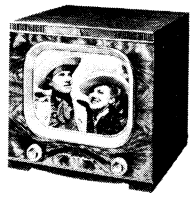
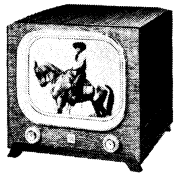
Motorola® Television
SERVICE MANUAL

CHASSIS
TS-89
TS-94
TS-95
MODELS
See Chart Below


16T1H


17T1A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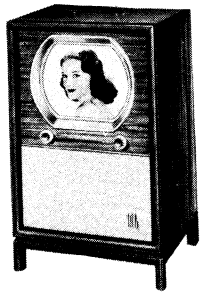
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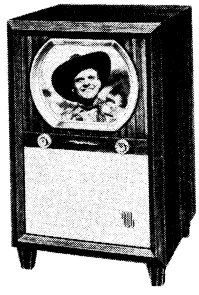
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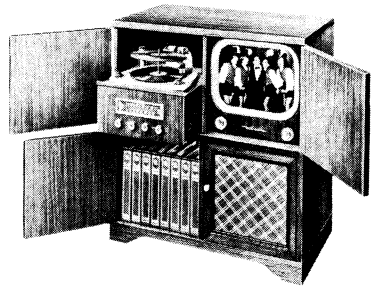

16F1H

GENERAL INFORMATION

NOTE: This manual contains complete service information and replacement parts list for television chassis TS-89, TS-94, and TS-95, and also a parts list for the receiver cabinets. Service data for the AM-FM radio chassis and the record changer will be found in their respective service manuals.

RECEIVER MODEL BREAKDOWN CHART

Model	Type of Set	TV Chassis Used	Radio Chassis Used	Record Changer Used
16T1H	Table, red-brn mahogany	TS-89		
16T1BH	Table, limed oak	TS-89		
17T1A	Table, red-brn mahogany	TS-89		
17T1BA	Table, limed oak	TS-89		
17T2A	Table, red-brn mahogany	TS-89		
17T2BA	Table, limed oak	TS-89		
16K2H	Console, red-brn mahogany	TS-94		
16K2BH	Console, limed oak	TS-94		
17K1A	Console, red-brn mahogany	TS-95		
17K1BA	Console, limed oak	TS-95		
16F1H	Console combination: red-brn mahg	TS-89	HS-234	RC-36A
16F1BH	Console combination: limed oak	TS-89	HS-234	RC-36A

TV CHASSIS - Television chassis TS-89 contains 20 tubes plus a 16" rectangular picture tube. TS-94 and and TS-95 have the same tube complement with the exception of the picture tube which is a 16" round tube in these chassis. The picture, sound, and scanning circuits, together with a conventional transformer type "B" supply, are contained on a single chassis.

RADIO CHASSIS - Radio chassis HS-234 contains 6 tubes plus a selenium rectifier and receives both AM and FM broadcasts. Except for common speakers, it operates entirely independently of the television receiver. Refer to HS-234 service manual for service information.

RECORD CHANGER - 3-speed Model RC-36A. Refer to RC-36A service manual for service information.

TV TUNING RANGE - Channels 2 through 13

TV IF FREQ - Channels 2, 3, 4, 5, 6, 11, 12 & 13
Sound: 21.9 mc
Picture: 26.4 mc
Channels 7, 8, 9 & 10
Sound: 27.3 mc
Picture: 22.8 mc

ANTENNAS - TV: table model; TA-6 "Bilt-In-Tenna"
TV: console; TA-4 "Bilt-In-Tenna". Provision for connection of an external antenna in both cases.
RADIO: Separate AM loop antenna mounted in cabinet and FM antenna built into the power cord.

TV ANTENNA IMPEDANCE - 300 ohms

POWER SUPPLY - 117 volts, 60 cycle AC current only

POWER CONSUMPTION - TV: 205 watts
RADIO & PHONO: 90 watts

TV AUDIO OUTPUT - 4 watts

4545 AUGUSTA BOULEVARD Motorola Inc. CHICAGO 51, ILLINOIS

PART NO. 54P701277 Price 25 Cents PRINTED IN U.

TV CHASSIS TUBE COMPLEMENT

Ref. No.	Tube	Function
V-1	6CB6	RF Amplifier
V-2	12AT7	Mixer-Oscillator
V-3	6AU6	1st IF Amplifier
V-4	6AU6	2nd IF Amplifier
V-5	6AG5	3rd IF Amplifier
V-6	6AL5	Video Detector
V-7	6AH6	Video Amplifier
V-8	6AU6	Audio Driver-Limiter
V-9	6AL5	Ratio Detector
V-10	6J5GT	Audio Amplifier
V-11	6V6GT	Audio Output
V-12	6SN7GT	1st & 2nd Clippers
V-13	12AU7	Vertical Sweep Generator
V-14	6W6GT	Vertical Sweep Output
V-15	6AL5	Phase Detector
V-16	6SN7GT	Horizontal Oscillator
V-17	6BQ6GT	Horizontal Output & High Voltage Generator
V-18	6W4GT	Damping Diode
V-19	1B3GT	High Voltage Rectifier
V-20	16TP4	Picture Tube: rectangular (TS-89)
V-20	16GP4	Picture Tube: round (TS-94 & TS-95)
V-21	5U4G	Low Voltage Rectifier

HIGH VOLTAGE WARNING

Operation of this receiver, outside its cabinet or with covers removed, involves a shock hazard from the power supplies. No work should be attempted on this receiver by anyone not thoroughly familiar with the precautions necessary when working on high voltage equipment.

CATHODE RAY PICTURE TUBE HANDLING PRECAUTIONS

Extreme care must be used in handling the picture tube. The tube is highly evacuated and, due to its large size, is subjected to a considerable atmospheric pressure. The handler should wear safety goggles and gloves for protection. Avoid nicking or scratching the glass by rough contact with other objects.

Before removing glass tubes, discharge the capacity formed by the inner and outer aquadag coatings on the tube by shorting the anode contact on the side of the tube to the outer surface with a well insulated piece of wire.

INSTALLATION AND OPERATING INSTRUCTIONS

RECEIVER LOCATIONS

The receiver may be placed anywhere in the room, but for greatest satisfaction it should be located:

1. Away from any bright light that may fall directly on the screen or be reflected from it; this includes windows and lamps. Some illumination in the room, off to one side, is desirable, however, to prevent eyestrain.

2. To provide comfortable viewing and ease of operation.

3. At least one-inch away from a wall to allow for cabinet ventilation. This is very important.

ANTENNAS

The choice of television antenna depends entirely on the location of the receiver with respect to all television station transmitting antennas in the area. Maximum pick-up is obtained when the receiving antenna is directly in line of sight with the transmitting antenna.

"Bilt-In-Tenna". All receivers using the TS-89, TS-94, and TS-95 series television chassis are equipped with the Motorola "Bilt-In-Tenna", mounted inside the cabinet, for use in good signal areas.

When this antenna is used, the following precautions should be observed for best reception:

1. In order to get maximum performance and satisfactory pictures from the "Bilt-In-Tenna", ample signals from the television station must be present at the location of the receivers. Normally, the strength of the signals will vary throughout the room in which the receiver is located. For this reason, better pictures will be obtained if the receiver is tried in all possible locations in the viewing room and is then placed where the clearest pictures are received from all stations. Avoid large metallic objects, such as radiators, metal panels, etc.

2. Lamps, vases and metallic objects, when placed on top of the receiver, may affect the efficiency of the "Bilt-In-Tenna".

Indoor Antenna. If additional pick-up is necessary, an indoor antenna, placed on or near the receiver, may be used. The antenna should be rotated and the arms should be adjusted for the best signal, with no ghosts or reflections. Normally, the arms should be extended on the low channels (2-6) and telescoped on the high channels (7-13).

Outdoor Antenna. The Motorola "Bilt-In-Tenna" or the indoor type antenna will give satisfactory reception in strong signal areas; but, if the receiver is located in a fringe or weak signal area, an outdoor antenna is recommended.

In areas free of obstructions and reflections, within reasonable proximity to television transmitters, a dipole and reflector will prove satisfactory. Since such an antenna has a relatively small band coverage, a special antenna covering all twelve television channels should be used if it is desired to receive stations on channels of widely separated frequencies.

Location of the antenna should be decided from the standpoint of maximum signal pick-up. In general, the antenna should be broadside to the transmitting antenna and should be as high as possible. If a reflector is used, the antenna should be oriented so that the driver element is closest to the station and the reflector farthest away.

Locating the antenna and lead-in as far away as possible from highways, hospitals, doctors' offices, electrical machinery, etc., will help to reduce noise pick-up from such sources. Also, it is desirable to keep the antenna at least six feet away from other antennas, metal roofs, gutters, or other metal objects to prevent unwanted reflections and shielding.

AM & FM Antennas. The AM-FM receiver chassis in the console combination receiver is provided with two built-in antennas; one for standard broadcast reception, and another for FM broadcast reception. In most locations these antennas will be satisfactory but, if certain stations are noisy or weak, reception from them can often be improved by attaching outdoor FM and broadcast antennas. The television, AM and FM input circuits are independent of each other, so separate antennas for each type of reception are necessary.

Lead-In. Since the TS-89, TS-94 and TS-95 chassis are designed for 300 ohms input, the standard 300 ohm twin lead line should be used for connecting the outside antenna to the receiver. Twisting the line one complete turn per foot of running length helps to reduce noise pick-up on the line. The lead-in should be supported on stand-off insulators and kept tight enough to prevent mechanical damage through swaying. Avoid running the lead-in close to metal gutters, iron standpipes, etc.

In areas of very strong signals, or where severe local interference is encountered, 300 ohm shielded twin lead is recommended. The shield braid should be grounded.

An approved lightning arrestor should be used.

RECEIVER ANTENNA CONNECTION

The antenna lead-in to the television receiver is connected to the two screws of the terminal strip on the rear of the cabinet. Disconnect the "Bilt-In-Tenna" leads from the terminal strip before attaching an external antenna lead-in. Sometimes reversing the lead-in connections at the receiver may improve picture quality and overall performance.

FM AND AM ANTENNA CONNECTIONS

Instructions for connecting external AM and FM antennas, should this be necessary, will be found on the back panel of the AM-FM receiver in models 16F1H and 16F1BH.

OPERATING CONTROLS

There are two dual controls, consisting of a small and a large knob each, on the front panel of the receiver. The function of each control is marked on the front panel; the "circle" indicating the large knob, and the "dot" indicating the small knob. See Figure 1 for front panel control functions.

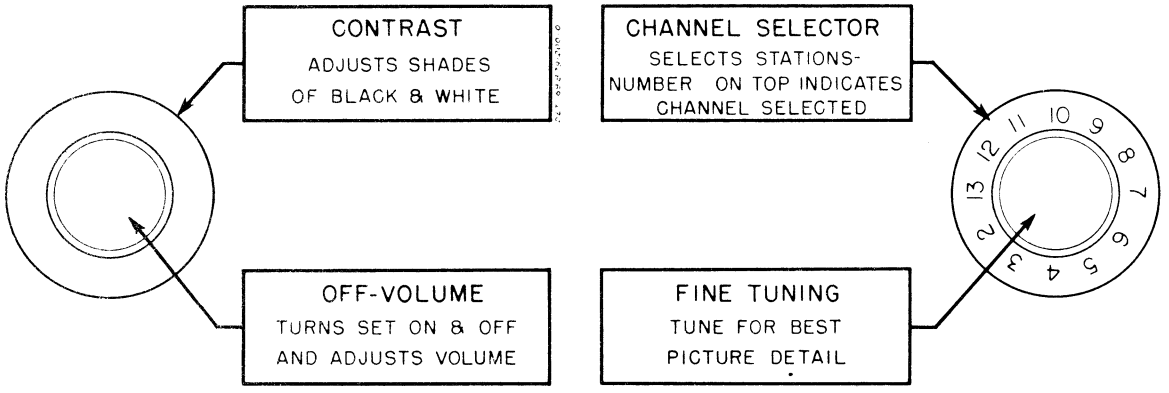


FIGURE 1. OPERATING CONTROLS

SERVICE ADJUSTMENTS

The receiver is completely adjusted at the factory, so normally none other than the front panel control operating instructions need be followed in putting the receiver in operation. However, to provide for any misadjustment of the service controls, due to handling, the following instructions are in order. See Figure 2 for location of the service adjustment controls.

FOCUS CONTROL

The FOCUS control should be adjusted until the fine horizontal line structure of the raster is clearly visible over the

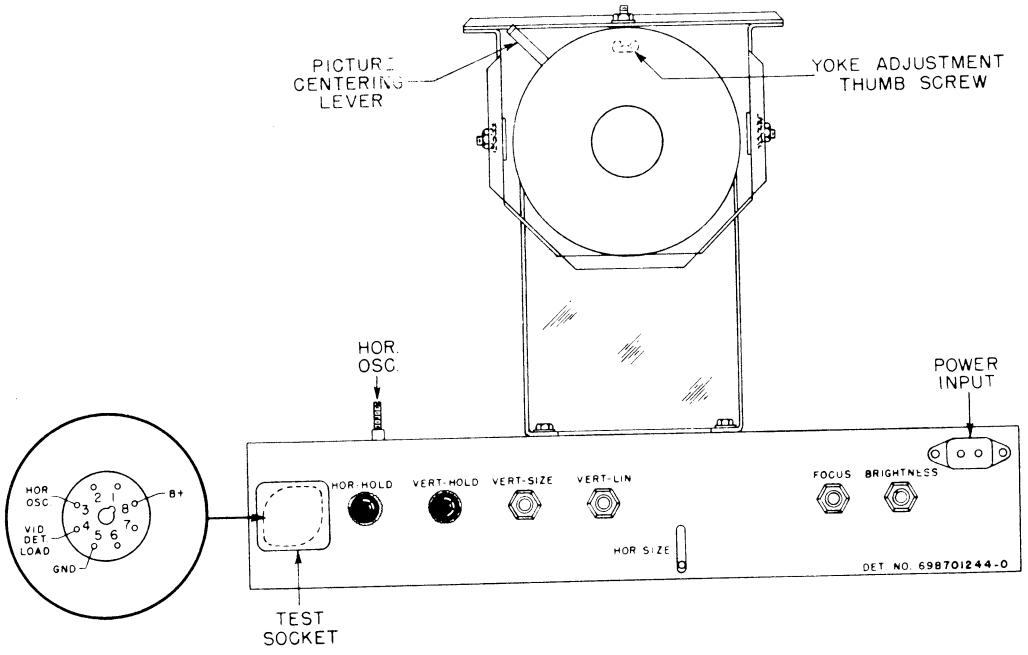


FIGURE 2. SERVICE ADJUSTMENT CONTROLS

picture area. The control should be tuned through the correct point several times so that optimum focus is obtained.

CENTERING

By means of a lever extending from the focus coil, thru the rear screen, the focus coil can be shifted to center the picture in its mask.

VERTICAL SIZE AND VERTICAL LINEARITY

Adjust the VERTICAL SIZE control until the picture fills the mask vertically. Adjust the VERTICAL LINEARITY control for best overall vertical linearity. Adjustment of the VERTICAL SIZE control will require a readjustment of the VERTICAL LINEARITY control and possibly of the VERTICAL HOLD control. Center picture with the centering lever on the focus coil.

HORIZONTAL SIZE

Adjust the HORIZONTAL SIZE lever until the picture fills the mask horizontally. Center picture with the centering lever.

HORIZONTAL OSCILLATOR ADJUSTMENT

The HORIZONTAL HOLD control should have a sync range of approximately 180 degrees. If the control is too critical, adjust as follows:

1. Short out HORIZONTAL OSCILLATOR coil L-23. This may be done with the chassis in the cabinet by shorting pins 3 & 8 of the test socket on chassis rear.

2. With the centering lever, move the picture to the left so that the right edge of the raster can be seen. Adjust the HORIZONTAL HOLD control to about the middle of its range and note the width of the blanking pulse. (The blanking pulse appears as a gray bar at the right edge of the picture).

3. Remove short from HORIZONTAL OSCILLATOR coil.

4. Adjust HORIZONTAL OSCILLATOR coil until the same amount of blanking pulse can be seen as was noted in step 2.

VERTICAL HOLD ADJUSTMENT

Adjust the VERTICAL HOLD control for the center of the vertical sync lock-in range.

BRIGHTNESS

Adjust the BRIGHTNESS control, in combination with the CONTRAST control for the most pleasing picture. Keep the brilliance slightly below maximum, however, in order to protect the fluorescent screen of the picture tube and to prevent poor picture detail.

ADJUSTMENT OF ION TRAP

Under conditions of rough shipment, it is possible for the ion trap to become misaligned. To prevent serious damage to the picture tube, the following method of adjustment should be used. See Figure 3.

The magnet should be placed on the neck of the tube in the direction indicated by the marking on the magnet (usually an arrow which points toward the picture tube screen) so that the stronger magnet of the double magnet type or the only magnet in the single magnet type is positioned over the internal pole pieces which are mounted on the gun structure. Adjust the BRIGHTNESS control for low intensity and move the magnet a short distance forward and backward at the same time rotating it to obtain the brightest raster. If, in obtaining the brightest raster, the ion trap magnet has to be moved more than 1/4" from the gun pole pieces the magnet

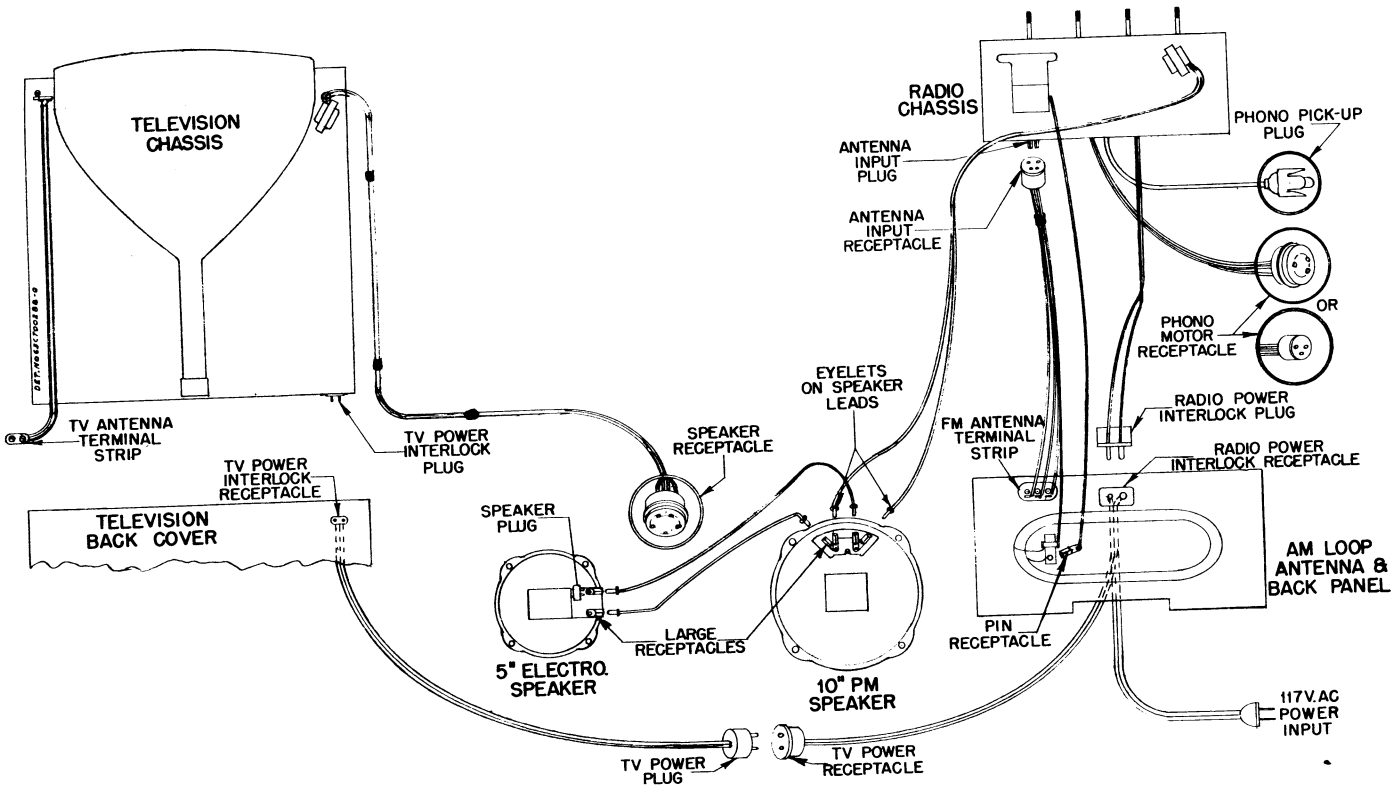


FIGURE 2A. CABLE CONNECTIONS ON COMBINATION MODELS

is probably weak and a new magnet should be tried. Never correct for a shadowed raster with the ion trap magnet if such correction results in decreased brightness. The ion trap magnet must always be adjusted for maximum brightness and if shadows occur at this setting they should be eliminated by adjusting the focus and deflection coils as explained under "Focus Coil and Deflection Yoke Adjustment".

CAUTION: Keep BRIGHTNESS control at low intensity until ion trap is properly set.

A mirror placed in front of the receiver will aid in making this adjustment.

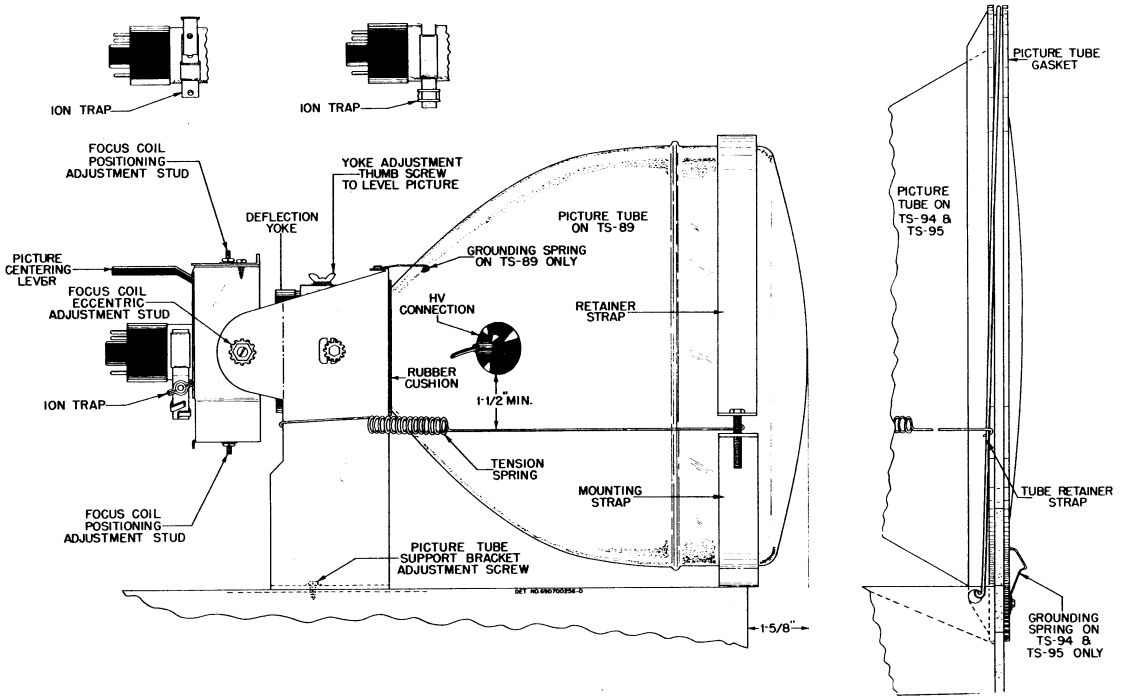


FIGURE 3. PICTURE TUBE ADJUSTMENT LOCATIONS

DEFLECTION YOKE ADJUSTMENT

If the deflection yoke shifts, the picture will be tilted. To correct, loosen the thumb screw on top of the deflection yoke and rotate yoke until the picture is straight. Before tightening the thumb screw, make certain that the deflection yoke is as far forward as possible.

