ELCOM BAUER TRANSMITTERS

BROADCAST PRODUCTS

TECHNICAL MANUAL

MODELS 612A/620A

WITH 625A CAVITY UPDATE

WARNING

THIS UNIT CONTAINS HIGH VOLTAGE, HIGH CURRENT POWER SUPPLIES.

Potentials up to **8000 volts*** at lethal current levels are present and exposed to maintenance personnel working with power on and interlocks defeated.

When maintenance requires working with power on and unit open, exercise extreme caution. Stand on insulated surface. Work with only one hand inside unit. Use only high voltage insulated tools. Have second person standing by at all times.

✱ Depending upon transmitter being used.

TECHNICAL PUBLICATIONS

THIS PAGE TO BE INCLUDED WITH MODEL 612A/620A INSTRUCTION MANUAL WHEN 625A UPDATE CAVITY HAS BEEN INSTALLED.

ADDITIONAL DRAWINGS REQUIRED --- 071-0263H

ADDITIONAL INSTRUCTIONAL MATERIAL REQUIRED --- Page 6-8 OF THE MODEL 625A INSTRUCTION MANUAL -- RF CAVITY PARTS LIST.

PARTS LOCATION DRAWING -- 610/625 CAVITY ASSEMBLY --- 015-6100-05

TABLE 6-2 REPLACEABLE PARTS LIST

RF AMPLIFIER ASSEMBLY

DESIG.	DESCRIPTION	SPARTA PART NUMBER	MFR.	MFR. PART NO.	TOTAL
BL101	Blower	231-0080-02	82877	CXH33A33A	1
C100, C101	Capacitor, cer., 100pf 15kv	110-0338	71590	857-100N	4
C102	Capacitor, vac. var.	115-0330	74970	CADC 3-30	1
C103 thru C107	Capacitor, cer., 1000pf 5kv	110-0390-01	71590	858S	9
C108, C109	Capacitor, feed thru 500pf, 1kv	110-1070-01	72982	CK70AW10ZM	2
C110 thru C113	Same as C103				
C114	Capacitor	022-4130	CAPE	022-4130	1
C115, C116	Same as C100				
J101	Connectors, input anchor assembly to 1-5/8" line	022-4173	23265		1
J102	Connector, output anchor assembly to 3-1/8" line	022-4174	23265		1
J103	Connectors, BNC	287-0034-01	02660	UG1094 A/U	1
L101	Inductor, input	022-4170	23265	022-4170	1
L102	Inductor, input	022-4171	23265	022-4171	1
L103	Inductor, plate shunt	022-4211	23265	022-4211	1
L104, L105	Inductor, variable	022-224-134	COX	022-224-134	2
L106	Inductor, output	022-4172	23265	022-4172	1
L107	Sampling loop		23265		1
RFCH1, RFCH2	Choke, Fil	022-4181	23265	022-4181	2
RFCH3	Choke, plate	022-4182	23265	022-4182	1
RFCH4	Choke, plate	022-4183	23265	022-4183	1
T101	Transformer, 6.3 VCT, 160A	326-0387	QUAL	1318	1
TB101	Terminal block	477-0050	71785	10-140	1
TB102	Terminal block	477-0017	71785	5-140	1
V101	Tube, PA	353-045502	06980	3CX15000A7	1
XV101	Socket PA tube Teflon ring	396-1032 022-4151	06980	SK1320	1

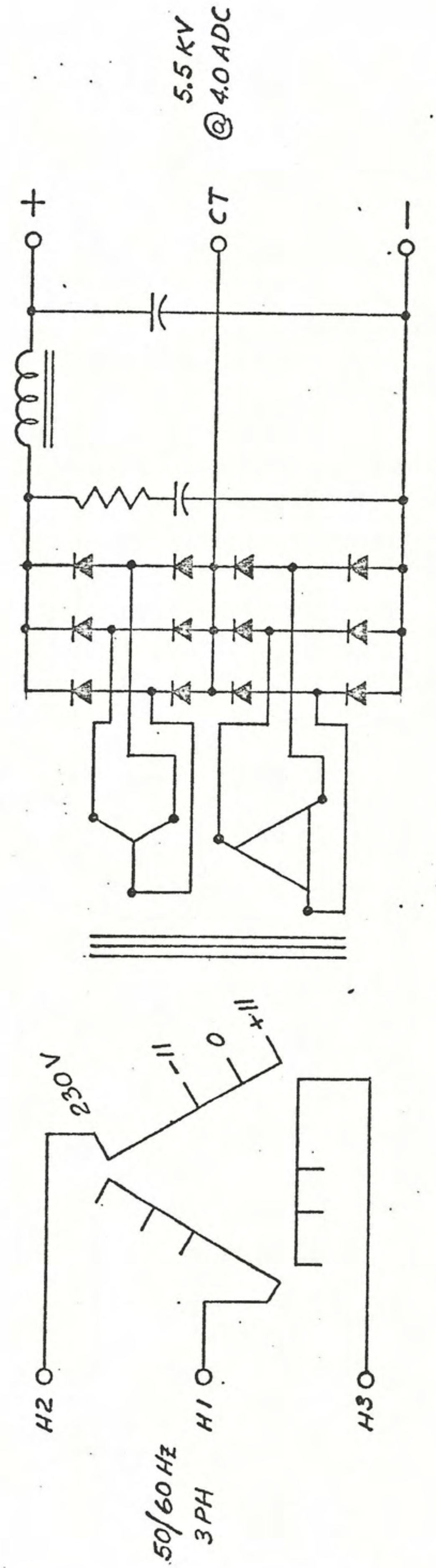
ADDENDUM

MODEL 612

FM TRANSMITTER

The description, operation, control circuitry and tuning procedures outlined in this manual for the Model 620 FM transmitter are also applicable to the Model 612 FM transmitter in every detail.

The changes in operating parameters and component parts peculiar to the Model 612 are contained in this addendum along with the H.V. power supply schematic.



MODEL 612

HIGH VOLTAGE POWER SUPPLY

SPARTA ELECTRONIC CORPORATION
BROADCAST TRANSMITTER
TYPE 612

TYPICAL OPERATING CONDITIONS

PARAMETER	PO= 7.5 KW	PO= 13 KW
Frequency	93.1 MHz	93.1 MHz
Driver Plate Volts	1250 VDC	1250 VDC
Driver Plate Current	60 MA	65 MA
IPA Grid Volts	180 VDC	175 VDC
IPA Grid Current	7.5 MA	6 MA
IPA Screen Volts	300 VDC	495 VDC
IPA Screen Current	18 MA	85 MA
IPA Filament Volts	5 VAC	5 VAC
RF Drive (Relative)	30	90
IPA Plate Volts	2600 VDC	2550 VDC
IPA Plate Current	.340 AMPS	.650 AMPS
PA Grid Current	.250 AMPS	.780 AMPS
PA Plate Volts	5600 VDC	5500 VDC
PA Plate Current	1.85 AMPS	3.0 AMPS
PA Filament Volts	7.5 VAC	7.5 VAC

Component Parts, Model 612 FM Transmitter

Desig.	Description	Part No.	Mfr.	Mfr. Part No.	Total
C-85	Capacitor 5MF, 10 KV	103-2013	Sangamo	-	1
L-20	Filter Reactor 3.5 Hy 3.5 ADC	317-0700	Energy Systems	-	1
T-4	Filament transformer 7.5V, 100 Amps.	326-9026	Quality	-	1
A-5	Power Supply	450-0430	Energy Systems	4T44	1
V3	Tube 3CX10000A7	353-0456	Eimac	3CX10000A7	1

Tuning the 620 Cavity

With any grounded grid amplifier of conventional design plate circuit resonance is indicted by a grid-current peak. The plate-current "dip" associated with resonance is so broad that it should not be used as an indication of resonance. All tuning and loading is done with reference to the grid current and power-output meters. The plate shorting bars are located closest to the transmission line. The antenna coupling bar is located closest to the tube. Note that there are two plate shorting bars and they must be moved together. Make certain that they are in perfect alignment and do not tilt.

(1) Operate the amplifier with full-power plate voltage. Make certain that the plate-tuning control is in the center of its range and the drive power is as low as possible.

(2) Slowly increase the drive power until about one ampere of final amplifier plate current flows. Note the power output indication, if any. If there is some power output, the plate-line shorting bar is approximately in the right place.

(3) Turn off the transmitter and slowly move the plate-line shorting bar 1/8 inch at a time. It is important that both the top and bottom bars are moved together. This adjustment isbest accomplished by using two long "Philips" screw drivers inserted through the holes in the tuning bars.

(4) Each time the bars are moved, Check the power output from the stage. Make no further adjustments until after maximum power-output is achieved with the adjustment of the plate-line shorting bars.

(5) Slowly increase the drive power until grid-current is obtained. Rock the plate-tuning control from its nominal position to determine if a peak ingrid current occurs within its range. Should a grid-current peak occur at one extreme or the other in the setting of this control it may be necessary to slightly readjust the position of the plate-line shorting bars.

(6) Continue to increase the drive power until rated power-out-put is obtained or until 1/2 Ampere of grid-current is obtained. Should rated power output be obtained before the proper grid current it will be necessary to reduce the "loading" control which is done by sliding the coupling bar closer to the transmission line. This must be done with the transmitter off. If the grid-current starts to increase above 1/2 Ampere before rated power output is obtained it will be necessary to increase the loading by moving the coupling bar closer to the tube. This also must be done with the transmitter off.

(7) Proper operation of the stage will be indicated by the simultaneous presentation of the following conditions:

(a) Grid current maximum at the center of the plate-tuning control range.

(b) 0.5 Ampere of Grid current and rated plate-current and plate voltage for the required power level (from the test-data-sheet.)

(c) Rated power output with acceptable efficiency.

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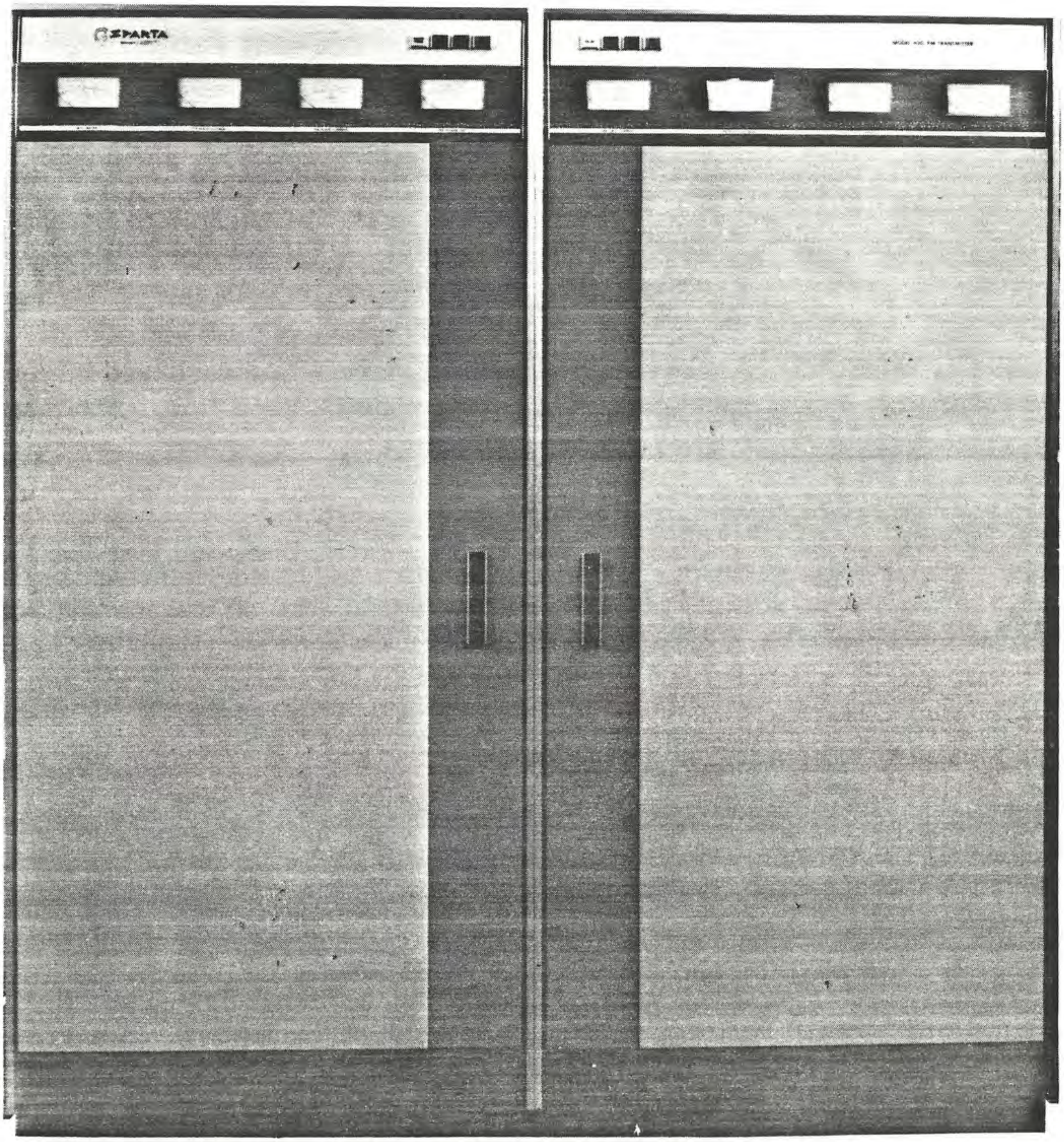


FIGURE I-I. TRANSMITTER FRONT VIEW

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION

This manual contains information required to install, operate, and maintain the SPARTA Model 620 FM Transmitter. Section I describes the transmitter and lists its specifications, Section II provides installation instructions, Section III contains operating procedures and Section IV describes the principle of operation. Maintenance procedures and troubleshooting diagrams are contained in Section V, and replaceable parts are identified and listed in Section VI. A complete operating and servicing manual covering the Model 660 FM Exciter is included as a part of this manual.

1-2. GENERAL DESCRIPTION

The Model 620 FM Transmitter (figure 1-1) provides an output of 20 kilowatts in the frequency range from 88 to 108 MHz, and is type-accepted by the Federal Communications Commission under Part 73, Broadcast Services.

As shown in figure 1-1, the transmitter consists basically of two sections. The left-hand section contains the exciter, driver, and intermediate power amplifier (IPA) stages, together with associated metering, control and power circuitry. The right-hand section contains the power amplifier (PA) and its associated metering, control, and power circuitry. A second PA section can be added now or later to increase the RF output to 40 kilowatts.

The IPA and PA cavities are cooled by high-speed blowers and each of the two cabinet sections are scavenged of incidental warm air by ventilating fans. The circuit design of the blower furnishing air to the PA cavity is such that it will continue to run for a preset interval after the transmitter is shut down to remove residual heat.

The Model 620 design includes such features as automatic power leveling and automatic overload recycling. Once the transmitter has been tuned to its authorized rated power output, the automatic power leveling circuit maintains this RF output level regardless of mains power fluctuations. The overload recycle circuit automatically restores the transmitter to normal operation following a momentary current overload in the monitored circuits. Consecutive recycling is limited to four (but not less than three) times within eight seconds following the operation of any overload relay. If the overload exists after a maximum of four recycles, the transmitter high-voltage circuits will remain off until the overload is reset manually. Tally lights mounted on the IPA and PA control panels are triggered by their associated overload relay. These lamps will remain lighted after a momentary overload to identify the circuit where the overload occurred. Only three transmitting tubes are used in the high-level stages: a 4X150A tetrode (driver), a 5CX1500A pentode (IPA), and a 3CX15000A7 triode (PA). The driver output is coupled out to the IPA by conventional techniques; however, the output coupling of the IPA and PA stages employ a stripline concept for greater efficiency and simplicity.

RF excitation is provided by the Model 660 FM Exciter, which is an all-solid-state unit that provides monaural, stereophonic and Subsidiary Communications Authorization (SCA) modes of operation in accordance with FCC and international standards. The modulation method is "direct FM" with no mixers or multipliers after the modulated oscillator.

The exciter can be equipped with modules for monaural or stereophonic operation. When equipped with a stereo module and a failure occurs within the stereo system, the Model 660 can be switched from stereo to monaural operation over either program channel by pushbutton mode selection. The exciter is also equipped with relay circuitry that enables remote switching to the monaural mode if one of the two stereo program lines is impaired.

Connections are provided to allow remote exciter mode selection (left, right, and stereophonic) and remote transmitter master start, plate power on-off, and power trim. Provisions are also included for remote metering of PA plate voltage and plate current.

1-2.1. Physical Characteristics

Physical characteristics of the Model 620, excluding the Model 660 FM Exciter, are given in table 1-1. Physical characteristics of the Model 660 are given in paragraph 1-2.1 of its individual operating and servicing manual.

Table 1-1. Physical Characteristics

Cabinet Dimensions:	75 inches high, 68 inches wide, 34 inches deep.
Weight:	2000 pounds (910 kilograms).
Cabinet Style:	Enclosed steel cabinet; access provided through hinged front panels and rear cabinet doors.
Input/Output Connections	
a. RF Output:	3-1/8 inch coaxial line flange.
b. Audio Inputs:	Barrier strip.
Cooling Provisions	
a. IPA Cavity:	One 1-phase 530 cfm blower.
b. PA Cavity :	One 3-phase 900 cfm blower.
c. Cabinet :	Three 1-phase 750 cfm fans.
Ambient Temperature:	To 50°C, 122°F; continuous duty at rated power output.
Altitude:	To 10,000 feet; continuous duty at rated power output.
Humidity:	0 to 95%.

1-2.2. Functional Characteristics

Functional characteristics of the Model 620, excluding the Model 660 FM Exciter, are given in table 1-2. Functional characteristics of the Model 660 are given in paragraph 1-2.2 of its individual operating and servicing manual.

Table 1-2. Functional Characteristics

Frequency Range:	88 to 108 MHz.
Type of Emission:	F3, F9 frequency modulation.
RF Power Output:	20 kilowatts (40 kilowatts with additional PA section).
RF Power Output Capability:	23 kilowatts maximum; adjustable down to 13 kilowatts as measured at output of the harmonic filter.
Output Impedance:	50 ohms, nominal.
VSWR:	1.25: 1 maximum.
Frequency Stability:	± 1 KHz.
Modulation Capability:	± 75 KHz (100%).
RF Bandwidth:	± 750 KHz at 3 db points.
Harmonic Attenuation:	-80 db minimum below carrier amplitude.
FM Noise Level:	62 db below 100% modulation at 400 Hz.
AM Noise Level:	55 db rms below a reference of 100% AM carrier.
Input Line Voltage:	200 to 250 vac, 3-phase, 60 Hz, 4-wire (50 Hz on special order).
Permissible Line Voltage Variation:	± 5% from nominal.
Power Line Input:	35 KVA maximum at 0.9 power factor
Tube Complement:	One 4X150A (driver); one 5CX1500A (IPA); and one 3X15000A7 (PA).
Controls and Indicators:	See table 3-1.
Remote control and Metering:	Terminal board provided for remote control and metering connections.
Overload Relay Protection:	Overload relays protect against excess current in the following circuits: 1. Driver Plate 2. IPA screen 3. IPA plate 4. PA grid

Table 1-2. Functional Characteristics (Continued)

	5. PA plate
	6. Reflected power
Overload Indicators:	One overload indicator and six overload tally lights. (See table 3-1.)
Other Protective Devices:	Twelve Panel-mounted fuses and one internal circuit breaker. Two additional fuses mounted on rear panel or exciter.

1-3. MODULE EQUIPMENT

The Model 660 FM Exciter is equipped with the following modules, which provide the capability of monaural FM operation:

a. One FM Exciter Module (001-7560-01)

b. One Monaural Module (001-7565-01)

c. One RF Amplifier Module (001-7559-01)

d. Two Dummy SCA Modules (001-7569-01)

The following modules, which are available from SPARTA ELECTRONIC CORPORATION provide the Model 660 with the capability of stereophonic and SCA operation:

a. One Stereo Generator Module (001-7562-01)

b. One 41 KHz SCA Module (001-7563-01)

c. One 67 KHz SCA Module (001-7566-01)

When operating in the monaural mode, the 41 KHz and 67 KHz SCA modules may be used individually or simultaneously. When operating in the stereophonic mode, the 41 KHz and 67 KHz generators are automatically muted. However, the 67 KHz module can be used in combination with the stereo generator in any mode of operation without program interruption if an optional 5 KHz filter kit is installed, and the muting connections changed. (See note 6 on figure 5-10 in the Model 660 FM Exciter operating and servicing manual.)

The 5 KHz filter kit (091-5971-01) may be specified for initial installation by SPARTA ELECTRONIC CORPORATION or it can be added to the SCA module at a later date. The kit consists of a low-pass filter which limits the SCA input band-width to 5 KHz. In addition to the input filter, the sub-carrier deviation should be limited to 6% to avoid interference with the stereo channel.

1-4. ACCESSORIES

The Model 660 is supplied with the following accessories:

a. One Module Extender (001-7570-01)

b. One DC Probe (001-0015-01)

The module extender permits any module to be withdrawn from the exciter main frame for voltage checks and maintenance. The dc probe extends the use of the right-hand multimeter to allow point-to-point voltage checks of the extended modules. Extensive circuit checking can therefore be accomplished without additional test equipment.

