PHILCO SERVICE

PHILCO Factory-Supervised Service

TELEVISION

PHILCO TELEVISION SERVICE MANUAL FOR R-F CHASSIS 42 DEFLECTION CHASSIS G-2

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CIRCUIT DESCRIPTION

The Philco 1952, Code 125 television receivers use two chassis. One chassis contains the r-f, video, audio, and sync circuits; the other chassis contains the power and deflection circuits.

Since these chassis are not isolated from the 60-cycle power line, all protruding shafts and mounting feet are isolated from the chassis. CAUTION: See A-C Line Isolation.

The r-f amplifier, oscillator, and mixer section is built on a separate sub-chassis. The r-f amplifier uses a 6BZ7 or a 6BQ7 tube. The oscillator and mixer each use one half of a 12AV7 tube. The output of the mixer is fed to a four-stage, stagger-tuned i-f amplifier system employing three 6AU6 tubes and one 6CB6 tube. One half of a 12AU7 is used as a video detector, a-g-c rectifier. The cathode and grid are used for video detection, while the cathode and plate are used for a-g-c rectification. A delay voltage, obtained from a voltage divider consisting of the CONTRAST control, R305 and R408, is applied to the cathode to prevent a-g-c action on weak signals, where maximum gain is required. The maximum delay voltage is obtained when the CONTRAST control is in the fully clockwise position, as is the case when the receiver is adjusted for weak signals. The a-g-c voltage is applied to the first three i-f stages to hold the output of the video detector essentially constant with large variations in input signal levels. A-G-C voltage for the r-f amplifier is obtained from the voltage divider in the sync-separator circuit. Because the voltage is dependent upon signal strength, it controls the gain of the r-f amplifier in proportion to the received signal. To prevent the a-g-c circuit of the tuner from going positive, one diode section of a 6T8 tube is used as a clamp.

Sound i-f (intercarrier) is obtained by utilizing the beat frequency produced when the 26.6-mc. video carrier and the 22.1-mc. sound carrier are mixed in the video detector. The 4.5-mc. beat frequency is the difference between 26.6 mc. and 22.1 mc., and contains the FM sound signal. This 4.5-mc. signal contains only a negligible amount of the video-amplitude modulation, provided that the amplitude of the 22.1-mc. signal is considerably lower than that of the 22.6-mc. signal. The proper relationship between the two carriers is established in the alignment of the receiver. There is sound output only when both the video and sound carriers are present.

The oscillator is tuned primarily to obtain the best picture, since the 4.5-mc. relationship always exists between the two carriers. The 4.5-mc. sound i-f (intercarrier), which is taken from the video detector, is amplified by one half of a 12AU7 and a 6AU6, and is fed to the FM detector, which utilizes two diode sections of a 6T8 tube. The triode section of the 6T8 is used as the first audio amplifier. The power amplifier uses a 7C5 tube.

One half of a 12AV7 tube is used as the first video amplifier, which feeds into a 6AQ5 video-output amplifier. The plate load of the first video amplifier is made up of two resistors, R302 and R303. To obtain higher voltage for synchronization, the composite signal for sync purposes is taken from across both R302 and R303, while the composite video for the video output is taken from across R303 only. C302 is used to by-pass high-frequency video around R302. The plate load of the video-output amplifier consists of L302 and R309. L302 is an adjustable peaking coil, and is adjusted at the factory for best video response.

The sync circuit consists of a first sync separator, a variable diode noise gate, a second sync separator, and a sync inverter. The composite video is fed to the first sync separator, one half of a 12AV7 tube. The output of the first sync separator is taken from the cathode and applied to the cathode of the noise gate, one half of a 12AU7 tube. A positive voltage, which is obtained from a voltage divider made up of R606 and R607, is applied to the diode plate, while the sync signal, of positive polarity, is applied to the cathode. The diode will pass the sync signal as long as the cathode remains negative with respect to the plate. The value of plate voltage is chosen so that this condition exists for all normal sync signals. However, when a noise signal greater than the sync signal is received, the cathode of the diode is driven positive with respect to the plate, and the diode is cut off, thus preventing the noise from passing on to the second sync separator.

The positive voltage applied to the plate of the diode is made proportional to the strength of the signal being received by obtaining it from the load side of a dropping resistor, R419, in the B+ line that supplies plate and screen voltages to the i-f stages. The current through R419, therefore, depends upon the amount of current drawn by the i-f stages. When a stronger signal is received, the a-g-c voltage increases; this decreases the current drawn by the i-f stages, and decreases the voltage drop across R419. Since this results in an increase in the voltage applied to the plate of the noise-gate diode, the level at which the diode will gate out the noise is raised. When a weaker signal is received, the opposite effect is obtained. The second sync separator, one half of a 12AU7 tube, removes all remaining video information from the composite signal. The output of the second sync separator is fed to the deflection chassis through the power-connecting cable. A sync inverter, one half of a 6SN7GT tube, reverses the polarity of the sync pulses for proper triggering of the sweep oscillators.

The vertical sync pulses are separated from the horizontal pulses in an integrating network and applied to the grid of the vertical blocking oscillator, which uses one half of a 6SN7GT tube. The output of the blocking oscillator is amplified by the 6AH4GT vertical output tube, and is applied to the vertical-deflection coils.

The horizontal sync pulses are applied to the grid of a phase comparer, one half of a 6SN7GT tube, through a capactive voltage divider. Within the lock-in range, the phase relationship of the horizontal sawtooth and the sync pulses at the grid of the phase comparer determines the frequency of the horizontal blocking oscillator. The blocking oscillator employs one half of a 6SN7GT tube. A 6BQ6GT tube is used as the horizontal amplifier. The screen voltage for the horizontal amplifier is supplied through a voltage-divider network. R817, the WIDTH control, and

R308B, the BRIGHTNESS control, are a part of this divider. R817 varies the voltage applied to the screen, thus adjusting for proper picture width. Adjusting R308B for brightness varies the bias on the picture tube. This change in bias causes a change in beam current which would tend to result in a change in picture width and high voltage. However, because R308B is also a part of the voltage-divider network in the screen circuit of the horizontal amplifier, the screen voltage is automatically altered to compensate for any tendency of a beam-current change to affect the picture width. The output of the horizontal amplifier is fed to the horizontal deflection coils through the horizontal-output transformer. A 6V3 tube is used as the horizontal damper tube.

The second anode voltage for the picture tube is supplied by one 1B3GT high-voltage rectifier tube. The B-plus voltage for the receiver is supplied by two selenium rectifiers, CR100 and CR101, in a full-wave voltage-doubler circuit, operating directly from the power line. Bias voltage is obtained across the speaker field coil (used as filter choke) which is in series with the negative side of the B-plus supply. The B-plus boost voltage derived from the horizontal-damper circuit supplies higher B-plus to the horizontal amplifier, vertical oscillator, and first anode of the picture tube. Filament current for all the tubes except the high-voltage rectifier is supplied by a step-down transformer.

IMPORTANT

A-C LINE ISOLATION

CAUTION: One side of the a-c line is connected to the chassis through C102 and L100. The other side is connected to the chassis through R102, CR100, and C103 in series. Grounding the chassis will result in a short circuit across one or the other of these two branches in the voltage-doubler circuit. During servicing and alignment it is desirable that an a-c line isolation transformer capable of handling at least 225 watts (Philco Part No. 45-9600) be used. Failure to use an isolation transformer will greatly increase the shock hazard, and may result in damage to the equipment.

SPECIFICATIONS

CHANNEL TUNING
Twelve-channel, wafer-switch incremental tuner; fine tuning of local oscillator.

FREQUENCY RANGE
Television Channels 2 through 13

INTERMEDIATE FREQUENCIES
Video carrier .... 26.6 mc.
Sound (intercarrier) .... 4.5 mc.

TRANSMISSION LINE .... 300-ohm, twin-wire lead

OPERATING VOLTAGE
110-120 volts, 60 cycles, a.c.

POWER CONSUMPTION .... 200 watts

TUBE COMPLEMENT

42 R-F CHASSIS

REF. SYMBOL	TUBE TYPE	FUNCTION
V1	6BQ7—miniature	R-F amplifier
V2	12AV7—miniature	Oscillator, mixer
V3, V4, V5	6AU6—miniature (3)	Video i-f amplifier
V6	6CB6—miniature	Video i-f amplifier
V7	12AU7—miniature	Video detector, a-g-c rectifier, first sound i-f amplifier
V8	6AU6—miniature	Second sound i-f amplifier
V9	6T8—miniature	FM detector, first audio amplifier, a-g-c clamp
V10	7C5—Loktal	Audio output
V11	12AV7—miniature	First video amplifier, first sync separator
V12	12AU7—miniature	Noise gate, second sync separator
V13	6AQ5—miniature	Video output
V20	17JP4, 20DP4A, or 20EP4A	Picture tube

G-2 DEFLECTION CHASSIS

REF. SYMBOL	TUBE TYPE	FUNCTION
V14	6SN7GT—octal	Sync inverter, vertical oscillator
V15	6AH4GT—octal	Vertical output
V16	6SN7GT—octal	Phase comparer, horizontal oscillator
V17	6BQ6GT—octal	Horizontal output
V18	6V3—miniature	Horizontal damper
V19	1B3GT—octal	High-voltage rectifier

B SUPPLY FUSE REPLACEMENT

The B supply protective fuse, F100, is wired into the low-voltage section, and is in series with the selenium rectifiers. For replacement, use a 1.6-ampere delayed-action-type fuse, Philco Part No. 45-2656-23.

CAUTION: Discharge the circuit before replacing the fuse.

HORIZONTAL SWEEP ADJUSTMENT

ADJUSTMENT OF HORIZ. OSC. FREQ. CONTROL AND HORIZONTAL LOCK-IN TRIMMER

The range of the HORIZ. HOLD control potentiometer is sufficient to compensate for normal variations in the frequency of the horizontal oscillator, and no other adjustment is ordinarily required. However, if the tube or other components are replaced in the horizontal-oscillator circuit, it may be necesssary to reset the HORIZ. OSC. FREQ. control and horizontal lock-in trimmer as follows, in order to obtain proper synchronism and deflection (these controls are located on the back and side of the chassis):

1. Turn the HORIZ. HOLD control fully clockwise.
2. Adjust the HORIZ. OSC. FREQ. control until four diagonal black bars appear, sloping to the right.
3. Turn the HORIZ. HOLD control counterclockwise until the picture comes in, then goes out of sync. Then turn the HORIZ. HOLD control slowly clockwise again, counting the number of black (blanking) bars, sloping down to the left, just before the picture pulls into sync. Adjust the horizontal lock-

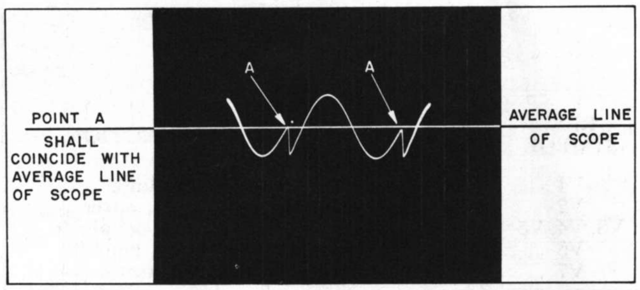

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Figure 1. Horizontal-Oscillator Waveshape, Showing Correct Adjustment of T800

in trimmer, C804, until there are two or two and one-half bars just before the picture pulls into sync. If the receiver does not lose sync when the HORIZ. HOLD control is fully counterclockwise, remove the signal momentarily to interrupt the sync, then proceed as above.

ADJUSTMENT OF HORIZONTAL-OSCILLATOR TRANSFORMER

CAUTION: Do not adjust tuning cores TC800 and TC801 in the horizontal-oscillator transformer, T800, unless it is absolutely necessary. These cores are preset at the factory with special equipment. The tuning cores in replacement transformers are also preset, and do not require adjustment after installation in the chassis. Condenser C807 is matched to T800, and must be replaced when T800 is replaced. Horizontal-oscillator transformer T800 and condenser C807 are supplied as a unit.

