INDEX

MODELS TV-127, 164, 167A, 191
12 1/2, 16 and 19 Inch Television and
Complete FM Radio

ELECTRICAL SPECIFICATIONS

POWER SUPPLY RATING
TV-127 - 185 watts on TV and 85 watts on FM
TV-164, TV-167A and TV-191 - 230 watts on TV and 105 watts on FM

AUDIO POWER OUTPUT RATING
TV-127 - 2.2 watts
TV-164, TV-167A and TV-191 - 2.5 watts

LOUDSPEAKER
TV-127 - 6"
TV-164 - 8", TV-167A and TV-191 - 12"
Voice Coil Impedence - 3.2 ohms at 400 cycles

RECEIVER ANTENNA INPUT IMPEDANCE
300 ohms balanced

TUBE COMPLEMENT See Figure 1.

TUNING RANGE
FM - 88-108 mc.
TV - Channels 2 - 6 (54-88 mc.)
Channels 7 -13 (174-216 mc.)

ALIGNMENT DATA

Picture Carrier Frequency	25.75 mc.
Accompanying Sound Trap	21.25 mc.
Adjacent Sound Trap	27.25 mc.
Sound I.F. Frequency	4.5 mc.
FM First I.F. Frequency	10.7 mc.
FM Second I.F. Frequency	4.5 mc.
FM Second Oscillator Frequency	15.2 mc.
Sound Ratio Detector Band Width	225 kc. (between peaks)
Video Response	to 4.0 mc..

FOCUS - Permanent Magnet

SWEEP DEFLECTION - Electromagnetic

OPERATING CONTROLS - See Figure 1

NON-OPERATING CONTROLS - See Figure 1

PHONO INPUT
High Impedance
Plug - Type PL55 or equivalent

TV FRONT END

The TV front end is a separate sub-chassis of the receiver. Mounted on this chassis are the RF amplifier, converter and oscillator, bandswitch, all RF and oscillator coils and the converter plate. Referring to the schematic diagram, it will be noticed that there are three double triodes available in the front end. One section of each triode is used for high band tuning, and the other section of each triode is used for low band tuning. The switching comprises a changeover in the B+ and antenna coils. The two bands are otherwise completely independent.

With the chassis inverted and the tuning dials facing the operator, all components on the left side of the front end are associated with the low band and all components associated with the high band are located on the right side WITH THE EXCEPTION OF THE LOW AND HIGH BAND ANTENNA COILS WHICH ARE INVERTED IN THEIR LOCATION. The antenna terminates in a band-pass transformer for the low or high band respectively and is switched to the proper transformer when the bandswitch is set to the desired band. The trimmer T3 adjusts the high band circuit. Tuning in the plate circuit of the RF amplifier and grid circuit of the converter is accomplished through a band-pass transformer which is continuously tuned by means of the 3-gang variable condensers located on the top of the chassis directly above their respective coils. The low band interstage transformer is aligned by iron slug S2. The high band interstage transformer is aligned by iron slug S4 and trimmers T4 and T5. The RF oscillators are of the tickler feedback type, tuned over the bands by means of the rear sections of the variable condensers. The low band oscillator is adjusted by brass slug S1 and trimmer T2 and the high band oscillator by brass slug S3 and trimmer T6. The converter plate circuit, common to the low and high band, consists of an RF choke in parallel with the converter coil S5 which is mounted at the rear of the front end sub-chassis.

PICTURE I.F. AMPLIFIER AND DETECTOR

The picture I.F. amplifier is of the conventional stagger tuned type, with four stages of I.F. amplification. In order to obtain proper band-pass characteristics, the picture I.F. coils are tuned as follows:

1. Converter coil - 23.8 Mc (iron slug S5)
2. First picture I.F. coil - 25.6 Mc (iron slug S6)
3. Second picture I.F. coil - 22.2 Mc (iron slug S7)
4. Third picture I.F. coil - 22.0 Mc (iron slug S8)
5. Fourth picture I.F. coil - 25.4 Mc (iron slug S9)

To align the I.F. system, the coils are peaked to the specified frequency with an unmodulated signal generator, The over-all I.F. response is then observed by use of the sweep generator and oscilloscope.

TRAP CIRCUIT

In order to avoid sound carrier interference in the picture, 2 sound traps are incorporated. They are tuned by iron slug S10 to a frequency of 21.25 Mc and by iron slug S21 to a frequency of 27.25 Mc to absorb excessive sound energy.

PICTURE SOUND DETECTOR

The detector is a germanium crystal rectifier (1N60) and is obtained in Video Detector Can Assembly 279-63.

SOUND SYSTEM

The sound channel operates on the intercarrier principle. The output of the second detector contains a 4.5 Mc component which is frequency modul-

ated with the sound, and is amplified by the 6CB6 Video amplifier and the 6AU6 Ratio detector driver. A 6AL5 Ratio detector demodulates the 4.5 Mc F.M. sound signal and feeds the two stage audio amplifier. A 4.5 Mc trap (79-85) is placed in the plate circuit of the video amplifier to prevent FM interference in the picture, and to raise the gain of the Video amplifier for 4.5 Mc. Provision is made for the connection of a record player for phonograph reproduction.

VIDEO AMPLIFIER, CONTRAST CONTROL AND A.G.C.

The single stage video amplifier uses a 6CB6 tube which provides a video amplification of approximately 25 times and has a flat frequency response up to 4 mc.

The contrast control is part of the A.G.C. system. It provides either a positive or a negative voltage which is placed in series with the developed A.G.C. voltage. When rotated in a clockwise direction, the series potential becomes more positive and tends to increase the signal output of the second detector. This action is particularly beneficial for weak signals because it counteracts the contact potential of the I.F. tubes.

DC RESTORER

Since the video amplifier is an AC amplifier, the DC component of the video signal that represents the average illumination of the original scene will not be passed. Unless this DC component is restored, difficulty will be experienced in maintaining proper scene illumination. For any given scene, this average illumination could be set properly by the brightness control. However, a change of scene would probably necessitate resetting this control. The DC restorer accomplishes this setting automatically, thus assuring proper picture illumination at all time.

SYNC. AMPLIFIER AND CLIPPER

The single stage sync. clipper amplifier separates the synchronizing information from the composite video signal signal and delivers well limited, amplified sync. pulses. The composite signal from the video amplifier is fed into a 6AU6 amplifier with the sync. pulses going in the positive direction. The grid and cathode of the 6AU6 act as peak rectifier. Thus a peak DC voltage equal to the composite video signal appears across the grid resistor keeping this tube biased off between sync. pulses. As soon as a new sync. pulse arrives, the grid will conduct and the sync pulse will appear amplified in the plate circuit. The video signal which follows the sync. pulse does not appear in the plate circuit since the sync. pulse has moved the grid potential to cut off again. Thus the video and blanking pulses are removed and only the sync. pulses appear at the sync. clipper plate.

VERTICAL SYNC. AMPLIFIER

The sync. pulses appearing at the sync. clipper plate are negative in polarity. One half of a 12AU7 acting as an amplifier and in conjunction with an integrating network effectively extracts the vertical synchronizing signal and feeds vertical sync. pulses of positive polarity to the vertical oscillator.

VERTICAL OSCILLATOR AND AMPLIFIER

The function of these circuits is to provide a sawtooth of current of the proper frequency and phase to perform the vertical scanning for the picture tube.

1. In models TV-164, TV-167A, and TV-191 a 6C4 tube with its associated components form a blocking oscillator and discharge circuit. The voltage

present at the plate of this tube is of the shape required to produce a sawtooth of current in the vertical deflection coil. This voltage is coupled to a 6S4 tube which amplifies it and supplies a sufficient amount of power to the vertical deflection coil.

2. In the Model TV-127 one-half of a 6SN7 tube with its associated components form a blocking oscillator and discharge circuit. The other half of the 6SN7 is used in the same manner as the 6S4 in the 16" and 19" models.

PHASE INVERTER AND HORIZONTAL DETECTOR

The horizontal phase detector (6AL5) is a dual diode in a circuit which produces a DC output voltage which is proportional to the phase displacement between two input voltages.

The composite sync. signal is split in phase by the 12AU7 phase inverter and the resultant signals (nearly equal and 180° out of phase) comprise one of the input voltages to the phase detector. The other input voltage is taken from a tap on the horizontal output transformer. This peaked sawtooth voltage is shifted in phase and properly shaped by an RC network before being applied as the other input voltage to the phase detector.

