

## The TVA92's Horizontal Output Tests

This Tech Tip presents a logical, step-by-step procedure for using the TVA92's Horizontal Output Tests. While these tests can be used individually, this test sequence gives you the best opportunity to safely identify different types of horizontal circuit defects. If you need additional information on how the horizontal output stage operates or would like an in-depth explanation of each test, please refer to the following Tech Tips:

- #207 "Understanding the TV Horizontal Output Stage"
- #208 "Making Horizontal Output Dynamic Measurements"
- #209 "Understanding the TVA92's Horizontal Output Load Test"
- #210 "Understanding the TVA92's Horizontal Output Device Sub & Drive."

### Recommended TVA92 Horizontal Output Tests Procedure

The following outline presents an overview of the recommended procedure



Fig. 1: Controls used to perform the HORIZ OUTPUT TESTS.

for using the TVA92's Horizontal Output Tests.

- I. HORIZ OUTPUT LOAD TESTS – AC power removed from the chassis (TV Off)
  - A. Check current draw - mA
  - B. Check output pulse time - uS
- II. HORIZ OUTPUT DYNAMIC TESTS – AC power applied to the chassis (TV On)
  - A. H.O.T. removed, HORIZ DEVICE SUB & DRIVE off
    1. Check unloaded B+ power supply - DCV
    2. Check for horizontal drive to the H.O.T. - INPUT DRIVE
  - B. H.O.T. removed, HORIZ DEVICE SUB & DRIVE on
    1. Check current draw for excessive load - DEVICE SUB CURRENT
    2. Check loaded B+ power supply - DCV
    3. Check flyback pulse amplitude - PULSE PPV
    4. Check flyback pulse time - PULSE TIME uS
  - C. H.O.T. installed, HORIZ DEVICE SUB & DRIVE off
    1. Monitor B+ power supply - DCV
    2. Monitor flyback pulse amplitude - PULSE PPV
    3. Monitor flyback pulse time - PULSE TIME uS

### Performing the TVA92 Horizontal Output Tests

The following procedure is a detailed look at the above outline. It describes how to do the tests, what readings to

expect, and what to do when a bad reading is indicated. This procedure covers the most common results and defects.

#### I. Horizontal Output Load Tests

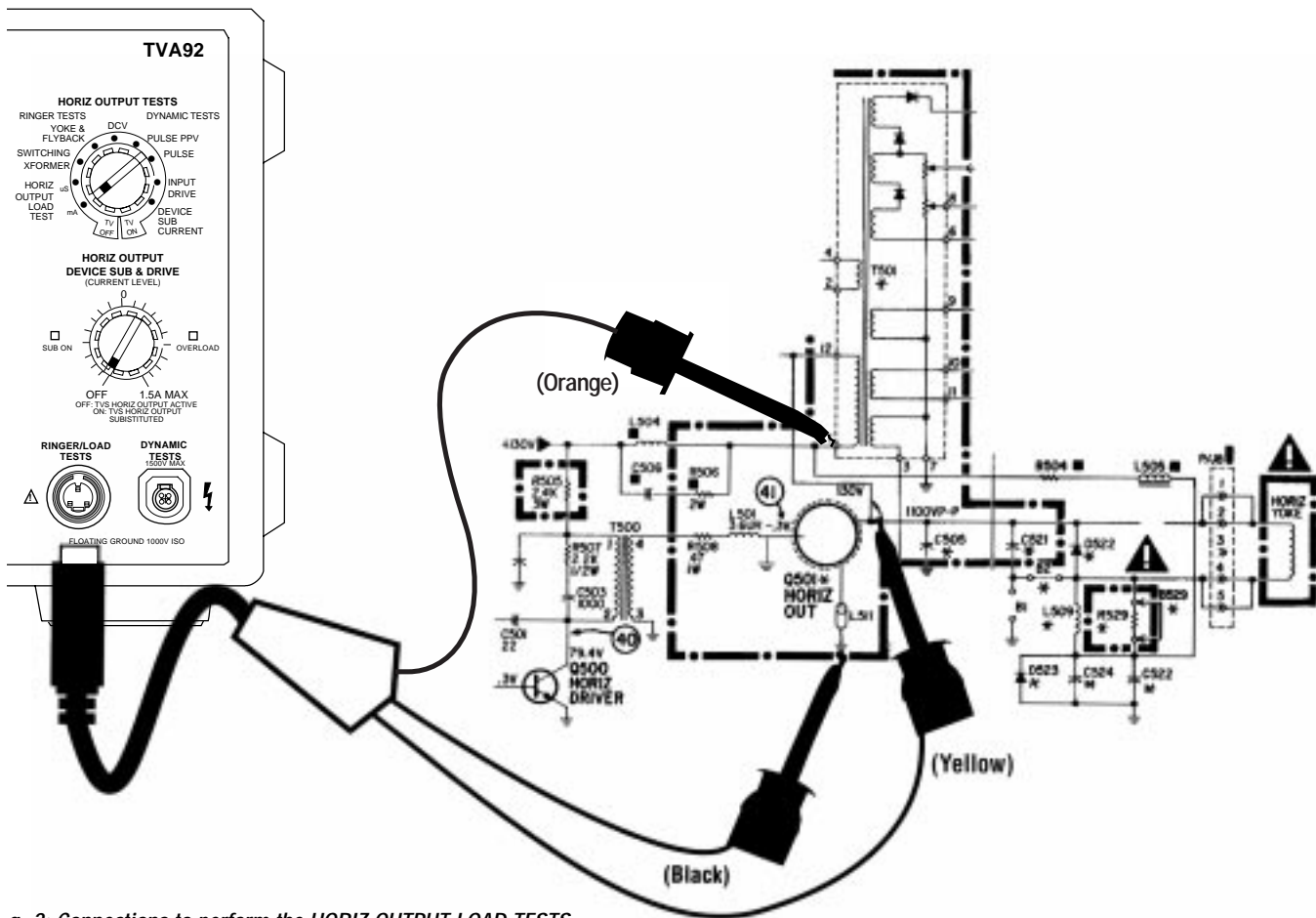
The first TVA92 Horizontal Output Tests to perform are the Load Tests. These two tests give an indication of any major defects in the horizontal stage. During the Load Tests the TVA92 supplies a B+ voltage at approximately 10% of normal to the horizontal output stage

