PS-15C
POWER SUPPLY

5010102

MANUAL $1.00

Kit 7010200
Wired 7010201

#332

Vhf engineering

DIVISION OF BROWNIAN ELECTRONICS CORP.

320 WATER ST. • PO BOX 1921 • BINGHAMTON, NY 13902 • 607-723-9574

The PS-15C is a well filtered regulated 12-14 volt power supply capable of handling up to 15 amps. It is designed for communications equipment where maximum current is drawn less than 50 percent of the time. For continuous operation, it must be derated approximately 20 percent.

PS-15C SPECIFICATIONS

VOLTAGE OUTPUT:	adjustable between 12 and 14 volts.
LOAD REGULATION:	2 percent from no load to 15 amps.
CURRENT OUTPUT:	15 amps intermittent (50 percent duty cycle) 10 amps continuous.
CURRENT LIMITING:	maximum short circuit current 1 amp nominal.
RIPPLE:	50 MV at 10 amps.
AMBIENT TEMP:	65°C maximum.

LIMITED WARRANTY

Factory wired units are warranted for one year. The unit must be returned to the factory postpaid with a note describing difficulty and date of purchase, include a check to cover return postage. Our liability under warranty is limited to repair, adjustment or replacement of units proven to be defective. No further warranty is expressed or implied. Units modified or obviously misused will not be covered by the warranty.

The parts in kits built according to our instructions carry the original manufacturers' warranty. Defective parts must be returned for credit. Units built from kits may be returned to the factory for repair and alignment for a nominal charge, plus parts and shipping.

WARNING!

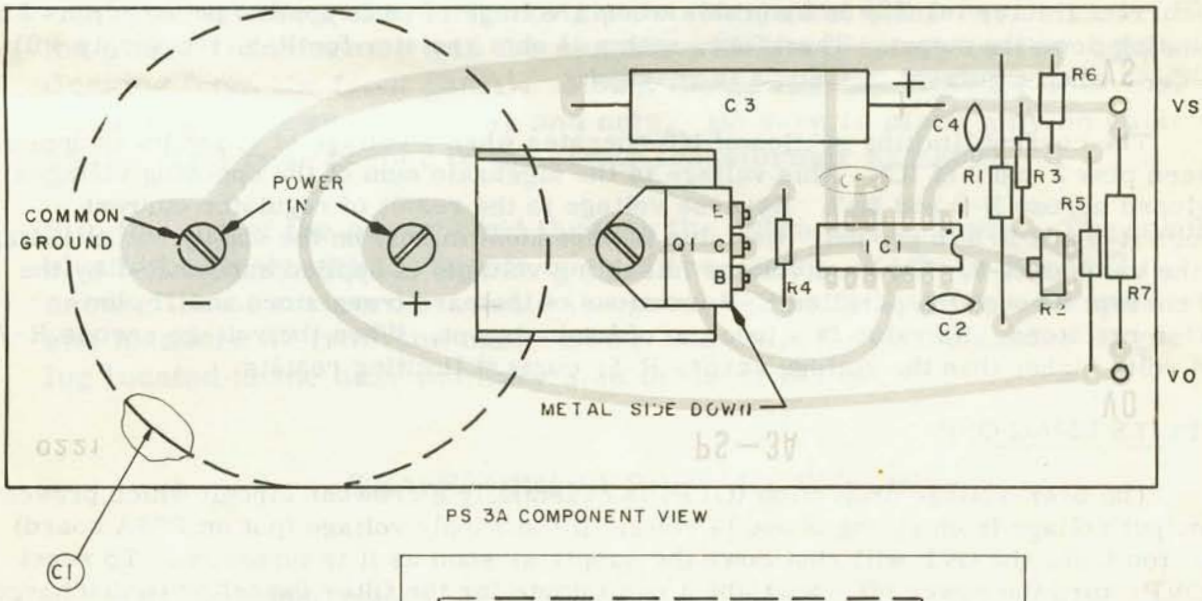
The input power connection is at the ac line potential (115 or 230V ac). Use caution when working in this area.

