



TM-363E

2007-01

Eff. w/Serial No. LE223624 For 350 LX Models

Eff. w/Serial No. LE282983 For 250 DX Models

Processes



TIG (GTAW) Welding



Stick (SMAW) Welding

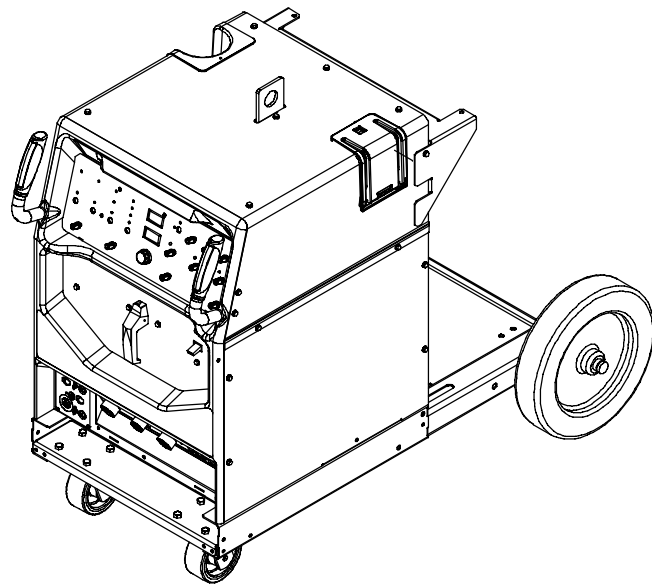
Description



Arc Welding Power Source

Effective with Serial No. LE223624 Thru LH010000L

Syncrowave[®] 250 DX / 350 LX And Syncrowave[®] 250 DX / 350 LX w/Integrated Cooler



CE And Non-CE Models

TECHNICAL MANUAL



Visit our website at
www.MillerWelds.com

File: TIG (GTAW)



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Declaration of Conformity for European Community (CE) Products

NOTE 

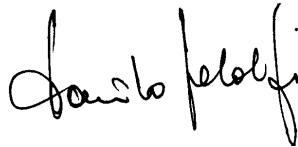
This information is provided for units with CE certification (see rating label on unit).

Manufacturer:

Miller Electric Mfg. Co.
1635 W. Spencer St.
Appleton, WI 54914 USA
Phone: (920) 734-9821

European Contact:

Mr. Danilo Fedolfi,
Managing Director
ITW Welding Products Italy S.r.l.
Via Privata Iseo 6/E
20098 San Giuliano
Milanese, Italy
Phone: 39(02)98290-1
Fax: 39(02)98290203



European Contact Signature: _____

Declares that the product:

Syncrowave® 250 DX

conforms to the following Directives and Standards:

Directives

Low Voltage Directive: 73/23/EEC

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

Machinery Directives: 98/37/EEC, 91/368/EEC, 92/31/EEC, 133/04, 93/68/EEC

Standards

Arc Welding Equipment – Part 2: Liquid Cooling Systems. IEC 60974-2 Ed. 1

Arc Welding Equipment – Part 10: Electromagnetic Compatibility (EMC) Requirements. IEC 60974-10, August 2002

Arc Welding Equipment – Part 1: Welding Power Sources: IEC 60974-1, Ed. 2.1

Degrees of Protection Provided By Enclosure (IP 23): IEC 60529 Ed. 2.1

Insulation Coordination For Equipment Within Low-Voltage Systems – Part 1: Principles, Requirements, And Tests.
IEC 60664-1 Ed. 1.1

Declaration of Conformity for European Community (CE) Products

NOTE 

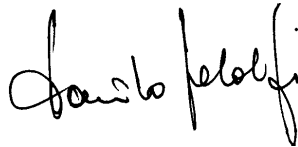
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Electromagnetic compatibility Directives: 89/336/EEC, 92/31/EEC

Machinery Directives: 98/37/EEC, 91/368/EEC, 92/31/EEC, 133/04, 93/68/EEC

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Insulation Coordination For Equipment Within Low-Voltage Systems – Part 1: Principles, Requirements, And Tests.
IEC 60664-1 Ed. 1.1

SECTION 1 – SAFETY PRECAUTIONS FOR SERVICING

▲ **Warning: Protect yourself and others from injury — read and follow these precautions.**

1-1. Symbol Usage

OM-363Q - 5/06, safety_stm 3/06



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.



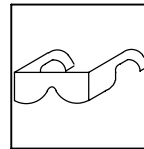
This group of symbols means Warning! Watch Out! possible ELECTRIC SHOCK, MOVING PARTS, and HOT PARTS hazards. Consult symbols and related instructions below for necessary actions to avoid the hazards.

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.**



FLYING METAL or DIRT 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.



ELECTRIC SHOCK can kill.

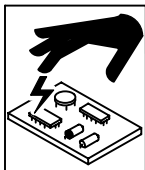
- Do not touch live electrical parts.
- Turn Off welding power source and wire feeder and disconnect and lockout input power using line disconnect switch, circuit breakers, or by removing plug from receptacle, or stop engine before servicing unless the procedure specifically requires an energized unit.

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 Troubleshooting 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.



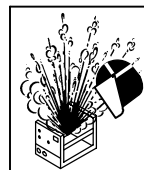
FIRE OR EXPLOSION hazard.

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



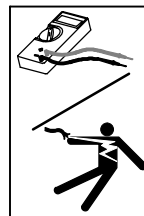
HOT PARTS can cause severe burns.

- Do not touch hot parts bare handed.
- Allow cooling period before working on equipment.
- To handle hot parts, use proper tools and/or wear heavy, insulated welding gloves and clothing to prevent burns.



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.



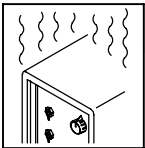
MOVING PARTS can cause injury.

- Keep away from moving parts such as fans.
- Keep away from pinch points such as drive rolls.
- Have only qualified persons remove doors, panels, covers, or guards for maintenance as necessary.
- Keep hands, hair, loose clothing, and tools away from moving parts.
- Reinstall doors, panels, covers, or guards when maintenance is finished and before re-connecting input power.



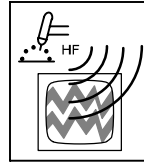
MAGNETIC FIELDS can affect pacemakers.

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



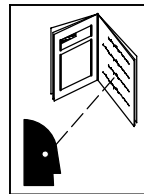
OVERUSE can cause OVERHEATING.

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

1-3. California Proposition 65 Warnings

- ▲ **Welding or cutting equipment 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.)**
- ▲ **Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. Wash hands after handling.**

For Gasoline Engines:

- ▲ **Engine exhaust contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.**

For Diesel Engines:

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

1-4. 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 before welding or going near welding operations. If cleared by your doctor, then following the above procedures is recommended.

SECTION 2 – DEFINITIONS

2-1. Warning Label Definitions

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

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

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
























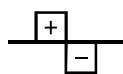








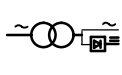


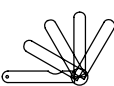
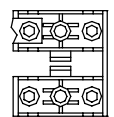


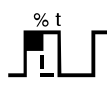


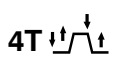
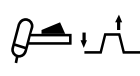




2 Electric shock from wiring can kill.

3 Do not operate unit or reach inside when torch/cable holder is removed.

4 Do not exceed 25 lb (12.4 kg) maximum load on gun/cable holder or holder may break.

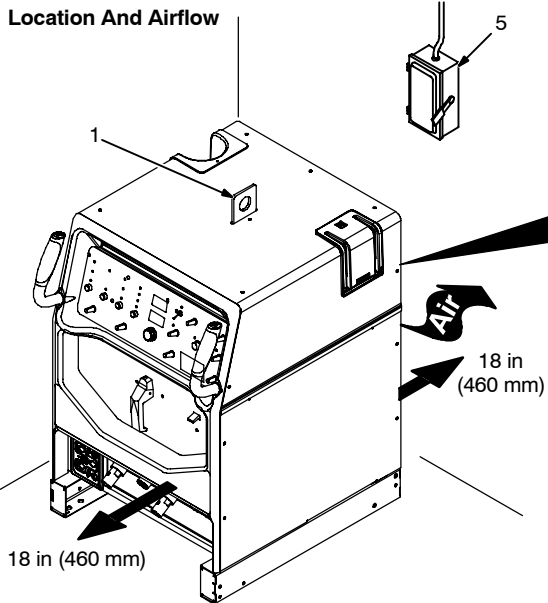
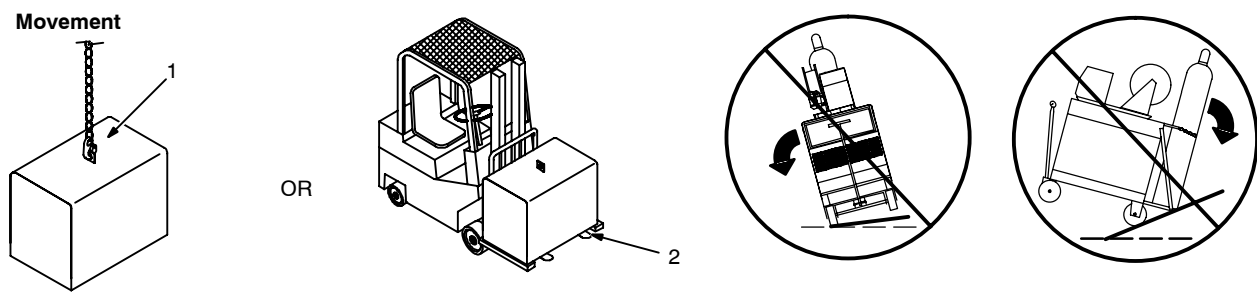
206 343

2-3. Symbols And Definitions

NOTE 		<i>Some symbols are found only on CE products.</i>					
A	Amperes		Panel-Local		Gas Tungsten Arc Welding (GTAW)		Shielded Metal Arc Welding (SMAW)
V	Volts		Do Not Switch While Welding		Arc Force (DIG)		Background Amps
	Output		Circuit Breaker		Remote		Temperature
	Protective Earth (Ground)		Alternating Current		High Frequency - Start		Water Input
	Postflow Timer t_2		Prewflow Timer t_1		High Frequency - Continuous		Water Output
	Gas (Supply)		Gas Output		Gas Input		Increase/Decrease Of Quantity
I	On		Off	%	Percent		Direct Current
	Balance Control		Maximum Cleaning		Maximum Penetration		Electrode Positive
	Electrode Negative		Final Slope t		Meter		Single-Phase
U₀	Rated No Load Voltage (Average)	U₁	Primary Voltage	U₂	Conventional Load Voltage		Line Connection
I₁	Primary Current	I₂	Rated Welding Current	X	Duty Cycle		Single-Phase Combined AC/DC Power Source
IP	Degree Of Protection	I_{1eff}	Maximum Effective Supply Current	I_{1max}	Rated Maximum Supply Current	Hz	Hertz
	Electrode		Work		Thickness Gauge		Spark Gap
S	Seconds		Final Amperage A		Initial Time t		Initial Amperage A
	Pulse Percent On Time $\% t$		Spot Time t		Lift-Arc™		4 Step Trigger Operation Sequence $4T$
	Trigger Hold		Pulsar On-Off		Pulse Frequency f		Input V
	Cooling						

SECTION 3 – INSTALLATION

3-1. Selecting A Location



250 DX Models

3

SERIAL NO. XXXXXXX3 LR5071
 STOCK NO. XXXXXXXXXXXXXXX4 US

PROTECTED BY ONE OR MORE OF THE FOLLOWING US. PATENTS:

XXXXX05 XXXXX06 XXXXX07 XXXXX09
 XXXXX10 XXXXX11 XXXXX15 XXXXX21
 XXXXX24 XXXXX25 XXXXX26 XXXXX32
 XXXXX42 XXXXX47 XXXXX48

EVIDENCE OF LABEL T AMPERING VOIDS WARRANT

4

Symbol	3A/15V				310A/11V							
	X	25%	40%	60%	100%	X	25%	40%	60%	100%		
	L	310	260	200	160	L	310	260	200	160		
	U _i =80V	U _i	17	16	16.4	18	U _i =80V	U _i	32	30	29	28.4

350 LX Models

3

SERIAL NO. XXXXXXX3 LR5071
 STOCK NO. XXXXXXXXXXXXXXX4 US

PROTECTED BY ONE OR MORE OF THE FOLLOWING US. PATENTS:

XXXXX05 XXXXX06 XXXXX07 XXXXX09
 XXXXX10 XXXXX11 XXXXX15 XXXXX21
 XXXXX24 XXXXX25 XXXXX26 XXXXX32
 XXXXX42 XXXXX47 XXXXX48

EVIDENCE OF LABEL T AMPERING VOIDS WARRANT

4

Symbol	3A/15V				400A/11V							
	X	30%	40%	60%	100%	X	30%	40%	60%	100%		
	L	400	360	300	260	L	400	360	300	260		
	U _i =80V	U _i	17.8	17.2	16.8	18	U _i =80V	U _i	33	34	32	30

- ▲ 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.

- 1 Lifting Eye
 2 Lifting Forks
 Use lifting eye or lifting forks to move unit.
 If using lifting forks, extend forks beyond opposite side of unit.
- 3 Serial Number/Patent Label
 4 Rating Label
 Use rating label to determine input power needs.

- 5 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.**
- ▲ Be careful when placing or moving unit over uneven surfaces.**

Ref. 117 264-C / 803 584-A / 216 202-D / 216 203-C / 208 998

3-2. Dimensions And Weights

Dimensions	
Height	36-1/4 in (921 mm)
Width	23 in (584 mm)
Length	28 in (711 mm)
A	25 in (635 mm)
B	1-25/64 in (35 mm)
C	1-5/8 in (41 mm)
D	22 in (559 mm)
E	20 in (508 mm)
F	22-1/4 (565 mm)
G	1-1/8 in (29 mm)
H	1/2 in (13 mm) Dia
Weight	
400 lbs (181 kg) For 250 DX Models	
496 lbs (225 kg) For 350 LX Models	

3-3. Cooler Specifications

Cooler Specifications			
Cooler Tank Capacity	3 gallons (11.4 L)		
Coolant Flow Rate	1 liter per minute (1.1 quart)		
Use With Torches Rated Up To 400 Amperes			
Cooling Power	1.28 kW	Maximum Pressure	60 PSI (.41 MPa)

3-4. Welding Power Source Specifications

A. For 350 LX Models

Rated Welding Output	PFC **	Amperes Input at AC Balanced Rated Load Output, 50/60 Hz, Single-Phase								KVA	KW	Amperage Range	Max OCV
		200V	220V	230V	400V	440V	460V	520V	575V				
NEMA Class I (60) – 300 Amperes, 32 Volts AC, 60% Duty Cycle	No PFC	125 3.3*	103 2.2*	110 2.0*	57 1.5*	52 1.2*	55 1.7*	43 1.0*	42 1.1*	25.0 0.9*	10.6 0.6*	3 – 400A	80V
	With PFC	92 77*	77 67*	78 69*	40 36*	39 33*	38 34*	33 28*	31 27.2*	18.0 16.6*	10.5 0.6*		
NEMA Class II (40) – 350 Amperes, 34 Volts AC, 40% Duty Cycle	No PFC	146 3.3*	120 2.2*	128 2.6*	66 2.5*	60 1.2*	65 1.7*	51 1.0*	50 1.1*	29.5 0.9*	13.7 0.4*	3 – 400A	80V
	With PFC	114 77*	95 67*	94 69*	49 36*	47 33*	47 34*	40 28*	38 27.2*	21.7 16.6*	13.3 0.6*		

*While idling
**Power Factor Correction

B. For 250 DX Models

Rated Welding Output	PFC**	Amperes Input at AC Balanced Rated Load Output, 60 Hz, Single-Phase				KVA	KW	Amperage Range	Max OCV
		200V	230V	460V	575V				
NEMA Class I (40) – 200 Amperes, 28 Volts AC, 60% Duty Cycle	No PFC	88 *3.3	77 *2.8	38 *1.5	31 *1.1	17.6 *.59	8.6 *.29	3 – 310A	80V
	With PFC	60 *55.3	52 *49.5	26 *24.5	21 *19.6	12.06 *11.2	8.11 *.39	3 – 310A	80V
NEMA Class II (40) – 250 Amperes, 30 Volts AC, 40% Duty Cycle	No PFC	110 *3.3	96 *2.8	48 *1.5	38 *1.1	21.98 *.59	11.76 *.29	3 – 310A	80V
	With PFC	82 *55.3	71 *49.5	35 *24.5	28 *19.6	16.32 *11.2	11.81 *1.93	3 – 310A	80V

*While idling
**Power Factor Correction

Rated Welding Output	PFC**	Amperes Input at AC Balanced Rated Load Output, 50/60 Hz, Single-Phase				KVA	KW	Amperage Range	Max OCV
		220V	400V	440V	520V				
NEMA Class I (40) – 200 Amperes, 28 Volts AC, 60% Duty Cycle	No PFC	82 *3.0	45 *1.6	41 *1.4	35 *1.2	17.6 *.59	8.6 *.29	3 – 310A	80V
	With PFC	61 *45.9	34 *25.1	31 *22.8	26 *23.2	12.06 *11.2	8.11 *.39	3 – 310A	80V
NEMA Class II (40) – 250 Amperes, 30 Volts AC, 40% Duty Cycle	No PFC	100 *3.0	55 *1.6	50 *1.4	42 *1.2	21.98 *.59	11.76 *.29	3 – 310A	80V
	With PFC	81 *45.9	44 *25.1	40 *22.8	34 *23.2	16.32 *11.2	11.81 *1.93	3 – 310A	80V

*While idling
**Power Factor Correction

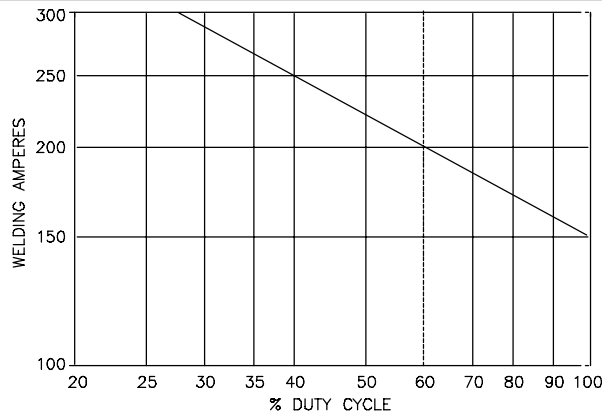
Rated Welding Output	PFC**	Amperes Input at AC Balanced Rated Load Output, 50 Hz, Single-Phase				KVA	KW	Amperage Range	Max OCV
		200V	230V	460V	575V				
NEMA Class I (40) – 175 Amperes, 27 Volts AC, 60% Duty Cycle	No PFC	80 *3.3	69 *2.8	35 *1.5	28 *1.1	15.9 *.59	7.4 *.29	3 – 310A	80V
	With PFC	52 *55.3	45 *49.5	22 *24.5	18 *19.6	10.3 *11.2	7.3 *.39	3 – 310A	80V
NEMA Class II (40) – 225 Amperes, 29 Volts AC, 40% Duty Cycle	No PFC	101 *3.3	88 *2.8	44 *1.5	35 *1.1	20.2 *.59	10.2 *.29	3 – 310A	80V
	With PFC	74 *55.3	64 *49.5	32 *24.5	26 *19.6	14.7 *11.2	10.1 *1.93	3 – 310A	80V

*While idling
**Power Factor Correction

3-5. Duty Cycle And Overheating



250 DX Models

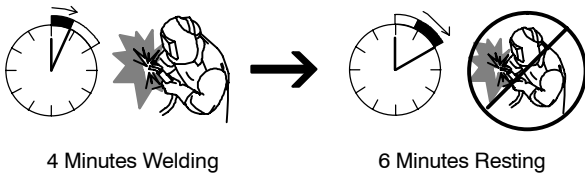


Duty Cycle is the percentage of 10 minutes that the unit can weld at rated load without overheating.

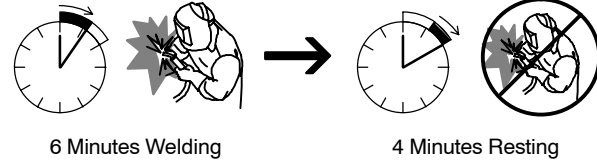
If unit overheats, output stops, front panel voltmeter/ammeter displays a HLP3 or HLP5 message (see Section 6-2), and cooling fans run. Wait fifteen minutes for unit to cool. Reduce amperage or duty cycle before welding.

▲ Exceeding duty cycle can damage unit and void warranty.

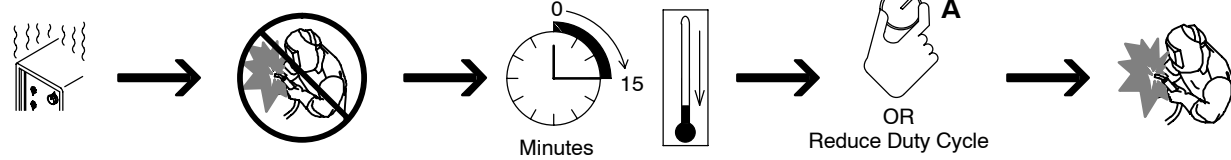
40% Duty Cycle At 250 Amperes



60% Duty Cycle At 200 Amperes

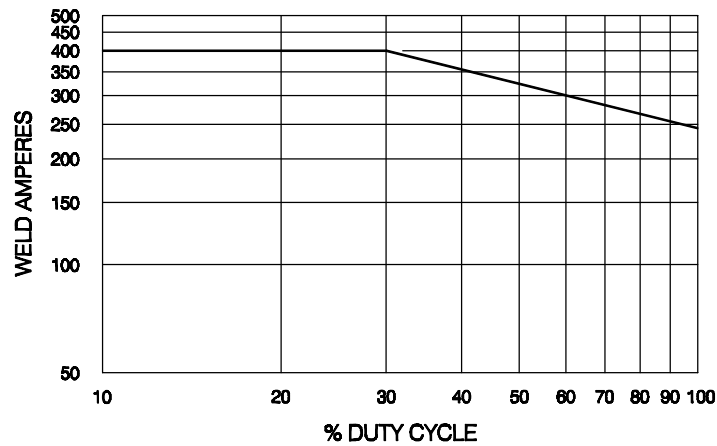


Overheating

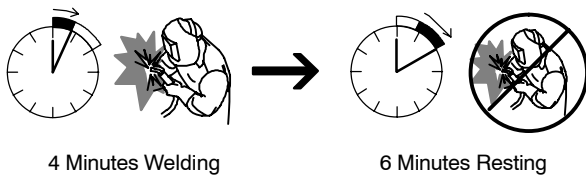


duty1 4/95 / Ref. 116 198

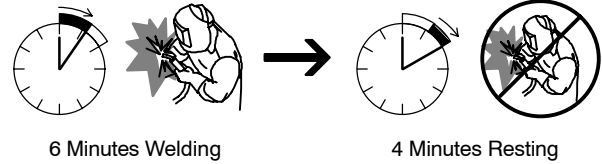
350 LX Models



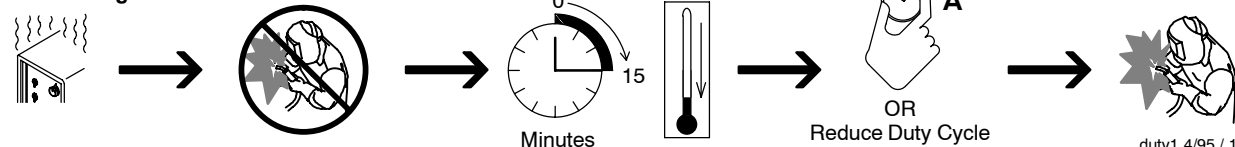
40% Duty Cycle At 350 Amperes



60% Duty Cycle At 300 Amperes



Overheating



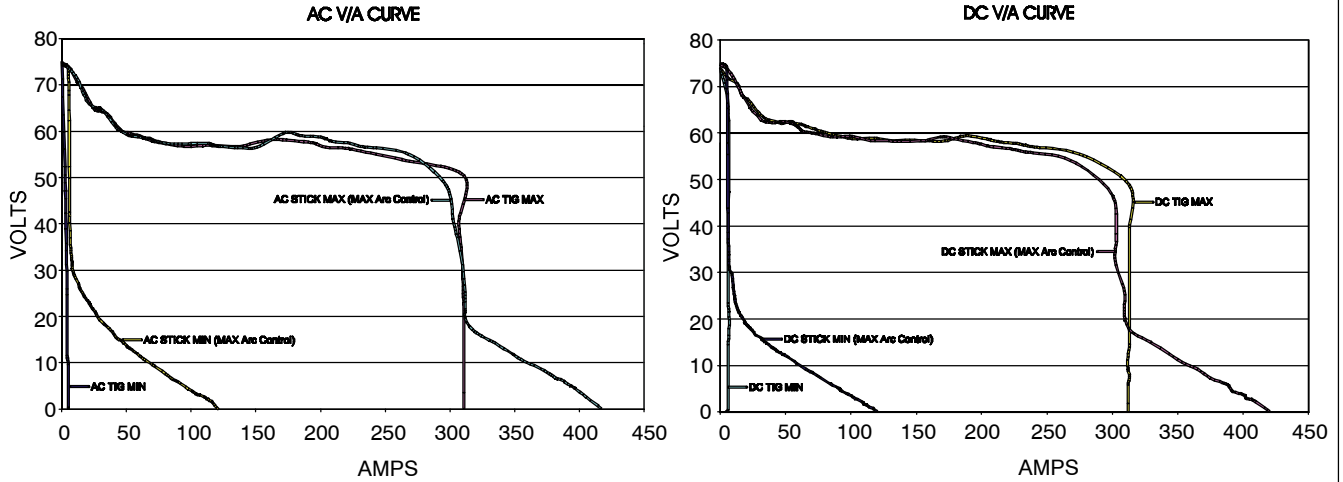
duty1 4/95 / 190 276

3-6. Volt-Ampere Curves

A. For 250 DX Models

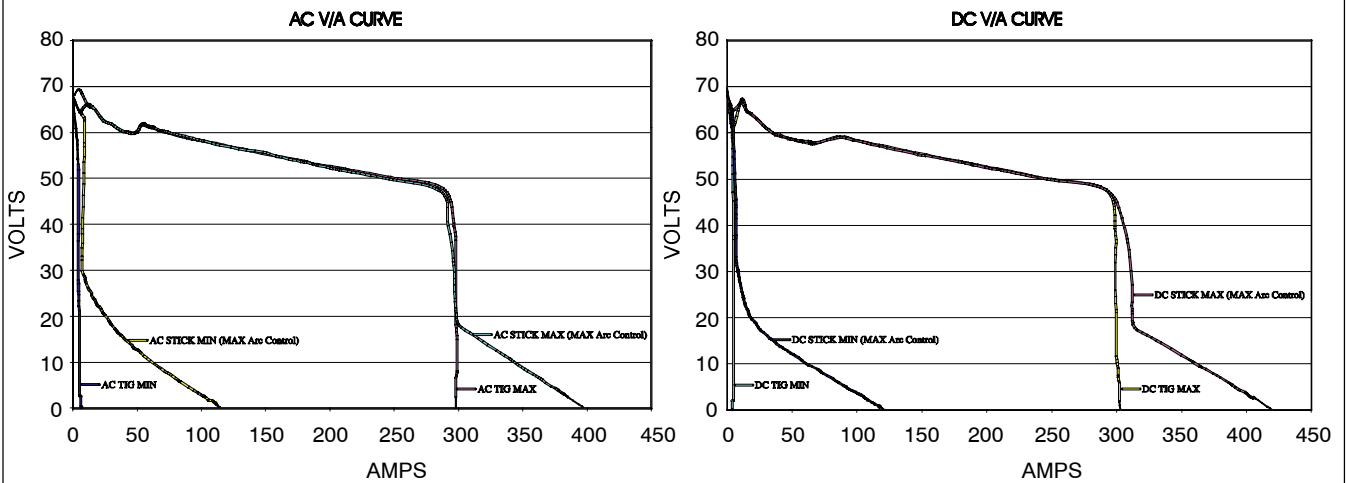
The volt-ampere curves show the minimum and maximum voltage and amperage output capabilities of the welding power source. Curves of other settings fall between the curves shown.

Non CE Models



194 385-A / 194 384-A

CE Models

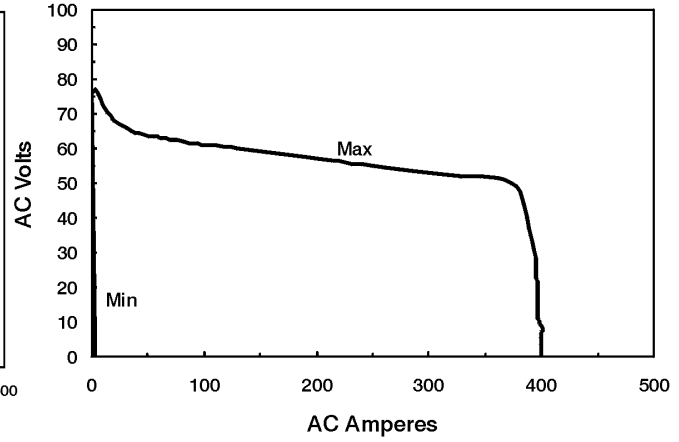
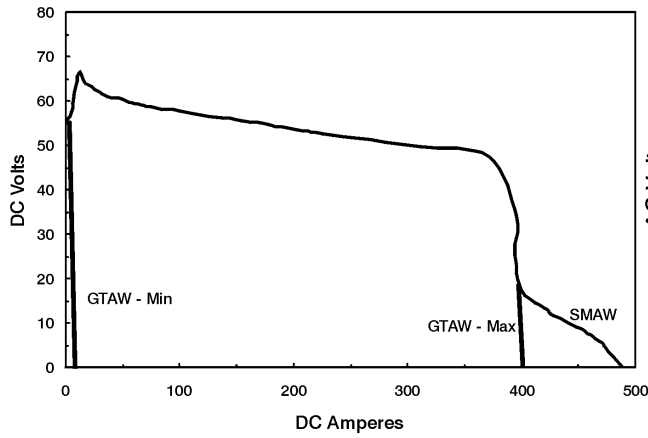


205 631 / 205 632

B. For 350 LX Models

350 Amperes Models

The volt-ampere curves show the minimum and maximum voltage and amperage output capabilities of the welding power source. Curves of other settings fall between the curves shown.



ssb1.1 10/91 - ST-190 277 / ST-190 278

3-7. 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 ▲ Turn off power before connecting to weld output terminals. ▲ Do not use worn, damaged, undersized, or poorly spliced cables.	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)
	Welding Amperes	10 – 60% Duty Cycle	60 – 100% Duty Cycle	10 – 100% Duty Cycle					
 Ref. 803 588-A	100	4	4	4	3	2	1	1/0	1/0
	150	3	3	2	1	1/0	2/0	3/0	3/0
	200	3	2	1	1/0	2/0	3/0	4/0	4/0
	250	2	1	1/0	2/0	3/0	4/0	2-2/0	2-2/0
	300	1	1/0	2/0	3/0	4/0	2-2/0	2-3/0	2-3/0
	350	1/0	2/0	3/0	4/0	2-2/0	2-3/0	2-3/0	2-4/0
	400	1/0	2/0	3/0	4/0	2-2/0	2-3/0	2-4/0	2-4/0
	500	2/0	3/0	4/0	2-2/0	2-3/0	2-4/0	3-3/0	3-3/0

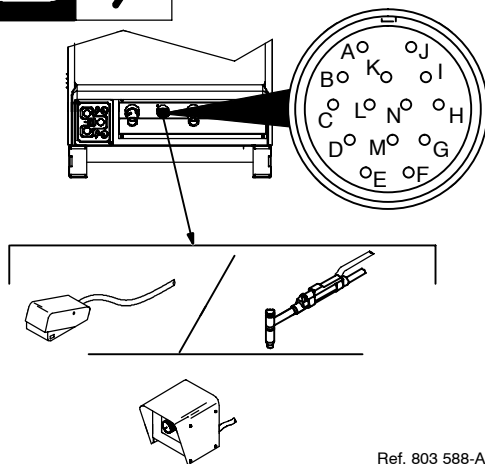
Weld cable size (AWG) is based on either a 4 volts or less drop or a current density of at least 300 circular mils per ampere
 *Select weld cable size for pulsing application at peak amperage value..

S-0007-D

3-8. Remote 14 Receptacle Information



▲ Turn off power before connecting to receptacle.

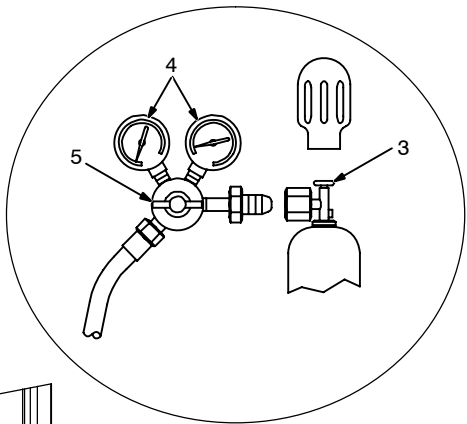


Ref. 803 588-A

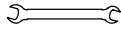
REMOTE 14	Socket*	Socket Information
24 VOLTS DC OUTPUT CONTACTOR	A	Contactors control 24 volts dc.
	B	Contact closure to A completes 24 volts dc contactor control circuit and enables output.
A REMOTE OUTPUT CONTROL	C	Output to remote control; 0 to +10 volts dc output to remote control.
	D	Remote control/feedback circuit common.
	E	0 to +10 volts dc input command signal from remote control.
A/V AMPERAGE VOLTAGE	F	Current feedback; +1 volt dc per 100 amperes.
	H	Voltage feedback; +1 volt dc per 10 volts output.
GND	K	Chassis common.

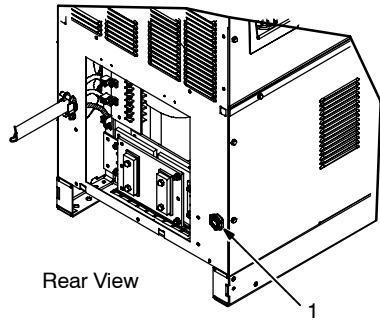
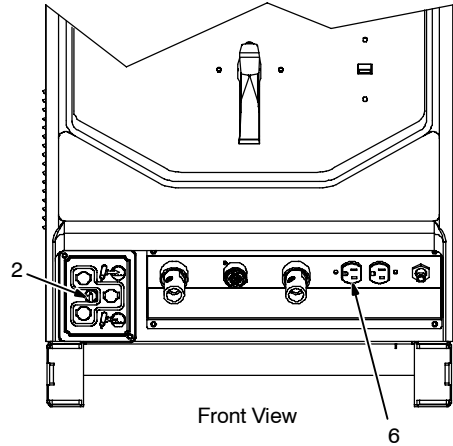
*The remaining sockets are not used.

3-9. Shielding Gas Connections And 115 Volts AC Duplex Receptacle



Tools Needed:

 5/8, 3/4, 1-1/8 in



▲ Turn Off power before connecting to receptacle.

- 1 Gas Valve In Connection
Located on rear of unit.
- 2 Gas Valve Out Connection
Connections have 5/8-18 right-hand threads.
- 3 Cylinder Valve
Open valve slightly so gas flow blows dirt from valve. Close valve.
- 4 Regulator/Flow Gauge
Connect regulator/flow gauge to gas cylinder.
Connect customer supplied gas hose between regulator/flow gauge and gas in fitting.
- 5 Flow Adjust
Typical flow rate is 20 cfh (cubic feet per hour).
- 6 115 V 15 Amp AC Receptacle
Receptacle is protected from overload by circuit breaker CB1 (see Section 7-3).

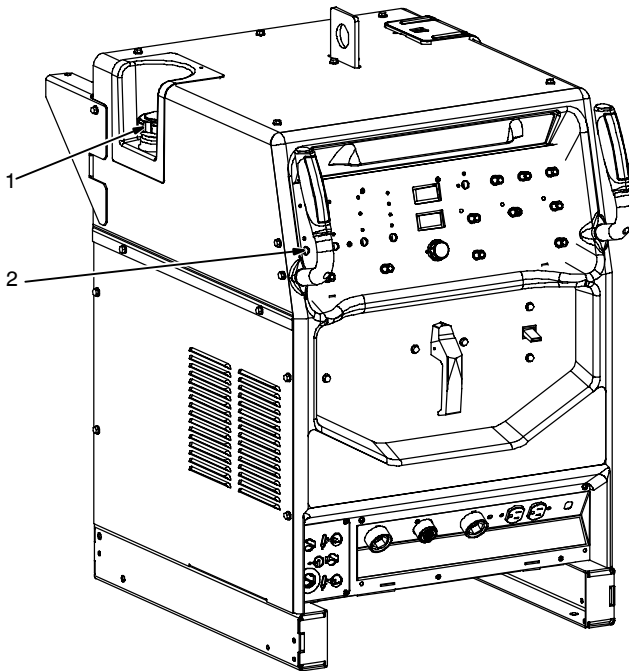
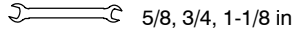
Ref. 803 588-A / Ref. 803 585-B / Ref. 157 858

3-10. Cooler Connections And Operation



Cooler Tank Capacity: 3 gallons (11.4 L)
Cooler Flow Rate: 1 liter per minute (1.1 qt)
Use With Torches Rated Up To 400 Amperes

Tools Needed:



▲ Turn Off power before connecting to coolant fittings.

1 Coolant Tank Cap

Use table below to select proper coolant. Remove cap and add coolant. Fill to capacity. Keep coolant level full.

Connect torch as shown in Section 3-11.

Priming

Initial setup requires priming of the coolant system before operation. To prime the system, proceed as follows:

2 Process Control Switch

For cooler operation, place Process Control switch in the GTAW (TIG) position according to Section 4-3.

Press and HOLD the Process Control switch. After 2 seconds the volt-meter displays *{CLR}* to indicate system priming has initiated.

Continue to hold the Process Control switch until the amp meter displays *{FLO}* to indicate priming is complete and adequate flow has been detected (approx. 40 seconds).

Operation

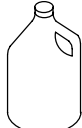
Cooler will activate when a valid arc is detected. A system pressure switch will detect and monitor coolant flow. If flow is not detected within 5 seconds of welding, weld output stops, and Help Message 19 is displayed on the volt/amp meters (see Section 6-2).

During normal operation cooler will continue to operate for 40 seconds after welding arc ends, or until the coolant temperature is adequately reduced.

Changing A Water-Cooled Torch

▲ Turn Off power before making torch and coolant connections.

Connect new torch and follow priming procedure described above. To avoid a Help Message Code, press and hold Process Control switch for approximately 40 seconds to ensure the torch is completely primed, even if amp meter displays *{FLO}* sooner.

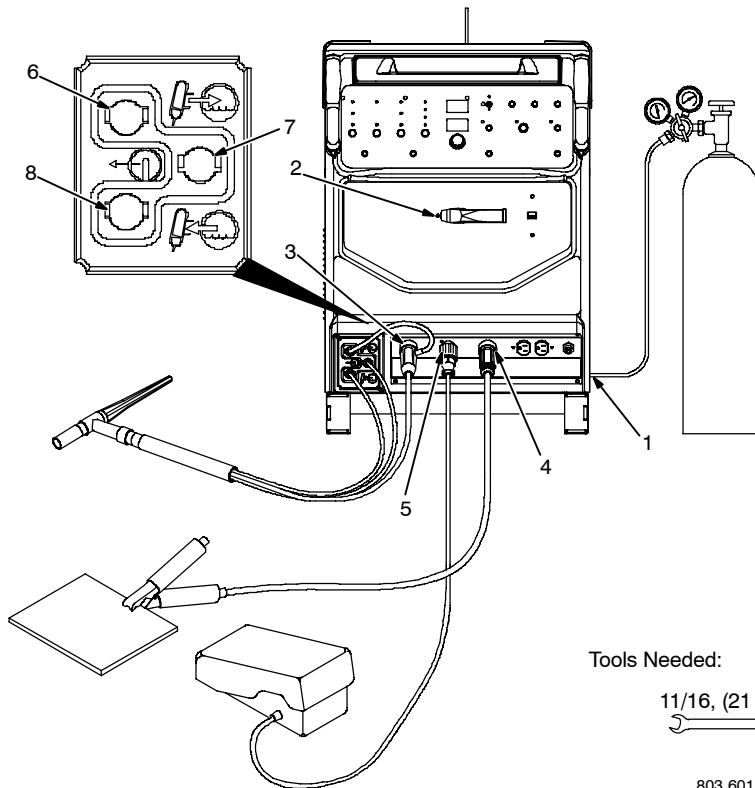
Application	GTAW Or Where HF* Is Used
 Coolant	MILLER Low Conductivity Coolant No. 043 810**; Distilled Or Deionized Water OK Above 32° F (0° C)

*HF: High Frequency Current

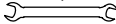
**MILLER coolants protect to -37° F (-38° C) and resist algae growth.

▲ Use of any coolant other than those listed in the table voids the warranty on any parts that come in contact with the coolant (pump, radiator, etc.).

3-11. TIG Connections With A Water-Cooled Torch



Tools Needed:

11/16, (21 mm)


803 601-B

▲ Turn Off power before making connections.

1 Gas-In Connection

Connect gas hose from gas supply to gas-in connector.

2 Output Selector Switch (See Section 4-2)

Switch is shown in DCEN (direct current electrode negative) position for TIG HF Impulse DCEN welding. For front panel control display, see Section 3-14. For TIG AC welding, place switch in AC position. For TIG AC front panel control display, see Section 3-15.

3 Electrode Weld Output Terminal

Connect TIG torch to electrode weld output terminal.

4 Work Weld Output Terminal

Connect work lead to work weld output terminal.

5 Remote 14 Receptacle

Connect desired remote control to Remote 14 receptacle (see Section 3-8).

6 Water-In (From Torch) Connection

Connect torch water-out (red) hose to welding power source water-in connection.

