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Instructions
**FOR
EQUIPMENT
Type**

77008-11

POWER SUPPLY

THE STRONG ELECTRIC CORP.
87 CITY PARK AVE., TOLEDO, OHIO

PREFACE

THE STRONG D. C. POWER SUPPLY is a continuous duty, three phase, full wave type transformer rectifier using silicon diodes as the power conversion elements and is designed for use with all models of the Strong X-60, 84-150 ampere (3000-4200 watt) xenon projection lamphouse.

THIS POWER SUPPLY is designed to operate from an A. C. source of 230 volts (190-250V.) and draws 38 amperes maximum per phase from a 230 volt line with a 150 ampere load. The D. C. output range is from 84-150 amperes at 24 to 33.5 volts.

WARNING

THIS POWER SUPPLY IS DESIGNED FOR USE WITH BOTH THE 3000 AND 4200 WATT XENON BULBS. IT IS SHIPPED CONNECTED "LO" ON TERMINAL BLOCK TB3 FOR OPERATION OF ONLY THE 3000 WATT BULB. FOR OPERATION OF THE 4200 WATT BULB, THE LEAD FROM THE BLOCKING DIODE CR2 MUST BE CONNECTED TO THE "HI" POSITION ON TERMINAL BLOCK TB3. CAREFULLY READ THE INSTALLATION AND OPERATION INSTRUCTIONS BEFORE ATTEMPTING TO IGNITE ANY XENON BULB.

THE A. C. LINE TAPS on terminal panel TBI are for a coarse adjustment to compensate for variations in the input line voltage. Moving the three relay leads from terminals "A" through "D" increases the D. C. output of the power supply. The three dial switches are used for the fine adjustment in the D. C. supply to the lamphouse.

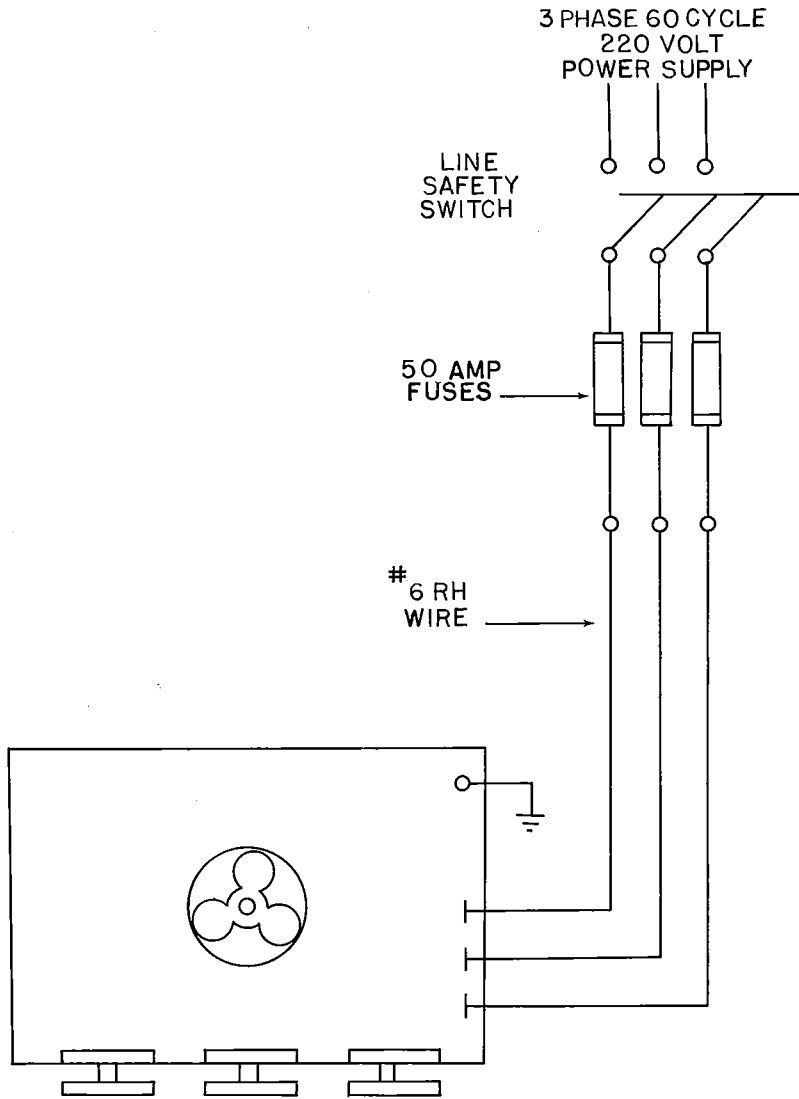
THE POWER SUPPLY is equipped with a cooling fan to maintain a safe operating temperature and a thermal switch, located on the rectifier heat sink, to stop operation of the equipment and protect the rectifier diodes if temperatures reach an abnormal level.

