LAB

HANDBOOK

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PHILCO
Factory-Supervised
Service

PHILCO COLOR TELEVISION

SCHOOL FOR SERVICE TECHNICIANS

PR2950B

LAB PROJECT #1

SUBJECT: Base layout of TV-123 chassis.

OBJECTIVE: To familiarize the student with the location and function of the major components and controls of the TV-123 receiver.

EQUIPMENT REQUIRED:

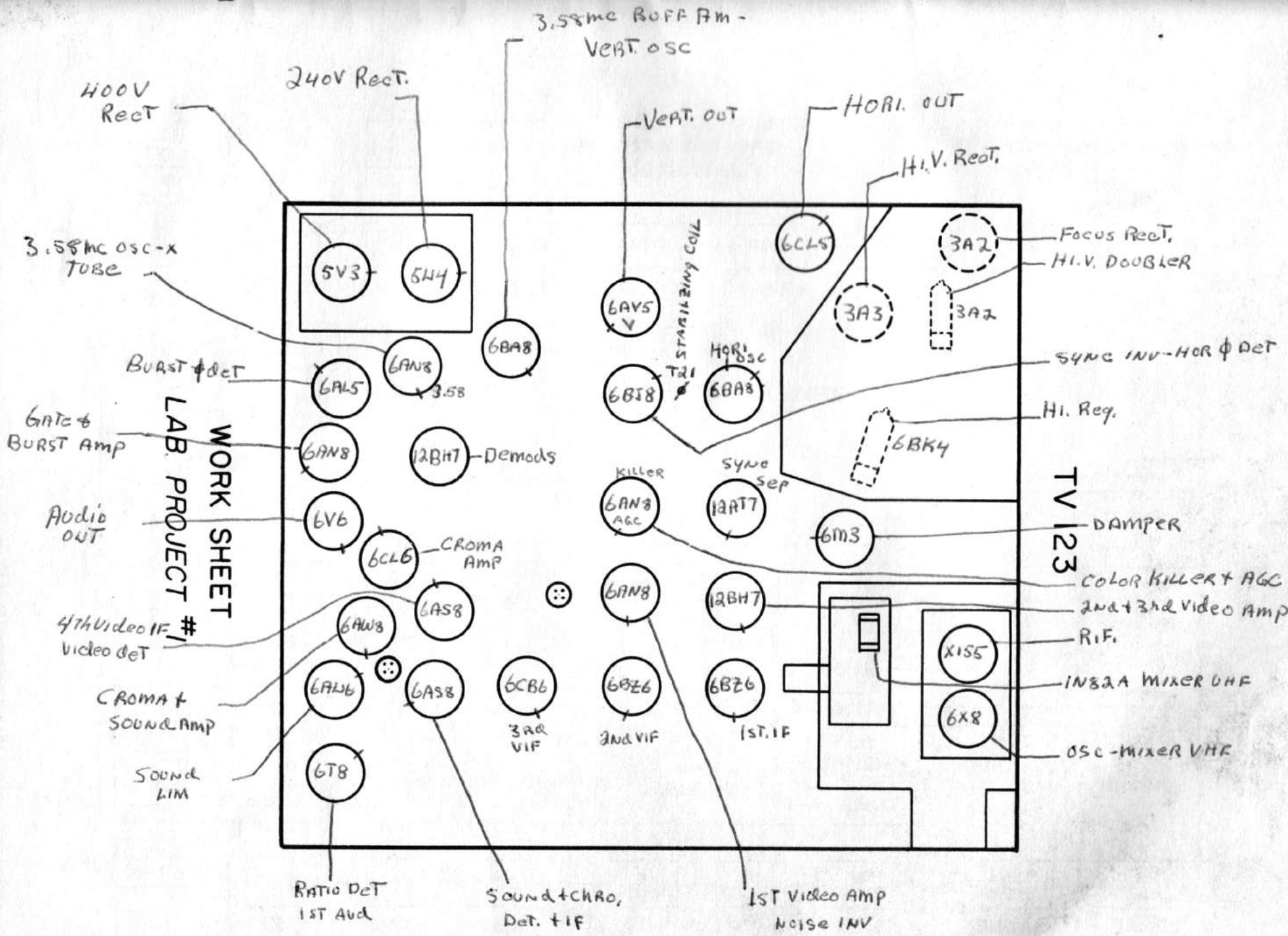
1. TV-123 chassis in rack (one per bench position)
2. Base layout work sheet. (one per student)

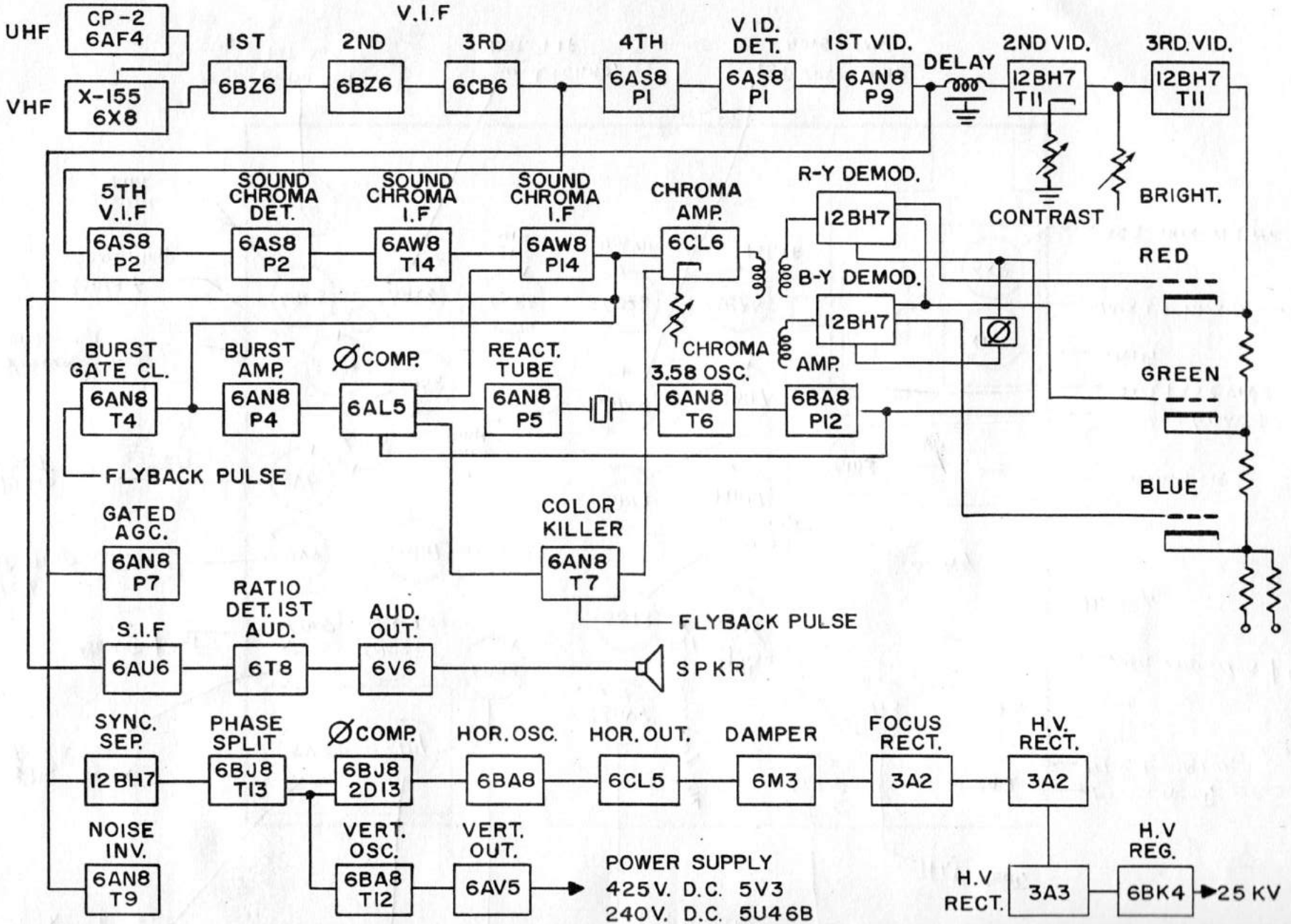
PROCEDURE:

