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SERVICE INSTRUCTIONS

LAMP SUPPLY UNITS

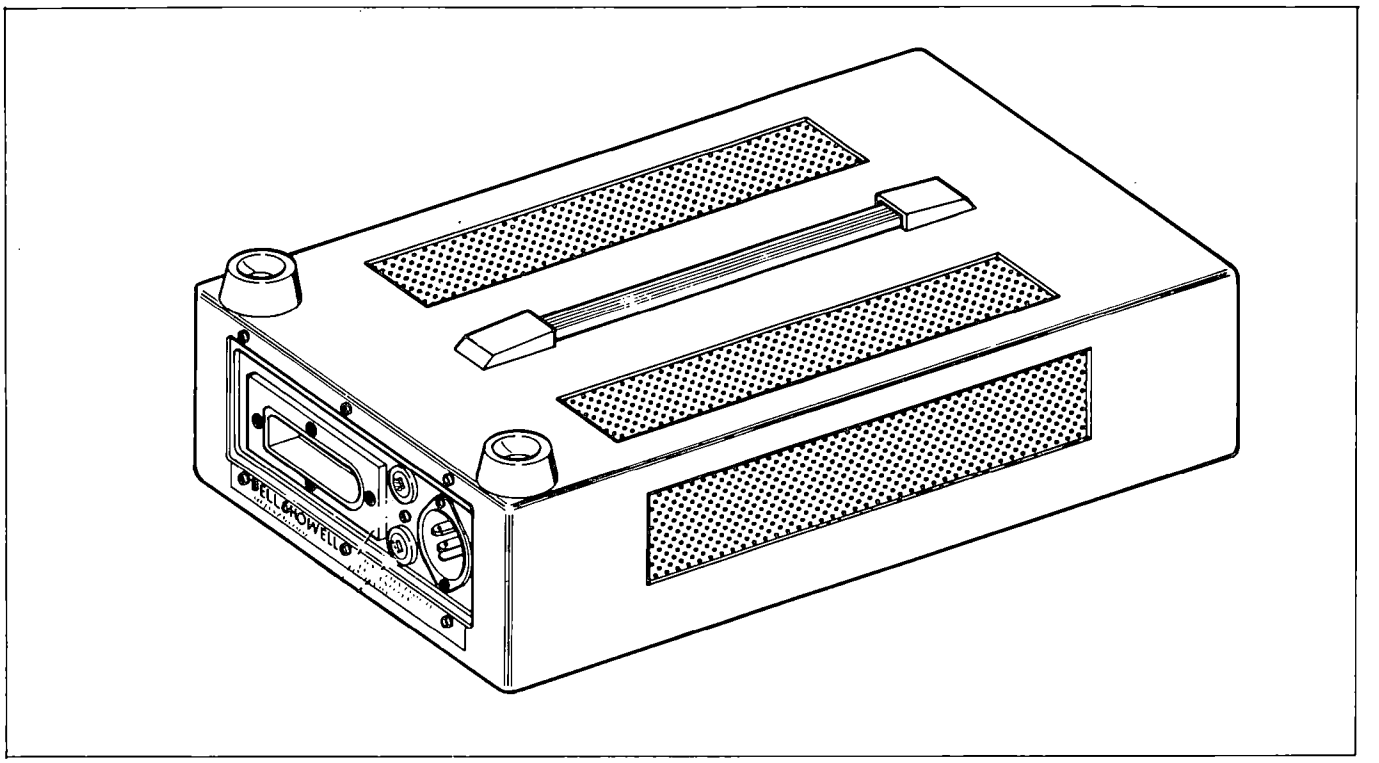
50 Hz – Part No. 013300
60 Hz – Part No. 013310

PHOTO PRODUCTS GROUP

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

PART NO. 70472-2 PRINTED IN U.S.A. REVISED JANUARY 1971



Lamp Supply Unit for Marc 300 Projection Lamp

TABLE OF SPECIFICATIONS

Bell & Howell Part Number:

50-Hz Unit 013300
60-Hz Unit 013310

Overall Dimensions: . . 3.75 in. h by 9.08 in. w by 13.25 in. lg

Input Voltage: . . . . . 120 volts AC ±10% (60 Hz)
115 volts AC ±10% (50 Hz)

Input Power: . . . . . 384 watts

Input Current: . . . . . 9 amperes AC

Load Current: . . . . . 7.75 amperes DC ± 5%

Load Voltage:

Pulse . . . . . 9KV Peak
Back Up . . . . . 330 volts DC
Run . . . . . 37.5 volts DC

Thermal Specifications: . . . . . (see Page 7)

Thermal Protection: . . . . . Two automatic resetting thermal protectors interrupt power if the internal temperature of the power supply exceeds 105°C (220°F.)

FACTORY SERVICE ADDRESSES

PRODUCT ONLY

CHICAGO

General Service Department
2200 Brummel Place
Evanston, Illinois 60202
Area Code: 312-673-3300

NEW YORK

General Service Department
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E. Farmingdale, L.I., New York 11735
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INTRODUCTION

GENERAL.

This Service Manual provides testing and repair instructions for Lamp Supply Units used with Bell & Howell Design 566A and 566X Projectors. The lamp supply unit, available as a 50-Hz unit (Bell & Howell Part No. 013300) or a 60-Hz unit (Bell & Howell Part No. 013310) is part of a system designed to operate one Marc 300 projection lamp.

Although the specific considerations contained herein relate only to the lamp supply unit, total system information must be considered. The information contained herein is proprietary and can only be used with the express permission of the Bell & Howell Company.

All illustrations referenced in the instructions are located at the rear of the manual. Replacement parts for both units are identified on the pictorial diagrams, Figures 7 and 8.

WARNING

WHEN THE LAMP SUPPLY UNIT IS ENERGIZED, THE 9000-VOLT STARTING PULSE IS PRESENT. EXTREME CAUTION MUST BE EXERCISED WHEN OPERATING THE POWER SUPPLY WHILE NOT CONNECTED TO A PROJECTOR OR WHILE THE POWER SUPPLY COVER IS REMOVED, IN ORDER TO PREVENT SEVERE ELECTRICAL SHOCK.

PRINCIPLES OF OPERATION.

The following description of circuit operation applies both to the 50-Hz Lamp Supply Unit (Part No. 013300) and the 60-Hz Lamp Supply Unit (Part No. 013310). Both units (referred to as LSU in the description) are designed to operate one Marc 300 projection lamp at 228.75 watts, 120 volts, for 60 Hz operation and 288.75 watts, 115 volts, for 50 Hz operation. Total system power, for the LSU and projection equipment, is fed through the LSU and then to the projection equipment. A power switch located in the projection equipment controls the application of power to the LSU. Electrical circuitry of the LSU is shown in the schematic wiring diagram, Figure 6.

CIRCUIT DESCRIPTION.

The power delivered to the lamp is limited by two a-c reactors in parallel in the input to the LSU. Two reactors are required to handle the high input current. In series with each reactor is a thermal protector TP1 sensing ambient temperature and the temperature of resistor R1. If the temperature exceeds 105°C, the controllers will remove power to the unit. As both thermal protectors will not open at exactly the same temperature, power will be removed in a sequence of first opening one reactor and then the second reactor. With only one reactor in the circuit, input current and lamp current will be about one-half of nominal.

Following the a-c reactors is a rectifier bridge circuit consisting of four 400-volt, 10-ampere rectifiers D1. In parallel with each rectifier is a 0.01-mfd, 1000-volt capacitor C5 for transient protection of the rectifiers. The d-c voltage is doubled by means of a voltage doubler circuit formed by the rectifiers and the 10-mfd, 400-volt capacitors C2. Also included in the doubler circuit is a boost transformer T2 to increase the d-c voltage about 8 volts to the d-c circuit which is required for lamp starting.

The next part of the circuit is a relay timing circuit consisting of the relay K1, resistor R4, diode D2, and capacitor C4. Before the lamp has been started, the d-c voltage from red/white to white/green is about 330 volts. The relay coil voltage required to pick up the relay is 110 volts d-c; thus, capacitor C4 will charge to the required voltage to energize the relay coil. The time required to reach this value is determined by R4 and C4. When the relay has been energized, the white/blue lead is connected to white/green, thus removing the voltage charging C4. Capacitor C4 cannot discharge through this part of the circuit as diode D2 is now reverse biased, causing capacitor C4 to discharge only through the relay coil. When capacitor C4 has discharged to the point of drop-out of the relay, the entire cycle will be repeated as long as the d-c voltage available is greater than the voltage required to energize the relay. The time constants of this circuit result is about a one-second on-time and a one-second off-time during cycling. When the lamp is running at 7.75 amperes d-c, the a-c reactors will cause the d-c voltage to be about 37.5 volts d-c, thus not allowing the relay timing circuit to operate.

