

*Produced By:*

**Commodore International Spare Parts GmbH  
Braunschweig, West Germany**

***SERVICE MANUAL***

**1930  
VGA COLOR MONITOR**

**AUGUST, 1990**

**PN-314255-01**

***INTERNATIONAL EDITION***

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1200 Wilson Drive, West Chester, Pennsylvania 19380 U.S.A.

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## IMPORTANT SAFETY NOTICE

Proper service and repair is important to the safe, reliable operation of all NAPCEC Equipment. The service procedures recommended by NAPCEC and described in this service manual are effective methods of performing service operations. Some of these service operations require the use of tools specially designed for the purpose. The special tools should be used when and as recommended.

It is important to note that this manual contains various CAUTIONS and NOTICES which should be carefully read in order to minimize the risk of personal injury to service personnel. The possibility exists that improper service methods may damage the equipment. It also is important to understand that these CAUTIONS and NOTICES ARE NOT EXHAUSTIVE. NAPCEC could not possibly know, evaluate and advise the service trade of all conceivable ways in which service might be done or of the possible hazardous consequences of each way. Consequently, NAPCEC has not undertaken any such broad evaluation. Accordingly, a servicer who uses a service procedure or tool which is not recommended by NAPCEC must first satisfy himself thoroughly that neither his safety nor the safe operation of the equipment will be jeopardized by the service method selected.

## WARNING

Critical components having special safety characteristics are identified with an S by the Ref. No. in the parts list and enclosed within a broken line\* along with the safety symbol on the schematics or exploded views.

Use of substitute replacement parts which do not have the same specified safety characteristics may create shock, fire, or other hazards.

Under no circumstances should the original design be modified or altered without written permission from the N.A.P. Consumer Electronics Corp. NAPCEC assumes no liability, express or implied, arising out of any unauthorized modification of design. Servicer assumes all liability.

\*Broken line: — • — • — • — •

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***SAFETY NOTICE***

**ANY PERSON ATTEMPTING TO SERVICE THIS CHASSIS MUST FAMILIARIZE HIMSELF WITH THE CHASSIS AND BE AWARE OF THE NECESSARY SAFETY PRECAUTIONS TO BE USED WHEN SERVICING ELECTRONIC EQUIPMENT CONTAINING HIGH VOLTAGES.**

***CAUTION***

**USE A SEPARATE ISOLATION TRANSFORMER FOR THIS UNIT WHEN SERVICING.**

## SAFETY PRECAUTIONS

### Picture Tube Replacement

The primary source of X-radiation in this monitor is the picture tube. The picture tube utilized in this chassis is specially constructed to limit X-radiation emissions. For continued X-radiation protection, the replacement tube must be the same type as the original, including suffix letter, or N.A.P. Consumer Electronics corp. (NAPCEC) approved type.

Safety goggles must be worn when the picture tube is replaced.

### Parts Replacement

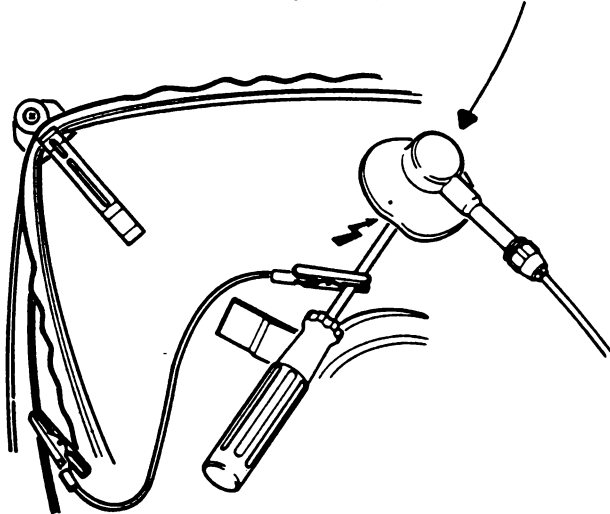
Many electrical and mechanical parts in NAPCEC monitors have special safety-related characteristics. These characteristics are often not evident from visual inspection nor can the protection afforded by them necessarily be obtained by using replacement components rated for higher voltage, wattage, etc. The use of a substitute part which does not have the same safety characteristics as the NAPCEC recommended replacement parts shown in this service manual may create shock, fire or other hazards.

## GENERAL



All ICs and many other semi-conductors are susceptible to electrostatic discharges (ESD). Careless handling during repair can reduce life drastically. When repairing, make sure that you are connected to the same potential as the mass of the set via a wrist wrap with resistance. Keep components and tools also at this potential.

To prevent ICs and transistors from being damaged, highvoltage flash-overs should be avoided. For checking the high voltage, a suitable meter should be used. The picture tube should be discharged only as indicated.



Be careful when measuring the EHT-section and the picture tube.

Use plastic instead of metal tools for adjusting. This is necessary to avoid a short-circuit or to avoid causing a circuit to become unstable.

Never replace components when the set is switched on.

### Removing the chassis

- Remove the backcover
- Slide out the chassis
- After repair the connecting cables of the chassis should be fixed in the original way.



## SPECIFICATIONS (subject to modification)

AC voltage - 120Vac +/- 10% - 60Hz  
 Power consumption at 120V - 85 Watts  
 EHT - 24 KV  
 Line frequency - 31480 Hz  
 Frame frequency - 60 Hz/70 Hz  
 Band width - 18 MHz  
 Picture tube (9CM082) - M34 JPS 77 X 69  
 Picture tube (9CM062) - M34 JPM 70X69

### RESOLUTION

Sync. polarity - pos/neg  
 HOR. VERT.  
 Pos. Neg. - 640 dots X 350 lines  
 Neg. Pos. - 640 dots X 400 lines  
 Neg. Neg. - 640 dots X 480 lines

### INPUT SPECS

RGB linear - all colors  
 Sync TTL level - pos/neg

### CONTROLS

Front : Power on/off SK1 (incl. LED indicator)  
 : Brightness (R558)  
 : Contrast (R322)  
 : Horizontal phase (centering) (R408)  
 : Vertical centering (R524)

Rear : Horizontal width (R541)  
 : Vertical height (R513 for 480 lines)

### INPUT SIGNAL CONNECTOR

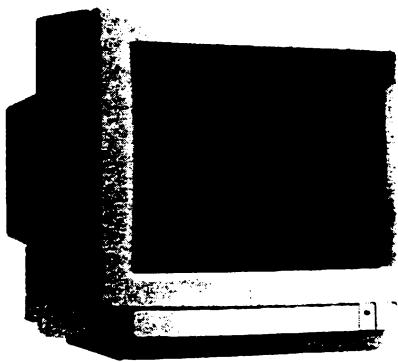
15 PIN "D" SHELL CONNECTOR

|               |                  |                      |
|---------------|------------------|----------------------|
| 1 - red       | 6 - red ground   | 11 - ground          |
| 2 - green     | 7 - green ground | 12 - n.c.            |
| 3 - blue      | 8 - blue ground  | 13 - horizontal sync |
| 4 - n.c.      | 9 - n.c.         | 14 - vertical sync   |
| 5 - self test | 10 - ground      | 15 - n.c.            |

### VGA STANDARD

| Horizontal frequency | Vertical frequency | H. Sync. polarity | V. Sync. polarity | Resolution (horizontal lines) |
|----------------------|--------------------|-------------------|-------------------|-------------------------------|
| 31.5 kHz             | 70 kHz             | Positive (+)      | Negative (-)      | 350                           |
| 31.5 kHz             | 70 kHz             | Negative (-)      | Positive (+)      | 400                           |
| 31.5 kHz             | 60 kHz             | Negative (-)      | Negative (-)      | 480                           |

## MECHANICAL/ELECTRICAL PARTS

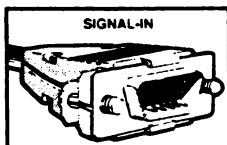


| Ref. | Description                   | Part. No.   |
|------|-------------------------------|-------------|
|      | Front Cabinet                 | 1492150171  |
|      | Rear Cabinet                  | 1492160058  |
|      | Push Button On/Off            | 1494200366  |
|      | Cover for Controls            | 1491320305  |
|      | Pad (Table Protectors)        | 4495200003  |
|      | Lock for Cover                | 1491410003  |
|      | Adjust Rod                    | 1191000039  |
|      | Slider Chassis                | 1493030033  |
|      | Pedestal                      | 1491080019  |
|      | Holder Line Input Transformer | 1491070126  |
|      | S Mains Cord                  | 4692020069  |
|      | S Picture Tube (9CM082)       | M34JPS77X69 |
|      | S Picture Tube (9CM062)       | M34JPM70X6E |
|      | Customer Inst. Book (9CM082)  | IB53790001  |
|      | Customer Inst. Book (9CM062)  | IB55180001  |
|      | Foot Pedestal (9CM082)        | 1491080019  |
|      | Foot Pedestal (9CM062)        | 1491030024  |
|      | Degaussing Coil               | 3691300012  |

## CUSTOMER ADJUSTMENT

### 1. Connection

Connecting the monitor to the computer. The monitor is fitted with a 15-pin D-shell connector.



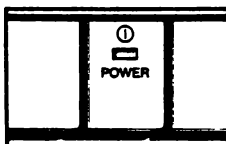
b. Contrast can be adjusted with control  (R322)


c. Brightness can be adjusted with control  (R558)




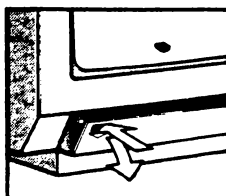
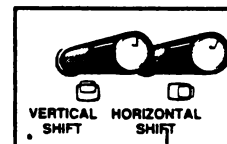
### 2. Adjustments and controls

a. Power on/off switch SK 1 (LED lights up)



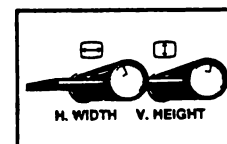
d. The image may be positioned horizontally with control  (R408)

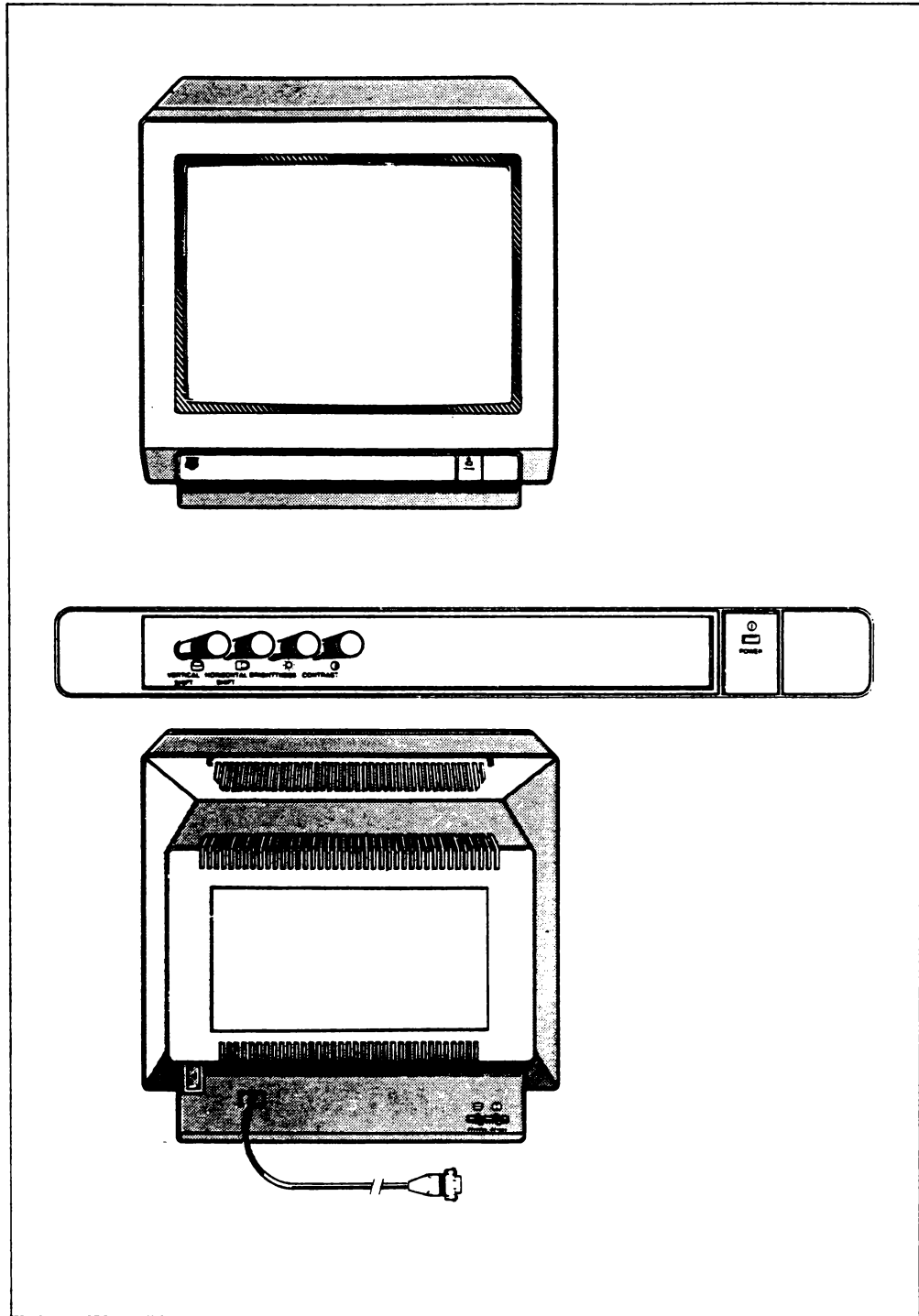
e. The image may be positioned vertically with control  (R524)



f. You can adjust the image height with control  (R513 for 480 lines)

g. The image width can be adjusted with control  (R541)





## SERVICE ADJUSTMENTS

### Adjustment notes:

#### Caution

1. Use an isolation transformer when applying power to the exposed chassis.
2. Line voltage maintained at 120V AC, 60Hz.
3. The unit should be allowed to warm up for at least 30 minutes prior to making any adjustments.
4. Voltages measured with respect to ground.