If for some reason it becomes necessary to adjust TC800 and TC801, proceed as follows:

1. Tune in a station and adjust the HORIZ. HOLD control until the picture is synchronized. If the picture cannot be synchronized, adjust the HORIZ. OSC. FREQ. control. If it is impossible to obtain synchronization by adjustment of the HORIZ. HOLD and HORIZ. OSC. FREQ. controls, adjust the oscillator core, TC801.
2. Connect an oscilloscope to the cathode (pin 6) of the horizontal oscillator, using a 15-$\mu\mu$f. condenser in series with the scope lead. Adjust the stabilizer core, TC800, until the wave shape resembles that in figure 1. The "average line" in figure 1 is established by shorting the input leads of the scope. Keep the picture synchronized while adjusting TC800.
3. Turn the HORIZ. HOLD control fully clockwise. Adjust the HORIZ. OSC. FREQ. control until four diagonal black bars appear, sloping to the right.
4. If four diagonal black bars cannot be obtained by adjusting the HORIZ. OSC. FREQ. control with the hold control in the clockwise position, adjust the oscillator core, TC801.

VIDEO-OUTPUT PEAKING-COIL ADJUSTMENT

The video-output peaking coil, L302, is adjusted at the factory for proper transient response of the video amplifiers. Ordinarily, this coil will require no further adjustment by the serviceman. On some stations, however, where excessive overshoot or excessive smear is present, a slight adjustment of L302 may improve the picture quality on that station, but at a possible sacrifice of quality on other channels. If L302 is replaced in servicing, adjustment will be required.

Before adjusting L302, check the tuner alignment and i-f alignment. (Never adjust L302 until the alignment of the receiver is correct.) Then tune in a station and adjust L302 so there are no trailing whites or smear in the picture. Turning TC301 clockwise reduces trailing whites and overshoot; turning TC301 counterclockwise reduces picture smear and increases trailing whites. The proper position is the point where no smear or trailing whites appear in the picture.

The above procedure for adjustment of TC301 applies to a particular station exhibiting smear or overshoot. After TC301 is adjusted, reception on all the other stations should be checked, to make certain that the adjustment has not impaired the picture quality.

TELEVISION ALIGNMENT
TELEVISION-CARRIER, OSCILLATOR, AND CHECK-POINT FREQUENCIES

CHANNEL	CHANNEL LIMITS (mc.)	VIDEO-CARRIER CHECK-POINT (A) FREQUENCY (mc.)	100% CHECK-POINT (B) FREQUENCY (mc.)	10% CHECK-POINT (C) FREQUENCY (mc.)	SOUND-CARRIER FREQUENCY (mc.)	LOCAL-OSCILLATOR FREQUENCY (mc.)
2	54–60	55.25	57.35	59.35	59.75	81.85
3	60–66	61.25	63.35	65.35	65.75	87.85
4	66–72	67.25	69.35	71.35	71.75	93.85
5	76–82	77.25	79.35	81.35	81.75	103.85
6	82–88	83.25	83.35	87.35	87.75	109.85
7	174–180	175.25	177.35	179.35	179.75	201.85
8	180–186	181.25	183.35	185.35	185.75	207.85
9	186–192	187.25	189.35	191.35	191.75	213.85
10	192–198	193.25	195.35	197.35	197.75	219.85
11	198–204	199.25	201.35	203.35	203.75	225.85
12	204–210	205.25	207.35	209.35	209.75	231.85
13	210–216	211.25	213.35	215.35	215.75	237.85

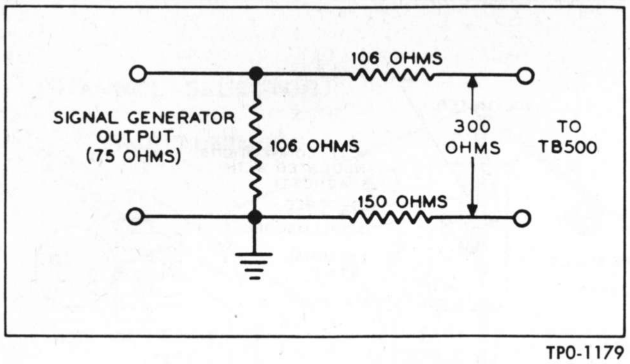

Figure 2. Aerial-Input Matching Network

GENERAL

The alignment consists of tuning each i-f coil to a given frequency, using an AM signal, then feeding in a sweep signal at the aerial terminals and touching up the adjustments to obtain the desired pass band.

The over-all response curve (r-f, i-f) of the circuits from the aerial terminals to the video detector, after the i-f stages have been aligned, should appear essentially the same regardless of the channel under test. If not, the tuner should be aligned.

The video-carrier intermediate frequency is 26.6 mc., and the sound intermediate (intercarrier) frequency is 4.5 mc. Alignment of these circuits requires careful workmanship and good equipment. The following precautions must be observed:

1. There must be a good bond between the receiver chassis and the test equipment. This is most easily obtained by having the top of the workbench metallic. The receiver chassis should be placed tuner-side down on the bench. If the bench has no metallic top, the test equipment and chassis can be bonded by a strip of copper about 2 inches wide. The section of the chassis nearest the tuner should rest on the strip.
2. Do not disconnect the picture tube, picture-tube yoke, or speaker while the receiver is turned on.
3. Allow the receiver and test equipmnet to warm up for 15 minutes before starting the alignment.
4. The marker (AM) signal generator should be calibrated accurately to the frequencies used and to the sound and video r-f carriers of each channel used during alignment. If Model 7008 is used, the built-in crystal calibrator provides an excellent means of calibration. An alternate method for calibrating the signal generator to the sound and video r-f carrier frequencies is to zero-beat the signal generator with the received signals.

For further information regarding calibration, refer to Philco Lesson PR-1745(J) entitled "Television Service in the Home."

TEST EQUIPMENT REQUIRED

The following test equipment is recommended for aligning the receiver:

1. Philco Precision Visual Alignment Generator for Television and FM, Model 7008, or equivalent.
2. Vacuum-tube voltmeter, or 20,000-ohms-per-volt voltmeter.
3. R-F Probe, Philco Part No. 76-3595 (for use with Model 7008 generator).

JIGS AND ADAPTERS REQUIRED

Mixer Jig

Connections to the grid of the mixer tube may be made through the alignment jack provided for that purpose. To connect the generator to this point, a mixer-grid, jig, Philco Part No. 45-1739, and a connecting cable, Philco Part No. 45-1635, may be used. As an alternate, a Philco alligator-clip adapter, Part No. 45-1636, with as short a ground lead as possible, may be used to connect the alignment jack. The ground lead should be connected as close as possible to the mixer tube. It is essential that the signal-generator output lead be terminated with a 68-ohm resistor (carbon) so that regeneration, caused by connection of the lead to the mixer, is held to a minimum.

Aerial-Input Matching Network

Figure 2 shows an impedance-matching network for coupling the signal generator to the aerial-input terminals of the receiver. This network, which is designed to have an input impedance of 75 ohms and an output impedance of 300 ohms, is used to match a 75-ohm generator to a 300-ohm aerial-input circuit. The resistors used in this network should be of carbon-composition construction, and should be chosen from a group, to obtain values within 10% of those indicated. The resistors should be placed in a shield can, to prevent variable effects. An aerial matching jig, Philco Part No. 45-1736, which consists of a matching transformer and connecting box, may be used in place of the resistor network.

ALIGN TEST Jack Adapter

The ALIGN TEST jack adapter, shown in figure 3, should be used during the i-f alignment to apply the proper bias to the a-g-c bus, and to provide a convenient oscilloscope connection. This adapter consists of a 5-prong plug, a 10,000-ohm potentiometer, a

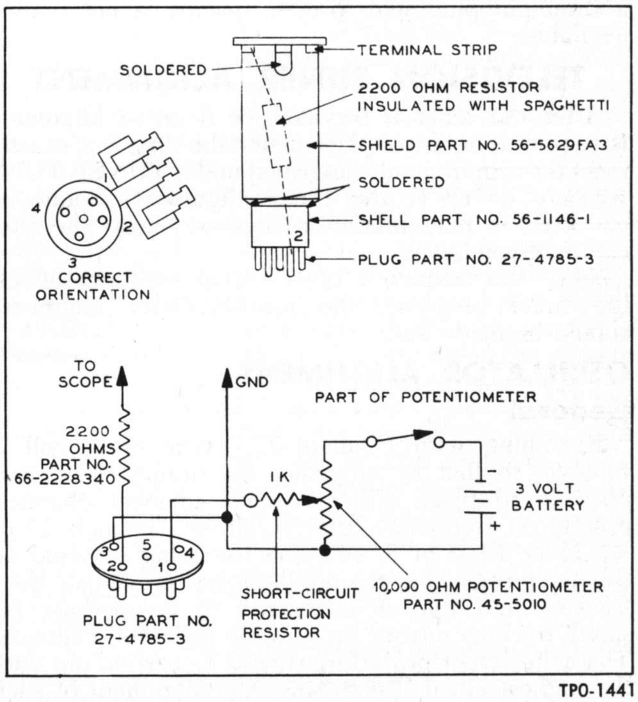

Figure 3. ALIGN TEST Jack Adapter

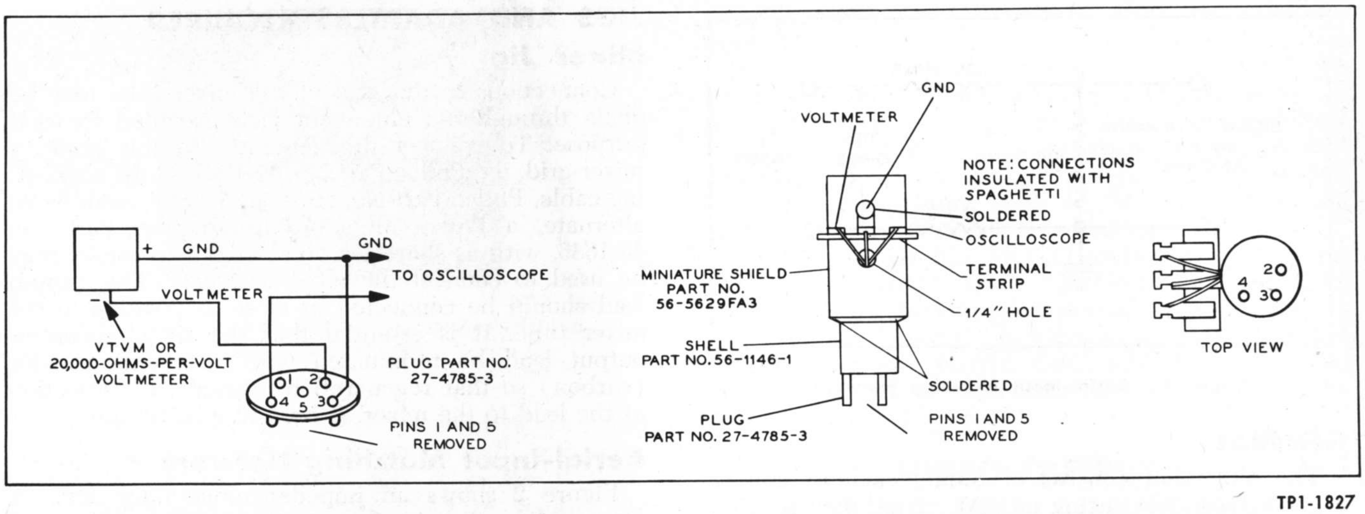

Figure 4. FM TEST Jack Adapter

2200-ohm isolating resistor, and a 3-volt battery. A suggested method of fabricating the adapter is also shown. It is suggested that the bias battery and potentiometer be mounted in a metal box of convenient size.

The potentiometer and switch are connected across the 3-volt battery. The switch is used to disconnect the potentiometer, to prevent the discharge of the battery while not in use. The 1000-ohm resistor in series with the arm of the control will prevent rapid discharge of the battery if the leads are accidentally shorted.

FM TEST Jack Adapter

Figure 4 shows the adapter that should be used to connect the voltmeter and oscilloscope to the FM detector test socket, J402. A suggested method of fabricating the adapter is also shown. Pins 1 and 5 are removed from a five-pin plug, 27-4785-3, because a three-pin plug with proper spacing is not readily available.

TELEVISION TUNER ALIGNMENT

After the tuner is serviced, or if an i-f alignment is required, or if a replacement tube does not exactly meet the requirements described under TUNER TUBE REPLACEMENT, the tuner alignment should be checked; if realignment is necessary, use the procedure given below.

Since the frequency of the local oscillator affects the tuner response, the local-oscillator alignment should be made first.

OSCILLATOR ALIGNMENT

General

Beginning with Channel 13, every other coil is tunable, so that by adjusting the tuning cores, it is possible to place either of two adjacent channels exactly on frequency; that is, either Channels 13 or 12, 11 or 10, 9 or 8, etc. The foregoing is based on the assumption that the oscillator has previously been tracked, and that it is desired to compensate for small tracking errors on several different channels. This adjustment procedure should be carried out with the highest channel first, since the alignment of each channel will affect the alignment of the channels below it in frequency. The FINE TUNING control should be preset for all adjustments, by placing the stop on the fine-tuning cam at the center of the Channel 6 oscillator tuning core. See figure 5.

