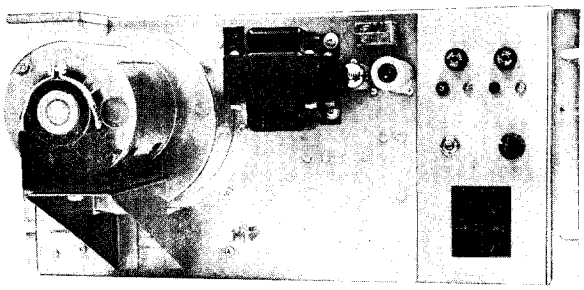
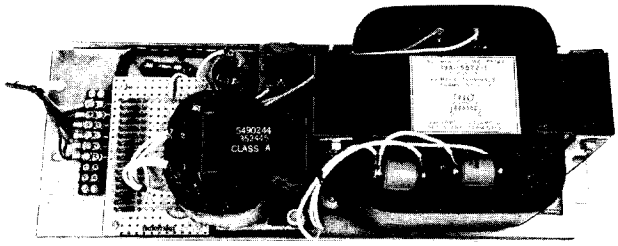
MASTR Progress Line

RF POWER AMPLIFIER POWER SUPPLY MODEL 4EP6B1



MAIN CHASSIS — FRONT VIEW



TRANSFORMER CHASSIS

SPECIFICATIONS *

Used With	Power Amplifiers EF-4-A (25-50 MHz) EF-5-A (132-174 MHz) EF-6-A (450-470 MHz)
Power Input	117 VAC ±20%, 50/60 Hz Standby: 95 Watts Transmit: 730 Watts
Power Output	2000 VDC @ 250 mA for PA Plate 300 VDC @ 25 mA for PA Screen 6 VDC @ 3 amperes for Filaments 140 VDC for Antenna Relay
Transistors	5
Silicon Rectifiers	9
Zener Diodes	3
Silicon Controlled Rectifiers	1
Tubes	(1) 6680/12AU7 (clamper circuit)
Duty Cycle	Continuous
Temperature Range	-30°C to +60°C (-22°F to +140°F)
Dimensions (H x W x D)	
Main Chassis	8-3/4" x 19" x 14-1/2"
Transformer	7" x 19" x 8-1/2"
Weight	
Main Chassis	31 pounds
Transformer	57 pounds

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

EP-6-B

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ILLUSTRATIONS

WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

DESCRIPTION

General Electric Power Supply Model 4EP6B1 supplies the filament, grid, antenna relay and high voltage to Power Amplifier Models 4EF4A1-3, 4EF5A1, and 4EF6A1. The power supply consists of a main chassis and a transformer chassis, mounted separately in the station cabinet. The overall height of the two panels is 15-3/4".

Voltages provided by the power supply are:

- 2000 VDC — B+ to PA
- 300 VDC — PA screen grid
- 6 VDC — Filaments and relays
- 140 VDC — Antenna relay
- 8 VDC — Drive relay (K454) on power supply chassis.

The high voltage output (2000 VDC) is taken from C451-1 and connected to PO#2 on the power amplifier through the station harness. The remaining voltages are fed to the power amplifier through a 4-wire cable (part of the PA) which connects to the power supply at J451.

Jacks are provided on the main chassis front panel to meter the grid current and filament voltage. The high B+ voltage is metered through the plate voltage meter located on the cabinet metering panel. Voltages are not exposed on the front side of the power supply panels. The rear cabinet door is interlocked for protection against exposure to high voltages. The high voltage indicator lamp illuminates when the high voltage supply is ON. The lamp turns off when the cabinet rear door is opened and the high voltage at C451-1 is discharged to ground by shorting bar S903.

The blower (BM451) is used to cool the PA tube and is mounted on the front of the power supply.

CIRCUIT ANALYSIS

The main chassis consists of all circuit components except the power transformer (T452), cabinet blower thermostat K455, filter choke L451, fuse F452, R457, R469, C458, C459, high voltage supply rectifiers (CR33 through CR36), R1 through R32, C455, and C456. These components are mounted on the transformer chassis.

AC INPUT

Unregulated

The high side of the 117-VAC input to the Power Supply is connected to TB451-9, and the neutral side is connected to TB451-7 and -8. Switch S452 is the control voltage ON-OFF switch with fuse F451 (1 amp) in series with the line. S451 is the supply switch to the plate transformer and blower BM451.

Regulated

When using a voltage regulator, the high side of the 117-VAC input is connected to TB451-10 and the neutral side is connected to TB451-7 and -8.

POWER CIRCUITS

Filament Supply (Figure 1)

The filament power circuit supplies a regulated (±5%) 6 VDC to the EF-4-A and EF-5-A PA tube filaments and 5 VDC to the EF-6-A tube filaments.

With the Control Switch (S452) in the ON position, power is applied to the primary of the filament voltage transformer T451. The output across the two brown secondary wires of T451 is rectified by a full-wave rectifier circuit, CR453 and CR454. The output at the center tap of T451 is filtered by choke input filter L452 and capacitors C452 and C461. The filter circuit output is applied through voltage dropping rectifier CR455 to the emitters of Q453 and Q451. If the output of Q453 and Q451 attempts to rise, the base of Q1 is made more positive. This decreases the positive voltage at the base of driver transistor Q452. Q452 will then conduct more heavily, causing a greater voltage drop across R455. The bases of Q451 and Q453 will become more positive, thereby cutting off Q451 and Q453 and keeping the voltage at the output terminal at a ±5% regulated voltage level.

If the output of Q453 and Q451 drops, Q1 conducts less, decreasing the forward bias on Q452 and reducing the voltage drop across R455. This will cause Q451 and Q453 to conduct more heavily and hold the output voltage within the ±5% regulated level.

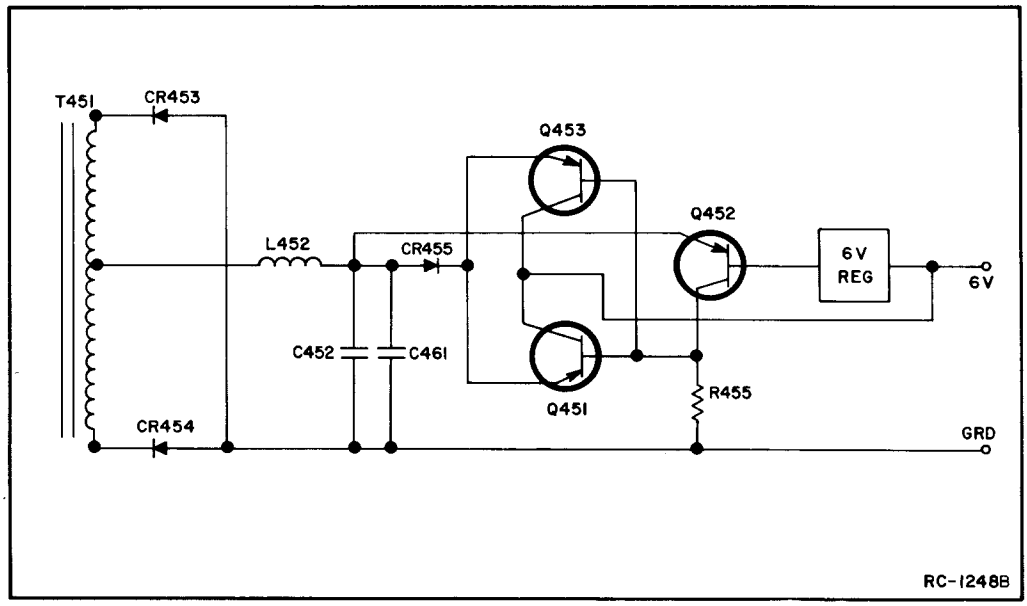

Figure 1 - Filament Supply

R4 seldom requires any adjustment. It is adjusted to 6 VDC for use with power amplifier type EF-4-A and EF-5-A and 5 VDC with power amplifier type EF-6-A at the factory for the proper ±5% regulation required from the A451 circuit.