If the yoke support and the picture tube have shifted in transit, or if for any reason these parts have been removed and replaced, it is best to do a complete job of repositioning. See Figure 3. The starting point is the position of the picture tube. On the TS-89 chassis it should be adjusted so that the distance from the center of the tube face to the front edge of the chassis is 1-5/8". The clamp on the front of the tube should then be tightened. On the TS-94 and TS-95 chassis, the picture tube position is fixed by the front tube mounting. The picture tube rear support bracket positioning adjustment screws should be loose enough to permit sliding the bracket forward until the rubber cushion fits snugly up against the flare of the tube. Loosen the yoke adjustment thumb screw and push the yoke up against the flare of the tube. CAUTION: Do not use force in sliding the bracket up. If too much force is used, a strain will be placed on the neck of the tube when the support bracket positioning adjustment screws are tightened. Also the yoke may be forced out of position. The opening in the yoke should be concentric with the neck of the tube.

FOCUS COIL

The focus coil should be positioned so that it is spaced 1/4" from the deflection yoke when parallel with the yoke. The opening in the focus coil should be concentric with the neck of the tube. The spacing should be adjusted before the front of the picture tube is clamped down because it is necessary to remove the tube to change the position of the focus coil. Its position is changed by choice of location of the coil mounting studs in the scalloped holes on the top and bottom of the coil mounting bracket. The opening in the focus coil can be made concentric with the neck of the tube by loosening the nuts on the studs which support the focus coil bracket and turning the studs with a screwdriver in the slots provided. The studs are eccentric and move the coil both vertically and horizontally. They should be used only to center the neck of the tube in the opening of the coil.

TEST SOCKET

A test socket is provided on the rear of the chassis which allows adjustment of the horizontal oscillator and checking of sensitivity without removing chassis from cabinet. See Figure 2 for socket connections.

ALIGNMENT

GENERAL

The chassis should be mounted on angle iron brackets (Motorola Part Number 7X700210) so that all connections and adjustments may be made easily.

Since the power cord circuit is broken by the interlock when the cabinet back is removed, it will be necessary to obtain an extra power cord with the female interlock receptacle in order to make a power connection to the receiver. Order Motorola Part No. 30B470756.

ORDER OF ALIGNMENT

A complete receiver alignment can be most conveniently performed in the following order:

1. Audio Take-Off & Ratio Detector
2. 4.5 Mc Trap
3. IF Coils & Mixer Transformer
4. Osc & RF Sections

AUDIO TAKE-OFF & RATIO DETECTOR ALIGNMENT

Equipment Required:

AM Signal Generator: (Optional)	Accurately calibrated at 4.5 mc Adjustable output
DC Meter:	Low range electronic voltmeter

Refer to Figure 4 for location of adjustments.

1. If possible, it is desirable to align the audio section from an actual station signal, since the 4.5 mc alignment frequency will be exact. The fine tuning trimmer should be turned off the station slightly, to prevent overloading the ratio detector.
2. If a signal generator is used, tune it accurately to 4.5 mc and adjust the output to approximately 10,000 microvolts. Connect the high side of the signal generator through a 1000 mmf capacitor to the grid (pin 1) of the video amplifier tube V-7 (6AH6), and the low side to chassis. The following applies whether the station signal or signal generator is used.
3. From either side of capacitor C-52, connect an electronic voltmeter to chassis decoupled thru 10K ohms.
4. Set the contrast control for maximum gain (fully clockwise).
5. Peak L-20 for maximum reading on meter.
6. Peak T-3 primary (top core) for maximum reading on meter.
7. Move the meter and decoupling resistor from C-52 to junction of R-41 and lead to volume control.
8. Adjust T-3 secondary (bottom core) for zero response on 2.5V scale of meter. This corresponds to the cross-over point on the FM detector curve. If desired, the symmetry of the curve may be checked by tuning the generator ±25 Kc from 4.5 mc and

NO.	TYPE	FUNCTION
V-1	6CB6	R-F AMP.
V-2	12AT7	MIXER - OSC.
V-3	6AU6	IST. I-F AMP.
V-4	6AU6	2ND. I-F AMP.
V-5	6AG5	3RD. I-F AMP.
V-6	6AL5	VIDEO DET.
V-7	6AH6	VIDEO AMP.
V-8	6AU6	AUDIO DRIVER-LIMITER
V-9	6AL5	RATIO DET.
V-10	6J5GT	AUDIO AMP.
V-11	6V6GT	AUDIO OUTPUT
V-12	6SN7GT	IST. & 2ND. CLIPPER
V-13	12AU7	VERT. SWEEP GEN.
V-14	6W6GT	VERT. SWEEP OUTPUT
V-15	6AL5	PHASE DET.
V-16	6SN7GT	HORIZ. OSC.
V-17	6BQ6GT	HORIZ. OUTPUT & H.V. GEN.
V-18	6W4GT	DAMPING DIODE
V-19	1B3GT	H.V. RECT.
V-21	5U4G	L.V. RECT.

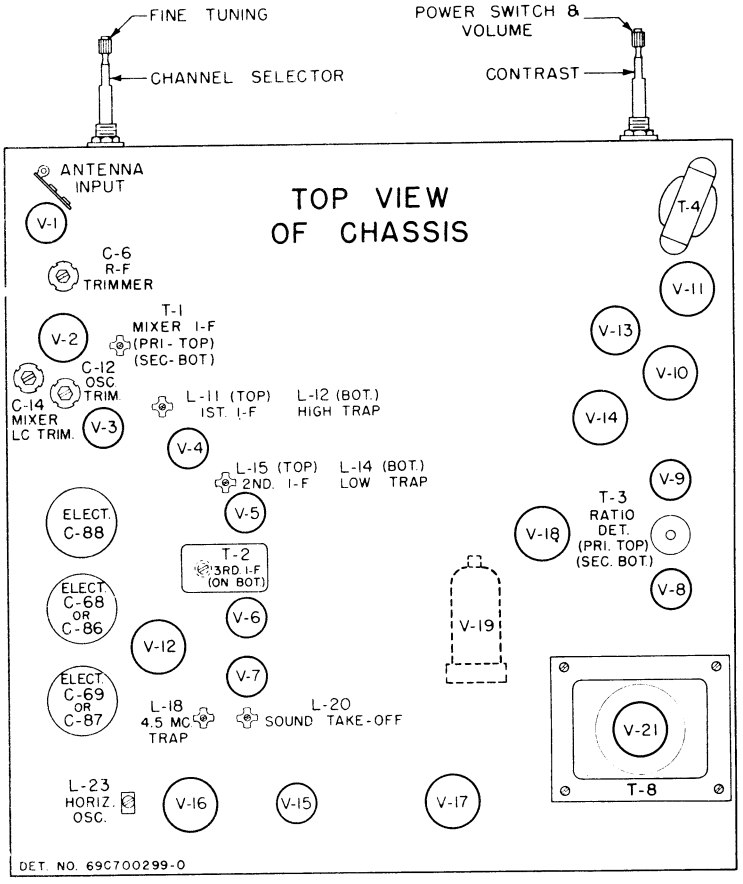


FIGURE 4. TUBE AND ALIGNMENT ADJUSTMENT LOCATIONS

noting the voltage produced, reversing the meter connections as necessary. For proper balance of the ratio detector system, the voltage in each direction should be approximately equal. If not, check the tuning of L-20 and the primary & secondary of T-3, the ratio detector. If necessary, replace the ratio detector tube V-9 (6AL5). The generator may be calibrated by tuning the secondary of T-3 to zero on a station signal and tuning the generator to the same zero response, noting whether it indicates 4.5 mc.

NOTE: As the adjustments are brought to resonance, it is advisable to reduce signal generator output to prevent overloading.

With a 10,000 microvolt signal into the grid of the video amplifier tube, and the contrast control turned fully clockwise, the voltage read from one side of capacitor C-52 should be greater than 5.0V.

4.5 MC TRAP ALIGNMENT

1. Connect the high side of the signal generator thru a 1000 mmf capacitor to the grid (pin 1) of the video amplifier tube V-7 (6AH6), and the low side to chassis.

2. Connect the voltmeter and germanium crystal rectifier, as shown in Figure 5, between the cathode of the picture tube (yellow lead) and chassis. Use the lowest voltage scale on the meter.

3. With the signal generator accurately set at 4.5 mc and maximum output, adjust trap L-18 for minimum reading on the meter.

IF AMPLIFIER ALIGNMENT

Equipment Required:

IF Sweep Generator meeting the following requirements:

18 to 30 mc, approximately 12 mc sweep width. Output constant and adjustable to at least .1 volt maximum with accurately calibrated, adjustable markers.

Cathode Ray Oscilloscope: preferably one with a calibrated input attenuator.

NOTE: If there is no built-in marker in the sweep generator, loosely couple the output of an accurately calibrated AM signal generator to the IF strip. At all times, keep the marker output low enough to prevent the marker from distorting the response curve.

If a wide band scope is used, the marker will be more distinct if a capacitor of 100 to 1000 mmf is placed across the scope input. Use the smallest size possible, since too large a value will affect the shape of the curve.

1. Remove the high voltage generator V-17 (6BQ6GT) tube from its socket to eliminate horizontal pick-up in the oscilloscope. Replace 6BQ6 with dummy load of 2500 ohm 25 watts connected from B plus side of fuse to chassis.

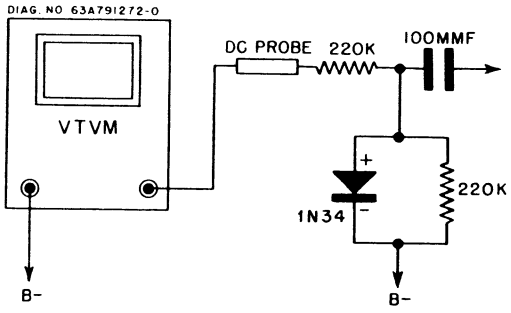


FIGURE 5. ELECTRONIC VOLTMETER CONNECTIONS

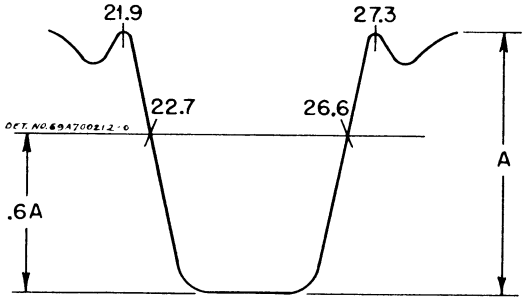


FIGURE 6. IF RESPONSE CURVE

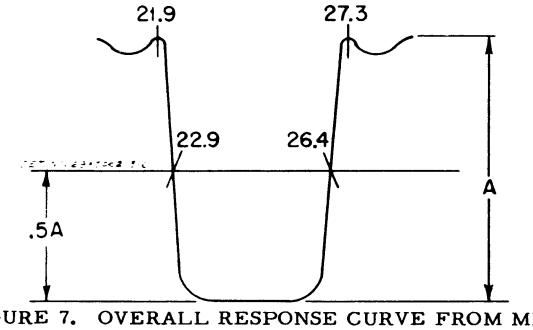


FIGURE 7. OVERALL RESPONSE CURVE FROM MIXER

2. By means of an external battery, apply a negative 3.0 volt bias from the bottom of the 1st IF tube grid resistor R-13 to chassis.

3. Using leads as short as possible, connect the hot side of the sweep generator to the grid (pin 1) of the 1st IF tube V-3 (6AU6) through a 5000 mmf capacitor (do not use the loose or "spraying" method of coupling). The low side is connected to chassis. Set the center frequency of the sweep to about 24.6 mc and adjust initially for a sweep deviation of approximately 12 mc. However, a sweep of from 8 to 10 mc may be found better for overall alignment.

4. Using R-26 (100K) as a decoupling resistor, connect the scope to pin 4 of test socket and chassis. If a stronger output is required, connect the scope between the picture tube cathode and chassis. The curve seen at this position will be the reverse of the polarity shown in Figure 6.

5. Set the contrast control at minimum.

NOTE: If a distorted or unstable picture is seen on the oscilloscope during alignment, it may be necessary to stop the oscillator by disconnecting resistor R-9 (1500) from the plate (pin 6) of the oscillator tube V-2B (12AT7), or by substituting another tube with pin 6 removed.

CAUTION:

1. Do not reduce the oscilloscope gain and increase signal input so that the top of the curve is flattened, due to limiting in the video or scope amplifiers.

2. The dress of plate & grid components in the IF affects tuning. Do not move indiscriminately.

3. On the IF coils and on the traps the resonance point will be found at two settings of the slug. The correct setting is the one which is found with the greater part of the adjusting screw out of the coil.

NOTE: The 1st & 2nd IF traps are tuned from bottom of chassis while IF cores are adjusted from the top.

6. Tune the low frequency trap L-14 located on the 2nd IF coil for maximum attenuation on the curve at 21.9 mc.

7. Tune the high frequency trap L-12 located on the 1st IF coil for maximum attenuation on the curve at 27.3 mc.

8. Adjust the 1st IF coil, L-11, to place a 26.6 mc marker on the high side of the response curve 60% down from maximum response. See Figure 6.

9. Adjust the 2nd IF coil, L-15, to place a 22.7 mc marker on the low side of the response curve 60% down from maximum response.

10. Adjust the 3rd IF plate transformer T-2 to provide a flat top or symmetrical response curve.

11. Reset the traps (steps 6 and 7) and again check the IF for proper response.

NOTE: It is suggested that the bias be removed for accurate setting of the traps.

12. With bias applied, connect the sweep between the grid (pin 2) of the mixer tube V-2A (12AT7) and chassis.

13. Disconnect the trimmer, C-14, in LC circuit in the grid of the mixer tube, or short the trimmer thru a 10,000 mmf ceramic disc type to chassis.

14. Bring both cores of the mixer transformer, T-1, simultaneously from the outside towards the center. The half-way markers should be 26.4 mc and 22.9 mc.

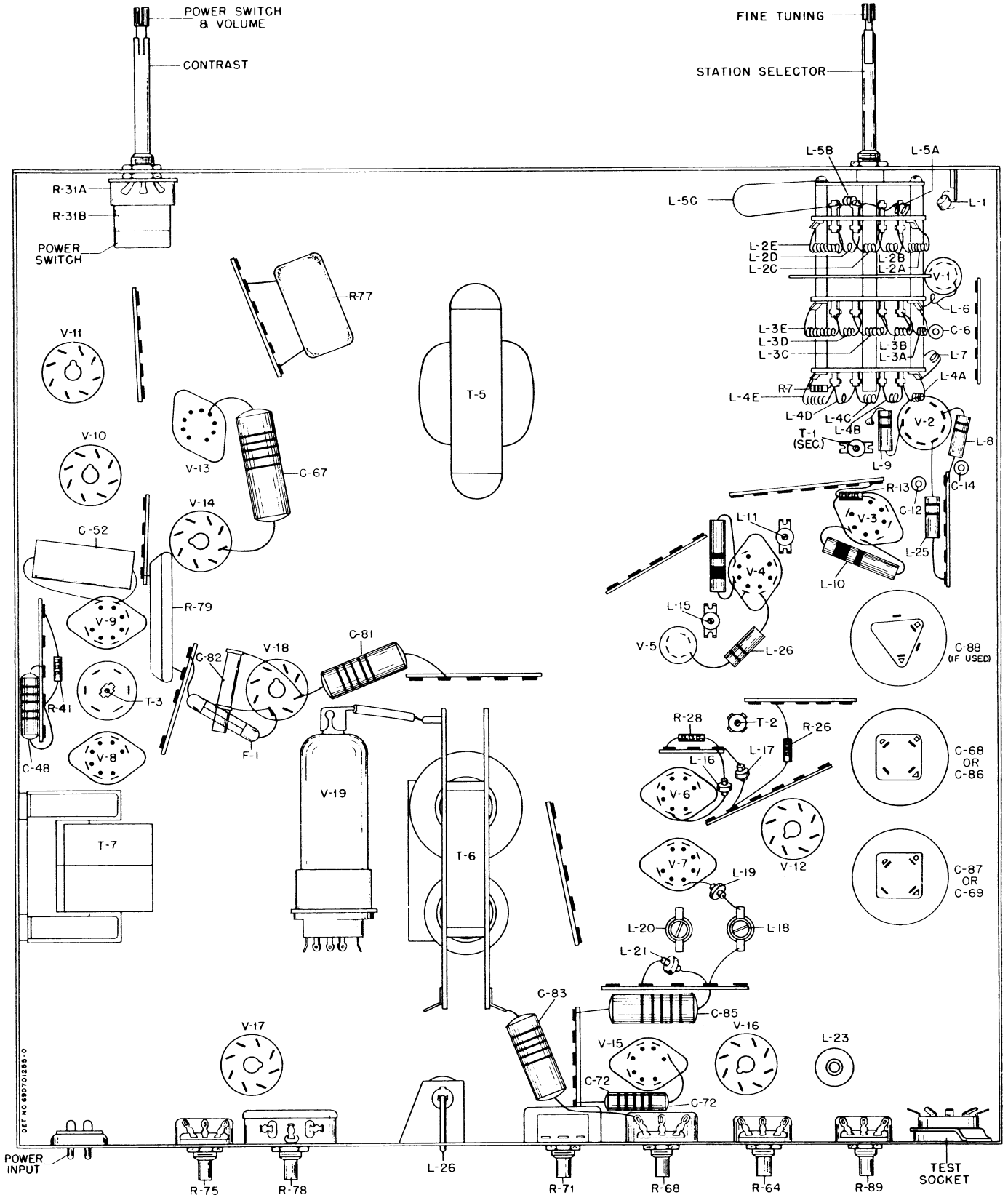


FIGURE 8. BOTTOM VIEW OF CHASSIS

NOTE: In aligning the three IF coils, each coil is adjusted individually, but when adjusting the primary and secondary of the mixer transformer, the adjustments should be made simultaneously. The important point to keep in mind is to obtain a flat response curve with as much gain as possible. The sides of the curve should be straight and as steep as possible. Simultaneous adjusting of the primary and secondary is the easiest way to obtain this result. The transformer by itself is, in effect, tuned for the same pass band as the three staggered circuits. See Figure 7. The only difference in the overall waveform should be that the sides of the overall wave are steeper. Constant use of the 50% markers (22.9 mc and 26.4 mc) should be resorted to, since it is absolutely necessary to obtain the proper curve. A slight dip (not exceeding 10%) is permissible in the mixer transformer response curve.

BANDWIDTH

The bandwidth may be determined by connecting an AM generator to the mixer grid. With the generator frequency at 24.6 mc, adjust the output for 1 volt reading on a VTVM connected to the plate (pin 7) of the video detector tube V-6 (6AL5) and chassis. Double the output of the generator. Now by tuning either side of 24.6 mc and noting the frequencies at which the VTVM again reads 1 volt, the 6 db bandwidth points are indicated. These points should be 22.9 mc and 26.4 mc. By watching the meter while tuning slowly thru the band any serious peaks or holes in the response can also be detected.

REGENERATION CHECK

After the above IF and mixer transformer alignment has been made, a check for regeneration in the IF amplifier strip should be made. This is done by removing the battery bias and observing the output response curve on the oscilloscope, as taken between the picture tube cathode and chassis. The bandwidth may change with the bias removed but should not change more than 0.2 mc. Set the contrast control to maximum gain. Decrease the input until the output signal shows a marked decrease. Any regeneration present will be indicated by sharp peaks on the overall response curve. The oscillator should be stopped, as described above, during this procedure.

CAUTION: Do not inject too much marker signal.

MIXER LC ADJUSTMENT

Reconnect bias removed for regeneration check. Replace trimmer C-14 in LC circuit of mixer grid or remove 10,000 mmf ceramic between trimmer and chassis. Adjust the trimmer so it is tuned to the center of the mixer response curve. This is indicated by observing the effect of the LC circuit on the mixer response. Increasing the capacity of the trimmer and bringing the LC circuit from above the IF range into the IF range, it will be noted that the mixer curve will pull down on the high side, straighten out as the LC circuit approaches the middle of the range, and pull down on the low side as the LC circuit approaches the low end of IF range. The proper tuning point is that point at which the mixer curve straightens out. In effect, the LC circuit is similar to a jack coil when it is within the IF range.

CAUTION: Tuning the LC circuit very low will cause oscillation.

IF SENSITIVITY MEASUREMENTS

IF Stages Only

1. Remove the battery bias from 1st IF tube grid.
2. Connect an AM signal generator, set at 24.6 mc, through a blocking capacitor of 5000 mmf, between chassis and the grid (pin 1) of the 1st IF tube V-3 (6AU6).
3. Connect an electronic voltmeter across the video detector load resistor R-28 (5600). Both leads from the meter should be decoupled with 100K ohm resistors.
4. Set the contrast control for maximum sensitivity.
5. Stop the oscillator tube by disconnecting resistor R-9 (1500) from the plate (pin 6) of tube V-2B (12AT7) or by substituting another tube with pin 6 removed.
6. The signal required to produce 1 volt (negative) above contact potential on the meter should be less than 700 microvolts.

Mixer & IF Stages

The preliminary preparations are the same as for checking the sensitivity of the IF stages except:

1. Connect the AM signal generator, set at 24.6 mc, through a 5000 mmf capacitor, between chassis and the grid (pin 2) of the mixer tube V-2A (12AT7).
2. The signal required to produce 1 volt (negative) above contact potential on the meter should be less than 125 microvolts.

OSCILLATOR, ANTENNA AND RF ALIGNMENT

NOTE: The IF must be aligned before the RF section can be properly phased.

