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SERVICE INFORMATION

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SUBJECT: PICTURE TUBE FAILURE DIAGNOSIS

SYMPTOMS: The following symptoms are covered in this bulletin. Refer to the appropriate paragraph for details on the verifying a defective tube.

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|-------------------------|------------------------------|
| 1. No Output | 8. Afterglow |
| 2. No Output of One Gun | 9. Purity |
| 3. High Brightness | 10. Yoke Buzz |
| 4. Low Brightness | 11. Yoke Tilt |
| 5. Poor Focus | 12. Moire |
| 6. Picture Tube Arcing | 13. "Halo" at Top of Picture |
| 7. Preglow | 14. Blocked Aperture |

- 1. NO OUTPUT**--The first thing to check for a no output condition is the filament or heaters. Normally, a visual inspection of the neck of the tube will indicate if the heaters are operating correctly. The heaters will glow if they are operating. If the heaters do not glow, verify that the heater voltage is present. If the voltage is present, verify continuity in the heater element. Other things to check which could cause a no output symptom include a mis-adjusted screen control, no screen voltage, and malfunctions in the blanking or CRT drive circuits. (Problems in blanking or CRT drive will normally give a "slick" raster, that is, the tube will be lit but the face will be black or just slightly above black. Adjusting the screen control would cause the face of the tube to become brighter, even though there is no video information present).
- 2. NO OUTPUT OF ONE GUN**--Before replacing the picture tube for this symptom, check for the presence of a video signal at the driver circuit of the missing color. Vary the bias and drive settings to ensure the tube is defective.
- 3. HIGH BRIGHTNESS** — This symptom can be caused by a leakage path between two electrodes within the tube. If only one color is affected, likely possibilities are heater to cathode or cathode to G1 leakage. If all three colors are affected, G2 to G3 leakage is a possibility. On some CTC169 chassis, diodes were placed on the CRT socket board. The diodes are CR5003, CR5004 and CR5005. If one of the diodes shorts, the symptom is high brightness with retrace lines for the one color with the shorted diode. For example, high red with retrace lines could be caused by a shorted CR5003. If the diode is found to be shorted, *remove all three*. They are not required and are no longer used in production.
- 4. LOW BRIGHTNESS**--This symptom could be caused by a short from G1 to G2 in the tube or an open circuit within the tube between a contact pin and an electrode. A poorly seated tube socket or poor pinto-socket continuity due to an accidental coating of RTV or any other substance on the pin could cause the same symptom. If surface contamination is seen on a pin, it can be removed by *gentle* scraping. Check the setting of the master screen control and level of the luminance signal before replacing the CRT.

5. **POOR FOCUS**--Poor focus could be the result of a bad tube, or a defect in the focus circuit. If the focus control can be adjusted and the best focus is at either end of the adjustment range, verify the focus voltage before replacing the tube. On instruments with dynamic focus, check the dynamic focus waveform. There have been some cases where the resistor (R1) in the CTC169 chassis dynamic focus circuit opens. The resulting symptom is poor corner focus, or poor overall focus.

6. **PICTURE TUBE ARCING**--A picture tube arc is an electrostatic discharge occurring inside the picture tube and are commonly experienced during early operation of a new television set. Arcs are typically caused by minute particles within the tube that exist in normal production. These particles dislodge during shipment and may cause an arc within the first few hours of operation. The occurrence of these arcs diminishes quickly as the set continues to play. Many sets will never experience an arc while others of the same model may experience several.

Picture tube arcs are common with new tubes from all TV manufacturers. While the chassis is designed to tolerate these electrostatic discharges, a major concern is microcontroller lock-up. If this occurs, control of operation is lost because the micro becomes "confused" and/or memory contents are altered. To correct lock-up, the set must remain unplugged for several minutes to clear the problem. To minimize the probability of a microcontroller lock-up, and the inconvenience to the customer of having to unplug the set, the chassis is designed to perform a restart function when an arc occurs. The reset circuit momentarily powers down the set after an arc.

A tube that continues to arc after the first three to four weeks of operation may need to be replaced. Sometimes tapping on the neck of the tube will cause the tube to arc, and may eventually clear the problem. A tube that continues to arc may eventually cause the set to shutdown and not turn back on. To verify that the tube is the problem, disconnect the CRT socket board and turn the set on. If the set comes on and runs, the tube is probably bad. If the set continues to shut down, the tube is usually not the problem.

7. **PREGLOW**--Preglow is defined as a faint horizontal line that appears across the center of the screen at turn on. The line is present for approximately three seconds, and the television operates normally when the picture appears.

In order to provide optimum degaussing, the vertical scan is delayed for a few seconds at turn on. This concentrates any small amount of stray emission into a line that is not visible at full scan. This condition will not deteriorate with life, and in most cases will improve.