1. The student is to label the blank parts on the work sheet and to indicate by arrows the path of the signals through the various stages.
2. Emphasis should be placed on test points and labeled as to purpose.

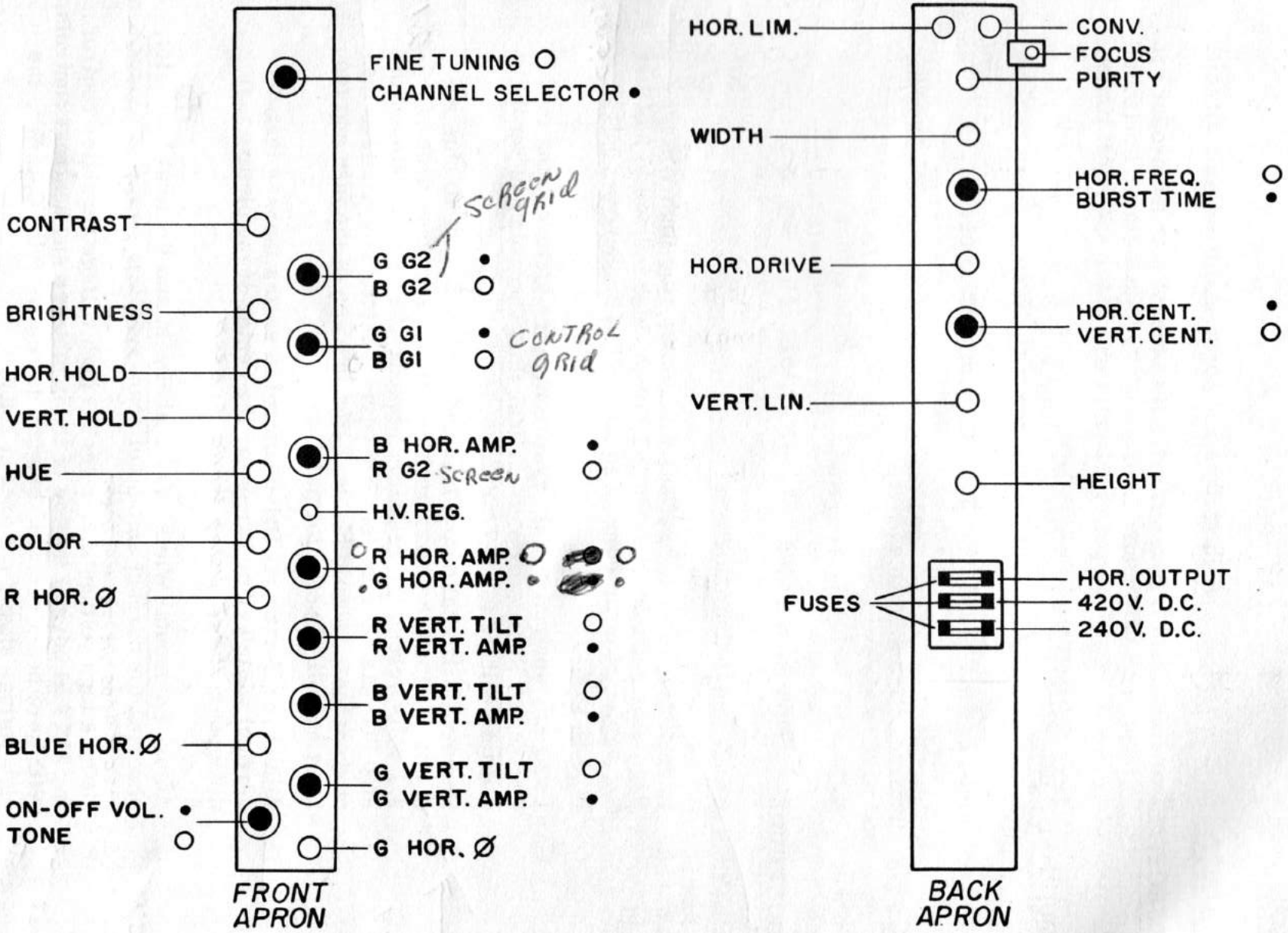
CONCLUSION:

The student upon completion of the work sheet, should completely familiarize himself with tube, test jack and control locations as it is imperative for efficient service that these points be well known.