A CHOKE AND CAPACITORS in the D. C. circuit reduce ripple to a minimum, consistent with the requirements of the xenon bulbs for long life.

CIRCUIT BREAKERS are installed in the 230 volt A. C. control circuit to protect components in the event a malfunction occurs.

IF AT ANY TIME you have a suggestion, or desire aid in securing anticipated results, write directly to Strong Electric Corporation, P. O. Box 1003, 87 City Park Avenue, Toledo, Ohio 43697.

INSTALLATION DIAGRAM



INSTALLATION - OPERATION

INSTALL THE POWER SUPPLY as close as possible to the lamphouse. Use the size wire specified on the installation diagram in the lamphouse manual, to keep the power loss between the power supply and lamphouse to a minimum.

THE D. C. CIRCUIT between the power supply and lamphouse must be a direct connection without fuses or switches in the circuit and avoid runs of over 15 feet, if possible.

THE A. C. INPUT POWER LINES between the power supply and fused safety switch should be as short as possible and conform to the size indicated on the installation diagram in this manual. A terminal lug, located inside the housing, is provided for the ground connection.

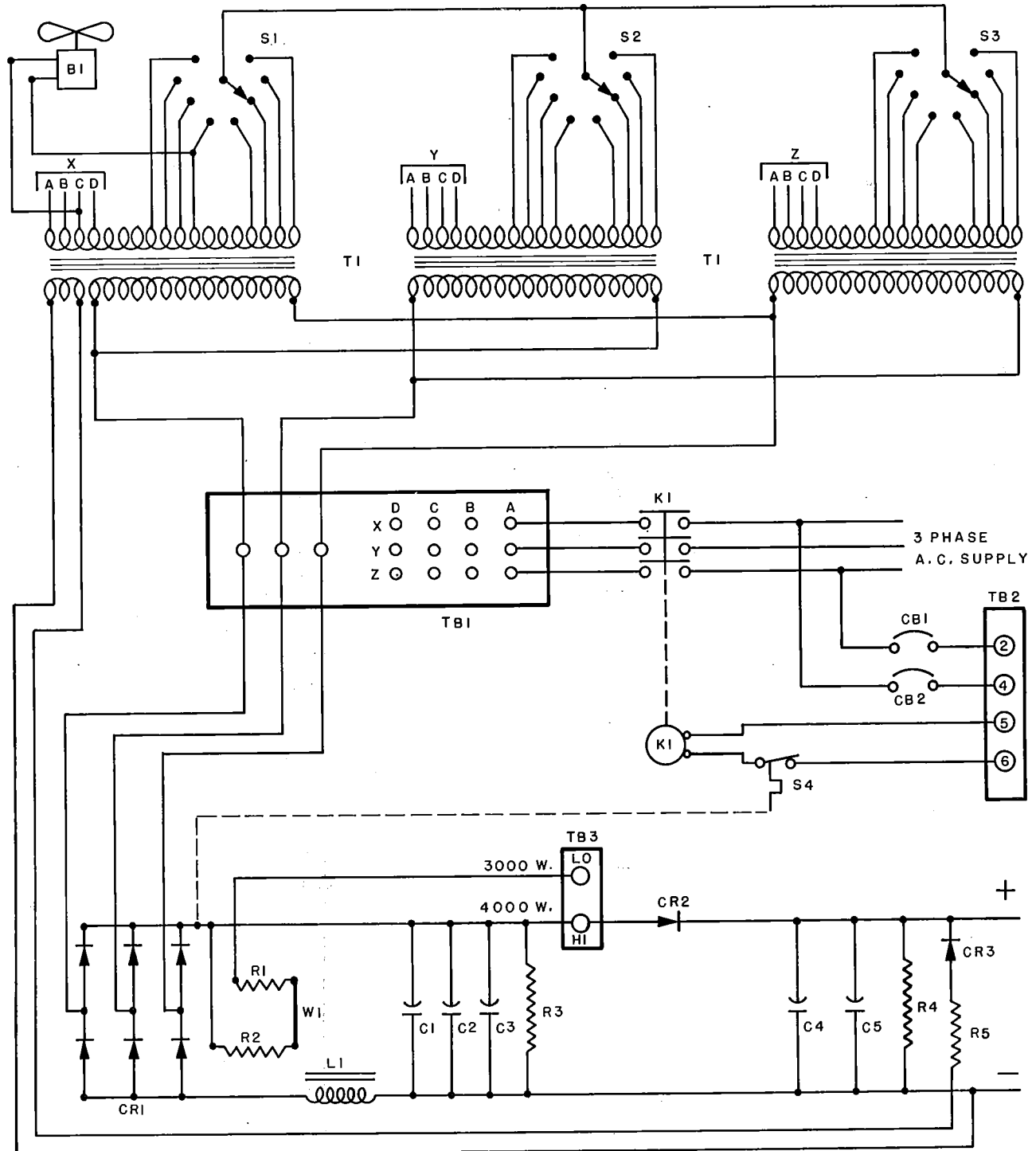
FOR BEST PERFORMANCE install the power supply in a well ventilated room. The power supply should not be operated in an ambient temperature over 120° Fahrenheit.

