# Admiral COLOR Television

## Models Using 29Z1 • 29Z1B • 29SZ1 • 29SZ1B CHASSIS

MODEL IDENTIFICATION CHART

| MODEL NUMBERS | CHASSIS | MODEL NUMBERS | CHASSIS |
|---|---|---|---|
| C322C2 | 29Z1 | CS322C26 | 29SZ1 |
| CS322C2 | 29SZ1 | C322C27 | 29Z1 |
| C322C3 | 29Z1 | CS322C27 | 29SZ1 |
| CS322C3 | 29SZ1 | LC322C36 | 29Z1B |
| C322C16 | 29Z1 | LCS322C36 | 29SZ1B |
| CS322C16 | 29SZ1 | LC322C37 | 29Z1B |
| C322C17 | 29Z1 | LCS322C37 | 29SZ1B |
| CS322C17 | 29SZ1 | LC322C39 | 29Z1B |
| C322C26 | 29Z1 | LCS322C39 | 29SZ1B |

SERVICE MANUAL NO. S592

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# SPECIFICATIONS

PICTURE TUBE

Type 21AXP22A round 21" three gun shadow mask type--aluminized tricolor phosphor dot screen. Magnetic deflection--magnetic convergence--electrostatic focus.

OPERATING VOLTAGE

110-120 volts, 60 cycles, AC only

WATTAGE

380 watts

INPUT IMPEDANCE

300 ohms balanced to ground.

ANTENNA

See "ANTENNA REQUIREMENTS" on page 4.

IF FREQUENCIES

Intercarrier IF: Video 45.75 MC; Sound 41.25 MC
Sound IF: 4.5 MC

FUSE LOCATION

See "Tube Location Diagram" on page 66.

## TUBE COMPLEMENT 29Z1

| | | |
|---|---|---|
| V101 | 6BN4 | VHF RF Amp. |
| V102 | 6CG8 | VHF Mixer-Osc. |
| V201 | 6BZ6 | 1st IF Amplifier |
| V202 | 6BZ6 | 2nd IF Amplifier |
| V203 | 6BZ6 | 3rd IF Amplifier |
| V204 | 6CB6 | 4th IF Amplifier |
| V205 | 12BY7 | Luminance (Y) Amplifier |
| V206 | 6AU6 | Gated AGC |
| V301 | 6U8 | Sound IF - 1st Audio Amp. |
| V302 | 6AL5 | Ratio Detector |
| V303 | 6V6GT | Audio Output |
| V401 | 6AW8 | 1st Chroma Amp.-Color Killer |
| V402 | 6CL6 | Chroma Amplifier |
| V403 | 12BH7 | Chroma Demodulator |
| V404 | 21AXP22A | Picture Tube |
| V501 | 6BH8 | Burst Amp.-Pulse Shaper |
| V502 | 6AL5 | Color Phase Discriminator |
| V503 | 6U8 | 3.58 MC Osc. - Osc. Control |
| V601 | 6CS6 | Sync Separator |
| V602 | 6CG7 | Sync Inv. - Vert. Osc. |
| V603 | 6AQ5 | Vertical Output |
| V604 | 6CG7 | Horizontal Oscillator |
| V605 | 6CB5A | Horizontal Output |
| V606 | 6AU4GTA | Damper |
| V607 | 1V2 | Focus Rectifier |
| V608 | 3A3 | H. V. Rectifier |
| V609 | 6BK4 | Shunt Regulator |
| V701 | 5U4GB | L. V. Rectifier |
| V702 | 5U4GB | L. V. Rectifier |

## TUBE COMPLEMENT 29Z1B

Chassis 29Z1B uses the same above tube complement but with the following exceptions:
Tube type 6BV8 -- Ratio detector and separate additional audio amplifier.
Tube type 6L6GB -- Audio Output.

## TUBE COMPLEMENT 29SZ1

Chassis 29SZ1 uses the same tube complement as 29Z1 but with the following addition:
Tube type 6AF4A -- UHF Oscillator.

## TUBE COMPLEMENT 29SZ1B

Chassis 29SZ1B uses the same tube complement as 29Z1B but with the following addition:
Tube type 6AF4A -- UHF Oscillator.

# IMPORTANT
## COLOR RECEIVER SET-UP
# HINTS

**FIRST** carefully read the data under "KNOW THE COLOR RECEIVER" below. Knowing "what to expect" of the performance of this color receiver and understanding the limitations of present day design will enable you to fully acquaint yourself with the color receiver.

**THEN** read the "PRELIMINARY SERVICE ADJUSTMENTS" on page 7, turn on the receiver, and determine which service adjustments are necessary. These adjustments should be made before the "COLOR SET-UP ADJUSTMENTS".

**NOW** determine if the receiver needs a "touch-up" or a "complete" color set-up adjustment. If the "COLOR SET-UP ADJUSTMENTS" on page 11 are first read completely, it will be easier to decide what adjustment is necessary. The "touch-up" and "complete" procedures are outlined under this section.

# KNOW THE COLOR RECEIVER

IMPORTANT: The following data should be read completely before making any color set-up adjustments.

## INSTALLATION REQUIREMENTS

The color receiver should be placed away from bright windows or lights. Some light in the room is desirable but should not fall directly on the screen. Receiver should always be viewed in a room with low light level.

Allow for adequate ventilation. Receiver should be placed away from radiators, heating vents, etc. Do not place too close to walls.

Be sure receiver is conveniently located near electrical outlet and for antenna connection.

## IMPORTANCE OF DARK AREA FOR SET-UP ADJUSTMENTS

Since ultimately, the fidelity of color reproduction is dependent upon the accuracy of the convergence and purity adjustments, these adjustments should be made in a darkened room with the receiver in the same location and position as used for viewing. Window shades, venetian blinds, etc. should be drawn or closed to eliminate as much light as possible. If enough light cannot be eliminated, the color receiver should not be set-up in that area or room. A large cardboard carton or cloth shroud can be placed over the cabinet to darken the screen for ease and accuracy in performing adjustments. It is preferable that the adjustments be made with the receiver in the location where it will be used. However, adjustments must be checked and readjusted if necessary, with the receiver in the final location, position, and with the same light conditions under which it will be viewed. This is necessary because of the affect of the earth's magnetic field and other external magnetic fields upon color purity and convergence. For example, a color receiver that is properly adjusted facing a particular direction, may reproduce faithful colors. If this receiver is turned or moved to face in another direction, purity and convergence may now be out of adjustment. The extent of the effect of moving the receiver after it is set up will vary from set to set and location to location.

## LIMITS OF PURITY AND CONVERGENCE

Perfect convergence normally cannot be obtained over the entire screen area. Picture tube and deflection yoke development of present-day design limit this condition, but it should be understood that with careful and accurate adjustments, a very good convergence covering at least 85% of the screen area can be achieved.

Good convergence in the four corners of the raster may not be obtained, but if 85% (plus or minus 5%) of the total area is accurately converged, this is considered a normal, acceptable condition.

The present-day color picture tube also limits color purity. With careful and accurate adjustments, good color purity can be achieved for each of the three fields with good black and white reproduction. Very small areas of impurity at any of the four corners or sides of the raster are considered acceptable.

## BLACK AND WHITE TRACKING

The black and white tracking adjustment is another important consideration. If properly made, the color set will produce black and white pictures within the normal useable range of both the Contrast and Brightness controls. If the adjustment is incorrect, the entire picture will appear tinted and the color will vary at different Brightness and Contrast control settings.

Complete "BLACK AND WHITE TRACKING" instructions are contained in the "COLOR SET-UP ADJUSTMENTS" on page 11.

## DEALER AND CUSTOMER INSTRUCTION

The Operating Instructions packed with the receiver should be reviewed with all those who will operate and use a color television set. The expected performance and limitations of the color set should also be explained to the dealer or customer. This will help them "understand" their color receiver.

## DEMAGNETIZING THE COLOR PICTURE TUBE

Satisfactory purity and/or convergence of a color receiver may be difficult or impossible to obtain if the metal parts of the picture tube or chassis have become magnetized. Therefore, a demagnetizing or degaussing procedure should be performed before making the Color Set-Up Adjustments. Instructions on how to make a demagnetizing coil are given under "DEMAGNETIZING COIL" on page 49.

## ANTENNA REQUIREMENTS

The antenna requirements for color reception are much more critical than for black and white reception. For best color reception, a broad band antenna should be used. It should also have an essentially flat frequency response characteristic across the frequency range of the desired channel. Some antennas of the "Yagi" type do not meet these requirements and should not be used. Built-in and Indoor antennas do not meet these requirements and should not be used.

The CONICAL type antenna is a good choice for color reception.

Antenna orientation is also more critical than for black and white reception. Some antenna positions may provide adequate black and white reception, but poor color reception. If color reception is poor, and the receiver is operating properly, the antenna should be oriented for best color reception while receiving a color program. If several stations are received from different directions, an antenna rotator may be required.

Multiple antenna installations, particularly those employing distribution amplifier systems, may not provide satisfactory color reception. Many TV boosters do not have sufficient bandwidth for color reception.

Standing waves present on the antenna lead-in can also result in poor color or no color reception. The lead-in should be properly matched to the receiver to eliminate this condition. To determine if standing waves are present, any one of the two following methods can be used:

METHOD 1. Insert a 12 db pad between receiver antenna terminals and lead-in as shown in Figure 1, or,

METHOD 2. Slide a piece of tinfoil (wrapped around the lead-in) along the lead-in.

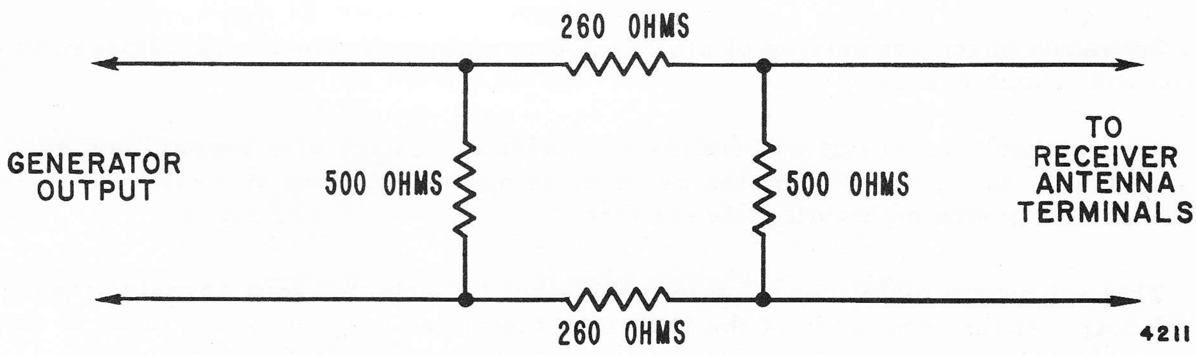



Figure 1. 12 db Pad.

In either of the above two methods, if the signal increases in intensity, it is an indication that standing waves are present.

If signal intensity does not improve, remove pad or tinfoil and reconnect antenna lead-in to set. If poor or no color reproduction is still experienced, the receiver or antenna should be checked further.

If signal intensity does improve, and METHOD 1 was used, leave pad connected.

If METHOD 2 was used, slide foil along lead-in until best picture is obtained. Fasten foil on lead-in with tape at that point.

# PRECAUTIONS

## HANDLING OF CHASSIS

The picture tube used in this chassis is much more fragile than any black and white picture tube. The possibility of accidental breakage is increased because of additional assemblies mounted on the neck of the tube. The following precautions should be taken.

1. It is important that shatterproof goggles, heavy gloves and a protective apron be worn while handling or installing a picture tube.

2. Do not slide the assemblies mounted on the neck of the picture tube hastily or carelessly, and without observing the procedures given.

3. Scratching, bumping or excessive pressure on the picture tube can result in an explosion of considerable violence.

The circuits of this chassis are more numerous and complex than in black and white receivers. Rough or careless handling increases the possibility of accidental circuit failures.

## HIGH VOLTAGE WARNING

Very high voltage is present at some points in this receiver. The 20,000 volt high voltage regulated supply has sufficient energy to cause severe injury or death.

It is imperative that the following high voltage precautions be observed.

1. Operation of the set outside of the cabinet or with the cabinet back removed is a potential shock hazard.

2. Severe shock can result without making physical contact with any high voltage sources. At all times when the receiver is operating, keep at least 3" away from all points where high voltage is present.

3. This set uses a metal coned picture tube that is protected by a covering insulator (boot). At the front edge of the tube near the metal-to-glass seal, there is considerable shock hazard within a distance of approximately 3" from this edge.

## X-RAY WARNING

When the set is operating, the screen of the picture tube radiates soft X-Rays. These are normally absorbed in the safety glass front, but operation of the receiver outside the cabinet leaves the screen unprotected. This results in a focal point of these X-Rays at about 9" in front of the central screen area. Exposure within this area for more than 17 hours a week may cause physical injury. The X-Rays are weaker around the edge and sides of the tube. Physical exposure time around this area is unlimited.

When making adjustments with an unprotected picture tube, avoid remaining in the area directly in front of the picture tube for more than the 17 hours per week time limit. If it becomes necessary, shield the front of the tube with plate glass (at least 1/4" thick). This will absorb all X-Rays from the front area of the screen.

# PRELIMINARY SERVICE ADJUSTMENTS

It is important that any preliminary service adjustments be made before the color set-up adjustments to prevent upsetting color purity or convergence.

Carefully check, and if necessary, make the following adjustments in the order listed below.

## CHANNEL SLUGS

The setting of the Fine Tuning control and Channel Slugs are much more critical for color reception.

Be sure the correct point of tuning, as described below, occurs at approximately mid-rotation of the Fine Tuning control.

> IMPORTANT: If the Channel Slug or Fine Tuning control is slightly misadjusted for a black and white program, the picture and sound may still be acceptable. With the same Channel Slug and Fine Tuning control setting for a color program, the picture may not be in color.

The customer should be familiarized with the importance of correctly setting the Fine Tuning control.

If Channel Slugs need adjustment, proceed as follows:

A. Turn on set. Allow 15 minutes for warm-up.

B. Tune in station and set for normal picture and sound.

C. Set Fine Tuning control at approximately mid-rotation.

> IMPORTANT: See Figure 2 for position of Fine Tuning cam for mid-rotation setting. When cam is in this position, Fine Tuning control is at mid-rotation.

D. Remove Channel Selector and Fine Tuning knobs and insert a 1/8" blade, flexible non-metallic tool through the hole adjacent to channel selector shaft. See Figure 2.

E. For each channel, carefully turn Channel Slug until sound bars appear in picture. Then turn slug toward best picture until sound bars just disappear.

Caution: Only slight rotation of slug is necessary. Turning the slug clockwise too far will cause it to fall into the coil.

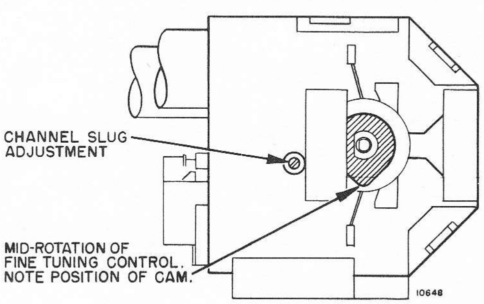



Figure 2. Front View of Tuner Showing Mid-Rotation of Fine Tuning Control.

## HORIZONTAL SNYC

The picture should remain in sync throughout the range of the Horizontal Hold control, even when interrupting the signal by switching on and off station. See Figure 3 for location of Horizontal frequency control.

The HORIZONTAL SYNC adjustment is performed the same way as on a black and white receiver using the multivibrator and discriminator method for horizontal sync and sweep. For example, all 20Y4 series black and white receivers use this method.

## RASTER TILT ADJUSTMENT

If raster is tilted, loosen the <u>three</u> wing bolts (A) (see Figure 3) and rotate yoke until picture is straight. Tighten the wing bolts.

> Note: Figure 3 shows the location of only two wing bolts (A). The third is located on the same bracket <u>directly</u> underneath the picture tube neck.

## HEIGHT AND LINEARITY

These adjustments are adjusted the same way on the color receiver as on a black and white receiver. Be sure to adjust for best height and linearity with the picture set at approximately 1/2" beyond the top and bottom limits of the mask. The HEIGHT and LINEARITY controls are located behind the removable panel under the safety glass frame. Remove the four screws from under bottom edge of the panel. Panel can then be easily removed. Adjusting HEIGHT and LINEARITY after color set-up adjustments may upset color purity and convergence. However, if only a <u>slight</u> touch-up is necessary following color set-up adjustments, the effect <u>may</u> be negligible.

## HORIZONTAL DRIVE

Adjust the HORIZONTAL DRIVE control to a point where the white vertical line(s) just disappear, or to maximum if drive lines do not appear. See Figure 3 for control location. Maximum drive is at maximum (completely clockwise) rotation of the control.

## HORIZONTAL AND VERTICAL CENTERING

Adjust for proper horizontal and vertical centering. See Figure 3 for control locations.

Metal shield - for stray magnetic fields

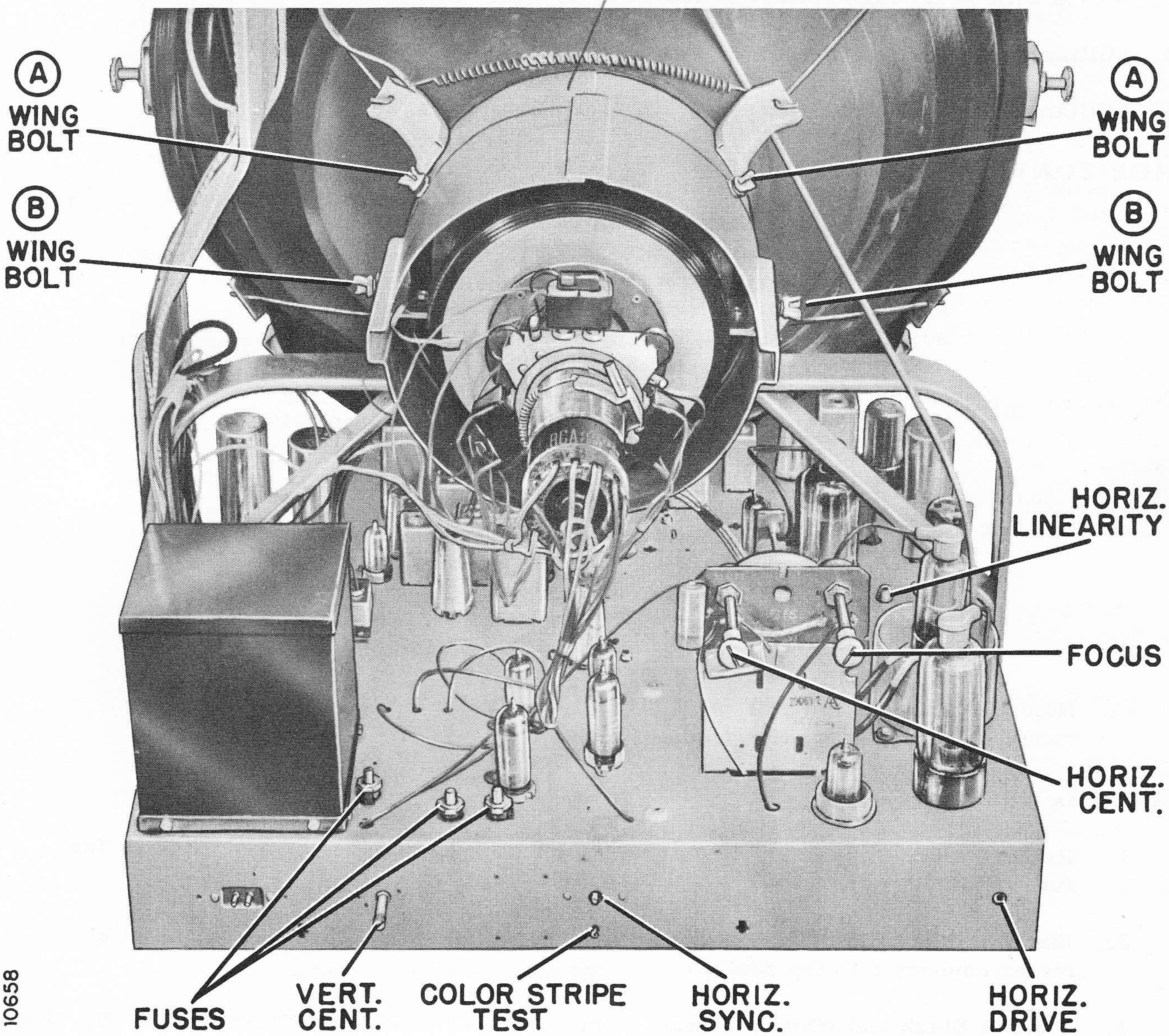



Figure 3. Top Rear View of Chassis Showing Adjustment and Control Locations.

# ADDITIONAL SERVICE ADJUSTMENTS

REQUIRING TEST INSTRUMENTS

The following test instruments are required for the following adjustments.

1. VTVM with 30 KV high voltage probe.
2. Milliammeter (0-1 ma range).
3. Milliammeter (0-500 ma range).

## HORIZONTAL LINEARITY

IMPORTANT: Unlike the adjustment on black and white TV receivers, the HORIZONTAL LINEARITY control on the color receiver is much more critical and requires a different adjustment procedure. Misadjustment of the HORIZONTAL LINEARITY control on a color receiver will have very little effect upon the actual horizontal linearity, but can result in damage to the 6CB5A (horizontal output tube) or associated components. For this reason, the adjustment is accurately set at the factory and normally should not require adjustment by the service technician. However, replacement of the horizontal output tube, linearity coil, etc. in the field may require adjustment of the HORIZONTAL LINEARITY control by the service technician. If adjustment is required, the following method is recommended.

Note: A DC milliammeter (0-500 ma range) is required for this adjustment.

Adjust as follows:

1. Remove fuse, F604 from its holder. See "Tube Location Diagram" page 66 for fuse location.
2. Insert a DC milliammeter between fuse holder terminals (positive terminal of meter connected to top cap).
3. Tune in Black and White picture. Adjust BRIGHTNESS, CONTRAST, FOCUS, VERTICAL, and HORIZONTAL controls for a normal picture.

BARKHAUSEN

4. Adjust the HORIZONTAL DRIVE control to the point where the vertical drive line(s) just disappears, or at maximum (clockwise) if no drive line is present.
5. Adjust the HORIZONTAL LINEARITY control for minimum current reading. (Minimum cathode current of horizontal output tube).
6. Repeat step 4 for optimum drive setting.
7. Adjust the HORIZONTAL CENTERING control to center the picture.

## HIGH VOLTAGE REGULATOR- HORIZONTAL LINEARITY

A line voltage of 117 volts should be maintained during this adjustment. See Figure 3 for adjustment locations.

8. Set the BRIGHTNESS and CONTRAST controls to minimum, ( for beam cutoff).

9. Connect a DC milliammeter (0-1 ma) in series with the cathode (Pin #1) of the 6BK4 regulator tube (positive lead to cathode). A test jumper is provided for meter insertion.

   Caution: Milliammeter leads will be at B plus potential (380 volts). Be sure to isolate meter from chassis.

10. Readjust the HORIZONTAL LINEARITY coil in the direction of less inductance, (slug moving outward from coil) until the cathode current of the Horizontal Output tube is approximately 200 milliamperes. Do not exceed 210 milliamperes as linearity is disrupted above this value of current. The High Voltage should read in the range of 18.5 to 21.5 KV, with regulator current of 750 to 1000 microamperes. Optimum setting is 200 milliamperes output tube current with 20 KV high voltage and regulator current of 950 microamperes.

    For line voltages between 105 and 117 volts, adjust HORIZONTAL LINEARITY control accordingly. For example, a line voltage of 110 volts results in a ratio of 110/117 or .94 (using 117 volts as standard). Therefore, the high voltage would be set at .94 x 20,000 volts or 18,800 volts. Maximum Horizontal Output tube current becomes .94 x 210 milliamperes or 197 milliamperes and minimum optimum regulator current .94 x 750 microamperes.

    Remove meters and replace test jumper wire and fuse. Repeat steps 4 and 7 if necessary. Overscan should be approximately 1 1/4 inch each side.

11. Recheck vertical height and linearity. Overscan should be at least 1/2 inch at top and bottom.

# COLOR SET - UP ADJUSTMENTS

<u>IMPORTANT</u>: Before making any color set-up adjustments (Purity or Convergence) be sure you have. . . .

1. read page 3, "IMPORTANT COLOR SET-UP HINTS", and followed through with the instructions,
2. checked and made any necessary preliminary service adjustments,
3. checked the receiver for performance after the preliminary service adjustments,
4. read this section completely,
5. decided whether the color receiver needs a "touch-up" of some color adjustments or a "complete" color set-up adjustment.

A "complete" color set-up adjustment consists of the following steps in the order given.

I CENTER STATIC CONVERGENCE (DC). See Figure 11.

II COLOR PURITY

III CONVERGENCE

IV TOUCH-UP OF PURITY

V TOUCH-UP OF CONVERGENCE

VI BLACK AND WHITE TRACKING (Good black and white pictures throughout the range of the Brightness control)

If the receiver requires a "complete" set-up adjustment, make all adjustments listed, including the "touch-up" adjustments.

If the receiver requires only a "touch-up" of some color adjustments, make those adjustments only.

Check the following parts for correct positioning. See Figure 4.

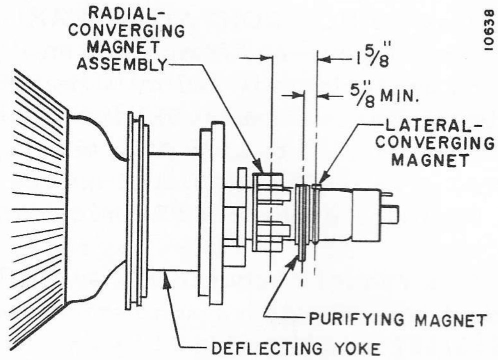



Figure 4. Side View Showing the Relative Placement of Neck Components.

## 1. BLUE LATERAL MAGNET ASSEMBLY

The magnet within the small circular holder (in the assembly) should be over the lateral converging pole piece, approximately at a two o'clock position as viewed from the base end of the picture tube.

The assembly slides along the neck of the tube similar to an ion trap magnet on a black and white receiver.

## 2. PURITY RINGS

The PURITY RINGS should be positioned over the opening between grid #3 and grid #4 of the electron guns. The PURITY RINGS slide along the tube neck.

## 3. CONVERGENCE YOKE ASSEMBLY

This assembly should be positioned so that its pole shoes are directly over the pole pieces in the electron guns. The inside of the tube neck surrounding these pole pieces is covered with Aqua-Dag making it impossible to see them. However, the pole pieces are located just in front of the large circular disc which is visible when the tube neck is viewed from the socket end.

If necessary to re-position the assembly, slide or turn on neck of tube. Be certain that the bottom of the assembly is horizontal.

When correctly placed, the center-line of the core associated with the blue gun should be approximately 1 5/8 inches in front of the center-line of the lateral-converging internal pole pieces.

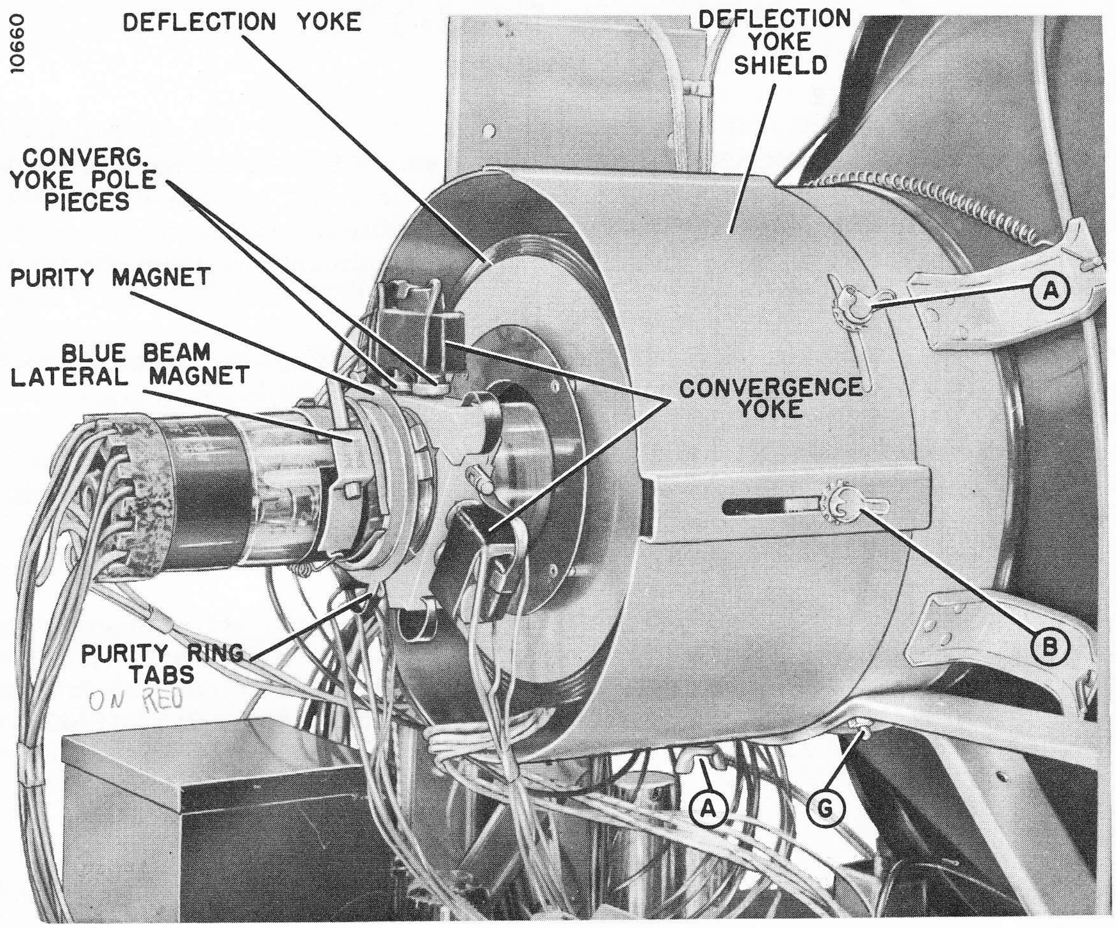



Figure 5. Transparent View of Neck of Picture Tube Showing Correct Positioning of Parts, Adjustment Locations and Identification.