Procedure Using Signal Generator

An r-f signal (unmodulated), at the oscillator frequency, is fed into the aerial input from an AM signal generator, and the oscillator tuning cores are adjusted for zero beat. The r-f signal should be accurate, preferably from a crystal source, or calibrated against the television station.

1. Connect a 3300-ohm resistor in series with the red lead from the tuner. Connect the "hot" lead of the oscilloscope to the junction of the red lead and the 3300-ohm resistor. (High oscilloscope gain may be necessary to obtain a visual beat. In this instance, base-line hum may be ignored.)
2. Connect the AM (marker) generator to the 300-ohm aerial-input terminals. For this purpose the aerial-input matching network is not required.
3. If the tuner is being aligned out of the chassis, connect the white lead to the negative terminal of a 1.5-volt battery. Ground the positive terminal.
4. Mechanically preset the fine-tuning cam as shown in figure 5.
5. Feed in an r-f signal (unmodulated), at the oscillator frequency for Channel 13 (237.85 mc.), with the CHANNEL SELECTOR set for Channel 13.
6. Adjust the tuning core for Channel 13 (see figure 5).
7. Adjust the tuning cores for Channels 11 and 9, in the order given.
8. Check the Channel 8 oscillator frequency. If it is too high, turn C527 several turns clockwise; if the frequency is too low, turn the trimmer counterclockwise (see figure 32).
9. Repeat steps 5, 6, 7, and 8 until Channels 13, 11, 9, and 8 are within plus or minus 500 kc. of the correct frequency.
10. Feed in an r-f (unmodulated) signal, at the oscillator frequency for Channels 7, 6, 4, and 2, consecutively (see NOTE below), and adjust the respective tuning cores. (See figure 5.)

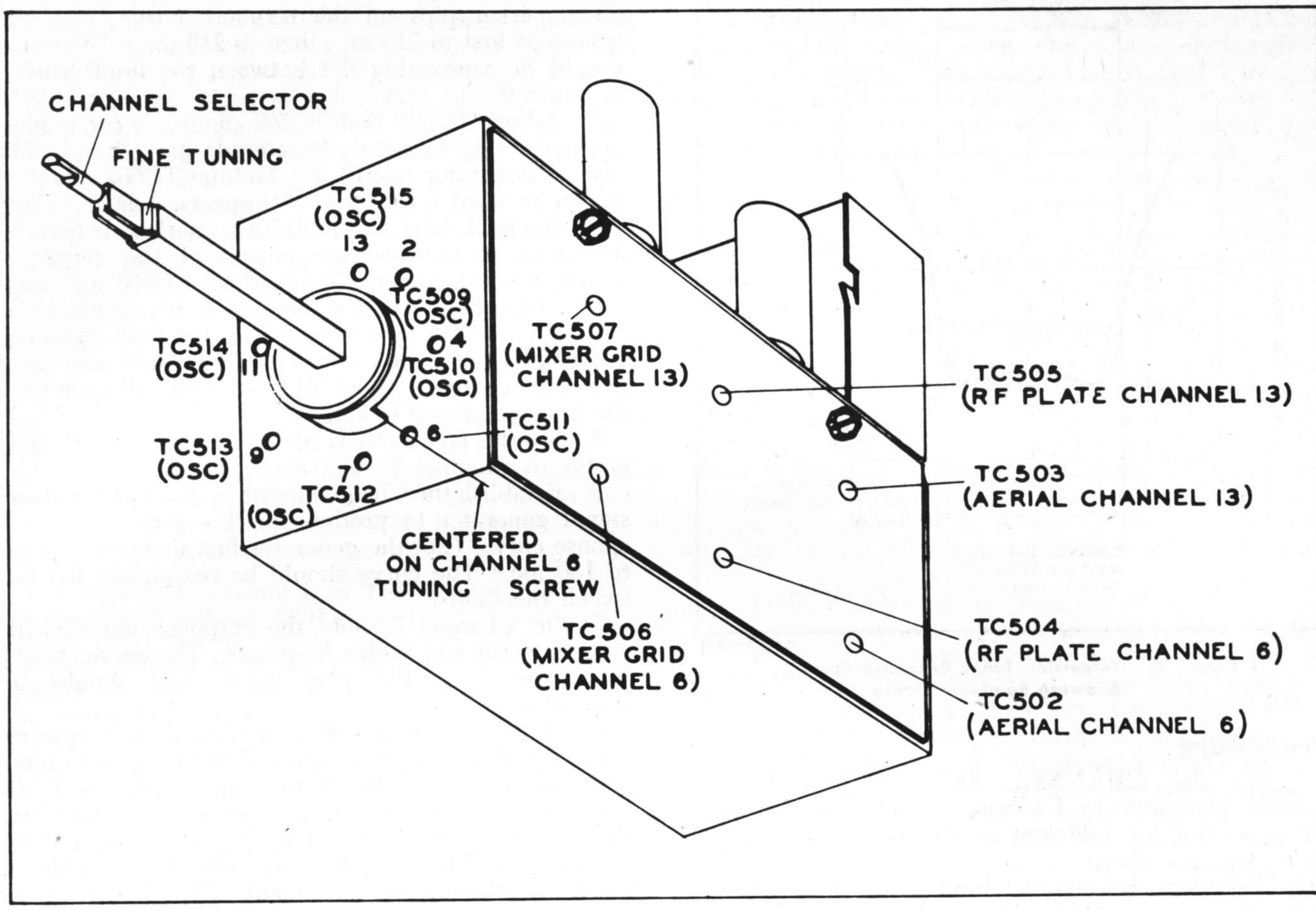

Figure 5. Television-Tuner, Oblique View, Showing Location of Adjustments

NOTE: The exact position of the FINE TUNING shaft should be marked when Channel 2 is correctly aligned. This position is to be used in step 6 of the i-f alignment procedure.

Procedure Using Station Signal

The following simplified procedure may be used to align the oscillator when the television i-f alignment is satisfactory and a station signal is available:

1. Mechanically preset the fine-tuning cam to the center of its range (see figure 5).
2. Tune in the highest-frequency channel to be received.
3. Adjust the tuning core for that channel, or the next highest, for the best picture; that is, starting with sound in the picture, turn the tuning core until the sound disappears. Repeat for each channel received in the area.

BANDPASS ALIGNMENT

General

The bandpass alignment consists of aligning the tuner at Channels 13 and 6 and then making it track down to Channels 7 and 2, respectively.

During the alignment, a fixed bias of 1.5 volts is applied to the r-f amplifier tube.

An FM (sweep) signal is applied to the aerial-input circuit, and an oscilloscope is connected to the mixer plate circuit. The oscilloscope gain should be as high as possible, consistent with hum level and "bounce" conditions. Hum conditions will cause distortion of the time base and response. Bounce conditions, which are caused by poor line regulation, will cause the response and time base to jump up and down. The use of too high an oscilloscope gain aggravates these conditions, whereas the use of too low a gain necessitates increasing the generator output to a point where the tuner may be overloaded. Overload may be checked by changing the generator output while observing the shape of the response curve; any change in the shape of the curve indicates overload, in which case a lower generator output and higher oscilloscope gain must be used. A 330-ohm resistor is shunted across the 1st i-f coil, to eliminate the absorption effect of this coil on the response curve.

1. Disconnect the white (a-g-c) lead from the tuner, and connect it to the negative terminal of a 1.5-volt battery. Ground the positive terminal.
2. Connect a 3300-ohm resistor in series with the red lead from the tuner. Connect the "hot" lead of the oscilloscope to the junction of the red lead and the 3300-ohm resistor.
3. Connect a 330-ohm resistor from the green lead to ground.
4. Connect the FM (sweep) generator to the 300-ohm aerial input through an aerial-input matching network. See figure 2.

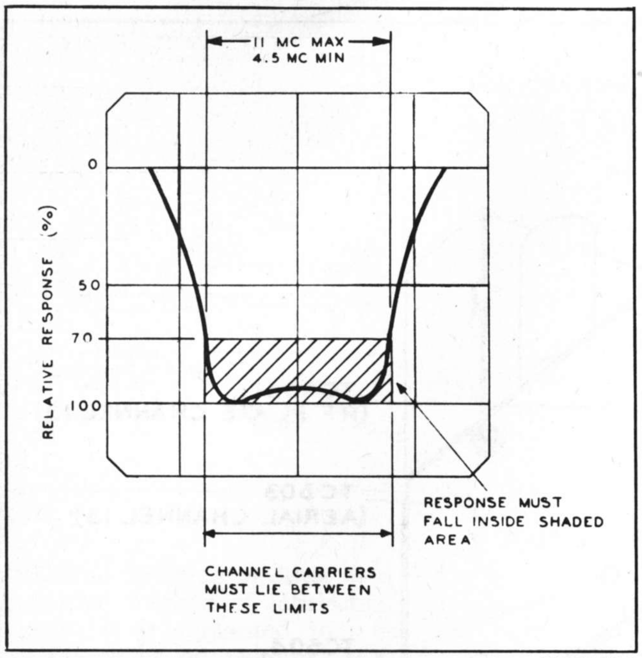

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Figure 6. Television-Tuner Response Curve, Showing Bandpass Limits

Procedure

1. Set the CHANNEL SELECTOR and FM (sweep) generator to Channel 13 (213 mc.). Adjust the generator for sufficient sweep to show the complete response curve.
2. Establish the channel limits (see figure 6) by using the marker (AM r-f) signal generator to produce marker pips on the response curve. (Set the generator first to 210 mc., then to 216 mc.) The curve should be reasonably flat between the limits shown in figure 6.
3. Adjust TC505 and TC507 (figure 5) for a symmetrical, approximately centered pass band. Set marker generator to 213 mc. Detune TC507 counterclockwise until a single peak appears. Adjust TC505 until the peak falls on the 213-mc. marker. It may be necessary to increase the output of the generator during this adjustment. Then adjust TC503 for maximum curve height and symmetry of the single peak. The aerial circuit is now tuned for the high channels.
4. Readjust TC505 and TC507 for a symmetrical response, centered about 213 mc. and falling within the limits as shown in figure 6.
5. Set the CHANNEL SELECTOR and FM generator to Channel 7 (177 mc.).
6. Establish the Channel limits by using the marker-signal generator to produce marker pips on the response curve. (Set the generator first to 174 mc., then to 180 mc.) The curve should be reasonably flat between the limits.
7. On Channel 7, note the response curve, with respect to tilt and center frequency. The curve should be centered in the pass band, and should be symmetrical.
8. If the curve is not symmetrical and appears unbalanced as shown in figure 7 leave the generator and tuner set to Channel 7 and adjust C506 and C515 (see figure 32) to obtain a response curve which is the mirror image (tilt in the opposite direction) of the original. This is a form of overcompensation to allow for the effect of Channel 13 adjustment on Channel 7. For example, if the Channel 7 response

