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HANDBOOK
OPERATING INSTRUCTIONS

**FREQUENCY SHIFT KEYER
TYPE 105 MODEL 4**

(NORTHERN RADIO CO., INC.)

TABLE OF CONTENTS

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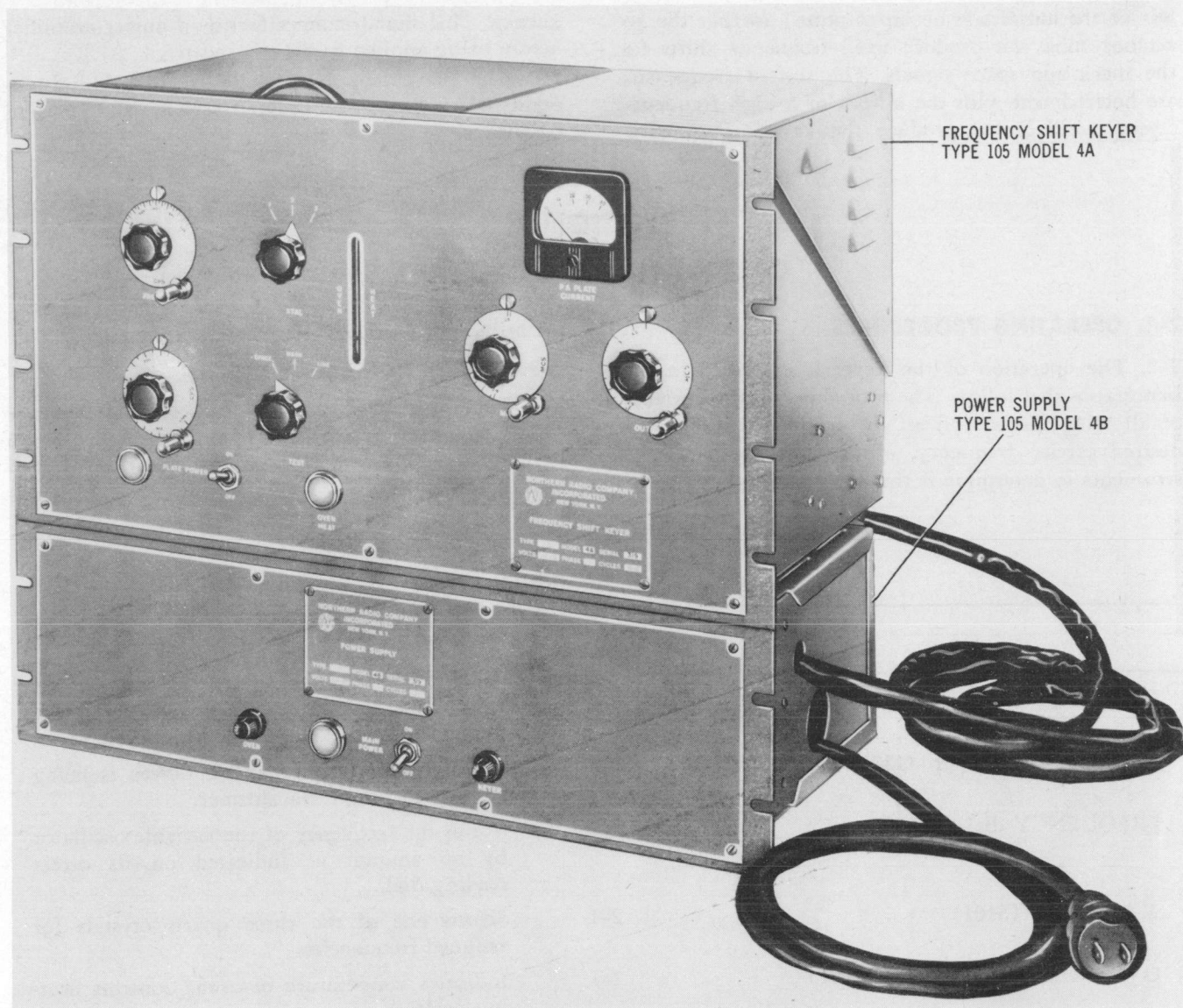


Figure 1-1. Frequency Shift Keyer Type 105 Model 4

SECTION I GENERAL DESCRIPTION

1-1. SCOPE OF HANDBOOK.