Filament measuring jacks (J1 and J2) are provided on the A451 board as an aid to servicing the equipment and are accessible from the rear of the supply. Use a DC voltmeter to measure the filament voltage at J1 and J2.

Re-adjust R4 only when service or troubleshooting checks indicate the output is not rated value.

Antenna Relay Supply (Figure 2)

The 140 VDC is supplied to the antenna relay located on the left rear of the power amplifier chassis. The 140 VDC is a keyed voltage derived from a half-wave rectifier circuit consisting of CR451 and C453 across the 117 VAC line. The output is measured from TB452-7 to -8.

Drive Relay Supply (Figure 3)

The drive relay supply is a half-wave rectifier circuit (CR452, C454, and R452) across the yellow-yellow secondary leads of T451 to provide 8 VDC keyed voltage to grid drive relay K454.

High Voltage Plate Supply (Figure 4)

The high voltage supply provides 2000 volts for the PA tube plate circuit. The full-wave bridge rectifier circuit consists of eight silicon rectifiers in each leg of the bridge (32 rectifiers total). The bridge circuit is connected across the secondary of power transformer T452. The rectified output is filtered by choke L451 and capacitor C451. R457, R469, C458, and C459 form a ringing suppression circuit. The high voltage output is taken off at terminal 1 of C451 and is connected to the

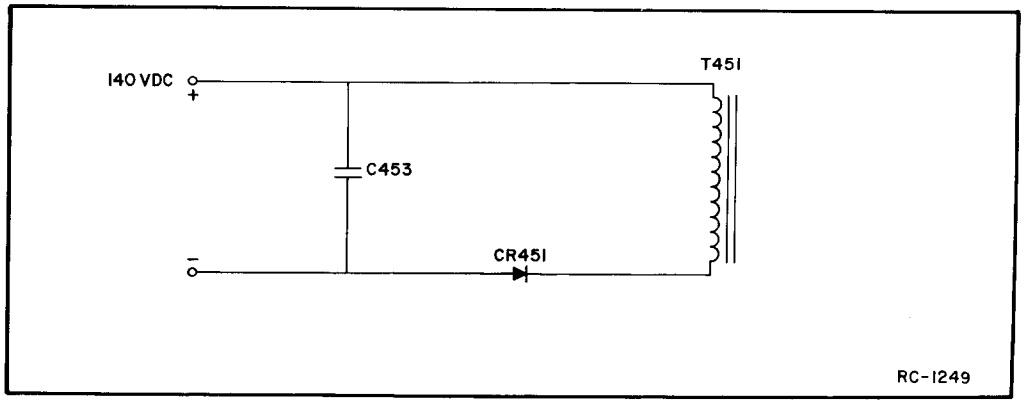

Figure 2 - Antenna Relay Supply

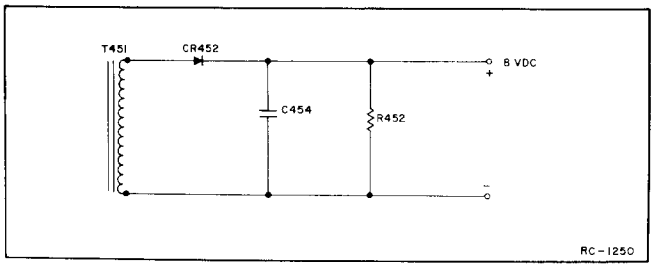

Figure 3 - Drive Relay Supply

power amplifier unit through the station harness.

Screen Voltage Supply (Figure 5)

The screen voltage supply provides 300 VDC for the PA tube screen grids. Screen voltage is obtained for the PA tube by use of a voltage divider in the plate supply circuit of the high voltage power supply. The voltage divider network (R462, R460, and R461) also serves as a bleeder. The screen voltage may be varied by adjusting the screen control R461 located on the front of the power supply chassis. Resistors R465, R466, and R467 are the voltage dividers for the metering terminal TB451-2.

The screen voltage supply maintains a constant power output, limiting screen current, and preventing plate voltage from appearing at the PA circuit, (for added protection) if plate voltage is not present.

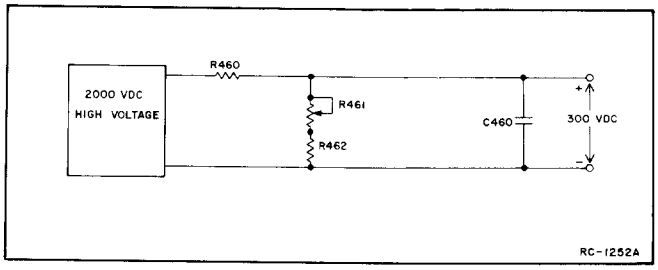

Figure 5 - Screen Voltage Supply

CONTROL CIRCUITS

Overload and Overload Hold Circuit

Silicon controlled rectifier (SCR1) is driven by excessive current in the secondary of the high voltage supply. When SCR1 fires, it shunts the drive to trigger transistor Q1. SCR1 operates until the drive is removed from the PA.

Grid Drive Circuit

Q1 keys grid drive relay K454, when driven by the self-developed grid bias from the PA tube. Indicator lamp I453 becomes illuminated as soon as the drive relay becomes energized. Grid current can be measured at grid jack J452 located on the front of the power supply chassis.