SECTION II

INSTALLATION

2-1. INSTALLATION PLANNING

Dimensions essential to know for proper installation of the Model 620 FM Transmitter are shown in figure 2-1.

2-1.1. Environmental Requirements

Location of the Model 620 must be within the following environmental requirements:

a. Maximum altitude:	10,000 feet
b. Maximum temperature:	+ 50° C (+ 122° F)
c. Minimum temperature:	-25° C (13° F)
d. Maximum humidity:	95%

2-1.2. Space Requirements

When installing the Model 620 it is important that sufficient space be left at the front and rear to permit full opening of the front access panels and rear cabinet doors. As shown in figure 2-1, at least 27 inches of space must be allowed in front of the cabinet and the unit should be emplaced with the rear no closer than 30 inches from the wall.

Adequate overhead space must be provided to permit the RF output connection to be made an to allow for adequate dispersal of cooling air discharged at the top of the cabinet. A minimum distance of two feet from the cabinet top to the ceiling is recommended.

2-1.3. Power Requirements

Requirements for input power and power consumption are specified in table 1-2, functional characteristics, in Section I.

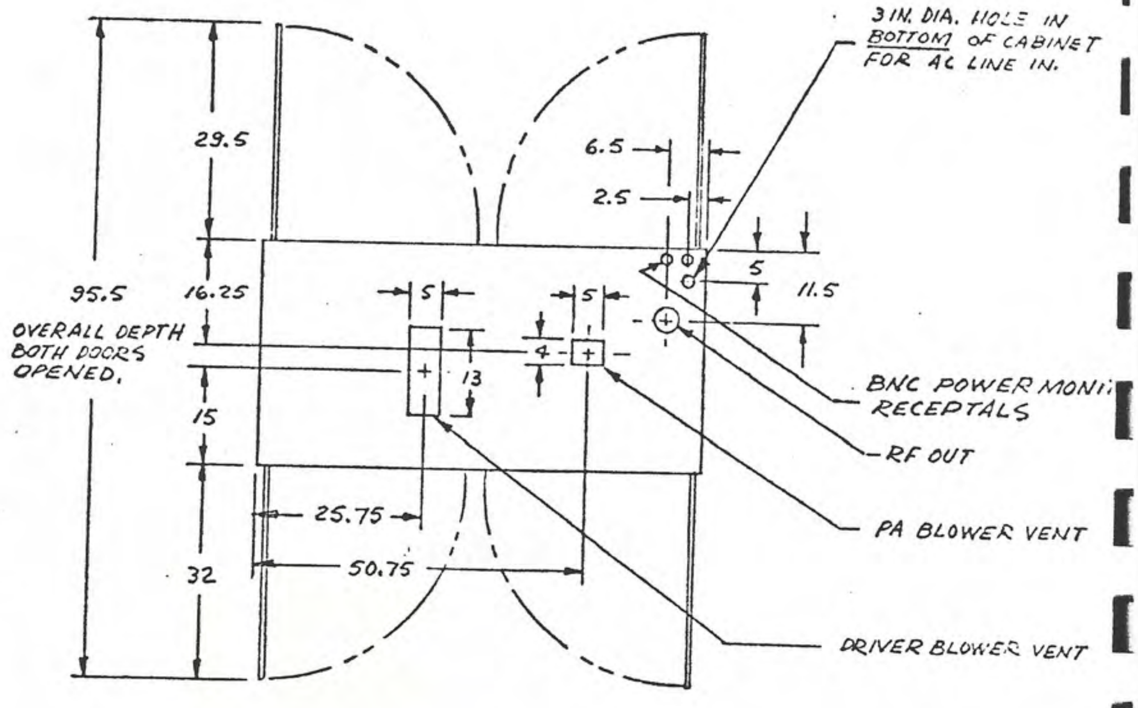
2-1.4. Cooling Requirements

There are no external cooling requirements for the Model 620. The unit is cooled by two three-phase blowers and three single-phase fans, which draw in air through filtered openings in the rear cabinet doors. PA blower B1 draws in air at a rate of 900 cfm; IPA blower draws in air at a rate of 530 cfm; and fans B3, B4, and B5 each draw in air at a rate of 750 cfm. Space provisions for opening the rear cabinet doors will ensure an adequate intake of cooling air.

A minimum overhead space of two feet will normally be adequate for dispersing air exhausted by the IPA blower and cabinet fans; however, the air exhausted by the PA blower will require an external vent. As a minimum it is recommended that 9-inch-diameter sheetmetal airconditioning duct be used to convert the PA blower exhaust outside the building. This will require the fabrication of a 9-inch-diameter sheetmetal transition measuring 4-3/16 inches by 5 inches at the blower output flange. This ducting should be limited to a maximum of 10 feet to prevent excessive back pressure.

2-2. UNPACKING AND INSPECTION

Inspect the equipment for shipping damage as soon as it is unpacked. Check for broken knobs, tubes, meter faces, and connectors. Inspect surfaces for dents and scratches. If the equipment is damaged in any way, contact the carrier immediately and report the circumstances.


3 IN. DIA. HOLE IN BOTTOM OF CABINET FOR AC LINE IN.
29.5
6.5
2.5
5
11.5
95.5
16.25
5
5
OVERALL DEPTH BOTH DOORS OPENED.
4
13
15
BNC POWER MONI
RECEPTALS
RF OUT
25.75
PA BLOWER VENT
32
50.75
DRIVER BLOWER VENT
TOP

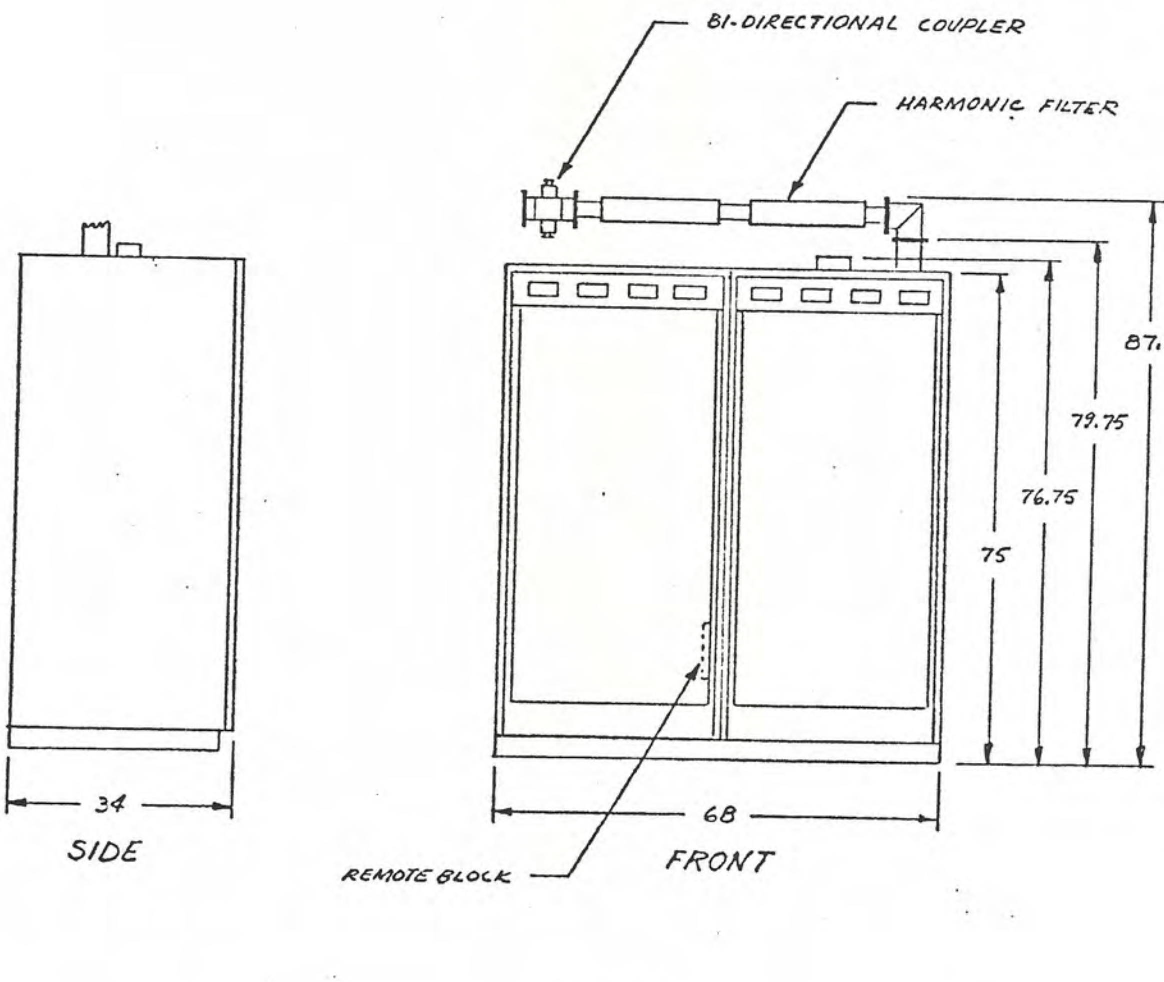

BI-DIRECTIONAL COUPLER
HARMONIC FILTER
87.75
79.75
76.75
75
34
68
SIDE
REMOTE BLOCK
FRONT

Figure 2-1.

2-3. HIGH-VOLTAGE POWER SUPPLY INSTALLATION

The high-voltage power supply, due to its heavy weight, is crated separately for shipment. After the transmitter enclosure has been positioned to its operational location, install the high-voltage power supply as follows:

a. If packaged, uncreate high-voltage power supply and remove wooden pallets.

b. At rear of transmitter, remove kickplate at bottom of PA section.

c. Roll high-voltage power supply into cabinet with primary connections facing the rear.

d. Secure power supply base plate to metal brackets and tighten all bolts.

e. Make secondary connections of high-voltage power supply as follows:

(1) Connect the one 14 AWG gage HV wire to B+ terminal

(2) Connect the one 18 AWG wire to B- terminal

f. Refer to figure 2-2 and connect primary leads of high-voltage transformer to relay K-17 as illustrated.

2-4. INPUT AND OUTPUT CONNECTIONS

With the exception of the RF output and the power monitor inputs from the directional coupler, all inputs and outputs of the Model 620 are routed into the unit through the two 3-inch diameter openings, one to the right and one to the left, on the base of the cabinet. The RF output termination is a 3-1/8 inch coaxial line flange and the power monitor inputs from the directional coupler are BNC receptacles; these connectors are located on top of the cabinet. (See Figure 2-1).

2-4.1. RF Input/Output Connections

The RF input and output connections of the Model 620 are made as follows (see figure 2-1):

CAUTION

Do not allow the combined weight supported by the RF output termination to exceed 50 pounds. Use an overhead cable hanger, if necessary to absorb most of the weight.

a. Connect and bolt in place a 90-degree, 3-1/8 inch coaxial coupling to the RF output termination on top of the cabinet.

b. Connect and bolt in place low-pass filter FL1 to 90-degree coaxial coupling.

c. Connect and bolt in place directional coupler DC_2 to low pass filter FL1.

d. Using 3-1/8 inch coaxial cable, connect RF output of directional coupler DC2 to transmitting antenna.

CAUTION

Ensure that the antenna has a VSWR of 1.25:1 or less otherwise the high reflected power could damage the R.F. cavity.

e. Using RG-58/U coaxial cables with BNC connectors at each end, connect forward power output of directional coupler DC2 (J11) to (J13) on top of cabinet. Connect reflected power output of directional coupler DC2 to (J14).

f. Using RG-58/U coaxial cable with BNC connectors at each end, connect sampled RF output of PA cavity (J15) to station monitor.

g. A short length of RG-58/U coaxial cable with BNC connectors at each end is connected between the exciter RF OUT jack and RF INPUT jack (J1) located on underside of IPA cavity. Make sure that these connectors are firmly in place.

2-4.2. Primary Power and Grounding

Mains power to the Model 620 should be routed through a 200-ampere safety disconnect switch with a 150-ampere fuse protecting each phase. (See fegure 5-1) (Schematic). The mains power input cable connects to TB-6 which is located on the left-hand wall of the PA section as viewed from the rear. (Figure 2-4).

It is essential that the exact mains voltage be determined at this point so that appropriate taps are connected on the primary windings of T-2 (V-1 and V-2 filament transformer), T-3 (PA plate voltage transformer), T4 (PA filament voltage transformer) and T-5 (driver and IPA plate and screen voltage transformer).

The primary winding of T-2 is tapped to allow operation from 200 VAC or 220 VAC mains sources. If the available mains voltage is between 200 and 220 VAC, connect the input to terminals 1 and 2 of TB-10 inside the IPA cavity. If the available mains voltage is above 220 VAC, connect the input to terminals 1 and 3 of TB-10. The primary winding of T-3 is connected in a delta configuration and tapped to allow operation from 208 VAC, 224 VAC, or 241 VAC mains sources. The appropriate taps are determined by selecting from table 2-1 the nominal input voltage tap closest to the actual input mains voltage, and positioning the metallic links accordingly. For example, assume that the input mains voltage is 220 VAC, which is closest to the nominal input voltage of 224 VAC shown in table 2-1. Consequently a metallic link would be connected from terminal H-3 to terminal c, from terminal H-2 to terminal c and from terminal H-1 to terminal c.

The primary winding of transformer T-4 is tapped for operation from 208 VAC, 224 VAC, and 241 VAC mains sources; the connections are made at terminals 1 and 2 (208 VAC) 1 and 3 (224 VAC), or 1 and 4 (241 VAC). If the available mains voltage is higher than 208 VAC, disconnect the two leads connected to terminal 2 and reconnect them to terminal 3 or 4 as appropriate.

The delta-connected primary winding of transformer T-5 is tapped to allow operation from 200 VAC, 224 VAC, or 241 VAC mains sources. The appropriate taps are determined by selecting from table 2-2 the nominal input voltage tap closest to the actual input mains voltage, and positioning the metallic links accordingly. (See figure 2-3). For example, assume that the input mains voltage is 220 VAC, which is closest to the nominal input voltage of 224 VAC shown in table 2-2. Consequently, a metallic link would be connected from terminal 1 to terminal 11, from terminal 9 to terminal 7 and from terminal 5 to terminal 3. Then connect the input mains voltage to terminals 1, 5 and 9.

Figure 2-3b shows the high-voltage secondary winding of T-5 connected in delta, which is the normal configuration for operating the Model 620 at an RF output of 20 kilowatts. If a second PA section is added to increase the RF output to 40 kilowatts, the secondary winding of T-5 must be connected in the wye configuration. This accomplished as follows:

a. Disconnect jumper cables connected between terminals 16C and 18, 18C and 17, and 17C and 16.

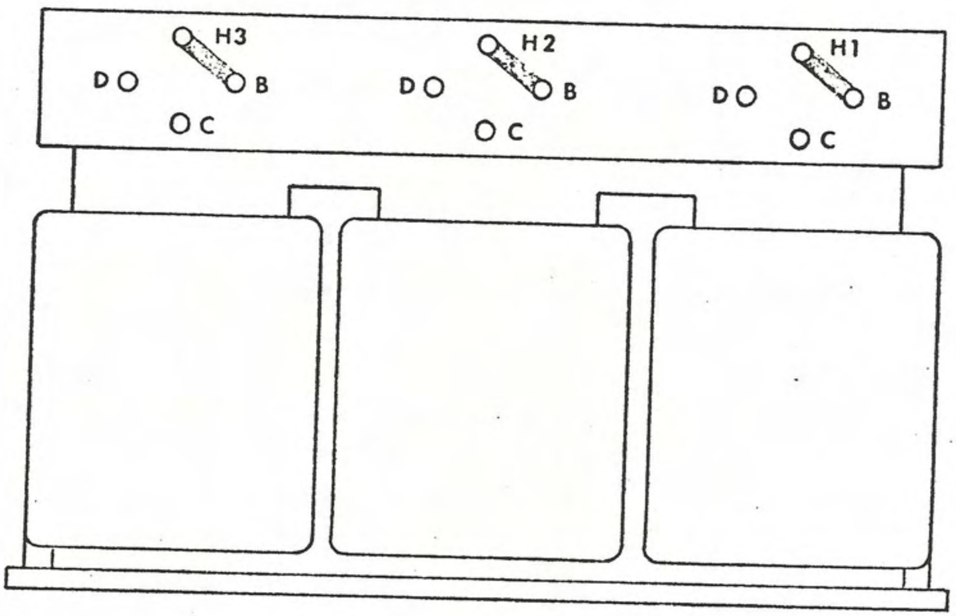
b. Connect one jumper cable from terminal 16C to 18C and another jumper cable from terminal 18C to 17C.

Table 2 - 1. Transformer T3 Primary Connections

200 - 250 Volt Input Range	Nominal Input Voltage	Mains Input Terminals			Metallic Links		
	ENERGY SYSTEMS POWER SUPPLY (FIG. 2-2)						
	208	H1	H2	H3	H3 to B	H2 to B	H1 to B
	224	H1	H2	H3	H3 to C	H2 to C	H1 to C
	241	H1	H2	H3	H3 to D	H2 to D	H1 to D

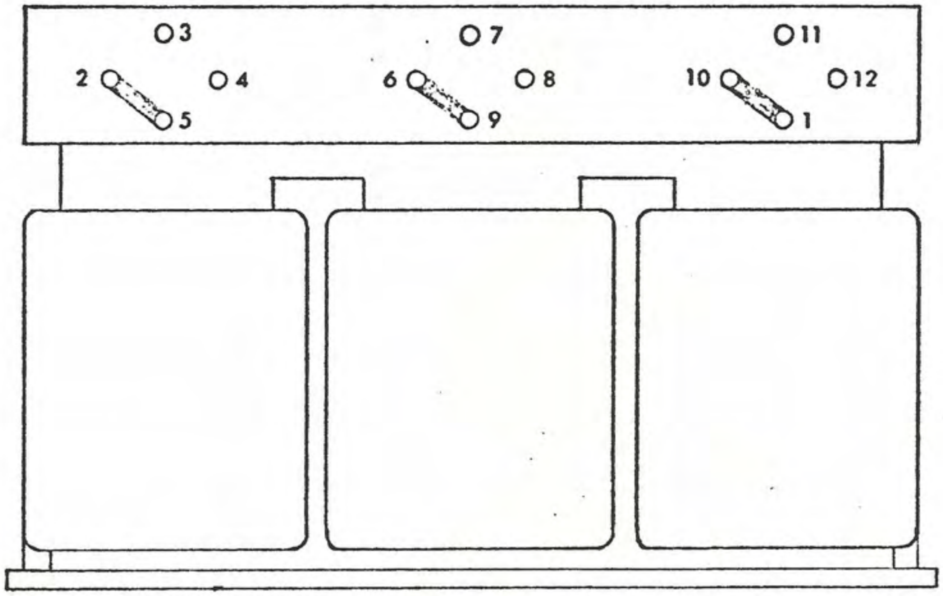
Table 2 - 2. Transformer T5 Primary Connections

200/250 VAC Input Range	Nominal Input Voltage	Mains Input Terminals			Metallic Links		
	208	5	9	1	2 to 5	6 to 9	10 to 1
	224	5	9	1	3 to 5	7 to 9	11 to 1
	241	5	9	1	4 to 5	8 to 9	12 to 1

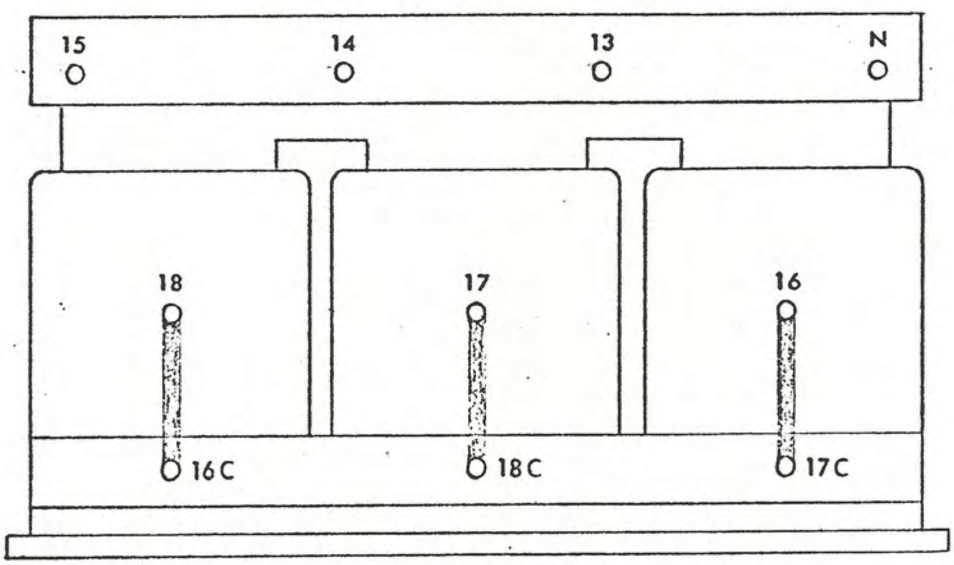


Energy Systems Power Supply 4T32

Figure 2-2. Transformer T3 Primary Links Connected for 208 VAC Mains Input. (See table 2-1.)



a. Primary Links Connected for 208 VAC Mains Input. (See table 2-2.)



b. High-Voltage Secondary Connected in Delta Configuration (Normal)

Figure 2-3. Transformer T5 Primary and Secondary Connections

Refer to the Model 660 operating and servicing manual, paragraph 2-2.1, and then verify that the primary power connections have been made for operating from a power source closest to the available mains power.

