Produced By:

Commodore International Spare Parts GmbH
Braunschweig, West Germany

SERVICE MANUAL

1930
VGA COLOR MONITOR

AUGUST, 1990 **PN-314255-01**

INTERNATIONAL EDITION

COMMODORE "INTERNATIONAL EDITION" SERVICE MANUALS CONTAIN PART NUMBER INFORMATION WHICH MAY VARY ACCORDING TO COUNTRY. SOME PARTS MAY NOT BE AVAILABLE IN ALL COUNTRIES.

Commodore Business Machines, Inc.
1200 Wilson Drive, West Chester, Pennsylvania 19380 U.S.A.

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

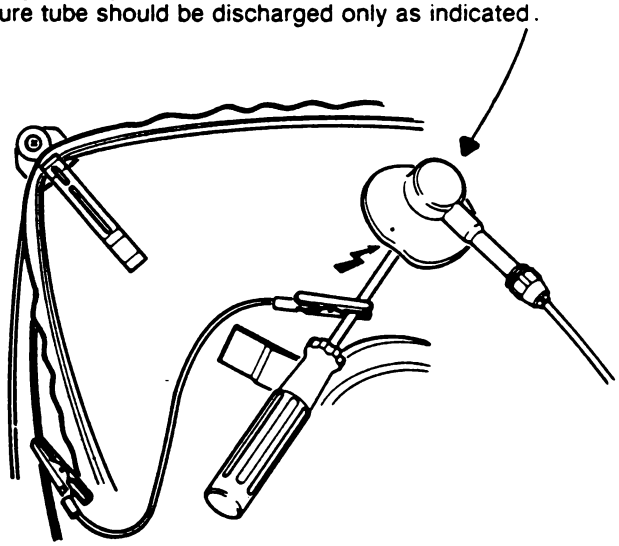
Many electrical and mechanical parts in NAPCEC monitors have special safety-related characteristics. These characteristics are often not evident from visual inspection nor can the protection afforded by them necessarily be obtained by using replacement components rated for higher voltage, wattage, etc. 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

ESD

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)

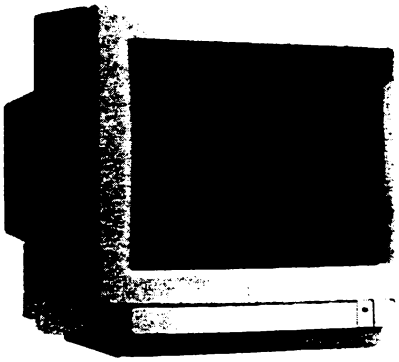
INPUT SIGNAL CONNECTOR
15 PIN "D" SHELL CONNECTOR

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

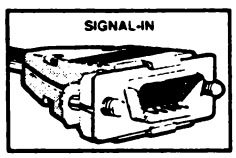


Ref.	Description	Part. No.
	Front Cabinet	1492150171
	Rear Cabinet	1492160058
	Push Button On/Off	1494200366
	Cover for Controls	1491320305
	Pad (Table Protectors)	4495200003
	Lock for Cover	1491410003
	Adjust Rod	1191000039
	Slider Chassis	1493030033
	Pedestal	1491080019
	Holder Line Input Transformer	1491070126
S	Mains Cord	4692020069
S	Picture Tube (9CM082)	M34JPS77X69
S	Picture Tube (9CM062)	M34JPM70X69
	Customer Inst. Book (9CM082)	IB53790001
	Customer Inst. Book (9CM062)	IB55180001
	Foot Pedestal (9CM082)	1491080019
	Foot Pedestal (9CM062)	1491030024
	Degaussing Coil	3691300012

CUSTOMER ADJUSTMENT

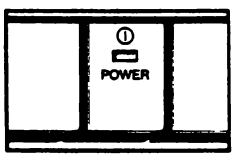
1. Connection

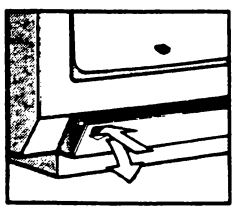
Connecting the monitor to the computer. The monitor is fitted with a 15-pin D-shell connector.



2. Adjustments and controls

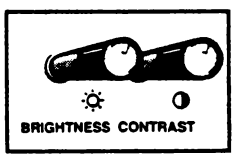
a. Power on/off switch SK 1 (LED lights up)





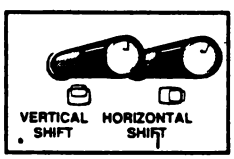
b. Contrast can be adjusted with control ◐ (R322)

c. Brightness can be adjusted with control ☼ (R558)



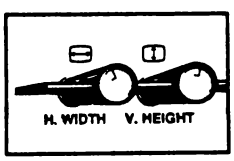
d. The image may be positioned horizontally with control ⧈ (R408)

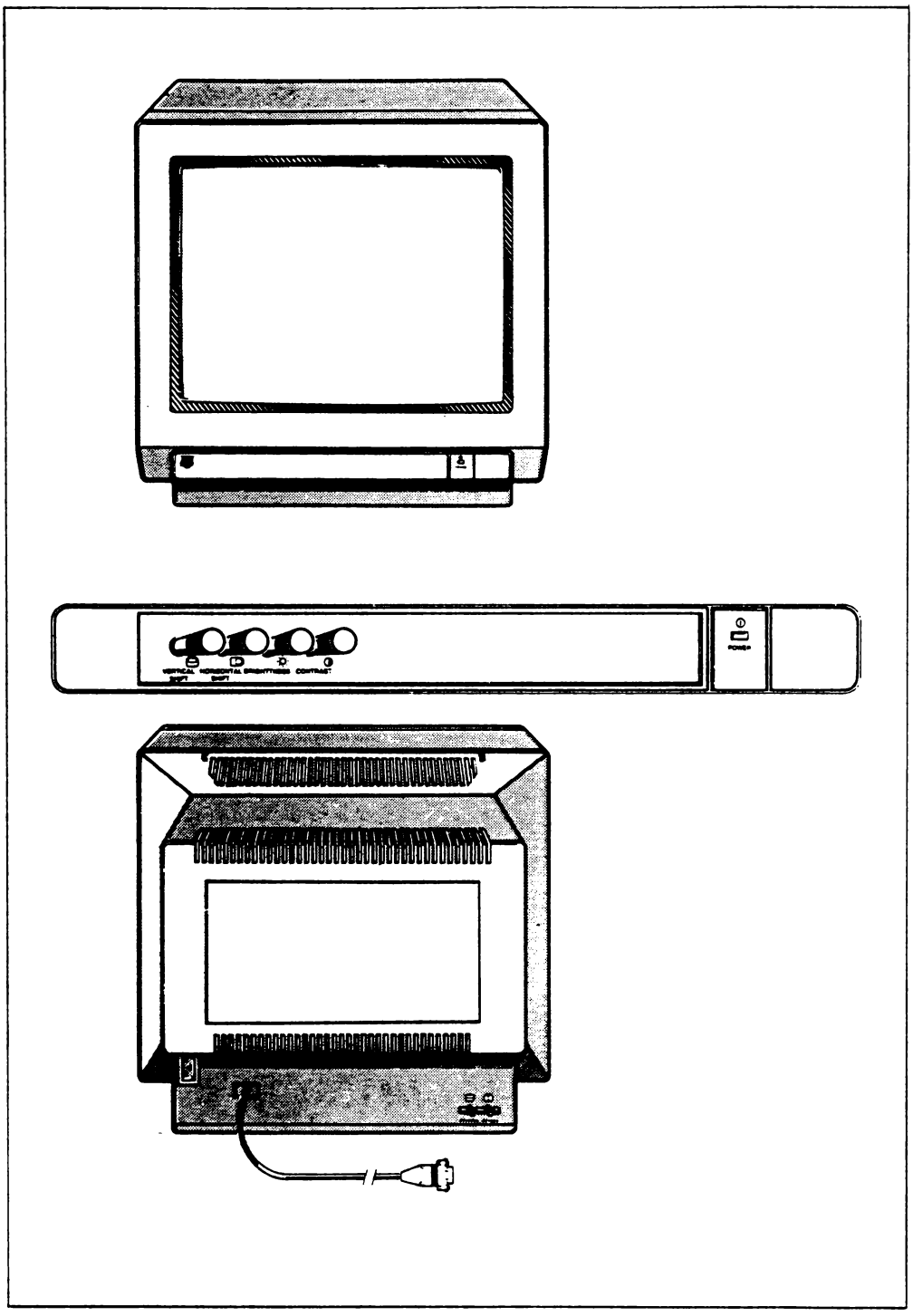
e. The image may be positioned vertically with control ⧈ (R524)