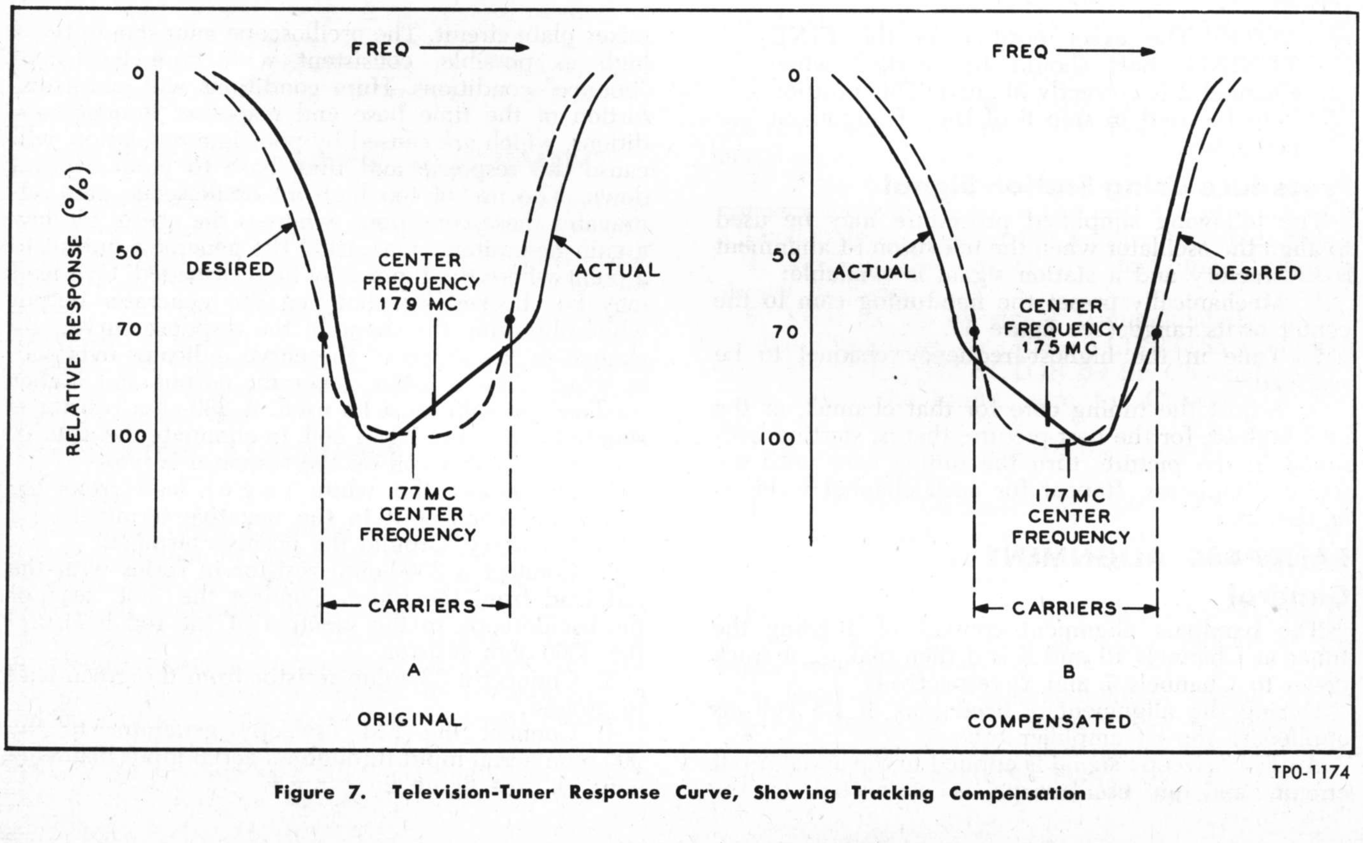

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Figure 7. Television-Tuner Response Curve, Showing Tracking Compensation

appears as in figure 7A, then the trimmer should be adjusted to obtain the response shown in figure 7B.

9. Reset the CHANNEL SELECTOR and generators to Channel 13. Readjust TC505 and TC507 for a symmetrical and centered band pass. (See step 4.)

10. Set the CHANNEL SELECTOR and generators to Channel 7, and check the response for center frequency and symmetry. Repeat steps 8 and 9 as many times as necessary to obtain the most symmetrical and centered response curves on Channels 13 and 7. Channels 7 through 13 are now correctly aligned.

11. Set the CHANNEL SELECTOR and sweep generator to Channel 6 (85 mc.).

12. Establish the channel limits, using the marker generator to produce marker pips on the response curve. (Set the generator first to 82 mc., then to 88 mc.)

13. Adjust TC504 and TC506 for a symmetrical, approximately centered pass band. Set the marker generator to 85 mc. Detune TC506 counterclockwise until a single peak appears.

CAUTION: Do not turn TC506 excessively, or it will fall out of the coil.

Adjust TC504 until the peak falls on the 85-mc. marker. It may be necessary to increase the output of the generator during this adjustment. Then adjust TC502 for maximum curve height and symmetry of the single peak. The aerial circuit is now tuned for Channels 2 through 6.

14. Readjust TC504 and TC506 for a symmetrical response, centered about 85 mc.

VIDEO I-F ALIGNMENT

PRELIMINARY

Before proceeding with the i-f alignment or making an alignment check, observe the following preliminary instructions:

1. Connect the oscilloscope to the 2200-ohm resistor from the ALIGN TEST jack adapter.
2. If additional attenuation of the marker signal is required when using Visual Alignment Generator Model 7008, insert a 10,000-ohm resistor in series with the output lead, or use a 2nd harmonic of Band A, which will give a marker of lower amplitude.
3. Preset the television controls as follows:
   a. CONTRAST control fully counterclockwise.
   b. BRIGHTNESS control to give a dim raster.
4. Insert the FM TEST jack adapter into J402.
5. Insert the ALIGN TEST jack adapter into J200.

PROCEDURE

1. Preset TC201 and TC203 fully counterclockwise. See figure 32. Preset TC200 and TC202 to the center of their ranges.

2. Connect the oscilloscope to J200, pin 2, through the 2200-ohm resistor from the ALIGN TEST jack adapter, and connect the AM generator to G1 (mixer grid on tuner).

3. Feed in a 28.1-mc. AM signal, and tune TC201 for minimum output (use first minimum). Use zero bias during this adjustment.

4. Feed in a 21.85-mc. AM signal, and tune TC203 for minimum output (use first minimum). Use zero bias during this adjustment.

5. Tune TC205, TC204, TC202, TC200, and TC507 for maximum output at the frequencies indicated in figures 32 and 33. Use 3 volts of bias, and attenuate the generator to keep the output below the level that will give a .6-volt output at the video detector with 30% amplitude modulation.

6. Feed in sweep and marker signals to Channel 2 through the aerial-input terminals. The tuner pass band should be checked, and the tuner aligned, if necessary. The local oscillator should be set to its correct frequency (81.85 mc. for Channel 2). Refer to step 10 of Procedure Using Signal Generator, under OSCILLATOR ALIGNMENT. The response should fall within the limits shown in figure 8. The ideal response curve is shown in figure 9. The frequencies shown in figures 8 and 9 are for Channel 2. To convert these response curves for Channels 3 through 13, refer to the chart of Television-Carrier, Oscillator, and Check-Point Frequencies and substitute the proper frequencies at points A, B, and C. Touch up TC205, TC204, TC202, TC200, and TC507. See NOTE below.

IMPORTANT: Do not turn any of the i-f tuning cores excessively after they have been set to the approximate position by the use of the AM signal generators; to do so may cause poor transient or phase response, resulting in trailing whites or smear. If a response within the limits shown cannot be obtained by a slight adjustment, carefully repeat the AM adjustments, and, if necessary, troubleshoot the i-f system. It is preferable to get a response curve within the tolerance range WITHOUT touching the adjustments made with the AM signals at the specified frequencies, rather than to attempt to obtain the ideal curve.

NOTE: TC205 rocks top of curve.
TC202 controls level of carrier.
TC204 controls dip or peak on carrier side.
TC200 controls dip or peak on sound side.

SOUND I-F ALIGNMENT

1. Remove the first i-f tube, and connect a v.t.v.m. or a 20,000-ohms-per volt voltmeter to the FM TEST jack adapter. Adjust the VOLUME control for moderate speaker output.

2. Feed in an accurately calibrated 4.5-mc. AM signal through the 2200-ohm resistor in the ALIGN TEST jack adapter to pin 2 of J200.

3. Tune TC400 and TC402 for maximum indications on the meter. The point of maximum meter indication for TC402 should also be the point of minimum speaker output.

4. Tune TC402 for minimum speaker output.

5. Connect an r-f probe or crystal detector to the grid (pin 2) of the picture tube. See NOTE below.

6. Tune TC300 for minimum indication on oscilloscope. If a crystal detector is not available, TC300 may be adjusted for minimum beat pattern, observed on the picture tube, with a station picture present.

7. Replace the 1st i-f tube. Tune in a station and use the speaker output as an indication.

8. Turn the FINE TUNING control clockwise to obtain a slightly fuzzy picture.

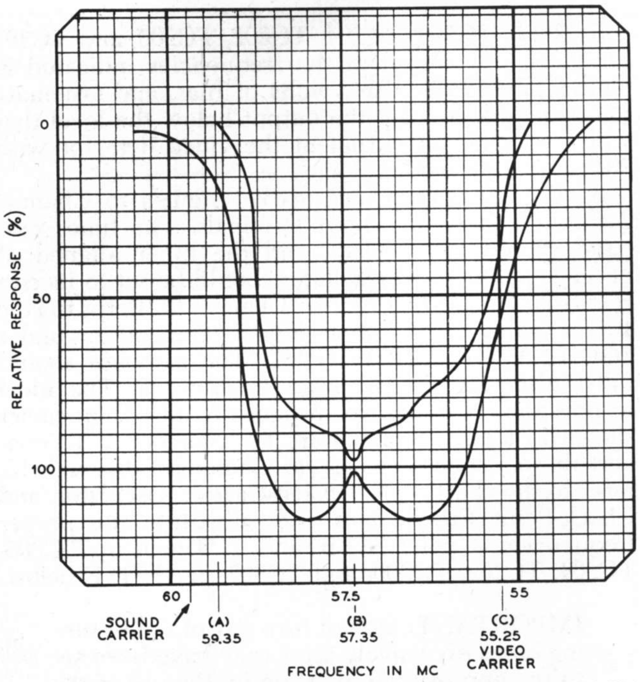


Figure 8. Over-all R-F, I-F Response Curve, Showing Tolerance Limits

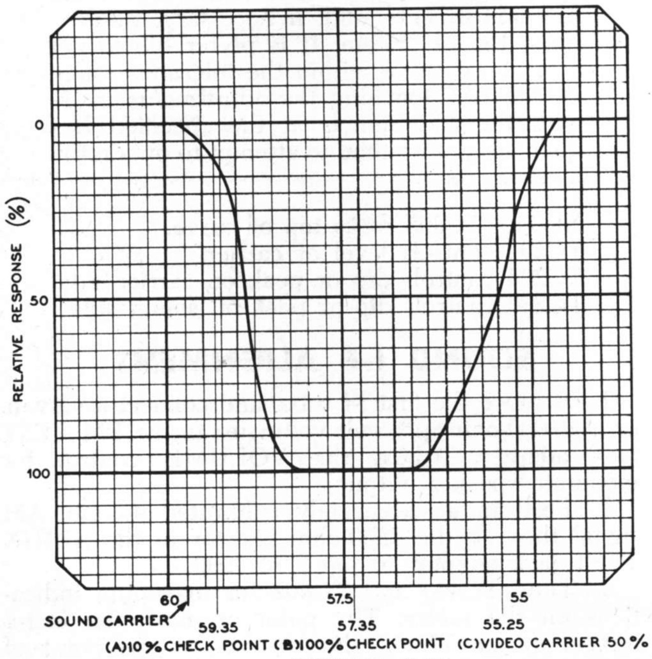


Figure 9. Ideal Over-all R-F, I-F Response Curve

9. Tune TC402 for minimum AM (noise) output. NOTE: The R-F Probe, Part No. 76-3595, is used as a detector of the 4.5-mc. signal, and the oscilloscope as an indicating device. An alternate crystal detector may be made up as shown in figure 10.

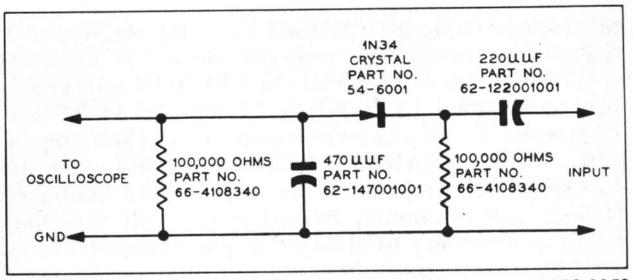
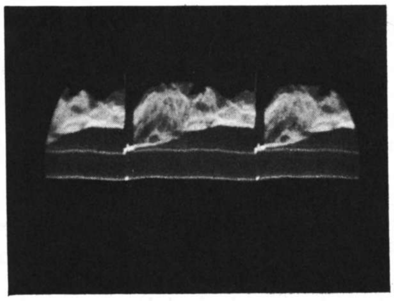


Figure 10. Wiring Diagram of Crystal Detector

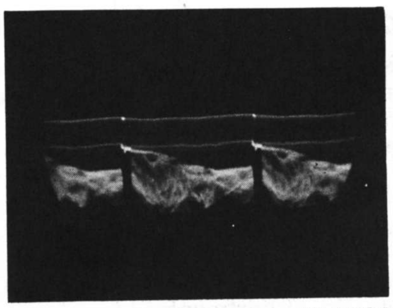
OSCILLOSCOPE WAVEFORM PATTERNS

The waveforms were taken with the receiver adjusted for normal picture and an approximate peak-to-peak output of 2 volts at the video detector. The voltages given with the waveforms are approximate peak-to-peak values. The frequencies shown are those of the waveform—not the sweep rate of the oscilloscope. The waveforms were taken with an oscilloscope having good high-frequency response. With oscilloscopes having poor high-frequency response, the sharp peaks of the horizontal waveforms will be more rounded than those shown, and the peak voltages will differ from the values shown.