PARTS LIST - PS3A
(Kit 7010190)
(Wired 7010191)

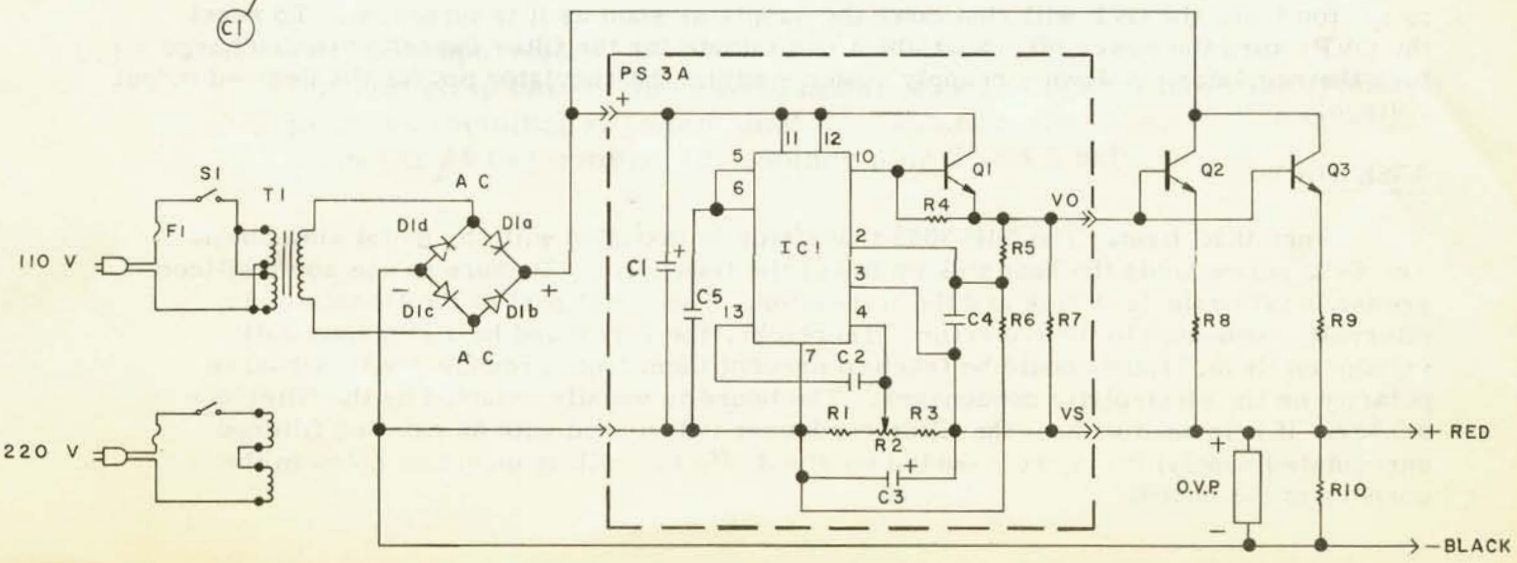
*C1	25000 MFD 40V	(2010610)
C2	.001	(2010370)
C3	470MFD 16V	(2010570)
C4	.001	(2010370)
C5	.01	(2010410)
IC1	NE550	(1050050)
Q1	MJE3055	(1020060)
R1	1K 5%	(2020240)
R2	2K Pot	(2020510)
R3	10K 5%	(2020340)
R4	5.6K 1/2W	(2020300)
R5	330 ohm 5%	(2020175)
	390 ohm 5% (PS15)	(2020180)
R6	3.3K 5%	(2020270)
*R7	.1 ohm 5W	(2020010)

Heat Sink Grease Capsule	(3050200)
P.C. Board	(4040220-1)
Heat Sink	
Small on PS3A & PS15	(4020100)
Large on PS25	(4020150)
3 Keystone Pins	(4060130)
Hardware	
Instruction Sheet	(5010203)

*C1 is not supplied with PS3A kit. When using PS3A with external pass transistors R7 is changed to 100 ohm 1 W resistor (2020110)



PS 3A COMPONENT VIEW



CIRCUIT DESCRIPTION

The PS-3A regulator card can supply up to 6 amps of regulated 12-14 volts from an unregulated source. It is designed for communications equipment where maximum current is drawn less than 50 percent of the time. For continuous operation, it must be derated to 3 amps with the heat sink supplied. The maximum current is limited by the power dissipation (input voltage minus output times current) and the current capabilities of the pass transistor, which is 90 watts and 10 amps respectively at room temperature for the TIP3055. With a supply voltage of 20 volts, the PS3A will handle 6 amps by adding additional heat sinking to keep the case temperature of the TIP3055 below 120^{o} centigrade. With the addition of external pass transistors, currents up to amps can be regulated.

