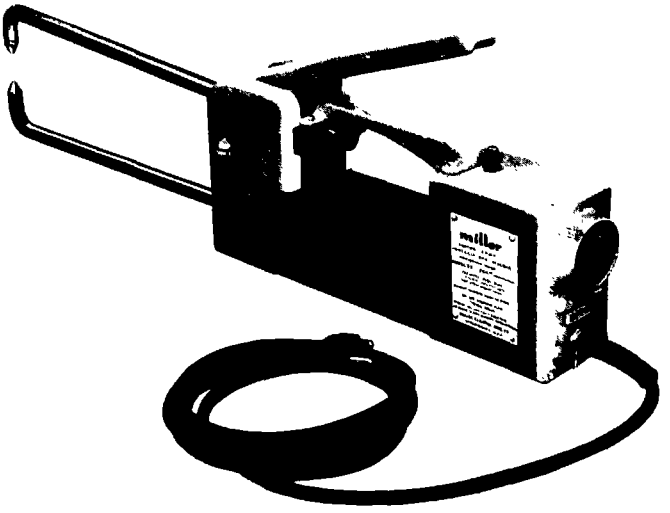
MO-740A-967

MODEL

LECTRO SPOT 11 (900 420)
LECTRO SPOT 22 (900 423)
LECTRO SPOT 33 (900 426)



OPERATING AND MAINTENANCE MANUAL

miller ELECTRIC MFG. CO., Appleton, Wisconsin

miller WELDERS

ADDITIONAL COPY
PRICE 20 CENTS

PRINTED IN U.S.A.

INTRODUCTION

GENERAL

This manual has been prepared especially for use in familiarizing personnel with the design, installation, operation and maintenance of the Spot Welding Machine. In some cases, the contents of this publication are generalized. All information presented herein should be given careful consideration to assure optimum performance and service of the equipment.

Process information is available from your nearest representative.

RECEIVING-HANDLING

To prepare the Spot Welding Machine for installation, several items should be checked. Clean all packing material from around the unit and carefully inspect for damage that may have been caused by shipping. Any claims for loss or damage that may have occurred in transit must be filed by the buyer with the carrier. Copy of bill of lading and freight bill will be furnished on request if occasion to file claim arises.

Be sure to READ ALL THE INSTRUCTIONS before attempting to operate the Spot Welding Machine.

When requesting information concerning the Spot Welding Machine, be sure, to furnish SERIAL and MODEL NUMBERS.

DESCRIPTION

Resistance welding is a method of forging two pieces of metal together with electrically induced heat and mechanically applied pressure. Heat is developed by resistance of the metal to high amperage, low voltage current passed through a limited area where the weld is to be made.

Current is applied through suitable copper alloy electrodes under predetermined pressure. When metal reaches a "plastic" state, mechanical pressure causes the two pieces of metal to unite at the weld area.

This is a union of parent metal. No foreign or additional metal is introduced. It is much the same as any conventional forging of two pieces, except in the method of applying heat and the fact that steady pressure takes the place of a hammer blow.

This Spot Welding Machine is designed for maximum portability in sheet metal fabrication where speed and strength of low cost resistance welding is required. The weight of the Spot Welding Machine is light enough so that it can be carried and held in position while making the weld.

This Spot Welding Machine consists of a power transformer, a multi-pressure operation lever which simultaneously operates the tongs and activates the weld current microswitch. After the weld current microswitch is activated, the electronic weld timer will automatically start and stop the weld current for a time interval pre-set by the weld control knob. The weld control knob gives precise adjustment of a weld period from 1 to approximately 90 cycles. A readi-weld pilot light shows when the timer is on.

This Spot Welding Machine Series consists of three models. Two 230 volt, 1.5 kva and 2.5 kva models and one 115 volt, 1.5 kva model.

SAFETY

Before attempting to make primary line connections, change parts or make repairs be sure, the unit is completely disconnected from the main power line.

Caution should be exercised in taking voltage measurement when trouble shooting the unit. Always avoid contact between any part of the human body and any current carrying part of the spot welding unit.

A ground wire is provided in the primary cord for grounding the Spot Welding Machine in case of internal insulation breakdown. DO NOT CUT OFF THE GROUND TERMINAL ON CORD PLUG.

Wearing of a face shield is recommended when operating the Spot Welding Machine. This will protect the eyes and face from hot molten metal particles in any position of spot welding.

SPECIFICATIONS

MODEL	RATED OUTPUT AMPERES 6" TONGS	RATED OUTPUT AMPERES 12" TONGS	RATED OUTPUT AMPERES 18" TONGS	OPEN CIRCUIT VOLTAGE	WORK CAP. MILD STEEL	15 PCT. DUTY CYCLE	50 PCT. DUTY CYCLE	PRIMARY INPUT SINGLE PHASE
115 v. 1.5 kva.	5500	4550	3600	1.6	1/8"	3.1 kva.	1.5 kva.	115 v., ac 60 cycle
230 v. 1.5 kva.	5500	4550	3600	1.6	1/8"	3.1 kva.	1.5 kva.	230 v., ac 60 cycle
230 v. 2.5 kva.	6750	5800	4850	2.5	5/32"	5.2 kva.	2.5 kva.	230 v., ac 60 cycle

The 115 volt electronic 60 cycle timer will operate reliably from 95 to 130 volts ac and the 230 volt models from 160 to 260 volts ac, however, a low line voltage condition will greatly reduce the heat available at the tips.

INSTALLATION

1. LINE DISCONNECT SWITCH

CAUTION

A precautionary measure should be taken to provide maximum protection against electrical shock. When electrical connections are made from the Spot Welding Machine to the main line disconnect switch, BE SURE the line disconnect switch is open or fuses removed until connections are completed.

☐A. Proper installation can contribute materially to the satisfactory and trouble-free operation of the Spot Welding Machine. Each step in this section should be studied carefully and followed in detail.

2. PRIMARY CONNECTIONS

☐A. The Spot Welding Machine should be operated from a single phase separately fused or circuit breaker protected circuit. The maximum capacity of the Spot Welding Machine is affected by the line voltage and if the circuit is overloaded, the performance of the Spot Welding Machine will be impaired.

For installing the Spot Welding Machine, a three conductor cable of proper size (see Table I) should be run from a line disconnect switch to either a 115 volt (parallel) receptacle or a 230 volt (tandem) receptacle. Remember that the cord on the Spot Welding Machine is 10 feet long. Install the receptacle at a location so that ample cord length is available for proper spot welding maneuverability. DO NOT use extension cords. Use of extension cords will greatly impair the maximum efficiency of the Spot Welding Machine.

TABLE I

RECOMMENDED WIRE AND FUSE SIZE

MODEL	WIRE SIZE (AWG)	FUSE SIZE (AMPERES)
115 Volt 1.5 kva	No. 10	30
230 Volt 1.5 kva	No. 12	20
230 Volt 2.5 kva	No. 10	30

☐B. All Spot Welding Machines are equipped with a 10 foot length of 3 conductor cable with plug attached. Spot Welding Machines have a 3 conductor cord with a parallel prong plug for the 115 volt model and a tandem prong plug for the 230 volt models. See Figure I.

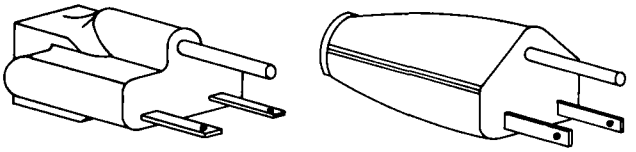


FIGURE I - 115 AND 230 VOLT PRIMARY PLUGS

The two parallel or tandem prongs are for connection to the power lines and the third prong (the green wire in the cord) is for grounding the Spot Welding Machine.