2-4.3. Exciter Input Signal Connections.

All input signal connections to the exciter are made TB-4 and TB-5, which is a 20-terminal barrier strip accessible at the rear of the 660 exciter. Refer to Figure 2-2 in the 660 Instruction Manual.

Use twisted-pair shielded cable for audio and SCA input connections. For monaural operation, connect audio signal leads to TB5-5 and TB5-7 (STEREO AUDIO L) and connect line shield to TB5-6 (GND).

For stereo operation, connect left audio line to TB5-5 and TB5-7 (STEREO AUDIO L) and line shield to TB5-6 (GND). Connect right audio line to TB5-8 and TB5-10 (STEREO AUDIO R) and line shield to TB5-9 (GND).

For SCA operation, connect balanced audio line to TB5-15 and TB5-17 (SCA 1 AUDIO IN) and line shield to TB5-16 (GND).

For the second SCA, connect balanced audio line to TB5-18 and TB5-19 (SCA AUDIO IN) and line shield to TB5-20. (GND).

NOTE

If the 67 KHz SCA is to be controlled locally, connect a jumper from TB5-11 (67 KHa DISABLE) to TB5-12 (GND). For paragraph 2-5.1.

2.5 REMOTE CONTROL CONNECTIONS

2-5.1. Exciter Remote Control

Remote control connections to the exciter are also made at TB4. Terminals 1, 2, 3, and 4 are used in stereo operation and provide duplicate remote functions of the LEFT, STEREO, and RIGHT pushbutton switches on the exciter front panel. These remote control functions require the use of three momentary-contact pushbutton switches at the remote control point.

To connect the pushbutton switches for remote stereo contro, use three twisted-pair conductors. Connect one wire of each twisted pair to its related terminal TB4-1, 2, and 3 and connect the common return wire of each twisted pair to TB4-4 (REMOTE GND).

Terminals 1, 2, 3 and 4 on TB5 provide remote metering of the SCA mode of operation when one or both SCA modules are installed. Terminals TB5-1 (67 KHz DISABLE) and TB5-2 (GND) are used to remotely disable the 67 KHz SCA mode of operation. A remote switch connected to these terminals provides normal SCA operation when in the closed position. When the switch is in the open position, the SCA module is disabled.

Subaudible telemetry tones can be applied to the SCA modules by making connections to TB5-3 and TB5-4 (METER IN). Use coaxial cable such as RG-58A/U for this function and ground the shield to TB4-9 (GND). The 41 KHz SCA module telemetering function connects to TB5-4 and the 67 KHz SCA module telemetering function connects to TB5-3.

2-5.2. IPA and PA Remote Control

Figure 2-5 shows the remote power control and metering functions of the Model 620. These connections provide the following functions:

a. Transmitter start and stop.

b. High-voltage on and off.

c. Power trim.

d. PA plate voltage readout.

e. PA plate current readout.

It it is desired to test or operate the transmitter before making the remote control connections, a jumper must be connected between terminals 11 and 13 on TB4 to complete the plate control circuit.

SECTION III

OPERATION

3-1. CONTROLS AND INDICATORS

As shown in figures 3-1 through figures 3-8, all operational controls and indicators are located at the front of the unit. Table 3-1 lists these operating controls and indicators and gives their reference designation and a brief functional description of each.

Table 3-1. Operating Controls and Indicators

Ref. Des.	Panel Nomenclature	Function
IPA METER PANEL (Fig. 3-1)		
DS-1	MASTER POWER	Indicates mains power applied to control circuits when lit.
DS-2	INTERLOCKS	Indicates time delay complete and IPA interlock switches closed when lit.
DS-3	PLATE	Indicates mains power applied to V1 and V2 plate and screen voltage supply when lit.
DS-4	OVERLOAD	Indicates transmitter overload when lit. Will extinguish each time transmitter automatically restarts itself. Remains lit if overload lock-out occurs.
M-1	MULTIMETER	As selected by MULTIMETER function switch S-14 (figure 3-4), provides readouts of driver (V1) plate voltage and plate current; IPA (V2) bias, screen, and filament voltages; IPA (V2) grid and screen currents; and RF input drive.
M-2	IPA PLATE CURRENT	Provides continuous readout of IPA plate current.
M-3	IPA PLATE VOLTAGE	Provides continuous readout of IPA plate voltage.
M-4	IPA POWER OUT	Provides relative power readout as adjusted by R-69.
IPA CAVITY FRONT PANEL (Fig. 3-2.3)		
C-9	DRIVER TUNING	Tunes V1 plate circuit to resonance.
C-80	IPA TUNING	Tunes V2 plate circuit to resonance.
IPA POWER DISTRIBUTION PANEL (Fig. 3-2.3)		
CB-1	MASTER POWER	Applies 3-phase mains power to entire transmitter except PA plates voltage power supply.
F-1	SPARE	
F-2	SPARE	
F-3	IPA BLOWER 2.0A SB	Provides ØC protection for IPA blower B2; illuminates to indicate blown fuse.

Table 3-1. Operating Controls and Indicators (Cont'd)

Ref. Des.	Panel Nomenclature	Function
	IPA POWER DISTRIBUTION PANEL (Fig. 3-2.3)(Cont'd)	
F-4	IPA BLOWER 2.0A SB	Provides ØA protection for IPA blower B2; illuminates to indicate blown fuse.
F-5	PA FILAMENT 5A	Provides protection for PA filament transformer T-4 and filament control circuit; illuminates to indicate blown fuse.
F-6	IPA FILAMENT 2A	Provides protection for driver and IPA filament transformer T-2; illuminates to indicate blown fuse.
F-7	CABINET FANS 2.5A SB	Provides protection for cabinet fans B3, B4, and B5; illuminates to indicate blown fuse.
F-8	IPA BIAS 0.25A SB	Provides protection for driver and IPA bias transformer T1; illuminates to indicate blown fuse.
F-9	MASTER ON 0.5A	Provides ØB protection for MASTER POWER switch S-1 (figure 3-4) and relay K-2; illuminates to indicate blown fuse.
F-10	TIME DELAY 0.5A SB	Provides ØA protection for time delay relay K-7 and for power control circuits; illuminates to indicate blown fuse.
F-11	CONTROLS 6.25A SB	Provides ØA protection for all control circuits; illuminates to indicate blown fuse.
F-12	CONTROLS 6.25A SB	Provides ØB protection for all control circuits; illuminates to indicate blown fuse.
M-10	ELAPSED TIME	Provides cumulative readout (in hours) of transmitter operating time.
R-13	FILAMENT CALIBRATE	Calibrates MULTIMETER M1 for readout of IPA filament voltage.
	IPA CONTROL PANEL (Fig. 3-4)	
DS-9	DRIVER PLATE CURRENT	Tally light. Indicates driver plate current overload has occured when lit; remains lit until RESET switch S-3 is set momentarily to TALLY.
DS-10	IPA SCREEN	Tally light. Indicates IPA screen current overload has occured when lit; remains lit until RESET switch S-3 is set momentarily to TALLY.

Table 3-1. Operating Controls and Indicators (Cont'd)

Ref. Des.	Panel Nomenclature	Function
IPA CONTROL PANEL (Fig. 3-4) (Cont'd)		
DS-11	IPA PLATE	Tally light. Indicates IPA plate overload has occurred when lit; remains lit until RESET switch S-3 is set momentarily to TALLY.
M-11	NONE	As selected by AC LINE VOLTAGE switch S-16, provides readouts of phase-to-phase ac line voltage.
R-34	IPA FILAMENT VOLTAGE	Adjusts IPA filament voltage as monitored on MULTIMETER M1.
S-1	MASTER POWER	Applies mains power to blowers, bias circuits, filament transformers, and control circuits.
S-2	CONTROL	Allows transmitter to be started and stopped in the local or remote modes.
S-3	RESET	Manually resets transmitter overload. Extinguishes all lighted tally lights.
S-4	MASTER PLATE	Applies mains power to contactors K-8 and K-17 through PA PLATE switch S-12 (figure 3-8).
R-69	IPA POWER OUT	Adjusts reading of M-4
S-14	MULTIMETER	Switches to circuits for readout on M-1.
S-17	POWER TRIM	Raises and lowers output power.
DS-5	FIL ON	Indicates mains power applied to PA filament transformer T-4 when lit.
DS-6	PA AIR	Indicates IPA and PA air interlock switches S-7 and S-8 closed when lit.
DS-7	INTERLOCKS	Indicates IPA and PA panel and door interlocks closed when lit.
DS-8	PLATE	Indicates mains power applied to PA plate voltage supply when lit.
M-5	PA GRID CURRENT	Provides continuous readout of PA grid current.
M-6	PA PLATE CURRENT	Provides continuous readout of PA plate current.
M-7	PA PLATE VOLTAGE	Provides continuous readout of PA plate voltage.
M-8	PA POWER OUT	As selected by PA POWER OUT switch S-15 (figure 3-7), provides readouts of PA forward and reflected RF power output.

Table 3-1. Operating Controls and Indicators (Cont'd)

Ref. Des.	Panel Nomenclature	Function
PA CAVITY FRONT PANEL (Fig. 3-7)		
C-81	PA TUNING	Tunes V-3 plate circuit to resonance.
PA CONTROL PANEL (Fig. 3-8)		
DS-12	PA GRID	Tally light. Indicates PA grid current overload has occurred when lit; remains lit until RESET switch S-3 (figure 3-4) is set momentarily to TALLY.
DS-13	PA PLATE	Tally light. Indicates PA plate current overload has occurred when lit; remains lit until RESET switch S-3 (figure 3-4) is set momentarily to TALLY.
DS-14	VSWR	Tally light. Indicates high reflected RF power output overload has occurred when lit; remains lit until RESET switch S-3 (figure 3-4) is set momentarily to TALLY.
M-9	NONE	Provides continuous readout of PA filament voltage.
S-11	AUTO POWER CONTROL	Activates automatic power-leveling circuit.
S-12	PA PLATE	Applies mains power to contactors K-8 and K-17 after MASTER PLATE switch is activated.
S-15	PA POWER OUT	Selects PA forward or reflected power output for readout on PA POWER OUT meter M-8 (figure 3-6).
R-91	PA FILAMENT VOLTAGE	Adjusts PA filament voltage as monitored on M-9.

3-2. INITIAL TURN-ON PROCEDURES

3-2.1. Exciter Initial Turn-On

Close the external safety disconnect switch and perform the following preliminary adjustments and checks before placing the Model 660 FM Exciter in operation:

a. Verify that proper fuses are installed in the two fuseholders on the exciter rear panel. Fuse F1 should be rated at 1 ampere and fuse F2 should be rated at 2.5 amperes.

b. Verify that all modules are seated firmly and locked in place.

c. Remove fuse F2 from fuseholder and temporarily connect a jumper between terminals 4 and 5 (PA ON) on TB-3 at rear of exciter.

d. At IPA power distribution panel (figure 3-3) set MASTER POWER circuit breaker CB1 to ON.

e. Set EXCITER MULTIMETER function switch S-1 (figure 3-5) to the following positions and verify and record meter indications in accordance with final test data shipped with the transmitter;

Switch Position	Meter Indication
(1) MOD OSC:	________
(2) REF OSC:	________
(3) BINARY OUT:	________
(4) RF INPUT:	________

NOTE

When operating power is initially applied to the exciter, the crystal oven in the FM exciter modules begins to warm up and the modulated oscillator circuit searches for phase lock; after a short interval, the oscillator will lock to the crystal reference frequency. The phase-locked condition can be verified by rotating EXCITER MULTIMETER switch S-1 to AFC UNLOCK and observing a zero indication on exciter multimeter M1.

f. Replace fuse F-2 in its fuseholder.

g. Set EXCITER MULTIMETER function switch S-1 to PA VOLTS and PA CURRENT and record exciter multimeter indications for future ference:

________________.

h. Set EXCITER MULTIMETER function switch to RF OUT and observe power output indication on exciter multimeter. (Full-scale indication of 100% is equivalent to 10 watts RF output.) Record multimeter indication:

______________________.

i. Connect electronic counter or calibrated frequency monitor to exciter RF output through a 20 db pad or to a "sniffer" in transmission line.

j. Set FREQUENCY ADJUST control on FM exciter module for precise center frequency. Set EXCITER MULTIMETER function switch S1 to AFC and set AFC ADJUST control for midscale indication on exciter multimeter.

k. Verify that all multimeter indications are in reasonable agreement with final test data.

l. Disconnect electronic counter and 20 db pad and restore exciter RF OUT connection to RF INPUT jack J1 on underside of IPA cavity.

m. Rotate exciter OUTPUT POWER ADJUST control fully counterclockwise.

n. Disconnect jumper connected in step c.

3-2.2. RF Amplifier Initial Turn-On

Protective devices and circuitry incorporated in the Model 620 provide maximum safety to operating personnel and minimize the occurrence of component damage during operation. High-voltage circuitry cannot be energized unless all access panel and door interlocks are closed. A time delay prevents plate and screen voltages from being applied to the tubes until the filament voltage has been applied to the tubes for a warmup period of approximately 45 seconds.

To energize the Model 620 proceed as follows:

WARNING

This unit contains high voltage, high current power supplies.
Potentials up to 7500 volts at lethal current levels are present and exposed to maintenance personnel working with power on and interlocks defeated.

Exercise extreme caution when maintenance requires working with power on and unit open. Stand on insulated surface. Work with only one hand inside unit and the other hand in your pocket. Use only high voltage insulated tools. Have second person standing by at all times.

a. Check for full closure of all interlocked access panels and rear cabinet doors.

b. Set CONTROL switch S2 (figure 3-4) to LOCAL.

c. With MASTER POWER circuit breaker CB1 in the ON position, check for no glow of fuses F_3 through F12. (See figure 3-3).

d. Set MASTER POWER switch S1 (figure 3-4) to ON and observe that MASTER POWER lamp DS1 lights. (See figure 3-1.) When blowers B1 and B2 build up sufficient air pressure, air interlock switches S7 (IPA air) and S8 (PA air) close and apply primary power to their respective filament transformers. Switch S8 also applies primary power to the 45-second time delay circuit. Note that PA AIR lamp DS6 lights, which indicates that both S7 and S8 air interlock switches have actuated. Note also that FIL ON lamp DS5 lights. (See figure 3-6).

NOTE

If air or interlock lights fail to glow after power has been applied for 45 seconds, the blowers may be rotating in reverse. In this case, secure all primary power and reverse any pair of the three, 3Ø power lines at TB-6.

e. Set MULTIMETER function switch S14 to IPA FILAMENT VOLTAGE and adjust IPA FILAMENT VOLTAGE control R34 for an indication of 5 vac on MULTIMETER M1. (See figures 3-1 and 3-3.) If the 5 vac indication cannot be obtained, change the primary tap on transformer T2 as required. (See paragraph 2-4.2.)

f. Adjust PA FILAMENT VOLTAGE control R91 for an indication of 6.15 vac on PA filament meter M9. (See figure 3-8) If the 6.15 vac indication cannot be obtained, change the primary tap on transformer T4 as required. (See paragraph 2-4.2.)

g. Open the lower front IPA section access panel so that power control motor B6 and screen potentiometer R27 can be observed. Press and hold POWER TRIM control S17 (figure 3-4) in the power position until R27 is in its minimum voltage position. Release POWER TRIM control and close access panel.

h. After the time delay has elapsed, note that INTERLOCKS lamp DS2 (IPA) and INTERLOCKS lamp DS7 (PA) light. (See figures 3-1 and 3-6).

i. Set MULTIMETER function switch S14 to DRIVER PLATE CURRENT. Open rear cabinet door of IPA section, defeat door interlock and remove exciter fuse F2.

NOTE

This is a necessary step in order to disable the exciter so that the bias of V1 can be set during its quiescent state.

j. Set PA PLATE switch S12 to ON and set MASTER PLATE switch S4 momentarily to ON and then release. (See figures 3-4 and 3-8.) Note that PLATE lamps DS3 and DS8 light. (See figures 3-1 and 3-6).

k. Observe MULTIMETER M1 indication. If indication is approximately 125 milliamperes, the bias adjustment is correct. Otherwise, adjust potentiometer R9 (figure 6-7) accordingly.

m. Set MASTER PLATE switch S4 momentarily to OFF. Replace exciter fuse F2 and close rear cabinet door.

n. Set MASTER PLATE momentarily to ON. IPA PLATE VOLTAGE meter M3 should indicate approximately 2600 vdc. PA PLATE VOLTAGE meter M7 should indicate approximately 7600 vdc.

o. Proceed with tuning procedure given in paragraph 3-3.