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

g. The image width can be ajusted 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 Purtiy 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.

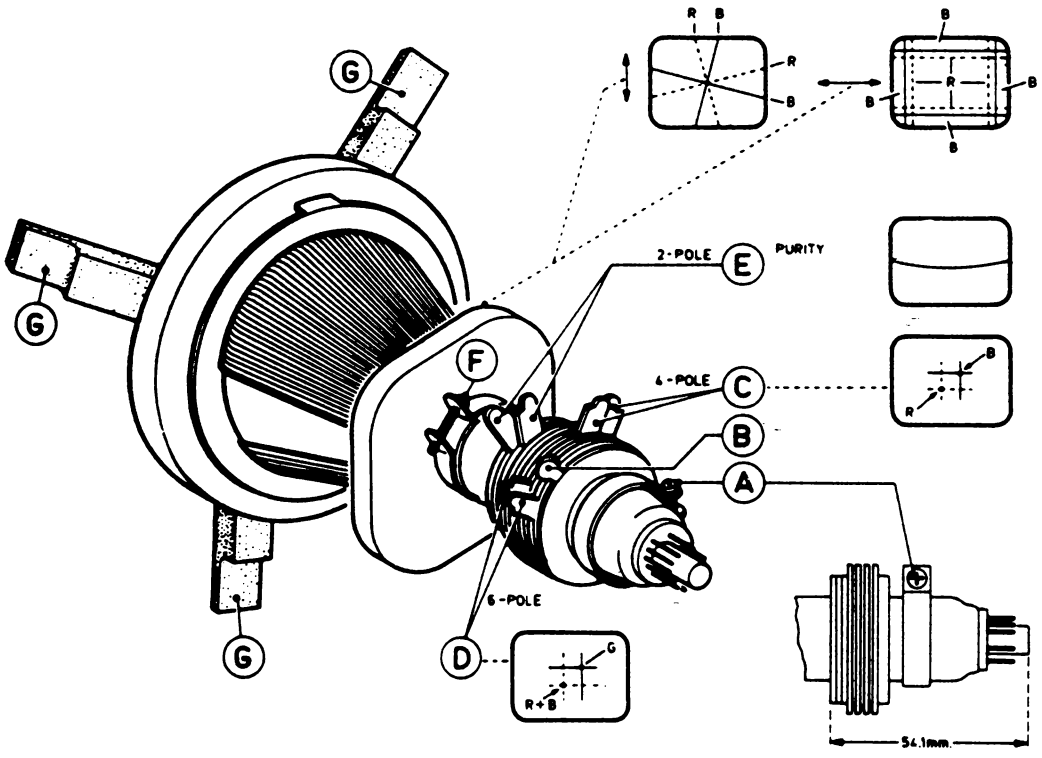


Fig. 1

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 magnectic 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.

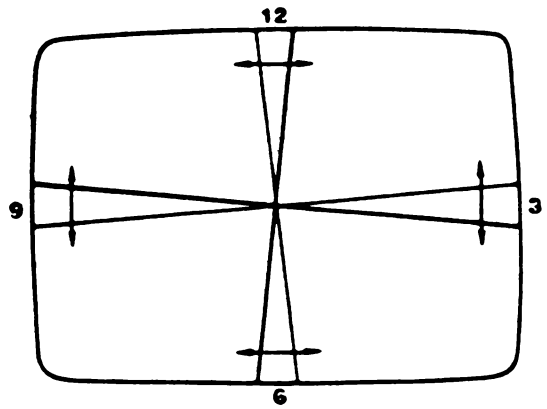


Figure 2 - Tilt yoke up or down to converge Red and Blue vertical lines at 6 and 12 o'clock positions, and Red and Blue horizontal lines at 3 and 9 o'clock positions.

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 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.