A THERMAL SWITCH, attached to the diode heat sink, senses the temperature and will open at $190 \pm 6^{\circ}$ F., breaking the AC control circuit to the coil of the line relay and protect the rectifiers from over-heating. This switch will remain open and prevent operation of the power supply until the temperature at the heat sink falls below $150 \pm 10^{\circ}$ Fahrenheit.

THE D. C. OUTPUT to the lamphouse is adjustable by means of the three dial switches, position #8 giving the highest output, and by moving the three AC leads from the relay across the tap panel from position "A" to "B", "C" and "D". These three leads at position "D" gives the highest output. The three AC leads, from the relay to the tap panel must be in the same lettered position.

THIS POWER SUPPLY is shipped connected "LO" on terminal block TB3 for operation of the 3000 watt bulb and the A. C. line taps on position "A". If using the 3000 watt bulb, attempt ignition with the controls in this position and advance the dial switches until the desired current is indicated at the ammeter on the lamphouse. If the desired current cannot be reached or if ignition is not sustained, then change the A. C. line taps to position "B" and return the dial switches to position #1. Advance each of the three dial switches a step at a time until the desired current is indicated on the lamphouse ammeter. Continue this procedure, changing the line taps and dial switches, until the desired operating current is obtained.

WIRING DIAGRAM



PARTS LIST
WIRING DIAGRAM

<u>Ref. Desig.</u>	<u>Part No.</u>	<u>Description</u>
B1	94248	Motor & Leads, Blower
-	94138A	Fan Blades
C1, 2, 3	84151	Capacitor, Filter, 12000 MFD, 125 WVDC.
C4	61132	Capacitor, Boost, 1200 MFD, 250 Volts
C5	88981	Capacitor, R. F. Bypass, .01 MFD, 500 Volts
CB1, 2	79107	Circuit Breaker
-	77911	Lead Assy., Circuit Breaker
CR1	77196	Silicon Rectifier Stack
-	77197	Diode, Replacement
-	77978	A. C. Leads (Stack CR1 to TB1- 3 req'd)
-	77917	D. C. Lead (CR1 to "Hi" on TB3)
-	77923	Lead Assy. (CR1 to Ballast Assy.)
-	77924	Lead Assy. (Ballast Assy. to "Lo" on TB3)
CR2	77928	Heat Sink & Blocking Diode Assy.
-	77186	Heat Sink
-	74279	Diode (CR2)
-	77908	Lead Assy. (CR2 to Lamphouse)
-	691	Screw, 1/4-20 x 3/4" Hex Hd.
-	835	Washer, 1/4" Flat
-	876	L'Washer, 1/4" Split
-	805	Nut 1/4-20 Steel
-	88237	Insulating Bushing, Heat Sink
-	1473	Screw, 6-32 x 1/2" Pan Hd.
-	77918	Lead Assy. (C4 to CR2)
CR3	77927	Diode, Boost, 2.5 Amp, 1000 PIV (with R5)
K1	94201-A	Contacto, 208-240 Volt Coil, 50/60 Hz
-	77912	Lead Assy. (K1 to TB1)
L1	77922	Choke & Leads Assy.