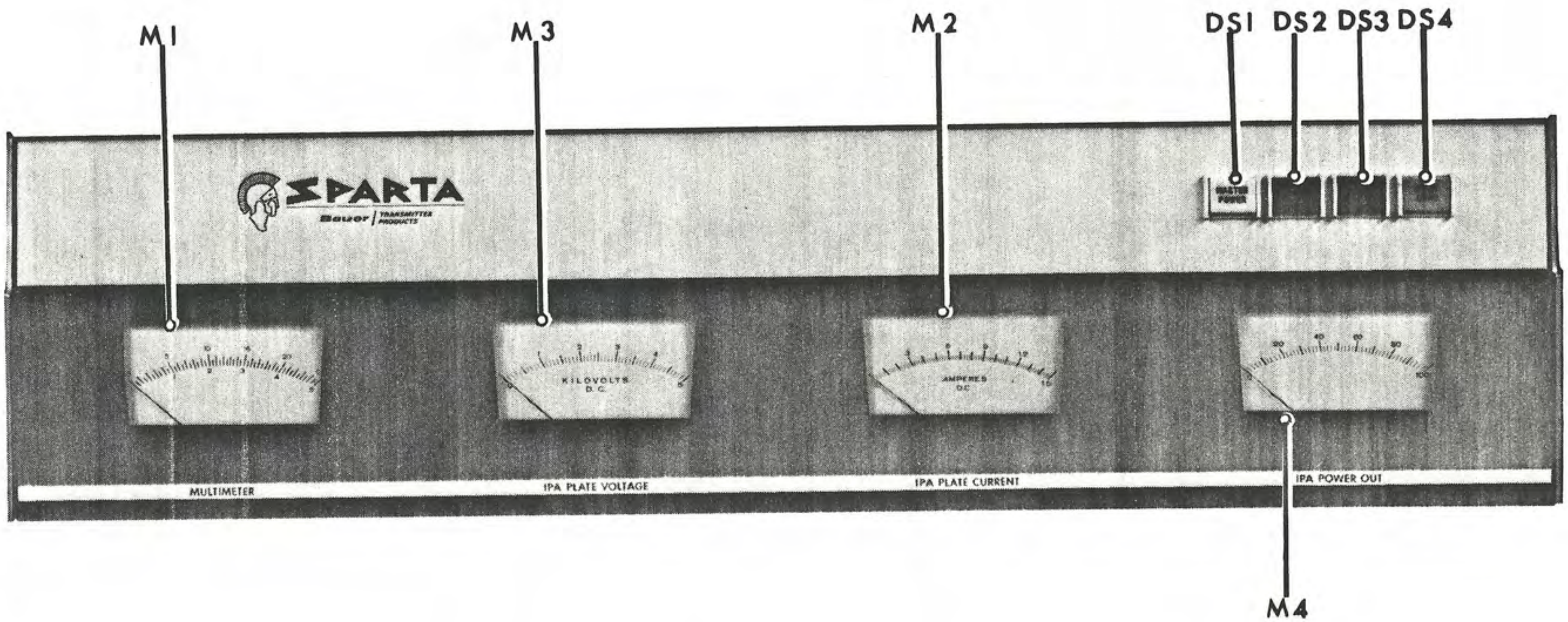


FIGURE 3-1. IPA METER PANEL

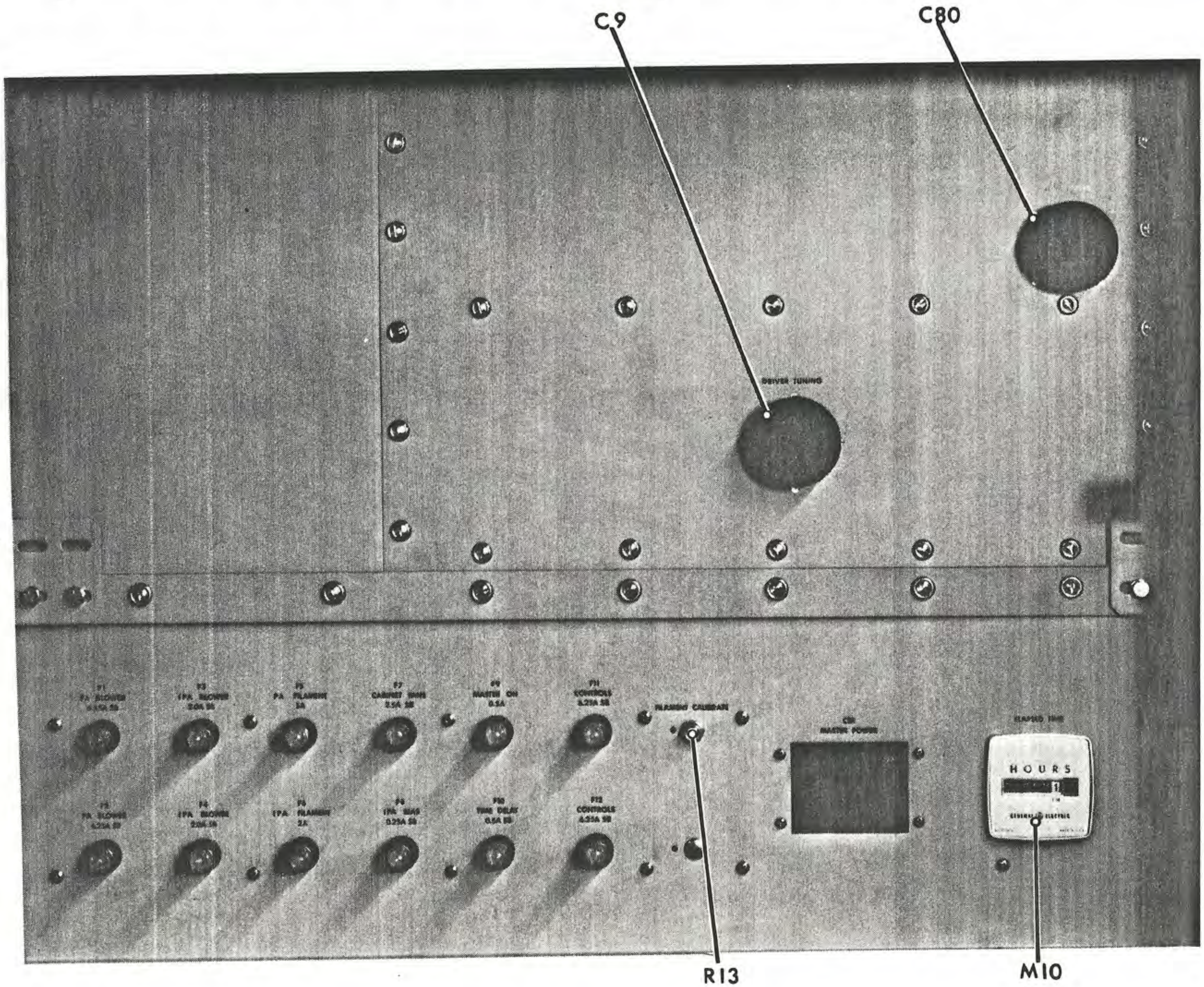


FIGURE 3-2.3. IPA DISTRIBUTION & FRONT CAVITY PANELS

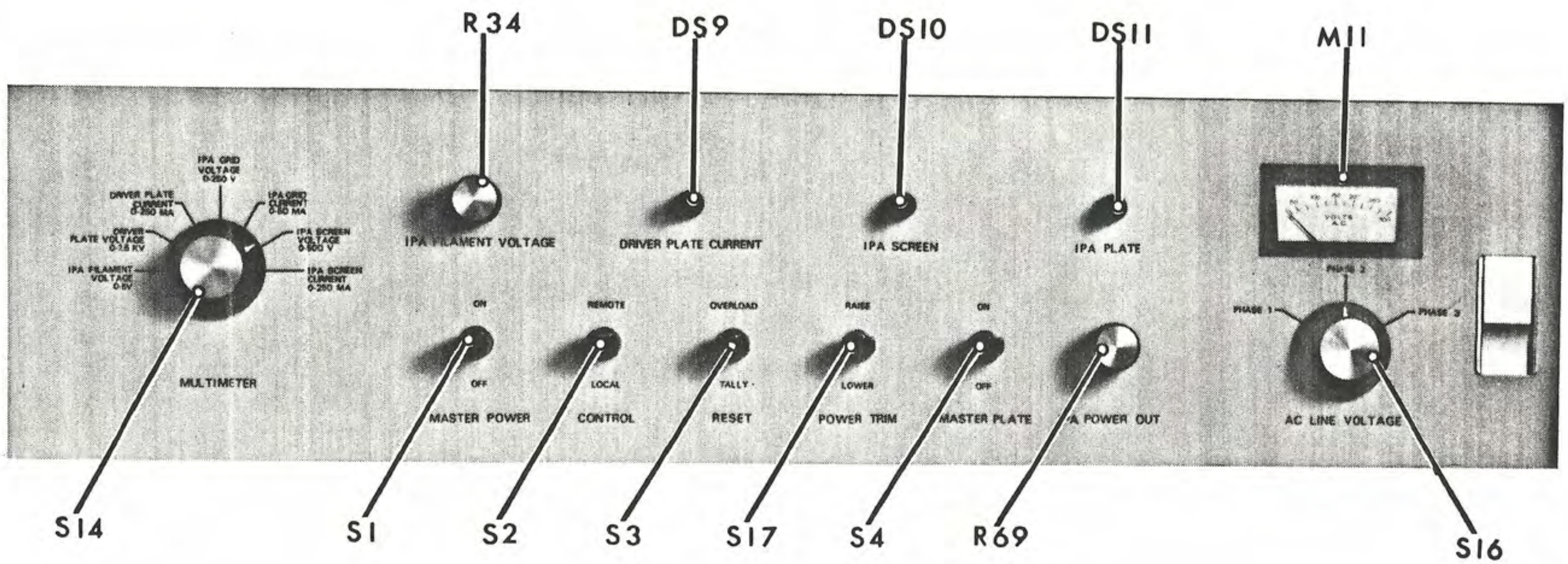


FIGURE 3-4 IPA CONTROL PANEL

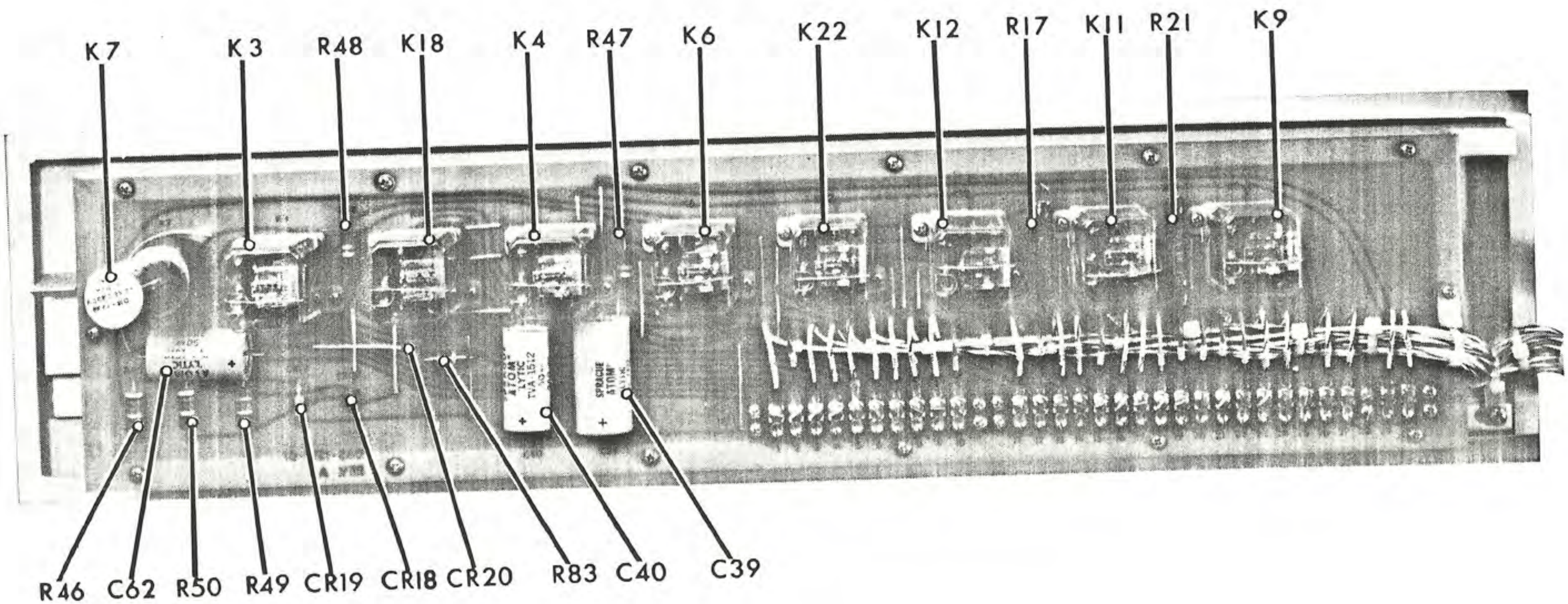


FIGURE 3-4B. CONTROL PANEL, REAR VIEW

3-3. TUNING PROCEDURE

Preliminary adjustments to all RF circuit elements have been made at the factory with the transmitter operating on its assigned frequency into a 50-ohm dummy load. Perform the initial turn-on procedures given in paragraphs 3-2.1 and 3-2.2, and proceed with the transmitter tuning as follows:

a. Set MULTIMETER function switch S14 (figure 3-4) to DRIVER PLATE CURRENT.

b. At front of IPA cavity, slowly adjust DRIVER TUNING control C9 until resonance is indicated by a dip in driver plate current as observed on MULTIMETER M1. An increased indication should also be noted on IPA PLATE CURRENT meter M2.

c. Slowly adjust IPA TUNING control C80 until resonance is indicated by a dip on IPA PLATE CURRENT meter M2. This dip should coincide with a maximum indication on IPA POWER OUT meter M4 and PA POWER OUT meter M8.

All subsequent tuning of the IPA plate circuit should be made on the basis of peaking the IPA screen current as observed on MULTIMETER M1 with MULTIMETER function switch S4 in the IPA SCREEN CURRENT position. Normally, an IPA screen current of 80 milliamperes should be indicated when all tuning adjustments have been made to obtain the desired RF output from the power amplifier.

Before increasing the IPA screen voltage, rotate PA TUNING control C81 first to its maximum clockwise position and then to its maximum counterclockwise position while observing PA POWER OUT meter M8; little or no change in RF output power should be noted. This condition indicates that the PA stripline circuit tuning and loading sliders are correct.

d. Set MULTIMETER function switch S14 to IPA GRID VOLTAGE and observe MULTIMETER M1, which should indicate 170 vdc. If necessary, set exciter OUTPUT POWER ADJUST control to achieve this value.

CAUTION

Do not allow the IPA screen current to exceed 125 milliamperes or the PA grid current to exceed 900 milliamperes.

e. Press and hold POWER TRIM control S17 in the raise position until PA POWER OUT meter M8 indicates the desired RF output.

Typical operating voltages and currents of the transmitter are given in table 3-2 and the efficiency curves are shown in figure 3-9. Figure 3-10, 3-11, and 3-12 show adjustments of the driver plate inductor, IPA plate line height, and IPA output coupling, respectively.

3-4. EXCITER MODE SELECTION

Monaural operation is enabled with the use of either the monaural or stereo modules installed in the exciter. For monaural operation with either module installed, audio signals are connected to the exciter STEREO AUDIO L input terminals 5 and 7 of TB4.

If the stereo module is in place, press the LEFT pushbutton on the upper panel to provide monaural operation. If the monaural module is in place, switching is not required for monaural operation.

Either one or both 41 -KHz and 67 -KHz SCA modules may be installed and used simultaneously when the exciter is operating in the monaural mode; thus, full-time operation of all three modes is permitted.

The exciter must be equipped with a stereo generator module to produce the stereo mode of operation.

When the stereo generator module is in place, either left channel, right channel, or stereo operation is available as selected by the LEFT, RIGHT, or STEREO pushbutton switches on the upper front panel. When the 41 -KHz SCA module is used in the exciter equipped for stereo operation, it is automatically disabled when the stereo mode is selected. This does not apply to the use of the 67 -KHz SCA module if it is equipped with a 5 -KHz filter, which prevents interference between the SCA and stereo subchannels.

Operating power to the exciter should be applied continuously. At the end of a broadcast period, set MASTER POWER switch S1 (figure 3-4) to OFF but leave MASTER POWER circuit breaker CB1 (figure 3-3) in the ON position. In this manner, the station can resume operation after a delay of approximately 45 seconds.

Table 3-2. Model 620 Typical Operating Voltages and Currents

Parameter	P_o = 15 KW	P_o = 20 KW
Frequency	93.7 MHz	93.7 MHz
Driver Plate Voltage	1200 vdc	1200 vdc
Driver Plate Current	72 ma	72 ma
IPA Grid Voltage	175 vdc	173 vdc
IPA Grid Current	5.4 ma	5.2 ma
IPA Screen Current	56 ma	94 ma
IPA Filament Voltage	5 vac	5 vac
IPA Plate Voltage	2550 vdc	2525 vdc
IPA Plate Current	640 ma	760 ma
PA Grid Current	460 ma	740 ma
PA Plate Voltage	7250 vdc	7200 vdc
PA Plate Current	3.42 amps	3.85 amps
PA Filament Voltage	6.15 vac	6.15 vac