The DC output voltage which is proportional to the phase displacement between the two input voltages, namely, the sync. pulses and the output sawtooth voltage, appears at the junction of the two 100K ohm resistors. A 4.7 megohm resistor is connected from this point to ground to provide a DC return for the horizontal sweep oscillator grid circuit. A conventional AFC filter consisting of the 470K ohm resistor in parallel with an 0.005 mfd. condenser in series with an 0.05 mfd. condenser is used. The voltage appearing across the 0.05 mfd. condenser is then the filtered control voltage which is applied to the horizontal sweep oscillator.

HORIZONTAL SWEEP OSCILLOSCOPE

The horizontal sweep oscillator has been developed to realize the characteristics which are most desirable for this purpose. The circuit shown is a stabilized cathode coupled miltivibrator, which combines the sensitivity of the multivibrator with the stability of the sine wave oscillator. The circuit is essentially a sine wave oscillator with good stability, but the resistor in series with the tuned circuit adds an impulse component which provides the desired rapid return time, and in conjunction with the other circuit constants, provides the proper control sensitivity both for the DC applied to the first grid for AFC, and with change in resistance in the second grid circuit for the manual control. Figure 4 shows the wave shape appearing at the plate of the first section of the oscillator.

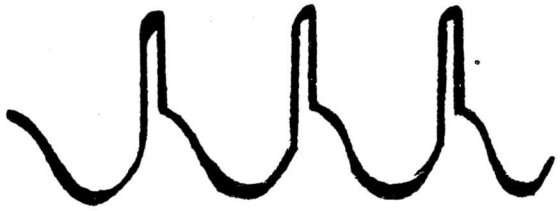


Figure 4 - Wave Shape at Plate of Horizontal Oscillator.

To place the circuit in operation, the 50K ohm horizontal hold control should be set in the center of its range and the variable inductor (part #72-66) adjusted until the picture is properly synchronized.

HORIZONTAL OUTPUT AND HIGH VOLTAGE SUPPLY

The horizontal output amplifier (6CD6G) and "flyback" type power supply uses standard components and is conventional except that no electrical centering means is provided. Centering of the raster is accomplished by manipulating the mechanical adjustments of the focus magnet and ion magnet. The correct centering procedure is outlined in the OPERATING INSTRUCTIONS booklet.

The function of the output tube (6CD6G) is to supply sufficient current of the proper waveform to the horizontal deflection coil in order to provide horizontal scanning for the cathode ray tube. The function of the damper tube (6W4GT) is to stop oscillation and thus help provide a linear trace. It also recovers some of the energy from the yoke kickback and uses it to help supply additional power to the horizontal and vertical sweep circuits.

The width of the picture is controlled by adjusting slug S22 which varies the amount of inductance shunted across a portion of the secondary of the horizontal output transformer. Clockwise rotation of the adjustment increases picture width.

Adjustment of the horizontal drive control located on the rear apron of the chassis determines otpimum linearity and maximum high voltage and, therefore, crispness of picture. Before setting Horizontal Size, advance Drive Control until white vertical lines appear near the center of picture. Then turn back slightly to make lines disappear. The Horizontal Size of the picture should now be set by use of the Horizontal Size Control.

After changing tubes or re-locating the receiver in different location, the Horizontal Size may have to be readjusted due to change in tube characteristics or line voltage, it is always advisable to readjust the Drive Control as mentioned above to maintain maximum high voltage.

Rotation of the horizontal linearity control, S20, will affect the center portion of the picture and should be adjusted for best horizontal linearity as follows:

A.) Rotate slug in counter-clockwise direction until it is completely out of the coil.
B.) Slowly rotate slug in clockwise direction until good linearity is indicated by observation of the test pattern.

NOTE: If this operation is carried too far, a second point will be noticed where, apparently, good linearity is obtained. With this setting however, the center of the picture is distorted and therefore the adjustment should not be left in this position. The correct setting is the one where good linearity is obtained with the slug in the "out" position.

The high voltage power supply is a "kickback" type where the power is obtained from the energy stored in the deflection inductances during each horizontal scan. When the 6CD6G plate current is cut off by the incoming pulse, a pulse appears on the primary of the output transformer due to the collapsing field in the deflection coil. This pulse of voltage is stepped up, rectified by a voltage doubler, filtered, and applied to the second anode of the picture tube.

LOW VOLTAGE POWER SUPPLY

Although the low voltage power supply is a conventional circuit delivering about 360 volts at 200 ma. in Models TV-164, TV-167A, and TV-191 and 300 volts at 190 ma. on Model TV-127, the voltage distribution circuit through the receiver is unique. Those circuits which operate at lower

voltages are connected in series with each other and placed across the higher voltage required for other circuits. The RF-IF cathodes return to chassis and the plates and screens are at +140 volts. The cathode of the audio power amplifier is returned to +140 volts. This tube then operates on the difference between +140 and +360 volts or +220 volts on Models TV-164, TV-167A and TV-191. On Model TV-127, the tube operates on the difference between +140 and +300 volts or plus 160 volts. Resistance is added in series with the audio output tube plate circuit which, together with the 20 mfd. condenser returned to the cathode, acts as a filter to keep its current variations from modulating the B supply voltage.

The audio output tube also operates as a series regulator tube to maintain the +140 volts relatively constant. Because its grid is connected to a divider running from +360 volts (300 volts for Model TV-127) to ground, any change in the +140 volts, due to current variations in the RF-IF circuits, changes the effective grid - cathode voltage of the audio output tube thereby providing a substantial amount of automatic voltage regulation.

FM TUNER

The FM tuner section of this receiver consists of a 6BA6 RF amplifier, a 6BE6 first converter and a 12AT7 second converter. The RF and first converter stages are conventional and produce an intermediate frequency of 10.7 mc. at the output of the first converter. The second converter is a dual triode, one section operating as a mixer and the other section operating as an oscillator. The 10.7 mc. IF tube of the first converter is heterodyned with a fixed oscillator operating at 15.2 mc. in the mixer triode section. The 15.2 mc. signal is generated in the oscillator section of the 12AT7 tube. The difference frequency of 4.5 mc. appears in the mixer plate and is coupled into the video detector. From this point the signal is handled in the same manner as the sound component of the TV signal.

ALIGNMENT PROCEDURE

TEST EQUIPMENT

To properly service this receiver, it is necessary that the following test equipment be available:

1. RF Sweep Generator - Frequency ranges:
   a) 20 to 27 Mc. b) 50 to 90 Mc. (at least 10 Mc. sweep width)
   c) 170 to 225 Mc. (at least 10 Mc. sweep width)
   Output must be adjustable to a maximum of 1 volt.

2. Cathode Ray Oscilloscope
   Preferably one with a wide band vertical deflection, an input calibrating source and a low capacity probe.

3. Signal Generator to provide frequencies in the following ranges:
   a) 4.4 to 4.5 Mc. b) 10.7 Mc c) 20 to 27 Mc.
   d) 52 to 90 Mc. e) 88 to 108 Mc. f) 172 to 219 Mc.

4. Vacuum Tube Voltmeter and High Voltage Multiplier Probe for use with this meter to permit measurements up to 15,000 volts.

ADJUSTMENTS REQUIRED (Refer to Figure 1 for location of alignment adjustments)

Front end - Normally only the RF oscillator coils will require the attention of the service technician. All other circuits are very broad and will therefore only rarely require readjustment. If a realignment should

be needed, only those thoroughly familiar with very high frequencies and sweep generators should attempt it. The oscillator coil adjustments are critical and may be affected by a tube change. Low band, as well as high band oscillator, are aligned by a trimmer and padder like a normal AM receiver.

A.) Low Band

Switch band selector to the low band, engage variable condenser completely. Then, tune slug S1 until the frequency of the oscillator equals 80 Mc. Disengage variable condenser completely and adjust trimmer T2 for an oscillator frequency of 110 Mc. Repeat this procedure several times to check accuracy.

B.) High Band

Throw the band selector switch to high band. Engage the variable condenser fully and adjust slug S3 until the oscillator frequency equals 200 Mc. Disengage condenser completely and adjust trimmer T6 to an oscillator frequency of 239 Mc. Repeat procedure several times.

The detailed alignment procedure which follows is intended primarily as a discussion of the method used, precautions to be taken and the reasons for these precautions. Then, for more convenient reference during alignment, a tabulation of the method is given. All the information necessary for alignment is given in the table. However, alignment by the table should not be attempted before reading the detailed instructions.