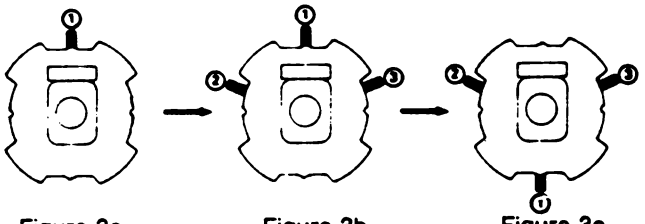


Figure 3a Figure 3b Figure 3c

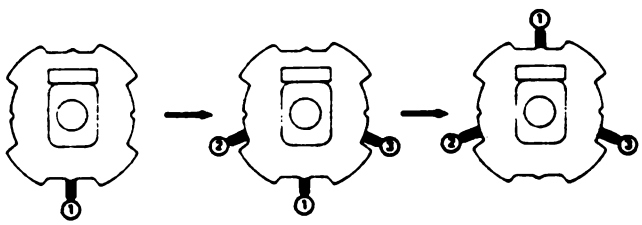


Figure 4a Figure 4b Figure 4c

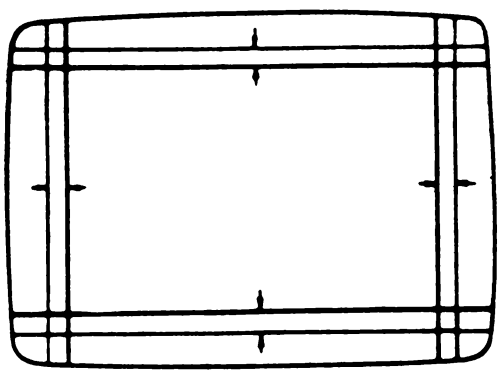
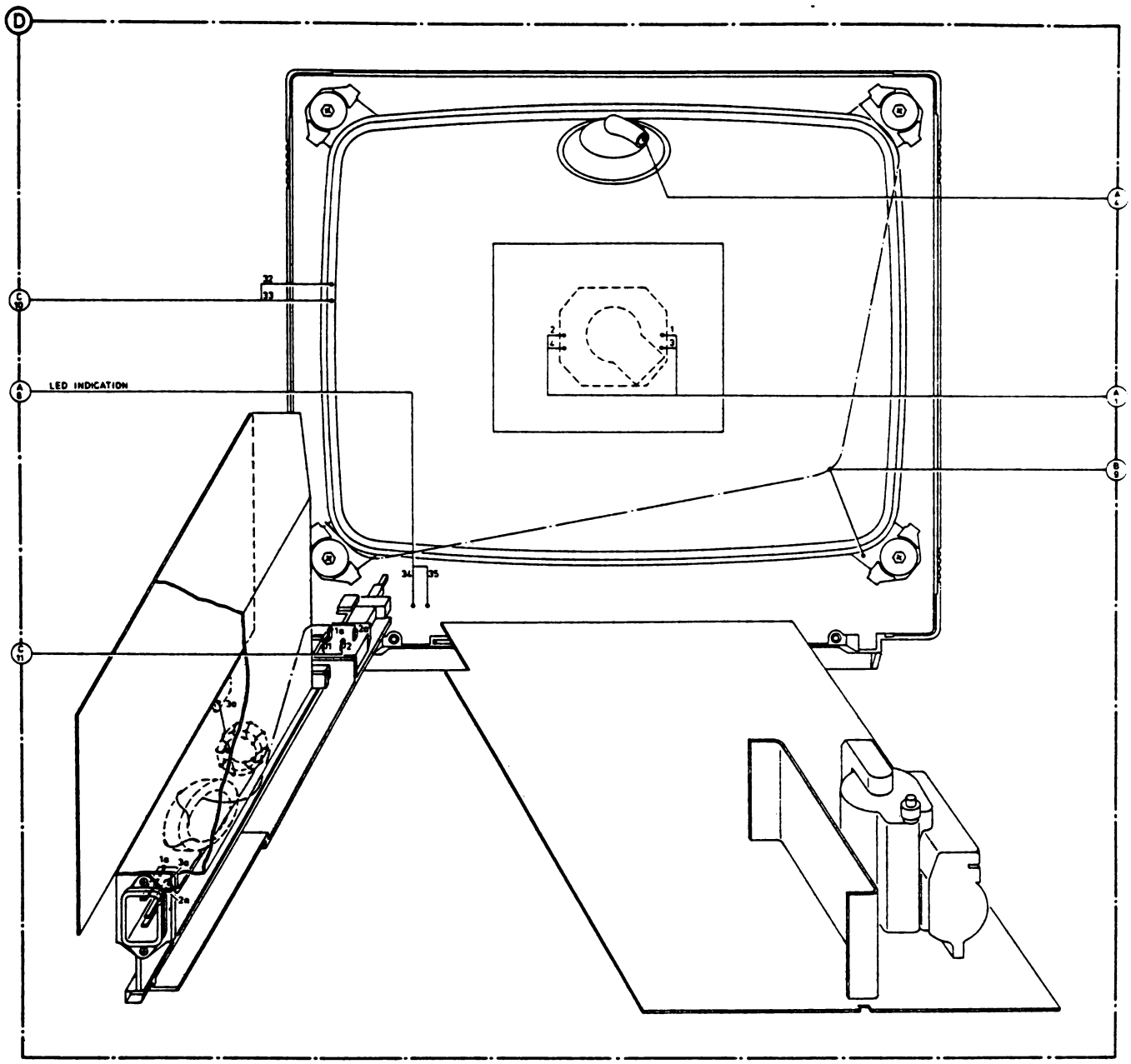


Figure 5 - Tilt yoke left to right to converge Red and Blue horizontal lines at the 6 and 12 positions, and Red and Blue vertical lines at 3 and 9 o'clock positions.

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 lincorporated 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 (μ), nanofarads (n) and picofarads (p). (0.001μ=1μ=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.

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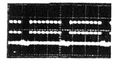
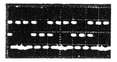
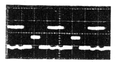
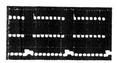
*Broken line: — • — • — • — •

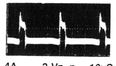
WAVEFORMS

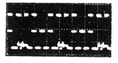

1. .6 Vp-p 10uS


2. .6 Vp-p 10uS


3. .7 Vp-p 10uS


4. 1 Vp-p 10uS


4A. .3 Vp-p 10uS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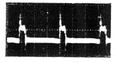
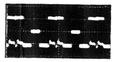
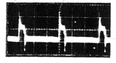
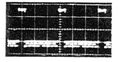
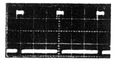