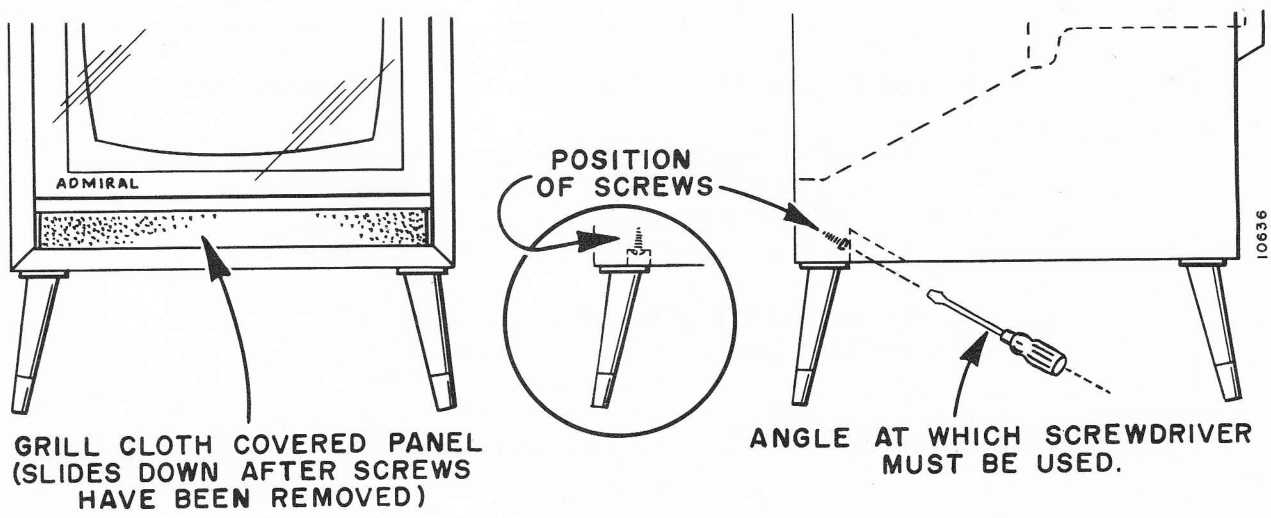



Figure 6. Front Panel Removal.

## 4. DEFLECTION YOKE

The DEFLECTION YOKE is automatically centered about the neck of the tube due to the yoke and picture tube mounting method. Normally, yoke centering need not be checked, but if it becomes necessary due to difficulty in making color adjustments or if the receiver requires a "complete" color adjustment, perform the following steps:

a. Slide BLUE LATERAL MAGNET and PURITY RINGS toward base of tube neck.

b. Slide CONVERGENCE COIL ASSEMBLY toward base of tube.

c. Check yoke centering about neck of picture tube.

If yoke is not centered and yoke brackets are not dented, etc., check the two hex nuts "G" under the yoke to be sure they are tight. See Figure 5. (Figure 5 shows location of only one hex nut "G". The other is in same position on opposite side of bracket.) Also check picture tube mounting rods. See "REMOVAL OF PICTURE TUBE" on page 48 for mounting method, etc.

# COLOR PURITY

Before adjusting for color purity, it is recommended that the magnetic parts of the picture tube be demagnetized. If any parts of the picture tube have become magnetized, purity or convergence may be difficult. Full instructions are given below. (See page 49 for demagnetizing coil construction procedure.)

## DEMAGNETIZING INSTRUCTIONS

1. With receiver off, place in same position toward you as for viewing. Remove the screws from the strip of wood at the top of the safety glass. Remove safety glass and mask.

2. Pull the rim magnets all the way out into their shields; else the demagnetizing coil may demagnetize the rim magnets. See Figure 7 for rim magnet locations.

3. Place the coil around the picture tube at the face plate. Energize the coil.

4. Keep the coil positioned around the picture tube for at least one minute, and then slowly withdraw the coil to a distance of 15 feet or more, keeping the plane of the coil parallel to the picture tube face plate at all times.

5. If impossible to back off to 15 feet, this distance can be simulated by withdrawing the coil to a distance of about 5 feet and then gradually reducing the coil supply voltage to zero by use of a Variac or similar device.

6. Repeat steps 3 through 5.

## CHECK and ADJUST COLOR PURITY as follows

1. If front panel has not been removed, remove the four screws from under the removable panel (covered with grille cloth on most models) located on front of the set, directly under safety glass frame. See Figure 6. The panel can then be easily removed. (Do not replace panel until all color adjustments have been completed.)

2. With receiver on, turn CONTRAST to minimum and BRIGHTNESS to near maximum (see Figure 8 ).

3. Turn RED, GREEN and BLUE SCREEN, and GREEN and BLUE GRID controls to minimum. See Figure 9.

4. Turn RED SCREEN to provide a bright raster. Observe field purity of red raster.

   Note: If small areas of impurity are noticed only around edges of raster, a "touch-up" of purity should be tried before proceeding with step 5. See "TOUCH-UP OF PURITY" on page 23.

   If large areas of impurity are noticed around edges, top, bottom, or central areas, continue with step 5.

5. Set all six RIM MAGNETS to minimum position (away from tube). See Figure 7 for RIM MAGNET locations.

6. Turn all HORIZONTAL CONVERGENCE AMPLITUDE and TILT controls 3/8" outward from the coil form ends. See Figure 10. See Figure 9 for location of controls.

7. Turn the VERTICAL CONVERGENCE AMPLITUDE controls counter-clockwise. Set the VERTICAL TILT controls at minimum (approximately mid-position).

8. Set the PURITY MAGNET for minimum magnetic field (colored tabs adjacent).

9. Set all six RIM MAGNETS to minimum (away from tube).

STATIC CENTER DOT CONVERGENCE

10. Apply the signal from a white dot generator to the color receiver. Turn CONTRAST control up to maximum. Turn all SCREEN and all GRID controls to minimum. Just extinguish the dot presentation with the brightness control. Then turn up the RED, GREEN and BLUE SCREEN controls, and GREEN and BLUE GRID controls for equal size small dots. The focus control may be reset to improve the similarity of dot shape.

11. Adjust the RED, GREEN, and BLUE DC CONVERGENCE controls, and the BLUE LATERAL MAGNET to produce one white dot at the center of the picture tube screen. See Figure 11.

12. Alternately observe purity of the RED, GREEN, and BLUE FIELDS by turning up the appropriate SCREEN and GRID controls (contrast control at minimum and brightness control near maximum).

If any impurity exists continue with Step 13.

13. Loosen screws "B" (see Figure 3). Move the yoke back and forth and rotate each PURITY RING going back and forth from one to the other until the purest red raster is obtained over most of the screen area (particularly over the central, top, and bottom areas).

14. Adjust the six RIM MAGNETS by rotating and pushing them in and out until the most uniform red raster appears around the edge of the screen.

15. Check the green raster purity by turning the RED SCREEN control completely to the left and turning the GREEN GRID and SCREEN controls up to obtain a green raster. The raster should appear green over the entire screen area. Turn the GREEN GRID and SCREEN controls completely to the left and turn the BLUE GRID and SCREEN controls up to obtain a blue raster. The raster should appear uniformly blue over the entire screen area.

16. Tighten screws "B".

17. Repeat static center dot convergence (step 11). If a pure red, green and blue raster is not obtained, the picture tube may not have been completely demagnetized. Repeat DEMAGNETIZING procedure and PURITY adjustments.

18. Recenter the raster with the centering controls when necessary.

Note: If individual pure rasters are still not acceptable, a compromise purity adjustment should be made.

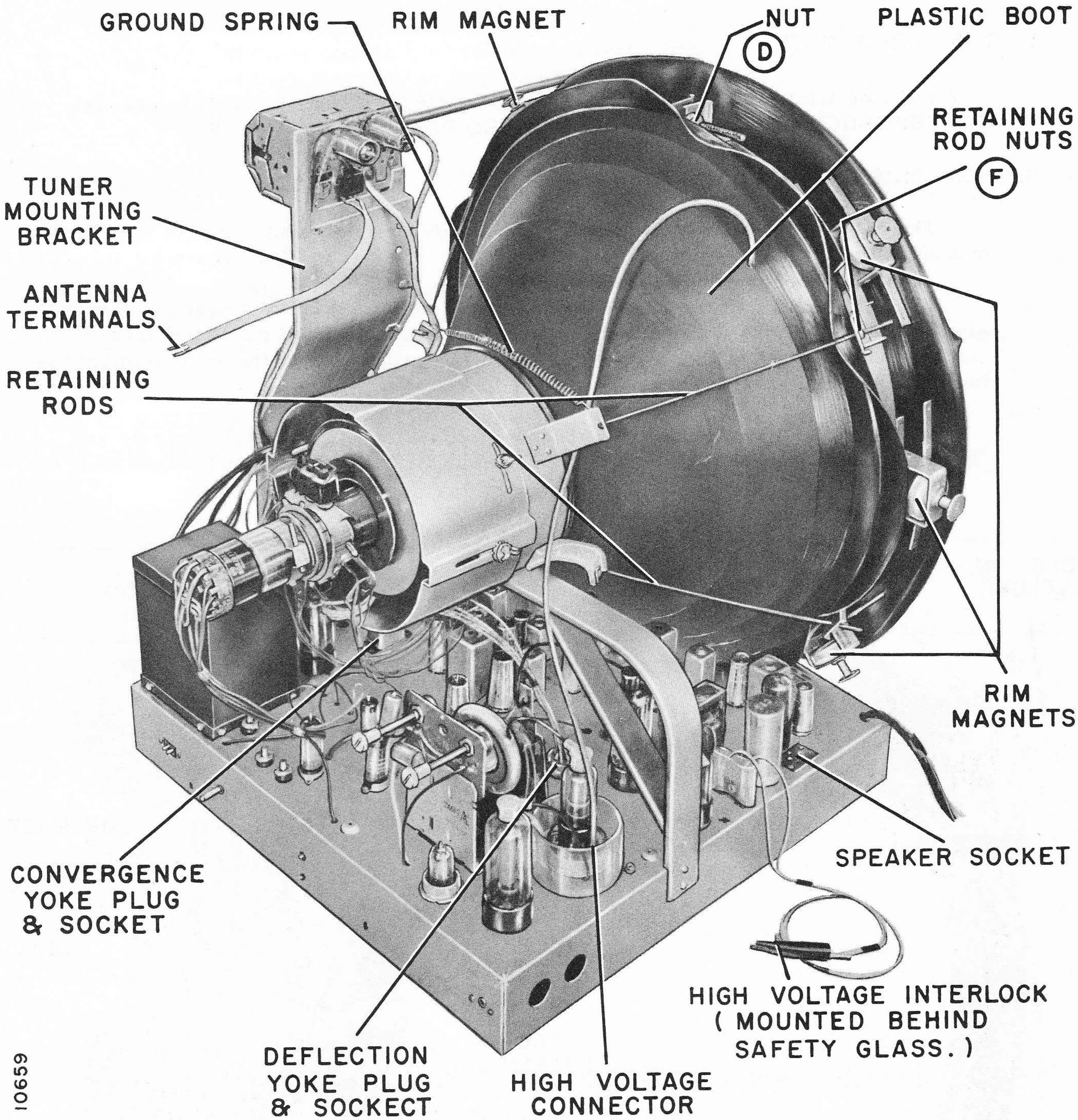



Figure 7. Right Rear View of Chassis Showing Control Locations.

# CONVERGENCE

Convergence is necessary so that the Red, Green and Blue Beams are converged over as much of the screen area as possible.

In general, very good convergence can be achieved over 85% (plus or minus 5%) of the screen area.

A. TEST EQUIPMENT

A suitable White Dot Generator (such as ADMIRAL Model TE-100) is necessary for CONVERGENCE adjustments. See "TEST EQUIPMENT" on Page 38.

B. LOCATION OF CONTROLS

The STATIC Convergence controls are located on the front apron of the chassis and the Blue Lateral Magnet in its holder on the tube neck. See Figure 5.

The DYNAMIC Convergence controls are located on the front apron of the chassis. Remove the four screws from under the removable front panel for access to controls. The panel is then easily removed. Identification of these adjustments is indicated in Figure 9 and on a label on the chassis apron.

The effects of the HORIZONTAL and VERTICAL AMPLITUDE controls and TILT controls are indicated in Figure 12. The HORIZONTAL TILT adjustment for

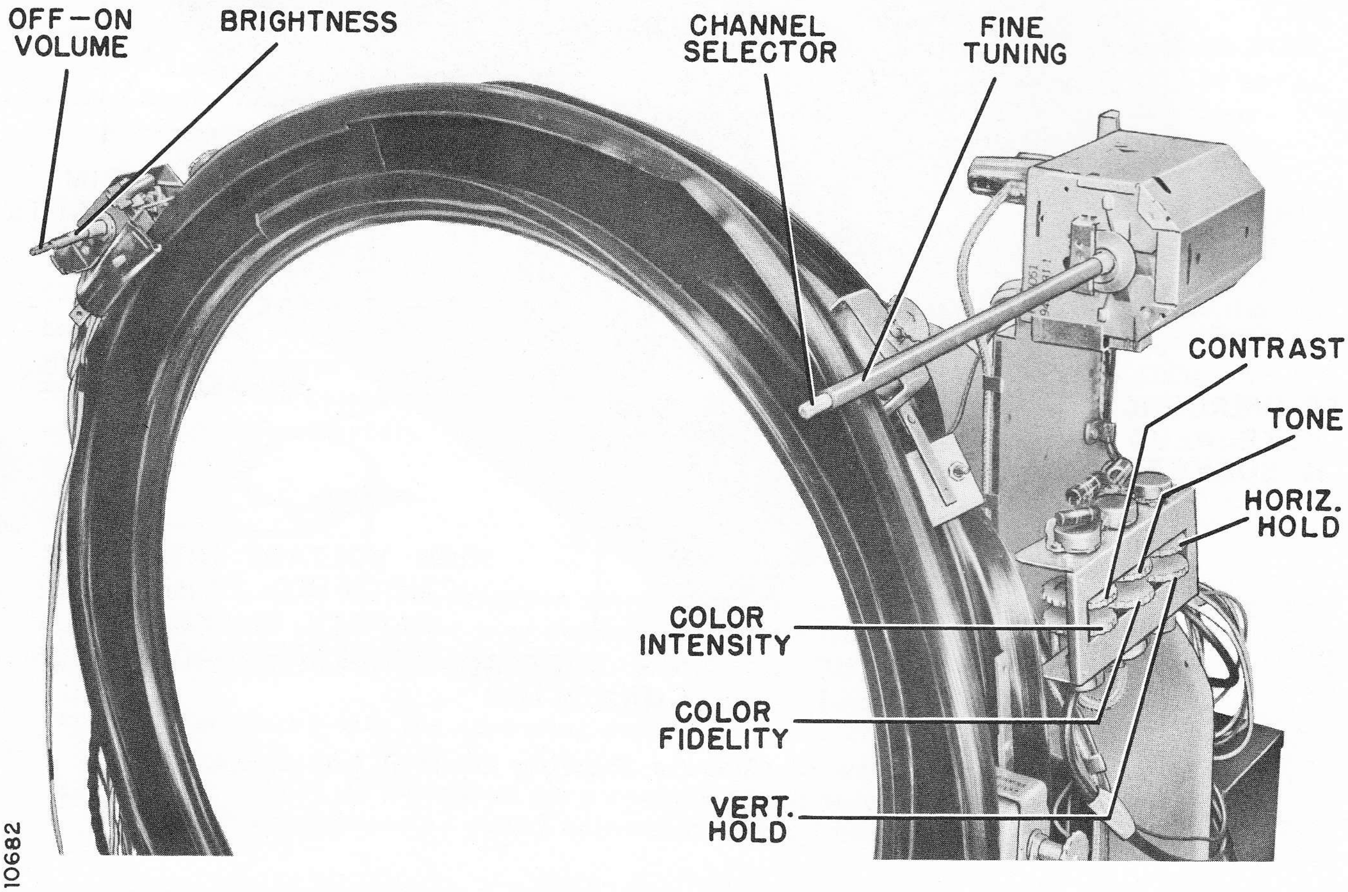



Figure 8. Right Front View of Chassis Showing Location of Operating Controls.

each color will cause the peaks of the horizontal waveform, formed when the HORIZONTAL AMPLITUDE controls are advanced fully to the right, to move from side to side.

C. SET-UP PROCEDURE

Apply the white dot signal to the receiver. See step 10 under PURITY.

Note: Adjust the three guns to provide dots of intensity distinct enough for viewing and equal in size, but of low enough intensity to keep the dot size at a minimum. Very low ambient light conditions are recommended.

IMPORTANT: If only a touch-up of convergence is needed, do not perform the following 3 steps.

1. Set all VERTICAL TILT controls to the center of their mechanical rotation range (zero saw waveform applied to convergence coils).

2. Set all VERTICAL AMPLITUDE controls completely to the left, (minimum waveforms applied to convergence coils).

3. Set all HORIZONTAL AMPLITUDE and all HORIZONTAL TILT controls (core studs) 3/8 inch outward from each coil. See Figure 10.

| STATIC CONVERGENCE CONTROLS | DYNAMIC CONVERGENCE CONTROLS | |
|---|---|---|
| 1. RED DC | 1. RED HORIZ. AMPL.<br>2. GREEN HORIZ. AMPL.<br>3. BLUE HORIZ. AMP. | 7. RED VERT. AMPL.<br>8. GREEN VERT. AMPL.<br>9. BLUE VERT. AMPL. |
| 2. GREEN DC | | |
| 3. BLUE DC | 4. RED HORIZ. TILT<br>5. GREEN HORIZ. TILT<br>6. BLUE HORIZ. TILT | 10. RED VERT. TILT<br>11. GREEN VERT. TILT<br>12. BLUE VERT. TILT |
| 4. BLUE LATERAL MAGNET | | |

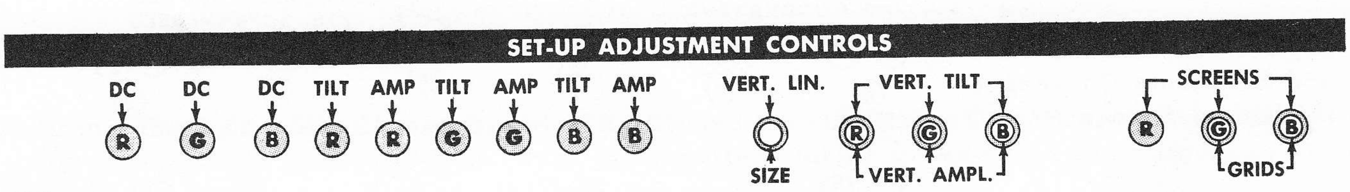



Figure 9. Location and Identification of Color Set-Up Adjustment Controls.

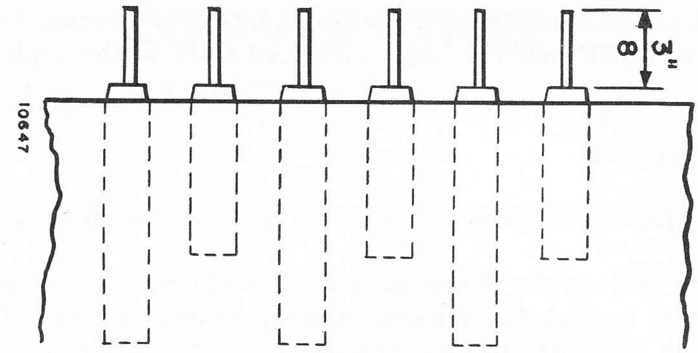



Figure 10. Preset Position of Horizontal Dynamic Controls Before Beginning Complete Convergence.

The following four statements should be kept in mind during the CONVERGENCE adjustments.

1. The purpose of the DYNAMIC controls is to form EQUAL SPACING between the color dots in each TRIANGULAR GROUP across as much screen area as possible.

2. The purpose of the STATIC controls is to converge each of these TRIANGULAR GROUPS into ONE single dot across as much screen area as possible.

3. The DYNAMIC voltages cause different dot movement over different areas of the screen.

4. The DC CONTROLS cause same dot movement over the entire screen area.

## PRELIMINARY CONVERGENCE

1. Turn the RED, GREEN and BLUE DC controls, and if necessary, turn the BLUE LATERAL MAGNET within its holder to form white dots in the central area of the screen. See Figure 11.

   Caution: Do not turn or rotate the BLUE LATERAL MAGNET ASSEMBLY.

Note: Either a cross hatch or dot video pattern can be used in the following convergence procedure. The cross hatch lends itself better for rapid convergence, however for accurate final adjustments, the dot pattern is more desirable.

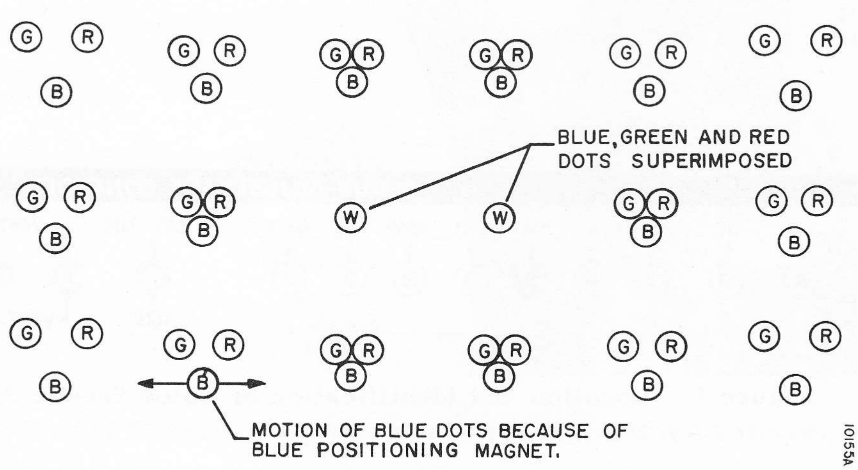



Figure 11. Red, Green, and Blue Dots Converged in Central Screen Area.

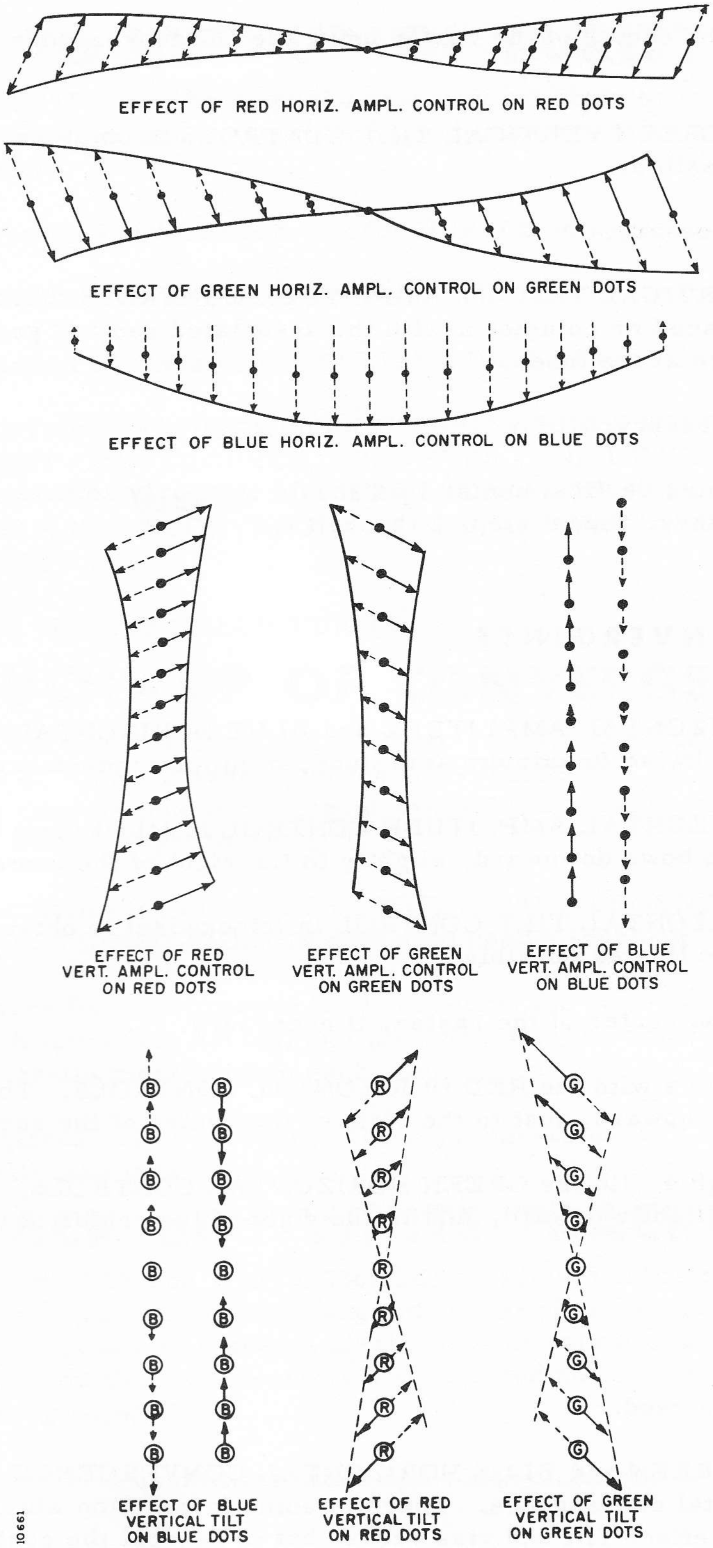



Figure 12. Effect of Dynamic Convergence Controls Upon Dots.

## VERTICAL CONVERGENCE

1. Adjust the RED, GREEN and BLUE SCREEN and the GREEN and BLUE GRID controls for normal red, green and blue cross hatch pattern (using cross hatch generator).

2. Using the blue vertical center line as reference, adjust the RED and GREEN VERTICAL AMPLITUDE CONTROLS to make the red and green lines symmetrical about, or to overlap the vertical blue center reference line.

3. Statically converge the center of the raster using the DC convergence controls and the blue lateral magnet.

4. Adjust the RED and GREEN VERTICAL TILT CONTROLS to obtain as straight a vertical center line as possible.

5. Repeat step 3, if necessary.

6. Adjust the BLUE VERTICAL TILT and AMPLITUDE CONTROLS to make the horizontal blue lines equally spaced or coincident with the associated red and green horizontal lines along the vertical axis of the tube.

7. Repeat step 3, if necessary.

8. The red, green and blue vertical center line should be nearly coincident (overlapped forming white). If necessary, repeat steps 2 through 7.

## HORIZONTAL CONVERGENCE

1. Turn the BLUE HORIZONTAL AMPLITUDE and BLUE HORIZONTAL TILT CONTROLS out fully counter-clockwise (maximum amplitude, minimum inductance).

2. Turn the BLUE HORIZONTAL AMPLITUDE CONTROL in (clockwise) until the blue horizontal center line bows downward, slightly to the right of the center of the screen.

3. Turn the BLUE HORIZONTAL TILT CONTROL in (clockwise) to obtain as straight a horizontal center blue line as possible.

4. Statically converge the center of the raster, if necessary.

5. Repeat steps 1 through 4 with the RED HORIZONTAL CONTROLS. The bow in the red center line is slightly upward, just to the right of the center of the screen in this case.

6. Repeat steps 1 through 4 with the GREEN HORIZONTAL CONTROLS. The bow in the green center line is slightly upward, just to the right of the center of the screen in this case.

## FINAL CONVERGENCE

The dot pattern should be used.

1. Touch up the RED, GREEN and BLUE HORIZONTAL CONVERGENCE CONTROLS for best over-all horizontal convergence. There is some interaction which causes the Amplitude Control to effect Tilt and visa versa, but in general the controls can be treated as labeled.

2. Touch up the RED, GREEN and BLUE VERTICAL CONVERGENCE CONTROLS for best over-all vertical convergence.

3. Set the best over-all static convergence using the DC CONTROLS and the BLUE LATERAL MAGNET. The blue lateral magnet influences slightly the beam from the red and green electron guns, therefore, after making final adjustment of the blue lateral magnet, readjust the RED and GREEN DC controls.

# TOUCH - UP OF PURITY

A TOUCH-UP of PURITY may be required on a new receiver or following the convergence adjustments. In either case, make the following adjustments until good purity is achieved for the red field.

1. Perform steps 2, 3 and 4 under COLOR PURITY on page 15.

2. Adjust RIM MAGNETS for good purity around edges of raster.

3. SLIGHTLY adjust the tabs on the PURITY RINGS, if necessary.

   CAUTION: ADJUSTMENT OF PURITY RINGS WILL UPSET CONVERGENCE. HOWEVER, THE RESULTS OF A VERY SLIGHT ADJUSTMENT MAY BE NEGLIGIBLE UPON CONVERGENCE AND MAY IMPROVE PURITY.

4. Perform step 12 under COLOR PURITY.

# TOUCH - UP OF CONVERGENCE

A TOUCH-UP of CONVERGENCE is not a "short-cut" for correctly adjusting the receiver for convergence. Careful reading of the CONVERGENCE procedure, or previous experience in making convergence adjustments will aid the service technician to determine which controls might need a slight touch-up.

It may be found that following the COLOR PURITY, CONVERGENCE and TOUCH-UP of PURITY adjustments that CONVERGENCE may also need a touch-up.

A touch-up procedure for convergence is (1) to follow the step-by-step procedure given under CONVERGENCE (complete set-up) and (2) make only the adjustments which are necessary to obtain the results mentioned in each step.

If the receiver requires only a touch-up, the adjustments under CONVERGENCE will be easier to make and will take less time.

# BLACK and WHITE TRACKING

The purpose of the BLACK and WHITE TRACKING adjustment is to produce a good black and white picture within the usable range of the Brightness and Contrast controls. If this adjustment is not properly made, a black and white picture will appear tinted with color as the Brightness or Contrast controls are adjusted and a color picture will be reproduced with the wrong colors.

Tune in a station that is transmitting black and white pictures.

Make adjustments as follows:

1. Turn the CONTRAST CONTROL completely to minimum.

2. Turn the GREEN and BLUE GRID CONTROLS to extreme left (minimum).

3. Adjust the RED, GREEN and BLUE SCREEN CONTROLS to about 1/2 rotation clockwise. At these settings the picture should be red when the brightness is turned up.

4. Adjust the Brightness control until the picture is just extinguished.

5. Turn the GREEN GRID control completely to the right and then reduce the setting until the green light just disappears.

6. Repeat step 5 for the BLUE GRID control.

7. If the picture appears GREENISH, turn GREEN SCREEN control very slightly to the right. Then turn GREEN GRID control to the left until picture is black and white.

   If the picture appears BLUISH, turn BLUE SCREEN control very slightly to the right. Then turn the BLUE GRID control to the left until the picture is black and white.

   If the picture appears REDDISH, turn RED SCREEN control to the left until picture is black and white.

8. If picture is still not black and white, repeat entire "Black and White Tracking" procedure.

# CIRCUIT DESCRIPTION

## VHF TUNER

The VHF tuner, 94D131-1, features high gain and stability and inherent high signal to noise ratio. Drift has been minimized by the use of rugged tuner construction and temperature compensated capacitors.

Simplicity of design and Printed Wiring will reduce service requirements to a minimum. Much longer tube life is made possible by the neutralized triode circuit. This single triode has less than half the dissipation of a dual-triode cascode. A desirable feature of the tuner's circuitry is that it is designed to operate on a relatively low B-Plus Voltage, as low as 125 volts, thus assuring longer life to components and tubes.