Equipment Required:

Sweep Generator:	Frequency range 40-220 mc; 10 mc sweep width Output constant and adjustable Adjustable markers (markers should be calibrated occasionally by checking against an accurate signal generator)
Oscilloscope:	Preferably one with a calibrated input attenuator.
Signal Generator:	Frequency range 40 to 220 mc Accurately calibrated AM modulated, 400 cycle

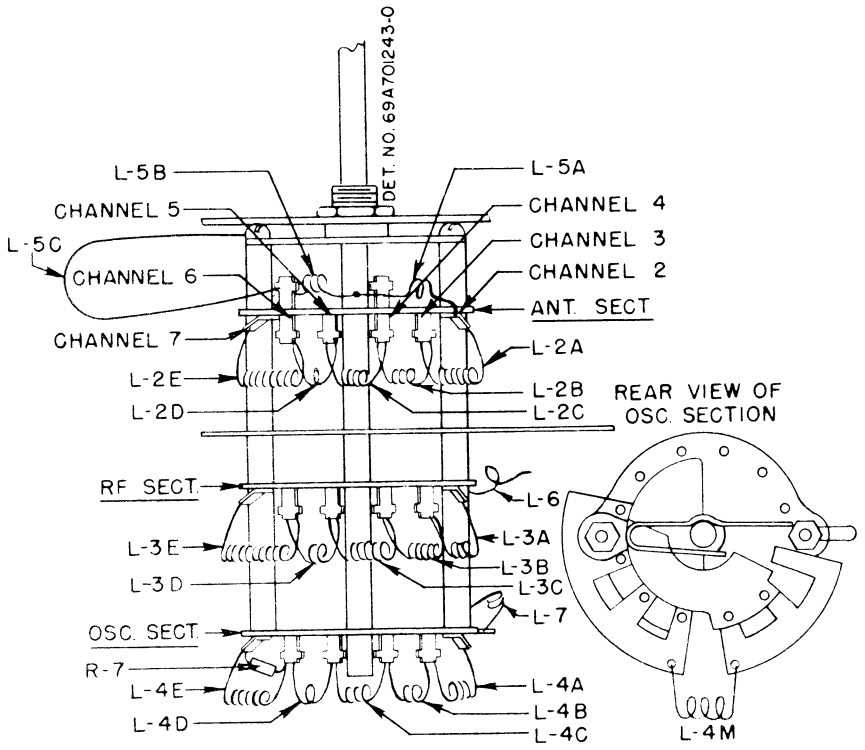


FIGURE 9. ANTENNA, RF AND OSCILLATOR COIL LOCATIONS

FREQUENCY CHART

Chan	Frequency	Picture	Sound	Oscillator
2	54-60	55.25	59.75	81.65
3	60-66	61.25	65.75	87.65
4	66-72	67.25	71.75	93.65
5	76-82	77.25	81.75	103.65
6	82-88	83.25	87.75	109.65
7	174-180	175.25	179.75	152.45
8	180-186	181.25	185.75	158.45
9	186-192	187.25	191.75	164.45
10	192-198	193.25	197.75	170.45
11	198-204	199.25	203.75	225.65
12	204-210	205.25	209.75	231.65
13	210-216	211.25	215.75	237.65

ANTENNA & RF ALIGNMENT PROCEDURE

1. Remove high voltage generator tube V-17 (6BQ6GT) from its socket and substitute a 2500 ohm 25 watt resistor connected from the B plus side of the 1/4 amp fuse to chassis. Stop the oscillator by disconnecting R-9 (1500) from plate (pin 6) of V-2B (12AT7).

2. Connect the sweep generator across the antenna terminals on the chassis with the antenna lead-in removed. The line from the sweep generator should be as short as possible.

3. Connect the oscilloscope through a decoupling resistor of 150,000 ohms, between the cathode (pin 3) of the mixer tube V-2 (12AT7) and chassis.

4. Short out the AGC circuit with a clip lead from the AGC bus to chassis.

5. Refer to Figure 4 for the RF trimmer location and to Figure 9 for the locations of the antenna and RF coils. The frequency chart listed previously gives the channel and alignment frequencies.

6. The antenna coils are tuned to the video carrier frequency and the RF coils are tuned to the sound carriers. Figure 10 shows the shape of the curve which should appear on the scope for channels 2-6 and Figure 11 the curves for channels 7-10 and 11-13.

7. Turn the station selector switch to channel 10. Set the center frequency of the sweep generator to the center frequency of channel 10 (195 mc).

8. Adjust ceramic trimmer, C-6, so that picture and sound markers are as in Figure 11.

9. Check channels 7 to 13 for proper response and, if necessary, tune the coil L-6. These coils may be tuned by spreading them to decrease inductance or compressing them to increase their inductance. See Figure 9 for location of coils. This will have more effect on channels 10 to 13 than 7 to 9. If L-6 is adjusted, it may be necessary to readjust RF trimmer C-6 and recheck the high channels.

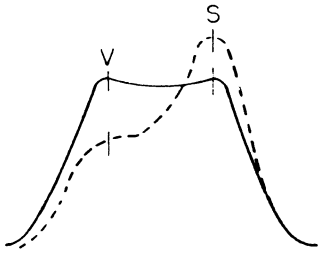
10. Move bandswitch to channel 6.

11. With center frequency of sweep generator at the center frequency of channel 6 (85 mc) introduce markers corresponding to sound and picture carriers and compare with curve of Figure 10.

NOTE: A convenient method of determining whether a coil is tuned correctly is to insert a brass or iron slug into the coil. Brass decreases and iron increases the inductance.

12. After channel 6 has been aligned, progress downward through channel 2.

CHANNELS 2 TO 6



—SOLID LINE INDICATES OPTIMUM RESPONSE.
---DOTTED LINES INDICATES PERMISSIBLE VARIATION. V=VIDEO S=SOUND

FIGURE 10. RF RESPONSE CURVES CHANNELS 2-6

CHANNELS 7 TO 13

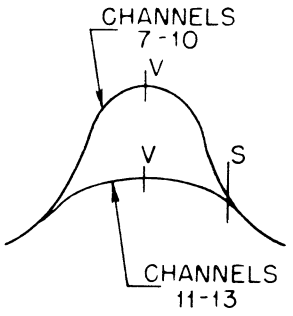


FIGURE 11. RF RESPONSE CURVES CHANNELS 7-13

CAUTION: Make certain the station selector switch is on the correct channel before checking band pass.

OSCILLATOR ADJUSTMENT

1. Put oscillator back in circuit.
2. Remove the short from the AGC circuit and apply a -3 volt battery bias to the AGC bus.
3. Move the scope to the test socket on the chassis rear with the high side connected to pin 4 and the low side to chassis.
4. Set the contrast control at minimum (counterclockwise).
5. Remove the fine tuning knob and turn shaft until the slot is in a horizontal position. This represents the mid-capacity position.
6. Turn station selector switch to channel 12.
7. Set the sweep generator on channel 12 with a center frequency of 207 mc and at least a 12 mc sweep. Keep the output low enough to show no evidence of limiting in the overall response curve.

NOTE: Before aligning the oscillator section, make certain that L-8 (3.3 microhenries) in the mixer grid is dressed away from C-16 (2 mmf) tied to the same grid.

8. Introduce a marker corresponding to the sound carrier of channel 12 (209.75 mc).
9. Adjust C-12 oscillator ceramic trimmer so that the sound marker falls into the 21.9 mc trap dip in the response curve.
10. Turn generator and station selector to channel 9 with the fine tuning shaft slot still in the horizontal position.
11. Spread or compress the 3-turn coil located in the center of the oscillator plate (L-4M, Figure 9) so that the sound marker for channel 9 falls into the 27.3 mc trap dip in the response curve. As the oscillator is tuned below the carrier on channels 7, 8, 9 & 10, the 27.3 mc trap will be in the same position as the 21.9 mc trap in step 9.
12. Repeat steps 6, 7, 8 & 9.
13. Turn generator and station selector to channel 13.
14. Turn fine tuning trimmer so that the sound marker for channel 13 falls into the 21.9 mc trap dip of response curve. The slot in the fine tuning shaft should not have moved more than 30 degrees from the horizontal position to accomplish this (each number on the station selector knob represents 30 degrees.)
15. If more than a 30 degree change in fine tuning trimmer was needed in step 14, adjust channel 13 oscillator coil (L-7) by spreading or compressing until the 30 degree requirement is met.

NOTE: Each adjustment of channel 13 oscillator coil will necessitate a re-checking of the oscillator trimmer C-12 on channel 12 as per steps 6, 7, 8 & 9.

16. Check channels 12, 11, 10, 9, 8, and 7 by noting whether the fine tuning trimmer can drop the sound marker for each channel in the trap dip by a 30 degree rotation. If one of the channels does not meet the 30 degree requirement, a compromise must be made by resetting channel 9 or 12, whichever is closer to the channel in question.

Examples: 1) If channel 11 does not meet the 30 degree requirement, return station selector and generator to channel 12 and tune ceramic trimmer C-12 toward channel 11 (trimmer frequencies lowered by tightening screw). This will tend to move channel 12 sound marker out of the trap dip, but this can be compensated for by the fine tuning trimmer. Do not adjust trimmer any more than is necessary to get the channel in question back within the 30 degree requirement.

2) If channel 10 does not meet the 30 degree requirement, move station selec-

tor and generator to channel 9 and tune the 3-turn coil (L-4M, Figure 9) toward channel 10 (coil freq raised by spreading turns). This will also tend to move channel 9 sound marker out of the trap dip, but this can be compensated for by the fine tuning trimmer. Again, do not adjust the coil any more than is necessary to bring the channel in question back within the 30 degree requirement.

17. Turn sweep generator and station selector switch to channel 6.

18. Adjust channel 6 oscillator coil (L-4E, Figure 9) so that the sound marker for channel 6 falls into the 21.9 mc trap dip with the fine tuning trimmer at mid-capacity (shaft slot in horizontal position). Always spread or compress channel 6 oscillator coil in units of 3 turns. Compressing turns will move curve toward sound marker, while spreading will move curve toward video marker.

IMPORTANT: Since the coils are in series, the proper alignment of channel 6 will simplify the phasing of the channels to follow.

19. Adjust channels 5 and 4 so that the sound marker for each channel falls into the 21.9 mc trap dip in the curve with the fine tuning trimmer set no more than 15 degrees from mid-capacity.

20. Channels 3 and 2 should be adjusted so that the sound marker falls into the 21.9 mc trap dip with the fine tuning trimmer within 15 degrees of maximum capacity.

OVERALL RECEIVER SENSITIVITY MEASUREMENT

An overall measurement of sensitivity is made as follows:

1. Connect an AM signal generator to the input terminals of the receiver chassis after removing the short 300 ohm lead which connects to the antenna input strip on the back of the cabinet. To match the generator to the receiver input a resistive matching network should be used. In the case of a generator with a 50 ohm output impedance, for example, place a 100 ohm resistor in series with the output terminal of the generator and a 150 ohm resistor in series with the ground terminal.

2. From cathode of picture tube to chassis connect a calibrated oscilloscope.

NOTE: To calibrate scope, connect it across 6.3 volt filament supply. The peak-to-peak amplitude on the screen will then be approximately 18V (6.3 x 2.8).

3. Set contrast control for maximum sensitivity.

4. Tune signal generator to the video carrier frequency of the channel being checked. Generator signal should be 30% modulated at 400 cycles. The signal from the generator to produce 20 volts peak-to-peak at picture tube cathode should be less than 25 microvolts on channels 2 to 6 and less than 75 microvolts on channels 7 to 13.

CIRCUIT DESCRIPTION

LOW VOLTAGE POWER SUPPLY

The low voltage power supply (Figure 12) provides plate voltage for all tubes except the high voltage applied to the second anode of the picture tube and heater voltage to all tubes except the damping diode and the HV rectifier, which is energized by horizontal sweep current.

Since the damping diode (V-18) develops a high voltage pulse at its cathode, and its cathode is tied to the filament to prevent breakdown in the tube, it is necessary to provide a separate, low-capacity, well-insulated transformer (T-7) to heat this filament. The plate supply is a conventional full wave rectifier using a 5U4 tube (V-21). The speaker field serves as the filter choke. The focus coil and its current adjusting resistor network is used also as a voltage divider to supply plate current to several tubes as shown in Figure 12.

Another voltage divider from this network to chassis consisting of R-76 (1 meg) and the potentiometer, R-75 (1 meg) provides a variable bias on the cathode of the picture tube, to serve as a brightness control.

THE RF TUNER

Antenna Input

Figure 13 is a simplified schematic of the tuner.

The antenna input coil, L-1, couples the balanced line to the single ended input circuit for the RF tube, V-1. Optimum antenna coupling for all channels is obtained by the coupling coils L-5A, L-5B, L-5C, and the coupling leads on channel positions 8, 10 and 12 of switch wafer S-1A. These can be considered the primary of the antenna transformer. The secondary, or tuned grid circuit, includes also the continuous, tapped coil mounted on wafer S-1B for the low channels (2-6) and the stamped metal plate in series with the coil for the high channels (7-13). The purpose of the antenna coil, coupling leads, and the secondary circuit, is to match the 300 ohm impedance of the transmission line from the antenna to the input impedance of the RF amplifier grid circuit and to tune this circuit for the channel selected. Referring to Figure 13, it will be seen that the switch in progressing from channel 2 to channel 13, shorts out the unused portion of the secondary winding or stamped metal plate. The bandwidth of channels 7 thru 13 is about 8 mc. The stamped metal plate is carefully designed so that with this bandwidth, no alignment adjustment is needed on the high channels. The individual coil sections on the low channels, however, may be tuned by spreading or compressing them as outlined in the alignment procedure.

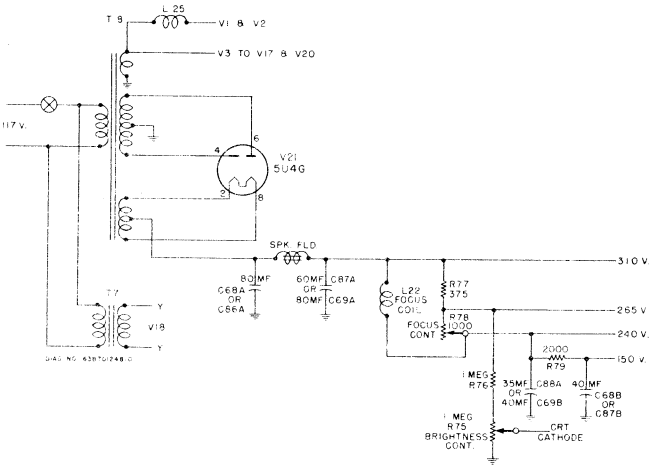


FIGURE 12. SIMPLIFIED SCHEMATIC OF LOW VOLTAGE POWER SUPPLY

RF Amplifier

The grid of the RF amplifier V-1 (6CB6) is returned to the AGC bus thru R-1 (22K) and the decoupling resistor R-2 (47K) bypassed by capacitor C-3. The plate load of this tube consists of another tapped coil for the low channels and a stamped metal plate for the high channels mounted, in this case, on switch wafer S-1C. Here again, the switch progressively shorts out the unused sections of the inductance in tuning from channel 2 to 13. In this case, however, a trimmer C-6 and a choke L-6 are provided to center the high channel response while the low channel coils may be tuned by expansion or compression.

The Mixer

The mixer uses 1/2 of V-2 (12AT7). C-17 (8 mmf) couples the RF amplifier output to the mixer grid. Oscillator injection is accomplished by C-16 (2 mmf). L-8 and C-14 form a series resonant circuit tuned to the center of the IF response, to prevent interaction between the IF and the mixer input.

The Oscillator

The oscillator uses the other half of V-2 (12AT7) in a Colpitts circuit. Here again, the tuning inductance consists of the tapped coil for the low channels and the stamped metal plate for the high channels mounted on wafer S-1D. L-7 and C-12 are provided to set the center frequency on the high channels while the low channels are aligned by spreading or compressing the individual coil sections. C-11 is provided as a fine tuning control for customer use. The oscillator operates above the RF on the low channels and on channels 11, 12, and 13, and below the RF on high channels 7, 8, 9, and 10. The choice of oscillator frequencies eliminates in-

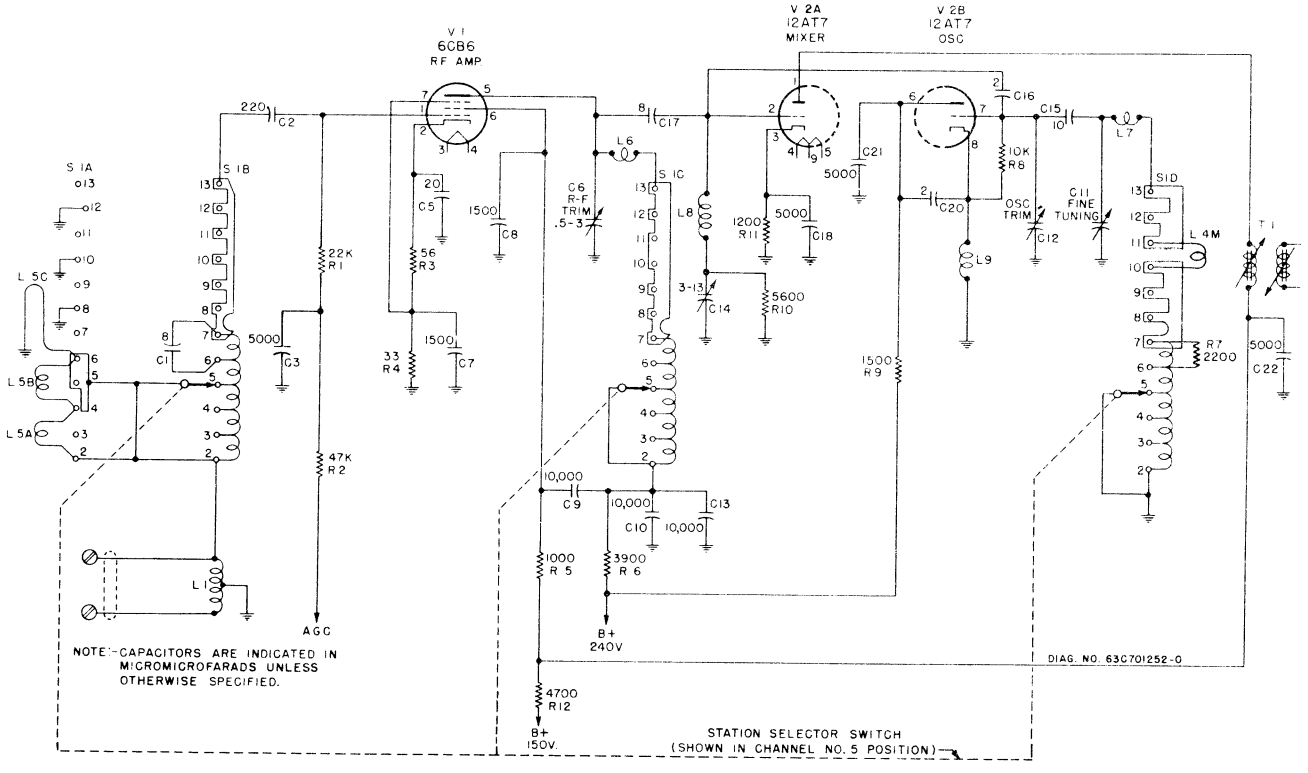


FIGURE 13. SIMPLIFIED SCHEMATIC OF RF TUNER

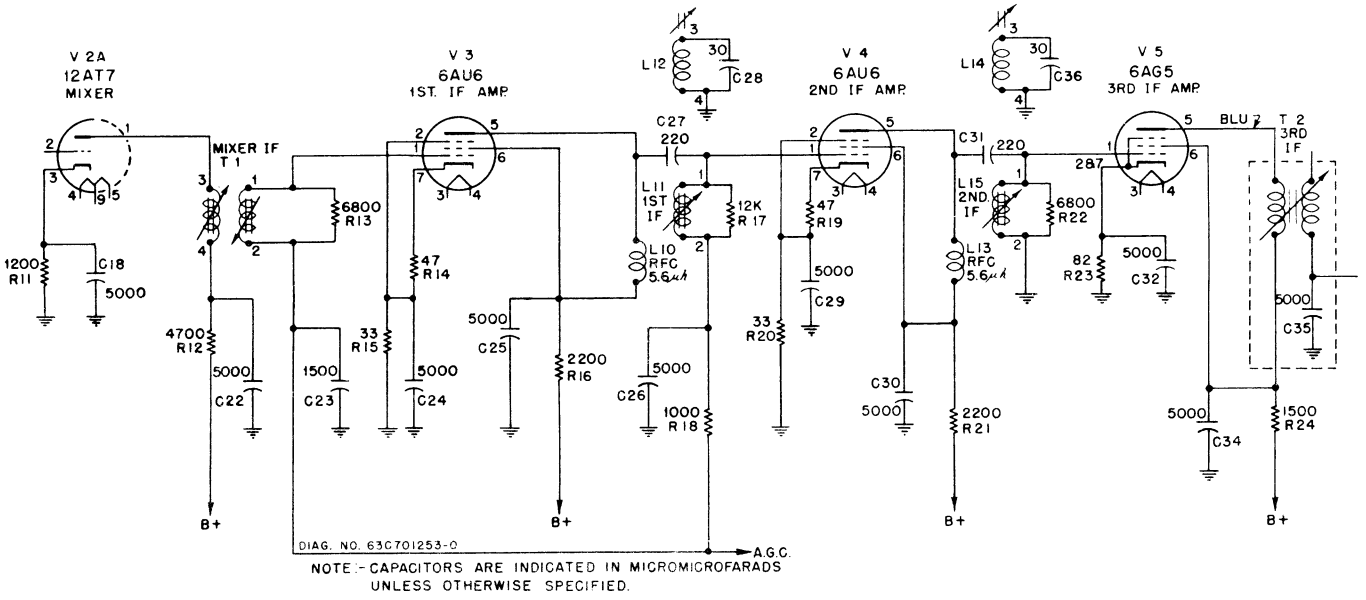


FIGURE 14. SIMPLIFIED SCHEMATIC OF IF AMPLIFIER

terference due to oscillator radiation on the high channels.

THE IF AMPLIFIER

The IF amplifier uses two 6AU6 tubes and one 6AG5 tube. Figure 14 is the schematic of the IF amplifier. T-1 couples the mixer plate to the first IF grid. Coupling between primary and secondary, which are individually slug-tuned, is fixed and is designed for proper bandwidth. The plate choke L-10, of the 1st IF tube V-3 (6AU6), is coupled to the grid coil, L-11, of the 2nd IF tube V-4 (6AU6) thru C-27 (220 mmf). At IF frequencies, the impedance of C-27 is negligible and for all practical purposes, L-10 and L-11 can be considered as being in parallel, L-11 being slug-tuned. A similar method is used between the 2nd and 3rd IF tubes. The 3rd IF plate is coupled to the detector by T-2, a unity-coupled transformer. The IF circuits are stagger-tuned for proper bandwidth as explained in the Alignment Instructions. L-12 and L-14 are separately tuned trap windings on IF coil forms L-11 and L-15, respectively. Together with C-28 and C-36, they form absorption type trap circuits which steepen the high and low skirts of the IF response for better picture quality and to stabilize the audio response with intercarrier sound.

Decoupling is used in the plate supply and AGC circuits, to prevent regeneration.

THE VIDEO DETECTOR

One-half of V-6 (6AL5) is used as the video detector. Figure 15 is a schematic of the video detector. Since for noise limiting purposes it is desirable to apply a signal with negative going sync pulses to the grid of the video amplifier, the detector load R-28 (5600) is placed in the plate circuit of the diode. L-16, L-17, and C-37, form a low pass filter to keep IF frequencies off the grid of the video amplifier.