CAUTION

DO NOT CUT OFF THE GROUND TERMINAL ON THE CORD PLUG. This should be attached to a suitable "ground" such as the electrical conduit system, a water system or a driven ground rod, before operating the Spot Welding Machine to assure operator's protection. It may be necessary to have an electrician install a modern grounding type power receptacle if the wiring is more than a few years old.

3. TONG INSTALLATION

☐A. Refer to Figure 2 for tong installation. The bottom tong (B) must be inserted into the bottom holder as far as it will go. Then tighten the socket head cap screw on the bottom tong clamp. There is only one socket head cap screw holding each tong in position.

☐B. Insert the top tong (A) into the top tong holder or clamp until the tip aligns with the bottom tip. Then tighten the socket head cap screw.

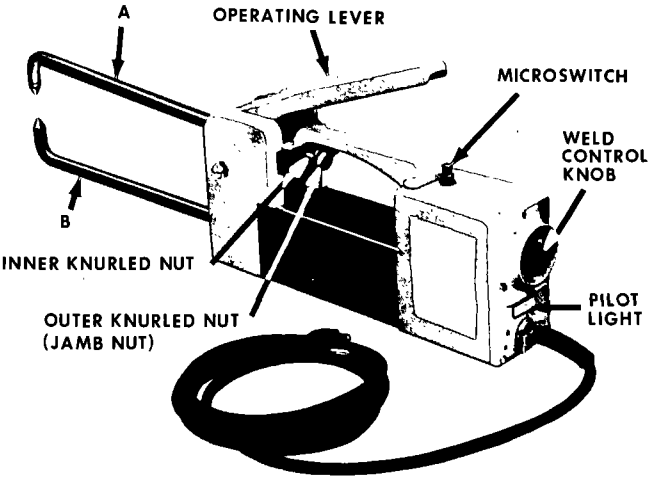


FIGURE 2 - SPOT WELDING MACHINE

4. TONG PRESSURE

☐A. Either remove the Spot Welding Machine from the line receptacle or make sure the weld control knob is in the maximum counterclockwise (OFF) position before adjusting tong pressure. This is necessary so that when the tongs are brought together the microswitch actuated by the operating lever will not turn on the weld current.

☐B. The operating lever is used to apply pressure to the spot welding tips and the microswitch under the handle activates the welding current. Bring the material to be welded into intimate contact before applying pressure from the spot welding tongs. DO NOT use the tong pressure to bring two pieces of metal together.

The correct tong pressure for the combined thickness of the metal to be spot welded is very easily adjusted. The inner and outer knurled nuts can be adjusted to adjust the distance between the tong tips. The outer knurled (jamb) nut is the locknut and inner knurled nut the tong pressure adjustment nut. Loosen the outer knurled (jamb) nut and then adjust the inner knurled nut for proper tong pressure. Pressure on the tong tips is increased by turning the inner knurled nut in the clockwise direction and decreased by turning it in the counterclockwise direction. There is no set rule for adjusting tong pressure, however, the simplest method is by visual inspection. This is done in the following manner. Place the metal to be spot welded between the tong tips. Depress the operating lever. When the tong tips close around the metal a slight deflection should be noticed in the upper or lower tong. Readjust the inner knurled nut until this slight deflection is noticed. A straight edge may be placed on top of the top tong or on the bottom of the bottom tong to check for this deflection. Only a slight deflection is necessary. There is no advantage in having excessive tong pressure; this will only result in possible damage to the Spot Welding Machine.

OPERATION

5. INPUT POWER

☐A. Be sure the Spot Welding Machine is connected to the proper voltage and securely grounded.

6. PRE-HEATING

☐A. Turn on the electronic timer turning the weld control knob in the clockwise direction. Allow one minute warm up period.

7. POSITIONING OF METALS

☐A. Place metals to be welded, firmly together before placing between the tongs (A & B). (See Figure 2) Do not use the Spot Welding Machine tongs to bring the two pieces of metal together. Never apply weld current to the tong tips without having metal between them.

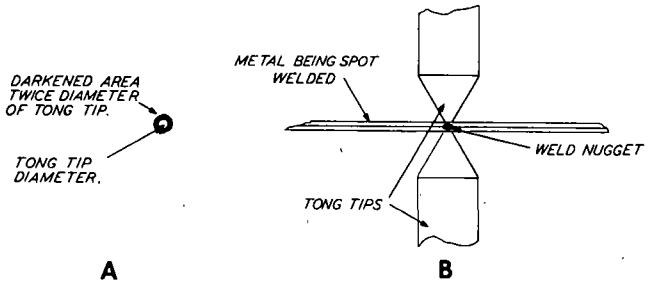


FIGURE 3 - SPOT WELDING PROCEDURE

8. WELD TIMER

☐A. After the metal is properly positioned, position the Spot Welding Machine or the metal so that the tong tips will come together gripping the metal where it is to be spot welded. Continue depressing the operating lever until it actuates the micro-switch. Current will then flow through the tongs and tong tips until the timer automatically times out and opens the welding current circuit. Do not release the operating lever until the timer has timed out. Releasing the operating lever with the welding current circuit energized will cause excessive burning of the tong tips.

Setting of the weld control knob for the length of the weld cycle is strictly a trial and error procedure. Illustrations in Figure 3 will help in determining the correct setting of the timer. After one spot weld is made, examine the darkened area around the spot weld. (Figure 3A) The diameter of this darkened ring should be approximately twice the diameter of the tong tip. For example, if the tong tip is 1/8 inch in diameter the darkened ring should be approximately double or 1/4 inch in diameter. Another thing to examine is the weld nugget and this can be done by spreading the two pieces of metal apart. In comparison to the size of the tong tips, the weld nugget should be in the size and shape as shown in Figure 3B.

After the timer is correctly set for one thickness of metal, DO NOT assume that this setting will remain the same for all metals of the same thickness or even the same metal of the same thickness. There are many factors which may vary the setting of the timer control knob. Line voltage fluctuation during the day will necessitate different timer settings. Condition of the tong tips will have a great effect on the timer setting. As the Spot Welding Machine is continued to be used, the diameter of the tong tips will increase. This increased tip diameter will require more spot welding current and in turn, a longer time setting. Different types of metal, coating of the metal, etc., are some other factors which will be a determing factor in the timer control setting.

"High-scale" metals, such as hot rolled steel are not readily spot welded due to the high electrical resistance of the scale. It is suggested that a light sanding on both sides of the metal, to remove the scale, will result in a much more satisfactory weld. It is important that the metal to be spot welded be clean.

Galvanized metals heavier than 20 gauge should not be spot welded with the 1.5 kva models. Eighteen gauge galvanized material may be welded with the 2.5 kva model. Keep tips clean and properly dressed. This is particularly necessary when welding galvanized metals.

Stainless steel and like alloys are readily spot welded.

Welding of any relatively low resistance metals such as copper, aluminum, brass, etc., is not recommended. However, if welds suitable for the application can be obtained, such usage of the spot welding machine is permissible.

IMPORTANT

Keep tong tips dressed down to within 1/8" diameter or less for the 1.5 kva models and to within 5/32" diameter or less for the 2.5 kva model. Greater diameters reduce the capacity of the unit. Heat concentrated in a smaller area improves efficiency and reduces heating of the Spot Welding Machine. See "Dressing Tong Tips" under Maintenance.

MAINTENANCE

CHANGING TONGS

Tongs are readily changed. There is one socket head cap screw holding each tong in position. When changing the tongs the bottom tong must be inserted into the holder as far as it will go. Then tighten the socket cap screw. The top tong is inserted into the holder until the tip aligns with the bottom tip, then tighten the socket head cap screw. NOTE: Wipe both tong and holder clean. Any bends or nicks on the end of the tongs that connect the tong holders will impair proper contact and reduce the maximum capacity and efficiency of the Spot Welding Machine. If corroded, polish with crocus cloth. Examine tong tips for dents, nicks, or mushroom.