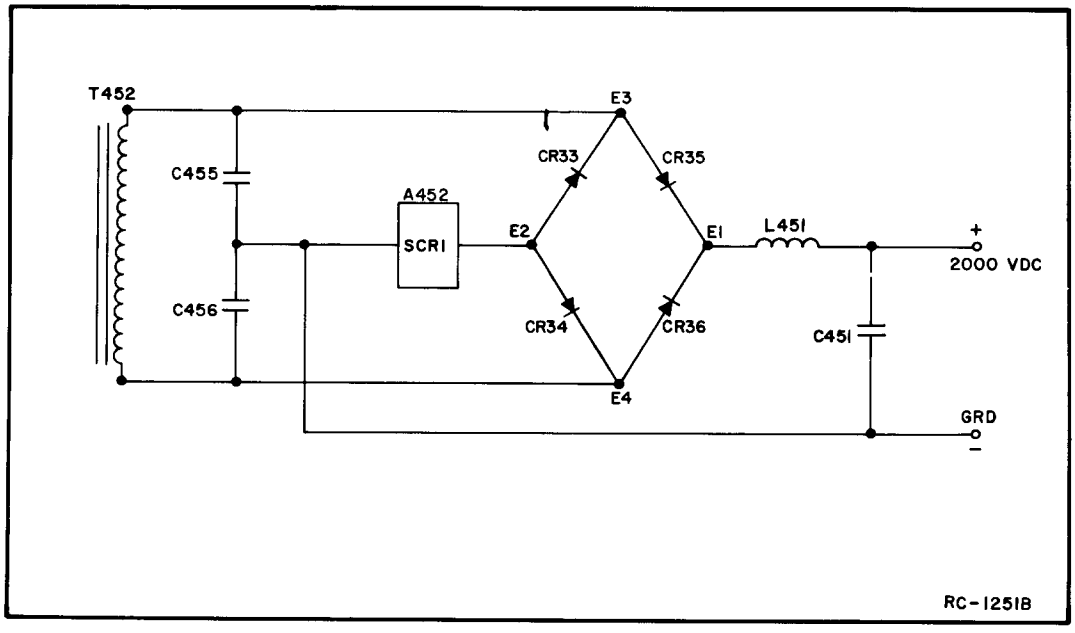

Figure 4 - High Voltage Supply

Screen Clamping Circuit

The V451 clamper tube (6680) is connected to the PA screen to hold the PA screen at a safe level when the self-developed bias on the PA tube is shut off. With no grid drive present, the clamper conducts, lowering its own plate voltage and the PA screen voltage. This action holds the PA plate current at a safe level. With grid drive present, the clamper cuts off and allows the circuit to rise to its normal level.

CAUTION

K454 and V451 are connected in parallel to protect the power amplifier tube when the transmitter is unkeyed. If V451 goes bad, pins 9 and 10 of K454 may weld together. If relay K454 is replaced, check V451.

External Interlock (S902)

Safety interlock switch S902, is mounted on the rear of the equipment cabinet and is connected to TB451-4 and -5 on the power supply chassis. Opening the rear door opens the interlock switch, causing K454 to de-energize. This opens the primary of the plate supply and turns OFF the Plate indicator light I451. Shorting bar S903 shorts the high voltage terminal on C451 to ground when the cabinet rear door is opened.

Air Flow Switch (K451)

Air Flow switch K451 (thermostat) with resistor R453 is located in the air duct of the blower mounted on the main power supply chassis. If the air fails and the thermostat temperature exceeds 200°F K451-1 and -2 will open, causing plate relay, K453 to de-energize and open the primary of the plate supply.

Plate Relay (K453)

When plate relay K453 is energized, 117 VAC is supplied to plate transformer T452. Plate relay K453 is connected in series with the grid drive relay (K454) to allow the proper grid current to develop before the 117 VAC is applied to the T452 primary.

Drive Relay (K454)

Drive relay K454 is energized only when adequate current exists in the grid circuit. When K454 is energized, it causes (1) the Grid current indicator lamp to light; (2) the filament voltage dropping resistor to be shorted out; (3) the PA screen to become ungrounded; (4) a set of contacts to close in series with the plate relay coil K453 so that the antenna relay becomes energized.

Cabinet Blower Thermostat (K455)

Thermostat for optional cabinet blower (K455) is located on the transformer chassis. A lead from the thermostat is brought out to TB451-6 for connection to the cabinet blower. The high side of the thermostat connects to the line through fuse F452. Whenever the temperature inside the cabinet exceeds 120°F, the thermostat cuts in, allowing the blower to operate. When the temperature in the cabinet drops to 100°F, the thermostat cuts off, causing the blower to stop.

Time Delay Relay (K456)

The thermal time delay relay K456 is actuated by the 6-volt filament circuit. It provides a 45-second time delay before closing a set of contacts in the primary circuit of the plate supply. This delay allows sufficient time for PA tube filament to warmup before plate voltage is applied to the PA tube.

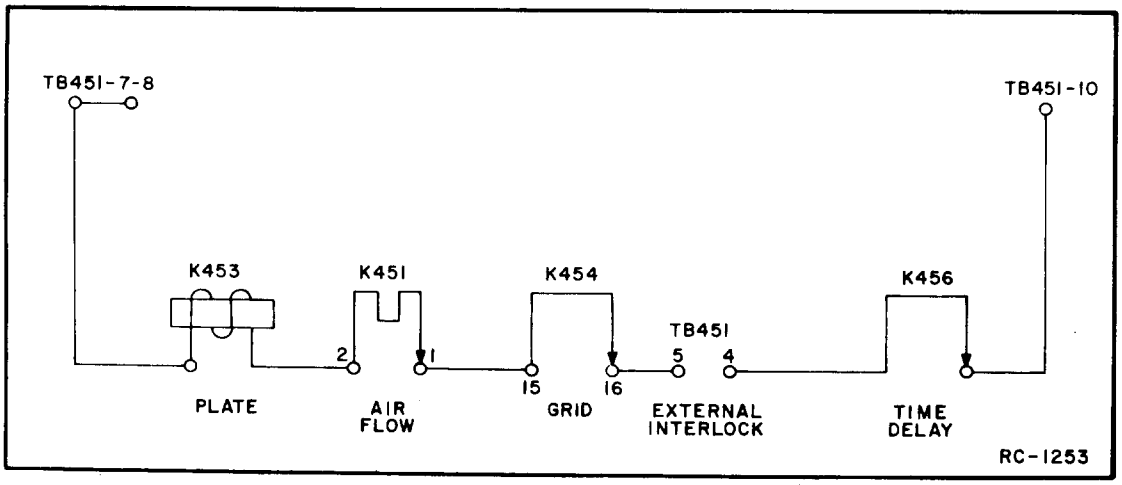

Figure 6 - Plate Relay String

INDICATORS

Plate (I451)

Plate indicator lamp (red) on the main chassis front panel becomes illuminated when the PA plate high voltage is turned ON.

Time Delay (I452)

Time Delay lamp (amber) on the main chassis front panel becomes illuminated when the time delay relay (K456) is energized.

Grid (I453)

Grid lamp (amber) on the main chassis front panel becomes illuminated when the proper grid bias is present at the PA tube grid.

Plate (I454)

Plate lamp (red) on the rear of the main chassis becomes illuminated when the PA plate high voltage is turned ON.

METERING

PA Plate Voltage

The PA plate voltage meter M904 is mounted on the cabinet meter panel and is connected to TB451-1 and -2 on the power supply chassis. R467 is the plate voltage metering resistor.

PA Plate Current

The PA Plate Current Meter M903 is mounted on the cabinet meter panel and is connected as shown in Figure 7. Note that both the PA screen current (approximately 25 mA) and PA plate current pass through the meter. To obtain actual plate current, subtract 25 mA from the meter reading.

Grid

To measure grid voltage, insert the probe from one of the tuning meters on the cabinet meter panel into grid jack J452 on the power supply chassis. R10 is the metering resistor for J452.

Filament

The filament metering jacks (J1 & J2) are located on the 6-VDC regulator board (A451).

ADJUSTMENT

The following adjustments have been made at the factory. They should be checked and adjusted only during periodic maintenance checks and when troubleshooting.

FILAMENT

Measure output at test points J1 and J2 on 6-VDC regulator board A451. Adjust R4 for 6 VDC when the power amplifier is type EF-4-A or EF-5-A; adjust R4 for 5 VDC when the type EF-6-A power amplifier is used.