ORDER OF ALIGNMENT

When a complete receiver alignment is necessary, it should be performed in the following order:

A.) Align ratio detector as indicated in alignment table at 4.5 Mc.
B.) Set 4.5 Mc. trap with slug S11.
C.) Align all I.F. transformers following procedure and table.
D.) Set sound traps to 21.25 Mc. with slug S10 and to 27.25 with slug S21.
E.) Retouch picture I.F. transformers for full band width as per alignment procedure in table.
F.) Align FM section as per alignment procedure in table.
G.) Connect receiver to an antenna and tune for a test pattern if possible.
H.) Pay special attention to the proper setting of the HORIZONTAL HOLD CONTROL. It is not enough to set the HORIZONTAL HOLD CONTROL at the time of installation to "hold" a picture. The setting should be checked for "pull-in". To make this check, the TUNING CONTROL should be tuned rapidly on and off a station. Find the point of adjustment for the HORIZONTAL HOLD CONTROL, where the picture will fall into frame, without hesitation.
I.) Adjust other size and hold controls as outlined in OPERATING INSTRUCTIONS booklet.
J.) Adjust FM trap slug S11 for minimum FM interference in picture.

PICTURE I.F. OSCILLATION

If the receiver is badly misaligned and two or more of the I.F. coils are tuned to the same frequency, or if the sound traps are not set properly, the receiver may fall into I.F. oscillatorn. I.F. oscillation shows up as a voltage in excess of a few tenths of a volt at the picture detector load resistor. If such a condition is encountered, it is sometimes possible to stop oscillation by adjusting the coils approximately by setting the adjustment screws to be nearly equal to those of another receiver known to be in proper alignment.

There is little likelihood of any oscillation occurring if the 21.25 Mc. trap (adjusted by slug S10) is at its proper frequency, and the third picture I.F. (slug S3) is set at 21.6 Mc. or lower. If oscillation persists, check for open by-pass condenser in I.F. strip.

FUNCTION	NOTES
1) Video I.F. Spot Frequency Alignment	Switch to TV Channels --- Contrast Co to Maximu --- Remove 12AT Oscillator
2) FM & TV SOUND I.F. and Ratio Detector Alignment	Switch to (Close Ga ---- Contrast C to Maximu

RATIO DETECTOR ALIGNMENT

Set the signal generator for approximately 1 volt output at 4.5 Mc. and connect it to the grid of the ratio detector driver. To align the primary of the Ratio Detector, connect the vacuum tube voltmeter to pin No. 2 of the 6AL5 and tune S13 for maximum negative voltage. To balance the secondary of the ratio detector, connect the vacuum tube voltmeter from the phono input jack to ground. Adjust S14. It will be found that it is possible to produce a positive or negative voltage depending on this adjustment. Obviously, to pass from a positive to a negative voltage, the voltage must go through zero. S14 should be adjusted for zero output. It is possible to use any television station for this alignment since the difference between the frequency of the picture and the sound carrier is 4.5 mc.

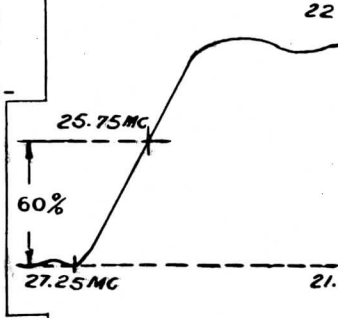
SOUND I.F. ALIGNMENT

Connect the signal generator to terminal #4 of the video detector assembly and maintain it at 4.5 Mc. Connect the vacuum tube voltmeter to pin No. 2 of the 6AL5 Ratio Detector and adjust slug S12 for maximum DC reading. Reduce output of signal generator to a very low lev l and readjust S12.

ALIGNMENT CHART

NOTES	CONNECT R.F. SIGNAL GENERATOR To:	CONNECT OUTPUT INDICATOR (V.T.V.M.) TO:	SET SIGNAL GENERATOR TO: (MC.)	ADJUST	OUTPUT INDICATIONS
Switch to TV Channels 2-6 --- Contrast Control to Maximum --- Remove 12AT7 Oscillator Tube	Low Band Mixer Grid (Pin #7)	Terminal #4 of Video Detector Coil Assembly	23.8	S5	Maximum on V.T.V.M.
			25.6	S6	" " "
			22.2	S7	" " "
			22.0	S8	" " "
			25.4	S9	" " "
			21.25	S10	Minimum on V.T.V.M.
			27.25	S21	" " "
Switch to FM (Close Gang) ---- Contrast Control to Maximum	Terminal #4 of Video Detector Coil Assembly	Pin #2 of 6AL5 Ratio Detector	4.5 Mc. (Use Weak Signal)	S13 and S12	Maximum on V.T.V.M.
	Pin #7 of 12AT7 FM 2nd Converter	Same	4.5 Mc. (Use Weak Signal)	S18	Maximum on V.T.V.M.
	Same	Phono Input Jack	4.5 Mc. (Use Weak Signal)	S14	Accurately for Zero Balance
	Pin #1 of 6BE6 FM 1st Converter	Same	10.7 Mc. (Use Weak Signal)	S17	Readjust for Zero Balance
	Same	Pin #2 of 6AL5 Ratio Detector	10.7 Mc. (Use Weak Signal	S16 and S15	Maximum on V.T.V.M.
		Repeak Slugs S13, S12, S18, S16 and S15 for Maximum Output Indication			

FUNCTION	NOTES	CONNECT R.F. SIGNAL GENERATOR TO:	CONNECT OUTPUT INDICATOR (V.T.V.M.) TO:	SET R.F. SIGNAL GENERATOR and DIAL POINTER TO:	ADJUST	IN
3) FM RF Alignment	Switch to FM ---- Contrast Control to Maximum ---- Before Aligning Check Zero Set of FM Dial Pointer	Antenna Terminals Through 2 150 ohm Resistors (Dummy)	Pin #2 of 6AL5 Ratio Detector	90 MC.	Oscillator Disc (P1) and R.F. Padder P2	Ma
				Set Generator to 106MC. and locate Signal on FM Dial. Note amount of error.	Set Tuner Pointer to the other side of 106 MC. by 1/2 the Error Found. Then Adjust T8.	M
			106 MC.	Oscillator Disc (P1)	Oscillator Disc (P1) and Antenna Trimmer (T7)	M
				Recheck Calibration at 90		
				If Necessary, Repeat.		

FUNCTION	CONNECT SWEEP GENERATOR TO: TO:	CONNECT R.F. SIGNAL GENERATOR TO:	SET R.F. SIGNAL GENERATOR TO:	CONNECT SCOPE TO:	ADJUSTMENTS
4) VIDEO I.F. SWEEP ALIGNMENT	Loosely coupled to 12AT7 mixer tube by means of a metal sleeve 1" wide. A miniature tube shield may be used. NOTE: Switch to Channels 2-6	Loosely coupled to Sweep Generator Output Cable.	Signal Generator is used as marker. Set from 20-28 Mc. as needed for markers.	Terminal #4 of Video Detector Coil Assembly 279-63 (Scope is synchronized to Sweep Generator.)	Adjust S5, S6, S7, S S9 (as needed) to g following response  NOTE: Keep input si at low level to avo overloading. Keep trast control at ce setting.

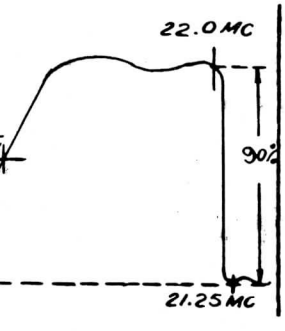
ADJUST	OUTPUT INDICATION
Oscillator Disc (P1) and R.F. Padder P2	Maximum on V.T.V.M
Set Tuner Pointer to the other side of 106 MC. by 1/2 the Error Found. Then Adjust T8.	Maximum to V.T.V.M.
Oscillator Disc (P1) and Antenna Trimmer (T7)	Maximum on V.T.V.M.

bration at 90 MC.

ry, Repeat.

DJUSTMENTS

S5, S6, S7, S8 and needed) to give owing response curve:



Keep input signal level to avoid ading. Keep control at center g.

SERVICE SUGGESTIONS

I. NO RASTER ON C.R.T. - SOUND NORMAL

A.) IF ALSO NO HIGH VOLTAGE

1. Check 1/4 amp. fuse. Before replacing blown fuse check the following:-

a.) Deflection yoke coils - check for grounded windings and shorts between Vertical and Horizontal windings.
b.) Defective horizontal output transformer.
c.) Defective 6CD6G, 1B3GT's or 6W4GT.
d.) Shorted yoke series condenser.
e.) Shorted Boost filter electrolytic

2. Check 6SN7GT horizontal oscillator tube and associated circuit components. No horizontal drive.
3. Check 500 mmfd. high voltage filter capacitors.
4. Open high voltage filter resistor.