1-2. This handbook describes the operating procedures and minor repairs that operating personnel may perform on Frequency Shift Keyer Type 105 Model 4A and Power Supply Type 105 Model 4B, manufactured by the Northern Radio Company, Incorporated by the Northern Radio Company, Incorporated, New York, N. Y. (See figure 1-1.)

1-3. PURPOSE OF EQUIPMENT.

1-4. GENERAL. The frequency shift keyer is used to convert existing amplitude-modulated transmitters so that they can transmit frequency shifted signals.

1-5. The keyer is essentially a variable frequency oscillator which replaces the fixed frequency oscillator in a transmitter. It produces carrier shifts for the transmission of mark and space teleprinter pulses. It can also be used to produce a linear frequency shift for the transmission of facsimile or telephoto signals.

1-6. The keyer (whether factory wired for 2.5 mc through 6.7 mc operation, or field modified for 1.75 mc through 4.5 mc operation) operates as follows. Incoming keyed pulses are passed through an amplitude limiting circuit to a reactance modulator which controls the frequency of a variable oscillator. The amplitude limiter produces fixed amplitude pulses (regard-

less of the amplitude of input pulse) so that the reactance tube can produce fixed frequency shifts for the mark and space signals. The shifted frequencies are heterodyned with the output of a high frequency crystal oscillator to produce the keyer's output fre-

quency. This signal is amplified by a power amplifier before being applied to the transmitter.

1-7. The power supply provides regulated and unregulated voltages for plate, screen, and biasing circuits.

SECTION II

OPERATING PROCEDURES

2-1. OPERATING PROCEDURES.

2-2. The operation of the keyer is described in the paragraphs that follow. The procedure consists, briefly, of allowing the equipment to warm up, tuning to a desired carrier frequency, observing front panel instruments to determine if the keyer is operating satis-

factorily, and changing frequencies as required.

2-3. DESCRIPTION OF CONTROLS.

2-4. Table 2-1 lists each of the keyer and power supply operating controls and their functions. Refer to figures 2-1 and 2-2 for the physical location of each of these controls.

TABLE 2-1
CONTROLS

Control	Figure Number	Function
MAIN POWER switch (S201)	2-2	In ON position applies the a-c line voltage to the power supply, and to the heating elements.
MAIN POWER lamp (I201)	2-2	When lit, indicates that a-c power is being applied to power transformer.
FREQUENCY dial (C115)	2-1	Varies the frequency of the variable oscillator by an amount as indicated on its direct reading dial.
XTAL knob (S101)	2-1	Selects one of the three quartz crystals for assigned frequencies.
OVEN HEAT thermostat (M101)	2-1	Indicates temperature of oven. Controls heating cycle.
PA PLATE CURRENT meter (M102)	2-1	Visual tuning device.
MIXER dial (C135)	2-1	Tuning control for mixer circuits.
OUTPUT (dial) (C136)	2-1	Tuning control for power amplifier.
SHIFT dial (R125)	2-1	Determines the amount of shift that any given keying signal will cause. The direct reading dial can be set for any amount of shift up to 1000 cps.
TEST knob (S102)	2-1	In MARK and SPACE, permits selection of mark or space keying conditions for test purposes. In LINE, permits normal frequency shift operation.
PLATE POWER switch (S104)	2-1	In the ON position, applies +250 volts d-c to the plate circuits of high level stages.
PLATE POWER lamp (I101)	2-1	When lit, indicates that power transformer is functioning.
OVEN HEAT lamp (I102)	2-1	When lit, indicates that heating system is on. When extinguished, indicates that heating system is off.

