

Constant Current Type Rectifier Welding Machine Model TR-250

For the Following Specs:

- 5883C-1
- 5884C-1
- 5883D-1
- 5884D-1



OWNER'S MANUAL Number **430429-240**
Revised December 1, 1997

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

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

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INTRODUCTION

How To Use This Manual

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

To ensure safe operation, read the entire manual, including the chapter on safety instructions and warnings.

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

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

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

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

Equipment Identification

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

Receipt Of Equipment

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

Move the equipment to the installation site before uncrating the unit. A lifting eye extends through the top of the cabinet on most equipment to facilitate handling with a hoist or crane. Use care to avoid damaging the equipment when using bars, hammers, etc., to uncrate the unit.

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

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

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

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DESCRIPTION OF EQUIPMENT

General

This transformer-rectifier type welding machine is designed to be simple and rugged, yet well suited to various manual arc welding processes.

For reference to the Volt-Ampere characteristic curves produced by either the AC or DC outputs, see Figures 3-3 and 3-4.

The unit's rated output is 250 Amperes at 30 Volts and 7.5 kW at a 30% duty cycle. Its input is 14 kW

of single phase current at voltage, frequency and current levels as shown in Table 3-1.

Controls

Refer to Figure 3-1.

NOTE: To obtain "reverse" welding polarity, simply reverse connections to DC Output Terminals.

UNIT SPEC NUMBERS	FREQ. HZ.	POSSIBLE INPUT VOLTAGES	CORRESPONDING INPUT CURRENTS (without optional power factor capacitors)	CORRESPONDING INPUT CURRENTS (with optional power factor capacitors)
5883C-1 5883D-1	60	200, 230, 460, 575	110, 96, 48, 38	90, 78, 39, 31
5884C-1 5884D-1	50/60	220, 380-415, 500	96, 67-55, 42	86, 60-50, 37

Table 3-1

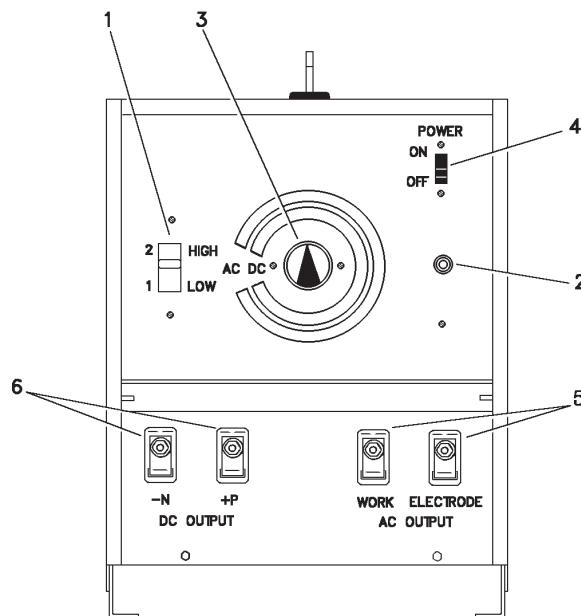


Figure 3-1 Control Panel

DESCRIPTION OF EQUIPMENT

1. **HIGH/LOW RANGE SWITCH** — In HIGH position, it provides an AC output of 130 to 315 Amperes, or a DC output of 100 to 250 Amperes. In LOW position, it provides an AC output of 42 to 175 Amperes, or a DC output of 38 to 149 Amperes. These two ranges correspond to the ranges shown on Fine Current Control.

CAUTION: Do not switch ranges while unit is under load.

2. **CIRCUIT BREAKER** — Protects control circuitry — (15 ampere).

3. **FINE CURRENT CONTROL** — Adjusts both AC and DC current in either range as selected by

