

SERVICE BULLETIN



Northern Electric RADIO

MODEL NC10 TELEVISION RECEIVER



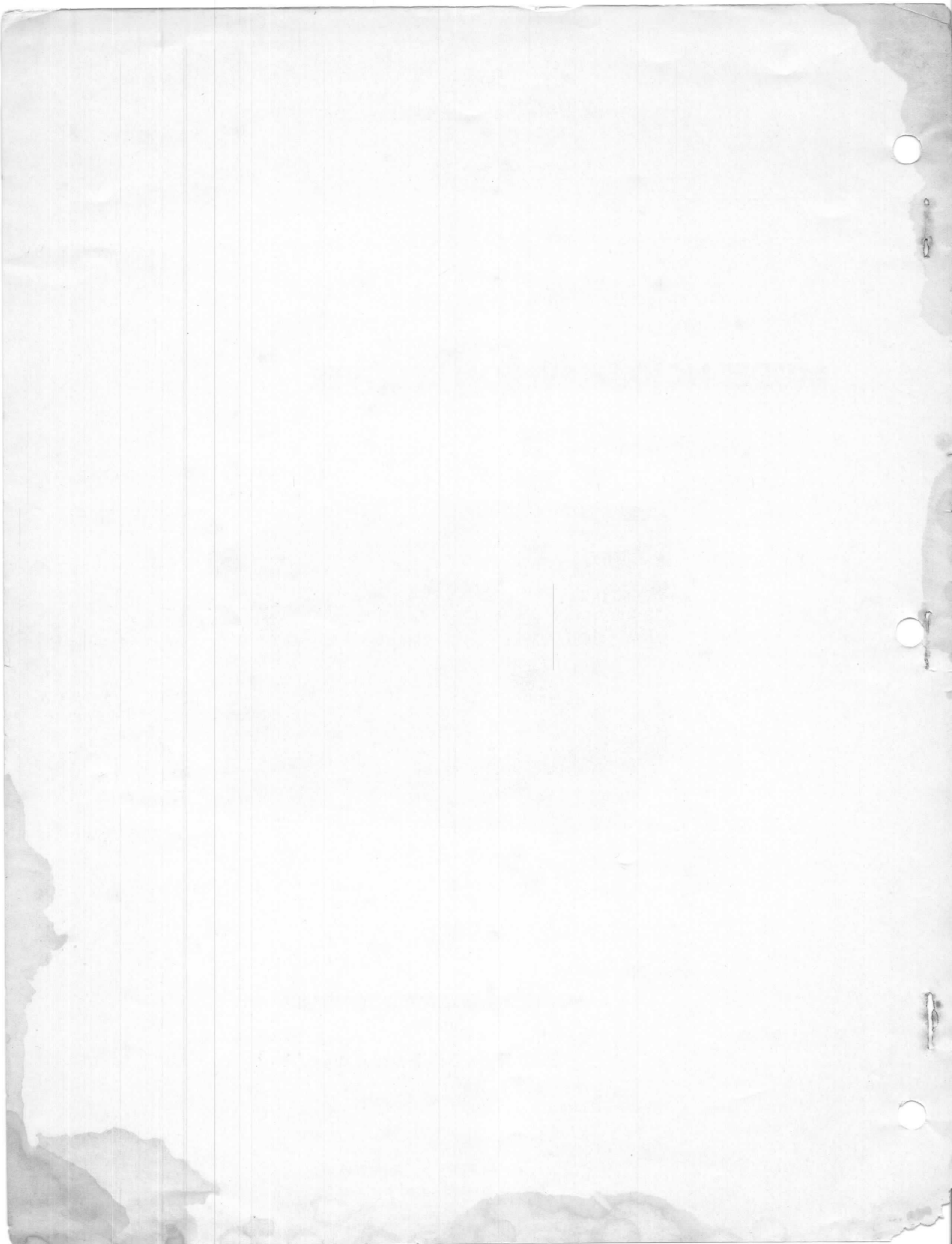
NORTHERN ELECTRIC COMPANY
Limited

1600 Notre Dame Street West

Montreal, Que.

Bulletin RS 132 — August 1950

MAILING CLASSIFICATIONS 4.13 & 28.17



SERVICE NOTES
MODEL NC10 TELEVISION RECEIVER

Electrical and Mechanical Specification

- | | | |
|-----|--------------------------|--|
| 1. | Power Supply Rating | 117 Volts, 25-60 cycle, 200 watts |
| 2. | Antenna | 300 ohm Balanced Antenna. Provision for two antennas - high and low band. |
| 3. | Tuning Range Two Bands | 54 Mc. - 88 Mc.
174 Mc. - 216 Mc. |
| 4. | Radio Frequency System | Continuous permeability tuning on both bands.
R.F. stage on both bands
Series 1 & 2 A.G.C.
Series 3 Keyed A.G.C. |
| 5. | Intermediate Frequencies | Picture: 26.4 Mc.,
3.1Mc. band width at 50% response point.
Sound: Intercarrier 21.9 Mc.
Beat with picture carrier at 2nd detector to produce 4.5 Mc. |
| 6. | I.F. System | 3 Stages - 6 tuned circuits, inter-carrier I.F. system.
Series 1 & 2 A.G.C.
Series 3 Keyed A.G.C.
4.5 Mc. Sound I.F. Limiter, Driver and Ratio Detector. |
| 7. | Kinescope | 10BP4 or 10BP4A Kinescope, magnetic deflection and focus, mechanical picture centering. |
| 8. | Picture Size | Direct view, normal 9" x 6-3/4"
Opera Glass - Full 9" Diameter
78% increase in area of picture center.
See Figure 3. |
| 9. | Console Coupler | Provision for connection to external radio or amplifier. |
| 10. | Speaker | 4" x 6" - oval - 3.5 ohm, maximum 3 watts;
2 watts at 400 c.p.s. with 10% distortion. |
| 11. | Cabinet | Table: Semi-modern. Mahogany, bleached mahogany or walnut.
Size; Height 14-1/2", Width 19-1/4",
Depth 20-1/2". |

Identification Table

<u>Model</u>	<u>Chassis</u>	<u>Front Panel</u>	<u>Wrap-around</u>
NC10M	02560	108131	108132
NC10W	02560	02657	02658
NC10Y	02560	02625	108150

Electrical and Mechanical Specification (Continued)

12. Controls

Front Panel

Channel Tuning	Large Selector Knob (Operating)
Opera Glass	Push-Button Switch (Operating)
Volume Control and "Off-On" Switch	Small Right-hand Knob (Operating)
Picture Contrast	Large Right-hand Knob (Operating)
Brilliance	Small Centre Knob (Operating)
Range Switch	Large Centre Knob (Operating)
Vertical Hold	Small Left-hand Knob (Operating)
Horizontal Hold	Large Left-hand Knob (Operating)

Back Panel (Reading from right to left)

Focus	Small Knurled (Service)
Vertical Size, Large	Small Knurled (Service)
Vertical Linearity Large	Small Knurled (Service)
Vertical Linearity Small	Small Knurled (Service)
Vertical Size, Small	Small Knurled (Service)
Horizontal Size Small	Slotted Stud (Service)
Horizontal Damping	Slotted Stud (Service)
Horizontal Linearity Large	Slotted Stud (Service)

