# LINEAR POWER AMPLIFIER

# 204F-1

## INSTRUCTION BOOK

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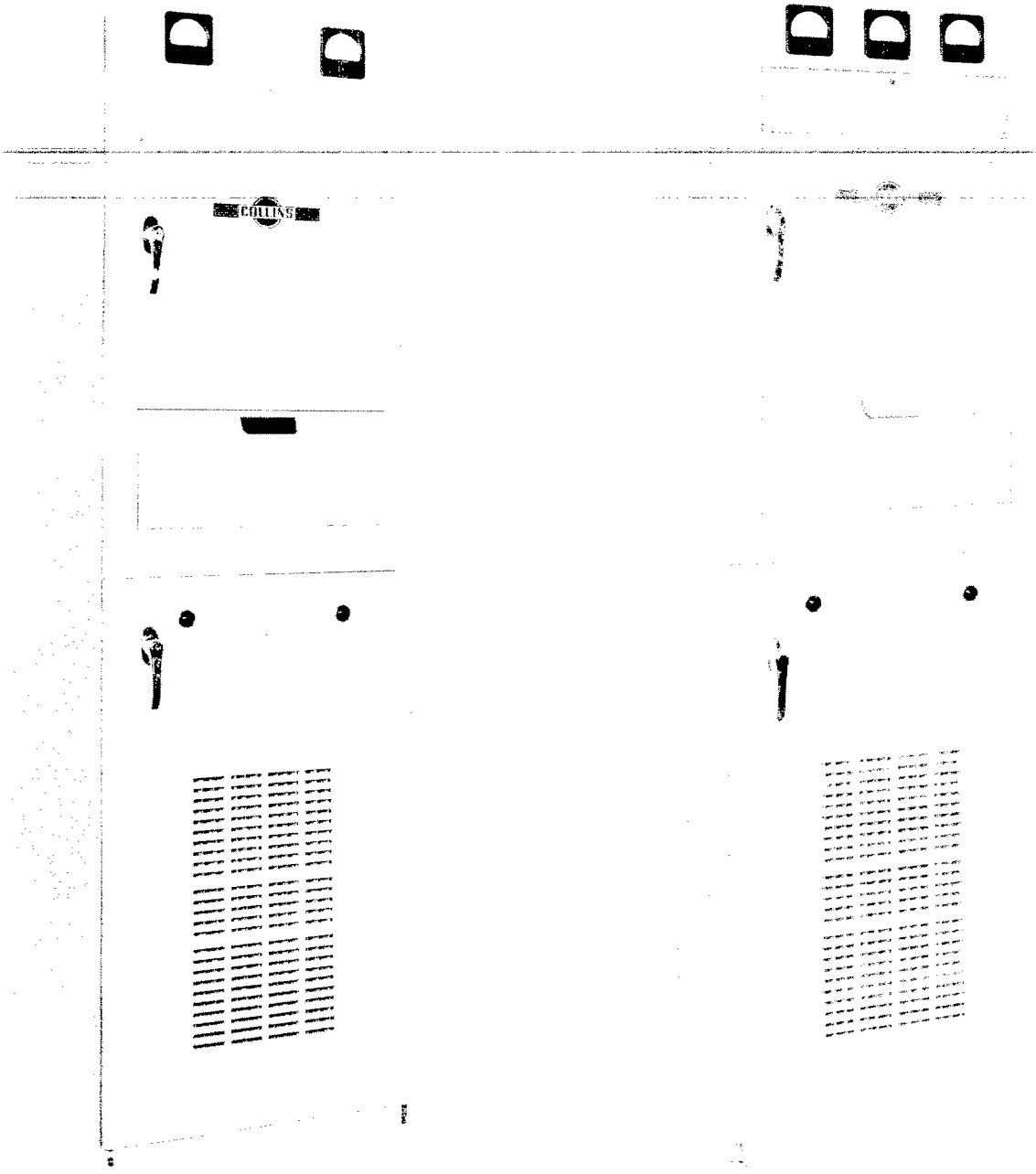



A

B
(R.F. Wattmeter Installed)

Figure 1-1. Linear Power Amplifier 204F-1

# SECTION I
# GENERAL DESCRIPTION

### 1.1 PURPOSE OF INSTRUCTION BOOK.

This instruction book contains instructions for the installation, operation, and maintenance of Linear Power Amplifier 204F-1.

### 1.2 PURPOSE OF EQUIPMENT.

Linear Power Amplifier 204F-1 is a three-stage, linear power amplifier designed to amplify low-power radio-frequency signals from an associated exciter unit to a level suitable for transmission from an antenna. The 204F-1 is primarily intended for single-sideband operation, but can be used with any type of input signal that does not exceed its bandwidth and power capabilities. The amplifier may be switched to either of two channels, and either channel may be tuned to any frequency between 2 and 30 megacycles. The 204F-1 is capable of delivering either 2.5 kilowatts peak envelope or 2.5 kilowatts average power continuously. It can be operated locally or remotely.

### 1.3 EQUIPMENT SUPPLIED.

Linear Power Amplifier 204F-1 is contained in a single cabinet, which is shown in figure 1-1 (figure 1-1B shows the optional wattmeter installed) and described in paragraph 1.5. The quantity and type of equipment supplied depends on the status number of the equipment and will be determined by the individual installation. For a complete list of status numbers, see table 1-5.

### 1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED.

Linear Power Amplifier 204F-1 is not intended for use as a single unit, but is intended for use as one portion of a complete system. Table 1-1 is a list of the equipment required for complete operation of the unit but which is not supplied. Equipment other than that listed in table 1-1 may be required, since the quantity and type of equipment required but not supplied is determined by the individual installation.

TABLE 1-1. EQUIPMENT REQUIRED BUT NOT SUPPLIED

| QUANTITY PER EQUIPMENT | ITEM | REQUIRED CHARACTERISTICS |
|---|---|---|
| 1 | External exciter | Output: 0.2 watt maximum, 0.1 watt nominal.<br>Frequency: 2 to 30 mc. |
| 1 (See note 1.) | Antenna coupler | Input impedance: 50 ohms.<br>Frequency: 2 to 30 mc.<br>Power handling capability: 2.5 kilowatts. |
| 1 | Fused disconnect switch | Three-pole, 250 volts a-c, 30 amperes with 30-ampere slow-blow fuses. |
| 3 (See note 2.) | Power conductors | For connection from fused disconnect switch to linear power amplifier TB1, use two no. 6 AWG (MIL-W-16878 type D or equivalent) conductors and one no. 10 AWG (MIL-W-16878 type D or equivalent) conductor. |

TABLE 1-1. EQUIPMENT REQUIRED BUT NOT SUPPLIED (Cont)

| QUANTITY PER EQUIPMENT | ITEM | REQUIRED CHARACTERISTICS |
|---|---|---|
| (See note 3.) | R-f conductors | For connection from exciter to linear power amplifier J1, use RG-58C/U coaxial cable. For connection from linear amplifier J6 or J8 to antenna coupler, use RG-17/U coaxial cable. For connection from linear amplifier J2 and J3 to exciter, use RG-58C/U coaxial cable. |
| (See notes 2 and 3). | Electrical conduit | For power run between fused disconnect switch and linear power amplifier, use one-inch conduit. ~~For any remote control circuits, use one-~~ inch conduit. |
| 1 (See notes 2 and 4.) | External air duct | Top opening cross section is 8 inches by 4 inches. |

NOTES:

1. Used only when standing-wave ratio exceeds 2 to 1.
2. Length determined by particular installation.
3. Quantity determined by particular installation.
4. External air duct is optional.

## 1.5 TEST EQUIPMENT REQUIRED.

Table 1-2 lists the test equipment required for maintenance procedures.

TABLE 1-2
TEST EQUIPMENT REQUIRED

| ITEM | RECOMMENDED MODEL |
|---|---|
| Signal generator | General Radio 1211B |
| Frequency meter | Collins 51J |
| Vacuum-tube voltmeter (2) | Hewlett-Packard 410B |
| Precision a-c voltmeter | Weston Model 433 |
| Voltohmmeter | Triplett Model 630 |
| Probe T connector | Hewlett-Packard 455A |
| Dummy load | 1-megohm resistor and 1-microfarad capacitor in parallel, capable of dissipating 2.5 kw. |

## 1.6 GENERAL DESCRIPTION.

1.6.1 PHYSCIAL DESCRIPTION. All components of Linear Power Amplifier 204F-1 are enclosed in a self-supporting aluminum cabinet which is 20 inches wide, 20 inches deep, and 70 inches high. The unit weighs approximately 600 pounds with components installed. Upper and lower doors at the front of the cabinet provide access to all interior areas of the unit. Cooling air is drawn into the equipment by an internal blower unit through a filter located on the lower door, and heated air is exhausted through an opening at the top of the cabinet. All power and signal connections can be made through the top of the cabinet.

The upper door provides a mounting surface for two (or three) meters and access to the upper half of the cabinet interior. Two hinged access panels in the upper door provide access to all operating controls. The upper half of the cabinet is divided into three compartments (see figure 1-2). The uppermost compartment is referred to as the access compartment, and all power and signal functions enter and leave the cabinet through this compartment. The middle compartment, referred to as the r-f compartment, encloses the power amplifier tubes and all the components associated with the anode circuits of these tubes. A small panel located along the upper edge of this compartment provides a mounting surface for the tuning controls associated with the r-f output circuits. These controls are accessible through the upper hinged panel in the upper cabinet door.

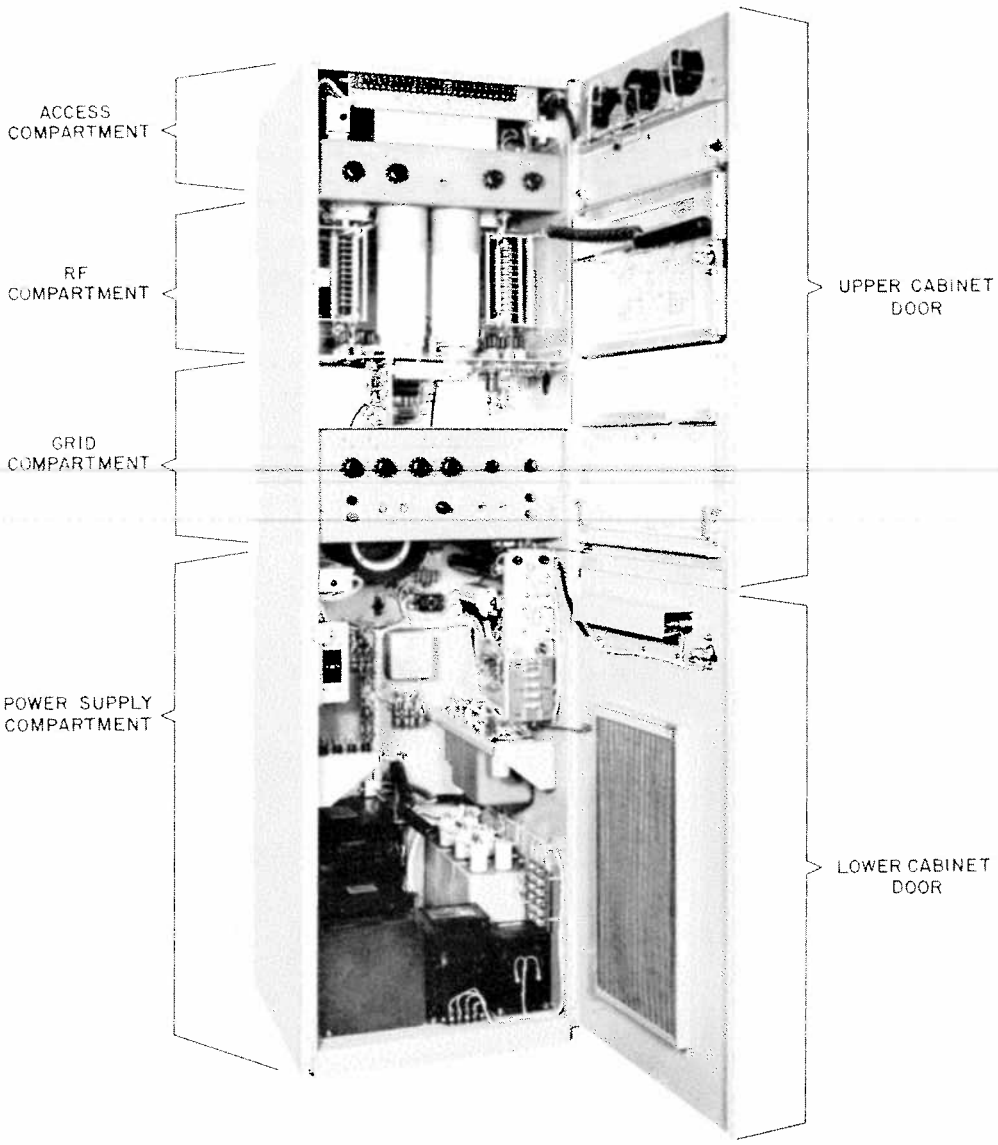



Figure 1-2. Linear Power Amplifier 204F-1, Cabinet Doors Open

The lowest of the three upper half compartments, the grid compartment, encloses all of the components associated with the input and driver amplifier stages, and those associated with the filament, cathode, control grid and screen grid elements of the power amplifier tubes. Most of these components are located in a rectangular enclosure referred to as the grid chassis. The grid chassis, which is removable for servicing, is divided into two parts.

The input amplifier and both driver amplifier tubes are mounted on the partition that divides the grid chassis. All components in the anode circuit of the driver amplifier stage and the filament, cathode, control grid and screen grid circuits of the power amplifier stage are in the area to the right of this divider wall. Filament transformer T4 is mounted on the cabinet wall and is not removed from the cabinet with the grid chassis. The components of the input amplifier stage and the filament, cathode, control grid, and screen grid circuits of the driver amplifier are located to the left of the divider wall.

The tuning controls associated with the input amplifier and driver amplifier stages are mounted on the front surface of the grid chassis, and are accessible through the opening normally covered by the lower hinged panel in the upper cabinet door.

The lower cabinet door provides access to the power supply compartment which occupies the lower half of the cabinet. All components associated with the transformation of primary power to the voltages necessary to operate the circuits of the linear power amplifier are located in the lower compartment. Operating controls for the power supply circuits (bias and grid balance adjustments) are brought out through openings in the front surface of the grid chassis.

1.6.2 ELECTRICAL DESCRIPTION. Linear Power Amplifier 204F-1 is a three-stage, linear power amplifier designed to amplify radio-frequency signals of approximately one-tenth-watt amplitude to a level of 2.5 kilowatts and deliver this power to an associated antenna for transmission. Either of two operating frequencies, which are in the range between 2 and 30 megacycles, can be selected. Channel changing is accomplished by switching with relays between two sets of tuned circuits in each stage. Each channel is capable of being tuned to any frequency within the range of the equipment. Any type of emission not exceeding the bandwidth or power capabilities is possible with the linear amplifier, however the unit is designed primarily for single-sideband operation. All necessary operating voltages are developed within the equipment from an external source of single-phase power. Power control circuits and a variety of protective devices provide a maximum of protection with a minimum of complexity. The equipment may be operated locally or remotely. An integral blower is provided to maintain the equipment at the proper operating temperature.

## 1.7 ELECTRICAL CHARACTERISTICS.

Table 1-3 lists the electrical characteristics of Linear Power Amplifier 204F-1.

## 1.8 TUBE AND FUSE COMPLEMENT.

Table 1-4 lists the tube and fuse complement of the Linear Power Amplifier 204F-1.

## 1.9 OPTIONAL FEATURES.

Linear Power Amplifier 204F-1 can be equipped with several features not normally supplied. Optional features are discussed in paragraph 4.8. If present, these features will be factory installed. Status numbers of the equipment indicate the amount of optional equipment installed on the linear amplifier. Table 1-5 lists the optional features available, the changes made for each feature, and the status number of the equipment with each feature installed.

TABLE 1-3. ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC | DESCRIPTION |
|---|---|
| Output frequency range | 2 mc to 30 megacycles. |
| Power output | 2.5 kilowatts peak envelope power or 2.5 kilowatts average power continuously. |
| Tuning | Manual adjustment to frequency by front-panel controls, tap changes, and capacitor changes. |
| Types of emission | Superior for SSB operation. Can be used with any type not exceeding bandwidth or power capabilities. |
| R-f bandwidth | At least 16 kilocycles wide at 1-db points. |
| Input impedance | 50 ohms. |
| Output impedance | 50 ohms. |
| Excitation required | 0.1 watt nominal, 0.2 watt maximum, from external exciter. |
| SSB distortion | At least 35-db signal-to-distortion ratio. |
| Input power requirements | 200 to 250 volts a-c, 50 or 60 cps, single-phase<br>28 volts d-c, 50 ma |

| | Power Input | Power Factor |
|---|---|---|
| Filaments On | .50 kw | 85% |
| Plate On (no signal) | 2.5 kw | 88% |
| Two-tone signal at 2.5 kw PEP | 4.2 kw | 90% |
| CW Signal 2.5 kw Average | 5.5 kw | 92% |

TABLE 1-4. TUBE AND FUSE COMPLEMENT

| DESIGNATION | TYPE | FUNCTION |
|---|---|---|
| V1 | 6CL6 | Input amplifier |
| V2 | 6146 | Driver amplifier |
| V3 | 6146 | Driver amplifier |
| V4 | 4CX1000A | Power amplifier |
| V5 | 4CX1000A | Power amplifier |
| V6 | 872A | High-voltage rectifier |
| V7 | 872A | High-voltage rectifier |
| V6 (See note) | 4B32 | High-voltage rectifier |
| V7 (See note) | 4B32 | High-voltage rectifier |
| V8 | 5726 | TGC rectifier |
| F1 | 1 ampere | CONTROL |
| F2 | 0.125 ampere | PA BIAS |
| F3 | 1 ampere | BLOWER |
| F4 | 1 ampere | AMPL. FIL. |
| F5 | 0.5 ampere | RECT. FIL. |
| F6 | 4 amperes (slow blow) | SCREEN |

NOTE: Used only on status number 522-1130-014.

TABLE 1-5. OPTIONAL FEATURES

| OPTIONS | STATUS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 522-1130-00 Single Input and Output | 522-1130-011 Dual Input and Output with Directional Coupler | | 522-1130-012 Single Input and Output with Recycle Overload Unit | | 522-1130-013 Dual Input and Output with Recycle Overload Unit | | 522-1130-014 Dual Input and Output with Watt-meter in Door | | 522-1130-015 Single Input and Output with Watt-meter in Door | |
| | Complete 204F-1 as is | Delete | Add | Add | | Delete | Add | Delete | Add | Delete | Add |
| R-f input relay (K13) 410-2129-00 | | | 1 | | | | 1 | | 1 | | |
| Bracket, Coaxial relay (K13) 544-7233-002 | | | 1 | | | | 1 | | 1 | | |
| Cable, r-f 545-3234-00 | | | 1 | | | | 1 | | 1 | | |

TABLE 1-5. OPTIONAL FEATURES (Cont)

| OPTIONS | STATUS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 522-1130-00 Single Input and Output | 522-1130-011 Dual Input and Output with Directional Coupler | | 522-1130-012 Single Input and Output with Recycle Overload Unit | | 522-1130-013 Dual Input and Output with Recycle Overload Unit | | 522-1130-014 Dual Input and Output with Watt-meter in Door | | 522-1130-015 Single Input and Output with Watt-meter in Door | |
| | | Delete | Add | Add | | Delete | Add | Delete | Add | Delete | Add |
| Unit, recycle overload 544-9493-00 | Complete 204F-1 as is | | | 1 | | | 1 | | | | |
| Output switching relay (K14) 970-1931-00 | | 1 | | | | 1 | | 1 | | | |
| Capacitor (C75) 913-1292-00 | | 1 | | | | 1 | | 1 | | | |
| Bracket, relay mounting (K14) 544-5839-002 | | 1 | | | | 1 | | 1 | | | |
| Rod, Connecting 545-2807-002 | | | 2 | | | | 2 | | 2 | | |
| Terminal lug 304-0008-00 | | | 2 | | | | 2 | | 2 | | |
| Directional Coupler 544-5707-004 | | | 2 | | | | 2 | | 2 | | 1 |
| Tube kit (V6, V7, 872A) 544-5738-00 | | | | | | | | 1 | | | |
| Tube kit (V6, V7, 4B32) 545-9087-00 | | | | | | | | | 1 | | |
| Door Assembly, Upper 544-5720-00 | | | | | | | | 1 | | 1 | |
| Door Assembly, Upper 545-9088-00 (add meter M3, 458-0478-00 and switch S15, 259-1202-00) | | | | | | | | | 1 | | 1 |
| Electrical Assembly (add R75, R76, R77, R78 and TB16) 546-0322-00) | | | | | | | | | 1 | | 1 |
| Antenna plug connector 545-9858-002 | | | | | | | | | | | 1 |
| Dual output relay (K15) 546-3288-00 | | | 1 | | | | 1 | | 1 | | |

(1) Remove transformer T6 and filter choke L22 from their shipping containers.

(2) Open lower cabinet door. Slide transformer T6 into rear left corner of cabinet with terminals on transformer facing right cabinet wall. Position transformer over mounting holes in base of cabinet and secure with four 6/16-18 NC machine screws provided.

(3) Connect equipment wiring to terminals of T6. All wires and terminals from which wires were removed are tagged with corresponding numbers. Match numbers and terminals.

(4) Slide filter choke L22 into front left corner of cabinet with terminals of unit facing rear of cabinet. Position choke over mounting holes and secure with four 1/4-20 NC machine screws provided. Connect wiring to terminals of L22.

**CAUTION**

Do not install electron tubes at this time.

2.2.3 EXTERNAL CONNECTIONS. External primary power, r-f signal, and control circuits are shown in figures 2-2 and 2-3.

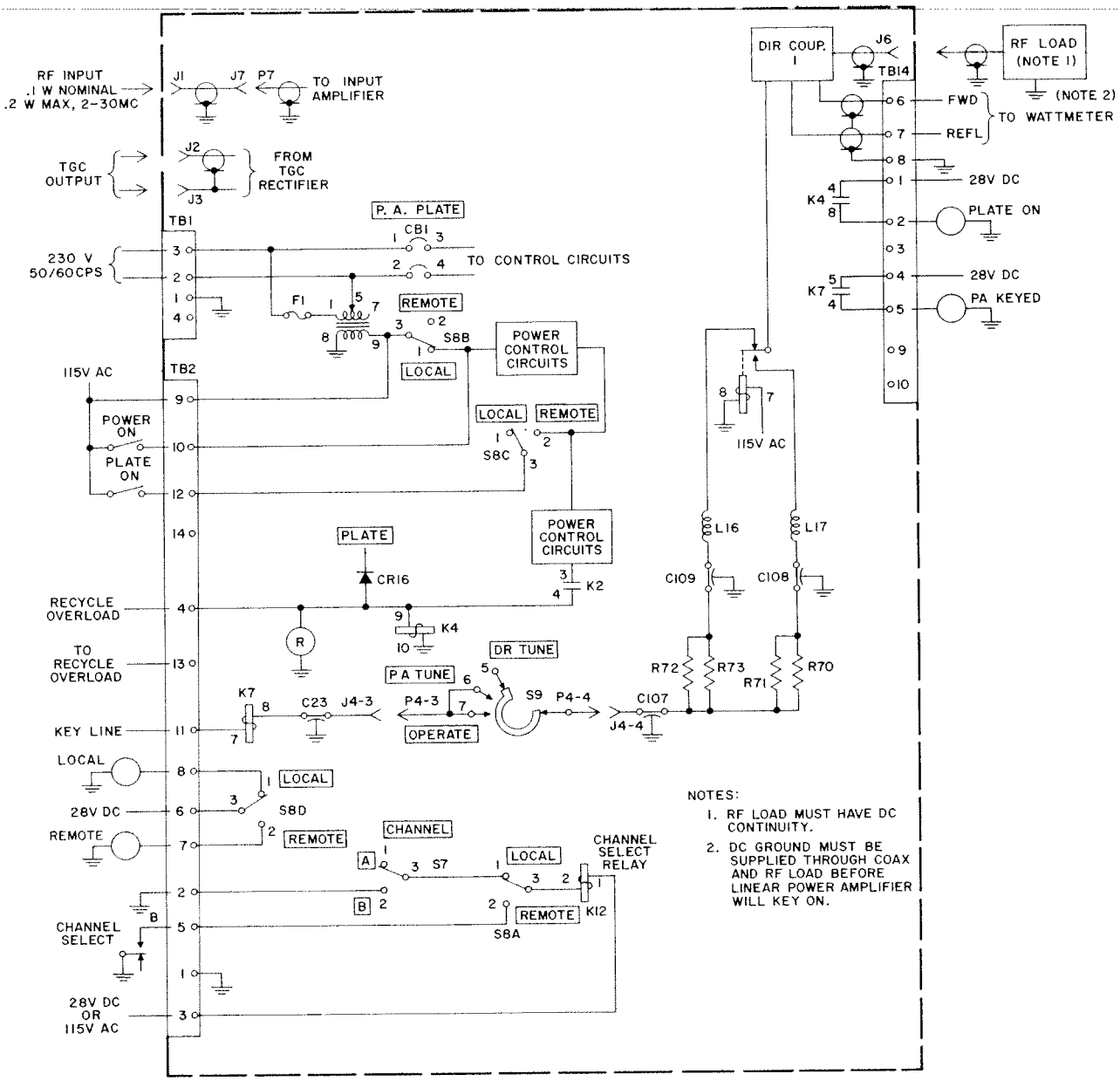



Figure 2-2. Linear Power Amplifier 204F-1, External Circuit Connections

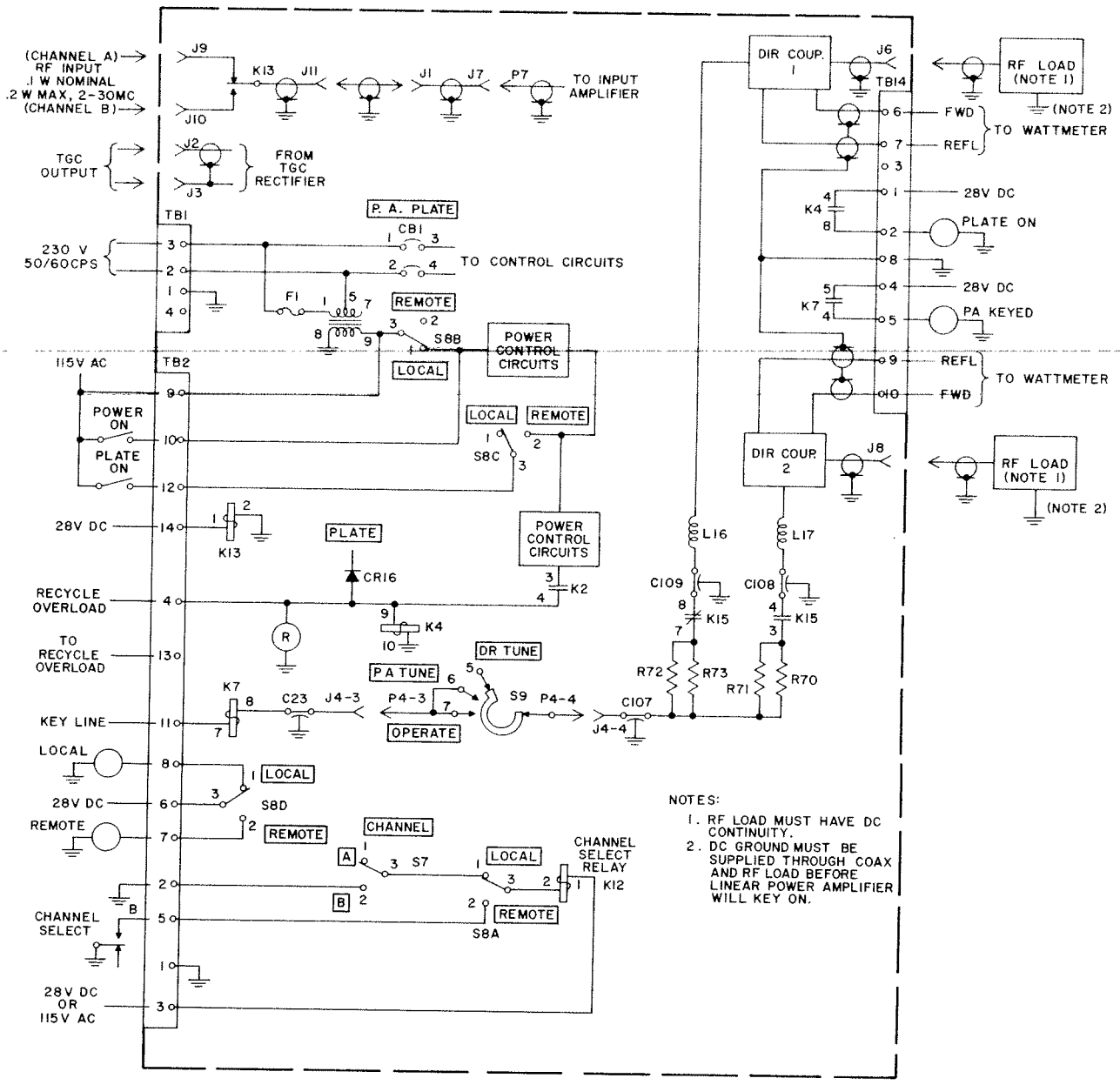



Figure 2-3. Linear Power Amplifier 204F-1, External Circuit Connections with Dual Input-Output Status

2.2.3.1 PRIMARY POWER CONNECTIONS TO FUSED DISCONNECT SWITCH. The linear power amplifier requires a source of primary power that can provide up to 5.5 kilowatts at 92-percent power factor, 200 to 250 volts, single-phase, 50 or 60 cycles per second. The primary power should be connected to the linear power amplifier through a triple-pole, 30-ampere capacity disconnect switch.

a. Mount the fused disconnect switch near the linear power amplifier. It is desirable to locate the disconnect switch where it can be seen from the front of the linear power amplifier.

b. Remove the fuses from the disconnect switch.

c. Install one-inch conduit between the disconnect switch and the linear power amplifier. Provisions have been made for connecting the conduit at the top of the cabinet (see figure 2-1). Insert two number 6 AWG and one 10 AWG (MIL-W-16878 type D or equivalent) conductors through the conduit and into the access compartment of the linear power amplifier. If a cable trench is used, run the conduit down from

the disconnect switch to the trench, along the trench to a point beneath the linear power amplifier, then up through the alternate power cable entrance at the base of the cabinet (see figure 2-1), using the same three conductors specified.

d. Connect the load-side terminals of the disconnect switch to terminals 2 and 3 of terminal board TB1, by means of the number 6 AWG conductors. Connect the number 10 AWG conductor to terminal 1 of TB1 and to the ground terminal of the disconnect switch.

2.2.3.2 CONNECTIONS TO EXCITER.

a. Install one-inch conduit between the associated exciter and the linear power amplifier. Provisions have been made for connecting the conduit at the top of the cabinet (see figure 2-1). All remote control and external interlock circuits will also enter the cabinet through this conduit.

b. To connect the linear power amplifier to its associated exciter perform one of the following steps:

(1) For the single-input status, prepare one length of RG-58C/U coaxial cable which will reach from the exciter to the linear power amplifier. Run the cable through the one-inch conduit. Terminate the linear power amplifier end of the coaxial cable with a type UG-88C/U connector. Connect this r-f connector to receptacle J1 (see figures 2-1 and 2-2). Terminate the exciter end of the cable with the type of connector that will mate with the signal output receptacle on the exciter. Connect the cable that mates with J1 to the signal output of the exciter.

(2) For the dual-input option, prepare two lengths of RG-58C/U coaxial cable which will reach from the exciter to the linear power amplifier. Run the cables through the one-inch conduit. Terminate the linear power amplifier ends of the coaxial cables with type UG-88C/U connectors. Connect the r-f connectors to receptacles J9 and J10 (see figure 2-3) of the linear power amplifier. Terminate the exciter end of the cables with the type of connectors that will mate with the signal output receptacles on the exciter. Connect the cables that mate with J9 and J10 to the signal output of the exciter.

c. Prepare two lengths of RG-58C/U coaxial cable which will reach from the exciter to the linear power amplifier. Run the cables through the one-inch conduit.

d. Terminate the linear power amplifier end of the coaxial cables with type UG-88C/U connectors. Attach the r-f connectors to receptacles J2 and J3 (see figures 2-1 and 2-2). Terminate the exciter end of the cable with the type of connector that will mate with the TGC input receptacles on the exciter. Connect the cables that mate with J2 and J3 to the TGC inputs on the exciter.

2.2.3.3 CONNECTIONS TO ANTENNA.

a. To connect the linear power amplifier to its associated antenna, perform one of the following steps:

(1) For the single-output status, prepare one length of RG-17/U coaxial cable of sufficient length to reach from the linear power amplifier to the antenna receptacle. Terminate the linear power amplifier end of the cable with a type UG-154/U connector. Connect this r-f connector to receptacle J6 on the linear power amplifier (see figures 2-1 and 2-2).

(2) For the dual-output option, two lengths of RG-17/U coaxial cable must be prepared to reach from the linear power amplifier to the antenna receptacle. Terminate the linear power amplifier end of the cables with type UG-154/U connectors. Attach these r-f connectors to receptacles J6 and J8 of the linear power amplifier (see figure 2-3). For a description of the dual-input, dual-output option, see paragraph 4.8.2.

NOTE

If the standing-wave ratio of the system exceeds 2 to 1 (see figure 3-4), an antenna coupler must be used. If a coupler is used, make connections from J6 and/or J8 to antenna coupler(s).

b. Terminate the antenna end of the cable(s) with the type of connector(s) that will mate with the receptacle on the antenna (or antenna coupler, if used). Secure cable to antenna (or antenna coupler, if used).

NOTE

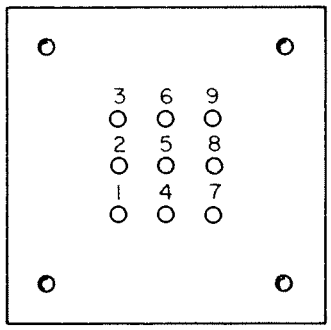
The r-f load (either antenna system or dummy load) must have d-c continuity. D-c ground must be supplied through the coaxial cable and the r-f load before the linear power amplifier will key-on.

2.2.3.4 LOCAL OPERATION ONLY. If only local operation is desired, make the following connections:

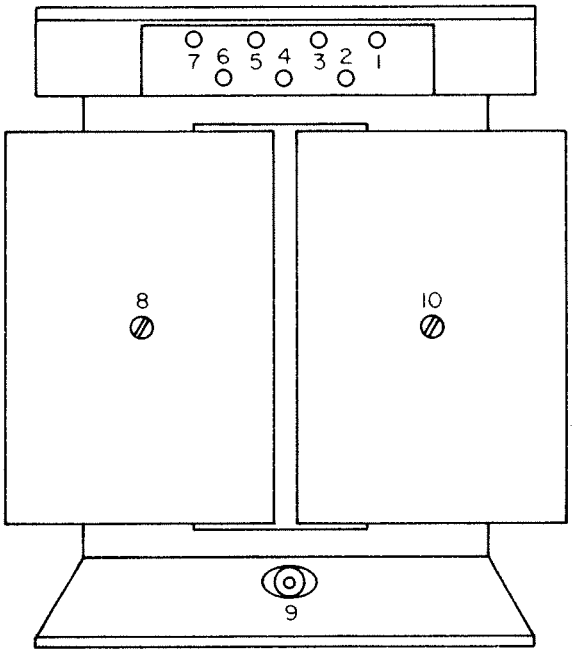
a. Connect terminals 1 and 2 of TB2.

b. Jumper terminals 3, 9, and 11 of TB2 with insulated wire. Terminals 9 and 11 of TB2 may be connected through the contacts of a relay controlled by the key line of the exciter, if desired.

2.2.3.5 CONNECTIONS TO REMOTE CONTROL AND EXTERNAL INTERLOCK CIRCUITS. The number and length of conductors required for remote control and external interlock circuits will be determined by the particular installation. For suggested control circuits, see figures 2-1 and 2-2. For a complete list of status numbers and options which may be use with the 204F-1, see table 1-5 and paragraph 4.8. Use number 20 AWG (MIL-W-16878 type C or equivalent) conductors between terminal boards TB2, T 3, and TB14 for any external circuits. Use number 22 AWG (MIL-W-16878 type C or equivalent) between pins 2, 3, 9, 10, and 12 of terminal board TB2 and any external




(A) POWER CONTROL TRANSFORMER T1




(B) POWER TRANSFORMER T6

| LINE VOLTAGE | APPLY BETWEEN TERMINALS | |
|---|---|---|
| 200 | 1 | 2 |
| 210 | 1 | 3 |
| 220 | 1 | 4 |
| 230 | 1 | 5 |
| 240 | 1 | 6 |
| 250 | 1 | 7 |

838-928-3

Figure 2-4. Linear Power Amplifier 204F-1, Power and Power Control Transformer Connections

circuit connections. All these wires will enter the cabinet through the one-inch conduit installed between the linear power amplifier and the external remote circuits.

NOTE

If the recycle overload unit is used in a system connected for remote operation, the connections may be slightly different from those without the overload unit. Figure 7-4 is a simplified schematic diagram of the remote overload recycle unit and shows typical external connections.

## 2.3 PRELIMINARY CHECKS AND ADJUSTMENTS.

2.3.1 MECHANICAL CHECKS.

a. Visually inspect the linear power amplifier for broken components.
b. Used forced dry air to eliminate dust collection inside the cabinet. Remove any loose foreign material.
c. Rotate blower wheel by hand to check for binding. Check to see if air filter is in place. Check if rubber stripping is in place around the power amplifier compartment of the upper door. Check to see if air vane switch in air exhaust duct is free to move.
d. Install all electron tubes except the two 4CX1000A power amplifiers.

2.3.2 ELECTRICAL CHECKS.

2.3.2.1 LINE VOLTAGE COMPENSATION. By making proper connections within the linear power amplifier, the primary power source voltage anywhere in the 200-volt to 250-volt range can be transformed to provide the correct voltages required for operation of the linear power amplifier.

a. Determine the voltage level available at the line side of the fused disconnect switch.

**WARNING**

High voltages which are dangerous to life may be present at power control transformer T1 and power transformer T6. Make certain that no power is applied when making connections outlined in steps b and c. Transformers T1 and T6 are both located in the lower left corner of the power supply compartment. Terminal locations for both T1 and T6 are shown in figure 2-4.

b. Connect the movable primary power lead (a white wire with brown tracer) to the appropriate terminal of T1. Determine the correct terminal from the table shown in figure 2-4.
c. Connect the movable primary power lead (a white wire with orange tracer) to the appropriate terminal of T6. Determine the correct terminal from the table shown in figure 2-4.

2.3.2.2 APPLICATION OF PRIMARY POWER. Refer to figure 3-1 for location of controls and indicators listed below:

a. Open lower cabinet door and cheat lower door interlock switch. Remove the right access hole cover plate located on the shelf separating the grid compartment.
b. Connect an a-c voltmeter (see table 1-2) to transformer T4 by the following method:

(1) Place the meter outside the cabinet and set for operation on the 0- to 15-volt scale.
(2) Run the meter leads in through the power supply compartment, up through the access hole, and connect them to terminals 7 and 8 of transformer T4.

c. Place DR TUNE-PA TUNE-OPERATE switch in DR TUNE position. Place LOCAL-REMOTE switch in LOCAL position. Place MULTIMETER switch in PA FIL VOLTS position.
d. Install the power amplifier air chimneys by twisting them into their bayonet sockets at the top of the r-f compartment. The base of the chimneys will rest on the cooling fins of the PA tubes, after the PA tubes have been installed.