When using the PS3A without external pass transistors, the maximum short circuit current is 6 amps. When used with external pass transistors, R-7 is changed to 100 ohms. The maximum current of 6 amps is multiplied by the number of pass transistors. The unregulated input must be at least two volts above the output under load to keep the pass transistors out of saturation. Any ripple on the input voltage must be added to the 2 volts difference. When the pass transistor saturates regulation is lost.

THEORY OF OPERATION

The NE550 is a precision voltage regulator chip that contains a zener voltage reference, operational amplifier, current limiter, and pass transistor. A portion of the output voltage controlled by R-4 is compared to a reference voltage, any difference or error is amplified by the op-amp and changes the bias on the internal pass transistor to eliminate the error. The reference voltage for the NE550 is 1.6 volts. Therefore, the output voltage is the ratio of the voltage divider (consisting of R-1, 2, and 3) times 1.6. The current limiter transistor saturates when a voltage of .6 is applied between pins 2 and 3, shuting down the output. Therefore, with a .1 ohm resistor for R-5, the supply will shut down when a current of 6 amps is reached.

The current limiting section of IC1 operates when a voltage of +.6 volts is applied between pins 2 and 3 of IC1. This voltage is the algebraic sum of the opposing voltages developed across R-5 and R-7. Reverse voltage is the result of regulator current through R-5 and R-6 to ground. Its value is dependent mainly on the supply output voltage and the value of R-6. Forward voltage (disabling voltage) is applied across R-7 by the load current through the paralled E-B junctions of the pass transistors and .1 ohm emitter resistors. Its value is a function of load current. When the voltage across R-7 is .6 volts higher than the voltage across R-5, current limiting results.

SUPPLIES USING OVP

The over-voltage protection (OVP) is essentially a crowbar circuit which prevents the output voltage from rising above 14 volts. If the supply voltage (pot on PS3A board) is set too high, the OVP will shut down the supply as soon as it is turned on. To reset the OVP: turn the power off - wait about one minute for the filter capacitor to discharge - turn the regulator pot down - reapply power - adjust the regulator pot for the desired output voltage.

ASSEMBLY

Install IC first. The TIP 3055 transistor is installed with the metal side down. The 6-32 screw holds the heat sink on top of the transistor. Be sure to use some silicon grease between the heat sink and the transistor. The metal part of the transistor is internally connected to the collector. Therefore, the screw and heat sink have full voltage on them. Care should be taken to prevent them from grounding out. Observe polarity on the electrolytic condensers. The board is usually mounted by the filter condenser. If it is used without the filter condenser (when used with an existing filtered unregulated supply) it may be mounted on stand offs by drilling mounting holes in the corners of the board.

PS15C INSTRUCTIONS

1.) Assemble the PS-3A regulator board as follows (refer to the pictorial of the parts layout). a.) Install the IC first, making sure the notch or dot is near pin 1 as marked on the board. b.) Bend the leads on Q1 towards the metal side at a 90 degree angle. c.) Coat the metal side of Q1 with the white heat sink grease and place it in the center of the "U" shaped heat sink. d.) Mount this assembly to the component side of the circuit board with 6/32 hardware. e.) Mount the remaining components as shown. NOTE: Be sure to substitute the 100 ohm 1 watt resistor in the PS15C kit for the .1 ohm 5 watt supplied with the PS-3A.

2.) Remove the power transformer from the chassis and set it aside temporarily. Mount the large filter condensor with its bracket and four 6/32 X $\frac{1}{2}$" screws and nuts. The bracket must be preformed by placing the condensor on a flat surface and bending the bracket around it. Make sure the positive connection of the condensor is towards the rear of the chassis before tightening the bracket.

3.) Mount the binding post, on-off switch and fuse holder as shown in the parts layout. Mount the four rubber feet on the bottom corners of the chassis.

4.) Insert a rubber grommet in the 3/8" hole on the rear apron. Insert the power cord through the grommet and strip outside jacket 12" from the end. Place the power transformer into the chassis with the primary on the right side (looking from the front panel). Mount the power transformer with four 10/32 X $\frac{1}{2}$" screws, washers, and nuts. Be sure to place a nylon cable clamp on the right rear corner of the power transformer as shown.