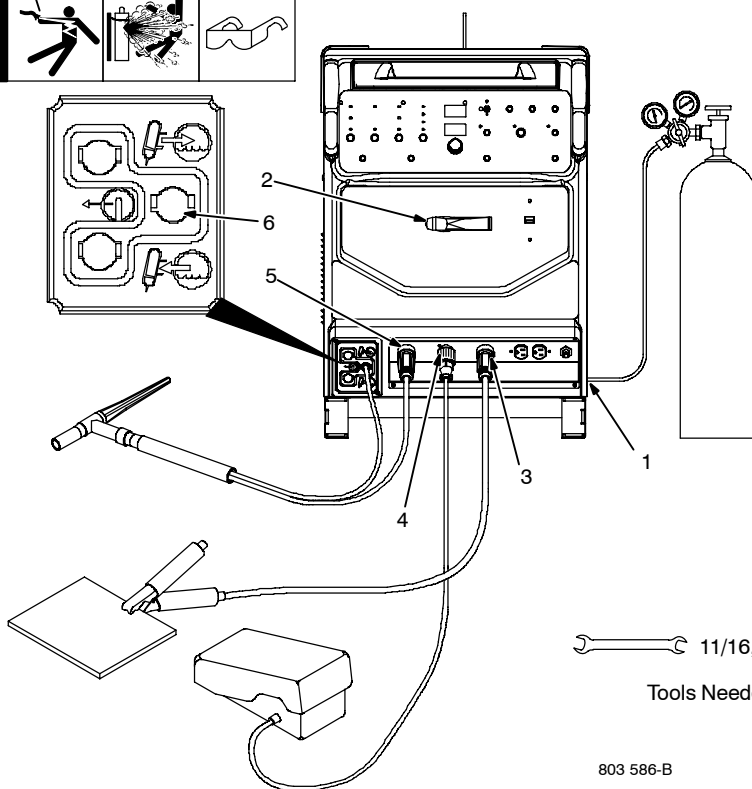
7 Gas-Out Connection

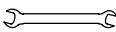
Connect torch gas hose to gas-out fitting.

8 Water-Out (To Torch) Connection

Connect torch water-in (blue) hose to welding power source water-out connection.

3-12. TIG Connections With A Two-Piece Air-Cooled Torch



 11/16, (21 mm)

Tools Needed:

803 586-B

▲ Turn Off power before making connections.

1 Gas-In Connection

Connect gas hose from gas supply to gas-in connection.

2 Output Selector Switch (See Section 4-2)

Switch is shown in DCEN (direct current electrode negative) position for TIG HF Impulse DCEN welding. For front panel control display, see Section 3-14. For TIG AC welding, place switch in AC position (see Section 4-2). For TIG AC front panel control display, see Section 3-15.

3 Work Weld Output Terminal

Connect work lead to work weld output terminal.

4 Remote 14 Receptacle

Connect desired remote control to Remote 14 receptacle (see Section 3-8).

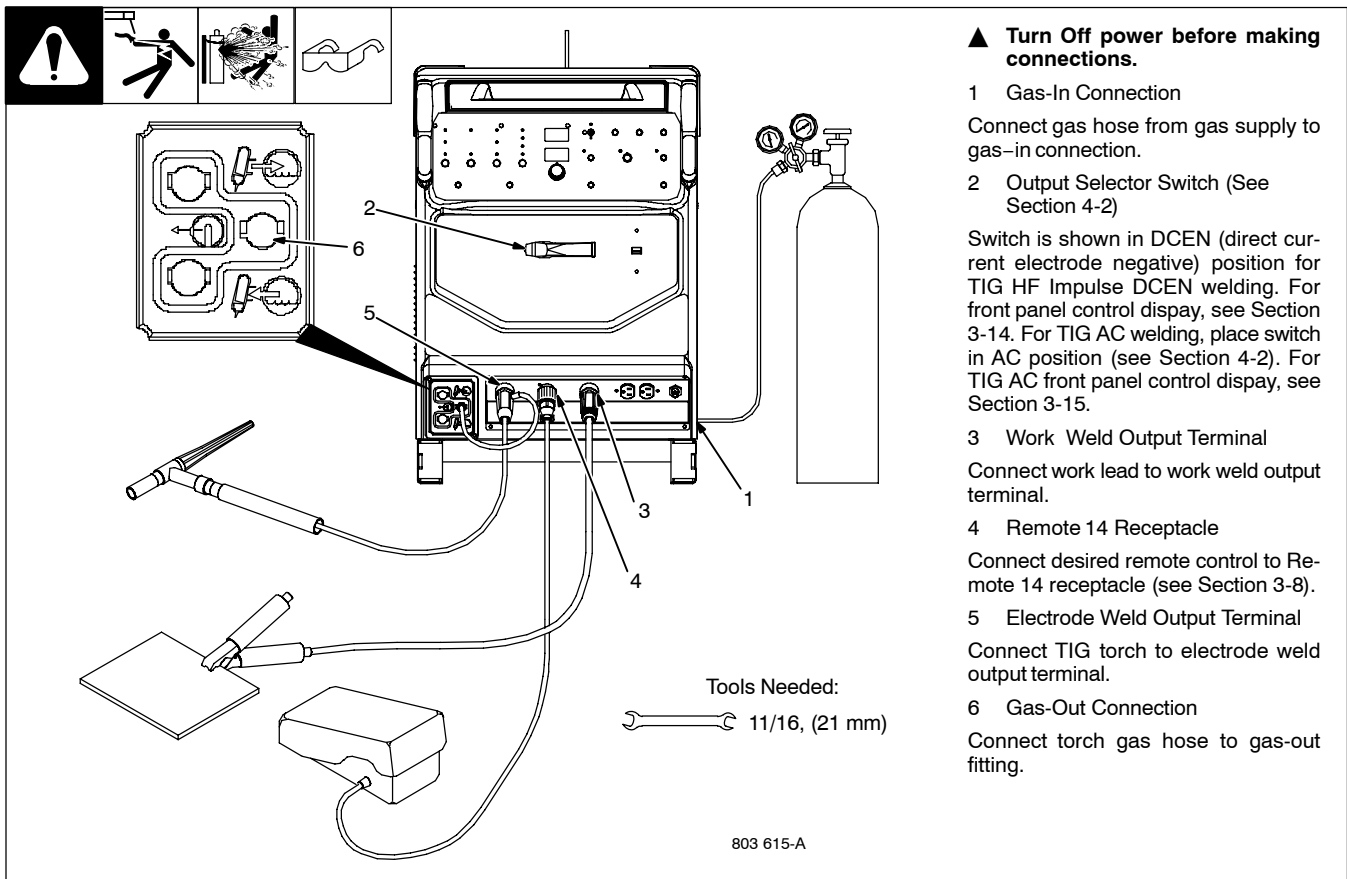
5 Electrode Weld Output Terminal

Connect TIG torch to electrode weld output terminal.

6 Gas-Out Connection

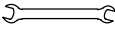
Connect torch gas hose to gas-out fitting.

3-13. TIG Connections With A One-Piece Air-Cooled Torch



▲ Turn Off power before making connections.

- 1 Gas-In Connection
Connect gas hose from gas supply to gas-in connection.
- 2 Output Selector Switch (See Section 4-2)
Switch is shown in DCEN (direct current electrode negative) position for TIG HF Impulse DCEN welding. For front panel control display, see Section 3-14. For TIG AC welding, place switch in AC position (see Section 4-2). For TIG AC front panel control display, see Section 3-15.
- 3 Work Weld Output Terminal
Connect work lead to work weld output terminal.
- 4 Remote 14 Receptacle
Connect desired remote control to Remote 14 receptacle (see Section 3-8).
- 5 Electrode Weld Output Terminal
Connect TIG torch to electrode weld output terminal.
- 6 Gas-Out Connection
Connect torch gas hose to gas-out fitting.

Tools Needed:
 11/16, (21 mm)

803 615-A

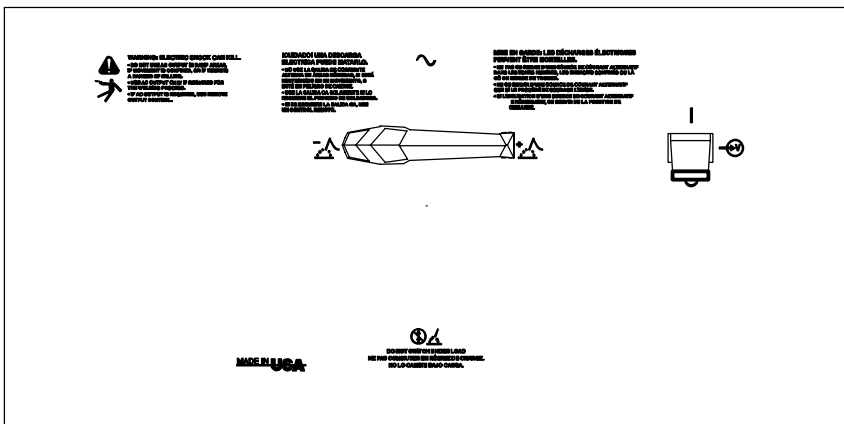
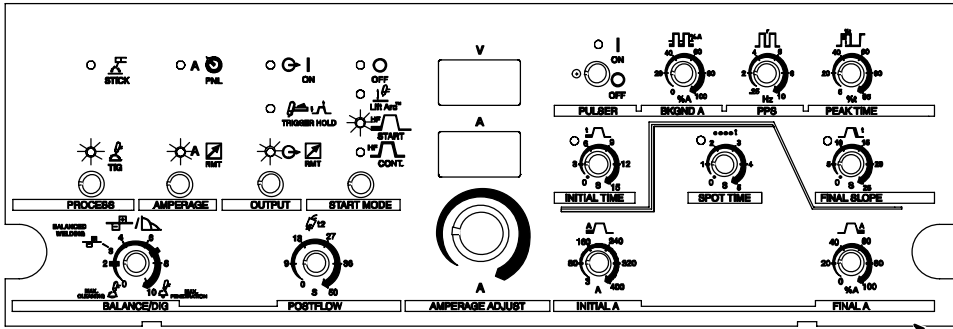
3-14. Front Panel Display For TIG HF Impulse DCEN (Direct Current Electrode Negative)



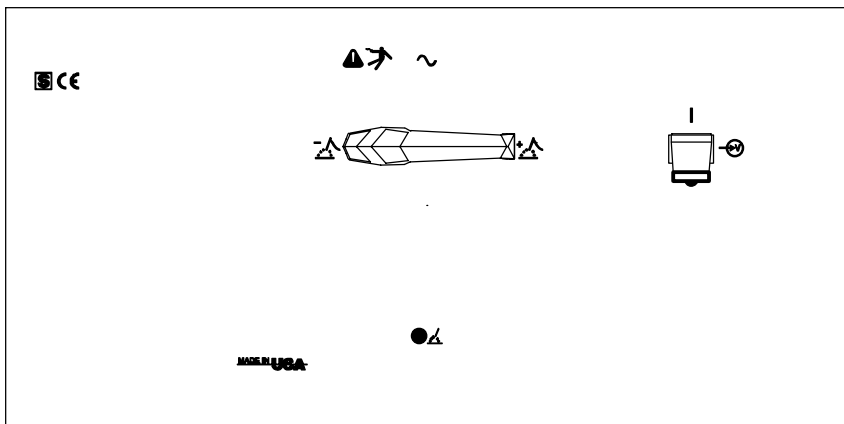
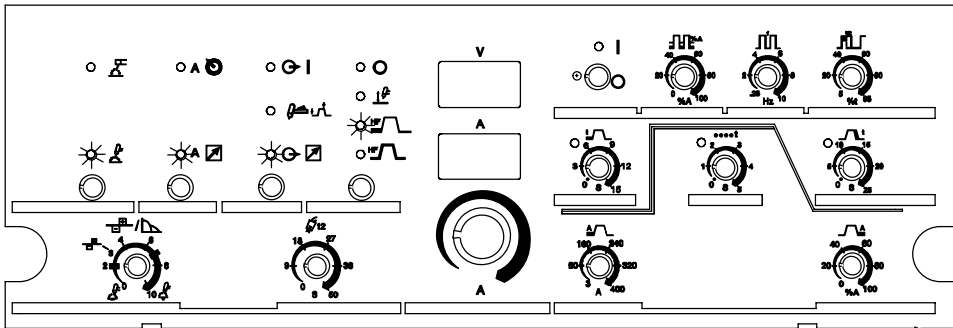
1 Front Panel
 Correct front panel display for basic TIG HF Impulse DCEN welding.

For all front panel switch pad controls: press switch pad to turn on light and enable function.

NOTE: Green on nameplate indicates a TIG function (see Section 4-1 for description of controls).



(CE Nameplate)



3-15. Front Panel Display For TIG AC

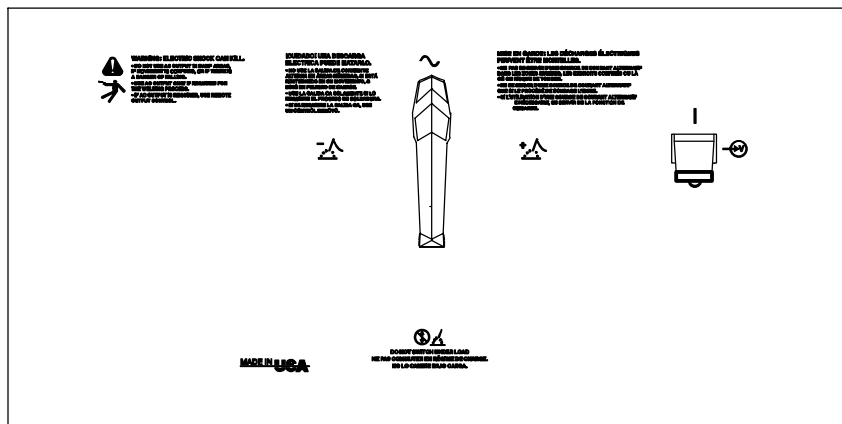
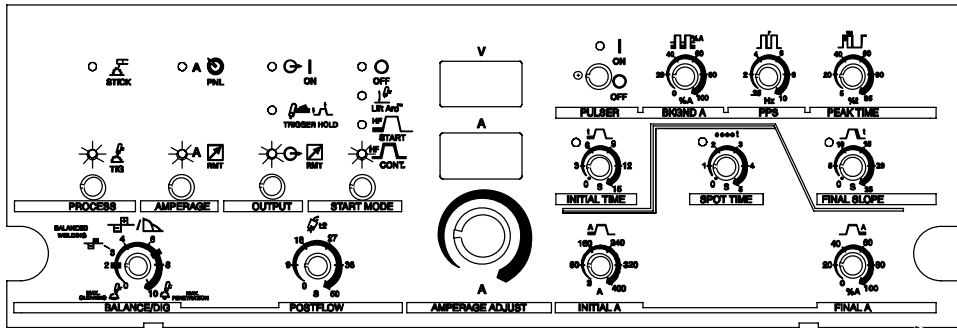


1 Front Panel

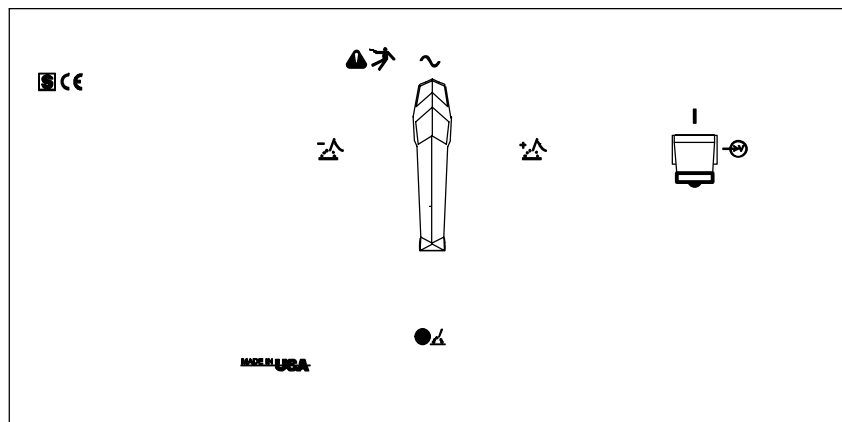
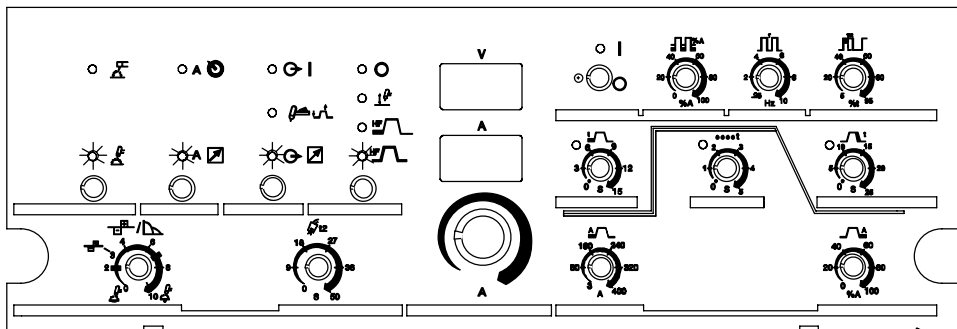
Correct front panel display for basic TIG AC welding.

For all front panel switch pad controls: press switch pad to turn on light and enable function.

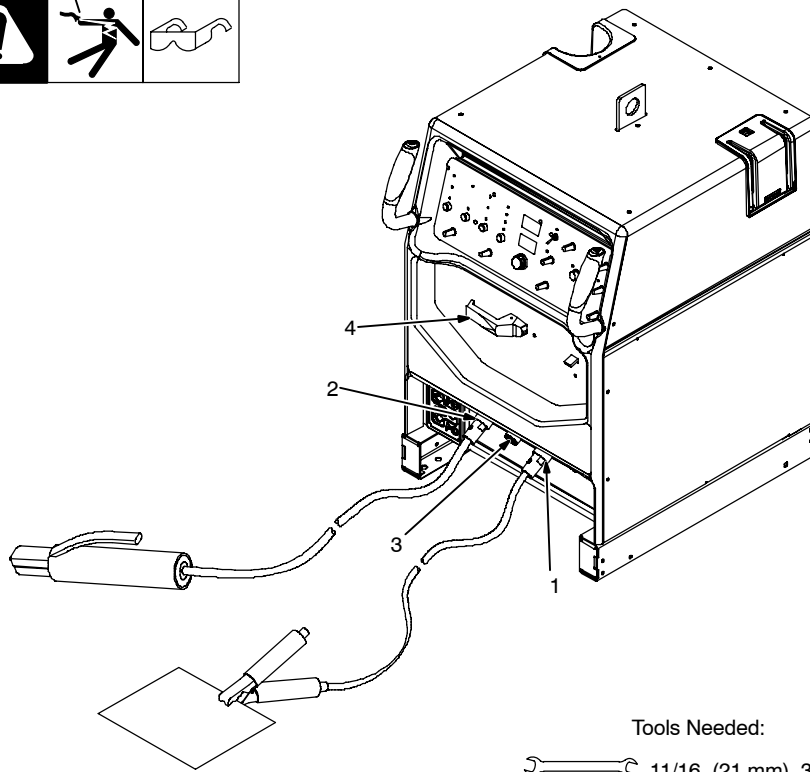
NOTE: Green on nameplate indicates a TIG function (see Section 4-1 for description of controls).



(CE Nameplate)



3-16. Stick Connections



▲ Turn Off power before making connections.

1 Work Weld Output Terminal
Connect work lead to work weld output terminal.

2 Electrode Weld Output Terminal

Connect electrode holder to electrode weld output terminal.

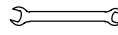
3 Remote 14 Receptacle

If desired, connect remote control to Remote 14 receptacle (see Section 3-8).

4 Output Selector Switch (See Section 4-2)

Switch is shown in DCEP (direct current electrode positive) position for Stick DCEP welding. For front panel control display, see Section 3-17. For Stick AC welding, place switch in AC position. For Stick AC front panel control display, see Section 3-18.

Tools Needed:

 11/16, (21 mm), 3/4 in

803 587-A

3-17. Front Panel Display For Stick DCEP (Direct Current Electrode Positive)

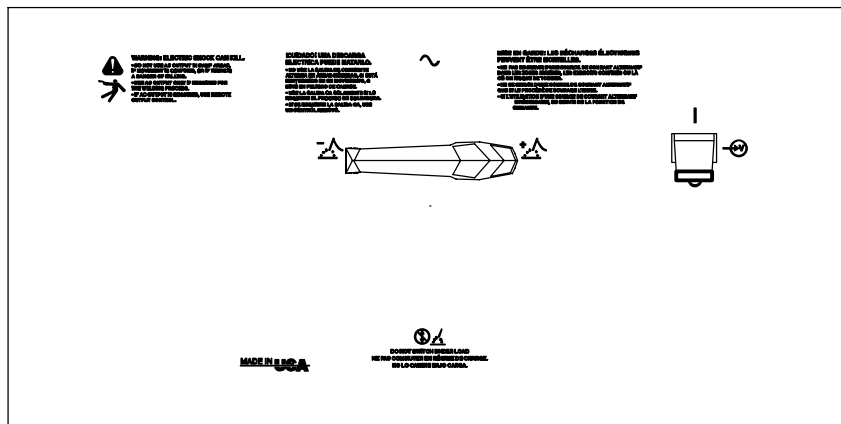
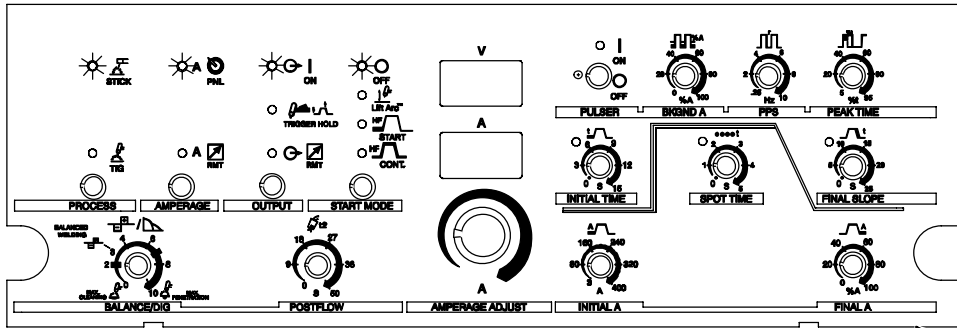


1 Front Panel

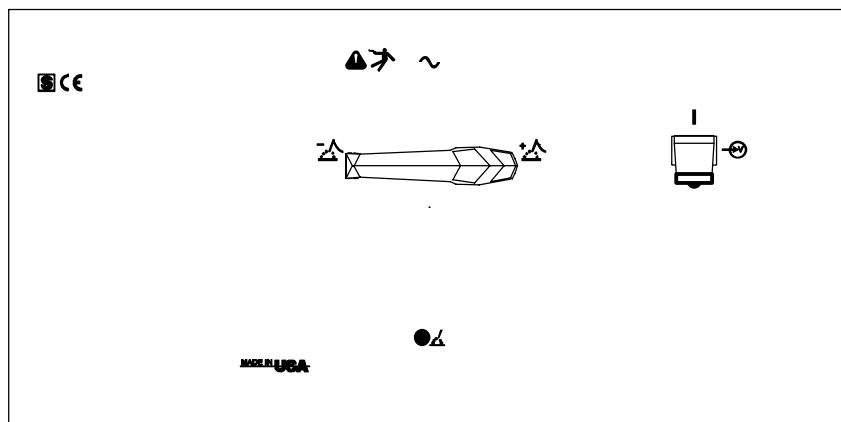
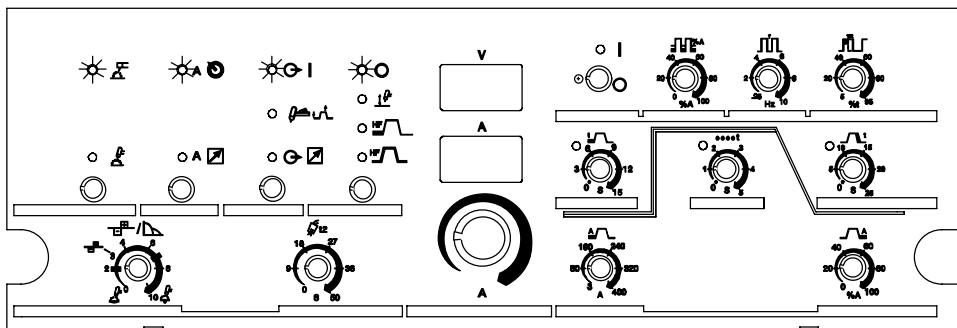
Correct front panel display for basic Stick DCEP welding.

For all front panel switch pad controls: press switch pad to turn on light and enable function.

NOTE: Gray on nameplate indicates a Stick function (see Section 4-1 for description of controls).



(CE Nameplate)



3-18. Front Panel Display For Stick AC

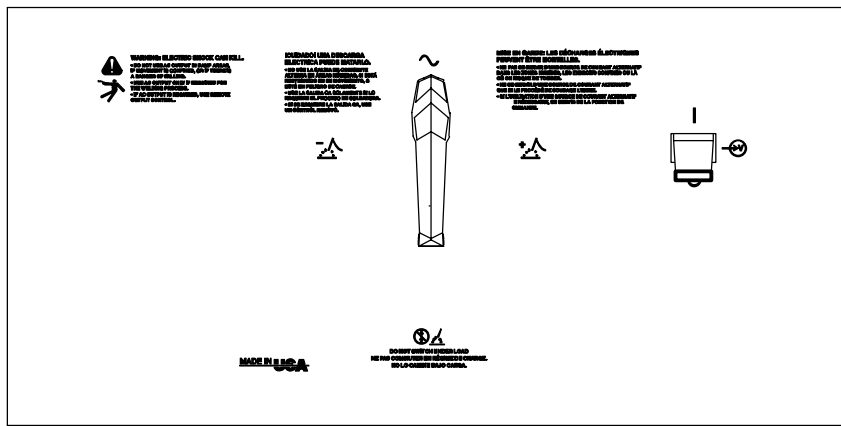
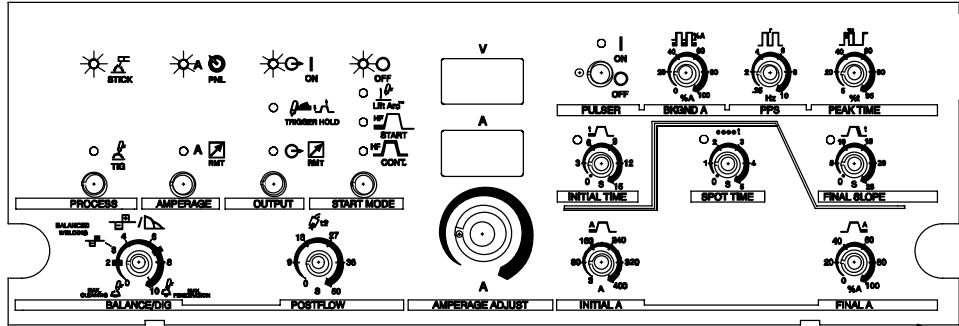


1 Front Panel

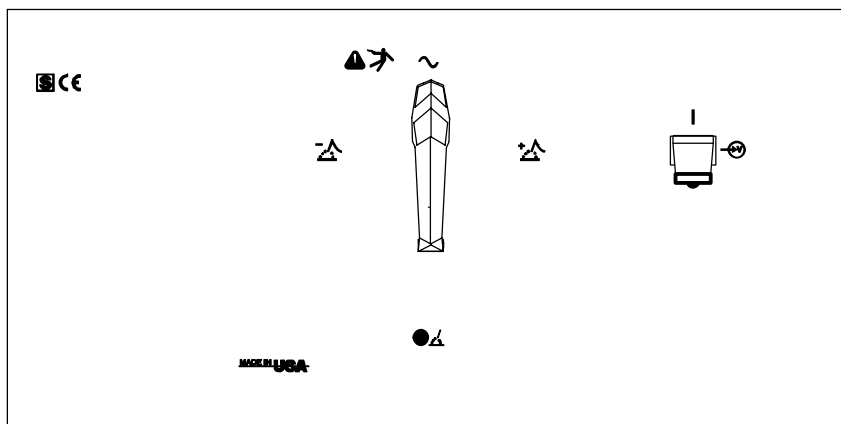
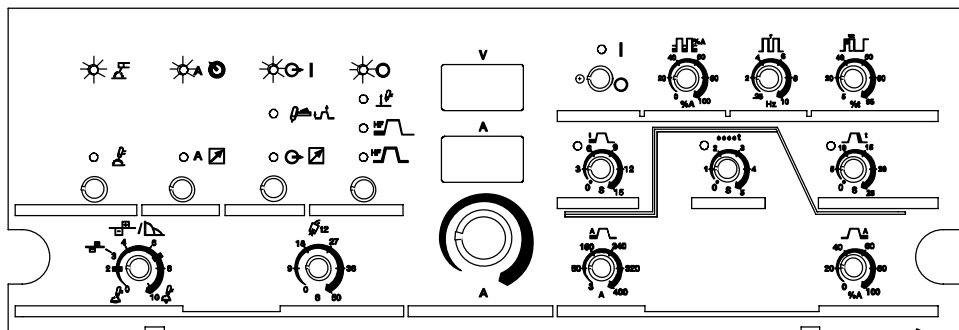
Correct front panel display for basic Stick AC welding.

For all front panel switch pad controls: press switch pad to turn on light and enable function.

NOTE: Gray on nameplate indicates a Stick function (see Section 4-1 for description of controls).





(CE Nameplate)



3-19. Electrical Service Guide

A. For 250 DX Models

NOTE 	<i>All values in both tables were calculated at 60% duty cycle.</i>
---	---

NOTE 	<i>Actual input voltage cannot exceed $\pm 10\%$ of indicated required input voltage shown in both tables. If actual input voltage is outside of this range, damage to unit may occur.</i>
---	---

50/60 Hertz Models	Without Power Factor Correction							
Input Voltage	200	220	230	400	440	460	520	575
Input Amperes At Rated Output*	88	82	77	45	41	38	35	31
Max Recommended Standard Fuse Or Circuit Breaker Rating In Amperes	Circuit Breaker ¹							
	Time-Delay Fuse ²							
	Normal Operating (Fast) Fuse ³							
	125	125	125	70	60	60	50	45
	125	125	125	70	60	60	50	45
Min Input Conductor Size In AWG ⁴	4	6	6	8	8	10	10	10
Max Recommended Input Conductor Length In Feet (Meters)	167 (51)	137 (42)	153 (47)	305 (93)	369 (112)	281 (86)	352 (107)	439 (134)
Min Grounding Conductor Size In AWG ⁴	6	6	6	8	10	10	10	10

* Input amperes at rated output is the amperage draw for that particular input voltage if the machine is run at its rated welding output (see Section 3-4 for rated welding output).

Reference: 1999 National Electrical Code (NEC)

- 1 If a circuit breaker is used in place of a fuse, choose a circuit breaker with time-current curves comparable to the recommended fuse.
- 2 "Time-Delay" fuses are UL class "RK5" .
- 3 "Normal Operating" (fast) fuses are UL class "K5" (up to and including 60 amp), and UL class "H" (65 amp and above).
- 4 Conductor data in this section specifies conductor size (excluding flexible cord or cable) between the panelboard and the equipment per NEC Table 310.16. If a flexible cord or cable is used, minimum conductor size may increase. See NEC Table 400.5(A) for flexible cord and cable requirements.

▲ Failure to follow these fuse and circuit breaker recommendations could create an electric shock or fire hazard.

50/60 Hertz Models	With Power Factor Correction							
Input Voltage	200	220	230	400	440	460	520	575
Input Amperes At Rated Output*	60	61	52	34	31	26	26	21
Max Recommended Standard Fuse Or Circuit Breaker Rating In Amperes	Circuit Breaker ¹							
	Time-Delay Fuse ²							
	Normal Operating (Fast) Fuse ³							
	90	90	80	50	45	40	40	30
	90	90	80	50	45	40	40	30
Min Input Conductor Size In AWG ⁴	8	8	8	10	10	10	10	12
Max Recommended Input Conductor Length In Feet (Meters)	87 (26)	102 (31)	115 (35)	226 (69)	274 (84)	308 (94)	383 (117)	295 (90)
Min Grounding Conductor Size In AWG ⁴	8	8	8	10	10	10	10	12

* Input amperes at rated output is the amperage draw for that particular input voltage if the machine is run at its rated welding output (see Section 3-4 for rated welding output).

Reference: 1999 National Electrical Code (NEC)

- 1 If a circuit breaker is used in place of a fuse, choose a circuit breaker with time-current curves comparable to the recommended fuse.
- 2 "Time-Delay" fuses are UL class "RK5" .
- 3 "Normal Operating" (fast) fuses are UL class "K5" (up to and including 60 amp), and UL class "H" (65 amp and above).
- 4 Conductor data in this section specifies conductor size (excluding flexible cord or cable) between the panelboard and the equipment per NEC Table 310.16. If a flexible cord or cable is used, minimum conductor size may increase. See NEC Table 400.5(A) for flexible cord and cable requirements.

▲ Failure to follow these fuse and circuit breaker recommendations could create an electric shock or fire hazard.

B. For 350 LX Models

NOTE	<i>All values in both tables were calculated at 60% duty cycle.</i>
-------------	---

NOTE	<i>Actual input voltage cannot exceed $\pm 10\%$ of indicated required input voltage shown in both tables. If actual input voltage is outside of this range, damage to unit may occur.</i>
-------------	---

50/60 Hertz Models	Without Power Factor Correction							
Input Voltage	200	220	230	400	440	460	520	575
Input Amperes At Rated Output*	125	103	110	57	52	55	43	42
Max Recommended Standard Fuse Or Circuit Breaker Rating In Amperes	Circuit Breaker ¹							
	Time-Delay Fuse ²							
	Normal Operating (Fast) Fuse ³							
	150	125	125	70	70	60	60	50
	175	175	175	90	90	80	70	70
Min Input Conductor Size In AWG ⁴	3	3	4	8	8	8	8	8
Max Recommended Input Conductor Length In Feet (Meters)	151 (46)	182 (56)	171 (52)	246 (75)	298 (91)	326 (99)	416 (127)	509 (155)
Min Grounding Conductor Size In AWG ⁴	6	6	6	8	8	8	8	8

* Input amperes at rated output is the amperage draw for that particular input voltage if the machine is run at its rated welding output (see Section 3-4 for rated welding output).

- Reference: 2005 National Electrical Code (NEC)
- 1 If a circuit breaker is used in place of a fuse, choose a circuit breaker with time-current curves comparable to the recommended fuse.
 - 2 "Time-Delay" fuses are UL class "RK5".
 - 3 "Normal Operating" (fast) fuses are UL class "K5" (up to and including 60 amp), and UL class "H" (65 amp and above).
 - 4 Conductor data in this section specifies conductor size (excluding flexible cord or cable) between the panelboard and the equipment per NEC Table 310.16. If a flexible cord or cable is used, minimum conductor size may increase. See NEC Table 400.5(A) for flexible cord and cable requirements.
- ▲ Failure to follow these fuse and circuit breaker recommendations could create an electric shock or fire hazard.**

50/60 Hertz Models	With Power Factor Correction							
Input Voltage	200	220	230	400	440	460	520	575
Input Amperes At Rated Output*	92	77	78	40	39	38	33	31
Max Recommended Standard Fuse Or Circuit Breaker Rating In Amperes	Circuit Breaker ¹							
	Time-Delay Fuse ²							
	Normal Operating (Fast) Fuse ³							
	110	100	90	50	50	45	40	35
	125	125	125	70	60	60	50	45
Min Input Conductor Size In AWG ⁴	4	6	6	8	8	8	10	10
Max Recommended Input Conductor Length In Feet (Meters)	145 (44)	119 (36)	130 (40)	263 (80)	318 (97)	347 (106)	300 (91)	367 (112)
Min Grounding Conductor Size In AWG ⁴	6	6	6	8	10	10	10	10

* Input amperes at rated output is the amperage draw for that particular input voltage if the machine is run at its rated welding output (see Section 3-4 for rated welding output).

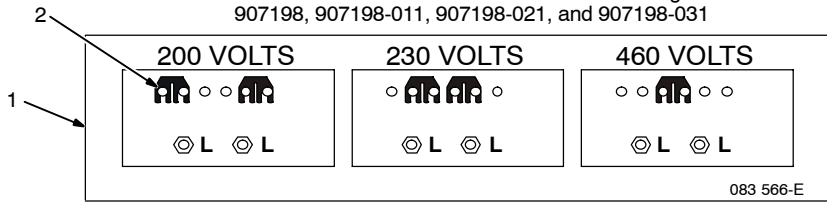
- Reference: 2005 National Electrical Code (NEC)
- 1 If a circuit breaker is used in place of a fuse, choose a circuit breaker with time-current curves comparable to the recommended fuse.
 - 2 "Time-Delay" fuses are UL class "RK5".
 - 3 "Normal Operating" (fast) fuses are UL class "K5" (up to and including 60 amp), and UL class "H" (65 amp and above).
 - 4 Conductor data in this section specifies conductor size (excluding flexible cord or cable) between the panelboard and the equipment per NEC Table 310.16. If a flexible cord or cable is used, minimum conductor size may increase. See NEC Table 400.5(A) for flexible cord and cable requirements.
- ▲ Failure to follow these fuse and circuit breaker recommendations could create an electric shock or fire hazard.**

3-20. Placing Jumper Links



Label found on 250 DX models with the following stock numbers:
907194, 907194-021 and, 907194-031

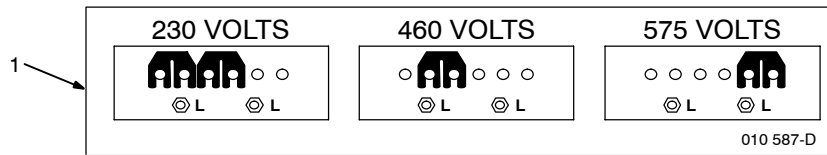
Label found on 350 LX models with the following stock numbers:
907198, 907198-011, 907198-021, and 907198-031



Or

Label found on 250 DX models with the following stock numbers:
907195, 907195-021 and, 907195-031

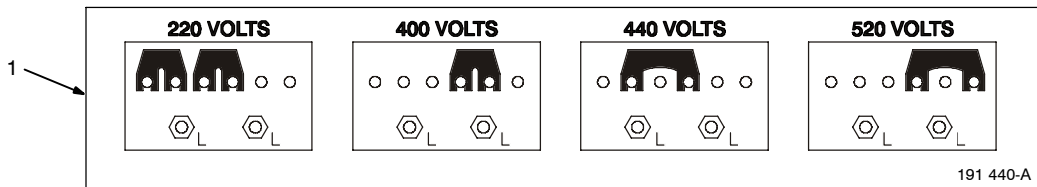
Label found on 350 LX models with the following stock numbers:
907199, 907199-021, and 907199-031



Or

Label found on 250 DX models with stock number 907197

Label found on 350 LX models with stock number 907200



▲ Disconnect and lockout/tag-out input power before installing or moving jumper links.

Check input voltage available at site.

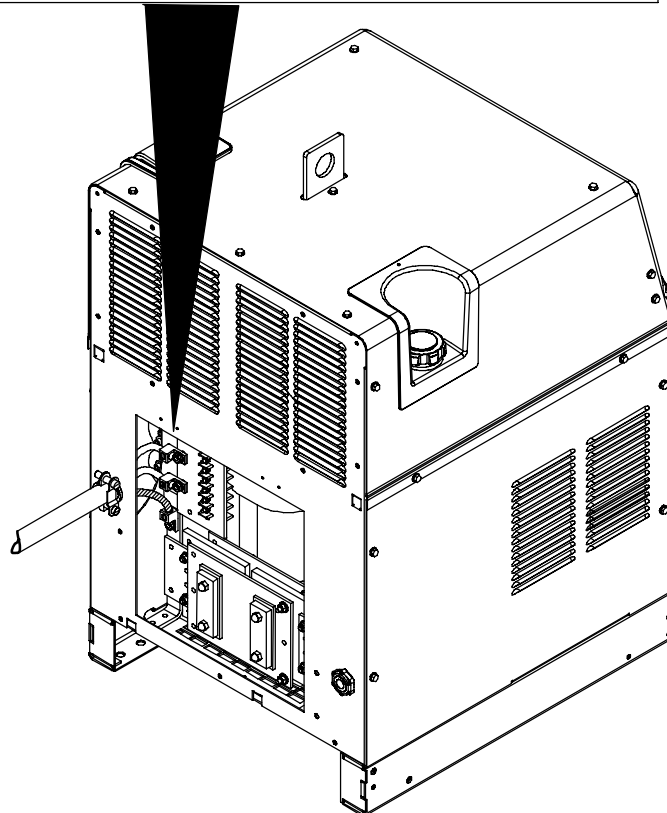
1 Jumper Link Label

Check label – only one label is on unit.

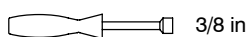
2 Jumper Links

Move jumper links to match input voltage.

Close and secure access door, or go on to Section 3-21.



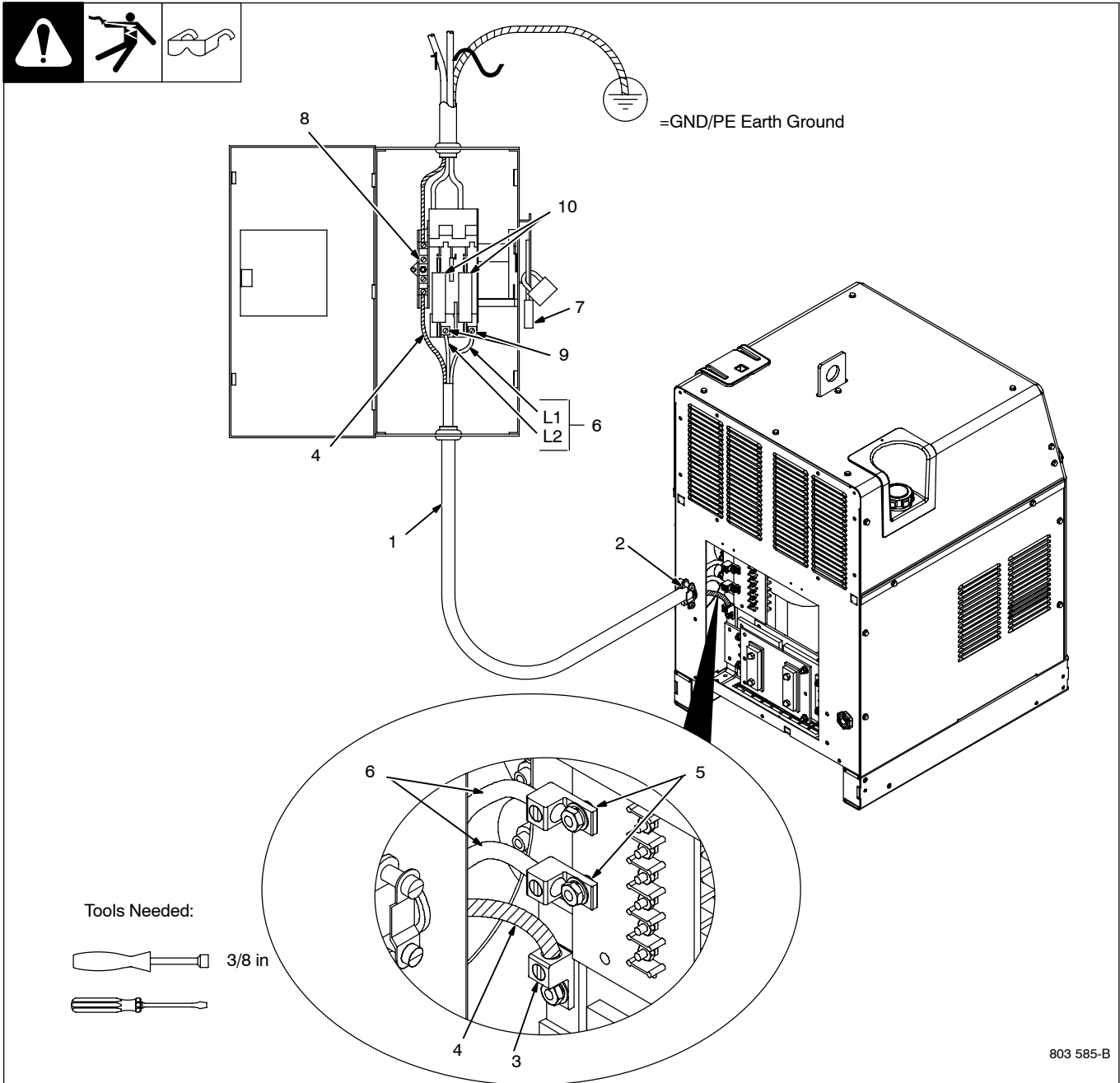
Tools Needed:



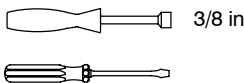
3/8 in

Ref. 803 585-B

3-21. Connecting Input Power



Tools Needed:



▲ Installation must meet all National and Local Codes – have only qualified persons make this installation.