DRESSING TONG TIPS

Electrodes are most effectively dressed by machining the tips. One of the most common mistakes in electrode dressing is the hand filing of the face of the electrode which usually results in dome shaped surface where a flat surface is required. Only in the hands of a very experienced filer can electrodes be properly dressed, and 99 times out of 100, filed tip faces are not parallel, therefore, hand filing is discouraged. The tendency for the file to be used at an angle is always present, with gross tip mismating and poor quality welds resulting.

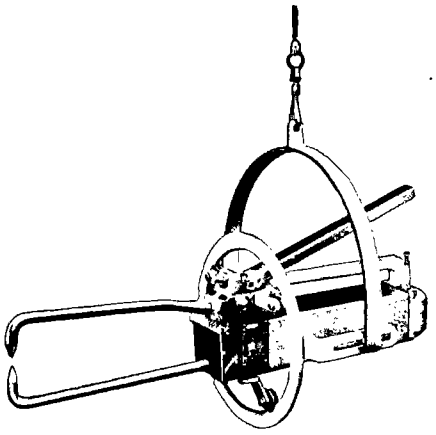
A file, however, can be advantageously used in removing the "mushroom" from the electrodes providing the filing is confined to the tapered sides of the tip instead of on the surface of the tip.

One of the hand operated electrode dressers, uses emery cloth, crocus cloth or sandpaper. These abrasives are placed over a hardened tip contour die in a special holder and a very light pressure is exerted on the tips. The rapid twisting motion of the dresser in sanding the tips results in a perfectly dressed electrode face.

TIMER

Tubes can be replaced without removing the timer from its housing. Remove the screws from the carrying handles and the screws on the side holding the screen. Remove the handle and the protective screen. To remove the tube shields, push in and twist counterclockwise and pull out. The tubes can then be removed.

OPTIONAL EQUIPMENT



GYRO-BAIL

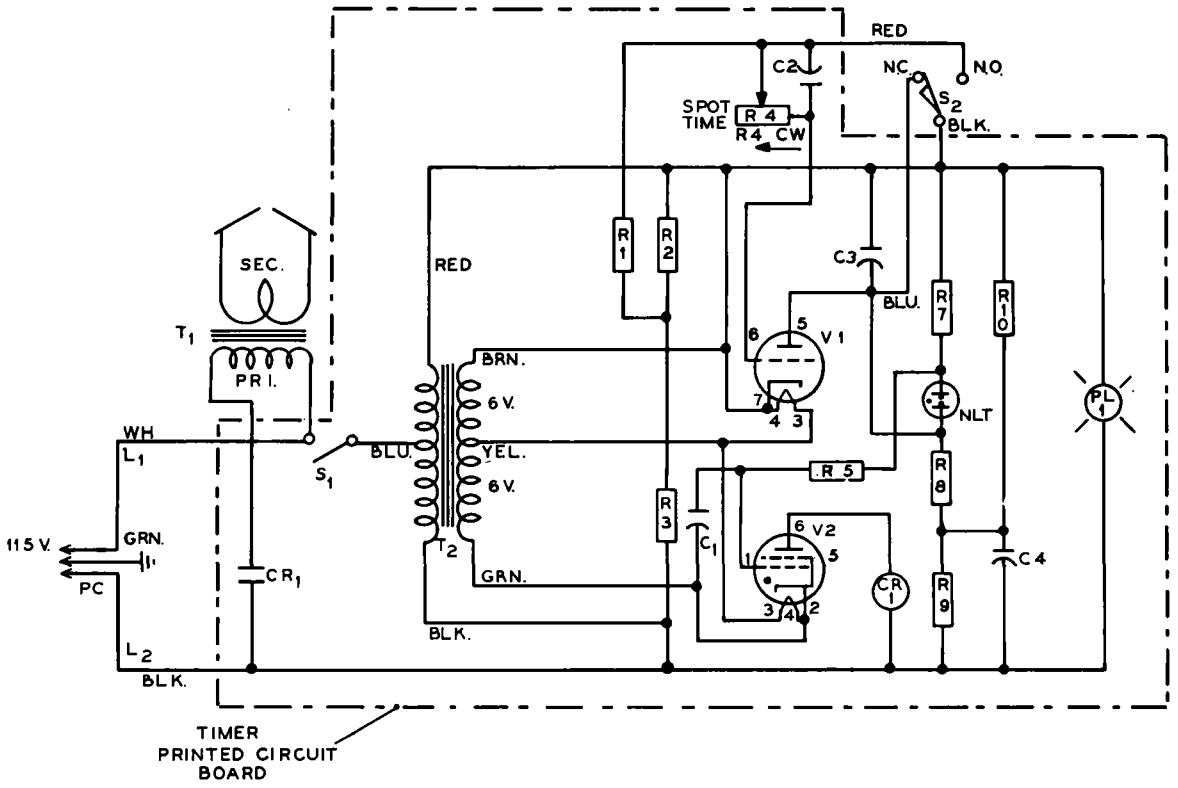
The Gyro-bail is a unique method of holding and maneuvering the Spot Welding Machine. The Gyro-bail fastens to the Spot Welding Machine and suspends from a boom or spring load cable (not furnished). It allows spot welding from any position.

TROUBLE SHOOTING

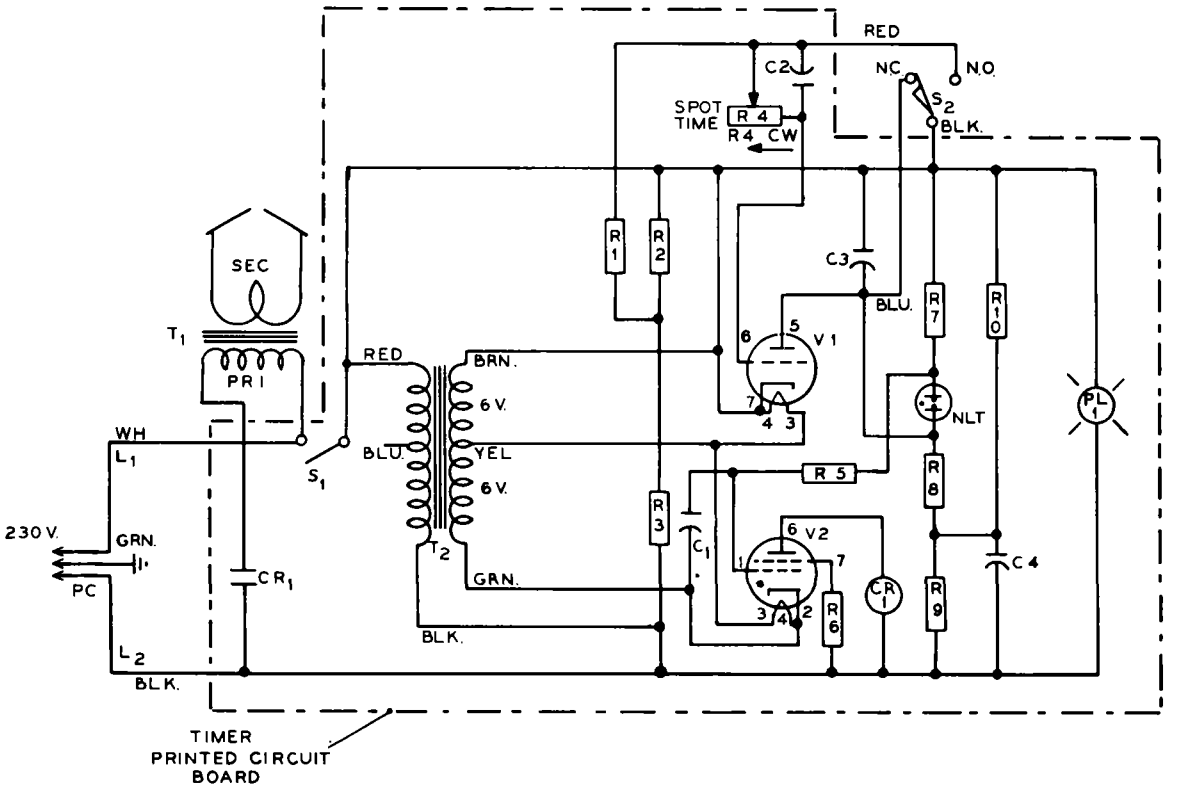
The function of this trouble shooting chart is to aid in rapidly locating and correcting the cause of improper operation and equipment failure. Whenever equipment operates unsatisfactorily, it is desirable to locate the cause and correct the trouble as quickly as possible.