Slip the end of the power cord through the nylon cable clamp. The insulation should be flush with the inside edge of the clamp. Tighten the 8/32 nut to secure the power cord. Locate the green (ground) lead from the power cord and measure 4" from the cable clamp and cut. Strip and solder to ground lug located at the base primary side of the transformer.

TRANSFORMER PRIMARY WINDING

5.) a.) For 110V operation:
Cut and strip two 2" pieces #18 brown wire. Connect one wire from the primary terminal #1 to terminal #3. Connect the other wire from terminal #4 to terminal #2. Solder pins 2 and 3 only.

b.) For 220V operation:
Cut and strip one 1" piece of #18 brown wire. Connect one end to primary terminal #2 and the other end to terminal #3 power transformer. Solder both connections.

6.) Locate the white wire coming from the power cord and measure 5" from the cable clamp. Strip and solder to the primary terminal marked 1 (on the pictorial). Locate the black wire coming from the power cable. Run it along the right hand side of the chassis, then across the front panel underneath the binding post and bring it up to the center terminal of the fuse holder. Strip and solder to the center fuse holder. Cut $3\frac{1}{2}$" length of #18 brown wire and strip both ends 1/8". Solder one end to the fuse holder side terminal and the other end to the inner terminal of the on-off switch.

7.) Cut a $5\frac{1}{2}$" length of #18 black wire and strip both ends 1/8". Solder one end to the remaining lug on the switch and the other end to terminal #4 on the power transformer.