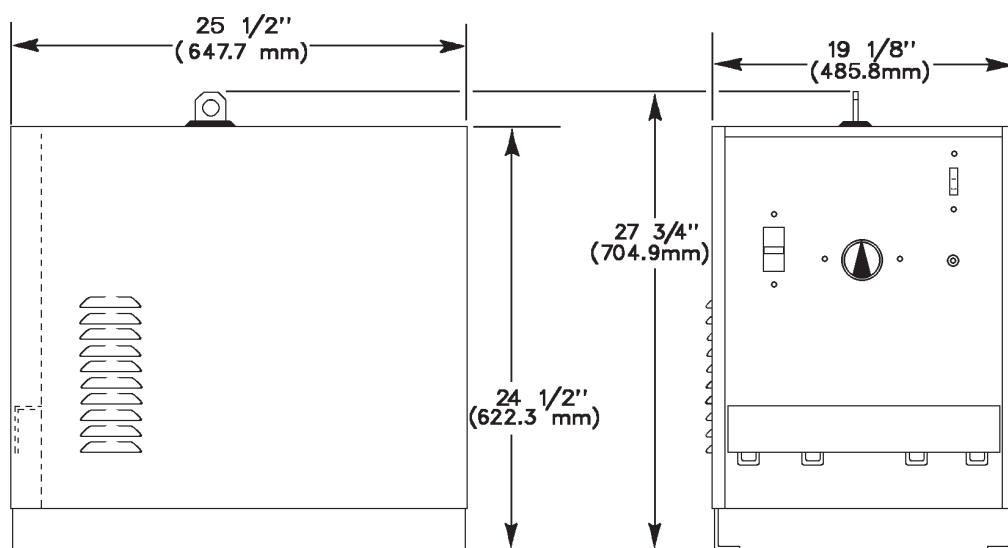
High/Low Range Switch. Can be adjusted while unit is under load.

4. **POWER ON/OFF SWITCH** — The ON position energizes the power source.

5. **AC OUTPUT TERMINALS** — Serve as connection points for cables leading to electrode holder and to workpiece for AC welding.

NOTE: Welding machine can supply either AC output or DC output but not both simultaneously.

6. **DC OUTPUT TERMINALS** — Serve as connection points for cables leading to electrode holder and to workpiece for DC welding.



Weight — 305 Lbs. (138 Kg)