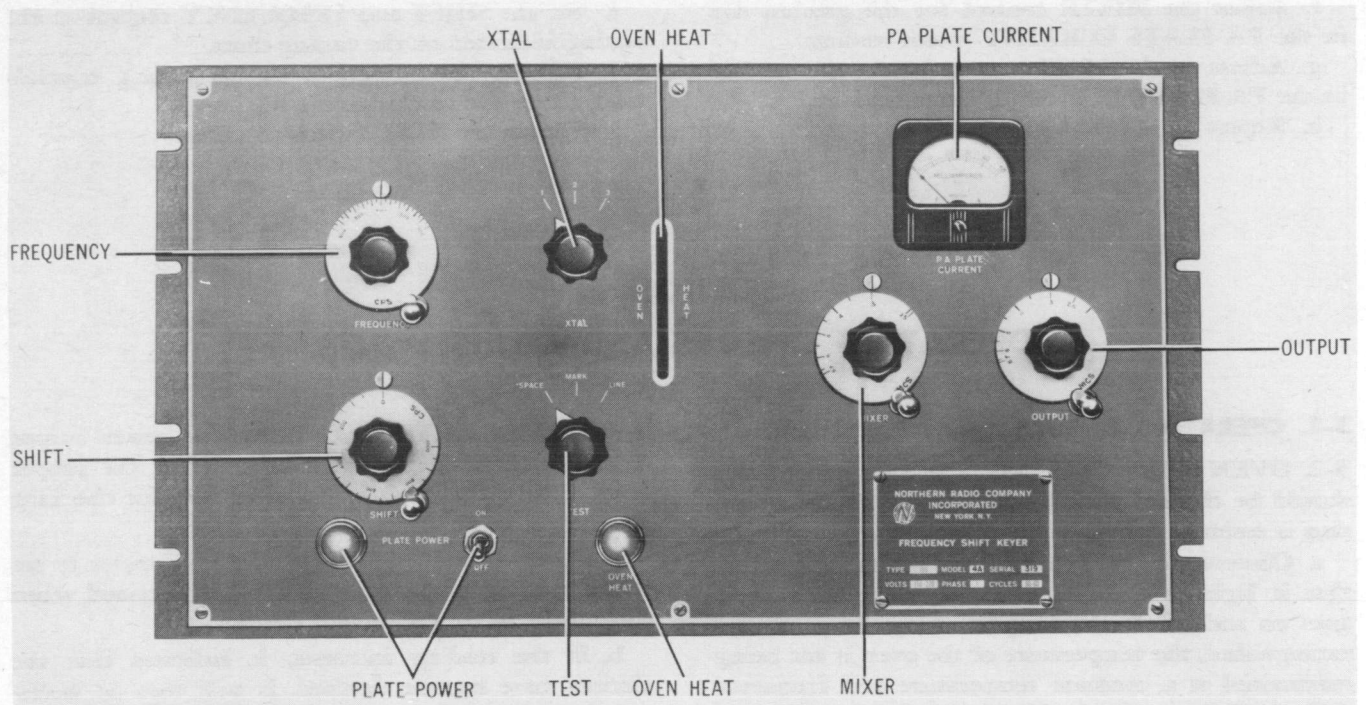


Figure 2-1. Frequency Shift Keyer, Front Panel Controls

2-5. WARM-UP PROCEDURE.

2-6. Refer to figures 2-1 and 2-2, and follow the instructions listed below. If an abnormal indication is obtained, refer to paragraph 3-2.

a. Throw the MAIN POWER switch to ON. Observe the MAIN POWER and OVEN HEAT pilot lamps; they should light.

b. Throw the PLATE POWER switch to ON. The PLATE POWER pilot lamp should light.

c. Observe the OVEN HEAT pilot lamp and OVEN HEAT mercury thermostat. When the oven temperature exceeds 60°C (140°F), the OVEN HEAT lamp should extinguish while the heating process is stopped. When the temperature drops below 60°C (140°F), the lamp will light as the heating process resumes.

d. Wait at least one hour for the over temperature to stabilize, so that the on-off heating cycle is regular.

2-7. TUNING PROCEDURE.

2-8. Obtain from organizational or field maintenance personnel a chart containing the settings of all front and rear panel controls for each of the assigned frequencies. Then tune the keyer as described below.

a. Warm up the keyer as described in paragraph 2-3.

b. Set the XTAL selector switch to the position for the desired assigned frequency.

c. Set the TEST switch to MARK or SPACE.

d. Set the SHIFT and FREQUENCY controls to 0.

e. Set the MIXER and OUTPUT controls to the assigned frequency.

