 - 2.2 Use forced ventilation or local exhaust to remove the fumes.
 - 2.3 Use ventilating fan to remove fumes.
- 3 Welding sparks can cause explosion or fire.
 - 3.1 Keep flammables away from welding. Do not weld near flammables.
 - 3.2 Welding sparks can cause fires. Have a fire extinguisher nearby, and have a watchperson ready to use it.
 - 3.3 Do not weld on drums or any closed containers.
- 4 Arc rays can burn eyes and injure skin.
 - 4.1 Wear hat and safety glasses. Use ear protection and button shirt collar. Use welding helmet with correct shade of filter. Wear complete body protection.
- 5 Become trained and read the instructions before working on the machine or welding.
- 6 Do not remove or paint over (cover) the label.



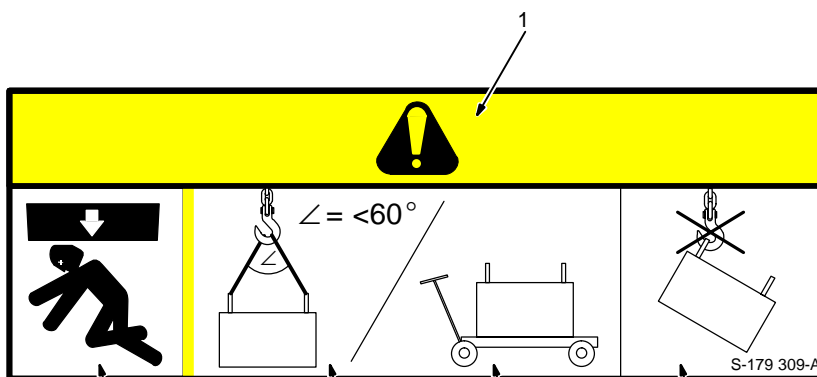
- 1 Warning! Watch Out! There are possible hazards as shown by the symbols.
- 2 Electric shock from wiring can kill.
- 3 Disconnect input plug or power before working on machine.
- 4 Hazardous voltage remains on input capacitors after power is turned off. Do not touch fully charged capacitors.
- 5 Always wait 60 seconds after power is turned off before working on unit, OR
- 6 Check input capacitor voltage, and be sure it is near 0 before touching any parts.

4/96



- 1 Warning! Watch Out! There are possible hazards as shown by the symbols.
- 2 When power is applied failed parts can explode or cause other parts to explode.
- 3 Flying pieces of parts can cause injury. Always wear a face shield when servicing unit.
- 4 Always wear long sleeves and button your collar when servicing unit.
- 5 After taking proper precautions as shown, connect power to unit.






4/96








- 1 Warning! Watch Out! There are possible hazards as shown by the symbols.
- 2 Falling equipment can cause injury and damage to unit.
- 3 Always lift and support unit using both handles. Keep angle of lifting device less than 60 degrees.
- 4 Use a proper cart to move unit.
- 5 Do not use one handle to lift or support unit.

1/96

2-2. Manufacturer's Rating Labels

				EN 60974-1		
	5A 10V		400A		36V	
		Uo 85	X	30%	60%	100%
			I2	400	300	250
			U2	36	32	30
	U1	V			I1 max	I1 eff
		400			31	17
3~50/60 Hz						
		IP23				
2x1~50/60 Hz		110V	7A	x 100%		

183 310 B

				EN 60974-1		
	50A 10V		400A		36V	
		Uo 85	X	30%	60%	100%
			I2	400	300	250
			U2	34	29	27
	U1	V			I1 max	I1 eff
		400			29	16
3~50/60 Hz						
		IP23				
2x1~50/60 Hz		110V	7A	x 100%		

183 311 A

2-3. Symbols And Definitions

A	Amperage		Panel		Alternating Current (AC)	V	Voltage
	Output		Circuit Breaker		Remote	I	On
	Off		Gas Tungsten Arc Welding	-	Negative		Voltage Input
	Direct Current (DC)	+	Positive		Inductance		Protective Earth (Ground)
	Constant Current		Constant Voltage		Foot Control		Line Connection
	Arc Force		Shielded Metal Arc Welding (SMAW)		Gas Metal Arc Welding (GMAW)		Three Phase Static Frequency Converter-Transformer-Rectifier
U₀	Rated No Load Voltage (Average)	U₁	Primary Voltage	U₂	Conventional Load Voltage	X	Duty Cycle
Hz	Hertz	IP	Degree Of Protection	I₂	Rated Welding Current	%	Percent
	Pulsed		Lift-Arc Trigger Hold Operation (GTAW)	1	Single Phase	3	Three Phase
I_{1max}	Rated Maximum Supply Current	I_{1eff}	Maximum Effective Supply Current		Increase		Lift-Arc Operation (GTAW)



SECTION 3 – INSTALLATION

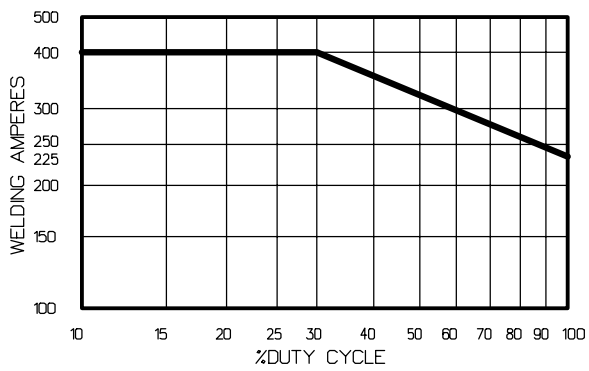
3-1. Specifications

Rated Welding Output	Voltage Range	Amperage Range	Maximum Open-Circuit Voltage DC	IP Rating	Amperes Input at Rated Load Output 50/60 Hz		
					400 V	KVA	KW
300 A @ 32 Volts DC, 60% Duty Cycle	10 – 35	5 – 400	90	23	17.0 (0.15*)	12.4 (0.09*)	11.5 (0.04*)

*While idling

3-2. Duty Cycle And Overheating



WELDING AMPERES

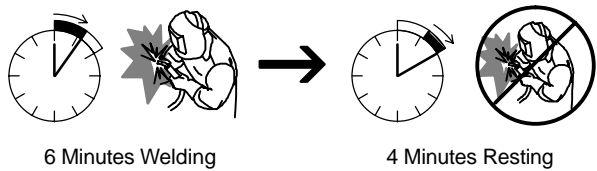
% DUTY CYCLE

Duty Cycle is percentage of 10 minutes that unit can weld at rated load without overheating.

If unit overheats, output stops, a Help message is displayed (see Section 8-3), and cooling fan runs. Wait fifteen minutes for unit to cool. Reduce amperage or duty cycle before welding.

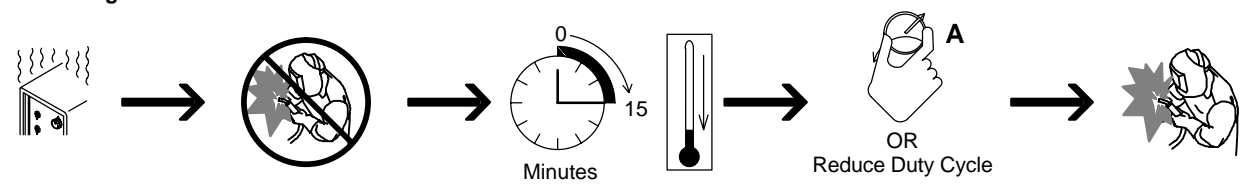
▲ Exceeding duty cycle can damage unit and void warranty.

60% Duty Cycle



6 Minutes Welding 4 Minutes Resting

Overheating



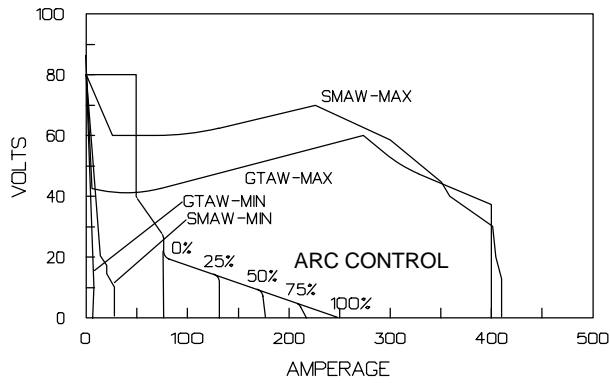
Minutes OR Reduce Duty Cycle

Ref. SA-178 651

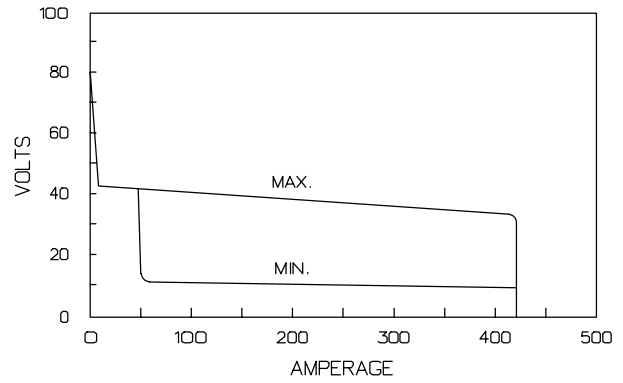
3-3. Volt-Ampere Curves

Volt-ampere curves show minimum and maximum voltage and amperage output capabilities of unit. Curves of other settings fall between curves shown.

A. CC Mode



B. CV Mode



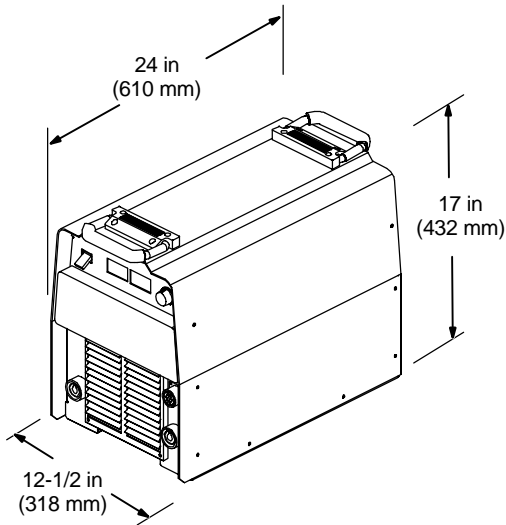
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3-4. Selecting A Location

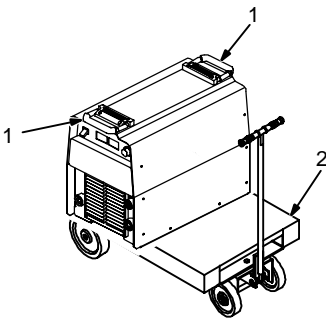


Dimensions And Weight

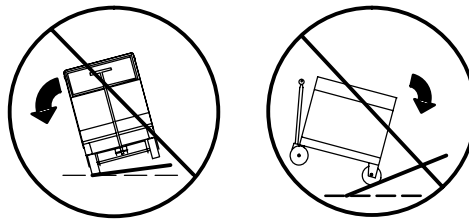
87 lb (39.5 kg)



Movement



▲ Do not move or operate unit where it could tip.



1 Lifting Handles

Use handles to lift unit.

2 Hand Cart

Use cart or similar device to move unit.

3 Plate Label

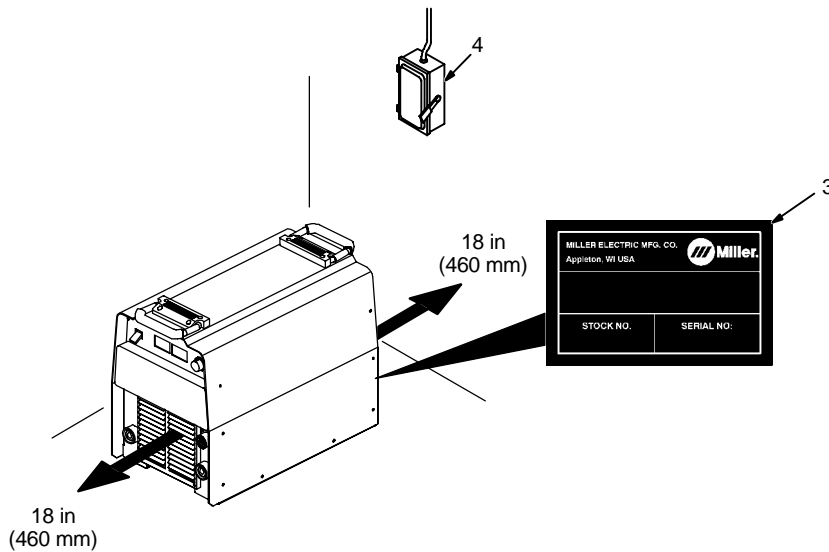
Use label to determine input power needs.

4 Line Disconnect Device

Locate unit near correct input power supply.

▲ Special installation may be required where gasoline or volatile liquids are present – see NEC Article 511 or CEC Section 20.

Location




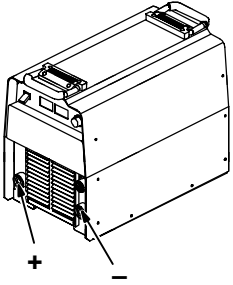
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3-5. Weld Output Terminals And Selecting Cable Sizes



▲ ARC WELDING can cause Electromagnetic Interference.

To reduce possible interference, keep weld cables as short as possible, close together, and down low, such as on the floor. Locate welding operation 100 meters from any sensitive electronic equipment. Be sure this welding machine is installed and grounded according to this manual. If interference still occurs, the user must take extra measures such as moving the welding machine, using shielded cables, using line filters, or shielding the work area.

 Weld Output Terminals	Welding Amperes	Total Cable (Copper) Length In Weld Circuit Not Exceeding*							
		100 ft (30 m)** Or Less		150 ft (45 m)	200 ft (60 m)	250 ft (70 m)	300 ft (90 m)	350 ft (105 m)	400 ft (120 m)
		10 – 60% Duty Cycle	60 – 100% Duty Cycle	10 – 100% Duty Cycle					
 Output Receptacles	100	4 (20)**	4 (20)	4 (20)	3 (30)	2 (35)	1 (50)	1/0 (60)	1/0 (60)
	150	3 (30)**	3 (30)	2 (35)	1 (50)	1/0 (60)	2/0 (70)	3/0 (95)	3/0 (95)
	200	3 (30)	2 (35)	1 (50)	1/0 (60)	2/0 (70)	3/0 (95)	4/0 (120)	4/0 (120)
	250	2 (35)	1 (50)	1/0 (60)	2/0 (70)	3/0 (95)	4/0 (120)	2-2/0 (2x70)	2-2/0 (2x70)
	300	1 (50)	1/0 (60)	2/0 (70)	3/0 (95)	4/0 (120)	2-2/0 (2x70)	2-3/0 (2x95)	2-3/0 (2x95)
	350	1/0 (60)	2/0 (70)	3/0 (95)	4/0 (120)	2-2/0 (2x70)	2-3/0 (2x95)	2-3/0 (2x95)	2-4/0 (2x120)
	400	1/0 (60)	2/0 (70)	3/0 (95)	4/0 (120)	2-2/0 (2x70)	2-3/0 (2x95)	2-4/0 (2x120)	2-4/0 (2x120)
	500	2/0 (70)	3/0 (95)	4/0 (120)	2-2/0 (2x70)	2-3/0 (2x95)	2-4/0 (2x120)	3-3/0 (3x95)	3-3/0 (3x95)
	600	3/0 (95)	4/0 (120)	2-2/0 (2x70)	2-3/0 (2x95)	2-4/0 (2x120)	3-3/0 (3x95)	3-4/0 (3x120)	3-4/0 (3x120)

*Weld cable size (AWG) is based on either a 4 volts or less drop or a current density of at least 300 circular mils per ampere.

** () = mm² for metric use.

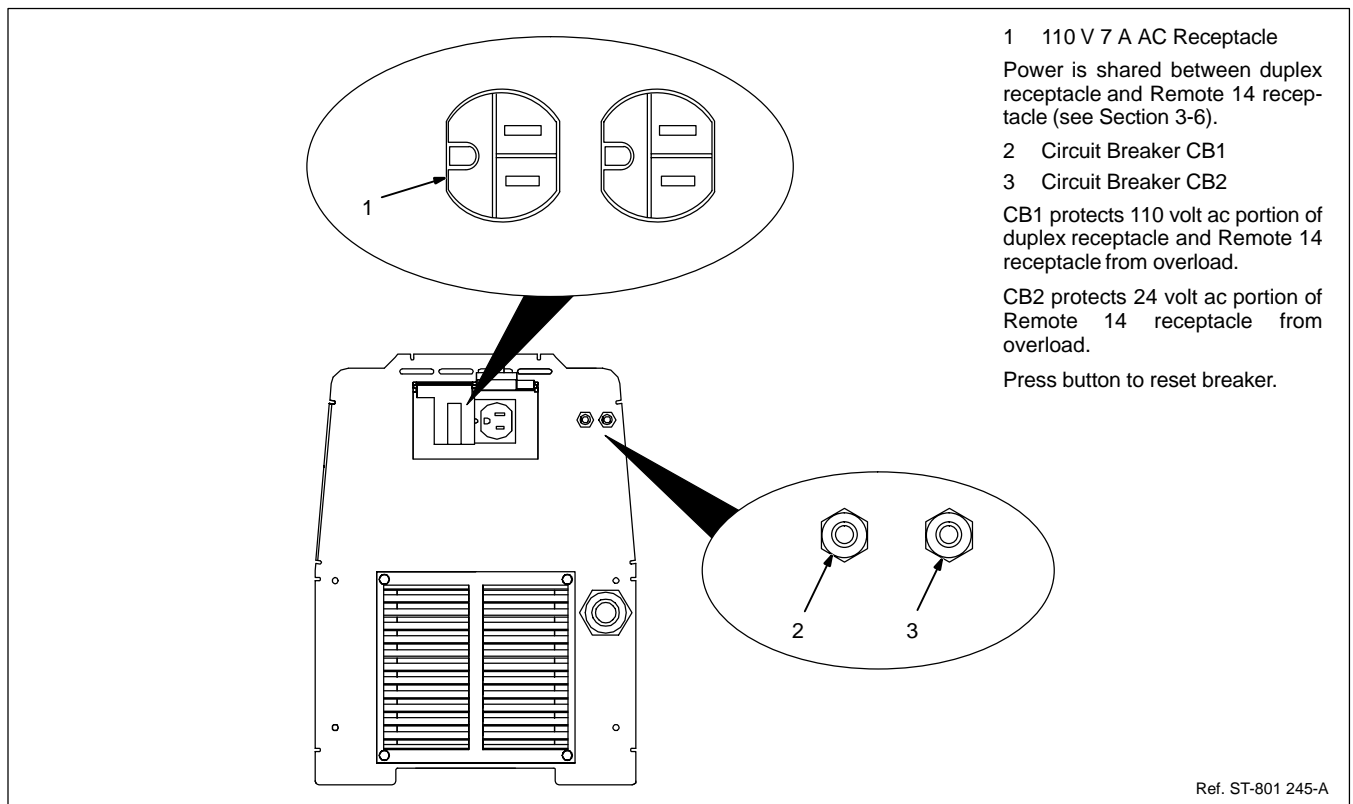
S-0007-E

3-6. Remote 14 Receptacle Information

	REMOTE 14	Socket*	Socket Information
	24 VOLTS AC OUTPUT (CONTACTOR)	A	24 volts ac. Protected by circuit breaker CB2.
	115 VOLTS AC OUTPUT (CONTACTOR)	B	Contact closure to A completes 24 volts ac contactor control circuit.
	REMOTE OUTPUT CONTROL	I	115 volts ac. Protected by circuit breaker CB1.
		J	Contact closure to I completes 115 volts ac contactor control circuit.
		C	Output to remote control; 0 to +10 volts dc, +10 volts dc in MIG mode.
	A/V AMPERAGE VOLTAGE	D	Remote control circuit common.
		E	0 to +10 volts dc input command signal from remote control.
		H	Voltage feedback; +1 volt dc per 10 output receptacle volts.
		F	Current feedback; +1 volt dc per 100 amperes.
GND	M	CC/CV select	
	G	Circuit common for 24 and 115 volts ac circuits.	
	K	Chassis common.	

*The remaining sockets are not used.

3-7. 110 Volt AC Duplex Receptacle



3-8. Electrical Service Guide


NOTE

Actual input voltage should not exceed $\pm 10\%$ of indicated required input voltage. If actual input voltage is outside of this range, output may not be available.


Input Voltage	400 (Three Phase Only)
Input Amperes At Rated Output	17.0
Max Recommended Standard Fuse Or Circuit Breaker Rating In Amperes	30
Reference: 1996 National Electrical Code (NEC).	S-0092J

“

3-9. Connecting Input Power

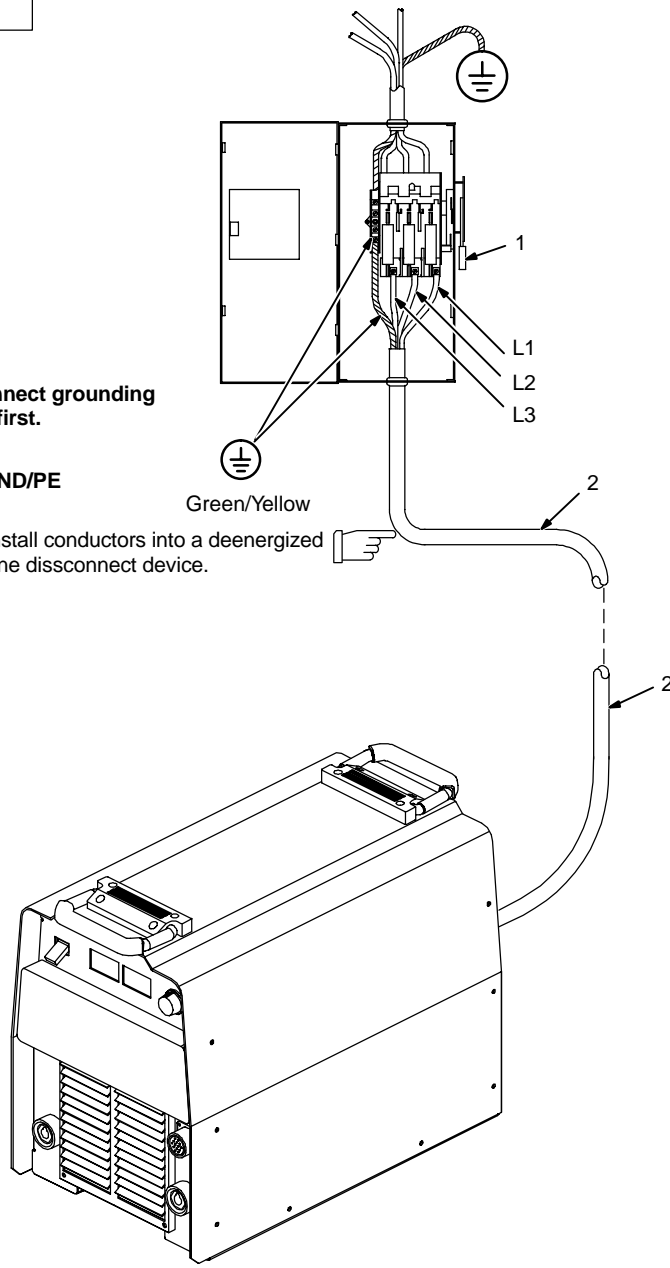


▲ Always connect grounding conductor first.

 = GND/PE

Green/Yellow

Install conductors into a deenergized line disconnect device.



▲ Disconnect and lockout/tag-out input power before connecting input conductors from unit.

▲ Have only qualified persons make this installation.

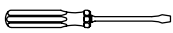
Check input voltage available at site.

- 1 Line Disconnect Device
- 2 Input And Grounding Conductors

Select type and size of overcurrent protection using Section 3-8.

▲ Always connect green/yellow wire to supply grounding terminal, never to a line terminal.