Figure 3-2 Dimensions and Weight Information

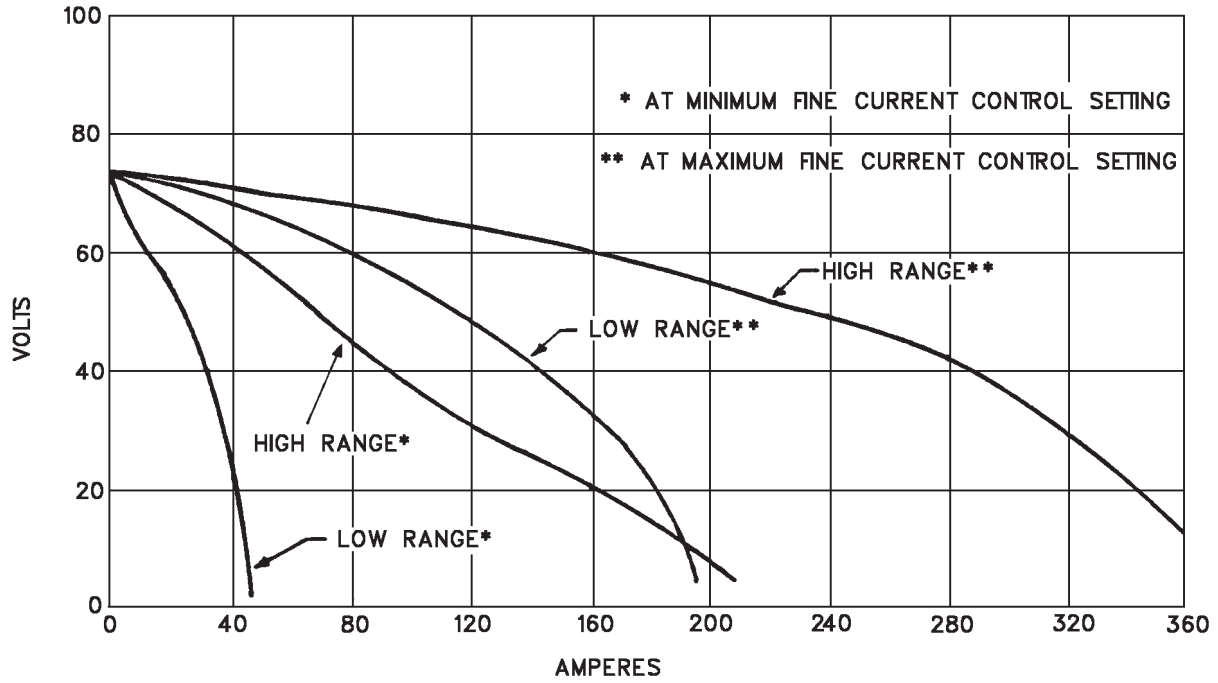


Figure 3-3 AC Output Volt-Ampere Characteristic Curves

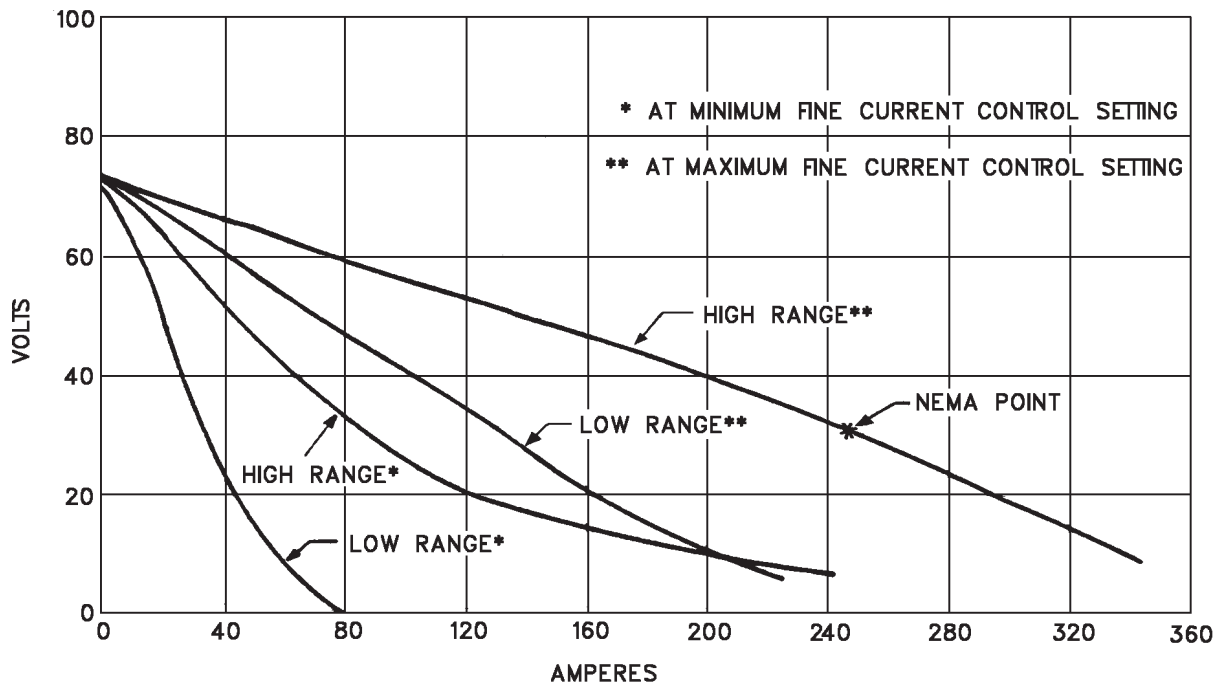


Figure 3-4 DC Output Volt-Ampere Characteristic Curves

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INSTALLATION

Location

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

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

Grounding

The frame of this welding machine should be grounded for personnel safety. Where grounding is mandatory under state or local codes, it is the responsibility of the user to comply with all applicable rules and regulations. Where no state or local codes exist, it is recommended that the National Electrical Code be followed. Refer to Table 4-1 for wire sizes.

The work or work table must also be grounded by using a conductor attached to a driven ground or water pipe as described below. See Figures 4-1 and 4-2.

The requirements and recommendations for grounding apply to rubber tire mounted equipment. In addition to the usual function of protecting personnel against the hazard of electrical shock due to fault in the equipment, grounding serves to discharge the static electrical charges which tend to build up on the surfaces of tire mounted equipment. These static charges sometimes cause painful shock to personnel, and in some instances, lead to the erroneous conclusion that an electrical fault exists in the equipment.

Use an input-power cable assembly which includes a grounding conductor to connect this equipment to the input power supply. When included in the cable assembly, the grounding conductor will be green or green with a yellow stripe, or bare. Connect the grounding conductor to the equipment grounding terminal, if provided, and if not, to the equipment frame, taking care to see that good electrical contact is made between conductor and frame. Connect the

