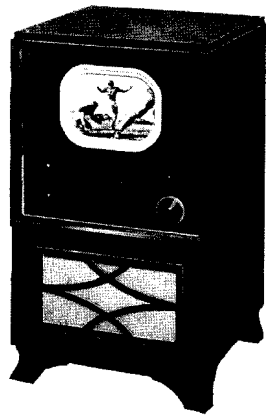
ELECTRICAL SPECIFICATIONS

Power Supply	105-125 Volts AC 60 Cycles Only
Power Consumption	220 Watts
Power Output	2.4 Watts Maximum 1.8 Watts Undistorted
Antenna Input Impedance	300 Ohms Balanced
Picture Area	55 Square Inch
Tuning Range	12 Channel
Intermediate Frequencies	Picture—25.75 Mc Sound—21.25 Mc
Loud Speaker	12" PM Dynamic
Voice Coil Impedance	3.2 Ohms 400 Cycles
Video Response	to 3.5MC
Focus	Magnetic
Sweep Deflection	Magnetic
Scanning	Interlaced, 525 Line
Horizontal Scanning Frequency	15,750 CPS
Vertical Scanning Frequency	60 CPS
Frame Frequency	30 CPS



MODEL D1991

TUBE COMPLEMENT

Symbol	Type	Function
V1	1—6BH6	R-F Amplifier
V2	1—6AG5	Converter
V3	1—6C4	R-F Oscillator
V4	1—6BA6	1st Sound I-F Amp.
V5	1—6AU6	2nd Sound I-F Amp.
V6	1—6AL5	Sound Discriminator
V7	1—6K6GT	Audio Output
V8	1—6AT6	1st Audio and Bias Clamp
V9	1—6AG5	1st Picture I-F Amp.
V10	1—6AG5	2nd Picture I-F Amp.
V11	1—6AG5	3rd Picture I-F Amp.
V12A-12B	1—6AL5	Picture 2nd Det. and Sync Limiter
V13	1—12AU7	1st and 2nd Video Amp.
V14	1—6SN7-GT	Sync Amplifier and Separator
V15	1—6SN7-GT	Vertical Sweep Oscillator, Discharge and Output
V16	1—6SN7-GT	Horizontal Sweep Oscillator and Sync Guide
V17	1—6BG6-G	Horizontal Sweep Output
V18	1—1B3-GT/8016	High Voltage Rectifier
V19	1—5V4-G	Horizontal Damper
V20	1—5U4-G	Power Supply Rectifier
V21	1—10BP4	Kinescope (Picture Tube)

MODEL D1993

RADIO FREQUENCY RANGES

Channel Number	Channel Frequency Mc	Picture Carrier Frequency Mc	Sound Carrier Frequency Mc	Receiver R-F Osc. Frequency Mc
2	54-60	55.25	59.75	81
3	60-66	61.25	65.75	87
4	66-72	67.25	71.75	93
5	76-82	77.25	81.75	103
6	82-88	83.25	87.75	109
7	174-180	175.25	179.75	201
8	180-186	181.25	185.75	207
9	186-192	187.25	191.75	213
10	192-198	193.25	197.75	219
11	198-204	199.25	203.75	225
12	204-210	205.25	209.75	231
13	210-216	211.25	215.75	237

RECEIVER LOCATION—Advise the owner as to the proper location for the television receiver. The following may be used as a guide:

1. Choose an area in the home where sunlight or light from lamps do not strike the face of the picture tube and cause glare.
2. Remember the necessity of an electrical outlet and the location of the point at which the antenna leads enter the room.
3. The receiver should be placed a short distance from the wall to allow adequate ventilation.
4. The receiver should be placed to permit easy access for operation and comfortable viewing from all angles.

ANTENNA— This receiver has been designed to use an antenna with a 300 ohm balanced transmission line. This line must be as short as possible because the longer the line the greater the chances are for picking up electrical disturbances. Stand-off insulation should be used to keep the line away from the mast, metal or walls. Twist this line about one turn per foot throughout the line to cancel out direct signal and/or noise pickup by the transmission line. It should also be securely anchored in place so that a change in weather will not affect its position.

HIGH VOLTAGE WARNING

This television receiver contains high voltages which are dangerous to life. Never operate or service the receiver outside of the cabinet or with the covers removed until all the safety precautions necessary for working with high voltage equipment have been observed.

KINESCOPE (Picture Tube) HANDLING PRECAUTION

Shatterproof goggles and heavy gloves must be worn by individuals while handling the kinescope or installing the kinescope into the receiver.

The kinescope encloses a high vacuum and due to the large surface area, is subected to excessive air pressure. Therefore, care should be taken not to bump or scratch the picture tube accidentally as it may cause the tube to implode resulting in damage to property or injury to an individual.

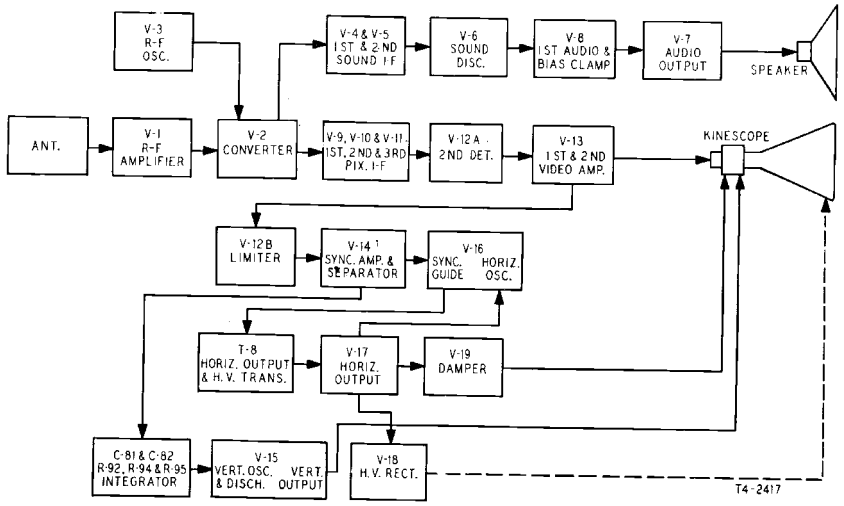


Fig. 2—Block Diagram

TUNING PROCEDURE

1. To turn the television receiver on, turn the OFF-ON SOUND CONTROL clockwise until a click is heard. Allow approximately 30 seconds for the tubes to warm up.
2. Turn the STATION SELECTOR CONTROL to the desired channel. This control may be turned in either direction.
3. Turn the CONTRAST CONTROL fully counterclockwise.
4. Turn the BRIGHTNESS CONTROL fully counterclockwise and then very slowly clockwise until light is readily visible on the screen.
5. Turn the CONTRAST CONTROL clockwise until activity or definite form is noted on the screen.
6. Adjust the FINE TUNING CONTROL for best tonal quality and the SOUND CONTROL for desired volume.
7. Turn the VERTICAL CONTROL until the picture stops moving up or down.
8. Adjust the HORIZONTAL CONTROL until the picture is obtained and centered.
9. Adjust the CONTRAST CONTROL until the best picture is obtained and if necessary make a slight re-adjustment of the BRIGHTNESS CONTROL.
10. After the receiver has been on for a while it may be necessary to readjust the FINE TUNING CONTROL for best sound quality.
11. When switching from one channel to another, it may be necessary to repeat steps number 6 and 9.
12. To turn off the receiver, turn only the OFF-ON SOUND CONTROL counterclockwise until a click is heard.