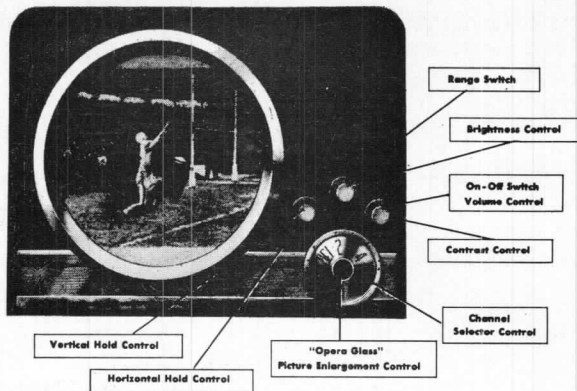


FIGURE 1

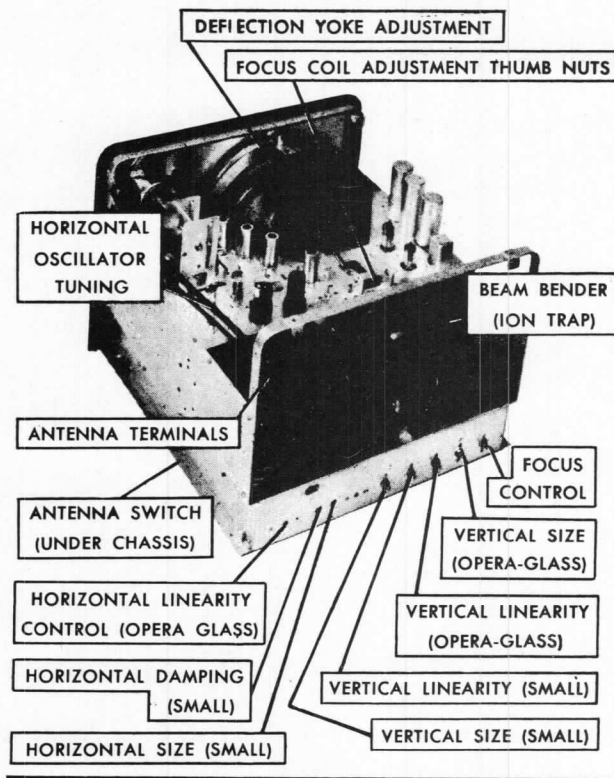


FIGURE 2

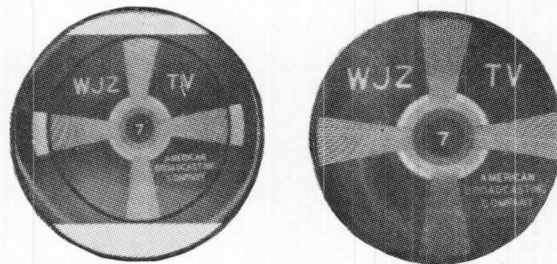
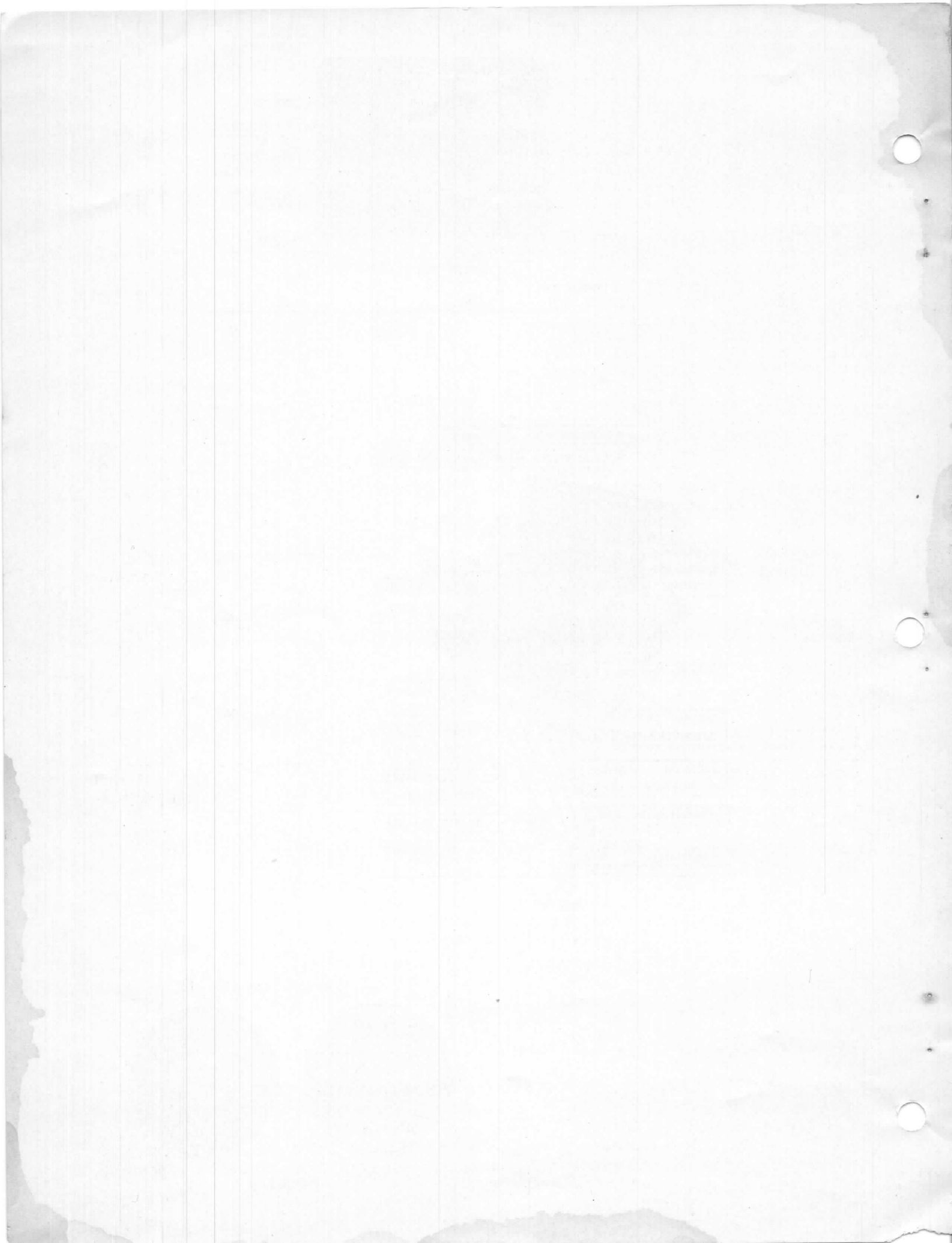


FIGURE 3



TUBES, TYPES AND FUNCTIONS

Series 1 and 2

1. 6AG5
2. 6J6
3. 6BH6
4. 6J6
5. 6AH6
6. 6BH6
7. 6AH6
8. 6AL5
9. 6AC7
10. 10BP4
or 10BP4A
11. 6AU6
12. 6T8
13. 6V6-GT
14. 12AU7
15. 6AL5
16. 6SN7-GT
17. 6BG6-G
18. 6W4-GT
19. 1B3-GT/8016
20. 6C4
21. 12AU7
22. 5U4G

- V18 Hi Band RF Amplifier
- V16 Hi Band Oscillator
and Converter
- V19 Lo Band RF Amplifier
- V17 Lo Band Oscillator
and Converter
- V12 1st Video IF Amplifier
- V11 2nd Video IF Amplifier
- V10 3rd Video IF Amplifier
- V9 Video Detector & AGC
- V8 Video Amplifier
- V21 Kinescope
- V13 Sound IF Limiter
- V14 Ratio Detector and
Sound Driver
- V15 Audio Output
- V7 DC Restorer and Sync.
Amplifier
- V6 Horizontal AFC Phase
Discriminator
- V2 Horizontal Oscillator
and Driver
- V3 Horizontal Sweep
Output
- V4 Horizontal Damper
- V5 High Voltage Rectifier
- V22 Vertical Sweep
Oscillator
- V1 Vertical Sweep Out-
put
- V20 Power Rectifier

Series 3

1. 6AG5
2. 6J6
3. 6BH6
4. 6J6
5. 6AH6
6. 6BH6
7. 6AH6
8. 6AL5
9. 6AC7
10. 10BP4
or 10BP4A
11. 6AU6
12. 6T8
13. 6V6-GT
14. 12AU7
15. 6AL5
16. 6SN7GT
17. 6BG-G
18. 6W4-GT
19. 1B3-GT/8016
20. 12AU7
21. 12AU7
22. 5U4G
23. 6AU6

- V18 Hi Band RF Amplifier
- V16 Hi Band Oscillator
and Converter
- V19 Lo Band RF Amplifier
- V17 Lo Band Oscillator
and Converter
- V12 1st Video IF Amplifier
- V11 2nd Video IF Amplifier
- V10 3rd Video IF Amplifier
- V9 Video Detector & AGC
- V8 Video Amplifier
- V21 Kinescope
- V13 Sound IF Limiter
- V14 Ratio Detector and
Sound Driver
- V15 Audio Output
- V7 DC Restorer and Sync.
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- V2 Horizontal Oscillator
and Driver
- V3 Horizontal Sweep
Output
- V4 Horizontal Damper
- V5 High Voltage Rectifier
- V22 Vertical Sweep
Oscillator and Sync.
Amplifier
- V1 Vertical Sweep Out-
put
- V20 Power Rectifier
- V23 AGC Amplifier

CHANNELS AND FREQUENCY RANGE

Channel Selector Position No.	Frequency Range Mc.	Picture Carrier Frequency Mc.	Sound Carrier Frequency Mc.
2	54-60	55.25	59.75
3	60-66	61.25	65.75
4	66-72	67.25	71.75
5	76-82	77.25	81.75
6	82-88	83.25	87.75
7	174-180	175.25	179.75
8	180-186	181.25	185.75
9	186-192	187.25	191.75
10	192-198	193.25	197.75
11	198-204	199.25	203.75
12	204-210	205.25	209.75
13	210-216	211.25	215.75

PICTURE TUBE HANDLING AND INSTALLATION INSTRUCTIONS

TUBE BREAKAGE: Extreme care must be used in the handling of the kinescope. It must always be borne in mind that they are subjected to considerable atmospheric pressure and mishandling could cause them to shatter.

**TUBE BREAKAGE:
(CONTINUED)**

Gloves should be worn to protect the hands and shatterproof goggles to protect the eyes during installation or removal of the tube. Be careful not to scratch or strike the tube, nor attempt to force it into the coil assembly if it fails to slide in easily.

**HIGH VOLTAGE
WARNING**

Operation of this television receiver with the covers removed, involves a shock hazard from the power supplies. Regular B+ voltages used are higher than in ordinary radio receivers. The metal shield should not be removed from the high voltage power supply during operation as 10,000 volts are generated in this circuit. Only personnel familiar with high voltage equipment should attempt to work on this receiver.

**INSTALLATION
INSTRUCTIONS**

Unpacking and Assembly

1. Open the bottom flaps of carton and remove all fillers.
2. Keep the bottom flaps extended; roll the set gently until the bottom is resting on the floor, then lift the carton off the receiver.
3. Remove the back panel, saving all screws.
4. Inspect all tubes and connectors to be sure they are intact and tight in their sockets.
5. Replace back panel and interlock.

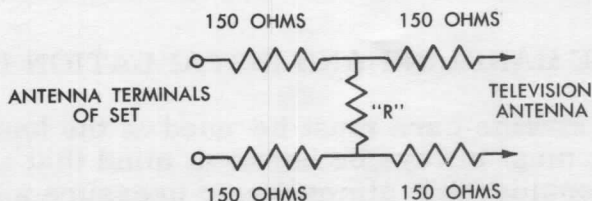
Antenna Requirements

This set is designed for 300 ohm balanced lead-in antenna. Provisions are made for either an all channels antenna or a separate high and low channels antenna. When a single all channels antenna is used, the antenna is connected to the lower pair of binding posts. To use separate antennas for high and low channels, it is necessary to remove the back from the set and disconnect the twin lead of the high frequency tuner from its junction with low frequency lead and solder it to the board. (This lead is identified with a tag giving these same instructions). The high channels antenna then connects to the top two binding posts of the antenna terminal strip and the low channels antenna connects to the lower two binding posts. The choice of the antenna should be one that will reduce ghosts and interference to a minimum while still giving good pictures. Each installation will present its own special problems. If a ground lead is required, it may be attached to any one of the screws which hold the back panel to the chassis.

**STRONG
TELEVISION
SIGNALS**

When overloading or oscillation is caused by strong television signals, the resistor pad network shown in Figure 4 may be used.

Fig. 4



The value of "R" should be 50 ohms or less, chosen to give the desired signal level.

SETTING UP INSTRUCTIONS

1. Turn on the receiver and, after several minutes warm-up, check the operation of the Brightness Picture Contrast and Volume Control. Also pressing the Opera Glass Knob should change the size of the raster on the tube. The set is now ready for operation and should be tuned to the desired channel. By adjustment of the various front panel controls, a locked picture of desired brightness and contrast, and also sound of the desired level should be obtained.

If the above cannot be achieved, the following suggestions should be followed:

(a) This set is equipped with a beam bender (ion trap). Check the setting to be sure that it is set for maximum brilliance of the raster with the brightness control in half of its maximum position. (This is accomplished by moving the beam bender back and forth and twisting bender on the neck of the picture tube until the correct position is found). In making the ion trap adjustment, the metal shield around the ion trap must not be removed and the brightness control should be progressively adjusted for average illumination on the face of the cathode ray tube.

(b) If, when a station is tuned in, the picture cannot be locked with the front panel controls, horizontal and vertical hold, set the horizontal hold in the centre of its rotation and hold, set the horizontal hold in the centre of its rotation and adjust the horizontal oscillator tuning slug (on top of the chassis) (See Fig. 2) until the picture locks in horizontally. Then adjust the vertical hold until the picture locks vertically.

(c) If the picture, when locked, is slanted, the deflection yoke will have to be adjusted by loosening the thumb screw and twisting the yoke to a point where the picture is proper and then tightening the thumb screw.

(d) If the picture is not centered, vertical and horizontal centering is accomplished by mechanically moving the focus coil; loosen the two thumb nuts and adjust position of the focus coil until the picture is properly centered. Tighten the thumb nuts and readjust the focus control.

(e) NO ADJUSTMENT OF THE SIZE AND LINEARITY CONTROLS SHOULD BE ATTEMPTED UNLESS A STATION TEST PATTERN CAN BE TUNED IN.