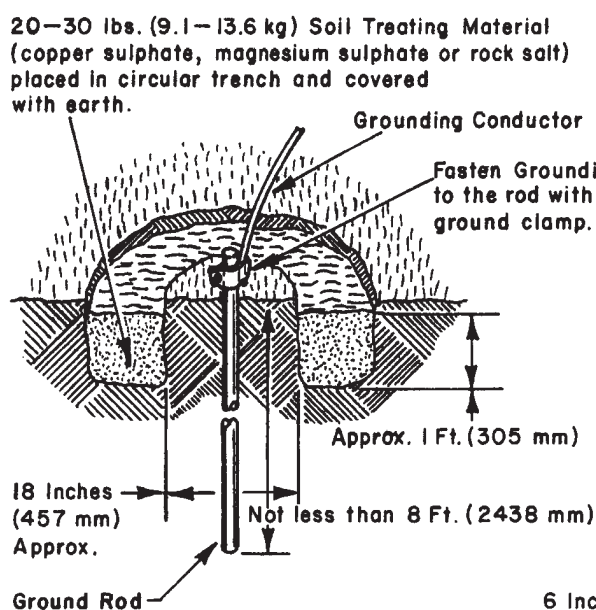


Figure 4-1 Outside Ground

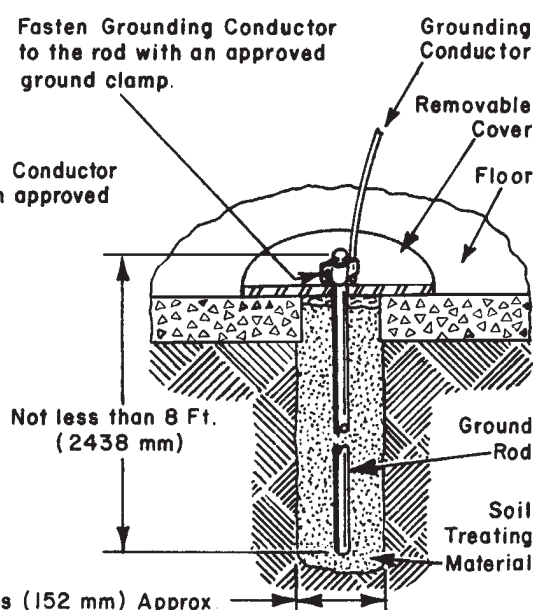


Figure 4-2 Inside Ground

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other end of the grounding conductor to the system ground.

If, for any reason, an input cable which does not include a grounding conductor is used, the equipment may be grounded with a separate conductor if permitted under applicable code, or by special permission of the jurisdictional body responsible for enforcement of the code. Minimum size and color coding requirements must be in accordance with any applicable state or local code, or the National Electrical Code.

If metallic armored cable or conduit is used, the metal sheathing or conduit must be effectively grounded as required by state or local code, or the National Electrical Code.

If a system ground is not available, the welding machine must be connected to a driven ground rod (see Figures 4-1 and 4-2) or to a water pipe that enters the ground not more than 10 feet (3,048 mm) from the machine. Refer to the Wire and Fuse Size Chart, Table 4-1, for selection of the proper grounding conductor.

NOTE: The grounding conductor must be as short as possible in order to produce the most efficient installation.

Treating An Outside Ground — The soil treating materials are placed in a circular trench around the rod, but not in direct contact. The crystals are gradually dissolved by surface waters and the solution is carried into the most useful area of earth surrounding the electrode (rod). Flood the trench several times when making original installation. See Figure 4-1.

Treating An Inside Ground — Reduce the diameter of the hole to 6 inches (152 mm), pour soil treating material in and around the rod. Add enough water to dissolve 8 pounds (4.0 kg) of soil treating material. Flood the hole every 6 months and replace the soil treating material when it is all dissolved. See Figure 4-2.

Internal Wiring Check

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

Remove the right side panel for access to LINE VOLTAGE CHANGEOVER BOARD. Check line voltage connections against instructions on VOLTAGE CHANGEOVER DIAGRAM supplied with this manual. If necessary, rearrange the link connections.

Input Connections To Power Source

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

Table 4-1 provides minimal information for selection of line conductors, fuses, and the equipment

Line Voltage	Line Current (Amperes)		Wire Size (AWG)*		Ground Wire Size (AWG)*	Lag Fuse Rating	
	With Capacitors**	Without Capacitors	With Capacitors**	Without Capacitors		With Capacitors**	Without Capacitors
200	90	110	No. 6	No. 4	No. 6	110	140
220	86	96	No. 6	No. 4	No. 8	110	140
230	78	96	No. 6	No. 6	No. 8	110	110
380	50	55	No. 8	No. 8	No. 8	80	80
415	60	67	No. 8	No. 8	No. 8	80	80
460	39	48	No. 10	No. 10	No. 8	60	60
500	37	42	No. 10	No. 10	No. 8	60	60
575	31	38	No. 10	No. 10	No. 8	60	60

* Input conductor sizes are based on allowable ampacities of insulated copper conductors, with not more than three conductors in a raceway or cable.

Table 4-1 Recommended Wire and Fuse Sizes

grounding conductor. This information is from the National Electrical Code NFPA 70-1990 Edition. Install this equipment per the latest edition, available from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.