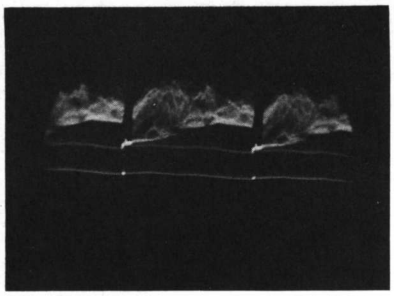
TP1-1200-A

Figure 11. Video-Detector Output Pin 2 of J200 2 Volts, 60 C.P.S.



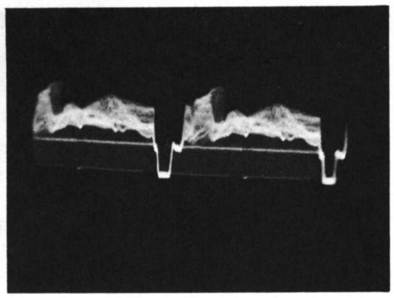
TP1-1200-B

Figure 12. Video-Amplifier Plate Pin 6 28 Volts, 60 C.P.S.



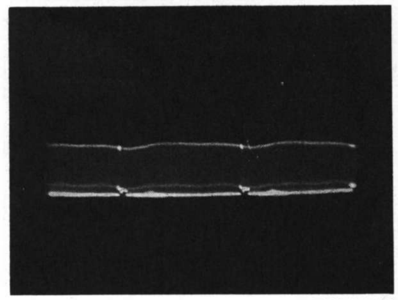
TP1-1200-A

Figure 13. CRT Grid Pin 2
118 Volts, 60 C.P.S.



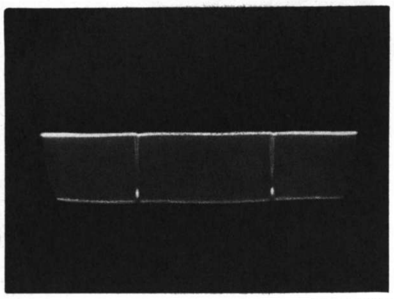
TP1-1092

Figure 14. Video Detector Output Pin 2 of J200
2 Volts, 15,750 C.P.S.



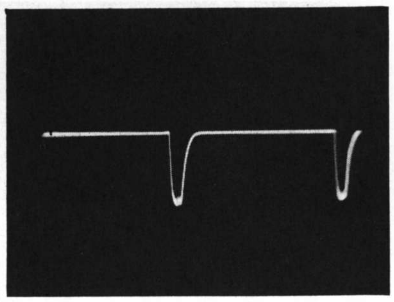
TP1-1203

Figure 15. First-Sync-Separator Cathode Pin 2
10 Volts, 60 C.P.S.



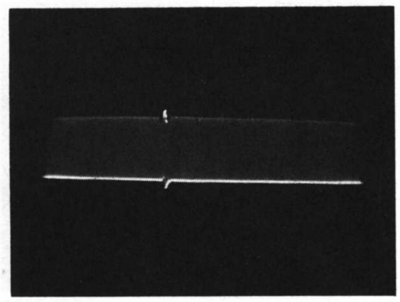
TP1-1090

Figure 16. Second-Sync-Separator Plate Pin 1
10 Volts, 60 C.P.S.



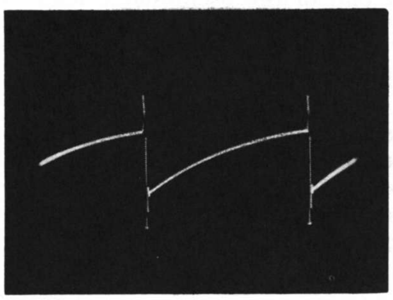
TP1-1091

Figure 17. Second-Sync-Separator Plate Pin 1
10 Volts, 15,750 C.P.S.



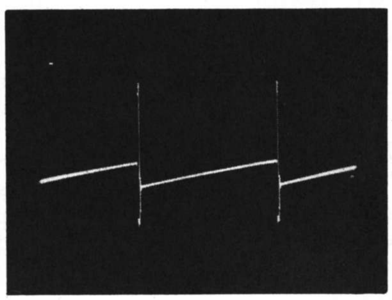
TP1-1087

Figure 18. Sync-Inverter Plate Pin 5
30 Volts, 60 C.P.S.



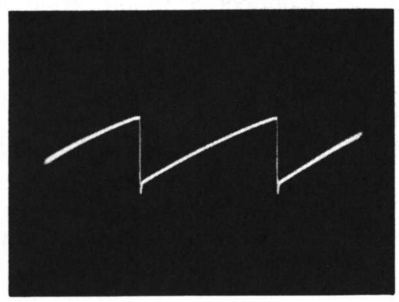
TP1-1202

Figure 19. Vertical-Oscillator Grid Pin 4
90 Volts, 60 C.P.S.



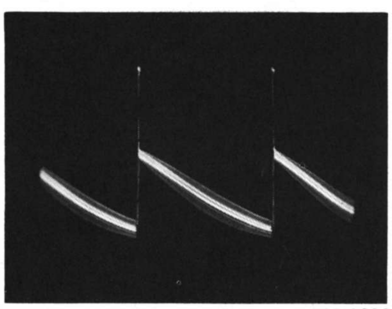
TP1-1097

Figure 20. Vertical-Oscillator Plate Pin 2
130 Volts, 60 C.P.S.



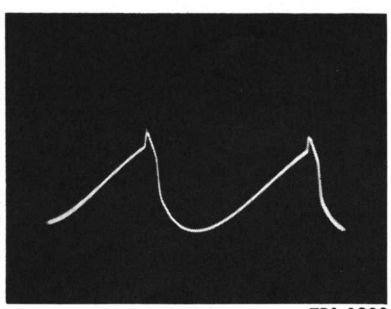
TP1-1100

Figure 21. Vertical-Amplifier Grid Pin 1
125 Volts, 60 C.P.S.



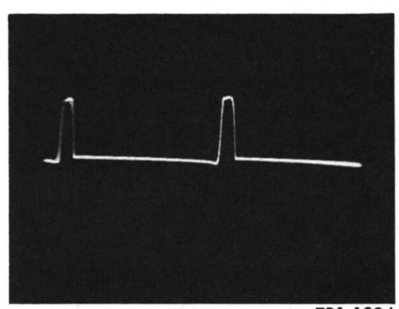
TP1-1099

Figure 22. Vertical-Amplifier Plate Pin 5
750 Volts, 60 C.P.S.



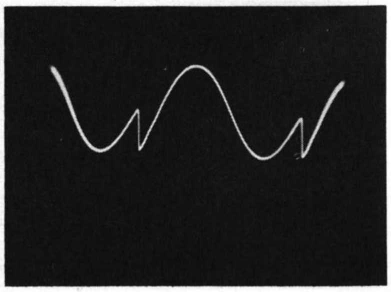
TP1-1088

Figure 23. Phase-Comparer Grid Pin 1
20 Volts, 15,750 C.P.S.



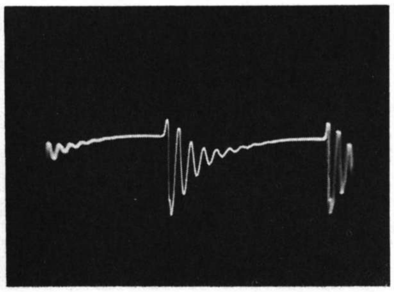
TP1-1094

Figure 24. Phase-Comparer Grid Pin 1 with Pin 4 Grounded
6 Volts, 15,750 C.P.S.



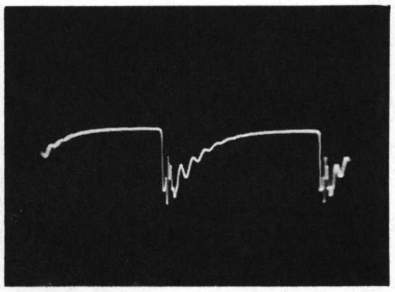
TP1-1089-A

Figure 25. Horizontal-Oscillator Cathode Pin 6*
20 Volts, 15,750 C.P.S.



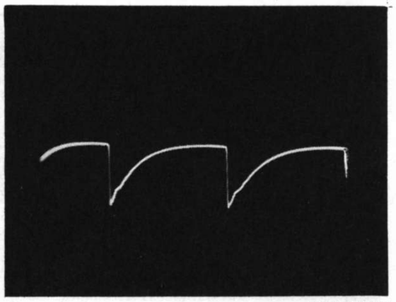
TP1-1205

Figure 26. Horizontal-Oscillator Grid Pin 4*
190 Volts, 15,750 C.P.S.



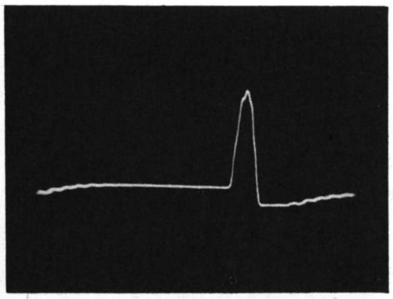
TP1-1098

Figure 27. Horizontal-Oscillator Plate Pin 5*
140 Volts, 15,750 C.P.S.



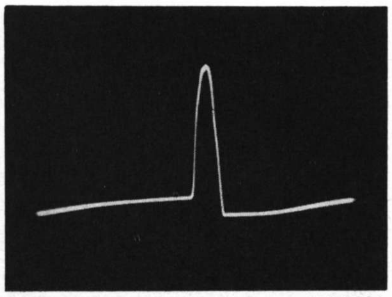
TP1-1095

Figure 28. Horizontal-Amplifier Grid Pin 5*
110 Volts, 15,750 C.P.S.



TP1-1201

Figure 29. Horizontal-Amplifier Plate See Caution**
5000 Volts, 15,750 C.P.S.

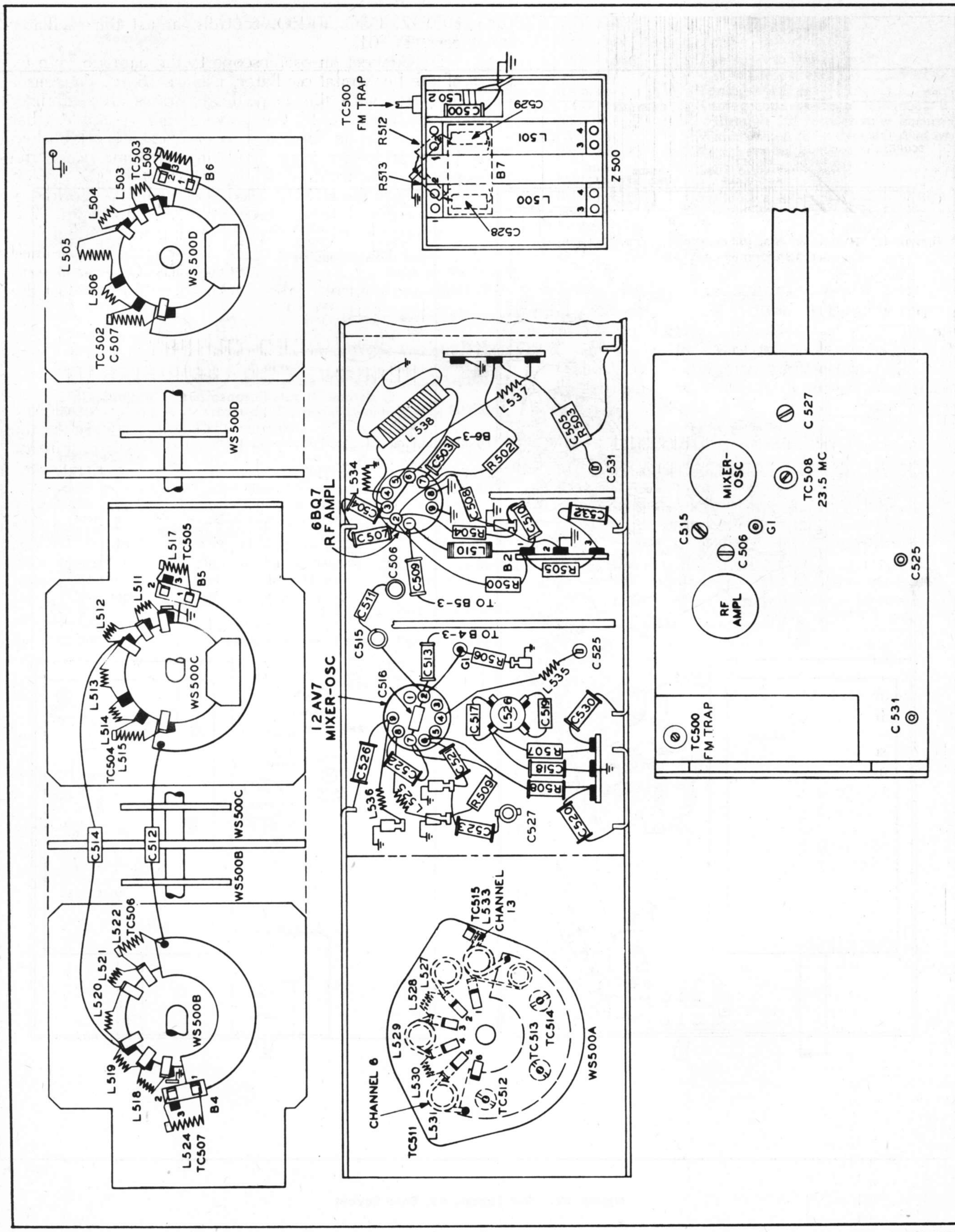


TP1-1206

Figure 30. Horizontal-Damper Cathode See Caution**
3500 Volts, 15,750 C.P.S.