This condition is quite normal and should not be regarded as a defect that requires corrective action. The condition has no effect on the performance or reliability of the picture tube. Picture tubes exhibiting this phenomenon are **not eligible for warranty consideration**.

8. **AFTERGLOW**--Afterglow is a condition where some portion of the screen remains lit for a period of time (typically five to fifteen minutes) after the instrument has been turned off. This condition is most noticeable under subdued lighting conditions.

The duration of the "afterglow" depends on the high voltage bleedoff rate at the second anode of the picture tube. The bleedoff rate is dependent on several factors:

- The internal leakage of the picture tube. The bleedoff rate tends to be slower in a low leakage tube.

Hence a *better* than nominal tube (leakage-wise) may be more prone to exhibiting "afterglow".

- To some extent on picture tube setup (bias and drive adjustments).

- The brightness/contrast control settings at turn off--The high voltage bleedoff will be faster with higher beam current (higher brightness and contrast settings).

This condition is quite normal and should not be regarded as a defect that requires corrective action. The condition has no effect on the performance or reliability of the picture tube. Picture tubes exhibiting this phenomenon are **not eligible for warranty consideration**.

9. PURITY--Impurities in all TCE color picture tubes fall into two basic categories, static and dynamic.

Static (or constant)--Some specific area of the screen is constantly impure. It does not change in size or location on the screen as the scene changes. There are several possible causes of static impurity. Some examples are:

- The magnetic environment the receiver is located in. High magnetic fields in close proximity to the receiver such as Hi-Fi speaker systems, electrical appliances, metal building beams, steam radiators, etc. can cause picture tube impurities.
- Improper or inadequate degaussing of the receiver.
- Improper setup of the receiver—either in production or after picture tube/yoke replacement.

Solution of Static Impurities A purity error may have been induced by exposure to an external magnetic surge of sufficient intensity to cause internal tube parts to become magnetized beyond the level that can be corrected by the internal degaussing system. Thoroughly degaussing the tube with an external degaussing coil will correct this condition. Confirm the internal degaussing circuit is operational. Make sure there are no environmental causes for the purity problem, such as the placement of loudspeakers, etc. If a corner purity problem still exists, order a stock number 176912 magnet kit. The kit contains four magnets and a quantity of fiberglass tape. The magnets are marked on one end to indicate polarity.

Purity problems are most apparent when viewing a flat red field. The magnets are placed with the adhesive side towards the tube funnel. The magnets should be placed on the tube diagonal towards the corner displaying the impurity. The adjustment range is between three to five inches from the yoke housing. The correction force increases as the magnet is moved closer to the yoke. If the magnet makes the impurity worse, rotate the magnet 180 degrees and try again. Do not use more than two magnets at any one location, and *use the tape to secure the magnets*. Magnets not secured with tape can fall off in time and contact live parts, causing a safety hazard. The use of the purity magnets can affect corner convergence and geometry. Make sure that no convergence problems were created by adding the purity magnets. The receiver must be completely degaussed after adding the magnets to see the true effect.

Static purity problems can also be caused by a tube with a loose shadow mask. If the impure area moves when the tube is tapped, the shadow mask may be the problem. If the impure area does not move or change color, the shadow mask can be eliminated as a possible cause.

Dynamic (or varying)—Impurities come and go in the viewing area and are related to scene content. Scenes which contain areas of peak white content (high beam current) can cause slight, temporary warping of the shadow mask in that area (sometimes referred to as “doming” or “blistering” in the service fraternity). A few seconds after the scene changes the mask returns to its normal configuration and the impurity is gone.

At first observation, these impurities could be misinterpreted as being caused by a defective picture tube resulting in needless replacement of the tube. **It the impurity (doming) is acceptable when the customer contrast control is reduced to a normal or adequate contrast level, the tube should be considered good.**

PURITY PROBLEMS ON 35" MODELS All 35" models have a field correction circuit. The circuit is referred to as purity correction in some models and as rotation in other models. The difference is in the magnetic shield of the picture tube. On sets with an external magnetic shield, the circuit is referred to as the purity correction circuit, and on sets with an internal magnetic shield, the circuit is referred to as the rotation circuit. In either case, the circuit will affect both the purity and raster rotation. On sets with an external magnetic shield, the circuit has a greater effect on purity, while on sets with an internal magnetic shield, the circuit has less effect on purity and a greater effect on the picture rotation.

The following adjustments should be made whenever complaints of purity problems or picture tilt are received on a 35" model.