The 6BN4 is used as a neutralized triode RF amplifier. The input transformer T101 matches the 300 ohm balanced input antenna lead-in to the unbalanced 75 ohm input of the tuner. The signal then is applied to two IF traps, one parallel, one in series. These traps are stagger-tuned to provide optimum IF rejection over the range from 41 to 46 MC. The capacitor C121 reduces oscillator radiation. From antenna coil L102A, the signal is applied to grid of the 6BN4. AGC bias is applied to this grid. Capacitor C105 varies the amplitude of the 180 degree phase shifted signal from the plate circuit to neutralize the plate to grid capacitance. The output of the triode is mutually coupled to the input tuned circuit of the pentode Mixer 6CG8. C108 tunes the plate circuit of the RF Amplifier. C110 tunes the grid circuit of the mixer stage.

The local oscillator circuit of the tuner is a conventional Colpitts circuit with "Book" fine tuning. The fine tuning stator area in the plate circuit is printed on the board. A hinged tin-dipped phosphor bronze plate is separated by insulating tape from this printed area. Hence, "Book Tuning". The Fine Tuning control provides a tuning range of from 2 to 4.5 MC on all VHF channels.

When replacement is made of feedthrough capacitors C102, C104, C109, C112, C113, C115, exact replacement feedthrough capacitors should be used.

## MIXER IF COUPLING NETWORK

The mixer IF coupling network is made up of four tuned circuits, two tuned to IF frequencies (L105 and T201), an adjacent channel sound trap (L202) and a trap (L201) for attenuating the sound carrier. The mixer plate circuit is tuned to 42.4 MC, and is capacitively-coupled to the IF input circuit which is tuned to approximately 46.0 MC. Capacitance-coupling is used to minimize oscillator radiation. The trap (L201), tuned to 41.25 MC, attenuates the sound carrier approximately 30 db to prevent the herringbone pattern on the picture tube caused by the 920 KC beat between the sound carrier and color subcarrier.

Cross modulation is the modulation of the desired signal by an unwanted signal or interference such as adjacent channels. To minimize interference, an adjacent channel sound trap (L202) in the mixer-IF coupling network provides approximately 46 db rejection at 47.25 MC.

## VIDEO IF CHANNEL

The video IF channel consists of 4 stages of IF amplification using three 6BZ6 tubes and one 6CB6 tube. The channel is designed for a 45.75 MC video carrier, a 42.17 MC color sub-carrier and a 41.25 MC sound carrier. The first and second stages are tuned to the video and color sub-carrier frequency sides of the IF response curve (46.0 MC and 45.1 MC) so that the sound carrier is kept at a low amplitude as long as possible to further prevent cross modulation. The third stage is tuned to approximately center of the IF response passband (43.2 MC) and serves as a "tilt" control. The "tilt" is adjusted to produce a flat response over the passband of approximately 4 MC at the 6 db points on the IF response curve.

The first, second and third IF amplifiers are controlled by automatic gain control. To further minimize cross modulation the tubes are of remote cut-off type. The screen grids on these three tubes are made further remote by using a dropping resistor in the B plus line.

## LUMINANCE CHANNEL

The luminance (Y) channel function is similar to that performed in black and white receivers -- that of amplifying the luminance information to the required amplitude to drive the picture tube and adjusting the peaking of the video circuits for fine detail in the picture. The "Y" channel consists of the luminance detector, delay line and one stage of amplification called Luminance Output.

The luminance detector (CR201) is a germanium diode and is operated at 7.0 volts peak output level. A crystal has a more linear characteristic resulting in better amplitude response for the gray portions of the picture. Also, a crystal diode was selected because its physical size provides easier shielding for IF harmonics. The small diodes have less shunt capacity providing less loss to high frequencies. Immediately following the luminance detector is an IF bypass condenser (C218) and a series rejection coil (L207) tuned to 43.5 MC. These two components filter out any IF or RF signals that may have passed through the luminance detector.

Delay Line — Since the luminance signal has a wider over-all bandwidth than the chrominance channel, it must be delayed in order to insure that the two signals arrive at the picture tube at the same time. The luminance signal thus is delayed .8 microsecond in the delay line.

The series peaking coil (L210) in the output of the delay line is to minimize reflections. A modified bridged T trap (L211) following the delay line provides rejection at 3.58 MC. R223, 4,300 ohms resistor, serves as a detector load, a termination for the delay line, and the center leg of the bridged T.

Luminance Output, V205 —The single stage 12BY7 luminance amplifier is direct-coupled to the picture tube cathodes, thus achieving DC restoration. A variable resistance (R225) in the luminance amplifier cathode functions as a Contrast control. To achieve greater gain and bandwidth in the plate circuit of the luminance amplifier, mutual inductance is used between peaking coils.

## SOUND CHANNEL

The sound channel consists of a detector, IF amplifier, ratio detector, audio amplifier and audio output. The sound and chroma are taken from a separate winding on the fourth video IF transformer.

The 4.5 MC intercarrier beat is detected in the combination sound and chrominance detector. The germanium diode used here is the same as is used in the luminance detector stage, Admiral part number 93A8-1.

The input transformer (L301) feeds the 4.5 MC sound IF to the grid of the pentode section of a 6U8 tube, sound IF amplifier. A conventional ratio detector stage is used to remove the audio information from the sound IF carrier. The remaining triode section of the 6U8 tube is used as the first audio amplifier. A tapped volume control (R308) and frequency compensation network in the grid circuit provide good low frequency response even at low settings of the control. A manual tone control (R314) is inserted in the plate circuit of the first audio stage. The audio output consists of one 6V6 tube.

## CHROMINANCE CHANNEL

The chrominance section of the color receiver removes the color information from the composite video signal, builds it up, demodulates it and distributes it in proper proportions to the three guns in the picture tube. Several stages work together to perform these tasks.

Chrominance Detector — A germanium diode, Admiral part number 93A8-1, is used as a combination chrominance and sound detector. The diode is the same type as the luminance detector diode. Provisions are made for the necessary by-pass and peaking networks.

A 4.5 MC bridged T trap (L401), located between the chrominance detector and first chroma amplifier, prevents the sound IF from entering the chroma channel. This trap provides 26 db attenuation to 4.5 MC.

Chroma Amplifiers — The three interstage circuits in the chrominance amplifiers are stagger-tuned, similar to video IF amplifiers, to provide a 1 MC flat bandpass. The two high elements in the grid and plate circuits of the first chroma amplifiers are tuned to 4.1 MC and 3.1 MC, respectively. Figure 18a shows a typical response of two such circuits. The plate circuit of the chroma output has a slightly broader response with less amplitude (see Figure 18b) and is tuned to 3.58 MC, approximately midway between 3.1 MC and 4.1 MC. The three-stage stagger-tuned response is shown in Figure 18c, flat for the full 1 MC bandpass required for good color detail. The input impedance of the output stage is lower than the output impedance of the first chroma amplifier. Matching is accomplished with the 2:1 turns ratio inter-stage coupling transformer T401. The chrominance output is coupled to the demodulators through capacitors C426 and C427.

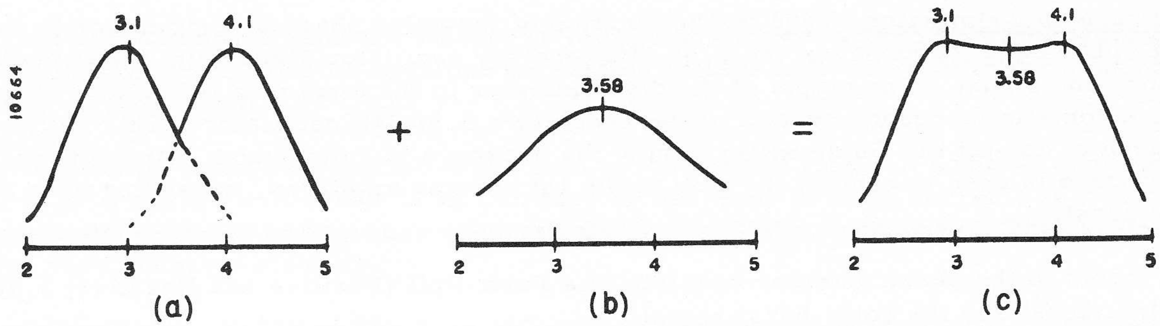



Figure 13. Typical Response Curves of Three Stagger-Tuned Circuits.

Four voltages are present at the grid of the first chroma amplifier. Let us consider each of these voltages individually:

A. The chrominance signal, containing hue and saturation, is coupled to the grid through a 3.3 mmfd capacitor. Due to the high impedance at low frequencies, this capacitor passes only sidebands suppressed 3.58MC sub-carrier.

B. During color reception, a positive pulse from the color intensity control is coupled to the grid of the first chroma amplifier through capacitor C503 and coils L402 and L403. The amplitude of this pulse can be varied manually by the color intensity control between 0 and 90 volts, peak to peak. The bias developed at the grid varies in proportion to the amplitude of the pulse. The gain of the tube varies inversely proportional to the amplitude of the pulse.

C. During black and white reception the Color-killer tube, V401B, conducts and provides a positive pulse to the grid of the first chroma. This pulse, approximately 80 volts, peak to peak, automatically accomplishes the same result as described in step "B" above in the absence of color.

D. Automatic Chroma Control voltage (comparable to automatic gain control) is the fourth voltage applied to the grid of the first chroma amplifier tube. The ACC voltage, described under the heading of Automatic Chroma Control is developed in the 3.58 MC phase discriminator stage. The amplitude of the incoming burst determines the amount of ACC voltage fed back to the grid as gain control voltage.

In brief; during color reception, the first chroma amplifier conducts fully during horizontal retrace time and according to the setting of the color intensity control during horizontal trace time. During black and white, the tube conducts only during horizontal retrace time.

Burst Amplifier, V501B — The color "burst" signal consists of 8 to 11 cycles of the 3.58 MC carrier used in the balanced modulators in the transmitter. Hence, the "burst" contains the same frequency and phase as that of the missing subcarrier and is used in the receiver as the Color Synchronizing signal. This color sync signal appears during horizontal retrace period on the back porch of the horizontal blanking pulse.

The color "burst" signal, amplified in the first chroma amplifier tube during horizontal retrace time, is taken off at the interstage coupling transformer T401 and applied to the grid of a pentode burst amplifier tube V501B. To insure "burst" separation from the chrominance signal, the cathode of the burst amplifier receives a negative gating pulse which allows the tube to conduct only during the horizontal retrace gating pulse time. The amplitude of the gating pulse is approximately 45 volts, peak to peak. The amplified "burst" signal, approximately 200 volts peak to peak, appears in the plate circuit and is developed across the plate load coil, L501. This "burst" signal is applied to the color phase discriminator through capacitor C511.

Color Phase Discriminator, V502 — The function of the color phase discriminator is to compare phase and frequency of the 3.58 MC receiver oscillator signal with incoming burst, the color sync signal. The output of the discriminator in the form of a DC voltage is used to provide automatic frequency control of the receiver's 3.58 MC oscillator. This same output is used to cut-off the Color Killer during the presence of color burst. An additional output voltage is used to control the gain of the 1st chroma amplifier, depending upon the level of burst.

The inputs to the phase detector consists of a Push-Pull (Positive and Negative) 3.58 MC oscillator signal and the color burst signal.

On a color signal, burst and oscillator inputs are compared in frequency and phase, "Positive going" 3.58 MC oscillator signal to one diode and "Negative going" oscillator signal to the other diode with the burst signal common to both diodes.

Each diode conducts equally when the phase of burst is 90 degrees displaced from the 3.58 MC oscillator signal appearing at either cathode. The 3.58 MC oscillator signals appearing at the two cathodes are, of course, of opposite phase ($180^{\circ}$). When the diodes conduct equally, the "voltage drops" across each diode load resistor, R521 and R522, are equal and of opposite polarity.

The oscillator control tube, V503A, requires a small value of operating bias; therefore, the oscillator tank coil is adjusted for a negative six (-6V) volts at Pin 1 cathode. This same negative six volts is applied to the color killer tube grid to effect its cut-off during color reception.

When the frequency and phase relationship between the oscillator voltage and the incoming burst signal is correct, the color phase discriminator supplies normal operating bias to the grid of the 3.58 MC oscillator control tube, V503A. If the 3.58 MC oscillator increases slightly in frequency, a more positive voltage is developed and applied to the grid of the oscillator control tube. This will essentially increase the capacitance of the control tube which shunts the oscillator tank, thus reducing oscillator frequency. If the oscillator frequency decreases slightly below 3.58 MC, a more negative voltage is developed and applied to the grid of the control tube, thus decreasing the capacitance and increasing the frequency of the 3.58 MC oscillator.

ACC - Automatic Chroma Control — The automatic chroma control functions similar to an automatic gain control on black and white receivers. A negative voltage determined by the amplitude of the incoming burst signal is fed back to the first chroma amplifier grid to increase or decrease gain through that stage.

The first chrominance amplifier also amplifies the color burst which is separated from the chrominance signal by means of a gated burst amplifier tube. This separated high-altitude burst is fed to the phase detector where it is compared with the output of the 3.58 MC oscillator. The balanced negative output of the phase detector is a measure of the relative burst signal amplitude; this control voltage is applied to the first chrominance amplifier to provide Automatic Chrominance Control.

The color intensity control, R 505, is a manual chrominance control. By varying a positive horizontal retrace pulse applied to the grid of the first chrominance amplifier, output of the chrominance amplifier varies inversely as the amplitude of the horizontal pulse while the burst output remains nearly constant.

3.58 MC Oscillator Control, V503A — The 3.58 MC Oscillator Control tube is used to correct the frequency or phase drift of the 3.58 MC oscillator. The amount of frequency or phase correction depends upon the amount of voltage developed by the phase discriminator tube. The phase discriminator develops correction voltage in proportion to the amount of frequency or phase drift.

The correction voltage is applied to the grid of the control tube. A positive or negative change in grid voltage will result in an increase or decrease in plate current, in turn resulting in a decrease or an increase respectively, in oscillâtor frequency. This system provides very accurate stability.

3.58 MC Oscillator, V503B — The 3.58 MC voltage is produced by a crystal controlled oscillator, the pentode section of a 6U8. The crystal is connected between the grid and screen. Electron coupling to the plate produces sufficient signal in the plate circuit of the oscillator to drive the phase discriminator and the triode demodulators. Transformer, T502, in the plate circuit provides such signal voltages.

Chrominance Demodulators, V403 — Two triode color demodulators of high amplification are used to demodulate R-Y, B-Y and G-Y from the chrominance signal. This high level type of demodulator provides adequate output to drive the picture tube directly with good linearity, DC stability, and independence of tube characteristics.

The chrominance signal is fed at high-amplitude to the plate while the 3.58 MC signal is applied to the grid. The grid circuit is self-biased and driven with sufficient voltage to assure class C operation. The plate receives adequate chroma signal to drive two of the three guns in the picture tube plus a smaller amount that is subtracted from the plate circuit and taken off of the common cathode to drive the third gun. This circuit takes advantage of the fact that the G-Y signal requirements are the smallest of the three color difference signals, and that the G-Y can be made up of the negative of R-Y and B-Y since G-Y= -.51 (R-Y) -.19 (B-Y). The G-Y signal produced in the cathode circuit subtracts from the B-Y and R-Y signals produced in the plate circuit. Therefore, sufficient chroma drive must be applied to the plates to produce the cathode signal as well as the plate signal.

To eliminate the cross talk between R-Y and B-Y which would normally exist due to the common cathode impedance, the R-Y and B-Y demodulating reference voltage angles are moved toward each other from their quadrature ($90^{\circ}$ separation) position to cancel out the introduced cross talk. The R-Y demodulator axis is moved 12.9 degrees away from R-Y in the direction of B-Y. The B-Y demodulator axis is moved 13.5 degrees away from the B-Y in the direction of R-Y. Total separation of the demodulator axis is 63.6 degrees.

The operation of the high level color demodulators differ from the well-known diode detectors used in black and white TV and in the color set, to obtain luminance information from the modulated carrier. There are two reasons for this difference.

1. Color information is transmitted by a suppressed carrier system and in order to detect these signals it is necessary to supply a carrier at the receiver. This carrier must be synchronized to burst, the only color carrier transmitted.

2. To obtain three outputs (red, green, blue) from one signal it is necessary to detect the signal at phases, other than the carrier. Two signals are detected (R-Y and B-Y) and the third (G-Y) is developed by adding together portions of the first two signals detected.

As a result red, green and blue are not detected in the color demodulators, but R-Y, B-Y, and G-Y where Y represents the black and white or luminance signals. Use is made of the picture tube to add together the chrominance information received from the color detectors, and the luminance information received from the luminance amplifier to produce the final red, green and blue signals. This is done by DC coupling the black and white information to the three cathodes of the picture tube, while the three outputs of the color demodulators are DC coupled to the respective grids of the picture tube.

The chief requirements for proper operation of the demodulators are--

1. The correct ratios between the separate plate-load resistors and the common cathode resistor.

2. The correct phase relationship between the two reference CW signals which are applied to the grids.

Detection of the chroma signal is accomplished by causing the two triodes to act as grid controlled rectifiers. The 3.58 MC sine wave voltage from the crystal controlled subcarrier oscillator is applied between grid and cathode of the R-Y detector. To detect at correct phase for the B-Y detector, a two stage phase shift network is used. This network delays the subcarrier applied to the B-Y detector so that correct outputs are produced.

This CW voltage is great enough so that the demodulator tubes operate class C; that is, each tube draws current for only a very short time during each cycle. Thus, the tubes operate as switches, turning on once each cycle. The bias on the tubes is determined by grid conduction, and by the parallel resistance-capacitance network in each grid. The series resonant coils L407, L408 and L409 filters the 3.58 MC component in the output circuits.

Phase Shift Network, L406 — Since one of the two chrominance demodulators requires a phase difference signal, a phase shift network is used to provide the exact amount of shift. One of the secondary windings on the 3.58 MC oscillator output transformer, T502, supplies the 3.58 MC signal to the two demodulator stages. One demodulator, V403A, receives the 3.58 MC signal direct; the other demodulator, V403B, receives the signal that has been delayed. A two-section low-pass filter having a 560 ohms characteristic impedance provides 63.6 degrees phase shift. The use of two-sections makes the value of circuit components less critical and improves stability. Only one adjustment is required to obtain 63.6 degrees relative phase shift; see Phase Alignment on page 48.

Pulse Shaper, V501A — The purpose of the pulse shaper circuitry is to narrow the positive gating pulse which is applied to the first chroma amplifier, V401A. If the pulse coupled to the first chroma amplifier is too wide, it might carry over into chroma time which would distort the chroma information appearing on the left side of the picture.

The pulse shaper tube is a cathode follower. The grid leak provided places the operating point of the tube at cut-off until the positive gating pulse applied to the grid goes sufficiently positive to cause conduction. Thus the positive pulse at the cathode will appear only during this shorter time. This is because the gating pulse is progressively narrower as it approaches its positive peak.

Color Killer, V401B — The function of the color killer circuitry is to disable the first chroma amplifier during black and white reception so that no video will pass through the chroma channel to cause color contamination of the black and white picture. Another function of the color killer is to pulse the first chroma amplifier into conduction only during burst time so that the chroma channel is always "open" when burst is present (during color transmission).

A negative going pulse, taken from a winding on the horizontal output transformer, is applied to the grid of the color killer tube. The positive pulse appearing in the plate circuit (during black and white transmission) is applied to the grid of the first chroma amplifier. This causes the first chroma amplifier to conduct during the burst time interval. The chroma amplifier is then cut-off because of grid current flow which develops a cut-off bias.

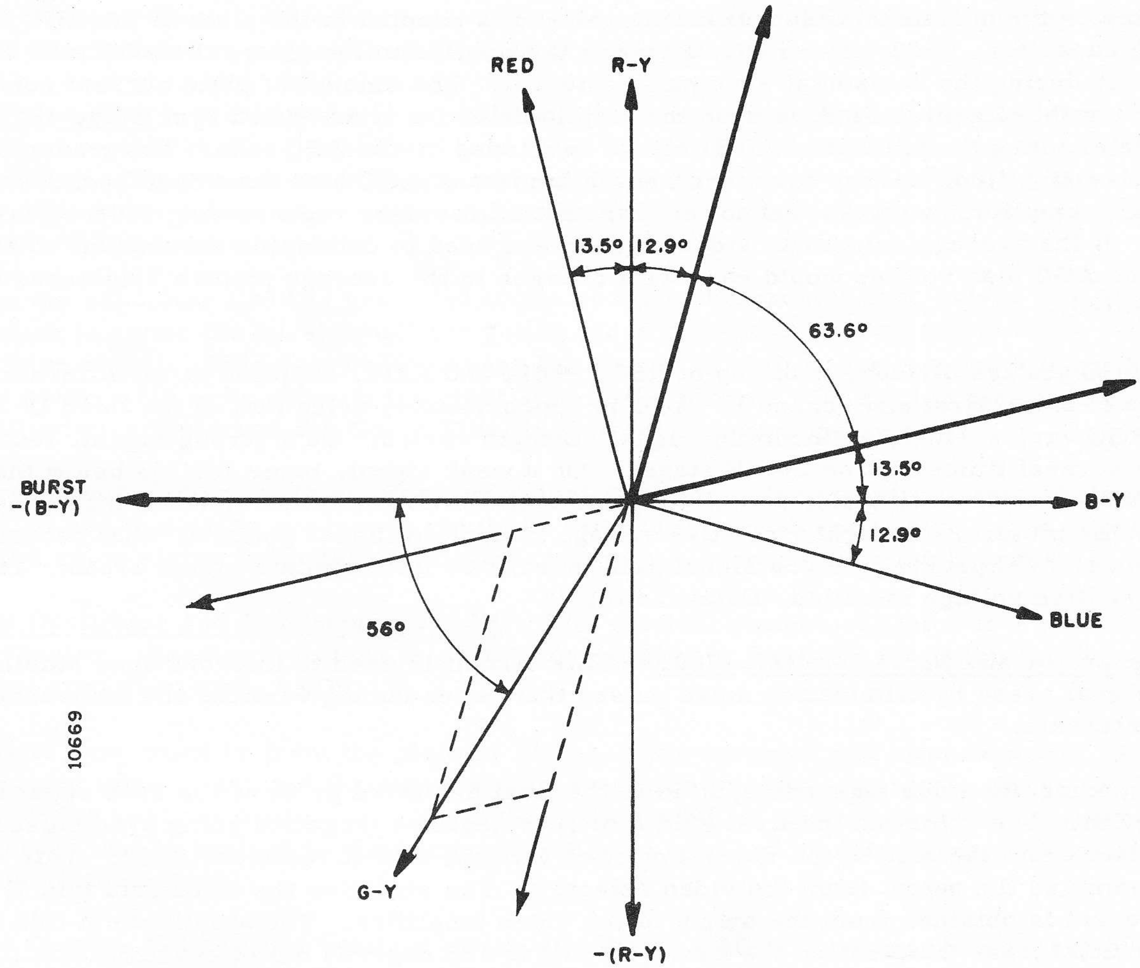



Figure 14. Vector Diagram Showing Relationship of Axes. Demodulator Axes Shown in Heavy Lines.

Due to the long RC time constant in the grid circuit, the tube remains cut-off until the next pulse. The amplifier is held beyond cut-off (during scan time) until another pulse appears (during retrace time). Thus no video passes through the chroma channel during black and white transmission.

When color burst is present at the input of the color phase discriminator, a DC voltage, negative polarity, is developed at pin #1 cathode of the color phase discriminator. This voltage supplies normal operating bias to the 3.58 MC oscillator control tube, and cut-off bias to the color killer tube. Thus the color killer is cut-off during color transmission and will not disable the chroma channel.

The first chroma amplifier conducts during color transmission and conducts only during retrace time during black and white transmissions.

The color killer conducts during black and white transmission (retrace time only) and is cut-off during color transmission.

AGC — A gated pentode circuit provides automatic gain control bias for the grids of the RF and first three IF amplifiers, based on the transmitted sync pulse level. The grid of the gated AGC tube, V206, is supplied with the composite video signal voltage from the output of the video amplifier by direct coupling through isolating resistor, R605. Pulsed plate voltage of 500 volts peak to peak developed during horizontal retrace time, is obtained from a winding on the horizontal output transformer and is coupled to the plate of the AGC tube through capacitor, C603. Since DC voltage is not applied to the plate, the AGC tube conducts only during the horizontal sync pulse interval. The amount of plate current conduction during this interval depends upon the amplitude of the transmitted sync pulse and, in turn, determines the amount of AGC voltage developed by the AGC tube. The transmitted sync pulse amplitude is used to determine the amount of AGC bias developed because this is a constant amplitude with respect to the transmitted carrier, representing 100% of carrier power. If the average composite video signal were used to determine the amount of AGC bias, the AGC bias voltage would vary with changes in the average picture brightness being transmitted.

An AGC voltage divider, made up of R604, R214 and R216, supplies three different amplitudes of bias; first and second IF AGC is approximately twice that of the third IF and the tuner AGC varies widely as incoming signal strength varies. On a strong signal, tuner AGC may be several times that on the IF stages. On a weak signal, tuner AGC is below that of the IF stages to provide better signal-to-noise ratio through the tuner, resulting in less snow in the picture. A slightly positive voltage is applied to test point "U" that cancels part of the tuner AGC providing more signal gain in weak or intermediate signal areas. This small positive voltage is called "Delay Voltage".

Sync Separator and Noise Limiter, V601 — This circuit is used to improve sync stability in noisy signal areas by eliminating noise pulses that occur during vertical and horizontal sync pulse intervals.

The composite video signal is applied to the first and third grids of the sync separator tube, 6CS6. The signal on the first grid (pin 1) is negative (negative going sync pulses) and is obtained from the grid of the video amplifier through a 47 K resistor, R222. This signal is the same as the output from the video detector. The signal on the third grid (pin 7) is positive and is obtained from the output of the video amplifier. The amplitude of this signal is much larger than that on the first grid and is 180 degrees out of phase.

The negative AC and DC voltages, developed across video detector load resistor, R223, are applied to the first grid (pin 1) of the 6CS6 through an isolating resistor, R222, 47,000 ohms.

The first grid is so biased by this voltage and the positive (bucking) voltage from the 385 volt supply through the 2.2 megohm resistor, R610, that any pulse greater than the amplitude of the sync pulses will cut the tube off and prevent these noise pulses from entering the synchronizing circuits and triggering the vertical and horizontal oscillators.

If a noise pulse is superimposed on the sync pulse, the action of the circuit will eliminate both the noise and sync pulses. When sync pulses are lost in this manner, the "fly wheel" effect of the oscillators will keep them synchronized until the next sync pulse arrives. Capacitor C607 provides coupling to the grid of the Sync Inverter Stage.

Sync Inverter, V602A — The negative going sync pulses from the plate of the sync separator are applied to the grid of the sync inverter.

Due to the high value of grid leak resistance, R618, and some cathode bias, the sync inverter also operates as a sync clipper. Negative going sync pulse peaks drive the tube to cut-off, resulting in sync clipping or amplitude limiting action.

Negative going clipped sync pulses from the cathode of the sync inverter are applied to a cathode of the sync discriminator through a coupling capacitor, C609.

Positive pulses of approximately equal amplitude are taken from a voltage divider consisting of resistors R615 and R616 in the plate circuit of this stage and are applied to a plate of the sync discriminator through a coupling capacitor, C608. The coupling capacitors are low in value to reduce feed-through of the vertical sync pulses.

Color Stripe Test — A test point is provided on the rear apron of the color chassis to test for color reception in those areas where a color stripe is transmitted during black and white transmission. This stripe as it is transmitted consists of a few cycles of 3.58 MC at burst phase. This color information occurs for a short time just after horizontal blanking and for a short time just before blanking.

When the capacitor C614 is grounded to the chassis, horizontal sync pulses are delayed just enough to cause the burst amplifier gating pulse to appear at time coincidence with the color stripe signal. This delay also causes the raster to shift to the left permitting the vertical color strip to be seen on the right side of the picture. The color stripe will appear yellowish-green when the Color Fidelity Control is set properly.

Correct reproduction of this color stripe indicates the color circuits in the receiver are functioning and that color programs should be faithfully reproduced. Also, good reproduction of the color stripe indicates a satisfactory antenna system for color broadcasts.

Vertical Oscillator and Discharge, V602B — The vertical sweep oscillator is a modified multi-vibrator. Feedback voltage to sustain oscillation is fed from the output of the vertical output amplifier tube, 6AQ5.

Vertical sync input is from the plate of V602A, sync inverter and clipper stage. This positive sync input is applied through the single-section integrator circuit, R628, C617, to the grid of the vertical oscillator. Variable resistor, R640, the height control, varies the plate voltage that is applied to the vertical oscillator tube and so determines the amplitude of the oscillator output.

Vertical Output, V603 — The vertical sweep amplifier, 6AQ5, provides the necessary voltage for vertical deflection. This tube is transformer coupled to the vertical yoke deflection coils. Voltage taken off at the cathode of the tube is used for vertical convergence. This voltage is applied to the vertical amplitude control circuits and to the DC convergence circuits. Voltage from three separate secondary windings on the vertical output transformer is applied to the vertical tilt control circuits.

Horizontal Sync Discriminator, CR601 — The horizontal sync discriminator is a dual selenium diode so connected to provide positive and negative outputs.

Balanced sync pulse voltage is applied to the plate of one diode and the cathode of the other; positive to the plate and negative to the cathode. A common reference voltage from a winding on the horizontal output transformer is fed through an RC waveshaping network to the remaining plate and cathode of the sync discriminator. The two DC outputs, one positive and one negative, are developed across equal values of load resistors, R620 and R621, and the difference voltage appears at the junction of the two resistors.

The discriminator develops a DC voltage across R622, 4.7 megohm resistor, that is proportional to the phase difference (by comparison) between the transmitted sync pulse voltage and the horizontal sweep reference voltage. When the frequency and phase relationship between the two voltages is correct, the sync discriminator supplies normal operating bias to the first triode section of the horizontal oscillator. When a change in phase or frequency relationship between the two occurs, the DC output voltage across R622 changes accordingly. This change in DC bias on one section of the horizontal oscillator makes the necessary phase or frequency correction. This Automatic Frequency Control Voltage (AFC) is filtered by C610, C611 and R623 to prevent noise pulses from reaching the oscillator grid.

Horizontal Oscillator, V604 — The horizontal oscillator is a modified cathode coupled multivibrator. Oscillator feedback is provided by the common cathode resistor R648 and plate to grid coupling capacitor C628.

The oscillator frequency is partially determined by the slug-adjusted coil L601 and capacitor C626. The slug adjustment of L601 is the Horizontal Lock control and functions as a coarse frequency adjustment. The RC time constant of C628, R649, R650 and C631 also determines the oscillator frequency, and variable resistor R650 is used as a fine frequency or Horizontal Hold control.