▲ Disconnect and lockout/tagout input power before connecting input conductors from unit.

▲ Make input power connections to the welding power source first.

▲ Always connect green or green/yellow conductor to supply grounding terminal first, and never to a line terminal.

See rating label on unit and check input voltage available at site.

1 Input Power Conductors (Customer Supplied Cord)

Select size and length of conductors using Section 3-19. Conductors must comply with national, state, and local electrical codes. If applicable, use lugs of proper amperage capacity and correct hole size.

Welding Power Source Input Power Connections

2 Strain Relief

Route conductors (cord) through strain relief and tighten screws.

3 Machine Grounding Terminal

4 Green Or Green/Yellow Grounding Conductor

Connect green or green/yellow grounding conductor to welding power source grounding terminal first.

5 Welding Power Source Line Terminals

6 Input Conductors L1 And L2

Connect input conductors L1 and L2 to welding power source line terminals.

Close and secure access door on welding power source.

Disconnect Device Input Power Connections

7 Disconnect Device (switch shown in OFF position)

8 Disconnect Device (Supply) Grounding Terminal

Connect green or green/yellow grounding conductor to disconnect device grounding terminal first.

9 Disconnect Device Line Terminals

Connect input conductors L1 and L2 to disconnect device line terminals.

10 Overcurrent Protection

Select type and size of overcurrent protection using Section 3-19 (fused disconnect switch shown).

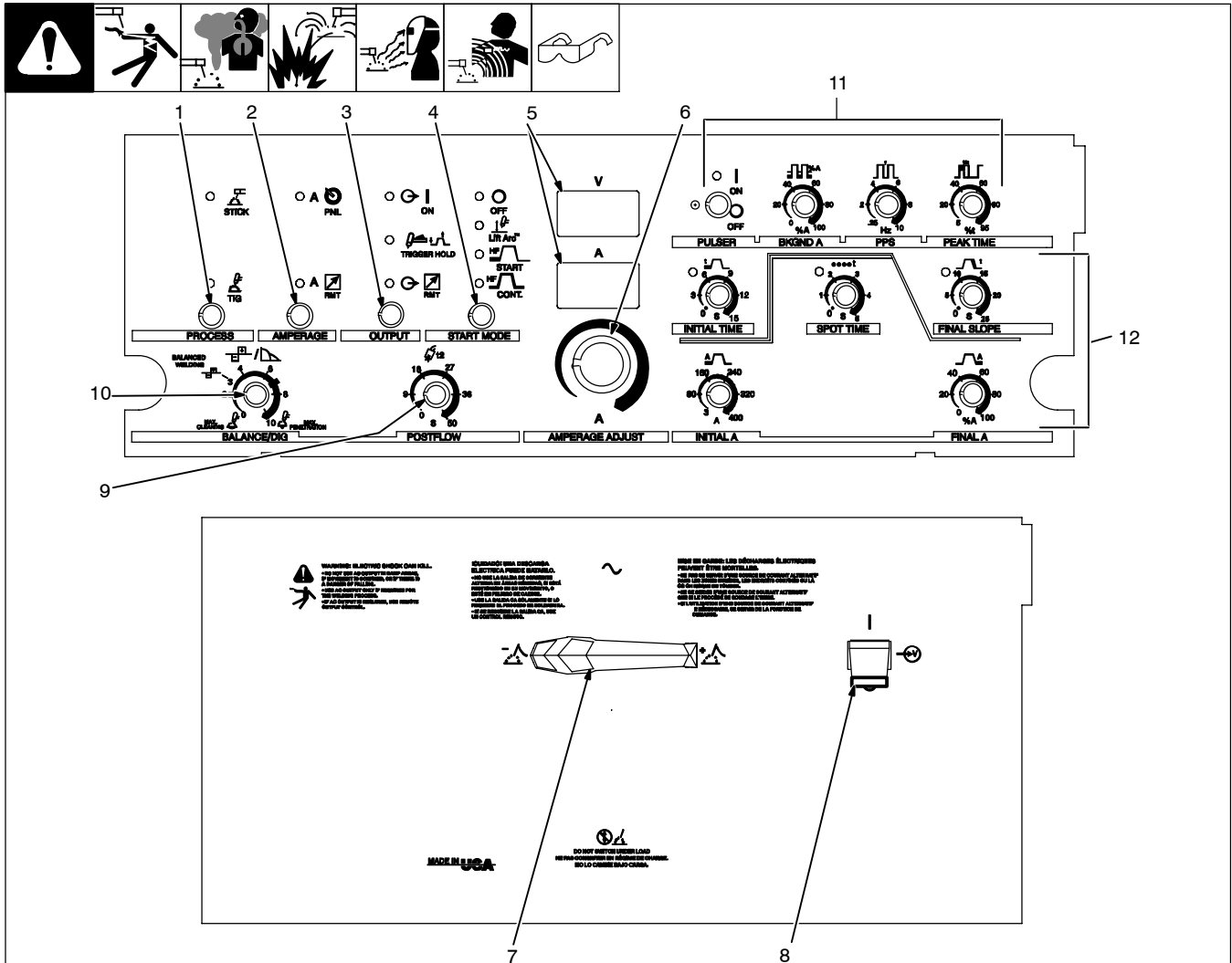
Close and secure door on line disconnect device. Remove lockout/tagout device, and place switch in the On position.

803 585-B

SECTION 4 – OPERATION

4-1. Controls (350 LX Nameplates Shown)

A. For 200/230/460 Volts And Non CE Units



☐ Top row of lights in upper left corner are On for SMAW. Bottom row are On for GTAW.

Green on nameplate indicates a TIG function, Gray indicates a Stick function.

1 Process Control

See Section 4-3.

2 Amperage Control

See Section 4-4.

3 Output Control

See Section 4-5.

4 Start Mode Control

See Section 4-9.

5 Voltmeter And Ammeter

Voltmeter displays average voltage (to the nearest 0.1 V) at the weld output terminals.

Use meter to preset amperage. Meter displays average weld amperage output of unit to nearest ampere when welding.

NOTE: Meters are self-calibrating. No adjust-

ment available.

6 Amperage Adjustment Control

Use control to adjust amperage, and preset amperage on ammeter. This control may be adjusted while welding.

For remote amperage control, front panel control setting is the maximum amperage available. For example: If front panel control is set to 200 amps, the range of the remote amperage control is 3 to 200 amps for 250 DX models, and 3 to 200 amps for 350 LX models.

For pulse welding, use Amperage Adjust control to select from 3-300 amps of peak amperage for 250 DX models, or 3-400 amps of peak amperage for 350 LX models (see Section 4-12).

For spot welding, use Amperage Adjust control to select from 3-310 amps for 250 DX models, or 3-400 amps for 350 LX models (see Section 4-16).

7 Output Selector Switch

See Section 4-2.

8 Power Switch

Use switch to turn unit Off and On.

9 Postflow Time Control

Use control to set length of time (0-50 seconds) gas flows after welding stops. It is important to set enough time to allow gas to flow until after the tungsten and weld puddle has cooled down.

Application:

Postflow is required to cool the tungsten and weld, and to prevent contamination of tungsten and weld. Increase postflow time if tungsten or weld are dark in appearance (approximately 1 second per 10 ampere of welding current).

10 Balance/DIG Control

See Section 4-10.

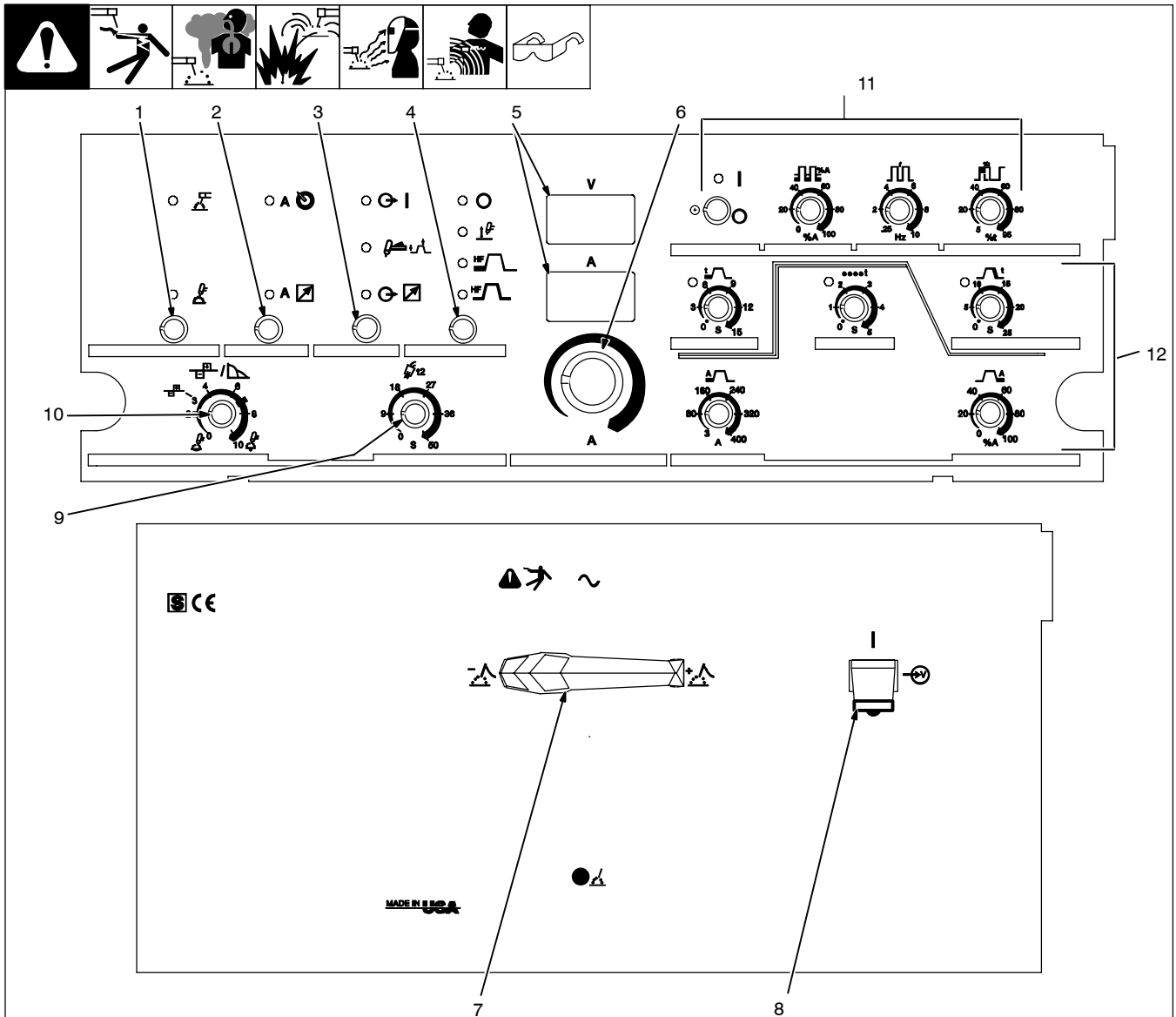
11 Pulser Controls (Optional on 250 DX model)

See Section 4-12.

12 Sequence Controls (Optional)

See Section 4-13.

B. For CE Units



☐ Top row of lights in upper left corner are On for SMAW. Bottom row are On for GTAW.

Green on nameplate indicates a TIG function, Gray indicates a Stick function.

1 Process Control

See Section 4-3.

2 Amperage Control

See Section 4-4.

3 Output Control

See Section 4-5.

4 Start Mode Control

See Section 4-9.

5 Voltmeter And Ammeter

Voltmeter displays average voltage (to the nearest 0.1 V) at the weld output terminals.

Use meter to preset amperage. Meter displays average weld amperage output of unit to nearest ampere when welding.

NOTE: Meters are self-calibrating. No adjustment available.

6 Amperage Adjustment Control

Use control to adjust amperage, and preset amperage on ammeter. This control may be adjusted while welding.

For remote amperage control, front panel control setting is the maximum amperage available. For example: If front panel control is set to 200 A, the range of the remote amperage control is 3 to 200 amps for 250 DX models, and 3 to 200 amps for 350 LX models..

For pulse welding, use Amperage Adjust control to select from 3-300 amps of peak amperage for 250 DX models, or 3-400 amps of peak amperage for 350 LX models (see Section 4-12).

For spot welding, use Amperage Adjust control to select from 3-310 amps for 250 DX models, or 3-400 amps for 350 LX models (see Section 4-16).

7 Output Selector Switch

See Section 4-2.

8 Power Switch

Use switch to turn unit Off and On.

9 Postflow Time Control

Use control to set length of time (0-50 seconds) gas flows after welding stops. It is important to set enough time to allow gas to flow until after the tungsten and weld puddle has cooled down.

Application:

Postflow is required to cool the tungsten and weld, and to prevent contamination of tungsten and weld. Increase postflow time if tungsten or weld are dark in appearance (approximately 1 second per 10 ampere of welding current).

10 Balance/DIG Control

See Section 4-10.

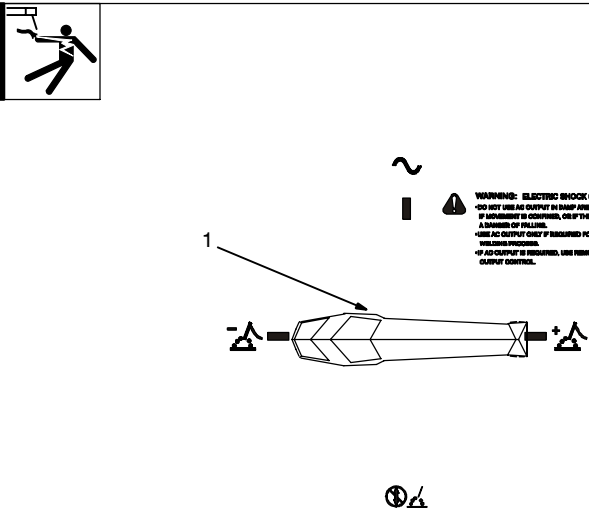
11 Pulser Controls (Optional on 250 DX model)

See Section 4-12.

12 Sequence Controls (Optional)

See Section 4-13.

4-2. Output Selector Switch



WARNING: ELECTRIC SHOCK CAN KILL.
 DO NOT USE AC OUTPUT IN DAMP AREAS, IF MOVEMENT IS CONFINED, OR IF THERE IS A DANGER OF FALLING.
 USE AC OUTPUT ONLY IF REQUIRED FOR THE WELDING PROCESS.
 IF AC OUTPUT IS REQUIRED, USE REMOTE OUTPUT CONTROL.

1 Output Selector Switch

▲ Do not use AC output in damp areas, if movement is confined, or if there is danger of falling. Use AC output ONLY if required for the welding process, and then use a remote control.

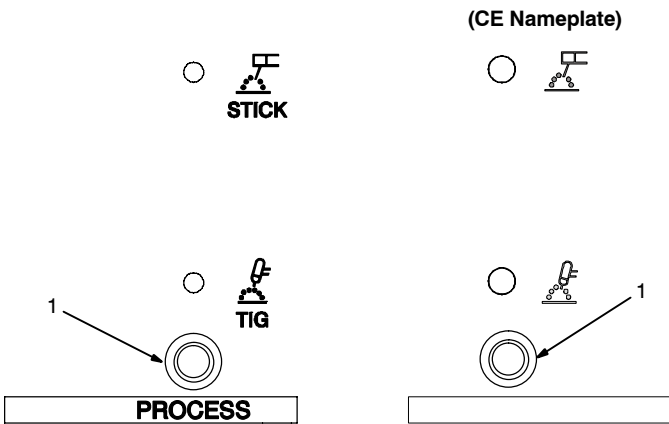
▲ Do not change position of switch while welding or while under load.

Use switch to select (DCEN) Direct Current Electrode Negative, AC, or (DCEP) Direct Current Electrode Positive output.

NOTE: Changing position of Output Selector switch may change Process control, Current control, and Start Mode control, and may require changing Output control settings to properly function with latest Output Selector switch setting.

4-3. Process Control



(CE Nameplate)





PROCESS

1 Process Control

Use control to select Shielded Metal Arc Welding (SMAW) or Gas Tungsten Arc Welding (GTAW) process.

  For SMAW, press button to toggle LED to Stick position.

  For GTAW, press button to toggle LED to TIG position.

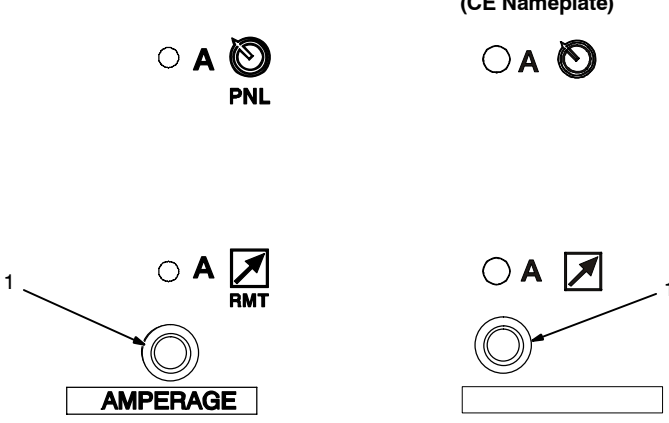
NOTE: Lit LED indicates selected mode.

When Output Selector switch position changes, LED may change position, based upon last selection.

Ref. 217 264-A / Ref. 215 460-A

4-4. Amperage Control



(CE Nameplate)





AMPERAGE

1 Amperage Control

Use control to select front panel or remote amperage control.

  For front panel amperage control, press button to toggle LED to Panel position.

  For remote amperage control, press button to toggle LED to Remote position (see Section 3-8).

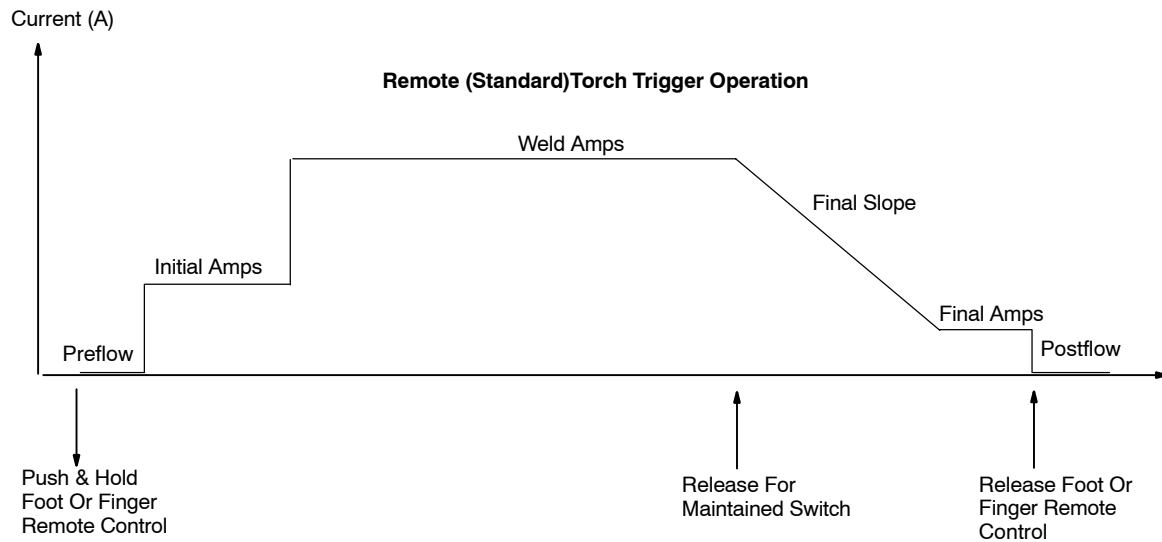
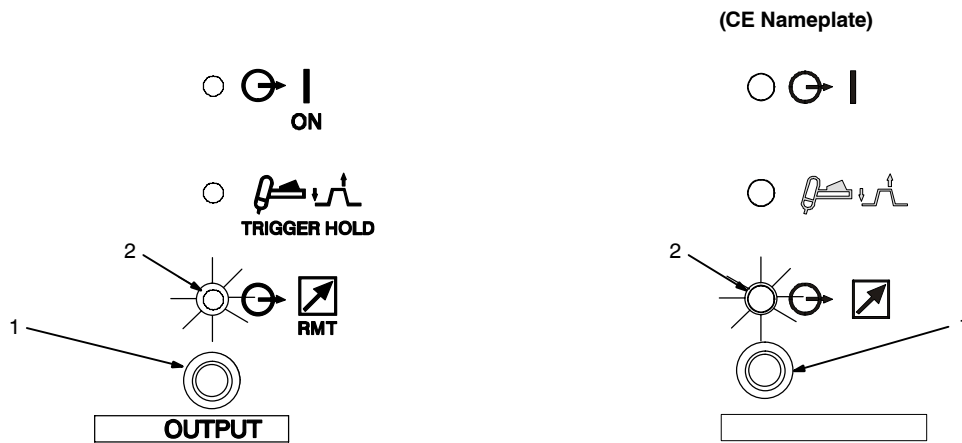
NOTE: Lit LED indicates selected mode.

When Output Selector switch position changes, LED may change position, based upon last selection.

4-5. Output Control



Remote (Standard) Torch Trigger Operation



1 Output Control

▲ **Weld output terminals are energized when power is On, and Output On LED is lit.**

Use control to select front panel, trigger hold, or remote output control.

NOTE: Lit LED indicates selected mode.

For weld output, press button to toggle LED to On position.

2 Remote Trigger (Standard) Operation

For remote output control, press button to toggle LED to Remote position (see Section 3-8).

Torch trigger operation is as shown.

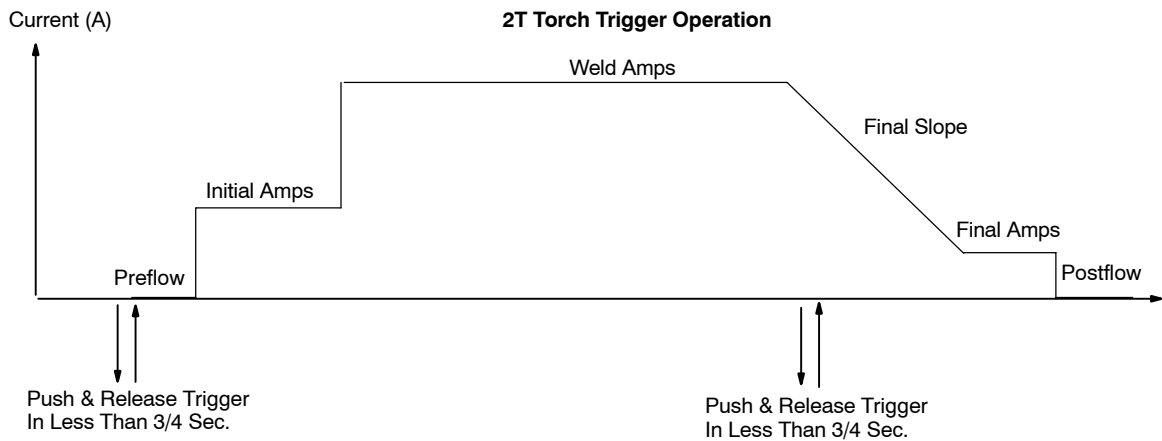
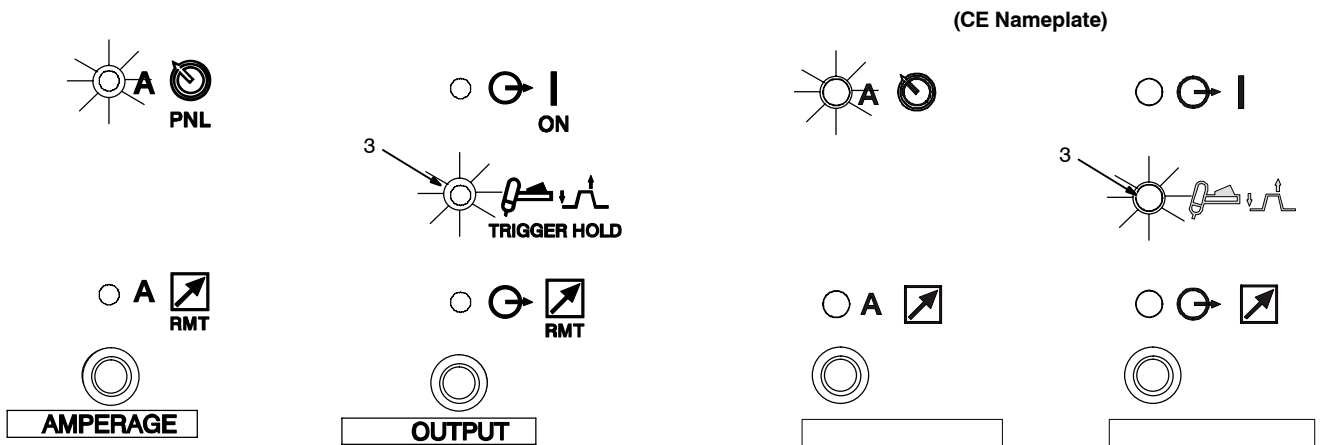
NOTE: Initial weld amperage and final amperage is controlled by the remote device, not by the welding power source.

NOTE: If On/Off only type trigger is used, it must be a maintained switch. All functions become active.

Application: Use Remote Trigger when the operator desires to use a foot pedal or finger amperage control.

When Output Selector switch (see Section 4-2) position changes, Output control LED will always switch to Remote.

Trigger Hold (2T)



NOTE: If torch trigger is held more than 3 seconds, operation reverts to Remote Trigger (Standard) mode (see previous page).
 If arc is broken and trigger is depressed, HLP-10 will be displayed (see Section 6-2).



Trigger Hold

For trigger hold operation, press button to toggle LED to Trigger Hold position.
 Torch trigger operation is as shown.

NOTE: When a foot or finger remote control is connected to the welding power source, only trigger input is functional, as amperage is controlled by the welding

power source.

Application: Trigger Hold (2T) can help to reduce operator fatigue when long extended welds are made.

4-6. 4T, 4T Momentary, And Mini Logoic Trigger Operation (Requires Optional Sequence Controls)

4T Torch Trigger Operation

If unit is equipped with optional Sequence Controls (see Section 4-13), 4T trigger method is available.

4T torch trigger operation is as shown.

While in 4T mode, there is a feature available during the main weld sequence that al-

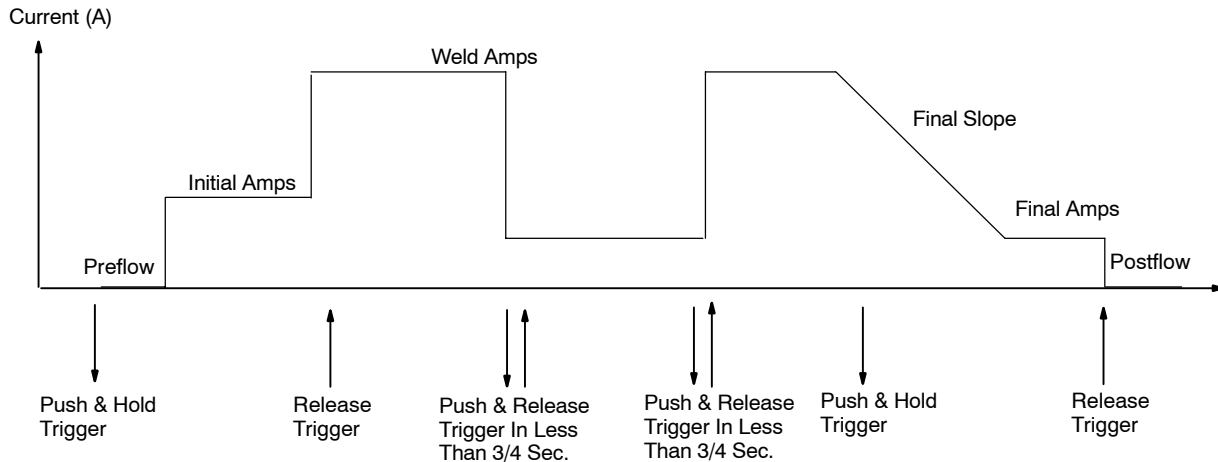
lows the operator to toggle between weld current and final current without breaking the arc.

NOTE: When a remote switch is connected to the welding power source, only trigger input is functional. Amperage is controlled by the welding power source.

Application:

Use 4T trigger method when the functions of a remote current control are desired, but only a remote on/off control is available.

Select 4T trigger method according to Section 4-7.



4T Momentary Torch Trigger Operation

If unit is equipped with optional Sequence Controls (see Section 4-13), 4T Momentary trigger method is available.

4T Momentary torch trigger operation is as shown.

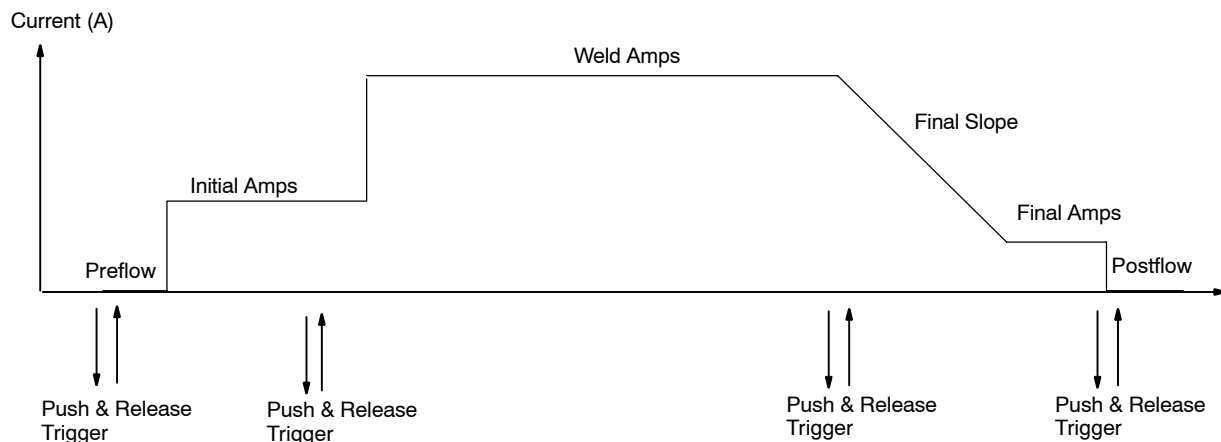
While in 4T Momentary mode, once the operator toggles out of weld current and begins final slope, toggling again will break the arc and go to postflow.

NOTE: When a remote switch is connected to the welding power source, only trigger input is functional. Amperage is controlled by the welding power source.

Application:

Use 4T Momentary trigger method when the functions of a remote current control are desired, but only a remote on/off control is available.

Select 4T Momentary trigger method according to Section 4-7.



Mini Logic Operation

If unit is equipped with optional Sequence Controls (see Section 4-13), Mini Logic operation is available.

Torch trigger operation is as shown.

During Mini Logic welding operation, the weld amperage can be manually changed

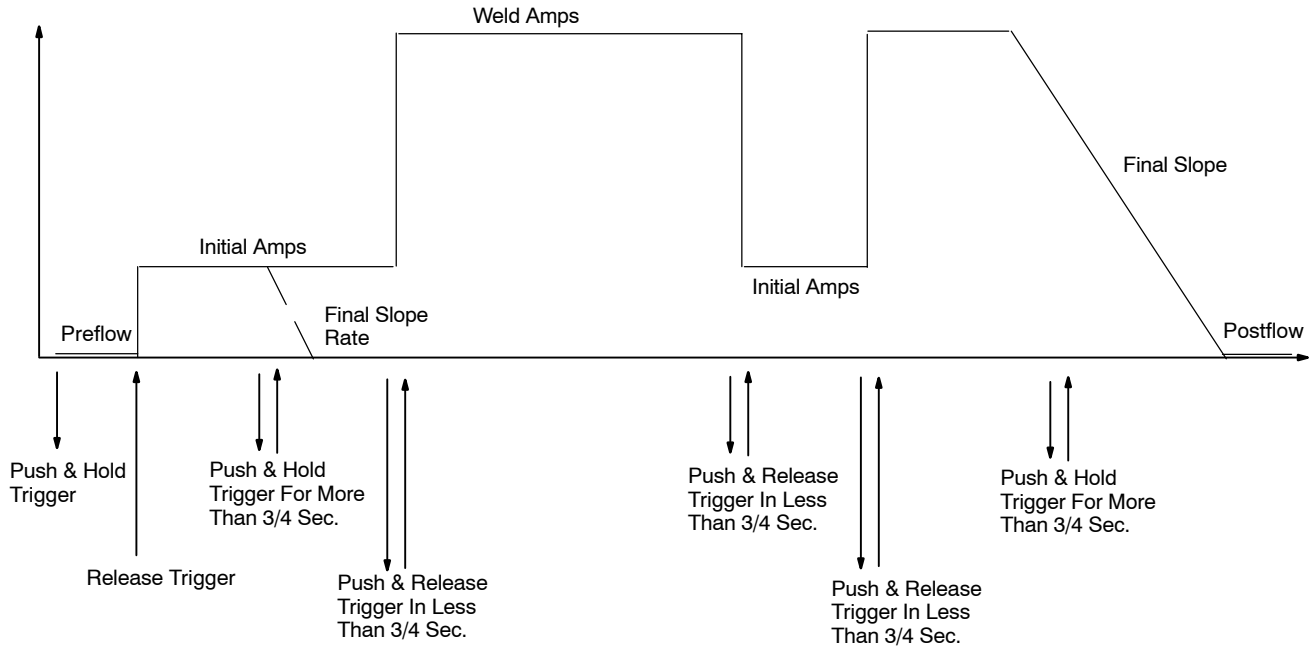
from the initial amps level to the main weld amps level by pressing and releasing the torch trigger in less than 3/4 seconds.

NOTE: When a remote switch is connected to the welding power source, only trigger input is functional. Amperage is controlled by

the welding power source.

Application: This ability to change amperage levels without either initial slope or final slope, gives the operator the opportunity to adjust filler metal without breaking the arc.

Select Mini Logic according to Section 4-7.



4-7. Reconfiguring Trigger Hold For 4T And Mini Logic Control

- ➡ 1 Output Control
- ⊖ 2 Power Switch

To reconfigure Trigger Hold, turn Off power, push and hold Output control button and turn On power switch. Hold button for approximately 7 seconds (or until software version number _____ - clears, and meters display [SEL] [H-2].

Press Output control button to change functions. Active function will be displayed on amperage (bottom) meter.

3 Meter Displays

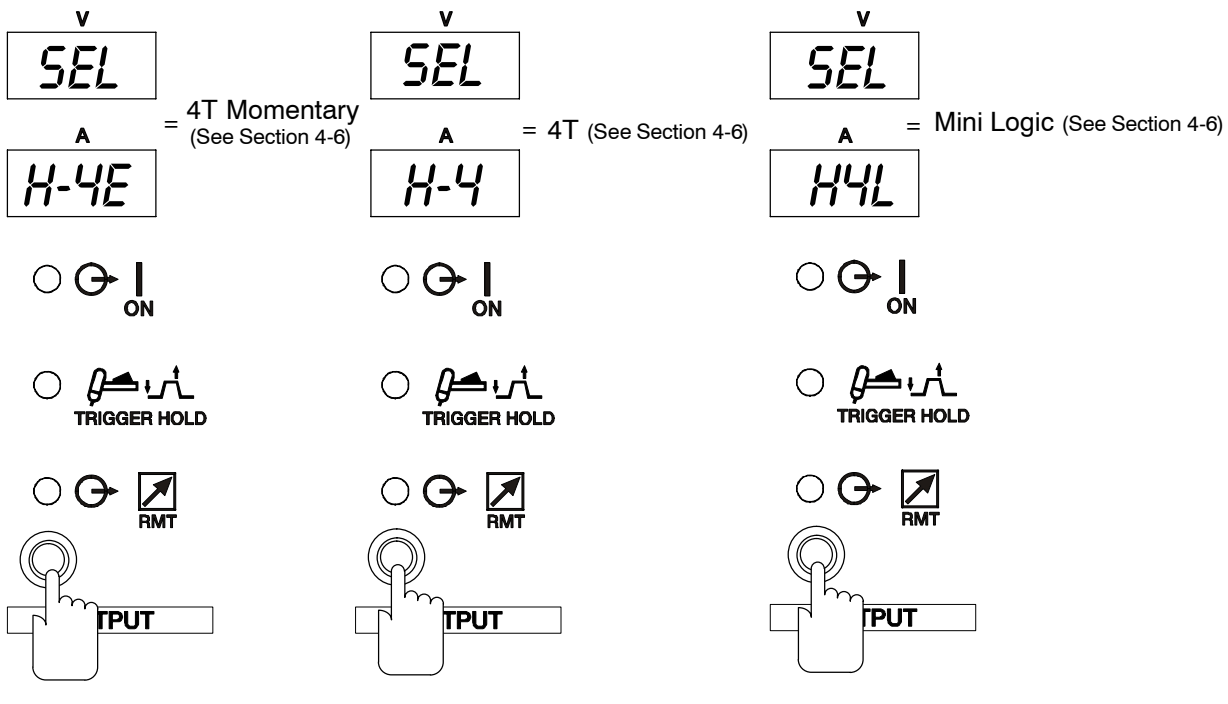
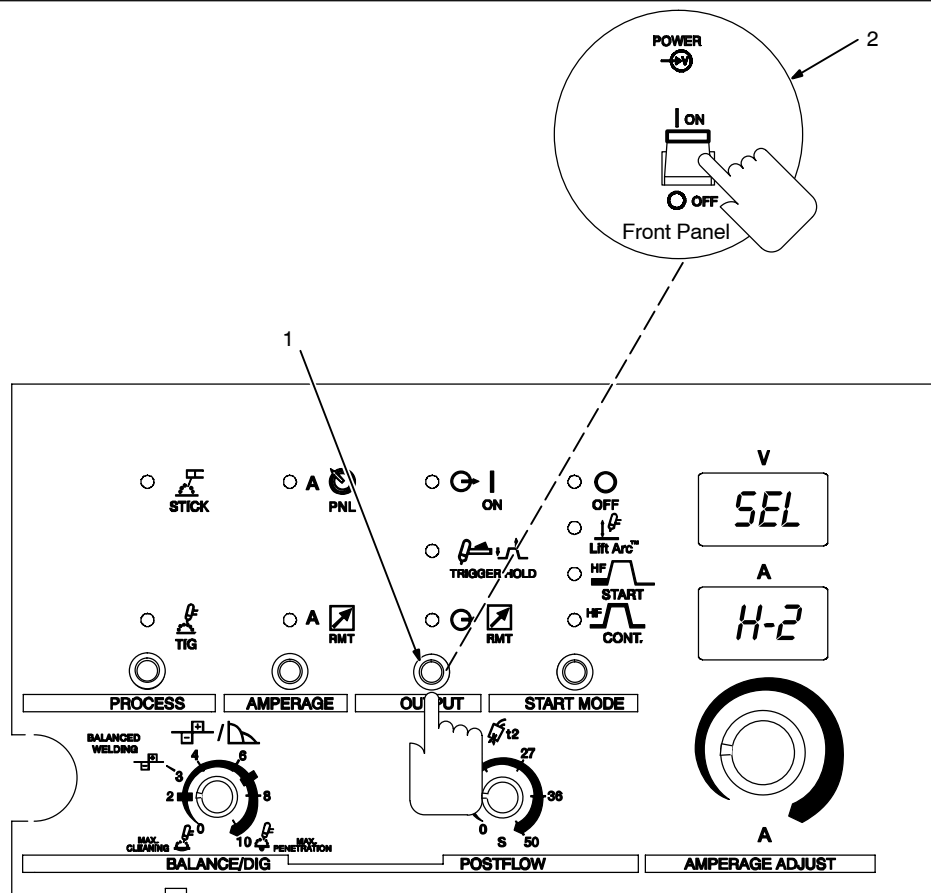
Meter displays for the different functions will be as shown.