Included in the LSU is a filter network to reduce the 120-Hz ripple current in the lamp. The filter consists of capacitor C1 and the pulse transformer T3 which serves as a d-c choke during running of the lamp. Capacitor C1 also supplies starting current for the lamp which is about 18 amperes peak. This current is limited by resistor R1 which is switched into the circuit by relay K1 during starting of the lamp. Note that resistor R1 should be removed from the

circuit if the lamp starts, as the relay will return to the non-energized condition. If resistor R1 is not removed, it will overheat and cause the power to be removed by means of the thermal protector TP1.

Approximately 8KV peak is required to initially ionize the lamp. This is generated in the LSU with the pulse transformer T3, capacitor C3 and resistor R3. With the relay in the non-energized position, capacitor C3 will charge to the d-c voltage available through the C3, R3 path. When the relay is picked up, capacitor C3 is placed across a portion of the pulse transformer which generates the high pulse voltage for starting the lamp.

CODE DATE INFORMATION

Year	January	February	March	April	May	June	July	August	September	October	November	December
1965	AA	BA	CA	DA	EA	FA	GA	HA	JA	KA	LA	MA
1966	AB	BB	CB	DB	EB	FB	GB	HB	JB	KB	LB	MB
1967	AC	BC	CC	DC	EC	FC	GC	HC	JC	KC	LC	MC
1968	AD	BD	CD	DD	ED	FD	GD	HD	JD	KD	LD	MD

ELECTRICAL TEST PROCEDURES

SPECIAL TEST EQUIPMENT REQUIRED.

Accurate testing of the Lamp Supply Unit requires the following special test equipment, as well as the commercially available test equipment listed in Table II. Complete specifications for the special test equipment are illustrated and listed in Figures 1, 2 and 3 of these instructions. These units are not available from Bell & Howell and must be assembled according to the specifications illustrated.

TABLE I. SPECIAL TEST EQUIPMENT

Description	Fig. Ref.	B & H Part No.
Open Circuit Starting Voltage Tester	1	S-013000-1-F3
Pulse Voltage Test Box for LSU	2	S-013000-1-F1
Inrush, Ripple and D-C Current Load Box	3	S-013000-1-F4

COMMERCIAL TEST EQUIPMENT REQUIRED.

Table II lists the commercially available test equipment required for performance of test procedures outlined in these instructions.

TABLE II. COMMERCIAL TEST EQUIPMENT

Test Equipment	Recommended Model (Or Equivalent)
Oscilloscope	Tektronix Model 535A
Plug-In Unit	Tektronix Model 53/54CA
10:1 Attennuator Probe	Tektronix Model P6006
Variac (Monitored)	General Radio Type W20MT3A (50/60 Hz)
Hi-Pot Tester	Associated Research Model 411
Thermocouple Meter	Simpson Model 388-3L
DC Voltmeter	Simpson Model 1327 (0-500 VDC)
DC Ammeter	Simpson Model 1327 (0-10 ADC)

TABLE III. TEST LIMITS

Parameter		Input Voltage (See *Note)	Limit		Testing Conditions
			Maximum	Minimum	
Starting:	Open Circuit	105 120	— 350 V	290 V —	See Fig. 1
	Pulse Voltage	105 120	— 12.0 KV Total (1200V across 1 K-ohm)	6.6 KV Total (660V across 1 K-ohm) —	See Fig. 2
	Load Inrush Current	120	36 amps (182V Peak across 5.1 ohm)	20 amps (102V Peak across 5.1 ohm)	See Fig. 3
	Relay Cycle Time	120	44 Cycles / 30 Seconds	12 Cycles / 30 Seconds	See Fig. 2
Running:	Output Current	120	7.9 D.C.	7.4 D.C.	See Fig. 3
	Ripple Current	120	2.4 A. P P (12.2V P-P across 5.1 ohm)	—	See Fig. 3
	Input Current	120	9.0 A. AC	—	See Fig. 3

*NOTE: Use 50-Hz input voltage for 50-Hz LSU (Part No. 013300).
Use 60-Hz input voltage for 60-Hz LSU (Part No. 013310).

WARNING

WHEN THE LAMP SUPPLY UNIT IS ENERGIZED, THE 9000-VOLT STARTING PULSE IS PRESENT. EXTREME CAUTION MUST BE EXERCISED WHEN OPERATING THE POWER SUPPLY WHILE NOT CONNECTED TO A PROJECTOR OR WHILE THE POWER SUPPLY COVER IS REMOVED, IN ORDER TO PREVENT SEVERE ELECTRICAL SHOCK.

HI-POTENTIAL TEST.

The Lamp Supply Unit shall withstand 900 volts A.C. for one (1) minute or 1080 volts A.C. for one (1) second when this potential is applied (from zero) between all current-carrying parts of the primary of the Lamp Supply Unit and all dead metal parts.

GENERAL ELECTRICAL INSPECTIONS.

(1) Check both fuses for proper ampere ratings (15A, 250V) and make certain that fuses can be removed and installed without difficulty.

(2) Use the low resistance range of a volt-ohmmeter and check for continuity between the ground pin of the A.C. receptacle and the metal chassis of the Lamp Supply Unit. Resistance should be near zero ohms. (NOTE: When the supply unit is removed from its case, connect a jumper cable between the bottom chassis and the front receptacle panel.)

(3) The oscilloscope must be isolated from ground by plugging the scope into an A.C. adapter plug (3-prong female to 2-prong male); then plugging the adapter into the A.C. outlet. (NOTE: If the chassis of the oscilloscope is grounded, one side of the Lamp Supply Unit output terminals will be grounded and the supply unit output terminals must be floating.)

WARNING

THE OSCILLOSCOPE IS NOT GROUNDED. DO NOT TOUCH BETWEEN OSCILLOSCOPE AND OTHER EQUIPMENT AS SERIOUS SHOCK HAZARD EXISTS.

TEST EQUIPMENT SET-UP.

(1) Plug variac into A.C. outlet.

(2) Connect supply unit A.C. line cord (Bell & Howell Part No. 40837) between supply unit and variac.

(3) Connect the six-prong plug of the power cable from the Inrush, Ripple and DC Current Load Box (Figure 3) to the Lamp Supply Unit.

(4) Connect the D.C. Ammeter to the Load Box.

(5) Connect oscilloscope to the Load Box through the 10X multiplier probe.

INRUSH CURRENT TEST.

(1) Set the AC/DC switch on the oscilloscope at the AC position.

(2) Set the VOLTS/CM control on the pre-amp plug-in unit at the 5-volt/CM position.

(3) Set the TIME/CM control at the 200 msec/CM position.

(4) Set the Multiplier control at NORMAL and the Trigger Mode Control at AC (LF REJECT).

(5) Set the Trigger Slope control at "+" INT position.

(6) Set the variac to 120V on the meter.

(7) On 50 Hz Lamp Supply Units only, check the operation of the blower fan.

(8) When the relay pulses (clicks), measure the pulse on the oscilloscope by clicking the ON-OFF switch on the variac. Pulse should be 102 volts minimum to 182 volts maximum. D.C. peak as measured across the 5.1 ohm load resistor (10.2 volts minimum to 18.2 volts maximum on scope with 10X multiplier probe).

RIPPLE CURRENT TEST.

(1) Set the VOLTS/CM control at the 0.2 volts/CM position.

(2) Set the TIME/CM control at the 5 msec/CM position.

(3) Set the Trigger Mode Control at AUTO.

(4) Turn on the variac and measure the ripple voltage on the scope (across the 5.1 ohm load resistor). Ripple voltage should not exceed 12 volts P-P maximum (1.2 volts P-P maximum on scope with 10X multiplier probe).

D.C. OUTPUT AND A.C. INPUT CURRENT TESTS.

(1) Press and hold the D.C. current button on the test load box (Figure 3) and note the current reading on the D.C. Ammeter. Current should read 7.4 to 7.9 amps D.C. Release the D.C. current button.