B.) IF HIGH VOLTAGE IS NORMAL

1. Ion trap magnet set incorrectly or reversed.
2. Defective C.R.T.
3. Wrong operating voltages at C.R.T. socket.
4. Check setting of brightness control.

II. NO VERTICAL DEFLECTION

1.) Check 6C4 (6SN7 in TV-127) vertical oscillator and associated circuit components.
2.) Check 6S4 (6SN7 in TV-127) vertical amplifier and associated circuit components.
3.) Check vertical deflection coils.
4.) Check vertical output transformer.
5.) Check for B+ supply voltage.

III. POOR VERTICAL LINEARITY

1.) If adjustments do not correct, change 6C4 and/or 6S4 vertical sweep tubes. (6SN7 in TV-127)
2.) Low B+ supply voltage.
3.) Defective vertical output transformer.

IV. UNSTABLE VERTICAL HOLD (JITTER)

1.) If adjustments do not correct, change 6C4 and/or 6S4 vertical sweep tubes. (6SN7 in TV-127)
2.) Check as in sections II and III for intermittent operation.
3.) Check 4700 mmfd. vertical oscillator grid capacitor.
4.) Excessive external noise conditions combined with weak signals due to poor reception or misalignment.
5.) Contrast control operated at excessive level.
6.) Excessive input signal causing overload. Attenuate antenna input.
7.) Check for loose connections or noisy tubes.

V. NO VERTICAL SYNC. (ROLLING)

1.) Check 1/2 12AU7 vertical sync. amplifier, and associated components.
2.) Check components associated with timer grid (pin 4) of 6SN7 vert. oscillator.

VI. TRAPEZOIDAL OR NON-SYMMETRICAL RASTER

1.) Improper setting of focus magnet or ion trap magnet. This will also cause shading at the sides or corners of the raster.
2.) Defective yoke.
3.) Defective C.R.T.
4.) Defective focus magnet.

VII. POOR HORIZONTAL LINEARITY

1.) If adjustments do not correct, change 6SN7GT, 6CD6G or 6W4GT tubes in horizontal sweep circuit.
2.) Horizontal output transformer defective.
3.) Defective deflection yoke.
4.) Check horizontal linearity control associated components.
5.) Broken slug inside linearity coil.
6.) Check circuit components coupling 6SN7GT horizontal oscillator tube to 6CD6G.
7.) Check D.C. operating voltages at tube sockets.
8.) Raster may be off center due to:
    a.) Focus magnet set wrong.
    b.) Shorted or leaky .25 mfd. capacitor returning horizontal deflection coil to B+.

VIII. NO HORIZONTAL SYNC. (PICTURE TEARING)

1.) S19 improperly adjusted - readjust for sync. with horizontal hold control at center of rotation.
2.) Check 1/2 12AU7 phase inverter and 6AL5 phase detector tubes and associated circuit components.
3.) Horizontal output transformer defective.
4.) Check horizontal oscillator coil, part #72-66.
5.) Check tubes and components in horizontal oscillator circuit. Check D.C. operating voltages.
6.) Dress C.R.T. cathode lead (yellow) away from deflection yoke cable. If too near, will cause horizontal jitter.

IX. NO HORIZONTAL OR VERTICAL SYNC. (SIGNAL NORMAL AT C.R.T.)

1.) Check 6AU6 sync. clipper and associated circuit components.
2.) Check 1/2 6AL5 D.C. restorer.
3.) Check 1N60 germanium crystal video detector.
4.) Defective deflection yoke.
5.) Defective 100 mfd., 25 V. cathode by-pass capacitor on 6S4. (6SN7 in TV-127)

X. RASTER AND SIGNAL ON C.R.T. BUT NO SOUND

1.) Check 6AU6 ratio detector driver, 6AL5 ratio detector and audio amplifier tubes and circuit components.
2.) Check shielded audio leads for grounds.
3.) Defective loudspeaker.
4.) Check phono input jack for bad contacts.

XI.

1.)
2.)
3.)
4.)

XII.

1.)
2.)
3.)

XIII

1.)
2.)
3.)
4.)
5.)
6.)
7.)

XIV.

1.)

2.)
3.)

XV.

1.)
2.)
3.)
4.)
5.)
6.)

XVI.

1.)
2.)
3.)

XVII

1.)
2.)
3.)
4.)
5.)
6.)

XI. SOUND DISTORTED

1.) Sheck alignment and balance of ratio detector.
2.) Check operating bias on 6AQ5 tube (at 117 volt A.C. line and with no signal, should be between 6 and 10 volts).
3.) Defective audio tubes.
4.) Defective loudspeaker.

XII. HUM OR BUZZ IN SOUND-VOLUME CONTROL MINIMUM

1.) Dress .05 mfd. coupling condenser to 6AT6 grid away from high band oscillator coil.
2.) Check main power supply filter capacitors.
3.) Check 80 mfd., 150V., 6AQ5 cathode by-pass capacitors.

XIII. PICTURE STABLE - POOR RESOLUTION

1.) Check video detector coil assembly and 1N60 germanium crystal.
2.) Check 6CB6 Video Amplifier tube.
3.) Check peaking coils in video amplifier.
4.) Check alignment of 4.5 Mc. trap.
5.) Check setting of focus magnet.
6.) Defective C.R.T.
7.) R.F. - I.F. circuits improperly aligned.

XIV. PICTURE SMEARY, TRAILERS

1.) Video amplifier overloaded by excessive input. Reduce contrast control setting.
NOTE: In strong signal areas, excessive input at the antenna terminals will produce smear, picture jitter, etc. An attenuator network at the antenna terminals will remedy this condition.
2.) Check for open 500 microhenry choke (75-26) in video detector can.
3.) Check video coupling capacitors and grid resistors.

XV. RASTER BUT NO SOUND, PICTURE OR SYNC.

1.) Defective antenna or transmission line.
2.) R.F. oscillator not operating or off frequency.
3.) R.F. unit completely inoperative. Check tubes and voltages.
4.) I.F. section inoperative. Check tubes and voltages.
5.) Check video detector coil assembly and crystal.
6.) Video amplifier inoperative. Check tubes and voltages.

XVI. PICTURE AND SOUND NOT TUNING TOGETHER

1.) Complete realignment.
2.) Extremely weak signal conditions due to location or poor antenna.
3.) Set being tuned improperly.

XVII. DIFFICULTY IN TUNING ACCOMPANIED BY BUZZ

1.) Check alignment of 21.25 mc. trap (S10)
2.) Check ratio detector alignment.
3.) Complete realignment.
4.) Weak or poor signal conditions due to location or antenna.
5.) Everything normal, but set is being tuned improperly.
6.) Contrast control turned up too far, overloading video amplifier.

VOLTAGE CHART TV-164, TV-167A, TV-191

Measurements made with receiver operating on 117 volt 60 cycle line, no signal input.
Volume control, brightness control, and contrast control set at minimum (counter clockwise position) except where noted.
Band Switch in Channel 2-6 position except where noted. Measurements made at low freq. end of bands (gang closed).
Voltages measured with vacuum tube voltmeter.
Grid voltages measured between grid and cathode. Other voltages measured to chassis.