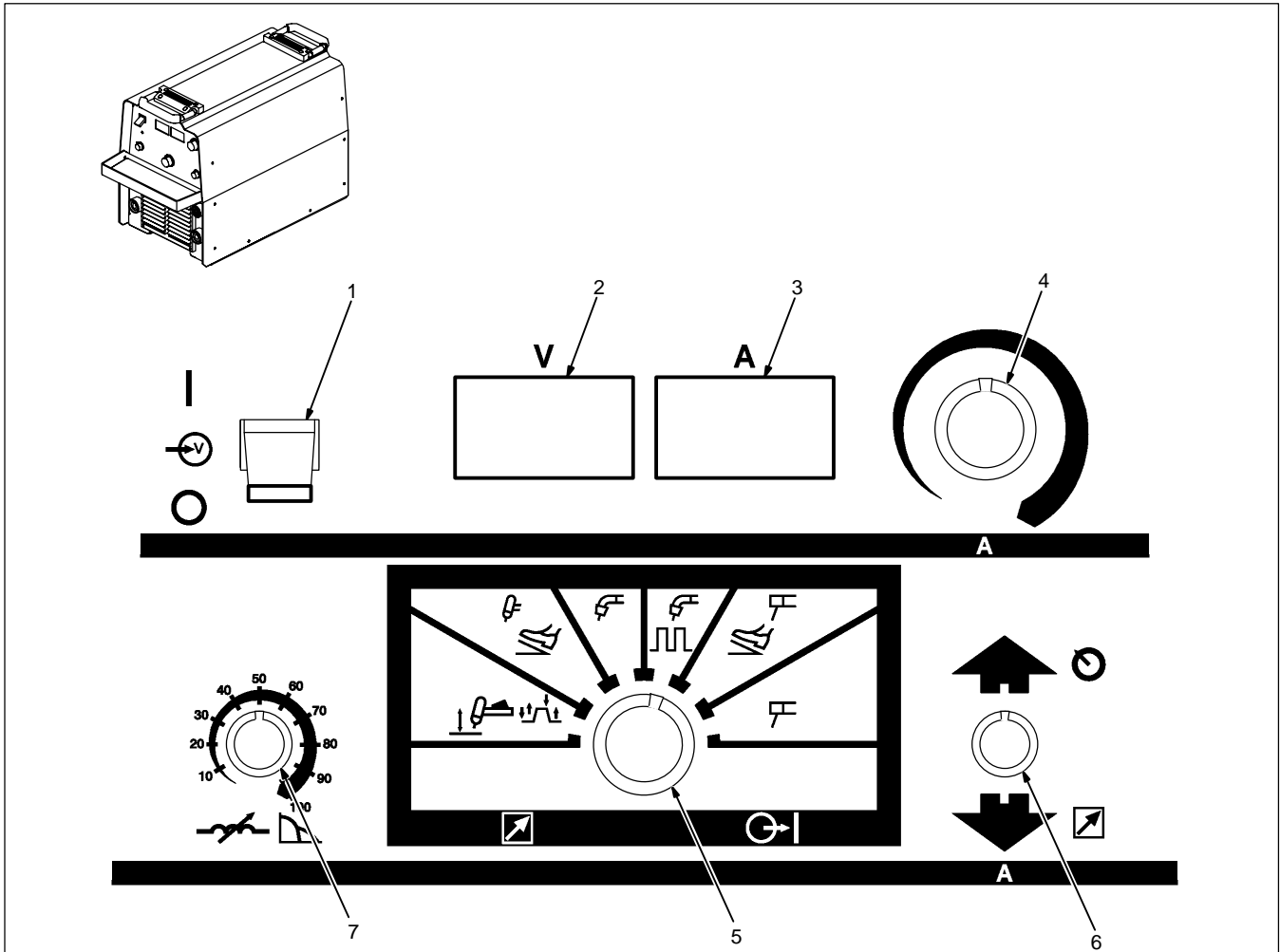
Tools Needed:



Input_9_99 / Ref. ST-144 221 / ST-801 192


SECTION 4 – OPERATION

4-1. Front Panel Controls



ST-179 275

1 Power On/Off Switch

 The fan motor is thermostatically controlled and only runs when cooling is needed.

2 Voltmeter (see Section 4-2)

3 Ammeter (see Section 4-2)

4 Voltage/Amperage Adjustment Control

5 Mode Switch

The Mode switch setting determines both the process and output On/Off control (see Section 4-3. Source of control (panel or remote) for the amount of output is selected on the Voltage/Amperage Control switch.

For Air Carbon Arc (CAC-A) cutting and gouging, place switch in Stick position. For

best results, place Inductance/Dig control in the maximum position.

6 Voltage/Amperage Control Switch

For front panel control, place switch in Panel position. For remote control, make connections to Remote 14 receptacle, and place switch in Remote position. In most modes, remote control is a percent of the Voltage/Amperage Adjustment control setting (the value selected on Voltage/Amperage Adjustment control is maximum available on remote). In the MIG mode, remote control provides full range of unit output regardless of V/A Adjust control setting.

7 Inductance/Dig Control

Control adjusts Dig when a Stick (SMAW) welding position is selected on mode switch.

When set lower, short-circuit amperage at low arc voltage is the same as normal welding amperage.

When set higher, short-circuit amperage is increased at low arc voltage to assist with arc starts as well as reduce sticking while welding (see volt-ampere curves in Section 3-3).

Select setting best suited for application.

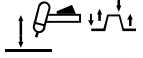



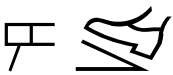

Control adjusts inductance when a MIG (GMAW) position is selected on the mode switch. Inductance determines the "wetness" of the weld puddle. When set higher, "wetness" (puddle fluidity) increases.

When pulsed MIG, or one of the TIG (GTAW) processes is selected, this control is not functional.

4-2. Meter Functions

NOTE

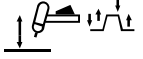













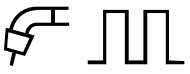



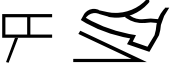








The meters display the actual weld output values for approximately three seconds after the arc is broken.

Mode	Meter Reading At Idle		Meter Reading While Welding	
 Lift-Arc Trigger Hold TIG (GTAW)	V Blank	A 85 Preset Amps	V 10.3 Actual Volts	A 85 Actual Amps
 TIG (GTAW)	V Blank	A 85 Preset Amps	V 10.3 Actual Volts	A 85 Actual Amps
 MIG (GMAW)	V 24.5 Preset Volts	A Blank	V 24.5 Actual Volts	A 250 Actual Amps
 Pulsed MIG (GMAW-P)	V PPP Pulse Display	A PPP Pulse Display	V 24.5 Actual Volts	A 250 Actual Amps
 Remote Control SMAW	V Blank	A 85 Preset Amps	V 24.5 Actual Volts	A 85 Actual Amps
 Panel Control SMAW	V 85.0 Actual Volts (OCV)	A 85 Preset Amps	V 24.5 Actual Volts	A 85 Actual Amps

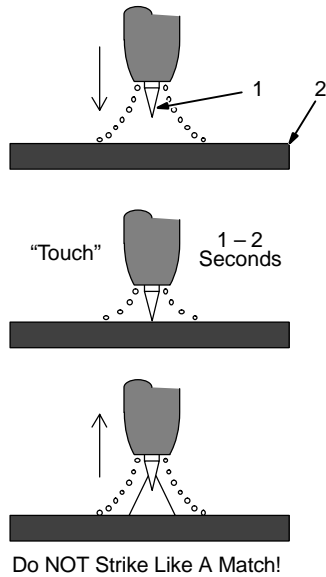
4-3. Mode Switch Settings

NOTE

The SMAW modes provide the Adaptive Hot Start™ feature, which automatically increases the output amperage at the start of a weld should the start require it. This eliminates electrode sticking at arc start.


Mode	Output Control
 <p>Lift-Arc Trigger Hold TIG (GTAW)</p>	<p>Select:  or  Amp</p> <hr/> <p>Requires:   Control</p>
 <p>TIG (GTAW) With HF Unit, Pulsing Device, Or Remote Control</p>	<p>Select:  or  Amp</p> <hr/> <p>Requires:   Control</p>
 <p>MIG (GMAW)</p>	<p>Select:  or  Volt</p> <hr/> <p>Requires:  Feeder</p>
 <p>Pulsed MIG (GMAW-P) (Requires an external pulsing device.)</p>	<p>Select:  Volt</p> <hr/> <p>Requires:   Feeder or Control</p>
 <p>Remote Control SMAW</p>	<p>Select:  or  Amp</p> <hr/> <p>Requires:   Control</p>
 <p>Panel Control SMAW</p>	<p>Select:  or  Amp</p> <hr/> <p>Weld  </p>

4-4. Lift-Arc Trigger Hold TIG



1 TIG Electrode

2 Workpiece

 Procedure requires:

  control

Start sequence:

- Touch tungsten electrode to workpiece at weld start point.
- Momentarily depress output switch.
- Slowly lift electrode. An arc will form when electrode is lifted.
- To stop welding, momentarily depress output switch and output will shut off.

Note: If output switch is momentarily depressed and tungsten is not touching workpiece:

Do not touch tungsten to work.

Output will shut off in 3 seconds.

Start sequence over.

Ref. S-156 279

SECTION 5 – THEORY OF OPERATION

1 Power On/Off Switch S1

Provides on/off control of welding power source.

2 Filter Board PC6

Filters line input power.

3 Input Rectifier SR1

Changes the ac line input power to full-wave rectified dc.

4 Control Transformer T2

Supplies power to control board PC1, interconnecting board PC2, and Remote 14 receptacle RC1.

5 Circuit Breaker CB1

Provides overload protection for 115 volts ac portion of Remote 14 receptacle RC1 and optional 115 volt ac receptacle.

6 Circuit Breaker CB2

Provides overload protection for 24 volts ac portion of Remote 14 receptacle RC1.

7 115 Volt AC Receptacle

Connects auxiliary equipment to welding power source (optional for CC models).

8 Remote 14 Receptacle RC1

Connects remote amperage or voltage and contactor controls.

9 Control Board PC1

Controls weld output by changing gate pulses (frequency of pulses) to IGBT power modules PM1 and PM2 after comparing current or voltage feedback to reference level set by R2 on PC3.

10 400 V Input Contactor W1

Connects the 190 volts ac secondary voltage from T2 to interconnecting board PC2 to balance voltage on input capacitors C3 and C4. Effective w/KK104771, this circuit has been removed.

11 Fan Motor FM

Provides cooling of internal components.

12 Display Board PC3

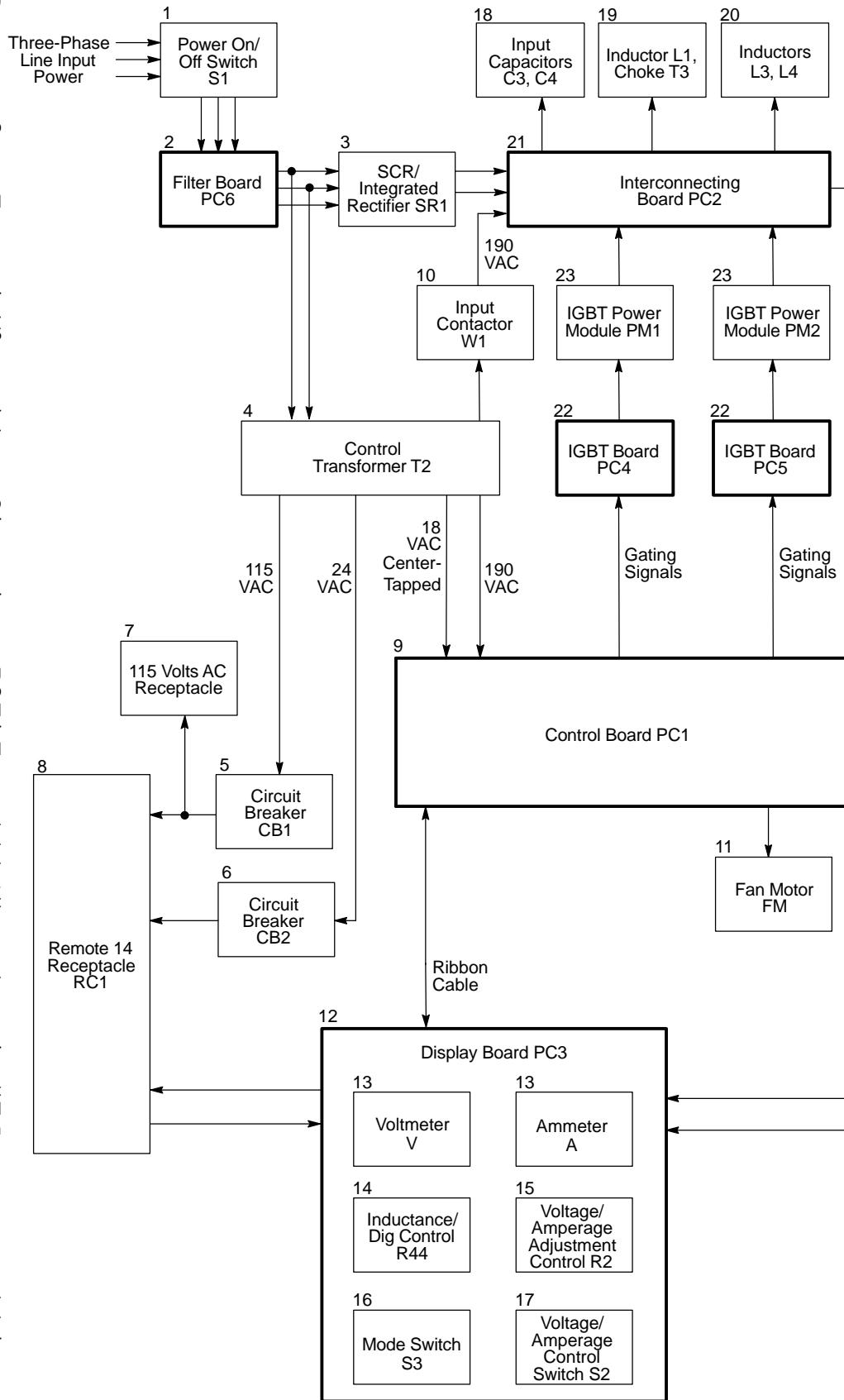
Consists of voltmeter V, ammeter A, Inductance/Dig control R44, Voltage/Amperage Adjustment control R2, Mode switch S3, and Voltage/Amperage Control switch S2.

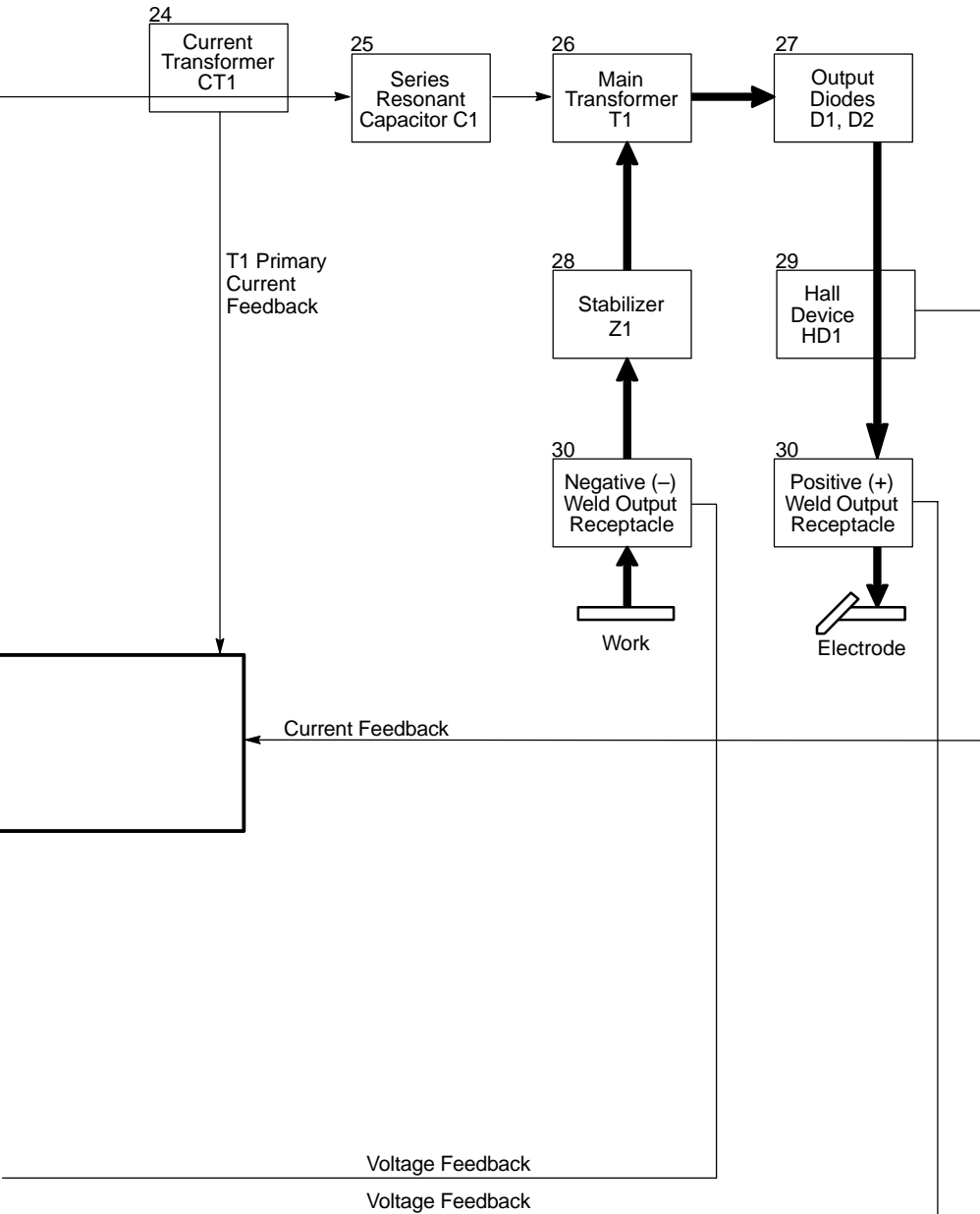
13 Voltmeter V, Ammeter A

See Section 4-2.

14 Inductance/Dig Control R44 (CC/CV Models) Or Dig Control R44 (CC Models)

In CV mode, R44 functions as an inductance control modifying the response of the arc. In CC mode, R44 functions as a dig control.





15 Voltage/Amperage Adjustment Control R2 (CC/CV Models) Or Amperage Adjustment Control R2 (CC Models)

Selects weld output voltage or amperage level. Setting defines maximum output when remote voltage and/or amperage control is used and Mode switch S3 is in a CC position.

16 Mode Switch S3

Selects type of weld output, meter function, and remote contactor or front panel for welding process.

17 Voltage/Amperage Control Switch S2 (CC/CV Models) Or Amperage Control Switch S2 (CC Models)

Selects front panel or remote voltage or amperage control.

18 Input Capacitors C3, C4

Filter the dc output voltage of SR1.

19 Inductor L1, Choke T3

Limit peak current in SR1, C3, and C4, and filter line input power.

20 Inductors L3, L4

Limit voltage and current in IGBT's during turn-on and turn-off.

21 Interconnecting Board PC2

Provides electrical connections for SR1, T1, C1, C3, C4, L1, L3, L4, T3, and IGBT's. Precharge and bleeder resistors are mounted on PC2.

22 IGBT Boards PC4, PC5

Provide interconnection of gate pulses from PC1 to PM1 and PM2.

23 IGBT Power Modules PM1, PM2

Use very fast on/off switching action to effectively turn the dc into ac.

24 Current Transformer CT1

Provides current feedback to PC1 from the primary of T1 for control circuit timing and to limit primary current.

25 Series Resonant Capacitor C1
Reduces losses in IGBT power modules PM1 and PM2.

26 Main Transformer T1

Energized by on/off switching action of PM1 and PM2, and supplies power to weld output circuit.

27 Output Diodes D1, D2

Rectify output of T1.

28 Stabilizer Z1

Smooths out welding current.

29 Hall Device HD1

Provides weld or secondary current feedback signal to PC1.

30 Positive (+) And Negative (-) Weld Output Receptacles

Provide weld output and allow changing of output polarity.

SECTION 6 – EXPLANATION OF ELECTRICAL PARTS

elect_parts 1/01

6-1. Safety Precautions – Read Before Using This Guide

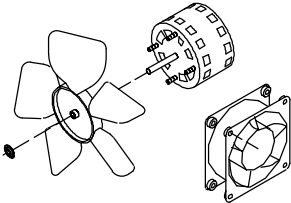
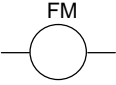


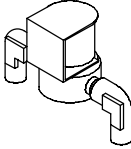
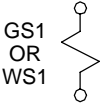
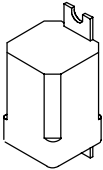
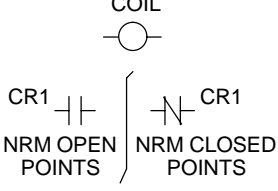
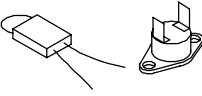
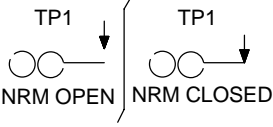
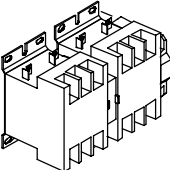
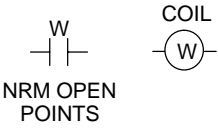


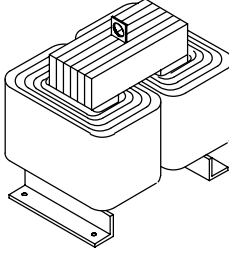
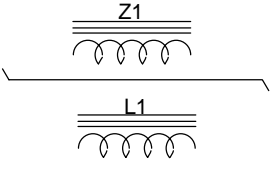


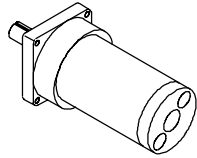
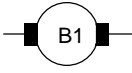
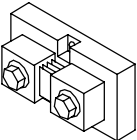
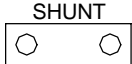
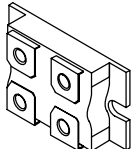
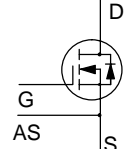
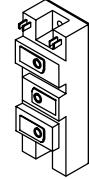
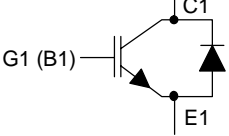
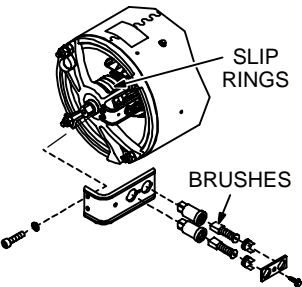
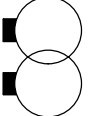

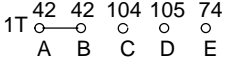
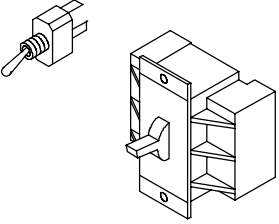
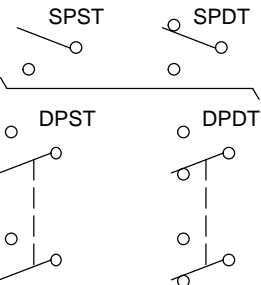
▲ WARNING: ELECTRIC SHOCK can kill.

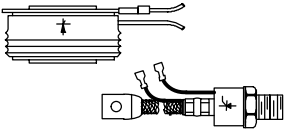
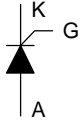
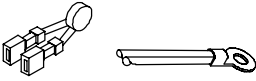
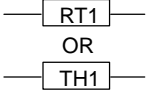
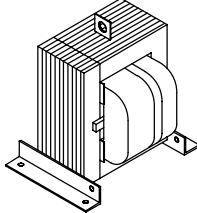
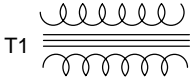
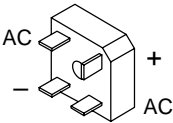
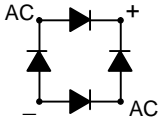
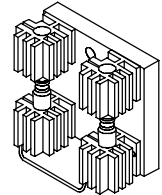

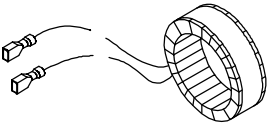
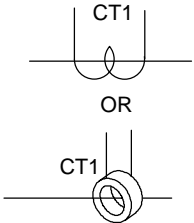
- Disconnect input power or stop engine before servicing.
- Do not touch live electrical parts.
- Do not operate machines with covers removed.
- Have only qualified persons install, use, or service equipment.

6-2. Explanation Of Electrical Parts

PART NAME	FUNCTION	PICTURE	CIRCUIT SYMBOL
CAPACITOR	A device that stores electrical energy. Large capacitors or a “bank” of capacitors can be used to “smooth out” the DC welding arc in a MIG welding power source. Smaller “disk” capacitors can be used for HF protection.		<p>POLARIZED NON-POL. </p> <p>C1 C1</p>
CIRCUIT BREAKER	A protection device that breaks a circuit when current levels exceed its rating. Unlike a fuse that needs to be replaced when blown, a circuit breaker can be reset.		
DIODE	A device that allows current to flow in one direction only. Most common use is to change AC to DC.		
FUSE	A protection device, usually an enclosed piece of wire that melts and breaks the circuit when the current exceeds the fuse rating.		
HALL DEVICE	Produces a small DC voltage proportional to the current it is sensing (usually welding current). This feedback signal can be used to regulate the welding output (line voltage compensation). It may even be used to drive an ammeter.		
RESISTOR	A device which resists the flow of electric current. Uses include limiting the current for a motor brake circuit in a wire feeder and for discharging a capacitor.		<p>FIXED </p> <p>FIXED TAPPED </p>
POTENTIOMETER OR RHEOSTAT	Both devices have a moveable brush that makes contact along a resistor, allowing you to easily change the resistance measured at the brush (sometimes referred to as a wiper). Their primary purpose is to give the operator a way to adjust welding parameters such as wire speed, preflow time, voltage, inductance, etc.		

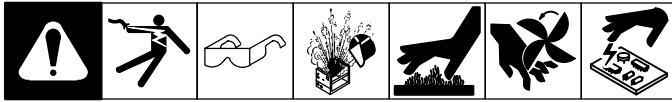
PART NAME	FUNCTION	PICTURE	CIRCUIT SYMBOL
FAN MOTOR	This device provides cooling of the internal parts of a welding power source.		
VARISTOR	A protection device whose resistance is dependent on the voltage applied to it. In normal operation it has a high resistance; however, a surge of voltage (voltage spike) will cause its resistance to go way down and absorb the spike. These devices are most often found in rectifying circuits, where they are used to protect the diodes.		
GAS OR WATER SOLENOID (VALVE)	These are electromechanical devices used to start or stop the flow of shielding gas or water.		
RELAY—COIL AND CONTACTS, NORMALLY OPEN AND NORMALLY CLOSED	This is an electromechanical device whose contacts change state (the normally open points close and the normally closed points open) when proper voltage is applied to the coil. These contact points in turn may control a fan motor, gas solenoid, contactor, etc. Circuit diagrams (schematics) always show the contact points in the power off state.		
THERMOSTAT, NORMALLY OPEN AND NORMALLY CLOSED	This is a switch that closes its normally open contacts (or opens its normally closed contacts) when a preset temperature is reached. When the temperature goes back down, it will reset itself. Uses of these devices include turning on a fan motor when needed and shutting off the output of a welding power source if it is overheating.		
CONTACTOR	A heavy duty relay. Usually used to make and break the welding arc or primary power.		
PILOT LIGHT	A light located on the front panel which indicates if the machine is on or off.		
STABILIZER/ REACTOR	When placed in a DC circuit, the inductor or stabilizer as it is usually called, will oppose any change in existing current. It is therefore widely used to "stabilize" the welding arc. When the inductor is placed in an AC circuit it is referred to as a reactor where it now acts to restrict the flow of current. A "tapped reactor" is used to create current ranges for welding.		