WORK SHEET
LAB PROJECT #1
TV 123
400V Rect
240V Rect.
3.58mc BUFF Amp - Vert. osc
Vert. out
Hori. out
Hi.V. Rect.
Focus Rect.
Hi.V. Doubler
3.58mc osc-x tube
Burst ϕ Det
Gate & Burst Amp
Audio out
4th Video IF & Video Det
Croma & Sound Amp
Sound Lim
Ratio Det 1st Aud
Sound & Chro, Det. & IF
1st Video Amp Noise Inv
2nd & 3rd Video Amp
RIF.
IN82A Mixer UHF
Osc-Mixer VHF
Damper
Color Killer & AGC
Sync Inv-Hor ϕ Det
Hi. Req.
Demods
Croma Amp
Sync Sep
Hori Osc
Killer AGC
3rd VIF
2nd VIF
1st. IF
5V3
5W4
6AN8
6AL5
6AN8
12BH7
6V6
6CL6
6AS8
6AW8
6AL6
6AS8
6T8
6BA8
6CB6
6AV5
6BI8
6BA8
6AN8
6AN8
6BZ6
6BZ6
6CL6
3A3
3A2
3A2
6BK4
12AT7
6M3
12BH7
X155
6X8


UHF
CP-2 6AF4
VHF
X-155 6X8
V.I.F
IST 6BZ6
2ND 6BZ6
3RD 6CB6
4TH 6AS8 P1
VID. DET. 6AS8 P1
IST VID. 6AN8 P9
DELAY
2ND VID. 12BH7 T11
3RD. VID. 12BH7 T11
CONTRAST
BRIGHT.
5TH V.I.F 6AS8 P2
SOUND CHROMA DET. 6AS8 P2
SOUND CHROMA I.F 6AW8 T14
SOUND CHROMA I.F 6AW8 P14
CHROMA AMP. 6CL6
R-Y DEMOD. 12BH7
B-Y DEMOD. 12BH7
CHROMA AMP.
RED
GREEN
BLUE
BURST GATE CL. 6AN8 T4
BURST AMP. 6AN8 P4
Ø COMP. 6AL5
REACT. TUBE 6AN8 P5
3.58 OSC. 6AN8 T6
6BA8 P12
FLYBACK PULSE
GATED AGC. 6AN8 P7
COLOR KILLER 6AN8 T7
FLYBACK PULSE
S.I.F 6AU6
RATIO DET. IST AUD. 6T8
AUD. OUT. 6V6
SPKR
SYNC. SEP. 12BH7
PHASE SPLIT 6BJ8 T13
Ø COMP. 6BJ8 2D13
HOR. OSC. 6BA8
HOR. OUT. 6CL5
DAMPER 6M3
FOCUS RECT. 3A2
H.V. RECT. 3A2
NOISE INV. 6AN8 T9
VERT. OSC. 6BA8 T12
VERT. OUT. 6AV5
POWER SUPPLY
425V. D.C. 5V3
240V. D.C. 5U46B
H.V RECT. 3A3
H.V REG. 6BK4
25 KV

TV 123



CONTROL LOCATIONS

LAB PROJECT #2

SUBJECT: High voltage and horizontal oscillator circuits.

OBJECTIVE: To familiarize the student with the proper procedure for setting the high voltage, horizontal output, horizontal oscillator and burst timing.

EQUIPMENT REQUIRED:

1. TV-123 chassis in rack (one per bench position)
2. V. T. V. M. with 30KV probe
3. 300 ma. d-c current meter or a 10 ohm, 1 watt resistor.
4. Oscilloscope

PROCEDURE:

1. High voltage and deflection circuits.

   A. Immediately after the set has warmed up, the High Voltage Regulator must be adjusted to limit the high voltage to 25KV at low values of beam current in the CRT. (Brightness control fully C. C. W.) C.C.W.

   B. Using any desired signal, synchronize the picture using the Horizontal Frequency and Vertical Hold Controls and set the a-c line voltage for 117 volts.

   C. Remove horizontal output fuse and replace with a 10 ohm resistor. Adjust the plate limiting coil for a voltage drop of 2.1 volts across the resistor; recheck after the adjustment of step "D" has been made. If a current meter is available, the current meter should be connected in place of the fuse and the limiting coil adjusted for 2.1 ma. 2.1 VOLTS

   FOR 2.1 V

   D. Adjust the Horizontal Drive control in such a manner that the vertical white bar or bars near the center of the picture just disappear. BEST USING WHITE SCREEN

   E. Adjust Horizontal Width, Vertical Height and Vertical Linearity, checking for correct amount of scan. USE CROSS HATCH PATTERN 9 LINES/H 8 1/2 V

   CHECK "C" AFTER E

   F. Using a high voltage meter set the high voltage regulator control for 25KV at normal setting of the brightness and contrast controls. With zero beam current, brightness control fully C. C. W., the high voltage should not exceed 26KV.

   AT 3A3 HV. ROOT.

   NO BRIGHTNESS CONDITION / NOT OVER 26KV

2. Horizontal Oscillator

A. Physically center the F Horizontal Hold control to mid-range.

B. Place a jumper across the horizontal stabilizing coil to ground (terminal B40-4 to ground.) and ground terminal B40-5 the triode-grid control circuit of the oscillator tube. USE TOP OF CHASSIS TO SHORT COIL

C. Adjust the Horizontal Frequency control until the oscillator is at sync frequency by observing the picture. Oscillator will not lock in because the triode-grid control circuit is grounded.

D. Remove the jumper from the stabilizing coil B40-4 and adjust the coil (T-21) until the oscillator is again at sync frequency.

E. Adjust the Horizontal Frequency control until approximately equal frequency deviations from 15,750KC are obtained at both ends of the hold control. This is done by counting the number of slanted blanking bars for each end of the hold control range. A tolerance of one bar is acceptable. For example, a count of three bars on one extreme and four bars on the other extreme is passable.

F. Remove the ground from terminal B40-5. With a scope connected at the grid of the burst amplifier tube (TP-10) the burst is adjusted by means of the burst timing control until the right hand edge of the burst falls at the right hand edge of the gate pulse when the horizontal hold control is turned all the way in a clockwise position. — PIN 8 — PROVISION MADE ON TOP

BURST AMP. TUBE

WAVE SHOWN ON #11, BURST AMPLIFIER FROM PIN 8 OF THE BURST PIPS ON MARKER

LAB PROJECT #3

SUBJECT: Convergence coil

OBJECTIVE: To familiarize the student with the proper procedure for adjusting the convergence coil.