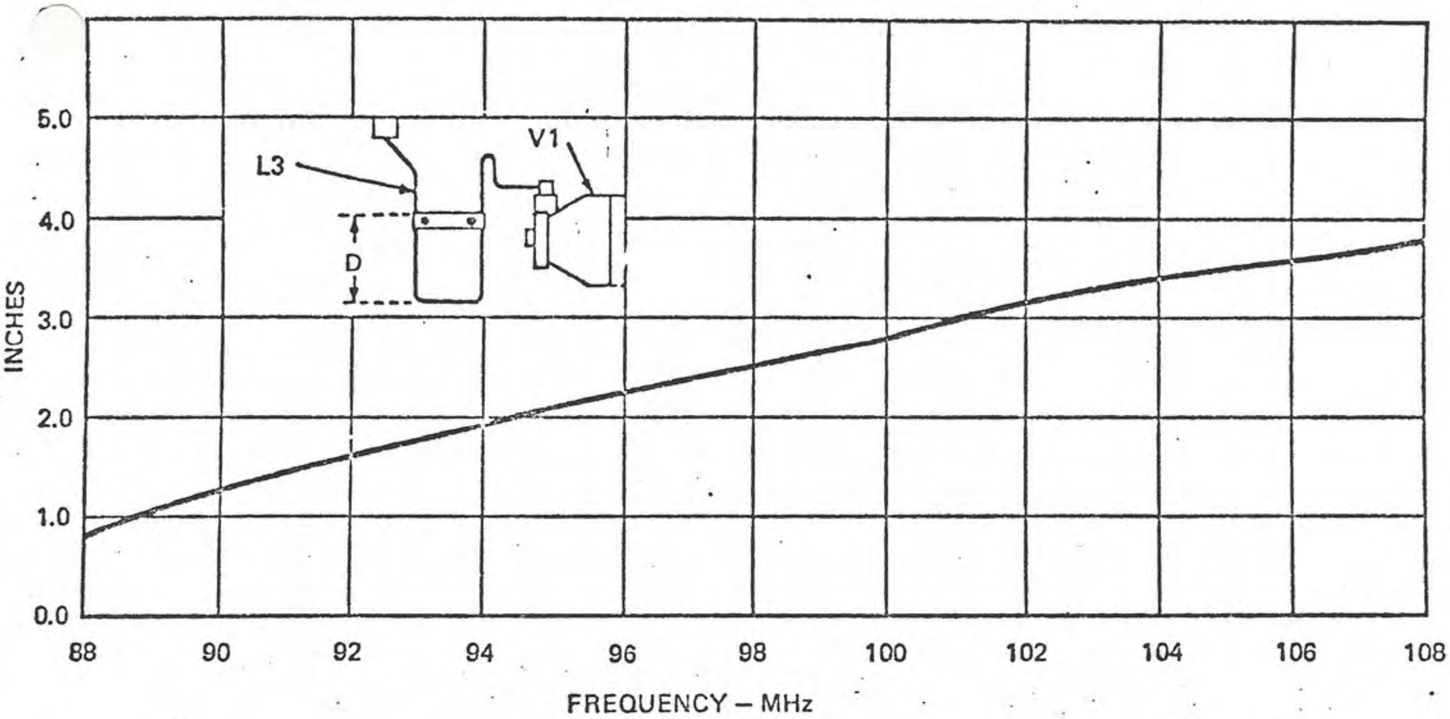


Figure 3-10. Driver Plate Inductor Tuning Vs. Frequency

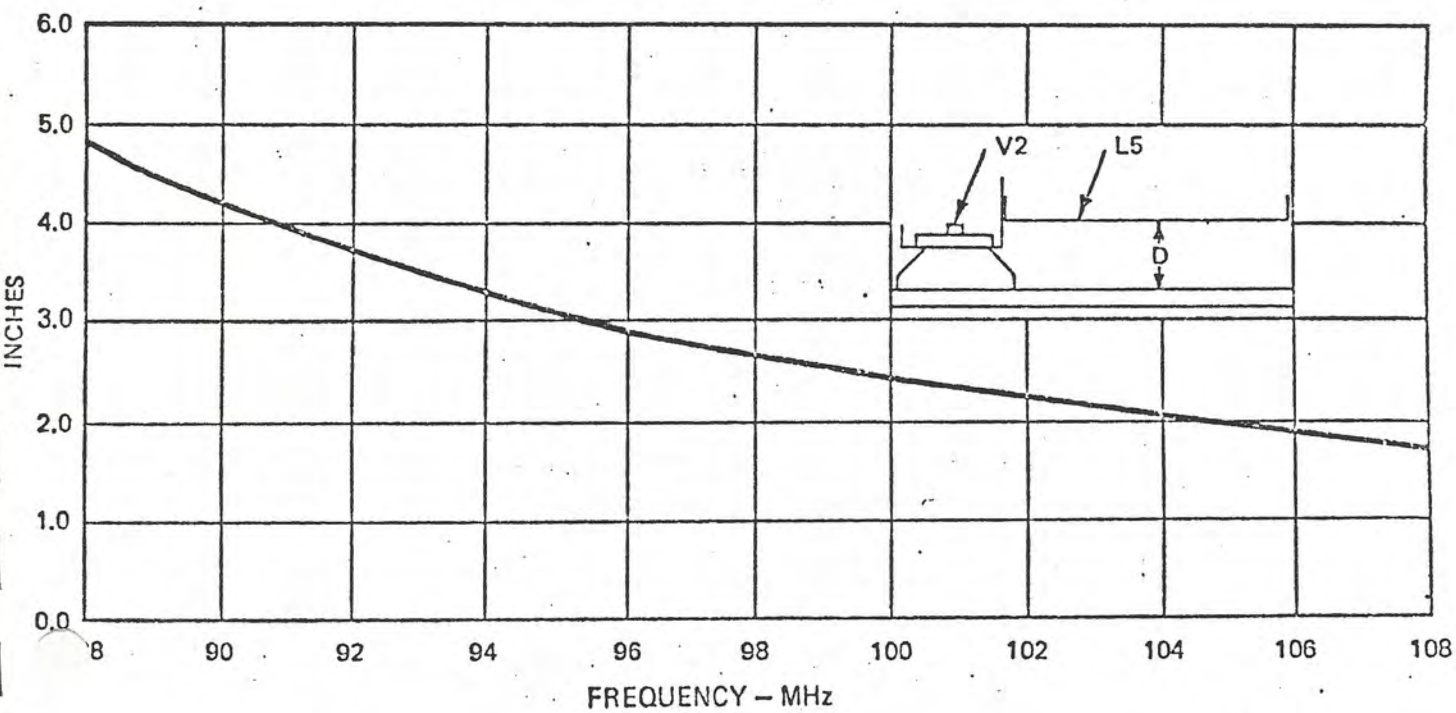


Figure 3-11. IPA Plate Line Height Vs. Frequency

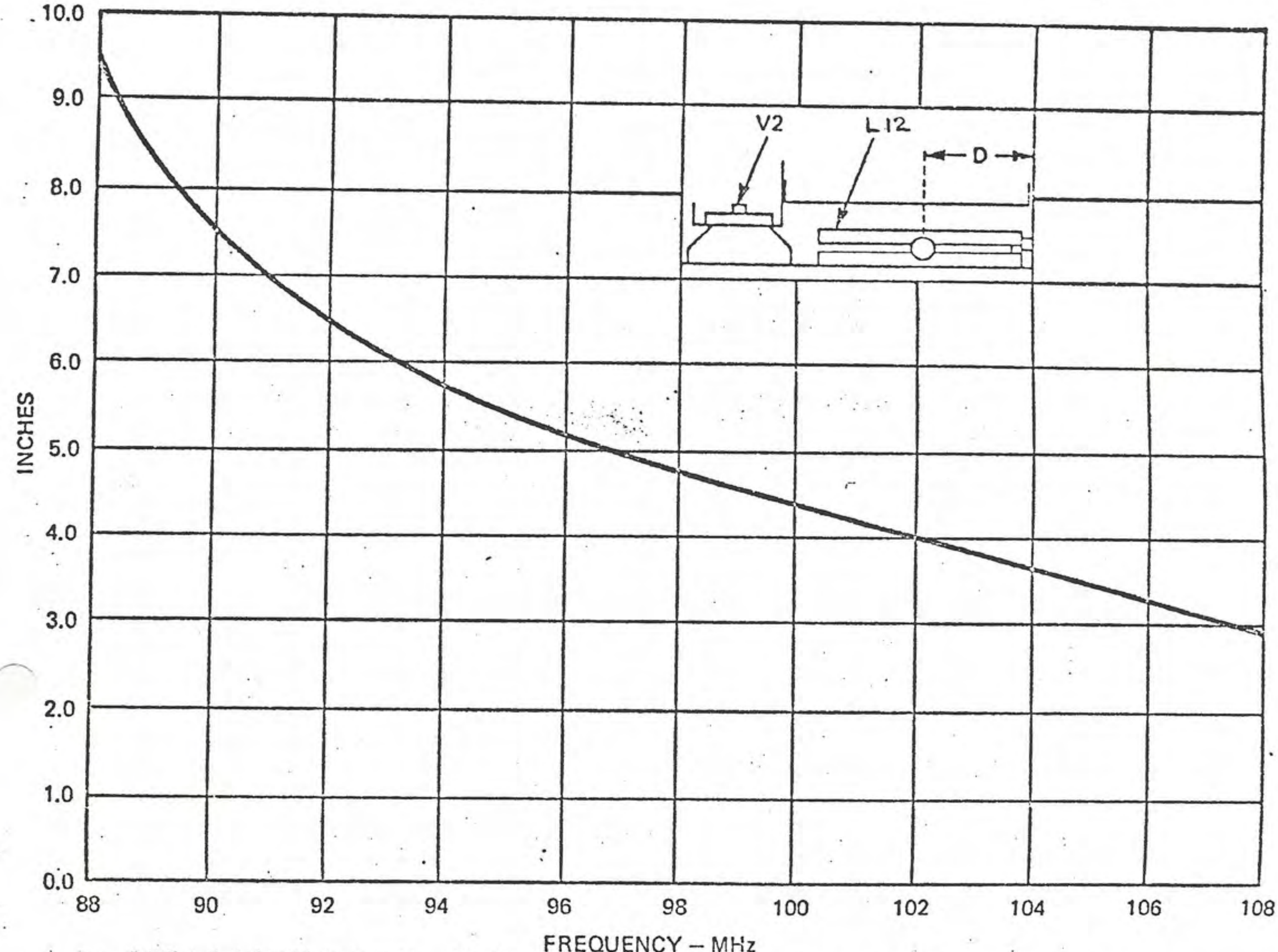


Figure 3-12. IPA Output Coupling Vs. Frequency

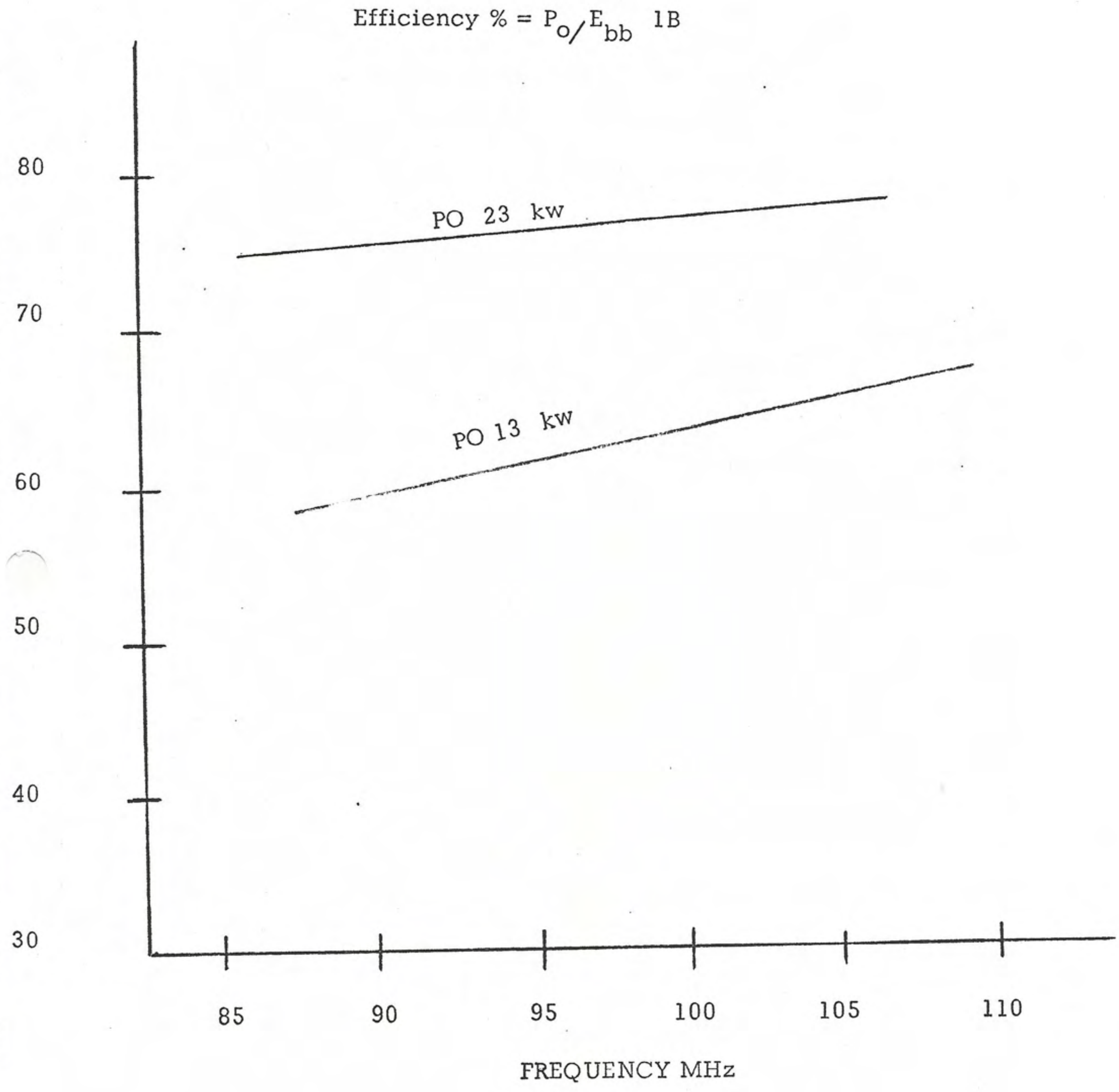


Figure 3-9. Curve of Efficiency vs. Frequency

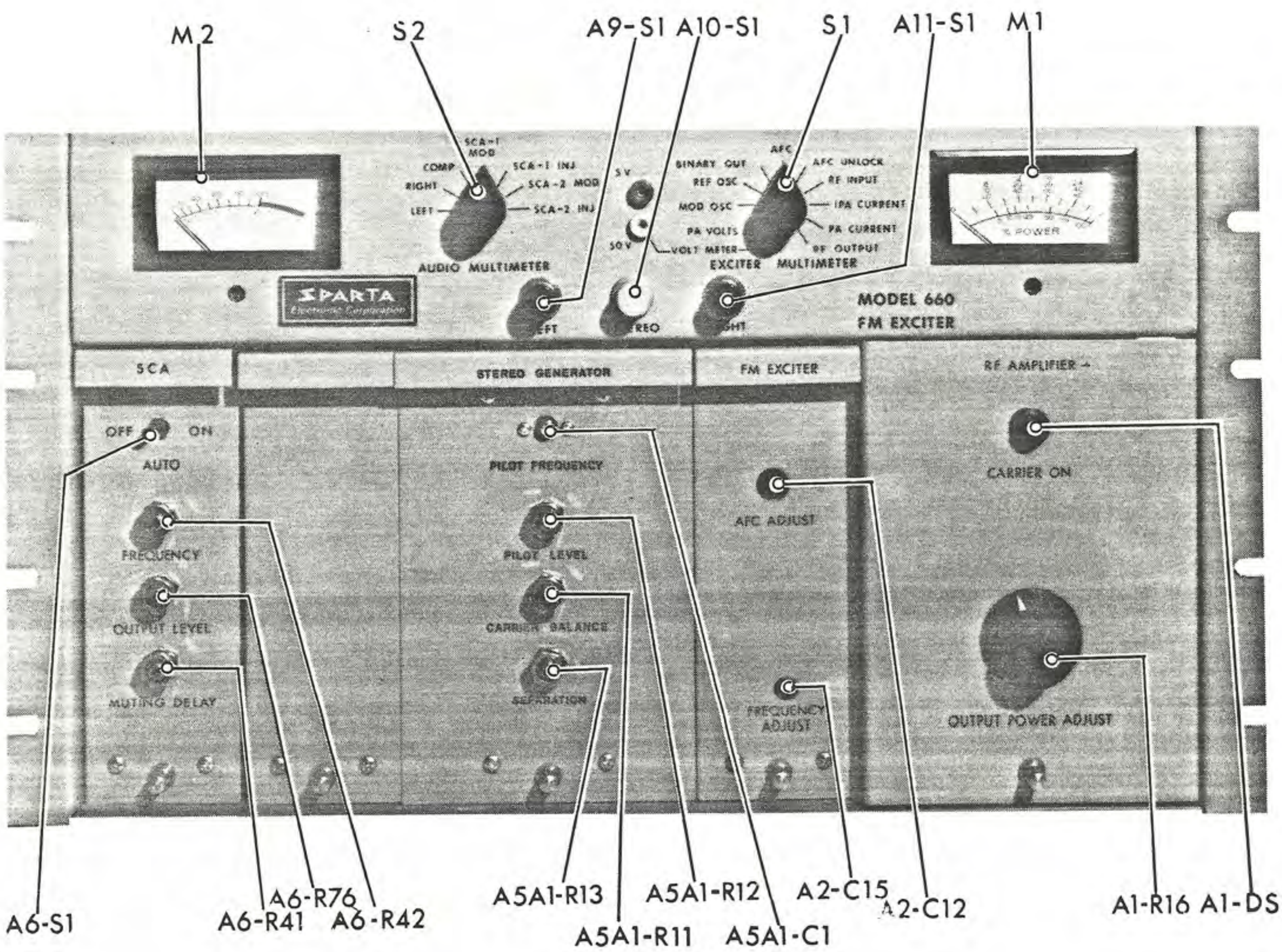


FIGURE 3-5 EXCITER FRONT PANEL

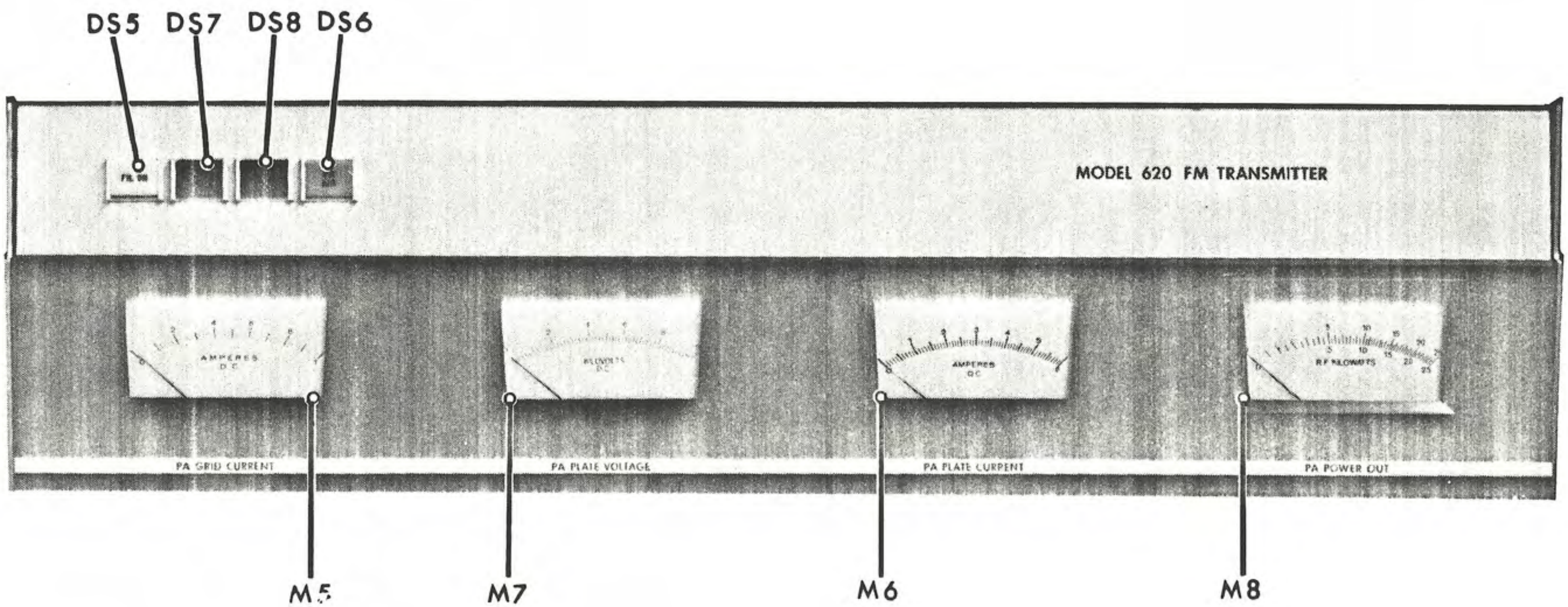


FIGURE 3-6 PA METER PANEL

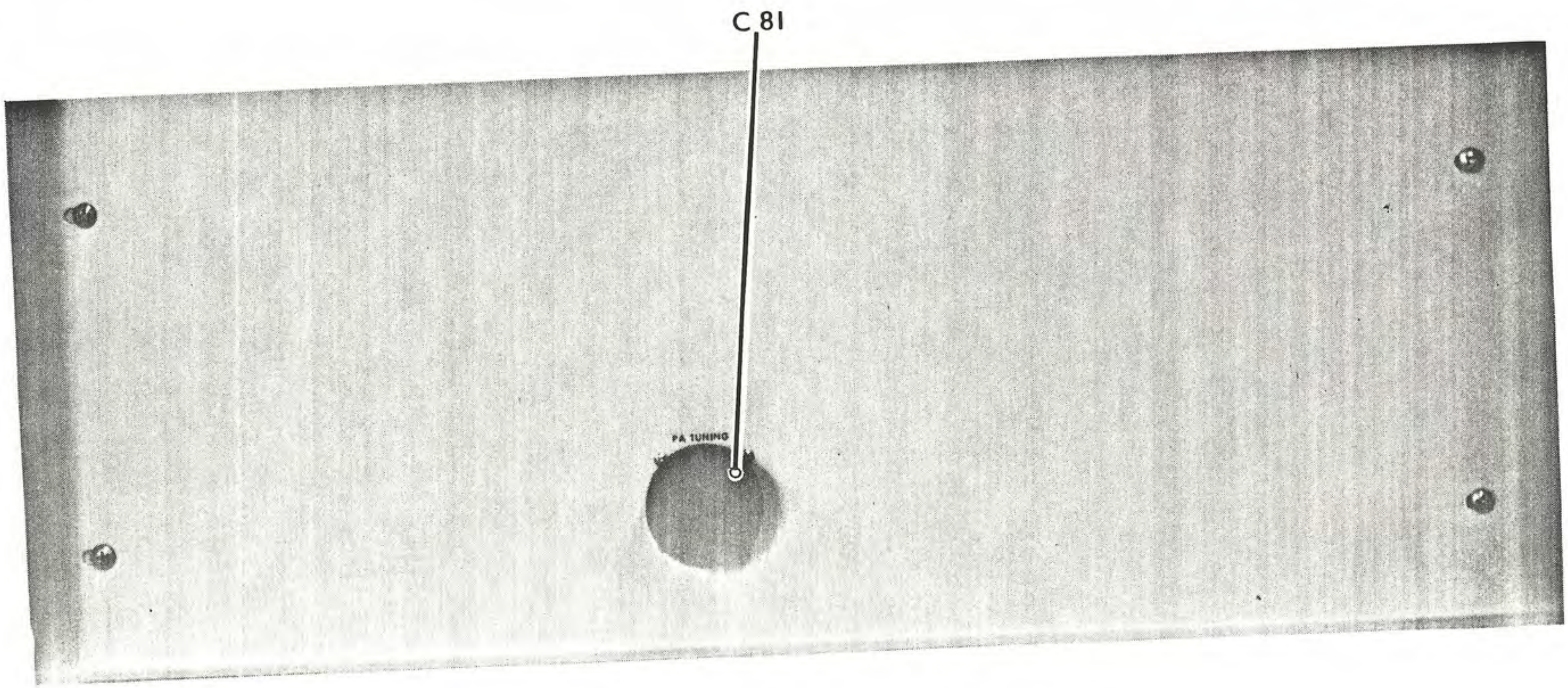


FIGURE 3-7 PA CAVITY FRONT PANEL

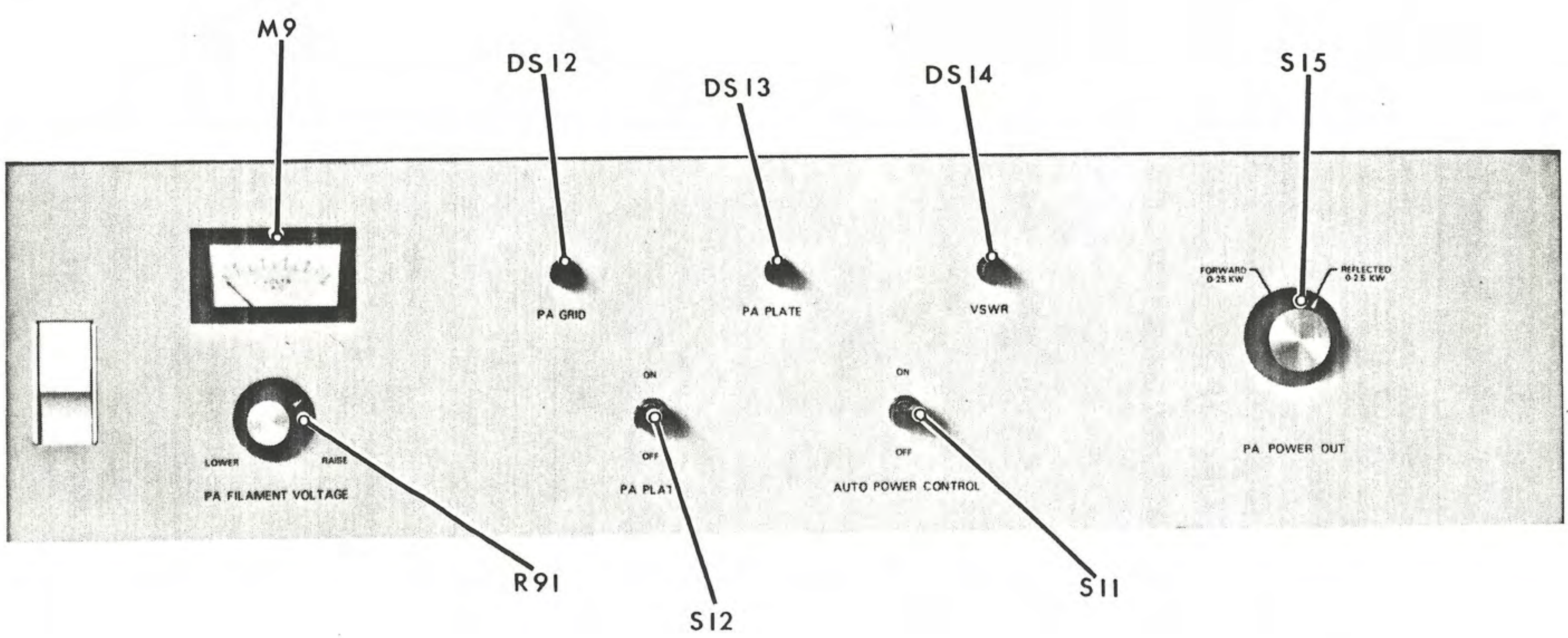


FIGURE 3-8. PA CONTROL PANEL

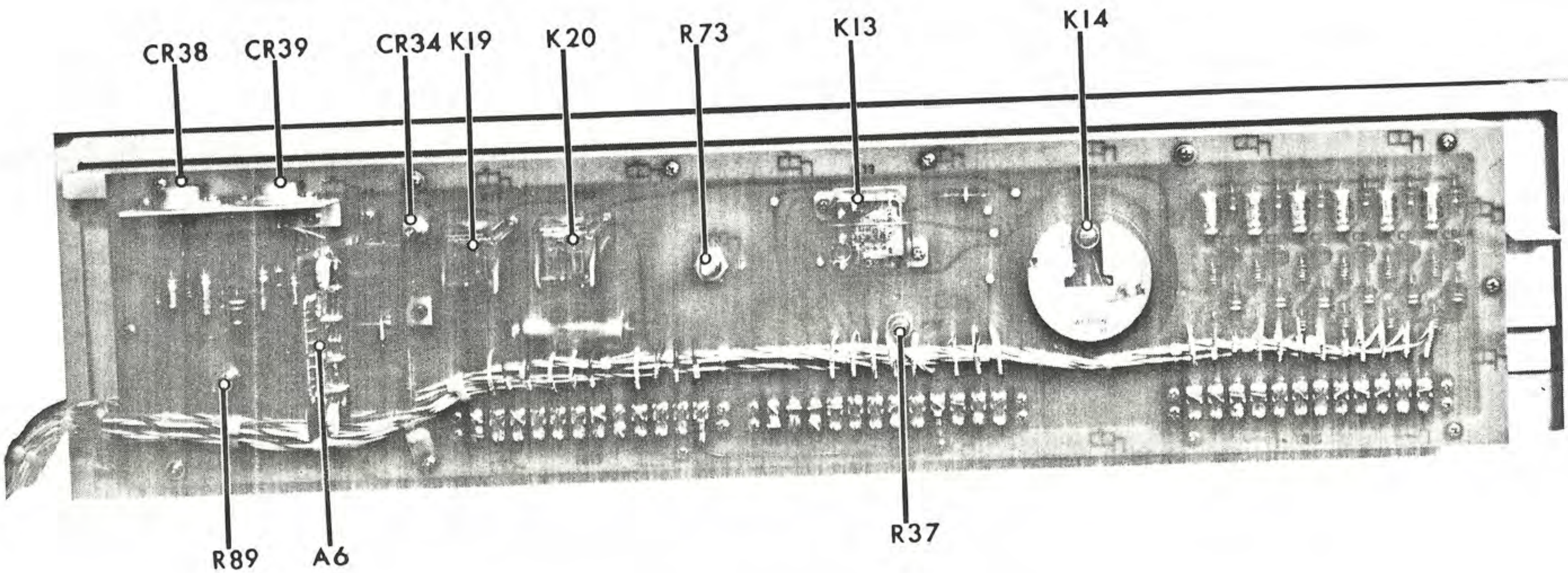


FIGURE 3-8B PA CONTROL PANEL.REAR VIEW

SECTION IV

PRINCIPLES OF OPERATION

4-1. GENERAL

The Model 620 is divided into the following functions: (1) control and interlock circuits, (2) power supplies, (3) IPA and PA RF cavities, (4) overload and automatic recycle circuits, and metering circuits. The Model 660 FM Exciter is functionally analyzed in Section IV of its individual operating and servicing manual.