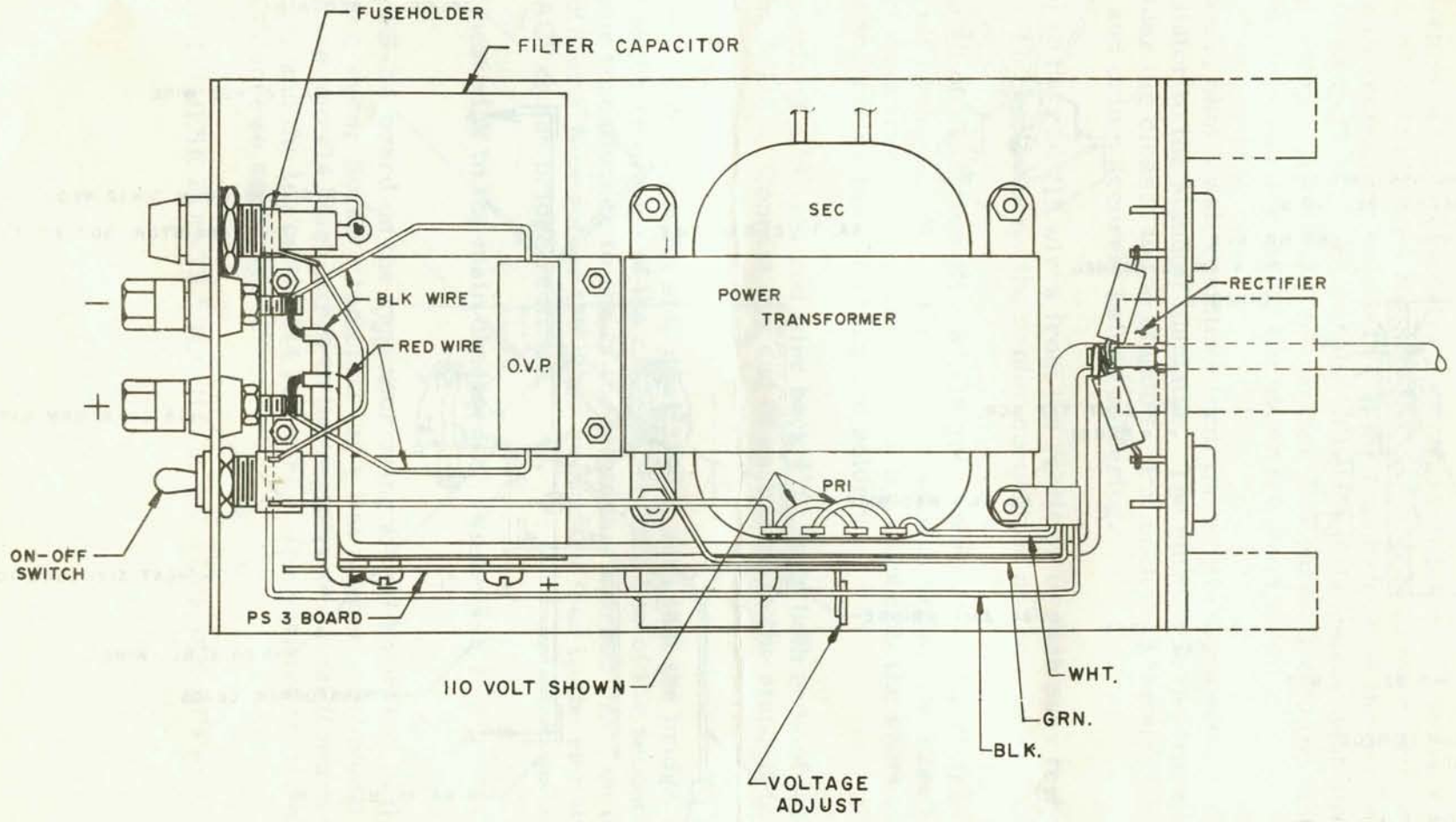
REFER TO THE BRIDGE RECTIFIER DETAILED DRAWING DURING THE FOLLOWING STEP

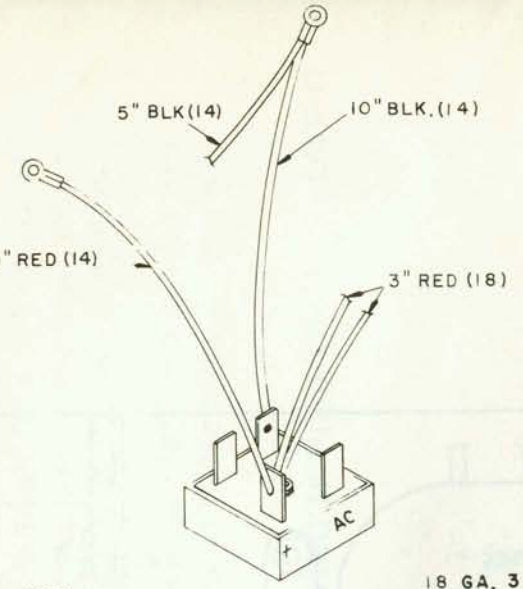
8.) Prepare the following wires:
a.) Cut a 10" black #14 wire and strip both ends $\frac{1}{4}$".
b.) Cut a 5" black #14 wire and strip both ends $\frac{1}{4}$".
c.) Cut a 9" red #14 wire and strip both ends $\frac{1}{4}$".
d.) Cut a 6" red #18 wire. Remove $\frac{1}{2}$" of insulation from the center of the wire and strip both ends $\frac{1}{4}$".

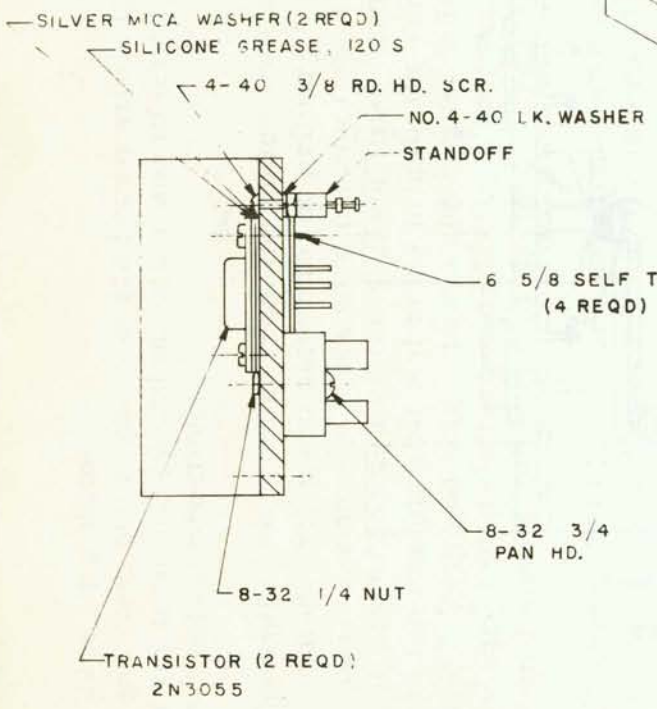
9.) Solder the prepared wires into the bridge as follows:
a.) Solder one end of the 10" #14 black wire to the minus terminal.
b.) Connect one end of the red #14 wire to the positive terminal. Wrap the center of the red #18 wire around the terminal and solder.
c.) Crimp and solder a terminal lug to the red lead.
d.) Crimp and solder a terminal lug to the end of both black leads.