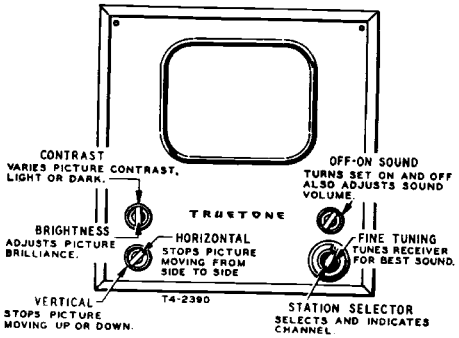


Fig. 3—Front Panel Controls

13. When the receiver is turned on again and the positions of the controls have not been changed, no further adjustments will be necessary except for the FINE TUNING CONTROL and SOUND CONTROL for the desired volume.
14. If the positions have been disturbed since the last time the receiver has been used it may be necessary to follow steps 1 to 10.

OPE —The receiver is shipped with the kinescope in place, however some of the kinescope adjustments may have been jarred loose in shipment. If adjustments are necessary, the following should be used as a guide:

1. After the receiver has been unpacked and the cradle removed, take off the cabinet back and make sure all the tubes are properly mounted in their respective sockets.
2. Remove the tape from the kinescope socket base and the corrugated cardboard lock holding the focus coil in place.
3. Connect an antenna to the antenna terminals at the rear of the cabinet and insert the line cord plug into a convenient outlet.
4. Turn on the receiver and wait about 60 seconds for the receiver to warm up. Turn the channel selector to a station that is transmitting and check the picture. If the picture is not centered on the screen, or visible at all, make the adjustments on the deflection yoke, focus coil and ion trap magnet assemblies as outlined on page 5.

KINESCOPE REPLACEMENT —Should the kinescope have to be replaced, remove the defective kinescope in the following manner:

1. Remove the front panel control knobs by pulling them straight from their shafts.
2. Remove two ornamental screws holding the front panel to the cabinet (see figure 5) and lift out panel.
3. Remove the cabinet back.
4. Disconnect the kinescope socket connector at the base of the tube and the high voltage anode lead from the front of the kinescope.
   WARNING—REMOVE STATIC CHARGE FROM THE ANODE LEAD BY GROUNDING IT AGAINST THE CHASSIS.
5. Remove the ion trap magnet, slipping it from the neck of the kinescope past the socket.
6. Loosen the wing nuts and wing screws on the deflection yoke and focus coil.
7. Loosen the strap holding the front of kinescope in place and withdraw the kinescope toward the front of the chassis.
8. To install a new kinescope, reverse the above procedure making sure that the kinescope is fitted closely against the kinescope cushion and that the high voltage well connector is at the top of the kinescope. If the kinescope sticks or fails to slip into place smoothly, investigate and remove the source of the trouble. Never force the tube.

KINESCOPE WINDOW — Clean the kinescope window with a dampened cloth or a soft lint-free cloth if dust or finger marks are present.

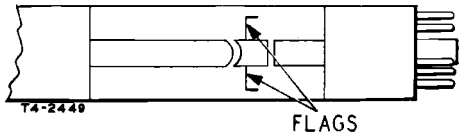


Fig. 4—Ion Trap Flags

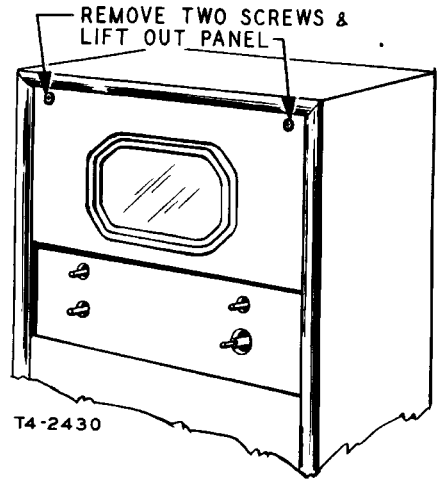


Fig. 5—Front Panel Removal

NON-OPERATING CONTROLS (Rear Of Chassis)

Horizontal Centering	R-106
Vertical Centering	R-105
Width	L-15
Height	R-86
Horizontal Linearity	L-16
Vertical Linearity	R-93
Horizontal Drive	C-55C
Horizontal Frequency (Fine)	C-55B
Horizontal Oscillator Frequency (Bottom Chassis)	L-14
Horizontal Locking Range	C-55A
Focus	R-104
Focus Coil	Wing Screw Adjustment
Ion Trap Magnet	Top Chassis Adjustment
Deflection Coil	Wing Nut Adjustment

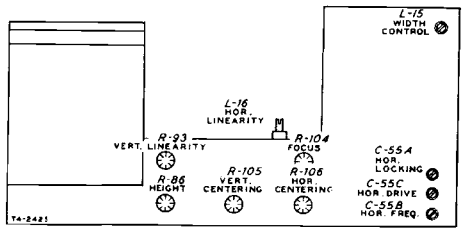


Fig. 6—Rear Chassis Adjustments

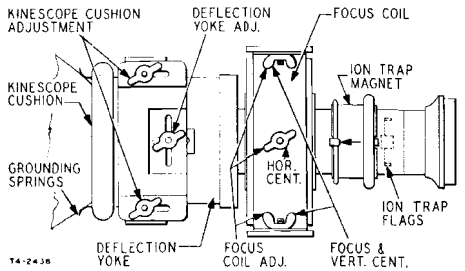


Fig. 7—Yoke, Focus and Ion Trap Magnet Adjustment

DEFLECTION YOKE ADJUSTMENT — If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

FOCUS COIL ADJUSTMENT — Turn the HORIZONTAL CENTERING (R-106) and VERTICAL CENTERING (R-105) CONTROLS to the halfway position. (See Figure 6). If a corner of the raster is shadowed, it indicates that the electron beam is striking the neck of the tube. Loosen the focus coil adjustment wing nuts and rotate the coil about its vertical and horizontal axes until the entire raster is visible, approximately centered and with no shadowed corners. Tighten the focus coil adjustment wing nuts with the coil in this position.

ION TRAP MAGNET ADJUSTMENT—The ion trap magnet should be positioned exactly as shown in Figure 7. Adjust the magnet by moving it back and forth and at the same time rotating it slightly around the neck of the kinescope until the brightest raster is obtained on the picture screen. Reduce the brightness control setting until the raster is slightly above average brilliance. Adjust the Focus Control R-104 (see Figure 6) until the line structure of the raster is clearly visible. Readjust the ion trap magnet for maximum raster brilliance. The final touches on this adjustment should be made with the brightness control at the maximum position with which good line focus can be maintained.

PICTURE ADJUSTMENT—For further adjustments, obtain a test pattern on the receiver. Turn on receiver and follow tuning procedure on page 3.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT—Turn the horizontal hold control to the extreme counter-clockwise position. The picture should remain in horizontal sync. Momentarily remove the signal by switching off channel and then back. Normally the picture will be out of sync. Turn the control clockwise slowly. The number of diagonal bars will be gradually reduced and when only 3-1/2 to 4-1/2 bars sloping downward to the left are obtained, the picture will pull into sync upon slight additional clockwise rotation of the control. The pull-in should occur when the control is approximately 90 degrees from the extreme counter-clockwise position. The picture should remain in sync for approximately 90 degrees of additional clockwise rotation of the control. At the extreme clockwise position, the picture should be out of sync and should show from 3-1/2 to 4-1/2 bars sloping downward to the right.

If the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned. Skip "Alignment of Horizontal Oscillator" and proceed with "Focus" adjustment.

ALIGNMENT OF HORIZONTAL OSCILLATOR — If in the above check the receiver failed to hold sync with the hold control at the extreme counter-clockwise position or failed to hold sync for at least 60 degrees of clockwise rotation of the control from the pull in point, it will be necessary to make the following adjustments.