4-2. CONTROL AND INTERLOCK CIRCUIT ANALYSIS

Primary power is applied through the customer's 200 ampere safety disconnect switch to the open contacts of K17 and to MASTER POWER circuit breaker CB1. When CB1 is placed in the ON position, primary power is applied to the open contacts of relay K2, relay K8, relay K21 and MASTER POWER switch S1. Placing MASTER POWER switch S1 in the ON position energizes relay K2, which distributes primary power as follows:

a. Phases A and C to IPA blower B2.

b. Phases A and B to the coil of relay 21 and to cabinet fans B3, B4, and B5.

c. Phases A and B to the driver and IPA bias supply and to the ØA and ØB busses.

The closed contacts of relay K21 apply three-phase power to PA blower B1. S13 is a 105° thermal switch with N/O contacts, and is mounted on the PA blower housing (B1), allowing the blower to continue running to purge the PA cavity of residual heat after the transmitter has been shut down.

S20 is a 180° thermal switch with N/C contacts, and is also mounted on the blower housing (B1), allowing plate voltages to be removed in the event of excessive heat. When blowers B1 and B2 come up to normal running speed, they close their respective airflow interlock switches (S7 and S8) and apply phase A power to PA AIR indicator lamp DS6. In addition, S7 applies phase A power to the primary circuit of filament transformer T2 and the heater element in time delay relay K7, and switch S8 applies phase A power to the phase-angle control circuit of filament transformer T4 and FIL ON indicator lamp DS5.

After 15 seconds of heating time, contacts 1 and 8 of K7 open and contacts 5 and 7 close. Contacts 5 and 7 apply phase B power to one side of the coil of K3, which is an auxiliary dc relay operated by the rectified voltage supplied by diode CR20 and capacitor C62. Contacts 3 and 9 of K3 open and remove heater voltage from K7, and contacts 6 and 9 close and apply latching power to maintain K3 energized. Contacts 5 and 8 of K3 provide an interlock function to apply dc power to the exciter RF amplifier module. Thirty seconds after heater voltage is removed from K7 (total delay time of approximately 45 seconds), contacts 1 and 8 of K7 close again and apply phase A power to the master plate control circuit through the interlock circuit, which is composed of the following switches:

a. IPA control panel (S18), IPA lower front access panel (S6), and IPA section rear door (S5).

b. PA control (S19), PA lower front access panel (S9), and PA section rear door (S10).

c. Contacts 4 and 7 of auxiliary relay K3 and contacts K5A of underbias relay K5, and S20, over temp. switch. (Relay K5 energizes and contacts K5A close if the bias voltage for the driver and IPA is normal).

The status of the interlock circuits is indicated by INTERLOCKS lamps DS2 (IPA) and DS7 (PA).

Phase A power is supplied to one side of the coil of relay K4 and to contactors K8 and K17 through the

IPA and PA interlock circuits. When MASTER PLATE switch S4A and PA PLATE switch S12 are set to the ON position, phase B power is applied to the other side of the coil of relay K4 through the normally closed contacts of the remote "master power off" switch, the normally closed contacts of S4B, the momentarily closed contacts of S4A and Resistor R38. Switches S4A and S4B are spring loaded and return to the off (center) position when released. Relay K4 energizes and remains latched after S4A is released by the voltage supplied through contacts K4A. Phase B power is supplied to the coils of contactors K8 and K17 through PA PLATE switch S12 and the closed contacts of K4. Contactor K8 applies three-phase power to the driver and IPA plate and screen supply and contactor K17 applies three-phase power to the PA plate supply.

Once the transmitter is tuned and placed in operation, the power output can be adjusted manually by POWER TRIM switch S17, or the power output can be automatically maintained at the authorized level by the automatic power leveling circuit. POWER TRIM switch S17, which is spring loaded and returns to off (center) when released, applies ground to the proper winding of motor B6 to cause it to rotate in the desired direction. The shaft of B6 is mechanically coupled to a power rheostat in the IPA screen voltage supply. (See paragraph 4-3.3.).

The dc voltage required to operate the automatic power-leveling module is furnished by CR35, CR36 and CR37 through AUTO POWER CONTROL switch S11. This voltage is filtered by C45 and clamped at +12 vdc by Zener diode CR34. The transmitted power output through directional coupler DC2 is sampled, rectified by CR30, and applied to module terminals 13 (+) and 8 (-). (See figure 5-1). If the transmitter output increases slightly, and output transistor (Q5) in the module conducts and supplies a ground return for relay K19, causing it to energize and connect ground to the "lower" contact of S17. Conversely, if the transmitter output decreases slightly, a second output transistor (Q6) in the module conducts and supplies a ground return for relay K20, causing it to energize and connect ground to the "raise" contact of S17.

4-3. POWER SUPPLY CIRCUIT ANALYSIS

4-3.1 Bias Power Supply

Primary power available through CONTROLS fuses F11 and F12 is applied to the primary winding of transformer T1. (See figure 5-1). The secondary voltage of T1 is rectified by a full-wave silicon rectifier stack, CR13; filtered by the combination of L1, C25 and C26; and applied to the voltage divider composed of R8, R9, and R10. The full -110 vdc developed across the voltage divider is applied to the grid of V2 through R6. Potentiometer R9 provides the means of adjusting the grid bias voltage of V1.

The coil of relay K5 is connected across C26 and senses the full output of the bias supply. If the voltage output of the bias supply is insufficient to properly bias V1 and V2, relay K5 de-energizes and opens the interlock circuit. (See figure 5-1).

4-3.2 Filament Power Supply

Primary power available through CONTROLS fuses F11 and F12 is applied to the primary winding of transformer T2 through IPA air interlock switch S7, IPA Filament Fuse F6 and IPA Filament voltage control R34. Mains power for T3 is available from PA filament fuse, F5. Conversely, the point in time upon which CR39 fires is determined primarily C53, C54 and R91. Thus, by shifting the points on each half of the primary voltage cycle, the effective voltage applied across the primary winding of T4 is controlled.

Forcing Transformer T3 is employed to allow a wider range of control when operating from mains voltage inputs of 200 to 208 vac. This transformer is bypassed when operating from Mains voltages above 208 vac.

4-3.3. Driver/IPA Plate and Screen Supply

Primary power from MASTER POWER circuit breaker CB1 is supplied to the delta-connected primary winding of transformer T5 through the contacts of K8. As shown in figure 5-1, T5 has two secondary sindings, one connected in delta and the other connected in wye. The output of the delta-connected secondary is rectified by CR1 through CR3, filtered by the combination of C27 and L8, and applied across bleeder resistors R19 and R20. The voltage (4500 vdc) developed across R19 and R20 is used as the plate supply for V2.

The output of the wye-connected secondary is used to develop the driver plate voltage (1200 vdc) and the screen voltages for the driver and IPA. The driver plate voltage is rectified by CR21 through CR23, filtered by L9-C29, and applied across bleeder R24.

Screen voltages for both V1 and V2 are developed from the voltage appearing across terminal 14 and neutral. The filtering action provided by choke L10 and capacitor C30 is common to both screen supplies. Additional filtering of the driver screen voltage appearing at the junction of R29-R30 is supplied by C41. The variable screen voltage for V2 is taken from the wiper arm of rheostat R27 which forms a part of the voltage divider network of R26, R27 and R28. The wiper arm of R27 is mechanically coupled to the shaft of B6, the rotation direction of which is controlled by the application through POWER TRIM switch S17. (See figure 5-1). The adjustable output taken from the wiper arm of R27 is applied to the screen circuit of V2 through the coil of IPA screen current overload relay K10.

4-3.4. PA Plate Voltage Supply

The Model 620 utilizes a caster-mounted 7500 vdc power supply, an Energy Systems Model 4T32. This supply has primary taps to allow operation from 208, 224 and 241 vac, 60 -Hz mains. This configuration has a single delta-connected secondary, the output of which is full-wave rectified and filtered to provide 7500 vdc at 5 amperes to the plate circuit of V3.

4-4. RF AMPLIFIER CIRCUIT ANALYSIS

A detailed circuit analysis of the Model 660 FM Exciter is provided in Section IV of its individual operating and servicing manual. The exciter provides an adjustable RF output of 5 to 12 watts to the grid of a 4X150A tetrode driver (V1) through jack J1 and capacitor C1. (See figure 5-1).

Driver V1 and intermediate power amplifier (IPA) V2 are housed in an aluminum enclosure, or cavity, in the upper left-hand side of the cabinet as viewed from the front. RF radiation leakage is prevented by the use of capacitor type feed-through connections to the cavity interior. RF gasketing is used to seal the removable rear cover.

The 4X150A driver tube plate line is inductively coupled to the IPA, which is a 5CX1500A pentode. The driver plate line inductos (L3) of V1 is adjustable by a sliding shorting bar and is tuned to resonance by DRIVING TUNING control C9. The IPA uses a stripline concept in the plate circuit for stability and simplicity. The stripline (L5) is adjustable in height which, in conjunction with IPA TUNING capacitor C80, tunes the plate circuit of V2 to resonance. The IPA output coupling to the input of the PA cavity is adjustable by inductor L12, which is a stripline with a stripline with a movable shorting bar. The RF output coupled out of the IPA cavity at jack J2 is fed to the input of the PA cavity. Inductor L18 is a pickup loop used to couple a sample of the IPA power output through a diode (CR32) and potentiometer (R69) to read meter M4.

The power amplifier, which utilizes a 3CX15000A7 in a grounded grid configuration, is housed in a separate aluminum enclosure, or cavity, in the upper right-hand side of the cabinet as viewed from the front. Input RF power from the IPA stage is applied through jack J3 to adjustable stripline inductor L13, which inductively couples RF into the cathode circuit of V3. The plate tank circuit of V3 is tuned to resonance by the adjustment of stripline L14 and PA TUNING capacitor C81. The RF output coupling to the antenna via the harmonic filter and directional coupler is accomplished by L15. Inductor L19 is a pickup loop used to couple a sample of the PA power output to an external monitor. The detected forward RF power output is also applied to the automatic power leveling module.

4-5. OVERLOAD AND AUTOMATIC RECYCLE CIRCUIT ANALYSIS

The RF amplifier circuits are protected against plate current overloads of V1, V2, and V3; screen current overloads of V2; grid current overloads of V3; and against overloads caused by high reflected RF output power. (See figure 5-1). Relays associated with these protective functions are as follows:

a. Driver plate current overload relay K9

b. IPA screen current overload relay K10

c. IPA plate current overload relay K11

d. PA grid current overload relay K12

e. PA plate current overload relay K13

f. High reflected RF power overload card A7 and its slave relay K22

The threshold at which relays K9 through K13 actuate is adjustable by a potentiometer shunted across the coil winding. The thresholds at which these relays are adjusted to trip are: 150 milliamperes for K9 and K10; 1 ampere for K11 and K12; 5 amperes for K13; and 500 watts for K22.

All overload relays are simple dc relays with one coil and three sets of normally open contacts.

During normal transmitter operation, capacitor C39 charges to the full -110 vdc bias voltage through resistor R47 and contacts 2 and 8 of K6. Now refer to figure 4-2 and note that the normally open "A" contacts of each overload relay are connected in parallel across the coil of master plate relay K4; the normally open "B" contacts are connected in the gate circuit of an associated silicon-controlled rectifier (CR44 through CR49); and the normally open "C" contacts are connected in parallel and in series with the ØA power connected to one side of the coil of relay K6 through OVERLOAD RESET switch S3A. (The other side of the coil of K6 is normally connected to ØB through contacts 2 and 7 of K18, the normally closed contacts of S4B, and the normally closed contacts of the remote master plate off switch.)

Assume that the driver plate current momentarily exceeds 150 milliamperes, which is the threshold current of relay K9. Contacts K9A close and place a direct short across the coil of K3, which causes K3 to deenergize and remove mains voltage from contactors K8 and K17, there shutting down the screen and plate supplies. Contacts K9B close and forward bias (ground) the gate of CR44, causing it to fire. This completes the current flow from the -110 vdc source to ground through CR44, DRIVER PLATE CURRENT overload tally light DS9, and the normally closed contacts of TALLY RESET switch S3B. Contacts K9C close and complete the application of ac power to the coil of K6, causing it to energize. Closed contacts 6 and 9 of K6 remove ground from the cathode of CR18, and closed contacts 5 and 8 connect capacitor C39 across capacitor C40 through resistor R48.

When capacitor C18 is charged to approximately 39 vdc, zener diode CR19 is reverse biased into breakdown and ground (+39 vdc) is applied through R49 to the gate of CR18, causing it to fire and energize relay K18. Contacts 2 and 7 of K18 open, causing relay K6 to deenergize and contacts 5 and 7 of K18 complete the application of ac power to the coil of K4 causing it to close and reconnect the mains power to contactors K8 and K17. With relay K6 deenergized, contacts 3 and 9 ground the cathode circuit of CR18, causing it to cut off and deenergize relay K18. The foregoing sequence of events is repetitive up to a maximum of four times within eight seconds, after which the charge across capacitor C39 is depleted to the point where it is insufficient to charge C40 to the 39 vdc level required to avalanche CR19. Therefore, the ac voltage supplied through contacts 5 and 7 of K18 will maintain K6 energized. In this circumstance, the transmitter overload must be manually reset.

4-6. METERING CIRCUIT ANALYSIS

4-6.1. Multimeter Circuits

As shown in figure 5-1, when MULTIMETER function switch S14 is set to IPA FILAMENT VOLTAGE, the MULTIMETER (M1) is connected through R13 and R12 to the junction of diodes CR14 and CR15 connected back-to-back across the filament of V2. Potentiometer R13 is used in this position to calibrate M1 for a full-scale indication of 5 volts for this function.

In the DRIVER PLATE VOLTAGE position, S14 connects M1 across shunt resistor R23. Resistor R23 (10 kilohms) and resistor R25 (2.5 megohms) are connected in series across bleeder resistor R24 in the +1200 vdc power supply. A potential of approximately 4.8 vdc is developed across R23, which is approximately half-scale indication of M1 for this function.

When in the DRIVER PLATE CURRENT position, S14 connects M1 across the 0.24 ohm resistor (R3) in the cathode circuit of V1. Since the total plate current of V1 flows through the cathode circuit, R3 is used to develop a small voltage drop (typically 15 millivolts) to represent the plate current drawn by V1. M1 has a full-scale indication of 250 milliamperes in this position of S14.

When in the IPA GRID VOLTAGE position, S14 connects the positive side of M1 to ground and the negative side through R11 and L4 to the control grid of V2. Under static conditions (i.e., without RF drive), approximately -100 vdc will be developed at the junction of R7 and R11. The series resistance of R11 provides M1 with a full-scale indication of 250 vdc in this position of S14.

When in the IPA GRID CURRENT position, M1 measures the voltage drop developed across the 1.2 ohm resistor (R7) in the grid circuit of V2. Under normal operating conditions, the control grid of V2 will draw slightly over 5 milliamperes and the voltage drop across R7 will be approximately 6 millivolts. M1 has a full-scale indication of 50 milliamperes in this position of S14.

When S14 is in the IPA SCREEN VOLTAGE position, M1 is connected in series with R16 and R15 to the screen grid of V2. The series limiting resistance of R16 provides M1 with a full-scale indication of 500 vdc in this position of S14. In the IPA SCREEN CURRENT position, S14 connects M1 directly across the 0.24 ohm resistor (R31) in the screen return line of V2. Under normal operating conditions the screen current of V2 is .094 ampere, which develops a voltage drop of 2.25 millivolts across R31. M1 has a full-scale indication of 250 milliamperes for this function.

4-6.2. IPA PLATE CURRENT, Plate Voltage, and Power Output Meter Circuits

The IPA PLATE CURRENT meter (M2) and IPA PLATE VOLTAGE meter (M3) provide continuous monitoring of these functions. Meter M2 has a 0-1.5 ampere movement and requires no external meter shunt. Meter M3 has a 0-1 milliampere movement and a 5 megohm resistor (R14) is used to provide a full-scale indication of 5 kilovolts.

4-6.3. PA Meter Circuits

Meters providing continuous monitoring of the PA status include M5 (PA GRID CURRENT), M6 (PA PLATE CURRENT), M7 (PA PLATE VOLTAGE), M8 (PA POWER OUT), and M9 (PA FILAMENT VOLTAGE).

Meters M5 and M6 have meter movements of 0-1 ampere and 0-6 amperes, respectively, and require no external meter shunts. A 1-ohm resistor (R74) in the plate voltage return line is used to develop a nominal 4 volt source for remote PA plate current readout.

Meter M7 is connected in series with R36, R39, R40, R41 and R42 to the 7200 vdc bus. The series resistance of these components limit the current flow through M1 to a nominal 750 microamperes. The current flow through R36 is used to develop a nominal 50 vdc for remote PA plate voltage readout.

PA POWER OUT meter M8 provides a readout of both forward and reflected RF power output as sensed and detected by directional coupler DC1 (CR30 and CR31) and selected by PA POWER OUT switch S15.

Meter M9 is a 0-10 vac meter connected across the filament of V3 through L16 and L17. Capacitor C32, in conjunction with L16 and L17, isolate the meter movement from stray RF.

4-6.4. AC Line Voltage and Elapsed Time Meter Circuits

ELAPSED TIME meter M10 is connected between phase C and phase B and provides a cumulative readout (in hours) of the transmitter operating time. Meter M1, as selected by AC LINE VOLTAGE switch S16, provides readouts of the three-phase mains supply: phase B to phase C, phase A to phase C, and phase A to phase B.