-	77919	Lead Assy. (L1 to C1)
-	77920	Lead Assy. (L1 to CR1)
-	77921	Lead Assy. (L1(-) to lamphouse)
R1, 2	77929	Ballast Resistor
R3	77158	Resistor, Bleeder (1500 Ohm, 12 Watt)
R4	88981	Resistor, Bleeder (100 K Ohm, 1/2 Watt)
R5	77927	Resistor, Current Limiting (200 Ohm, 12 Watt) (with CR3)
S1, 2, 3	15494B	Dial Switch & Lead Assy.
S4	88118	Thermal Switch
T1	*	Transformer, Banked
	*	Transformer, Wired with S1, S2, S3
	*	Order By Type & Serial No. on Nameplate
TB1	77141	Terminal Panel

<u>Ref. Desig.</u>	<u>Part No.</u>	<u>Description</u>
TB2	69149	Terminal Block, A. C. Control
-	77191	Terminal Marker Strip
TB3	77925	Terminal Block Assy. ("Hi"- "Lo")
-	77193	Terminal Block Insulator
W1	77926	Buss, Ballast

FOR 4200 WATT OPERATION, START WITH THE A.C. LINE TAPS IN POSITION "A" AND THE DIAL SWITCHES AT STEP #1. MOVE THE LEAD FROM THE CR2 BLOCKING DIODE OVER TO THE "HI" (4200 WATT) POSITION ON TERMINAL BLOCK TB3. This position bypasses the ballast resistors R1 and R2 in the D.C. circuit for 4200 watt operation. Repeat the procedure regarding the position of the A.C. line taps and dial switches, as previously stated for the 3000 watt bulb until the desired current is indicated on the lamp ammeter.

EACH DIAL SWITCH must be set on step (1). Each switch must be set on the same number and as they are moved from (1) to (8) the current to the bulb will be increased.

CONNECT THE LAMPHOUSE to the power supply in accordance with the lamp instruction manual and installation diagram. Make sure that the polarity of the D.C. leads to the lamphouse is not reversed. Reversed polarity will cause rapid destruction of the xenon bulb.

DO NOT BLOCK AIR VENT on top of the power supply, or operate with the front panel or top removed as this will cause the equipment to over-heat. Ignite the xenon lamp as specified in the lamp instruction manual. Wait a few minutes until the current stabilizes; then adjust the power supply for the current as specified by the bulb manufacturer.

ARC CURRENT TOO LOW: (To increase current)

The arc current can be raised by turning the dial switch to a higher number. All 3 dial switches must be on the same number. If the switches are on number 8 and the current is still too low it can be raised by changing the coarse tap leads in the power supply to a higher tap (letter) i.e. tap "B" to tap "C". Again, when one lead is changed, all 3 must be changed. When the tap leads are changed, the dial switches must be set to number 1 step and then raised to a higher number if the current is too low. Do not exceed rated operating range of the xenon bulb being used in the lamphouse.