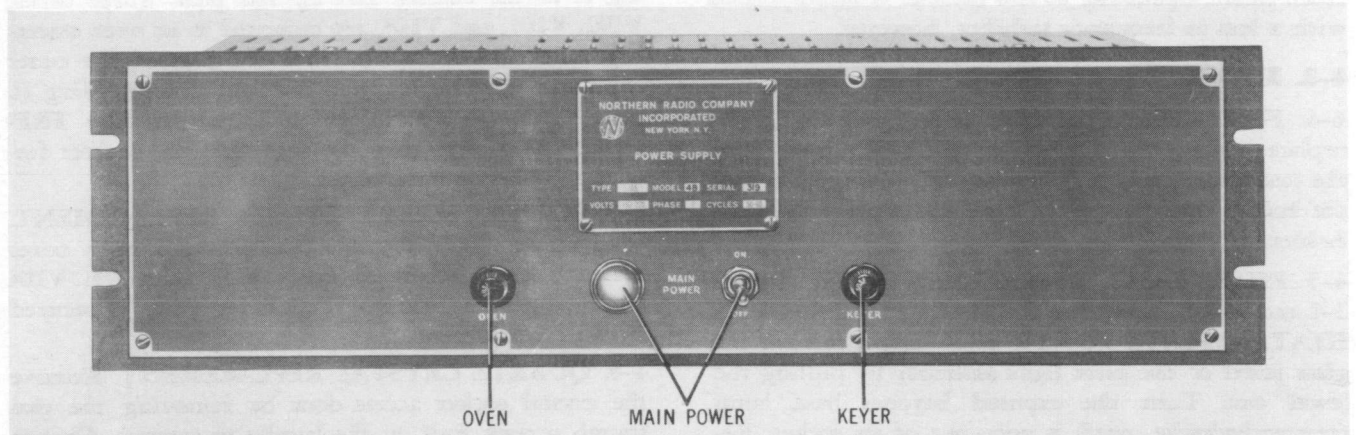


Figure 2-2. Power Supply, Front Panel Controls

- f. Adjust the MIXER control for the greatest dip in the PA PLATE CURRENT meter reading.
- g. Adjust the OUTPUT control for the greatest dip in the PA PLATE CURRENT meter reading.
- h. Repeat steps f. and g.

- i. Set the SHIFT and FREQUENCY control to the setting indicated on the tuning chart.
- j. Tighten the lockscrews on all tuning controls taking care not to change the settings.
- k. Throw the TEST switch to LINE.

SECTION III OPERATING CHECKS AND ADJUSTMENTS

3-1. OPERATING CHECKS AND ADJUSTMENTS.

3-2. OVEN HEAT CYCLING. The oven temperature should be checked periodically because proper operation is essential for maintaining frequency stability.

a. Observe the OVEN HEAT indicating lamp to see that it lights and extinguishes as the heating cycle goes on and off. If the lamp is always lit or always extinguished, the temperature of the oven is not being maintained at a constant temperature and frequency drift is likely to result. If the lamp does not light, replace it as described in paragraph 4-6.

b. If the OVEN lamp does not cycle, refer the trouble to organizational or field maintenance personnel.

3-3. POWER OUTPUT CHECK. The power output of the equipment must be maintained at the proper level. Follow the procedure listed below for checking the output level.

a. Observe the PA PLATE CURRENT meter to see if the reading is the same as the one obtained when tuning the mixer and output circuits.

b. If the reading increases, it indicates that the circuits have become detuned. It will then be necessary to retune them as described in paragraph 2-7.

c. If the meter reading increases to 50 ma, it indicates that the power amplifier is not being driven due to a defective crystal or defective stage. Refer the trouble to maintenance personnel.

SECTION IV EMERGENCY OPERATION AND REPAIR

4-1. EMERGENCY OPERATION.

4-2. If the mercury thermostat fails or is broken, as indicated by the symptoms described in paragraph 3-3, disengage plug P102 from jack J102. This plug is located between the outer oven assembly and the keyer front panel. Operating in this manner is accomplished with a loss in frequency stability, however.

4-3. REPAIR.

4-4. FUSE REPLACEMENT. (See figure 2-2.) To replace either the OVEN or KEYER fuses, turn the fuseholder counterclockwise until it unscrews. Pull the holder out, change the fuse, and replace the fuseholder.