HORIZONTAL FREQUENCY ADJUSTMENT—Turn the horizontal hold control to the extreme clockwise position. Tune in a television station and adjust the rear apron horizontal frequency trimmer C-55B (see Figure 6) until the picture is out of sync and shows 3-1/2 to 4-1/2 bars sloping downward to the right. If the trimmer has insufficient range, set the trimmer to mid-position (1 turn out from maximum capacity) and adjust the L-14 horizontal frequency adjustment until this condition is obtained. See Figure 9 for the location of L-14.

HORIZONTAL LOCKING RANGE ADJUSTMENT—Set the horizontal hold control to the extreme counter-clockwise position. Momentarily remove the signal by switching off channel and then back. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync. If more than 4-1/2 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C-55A (See Figure 6) slightly clockwise. If less than 3-1/2 bars are present, adjust trimmer C-55A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 3-1/2 to 4-1/2 bars are present. Repeat the adjustments under "Horizontal Frequency Adjustment" and "Horizontal Locking Range Adjustment" until the condition specified under each are fulfilled. When the horizontal hold operates as outlined under "Check of Horizontal Oscillator Alignment" the oscillator is properly adjusted.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS — Adjust the height control R-86 (See Figure 6) until the picture fills the mask vertically. Adjust the vertical linearity control R-93 (See Figure 6) until the picture is symmetrical from top to bottom. Adjustment of either control will require a readjustment of the other. Adjust vertical centering control R-105 (See Figure 6) to align the picture with the mask.

WIDTH, DRIVE AND HORIZONTAL LINEARITY ADJUSTMENTS—Turn the width control L-15 (at top of power supply cover) to the maximum clockwise position. Vary the horizontal drive trimmer C-55C (See Figure 6) to yield the best compromise between brightness and linearity. Adjust the horizontal linearity control L-16 (See Figure 6) for best linearity of the right half of the picture. Readjust the width control L-15, until the picture just fills the mask. Adjust horizontal centering control R-106 (See Figure 6) to align the picture with the mask.

FOCUS—Adjust the focus control R-104 (see Fig. 6) for maximum definition of the vertical wedge of the picture. Check to see that all cushion, yoke and focus coil thumb screws are tight. Replace the cabinet back making sure that the back is on tight, otherwise it may rattle at high volume.

CHECK OF R-F OSCILLATOR ADJUSTMENTS—With a crystal calibrated test oscillator or heterodyne frequency meter, check to see if the receiver R-F oscillator is adjusted to the proper frequency on all channels. The adjustments for all channels are available from the front of the cabinet by removing the front panel as shown in Figure 5. Tune in all available television stations.

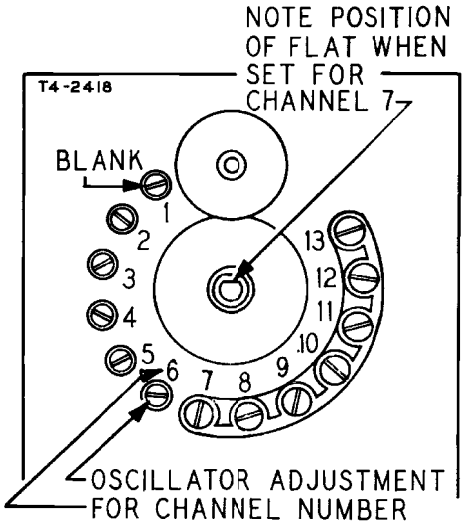


Fig. 8—R-F Oscillator Adjustments

VIDEO PEAKING LINK—A video peaking link is provided to permit changing the video response. This link is connected at the factory with the peaking in. However, if transients are produced on high contrast pictures, or picture is smeared or fuzzy, or if the receiver is operated in areas where the signal strength is weak, open the video peaking link connecting L-13 and R-52.

VENTILATION CAUTION—The receiver is provided with adequate ventilation holes in the bottom and back of the cabinet. Care should be taken not to allow these holes to be covered or ventilation to be impeded in any way.

SERVICE SUGGESTIONS

NO RASTER ON KINESCOPE —If raster cannot be obtained check below for the possible causes.

1. Ion trap magnet adjustment is incorrect.
2. No high voltage, check V-17 (6BG6-G) and V-18 (1B3-GT/8016) tubes and circuits. If the horizontal deflection circuits are operating, as evidenced by the correct wave form measured on terminal 4 of horizontal output transformer (T-8), the trouble can be isolated to the high voltage rectifier (V-18) circuit. Either the high voltage winding (points 2 to 3 on T-8) is open, tube V-18 is defective, its filament circuit is open, or the high voltage filter capacitor (C-76) is shorted.
3. Damper tube V-19 (5V4-G) defective. Plate voltage supply for V-17 (6BG6-G) horizontal output tube is obtained through the damper tube. Check tube and heater winding on power transformer (T-9). If the tube is alright, check the horizontal linearity coil (L-16) for continuity and check capacitors C-69 and C-75 for short circuit.
4. Defective kinescope. Heater open, cathode return circuit open.
5. No plate voltage. Electrolytic capacitor shorted. Open speaker field coil. All +B measurements are accessible for measurement by removing cover from bleeder box.
6. Horizontal oscillator and control tube V-16 (6SN7-GT) defective. Check for sawtooth on grid of horizontal output tube V-17 (6BG6-G). If not present, check voltages and components in the V-16 (6SN7-GT) circuits.

HORIZONTAL DEFLECTION ONLY —If only horizontal deflection is obtained as evidenced by a straight line across the face of the kinescope, it can be caused by the following:

1. Vertical oscillator and output tube V-15 (6SN7-GT) inoperative. Check voltages on grid and plate.
2. Vertical output transformer (T-7) open.
3. Yoke vertical coils open.

POOR VERTICAL LINEARITY—If adjustment of the vertical, height and linearity controls will not correct this condition, any of the following may be the cause:

1. Vertical output transformer (T-7) defective.
2. Capacitors C-80A or C-78A defective.
3. V-15 (6SN7-GT) defective, check voltages.
4. Excess leakage or incorrect value in capacitor C-82.
5. Low plate and bias voltages. Check rectifier tube and capacitors in +B supply circuits.
6. Capacitor C-81 defective.

POOR HORIZONTAL LINEARITY—If adjustment of controls does not correct this condition, check the following:

1. Check or replace horizontal output tube V-17 (6BG6-G).
2. Check or replace damper tube V-19 (5V4-G).
3. Check linearity coil L-16 for short circuit.
4. Check capacitors C-69 and C-75 for defects.

TRAPEZOIDAL OR NONSYMMETRICAL RASTER—

1. Improper adjustment of focus coil or ion trap magnet.
2. Defective yoke.

WRINKLES ON LEFT SIDE OF RASTER—This condition can be caused by:

Defective yoke due to R-97, R-98 or C-86 (internal in yoke assembly) being wrong value or open. These components are mounted in rear of yoke assembly.

SMALL RASTER —This condition can be caused by:

1. Low +B or line voltage.
2. Insufficient output from horizontal output tube V-17 (6BG6-G). Replace tube.
3. Insufficient output from vertical output tube V-15 (6SN7-GT). Replace tube.

SERVICE SUGGESTIONS (Continued)

RASTER; NO IMAGE, BUT ACCOMPANYING SOUND—This condition can be caused by:

1. No signal on kinescope grid. Check picture I-F amplifier tubes V-9, 10 and 11 (6AG5's), second detector V-12 (6AL5) and video amplifier V-13 (12AU7).
2. Bad contact to kinescope grid (lead to socket broken).
3. Leakage in V-13 (12AU7) grid capacitor C-42. If the above components are not found to be defective, check the following:
1. Check all potentials in video circuits.
2. Check kinescope grid circuit for poor or dirty contact.
3. Check adjustment of focus control R-104. It should be effective on either side of proper focus.
4. Check and realign, if necessary, the picture I-F and R-F circuits.