PART NAME	FUNCTION	PICTURE	CIRCUIT SYMBOL
MOTOR	A device that is typically used to feed wire in a MIG welding system.		
SHUNT	A precision low-value resistor typically used to supply a small voltage to drive an ammeter.		
MOSFET	A device that is used as an "electronic switch". When a signal is applied to the gate (G), current is allowed to flow from the source (S) to the drain (D). This device can be used to control a relay, the speed of a motor, or even the output of a welding machine.		
IGBT	A device that is used as an "electronic switch". When a signal is applied to the gate (G), current is allowed to flow from the emitter (E) to the collector (C). This device is typically used in "Inverter" designed welding machines to control the welding output.		
BRUSHES/SLIP RINGS	Components that allow electrical connections between stationary and rotating contacts.		
TERMINAL STRIP	An insulated connection point for wires. They are used for the ease of making multiple connections and can be a convenient point for making electrical checks when troubleshooting. (Notice the "jumper link" connecting terminals A and B together.)		
SWITCH	A mechanical device that completes or breaks the path of the current or sends it over a different path.		

PART NAME	FUNCTION	PICTURE	CIRCUIT SYMBOL
SCR	A Silicon Controlled Rectifier (SCR) is an electrical device with three connections, anode, cathode, and gate. It will allow current to flow in only one direction and will only do so after receiving a signal on the gate lead. SCR's are used to change AC to DC and to control the output to a load such as a welding arc.		
THERMISTOR	A thermally sensitive resistor. The resistance of a thermistor changes with a change in temperature. Primarily used for "Fan on Demand" and "Thermal Shutdown" circuits.		
TRANSFORMER	A device that changes AC voltage from one magnitude to another. Typically used to reduce high primary voltages to lower welding voltages.		
INTEGRATED BRIDGE RECTIFIER	An arrangement of four diodes used to change AC to DC.		
SPARK GAP	The arrangement of two electrodes between which a discharge of electricity will occur. Typically used to produce "high frequency" which can be used for arc starting when TIG welding.		
CURRENT TRANSFORMER	A transformer that produces an AC voltage used for measuring purposes. The primary winding is in series with the circuit carrying the current to be measured. Its main use in engine-driven equipment is to activate the "Automatic Idle" circuit by sensing welding current or auxiliary power current.		

SECTION 7 – PRE-POWER CHECKLIST

7-1. Checking Unit Before Applying Power



☞ See Section 8-4 or 8-5 for test points and values and Section 11 for parts location.

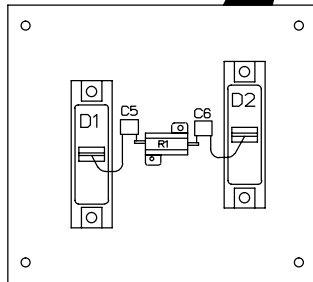
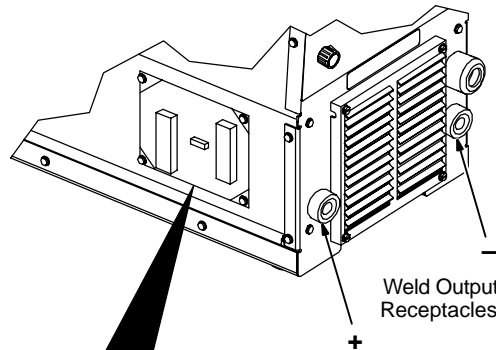
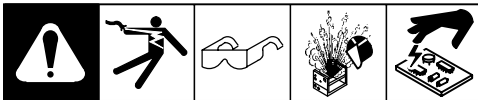
- ▲ Discharge input capacitors according to Section 9-3 and be sure voltage is near zero before touching any parts.
- ▲ Before troubleshooting or applying power to unit, complete following checks to avoid causing further damage.
- ▲ Although control board PC1 and hall device HD1 are briefly checked in this procedure, more complete tests may be needed later for these parts. This check is simply to get a basic okay to power up unit.

NOTE



The pre-power checklist should be followed if any of the following conditions exist:
 the unit is completely inoperative;
 the symptoms are unknown;
 visual damage is found on any of the following components: capacitors C3 and C4, control board PC1, IGBT power modules PM1 and PM2, interconnecting board PC2, or input rectifier SR1;
 there is no output or limited output.

7-2. Output Diodes D1, D2

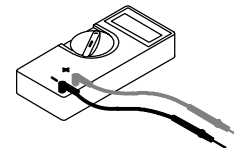


Diodes D1, D2

- ▲ Read and follow safety information in Section 7-1 before proceeding.

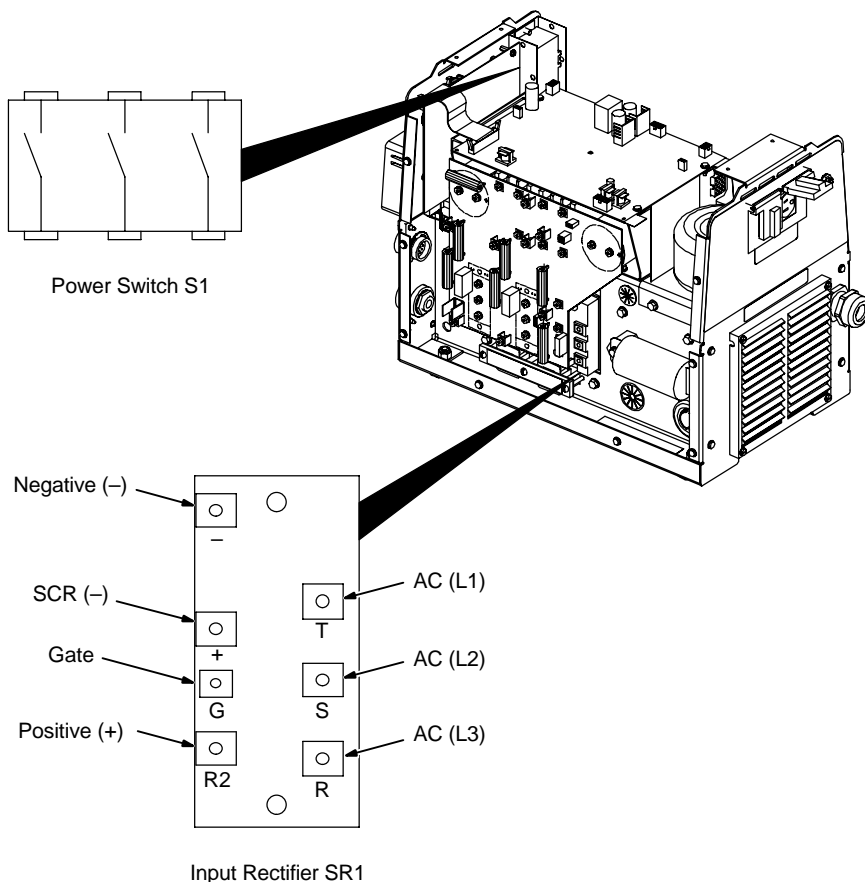
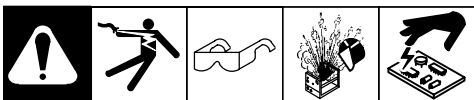
- 1 First, check resistance across weld output receptacles (ohms position). Resistance should be greater than 100 ohms.
- 2 If resistance is less than 100 ohms, isolate diodes D1 and D2 and retest individually (diode test).

Test Equipment Needed:



Ref. SD-183 484 / ST-801 705

7-3. Input Rectifier SR1



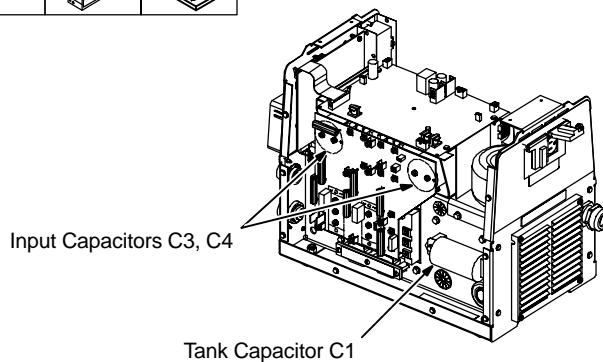
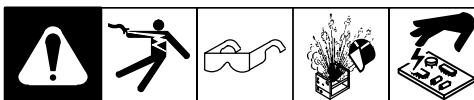
▲ Read and follow safety information in Section 7-1 before proceeding.

☞ Resistance values are based on in-circuit measurements.

- 1 Visually inspect SR1 for damage.
- 2 Check 6 diodes (diode test). Check from each ac terminal to the positive (+) terminal and from each ac terminal to the negative (-) terminal.
- 3 Check precharge SCR (ohms position). Connect negative lead to SCR (-) terminal and positive lead to positive (+) terminal. Resistance should be 200 ohms $\pm 10\%$. If meter reads infinite resistance (OL), check resistor R7 on interconnecting board PC2. Connect a jumper between positive (+) and gate terminals. Resistance should be approximately 35 ohms.
- 4 If results are in doubt, use an IGBT tester (MILLER Part No. 043 553) to test the SCR portion of SR1 as follows:
 - A. Disconnect plug PLG13 from receptacle RC1 on interconnecting board PC2.
 - B. Connect red clip to positive (+) terminal.
 - C. Connect black clip to SCR (-) terminal.
 - D. Connect yellow clip to gate terminal.
- 5 If SR1 is defective, check the three poles of power switch S1 (switch off = OL, switch on = 0 ohms).

ST-801 550 / Ref. SD-183 484

7-4. Tank Capacitor C1 and Input Capacitors C3, C4



▲ Read and follow safety information in Section 7-1 before proceeding.

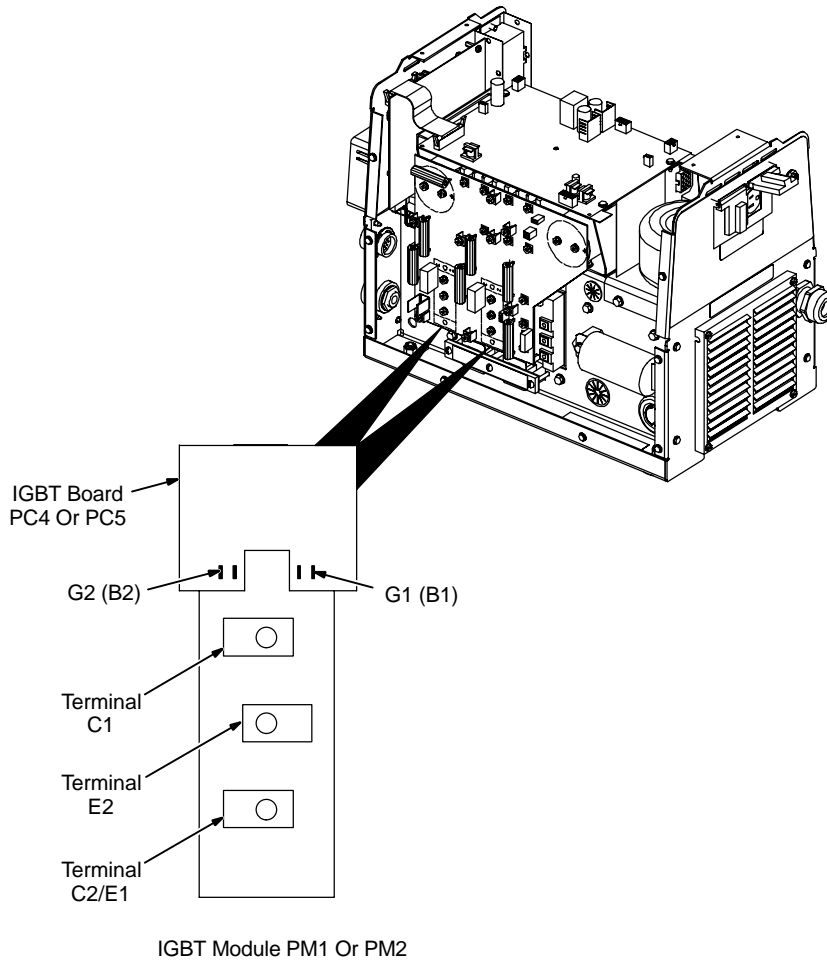
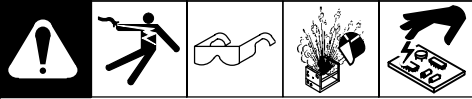
☞ This is not a conclusive test. For best results use a capacitor tester to check capacitance.

☞ If either C3 or C4 is shorted, remove interconnecting board PC2 and check IGBT's PM1 and PM2.

- 1 Check C1, C3, and C4 for a short (ohms position).

ST-801 550

7-5. IGBT Modules PM1, PM2



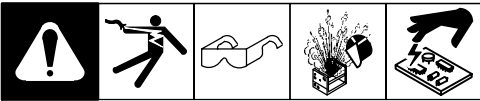
▲ Read and follow safety information in Section 7-1 before proceeding.

☞ It is not necessary to remove interconnecting board PC2 to test the IGBT's unless input capacitor C3 or C4 is shorted.

- 1 Visually inspect PM1 and PM2 for damage.
- 2 Disconnect gate lead plug PLG5 from receptacle RC5 on control board PC1.
- 3 Check C1 to E1 and C2 to E2 on PM1 and PM2 for resistance greater than 100 ohms (ohms position). Zero ohms indicates a short.
- 4 Check E1 to PLG5-10 and E2 to PLG5-7 for 100 k ohms $\pm 10\%$ (ohms position) on PM1. Then check E1 to PLG5-6 and E2 to PLG5-9 for 100 k ohms $\pm 10\%$ (ohms position) on PM2.
- 5 If results are in doubt, use an IGBT tester (MILLER Part No. 043 553) as follows:
 - A. Check two IGBT's per module.
 - B. Connect red clip to C.
 - C. Connect black clip to E.
 - D. Connect yellow clip to G (white leads at plug PLG5).
- 6 If IGBT's are defective, check D1, D2, D3, and D4 on PC2 (see Section 7-6).

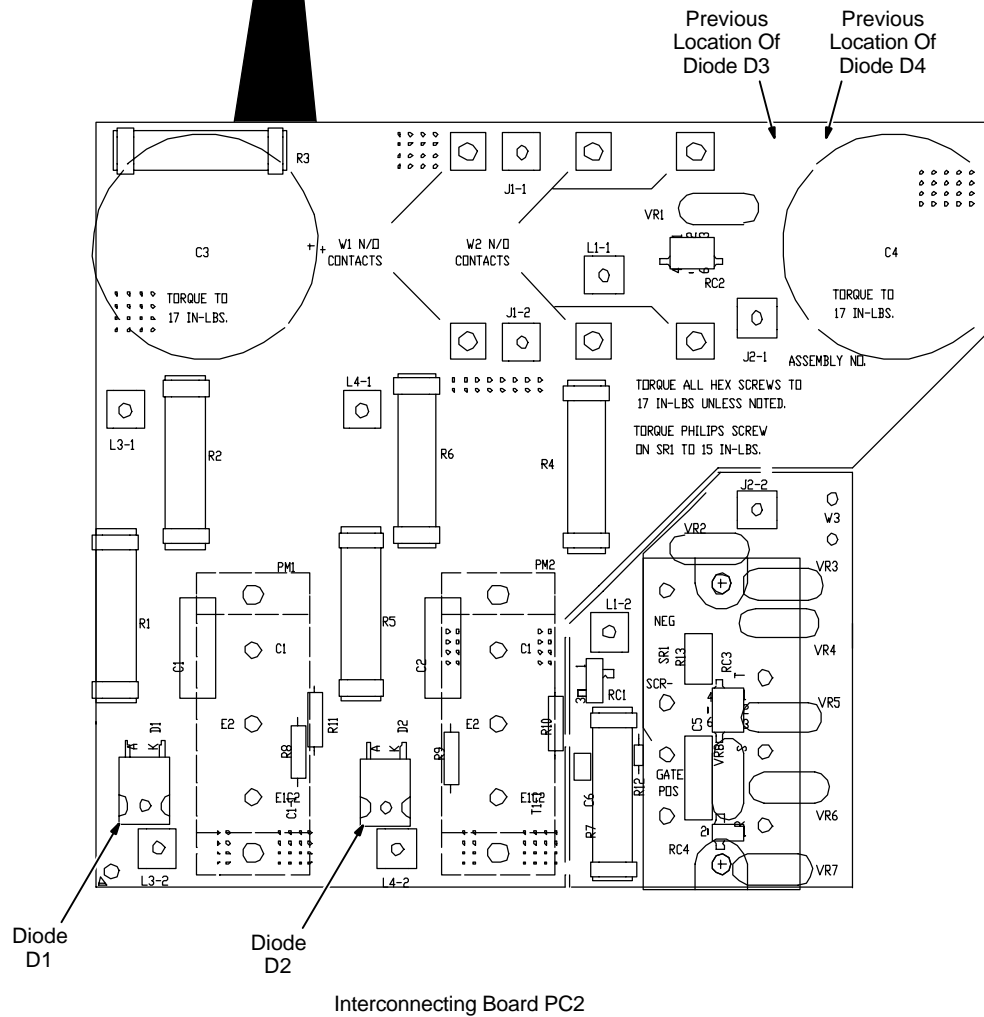
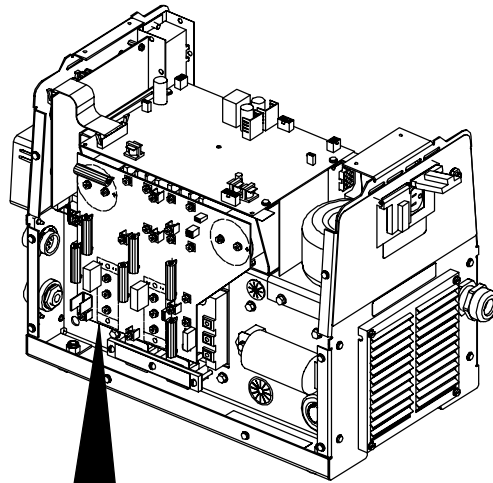
ST-801 550 / Ref. SD-183 484

7-6. Diodes D1, D2, D3, D4



▲ Read and follow safety information in Section 7-1 before proceeding.




- 1 Check D1 and D2 on PC2 for 2000 ohms $\pm 10\%$.
- 2 Prior to Serial No. KK276107, check D3 and D4 on PC2 (diode test). Effective with Serial No. KK276107, these diodes are no longer present.



ST-801 550 / 195 587

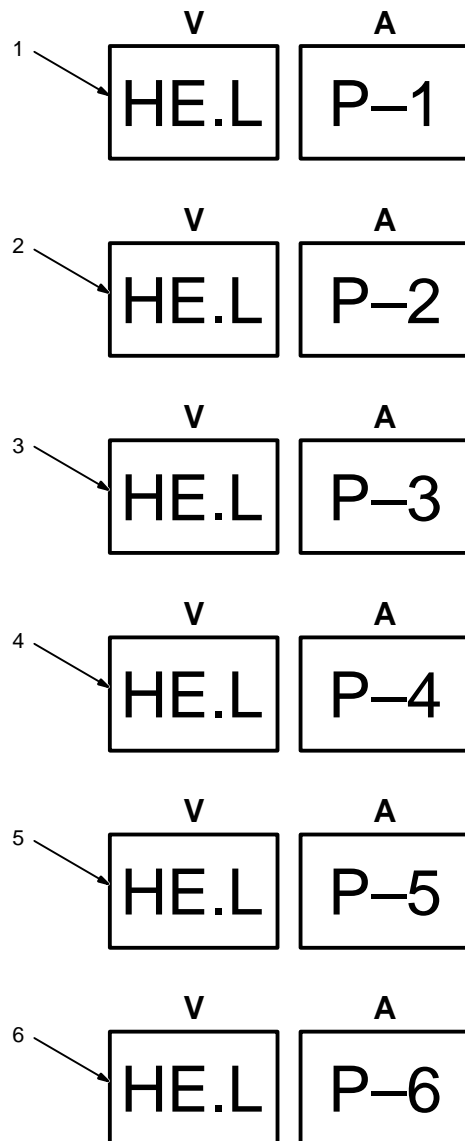
SECTION 8 – TROUBLESHOOTING

8-1. Troubleshooting Table

		 See Section 8-4 or 8-5 for test points and values and Section 11 for parts location.
		 Use MILLER Testing Booklet (Part No. 150 853) when servicing this unit.
Trouble	Remedy	
No weld output; unit completely inoperative. Follow pre-power checklist (see Section 7).	Place line disconnect switch in On position (see Section 3-9).	
	Check and replace line fuse(s), if necessary, or reset circuit breaker (see Section 3-9).	
	Check for proper input power connections (see Section 3-9).	
	Check continuity of Power switch S1, and replace if necessary.	
	Check filter board PC6 for proper connections. Check input and output voltages. Replace PC6 if necessary.	
No weld output; meter display On. Follow pre-power checklist (see Section 7).	Check control transformer T2 for signs of winding failure. Check continuity across windings, and check for proper connections. Check secondary voltages. Replace T2 if necessary.	
	If using remote control, be sure Voltage/Amperage Control switch S2 (CC/CV models) or Amperage Control switch S2 (CC models) is in Remote 14 position.	
	Prior to Serial No. KG150087, input voltage outside acceptable range of variation (see Section 8-2). Effective with Serial No. KG150087, see Section 8-3 for HELP screens.	
	Unit overheated and HELP 3 or HELP 5 screen is displayed. Allow unit to cool with fan On (see Section 8-2 or 3-2).	
	Check, repair, or replace remote control.	
	Check resistance and connections of hall device HD1; HD1 is 1800 ohms $\pm 10\%$ between pins 1 and 3 of plug PLG9. Check input and output voltages. Replace HD1 if necessary.	
	Check output diodes D1 thru D2, and replace if necessary.	
	Check input integrated rectifier SR1, and replace if necessary.	
	Check IGBT modules PM1 and PM2, and replace if necessary.	
	Check control board PC1 and connections, and replace if necessary (see Section 8-7).	
Low weld output with no control.	Check position of Voltage/Amperage Control switch S2 (see Section 4-1).	
	Check resistance and connections of hall device HD1; HD1 is 1800 ohms $\pm 10\%$ between pins 1 and 3 of plug PLG9. Check input and output voltages. Replace HD1 if necessary.	
	Check control board PC1 and connections, and replace if necessary (see Section 8-7).	
	Check display board PC3 and connections, and replace if necessary (see Section 8-9).	
Maximum weld output with no control.	Check resistance and connections of hall device HD1; HD1 is 1800 ohms $\pm 10\%$ between pins 1 and 3 of plug PLG9. Check input and output voltages. Replace HD1 if necessary.	
	Check control board PC1 and connections, and replace if necessary (see Section 8-7).	
	Check display board PC3 and connections, and replace if necessary (see Section 8-9).	
	Check volt sense lead connections from weld output studs to PC1.	
Limited output and low open-circuit voltage.	Check incoming power for correct voltage. Replace line fuse if open (see Section 3-9).	
	Check for proper input and output connections.	
	If using remote amperage/voltage control, check position of Amperage/Voltage control R2.	
	Check control board PC1 and connections, and replace if necessary (see Section 8-7).	
	Check display board PC3 and connections, and replace if necessary (see Section 8-9).	
	Check connection at stabilizer and T1 transformer.	

Trouble	Remedy
Erratic or improper weld output.	Use proper size and type of weld cable (see Section 3-5).
	Clean and tighten all weld connections.
	Check for proper input and output connections.
	Replace electrode.
	Check resistance and connections of remote amperage control potentiometer, and replace if necessary.
	Check resistance and connections of hall device HD1; HD1 is 1800 ohms $\pm 10\%$ between pins 1 and 3 of plug PLG9. Check input and output voltages. Replace HD1 if necessary.
	Check control board PC1 and connections, and replace if necessary (see Section 8-7).
No 24 volts ac output at Remote 14 receptacle RC1.	Reset circuit breaker CB2 if necessary (see Section 3-7).
	Check Remote 14 receptacle RC1 wiring and connections.
No 115 volts ac output at Remote 14 receptacle RC1 or optional duplex receptacle.	Reset circuit breaker CB1 if necessary (see Section 3-7).
	Check receptacle(s) wiring and connections.
Fan motor does not run after approximately four minutes of operation at rated load.	Check and clear blocked fan blade.
	Check thermistors RT1 and RT2 on display board PC3 (see Section 8-9).
	Check coil voltage and connections of fan motor FM. Check continuity of coil. Replace FM if necessary.
Wandering arc; poor control of arc direction.	Use proper size tungsten.
	Use properly prepared tungsten.
	Reduce gas flow rate.
Tungsten electrode oxidizing and not remaining bright after conclusion of weld.	Shield weld zone from drafts.
	Increase postflow time.
	Check and tighten all gas fittings.
	Water in torch. Refer to torch manual.

8-2. Voltmeter/Ammeter Help Displays Prior To Serial No. KG150087



1 Help 1 Display

Indicates a malfunction in the primary power circuit of the unit. If this display is shown, check tank capacitor C1 (see Section 7-4) and control board PC1 (see Section 8-7).

2 Help 2 Display

Indicates a malfunction in the thermal protection circuitry of the unit. If this display is shown, check thermistors RT1 and RT2, and display board PC3 (see Section 8-9).

3 Help 3 Display

Indicates the unit has overheated and has automatically shut down to allow the fan to cool it (see Section 3-2). Operation will continue when the unit has cooled down.

4 Help 4 Display

Indicates that the input voltage is too low and the unit has automatically shut down. Operation will continue when the voltage is within the operating range ($\pm 15\%$). Have an electrician check the input voltage if this display is shown.