NOTE

Do not install PA tubes at this time.

e. Close upper cabinet door. Insert 30-ampere, slow-blow fuses in the external disconnect switch and close the switch. Place P.A. PLATE circuit breaker in the ON position.

**WARNING**

High voltages which are dangerous to life are now present in the linear power amplifier.

f. Press FILAMENTS-ON button and observe that FILAMENTS indicator lights. Blower B1 should be operating. When the blower is supplying sufficient air to close air interlock switch S6, primary power is applied to filament transformer T4. This can be checked by observing the indication on the MULTIMETER.

NOTE

Allow the equipment to operate with filaments applied for 15 minutes before applying plate voltage. This delay allows the mercury in the high-voltage rectifiers to distribute properly and prevents arc-back. This additional delay should be used whenever the rectifiers have been removed from their sockets.

g. Adjust PA FILAMENT control until the meter connected to T4 indicates exactly six volts. Observe that MULTIMETER indicates exactly six volts. If MULTIMETER does not indicate correctly, adjust R45, which is located on a mounting panel in the upper left corner of the power supply compartment, until MULTIMETER indicates exactly six volts.

h. Press FILAMENTS-OFF button, and place external disconnect switch in off position. Open upper cabinet door and remove meter. Replace access hole cover and enable lower door interlock switch.

i. Install the two 4CX1000A power amplifier tubes, V4 and V5, by the method described in paragraph 5.7.3.c. Close both upper and lower cabinet doors.

NOTE

When plate power is not applied to the linear power amplifier, the upper cabinet door may be opened without causing the three-minute timer to run down. Caution should be used when the upper cabinet door is open with FILAMENTS-ON button depressed. In this condition, filament power is applied to the linear power amplifier, and the equipment should not be operated more than 30 minutes with the upper door open and filament power applied.

j. Press FILAMENTS-ON button. When the air interlock switch closes, observe that MULTIMETER is indicating 6 ±0.25 volts. If the meter is not reading in this range for the PA FIL VOLTS position, adjust PA FILAMENT control until the meter indicates 6 volts.

2.3.3 INITIAL ADJUSTMENTS. Refer to figure 3-1 for location of controls and indicators listed below:

a. Place DR TUNE-PA TUNE-OPERATE switch in PA TUNE position. Place MULTIMETER switch in PA PLATE VOLTS position. Key linear power amplifier on.

b. Press PLATE-ON button and observe that PLATE indicator lights. If filament control circuits have been de-energized prior to this step, there may be a delay of approximately 3 minutes before the PLATE indicator lights.

c. After PLATE indicator lights, observe that MULTIMETER is indicating 3200 ±200 volts.

d. Place MULTIMETER switch in LT PA CATH position, and adjust LEFT PA BIAS control until MULTIMETER indicates 250 milliamperes. Place MULTIMETER switch in RT PA CATH position, and adjust RIGHT PA BIAS control until MULTIMETER indicates 250 milliamperes.

e. Apply excitation from an external exciter (see table 1-1). Key exciter on and tune to proper frequency according to paragraph 3.5.

f. Alternate the MULTIMETER switch between RT PA CATH and LT PA CATH positions while adjusting PA GRID BAL control for equal indications on MULTIMETER.

g. Place MULTIMETER switch in PA SCREEN position, and DR TUNE-PA TUNE-OPERATE switch in OPERATE. Observe that MULTIMETER indicates zero milliampere.

h. Place MULTIMETER switch in DRIVER PLATE position, and observe that MULTIMETER indicates approximately 120 milliamperes.

i. Press FILAMENTS-OFF button and place external disconnect switch in off position.

2.3.4 THERMAL OVERLOAD ADJUSTMENT. After the initial adjustments of paragraph 2.3.3 have been completed, check the thermal overload circuit as follows:

a. Place external disconnect switch in off position.

b. Remove the two plates covering the rear portion of the top of the cabinet. Connect an a-c voltmeter (see table 1-2) between terminals 1 and 2 on TB 13. Set meter for operation on the 0- to 30-volt scale. The terminals of TB13 are not numbered. A white wire with brown and orange tracers is connected to terminal 1. A white wire with black and green tracers is connected to terminal 2.

c. Place external disconnect switch in on position. Press PLATE-ON button and wait for PLATE indicator to light. After indicator lights, set OVERLOAD control for reading of 23 volts on the a-c voltmeter. Allow equipment to operate for 15 minutes. If equipment cuts off before the 15-minute operating time has elapsed, the voltage must be decreased.

NOTE

The setting of the OVERLOAD control is a function of ambient temperature. The adjustment for an indication of 23 volts applies only when the room temperature is 29 degrees centigrade (84 degrees Fahrenheit). If room temperature is higher, the voltage will have to be reduced and vice versa to achieve the same results as those at 29 degrees centigrade. (See step e.)

d. Place MULTIMETER in RT PA CATH position, and turn RIGHT PA BIAS adjustment until MULTIMETER indicates 350 milliamperes. Place MULTIMETER in LT PA CATH position, and turn LEFT PA BIAS adjustment until MULTIMETER indicates 350 milliamperes. Within one minute, the thermal overload circuit will operate removing screen and plate voltage from V4 and V5. Operation of the overload circuit will be indicated by the PLATE indicator being extinguished.

CAUTION

If overload circuit does not activate within the allowable one-minute delay, readjust left and right cathode current indications for 250 milliamperes. The overload current of 350 milliamperes exceeds the dissipation of tubes V4 and V5 and will cause the tubes to burn out if allowed to flow more than one minute.

e. If the overload circuit does not activate within the allowable one-minute delay, repeat steps c and d, but increase the voltage in step c to 25 volts. Repeat operation as many times as necessary to obtain proper results. If ambient temperature changes, the complete thermal overload adjustment should be readjusted to the new ambient temperature.

f. Readjust RIGHT and LEFT PA BIAS adjustments for indications of 250 milliamperes on MULTIMETER. Press FILAMENTS-OFF, and place external disconnect switch in off position.

g. Disconnect the voltmeter from TB13, and replace the two plates on the rear portion of the top of the cabinet.

2.3.5 PLATE OVERLOAD CIRCUIT CHECK. Linear Power Amplifier 204F-1 should be tuned to an operating frequency as described in paragraph 3.5. With the proper signal input from the associated exciter, proceed as follows:

a. Place MULTIMETER switch in PA SCREEN position and DR TUNE-PA TUNE-OPERATE switch in OPERATE position.

b. Increase the r-f signal level at the exciter until the plate overload circuit operates. Operation of the overload circuit, which is indicated by the PLATE indicator being extinguished, should occur when the PLATE CURRENT meter is indicating between 1.6 and 1.65 amperes.

CAUTION

Do not let the power amplifier screen current exceed 80 milliamperes. Reduce the amount of screen current with the PA LOAD (CHANNEL A or B) control if necessary.

c. If overload circuit does not function properly, adjust R79 (located in the upper right-hand side of the power supply compartment on the bias chassis between fuses F1 and F2) to obtain the proper indication.

d. Press PLATE-OFF button, wait three minutes and press FILAMENTS-OFF button.

e. Place external disconnect switch in off position.

2.3.6 ABNORMAL INDICATIONS. If the linear power amplifier appears to be unstable at any point in the installation procedures, make adjustments described in paragraphs 5.2.5 and 5.2.6. If trouble appears to be present in the equipment, consult table 5-2.

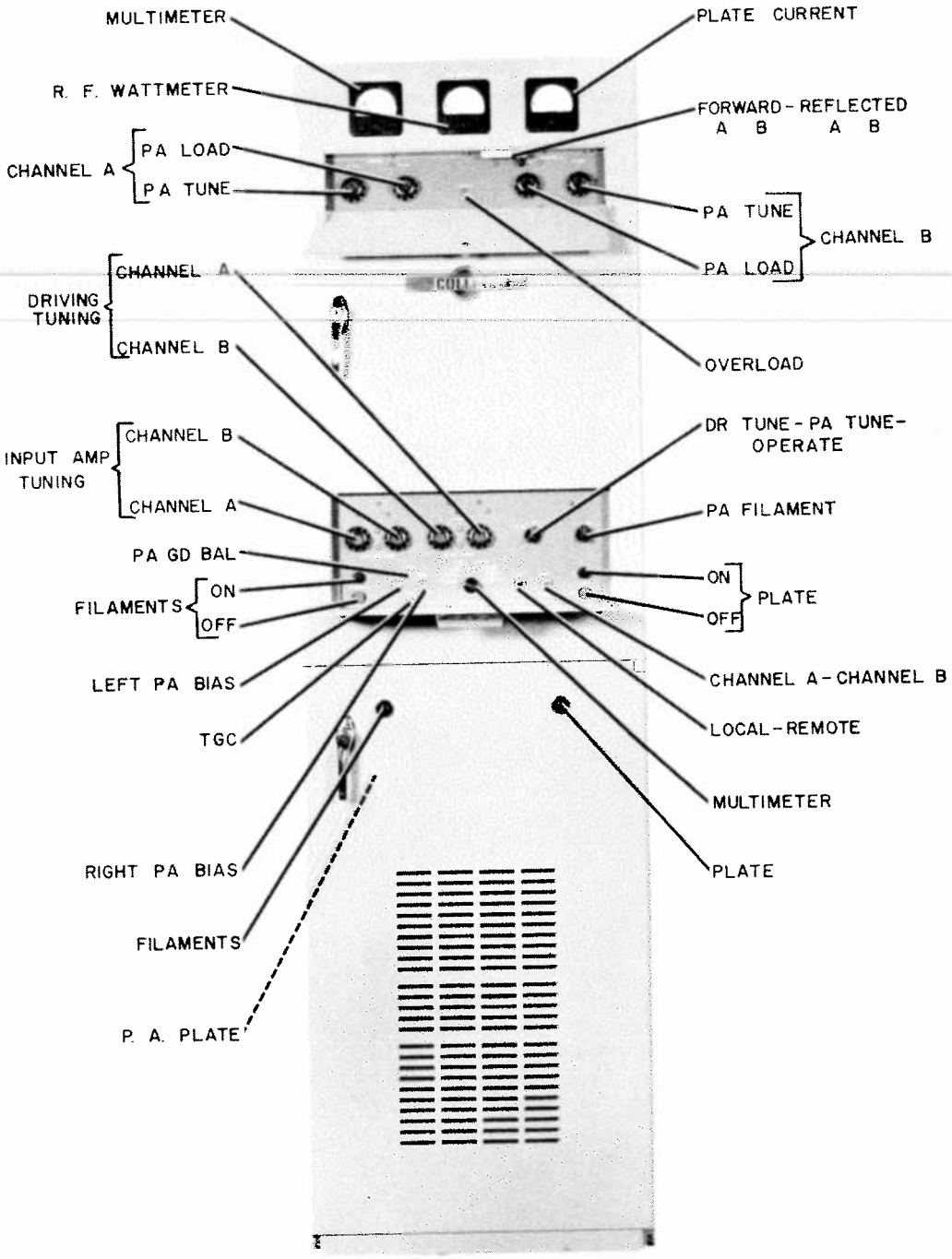



Figure 3-1. Linear Power Amplifier 204F-1, Operating Controls

# SECTION III
# OPERATION

## 3.1 GENERAL.

Linear Power Amplifier 204F-1 may be controlled locally or remotely for either attended or unattended operation. All operating voltages are applied and removed by FILAMENT ON-OFF and PLATE ON-OFF pushbuttons. All power supply circuits are equipped with protective devices that prevent damage to the equipment and injury to operating personnel. Either of two sets of tuned circuits may be selected by relay action. Each set of tuned circuits may be tuned to any frequency within the range between 2 and 30 megacycles. Each set of tuned circuits must be pretuned to the desired frequency by variable capacitors, tapped coils, and padding capacitors within the circuits.

**WARNING**

The operation of Linear Power Amplifier 204F-1 involves the use of high voltages that can be fatal. Under no circumstances should any person reach within the cabinet without the immediate presence of another person who is capable of rendering aid. Do not depend on interlocks or shorting switches. Always use the high-voltage shorting sticks that are furnished.

## 3.2 FUNCTION AND LOCATION OF ADJUSTMENTS, CONTROLS, AND INDICATORS.

Figure 3-1 shows the location of the adjustments, controls, and indicators used to operate the linear power amplifier. Their functions are given in table 3-1.

## 3.3 OPERATING PROCEDURE.

Make certain that Linear Power Amplifier 204F-1 has been placed in operation by the installing activity covered in section II.

NOTE

If at any time the linear power amplifier appears to be unstable, refer to neutralizing adjustments in paragraphs 5.2.5 and 5.2.6. A complete set of adjustment procedures is included in section V.

TABLE 3-1. FUNCTION OF CONTROLS, ADJUSTMENTS, AND INDICATORS

| CONTROL OR INDICATOR | FUNCTION |
|---|---|
| LOCAL-REMOTE | A two-position toggle switch. In the LOCAL position, the FILAMENTS and PLATE controls may be operated. In the REMOTE position, FILAMENTS and PLATE ON-OFF controls may be operated remotely. |
| FILAMENTS-ON | A pushbutton switch which supplies filament and bias voltages. This switch also applies power to the internal blower. |
| FILAMENTS-OFF | A pushbutton switch which removes all operating voltages. |
| FILAMENTS | A green indicator which lights when the FILAMENTS-ON switch is pressed. |
| PA FILAMENT | A control that sets the filament voltage level of all tubes except the high-voltage rectifiers. |
| P.A. PLATE | A three-section circuit breaker that controls the application of primary power to the high-voltage rectifier plate circuit, the power amplifier screen voltage supply, and the plate hold relay, K3. |

TABLE 3-1. FUNCTION OF CONTROLS, ADJUSTMENTS, AND INDICATORS (Cont)

| CONTROL OR INDICATOR | FUNCTION |
|---|---|
| OVERLOAD | A screwdriver adjustment that sets the operating point of the thermal overload circuit so power will not be applied to the power amplifier plate circuit unless adequate cooling air is being supplied. |
| PLATE-ON | A pushbutton switch which applies all screen and plate supply voltage, including power amplifier plate voltage, after the filaments have been applied for approximately three minutes. |
| PLATE-OFF | A pushbutton switch which removes screen and plate supply voltages. |
| PLATE | A red indicator which lights when the power amplifier plate voltage is applied. |
| LEFT PA BIAS | A screwdriver adjustment that sets the value of bias voltage applied to the left power amplifier V4. |
| RIGHT PA BIAS | A screwdriver adjustment that sets the value of bias voltage applied to the right power amplifier V5. |
| TGC | A screwdriver adjustment that sets the threshold level of the TGC rectifier. |
| PA GD BAL | A screwdriver adjustment that balances the dynamic cathode currents of the powe amplifier tubes. |
| DR TUNE-PA TUNE-OPERATE | A three-position rotary switch. In DR TUNE position, the power amplifier is held unkeyed and the input amplifier and driver amplifier stages are operated at reduced output. In the PA TUNE position, the power amplifier is keyed and the input amplifier and driver amplifier stages are still operated at reduced output. In the OPERATE position, the input amplifier and driver amplifier will operate at full output with the power amplifier keyed. |
| DRIVER TUNING | A control which allows the selection and tuning of the driver amplifier stage in either the CHANNEL A or CHANNEL B position. |
| INPUT AMP TUNING | A control which allows the selection and tuning of the input amplifier stage in either the CHANNEL A or CHANNEL B position. |
| CHANNEL A-CHANNEL B | A two-position toggle switch that allows the selection of either channel A or channel B tuned circuits. |
| CHANNEL A-PA TUNE | A control used to tune the channel A output network to resonance. |
| CHANNEL A-PA LOAD | A control used to load the channel A output network. |
| CHANNEL B-PA TUNE | A control used to tune the channel B output network to resonance. |
| CHANNEL B-PA LOAD | A control used to load the channel B output network. |
| HOURS | A meter indicator that records the total elapsed time filament voltage has been applied. |
| PLATE CURRENT | A meter that indicates the power amplifier plate current. |
| MULTIMETER | A meter that indicates pertinent voltages and currents. The function measured is selected by the eight-position MULTIMETER switch. (See paragraph 4.7.1). |
| R.F. WATTMETER (See note.) | A meter that indicates the r-f output level. (See paragraph 4.8.3.) |
| FORWARD A-B, REFLECTED A-B (See note.) | A four-position wafer switch that switches the R.F. WATTMETER to read forward or reflected output in either the CHANNEL A or CHANNEL B position. |

NOTE: Used only in equipments with status numbers 522-1130-014 and 522-1130-115.

3.3.1 LOCAL OPERATION.

a. Place the external disconnect switch in the off position, and place the following controls in the positions indicated:

(1) Place the P.A. PLATE circuit breaker in the ON position.
(2) Place the LOCAL-REMOTE control in the LOCAL position.
(3) Place the DR TUNE-PA TUNE-OPERATE control in DR TUNE position.
(4) Place the MULTIMETER control in the PA SCREEN position.
(5) In equipment with status numbers 522-1130-014 and 522-1130-015 only, place the REFLECTED-FORWARD control in the FORWARD position.
(6) Make certain both high-voltage shorting sticks are in their holders, and close both upper and lower cabinet doors.

b. Place the external disconnect switch in the on position. Press the PLATE-ON button. Observe that FILAMENTS indicator lights. After a three-minute time delay, the PLATE indicator will light.
c. To shut down the linear power amplifier, press the FILAMENTS-OFF button and/or place the external disconnect switch in the off position.

3.3.2 REMOTE OPERATION.

a. Place the external disconnect switch in the off position. Place the following controls in the positions indicated:

(1) Place the P.A. PLATE circuit breaker in the ON position.
(2) Place the LOCAL-REMOTE control in the REMOTE position.
(3) Place the DR TUNE-PA TUNE-OPERATE control in the DR TUNE position.
(4) Place the MULTIMETER control in the PA SCREEN position.
(5) In equipment with status numbers 522-1130-014 and 522-1130-015 only, place the REFLECTED-FORWARD switch in the FORWARD position.
(6) Make sure both high-voltage shorting sticks are in their holders and close both upper and lower cabinet doors.

b. Place the external disconnect switch in the on position.
c. The linear power amplifier may now be controlled at the remote location (see paragraph 4.4.2.3).

3.3.3 EMERGENCY SHUTDOWN.

Place the external disconnect switch in the off position.

## 3.4 OPERATIONAL CHECK.

3.4.1 METER INDICATIONS. With the linear power amplifier keyed-on and excitation applied, the following indications should be obtained:

a. With the MULTIMETER switch in the PA SCREEN position, the meter indication should not exceed 80 ma.
b. With the MULTIMETER switch in PA FIL VOLTS position, the meter indication should be 6 ±0.25 volts.
c. With the MULTIMETER switch in the PA PLATE VOLTS position, the meter indication should be not less than 2.9 kilovolts.
d. The PLATE CURRENT meter indications should not exceed 1.5 amperes.
e. On equipments with status numbers 522-1130-014 and 522-1130-015 only, read reflected and forward output power on the R.F. WATTMETER, then consult the swr chart of figure 3-4 to determine the standing-wave ratio.

NOTE

If swr exceeds 2 to 1, an antenna coupler must be used.

## 3.5 TUNING PROCEDURE.

The linear power amplifier contains two complete sets of tuned circuit components in the input amplifier stage, driver amplifier stage, and in the output network. Selection of one set of components in each amplifier stage and the output network is controlled by relay action. Channel A circuits are used in the energized position of the relays, and channel B circuits are used when the relays are de-energized. The two sets of components are referred to as the channel A and channel B circuits.

NOTE

One section of relay K11 is energized in either position of the channel selector switch.

Each set of components may be tuned to any frequency in the range between 2 and 30 megacycles. Continuously variable capacitors, tapped coils, and padding capacitors are provided to cover this frequency range. A guide to the setting of the variable capacitors, and taps on the coils required for a given frequency is presented in the form of a TUNING CHART (see figure 6-1) fastened to the rear surface of the lower hinged panel on the upper cabinet door. The following tuning procedure is used whenever Linear Power Amplifier 204F-1 is set to a new frequency.

NOTE

Before attempting tuning procedures, make certain that the associated exciter is providing the proper input and that the associated antenna system is connected properly and is providing a d-c ground path.

a. Set external disconnect switch to on.
b. Place MULTIMETER switch in PA FIL VOLTS position and press FILAMENTS-ON button. Check

that MULTIMETER indicates six volts. Adjust PA FILAMENT control to obtain this reading if necessary. Place MULTIMETER switch in PA SCREEN position.

c. Press the PLATE-OFF button. Open the upper cabinet door. When plate power is not applied to the linear power amplifier, the upper cabinet door may be opened without causing the three-minute timer to run down. Do not operate the equipment more than 30 minutes with the upper door open and filament power applied.

**WARNING**

Short the power amplifier neutralizing capacitor to ground with the shorting stick on the inside of the door. This capacitor is located between the two PA tubes. While working inside the r-f compartment, remember that +130 volts d-c is present on the TGC board in the upper right-hand corner of the grid chassis, and that 110 volts a-c is present at the OVERLOAD adjustment at the rear center of the upper control panel.

d. Set the turn-shorting device on INPUT AMP TUNING coil (L1 for channel A, L2 for channel B) to the number of turns specified in the COILS TURNS column under the INPUT AMP PLATE heading of the TUNING CHART. This tuning coil is located in the left half of the grid chassis directly above the INPUT AMP TUNING (CHANNEL A or B) control. Set the shorting device by lifting the support rod slightly and sliding the shorting contact. Place finger on top of sliding contactor and rock slightly to be sure contact is made with coil.

e. Set the turn-shorting device on DRIVER TUNING coil (L6 for channel A, L7 for channel B) to the number of turns specified in the COIL TURNS column under the DRIVER PLATE heading of the TUNING CHART. The coils are located in the right half of the grid chassis directly above the DRIVER TUNING (CHANNEL A or B) control.

f. Set INPUT AMP TUNING (CHANNEL A or B) control (lower control panel) to the dial setting indicated in the TUNING column under the INPUT AMP PLATE heading of the TUNING CHART. Set DRIVER TUNING (CHANNEL A or B) control (lower control panel) to the dial setting indicated in the TUNING column under the DRIVER PLATE heading of the TUNING CHART. Interpolate if necessary.

g. Set the PA TUNE (CHANNEL A or B) control, on the upper control panel, to the setting indicated in the TUNING CHART. Use the information in the VARIABLE column under the PA PLATE TUNING CAP heading. Interpolate if necessary.

h. Note the information given in the FIXED COLUMN under the PA PLATE TUNING CAP heading. The

TABLE 3-2. PADDING CAPACITY SELECTION

| VALUE OF PADDING CAPACITY | CAPACITORS IN PARALLEL WITH C26 | CAPACITORS IN PARALLEL WITH C27 |
|---|---|---|
| 547 | C92, C38, C28, C30, C36, C90, C46, C34, C32 | C47, C35, C33, C31, C37, C89, C91, C39, C29 |
| 472 | C92, C38, C28, C30, C36, C90, C46, C34 | C47, C35, C33, C31, C37, C89, C91, C39 |
| 322 | C92, C38, C28, C30, C36, C90 | C47, C35, C33, C31, C37, C89 |
| 247 | C92, C38, C28, C30, C36 | C47, C35, C33, C31, C37 |
| 172 | C92, C38, C28, C30 | C47, C35, C33, C31 |
| 97 | C92, C38, C28 | C47, C35, C33 |
| 50 | C92, C38 | C47, C35 |
| | NOTE: Capacitors C92 and C38 are permanently connected in parallel, and may be connected to C26 by closing a knife-blade switch located directly below C26 in the r-f compartment. C28, C30, C36, C90, C46, C34, and C32 are connected together and to the combination of C92 and C38 by removable links. | NOTE: Capacitors C47 and C35 are permanently connected in parallel and may be connected to C27 by closing a knife-blade switch located directly below C27 in the r-f compartment. C33, C31, C37, C89, C91, C39, and C29 are connected together and to the combination of C47 and C35 by removable links. |

first figure given is the value of capacitance that should be connected in parallel with capacitor C26 for channel A, C27 for channel B. Refer to table 3-2 to determine the method of obtaining this capacitance. Connect the proper capacitors in parallel with either of the fixed capacitors. For all frequencies, refer to the tuning-loading charts (figures 3-2 and 3-3), and connect the fixed capacitors according to the capacitor strapping diagram column. If the desired frequency exceeds 9 megacycles, no fixed capacitance is needed. Pull the knife switch to remove the fixed capacitors from the circuit.

i. Remove the PA chimney (left or right) by grasping the top of the chimney and rotating it out of its bayonet socket. Set the lower shorting clip on the PA tank coil (L14 for channel A, L15 for channel B) to the number of turns given in the PA COIL TURNS column of the TUNING CHART. The coil is located in the left half of the r-f compartment for channel A or in the right half of the r-f compartment for channel B. Set the upper shorting clip halfway between the lower clip and the top turn of the coil.

NOTE

To set shorting clip, loosen locking screw, disengage knife switch, slide to correct position, engage switch, and tighten locking screw. If there is any doubt as to the precise turn which is to be engaged, count the turns, beginning with the bottom turn as zero.

j. Set the PA LOAD (CHANNEL A or B) control to the setting indicated in the VARIABLE column under the PA PLATE LOADING CAP heading in the TUNING CHART. Interpolate if necessary.

k. Note the value of capacitance indicated in the FIXED column under the PA PLATE LOADING CAP heading of the TUNING CHART. The two figures given are the values of capacitance that should be placed in parallel with PA LOAD capacitor when the operating frequency lies in the lower or upper portion of the frequency band. Engaging either knife switch connects the fixed capacitor in parallel with the loading capacitor. Refer to the tuning-loading charts shown in figures 3-2 and 3-3.

(1) CHANNEL A. If the value of capacitance required is 2400 uuf, connect both C42 and C44 in parallel with C40. This is done by closing the two knife-blade switches located directly beneath the capacitors. If 1600 uuf are required, connect C44 in parallel with C40. When 800 uuf are required, connect C42 in parallel with C40. The 800- and 1600-uuf capacitors are located near the top of the r-f compartment in front of the PA load capacitors. Their capacity is marked on the knife switch.

(2) CHANNEL B. If the value of capacitance required is 2400 uuf, connect both C43 and C45 in parallel with C41. This is done by closing the knife-blade switches located directly beneath the capacitors. If 1600 uuf are required, connect C45 in parallel with C41. When 800 uuf are required, connect C43 in parallel with C41. The 800- and 1600-uuf capacitors are located near the top of the r-f compartment in front of the PA load capacitors. Their capacity is marked on the knife switch.

l. Set CHANNEL A-CHANNEL B switch to the desired position, DR TUNE-PA TUNE-OPERATE switch to DR TUNE, and LOCAL-REMOTE switch to LOCAL.

m. Close upper cabinet door. Press PLATE-ON button.

n. Place MULTIMETER switch in PA LOAD position, and determine that associated exciter is delivering a signal of proper frequency and of normal amplitude to the linear power amplifier.

o. Adjust INPUT AMP TUNING (CHANNEL A or B) control for peak MULTIMETER indication. Adjust DRIVER TUNING (CHANNEL A or B) control for peak MULTIMETER indication.

p. Place DR TUNE-PA TUNE-OPERATE control in PA TUNE position. Determine that keying relay is energized.

q. Adjust PA TUNE (CHANNEL A or B) control for MULTIMETER dip.

r. Adjust PA LOAD (CHANNEL A or B) control for MULTIMETER zero. Readjust PA TUNE control for MULTIMETER dip.

CAUTION

If MULTIMETER-PA SCREEN or PLATE CURRENT meter indications exceed the maximum stated values, immediately depress the FILAMENTS-OFF button and proceed as follows:

(1) If PA SCREEN indication exceeds the maximum allowable ±80 ma, check the setting of the PA LOAD control which sets the value of PA screen current.
(2) If PLATE CURRENT meter exceeds the maximum allowable value of 1.5 amperes, check the setting of the PA TUNE control, which brings the output network into resonance.
(3) If MULTIMETER or PLATE CURRENT meter indications still exceed maximum values after adjustment, check setting of the TGC adjustment as described in paragraph 5.2.4.

s. It may be necessary to repeat steps q and r several times due to the interaction of the PA TUNE and PA LOAD controls. The PA LOAD control varies the PA screen current (for a given value of drive voltage) and the PA TUNE control brings the output network into resonance. Under normal conditions for voice operation, loading to zero is usually adequate. However, loading to zero may not produce optimum operating conditions, since the r-f voltmeter circuit connected into the MULTIMETER in the PA LOAD position has some degree of tolerance. If optimum operation is desired, make the following adjustments:

(1) Place DR TUNE-PA TUNE-OPERATE control in PA TUNE position. Place MULTIMETER switch in PA SCREEN position.

(2) Adjust PA TUNE (CHANNEL A or B) control for MULTIMETER dip. Adjust PA LOAD (CHANNEL A or B) control for MULTIMETER zero.

(3) Increase r-f drive voltage at the exciter until PLATE CURRENT meter indication reaches 1.45 amperes or PA SCREEN (MULTIMETER) indication reaches 40 milliamperes. If the two currents reach these given values simultaneously, the set is tuned for optimum conditions and steps (4) through (6) may be omitted. If not, complete steps (4) through (6).

(4) Reduce the drive level at the exciter until PLATE CURRENT meter indicates one ampere.

NOTE

The r-f drive level is reduced to assure that the linear power amplifier does not go into oscillations at the higher frequencies.

(5) If the screen current reached 40 milliamperes before the plate current indication reached 1.45 amperes in step (3), adjust PA LOAD (CHANNEL A or B) until the screen current drops off. Switch MULTIMETER to PA LOAD position and adjust PA TUNE (CHANNEL A or B) for resonance (MULTIMETER dip).

(6) Repeat step (5) until optimum conditions (plate current of 1.45 amperes and screen current of 40 milliamperes) are reached. This condition may not give zero indication on MULTIMETER in PA LOAD position.

t. Place MULTIMETER switch in the PA SCREEN position and DR TUNE-PA TUNE-OPERATE switch in OPERATE. Observe that MULTIMETER indicates less than maximum allowable current of ±80 ma and the PLATE CURRENT meter indicates less than the maximum allowable current of 1.5 amperes.

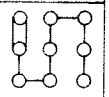
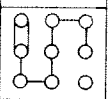
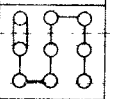
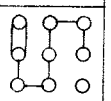
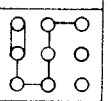
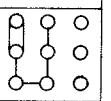
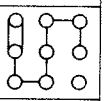
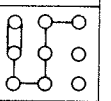
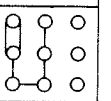
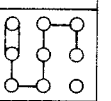
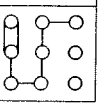
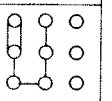
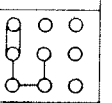
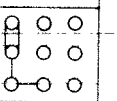
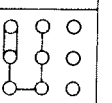
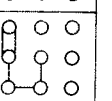
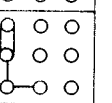
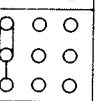
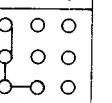
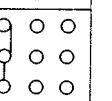
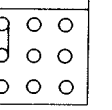
u. On equipments with status numbers 522-1130-014 and 522-1130-015 only, set FORWARD-REFLECTED switch to proper channel FORWARD position, and set exciter gain to desired forward power as indicated on R.F. WATTMETER. Check reflected power reading.

## 3.6 OPERATION WITH OPTIONAL FEATURES.

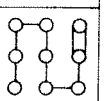
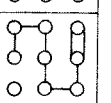
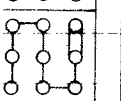
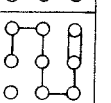
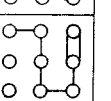
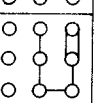
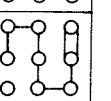
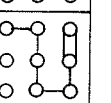
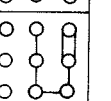
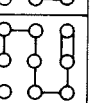
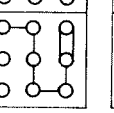
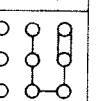
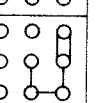
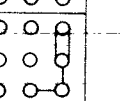
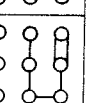
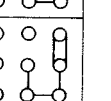
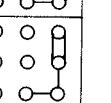
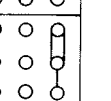
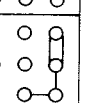
The 204F-1 can be equipped with several optional features, but in most cases, the operation of the equipment will not be altered. For a description of the optional features that may be included, see paragraph 4.8.

# TUNING CHART

## CHANNEL A

| FREQ RANGE (MC) | COIL TURNS (NOTE 1) | CAP. STRAP. DIAG. (NOTES 2 & 3) |
|---|---|---|
| 2.00 - 2.10 | 18 |  |
| 2.10 - 2.25 | 18 |  |
| 2.25 - 2.32 | 15 |  |
| 2.32 - 2.50 | 15 |  |
| 2.50 - 2.65 | 15 |  |
| 2.65 - 2.70 | 15 |  |
| 2.70 - 2.85 | 12 |  |
| 2.85 - 3.05 | 12 |  |
| 3.05 - 3.30 | 12 |  |
| 3.30 - 3.35 | 9 |  |
| 3.35 - 3.60 | 9 |  |
| 3.60 - 3.90 | 9 |  |
| 3.90 - 4.30 | 9 |  |
| 4.30 - 4.50 | 9 |  |
| 4.50 - 4.65 | 7 |  |
| 4.65 - 5.15 | 7 |  |
| 5.15 - 5.80 | 7 |  |
| 5.80 - 6.00 | 7 |  |
| 6.00 - 6.50 | 6 |  |
| 6.50 - 7.80 | 6 |  |
| 7.80 - 8.00 | 6 | Nc Fixed Capaci-tance |
| 8.00 - 9.00 | 5 |  |

## CHANNEL B

| FREQ RANGE (MC) | COIL TURNS (NOTE 1) | CAP. STRAP. DIAG. (NOTES 2 & 3) |
|---|---|---|
| 2.00 - 2.10 | 18 |  |
| 2.10 - 2.25 | 18 |  |
| 2.25 - 2.32 | 15 |  |
| 2.32 - 2.50 | 15 |  |
| 2.50 - 2.65 | 15 |  |
| 2.65 - 2.70 | 15 |  |
| 2.70 - 2.85 | 12 |  |
| 2.85 - 3.05 | 12 |  |
| 3.05 - 3.30 | 12 |  |
| 3.30 - 3.35 | 9 |  |
| 3.35 - 3.60 | 9 |  |
| 3.60 - 3.90 | 9 |  |
| 3.90 - 4.30 | 9 |  |
| 4.30 - 4.50 | 9 |  |
| 4.50 - 4.65 | 7 |  |
| 4.65 - 5.15 | 7 |  |
| 5.15 - 5.80 | 7 |  |
| 5.80 - 6.00 | 7 |  |
| 6.00 - 6.50 | 6 |  |
| 6.50 - 7.80 | 6 |  |
| 7.80 - 8.00 | 6 | No Fixed Capaci-tance |
| 8.00 - 9.00 | 5 |  |

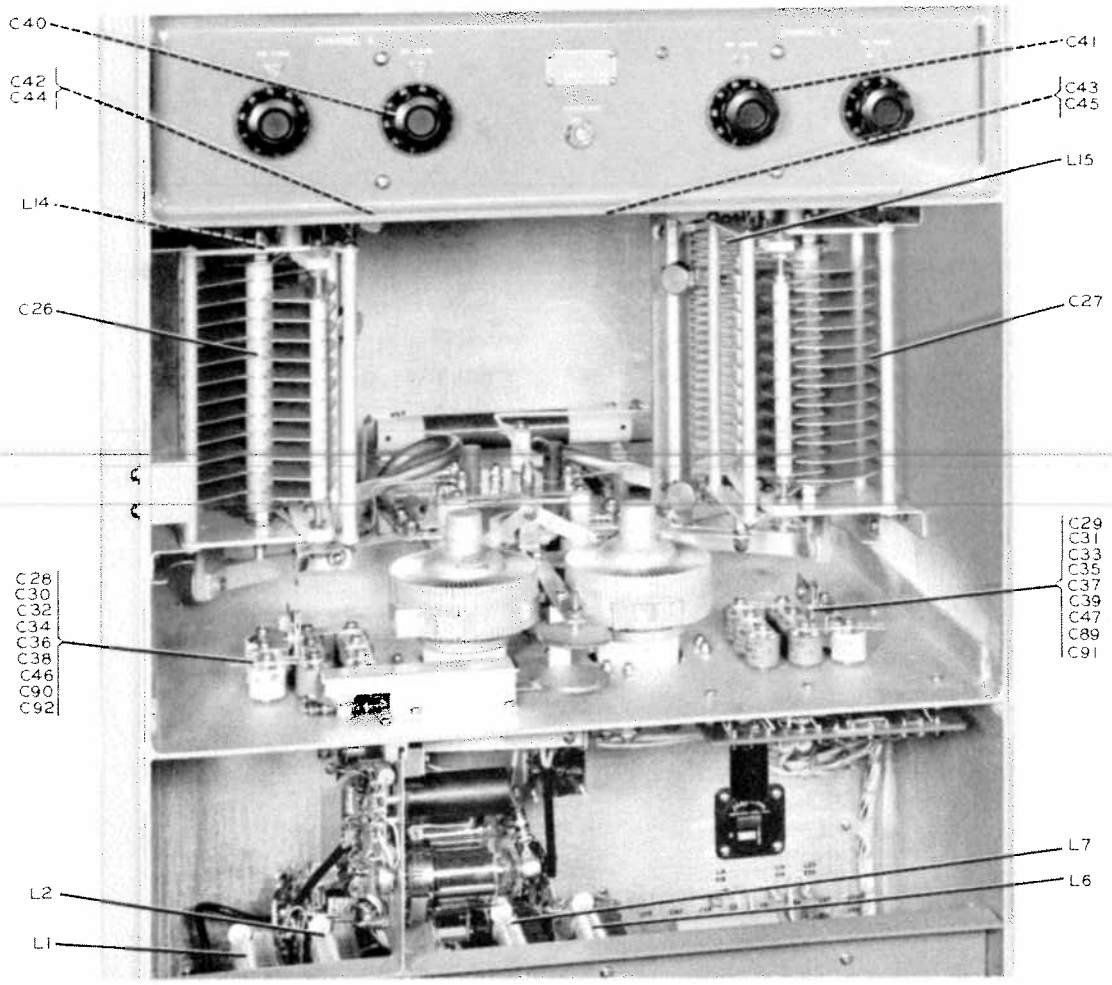
## NOTES:

1. The Coil Turns column gives settings for the lower shorting clip on PA tank coils L14 (channel A) and L15 (channel B). See tuning chart on lower control panel door for coil turns setting above nine megacycles.

2. The Capacitor Strapping Diagram column shows strapping arrangements for the fixed capacitors to be added in parallel with PA TUNE capacitors C26 (channel A) and C27 (channel B). Fixed capacitors are located on the bottom panel of the r-f compartment directly below the associated PA TUNE capacitor.

3. Add fixed capacitance by closing the knife switch located directly below the associated channel PA TUNE capacitor. No fixed capacitance is required for frequencies above nine megacycles.

Figure 3-2. Linear Power Amplifier 204F-1, Tuning Chart




**CHANNEL A OR B**

| FREQUENCY RANGE (MC) | COIL TURNS (SEE NOTE 1) | FIXED CAPACITANCE (uuf) (SEE NOTES 2 AND 3) |
|---|---|---|
| 2.000 - 2.025 | 18 | 800 and 1600 |
| 2.025 - 2.250 | 18 | 1600 |
| 2.250 - 2.330 | 15 | 800 and 1600 |
| 2.330 - 2.700 | 15 | 1600 |
| 2.700 - 2.725 | 12 | 800 and 1600 |
| 2.725 - 3.150 | 12 | 1600 |
| 3.150 - 3.300 | 12 | 800 |
| 3.300 - 3.350 | 9 | 800 and 1600 |
| 3.350 - 4.000 | 9 | 1600 |
| 4.000 - 4.500 | 9 | 800 |
| 4.500 - 4.800 | 7 | 1600 |
| 4.800 - 6.000 | 7 | 800 |
| 6.000 - 7.000 | 6 | 800 |
| 7.000 - 8.000 | 6 | No fixed capacitance |
| 8.000 - 8.200 | 5 | 800 |

**NOTES:**

1. The Coil Turns column gives settings for the lower shorting clip on PA tank coils L14 (channel A) and L15 (channel B). See tuning chart on lower control panel door for coil turns setting above 8.20 megacycles.