Since this chassis operates on the intercarrier sound system, the detector heterodynes the video and sound IF frequencies, and produces the 4.5 mc beat frequency which becomes the new audio IF frequency. The negative DC voltage developed at the high side of the detector load R-28 (5600) will be a function of carrier level. This voltage is fed to the AGC bus thru R-27 (1.5 meg) and controls the gain of the RF and 1st and 2nd IF amplifiers.

THE VIDEO AMPLIFIER

The video amplifier V-7 (6AH6) not only amplifies the video signal but also the 4.5 megacycle audio IF beat. Figure 16 is a schematic of the video amplifier. In its plate circuit, this beat is separated from the video signal and fed to the grid circuit of the audio driver-limiter tube V-8 (6AU6) by C-43 (2.2 mmf) and L-20, the sound take-off coil. The 4.5 mc trap, L-18 and C-42, is a parallel resonant circuit which, when properly tuned, offers a high impedance to this frequency, to prevent its reaching the picture tube.

By applying a negative signal to the grid of the video amplifier, a noise limiting action is achieved because noise pulses of amplitude greater than the sync level will drive the tube to cut off and, therefore, will not be present in the plate circuit. Since a single video amplifier tube is used, the signal at its plate will be positive and, as might be expected,

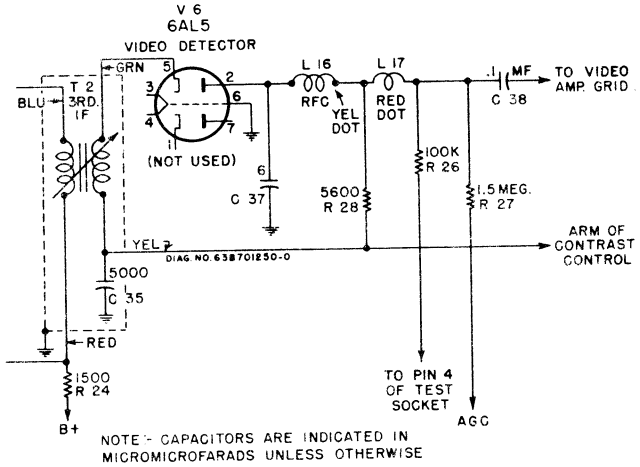


FIGURE 15.
SIMPLIFIED SCHEMATIC OF VIDEO DETECTOR

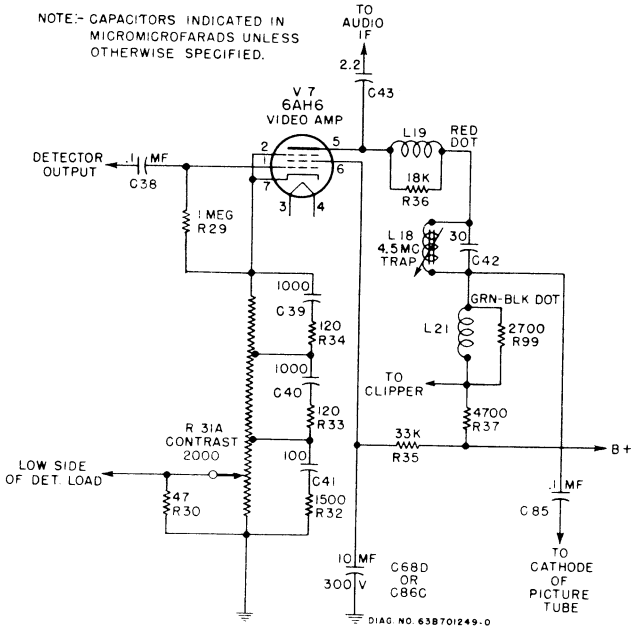


FIGURE 16.
SIMPLIFIED SCHEMATIC OF THE VIDEO AMPLIFIER

is used to modulate the cathode of the picture tube rather than the grid, because the blanking pulses must cut the picture tube off and the polarity of the video information must be such that dark picture elements result in making the grid more negative with respect to the cathode.

L-19 and L-21 are peaking coils to extend the high frequency response of the amplifier. The contrast control, R-31A, is placed in the cathode circuit of the video amplifier and controls the bias and, therefore, the gain of the tube. The network of resistors and condensers across the taps on the contrast control decreases degeneration at the higher frequencies and, therefore, helps to extend the high frequency response. The composite video signal is fed to the picture tube cathode thru coupling condenser C-85 (1).

THE AGC

The negative DC voltage developed across the detector load resistor R-28 (5600), is the AGC voltage. It will be noted that the low side of this resistor is connected to the arm of the contrast control potentiometer, R-31A. R-30 (47) is shunted across the arm of the contrast control and chassis. In weak signal areas, this arrangement results in a delay in the AGC action. For a weak signal, minimum bias is desired on the video amplifier, therefore, the arm of the contrast control will be closest to the cathode end of the potentiometer. Because R-30 is then shunted across the entire contrast control, most of the plate current will flow thru it and develop a positive voltage of approximately one volt at the arm with respect to chassis. Since the low side of the detector load is tied to this positive voltage, no AGC voltage will develop until the signal is strong enough to overcome this positive voltage and, therefore, no AGC bias is applied to the controlled tubes under weak signal conditions. In a strong signal area, however, where the arm of the contrast control approaches the chassis end of the control, R-30 is shorted out and full AGC voltage is developed.

THE AUDIO SYSTEM

The audio system employs a driver limiter, V-8 (6AU6); a ratio detector V-9 (6AL5); a first audio amplifier, V-10 (6J5), and an audio output tube, V-11 (6V6). Figure 17 is a schematic of the audio system. The driver-limiter is operated at low plate and screen voltages to act as a partial limiter to minimize any amplitude modulation. A conventional ratio detector and audio amplifier are used.

THE CLIPPER

The clipper uses a 6SN7GT tube. The clipper schematic

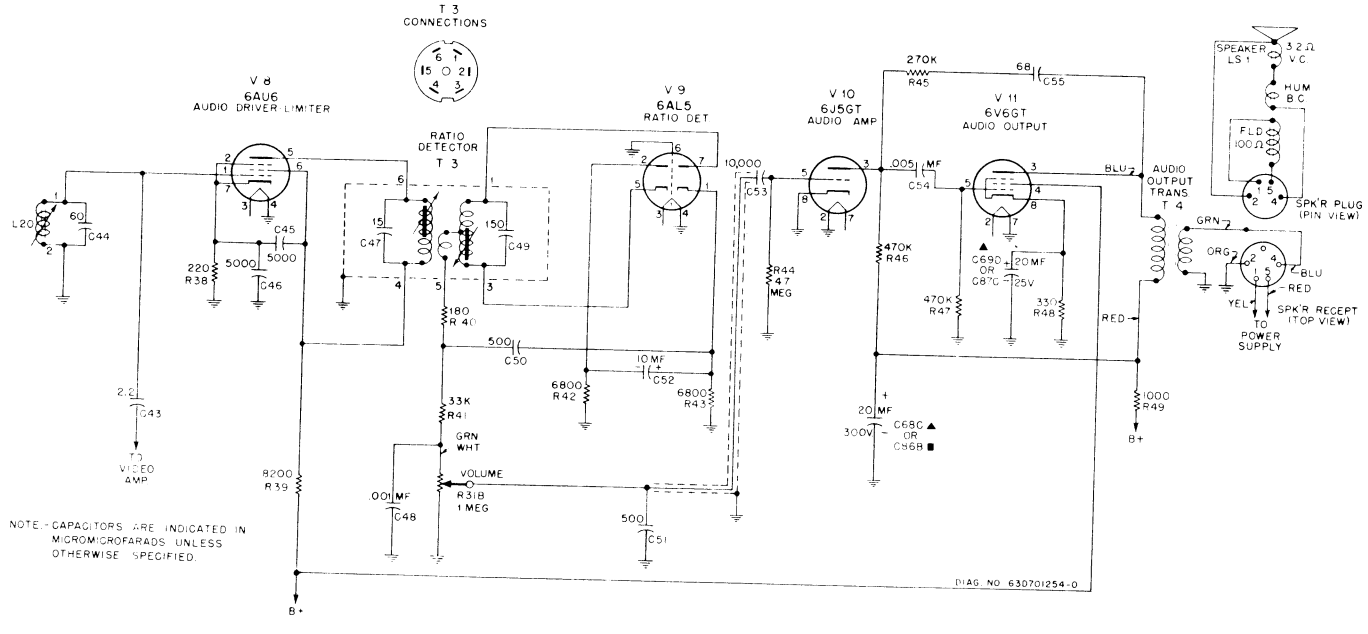


FIGURE 17. SIMPLIFIED SCHEMATIC OF AUDIO SYSTEM

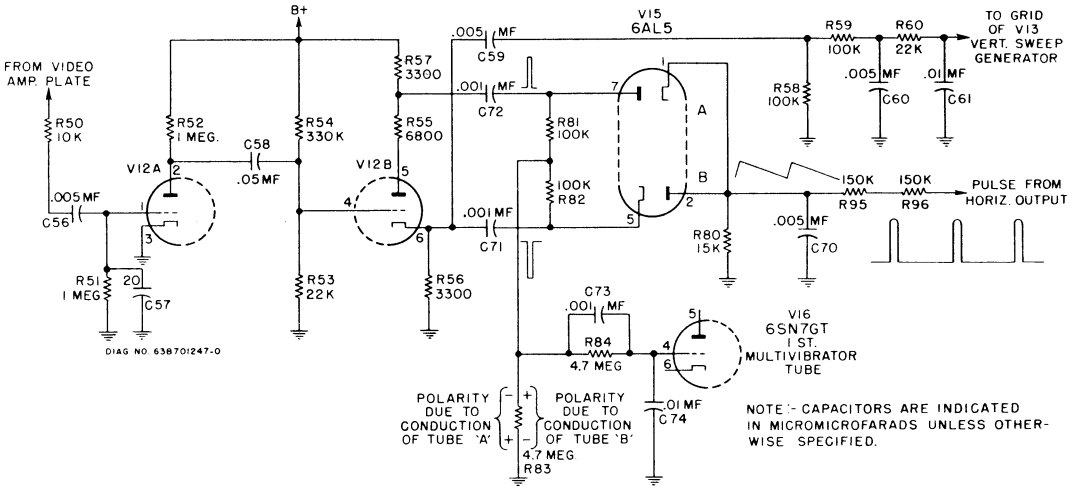


FIGURE 18. SIMPLIFIED SCHEMATIC OF CLIPPERS AND PHASE DETECTOR

is shown in Figure 18. The composite video signal with positive going sync is applied thru R-50 (10K) and C-56 (.005) to the grid of the first clipper from the plate circuit of the video amplifier. Under no signal conditions, the tube is unbiased. The positive signal, however, will cause the tube to draw grid current and the voltage drop across R-51 (1 meg), negative at the grid, will charge C-56 to such a value that only the most positive part of the signal, which is the sync pulse, will cause plate current to flow. Therefore, the video information and the blanking pulses are clipped off and only the sync pulses, now negative in polarity, appear in the plate circuit. The second clipper is so biased that the peaks of the sync pulses will drive the tube to cut-off, which results in squared pulses of positive polarity in the plate circuit and of negative polarity in the cathode circuit of this tube. A slight increase in sync pulse amplitude is obtained by a small positive voltage applied to the grid of the second clipper by R-54 (330K).

THE VERTICAL SCANNING SYSTEM

Figure 19 is a schematic of the Vertical Scanning System.

The negative sync pulses are fed from the cathode circuit of the second clipper, V-12B, to the integrating network composed of R-59, C-60, R-60, and C-61 where the serrations of the vertical group are changed to a single negative pulse to trigger the vertical scanning oscillator. C-59 (.005) and R-58 (100K) form a differentiating network which helps to stabilize the vertical scanning system by eliminating low frequency disturbances such as line fluctuations, etc.

The vertical scanning oscillator is an asymmetrical, cathode coupled multivibrator using the dual triode V-13 (12AU7). The circuit component values are chosen so that V-13B's conductance time is about 7% of the entire cycle to insure that retrace time of the scan will have the proper relationship to the trace time. The saw-forming condenser C-66 (.05) is placed in the plate circuit of V-13B while the sync pulses are applied to the grid of V-13A. For the purpose of explaining the free-running action of the circuit, assume that the end of the trace period has almost been reached. At this time V-13A is conducting, C-63 (.01) is discharging thru V-13A, R-63 (330K) and R-64 (the vertical hold control). This discharge current makes the grid end of R-63 negative and together with the plate current of V-13A thru R-62 (2700) the common cathode resistor, biases V-13B beyond cut-off. The energy stored in C-63 is finally reduced to the point where the voltage drop across R-63 and R-64, due to the discharge current of C-63, is no longer sufficient to keep the grid of V-13B below cut-off and the tube begins to conduct current. The increased current thru the common cathode resistor R-62 increases the bias on V-13A and reduces its plate current. The rise in voltage at the plate of V-13A starts to charge C-63 and this charging current applies positive voltage to the grid of V-13B. This pulse of voltage throws V-13B into heavy conduction and develops a pulse of voltage across the common cathode resistor R-62 which drives V-13A beyond cut-off. C-66, the saw-forming

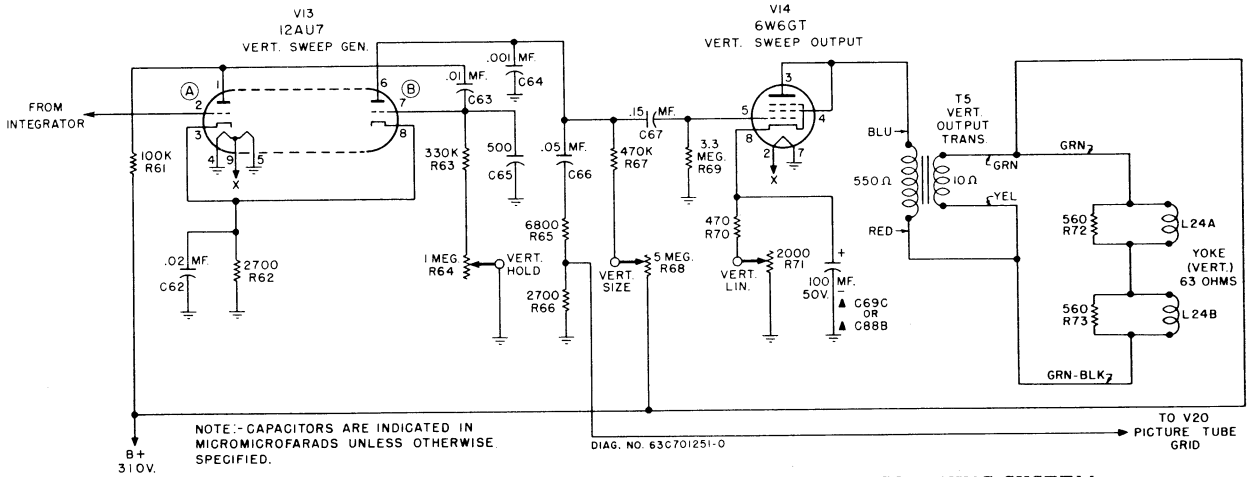


FIGURE 19. SIMPLIFIED SCHEMATIC OF VERTICAL SCANNING SYSTEM

condenser, discharges suddenly thru the virtual short circuit caused by the heavy conduction of V-13B. This corresponds to the retrace time in the scan cycle. As C-63 approaches full charge, the charging current thru the grid circuit of V-13B decreases and the positive voltage applied to the grid of V-13B is reduced, which results in a reduction of plate current and, therefore, a reduction of bias on the grid of V-13A. Eventually, this tube starts to conduct and C-63 begins to discharge and again this discharge current thru R-63 and R-64 cuts V-13B off. C-66 begins to charge from B plus initiating the trace time of the scan and the beginning of another cycle.

The frequency of the multivibrator is adjusted by means of the hold control R-64 so that the sync pulse from the transmitting station, negative in polarity, arrives at the grid of V-13A at the time when V-13B is beginning to conduct which, as we have seen, causes the grid of V-13A to go negative. The added negative voltage of the sync pulse insures that V-13A will be driven to cut-off at sync pulse rate for each cycle, thus initiating the retrace in exact step with the transmitting station's vertical scan.

The voltage developed at the plate of V-13B will be the combination sawtooth and pulse voltage shown in Figure 22(1). The pulse is formed by the peaking resistors R-65 and R-66. When V-13B goes into conduction, the voltage at the plate of V-13B drops suddenly to a value determined by the relationship of the plate resistance of V-13B to the total resistance in the discharge circuit of C-66, which consists of R-65, R-66, and the plate resistance of V-13B. After this initial instant, the charge on C-66 decreases, causing the voltage decrease at the plate shown between points "c" and "d" of Figure 22(1). When the positive pulse on the grid of V-13B has decreased to the value where the negative charge on C-63 becomes operative and cuts off V-13B, the voltage on the plate of V-13B and, correspondingly, on the grid of V-14, rises quickly to point "a" on the curve, the start of the trace.

By returning the grid of the picture tube to the junction of the two peaking resistors R-65 and R-66, a negative pulse of suitable amplitude to cut the picture tube off during retrace is obtained, resulting in elimination of retrace lines on the screen.

The negative pulse shown between point "b" and "a" of Figure 22(1), acting on the grid of the vertical output tube V-14, tends to cut the tube off and raises its plate resistance to the larger value required to dissipate the energy in the plate circuit inductance during the short retrace period.

Since the plate circuit of the vertical output stage V-14 has inductance, and as the time constant of an inductive circuit decreases with an increase of resistance, just the opposite of an RC circuit, the increase in plate resistance of the tube is used to obtain the short time constant circuit required for proper retrace time. The windings on the vertical output transformer are connected series opposing which reduces the step-down ratio and, hence, the inductance in the plate of V-14 in order to shorten the retrace time.

The controls found in this circuit are:

1. The Vertical Hold Control R-64 (1 meg). This control varies the resistance in the discharge circuit of C-63 (.01) and, hence, provides a means of varying the frequency of the multivibrator. In practice, this control is adjusted so that the incoming negative sync pulses on the grid of V-13A, which are of constant amplitude, will cut V-13A off and throw V-13B into conduction in exact synchronization with the transmitting station's vertical scan.

2. The Vertical Size Control R-68 (5 meg). This control varies the charging current into C-66 (.05) and, hence, the amplitude of the voltage developed across it. Variation of this voltage varies the drive on the grid of V-14 and controls vertical size.

3. Vertical Linearity R-71 (2000). This control, thru resistor R-70 (470) sets the bias on the grid of the vertical output tube and determines the tube's operating point on its plate current curve. Since this curve is not linear, some distortion can be introduced to counteract any non-linearity in the sawtooth grid voltage.

Since the size control is part of the multivibrator circuit and has an effect also on its frequency, there will be some interaction between the size and hold controls. Usually, readjustment of the size will require readjustment of hold control.

HORIZONTAL SCANNING SYSTEM

The horizontal scanning system comprises a phase detector V-15 (6AL5), a cathode coupled multivibrator V-16 (6SN7), the output tube V-17 (6BQ6) and a damping diode V-18 (6W4). Figure 20 is a simplified schematic of this system.

The Horizontal Oscillator

In order to see how the phase detector automatically corrects for multivibrator frequency change, it will be necessary to understand how the correction voltage affects the multivibrator. The horizontal oscillator is also an asymmetrical, cathode coupled multivibrator.

The operation is as follows. Assume that the trace period is almost completed. At this time, tube "A" is conducting, tube "B" is cut off. C-76 is discharging thru tube "A", R-88 (120K) and R-89 (the hold control). The discharge current of C-76 is still high enough to keep the grid of tube "B" negative and cut off. Bias is being applied to both tubes by current flow thru R-86 (1000) the common cathode resistor. When the energy stored in C-76 is reduced to the point where its discharge current no longer holds the grid of tube "B" below conductance, tube "B" starts to pass current and this current causes a greater voltage drop across R-86, the common cathode resistor, which increases the bias on tube "A" reducing its plate current. The resulting increase in voltage at the plate of tube "A" begins to charge C-76 and this charging current applies positive voltage to the grid of tube "B". The resulting heavier conduction of tube "B" develops a pulse of voltage across R-86 which cuts tube "A" off and results in a positive pulse at the plate of tube "A" which throws tube "B" into heavy conduction. This allows C-77, the saw-forming condenser to discharge thru tube "B" and R-91. When C-76 becomes charged, the charging current thru the grid circuit of tube "B" decreases and the positive voltage on the grid, which has far exceeded the bias developed across R-86 is reduced. This results in reducing the plate current thru tube "B" and, therefore, the bias applied to tube "A" by the voltage drop across R-86. Tube "A" starts to conduct and condenser C-76 starts to discharge, cutting tube "B" off. C-77 begins to charge, starting the next trace.

L-23 and C-75 in the plate circuit of tube "A", form a resonant circuit which is tuned to the horizontal frequency (15,750 cps). The 15,750 cycle sine wave generated by this circuit, if properly phased, will insure that the positive pulse at the plate of tube "A", which throws tube "B" into conduction, will be more frequency stable.

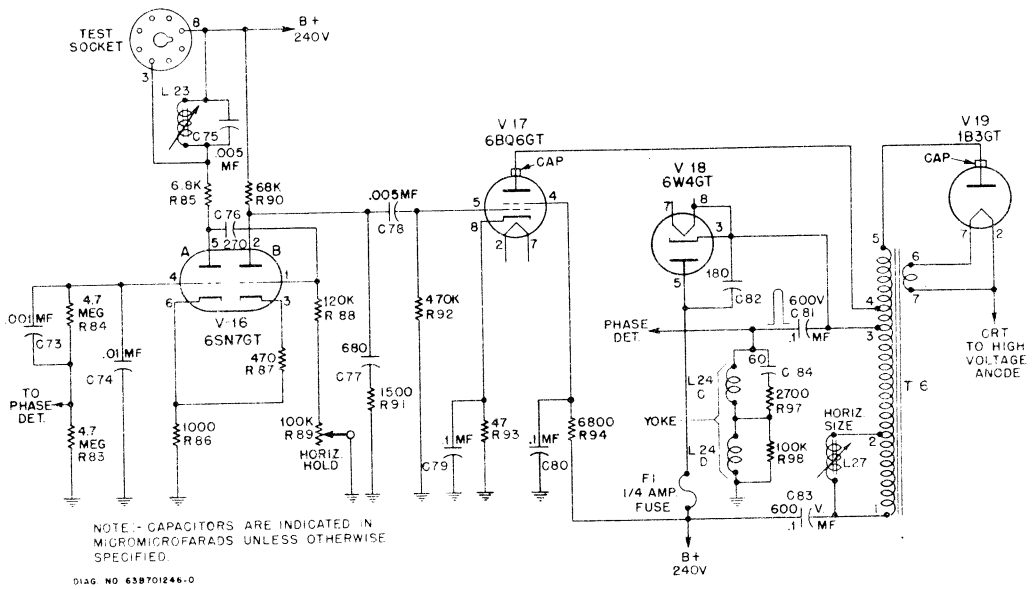


FIGURE 20. SIMPLIFIED SCHEMATIC OF HORIZONTAL SCANNING AND HIGH VOLTAGE SYSTEM

C-77 and R-91, the peaking resistor, will produce the same combination pulse and sawtooth voltage shown in Figure 22(1). This action was explained in the vertical circuit.