In case of troubles other than those listed below, the timer may be returned to the manufacturer's service department for repair or rebuilt timer may be had on an exchange basis. Contact the manufacturer's service department for details.

TROUBLE	POSSIBLE CAUSE	REMEDY
No weld current. Pilot light is on.	Micro-switch burned out.	Check cause. Replace if defective.
	Tubes blown.	Check 2D21 and 6C4 tubes. Replace if defective.
	Primary line overloaded.	Check line voltage under load. Line voltage should be between 95 to 130 volts ac for the 115 volt model and 160 to 260 volts ac for the 230 volt models.
Time interval is shorter than normal.	6C4 tube blown.	Check for cause. Replace if defective.
Longer time interval than is required for proper weld.	Poor tips.	Check condition of tips.
	Tightness of tongs.	Check for cause. Remedy if necessary.
	Dirt on metal.	Check metal being spot welded. Check line voltage.

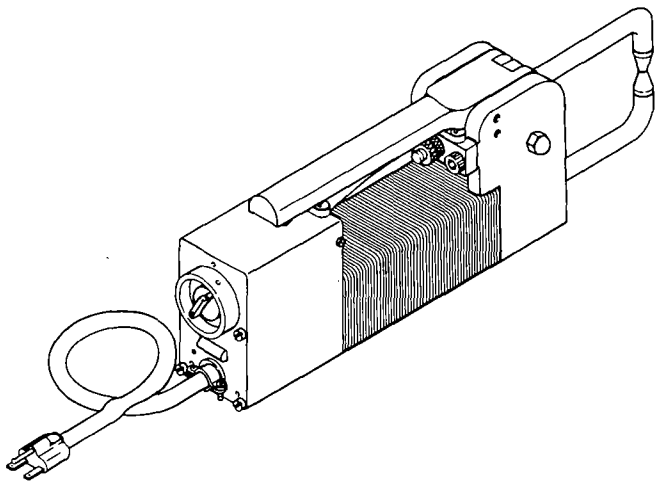


CIRCUIT DIAGRAM FOR ELECTRONIC TIMER 115 VOLTS



CIRCUIT DIAGRAM FOR ELECTRONIC TIMER 230 VOLTS

FORM: PL-740D-4/70



PARTS LIST

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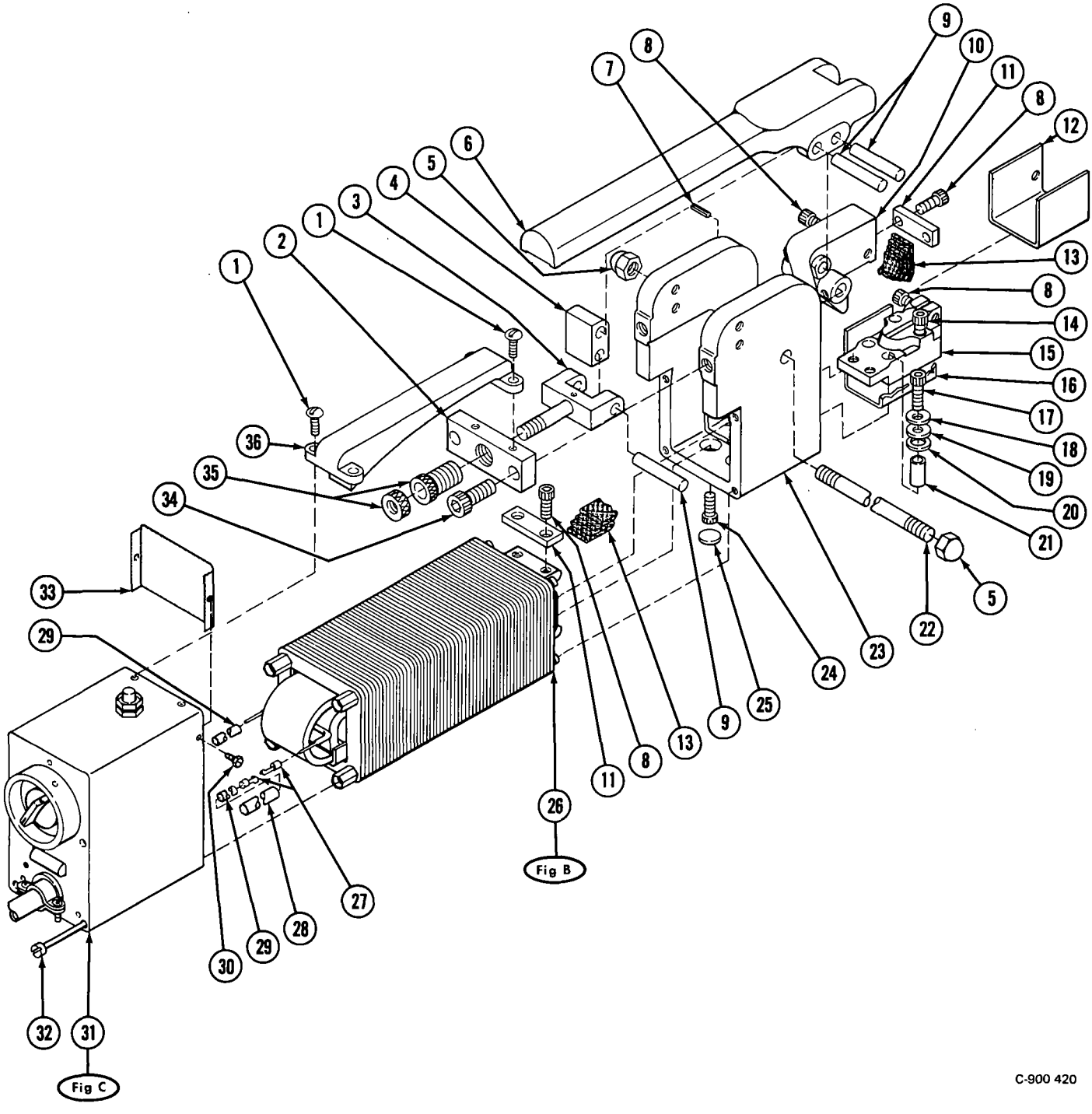