1. Make sure the STRENGTH switch is in the OFF position. NOTE: If the STRENGTH switch was not in the OFF position, turn the TV off for approximately two minutes and then turn it back on again. If the discoloration is still there, continue to the next step.
2. Move the STRENGTH switch to the LOW position. If this improves the discoloration/tilt but does not eliminate it, move the STRENGTH switch to the HIGH position. This should correct the situation. If moving the STRENGTH switch makes the discoloration/tilt worse, proceed to the next step.
3. Change the position of the POLARITY switch. If this improves the discoloration but does not eliminate it, move the STRENGTH switch to the HIGH position. This should correct the situation.

It may be necessary to reset the POLARITY and STRENGTH switches if the TV is moved or repositioned in the room, especially if the TV will be facing a different direction.

- 10. YOKE BUZZ**—A mechanical buzz may be coming from the yoke. To confirm, collapse vertical scan by obtaining a service line. Refer to the appropriate TCE Service Data for the proper procedure to obtain the service line. If the buzz stops, the yoke is the most likely cause of the noise.

Various styles of yokes are used and can exhibit this symptom. In all cases the problem is eliminated by using hot melt glue on any point on the yoke where there is metal to plastic contact. It may be necessary to force the glue into any gaps between the metal and plastic frame to eliminate the buzz. On some versions of the yoke, some metal components (such as the corner shunts) may be covered by tape. Locate the four spring steel "corner shunts" on the yoke. The shunts are located at the front plastic portion of the yoke at 10, 2, 4, and 8 o'clock positions. They may be covered by gray cloth tape. Do not attempt to remove the corner shunts.

1. If present, remove and discard the tape covering the corner shunts.
2. Place the instrument on its face, being careful not to scratch the cabinet or the face of the tube.
3. Cover the corner shunts and surrounding plastic with hot melt glue. Be sure to use hot melt glue that is rated for electronic applications. Glue of this type is available from electronic supply stores. Force the glue into any noticeable air gaps between the spring steel corner shunts and the plastic they are mounted on.

Note: RTV compound is not recommended for the repair since the compound remains pliable after it cures. The hot melt glue prevents the corner shunts from vibrating.

The metal components on the yoke are used for convergence and pincushion correction. **Do not attempt to correct the yoke buzz condition by removing the metal components.**

11. YOKE TILT--A certain amount of yoke tilt is considered customer acceptable and is necessary for manufacturing tolerances. The guideline is normally 1/4 inch from center to edge on 27 inch product. If the amount of tilt exceeds this amount, the tube may need to be replaced. Before the tube is replaced, loosen the mounting ears and attempt to reposition the tube to correct the tilt. **Do not attempt to loosen a yoke that is bonded to the tube.** On all 35" models, the field correction circuit can be adjusted to correct tilt and purity problems. The following adjustments should be made whenever complaints of purity problems or picture tilt are received on a 35" model.

1. Make sure the STRENGTH switch is in the OFF position. NOTE: If the STRENGTH switch was not in the OFF position, turn the TV off for approximately two minutes and then turn it back on again. If the discoloration is still there, continue to the next step.
2. Move the STRENGTH switch to the LOW position. If this improves the discoloration/tilt but does not eliminate it, move the STRENGTH switch to the HIGH position. This should correct the situation. If moving the STRENGTH switch makes the discoloration/tilt worse, proceed to the next step.
3. Change the position of the POLARITY switch. If this improves the discoloration but does not eliminate it. Move the STRENGTH switch to the HIGH position. This should correct the situation.

It may be necessary to reset the POLARITY and STRENGTH switches if the TV is moved or repositioned in the room, especially if the TV will be facing a different direction.

12. MOIRE--Moire is an optical interference pattern in the tube that produces a wood grain structure in a flat

field at low beam current. It is the result of a beat between the scanning lines and the vertical repeat spacing for the beam slots in the shadow mask. It can be minimized by slightly adjusting the height to alter the spacing between the scanning lines. The setting of the focus control can also affect moire. Focus should be adjusted for best resolution at high beam current. This will result in very acceptable focus at low beam current, but will prevent the scanning lines from becoming so fine that moire can easily result. If focus is set for best performance at low beam current, there is the risk of moire, and focus may be unacceptable at high beam current.

13. "HALO" OR BRIGHT AREA AT THE TOP OF THE PICTURE TUBE--This symptom has been described as a halo or bright area at the top center of the tube, and also as if a light were on inside the tube at the top. The symptom appears during dark scenes and scene changes when the picture fades to black. The video is unblanked before the end of the vertical retrace interval. If any information is present during the last few lines of the vertical blanking interval, the beam is reflected off the shield and diffused over the top center portion of the screen. The problem is most apparent with laser video disk players and certain cable systems. The problem can be eliminated by slowly reducing the height until the symptom disappears. The problem is most common on 27" sets.

14. BLOCKED APERTURE--This symptom is small black dots on the face of the tube that are present only when the set is on. Debris in the tube can become lodged in the holes in the shadow mask.