#### Adjustments

##### 1. +120 Vdc supply voltage

- Contrast and brightness to minimum.
- Connect a voltmeter across C145 and turn on the monitor.
- Adjust R114 for a reading of 120V on the meter.

##### 2. Synchronization

###### Horizontal synchronization

- Inject a cross-hatch pattern and short R413/C415.
- Adjust R419 until the picture is straight.
- Remove the short-circuit

###### Vertical synchronization

- Turn off the vertical sync. by removing input signal.
- Adjust R504 for 47 Hz at pin 3 of IC501

##### 3. Focus

Adjust the focus control for optimal focus.

##### 4. Adjustment of picture geometry

- Inject a cross-hatch pattern and set brightness and contrast to the mechanical mid-position.

###### East-West correction

- Adjust R539 so that the vertical lines at the left-hand and the right-hand side are straight (480 lines).

###### Vertical linearity

- Adjust R516 so that a good linearity is obtained between upper and lower side of the picture (480 lines).

###### Horizontal amplitude

- Set the horizontal width to 240 mm with R541 (480 lines).

###### Horizontal position

- The horizontal centering can be adjusted with R441.
- Adjust R411 so that R408 allows as much shifting to the left as to the right (480 lines).

###### Vertical amplitude

- Adjust the vertical height to 180 mm with R513 (480 lines) (R507 for 400 lines and R509 for 350 lines).
- The vertical centering can be adjusted with R524.

###### Brightness presetting

- Set brightness to mechanical mid-position.
- Adjust R567 so that the voltage across C555 is -41V

##### 5. VG2 adjustment and cut-off points in picture tube

- Adjust brightness to mechanical mid-position and adjust contrast to maximum.
- Adjust VG2 (SCREEN) to minimum.
- Adjust R726, R733 and R739 to mechanical mid-position.
- Inject a white pattern signal and adjust VG2 (SCREEN) until one color becomes visible.
- Set the pattern generator to purity with the color that was first visible.
- Readjust VG2 to just visible light.
- Adjust the 2 remaining colors with their corresponding purity color for the same light output using potentiometers R726, R733 or R739.
- Now return to white pattern signal and adjust potentiometers R726, R733 and R739 until an optimum background color is formed.
- Using potentiometers R328, R332 and R335 (with white pattern signal), adjust the background color so that at minimum brightness and maximum brightness the background color is the same.

## SERVICE ADJUSTMENTS (Continued)

Note: The following adjustments need only be performed if the CRT has been replaced. Minor corrections for purity and convergence may be accomplished through the use of the Purity and Convergence Assembly located on the neck of the CRT.

**Color Purity adjustment (Refer to Figure 1)**

1. Loosen the yoke clamp screw and slide the yoke back away from the rubber wedges.
2. Remove the rubber wedges (G) and slide the yoke forward until it rests firmly against the bell of the CRT.
3. Tighten the yoke clamp screw slightly so that the yoke can still be moved with some friction.
4. Place the multi-pole Purity and Convergence Assembly in the position shown in Figure 1.
5. Tighten screw (A) and turn securing ring (B) counterclockwise. Position the unit so that it faces in an East/West direction and degauss the instrument.
6. Turn on the power and inject a cross-hatch pattern signal. Allow a 10 minute warm-up period.
7. Roughly adjust the static convergence, using tabs C and D.
8. Set the Vertical Centering Control (R524) to its mechanical center. Disconnect R728 and R735 to turn off the green and blue guns.
9. Adjust the Two-pole purity rings (E) to center the red vertical and horizontal lines.
10. Inject a white pattern signal and move the deflection yoke to obtain a full red raster.
11. Turn on the green and blue guns by reconnecting R728 and R735. If a uniformly white raster does not appear, minor adjustments may be made by adjusting the purity rings (E).
12. Inject a cross-hatch pattern signal to ensure that the yoke is not tilted. If necessary rotate the yoke to obtain a level raster.
13. Tighten screw F and adjust R524 for proper vertical centering. Proceed to the Static Convergence Adjustment.

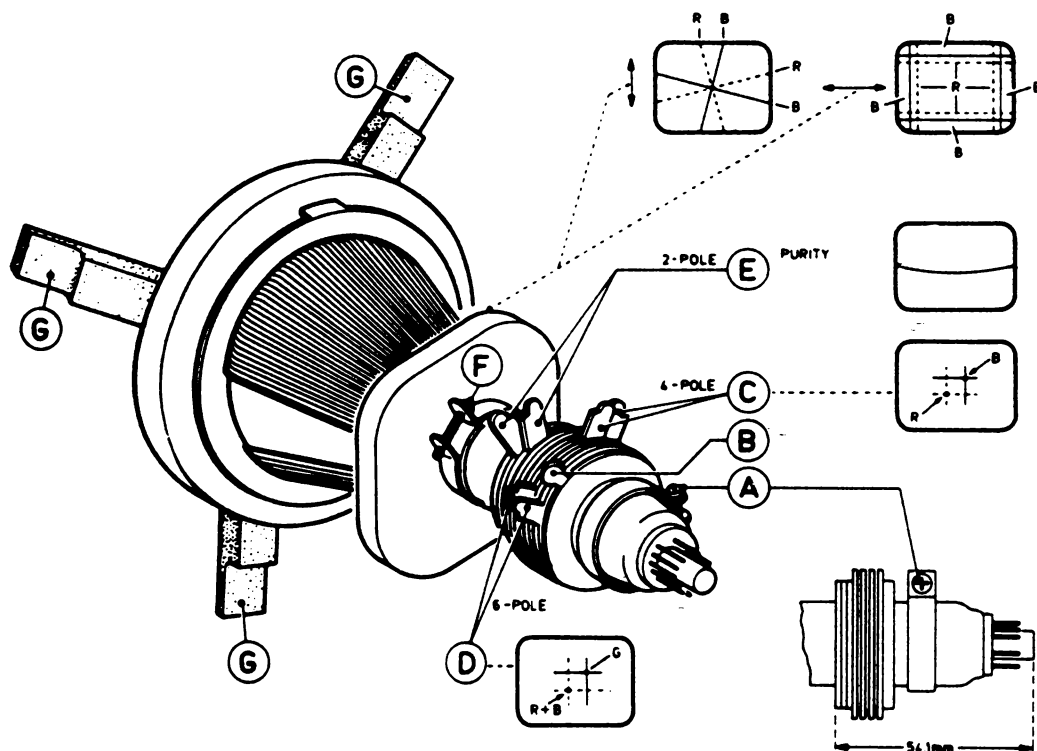


Fig. 1

## SERVICE ADJUSTMENTS (Continued)

### Static Convergence Adjustment

1. Inject a cross-hatch pattern signal and allow a 10 minute warm-up period.
2. Turn off the green gun by disconnecting R728. Turn locking ring (B) counterclockwise.
3. Slowly spread, and if necessary, rotate the 4-pole magnetic rings (C) to converge red and blue lines at the center of the screen.
4. Reconnect R728 to turn on the green gun and disconnect R735 to turn off the blue gun.
5. Slowly spread, and if necessary, rotate the 6-pole magnetic rings (D) to converge the red and green lines at the center of the screen.
6. Reconnect R735 to turn on the blue gun.
7. For optimum performance, repeat steps 1 through 6. Proceed to the Dynamic Convergence Adjustment.

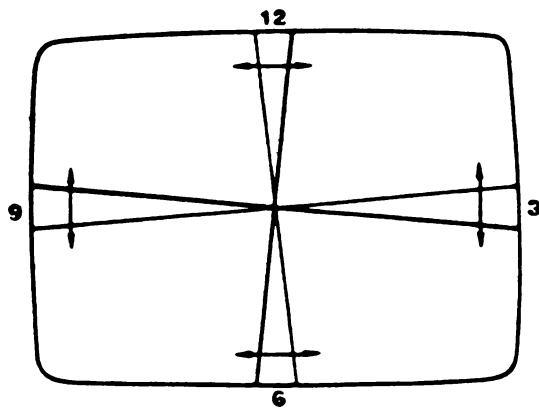


Figure 2 - Tilt yoke up or down to converge Red and Blue vertical lines at 6 and 12 o'clock positions, and Red and Blue horizontal lines at 3 and 9 o'clock positions.

### Dynamic Convergence Adjustment

1. Inject a cross-hatch pattern signal and turn off the green gun by disconnecting R728.
2. Tilt the yoke up and down to achieve the best convergence of the red and blue vertical lines at the 6 and 12 o'clock and the red and blue horizontal lines at the 3 and 9 o'clock positions (see Figure 2).
3. When the correct position has been found, place a rubber wedge between the yoke and CRT. If the yoke is tilted up, place wedge 1 as shown in Figure 3a; if it is tilted down, place wedge 1 as shown in Figure 4a.
4. Tilt the yoke to the left and right to find the point of best possible convergence of the red and blue lines at the edges, top, and bottom of the screen as shown in Figure 5.
5. When the correct position is located, place wedges 2 and 3 as shown in Figure 3b or 4b.
6. Remove wedge 1 and place it in the final position as shown in Figure 3c or 4c. Reconnect resistor R728 to turn on the green gun.

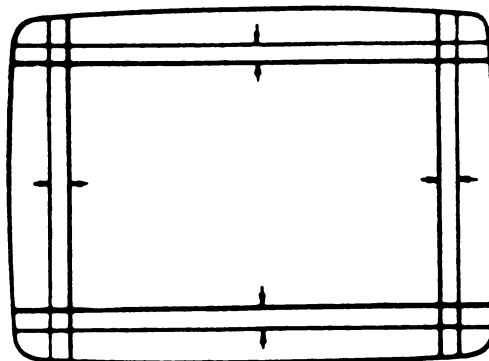
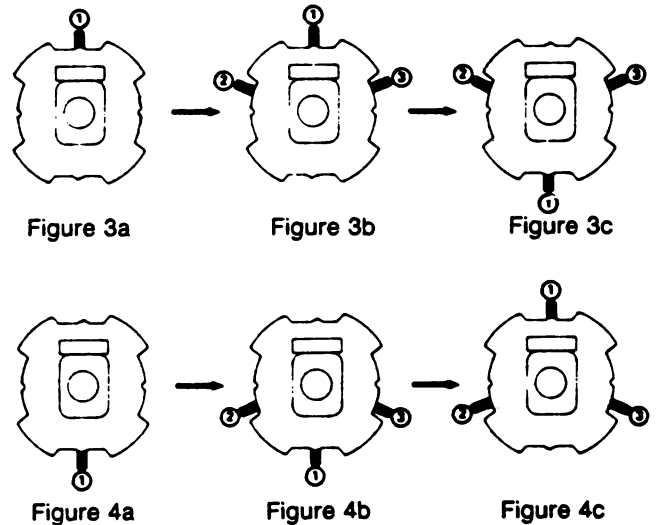
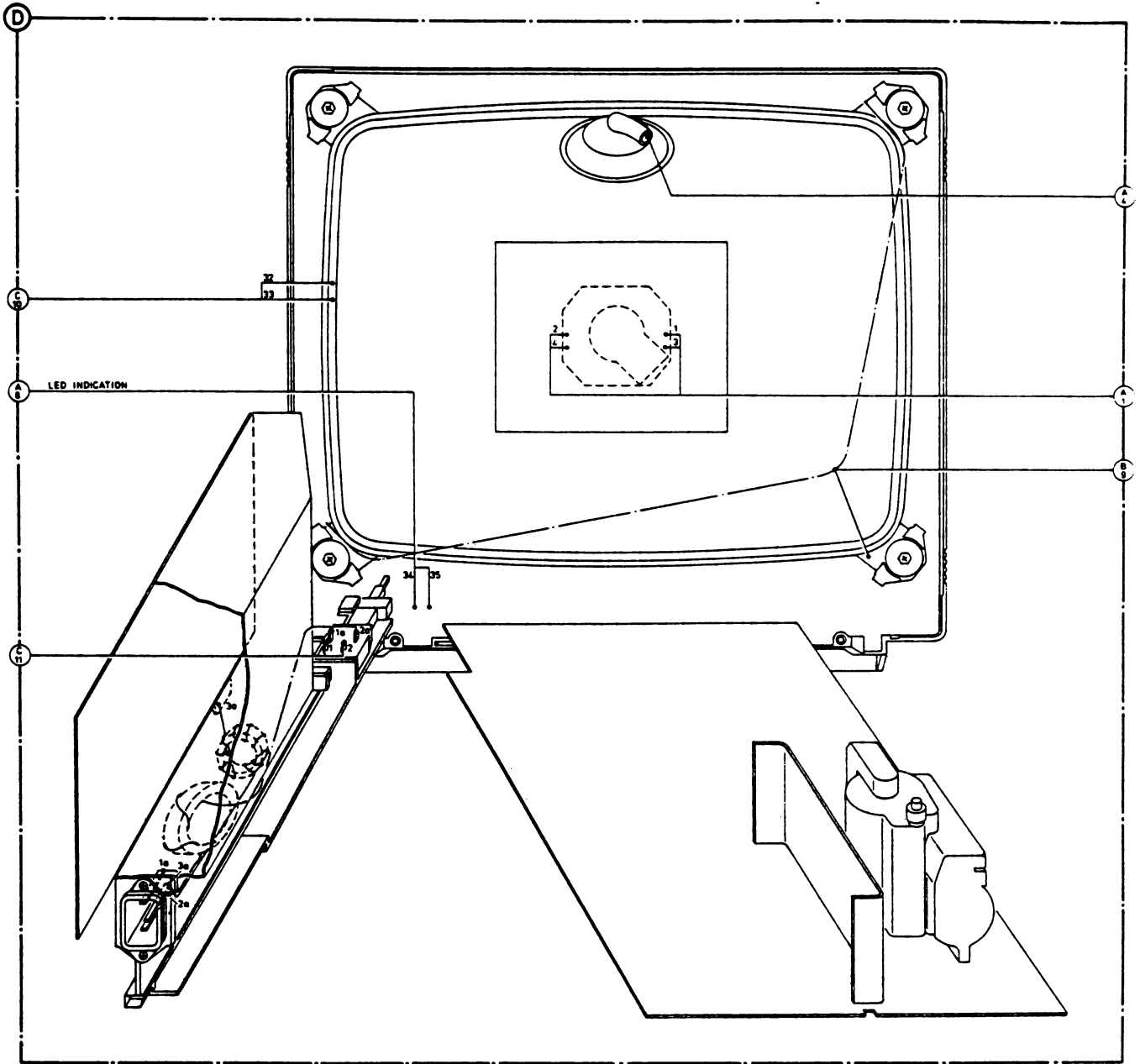