ARC CURRENT TOO HIGH: (To decrease current)

The arc current can be lowered by turning the dial switches to a lower number. All 3 switches must be on the same number. If the switches are on number 1, the current can be lowered by changing the coarse tap leads in the power supply, to a lower tap (letter) i.e. tap "B" to tap "A". Again, when one tap lead is changed all 3 must be changed. When the coarse tap leads are changed, the dial switches must be set to number 1 step and then raised to a higher number if the current is too low.

INSTRUCTIONS FOR REPLACEMENT OF SILICON STACK OR DIODES

IN CASE OF REPEATED BLOWN FUSES, noticeable reduction in light output, or excessive flicker, check for failure of a diode in the rectifier stack. Diodes of a silicon stack can be checked with an ohmmeter. In event of an open or shorted diode, it is relatively easy to make a replacement after the faulty element is located.

SINCE REPAIR OR REPLACEMENT of the unit or a diode will be required, it is best to remove the inoperative stack and ballast resistors entirely from the power supply. Disconnect the three A. C. leads from the stack, the two positive leads from the TB3 (HI-LO) terminal block and the negative lead from the stack. Disconnect the two leads from the S4 thermal switch on the stack. Remove the two front retaining screws that secure the stack assembly to the bottom of the power supply housing. Lift the entire assembly out from the bottom of the housing being very careful not to damage the ballast resistors mounted under the rectifier stack.

WITH AN OHMMETER set on lowest range, check the resistance between the DC positive and each of the three AC terminals. Reverse ohmmeter leads and check the resistance again. Repeat this step between the negative terminal and each of the three AC terminals.

A GOOD DIODE will show high resistance in one direction and low resistance in the other. A shorted diode will have a very low resistance in either direction. An open diode will have infinite resistance in both directions.

ONCE THE FAULTY DIODE is located, two wrenches will be required for replacement. Proceed as follows:

- (1) Disconnect the flexible wire to the defective diode and remove the diode using two wrenches, one for the hex diode face and the other for the retaining nut and lock nut.
 - (2) Install the new diode and tighten securely to insure perfect heat and electrical conductivity. Then connect the diode flexible lead to the diode terminal.
 - (3) Replace the silicon stack in the power supply by reversing the disassembly procedures. Be careful not to damage the ballast resistors. Be certain the D. C. lead from the stack is placed on the "HI" (4000W.) terminal on TB3 and the D. C. lead from the ballast resistor is connected to the "LO" (3000W.) terminal on TB3.
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TROUBLE CHART

NORMAL OPERATION:

When the line power switch is turned on, voltage is applied to the line side of the line contactor in the power supply, and to the 230V. AC control circuit of the lamp. The control circuit to the lamphouse is protected by two circuit breakers. A thermal switch, fastened to the diode heat sink to protect the diodes from overheating, will open the coil circuit of the contactor and stop operation of the power supply in the event the temperature at the heat sink reaches $190 \pm 6^{\circ}$ Fahrenheit. Opening and closing of this switch due to excessive heat will cause intermittent operation of the xenon lamp.

When the power switch in the lamp is turned on the line contactor in the power supply will be energized, a loud click will be heard as the contacts close and line voltage will be applied to the transformers. The cooling fan in the power supply will start and voltage applied to the silicone rectifier unit. Power is then applied to the CR3 boost diode circuit and R5 current limiting resistor; charging the C4 boost capacitor to the peak voltage developed in the boost tertiary winding of the transformer. Resistor R4 is the bleeder for capacitor C4. Approximately 100 volts DC is momentarily applied to the DC circuit for the xenon bulb ignition. Upon ignition the boost circuit is reduced and 24 to 33.5 volts D. C. is supplied to the lamphouse to maintain operation of the xenon arc. Capacitor C5 functions as a RF bypass circuit at the time of ignition to protect the CR1 rectifier circuit.

The choke and capacitors C1, 2, 3 serve as filters to reduce the D. C. ripple to the level required to insure long bulb life. Resistor R3 functions as a bleeder for C1, 2, 3 capacitors and diode CR2 is the blocking diode in the D. C. circuit, to permit build-up of the high D. C. voltage required for bulb ignition. R1 and 2 function as current dropping resistors for operation of the 3000 watt xenon lamp.