In setting up the size and linearity controls, the test pattern should be tuned in and locked horizontally and vertically by the hold controls and then the Opera Glass Switch operated so that the picture is enlarged. With the Vertical Linearity (large) and Vertical Size (large) controls the picture should be set for the correct aspect ratio and best linearity. The Horizontal Linearity (large) should be adjusted for the best linearity in the right-hand side of the picture. The position of picture should now be set in the middle of the screen by positioning the focus coil around the neck of the tube.

Restore the picture to the normal size with the Opera Glass Switch and adjust the Horizontal Size Small control for the correct width which should fill the face of tube with the

SETTING UP INSTRUCTIONS (CONTINUED)

test pattern in a horizontal direction with a 117 V A.C. on the line. Then adjust the Vertical linearity small and Vertical Size controls for the correct aspect ratio and the best vertical linearity. The Horizontal Damper control should be adjusted for the best horizontal linearity on the left-hand side of the picture.

2. The set-up should now be re-checked and then safety back cover installed.

3. The correct tuning for this receiver is to adjust the channel selector control for the best detailed picture on any desired television station and, at this setting of the control, the reception is generally best for sound, also. It will be noticed that simultaneous reception of picture and sound is obtained over a range of tuning of the channel selector control, but the best picture reproduction occurs when this control is adjusted on that side of the received signal towards the next highest channel number. Refinement of the tuning at this point can then be made for best picture reproduction and maximum clarity of sound.

4. If it is necessary to remove the front panel from this receiver, an Allen wrench of the proper size is mounted in a clip on the top of the chassis immediately back of the R.F. tuner. This should be used through a rectangular cut-out in the right-hand side of the chassis side panel, just back of the front panel. With the channel selector control rotated fully clockwise and then anti-clockwise, the two set screws will be available. When replacing this knob the pulley on the tuner assembly should be rotated clockwise against the stop and the first set screw tightened - then rotate fully anti-clockwise and tighten the other set screw.

CIRCUIT ALIGNMENT

Before any attempt is made at complete alignment, it is imperative to make certain that the scanning and brilliance circuits are operating normally.

Also check the voltages on the various I.F. circuits to make certain voltages are within tolerance, as specified on the voltage diagram.

Note: Make certain the voltage diagram corresponds to the series being checked as two voltage diagrams are given.

TEST EQUIPMENT

The following test equipment is recommended for proper alignment and testing of the receiver:

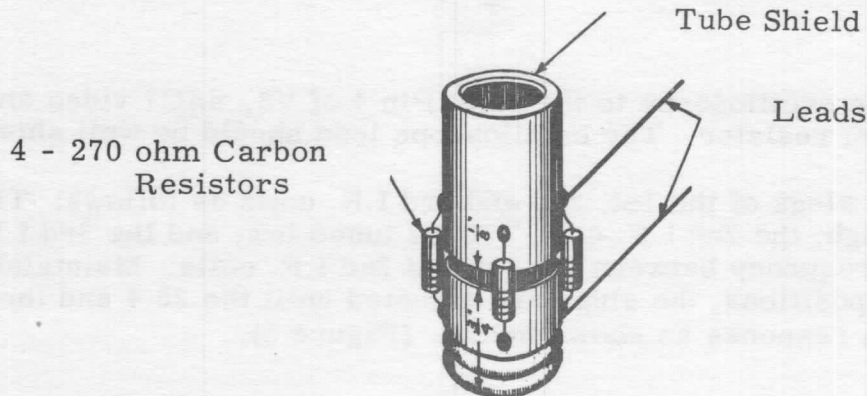
1. Vacuum Tube Voltmeter, one range of which should not read more than 3 volts D.C. at full scale, complete with high voltage (10,000 volts) probe. (Sylvania Polymer Model 134 is recommended).

2. Oscilloscope with a good 60 cycle response and reasonable gain. (Sylvania Oscilloscope Model 132 or Model 400 is recommended).

3. R.F. Signal Generator having good frequency stability and accurate dial calibration for the following frequencies:

TEST EQUIPMENT (Continued)

- (a) Picture and Sound Intermediate Frequencies and trap frequencies ranging from 20 MC. to 30 MC.
- (b) Picture and Sound Carrier Frequencies for all channels (50 Mc. to 220 Mc.)
4. Sweep Generator with reliable calibrated output and with accurate dial reading within 1/2 of a megacycle.
5. Coupler Unit. Required to feed I.F. signal to the converter circuit and is made up as follows.



ALIGNMENT SEQUENCE

Before alignment, the technician should familiarize himself with the alignment sequence to avoid overlooking some stage.

1. Video I.F. triple
2. Sound I.F. trap
3. Video I.F. double
4. Sound take off
5. Ratio Detector
6. R.F. Tuner - **IMPORTANT**: Under no circumstances should any attempt be made to align the R.F. tuner. Refer to parts list.

ALIGNMENT

General. All precautions for aligning high frequency devices should be observed. Signal generators and oscilloscope leads should be well shielded and as short as possible.

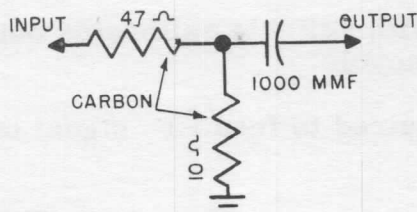
Video. The video I.F. system consists of a double tuned converter plate circuit and three single tuned circuits. The three single tuned circuits are the 1st, 2nd and 3rd I.F. stages, and they are aligned as a "triple". It is necessary to align the video I.F. system in two steps, the first being the alignment of the triple and the second being the alignment of the wide band, double tuned circuits in the converter plate.

Alignment of the "triple".

1. Apply an external bias of -3 volts D.C. to the AGC bus at the junction of R5, R119 and C75. The contrast control is set for maximum contrast.

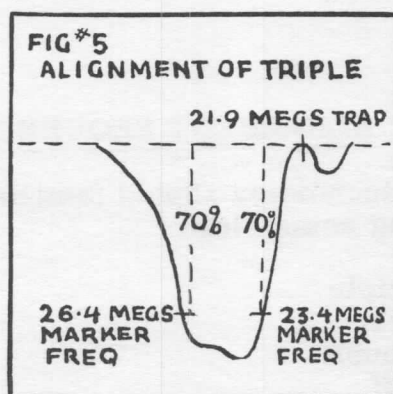
ALIGNMENT (Continued)

2. Connect the output of the sweep generator to the grid (Pin 1) of V12 6AH6 1st video I.F. amplifier through the network shown below.



3. Connect the oscilloscope to the grid, Pin 4 of V8, 6AC7 video amplifier, through a 47,000 ohm resistor. The oscilloscope lead should be well shielded.

4. Adjust the slugs of the 1st, 2nd and 3rd I.F. coils as follows: The 1st I.F. coil, T9, is tuned high, the 2nd I.F. coil, T10, is tuned low, and the 3rd I.F. coil, T11, is tuned to a frequency between the 1st and 2nd I.F. coils. Maintaining these relative frequency positions, the slugs are adjusted until the 26.4 and the 23.35 Mc. markers are at 70% response as shown below. (Figure 5).



Alignment of the Sound I.F. Trap.

5. Using a 21.9 Mc. marker, adjust the 21.9 Mc. trap, L2, so that the marker is coincident with the valley of the trap.

6. Check the response curves and readjust T9, T10 and T11 if necessary to produce the flatness and symmetry of wave shape as shown in Figure 5.

Alignment of the "double".

7. The external bias of -3 volts D.C. is still applied to the AGC bus. The band switch is turned to the Lo Band position. The output from the sweep generator is coupled into the plate of the Lo Band converter tube V17, 6J6 tube by means of the specially prepared coupler unit.

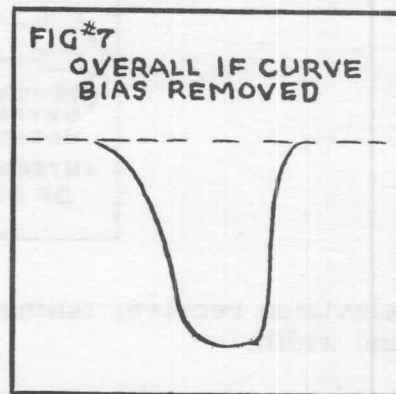
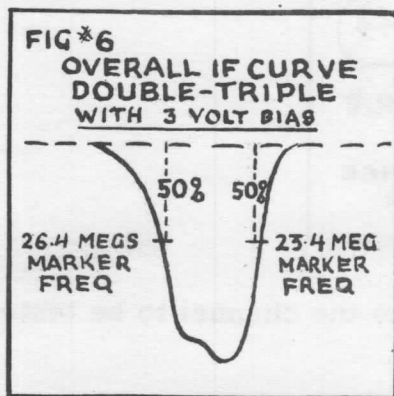
8. Adjust the primary L26 and the secondary of T8 cores for maximum response and desired band pass, 50% response at 26.4 Mc. and 23.35 Mc. as shown in Figure 6.

ALIGNMENT (Continued)

9. If, after adjustment, curve is not as Figure 6, adjust T11 in conjunction with the fine adjustment of L26 and T8 to obtain the desired curve with the markers at 50%.

10. Remove the external bias.

11. Decrease the output of the sweep generator until no overload is noticed. The overall I.F. response curve should appear as Figure 7. If this is not obtained, replace the external bias and repeat Steps 7, 8 and 9.



Sound Take-Off Alignment.

12. Connect an R.F. vacuum tube voltmeter to the grid of the kinescope (pin 2). Apply 4-1/2 Mc. unmodulated signal (maximum output) to grid of the video amplifier 6AC7, V2 (Pin 4). Adjust sound take-off coil T5 for minimum meter reading. Two or more minimums may be obtained; the correct minimum is the one which can be tuned through.

Ratio Detector.

13. Apply 4-1/2 Mc. unmodulated signal to the grid of the video amplifier (6AC7 tube) V8, Pin 4. (Be careful to apply minimum amount of signal required to obtain a reading on the vacuum tube voltmeter).

14. Connect the vacuum tube voltmeter to Pin 2, 6T8 tube, V14. Set the vacuum tube voltmeter to low D.C. scale and adjust primary circuit (under chassis) slug of the ratio detector transformer for maximum reading.

15. Connect the vacuum tube voltmeter to junction of R80 and R79 and connect the ground lead of the meter to the junction of R78 and C57 and C58.

16. Adjust output of signal generator until reading is obtained.

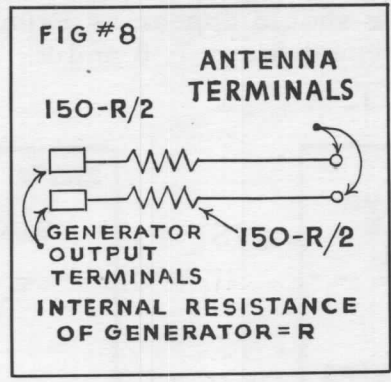
17. Adjust secondary of the ratio detector transformer T6 (above chassis) slug for zero reading. NOTE - Adjustment should tune through zero. Increasing the input in steps to produce one volt input signal, readjust several times for zero.