Capacitor C629 and resistor R651 form a waveshaping network to develop a saw-tooth waveform from the output of the horizontal oscillator. Capacitor C627 bypasses unwanted high frequencies from the plate of the horizontal oscillator that might cause horizontal instability or bending at top of picture.

Variable resistor R648 varies the plate voltage of the output section of the horizontal oscillator tube and consequently determines the amount of drive to the horizontal output stage. This variable resistor is the Horizontal Drive control.

Horizontal Output, V605 — A beam power amplifier tube, 6CB5A, in the horizontal output circuit has the multiple function of providing driving power for horizontal deflection, the high voltage pulses for the focus and high voltage rectifiers, and voltages for the dynamic convergence circuits. The horizontal amplifier is auto-transformer coupled to the horizontal deflection coils, as well as the focus and high voltage rectifiers. Voltage for the DC convergence circuits is supplied from the cathode of the 6CB5A. Secondary windings of the horizontal output transformer, T602, supplies pulsed voltages to the horizontal dynamic convergence circuits, horizontal phase discriminator, AGC tube, pulse shaper tube, and the color killer tube.

The high voltage interlock, M602, is disconnected when the safety glass is removed. This disconnect removes the screen grid voltage from the horizontal output tube, thus disabling the high voltage supply.

Damper, V606 — The two purposes of the damper tube are to suppress oscillation in the horizontal deflection yoke circuit, and to increase the plate supply voltage for several circuits in the television chassis.

The connections of the horizontal output transformer T602, are such that the DC Plate supply and the horizontal sweep voltage are in series. Conduction of the damper tube causes the voltage at the cathode to rise. This increased voltage exceeds the B plus voltage by about 330 volts and is called the "Bootstrap" voltage. This voltage is also known as "B Boost". Bootstrap voltage supplies the horizontal output tube and other stages in the receiver with a voltage that is higher than the voltage delivered by the conventional low voltage power supply. The horizontal linearity control, L610, in the plate circuit varies the waveform of the current flow through the damper tube and consequently through the horizontal deflection coils, resulting in a change in linearity.

Focus Voltage Rectifier, V607 — The Focus Voltage Rectifier tube, 1V2, plate receives a relatively high voltage pulse from a tap on the horizontal output transformer. The AC input to the plate of the 1V2 tube is controlled by R659, which serves as a focus voltage control.

The DC output voltage which is applied to the focusing anodes of the picture tube can be varied from 3000 to 4500 volts.

High Voltage Rectifier, V608 — The high side of the horizontal output autotransformer supplies the high voltage pulses to the plate of HV rectifier tube, type 3A3. The full DC output voltage of 20,000 volts is applied to the ultor ring of the picture tube. The filter capacitor consists of the metal bell of the picture tube acting as one plate, the "Boot" as the dielectric, and the outside conductive surface of Boot as the other plate. The inside of the boot also has a conductive surface. The total effective capacity in the high voltage circuit is 1,500 mmf.

Shunt Regulator, V609 — The high voltage regulator tube, 6BK4, is connected between the 20,000 volt output of the HV rectifier V608 and 380 volt B plus. A fixed resistance bleeder network, R677 and R680 between Bootstrap voltage and ground supplies a fixed positive voltage to the grid of the regulator tube to provide a means of setting the high voltage level. The circuit acts as a voltage regulator to the extent that as the grid voltage increases or decreases the regulator tube conduction increases or decreases, thus regulating the high voltage DC. This increase or decrease of the high voltage DC is caused by different brightness levels of the picture tube (more or less beam current).

Low Voltage Rectifiers, V701, V702 — The low voltage power supply consists of T701, the Power transformer, two type 5U4GB rectifiers, (connected full wave-parallel) and the filter C703A, L701, C704A, R703 and C704B. A two ampere fuse is connected between the high voltage secondary center-top and ground. The basic supply delivers DC output of 385 volts and 300 volts. The total power consumption of the 29Z1 Color TV receiver is 380 watts.

Convergence Circuit — Parabolic waveshapes are provided for both vertical and horizontal convergence. A vertical saw tooth is obtained from the cathode of the vertical output tube, 6AQ5. This voltage is applied across the vertical windings of the convergence yoke which integrates this voltage into a parabola of current. Vertical tilt is provided by a saw tooth of voltage from the vertical output transformer.

The horizontal parabola is obtained by double integration of a positive horizontal gating pulse from the horizontal output transformer. Inductances are used to control both the amplitude and the tilt of the horizontal parabola.

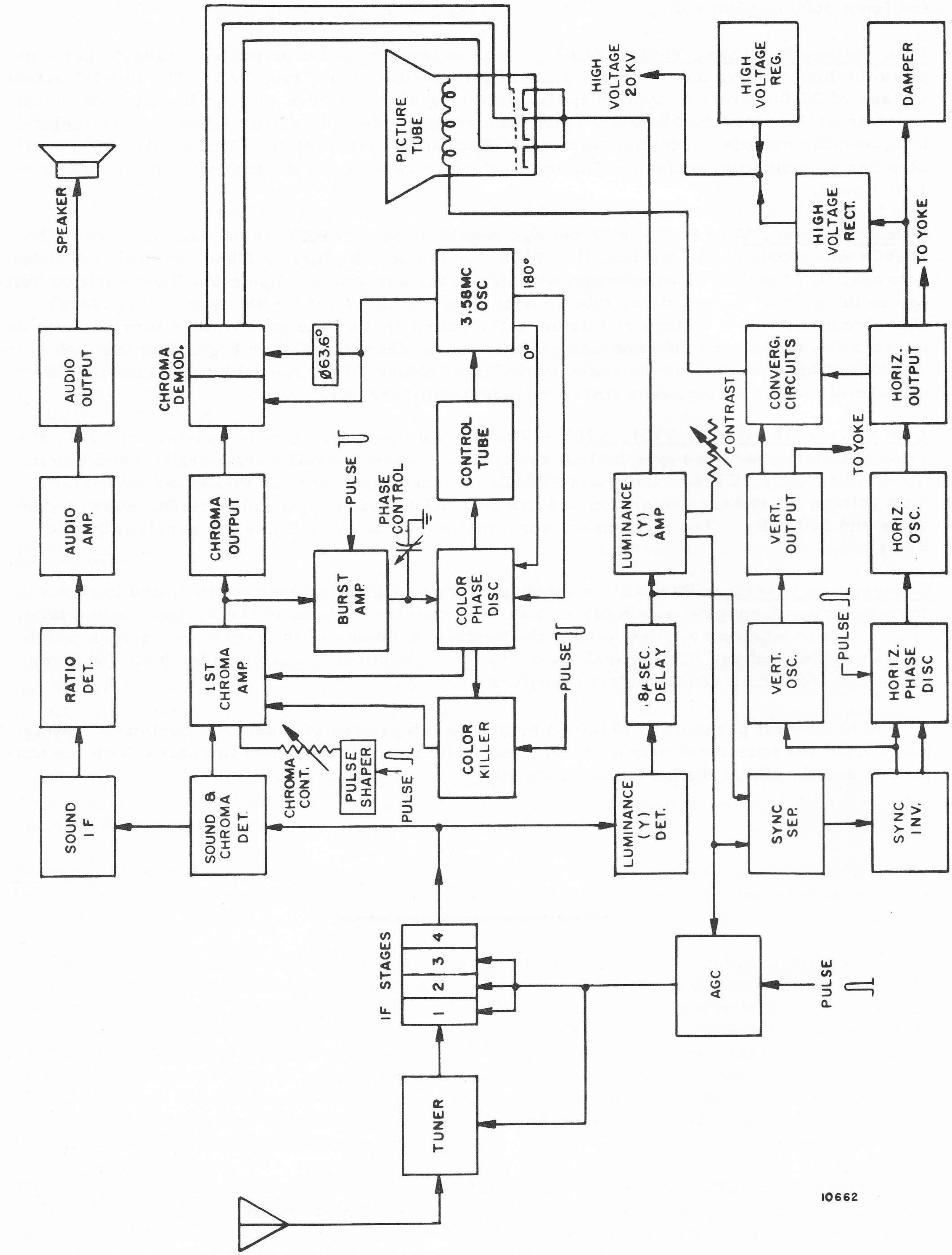



Figure 15. Block Diagram of 29Z1 Color TV Chassis.

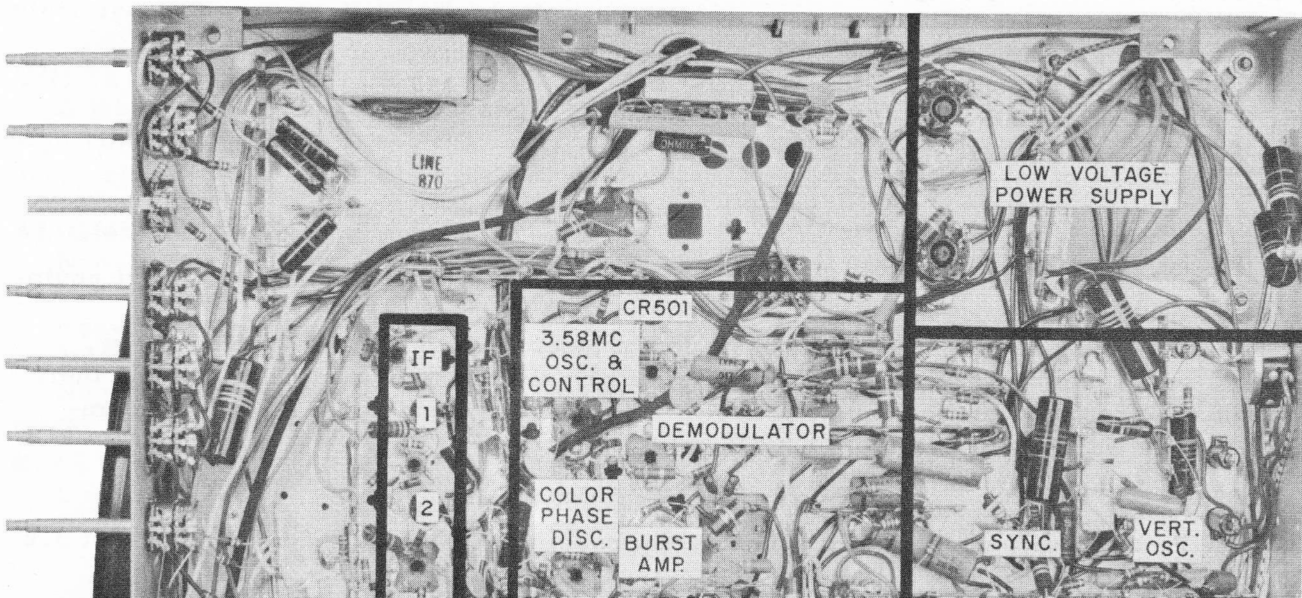



Figure 16. Sectional Identification of Circuits.

# ALIGNMENT

## GENERAL

Complete alignment consists of the following individual procedures.
(1) Video IF and Trap Alignment
(2) IF Response Curve Check
(3) Tuner Alignment
(4) Sound IF Alignment
(5) Chroma Alignment
(6) Sub-carrier - Color Sync - Color Phase Alignment

## TEST EQUIPMENT

To properly service this color receiver, it is recommended that the following test equipment be available.

IMPORTANT: Many service instruments do not meet the requirements given below. Additional test equipment is needed for color receiver alignment and adjustments and their requirements are more critical than for black and white TV servicing. A list of recommended equipment is available from your Admiral distributor.

### OSCILLOSCOPE

Standard - but with flat vertical frequency response (wide band deflection) to at least 3.6 MC; vertical sensitivity at least .1 volt (RMS) per inch.

Note: Most oscilloscopes have a vertical frequency response to about 1.5 MC. These oscilloscopes are not suitable for color circuitry alignment although they are satisfactory for black and white receivers.

### SIGNAL MARKER GENERATOR

4.5 MC frequency
38-50 MC frequency range
50-90 MC frequency range
170-225 MC frequency range
Must have a calibration crystal for checking dial accuracy.

### SWEEP GENERATOR

The sweep generator must provide sweep frequencies from 38 to 50 MC, 50 to 90 MC, and 170 to 225 MC. The sweep width must be at least 10 MC. The output must be adjustable with at least one tenth of a volt maximum. The output impedance should be 300 ohms balanced to ground.

A sweep generator not having constant output voltage over the swept range and linear sweep, will produce curves which are widely different from the ideal curves shown in the following pages. If repeated difficulty is encountered in obtaining these curves, the sweep generator should be checked. A simple check is to observe the response curve for a set that is in alignment.

Before suspecting the generator, be sure the alignment instructions in this manual have been followed carefully.

### VACCUM TUBE VOLTMETER

Preferably with low range (3 volts), DC zero center scale. It should also be equipped with a high voltage probe (30,000 volts range) for other adjustments and servicing.

## COLOR BAR GENERATOR

A Color Bar Generator is needed for Color Phase Alignment, and for troubleshooting color circuits. It is preferred that the generator produce signals according to NTSC Standards. The following outputs are required:

a. Variety of color bars, preferably of primary and complimentary colors.
b. Bars representing R-Y and B-Y.
c. 4.5 MC carrier.

The generator must be crystal controlled for stability. The outputs may be of RF or video frequencies; facilities for both are desirable.

## WHITE DOT GENERATOR

A White Dot Generator (such as ADMIRAL Model TE-100) is needed for convergence adjustments. The Generator must produce stable, small size dots. Model TE-100 produces either dots, or vertical bars or horizontal bars.

## ALIGNMENT TOOLS

Non-Metallic (FIBER) Screwdriver - 16 inches long - 1/8 inch diameter - Admiral part #98A30-19.

Non-Metallic-Alignment Wrench - 9 inches long, for Hexagonal Core IF Slugs - Admiral part #98A30-12.

Non-Metallic Alignment Wrench - 9 inches long, for small Hexagonal Core Slugs - Admiral part #98A30-14.

## BIAS SUPPLY

0 - 4.5 Volts (battery or electronic).
0 - 15 Volts (battery or electronic).

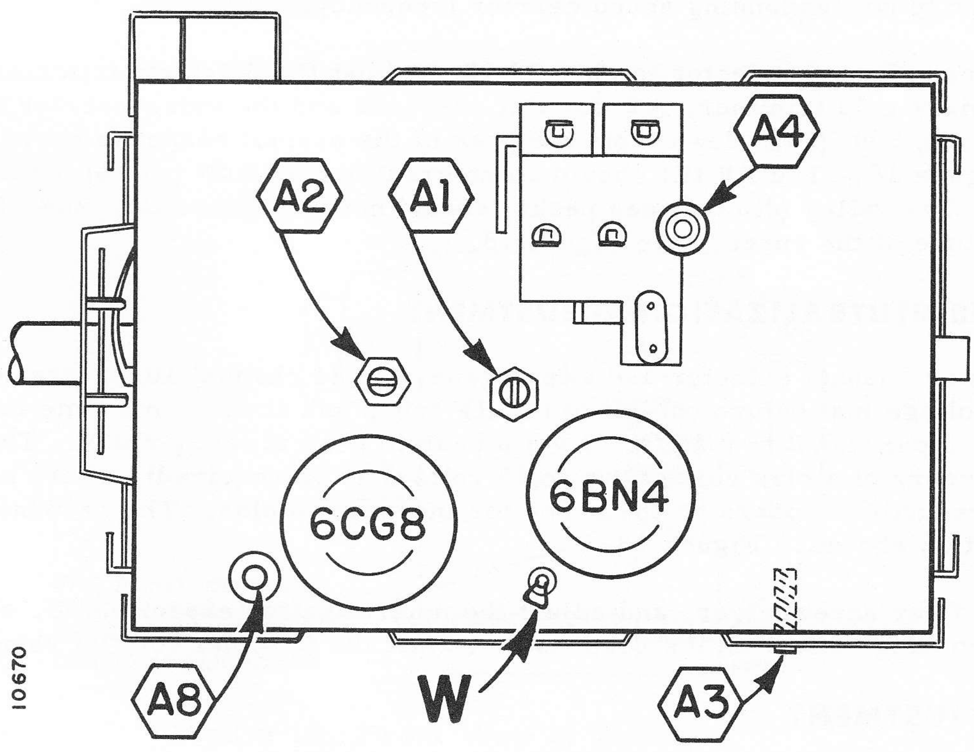



Figure 17. Top of Tuner Showing Alignment Adjustment Locations and Test Points.

## TUNER ALIGNMENT

Before aligning the VHF tuner, the IF amplifier including the converter plate circuit should be checked and aligned, if necessary.

1. Connect VHF sweep generator and marker to the antenna terminals.

2. Set the tuner channel selector and sweep generator for channel 2. Set marker to channel 2 sound (59.75 MC).

3. Construct a decoupling network shown in heavy lines in Figure 22 and connect across test point V, Luminance Detector Load. Connect test scope to point indicated.

4. Connect 4 volt bias supply, negative to test point T, on IF AGC buss, positive to chassis.

5. Connect 3 volt bias supply, negative to test point U, on RF AGC buss, positive to chassis.

CAUTION: The output controls of the sweep and marker generators, and vertical gain control of the scope should be adjusted to prevent overloading of the receiver or scope. If the waveform shape changes when either control is advanced, an overload condition exists. In this case, reduce sweep output or scope gain or both. Marker pip should be barely visible.

6. Set Fine Tuning control at center position. The sound carrier marker should now appear in the sound trap. If not, adjust, starting from channel 2 through 13, oscillator coil slug to position the sound carrier marker in the sound trap. Before adjusting each channel slug, set sweep to appropriate channel, and marker to corresponding sound carrier frequency.

7. Set tuner channel selector to channel 10. Adjust the RF-plate trimmer A1, and mixer grid trimmer, A 2 for flat response and the video-carrier marker appearing 6 db (50%) down from the peak of the overall response curve as shown on Figure 18. The RF tilt should be no greater than 2 db ( 20%) for all channels. The valley (dip between peaks) should not vary more than 20% of the total amplitude of the curve. See Figure 18.

### TUNER NEUTRALIZATION ADJUSTMENT

8. Set tuner channel selector and sweep generator to channel 10. Increase RF-Bias to a voltage just before cut-off of the RF tube, and at the same time increase the sweep input signal to maintain 2 volts peak to peak at test point V. This condition occurs at a bias voltage (up to 15 volts may be required), where no more gain reduction appears on the scope for increase in bias. The response should be flat as shown in Figure 18.

Use a fiber screwdriver, and adjust the neutralization capacitor A3, observing the "rocking" effect on the response. Adjust the trimmer for flat response.

## IF TRAP ADJUSTMENT

1. Connect an IF sweep generator to antenna terminals.

2. Set sweep at 43 MC (Center Frequency), sweeping seven MC. Set Attenuator for maximum output.

3. Connect test scope to test point "V" using decoupling network as shown in Figure 22. Set scope for high gain.

4. Adjust the IF trap A4 for minimum response as observed on the test scope.

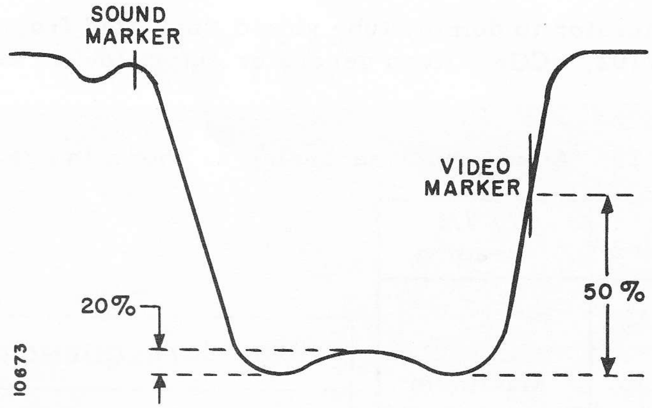



Figure 18. Over-all RF - IF Response Curve.

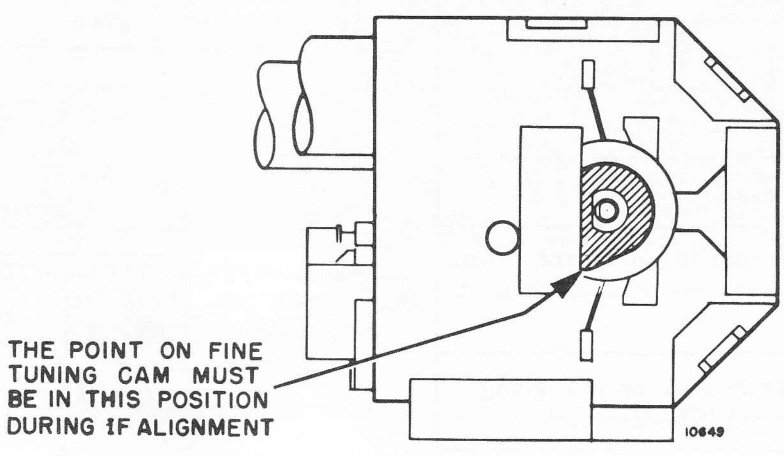



Figure 19. Front View of Tuner.

# IF AMPLIFIER AND TRAP ALIGNMENT

1. Construct the decoupling network shown in heavy lines in Figure 20 and connect across R401, chroma detector load resistor, test point "C". Connect VTVM to point indicated.

2. Connect 4 volts bias supply, negative to test point "T" on AGC buss and positive to chassis.

3. Connect RF marker generator to dummy tube shield (insulated from ground) of RF mixer-oscillator tube V102, 6CG8. Keep generator output low so as not to exceed 2 volts on VTVM.

4. Rotate tuner to channel 10. Adjust the Fine Tuning as shown in Figure 19.

| Step | Marker Gen. Freq. MC | Adjust | VTVM Reading |
|---|---|---|---|
| 1 | 43.2 MC | A5 | Maximum |
| 2 | 41.25 MC | A6 | |
| 3 | 45.1 MC | A7 | |
| 4 | Connect a .005 mf. capacitor from terminal 3 of T201 to ground. | | |
| 5 | 42.4 MC | A8 | Maximum |
| 6 | 46.0 MC | A9 | |
| 7 | Remove the .005 mf. capacitor connected in step 4. | | |
| 8 | 41.25 MC | A10 | Minimum |
| 9 | 47.25 MC | A11 | |
| 10 | Repeat step 8. | | |
| 11 | Remove the decoupling network from test point "C" and re-connect to test point "V". | | |
| 12 | Detune 41.25 trap A14 by inserting a piece of iron into the core. | | |
| 13 | Detune A13 by misadjusting its own slug before doing step 14. (Top). | | |
| 14 | 44.2 MC | A12 | Maximum |
| 15 | 42.4 MC | A13 | |
| 16 | Remove piece of iron from A14. | | |
| 17 | 41.25 MC | A14 | Minimum |

**FREQUENCY TABLE**

| Channel Number | Channel Freq., MC | Video Carrier, MC | Sound Carrier, MC | VHF Osc., MC |
|---|---|---|---|---|
| 2 | 54–60 | 55.25 | 59.75 | 101 |
| 3 | 60–66 | 61.25 | 65.75 | 107 |
| 4 | 66–72 | 67.25 | 71.75 | 113 |
| 5 | 76–82 | 77.25 | 81.75 | 123 |
| 6 | 82–88 | 83.25 | 87.75 | 129 |
| 7 | 174–180 | 175.25 | 179.75 | 221 |
| 8 | 180–186 | 181.25 | 185.75 | 227 |
| 9 | 186–192 | 187.25 | 191.75 | 233 |
| 10 | 192–198 | 193.25 | 197.75 | 239 |
| 11 | 198–204 | 199.25 | 203.75 | 245 |
| 12 | 204–210 | 205.25 | 209.75 | 251 |
| 13 | 210–216 | 211.25 | 215.75 | 257 |

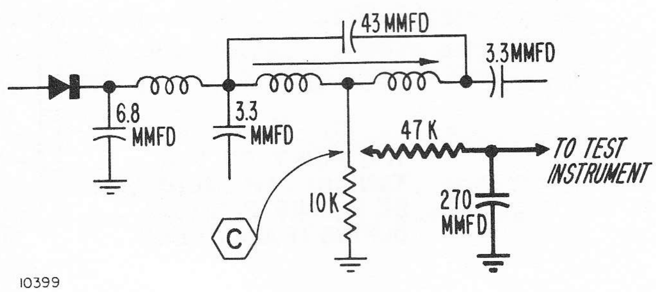



Figure 20. Decoupling Network (heavy line) Shown Across Chrominance Detector Load Resistor.

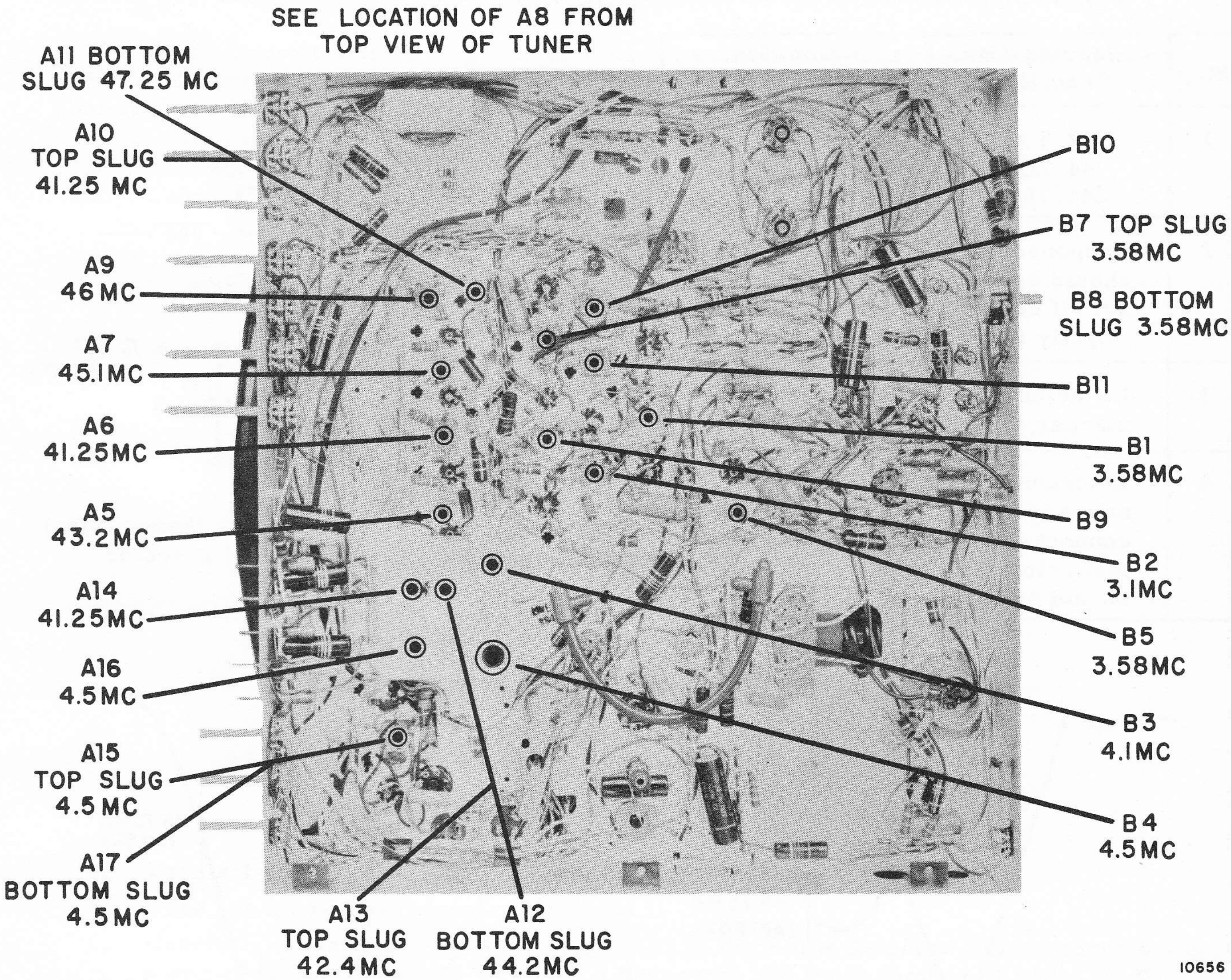



Figure 21. Bottom View of Chassis Showing Alignment Locations.

# IF RESPONSE CURVE CHECK

1. Connect sweep generator and marker generator to dummy shield (insulated from chassis) of 6CG8, V102, mixer-oscillator tube.

2. Connect oscilloscope through decoupling network (as shown in Figure 22) to luminance detector load - test point "V".

3. Connect 4 volts bias supply, negative to test point "T" positive to chassis.

| Step | Marker Gen. Freq. MC | Sweep Gen. Frequency |
|---|---|---|
| 1 | 42.5 MC<br>44.7 MC<br>45.75 MC | IF Center freq. (43.5 MC) |
| 2 | Response curve and marker pips should appear as shown in Figure 23. If curve is tilted, re-adjust A5 slightly to obtain equal peaks. | |
| 3 | Re-adjust A7 to position 45.75 MC marker at 50%. | |
| 4 | Disconnect oscilloscope from luminance load, test point "V", and re-connect through decoupling filter to test point "C" chroma load. Curve should appear as in Figure 24. | |

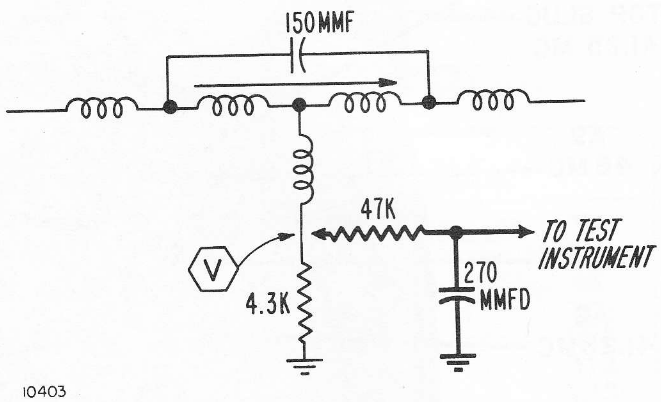



Figure 22. Decoupling Network (heavy lines) Shown Across Luminance (Y) Detector Load Resistor.

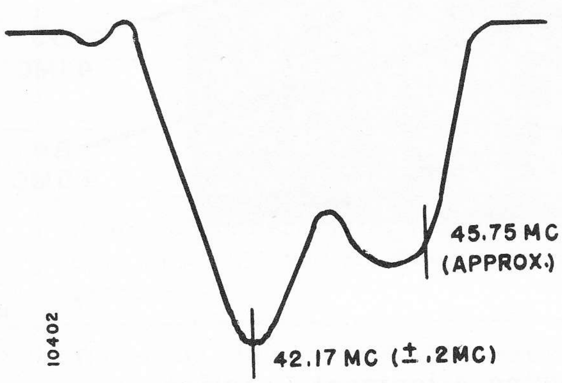



Figure 23. IF Response Curve with Markers, at Test Point V.