SCREEN

Refer to "Alignment Procedure" in Power Amplifier Maintenance Manual for adjustment of screen control R461.

PLATE OVERLOAD

Plate Overload potentiometer R1 on the A452 board has been set at the factory to maintain plate current at 350 mA. A plate current of 375 mA turns on SCR1, causing the plate voltage to drop out.

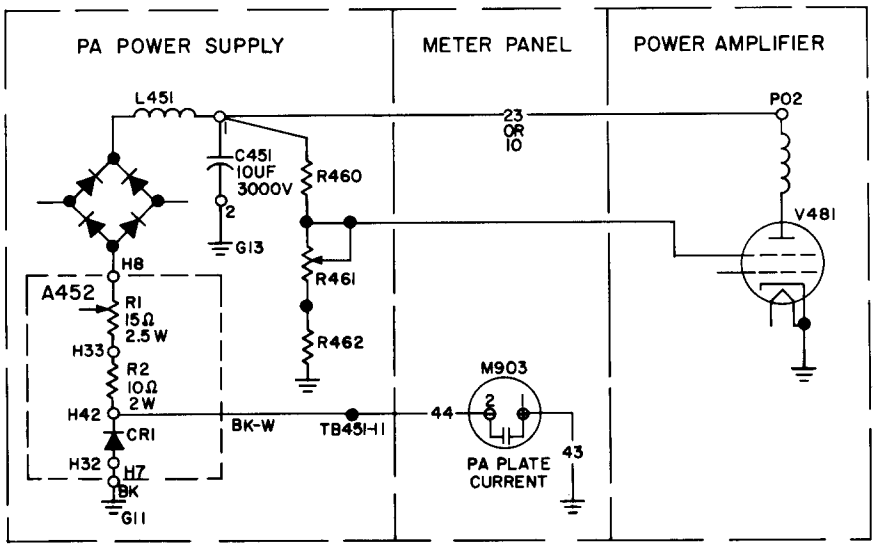

Figure 7 - PA Plate Current Metering Circuit

MAINTENANCE

To obtain optimum performance from the equipment, a program of regular preventive maintenance should be followed. This preventive maintenance should include the following:

1. A mechanical inspection of the unit for loose, broken or damaged components.
2. A check of the input voltage.
3. Measurement of PA PLATE voltage (M904), PLATE current (M903), GRID current (J452), and FILAMENT (J1 and J2). A log should be kept of these readings when the equipment is first installed so that tube or component failures can be anticipated and the defect corrected before trouble becomes serious.
4. Check clamper tube V451.
5. Blower and relay maintenance as described in the sections below:

BLOWER

The blower which is installed on the Power Supply and used for cooling the PA tube on the Power Amplifier should be cleaned periodically to maintain its efficiency. The motor bearings must be oiled (with an oil similar to Gulfcrest A (WCR) low viscosity) every three months. Do not allow oil to get on the impeller blades. If the impeller blades have become coated with oil they should be removed, washed in a grease solvent and hot water, and then replaced.

RELAYS

The relays in these units require little care. However, they should be inspected periodically to assure maximum operating efficienty. If the contacts become pitted, they should be cleaned with a burnishing tool to smooth out any metallic deposits. When relay contacts carry little or no current, the contacts do not clean themselves and an insulating coating is apt to form. This coating may be removed by cleaning the contacts with a burnishing tool. Do not oil the relay bearings. When relays are in dusty locations, lubricated bearings will collect dust and grit and will wear more rapidly than non-lubricated bearings. Some of the relays used are of the multiple-contact type and, in the unenergized position, should have contact spacings of approximately 0.1625 to 0.125 inch. More important, the contact spacings on any multiple-contact relay should be equal so that the contact pressures will be equal when the relay is energized. The back pressure of the antenna relay should be at least 15 grams. Low back pressure will shorten the life of contacts, due to excessive arcing, and may also cause noise in the receiver, due to chatter of the antenna relay contact.

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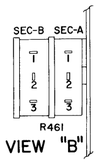
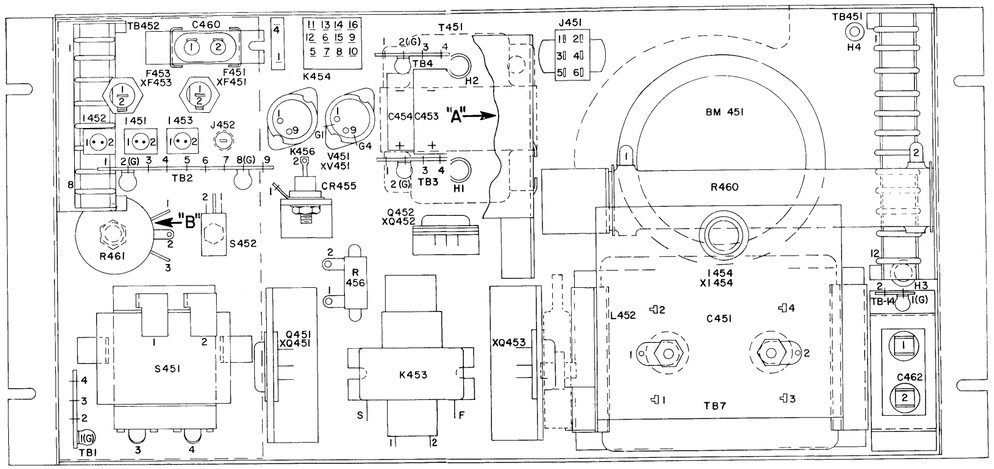
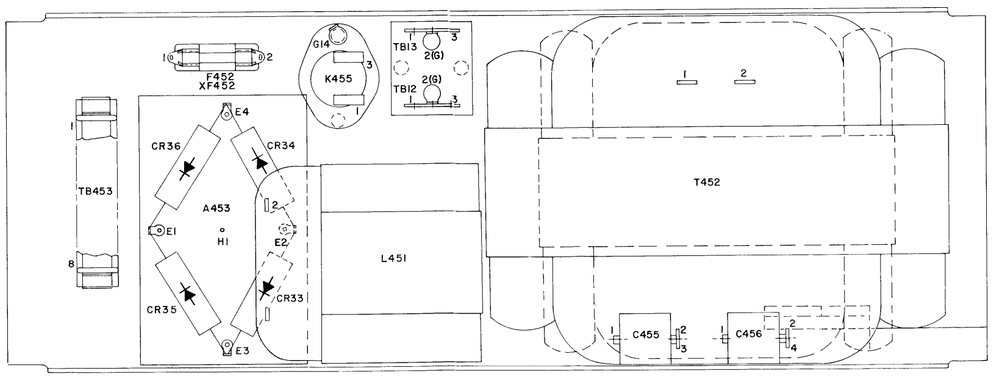
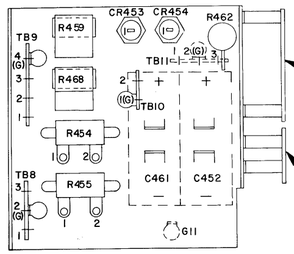




MAIN CHASSIS - REAR VIEW

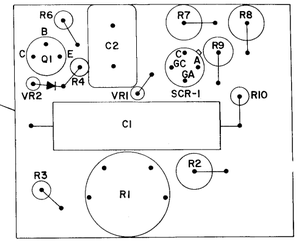


TRANSFORMER CHASSIS - REAR VIEW

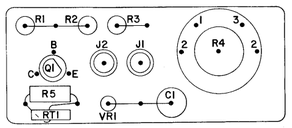


VIEW "A"