EQUIPMENT REQUIRED:

1. TV-123 chassis rack.
2. Oscilloscope
3. Method of calibrating scope.

PROCEDURE:

2.8 FACTORY CONSTANT

1. Calibrate the scope for 40 V. P. P.
2. Disconnect the convergence assembly plug from its socket on the cable from the chassis.
3. Connect the scope between pin #2 of the convergence assembly socket and ground.
4. Turn the blue horizontal amplitude control to maximum.(Full clockwise.)
5. Adjust the convergence coil until the parabola is 40 volts peak to peak in amplitude.

THIS IS TO BE SURE YOU GET THE PROPER PARABOLA WAVE SHAPE WITH THE BLUE AMPLITUDE CONTROL

LAB PROJECT #4

SUBJECT: Convergence and color purity.

OBJECTIVE: To familiarize the student with the proper procedure for converging and making color purity.

EQUIPMENT REQUIRED:

1. TV-123 chassis in rack
2. Mirror on stand
3. Philco (7100) color-bar and pattern generator.

PROCEDURE:

1. Check the following mechanical dimensions:
   - A. The yoke should be physically centered around the neck of the CRT.
   - B. The convergence coil and magnet assembly should be positioned over the internal pole pieces in the neck of the CRT. The red, green and blue convergence magnet assemblies should be positioned to line up as closely as possible to the exact position of the three guns.
   - C. The blue lateral magnet should be aligned exactly over the two internal pole pieces and the adjustable magnet should be directly above the blue gun.
   - D. Set all dynamic convergence amplitude controls to minimum and mechanically center the vertical tilt controls in mid-range.
2. Using an inverted cross-hatch pattern (white lines on a black field), adjust the red, green and blue STATIC convergence magnets and blue lateral magnet to converge all three beams at the center of the tube.
3. Check for symmetrical misconvergence at the corners of the tube face both horizontally and vertically. If there is any non-symmetry, the yoke may have to be shifted to either side or up or down to eliminate this.
4. Check the height, vertical linearity, focus, horizontal and vertical centering using a cross-hatch pattern and readjust if necessary.
5. Tune receiver to a blank channel. Turn off the green and blue guns using G1 G2 controls leaving only a red field and set up proper red color purity in the following manner.
   - A. Pull out all equalizer magnets around the rim of the tube for minimum effect and center the color purity control to the mid-point of its rotation.

B. Rotate the color purity magnet around the neck of CRT for best red field in the center. Adjust purity magnet pole tabs also for best red center.

C. If there are edge impurities, move the yoke backward or forward axially only maintaining best red center.

D. Set equalizer magnets to eliminate remaining errors in red field. Compromise this setting to get best blue and green field simultaneously. Use G2 controls to turn off unwanted fields when viewing blue and green.

E. Using the G2 controls, obtain a rough white balance. Turn on the red gun (G2 control approx. 2/3 clockwise), turn up the green G2 control to obtain yellow, then turn up the blue G2 to obtain white. Reset the equalizer magnets for the best white, but do not sacrifice red, green or blue purity any more than necessary.

F. Turn the neutralizing potentiometer from one end of its range to the other and make certain a color purity change occurs.

6. Using the cross-hatch pattern, reconverge in the center with the convergence magnets.

7. Turn off the blue gun using the blue G2 control. Using the red vertical dynamic controls, set the amplitude control to maximum and set the vertical tilt control for symmetrical bowing about a center green vertical line. Turn the red amplitude control to minimum. Go through the same procedure for green.

8. Alternately, turn up equal amounts of red and green vertical amplitudes, a little at a time, until both vertical lines are parallel from top to bottom. Check all horizontal line segments down the center of the tube only. If the red-green separation in each of the horizontal line segments is not equal from top to bottom, such as greater or lesser spacing near the center than at the top or bottom (an error symmetrical about the center), then the ratio of red to green amplitudes is incorrect, and they must be varied with respect to each other until equal spacing is obtained simultaneously with parallel red and green vertical lines. If the error in spacing is a gradual increase or decrease from top to bottom, the red and green tilts must be changed to obtain the desired result. Reconverge the center with the red and green convergence magnets.

9. Turn up the blue G2 control until blue is similar in brightness to red and green. Turn the blue vertical amplitude to maximum. Set the tilt control so that there is an equal displacement and in the same direction from the red and green horizontal stripes from the top and bottom lines. Turn down the blue amplitude control so that blue is equally displaced from the red-green horizontal lines from top to bottom. Converge in the center using the convergence magnets.

10. Using the blue G2' control, turn off the blue gun. Turn up the red horizontal amplitude control to maximum and while looking at the vertical set lines within a narrow horizontal band across the center of the CR tube, the red horizontal phase control for a symmetrical displacement of the red vertical lines with respect to the corresponding green vertical lines and in the same direction across the face of the tube. Turn the red amplitude control down to minimum. The same procedure should be followed for the green horizontal amplitude and phase controls.

11. Alternately increase the red and green horizontal controls a little at a time until equal displacement of red and green vertical lines across the face of the tube have been obtained. Check the center horizontal line for parallel red and green lines.

    If the red and green horizontal lines are bowed with respect to each other, the amplitude ratio is incorrect. If the lines are not bowed, but are crossed, then the phase controls must be readjusted to obtain the final result of equally spaced vertical lines simultaneous with parallel horizontal lines.

    Readjust the convergence magnets for convergence in the center. The red and green lines should be completely converged over the entire tube area. Any slight misconvergence in the corners cannot be corrected with the dynamic controls.

12. Turn up the blue G2' control. Turn blue horizontal amplitude control to maximum and vary the blue phase control so that a symmetrical bowing is obtained about the center horizontal line. Turn down the amplitude control until the blue beam is parallel to the red-green line. Converge in the center with the convergence magnets.

LAB PROJECT #5

SUBJECT: AGC Control

OBJECTIVE: To familiarize the student with the method used to set AGC

EQUIPMENT REQUIRED:

1. TV-123 chassis in rack
2. Oscilloscope
3. Method of calibrating scope
4. Test lead to use for shorting.

PROCEDURE:

1. Tune the receiver to a reasonably stationary signal. SAME AS IN CONVERGENCE
2. Calibrate the scope for 35 V. P. P. deflection. 2.8 X 6 (OR WHAT I USE TO CAL. THE SCOPE
3. Connect the scope to the plate of the 1st video amplifier. (B13-3)
4. Adjust the scope vertical centering control until top of sync tips are even with the lower scope calibration mark. Then, turn scope horizontal gain to minimum.
5. Intermittently short the 2nd detector output (J2, VIDEO TEST JACK) to "B minus" while observing the scope.
6. Set the AGC control for a 35 volt difference between sync tips and B+ which is the uppermost point of travel of the scope trace when the 2nd detector is momentarily shorted to "B minus".