SIGNAL APPEARS ON KINESCOPE GRID BUT IMPOSSIBLE TO SYNCHRONIZE THE PICTURE VERTICALLY AND HORIZONTALLY —A condition of this nature can be caused by:

1. Defective sync amplifier and separator V-14 (6SN7-GT).
2. If tube is O.K. check voltages, and associated circuits.

SIGNAL ON KINESCOPE GRID AND HORIZONTAL SYNC ONLY —If this condition is encountered, check:

1. Vertical integrating network capacitors C-71, C-72, C-73 and C-74; and resistors R-79, R-80 and R-81.

PICTURE STABLE BUT WITH POOR RESOLUTION —If the picture resolution is not up to standard, it may be caused by any of the following:

1. Defective picture detector V-12 (6AL5) or video amplifier V-13 (12AU7).
2. Open video peaking coil. Check all peaking coils L-8, L-9, L-10, L-11 for continuity. Note that L-9 and L-11 have shunting resistors.

PICTURE SMEAR:

1. Normally, smear can be attributed to phase shift at the low frequency end of the video characteristic. This can be caused by improper values of resistors and capacitors in the video circuits. Check for grid current on video amplifier tube V-13 (12AU7).
2. This trouble can also originate at the transmitter. Check reception from another station.

PICTURE JITTER:

1. If regular sections at left of the picture are displaced, replace the horizontal output tube V-17 (6BG6-G).
2. Vertical instability may be due to loose connections or noise received with the signal.
3. Horizontal instability may be due to unstable transmitted sync or to noise.

ALIGNMENT PROCEDURE

TEST EQUIPMENT—To service this receiver properly, it is recommended that the following test equipment be available:

R-F SWEEP GENERATOR meeting the following requirements:

(a) Frequency ranges:

18 to 30 mc, 1 mc sweep width
40 to 90 mc, 10 mc sweep width
170 to 225 mc, 10 mc sweep width

(b) Output adjustable with at least .1 volt maximum.

(c) Output constant on all ranges.

(d) Flat output in all attenuator positions.

CATHODE-RAY OSCILLOSCOPE preferably one with a wide band vertical deflection and an input calibrating source.

SIGNAL GENERATOR to provide the following frequencies: (Output on these ranges should be adjustable and at least .1 volt maximum.)

(a) Intermediate frequencies:

21.25 mc sound i-f and sound traps
22.8 mc converter transformer
23.9 mc first picture i-f coil
24.5 mc third picture i-f coil
26.0 mc second picture i-f coil

ALIGNMENT PROCEDURE (Continued)

(b) Radio frequencies:

Channel Number	Picture Carrier Freq. Mc	Sound Carrier Freq. Mc
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

HETERODYNE FREQUENCY METER with crystal calibrator if the signal generator is not crystal controlled.

ELECTRONIC VOLTMETER and a high voltage probe for use with this meter to permit measurements up to 10 kilovolts.

SERVICE PRECAUTIONS —To service the receiver remove the chassis from the cabinet. To do so, remove the knobs, the front panel, the cabinet back and then the 5 chassis mounting bolts. The chassis normally should be serviced without the kinescope. However, if it is necessary tc view the raster during servicing, the kinescope should be inserted only after the chassis is turned on end. The kinescope should never be allowed to support its weight by resting in the deflection yoke. A bracket should be used to support the tube at its viewing screen. By turning the chassis on end with the power transformer up, all cdjustments will be conveniently available. Since this is the only safe position in which the chassis will rest ard still leave adjustment accessible, the trimmer location drawings are oriented similarly for ease of use.

CAUTION: Do not permit the kinescope second-anode lead to become shorted to the chassis. To do so will cause a considerable overload on the high-voltage filter resistor R-82.

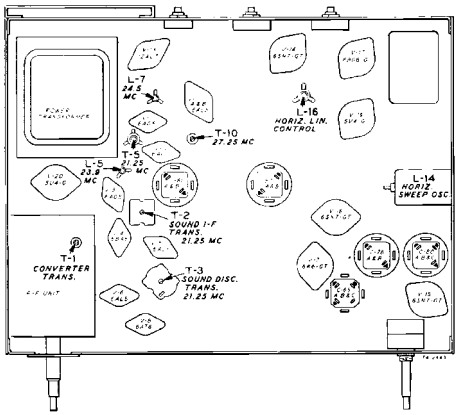


Fig. 9—Bottom Chassis Components

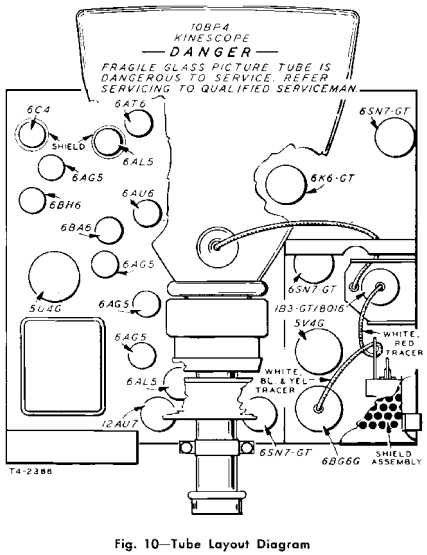


Fig. 10—Tube Layout Diagram

RETOUCHING OF PICTURE I-F ADJUSTMENTS —The picture i-f response curve varies somewhat with change of bias and for this reason it should be aligned with approximately the same signal input as it will receive in operation.

If the receiver is located at the edge of the service area, it should be aligned with approximately —1 volt i-f grid bias. However, for normal conditions, (signals of 1000 microvolts or greater), it is recommended that the picture i-f be aligned with a grid bias of —3 volts. Set the picture control for —3 volts at the junction of R-41 and R-43.

Connect the r-f sweep generator to the receiver antenna terminals.

Connect the signal generator to the antenna terminals and feed in the 25.75 megacycles i-f picture carrier marker and a 23 megacycles marker.

Connect the oscilloscope across the picture detector load resistor R-51.

Set the channel switch to channel (between 1 and 6) found to have the best response.

Set the sweep output to produce approximately .3 volt peak to peak across the picture detector load resistor.

Observe and analyze the response curve obtained. The response will not be ideal and the i-f adjustments must be retouched in order to obtain the desired curve. In making these adjustments, care should be taken that no two transformers are tuned to the same frequency as i-f oscillation may result.

On final adjustment the picture carrier marker must be at approximately 45% response. The curve must be approximately flat topped and with the 23 mc marker at 90% response.

The most important consideration in making the i-f adjustments is to get the picture carrier at the 45% response point. If the picture carrier operates too low on the response curve, loss of low frequency video response, of picture brilliance, of blanking, and of sync may occur. If the picture carrier operates too high on the response curve, the picture definition is impaired by loss of high frequency video response.

SENSITIVITY CHECK —A comparative sensitivity check can be made by operating the receiver on a weak signal from a television station and comparing the picture and sound obtained to that obtained on other receivers under the same conditions.

This weak signal can be obtained by connecting the shop antenna to the receiver through an attenuator pad of the type shown in Figure 17. The number of stages in the pad depends upon the signal strength available at the antenna. A sufficient number of stages should be inserted so that a somewhat less than normal contrast picture is obtained when the picture control is at the maximum clockwise position.

Only carbon type resistors should be used to construct the attenuator pad. Since many of the low value molded resistors generally available are of wire wound construction, it is advisable to break and examine one of each type of resistor used in order to determine its construction.

RESPONSE CURVES — The response curves shown in Figure 18 were taken from a production set. Although these curves are typical, some variations can be expected.