OVERLOAD & RF SENSING A452



6-VDC REGULATOR A451



VOLTAGE & RESISTANCE READINGS

CONDITIONS OF MEASUREMENT:

1. ALL MEASUREMENTS MADE FROM INDICATED POINT TO CHASSIS WITH ALL CABLES DISCONNECTED FROM UNIT.
2. VOLTAGES ARE TYPICAL READINGS ON A 20,000 OHM-PER-VOLT DC METER, UNLESS OTHERWISE NOTED.
   A- WHERE TWO VOLTAGES ARE GIVEN FOR ONE POINT (I.E. 0.6,0 V) FIRST READING IS FOR "STANDBY" AND SECOND IS FOR "TRANSMIT".
3. ALL MEASUREMENTS MADE WITH A METER RANGE THAT GIVES ONE-THIRD TO FULL SCALE DEFLECTION OF THE METER.
4. ALL DC VOLTAGES ARE POSITIVE WITH RESPECT TO CHASSIS, UNLESS MARKED "−" FOR NEGATIVE.
5. RESISTANCE ARE TYPICAL READINGS WITH ALL VOLTAGES REMOVED.

NUMBER	VOLTAGE ± 10	RESISTANCE ± 20	FUNCTION
TB451-1	0	0	GROUND
-2	0	430K	PLATE VOLTAGE
-3	--	---	--------
-4	117 VAC	---	CABINET INTERLOCK
-5	117 VAC	---	CABINET INTERLOCK
-6	117 VAC ✱	---	BLOWER
-7	117 VAC NEUTRAL	---	--------
-8	117 VAC NEUTRAL	---	--------
-9	117 VAC HIGH	---	UNREGULATED PLATE
-10	117 VAC HIGH	---	REGULATED CONTROL
-11	---	---	--------
-12	---	---	--------
TB452-1	117 VAC NEUTRAL	---	T452 PRIMARY
-2	117 VAC HIGH	---	T452 PRIMARY
-3	0	0	T452 CENTER TAP
-4	117 VAC HIGH	---	-----
-5	117 VAC HIGH	---	T451 PRIMARY
-6	117 VAC NEUTRAL	---	-----
-7	--------	---	ANTENNA RELAY
-8	140 VDC	---	ANTENNA RELAY
J452-1	0	0	GROUND
-2	5.5 TO 6 VDC	0	FILAMENT
-3	-35 TO -125 VDC	5100	GRID
-4	150 TO 300 VDC ✱✱	5K TO 50K	SCREEN
C451-1	2000 VDC ✱✱✱	85K TO 135K	HIGH VOLTAGE

✱ OPERATE ABOVE 50°C

✱✱ DETERMINED BY THE SETTING OF R461 (SCREEN ADJUSTMENT)

✱✱✱ MEASURED ON METER M904.

POWER SUPPLY OUTPUT READINGS

STAGE	TEST POINT	OUTPUT
FILAMENT	J1 & J2	6 VDC
GRID	J452 & GROUND	2.5 VDC (0.7 TO 2.5 VDC FOR EF-6-A POWER AMPLIFIER)
SCREEN ✱	ADJUST R461	250 MA
PA PLATE ✱✱	M904 METER	2000 VDC
ANTENNA RELAY	TB3-4(+) & TB4-3(−)	140 VDC
GRID DRIVE RELAY	TB3-1(+) & TB4-1(−)	8 VDC

✱ SCREEN IS ADJUSTED BY R461 TO OBTAIN 250 MA MAX. ON PLATE CURRENT METER M903.

✱✱ WITH METER SWITCH IN PLATE VOLTAGE POSITION, CHECK VOLTAGE READING ON PLATE VOLTAGE METER M904.

OUTLINE DIAGRAM

POWER SUPPLY MODEL 4EP6B1

(19R620755, Rev. 2)

TROUBLESHOOTING PROCEDURES

QUICK CHECKS

SYMPTOM	CHECK THE FOLLOWING
No power supply output voltages when unit is keyed.	1. Fuses F451, F452, and F453.
	2. TB451-8-9 for 117 VAC unregulated, if used.
	3. TB451-8-10 for 117 VAC regulated, if used.
	4. TB452-1-2 for 117 VAC.
	5. TB453-1-2 for 117 VAC.
	6. K454 should become energized, when RF is applied to the PA.
	7. S452, T451, CR451, C453, and K456 for opens or shorts.
No 2000 VDC reading on PA Plate voltmeter (M904).	1. C451, R469, R457, C458, C459, and BM451 for opens or shorts.
	2. CR33 through CR36 on rectifier board (A453).
	3. T452, C455, and C456 for opens or shorts.
No Grid voltage at J452.	R461, C460, K454 for opens or shorts.
No 140 VDC at TB452-7-8.	C453 and CR451 for opens or shorts.
No 6 VDC at J1 & J2.	Q1, R4, C1, Q452, Q453, Q451, CR455, and R455 for opens or shorts. Open F453.
No 8 VDC at TB3-1.	1. CR452, C454, R452 for opens or shorts.
	2. Check for 8 VDC across T451 yellow-yellow leads.
No screen current reading on PA plate current meter (M904).	1. 2000 VDC must be operating properly, then check R460, R461, R462, and C460 for opens or shorts.
	2. Check 12AU7.
Blower does not operate.	K462, K455, K451, and R453 for opens or shorts. Open F452.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT. FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
19D402530G1	E
19D402530G2	C

● ADD JUMPER WHEN POWER SUPPLY IS USED WITH THE 4EP6A1 POWER AMPLIFIER.