Figure 5 - Tilt yoke left to right to converge Red and Blue horizontal lines at the 6 and 12 positions, and Red and Blue vertical lines at 3 and 9 o'clock positions.

### INTERCONNECT WIRING DIAGRAM



## SCHEMATIC NOTES

1. DC voltages and waveforms should be measured with respect to ground as close as possible to the point to be measured.
2. All voltages are positive DC with respect to ground, be it the isolated ground (ground ) or the AC ground (ground ) and may vary due to normal production tolerances. Voltage sources are also nominal, with the exception of the 120Vdc source which is set at the factory to be +/- 1Vdc.
3. DC voltages and waveforms without brackets were measured under the following conditions:
  - A. Line voltage maintained at 120 Vac, 60Hz via an isolation transformer.
  - B. Contrast and brightness set at the mechanical mid-position (detent).
  - C. Using a color bar pattern from an RGB pattern generator (Network Technologies Incorporated Montest-A5D3 or equivalent). On a scan format of 31.5kHz./480 line resolution.
4. DC voltages with brackets and waveforms with the suffix ( A ) and in a box were taken in the self test mode and in the same conditions as in steps 3A and 3B.
5. For voltage, wattage or tolerance ratings of capacitors or resistors, refer to the electrical replacement parts list.
6. The CRT board is provided with printed spark gaps. Each spark gap is arranged between an electrode of the CRT and the aquadag coating.
7. During manufacture alternative semiconductors may be used. However the semiconductors specified in the parts list and circuit diagram can always be used as replacements.
8. Capacitance values are listed in microfarads ( $\mu$ ), nanofarads (n) and picofarads (p). ( $0.001\mu=1\mu=1000p$ )
9. \* = indicates component raised 1/4 inch above the P.C.Board.


## CHASSIS REMOVAL

With the back removed, all power disconnected and looking from the back.

1. Remove the bottom left CRT Screw with the Ground wire.
2. Remove the screw at the top of the Power Supply Panel with the ground wire.
3. Remove the screw above the AC power input plug.
4. Remove all cable and wire tie downs.
5. Unplug M102 and M110 from the Main Chassis.
6. Turn the back to the left. Start at the AC input plug and look to the right. Remove the first screw in the support bracket.
7. Now lift and pull the Main Chassis and the Power supply to the rear. Lay the Power supply to the left.
8. Remove the chassis rails and replug M102 to the Main Chassis.  
To replace the the Main Chassis and Power Supply do the steps in reverse order.

**CAUTION**  
**USE A SEPARATE ISOLATION TRANSFORMER FOR THIS UNIT WHEN SERVICING.**

## WARNING

Critical components having special safety characteristics are identified with an S by the Ref. No. in the parts list and enclosed within a broken line\* along with the safety symbol  on the schematics or exploded views.

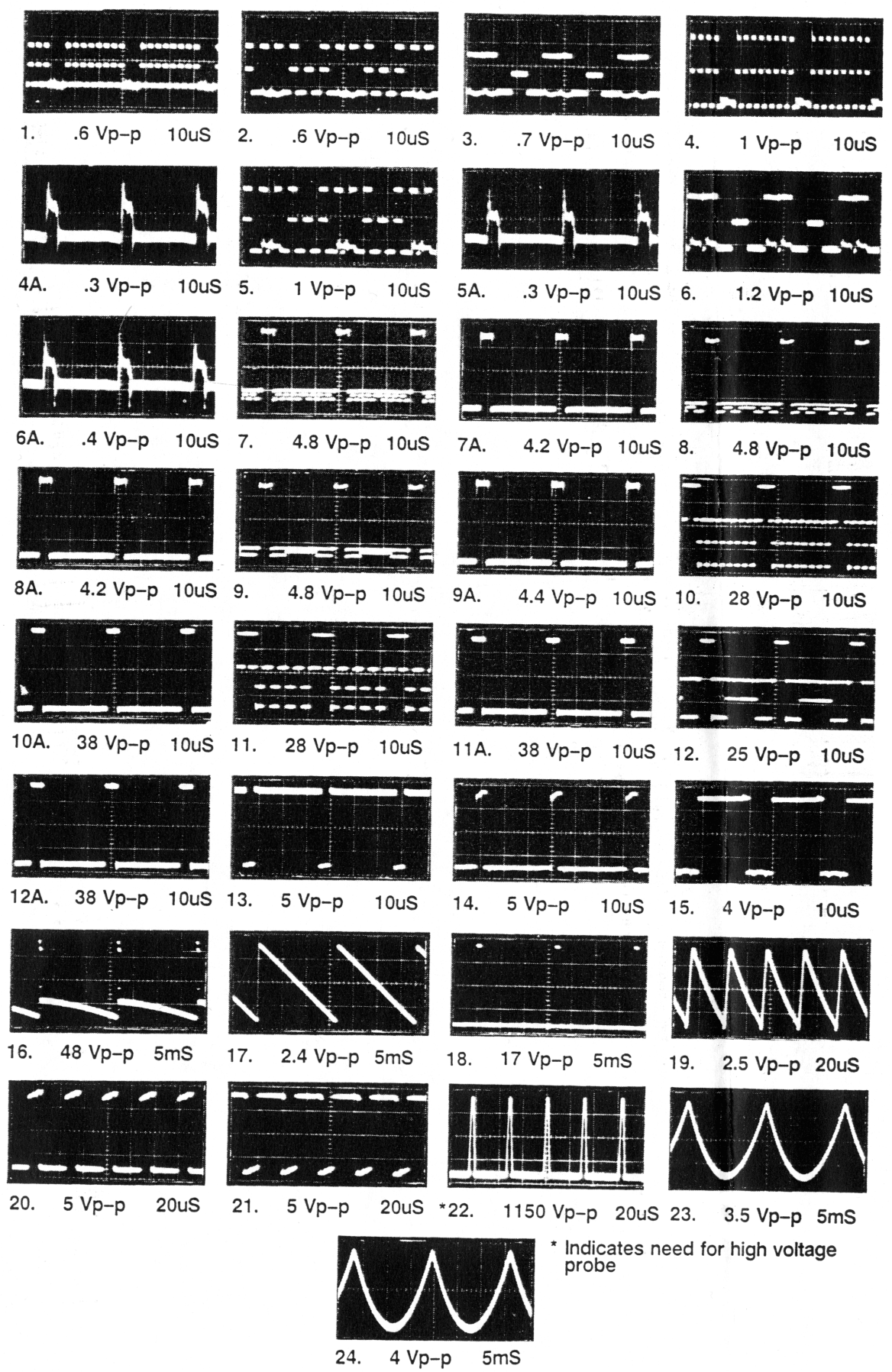
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\*Broken line: 

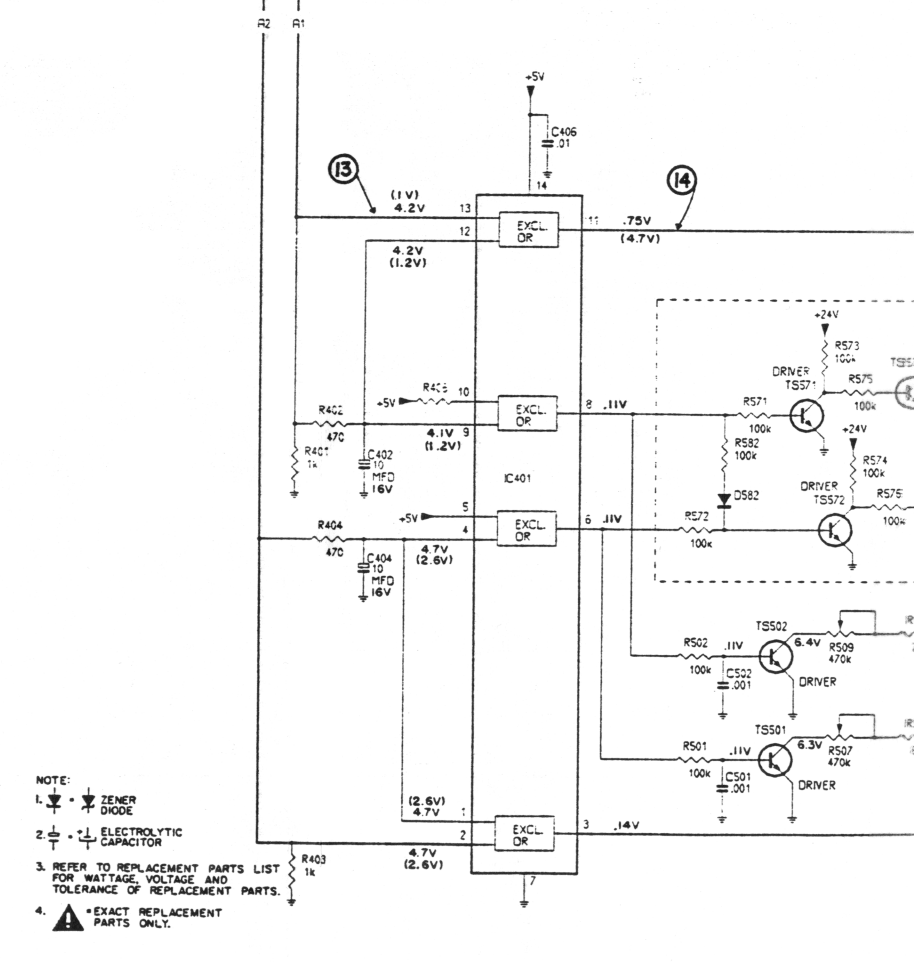
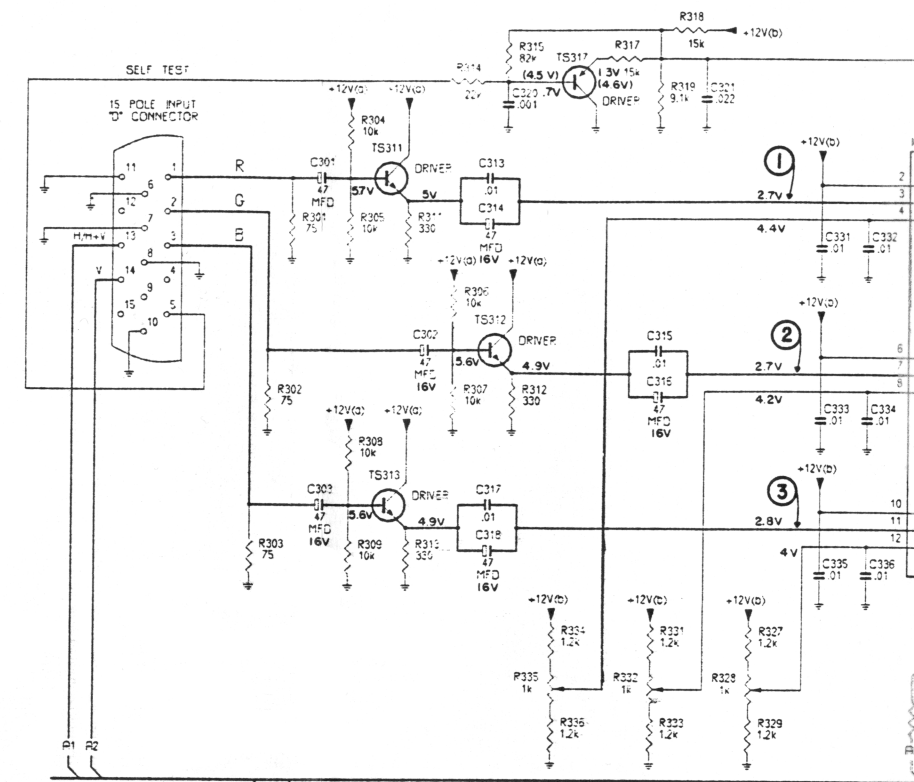