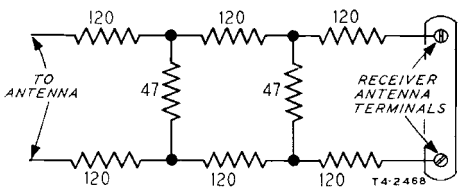


Fig. 17—Attenuator Pad

The response curves are shown in the classical manner of presentation, that is with response up and low frequency to the left. The manner in which they will be seen in a given test set-up will depend upon the characteristics of the oscilloscope and the sweep generator. The curves may be seen inverted and/or switched from left to right depending on the deflection polarity of the oscilloscope and the phasing of the sweep generator.

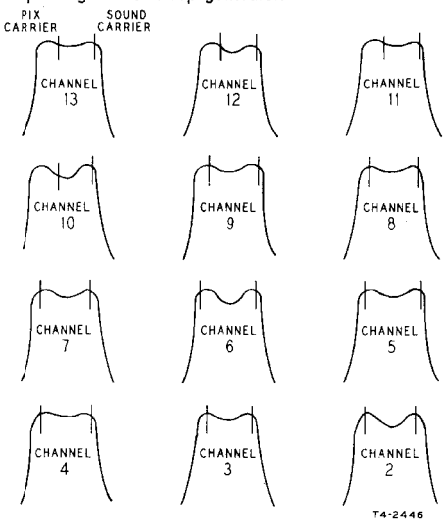


Fig. 18—Response Curves

CRITICAL LEAD DRESS—

1. Do not permit any strains to be placed on the leads of R-68, R-59, R-63, R-62, R-58, R-61, R-67 and R-64. Do not permit these resistors to be exposed to the heat of a soldering iron any more than is absolutely necessary.
2. Dress the temperature compensating resistor R-64 approximately one quarter inch from the power transformer and the chassis.
3. Dress all video coupling capacitors and peaking coils up and away from the chassis.
4. Contact between the R-F oscillator frequency adjustment screws and the oscillator coils on channel switch outlets must be avoided.
5. Dress T-8 winding leads as shown in Figure 16.

ALIGNMENT TABLE

DISCRIMINATOR AND SOUND I-F ALIGNMENT

Step No.	Connect Signal Generator to	Signal Gen. Freq. Mc.	Connect Sweep Generator to	Sweep Gen. Freq. Mc.	Connect Oscilloscope to	Connect Voltmeter to	Miscellaneous Connections and Instructions	Adjust	Refer to
1	2nd sound i-f grid (pin 1, V-5)	21.25 .1 volt output	Not used		Not used	In series with 1 meg. to junction of R-14 and R-13	Meter on 10 volt scale	Detune T-3 (bottom) Adjust T-3 (top) for max. on meter.	Fig. 11 Fig. 12
2	2nd sound i-f grid (pin 1, V-5)	21.25 .1 volt output	Not used		Not used	Discriminator output (pin 1 of V-6)	Meter on 3 volt scale	T-3 (bottom) for zero on meter.	Fig. 12
3	2nd sound i-f grid (pin 1, V-5)	21.25 .1 volt output	2nd sound i-f grid (pin 1, V-5)	21.25 center 1 mc .1 volt output	Discriminator output (pin 1 of V-6)	Not used	Check for symmetrical response waveform (positive and negative). If not equal adjust T-3 (top) until they are equal. See Note 1.		Fig. 11 Fig. 12 A
4	Trap winding on T-1 (top of chassis)	21.25 reduced output	Trap winding on T-1	21.25 reduced output	Terminal A, T-2 in series with 33,000 ohms. See Note 2.	Not used	Sweep output reduced to provide .3 volt p-to-p on scope. See Note 3.	T-2 (top and bottom) for max. gain and symmetry at 21.25 mc.	Fig. 11 Fig. 12 B

NOTE: 1: The peak to peak bandwidth of the discriminator should be approximately 350 kc. and should be linear from 21.175 mc. to 21.325 mc.

NOTE 2: If a 60 cycle sweep rate is used, it will be necessary to reduce the time constant in the 2nd sound i-f grid circuit in order to reproduce the desired response curve. To do this, shunt R-10 (Terminal "A" of T-2 to chassis) with 5600 ohms.

NOTE 3: The sweep generator output should be set to produce approximately 0.3 volt peak-to-peak at the second sound i-f grid return (Terminal "A" of T-2) for final touch-up on this adjustment. Signal voltage in excess of 0.3 volt will tend to broaden the response curve—permitting misadjustment to pass unnoticed.

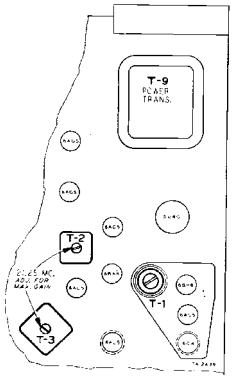


Fig. 11—Top Chassis Audio I-F Adjustments

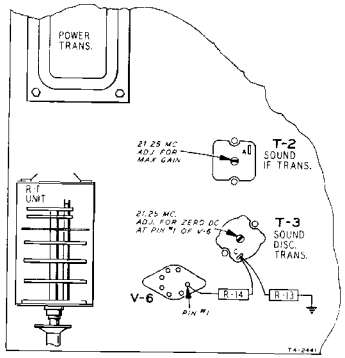


Fig. 12—Bottom Chassis Audio I-F and Discriminator Adjustments

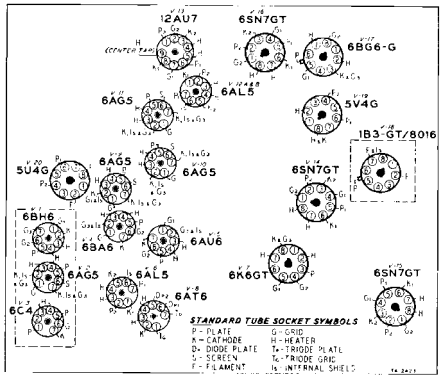


Fig. 13—Bottom Socket View

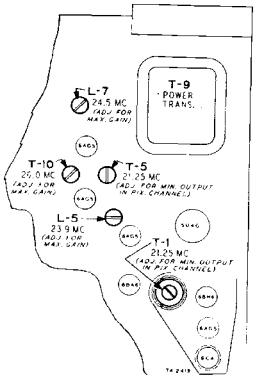


Fig. 14—Top Chassis Video I-F Adjustments

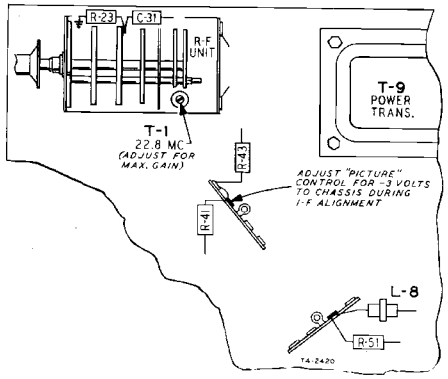


Fig. 15—Bottom Chassis Video I-F Adjustments

PICTURE I-F AND TRAP ADJUSTMENT

Step No.	Connect Signal Generator to	Signal Gen. Freq. Mc.	Connect Sweep Generator to	Sweep Gen. Freq. Mc.	Connect Oscilloscope to	Connect Voltmeter to	Miscellaneous Connections and Instructions	Adjust	Refer to
5	Not used		Not used		Not used	Junction R-41 and R-43	Set "Station Selector" switch to channel 13	Adjust "Picture" control for —3 volts reading on Voltmeter	Fig. 15
6	Junction C-31 and R-23	21.25	Not used		Not used	Junction of L-8 and R-51	Meter on 3 volt scale	T-1 (top) for min. on meter	Fig. 14 Fig. 15
7	Junction C-31 and R-23	21.25	Not used		Not used	Junction of L-8 and R-51	Meter on 3 volt scale	T-5 for min.	Fig. 14
8	Junction C-31 and R-23	27.25	Not used		Not used	Junction of L-8 and R-51	Meter on 3 volt scale	T-10 (bottom) for min.	Fig. 9
9	Junction C-31 and R-23	22.8	Not used		Not used	Junction of L-8 and R-51		T-1 (bottom) for max.	Fig. 15
10	Junction C-31 and R-23	23.9	Not used		Not used	Junction of L-8 and R-51		L-5 (top chassis) for max.	Fig. 14
11	Junction C-31 and R-23	26.0	Not used		Not used	Junction of L-8 and R-51		T-10 (top chassis) for max.	Fig. 14
12	Junction C-31 and R-23	24.5	Not used		Not used	Junction of L-8 and R-51		L-7 (top chassis) for max.	Fig. 14

NOTE: Oscillation may occur if the i-f section is badly out of alignment. This will be evidenced by a meter reading in excess of 3 volts and is caused by the "staggered" i-f stages being tuned to approximately the same frequency. If this condition is encountered, adjust the core studs of T-1 (bottom) L-5, T-10 and L-7 until oscillation ceases. Oscillation may not be encountered until proceeding with steps 9, 10, or 11.