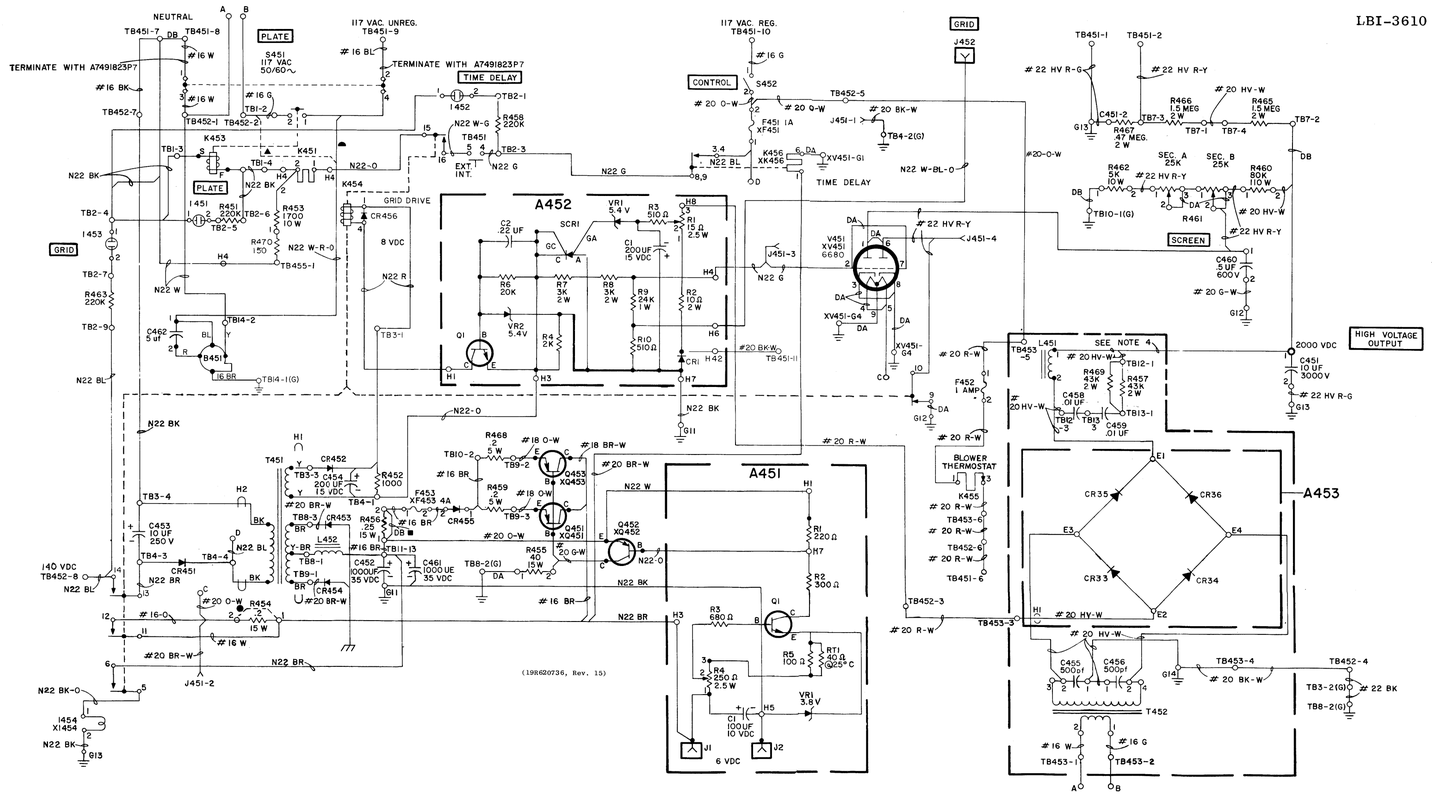
◓ FOR CONTINUOUS BLOWER OPER.

▲ FOR KEYED BLOWER OPER.

■ REMOVE JUMPER ONLY WHEN POWER SUPPLY IS USED WITH THE 4EP6A1 POWER AMPLIFIER.

ALL RESISTORS ARE ½ WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.