4-5. PILOT LAMP REPLACEMENT. (See figures 2-1 and 2-2.) To replace the MAIN POWER, OVEN HEAT, or PLATE POWER pilot lamps, remove the glass jewel of the pilot light assembly by pulling the jewel out. Turn the exposed bayonet base lamp counterclockwise, until it pops out of its socket. Replace the lamp by pushing down gently, and turning

clockwise one quarter of a turn.

4-6. KEYER TUBE REPLACEMENT. (See figure 4-1.) Four tubes, V104 through V107, are mounted on the r-f chassis. To replace these tubes remove the keyer cover plate by removing the two thumb screws securing it to the chassis. Lift up and pull. Three tubes, V102, V101, and V103, are mounted in an oven assembly. They are accessible from the rear of the outer oven and may be removed without disassembling it. If V102 or V103 is replaced, readjust the FREQUENCY control to make sure that the correct frequency is being maintained.

4-7. POWER SUPPLY TUBE REPLACEMENT. (See figure 4-2.) Remove the power supply cover plate to gain access to tubes V201 through V204 mounted on the chassis. The cover plate is secured by four rear screws.

4-8. QUARTZ CRYSTAL REPLACEMENT. Remove the crystal socket access door by removing the two thumb screws. Pull on the handle to remove. Change the crystals as required.