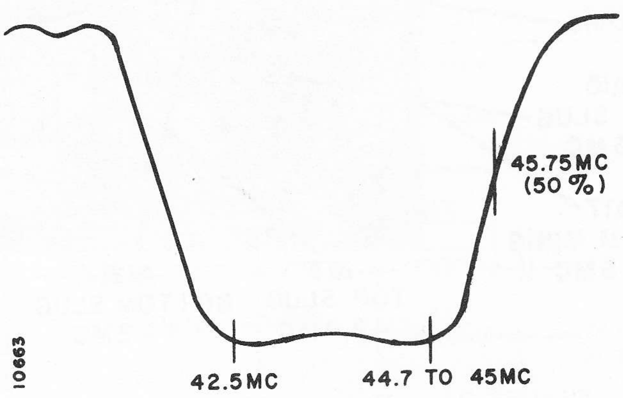



Figure 24. IF Response Curve at Test Point "C".

## 4.5 MC SOUND IF ALIGNMENT

It is preferable to use a TV signal rather than a signal generator for this alignment. However, if a TV signal is not available, a signal generator which has been checked against a crystal calibrator or other frequency standard may be used. Accuracy required is within one kilocycle.

If a television signal is to be used, connect antenna, set CHANNEL SELECTOR for strongest TV signal available and tune in a picture. Follow chart below using TV signal instead of generator set to exactly 4.5 MC. Connect VTVM as instructed in step "a".

If a signal generator is to be used, disconnect antenna and short antenna terminals together. Connect VTVM and marker generator as instructed in steps "a" and "b" below. Then follow chart.

a. Connect high side of VTVM to test point "Y", common lead to chassis.
b. Connect RF marker generator to junction of L206 and C301.

| Step | Marker Gen. Freq. (MC) | Adjust | VTVM Reading |
|---|---|---|---|
| 1 | Exactly 4.5 MC | A15 | Maximum |
| 2 | Exactly 4.5 MC | A16 | |
| 3 | Disconnect VTVM from test point "Y" and re-connect to test point "Z". | | |
| 4 | Exactly 4.5 MC | A17 | Zero |
| 5 | Repeat steps 1 and 2. | | |

## TOUCH - UP OF RATIO DETECTOR SECONDARY -A17- USING TELEVISION SIGNAL

Adjustment need be made on one channel only.

a. Turn set on and allow about 15 minutes for warm up.
b. Tune set for normal picture and sound.
c. Carefully adjust the secondary slug (A17) of the Ratio Detector Transformer using a non-metallic alignment tool with a hexagonal end (part number 98A30-12). Both slugs (A15 and A17) have hollow cores. Either slug may be adjusted from the top or bottom of the chassis by passing the alignment tool through the core of the first slug encountered. A17 is the slug closest to the chassis.

   Adjust A17 for best sound with minimum buzz level. Do this carefully as only slight rotation in either direction will generally be required. Correct adjustment point is located between the two maximum buzz peaks that will be noticed when turning the slug back and forth about 1/4 to 1/2 turn.
d. If necessary, repeat individual channel slug adjustment and conclude with retouching the ratio detector secondary. Note: If oscillator adjustment is required for other channels, it will not be necessary to repeat the ratio detector secondary adjustment after once correctly adjusting it.

## SUB-CARRIER ALIGNMENT

1. By-pass to ground pin 7 of V401A, 1st chroma amplifier with .01 capacitor.

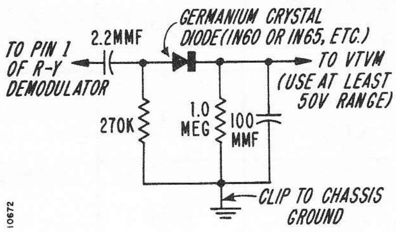
2. Connect DC VTVM through 100K resistor to pin 7 of V502, color phase discriminator.

3. Adjust top and bottom slugs, B7 and B8, of T502, sub-carrier oscillator transformer, for maximum output. Repeat until maximum is obtained.

4. Remove by-pass capacitor from pin 7 of V401A.

## CHROMA ALIGNMENT

1. Connect a detector as shown.




2. Turn color intensity control, R505 clockwise about 3/4 of its range. With cliplead, ground the color killer pulse (junction of C501, R501).

3. Connect a .01 mfd. capacitor across the phase shift network coil, L406, terminal #1 to #3.

4. Connect an RF Signal Generator through a 3.3K ohm resistor to the junction of L401 and C402, input of 1st chroma amplifier.

5. Ground the grid, pin 1, of the 4th IF tube, V204.

6. Detune 4.5 mc. trap, L401 (B4) by turning slug out about three turns.

7. Adjust chroma stages in the following order, using 3.58 mc., 3.1 mc., and 4.1 mc. spot frequencies.

| Stage | Slug | Frequency | Output |
|---|---|---|---|
| 3rd | B1 | 3.58 mc. | Maximum |
| 2nd | B2 | 3.1 mc. | Maximum |
| 1st | B3 | 4.1 mc. | Maximum |

8. Remove ground from IF grid, and disconnect signal generator.

9. Tune in black and white station, adjust fine tuning for maximum reading on VTVM. Then adjust the 4.5 mc. trap, L401 (B4) for minimum reading on VTVM.

10. Remove detector and phase shift coil bypass capacitor.

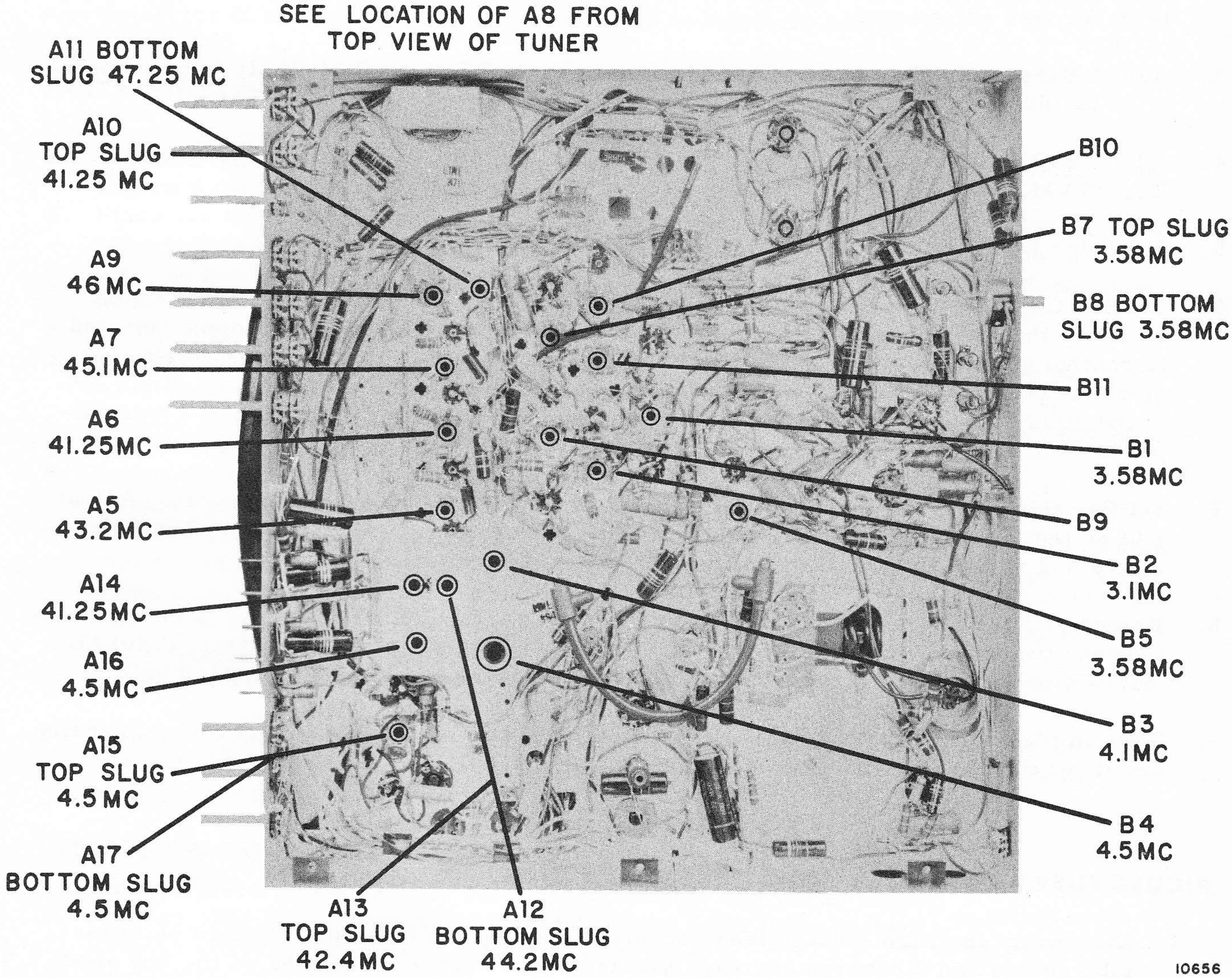



Figure 25. Bottom View of Chassis Showing Alignment Locations.

## COLOR SYNC - COLOR PHASE ALIGNMENT

1. With clip lead, connect junction of C501, R501 and R504 to ground; this shorts the color killer pulse to ground. Connect Color Bar Generator with RF output to antenna terminals and adjust fine tuning correctly, i.e., for minimum 920 KC beat on screen of picture tube.

2. Connect 'Scope probe to cathode of picture tube, V404. Adjust 3.58 MC trap (B5) for minimum sub-carrier on color bar 'Scope pattern. 'Scope gain should be set at high level for this adjustment.

3. Adjust Burst Amplifier plate coil (B9) for maximum DC at pin 7 of V502; approximately 80 to 100 volts negative. Note and remember this reading. Use VTVM.

4. Adjust B10 so that color is in sync and voltage at pin 1 of V502 is 6 volts negative. Use VTVM.

5. Set Color Intensity control for low level color bars.

6. Set Bar Generator for B-Y output. Set Color Fidelity control to mid-range. Touch up B9 so that B-Y output at R-Y demodulator is zero as observed on 'Scope connected to control grid of red gun. Recall peak output of step 3 above. If voltage obtained in step 6 is less than 10% of that obtained in step 3, return to B9 and adjust to within 10% of maximum reading originally obtained in step 3. Touch up B1 for zero B-Y bar output at control grid of red gun.

7. Set Bar Generator for R-Y output. Connect 'Scope to control grid of blue gun. Adjust B11 so that R-Y output at B-Y demodulator is zero as observed on scope. Recheck step 6 and repeat if necessary as there is some interaction.

8. Remove clip lead connect in step 1 from junction of C501, R501 & R504. Connect VTVM between the junction of L403 & R513 and pin 6 (cathode) of 1st Chroma Amp. (V401A). With Color Intensity control set at maximum, meter should read 0 volt, ±1.0 volt.

9. Tune in black and white station. With meter connected as in step 8, and Color Intensity set at maximum, reading should be at least minus 10 volts.

# SERVICE HINTS

### PICURE TUBE REMOVAL

1. Disconnect the High Voltage lead connector coming from the High Voltage rectifier tube socket and discharge any High Voltage static charge remaining on the 2nd anode ring around the faceplate of the tube. See Figure 7 for location of High Voltage connector. This will guard against any unnecessary and dangerous High Voltage shock (20 KV) while handling the tube.
2. Remove picture tube socket, blue lateral magnet, purity rings, convergence coil assembly. See Figures 3 and 7.
3. Remove yoke, see yoke removal instructions in this section.
4. Remove the four hexagonal nuts that hold the picture tube mounting strap to the four retaining rods connected to the metal yoke bracket around neck of tube.
5. Loosen, but do not remove two nuts shown as "G", Figure 5. This will permit the yoke housing to be tilted upward allowing upward movement of tube during removal.
6. Remove bolt and nut "D" on the picture tube mounting strap.

IMPORTANT: Three insulating "boots" and High Voltage connector remain. REMEMBER their exact positions in order to re-install properly on new picture tube.

7. The picture tube is now ready for removal. Grasp the tube near the top and bottom of the faceplate and gradually lift until free. Great care should be taken to prevent bumping the tube which might cause damage between the glass face and metal cone. Do not allow the metal shell to come in contact with any magnetized material as this will cause local magnetization of the shell resulting in color purity contamination.

8. Place the picture tube, face down on a clean cloth or soft paper on a flat surface.

9. Remove the insulating "boots" and High Voltage connector.

IMPORTANT: Remember the exact location of the insulating "boots" and the High Voltage connector in order to re-install properly on new picture tube.

## INSTALLING PICTURE TUBE

1. Position the tube so that the blue gun will be on top when installed in chassis. See Figure 5 for identification of blue gun.
2. Place the High Voltage connector on the ultor ring, lead extending to the right, at a point in line with pin 14 on the base of the tube. Looking at the face of the tube with the blue gun on top, the connector should be approximately in the "11 o'clock" position.
3. Install the cone shaped boot first.
4. The second boot fits snugly around the ultor ring and outer circumference of the picture tube. Place one end to the immediate left of the High Voltage connector and slip onto the tube counterclockwise. The boot will overlap. Fold the High Voltage lead to the left and bring out where the boot overlaps ends.
5. Install the third boot so the overlap is in the upper right (approximately the "1 o'clock" position) looking at the face of the tube.
6. Install picture tube into chassis. CAUTION: In order to tilt the tube enough to slide over the mounting brackets, the yoke must be removed. See Yoke Removal instructions.
7. Install the Rim Magnet Assembly strap, yoke, convergence coil assembly, purity rings, blue lateral magnet and picture tube socket.
8. Retighten hex nuts "G". See Figure 5.
9. Install the four retaining rods between picture tube support strap and yoke mounting bracket. Adjust the tension on these four rods to perfectly center the neck of the picture tube through the yoke shield.

## DEFLECTION YOKE REMOVAL

1. Remove picture tube socket, blue lateral magnet and purity rings.
2. Remove yoke and convergence assembly plugs from their sockets.
3. Remove convergence coil assembly. See Figure 5.
4. Remove the two wing bolts "B". See Figure 5.
5. Carefully remove Deflection Yoke.

## CONSTRUCTING A DEMAGNETIZING COIL

A demagnetizing coil suitable for degaussing the magnetic parts of the 21AXP22A color picture tube is described below. This coil is intended to degauss the magnetic parts of the color picture tube should they become magnetized during shipment or handling.

Inability to obtain a pure red, blue and green raster after carefully making the color purity adjustments, including the adjustment of the rim magnets, is evidence that the picture tube may have become magnetized. Full instructions and parts required for construction are given below. The use of the coil is described under "COLOR PURITY" on page 15.

Parts Required for Construction

The materials needed for the demagnetizing coil can be obtained at most electrical supply houses.

| | |
|---|---|
| 40' | 0.01" Fish paper - 2-1/2" in width |
| 30' | Cambric Yellow varnished tape |
| 5' | Scotch brand vinyl electrician's tape |
| 1250' | #16 Formex magnet wire - about 12 lbs. |
| AC line cord and plug | |

Coil Construction

1. Make a cylindrical form 22-1/2" O. D. and approximately 4" wide. Several methods of construction can be used in making this form. This coil is not critical and following the general procedure will result in a satisfactory coil.

   Method A

   (a) With a piece of 1/4" plywood 4" wide and 70-11/16" long, make a series of 1/8" deep cuts with a saw on one side. These cuts should be made about every 1/2" to facilitate bending the plywood into the required circular form.

   (b) On a large flat surface, scribe a 22-1/4" circle and lay out the plywood strip to fit within the circle. Use nails at several points along the circle to hold the plywood in place. Pay particular attention to the ends of the plywood in order to get a smooth, circular joint.

   Method B

   Follow steps (a) and (b) in Method A under steps 1, but use a piece of sheet metal 4" wide and 70-11/16" long. This won't be as rigid as plywood and will require more nails to hold it in a circular shape.

2. Allow 2" for start lead, and using #16 Formex magnet wire, layer wind 200 turns in 4 layers of 50 turns each on the form. Use .01" thick fish paper between layers for insulation.
3. Use clear scotch tape in spots to prevent coil turns from loosening.
4. After the coil is wound, bring the end lead out near the start lead, and allow at least 2" for splicing. Secure the end lead.
5. Remove the coil by cutting plywood form in half.
6. Cover windings with 1 layer of cambric yellow varnished tape or equivalent and secure ends with electrician's tape.
7. Splice and solder ends to AC cord.
8. Securely anchor and cover leads with electrical scotch tape.

# COLOR TV TROUBLE SHOOTING CHART

| SYMPTOM | CHECK (USING COLOR BAR GENERATOR) |
|---|---|
| No color.<br>Picture and Sound OK. | Fine Tuning, Color Intensity Control settings.<br><br>Tubes V401, V402, V403, V501, V502, V503.<br>CHROMA AMP, OUT, R-Y demod, BURST AMP, Color phase disc. 3.58 mc osc. control<br><br>Bias on control grid of V503B.<br>Loss of bias (negative voltage) indicates loss of 3.58 mc oscillation.<br><br>Bias on control grid of V401A.<br>Bias on grid of V401B. Should be - 5.6 volts.<br><br>Waveforms at plate of V403A and V403B.<br>Waveforms at control grids of V404, picture tube. |
| Loss of Color Sync.<br>Picture and Sound OK.<br>Colors gradually change around spectrum. | Fine Tuning Control setting.<br><br>Tubes V501, V502, V503.<br><br>Bias on control grid of V503A.<br><br>Voltage at pin #1 of V502. Should be - 6 volts. |
| Improper Colors.<br>Picture and Sound OK. | Color Fidelity control for proper range and operation. Proper colors should be reproduced at approximately mid-range of Color Fidelity control. If not, set Color Fidelity to mid-range and adjust L501 (see schematic) for proper colors.<br><br>Tube V403.<br><br>Waveforms at cathode and plates of V403.<br>Waveforms at control grids of V404, picture tube. |
| Poor Purity.<br>Picture apparently OK.<br>Sound OK. | Adjustment of Purity Rings, Rim Magnets, and Yoke positioning.<br><br>If unable to obtain good Purity, degauss Picture Tube and re-check Purity adjustments. |
| Poor Convergence.<br>Sound OK. | Using a White Dot Generator, follow the Convergence Adjustment procedure in manual S592.<br><br>Waveforms at terminal U2 on T602, center terminals (movable arm) of Vert. Amp., Vert. Tilt, and DC controls.<br><br>Continuity of coils on Convergence Yoke Assembly. |

| SYMPTOM | CHECK (USING COLOR BAR GENERATOR) |
|---|---|
| Picture background appears Reddish, or Bluish, or Greenish. Sound OK. | If Reddish, check Red Screen control adjustment.<br>If Bluish, check Blue Screen and Grid adjustment.<br>If Greenish, check Green Screen and Grid control settings.<br><br>Turn Color Intensity control to minimum (remove color information from picture). Perform Black and White Tracking adjustment as per instructions in manual S592.<br><br>Waveforms at control grids of V404, Picture tube.<br><br>Tube V403.<br><br>Voltages at control grids of V404, Picture tube.<br>Check for cathode-to-grid shorts in V404. |
| Picture is dim.<br>Sound OK. | Brightness control setting.<br><br>Tube V205.<br>Circuitry of tube V205.<br><br>Luminance Detector, CR201. |
| Loss of color and sound.<br>Picture OK. | Sound and Chroma Detector, CR202. |
| Sound Bars in Picture. | Fine Tuning setting.<br>Oscillator Slug setting.<br><br>RF, IF, Subcarrier Alignment. |
| 920 KC beat interference pattern in picture (appears as medium fine cross-hatch).<br><br>Sound OK. | Fine Tuning Setting.<br><br>Oscillator slug adjustment.<br><br>IF alignment (especially Traps L201, L202, and L205 for correct alignment). |

## DEAD RECEIVER

| SYMPTOM | CHECK |
| --- | --- |
| Dead receiver. Loss of Sound and Raster.<br><br>Tube filaments are not lit. | Plug, Line, cord, and Interlock connector.<br><br>On-off switch.<br><br>Power Transformer. |
| Dear receiver. Loss of Sound and Raster.<br><br>Tube filaments are lit. | Fuse (2 amp, F701).<br>Fuse (3/4 amp, F601).<br><br>Deflection yoke plug. (Removed from socket).<br><br>Circuit components of Low Voltage Power Supply. |

## MONOCHROME PICTURE AND SOUND

| | |
| --- | --- |
| Loss of Sound and Picture.<br><br>Raster OK. | Tubes V101, V102, V201, V202, V203, V204, V206. |
| Intermittent Sound and Picture.<br><br>Raster OK. | Antenna and Transmission line for loose or broken connection. Be sure Transmission line is not shorting at receiver antenna terminals.<br><br>Tubes V101, V102 and circuitry.<br>Tubes V201, V202, V203, V204 and circuitry.<br><br>Dirty coil contacts in tuner. |
| Weak or loss of Picture.<br>Weak Sound.<br><br>Raster OK. | Fine Tuning setting.<br>Oscillator slug setting. Tubes V101, V102.<br><br>Tubes V201, V202, V203, V204, V206.<br><br>RF and IF alignment. |

## MONOCHROME PICTURE

| | |
| --- | --- |
| Intermittent or loss of picture.<br><br>Sound and Raster OK. | Tubes V205, V206.<br><br>Faulty Contrast control.<br><br>Luminance Detector CR201. |
| Weak Picture (lack of contrast).<br><br>Sound and Raster OK. | Tube V205. Luminance Detector CR201.<br><br>Circuitry of V205, Waveform at plate of V205. |

| SYMPTOM | CHECK |
|---|---|
| Poor Horizontal Linearity.<br>Insufficient width.<br>Insufficient brightness | Tubes V605, V606.<br><br>Low Voltage Rectifier Tubes V701, V702.<br><br>Horizontal Drive setting.<br><br>Horizontal Linearity control setting.<br>CAUTION: Do not attempt to set the Horizontal Linearity control except by following the step by step procedure given in Manual S592. |
| Picture Jitter (sideways)<br><br>Sound OK, or Hissing. | Horizontal Hold control and/or Lock adjustment (especially in weak signal areas).<br><br>Noisy or microphonic tubes V101, V102, V201, V202, V203, V204, V205, V604, V605.<br><br>Arcing in Sweep (horizontal) section of receiver. |
| Smeared picture.<br><br>Sound OK. | Fine Tuning setting.<br><br>Tube V205.<br><br>Luminance Detector, CR201. Open Peaking coils, L302.<br><br>RF, IF alignment. |
| Poor Picture Detail.<br><br>Sound OK. | Fine Tuning setting.<br><br>Mismatch in antenna system.<br><br>Tube V205 or circuitry.<br><br>RF, IF alignment. |
| Sound Bars in picture. | Fine Tuning or Oscillator slug adjustment.<br><br>RF, IF alignment including traps. |
| "Snow" in picture. | Antenna or transmission line.<br><br>RF, IF alignment.<br><br>Tube V101. |
| Poor horizontal linearity. | Horizontal Drive setting. Horizontal Linearity control setting.<br>CAUTION: Use procedure outlined in Manual S592 for linearity procedure.<br><br>Tubes V605, V606. Waveforms at V604, V605. |

(5)

| SYMPTOM | CHECK |
|---|---|
| Poor Vertical Linearity | Vertical Linearity control setting.<br><br>Tubes V602, V603.<br><br>Vertical Output Transformer.<br><br>Leaky Capacitor C621, C622. |
| Vertical Bars on right side of Raster. | Tubes V604, V605, V606. |
| Herringbone pattern in picture. FM or other form of interference. | Trap alignment of L201, L202, L205.<br><br>Regeneration in IF amplifier (caused by IF misalignment.<br><br>Alignment of IF trap, L101. |
| Light and/or Dark Vertical lines (bars). Usually at left side of raster. | Tubes V605, V606.<br><br>Setting of Horizontal Drive. |
| Two heavy, black horizontal bars in picture. | Open filter capacitor in power supply. |
| One heavy, black horizontal bar in picture. | Heater to cathode short in picture tube, V404.<br><br>Heater to cathode short in V101, V102, V201, V202, V203, V204, V205, V403. |
| Bend in picture at top. | Horizontal Lock adjustment, L601.<br><br>Tube V604 and circuitry. |

SOUND

| | |
|---|---|
| Distorted Sound. | Tubes V301, V302, V303.<br><br>Ratio Detector Transformer alignment. |
| Loss of Sound.<br>Picture OK. | Tubes V301, V302, V303.<br><br>Audio output transformer, T302. |
| Weak Sound. | Tubes V301, V303.<br><br>Sound alignment. |

| SYMPTOM | CHECK |
|---|---|
| Noisy Sound.<br>Picture OK. | Tubes V301, V302, V303.<br><br>Volume control (faulty).<br><br>Circuitry (loose connection) in V301, V302, V303. |
| Sync Buzz in Sound. | Fine Tuning setting.<br><br>Faulty capacitor, C301.<br><br>Sound alignment. |
| Intermittent Sound. | Tubes V301, V302, V303.<br><br>Speaker or Audio Output Transformer, T302. |

SYNC

| | |
|---|---|
| Poor horizontal and vertical sync (weak signal area). | Tube V101. |
| Loss of vertical sync.<br><br>Horizontal sync OK. | Tube V602.<br><br>Capacitor C617, C618.<br><br>Waveform (check for presence of sync pulse) at control grid of V602B. |
| Loss of vertical and horizontal sync.<br><br>Intermittent or weak horizontal and/or vertical sync. | Tubes V601, V602. |
| Loss of Horizontal Sync.<br><br>Vertical Sync OK. | Tube V604 and circuitry.<br><br>Horizontal Lock adjustment, L601.<br><br>Sync Discriminator, CR601.<br><br>Waveforms at tubes V602A, V604, and at Sync Discriminator, CR601. |
| Picture "locks in" only at center of Horizontal Hold control. Falls out of sync at extreme settings of control. | Sync Discriminator CR601 and circuitry.<br><br>Check R620 and R621 for correct value. |

RASTER

| SYMPTOM | CHECK |
|---|---|
| No Raster.<br>Sound OK. | Tubes V604, V605, V606, V607, V608, V404.<br><br>Horizontal oscillator circuit.<br>Horizontal output circuit.<br>Horizontal output transformer.<br><br>Damper circuit.<br><br>Leaky or shorted capacitors, C628, C630. |
| Intermittent Raster.<br>Sound OK. | Tubes V604, V605, V606, V607, V608, V404 (PIX TUBE).<br><br>2nd Anode Power Supply for arc-over or corona discharge.<br><br>Horizontal oscillator and output circuits.<br>Damper circuits.<br><br>Waveforms at V604, V605 grids. |
| Raster "blooms" as brightness is increased. | Horizontal output tube V605.<br><br>2nd Anode rectifier V608.<br><br>High voltage regulator, V609.<br><br>High voltage (20 KV) at picture tube anode. |
| Insufficient raster brilliance. | Horizontal Drive adjustment.<br><br>2nd Anode Power Supply Voltage.<br><br>Picture tube, V404. |
| Tilted Raster. | Position of deflection yoke. |
| Raster not centered. | Setting of Positioning controls, R660, R682.<br><br>R660, R682 for open. |
| Excessive Raster size (Over-scan). | Vertical Linearity and Height control adjustments.<br><br>2nd Anode Power Supply. |
| "Keystoned" raster. | Deflection yoke for shorted turns. |

| SYMPTOM | CHECK |
|---|---|
| Insufficient raster width. | Horizontal Drive (R646) adjustment.<br><br>Tubes V604, V605.<br><br>Power rectifier voltage output. |
| Insufficient raster height. | Height and Vertical Linearity adjustments.<br><br>Vertical oscillator and vertical output tubes V602, V603. |
| No vertical deflection. | Tubes V602, V603.<br><br>Deflection coils for open circuit.<br><br>Vertical Linearity control for open circuit.<br><br>Waveforms at V602B, V603. |
| Foldover of vertical sweep. | Vertical oscillator tube, V602B.<br><br>Vertical output tube, V603.<br><br>Capacitor C623 for short. |
| Raster too small.<br>Insufficient Height and Width. | Line voltage.<br><br>Power rectifier, voltage output.<br><br>Height, Vertical Linearity, Horizontal Drive adjustments. |
| Excessive brightness.<br>Brightness control has no effect. | Brightness control R438 for open. |
| Improper focus. | Focus rectifier tube, V607.<br><br>Voltage at Pin 9 of V404, Picture tube (3.8 KV. DC).<br><br>Focus rectifier control for value.<br><br>Resistors R672, R673 for value. |

# PARTS LIST

Electrical components have symbols in 100 series, 200 series, etc., according to location on schematic. Order parts by part number and description from Admiral distributor.