SCHEMATIC DIAGRAM

POWER SUPPLY MODEL 4EP6B1

PARTS LIST

LBI-3599E

POWER SUPPLY
MODEL 4EP6B1
19D402530G1, G2

SYMBOL	GE PART NO.	DESCRIPTION
		MAIN CHASSIS 19D402530G1
A451		COMPONENT BOARD ASSEMBLY 19C303760G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5496267P7	Tantalum: 100 µf ±20%, 10 VDCW; sim to Sprague Type 150D.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J1	4037265P2	Jack, tip, stake-in: red melamine body; sim to Component Mfg Service A-1128.
J2	4037265P1	Jack, tip, stake-in: black phen body; sim to Component Mfg Service A-1128.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A115123P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77P221J	Composition: 220 ohms ±5%, 1/2 w.
R2	3R77P301J	Composition: 300 ohms ±5%, 1/2 w.
R3	3R77P681J	Composition: 680 ohms ±5%, 1/2 w.
R4	19B209113P1	Variable, wirewound: 250 ohms ±20%, 2.5 w.
R5	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
		- - - - - - - - - - THERMISTORS - - - - - - - - - -
RT1	5490828P17	Disc: 40 ohms ±10%, 1.25 w max; sim to Globar Type C1605H-1.
		- - - - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR1	4036887P3	Silicon, Zener.
A452		COMPONENT BOARD ASSEMBLY 19B205029G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	7489483P20	Electrolytic: 200 µf +75% -10%, 15 VDCW; sim to Sprague 30D174A1.
C2	19A115028P16	Polyester: 0.22 µf ±20%, 200 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1*	4037822P1	Silicon. Added by REV D.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A115300P1	Silicon, NPN; sim to Type 2N3053.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	19B209113P4	Variable, wirewound: 15 ohms ±10%, 2.5 w.
R2	19A116310P23	Composition: 10 ohms ±5%, 2 w.
R3	3R77P511J	Composition: 510 ohms ±5%, 1/2 w.
R4	3R77P202J	Composition: 2000 ohms ±5%, 1/2 w.
R6	3R77P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R7 and R8	3R79P302J	Composition: 3000 ohms ±5%, 2 w.
R9	3R78P243J	Composition: 24,000 ohms ±5%, 1 w.
R10	3R77P511J	Composition: 510 ohms ±5%, 1/2 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
SCR1	19A115198P1	Silicon controlled; sim to Type 3N81.
		- - - - - - - - VOLTAGE REGUULATORS - - - - - -
VR1 and VR2	4036887P5	Silicon, Zener.
		- - - - - - - - - - MOTORS - - - - - - - - - -
BM451*	19A116674P1	AC: 115 v ±20%, 50/60 Hz, 1/12 hp; cw rotation; sim to GE 5KCP19DG.
		In REV J:
	19A115844P1	AC: 115 v ±20%, 50/60 Hz, 1/12 hp; cw rotation; sim to GE 5KCP14DG.
		In REV H:
	19A116562P1	Centrifugal: single phase, .70 amps at 60 Hz, cw rotation; sim to Rotron Inc Model, DRPP, Type KS-3503. Motor Series 364AS.
		In REV C-G:
	19A115844P1	AC: 115 v ±20%, 50/60 Hz, 1/12 hp; cw rotation; sim to GE 5KCP14DG.
		In Models earlier than REV C:
	5490269P1	AC: 115 v ±20%, 50/60 Hz, 1.10/1.30 amps, 3450/2850 RPM, 1/20 hp, cw rotation; sim to GE 5KH14CG44A.
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C451	5495580P2	Paper: 10 µf ±10%, 3000 VDCW; sim to GE 28F637.
C452	5493132P1	Electrolytic: 1000 µf +250% -15%, 35 VDCW; sim to GE 43F2066AA1.
C453	7774786P22	Electrolytic: 10 µf +100% -10%, 250 VDCW; sim to PR Mallory TC52.
C454	7489483P20	Electrolytic: 200 µf ±75% -10%, 200 VDCW; sim to Sprague Type 30D.
C460	3R121P8	Paper: .05 µf ±10%, 600 VDCW; sim to GE 23F870.
C461	5493132P1	Electrolytic: 1000 µf +250% -15%, 35 VDCW; sim to GE 43F2066AA1.
C462*	19B209391P1	Paper: 5 µf ±10%, 370 VRMS at 60 Hz; sim to GE 72F5021FB.
		In REV H:
	3R88P7	Paper: 2 µf ±10%, 1000 VDCW; sim to Pittsfield 23F1026G2.
		In REV C-G:
	19B209391P1	Paper: 5 µf ±10%, 370 VRMS at 60 Hz. Added by REV C.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR451 and CR452	4037822P1	Silicon.
CR453 and CR454	4037898P2	Silicon.
CR455	4037898P1	Silicon.
CR456*	4037822P1	Silicon. Added by REV A.
		- - - - - - - - - - - FUSES - - - - - - - - - - -
F451	7487942P5	Slow blowing: 1 amp at 250 v; sim to Bussmann MDL-1.
F453	1R16P7	Quick blowing: 4 amps at 250 v; sim to Littelfuse 312004 or Bussmann MTH-4.
		- - - - - - - INDICATING DEVICES - - - - - - -
I451	4029824P3	Light, indicator, glow: red lens; sim to E-Lite Type 1B2.
I452 and I453	4029824P2	Light, indicator, glow: amber lens; sim to E-Lite Type 1B2.
I454	19C307037P3	Lamp, incandescent: miniature, 14.5 v ±.01 v; sim to GE 53.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J451	7473192P4	Connector, phen: 6 female contacts rated 10 amps at 730 VRMS; sim to HB Jones 261-32-06-010.
J452	7150763P4	Jack, tip, stake-in: nylon body, 600 VRMS max; sim to Alden Products 110BC1-green.
		- - - - - - - - - - - RELAYS - - - - - - - - - - -
K451	19B216653G1	Thermal Relay Assembly. Includes: Thermostat, disc type: temp range -200°F ±5% open, 175°F ± 10% close; rated 10 amps at 110 VAC, 60 Hz. Resistor, wirewound 1700 ohms ±10%, 10 w.
K452*	5490225P1	Armature, enclosed: 117 VAC ±20%, 50/60 Hz operating, 1 form A contact, rated 10 amps; sim to R-B-M 91252-184. Deleted by REV C.
K453	19B209287P1	Mercury plunger: 117 VAC ±20%, 5 w operating, 1 form C contact, rated 30 amps at 110 VAC or 5 amps at 110 VDC; sim to Durakool BF-2376.
K454	5491595P18	Armature: 1.5 w max operating, 90 ohms ±15% coil res, 5 form A and 1 form B contacts, rated 1 amp at 12 VDC; sim to Allied Control T154-X-187.
K456	5490322P12	Thermal, time delay: 9-pin miniature base, SPST, NO, rated 3 amps at 115 VAC, 6.3 v heater, 45 sec ±25% time delay; sim to Amperite 6NO45T.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L452	19B209080P1	Reactor: 12 mh min, 0.3 ohm DC res max, 150 v peak, 18 VDC operating.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q451	19A115268P1	Germanium, PNP.
Q452	19A115376P1	Germanium, PNP.
Q453	19A115268P1	Germanium, PNP.
		- - - - - - - - - - - RESISTORS - - - - - - - - - -
R451	3R77P224K	Composition: 0.22 megohm ±10%, 1/2 w.
R452	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R453		(Part of Thermal Relay Assembly K451).
R454	5496941P4	Wirewound: 0.2 ohm ±10%, 15 w; sim to Tru-Ohm Type MOR-15.
R455	5496941P27	Wirewound: 40 ohms ±5%, 15 w; sim to Tru-Ohm Type MOR-15.
R456	5496941P5	Wirewound: 0.25 ohm ±10%, 15 w; sim to Tru-Ohm Type MOR-15.
R458	3R77P224K	Composition: 0.22 megohm ±10%, 1/2 w.
R459	5493035P16	Wirewound: 0.2 ohms ±10%, 5 w; sim to Tru-Ohm Type X-60.
R460	2R19P120	Wirewound: 80,000 ohms ±5%, 110 w; sim to Ward Leonard K41391-2.
R461	5490213P1	Variable, wirewound: 50,000 ohms ±10%, 4 w; sim to Chicago Telephone Supply Type 25.
R462	2R12P38	Wirewound: 5000 ohms ±5%, 10 w; sim to Ward Leonard K41382-1.
R463	3R77P224K	Composition: 0.22 megohm ±10%, 1/2 w.
R465 and R466	5496955P518	Deposited carbon: 1.5 megohm ±1%, 2 w; sim to Texas Instrument CD2R.
R467	3R79P474K	Composition: 0.47 megohm ±10%, 2 w.
R468	5493035P16	Wirewound: 0.2 ohms ±10%, 5 w; sim to Tru-Ohm Type X-60.
R470*	3R79P151J	Composition: 150 ohms 5%, 2 w. Added by REV F.
		- - - - - - - - - - - SWITCHES - - - - - - - - - -
S451	5490331P2	Circuit breaker: DPST, 10 amps; sim to Trumbull TQL2120 (modified).
S452	7478623P1	Toggle: SPST, 3 amps at 250 VDC; sim to Arrow-Hart and Hegeman 20994-BJC.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - -
T451	19B209277P1	Power, step-down: Pri: 117 VRMS, 50/60 Hz, Sec 1: 10 VDC ±3%, Sec 2: 8 VDC ±3%.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB1	7775500P3	Phen: 4 terminals.
TB2	7775500P25	Phen: 9 terminals.
TB3 and TB4	7775500P108	Phen: 4 terminals.
TB7	19A121898G1	Terminal board: 4 contacts.
TB8	7775500P7	Phen: 3 terminals.
TB9	7775500P6	Phen: 4 terminals.
TB10	7775500P4	Phen: 2 terminals.
TB11	7775500P7	Phen: 3 terminals.
TB14*	7491825P1	Terminal, solderless: sim to AMP 33766.
		Earlier than REV G:
	7775500P4	Phen: 2 terminals. Added by REV C.
TB451	19C301086P8	Feed-thru, phen: 12 terminals rated at 15 amps at 1200 VRMS; sim to GE CR151D.
TB452	19C301086P5	Feed-thru, phen: 8 terminals rated at 15 amps at 1200 VRMS; sim to GE CR151D.
TB455*	7775500P44	Phen: 2 terminals. Added by REV F.
		- - - - - - - - - - - TUBES - - - - - - - - - - -
V451		Type 6680.
		- - - - - - - - - - - SOCKETS - - - - - - - - - -
XF451	19B209005P1	Fuseholder, post type, phen: 15 amps at 250 v; sim to Littelfuse 342012.
XF453	19B209005P1	Fuseholder, post type, phen: 15 amps at 250 v; sim to Littelfuse 342012.
XI454	7141855P5	Light, indicator, incandescent: light red translucent plastic lens; sim to Dialight 95-410-951.
XK454	5491595P5	Relay: 16 contacts; sim to Allied Control 30054-2.
XK456	7480532P3	Tube, mica-filled phen: 9 pins rated at 1 amp at 500 VRMS; sim to Elco 04-915-18.
XV451	7480532P8	Tube, mica-filled phen: 9 pins rated at 1 amp at 500 VRMS; sim to Elco 04-903-84.
XQ451 thru XQ453	5491888P1	Transistor, power, phen: sim to Cinch 133-92-10-034.
		TRANSFORMER CHASSIS 19D402530G2
A453*		RECTIFIER BOARD ASSEMBLY 19C303735G2 (Added by REV B)
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR33 thru CR36	19A115808P1	Silicon.
		In Models of REV A and earlier:
A453*		RECTIFIER BOARD ASSEMBLY 19C303735G1
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1 thru CR32	4037822P2	Silicon.
		- - - - - - - - - - - RESISTORS - - - - - - - - - -
R1 thru R32	3R77P105K	Composition: 100,000 ohms ±10%, 1/2 w.
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C455 and C456	5490306P2	Ceramic: 500 pf +50% -20%, 20,000 VDCW; sim to Sprague 708C50.
C458 and C459	5490825P3	Ceramic disc: 10,000 pf +100% -20%, 2000 VDCW; sim to RMC JF Discap.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR456*	4037822P1	Silicon. Added by REV A. Deleted by REV B.
		- - - - - - - - - - - - FUSES - - - - - - - - - - -
F452	7487942P5	Cartridge, slow blowing: 1 amp at 250 v; sim to Bussmann MDL-1.
		- - - - - - - - - - - - RELAYS - - - - - - - - - - -
K455	5490221P1	Thermostst, disc type: temp range -100°F ±5° open, 120°F ±5° closed; rated 10 amps at 120/240 VAC or 12 amps at 30 VDC; sim to Spencer-Klixon 20400F46-14/F120-2.
		- - - - - - - - - - - INDUCTORS - - - - - - - - - -
L451	5490244P1	Choke: 10 h min, 100 ohms DC res max, 1400 v peak, 2000 VDC operating.
		- - - - - - - - - - - RESISTORS - - - - - - - - - -
R457	3R79P433J	Composition: 43,000 ohms ±5%, 2 w.
R469	3R79P433J	Composition: 43,000 ohms ±5%, 2 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - -
T452	19A115572P1	Power, step up: Pri: 117 VRMS, 50/60 Hz, Sec: 2000 VDC ±3%.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB12 and TB13	7775500P7	Phen: 3 terminals.
TB453	19C301087P4	Phen: 8 terminals rated at 15 amps at 1200 VRMS; sim to GE CR151D.
		- - - - - - - - - - - SOCKETS - - - - - - - - - -
XF452	7141008P1	Fuseholder: 5 amps at 125 v; sim to Littelfuse E-357001.
		- - - - - - - - - - - - CABLES - - - - - - - - - - -
W451	19B205094G1	Cable: includes 12 spade terminals, approx 13-3/4 inches.
		MECHANICAL PARTS
	5490323P1	Blower housing: sim to Detroit Stamping Type 350. (Used in 19D402530G1).
	7484137P3	Fan impeller: centrifugal, cw rotation; sim to Torrington Type 326-128. (Used in 19D402530G1).
	7487773P5	Set screw knob: sim to Eastman Chemical 28739. (Used with R461 in 19D402530G1).
	4038930P1	Clip. (Used with R459, 468 in 19D402530G1).
	7118719P6	Spring tension clip: sim to Prestole E-50008-038. (Used with C452, 461 in 19D402530G1).
	4036899P4	Standoff insulator: ceramic; sim to Centralab 3BX3778C. (Used with TB12, 13 in A453, 19D402530G2).
	7142162P76	Spacer. (Used with K455 in 19D402530G2).
	4034401P1	Insulator. (Used with L451 in 19D402530G2).
	4035306P53	Fiber washer. (Used with insulated standoff in A453, 19D402530G2).
	7480532P7	Tube shield: sim to Elco 04-991-06. (Used with K456 in 19D402530G1).
	7486892P3	Bracket, capacitor mounting: (Used with C460 in 19D402530G1).
	7142162P91	Spacer. (Used in A451, 452, 19D402530G1).
	4029416P1	Oiler, hand: sim to Eagle Mfg 968. (Oil can for blower, used in 19D402530G1).
	7118719P4	Clip, spring tension: sim to Prestole E-50005-038. (To hold oil can, used in 19D402530G1).
	4036555P1	Insulator, washer: nylon. (Used with Q1, SCR1 in A452, 19D402530G1).