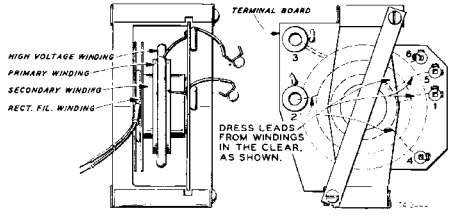


Fig. 16—Transformer Winding Leads

REPLACEMENT PARTS LIST

S-25A1 R. F. TUNER ASSEMBLY

C-1, C-2, C-3, C-5, C-30, C-34, C-35, C-44	47X554	680 mmf		Ceramic
C-4	47X496	500 mmf		Ceramic
C-6	47X517	50 mmf		Ceramic
*C-7		0.68 mmf		Ceramic
C-8	47X487	25 mmf		Ceramic
*C-9		1.5 mmf		Ceramic
C-10	47X507	5000 mmf		Ceramic
C-11	47X534	270 mmf		Molded Mica
*C-12		62 mmf		Ceramic
*C-31		0.47 mmf		Ceramic
*C-32		1.5 mmf		Ceramic
*C-33A, *C-33B		1.2 mmf		Trimmer
C-36	47X545	1500 mmf		Ceramic
C-45	47X556	3 mmf		Ceramic
R-1, R-2, R-3, R-25	B85102	1000	0.5 W	Carbon
R-4	B85151	150 Ohms	0.5 W	Carbon
R-5, R-38	B85223	22 K Ohms	0.5 W	Carbon
R-6	B85105	1 megohm	0.5 W	Carbon
R-7	B85823	82 K Ohms	0.5 W	Carbon
R-21	B85333	33 K Ohms	0.5 W	Carbon
R-22	B85103	10 K Ohms	1.0 W	Carbon
R-23	B85475	4.7 K Ohms	0.5 W	Carbon
R-24	B85471	470 Ohms	0.5 W	Carbon
R-107	B85682	6800 Ohms	1.0 W	Carbon
*L-1, *L-2, *L-3, *L-4		R. F. Tuner Coils		
L-12	9A2033	Filament Choke		
T-1	9A2032	R-F Trap Trans.		

*Parts are not interchangeable — complete Tuner Assembly must be ordered

CAPACITORS

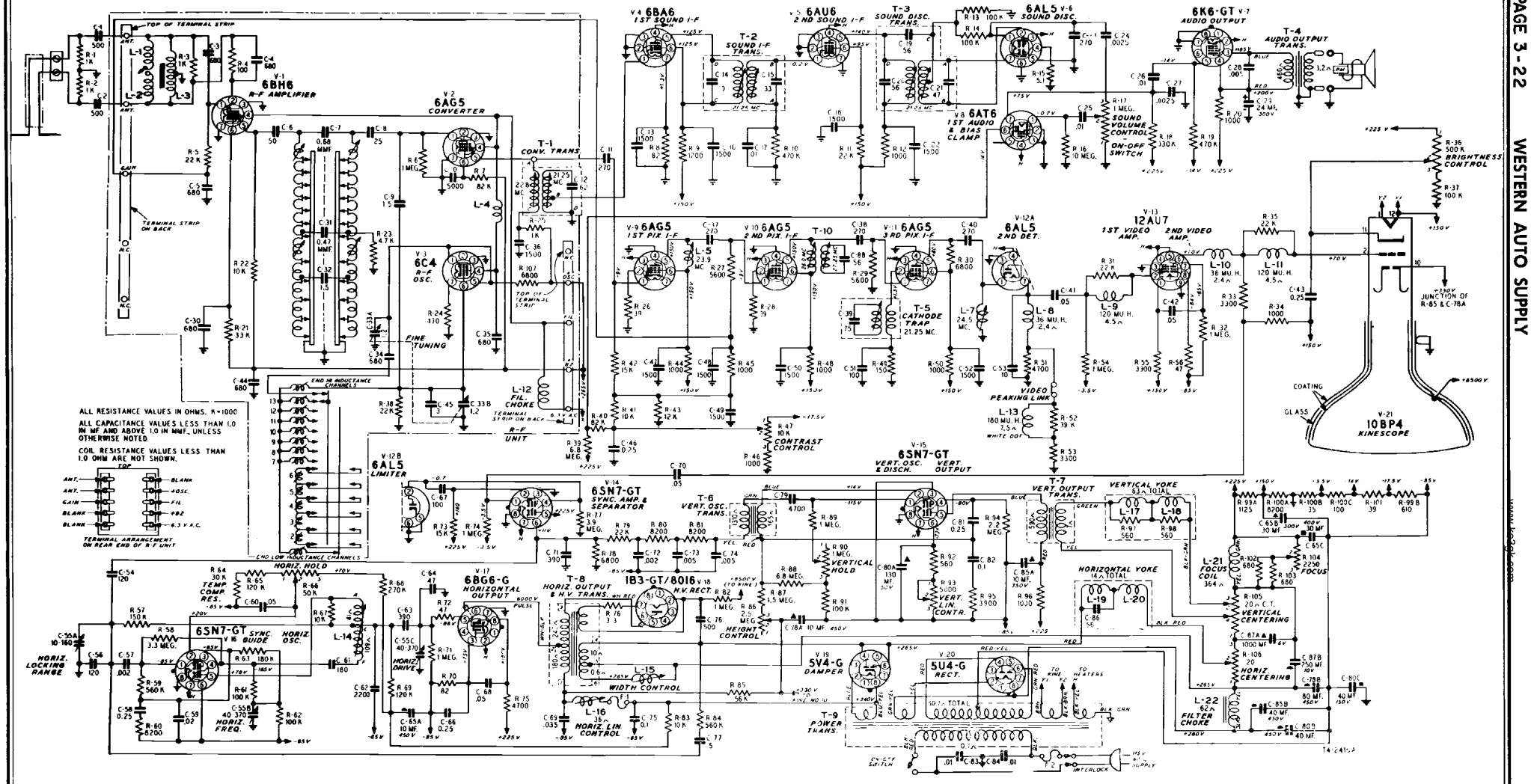
C-13, C-16, C-18, C-22, C-47, C-48, C-49, C-50, C-52	47X545	1500 mmf		Ceramic
C-14, C-15		Part of T-2 (Sound I-F Trans)		
C-17, C-25, C-26	D67103	.01 mf	400 V	Tubular
C-19, C-20, C-21		Part of T-3 (Sound Disc. Trans.)		
C-23, C-37, C-38, C-40	47X534	270 mmf	1000 V	Molded Mica
C-24, C-27	D64252	.0025 mf	400 V	Tubular
C-28	F65502	.005 mf	600 V	Tubular
C-29	45X372	24 mf	300 V	Dry Electrolytic
C-39		Part of T-5 (Cathode Trap)		
C-41, C-42, C-60, C-70	D67505	.05 mf	400 V	Tubular
C-43, C-46, C-58, C-66, C-81	D65254	.25 mf	400 V	Tubular
C-51	47X546	100 mmf		Ceramic
C-53	47X542	10 mmf	500 V	Molded Mica
C-54, C-56	47X532	120 mmf	1000 V	Molded Mica
C-55A, C-55B, C-55C	17A259	10-160 mmf 40-370 mmf 40-370 mmf		Trimmer
C-57, C-72	F66202	.002 mf	600 V	Tubular
C-59	D65203	.02 mf	400 V	Tubular
C-61	47X536	180 mmf	1000 V	Molded Mica
C-62	47X531	2200 mmf	1000 V	Molded Mica
C-63, C-71	47X535	390 mmf	1000 V	Molded Mica
C-64	47X541	47 mmf	500 V	Molded Mica
C-65A, C-65B, C-65C	45X371	10 mf 30 mf 30 mf	450 V 300 V 400 V	Dry Electrolytic
C-67	47X544	100 mmf	1000 V	Molded Mica
C-68	F67503	.05 mf	600 V	Tubular
C-69	46X408	.035 mf	1000 V	Tubular
C-73, C-74	D65502	.005 mf	400 V	Tubular
C-75, C-82	46X409	.1 mf	1000 V	Tubular
C-76	47X530	500 mmf		High Voltage Ceramic
C-77	47X533	5 mmf	1500 V	Molded Mica
C-78A, C-78B	45X369	10 mf 80 mf	450 V 450 V	Dry Electrolytic
C-79	47X543	4700 mmf	5000 V	Molded Mica
C-80A, C-80B, C-80C	45X370	130 mf 40 mf 40 mf	50 V 450 V 150 V	Dry Electrolytic
C-83, C-84	46X410	.01 mf	400 V	Molded Paper
C-85A, C-85B	45X367	10 mf 40 mf	350 V 450 V	Dry Electrolytic
C-86		Part of Deflection Yoke Assembly		
C-87A, C-87B	45X368	1000 mf 250 mf	6 V 10 V	Dry Electrolytic