(2) Press and hold the A.C. current button on the test load box and note the current reading on the A.C. Ammeter. Current should not exceed 9 amps A.C. Release the A.C. current button.

PULSE VOLTAGE AND RELAY CYCLE TIME TESTS.

(1) Connect the six-prong plug of the power cable from the Pulse Voltage Test Box (Figure 2) to the Lamp Supply Unit.

(2) Connect the oscilloscope to the test box through the 10X multiplier probe.

(3) Set the VOLTS/CM control at the 20 volts/CM position.

(4) Set the TIME/CM control at the 5 microsecond/CM position.

(5) Set the Trigger Mode Control at AC (LF REJECT) and the Trigger Slope Control at "+" INT.

(6) Switch the variac ON and adjust the Stability and Triggering Level controls (per manufacturer's instruction book) to obtain a single pulse.

(7) Adjust the Horizontal Position control to center the pulse on the face of the CRT.

(8) Adjust the variac for 120 volts A.C. on the meter and measure the peak amplitude of the starting pulse. The pulse should not be greater than 12,000 volts (120 volts on scope with 10X multiplier probe).

(9) Using the sweep second hand of a watch or clock, count the number of pulses in a 30-second period. There should be between 12 and 44 pulses in a 30-second period.

(10) Adjust the variac for 105 volts A.C. on the meter and measure the peak amplitude of the starting pulse. The pulse should not be less than 6,600 volts peak (66 volts on scope with 10X multiplier probe).

OPEN CIRCUIT VOLTAGE TEST.

(1) Connect the six-prong plug of the power cable from the Open Circuit Starting Voltage Tester (Figure 1) to the Lamp Supply Unit.

(2) Switch the variac ON and adjust for 105 volts on the A.C. meter. The D.C. output voltage should be greater than 290 volts D.C. on the D.C. meter.

(3) Adjust the variac for 120 volts on the A.C. meter. The D.C. output voltage should be less than 350 volts on the D.C. meter.

TROUBLE SHOOTING

WARNING

WHEN THE LAMP SUPPLY UNIT IS ENERGIZED, THE 9000-VOLT STARTING PULSE IS PRESENT. EXTREME CAUTION MUST BE EXERCISED WHEN OPERATING THE POWER SUPPLY WHILE NOT CONNECTED TO A PROJECTOR OR WHILE THE POWER SUPPLY COVER IS REMOVED, IN ORDER TO PREVENT SEVERE ELECTRICAL SHOCK.

TROUBLESHOOTING FOR OVERHEATING IN LAMP SUPPLY UNIT.

Thermocouple location and identification for 50-Hz and 60-Hz Lamp Supply Units will be found in Figures 4 and 5 respectively. The termocouple temperature readings in Table IV provided to aid in locating an overheated component in the Lamp Supply Unit. Readings should be taken under the following test conditions.

Input Voltage — 120 volts (±10%) for 60 Hz
115 volts (±10%) for 50 Hz
Input Power — 384 watts
Lamp Current — 7.74 amperes
Running Time — 4-1/2 hours continuous

TABLE IV. MAXIMUM THERMOCOUPLE TEMPERATURE LIMITS

*T.C. No.	Limit (°C)	*T.C. No.	Limit (°C)
1	115 (G.E.)	8	90 (U.L.)
2	90 (U.L.)	9	90 (U.L.)
3	90 (U.L.)	10	90 (U.L.)
4	65 (G.E.)	11	90 (U.L.)
5	90 (U.L.)	12	60 (G.E.)
6	90 (U.L.)	13	65 (G.E.)
7	90 (U.L.)	14	70 (G.E.)

*Thermocouple identification number, Figures 4 and 5

TROUBLE SHOOTING FOR FAULTY LAMP OPERATION

The following trouble shooting procedures are to be performed with the Lamp Supply Unit connected to the projector, and will enable the service station to more quickly determine the nature of the failure and to isolate the trouble to a defective component or components. Verification of component failure can be made by performing a standard continuity check or by substituting a new part for the suspected component. Refer to the schematic diagram (Figure 6) or the pictorial diagrams (Figures 7 and 8) for component location and identification. If the defect cannot be readily determined, perform the tests outlined in the Test Procedures section.

TROUBLE	PROBABLE CAUSE	REMEDY
Lamp does not start (no flash; no high voltage)	1. Blown fuse F1.	1. Replace fuse.
	2. Defective relay K1.	2. Replace relay.
	3. Defective pulse transformer T3.	3. Replace transformer.
	4. Defective capacitor C3.	4. Replace capacitor.
	5. Defective lamp.	5. Replace lamp.
Lamp does not start (faint flash; high voltage present but no back-up voltage)	1. Defective capacitors C2.	1. Replace capacitors.
	2. Defective capacitor C1.	2. Replace capacitor.
	3. Defective boost transformer T2.	3. Replace transformer.
	4. Defective lamp.	4. Replace lamp.
Lamp does not start (bright flash; high voltage and back-up voltage present but not sustained)	1. Defective lamp.	1. Replace lamp.
Lamp light output low	1. Open reactor T1.	1. Replace reactor.
	2. Open thermal protector TP1.	2. Replace thermal protector.
	3. Surge limiting resistor in circuit R1 (open relay K1 contacts 2-4).	3. Replace relay K1.
Visible flicker on screen	1. Defective filter capacitor C1.	1. Replace capacitor.
	2. Open diode in bridge assembly D1.	2. Replace bridge assembly.
Lamp drop-out after a few minutes of operation	1. Thermal protector TP1 opens due to surge resistor R1 running in circuit.	1. Check for possible faulty relay K1; perform tests in Test Procedures section.
Lamp drop-out after several hours of continuous operation	1. Lamp supply unit overheating (temperature controller T1 remains open)	1. Check ambient temperature in enclosure (65°C) maximum); provide proper ventilation.
Open line fuse F1	1. Shorted or grounded reactor T1.	1. Replace reactor.
Lamp breaks	1. Natural end of lamp life.	1. Replace lamp.
	2. Shorted reactor T1.	2. Replace lamp and reactor.
	3. Surge limiting resistor R1 not in circuit during start.	3. Perform tests in Test Procedures section.

TROUBLE SHOOTING WITH TEST EQUIPMENT.

If the results of tests performed in the Electrical Test Procedures section fail to meet noted specification requirements, use the following troubleshooting guide to isolate and correct the trouble. Refer to the schematic wiring diagram (Figure 6) and the pictorial diagrams (Figures 7 and 8) for component location and identification.

WARNING

WHEN THE LAMP SUPPLY UNIT IS ENERGIZED, THE 9000-VOLT STARTING PULSE IS PRESENT. EXTREME CAUTION MUST BE EXERCISED WHEN OPERATING THE POWER SUPPLY WHILE NOT CONNECTED TO A PROJECTOR OR WHILE THE POWER SUPPLY COVER IS REMOVED, IN ORDER TO PREVENT SEVERE ELECTRICAL SHOCK.

TROUBLE	PROBABLE CAUSE	REMEDY
	(TROUBLES DURING STARTING)	
No open circuit voltage (see Figure 1)	1. Blown fuse F1.	1. Replace fuse.
	2. Open connection.	2. Check circuit and correct condition.
	3. Shorted boost transformer T2.	3. Replace transformer.
	4. Shorted rectifier bridge D1.	4. Replace rectifier bridge.
Low open circuit voltage (see Figure 1)	1. Defective voltage doubler capacitor C2.	1. Replace capacitor.
	2. Open rectifier bridge D1.	2. Replace rectifier bridge.
	3. Defective boost transformer T2.	3. Replace transformer.
	4. Leaky filter capacitor C1.	4. Replace capacitor.
	5. Open leads.	5. Perform continuity check; correct condition.
Variable open circuit voltage (see Figure 1)	1. Open surge resistor R1 (varies with relay cycling).	1. Replace resistor.
No pulse voltage (see Figure 2)	1. Defective pulse transformer T3.	1. Replace transformer.
	2. Relay K1 not cycling (bad contacts).	2. Clean contacts or replace relay.
	3. Open connection or short circuit.	3. Check circuit and correct condition.
	4. Open surge resistor R1.	4. Replace resistor.
	5. Open or shorted filter capacitor C1.	5. Replace capacitor.