LAB PROJECT #6

SUBJECT: White balance

OBJECTIVE: To familiarize the student with the correct method of white balancing a receiver.

EQUIPMENT REQUIRED:

1. TV-123 chassis in rack
2. Oscilloscope
3. Method of calibrating scope.
4. Philco (7100) color-bar and pattern generator.

PROCEDURE:

1. Calibrate the scope for 65 volts peak to peak.
2. Be sure the AGC control has been properly set and set the line voltage to 117 VAC.
3. Rotate the brightness control clockwise to a position of approximately 1/2 full rotation from minimum.
4. Connect the scope to the red cathode of the CRT. (Pin #4)
5. Turn the receiver to a reasonably stationary signal containing whites and blacks.
6. Adjust the contrast control for 65 volts peak to peak measurement of white to black video information.
7. Adjust the brightness control clockwise to a point where the sync tips start to compress. Then, back off the control slightly until just out of compression.
8. Set the blue G1 control and the green G1 control to minimum. Full C. C. W.
9. Set the blue G2 and green G2 controls to minimum. Full C. C. W.
10. Adjust the vertical hold control until the vertical blanking bar is positioned midway between top and bottom of the picture.
11. Adjust the red G2 control until the blanking bar just goes black.
12. Connect the Philco-Color Bar and Pattern Generator (model 7100) to the receiver antenna terminals and set the pattern selector switch to the black and white bar position.

13. Adjust the green G1 control and the green G2 control so that all levels of the bar chart are similar shades of yellow. The G2 control has a primary influence over the darker parts of the chart and the G1 control over the lighter portions. For example; should the light parts be too green and the dark parts too red, the green G1 control should be turned back back and the green G2 control increased.

14. Adjust the blue G1 control and blue G2 control for a neutral gray and white in the bar chart. The same procedure as used for adjusting the green G1 control and green G2 control apply to the blue G1 control and blue G2 control. For example; if the dark part of the picture is too blue and and the light part too yellow, the blue G2 control should be decreased and the blue G1 control increased.

LAB PROJECT #7

SUBJECT: Oscilloscope waveforms

OBJECTIVE: To familiarize the student with the appearance of the oscilloscope waveforms at various points in the television receiver.

EQUIPMENT REQUIRED:

1. TV-123 chassis in rack.
2. Oscilloscope.
3. Wide band scope amplifier.
4. Philco (7100) color-bar and pattern generator.
5. Oscilloscope waveform worksheets.
6. Set of work sheets.

PROCEDURE:

The student should connect the oscilloscope to the various points indicated on the work sheets and sketch the waveforms observed in the spaces allotted on the work sheets.

TV 123

WORK SHEET 1
LAB PROJECT 7

OSCILLOSCOPE WAVEFORMS

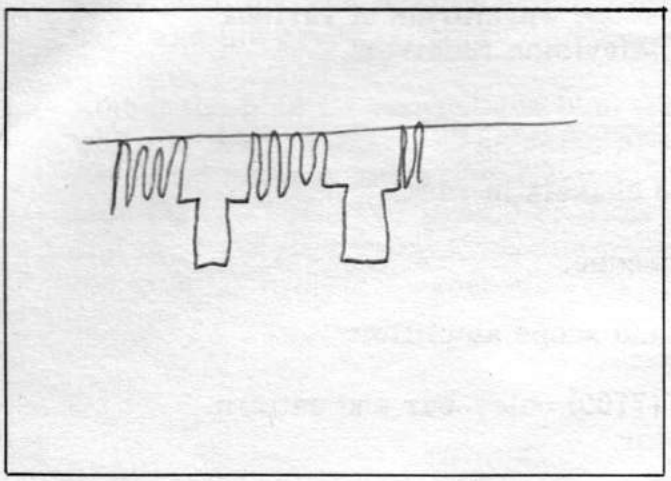


Figure #1
Video Test Jack (pin #2)

15, 750 cps - Television Station Signal

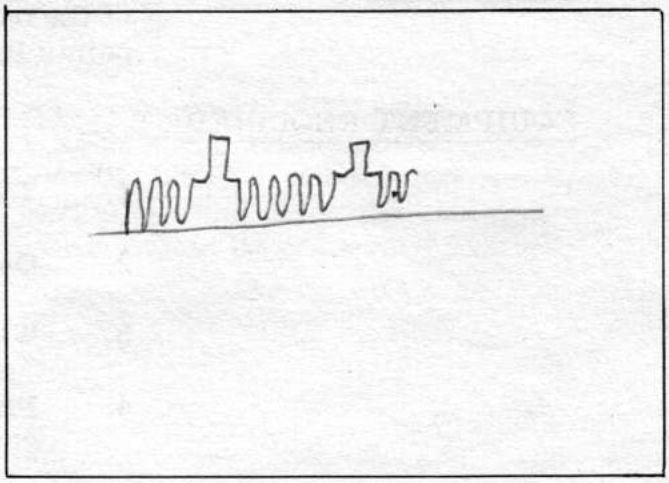


Figure #2
Plate of 3rd Video Amplifier (pin #1)

15, 750 cps - Television Station Signal

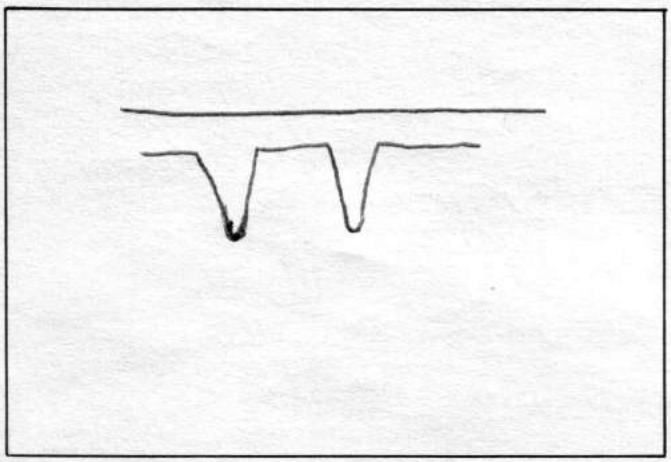


Figure #3
Sync Separator, plate (pin #6)