RESISTORS

		Ohms	Watts	
R-8	32B4820	82	0.5	Carbon
R-9	32B4122	1200	0.5	Carbon
R-10, R-19	32B5474	470 K	0.5	Carbon
R-11, R-79	32B5223	22 K	0.5	Carbon
R-12, R-44, R-45, R-48, R-50, R-96	32B5102	1000	0.5	Carbon
R-13, R-14	32B3104	100 K	0.5	Carbon
R-15	43X239	5.1	0.5	Wirewound
R-16	32B5106	10 meg.	0.5	Carbon
R-17	36X378	1 meg.		Volume Control and switch
R-18	32B4334	330 K	0.5	Carbon
R-20	32C5102	1000	1.0	Carbon
R-26, R-28	32B4390	39	0.5	Carbon
R-27, R-29	32B3562	5600	0.5	Carbon
R-30, R-78	32B3682	6800	0.5	Carbon
R-31		Part of L-9		
R-32				
R-54, R-71, R-74	32B5105	1 meg.	0.5	Carbon
R-33	32C4332	3300	1.0	Carbon
R-34, R-46	32B4102	1000	0.5	Carbon
R-35		Part of L-11		
R-36, R-47	78X1	500 K 10 K		Brightness and Contrast Control
R-37	32B5104	100 K	0.5	Carbon
R-39	32B4563	6.8 meg	0.5	Carbon
R-40	32B4823	82 K	0.5	Carbon
R-41, R-67, R-83	32B4103	10 K	0.5	Carbon
R-42	32B4390	15 K	0.5	Carbon
R-43	32B4123	12 K	0.5	Carbon
R-49	32B4151	150	0.5	Carbon
R-51	32B4472	4700	0.5	Carbon
R-52		Part of L-13		
R-53, R-55	32B4332	3300	0.5	Carbon
R-56, R-72	32B5470	47	0.5	Carbon
R-57	32B4154	150 K	0.5	Carbon
R-58	32C3335	3.3 meg	1.0	Carbon
R-59	32B3564	560 K	0.5	Carbon
R-60, R-80, R-81	32B4822	8200	0.5	Carbon
R-61	31B1104	100 K	0.5	Carbon
R-62	32C3104	100 K	1.0	Carbon
R-63	32B4184	180 K	0.5	Carbon
R-64	34A1	30 K	0.25	Temp. Comp.
R-65	32B4124	120 K	0.5	Carbon
R-66, R-90	78X2	50 K 1 meg.		Vertical and Horizontal Hold Control
R-68	32C4274	270 K	1.0	Carbon
R-69	32C4124	120 K	1.0	Carbon
R-70	32C4820	82	1.0	Carbon
R-73	32C5153	15 K	1.0	Carbon
R-75	32C4472	4700	1.0	Carbon
R-76	43X238	3.3	0.5	Wirewound
R-77	32B4395	3.9 meg	0.5	Carbon
R-82	32C5105	1 meg.	1.0	Carbon
R-84	32B4504	560 K	0.5	Carbon
R-85	32B4563	56 K	0.5	Carbon
R-86	77X3	2.5 meg		Height Control
R-87	32B4155	1.5	0.5	Carbon
R-88	32B5685	6.8	0.5	Carbon
R-89	32B3105	1 meg	0.5	Carbon
R-91	32B4104	100 K	0.5	Carbon
R-92	32B4561	560	0.5	Carbon
R-93	77X4	5000		Vertical Lin. Control
R-94	32B5225	2.2 meg	0.5	Carbon
R-95	32B4392	3900	0.5	Carbon
R-97, R-98		Part of Vertical Yoke		
R-99A, R-99B	43X234	1125 610	20 20	Wirewound
R-100A, R-100B, R-100C	43X235	8200 35 100	5.0 0.8 2.0	Voltage Divider
R-101	32C4390	39	1.0	Carbon
R-102, R-103	32C5681	680	1.0	Carbon
R-104	77X1	2250		Focus Control
R-105	77X2	20		Vertical Centering
R-106	77X5	20		Horizontal Centering

TRANSFORMERS AND COILS

L-5, L-7	9A1980	1st and 3rd Pix I.F. Coil
L-8, L-10	9A1979	Peaking Coil
L-9, L-11	9A1978	Peaking Coil
L-13	9A1977	Peaking Coil
L-14	9A1984	Transformer (Sync Guide)
L-15	9A1976	Width Control Coil
L-16	9A1981	Coil (Horiz. Linearity)
L-17, L-18, L-19, L-20		Part of 9A1987 Deflection Yoke Assembly (See Miscellaneous)
L-21	9A1974	Focus Coil
L-22	52X87	Filter Choke
T-2	9A1986	Sound I-F Transformer
T-3	9A1983	Sound Dis. Transformer
T-4	51X139	Audio Output Transformer
T-5	9A1985	Cathode Trap Transformer
T-6	54X4	Vertical Oscillator Transformer
T-7	51X140	Vertical Output Transformer
T-8	53X296	Horizontal Output & H. V. Trans.
T-9	53X297	Power Transformer
T-10	9A1982	2nd Pix I-F Transformer