This welding machine operates on a single-phase, AC input. See nameplate of the machine to determine required input voltage and frequency. Make certain that the welding machine is connected for the power supply voltage available. The input power cables should be connected to the power supply through a fused disconnect switch (furnished by the customer). Refer to the identification nameplate to determine the rating of the machine, then consult the local power company for wire and fuse size code. If no code exists, use the size of wire fuses listed in Table 4-1.

WARNING: The fused disconnect switch: Open or place in the OFF position and remove the fuses. To avoid an accident, make the electric power connections to the welding machine first, then to the fused disconnect switch. This will prevent an accidental application of power while the machine is being connected.

1. A line (wall) disconnect switch, with fuses or circuit breakers should be provided at the main power panel. The primary power input must have three insulated copper conductors (two power leads and one ground wire). The wires may be heavy rubber-covered cable or may be run in a solid or

flexible conduit. Do not connect the input conductors until step 3.

2. For access to input terminal board, remove the screws which secure the right side panel of the power supply. The input terminal board, Figure 4-3 or Figure 4-4, is clearly marked to show the available primary voltage connections which may be used. Set the voltage links, on this board, to match your actual incoming voltage. As shipped from the factory, the input terminal board voltage links are set up for the highest line voltage.

3. Thread the input conductor cables from the wall disconnect switch through the (knock out) hole in the rear panel. Connect the conductors to terminals L1 and L2 (on the input terminal board) using UL listed pressure wire connectors. Connect the ground wire to the grounding stud provided on the transformer just below the changeover board.

WARNING: It is of the utmost importance that the chassis be connected to an approved electrical ground to prevent accidental shocking. Take care not to connect the ground wire to any of the primary leads.

4. Recheck all connections to make sure that they are tight, well insulated, and that the proper connection has been made.

Welding Leads

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

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

NOTE: Lead size shown is for 90°C (194°F) insulation, 30°C (86°F) ambient, and not over 4.5 volts lead drop.

Table 4-2

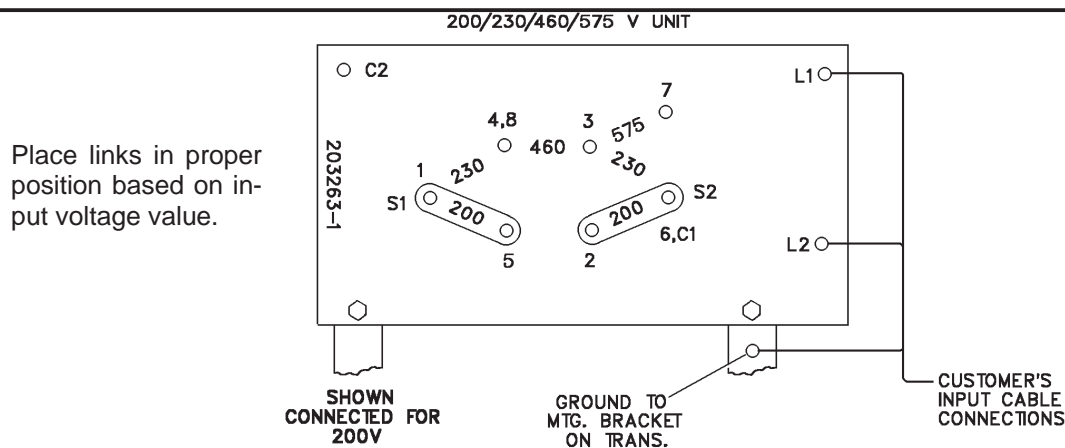


Figure 4-3 Input Voltage Connection and Changeover

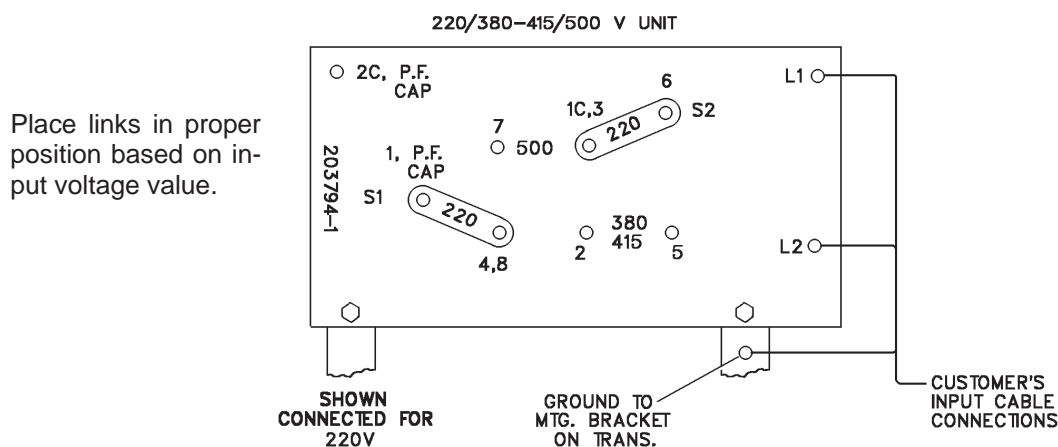


Figure 4-4 Input Voltage Connection and Changeover

OPERATION

1. Connect welding ground (“work”) cable to workpiece and connect opposite end into proper welding machine output terminal as shown in Table 5-1.