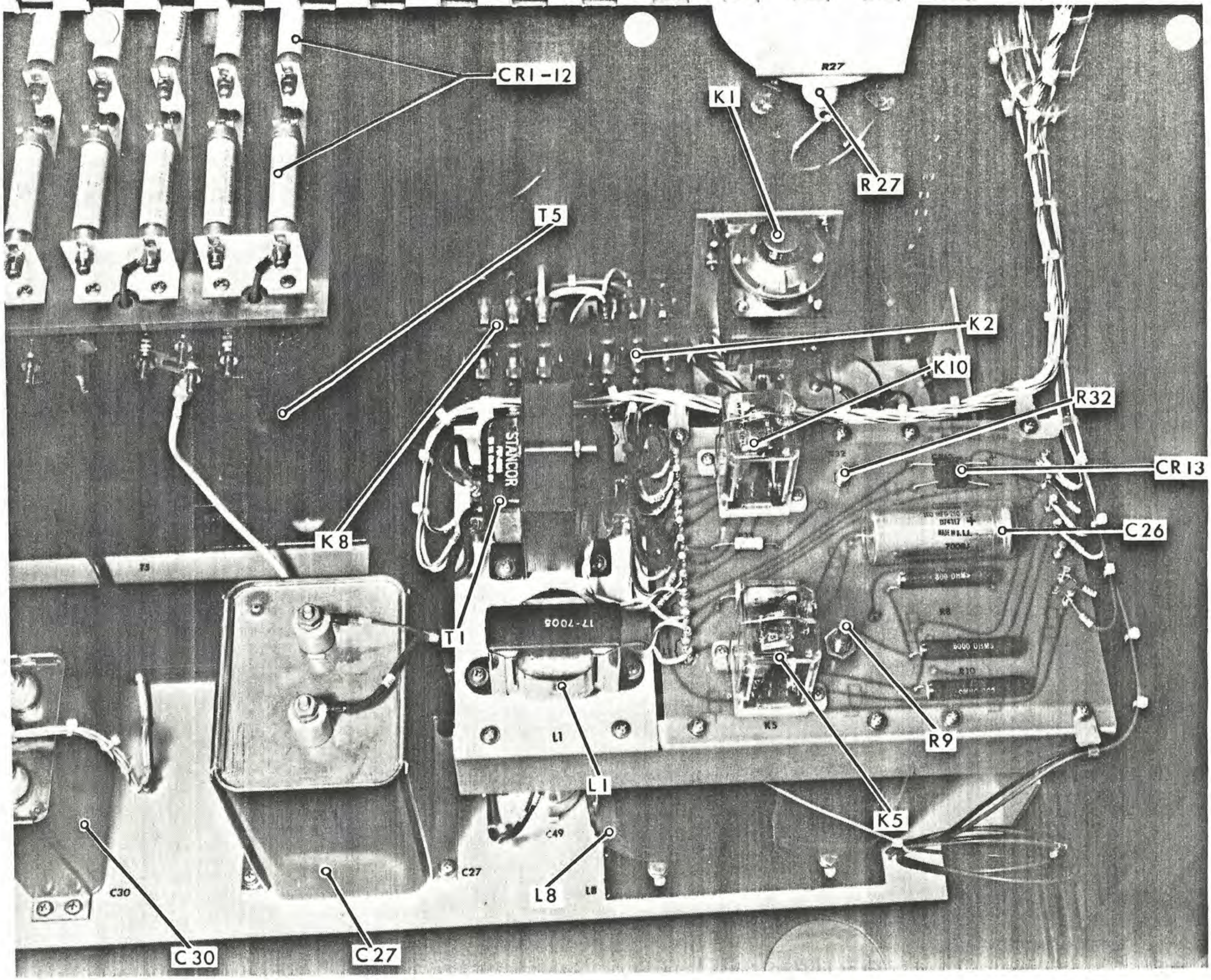
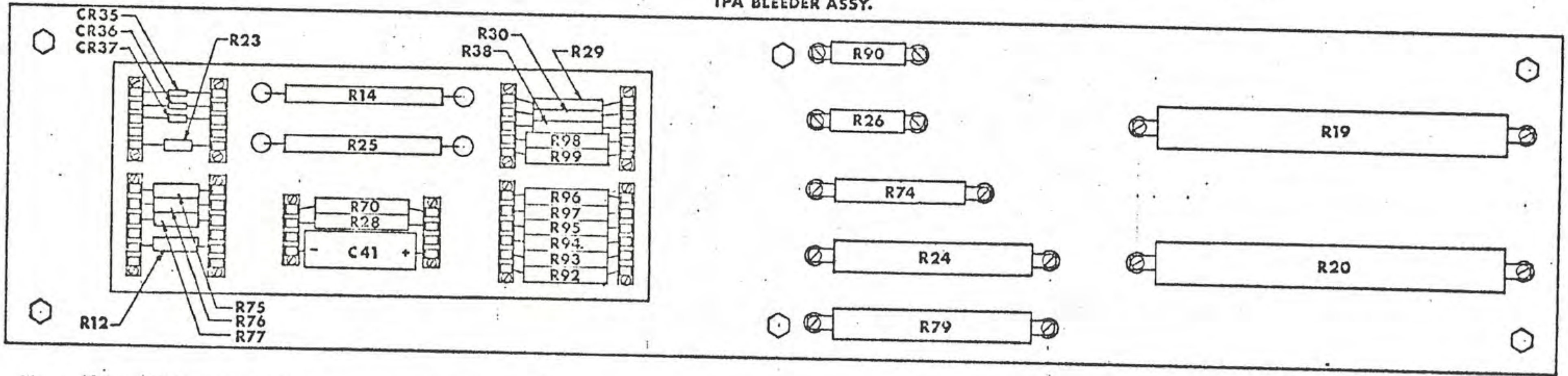
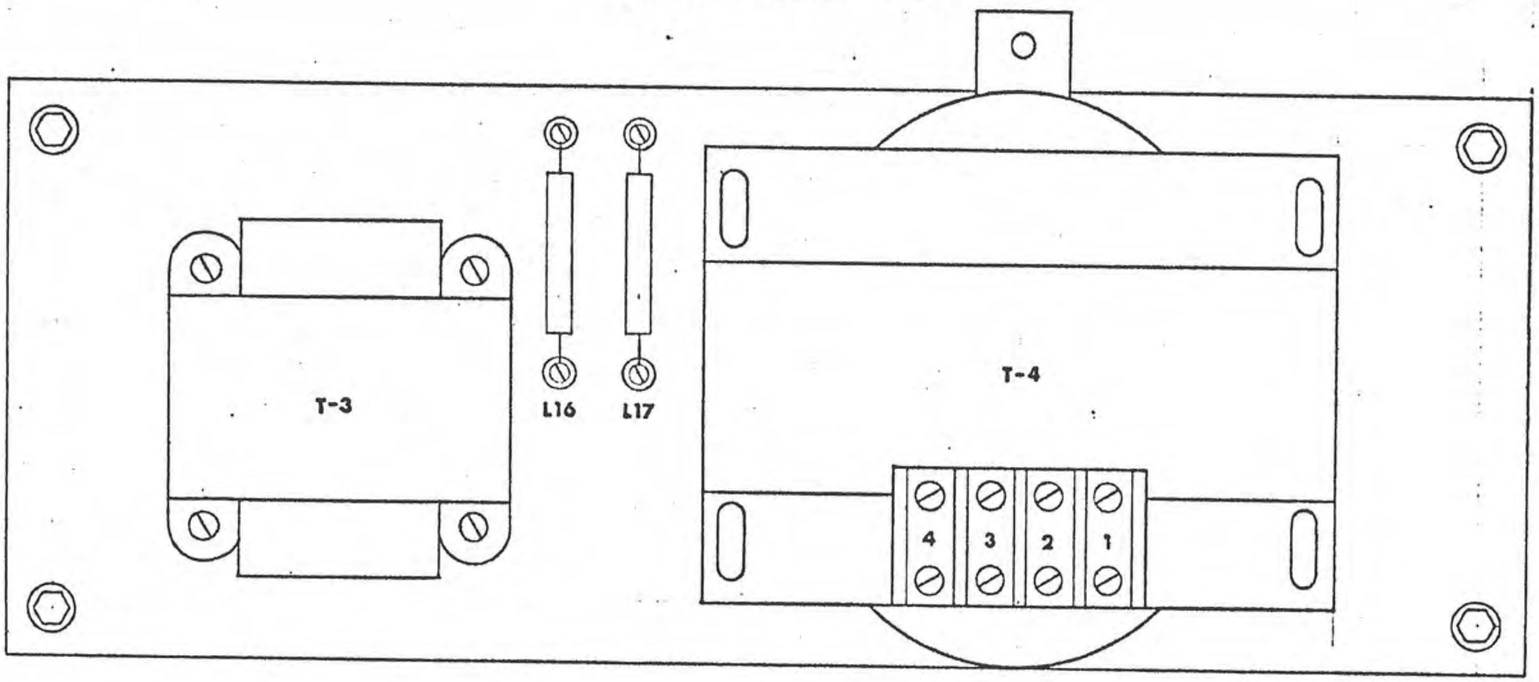


FIGURE 6-7. BIAS & LOW VOLTAGE SUPPLY & CONTROLS

IPA BLEEDER ASSY.



PA FIL. TRANSFORMER ASSY.



PA BLEEDER ASSY.

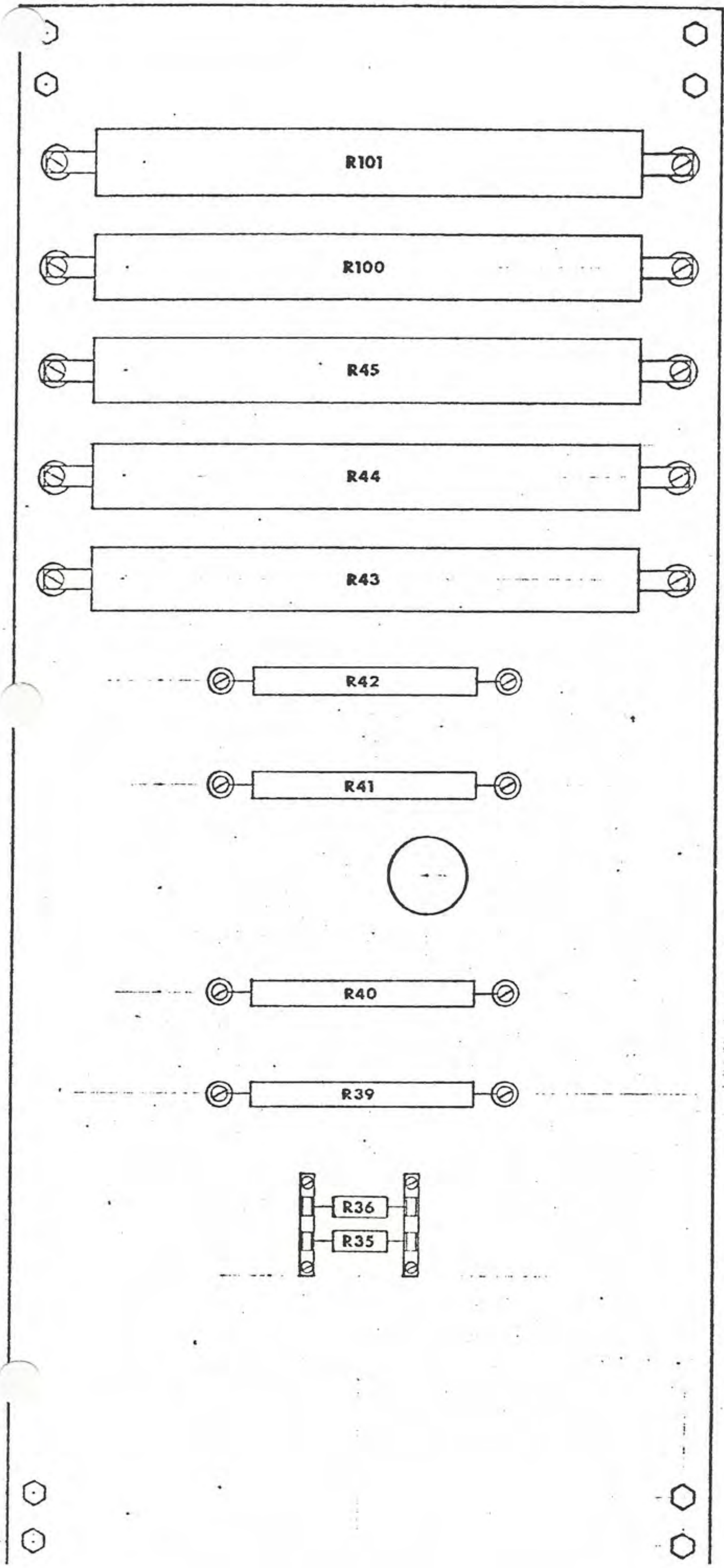
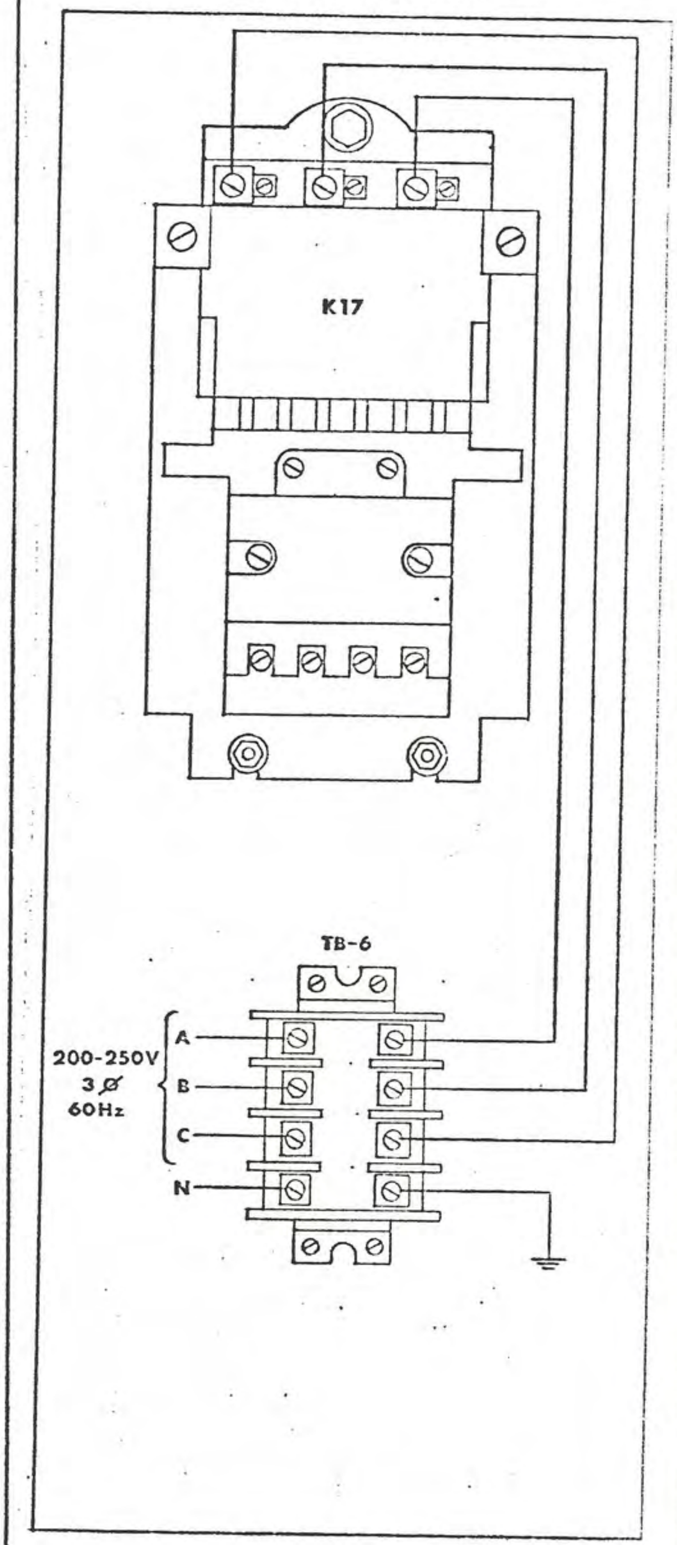


PLATE CONTACTOR ASSY.



SECTION V

MAINTENANCE

5-1. PERIODIC INSPECTION AND MAINTENANCE

WARNING

> Even if the transmitter is completely shut down, be extremely cautious whenever adjustment or maintenance is required to be conducted in the vicinity of components that are normally energized with high potentials. To ensure safety, use an insulated shorting (or dead man's stick) and ground all high-voltage capacitors, plate lines, etc.

Only the cabinet cooling air filters and the tube anode coolers require periodic special attention. Otherwise, periodic inspection, cleaning, and maintenance requirements for the Model 620 are in accordance with standard practice for maintaining any communications equipment to provide optimum performance with minimum failures.

5-1.1 Air Filters

The cabinet cooling air filters for the Model 620 are located on the rear cabinet doors. If these filters are permitted to become clogged with dust and dirt particles the flow of air to blowers B1 and B2 may become so restricted that airflow interlock switches S7 and S8 will not close, rendering the unit inoperative. Periodically, as determined by their condition, the filters should be cleaned to ensure a free flow of clean air through the unit. Remove the filters and immerse and agitate them in hot soapy water. When clean, rinse filters and allow to dry before replacing them in the unit.

5-1.2. Anode Coolers

To ensure proper cooling of amplifier tubes V1, V2, and V3, the anode coolers of these tubes should be periodically inspected for particles of dirt or dust that might interfere with effective cooling. To remove and replace V1, V2, and V3, refer to paragraph 5-2 of this section. Once removed from the RF amplifier cavity, the anode coolers of these tubes may be cleaned by simply blowing a jet of air through the cooling elements.

5-2. REMOVAL AND REPLACEMENT OF AMPLIFIER TUBES

Certain precautionary steps should be taken to ensure the safety of maintenance personnel when removing and replacing the amplifier tubes as well as to ensure proper handling of the tubes. To remove and replace the amplifier tubes, proceed as follows:

a. Set MASTER PLATE switch S4 momentarily to the OFF position.

b. Set MASTER POWER switch S1 to OFF and open rear cabinet doors.

c. Remove back cover of IPA or PA cavity, as appropriate.

d. Remove V1 as follows:

(1) Remove screw and nut that secure C8 and L2 to V1 anode clamp; swing inductor L2 out of the way.

(2) Remove anode clamp and chimney.

(3) Pull V1 straight out of its socket.

e. Remove V2

(1) Loosen anode clamp.

(2) Rotate V2 counterclockwise 1/4 turn so that tube flanges are free from socket blade contacts.

(3) Lift V2 straight out of its socket.

f. Remove V3 as follows:

(1) Remove the two Phillips head screws protruding through right-hand side of cavity wall as viewed from the rear.

(2) Lift air baffle from around tube and raise baffle to top of cavity. Cock baffle slightly so that it remains free of tube.

(3) Loosen anode clamp and remove. Grasp tube by the two half rings and lift tube straight up out of its socket.

(4) Tilt tube 90 degrees toward cavity opening and pull tube straight out of cavity.

g. Replace V1 as follows:

(1) Insert tube in socket and rotate slightly to align tube base keyway with socket keyway. Press tube firmly until seated all the way into socket.

(2) Replace chimney and anode clamp.

(3) Replace screw and nut, making sure to reconnect L2 and C8 to anode clamp.

h. Replace V2 as follows:

(1) Lower tube into socket. Rotate tube slightly so that flanges clear blade contacts and tube seats fully into socket.

(2) Rotate tube clockwise 1/4 turn so that tube flanges engage socket blade contacts.

(3) Tighten anode clamp.

i. Replace V3 as follows:

(1) Grasp tube by half rings and insert tube, bottom end first, into cavity.

(2) Carefully lower tube into its socket and ensure that it is fully seated.

(3) Replace anode clamp and tighten.

(4) Lower air baffle to its proper position and replace the two Phillips head screws removed in step (1) above.

j. Replace back cover of IPA or PA cavity, as appropriate, and close rear cabinet door.

NOTE

When replacing the PA cavity cover, make sure that the flange on the inside of the cover is positioned such that it helps prevent the air baffle from being lifted upward by air pressure from the PA blower.

5-3. OVERLOAD RELAY ADJUSTMENT

The only test equipment required to adjust the overload relays are an ohmmeter and an adustable (0 to 25 vdc) power supply capable of delivering 5 amperes.

5-3.1. Driver Plate Current Overload

To adjust the overload threshold of K9 (figure 3-4B), proceed as follows:

a. Remove TIME DELAY fuse F10 (figure 3-3)

b. Set MASTER POWER circuit breaker CB1 and MASTER POWER switch S1 to ON.

c. Open IPA control panel and connect ohmmeter leads to terminals 3 and 36 on IPA control panel printed wiring board. Set ohmmeter to RX1 scale.

d. Connect negative lead of adjustable power supply to chassis ground and positive lead to terminal 27 on IPA control panel printed wiring board.

e. Set MULTIMETER function switch S14 to DRIVER PLATE CURRENT.

f. Energize power supply and adjust its output for an indication of 150 milliamperes as observed on MULTIMETER M1.

g. Adjust potentiometer R102 (figure 3-4B) to the point where K9 actuates (ohmmeter will indicate continuity) and DRIVER PLATE CURRENT overload tally indicator DS9 lights.

h. Disconnect power supply and ohmmeter, and replace TIME DELAY fuse F10.

i. Set OVERLOAD switch S3 momentarily to TALLY to extinguish DS9.

5-3.2. IPA Screen Current Overload

To adjust the overload threshold of K10 (figure 6-7), proceed as follows:

a. Perform steps a, b, and c of paragraph 5-3.1.

b. Connect negative lead of power supply to capacitor C23.

Connect positive lead to terminal 15 on bias assembly (See figure 6-7)

c. Set MULTIMETER function switch S14 to IPA SCREEN CURRENT.

d. Energize power supply and adjust its output for an indication of 150 milliamperes as observed on Multimeter M1.

e. Adjust potentiometer R32 (figure 6-7) to the point where K10 actuates (ohmmeter will indicate continuity) and IPA SCREEN overload tally indicator DS10 lights.

f. Disconnect power supply and ohmmeter, and replace TIME DELAY fuse F10.

g. Set OVERLOAD switch S3 momentarily to TALLY to extinguish DS10.

5-3.3. IPA Plate Current Overload

To adjust the overload threshold of K11 (figure 3-4B), proceed as follows:

a. Perform steps a, b, and c of paragraph 5-3.1.

b. Connect negative lead of power supply to chassis ground and connecte positive lead to terminal 20 on IPA control panel printed wiring board.

c. Energize power supply and adjust its output for an indication of 1 ampere as observed on IPA PLATE CURRENT meter M2.

d. Adjust potentiometer R22 to the point where K11 actuates (ohmmeter will indicate continuity) and IPA PLATE overload tally indicator DS11 lights.

e. Disconnect power supply and ohmmeter, and replace TIME DELAY fuse F10.

f. Set OVERLOAD switch S3 momentarily to TALLY to extinguish DS11.

5-3.4. PA Grid Current Overload

To adjust the overload threshold of K12 (figure 3-4B), proceed as follows:

a. Perform steps a, b, and c of paragraph 5-3.1.

b. Connect negative lead of power supply to chassis ground and positive lead to terminal 17 on IPA control panel printed wiring board.

c. Energized power supply and adjust its output for an indication of as observed on PA GRID CURRENT meter M5.

d. Adjust potentiometer R18 to the point where K12 actuates (ohmmeter will indicate continuity) and PA GRID overload tally indicator DS12 lights.

e. Disconnect power supply and ohmmeter, and replace TIME DELAY fuse F10.

f. Set OVERLOAD switch S3 momentarily to TALLY to extinguish DS12.