5A. .3 Vp-p 10uS

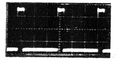

6. 1.2 Vp-p 10uS

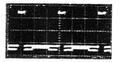

6A. .4 Vp-p 10uS

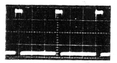

7. 4.8 Vp-p 10uS

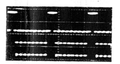

7A. 4.2 Vp-p 10uS

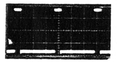

8. 4.8 Vp-p 10uS

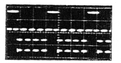

8A. 4.2 Vp-p 10uS


9. 4.8 Vp-p 10uS

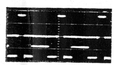

9A. 4.4 Vp-p 10uS

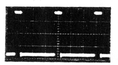

10. 28 Vp-p 10uS

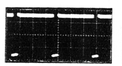

10A. 38 Vp-p 10uS


11. 28 Vp-p 10uS

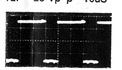

11A. 38 Vp-p 10uS

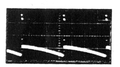

12. 25 Vp-p 10uS

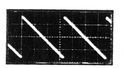

12A. 38 Vp-p 10uS

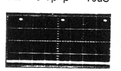

13. 5 Vp-p 10uS


14. 5 Vp-p 10uS


15. 4 Vp-p 10uS

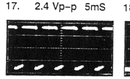

16. 48 Vp-p 5mS

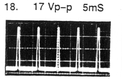

17. 2.4 Vp-p 5mS

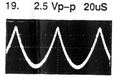

18. 17 Vp-p 5mS

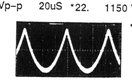

19. 2.5 Vp-p 20uS


20. 5 Vp-p 20uS

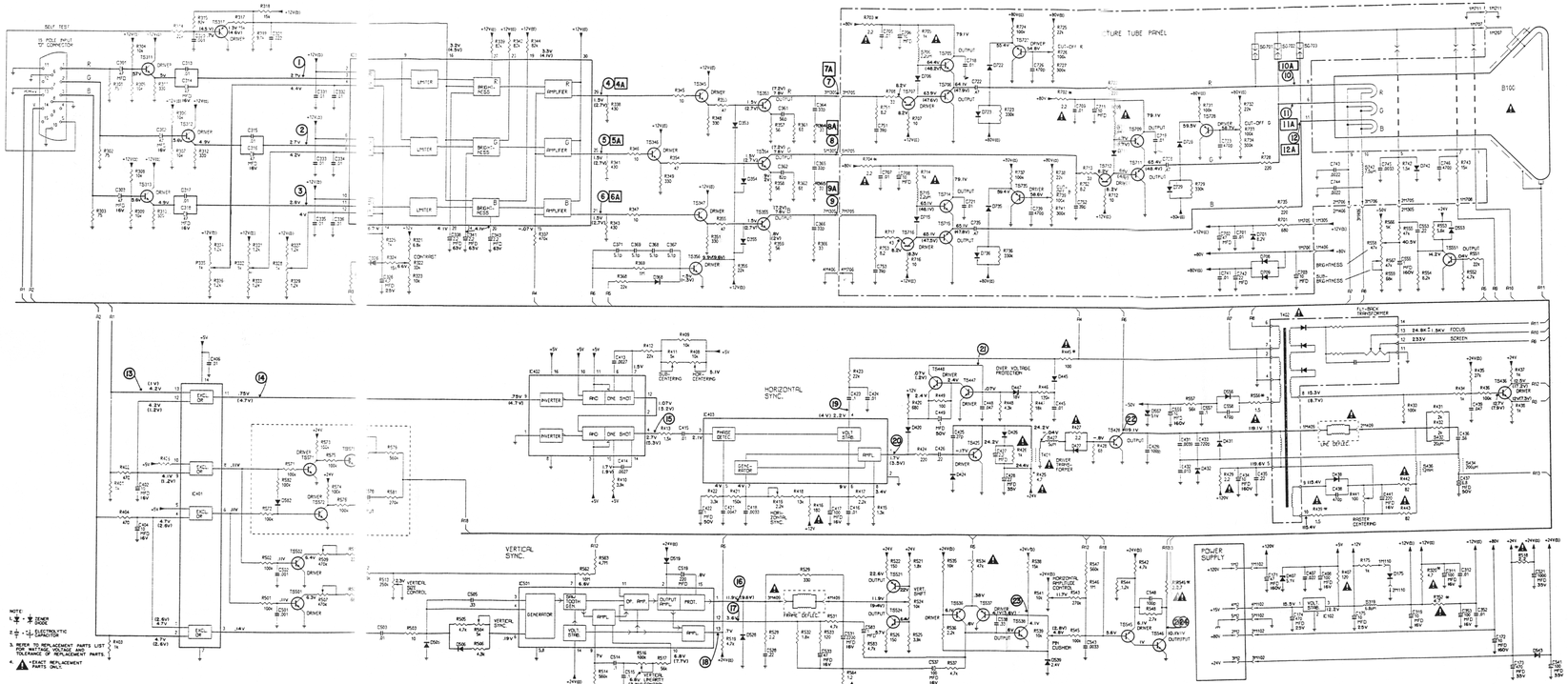

21. 5 Vp-p 20uS

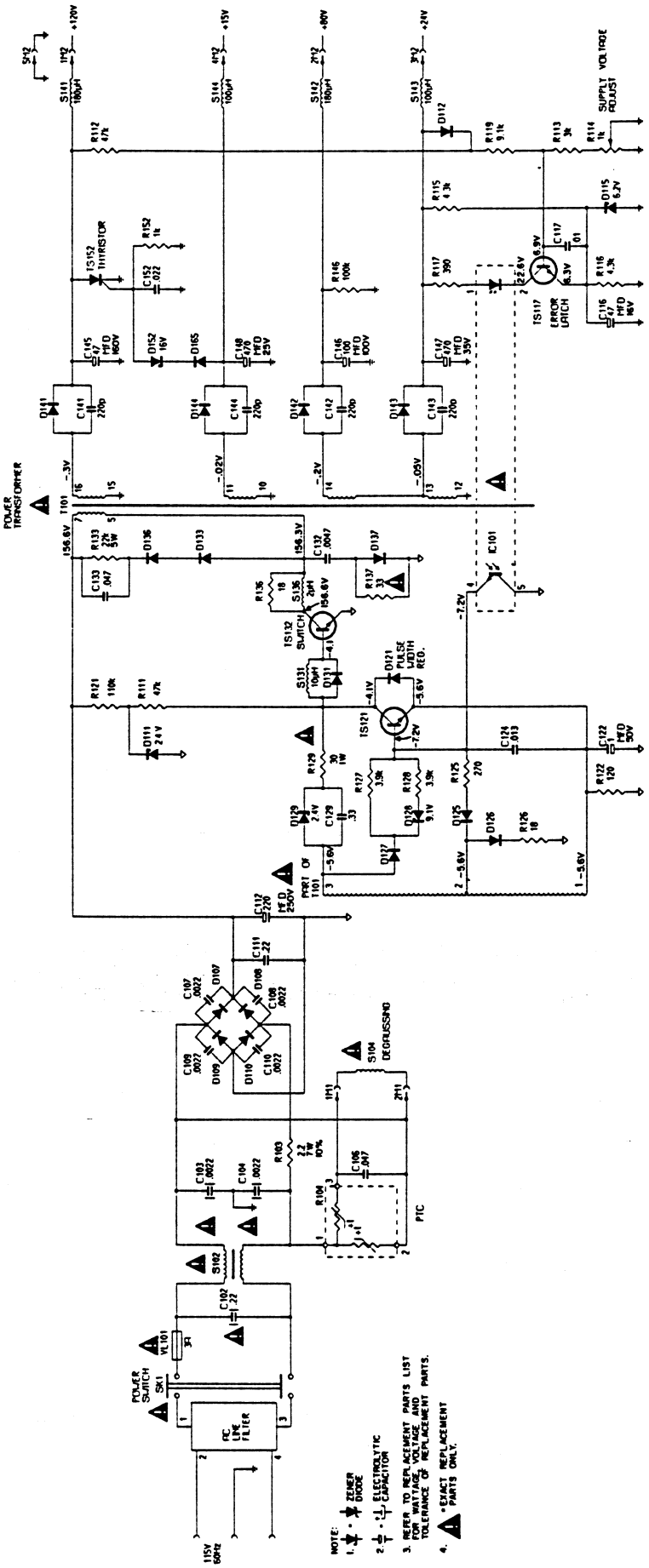

*22. 1150 Vp-p 20uS


23. 3.5 Vp-p 5mS


24. 4 Vp-p 5mS

* Indicates need for high voltage probe

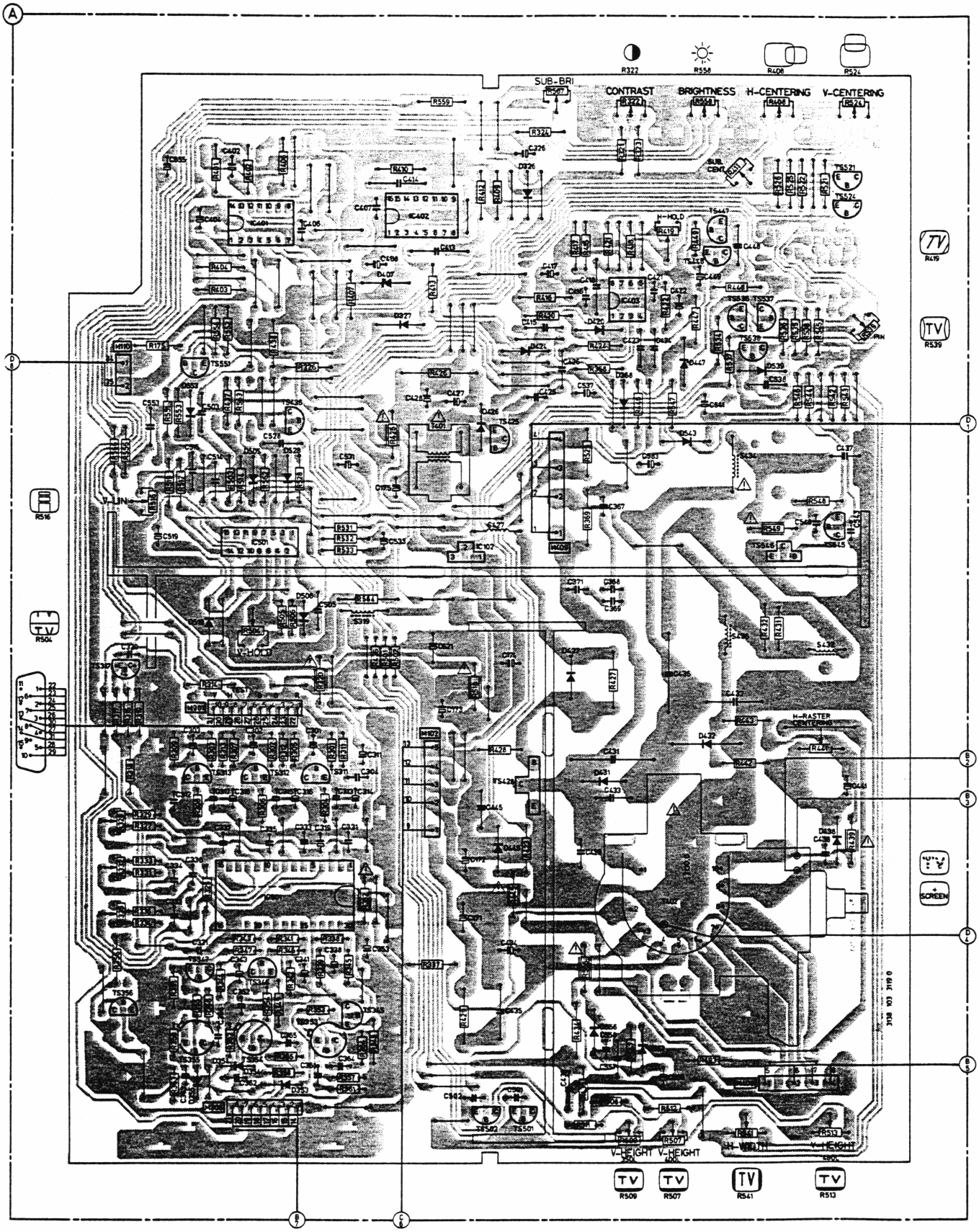




POWER SUPPLY SCHEMATIC DIAGRAM

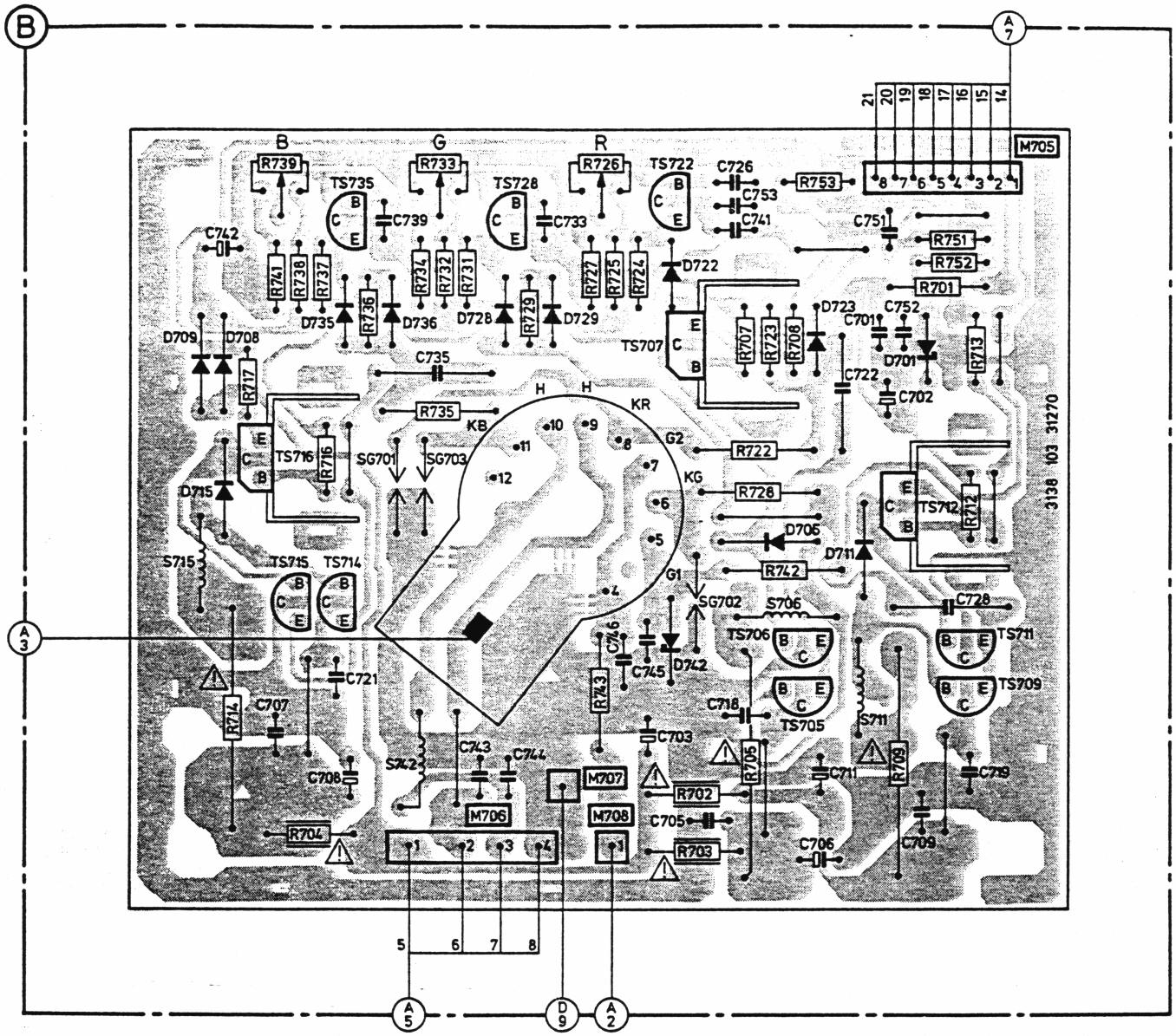
MAIN P.C. BOARD

(viewed from the component side)