Connect electrode holder cable into proper welding machine output terminal as shown in Table 5-1.

2. Place proper electrode in electrode holder.

3. Set High/Low Range Switch to desired range.

CAUTION: Do not switch ranges while unit is under load.

4. Set Fine Current Control to approximate desired value.

5. Set Power On/Off Switch to ON position to make open circuit voltage appear at electrode.

6. Strike an arc and adjust Fine Current Control as necessary to produce desired results.

CAUTION: Use care not to exceed the 30% duty cycle rating, as welding machine can be damaged by overheating.

7. Retract electrode from workpiece to extinguish arc and to re-establish open circuit voltage at electrode.

8. Leave unit turned on for at least 2 to 3 minutes after finishing welding. This allows fan to cool welding machine interior.

DESIRED WELDING CURRENT	REQUIRED WORK CABLE CONNECTION	REQUIRED ELECTRODE HOLDER CABLE CONNECTION
AC	AC Output WORK Terminal	AC Output ELECTRODE Terminal
DCEN (Straight Polarity)	DC Output POSITIVE Terminal	DC Output NEGATIVE Terminal
DCEP (Reverse Polarity)	DC Output NEGATIVE Terminal	DC Output POSITIVE Terminal

Table 5-1

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MAINTENANCE

Lubrication

The fan motor is totally enclosed with sleeve bearings. It is recommended that the sleeve bearings are lubricated once or twice a year. If the motor is energized eight hours or less a day, lubrication of once a year is sufficient. To re-oil the motor, remove the two oil plugs and add a few drops of SAE 20 motor oil. Do not over lubricate! Replace the two oil plugs.

Inspection and Cleaning

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

WARNING: Disconnect line voltage from the unit before attempting any servicing inside unit. Turn OFF and remove fuses of disconnect switch (supplying AC power to welding machine).

Check and tighten all electrical connections as necessary to eliminate unnecessary losses and to

avoid subsequent trouble from overheating or open circuits. Check for broken wiring or damaged insulation on wiring.

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

Replacement of Silicon Diodes

The silicon rectifier is composed of silicon diodes, some of which are positive (+) base and some negative (-) base. In general, diodes mounted on the same plate are of the same polarity. Should it become necessary to replace a diode, great care must be taken to replace it with one of like polarity.

An absolutely sure means of identification is to note the small arrow on the side of the diode. If the arrow points toward the stud, the diode is referred to as a "positive base". If the arrow points toward the lead (cable) end of the diode, the diode is referred to as a "negative base".

When ordering replacement diodes, make certain to indicate whether the diode to be replaced is positive or negative base. Part numbers will indicate this, but for absolute surety, indicate polarity as well. Consult your Thermal Arc dealer for proper diode tightening torques.

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TROUBLESHOOTING

The following chart contains information which can be used to diagnose and correct unsatisfactory operation or failure of the various components of the welding machine. Each symptom of trouble is followed by a list of probable causes and procedures to correct them.

Troubleshooting Guide

Welding machine will not start.

Power lines dead

Check voltage.

Broken power lead

Repair.

Power switch off

Place power switch in ON position.

Broken leads at line switch or transformer

Repair.

Fuses blow in line disconnect switch

Wrong line voltage

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

Voltage changeover incorrectly connected

Check Primary Transformer Diagram.

Fuse too small

Install proper size fuses.

Short circuit in primary connections

Remove short circuit.

Transformer failed

Replace.

Fan will not run

Fan motor failed

Replace motor.

Welding machine will deliver only minimum current in any range

Control circuit breaker tripped

Reset circuit breaker.

Rheostat failed

Replace rheostat.

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TROUBLESHOOTING

Control rectifier failed

Replace control rectifier.

Reactor control coil failed

Replace reactor.

Welding machine will not deliver welding current

Electrode cable or holder may be grounded

Use only cable and holder with second insulation.

Range switch not on proper range

Set exactly on proper range.

Transformer secondary winding open

Have transformer repaired.

Reactor winding open

Have reactor repaired.

Diode failed

Replace diode.