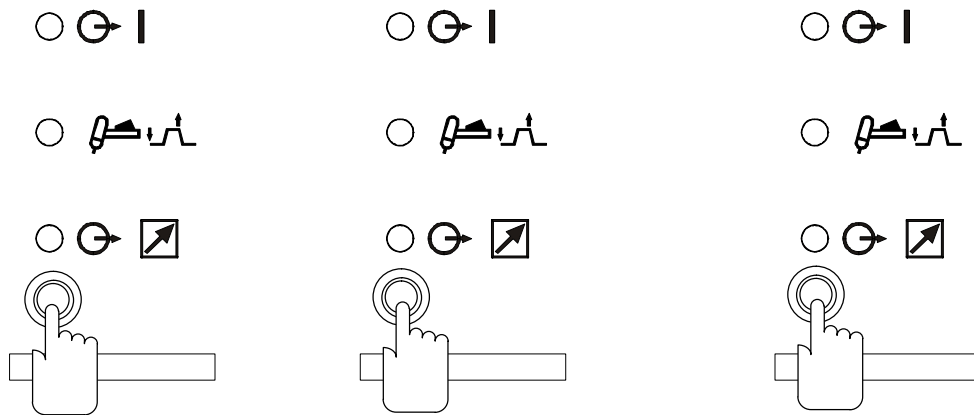
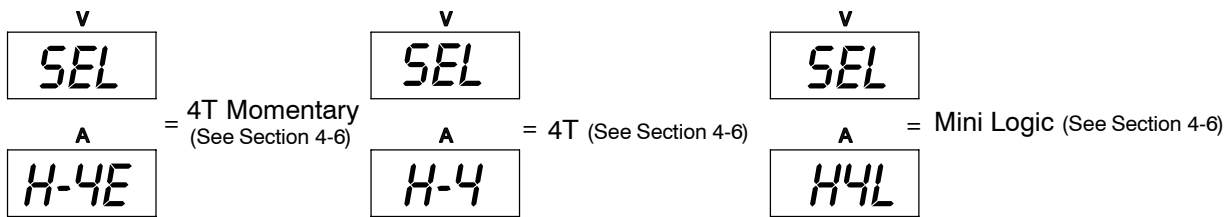
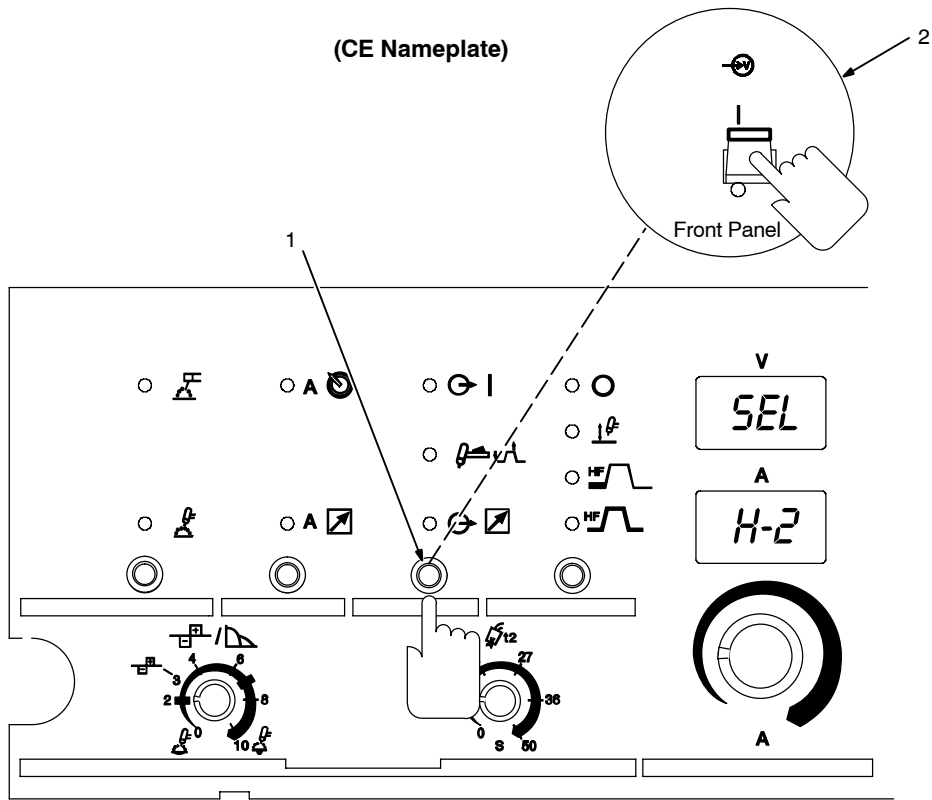
Press torch trigger or turn power Off to save setting.

Proceed to Section 4-6 for 4T Operation.

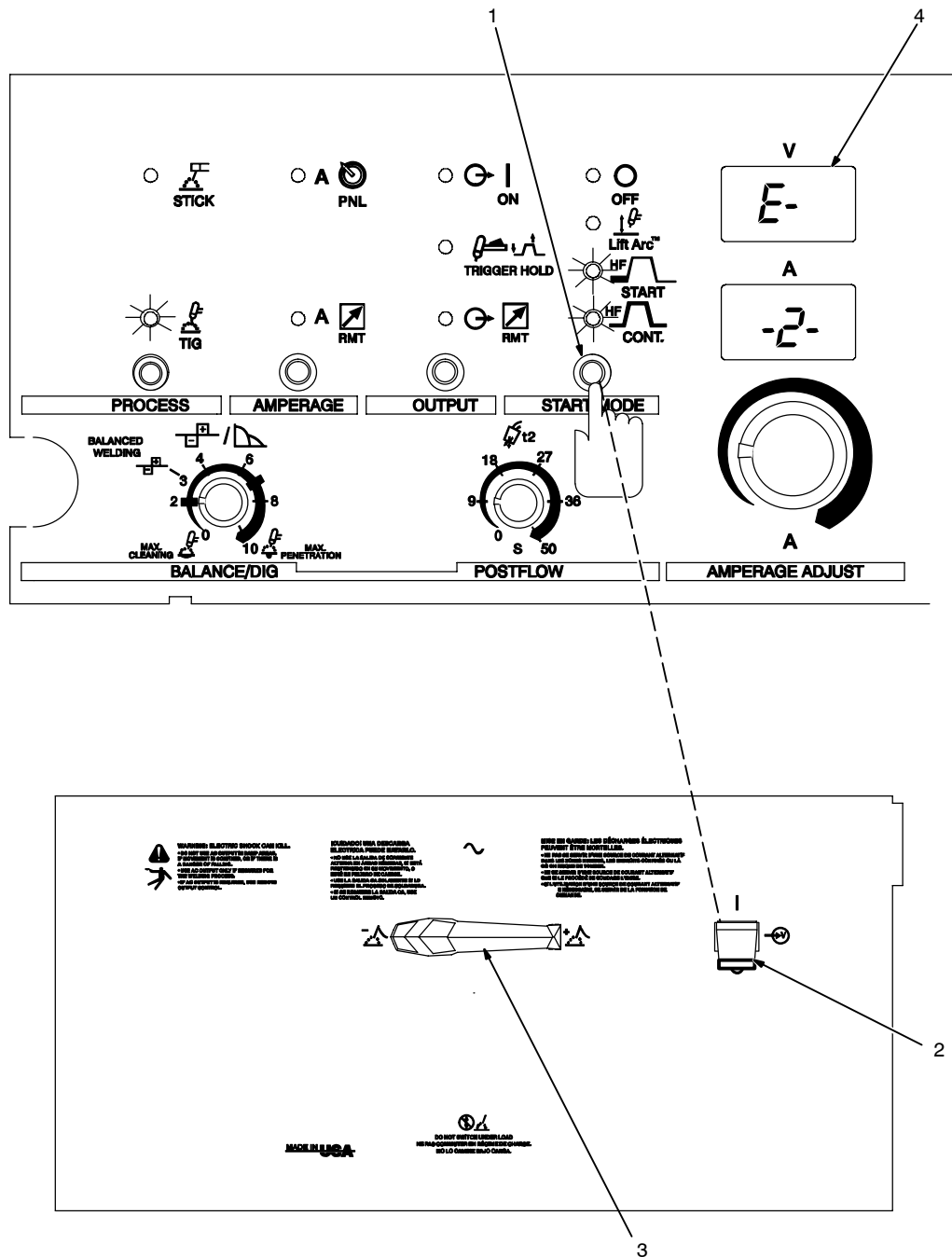
Proceed to Section 4-6 for Mini Logic operation.

NOTE: These features are only available when optional Sequencer is installed.





4-8. Selecting TIG Starting Characteristics Using Syncro-Start™ Technology



Use this function to select desired TIG starting characteristics.

- 1 Start Mode
- 2 Power Switch
- 3 Output Selector Switch
- 4 Meters

To select or change TIG starting characteristics, proceed as follows: turn Off power. Place Output Selector switch in desired position (each position, DCEN, AC, or DCEP has three applicable start characteristics options). Push and hold Start Mode button and

turn On power. Hold button for approximately 7 seconds (or until software version number _____ clears meters).

The TIG LED and all four Start LEDs will light, and the meters will display [E] [-2], [AC] [-2], or [EP] [-2], depending on position of Polarity switch.

Press Start Mode button again to step through the three start characteristics choices. Amperage (bottom) meter displays active choice 1= light start, 2=medium/normal start, 3=high/hot start.

Press torch trigger or turn Off power to save setting.

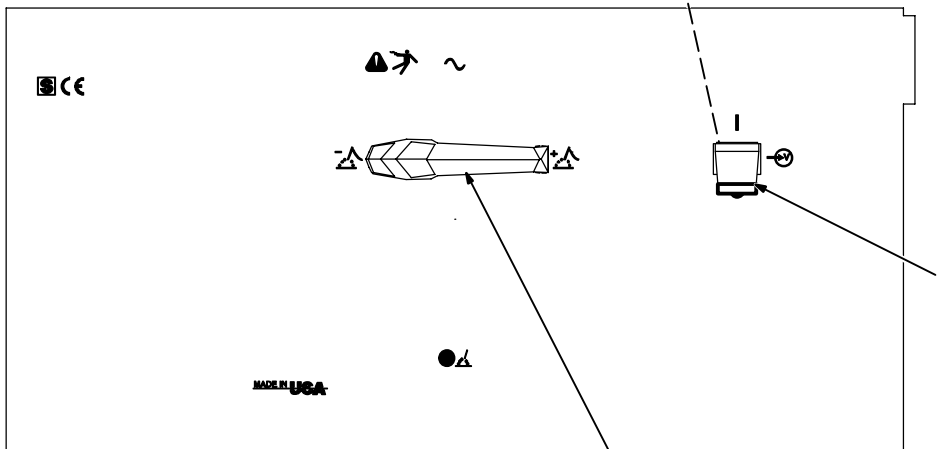
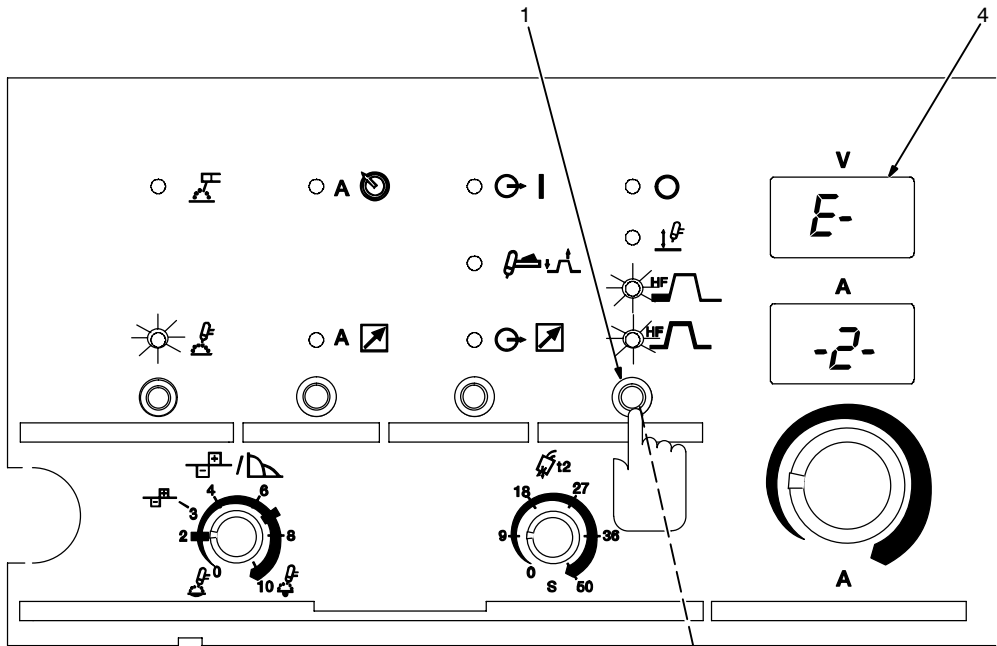
Application:

Select 1 (light/soft start) – when welding at low amperages on thin gauge material.

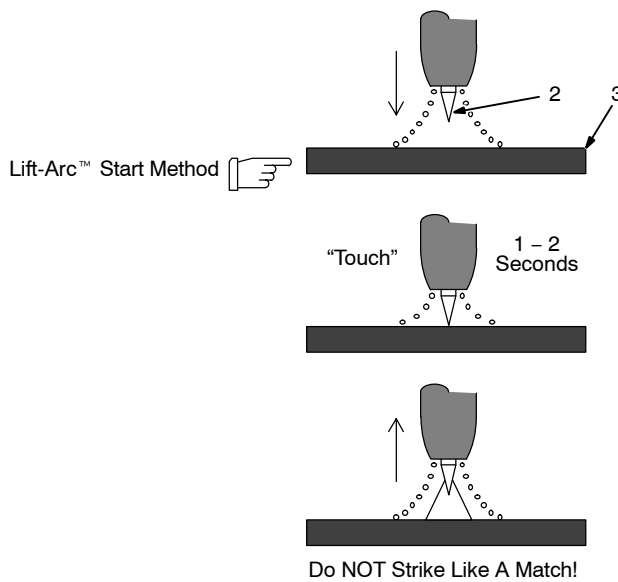
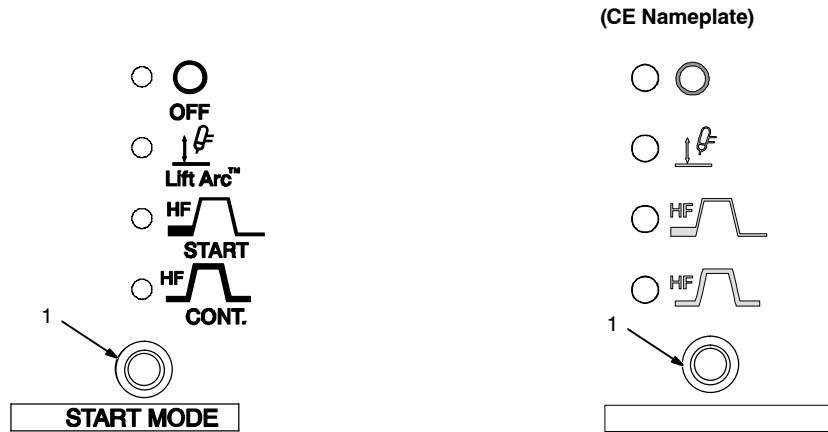
Select 2 (medium/normal start) – factory default setting used for most welding applications.

Select 3 (high/hot start) – when welding at high amperages on thick materials with a large diameter tungsten.

(CE Nameplate)



4-9. Start Mode



1 Start Mode

☀ For SMAW welding, press button to toggle LED to Off position.

For GTAW welding, use control to select Off for no HF, Lift-Arc™, HF for arc starting only, or continuous HF.

Application:

When Off is selected, use the scratch method to start an arc for both the SMAW and GTAW processes.

☞ **When Lift-Arc is selected, start arc as follows:**

- 2 TIG Electrode
- 3 Workpiece

Touch tungsten electrode to workpiece at weld start point, enable output with torch trigger, foot control, or hand control. **Hold electrode to workpiece for 1-2 sec-**

onds, and slowly lift electrode. An arc will form when electrode is lifted.

Shielding gas begins to flow when electrode touches work piece.

Normal open-circuit voltage is not present before tungsten electrode touches workpiece; only a low sensing voltage is present between electrode and workpiece. The solid state output contactor does not energize until after electrode is touching workpiece. This allows electrode to touch workpiece without overheating, sticking, or getting contaminated.

Application:

Lift-Arc is used for the DCEN GTAW process when HF Start method is not permitted, or to replace the scratch method.

☞ **When HF Start is selected, start arc as follows:**

High frequency turns on to help start arc when output is enabled. High frequency

turns off when arc is started, and turns on whenever arc is broken to help restart arc.

Application:

HF Start is used when the DCEN GTAW process is required.

☞ **When HF Continuous is selected, start arc as follows:**

High frequency turns on when output is energized and remains on for duration of weld.

Application:

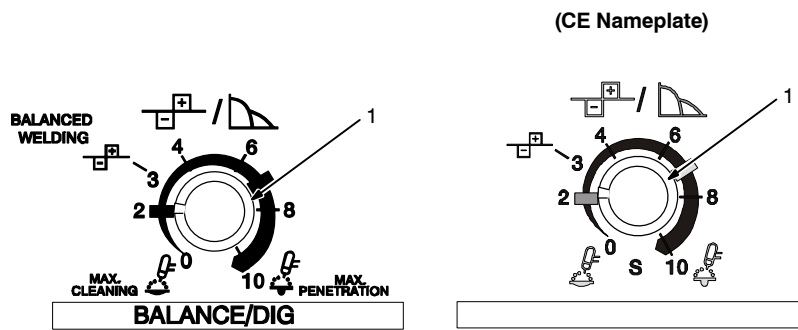
HF Continuous is used when the AC GTAW process is required.

NOTE: Lit LED indicates selected mode.

When Output Selector switch position changes, LED may change position, based upon last selection.

NOTE: Some start methods may not be available for all processes.

4-10. Balance/DIG Control



1 Balance/DIG Control

Balance Control (AC GTAW):

Control changes the AC output square wave. Rotating the control towards 10 provides deeper penetration. Rotating the control towards 0 provides more cleaning action of the workpiece.

When the control is in the Balanced position, the wave shape provides equal penetration and cleaning action.

Application:

When welding on oxide forming materials such as aluminum or magnesium, excess cleaning is not necessary. To produce a good weld, only a minimal amount, approximately a 0.10 in (2.5mm) of etched zone along the weld toes is required.

Set control to 3 and adjust as necessary. Joint configuration, set-up, process variables, and oxide thickness may affect setting.

NOTE: Arc rectification can occur when welding above 200 amps and/or while welding with helium gas. If this condition occurs, increasing the Balance control towards maximum penetration, may help to restabilize the arc.


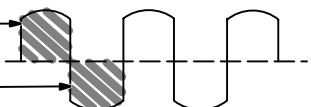

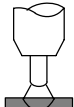

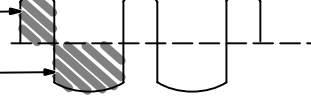
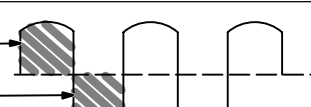
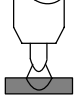

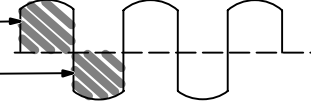

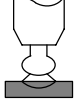
DIG Control (AC And DC SMAW):

When set at 0, short-circuit amperage at low arc voltage is the same as normal welding amperage.

When setting is increased, short-circuit amperage at low arc voltage increases. Set control at 2 and adjust as necessary. Joint configuration, set-up, and process variables may affect setting.

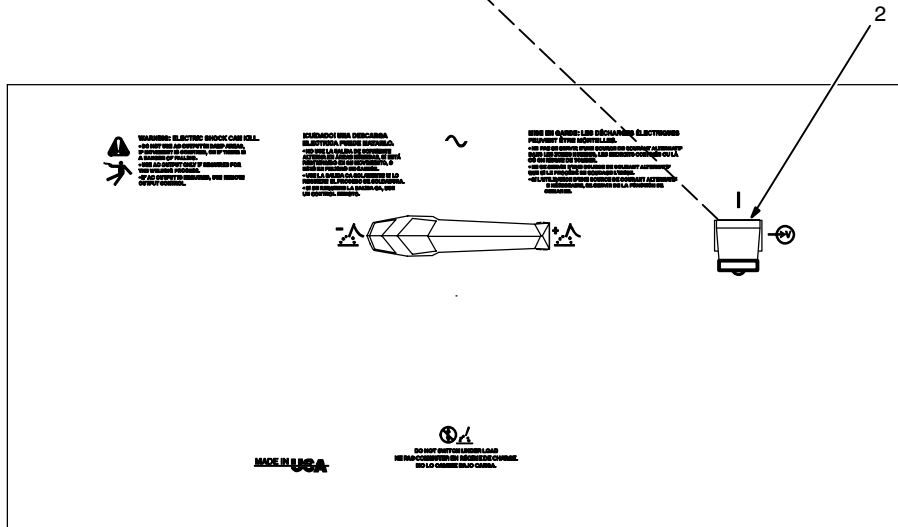
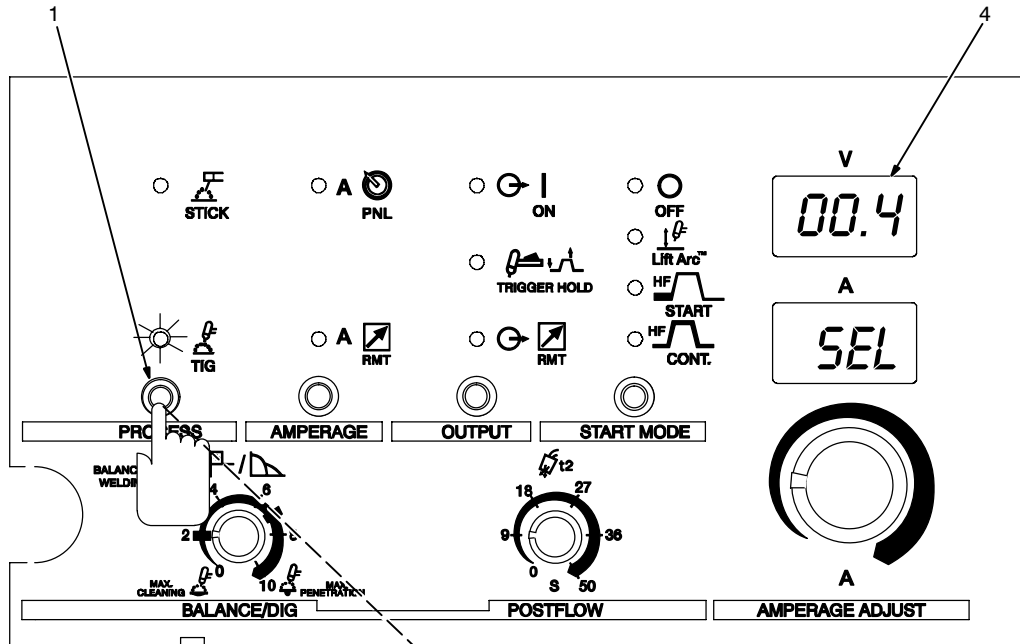
Application:

Control helps arc starting or making vertical, or overhead welds by increasing amperage at low arc voltage, and reduces electrode sticking while welding.

Balance Control Examples		
Setting	Output Waveforms	Arc
Balanced 	50% Electrode Positive  50% Electrode Negative 	
Max Penetration 	32% Electrode Positive  68% Electrode Negative 	
Max Cleaning 	55% Electrode Positive  45% Electrode Negative 	

Ref. S-0795-A

4-11. Prewflow Time Control



Use control to set length of time (0.2, 0.4, 0.6, 0.8, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0 seconds) gas flows before welding starts.

- 1 Process Control
- 2 Power Switch
- 3 Meters

To change preflow time, proceed as follows:

Turn power off. Push and hold Process Control button and turn On power. Hold button for approximately 7 seconds (or until software version number _____ clears meters).

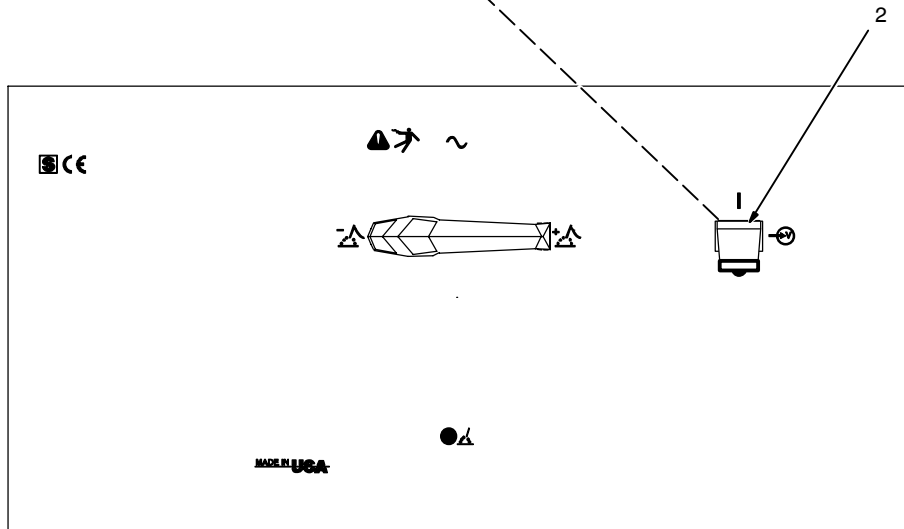
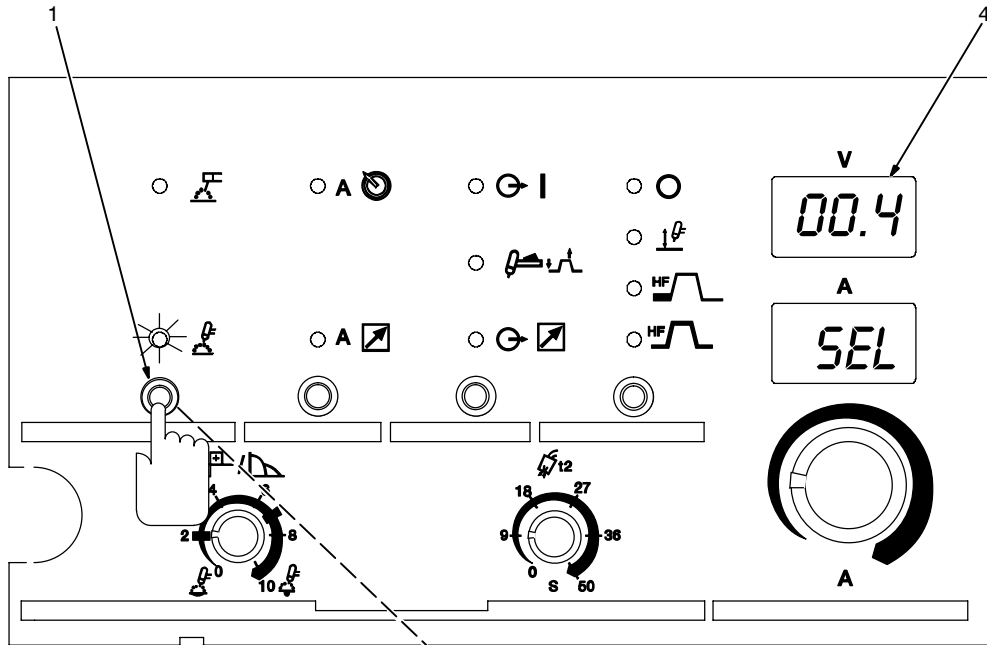
The TIG LED will light and the meters will display [0.4] [SEL]. The factory preflow default setting is 0.4 seconds. To change preflow

time, press and release Process Control button until desired time is displayed on meters.

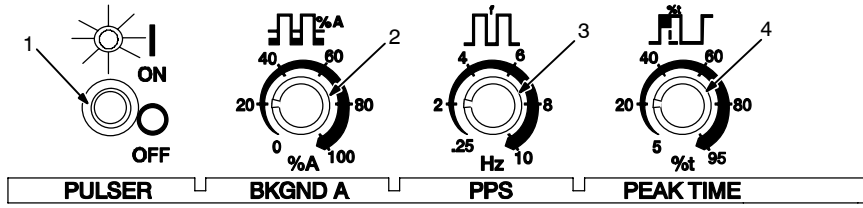
Application:

Preflow is used to purge the immediate weld area of atmosphere. Prewflow also aids in consistent arc starting.

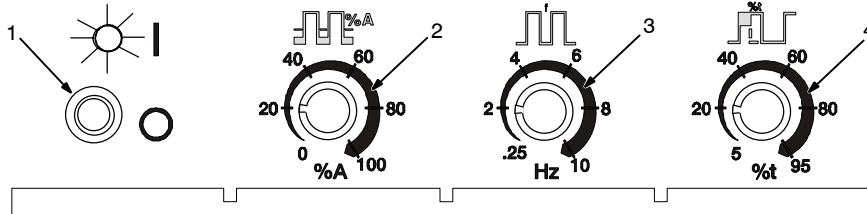
(CE Nameplate)



4-12. Pulse Controls (Standard On 350 LX Models, Optional On 250 DX Models)



(CE Nameplate)



- 1 On/Off Control
- Use control to turn pulse function On and Off.

- 2 Background Amps
- Use Background Amps control to set the low pulse of the weld amperage, which cools the weld puddle and affects overall heat input. Background Amps is set as a percentage of peak amperage.

- 3 Pulse Frequency
- Ranges from 0.25–10.0 pps (pulses per second). Control is used to determine appearance of weld bead.

- 4 Peak Time
- A range of 5–95% of each pulse cycle can be spent at the peak amperage level.

Peak amperage (3-310 amps for 250 DX models, and 3–400 amps for 350 LX models), is set with the Amperage Adjustment control (see Section 4-1). Peak amperage is the highest welding amperage allowed to occur in the pulse cycle. Weld penetration varies directly with peak amperage.

5 Pulsed Output Waveforms

Example shows affect changing the Peak Time control has on the pulsed output waveform.

Application:


Pulsing refers to the alternating raising and lowering of the weld output at a specific rate. The raised portions of the weld output are controlled in width, height, and frequency, forming pulses of weld output. These pulses and the lower amperage level between them (called the background amperage) alternately heat and cool the molten weld puddle. The combined effect gives the operator better control of penetration, bead width, crowning, undercutting, and heat input. Controls can be adjusted while welding.






Pulsing can also be used for filler material addition technique training.

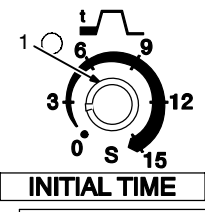
NOTE: Function is enabled, when LED is lit.

Percent (%) Peak Time Control Setting	Pulsed Output Waveforms
Balanced (50%) 	
More Time At Peak Amperage (80%) 	
More Time At Background Amperage (20%) 	

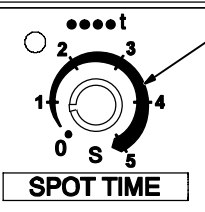
4-13. Sequence Controls (Optional)



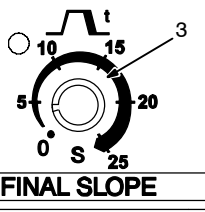
-  1 Initial Time Control
See Section 4-14.
-  2 Initial Amperage Control
See Section 4-14.
-  3 Final Slope Control
See Section 4-15.
-  4 Final Amperage Control
See Section 4-15.
-  5 Spot Time Control
See Section 4-16.



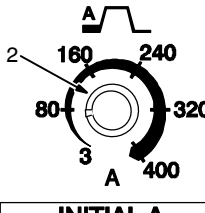
INITIAL TIME



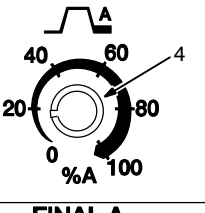
SPOT TIME



FINAL SLOPE

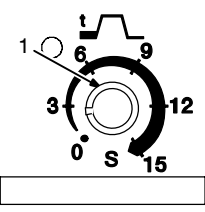


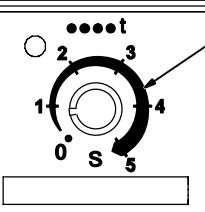
INITIAL A

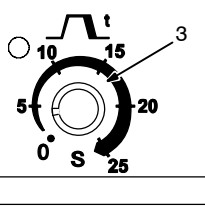


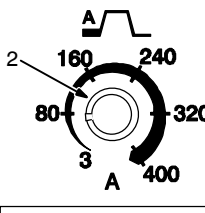
FINAL A

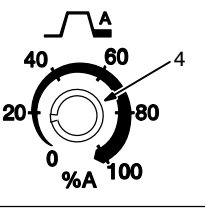
(CE Nameplate)



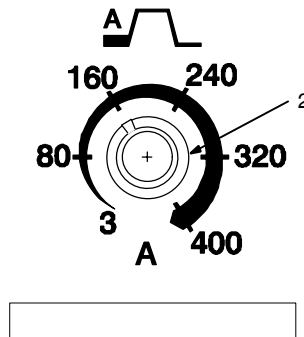
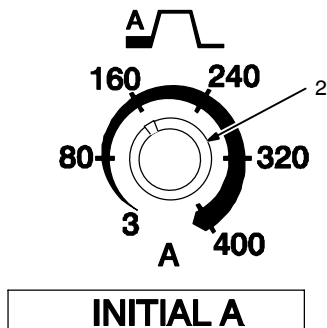
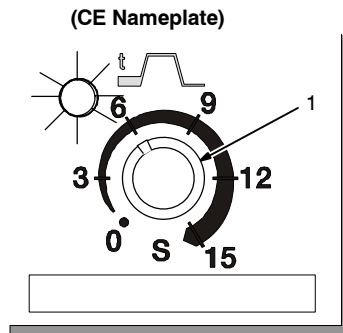
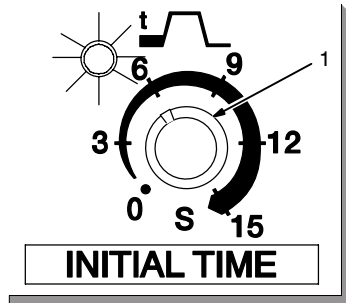








4-14. Initial Time Control And Initial Amperage Control



- 1 Initial Time Control
 Indicator light is on when Initial Time control function is active.

NOTE: Initial Sequence control function is inactive when Spot Time function is active.

Use control to select 0–15 seconds of start time.

- 2 Initial Amperage Control
 Indicator Light is on when Initial Sequence control function is active.

NOTE: Initial Amperage control function is inactive when Spot Time function is active.

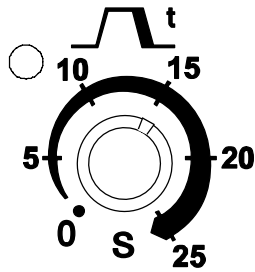
Use control to select a starting amperage (3–400 amps) that is different from the weld amperage. Note: Initial Amperage can be used with or without a remote control (Initial Amperage and Initial Time control settings will override a remote control device).

Application:

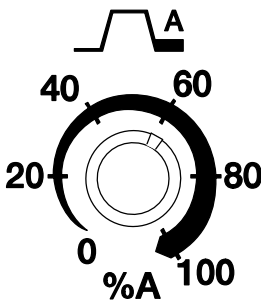
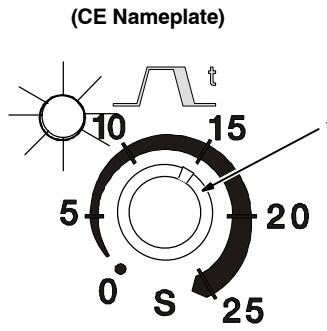
Initial Amperage can be used while GTAW welding to assist in preheating cold material prior to depositing filler material, or to ensure a soft start. Initial Amperage can also be used for SMAW to ensure a more consistent arc strike.

NOTE: Function is enabled, when LED is lit.

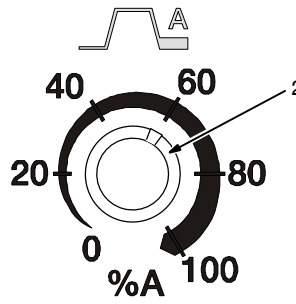
4-15. Final Slope Control And Final Amperage Control



FINAL SLOPE



FINAL A



1 Final Slope Control

Indicator light is on when Final Slope control function is active.

Note: Final Slope control function is inactive when Spot Time function is active.

Use control to reduce amperage over a set period of time (0–15 seconds) at the end of the weld cycle when NOT using a remote current control.



2 Final Amperage Control

Indicator light is on when Final Amperage control function is active.

Note: Final Amperage control function is inactive when Spot Time function is active (see Section 4-16).

Final amperage is the amperage to which weld amperage has sloped down to (0–100% of amperage set on Amperage Adjust control).

Application:

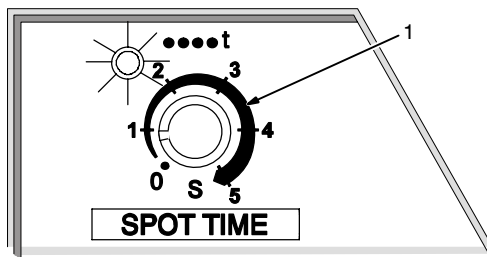
Final Slope should be used while GTAW welding materials that are crack sensitive, and/or the operator wants to eliminate the crater at the end of the weld.

Note: This applies if the operator is using an on/off only type control to start and stop the welding process.

Note: Do not use this function with a foot or finger amperage control.

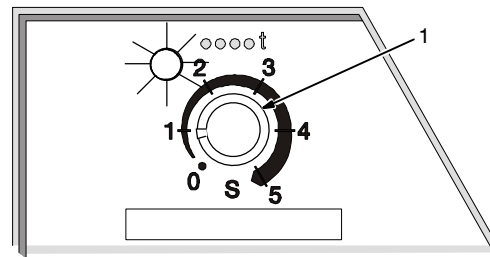
NOTE: Function is enabled, when LED is lit.

4-16. Spot Time Control



SPOT TIME

(CE Nameplate)



1 Spot Time Control



Indicator light is on when Spot Time function is active. When Spot Time function is active, Initial Time, Initial Amperage, Final Slope, and Final Amperage functions are inactive (see Section 4-13).

Used with the (GTAW) TIG Spot process, generally with a direct current electrode negative (DCEN) set-up.

Use control to select 0–15 seconds of spot time.

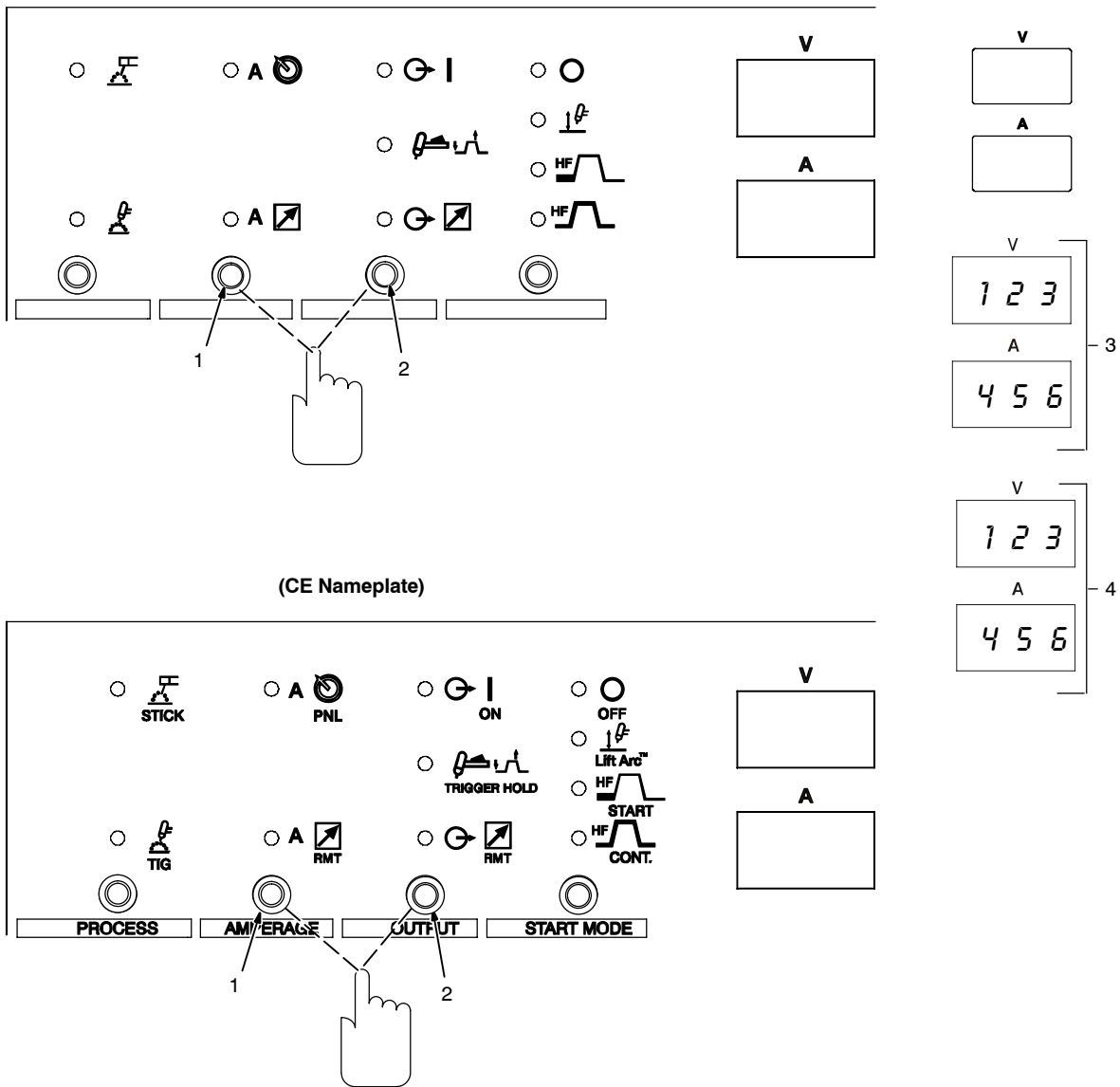
Use Amperage Adjust control (see Section 4-1) to set amperage.

Application:

TIG spot welding is used for joining thinner materials that are in close contact with the fusion method. A good example would be joining coil ends.

NOTE: Function is enabled, when LED is lit.

4-17. Timer/Cycle Counter



1 Amperage Control

2 Output Control (Contactor)

To read timer/cycle counter, hold Amperage and Output (contactor) buttons while turning on power. When machine first powers up, the displays will show the

software number and revision for the first seven seconds. It will then show arc time and cycle count.