2. The Fixed Capacitance column gives values of the fixed capacitors to be added in parallel with PA LOAD capacitors C40 (channel A) and C41 (channel B). Fixed capacitors (two for each channel) are located underneath the top panel of the r-f compartment near the associated channel PA LOAD capacitor.

3. Add fixed capacitance by closing the knife switch associated with the capacitor of corresponding value. Capacitance values are noted on the knife switches. No fixed capacitance is required for frequencies above 8.20 megacycles.

Figure 3-3. Linear Power Amplifier 204F-1, Loading Chart and Location of Tuning and Loading Adjustments

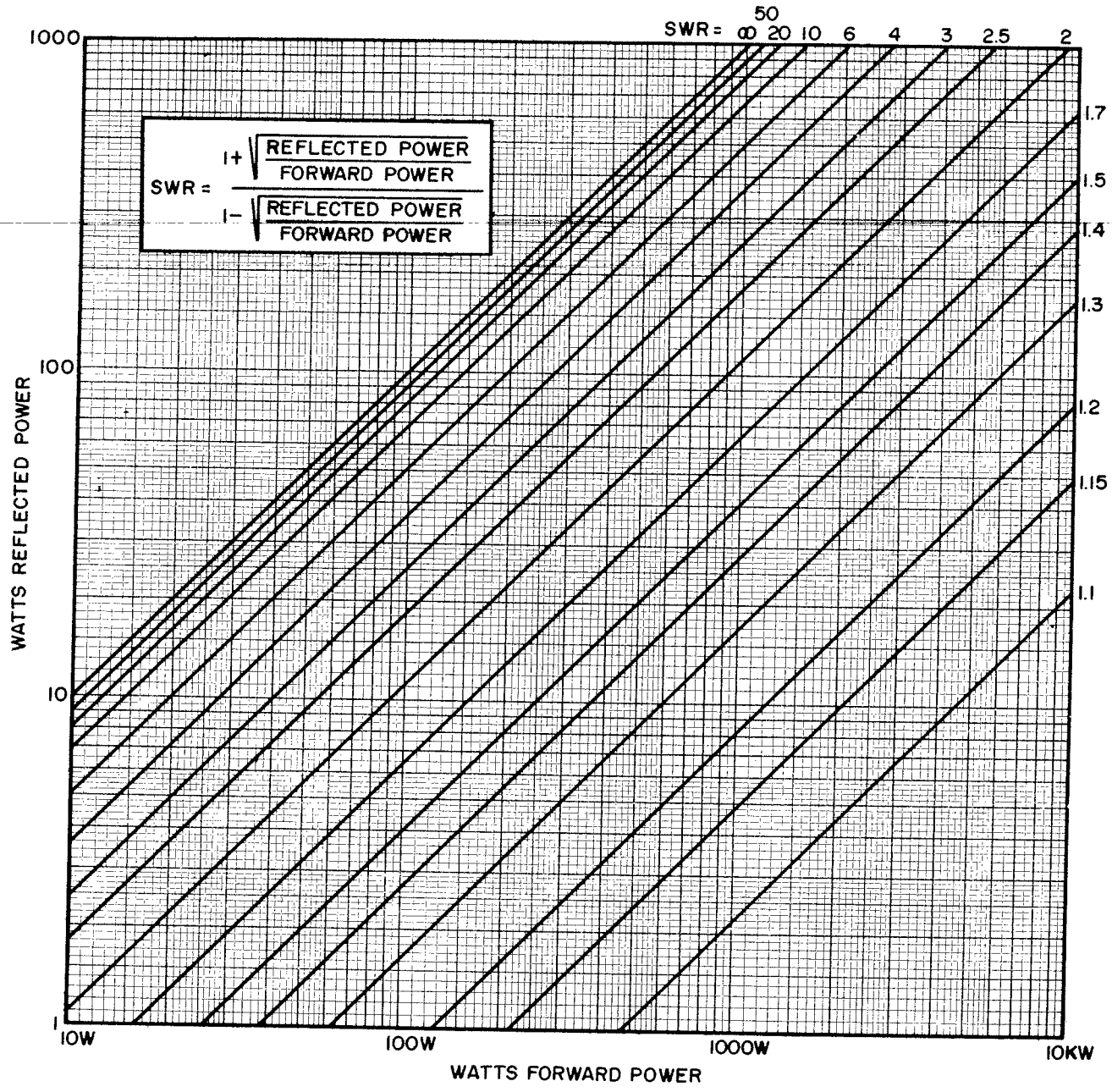



Figure 3-4. Linear Power Amplifier 204F-1, Standing-Wave Ratio Chart

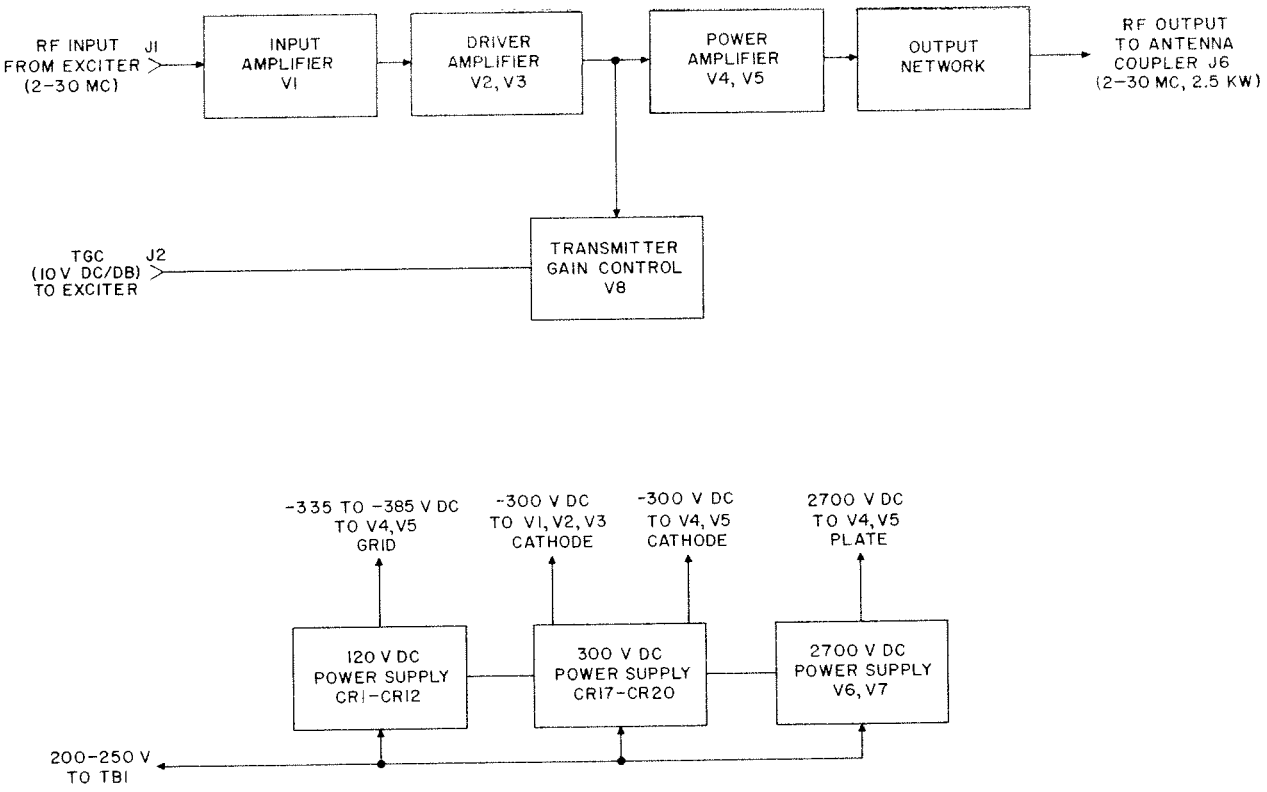



Figure 4-1. Linear Power Amplifier 204F-1, Block Diagram

# SECTION IV
# PRINCIPLES OF OPERATION

## 4.1 INTRODUCTION.

Linear Power Amplifier 204F-1 is a three-stage, linear power amplifier designed to amplify radio-frequency signals of approximately one-tenth-watt amplitude to a level of 2.5 kilowatts. Either of two operating frequencies, which are in the range between 2 and 30 megacycles, can be selected. Channel changing is accomplished by switching with relays between two sets of tuned circuits in each stage. Each channel is capable of being tuned to any frequency within the range of the equipment. All necessary operating voltages are developed within the equipment from an external source of single-phase power. Power control circuits and a variety of protective devices provide a maximum of protection with a minimum of complexity. An integral blower unit is provided to maintain the equipment at the proper operating temperature. Figure 4-1 is a block diagram of the linear power amplifier.

## 4.2 RADIO-FREQUENCY AMPLIFIER CIRCUITS.

### 4.2.1 GENERAL.

The radio-frequency amplifier circuits of the linear power amplifier consist of an input amplifier stage, driver amplifier stage, power amplifier stage, and an output network. An r-f signal that originates in the associated exciter unit is applied to the input amplifier stage at a level of approximately one-tenth watt (0.1 watt nominal and 0.2 watt maximum). This signal is amplified in the input amplifier, driver amplifier, and power amplifier stages and delivered through the output network to the associated antenna at levels of up to 2.5 kilowatts of peak envelope or average power. Swamping networks in the input amplifier and driver amplifier stages are designed to reduce variations in gain, and feedback around all three stages is designed to reduce distortion.

The input signal may be either one of two predetermined frequencies in the range between 2 and 30 megacycles. Relay action, controlled either locally or remotely, is used to select either of two pretuned r-f channels.

All filament, bias, screen, and plate supply voltages that are required for the proper operation of the radio-frequency amplifier stages are developed within the linear power amplifier. Filament transformer T4 supplies the filaments of tubes V1 through V5. Cathode bias is developed in the input amplifier and driver amplifier stages, and fixed bias is supplied to the power amplifier stage. Plate and screen voltages for the input and driver amplifier stages are obtained from a 300-volt power supply. Screen voltage for the power amplifier stage is obtained from this same supply. Plate voltage for the power amplifier stage is obtained by combining the output of the 300-volt and 2700-volt power supplies. The cathode circuits of all three amplifier stages are operated at approximately 300 volts negative with respect to ground. The screen circuit of the power amplifier stage is operated at ground potential. The screen and plate elements of the input amplifier and driver amplifier stages are operated slightly negative with respect to ground but positive with respect to the cathode. The plate circuit of the power amplifier stage is operated at approximately 2700 volts positive with respect to ground.

### 4.2.2 INPUT AMPLIFIER STAGE.

Figure 4-2 is a simplified schematic diagram of the input amplifier stage. This stage, operated as a class A voltage amplifier, consists of a single 6CL6 pentode tube, V1, and associated components. Filament voltage for V1 is supplied by transformer T4. Cathode bias is developed across R2. Plate and screen voltages are obtained from the 300-volt power supply circuit through dropping resistor R4. The supply side of R4 is connected to the positive end of the 300-volt supply. The suppressor grid, control grid, and cathode circuits of V1 are returned to the negative end of the 300-volt supply through dropping resistor R40, which is shorted out when DR TUNE-PA TUNE-OPERATE switch S9 is in the OPERATE position. The potential on the plate of V1 is negative with respect to ground, but positive with respect to the cathode. The plate potential is controlled by the position of S9 and is greater when S9 is in the OPERATE position. A filter, consisting of R7 and L3, keeps r-f energy out of the power supply.

NOTE

If the linear power amplifier is furnished with a dual r-f input circuit, refer to paragraph 4.8.1.

The r-f signal from the associated exciter enters the linear amplifier at r-f connector J1. An untuned input circuit terminates this coaxial cable input line, and connects the incoming signal to the cathode of V1. A second input to V1 is an r-f feedback signal from the power amplifier stage, which is applied to the control grid through C2. The amplified input signal is developed across either one of two tuned circuits in the plate circuit of V1. One tuned circuit,

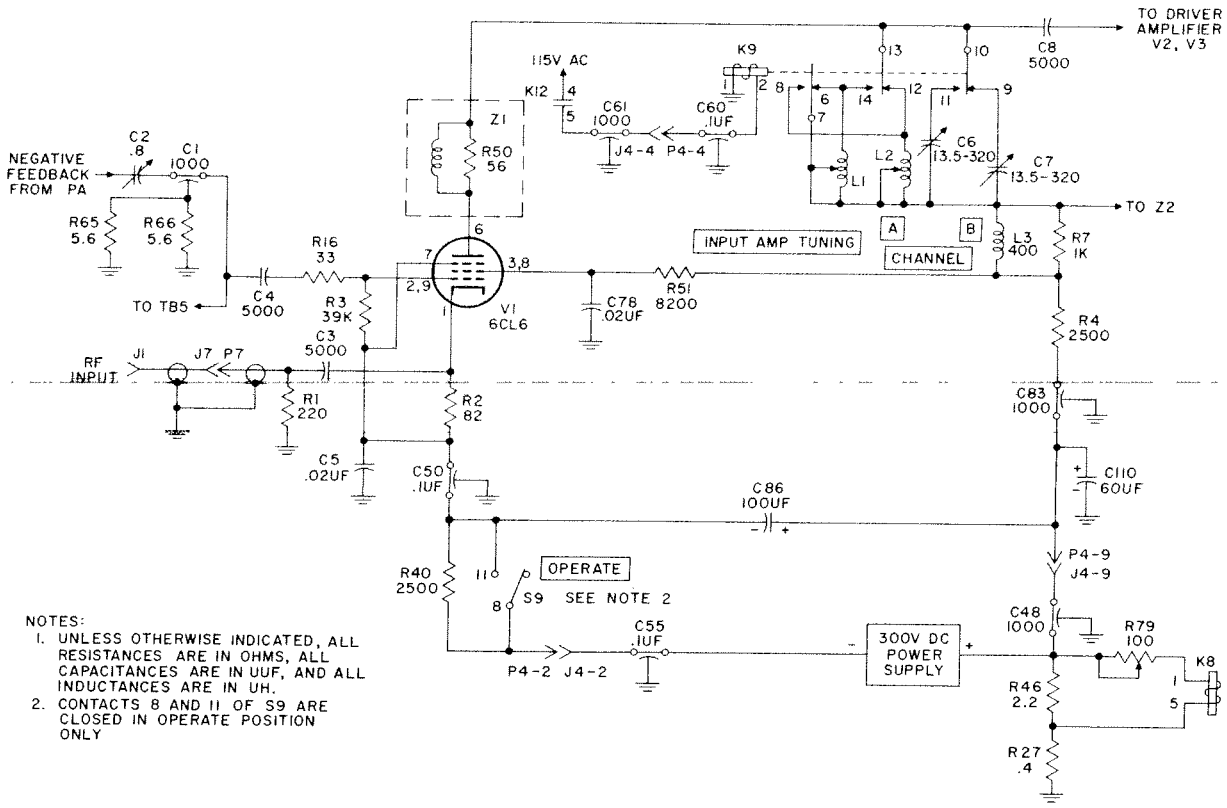



Figure 4-2. Linear Power Amplifier 204F-1, Input Amplifier, Simplified Schematic Diagram

composed of L1 and C6, is connected to the plate circuit when relay K9 is energized and is referred to as the channel A tuned circuit, since K9 is energized when CHANNEL A-CHANNEL B switch is in the CHANNEL A position. The channel B tuned circuit, a combination of L2 and C7, is connected into the plate circuit of V1 when relay K9 is de-energized.

Since L1 and L2 are physically located near each other, there is a chance of energy being coupled from the active coil to the inactive coil by induction. To prevent this loss of r-f energy, L1 is shorted out when L2 is in the circuit and vice-versa. Inductors L1 and L2 are both equipped with a turn shorting device that is manually positioned to short out an appropriate number of turns so the tuned circuit will resonate at the correct operating frequency. The output of the input amplifier stage is coupled through capacitor C8 to the grid circuit of the driver amplifier stage. The series combination of L4 and R8 in the grid circuit of the driver amplifier stage is the swamping network for the input amplifier stage. Parasitic suppressor Z1 is placed in the plate circuit of V1 to suppress oscillations.

### 4.2.3 DRIVER AMPLIFIER STAGE.

Figure 4-3 is a simplified schematic diagram of the driver amplifier stage, which utilizes a pair of 6146 tubes, V2 and V3, connected in parallel. This stage is operated as a class AB1 voltage amplifier. Filament voltage for both tubes is obtained from the same winding of transformer T4. Cathode bias voltage is developed across resistors R9 and R10. The plate circuits of V2 and V3 are connected to the positive end of the 300-volt power supply, which is effectively at ground potential, through r-f chokes L8 and L9, meter shunts R17 and R18 and plate overload control R79. Screen voltage is tapped off a divider network consisting of R11 and R12. This divider is connected between the positive end of the 300-volt power supply and the cathode circuits of V2 and V3. The cathode and grid circuits of V2 and V3 are returned to the negative end of the 300-volt supply through resistor R40, which is shorted out when S9 is in the OPERATE position.

The input to the driver amplifier stage is coupled through C8 and applied to the control grids of V2 and V3 through parasitic suppressors Z3 and Z4. The series combination of L4 and R8 provides a d-c return for the grid elements of V2 and V3, and acts as a swamping network for the input amplifier stage. The input signal, amplified by the parallel combination of V2 and V3, is coupled through parasitic suppressor Z2 to the plate circuit of the driver amplifier stage.

The plate circuit of the driver amplifier stage contains a swamping network and two tuned circuits. The swamping network, consisting of L5, R56 through R61 and C85, has the effect of reducing undesirable variations in gain. The combination of L6 and C14, the channel A tuned circuit, is connected into the plate circuit when relay K10 is energized. The combination of L7 and C15, the channel B tuned circuit, is connected into the plate circuit when K10 is de-energized. Since L6 and L7 are physically located near each other, there is a chance of energy being coupled from the active coil to the inactive coil by induction. To prevent such loss of r-f energy, coil L6 is shorted out when L7 is in the circuit and vice-versa. Inductors L6 and L7 are both equipped with a turn-shorting device, which is manually set so the tuned circuits will resonate at the proper frequency. Capacitor C10 neutralizes the plate-to-grid capacity of the driver amplifier stage. Capacitor C12 couples a small portion of the driver amplifier stage output signal to a metering circuit. The output of the driver amplifier stage is coupled to the power amplifier stage through capacitors C16, C99, C100 and parasitic suppressors Z5 and Z6.

4.2.4 POWER AMPLIFIER STAGE.

Figure 4-4 is a simplified schematic of the power amplifier stage. This stage, operated as a class $AB_1$ power amplifier, uses a pair of 4CX1000A tubes connected in parallel. Filament voltages for V4 and V5 are obtained from transformer T4. The screen elements of V4 and V5 are connected directly to ground. The cathode of V4 is connected through r-f choke L19, meter shunt R36, the contacts of relay K11 and either dropping resistor R69 or the

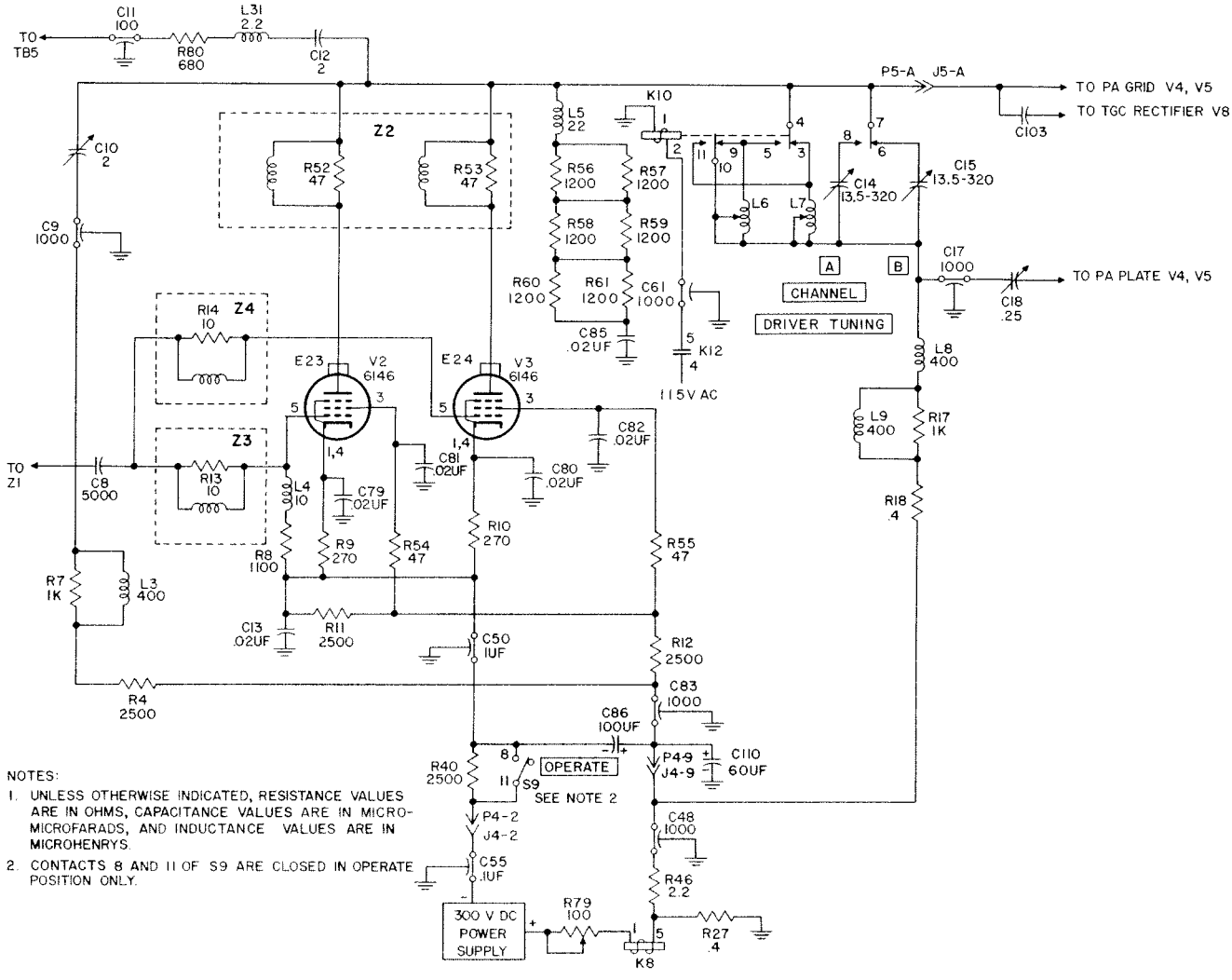



Figure 4-3. Linear Power Amplifier 204F-1, Driver Amplifier, Simplified Schematic Diagram

contacts of relay K7 to the negative end of the 300-volt supply. The cathode of V5 is connected through r-f choke L20, meter shunt R37, the contacts of relay K11, and either dropping resistor R69 or the contacts of relay K7 to the negative end of the 300-volt supply. Plates of both V4 and V5 are connected through r-f choke L12 to the positive end of the 2700-volt supply. The control grid of V4 is connected through r-f chokes L27 and L28 to LEFT PA BIAS adjustment R15. The control grid of V5 is connected to RIGHT PA BIAS adjustment R41 through r-f chokes L10 and L11.

The output of the driver amplifier stage is coupled through dual capacitor C16 to the grids of V4 and V5. The relative amount of signal input to each tube is determined by the setting of C16, which is mechanically driven by the PA GD BAL control. The input signal is amplified by V4 and V5 and delivered to the output network through capacitor C25. Capacitor C18 is provided to neutralize the plate-to-grid capacity of the power amplifier stage. Capacitor C2 couples a portion of the power amplifier stage output signal to the control grid circuit of the input amplifier stage (as an r-f feedback signal) and a portion to an output metering circuit.

4.2.5 OUTPUT NETWORK.

See figure 7-1. The signal output of the power amplifier stage is connected through the contacts of relay K11 to either one of two pi networks. One network is provided for each channel. The purpose of these networks is to match the power amplifier stage to the associated antenna system and to provide harmonic attenuation. The output of the network in use is connected through the contacts of relay K14 to J6. The r-f signal present at J6 is the r-f output of the linear power amplifier.

NOTE

If the linear power amplifier is equipped with the dual r-f output feature, refer to paragraph 4.8.1.

Relay K11 is an assembly of two relays designated K11A and K11B. Either K11A or K11B will be energized at all times that power is applied. Relay K11A will be energized when relay K12 is de-energized and channel A operation is desired. Relay K11B will be energized when channel B operation is desired. When relay K11A is energized, the signal output of the power amplifier stage is connected to the network that contains C26, L14, and C40. Depending on the frequency of operation, C26 may be shunted by two or more capacitors (C92 and C38 in parallel, C28, C30, C36, C90, C46, C34, and C32). Capacitors C92 and C38 in parallel are connected to C26 by the action of a knife blade switch that does not have a reference designation. Capacitors C28, C30, C36, C90, C46, C34, and C32 are connected to the parallel combination of C92 and C38 and to each other by removable links. Two shorting clips are furnished on L14. One is used to select the proper number of turns for the operating frequency. The second shorting clip is used to divide the remaining shorted turns into two circuits. This configuration prevents the shorted turns from acting as a tuned circuit at a harmonic of the output frequency. Such a tuned circuit could absorb part of the r-f output power. To prevent the unused output network from absorbing any r-f power, the contacts of relay K11B, which is de-energized, short out L30 and L15. Capacitors C42 and C44 may be connected in parallel with C40. Either one or both of these capacitors may be placed in parallel with C40 through the action of knife-blade type switches, which have not been assigned a reference designation. The output of the channel A network is coupled through the normally closed contacts of relay K14 to J6.

If the optional directional coupler (see paragraph 4.8.2) is used, its circuits serve a dual purpose. They serve to couple the r-f output to a transmission line that connects to the associated antenna and to produce a current proportional to the amount of r-f power output. The circuits producing this proportional current are brought out to the terminals of TB14. These terminals may be used to connect a meter which, when properly calibrated, can be used as a wattmeter (see paragraph 4.8.3).

When relay K11B and K14 are energized, the channel B network, which is identical to the channel A circuit except for reference designation, is used to couple the output of the power amplifier stage to the associated antenna.

4.2.6 NEUTRALIZING CIRCUITS.

Neutralizing is used in both the driver and power amplifier circuits. The effective capacitance bridge circuit for each neutralizing circuit is shown in figure 4-5. The voltage at one end of the tuned circuit (A) is 180 degrees out of phase with the voltage at the other end (B). When the ratio of $C_{GP}$ to $C_I$ (total input capacity) is equal to the ratio of C10 to C9 for the driver amplifier stage (C18 to C17 for the PA stage), the bridge is balanced, and the plate r-f voltage will not cause current flow between A and B (through the tuned circuit). The neutralization capacitor is adjusted to obtain this ratio. Thus the grid-tuned circuit and the plate-tuned circuit are isolated and act independently of each other. Networks Z2, Z3, and Z4 of the driver amplifier stage and Z5 and Z6 of the power amplifier stage are used to suppress parasitic oscillations.

## 4.3 TRANSMITTER GAIN CONTROL.

Figure 4-6 is a simplified schematic diagram of the transmitter gain control (TGC) circuit. The level of power output from the linear power amplifier is

controlled by limiting the level of signal input. Automatic control of the signal level from the associated exciter unit is accomplished by a biased TGC rectifier circuit. A small portion of the signal present in the plate circuit of the driver amplifier stage is coupled to the cathode of one half of V8, a 5726 dual diode. This cathode is biased positively. The amount of bias is determined by the setting of TGC adjustment R63. When the signal at the input to the linear power amplifier, hence the plate of the driver amplifier stage, exceeds a certain level, V8 conducts on the negative signal peaks. The output of V8 is connected through relay K12 to either J2 or J3 (the contacts of relay K12 connect the output of the TGC circuit to J2 when the relay is de-energized and to J3 when the relay is engergized). Relay K12 is energized when the CHANNEL A-CHANNEL B switch is in the CHANNEL B position. The second half of dual diode V8 is used as a rectifier and is part of the supply that develops a bias voltage for the first half.

NOTE

During the time that the linear power amplifier is being tuned, the input amplifier and driver amplifier stages are operated at reduced plate and screen voltages. The signal level in the plate circuit of the driver amplifier stage will not be great enough to produce an output from the TGC circuit.

## 4.4 POWER SUPPLY CIRCUITS.

4.4.1 GENERAL.

All power to operate the circuits of the linear power amplifier enters the equipment as a single-phase voltage at the terminals of TB1 (see figure 2.2). This voltage may be at any level between 200 and 250 volts a-c, and may have a frequency of either 50 or 60 cps. This voltage is applied both directly and through power control circuitry to the filament, bias, screen, and plate supply circuits of the linear power amplifier. Primary power voltage is applied directly to the primary of transformer T1, which is a combination autotransformer and step-down transformer. The autotransformer feature of T1 is used to ensure that the level of voltage applied to filament transformers T2 and T4, and power transformer T3 is approximately 230 volts regardless of the level of the primary power input voltage. The step-down feature of T1 is used to supply operating voltages to power control, channel switching, TGC bias, and thermal overload circuits. The primary power voltage is also applied through the contacts of relays K1, K4, and K6 (which are all controlled by a power contol circuit), and circuit breaker CB1 to all filament, bias, screen, and plate supply circuits.

4.4.2 POWER CONTROL CIRCUITS.

4.4.2.1 GENERAL. The power control circuits of the linear power amplifier have two primary functions. The first is to provide the proper sequence of application of primary power to the various power supply circuits of the 204F-1. The second is the automatic removal of plate and screen supply voltages in case of an overload. Figure 4-7 is a simplified schematic diagram of the power control circuits.

4.4.2.2 LOCAL OPERATION. The secondary voltage of T1, which is approximately 115 volts a-c, is used as a power control voltage throughout the 204F-1 when LOCAL-REMOTE switch S8 is in the LOCAL position. The power control voltage is connected through S8B, lower door interlock S11C and FILAMENTS-OFF switch S1 to FILAMENTS-ON switch S2. Switch S2 is normally open, but when depressed, connects the power control voltage to the coil of relay K1, energizing the relay. Holding contacts of K1 couple the power control voltage to its coil and to the actuating circuit of time-delay relay K2 when K1 is energized. The other contacts of relay K1 connect the primary power voltage through fuse F3 to blower motor B1, and a voltage of approximately 230 volts a-c from the primary of transformer T1 through fuse F5 to filament transformer T2, through fuse F2 to power transformer T3 and through fuse F4 to filament transformer T4. FILAMENTS indicator DS1 is connected in parallel with the coil of relay K1, and is provided to indicate that the relay is energized when S2 is depressed and remains so when S2 is released. The power control voltage at the load side of FILAMENTS-OFF switch S1 is applied through PLATE-OFF switch S3 to PLATE-ON switch S4. When normally open switch S4 is closed, the power control voltage is applied through the normally closed contacts of relay K8, circuit breaker CB1, and thermal-overload switch S5 to the coil of relay K3. The coil circuit of relay K3 is completed through the normally closed contacts of relay K5. Relay K3 is energized when S4 is depressed, and remains energized when the switch is released due to the action of holding contacts on K3. The holding contacts on relay K3 also couple the power control voltage to the contacts of time-delay relay K2. The combined action of the holding contacts and a second set of contacts on the relay provide the same function as the FILAMENTS-ON switch (apply the power control voltage to the coil of relay K1, indicator DS1, and the actuating circuit of time-delay relay K2) during sequence-start operation. A third set of contacts on relay K3 provide a discharge path for capacitor C73, and are in use when the relay is de-energized. This discharge path for C73 is necessary to allow the equipment to reset itself quickly if the overload recycle unit is used.

Relay K2 is a time-delay relay, and is set to close a pair of contacts approximately three minutes after the power control voltage is applied to its actuating circuit. If the FILAMENTS-ON button is pressed prior to pressing the PLATE-ON button, the power control voltage will be applied to the actuating circuit through the holding contacts on relay K1. If sequence-start operation is desired, the PLATE-ON button may be pressed without first pressing the FILAMENTS-ON button. This will apply the power

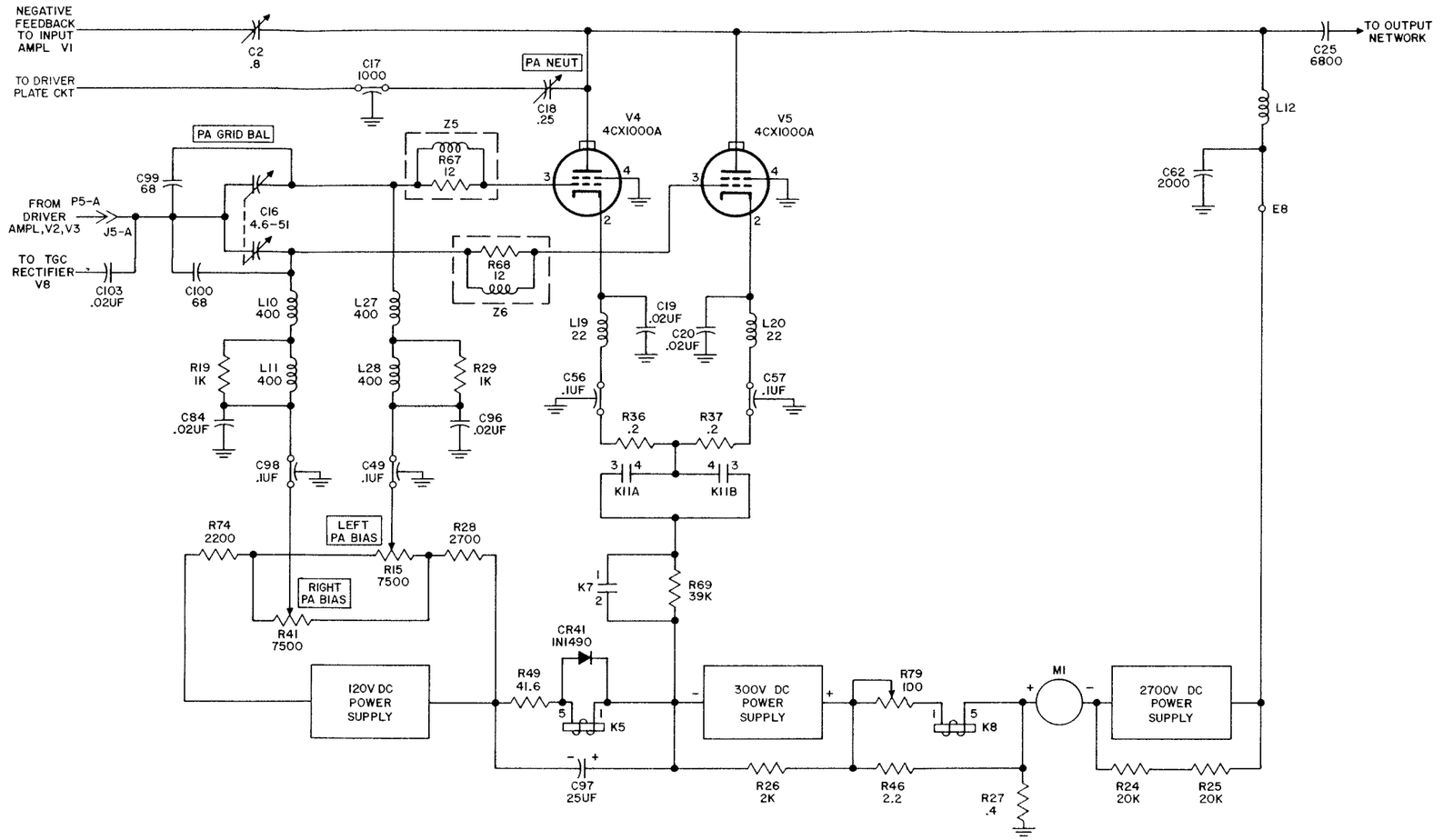
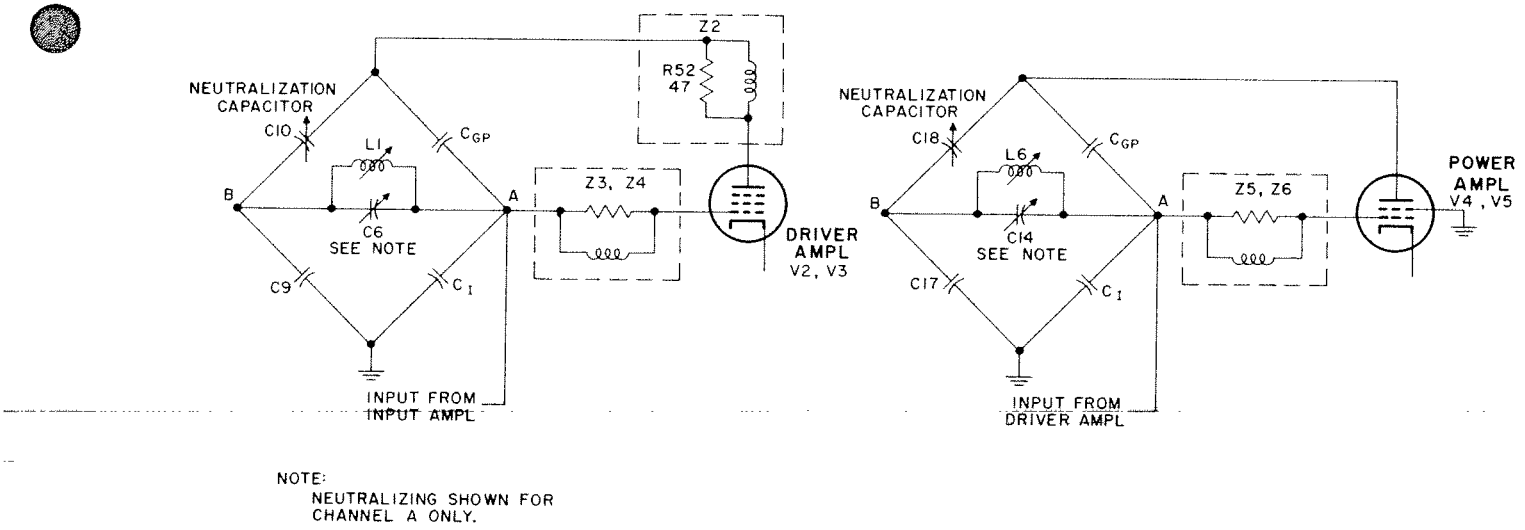



Figure 4-4. Linear Power Amplifier 204F-1, Power Amplifier, Simplified Schematic Diagram




NOTE:
NEUTRALIZING SHOWN FOR
CHANNEL A ONLY.