The Phase Detector

The foregoing explanation is based on the assumption that tube "A's" grid is returned to a fixed potential point. It can be seen that if this grid is returned to a point which varies in potential with frequency of the multivibrator, it would be possible to make this variation a means of frequency control. Assume that the grid of "A" in Figure 20 is made more positive. This causes the bias of "B" to increase because of the increased drop across the common cathode resistor R-86. Capacitor C-76 will then discharge for a longer time before "B" conducts, thereby decreasing the frequency of oscillation. If the grid were made more negative, the bias across the common cathode resistor would be less and C-76 would discharge for less time before "B" started to conduct, thereby increasing the frequency.

Figure 18 is a simplified schematic of the clipper and phase detector circuits. The phase detector V-15 (6AL5) is so connected that a comparison of the phase of the incoming sync pulses and a sawtooth derived from the horizontal output system is made. A positive sync pulse from the plate of the 2nd clipper V-12 (6SN7) is fed thru C-72 (.001) to the plate of diode "A" of V-15. A negative sync pulse from the cathode of V-12 is applied thru C-71 (.001) to the cathode of diode "B" of V-15. A sawtooth, derived from the integration of a pulse in the horizontal output circuit, at the yoke, by the integrating network, composed of R-95 (150K), R-96 (150K), and C-70 (.005) is applied to the cathode of diode "A" and the plate of diode "B", which are tied together and returned to chassis thru R-80 (15K). The load for diodes "A" and "B" consists of resistors R-81 (100K) and R-82 (100K) whose junction returns to the high side of the grid resistor R-83 of the first horizontal multivibrator tube V-16 (6SN7). The voltage applied to the two diodes will be a function of the amplitude of the sawtooth, the amplitude of the sync pulses and the phase relationship between the pulses and the sawtooth.

If the sawtooth, whose phase and frequency are a function of the multivibrator's phase and frequency, is operating in the middle of the lock-in range, the sync pulse will occur in the center of the retrace time. See Figure 21(1). The sync pulses have an amplitude of from 6 to 8 volts while the sawtooth amplitude is about two volts. The RC time constant in the pulse input circuit to the diodes is long enough to maintain an average pulse voltage of 6 to 8 volts for two or three horizontal lines, which means that in the "on frequency" condition shown in Figure 21(1), the diodes conduct only on the pulses and since these are equal in amplitude and develop voltages of opposite polarity across R-83 in the first multivibrator grid circuit as shown in Figure 18, no control voltage is applied to the grid of V-16.

If the oscillator tends to increase in frequency, with respect to the sync pulses, the phase relationship shown in Figure 21(2) exists at the diodes. The phase of the sawtooth has now shifted so that at the same instant that the pulse is applied to the plate of diode "A" the positive saw is also applied to its cathode, so that only the shaded portion of the pulse causes conduction of diode "A". Diode "B", however, still conducts on the total amplitude of the negative pulse applied to its cathode aided by the positive saw applied to its plate at the same time. Since current flow thru diode "A" makes the grid end of R-83 negative, with respect to chassis, the decreased current flow caused by the sawtooth voltage bucking the pulse voltage at diode "A" results in a more positive voltage across R-83 applying a more positive voltage to the grid of V-16 which, as we have seen, results in decreasing the oscillator's frequency.

If the oscillator tends to decrease in frequency, with respect to the sync pulses, the phase relationship shown in Figure 21(3) exists at the diodes. At the same instant that the negative pulse is applied to the cathode of diode "B", the negative saw is applied to its plate so that only the shaded portion of the pulse causes conduction. Diode "A", however, conducts on the full amplitude of the positive pulse applied to its plate aided by the negative saw applied to its cathode at the same time. Since current flow thru diode "B" makes the grid end of R-83 positive, with respect to chassis, the decreased current thru diode "B" results in applying a more negative voltage to the grid of V-16 which, as we have seen, results in increasing the oscillator frequency. C-73, R-84 and C-74 provide two time constant filters which are necessary to obtain "fly-wheel" action of this AFC sync circuit.

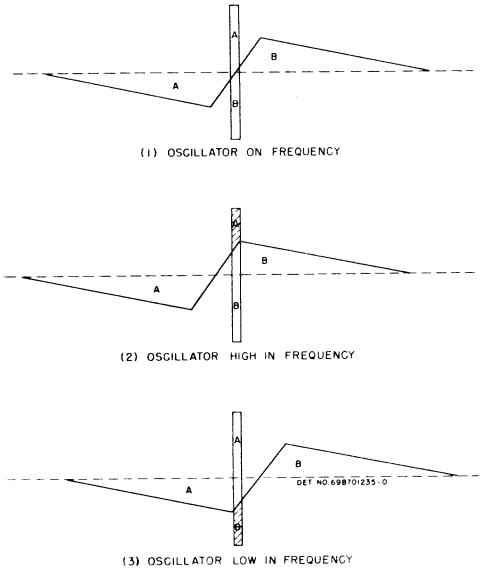


FIGURE 21. WAVEFORMS AT PHASE DETECTOR

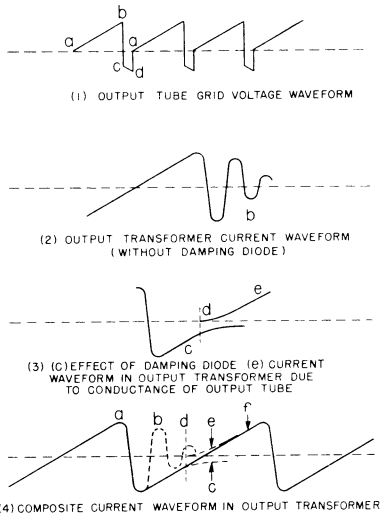


FIGURE 22. WAVEFORMS IN HORIZONTAL SCANNING SYSTEM

The Horizontal Output System

The combination sawtooth and pulse waveform developed across C-77 (680) and R-91 (1500) by the multivibrator circuit, is fed to the grid of the horizontal output tube V-17 (6BQ6). Figure 20 is a simplified schematic of the horizontal output system. It will be noted that in this system an auto-transformer is used. In the horizontal scan it is necessary that retrace be completed in about 7 microseconds. In order to accomplish reversal of current in the inductance of the output transformer and the yoke in this short a time, it is necessary to make this circuit resonant at such a frequency that the half cycle time will equal 7 microseconds, because only by shock exciting such a circuit into oscillation will retrace be accomplished in the time allowed. The circuit is made resonant by the inductance of the output transformer and yoke, the distributed capacity and the tube capacity. Bearing this in mind, the operation can be explained as follows. Referring to Figure 22(1), assume that the voltage on the grid of the output tube is increasing, point "a". The grid is now being made less negative and the output tube starts to draw current which is supplied from B plus thru the damping diode. When point "b" is reached on the grid voltage waveform, the output tube is suddenly cut off because its grid has been made highly negative (point "c" on the grid voltage waveform). With the tube cut off, the resonant plate load is undamped and the circuit is shocked into oscillation. The reversal of current through the output inductance produces a positive voltage pulse which makes the cathode of the damping diode (V-18) positive, with respect to its plate; therefore, it cannot conduct. C-82 (180) is placed across the diode to provide a low impedance for the oscillatory current. If the damping diode V-18 were not present, this oscillation would continue and current would flow in the output transformer as shown in Figure 22(2). In order to insure a linear trace, however, this oscillation must be stopped and the damping diode serves this purpose. When the current nears its maximum negative value, the polarity and amplitude of the voltage pulse on the damping diode is such that its plate becomes positive, with respect to its cathode, so that the tube conducts heavily and loads the circuit sufficiently to prevent continuation of the oscillation. The current then follows the decay curve shown at "c" in Figure 22(3). At the time ["d" in Figure 22(3)] the voltage at the grid of the output tube has become less than cut off [point "a" in Figure 22(1)] and the tube again demands current. The rising current in the tube results in superimposing the waveform "e" of Figure 22(3) on the current flow already in the output transformer due to the decaying current which resulted from the damped oscillation. Combination of these two currents results in the linear trace current indicated at "f" in Figure 22(4), which is a composite waveform of the entire action. During the peak conduction of the damping diode, C-83 (.1) charges and its polarity is such that when the output tube calls for current, the charge on the condenser will be in series with the B plus supply so that the voltage at the output tube plate is raised from the 250 volt B plus supply to about 475 volts by this so-called "bootstrap" voltage. When the grid voltage waveform of the output tube again reaches point "b" of Figure 22(1), the tube is cut off and another cycle starts.

In order to properly match the yoke inductance to the required output inductance for the tube, the yoke is connected to a tap on the winding which effectively makes an auto-transformer of this section. The positive pulse of voltage at this tap is coupled to the yoke thru C-81 (.1) and results in a sawtooth of current thru the yoke. It will be remembered that a portion of this pulse is also fed to the phase detector for the AFC action thru R-95 and R-96.

High Voltage

To take advantage of the large voltage pulse developed across the output inductance by the heavy current flow caused by the retrace oscillation, the plate winding is made the primary of an auto-transformer whose step-up ratio is such as to develop pulses of about 14 Kv at its high end. These pulses are rectified by V-19 (1B3) and the resulting DC is applied to the second anode of the picture tube. The filament voltage for the 1B3 rectifier is obtained from an additional winding on the output transformer.

CONTROLS

L-23 is the coil of the sine wave generating circuit in the horizontal multivibrator circuit and should be tuned to 15,750 cycles as explained in the service instructions.

R-89 is the horizontal hold control which can be adjusted for correct frequency operation of the multivibrator.

L-27, paralleling a small portion of the output choke controls, to a small degree, the inductance of the choke and acts as a size control.

REPLACEMENT PARTS LIST

NOTE: When ordering parts, specify model number of set in addition to part number and description of part.

CHASSIS TS-89, TS-94 & TS-95 ELECTRICAL PARTS

Ref. No.	Part No.	Description	List Price
Capacitors			
C-1	-	See Tuning Unit Parts List.....	-
C-2	21K77375	Ceramic tubular: 220 mmf 500V ...	.20
C-3	21A470789	Ceramic disc: 5000 mmf 450V	.30
C-4	21K77375	Ceramic tubular: 200 mmf 500V ..	.20
C-5	21K470322	Molded: 20 mmf 500V	.25
C-6	1X790189	Trimmer, ceramic: .5-3 mmf; with screw and mtg nut	.20
C-7	21A470790	Ceramic disc: 1500 mmf 500V	.30
C-8	21A470790	Ceramic disc: 1500 mmf 500V	.30
C-9	21K482726	Ceramic disc: 10,000 mmf 450V...	.30
C-10	-	See Tuning Unit Parts List	-
C-11	-	Fine tuning trimmer (part of station selector switch)	-
C-12	1X790189	Trimmer, ceramic: .5-3 mmf; with screw and mtg nut	.20
C-13	-	See Tuning Unit Parts List	-
C-14	1X792784	Trimmer, ceramic: 3-13 mmf; with screw & mtg nut	.45
C-15	-	See Tuning Unit Parts List	-
C-16	21K478280	Molded: 2 mmf 500V	.25
C-17	21K478234	Molded: 8 mmf 500V	.25
C-18	21A470789	Ceramic disc: 5000 mmf 450V	.30
C-19	21K77375	Ceramic tubular: 220 mmf 500V ..	.20
C-20	21K478280	Molded: 2 mmf 500V	.25
C-21	21A470789	Ceramic disc: 5000 mmf 450V	.30
C-22	21A470789	Ceramic disc: 5000 mmf 450V	.30
C-23	21A470790	Ceramic disc: 1500 mmf 500V	.30
C-24	21A470789	Ceramic disc: 5000 mmf 450V	.30
C-25	21A470789	Ceramic disc: 5000 mmf 450V	.30
C-26	21A470789	Ceramic disc: 5000 mmf 450V	.30
C-27	21K77375	Ceramic tubular: 220 mmf 500V ..	.20
C-28	21K470329	Molded: 30 mmf 500V (temperature compensated)	.30
C-29	21A470789	Ceramic disc: 5000 mmf 450V	.30
C-30	21A470789	Ceramic disc: 5000 mmf 450V	.30
C-31	21K77375	Ceramic tubular: 220 mmf 500V ..	.20
C-32	21A470789	Ceramic disc: 5000 mmf 450V	.30
C-33	21A470789	Ceramic disc: 5000 mmf 450V	.30
C-34	21A470789	Ceramic disc: 5000 mmf 450V	.30
C-35	21A470789	Ceramic disc: 5000 mmf 450V	.30
C-36	21K470329	Molded: 30 mmf 500V (temperature compensated)	.30
C-37	21K470324	Molded: 6 mmf 500V	.25
C-38	8R9854	Paper: .1 mf 200V	.25
C-39	21K780599	Ceramic tubular: 1000 mmf 500V .	.25
C-40	21K780599	Ceramic tubular: 1000 mmf 500V .	.25
C-41	21B77286	Ceramic tubular: 100 mmf 500V ..	.20
C-42	21K470329	Molded: 30 mmf 500V	.30
C-43	21A478274	Molded: 2.2 mmf 500V	.25
C-44	21K790683	Molded: 60 mmf 500V	.25
C-45	21A470789	Ceramic disc: 5000 mmf 450V	.30
C-46	21A470789	Ceramic disc: 5000 mmf 450V	.30
C-47	21K790439	Silver mica: 15 mmf (part of T-3 base)	.20
C-48	8R9866	Paper: .001 mf 600V	.20
C-49	21A790131	Ceramic tubular: 150 mmf 500V ..	.35
C-50	21R6590	Mica: 500 mmf 500V	.25
C-51	21R6590	Mica: 500 mmf 500V	.25
C-52	23A90205	Electrolytic: 10 mf 50V	.45
C-53	21K482726	Ceramic disc: 10,000 mmf 450V ..	.30
C-54	8R9869	Paper: .005 mf 600V	.20
C-55	21R6650	Mica: 68 mmf 500V	.20
C-56	8R9869	Paper: .005 mf 600V	.20
C-57	21K470322	Molded: 20 mmf 500V	.25
C-58	8R9873	Paper: .05 mf 600V	.25
C-59	8R9869	Paper: .005 mf 600V	.20
C-60	8R9869	Paper: .005 mf 600V	.20
C-61	8R9870	Paper: .01 mf 600V	.25
C-62	8R9851	Paper: .02 mf 200V	.20
C-63	8R9870	Paper: .01 mf 600V	.25
C-64	8R9866	Paper: .001 mf 600V	.20
C-65	21R6590	Mica: 500 mmf 500V	.25
C-66	8R9873	Paper: .05 mf 600V	.25
C-67	8R9875	Paper: .15 mf 600V	.35
C-68A, B,C,D	23B700160	Electrolytic: 4-section; A-80 mf/ 400V; B-40 mf/300V; C-20 mf/300V; D-10 mf/300V	3.05
C-69A, B,C,D	23B700159	Electrolytic: 4-section; A-80 mf/ 400V; B-40 mf/400V; C-100 mf/50V; D-20 mf/25V	3.10
C-70	8R9869	Paper: .005 mf 600V	.20
C-71	8R9866	Paper: .001 mf 600V	.20
C-72	8R9866	Paper: .001 mf 600V	.20
C-73	8R9866	Paper: .001 mf 600V	.20
C-74	8R9870	Paper: .01 mf 600V	.25
C-75	8R9869	Paper: .005 mf 600V	.20
C-76	21K400037	Ceramic tubular: 270 mmf 500V ..	.25
C-77	21R2741	Mica: 680 mmf 500V	.35
C-78	8R9869	Paper: .005 mf 600V	.20
C-79	8R9854	Paper: .1 mf 200V	.25
C-80	8R9874	Paper: .1 mf 600V	.35
C-81	8R490263	Molded paper: .1 mf 600V	.35
C-82	21K700883	Ceramic tubular: 180 mmf 3000V (TS-89)	.50
	21K700620	Ceramic tubular: 150 mmf 3000V (TS-94 & TS-95)	.30
C-83	8R9874	Paper: .1 mf 600V	.35
C-84	21K790574	Ceramic tubular:60 mmf (in deflection yoke)	.35
C-85	8R9874	Paper: .1 mf 600V	.35
C-86A, B & C	23B700613	Electrolytic: 3-section; A-80 mf/ 400V; B-20 mf/300V; C-10 mf/300V.	2.55
C-87A, B & C	23B700614	Electrolytic: 3-section; A-60 mf/ 400V; B-40 mf/300V; C-20 mf/25V..	2.45
C-88A & B	23B700615	Electrolytic: 2-section; A-35 mf/ 400V; B-100 mf/50V	1.50
C-89	8R9810	Paper: .25 mf 100V	.25
C-90	21A790833	High voltage: 500 mmf 20,000V (TS-94 & 95 only)	1.85
Fuses			
F-1	65A700851	Fuse: 1/4 amp; glass; with leads .	.25
Coils			
L-1	24A790033	Antenna impedance matching coil ..	.50
L-2	-	See Tuning Unit Parts List	-
L-3	-	See Tuning Unit Parts List	-
L-4	-	See Tuning Unit Parts List	-
L-4M	-	See Tuning Unit Parts List	-
L-5	-	See Tuning Unit Parts List	-
L-6	24K792825	RF coil (channel 13)	.25
L-7		See Tuning Unit Parts List	-
L-8	24K792577	RF choke: molded; 3.3 microhenries	.20
L-9	24K780128	RF choke: molded; 2.2 microhenries	.20
L-10	24K790035	RF choke: molded; 5.6 microhenries	.30
L-11	24B792586	1st IF coil: complete with LC trap, cores & mtg nuts	1.10
L-12	-	Trap coil (part of L-11)	-
L-13	24K790035	RF choke: molded; 5.6 microhenries	.20
L-14	-	Trap coil (part of L-15)	-
L-15	24K792587	2nd IF coil: complete with LC trap, cores & mtg nuts	1.40
L-16	24K792771	RF choke (yellow dot)	.35
L-17	24K792772	RF choke (red dot)	.35
L-18	24B792735	4.5 mc trap: less core & mtg nut..	.50
L-19	24A790579	Compensating coil: red dot (wound on R-36)	.50
L-20	24A470159	Sound take-off: less core & mtg nut	.35
L-21	24A792588	Compensating coil: grn-blk dot ...	.50
L-22	24B700548	Focus coil	9.00
L-23	24K790059	Horizontal oscillator: less core & clip	.95

Ref. No.	Part No.	Description	List Price
L-24	24C700050		
	or 24K792173		
	or 24C792506		
	or 24K792508		
	or 24C792171	(TS-89 only)	
	or 24K700714	(TS-89 only)	
	or 24K700694	(TS-89 only)	
	or 24K700778	(TS-89 only)	
	or 24K700776	(TS-89 only)	
	or 24K700774	(TS-89 only) Deflection yoke: complete	11.00
L-25	24K790145	RF choke: molded; 0.47 microhenries	.20
L-26	24K790145	RF choke: molded; 0.47 microhenries	.20
L-27	24K700089	Horizontal size coil: less core & clip	.55

Speakers

LS-1	50C791426	Electrodynamic: 5"; 100 ohm field (hot) 3.2 ohm voice coil (16F1H)	4.15
		.....exch	3.10
	50C489002	Electrodynamic: 6"; 100 ohm field (hot) 3.2 ohm voice coil (17T1A & 17T2A)	5.10
		exch	3.80
	50K700850	Electrodynamic: 8"; 100 ohm field (hot) 3.2 ohm voice coil (17K1A & 16K2H)	5.75
		exch	4.35
	50K700729	Electrodynamic: 8"; 100 ohm field (hot) 3.2 ohm voice coil (16T1H)	5.75
		exch	4.35
	50C791427	PM: 10"; 3.2 ohm voice coil (16F1H)	5.95
		exch	4.45

Resistors

Note: All resistors are insulated carbon type unless otherwise specified.