TROUBLE	PROBABLE CAUSE	REMEDY
No load inrush current (see Figure 3)	1. Open surge resistor R1.	1. Replace resistor.
Low load inrush current (see Figure 3)	1. Value of surge resistor R1 increases (overheating).	1. Check and remedy cause of overheating.
High load inrush current (see Figure 3)	1. Shorted surge resistor R1.	1. Replace resistor.
	2. Defective relay K1.	2. Replace relay.
Relay does not cycle (see Figure 2)	1. Defective relay K1 (jammed armature; open or shorted relay coil).	1. Replace relay.
Relay cycle time too low (see Figure 2)	1. Value of resistor R4 increases (overheating).	1. Check and remedy cause of overheating.
	2. Defective relay K1.	2. Replace relay.
Relay cycle time too high (see Figure 2)	1. Defective timing capacitor C3 (high series resistance).	1. Replace capacitor.
	2. Defective rectifier D2 in switching circuit.	2. Replace rectifier.
	3. Defective relay K1.	3. Replace relay.
	(TROUBLES WHILE RUNNING)	
Low output current (see Figure 3)	1. Open reactor T1.	1. Replace reactor.
	2. Open thermal protector TP1.	2. Replace thermal protector.
High output current (see Figure 3)	1. Open cell in rectifier bridge D1.	1. Replace rectifier bridge.
High ripple current	1. Defective filter capacitor C1.	1. Replace capacitor.
	2. Defective bridge rectifier D1.	2. Replace bridge rectifier.

NOTE: Input current (Figure 3) must correlate with output current.

LIST OF MATERIAL REQUIRED FOR
OPEN CIRCUIT STARTING VOLTAGE TESTER (FIGURE 1)

Detail No.	Description	Qty. Req'd.	Part Number
1	CAPACITOR, 5.0 mfd, 600 vdc (C1)	1	G.E. Type 23F1214 or Allied No. 43D0084
2	1/32 by 2 by 5-21/32 inch aluminum	1	
3	SCREW, Round hd machine, 8-32NC by 3/8 inch	2	
4	BINDING POST, Dual (J2, J3)	2	H.H. Smith Type 269RB or Allied No. 47D1324
5	TERMINAL, Insulated stand off	4	Grayhill Type 18-2 or Allied No. 47D5291
6	SCREW, Socket hd machine, 8-32NC by 1/2 inch	16	
7	FOOT, Rubber	4	
8	SCREW, Socket hd machine, 1/4-20NC by 1/2 inch	4	
9	PLEXIGLAS, Clear, 3/8 by 5-1/4 by 8 inches	1	
10	PLEXIGLAS, Clear, 3/8 by 4 by 5-1/4 inches	2	
11	PLEXIGLAS, Clear, 3/8 by 4-3/4 by 8 inches	1	
12	PLEXIGLAS, Clear, 3/8 by 5-1/4 by 8 inches	1	
13	PLEXIGLAS, Clear, 3/8 by 4-3/4 by 8 inches	1	
14	CABLE ASSEMBLY (J1)	1	Bell & Howell No. 40845
15	LUG, Solder (any suitable type)	2	

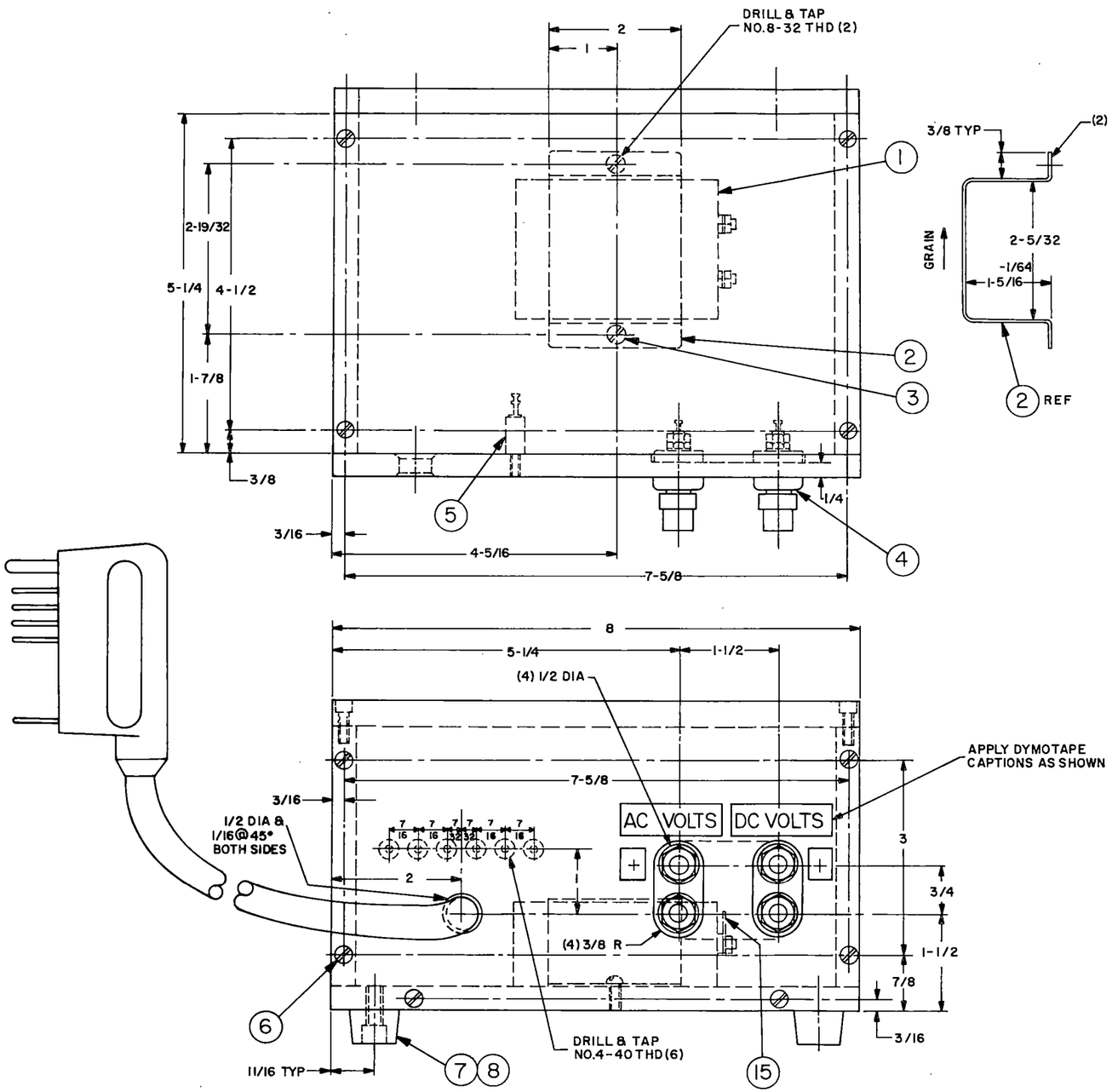
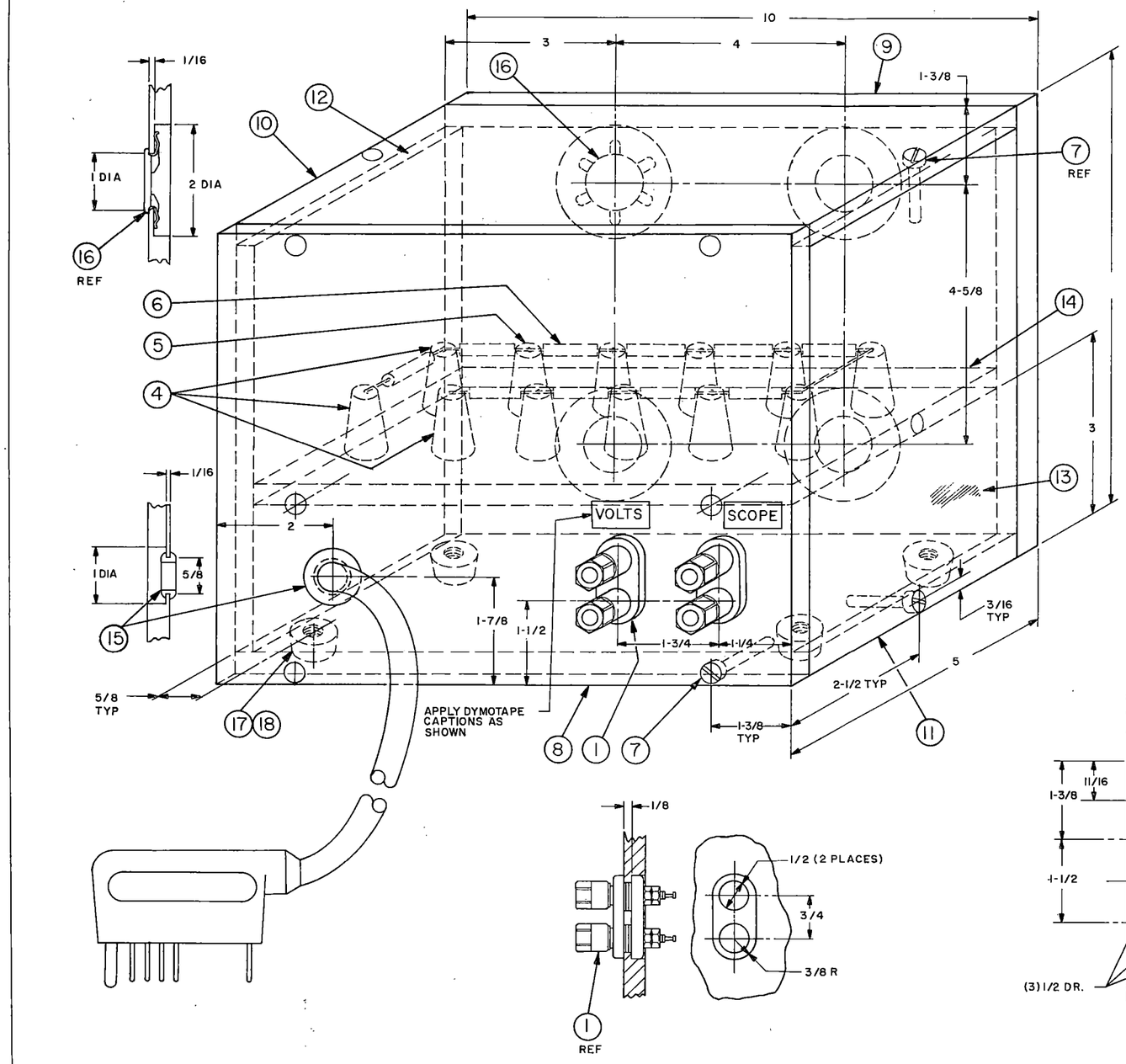
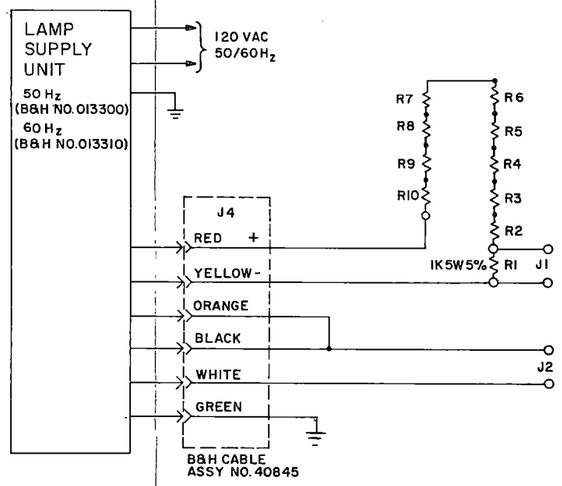