MEASUREMENT OF OVERALL BAND WIDTH AND SENSITIVITY

1. Connect the vacuum tube voltmeter to junction of L10, L11 and R18.

MEASUREMENT OF OVERALL BAND WIDTH AND SENSITIVITY (Continued)

2. Connect the meter ground leads to junction of R16, R17 and C15.
3. Connect the calibrated signal generator to the proper termination as shown in Figure 8 to the antenna terminal.



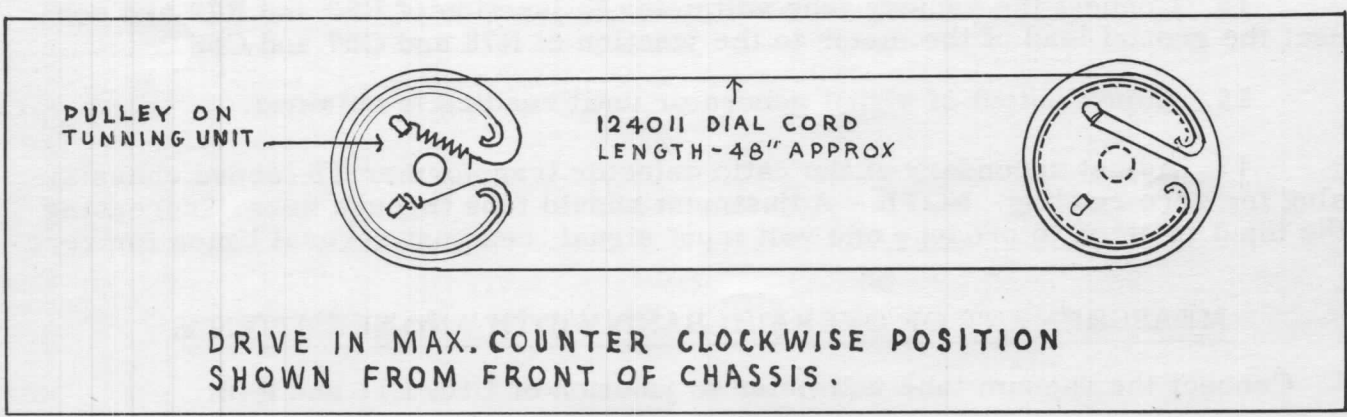
4. Set the television receiver tuning indicator to the channel to be tested for sensitivity and band width.
5. Starting at the low frequency of the channel under test, plot a curve from the recorded results of the required signal strength to produce one volt on the vacuum tube voltmeter in half megacycle steps across the entire channel. See Figure 9 for example of curve showing sensitivity and band width. Figure 9 also shows average sensitivity for Hi and Lo bands.
6. The band width in all cases should be 3.1 Mc. to 3.3 Mc. All trimmer locations are shown in Figure 11.

ADJUSTMENT OF DRIVE CONDENSER

Connect the vacuum tube voltmeter with the high voltage probe to the output of the high voltage supply (anode cap) with the kinescope in operation.

With normal brilliance, adjust the drive condenser C40 for maximum voltage.

Check to ascertain whether "bark hausen" oscillations appear on the kinescope, while tuning to high and low bands. These appear as vertical bars and, if present, can be eliminated by slight readjustment of C40.



MICROVOLTS INPUT FOR STANDARD OUTPUT

RF CURVE FOR CHANNEL # 4

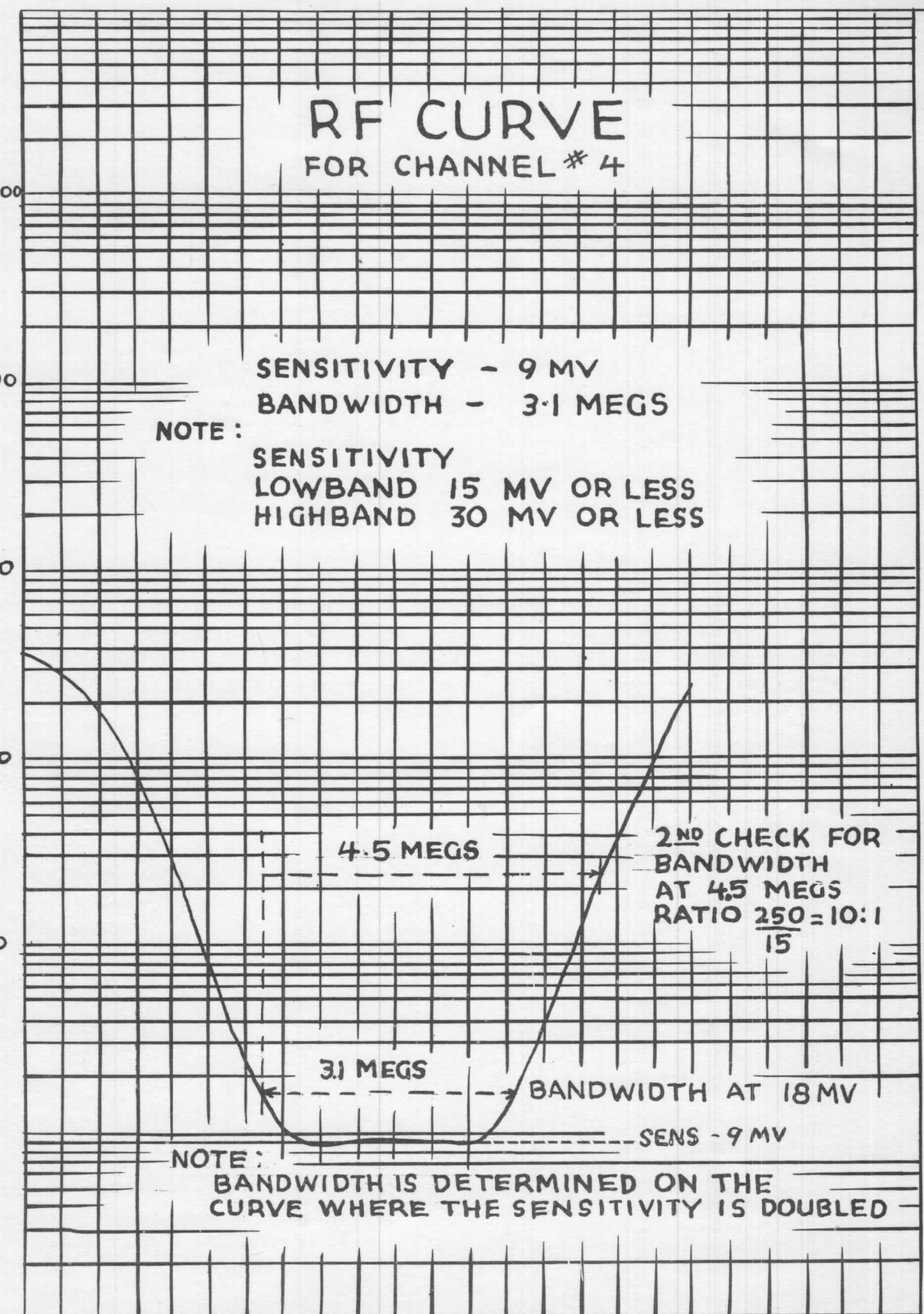
1000000
1000000
100000
10000
1000
100
10

SENSITIVITY - 9 MV
BANDWIDTH - 3.1 MEGS

NOTE :

SENSITIVITY
LOWBAND 15 MV OR LESS
HIGHBAND 30 MV OR LESS

64 66 68 70 72 74
FREQUENCY IN MEGACYCLES



NOTE :

BANDWIDTH IS DETERMINED ON THE CURVE WHERE THE SENSITIVITY IS DOUBLED

Figure 9.

RF CURVE

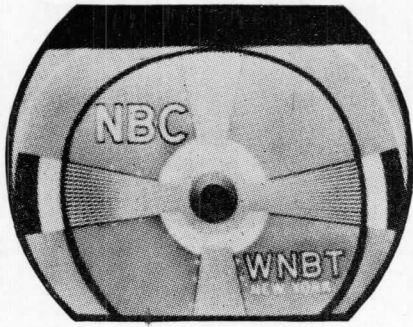
NOTE:
SENSITIVITY - 20 MV
BANDWIDTH - 30 MHz

DATE: 12-30-61
BY: J. H. ...