10.) Mount the two pass transistors on the heat sink as follows:
a.) Coat both sides of a mica insulator with heat sink grease. Slip the coated insulator over the pins of the transistor. Carefully plug the transistors through the heat sink into a socket held on the inside. Be sure to orient the transistor so the pins are centered in the holes of the heat sink and the positioning holes of the sockets line up properly. Secure the entire assembly using #6 X 5/8" self tapping screws.

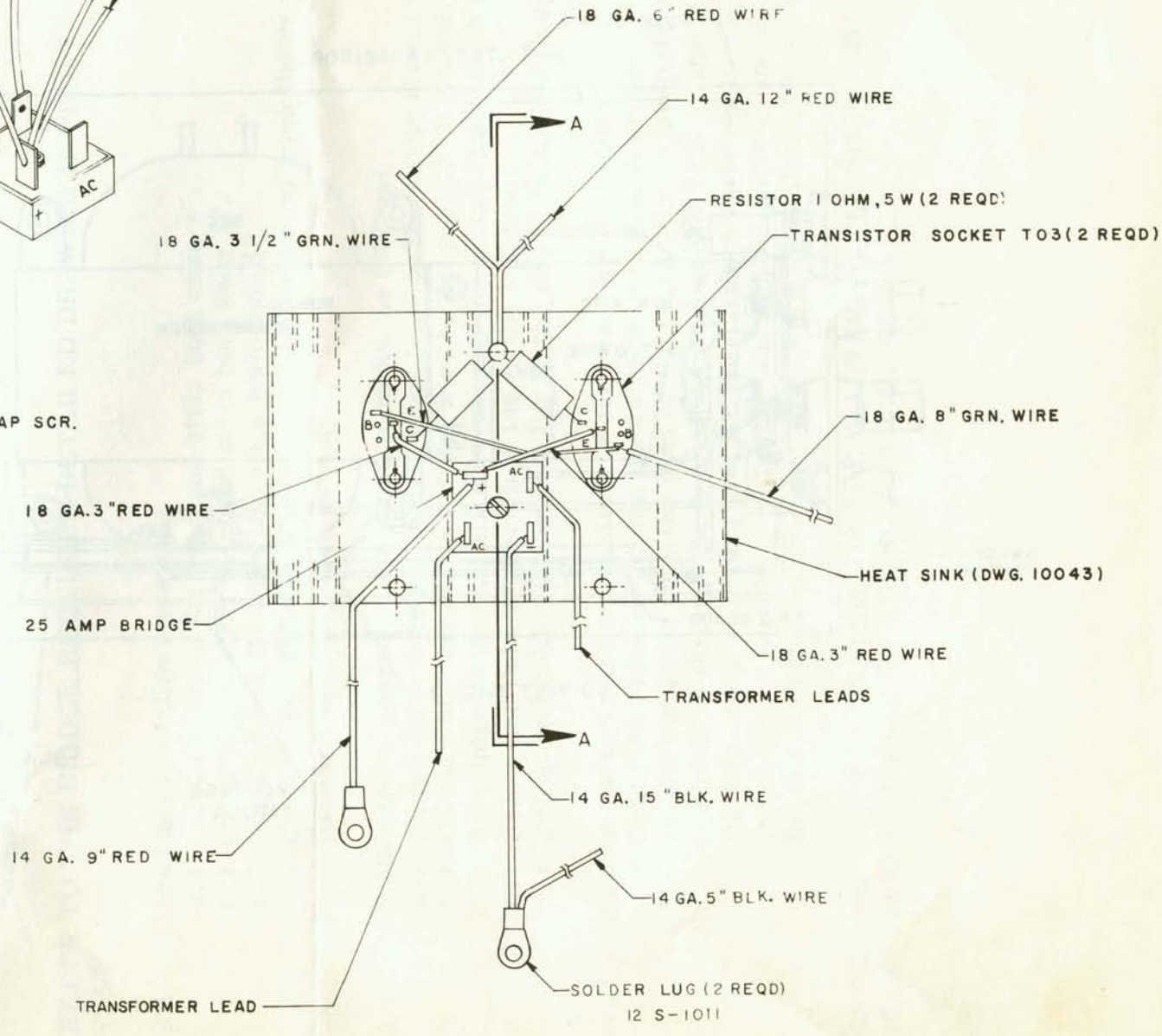
IF THE PINS OF THE TRANSISTOR ARE INADVERTANTLY SHORTED TO THE HEAT SINK, MAJOR DAMAGE TO THE SUPPLY CAN RESULT