Welding arc loud and spatters excessively

Current setting too high

Check setting and output with ammeter.

Polarity wrong

Check polarity, try reversing polarity.

Incorrect rod used on AC welding

Use AC or AC/DC rod for AC welding.

Reverse polarity DC rod on straight polarity

Use straight polarity rod for straight polarity welding.

Filter coil short circuited

Replace filter.

Diode failed

Replace diode.

Control coil failure

Repair or replace transformer.

Welding arc sluggish

Current too low

Check output and current recommended for electrode being used.

Poor connections

Check all electrode holders, electrode cable and ground cable connections.

Cables too long or too small

Check cable voltage drop, use larger cable.

Low line voltage

Check power source. Notify power company if necessary.

Arc difficult to strike

Wrong type electrode

Use proper electrode.

Operator gets shock when ground cable, work or work table is touched

Work table and work not grounded

Ground work and work table to plant ground. See Grounding section.

Operator gets shock when welding machine case is touched

Case of welding machine not grounded

Ground welding machine cabinet.

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PARTS LIST

Equipment Identification

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

How To Use This Parts List

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

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

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

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

How To Select Recommended Spares

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

SPEC NUMBER

5883C-1

5884C-1

5883D-1

5884D-1

APPLICATION CODE

A

B

C

D

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PARTS LIST

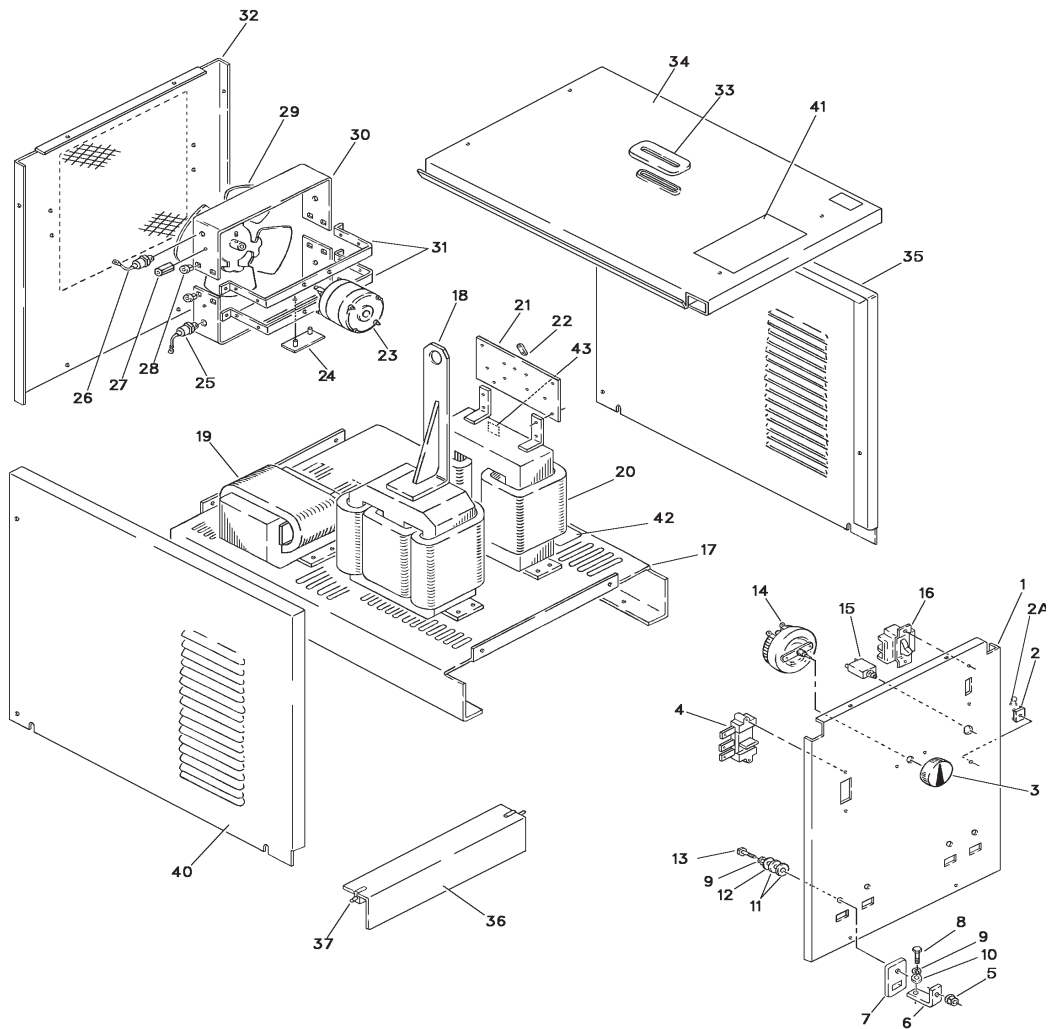


Figure 8-1

Parts List for Figure 8-1

Quantity	Recomm.	Item	Part	Description	Qty	Application
Spares	Class 1	Class 2	nO	Number	per	Code
Class 1	Class 2				Assy	
			5883C-1	Welder - TR-250, 60 Hz	1	A
			58884C-1	Welder - TR-250, 50 Hz	1	B
			5883D-1	Welder - TR-250, 60 Hz	1	C
			5884D-1	Welder - TR-250, 50 Hz	1	D
		1	204084-1	. Panel - Control, Front	1	AB
			204084-2	. Panel - Control, Front	1	CD
	1	2	409554-1	. Rectifier - Silicon	1	All
		2A	202258-5	. Suppressor Ay	1	All
		3	408850-1	. Knob - Control	1	AB
			408850-6	. Knob - Control	1	CD
		4	203854-1	. Switch - High-Low	1	All