3 Timer Display

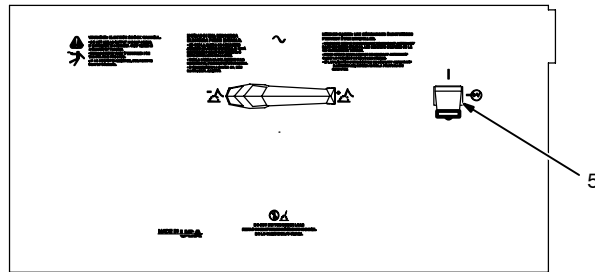
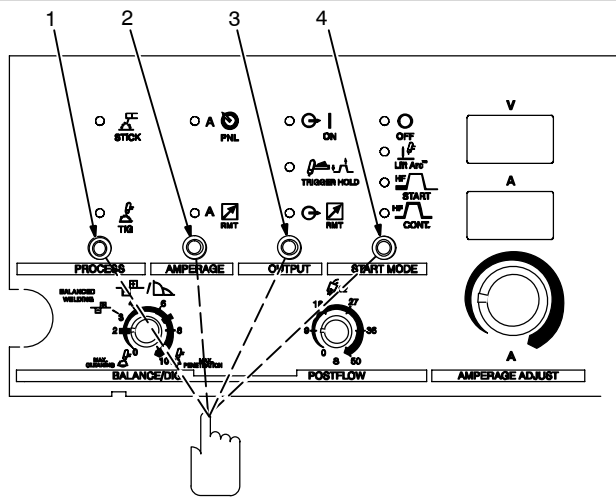
The hours and minutes are displayed on the volt and amp meters for the first five

seconds, and are read as 1, 234 hours and 56 minutes.

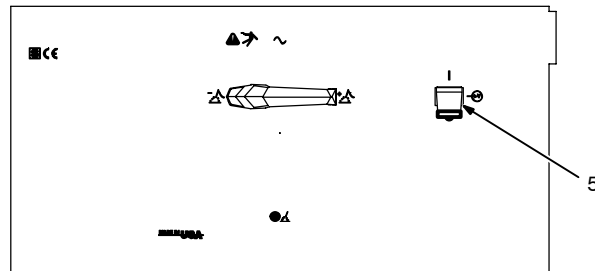
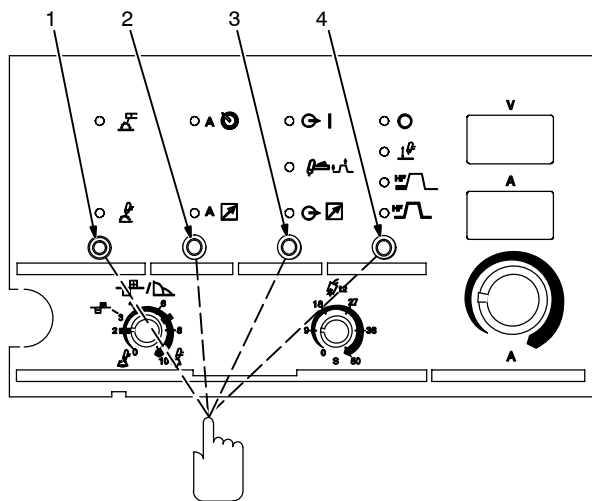
4 Cycle Display

The cycles are displayed on the volt and amp meters for the next five seconds, and are read as 123, 456 cycles.

4-18. Resetting Unit To Factory Default Settings (All Models)



(CE Nameplate)



- 1 Process Control
- 2 Amperage Control
- 3 Output Control
- 4 Start Control

- 5 Power Switch
- To reset all welding power source functions to original factory settings, turn power off. Push and hold the Process, Amperage,

Output, and Start controls and turn On power. Hold switch pads for approximately 7 seconds (or until software version number -----_ clears meters).

SECTION 5 – THEORY OF OPERATION

1 Input Terminal Board TE1

Provides means for operation on different input voltages.

2 Power Switch S1

Provides on/off control of welding power source.

3 Main Transformer T1

Supplies power to weld output circuit, various control circuits, main control board PC1, and fan motors FM1 and FM2.

4 Main Rectifier

Changes the ac output from T1 to full-wave rectified dc and controls output current level.

5 Fan Motors FM1, FM2

Provides cooling of internal components.

6 115 VAC Duplex Receptacle RC2

Provides connection point for auxiliary equipment.

7 Circuit Breaker CB1

Protects 115 volts AC winding.

8 Control Board PC1

Controls weld output by changing the SCR gate pulses (conduction times) after comparing current feedback to selected amperage signal. Also provides user interface.

9 Thermistor TH1

Provides temperature feedback about the rectifier back to control board PC1.

10 Thermistor TH2

Provides temperature feedback to the control board PC1 about main transformer T1.

11 Remote 14 Pin Receptacle RC1

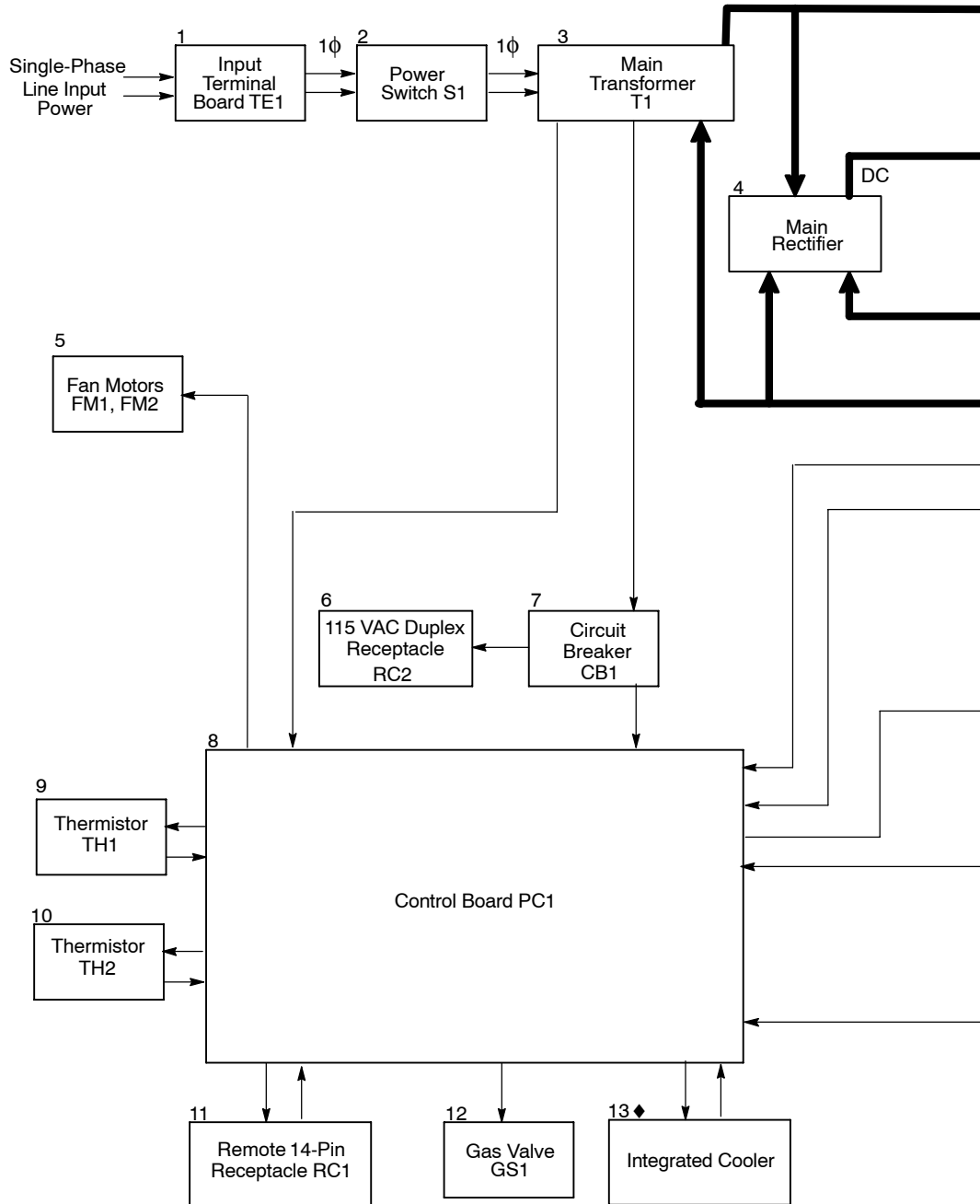
Provides connect point for remote amperage and contactor devices.

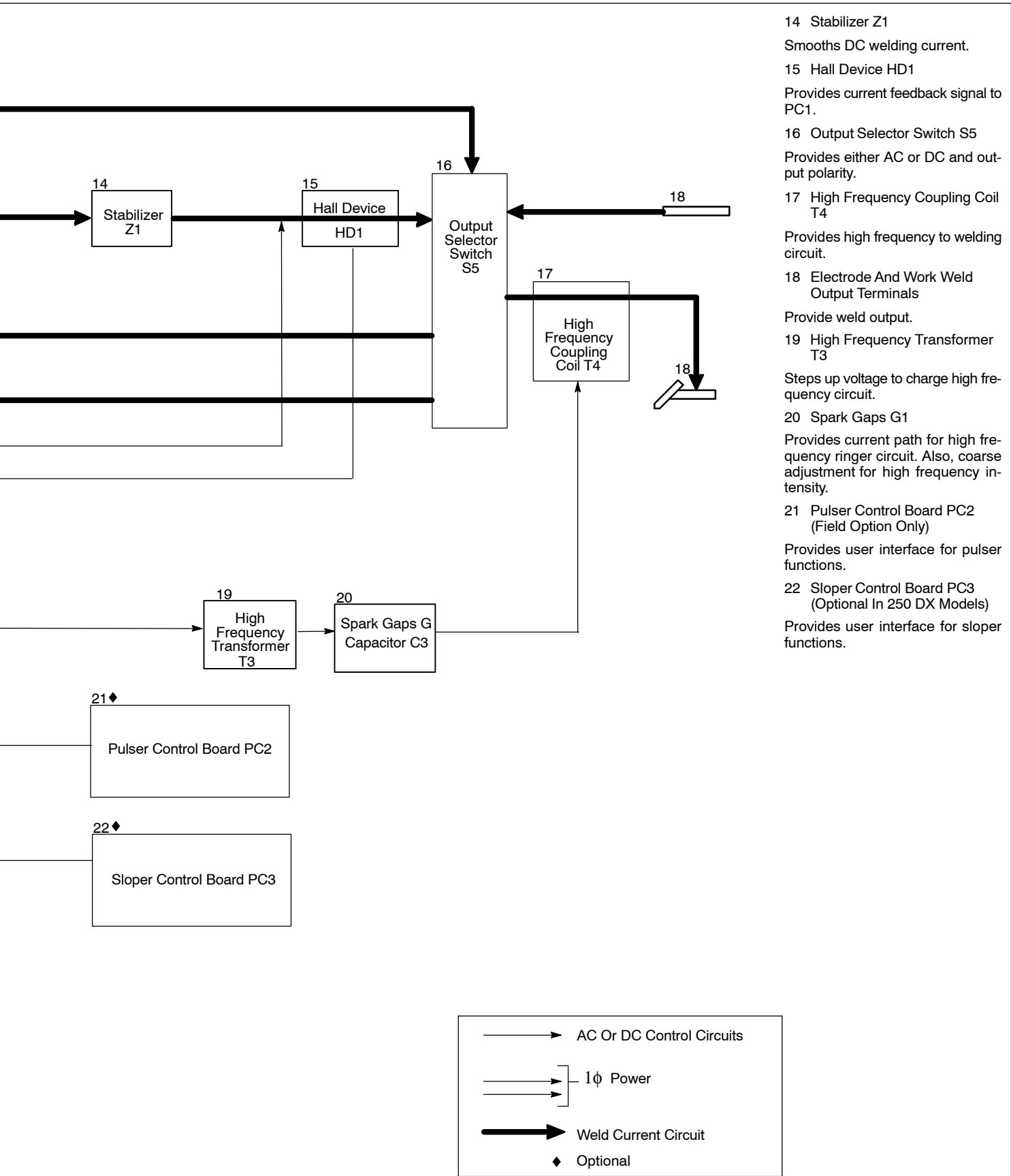
12 Gas Valve GS1

Provides control of shielding gas.

13 Integrated Cooler

Provides control of cooling for the TIG torch.



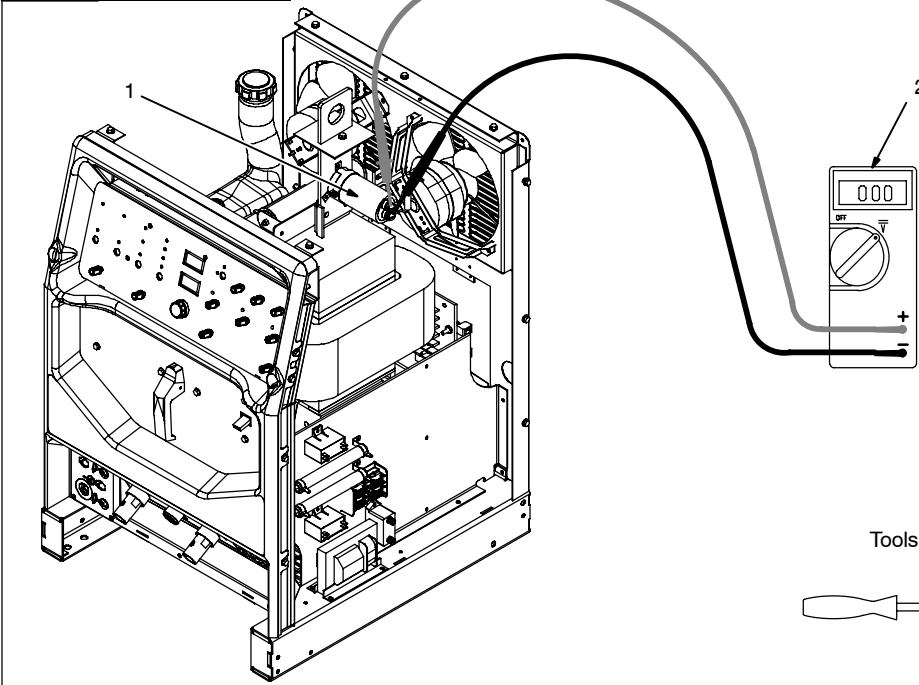


SECTION 6 – TROUBLESHOOTING



- ▲ Turn Off welding power source and disconnect and lockout/tagout input power before servicing.
- ▲ Measure input capacitor voltage according to Section 6-1, and be sure voltage is near zero before touching any parts.

6-1. Measuring 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.
- ▲ Disconnect and lockout/tagout input power before beginning.

Remove cover and side panels.

- 1 Electrolytic Capacitor C2
- 2 Voltmeter

Check capacitor C2 as shown.

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

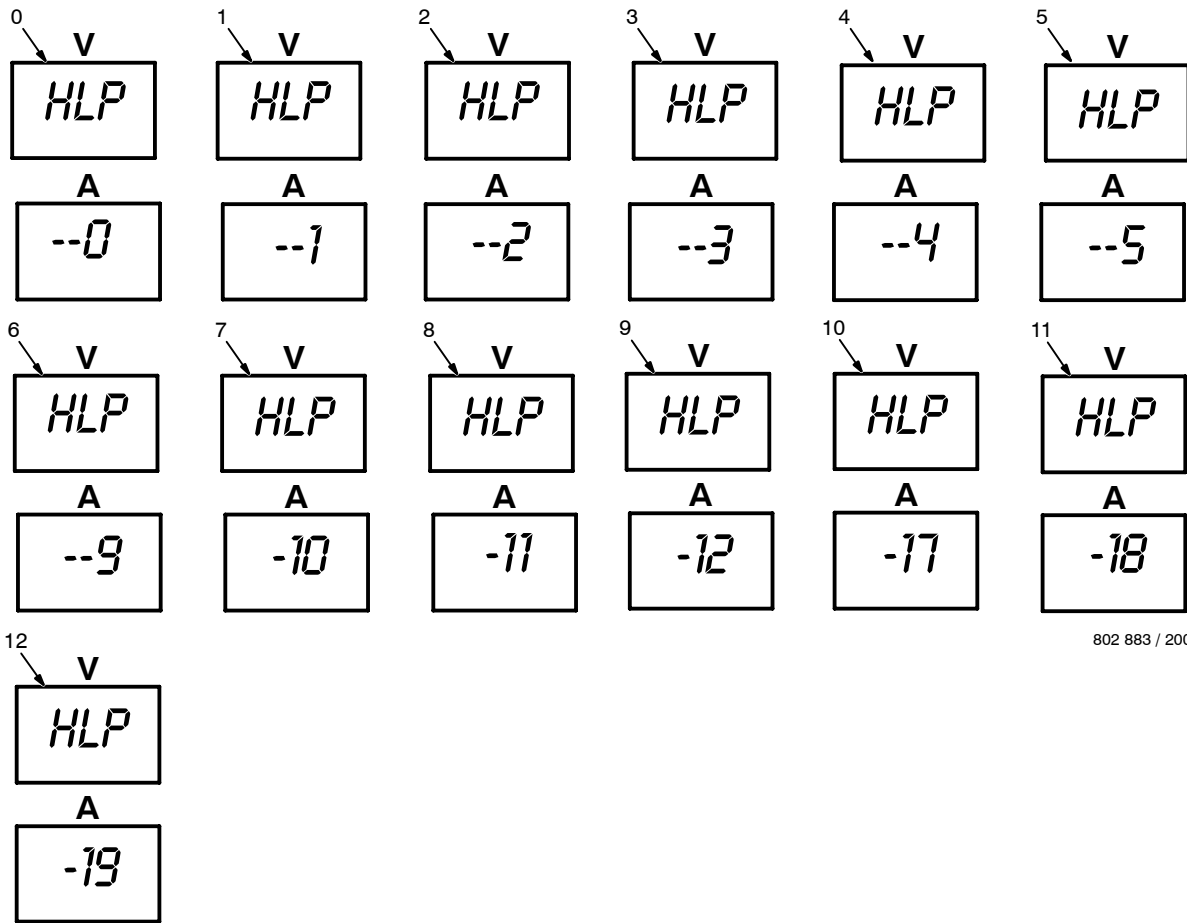
Proceed with job inside unit. Reinstall cover and side panels when finished.

Tools Needed:



803 787-A

6-2. Voltmeter/Ammeter Help Displays



802 883 / 200 852-B

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

0 Help 0 Display

Indicates a short in the thermal protection circuitry located on the transformer/stabilizer of the unit.

1 Help 1 Display

An SCR overcurrent or undercurrent condition has occurred. Turn power off and back on to correct condition.

2 Help 2 Display

Indicates an open in the thermal protection circuitry located on the transformer/stabilizer of the unit.

3 Help 3 Display

Indicates the transformer/stabilizer of the unit has overheated. The unit has shut down to allow the fan to cool it (see Section 3-5). Operation will continue when the unit has cooled.

4 Help 4 Display

Indicates an open in the thermal protection circuitry located on the rectifier assembly of the unit.

5 Help 5 Display

Rectifier assembly has overheated. The unit has shut down to allow the fan to cool unit (see Section 3-5). Operation will continue when the unit has cooled.

6 Help 9 Display

Indicates a short in the thermal protection circuitry located on the rectifier assembly of the unit.

7 Help 10 Display

Indicates Remote Output control is activated. Release Remote Output control to clear help message.

8 Help 11 Display

Output Selector switch is not in correct position (see Section 4-2).

9 Help 12 Display

Indicates a non-allowable set-up of the front panel.

10 Help 17 Display

Malfunction in the thermal protection circuitry of the cooler.

11 Help 18 Display

Coolant system coolant has overheated. The unit has shut down to allow the coolant to cool (see Section 3-5). Operation will continue when the coolant has cooled.

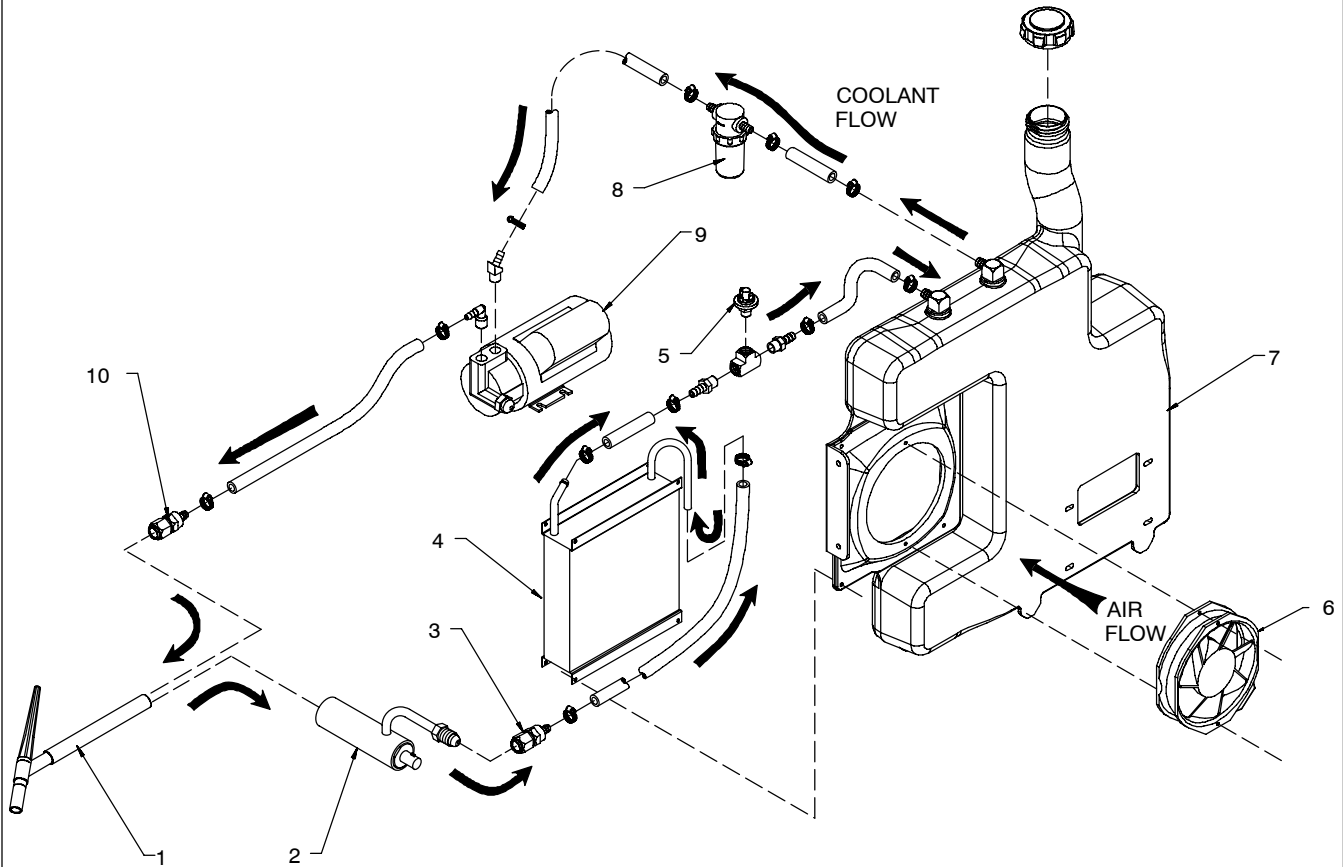
12 Help 19 Display

Indicates low coolant flow in the coolant system. The unit output has shut down and will not start again until the coolant flow level is corrected, and the power is turned off and back on.

6-3. Direction Of Coolant Flow

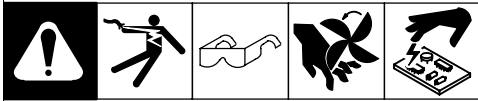


- 1 Torch
- 2 Dinse Adapter
- 3 Check Valve
- 4 Radiator
- 5 Pressure Switch
- 6 Fan
- 7 Tank
- 8 Filter
- 9 Pump/Motor
- 10 Check Valve



804 106-A

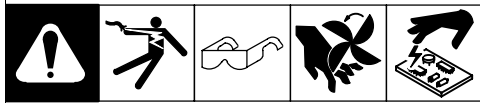
6-4. Troubleshooting The Welding Power Source



Refer to Section 6-2 for any Help (HLP) message displayed on voltmeter/ammeter.

Trouble	Remedy
No weld output; unit completely inoperative.	Place line disconnect switch in On position (see Section 3-21).
	Check and replace line fuse(s), if necessary (see Section 3-21).
	Check for proper input power connections (see Section 3-21).
	Check for proper jumper link position (see Section 3-20).
No weld output; unit on.	If using remote control, place Output control in Remote 14 position, and make sure remote control is connected to Remote 14 receptacle. If remote is not being used, place Output control in On position (see Section 4-1).
	Check, repair, or replace remote control.
	Have Factory Authorized Service Agent check unit.
Unit provides only maximum or minimum weld output.	Make sure Amperage control is in proper position (see Section 4-1).
	Have Factory Authorized Service Agent check unit.
Erratic or improper weld output.	Use proper size and type of weld cable (see Section 3-7).
	Clean and tighten all weld connections.
	Check position of Output Selector control (see Section Figure 4-1).
	If using remote control, check position of Amperage Adjustment control (see Section 4-1).
No control of weld output.	If using remote control, place Output control in Remote 14 position, and make sure remote control is connected to Remote 14 receptacle. If remote is not being used, place Output control in On position (see Section 4-1).
	Make sure Amperage control is in proper position (see Section 4-1).
No output from duplex receptacle RC2 and no high frequency.	Reset circuit breaker CB1 (see Section 7-3).
Lack of high frequency; difficulty in starting GTAW arc.	Reset circuit breaker CB1 (see Section 7-3).
	Select proper size tungsten (see Section 10).
	Be sure torch cable is not close to any grounded metal.
	Check cables and torch for cracked insulation or bad connections. Repair or replace.
	Check spark gaps (see Section 7-4).
Wandering arc – poor control of direction of arc.	Reduce gas flow rate.
	Select proper size tungsten (see Section 10).
	Properly prepare tungsten (see Section 10).
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.
	Properly prepare tungsten.
	Check for water in torch, and repair torch if necessary.
Fan not operating.	Unit equipped with Fan-On-Demand™. Fans run only when necessary. Unit equipped with circuitry to protect against overheating.

6-5. Troubleshooting The Welding Coolant System



Refer to Section 6-2 for any Help (HLP) message displayed on voltmeter/ammeter.

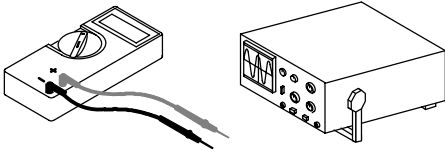
Trouble	Remedy
Coolant system does not work.	Check line fuses or circuit breaker, and replace or reset if necessary.
	Motor overheated. Unit starts running when motor has cooled.
	Check and replace motor if necessary.
Decreased or no coolant flow.	Add coolant (see Section 3-10).
	Check for clogged hoses or coolant filter.
	Disconnect return line and place it in a container of clean coolant. Prime unit according to Section 3-10. Flow rate should be a minimum of 1 liter (1.1 qt) per minute. If flow rate is still low, check pump motor and/or circuit board PC1 and replace if necessary.
Decreased cooling ability; coolant too hot.	Clean heat exchanger fins and blower assembly (see Section 7-2).
Foaming Coolant	Check for cracked or loose hoses or loose cover on filter, and tighten or replace.
	Check for loose cap or bad seal on filter assembly, and tighten or replace as necessary.

6-6. Troubleshooting Circuit Diagram

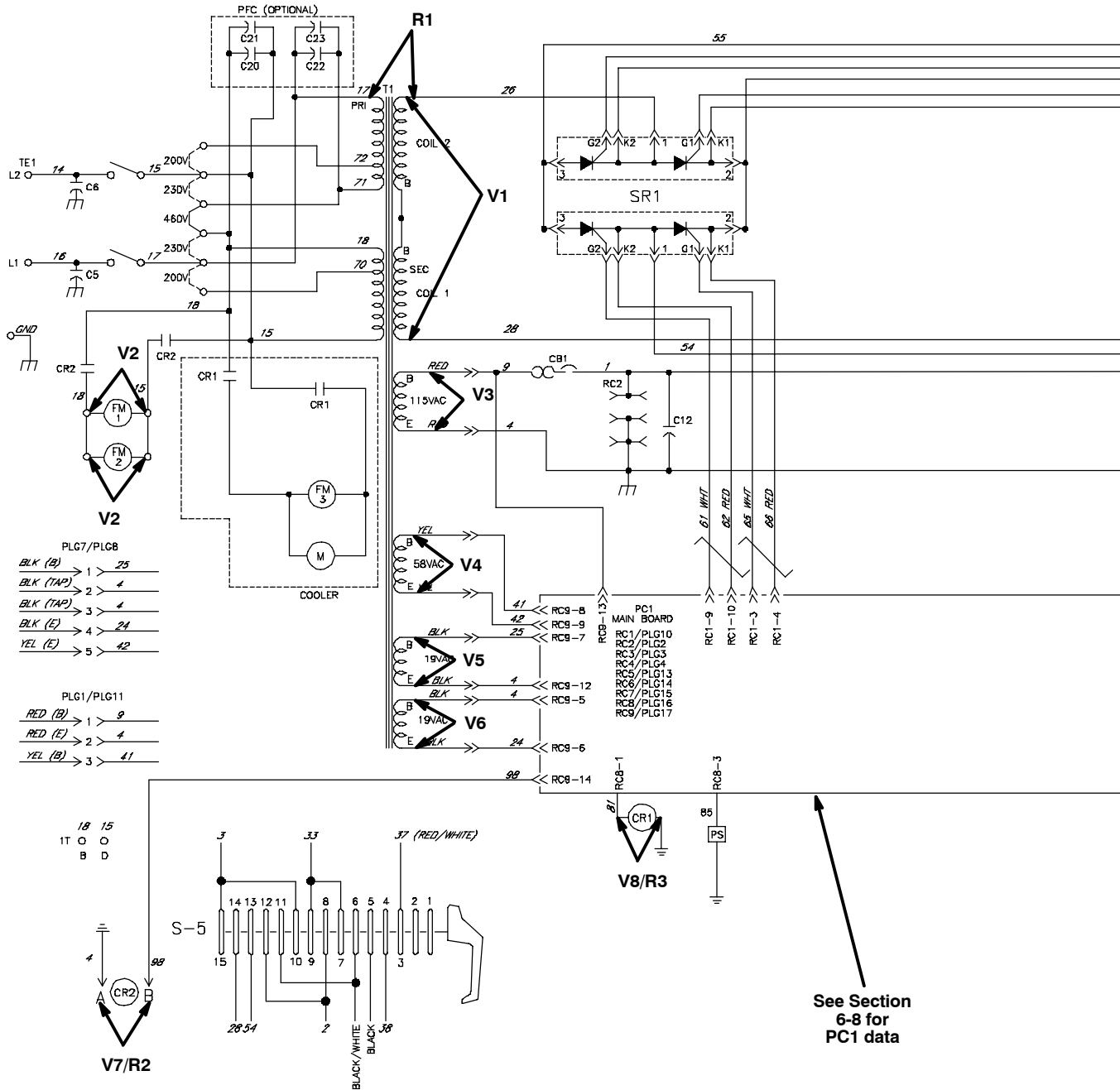
▲ Disable high frequency by placing Mode switch in Off position before testing unit.

▲ Discharge capacitor according to Section 6-1 and be sure voltage is near zero (0) before touching any parts.

Test Equipment Needed:

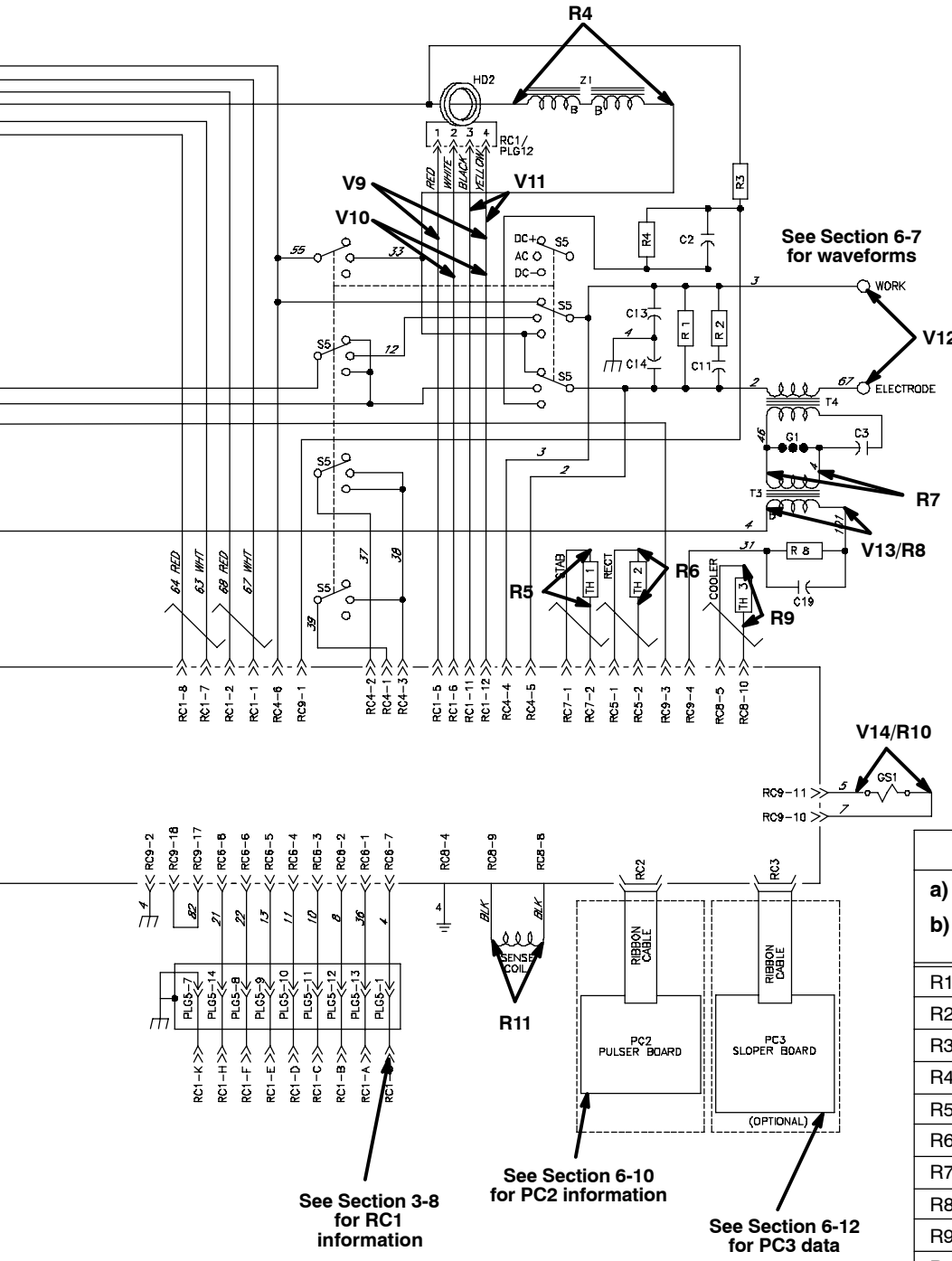
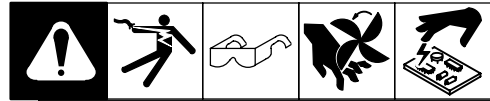


☞ No calibration available for voltmeter V or ammeter A.



See Section 6-8 for PC1 data

⚠ Circuit diagram for 350 LX models shown – Voltage and resistance test point locations and values are the same for 250 DX Models



Voltage Readings

- a) Tolerance – ±10% unless specified
- b) Reference – to circuit common (lead 4) unless noted
- c) Wiring Diagram – see Section 8
- d) Reference – single arrow: reference to circuit common (lead 4); double arrow: reference to points indicated

V1	83 volts ac
V2	230 volts ac
V3	115 volts ac
V4	58 volts ac for 350 LX models 53 volts ac for 250 DX models
V5	19 volts ac
V6	19 volts ac
V7	115 volts ac with fans on
V8	115 volts ac with cooler on
V9	+15 volts dc
V10	-15 volts dc
V11	+2.0 volts dc per 100 amperes of weld output
V12	75 volts ac / 75 volts dc
V13	115 volts ac w/ HF on
V14	+24 volts dc w/contactor on and in GTAW mode

Resistance Values

- a) Tolerance – ±10% unless specified
- b) Turn Off unit and disconnect input power before checking resistance


R1	All values for T1 are less than 1 ohm
R2	1.8 k ohms
R3	1.8 k ohms
R4	Less than 1 ohm
R5	10 k ohms @ 25° C/77° F
R6	30 k ohms @ 25° C/77° F
R7	6.1 k ohms
R8	5.1 ohms
R9	30 k ohms @ 25° C/77° F
R10	90 ohms
R11	3.4 ohms

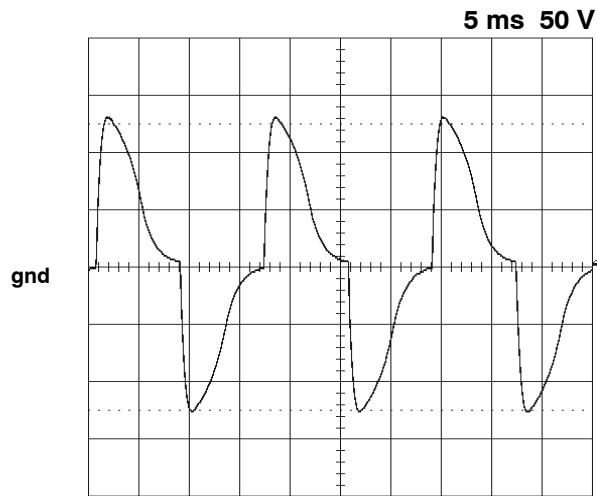
See Section 3-8 for RC1 information

See Section 6-10 for PC2 information

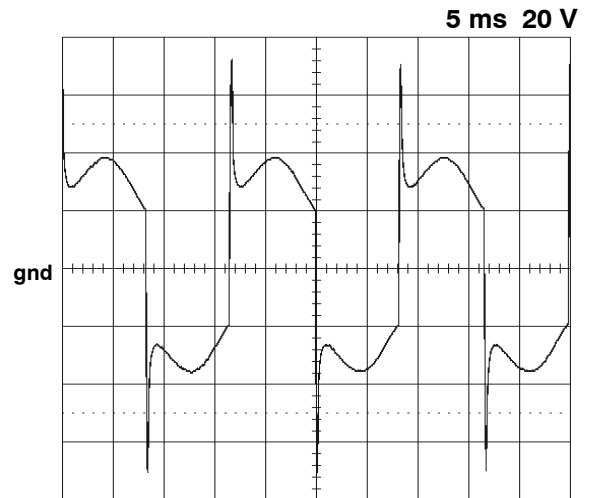
See Section 6-12 for PC3 data

6-7. Waveforms for Sections 6-6

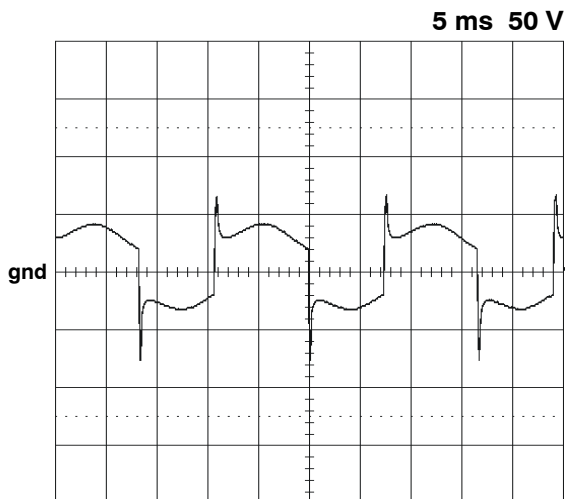
 The waveforms represent the output of the welding power source. When operating properly, the power source waveforms should match those shown.