15, 750 cps - Television Station Signal

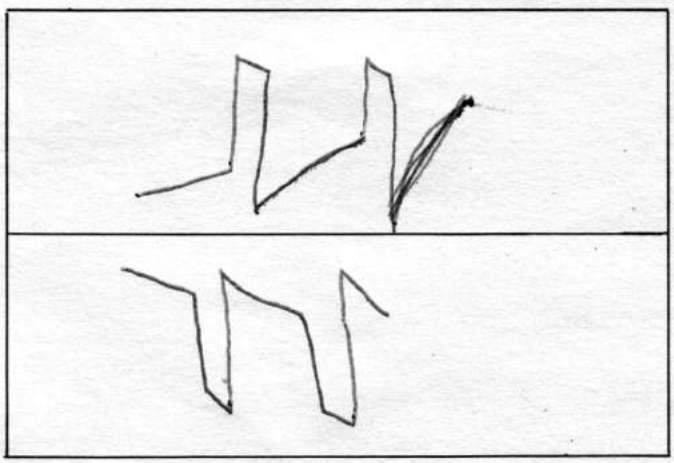


Figure #4
Horizontal oscillator phase comp.

Input plate (pin #6)
Input cathode (pin #2)

15, 750 cps - Television Station Signal

TV 123

WORK SHEET 2
LAB PROJECT 7

OSCILLOSCOPE WAVEFORMS

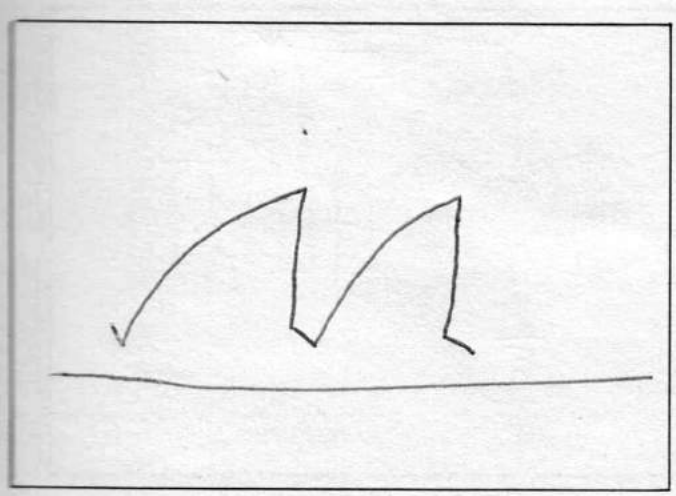


Figure #5
Grid - Horiz. Output Tube (pin #4)

15, 750 cps - Television Station Signal

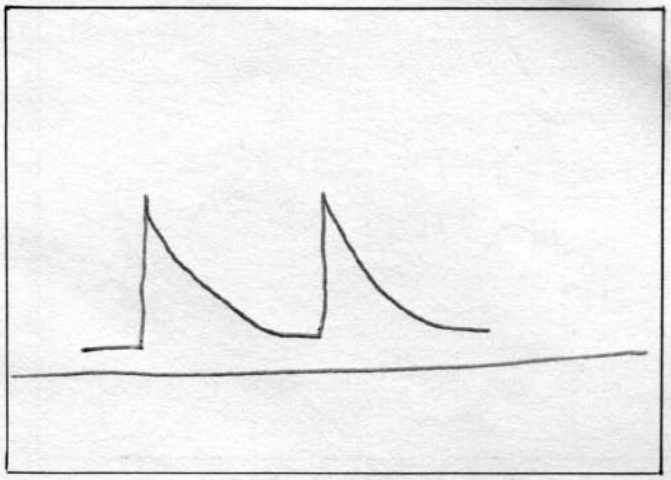


Figure #6
Grid to Cathode of Vert. Output Tube (pin #1 to pin #3)
60 cps - Television Station Signal

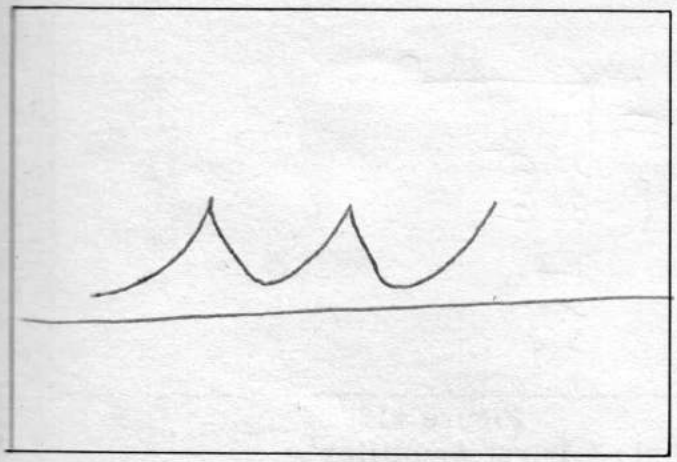


Figure #7
Cathode to ground of Vert. Output Tube (pin #3 to ground)

60 cps - Television Station Signal

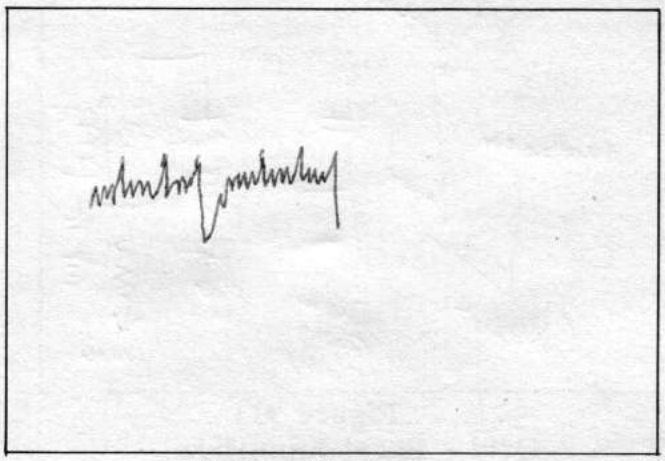


Figure #8
Chroma Test Jack (pin #2)