Figure A – Main Assembly

Effective with Serial Number W525291

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity Models 115 V. 1.5 kva	208 V. 1.5 kva	230 V. 1.5 kva	208 V. 2.5 kva	230 V. 2.5 kva
Figure A			**Main Assembly**					
1		602 095	SCREW, machine - trusshead 10-32 x 5/8"	4	4	4	4	4
2		010 776	BRACKET, mtg - pressure adjustment	1	1	1	1	1
3		072 006	YOKE, toggle adjustment	1	1	1	1	1
4		072 007	LINKAGE, toggle	1	1	1	1	1
5		601 854	NUT, cap - hex 3/8-24 aluminum	2	2	2	2	2
6		010 763	LEVER, operating	1	1	1		
6		010 783	LEVER, operating				1	1
7		602 322	PIN, roll 1/8 x 11/16"	1	1	1	1	1
8		010 765	SCREW, cap - socket hd 1/4-28 x 1"	6	6	6	6	6
9		010 775	PIN, pivot 5/16 x 1-13/16"	3	3	3	3	3
10		010 767	CLAMP, top tong	1	1	1	1	1
11		010 764	CLAMP, top braid	2	2	2	2	2
12		602 466	INSULATION, braid and bottom clamp	1	1	1	1	1
13		*010 623	BRAID, set of four	1set	1set	1set	1set	1set
14		010 771	SCREW, cap - socket hd 10-32 x 1-1/2"	2	2	2	2	2
15		010 770	CLAMP, bottom tong	1	1	1	1	1
16		026 615	INSULATION, clamp - bottom	1	1	1	1	1
17		010 772	SCREW, cap - socket hd 10-32 x 1-1/4"	2	2	2	2	2
18		602 238	WASHER, flat 3/16"	4	4	4	4	4
19		602 193	WASHER, fiber 1/4 I.D. x 1/2 O. D. x 1/16"	4	4	4	4	4
20		602 192	WASHER, fiber 3/16 I.D. x 1/2 O.D. x 1/16"	4	4	4	4	4
21		026 766	INSULATION, nylon 3/16 O.D. x 1"	2	2	2	2	2
21		026 767	INSULATION, nylon 3/16 O.D. x 5/8"	2	2	2	2	2
22		010 245	STUD, 3/8-24 x 3-11/16"	1	1	1	1	1
23		017 674	CASTING, front	1	1	1	1	1
24		010 773	SCREW, cap - socket hd 1/4-28 x 5/8"	2	2	2	2	2
25		026 759	PLUG, insulator - secondary screw	2	2	2	2	2
26	T1	036 831	TRANSFORMER ASS'Y (See Fig. B Page 3)	1				
26	T1	036 479	TRANSFORMER ASS'Y (See Fig. B Page 3)		1			
26	T1	036 688	TRANSFORMER ASS'Y (See Fig. B Page 3)			1		
26	T1	036 481	TRANSFORMER ASS'Y (See Fig. B Page 3)				1	
26	T1	036 833	TRANSFORMER ASS'Y (See Fig. B Page 3)					1
27		600 775	CONNECTOR, knife - wire size 16-14	4	4	4	4	4
28		026 842	INSULATION, No. 2 sleeving 2-1/2"long	1	1	1	1	1
29		026 763	INSULATION, No. 5 sleeving 2-1/2"long	2	2	2	2	2
30		602 168	SCREW, sheet medal 8 x 3/8"	2	2	2	2	2
31		034 807	TIMER ASS'Y, w/casting & cord (See Fig. C Page 4)	1				
31		034 844	TIMER ASS'Y, w/casting & cord (See Fig. C Page 4)		1		1	
31		034 802	TIMER ASS'Y, w/casting & cord (See Fig. C Page 4)			1		1
32		602 107	SCREW, machine - fil hd 10-32 x 4"	4	4	4	4	4
33		010 781	SCREEN, protective	1	1	1	1	1
34		010 777	SCREW, cap - socket hd 5/16 - 24 x 1"	2	2	2	2	2
35		*010 778	ADJUSTMENT, pressure w/locknut	1	1	1	1	1
36		019 656	HANDLE, carrying	1	1	1		
36		019 659	HANDLE, carrying				1	1
		602 262	HANDLE, wood	1	1	1	1	1
		601 778	BOLT, carriage 1/4 x 4-1/2"	1	1	1	1	1

*Recommended Spare Parts

BE SURE TO PROVIDE STOCK, MODEL AND SERIAL NUMBERS WHEN ORDERING REPLACEMENT PARTS.

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity / Models 115 V. 1.5 kva	208 V. 1.5 kva	230 V. 1.5 kva	208 V. 2.5 kva	230 V. 2.5 kva
Figure B			**Transformer Assembly (See Fig. A Page 2 Item 26)**	036 831 Page 2 Item 26	036 479 Page 2 Item 26	036 688 Page 2 Item 26	036 481 Page 2 Item 26	036 833 Page 2 Item 26
45		026 601	INSULATION, coil (consisting of)	1	1	1		
46		026 772	. INSULATION, 15 mil 4-5/8 x 8 "	2	2	2		
47		026 765	. TUBING, plastic 1-1/4"	1	1	1		
48		026 774	. INSULATION, 15 mil 1-5/8 x 1-3/4"	1	1	1		
49		026 770	. INSULATION, 15 mil 5/8 x 7-7/8"	2	2	2		
45		026 602	INSULATION, coil (consisting of)				1	1
46		026 773	. INSULATION, 15 mil 4-5/8 x 11"				2	2
47		026 765	. TUBING, plastic 1-1/4"				1	1
48		026 774	. INSULATION, 15 mil 1-5/8 x 1-3/4"				1	1
49		026 771	. INSULATION, 15 mil 5/8 x 10-7/8"				2	2
50	T1	**033 610	COIL, primary 115 volt 1.5 kva	1				
50	T1	**033 543	COIL, primary 208 volt 1.5 kva		1			
50	T1	**033 611	COIL, primary 230 volt 1.5 kva			1		
50	T1	**033 544	COIL, primary 208 volt 2.5 kva				1	
50	T1	**033 612	COIL, primary 230 volt 2.5 kva					1
51	T1	**036 613	CORE, transformer	1	1	1		
51	T1	**036 614	CORE, transformer				1	1
52		026 764	INSULATION, 15 mil 1-3/4 x 2-1/2"	1	1	1	1	1
53		010 762	BOLT, core 10-32 x 7-5/8"	4	4	4		
53		010 782	BOLT, core 10-32 x 10-5/8"				4	4
54		010 244	NUT, special - core bolt	4	4	4	4	4
55	T1	**033 914	BAR, secondary	1	1	1		
55	T1	**033 915	BAR, secondary				1	1