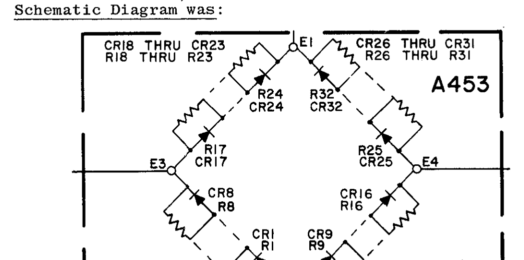
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

PRODUCTION CHANGES

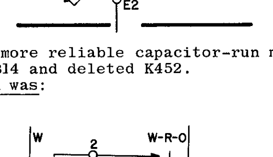
Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - To provide relay arc-suppression. Added CR456.

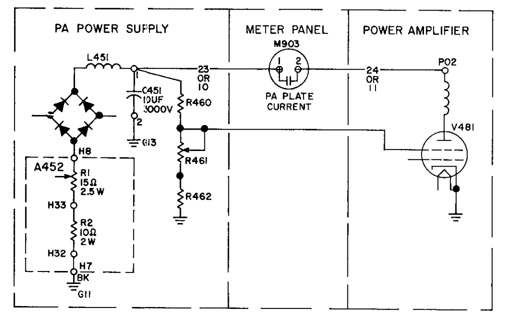
REV. B - To improve reliability on Rectifier Board A453, replaced C1 thru C32 with C33 thru C36, and deleted R1 thru R32.
Schematic Diagram was:



REV. C - To incorporate a more reliable capacitor-run motor. Replaced BM451, added C462 and TB14 and deleted K452.
Schematic Diagram was:



REV. D - To eliminate PA plate meter damage if 2000 VDC line becomes shorted. Added CR1 to A452 and changed meter connection point.

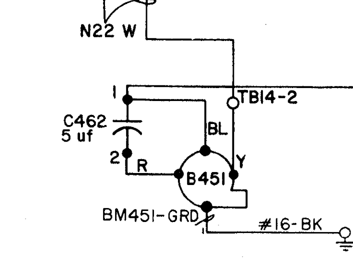


REV. E - To eliminate contact arcing between pin 8 and pin 9 on relay K454. Wires connecting to K454-7 and -8 were moved to K454-13 and -14, respectively.

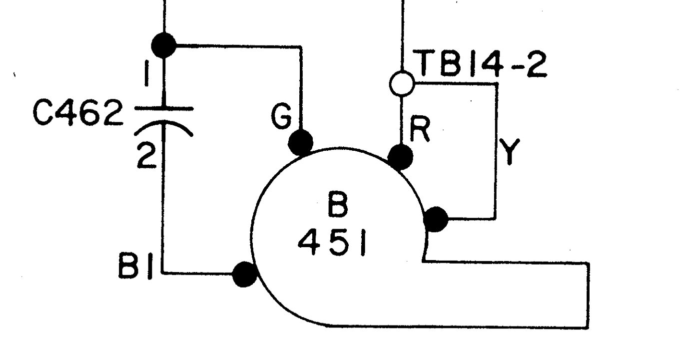
REV. F - To prevent premature opening oi thermostat in the Air Flow Detector from shutting down the station. Add TB 455 and R470.

REV. G - To prevent the possibility of shock if the blower motor shorts internally. Added ground wire to the blower housing assembly.

REV. H - To incorporate new motor. Changed BM451 and C462.
Schematic Diagram was:



REV. J - To incorporate different motor. Changed BM451 and C462.
Schematic Diagram was:



REV. K - To improve motor reliability. Changed BM451.