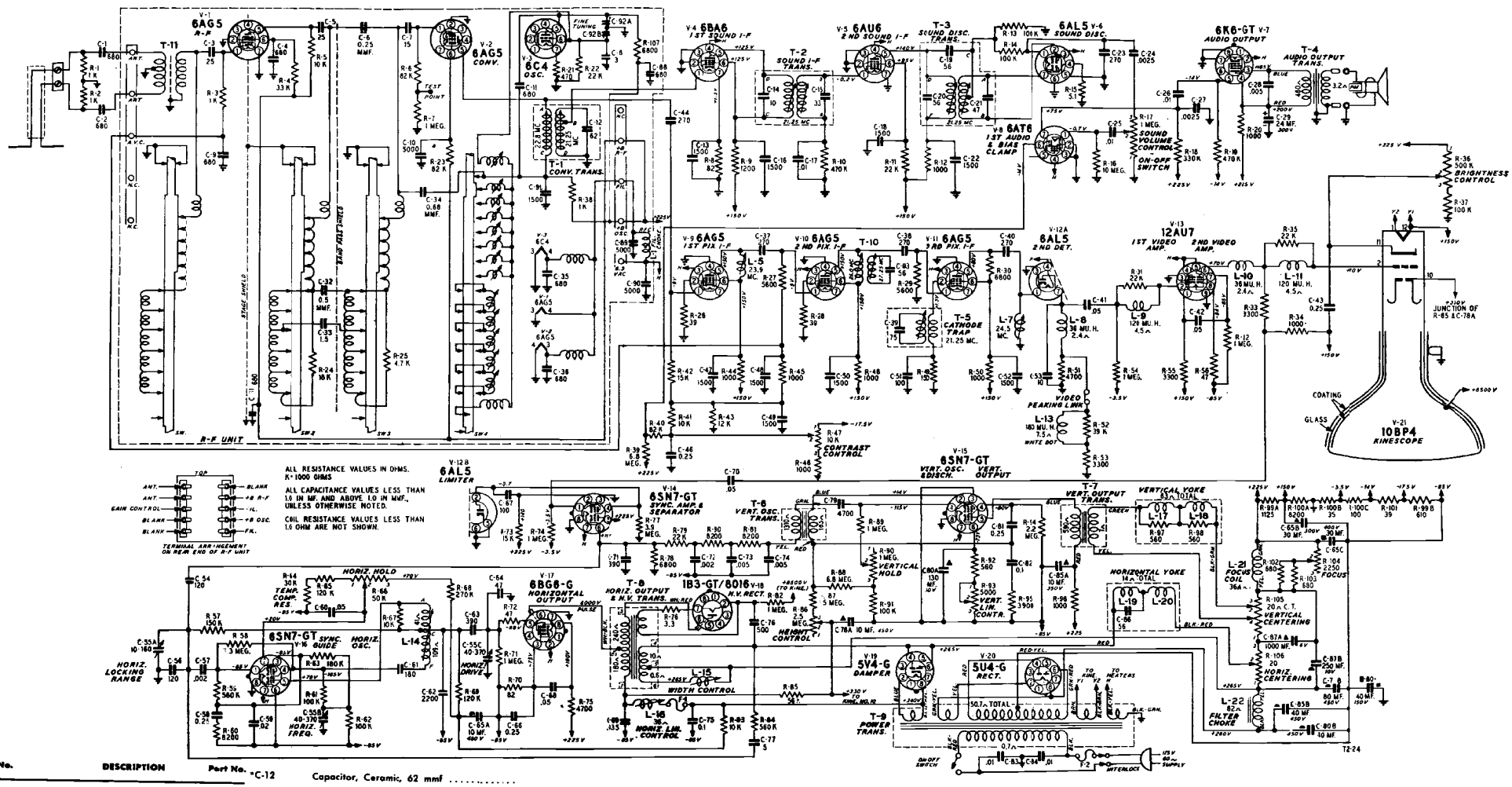


MISCELLANEOUS

12A490	12" P. M. Speaker	3A428	Tube Socket (Miniature)	10A717	Knob (Fine Tuning)	14X453	Ventilator Grille (Back of Cabinet)
S-25A1	R-F Tuner Assembly	3A443	Tube Socket (9 pin)	10A714	Knob (Brightness and Horizontal)	S-3A1	Socket Assembly (H.V. Rectifier)
9A1987	Deflection Yoke Assembly	3A444	Tube Socket (Ceramic)	10A716	Knob (Contrast, Vertical and On-Off Sound)	S-32X4	Line Cord and Shield Assembly
6A306	Anode Connector	3A445	Tube Socket Octal	10A715	Knob (On-Off Sound)	S-25X36	Rubber Strip and Bracket Assembly
28X560	Spring (Anode Connector)	3A448	Socket (Hi-Voltage Capacitor)	10A718	Knob (Channel Tuning)	S-13X644	R.F. Cable and Terminal Assembly
2A382	Beam Bender	13X614	Tube Socket (Kinescope)	32X396	Tube Shield (6C4 -R.F. Osc.)	S-8X1	Hood Assembly
		17X102	Pix Crystal	32X221	Tube Shield (6AL5 Sound Disc)	20X1558	Wing Screw — Def. Yoke
		4X1040	Escutcheon (Tel. Knob)	14X449	Ventilator Grille (Metal)	25X1597	Support Bracket

25X1595	Top Bracket		
25X1598	Middle Bracket		
25A1047	Support Assembly	Focus Coil	
25A1049	Stud Assembly		
20X1557	Wing Nut		
8X191	Mask		

16X132	Fuse (3 amperes 250 volts)	
16X133	Fuse (¼ ampere 250 volts)	
16X131	Fuse Holder	



S-25A3 R-F TUNER ASSEMBLY

Ref. No.	DESCRIPTION	Part No.
C-1, C-2, C-4, C-9, C-11, C-31, C-35, C-36, C-88	Capacitor, Ceramic, 680 mmf	47X554
C-3, C-5	Capacitor, Ceramic 25 mmf	47X487
*C-6	Capacitor, Ceramic, 0.25 mmf	
C-7	Capacitor, Ceramic, 15 mmf	47X552
*C-8	Capacitor, Ceramic, 3 mmf	
C-10, C-89, C-90	Capacitor, Ceramic, 5000 mmf	47X507
*C-12	Capacitor, Ceramic, 62 mmf	
*C-32	Capacitor, Ceramic, 0.5 mmf	
*C-33	Capacitor, Ceramic, 1.5 mmf	
*C-34	Capacitor, Ceramic, 0.68 mmf	
C-44	Capacitor, Ceramic, 270 mmf	47X534
C-91	Capacitor, Ceramic, 1500 mmf	47X545
*C-92	Capacitor, Fine Turing	
R-1, R-2, R-3, R-38	Resistor, Carbon 1000 Ohm 0.5 W.	B85102
R-4	Resistor, Carbon 33 K Ohm 0.5 W.	B85333
R-5	Resistor, Carbon 10 K Ohm 0.5 W.	B85103
R-6	Resistor, Carbon 82 K Ohm 0.5 W.	B85823
R-7	Resistor, Carbon 1 Megohm 0.5 W.	B85105
R-21	Resistor, Carbon 470 Ohm 0.5 W.	B85470
R-22	Resistor, Carbon 22 K Ohm 0.5 W.	B85223
R-23	Resistor, Carbon 82 K Ohm 0.5 W.	B85823
R-24	Resistor, Carbon 18 K Ohm 0.5 W.	B85183
R-25	Resistor, Carbon 4.7 K Ohm 0.5 W.	B85472
R-107	Resistor, Carbon 6800 Ohm 1.0 W.	C85682
L-1	Choke, Filament	9A2023
T-1	Converter Transformer	9A2035
*T-11	Part of R-F Tuner	

*PARTS ARE NOT INTERCHANGEABLE — COMPLETE TUNER ASSEMBLY MUST BE ORDERED.

S-25A3 R-F Tuner Assembly

The difference between series "A" and "B" receivers is in the tuner assembly. For issue "B" receivers the tube complement of the tuner assembly is as follows:

SYMBOL	TYPE	FUNCTION
V1	6AG5	R-F Amplifier
V2	6AG5	Converter
V3	6C4	R-F Oscillator

A parts list of the new S-25A3 Tuner Assembly and a schematic diagram are included in this manual to aid in the servicing of the issue "B" receivers.