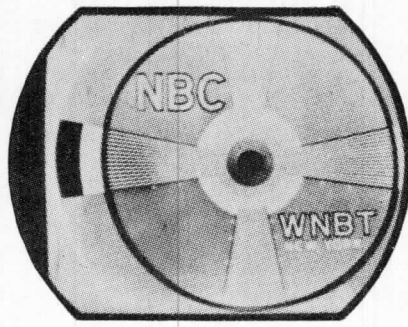
NOTE:
BANDWIDTH IS DETERMINED BY THE
CURVE WHERE THE SENSITIVITY IS 20 MV

FREQUENCY IN MEGACYCLES

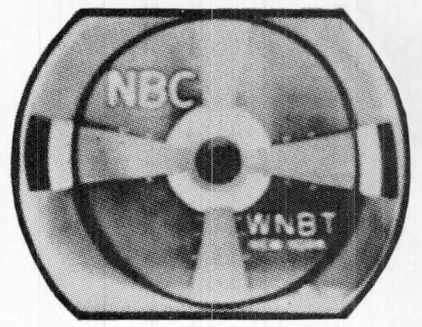
THEY ARE DERIVED FROM THE FOLLOWING



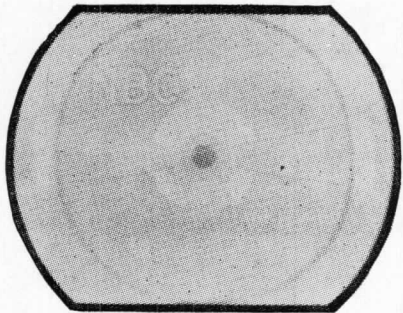
PICTURE OFF CENTRE - ADJUST FOCUS COIL POSITION



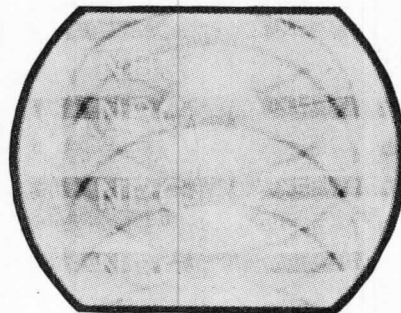
PICTURE OFF CENTRE - ADJUST FOCUS COIL POSITION



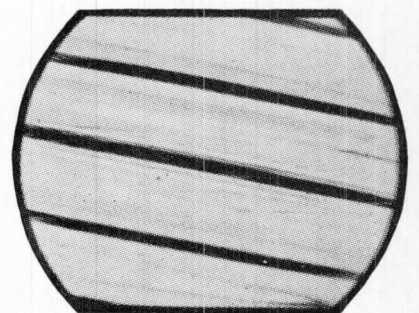
PICTURE OUT OF FOCUS - ADJUST FOCUS CONTROL



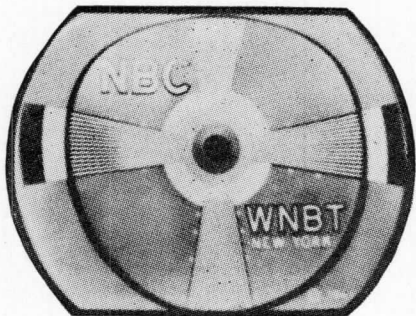
PICTURE TOO BRIGHT - ADJUST BRIGHTNESS CONTROL



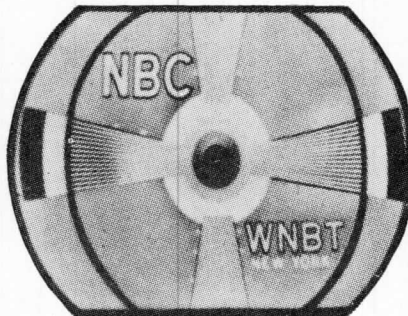
PICTURE JUMPING FRAME - ADJUST VERTICAL HOLD



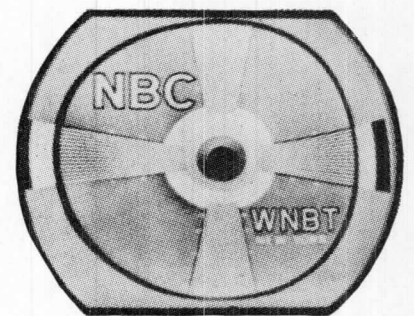
PICTURE JUMPING FRAME - ADJUST HORIZONTAL SPEED



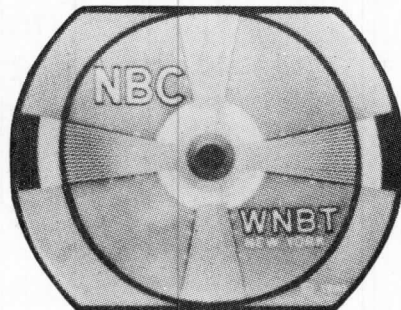
POOR SYMMETRY - SEE INSTRUCTIONS ON VERTICAL LINEARITY AND SIZE ADJUSTMENTS



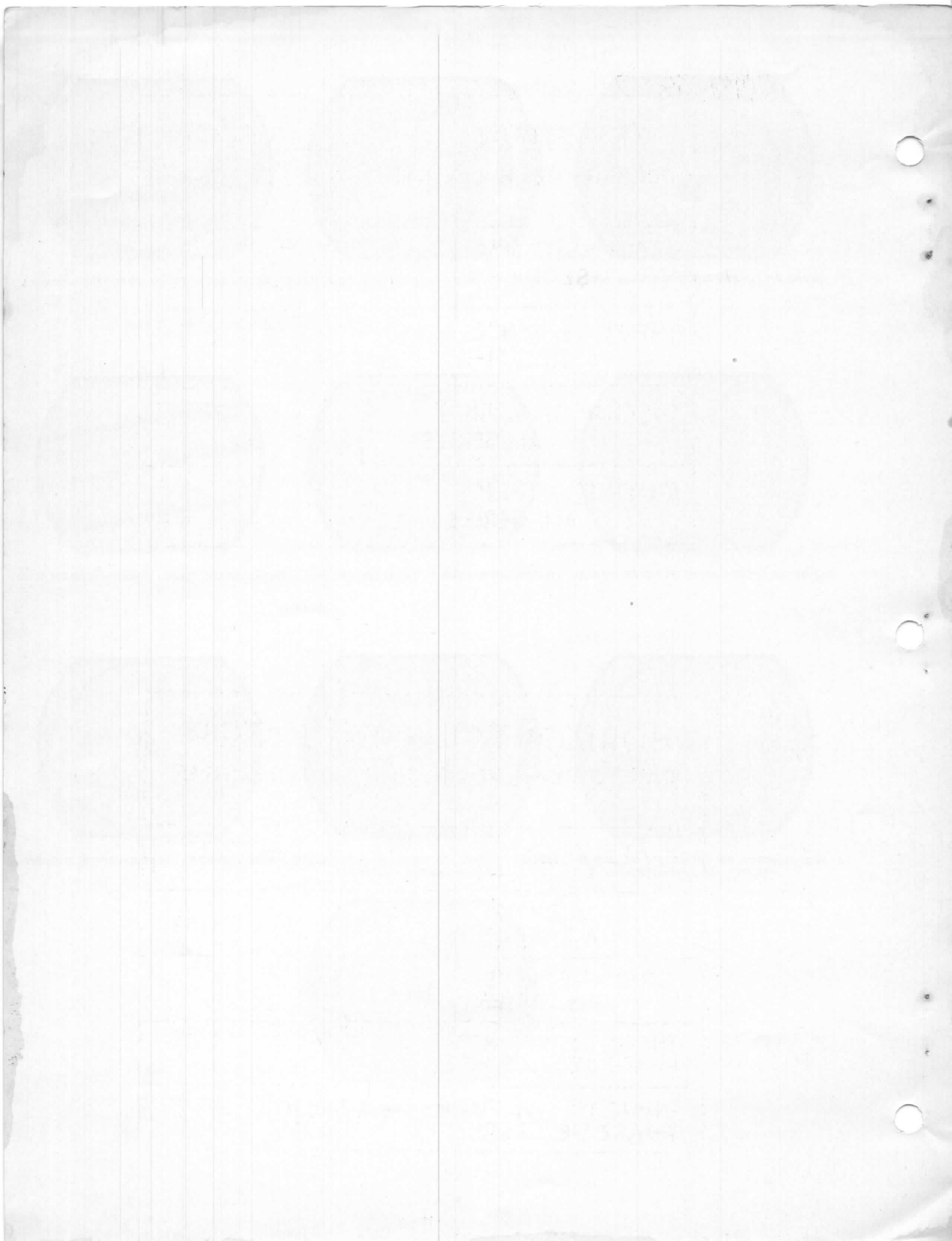
PICTURE TOO LARGE - SEE INSTRUCTIONS ON VERTICAL LINEARITY AND SIZE ADJUSTMENTS



POOR SYMMETRY - ADJUST HORIZONTAL LINEARITY

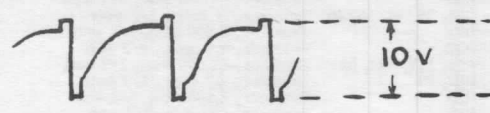
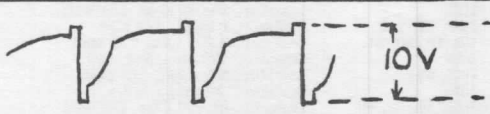
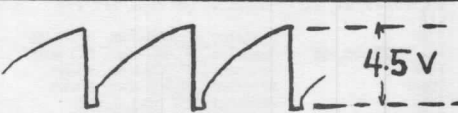
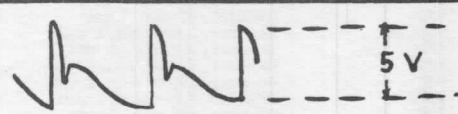


NORMAL PICTURE



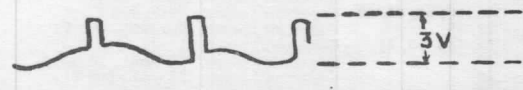
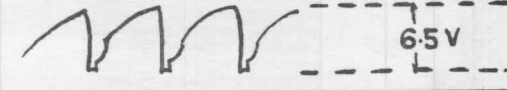
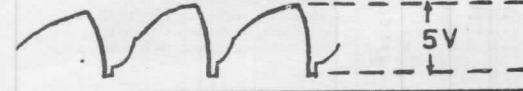
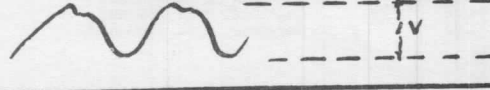
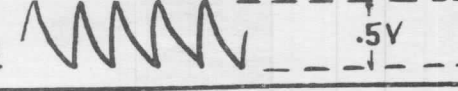
VERTICAL OSCILLATOR

PEAK TO PEAK VOLTAGES - WAVEFORMS

INPUT V_{22} PIN*2 SERIES*3	
INPUT V_{22} PIN*6 SERIES*1-2	
DISCHARGE V_1 PIN*7 ALL SERIES	
OUTPUT V_1 PIN*6 ALL SERIES	

HORIZONTAL OSCILLATOR

PEAK TO PEAK VOLTAGES - WAVEFORMS

PLATE V_2 PIN*5 ALL SERIES	
PLATE V_2 PIN*2 ALL SERIES	
GRID V_3 PIN*5 ALL SERIES	
INPUT TO V_6 PIN*2 PHASE DET. SERIES*3	
INPUT TO V_6 PIN*2 PHASE DET. SERIES*1-2	