THE LEAD FROM THE CR2 BLOCKING DIODE TO THE TB3 TERMINAL BLOCK, MUST BE CONNECTED TO THE TERMINAL MARKED FOR THE RATING OF THE BULB BEING USED. Improper connection may result in destruction of the 3000 watt bulb and under-power or lack of ignition for the 4200 watt bulb. The R1 and R2 ballast resistors are bypassed in the D. C. circuit for operation of the 4000/4200 watt bulb. An open or break in the D. C. circuit at either the R1 or R2 ballast resistors will result in loss of power on the "LO" (3000W) terminal on TB3.

<u>TROUBLE</u>	<u>PROBABLE CAUSE</u>	<u>TEST</u>	<u>REMEDY</u>
Line contactor does not energize (no loud click from contactor when lamp power switch is turned on.)	Line power switch not turned on.	Check line switch.	Turn on.
	Blown line fuses.	Check line fuses.	Replace blown fuses.
	Circuit breakers open.	Check for short in control circuit.	Reset circuit breakers, repair short.
	Open thermal switch.	To isolate switch, place a jumper on terminal #6 to the relay coil terminal where the lead from the thermal switch is connected.	Replace switch if defective. Leave unit cool down. Unit running hot - opens switch.
	Contactor coil burned out.	Check for line voltage across A. C. control terminals 5 and 6, with lamp power switch on.	If line voltage appears across these terminals replace contactor.
	Lamphouse interlock switches.	If line voltage is not measured across 5 & 6 but is measured across 2 & 4 on terminal board.	See lamp manual "Trouble Chart" section.
	Loose connection or broken lead in wires 2 & 4 or 5 & 6 between lamp & power supply.	Check continuity on 2-4 and 5-6 (Red or amber lights on lamphouse not energized.)	Tighten connections or replace broken wire. See also lamp manual "Trouble Chart".
Contactor clicks on but bulb does not ignite. (Bulb does not flash).	Contacts in K1 line contactor burned.	Check AC voltage on Term. Panel in power supply.	Replace contactor if voltage is not indicated.

<u>TROUBLE</u> (Cont'd)	<u>PROBABLE CAUSE</u>	<u>TEST</u>	<u>REMEDY</u>
Contactor clicks on but bulb does not ignite. (Bulb does not flash.)	Lamphouse igniter.	(See lamp manual)	
	Shorted blocking diode CR2.	(See test under Low-No Load D. C. Voltage)	Replace diode.
Low-No load DC voltage to lamp (less than 100 volts measured across terminals 10 & 15 at capacitors C4, C5 in lamp-house, behind rear access panel.)	Coarse taps or dial switches set wrong.	Check installation procedure in this manual.	Adjust taps and dial switches properly.
	Blown line fuse.	Check line fuses.	Replace bad fuse.
	Defective C4 boost capacitor.	Connect DC voltmeter, capable of reading 150 volts across terminals 10 and 15 in lamp. Turn on lamp power switch for 5 seconds. Note voltmeter reading, turn off lamp power switch. Voltage must fall slowly.	If voltage rapidly falls to zero, replace capacitor.
	Contacts in line contactor defective or burned.	Check contacts.	Replace contactor.
	Dial switch.	Check that fingers of switches make solid contact with switch contacts.	Replace dial switch fingers or entire dial switch.
	Defective boost diode (CR3). Possible defect if only 100 VDC measured.	Check continuity across the diode with an ohmmeter. Must show low resistance in only one direction when reversing ohmmeter leads.	If test show low resistance in both directions or does not show low resistance in either direction replace diode assy.