Figure 4-5. Linear Power Amplifier 204F-1, Equivalent Bridge Neutralizing Circuits, Simplified Schematic

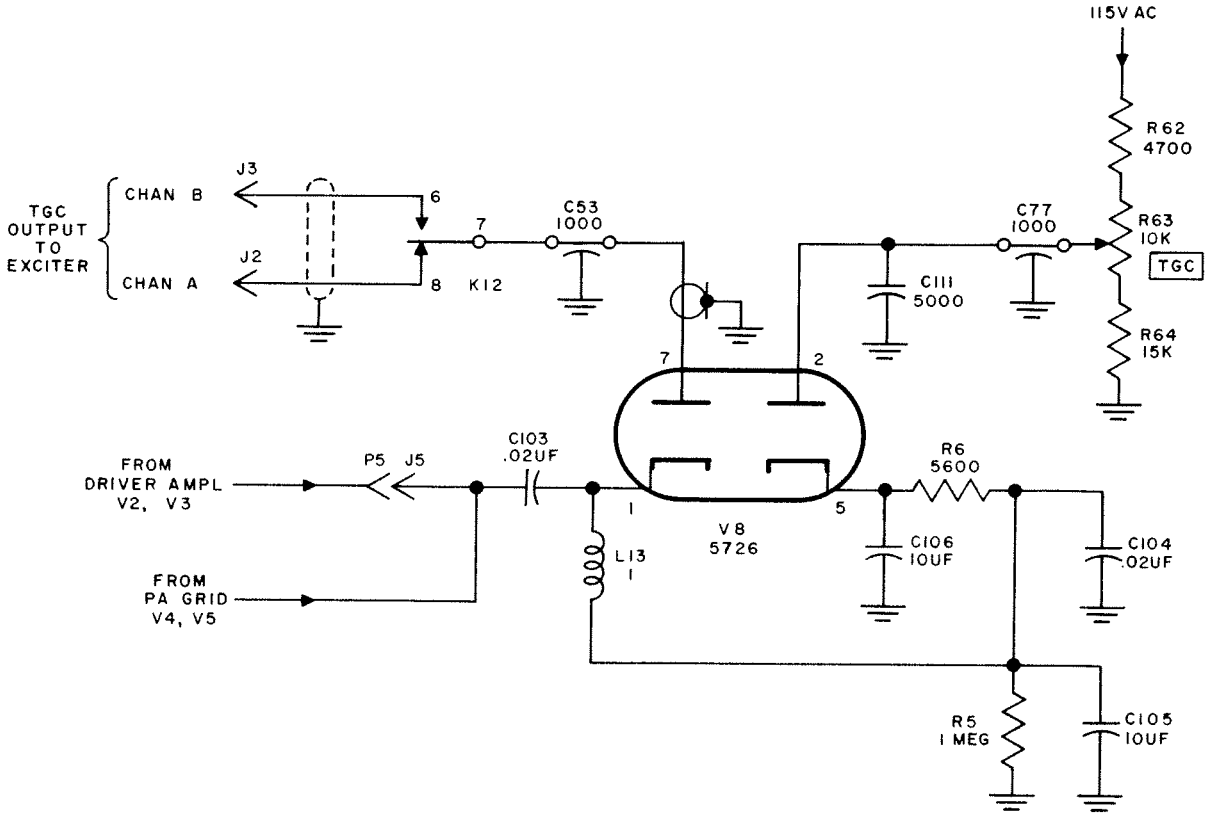



Figure 4-6. Linear Power Amplifier 204F-1, TGC Rectifier, Simplified Schematic Diagram

control voltage to the coil circuit of relay K1, through the contacts of K3, and to the actuating circuit of relay K2 through contacts on relay K1. In either case, the contacts of relay K2 will not close until approximately three minutes after the power control voltage has been applied. This will allow time for the filament circuits, which are energized when relay K1 is energized, to warm up. If the FILAMENTS-ON button is pressed first and more than three minutes elapse before pressing the PLATE-ON button, the power control voltage from the holding contacts of relay K3 will be applied immediately to relay K4, PLATE indicator DS2, and a time-delay circuit in the coil circuit of relay K6 when the PLATE-ON button is pressed. If the PLATE-ON button is depressed in less than three minutes after the FILAMENTS-ON button, the power control voltage will not be applied until the contacts of relay K2 close, which will be approximately three minutes after the FILAMENTS-ON button is pressed.

If relay K3 is energized and the contacts of relay K2 are closed, the power control voltage is applied to the coil of relay K4. PLATE indicator DS2 is connected in parallel with the coil of relay K4 and is provided to indicate that relay K3 is energized and the contacts of relay K2 are closed. In the energized condition, the normally open contacts of relay K4 connect the primary power voltage present at the load side of circuit breaker CB1 to power transformers T5 and T6. The primary power voltage is applied to T5 and T6 through resistor R21, which is connected across the contacts of relay K6. Dropping resistor, R21, prevents the application of full primary power to the transformers. Fuse F6 is connected in the primary of T5, and provides overload protection for the transformer. Overload protection for T6 is provided by circuit breaker CB1.

The power control voltage is applied to the time-delay circuit in the coil circuit of relay K6 at the same time it is applied to the coil of K4. This time-delay circuit assures that relay K6 will not become energized until 0.15 second after relay K4. The power control voltage is rectified by CR16. The pulsed d-c from CR16 is used to charge C73, which is in parallel with the coil of relay K6. Approximately 0.15 second after the power control voltage is applied, the voltage developed across C73 is sufficient to energize relay K6 and does so. When relay K6 is energized, resistor R21 is shorted out and full primary power is applied to transformers T5 and T6. When K3 is de-energized, relays K4 and K6 are de-energized. One set of contacts on relay K3 is provided to discharge capacitor C73 so that the time-delay circuit will control the operation of K6 when K3 is energized.

The power supply circuits of the linear power amplifier may be de-energized by pressing the PLATE-OFF button and then the FILAMENTS-OFF button, or by merely depressing the FILAMENTS OFF button.

NOTE

If the PLATE-OFF button is pressed first and approximately three minutes are allowed to elapse before pressing the FILAMENTS-OFF button, plate and screen voltages will be removed from the r-f amplifier stage, but cooling air will still be provided to reduce the temperature of components. This procedure is not required, but is advisable.

When the FILAMENTS-OFF button is pressed, whether or not the PLATE-OFF button has been pressed, all filament, bias, screen, and plate voltages are removed from the r-f amplifier stages. Primary power is still present in the power supply compartment, and the 204F-1 can be completely de-energized only by placing the external disconnect switch in the off position.

4.4.2.3 REMOTE OPERATION. See figure 2-2 for typical remote circuit connections. The secondary voltage of T1 is brought out to terminal 9 of TB2, and may be used as the power control voltage when the LOCAL-REMOTE switch is placed in the REMOTE position. If it is to be used as the power control voltage, terminal 9 of TB2 will be connected through a normally closed switch in the remote control circuits to terminal 10 of TB2. If this voltage is not used, a voltage that originates in the remote control circuit may be connected through a normally closed switch, also in the remote control circuit, to terminal 10 of TB2. This permits normal local operation even though the LOCAL-REMOTE switch is in the REMOTE position. The power control voltage at terminal 10 of TB2, regardless of source, is connected to a normally open switch in the remote control circuits. When this switch is depressed, the power control voltage is connected to terminal 12 of TB2. From this terminal, the power control voltage is connected through 58C and through the normally closed contacts of relay K8, circuit breaker CB1, and thermal-overload switch S5 to the coil of K3. The power control circuits will respond in the same manner as if the PLATE-ON button were pressed, but the FILAMENTS-ON button were not. (See paragraph 4.4.2.2.)

4.4.3 FILAMENT CIRCUITS.

The filament voltages for all tubes in the linear power amplifier are supplied from two transformers. Transformer T2 supplies approximately five volts a-c to operate the filaments of high-voltage rectifier tubes V6 and V7. Transformer T4 supplies approximately 6.3 volts a-c to input amplifier tube V1 and to driver amplifier tubes V2 and V3, approximately 6.3 volts a-c to power amplifier tubes V4 and V5, and approximately 6.3 volts a-c to TGC tube V8. The exact value of voltage applied to the primaries of T2 and T4, hence the exact value of secondary voltages, is determined by the setting of the tap on transformer T1. A time lapse indicator, M4, is connected in parallel with the primary of T4, and is provided to indicate the time that power has been applied to the filaments of V4 and V5.

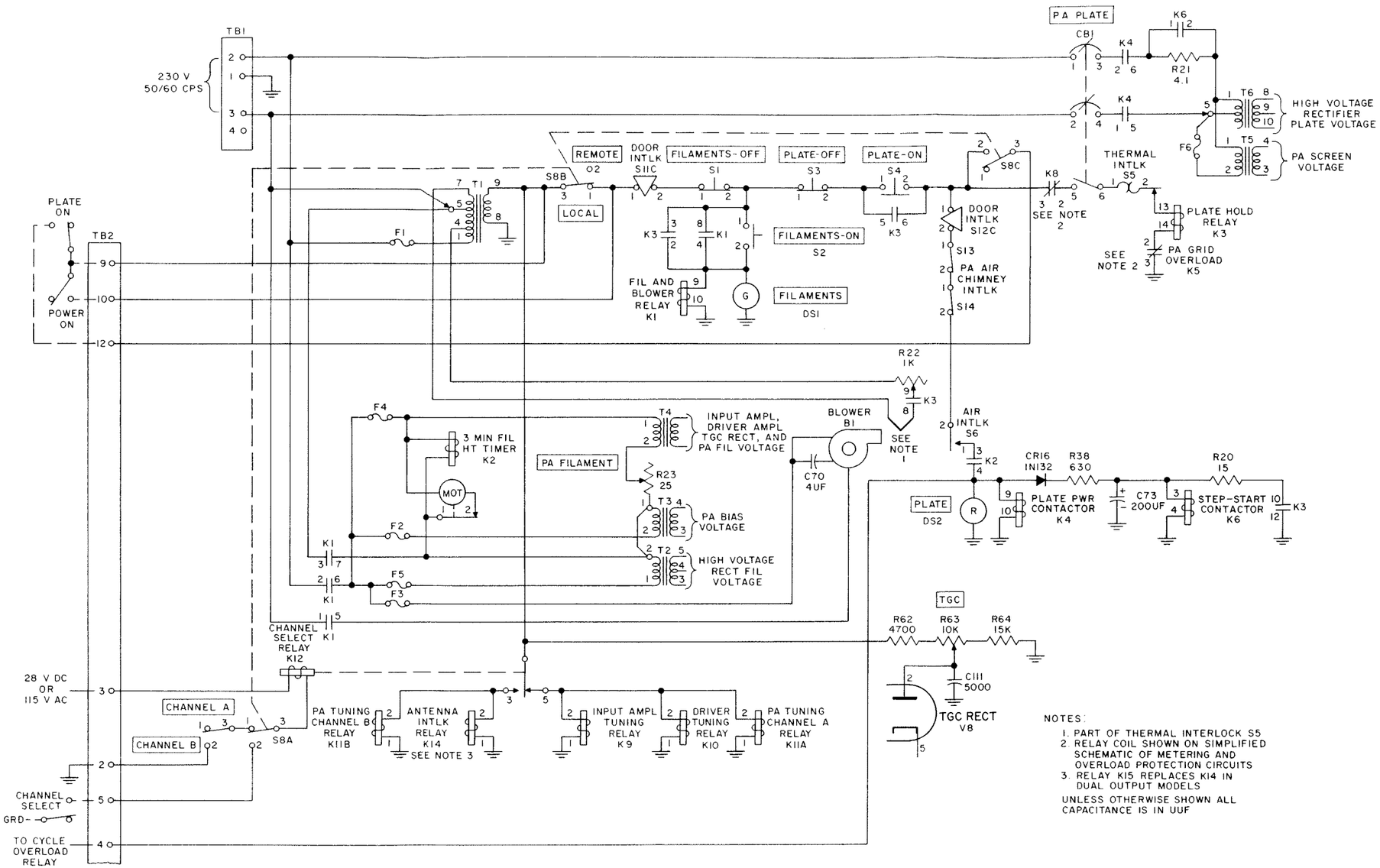



Figure 4-7. Linear Power Amplifier 204F-1, Power Control Circuits, Simplified Schematic Diagram

4.4.4 BIAS, SCREEN, AND PLATE SUPPLY CIRCUITS.

Three d-c power supply circuits are used to develop all the bias, screen, and plate supply voltages required to operate the linear power amplifier. Transformer T6, high-voltage rectifiers V6 and V7, and associated component parts constitute a d-c power supply that develops a voltage of approximately 2700 volts. Transformer T5, silicon power rectifiers CR1 through CR12, and associated components develop a d-c voltage of approximately 300 volts. A d-c voltage of approximately 120 volts is developed in a supply circuit that consists of transformer T3, silicon power rectifiers CR17 through CR20, and associated components. The negative end of the 2700-volt supply is connected to the positive end of the 300-volt supply through meter M1 in series with resistor R46 and the coil of relay K8 in parallel. The negative end of the 300-volt supply is connected through the coil of K5 and meter shunt R49 to the positive end of the 120-volt supply.

The negative end of the 300-volt power supply is connected to the filament and cathode elements of the input amplifier and driver amplifier stages, while the positive end of the supply is connected to the plate and screen elements. The positive end of the 300-volt supply is connected to ground through meter shunt R27, and is effectively at ground potential.

The cathode circuit of the power amplifier stage is returned to the negative terminal of the 300-volt supply, and the screen grid elements of the two power amplifier tubes are grounded. The positive end of the 2700-volt supply is connected to the plate circuit of the power amplifier stage. This combination effectively places a potential of 300 volts between screen and cathode and a potential of 3000 volts between plate and cathode. The negative end of the 300-volt power supply is connected to the cathode circuit of the power amplifier stage through contacts 1 and 2 of keying relay K7. If relay K7 is energized, negative 300 volts will be applied to the cathode elements of the power amplifier stage. If relay K7 is not energized, dropping resistor R69 will be placed in the cathode circuit of the power amplifier stage and will bias the tubes below cutoff.

The bias voltages for V4 and V5 are developed across variable resistors R15 and R41, respectively. The bias voltage appearing at the arm of either resistor has a range of -35 to -85 volts with respect to the negative end of the 300-volt power supply (effectively the cathode of the power amplifier stage).

High-voltage grounding switches S11 and S12 are connected to both the positive end of the 2700-volt supply and to the negative end of the 300-volt power supply. Switch S11, which is the lower door interlock switch, automatically grounds these two points when the lower door is opened. Switch S12, which is the upper door interlock, automatically grounds the same points when the upper door is opened.

## 4.5 CHANNEL SWITCHING CIRCUIT.

Channel switching is accomplished by relay action. Channel A circuits are in use in the energized position of the relays, and channel B circuits are in use when the relays are de-energized.

NOTE

One section of relay K11 is energized in both positions of the channel selector switch. Section K11A is energized in the CHANNEL A position. Section K11B is energized in the CHANNEL B position.

4.5.1 LOCAL OPERATION WITH INTERNAL 120 V A-C.

When the linear power amplifier is connected for local operation only, the LOCAL-REMOTE switch must be in the LOCAL position for the channel switching circuits to function properly. In this mode of operation, terminal 2 of TB2 is grounded, and terminal 3 of TB2 is jumpered to terminal 9 of TB2. This connects the power control voltage from the secondary of transformer T1 to the coil of relay K12, and the coil circuit of relay K12 is completed through the CHANNEL A-CHANNEL B switch. In the CHANNEL A position of this switch, relay K12 is de-energized. The power control voltage is applied through the contacts of relay K12 to the coil circuits of relays K9, K10, and K11A. In the CHANNEL B position of the CHANNEL A-CHANNEL B switch, relay K12 is energized and the power control voltage is applied to the coil circuits of relay K11B and K14. Another set of contacts on relay K12 switch the output of the transmitter gain control circuit.

4.5.2 REMOTE OPERATION.

When the 204F-1 is connected for remote operation, the channel switching circuit may be controlled by either the CHANNEL A-CHANNEL B switch or a similar switch in the remote control circuits. The channel switching circuits function as described in paragraph 4.5.1 when the LOCAL-REMOTE switch is in the LOCAL position. When the LOCAL-REMOTE switch is placed in the REMOTE position, a ground is provided for relay control voltage through terminal 5 of TB2, if channel B operation is desired. This ground, at terminal 5 of TB2, will cause relay K12 to energize.

## 4.6 KEYING CIRCUITS.

4.6.1 GENERAL.

The keying circuit, which is built into the 204F-1 is used to prevent the transmitter from keying unless an antenna is connected to the output of the linear power amplifier. The power amplifier stage of the linear power amplifier is biased above cutoff only

when keying relay K7 is energized. The keying circuit is an additional safety factor, and a d-c ground must be provided through the antenna system before the keying circuit will function. One side of the coil of relay K7 is brought to terminal 11 of terminal board TB2. This connection is referred to as the key line. The other side of the coil of relay K7 is returned to ground through the d-c continuity of the r-f load. The ground side is normally returned through the DR TUNE-PA TUNE-OPERATE switch (when this switch is in the PA TUNE or OPERATE position), resistors R72 and R73 in parallel, capacitor C109, inductor L16, and the associated antenna system.

NOTE

For this ground path of relay K7 to be present, the r-f load must have d-c continuity and a d-c ground must be supplied through the output coaxial cable and r-f load before the linear power amplifier will key on.

If the linear power amplifier is supplied with the dual-input, dual-output option, the ground path will be switched by relay K15 through on alternate path to the antenna system. For dual-input, dual-output option, refer to paragraph 4.8.1.

4.6.2 LOCAL OPERATION.

When the 204F-1 is connected for local operation only, terminal 11 of TB2 is connected to terminal 9 of TB2. Terminal 9 of TB2 is connected to the secondary of transformer T1, thereby connecting the power control voltage to one side of relay K7. If the antenna system is properly connected and a d-c ground path is provided, relay K7 will be energized when the DR TUNE-PA TUNE-OPERATE switch is placed in either the PA TUNE or OPERATE positions. A relay operated from the key line of the associated exciter may be inserted between terminals 9 and 11 of TB2. In this configuration, the relay and the DR TUNE-PA TUNE-OPERATE switch are used together to control the operation of relay K7.

4.6.3 REMOTE OPERATION.

When the linear power amplifier is connected for remote operation, the voltage used to energize relay K7 originates in the remote control unit. This voltage may be connected through the contacts of a relay controlled from the key line of the associated exciter unit. The DR TUNE-PA TUNE-OPERATE switch must be in the PA TUNE or OPERATE position for the remote control voltage or keying relay to be effective.

## 4.7 METERING AND OVERLOAD PROTECTION CIRCUITS.

4.7.1 METERING CIRCUITS.

Figure 4-8 is a simplified schematic diagram of the metering circuits. Panel meters are provided to give a visual indication of driver amplifier stage plate current, power amplifier V4 cathode current, power amplifier V5 cathode current, power amplifier stage grid current, power amplifier loading, power amplifier stage screen current, power amplifier stage filament voltage, and power amplifier stage plate voltage. The panel meter that is labeled PLATE CURRENT is permanently connected into the power amplifier plate circuit, and continuously indicates the amount of current flowing in the power amplifier plate circuit. The meter that is labeled MULTIMETER is connected across a series of suitable shunt resistances and multipliers by an eight-position wafer switch, which is also labeled MULTIMETER. The function of the MULTIMETER in each of the MULTIMETER switch positions is discussed in the following paragraphs.

In the DRIVER PLATE position of the MULTIMETER switch, the MULTIMETER is connected across R18, which is in the plate supply circuit of the driver amplifier stage. The value of the R18 is such that the scale of the MULTIMETER is 0 to 400 milliamperes.

When the LT PA CATH position of the MULTIMETER switch is selected. The MULTIMETER is connected across R36. R36 is electrically located in the cathode circuit of V4, and is of such a value that the scale of the MULTIMETER is 0 to 800 milliamperes.

The scale of the MULTIMETER is 0 to 800 milliamperes, and the MULTIMETER is connected across R37 when the MULTIMETER switch is placed in the RT PA CATH position. R37 is in the cathode circuit of V5.

The MULTIMETER is connected across R49 in the PA GRID position of the MULTIMETER switch. The combined grid current from V4 and V5 flows through this resistor. The meter scale is 0 to 4 milliamperes when connected across this resistor.

The output of an r-f voltmeter circuit is connected to the MULTIMETER when the MULTIMETER switch is placed in the PA LOAD position. The voltmeter circuit is composed of C87, C88, CR14A, CR14B, L25, and L26, and R42. In the DR TUNE position of the DR TUNE-PA TUNE-OPERATE switch, the voltage at the arm of R42 is proportional to the level of r-f signal developed across the tuned circuit in the driver amplifier stage. In the PA TUNE and OPERATE positions of the DR TUNE-PA TUNE-OPERATE switch, the voltage at the arm of R42 is proportional to the difference of the level of r-f signals developed across the tuned circuits in the driver amplifier stage and in the output network. The voltage applied to the MULTIMETER is applied through R39 if the DR TUNE-PA TUNE-OPERATE switch is in the DR TUNE position. This resistor limits the applied voltage to a value that will not overdrive the meter movement. This position of the MULTIMETER switch is used in the tuning of the

r-f amplifier stages. The tuned circuits of the input and driver amplifier stages are tuned for a maximum indication when the DR TUNE-PA TUNE-OPERATE switch is in the DR TUNE position. The output network is tuned for a minimum indication when the DR TUNE-PA TUNE-OPERATE switch is in the PA TUNE position.

Placing the MULTIMETER switch in the PA SCREEN position connects the MULTIMETER across R27, which is in the screen supply circuit to the power amplifier stage. The scale of the MULTIMETER in the PA SCREEN position of the MULTIMETER switch is 0 to 400 milliamperes.

The same filament voltage that is applied to V5 is applied to the MULTIMETER through a voltage divider and rectifier circuit when the MULTIMETER switch is placed in the PA FIL VOLTS position. The actual voltage applied to the meter is determined by the setting of R45, which is used as a calibration adjustment, and is proportional to the applied filament voltage. The meter scale is 0 to 8 volts when properly calibrated.

The MULTIMETER is connected across R35 when the MULTIMETER switch is placed in the PA PLATE VOLTS position. R35 is one of a series of resistors (R30 through R35) that is connected between the positive end of the 2700-volt power supply and the negative end of the 300-volt power supply. The voltage applied to the meter is proportional to the 3000 volts developed between these two points. The meter scale in this position of the MULTIMETER switch is 0 to 4 kilovolts.

4.7.2 OVERLOAD PROTECTION CIRCUITS.

4.7.2.1 THERMAL OVERLOAD CIRCUIT. When relay K3 is energized (see paragraph 4.4.2.2), one set of contacts on the relay connects a voltage of approximately 25 volts a-c through OVERLOAD adjustment R22 to the heating element of thermal-overload switch S5. Cooling air from blower B1 passes over this heating element preventing the heat generated from affecting the switching element. If the blower should cease to operate, or if the temperature of the cooling air should rise above a certain level, the heat generated by the heating element will cause the switching element to operate. This will open the coil circuit of relay K3 and de-energize the relay. When relay K3 is de-energized, the power control voltage is removed from relays K4 and K6. This in turn removes primary power from the primaries of transformers T5 and T6, removing screen and plate supply voltages from the r-f amplifier stages.

4.7.2.2 GRID OVERLOAD CIRCUIT. If, for any reason, an excessive amount of grid current flows in the power amplifier stage, relay K5 will become energized. When relay K5 is energized, relay K3 is de-energized causing the removal of screen and plate voltages from the r-f amplifier stages (see paragraph 4.7.2.1).

4.7.2.3 PLATE OVERLOAD CIRCUIT. Relay K8 is energized when, for any reason, an excessive amount of plate current flows in the power amplifier stage. When relay K8 is energized, relay K3 is de-energized, removing screen and plate supply voltages from all of the r-f amplifier stages (see paragraph 4.7.2.1).

4.7.2.4 RECYCLE OVERLOAD. (See paragraph 4.8.4.)

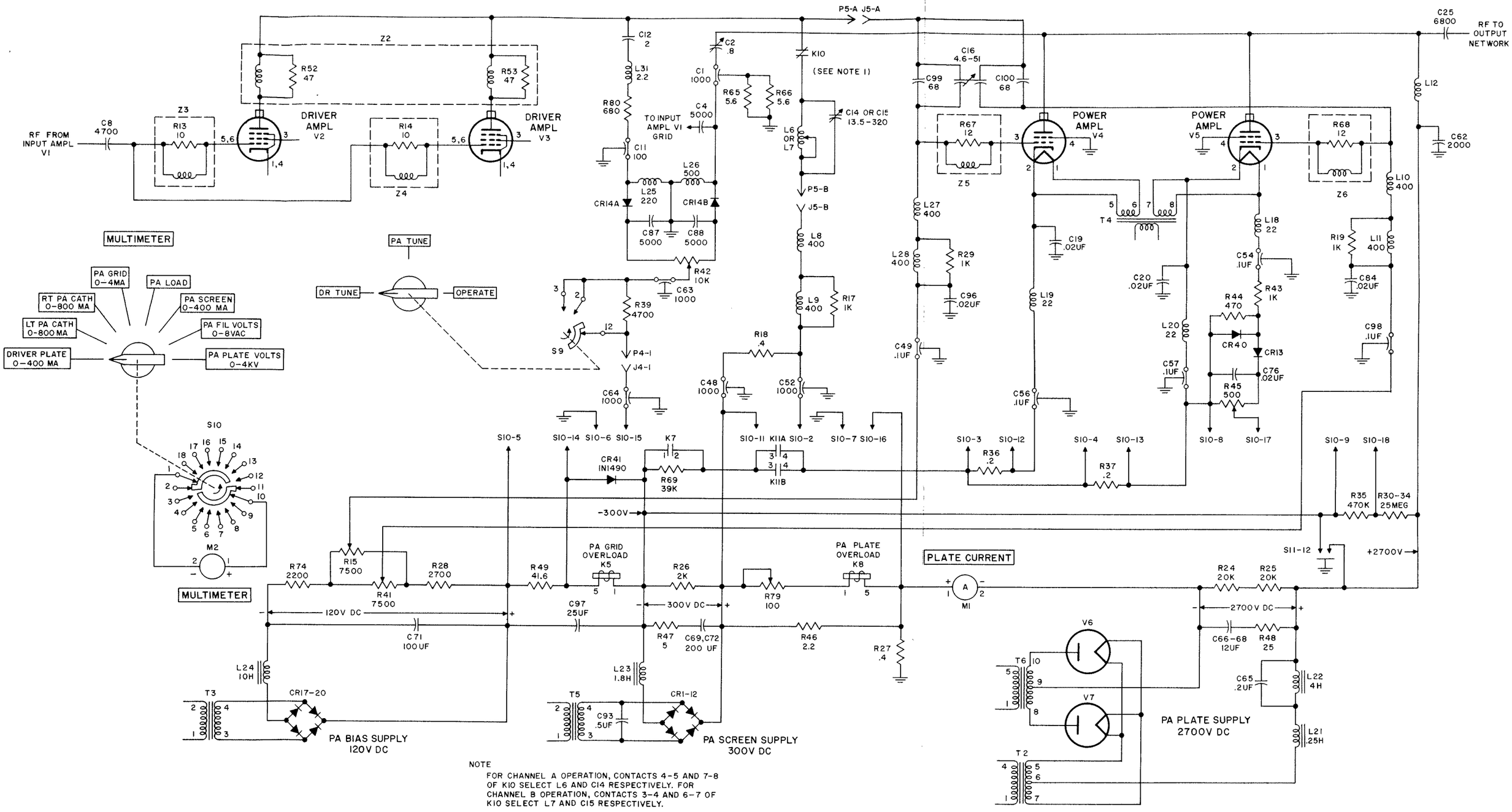
## 4.8 OPTIONAL FEATURES.

A number of optional features may be installed on the 204F-1 linear power amplifier. Several of the options are discussed in the following paragraphs. Status numbers indicate the amount of optional equipment installed on the 204F-1. The status number of the single input-output power amplifier without optional features is 522-1130-00.

4.8.1 DUAL INPUT AND OUTPUT.

The dual r-f input and dual r-f output appears in status numbers 522-1130-011, 522-1130-013, and 522-1130-014. This feature allows the 204F-1 to be used in two separate systems. The dual-input channel feature is connected to J1 of the 204F-1. (See figure 2-3.) The channel A r-f signal is fed into J9, and the channel B r-f signal is fed into J10. Channel selection of the input is controlled by relay K13. Contact 1 of K13 is grounded, and contact 2 of the coil is connected to pin 14 of terminal board TB2, which supplies the voltage to energize the relay.

Two directional couplers can be used in dual r-f output status options. The directional coupler is covered in paragraph 4.8.2. Only one input channel and one output channel can be in use at any given time. The channel in use is selected by relay K11A or relay K11B, just as in the single-output status. Relay K15 has been added in the dual-output status as a safety measure. This relay makes it impossible to key the linear power amplifier on when the channel selector switch is in the CHANNEL A position unless there is a proper r-f load connected and a d-c ground is provided through directional coupler DC1. It is not possible for the keying path to be completed through DC2 when operating in CHANNEL A. When operating in CHANNEL B, a proper r-f load must be connected and a d-c ground must be provided through directional coupler DC2. It is not possible for the keying path to be completed through DC1 when operating in CHANNEL B position. Relay K15 is normally de-energized when the channel selector switch is in the CHANNEL A position. This condition provides a keying path through L16, C109, the contacts of K15, through the parallel combination of R72 and R73, C107 to pins 5 and 4 of the DR TUNE-PA TUNE-OPERATE switch, but breaks the circuit to directional coupler DC2. Relay K15 is energized when the channel selector switch is in the CHANNEL B position. This condition provides a keying path through L17, C108, the parallel combination of R70 and R71, C107 to pins 4 and 5 of the DR TUNE-PA TUNE-OPERATE switch, but breaks the circuit to directional coupler DC1. The r-f




NOTE

FOR CHANNEL A OPERATION, CONTACTS 4-5 AND 7-8 OF K10 SELECT L6 AND C14 RESPECTIVELY. FOR CHANNEL B OPERATION, CONTACTS 3-4 AND 6-7 OF K10 SELECT L7 AND C15 RESPECTIVELY.

Figure 4-8. Linear Power Amplifier 204F-1, Metering and Overload Protection Circuits, Simplified Schematic

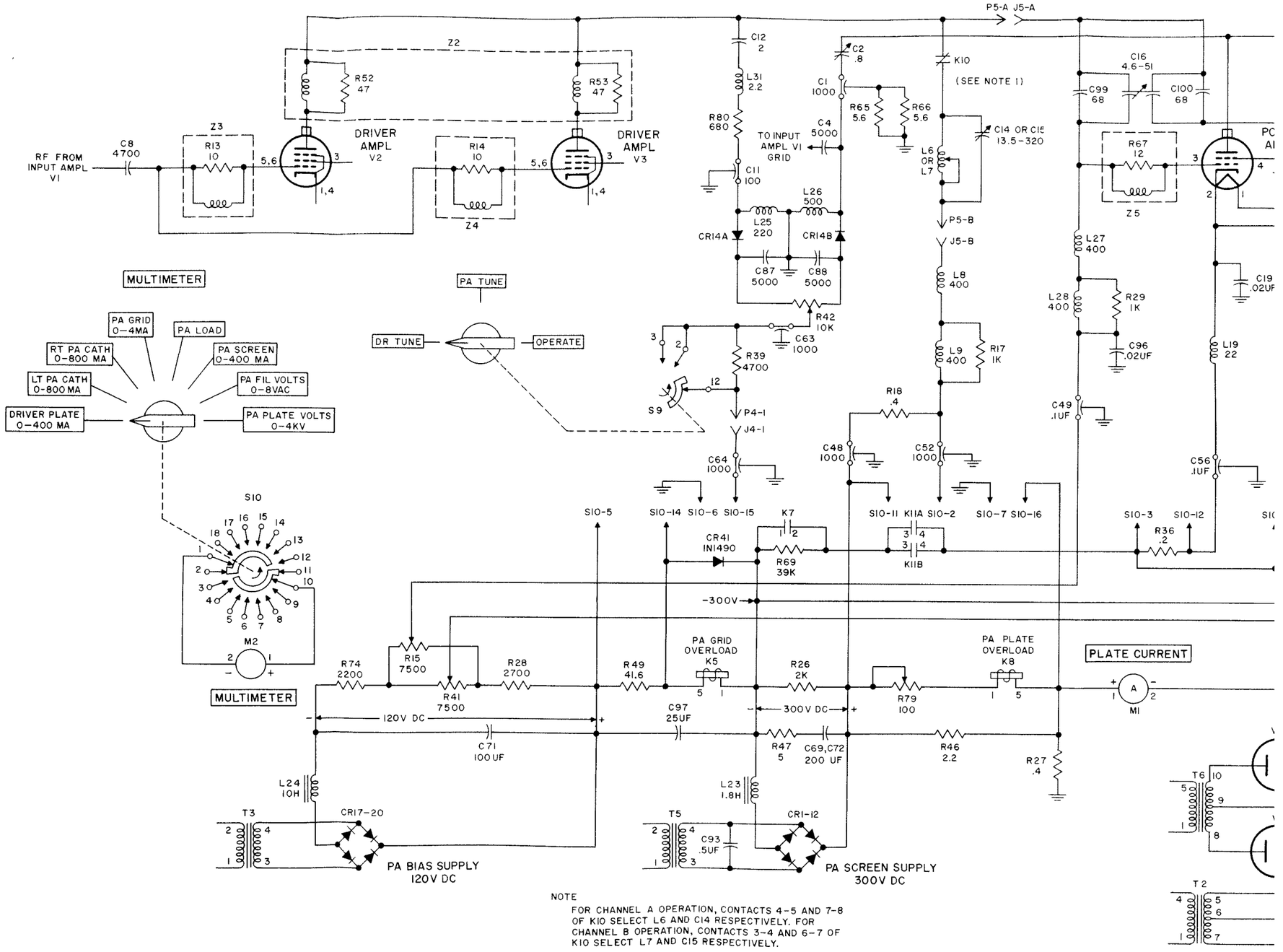

P5-A J5-A
Z2
R52 47
R53 47
Z3
R13 10
R14 10
Z4
RF FROM INPUT AMPL V1
C8 4700
DRIVER AMPL V2
DRIVER AMPL V3
5,6
3
1,4
C12 2
L31 2.2
R80 680
C11 100
C1 1000
C2 .8
C4 5000
TO INPUT AMPL V1 GRID
R65 5.6
R66 5.6
K10
(SEE NOTE 1)
C14 OR C15 13.5-320
L6 OR L7
L26 500
L25 220
CR14A
CR14B
C87 5000
C88 5000
R42 10K
C63 1000
P5-B
J5-B
L8 400
L9 400
R17 1K
C16 4.6-51
C99 68
C100 68
R67 12
Z5
L27 400
L28 400
R29 1K
C96 .02UF
C19 .02UF
L19 22
C49 .1UF
C56 .1UF
MULTIMETER
PA GRID 0-4MA
PA LOAD
RT PA CATH 0-800 MA
PA SCREEN 0-400 MA
LT PA CATH 0-800MA
PA FIL VOLTS 0-8VAC
DRIVER PLATE 0-400 MA
PA PLATE VOLTS 0-4KV
PA TUNE
DR TUNE
OPERATE
R39 4700
S9
P4-1
J4-1
C64 1000
R18 .4
C48 1000
C52 1000
S10
M2
MULTIMETER
S10-5
S10-14 S10-6 S10-15
K7
CR41 IN1490
R69 39K
S10-11 K11A S10-2
K11B
S10-7 S10-16
S10-3 S10-12
R36 .2
-300V
R74 2200
R15 7500
R41 7500
R28 2700
R49 41.6
PA GRID OVERLOAD K5
R26 2K
PA PLATE OVERLOAD K8
PLATE CURRENT
M1
R79 100
120V DC
300V DC
C97 25UF
C71 100UF
R47 5
C69,C72 200 UF
R46 2.2
R27 .4
L24 10H
L23 1.8H
T3
T5
CR17-20
CR1-12
C93 .5UF
PA BIAS SUPPLY 120V DC
PA SCREEN SUPPLY 300V DC
T6
T2
NOTE
FOR CHANNEL A OPERATION, CONTACTS 4-5 AND 7-8 OF K10 SELECT L6 AND C14 RESPECTIVELY. FOR CHANNEL B OPERATION, CONTACTS 3-4 AND 6-7 OF K10 SELECT L7 AND C15 RESPECTIVELY.

Figure 4-8. I
F

output of channel A is fed to J6 and the r-f output of channel B is fed to J8. Input jack J9 and J10 are physically located on relay K13.

4.8.2 DIRECTIONAL COUPLER.

One or more directional couplers are employed on all equipment with status numbers 522-1130-011, 522-1130-013, 522-1130-014, and 522-1130-015.

Figure 7-2 is a schematic diagram of the optional directional coupler. The r-f output from the power amplifier plate tank circuit is fed to connector J1. The r-f current flows through a transmission line center conductor to output connector J2. The transmission line conductor passes through the center of a toroidal coil and forms the primary of toroidal transformer T1. Induced toroid current produces a voltage that divides equally across resistors R1 and R2. Since the junction of R1 and R2 is grounded, the voltages across R1 and R2 are opposite in phase and proportional to the transmission line current. The transmission line voltage is applied across two capacity dividers, C1-C3 and C2-C4, resulting in two equal voltages of the same phase across C3 and C4. When the transmission line is mismatched (terminated in an impedance other than 50 ohms), the voltages across R1 and R2 represent the vector sum of two components, one proportional to the current of the forward wave and the other proportional to the current of the reflected wave. Similarly, the voltages across C3 and C4 represent the vector sum of forward and reflected wave voltage components. Capacitors C1 and C2 are adjusted so the magnitude of the forward voltage and current components are equal. Then magnitude of the reflected components are also equal.

The phase relationships between the various components are such that the r-f voltage across rectifier CR1 is equal to the arithmetic sum of the two equal forward components, and the r-f voltage across rectifier CR2 is equal to the arithmetic sum of the two equal forward components, and the r-f voltage across rectifier CR2 is equal to the arithmetic sum of the two equal reflected components. The r-f voltages are rectified and filtered by CR1, CR2, C3 and C4 to produce forward and reflected currents that can be applied to a wattmeter. Calibrating resistors R3 and R4 are selected so forward and reflected currents through the meter give accurate indications of the power level. Capacitors C7 and C8 compensate for the residual series inductance of resistors R1 and R2.

One directional coupler, DC1, can be employed with the single input-output power amplifier or two directional couplers, DC1 and DC2, can be used with the optional dual input-output feature.

4.8.3 WATTMETER INSTALLED IN DOOR.

A 100-microammeter wattmeter is installed in the upper door in equipments with status number 522-1130-014 and 522-1130-105. The r-f output voltages are rectified and filtered in the directional couplers to produce forward and reflected currents that can be applied to the wattmeter. Calibrating resistors in the directional couplers are selected so forward and reflected currents through the meter give accurate indications of the power level of the 204F-1. This feature makes it possible to measure forward and reflected output power with no external test equipment. The currents are coupled out of the directional couplers to TB16 and the wattmeter is connected to the other side of TB16. External meters can be connected to TB16 and in series with the wattmeter in the door to allow monitoring and tuning of the equipment from a remote location. A four-position wafer switch on the meter allows the operator to monitor channel A forward and reverse power and channel B forward and reverse power. Figure 7-3 is a schematic diagram of the wattmeter installed in the door.

4.8.4 RECYCLE OVERLOAD UNIT.

A one-shot recycle overload unit, which is an optional feature on the 204F-1 with status numbers 522-1130-012 and 522-1130-013, may be connected to the power control circuits. Refer to figure 7-4 for a simplified schematic of this unit and a typical method of connecting it to the 204F-1. A d-c voltage of approximately 28 volts positive with respect to ground is applied directly to terminal 4, and through toggle switches to terminals 2 and 3, of TB1 of the recycle unit. When the toggle switches are placed in the closed position, the d-c voltage is applied to the coil circuit of relays K1 and K2 of the recycle unit. When K2 is energized, the power control voltage from the secondary of T1 is connected to terminal 10 of TB2. When K1 is energized, the power control voltage from the secondary of T1 is connected to terminal 12 of TB2. Sequence-start operation will take place as outlined in paragraph 4.4.2.2. After approximately three minutes, the power control voltage will appear at terminal 4 of TB2, which is connected to the actuating circuit of timer B1 in the recycle unit. This timer is set to operate a set of contacts approximately five seconds after the power control voltage is applied. The contacts are located in series with the coil circuit of relay K1 in the recycle unit. Therefore, a little over three minutes after relay K1 is energized by operating a toggle switch in the remote control circuits, K1 is automatically de-energized. Terminals 1 and 2 of TB14 are jumpered by the contacts of relay K4 in the 204F-1 at approximately the same time as relay K1 in the recycle unit is de-energized, connecting the d-c voltage to the coil circuit of a relay in the remote control circuits. In the energized position of relay K1, the d-c voltage is applied to an indicator lamp, which is used to indicate that the power circuits of the 204F-1 are energized. In the de-energized position, the d-c voltage is applied to an alarm circuit. A toggle switch is connected in the alarm circuit to prevent sounding an alarm during the first three minutes of operation. This switch is closed after the indicator lamp becomes lighted.