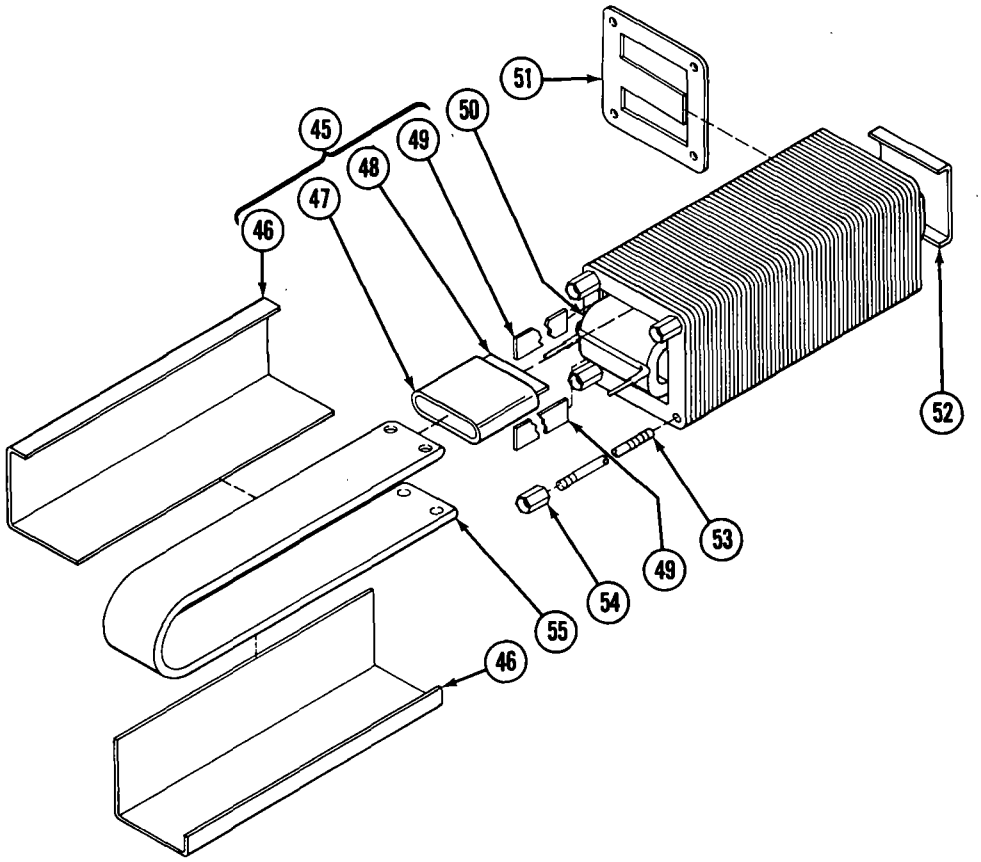

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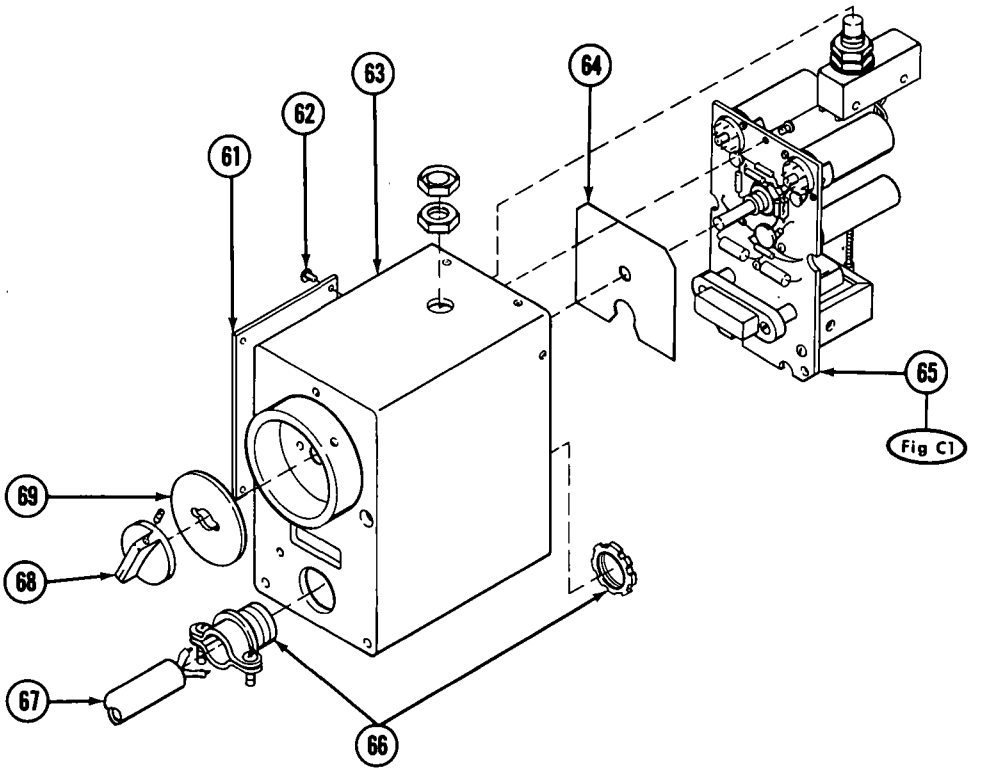
Figure B – Transformer Assembly

**Replace at Factory or Authorized Service Station
BE SURE TO PROVIDE STOCK, MODEL AND SERIAL NUMBERS WHEN ORDERING REPLACEMENT PARTS.

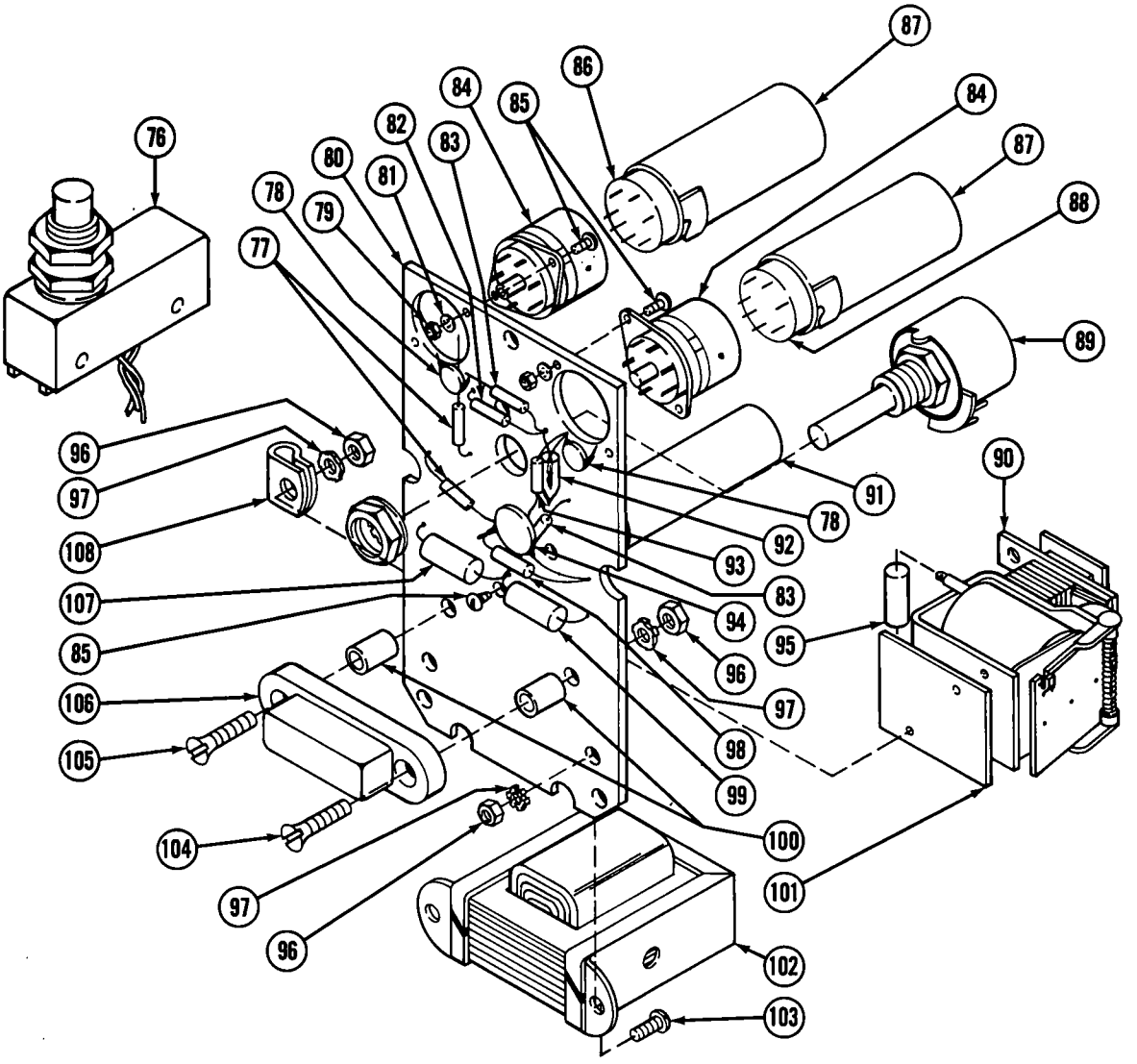
Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity Models 115 V. (034 807 Page 2 Item 31)	208 V. (034 844 Page 2 Item 31)	230 V. (034 802 Page 2 Item 31)
Figure C			**Timer Assemlby, W/Casting & Cord (See Fig. A Page 2 Item 31)**			
61			NAMEPLATE (order by stock, model and serial number)	1	1	1
62		602 141	SCREW, self - tapping 4-40 x 3/16"	4	4	4
63		017 675	CASTING, rear	1	1	1
64		026 850	INSULATION, timer	1	1	1
65		034 806	TIMER ASS'Y, electronic (See Fig. C1 Page 6)	1		
65		034 845	TIMER ASS'Y, electronic (See Fig. C1 Page 6)		1	
65		034 801	TIMER ASS'Y, electronic (See Fig. C1 Page 6)			1
66		010 610	CONNECTOR, 1/2"	1	1	1
67		023 618	CORD, power 115 volt	1		
67		023 625	CORD, power 230 volt		1	1
68		019 995	KNOB, timer control	1	1	1
69		011 120	PLATE, indicator	1	1	1