TUBE TYPE	FUNCTION	PLATE		SCREEN		CATHODE		GRID		NOTES ON MEASUREMENTS
		PIN	VOLTS	PIN	VOLTS	PIN	VOLTS	PIN	VOLTS	
12AT7	High Band R.F.	1	140	-	-	3	0	2	-3.0	Band Switch Sent on TV Ch. 7 to 13 Gang Closed
12AT7	High Band Mixer	1	140	-	-	3	2.5	2	-2.5	
12AT7	High Band Osc.	1	140	-	-	3	0	2	-3.0	
12AT7	Low Band R.F.	6	140	-	-	8	0	7	-3.25	Band Switch Set on TV Ch. 2 to 6 Gang Closed
12AT7	Low Band Mixer	6	140	-	-	8	0	7	-1.5	
12AT7	Low Band Osc.	6	140	-	-	8	0	7	-1.0	
6AU6	1st I.F.	5	140	6	140	7	.1	1	-3.5	
6AU6	2nd I.F.	5	140	6	140	7	.1	1	-3.5	
6AU6	3rd I.F.	5	140	6	140	7	.1	1	-3.5	
6AH6	4th I.F.	5	256	6	140	7	1.5	1	-1.5	
6AU6	Ratio Det. Driver	5	140	6	140	7	1.25	1	-1.25	
6AL5	Ratio Det.	7	-.1	-	-	1	0	-	-	These voltages vary with signal and noise
		2	0	-	-	5	-.1	-	-	
6AT6	1st Audio	7	80	-	-	2	0	1	-1	
6AQ5	Audio Output	5	340	6	350	2	140	7	-10	Cont. Grid to Gnd - 130V varies with signal.
6CB6	Video Amp.	5	190	6	140	2	0	1	-1.7	Contrast Min.
		5	210	6	130	2	0	1	-1.9	Contrast Max.
6AL5	D.C. Rest.	7	-.25	-	-	1	.75	-	-	
"	A.G.C.	2	-3.5	-	-	5	-2.75	-	-	Contrast Min
		2	2.25	-	-	5	4.0	-	-	Contrast Max
6C4	Vert.Osc.	1	115	-	-	7	0	6	-40	Vert Controls set for normal picture
6S4	Vert.Output	9	440	-	-	2	25	6	-25	
6SN7	Hor.Osc.	2	260	-	-	3	10	1	-8	Hor. controls set for normal picture
"		5	180	-	-	6	10	4	-20	
6CD6G	Hor.Output	Cap	See Note1	8	140	3	12	5	-30	
6W4GT	Damper	5	360	-	-	3	550	-	-	
1B3GT	HV Rect.	-	-	-	-	2	7.2 KV	-	-	
1B3GT	HV Rect.	-	-	-	-	2	14 KC	-	-	

TUBE	FUNCTION	PLATE		SCREEN		CATHODE		GRID		NOTES ON MEASUREMENTS
		PIN	VOLTS	PIN	VOLTS	PIN	VOLTS	PIN	VOLTS	
16TP4) 16KP4) 19AP4)	Picture tube	Cap Cap	14 KV 12.8KV	10 10	360 360	11 11	140 30	2 2	-100 -25	Min. Brightness Max. Brightness
6BA6	FM - RF Amp.	5	135	6	95	7	1	1	-1	Band Switch in FM-Phono Position
6BE6	FM - 1st Conv.	5	140	6	90	2	0	1	-2	
12AT7	FM - 2nd Osc.	1	140	-	-	3	0	2	-5	
12AT7	FM - 2nd Mix.	6	140	-	-	8	0	7	-4	
5U4G	Rect.	4	370 AC			2	360			Band switch in FM-Phono posit.
5U4G	Rect.	6	370 AC							
5U4G	Rect.	4	380 AC			2	360			Band Switch in TV Ch. 2-6 Pos.
5U4G	Rect.	6	380 AC							

Note 1 +520 V. at + end of 20 mf 250 V. Booster Electrolytic, 5500V. Pulses at 6CD6G Plate. Do Not Measure at this Point.

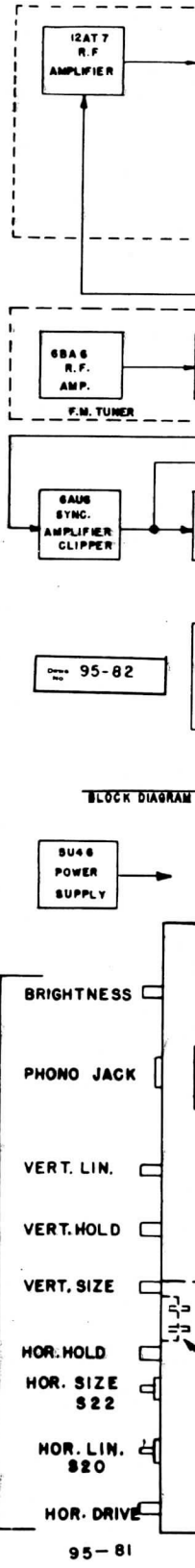
VOLTAGE CHART TV-127

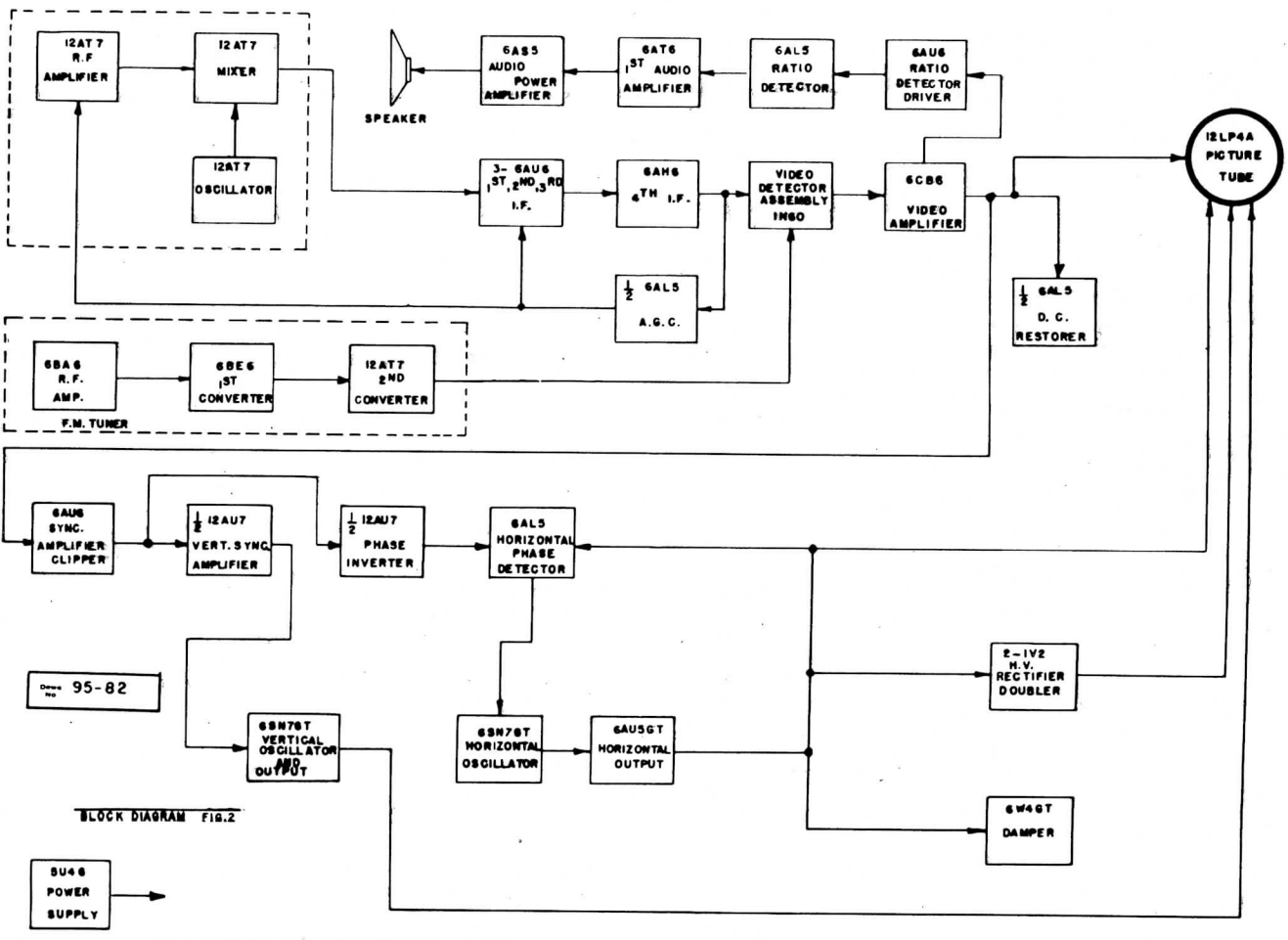
MEASUREMENTS MADE WITH RECEIVER OPERATING ON 117 volt 60 cycle line, no signal input.
Volume control, brightness control, and contrast control set at minimum (counter clockwise position) except where noted.
Band Switch in Channel 2-6 position except where noted. Measurements made at low freq. end of bands (gang closed).
Voltages measured with vacuum tube voltmeter.
Grid voltages measured between grid and cathode. Other voltages measured to chassis