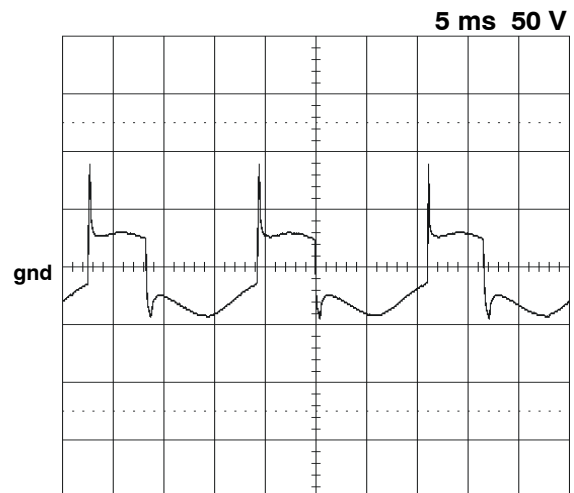
A. AC Open-Circuit Voltage, Amperage Adjustment Control At Max, Arc/Balance Control At Balanced Position



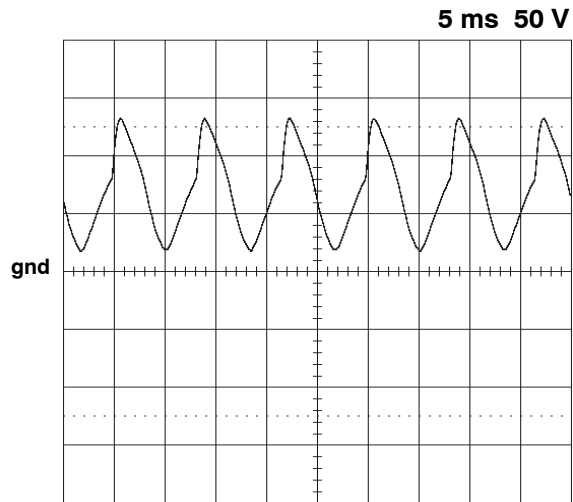
B. 30 Volts AC, 250 Amperes, Arc/Balance Control At Balanced Position (Resistive Load)



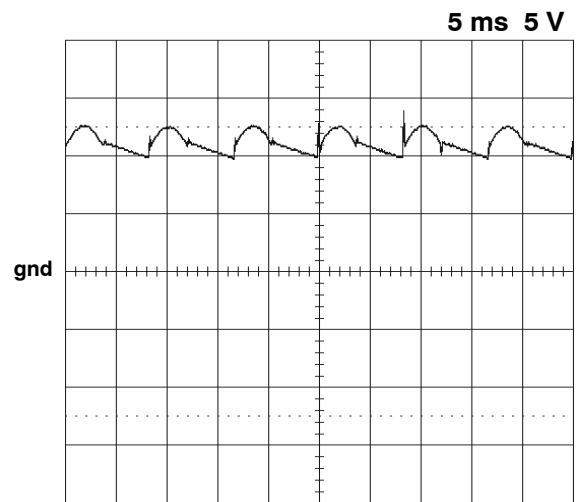
C. 30 Volts AC, 250 Amperes, Arc/Balance Control At Max Cleaning Position (Resistive Load)



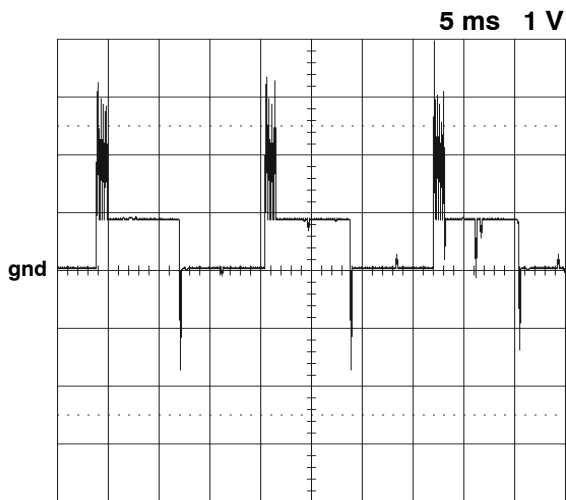
D. 30 Volts AC, 250 Amperes, Arc/Balance Control At Max Penetration Position (Resistive Load)



E. DC Open-Circuit Voltage, Amperage Adjustment Control At Max, Arc/Balance Control At Balanced Position, Waveform May Not Be Stable



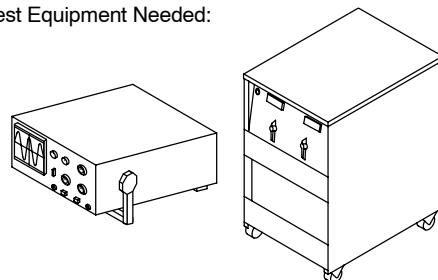
F. 10 Volts DC, 150 Amperes, Arc/Balance Control At Balanced Position (Resistive Load)



G. SCR Gate Pulses With Respect To Cathode At 10 Volts AC, 150 Amperes (Resistive Load)



Test Equipment Needed:

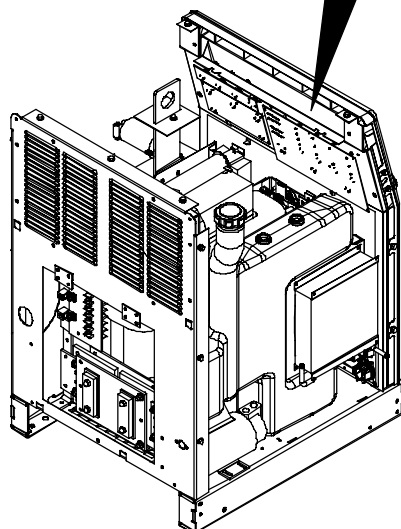
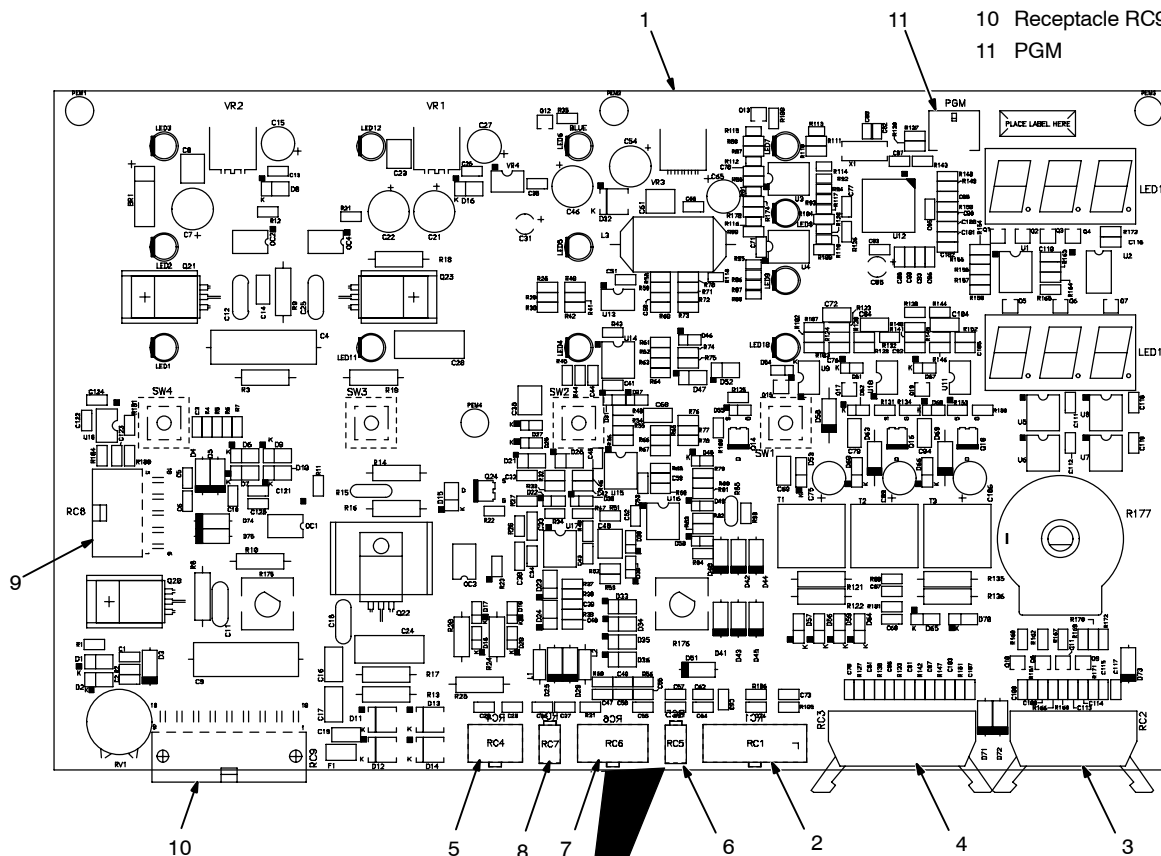


6-8. Control Board PC1 Testing Information (Use with Section 6-9)

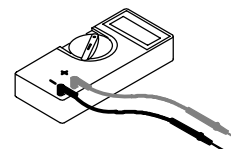
▲ Disable high frequency by placing Mode switch in Off position before testing unit.

Be sure plugs are secure before testing. See Section 6-9 for specific values during testing.

- 1 Control Board PC1
- 2 Receptacle RC1
- 3 Receptacle RC2
- 4 Receptacle RC3
- 5 Receptacle RC4
- 6 Receptacle RC5
- 7 Receptacle RC6
- 8 Receptacle RC7
- 9 Receptacle RC8
- 10 Receptacle RC9
- 11 PGM



Test Equipment Needed:



6-9. Control Board PC1 Test Point Values



PC1 Voltage Readings

- a) Tolerance – $\pm 10\%$ unless specified
- b) Reference – to circuit common (lead 4) unless noted

Receptacle	Pin	Value
RC1	1	Gate pulse for module 1, SCR 2
	2	Reference for pin 1
	3	Gate pulse for module 2, SCR 1
	4	Reference for pin 3
	5	+15 volts DC for hall device HD1
	6	-15 volts DC for hall device HD1
	7	Gate pulse for module 1, SCR 1
	8	Reference for pin 7
	9	Gate pulse for module 2, SCR 2
	10	Reference for pin 9
	11	Hall device HD1 current feedback signal, 2 volts per 100 amps
	12	Ground reference signal for hall device HD1
RC2	1	Ground reference signal for pulser board PC2
	2	Ground reference signal for potentiometers on pulser board PC2
	3	Pulse Peak Time reference, 0 to +5 volts DC variable
	4	Not used
	5	Pulse Background Amperage reference, 0 to +5 volts DC variable
	6	Pulser board present, 0 volts DC while connected, and +5 volts DC while not connected
	7	Pulse Frequency reference, 0 to +5 volts DC variable
	8	Pulser LED, +3.6 volts DC while on, 0 volts DC while off
	9	Pulser On/Off, 0 volts DC, +5 volts DC while off
	10	+5 volts DC
RC3	1	Final Amperage reference, 0 to +5 volts DC variable
	2	Initial Time reference, 0 to +5 volts DC variable
	3	Final Time reference, 0 to +5 volts DC variable
	4	Ground reference for sequencer board PC3
	5	Initial Amperage reference, 0 to +5 volts DC variable
	6	Ground reference for potentiometers on sequencer board
	7	Spot Time reference, 0 to +5 volts DC variable
	8	+5 volts DC
	9	Not used
	10	Initial Time LED, +3.6 volts DC while on, 0 volts DC while off
	11	Final Time LED, +3.6 volts DC while on, 0 volts DC while off
	12	Spot Time LED, +3.6 volts DC while on, 0 volts DC while off
	13	Sequencer board present, 0 volts DC while connected, +5 volts DC While not connected

Receptacle	Pin	Value
	14	Not used
RC4	1	Output selector switch S5 position sense signal, 0 volts DC while in AC or DCEN positions, +5 volts DC while in DCEP position
	2	Output selector switch S5 position sense signal, 0 volts DC while in AC or DCEP positions, +5 volts DC while in DCEN position
	3	Output selector switch S5 position sense ground reference
	4	Voltage feedback sense lead – work
	5	Voltage feedback sense lead – electrode
	6	Background voltage negative; -98 volts DC
RC5	1	Thermistor input from rectifier, +5 to 0 volts DC variable
	2	+5 volts DC for rectifier thermistor
RC6	1	+24 volts DC output
	2	Contacting; +24 volts DC with external output control closed
	3	Remote Amperage control reference, +10 volts DC
	4	Ground reference for Remote Amperage control
	5	Remote Amperage control input, 0 to +10 volts DC variable
	6	Output current feedback, +1 volt DC per 100 amps of weld output
	7	Ground reference for +24 volts DC
	8	Output voltage feedback, +1 volt DC per 10 volts of weld output
RC7	1	Thermistor input from stabilizer, +5 to 0 volts DC variable
	2	+5 volts DC for stabilizer thermistor
RC8	1	Cooler on demand control, 115 volts AC while on; 0 volts AC while off
	2	Ground reference for water hookup
	3	Pressure switch, 0 volts DC while closed, +5 volts Dc while open
	4	Cooler present, 0 volts Dc while connected, +5 volts DC while not connected
	5	Thermistor input from cooler, +5 to 0 volts DC variable
	6	115 volts AC from cooler
	7	Water hookup, 0 volts DC while door is closed, +5 volts DC while door is open
	8	Water hookup, 0 volts DC while door is closed, +5 volts DC while door is open
	9	Ground reference for water hookup
	10	+5 volts DC for cooler thermistor
RC9	1	Background voltage positive, +98 volts DC
	2	Ground reference for chassis
	3	115 volts AC input from transformer T1
	4	High Frequency control, 115 volts Ac while on, 0 volts AC while off
	5	Ground reference for 19 volts AC winding
	6	19 volts AC input from transformer T1
	7	19 volts AC input from transformer T1
	8	104 volts AC input from transformer T1, background voltage
	9	104 volts AC input from transformer T1, background voltage

Receptacle	Pin	Value
	10	Ground reference for gas valve
	11	+24 volts DC signal to gas valve
	12	Ground reference for 19 volts AC winding
	13	115 volts AC
	14	Fan-On-Demand control, 115 volts AC while on, 0 volts AC while off
	15	115 volts AC from HF
	16	Ground reference, 115 volts AC input from transformer T1
	17	Machine select, +5 volts DC (Syncrowave 250 DX), 0 volts DC (Syncrowave 350 LX)
	18	Ground reference for machine select
PGM	1	0 volts DC while in reset, +5 volts DC otherwise
	2	+5 volts DC
	3	MOSI (nothing to measure)
	4	Ground reference
	5	SCK (nothing to measure)
	6	MISO (nothing to measure)

6-10. Pulsar Board PC2 Testing Information (Use with Section 6-11)

▲ Disable high frequency by placing Mode switch in Off position before testing unit.

Be sure plugs are secure before testing. See Section 6-11 for specific values during testing.

1 Pulsar Board PC2
2 Plug PLG2

Test Equipment Needed:

803 787-A / 215 447-B

6-11. Pulsar Board PC2 Test Point Values

PC2 Voltage Readings

a) Tolerance – $\pm 10\%$ unless specified
b) Reference – to circuit common (lead 4) unless noted

Receptacle	Pin	Value
PLG2	1	Ground reference for pulser board
	2	Ground reference for potentiometers on pulser board
	3	Pulse Peak Time reference, 0 to +5 volts DC variable
	4	Not used
	5	Pulse Background Amperage reference, 0 to +5 volts DC variable
	6	Pulsar board present, 0 volts DC while connected and +5 volts DC while not connected
	7	Pulse Frequency reference, 0 to +5 volts DC variable
	8	Pulsar LED, +3.6 volts DC while on, 0 volts DC while off
	9	Pulsar On/Off, 0 volts DC while on; +5 volts DC while off
	10	+5 volts DC

6-12. Sequencer Board PC3 Testing Information (Use with Section 6-13)

ASSEMBLY
215441

1
2

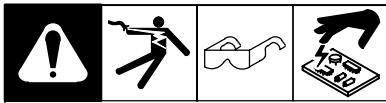
▲ Disable high frequency by placing Mode switch in Off position before testing unit.

- 1 Timer Board PC3
- 2 Plug PLG3

Test Equipment Needed:

803 787-A / 215 442-A

6-13. Sequencer Board PC3 Test Point Values





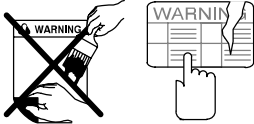
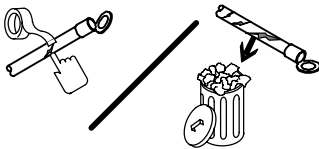
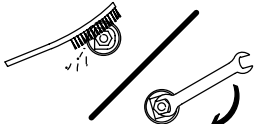
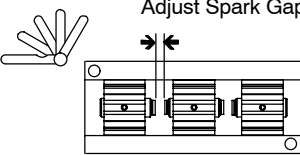
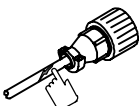

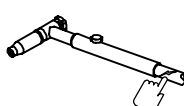

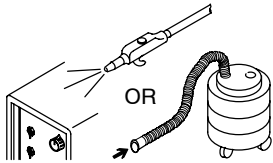
PC3 Voltage Readings

- a) Tolerance – $\pm 10\%$ unless specified
- b) Reference – to circuit common (lead 4) unless noted

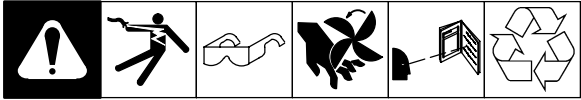


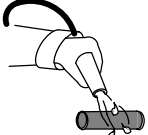
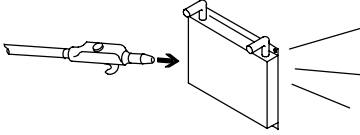

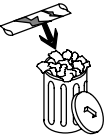
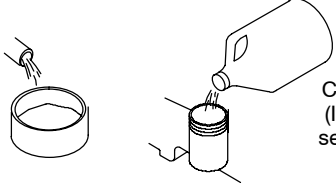


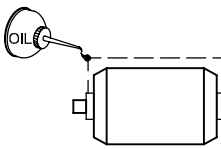
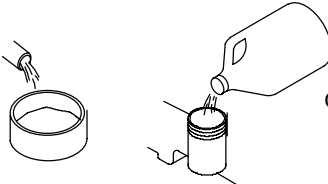
Receptacle	Pin	Value
PLG3	1	Final Amperage reference, 0 to +5 volts DC variable
	2	Initial Time reference, 0 to +5 volts DC variable
	3	Final Time reference, 0 to +5 volts DC variable
	4	Ground reference for sloper (sequencer) board
	5	Start Amperage reference, 0 to +5 volts DC variable
	6	Ground reference for potentiometers on sloper (sequencer) board
	7	Spot Time, 0 to +5 volts DC
	8	+5 volts DC
	9	Not used
	10	Initial LED, +3.6 volts DC while on, 0 volts DC while off
	11	Final LED, +3.6 volts DC while on, 0 volts DC while off
	12	Spot LED, +3.6 volts DC while on, 0 volts DC while off
	13	Sloper (sequencer) board present, 0 volts DC while connected and +5 volts DC while not connected
	14	Not used

SECTION 7 – MAINTENANCE

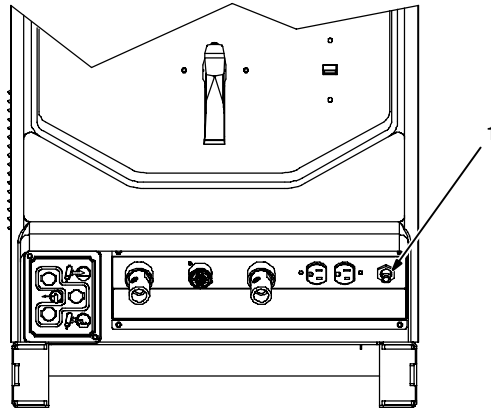
7-1. Routine Welding Power Source Maintenance

		<ul style="list-style-type: none"> ▲ Turn Off welding power source and disconnect and lockout/tagout input power before maintaining. ▲ Measure voltage of input capacitors according to Section 6-1, and be sure voltage is near zero before touching any parts. 						
 3 Months								
	<p>Replace Unreadable Labels</p>		<p>Repair Or Replace Cracked Weld Cables</p>		<p>Clean And Tighten Weld Terminals</p>			
	<p>Adjust Spark Gaps</p>		<p>14-Pin Cord</p>		<p>Gas Hose</p>		<p>Torch Cable</p>	<p>Replace Cracked Parts</p>
 6 Months								
		<p>Blow Out Or Vacuum Inside, During Heavy Service, Clean Monthly</p> <p>▲ Warranty is void if machine fails due to contaminates inside.</p>						

7-2. Routine Cooler Maintenance

				<p>▲ Disconnect power before maintaining.</p>	
 1 Month					
	<p>▲ Clean coolant strainer. Severe conditions may require more frequent cleaning (continuous use, high/low temperatures, dirty environment, etc.). Failure to properly clean coolant strainer voids pump warranty.</p>			<p>Blow Out Heat Exchanger Fins</p>	
 6 Months					
	<p>Replace Cracked Hoses</p>		<p>Change Coolant (If Using Water) see Section 3-10</p>		<p>Replace Damaged Or Unreadable Labels</p>
 12 Months					
	<p>Oil Motor</p>				<p>Change Coolant (If Using MILLER Coolant) see Section 3-10</p>

7-3. Circuit Breaker CB1



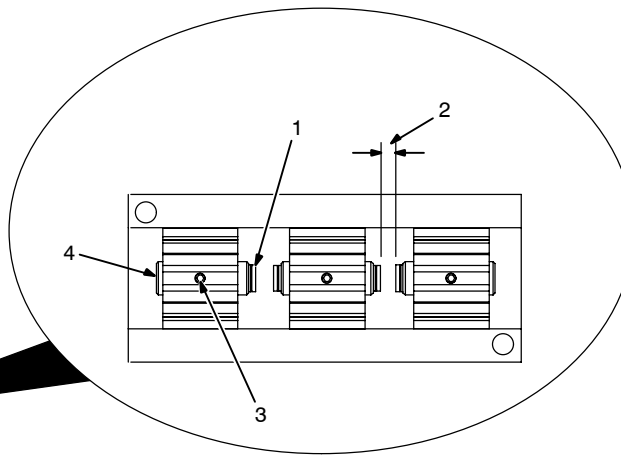
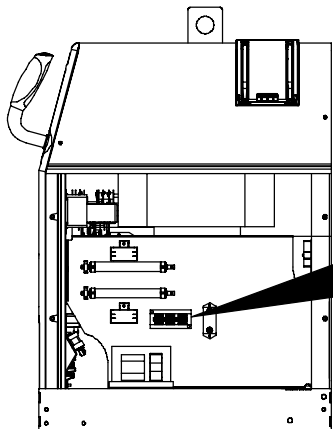
▲ Turn off power before resetting breaker.

1 Circuit Breaker CB1

If CB1 opens, high frequency and output to the 115 volts ac duplex receptacle stop. Press button to reset breaker.

Ref. 803 588-A

7-4. Adjusting Spark Gaps



▲ Turn Off welding power source and disconnect and lockout/tagout input power before adjusting spark gaps.

Remove right side panel..

1 Tungsten End Of Point

Replace point if tungsten end disappears; do not clean or dress tungsten.

2 Spark Gap

Normal spark gap is 0.008 in (0.203 mm).

If adjustment is needed, proceed as follows:

3 Adjustment Screws

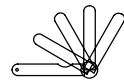
Loosen screws. Place gauge of proper thickness in spark gap.

4 Pressure Point

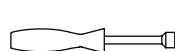
Apply slight pressure at point until gauge is held firmly in gap. Tighten screws. Adjust other gap.

Reinstall right side panel.

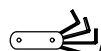
Tools Needed:



0.008 in (0.203 mm)




3/8 in



5/32 in

803 592-B

SECTION 8 – ELECTRICAL DIAGRAM

 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.

Model	Serial Or Style Number	Circuit Diagram	Wiring Diagram
Syncrowave 250 DX	LE282983 thru LE420473	215 704-C	215 705-B♦♦
	LE420474 and following	222 681-D	222 682-D
Syncrowave 350 LX	LE223624 thru LE420473	219 003-C	219 004-B♦♦
	LE420474 and following	222 683-D	222 684-D
Circuit Board PC1	LE223624 and following	209 880-B	
Circuit Board PC2	LE223624 and following	215 448-A	
Circuit Board PC3	LE223624 and following	215 443-A	
♦♦ Not included in this manual			

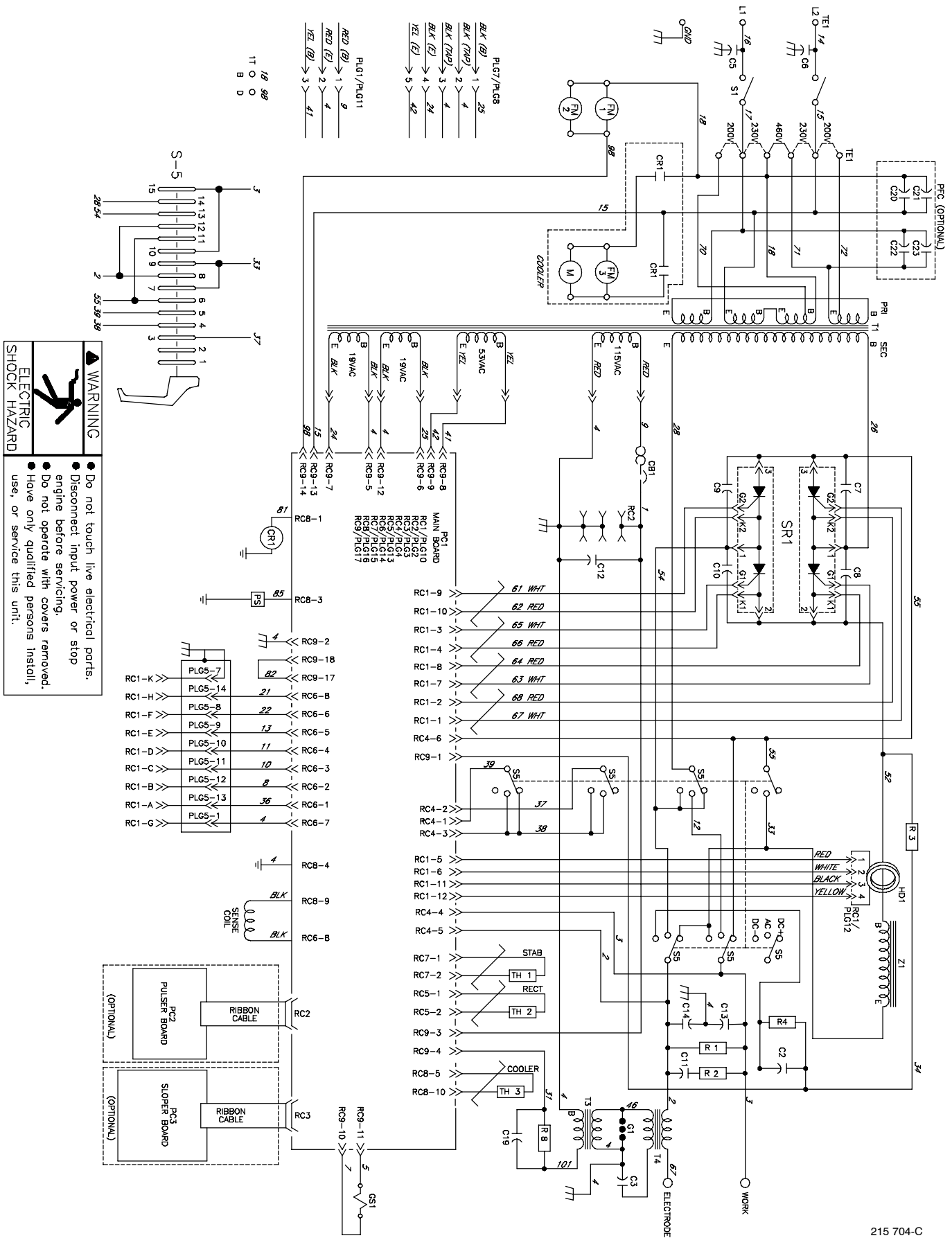


Figure 8-1. Circuit Diagram For Syncrowave 250 DX Models Eff w/LE223624 Thru LE420473

WARNING

ELECTRIC SHOCK HAZARD

- 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.

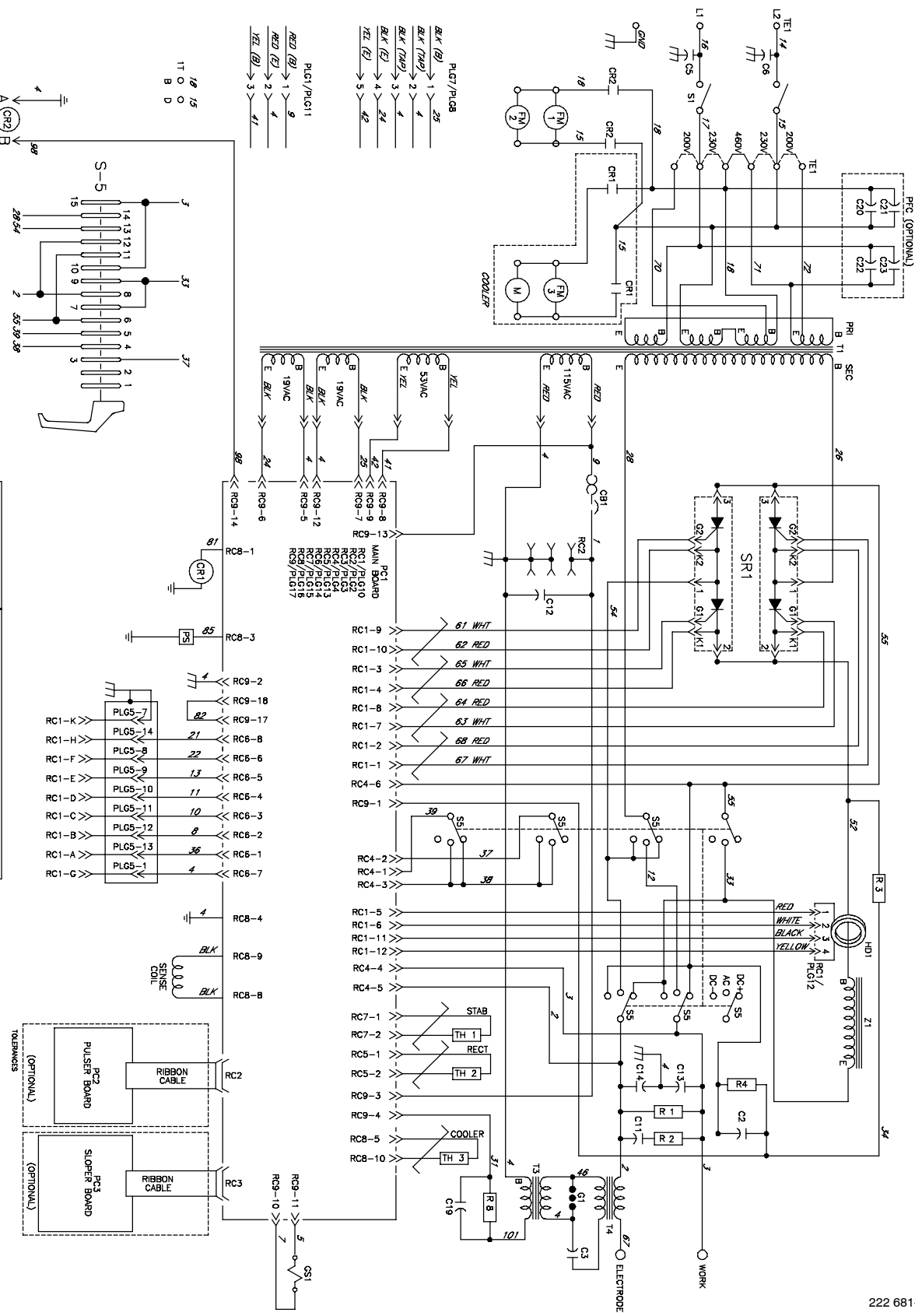


Figure 8-2. Circuit Diagram For Syncrowave 250 DX Models Eff w/LE420474 And Following

222 681-D

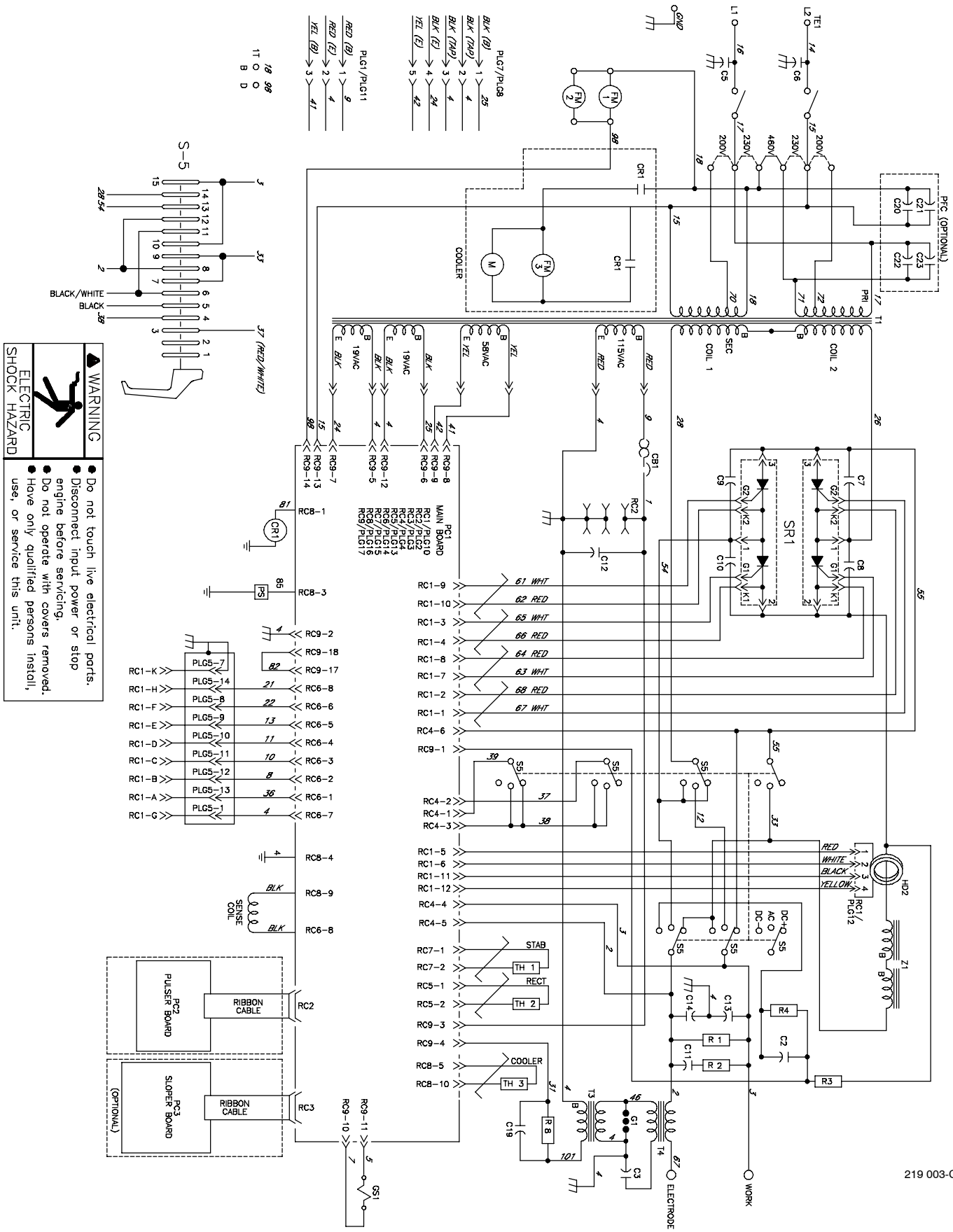


Figure 8-3. Circuit Diagram For Syncrowave 350 LX Models Eff w/LE223624 Thru LE420473

219 003-C

WARNING

ELECTRIC SHOCK HAZARD

- 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.

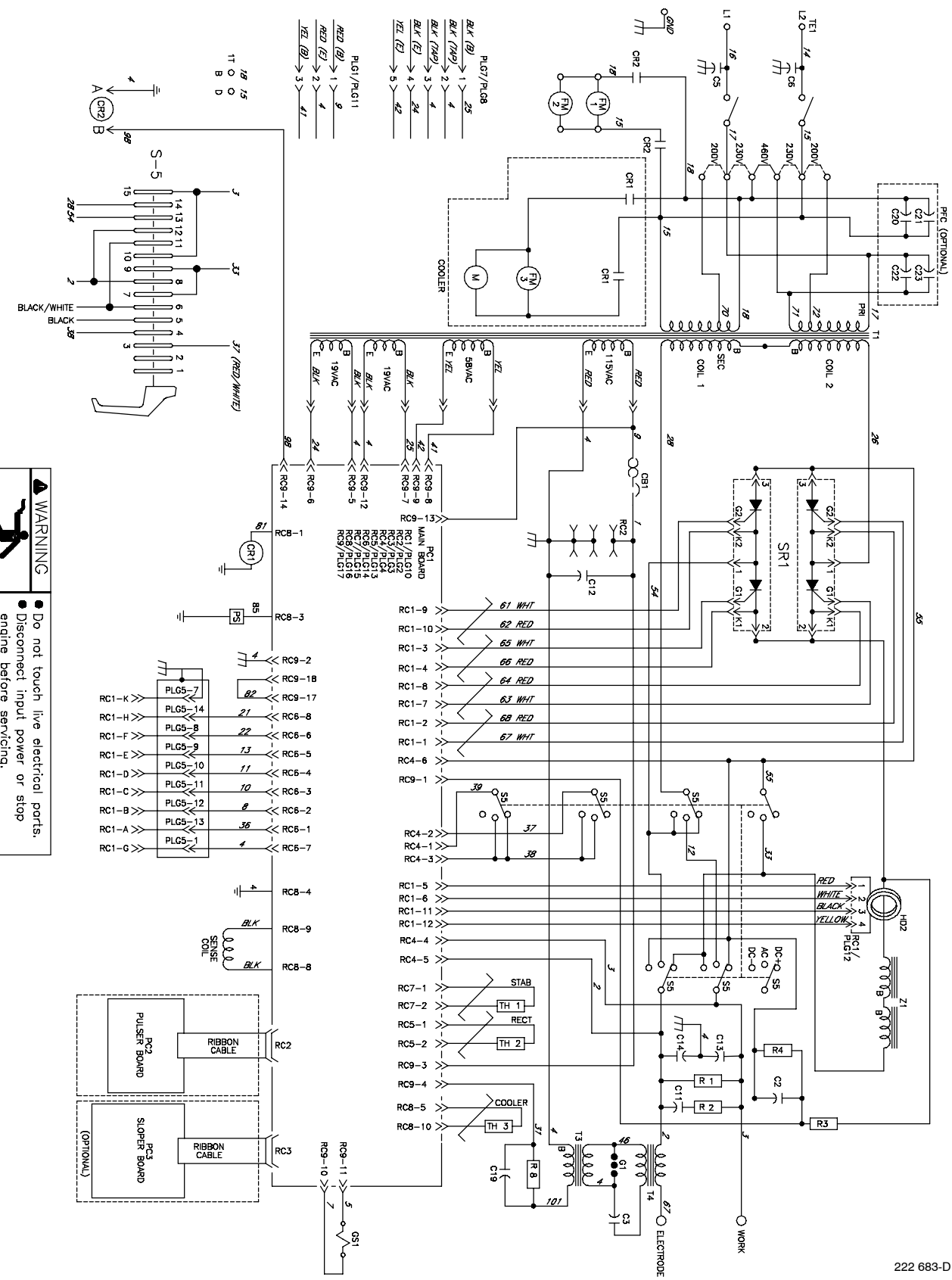
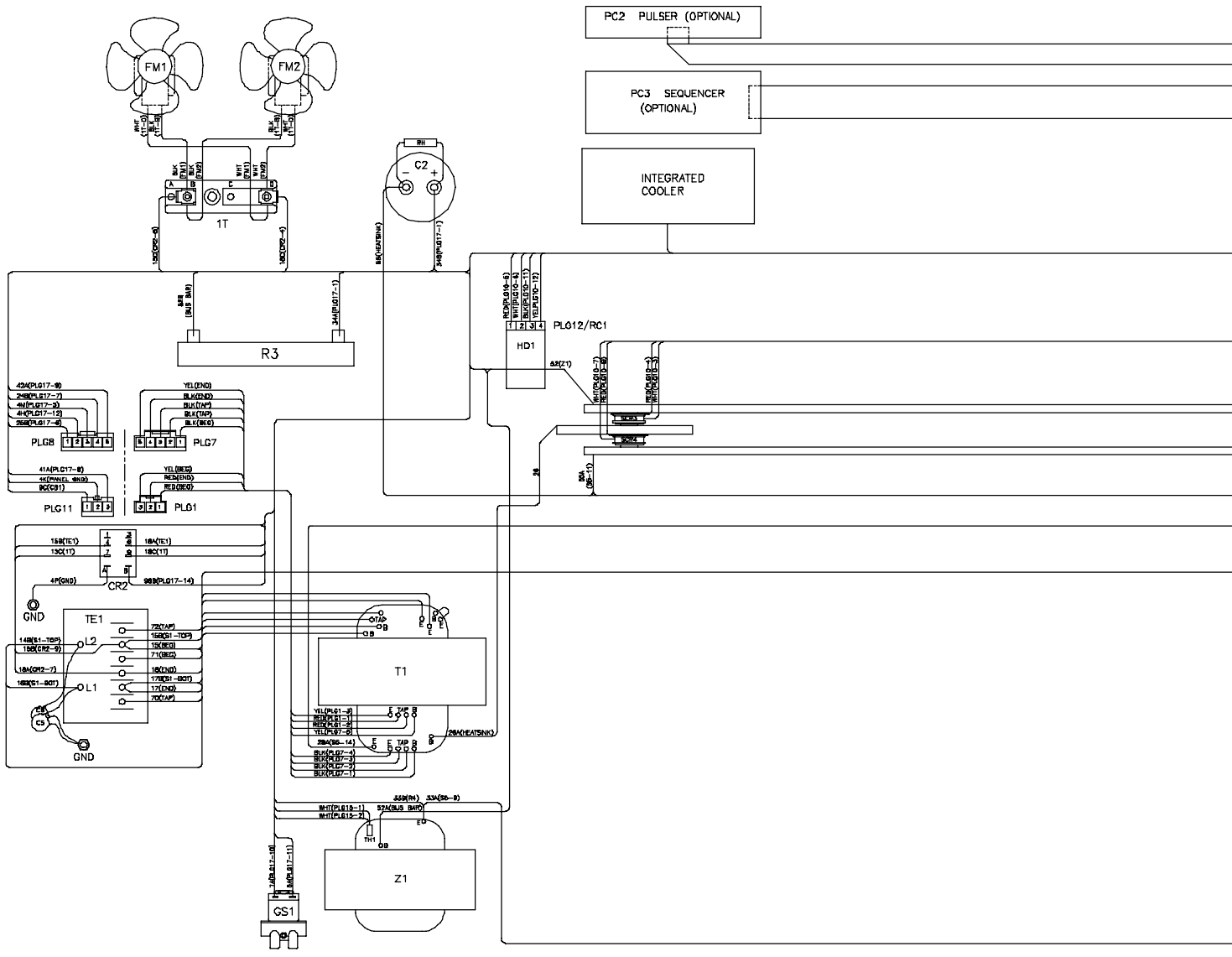