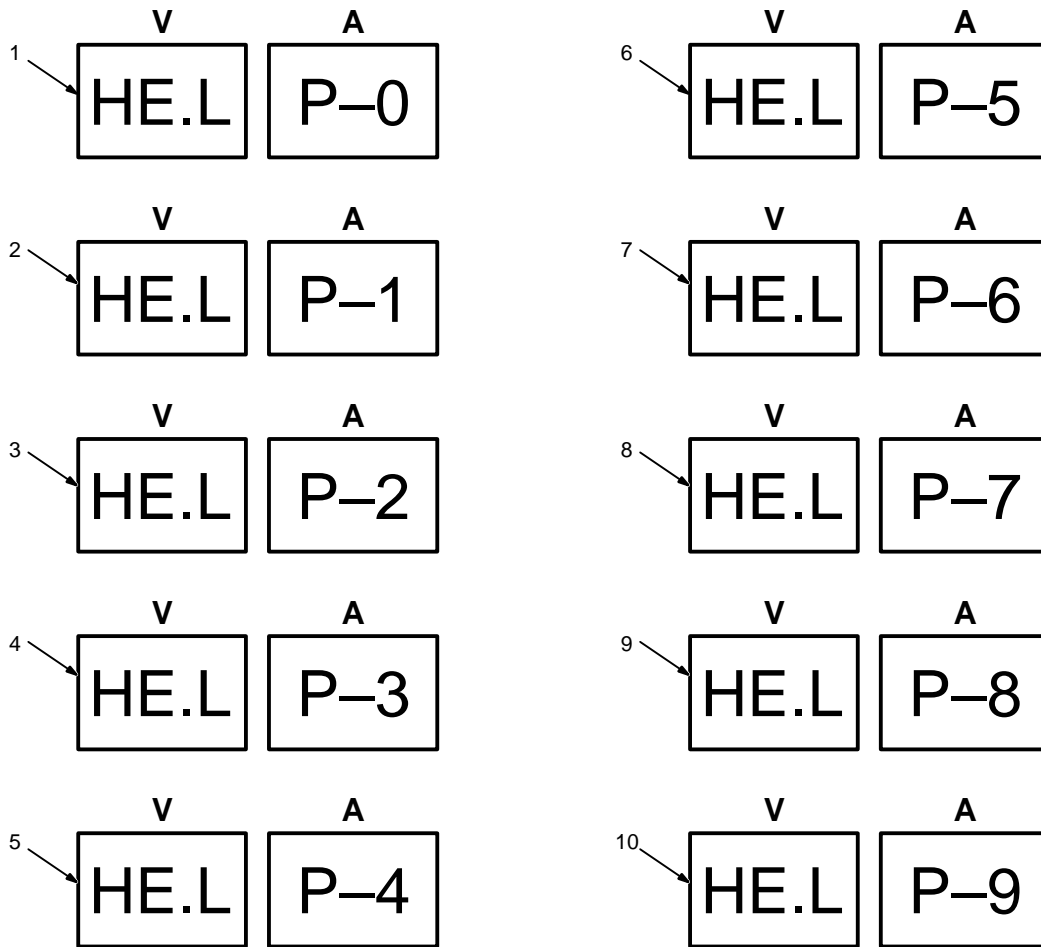
5 Help 5 Display

Indicates that the input voltage is too high and the unit has automatically shut down. Operation will continue when the voltage is within the operating range ($\pm 15\%$). Have an electrician check the input voltage if this display is shown.

6 Help 6 Display

Indicates a malfunction in the secondary power circuit of the unit. If this display is shown, check control board PC1 (see Section 8-7).

8-3. Voltmeter/Ammeter Help Displays Effective With KG150087



All directions are in reference to the front of the unit. All circuitry referred to is located inside the unit.

1 Help 0 Display

Indicates a shorted thermistor RT2 on the left side of the unit. If this display is shown, check thermistor RT2.

2 Help 1 Display

Indicates a malfunction in the primary power circuit. If this display is shown, check tank capacitor C1 (see Section 7-4), control board PC1 (see Section 8-7), and display board PC3 (see Section 8-9).

3 Help 2 Display

Indicates a malfunction in the thermal protection circuitry located on the left side of the unit. If this display is shown, check thermistor RT2 and display board PC3 (see Section 8-9).

4 Help 3 Display

Indicates the left side of the unit has over-

heated. The unit has shut down to allow the fan to cool it (see Section 3-2). Operation will continue when the unit has cooled.

5 Help 4 Display

Indicates a malfunction in the thermal protection circuitry located on the right side of the unit. If this display is shown, check thermistor RT1 and display board PC3 (see Section 8-9).

6 Help 5 Display

Indicates the right side of the unit has overheated. The unit has shut down to allow the fan to cool it (see Section 3-2). Operation will continue when the unit has cooled.

7 Help 6 Display

Indicates that the input voltage is too low and the unit has automatically shut down. Operation will continue when the voltage is within the acceptable lower range limit (15% below the applicable input voltage). If this display is

shown, have an electrician check the input voltage.

8 Help 7 Display

Indicates that the input voltage is too high and the unit has automatically shut down. Operation will continue when the voltage is within the acceptable upper range limit (15% above the applicable input voltage). If this display is shown, have an electrician check the input voltage. Effective with KK104771, Help 7 can also indicate a bus voltage imbalance.

9 Help 8 Display

Indicates a malfunction in the secondary power circuit of the unit. If this display is shown, check control board PC1 (see Section 8-7). When this occurs, have an electrician check the primary and secondary connections.

10 Help 9 Display

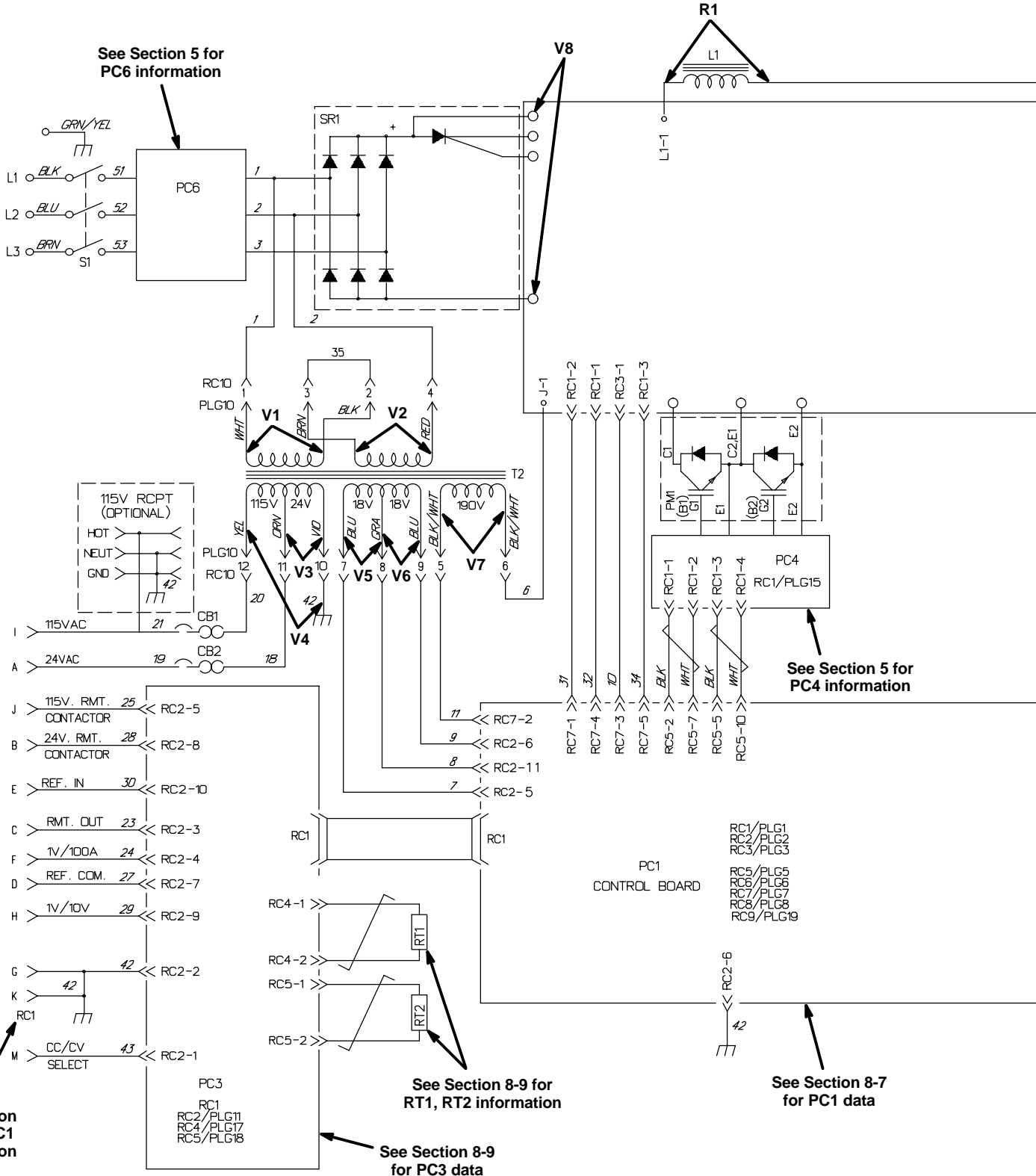
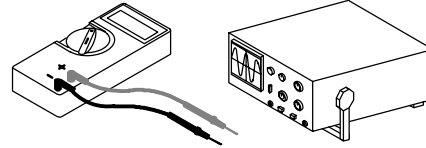
Indicates a shorted thermistor RT1 on the right side of the unit. If this display is shown, check thermistor RT1.

8-4. Troubleshooting Circuit Diagram For Welding Power Source Prior To KK104771

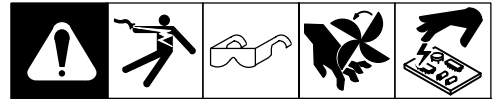
▲ Discharge input capacitors according to Section 9-3, and be sure voltage is near zero before touching any parts.

☞ No calibration available for voltmeter V or ammeter A.

Test Equipment Needed:

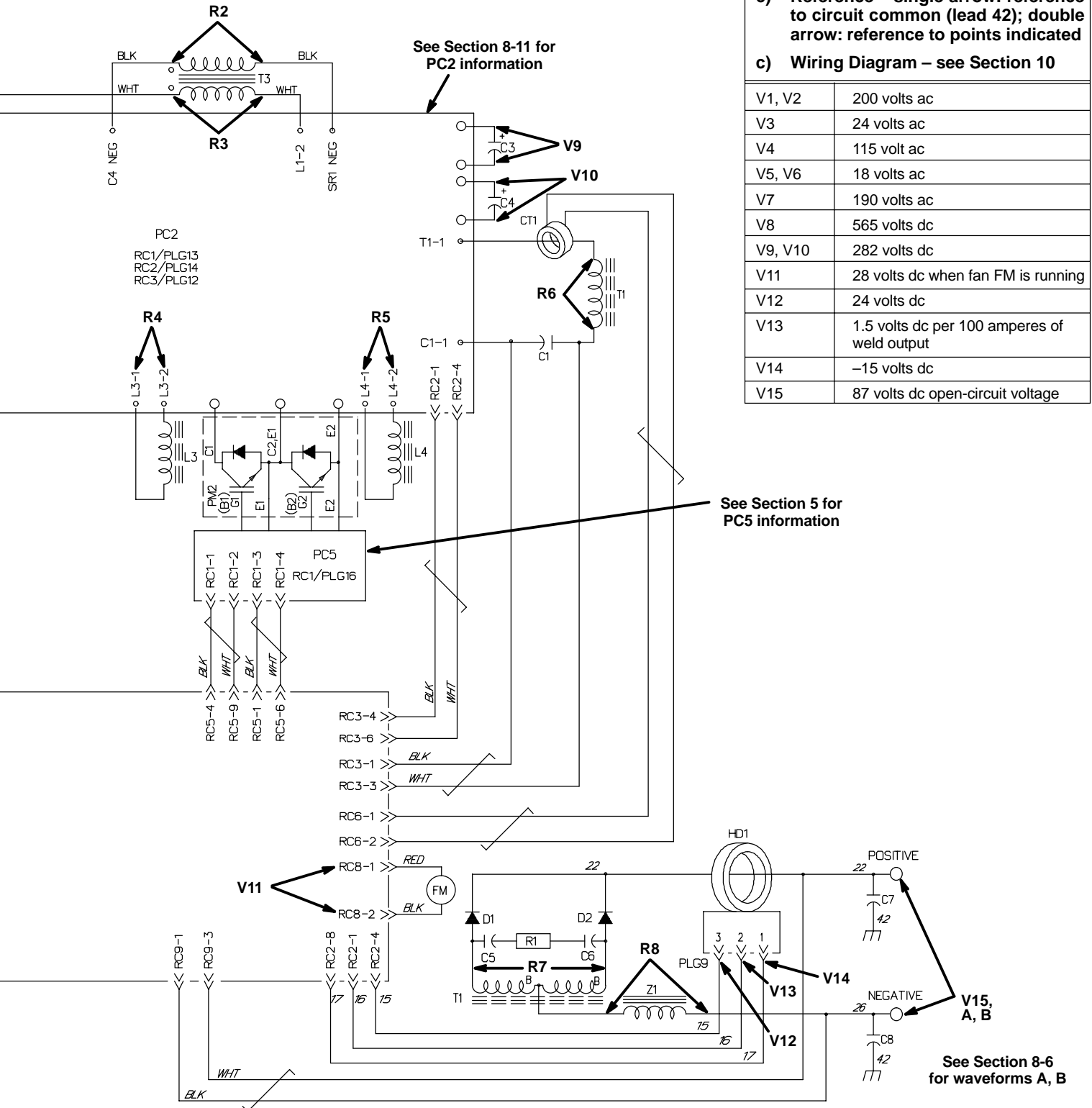


Resistance Values	
a) Tolerance – $\pm 10\%$ unless specified	
b) Turn Off unit and disconnect input power before checking resistance	
R1 thru R9	Less than 1 ohm



Voltage Readings	
a) Tolerance – $\pm 10\%$ unless specified	
c) Reference – single arrow: reference to circuit common (lead 42); double arrow: reference to points indicated	
c) Wiring Diagram – see Section 10	

V1, V2	200 volts ac
V3	24 volts ac
V4	115 volt ac
V5, V6	18 volts ac
V7	190 volts ac
V8	565 volts dc
V9, V10	282 volts dc
V11	28 volts dc when fan FM is running
V12	24 volts dc
V13	1.5 volts dc per 100 amperes of weld output
V14	-15 volts dc
V15	87 volts dc open-circuit voltage

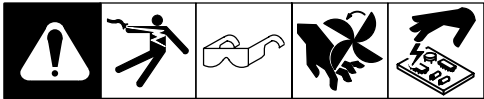


See Section 5 for PC5 information

See Section 8-11 for PC2 information

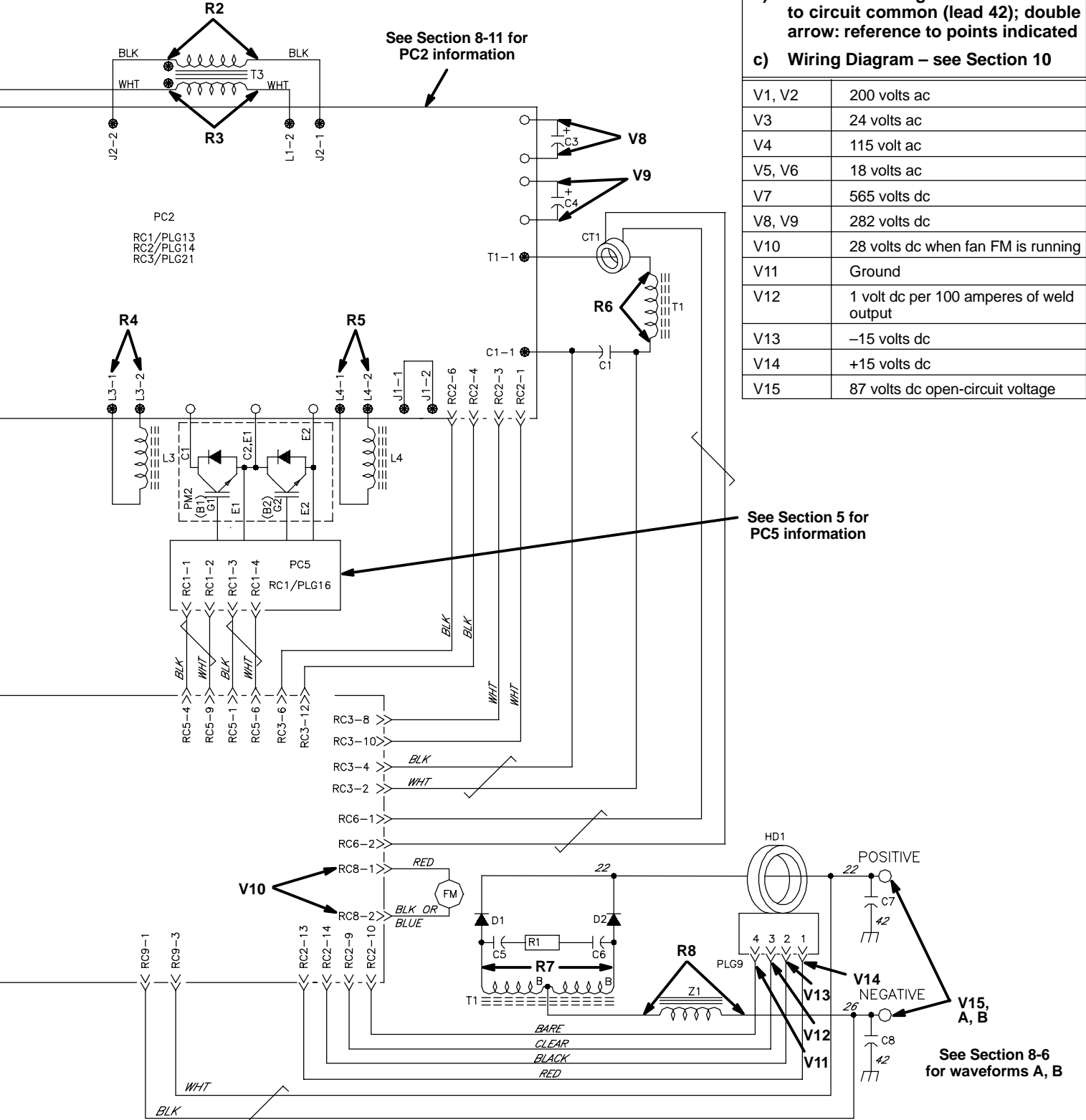
See Section 8-6 for waveforms A, B

Resistance Values	
a) Tolerance	– ±10% unless specified
b) Turn Off unit and disconnect input power	before checking resistance
R1 thru R9	Less than 1 ohm



Voltage Readings	
a) Tolerance	– ±10% unless specified
c) Reference	– single arrow: reference to circuit common (lead 42); double arrow: reference to points indicated
c) Wiring Diagram	– see Section 10

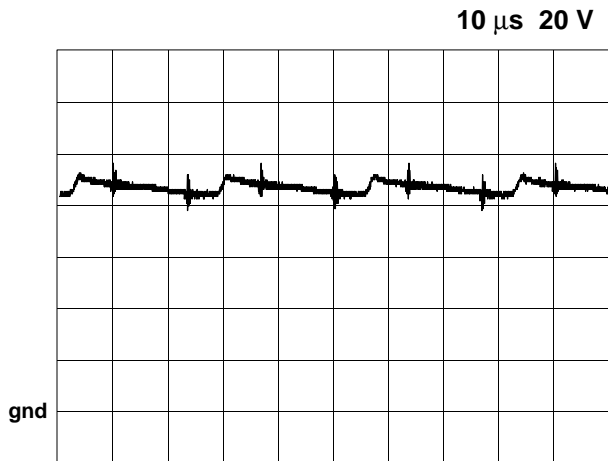
V1, V2	200 volts ac
V3	24 volts ac
V4	115 volt ac
V5, V6	18 volts ac
V7	565 volts dc
V8, V9	282 volts dc
V10	28 volts dc when fan FM is running
V11	Ground
V12	1 volt dc per 100 amperes of weld output
V13	–15 volts dc
V14	+15 volts dc
V15	87 volts dc open-circuit voltage



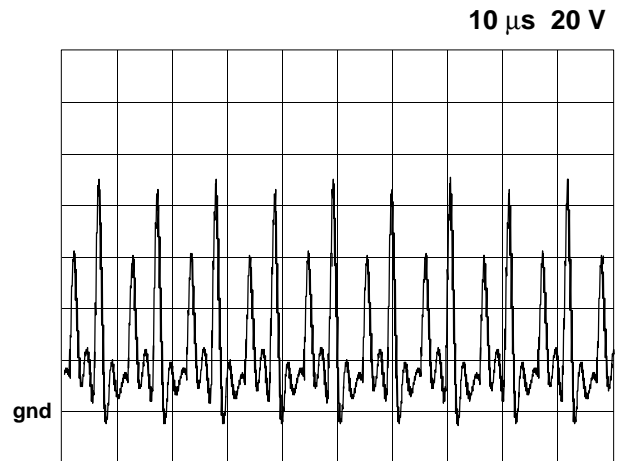
See Section 5 for PC5 information

See Section 8-6 for waveforms A, B

8-6. Waveforms For Sections 8-4 And 8-5



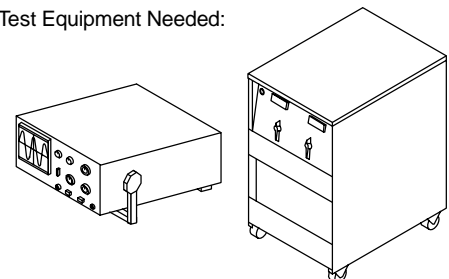
A. CC Or CV Mode, DC Open-Circuit Voltage



B. CC Or CV Mode, 25 Volts DC, 200 Amperes (Resistive Load)



Test Equipment Needed:

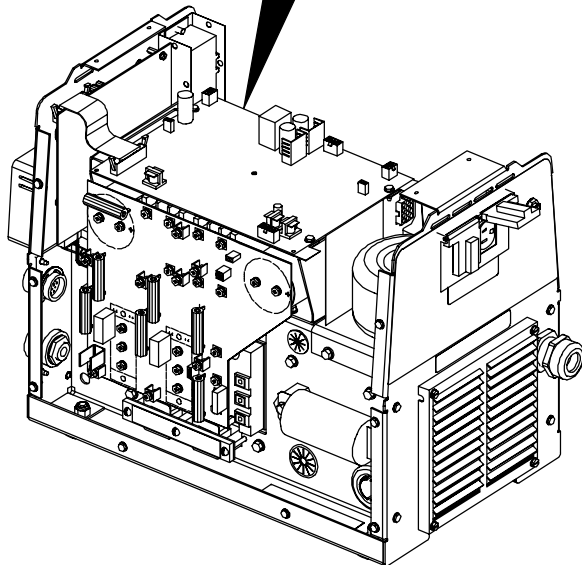
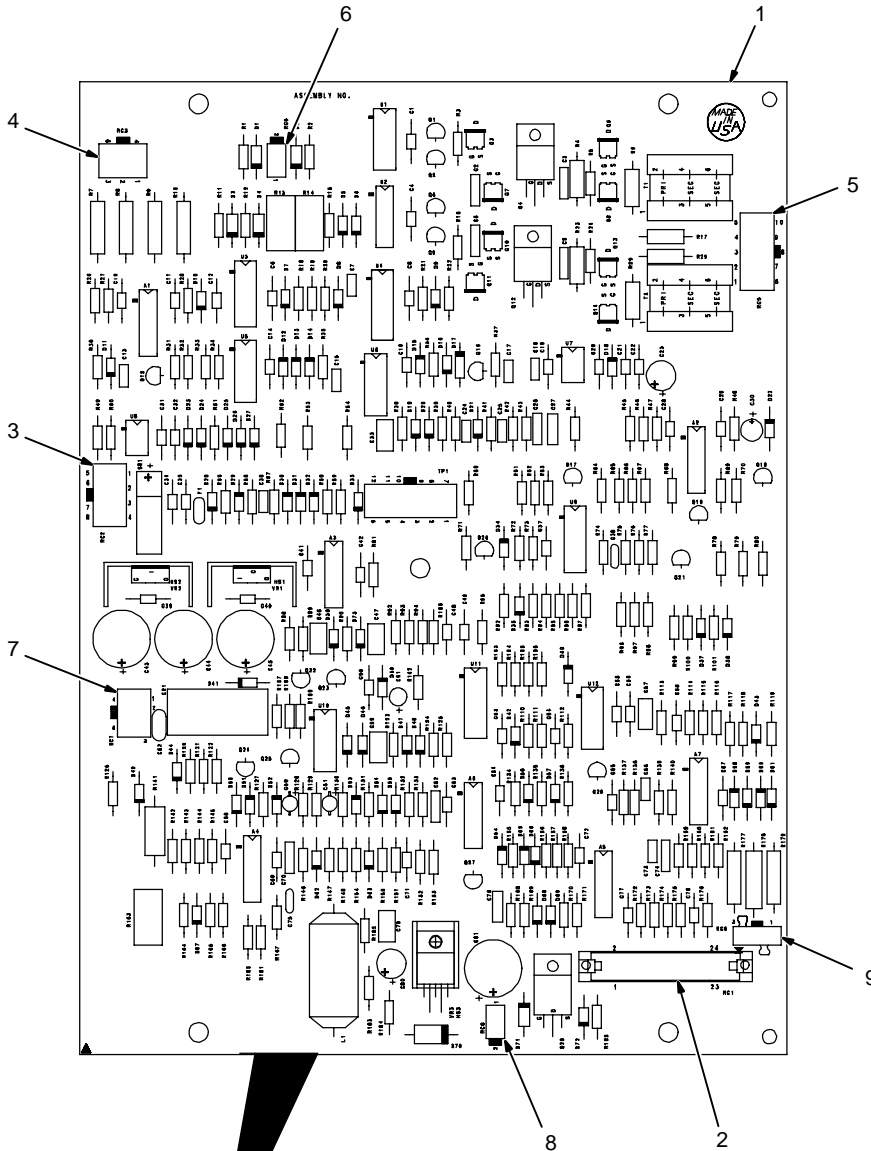


8-7. Control Board PC1 Testing Information (All Models – Use With Section 8-8)

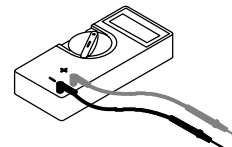
▲ Discharge input capacitors according to Section 9-3, and be sure voltage is near zero before touching any parts.