TUBE TYPE	FUNCTION	PLATE		SCREEN		CATHODE		*GRID		NOTES ON MEASUREMENTS
		PIN	VOLTS	PIN	VOLTS	PIN	VOLTS	PIN	VOLTS	
12AT7 (a)	High Band R.F.	1	145	-	-	3	0	2	-4	Band switch
12AT7 (b)	High Band Mixer	1	145	-	-	3	2.5	2	-2.5	set on TV Ch. 7-13
12AT7 (c)	High Band Osc.	1	145	-	-	3	0	2	-4	Gang closed
12AT7 (a)	Low Band R.F.	6	145	-	-	8	0	7	-4	Band switch
12AT7 (b)	Low Band Mixer	6	145	--	-	8	0	7	-1.5	set on TV Ch. 2-6
12AT7 (c)	Low Band Osc.	6	145	-	-	8	0	7	-1.5	Gang closed
6AU6	1st I.F.	5	145	6	145	7	.1	1	-4	Band switch to Ch. 2-6
6AU6	2nd I.F.	5	290	6	145	7	.1	1	-4	
6AU6	3rd I.F.	5	290	6	145	7	.1	1	-4	
6AH6	4th I.F.	5	290	6	145	7	2	1	-2	
6AU6	Ratio Det. Driver	5	145	6	145	7	1.5	1	-1.5	

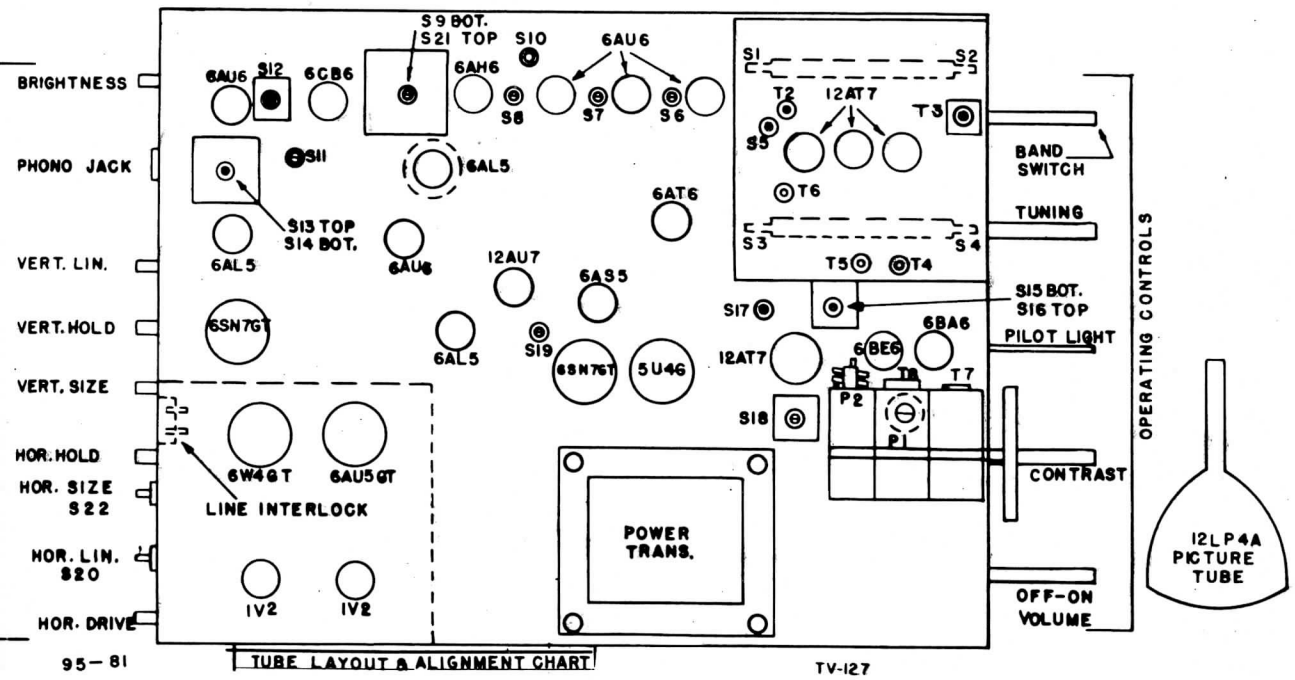
TUBE TYPE	FUNCTION	PLATE		SCREEN		CATHODE		*GRID		NOTES ON MEASUREMENTS
		PIN	VOLTS	PIN	VOLTS	PIN	VOLTS	PIN	VOLTS	
6AL5	Ratio Detector	7	0	-	-	1	.1	-	-	These voltages will vary with different signal or noise conditions.
		2	-.1	-	-	5	0	-	-	
6AT6	1st audio amplifier	7	75	-	-	2	0	1	-.7	
6AS5	Audio power amp.	7	280	6	275	1	145	2.5	-13	
6CB6	Video amplifier	5	190	6	145	2	0	1	-1.7	Contrast Min
		5	210	6	135	2	0	1	-1.9	Contrast Max
1/2 6AL5	D.C. Restorer	7	-.3	-	-	1	.4	-	-	
"	A.G.C.	2	-4	-	-	5	-3.5	-	-	Contrast Min.
		2	2	-	-	5	5	-	-	Contrast Max.
6AU6	Sync.clipper amp.	5	55	6	35	7	0	1	-1	
1/2 12AU7	Vertical sync.amp.	6	100	-	-	8	55	7	-1	
1/2 12AU7	Phase inverter	1	110	-	-	3	55	2	1	
6AL5	Horizontal Phase det.	2	-15	-	-	5	.1	-	-	
		7	.1	-	-	1	20	-	-	
1/2 6SN7	Vert. osc.	5	120	-	-	6	0	4	-50	All vertical controls set at normal picture setting
1/2 6SN7	Vert. output	2	410	-	-	3	15	1	-15	
1/2 6SN7	Hor. osc.	2	270	-	-	3	12	1	-10	All horizontal controls set at normal picture setting
1/2 6SN7		5	140	-	-	6	12	4	-25	
6AU5	Horiz. output	5	See Note 1	8	200	3	7	1	-30	
6W4GT	Damper	5	300	-	-	3	440	-	-	
1V2	H.V. Rect. (a)	-	-	-	-	4	12 KV	-	-	
1V2	H.V. Rect. (b)	-	-	-	-	4	6 KV	-	-	
12LP4A	Picture tube	Cap	12 KV	10	400	11	150	2	-110	Brightness min
		Cap	10.1KV	10	390	11	40	2	-30	Brightness max
6BA6	FM - RF Amplifier	5	145	6	100	7	1.2	1	-1.2	Band switch to FM position (gang closed)
6BE6	FM - 1st Converter	5	145	6	100	2	0	1 7	-3 0	
1/2 12AT7	FM - 2nd Mixer	6	145	-	-	3	0	7	-2.5	
1/2 12AT7	FM - 2nd Osc.	1	145	-	-	3	0	2	-2	
5U4G	Rect.	4	290 AC	-	-	2	300	-	-	
5U4G	Rect.	6	290 AC	-	-			-	-	
5U4G	Rect.	4	290 AC	-	-	2	315	-	-	Band switch to TV Ch. 2-6 position
5U4G	Rect.	6	290 AC	-	-			-	-	

Note 1 --- +440 V. at + end of 20 mf 250 V. Booster Electrolytic, 4000 V. Pulses at 6AU5 Plate. Do not measure at this point.