# WAVEFORMS



\* Indicates need for high voltage probe

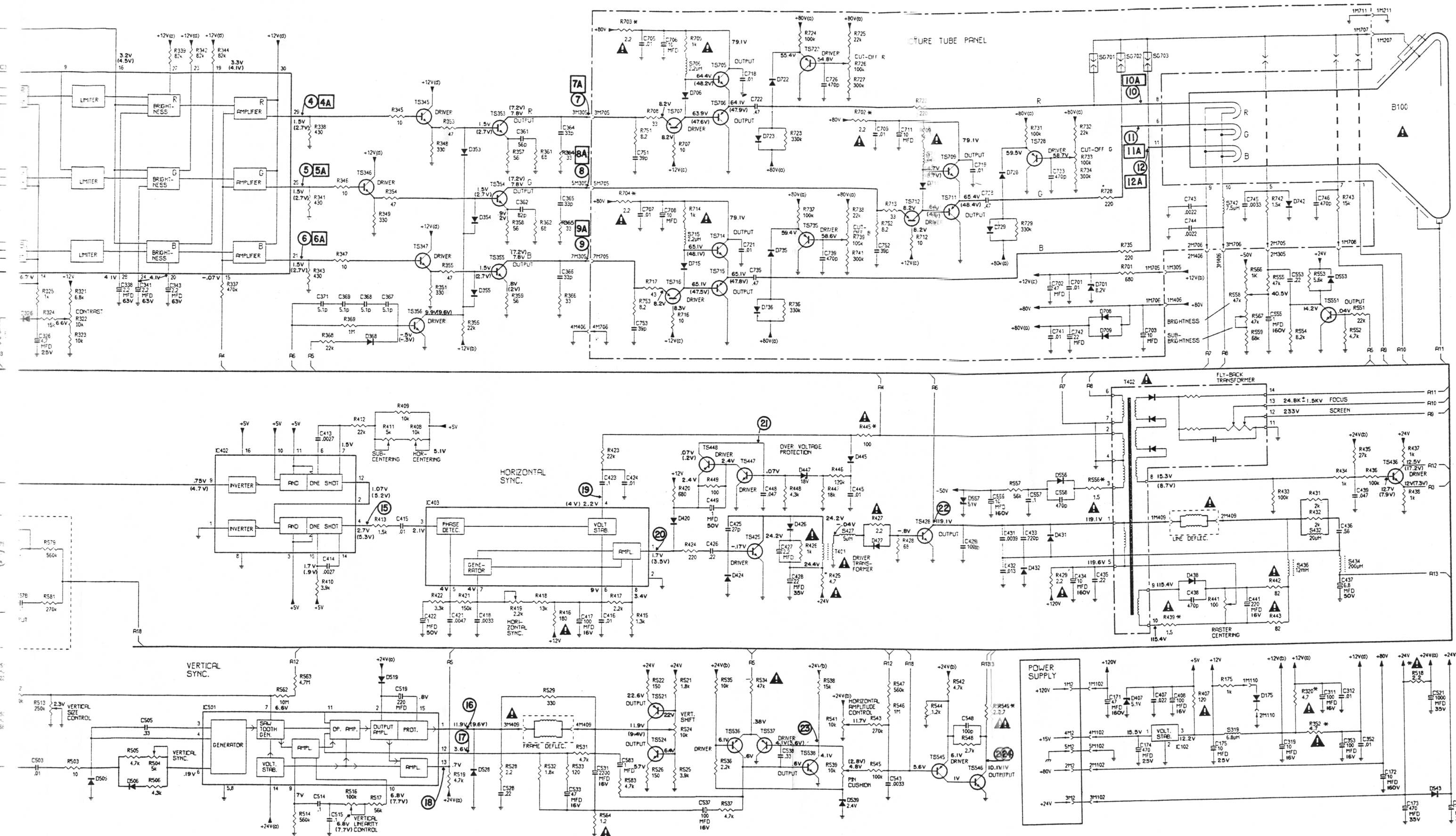
# 9CM062, 9CM082

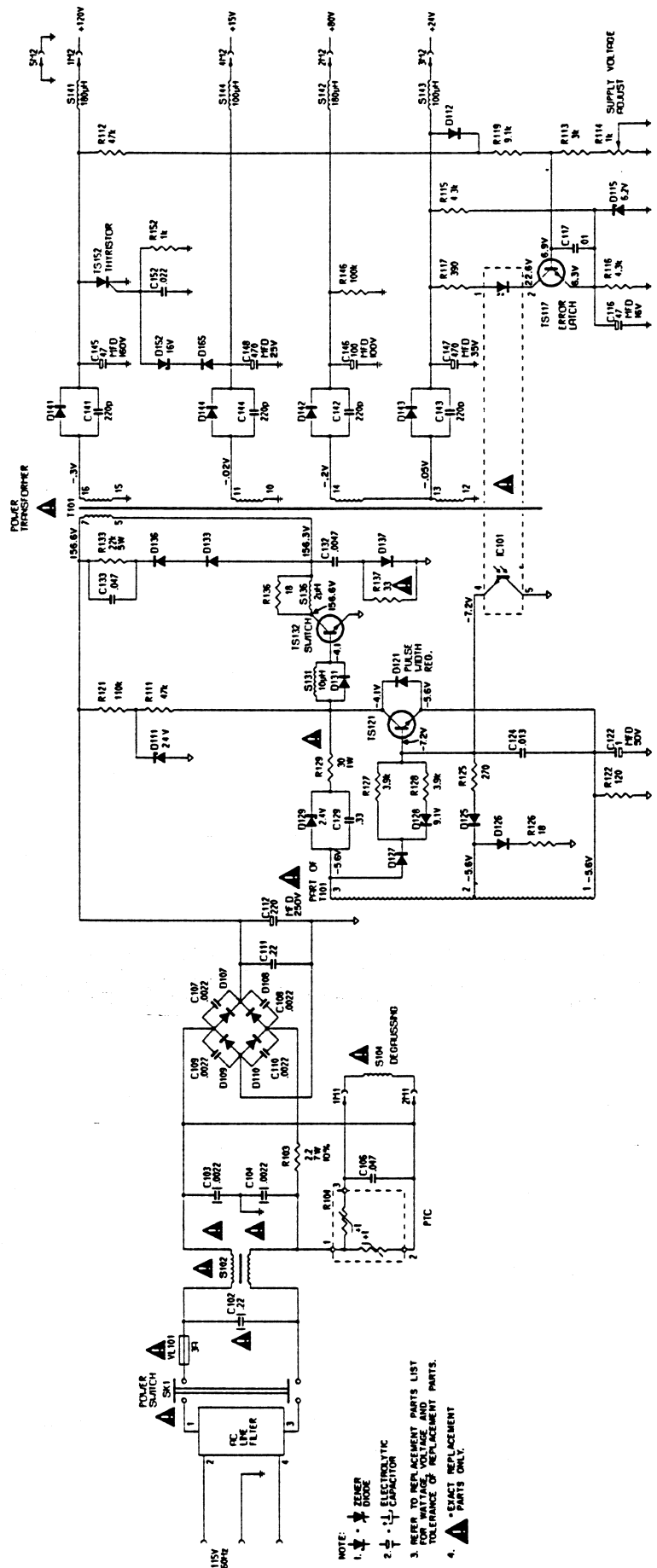


NOTE:  
 1. \* ZENER DIODE  
 2. \* ELECTROLYTIC CAPACITOR  
 3. REFER TO REPLACEMENT PARTS LIST FOR WATTAGE, VOLTAGE AND TOLERANCE OF REPLACEMENT PARTS.  
 4. \* EXACT REPLACEMENT PARTS ONLY.

# MAIN PANEL SCHEMATIC DIAGRAM

# 1930 SERVICE MANUAL



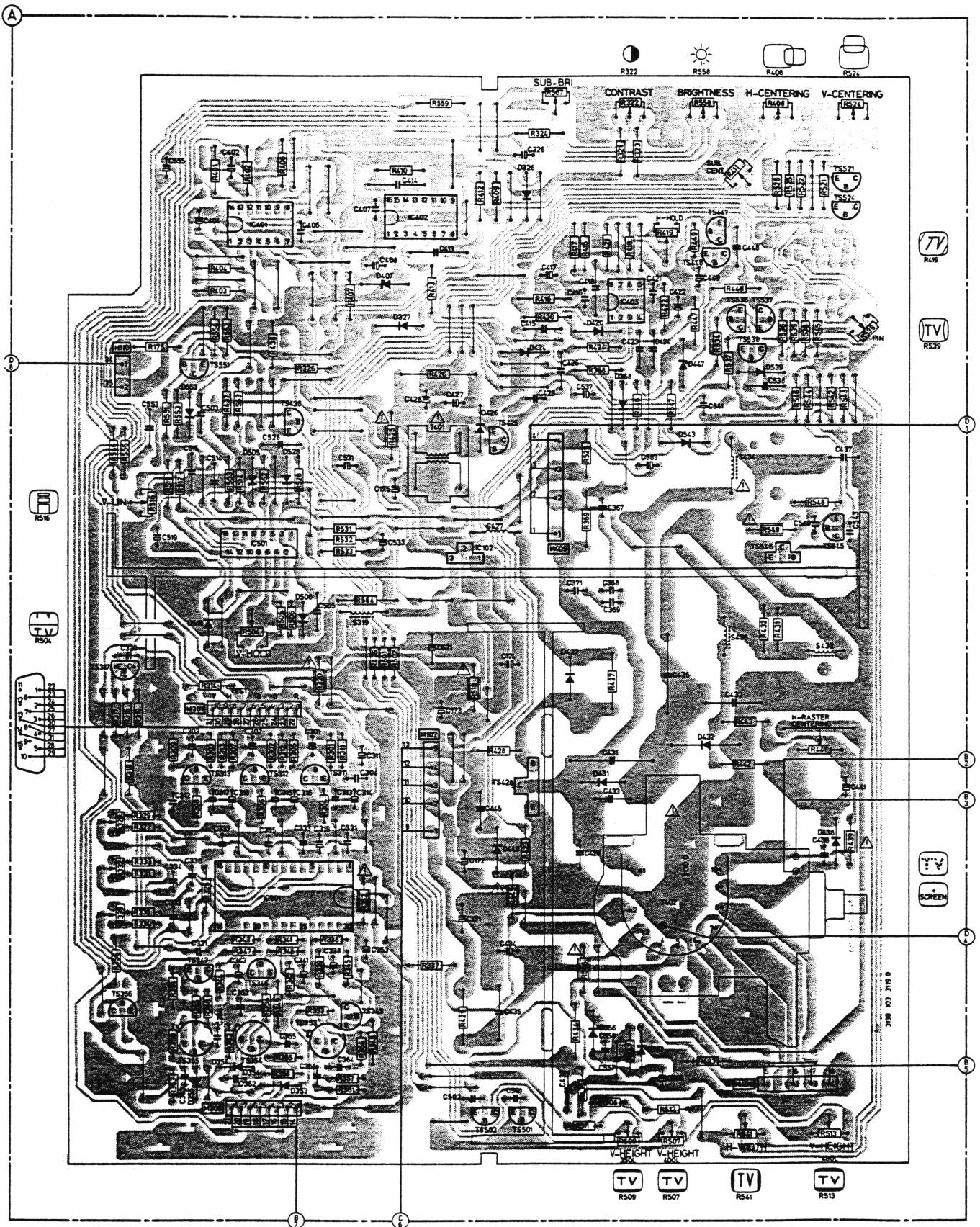


POWER SUPPLY SCHEMATIC DIAGRAM

NOTE:  
 1. ZENER DIODE  
 2. ELECTROLYTIC CAPACITOR  
 3. REFER TO REPLACEMENT PARTS LIST FOR RATINGS, VOLTAGE AND TOLERANCE OF REPLACEMENT PARTS.  
 4. \* EXACT REPLACEMENT PARTS ONLY.