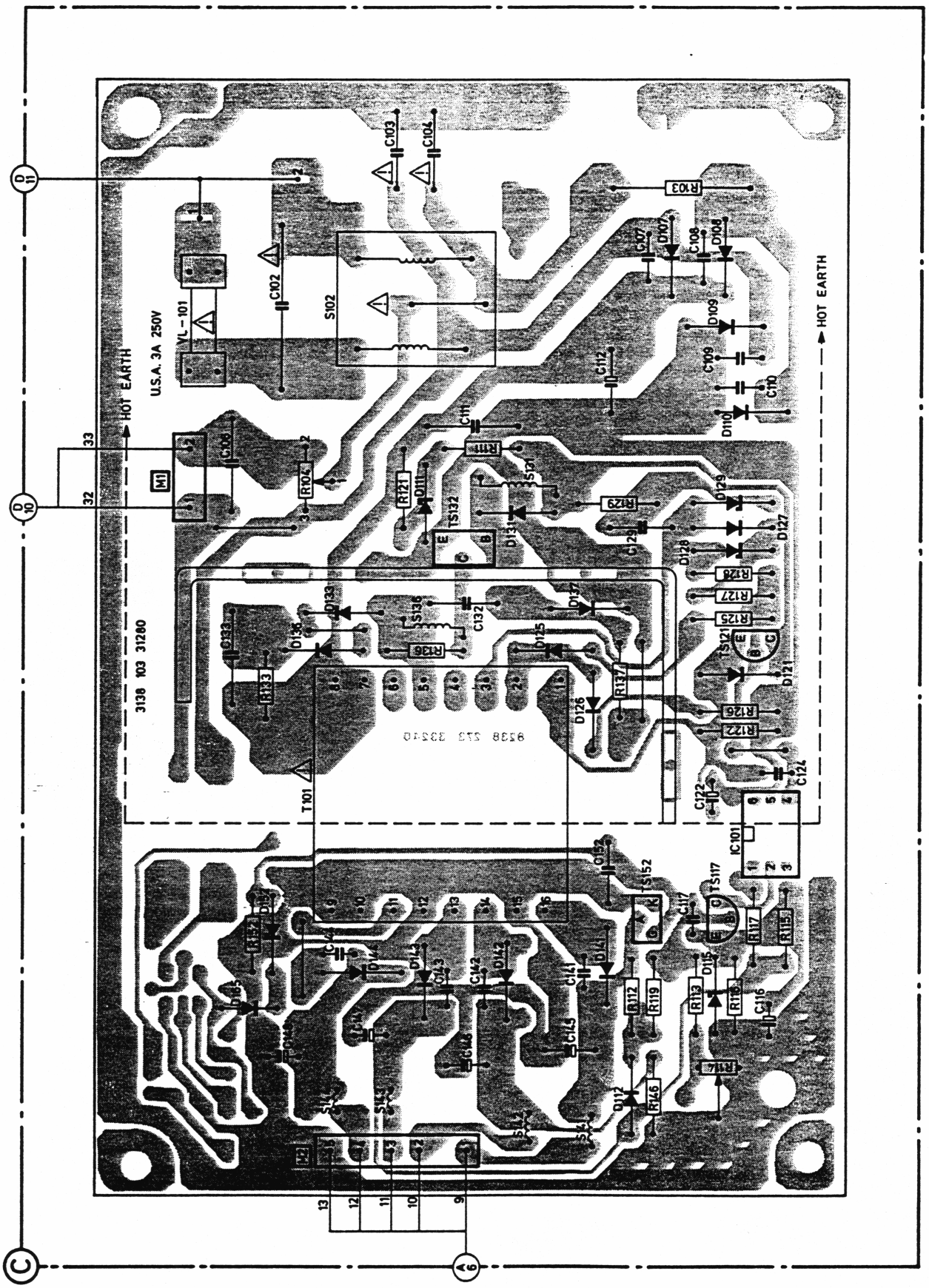
PICTURE TUBE P.C. BOARD

(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.
	Connector 2 pole	4613990296
D175	LED green	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	Part. No.
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, elelctrolytic	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.
Resistors		
(All are 5%, 0.2W metal film unless otherwise specified)		
R175	1kΩ, 0.33W	2302861022
R301	75Ω	2394027505
R302	75Ω	2394027505
R303	75Ω	2394027505
R304	10kΩ	2394011035
R305	10kΩ	2394011035
R306	10kΩ	2394011035
R307	10kΩ	2394011035
R308	10kΩ	2394011035
R309	10kΩ	2394011035
R311	330Ω	2302123315
R312	330Ω	2302123315
R313	330Ω	2302123315
R314	22kΩ, 0.33W	2302822235
R315	82kΩ, 0.33W	2394038235
R317	15kΩ, 0.33W	2302821535
R318	15kΩ, 0.33W	2302821535
R319	9.1kΩ, 0.33W	2394049125
S R320	4.7Ω	2302684785
R321	6.8kΩ, 0.33W	2302126825
R322	10kΩ, potm	2291070004
R323	10kΩ, 0.33W	2302821035
R324	15kΩ, 0.33W	2302821535
R325	1kΩ, 0.33W	2302861022
R326	15kΩ, 0.33W	2302821535
R327	1.2kΩ	2302041225
R328	1kΩ, potm	2204291267
R329	1.2kΩ	2392041225
R331	1.2kΩ	2392041225
R332	1kΩ, potm	2204291267
R333	1.2kΩ	2392041225
R334	1.2kΩ	2392041225
R335	1kΩ, potm	2204291267
R336	1.2kΩ	2392041225
R337	470kΩ, 0.33W	2302124745
R338	430Ω	2394024315
R339	82kΩ	2394028235
R341	430Ω	2394024315
R342	82kΩ	2394028235
R343	430Ω	2394024315
R344	82kΩ	2394028235
R345	10Ω	2394011005
R346	10Ω	2394011005
R347	10Ω	2394011005
R348	330Ω, 0.33W	2303203315
R349	330Ω, 0.33W	2303203315
R351	330Ω, 0.33W	2303203315
S R352	4.7Ω	2302684785
R353	47Ω	2392044705
R354	47Ω	2392044705
R355	47Ω	2392044705
R356	22kΩ, 0.33W	2302822235
R357	56Ω	2394045605
R358	56Ω	2394045605
R359	56Ω	2394045605
R361	68Ω	2394026805
R362	68Ω	2394026805
R364	33Ω	2392043305
R365	33Ω	2392043305
R366	33Ω	2392043305
R368	22kΩ, 0 33W	2302822235
R369	1MΩ, 0.5W, 5%	2394041055
R401	1kΩ, 0.33W	2302861022
R402	470Ω, 0.33W	2302124715
R403	1kΩ, 0.33W	2302861022
R404	470Ω, 0.33W	2302124715
R406	1kΩ, 0.33W	2302861022
R407	120Ω, 1W, 5%	2394051215
R408	10kΩ, potm	2291070003
R409	10kΩ, 0.33W	2302821035
R410	3.9kΩ, 0.33W	2302123922
R411	5kΩ, potm	2204291273
R412	22kΩ, 1%	2390990028
R413	1.5kΩ, 0.33W	2302890466
R415	1.3kΩ, 0.33W	2394041325
S R416	180Ω, 2W, 5%	2394061815
R417	2.2kΩ, 0.33W	2302122225
R418	13kΩ, 0.33W	2394031335
R419	2.2kΩ, potm	2204692222
R420	680Ω, 0.33W	2302126815
R421	150kΩ, 0.33W	2394041545
R422	3.3kΩ, 0.33W	2302823325
R423	22kΩ, 0.33W	2302822235
R424	220Ω, 0.33W	2394262215
S R425	4.7Ω	2302684785
S R426	1kΩ, 2W, 5%	2394061025
S R427	2.2Ω, 5W, 5%	2499090002
R428	68Ω, 0.5W	2302126805
S R429	2.2Ω, 5W, 5%	2499090002
R431	2kΩ, 0.5W	2302122025
R432	2kΩ, 0.5W	2302122025
R433	100kΩ, 0.33W	2394041045
R434	1kΩ, 0.5W	2394041025
R435	27kΩ, 0.33W	2302122735
R436	100kΩ, 0.33W	2394041045
R347	1kΩ, 0.33W	2302861022
R348	1kΩ, 0.33W	2302861022
S R439	1.5Ω	2302681585
R441	100Ω, potm	2291070002
S R442	82Ω, 1W	2392058205
S R443	82Ω, 1W	2392058205
S R445	100Ω	2302681015
R446	120kΩ, 1%	2390990029
R447	18kΩ, 1%	2390990030
R448	4.3kΩ, 1%	2390990031
R449	100Ω	2302121015
R501	100kΩ, 0.33W	2394041045
R502	100kΩ, 0.33W	2394041045
R503	10Ω, 0.33W	2303201005
R504	5kΩ, potm	2203874722
R505	4.7kΩ	2394044795
R506	4.3kΩ	2394024325
R507	470kΩ, potm	2204291268
R508	680kΩ	2394026845
R509	470kΩ, potm	2204291268
S R511	220kΩ	2302861273
R512	150kΩ, 0.33W	2394041545
R513	250kΩ, potm	2291010104
R514	560kΩ, 0.33W	2302125645
R516	100kΩ, potm	2204291269