A-034 802

Figure C – Timer Assembly W/Casting & Power Cord

BE SURE TO PROVIDE STOCK, MODEL AND SERIAL NUMBERS WHEN ORDERING REPLACEMENT PARTS.

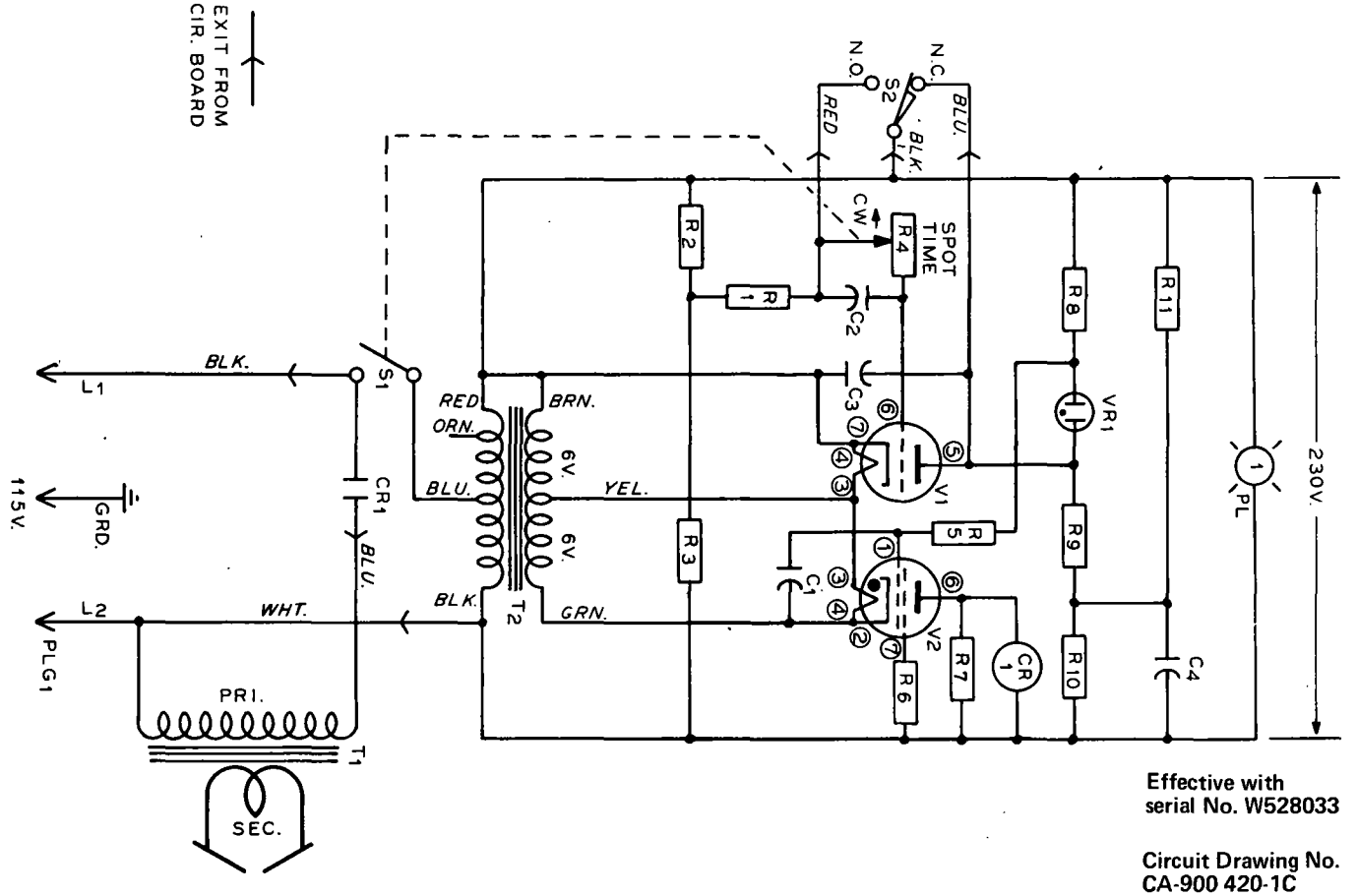


C-034 801

Figure C1 — Timer Assembly, Electronic

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity Models 115 V.	208 V.	230 V.
Figure C1			**Timer Assembly, Electronic (See Fig. C Page 4 Item 65)**	034 806 Page 4 Item 65	034 845 Page 4 Item 65	034 801 Page 4 Item 65
76	S2	*011 758	SWITCH, mirco	1	1	1
77	R6,11	601 392	RESISTOR, 470K ohm 1/2 watt	1	1	1
78	C1,3	031 646	CAPACITOR, .001 mfd	2	2	2
79		601 858	NUT, hex 4-40	4	4	4
80		101 078	BOARD, printed circuit	1	1	1
81		602 196	WASHER, lock - internal No. 4	4	4	4
82	R8	601 385	RESISTOR, 12K ohm 1/2 watt	1	1	1
83	R1,5	601 382	RESISTOR, 68K ohm 1/2 watt	2	2	2
84	V1,2	027 613	SOCKET, tube	2	2	2
85		602 063	SCREW, rnd head 4-40 x 1/4"	6	6	6
86	V2	*027 610	TUBE, 2K21	1	1	1
87	V1,2	027 614	SHIELD, tube	2	2	2
88	V1	*027 609	TUBE, 6C4	1	1	1
89	S1,R4	*030 954	POTENTIOMETER, 3 meg ohm 1/2 watt	1	1	1
90	CR1	*034 791	RELAY, SPST 230 volt - half wave	1	1	1
91	C2	*031 727	CAPACITOR, .15 mfd 200 volt	1	1	1
92	VR1	027 611	LAMP, voltage regulator NE81	1	1	1
93	R9	601 381	RESISTOR, 47K ohm 1/2 watt	1	1	1
94	C4	031 643	CAPACITOR, .01 mfd	1	1	1
95	R7	030 695	RESISTOR, 3.5K ohm 5 watt	1	1	1
96		601 859	NUT, hex 6-32	4	4	4
97		602 199	WASHER, lock - external No. 6	4	4	4
98	R10	030 786	RESISTOR, 220K ohm 1/2 watt	1	1	1
99	R3	601 383	RESISTOR, 56K ohn 1 watt	1	1	1
100		010 243	SPACER, 1/4 O.D. x .150 I.D. x 3/8"	2	2	2
101		038 183	INSULATION, fiber 1/16 x 1 x 1-3/4"	1	1	1
102	T2	036 830	TRANSFORMER	1	1	1
103		602 070	SCREW, machine - trusshead 6-32 x 3/8"	2	2	2
104		602 074	SCREW, machine - flat head 6-32 x 7/8"	1	1	1
105		602 076	SCREW, machine - flat head 6-32 x 1"	1	1	1
106	PL1	027 612	LIGHT, pilot 220 volt	1	1	1
107	R2	601 384	RESISTOR, 39K ohm 1 watt	1	1	1
108		010 140	CLAMP, 3/16 x 1/2" nylon	1	1	1

*Recommended Spare Parts
BE SURE TO PROVIDE STOCK, MODEL AND SERIAL NUMBERS WHEN ORDERING REPLACEMENT PARTS.