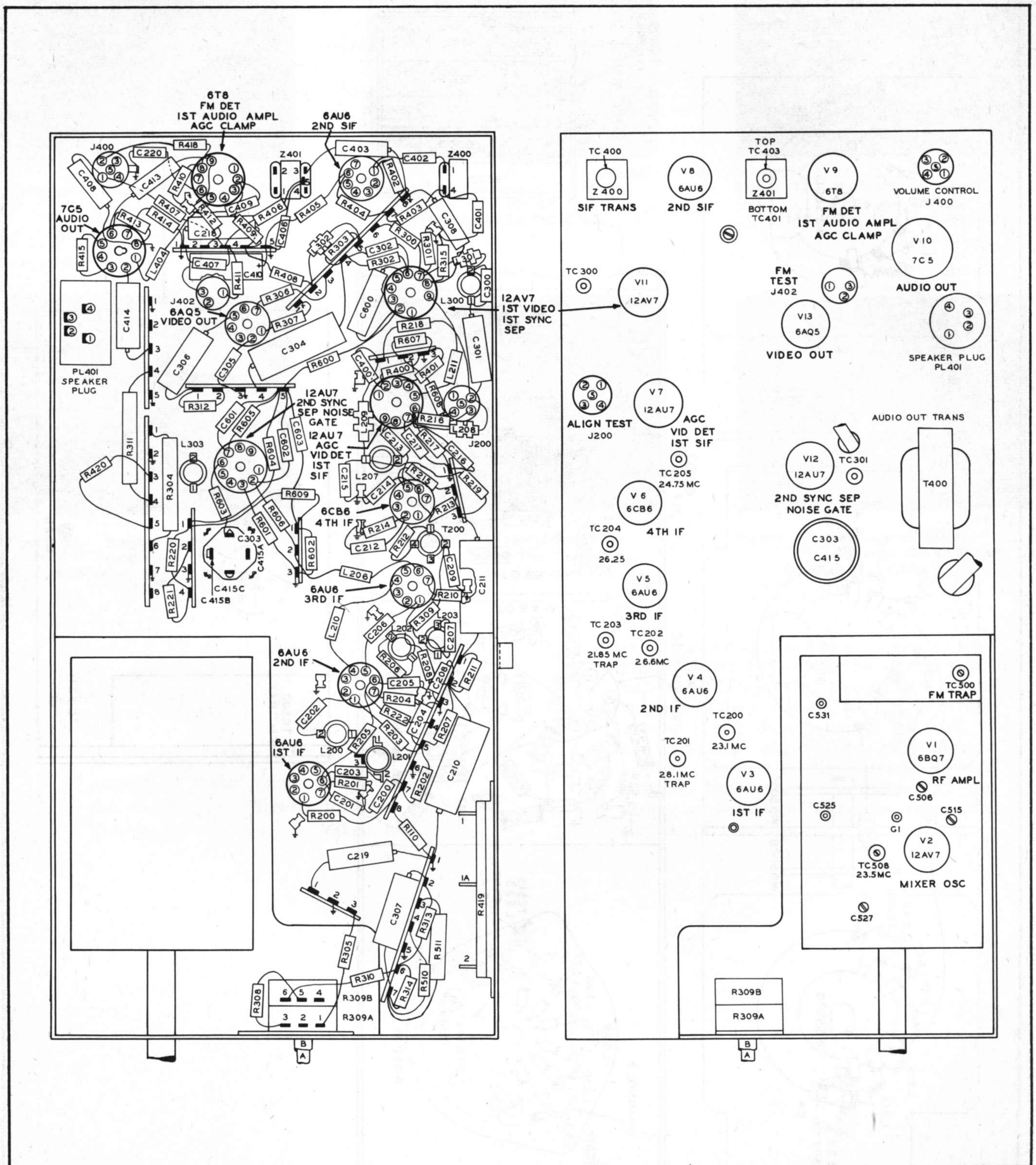
* Connect a 15-$\mu\mu$f. condenser in series with the oscilloscope lead. The oscilloscope should be calibrated with the 15-$\mu\mu$f. condenser in the circuit.

** CAUTION: High-voltage pulses are present at these points. Do not connect the oscilloscope directly to these tubes. The waveforms may be taken with the alligator clip of the oscilloscope lead clipped over the insulation of the tube-cap leads. (To prevent puncture of the insulation of the cap leads, wrap friction tape around the leads and file off the teeth of the alligator clip.) The peak-to-peak voltage shown is the actual voltage present; however, the amplitude of the scope presentation depends upon the degree of coupling.



TP1-2218

Figure 31. Television Tuner, Base Layout



TP2-1196

Figure 32. R-F Chassis 42, Base Layout

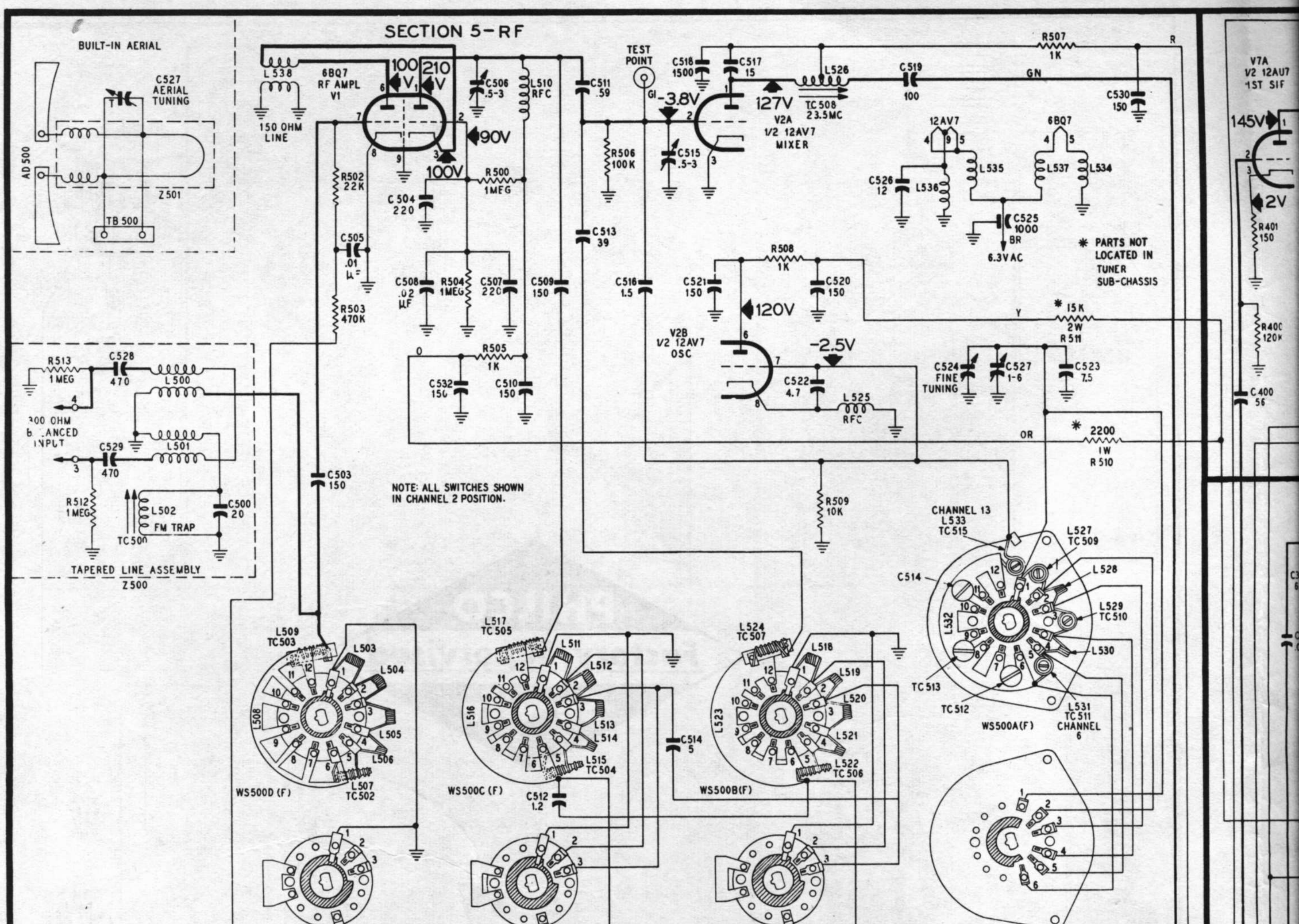
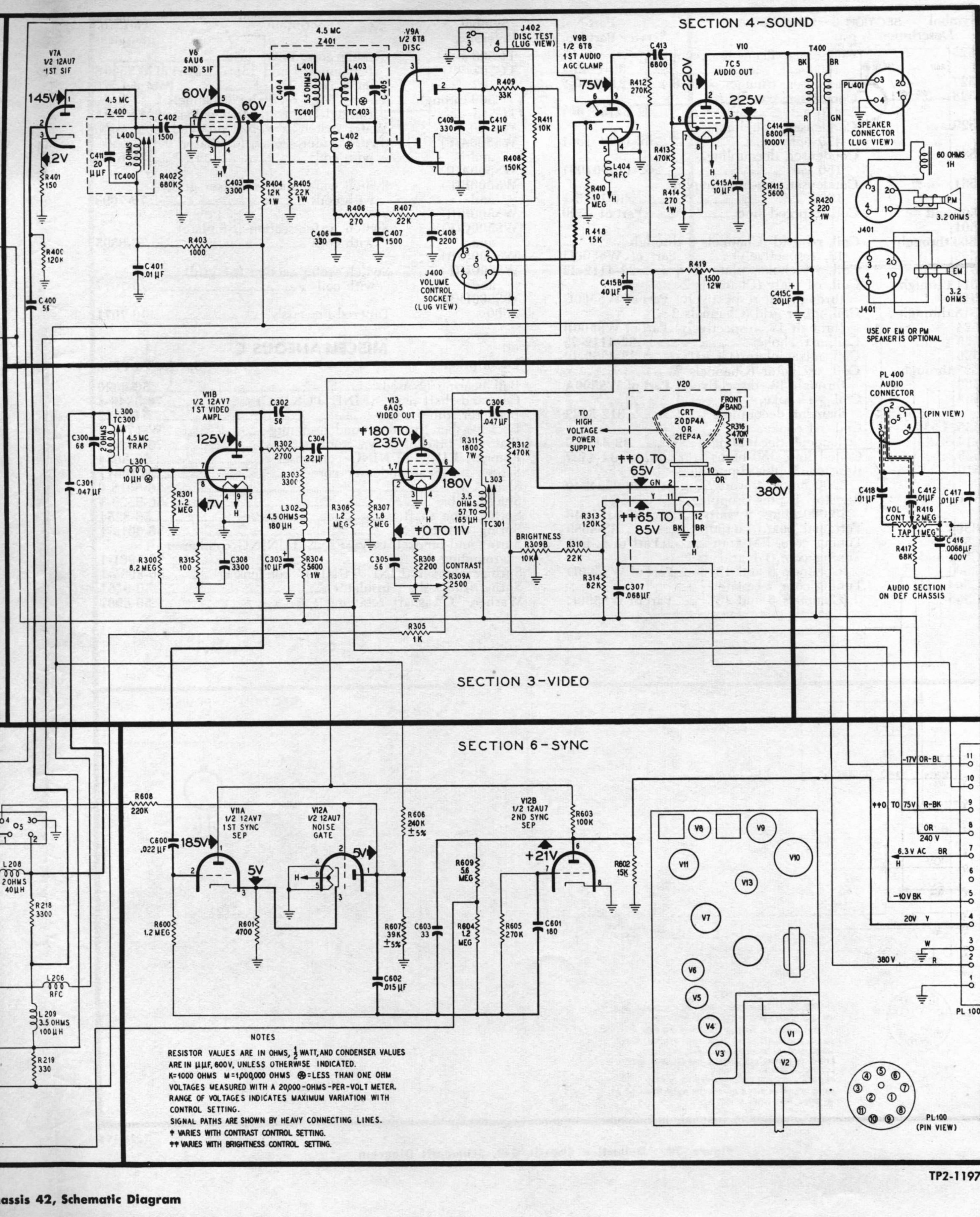
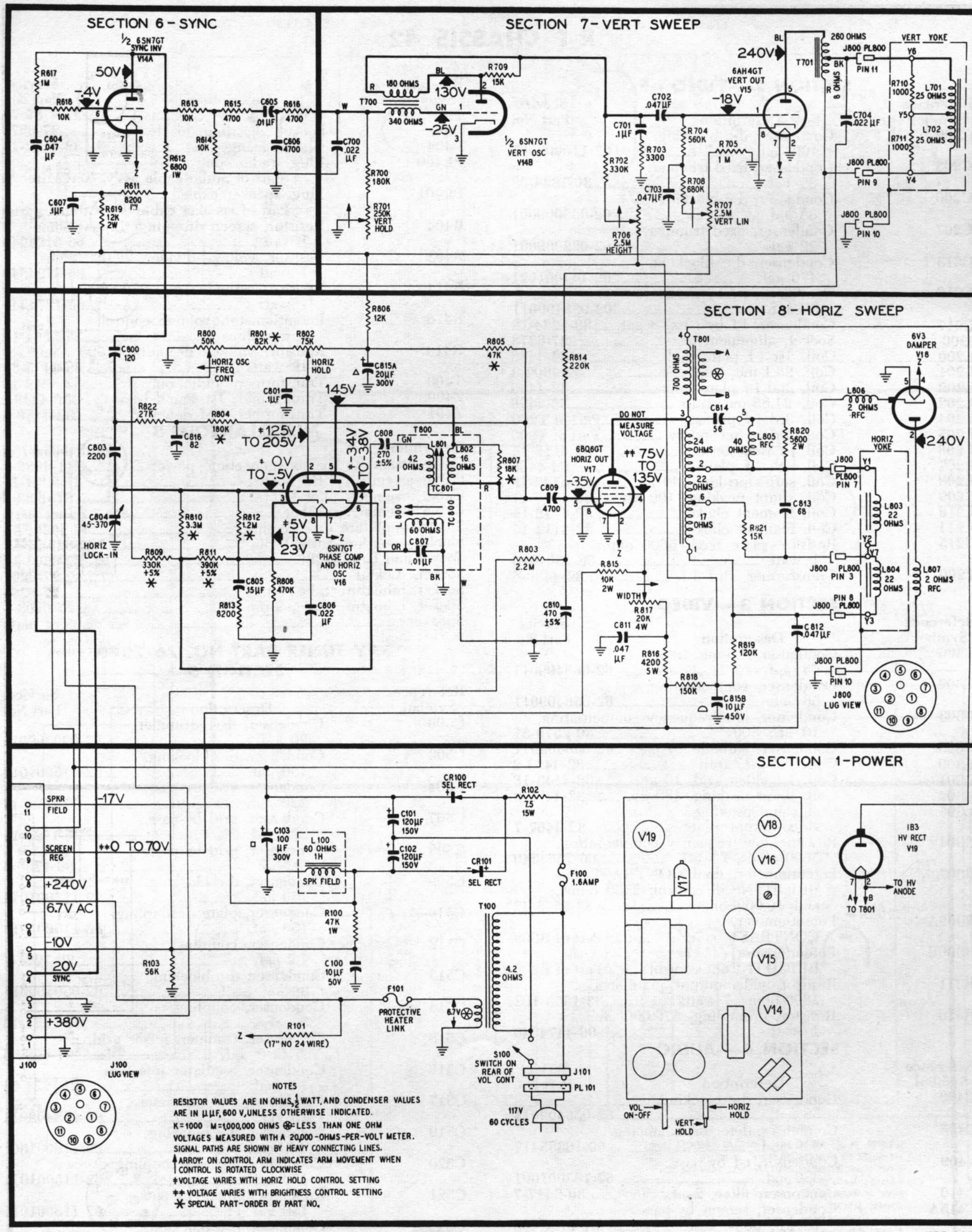