When relay K3 is de-energized for any reason (overload or accidental depression of the PLATE-OFF or FILAMENTS-OFF switch), the remote control

alarm circuit is energized and the recycle unit attempts to re-energize the power supply circuits of the 204F-1. The remote control alarm circuit is energized when relay K4 is de-energized, which occurs whenever relay K3 is de-energized. The power control voltage is no longer present at terminal 4 of TB2 when relay K3 is de-energized. The contacts of timer B1 close when the power control voltage is removed. When the contacts of the timer close, relay K1 in the recycle unit is energized. This connects the power control voltage to terminal 12 of TB2, hence to the coil of relay K3. Depending on whether the filament, bias, plate, and screen supplies, or just the plate and screen supplies have been de-energized, the power control voltage will be restored to the actuating circuit of timer B1 in three minutes or immediately. Relay K1 in the recycle unit will, therefore, be de-energized in either a little over three minutes or in approximately five seconds.

# SECTION V
# MAINTENANCE

## 5.1 PREVENTIVE MAINTENANCE.

5.1.1 PERIODIC INSPECTIONS. Table 5-1 is an inspection schedule for Linear Power Amplifier 204F-1.

TABLE 5-1
INSPECTION SCHEDULE

| INSPECTION | INTERVAL |
|---|---|
| 1. Check power amplifier static and dynamic plate current balance as described in paragraph 2.3.3.d. | Daily |
| 2. Inspect air filter in lower cabinet door. (See figure 6-1.) If filter is dirty, remove and clean as described in paragraph 5.1.3. | Weekly |
| 3. Use forced dry air to eliminate dust collection inside cabinet. Special attention should be paid to the heat-radiating fins on the PA tubes and the PA tuning coil. | 6 months |
| 4. Check input amplifier V1, driver amplifiers V2 and V3, and TGC rectifier V8 on the tube tester. | 6 months |
| 5. Inspect exposed contacts of all contactors and relays for excessive burning and pitting. If maintenance is required, refer to paragraph 5.1.4. | 6 months |
| 6. Check power amplifier filament voltage calibration as described in paragraph 5.2.1.1. | 6 months |
| 7. Check thermal overload circuit as described in paragraph 5.2.2. | 6 months |

5.1.2 LUBRICATION. No special lubrication procedures are necessary for maintenance of the 204F-1. Lubriplate grease may be applied to door latch blocks and meter panel hinges every six months.

5.1.3 AIR FILTER CLEANING.

a. Remove filter MP5 (see figure 6-1) from the lower cabinet door. Wash by passing a fine spray of hot water through the filter in the direction opposite that of the air-flow arrows.

**CAUTION**

Do not direct a high velocity stream of water against the filter. Do not disturb the normal distribution of the shredded material in the filter.

b. Dip the filter in a water-soluble oil. Let it lie face down until oil ceases to drip from the filter.

c. Replace the filter with the air-flow arrows pointing in the direction of air flow.

5.1.4 RELAY MAINTENANCE. Relay failure usually is caused by dirty or irregular contact surfaces, dust or dirt which collects on the contacts will cause high contact resistance, sticking, and sluggish operation. Pits or metal spikes, caused by arcing or overloading, will cause high contact resistance and may cause locked or bridged contacts. Burnish irregular contact surfaces, being careful not to remove excessive contact metal. The contacts should be in the closed position, i.e., break contacts should be burnished while exerting their normal pressure, and make contacts should be burnished while the armature is hand operated. Clean contacts that are dirty and always clean after burnishing.

**CAUTION**

Relays K9 and K10, located on the grid chassis, have gold-plated contacts. Extreme care should be exercised in burnishing these contacts to prevent cutting through the thin gold plate. Use only proper burnishing tool. Do not attempt to file contacts.

## 5.2 CORRECTIVE MAINTENANCE.

5.2.1 MULTIMETER CALIBRATION.

5.2.1.1 PA FIL VOLTS POSITION.

a. Place external disconnect switch in off position and open upper cabinet door.

b. Open lower cabinet door and cheat lower door interlock switch. Remove the right access hole cover plate located on the shelf separating the grid compartment from the power supply compartment.

c. Connect an a-c voltmeter (see table 1-2) to transformer T4 by the following method.

(1) Place the meter outside the cabinet and set for operation on the 0- to 15-volt scale.

(2) Run the meter leads in through the power supply compartment, up through the access hole, and connect them to terminals 7 and 8 of transformer T4.

d. Place the MULTIMETER switch in the PA FIL VOLTS position. Place the DR TUNE-PA TUNE-OPERATE switch in the DR TUNE position. Close the upper cabinet door.

e. Place the external disconnect switch in the on position, and press the FILAMENTS-ON button.

f. Adjust PA FILAMENT control until the meter connected to transformer T4 indicates exactly six volts. Observe that MULTIMETER indicates exactly six volts. If MULTIMETER does not indicate correctly, adjust R45, which is located on a mounting panel in the upper left corner of the power supply compartment, until MULTIMETER indicates exactly six volts.

g. Press FILAMENTS-OFF button, and place external disconnect switch in off position. Open upper cabinet door and remove meter. Replace access hole cover and enable lower door interlock switch.

5.2.1.2 PA LOAD POSITION. Linear Power Amplifier 204F-1 should be tuned to 19 megacycles as described in paragraph 3.5. With the proper signal input from the associated exciter, proceed as follows:

a. Place MULTIMETER switch in PA LOAD position.

b. Observe that MULTIMETER needle indicates exactly zero.

c. If MULTIMETER indication is incorrect, adjust R42 for proper indication.

NOTE

R42 is located on the grid chassis, and cannot be adjusted with power applied. To make this adjustment, press PLATE-OFF button on linear power amplifier, open the upper cabinet door, turn the adjustment slightly in one direction, energize the equipment, and observe the effect. Repeat this procedure until proper indication is obtained.

5.2.2 THERMAL OVERLOAD ADJUSTMENT.

a. Place external disconnect switch in off position.

b. Remove the two plates covering the rear portion of the top of the cabinet. Connect an a-c voltmeter (see table 1-2) between terminals 1 and 2 of TB13 and set the meter for operation on the 0- to 30-volt scale. The terminals of TB13 are not numbered. A white wire with brown and orange tracers is connected to terminal 1. A white wire with black and green tracers is connected to terminal 2.

c. Place external disconnect switch in on position, and press PLATE-ON button. After PLATE indicator is illuminated, set OVERLOAD control for a reading of 23 volts on the meter. Allow equipment to operate for 15 minutes. If equipment cuts off before the 15-minute operating time has elapsed, the voltage must be decreased.

NOTE

The setting of the OVERLOAD control is a function of ambient temperature. The adjustment for an indication of 23 volts applies only when the room temperature is 29 degrees centigrade (84 degrees Fahrenheit). If room temperature is higher, the voltage will have to be reduced and vice versa to achieve the same results as those at 29 degrees centigrade. (See step e.)

d. Place MULTIMETER in RT PA CATH position. Turn RIGHT PA BIAS control until MULTIMETER indicates 350 milliamperes. Place MULTIMETER switch in LT PA CATH position, and adjust LEFT PA BIAS control until MULTIMETER indicates 350 milliamperes. Within one minute, the thermal overload circuit should operate, removing screen and plate voltages from V4 and V5. Operation of the overload circuit will be indicated by the PLATE indicator being extinguished.

CAUTION

If overload circuit does not activate within the allowable one-minute delay, readjust left and right cathode current indications for 250 milliamperes. The overload current of 350 milliamperes exceeds the dissipation of tubes V4 and V5 and will cause the tubes to burn out if allowed to flow more than one minute.

e. If the overload circuit does not activate within the allowable one-minute delay; repeat steps c and d, but increase voltage in step c to 25 volts. Repeat operation as many times as necessary to obtain proper results. If ambient temperature changes, the complete thermal overload adjustment should be readjusted to the new ambient temperature.

f. Readjust both LEFT PA BIAS and RIGHT PA BIAS controls for an indication of 250 milliamperes on the MULTIMETER.

g. Press FILAMENTS-OFF button, and place external disconnect switch in off position. Disconnect voltmeter from TB13, and replace the two plates at the rear portion of the top of the cabinet.

5.2.3 PLATE OVERLOAD CIRCUIT CHECK. Linear Power Amplifier 204F-1 should be tuned to an operating frequency as described in paragraph 3.5. With the proper signal input from the associated exciter, proceed as follows:

a. Place MULTIMETER switch in PA SCREEN position and DR TUNE-PA TUNE-OPERATE switch in OPERATE position.

b. Increase the r-f signal level at the exciter until the plate overload circuit operates. Operation of the overload circuit, which is indicated by the PLATE indicator being extinguished, should occur when the

PLATE CURRENT meter is indicating between 1.6 and 1.65 amperes.

CAUTION

Do not let the power amplifier screen current exceed 80 milliamperes. Reduce the amount of screen current with the PA LOAD (CHANNEL A or B) control if necessary.

c. If overload circuit does not function properly, adjust R79 (located in the upper right-hand side of the power supply compartment on the bias chassis between fuses F1 and F2) to obtain the proper indication.
d. Press PLATE-OFF button, wait three minutes and press FILAMENTS-OFF button.
e. Place external disconnect switch in off position.

5.2.4 TGC CIRCUIT CALIBRATION.

a. Place external disconnect switch in off position.
b. Insert probe T-connector (see table 1-2) in series with output transmission line connected to antenna system.
c. Disconnect the coaxial cable connected to J3 of the linear power amplifier. Connect dummy load (see table 1-2) across cable terminals. Connect a vacuum-tube voltmeter (see table 1-2) across dummy load, and set meter to read a negative voltage of greater than ten volts.
d. Connect a single-tone, audio signal to input of the associated exciter. Set the exciter controls to produce a single-sideband signal at the frequency to which the channel A circuits are tuned.
e. Connect a vacuum-tube voltmeter equipped with a capacitive voltage divider (see table 1-2) to the probe T-connector. Set meter to read an a-c voltage of greater than 35 volts. The meter will be used to measure a voltage of approximately 355 volts, but the capacitive voltage divider provides a ten-to-one step-down ratio.
f. Tune linear power amplifier to frequency of channel A circuits as described in paragraph 3.5. With the proper r-f input from the exciter, complete the following steps:
g. Place DR TUNE-PA TUNE-OPERATE switch in OPERATE position.
h. Increase audio signal level of input to exciter until vtvm connected to the T-connector gives indication of 35.5 volts. Observe that vtvm across dummy load indicates exactly -10 volts d-c. If vtvm does not indicate exactly -10 volts, turn TGC adjustment until meter indicates correct voltage.
i. Reduce level of audio signal input to exciter until vtvm connected to probe T-connector indicates 31.6 volts. Observe that vtvm connected across dummy load indicates less than 0.3-volt d-c.
j. Press PLATE-OFF button, wait three minutes, and press FILAMENTS-OFF button. Place external disconnect switch in off position.
k. Disconnect vtvm from dummy load. Disconnect dummy load from coaxial cable, and connect cable to J3.
l. Disconnect vtvm from T-connector. Remove T-connector from output transmission line.
m. Close upper cabinet door, and restore equipment to normal operation.

5.2.5 POWER AMPLIFIER NEUTRALIZATION.

NOTE

The power amplifier neutralization adjustment should be made with the equipment operating at one of the higher frequencies. At the lower frequencies, the plate current dip is very slight and may be overlooked. Neutralization becomes more important at the higher frequencies, hence the adjustment should be made under these critical conditions.

a. Place external disconnect switch in off position.
b. Insert probe T-connector (see table 1-2) in series with transmission line connected to antenna system.
c. Connect a single-tone, audio signal to the input of the associated exciter. Set exciter controls to produce a single-sideband signal at frequency to which channel A circuits are tuned.
d. Connect a vacuum-tube voltmeter equipped with the capacitive voltage divider (see table 1-2) to the probe T-connector. Set meter to read an a-c voltage greater than 35 volts. The meter will be used to measure a voltage of approximately 355 volts, but the capacitive voltage divider provides a ten-to-one step-down ratio.
e. Tune linear power amplifier to frequency of channel A circuits as described in paragraph 3.5. With proper r-f input from exciter, complete the following steps:
f. Place DR TUNE-PA TUNE-OPERATE switch in OPERATE position.
g. Place external disconnect switch in on position and press PLATE-ON button.
h. After PLATE indicator lights, increase level of audio signal input to exciter until vtvm indicates approximately 30 volts.
i. Rock CHANNEL A PA TUNE control. Observe that indication on voltmeter reaches a peak at same time indication on PLATE CURRENT meter reaches a minimum.
j. If indication on vtvm reaches a peak and indication on PLATE CURRENT meter reaches a minimum at the same time, the power amplifier stage is properly neutralized and steps k through o may be ignored. If the power amplifier stage is not properly neutralized, perform steps k through q.
k. Observe whether vtvm indication reaches a maximum or PLATE CURRENT meter indication reaches a minimum first as the CHANNEL A PA TUNE control is rotated clockwise.
l. Press PLATE-OFF button, wait approximately three minutes, and press FILAMENTS-OFF button. Place external disconnect switch in off position.

m. Open upper cabinet door. Adjust C18, which is located in the r-f compartment, one turn either clockwise of counterclockwise depending on the indication obtained in step k. If the vtvm indication reaches a maximum first, decrease the capacity of C18. If the PLATE CURRENT indication reaches a minimum first, increase capacity of C18.

n. Close upper cabinet door, place external disconnect switch in on position and press PLATE-ON button.

o. After PLATE indicator lights, repeat steps i and j until proper neutralization is obtained.

p. When power amplifier stage is properly neutralized, press PLATE-OFF button. Wait three minutes and press FILAMENTS-OFF button, then place external disconnect switch in off position.

q. Disconnect vtvm from T-connector and remove T-connector from the output transmission line.

5.2.6 DRIVER AMPLIFIER NEUTRALIZATION.

NOTE

The driver amplifier neutralization adjustment should be made with the equipment operating at one of the higher frequencies. At the lower frequencies, the meter dip is very slight and may be overlooked. Neutralization becomes more important at the higher frequencies, hence the adjustment should be made under these critical conditions.

a. Place external disconnect switch in off position. Open both upper and lower cabinet doors.

b. Connect two vacuum-tube voltmeters (see table 1-2) to either V2 or V3 by the following method:

(1) Remove access hole covers in the panel separating the grid and power supply compartments of the linear power amplifier. Place both meters outside the cabinet.

(2) Set one meter to read a voltage of approximately 10 volts a-c. Run the meter leads into the power supply compartment, up through the access hole, and connect them to the grid of V2 (V3).

(3) Set the second meter to read a voltage of greater than 100 volts a-c. Run the meter leads into the power supply compartment, through the access hole, and connect them to the plate of V2 (V3).

c. Cheat lower door interlock, and leave lower door open. Close upper cabinet door.

d. Connect a single-tone, audio signal to the input of associated exciter. Set exciter controls to produce a single-sideband signal at frequency to which channel A circuits are tuned.

e. Tune the linear power amplifier to frequency which channel A circuits are tuned by the procedure of paragraph 3.5. With proper r-f input from exciter, complete the following steps:

f. Place DR TUNE-PA TUNE-OPERATE switch in OPERATE position.

g. Press PLATE-ON button and observe that PLATE indicator lights within three minutes.

h. After PLATE indicator lights, increase level of audio signal input to exciter until vtvm connected to plate of V2 (V3) indicates approximately 100 volts a-c.

i. Adjust both CHANNEL A INPUT AMP TUNING and CHANNEL A DRIVER TUNING controls for maximum indication on the vtvm connected to plate of V2 (V3).

j. Rock CHANNEL A DRIVER TUNING control. Observe that indication on meter connected to grid of V2 (V3) does not change as control is moved.

NOTE

An unneutralized circuit will cause driver grid voltage to decrease as tuning control is moved either side of resonance. Since the driver stage is being operated class $AB_1$, the voltage decrease in the grid circuit will be small. The voltage decrease may be only 0.5 volt.

k. If the indication on the grid circuit meter does not vary as the CHANNEL A DRIVER TUNING control is moved, the driver amplifier stage is properly neutralized, and steps l through o can be ignored. If neutralization is required, complete the following steps:

l. Press PLATE-OFF button, wait three minutes, then press FILAMENTS-OFF button. Place external disconnect switch in off position.

m. Open upper cabinet door. Adjust C10, which is located in the grid box adjacent to V2 and V3, approximately three turns in either direction.

n. Close upper cabinet door, place external disconnect switch in on position, press PLATE-ON button and wait for PLATE indicator to light. Repeat steps f through j. Observe the effect of adjusting C10. Repeat steps l and m and adjust C10 in proper direction.

o. Repeat step n as many times as necessary to obtain proper neutralization.

p. Press PLATE-OFF button, wait three minutes, then press FILAMENTS-OFF button.

q. Place external disconnect switch in off position. Open upper cabinet door, and disconnect both voltmeters. Replace access hole covers. Enable lower door interlock switch.

5.2.7 SETTING OF GRID OVERLOAD RELAY K5. The adjustment of relay K5 should normally not have to be checked after the unit has been installed. However, if there is reason to believe trouble exists in the relay, or if it must be replaced, the following procedure should be used to adjust the relay properly:

a. Place a 28-volt d-c battery across the coil of the relay and place a d-c ammeter in series with the battery.

b. Adjust the arm of the relay for four milliamperes of current as indicated on the meter. Several attempts may be necessary to assure that the relay will operate with four milliamperes of current flow, since the adjustment is quite sensitive.

## 5.3 TROUBLE SHOOTING.

Most trouble can be localized to a particular circuit by properly observing and analyzing indicator lights, fuse indications, and meter readings. Once the faulty circuit has been identified, circuit tracing with an ohmmeter usually will locate the faulty part or connection. Table 5-2 lists an indication, probable trouble, and corrective procedure for certain trouble which may occur.

CAUTION

Certain steps of table 5-2 demand that the cabinet doors be left open with power applied and door interlock switches cheated. Use extreme caution when reaching into the cabinet to make required voltage measurements. Under no circumstances should power be applied to the equipment for more than 30 minutes with cabinet doors open.

Table 5-2 is not intended to be a complete list. To isolate hard-to-locate faults, refer to the schematics and voltage and resistance measurements. The indications in table 5-2 are listed in the order in which they would appear during a normal operating sequence with circuit breakers closed and primary power applied.

NOTE

With TGC outputs connected, the linear power amplifier forms a closed loop system with its associated exciter. A trouble appearing in the exciter may give an erroneous indication of trouble in the linear power amplifier if the loop is not opened. Before attempting to trouble shoot any of the r-f sections of the linear power amplifier, perform the following steps:

(1) Disconnect TGC outputs at jacks J2 and J3. This breaks the closed loop.

(2) Disconnect the normal r-f input from the associated exciter and connect an r-f input signal from a signal generator (see table 1-2) that is capable of delivering 0.2 watt maximum power.

## 5.4 TYPICAL METER INDICATIONS.

Table 5-3 contains typical meter indications for the linear power amplifier with no r-f input signal.

## 5.5 VOLTAGE AND RESISTANCE MEASUREMENTS.

Table 5-4 contains voltage measurements, and table 5-5 contains resistance measurements for the linear power amplifier.

## 5.6 CABLE CHART.

Table 5-6 contains "to-from" information for cables installed in the linear power amplifier.

## 5.7 COMPONENT REPLACEMENT.

### 5.7.1 GENERAL.

Once a fault has been traced to a component, the faulty component must be removed from the cabinet without damage to any adjacent components, and a new component of the proper type must be installed. The majority of components are accessible by merely opening the upper or lower cabinet door or by removing the cover plates at the top of the cabinet.

### 5.7.2 REMOVAL OF GRID CHASSIS.

Some components are accessible only after the grid chassis has been removed from the cabinet. To remove the grid chassis, proceed as follows:

a. Remove knob from MULTIMETER switch. Loosen the six twist-lock screws on front side of grid chassis.
b. Pull grid chassis slightly forward. Disconnect coaxial connector P7 from J7 in the grid compartment.
c. Pull chassis straight forward out of cabinet.
d. To replace, reverse above procedure.

### 5.7.3 REPLACEMENT OF POWER AMPLIFIER TUBES.

Special caution must be used in installing or removing the power amplifier tubes V4 and V5. If it is necessary to replace the power amplifier tubes, proceed carefully as follows:

a. Remove the air chimney by twisting it out of its bayonet socket at the top of the r-f compartment.
b. Grasp the tube by the plate cooling fins, and gently rotate 1/3 turn counterclockwise. Pull the tube straight out from its socket. Do not force at any time, but feel for binding or interference as the tube is withdrawn from the socket. Inspect the connector tabs inside the socket to make sure they were not deformed in tube removal.
c. Remove the new tube from its carton. Inspect it to be certain that the tube base contacts have not been damaged in shipping. These contacts are the thin metal tabs which extend radially from the ceramic lower portion of the tube.
d. Insert the tube GENTLY into its socket, making sure the tube base contacts are not jammed or bent in the process. In order to do this, start the socket key into the keyway inside the tube and lower the tube gently, feeling for any binding between socket key and tube keyway. If binding occurs, withdraw the tube, rotate 1/3 turn and try again. In two of the three possible positions, the tube may bind in entering the socket. This is because the tube keyway and the socket key are slightly off center. Find the orientation which does not bind, and insert the tube all the way into the socket.

e. Turn the tube clockwise against the stop to tighten the tube base contacts under the socket contacts. Tighten clamp around tube.

CAUTION

If an attempt is made to tighten the tube into its contacts when the tube is not properly bottomed in its socket, both tube and socket may be damaged. The manufacturer assumes no responsibility for tubes or sockets damaged by improper handling and installation.

f. Replace the air chimney by inserting it into its bayonet socket at the top of the r-f compartment and placing its base around the cooling fins of the tube.

TABLE 5-2. TROUBLE-SHOOTING CHART

| STEP | PRELIMINARY ACTION | NORMAL INDICATION | NEXT STEP |
|---|---|---|---|
| 1 | Place LOCAL-REMOTE switch in LOCAL position, DR-TUNE-PA TUNE-OPERATE switch in DR TUNE, and press PLATE-ON button. Make certain both cabinet doors are closed. | FILAMENTS indicator lights and stays on. Blower B1 starts when FILAMENTS indicator lights. PLATE indicator lights within three minutes and stays on.<br>NOTE<br>If PLATE indicator lights immediately, proceed to step 8. | If indications are normal, proceed to step 11.<br>If FILAMENTS indicator does not light, check pins 8 and 9 of T1 for 115 v a-c. If voltage is present, proceed to step 2. If voltage is not present, check fuses in disconnect switch and CONTROL fuse F1. |
| 2 | Same as step 1. | FILAMENTS indicator not lighted, but voltage present at pins 8 and 9 of T1. | Check for 115 v a-c across DS1. If present, replace indicator. If not present, proceed to step 3. |
| 3 | Same as step 1. | No voltage at DS1, but voltage present at pins 8 and 9 of T1. | Check lower door interlock S11C and switches S1 and S2. |
| 4 | Same as step 1. | FILAMENTS indicator lights, but blower B1 will not start. | Check BLOWER fuse F3. If trouble is still present, check for 230 v a-c at blower B1. If voltage is present, check blower unit. If voltage is not present, perform relay maintenance (see paragraph 5.1.4) on relay K1 or replace K1. |
| 5 | Same as step 1. | FILAMENTS indicator lights, blower B1 operating, but PLATE indicator does not light within three minutes. | Check voltage across DS2. If voltage is present, replace indicator. If voltage is not present, proceed to step 6. |
| 6 | Same as step 1. | FILAMENTS indicator lighted, blower B1 operating, PLATE indicator not lighted, but indicator is good. | Check AMPL. FIL fuse F4. If trouble is still present, check for 115 v a-c across relay K2. If voltage is present, replace K2. If voltage is not present, check contacts 3 and 7 of relay K1.<br>If timer circuit is functioning properly, proceed to step 7. |
| 7 | Same as step 1. | FILAMENT indicator lighted, blower B1 operating, timer circuit functioning but PLATE indicator not lighted. | Check continuity from S1, through S3, S4, S12C, S13, S14, S6, contacts 3 and 4 of K2. Replace any defective components. |

TABLE 5-2. TROUBLE-SHOOTING CHART (Cont)

| STEP | PRELIMINARY ACTION | NORMAL INDICATION | NEXT STEP |
|---|---|---|---|
| 8 | Same as step 1. | PLATE indicator lights immediately. | Replace relay K2. |
| 9 | Same as step 1. | PLATE indicator lights after three-minute delay, but does not remain lighted. | Check for 115 v a-c between pin 13 of plate hold relay K3 and ground. If voltage is not present, proceed to step 10. If voltage is present (a) Check for defective relay K3. (b) Check for improper setting or failure of TGC (see paragraph 5.2.4), causing PA grid overload relay K5 to open contacts 2 and 3. |
| 10 | Same as step 1. | PLATE indicator lights after three-minute delay, but does not remain lighted and voltage is present between pin 13 of relay K3 and ground. | Check for excessive PA plate current and make adjustment in paragraph 5.2.3. Also check PA grid overload relay K5 and check setting of paragraph 5.2.7. Check contacts 5 and 6 of CB1. Check continuity of thermal interlock switch S5 and make adjustment of paragraph 5.2.2. |
| 11a | Tune signal generator (see table 1-2) to frequency of channel A circuits. Place channel selector switch in CHANNEL A position. Place DR TUNE-PA TUNE-OPERATE switch in OPERATE. Place LOCAL-REMOTE switch in LOCAL. Monitor pins 6 and 7 of TB14 with r-f wattmeter (on status numbers 522-1130-014 and 522-1130-015), place FORWARD-REFLECTED switch in FORWARD A position to read power output. Press PLATE-ON button and wait for PLATE indicator to light. | Linear power amplifier operating with approximately 2.5-kw output power. PLATE CURRENT meter indicates a minimum of 1 ampere, but less than 1.5 amperes. | If indications are normal, the linear power amplifier is operating properly.<br><br>If output power indication is zero, but PLATE CURRENT meter indication is normal, trouble is indicated between the plate of the PA tubes and TB14. (a) Tune signal generator to frequency of channel B circuits and switch to CHANNEL B position. If indications are normal, trouble is indicated in channel A output circuits, relay K14 or relay K11A. Refer to figure 7-1 and make continuity check. (b) If indications are not normal in the CHANNEL B position, check relay K11A and K11B (both sections of this relay receive their coil voltages through the contacts of relay K12), relay K14, C25, C75. |
| 11b | Same as 11a. | Same as 11a. | If output power indication is normal and PLATE CURRENT meter indication is zero, check PLATE CURRENT meter M1. |
| 11c | Same as 11a. | Same as 11a. | If output power indication is zero and PLATE CURRENT meter indication is 0.5 ampere or less, check r-f output at pin 6 of V1.<br><br>If r-f output is present at pin 6, proceed to step 12. |

TABLE 5-2. TROUBLE-SHOOTING CHART (Cont)

| STEP | PRELIMINARY ACTION | NORMAL INDICATION | NEXT STEP |
|---|---|---|---|
| 11c (Cont) | | | If r-f output is not present, check input network and refer to tables 5-4 and 5-5 to trouble-shoot input amplifier stage. |
| 12 | Place LOCAL-REMOTE switch in LOCAL. Place DR TUNE-PA TUNE-OPERATE switch in OPERATE. Tune signal generator to frequency of channel B circuits and place CHANNEL switch in B position. | Same as 11a. | If indications are normal, trouble is indicated in CHANNEL A INPUT AMP TUNING circuit. Check relay K9 (relay K9 receives its coil voltage through contacts 4 and 5 of K12, C61, and C60), L1, and C6.<br>If indications are not normal, check r-f signal at E23 and E24.<br>If r-f signal is present at both E23 and E24, proceed to step 13.<br>If r-f signal is not present at either E23 or E24, check for C8 opening up.<br>If r-f signal is present at E23 but not E24, check Z3. Refer to tables 5-4 and 5-5 to trouble-shoot driver amplifier V2.<br>If r-f signal is present at E24 but not E23, check Z4. Refer to tables 5-4 and 5-5 to trouble-shoot driver amplifier V3. |
| 13 | Place LOCAL-REMOTE switch in LOCAL. Place DR TUNE-PA TUNE-OPERATE switch in OPERATE. Tune signal generator to frequency of channel A circuits. Place CHANNEL switch in A position. Press PLATE-ON button and wait for PLATE indicator to light. | Same as 11a. | Check for r-f signal at pin 3 of V4. If r-f signal is present, refer to tables 5-4 and 5-5 to trouble-shoot power amplifier V4 and/or replace V4.<br>If r-f signal is not present, check for r-f signal at pin 3 of V5.<br>If r-f signal is present at V5, check Z5.<br>If r-f signal is not present at pin 3 of V5, proceed to step 14. |
| 14 | Place LOCAL-REMOTE switch in LOCAL. Place DR TUNE-PA TUNE-OPERATE switch in OPERATE. Tune signal generator to frequency of channel B circuits. Place CHANNEL switch in B position. Press PLATE-ON button and wait for PLATE indicator to light. | Same as 11a. | If indications are normal, trouble is indicated in the CHANNEL A DRIVER TUNING circuit. Check (1) Relay K10 (relay K10 receives its coil voltage through contacts 4 and 5 of relay K12, and C61). (2) Check L6 and C14.<br>If indications are not normal, check for r-f signal at P5A. If signal is present, check C16, V4 and V5, Z5 and Z6.<br>If signal is not present at P5A, check K10 (relay K10 receives its coil voltage through contacts 4 and 5 of relay K12 and C61), Z2, and check for short across L5. |

TABLE 5-3. TYPICAL METER INDICATIONS, NO R-F INPUT SIGNAL

| METER | METER SWITCH POSITION | INDICATION |
|---|---|---|
| MULTIMETER | DRIVER PLATE | 130 ma ±17% |
| MULTIMETER | LT PA CATH | 250 ma |
| MULTIMETER | RT PA CATH | 250 ma |
| MULTIMETER | PA GRID | 0 |
| MULTIMETER | PA LOAD | 0 |
| MULTIMETER | PA SCREEN | 0 |
| MULTIMETER | PA FIL VOLTS | 6 v a-c ±0.25 |
| MULTIMETER | PA PLATE VOLTS | 3.2 kv d-c ±200 v |
| PLATE CURRENT | | 0.5 ampere |

TABLE 5-4. VOLTAGE MEASUREMENTS

Conditions of Measurements:

a. Open both cabinet doors and cheat both door interlocks. Place LOCAL-REMOTE switch in LOCAL.
b. Press FILAMENTS-ON button and press PLATE-ON button.
c. Use vacuum-tube voltmeter of table 1-2.

| TUBE | POSITION OF DR TUNE-PA TUNE-OPERATE SWITCH | | |
|---|---|---|---|
| V1 (6CL6) | DR TUNE | PA TUNE | OPERATE |
| Pin 4 to pin 5 | 6.3 v a-c | 6.3 v a-c | 6.3 v a-c |
| Pin 6 to pin 1 | +80 v d-c | +80 v d-c | +225 v d-c |
| Pin 7 to pin 1 | -1.2 v d-c | -1.2 v d-c | -4.0 v d-c |
| Pin 2 to pin 1 | -1.2 v d-c | -1.2 v d-c | -3.5 v d-c |
| Pin 9 to pin 1 | -1.2 v d-c | -1.2 v d-c | -3.5 v d-c |
| Pin 3 to pin 1 | +70 v d-c | +70 v d-c | +170 v d-c |
| Pin 8 to pin 1 | +70 v d-c | +70 v d-c | +170 v d-c |
| Pin 6 to ground | -25 v d-c | -25 v d-c | -80 v d-c |
| V2, V3 (6146) | | | |
| Pin 2 to pin 7 | 6.3 v a-c | 6.3 v a-c | 6.3 v a-c |
| Pin 1 to ground | -120 v d-c | -120 v d-c | -280 v d-c |
| Pin 4 to ground | -120 v d-c | -120 v d-c | -280 v d-c |
| Pin 5 to pins 1, 4 | -6 v d-c | -6 v d-c | -18 v d-c |
| Plate cap to pins 1, 4 | +120 v d-c | +120 v d-c | +280 v d-c |
| Pin 3 to pins 1, 4 | +50 v d-c | +50 v d-c | +130 v d-c |
| V4, V5 (4CX1000A) | | | |
| Pin 1 to pin 2 | 6 v a-c | 6 v a-c | 6 v a-c |
| Plate to pin 2 | +3000 v d-c | +3000 v d-c | +3000 v d-c |
| Plate to ground | +2700 v d-c | +2700 v d-c | +2700 v d-c |
| Pin 4 to pin 2 | +28 v d-c | +290 v d-c | +320 v d-c |
| Pin 3 to pin 2 | -100 v d-c | -55 v d-c | -60 v d-c |

TABLE 5-5. RESISTANCE MEASUREMENTS

Conditions of Measurements:

a. Open both cabinet doors and cheat both door interlock switches. Place LOCAL-REMOTE switch in LOCAL position.
b. Press FILAMENTS-OFF switch.
c. Use vacuum-tube voltmeter of table 1-2 and measure from each pin to ground.

| TUBE | POSITION DR TUNE-PA TUNE-OPERATE SWITCH | PIN NUMBER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | PLATE CAP |
| V1 (6CL6) | DR/PA-TUNE | 130 | 41K | 10.5K | 0.3 | 0.4 | 2.5K | 0.3 | 10.5K | --- |
| | OPERATE | 1.8K | 41K | 10.5K | 1.7K | 1.7K | 2.5K | 1.7K | 10.5K | --- |
| V2, V3 (6146) | DR/PA-TUNE | 280 | 0.3 | 1.3K | 280 | 1.1K | 270 | 0.4 | 0 | 5 |
| | OPERATE | 2K | 1.7K | 2K | 2K | 2.7K | 2K | 1.7K | 0 | 5 |
| V4, V5 (4CX1000A) | DR/PA TUNE | 1.75 meg | 1.75 meg | 14K | 0 | --- | --- | --- | --- | 44K |
| | OPERATE | 1.75 meg | 1.75 meg | 14K | 0 | --- | --- | --- | --- | 44K |

TABLE 5-6. CABLE CHART

| FROM | TO | WIRE CODE | FROM | TO | WIRE CODE | FROM | TO | WIRE CODE |
|---|---|---|---|---|---|---|---|---|
| C23 | J4-3 | RB905 | C54 | E16 | RB902 | C63 | R42-2 | RA95 |
| C23 | K7-8 | RB905 | C55 | E4 | RB913 | C63 | S9-2 | RB925 |
| C48 | E3 | RB912 | C55 | J4-2 | RB913 | C64 | J4-1 | RB925 |
| C48 | J4-9 | RB912 | C56 | S10-12 | RB935 | C64 | S10-15 | RB925 |
| C48 | RB10-26 | RE912 | C57 | S10-13 | RB926 | C65-1 | L21-2 | LE9 |
| C48 | S10-11 | RB906 | C58 | K2-1 | RB93 | C65-2 | R48-1 | LE9 |
| C49 | R15-2 | RB906 | C58 | TB4-3 | RB93 | C66-2 | T6-9 | VE91 |
| C49 | TB10-13 | RB906 | C58 | M4-2 | RB93 | C67-2 | M1-2 | VE91 |
| C50 | P4-6 | RB96 | C58 | T4-1 | RB93 | C68-2 | R24-1 | VE91 |
| C50 | S9-11 | RB96 | C59 | J4-7 | RB92 | C69-2 (+) | TB12-4 | RB912 |
| C50 | XV3-2 | RB90 | C59 | M4-1 | RB92 | C71-1 (+) | E42 | RB923 |
| C51 | P4-5 | RB91 | C59 | T3-1 | RB92 | C71-1 (+) | TB11-4 | RB923 |
| C51 | XV3-7 | RB91 | C60 | K9-2 | RA925 | C71-2 (-) | E41 | RB916 |
| C52 | S10-2 | RB915 | C60 | K10-2 | RA936 | C71-2 (-) | L24-2 | RB916 |
| C52 | TB10-25 | RB915 | C60 | P4-4 | RB936 | C72-2 (+) | R26-1 | RB912 |
| C53 | K12-7 | RAS9 | C61 | J4-4 | RB936 | C73 (-) | K6-4 | RB9 |
| C53 | TB10-6 | RAS9 | C61 | K12-5 | RB936 | C73 (+) | K6-8 | RB902 |

TABLE 5-6. CABLE CHART (Cont)

| FROM | TO | WIRE CODE | FROM | TO | WIRE CODE | FROM | TO | WIRE CODE |
|---|---|---|---|---|---|---|---|---|
| C75 | K12-3 | RB926 | E1 | DS2-1 | RB9 | E42 | C71-1 (+) | RB923 |
| C77 | R63-2 | RB916 | E1 | E5 | RB9 | E43 | K3-10 | RB923 |
| C77 | TB10-2 | RB916 | E2 | K1-10 | RB9 | F1-1 | TB1-2 | RC90 |
| C83 | C86-2 (+) | RB912 | E2 | K4-10 | RB9 | F1-2 | T1-1 | RC90 |
| C83 | P4-9 | RB912 | E2 | TB1-1 | VG9 | F2-1 | K1-6 | RB9356 |
| C86-2 (+) | C83 | RB912 | E3 | C48 | RB912 | F2-2 | T3-2 | RB90 |
| C93-1 | T5-4 | RB91 | E3 | R26-1 | RB912 | GND (C49) | E39 | 18S |
| C93-1 | TB12-1 | RB91 | E3 | R79-2 | RB91 | GND (C53) | TB10-12 | S |
| C93-2 | T5-3 | RB91 | E4 | C55 | RB913 | GND (J2) | E39 | S |
| C93-2 | TB12-2 | RB91 | E4 | K5-1 | RB913 | GND (J2) | GND (J7) | S |
| C94-1 | S12C-2 | RB92 | E4 | K7-1 | RB913 | GND (J7) | GND (J2) | S |
| C95-1 | S6-2 | RB93 | E4 | R26-2 | RB913 | J1 | J7 | RG-58C/U |
| C98 | R41-2 | RB903 | E4 | S10-9 | RB913 | J2 | K12-8 | RAS90 |
| C98 | TB10-15 | RB903 | E4 | S11B | RB913 | J3 | K12-6 | RAS92 |
| C101 | T1-4 | RB902 | E4 | TB6-1 | RB913 | J4-1 | C64 | RB925 |
| C102 | K3-9 | RB903 | E5 | E1 | RB9 | J4-2 | C55 | RB913 |
| C107 | E35 | RB95 | E5 | K5-3 | RB9 | J4-3 | C23 | RB905 |
| C107 | J4-10 | RB95 | E5 | T1-8 | RB9 | J4-4 | C61 | RB936 |
| C108 | TB15-3 | RB92 | E7 | K8-5 | RB91 | J4-5 | T4-4 | RB91 |
| C109 | TB15-1 | RB92 | E7 | M1-1 | VE90 | J4-6 | T4-3 | RB96 |
| CB1-1 | TB1-2 | VG90 | E7 | S10-16 | RB912 | J4-7 | C59 | RB92 |
| CB1-2 | TB1-3 | VG91 | E8 | S11A | LE9 | J4-8 | T4-2 | RB90 |
| CB1-3 | K4-2 | VG92 | E9 | K10-1 | RA9 | J4-9 | C48 | RB912 |
| CB1-4 | K4-1 | VG93 | E13 | E42 | RB93 | J4-10 | C107 | RB95 |
| CB1-5 | TB13-3 | RB903 | E13 | S10-5 | RB93 | J7 | J1 | RG-58C/U |
| CB1-6 | K8-2 | RB903 | E14 | S10-13 | RB926 | K1-1 | TB1-3 | RB91 |
| CR16-1 | K4-9 | RB902 | E16 | C54 | RB902 | K1-2 | TB1-2 | RC90 |
| DC1 (fwd) | TB14-6 | RAS92 | E17 | TB2-1 | RB9 | K1-3 | T1-5 | RC92 |
| DC1 (gnd) | TB14-8 | S | E18 | T4-8 | RB902 | K1-4 | K1-9 | RB93 |
| DC1 (refl) | TB14-7 | RAS91 | E19 | T4-5 | RB935 | K1-4 | K3-2 | RB93 |
| DC2 (fwd) | TB14-10 | RAS90 | E20 | T4-7 | RB926 | K1-5 | TB3-3 | RB91 |
| DC2 (gnd) | TB14-8 | S | E35 | C107 | RB95 | K1-6 | F2-1 | RB9356 |
| DC2 (refl) | TB14-9 | RAS9 | E38 | K12-4 | RB95 | K1-6 | TB4-1 | RC913 |
| DS1-1 | E1 | RB9 | E39 | GND (C49) | S | K1-7 | K2-2 | RB93 |
| DS1-2 | S2-2 | RB93 | E39 | GND (J2) | S | K1-7 | T3-1 | RB92 |
| DS2-1 | E1 | RB9 | E40 | K13-1 | RB9 | K1-7 | TB4-4 | RB92 |
| DS2-2 | K2-4 | RB902 | E41 | C71-2 | RB916 | K1-8 | K3-3 | RB902 |
| E1 | DS1-1 | RB9 | E42 | E13 | RB93 | K1-8 | S2-1 | RB902 |