REPLACEMENT PARTS

RESISTORS	01538	R50, 51, R30	Resistor, 560 ohm, 1/2 watt
	28145	R7	Resistor, 82 ohm, 1/2 watt
	01579	R52	Resistor, 1.8 meg., 1/2 watt
	01569	R70, 116	Resistor, .22 meg., 1/2 watt
	01588	R87	Resistor, 10 meg., 1/2 watt
	28148	R9	Resistor, 150 ohm, 1/2 watt
	28144	R3, 61	Resistor, 68 ohm, 1/2 watt
	149271	R66	Resistor, 5.6 ohm, 1/2 watt
	28150	R85	Resistor, 220 ohm, 1/2 watt
	01556	R78, 15, 1	Resistor, 18,000 ohm, 1/2 watt
	01543	R55	Resistor, 1,500 ohm, 1/2 watt
	01580	R47	Resistor, 2.2 meg., 1/2 watt
	01540	R46	Resistor, 320 ohm, 1/2 watt
	01586	R42	Resistor, 6.8 meg., 1/2 watt
	01573	R38, 83, 89	Resistor, .47 meg., 1/2 watt
	01562	R75	Resistor, 56,000 ohm, 1/2 watt
	01565	R35, 36, 44, 56, 40	Resistor, .1 meg., 1/2 watt
	01548	R31	Resistor, 3,900 ohm, 1/2 watt
	01584	R37	Resistor, 4.7 meg., 1/2 watt
	01561	R28, 117, 122, 92	Resistor, 47,000 ohm, 1/2 watt
	01570	R27, 58	Resistor, .27 meg., 1/2 watt
	01545	R26	Resistor, 2,200 ohm, 1/2 watt
	28147	R18	Resistor, 120 ohm, 1/2 watt
	01541	R24, 69	Resistor, 1,000 ohm, 1/2 watt
	01555	R77	Resistor, 15,000 ohm, 1/2 watt
	149994	R32, 62, 123	Resistor, 1 meg., 1/2 watt
	01552	R8, 16, 60, 81	Resistor, 8,200 ohm, 1/2 watt
	01537	R49	Resistor, 470 ohm, 1/2 watt
	01578	R43, 65	Resistor, 1.5 meg., 1/2 watt
	01571	R29	Resistor, .33 meg., 1/2 watt
	01557	R12, 34, 79, 80	Resistor, 22,000 ohm, 1/2 watt
	28152	R5, 119	Resistor, 330 ohm, 1/2 watt
	28146	R4, 10, 13, 21, 22, 118	Resistor, 100 ohm, 1/2 watt
	01559	R39	Resistor, 33,000 ohm, 1/2 watt
	01553	R2, 6, 72, 86, 48	Resistor, 10,000 ohm, 1/2 watt
	149188	R59	Resistor, 22,000 ohm, 1 watt
	149186	R144	Resistor, 15,000 ohm, 1 watt
	149170	R88	Resistor, 270 ohm, 1 watt
	149171	R84	Resistor, 330 ohm, 1 watt
	149158	R17	Resistor, 15 ohm, 1 watt
	149166	R63	Resistor, 82 ohm, 1 watt
	149184	R25, 54	Resistor, 5,600 ohm, 1 watt
	149202	R68	Resistor, .68 meg., 1 watt
	149055	R115	Resistor, 12,000 ohm, 2 watt
	31973	R91	Resistor, 15,000 ohm, 2 watt
	149054	R64	Resistor, 8,200 ohm, 2 watt
	149042	R82	Resistor, 680 ohm, 2 watt
	149027	R11	Resistor, 22 ohm, 2 watt
	149966	R20	Resistor, 7,000 ohm, 20 watt
	01700	R67	Resistor, 4,000 ohm, 10 watt
	149967	R41	Resistor, 1,200 ohm, 20 watt
	01547	R33	Resistor, 3,300 ohm, 1/2 watt
	37200	R74	Resistor, 8,200 ohm, 1 watt

CAPACITORS	110037	C40	Capacitor, aligner
	110666	C49	Capacitor, 56 mmf., 1000 V.
	111983	C69	Capacitor, electrolytic
	111059	C41	Capacitor, electrolytic
	111060	C68	Capacitor, electrolytic
	111069	C114	Capacitor, electrolytic, 25 mfd., 25 V.
	111063	C56	Capacitor, electrolytic, 1 mfd., 50 V.
	111030	C43	Capacitor, electrolytic, 5 mfd., 50 V.
	111982	C115	Capacitor, electrolytic, 500 mfd., 15 V.
	110674	C110	Capacitor, paper, .062 mfd., 400 V.
	110568	C65, 66	Capacitor, paper, .01 mfd., 1000 V.
	110557	C62	Capacitor, paper, .022 mfd., 600 V.
	110660	C58	Capacitor, paper, .047 mfd., 200 V.
	110537	C57	Capacitor, paper, .0033 mfd., 400 V.
	110542	C54	Capacitor, paper, .022 mfd., 400 V.
	110561	C45	Capacitor, paper, .1 mfd., 600 V.
	110558	C44, 33	Capacitor, paper, .033 mfd., 600 V.
	110548	C32, 50	Capacitor, paper, .22 mfd., 400 V.
	110536	C34	Capacitor, paper, .0022 mfd., 400 V.
	110544	C36, 42	Capacitor, paper, .047 mfd., 400 V.
	110540	C26, 61, 21	Capacitor, paper, .01 mfd., 400 V.
	110547	C17	Capacitor, paper, .15 mfd., 400 V.
	110675	C7	Capacitor, paper, 2 mfd., 50 V.
	110538	C24, 30, 59, 64, 67	Capacitor, paper, .0047, 400 V.
	110534	C22, 23	Capacitor, paper, .001 mfd., 400 V.
	110546	C52, 116, 19, 31	Capacitor, paper, .1 mfd., 400 V.
	110658	C48	Capacitor, paper, 500 mmf., 10,000 V.
	110428	C29	Capacitor, paper, .25 mfd., 600 V.
	110453	C53	Capacitor, ceramic, 220 mmf.
	110671	C107	Capacitor, ceramic, 6.8 mmf.
	110484	C1	Capacitor, ceramic, 2.5 mmf.
	110437	C106	Capacitor, ceramic, .68 mmf.
	110454	C55	Capacitor, ceramic, 330 mmf.
	110665	C51	Capacitor, ceramic, 39 mmf.
	110664	C46, 47	Capacitor, ceramic, 36 mmf.
	110464	C8	Capacitor, ceramic, 470 mmf.
	110598	C72	Capacitor, ceramic, 5 mmf.
	110451	C105	Capacitor, ceramic, 100 mmf.
	110460	C11	Capacitor, ceramic, 100 mmf.
	110586	C2, 3, 4, 5, 6, 9, 10, 18, 27, 28, 63, 70, 73, 74, 75, 112, 12, 13	Capacitor, ceramic, .005 mfd.
	110397	C16	Capacitor, mica, 500 mmf.
	110208	C39, 37	Capacitor, mica, 270 mmf.
	110216	C38	Capacitor, mica, 390 mmf.
	110272	C35	Capacitor, mica, 3900 mmf.

CONTROLS AND KNOBS

134089	Knob, 7-13, 206	} NC10W NC10M
134086	Knob, brightness	
134088	Knob, horizontal	
134085	Knob, vertical	
134090	Knob, picture	
134087	Knob, volume	
134091	Knob, opera glass	
134092	Knob, tuning	

134110	Knob, 7-13, 2-6	} NC10Y
134113	Knob, brightness	
134109	Knob, horizontal	
134112	Knob, vertical	
134111	Knob, picture	
134114	Knob, volume	
145082	R93	Potentiometer, 100 ohm
145079	R45, 113	Potentiometer, 5000 ohm
145100	R53	Potentiometer, .6 meg.
145081	R90	Potentiometer, 10,000 ohm
145085	R19	Potentiometer, 750 ohm, .25 meg.
145102	R57	Potentiometer, 50,000 ohm, 2 meg.
145076	R71	Potentiometer & Range Switch

TRANSFORMERS, COILS AND CHOKES

161988	T1	Power Transformer
161016	T3	Horizontal Deflection Transformer
114658	T2	Transformer, Vert. Block Osc.
114375		Transformer, Ratio Detector
114071	L16	Coil Ass'y. Linearity
114075	L17	Coil Assembly Booster
114074	L34	Coil Ass'y., horizontal size
161244	T7	Transformer Sound Output
161014	L33	Choke, 150 ma.
161198	L35	Choke, 200 ma.
161242	T4	Transformer, Vertical Deflectional
114382	T10, 11	Coil Ass'y., Video I.F.
114376	T9	Coil, Video I.F.
114385	T8	Coil, Video I.F.
114374	T5	Transformer Sound Coupling
114069	L12	Coil Ass'y., horizontal osc.
114660	L31	Coil Assembly Focus Coil
114654	L11	Coil Assembly Peaking
114655	L15	Coil Assembly Peaking
114656	L14	Coil Assembly Peaking
114657	L10	Coil Assembly Peaking
114995	T35	Pulse Transformer

MISCELLANEOUS

101101	Bottom Panel	
174006	Mask	
125041	Escutcheon, tube ring	
125040	Escutcheon, panel overlay	
138023	Lens	
155974	Speaker and Cable Assembly	
101107	Back Panel Assembly	
152011	Socket, octal, wafer	
152056	Socket, 9 pin molded	
152062	Socket, 7 pin	
152076	Socket, 9 pin wafer	
152999	Phono Jack (speaker)	
30394	Plate, metal electrolytic mtg.	
152011	Socket, octal, wafer	
113045	Tube Clamp	
152014	Socket, octal, molded	
165008	A. C. Receptacle	
152999	Phono Jack	
128002	Fuse Holder	
104036	Base, video tube	
124011	Dial Cord	
156001	Spring	
02680	Wrench, Allen W/et Key #8, long arm	
158036	Switch, Push Button	
150045	Shaft	
33295	Spring, tension	
114659	L32	Deflection Yoke Assembly
114617	Deflection Yoke	
152077	Socket Assembly	
02682	Shield Assembly Transformer	
02598	Shield Assembly, tube	
165012	Connector, Anode	
128003	Fuse, .25 amp.	
151036	Shield, tube	
164012	Tuning Unit Assembly	
	NOTE: Under no circumstances should any repairs be attempted on this unit. Return to the factory for all repairs and adjustments.	

REPLACEMENT PARTS PECULIAR TO SERIES 1 AND 2

RESISTORS

28152	R1	Resistor, 330 ohm, 1/2 watt
01565	R11	Resistor, 100,000 ohm, 1/2 watt
01575	R14	Resistor, 680,000 ohm, 1/2 watt
01567	R15	Resistor, 150,000 ohm, 1/2 watt
01579	R29	Resistor, 15 ohm, 1/2 watt
28146	R118	Resistor, 100 ohm, 1/2 watt
01545	R74	Resistor, 2,200 ohm, 1/2 watt