Effective with serial No. W528033

Circuit Drawing No. CA-900 420-1C

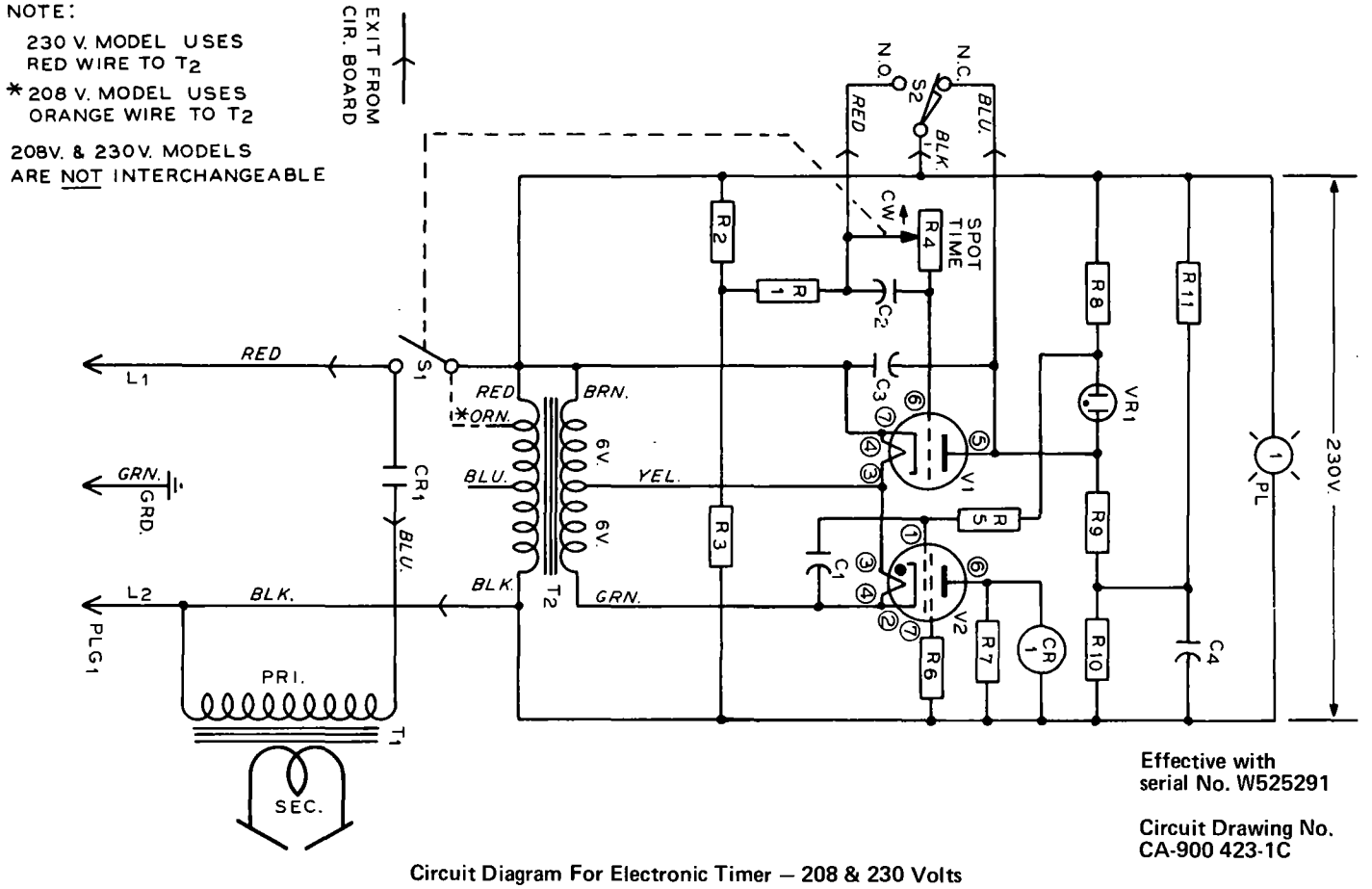
Circuit Diagram For Electronic Timer – 115 Volts

NOTE:

230 V. MODEL USES RED WIRE TO T_2

*208 V. MODEL USES ORANGE WIRE TO T_2

208V. & 230V. MODELS ARE NOT INTERCHANGEABLE



Effective with serial No. W525291

Circuit Drawing No. CA-900 423-1C

Circuit Diagram For Electronic Timer – 208 & 230 Volts

NUMERICAL PART NUMBER INDEX

Factory Part No.	Page No.	Item No.
010 140	6	108
010 243	6	100
010 244	3	54
010 245	2	22
010 610	4	66
010 623	2	13
010 762	3	53
010 763	2	6
010 764	2	11
010 765	2	8
010 767	2	10
010 770	2	15
010 771	2	14
010 772	2	17
010 773	2	24
010 775	2	9
010 776	2	2
010 777	2	34
010 778	2	35
010 781	2	33
010 782	3	53
010 783	2	6
011 120	4	69
011 758	6	76
017 674	2	23
017 675	4	63
019 656	2	36
019 659	2	36
019 995	4	68
023 618	4	67
023 625	4	67
026 601	3	45
026 602	3	45
026 615	2	16
026 759	2	25
026 763	2	29
026 764	3	52
026 765	3	47
026 766	2	21
026 767	2	21
026 770	3	49
026 771	3	49
026 772	3	46
026 773	3	46
026 774	3	48
026 842	2	28
026 850	4	64
027 609	6	88
027 610	6	86
027 611	6	92
027 612	6	106
027 613	6	84
027 614	6	87
030 695	6	95
030 786	6	98
030 954	6	89
031 643	6	94
031 646	6	78
031 727	6	91
033 543	3	50
033 544	3	50
033 610	3	50
033 611	3	50
033 612	3	50
033 914	3	55
033 915	3	55
034 791	6	90
034 801	4	65
034 802	2	31
034 806	4	65
034 807	2	31
034 844	2	31
034 845	4	65
036 479	2	26
036 481	2	26
036 613	3	51
036 614	3	51
036 688	2	26
036 830	6	102
036 831	2	26
036 833	2	26
038 183	6	101
072 006	2	3
072 007	2	4
101 078	6	80
600 775	2	27
601 381	6	93
601 382	6	83
601 383	6	99
601 384	6	107
601 385	6	82
601 392	6	77
601 778	2	*
601 854	2	5
601 858	6	79
601 859	6	96
602 063	6	85
602 070	6	103
602 074	6	104
602 076	6	105
602 095	2	1
602 107	2	32
602 141	4	62
602 168	2	30
602 192	2	20
602 193	2	19
602 196	6	81
602 199	6	97
602 238	2	18
602 262	2	*
602 322	2	7
602 466	2	12

*Part Not Called Out By Part Number.