TABLE 5-6. CABLE CHART (Cont)

| FROM | TO | WIRE CODE | FROM | TO | WIRE CODE | FROM | TO | WIRE CODE |
|---|---|---|---|---|---|---|---|---|
| K1-9 | K1-4 | RB93 | K6-4 | K3-12 | RB90 | L22-1 | L21-2 | LE9 |
| K1-9 | S2-2 | RB93 | K6-4 | K4-10 | RB9 | L22-2 | R48-1 | LE9 |
| K1-10 | E2 | RB9 | K7-1 | F4 | RB913 | L23-1 | TB12-3 | RB913 |
| K2-1 | C58 | RB93 | K7-2 | K11-3 | RB923 | L23-2 | R47-1 | RB913 |
| K2-2 | K1-7 | RB93 | K7-4 | TB14-5 | RB906 | L24-1 | TB11-3 | RB916 |
| K2-3 | S6-1 | RB93 | K7-5 | TB14-4 | RB903 | L24-2 | C71-2 (-) | RB916 |
| K2-4 | DS2-2 | RB902 | K7-7 | TB2-11 | RB936 | M1-1 | E7 | VE90 |
| K2-4 | K4-9 | RB902 | K7-8 | C23 | RB905 | M1-2 | C67-2 | VE91 |
| K2-4 | TB2-4 | RB902 | K8-1 | R79-1 | RB91 | M2-1 | S10-10 | RB936 |
| K3-2 | K1-4 | RB93 | K8-1 | S4-2 | RB902 | M2-2 | S10-1 | RB956 |
| K3-3 | K1-8 | RB902 | K8-2 | CB1-6 | RB903 | M4-1 | C59 | RB92 |
| K3-5 | S4-1 | RB96 | K8-3 | K3-6 | RB912 | M4-2 | C58 | RB93 |
| K3-6 | S12C-1 | RB95 | K8-3 | S4-2 | RB902 | P4-1 | S9-12 | RB925 |
| K3-6 | K8-3 | RB912 | K8-5 | E7 | RB91 | P4-2 | S9-8 | RB913 |
| K3-8 | RB13-1 | RB913 | K9-1 | TB7-2 | RA9 | P4-3 | S9-6 | RB905 |
| K3-9 | C102 | RB903 | K9-2 | C60 | RA925 | P4-4 | C60 | RB936 |
| K3-10 | E43 | RB923 | K10-1 | E9 | RA9 | P4-5 | C51 | RB91 |
| K3-12 | K6-4 | RB90 | K10-2 | C60 | RA936 | P4-6 | C50 | RB96 |
| K3-13 | TB13-4 | RB92 | K11A-2 | K12-5 | RB936 | P4-7 | R23-1 | RB92 |
| K3-14 | K5-2 | RB9 | K11A-4 | S10-3 | RB923 | P4-8 | R23-2 | RB90 |
| K4-1 | CB1-4 | VG93 | K11B-2 | K12-3 | RB926 | P4-9 | C83 | RB912 |
| K4-2 | CB1-3 | VG92 | K11-3 | K7-2 | RB923 | P4-10 | S9-4 | RB95 |
| K4-4 | TB14-1 | RB926 | K12-1 | TB2-3 | RB96 | P7 | TB9-3 | 13S |
| K4-5 | T6-5 | VG93 | K12-2 | S8A-3 | RB9 | P7 | TB9-4 | RG-58C/U |
| K4-6 | R21-1 | VG92 | K12-3 | C75 | RB926 | R4 | TB9-5 | RA96 |
| K4-8 | TB14-2 | RB925 | K12-3 | K11B-2 | RB926 | R12 | TB7-3 | RA926 |
| K4-9 | CR16-1 | RB902 | K12-4 | E38 | RB95 | R15-2 | C49 | RB906 |
| K4-9 | K2-4 | RB902 | K12-4 | S8B-3 | RB93 | R21-1 | K4-6 | VG92 |
| K4-10 | E2 | RB9 | K12-5 | C61 | RB936 | R21-1 | K6-1 | VG92 |
| K4-10 | K6-4 | RB9 | K12-5 | K11A-2 | RB936 | R21-2 | K6-2 | VG92 |
| K5-1 | E4 | RB913 | K12-6 | J3 | RAS92 | R21-2 | T6-1 | VG92 |
| K5-2 | K3-14 | RB9 | K12-7 | C53 | RAS9 | R23-1 | P4-7 | RB92 |
| K5-3 | E5 | RB9 | K12-8 | J2 | RAS90 | R23-2 | P4-8 | RB90 |
| K5-5 | S10-14 | RB905 | K13-1 | E40 | RB9 | R24-1 | C68-2 | VE91 |
| K6-1 | R21-1 | VG92 | K13-2 | TB2-14 | RB90 | R26-1 | C72-2 (+) | RB912 |
| K6-2 | R21-2 | VG92 | L21-1 | T2 (C.T.) | LE9 | R26-1 | E3 | RB912 |
| K6-3 | C73 (+) | RB902 | L21-2 | C65-1 | LE9 | R26-2 | E4 | RB913 |
| K6-4 | C73 (-) | RB9 | L21-2 | L22-1 | LE9 | R26-2 | R47-1 | RB913 |

TABLE 5-6. CABLE CHART (Cont)

| FROM | TO | WIRE CODE | FROM | TO | WIRE CODE | FROM | TO | WIRE CODE |
|---|---|---|---|---|---|---|---|---|
| R41-2 | C98 | RB903 | S9-8 | P4-2 | RB913 | T3-1 | K1-7 | RB92 |
| R42-2 | C63 | RA95 | S9-11 | C50 | RB96 | T3-2 | F2-2 | RB90 |
| R45-2 | S10-17 | RB902 | S9-12 | P4-1 | RB925 | T3-3 | TB11-2 | RB915 |
| R47-1 | L23-2 | RB913 | S10-1 | M2-2 | RB956 | T3-4 | TB11-1 | RB915 |
| R47-1 | R26-2 | RB913 | S10-2 | C52 | RB915 | T4-1 | C58 | RB93 |
| R48-1 | C65-2 | LE9 | S10-3 | K11A-4 | RB923 | T4-2 | J4-8 | RB90 |
| R48-1 | L22-2 | LE9 | S10-5 | E13 | RB93 | T4-3 | J4-6 | RB96 |
| R48-1 | S11A | LE9 | S10-9 | E4 | RB913 | T4-4 | J4-5 | RB91 |
| R63-2 | C77 | RB916 | S10-10 | M2-1 | RB936 | T4-5 | E19 | RB935 |
| R79-1 | K8-1 | RB91 | S10-11 | C48 | RB906 | T4-5 | XV4-2 | RE90 |
| R79-2 | E3 | RB91 | S10-12 | C56 | RB935 | T4-6 | XV4-1 | RE95 |
| S1-1 | S11C-2 | RB92 | S10-13 | C57 | RB926 | T4-7 | E20 | RB926 |
| S2-1 | K1-8 | RB902 | S10-13 | E14 | RB926 | T4-7 | XV5-2 | RE91 |
| S2-1 | S3-1 | RB95 | S10-14 | K5-5 | RB905 | T4-8 | E18 | RB902 |
| S2-2 | DS1-2 | RB93 | S10-15 | C64 | RB925 | T4-8 | XV5-1 | RE96 |
| S2-2 | K1-9 | RB93 | S10-16 | E7 | RB912 | T4-9 | TB10-5 | RB956 |
| S3-1 | S2-1 | RB95 | S10-17 | R45-2 | RB902 | T4-10 | TB10-3 | RB923 |
| S4-1 | K3-5 | RB96 | S10-18 | TB6-2 | RB91 | T5-1 | T6-1 | RC92 |
| S4-2 | K8-3 | RB902 | S11A | E8 | LE9 | T5-2 | TB4-5 | RC95 |
| S4-2 | S8C-2 | RB902 | S11A | R48-1 | LE9 | T5-3 | C93-2 | RB91 |
| S6-1 | K2-3 | RB93 | S11A | S12A | LE9 | T5-4 | C93-1 | RB91 |
| S6-2 | C95-1 | RB93 | S11B | E4 | RB913 | T6-1 | R21-2 | VG92 |
| S7-2 | TB2-2 | RB93 | S11B | S12B | RB913 | T6-1 | T5-1 | RC92 |
| S8A-2 | TB2-5 | RB95 | S11C-1 | S8B-1 | RB92 | T6-5 | K4-5 | VG93 |
| S8A-3 | K12-2 | RB9 | S11C-2 | S1-1 | RB92 | T6-5 | TB4-6 | RC95 |
| S8B-1 | S11C-1 | RB92 | S12A | S11A | LE9 | T6-8 | V7 | LE9 |
| S8B-1 | TB2-10 | RB92 | S12B | S11B | RB913 | T6-9 | C66-2 | VE91 |
| S8B-3 | K12-4 | RB93 | S12C-1 | K3-6 | RB95 | T6-10 | V6 | LE9 |
| S8B-3 | T1-9 | RB93 | S12C-2 | C94-1 | RB92 | TB1-1 | E2 | VG9 |
| S8B-3 | TB2-9 | RB903 | T1-1 | F1-2 | RC90 | RB1-2 | CB1-1 | VG90 |
| S8C-2 | S4-2 | RB902 | T1-4 | C101 | RB902 | TB1-2 | F1-1 | RC90 |
| S8C-3 | TB2-12 | RB906 | T1-5 | K1-3 | RC92 | TB1-2 | K1-2 | RC90 |
| S8D-1 | TB2-8 | RB913 | T1-5 | TB1-3 | RC91 | TB1-3 | CB1-2 | VG91 |
| S8D-2 | TB2-7 | RB916 | T1-7 | TB13-2 | RB905 | TB1-3 | K1-1 | RB91 |
| S8D-3 | TB2-6 | RB915 | T1-8 | E5 | RB9 | TB1-3 | T1-5 | RC91 |
| S9-2 | C63 | RB925 | T1-9 | S8B-3 | RB93 | TB2-1 | E17 | RB9 |
| S9-4 | P4-10 | RB95 | T2 (C.T.) | L21-1 | LE9 | TB2-2 | S7-2 | RB93 |
| S9-6 | P4-3 | RB905 | T3-1 | C59 | RB92 | TB2-3 | K12-1 | RB96 |

TABLE 5-6. CABLE CHART (Cont)

| FROM | TO | WIRE CODE | FROM | TO | WIRE CODE | FROM | TO | WIRE CODE |
|---|---|---|---|---|---|---|---|---|
| TB2-4 | K2-4 | RB902 | TB10-2 | C77 | RB916 | TB14-6 | DC1 (fwd) | RAS92 |
| TB2-5 | S8A-2 | RB95 | TB10-3 | T4-10 | RB923 | TB14-7 | DC1 (refl) | RAS91 |
| TB2-6 | S8D-3 | RB915 | RB10-5 | T4-9 | RB956 | TB14-8 | DC1 (gnd) | S |
| TB2-7 | S8D-2 | RB916 | TB10-6 | C53 | RAS9 | TB14-8 | DC2 (gnd) | S |
| TB2-8 | S8D-1 | RB913 | TB10-12 | GND (C53) | 18S | TB14-9 | DC2 (refl) | RAS9 |
| TB2-9 | S8B-3 | RB903 | TB10-13 | C49 | RB906 | TB14-10 | DC2 (fwd) | RAS90 |
| TB2-10 | S8B-1 | RB92 | TB10-15 | C98 | RB903 | TB15-1 | C109 | RB92 |
| TB2-11 | K7-7 | RB936 | TB10-25 | C52 | RB915 | TB15-3 | C108 | RB92 |
| TB2-12 | S8C-3 | RB906 | TB10-26 | C48 | RB912 | V6 | T6-10 | LE9 |
| TB2-14 | K13-2 | RB90 | TB11-1 | T3-4 | RB915 | V7 | T6-8 | LE9 |
| TB3-2 | TB4-2 | RB91 | TB11-2 | T3-3 | RB915 | XV1-4 | XV2-2 | RA90 |
| TB3-3 | K1-5 | RB91 | TB11-3 | L24-1 | RB916 | XV1-5 | XV2-7 | RA91 |
| TB4-1 | K1-6 | RC913 | TB11-4 | C71-1 (+) | RB923 | XV2-2 | XV1-4 | RA90 |
| TB4-2 | TB3-2 | RB91 | TB12-1 | C93-1 | RB91 | XV2-2 | XV3-2 | RA90 |
| TB4-3 | C58 | RB93 | TB12-2 | C93-2 | RB91 | XV2-7 | XV1-5 | RA91 |
| TB4-4 | K1-7 | RB92 | TB12-3 | L23-1 | RB913 | XV2-7 | XV3-7 | RA91 |
| TB4-5 | T5-2 | RC95 | TB12-4 | C69-2 (+) | RB912 | XV3-2 | C50 | RB90 |
| TB4-6 | T6-5 | RC95 | TB13-1 | K3-8 | RB913 | XV3-2 | XV2-2 | RA90 |
| TB6-1 | E4 | RB913 | TB13-2 | T1-7 | RB905 | XV3-7 | C51 | RB91 |
| TB6-2 | S10-18 | RB91 | TB13-3 | CB1-5 | RB903 | XV3-7 | XV2-7 | RA91 |
| TB7-2 | K9-1 | RA9 | TB13-4 | K3-13 | RB92 | XV4-1 | T4-6 | RE95 |
| TB7-3 | R12 | RA926 | TB14-1 | K4-4 | RB926 | XV4-2 | T4-5 | RE90 |
| TB9-3 | P7 | 13S | TB14-2 | K4-8 | RB925 | XV5-1 | T4-8 | RE96 |
| TB9-4 | P7 | RG-58C/U | TB14-4 | K7-5 | RB903 | XV5-2 | T4-7 | RE91 |
| TB9-5 | R4 | RA96 | TB14-5 | K7-4 | RB906 | | | |

# SECTION VI
# PARTS LIST

Linear Power Amplifier 204F-1

| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| | LINEAR POWER AMPLIFIER 204F-1<br>Single Input and Output | 522-1130-00 |
| B1 | BLOWER ASSEMBLY, CENTRIFUGAL: Input Voltage, 230 VAC; Input Current 0.37 amp; Speed, 3350 rpm | 009-1402-00 |
| C1 | CAPACITOR, FIXED, MICA: 0.001 uuf, ±10%; 1000 vdcw | 912-2055-00 |
| C2 | CAPACITOR, FABRICATED UNIT: Consists of Following: | |
| | CAPACITOR, FEEDBACK, ADJUST | 544-5820-002 |
| | BRACKET, FEEDBACK CAPACITOR | 544-5828-002 |
| | CAPACITOR, FEEDBACK | 544-5920-002 |
| C3 | CAPACITOR, FIXED, CERAMIC: 0.005 uf, +100 -20%; 500 vdcw | 913-1187-00 |
| C4 | Same as C3 | |
| C5 | CAPACITOR, FIXED, CERAMIC: 0.02 uf, +100 -20%; 500 vdcw | 913-2142-00 |
| C6 | CAPACITOR, VARIABLE, AIR: 13 -320 uuf, No. Plates 43 per Section | 921-0141-00 |
| C7 | Same as C6 | |
| C8 | Same as C3 | |
| C9 | CAPACITOR, FIXED, MICA: 0.001 uf, ±10%, 1000 vdcw | 912-2055-00 |
| C10 | CAPACITOR, FABRICATED UNIT: | 544-5740-00 |
| C11 | CAPACITOR, FIXED, MICA: 100 uuf, ±20%; 500 vdcw | 912-3602-00 |
| C12 | CAPACITOR, FIXED, CERAMIC: 2 uuf, ±1/4 uuf; 500 vdcw | 916-0075-00 |
| C13 | Same as C5 | |
| C14 | Same as C6 | |
| C15 | Same as C6 | |
| C16 | CAPACITOR, VARIABLE, AIR: 4.6 -51 uuf; No. Plates 19 | 922-0080-00 |
| C17 | CAPACITOR, FIXED, CERAMIC: 1000 uuf, ±20%; 2500 vdcw | 913-3508-00 |
| C18 | CAPACITOR, FABRICATED UNIT: Consists of Following: | |
| | CAPACITOR-NEUT, ADJUST | 544-5819-002 |
| | PLATE - CAPACITOR, COUNTERSUNK | 544-5916-002 |
| C19 | Same as C5 | |
| C20 | Same as C5 | |
| C21 | NOT USED | |
| C22 | NOT USED | |
| C23 | CAPACITOR, FIXED, CERAMIC: 0.001 uf, +80 -20%; 500 vdcw | 913-1292-00 |
| C24 | NOT USED | |
| C25 | CAPACITOR, FIXED, CERAMIC: 6800 uuf, -20 +40%; 3.5 KV | 913-3612-00 |
| C26 | CAPACITOR, VARIABLE, AIR: 35 -140 uuf; No. Plates 23 per Section | 921-0013-00 |
| C27 | Same as C26 | |
| C28 | CAPACITOR, FIXED, CERAMIC: 47 uuf, ±5%; 5000 vdcw | 913-0827-00 |
| C29 | CAPACITOR, FIXED, CERAMIC: 75 uuf, ±5%; 5000 vdcw | 913-0830-00 |
| C30 | Same as C29 | |
| C31 | Same as C29 | |
| C32 | Same as C29 | |
| C33 | Same as C28 | |
| C34 | Same as C29 | |
| C35 | CAPACITOR, FIXED, CERAMIC: 25 uuf, ±5%; 2500 vdcw | 913-4253-00 |
| C36 | Same as C29 | |
| C37 | Same as C29 | |
| C38 | Same as C35 | |
| C39 | Same as C29 | |
| C40 | CAPACITOR, VARIABLE, AIR: 100 -950 uuf, Air Gap, 0.075 | 920-0139-00 |
| C41 | CAPACITOR, VARIABLE, AIR: 80 -930 uuf, No. Plates 71 per Section | 920-0142-00 |
| C42 | CAPACITOR, FIXED, GLASS: 800 uuf, ±5%; 2000 vdcw | 914-0702-00 |
| C43 | Same as C42 | |
| C44 | CAPACITOR, FIXED, GLASS: 1600 uuf, ±5%; 2000 vdcw | 914-0703-00 |
| C45 | Same as C44 | |
| C46 | Same as C29 | |
| C47 | Same as C35 | |
| C48 | Same as C23 | |
| C49 | CAPACITOR, FIXED, PAPER: 0.10 uf, ±20%, 500 vdcw | 241-0090-00 |
| C50 | Same as C49 | |
| C51 | Same as C49 | |
| C52 | Same as C23 | |
| C53 | Same as C23 | |
| C54 Thru C60 | Same as C49 | |
| C61 | Same as C23 | |
| C62 | CAPACITOR, FIXED, CERAMIC: 0.002 uf, ±20%; 6000 vdcw | 913-3540-00 |
| C63 | CAPACITOR, FIXED, CERAMIC: 0.001 uf, +80 -20%; 500 vdcw | 913-1292-00 |
| C64 | Same as C23 | |
| C65 | CAPACITOR, FIXED, FILM: 0.2 uf, ±10%; 7500 vdcw | 933-0085-00 |
| C66 | CAPACITOR, FIXED, PAPER: 4 uf, ±10%; 4000 vdcw | 962-4216-00 |
| C67 | Same as C66 | |
| C68 | Same as C66 | |
| C69 | CAPACITOR, FIXED, GLASS: 100 uf, 55%; 350 vdcw | 183-1801-00 |
| C70 | CAPACITOR, FIXED, PAPER: 4 uf, ±20%; 600 vdcw | 962-4007-00 |
| C71 | Same as C69 | |
| C72 | Same as C69 | |
| C73 | CAPACITOR, FIXED, ELECTROLYTIC: 200 uuf, 55%; 100 vdcw | 183-1802-00 |
| C74 | CAPACITOR, FIXED, FILM: 0.1 uf, ±10%; 7500 vdcw | 933-0084-00 |
| C75 | Same as C23 | |
| C76 | Same as C5 | |
| C77 | Same as C23 | |
| C78 | Same as C5 | |
| C79 | Same as C5 | |
| C80 | Same as C5 | |
| C81 | Same as C5 | |
| C82 | Same as C5 | |
| C83 | Same as C63 | |
| C84 | Same as C5 | |
| C85 | Same as C5 | |
| C86 | Same as C69 | |
| C87 | Same as C3 | |
| C88 | Same as C3 | |
| C89 | Same as C29 | |
| C90 | Same as C29 | |
| C91 | Same as C29 | |
| C92 | Same as C35 | |
| C93 | CAPACITOR, FIXED, CERAMIC: 0.5 uf, ±2%; 500 vdcw | 916-5312-00 |
| C94 | Same as C23 | |
| C95 | Same as C23 | |
| C96 | Same as C23 | |
| C97 | CAPACITOR, FIXED, ELECTROLYTIC: 25 uf, -0 +100%; 500 vdcw | 183-1356-00 |
| C98 | Same as C49 | |
| C99 | CAPACITOR, FIXED, CERAMIC: 68 uuf, ±1%; 500 vdcw | 916-5314-00 |
| C100 | Same as C99 | |
| C101 | Same as C23 | |
| C102 | Same as C23 | |
| C103 | Same as C84 | |
| C104 | Same as C84 | |
| C105 | CAPACITOR, FIXED, ELECTROLYTIC: 10 uf, -0 +100%; 150 vdcw | 183-1358-00 |
| C106 | Same as C105 | |
| C107 | Same as C23 | |
| C108 | CAPACITOR, FIXED, PAPER DIELECTRIC: 0.1 uf 20%, 300 vdcw | 241-0087-00 |
| C109 | Same as C108 | |
| C110 | CAPACITOR, FIXED, ELECTROLYTIC: 60 uf; 15 vdcw | 183-1382-00 |
| C111 | CAPACITOR, FIXED, CERAMIC: .005 uf; 500 vdcw | 913-1187-00 |
| CB1 | CIRCUIT BREAKER: Trip Rating, 25 amp AC; Max Operating Voltage, 230 vdcw; Interrupting Capacity, 500 amp | 260-2695-00 |
| CR1 Thru CR12 | RECTIFIER, SILICON: Peak Inverse Voltage, 400; Max Current Rating, 1.5 at 100°C ambient | 353-1560-00 |
| CR13 | RECTIFIER, GERMANIUM: 1N198 diode | 353-0160-00 |
| CR14 | RECTIFIER, GERMANIUM: Matched pair of 1N198 diodes | 353-0185-00 |
| CR15 | NOT USED | |

Linear Power Amplifier 204F-1

| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| CR16 | RECTIFIER, GERMANIUM: RMS Input Voltage, 140; DC Output Voltage, 63 ±3 Volts; DC Output Current, 500 ma | 353-1021-00 |
| CR17 | RECTIFIER, SILICON: Peak Inverse Voltage, 400; Max Current Rating, 0.5 amp | 353-1567-00 |
| CR18 | Same as CR17 | |
| CR19 | Same as CR17 | |
| CR20 | Same as CR17 | |
| CR40 | Same as CR13 | |
| CR41 | RECTIFIER, SILICON: 1N1490 diode | 353-1659-00 |
| DC1 | NOT USED | |
| DC2 | NOT USED | |
| DS1 | LIGHT BULB: Candelabra Base; Current 0.027 125 vdcw; 3 w | 262-3310-00 |
| DS2 | Same as DS1 | |
| E1 | GROUND STUD | |
| E2 | GROUND STUD | |
| E3 | TERMINAL POST | 306-0234-00 |
| E4 | Same as E3 | |
| E5 | GROUND STUD | 312-3020-00 |
| E6 | GROUND STUD | |
| E7 | Same as E3 | |
| E8 | HIGH VOLTAGE FEEDTHRU | 190-1123-00<br>190-1127-00 |
| E9 | GROUND STUD | 304-1000-00 |
| E10 | GROUND LUG | 304-0317-00 |
| E11 | Same as E3 | |
| E12 | NOT USED | |
| E13 | Same as E3 | |
| E14 | Same as E3 | |
| E15 | Same as E3 | |
| E16 | Same as E3 | |
| E17 | GROUND STUD | |
| E18 | Same as E3 | |
| E19 | Same as E3 | |
| E20 | Same as E3 | |
| E21 | BASE LINER for XV1 | 541-6533-003 |
| E22 | TUBE SHIELD for V1 | 541-6555-003 |
| E23 | PLATE CLIP for V2 | 301-6000-00 |
| E24 | Same as E23 (p/o V3) | |
| E25 | PLATE CLAMP ASS'Y for V4 | 544-5821-002 |
| E26 | PLATE CLAMP ASS'Y for V5 | 544-5821-002 |
| E27 | PLATE CAP for V6 | 301-1005-00 |
| E28 | Same as E27 (p/o V7) | |
| E29 | GROUND LUG | |
| E30 | Same as E3 | |
| E31 | Same as E3 | |
| E32 | GROUND LUG | |
| E33 | GROUND LUG | |
| E34 | Same as E3 | |
| E35 | ARRESTOR: Carbon Block | 541-6779-002 |
| E36 | BASE LINER for XV8 | 541-6532-003 |
| E37 | TUBE SHIELD for V8 | 541-6550-003 |
| E38 | Same as E3 | |
| E39 | GROUND LUG | |
| E40 | GROUND LUG | |
| E41 | Same as E3 | |
| E42 | Same as E3 | |
| E43 | TERMINAL POST on right Mtg. Clip of R38 | 306-0389-00 |
| E44 | GROUND LUG | 304-0318-00 |
| F1 | FUSE, CARTRIDGE: Resistance, 0.5 ohm; Current Rating, 1.00 amp; 250 vdcw, max | 264-4280-00 |
| F2 | FUSE, CARTRIDGE: Resistance, 29 ohms; Current Rating, 0.125 amp; 250 vdcw, max | 264-4230-00 |
| F3 | Same as F1 | |
| F4 | Same as F1 | |
| F5 | FUSE, CARTRIDGE: Resistance, 1.75 ohms; Current Rating, 0.500 amp; 250 vdcw, max | 264-4260-00 |
| F6 | FUSE, CARTRIDGE: Dual Element Time Delay; Current Rating, 4 amp; Max Voltage Rating, 32 | 264-0110-00 |
| J1 | CONNECTOR, RECEPTACLE: UG-912/U, Type BNC; Single Contact | 357-9307-00 |
| J2 | Same as J1 | |
| J3 | Same as J1 | |
| J4 | CONNECTOR, RECEPTACLE: Chassis Mounting Socket with Angle Brackets; Twelve Prongs | 366-2120-00 |
| J5 | SOCKET, CRYSTAL: Two Terminal Crystal Socket for 0.125 diameter pins spaced 0.500 In. | 292-0017-00 |
| J6 | CONNECTOR, RECEPTACLE: UG-352A/U Type LC receptacle | 357-9187-00 |
| J7 | Same as J1 | |
| J8 | Same as J6 | |
| J9 Thru J11 | NOT USED | |
| K1 | CONTACTOR, POWER: Contact arrangement, 4 pole, normally open; Contact rating, 10 amp; Coil Voltage, 115 Volts, +10 -15 | 401-1357-00 |
| K2 | RELAY, TIME DELAY: Contact arrangement, 1C(SPDT); Contact rating, 10 amp at 115 Volts AC; Coil Voltage, 115 Volts AC; Time delay, 3 minutes ±10 | 402-0337-00 |
| K3 | RELAY, GENERAL PURPOSE: Contact arrangement, 4C (4PDT); Contact rating, 10 amp at 115 Volts AC; Coil Voltage, 115 Volts AC, Coil Resistance, 330 ohms, ±10% | 970-1933-00 |
| K4 | CONTACTOR, POWER: Contact arrangement, 4 pole, normally open; Contact rating, 25 amp; Coil Voltage, 115 Volts, +10 -15 | 401-1369-00 |
| K5 | RELAY, SENSITIVE: 1 amp 28 Volts DC or 115 Volts AC; Operate current, .70 ma Dc max | 408-1073-00 |
| K6 | RELAY, SPECIAL PURPOSE: Contact arrangement, SPST; Contact rating, 25 amp at 28 VDC or 115 VAC; Coil Voltage, 48 Volts DC; Coil Resistance, 600 ohms, ±10% | 970-1930-00 |
| K7 | RELAY, GENERAL PURPOSE: Contact arrangement, 2C (DPDT); Contact rating, 10 amp at 115 VAC; Coil Voltage, 28 Volts DC or 115 Volts AC; Coil Resistance, 390 ohms, ±10% | 970-1934-00 |
| K8 | RELAY, GENERAL PURPOSE: | 408-1080-00 |
| K9 | CONTACT, CIRCUIT CONTROL: Contact arrangement, 4C; Contact rating, 0.2 amp at 300 VDC and 2 amp RF; Coil Voltage, 115 Volts AC; Coil Resistance, 220 ohms, ±10% | 970-1932-00 |
| K10 | Same as K9 | |
| K11 | RELAY, SOLENOID: Pull Type Solenoid; Voltage, 115 VAC, 50/60 cps; Current, 2.5 amp surge | 411-0018-00 |
| K12 | Same as K7 | |
| K13 | NOT USED | |
| K14 | RELAY, CIRCUIT CONTROL: Contact arrangement, 2C; Contact rating, 2 amp at 300 VDC, Coil Voltage, 115 Volts AC; Coil Resistance, 400 ohms, ±10% | 970-1931-00 |
| K15 | NOT USED | |
| L1 | COIL ASSEMBLY: FAB. | 544-5984-003 |
| L2 | Same as L1 | |
| L3 | CHOKE, RADIO FREQUENCY: Inductance, 400 uh; DC Resistance, 2.1 ohms max; Current rating, 700 ma | 240-0023-00 |
| L4 | CHOKE, RADIO FREQUENCY: Inductance, 5.6 ±10%; DC Resistance, 0.95 ohms; max DC current, 1300 ma | 240-0179-00 |
| L5 | CHOKE, RADIO FREQUENCY: Inductance, 22 uh ±10%; DC Resistance, 0.3 ohms; max DC Current, 1800 ma | 240-0186-00 |
| L6 | Same as L1 | |
| L7 | Same as L1 | |
| L8 | Same as L3 | |
| L9 | Same as L3 | |
| L10 | Same as L3 | |
| L11 | Same as L3 | |
| L12 | COIL ASSEMBLY: | 544-5988-003 |
| L13 | CHOKE, RADIO FREQUENCY: Inductance, 1.0 mh ±10%; "Q" 70 min at 790 KC; Current Capacity, 60 ma | 240-0313-00 |
| L14 | INDUCTOR, RADIO FREQUENCY: RF fixed tank inductor; 3 external spacer bar type Construction; approx inductance, 20 uh | 980-0120-00 |
| L15 | Same as L14 | |
| L16 | CHOKE, RADIO FREQUENCY: Inductance, approx 44 uh; DC Resistance, 3.54 ohms; Current Capacity, 1.6 amp max DC | 240-0807-00 |
| L17 | COIL, RADIO FREQUENCY: single layer wound; two #18 AWG x 1-1/2 in. lg terminals; 44 uh inductance; 1.6 amp dc current | 240-0807-00 |
| L18 | Same as L5 | |
| L19 | Same as L5 | |
| L20 | Same as L5 | |
| L21 | REACTOR, FILTER: Inductance, 0.25 henry; Rated Current, 1.6 amp d-c; DC Resistance, 5 ohms max at +25°C | 668-0343-00 |
| L22 | REACTOR, FILTER: Inductance, 4.0 henry; Rated Current, 1.6 amp d-c; DC Resistance, 25 ohms max at +25°C | 678-1439-00 |
| L23 | REACTOR, FILTER: Inductance, 1.8 henry; Rated Current, 1.8 amp d-c; DC Resistance, 11 ohms max at +25°C | 668-0342-00 |
| L24 | REACTOR, FILTER: Inductance, 8.0 henry; Rated Current, 55 ma DC; DC Resistance, 225 ohms max at 25°C | 678-9001-00 |
| L25 | CHOKE, RADIO FREQUENCY: Inductance, 200 uh ±5%; Current Capacity, 100 ma | 240-0198-00 |
| L26 | Same as L25 | |
| L27 | Same as L3 | |
| L28 | Same as L3 | |
| L29 | COIL, PA, FIXED TURN: Left-hand wound; 1 turn soft copper tubing, bright alloy plated, 3/8 in. dia by .032 in. thk wall | 544-5992-003 |

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| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| L30 | COIL, PA, FIXED TURN: Right-hand wound; 1 turn soft copper tubing, bright alloy plated, 3/8 in. dia by .032 in. thk wall | 544-5991-003 |
| L31 | CHOKE, RADIO FREQUENCY: Inductance 2.2 uh 10% | 240-0156-00 |
| M1 | METER, DC AMMETER: D'Arsonval movement; Range, 0-2 amp; Scale div 40; Meter Resistance, 0.025 ohms; Accuracy, ±2% | 450-0099-00 |
| M2 | METER, DC: Meter Range, 0-200 V ADC, Adjust to 40-0-160 UA; Meter Resistance, 1000 ohms, ±5%; Accuracy, ±2% of full scale deflection | 458-0474-00 |
| M3 | NOT USED | |
| M4 | METER, ELAPSED TIME: Meter Range, 0-10,000 hours in 0.1 hour steps | 458-0900-00 |
| MP1 | CHIMNEY, UPPER: plastic tubing, 3-5/8 in. od by 1/16 in. thk wall; 7-1/2 in. lg. overall; 0.203 in. dia hole drilled thru both walls (incl S13) | 544-5730-00 |
| MP2 | Same as MP1 (incl. S14) | |
| MP3 | ROD ASSEMBLY, SHORTING: c/o 1/4 in. dia. brass rod, plastic handle, 4 in. coiled wire, two terminals and hardware; approx. 18 in. lg. o/a. | 544-9802-002 |
| MP4 | Same as MP3 | |
| MP5 | FILTER, AIR CONDITIONING: aluminum; 1 in. by 10 in. by 20 in. | 009-1286-00 |
| MP6 | CHART, TUNING | 544-5982-003 |
| P1 | NOT USED | |
| P2 | NOT USED | |
| P3 | NOT USED | |
| P4 | CONNECTOR: Male, 12-pin Jones type | 365-2120-00 |
| P5 | CONNECTOR: Fabricated, 2 pin. | |
| P6 | NOT USED | |
| P7 | CONNECTOR: Type UG88C/U | 357-9292-00 |
| R1 | RESISTOR, FIXED, COMPOSITION: 220 ohms, ±10%; 1/2 w | 745-1324-00 |
| R2 | RESISTOR, FIXED, COMPOSITION: 82 ohms, ±10%; 1/2 w | 745-1307-00 |
| R3 | RESISTOR, FIXED, COMPOSITION: 39,000 ohms, ±10%; 1/2 w | 745-1419-00 |
| R4 | RESISTOR, FIXED, COMPOSITION: 2500 ohms, ±10%; 14 w | 747-0772-00 |
| R5 | RESISTOR, FIXED, COMPOSITION: 1 megohm, ±10%; 1/2 w | 745-1478-00 |
| R6 | RESISTOR, FIXED, COMPOSITION: 5600 ohms, ±10%, 1/2 w | 745-1384-00 |
| R7 | RESISTOR, FIXED, COMPOSITION: 1000 ohms, ±10%; 2 w | 745-5652-00 |
| R8 | RESISTOR, FIXED, FILM: 1100 ohms, ±1%; 1/4 w | 705-7098-00 |
| R9 | RESISTOR, FIXED, COMPOSITION: 270 ohms, ±10%; 2 w | 745-5628-00 |
| R10 | Same as R9 | |
| R11 | Same as R4 | |
| R12 | Same as R4 | |
| R13 | RESISTOR, FIXED, COMPOSITION: 10 ohms ±10%; 1/2 w (p/o Z3) | 745-1268-00 |
| R14 | Same as R13 (p/o Z4) | |
| R15 | RESISTOR, VARIABLE, WIRE WOUND: 7500 ohms, ±10%; 2 w | 750-0544-00 |
| R16 | RESISTOR, FIXED, COMPOSITION: 33 ohms, ±10%; 1/2 w | 745-1289-00 |
| R17 | Same as R7 | |
| R18 | RESISTOR, FIXED, WIRE WOUND: 0.4 ohm, ±1%; 3 w | 747-9623-00 |
| R19 | Same as R7 | |
| R20 | RESISTOR, FIXED, COMPOSITION: 15 ohms, ±10%; 1 w | 745-3275-00 |
| R21 | RESISTOR, FIXED, WIRE WOUND: 4.1 ohms, ±10%; Rated amp, 7.6 | 714-1613-00 |
| R22 | RESISTOR, VARIABLE, WIRE WOUND: 1000 ohms, ±10%; Rated amp, 0.16, 25 w | 735-0050-00 |
| R23 | RESISTOR, VARIABLE WIRE WOUND: 25 ohms, ±10%; Rated amp, 1.0; 25 w | 735-0039-00 |
| R24 | RESISTOR, FIXED, WIRE WOUND: 20,000 ohms, ±5%; 210 w | 746-6723-00 |
| R25 | Same as R24 | |
| R26 | RESISTOR, FIXED, WIRE WOUND: 2000 ohms, ±5%; 113 w | 747-3706-00 |
| R27 | RESISTOR, FIXED, WIRE WOUND: 0.4 ohms, ±3%; 25 w | 747-9535-00 |
| R28 | RESISTOR, FIXED, COMPOSITION: 2700 ohms, ±10%; 2 w | 745-5670-00 |
| R29 | Same as R7 | |
| R30 | RESISTOR, FIXED, FILM: 4.9 megohms, ±1%; 2 w | 705-4255-00 |
| R31 | Same as R30 | |
| R32 | Same as R30 | |
| R33 | Same as R30 | |
| R34 | Same as R30 | |
| R35 | RESISTOR, FIXED, COMPOSITION: 470,000 ohms, ±10%; 1 w | 745-3464-00 |
| R36 | RESISTOR, FIXED, WIRE WOUND: 0.2 ohms, ±1%; 5 w | 747-9707-00 |
| R37 | Same as R36 | |
| R38 | RESISTOR, FIXED, WIRE WOUND: 630 ohms, ±5%; 11 w | 747-0247-00 |
| R39 | RESISTOR, FIXED, COMPOSITION: 4700 ohms, ±10%; 1/2 w | 745-1380-00 |
| R40 | Same as R4 | |
| R41 | Same as R15 | |
| R42 | RESISTOR, VARIABLE, COMPOSITION: 10,000 ohms ±20%; 1/2 w | 380-6277-00 |
| R43 | RESISTOR, FIXED, COMPOSITION: 1000 ohms, ±10%; 1, 2 w | 745-1352-00 |
| R44 | RESISTOR, FIXED, COMPOSITION: 470 ohms, ±10%; 1/2 w | 745-1338-00 |
| R45 | RESISTOR, VARIABLE, COMPOSITION: 500 ohms, ±20%; 1 w | 380-2603-00 |
| R46 | RESISTOR, FIXED, WIRE WOUND: 2.2 ohms, ±3%; 25 w | 747-9536-00 |
| R47 | RESISTOR, FIXED, WIRE WOUND: 5 ohms, ±10%; 14 w | 747-0718-00 |
| R48 | RESISTOR, FIXED, WIRE WOUND: 25 ohms, ±5%; 26 w | 747-1654-00 |
| R49 | RESISTOR, FIXED, WIRE WOUND: 41.6 ohms, ±1%; 3 w | 747-9689-00 |
| R50 | RESISTOR, FIXED, COMPOSITION: 56 ohms ±10%; 1/2 w (p/o Z1) | 745-1300-00 |
| R51 | RESISTOR FIXED, COMPOSITION: 8200 ohms ±10%; 2 w | 745-5691-00 |
| R52 | RESISTOR FIXED, COMPOSITION: 47 ohms ±10%; 2 w (p/o Z2) | 745-5596-00 |
| R53 | Same as R52 (p/o Z2) | |
| R54 | RESISTOR, FIXED, COMPOSITION: 47 ohms, ±10%; 1/2 w | 745-1296-00 |
| R55 | Same as R54 | |
| R56 | RESISTOR, FIXED, COMPOSITION: 1200 ohms, ±5%; 2 w | 745-5655-00 |
| R57 | Same as R56 | |
| R58 | Same as R56 | |
| R59 | Same as R56 | |
| R60 | Same as R56 | |
| R61 | Same as R56 | |
| R62 | RESISTOR, FIXED, COMPOSITION: 4700 ohms ±10%; 2 w | 745-5680-00 |
| R63 | RESISTOR, VARIABLE, COMPOSITION: 10,000 ohms, ±20%; 1/2 w | 380-6290-00 |
| R64 | RESISTOR, FIXED, COMPOSITION: 15 k ohms, ±10%; 2 w | 745-5701-00 |
| R65 | RESISTOR, FIXED, COMPOSITION: 5.6 ohms, ±10%; 1/2 w | 745-1546-00 |
| R66 | Same as R65 | |
| R67 | RESISTOR, FIXED, COMPOSITION: 12 ohms 10%; 1 w (p/o Z5) | 745-3272-00 |
| R68 | Same as R67 (p/o Z6) | |
| R69 | RESISTOR, FIXED, COMPOSITION: 39,000 ohms, ±10%; 1 w | 745-3415-00 |
| R70 | RESISTOR, FIXED, COMPOSITION: 10 ohms, ±10%; 1 w | 745-3268-00 |
| R71 | Same as R70 | |
| R72 | Same as R70 | |
| R73 | Same as R70 | |
| R74 Thru R78 | NOT USED | |
| R79 | RESISTOR, VARIABLE, COMPOSITION: 100 ohms, ±20%; 1 w | 380-5269-00 |
| R80 | RESISTOR, FIXED, COMPOSITION: 680 ohms, ±10%; 2 w | 745-5645-00 |
| S1 | SWITCH, PUSHBUTTON: Pushbutton Station; Normally open and closed; Color, Red Button | 260-2030-00 |
| S2 | SWITCH, PUSHBUTTON: Pushbutton Station; Normally open and closed; Color, Red Button | 260-2020-00 |
| S3 | Same as S2 | |
| S4 | Same as S1 | |
| S5 | SWITCH, CARTRIDGE: Thermo Switch; Opening Temperature 257°F ±10°F, Nonadjusting; Electrical Rating, 1 amp at 115 VAC and 32 VDC | 267-0088-00 |
| S6 | SWITCH, MICRO: Snap Action Single Pole Double Throw Micro Switch; Rating, 5 amp; 250 Volts AC | 260-0700-00 |
| S7 | SWITCH, TOGGLE: SPDT; Current Capacity, 4.0 amp | 266-3075-00 |
| S8 | SWITCH, THERMOSTATIC: Opening Temperature ±10°C ±3°; Closing Temperature, +20 ±3°C; Operating Volt DC, 6, 12, 30, 50; AC, 125, 250 | 266-0072-00 |
| S9 | SWITCH, ROTARY, WAFER: 2 Circuit (2 pole), 3 Position, 1 section with 30° Detent and stops | 259-1002-00 |