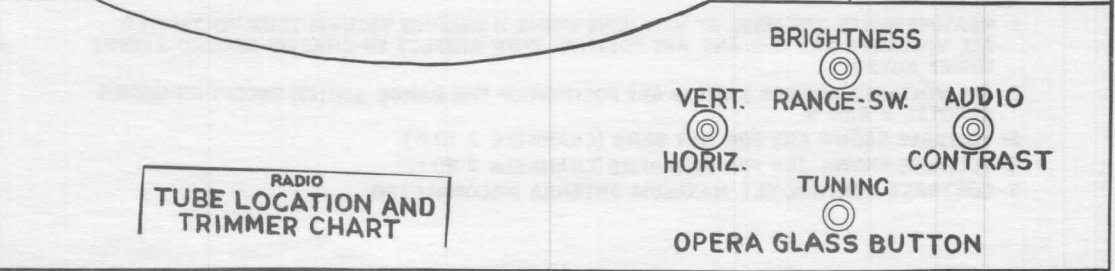
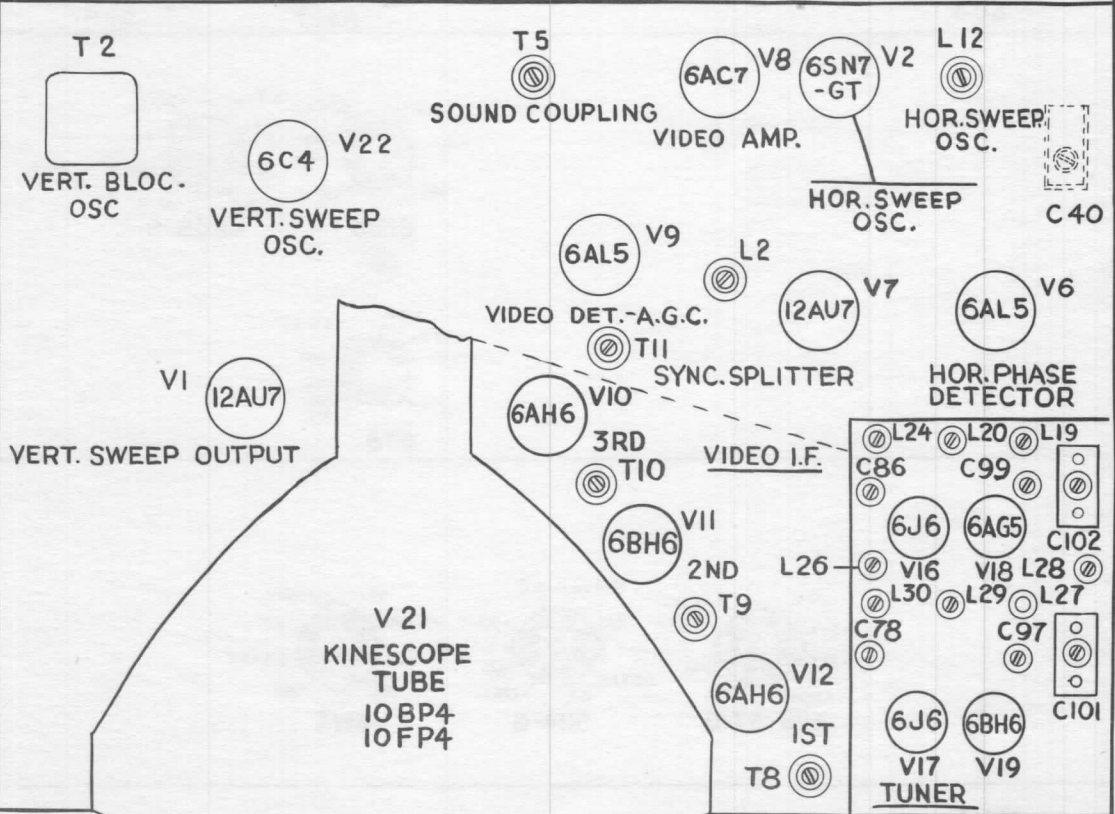
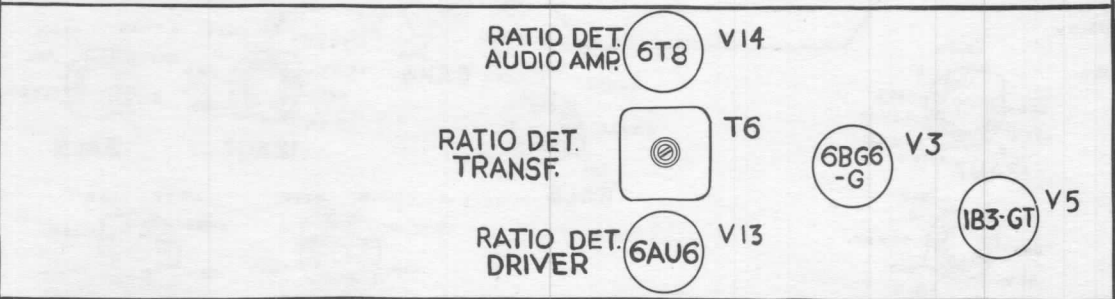
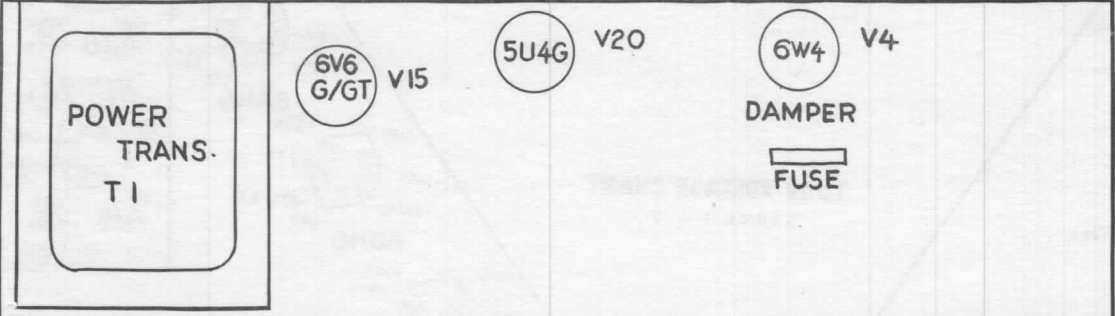
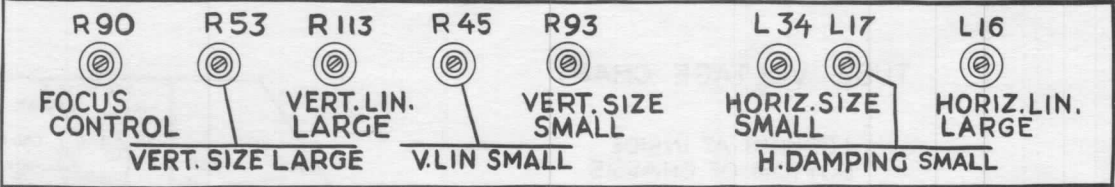
CAPACITORS

110672	C14	Capacitor, .01 mfd.
110464	C16	Capacitor, 470 mmf.
110465	C17	Capacitor, 680 mmf.
110597	C25	Capacitor, 47 mmf.
110653	C20	Capacitor, 22 mmf.
111070	C115	Capacitor, 100 mfd., 6 volt
110561	C52	Capacitor, .1 mfd.
111070	C11	Capacitor, 100 mmf.

CONTROLS

145105	R19	Control, 3,000 ohm
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REAR



RADIO TUBE LOCATION AND TRIMMER CHART

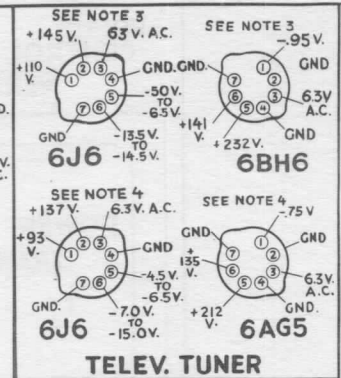
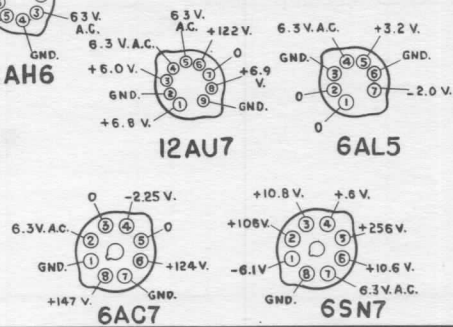
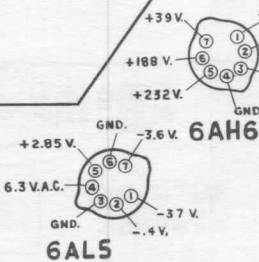
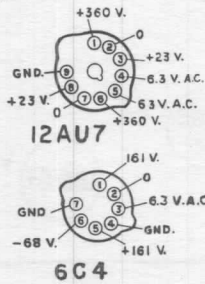
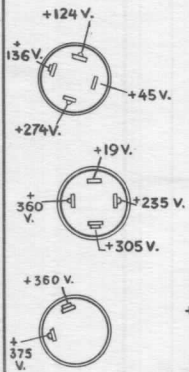
FRONT

TUBE VOLTAGE CHART

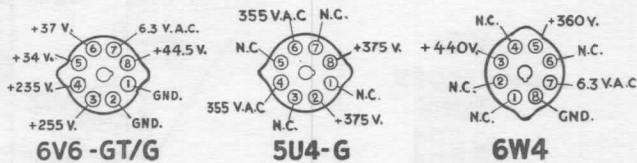
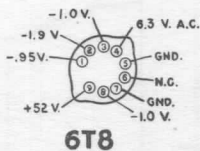
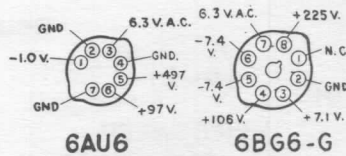
LOOKING AT INSIDE BOTTOM OF CHASSIS

FRONT

TUBE VOLTAGE CHART SERIES 1 & 2



TELEV. TUNER



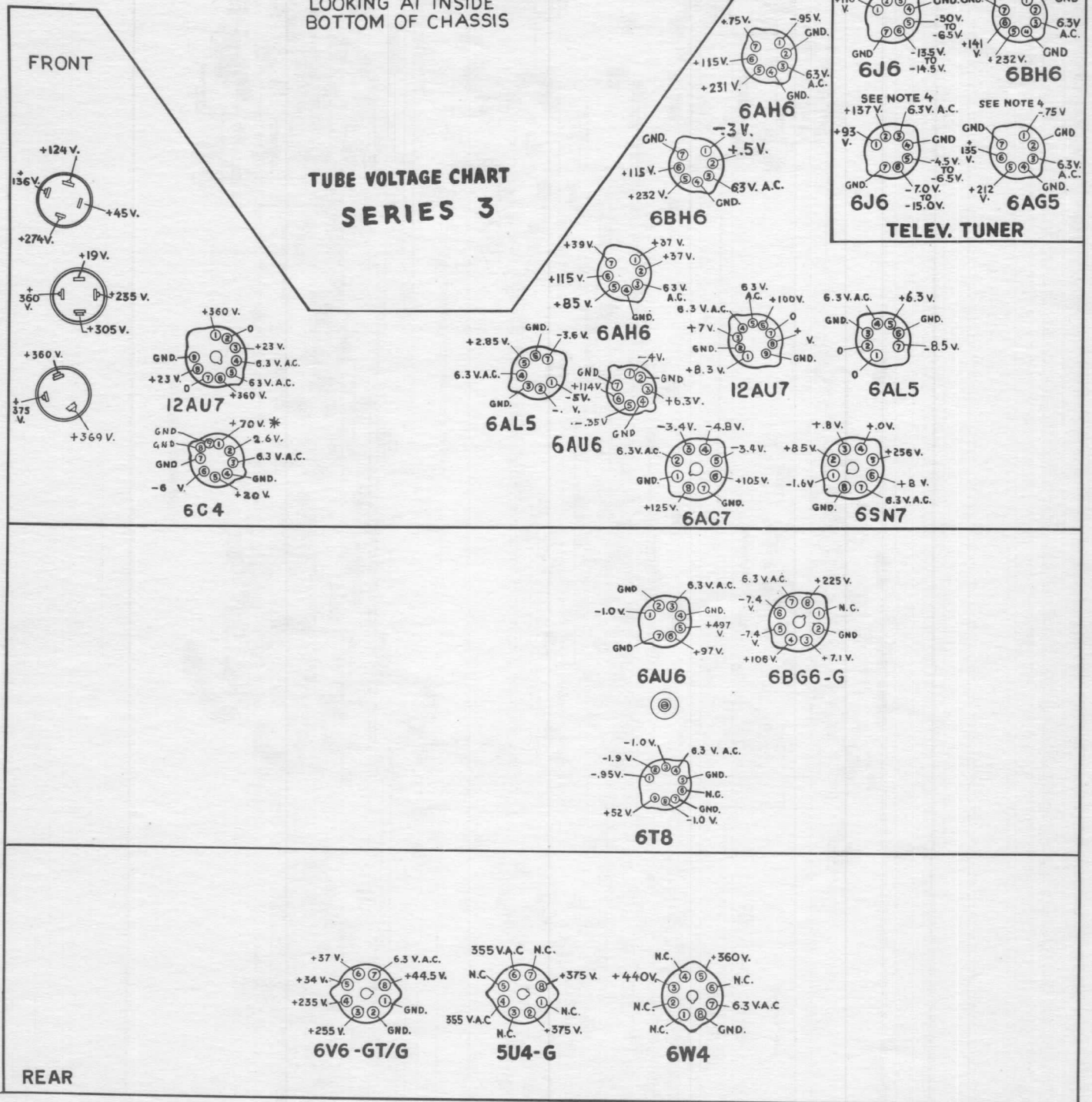
REAR

NOTES:

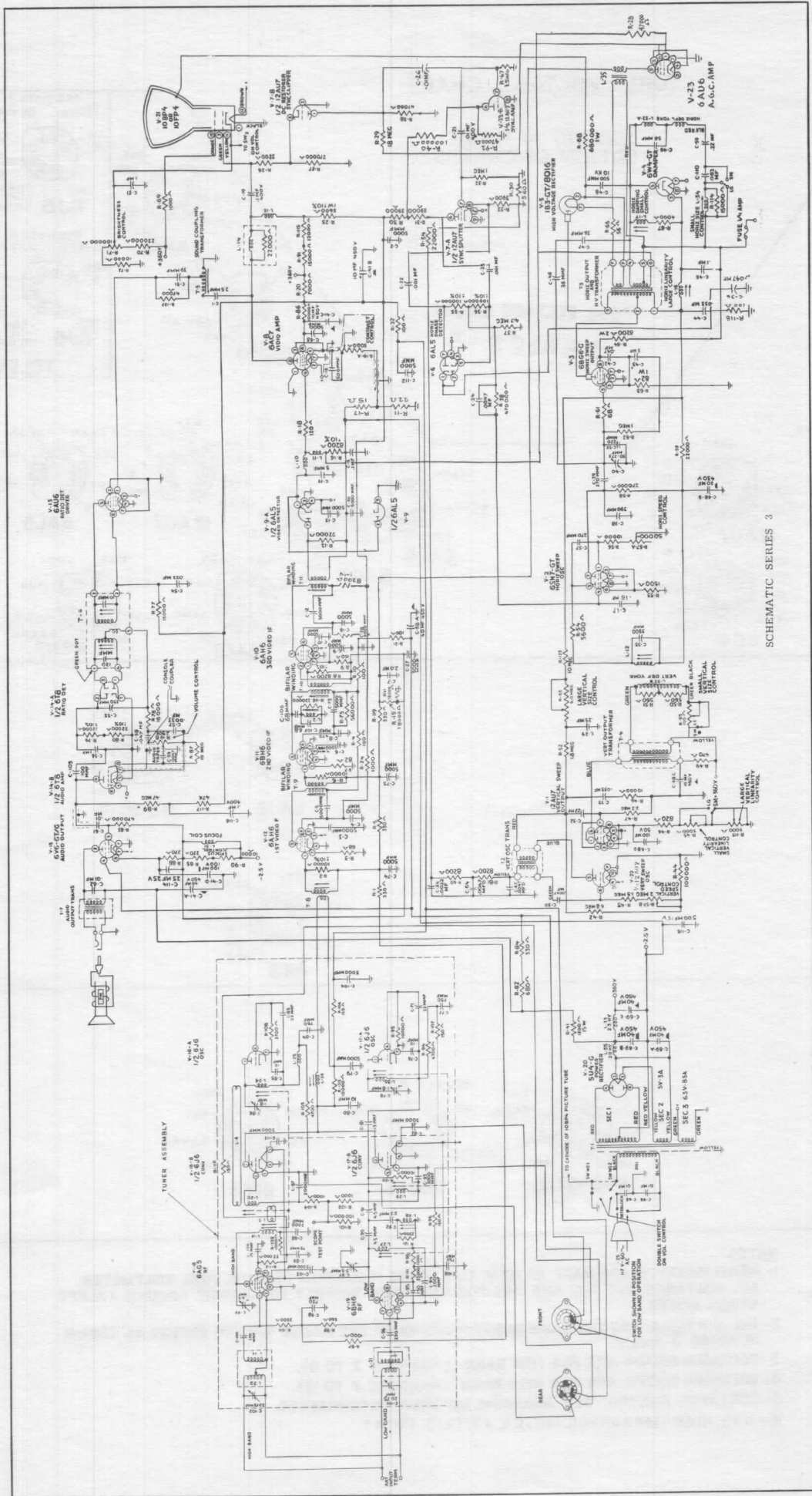
- 1- MEASUREMENTS ARE MADE AT 117 V. LINE USING 11 MEGOHM VACUUM TUBE VOLTMETER. ALL VOLTAGES ARE D.C. AND ARE POSITIVE WITH RESPECT TO CHASSIS GROUND EXCEPT WHERE NOTED.
- 2- ALL VOLTAGES ARE THE SAME IN ANY POSITION OF THE RANGE SWITCH EXCEPT AS SHOWN IN NOTES 3 AND 4.
- 3- VOLTAGES SHOWN ARE FOR LOW BAND (CHANNELS 2 TO 6).
- 4- VOLTAGES SHOWN ARE FOR HIGH BAND (CHANNELS 7 TO 13).
- 5- CONTRAST CONTROL SET MAXIMUM, ANTENNA DISCONNECTED.

TUBE VOLTAGE CHART

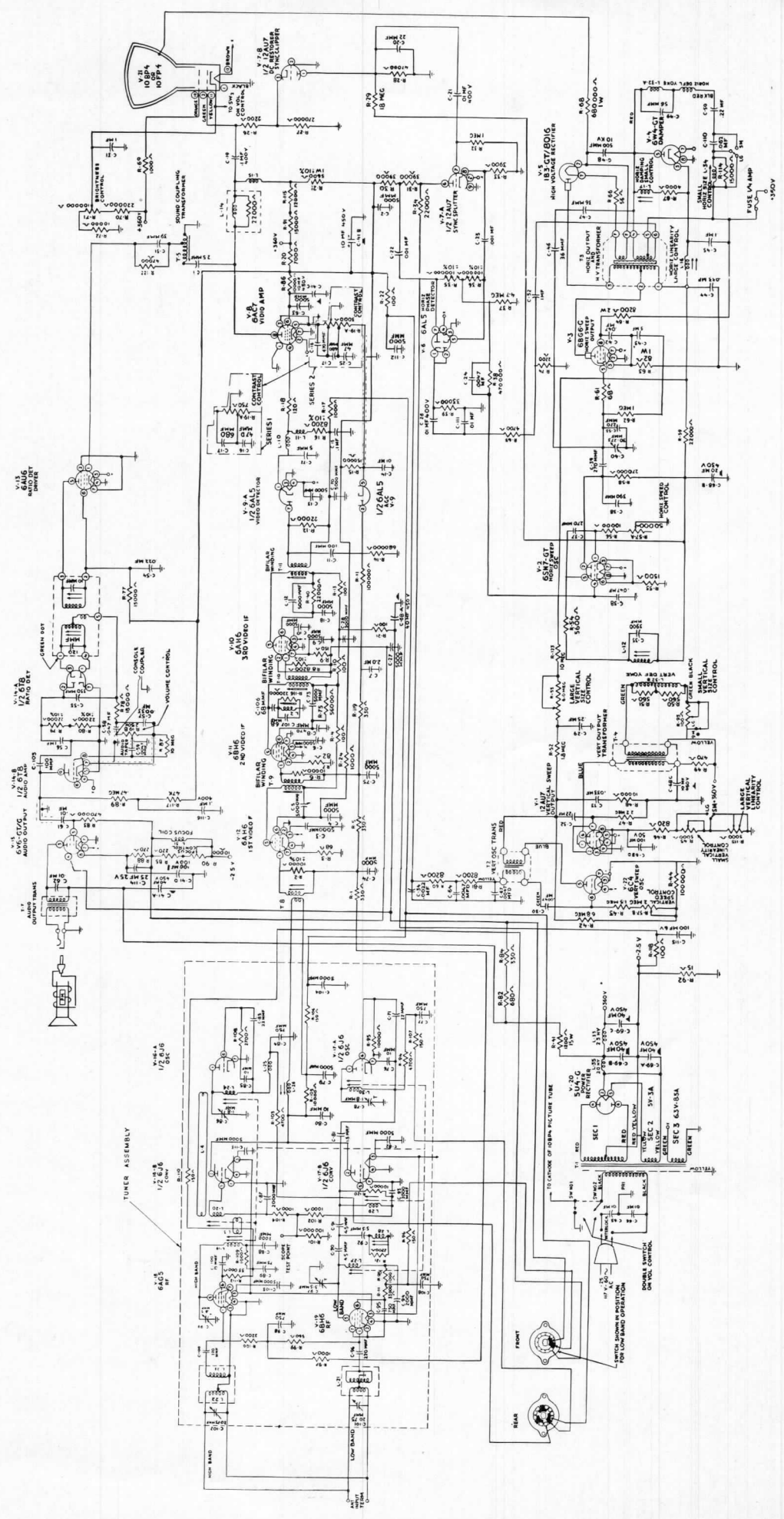
LOOKING AT INSIDE BOTTOM OF CHASSIS



- NOTES:**
- 1- MEASUREMENTS ARE MADE AT 117 V. LINE USING 11 MEGOHM VACUUM TUBE VOLTMETER. ALL VOLTAGES ARE D.C. AND ARE POSITIVE WITH RESPECT TO CHASSIS GROUND EXCEPT WHERE NOTED.
 - 2- ALL VOLTAGES ARE THE SAME IN ANY POSITION OF THE RANGE SWITCH EXCEPT AS SHOWN IN NOTES 3 AND 4.
 - 3- VOLTAGES SHOWN ARE FOR LOW BAND (CHANNELS 2 TO 6).
 - 4- VOLTAGES SHOWN ARE FOR HIGH BAND (CHANNELS 7 TO 13).
 - 5- CONTRAST CONTROL SET MAXIMUM, ANTENNA DISCONNECTED.
- *-USE HIGH IMPEDANCE METER AT THIS POINT



SCHEMATIC SERIES 3



SCHEMATIC SERIES 1 AND 2