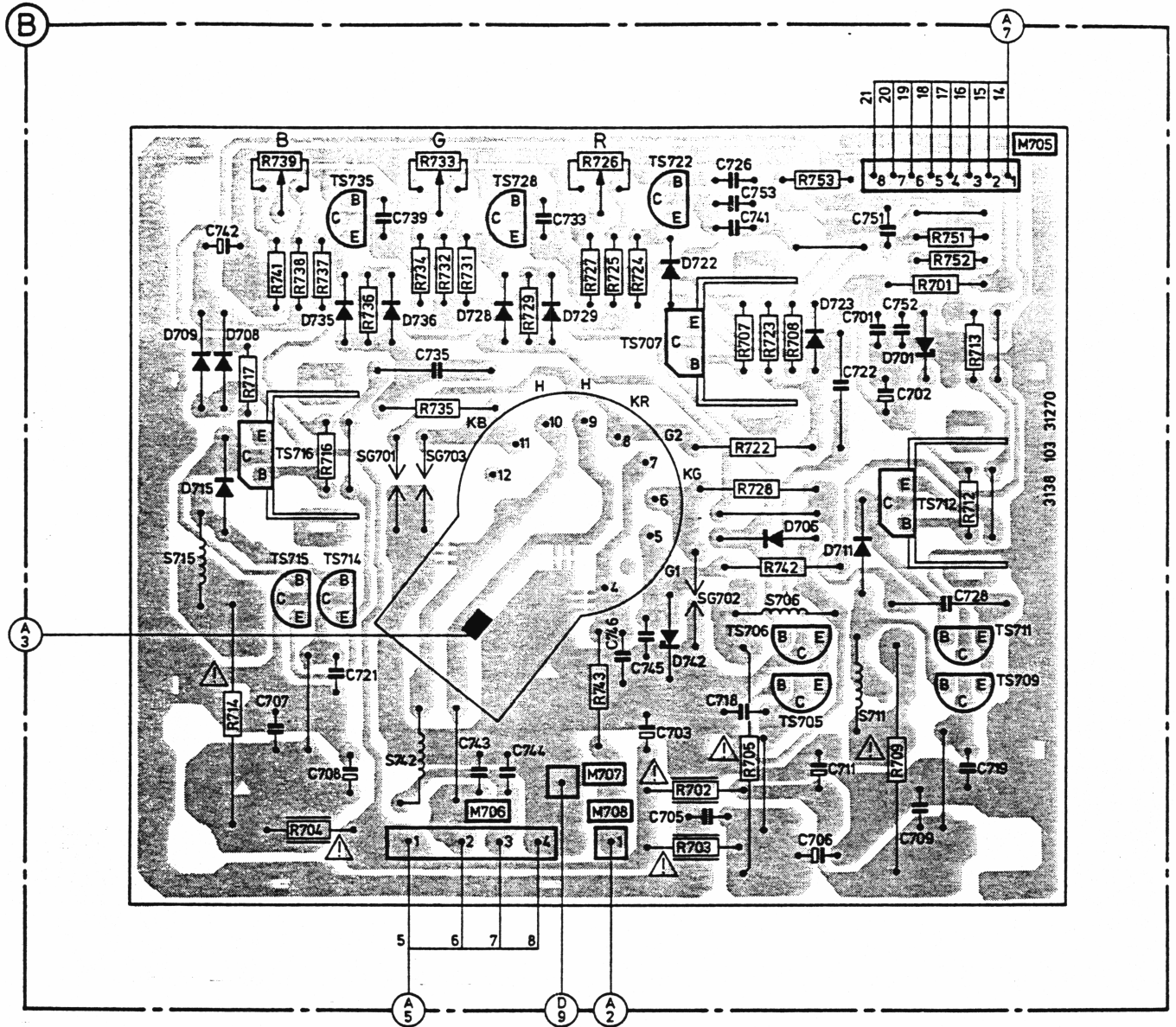
# MAIN P.C. BOARD

(viewed from the component side)

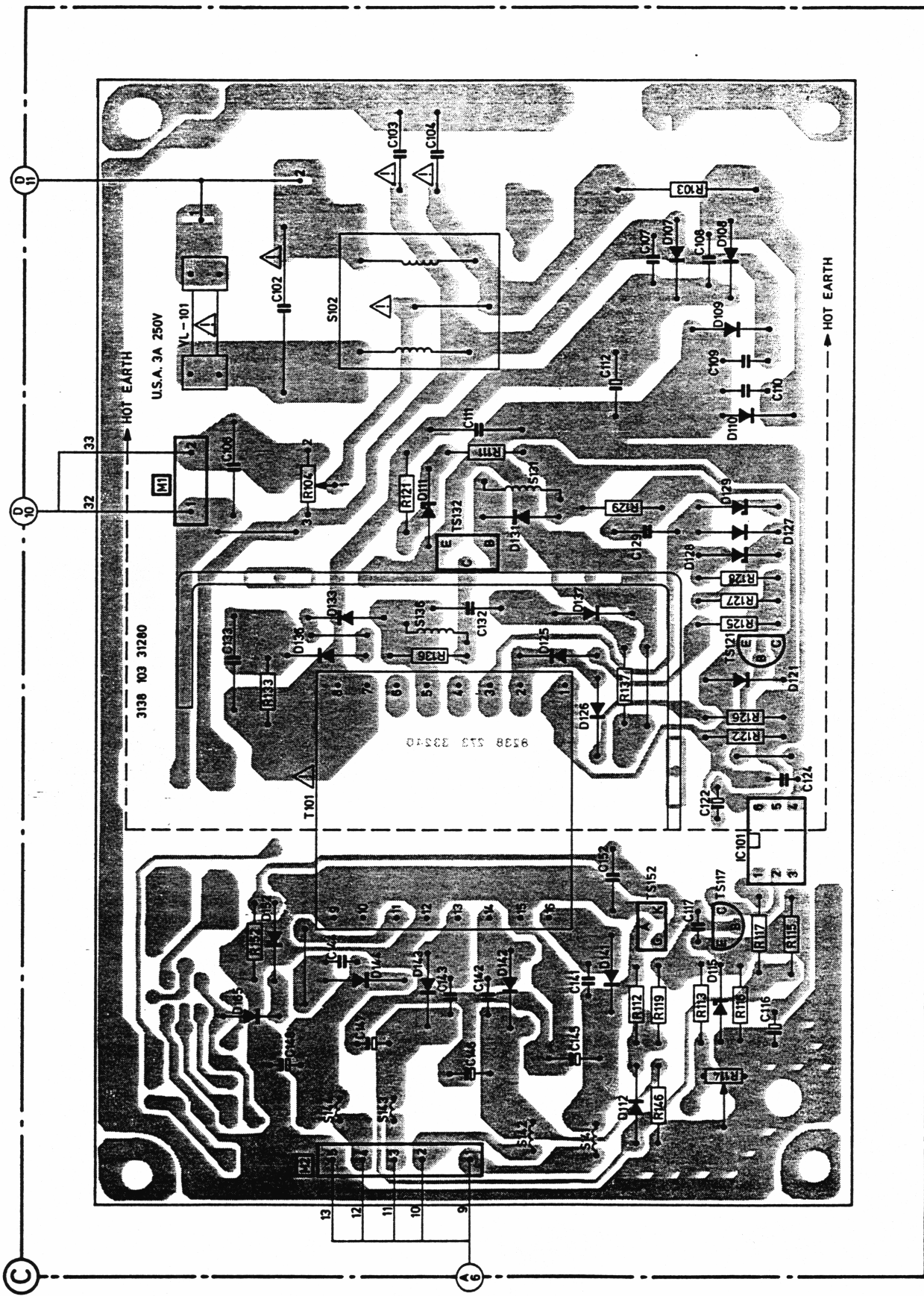




### PICTURE TUBE P.C. BOARD (viewed from the component side)



### POWER SUPPLY P.C. BOARD (viewed from the component side)



## 9CM062/9CM082 REPLACEMENT PARTS LIST

To ensure optimum performance and reliability always use genuine factory replacement parts.

## PART OF LED ASSY

| Ref. | Description                   | Part. No.                |
|------|-------------------------------|--------------------------|
| D175 | Connector 2 pole<br>LED green | 4613990296<br>5392100470 |

PARTS OF CHASSIS  
MISCELLANEOUS

| Ref. | Description                 | Part. No.  |
|------|-----------------------------|------------|
|      | micro connector 2 pole      | 1813930150 |
|      | micro connector 8 pole      | 1814521282 |
|      | socket 5 pole               | 1814521053 |
|      | micro connector 10 pole     | 1814521446 |
|      | connector 4 pole (dia 1.5)  | 1814521348 |
|      | connector 4 pole (dia 2.35) | 1814521052 |

Ref. Description  
Capacitors

|      |                             |            |
|------|-----------------------------|------------|
| C171 | 47μF, 160V, electrolytic    | 2701741025 |
| C172 | 10μF, 160V, electrolytic    | 2796331000 |
| C173 | 470μF, 35V, electrolytic    | 2701741019 |
| C174 | 470μF, 25V, electrolytic    | 2701741018 |
| C175 | 10μF, 25V, electrolytic     | 2796141000 |
| C301 | 47μF, 16V, electrolytic     | 2701741016 |
| C302 | 47μF, 16V, electrolytic     | 2701741016 |
| C303 | 47μF, 16V, electrolytic     | 2701741016 |
| C311 | 100μF, 16V, electrolytic    | 2701741029 |
| C312 | 0.010μF, 10%, 50V, ceramic  | 2508331038 |
| C313 | 0.010μF, 10%, 50V, ceramic  | 2508331038 |
| C314 | 47μF, 16V, electrolytic     | 2701741016 |
| C315 | 0.010μF, 10%, 50V, ceramic  | 2508331038 |
| C316 | 47μF, 16V, electrolytic     | 2701741016 |
| C317 | 0.010μF, 10%, 50V, ceramic  | 2508331038 |
| C318 | 47μF, 16V, electrolytic     | 2701741016 |
| C319 | 10μF, 16V, electrolytic     | 2701741028 |
| C320 | 0.0010μF, 10%, 50V, ceramic | 2508281029 |
| C321 | 0.022μF, 20%, 50V, ceramic  | 2508332238 |
| C326 | 4.7μF, 25V, electrolytic    | 2701741020 |
| C331 | 0.010μF, 10%, 50V, ceramic  | 2508331038 |
| C332 | 0.010μF, 10%, 50V, ceramic  | 2508331038 |
| C333 | 0.010μF, 10%, 50V, ceramic  | 2508331038 |
| C334 | 0.010μF, 10%, 50V, ceramic  | 2508331038 |
| C335 | 0.010μF, 10%, 50V, ceramic  | 2508331038 |
| C336 | 0.010μF, 10%, 50V, ceramic  | 2508331038 |
| C337 | 0.010μF, 10%, 50V, ceramic  | 2508331038 |
| C338 | 2.2μF, 63V, electrolytic    | 2791202297 |
| C341 | 2.2μF, 63V, electrolytic    | 2791202297 |
| C343 | 2.2μF, 63V, electrolytic    | 2791202297 |
| C352 | 0.010μF, 10%, 50V, ceramic  | 2508331038 |
| C353 | 100μF, 16V, electrolytic    | 2701741029 |
| C361 | 56pF, 5%, 50V, ceramic      | 2508415605 |
| C362 | 82pF, 5%, 50V, ceramic      | 2509040815 |
| C364 | 33pF, 5%, 50V, ceramic      | 2602320545 |
| C365 | 33pF, 5%, 50V, ceramic      | 2602320545 |
| C366 | 33pF, 5%, 50V, ceramic      | 2602320545 |
| C367 | 5.1pF, 10%, 500V, ceramic   | 2509041403 |
| C368 | 5.1pF, 10%, 500V, ceramic   | 2509041403 |
| C369 | 5.1pF, 10%, 500V, ceramic   | 2509041403 |