Be sure plugs are secure before testing. See Section 8-8 for specific values during testing.

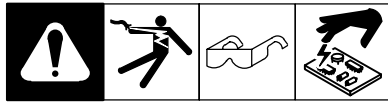
- 1 Control Board PC1
- 2 Receptacle RC1
- 3 Receptacle RC2
- 4 Receptacle RC3
- 5 Receptacle RC5
- 6 Receptacle RC6
- 7 Receptacle RC7
- 8 Receptacle RC8
- 9 Receptacle RC9



Test Equipment Needed:




8-8. Control Board PC1 Test Point Values (All Models)



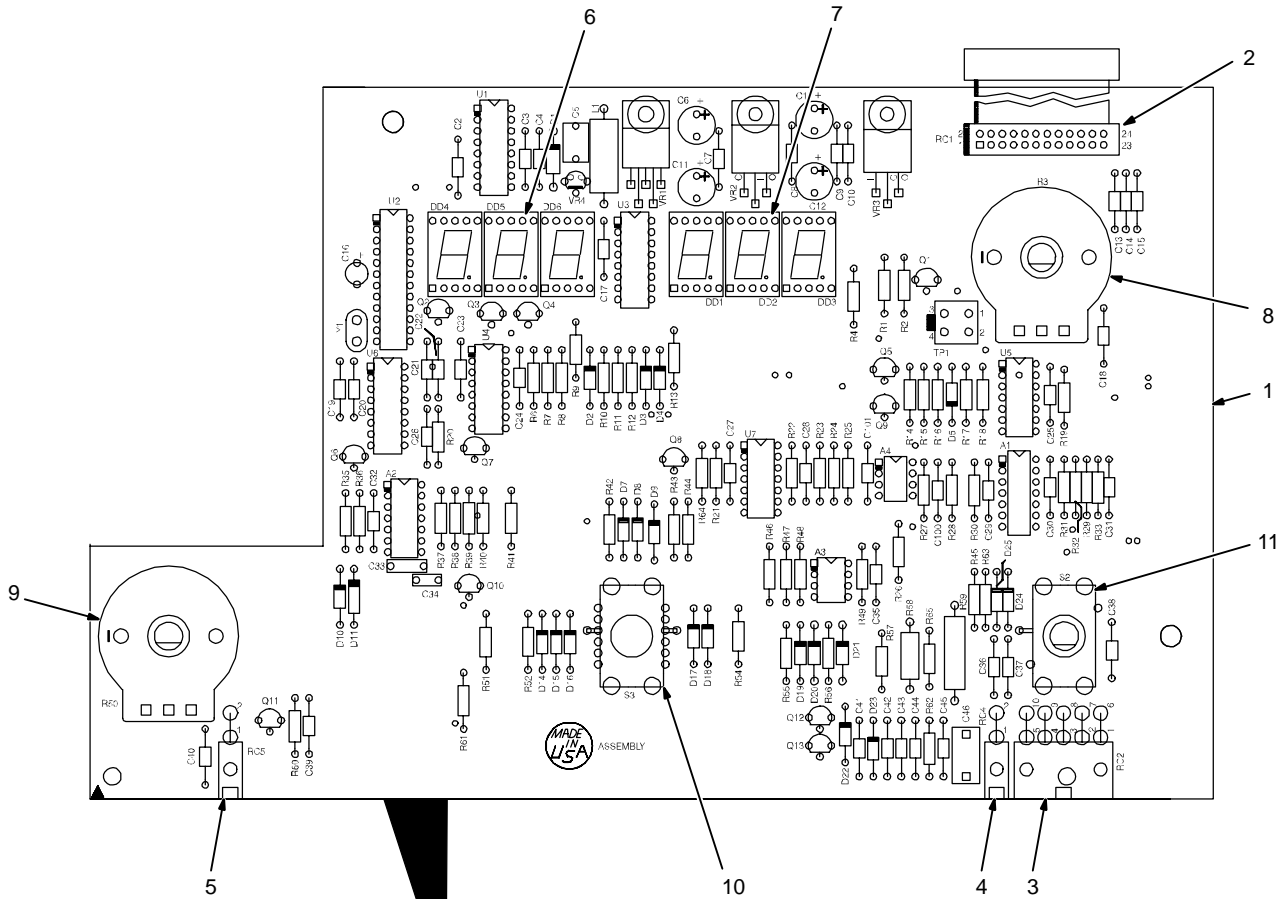
PC1 Voltage Readings

- a) Tolerance – $\pm 10\%$ unless specified
 b) Reference – to circuit common (lead 42) unless noted

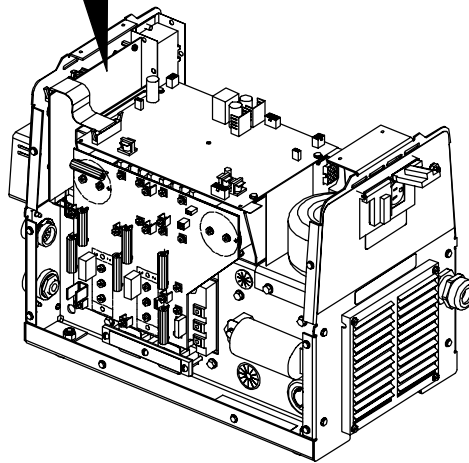
Receptacle	Pin	Value
RC1	1	+24 volts dc output
	2	Not used
	3	+24 volts dc output
	4	+1 volt dc output per 10 volts dc of weld output
	5	–24 volts dc output
	6	+15 volts dc output when HELP 1 screen is displayed, 0 volts dc with normal conditions
	7	–24 volts dc output
	8	0 to +10 volts dc input from min to max of Inductance/Dig control R44 (CC/CV models) or Dig control R44 (CC models)
	9	Circuit common
	10	Circuit common
	11	–24 volts dc input with fan motor FM off, –10 volts dc with fan motor FM on
	12	Prior to Serial No. KG150087, circuit common; effective with Serial No. KG150087, 0 volts dc output during normal operation, +15 volts dc output when HELP 8 screen is displayed
	13	+15 volts dc input with Mode switch S3 in lift arc position
	14	Prior to Serial No. KG150087, circuit common; effective with Serial No. KG150087, +15 volts dc output during normal operation, 0 volts dc output when HELP 6 screen is displayed
	15	+15 volts dc input with Mode switch S3 in Dig (SMAW) position, 0 volts dc input with S3 in GMAW or GTAW position
	16	Prior to Serial No. KG150087, circuit common; effective with Serial No. KG150087, +15 volts dc output during normal operation, 0 volts dc output when HELP 7 screen is displayed
	17	+15 volts dc input with weld output on, 0 volts dc input with weld output off
	18	+15 volts dc input with Mode switch S3 in droop (stick) position, 0 volts dc input with S3 in GMAW or GTAW position
	19	For CC/CV models only, +1.0 to +3.5 volts dc input, CV preset
	20	+1 volt dc output per 100 amperes of weld output
	21	+15 volts dc input with Mode switch S3 in CV position, 0 volts dc input with S3 in CC position (always 0 volts dc for CC models)
	22	0 to +10 volts dc input from min to max of Voltage/Amperage Adjustment control R2 (CC/CV models) or Amperage Adjustment control R2 (CC models); +13 volts dc in Pulse mode and weld output off
	23	Prior to Serial No. KG150087, negative (–) voltage feedback input with respect to pin RC1-24; effective with Serial No. KG150087, not used
	24	Prior to Serial No. KG150087, positive (+) voltage feedback input with respect to pin RC1-23; effective with Serial No. KG150087, not used
RC2	1	+1.5 volts dc input per 100 amperes of weld output (Prior to KK104771) Not used (Effective w/KK104771)
	2	18 volts ac input with respect to pin RC2-5 (Prior to KK104771) Not used (Effective w/KK104771)
	3	18 volts ac input with respect to pin RC2-5 (Prior to KK104771) Not used (Effective w/KK104771)
	4	+24 volts dc output (Prior to KK104771) Not used (Effective w/KK104771)
	5	Circuit common (Prior to KK104771) 18 volts ac input with respect to pin RC2-11 (Effective w/KK104771)

Receptacle	Pin	Value
RC2	6	Circuit common (Prior to KK104771) 18 volts ac input with respect to pin RC2-11 (Effective w/KK104771)
	7	+15 volts dc output (Prior to KK104771) Not used (Effective w/KK104771)
	8	-15 volts dc output (Prior to KK104771) Not used (Effective w/KK104771)
	9	+1 volts dc input per 100 amperes of weld output (Effective w/KK104771)
	10	Circuit common (Effective w/KK104771)
	11	Circuit common (Effective w/KK104771)
	12	Circuit common (Effective w/KK104771)
	13	+15 volts dc output (Effective w/KK104771)
	14	-15 volts dc output (Effective w/KK104771)
RC3	1	Do not measure – high voltage present
	2	Do not measure – high voltage present
	3	Do not measure – high voltage present
	4	Do not measure – high voltage present
	5	Not used
	6	Negative (-) of C4 282 volts dc with respect to pin RC3-8 (Effective w/KK104771)
	7	Not used
	8	Positive (+) of C4 282 volts dc with respect to pin RC3-6 (Effective w/KK104771)
	9	Not used
	10	Positive (+) of C3 282 volts dc with respect to pin RC3-12 (Effective w/KK104771)
	11	Not used
	12	Negative (-) of C3 282 volts dc with respect to pin RC3-10 (Effective w/KK104771)
RC4	--	Not used
RC5	 Make no connections – damage to test equipment or components can occur.	
RC6	1	Current transformer CT1 feedback input with respect to pin RC6-2
	2	Current transformer CT1 feedback input with respect to pin RC6-1
RC7	1	Reference for pins RC7-4 and RC7-5
	2	190 volts ac input with respect to black/white lead of control transformer T2 (Prior to KK104771)
	3	190 volts ac input with respect to pin RC7-2 after precharge (Prior to KK104771)
	4	0 volts dc during precharge, +0.27 volts dc after precharge with respect to pin RC7-1
	5	0 volts dc after precharge, +0.6 volts dc at power-up with respect to pin RC7-1
	6	Not used
RC8	1	+28 volts dc output with respect to pin RC8-2
	2	-28 volts dc output with respect to pin RC8-1
RC9	1	Prior to Serial No. KG150087, not used; effective with Serial No. KG150087, negative (-) voltage feedback input with respect to pin RC9-3
	2	Not used
	3	Prior to Serial No. KG150087, not used; effective with Serial No. KG150087, positive (+) voltage feedback input with respect to pin RC9-1

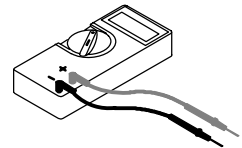
8-9. Display Board PC3 Testing Information (All Models – Use With Section 8-10)



☞ CC/CV Model Shown



Test Equipment Needed:



ST- 801 550 / SC-181 483-A

▲ **Discharge input capacitors according to Section 9-3, and be sure voltage is near zero before touching any parts.**

Be sure plugs are secure before testing. See Section 8-10 for specific values during testing.

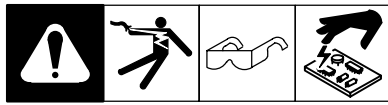
- 1 Display Board PC3
- 2 Receptacle RC1
- 3 Receptacle RC2

- 4 Receptacle RC4
- Connection point for thermistor RT1.
- 5 Receptacle RC5
- Connection point for thermistor RT2.
- 6 Voltmeter V
- 7 Ammeter A

☞ No calibration available for voltmeter V or ammeter A.

- 8 Voltage/Amperage Adjustment Control R2 (CC/CV Model) Or Amperage Adjustment Control R2 (CC Model)
- 9 Inductance/Dig Control R44 (CC/CV Model) Or Dig Control R44 (CC Model)
- 10 Mode Switch S3
- 11 Voltage/Amperage Control Switch S2 (CC/CV Model) Or Amperage Control Switch S2 (CC Model)

8-10. Display Board PC3 Test Point Values (All Models)



PC3 Voltage Readings

- a) Tolerance – $\pm 10\%$ unless specified
 b) Reference – to circuit common (lead 42) unless noted

Receptacle	Pin	Value
RC1	1	+24 volts dc input
	2	Not used
	3	+24 volts dc input
	4	+1 volt dc input per 10 volts dc of weld output
	5	-24 volts dc input
	6	+15 volts dc input when HELP 1 screen is displayed, 0 volts dc during normal conditions
	7	-24 volts dc input
	8	0 to +10 volts dc output for dig/inductance
	9, 10	Circuit common
	11	-24 volts dc output with fan motor FM off, -10 volts dc output with fan motor FM on
	12	Prior to Serial No. KG150087, circuit common; effective with Serial No. KG150087, 0 volts dc input during normal operation, +15 volts dc input when HELP 8 screen is displayed
	13	+15 volts dc output in Lift Arc mode
	14	Prior to Serial No. KG150087, circuit common; effective with Serial No. KG150087, +15 volts dc input during normal operation, 0 volts dc input when HELP 6 screen is displayed
	15	+15 volts dc output with Mode switch S3 in Dig (SMAW) position, 0 volts dc output with S3 in GMAW or GTAW position
	16	Prior to Serial No. KG150087, circuit common; effective with Serial No. KG150087, +15 volts dc input during normal operation, 0 volts dc input when HELP 7 screen is displayed
	17	+15 volts dc output with output on, 0 volts dc output with output off
	18	+15 volts dc output with Mode switch S3 in droop (SMAW) position, 0 volts dc output with S3 in remaining positions
	19	For CC/CV models only, +1.0 to +3.5 volts dc output, CV preset
	20	+1 volt dc input per 100 amperes of weld output
	21	+15 volts dc output with Mode switch S3 in CV position, 0 volts dc output with S3 in CC position (always 0 volts dc for CC models)
	22	0 to +10 volts dc input from min to max of Voltage/Amperage Adjustment control R2 (CC/CV models) or Amperage Adjustment control R2 (CC models); +13 volts dc in Pulse mode and weld output off
	23	Prior to Serial No. KG150087, negative (-) voltage feedback input with respect to pin RC1-24; effective with Serial No. KG150087, not used
	24	Prior to Serial No. KG150087, positive (+) voltage feedback input with respect to pin RC1-23; effective with Serial No. KG150087, not used
	RC2	1
2		Circuit common
3		For CC/CV models, in MIG mode: +10 volts dc output; in all other modes: 0 to +10 volts dc output from min to max of Voltage/Amperage Adjustment control R2.
4		+1 volt dc output per 100 amperes of actual or preset amperage output
5		115 volts ac input for weld output (On/Off)
6		Prior to Serial No. KG150087, voltage feedback input with respect to pin RC2-1, same as negative (-) weld output receptacle; effective with Serial No. KG150087, circuit common (lead 42)
7		Reference common
8		24 volts ac input for weld output (On/Off)
9		+1 volt dc output per 10 volts dc of weld output
10		0 to +10 volts dc input command signal from min to max of remote control
RC4	1, 2	Approximately 33 k ohms at 68°F (20°C)
RC5	1, 2	Approximately 33 k ohms at 68°F (20°C)

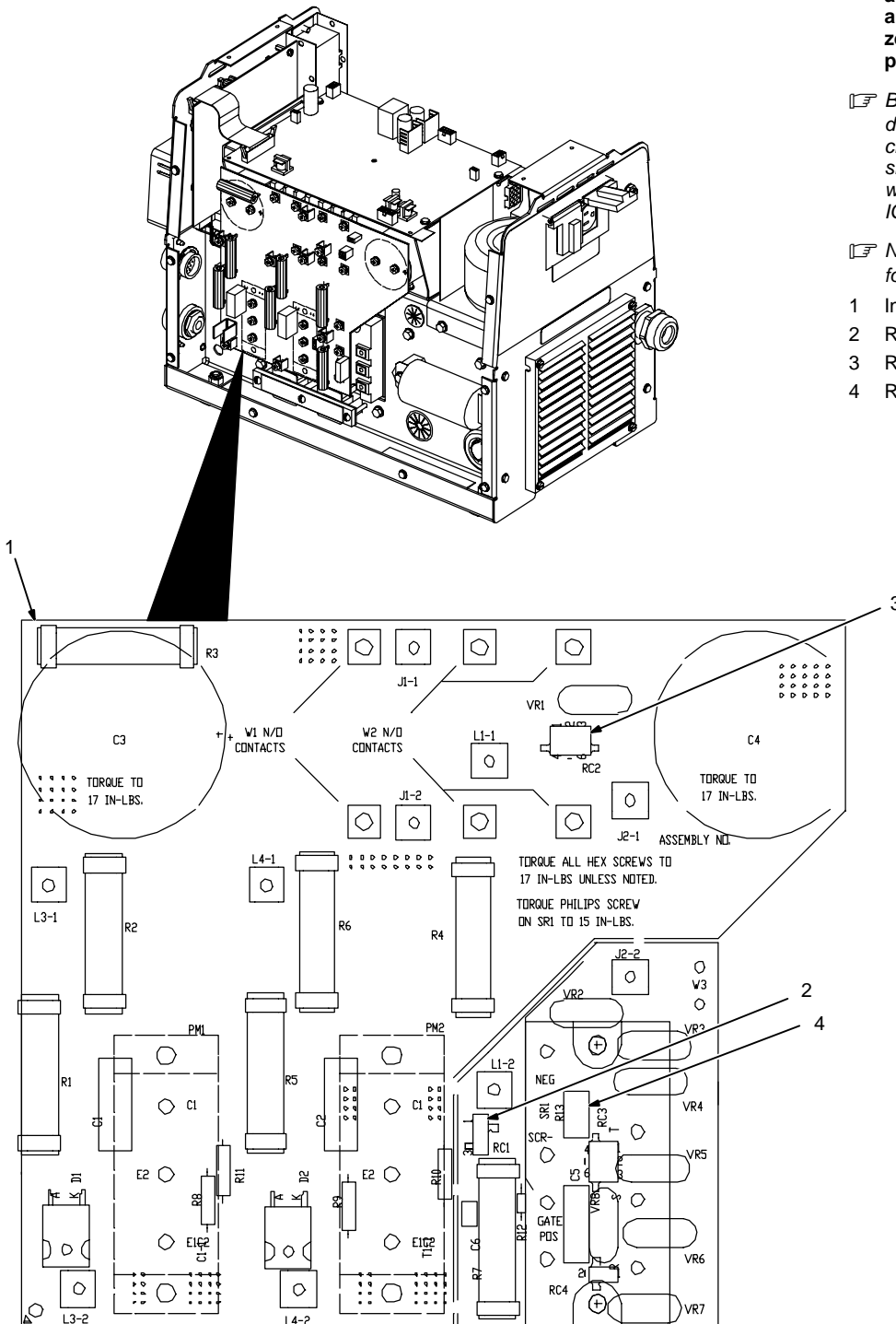
8-11. Interconnecting Board PC2 Testing Information (All Models)

▲ Discharge input capacitors according to Section 9-3, and be sure voltage is near zero before touching any parts.

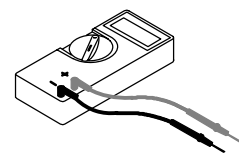
☞ Be sure to use torque values indicated on PC2 when servicing. Use component-to-heat sink torque value of 26 in-lb when servicing SR1 and IGBT's PM1 and PM2.

☞ No test point values provided for this PC board.

- 1 Interconnecting Board PC2
- 2 Receptacle RC1
- 3 Receptacle RC2
- 4 Receptacle RC3



Test Equipment Needed:



ST-801 550 / 195 587

SECTION 9 – MAINTENANCE

9-1. Routine Maintenance

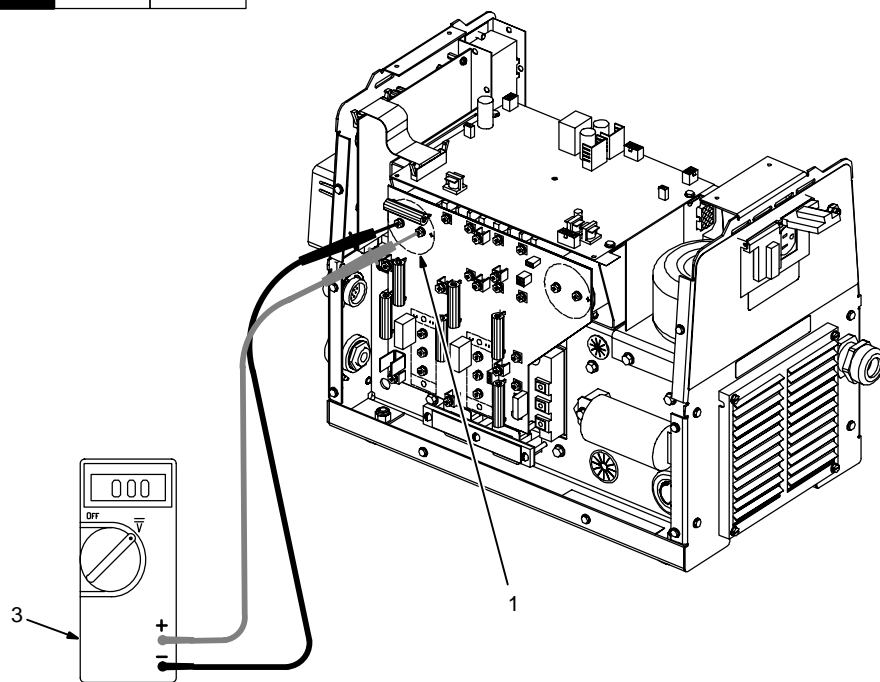
		▲ Disconnect power before maintaining.		Maintain more often during severe conditions.
3 Months				
		Replace Damaged Or Unreadable Labels		Repair Or Replace Cracked Cables
				Replace Cracked Torch Body
				Repair Or Replace Cracked Cables And Cords
				Clean And Tighten Weld Connections
6 Months				
				Blow Out Inside

9-2. Blowing Out Inside Of Unit

		▲ Do not remove case when blowing out inside of unit.
		To blow out unit, direct airflow through front and back louvers as shown.

ST-801 192

9-3. Measuring Input Capacitor Voltage



▲ Significant DC voltage can remain on capacitors after unit is Off. Always check capacitors as shown to be sure they have discharged before working on unit.

Turn Off welding power source and disconnect input power.

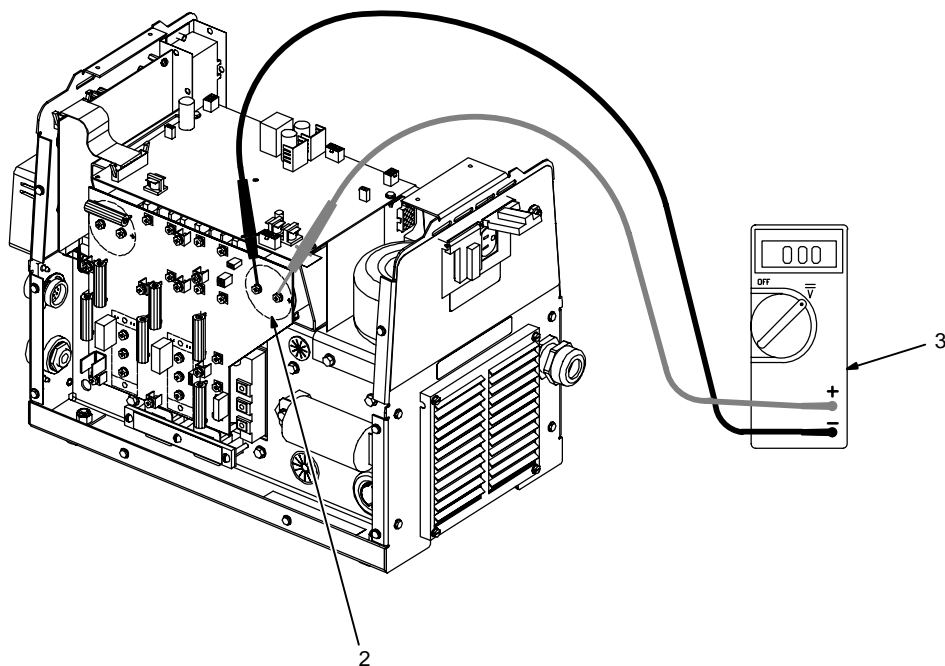
Remove case.

- 1 Input Capacitor C3 Terminals
- 2 Input Capacitor C4 Terminals
- 3 Voltmeter

Check input capacitors as shown.

Measure the dc voltage across the positive (+) and negative (-) terminals until voltage drops to near 0 (zero) volts.

Proceed with job inside unit. Reinstall case when finished.



Tools Needed:



ST-801 550

9-4. Checking Bus Voltage Imbalance

NOTE

Check for a bus voltage imbalance whenever any of the following components are replaced: capacitors C3 or C4; control board PC1; interconnecting board PC2; IGBT power modules PM1 or PM2; or input rectifier SR1.



▲ This procedure requires an energized unit. Have only personnel familiar with and following standard safety practices do the job.

Turn off welding power source.

Remove case.

- 1 Input Capacitor C3 Terminals
- 2 Input Capacitor C4 Terminals
- 3 Voltmeter
- 4 Receptacle 3/Plug 12

Measure the dc voltage across the positive (+) and negative (-) terminals on C3 and C4 as shown in Section 9-3 until voltage drops to near 0 (zero) volts.

Prior to Serial No. KK266150, disconnect plug 12 from receptacle 3.