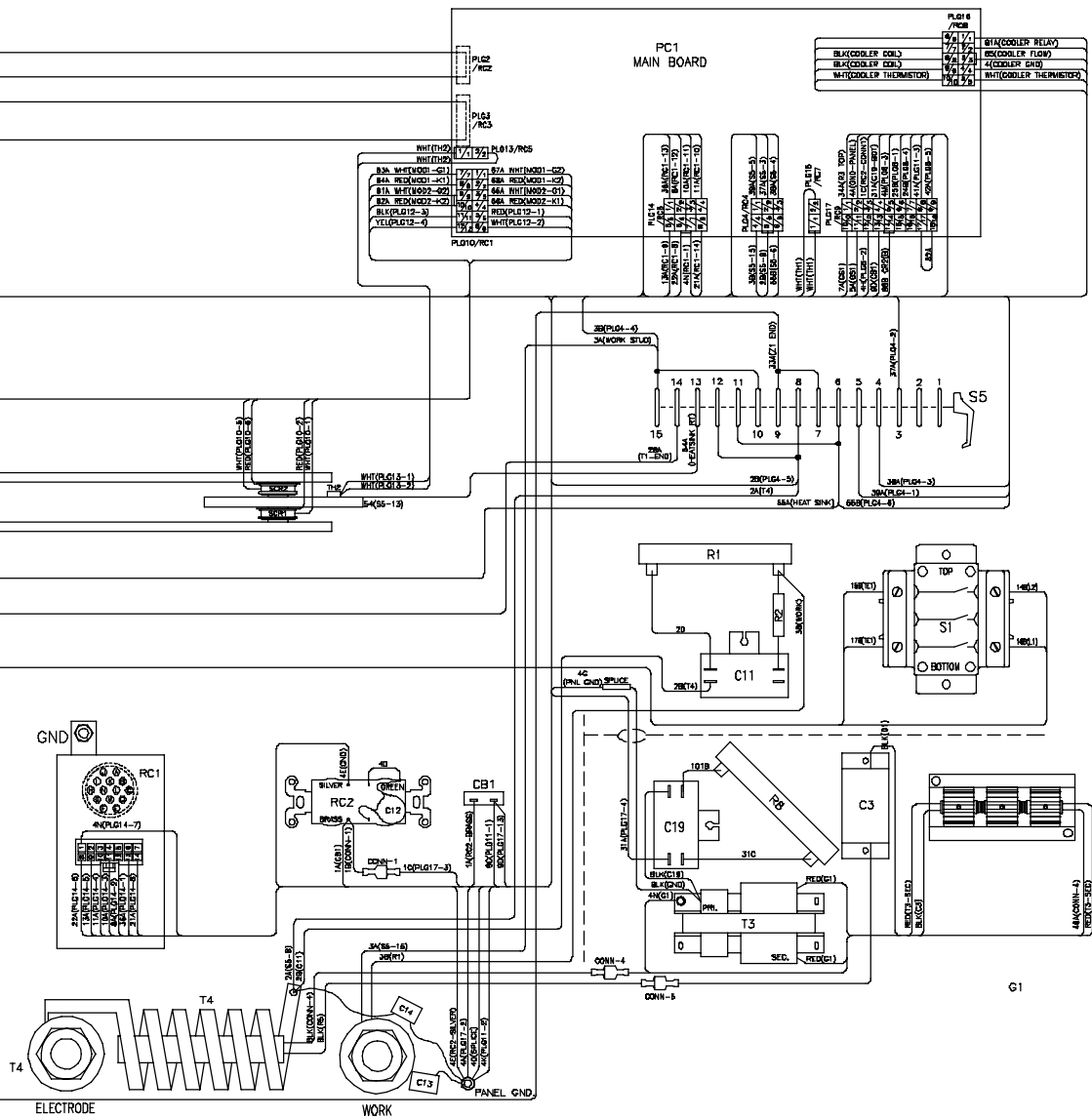
Figure 8-4. Circuit Diagram For Syncrowave 350 LX Models Eff w/LE420474 And Following

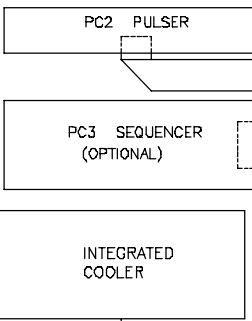
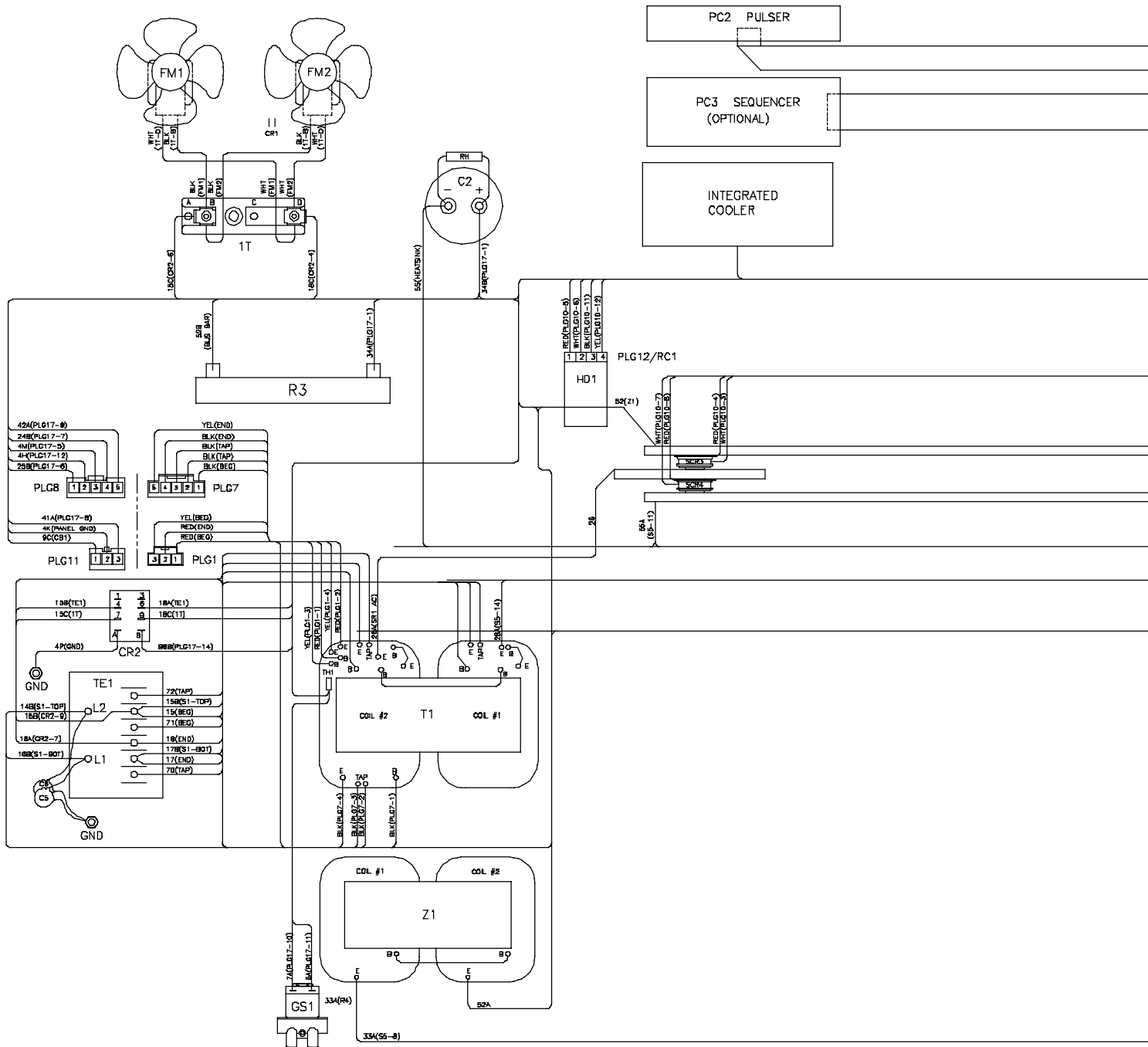
222 683-D



	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 8-5. Wiring Diagram For Syncrowave 250 DX Models Eff w/LE420474 And Following






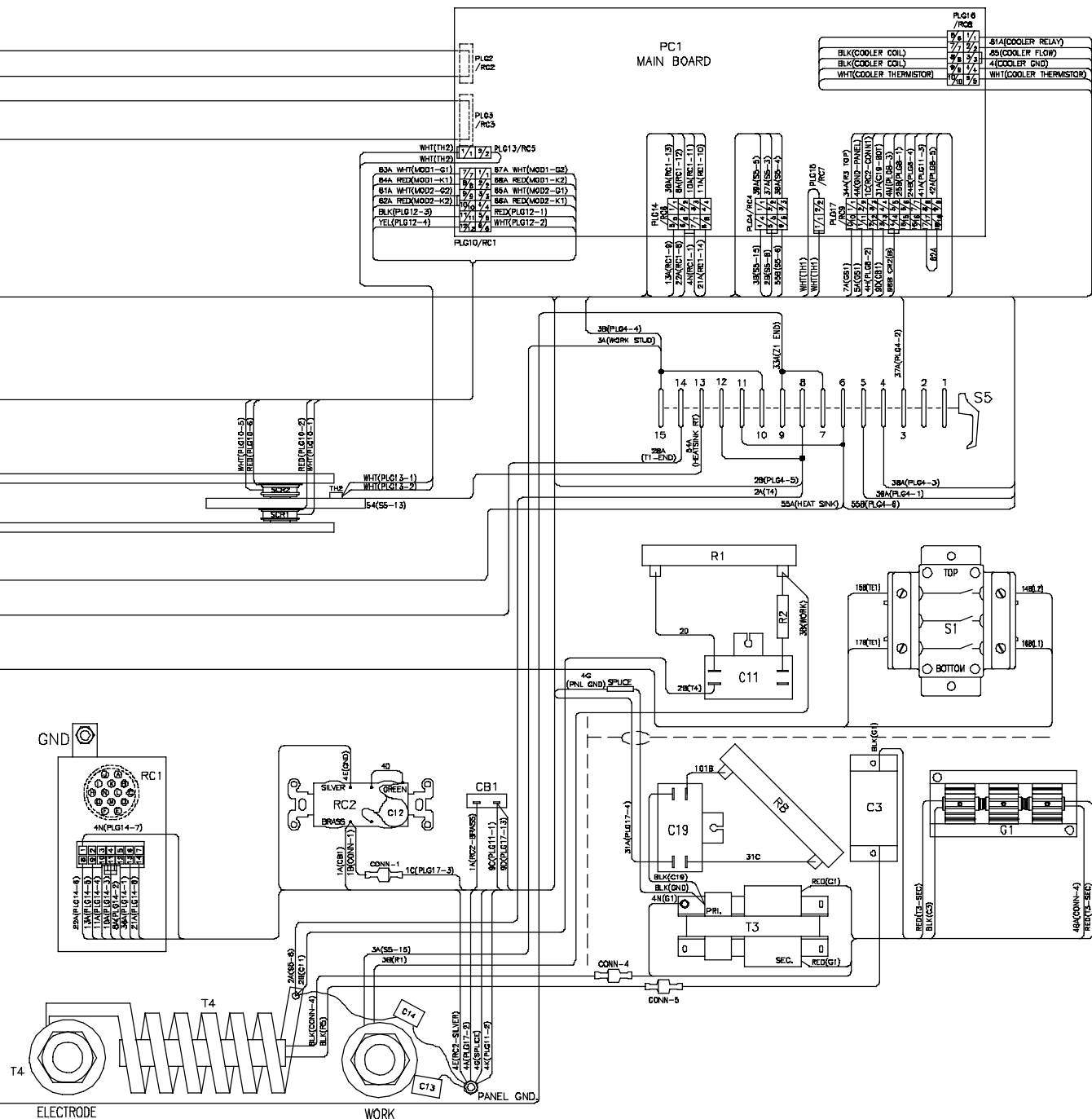
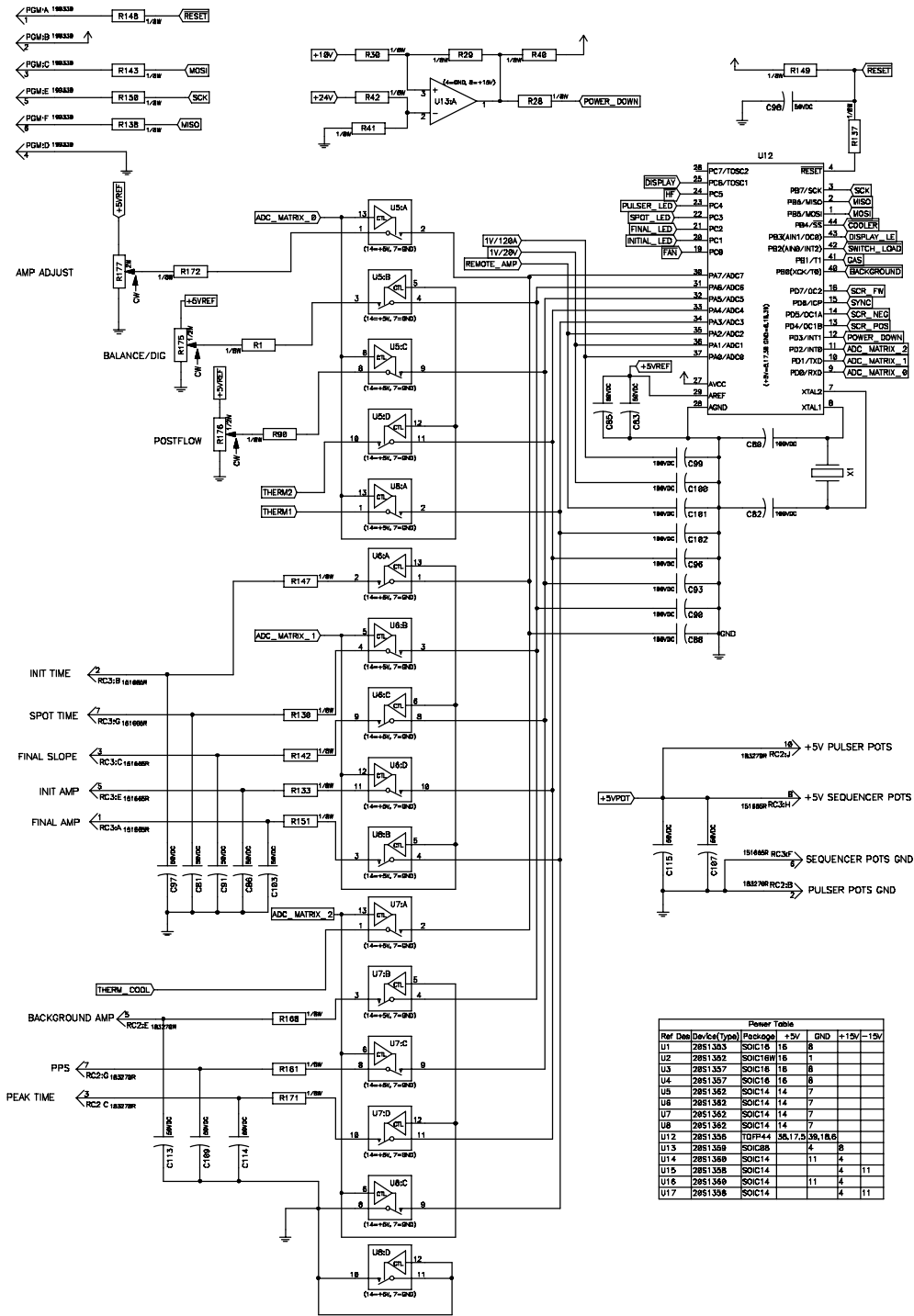
	WARNING
	<ul style="list-style-type: none"> ● Do not touch live electrical parts. ● Disconnect input power or stop engine before servicing. ● Do not operate with covers removed. ● Have only qualified persons install, use, or service this unit.
ELECTRIC SHOCK HAZARD	

Figure 8-6. Wiring Diagram For Sincrowave 350 LX Models Eff w/LE420474 And Following



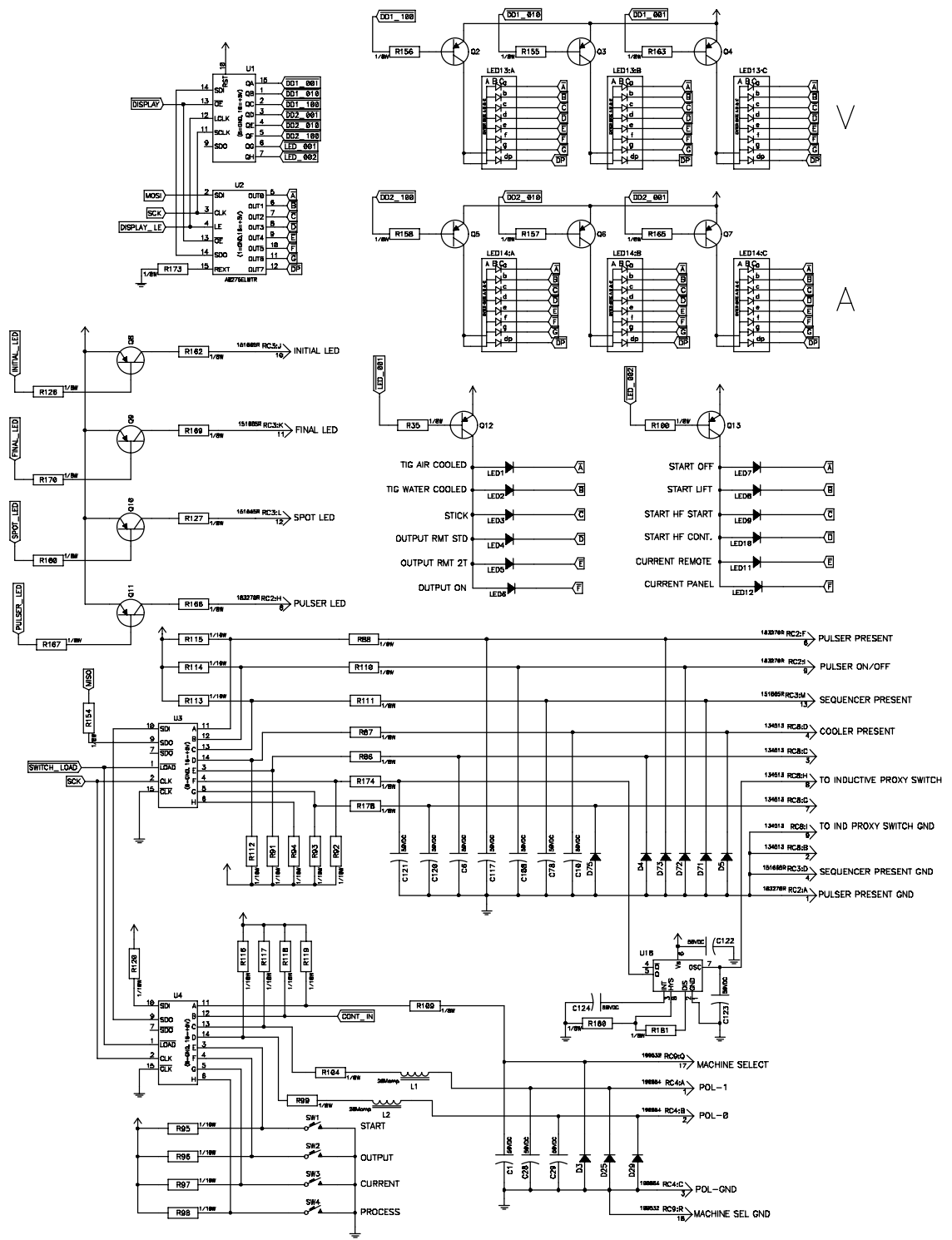


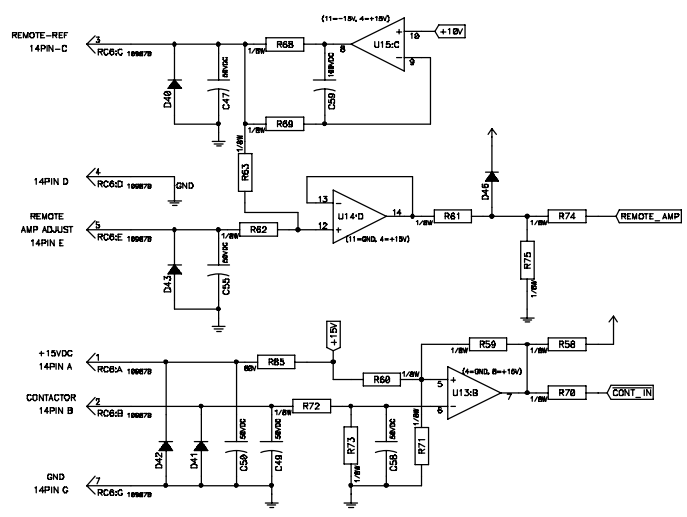
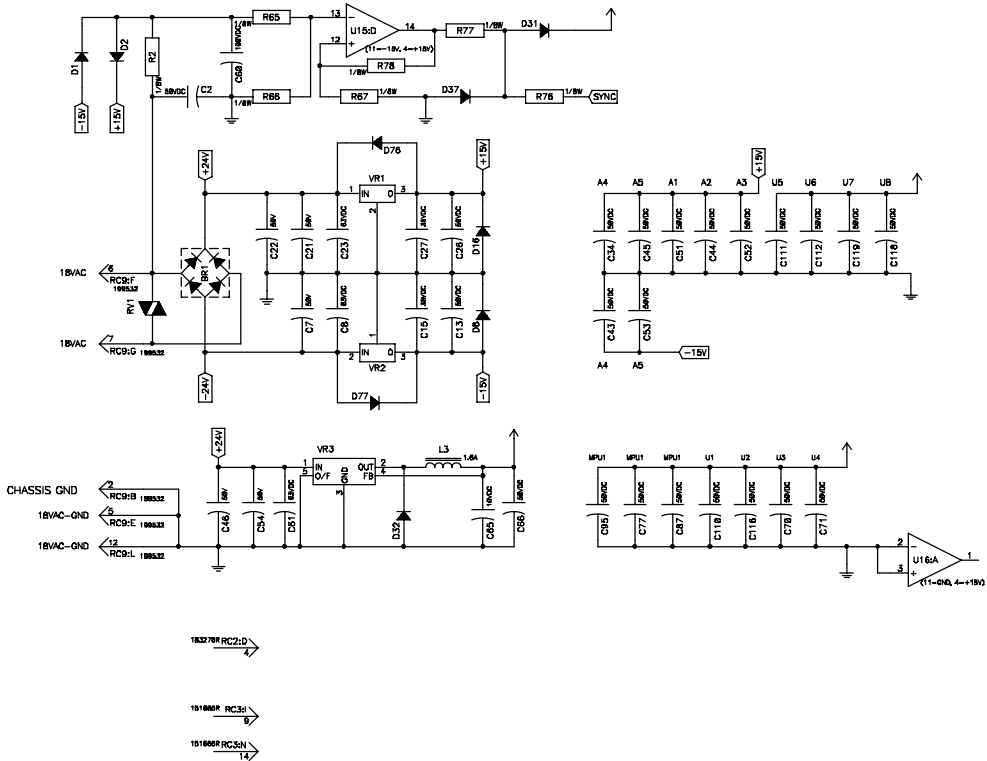
WARNING

ELECTRIC SHOCK HAZARD

- 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.

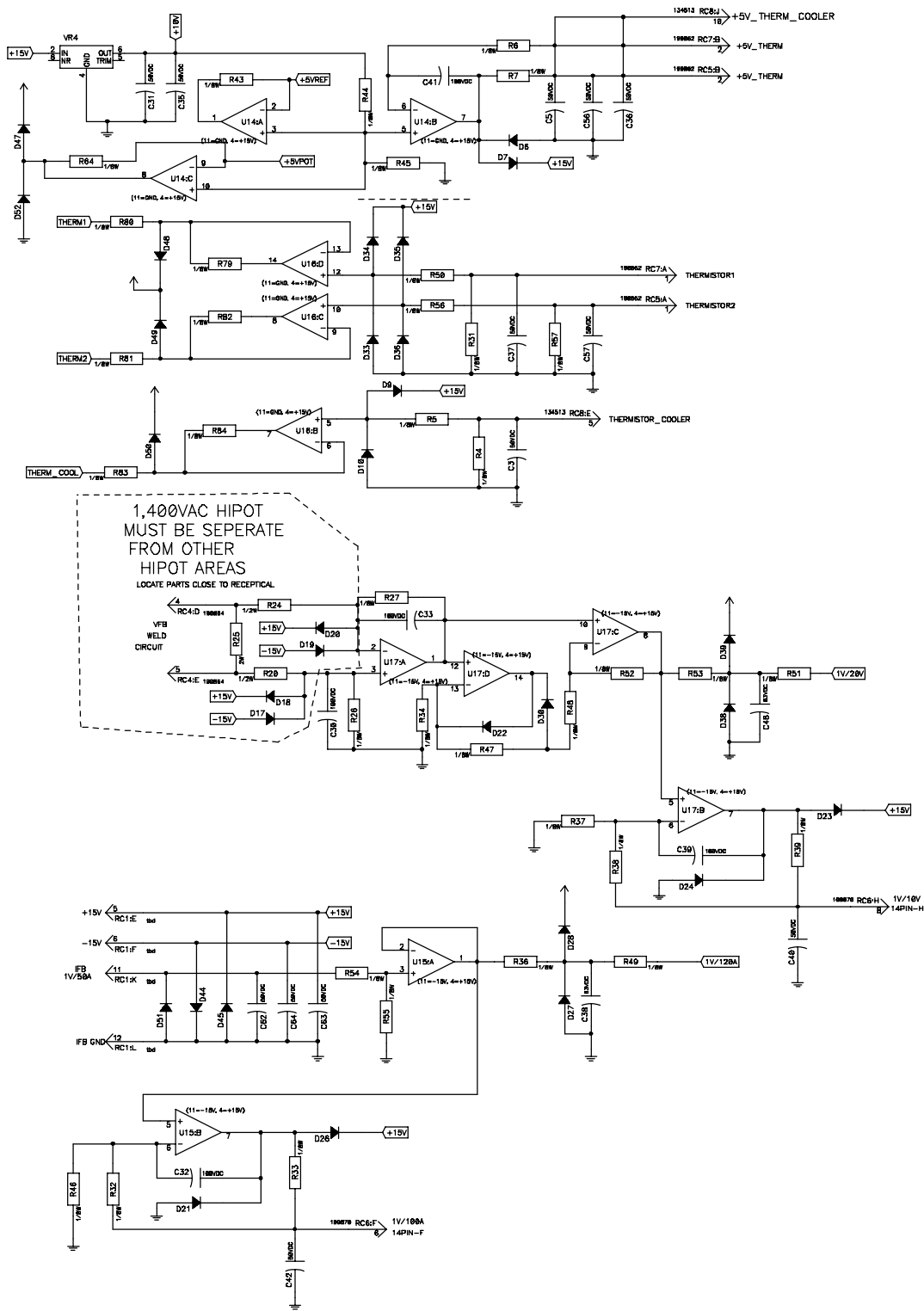
Figure 8-7. Circuit Diagram For Main Control Board PC1 Effective With Serial No. LE223624 And Following (Part 1 Of 3)

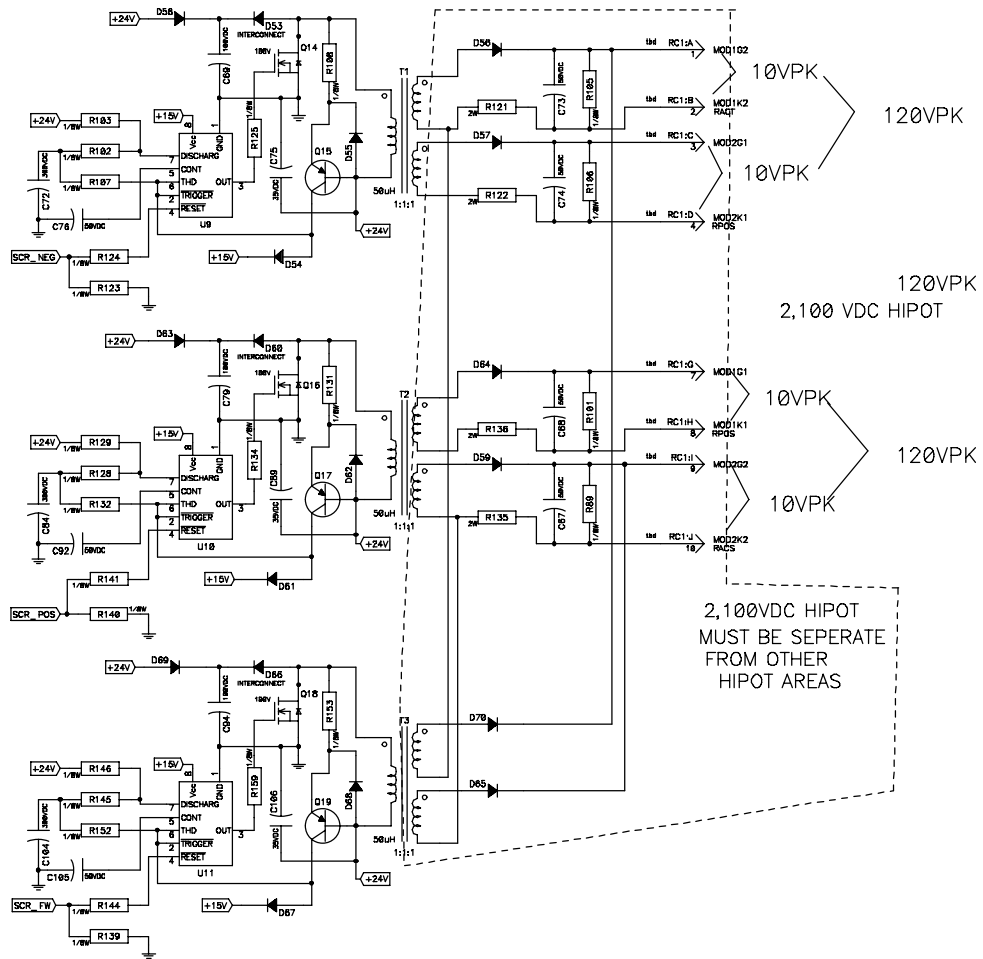




 WARNING ELECTRIC SHOCK HAZARD	<ul style="list-style-type: none"> Do not touch live electrical parts. Disconnect input power or stop engine before servicing. Do not operate with covers removed. Have only qualified persons install, use, or service this unit.
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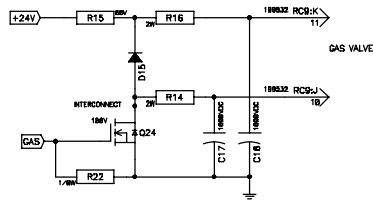
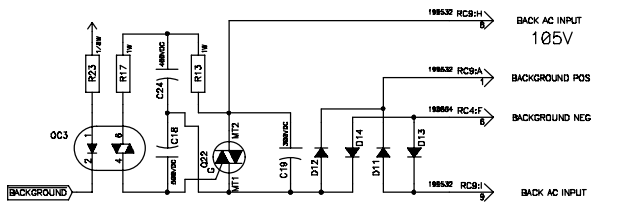
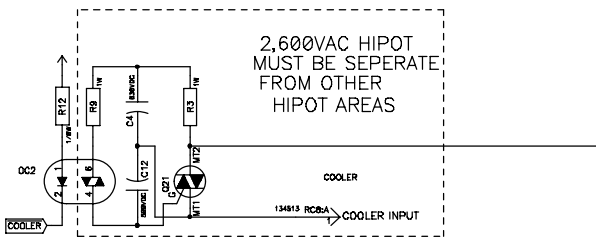
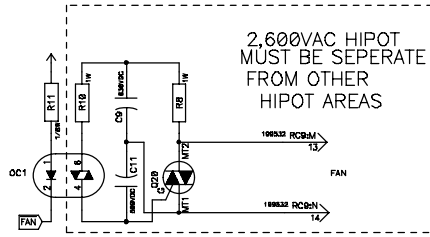
Figure 8-8. Circuit Diagram For Main Control Board PC1 Effective With Serial No. LE223624 And Following (Part 2 Of 3)





 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 8-9. Circuit Diagram For Main Control Board PC1 Effective With Serial No. LE223624 And Following (Part 3 Of 3)



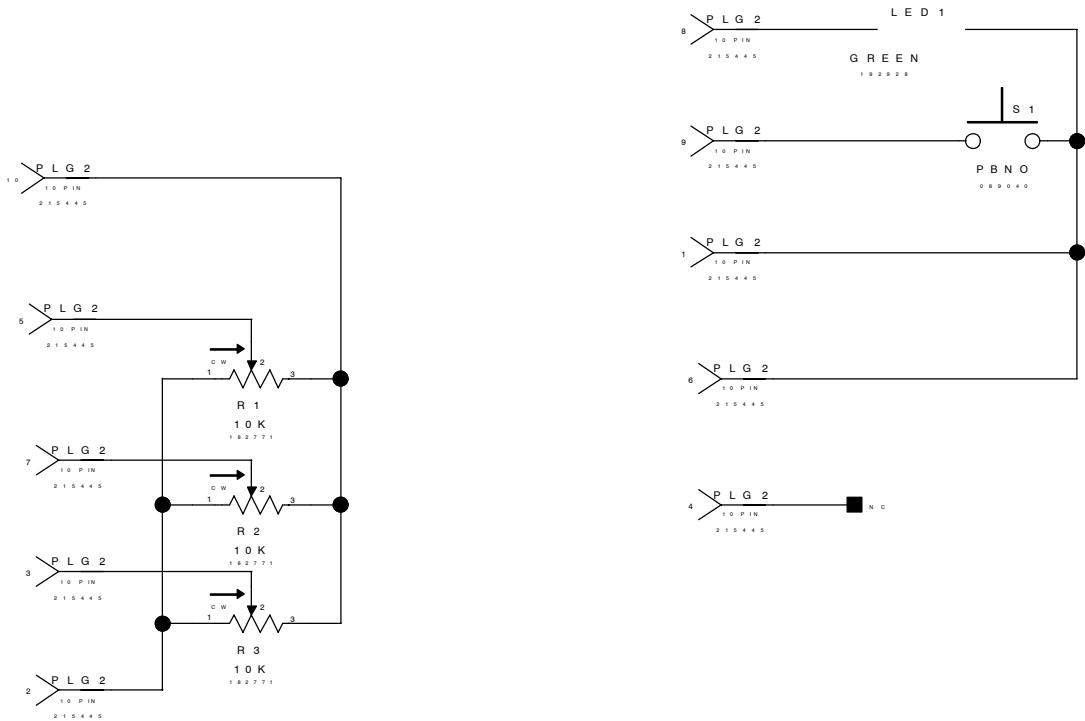
198532 RCB:O 15



134613 RCB:F 6

198532 RCB:P 16

THE FOLLOWING PARTS THAT ARE NOT SHOWN IN THE SCHEMATIC, ARE TO BE INCLUDED IN THE PRINTED CIRCUIT BOARD ASSEMBLY:

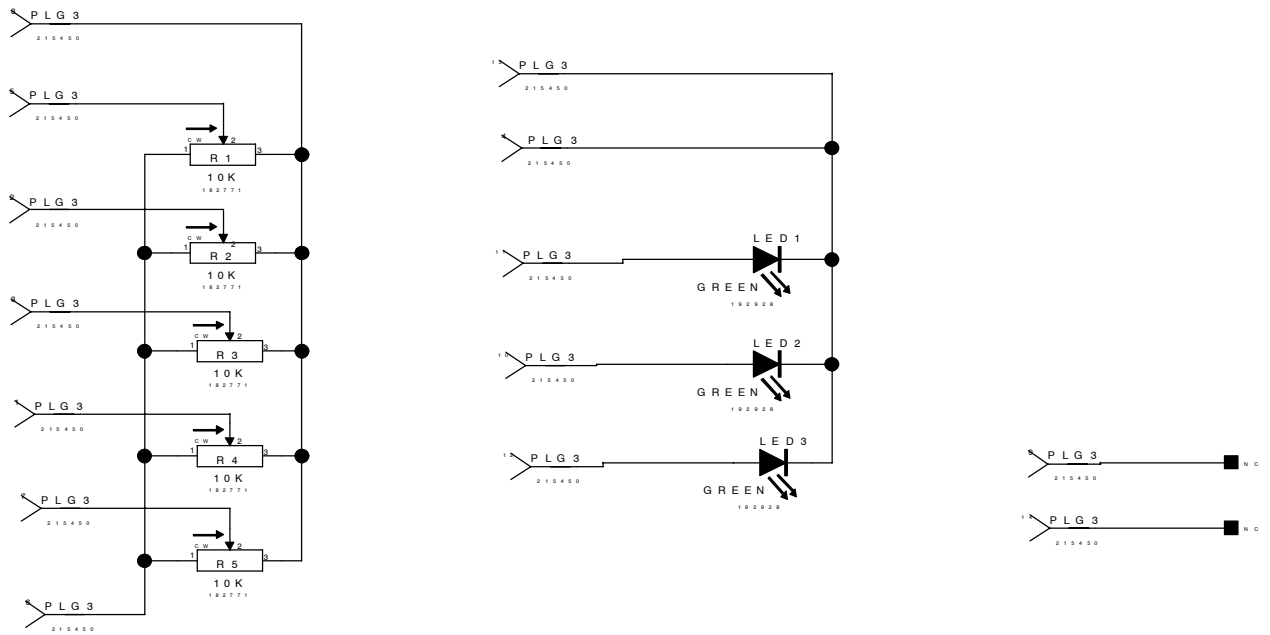
- PRINTED CIRCUIT BOARD
 PROGRAM - 0U12
 TEST PROCEDURE
 HEAT SINK - 0Q20_A
 HEAT SINK - 0Q21_A
 HEAT SINK - 0Q22_A
 HEAT SINK - 0Q22_A
 RIVSCREW - 0Q20_B
 RIVSCREW - 0Q21_B
 RIVSCREW - 0Q22_B
 RIVSCREW - 0Q23_B
 CONFORMAL COATING AS REQUIRED @PCB
 SCREW #3-48 UNC X .50 PAN HD. - 0RC2_A
 SCREW #3-48 UNC X .50 PAN HD. - 0RC2_B
 SCREW #3-48 UNC X .50 PAN HD. - 0RC3_A
 SCREW #3-48 UNC X .50 PAN HD. - 0RC3_B
 NUT #5-48 UNC HEX - 0RC2_C
 NUT #5-48 UNC HEX - 0RC2_D
 NUT #5-48 UNC HEX - 0RC3_C
 NUT #5-48 UNC HEX - 0RC3_D
 #6-32 PEM STANDOFF
 #8-32 PEM STANDOFF
 #6-32 PEM STANDOFF
 #8-32 PEM STANDOFF
 RTV - 0RV1





	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	

215 448-A

Figure 8-10. Circuit Diagram For Pulser Board PC2 (Optional In 250 DX Models, Standard In 350 LX Models) Effective With Serial No. LE223624



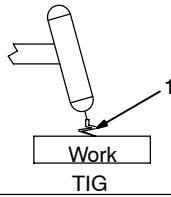
 WARNING	<ul style="list-style-type: none"> ● Do not touch live electrical parts. ● Disconnect input power or stop engine before servicing. ● Do not operate with covers removed. ● Have only qualified persons install, use, or service this unit.
	
ELECTRIC SHOCK HAZARD	

215 443-A

Figure 8-11. Circuit Diagram For Optional Sequencer Board PC3 Effective With Serial No. LE223624

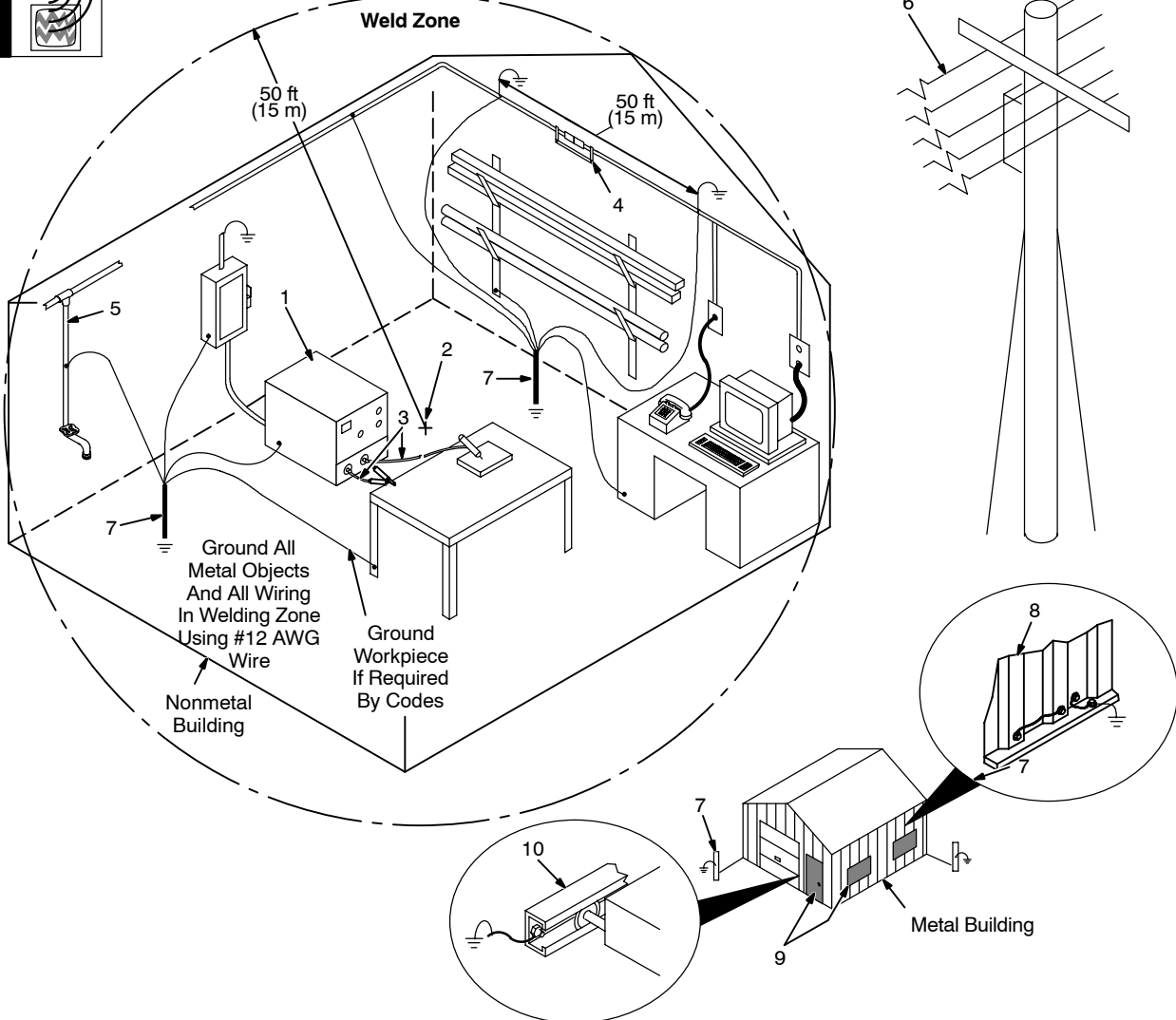
SECTION 9 – HIGH FREQUENCY (HF)

9-1. Welding Processes Requiring High Frequency



1 High-Frequency Voltage
TIG – helps arc jump air gap between torch and workpiece and/or stabilize the arc.

9-2. Correct Installation



1 HF Source (Welder With Built-In HF Or Separate HF Unit)

Ground metal machine case, work output terminal, line disconnect device, input supply, and worktable.

2 Welding Zone And Centerpoint

A circle 50 ft (15 m) from centerpoint between HF source and welding torch in all directions.

3 Weld Output Cables

Keep cables short and close together.

4 Conduit Joint Bonding And Grounding

Electrically join (bond) all conduit sections using copper straps or braided wire. Ground conduit every 50 ft (15 m).

5 Water Pipes And Fixtures

Ground water pipes every 50 ft (15 m).

6 External Power Or Telephone Lines

Locate HF source at least 50 ft (15 m) away from power and phone lines.

7 Grounding Rod

Consult the National Electrical Code for specifications.

8 Metal Building Panel Bonding Methods

Bolt or weld building panels together, install copper straps or braided wire across seams, and ground frame.