9CM062/9CM082 REPLACEMENT PARTS LIST (Continued)

Ref.	Description	Part. No.
Resistors (continued)		
R517	56kΩ, 0.33W	2303205635
S R518	2.2Ω	2302682285
R519	4.7kΩ, 0.33W	2302124725
R521	1.8kΩ, 0.33W	2302121825
R522	150Ω, 1W	2302931515
R524	10kΩ, potm	2291070003
R525	3.9kΩ, 0.33W	2302123922
R526	150Ω, 1W	2302931515
R528	2.2Ω, 0.33W	2392042295
R529	330Ω, 0.5W	2303203315
R531	4.7kΩ, 0.33W	2302124725
R532	1.8kΩ, 0.33W	2302121825
R533	120Ω, 0.33W	2302121215
S R534	47kΩ, 0.33W	2302124735
R535	10kΩ, 0.33W	2302821035
R536	2.2kΩ, 0.33W	2302122225
R537	4.7kΩ, 0.33W	2302124725
R538	15kΩ, 0.33W	2302821535
R539	10kΩ, potm	2204291270
R541	10kΩ, potm	2291010086

Ref.	Description	Part. No.
Resistors		
R542	4.7kΩ, 0.33W	2302124725
R543	270kΩ, 0.33W	2394032745
R544	1.2kΩ, 0.33W	2302121225
R545	100kΩ, 0.33W	2394041045
R546	1MΩ, 0.33W	2394041055
R547	560kΩ, 0.33W	2302125645
R548	2.7kΩ, 0.33W	2302822725
S R549	2.7Ω	2302890464
R551	22kΩ, 0.33W	2302822235
R552	4.7kΩ, 0.33W	2302124725
R553	5.6kΩ, 0.5W	2302225625
R554	8.2kΩ, 0.5W	2302128225
R555	47kΩ, 0.33W	2302124735
S R556	1.5Ω	2302681585
R557	56kΩ, 0.33W	2302205635
R558	47kΩ, potm	2291070006
R559	68kΩ, 0.33W	2302826835
R562	10MΩ, 0.33W	2302121065
R563	4.7MΩ, 0.33W	2302124755
S R564	1.2Ω, 1W	2394051295
R566	1kΩ, 0.33W	2302861022
R567	47kΩ, potm	2291010048

Ref.	Description	Part. No.
Coils and transformers		
S319	coil 6.8µH	3618136899
S T401	hor. drive transf	3091000218
S T402	line outp. transf	2290000032
S427	coil 5µH	3618271774
S432	linearity coil	3691150001
S434	coil 200µH	3618271770
S436	coil 12mH	3618271771

Ref.	Description	Part. No.
Diodes		
D326	diode	5301811001
D327	diode	5301811001
D353	diode	5301811001
D354	diode	5301811001
D355	diode	5301811001
D368	diode	5301811001
D407	zener diode 5.1V	5302390242
D424	diode	5301811001
D426	diode	5301711002
D427	diode	5391500200
D431	diode	5302261002
D432	diode	5302390244
D438	diode	5391510050
D445	diode	5302681002
D447	zener diode 18V	5302250180
D505	diode	5301811001
D506	diode	5301811001
D519	diode	5301711002
D528	diode	5301711002
D534	diode	5301711002
D539	zener diode 2.4V	5390140249
D553	diode	5301711002
D554	diode	5302681002
D556	diode	5391500450
D557	zener diode 51V	5390255109

Ref.	Description	Part. No.
Transistors		
TS311	NPN, driver	6103700001
TS312	NPN, driver	6103700001
TS313	NPN, driver	6103700001
TS317	PNP, driver	6103720002
TS345	NPN, driver	6190004470
TS346	NPN, driver	6190004470
TS347	NPN, driver	6190004470
TS353	NPN, output	6190102330
TS354	NPN, output	6190102330
TS355	NPN, output	6190102330
TS356	NPN, driver	6104350002
TS425	NPN, driver	6105350003
TS428	NPN, output	6104400109
TS436	NPN, driver	6105000004
TS447	NPN, driver	6103700001
TS448	PNP, driver	6103720002
TS501	NPN, driver	6104350002
TS502	NPN, driver	6104350002
TS521	PNP, output	6190101480
TS524	NPN, output	6103680002
TS536	PNP, driver	6190102320
TS537	PNP, driver	6190102320
TS538	NPN, output	6104350002
TS545	PNP, driver	6103720002
TS546	NPN, output	6190005570
TS551	NPN, output	6105350003

9CM062/9CM082 REPLACEMENT PARTS LIST (Continued)

Ref.	Description	Part. No.
Integrated circuits		
IC102	Voltage stabilizer	6192140331
IC301	RGB interface	6123300516
IC401	Exclusive OR	6123300517
IC402	Multivibrator	6123300426
IC403	Horizontal sync.	6123300518
IC501	Vertical sync.	6123300423

PARTS OF POWER SUPPLY

Ref.	Description	Part. No.
Miscellaneous		
	Power supply complete	7044251878
	Power switch	1606780548
	Power socket	1813930250
	Connector 2 pole	1814521280
	Connector 5 pole	1814521053
S VL101	Fuse 3A/250V	1813900214

Ref.	Description	Part. No.
Capacitors		
S C102	0.22µF. 20%. 250V. polyester	2602320841
S C103	0.0022µF. 125V. ceramic	2598230002
S C104	0.0022µF. 125V. ceramic	2598230002
C106	0.047µF. 20%. 400V. polyester	2509041325
C107	0.0022µF. 10%. 1KV. ceramic	2509041035
C108	0.0022µF. 10%. 1KV. ceramic	2509041035
C109	0.0022µF. 10%. 1KV. ceramic	2509041035
C110	0.0022µF. 10%. 1KV. ceramic	2509041035
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