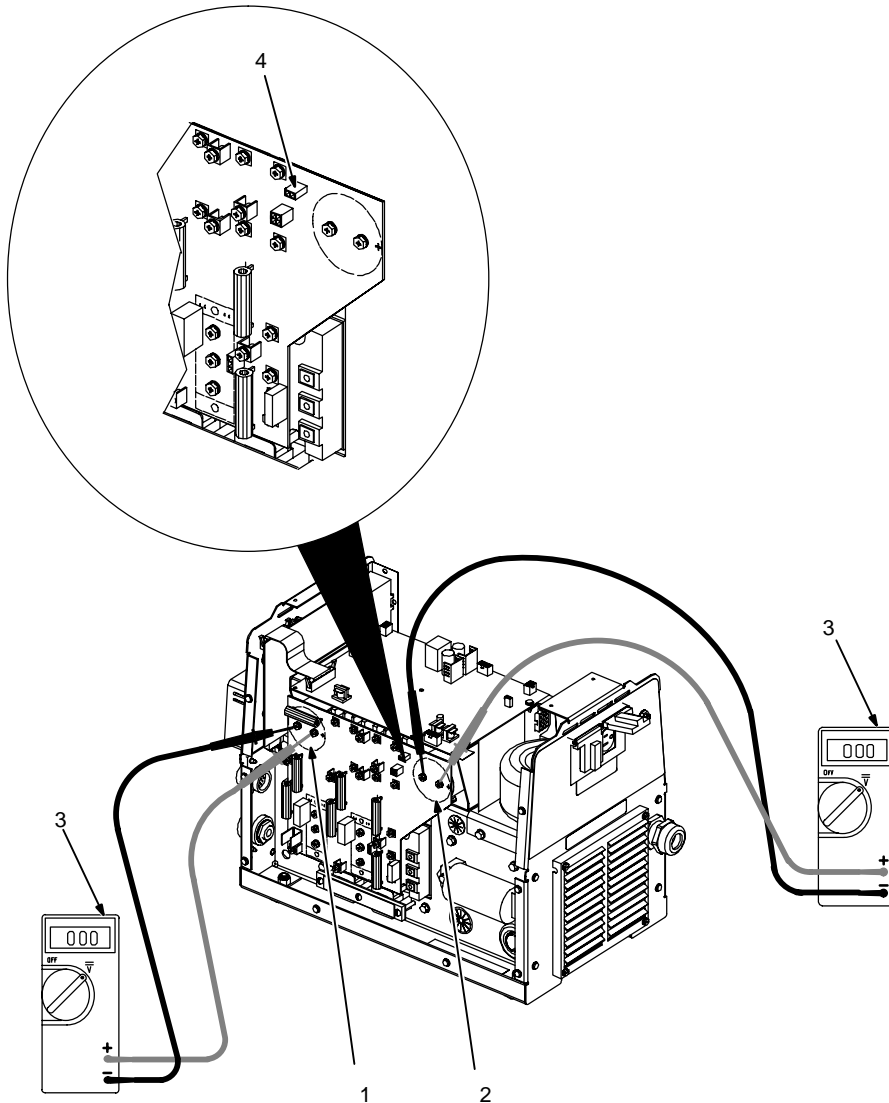
Connect two voltmeters across capacitors C3 and C4 as shown.

Place Process Selector switch in Remote TIG position.

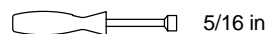
Turn on input power and monitor the voltage levels across the capacitor terminals. The bus voltages should remain equal to each other $\pm 15\%$ (± 48 vdc maximum difference). If the voltage difference exceeds the $\pm 15\%$, **immediately** turn off the unit and repeat the entire Pre-Power Checklist. If the voltage remains balanced for 10 seconds, place the Process Selector Switch in the SMAW position. If the voltage difference now exceeds the $\pm 15\%$, **immediately** turn off the unit and repeat the entire Pre-Power Checklist.

Turn off unit and wait for voltage to drop to near 0 (zero) volts according to Section 9-3. Prior to Serial No. KK266150, reconnect plug 12 to receptacle 3.

Reinstall case.




Tools Needed:



ST-801 523-A / ST-801 536

SECTION 10 – ELECTRICAL DIAGRAMS

 The circuits in this manual can be used for troubleshooting, but there might be minor circuit differences from your machine. Use circuit inside machine case or contact distributor for more information.

The following is a list of all diagrams for models covered by this manual. To order a copy, proceed as follows:

Model	Serial Or Style Number	Circuit Diagram	Wiring Diagram
XMT 304	KG139511 thru KG150086	SC-179 690	SD-179 691
	KG150087 thru KK104770	SC-181 838-C	SD-179 691
	KK104771 and following	SC-197 552	SD-195 874
Circuit Board PC1	KG139511 thru KG150086	D-178 570♦♦	
	KG150087 thru KH541060	SD-182 087♦♦	
	KH541061 thru KK104770	SD-188 073♦♦	
	KK104771 and following	SD-193 758	
Circuit Board PC2	KG139511 thru KG150086	B-173 591♦♦	
	KG150087 thru KH357759	SB-182 259♦♦	
	KH357759 thru KJ171291	SB-183 623♦♦	
	KJ171292 thru KK276102	SB-190 430♦♦	
	KK276103 and following	SB-195 589	
Circuit Board PC3 (CC Models)	KG177169 thru KH523188	SD-183 331♦♦	
	KH523189 and following	SD-190 712	
Circuit Board PC3 (CC/CV Models)	KG139511 thru KG150086	D-183 327♦♦	
	KG150087 thru KH357826	SD-181 491-A♦♦	
	KH357827 and following	SD-190 709	
Circuit Boards PC4, PC5	KG139511 thru KH391019	SA-173 599♦♦	
	KH391020 and following	SA-188 015	
Circuit Board PC6	KG150087 thru KH391014	SA-181 127♦♦	
	KH391015 and following	SA-186 775	
♦♦ Not included in this manual			

	⚠ WARNING
	<ul style="list-style-type: none"> Do not touch live electrical parts. Disconnect input power or stop engine before servicing. Do not operate with covers removed. Have only qualified persons install, use, or service this unit.
ELECTRIC SHOCK HAZARD	

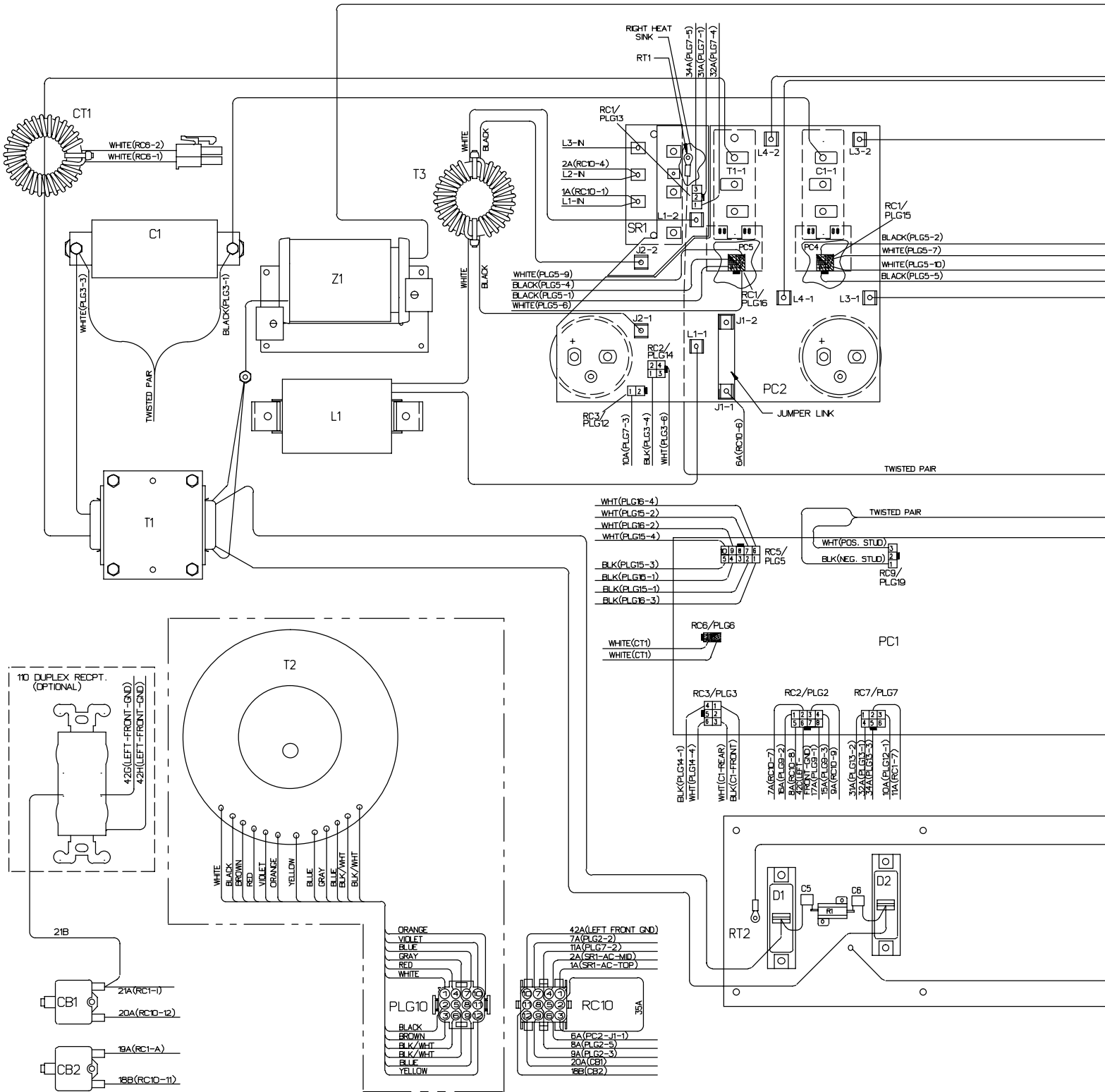
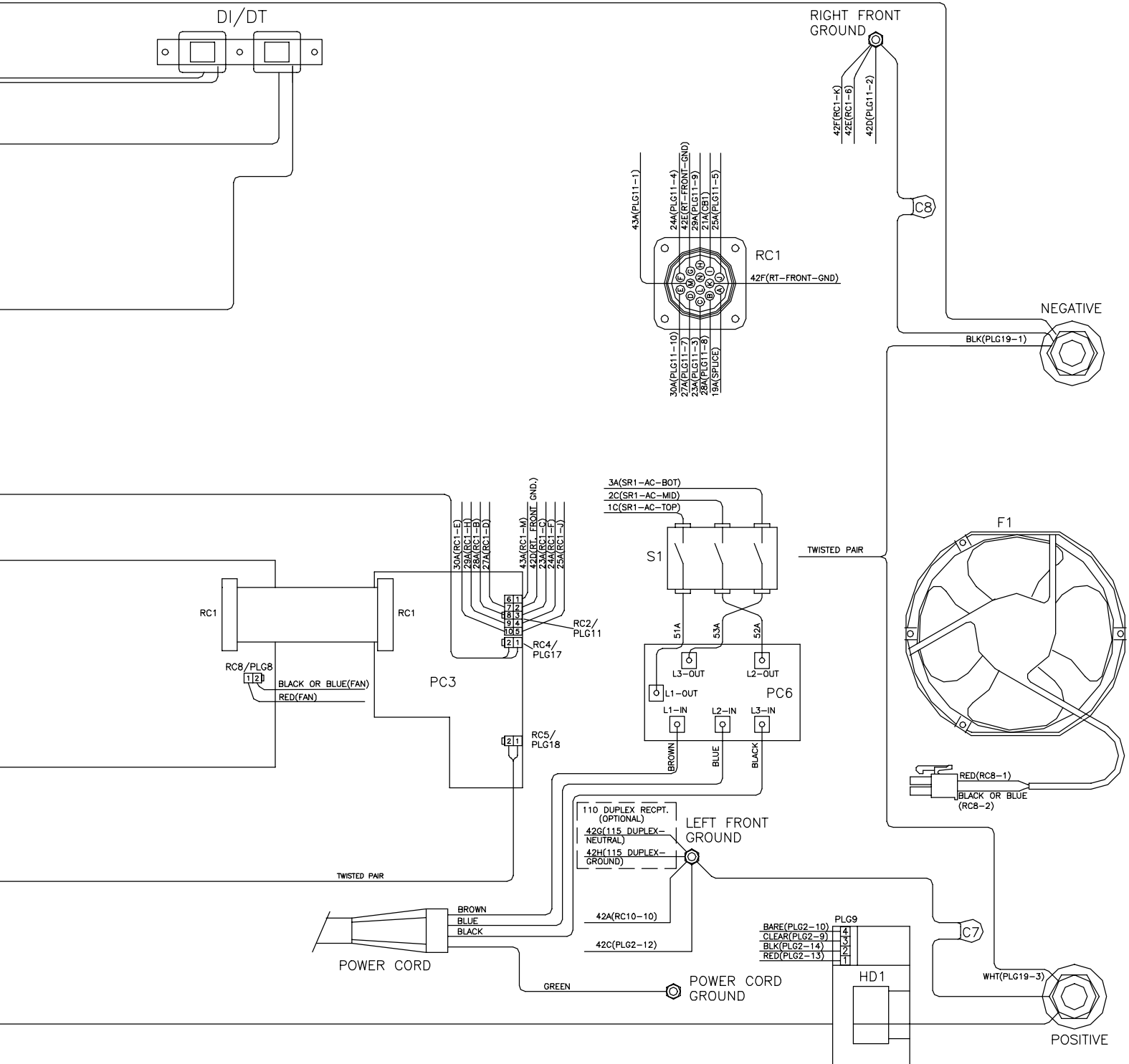

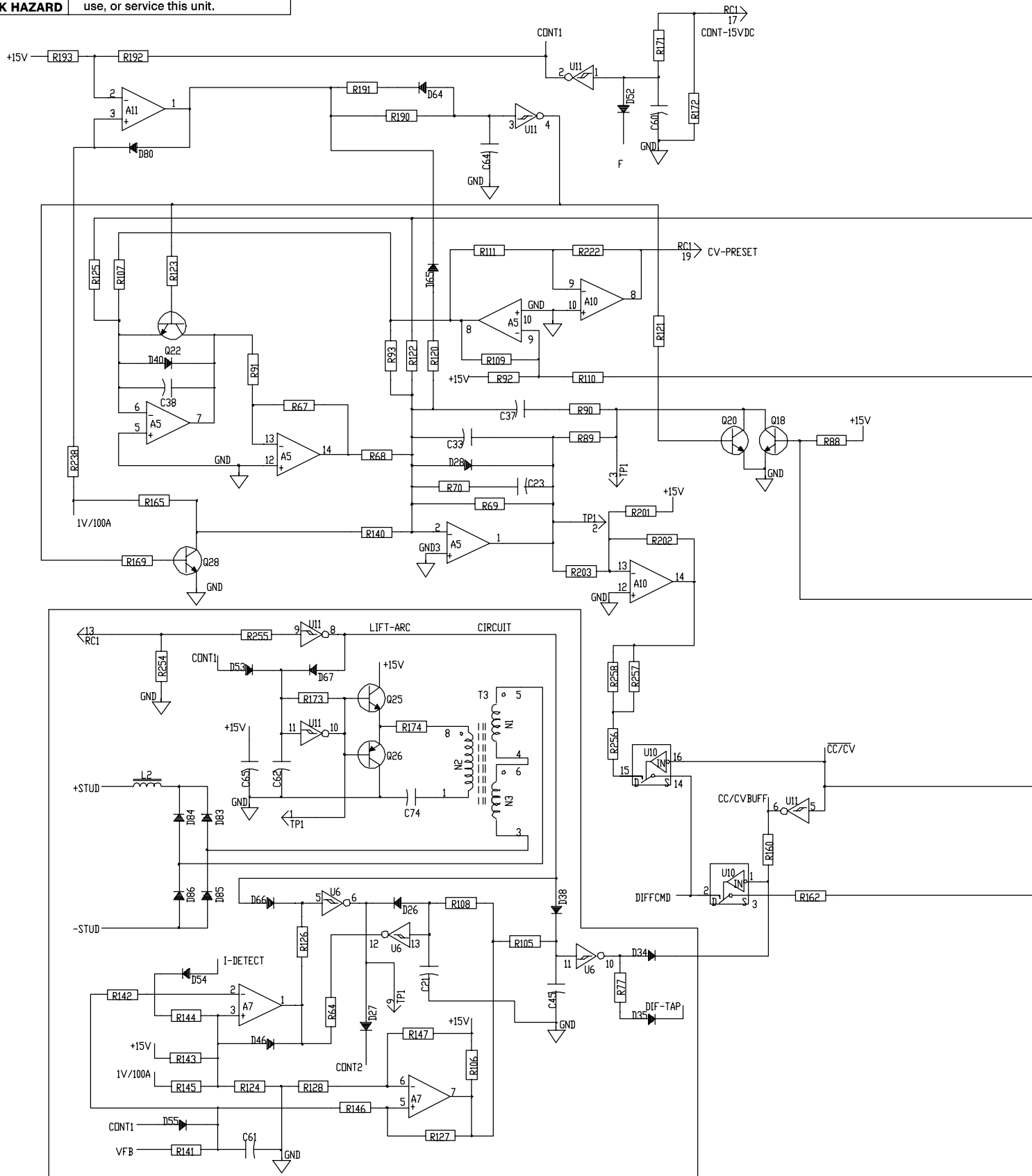


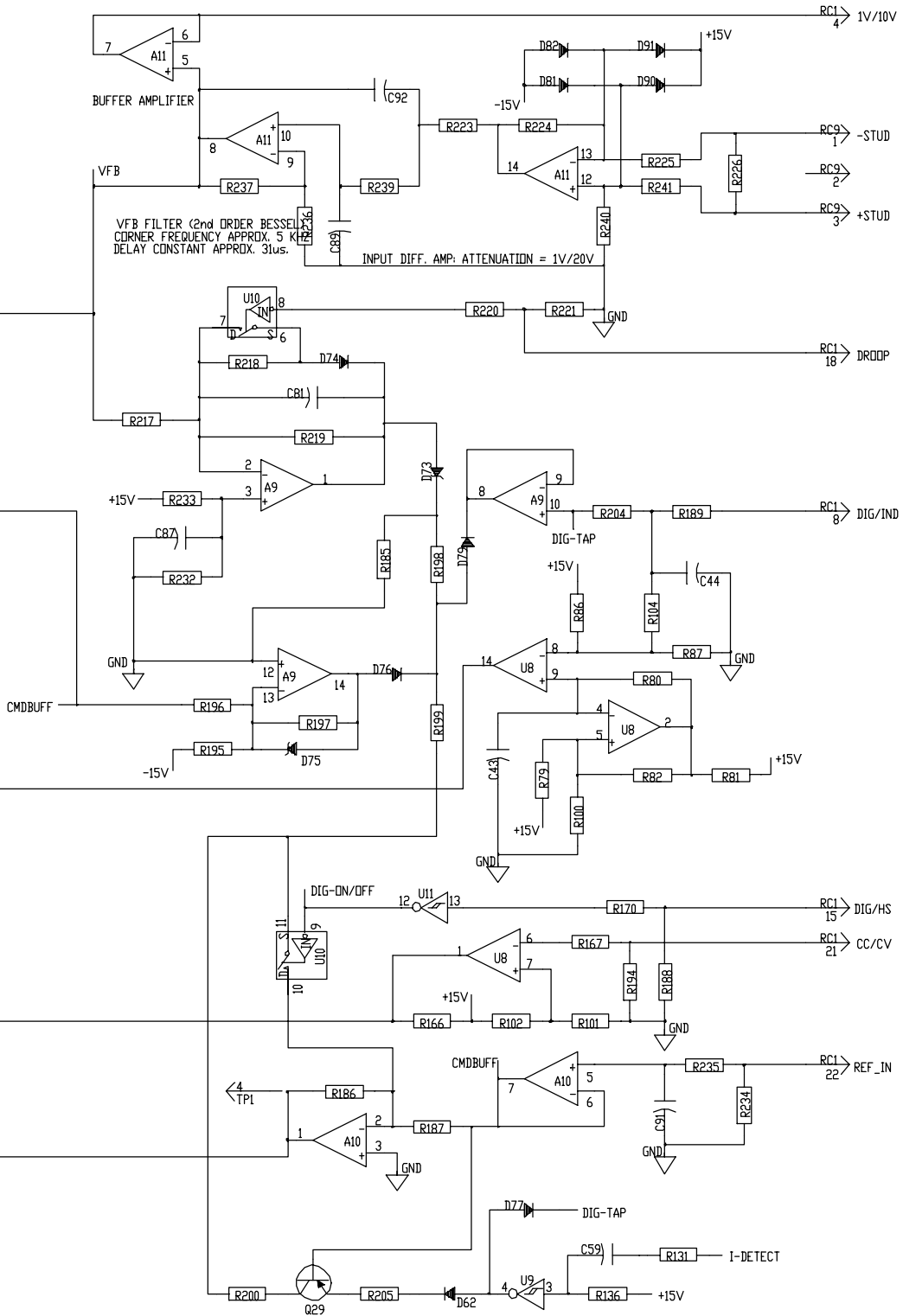
Figure 10-4. Wiring Diagram For XMT 304 Effective With Serial No. KG139511 Thru KK104770

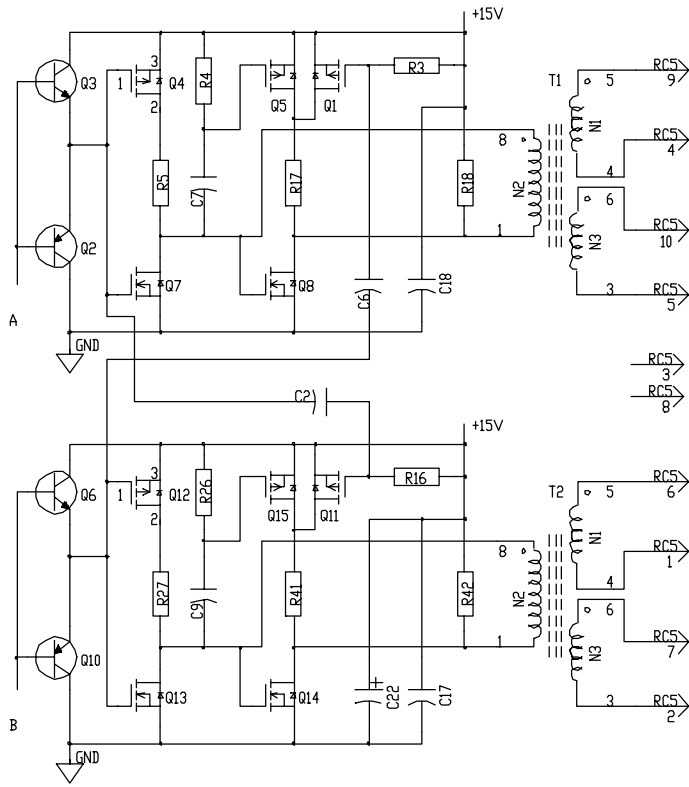


 ELECTRIC SHOCK HAZARD	⚠ WARNING
	<ul style="list-style-type: none"> • Do not touch live electrical parts. • Disconnect input power or stop engine before servicing. • Do not operate with covers removed. • Have only qualified persons install, use, or service this unit.