Figure 1. Open Circuit Starting Voltage Tester

LIST OF MATERIAL REQUIRED FOR
PULSE VOLTAGE TEST BOX (FIGURE 2)

Detail No.	Description	Qty. Req'd.	Part Number
1	BINDING POST, Dual (J1, J2)	2	H.H. Smith Type 269RB or Allied No. 47D1324
3	CABLE ASSEMBLY (J4)	1	Bell & Howell No. 40845
4	BUSHING, Insulated, thru-panel (TH1, 2 and 3)	3	E.F. Johnson Type 135-50 or Allied No. 46Z217
5	Insulator, Cone, Steatite (TH4)	9	E.F. Johnson Type 135-501 or Newark No. 37F064
6	RESISTOR, Non-inductive, 1K, 5W ±5% (R1 thru R10)	10	Sprague Type 453E or Allied No. 25Z925C
7	SCREW, Socket hd machine, 10-32 by 1 inch	18	
8	PLEXIGLAS, Clear, 3/8 by 8 by 10-inches	1	
9	PLEXIGLAS, Clear, 3/8 by 8 by 10-inches	1	
10	PLEXIGLAS, Clear, 3/8 by 4-1/4 by 10 inches	1	
11	PLEXIGLAS, Clear, 3/8 by 4-1/4 by 10 inches	1	
12	PLEXIGLAS, Clear, 3/8 by 4-1/4 by 7-1/4 inches	1	
13	PLEXIGLAS, Clear, 3/8 by 4-1/4 by 7-1/4 inches	1	
14	PLEXIGLAS, Clear, 3/8 by 4-1/4 by 9-1/4 inches	1	
15	GROMMET, Rubber, 1/2 inch I.D.	1	
16	BEZEL, Ventilating, 1-inch diameter	4	
17	FOOT, Rubber	4	
18	SCREW, Socket hd machine, 1/4-20 by 1/2 inch	4	





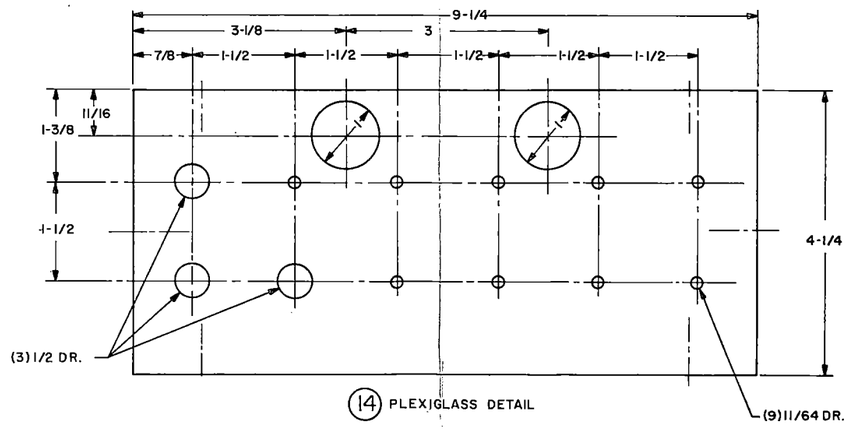


Figure 2. Pulse Voltage Test Box for Lamp Supply Unit

LIST OF MATERIAL REQUIRED FOR
INRUSH, RIPPLE AND DC CURRENT LOAD BOX (FIGURE 3)

Detail No.	Description	Qty. Req'd.	Part Number
1	RECTIFIER, Silicon control (D1)	1	G.E. Type C-35-D or Newark No. C-35-D
2	HEAT SINK (For D1)	1	Wakefield No. NC441K or Allied No. 60D6533
3	BINDING POST, Dual (J1, J2, J3)	3	H.H. Smith Type 269RB or Allied No. 47D1324
4	CABLE ASSEMBLY (J4)	1	Bell & Howell No. 40845
5	AMMETER, A-C, 0-15A, 4-1/2 inches (M1)	1	Simpson Type 1359 (No. 3320)
6	RESISTOR, Non-inductive, 25 ohm, 100 W (R1 thru R5)	5	Ohmite No. 2203
7	RELAY, Mercury, 115 volt coil, 50 amp contacts, normally-closed (RLY1, RLY2)	2	Newark No. 59F1611
8	SWITCH, Push button, SPST, normally-open (S1, S2)	2	Grayhill Type 2201 or Allied No. 56D4872
9	TERMINAL, Insulated standoff	6	Grayhill Type 18-2 or Allied No. 47D5291
10	SCREW, Socket hd machine, 8-32 by 5/8 inch	16	
11	PLEXIGLAS, Clear, 3/8 by 9-1/4 by 14 inches	2	
12	PLEXIGLAS, Clear, 3/8 by 7 by 14 inches	1	
13	WIRE, Solid copper, 1/8 inch diameter by 3-5/8 inches	2	
14	BAR, CRS, 1/16 by 1-23/32 by 2-11/16 inches	2	
15	RIVET (to suit)	8	
16	BAR, CRS, 1/16 by 3/4 by 1-1/32 inch	4	
17	SCREW, Socket hd machine, 8-32 by 3/8 inch	4	
18	FOOT, Rubber	4	
19	SCREW, Socket hd machine, 1/4-20 by 1/2 inch	4	
20	BEZEL, Ventilating, 1 inch diameter	4	
21	PLEXIGLAS, Clear, 3/8 by 7 by 14 inches	1	
22	PLEXIGLAS, Clear, 3/8 by 9-1/4 by 14 inches	1	
23	PLEXIGLAS, Clear, 3/8 by 6-1/4 by 9-1/4 inches	1	
24	PLEXIGLAS, Clear, 3/8 by 6-1/4 by 9-1/4 inches	1	
25	CORD AND PLUG, 3-conductor	1	Bell & Howell No. 31576
26	SCREW, Round hd machine, 6-32 by 1/2 inch	4	
27	SPACER, 1/4 inch long for No. 6 screw	4	