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| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| S10 | SWITCH, ROTARY, WAFER: 2 Circuit (2 pole), 8 Position, 1 section with 20° Detent and stops | 259-1001-00 |
| S11 | SWITCH ASSEMBLY, SHORTING: | 543-1460-003 |
| S12 | Same as S11 | |
| S15 | NOT USED | |
| T1 | TRANSFORMER, STEP-DOWN: Primary Leads 1 and 2, 200 Volts; 1 and 3, 210 Volts; 1 and 4, 220 Volts; 1 and 5, 230 Volts; 1 and 6, 240 Volts; 1 and 7, 250 Volts; Secondary Leads 8 and 9, 115 Volts ±2 | 662-0338-00 |
| T2 | TRANSFORMER, FILAMENT: Primary Voltage, 115; Secondary Voltage, 5, CT | 672-0406-00 |
| T3 | TRANSFORMER, POWER: Primary Leads 1 and 2, Primary Voltage, 230; Secondary Leads 3 and 4, Necessary as to Application | 662-0336-00 |
| T4 | TRANSFORMER, FILAMENT: Primary Leads 1 and 2, Primary Voltage, 220; Secondary Leads 3 and 4, 9 and 10, 6.3 ±3% Volts; Secondary Leads 5 and 6, 7 and 8, 6.0 ±3% Volts | 662-0337-00 |
| T5 | TRANSFORMER, POWER: Primary Leads 1 and 2, Primary Voltage, 230; Secondary Leads 3 and 4, Necessary Voltage as needed for Application | 662-0339-00 |
| T6 | TRANSFORMER, POWER: Primary Leads 1 and 2, Primary Voltage, 200; 1 and 3, 210; 1 and 4, 220; 1 and 5, 230; 1 and 6, 240; 1 and 7, 250; Secondary Leads 8 and 10, Necessary as to Application | 662-0340-00 |
| TB1 | TERMINAL BOARD: Barrier Type Terminal Board with 4 Screw Terminals | 306-0778-00 |
| TB2 | TERMINAL, STANDOFF: Center Conductor; Voltage Rating, 1000 VDC; Capacity, 5 uuf to Base | 367-0442-00 |
| TB3 | TERMINAL STRIP: Telephone Type terminal strip with 8 row of 20 terminals each | 367-0432-00 |
| TB4 | TERMINAL STRIP: Single Screw Barrier Terminal Strip; 6 Terminals | 367-0565-00 |
| TB5 | TERMINAL BOARD: Hollow Lug Terminal Board with Double Ground Lug and Two Mounting Posts | 306-0294-00 |
| TB6 | TERMINAL BOARD: For Mounting Resistors R30 Thru R35 | 544-5954-002 |
| TB7 | TERMINAL STRIP: Mounting Strip with 4 Solder Lug Terminals; One Terminal as a Ground | 306-9032-00 |
| TB8 | TERMINAL STRIP: 3 Solder Lug Terminal Strip with one Lug as a ground | 306-0001-00 |
| TB9 | TERMINAL, TURRET: Cold Headed Turret Type Terminal for Staking into Terminal or Printed Board | 306-0550-00 |
| TB10 | TERMINAL BOARD, ASSEMBLY: Board contains 20 Terminals | 544-5776-004 |
| TB11 | TERMINAL BOARD, ASSEMBLY: | 544-5948-002 |
| TB12 | TERMINAL BOARD, ASSEMBLY: | 544-5949-002 |
| TB13 | Same as TB3 | |
| TB14 | TERMINAL STRIP: Barrier Type; No. of Terminals, 10 | 367-0438-00 |
| TB15 | TERMINAL STRIP: Two Solder Lug Terminal Strips with Separate Ground Lug | 306-0168-00 |
| TB16 | NOT USED | |
| V1 | ELECTRON TUBE: Type 6CL6; 9 Pin Miniature | 255-0216-00 |
| V2 | ELECTRON TUBE: Type 6146; 7 Pin Miniature | 256-0101-00 |
| V3 | Same as V2 | |
| V4 | ELECTRON TUBE: Type 4CX1000A | 256-0123-00 |
| V5 | Same as V4 | |
| V6 | ELECTRON TUBE: Type 872A | 256-0037-00 |
| V7 | Same as V6 | |
| V8 | ELECTRON TUBE: Type 5726; 7 Pin Miniature | 253-0003-00 |
| XDS1 | LAMPHOLDER: Panel mounting type lampholder (inc. Green jewel 262 0258 00) | 262-0255-00 |
| XDS2 | Same as XDS1 (inc. Red jewel 262 0259 00) | |
| XF1 thru XF6 | FUSE HOLDER: Extractor post fuse holder for use with 3AG fuses; Rating, 15 amp; 125 Volts | 265-1019-00 |
| XV1 | SOCKET, ELECTRON TUBE: 9 Pin Miniature | 220-1337-00 |
| XV2 | SOCKET, ELECTRON TUBE: Eight Prong Octal Tube Socket | 220-1005-00 |
| XV3 | Same as XV2 | |
| XV4 | SOCKET, ELECTRON TUBE: For use with V4 | 220-1333-00 |
| XV5 | Same as XV4 | |
| XV6 | SOCKET, TUBE: Bayonet Lock, Four Prong Base for Tubes with 50 Watt Base | 220-5420-00 |
| XV7 | Same as XV6 | |
| XV8 | SOCKET, ELECTRON TUBE: 7 Pin Miniature | 220-1203-00 |
| Z1 | SUPPRESSOR, PARASITIC: 4 turns #20 AWG single conductor wire wrapped around a 1/2 w, 56 ohm resistor; incl. R50 | 545-6157-002 |
| Z2 | SUPPRESSOR, PARASITIC: 3 turns #20 AWG single conductor wire wrapped around two 47 ohm, 2 w resistors; incl R52 and R53. | 544-5769-002 |
| Z3 | SUPPRESSOR, PARASITIC: 3 turns #20 AWG single conductor wire wrapped around a 10 (Cont) | 544-5778-002 |

| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| | (Cont) ohm 1/2 w resistor; inc. R13 | |
| Z4 | Same as Z3: incl R14 | |
| Z5 | SUPPRESSOR, PARASITIC: 3 turns #18 AWG single conductor wire wrapped around a 12 ohm ±10%, 1 w resistor; incl R67 | 545-7768-002 |
| Z6 | Same as Z5; incl R68 | |
| | The above parts list represents the basic symbolized items of the transmitter assembly in this publication, except as modified for each additional captioned item of equipment. | |
| | LINEAR POWER AMPLIFIER 204F-1 Dual Input-Output with Directional Coupler (changes from 522-1130-00) | 522-1130-011 |
| C75 | NOT USED | |
| DC1 | DIRECTIONAL COUPLER: See separate parts list for component listing | 544-5707-004 |
| DC2 | Same as DC1 | |
| J9 Thru J11 | Part of K13 | |
| K13 | RELAY, COAXIAL: Contact arrangement, 1C; contact rating, 100 watts, at 160 mc; Coil Voltage, 28 Volts DC; Coil Resistance, 280 ohms, ±10% | 410-0129-00 |
| K14 | NOT USED | |
| K15 | RELAY, ANTENNA INTERLOCK: | 970-1934-00 |
| | LINEAR POWER AMPLIFIER 204F-1 Single Input-Output with Recycle Overload Unit (changes from 522-1130-00) | 522-1130-012 |
| | RECYCLE OVERLOAD UNIT: See separate parts list for component listing | 544-9493-00 |
| | LINEAR POWER AMPLIFIER 204F-1 Dual Input-Output with Recycle Overload Unit (changes from 522-1130-00 are those listed under 522-1130-011 and 522-1130-012) | 522-1130-013 |
| | LINEAR POWER AMPLIFIER 204F-1 Dual Input-Output with Wattmeter in Door (changes from 522-1130-00 are those listed under 522-1130-011, 522-1130-015, and the following) | 522-1130-014 |
| V6 | ELECTRON TUBE: Type 4B32 | 256-0097-00 |
| V7 | Same as V6 | |
| | LINEAR POWER AMPLIFIER 204F-1 Single Input-Output with Wattmeter in Door (changes from 522-1130-00) | 522-1130-015 |
| DC1 | DIRECTIONAL COUPLER: See separate parts list for component listing | 544-5707-004 |
| M3 | METER, DC MICROAMMETER: Meter Scale, 0-5KV; Meter Range, 0-100 UA DC; Meter Resistance, 2000 ohms ±5%; Accuracy, ±2% of full scale deflection | 458-0475-00 |
| R75 | RESISTOR, FIXED, COMPOSITION: 2000 ohms, ±5%; 1/4 w | 745-0759-00 |
| R76 | Same as R75 | |
| R77 | Same as R75 | |
| R78 | Same as R75 | |
| S15 | SWITCH, ROTARY, WAFER: 5 Circuit (5 pole), 4 Position, 1 section with 20° Detent and stops | 259-1202-00 |
| TB16 | TERMINAL BOARD: Board contains 10 terminals; One terminal as ground | 367-0438-00 |
| | DIRECTIONAL COUPLER | 544-5707-004 |
| C1 | CAPACITOR, ASSEMBLY: c/o brass plate 0.064 in. thk, 9/16 in od, 8-32 NC-2B id, brass stud externally thd 8-32 NC-2B, 3/4 in. lg | 543-3492-002 |
| C2 | Same as C1 | 543-3492-002 |
| C3 | CAPACITOR, FIXED, MICA: 100 uuf, ±20%, 500 v dc | 912-0669-00 |
| C4 | Same as C3 | 912-0669-00 |
| C5 | CAPACITOR, FIXED, ELECTROLYTIC: aluminum; 8 uf, -15% +100%, 120 cps, 6 v dc | 183-1167-00 |
| C6 | Same as C5 | 183-1167-00 |

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| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|---|---|---|
| C7 | CAPACITOR, FIXED, CERAMIC: 39 uuf, ±1%, 500 v dc | 916-4350-00 |
| C8 | Same as C7 | 916-4350-00 |
| C9 | CAPACITOR, FIXED, CERAMIC: 1000 uuf, +80% -20%, 500 v dc | 913-1292-00 |
| C10 | Same as C9 | 913-1292-00 |
| C11 | CAPACITOR, FIXED, CERAMIC: 68 uuf, ±1%, 500 v dc | 916-4786-00 |
| C12 | Same as C11 | 916-4786-00 |
| CR1 | SEMICONDUCTOR DEVICE, DIODE: germanium; Sylvania type 1N60 | 353-2010-00 |
| CR2 | Same as CR1 | 353-2010-00 |
| J1 | CONNECTOR, RECEPTACLE, ELECTRICAL: 1 rd female contact, 50 ohms, straight shape | 357-9187-00 |
| J2 | Same as J1 | 357-9187-00 |
| L1 | COIL, RADIO FREQUENCY: universal wound, 4 pi; 139 turns #36 AWG each section; 2.0 mh inductance, 50,000 ohms; 100 ma current | 240-0134-00 |
| L2 | Same as L1 | 240-0134-00 |
| R1 | RESISTOR, FIXED, COMPOSITION: 10 ohms, ±1%, 2 w | 714-1075-00 |
| R2 | Same as R1 | 714-1075-00 |
| *R3 | RESISTOR, FIXED, FILM: 18,700 ohms, ±1%, 1/4 w | 705-7157-00 |
| *R3 | RESISTOR, FIXED, FILM: 19,600 ohms, ±1%, 1/4 w | 705-7158-00 |
| *R3 | RESISTOR, FIXED, FILM: 20,500 ohms, ±1%, 1/4 w | 705-7159-00 |
| *R3 | RESISTOR, FIXED, FILM: 21,500 ohms, ±1%, 1/4 w | 705-7160-00 |
| *R3 | RESISTOR, FIXED, FILM: 18,200 ohms, ±1%, 1/4 w | 705-7298-00 |
| *R3 | RESISTOR, FIXED, FILM: 19,100 ohms, ±1%, 1/4 w | 705-7303-00 |
| *R3 | RESISTOR, FIXED, FILM: 20,000 ohms, ±1%, 1/4 w | 705-7304-00 |
| *R3 | RESISTOR, FIXED, FILM: 21,000 ohms, ±1%, 1/4 w | 705-7305-00 |
| *R3 | RESISTOR, FIXED, FILM: 22,100 ohms, ±1%, 1/4 w | 705-7306-00 |
| *R4 | Same as *R3 | 705-7157-00 |
| *R4 | Same as *R3 | 705-7158-00 |
| *R4 | Same as *R3 | 705-7159-00 |
| *R4 | Same as *R3 | 705-7160-00 |
| *R4 | Same as *R3 | 705-7298-00 |
| *R4 | Same as *R3 | 705-7303-00 |
| *R4 | Same as *R3 | 705-7304-00 |
| *R4 | Same as *R3 | 705-7305-00 |
| *R4 | Same as *R3 | 705-7306-00 |
| R5 | RESISTOR, FIXED, COMPOSITION: 1000 ohms, ±10%, 1/2 w | 745-1352-00 |
| R6 | RESISTOR, FIXED, COMPOSITION: same as R5 | 745-1352-00 |
| | RECYCLE OVERLOAD UNIT | 544-9493-00 |
| B1 | RELAY, TIMER: | 402-0124-00 |
| C1 | CAPACITOR, FIXED, ELECTROLYTIC: 60 uf, -0 +100%; 50 vdcw | 183-1351-00 |
| K1 | RELAY: Coil Voltage, 26.5 V; Coil Resistance 380 ohms, ±10%; C Type Contacts | 972-1168-00 |
| K2 | Same as K1 | |
| R1 | RESISTOR, FIXED, COMPOSITION: 5600 ohms, ±10%; 1 w | 745-3384-00 |
| TB1 | TERMINAL STRIP: 6 Terminal; 3-1/16 in. long | 367-0434-00 |

*R3, R4 value selected in final test.

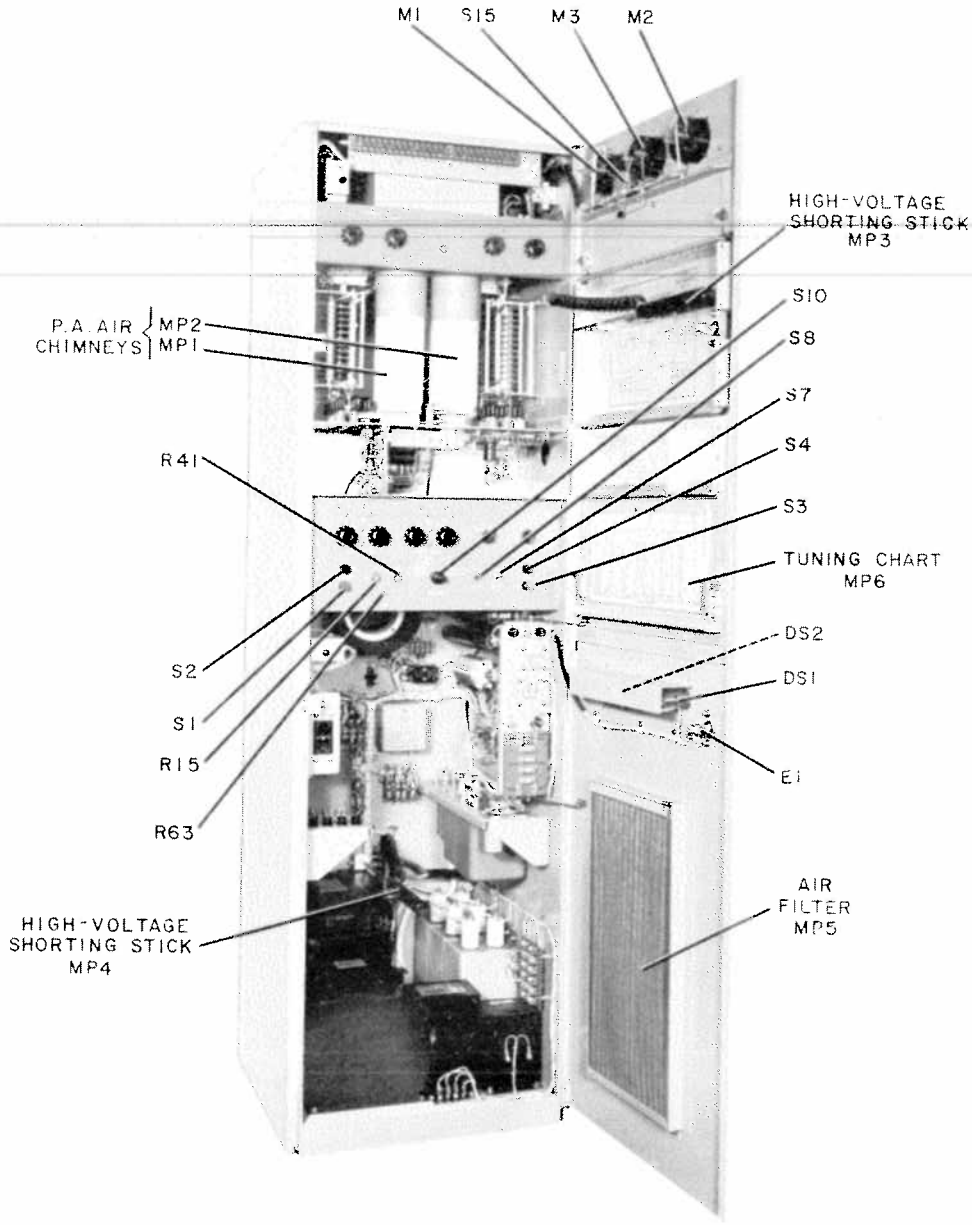



Figure 6-1. Linear Power Amplifier 204F-1, Front View, Cabinet Doors Open

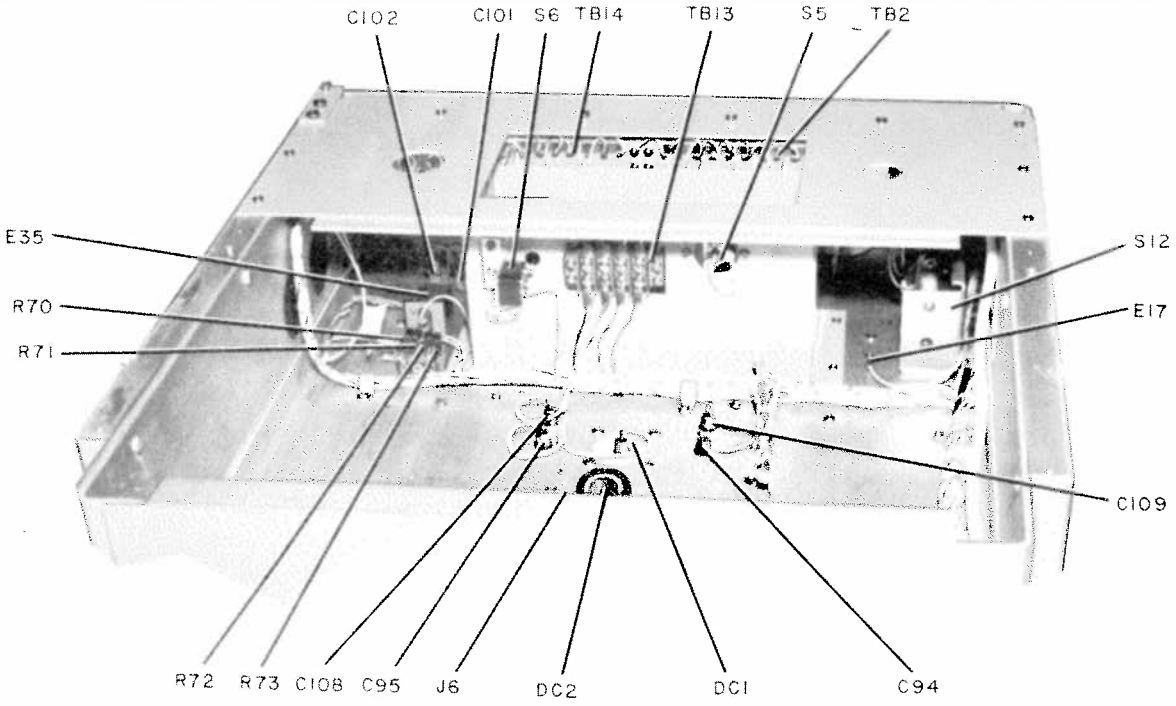



Figure 6-2. Linear Power Amplifier 204F-1, Access Compartment, Parts Identification

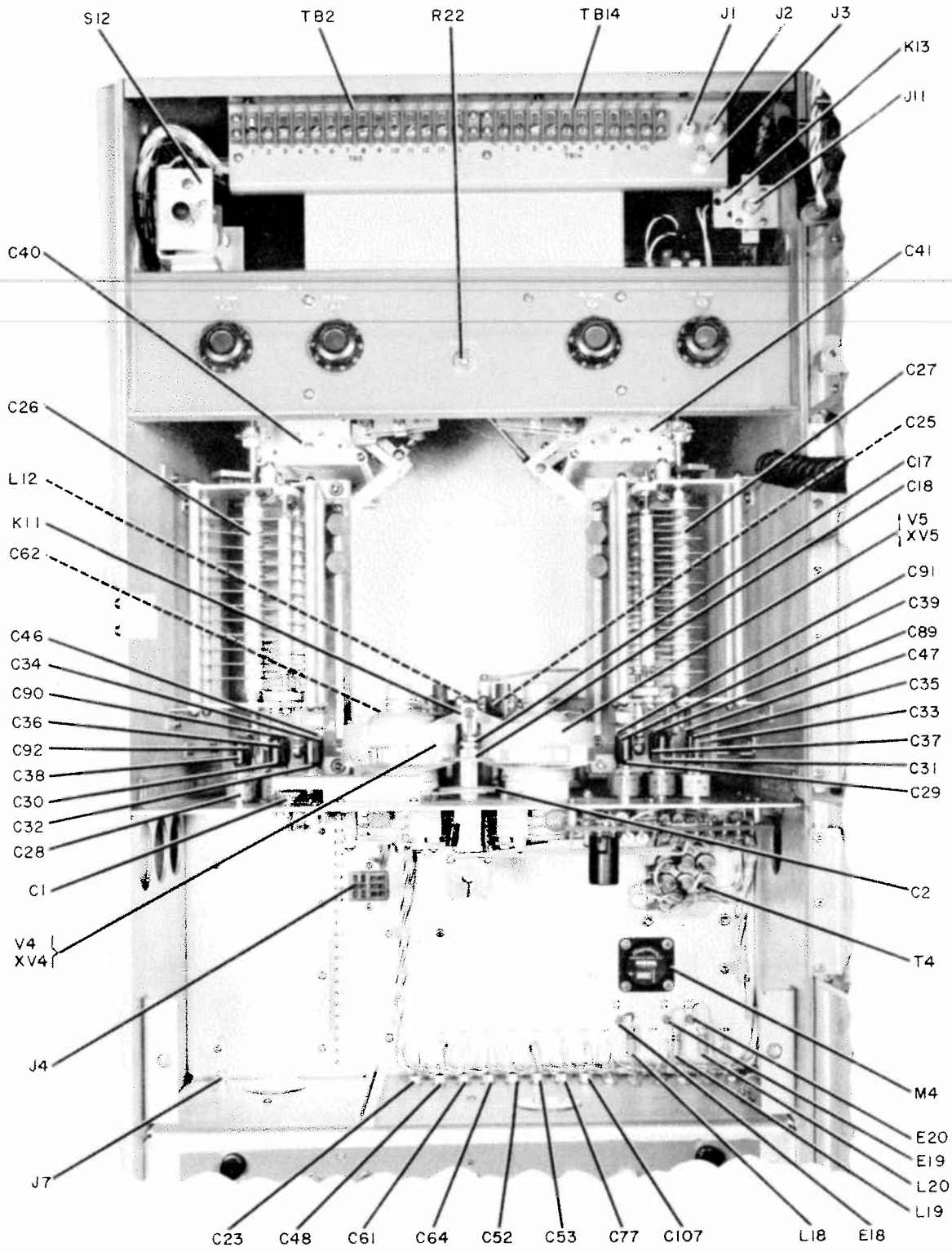



Figure 6-3. Linear Power Amplifier 204F-1, Access, R-F, and Grid Compartments, Parts Identification

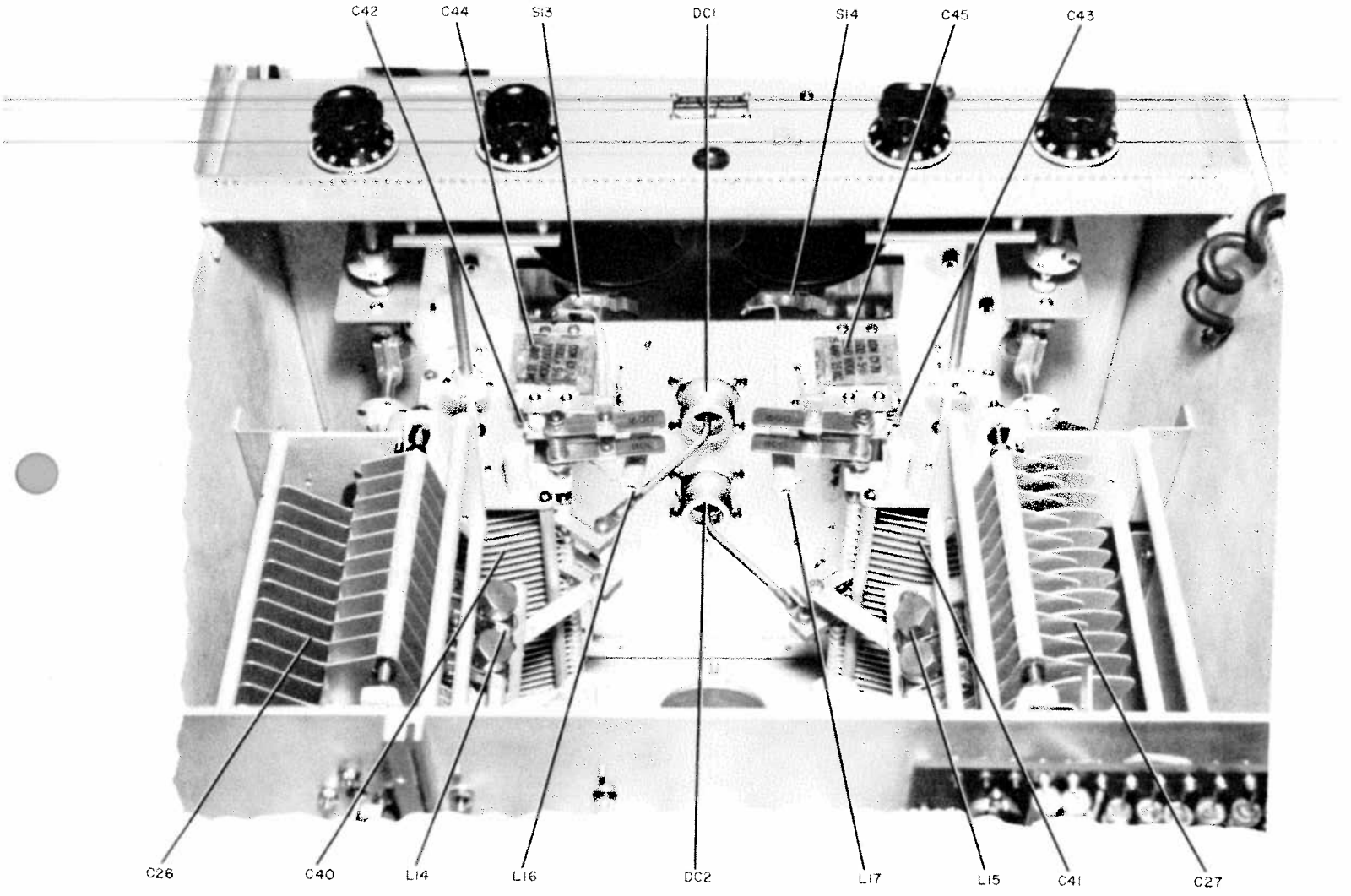
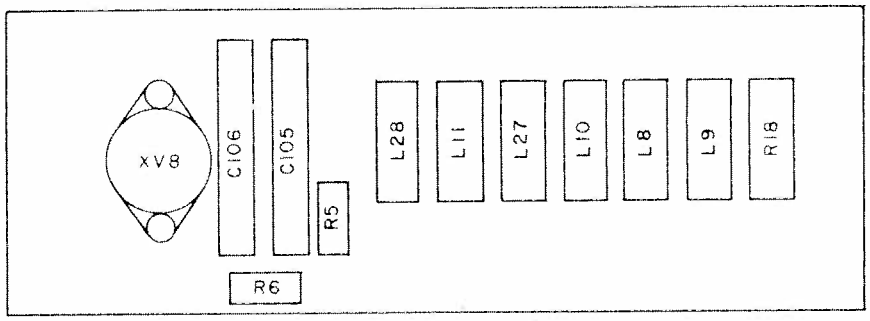
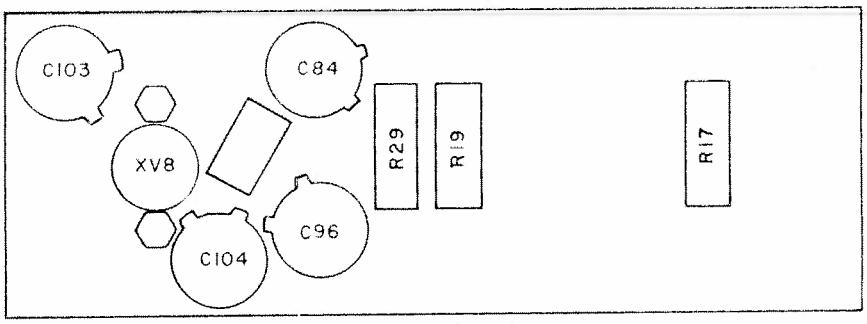



Figure 6-4. Linear Power Amplifier 204F-1, R-F Compartment, Parts Identification




BOTTOM VIEW TB10




TOP VIEW TB10

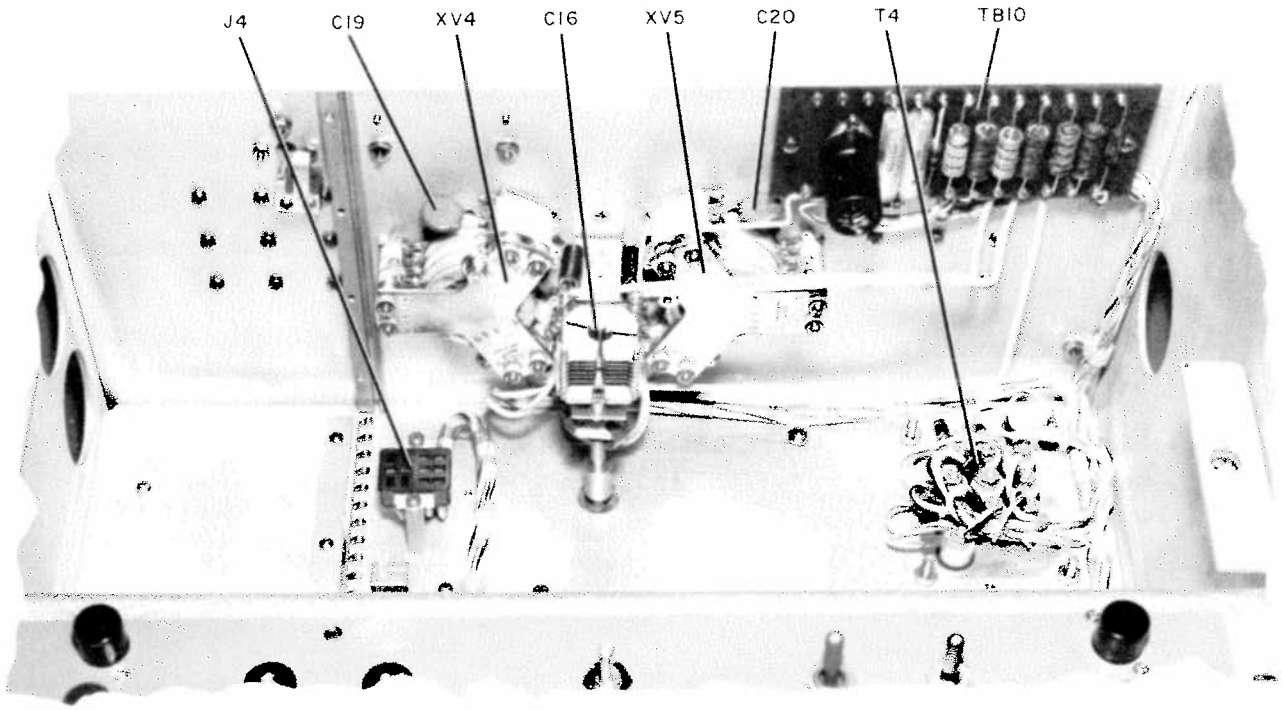



Figure 6-5. Linear Power Amplifier 204F-1, Grid Compartment, Parts Identification