15, 750 cps - Color Bar Generator

TV 123

WORK SHEET 3
LAB PROJECT 7

OSCILLOSCOPE WAVEFORMS

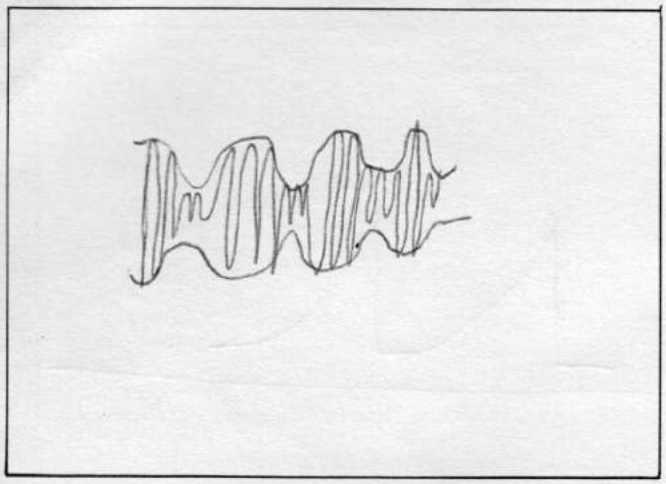


Figure #9
Plate - 2nd Chroma/Sound I. F.
(pin #9)

15, 750 cps - Color Bar Generator

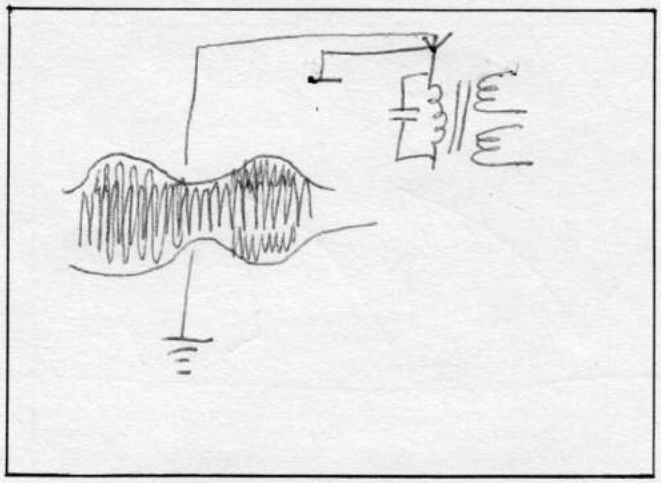


Figure #10
Plate - Chroma Amplifier
(pin #6)

15, 750 cps - Color Bar Generator

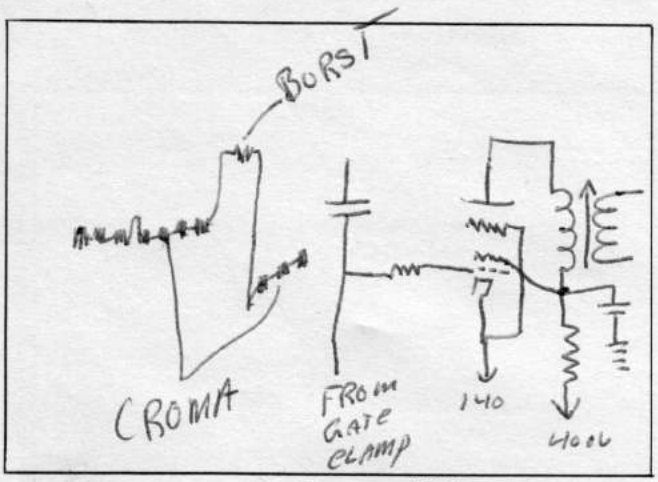


Figure #11
Grid - Burst Amplifier
(pin #8)

15, 750 cps - Color Bar Generator

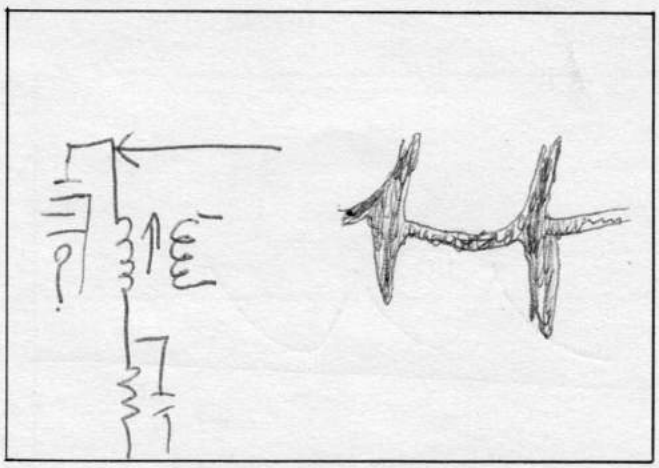


Figure #12
Plate - Burst Amplifier
(pin #6)

15, 750 cps - Color Bar Generator

TV 123

WORK SHEET 4
LAB PROJECT 7

OSCILLOSCOPE WAVEFORMS

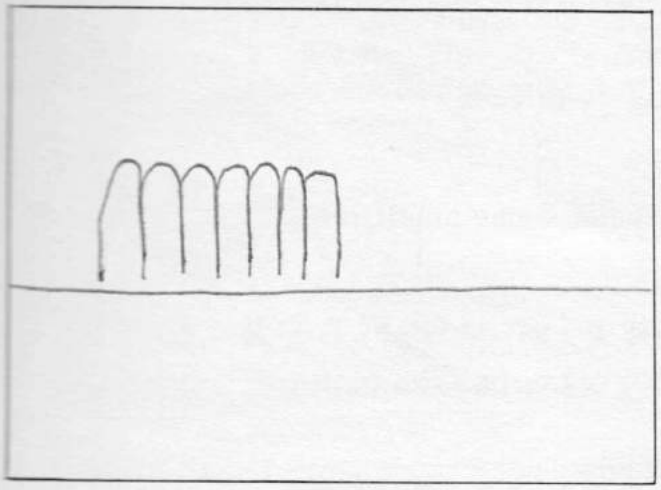


Figure #13
Plate - C. W. Amplifier
(pin #9)

15, 750 cps - Color Bar Generator

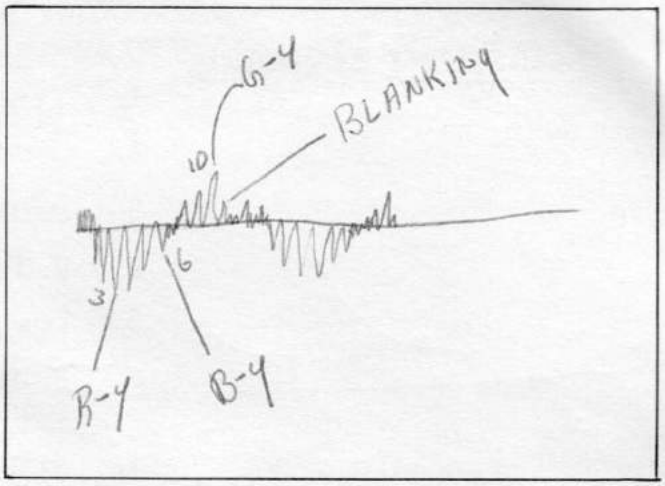


Figure #14
Grid - red gun - CRT
(chassis tie lug)