5-3.5 PA Plate Current Overload

To adjust the overload threshold of K13 (figure 3-8B), proceed as follows:

a. Perform steps a, b, and c of paragraph 5-3.1.

b. Connect negative lead of power supply to terminal 12 on PA control panel printed wiring board. Connect positive lead to TB4-19.

c. Energize power supply and adjust its output for an indication of 5 amperes as observed on PA PLATE CURRENT meter M6.

d. Adjust potentiometer R73 (figure 3-8B) to the point where K13 actuates (ohmmter will indicate continuity) and PA PLATE overload tally indicator

DS13 lights.

e. Disconnect power supply and ohmmeter, and replace TIME DELAY fuse F10.

f. Set OVERLOAD switch S3 momentarily to TALLY to extinguish DS13.

SECTION VI

REPLACEABLE PARTS

6-1 Ordering Information

When ordering parts for the Model 620 FM Transmitter, give the model number and the serial number of the equipment and the reference designation and Sparta part number. To order a part not listed in paragraph 6-3 of this section, give a complete description of the part including function and location.

All parts should be ordered from:

SPARTA ELECTRONIC CORPORATION
5851 Florin-Perkins Road
Sacramento, California 95828
Telephone: (916) 383-5353
Telex: 377-488
Cable Address: SPARTA

6-2 Parts Location

The location of parts listed in table 6-2 are shown in figures 6-1 through 6-13.

6-3 Tables of Replacement Parts

A list of manufacturers of the component parts of the Model 620 FM Transmitter is provided by table 6-1. Table 6-2 contains a listing of replaceable parts for the Model 620. The manufacturer of the particular part listed in table 6-2 is indicated by a code number, which is used to identify the manufacturer as listed in table 6-1.

DESIG.	DESCRIPTION	SPARTA PART NUMBER	MFR.	MFR. PART NO.	TOTAL
A1	660 Exciter	092-0009	Sparta		1
A2	IPA Cavity Assy	001-8059-02	Sparta		1
A3	PA Cavity Assy	425-0029	Sparta		1
A4	Harmonic Filter	268-0017			1
A5	PA Power Supply	450-0032-01	Energy Syst.	4B126	1
A6	Magsence	368-0232	Control Data	77A	1
A7	Auto Power Card		Sparta		1
C1	Capacitor .001 uf	110-0068	Sprague	5HK D10	16
C2	Capacitor 1000 pf	110-0390-01	Centralab	858S	10
C3 - C6	Same as C1				
C7	N/A				
C8	Same as C2				
C9	Capacitor Var Air	109-0086-01	Sparta		
C10 - C14	Same as C2				
C15 & C16	Capacitor 1000 pf	110-1070-01	Mill Spec	CK70AW102M	6
C17 & C18	Capacitor 2000 pf	110-1078	Erie	1202-005	2
C19	Same as C15				
C20	Capacitor .01 uf	110-1092-01	Erie	2498, 10,000 pf	1
C21 - C23	Same as C15				
C24	Capacitor 1000 pf	110-1114-01	Telco	HLC2014/V	1
C25	Capacitor 4uf 250V	112-1365-03	Sprague	45D10183	1
C26	Capacitor 100 uf 250V	112-1365-10	Sprague	45D10198	1
C27	Capacitor 4 uf 5KV	103-1939-01	GE	23F1135G102	1
C28	Same as C1				
C29	Capacitor 6 uf 2KV	103-2567-03	Cornell Dub.	TC020060X	1

DESIG.	DESCRIPTION	SPARTA PART NUMBER	MFR.	MFR. PART NO.	TOTAL
C30	Capacitor 10 uf 1KV	103-2567-01	Cornell Dub.	TCO10100X	1
C31 - C35	Same as C1				
C36	N/A				
C37 & C38	Same as C1				
C39	Capacitor 150 uf 150V	112-0450-01	Sprague	TVA-1422	1
C40	Capacitor 50 uf 250V	112-0462-01	Sprague	TVA-1512	2
C41	Capacitor 30 uf 450V	112-1365-08	Sprague	45D10268	1
C42 & C43	Same as C1				
C44	Capacitor 0.5 uf	238-1001-01		Part of motor rheostat assy.	1
C45	Capacitor 1000 uf 35V	112-1470-01	Syncro Corp.	EMW 01946	1
C46 - C48	N/A				
C49	Capacitor 1500 uf 50V	112-0152-01	Mallory	CG152U50B1	1
C50	Capacitor 2600 uf 50V	112-1430-01	Sprague	36D262G050AB2A	1
C51	Capacitor 10 uf 20V	112-1378-01	Sprague	30D106G015BA4	2
C52 & C53	Capacitor 5 uf 35V	112-1375-01	Sprague	30D505G050BB4	2
C54	Same as C51				
C55 - C60	Capacitor 50 uf 15V	112-1387-01	Sprague	30D506G015CB4	6
C61	Capacitor 75 pf 7.5KV	110-0387-01	Centralab	850S	1
C62	Same as C40				
C63 - C68	N/A				
C69 & C70	Capacitor .001 uf 1 KV	110-0204-01	Centralab	DP-102G	3
C71 - C73	Same as C2				
C74	N/A				
C75	Same as C69				
C76 - C79	N/A				
C80	Capacitor	022-1158-01	Sparta		1

DESIG.	DESCRIPTION	SPARTA PART NUMBER	MFR.	MFR. PART NO.	TOTAL
C81	Capacitor PA Flapped		Sparta		1
C82	Capacitor PA B + Feedthrough		Sparta		1
C83 & C84	Capacitor PA Fiv Feedthrough		Sparta		2
CB1	Circuit Breaker	280-0072-01	GE	THQC 32030	1
CR1 - CR12	Diode	161-0355-02	Semikron	HSKE 3500/1550-.5	12
CR13	Diode Bridge	161-0350-09	I.R.	18DB6A	1
CR14 & CR15	Diode	161-0293-01	Motorola	1N4002	2
CR16 & CR17	Diode	161-0269-01	Motorola	1N4005	8
CR18	SCR	161-0354-01	GE	C6B	7
CR19	Zener Diode	161-0352-06	Motorola	1N3034B	1
CR20	Same as CR16				
CR21 - CR26	Diode	161-0355-01	Semikron	HSKE 2500/1100 .3	6
CR27 - CR29	N/A				
CR30	Diode	433-0527-03	Bird	25KB3	1
CR31	Diode	433-0527-04	Bird	2500B3	1
CR32	Diode	161-0096-01	T.I.	1N914	1
CR33	N/A				
CR34	Zener Diode	161-0352-04	Motorola	1N2976A	1
CR35 - CR37	Same as CR16				
CR38 - CR39	Diode SCR	149-0305-08	RCA	2N3670	2
CR40 - CR43	Same as CR16				
CR44 - CR49	Same as CR18				
DS1 - DS8	Lamp	244-0034-02	Chicago	387 Neon	8
DS9 - DS14	Lamp		Dialco	507-3838	6
F1 & F2	Fuse 6.25 S.B. (Spare)	261-0093-01	Bussman	MPA 6 1/4	4
F3 & F4	Fuse 2.0A S.B.	261-0080-01	Bussman	MDA2	2
F5	Fuse 5A	261-0023-01	Bussman	MTH-5	1

DESIG.	DESCRIPTION	SPARTA PART NUMBER	MFR.	MFR. PART NO.	TOTAL
F6	Fuse 2.0A	261-0020-01	Bussman	AGC2	1
F7	Fuse 2.5A S.B.	261-0081-01	Bussman	MDA 2 1/2	1
F8	Fuse .25A S.B.	261-0060-01	Bussman	MDA 1/4	1
F9	Fuse .50A	261-0015-01	Bussman	AGC 1/2	1
F10	Fuse 0.5A S.B.	261-0064-01	Bussman	MDL 1/2	1
F11 & F12	Same as F1				
J1	Connector BNC	287-0034-01	Amphenol	UG1094 A/U	3
J2	Flange	433-0139-01	Prodelin		2
J2A	Elbow	433-0147-01	Prodelin		1
J3	Connector Type N	287-0223	Amphenol	UG58A/U	1
J3A	Connector Rt. Angle	287-0229-01	Amphenol	UG27C/U	1
J4	Flange 3 1/8" PA cavity		Andrew		1
J5 & J6 or DC1	Flange 3 1/8" Directional Coupler	433-0530-01	Bird	461000	1
J7 & J8	Same as J1				
J9 & J10	Connector				
K1	Relay 3 Ø OVLD	180-0408-01	Rowan	Rowan	1
K2	Relay Control	180-0412-04	Rowan	EBC230BA	2
K3	Relay	180-0391-03	P & B	KUP14D15-110	2
K4	Relay	180-0391-02	P & B	KUP14D15-240	2
K5	Same as K3				
K6	Same as K4				
K7	Relay Time Delay	180-0415-01	G/V	DM7393-230	1
K8	Same as K2				
K9 & K10	Relay	180-0391-05	P & B	KUP14D15-12	2
K11 - K13	Relay	180-0391-04	P & B	KUP14D15-6	3
K15 & K16	N/A				
K17	Relay	180-0418-01	Furnas	40HB32A	1

DESIG.	DESCRIPTION	SPARTA PART NUMBER	MFR.	MFR. PART NO.	TOTAL
K18	Relay	180-0391-01	P & B	KUP5D15-24	1
K19 & K20	Relay	180-0420-01	Syscom	2180-1	2
K21	Same as K2				
K22	Relay		P & B	KUP14A15	1
L1	Choke 4hy 90 ma	317-0025-01	Triad	C9X	1
L2	RF Choke 7 uh	186-0594-01	Ohmite	Z50	3
L3	Loop Grid Coupling	022-1188-01	Sparta		1
L4	RF Choke 1.8 uh	186-0595-01	Ohmite	Z144	2
L5	Plate Line Assy IPA	001-8126-01	Sparta		1
L6	Same as L4				
L7	Same as L2				
L8	Choke 10 hy .95A	317-0023-01	Energy Syst.	4F65	1
L9	Choke 10 hy 200 ma	317-0026-01	Triad	C16A	1
L10	Choke 6 hy 160 ma	317-0024-01	Triad	C12A	1
L11	RF Choke		Sparta		1
L12	Output Coup. IPA	001-8176-01	Sparta		1
L13	Fil. Line PA		Sparta		1
L14	Plate Line PA		Sparta		1
L15	Output Coup. PA		Sparta		1
L16 & L17	Same as L2				
L18	IPA Sampling Loop	022-1135-01	Sparta		1
L19	PA Sampling Loop	022-1135-01	Sparta		1
M1	Meter 0-5/25 1 ma	368-9134-01	Hoyt		1
M2	Meter 0-1.5 ADC	368-9138-01	Hoyt		1
M3	Meter 0-5 KV 1 ma	368-9106-01	Hoyt		1
M4	Meter 0-100 1 ma	368-9105-01	Hoyt		1
M5	Meter 0-1 ADC	368-9107-01	Hoyt		1

DESIG.	DESCRIPTION	SPARTA PART NUMBER	MFR.	MFR. PART NO.	TOTAL
M6	Meter 0-6 ADC	368-9139-01	Hoyt		1
M7	Meter 0-10 KV 1 ma	368-9136-01	Hoyt		1
M8	Meter 0-25 KW 0-100 ma	368-9141-01	Hoyt		1
M9	Meter 0-10 VAC	368-9132-01	Hoyt		1
M10	Meter Hour	368-0237-01	GE	50-236402ABAAZ	1
M11	Meter 0-300 VAC	368-9142-01	Hoyt		1
P1	Connector	287-0056-01	Amphenol		2
P2 & P3	Connector	287-0799-01	Prodelin		2
P4	Flange	433-0343-01	Prodelin		2
R1	Resistor 100 ohms 3 1/4W 5%	131-0618-01	Ohmite		2
R2	Resistor 50 ohms 30W 10%	136-1650-02			1
R3	Resistor 0.24 ohms 1%	131-1375-02	Schmidt		2
R4	Resistor 0.1 ohms 3% 3W	131-1381-01	Dale		1
R5	Resistor 1K 2W	136-1548-01			
R6	Resistor 5K 12W	131-0122-01	Ohmite		1
R7	Resistor 1.2 ohms 1%	131-1375-07	Schmidt		1
R8	Resistor 800 ohms 12W	131-0107-01	Ohmite		1
R9	Resistor 1K 25W Var.	137-0252-05	Ohmite		1
R10	Resistor 600 ohms 10W	131-0104-01	Ohmite		1
R11	Resistor 250K 1/2W 1%	134-3002-01	Dale		1
R12	Resistor 1K 2W 10%	136-1548-01			1
R13	Resistor 1K 2W Var		Ohmite		1
R14	Resistor 5 Meg 5W 1%	134-2900-01	Dale		1
R15	Same as R1				
R16	Resistor 500K 1W 1%	134-3001-01	Dale		1
R17	Resistor 2 ohms 12W	131-0078-01	Ohmite		2
R18	Resistor 3 ohms 12.5W Var	137-0895-04	Ohmite		2
R19 & R20	Resistor 75K 225W	131-0399-01	Ohmite		2

DESIG.	DESCRIPTION	SPARTA PART NUMBER	MFR.	MFR. PART NO.	TOTAL
R21	Same as R17				
R22	Same as R18				
R23	Resistor 10K 1/2W 10%	136-1172-01			2
R24	Resistor 100K 100W	131-0327-01			1
R25	Resistor 2.5 Meg 5W 1%	134-2902-02			5
R26	Resistor 5K 25W	131-0231-01	Ohmite		1
R27	Resistor 4.5K 150W Var	137-0231-01	Ohmite		1
R28	Resistor 300 ohms 20W	131-0160-01	Ohmite		1
R29 & R30	Resistor 15K 12W	131-0134-01	Ohmite		2
R31	Same as R3				
R32	Resistor 100 ohms 5W	137-0895-14	Centralab		1
R33	Resistor 82 ohms 3W	131-0630-01			1
R34	Resistor 22 ohms 50W	137-0229-03	Ohmite		1
R35	Resistor 10K 2W 10%	136-1572-01			1
R36	Resistor 6.8K 2W 10%	136-1568-01			1
R37	Resistor 1K 2W Var	130-0087-01	Ohmite		1
R38	Resistor 1K 12W	131-0109-01	Ohmite		1
R39 - R42	Same as R25				
R43 - R45	Resistor 100K 225W	131-0400-01	Ohmite		3
R46	Resistor 470 ohms 2W 10%	136-1540-01	Ohmite		2
R47 & R48	Resistor 22K 2W 10%	136-1580-01	Ohmite		2
R49	Resistor 2.7K 2W 10%	136-1557-01	Ohmite		1
R50	Same as R46				
R50 - R56	Resistor 560 ohms 1/2W 10%	136-1142-01	Ohmite		6
R57 - R62	Resistor 33K 1/2W 10%	136-1184-01	Ohmite		8
R63 - R68	Resistor 22K 1W 10%	136-1381-01	Ohmite		6
R69	Resistor 25K 2W Var	130-0095	Ohmite	CMV 2531	
R70	Resistor 800 ohms 20W	131-0167-01	Ohmite		1

DESIG.	DESCRIPTION	SPARTA PART NUMBER	MFR.	MFR. PART NO.	TOTAL
R71	Resistor 100 ohms 2W 10%	136-1524-01	Ohmite		1
R72	Resistor 3K 1/2W 1%	134-3003-02	Dale		1
R73	Resistor 1 ohm 50W Var	137-0229-04	Ohmite		1
R74	Resistor 1 ohm 50W Var	131-0252-01	Ohmite		1
R75 - R77	Resistor 22 ohms 2W 10%	136-1508-01			3
R78	N/A				
R79	Resistor 100 ohms 100W	131-0305-01	Ohmite		1
R80	Resistor 8.2K 2W 10%	136-1569-01			1
R81 & R82	N/A				
R83	Resistor 5.6K 2W 10%	136-1565-01			1
R84	Same as R57				
R85 & R86	Resistor 2.2K 1/2W 10%	136-1156-01			2
R87	Same as R57				
R88	Resistor 4.7K 2W	136-1564-01			1
R89	Resistor 15K 2W Var	136-1572	Ohmite		1
R90	Resistor 1 ohm 25W	137-0751-01	Ohmite		1
R91	Resistor 5K 5W Var	137-0048-01	Centralab		1
R92	Resistor 3K 12W	131-0118-01	Ohmite		4
R93	Resistor 6K 12W	131-0123-01	Ohmite		1
R94	Same as R92				
R95	Resistor 2.5K 12W	131-0117-01	Ohmite		2
R96	Same as R92				
R97	Same as R95				
R98 & R99	Same as R92				
R100 & R101	Resistor 25 ohms 225W	131-0376	Ohmite		2
R102	Resistor 175 ohms 12.5W	137-0895-17	Ohmite		1
R103	N/A				
R104	N/A				

DESIG.	DESCRIPTION	SPARTA PART NUMBER	MFR.	MFR. PART NO.	TOTAL
R105 - R110	Resistor 68K 1/2W 10%	136-1192-01			1
R111 & R112	Same as R100 *				
R113	Same as R23				
R114	Resistor 10 ohms 1/2W 10%	136-1100-01			1
S1	Switch Master On	296-0421-02	Switch-craft	13001 L	2
S2	Switch Remote-Local	296-0421-09	Switch-craft	13006L or 13005L	1
S3	Switch Reset	296-0421-04	Switch-craft	13036	2
S4	Same as S3 IPA Plate on				
S5 & S6	Switch Interlock	926-0311-01	Micro-switch	2AC6	6
S7 & S8	Switch Air PA & IPA	305-0001-01	McLean	S1278	2
S9 & S10	Same as S5				
S11	Same as S1 Auto power control on & off				
S12	Switch PA Plate On	296-0421-06	Switch-craft	13004L	1
S13	PA Blower Override	305-0029-02	T1	C4344-137	1
S14	Switch Multimeter	925-0027-01	Centralab	PA 1005	1
S15 & S16	Switch Line voltage for & reflected	295-0379-01	Centralab	2551	2
S17	Switch Power Trim	296-0421-08	Switch-craft	13033	1
S18 & S19	Same as S5				
S20	Overtemp Switch	305-0029-01	T1	C4344-137	1
T1	Transformer Bias	326-0388-01	Stancor	PCF2025	1
T2	Transformer Fil IPA	316-0152-01	Electro	E30211	1
T3	Transformer Fil Control PA	326-0391-01	Stancor	P6379	1

* Used only with Electro Engineering Power Supply.

DESIG.	DESCRIPTION	SPARTA PART NUMBER	MFR.	MFR. PART NO.	TOTAL
T4	Transformer Fil PA	326-0387-01	Electro	E16799	1
T5	Transformer Plate IPA	326-0392-01	Electro	E16806B	1
V1	Tube IPA Driver	353-0120-01	Eimac	4X150A	1
V2	Tube IPA Final	353-0448-01	Eimac	5CX1500A	1
V3	Tube PA Final	353-0445-02	Eimac	3CX15000A7	1
XDS1	Socket & Lens Master Power	247-1416-01	Dialco		1
XDS2	Socket & Lens Interlock	247-1416-03	Dialco		1
XDS3	Socket & Lens IPA Plate	247-1416-04	Dialco		2
XDS4	Socket & Lens Overload	247-1416-05	Dialco		2
XDS5	Socket & Lens Fil On	247-1416-02	Dialco		1
XDS6	Socket & Lens PA Air	247-1416-06	Dialco		1
XDS7	Same as XDS2				
XDS8	Same as XDS3				
XDS9 - XDS14	Socket & Lens	247-1419-01	Dialco	250-8738-1433-504	6
XF1 - XF12	Socket Fuse	261-0039-01	Bussman	HKL-X	12
XK3 - XK6	Socket Relay	396-0057-02	P & B	9KU2	11
XK7	Socket Relay	396-0064-01	Cinch	8PC-B	3
XK9 - XK13	Same as XK3				
XK18	Same as XK3				
XK19 & XK20	Same as XK7				
XK21	N/A				
XK22	Same as XK3				
XV1	Socket Tube 4X150A	396-0194-01	Eimac	SK620A	1
XV2	Socket Tube 5CX1500A	022-1192-01	Sparta		1
XV3	Socket Tube 3CX15000A7		Eimac		1
TB1	Terminal Block 5 position	477-0035-01	Kulka	601B-5	1
TB2 & TB3	Terminal Block 2 position	477-0002-01	Cinch Jones	2-164	3

DESIG.	DESCRIPTION	SPARTA PART NUMBER	MFR.	MFR. PART NO.	TOTAL
TB4 & TB5	Terminal Block 20 position	477-0020-01	Cinch Jones	20-164	3
TB6	Terminal Block 4 position				
TB7	Terminal Block 5 position	477-0005	Cinch Jones	5-164	1
TB8	Terminal Block 10 position	477-0010-01	Cinch Jones	10-164	2
TB9	Terminal Block 3 position	477-0178-01	Buchanan	222	1
TB10 & TB11	Same as TB8				
TB12	Same as TB4				
TB13 - TB15	Terminal Block 12 position	477-0012-01	Cinch Jones	12-164	3
TB16	Same as TB2				
B1	Blower PA	231-0088-01	Dayton	7C459	1
B2	Blower IPA	022-1358-02	Sparta		1
B3 - B5	Fan	231-0089-01	Kool-tronics	K2B1000B	3
B6	Motor Raise-Lower	238-1001-01	Hurst	PCDA115V	1

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