BLOCK DIAGRAM FIG.2



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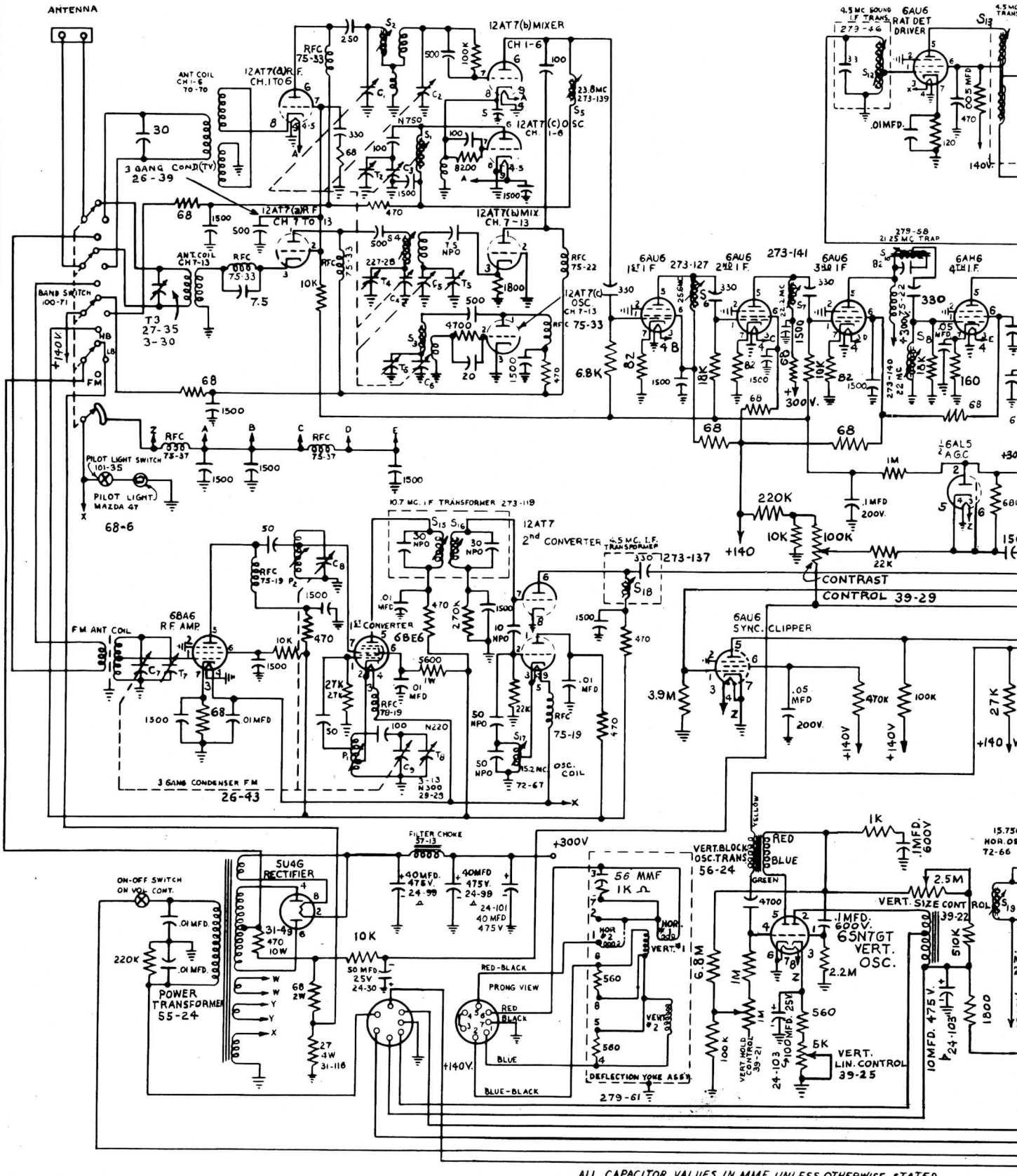
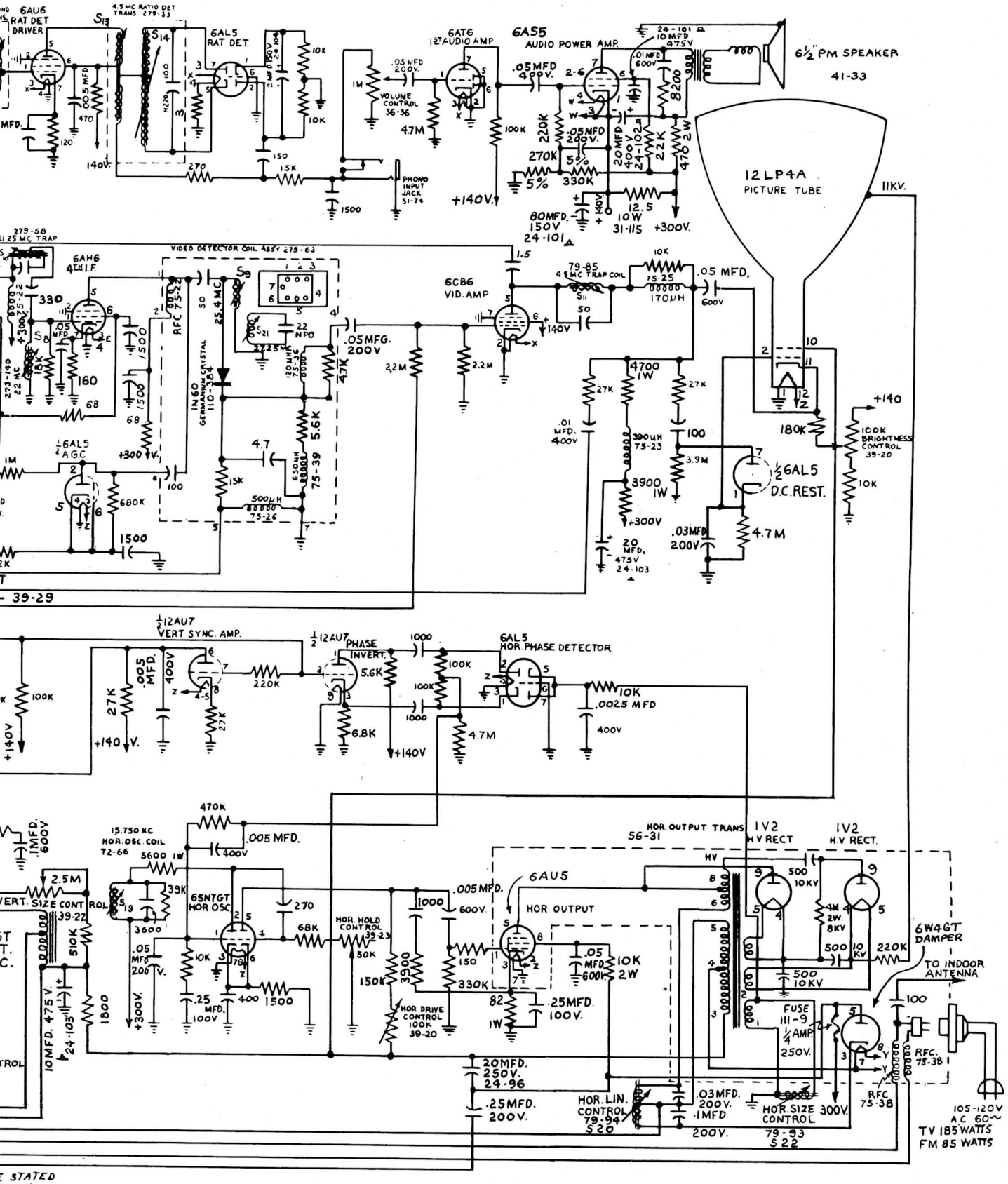
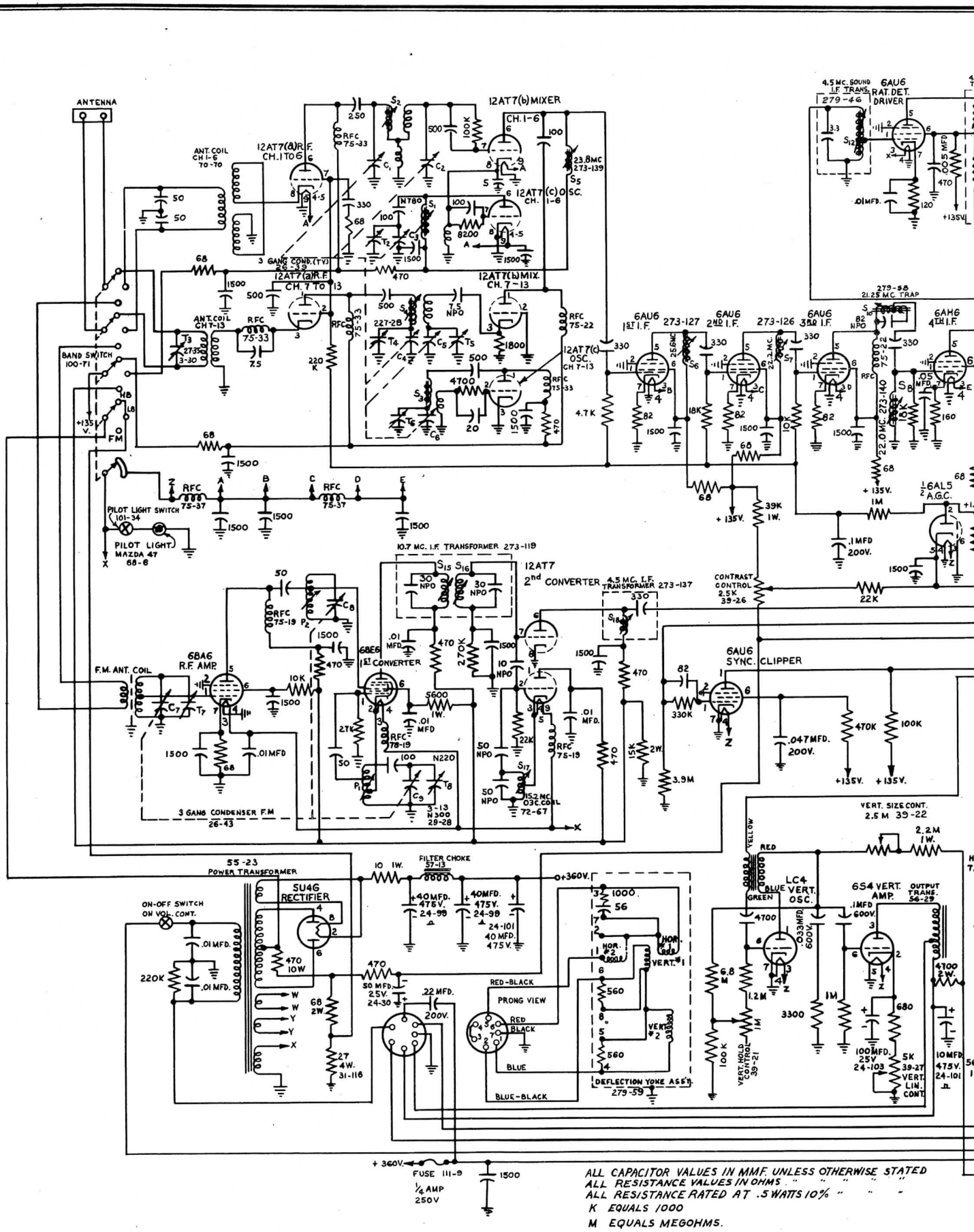
TUBE LAYOUT & ALIGNMENT CHART