15, 750 cps - Color Bar Generator

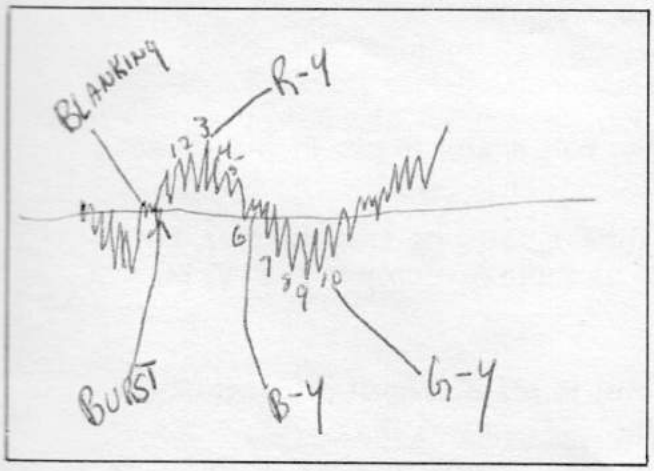


Figure #15
Grid - Blue Gun - CRT
(chassis tie lug)

15, 750 cps - Color Bar
Generator

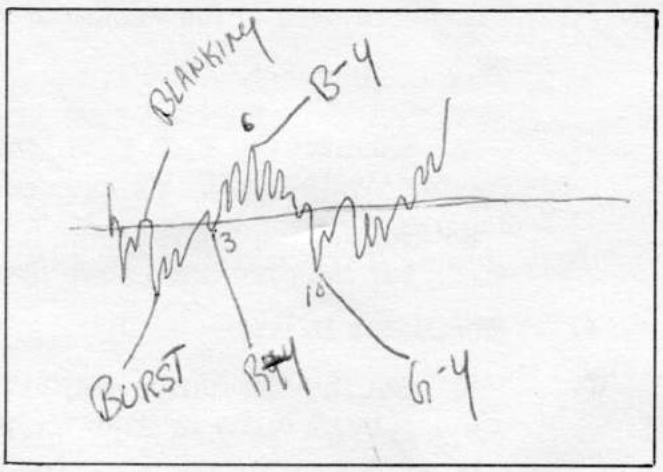


Figure #16
Grid - Green Gun - CRT
(chassis tie lug)

15, 750 cps - Color Bar Generator

LAB PROJECT #8

SUBJECT: Phase detector, 3.58-mc oscillator and demodulator alignment.

OBJECTIVE: To familiarize the student with the proper procedure for the adjustment of these circuits.

EQUIPMENT REQUIRED:

1. TV-123 chassis in rack.
2. Oscilloscope
3. Philco wideband scope amplifier
4. V. T. V. M.
5. Low capacity r-f probe for V. T. V. M.
6. Philco (7100) color-bar and pattern generator.
7. Alignment tools
8. Shorting leads (2)

PROCEDURE:

1. Connect the Philco color-bar and pattern generator (7100) to the antenna terminals and set the selector switch for "color bars".
2. Adjust the receiver for reception of color-bar pattern then place the "Hue " control in the center of its range.
3. Burst Alignment.
   - A. Connect the V. T. V. M. (minus d-c volt scale) to pin #7 the phase detector. (TP-15)
   - B. Adjust the "Burst transformer" (phase detector transformer T-18) for maximum negative d-c output as indicated on the V. T. V. M.
4. Oscillator Drive.
   - A. Set the "Deviation coil" (T-16) (coil in plate circuit of reactance tube) 7 turns in from top position.
   - B. Connect the low capacity r-f probe from the V. T. V. M. to the grid (pin #7) of the c-w amplifier. (TP-14)
   - C. Adjust the core of the 3.58-mc oscillator cathode coil (T-19) starting from top position of core, to give 1.75 volts ($\neq$ 0.25V) as indicated on the V. T. V. M.

5. Oscillator Frequency.

   A. Ground the grid (pin #2) of the gate clamp. (TP-8)

   B. Ground the junction of 1.8K and 560K resistors in grid circuit of chroma amplifier, (B19-5).

   C. Adjust the "Deviation coil" (T-16) until the color oscillator is at 3.58-mc. This can be observed on the face of the CRT. When the color oscillator is at 3.58-mc, the color in the bar pattern will stop running through the bars and become almost stationary.

   D. Remove the short from TP-8 and B19-5.

6. Buffer (C-W. Amplifier)

   A. Replace short from TP-8 to ground.

   B. Connect the V. T. V. M. (minus d-c volt scale) to pin #7 of the phase detector (TP-15).

   C. Adjust the "Buffer transformer", T-20 (trans. in plate circuit of C-W amplifier) for maximum negative d-c voltage output as indicated on the V. T. V. M.

   D. Remove short from TP-8.

7. Master Phasing

   A. Check "Hue" control setting. It should be set at mid-range.

   B. Connect the oscilloscope to the grid (tie lug under chassis or pin #2 of CRT socket), of the red gun of the CRT.

   C. While observing the scope pattern created by the color-bar generator adjust the "Burst transformer", T-18 (phase detector transformer) for nul of the (B-Y) and "burst" bars (6th and 12th bars) as indicated on the scope.

8. Quadrature

   A. Connect the oscilloscope to the grid (tie lug under chassis or pin #2 on the CRT socket) of the blue gun of the CRT.

   B. While observing the scope, adjust the "phase shift coil" (T-17) for nul of the (R-Y) (the 3rd bar) and the 9th bar as indicated on the scope.

9. Phase-Detector Balance

A. Color Reception

1. After completing alignment the phase-detector balance should be checked. The balance, measured at B35-6, should be within $\pm$ 0.5 volts with burst being received. If not, the circuit components and phase-detector tube should be checked.

B. Noise Balance

1. After completing alignment, the phase-detector balance should be checked under no signal conditions with only noise being received. If the balance measured at B35-6 is not within $\pm$ 0.8 volts, the circuit and components should be checked.