R-1	6R6397	22,000 10% 1/2W .....doz	1.00
R-2	6R6048	47,000 10% 1/2W .....doz	1.00
R-3	6R5614	56 10% 1/2W .....doz	1.00
R-4	6R2036	33 10% 1/2W .....doz	1.00
R-5	6R6229	1000 10% 1/2W .....doz	1.00
R-6	6R5659	3900 10% 1/2W .....doz	1.00
R-7	-	See Tuning Unit Parts List	-
R-8	6R6320	10,000 10% 1/2W .....doz	1.00
R-9	6R6038	1500 10% 1/2W .....doz	1.00
R-10	6R6117	5600 10% 1/2W .....doz	1.00
R-11	6R6393	1200 10% 1/2W .....doz	1.00
R-12	6R6080	4700 10% 1/2W .....doz	1.00
R-13	6R6428	6800 10% 1/2W .....doz	1.00
R-14	6R5550	47 10% 1/2W .....doz	1.00
R-15	6R2036	33 10% 1/2W .....doz	1.00
R-16	6R6069	2200 10% 1/2W .....doz	1.00
R-17	6R6394	12,000 10% 1/2W .....doz	1.00
R-18	6R6229	1000 10% 1/2W .....doz	1.00
R-19	6R5550	47 10% 1/2W .....doz	1.00
R-20	6R2036	33 10% 1/2W .....doz	1.00
R-21	6R6069	2200 10% 1/2W .....doz	1.00
R-22	6R6428	6800 10% 1/2W .....doz	1.00
R-23	6R2035	82 10% 1/2W .....doz	1.00
R-24	6R6038	1500 10% 1/2W .....doz	1.00
R-25	6R6031	100,000 10% 1/2W .....doz	1.00
R-26	6R6031	100,000 10% 1/2W .....doz	1.00
R-27	6R6460	1.5 meg 10% 1/2W .....doz	1.00
R-28	6R6117	5600 10% 1/2W .....doz	1.00
R-29	6R6004	1 meg 20% 1/2W .....doz	1.00
R-30	6R5550	47 10% 1/2W .....doz	1.00
R-31A, & B	18A791705	Contrast & volume control: dual; 2000 tapped and 1 meg respectively; includes power switch (TS-89 & 94)	2.60
	18A792009	Contrast & volume control: dual; 2000 tapped and 1 meg respectively; includes power switch (TS-95)	1.75

Ref. No.	Part No.	Description	List Price
R-32	6R6038	1500 10% 1/2W .....doz	1.00
R-33	6R5551	120 10% 1/2W .....doz	1.00
R-34	6R5551	120 10% 1/2W .....doz	1.00
R-35	6R6400	33,000 10% 1W .....each	.15
		doz	1.45
R-36	-	18,000 (part of L-19)	-
R-37	6R5671	4700 10% 2W	.20
R-38	6R6270	220 10% 1/2W .....doz	1.00
R-39	6R2004	8200 10% 1/2W .....doz	1.00
R-40	6R5660	180 10% 1/2W .....doz	1.00
R-41	6R6410	33,000 10% 1/2W .....doz	1.00
R-42	6R6428	6800 10% 1/2W .....doz	1.00
R-43	6R6428	6800 10% 1/2W .....doz	1.00
R-44	6R6446	4.7 meg 10% 1/2W .....doz	1.00
R-45	6R6414	270,000 10% 1/2W .....doz	1.00
R-46	6R6377	470,000 10% 1/2W .....doz	1.00
R-47	6R6377	470,000 10% 1/2W .....doz	1.00
R-48	6R6022	330 10% 1/2W .....doz	1.00
R-49	6R3922	1000 10% 2W	.20
R-50	6R6320	10,000 10% 1/2W .....doz	1.00
R-51	6R6004	1 meg 20% 1/2W .....doz	1.00
R-52	6R6004	1 meg 20% 1/2W .....doz	1.00
R-53	6R6397	22,000 10% 1/2W .....doz	1.00
R-54	6R2096	330,000 10% 1/2W .....doz	1.00
R-55	6R6428	6800 10% 1/2W .....doz	1.00
R-56	6R5581	3300 10% 1/2W .....doz	1.00
R-57	6R5581	3300 10% 1/2W .....doz	1.00
R-58	6R6031	100,000 10% 1/2W .....doz	1.00
R-59	6R6031	100,000 10% 1/2W .....doz	1.00
R-60	6R6397	22,000 10% 1/2W .....doz	1.00
R-61	6R6031	100,000 10% 1/2W .....doz	1.00
R-62	6R5577	2700 10% 1/2W .....doz	1.00
R-63	6R2096	330,000 10% 1/2W .....doz	1.00
R-64	18A90147	Vertical hold control: 1 meg	.80
R-65	6R6428	6800 10% 1/2W .....doz	1.00
R-66	6R5577	2700 10% 1/2W .....doz	1.00
R-67	6R6377	470,000 10% 1/2W .....doz	1.00
R-68	18A90145	Vertical size control: 5 meg	.80
R-69	6R6497	3.3 meg 10% 1/2W .....doz	1.00
R-70	6R6090	470 10% 1/2W .....doz	1.00
R-71	18A790146	Vertical linearity control: 2000..	1.50
R-72	6R6291	560 10% 1/2W (in deflection yoke) .....doz	1.00
R-73	6R6291	560 10% 1/2W (in deflection yoke) .....doz	1.00
R-74	6R6048	47,000 10% 1/2W .....doz	1.00
R-75	18A90147	Brightness control: 1 meg	.80
R-76	6R6004	1 meg 20% 1/2W .....doz	1.00
R-77	17K700782	Wire wound: 375 10% 10W	.35
R-78	18K700165	Focus control: 1000	1.55
R-79	17K792705	Wire wound: 2000 10% 10W	.35
R-80	6R6477	15,000 10% 1/2W .....doz	1.00
R-81	6R6031	100,000 10% 1/2W .....doz	1.00
R-82	6R6031	100,000 10% 1/2W .....doz	1.00
R-83	6R6446	4.7 meg 10% 1/2W .....doz	1.00
R-84	6R6446	4.7 meg 10% 1/2W .....doz	1.00
R-85	6R6428	6800 10% 1/2W .....doz	1.00
R-86	6R6229	1000 10% 1/2W .....doz	1.00
R-87	6R6090	470 10% 1/2W .....doz	1.00
R-88	6R5631	120,000 10% 1/2W .....doz	1.00
R-89	18A791574	Horizontal hold control: 100,000..	.80
R-90	6R6074	68,000 10% 1/2W .....doz	1.00
R-91	6R6038	1500 10% 1/2W .....doz	1.00
R-92	6R6377	470,000 10% 1/2W .....doz	1.00
R-93	6R5583	47 10% 1W .....each	.15
		doz	1.45
R-94	6R5690	6800 10% 2W	.20
R-95	6R5721	150,000 10% 1W .....each	.15
		doz	1.45
R-96	6R5721	150,000 10% 1W .....each	.15
		doz	1.45
R-97	6R5577	2700 10% 1/2W (in deflection yoke) .....doz	1.00
R-98	6R6328	100,000 10% 1W (in deflection yoke) .....each	.15
		doz	1.45
R-99	-	2700 (part of L-21)	-

Transformers

T-1	24K792578	Mixer IF: less cores & mtg nuts....	.45

Ref. No.	Part No.	Description	List Price
T-2	24B792585	3rd IF: less core & mtg nut	.65
T-3	24B790125	Ratio detector: complete with cores & clips; less shield can	2.00
T-4	25B790686	Audio output	1.40
T-5	25B792168	Vertical output	3.20
T-6	24K792753	High voltage transformer (TS-89) ..	7.25
	24K701099	High voltage transformer (TS-94 & TS-95)	7.25
T-7	25B790140	Filament transformer: isolating....	3.05
T-8	25C700161		
or	25C700169		
or	25C701025		
or	25K700882	Power Transformer	14.20

TUNING UNIT TT-14 (TS-89 & TS-94)

S-1	1X700132	TT-14 tuning unit: includes station selector switch, fine tuning trimmer, and the following components:	10.85
C-1	21K478234	Capacitor: molded; 8 mmf	.25
C-10	21K482726	Capacitor, ceramic disc; 10,000 mmf	.30
C-13	21K482726	Capacitor, ceramic disc; 10,000 mmf	.30
C-15	21K400173	Capacitor, molded: 10 mmf (temperature comp)	.30
L-2	24C792764	Antenna coil: channels 2 through 6; includes L-2A through L-2E (L-2F through L-2L are part of switch)...	.25
L-3	24K790536	RF coil: channels 2 through 6; includes L-3A through L-3E (L-3F through L-3L are part of switch)	.20
L-4	24C700114	Oscillator coil: channels 2 through 6; includes L-4A through L-4E (L-4F through L-4L are part of switch)	.05
L-4M	24K700115	Oscillator coil: channel 10	.10
L-5	24K792765	Antenna primary: low freq (includes L-5A, L-5B, L-5C)	.15
L-7	24K700116	Oscillator coil: channel 13	.10
R-7	6R6069	Resistor: 2200 10% 1/2W .....doz	1.00
	42K790136	Clip, spring (on collar)	.10
	43K700725	Collar, spring (on rear end of fine tuning shaft)	.10
	42K700726	Shaft, fine tuning	.50

TUNING UNIT TT-13 (TS-95) Same as TT-14 except for shaft length.

S-1	1X700100	TT-13 tuning unit: includes same components as TT-14 except:	10.85
	47K700728	Shaft, fine tuning	.50

Tubes

V-1	6CB6	RF Amplifier	-
V-2	12AT7	Mixer-Oscillator	-
V-3	6AU6	1st IF Amp	-
V-4	6AU6	2nd IF Amp	-
V-5	6AG5	3rd IF Amp	-
V-6	6AL5	Video Detector	-
V-7	6AH6	Video Amp	-
V-8	6AU6	Audio Driver-Limiter	-
V-9	6AL5	Ratio Detector	-
V-10	6J5	Audio Amp	-
V-11	6V6	Audio Output	-
V-12	6SN7GT	1st & 2nd Clippers	-
V-13	12AU7	Vertical Sweep Generator	-
V-14	6W6	Vertical Sweep Output	-
V-15	6AL5	Phase Detector	-
V-16	6SN7GT	Horizontal Oscillator	-
V-17	6BQ6GT	Horizontal Output & High Voltage Generator	-
V-18	6W4GT	Damping Diode	-
V-19	1B3GT	High Voltage Rectifier	-
V-20	16TP4	Picture Tube: rect (TS-89)	-
	16GP4	Picture Tube: round (TS-94 & 95)...	-
V-21	5U4G	Low Voltage Rectifier	-

Ref. No.	Part No.	Description	List Price
CHASSIS TS-89 MECHANICAL PARTS			
	7K700153	Bracket, coil mtg: cad pl (L-27)	.05
	7B700194	Bracket, focus coil housing: cop pl (around focus coil)	.60
	7A700196	Bracket, focus coil mtg: cop pl (across top of focus coil)	.25
	7A791965	Bracket, interlock safety: cad pl	.05
	1X700526	Bracket, rear tube support: with grounding spring & anode lead ins. (large rear support bracket)	1.50
	7A792568	Bracket, yoke adjustment: cop pl (across top of yoke)	.30
	35K700532	Bumper, rubber (circular bumper in rear support brkt)	.15
	42A701441	Cap, plate: with insulator (V-17)	.25
	42K471342	Cap, plate (V-19)	.05
	42A700147	Clamp, lead retainer (on high volt rect filament leads) .....doz	.15
	42B70721	Clip, coil mtg (T-3 secondary) .....doz	.25
	42A76244	Clip, coil retainer (L-23) .....doz	.25
	42A72609	Clip, tube shield grounding (V-10)	.05
	42A780193	Connector, 2nd anode: with cap & lead ...	1.00
	39K17396	Contact, pin terminal (in spkr receptacle) .....per/c	.50
	46A478242	Core, brass, & screw (T-2)	.15
	46K791756	Core, brass, & screw (L-11 & L-15)	.05
	46A470310	Core, iron, & screw (T-1 primary, L-18 & L-20)	.15
	46A70023	Core, iron, & screw (T-3 primary, L-14)..	.15
	46A470302	Core, iron, & screw (T-3 secondary)	.20
	46K480256	Core, iron, & screw (L-12, L-14 & T-1 secondary)	.15
	46K471143	Core, iron, & screw (L-23)	.15
	46A700090	Core, iron: with slide adjustment (L-27).	.45
	15B791111	Cover, test socket	.10
	35K792757	Cushion, focus coil: rubber	.20
	35K792183	Cushion, pad (at top of picture tube front)	.35
	35K792182	Cushion, pad (beneath picture tube front)	.10
	35K792184	Cushion, pad (small pads at sides of picture tube)	.05
	5A790684	Grommet, rubber (V-14 & V-16 socket mtg) .....doz	.35
	5K470916	Grommet, insulating: 3/16" hole.....doz	.20
	5K792031	Grommet, insulating: 9/32" hole .....doz	.30
	35A791581	Insulator, anode lead (dresses 2nd anode lead from chassis) .....doz	.20
	14A780184	Insulator, antenna lead (beneath antenna input terminal strip) .....doz	.15
	14K87179	Insulator, coil (in ratio detector can) .....doz	.25
	14K791892	Insulator, coil (in 3rd IF can) .....doz	.35
	4S7655	Lockwasher, int: 3/8"; cad pl (front control mtg) .....per/c	.50
	4S2640	Lockwasher, int: 1/2" thin; cad pl (mounts 7B700194 bracket) .....doz	.25
	4S7650	Lockwasher, int: #6; cad pl (T-2 shield mtg) .....per/c	.50
	4S7688	Lockwasher, int-ext; 1/4"; cad pl (mounts 7B700194 bracket) .....doz	.15
	4S9751	Lockwasher, int-ext: #8; cad pl (T-8 mtg) .....per/c	.50
	29R5239	Lug, soldering: #8 HT .....doz	.15
	29R5347	Lug, soldering: 8L HT (on power transformer mtg screw) .....doz	.15
	2A470049	Nut, coil & core mtg (T-1, T-2, L-11, L-12, L-14, L-15, L-18 & L-20) .....doz	.50
	2K791404	Nut, coil & core mtg (L-27) .....doz	.50
	4S7022	Nut, hex: 1/4-20 x 7/16; cad pl (mounts 7B700194 brkt) .....doz	.15
	2S7004	Nut, hex: 3/8-32 x 9/16; cad pl (front control mtg) .....doz	.20
	2S7003	Nut, hex: 8-32 x 5/16 stl; cad pl (T-8 mtg) .....per/c	.50
	2S7050	Nut, hex: palnut; 6-32 (T-2 shield mtg) .....per/c	.50
	2S7051	Nut, hex: palnut; 3/8-32 x 9/16; cad pl (rear controls mtg) .....doz	.15
	2A790191	Nut, special: cad pl (mounts three ceramic trimmers) .....doz	.30

Part Number	Description	List Price
2B70703	Nut, special: palnut (T-3 primary core mtg) .....doz	.30
64K791818	Plate, chassis cover: cop pl (removable plate on chassis side)	.30
64A90034	Plate, electrolytic mtg (when 2 electrolytics used)	.05
64A700690	Plate, electrolytic mtg: cad pl (when 3 electrolytics used) .....doz	.35
64K700748	Plate, socket cover (covers unused electrolytic socket) .....doz	.30
64A700745	Plate, transformer cover (beneath power transformer)	.10
28K471323	Plug, line cord: 2-pin; waxed	.20
9A22367	Receptacle, 5-prong (speaker receptacle).	.15
5S8497	Rivet: .088 x 1/8 stl; pol nkl (V-1, V-2, & V-5 socket mtg) .....per/c	.50
5S7770	Rivet: .088 x 5/32 stl; pol nkl (mounts antenna lead insulator) .....per/c	.50
5S2815	Rivet: .088 x 7/32 stl; pol nkl (9K780442 & 9K484167 socket mtg) .....per/c	.50
5S7707	Rivet: .122 x 5/32 stl; pol nkl (9K471270 socket mtg) .....per/c	.50
5S7701	Rivet: .122 x 3/16 stl; pol nkl (mounts anode lead insulator) .....per/c	.50
5S7703	Rivet: .122 x 7/32 stl; pol nkl (grounding spring mtg) .....per/c	.50
5S7700	Rivet: .122 x 1/4 stl; pol nkl (line cord plug mtg) .....per/c	.50
5S7728	Rivet: .122 x 5/16 stl; pol nkl (V-19 socket mtg) .....per/c	.50
5S6846	Rivet: .145 x 5/32 stl; pol nkl (audio and vertical output transformer mtg).doz	.15
5K71246	Rivet, shoulder: nkl pl (V-14 & V-16 socket mtg) .....doz	.15
3A700198	Screw, eccentric; cad pl (7B700194 bracket mtg)	.05
3S490354	Screw, machine: 6-32 x 5/8 slotted hex head; cad pl (C-6 & C-12 trimmer adjustment) .....doz	.15
3S490822	Screw, machine: 6-32 x 1 slotted hex head; cad pl (C-14 trimmer adjustment).....doz	.15
3S7163	Screw, machine: 8-32 x 1/4 plain hex head; cad pl (mounts V-19 mtg plate assembly) .....per/c	.50
3S490642	Screw, machine: 10-32 x 1-1/2 plain hex head; cad pl (tube retainer strap mtg) .....doz	.15
3S7454	Screw, sheet metal: #8 x 1/4 PKZ plain hex head; cad pl (video shield mtg)per/c	.50
3S7467	Screw, sheet metal: #8 x 3/8 PKZ plain hex head; cad pl (T-8 mtg) .....doz	.15
3A470369	Screw, thumb: cad pl (deflection yoke adjustment) .....doz	.50
26K485936	Shield, coil (T-3)	.20
1X792785	Shield, coil: with spade bolts (T-2 can).	.30
26A700717	Shield, video: cad pl (shields video amp from horizontal trans)	.10
26A26283	Shield, tube (for glass 6J5 audio amp)....	.05
26A90301	Shield, tube: miniature	.15
9K700549	Socket, picture tube: 5-pin; with leads..	.70
9K700551	Socket, picture tube: 12-pin; with leads.	.75
9A792167	Socket, tube: miniature 7-prong (V-1)....	.20
9K780442	Socket, tube: miniature 7-prong (V-3, V-4 & V-6)	.20
9K484167	Socket, tube: miniature 7-prong (V-7, V-8, V-9 & V-15)	.20
9A471343	Socket, tube: miniature; tan molded (V-5)	.35
9A485495	Socket, tube: noval; laminated; less adapter (V-13)	.25
9K484816	Socket, tube: noval; molded (V-2)	.40
9K471270	Socket, tube: octal (all octal sockets except V-14, V-16 & V-19)	.20
9A790685	Socket, tube: octal (V-14 & V-16)	.20
9A480274	Socket, tube: octal; molded (V-19)	.20
41A70705	Spring, coil (T-3) .....doz	.15
41A700143	Spring, compression (L-27) .....per/c	.50
41A700563	Spring, grounding (grounds picture tube outer coating)	.10
41K792447	Spring, tension (picture tube support)...	.20
1X792436	Strap, picture tube mtg: with pads (lower strap around tube front)	1.40
1X792437	Strap, picture tube retainer: with pad (upper strap around tube front)	1.20
31A21990	Strip, terminal: 2-screw (antenna input terminal)	.10
31K31217	Strip, terminal: 1 ins, #2 gnd, 3/8" spacing	.05
31K90044	Strip, terminal: 2 ins, #2 gnd; 3/8" spacing	.05
31A700148	Strip, terminal: 2 ins, #2 mtg; 3/8" spacing	.05
31K471564	Strip, terminal: 3 ins, #2 gnd; 3/8" spacing	.05
31K51511	Strip, terminal: 3 ins, #3 gnd; 3/8" spacing	.05
31A700697	Strip, terminal: 3 ins, #3 gnd; #4 large; 3/8" spacing	.05
31K471565	Strip, terminal: #3 ins, #4 gnd; 3/8" spacing	.05
31K37494	Strip, terminal: 4 ins, #3 gnd; 3/8" spacing	.10
31A790122	Strip, terminal: 4 ins, #3 gnd; 1/2" spacing	.10
31K471569	Strip, terminal: 4 ins, #4 gnd; 3/8" spacing	.10
31K26658	Strip, terminal: 5 ins, #3 gnd; 3/8" spacing	.10
31K90046	Strip, terminal: 5 ins, #4 gnd; 3/8" spacing	.10
31A791613	Strip, terminal: special (on high voltage transformer)	.05
24A792821 or 24A792827	Trap, ion: PM; with collar	1.00
1X700523	Tube mtg plate: with mtg bracket and tube socket (for high voltage rectifier)	.35
4S7569	Washer, flat: 5/16 x .145 x .027 cad pl (V-14 & V-16 socket mtg) .....per/c	.50
4S1720	Washer, flat: 3/8 x .156 x .030 stl; cad pl (mounts rear tube support brkt).per/c	.50
4S1706	Washer, flat: 3/8 x .203 x .033 stl; cad pl (tube retainer strap mtg)...per/c	.50
4A77577	Washer, insulating (L-27 mtg) .....doz	.15
4A791447	Washer, insulating (T-8 mtg) .....doz	.15
INSULATING COMPONENTS		
11M490423	Coating, high voltage insulating: red-brown (on high voltage rectifier socket)	
11M490387	Wax, Biwax (on high volt transformer)....	
CHASSIS TS-94 & TS-95 MECHANICAL PARTS - Same as TS-89 except:		
37K790951	Band, rubber (around gasket)	.05
7K485464	Bracket, chassis mtg	.10
1X700677	Bracket, rear tube support: includes anode lead insulator (large rear support bracket)	1.65
7A791956	Bracket, tube mtg ("L" bracket on chassis front)	.15
39A790979	Contact, high voltage lead (picture tube contact)	.10
32B790946 or 32K700692	Gasket, picture tube (plastic ring around picture tube)	4.60
4S7650	Lockwasher, internal: #6; cad pl (C-90 mtg) .....per/c	.50
4S7652	Lockwasher, external: #10; cad pl (retainer strap mtg) .....per/c	.50
13D790936 or 13K792048	Mask, picture tube	3.00
2S7005	Nut, hex: 6-32 x 1/4; cad pl (C-90 mtg) .....per/c	.50
35K700799	Pad, cushion (inside gasket for securing picture window - for Rauland picture tube only)	.05
64D791722	Plate, front tube support: fibreboard....	.70
28A790978	Plug, high voltage lead	.05
9A790977	Receptacle, HV lead (less 41A790942 insert spring & HV cable)	.15
3S490642	Screw, machine: 10-32 x 1-1/2 plain hex head; cad pl (retainer strap mtg) ...doz	.15

Part Number	Description	List Price
1X700031	Shield, picture tube: plastic; with HV cable, contact lead & plug (around metal cone of picture tube)	2.95
41A791727	Spring, grounding (grounds front of picture window)	.05
41A790942	Spring, insert (for HV lead receptacle 9A790977)	.05
42A791958	Strap, tube retainer (metal strap around picture tube front)	.40
61C790865	Window, picture tube: 16"; safety glass..	8.20