Figure 33. R-F Chassis 42, Sche



TP2-1197

Chassis 42, Schematic Diagram



TP2-1198

Figure 34. Deflection Chassis G-2, Schematic Diagram

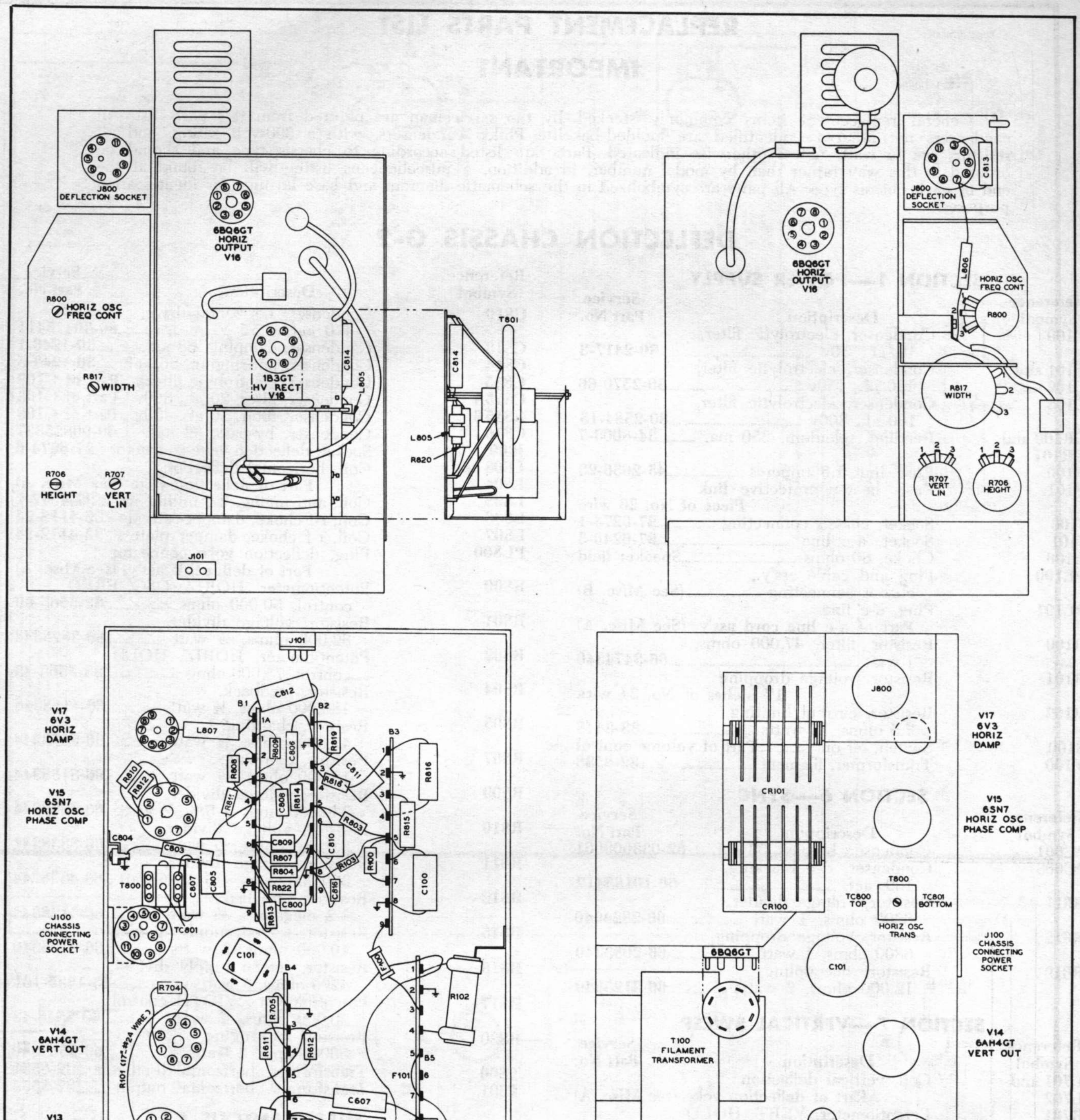


Figure 35. Deflection Chassis G-2, Base Layout

REPLACEMENT PARTS LIST

IMPORTANT

General replacement items commonly stocked by the serviceman are omitted from this parts list. All condensers not otherwise identified are molded-bakelite Philco condensers, with a 600-volt rating, and all resistors are ½ watt, unless otherwise indicated. Parts are listed according to chassis type and should be ordered in this way rather than by model number; in addition, a miscellaneous listing will be found at the end of each chassis type. All parts are symbolized in the schematic diagram and base layouts, for identification purposes.

DEFLECTION CHASSIS G-2

SECTION 1—POWER SUPPLY

Reference Symbol	Description	Service Part No.
C100	Condenser, electrolytic filter, 10 µf., 50v	30-2417-3
C101 and C102	Condenser, electrolytic filter, 120 µf., 150v	30-2570-66
C103	Condenser, electrolytic filter, 100 µf., 300v	30-2584-15
CR100 and CR101	Rectifier, selenium, 350 ma.	34-8003-7
F100	Fuse, line, 1.6 amperes	45-2656-23
F101	Fuse, heater protective link	Piece of No. 26 wire
J100	Socket, chassis connecting	27-6274-1
J101	Socket, a-c line	27-6240-3
L100	Choke, 60 ohms	Speaker field
PL100	Plug and cable ass'y., chassis connecting	(See Misc. B)
PL101	Plug, a-c line	Part of a-c line cord ass'y. (See Misc. A)
R100	Resistor, filter, 47,000 ohms, 1 watt	66-3474340
R101	Resistor, voltage dropping	17 inches of No. 24 wire
R102	Resistor, current limiting, 7.5 ohms, 15 watts	33-3448
S100	Switch, off-on	Part of volume control
T100	Transformer, filament	32-8538

SECTION 6—SYNC

Reference Symbol	Description	Service Part No.
*C601	Condenser, by-pass, 33 µµf.	62-033009001
*C603	Condenser, d-c blocking, 180 µµf.	60-10185417
R611	Resistor, voltage divider, 8200 ohms, 1 watt	66-2824340
R612	Resistor, voltage dropping, 6800 ohms, 1 watt	66-2685340
R619	Resistor, decoupling, 12,000 ohms, 2 watts	66-3125340

SECTION 7—VERTICAL SWEEP

Reference Symbol	Description	Service Part No.
L701 and L702	Coil, vertical deflection	Part of deflection yoke (see Misc. A)
R701	Potentiometer, VERT. HOLD control, 250,000 ohms	Part of R802
R706	Potentiometer, HEIGHT control, 2.5 megohms	33-5565-32
R707	Potentiometer, VERT. LIN. control, 2.5 megohms	33-5565-32
T700	Transformer, vertical oscillator	32-8431-2
T701	Transformer, vertical output	32-8539