**CAUTION**

The HORIZ OUTPUT LOAD TESTS produce flyback voltages at the collector of the chassis horizontal output transistor and the flyback secondaries. Do not come in contact with energized circuit points during the Load Tests.

#### A. Current – mA

1. Remove power from the TV. These tests should never be performed with AC power applied to the chassis. The load tests can be performed with the H.O.T. in or out-of-circuit. If you find the H.O.T. is shorted, remove it and proceed with the Load Tests.
2. Connect the RINGER/LOAD TEST leads as follows: black lead to the H.O.T.'s emitter or equivalent connection if the H.O.T. is removed, yellow lead to the H.O.T.'s collector or equivalent connection if the H.O.T. is removed, and orange to the B+ connection on the flyback.
3. Set the HORIZ OUTPUT TEST selector to HORIZ OUTPUT LOAD TEST mA and note the current reading on



g. 2: Connections to perform the HORIZ OUTPUT LOAD TESTS.

the LCD. The acceptable range is 5-80mA.

4. A reading of greater than 80mA indicates excessive current. To isolate the defect, disconnect the yellow clip lead from the collector and note the current reading.

a) DC leakage is indicated if the current stays above 15mA. The defect is caused by a DC leakage path on the primary side of the flyback, such as a damper diode, retrace capacitor or leaky component in the B+ line.

b) AC leakage is indicated if the current falls below 15mA. A defective IHVT, horizontal yoke, or secondary loading can cause a short of this type.

ote: A reading close to or above 250mA indicates a direct DC short to ground, usually caused by a shorted H.O.T. or amper diode.

5. A reading of less than 5mA or dashes indicates an invalid connection or open in the circuit. Be sure the mA reading is within the acceptable range before proceeding to the Dynamic Test.

### B. Timing – uS

1. Set the HORIZ OUTPUT TESTS selector to HORIZ OUTPUT LOAD TEST uS and note the timing reading on the LCD.
2. The acceptable range is 11.3-15.9uS with a stable reading.
3. A reading that is stable but outside this range indicates a defective timing component.
  - a) A reading that is greater than 15.9uS is likely caused by an open yoke or yoke series capacitor.
  - b) A reading that is less than 11.3uS is likely caused by defective retrace timing capacitors, IHVT, or excessive loading on the secondaries.

Note: A few chassis manufactured by NAP may normally return timing readings slightly less than 11.3uS.

4. A reading that is fluctuating indicates that the flyback pulse waveshape contains ringing or multiple pulses. This is likely due to a defective flyback, excessive loading on the secondaries, or leakage.

Note: A few chassis may return a reading that fluctuates from normal to 0.1-0.5uS. This is due to the different impedance in the leads and circuit, not a defect in the set.

5. A reading of dashes (“- -”) indicates improper lead hook-up or an open in the circuit. Be sure the pulse time is within the acceptable range before proceeding.

## II. Horizontal Output Dynamic Tests

The three sections of the TVA92’s Horizontal Output Dynamic Tests provide a quick and easy B+ voltage measurement, input drive test, horizontal output waveform analysis, and horizontal output device substitution.