9 Windows And Doorways

Cover all windows and doorways with grounded copper screen of not more than 1/4 in (6.4 mm) mesh.

10 Overhead Door Track

Ground the track.

SECTION 10 – SELECTING AND PREPARING TUNGSTEN ELECTRODE FOR DC OR AC WELDING

ac/dc_gtaw 2/2000



▲ Whenever possible and practical, use DC weld output instead of AC weld output.

10-1. Selecting Tungsten Electrode (Wear Clean gloves To Prevent Contamination Of Tungsten)

Electrode Diameter	Amperage Range - Gas Type♦ - Polarity	
	(DCEN) – Argon Direct Current Electrode Negative	AC – Argon 65% Electrode Negative
2% Ceria (Orange Band), 1.5% Lanthanum (Gray Band), Or 2% Thorium (Red Band) Alloy Tungstens		
.040" (1 mm)	25-85	20-80
1/16" (1.6 mm)	50-160	50-150
3/32" (2.4 mm)	135-235	130-250
1/8" (3.2 mm)	250-400	225-360
Pure Tungsten (Green Band)		
.040" (1 mm)	Pure Tungsten Not Recommended For DCEN – Argon	10-60
1/16" (1.6 mm)		50-100
3/32" (2.4 mm)		100-160
1/8" (3.2 mm)		150-210

♦ Typical argon shielding gas flow rates are 11 to 35 cfh (cubic feet per hour).

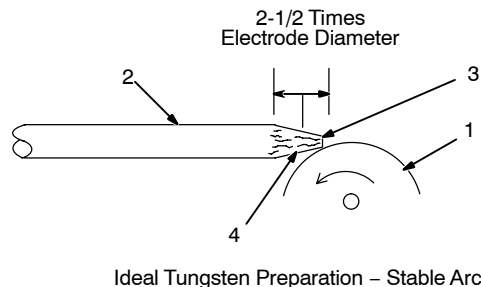
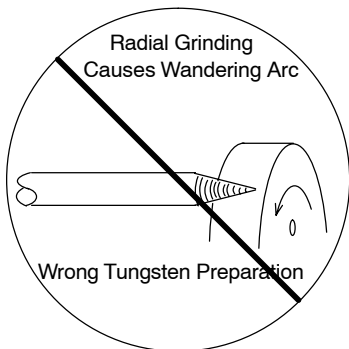
Figures listed are a guide and are a composite of recommendations from American Welding Society (AWS) and electrode manufacturers.

10-2. Preparing Tungsten Electrode For Welding



▲ Grinding the tungsten electrode produces dust and flying sparks which can cause injury and start fires. Use local exhaust (forced ventilation) at the grinder or wear an approved respirator. Read MSDS for safety information. Consider using tungsten containing ceria, lanthana, or yttria instead of thoria. Grinding dust from thoriated electrodes contains low-level radioactive material. Properly dispose of grinder dust in an environmentally safe way. Wear proper face, hand, and body protection. Keep flammables away.

A. Preparing Tungsten For DC Electrode Negative (DCEN) Welding Or AC Welding With Inverter Machines



1 Grinding Wheel

Grind end of tungsten on fine grit, hard abrasive wheel before welding. Do not use wheel for other jobs or tungsten can become contaminated causing lower weld quality.

2 Tungsten Electrode

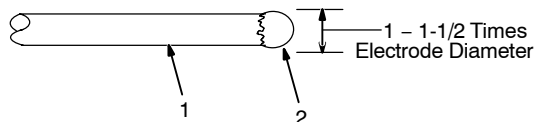
3 Flat

Diameter of this flat determines amperage capacity.

4 Straight Ground

Grind lengthwise, **not radial**.

B. Preparing Tungsten For Conventional AC Welding



1 Tungsten Electrode

2 Balled End

Ball end of tungsten by applying AC amperage recommended for a given electrode diameter (see Section 10-1). Let ball on end of the tungsten take its own shape.

Notes

DECIMAL EQUIVALENTS

	$\frac{1}{64}$	.015625
	$\frac{1}{32}$	.03125
	$\frac{3}{64}$	.046875
$\frac{1}{16}$	$\frac{5}{64}$	.0625
	$\frac{7}{64}$	.078125
	$\frac{9}{32}$	.09375
	$\frac{11}{64}$	.109375
$\frac{1}{8}$	$\frac{13}{64}$	.125
	$\frac{15}{64}$	.140625
	$\frac{17}{32}$	.15625
	$\frac{19}{64}$	.171875
$\frac{3}{16}$	$\frac{21}{64}$	.1875
	$\frac{23}{64}$	.203125
	$\frac{25}{32}$	.21875
	$\frac{27}{64}$	.234375
$\frac{1}{4}$	$\frac{29}{64}$	.25
	$\frac{31}{64}$	.265625
	$\frac{33}{32}$	.28125
	$\frac{35}{64}$	.296875
$\frac{5}{16}$	$\frac{37}{64}$	.3125
	$\frac{39}{64}$	.328125
	$\frac{41}{32}$	.34375
	$\frac{43}{64}$	.359375
$\frac{3}{8}$	$\frac{45}{64}$	.375
	$\frac{47}{64}$	.390625
	$\frac{49}{32}$	.40625
	$\frac{51}{64}$	.421875
$\frac{7}{16}$	$\frac{53}{64}$	.4375
	$\frac{55}{64}$	.453125
	$\frac{57}{32}$	.46875
	$\frac{59}{64}$	.484375
$\frac{1}{2}$	$\frac{61}{64}$	.5
	$\frac{63}{64}$	.515625
	$\frac{65}{32}$	.53125
	$\frac{67}{64}$	.546875
$\frac{9}{16}$	$\frac{69}{64}$	.5625
	$\frac{71}{64}$	.578125
	$\frac{73}{32}$	.59375
	$\frac{75}{64}$	.609375
$\frac{5}{8}$	$\frac{77}{64}$	.625
	$\frac{79}{64}$	.640625
	$\frac{81}{32}$	.65625
	$\frac{83}{64}$	.671875
$\frac{11}{16}$	$\frac{85}{64}$	.6875
	$\frac{87}{64}$	.703125
	$\frac{89}{32}$	.71875
	$\frac{91}{64}$	.734375
$\frac{3}{4}$	$\frac{93}{64}$	.75
	$\frac{95}{64}$	.765625
	$\frac{97}{32}$	.78125
	$\frac{99}{64}$	.796875
$\frac{13}{16}$	$\frac{101}{64}$	.8125
	$\frac{103}{64}$	.828125
	$\frac{105}{32}$	.84375
	$\frac{107}{64}$	.859375
$\frac{7}{8}$	$\frac{109}{64}$	.875
	$\frac{111}{64}$	.890625
	$\frac{113}{32}$	.90625
	$\frac{115}{64}$	.921875
$\frac{15}{16}$	$\frac{117}{64}$	.9375
	$\frac{119}{64}$	.953125
	$\frac{121}{32}$	.96875
	$\frac{123}{64}$	.984375
1		1.



TM-363E

2007-01

Processes



TIG (GTAW) Welding



Stick (SMAW) Welding

Description



Arc Welding Power Source

Syncrowave[®] 250 DX / 350 LX

And

Syncrowave[®] 250 DX / 350 LX

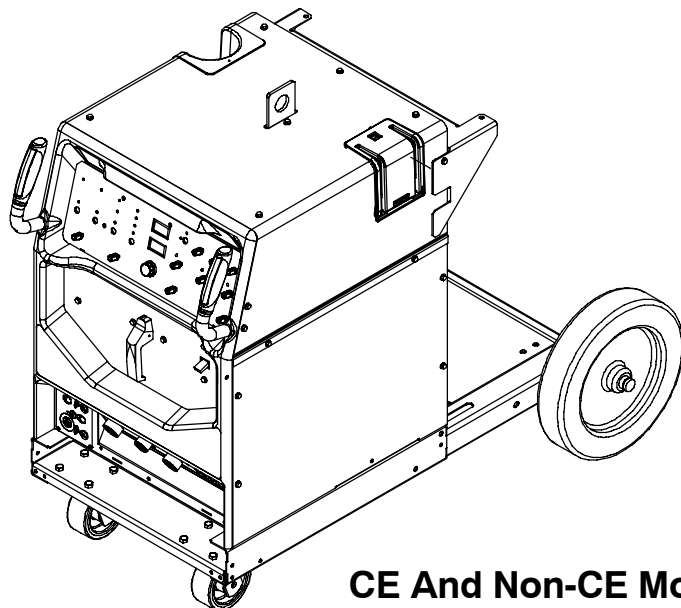
w/Integrated Cooler

PARTS LIST

Eff w/LE223624 And Following For 350 LX Models

Eff w/LE282983 And Following For 250 DX Models

For OM-363 (213 117) Revision A And Following




CE And Non-CE Models



Visit our website at
www.MillerWelds.com

SECTION 11 – PARTS LIST

350 LX Model Illustrated

 Hardware is common and not available unless listed.

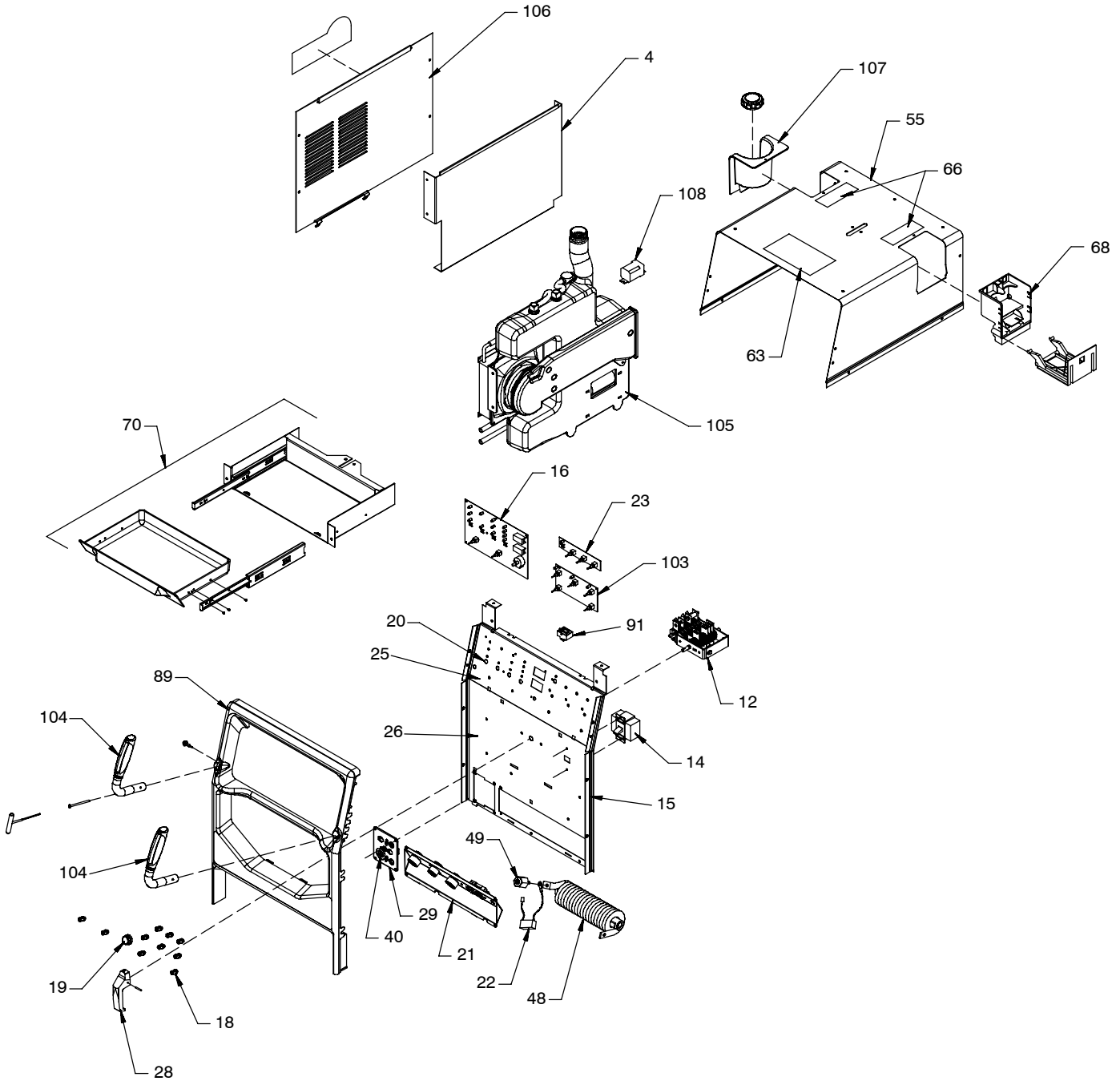
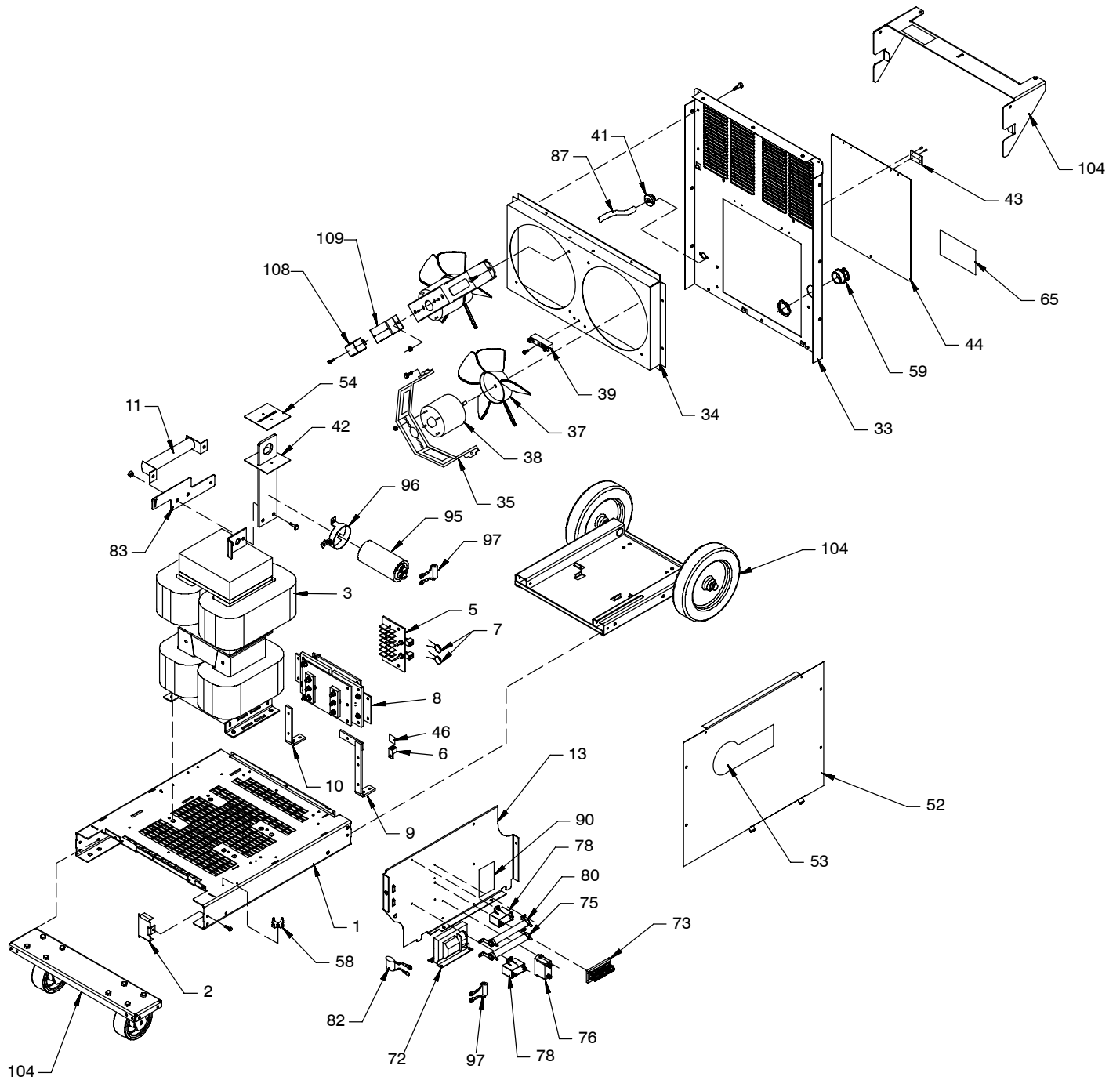


Figure 12-1. Main Assembly

350 LX Model Illustrated



Item No.	Dia. Mkgs.	Part No.	Description	Quantity	
				Model 250 DX	350 LX
Figure 12-1. Main Assembly					
...	1	211038	.. BASE,ASSY	1	1
...	2	215656	.. END CAP	4	4
...	3	T1/Z1 212555	.. XFMR/STABILIZER ASSY, 200/230/460	1	
...	3	T1/Z1 211041	.. XFMR/STABILIZER ASSY, 230/460/575	1	
...	3	T1/Z1 219652	.. XFMR/STABILIZER ASSY, 220/400/440/520	1	
...	3	T1/Z1 215767	.. XFMR/STABILIZER ASSY, 200/230/460		1
...	3	T1/Z1 215389	.. XFMR/STABILIZER ASSY, 230/460/575		1
...	3	T1/Z1 217801	.. XFMR/STABILIZER ASSY, 220/400/440/520		1
...		TH1 201443	.. THERMISTOR, NTC 10K OHM @ 25 DEG C 27.5 IN LEAD	1	1
...	4	212550	.. PANEL, LEFT WINDTUNNEL (for non-TIGRUNNER models)	1	1
...	5	TE1 214127	.. TERM ASSY, PRI 1PH 3V	1	1
...	6	213248	.. LUG, UNIV W/SCREW 2/0-14 WIRE .266STD	1	1
...	7	C5, 6 111634	.. CAPACITOR ASSY,	1	1
...	8	SR1 212558	.. RECTIFIER, SCR MAIN (INCLUDES)	1	1
...		218581	.. THYRISTOR, SCR 300A 300V HOCKEY PUCK	1	1
...		TH2 217069	.. THERMISTOR, NTC 30K OHM @ 25 DEG C 40 IN LEAD (PRIOR TO LG220001I)	1	1
...		TH2 218580	.. THERMISTOR, NTC 30K OHM @ 25 DEG C 40 IN LEAD (EFF W/LG220001I)	1	1
...	9	218670	.. BRACKET, RECTIFIER RH	1	1
...	10	212559	.. BRACKET, RECTIFIER LH	1	1
...	11	R3 218173	.. RESISTOR, WW FXD 400 W 35 OHM W/MTG BKT	1	1
...	12	S5 215390	.. SWITCH ASSY, POLARITY W/LEADS & HARDWARE (DX)	1	1
...	13	+213105	.. PANEL, RIGHT WINDTUNNEL	1	1
...	14	S1 215937	.. SWITCH, TGL ASSY	1	1
...	15	213114	.. FRONT PANEL ASSY,	1	1
...		117860	.. BLANK, SNAP-IN NYL .187 MTG HOLE BLACK	1	1
...		107983	.. BLANK, SNAP-IN NYL .500 MTG HOLE BLACK	1	1
...		143397	.. BLANK, SNAP-IN NYL .312 MTG HOLE BLACK	8	8
...	16	PC1 209877	.. CIRCUIT CARD ASSY, CONTROL & INTERFACE W/PROGRAM	1	1
...		PLG13,15 131054	.. HOUSING RCPT+SKTS,(SERVICE KIT)	2	2
...		PLG14 115092	.. HOUSING PLG+SKTS,(SERVICE KIT)	1	1
...		PLG4 115093	.. HOUSING PLG+SKTS,(SERVICE KIT)	1	1
...		PLG17 203800	.. HOUSING PLG+SKTS,(SERVICE KIT)	1	1
...		PLG16 115091	.. HOUSING PLG+SKTS,(SERVICE KIT)	1	1
...		PLG10 130	.. HOUSING PLG+SKTS,(SERVICE KIT)	1	1
...	18	183332	.. KNOB, POINTER .570 DIA X .125 ID W/SPRING CLIP	2	5
...	19	174991	.. KNOB, POINTER 1.250 DIA X .250 ID W/SPRING CLIP-.21	1	1
...	20	195778	.. ACTUATOR PUSH BUTTON ASSY	1	1
...	21	Figure 12-2	.. PANEL,LOWER DINSE CONN ASSY	1	1
...	22	C14 209587	.. CAPACITOR ASSY,	1	1
...	23	PC2 ♦♦ 195344	.. CIRCUIT CARD ASSY, PULSER (INCLUDES)	1	
...	23	PC2 195344	.. CIRCUIT CARD ASSY, PULSER (INCLUDES)		1
...		215446	.. CIRCUIT CARD, PULSER	1	1
...		183332	.. KNOB, POINTER .570 DIA X .125 ID W/SPRING CLIP	3	3
...		195778	.. ACUATOR, PUSH BUTTON ASSY	1	1
...		190512	.. STAND-OFF, NO. 6-32 X .640LG X .250 HEX AL FEM	1	1
...	25		.. NAMEPLATE, UPPER (ORDER BY MODEL AND SERIAL NUMBER)	1	
...	26		.. NAMEPLATE, LOWER (ORDER BY MODEL AND SERIAL NUMBER)	1	
...	28	175952	.. PLASTIC, HANDLE SWITCH	1	1
...		169136	.. PIN, HANDLE	1	1
...	29	215685	.. PANEL, GAS	1	1
...	29	♦ 215691	.. PANEL, GASWATER	1	1

Item No.	Dia. Mkgs.	Part No.	Description	Quantity	
				Model 250 DX	Model 350 LX
Figure 12-1. Main Assembly (continued)					
33		212548	PANEL, REAR	1	1
34		184058	FAN, PLENUM	1	1
35		187807	BRACKET, MTG MOTOR FAN	2	2
37		150783	BLADE, FAN 9.000 5WG 39DEG .312 BORE CW PLSTC	2	2
38	FM1, 2	220393	MOTOR, FAN 230V 50/60HZ 1550 RPM .312 DIA SHAFT	2	2
39	1T	199312	BLOCK, TERMINAL FAST-ON, 20 AMP, 250 VOLT	1	1
40	GS1	215776	VALVE, 24VDC 2WAY CUSTOM PORT 1/8 ORF W/FRICT	1	1
41		208408	FTG, BRS BARBED FEM 1/4 TBG X .625-18 FLANGE MTG	1	1
		217111	PLUG, PROTECTIVE	2	2
42		204293	SUPPORT, LIFT EYE	1	
42		212552	SUPPORT, LIFT EYE		1
43		218280	HINGE, CONT POLYOLEFIN COPOLYMER 2.000 L W/.125H	1	1
44		+215657	DOOR, ACCESS (PRIOR TO LG220001L)	1	1
44		+229068	DOOR, ACCESS (EFF W/LG220001L)	1	1
46		217553	LABEL, GROUND/PROTECTIVE EARTH	1	1
48	T4	215771	COIL, HF COUPLING	1	1
49		207560	INSULATOR, STANDOFF WITH STUD	2	2
52		*211043	PANEL, SIDE	2	2
53		199479	LABEL, MILLER	2	2
54		026627	GASKET, LIFTING EYE COVER	1	1
55		+211040	COVER, TOP	1	1
58		208294	CONNECTOR, FASTON MALE 4-PRONG	1	2
59		010467	CONN, CLAMP CABLE 1.250	1	1
63		203990	LABEL, WARNING GENERAL PRECAUTIONARY STATIC	1	1
65		218598	LABEL, WARNING ELECTRIC SHOCK AND INCORRECT INPUT P	1	1
66			FOR MODELS WITHOUT TIGRUNNER OR COOLER OPTIONS		
66		201019	LABEL, WARNING ELECTRIC SHOCK EXCESS WEIGHT (200/230/460 VOLT MODELS ONLY)	2	2
66		217137	LABEL, WARNING ELECTRIC SHOCK CAN KILL (ENG/FR) (230/460/575 VOLT MODELS ONLY)	2	2
66		206343	LABEL, WARNING ELECTRIC SHOCK EXCESS WEIGHT WORDLES (220/400/440/520 VOLT MODELS ONLY)	2	2
66			FOR MODELS WITH TIGRUNNER OR COOLER OPTIONS, THERE ARE TWO SEPERATE LABELS FOR EACH VOLTAGE. CHECK BELOW TO ORDER CORRECT LABEL OR LABELS FOR CORRESPONDING VOLTAGES.		
66		201019	LABEL, WARNING ELECTRIC SHOCK EXCESS WEIGHT (200/230/460) VOLT MODELS ONLY	1	1
66		219178	LABEL, CAUTION INCORRECT COOLANT (200/230/460 VOLT MODELS ONLY)	1	1
66		217137	LABEL, WARNING ELECTRIC SHOCK CAN KILL (ENG/FR) (230/460/575 VOLT MODELS ONLY)	1	1
66		219177	LABEL, CAUTION INCORRECT COOLANT (ENG/FR) 230/460/575 VOLT MODELS ONLY	1	1
66		206343	LABEL, WARNING ELECTRIC SHOCK EXCESS WEIGHT WORDLES (220/400/440/520 VOLT MODELS ONLY)	1	1
66		219176	LABEL, CAUTION INCORRECT COOLANT (CE) 220/400/440/520 VOLT MODELS ONLY	1	1
68		*204389	HOLDER, TORCH/CABLE	2	2
70		212557	DRAWER, ASSY (includes)	1	1
		213111	DRAWER, PLASTIC	1	1
		213112	DRAWER, FRAME	1	1
		217255	SLIDE, DRAWER	2	2
72	T3	219927	XFMR, HIGH VOLTAGE 115V PRI 3600V SEC 34 MA W/TERM	1	1
73	G1	199854	KIT, SPARK GAP ASSY QUAD, (Prior to LF251061)	1	1
73	G1	221738	SPARK GAP ASSY, (includes) (Eff w/LF251061)	1	1
		221735	BASE, SPARK GAP	1	1
		221734	HOLDER, POINTS	3	3
		221736	POINTS, SPARK GAP (DUAL)	1	1
		221737	POINTS, SPARK GAP (SINGLE)	2	2

Item No.	Dia. Mkgs.	Part No.	Description	Quantity	
				Model 250 DX	Model 350 LX
Figure 12-1. Main Assembly (continued)					
.....		227581	... SCREW, 250-20X .37 SOC HD-HEX NYLON 6/6	3	3
.. 75	.. R8	.. 188067	.. RESISTOR, WW FXD 100 W 200 OHM W/CLIPS	1	1
.. 76	.. C3	.. 215779	.. CAPACITOR, MICA .002 UF 10000 V PANEL MTG W/LEA	1	1
.. 78	.. C11, 19	.. 195552	.. CAPACITOR, POLYP MET FILM 20. UF 250 VAC 10%	2	2
.. 80	.. R1	.. 220808	.. RESISTOR, WW FXD 100 W 50 OHM W/CLIPS	1	1
.. 82	.. C13	.. 206878	.. CAPACITOR ASSY,	1	1
.. 83		.. 216081	.. BRACKET, RESISTOR	1	1
.. 87		.. 218170	.. HOSE, NPRN BRD NO 1 X .250 ID X 24.000	1	1
.. 89		.. 211039	.. BEZEL, FRONT	1	1
.. 90		.. 224459	.. LABEL, WARNING ELECTRICAL SHOCK ETC	1	1
.. 91	.. HD1	.. 191941	.. TRANSDUCER, CURRENT	1	1
.. 95	.. C2	.. 031668	.. CAPACITOR, ELCTLT 4000 UF 100 VDC	1	1
.. 96		.. 108105	.. CLAMP, CAPACITOR	1	1
.. 97	.. R2, 4	.. 118459	.. RESISTOR, WW FXD 10 W 1K OHM	2	2
.. 103	.. PC3 ♦♦	.. 195345	.. CIRCUIT CARD ASSY, SEQUENCER (INCLUDES)	1	1
.....		.. 215441	.. CIRCUIT CARD ASSY, SEQUENCER	1	1
.....		.. 183332	.. KNOB, POINTER .570 DIA X .125 ID W/SPRING CLIP	5	5
.. 104	.. ♦ Figure 12-4	..	.. TIGRUNNER RUNNING GEAR	1	1
.. 105	.. ♦ Figure 12-3	..	.. ASSY, COOLER	1	1
.. 106	.. ♦ 212556	..	.. PANEL, SIDE	1	1
.. 107	.. ♦ 211037	..	.. HOLDER, COOLANT FILLER	1	1
.. 108	.. CR1 ♦	.. 059266	.. RELAY, ENCL 120VAC DPDT 10A/120VAC 8PIN (PRIOR TO LE420474)	1	1
.. 108	CR1, CR2 ♦	.. 059266	.. RELAY, ENCL 120VAC DPDT 10A/120VAC 8PIN (EFF W/LE420474)	2	2
.. 109		.. 222451	.. BRACKET, RELAY (EFF W/LE420474)	1	1
.....	.. ♦ 194744	..	.. RFCS-14HD (FOOT CONTROL)	1	1

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

♦ Part of TIGRUNNER option.

♦♦ Field option only.

♣ For TIGRUNNER models, the quantity is 1.

To maintain the factory original performance of your equipment, use only Manufacturer's Suggested Replacement Parts. Model and serial number required when ordering parts from your local distributor.

☞ Hardware is common and not available unless listed.

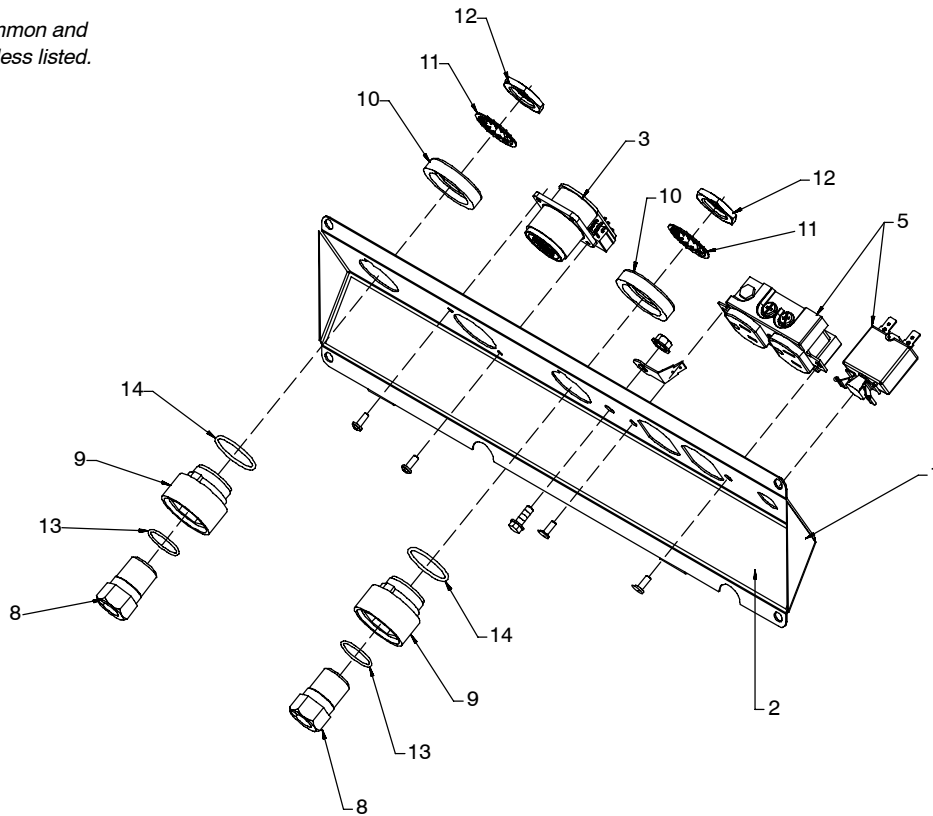


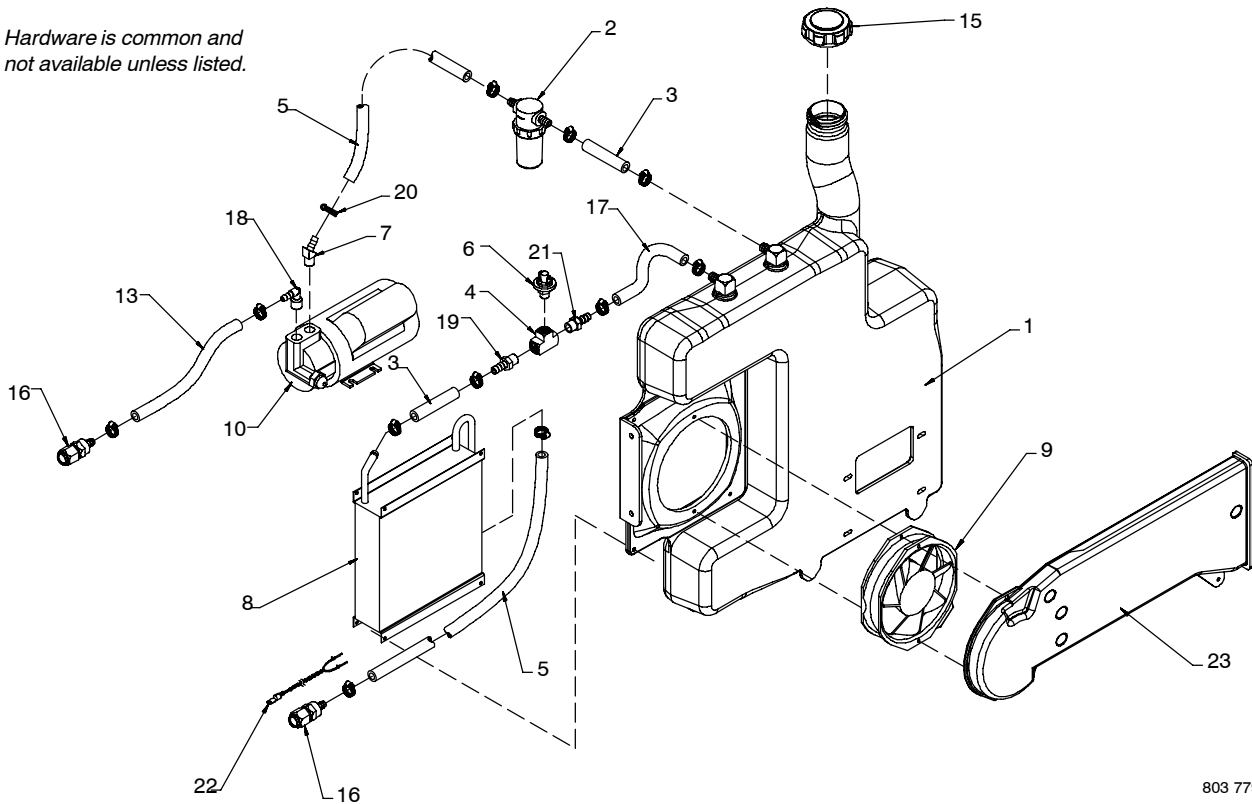
Figure 12-2. Panel, Lower Dinse Connector Assembly

803 775-A

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
220 509 Figure 12-2. Panel, Lower Dinse Connector Assy (Figure 12-1 Item 21)				
1		213109	PANEL, LOWER DINSE CONN	1
2		218784	LABEL, COMPONENT IDENTIFICATION	1
3		224529	CONN, CIRC MS/CPC 14SKT SIZE 20 RCPT W/FILTERING	1
5		218174	RECEPTACLE, W/LEADS & CIRCUIT BREAKER	1
8		202553	RECEPTACLE, TWIST LOCK BRASS POWER (FEMALE)	2
9		185712	INSULATOR, BULKHEAD FRONT	2
10		185713	INSULATOR, BULKHEAD REAR	2
11		185714	WASHER, TOOTH 22MMID X 31.5MMOD 1.310-1MMT INTERN	2
12		185717	NUT, M20-1.5 1.00HEX .19H BRS LOCKING	2
13		186228	O-RING, 0.739 ID X 0.070 H	2
14		185718	O-RING, 0.989 ID X 0.070 H	2

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Hardware is common and not available unless listed.



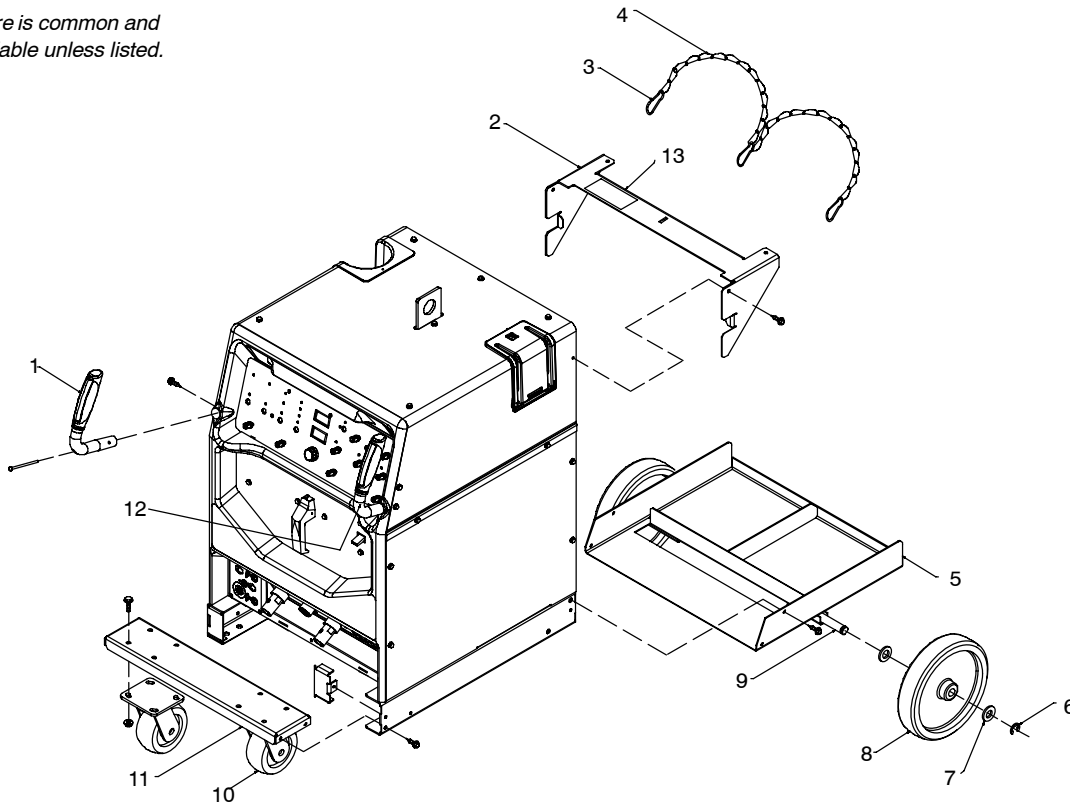
803 779-F

Figure 12-3. Optional Cooler Assembly

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
229 675 Figure 12-3. Cooler Assy (Optional) Figure 12-1 Item 105				
...	1	211036	TANK, COOLANT	1
...	2	215667	FILTER,	1
...	3	215669	HOSE, RUBBER BRAIDED 3/8 ID X 1/2 OD X 2 IN (PRIOR TO LE352937)	1
...	3	215669	HOSE, RUBBER BRAIDED 3/8 ID X 1/2 OD X 2 IN (EFF W/LE352937)	2
...	4	215688	FITTING, MANIFOLD	1
...	5	215675	HOSE, RUBBER BRAIDED 3/8 ID X 5/8 OD X 19 IN	2
...	6	215679	SWITCH, PRESSURE	1
...	7	221819	FTG, HOSE BRS BARBED 45 DEGREE ELBOW M3/8 X 3/8 NPT	1
...	8	217173	RADIATOR, HEAT EXCHANGER	1
...	9	211042	FAN, AC 230V BRUSHLESS	1
...	10	211045	PUMP, COOLANT	1
...	12	215682	HOSE, RUBBER BRAIDED 3/8 ID X 1/2 OD X 8 1/2 IN (PRIOR TO LE352936)	1
...	13	215683	HOSE, RUBBER BRAIDED 3/8 ID X 1/2 OD X 16 IN (PRIOR TO LE352937)	1
...	13	215683	HOSE, RUBBER BRAIDED 3/8 ID X 1/2 OD X 13.5 IN (EFF W/LE352937)	1
...	15	166608	CAP, TANK SCREW-ON W/VENT	1
...	16	220921	VALVE, CHECK BIDIRECTIONAL	2
...	17	215690	HOSE, RUBBER BRAIDED 3/8 ID X 1/2 OD X 4 1/2 IN (PRIOR TO LE352937)	1
...	17	215690	HOSE, RUBBER BRAIDED 3/8 ID X 1/2 OD X 3 1/2 IN (EFF W/LE352937)	1
...	18	5523	FTG, HOSE BRS BARBED ELBOW M 3/8 TBG X 3/8 NPT	1
...	19	126978	FTG, BRS BARBED M 3/8 TBG X 3/8 NPT	1
...	21	215673	FITTING,	1
...	22	TH3 217069	THERMISTOR,NTC 30K OHM @ 25 DEG C 40IN LEAD	1
...	23	227110	PLENUM,COOLER FAN	1

To maintain the factory original performance of your equipment, use only Manufacturer's Suggested Replacement Parts. Model and serial number required when ordering parts from your local distributor.

☞ Hardware is common and not available unless listed.



Ref. 803 725-B

Figure 12-4. Optional Running Gear

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
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Figure 12-4. Running Gear (Optional) (Figure 12-1 Item 104)

...	1	218134	.. HANDLE, LH	1
...	2	+215928	.. BOTTLE SUPPORT	1
...	3	168663	.. HOOK SPRING SNAP	3
...	4	602387	.. CHAIN	2
...	5	191158	.. BOTTLE TRAY	1
...	6	121614	.. RETAINING RING	2
...	7	602250	.. WASHER, 812 ID X 1.469 OD X .134 T STL PLD ANSI. 750	4
...	8	163463	.. WHEEL (PRIOR TO LG260242L)	2
...	8	209869	.. WHEEL (EFF W/LG260242L)	2
...	9	191167	.. AXLE	1
...	10	168247	.. CASTER, SWIVEL	2
...	11	191163	.. CASTER MOUNTING BRACKET	1
...	12	218135	.. HANDLE, RH	1
...	13	217140	.. LABEL,WARNING CYL MAY EXPLODE IF DAMAGED (ENG/FR) .. (230/460/575 VOLT MODELS ONLY)	1
...	13	200285	.. LABEL,WARNING CYLINDER MAY EXPLODE IF DAMAGED .. (200/230/460 VOLT MODELS ONLY)	1

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

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