TV-127


ANTENNA
12AT7(b) MIXER
CH 1-6
12AT7(a) R.F. CH. 1 TO 6
12AT7(c) OSC. CH. 1-6
12AT7(a) R.F. CH 7 TO 13
12AT7(b) MIX. CH. 7-13
12AT7(c) OSC. CH 7-13
3 GANG COND (TV) 26-39
ANT. COIL CH 1-6 70-70
ANT. COIL CH 7-13
BAND SWITCH 100-71
T3 27-35 3-30
+140V
HB
LB
FM
PILOT LIGHT SWITCH 101-35
PILOT LIGHT MAZDA 47
68-6
4.5 MC SOUND I.F. TRANS. 273-46
6AU6 RAT DET DRIVER
.01MFD.
.005 MFD
140V.
279-58 21.25 MC TRAP
6AU6 1ST I.F.
273-127
6AU6 2ND I.F.
273-141
6AU6 3RD I.F.
6AH6 4TH I.F.
+300V.
6AL5 AGC
.1MFD 200V.
220K
10K
100K
CONTRAST CONTROL 39-29
10.7 MC. I.F. TRANSFORMER 273-119
12AT7 2ND CONVERTER
4.5 MC. I.F. TRANSFORMER 273-137
+140
6BA6 R.F. AMP
FM ANT. COIL
1ST CONVERTER 6BE6
3 GANG CONDENSER FM 26-43
OSC. COIL 72-67
6AU6 SYNC. CLIPPER
3.9M
.05 MFD
200V.
470K
100K
27K
+140V
FILTER CHOKE 57-13
+300V
5U4G RECTIFIER
ON-OFF SWITCH ON VOL. CONT.
.01 MFD.
220K
POWER TRANSFORMER 55-24
470 10W
68 2W
27 4W 31-116
40MFD. 475V. 24-98
24-101 40 MFD 475V
10K
50 MFD. 25V 24-30
+140V.
RED-BLACK
PRONG VIEW
RED
BLACK
BLUE
BLUE-BLACK
56 MMF
1K
DEFLECTION YOKE ASS'Y 279-61
VERT. BLOCK OSC. TRANS. 56-24
YELLOW
RED
BLUE
GREEN
1K
.1MFD. 600V.
2.5M
VERT. SIZE CONTROL 39-22
65N7GT VERT. OSC.
2.2M
6.8M
1M
100K
VERT. HOLD CONTROL 39-21
.1MFD. 25V.
24-103
560
5K
VERT. LIN. CONTROL 39-25
10MFD. 475 V.
24-103
1800
510K
ALL CAPACITOR VALUES IN MMF. UNLESS OTHERWISE STATED
ALL RESISTANCE VALUES IN OHMS
ALL RESISTANCE RATED AT .5 WATTS 10%
K EQUALS 1000
M EQUALS MEGOHMS.
DATE 4-12-50
DWG.# 90-75


6AU6 RAT DET DRIVER
4.5 MC RATIO DET TRANS 279-33
6AL5 RAT DET.
6AT6 1ST AUDIO AMP
6AS5 AUDIO POWER AMP.
6½" PM SPEAKER 41-33
12LP4A PICTURE TUBE
11KV.
+140V.
+300V.
80MFD. 150V 24-101
VOLUME CONTROL 36-36
PHONO INPUT JACK 51-74
279-58 4.25 MC TRAP
VIDEO DETECTOR COIL ASSY 279-63
6AH6 4TH I.F.
6CB6 VID. AMP
79-85 4.5 MC TRAP COIL
1N60 GERMANIUM CRYSTAL 110-364
RFC 75-22
75-39
75-26
6AL5 AGC
½6AL5 D.C. REST.
100K BRIGHTNESS CONTROL 39-20
39-29
½12AU7 VERT SYNC. AMP.
½12AU7 PHASE INVERT.
6AL5 HOR. PHASE DETECTOR
15.750 KC HOR. OSC. COIL T2-66
6SN7GT HOR. OSC.
HOR. HOLD CONTROL 39-23
HOR. DRIVE CONTROL 100K 39-20
6AU5 HOR OUTPUT
HOR. OUTPUT TRANS 56-31
1V2 H.V RECT.
6W4GT DAMPER
TO INDOOR ANTENNA
FUSE 111-9 ¼ AMP. 250V.
RFC 75-38
HOR. LIN. CONTROL 79-94 S20
HOR. SIZE CONTROL 79-93 S22
105-120V A.C. 60~
TV 185 WATTS FM 85 WATTS
VERT. SIZE CONTROL 39-22
10MFD. 475V 24-103
20MFD. 250V. 24-96
20 MFD. 475V 24-103
12.5 10W 31-115


ANTENNA
12AT7(a) R.F. CH. 1 TO 6
12AT7(b) MIXER CH. 1-6
12AT7(c) OSC. CH. 1-6
3 GANG COND. (TV) 26-38
12AT7(a) R.F. CH. 7 TO 13
12AT7(b) MIX. CH. 7-13
12AT7(c) OSC. CH. 7-13
BAND SWITCH 100-71
PILOT LIGHT SWITCH 101-34
PILOT LIGHT MAZDA 47 68-8
6AU6 1ST I.F.
6AU6 2ND I.F.
6AU6 3RD I.F.
6AH6 4TH I.F.
4.5 MC. SOUND I.F. TRANS. 279-46
6AU6 RAT. DET. DRIVER
21.25 MC. TRAP 279-58
22.0 MC. 273-140
1/2 6AL5 A.G.C.
+135V.
39K 1W.
1M
.1MFD 200V.
CONTRAST CONTROL 2.5K 39-26
22K
10.7 MC. I.F. TRANSFORMER 273-119
12AT7 2nd CONVERTER
4.5 MC. I.F. TRANSFORMER 273-137
6AU6 SYNC. CLIPPER
.047MFD. 200V.
470K
100K
+135V.
6BA6 R.F. AMP.
F.M. ANT. COIL
6BE6 1ST CONVERTER
3 GANG CONDENSER F.M. 26-43
152 MC. OSC. COIL 72-67
VERT. SIZE CONT. 2.5 M 39-22
2.2M 1W.
55-23 POWER TRANSFORMER
5U4G RECTIFIER
ON-OFF SWITCH ON VOL. CONT.
FILTER CHOKE 57-13
+360V.
40MFD. 475V. 24-98
24-101 40 MFD. 475V.
LC4 VERT. OSC.
654 VERT. AMP.
OUTPUT TRANS. 56-29
VERT. HOLD CONTROL 39-21
VERT. LIN. CONT. 39-27
100MFD. 25V 24-103
10MFD. 475V. 24-101
.22 MFD. 200V.
PRONG VIEW
RED-BLACK
RED
BLACK
BLUE
BLUE-BLACK
DEFLECTION YOKE ASS'Y. 279-59
FUSE 111-9 1/4 AMP 250V
ALL CAPACITOR VALUES IN MMF. UNLESS OTHERWISE STATED
ALL RESISTANCE VALUES IN OHMS " " " " "
ALL RESISTANCE RATED AT .5 WATTS 10% " " "
K EQUALS 1000
M EQUALS MEGOHMS.

MODELS TV-164, TV-167A, TV-191