MODEL 16F1H CABINET PARTS

1X792539	Back Cover (AM-FM): complete with loop antenna and line cord	4.00
1X700879	Back Cover (TV): complete with picture tube rear cover, centering adjustment cover and line cord	3.30
64C792544	Back Cover: 36" x 16" (covers album compartment & radio-phono)	1.60
13D792187	Bezel, picture tube (picture window frame)	8.85
1X792494	Bracket, window mtg: with pad	.10
16F792474	Cabinet, console: red-brown mahogany; less bezel, window & dial escutcheon....	-
55B72307	Catch, bullet: statuary bronze (door latch - on cabinet)	.05
42A470832	Clamp, cable: plastic (for line cord)....	.10
42A792502	Clip, mask retainer .....doz	.30
13K792476	Cloth, grille: mahogany	3.00
30K21859	Cord, line: with plug: 9 ft (AM-FM back cover)	1.00
1X790358	Cord, line: with plug & shell (TV back cover)	1.35
15B791076	Cover, centering adjustment: rubber (on back cover)	.40
1X792546	Cover, chassis bottom: with hi-voltage insulator	3.30
15A690556	Cover, interlock switch: (on AM-FM back cover)	.15
15B790987	Cover, picture tube rear (on back cover).	.70
13K792535	Escutcheon, dial	2.25
5S3139	Eyelet: .202 x .475 brass; ant cop (on TV back cover) .....doz	.15
5S7820	Eyelet: .450 x .125 brass; CSP (on spkr lead) .....doz	.15
5S7855	Eyelet: .484 x .156 brass; CSP (on spkr lead) .....doz	.15
55K790731	Hinge, stop: semi-invisible; statuary bronze (record album door -specify left or right-hand)	.30
55K790733	Hinge, stop: semi-invisible; statuary bronze (upper doors -specify left or right-hand)	.25
14K790743	Insulator, chassis base (under AM-FM chassis)	.50
14B792069	Insulator, hi-voltage (on chassis bottom)	.20
14K791482	Insulator, shield: 2-1/2" x 3/4" (phono & power lead clamp) .....doz	.25
36A485457	Knob, control (hold controls on TV chassis rear)	.15
36B790505	Knob, control (contrast)	.65
36B790506	Knob, control (station selector-TV)	.80
36K792562	Knob, control: wal-mahogany (AM-FM controls)	.45
36K792078	Knob, control: wal-mahogany (TV volume & fine tuning)	.45
4S7650	Lockwasher: #6 int; cad pl (hi-volt insulator & TV line cord mtg) .....per/c	.50
4S9751	Lockwasher: #8 int-ext; cad pl (spkr mtg) .....per/c	.50
62K70581	Logotype: "Motorola"; gold enamel.....	.40
1X792503	Mask, picture tube: with retainer clips..	5.25
2S7005	Nut, hex: 6-32 x 1/4 stl; cad pl (interlock plug mtg) .....per/c	.50
2S7003	Nut, hex: 8-32 x 5/16 stl; cad pl (spkr mtg) .....per/c	.50
2A71185	Nut, teenut (for motor board)	.05
35K792499	Pad, cushion (window mtg) .....doz	.30
35K792501	Pad, cushion (on window mtg brkts)....doz	.20
64K792537	Panel, separator (between TV & radio chassis)	.30
28A791030	Plug, 2-pin (on TV line cord)	.05
55K790735	Pull, door: brushed brass (album & fixed door)	.75
55K792482	Pull, door: brushed brass (right & left upper door)	1.25
9K700142	Receptacle, 2-prong: rect (line cord on AM-FM back)	.10
9A791031	Receptacle, 2-prong: round (TV power)....	.05
9K90618	Receptacle, 4-pin: with shell (antenna receptacle)	.10
5S7706	Rivet: .122 x 1/8 stl; pol nkl (hi-volt insulator mtg) .....per/c	.50
5S1683	Rivet: .122 x 3/16 brs; pol nkl (mask clip mtg) .....per/c	.50
5S7751	Rivet: .122 x 1/4 stl; ant cop (picture tube rear cover mtg) .....per/c	.50
5S7700	Rivet: .122 x 1/4 stl; pol nkl (AM-FM interlock cover mtg) .....per/c	.50
5K791856	Rivet, shoulder: annealed (line cord mtg) .....doz	.30
3S7471	Screw, machine: 6-32 x 1/4 thread cut plain hex head; cad pl (interlock receptacle mtg) .....doz	.15
3S490354	Screw, machine: 6-32 x 5/8 slotted hex head; cad pl (interlock plug mtg)....doz	.15
3S7374	Screw, machine: 8-32 x 5/16 plain hex head; cad pl (bezel mtg) .....per/c	.50
3K489169	Screw, machine: 8-32 x 1 cross slot head; statuary bronze (large door pull mtg)doz	.15
3K653	Screw, machine: 8-32 x 1-1/4 (spkr mtg) .....doz	.20
3S7536	Screw, sheet metal: #6 x 3/8 PKA slotted acorn head; ant cop (large back cover mtg) .....per/c	.50
3S7509	Screw, sheet metal: #6 x 5/8 PKA slotted acorn head; ant cop (back cover mtg).doz	.15
3S490819	Screw, sheet metal: #6 x 7/8 PKA slotted acorn head; statuary bronze (back cover mtg) .....doz	.15
3S8153	Screw, sheet metal: #8 x 3/4 PKA plain hex head; cad pl (chassis bottom cover mtg) .....doz	.15
3S7457	Screw, sheet metal: #8 x 7/8 PKA plain hex head; cad pl (AM-FM chassis mtg).doz	.15
3S3359	Screw, sheet metal: #8 x 1-5/8 PKA plain hex head; cad pl (TV chassis mtg)....doz	.15
55K72308	Strike & nail: 1/2 steel; statuary bronze (door latch -on door)	.05
35A791581	Strip, lead (dresses leads to side of cab) .....doz	.20
64K791029	Tracks & channel (radio & record changer drawer tracks) .....pair	3.50
4A792497	Washer, cut: cad pl (bezel mtg) .....doz	.25
4K780040	Washer, felt (under TV control knobs).doz	.25
4S1767	Washer, flat: 5/16 x .130 x .025 brs; pol nkl (mask clip mtg) .....per/c	.50
4S7562	Washer, flat: 7/16 x .187 x .033 stl; cad pl (interlock plug mtg) .....per/c	.50
4S7629	Washer, flat: 1/2 x 3/16 x .048 stl; cad pl (bottom cover mtg) .....per/c	.50
4S490412	Washer, flat: 11/16 x .156 x .031 stl; cad pl (AM-FM chassis mtg) .....doz	.15
4S7646	Washer, flat: 11/16 x 3/16 x .067; cop pl (TV chassis mtg) .....per/c	.50
61C792189	Window, picture tube: 16"; safety glass..	8.25

MODEL 16F1BH CABINET PARTS - Same as 16F1H except:

16K792475	Cabinet, console: limed oak; less bezel, window & dial escutcheon	-
55K482792	Catch, bullet: brass (door latch - on cabinet)	.05
13K792477	Cloth, grille: blonde	2.50
55K790732	Hinge, stop: semi-invisible; brushed brass (record album door - specify left or right-hand)	.45

Part Number	Description	List Price
55K790734	Hinge, stop: semi-invisible; brushed brass (upper doors - specify left or right-hand)	.25
36K792561	Knob, control: tan (AM-FM controls)	.45
36K792079	Knob, control: tan (TV volume & fine tuning)	.45
3K489170	Screw, machine: 8-32 x 1 cross slot head; satin brass (large door pull mtg)....doz	.15
55K482793	Strike & nail: 1/2 stl; brs (door latch - on door)	.05

MODEL 16T1LH CABINET PARTS

1X700878	Back Cover: complete with picture tube rear cover, centering adj cover & line cord	3.85
13D792187	Bezel, picture tube (window frame)	8.85
1X792494	Bracket, window mtg: with pad	.10
37A12748	Bumper, recess: rubber (cabinet feet)....	.05
16E792465	Cabinet, table model: red-brown mahogany; less bezel & window	-
42A792502	Clip, mask retainer .....doz	.30
13K792466	Cloth, grille: mahogany	.30
30B470756	Cord, line: with plug & receptacle	1.50
15B791076	Cover, centering adj: rubber (on back cover)	.40
1X792495	Cover, chassis bottom: with hi-voltage insulator	1.80
15B790987	Cover, picture tube rear (on back cover).	.70
5S3139	Eyelet: .202 x .475 brass; ant cop pl (on back cover) .....doz	.15
14B792069	Insulator, hi-voltage (on chassis bottom cover)	.20
36B790506	Knob, control (station selector)	.80
36B790505	Knob, control (contrast)	.65
36A485457	Knob, control: black (hold controls on chassis rear)	.15
36K792078	Knob, control: wal-mahog (volume & fine tuning)	.45
4S7650	Lockwasher: #6 int; cad pl (line cord mtg) .....per/c	.50
4S9751	Lockwasher: #8 int-ext; cad pl (spkr mtg) .....per/c	.50
62K790672	Logotype: "Motorola"; brass pl	.65
1X792503	Mask, picture tube: with retainer clips..	5.25
13A792195	Medallion: brs pl ("M" on cabinet front).	.55
	Molding, bead: 3/16 x 1 x 5; mahogany (strip at each side of cabinet top)	
2S7003	Nut, hex: 8-32 x 5/16 stl; cad pl (spkr mtg) .....per/c	.50
2S490359	Nut, speednut (spkr mtg) .....doz	.15
2A912119	Nut, wing nut: cad pl (spkr mtg) .....doz	.30
35K792499	Pad, cushion (window mtg) .....doz	.30
35K792501	Pad, cushion (on window mtg brkts)....doz	.20
5K791856	Rivet, shoulder: annealed (line cord mtg) .....doz	.30
5S7706	Rivet: .122 x 1/8 stl; pol nkl (hi-volt insulator mtg) .....per/c	.50
5S7701	Rivet: .122 x 3/16 stl; pol nkl (mask clip mtg) .....per/c	.50
5S7751	Rivet: .122 x 1/4 stl; ant cop pl (picture tube rear cover mtg).....per/c	.50
3K791825	Screw, decorative head: insulated; 8-32 x 1; statuary bronze (speaker mtg) ....doz	.15
3S7374	Screw, machine: 8-32 x 5/16 plain hex head; cad pl (bezel mtg) .....per/c	.50
3S490453	Screw, sheet metal: #6 x 3/8 PKA plain acorn head; ant cop pl (back cover mtg) .....doz	.15
3S7536	Screw, sheet metal: #6 x 3/8 PKA slotted acorn head; ant cop (window mtg brackets) .....per/c	.50
3S490454	Screw, sheet metal: #6 x 5/8 PKA plain acorn head; ant cop pl (back cover mtg) .....doz	.15
3S490332	Screw, sheet metal: #6 x 7/8 PKA plain hex head; statuary bronze (back cover mtg) .....per/c	.50
3S8104	Screw, sheet metal: #8 x 1-1/2 PKA plain hex head; cad pl (chassis mtg) .....doz	.15
35A791581	Strip, lead (dresses leads to side of cabinet) .....doz	.20
4A792497	Washer, cut: cad pl (bezel mtg).....doz	.25
4K780040	Washer, felt (under control knobs) ...doz	.25
4S1767	Washer, flat: 5/16 x .130 x .025 brass; pol nkl (mask clip mtg) .....per/c	.50
4S7646	Washer, flat: 11/16 x 3/16 x .067; cop pl (chassis mtg) .....per/c	.50
61C792189	Window, picture tube: 16"; safety glass..	8.25

MODEL 16T1BH CABINET PARTS - Same as 16T1H except:

16K792559	Cabinet, table model: limed oak; less window & bezel	-
13K792573	Cloth, grille: eggshell	.30
36K792079	Knob, control: tan (volume and fine tuning)	.45
3A791824	Screw, decorative head: insulated; 8-32 x 1; brs pl (spkr mtg) .....doz	.15

MODEL 16K2H CABINET PARTS

1X700822	Back Cover Assembly: complete with line cord, picture tube rear cover, and centering adjustment cover	3.90
13K792792	Bezel, picture tube (window frame)	6.65
16F700006	Cabinet, console: red-brn mahog; less bezel	-
13K700008	Cloth, grille: negre	3.75
30B470756	Cord, line: with plug & receptacle	1.50
15K792068	Cover, centering adjustment: rubber (on back cover)	.40
1X792546	Cover, chassis bottom: with high voltage insulator	3.30
15B790987	Cover, picture tube rear (on back cover).	.70
5S3139	Eyelet: .202 x .475 brass (on back cover) .....doz	.15
14B792069	Insulator, high voltage (on chassis bottom cover)	.20
36B790505	Knob, control (contrast)	.65
36B790506	Knob, control (station selector)	.80
36K792078	Knob, control: wal-mahog (fine tuning & off-volume)	.45
36A485457	Knob, control: black (hold controls on chassis rear)	.15
4S7650	Lockwasher, int: #6; cad pl (hi-volt insulator mtg) .....per/c	.50
4S2639	Lockwasher, int-ext: 5/16 (chassis mtg) .....doz	.40
4S7657	Lockwasher, ext: #8 cad pl (spkr mtg)per/c	.50
62K790672	Logotype: "Motorola"; brass pl	.65
13A790824	Medallion ("M" on grille cloth)	.50
2S7003	Nut, hex: 8-32 x 5/16 stl; cad pl (spkr mtg) .....per/c	.50
2S7007	Nut, hex: 8-32 x 1/4; cad pl (spkr mtg) .....per/c	.50
2S7022	Nut, hex: 1/4-20 x 7/16 steel; cad pl (chassis mtg) .....doz	.15
5S7706	Rivet: .122 x 1/8 stl; pol nkl (hi-volt insulator mtg) .....per/c	.50
5S7751	Rivet: .122 x 1/4 stl; ant cop (picture tube rear cover mtg) .....per/c	.50
5K790011	Rivet, shoulder: annealed (line cord plug) .....doz	.25
3S2226	Screw, machine: 1/4-20 x 1-1/4 plain hex head; stl; cad pl (chassis mtg) .....doz	.50
3S7374	Screw, machine: 8-32 x 5/16 plain hex head; cad pl (bezel mtg) .....per/c	.50
3S7536	Screw, sheet metal: #6 x 3/8 PKA slotted acorn head; ant cop finish (back cover mtg) .....per/c	.50
3S7509	Screw, sheet metal: #6 x 5/8 PKA slotted acorn head; ant cop finish (back cover mtg) .....doz	.15
3S490819	Screw, sheet metal: #6 x 7/8 PKA slotted acorn head; ant cop (back cover mtg).doz	.15
3S8153	Screw, sheet metal: #8 x 3/4 PKA plain hex head; cad pl (bottom cover mtg).....doz	.15
3K653_	Screw, speaker mtg .....doz	.20

Part Number	Description	List Price
56K700009	Strap, antenna support (lower loop ant support)	.10
35A791581	Strip, lead (dresses leads to side of cabinet) ....doz	.20
4K780040	Washer, felt (under control knobs)....doz	.25
4S1720	Washer, flat: 3/8 x .156 x .030 stl; cad pl (line cord mtg) ....per/c	.50
4S488234	Washer, flat: 7/8 x 3/8 x .060 stl; cad pl (chassis mtg) ....doz	.25
4S7562	Washer, flat: 7/16 x .187 x .033 stl; cad pl (speaker mtg) ....per/c	.50
4S7629	Washer, flat: 1/2 x 3/16 x .048 stl; cad pl (bottom cover mtg)....per/c	.50
4S7563	Washer, flat: 5/8 x.203 x .033 stl; cad pl (bezel mtg) ....doz	.15

MODEL 16K2BH CABINET PARTS - Same as 16K2H except:

16K700007	Cabinet, console: limed oak	-
13K791084	Cloth, grille: blonde	3.75
36K792079	Knob, control: tan (fine tuning & off-volume)	.45

MODEL 17K1A CABINET PARTS

1X700822	Back Cover: complete with picture tube rear cover, centering adjustment cover, and line cord	3.90
13K792792	Bezel, picture tube (window frame).....	6.65
16F700633	Cabinet, console: red-brn mahog; less bezel	-
	Cloth, grille: mahogany: 21-1/2 x 14-1/4.	
30B470756	Cord, line: with plug & receptacle	1.50
15K792068	Cover, centering adjustment (on back cover)	.40
1X792546	Cover, chassis bottom: with hi-volt insulator	3.30
15K700162	Cover, picture tube rear (on back cover).	.45
5S3139	Eyelet: .202 x .475 brs; ant cop finish (on back cover) ....doz	.15
14B792069	Insulator, high-voltage (on bottom cover)	.20
36B790505	Knob, control (contrast)	.65
36B790506	Knob, control (station selector)	.80
36K780522	Knob, control: ivory (hold controls on chassis rear)	.15
36K792078	Knob, control: wal-mahog (fine tuning & off-volume)	.45
4S7650	Lockwasher, internal: #6; cad pl (hi-volt insulator mtg) ....per/c	.50
4S2639	Lockwasher, internal-external: 5/16"; cad pl (chassis mtg) ....doz	.40
4S7657	Lockwasher, external: #8; cad pl (spkr mtg) ....per/c	.50
62K790672	Logotype: "Motorola"; brs pl	.65
13A790824	Medallion: brs pl ("M" on grille cloth)..	.50
2S7007	Nut, hex: 8-32 x 1/4; cad pl (spkr mtg) ....per/c	.50
2S7003	Nut, hex: 8-32 x 5/16; cad pl (spkr mtg) ....per/c	.50
2S7022	Nut, hex: 1/4-20 x 7/16 stl; cad pl (chassis mtg) ....doz	.15
5S7706	Rivet: .122 x 1/8 stl; pol nkl (hi-volt insulator mtg) ....per/c	.50
5S7751	Rivet: .122 x 1/4 stl; ant cop (picture tube rear cover mtg) ....per/c	.50
5K790011	Rivet, shoulder: annealed (line cord mtg) ....doz	.25
3S7374	Screw, machine: 8-32 x 5/16 plain hex head; cad pl (bezel mtg) ....per/c	.50
3K653	Screw, machine: 8-32 x 1-1/4; copper oxide (spkr mtg) ....doz	.20
3S2226	Screw, machine: 1/4-20 x 1-1/4 plain hex head; cad pl (chassis mtg) ....doz	.50
3S7536	Screw, sheet metal: #6 x 3/8 PKA slotted acorn head (antenna lead strip & back cover mtg) ....per/c	.50
3S7509	Screw, sheet metal: #6 x 5/8 PKA slotted acorn head; ant cop (back cover mtg).doz	.15
3S490819	Screw, sheet metal: #6 x 7/8 PKA slotted acorn head; ant cop (back cover mtg).doz	.15
3S3397	Screw, sheet metal: #8 x 5/16 PKZ plain hex head; cad pl (chassis mtg brkt)per/c	.50
3S8153	Screw, sheet metal: #8 x 3/4 PKA plain hex head (bottom cover mtg) ....doz	.15
56K700009	Strap, antenna support (supports lower loop antenna)	.10
35A791581	Strip, lead (dresses leads to side of cabinet) ....doz	.20
64K700637	Strip, trim: brs pl (20-1/2" strip across cabinet front)	1.65
4K780040	Washer, felt (under control knobs)....doz	.20
4S1720	Washer, flat: 3/8 x .156 x .030 stl; cad pl (line cord mtg) ....per/c	.50
4S7562	Washer, flat: 7/16 x .187 x .033 stl; cad pl (spkr mtg) ....per/c	.50
4S7629	Washer, flat: 1/2 x 3/16 x .048 stl; cad pl (bottom cover mtg) ....per/c	.50
4S7563	Washer, flat: 5/8 x .203 x .033 stl; cad pl (bezel mtg) ....doz	.15
4S488234	Washer, flat: 7/8 x 3/8 x .060 stl; cad pl (chassis mtg) ....doz	.25

MODEL 17K1BA CABINET PARTS - Same as 17K1A except:

16K700634	Cabinet, console: limed oak; less bezel..	-
	Cloth, grille: eggshell	
36K792079	Knob, control: tan (fine tuning & off-volume)	.45

MODEL 17T1A CABINET PARTS

1X700758	Back Cover: complete with picture tube rear cover, centering adjustment cover, and line cord	3.90
13D700605	Bezel, picture tube (window frame)	4.00
7B700515	Bracket, mask mtg	.05
1X792494	Bracket, window mtg: with pad	.10
37A12748	Bumper, recess: rubber (cabinet feet)....	.05
16E700641	Cabinet, table model: red-brn mahogany; less window & bezel	-
42A792502	Clip, mask retainer ....doz	.30
13K700643	Cloth, grille: mahogany; 7x7	.40
30B470756	Cord, line: with plug & receptacle	1.50
15B791076	Cover, centering adjustment: rubber (on back cover)	.40
1X792495	Cover, chassis bottom: with hi-volt insulator	1.80
15B790987	Cover, picture tube rear (on back cover).	.70
5S3139	Eyelet: .202 x .475 brs; ant cop (on back cover) ....doz	.15
14B792069	Insulator, high voltage (on bottom cover)	.20
36B790505	Knob, control (contrast)	.65
36B790506	Knob, control (station selector)	.80
36A485457	Knob, control: black (hold controls on chassis rear)	.15
36K792078	Knob, control: wal-mahog (fine tuning & off-volume)	.45
4S7650	Lockwasher, internal: #6; cad pl (hi-volt insulator & line cord mtg) ....per/c	.50
4S9751	Lockwasher, internal-external: #8; cad pl (speaker mtg) ....per/c	.50
62K480492	Logotype: "Motorola"; gold enamel	.20
1X700757	Mask, picture tube: with clips & mtg brkt	4.70
13A792195	Medallion ("M" on cabinet front)	.55
2S7003	Nut, hex: 8-32 x 5/16 stl; cad pl (spkr mtg) ....per/c	.50
2S490359	Nut, speednut (spkr mtg) ....doz	.15
35K792501	Pad, cushion (on window mtg brkts)....doz	.20
35K792499	Pad, cushion (window mtg) ....doz	.30
64A700645	Plate, medallion mtg: brushed brass	.15
5S7706	Rivet: .122 x 1/8 stl; pol nkl (hi-volt insulator mtg) ....per/c	.50
5S1683	Rivet: .122 x 3/16 brs; pol nkl (mask clip mtg) ....per/c	.50
5S7751	Rivet: .122 x 1/4 stl; pol nkl (picture tube rear cover mtg) ....per/c	.50

Part Number	Description	List Price
5K791856	Rivet, shoulder: annealed (line cord mtg) .....doz	.30
3S7374	Screw, machine: 8-32 x 5/16 plain hex head; cad pl (bezel mtg) .....per/c	.50
3K791825	Screw, machine: 8-32 x 1 insulated head; statuary bronze (speaker mtg) .....doz	.15
3S7536	Screw, sheet metal: #6 x 3/8 PKA slotted acorn head; ant cop (window mtg brkts, bottom & back cover mtg) .....per/c	.50
3S7509	Screw, sheet metal: #6 x 5/8 PKA slotted acorn head; ant cop (back cover mtg).doz	.15
3S490819	Screw, sheet metal: #6 x 7/8 PKA slotted hex head; statuary bronze (back cover mtg) .....doz	.15
3S7467	Screw, sheet metal: #8 x 3/8 PKZ plain hex head; cad pl (mask mtg) .....doz	.15
3S7526	Screw, sheet metal: #8 x 1-1/8 PKA plain hex head; cad pl (chassis mtg) .....doz	.15
3S8104	Screw, sheet metal: #8 x 1-1/2 PKA plain hex head; cad pl (chassis mtg).....doz	.15
35A791581	Strip, lead (dresses leads to side of cabinet) .....doz	.20
4A792497	Washer, cut: cad pl (bezel mtg).....doz	.25
4K780040	Washer, felt (under control knobs)....doz	.25
4S1767	Washer, flat: 5/16 x .130 x .025 brs; pol nkl (mask clip mtg) .....per/c	.50
4S1720	Washer, flat: 3/8 x .156 x .030 stl; cad pl (mask mtg) .....per/c	.50
4S7614	Washer, flat: 11/16 x 11/64 x .036 stl; cad pl (chassis mtg) .....doz	.15
61K700607	Window, picture tube: rect	6.00

MODEL 17T1BA CABINET PARTS - Same as 17T1A except:

16K700642	Cabinet, table model: limed oak; less window & bezel	-
13K700644	Cloth, grille: blonde; 7 x 7	.30
36K792079	Knob, control: tan (fine tuning & off-volume)	.45
3A791824	Screw, machine: 8-32 x 1; insulated head; brushed brass (speaker mtg) .....doz	.15