|      |                                |            |
|------|--------------------------------|------------|
| C371 | 5.1pF, 10%, 500V, ceramic      | 2509041403 |
| C402 | 10μF, 16V, electrolytic        | 2701741028 |
| C404 | 10μF, 16V, electrolytic        | 2701741028 |
| C406 | 0.010μF, 10%, 50V, ceramic     | 2508331038 |
| C407 | 0.022μF, 20%, 50V, ceramic     | 2508332238 |
| C408 | 100μF, 16V, electrolytic       | 2701741029 |
| C413 | 0.0027μF, 10%, 50V, polyester  | 2509041381 |
| C414 | 0.0027μF, 10%, 50V, polyester  | 2509041381 |
| C415 | 0.010μF, 10%, 100V, polyester  | 2509041054 |
| C416 | 0.010μF, 10%, 50V, ceramic     | 2508331038 |
| C417 | 100μF, 16V, electrolytic       | 2701741029 |
| C418 | 0.0033μF, 5%, 50V, polyester   | 2602320842 |
| C421 | 0.0047μF, 20%, 50V, ceramic    | 2508304728 |
| C422 | 1μF, 50V, electrolytic         | 2701741015 |
| C423 | 0.1μF, 10%, 100V, polyester    | 2508141049 |
| C424 | 0.010μF, 20%, 400V, polyester  | 2509581039 |
| C425 | 27pF, 5%, 500V, ceramic        | 2509040814 |
| C426 | 0.22μF, 10%, 100V, polyester   | 2508142249 |
| C427 | 2.2μF, 63V, electrolytic       | 2791202297 |
| C428 | 22μF, 35V, electrolytic        | 2701741099 |
| C429 | 100pF, 10%, 2KV, ceramic       | 2509041404 |
| C431 | 0.0039μF, 5%, 1.6KV, polyester | 2602320837 |
| C432 | 0.013μF, 5%, 400V, polyester   | 2509040290 |
| C433 | 220pF, 10%, 2KV, ceramic       | 2602320844 |
| C434 | 10μF, 160V, electrolytic       | 2796331000 |
| C435 | 0.22μF, 10%, 250V, polyester   | 2602320543 |
| C436 | 0.56μF, 10%, 250V, polyester   | 2596135649 |
| C437 | 6.8μF, 50V, bi-polar           | 2701741027 |
| C438 | 470pF, 10%, 500V, ceramic      | 2602320845 |
| C439 | 0.047μF, 10%, 250V, polyester  | 2508154739 |
| C441 | 220μF, 16V, electrolytic       | 2701741017 |
| C445 | 0.010μF, 20%, 400V, polyester  | 2509581039 |
| C448 | 0.047μF, 10%, 250V, polyester  | 2508154739 |
| C449 | 1μF, 50V, electrolytic         | 2701741015 |
| C501 | 0.001μF, 10%, 50V, ceramic     | 2508281029 |
| C502 | 0.001μF, 10%, 50V, ceramic     | 2508281029 |
| C503 | 0.010μF, 10%, 100V, polyester  | 2509041054 |
| C505 | 0.33μF, 10%, 63V, polyester    | 2508143349 |
| C514 | 0.10μF, 10%, 100V, polyester   | 2508141049 |
| C515 | 0.10μF, 10%, 100V, polyester   | 2508141049 |
| C519 | 220μF, 35V, electrolytic       | 2602320854 |
| C521 | 1000μF, 35V, electrolytic      | 2701741022 |
| C528 | 0.22μF, 10%, 100V, polyester   | 2508142249 |
| C531 | 2200μF, 16V, electrolytic      | 2701741030 |
| C533 | 47μF, 16V, electrolytic        | 2701741016 |
| C537 | 100μF, 16V, electrolytic       | 2701741029 |
| C538 | 0.33μF, 10%, 63V, polyester    | 2508143349 |
| C541 | 100μF, 35V, electrolytic       | 2509041326 |
| C543 | 0.0033μF, 10%, 50V, ceramic    | 2602320850 |
| C548 | 100pF, 10%, 50V, ceramic       | 2508311019 |
| C553 | 0.22μF, 10%, 100V, polyester   | 2508142249 |
| C555 | 1μF, 160V, electrolytic        | 2701741021 |
| C556 | 10μF, 160V, electrolytic       | 2796331000 |
| C557 | 0.1μF, 20%, 250V, polyester    | 2508881049 |
| C558 | 470pF, 10%, 500V, ceramic      | 2602320845 |

## 9CM062/9CM082 REPLACEMENT PARTS LIST (Continued)

| Ref.   | Description           | Part. No.  |        |                        |
|--|-----------------------|------------|--------|------------------------|
| <b>Resistors</b>   |                       |            |        |                        |
| (All are 5%, 0.2W metal film unless otherwise specified) |                       |            |        |                        |
| R175   | 1k $\Omega$ , 0.33W   | 2302861022 | R368   | 22k $\Omega$ , 0.33W   |
| R301   | 75 $\Omega$           | 2394027505 | R369   | 1M $\Omega$ , 0.5W, 5% |
| R302   | 75 $\Omega$           | 2394027505 | R401   | 1k $\Omega$ , 0.33W    |
| R303   | 75 $\Omega$           | 2394027505 | R402   | 470 $\Omega$ , 0.33W   |
| R304   | 10k $\Omega$          | 2394011035 | R403   | 1k $\Omega$ , 0.33W    |
| R305   | 10k $\Omega$          | 2394011035 | R404   | 470 $\Omega$ , 0.33W   |
| R306   | 10k $\Omega$          | 2394011035 | R406   | 1k $\Omega$ , 0.33W    |
| R307   | 10k $\Omega$          | 2394011035 | R407   | 120 $\Omega$ , 1W, 5%  |
| R308   | 10k $\Omega$          | 2394011035 | R408   | 10k $\Omega$ , potm    |
| R309   | 10k $\Omega$          | 2394011035 | R409   | 10k $\Omega$ , 0.33W   |
| R311   | 330 $\Omega$          | 2302123315 | R410   | 3.9k $\Omega$ , 0.33W  |
| R312   | 330 $\Omega$          | 2302123315 | R411   | 5k $\Omega$ , potm     |
| R313   | 330 $\Omega$          | 2302123315 | R412   | 22k $\Omega$ , 1%      |
| R314   | 22k $\Omega$ , 0.33W  | 2302822235 | R413   | 1.5k $\Omega$ , 0.33W  |
| R315   | 82k $\Omega$ , 0.33W  | 2394038235 | R415   | 1.3k $\Omega$ , 0.33W  |
| R317   | 15k $\Omega$ , 0.33W  | 2302821535 | S R416 | 180 $\Omega$ , 2W, 5%  |
| R318   | 15k $\Omega$ , 0.33W  | 2302821535 | R417   | 2.2k $\Omega$ , 0.33W  |
| R319   | 9.1k $\Omega$ , 0.33W | 2394049125 | R418   | 13k $\Omega$ , 0.33W   |
| S R320   | 4.7 $\Omega$          | 2302684785 | R419   | 2.2k $\Omega$ , potm   |
| R321   | 6.8k $\Omega$ , 0.33W | 2302126825 | R420   | 680 $\Omega$ , 0.33W   |
| R322   | 10k $\Omega$ , potm   | 2291070004 | R421   | 150k $\Omega$ , 0.33W  |
| R323   | 10k $\Omega$ , 0.33W  | 2302821035 | R422   | 3.3k $\Omega$ , 0.33W  |
| R324   | 15k $\Omega$ , 0.33W  | 2302821535 | R423   | 22k $\Omega$ , 0.33W   |
| R325   | 1k $\Omega$ , 0.33W   | 2302861022 | R424   | 220 $\Omega$ , 0.33W   |
| R326   | 15k $\Omega$ , 0.33W  | 2302821535 | S R425 | 4.7 $\Omega$           |
| R327   | 1.2k $\Omega$         | 2302041225 | S R426 | 1k $\Omega$ , 2W, 5%   |
| R328   | 1k $\Omega$ , potm    | 2204291267 | S R427 | 2.2 $\Omega$ , 5W, 5%  |
| R329   | 1.2k $\Omega$         | 2392041225 | R428   | 68 $\Omega$ , 0.5W     |
| R331   | 1.2k $\Omega$         | 2392041225 | S R429 | 2.2 $\Omega$ , 5W, 5%  |
| R332   | 1k $\Omega$ , potm    | 2204291267 | R431   | 2k $\Omega$ , 0.5W     |
| R333   | 1.2k $\Omega$         | 2392041225 | R432   | 2k $\Omega$ , 0.5W     |
| R334   | 1.2k $\Omega$         | 2392041225 | R433   | 100k $\Omega$ , 0.33W  |
| R335   | 1k $\Omega$ , potm    | 2204291267 | R434   | 1k $\Omega$ , 0.5W     |
| R336   | 1.2k $\Omega$         | 2392041225 | R435   | 27k $\Omega$ , 0.33W   |
| R337   | 470k $\Omega$ , 0.33W | 2302124745 | R436   | 100k $\Omega$ , 0.33W  |
| R338   | 430 $\Omega$          | 2394024315 | R347   | 1k $\Omega$ , 0.33W    |
| R339   | 82k $\Omega$          | 2394028235 | R348   | 1k $\Omega$ , 0.33W    |
| R341   | 430 $\Omega$          | 2394024315 | S R439 | 1.5 $\Omega$           |
| R342   | 82k $\Omega$          | 2394028235 | R441   | 100 $\Omega$ , potm    |
| R343   | 430 $\Omega$          | 2394024315 | S R442 | 82 $\Omega$ , 1W       |
| R344   | 82k $\Omega$          | 2394028235 | S R443 | 82 $\Omega$ , 1W       |
| R345   | 10 $\Omega$           | 2394011005 | S R445 | 100 $\Omega$           |
| R346   | 10 $\Omega$           | 2394011005 | R446   | 120k $\Omega$ , 1%     |
| R347   | 10 $\Omega$           | 2394011005 | R447   | 18k $\Omega$ , 1%      |
| R348   | 330 $\Omega$ , 0.33W  | 2303203315 | R448   | 4.3k $\Omega$ , 1%     |
| R349   | 330 $\Omega$ , 0.33W  | 2303203315 | R449   | 100 $\Omega$           |
| R351   | 330 $\Omega$ , 0.33W  | 2303203315 | R501   | 100k $\Omega$ , 0.33W  |
| S R352   | 4.7 $\Omega$          | 2302684785 | R502   | 100k $\Omega$ , 0.33W  |
| R353   | 47 $\Omega$           | 2392044705 | R503   | 10 $\Omega$ , 0.33W    |
| R354   | 47 $\Omega$           | 2392044705 | R504   | 5k $\Omega$ , potm     |
| R355   | 47 $\Omega$           | 2392044705 | R505   | 4.7k $\Omega$          |
| R356   | 22k $\Omega$ , 0.33W  | 2302822235 | R506   | 4.3k $\Omega$          |
| R357   | 56 $\Omega$           | 2394045605 | R507   | 470k $\Omega$ , potm   |
| R358   | 56 $\Omega$           | 2394045605 | R508   | 680k $\Omega$          |
| R359   | 56 $\Omega$           | 2394045605 | R509   | 470k $\Omega$ , potm   |
| R361   | 68 $\Omega$           | 2394026805 | S R511 | 220k $\Omega$          |
| R362   | 68 $\Omega$           | 2394026805 | R512   | 150k $\Omega$ , 0.33W  |
| R364   | 33 $\Omega$           | 2392043305 | R513   | 250k $\Omega$ , potm   |
| R365   | 33 $\Omega$           | 2392043305 | R514   | 560k $\Omega$ , 0.33W  |
| R366   | 33 $\Omega$           | 2392043305 | R516   | 100k $\Omega$ , potm   |

9CM062/9CM082 REPLACEMENT PARTS LIST (Continued)