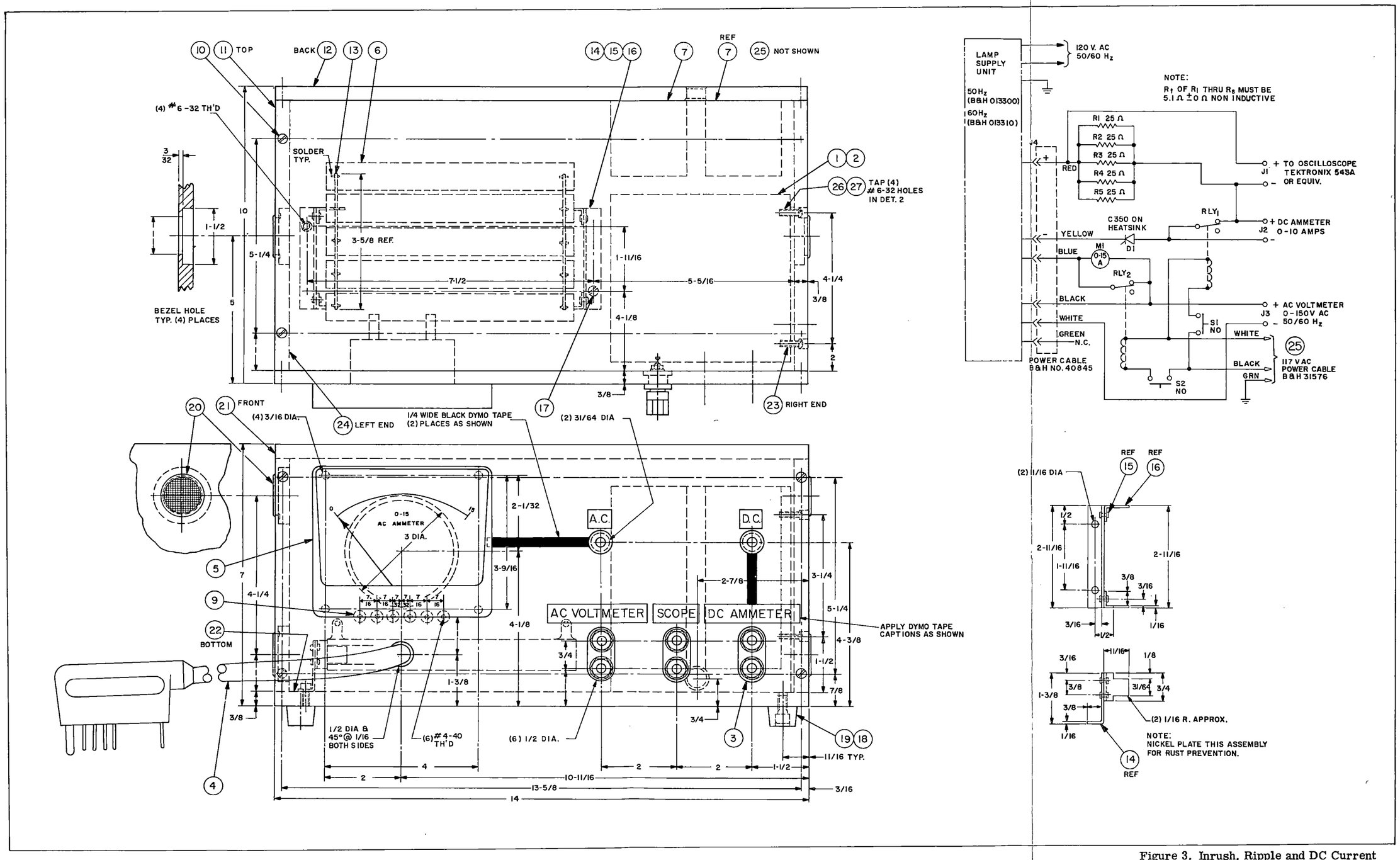


Figure 3. Inrush, Ripple and DC Current Load Box

THERMOCOUPLE IDENTIFICATION
(See Figures 4 and 5)

Item No.	Description
1	CENTER — Bridge Rectifier Case D1
2	COIL — A.C. Reactor T1
3	CORE — A.C. Reactor T1
4	CASE — Filter Capacitor C1
5	COIL — Pulse Transformer T3
6	BRACKET — Pulse Transformer T3
7	COIL — Pulse Transformer T3
8	COIL — Boost Transformer T2
9	CORE — Boost Transformer T2
10	COIL — A.C. Reactor T1
11	CORE — A.C. Reactor T1
12	EXPOSED END — Voltage Doubler Capacitor C2
13	AMBIENT AIR (Inside Enclosure)
14	CASE — "Klixon" Thermal Protector TP1

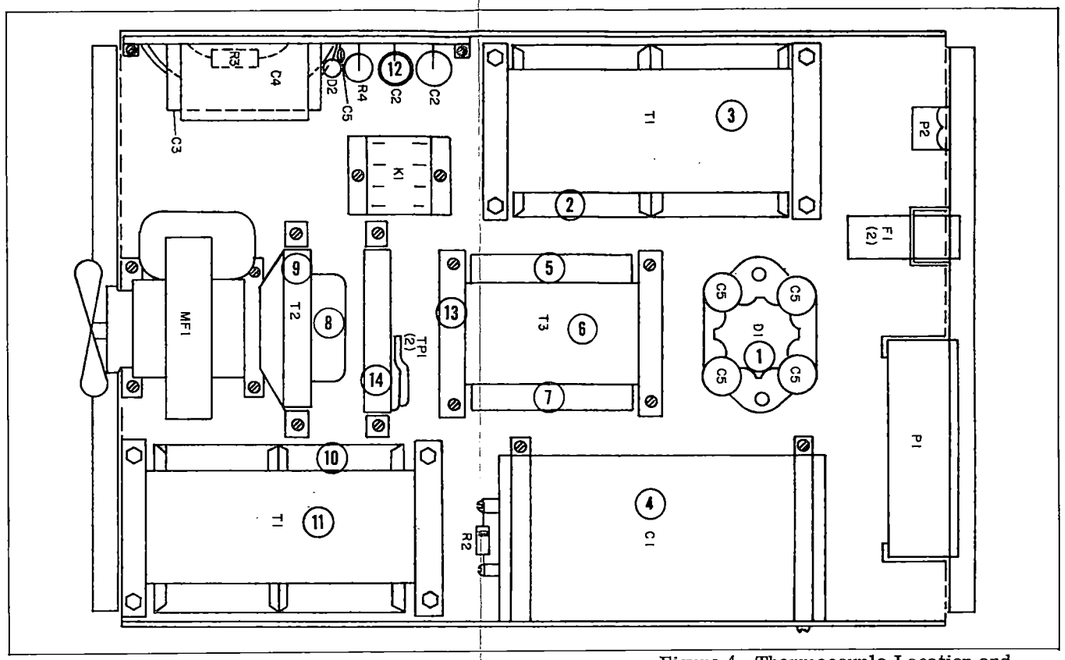


Figure 4. Thermocouple Location and Identification for 50 Hz Unit, Part No. 013300