MODEL 17T2A CABINET PARTS

1X700758	Back Cover: with picture tube rear cover, centering adj cover, and line cord	3.90
13D700605	Bezel, picture tube (window frame).....	4.00
	Board, baffle: chipboard	
7B700515	Bracket, mask mtg	.05
1X792494	Bracket, window mtg: with pad	.10
55K700129	Bumper: feltoid (cabinet feet)	.05
16F700608	Cabinet, table model: red-brn mahogany; less window & bezel	-
42A792502	Clip, mask retainer .....doz	.30
13K700611	Cloth, grille: mahogany	.30
30B470756	Cord, line: with plug and receptacle	1.50
15B791076	Cover, centering adjustment: rubber (on back cover)	.40
1X792495	Cover, chassis bottom: with hi-volt insulator	1.80
15B790987	Cover, picture tube rear (on back cover).	.70
5S3139	Eyelet: .202 x .475 brs; ant cop (on back cover) .....doz	.15
14B792069	Insulator, high voltage (on bottom cover)	.20
36B790505	Knob, control (contrast)	.65
36B790506	Knob, control (station selector)	.80
36K780522	Knob, control: ivory (hold controls on chassis rear)	.15
36K792078	Knob, control: wal-mahog (fine tuning & off-volume)	.45
4S7650	Lockwasher, internal: #6; cad pl (line cord mtg) .....per/c	.50
4S9751	Lockwasher, internal-external: #8; cad pl (spkr mtg) .....per/c	.50
62K480492	Logotype: "Motorola"; gold enamel	.20
1X700757	Mask, picture tube: with clips & mtg brkt	4.70
13A792195	Medallion: brs pl ("M" on cabinet front).	.55
2S7003	Nut, hex: 8-32 x 5/16 stl; cad pl (spkr mtg) .....per/c	.50
2S490359	Nut, speednut (speaker mtg) .....doz	.15
35K792501	Pad, cushion (on window mtg brkts)....doz	.20
35K792499	Pad, cushion (window mtg) .....doz	.30
64A700645	Plate, medallion mtg: brs pl	.15
5S7706	Rivet: .122 x 1/8 stl; pol nkl (hi-volt insulator mtg) .....per/c	.50
5S1683	Rivet: .122 x 3/16 brs; pol nkl (mask clip mtg) .....per/c	.50
5S7751	Rivet: .122 x 1/4 stl; pol nkl (picture tube rear cover mtg) .....per/c	.50
5K791856	Rivet, shoulder: annealed (line cord mtg) .....doz	.30
3S7374	Screw, machine: 8-32 x 5/16 plain hex head; cad pl (bezel mtg).....per/c	.50
3K791825	Screw, machine: 8-32 x 1 insulated head; statuary bronze (speaker mtg).....doz	.15
3S7536	Screw, sheet metal: #6 x 3/8 PKA slotted acorn head; ant cop (window mtg brkts, bottom & back cover mtg) .....per/c	.50
3S7509	Screw, sheet metal: #6 x 5/8 PKA slotted acorn head; ant cop (back cover mtg).doz	.15
3S490819	Screw, sheet metal: #6 x 7/8 PKA slotted hex head; statuary bronze (back cover mtg) .....doz	.15
3S7467	Screw, sheet metal: #8 x 3/8 PKZ plain hex head; cad pl (mask mtg) .....doz	.15
3S7526	Screw, sheet metal: #8 x 1-1/8 PKA plain hex head; cad pl (chassis mtg).....doz	.15
3S8104	Screw, sheet metal: #8 x 1-1/2 PKA plain hex head; cad pl (chassis mtg).....doz	.15
35A791581	Strip, lead (dresses leads to side of cabinet) .....doz	.20
4A792497	Washer, cut: cad pl (bezel mtg).....doz	.25
4K780040	Washer, felt (under control knobs)....doz	.25
4S1767	Washer, flat: 5/16 x .130 x .025 brs; pol nkl (mask clip mtg) .....per/c	.50
4S1720	Washer, flat: 3/8 x .156 x .030 stl; cad pl (mask mtg) .....per/c	.50
4S7646	Washer, flat: 11/16 x 3/16 x .067 wrought iron; cop pl (chassis mtg) .....per/c	.50
61K700607	Window, picture tube: rectangular; safety glass	6.00

MODEL 17T2BA CABINET PARTS - Same as 17T2A except:

16K700609	Cabinet, table model: limed oak; less window & bezel	-
13K700612	Cloth, grille: eggshell	.30
36K792079	Knob, control: tan (fine tuning & off-volume)	.45

BILT-IN-TENNAS

TA-4 (for Models 16K2H & 17K1A)

1X791759	TA-4 Double Loop Antenna: complete	6.50
21R6593	Capacitor, mica: 15 mmf	.20
21K70720	Capacitor, molded: 5 mmf	.10
24A791771	Coil, antenna loading	.25
29A791608	Lug, spade .....doz	.15
31K471564	Strip, terminal: 3 ins, #2 gnd; 3/8" spacing	.05

TA-6 (for Models 16T1H, 17T1A, & 17T2A)

1X791900	TA-6 Single Loop Antenna: complete	4.00
21R2763	Capacitor, mica: 6 mmf 300V	.20
21R2764	Capacitor, mica: 18 mmf 300V	.20
24A791748	Coil, antenna loading (on terminal strip)	.25
24A791989	Coil, high frequency compensating	.25
35A791581	Strip, antenna lead .....doz	.20
31K34326	Strip, terminal: 2 ins, #3 gnd; 3/8" spacing	.05

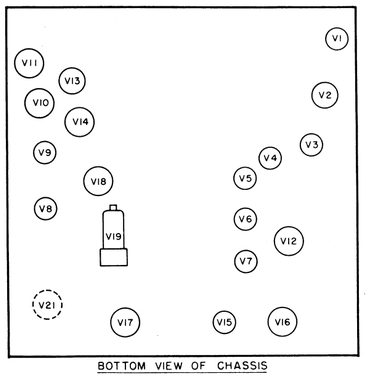
TA-9 (for Model 16F1H) - Same as TA-6 except for lead length

1X792518	TA-9 Single Loop Antenna: complete	3.45

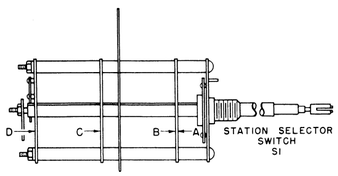
Motorola®

TELEVISION CHASSIS TS-89, TS-94 & TS-95

Date: 16 June 1950
Diag. No. 63E701200-O



BOTTOM VIEW OF CHASSIS



STATION SELECTOR SWITCH S1

NOTE:- STATION SELECTOR SWITCH S1 SHOWN IN CHANNEL NO. 2 POSITION.

⊕ = IRON TUNING CORES.

‡ = BRASS TUNING CORES.

NOTES

D.C. VOLTAGE MEASUREMENTS MADE WITH A VTVM FROM POINT INDICATED TO CHASSIS. CONTRAST CONTROL MAX. CLOCKWISE POSITION. ALL OTHER CONTROLS IN NORMAL OPERATING POSITION. STATION SELECTOR SWITCH ON CHANNEL POSITION DEVELOPING LESS THAN 1 VOLT NOISE AT PIN 4 OF TEST SOCKET. ANTENNA DISCONNECTED. LINE VOLTAGE 117 VOLTS. VOLTAGES OMITTED HAVE NO SERVICE VALUE.

A.C. WAVE FORMS AND AMPLITUDES TAKEN WITH CONTRAST CONTROL SET FOR SIGNAL OF 45 VOLTS PEAK TO PEAK LEVEL AT PLATE OF VIDEO AMPLIFIER. ALL OTHER CONTROLS IN OPERATING POSITION.

RESISTORS INDICATED IN OHMS, K=1000 (ONE THOUSAND) OHMS.

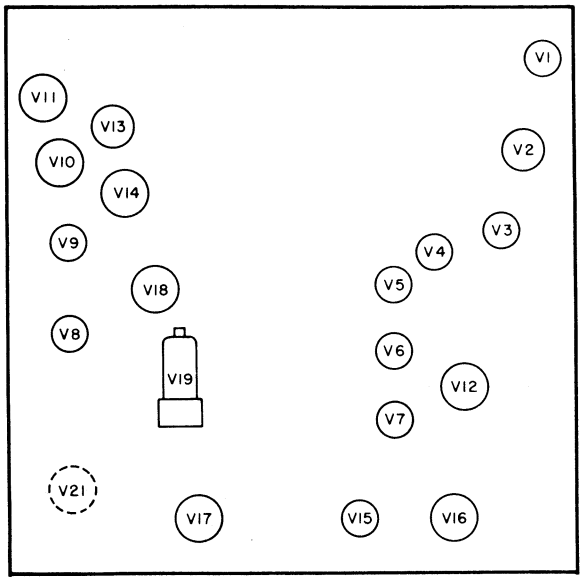
CAPACITORS INDICATED IN MICROMICROFARADS UNLESS OTHERWISE SPECIFIED.

INDUCTANCES INDICATED IN MICROHENRIES UNLESS OTHERWISE SPECIFIED.

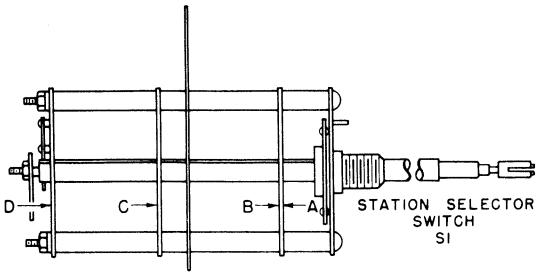
CAUTION: DO NOT ATTEMPT VOLTAGE READINGS ON HIGH VOLTAGE RECTIFIER OR SCOPE READINGS ON 6BQ6 PLATE WITH ORDINARY EQUIPMENT.

T6 D.C. RESISTANCES	
TERM.	RES.
1 TO 2	1.2 OHMS
2 TO 3	10 OHMS
3 TO 4	9 OHMS
4 TO 5	70 OHMS

DIAG. NO. 63E701200-O



BOTTOM VIEW OF CHASSIS



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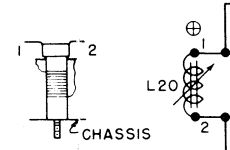
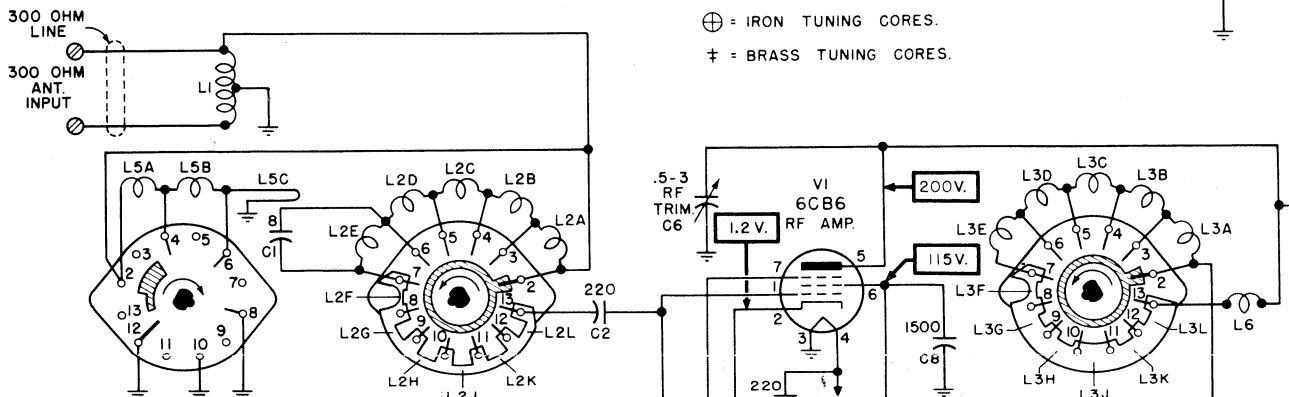
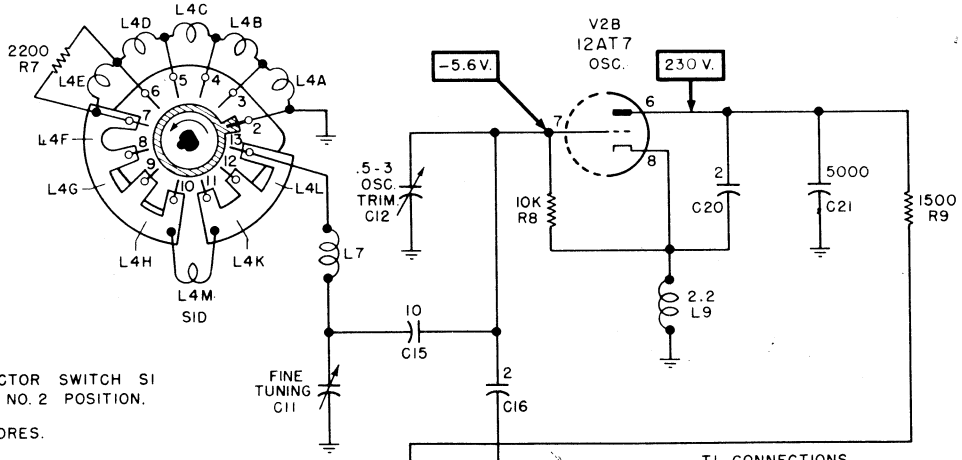
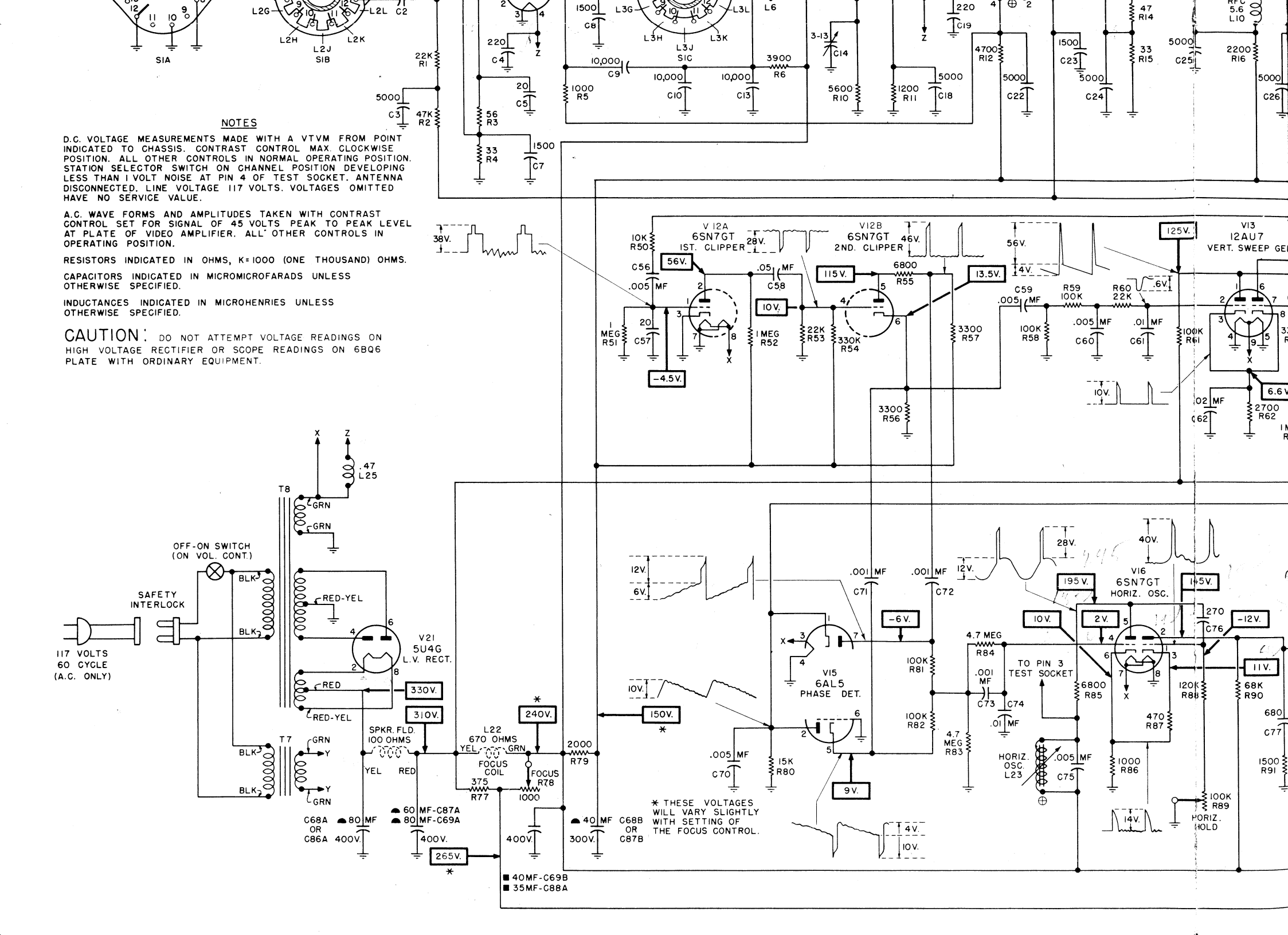


L-18 & L-20 CONNECTIONS





T1 CONNECTIONS



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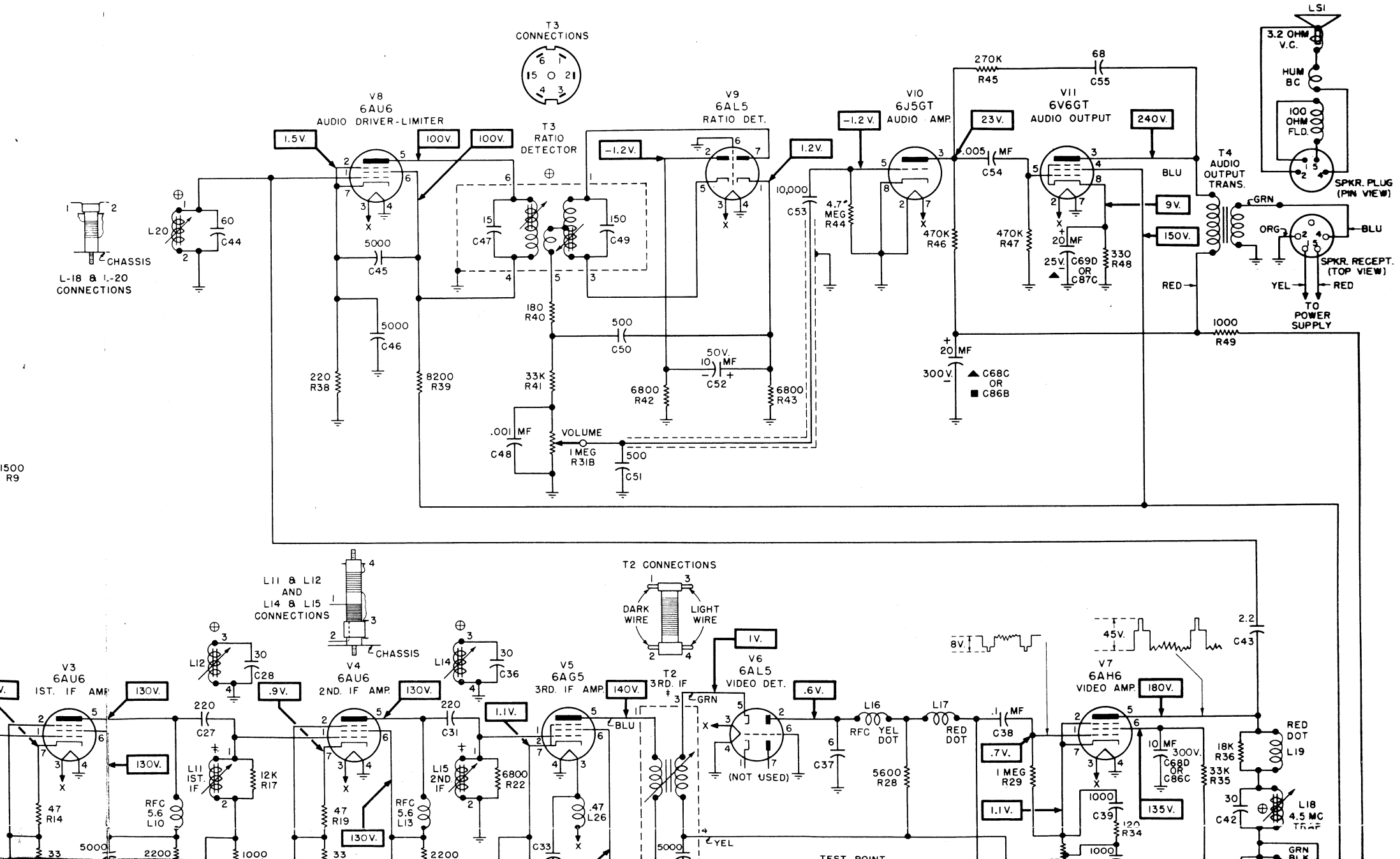

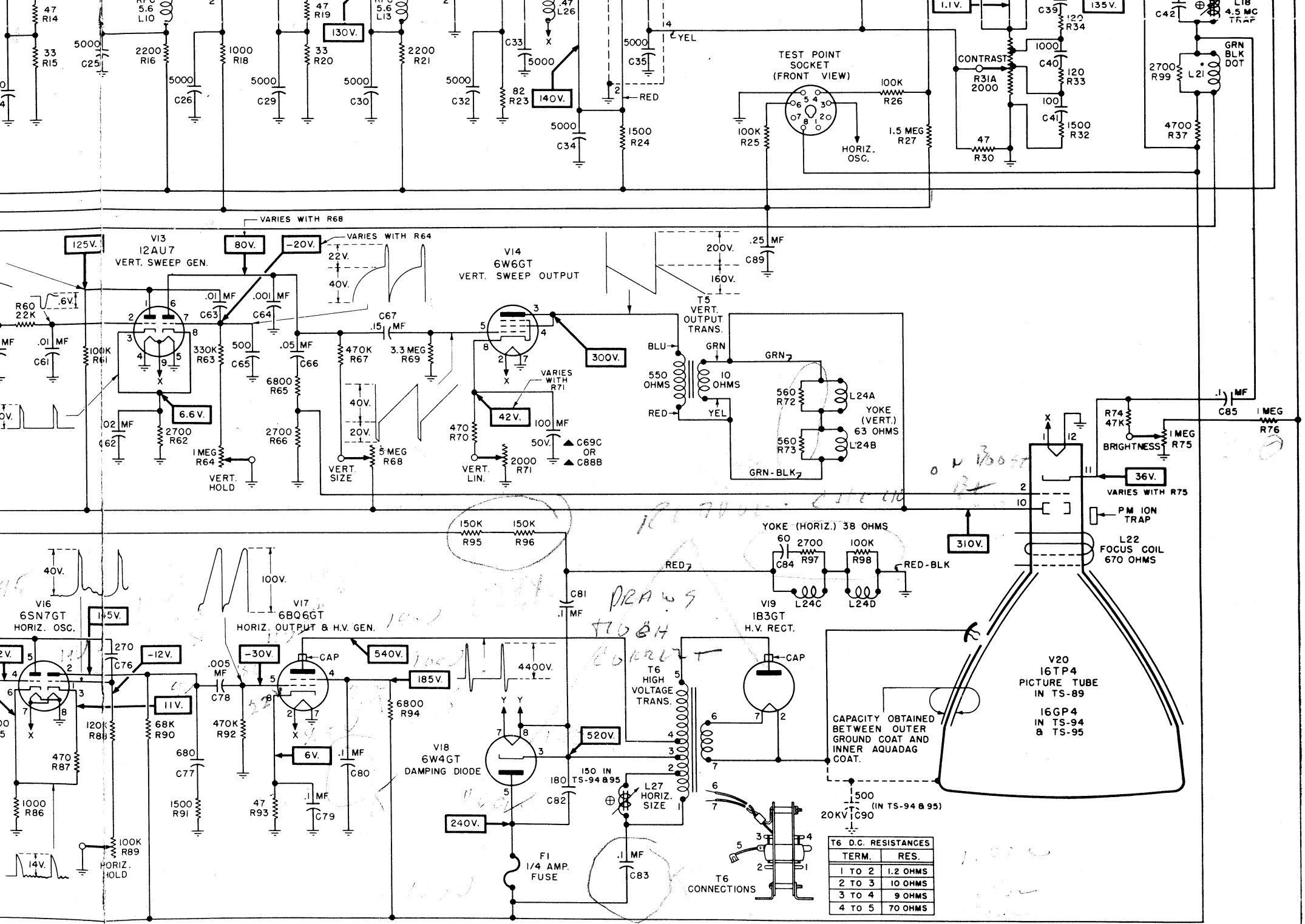

DIAG. NO. 63E701200-0