**Figure 10-6. Circuit Diagram For Control Board PC1
Effective With Serial No. KK104771 And Following (Part 1 Of 3)**





GATE DRIVES

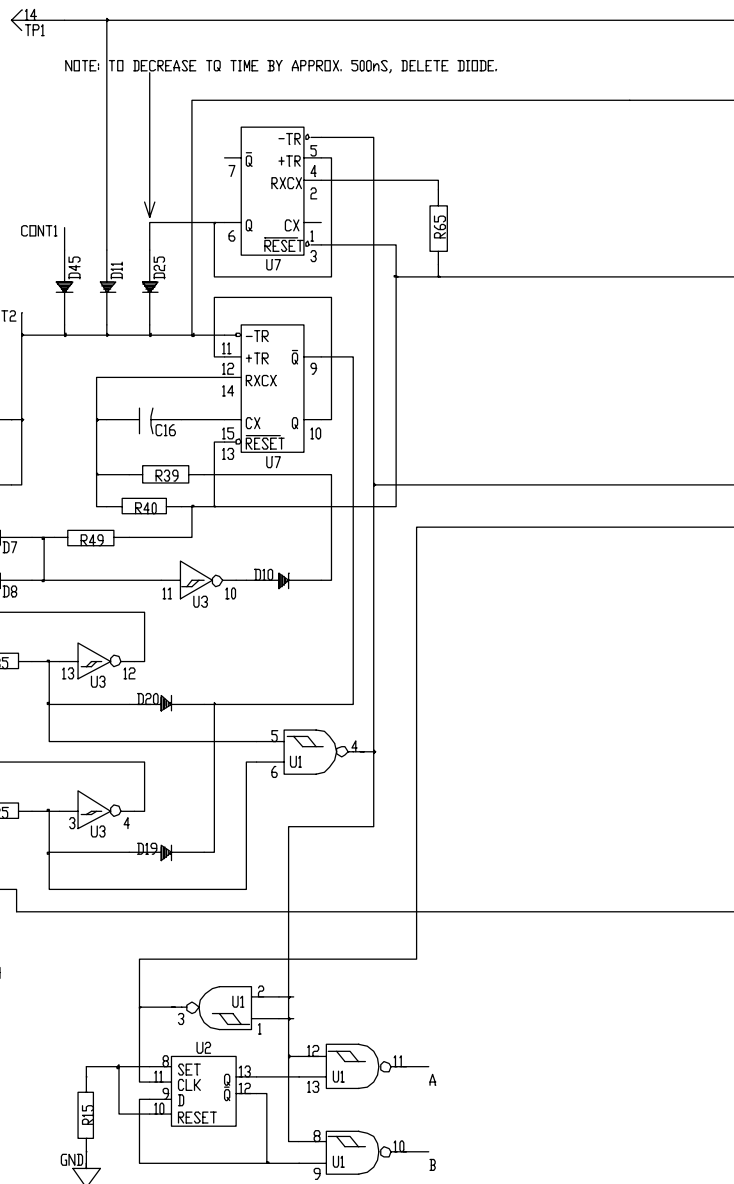
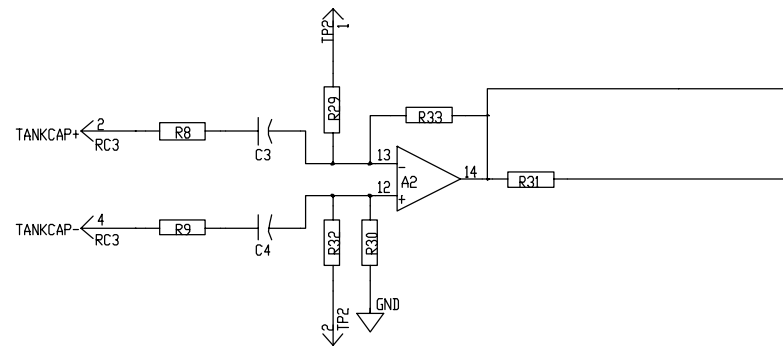
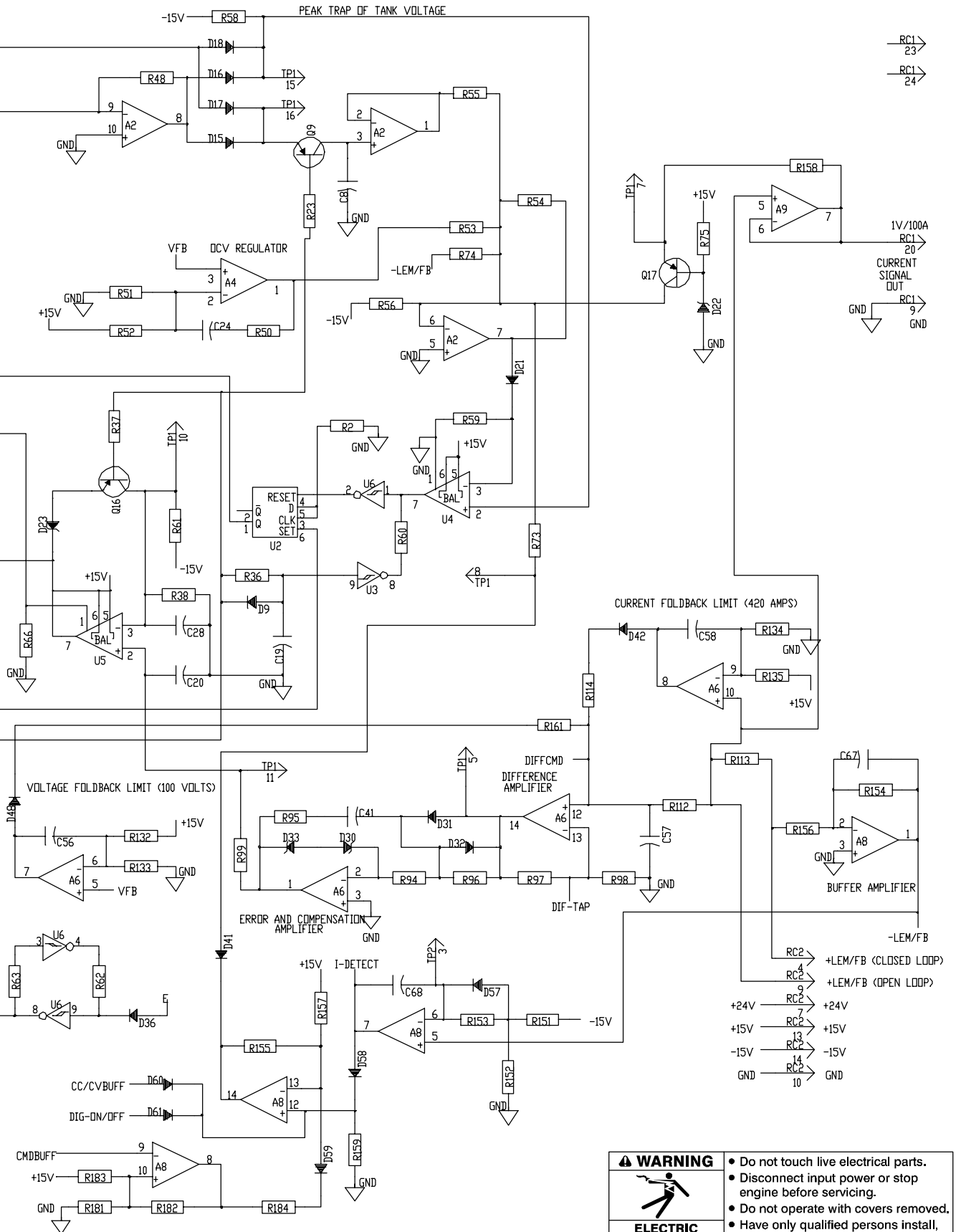
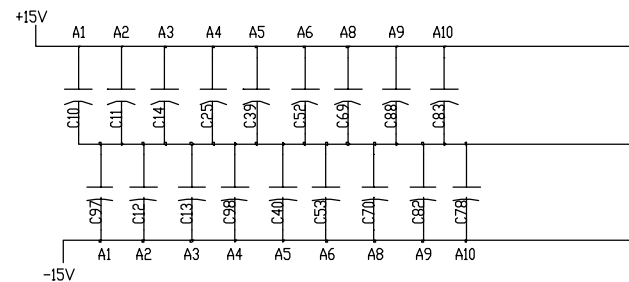
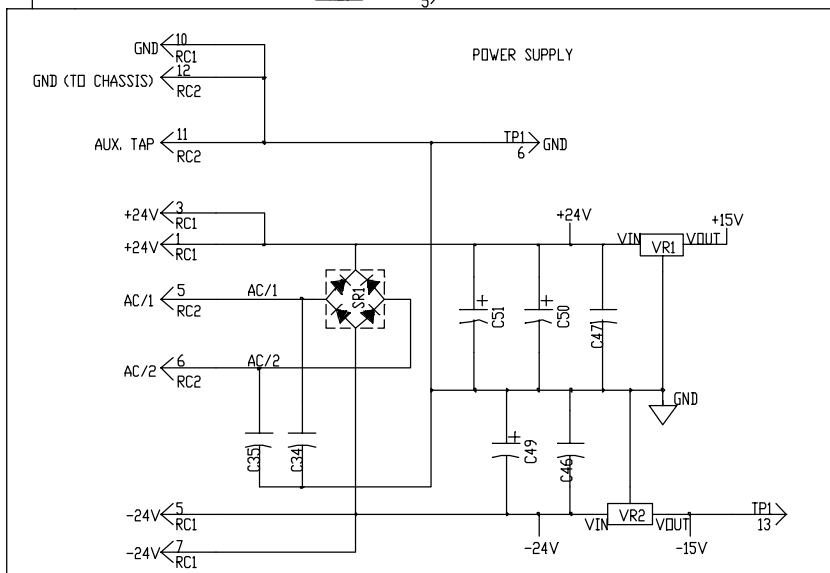
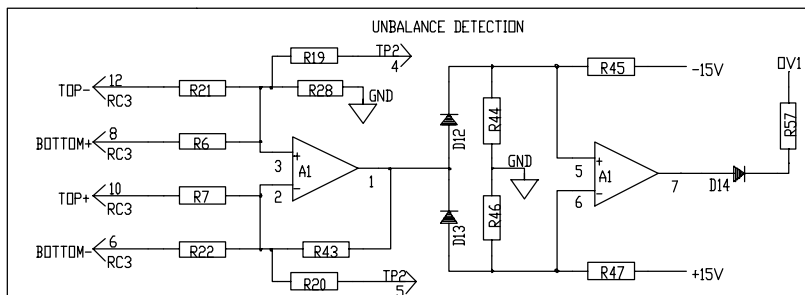
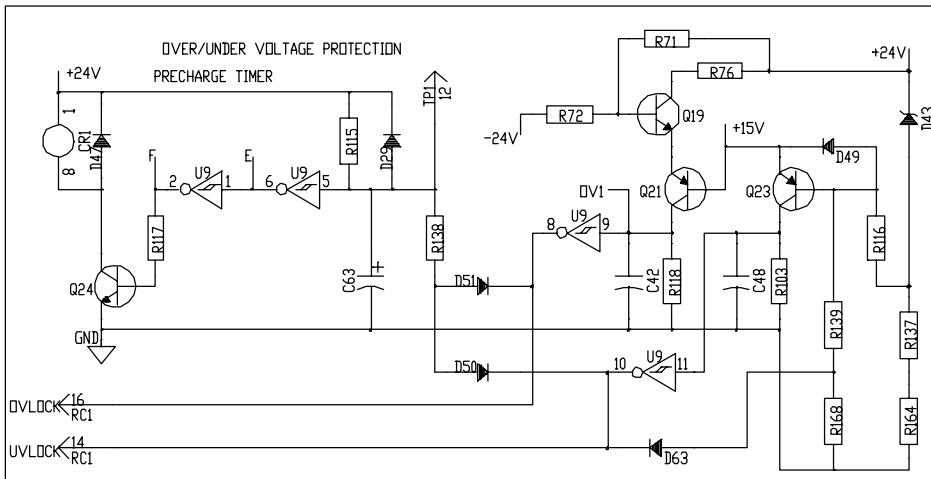


Figure 10-7. Circuit Diagram For Control Board PC1 Effective With Serial No. KK104771 And Following (Part 2 Of 3)

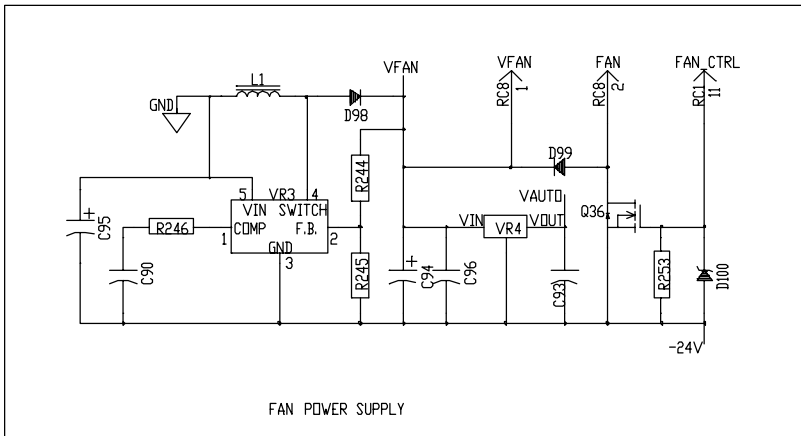




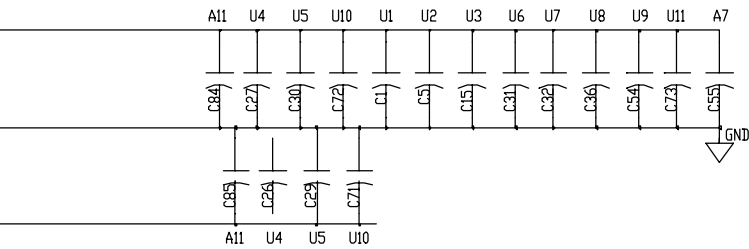
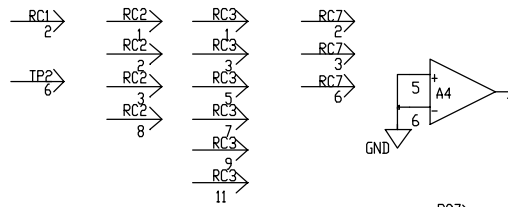
- Do not touch live electrical parts.
- Disconnect input power or stop engine before servicing.
- Do not operate with covers removed.
- Have only qualified persons install, use, or service this unit.



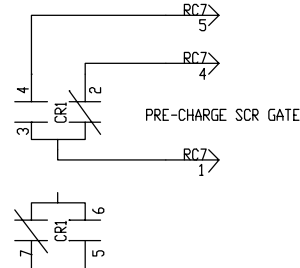
**Figure 10-8. Circuit Diagram For Control Board PC1
Effective With Serial No. KK104771 And Following (Part 3 Of 3)**

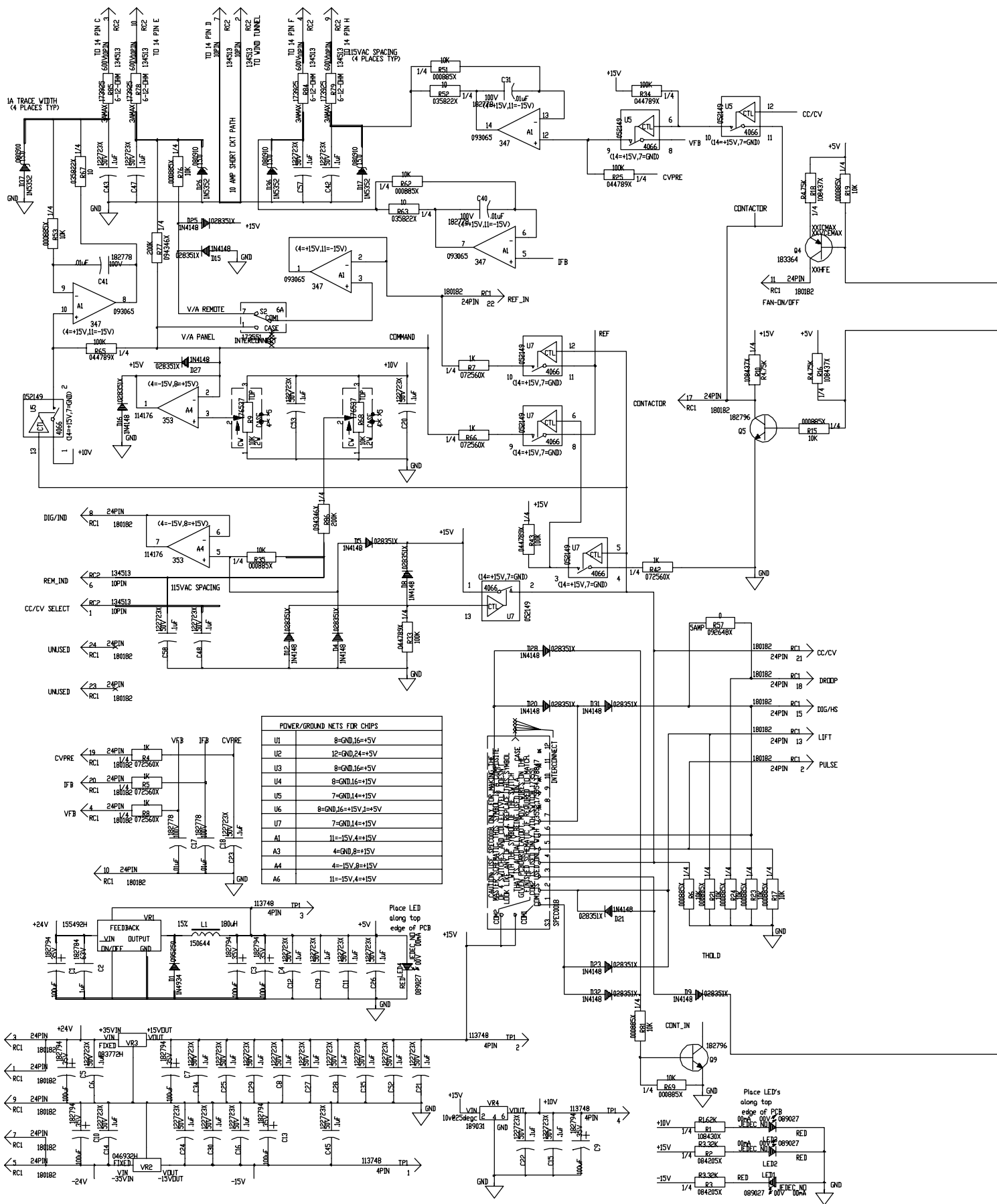


POWER/GROUND NETS FOR CHIPS	
U1	7=GND,14=+15V
U2	7=GND,14=+15V
U3	7=GND,14=+15V
U4	4=-15V,8=+15V
U5	4=-15V,8=+15V
U6	7=GND,14=+15V
U7	8=GND,16=+15V
U8	12=GND,3=+15V
U9	7=GND,14=+15V
U10	4=-15V,5=GND,12=+15V,13=+15V
U11	7=GND,14=+15V
U12	12=-24V,3=VFAN
U13	7=GND,14=+15V
A1	4=-15V,8=+15V
A2	4=+15V,11=-15V
A3	6=-15V,11=+15V
A4	4=-15V,8=+15V
A5	4=+15V,11=-15V
A6	4=+15V,11=-15V
A7	4=GND,8=+15V
A8	4=+15V,11=-15V
A9	4=+15V,11=-15V
A10	4=+15V,11=-15V
A11	4=+15V,11=-15V
A12	

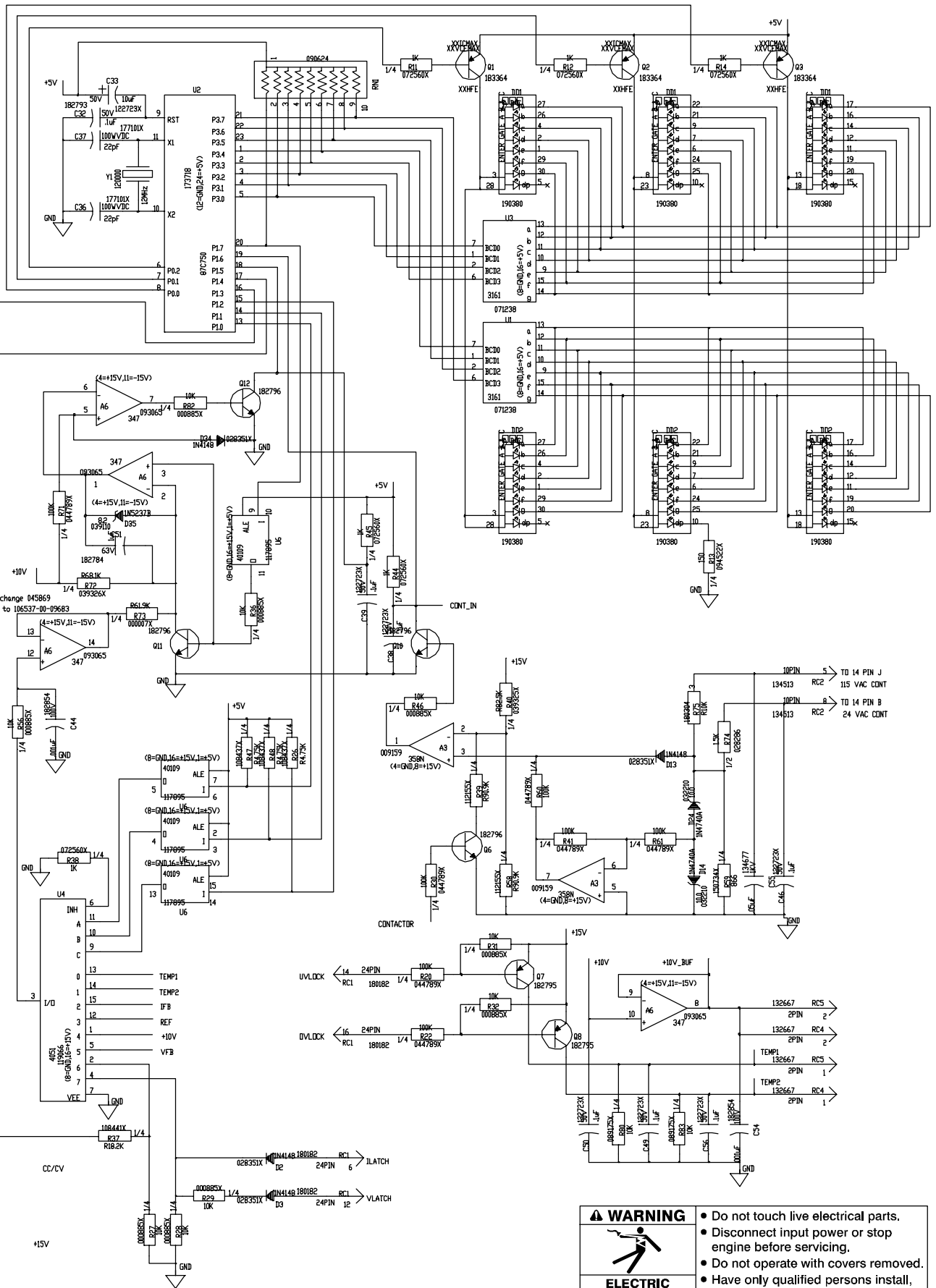



BYPASS CAPS





**Figure 10-9. Circuit Diagram For Display Board PC3 (CC Models)
Effective With Serial No. KH523189 And Following**



 ELECTRIC SHOCK HAZARD	WARNING
	<ul style="list-style-type: none"> • Do not touch live electrical parts. • Disconnect input power or stop engine before servicing. • Do not operate with covers removed. • Have only qualified persons install, use, or service this unit.

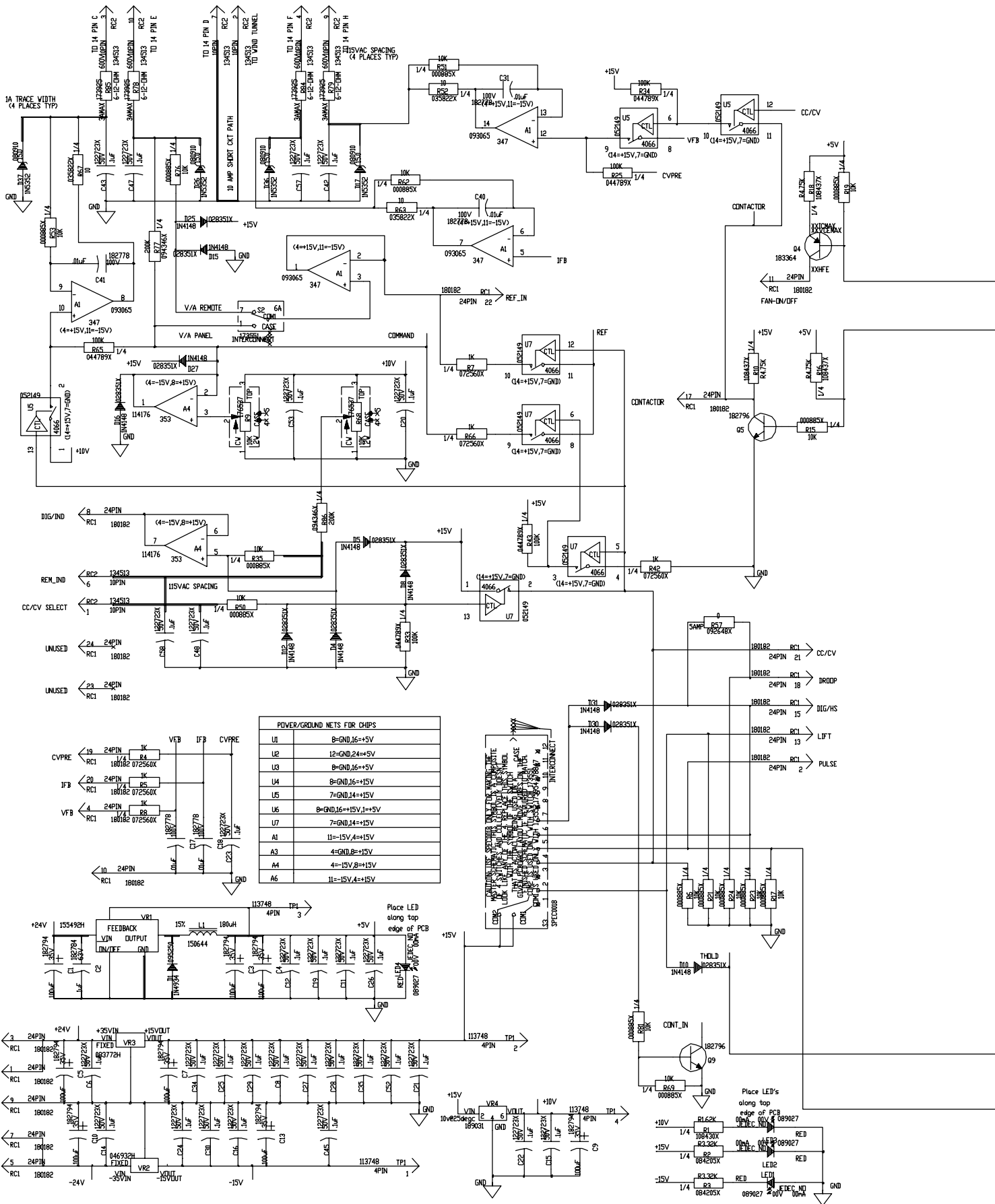
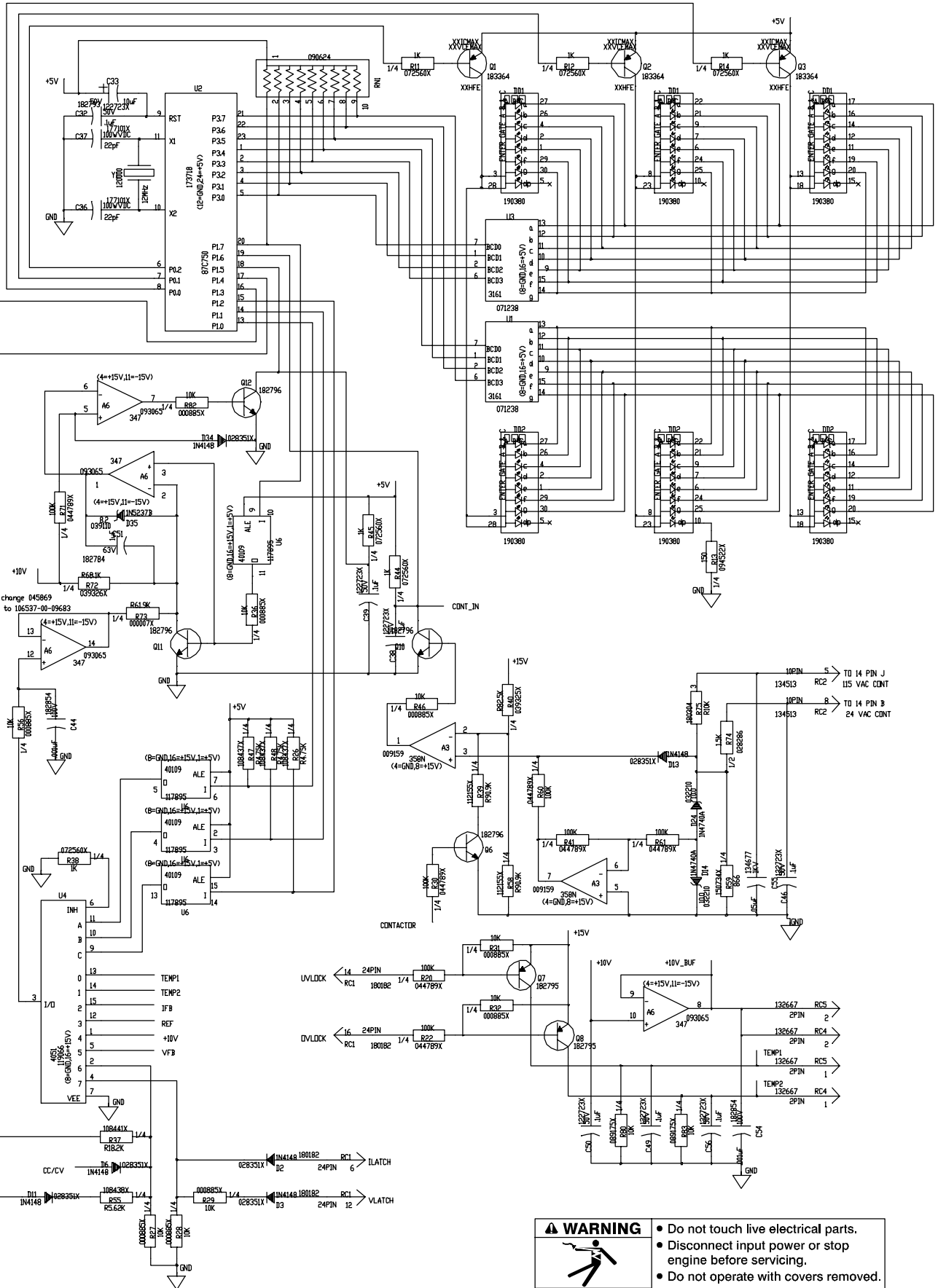