Ref.	Description	Part. No.
Resistors		
(all are 5% metal film unless otherwise specified)		
R103	2.2Ω. 7W. 10%	2401440096
R104	10Ω. dual ptc	2302890465
R111	47kΩ. 0.33W	2302124735
R112	47kΩ. 0.5W	2302124735
R113	3kΩ. 0.5W	2303223025
R114	1kΩ. potm	2204291267
R115	4.3kΩ. 0.5W	2392044325
R116	4.3kΩ. 0.5W	2392044325
R117	390Ω. 0.5W	2394163915
R119	9.1kΩ. 0.5W	2394049215
R121	110kΩ. 0.5W	2392041145
R122	120Ω. 0.33W	2302121215
R125	270Ω. 0.33W	2302122715
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

Ref.	Description	Part. No.
Coils and transformers		
S T101	mains transformer	3091000269
S S102	line choke ac	3693400009
S131	coil 10µH	3618271360
S136	coil 2µH	5699000032
S141	coil 180µH	3618271580
S142	coil 180µH	3618271580
S143	coil 100µH	3618271361
S144	coil 100µH	3618271361

9CM062/9CM082 REPLACEMENT PARTS LIST (Continued)

Ref.	Description	Part. No.
Diodes		
D107	diode	5302551001
D108	diode	5302551001
D109	diode	5302551001
D110	diode	5302551001
D111	zener diode 24V	5302250240
D112	diode	5301811001
D115	zener diode 6.2V	5301570629
D121	diode	5301811001
D125	diode	5301811001
D126	diode	5301811001
D127	diode	5301811001
D128	zener diode 9.1V	5301990919
D129	zener diode 2.4V	5390140249
D131	diode	5301811001
D133	diode	5391500200
D136	diode	5391500200
D137	diode	5391500430
D141	diode	5391500200
D142	diode	5391500200
D143	diode	5391500200
D144	diode	5391500200
D152	zener diode 16V	5390990690
D165	diode	5301811001

Ref.	Description	Part. No.
Transistors and Integrated Circuits		
IC101	Photo coupler	5392900120
TS117	NPN. error latch	6105000004
TS121	NPN. pulse width regulator	6190004040
TS132	NPN. switch	6190005560
TS152	Thyristor	6191400010

Ref.	Description	Part. No.
Capacitors		
C701	0.010μF. 10%. 50V. ceramic	2508331038
C702	47μF. 16V. electrolytic	2701741016
C703	10μF. 160V. electrolytic	2796331000
C705	0.010μF. 20%. 500V. ceramic	2509040919
C706	10μF. 160V. electrolytic	2796331000
C707	0.010μF. 20%. 500V. ceramic	2509040919
C708	10μF. 160V. electrolytic	2796331000
C709	0.010μF. 20%. 500V. ceramic	2509040919
C711	10μF. 160V. electrolytic	2796331000
C718	0.010μF. 20%. 500V. ceramic	2509040919
C719	0.010μF. 20%. 500V. ceramic	2509040919
C720	0.010μF. 20%. 500V. ceramic	2509040919
C722	0.47μF. 10%. 100V. polyester	2508144749
C726	470pF. 10%. 500V. ceramic	2602320845
C728	0.47μF. 20%. 100V. polyester	2508144749
C733	470pF. 10%. 500V. ceramic	2602320845
C735	0.47μF. 20%. 100V. polyester	2508144749
C739	470pF. 10%. 500V. ceramic	2602320845
C741	0.010μF. 20%. 500V. ceramic	2509040919
C742	22μF. 160V. electrolytic	2790332207
C743	0.0022μF. 10%. 500V. ceramic	2598280004
C744	0.0022μF. 10%. 500V. ceramic	2598280004
C745	0.0033μF. 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

PARTS OF PICTURE TUBE PANEL

Ref.	Description	Part. No.
Miscellaneous		
	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.
	Resistors (all are 5% metal film unless otherwise specified)	
R701	680Ω, 0.33W	2302126815
S R702	2.2Ω	2302682285
S R703	2.2Ω	2302682285
S R704	2.2Ω	2302682285
S R705	1kΩ, 3W	2394071025
R707	10Ω, 0.2W	2394011005
R708	33Ω, 0.2W	2392043305
S R709	1kΩ, 3W	2394071025
R712	10Ω, 0.2W	2394011005
R713	33Ω, 0.2W	2392043305
S R714	1kΩ, 3W	2394071025
R716	10Ω, 0.2W	2394011005
R717	43Ω, 0.2W	2394024305
R722	220Ω, 0.5W	2394042215
R723	330kΩ, 0.2W	2302123342
R724	100kΩ, 0.2W	2394041045
R725	22kΩ, 0.2W	2394042235
R726	100kΩ, potm	2204291272
R727	300kΩ, 0.2W	2302123042
R728	220Ω, 0.5W	2394042215
R729	330kΩ, 0.2W	2302123342
R731	100kΩ, 0.2W	2394041045
R732	22kΩ, 0.2W	2394042235
R733	100kΩ, potm	2204291272
R734	300kΩ, 0.2W	2302123042
R735	220Ω, 0.5W	2394042215
R736	330kΩ, 0.2W	2302123342
R737	100kΩ, 0.2W	2394041045
R738	22kΩ, 0.2W	2394042235
R739	100kΩ, potm	2204291272
R741	300kΩ, 0.2W	2302123042
R742	1.5kΩ, 0.5W	2394041525
R743	15kΩ, 0.5W	2394041535
R751	8.2Ω, 0.5W	2392048295
R752	8.2Ω, 0.5W	2392048295
R753	8.2Ω, 0.5W	2392048295

Ref.	Description	Part. No.
	Coils	
S706	coil 2.2μH	3618272028
S711	coil 2.2μH	3618272028
S715	coil 2.2μH	3618272028
S742	coil 7.5μH	3290000013

Ref.	Description	Part. No.
	Diodes	
D701	zener diode 8.2V	5302390245
D706	diode	5301811001
D708	diode	5301711002
D709	diode	5301711002
D711	diode	5301811001
D715	diode	5301811001
D722	diode	5302681002
D723	diode	5302681002
D728	diode	5302681002
D729	diode	5302681002
D735	diode	5302681002
D736	diode	5302681002
D742	diode	5302681002

Ref.	Description	Part. No.
	Transistors	
TS705	NPN, output	6104150001
TS706	PNP, output	5302390241
TS707	PNP, driver	5302390253
TS709	NPN, output	6104150001
TS711	PNP, output	5302390241
TS712	PNP, driver	5302390253
TS714	NPN, output	6104150001
TS715	PNP, output	5302390241
TS716	PNP, driver	5302390253
TS722	PNP, driver	5302390241
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 as 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

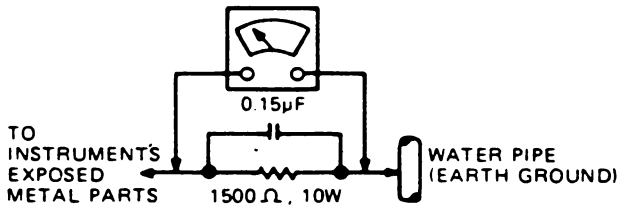
1. Be sure procedures and instructions to all your service personnel cover the subject of X-radiation. Potential sources of X-rays in TV receivers are the picture tube and the high voltage circuits. The basic precaution which must be exercised is to keep the HV at the factory recommended level.
2. To 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.