		5	No Number	. Nut - 1/2 -13, Hex Flg. ST.	4	All
		6	5CW-974	. Bus - Bar	4	All
		7	369682	. Bushing - Insulator	4	All
		8	No Number	. Screw - 1/2 -13 x 1, HHC, ST.	4	All
		9	No Number	. Washer - LK, Std. 1/2	8	All
		10	No Number	. Washer - FL, ST. 1/2	4	All
		11	5CW-976A	. Washer - Insulator, Cable Stud	8	All
		12	No Number	. Washer - FL, 1/2, ST.	4	All
		13	No Number	. Screw - 1/2 -13 x 1-3/4, HHC, ST.	4	All
	1	14	405583	. Rheostat - 320 Ohm, 300 W.	1	All
		15	203627-2	. Circuit Breaker	1	All
	1	16	409604	. Switch - Power, DPST	1	All
		—	W-9350-292	. Cable - A.C., Output Term.	1	All
		—	W-9350-235	. Cable - A.C., Output	1	All
		17	203744	. Base - Mtg.	1	AB
			203744-1	. Base - Mtg.	1	CD
		18	203770-3	. Reactor - Control Assembly	1	AC
			203770-4	. Reactor - Control Assembly	1	BD
		19	203737	. Choke - Filter	1	All
		20	203734-1	. Transformer - Assembly	1	AC
			203802-1	. Transformer - Assembly	1	BD
		21	203261	. . Board - Changeover	1	AC
			203261-2	. . Board - Changeover	1	BD
		22	CW-811	. Link - Changeover	2	All
	1	23	12TW-595-1	. Motor - Fan	1	All
	1	24	367022-1	. Suppressor - Surge Assembly	1	All
	2	25	402833-3	. Diode - Neg. Base	2	All
		—		Not Illustrated		

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PARTS LIST

Parts List for Figure 8-1

Quantity Recomm. Spares Class 1	Item nO Class 2	Part Number	Description	Qty per Assy	Application Code
2	26	402832-3	. Diode - Pos. Base	2	All
	27	404033	. Insulator - Heat Sink	2	All
	28	406319-1	. Grommet - Mtg.	8	All
	29	8RT-609	. Fan	1	All
	30	203745	. Heat Sink - Diode	2	All
	31	201751	. Bracket - Motor Mount	2	AB
		201751-1	. Bracket - Motor Mount	2	CD
	32	203740	. Panel - Rear	1	AB
		203740-1	. Panel - Rear	1	CD
	—	203907-1	. Bar - Bus	2	All
	33	12CW-2170	Grommet - Top	1	All
	34	203739	Panel - Top	1	AB
		203739-1	Panel - Top	1	CD
	35	203742	Panel - Side, Right	1	AB
		203742-1	Panel - Side, Right	1	CD
	36	203413	Door	1	AB
		203413-1	Door	1	CD
	37	203453	Hinge - Door	2	All
	38		Delete		
	39		Delete		
	40	203743	Panel - Left Side	1	AB
		203743-1	Panel - Left Side	1	CD
	41	204036	Label - Warning	1	All
	42	408891	Label - Warning, Ground	1	All
	43	830116	Label - Ground	1	All

— Not Illustrated

DIAGRAMS

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

MODEL NO.	SPECS NO.	CONNECTION & SCHEMATIC DIAGRAM	VOLTAGE CHANGEOVER
TR-250	5883C-1	204082	203769
	5883D-1	204082	203769
	5884C-1	204083	203603
	5884D-1	204083	203603