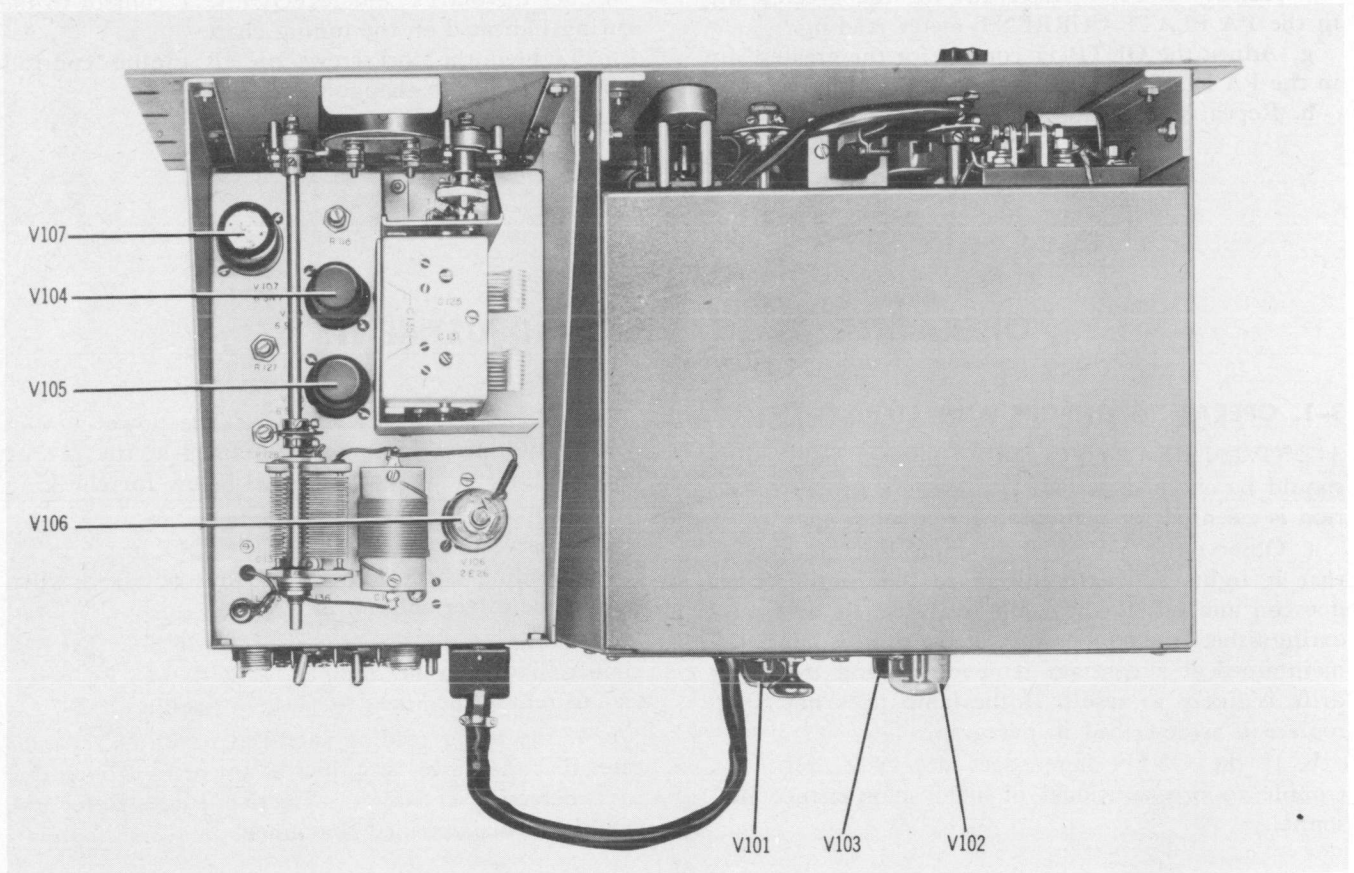


Figure 4-1. Frequency Shift Keyer, Tube Locations

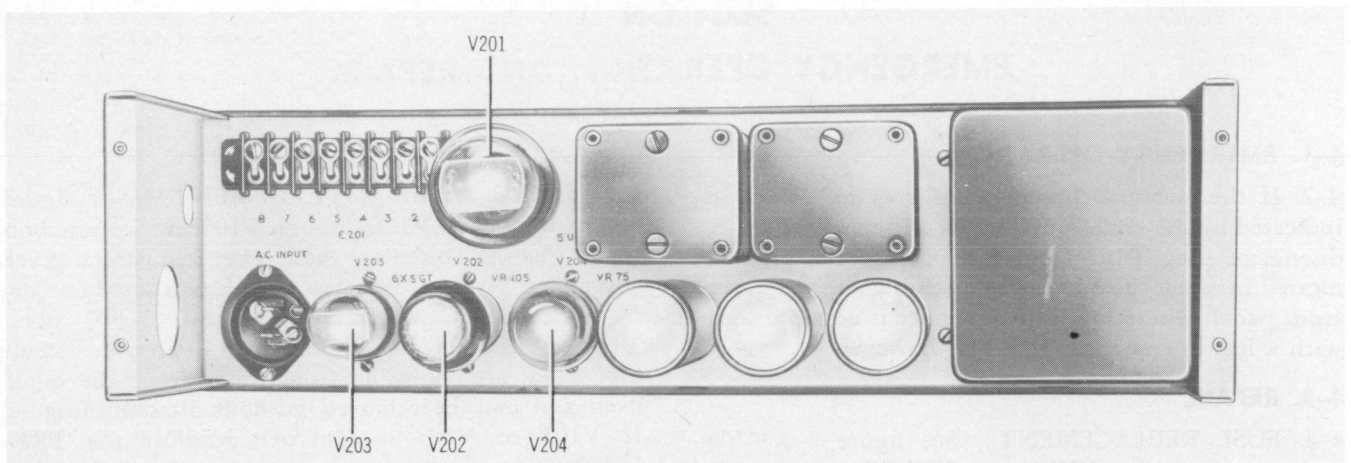
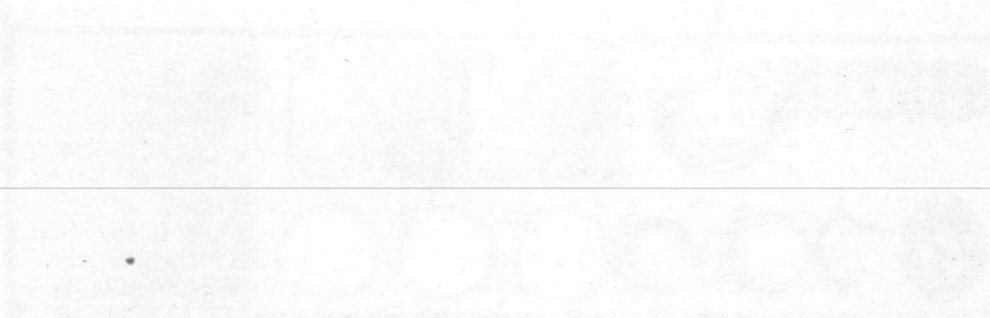


Figure 4-2. Power Supply, Tube Locations



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