## RESISTORS

| Sym. | Description | Part No. |
|---|---|---|
| R101 | 1,000 ohms | 60B 8-102 |
| R102 | 2,200 ohms | 60B 8-222 |
| R103 | 3,900 ohms | 60B 8-392 |
| R104 | 220,000 ohms | 60B 8-224 |
| R105 | 10,000 ohms | 60B 8-103 |
| R106 | 6,800 ohms | 60B 8-682 |
| R107 | 1,000 ohms | 60B 8-102 |
| R108 | 51 ohms, 5% (94D131-1 Tuner only) | 60B 7-510 |
| R110 | 10,000 ohms | 60B 8-103 |
| R111 | 15,000 ohms (94D131-2 Tuner only) | 60B 8-153 |
| R201 | 22,000 ohms, 5% | 60B 7-223 |
| R202 | 10 ohms, 5% | 60B 7-100 |
| R203 | 10,000 ohms | 60B 8-103 |
| R204 | 56 ohms, 5% | 60B 7-560 |
| R205 | 1,000 ohms | 60B 8-102 |
| R206 | 39,000 ohms, 5% | 60B 8-393 |
| R207 | 4,700 ohms, 2 watts | 60B 20-472 |
| R208 | 1,000 ohms | 60B 8-102 |
| R209 | 56 ohms, 5% | 60B 7-560 |
| R210 | 10 ohms, 5% | 60B 7-100 |
| R211 | 4,700 ohms, 2 watts | 60B 20-472 |
| R212 | 15 ohms, 5% | 60B 7-150 |
| R213 | 1,000 ohms | 60B 8-102 |
| R214 | 82,000 ohms | 60B 8-820 |
| R215 | 62 ohms, 5% | 60B 7-620 |
| R216 | 68,000 ohms, 5% | 60B 7-683 |
| R217 | 3,900 ohms, 5% | 60B 7-392 |
| R218 | 4,700 ohms, 2 watts | 60B 20-472 |
| R219 | 470 ohms | 60B 8-471 |
| R220 | 4,700 ohms (Run 1) | 60B 8-472 |
|  | 2,700 ohms (Run 13) | 60B 8-272 |
| R221 | 27,000 ohms, 5% | 60B 7-273 |
| R222 | 47,000 ohms | 60B 8-473 |
| R223 | 4,300 ohms, 5% | 60B 7-432 |
| R225 | 500 ohms, <u>Contrast control</u> | 75C 13-74 |
| R226 | 22,000 ohms, 1 watt | 60B 14-223 |
| R227 | 47,000 ohms | 60B 8-473 |
| R229 | 6,800 ohms | 60B 8-682 |
| R230 | 47 ohms | 60B 8-470 |
| R231 | 2,200 ohms (Added at Run 13) | 60B 8-222 |
| R232 | 5,000 ohms, 5 watts | 61A 17-9 |
| R301 | 120 ohms | 60B 8-121 |
| R302 | 10,000 ohms, 2 watts | 60B 20-103 |
| R303 | 390 ohms | 60B 8-391 |
| R304 | 47,000 ohms | 60B 8-473 |
| R305 | 10,000 ohms | 60B 8-103 |
| R306 | 10,000 ohms | 60B 8-103 |
| R307 | 22,000 ohms | 60B 8-223 |
| R308 | 1 megohm, <u>Volume control</u> (Includes R438) | 75B 11-31 |
| R309 | 470 ohms | 60B 8-471 |
| R310 | 2.2 megohms | 60B 8-225 |
| R311 | 3,900 ohms, 2 watts | 60B 20-392 |
| R312 | 2,700 ohms, 2 watts | 60B 20-272 |
| R313 | 100,000 ohms | 60B 8-104 |
| R314 | .5 megohm, <u>Tone control</u> | 75C 13-73 |
| R316 | 220,000 ohms | 60B 8-224 |
| R317 | 390,000 ohms | 60B 8-394 |
| R318 | 10,000 ohms, 1 watt | Part of L302 |
| R319 | 2,500 ohms, 10 watts | 61B 20-8 |
| R331 | 330 ohms, 1 watt | 60B 14-331 |

## RESISTORS Cont'd

| Sym. | Description | Part No. |
|---|---|---|
| R401 | 10,000 ohms, 5% | 60B 7-103 |
| R402 | 10,000 ohms, 5% | 60B 7-103 |
| R403 | 120 ohms (Run 1 only) | 60B 8-121 |
| R404 | 2,500 ohms, 7 watts | 61B 20-8 |
| R405 | 470,000 ohms | 60B 8-474 |
| R406 | 27,000 ohms, 2 watts | 60B 20-273 |
| R407 | 1,000 ohms | 60B 8-102 |
| R408 | 10,000 ohms, 1 watt | 60B 14-103 |
| R409 | 1,200 ohms, 2 watts | 60B 20-122 |
| R410 | 1,500 ohms, 2 watts | 60B 20-152 |
| R411 | 470,000 ohms | 60B 8-474 |
| R412 | 15,000 ohms, 2 watts | 60B 20-153 |
| R413 | 10,000 ohms, 2 watts, 5% | 60B 19-103 |
| R414 | 470 ohms, 1 watt | 60B 14-471 |
| R415 | 2,700 ohms | 60B 8-272 |
| R416 | 2,700 ohms | 60B 8-272 |
| R417 | 680 ohms, 1 watt | 60B 14-681 |
| R418 | 18,000 ohms, 2 watts | 60B 20-183 |
| R419 | 18,000 ohms, 2 watts | 60B 20-183 |
| R420 | 100,000 ohms | 60B 8-104 |
| R421 | 2,700 ohms | 60B 8-272 |
| R422 | 100,000 ohms | 60B 8-104 |
| R423 | 2,700 ohms | 60B 8-272 |
| R424 | 3,300 ohms, 2 watts | 60B 20-332 |
| R425 | 100,000 ohms | 60B 8-104 |
| R426 | 2,700 ohms | 60B 8-272 |
| R427 | 100,000 ohms | 60B 8-104 |
| R428 | 1 megohm, <u>Blue Screen control</u> (Includes R441) | 75B 17-19 |
| R429 | 560,000 ohms | 60B 8-564 |
| R430 | 1 megohm, <u>Green Screen control</u> (Includes R435) | 75B 17-19 |
| R431 | 1 megohm, <u>Red Screen Control</u> | 75C 20-50 |
| R432 | 220,000 ohms | 60B 8-224 |
| R433 | 100,000 ohms | 60B 8-104 |
| R434 | 100,000 ohms | 60B 8-104 |
| R435 | 500,000 ohms, <u>Green Grid control</u> (Includes R430) | 75B 17-19 |
| R436 | 82,000 ohms | 60B 8-823 |
| R437 | 56,000 ohms | 60B 8-563 |
| R438 | 500,000 ohms, <u>Master Brightness Control</u> (Includes R308) | 75B 11-31 |
| R439 | 82,000 ohms | 60B 8-823 |
| R440 | 180,000 ohms | 60B 8-184 |
| R441 | 500,000 ohms, <u>Blue Grid control</u> (Includes R428) | 75B 17-19 |
| R442 | 100,000 ohms | 60B 8-104 |
| R443 | 68,000 ohms, 5% | 60B 7-683 |
| R444 | 22,000 ohms | 60B 8-223 |
| R445 | 330,000 ohms | 60B 8-334 |
| R501 | 330,000 ohms | 60B 8-334 |
| R502 | 33,000 ohms, 2 watts (Added at Run 13) | 60B 20-333 |
| R503 | 18,000 ohms, 2 watts | 60B 20-183 |
| R504 | 12,000 ohms | 60B 8-123 |
| R505 | 2,000 ohms, <u>Color Intensity Control</u> | 75C 13-70 |
| R506 | 4,700 ohms | 60B 8-472 |
| R507 | 100,000 ohms | 60B 8-104 |
| R508 | 470,000 ohms | 60B 8-474 |
| R509 | 2,200 ohms (Run 1) | 60B 8-222 |
|  | 1,000 ohms (Run 13) | 60B 8-102 |
| R510 | 6,800 ohms | 60B 8-682 |

## RESISTORS Cont'd

| Sym. | Description | Part No. |
|---|---|---|
| R511 | 4,700 ohms, 1 watt.................. | 60B 14-472 |
| R512 | 82 ohms............................ | 60B 8-820 |
| R513 | 680,000 ohms....................... | 60B 8-684 |
| R514 | 1,000 ohms......................... | 60B 8-102 |
| R515 | 470 ohms........................... | 60B 8-471 |
| R516 | 27,000 ohms, 5%.................... | 60B 7-273 |
| R517 | 1,000 ohms......................... | 60B 8-102 |
| R519 | 12 megohms......................... | 60B 8-126 |
| R520 | 6.8 megohms (Run 1)................ | 60B 8-685 |
| | 10 megohms (Run 13)................ | 60B 8-106 |
| R521 | 1 megohm, 5%....................... | 60B 7-105 |
| R522 | 1 megohm, 5%....................... | 60B 7-105 |
| R523 | 3,300 ohms, 2 watts................ | 60B 20-332 |
| R524 | 33,000 ohms........................ | 60B 8-333 |
| R525 | 6,800 ohms......................... | 60B 8-682 |
| R526 | 1 megohm........................... | 60B 8-105 |
| R527 | 2,200 ohms......................... | 60B 8-222 |
| R528 | 22,000 ohms........................ | 60B 8-223 |
| R529 | 150,000 ohms....................... | 60B 8-154 |
| R530 | 390,000 ohms....................... | 60B 8-394 |
| R531 | 100,000 ohms....................... | 60B 8-104 |
| R532 | 100 ohms (Run 1 only).............. | 60B 8-101 |
| R533 | 100 ohms........................... | 60B 8-101 |
| R534 | 47,000 ohms (Added at Run 13)...... | 60B 8-473 |
| R535 | 1,000 ohms (Added at Run 13)....... | 60B 8-102 |
| R601 | 47,000 ohms........................ | 60B 8-473 |
| R602 | 3.9 megohms, 5%.................... | 60B 7-395 |
| R603 | 15 megohms......................... | 60B 8-156 |
| R604 | 1.5 megohms, 5%.................... | 60B 7-155 |
| R605 | 56,000 ohms........................ | 60B 8-563 |
| R606 | 15,000 ohms........................ | 60B 8-153 |
| R607 | 270,000 ohms....................... | 60B 8-274 |
| R608 | 220,000 ohms....................... | 60B 8-224 |
| R610 | 2.2 megohms........................ | 60B 8-225 |
| R611 | 3.3 megohms........................ | 60B 8-335 |
| R612 | 22,000 ohms, 2 watts (Run 1)....... | 60B 20-223 |
| | 27,000 ohms, 2 watts (Run 13)...... | 60B 20-273 |
| R613 | 56,000 ohms........................ | 60B 8-563 |
| R614 | 270,000 ohms (Run 1)............... | 60B 8-274 |
| | 330,000 ohms (Run 13).............. | 60B 8-334 |
| R615 | 2,700 ohms......................... | 60B 8-272 |
| R616 | 4,700 ohms (Run 1)................. | 60B 8-472 |
| | 10,000 ohms (Run 13)............... | 60B 8-103 |
| R617 | 2.2 megohms........................ | 60B 8-225 |
| R618 | 4.7 megohms........................ | 60B 8-475 |
| R619 | 2,200 ohms......................... | 60B 8-222 |
| R620 | 100,000 ohms, 5%................... | 60B 7-104 |
| R621 | 100,000 ohms, 5%................... | 60B 7-104 |
| R622 | 4.7 megohms........................ | 60B 8-475 |
| R623 | 470,000 ohms....................... | 60B 8-474 |
| R624 | 2,200 ohms......................... | 60B 8-222 |
| R625 | 5,600 ohms......................... | 60B 8-562 |
| R626 | 2,500 ohms, 7 watts................ | 61B 20-6 |
| R628 | 120,000 ohms....................... | 60B 8-124 |
| R629 | 6.8 megohms........................ | 60B 8-685 |
| R630 | 1 megohm........................... | 60B 8-105 |
| R631 | 2.5 megohms, Vertical Linearity control (Includes R640).......... | 75C 35-3 |
| R632 | 2.5 megohms, Vertical Hold control.. | 75D 13-80 |
| R633 | 39,000 ohms........................ | 60B 8-393 |
| R634 | 15,000 ohms........................ | 60B 8-153 |
| R635 | 18,000 ohms........................ | 60B 8-183 |
| R636 | 22,000 ohms, 1 watt................ | 60B 14-223 |
| R637 | 2.2 megohms........................ | 60B 8-225 |
| R638 | 100 ohms........................... | 60B 8-101 |
| R639 | 470,000 ohms....................... | 60B 8-474 |
| R640 | 5 megohms, Height control (Includes R631).................. | 75C 35-3 |
| R641 | 3.9 megohms........................ | 60B 8-395 |

## RESISTORS Cont'd

| Sym. | Description | Part No. |
|---|---|---|
| R642 | 100,000 ohms....................... | 60B 8-104 |
| R643 | 2.7 megohms, 1 watt................ | 60B 14-275 |
| R644 | 270,000 ohms....................... | 60B 8-274 |
| R645 | 150,000 ohms....................... | 60B 8-154 |
| R646 | 50,000 ohms, Horiz. Drive control... | 75C 20-34 |
| R647 | 10,000 ohms........................ | 60B 8-103 |
| R648 | 2,000 ohms, 5%..................... | 60B 7-202 |
| R649 | 150,000 ohms....................... | 60B 8-154 |
| R650 | 25,000 ohms, Horiz. Hold control.... | 75C 13-72 |
| R651 | 8,200 ohms, 5%..................... | 60B 7-822 |
| R652 | 1,200 ohms, 5% (Part of M601)...... | 60B 7-122 |
| R653 | 1,200 ohms, 5% (Part of M601)...... | 60B 7-122 |
| R654 | 120 ohms........................... | 60B 8-121 |
| R655 | 1 megohm........................... | 60B 8-105 |
| R656 | 56 ohms............................ | 60B 8-560 |
| R657 | 10,000 ohms, 10 watts.............. | 61B 20-3 |
| R658 | 4,700 ohms, 1 watt................. | 60B 14-472 |
| R659 | 200,000 ohms, Focus control........ | 75C 33-1 |
| R660 | 100 ohms, Horiz. Centering control.. | 75C 33-2 |
| R670 | 1.5 ohms, 5% (Run 1 only).......... | 60B 28-60 |
| | 3.3 ohms (Run 13).................. | 60B 28-10 |
| R671 | 10 megohms, 2 watts................ | 60B 20-106 |
| R672 | 1 megohm, 2 watts.................. | 60B 20-105 |
| R673 | 1 megohm, 2 watts.................. | 60B 20-105 |
| R674 | 10 megohms, 2 watts................ | 60B 20-106 |
| R675 | 10 megohms, 2 watts................ | 60B 20-106 |
| R676 | 10,000 ohms........................ | 60B 8-103 |
| R677 | 1.8 megohms, 1 watt, 5%............ | 60B 13-185 |
| R680 | 1.8 megohms, 1 watt, 5%............ | 60B 13-185 |
| R681 | 100 megohms, 1 watt, 20%........... | 60B 15-107 |
| R682 | 40 ohms, Vert. Centering control.... | 75C 20-49 |
| R683 | 22 ohms, 2 watts (Run 1)........... | 60B 20-220 |
| | 33 ohms, 2 watts (Run 13).......... | 60B 20-330 |
| R684 | 22 ohms, 2 watts (Run 1)........... | 60B 20-220 |
| | 33 ohms, 2 watts (Run 13).......... | 60B 20-330 |
| R685 | 22 ohms, 2 watts................... | 60B 20-220 |
| R686 | 68 ohms............................ | 60B 8-680 |
| R687 | 100 ohms, Red DC control........... | 75C 35-4 |
| R688 | 100 ohms, Green DC control......... | 75C 35-4 |
| R689 | 100 ohms, Blue DC control.......... | 75C 35-4 |
| R690 | 100 ohms, Red Vert. Tilt control.... | 75C 35-2 |
| R691 | 100 ohms, Green Vert. Tilt control.. | 75C 35-2 |
| R692 | 100 ohms, Blue Vert. Tilt control... | 75C 35-2 |
| R693 | 100 ohms, Red Vert. Amp. control.... | 75C 35-2 |
| R694 | 100 ohms, Green Vert. Amp. control.. | 75C 35-2 |
| R695 | 100 ohms, Blue Vert. Amp. control... | 75C 35-2 |
| R696 | 2,200 ohms, 2 watts (Added at Run 13). | 60B 20-222 |
| R697 | 47 ohms (Added at Run 13).......... | 60B 8-470 |
| R698 | 8.2 ohms, 1 watt (Added at Run 13).. | 60B 28-62 |
| R701 | 470,000 ohms....................... | 60B 8-474 |
| R702 | 100,000 ohms....................... | 60B 8-104 |
| R703 | 430 ohms, 20 watts................. | 61A 1-42 |
| R704 | 800 ohms, 10 watts................. | 61B 20-7 |
| R705 | 6,800 ohms, 2 watts................ | 60B 20-682 |
| R706 | 5,600 ohms, 2 watts................ | 60B 20-562 |

## CAPACITORS

| Sym. | Description | Part No. |
|---|---|---|
| C101 | 120 mmf, 10%, ceramic.............. | 94D 131-79 |
| C102 | 30 mmf, 5%, ceramic, feed-through... | 94D 131-80 |
| C103 | 28 mmf, 10%, ceramic............... | 94D 131-81 |
| C104 | 1,000 mmf, ceramic, feed-through.... | 94D 131-82 |
| C105 | 1 to 4.5 mmf, ceramic trimmer....... | 94D 131-83 |
| C106 | 5 mmf, ceramic..................... | 94D 131-84 |
| C107 | 1,000 mmf, ceramic................. | 94D 131-85 |
| C108 | 1 to 4.5 mmf, ceramic trimmer...... | 94D 131-83 |
| C109 | 47 mmf, 5% ceramic, feed-through.... | 94D 131-86 |
| C110 | 1 to 4.5 mmf, ceramic trimmer...... | 94D 131-83 |

## CAPACITORS Cont'd

| Sym. | Description | Part No. |
|---|---|---|
| C111 | 47 mmf, 10%, ceramic | 94D 131-87 |
| C112 | 1,000 mmf, ceramic, feed-through | 94D 131-82 |
| C113 | 30 mmf, 20%, ceramic, feed-through | 94D 131-88 |
| C114 | 1,000 mmf, ceramic, N750 temp.coeff. | 94D 131-89 |
| C115 | 1,000 mmf, ceramic, feed-through | 94D 131-90 |
| C116 | 3 mmf, 10%, ceramic, NPO temp.coeff. | 94D 131-91 |
| C117 | 6.8 mmf, 10%, ceramic, N330 temp. coeff | 94D 131-92 |
| C118 | 2 mmf, 5% ceramic, N550 temp.coeff. | 94D 131-93 |
| C119 | Fine Tuning Capacitor | Not Supplied as replace-able part. |
| C120 | 15 mmf, 5%,cer.(94D131-1 Tuner only) | 94D 131-94 |
| C121 | 12 mmf, 10%, ceramic | 94D 131-95 |
| C122 | 1,000 mmf, ceramic, feed-through | 94D 131-82 |
| C123 | 1,000 mmf, ceramic, feed-through | 94D 131-82 |
| C202 | 8.2 mmf + .25 mmf, cer. (Chassis using 94D131-1 Tuner only) | 65D 6-123 |
| | 10 mmf, ceramic (Chassis using 94D131-2 Tuner only) | 65C 6-115 |
| C203 | 91 mmf (Part of L201, L202) | 65D 10-96 |
| C204 | 68 mmf (Part of L201, L202) | 65D 10-97 |
| C205 | 1,500 mmf (Part of L201, L202) | 65D 10-100 |
| C206 | 820 mmf, ceramic disc | 65D 10-91 |
| C207 | 820 mmf, ceramic disc | 65D 10-91 |
| C208 | 820 mmf, ceramic disc | 65D 10-91 |
| C209 | .005 mf, ceramic (Added at Run 13) | 65D 10-5 |
| C210 | 820 mmf, ceramic disc | 65D 10-91 |
| C211 | .005 mf, ceramic disc | 65D 10-5 |
| C212 | 820 mmf, ceramic disc | 65D 10-91 |
| C213 | 820 mmf, ceramic disc | 65D 10-91 |
| C214 | 820 mmf, ceramic disc | 65D 10-91 |
| C215 | 100 mmf, ceramic | 65D 6-19 |
| C216 | 6.8 mmf, 10%, ceramic | 65D 10-102 |
| C217 | 4.7 mmf, tube ceramic | 65D 10-101 |
| C218 | 6.8 mmf, 10%, ceramic | 65D 10-102 |
| C219 | 82 mmf, 10%, ceramic disc | 65D 10-98 |
| C220 | 6.8 mmf, 10%, ceramic | 65D 6-82 |
| C221 | 150 mmf, silver,mica (Part of L211). | 65B 20-151 |
| C222 | .01 mf, ceramic disc | 65D 10-3 |
| C223 | .0015 mf, 600 volts | 64B 8-18 |
| C224 | 10 mf, 450 volts, electrolytic (C703C ) | Part of C703 |
| C225 | 4 mf, 150 volts, electrolytic | 67A 4-2 |
| C226 | .005 mf, ceramic disc | 65D 10-5 |
| C231 | 820 mmf, ceramic disc | 65D 10-91 |
| C232 | 820 mmf, ceramic disc | 65D 10-91 |
| C233 | 820 mmf, ceramic disc | 65D 10-91 |
| C234 | 820 mmf, ceramic disc | 65D 10-91 |
| C235 | .02 mf, ceramic disc | 65D 10-28 |
| C236 | 1.0 mf, 100 volts, paper | 64A 10-3 |
| C237 | 24 mmf, (used with 94D131-2 tuner only) | 65C 6-112 |
| C301 | 3.3 mmf, ceramic (Part of L401) | 65D 6-89 |
| C302 | 12 mmf, ceramic disc (Part of L301). | 65D 10-94 |
| C303 | .005 mf, ceramic disc | 65D 10-5 |
| C304 | .0022 mf, ceramic disc | 65D 10-89 |
| C305 | .0022 mf, ceramic disc | 65D 10-89 |
| C306 | 180 mmf, 5%, ceramic disc | 65D 10-52 |
| C307 | 4 mf, 50 volts, electrolytic | 67A 4-9 |
| C308 | 390 mmf, ceramic | Part of M301 |
| C309 | .0022 mf, ceramic | Part of M301 |
| C310 | .005 mf, ceramic | Part of M301 |
| C311 | .02 mf, ceramic disc | 65D 10-28 |
| C312 | .02 mf, ceramic disc | 65D 10-28 |

## CAPACITORS Cont'd

| Sym. | Description | Part No. |
|---|---|---|
| C313 | 47 mmf, ceramic disc | 65D 10-80 |
| C314 | .033 mf, 600 volts | 64B 8-29 |
| C315 | .047 mf, 400 volts | 64B 8-28 |
| C316 | .0047 mf, 600 volts | 64B 8-15 |
| C317 | .005 mf, ceramic disc | 65D 10-5 |
| C318 | .005 mf, ceramic disc | 65D 10-5 |
| C320A | 20 mf, 450 volts, | |
| C320B | 50 mf,350 volts (C616) electrolytic. | 67D 15-138 |
| C320C | 5 mf,450 volts (C633) | |
| C320D | 20 mf, 25 volts | |
| C401 | 43 mmf, ceramic disc (Part of L401). | 65D 10-95 |
| C402 | 3.3 mmf, ceramic disc (Part of L401) (Run 1) | 65D 6-89 |
| | 6.8 mmf, ceramic disc (Part of L401) (Run 13) | 65D 6-82 |
| C403 | 100 mmf, ceramic disc (Part of L402) (Run 1) | 65D 10-84 |
| | 180 mmf, ceramic disc (Part of L402) (Run 13) | 65D 10-52 |
| C404 | 4 mf, 150 volts, electrolytic | 67A 4-2 |
| C405 | .02 mf, ceramic disc | 65D 10-28 |
| C406 | .005 mf, ceramic disc (Run 1) | 65D 10-5 |
| C407 | 1,200 mmf, 10%, ceramic disc | 65D 10-128 |
| C408 | .01 mf, 500 volts, ceramic disc | 65D 10-3 |
| C409 | .005 mf, ceramic disc | 65D 10-5 |
| C410 | 1 mf, 100 volts | 64A 10-3 |
| C411 | 2,400 mmf, 5%, mica | 65B 20-242 |
| C412 | .01 mf, 500 volts, ceramic disc | 65D 10-3 |
| C414 | 18 mmf, ceramic disc | 65D 10-104 |
| C415 | .02 mf, ceramic disc | 65D 10-28 |
| C416 | 47 mmf, ceramic | 65D 6-84 |
| C417 | 18 mmf, ceramic disc | 65D 10-104 |
| C418 | .02 mf, ceramic disc | 65D 10-28 |
| C419 | 47 mmf, ceramic disc (Part of L406). | 65D 10-92 |
| C420 | 27 mmf, ceramic disc (Part of L406). | 65D 10-93 |
| C422 | .01 mf, 500 volts, ceramic disc | 65D 10-3 |
| C423 | .01 mf, 500 volts, ceramic disc | 65D 10-3 |
| C424 | .01 mf, 500 volts, ceramic disc | 65D 10-3 |
| C425 | .1 mf, 600 volts, molded | 64B 8-7 |
| C426 | 22 mmf, 2%, tub., ceramic | 65C 6-30 |
| C427 | 22 mmf, 2%, tub., ceramic | 65C 6-30 |
| C428 | .01 mf, 1,000 volts, molded | 64A 2-13 |
| C429 | .01 mf, 1,000 volts, molded | 64A 2-13 |
| C430 | .01 mf, 1,000 volts, molded | 64A 2-13 |
| C501 | .1 mf, 600 volts, molded | 64B 8-7 |
| C502 | .001 mf, 600 volts, molded (Run 1) | 64B 8-19 |
| | 470 mmf, ceramic disc (Run 13) | 65B 10-70 |
| C503 | .01 mf, 500 volts, ceramic disc (Run 1) | 65D 10-3 |
| | .001 mf, 400 volts, 10% (Run 13) | 64A 2-24 |
| C504 | .1 mf, 600 volts, molded | 64B 8-7 |
| C505 | .0047 mf, 600 volts, molded | 64B 8-15 |
| C506 | .005 mf, ceramic disc | 65D 10-5 |
| C507 | .02 mf, ceramic disc | 65D 10-28 |
| C508 | .1 mf, 200 volts, molded | 64B 8-39 |
| C509 | .02 mf, ceramic disc | 65D 10-28 |
| C510 | 3.5 - 28 mmf, Color Fidelity | 66B 40-5 |
| C511 | .0022 mf, ceramic disc | 65D 10-89 |
| C512 | .005 mf, ceramic disc | 65D 10-5 |
| C513 | .0022 mf, ceramic disc | 65D 10-89 |
| C514 | 2 mmf, ceramic | 65D 6-58 |
| C515 | .01 mf, 500 volts, ceramic disc | 65D 10-3 |
| C516 | 27 mmf, ceramic disc (Part of T502). | 65D 10-93 |
| C517 | .02 mf, ceramic disc | 65D 10-28 |

## CAPACITORS Cont'd

| Sym. | Description | Part No. |
|---|---|---|
| C518 | 220 mmf, ceramic disc.............. | 65D 10-83 |
| C519 | .0022 mf, ceramic disc............. | 65D 10-89 |
| C520 | .22 mf, 400 volts, molded.......... | 64B 8-24 |
| C521 | .047 mf, 400 volts................. | 64B 8-28 |
| C522 | 12 mmf, ceramic disc (Part of L502). | 65D 10-94 |
| C523 | .02 mf, ceramic disc............... | 65D 10-28 |
| C524 | 220 mmf, mica...................... | 65B 21-221 |
| C525 | 82 mmf, 10%, ceramic disc.......... | 65D 10-98 |
| C601 | 1 mf, 100 volts.................... | 64A 10-3 |
| C602 | .005 mf, ceramic disc.............. | 65D 10-5 |
| C603 | .001 mf, 1,600 volts............... | 64A 2-28 |
| C604 | 150 mmf............................ | Part of M605 |
| C605- | .01 mf............................. | Part of M605 |
| C606 | .22 mf, 600 volts, molded.......... | 64B 8-5 |
| C607 | .005 mf, ceramic disc.............. | 65D 10-5 |
| C608 | .001 mf, 400 volts, 10%............ | 64A 2-24 |
| C609 | .001 mf, 400 volts, 10%............ | 64A 2-24 |
| C610 | .005 mf, ceramic disc.............. | 65D 10-5 |
| C611 | .047 mmf, 200 volts................ | 64B 8-41 |
| C612 | .0047 mf, 600 volts, molded........ | 64B 8-15 |
| C613 | .001 mf, 600 volts, molded......... | 64B 8-19 |
| C614 | .001 mf, 600 volts, molded......... | 64B 8-19 |
| C616 | 50 mmf, 350 volts, electrolytic (C320B)......................... | 67D 15-138 |
| C617 | .01 mf, 600 volts, molded (Run 1)........................... | 64B 8-13 |
| C617 | .0047 mf, 600 volts (Run 13)....... | 64B 8-15 |
| C618 | .0047 mf, 600 volts................ | 64B 8-15 |
| C619 | .0015 mmf, 600 volts, molded....... | 64B 8-18 |
| C620 | .12 mf, 600 volts, 10%, molded..... | 64B 22-43 |
| C621 | .033 mmf, 600 volts................ | 64B 22-10 |
| C622 | .33 mf, 200 volts, 10%............. | 64B 22-36 |
| C623 | .056 mmf, 400 volts, 10%........... | 64B 22-44 |
| C624 | .0027 mmf, 1,600 volts, 10%........ | 64A 2-37 |
| C625 | .1 mf, 600 volts, molded........... | 64B 8-7 |
| C626 | .0039 mf, 10%, mica (Part of L601).. | 65B 20-392 |
| C627 | 22 mmf, 10%, mica (Part of L601).... | 65B 21-220 |
| C628 | 220 mmf, ceramic disc.............. | 65D 10-83 |
| C629 | 470 mmf, 10%, mics................. | 65B 21-471 |
| C630 | .01 mf, 600 volts, molded.......... | 64B 8-13 |
| C631 | .1 mf, 200 volts, molded........... | 64B 8-39 |
| C632 | 82 mmf, 10%, ceramic disc.......... | 65D 10-98 |
| C633 | 5 mf, 450 volts (C320C)............ | 67D 15-138 |
| C634 | .1 mf, 600 volts, molded........... | 64B 8-7 |
| C635 | .22 mmf, 600 volts, molded......... | 64B 8-5 |
| C636 | 250 mmf, 3 KV, 5%, ceramic disc..... | 65D 10-114 |
| C637 | 250 mmf, 3 KV, 5%, ceramic disc..... | 65D 10-114 |
| C638 | .47 mmf, 200 volts, 10%............ | 64B 22-35 |
| C639 | .47 mmf, 200 volts, 10%............ | 64B 22-35 |
| C640 | .1 mf, 600 volts, molded........... | 64B 8-7 |
| C641 | .15 mmf, 500 volts, molded......... | 64B 8-25 |
| C642 | 56 mmf, 5,000 volts, ceramic disc... | 65D 10-126 |
| C643 | .047 mmf, 600 volts, molded........ | 64B 8-9 |
| C644 | .0033 mmf, 600 volts, molded....... | 64B 8-16 |
| C645 | .39 mmf, 200 volts, 10%............ | 64B 22-42 |
| C646 | .39 mmf, 200 volts, 10%............ | 64B 22-42 |
| C647 | .47 mmf, 200 volts, 10%............ | 64B 22-35 |
| C648 | .47 mmf, 200 volts, 10%............ | 64B 22-35 |
| C701 | .047 mmf, 600 volts, molded........ | 64B 8-9 |
| C702 | .047 mmf, 600 volts, molded........ | 64B 8-9 |
| C703A | 80 mf, 450 volts } electrolytic...... | 67D 15-137 |
| C703B | 10 mf, 350 volts } electrolytic...... | 67D 15-137 |
| C703C | 10 mf, 450 volts } electrolytic...... | 67D 15-137 |
| C704A | 100 mf, 450 volts } electrolytic..... | 67D 15-136 |
| C704B | 50 mf, 450 volts } electrolytic..... | 67D 15-136 |
| C707 | .047 mmf, 600 volts, molded........ | 64A 2-36 |