SECTION 8—HORIZONTAL SWEEP

Reference Symbol	Description	Service Part No.
C800	Condenser, voltage divider, 120 µµf.	60-10125237
*	This part is located on the r-f chassis	
C804	Condenser, horizontal lock-in padder	31-6473-22
C808	Condenser, d-c blocking, 270 µµf. ±5%	60-10275337
C810	Condenser, horizontal drive, 470 µµf. ±5%	60-30475411
C813	Condenser, damping, 68 µµf.	30-1246-1
C814	Condenser, antiringing, 56 µµf.	30-1243-5
C815	Condenser, electrolytic filter	Part of C103
C815A	Condenser, filter, 20 µf., 300v	Part of C103
C815B	Condenser, filter, 10 µf., 450v	Part of C103
C816	Condenser, by-pass, 82 µµf.	60-00825337
J800	Socket, deflection yoke connector	27-6274-6
L803 and L804	Coil, horizontal deflection	Part of deflection yoke (See Misc. A)
L805	Coil, antiringing, 2.5 millihenrys	32-4542-2
L806	Coil, r-f choke, damper cathode	32-4112-24
L807	Coil, r-f choke, damper plate	32-4112-24
PL800	Plug, deflection yoke connector	Part of defl. cable ass'y. (see Misc. A)
R800	Potentiometer, HORIZ. OSC. FREQ. control, 50,000 ohms	33-5565-30
R801	Resistor, voltage divider, 82,000 ohms, ½ watt	66-3828344
R802	Potentiometer, HORIZ. HOLD control, 75,000 ohms	33-5563-43
R804	Resistor, feedback, 180,000 ohms, ½ watt	66-4188344
R805	Resistor, charging, 47,000 ohms, ½ watt	66-3478244
R807	Resistor, damping, 18,000 ohms, ½ watt	66-3188344
R809	Resistor, voltage divider, 330,000 ohms +5%, ½ watt	66-4338244
R810	Resistor, voltage divider, 3.3 megohms, ½ watt	66-5338344
R811	Resistor, voltage divider, 390,000 ohms +5%, ½ watt	66-4398244
R812	Resistor, grid leak, 1.2 megohms, ½ watt	66-5128344
R815	Resistor, screen supply divider, 10,000 ohms, 2 watts	66-3105340
R816	Resistor, screen supply divider, 4200 ohms, 5 watts	33-1335-101
R817	Potentiometer, WIDTH control, 20,000 ohms, 4 watts	33-5546-43
R820	Resistor, antiringing, 5600 ohms, 2 watts	66-2565340
T800	Transformer, horizontal oscillator	32-8551
T801	Transformer, horizontal output	32-8555

MISCELLANEOUS A

Description	Service Part No.
Beam bender	76-6077-2
Cable ass'y., audio control	41-3974
Cable ass'y., high voltage	41-4064-6
Cable and plug ass'y., deflection	41-4086-18
Cap and lead ass'y., 6BQ6 plate	76-5664-7
Cap and lead ass'y., 6V3 plate	76-5664
Cord, line	41-3865
Deflection yoke ass'y.	32-9648
Focus, ass'y., pm	76-6126-4
Insulator, stand off, 1B3 socket	54-7309-2
Shield, corona, octal socket	76-7436
Shock mount, octal socket and spring	76-6119
Socket, octal	27-6174
Socket, 9-pin miniature	27-6203-5
Socket, 1B3GT	27-6174-5
Spring, CRT ass'y.	56-9733

R-F CHASSIS 42

SECTION 2—VIDEO I-F

Reference Symbol	Description	Service Part No.
C202	Condenser, d-c blocking, 100 μμf.	62-110009001
C203	Condenser, fixed trimmer, 39 μμf.	30-1224-63
C206	Condenser, d-c blocking, 33 μμf.	62-033009001
C207	Condenser, fixed trimmer, 22 μμf.	62-022009001
C213	Condenser, d-c blocking, 470 μμf.	62-147001021
C216	Condenser, r-f by-pass, 56 μμf.	62-056409011
C217	Condenser, i-f by-pass, 8 μμf.	30-1224-13
J200	Socket, alignment test	27-6273
L200	Coil, 1st i-f plate tank	32-4486
L201	Coil, 28.1-mc. trap	32-4303-3
L202	Coil, 2nd i-f plate tank	32-4486
L203	Coil, 21.85-mc. trap	32-4496
L204	Coil, 3rd i-f primary	Part of T200
L205	Coil, 3rd i-f secondary	Part of T200
L206	Coil, i-f isolation	32-4112-15
L207	Coil, 4th i-f plate	32-4486
L208	Coil, series peaking, 40 μh.	32-4143-16
L209	Coil, shunt peaking, 100 μh.	32-4143-17
L210	Coil, filament choke	32-4112-15
L211	Coil, filament choke	32-4112-15
R215	Resistor, plate feed, 5600 ohms, 1 watt	66-2564340
T200	Transformer, 3rd i-f	32-4486-6

SECTION 3—VIDEO

Reference Symbol	Description	Service Part No.
C300	Condenser, 4.5-mc. trap, 68 μμf.	62-068409011
C302	Condenser, compensating, 56 μμf.	62-056409011
C303	Condenser, low-frequency compensating, 10 μf., 300v	30-2570-57
C305	Condenser, cathode by-pass	62-056409011
L300	Coil, 4.5-mc. trap	32-4463-2
L301	Coil, 1st video grid, 10 μh.	32-4143-18
L302	Coil, shunt peaking, 180 μh.	32-4480-9
L303	Coil, shunt peaking, video-output plate	32-4467-7
R304	Resistor, low-frequency compensating, 5600 ohms, 1 watt	66-2564340
R309	Potentiometer, dual CONTRAST and BRIGHTNESS control, 2500 ohms, and 10,000 ohms	33-5563-42
R309A	Potentiometer, CONTRAST control	Part of R309
R309B	Potentiometer, BRIGHTNESS control	Part of R309
R311	Resistor, video-output plate load, 1800 ohms, 7 watts	33-1335-102
R316	Resistor, grounding, 470,000 ohms, 1 watt	66-4474340

SECTION 4—AUDIO

Reference Symbol	Description	Service Part No.
C400	Condenser, d-c blocking, 56 μμf.	62-056409011
C406	Condenser, detector, balancing, 330 μμf.	60-10335417
C409	Condenser, r-f by-pass, 330 μμf.	62-133001001
C410	Condenser, filter, 2 μf., 50v	30-2417-7
C415A	Condenser, screen by-pass, 10 μf., 300v	Part of C303
C415B	Condenser, filter, 40 μf., 300v	Part of C303
C415C	Condenser, electrolitic, 20 μf., 300v	Part of C303
J400	Socket, volume control	27-6273
J401	Socket, speaker	27-4785-22
J402	Socket, discriminator test	27-6273
L404	Choke, filament	32-4112-15
PL400	Plug, audio control — Part of audio cable ass'y. (see Misc. A)	
PL401	Plug, speaker cable — Part of speaker cable (see cabinet parts)	
R404	Resistor, screen dropping, 12,000 ohms 1 watt	66-3124340
R405	Resistor, voltage divider, 22,000 ohms, 1 watt	66-3224340
R414	Resistor, cathode bias, 270 ohms, 1 watt	66-1274340
R416	Potentiometer, volume control, 2 megohms	33-5564-14
R419	Resistor, voltage dropping, 1500 ohms, 12 watts	33-3435-35
T400	Transformer, audio output	32-8242-11
Z400	Transformer, 1st sound i-f ass'y.	32-4449A
Z401	Transformer, FM detector	32-4450-5

MISCELLANEOUS B

Description	Service Part No.
Cable assembly, chassis connection, power	41-4086-1
Cable assembly, CRT socket	41-3964-15
Cable assembly, pilot light	27-6233-6
Cable assembly, speaker	See cabinet parts
Shield, miniature tube, 7-pin	56-5629FA3
Shield, miniature tube, 9-pin	56-5629-5FA3
Socket and base, 6CB6	29-6203-14
Socket, Loktal	27-6207
Socket, miniature tube, 7-pin	27-6265
Socket, miniature tube, 9-pin	27-6203-5
Speaker	See cabinet parts

TV TUNER PART NO. 76-7070
SECTION 5

Reference Symbol	Description	Service Part No.
C500	Condenser, fixed trimmer, 20 μμf.	62-020309011
C503	Condenser, d-c blocking, 150 μμf.	62-115001011
C504	Condenser, grid by-pass, 220 μμf.	30-1225-11
C507	Condenser, grid by-pass, 220 μμf.	30-1225-11
C508	Condenser, grid by-pass, .02 μf.	30-1238-5
C509	Condenser, d-c blocking, 150 μμf.	62-115001011
C510	Condenser, plate decoupling, 150 μμf.	62-115001011
C512	Condenser, coupling, 1.2 μμf.	30-1221-7
C513	Condenser, d-c blocking, 39 μμf.	62-039409011
C514	Condenser, coupling, 5 μμf.	30-1221-13
C515	Condenser, trimmer, mixer grid, .5 to 3 μμf.	31-6520-3
C516	Condenser, oscillator injection, 1.5 μμf.	30-1224-59
C517	Condenser, fixed trimmer, 15 μμf.	62-015409011
C519	Condenser, d-c blocking, 100 μμf.	62-110001001
C520	Condenser, plate decoupling, 150 μμf.	62-115001011
C521	Condenser, plate by-pass, 150 μμf.	62-115001011
C522	Condenser, d-c blocking, 4.7 μμf. ±5%	30-1224-85
C523	Condenser, fixed trimmer, 7.5 μμf. ±10%	30-1224-84
C524	Condenser, fine tuning	76-5755

Symbol Description	Description	Part No. Service Part No.
C525	Condenser, filament decoupling, 1000 $\mu\mu$f.	30-1245-1
C527	Condenser, trimmer, 1 to 6 $\mu\mu$f.	31-6520-2
C528	Condenser, coupling, 470 $\mu\mu$f.	62-147001001
C529	Condenser, coupling, 470 $\mu\mu$f.	62-147001001
C530	Condenser, decoupling, 150 $\mu\mu$f.	62-115001001
C531	Condenser, a-g-c decoupling, 1000 $\mu\mu$f.	30-1245-1
L500 and L501	Coil, tapered line	Part of Z500
L503 through L509	Coil, r-f grid (Channels 2 through 13, respectively)	Part of WS500D
L510	Coil, r-f choke, plate feed	32-4112-22
L511 through L517	Coil, r-f plate (Channels 2 through 13, respectively)	Part of WS500C
L518 through L524	Coil, mixer grid (Channels 2 through 13, respectively)	Part of WS500B
L525	Coil, r-f choke	32-4112-25
L526	Coil, mixer plate (1st i-f)	32-4359-12
L527 through L533	Coil, oscillator (Channels 2 through 13, respectively)	Part of WS500A
L534	Coil, r-f choke, filament decoupling	312-5132
L535, L536 and L537	Coil, r-f choke, filament decoupling	32-4112-2
L538	Coiled line, 150 ohms	32-4527
R510	Resistor, B plus dropping, 2200 ohms, 1 watt	66-2224340
R511	Resistor, B plus dropping, 15,000 ohms, 2 watts	66-3155340
TB500	Terminal board (aerial)	38-8689
TC500	Tuning core, FM trap	Part of L 502
TC502 and TC503	Tuning core, r-f grid (Channels 6 and 13)	Part of WS500D
TC504 and TC505	Tuning core, r-f plate (Channels 6 and 13)	Part of WS500C

Symbol Reference	Description	Part No. Service
TC506 and TC507	Tuning core, mixer grid (Channels 6 and 13)	Part of WS500B
TC508	Tuning core, 1st i-f	Part of L526
TC509 through TC515	Tuning core, oscillator (Channels 2 through 13, respectively)	Part of WS500A
WS500	Wafer switch ass'y.	Not supplied as an ass'y.
WS500A(F) and WS500A(R)	Switch wafer section (oscillator) with coils	76-6784
WS500B(F) and WS500B(R)	Switch wafer section (mixer grid) with coils	76-7098
WS500C(F) and WS500C(R)	Switch wafer section (r-f plate) with coils	76-6895
WS500D(F) and WS500D(R)	Switch wafer section (r-f grid) with coils	76-7077
Z500	Tapered-line ass'y.	76-7071

MISCELLANEOUS C

Description	Service Part No.
Ball bearing (2 used)	56-8020
Cam-and-shaft ass'y. (FINE TUNING)	76-5846-4
Insulator, tuner shaft	54-4912
Lock washer, trimmer-condenser mtg.	W-1775-3
Plate-and-bracket ass'y., front	76-5924-3
Plunger, FINE TUNING condenser	56-8034
Screw, trimmer-condenser core	2W10617
Shaft	56-8018-6
Shield, tube	56-5629-5
Spring, cam shaft	56-8254
Spring detent	56-8019-1
Spring-and-bracket ass'y., FINE TUNING condenser grounding	76-5961-1
Spring, plunger (FINE TUNING condenser)	56-8035-1
Spring, tuner-shaft insulator	56-9181
Washer, "C", shaft retaining	56-8061

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Printed in U.S.A.