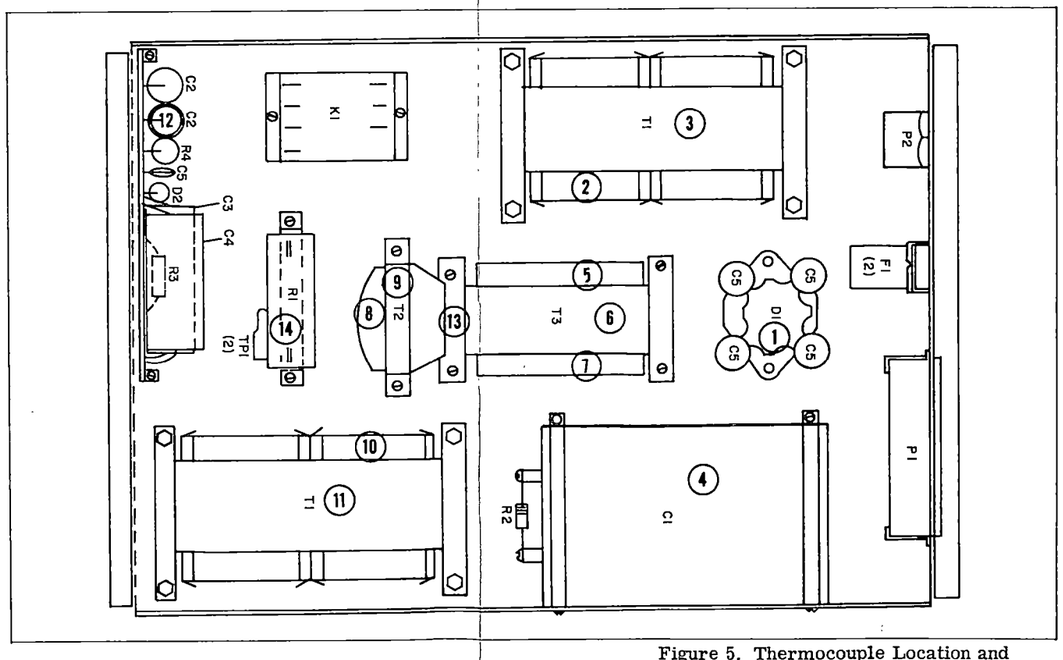
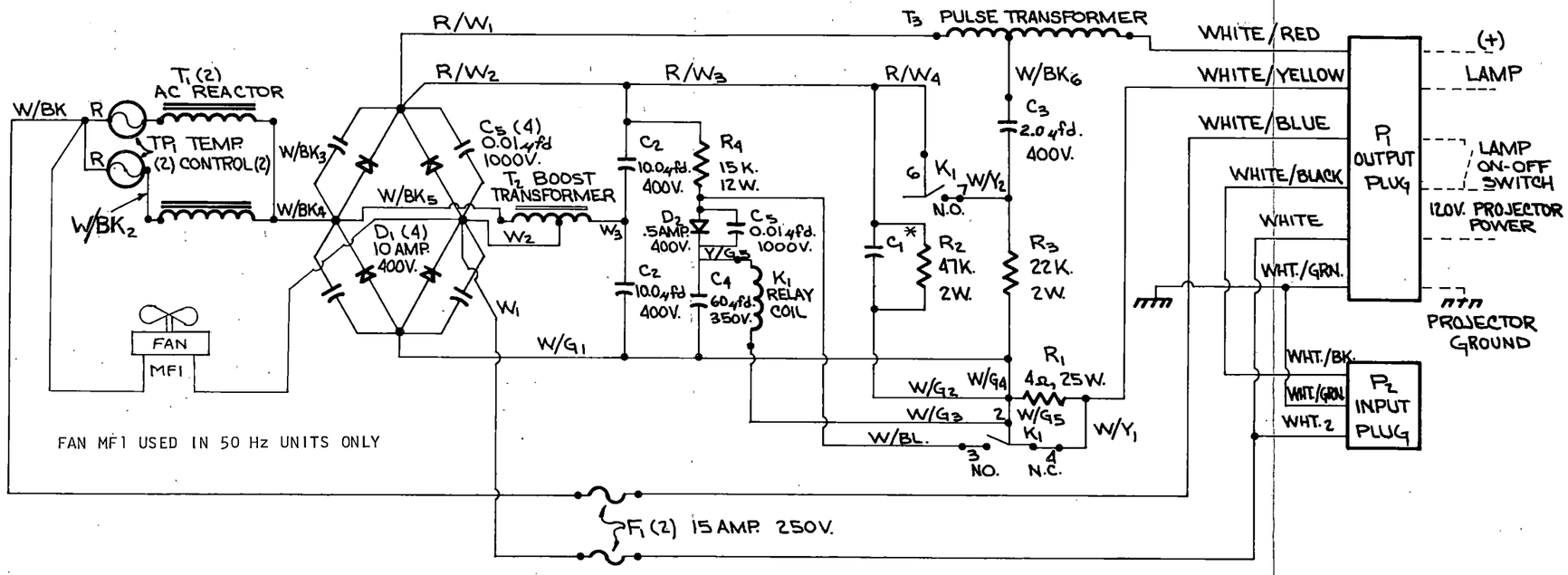


Figure 5. Thermocouple Location and Identification for 60 Hz Unit, Part No. 013310



*NOTE: ON 50 Hz LAMP SUPPLY UNITS, CAPACITOR C1 IS 1900 MFD, 350 WVDC
ON 60 Hz LAMP SUPPLY UNITS, CAPACITOR C1 IS 1500 MFD, 350 WVDC

Figure 6. Schematic Wiring Diagram, 50/60 Hz Lamp Supply Units

REPLACEMENT PARTS FOR 50 Hz LAMP SUPPLY UNIT
(Bell & Howell Part No. 013300)

Reference Symbol	Description	Part Number Bell & Howell
C1	CAPACITOR, Filter, 1900 mfd, 350 WVDC	70786
C5	CAPACITOR, 0.01 mfd, 1000 WVDC	70773
D1	RECTIFIER BRIDGE	70771
F1	FUSE, 15-ampere, 250 volt	611895
K1	RELAY	70769
MF1	FAN	70788
P1	PLUG, Output	70767
P2	PLUG, Input	70785
R1	RESISTOR, 4-ohm, 25-watt	70774
R2	RESISTOR, 47 K-ohm, 2-watt	70775
T1	REACTOR, A-C	70784
T2	TRANSFORMER, Boost	70765
T3	TRANSFORMER, Pulse	70766
TP1	THERMAL PROTECTOR	70770
---	CIRCUIT BOARD ASSEMBLY, Complete	70787
C2	. CAPACITOR, 10 mfd, 400 WVDC	70777
C3	. CAPACITOR, 2 mfd, 400 WVDC	70778
C4	. CAPACITOR, 60 mfd, 350 WVDC	70779
C5	. CAPACITOR, 0.01 mfd, 1000 WVDC	70773
D2	. DIODE, 1.2 amp,,400 volt	70782
R3	. RESISTOR, 22 K-ohm, 2 watt	70780
R4	. RESISTOR, 15 K-ohm, 12 watt	70781

CAUTION

When replacement of parts is necessary, use only genuine Bell & Howell parts as listed in the above parts list. Do not substitute supposedly comparable commercial parts.