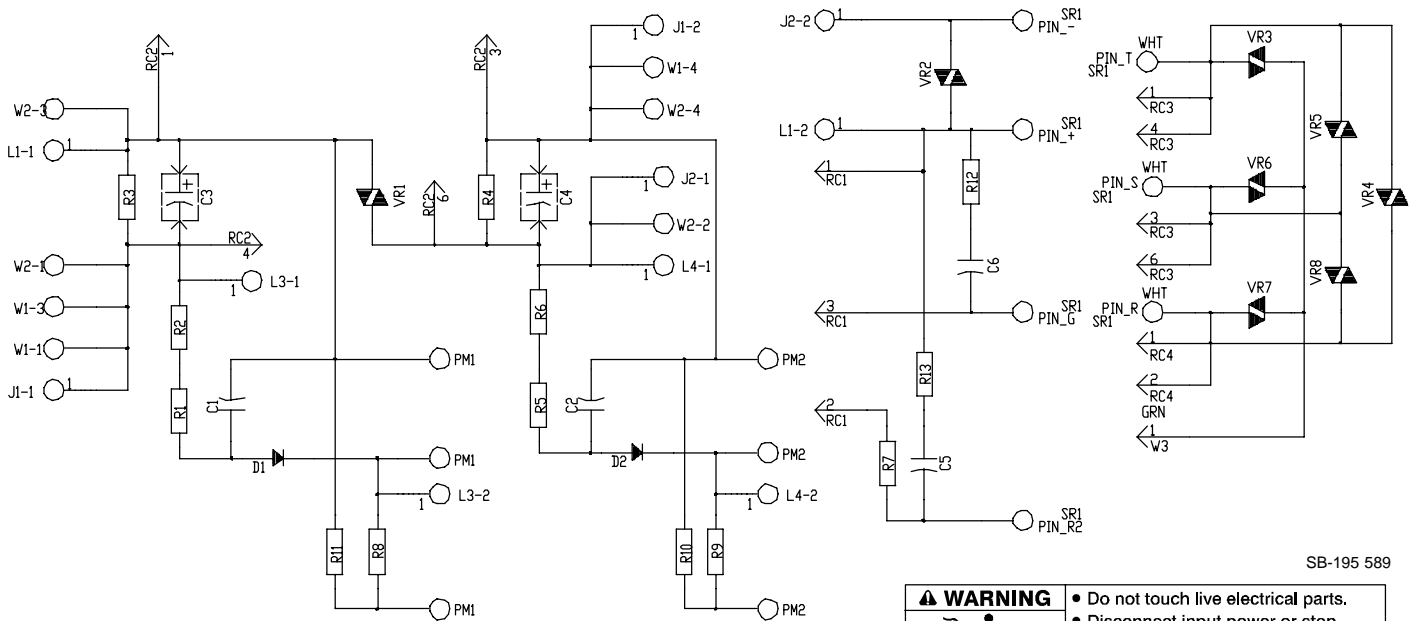
Figure 10-10. Circuit Diagram For Display Board PC3 (CC/CV Models)
Effective With Serial No. KH357827 And Following



⚠ WARNING

- Do not touch live electrical parts.
- Disconnect input power or stop engine before servicing.
- Do not operate with covers removed.
- Have only qualified persons install, use, or service this unit.

ELECTRIC SHOCK HAZARD



SB-195 589


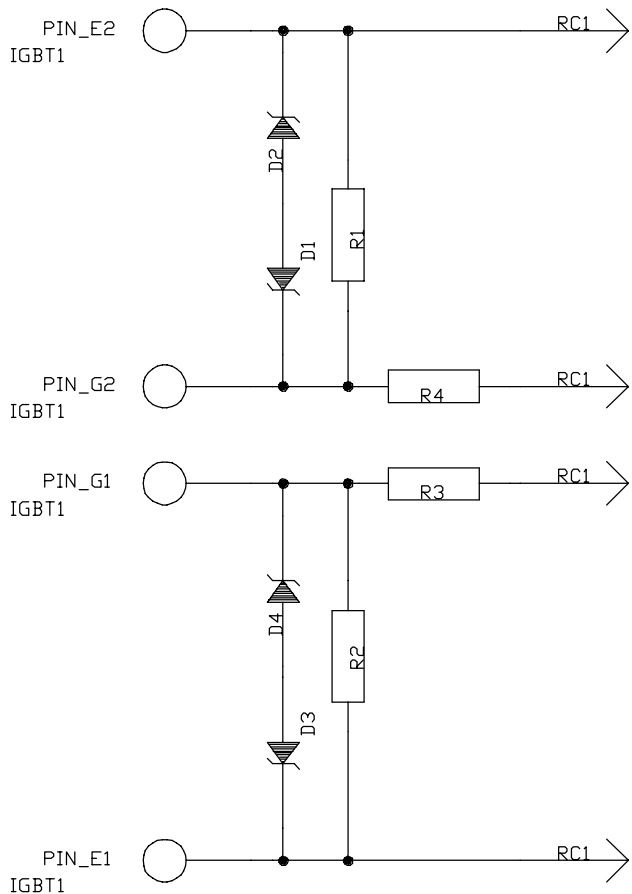

 ELECTRIC SHOCK HAZARD	WARNING
	<ul style="list-style-type: none"> • Do not touch live electrical parts. • Disconnect input power or stop engine before servicing. • Do not operate with covers removed. • Have only qualified persons install, use, or service this unit.


Figure 10-11. Circuit Diagram For Interconnecting Board PC2 Effective With Serial No. KK276103 And Following

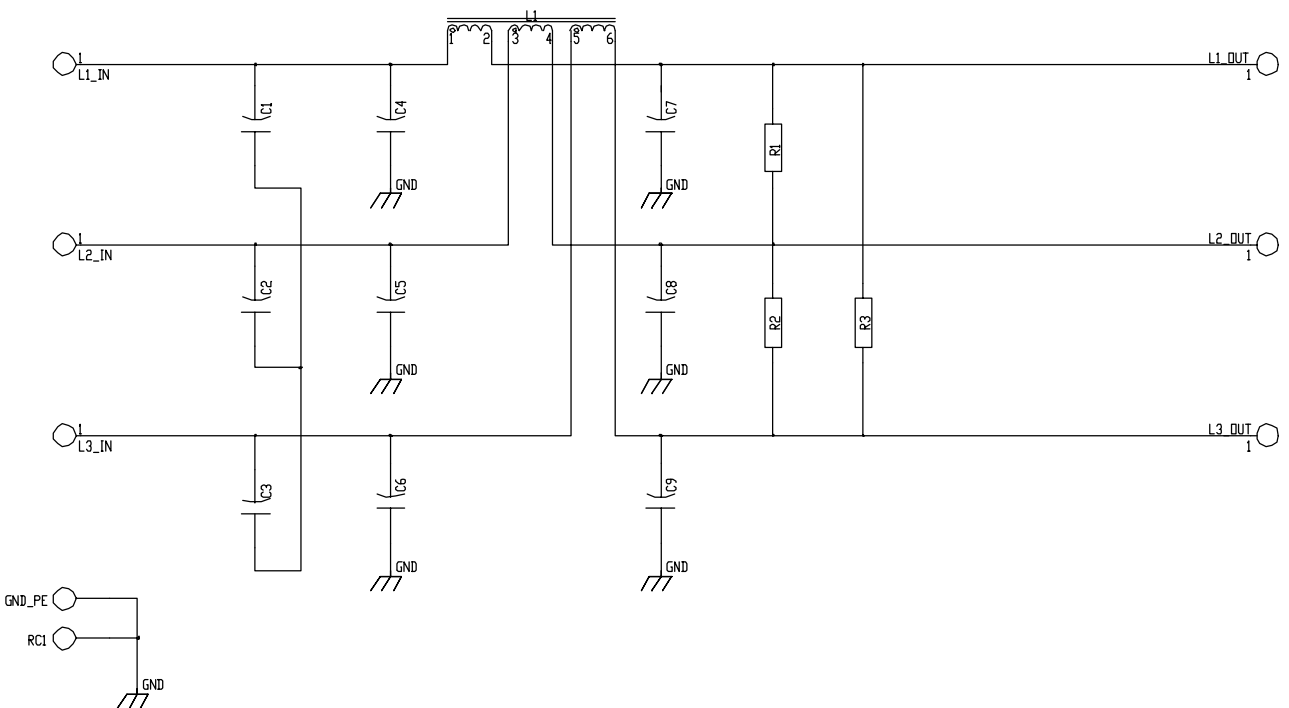


 ELECTRIC SHOCK HAZARD	WARNING
	<ul style="list-style-type: none"> • Do not touch live electrical parts. • Disconnect input power or stop engine before servicing. • Do not operate with covers removed. • Have only qualified persons install, use, or service this unit.

188 015

Figure 10-12. Circuit Diagram For IGBT Boards PC4, PC5 Effective With Serial No. KH391020 And Following

 ELECTRIC SHOCK HAZARD	WARNING
	<ul style="list-style-type: none"> • Do not touch live electrical parts. • Disconnect input power or stop engine before servicing. • Do not operate with covers removed. • Have only qualified persons install, use, or service this unit.



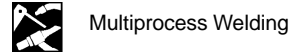
SA-186 775

Figure 10-13. Circuit Diagram For Filter Board PC6 Effective With Serial No. KH391015 And Following



TM-180 670B September 2001

Processes



Description



Arc Welding Power Source

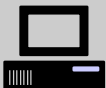
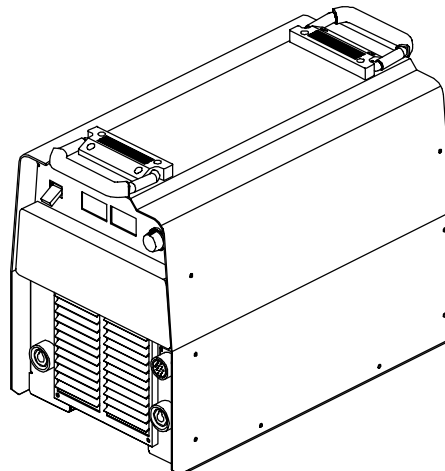
CE

XMT[®] 304 (400 Volt Models)

PARTS LIST

Eff w/KG139511 And Following

For OM-180 670 Revisions * Thru M



Visit our website at
www.MillerWelds.com

SECTION 11 – PARTS LIST FOR KG139511 AND FOLLOWING

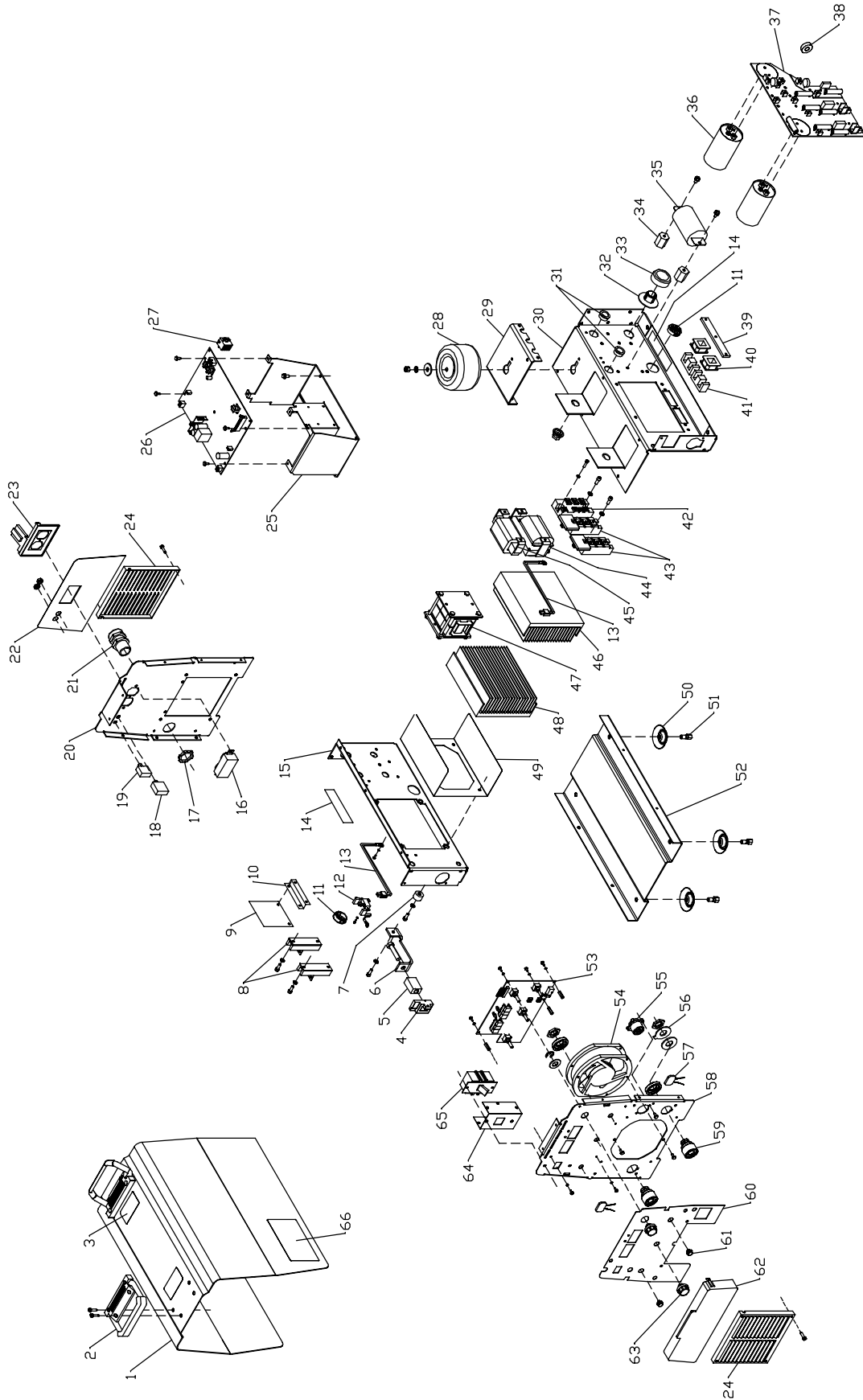


Figure 11-1. Parts Assembly

Eff w/KG139511 And Following

Item No.	Dia. Mkgs.	Part No.	Description	Quantity	
Figure 11-1. Parts Assembly					
...	1	...	+175 148 .. WRAPPER	1	
...		...	175 256 .. INSULATOR, side RH	2	
...		...	178 551 .. INSULATOR, side LH	2	
...	2	...	195 585 .. HANDLE	2	
...	3	...	179 309 .. LABEL, caution falling equipment	2	
...	4	HD1	156 313 .. TRANSDUCER, current 300A (Prior to KK104771)	1	
...		PLG9	130 204 .. CONNECTOR & PINS (Prior to KK104771)	1	
...	5	...	175 142 .. BUS BAR, lem (Prior to KK104771)	1	
...	6	...	175 139 .. BUS BAR, output rectifier (Prior to KK104771)	1	
...	4	HD1	189 567 .. TRANSDUCER, current 300A (Eff w/KK104771)	1	
...		PLG9	183 046 .. CABLE, LEM (Eff w/KK104771)	1	
...	5	...	194 546 .. BUS BAR, lem (Eff w/KK104771)	1	
...	6	...	175 139 .. BUS BAR, output rectifier (Eff w/KK104771)	1	
...	7	...	181 853 .. INSULATOR, screw	1	
...	8	D1,2	179 630 .. KIT DIODE, ultra fast recovery	2	
...	9	PC6	191 916 .. CIRCUIT CARD, filter board kit (Prior to KH391014)	1	
...	9	PC6	185 697 .. CIRCUIT CARD, filter board (Eff w/KH391014)	1	
...	10	...	187 146 .. BRACKET, mtg filter board (Eff w/KH391014)	1	
...	11	...	179 276 .. BUSHING, snap-in nyl 1.000 ID x 1.375mtg hole	2	
...	12	C5,6 R1	175 194 .. RESISTOR/CAPACITOR	1	
...	13	RT1,2	173 632 .. THERMISTOR, NTC 30K ohm	2	
...	14	...	185 836 .. LABEL, warning exploding parts	2	
...	15	...	+183 551 .. WINDTUNNEL, LH	1	
...	16	...	604 176 .. RECEPTACLE, str dx grd 2P3W 15A 125V (with aux. power)	1	
...	17	...	198 245 .. NUT, .750NPT	1	
...	18	CB1	161 078 .. CIRCUIT BREAKER, man reset 1P 7A 250VAC (with aux. power)	1	
...	18	CB1	089 807 .. CIRCUIT BREAKER, man reset 1P 2.5A 250VAC (without aux. power)	1	
...	19	CB2	083 432 .. CIRCUIT BREAKER, man reset 1P 10A 250VAC	1	
...	20	...	191 918 .. PANEL, rear	1	
...	21	...	186 440 .. BUSHING, strain relief	1	
...		...	198 246 .. WASHER, flat	1	
...		...	179 625 .. CABLE, pwr 6mm 4/c 60	1	
...	22	PLATE, ident rear (order by model and serial number)	1
...	23	...	175 282 .. COVER, receptacle (with aux. power)	1	
...	24	...	175 138 .. BOX, louver	2	
...	25	...	192 853 .. BRACKET, mtg contactor/capacitor/PC Board	1	
...	26	PC1	178 567 .. CIRCUIT CARD, control (Prior to KG150087)	1	
...	26	PC1	188 071 .. CIRCUIT CARD, control (Eff w/KG150087 thru KK104771)	1	
...		PLG2	115 092 .. CONNECTOR & SOCKETS	1	
...		PLG3	115 093 .. CONNECTOR & SOCKETS	1	
...		PLG5	115 091 .. CONNECTOR & SOCKETS	1	
...		PLG7	115 093 .. CONNECTOR & SOCKETS	1	
...	26	PC1	193 756 .. CIRCUIT CARD, control (Eff w/KK104771 and on)	1	
...		PLG2	131 056 .. CONNECTOR & SOCKETS	1	
...		PLG3	130 203 .. CONNECTOR & SOCKETS	1	
...		PLG5	115 091 .. CONNECTOR & SOCKETS	1	
...		PLG7	115 093 .. CONNECTOR & SOCKETS	1	
...	27	RC10	166 679 .. CONNECTOR & SOCKETS	1	
...	28	T2	183 261 .. TRANSFORMER, control 200/400VAC (without aux. power)	1	
...	28	T2	195 829 .. TRANSFORMER, control 200/400VAC (with aux. power)	1	
...	29	...	183 549 .. BRACKET, mtg aux transformer	1	
...	30	...	+192 855 .. WINDTUNNEL, RH	1	
...	31	...	153 403 .. BUSHING, snap-in nyl .750 ID x 1.000mtg	2	
...	32	...	177 547 .. BUSHING, snap-in nyl 1.125mtg	1	
...	33	CT1	175 199 .. TRANSFORMER, current	1	
...	34	...	025 248 .. STAND-OFF, insul	2	
...	35	C1	188 446 .. CAPACITOR, polyp film .5uf 900VDC	1	

Eff w/KG139511 And Following

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
Figure 11-1. Parts Assembly (Continued)				
... 36	C3,4	193 285	.. CAPACITOR, elcltl 2700uf 450VDC (Prior to KJ297193, kit includes capacitors C3, C4 and mounting bracket part no. 193 288)	1
... 36	C3,4	192 935	.. CAPACITOR, elcltl 2700uf 450VDC (Eff w/KJ297193)	2
... 37	PC2	+185 090	.. CIRCUIT CARD, interconnect (Prior to KK276107) (when ordering PC2, also order MOV protection board 198 095)	1
.....	PLG12	131 054	.. CONNECTOR & SOCKETS	1
.....	PLG13	131 204	.. CONNECTOR & SOCKETS	1
.....	PLG14,15	115 094	.. CONNECTOR & SOCKETS	2
... 37	PC2	197 585	.. CIRCUIT CARD, interconnect (Eff w/KK276107)	1
.....	PLG13	131 204	.. CONNECTOR & SOCKETS	1
.....	PLG14,21	115 093	.. CONNECTOR & SOCKETS	2
... 38	T3	182 108	.. CHOKE, common mode	1
... 39		175 140	.. BRACKET, DI/DT	1
... 40		175 482	.. COIL, DI/DT	2
... 41		109 056	.. CORE	2
... 42	SR1	179 629	.. KIT DIODE, power module	1
... 43	PM1,2	180 110	.. KIT, transistor IGBT module	1
... 44	Z1	173 570	.. STABILIZER	1
... 45	L1	173 563	.. INDUCTOR, input	1
... 46		173 631	.. HEAT SINK, power module	1
... 47	T1	179 616	.. TRANSFORMER, HF	1
... 48		175 192	.. HEAT SINK, rect	1
... 49		175 255	.. INSULATOR, rectifier	1
.....		175 969	.. INSULATOR, PC card	2
.....		181 197	.. GASKET, DI/DT rubber	1
... 50		173 693	.. FOOT, mtg unit	4
... 51		176 736	.. SCREW, mtg foot	4
... 52		175 132	.. BASE	1
... 53	PC3	*178 518	.. CIRCUIT CARD, front panel display (CC/CV model) (Prior to KG150087)	1
... 53	PC3	*190 707	.. CIRCUIT CARD, front panel display (CC/CV model) (Eff w/KG150087)	1
... 53	PC3	*190 710	.. CIRCUIT CARD, front panel display (CC only model)	1
.....	PLG11	115 091	.. CONNECTOR & SOCKETS	1
... 54	FM	175 084	.. MOTOR, fan 24VDC 3000RPM	1
... 55	RC1	175 217	.. RECEPTACLE, w/leads & plug (Prior to KG150087)	1
... 55	RC1	180 128	.. RECEPTACLE, w/leads & plug (Eff w/KG150087 thru KH357825)	1
... 55	RC1	185 730	.. RECEPTACLE, w/leads & plug (Eff w/KH357826 and on)	1
... 56		178 548	.. TERMINAL, connector friction	2
... 57	C7,8	186 543	.. CAPACITOR, cer disc .1uf 500VDC	2
... 58		185 732	.. PANEL, front	1
... 59		129 525	.. RECEPTACLE, twlk insul fem	2
... 60			.. NAMEPLATE, (order by model and serial number)	1
.....		070 590	.. TUBING, gl acryl .325 (order by ft)	1ft
.....		180 520	.. INSULATION, PC card	1
.....		145 088	.. KIT, connection Dinse	1
... 61		174 992	.. KNOB, pointer .840	2
... 62		175 855	.. DOOR, front	1
... 63		174 991	.. KNOB, pointer 1.250	2
... 64		176 226	.. INSULATOR, switch power	1
... 65	S1	128 756	.. SWITCH, tgl 3PST 40A 600VAC	1
... 66		179 310	.. LABEL, warning general precautionary	2

+When ordering a component originally displaying a precautionary label, the label should also be ordered.

*Prior to LB088400, individual seven segments can be replaced with Part No.186 914. Effective w/LB088400, displays are soldered in and not replaceable. Replace with proper PCB assembly.

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

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