## COILS

| Sym. | Description | Part No. |
|---|---|---|
| L101 | Trap Coil (Series tuned)........... | 94D 131-51 |
| | Tuning Core (for L101)............. | 94D 131-77 |
| L102 | Channel Coil (Stamped 2N4, 3N4, 4N4, etc.) | |
| | for Channel #2....... | 94D 131-52 |
| | for Channel #3....... | 94D 131-53 |
| | for Channel #4....... | 94D 131-54 |
| | for Channel #5....... | 94D 131-55 |
| | for Channel #6....... | 94D 131-56 |
| | for Channel #7....... | 94D 131-57 |
| | for Channel #8....... | 94D 131-58 |
| | for Channel #9....... | 94D 131-59 |
| | for Channel #10...... | 94D 131-60 |
| | for Channel #11...... | 94D 131-61 |
| | for Channel #12...... | 94D 131-62 |
| | for Channel #13...... | 94D 131-63 |
| L103 | Trap Coil (Parallel tuned)......... | 94D 131-64 |
| L104 | Screen Coil........................ | 94D 131-65 |
| L105 | Mixer Plate Coil................... | 94D 131-66 |
| | Tuning Core (for L105)............. | 94D 131-78 |
| L106 | RF Choke Coil...................... | 94D 131-67 |
| L201 | 41.25 MC Trap Coil................. | 72B 164-1 |
| L202 | 47.25 MC Trap Coil................. | 72B 164-1 |
| L203 | Choke Coil......................... | 73B 24-3 |
| L204 | Choke Coil......................... | 73B 24-3 |
| L205 | 41.25 MC Trap Coil................. | 72B 166-1 |
| L206 | Peaking Coil....................... | 73B 5-27 |
| L207 | 43.5 MC Choke...................... | 73B 24-1 |
| L208 | Peaking Coil....................... | 73B 25-5 |
| L209 | Delay Line......................... | 72B 168-1 |
| L210 | Peaking Coil....................... | 73B 5-31 |
| L211 | 3.58 MC Trap Coil.................. | 72D 165-5 |
| L212 | Peaking Coil....................... | 73B 5-28 |
| L213 | Peaking Coil....................... | 73B 5-27 |
| L217 | Choke, Filament.................... | 73A 2-5 |
| L218 | Choke, Filament.................... | 73A 2-5 |
| L219 | Choke, Filament.................... | 73A 2-5 |
| L301 | Sound Takeoff Coil................. | 72B 157-1 |
| L302 | Peaking Coil....................... | 73B 25-7 |
| L401 | 4.5 MC Sound Trap Coil............. | 72D 165-2 |
| L402 | 1st Chroma Coil.................... | 72D 165-7 |
| L403 | Choke (6 MC)....................... | 73B 24-6 |
| L405 | Output Chroma Coil................. | 72B 163-1 |
| L406 | Phase Shift Coil................... | 72B 158-1 |
| L407 | Choke 3.6 MC Resonant.............. | 73B 24-5 |
| L408 | Choke 3.6 MC Resonant.............. | 73B 24-5 |
| L409 | Choke 3.6 MC Resonant.............. | 73B 24-5 |
| L501 | Burst Amp. Plate Coil.............. | 72B 181-1 |
| L502 | Reactance Tube Plate Coil.......... | 72B 156-1 |
| L503 | Peaking Coil....................... | 73B 5-28 |
| L601 | Horizontal Oscillator Coil......... | 94C 17-11 |
| L602 | Choke Coil......................... | 73B 33-1 |
| L603 | Choke Coil......................... | 73B 33-1 |
| L604 | Horizontal Red Amp................. | 94B 133-2 |
| L605 | Horizontal Red Tilt................ | 94B 133-1 |
| L606 | Horizontal Green Amp............... | 94B 133-2 |
| L607 | Horizontal Green Tilt.............. | 94B 133-1 |
| L608 | Horizontal Blue Amp................ | 94B 133-2 |
| L609 | Horizontal Blue Tilt............... | 94B 133-1 |
| L610 | Horizontal Tuning Coil............. | 94B 114-3 |
| L701 | Power Supply Filter Choke.......... | 74B 18-20 |

## TRANSFORMERS

| Sym. | Description | Part No. |
|---|---|---|
| T101 | Antenna Input Assembly | 94D 131-68 |
| T201 | IF Input Transformer | 72D 161-1 |
| T202 | 1st IF Transformer | 72D 111-40 |
| T203 | 2nd IF Transformer | 72B 154-1 |
| T204 | 3rd IF Transformer | 72D 111-39 |
| T205 | IF Output Transformer | 72B 159 |
| T206 | Luminance Compensation Transformer | 72B 167-1 |
| T301 | Ratio Detector Transformer | 72C 68-2 |
| T302 | Audio Output Transformer | 79B 66-7 |
| T401 | 2nd Chroma Transformer | 72B 155-1 |
| T502 | Sub-Carrier Oscillator | 72B 178-1 |
| T601A T601B | Yoke Assembly | 94D 132-1 |
| T602 | Horizontal Output Transformer | 79D 69-2 |
| T603 | Vertical Output Transformer | 79C 72-1 |
| T701 | Power Transformer | 80C 53-1 |

## TUNERS

| Description | Part No. |
|---|---|
| VHF Tuner (used in early sets) | 94D 131-1 |
| VHF Tuner (used in later sets) | 94D 131-2 |
| VHF-UHF Tuner | 94D 107-1 |

## MISC. CHASSIS PARTS

| Sym. | Description | Part No. |
|---|---|---|
| CR201 | Crystal, Luminance Detector | 93A 8 |
| CR202 | Crystal, Sound & Chroma Detector | 93A 8 |
| CR501 | Crystal, 3.58 MC Oscillator (Wired In) | 93B 3-3 |
| CR501 | Crystal, 3.58 MC Oscillator (Plug In) | 93B 3-4 |
| CR601 | Diode, Dual Selenium | 93A 5-2 |
| F601 | Fuse, 3/4 Amp | 84A 13-9 |
| F604 | Fuse, 3/10 Amp | 84A 13-6 |
| F701 | Fuse, 2 Amps | 84A 13-14 |
| J601 | Plug, Yoke | 88A 9-4 |
| J602 | Socket, Convergence Yoke | 88A 20-2 |
| J603 | Cable, High Voltage Anode | 88B 34-10 |
| M201 | Plug, IF Input Cable | 88A 2-5 |
| M301 | Sound Couplate | 63C 6-15 |
| M302 | Socket, Speaker | 87A 4-4 |
| M303 | Plug, Speaker | 88B 3-7 |
| M304 M305 | Speaker Assembly | See Cabinet Parts |
| M601 | Yoke Assembly | 94D 132-1 |
| M602 | High Voltage Interlock Switch | 76A 35 |
| M604 | Pole Piece Assembly | 94D 134-1 |
| M605 | Sync Couplate | 63C 6-8 |
| M701 | Line Cord & Plug Assembly | 89A 22-1 |
| M702 | Socket, AC Power | 88A 36 |
| M704 | Pilot Light | See Cabinet Parts |

## MISC. CHASSIS PARTS Cont'd

| Sym. | Description | Part No. |
|---|---|---|
| P601 | Plug, Yoke | 88A 9-4 |
| P604 | Plug, Pole Piece Assembly | 88A 20-1 |
| S701 | Switch, AC | Part of R308 |
| | Clip, Contact (Insulating Cone) | 18B 178 |
| | Connector, Plate Cap (6BK4) | 88C 16-65 |
| | Dag Spring | 19A 121 |
| | Holder, 3/10 Amp Fuse | 84A 12-2 |
| | Holder, 3/4 Amp Fuse | 84A 12-4 |
| | Holder, 2 Amp Fuse | 84A 12-6 |
| | Insulating Cone, Painted (picture tube) | 33C 219 |
| | Insulating Cylinder, H.V. (3A3 tube) | 33B 215 |
| | Insulating Ring (picture tube) | 33B 155-1 |
| | Insulator, Rim Magnet | 33A 176 |
| | Insulating Knob (focus and centering controls) | 33A 196 |
| | Magnet, Blue Lateral | 94A 136 |
| | Magnet, Purity | 94A 104 |
| | Magnet Assembly, Rim | 94B 135 |
| | Pole Piece Exciter Spring | 18B 170 |
| | Pole Piece Holder | 18A 169 |
| | Pole Piece Retainer Spring | 33B 216 |
| | Rubber Channel (Yoke Bracket) | 12A 9-16 |
| | Shield, Tube | |
| | for 7 pin miniature | 87C 7-19 |
| | for 9 pin miniature | 87C 7-20 |
| | for 9 pin (long) | 87C 7-25 |
| | Socket, Tube | |
| | 7 pin miniature | 87A 39-1 |
| | 9 pin miniature | 87A 25-1 |
| | 7 pin, shield base | 87B 23-4 |
| | 7 pin, shield base (V302, 6AL5) | 87A 14-7 |
| | 9 pin, shield base | 87B 23-2 |
| | 9 pin, for V607 (Mica) | 33B 142 |
| | 7 pin, for V603 (Mica) | 87A 39-3 |
| | Octal, for V606 (Mica) | 87B 30-7 |
| | Octal, for V605, 609, 303, 701 & 702. | 87A 5-1 |
| | Octal, for V608 (with shield) | 87B 61-3 |
| | Picture Tube | 87A 53-3 |

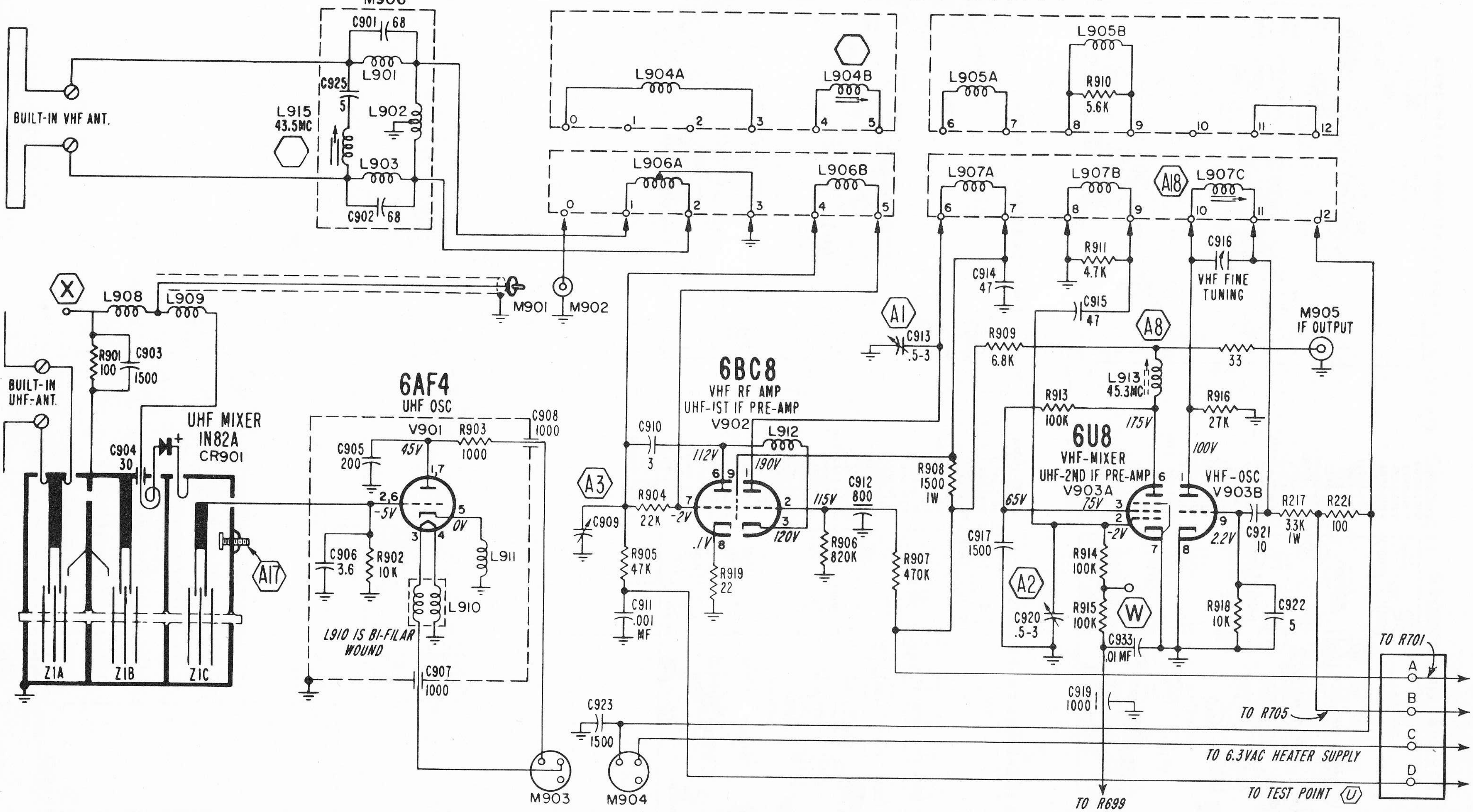
## MISC PARTS FOR TUNERS

| Description | Part No. |
|---|---|
| Shield, Tube | 94D 131-50 |
| Screw, Trimmer (4-36x3/4") | 94D 131-69 |
| Nut, Locking (for trimmer) | 98A 45-31 |
| Bracket, Fine Tuning | 94D 110-92 |
| Spring, Drum Retainer | 94D 131-70 |
| Fine Tuning Shaft and Cam Assem | 94D 131-71 |
| Turret Assembly, Less Coils | 94D 131-72 |
| Spring, Wiper | 94D 131-73 |
| Cover, Bottom | 94D 131-74 |
| Slug, Oscillator Tuning | 98A 45-88 |
| Spring, Slug Retaining | 98A 45-52 |
| Spring and Roller, Detent | 94D 131-75 |
| Spring, Turret Grounding | 94D 131-76 |

# CABINET PARTS LIST

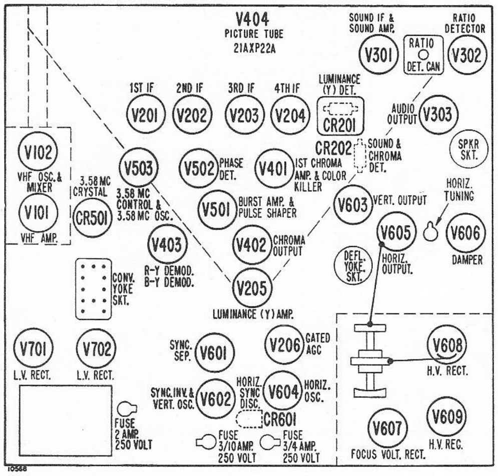
| Description | C322C2 CS322C2 MAHOGANY | C322C3 CS322C3 BLOND | C322C16 CS322C16 MAHOGANY | C322C17 CS322C17 BLOND | C322C26 CS322C26 MAHOGANY | C322C27 CS322C27 BLOND | LC322C36 LCS322C36 MAHOGANY | LC322C37 LCS322C37 BLOND | LC322C39 LCS322C39 SIERRA |
|---|---|---|---|---|---|---|---|---|---|
| Back, Cabinet (less bell and cord).. | 43D263-3 | 43D263-3 | 43D263-3 | 43D263-3 | 43D263-3 | 43D263-3 | 43D263-3 | 43D263-3 | 43D263-3 |
| Back, Speaker Compartment.......... | | | | | | | 43D261-4 | 43D261-4 | 43D261-4 |
| Bell, Cabinet Back................. | 32B214-7 | 32B214-7 | 32B214-7 | 32B214-7 | 32B214-7 | 32B214-7 | 32B214-7 | 32B214-7 | 32B214-7 |
| Bolt, Chassis Mourting ($\frac{1}{4}$-20 x $1\frac{1}{4}$"). | 1A67-44-71 | 1A67-44-71 | 1A67-44-71 | 1A67-44-71 | 1A67-44-71 | 1A67-44-71 | 1A67-44-71 | 1A67-44-71 | 1A67-44-71 |
| Bracket, Control Mtg. & Tuner Bearing........................ | 15B1347 | 15B1347 | 15B1347 | 15B1347 | 15B1347 | 15B1347 | 15B1347-2 | 15B1347-2 | 15B1347-2 |
| Bracket, Tuner Support............ | 15A1378 | 15A1378 | 15A1378 | 15A1378 | 15A1378 | 15A1378 | 15A1510 | 15A1510 | 15A1510 |
| Bracket, Volume Control Bearing.... | 15A1397 | 15A1397 | 15A1397 | 15A1397 | 15A1397 | 15A1397 | 15A1397 | 15A1397 | 15A1397 |
| Bracket, Tuner Shaft Support (VHF only) Fiber................ | 32A201-4 | 32A201-4 | 32A201-4 | 32A201-4 | 32A201-4 | 32A201-4 | 32A201-4 | 32A201-4 | 32A201-4 |
| Bracket, Tuner Shaft Support (UHF-VHF) Fiber................. | 32A201-5 | 32A201-5 | 32A201-5 | 32A201-5 | 32A201-5 | 32A201-5 | 32A201-5 | 32A201-5 | 32A201-5 |
| Bracket, Hi-Fi Control Mounting..... | | | | | | | 15B1511 | 15B1511 | 15B1511 |
| Cabinet........................... | 35E384-3 | 35E384-4 | 35E384-1 | 35E384-2 | 35E386-1 | 35E386-2 | 35E388-1 | 35E388-2 | 35E388-3 |
| Clip, Glass and Mask Retainer....... | 18A171-2 | 18A171-2 | 18A171-2 | 18A171-2 | 18A171-2 | 18A171-2 | 18A171-2 | 18A171-2 | 18A171-2 |
| Escutcheon, Preference Controls..... | 23B258 | 23B258 | 23B258 | 23B258 | 23B258 | 23B258 | 23B258 | 23B258 | 23B258 |
| Escutcheon, Bass Control.......... | | | | | | | 23A279-2 | 23A279-2 | 23A279-2 |
| Escutcheon, Treble Control.......... | | | | | | | 23A279-1 | 23A279-1 | 23A279-1 |
| Grille Screen (Speaker)............ | 36B55-21 | 36B55-22 | 36B55-21 | 36B55-22 | | | | | |
| Grille Cloth (bottom).............. | 36C3-322 | 36C3-323 | 36C3-324 | 36C3-325 | 36C3-316 | 36C3-317 | 36C3-328 | 36C3-329 | 36C3-328 |
| Grille Cloth (side)................ | | | | | | | 36C3-326 | 36C3-327 | 36C3-326 |
| Interlock Switch.................. | 76A35 | 76A35 | 76A35 | 76A35 | 76A35 | 76A35 | 76A35 | 76A35 | 76A35 |
| Knob, Spin Tuning (UHF-VHF)........ | A5332 | A5332 | A5332 | A5332 | A5332 | A5332 | A5332 | A5332 | A5332 |
| Knob, Vernier (VHF only)........... | 33D165-138 | 33D165-138 | 33D165-138 | 33D165-138 | 33D165-138 | 33D165-138 | 33D165-138 | 33D165-138 | 33D165-138 |
| Knob, Contrast.................... | 33D165-139 | 33D165-139 | 33D165-139 | 33D165-139 | 33D165-139 | 33D165-139 | 33D165-139 | 33D165-139 | 33D165-139 |
| Knob, Channel Selector (VHF only)... | 33D199-16 | 33D199-1 | 33D199-22 | 33D199-10 | 33D199-22 | 33D199-10 | 33D199-22 | 33D199-10 | 33D199-10 |
| Knob, Volume and Switch........... | 33D199-17 | 33D199-2 | 33D199-23 | 33D199-11 | 33D199-23 | 33D199-11 | 33D199-23 | 33D199-11 | 33D199-11 |
| Knob, Channel Selector (UHF-VHF).... | 33D199-18 | 33D199-3 | 33D199-24 | 33D199-12 | 33D199-24 | 33D199-12 | 33D199-24 | 33D199-12 | 33D199-12 |
| Knob, Channel Indicator (UHF only).. | 33D199-9 | 33D199-9 | 33D199-9 | 33D199-9 | 33D199-9 | 33D199-9 | 33D199-9 | 33D199-9 | 33D199-9 |
| Knob, Treble and Bass.............. | | | | | | | 33C81-19 | 33C81-19 | 33C81-19 |
| Leg, Cabinet...................... | 35E384-52 | 35E384-53 | 35E384-52 | 35E384-53 | 35E386-52 | 35E386-53 | | | |
| Line Cord......................... | 89A22-1 | 89A22-1 | 89A22-1 | 89A22-1 | 89A22-1 | 89A22-1 | 89A22-1 | 89A22-1 | 89A22-1 |
| Mask, Picture Window.............. | 23E237-7 | 23E237-8 | 23E237-5 | 23E237-6 | 23E237-3 | 23E237-4 | 23E237-5 | 23E237-6 | 23E237-6 |
| Monogram (Royal 600)............... | | | 26C61 | 26C61 | 26C61 | 26C61 | 26C61 | 26C61 | 26C61 |
| Monogram (Admiral)................ | 26C62 | 26C62 | 26C62 | 26C62 | | | 26C62 | 26C62 | 26C62 |
| Pilot Lamp........................ | | | 81A1-12 | 81A1-12 | 81A1-12 | 81A1-12 | 81A1-12 | 81A1-12 | 81A1-12 |
| Shield (Pilot Lamp)................ | | | 82A24-2 | 82A24-2 | 82A24-2 | 82A24-2 | 82A24-2 | 82A24-2 | 82A24-2 |
| Speaker, w/o Transf.(6" x 9" oval).. | | | | | 78C107-4 | 78C107-4 | | | |
| Speaker, with Transf.(6" x 9" oval). | | | | | 78C107-5 | 78C107-5 | | | |
| Speaker, (8" round)............... | 78D119-4 | 78D119-4 | | | | | | | |
| Speaker, w/o Transf. (8" round)..... | | | 78D118-6 | 78D118-6 | | | 78D127-2 | 78D127-2 | 78D127-2 |
| Speaker, with Transf. (8" round).... | | | 78D118-5 | 78D118-5 | | | 78D127-1 | 78D127-1 | 78D127-1 |
| Speaker, with Leads ($3\frac{1}{2}$")........... | | | | | | | 78B91-4 | 78B91-4 | 78B91-4 |
| Speaker, with Lugs ($3\frac{1}{2}$")............ | | | | | | | 78B91-5 | 78B91-5 | 78B91-5 |
| Trim Strip (Gold)................ | | | | | 23C238-3 | 23C238-3 | | | |
| Trim Strip, Glass Retainer.......... | | | | | | | 23B236-6 | 23B236-6 | 23B236-6 |
| TV Operating Instructions.......... | 41C20-142 | 41C20-142 | 41C20-142 | 41C20-142 | 41C20-142 | 41C20-142 | 41C20-167 | 41C20-167 | 41C20-167 |
| Window, Safety Glass............... | 21C86-2 | 21C86-2 | 21C86-2 | 21C86-2 | 21C86-2 | 21C86-2 | 21C86-2 | 21C86-2 | 21C86-2 |

# VHF-UHF TUNER 94E107-1



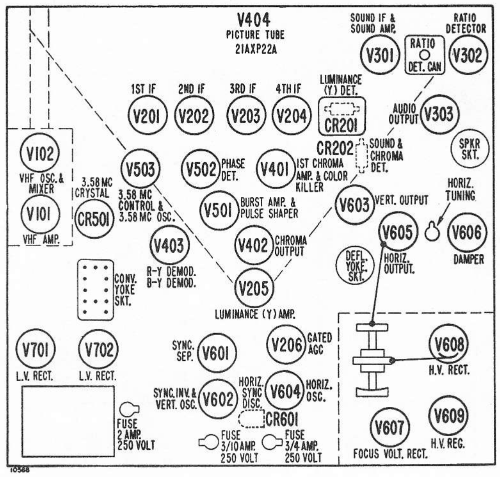

**UHF VHF TUNER SCHEMATIC**

## TUBE LOCATIONS CHASSIS 29Z1



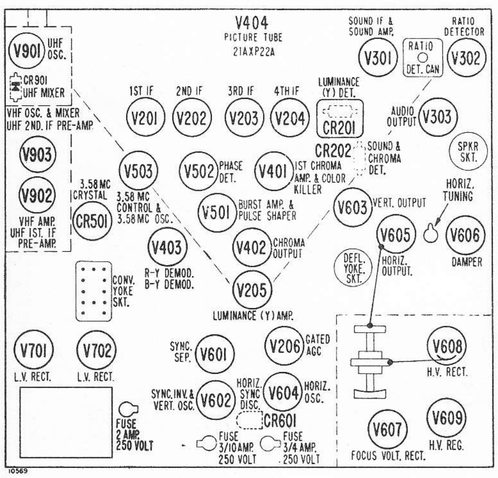

V101-6BN4
V102-6CG8
V201-6BZ6
V202-6BZ6
V203-6BZ6
V204-6CB6
V205-12BY7
V206-6AU6
V301-6U8
V302-6AL5
V303-6V6GT
V401-6AW8
V402-6CL6
V403-12BH7
V404-21AXP22A
V501-6BH8
V502-6AL5
V503-6U8
V601-6CS6
V602-6CG7
V603-6AQ5
V604-6CG7
V605-6CB5A
V606-6AU4GTA
V607-1V2
V608-3A3
V609-6BK4
V701-5U4GB
V702-5U4GB
CR201-93A8
CR202-93A8
CR501-93B3-4
CR601-93A5-2

## TUBE LOCATIONS CHASSIS 29Z1B



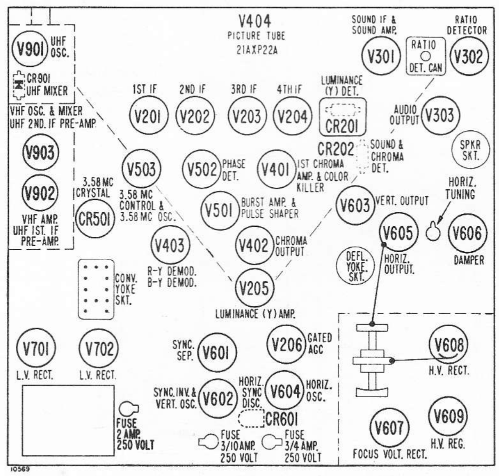

V101-6BN4
V102-6CG8
V201-6BZ6
V202-6BZ6
V203-6BZ6
V204-6CB6
V205-12BY7
V206-6AU6
V301-6U8
V302-6BV8
V303-6L6
V401-6AW8
V402-6CL6
V403-12BH7
V404-21AXP22A
V501-6BH8
V502-6AL5
V503-6U8
V601-6CS6
V602-6CG7
V603-6AQ5
V604-6CG7
V605-6CB5A
V606-6AU4GTA
V607-1V2
V608-3A3
V609-6BK4
V701-5U4GB
V702-5U4GB
CR201-93A8
CR202-93A8
CR501-93B3-4
CR601-93A5-2

## TUBE LOCATIONS CHASSIS 29SZ1




CR-901-1N82A
V901-6AF4A
V902-6BC8
V903-6U8
V201-6BZ6
V202-6BZ6
V203-6BZ6
V204-6CB6
V205-12BY7
V206-6AU6
V301-6U8
V302-6AL5
V303-6V6GT
V401-6AW8
V402-6CL6
V403-12BH7
V404-21AXP22A
V501-6BH8
V502-6AL5
V503-6U8
V601-6CS6
V602-6CG7
V603-6AQ5
V604-6CG7
V605-6CB5A
V606-6AU4GTA
V607-1V2
V608-3A3
V609-6BK4
V701-5U4GB
V702-5U4GB
CR201-93A8
CR202-93A8
CR501-93B3-4
CR601-93A5-2

## TUBE LOCATIONS CHASSIS 29SZ1B




CR-901-1N82A
V901-6AF4A
V902-6BC8
V903-6U8
V201-6BZ6
V202-6BZ6
V203-6BZ6
V204-6CB6
V205-12BY7
V206-6AU6
V301-6U8
V302-6BV8
V303-6L6
V401-6AW8
V402-6CL6
V403-12BH7
V404-21AXP22A
V501-6BH8
V502-6AL5
V503-6U8
V601-6CS6
V602-6CG7
V603-6AQ5
V604-6CG7
V605-6CB5A
V606-6AU4GTA
V607-1V2
V608-3A3
V609-6BK4
V701-5U4GB
V702-5U4GB
CR201-93A8
CR202-93A8
CR501-93B3-4
CR601-93A5-2

# SCHEMATIC NOTES

⟨A1⟩, ⟨A2⟩,......⟨Y⟩, ⟨Z⟩,etc. indicate alignment points and alignment connections.

Fixed resistor values shown in ohms ± 10% tolerance, 1/2 watt; capacitor values shown in micromicrofarads ±20% tolerance unless otherwise specified.

NOTE: K=R X 1,000, MEG=R X 1,000,000. MF= microfarad.

## CONDITIONS FOR MEASURING VOLTAGES

Warning: Pulsed high voltages are present at the caps of V605, V607, V608, V609, and at pin 3 of V606. Do not attempt to measure voltages at these points without suitable equipment. A VTVM with a 30,000 volt high voltage probe should be used when measuring picture tube high voltage (to ultor ring).

Set the CHANNEL SELECTOR on an unused channel. CONTRAST and COLOR INTENSITY controls fully clockwise. BRIGHTNESS and VOLUME controls at minimum. All other controls at normal settings.

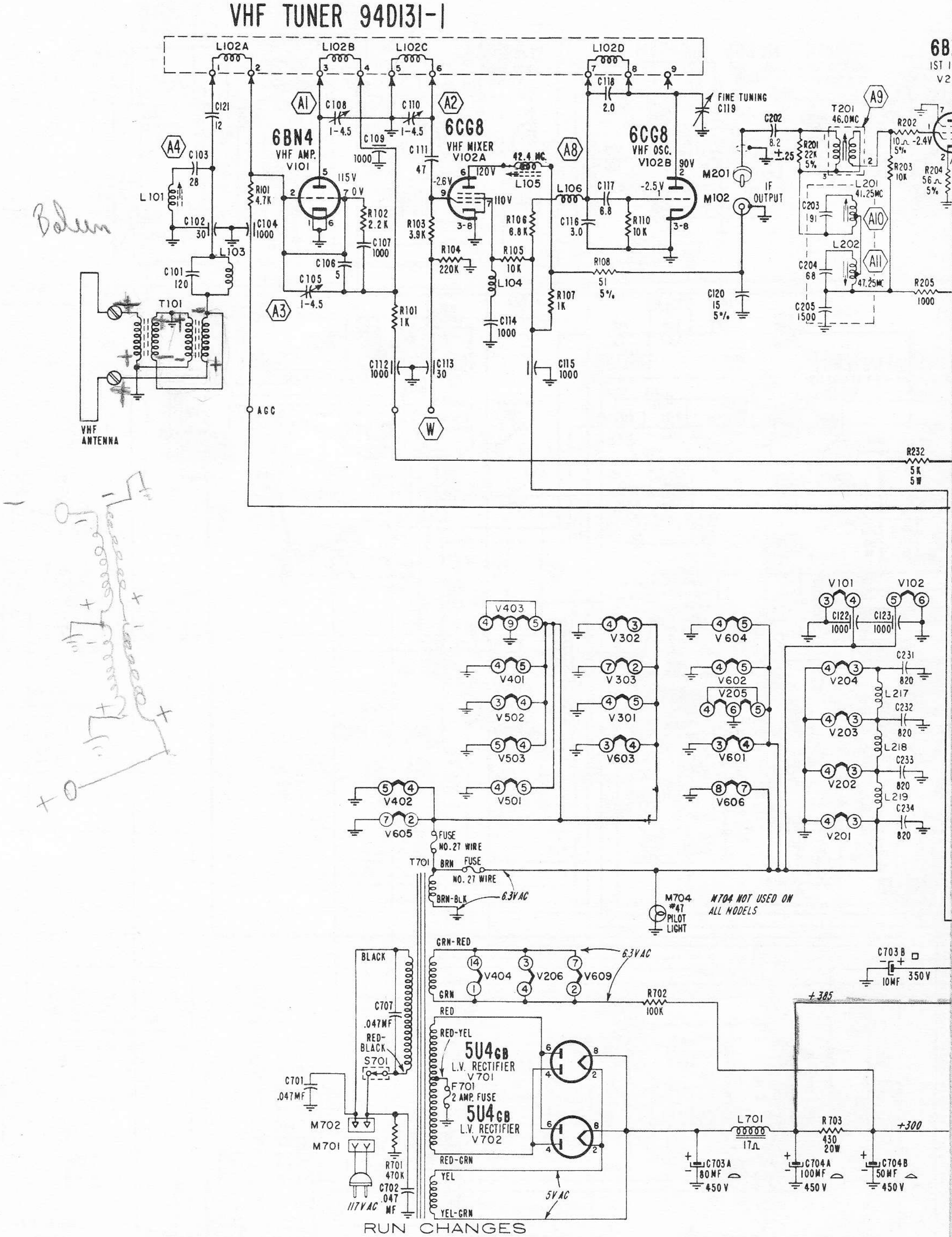
- Antenna disconnected and terminals shorted together.
- Line voltage: 117 volts AC.
- DC voltages measured with a VTVM between tube socket terminals and chassis, unless otherwise indicated.
- Voltages at V101 and V102 measured from the top of the tuner with tubes in socket. Use of an adapter is recommended.
- Voltages at picture tube are shown with SCREEN and GRID controls set at minimum and maximum.