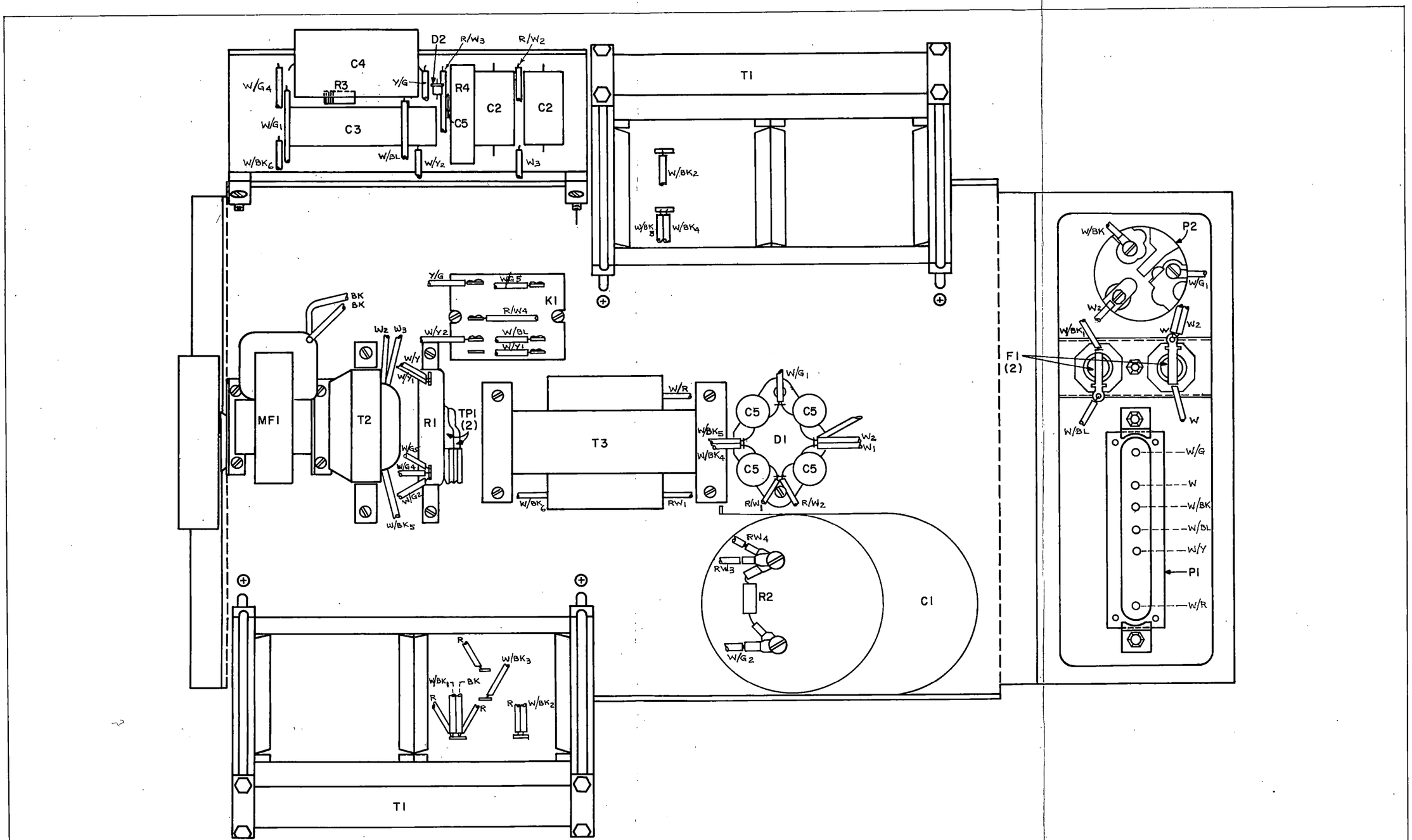


Figure 7. Interconnection Diagram for 50 Hz Lamp Supply Unit (B&H Part No. 013300)

REPLACEMENT PARTS FOR 60 Hz LAMP SUPPLY UNIT
(Bell & Howell Part No. 013310)

Reference Symbol	Description	Part Number Bell & Howell
C1	CAPACITOR, Filter, 1500 mfd, 350 WVDC	70772
C5	CAPACITOR, 0.01 mfd, 1000 WVDC	70773
D1	RECTIFIER BRIDGE	70771
F1	FUSE, 15-ampere, 250 volt	611895
K1	RELAY	70769
P1	PLUG, Output	70767
P2	PLUG, Input	70768
R1	RESISTOR, 4-ohm, 25-watt	70774
R2	RESISTOR, 47 K-ohm, 2-watt	70775
T1	REACTOR, A-C	70764
T2	TRANSFORMER, Boost	70765
T3	TRANSFORMER, Pulse	70766
TP1	THERMAL PROTECTOR	70770
---	CIRCUIT BOARD ASSEMBLY, Complete	70776
C2	. CAPACITOR, 10 mfd, 400 WVDC	70777
C3	. CAPACITOR, 2 mfd, 400 WVDC	70778
C4	. CAPACITOR, 60 mfd, 350 WVDC	70779
C5	. CAPACITOR, 0.01 mfd, 1000 WVDC	70773
D2	. DIODE, 1.2 amp, 400 volt	70782
R3	. RESISTOR, 22 K-ohm, 2 watt	70780
R4	. RESISTOR, 15 K-ohm, 12 watt	70781

CAUTION

When replacement of parts is necessary, use only genuine Bell & Howell parts as listed in the above parts list. Do not substitute supposedly comparable commercial parts.

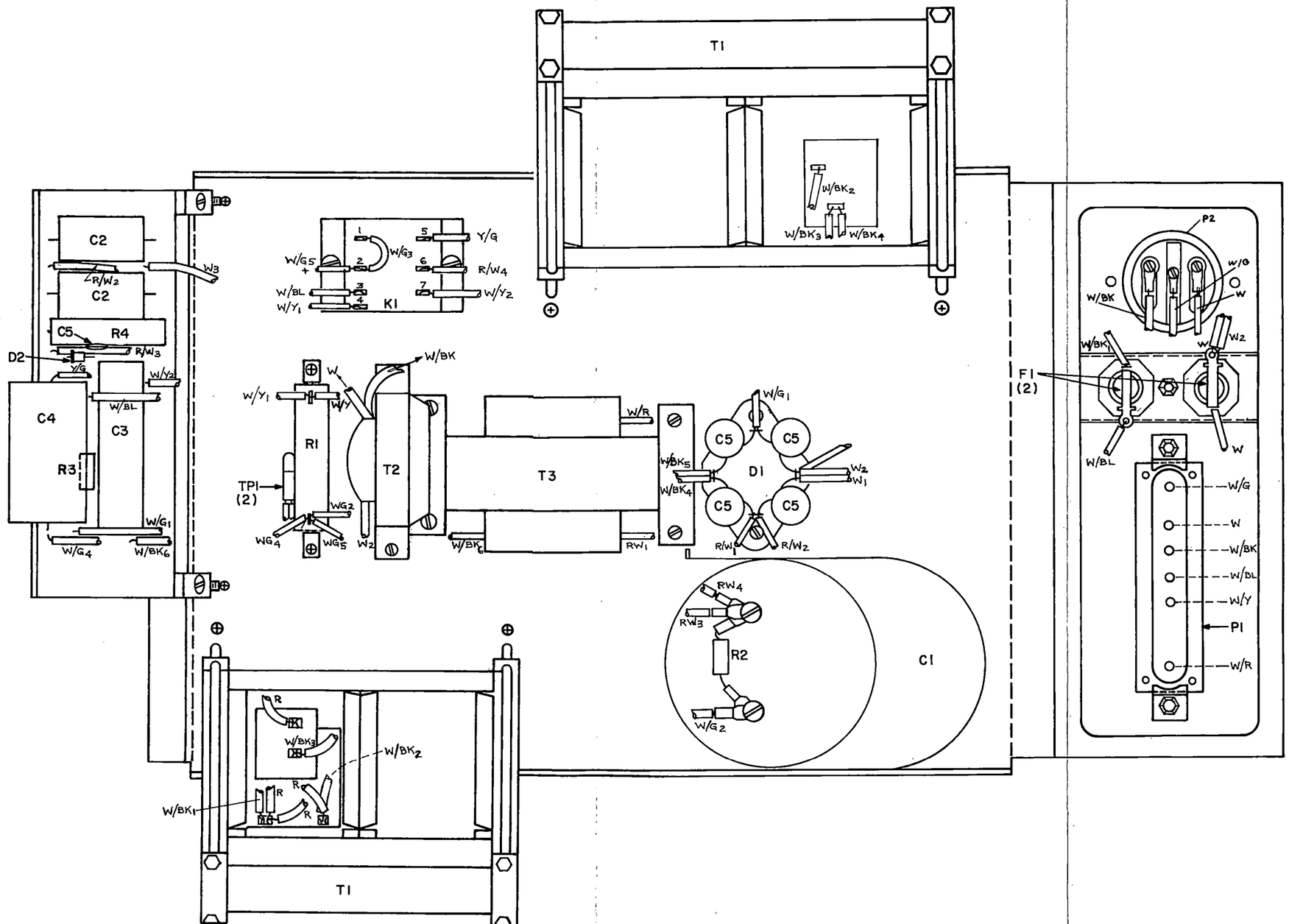


Figure 8. Interconnection Diagram for 60 Hz Lamp Supply Unit (B&H Part No. 013310)