FUSEHOLDER
FILTER CAPACITOR
SEC
BLK WIRE
RED WIRE
O.V.P.
POWER
TRANSFORMER
RECTIFIER
PRI
ON-OFF
SWITCH
PS 3 BOARD
110 VOLT SHOWN
WHT.
GRN.
BLK.
VOLTAGE
ADJUST


5" BLK(14)
10" BLK.(14)
9" RED (14)
3" RED (18)
AC
+


SILVER MICA WASHER (2 REQD)
SILICONE GREASE, 120 S
4-40 3/8 RD. HD. SCR.
NO. 4-40 LK. WASHER
STANDOFF
6 5/8 SELF TAP SCR. (4 REQD)
8-32 3/4 PAN HD.
8-32 1/4 NUT
TRANSISTOR (2 REQD) 2N3055

SECTION A A


18 GA. 6" RED WIRE
14 GA. 12" RED WIRE
A
RESISTOR 1 OHM, 5 W (2 REQD)
TRANSISTOR SOCKET TO3 (2 REQD)
18 GA. 3 1/2" GRN. WIRE
18 GA. 8" GRN. WIRE
18 GA. 3" RED WIRE
HEAT SINK (DWG. 10043)
25 AMP BRIDGE
18 GA. 3" RED WIRE
TRANSFORMER LEADS
A
14 GA. 15" BLK. WIRE
14 GA. 9" RED WIRE
14 GA. 5" BLK. WIRE
TRANSFORMER LEAD
SOLDER LUG (2 REQD) 12 S-1011

11.) Mount the standoff in the center hole closest to the edge of the heat sink using a #4-40 X 3/8 screw and lock washer between the standoff and the heat sink.

12.) Coat the bottom of the previously prepared rectifier with heat sink grease (place an 8-32 X 3/8" screw through the center hole in the rectifier and mount it in the remaining hole between the transistors on the heat sink). Secure with an 8-32 X $\frac{1}{4}$" hex nut placed between the center heat sink fins. Before tightening, align the bridge so that it is parallel with the heat sink and the red #18 wires are facing the upper left hand side.

13.) Connect two .1 ohm 5 watt resistors from the emitter connections of each pass transistor to the standoff insulator. The emitter is the transistor socket solder lug closest to the standoff. Put each lead through the hole in the lug and crimp securely before soldering.

14.) Solder one of the red #18 wires from the rectifier to each pass transistor collector. The collector is the center connection on the socket.

15.) Strip about $\frac{1}{2}$" of insulation off a 8" #18 green wire about 3 1/8" from one end. Strip 1/4" off each end. Wrap the $\frac{1}{2}$" bare section around the base lead lug of the right pass transistor socket and solder. Connect the short end to the other pass transistor base lead lug and solder.

16.) Strip both ends of a 15" #14 red wire back $\frac{1}{2}$". Strip both ends of a 6" #18 red wire back 1/4". Connect one end of each wire to the standoff insulator and solder.

17.) Take the heat sink, lay it fin side down, being sure that the bridge rectifier is closest to the rear edge of the chassis. Solder one of the secondary leads on the power transformer to one of the terminals marked "AC" on the bridge rectifier. Now solder the other secondary lead to the remaining lug marked "AC" on the bridge rectifier.

18.) Mount the heat sink to the main chassis with two 8-32 X $\frac{1}{2}$" screws, washers and nuts.

19.) Mount the PS-3A board on the capacitor using #10-32 hardware in the following sequence: Screw - terminal lug - flat washer - PC board - capacitor. The lug on the two #14 black wires to the negative terminal (toward the front cover), and the lug on the #14 red wire to the positive terminal. Tighten both screws securely.