## CONDITIONS FOR OBSERVING WAVEFORMS

Warning: Pulsed high voltages are present at the caps of V605, V607, V608, V609, and at pin 3 of V606. Do not attempt to observe waveforms at these points unless suitable test equipment is used.

- Waveforms should resemble those shown on the schematic.
- Waveforms are taken with a transmitted black and white signal input to the television chassis.
- Set all controls for normal picture.
- Oscilloscope sweep is set at 30 cycles for vertical waveforms and at 7,875 cycles for horizontal waveforms, to permit 2 complete cycles to be observed.
- Peak-to-peak voltages will vary from those shown on the schematic, depending on the test equipment employed and chassis parts tolerances.
- Chroma waveforms shown are the result of injecting a signal from a typical color bar generator.

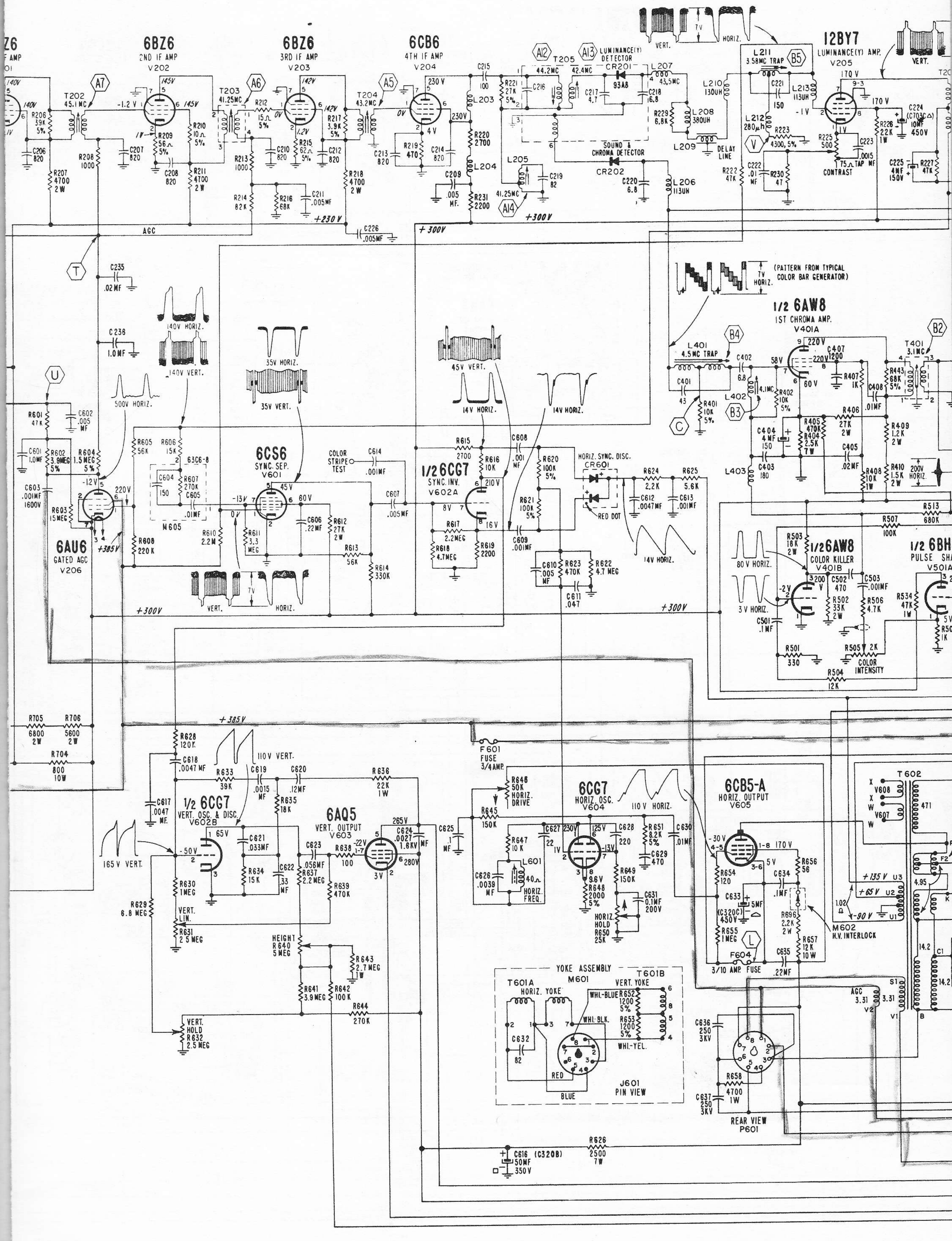
1949
1959




RUN CHANGES

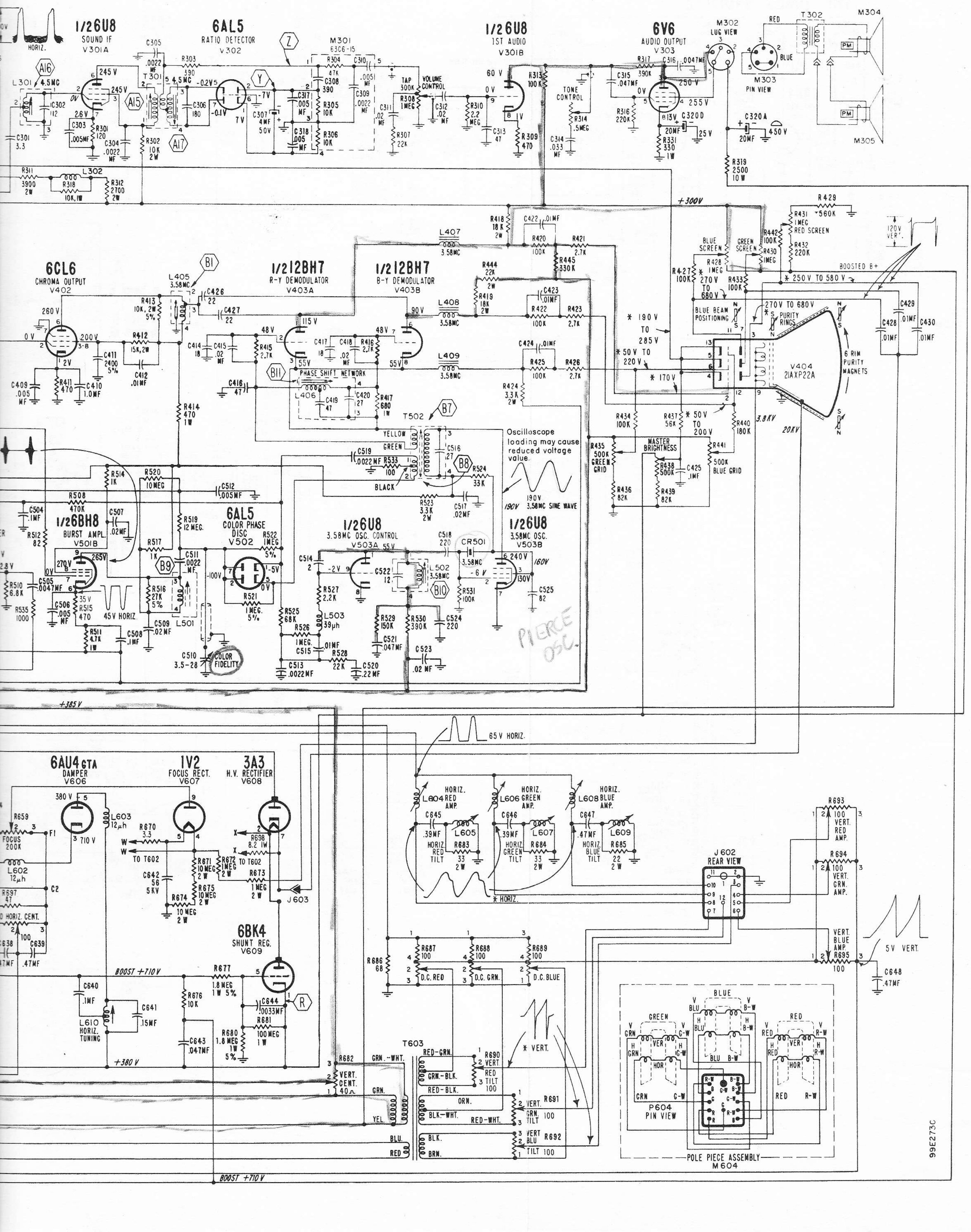
(1) *Pilot production*

(13) *Start of regular production*

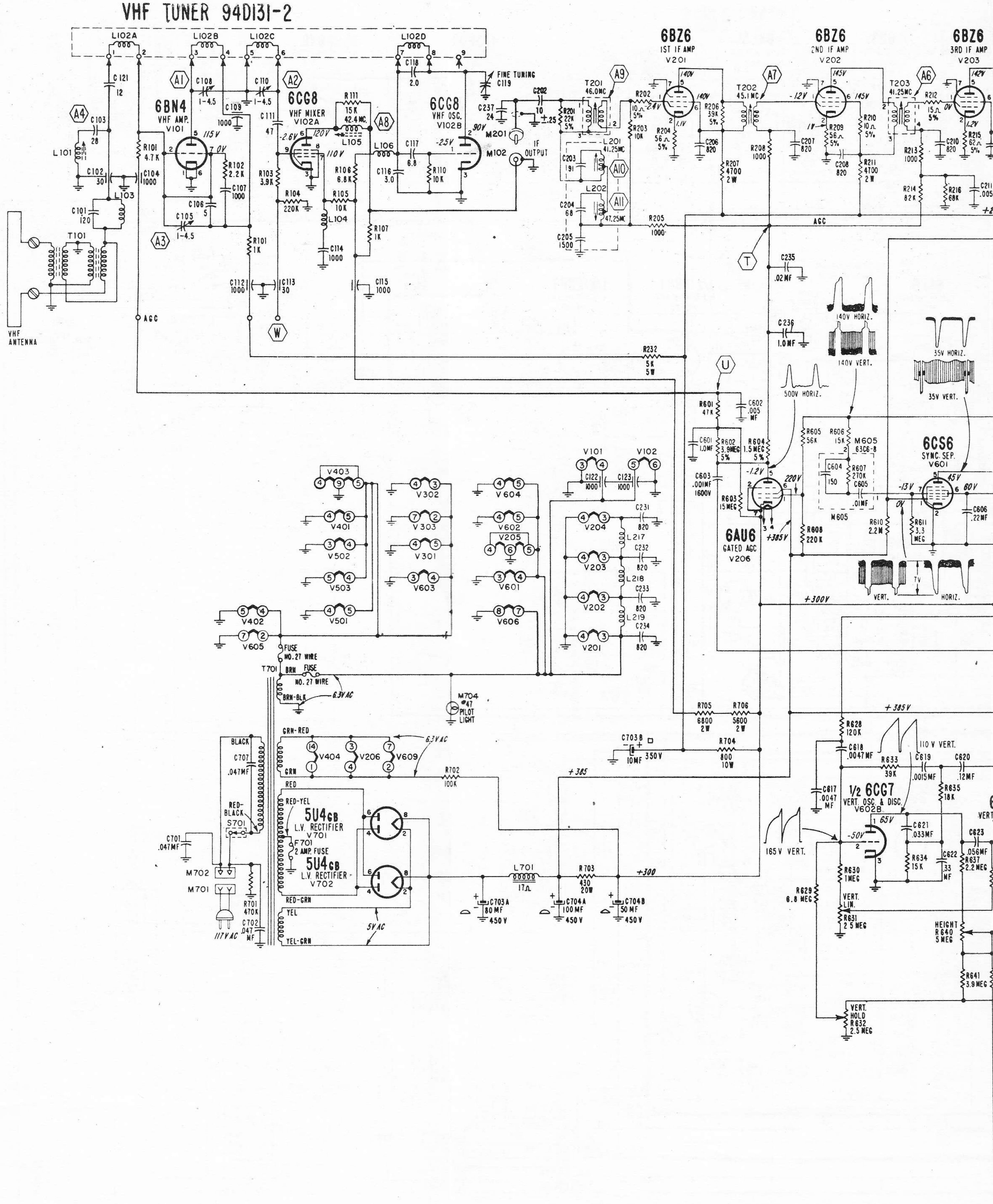


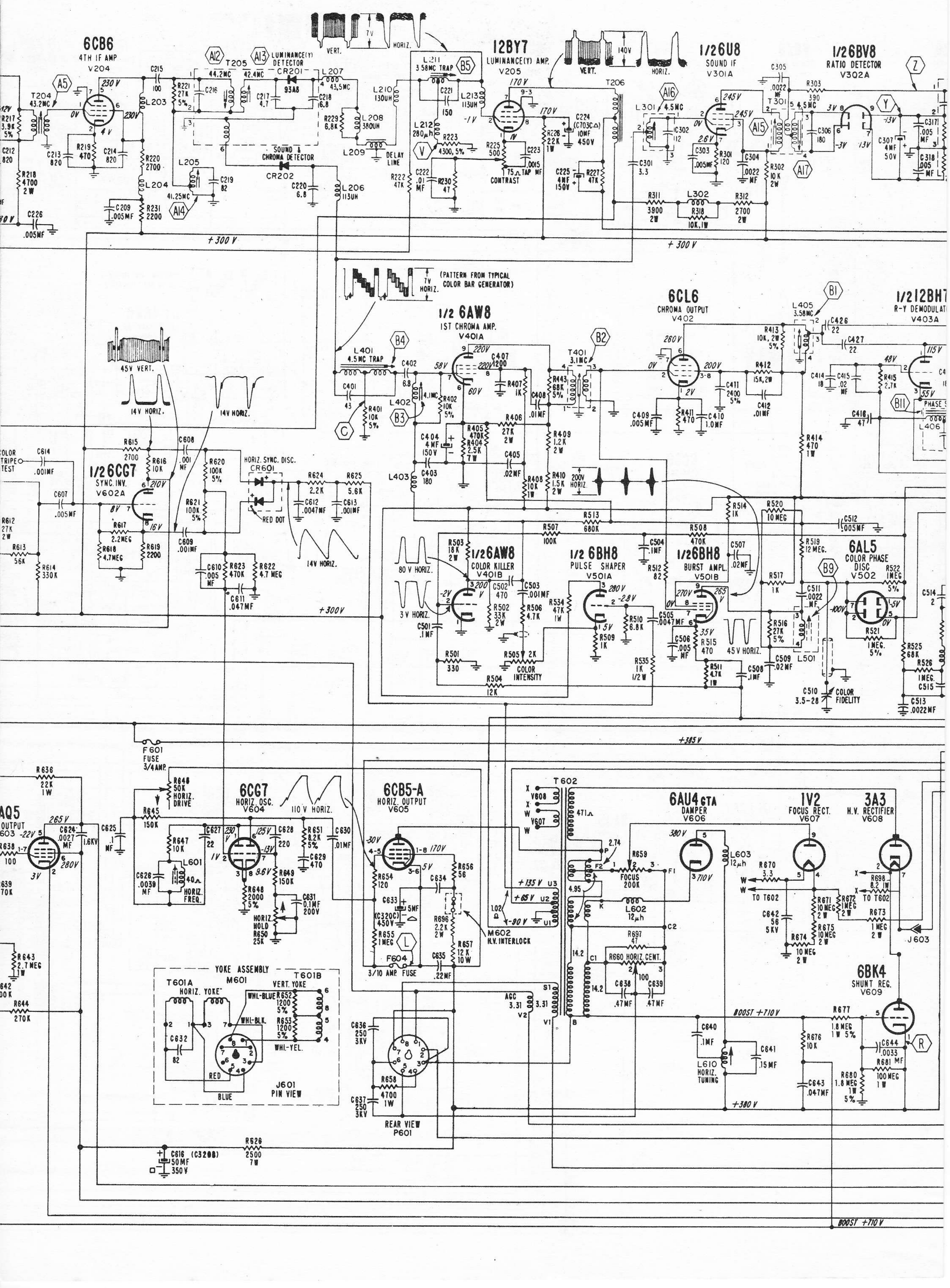
6BZ6
2ND IF AMP
V202
6BZ6
3RD IF AMP
V203
6CB6
4TH IF AMP
V204
12BY7
LUMINANCE(Y) AMP.
V205
T202
45.1MC
T203
41.25MC
T204
43.2MC
T205
44.2MC
42.4MC
LUMINANCE(Y) DETECTOR
CR201
93A8
L207
43.5MC
L208
380UH
L209
DELAY LINE
L210
130UH
L211
3.58MC TRAP
L212
280μH
L213
113UH
SOUND & CHROMA DETECTOR
CR202
L205
41.25MC
L206
113UH
R223
4300, 5%
R225
500
CONTRAST
C224
(C703C△)
10MF
450V
C225
4MF
150V
AGC
+230V
+300V
C226
.005MF
C235
.02MF
C236
1.0MF
140V HORIZ.
140V VERT.
500V HORIZ.
35V HORIZ.
35V VERT.
45V VERT.
14V HORIZ.
(PATTERN FROM TYPICAL COLOR BAR GENERATOR)
7V HORIZ.
1/2 6AW8
1ST CHROMA AMP.
V401A
L401
4.5MC TRAP
L402
4.1MC
T401
3.1MC
L403
200V HORIZ.
6AU6
GATED AGC
V206
6CS6
SYNC. SEP.
V601
M605
COLOR STRIPE TEST
1/2 6CG7
SYNC. INV.
V602A
HORIZ. SYNC. DISC.
CR601
RED DOT
14V HORIZ.
VERT.
HORIZ.
+385V
+300V
1/2 6AW8
COLOR KILLER
V401B
80V HORIZ.
3V HORIZ.
1/2 6BH8
PULSE SHA
V501A
R505 2K
COLOR INTENSITY
R504
12K
R705
6800
2W
R706
5600
2W
R704
800
10W
R628
120K
C618
.0047MF
110V VERT.
165V VERT.
1/2 6CG7
VERT. OSC. & DISC.
V602B
6AQ5
VERT. OUTPUT
V603
VERT. LIN.
R631
2.5MEG
HEIGHT
R640
5MEG
VERT. HOLD
R632
2.5MEG
F601
FUSE
3/4AMP.
R646
50K
HORIZ. DRIVE
6CG7
HORIZ. OSC.
V604
110 V HORIZ.
L601
HORIZ. FREQ.
HORIZ. HOLD
R650
25K
6CB5-A
HORIZ. OUTPUT
V605
F604
3/10 AMP. FUSE
M602
H.V. INTERLOCK
T602
V608
V607
+135V U3
+65V U2
-90V U1
AGC
3.31
YOKE ASSEMBLY
M601
T601A
HORIZ. YOKE
T601B
VERT. YOKE
WHL-BLUE
WHL-BLK.
WHL-YEL.
RED
BLUE
J601
PIN VIEW
C636
250
3KV
C637
250
3KV
R658
4700
1W
REAR VIEW
P601
C616 (C320B)
50MF
350V
R626
2500
7W

# Schematic for 29Z1 Color Television Chassis Stamped Run 13

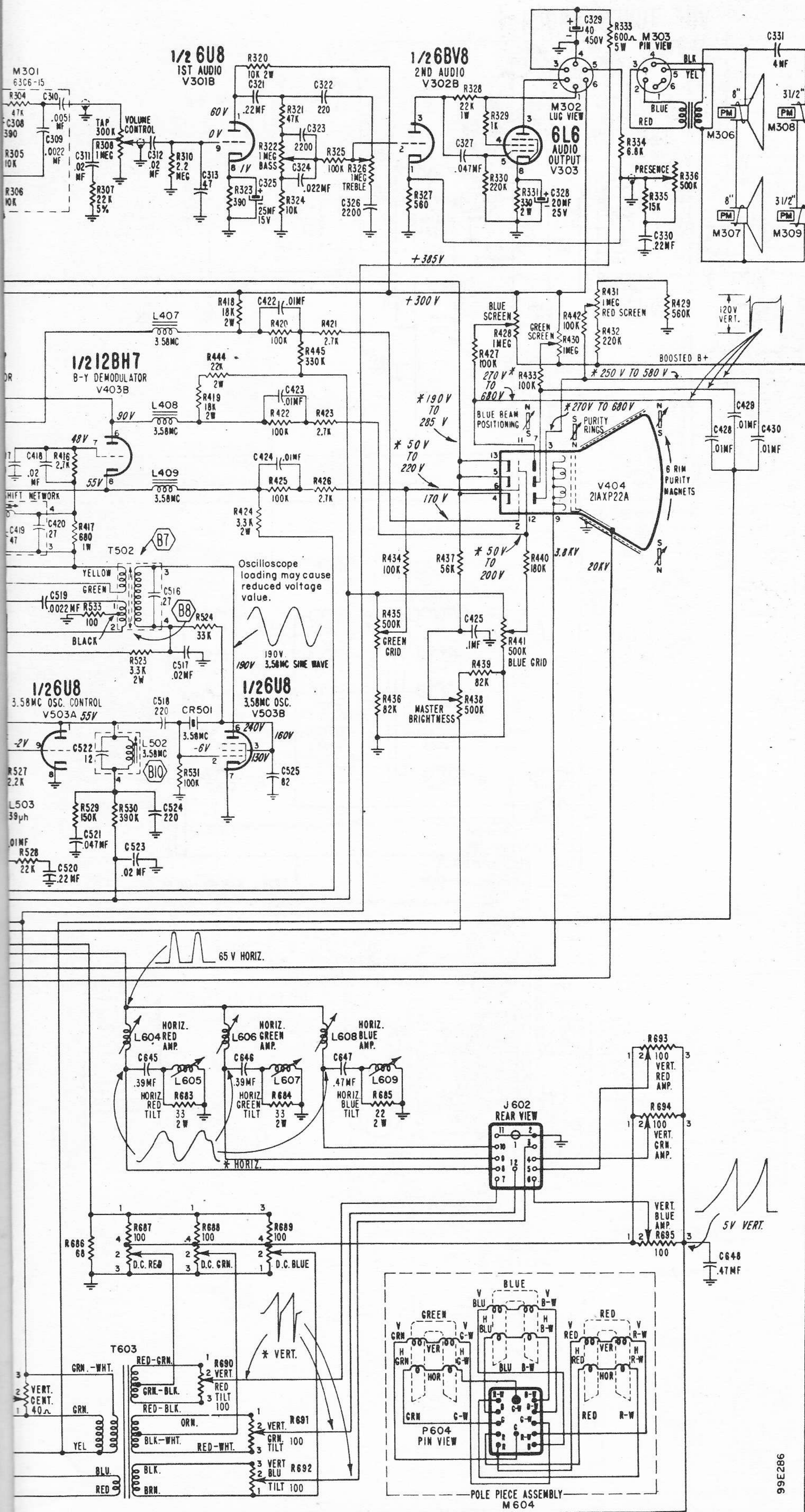


# Schematic For 29Z1B Color Television Chassis

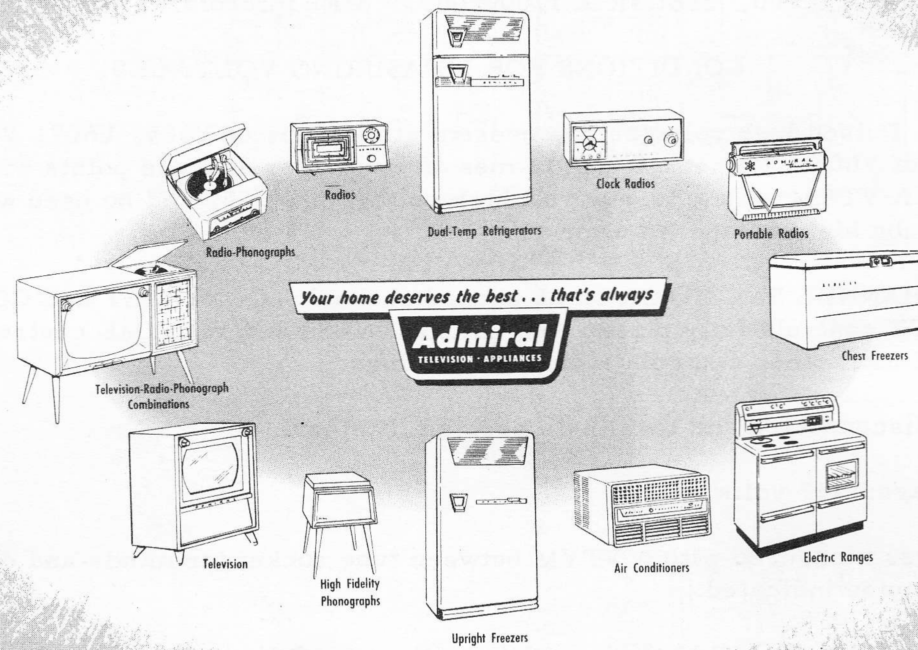




6CB6
4TH IF AMP
V204
T204
43.2MC
T205
44.2MC
42.4MC
LUMINANCE(Y) DETECTOR
CR201
93A8
L207
43.5MC
SOUND & CHROMA DETECTOR
CR202
L205
41.25MC
L204
L206
113UH
L211
3.58MC TRAP
L210
130UH
L208
380UH
L209
DELAY LINE
L212
280μh
L213
113UH
12BY7
LUMINANCE(Y) AMP.
V205
R225
500
CONTRAST
T206
1/2 6U8
SOUND IF
V301A
L301
4.5MC
T301
4.5MC
1/2 6BV8
RATIO DETECTOR
V302A
L302
+300 V
(PATTERN FROM TYPICAL COLOR BAR GENERATOR)
1/2 6AW8
1ST CHROMA AMP.
V401A
L401
4.5MC TRAP
L402
4.1MC
T401
3.1MC
6CL6
CHROMA OUTPUT
V402
L405
3.58MC
1/2 12BH7
R-Y DEMODULAT
V403A
L406
45V VERT.
14V HORIZ.
1/2 6CG7
SYNC. INV.
V602A
HORIZ. SYNC. DISC.
CR601
RED DOT
COLOR STRIPE TEST
1/2 6AW8
COLOR KILLER
V401B
1/2 6BH8
PULSE SHAPER
V501A
1/2 6BH8
BURST AMPL.
V501B
6AL5
COLOR PHASE DISC
V502
L501
80 V HORIZ.
3 V HORIZ.
45 V HORIZ.
R505 2K COLOR INTENSITY
C510 3.5-28 COLOR FIDELITY
+300V
+385 V
F601
FUSE
3/4 AMP.
R648
50K
HORIZ. DRIVE
6CG7
HORIZ. OSC.
V604
110 V HORIZ.
L601
HORIZ. FREQ.
R650
25K
HORIZ. HOLD
6CB5-A
HORIZ. OUTPUT
V605
M602
H.V. INTERLOCK
F604
3/10 AMP. FUSE
T602
6AU4GTA
DAMPER
V606
R659
FOCUS
200K
L602
12μh
L603
12μh
R660 HORIZ. CENT.
1V2
FOCUS RECT.
V607
TO T602
3A3
H.V. RECTIFIER
V608
J603
6BK4
SHUNT REG.
V609
BOOST +710 V
L610
HORIZ. TUNING
+380 V
YOKE ASSEMBLY
M601
T601A
HORIZ. YOKE
T601B
VERT. YOKE
WHI-BLUE
WHI-BLK.
WHI-YEL.
RED
BLUE
J601
PIN VIEW
REAR VIEW
P601
C616 (C320B)
50MF
350V
R626
2500
7W
AQ5
OUTPUT
V603
BOOST +710 V



1/2 6U8
1ST AUDIO
V301B
1/2 6BV8
2ND AUDIO
V302B
6L6
AUDIO
OUTPUT
V303
M302
LUG VIEW
M303
PIN VIEW
M301
VOLUME
CONTROL
BASS
TREBLE
PRESENCE
M306
M307
M308
M309
+385V
+300 V
1/2 12BH7
B-Y DEMODULATOR
V403B
L407
L408
L409
3.58MC
BLUE SCREEN
GREEN SCREEN
RED SCREEN
BOOSTED B+
120V VERT.
BLUE BEAM POSITIONING
PURITY RINGS
V404
21AXP22A
6 RIM PURITY MAGNETS
3.8KV
20KV
GREEN GRID
BLUE GRID
MASTER BRIGHTNESS
T502
YELLOW
GREEN
BLACK
Oscilloscope loading may cause reduced voltage value.
190V 3.58MC SINE WAVE
1/2 6U8
3.58MC OSC. CONTROL
V503A
1/2 6U8
3.58MC OSC.
V503B
CR501
L502
65 V HORIZ.
HORIZ. RED AMP.
HORIZ. GREEN AMP.
HORIZ. BLUE AMP.
HORIZ. RED TILT
HORIZ. GREEN TILT
HORIZ. BLUE TILT
* HORIZ.
J 602
REAR VIEW
VERT. RED AMP.
VERT. GRN. AMP.
VERT. BLUE AMP.
5V VERT.
D.C. RED
D.C. GRN.
D.C. BLUE
T603
* VERT.
VERT. CENT.
RED TILT
GRN. TILT
BLU TILT
POLE PIECE ASSEMBLY
M604
P604
PIN VIEW
BLUE
GREEN
RED
99E286

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