<u>TROUBLE</u>	<u>PROBABLE CAUSE</u>	<u>TEST</u>	<u>REMEDY</u>
(Cont'd) Low-No Load DC voltage to lamp (less than 100 volts measured across terminals 10 & 15 at capacitors C4, C5 in lamphouse, behind rear access panel.	Shorted or open blocking diode CR2. Check voltage. Possible defect if only 100V. DC measured.	Remove CR2 lead from TB3 terminal block and check with an ohmmeter, the continuity from the heat sink to the lead. Should show continuity in only one direction when reversing ohmmeter leads.	If test show continuity in both directions, replace diode.
	Defective current limiting resistor R5.	Measure resistance with an ohmmeter. Check reading with listed resistance value $\pm 20\%$.	If defective, replace resistor and CR3 diode.
Bulb goes out during operation.	Defective fan.	Test for 115V. AC at "C" tap on terminal board and #5 contact on dial switch.	Replace motor.
	Thermal switch on heat sink.	To isolate switch place a jumper on terminal #6 to the relay coil terminal where the lead from the thermal switch is connected.	Replace switch if defective. If temperature at heat sink reaches 190 $^{\circ}$ F. thermal switch will open.
	Air flow switches in lamphouse.	Check that switches remain closed. Check that air flow thru power supply is not blocked.	See lamphouse "Trouble Shooting". Clean screen on bottom of power supply & check opening in top is not blocked.

<u>TROUBLE</u>	<u>PROBABLE CAUSE</u>	<u>TEST</u>	<u>REMEDY</u>
Fan does not run but contactor clicks on.	Blown line fuse.	Check fuse.	Replace.
	Contacts in line contactor burned or defective.	Check for clicking sound from igniter relay, at back of lamp with lamp power switch on.	Replace defective contactor if no clicking is heard from igniter relay.
	Defective fan motor.	Test same as above.	If clicking is heard from igniter relay, replace fan motor.
Repeatedly blows line fuses.	Wrong size fuses.	Check size of fuses.	Replace with proper size fuses (see installation diagram).
	Wired improperly.	Check wiring (see Installation Diagram).	Wire properly.
	Shorted CR1 silicon rectifier unit.	Check silicon unit (See instruction for replacement of silicon stack diodes) in this manual.	Replace defective diodes.
	Shorted transformer.	Disconnect silicon unit at terminal panel. Turn on lamp power switch.	If fuses still blow replace transformer bank.
	Shorted filter capacitor C1, 2, 3 or boost capacitor C4.	Test with capacitor checker.	Replace if defective.

<u>TROUBLE</u>	<u>PROBABLE CAUSE</u>	<u>TEST</u>	<u>REMEDY</u>
Repeated shorted diodes.	Insufficient air flow thru power supply.	Check for blocking of air thru silicon unit, screen in bottom of case, air outlet on top of case.	Clean power supply and remove any obstructions to air circulation.
	Defective fan.	Fan blade moving slow, not much air.	Replace fan motor.
	Wrong replacement diode being used.		Replace defective with proper one.
	Defective C5 ceramic RF capacitor on boost capacitor C4.	Remove and test with capacitor tester if available.	Replace capacitor.
Excessive light flicker.	Improper dial switch or coarse tap settings.	Check that all 3 dial switches are on the same step number. Check that all 3 coarse taps are on the same letter taps.	Set properly.
	Defective silicon unit.	Check silicon unit. See "Instruction for replacement of silicon stack diodes in this manual.	Replace defective diodes.
	Defective xenon bulb.	(See lamp manual trouble shooting.)	
	Filter capacitor C1, 2, 3.	See test under repeatedly blows line fuse.	Replace if defective.

<u>TROUBLE</u>	<u>PROBABLE CAUSE</u>	<u>TEST</u>	<u>REMEDY</u>
Reduced light output.	Defective xenon bulb.	(See lamp manual troubleshooting.)	
	Defective CR1 silicon diode.	See previous test for rectifier.	Replace if defective.
Xenon bulb does not light (bulb flashes).	Defective xenon bulb.	(See lamp manual trouble shooting.)	
	Open blocking diode CR3.	See previous test for CR3.	Replace CR3 if defective.
	Power setting too low to maintain ignition of xenon bulb.	-----	Turn dial switch up a step or two. Do not attempt to operate bulb below the manufacturer's recommended min. rating.
Circuit breakers CB1, 2 open repeatedly. Lamp power switch "on".	Defective fan or igniter in lamphouse	-----	See lamp manual trouble chart.