ANY RESISTANCE AT THESE POINTS WILL HAVE AN ADVERSE EFFECT ON REGULATION

20.) Connect the black #14 wire to the black terminal post. Connect the red #14 wire to the red terminal post. Connect a 220 ohm 2 watt resistor between the terminal posts and solder.

21.) Solder the red #18 wire from the stand off insulator to the top (VS) terminal on the PS-3A regulator card. Solder the green #18 wire to the bottom (VO) terminal.

22.) Place the OVP on top of the capacitor bracket orienting it so that the red lead is opposite the red binding post and the black lead is opposite the black binding post. Cut and strip leads, then solder the red lead to the red binding post and the black lead to the black binding post. This completes the wiring of the PS15C power supply.

BEFORE APPLYING POWER, CAREFULLY CHECK ALL SOLDER CONNECTIONS

FINAL TEST AND ASSEMBLY

1.) Install the fuse in the fuse holder (5 amp for 100V, 3 amp for 220V).

2.) Set the voltage adjust control (R-2) in the regulator card to mid position.

3.) Connect a volt meter to the output terminals. Set the meter to read 20-50 volts full scale.

4.) Plug in supply and turn switch on. Adjust R-2 for a nominal 13.8 volts output.

5.) If the control is adjusted above 15 volts, the O.V.P. will shut down the supply. The O.V.P. is reset by turning off the supply for approximately one minute (be sure to reset control to mid position).

6.) Slide the four Tinnerman fasteners over the mounting holes on the main chassis flanges.

7.) Place the cover on the chassis with the beveled end toward the front. Line up the mounting holes with the Tinnerman fasteners and secure the cover using four #6 X 3/8 self taping screws.

TROUBLE SHOOTING

NO OUTPUT

1.) Check fuse or circuit breaker.

2.) The overvoltage protection device may be shutting down the supply as soon as it is turned on. To reset the OVP: Turn the power off - wait about one minute for the filter capacitor to discharge - turn the regulator pot down - reapply power - adjust the regulator pot for the desired output voltage.

3.) Measure voltage across filter capacitor.
   a.) If 22-25 VDC is present, proceed to step 7.
   b.) If no voltage is present, proceed to step 4.

4.) Check the bridge rectifier for shorts or open.

5.) Check the power cord continuity.

6.) Check the transformer primary and secondary for continuity.

7.) Measure the voltage at the base of the pass transistor on the PS3 card. This measurement can be made at the "VO" terminal.
   a.) If no voltage is present, proceed to step 10.
   b.) If 12-24 volts is present, proceed to step 8.

8.) Check the pass transistor on the PS3 card for open junctions.

9.) Check the .1 ohm resistors for open circuit.

10.) Measure the voltage at the base of Q1.
   a.) If the reading is 12-24 volts, Q1 may be defective. (see test chart below) Check carefully for cold solder joints.
   b.) If the reading is 0 volts, proceed to step 11.

11.) Check the voltage at IC1 pin 4.
   a.) If the reading is over 1.6 volts, check R1, R2, and R3 for open.
   b.) If the reading is below 1.6 volts, check the voltage on IC1 pins 11 and 12. If it is between 22-24 volts, IC1 may be bad. If it is 0 volts, check for open land or cold solder joints on circuit board.

VOLTAGE DROP UNDER LOAD

1.) Reduce the load and recheck the output voltage. The current limit will reduce the output voltage if a load greater than the supply can handle is applied.

2.) Check the voltage across the filter capacitor (C1) under load.
a.) If the reading is under 20 volts, proceed to step 4.
b.) If the reading is 20-24 volts, proceed to step 3.

3.) Check the solder connections to the front panel output terminals. Be sure that the screws which hold the PS3 in place are tight.

4.) Check diode D1 for an open junction.

5.) Check the solder connections between the transformer and rectifier.

6.) Be sure that the screws which hold the PS3 in place are tight.

7.) Check Q1 for an open junction (see chart below). If Q1 checks good, IC1 may be bad.

EXCESSIVE HUM

1.) Be sure that the screws which hold the PS3 in place are tight.

2.) Check the bridge rectifier for open diodes.

3.) Check line voltage. Excessively low line voltage may cause hum under heavy loads. Lowering the output voltage of the supply may correct this problem.