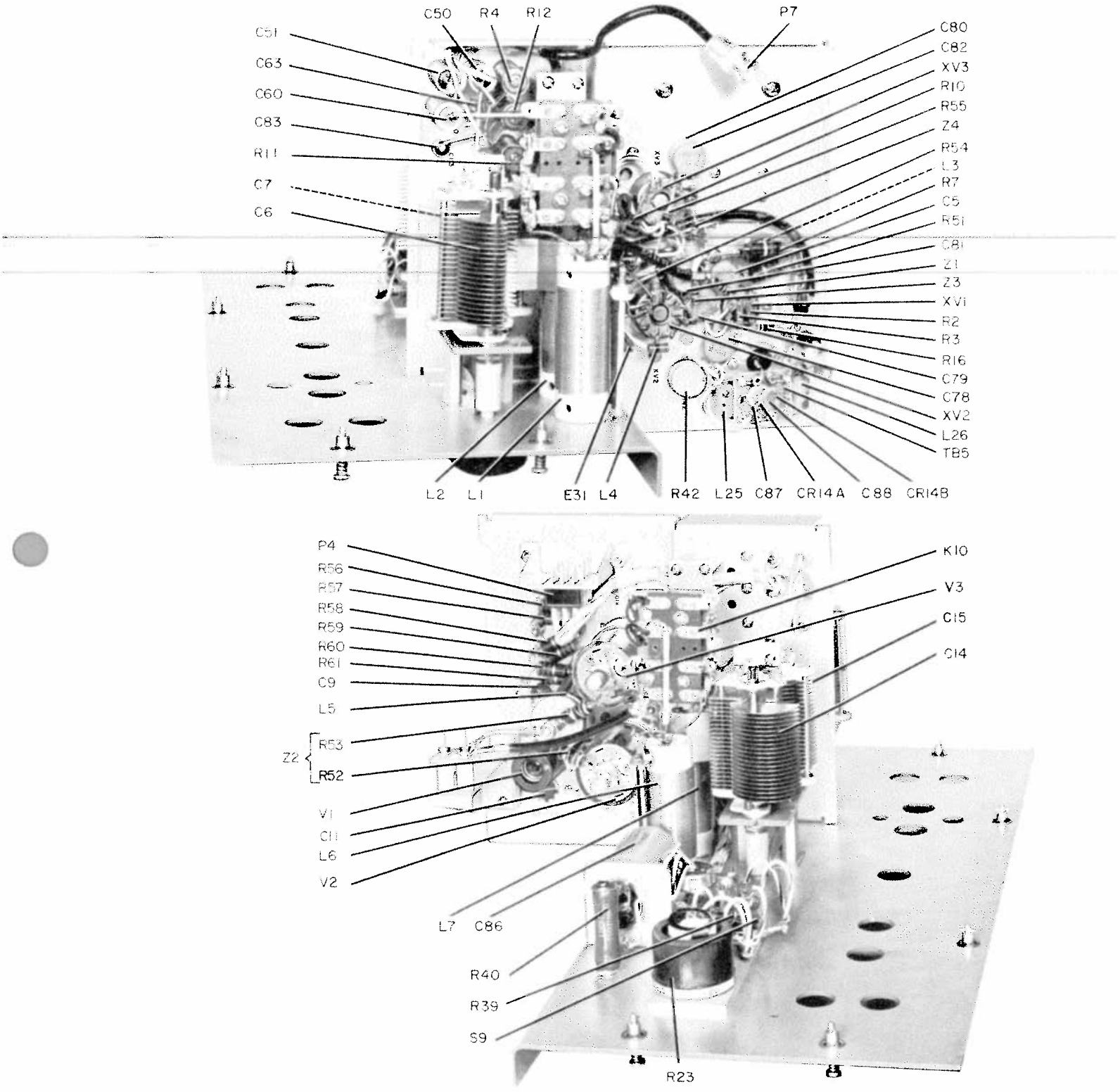



Figure 6-6. Linear Power Amplifier 204F-1, Grid Chassis, Parts Identification

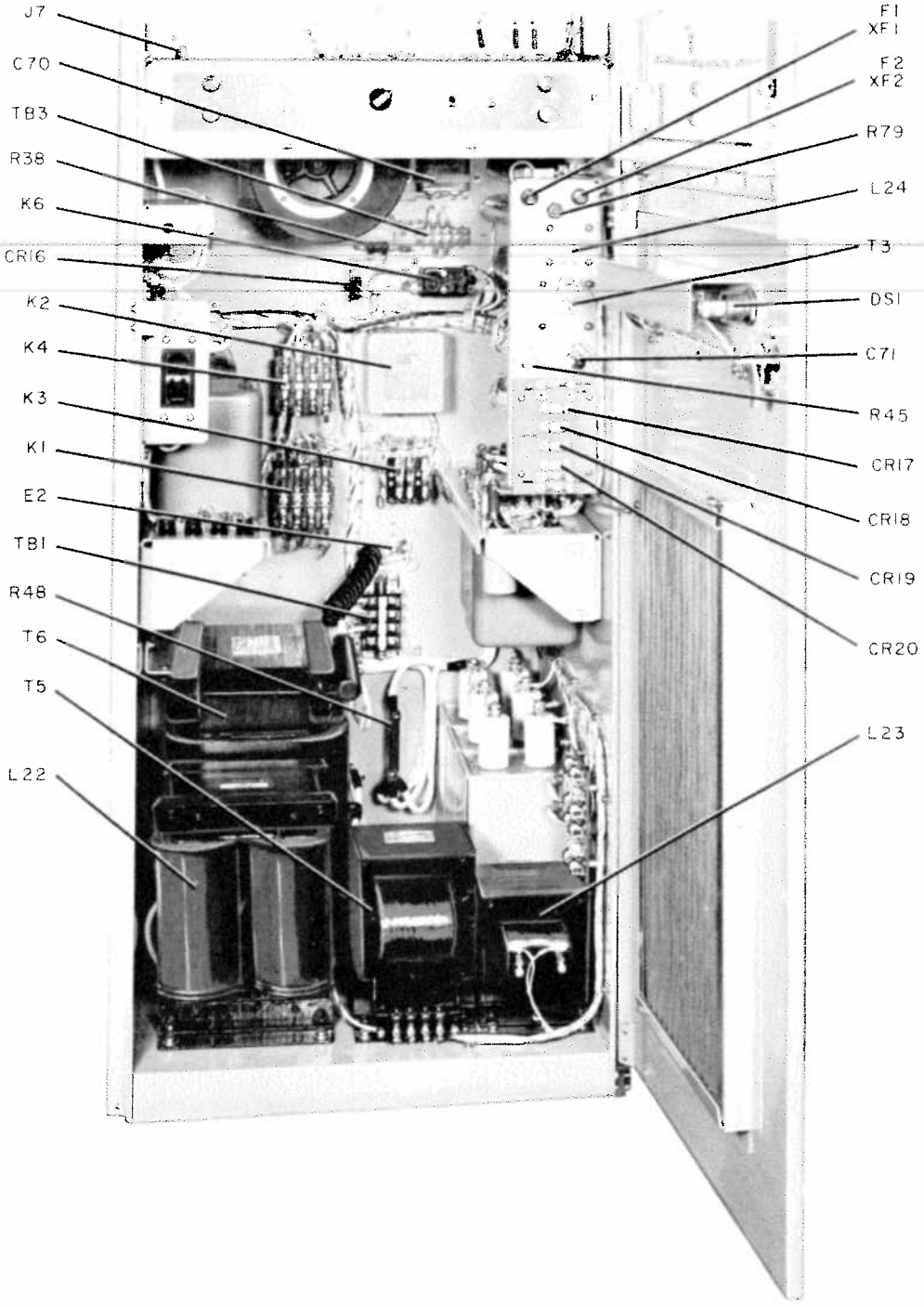



Figure 6-7. Linear Power Amplifier 204F-1, Power Supply Compartment, Front View, Parts Identification

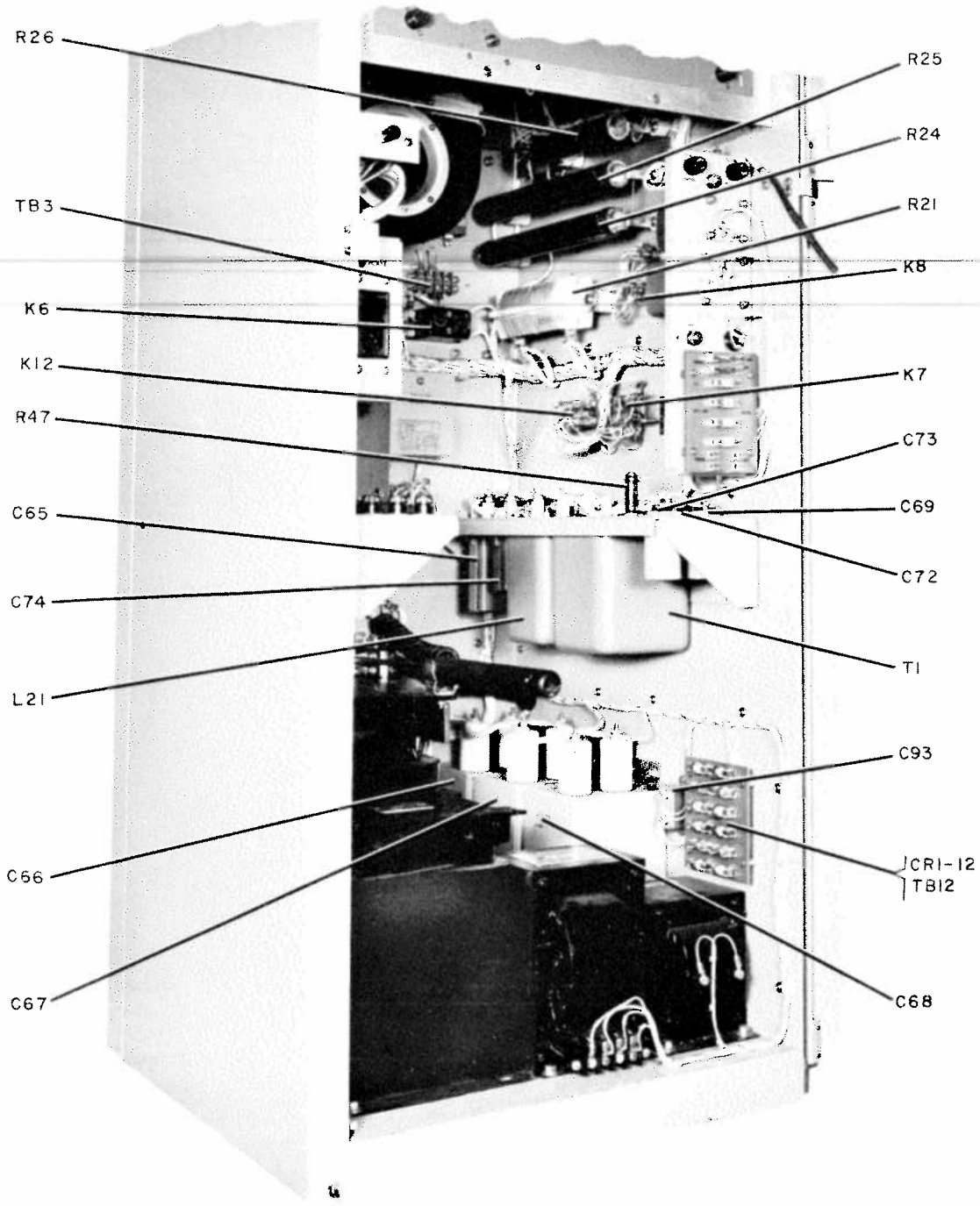



Figure 6-8. Linear Power Amplifier 204F-1, Power Supply Compartment, Right-Side View, Parts Identification

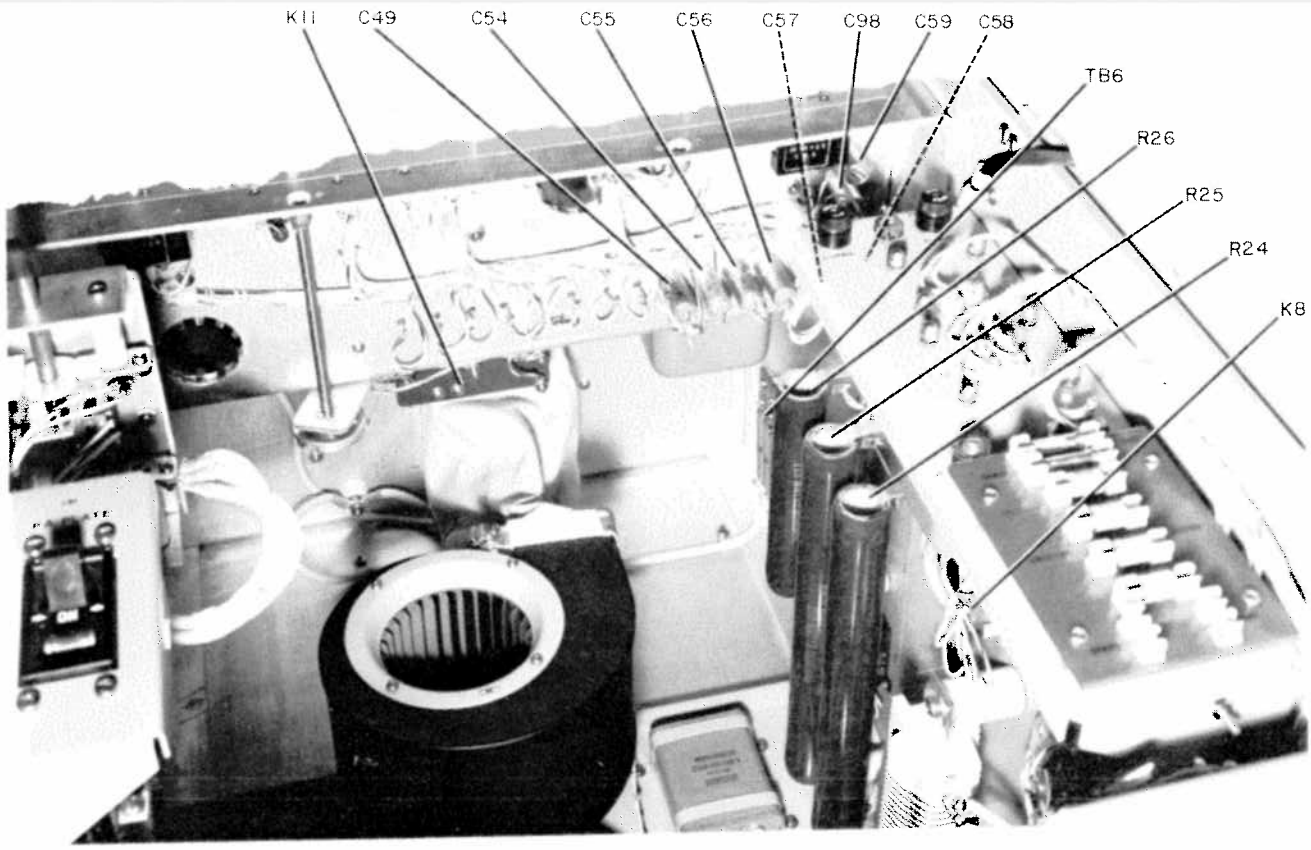



Figure 6-9. Linear Power Amplifier 204F-1, Power Supply Compartment, Upper Right-Side View, Parts Identification

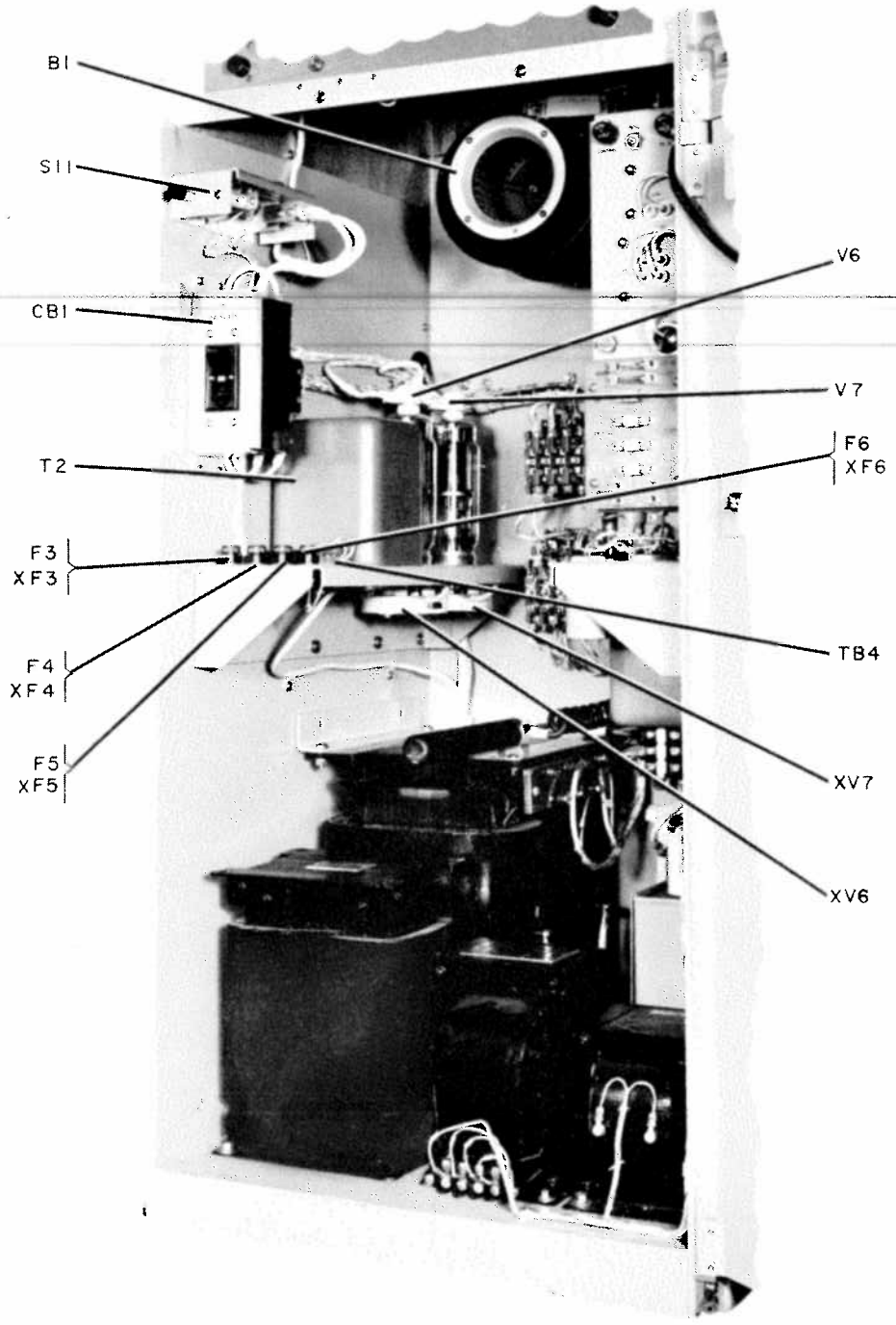
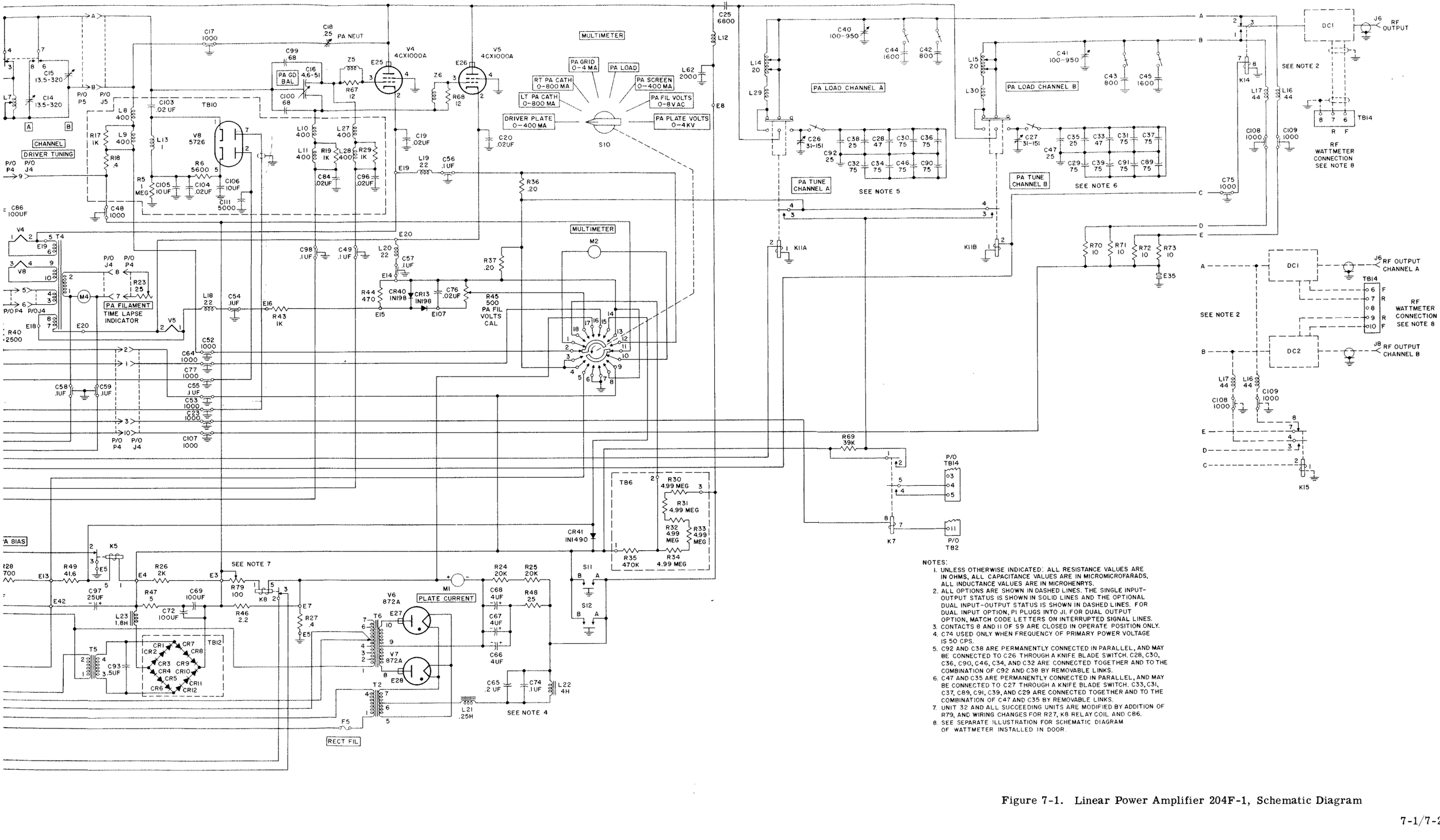



Figure 6-10. Linear Power Amplifier 204F-1, Power Supply Compartment, Left-Side View, Parts Identification

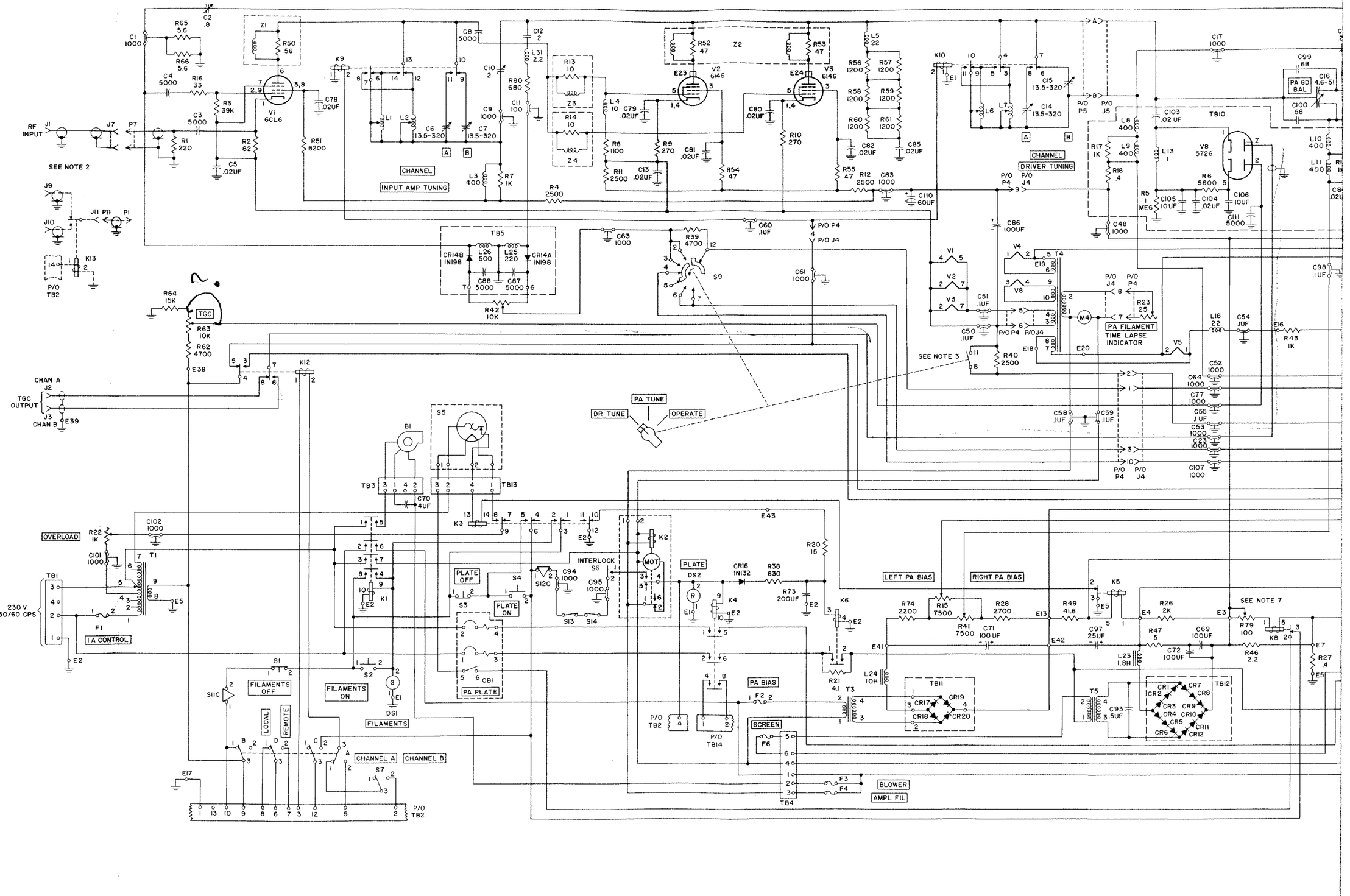
# SECTION VII
# ILLUSTRATIONS




NOTES:

1. UNLESS OTHERWISE INDICATED: ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS, ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
2. ALL OPTIONS ARE SHOWN IN DASHED LINES. THE SINGLE INPUT-OUTPUT STATUS IS SHOWN IN SOLID LINES AND THE OPTIONAL DUAL INPUT-OUTPUT STATUS IS SHOWN IN DASHED LINES. FOR DUAL INPUT OPTION, P1 PLUGS INTO J1. FOR DUAL OUTPUT OPTION, MATCH CODE LETTERS ON INTERRUPTED SIGNAL LINES.
3. CONTACTS 8 AND 11 OF S9 ARE CLOSED IN OPERATE POSITION ONLY.
4. C74 USED ONLY WHEN FREQUENCY OF PRIMARY POWER VOLTAGE IS 50 CPS.
5. C92 AND C38 ARE PERMANENTLY CONNECTED IN PARALLEL, AND MAY BE CONNECTED TO C26 THROUGH A KNIFE BLADE SWITCH. C28, C30, C36, C90, C46, C34, AND C32 ARE CONNECTED TOGETHER AND TO THE COMBINATION OF C92 AND C38 BY REMOVABLE LINKS.
6. C47 AND C35 ARE PERMANENTLY CONNECTED IN PARALLEL, AND MAY BE CONNECTED TO C27 THROUGH A KNIFE BLADE SWITCH. C33, C31, C37, C89, C91, C39, AND C29 ARE CONNECTED TOGETHER AND TO THE COMBINATION OF C47 AND C35 BY REMOVABLE LINKS.
7. UNIT 32 AND ALL SUCCEEDING UNITS ARE MODIFIED BY ADDITION OF R79, AND WIRING CHANGES FOR R27, K8 RELAY COIL AND C86.
8. SEE SEPARATE ILLUSTRATION FOR SCHEMATIC DIAGRAM OF WATTMETER INSTALLED IN DOOR.

Figure 7-1. Linear Power Amplifier 204F-1, Schematic Diagram


RF INPUT
J1
J7
P7
SEE NOTE 2
V1 6CL6
Z1
Z2
Z3
Z4
CHANNEL
INPUT AMP TUNING
CHANNEL
DRIVER TUNING
V2 6146
V3 6146
E23
E24
TB10
V8 5726
PA GD BAL
PA FILAMENT
TIME LAPSE
INDICATOR
M4
TB5
CR14B IN198
CR14A IN198
S9
TGC
CHAN A
J2
TGC OUTPUT
J3
CHAN B
E39
E38
K12
PA TUNE
DR TUNE
OPERATE
B1
S5
TB3
TB13
C70 4UF
K3
K2
MOT
OVERLOAD
T1
TB1
230 V 50/60 CPS
F1
1A CONTROL
S1
S2
S11C
FILAMENTS OFF
FILAMENTS ON
FILAMENTS
DS1
LOCAL
REMOTE
CHANNEL A
CHANNEL B
E17
P/O TB2
PLATE OFF
PLATE ON
S3
S4
S12C
S13
S14
INTERLOCK S6
PLATE
DS2
CR16 IN132
K4
K6
CB1
PA PLATE
PA BIAS
P/O TB2
P/O TB14
SCREEN
F6
TB4
F3
F4
BLOWER
AMPL FIL
LEFT PA BIAS
RIGHT PA BIAS
T3
T5
TB11
TB12
CR17
CR18
CR19
CR20
CR1
CR2
CR3
CR4
CR5
CR6
CR7
CR8
CR9
CR10
CR11
CR12
K5
K8
SEE NOTE 7
SEE NOTE 3
K10
K9
K13
P/O TB2
P/O P4
P/O J4
P/O P5
P/O J5
E1
E2
E5
E10
E18
E19
E20
E41
E42
E43
R1 220
R2 82
R3 39K
R4 2500
R5 1 MEG
R6 5600
R7 1K
R8 1100
R9 270
R10 270
R11 2500
R12 2500
R13 10
R14 10
R15 7500
R16 33
R17 1K
R18 4
R20 15
R21 4.1
R22 1K
R23 25
R26 2K
R27 .4
R28 2700
R37 1K
R38 630
R39 4700
R40 2500
R41 7500
R42 10K
R43 1K
R46 2.2
R47 5
R49 41.6
R50 56
R51 8200
R52 47
R53 47
R54 47
R55 47
R56 1200
R57 1200
R58 1200
R59 1200
R60 1200
R61 1200
R63 10K
R64 15K
R65 5.6
R66 5.6
R73 200UF
R79 100
C1 1000
C2 .8
C3 5000
C4 5000
C5 .02UF
C6 13.5-320
C7 13.5-320
C8 5000
C9 1000
C10 2
C11 100
C12 2
C13 .02UF
C14 13.5-320
C15 13.5-320
C16 4.6-51
C17 1000
C48 1000
C50 .1UF
C51 .1UF
C52 1000
C53 1000
C54 1UF
C55 .1 UF
C58 .1UF
C59 .1UF
C60 .1UF
C61 1000
C63 1000
C64 1000
C69 100UF
C71 100 UF
C72 100UF
C77 1000
C78 .02UF
C79 .02UF
C80 .02UF
C81 .02UF
C82 .02UF
C83 1000
C85 .02UF
C86 100UF
C87 5000
C88 5000
C93 3.5UF
C94 1000
C95 1000
C97 25UF
C98 .1UF
C99 68
C100 68
C101 1000
C102 1000
C103 .02 UF
C104 .02UF
C105 10UF
C106 10UF
C107 1000
C110 60UF
C111 5000
L1
L2
L3 400
L4 10
L5 22
L7
L8 400
L9 400
L10 400
L11 400
L13 1
L18 22
L23 1.8H
L24 10H
L31 2.2
L25 220
L26 500
CR148 IN198
CR14A IN198
K1
K2
K3
K4
K5
K6
K8
K9
K10
K11
K12
K13
S7
S11C
S12C
S13
S14
T1
T3
T4
T5
V1
V2
V3
V4
V5
V8
E1
E2
E5
E10
E17
E18
E19
E20
E38
E39
E41
E42
E43

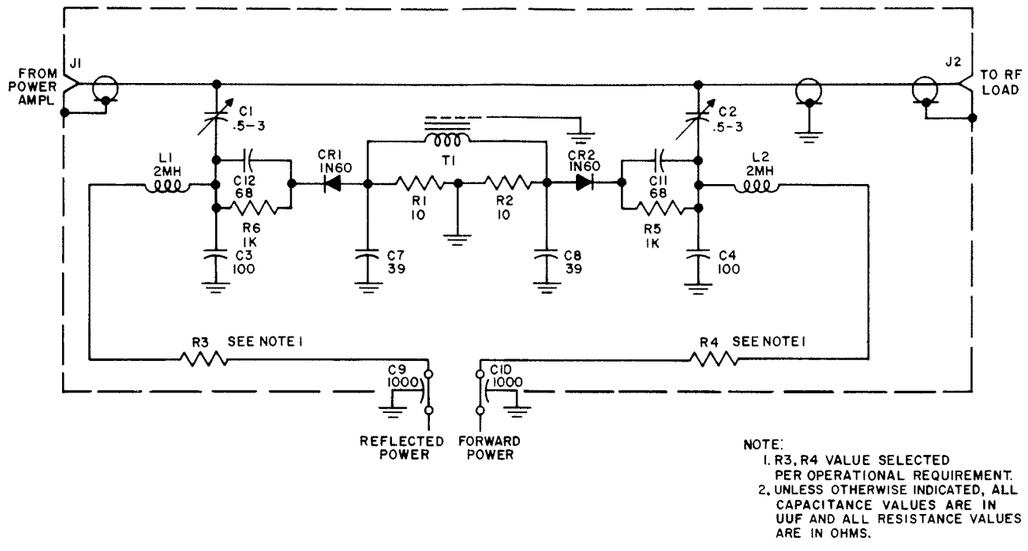
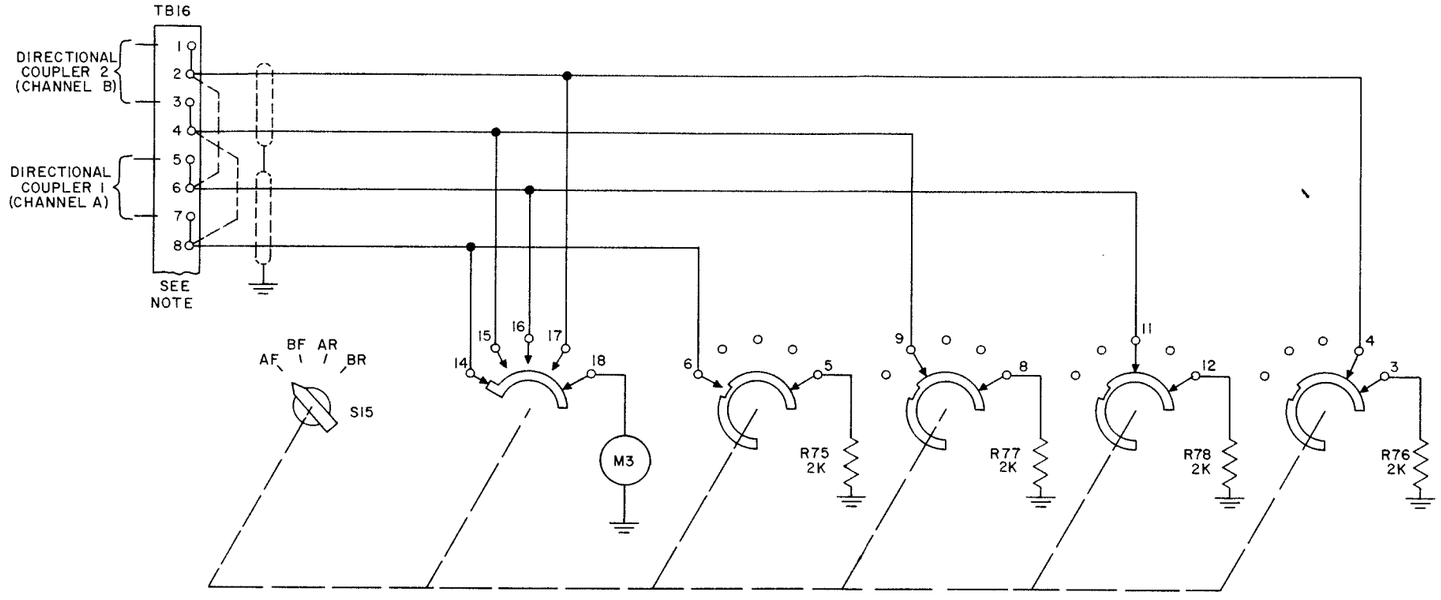



Figure 7-2. Directional Coupler, Schematic Diagram




NOTE:

WHEN ONE DIRECTIONAL COUPLER IS USED, ADD JUMPERS 2-6 AND 4-8 AT TB16.
WHEN EXTERNAL WATTMETER IS USED, REMOVE JUMPERS 1-2, 3-4; 5-6, AND 7-8 AT TB16.

Figure 7-3. Output Wattmeter Installed in Door, Schematic Diagram

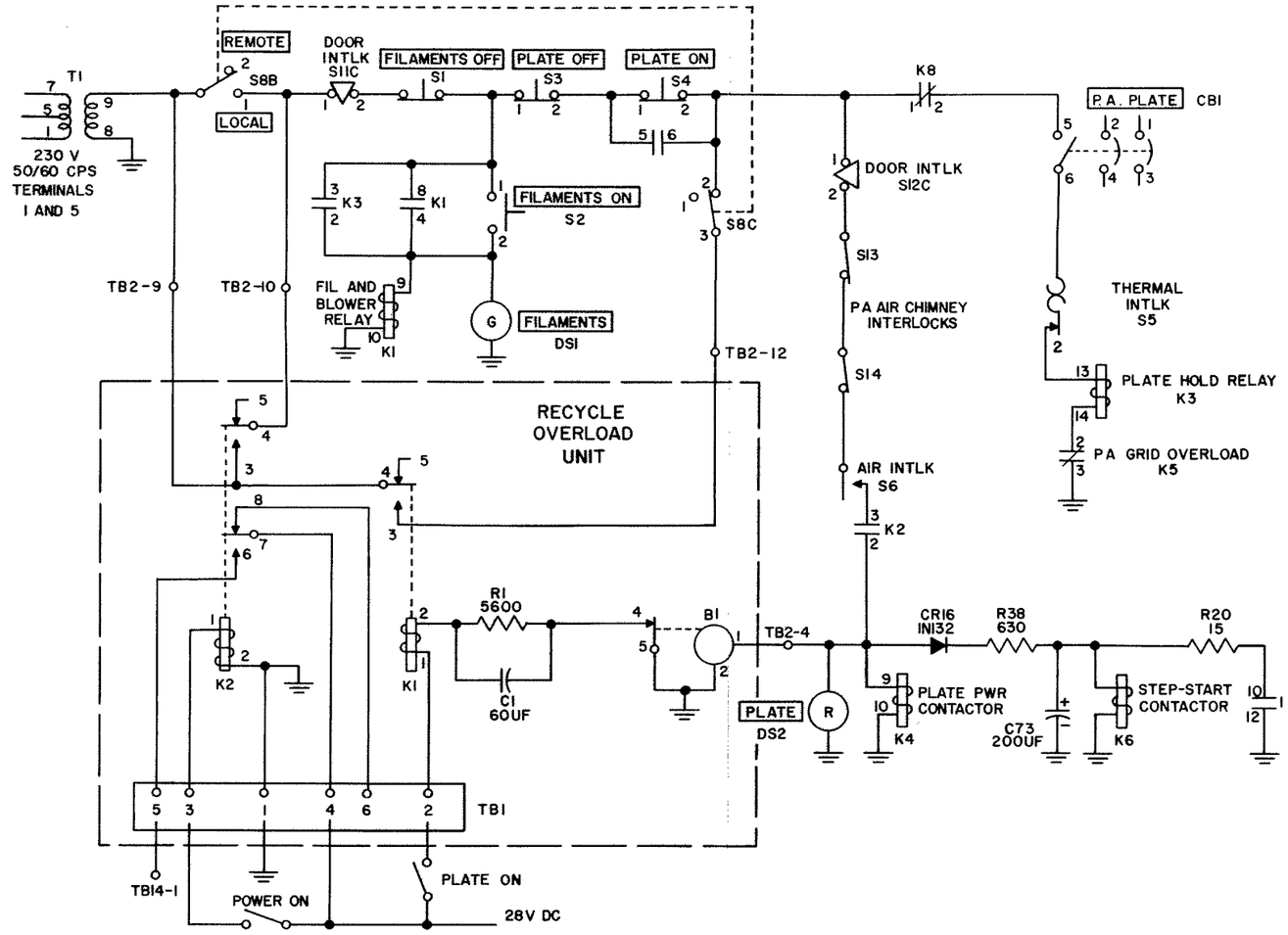



Figure 7-4. Linear Power Amplifier 204F-1, Recyc Overload Unit, Simplified Schematic Diagram