| Ref.                          | Description       | Part. No.  | Ref.               | Description      | Part. No.  |
|-------------------------------|-------------------|------------|--------------------|------------------|------------|
| <b>Resistors (continued)</b>  |                   |            | <b>Diodes</b>      |                  |            |
| R517                          | 56kΩ, 0.33W       | 2303205635 | D326               | diode            | 5301811001 |
| S R518                        | 2.2Ω              | 2302682285 | D327               | diode            | 5301811001 |
| R519                          | 4.7kΩ, 0.33W      | 2302124725 | D353               | diode            | 5301811001 |
| R521                          | 1.8kΩ, 0.33W      | 2302121825 | D354               | diode            | 5301811001 |
| R522                          | 150Ω, 1W          | 2302931515 | D355               | diode            | 5301811001 |
| R524                          | 10kΩ, potm        | 2291070003 | D368               | diode            | 5301811001 |
| R525                          | 3.9kΩ, 0.33W      | 2302123922 | D407               | zener diode 5.1V | 5302390242 |
| R526                          | 150Ω, 1W          | 2302931515 | D424               | diode            | 5301811001 |
| R528                          | 2.2Ω, 0.33W       | 2392042295 | D426               | diode            | 5301711002 |
| R529                          | 330Ω, 0.5W        | 2303203315 | D427               | diode            | 5391500200 |
| R531                          | 4.7kΩ, 0.33W      | 2302124725 | D431               | diode            | 5302261002 |
| R532                          | 1.8kΩ, 0.33W      | 2302121825 | D432               | diode            | 5302390244 |
| R533                          | 120Ω, 0.33W       | 2302121215 | D438               | diode            | 5391510050 |
| S R534                        | 47kΩ, 0.33W       | 2302124735 | D445               | diode            | 5302681002 |
| R535                          | 10kΩ, 0.33W       | 2302821035 | D447               | zener diode 18V  | 5302250180 |
| R536                          | 2.2kΩ, 0.33W      | 2302122225 | D505               | diode            | 5301811001 |
| R537                          | 4.7kΩ, 0.33W      | 2302124725 | D506               | diode            | 5301811001 |
| R538                          | 15kΩ, 0.33W       | 2302821535 | D519               | diode            | 5301711002 |
| R539                          | 10kΩ, potm        | 2204291270 | D528               | diode            | 5301711002 |
| R541                          | 10kΩ, potm        | 2291010086 | D534               | diode            | 5301711002 |
| <b>Resistors</b>              |                   |            | D539               | zener diode 2.4V | 5390140249 |
| R542                          | 4.7kΩ, 0.33W      | 2302124725 | D553               | diode            | 5301711002 |
| R543                          | 270kΩ, 0.33W      | 2394032745 | D554               | diode            | 5302681002 |
| R544                          | 1.2kΩ, 0.33W      | 2302121225 | D556               | diode            | 5391500450 |
| R545                          | 100kΩ, 0.33W      | 2394041045 | D557               | zener diode 51V  | 5390255109 |
| R546                          | 1MΩ, 0.33W        | 2394041055 | <b>Transistors</b> |                  |            |
| R547                          | 560kΩ, 0.33W      | 2302125645 | TS311              | NPN, driver      | 6103700001 |
| R548                          | 2.7kΩ, 0.33W      | 2302822725 | TS312              | NPN, driver      | 6103700001 |
| S R549                        | 2.7Ω              | 2302890464 | TS313              | NPN, driver      | 6103700001 |
| R551                          | 22kΩ, 0.33W       | 2302822235 | TS317              | PNP, driver      | 6103720002 |
| R552                          | 4.7kΩ, 0.33W      | 2302124725 | TS345              | NPN, driver      | 6190004470 |
| R553                          | 5.6kΩ, 0.5W       | 2302225625 | TS346              | NPN, driver      | 6190004470 |
| R554                          | 8.2kΩ, 0.5W       | 2302128225 | TS347              | NPN, driver      | 6190004470 |
| R555                          | 47kΩ, 0.33W       | 2302124735 | TS353              | NPN, output      | 6190102330 |
| S R556                        | 1.5Ω              | 2302681585 | TS354              | NPN, output      | 6190102330 |
| R557                          | 56kΩ, 0.33W       | 2302205635 | TS355              | NPN, output      | 6190102330 |
| R558                          | 47kΩ, potm        | 2291070006 | TS356              | NPN, driver      | 6104350002 |
| R559                          | 68kΩ, 0.33W       | 2302826835 | TS425              | NPN, driver      | 6105350003 |
| R562                          | 10MΩ, 0.33W       | 2302121065 | TS428              | NPN, output      | 6104400109 |
| R563                          | 4.7MΩ, 0.33W      | 2302124755 | TS436              | NPN, driver      | 6105000004 |
| S R564                        | 1.2Ω, 1W          | 2394051295 | TS447              | NPN, driver      | 6103700001 |
| R566                          | 1kΩ, 0.33W        | 2302861022 | TS448              | PNP, driver      | 6103720002 |
| R567                          | 47kΩ, potm        | 2291010048 | TS501              | NPN, driver      | 6104350002 |
| <b>Coils and transformers</b> |                   |            | TS502              | NPN, driver      | 6104350002 |
| S319                          | coil 6.8μH        | 3618136899 | TS521              | PNP, output      | 6190101480 |
| S T401                        | hor. drive transf | 3091000218 | TS524              | NPN, output      | 6103680002 |
| S T402                        | line outp. transf | 2290000032 | TS536              | PNP, driver      | 6190102320 |
| S427                          | coil 5μH          | 3618271774 | TS537              | PNP, driver      | 6190102320 |
| S432                          | linearity coil    | 3691150001 | TS538              | NPN, output      | 6104350002 |
| S434                          | coil 200μH        | 3618271770 | TS545              | PNP, driver      | 6103720002 |
| S436                          | coil 12mH         | 3618271771 | TS546              | NPN, output      | 6190005570 |
|                               |                   |            | TS551              | NPN, output      | 6105350003 |



9CM062/9CM082 REPLACEMENT PARTS LIST (Continued)

| Ref.                         | Description                    | Part. No.  | Ref.   | Description       | Part. No.  |
|------------------------------|--------------------------------|------------|--|-------------------|------------|
| <b>Integrated circuits</b>   |                                |            | <b>Resistors</b><br>(all are 5% metal film unless otherwise specified) |                   |            |
| IC102                        | Voltage stabilizer             | 6192140331 | R103   | 2.2Ω. 7W. 10%     | 2401440096 |
| IC301                        | RGB interface                  | 6123300516 | R104   | 10Ω. dual ptc     | 2302890465 |
| IC401                        | Exclusive OR                   | 6123300517 | R111   | 47kΩ. 0.33W       | 2302124735 |
| IC402                        | Multivibrator                  | 6123300426 | R112   | 47kΩ. 0.5W        | 2302124735 |
| IC403                        | Horizontal sync.               | 6123300518 | R113   | 3kΩ. 0.5W         | 2303223025 |
| IC501                        | Vertical sync.                 | 6123300423 | R114   | 1kΩ. potm         | 2204291267 |
| <b>PARTS OF POWER SUPPLY</b> |                                |            | R115   | 4.3kΩ. 0.5W       | 2392044325 |
| <b>Miscellaneous</b>         |                                |            | R116   | 4.3kΩ. 0.5W       | 2392044325 |
|                              | Power supply complete          | 7044251878 | R117   | 390Ω. 0.5W        | 2394163915 |
|                              | Power switch                   | 1606780548 | R119   | 9.1kΩ. 0.5W       | 2394049215 |
|                              | Power socket                   | 1813930250 | R121   | 110kΩ. 0.5W       | 2392041145 |
|                              | Connector 2 pole               | 1814521280 | R122   | 120Ω. 0.33W       | 2302121215 |
|                              | Connector 5 pole               | 1814521053 | R125   | 270Ω. 0.33W       | 2302122715 |
| S VL101                      | Fuse 3A/250V                   | 1813900214 | R126   | 18Ω. 0.33W        | 2392041895 |
|                              |                                |            | R127   | 3.9kΩ. 0.33W      | 2302123922 |
|                              |                                |            | R128   | 3.9kΩ. 0.33W      | 2302123922 |
|                              |                                |            | S R129   | 30Ω. 1W           | 2394053005 |
|                              |                                |            | R133   | 22kΩ. 5W          | 2302890472 |
|                              |                                |            | R136   | 18Ω. 0.5W         | 2392041895 |
|                              |                                |            | S R137   | 33Ω. 1W           | 2394053305 |
|                              |                                |            | R146   | 100kΩ. 0.5W       | 2394041045 |
|                              |                                |            | R152   | 1kΩ. 0.33W        | 2302861022 |
| <b>Capacitors</b>            |                                |            | <b>Coils and transformers</b>  |                   |            |
| S C102                       | 0.22μF. 20%. 250V. polyester   | 2602320841 | S T101   | mains transformer | 3091000269 |
| S C103                       | 0.0022μF. 125V. ceramic        | 2598230002 | S S102   | line choke ac     | 3693400009 |
| S C104                       | 0.0022μF. 125V. ceramic        | 2598230002 | S131   | coil 10μH         | 3618271360 |
| C106                         | 0.047μF. 20%. 400V. polyester  | 2509041325 | S136   | coil 2μH          | 5699000032 |
| C107                         | 0.0022μF. 10%. 1KV. ceramic    | 2509041035 | S141   | coil 180μH        | 3618271580 |
| C108                         | 0.0022μF. 10%. 1KV. ceramic    | 2509041035 | S142   | coil 180μH        | 3618271580 |
| C109                         | 0.0022μF. 10%. 1KV. ceramic    | 2509041035 | S143   | coil 100μH        | 3618271361 |
| C110                         | 0.0022μF. 10%. 1KV. ceramic    | 2509041035 | S144   | coil 100μH        | 3618271361 |
| C111                         | 0.22μF. 10%. 250V. polyester   | 2602320543 |  |                   |            |
| C112                         | 220μF. 200V. electrolytic      | 2701392220 |  |                   |            |
| C116                         | 47μF. 16V. electrolytic        | 2701741016 |  |                   |            |
| C117                         | 0.010μF. 20%. 50V. ceramic     | 2602320530 |  |                   |            |
| C122                         | 1μF. 50V. electrolytic         | 2701741015 |  |                   |            |
| C124                         | 0.013μF. 5%. 100V. polyester   | 2602320834 |  |                   |            |
| C129                         | 0.33μF. 10%. 63V. polyester    | 2508143349 |  |                   |            |
| C132                         | 0.0047μF. 10%. 630V. polyester | 2509040712 |  |                   |            |
| C133                         | 0.047μF. 20%. 400V. polyester  | 2509041325 |  |                   |            |
| C141                         | 220pF. 10%. 500V. ceramic      | 2602320546 |  |                   |            |
| C142                         | 220pF. 10%. 500V. ceramic      | 2602320546 |  |                   |            |
| C143                         | 220pF. 10%. 500V. ceramic      | 2602320546 |  |                   |            |
| C144                         | 220pF. 10%. 500V. ceramic      | 2602320546 |  |                   |            |
| C145                         | 47μF. 160V. electrolytic       | 2701741025 |  |                   |            |
| C146                         | 100μF. 100V. electrolytic      | 2791261017 |  |                   |            |
| C147                         | 470μF. 35V. electrolytic       | 2701741019 |  |                   |            |
| C148                         | 470μF. 25V. electrolytic       | 2701741018 |  |                   |            |
| C152                         | 0.022μF. 5%. 400V. polyester   | 2509582239 |  |                   |            |

9CM062/9CM082 REPLACEMENT PARTS LIST (Continued)

| Ref.                                       | Description                | Part. No.        | Ref.              | Description                        | Part. No.  |
|--|----------------------------|------------------|-------------------|------------------------------------|------------|
| <b>Diodes</b>                              |                            |                  | <b>Capacitors</b> |                                    |            |
| D107                                       | diode                      | 5302551001       | C701              | 0.010 $\mu$ F. 10%. 50V. ceramic   | 2508331038 |
| D108                                       | diode                      | 5302551001       | C702              | 47 $\mu$ F. 16V. electrolytic      | 2701741016 |
| D109                                       | diode                      | 5302551001       | C703              | 10 $\mu$ F. 160V. electrolytic     | 2796331000 |
| D110                                       | diode                      | 5302551001       | C705              | 0.010 $\mu$ F. 20%. 500V. ceramic  | 2509040919 |
| D111                                       | zener diode 24V            | 5302250240       | C706              | 10 $\mu$ F. 160V. electrolytic     | 2796331000 |
| D112                                       | diode                      | 5301811001       | C707              | 0.010 $\mu$ F. 20%. 500V. ceramic  | 2509040919 |
| D115                                       | zener diode 6.2V           | 5301570629       | C708              | 10 $\mu$ F. 160V. electrolytic     | 2796331000 |
| D121                                       | diode                      | 5301811001       | C709              | 0.010 $\mu$ F. 20%. 500V. ceramic  | 2509040919 |
| D125                                       | diode                      | 5301811001       | C711              | 10 $\mu$ F. 160V. electrolytic     | 2796331000 |
| D126                                       | diode                      | 5301811001       | C718              | 0.010 $\mu$ F. 20%. 500V. ceramic  | 2509040919 |
| D127                                       | diode                      | 5301811001       | C719              | 0.010 $\mu$ F. 20%. 500V. ceramic  | 2509040919 |
| D128                                       | zener diode 9.1V           | 5301990919       | C720              | 0.010 $\mu$ F. 20%. 500V. ceramic  | 2509040919 |
| D129                                       | zener diode 2.4V           | 5390140249       | C722              | 0.47 $\mu$ F. 10%. 100V. polyester | 2508144749 |
| D131                                       | diode                      | 5301811001       | C726              | 470pF. 10%. 500V. ceramic          | 2602320845 |
| D133                                       | diode                      | 5391500200       | C728              | 0.47 $\mu$ F. 20%. 100V. polyester | 2508144749 |
| D136                                       | diode                      | 5391500200       | C733              | 470pF. 10%. 500V. ceramic          | 2602320845 |
| D137                                       | diode                      | 5391500430       | C735              | 0.47 $\mu$ F. 20%. 100V. polyester | 2508144749 |
| D141                                       | diode                      | 5391500200       | C739              | 470pF. 10%. 500V. ceramic          | 2602320845 |
| D142                                       | diode                      | 5391500200       | C741              | 0.010 $\mu$ F. 20%. 500V. ceramic  | 2509040919 |
| D143                                       | diode                      | 5391500200       | C742              | 22 $\mu$ F. 160V. electrolytic     | 2790332207 |
| D144                                       | diode                      | 5391500200       | C743              | 0.0022 $\mu$ F. 10%. 500V. ceramic | 2598280004 |
| D152                                       | zener diode 16V            | 5390990690       | C744              | 0.0022 $\mu$ F. 10%. 500V. ceramic | 2598280004 |
| D165                                       | diode                      | 5301811001       | C745              | 0.0033 $\mu$ F. 500V. ceramic      | 2598280005 |
|  |                            |                  | C746              | 470pF. 10%. 2KV. ceramic           | 2602320547 |
|  |                            |                  | C751              | 39pF. 5%. 50V. ceramic             | 2509040928 |
|  |                            |                  | C752              | 39pF. 5%. 50V. ceramic             | 2509040928 |
|  |                            |                  | C753              | 39pF. 5%. 50V. ceramic             | 2509040928 |
| <b>Ref.</b>                                | <b>Description</b>         | <b>Part. No.</b> |                   |                                    |            |
| <b>Transistors and Integrated Circuits</b> |                            |                  |                   |                                    |            |
| IC101                                      | Photo coupler              | 5392900120       |                   |                                    |            |
| TS117                                      | NPN. error latch           | 6105000004       |                   |                                    |            |
| TS121                                      | NPN. pulse width regulator | 6190004040       |                   |                                    |            |
| TS132                                      | NPN. switch                | 6190005560       |                   |                                    |            |
| TS152                                      | Thyristor                  | 6191400010       |                   |                                    |            |

**PARTS OF PICTURE TUBE PANEL**

| Ref.                 | Description                 | Part. No.  |
|----------------------|-----------------------------|------------|
| <b>Miscellaneous</b> |                             |            |
|                      | Picture tube panel complete | 7092500210 |
|                      | Connector 1 pole            | 1814521279 |
|                      | Micro connector 8 pole      | 1814521282 |
|                      | Connector 6 pole            | 1814521281 |
|                      | CRT socket                  | 5490400043 |
|                      | Connector 1 pole            | 1814521445 |
| S SG701              | spark gap                   | 1895000003 |
| S SG702              | spark gap                   | 1895000003 |
| S SG703              | spark gap                   | 1895000003 |

## 9CM062/9CM082 REPLACEMENT PARTS LIST (Continued)

| Ref.   | Description | Part. No.  | Ref.               | Description        | Part. No.        |
|--|-------------|------------|--------------------|--------------------|------------------|
| <b>Resistors</b>                                   |             |            | <b>Coils</b>       |                    |                  |
| (all are 5% metal film unless otherwise specified) |             |            |                    |                    |                  |
| R701   | 680Ω. 0.33W | 2302126815 | S706               | coil 2.2μH         | 3618272028       |
| S R702   | 2.2Ω        | 2302682285 | S711               | coil 2.2μH         | 3618272028       |
| S R703   | 2.2Ω        | 2302682285 | S715               | coil 2.2μH         | 3618272028       |
| S R704   | 2.2Ω        | 2302682285 | S742               | coil 7.5μH         | 3290000013       |
| S R705   | 1kΩ. 3W     | 2394071025 |                    |                    |                  |
| R707   | 10Ω. 0.2W   | 2394011005 |                    |                    |                  |
| R708   | 33Ω. 0.2W   | 2392043305 |                    |                    |                  |
| S R709   | 1kΩ. 3W     | 2394071025 | <b>Ref.</b>        | <b>Description</b> | <b>Part. No.</b> |
| R712   | 10Ω. 0.2W   | 2394011005 | <b>Diodes</b>      |                    |                  |
| R713   | 33Ω. 0.2W   | 2392043305 | D701               | zener diode 8.2V   | 5302390245       |
| S R714   | 1kΩ. 3W     | 2394071025 | D706               | diode              | 5301811001       |
| R716   | 10Ω. 0.2W   | 2394011005 | D708               | diode              | 5301711002       |
| R717   | 43Ω. 0.2W   | 2394024305 | D709               | diode              | 5301711002       |
| R722   | 220Ω. 0.5W  | 2394042215 | D711               | diode              | 5301811001       |
| R723   | 330kΩ. 0.2W | 2302123342 | D715               | diode              | 5301811001       |
| R724   | 100kΩ. 0.2W | 2394041045 | D722               | diode              | 5302681002       |
| R725   | 22kΩ. 0.2W  | 2394042235 | D723               | diode              | 5302681002       |
| R726   | 100kΩ. potm | 2204291272 | D728               | diode              | 5302681002       |
| R727   | 300kΩ. 0.2W | 2302123042 | D729               | diode              | 5302681002       |
| R728   | 220Ω. 0.5W  | 2394042215 | D735               | diode              | 5302681002       |
| R729   | 330kΩ. 0.2W | 2302123342 | D736               | diode              | 5302681002       |
| R731   | 100kΩ. 0.2W | 2394041045 | D742               | diode              | 5302681002       |
| R732   | 22kΩ. 0.2W  | 2394042235 |                    |                    |                  |
| R733   | 100kΩ. potm | 2204291272 | <b>Ref.</b>        | <b>Description</b> | <b>Part. No.</b> |
| R734   | 300kΩ. 0.2W | 2302123042 | <b>Transistors</b> |                    |                  |
| R735   | 220Ω. 0.5W  | 2394042215 | TS705              | NPN, output        | 6104150001       |
| R736   | 330kΩ. 0.2W | 2302123342 | TS706              | PNP, output        | 5302390241       |
| R737   | 100kΩ. 0.2W | 2394041045 | TS707              | PNP, driver        | 5302390253       |
| R738   | 22kΩ. 0.2W  | 2394042235 | TS709              | NPN, output        | 6104150001       |
| R739   | 100kΩ. potm | 2204291272 | TS711              | PNP, output        | 5302390241       |
| R741   | 300kΩ. 0.2W | 2302123042 | TS712              | PNP, driver        | 5302390253       |
| R742   | 1.5kΩ. 0.5W | 2394041525 | TS714              | NPN, output        | 6104150001       |
| R743   | 15kΩ. 0.5W  | 2394041535 | TS715              | PNP, output        | 5302390241       |
| R751   | 8.2Ω. 0.5W  | 2392048295 | TS716              | PNP, driver        | 5302390253       |
| R752   | 8.2Ω. 0.5W  | 2392048295 | TS722              | PNP, driver        | 5302390241       |
| R753   | 8.2Ω. 0.5W  | 2392048295 | TS735              | PNP, driver        | 5302390241       |

**WARNING**

Critical components having special safety characteristics are identified with an S by the Ref. No. in the parts list and enclosed within a broken line\* along with the safety symbol ▲ on the schematics or exploded views.

Use of substitute replacement parts which do not have the same specified safety characteristics may create shock, fire, or other hazards.

Under no circumstances should the original design be modified or altered without written permission from the N.A.P. Consumer Electronics Corp. NAPCEC assumes no liability, express or implied, arising out of any unauthorized modification of design. Servicer assumes all liability.

\*Broken line: — . — . — . — .

# NAPCEC SAFETY GUIDELINES FOR THE PROFESSIONAL SERVICE TECHNICIAN

## Safety Checks

After the original service problem has been corrected, a complete safety check should be made. Be sure to check over the entire set, not just the areas where you have worked. Some previous servicer may have left an unsafe condition, which could be unknowingly passed on to your customer. Be sure to check all of the following:

## Fire and Shock Hazard

1. Be sure all components are positioned in such a way as to avoid the possibility of adjacent component shorts. This is especially important on those chassis which are transported to and from the service shop.
2. Never release a repaired receiver unless all protective devices such as insulators, barriers, covers, strain reliefs, and other hardware have been installed according to the original design.
3. Soldering and wiring must be inspected to locate possible cold solder joints, solder splashes, sharp solder points, frayed leads, pinched leads, or damaged insulation (including ac cord). Be certain to remove loose solder balls and all other loose foreign particles.
4. Check across-the-line components and other components for physical evidence of damage or deterioration and replace if necessary. Follow original layout, lead length and dress.
5. No lead or component should touch a receiving tube or a resistor rated at 1 watt or more. Lead tension around protruding metal surfaces or edges must be avoided.
6. Critical components having special safety characteristics are identified with an S by the Ref. No. in the parts list and enclosed within a broken line\* along with the safety symbol ▲ on the schematics. Replacement parts without the same safety characteristics may create shock, fire or other hazards.
7. When servicing any receiver, always use a separate isolation transformer for the chassis. Failure to use a separate isolation transformer may expose you to possible shock hazard, and may cause damage to servicing instruments.
8. Many receivers use a polarized line cord (one wide pin on the plug). Defeating this safety device may create a potential hazard to the servicer and the user. Extension cords which do not incorporate the polarizing feature should never be used.
9. After re-assembly of the set, always perform an ac leakage test or resistance test from the line cord to all exposed metal parts of the cabinet. Also, check all metal control shafts (with knobs removed), antenna terminals, handles, screws, etc. to be sure the set is safe to operate without danger of electrical shock.

\*Broken line: — . — . — . — .

## Implosion

1. All picture tubes used in current model receivers are equipped with an integral implosion system. Care should always be used, and safety glasses worn, whenever handling any picture tube. Avoid scratching or otherwise damaging the picture tube during installation.
2. Use only replacement tubes as specified by the manufacturer.

## X-radiation

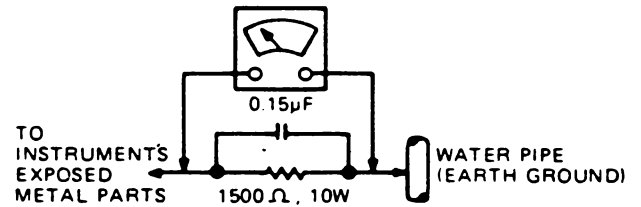
1. Be sure procedures and instructions to all your service personnel cover the subject of X-radiation. Potential sources of X-rays in TV receivers are the picture tube and the high voltage circuits. The basic precaution which must be exercised is to keep the HV at the factory recommended level.
2. To avoid possible exposure to X-radiation and electrical shock, only the manufacturer's specified anode connectors must be used.
3. It is essential that the service technician has available at all times an accurate HV meter. The calibration of this meter should be checked periodically against a reference standard.
4. When the HV circuitry is operating properly there is no possibility of an X-radiation problem. High voltage should always be kept at the manufacturer's rated value—no higher—for optimum performance. Every time a color set is serviced, the brightness should be run up and down while monitoring the HV with a meter to be certain that the HV does not exceed the

specified value and that it is regulated correctly. We suggest that you and your service technicians review test procedures so that HV and HV regulation are always checked as a standard servicing procedure, and the reason for this prudent routine be clearly understood by everyone. It is important to use an accurate and reliable HV meter. It is recommended that the HV reading be recorded on each customers' invoice, which will demonstrate a proper concern for the customers' safety.

5. When troubleshooting and making test measurements in a receiver with a problem of excessive high voltage, reduce the line voltage by means of a Variac to bring the HV into acceptable limits while troubleshooting. Do not operate the chassis longer than necessary to locate the cause of the excessive HV.
6. New type picture tubes are specifically designed to withstand higher operating voltages without creating undesirable X-radiation. It is strongly recommended that any shop test fixture which is to be used with the new higher voltage chassis be equipped with one of the new type tubes designed for this service. Addition of a permanently connected HV meter to the shop test fixture is advisable. The CRT types used in these new sets should never be replaced with any other types, as this may result in excessive X-radiation.
7. It is essential to use the specified picture tube to avoid a possible X-radiation problem.
8. Most TV receivers contain some type of emergency "Hold Down" circuit to prevent HV from rising to excessive levels in the presence of a failure mode. These various circuits should be understood by all technicians servicing them, especially since many hold down circuits are inoperative as long as the receiver performs normally.

#### Leakage Current Cold Check

1. Unplug the ac line cord and connect a jumper between the two prongs of the plug.
2. Turn on the power switch.
3. Measure the resistance value between the jumpered ac plug and all exposed cabinet parts of the receiver, such as screw heads, antennas and control shafts. When the exposed metallic part has a return path to the chassis, the reading should be between 1 megohm and 5.2 megohms. When the exposed metal does not have a return path to the chassis, the reading must be infinity. Remove the jumper from the ac line cord.



#### Leakage Current Hot Check

1. Do not use an isolation transformer for this test. Plug the completely re-assembled receiver directly into the ac outlet.
2. Connect a 1.5k ohm, 10 watt resistor paralleled by a 0.15uF. capacitor between each exposed metallic cabinet part and a good earth ground such as a water pipe, as shown above.
3. Use an ac voltmeter with at least 5000 ohms/volt sensitivity to measure the potential across the resistor.
4. The potential at any point should not exceed 0.75 volts. A leakage current tester may be used to make this test; leakage current must not exceed 0.5 milliamps. If a measurement is outside the limits specified, there is a possibility of shock hazard. The receiver should be repaired and re-checked before returning it to the customer.
5. Repeat the above procedure with the ac plug reversed. (Note: An ac adapter is necessary when a polarized plug is used. Do not defeat the polarizing feature of the plug.)

#### Picture Tube Replacement

The primary source of X-radiation in this television is the picture tube. The picture tube utilized in this chassis is specially constructed to limit X-radiation emissions. For continued X-radiation protection, the replacement tube must be the same type as the original, including suffix letter, or an N.A.P. Consumer Electronics Corp. (NAPCEC) approved type.

#### Parts Replacement

Many electrical and mechanical parts in NAPCEC television sets have special safety-related characteristics. These characteristics are often not evident from visual inspection nor can the protection afforded by them necessarily be obtained by using replacement components rated for higher voltage, wattage, etc. The use of a substitute part which does not have the same safety characteristics as the NAPCEC recommended replacement part shown in this service manual may create shock, fire or other hazards.



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