### A. Dynamic B+ and Input Drive Measurements

The first Dynamic Test enables you to check the regulated B+ supplied to the horizontal output stage and the input drive to the base of the H.O.T.

1. Remove the H.O.T. from the chassis and connect the Dynamic Test Leads

TEST:	NORMAL RANGE	BAD RANGE
mA	5-80 mA	<5 mA or >80 mA
μS	11.3 – 15.9 μS	<11.3 μs or >15.9 μS

Table 1: HORIZ OUTPUT LOAD TESTS Good/Bad ranges.

HORIZ LOAD TEST READOUTS		MOST LIKELY CAUSES
mA	μS	
----	----	<ul style="list-style-type: none"> <li>• Improper Connections</li> <li>• Open Flyback</li> <li>• Open Output Stage Circuit Paths</li> </ul>
BAD	----	<ul style="list-style-type: none"> <li>• Severe B+ Supply Short Or Leakage Path</li> <li>• &lt; 5 mA = Open Flyback Or Circuit Path</li> </ul>
GOOD	----	<ul style="list-style-type: none"> <li>• Open Flyback</li> <li>• Improper "Collector" Connection</li> <li>• Open Ringer/Load Fuse</li> </ul>
GOOD	GOOD	<ul style="list-style-type: none"> <li>• No Severe Loading Or Timing Defects</li> </ul>
BAD	GOOD	<ul style="list-style-type: none"> <li>• Severe B+ Leakage And/Or Flyback Secondary Short Or Leakage Path</li> <li>• Flyback Transformer</li> </ul>
GOOD	BAD	<ul style="list-style-type: none"> <li>• Defective Output Timing Components</li> <li>• Flyback Transformer</li> <li>• Severe Flyback Secondary Short Or Leakage Path</li> </ul>
BAD	BAD	<ul style="list-style-type: none"> <li>• Severe B+ Leakage</li> <li>• Flyback Secondary Short Or Leakage Path</li> <li>• Flyback Transformer</li> <li>• Defective Output Timing Components</li> </ul>

NOTE: Fluctuating μS readout values indicate abnormal flyback pulse ringing or timing.

Table 2: Possible HORIZ OUTPUT LOAD TEST readings and likely causes.

as follows: red to the collector connection, blue to the base connection, and black to the emitter connection or circuit ground.

**Note: A few chassis do not connect the H.O.T. emitter to ground. In this case, connect the black clip-lead to circuit ground, not the emitter connection.**

2. Set the HORIZ OUTPUT TESTS selector to DCV, apply AC power to the chassis, and note the voltage reading on the LCD. This reading should closely match the schematic's value for regulated B+. If the reading does not stabilize to this value, turn the HORIZ OUTPUT DEVICE SUB &

DRIVE on just enough so the SUB ON LED lights. This will provide feedback to the power supply if necessary. The DCV reading should be near the schematic's value. If it is not, the power supply is malfunctioning and should be repaired before continuing. Turn the DEVICE SUB & DRIVE off before continuing.

3. Set the HORIZ OUTPUT TEST selector to INPUT DRIVE, apply power to the chassis, and note the reading on the LCD. The LCD should read "ON." Some chassis' horizontal circuits run off of a scan derived supply. With these types of sets you need to turn the TV off and back on again watching the LCD to see if it will momentarily

flash "ON." If it reads "ON", or will momentarily when the set is powering up, a drive signal is present. If it reads "OFF" there is a defect previous to the base of the H.O.T. This defect does not necessarily need to be repaired before continuing.

### B. Dynamic H.O.T. Sub & Drive

These next steps allow you to substitute for the H.O.T. and operate the TV at full voltage without risking an expensive replacement H.O.T.

1. Set the HORIZ OUTPUT TESTS selector to DEVICE SUB CURRENT.
2. Turn the HORIZ OUTPUT DEVICE SUB & DRIVE slightly on until the SUB ON LED lights and watch the current reading on the LCD. If the current exceeds 500mA, turn the HORIZ DEVICE SUB & DRIVE off. There is likely a defect in the circuit that needs to be repaired before continuing. If the current stays below 500mA turn the knob quickly to the 12 or 1 o'clock position (higher for larger sets). Adjust the HORIZ OUTPUT DEVICE SUB & DRIVE control to get normal horizontal deflection without "foldover" in the center of the CRT display. The current reading may now be over 1A depending on the size of the set.
3. With the HORIZ OUTPUT TESTS selector, check the DCV to see that the power supply is regulating and the PULSE PPV and PULSE TIME μS to measure the amplitude and width of the horizontal output pulse to be sure that the horizontal output stage is operating properly. Repair any problems before continuing.

### C. Dynamic Horizontal Output Parameter Measurements

This final step monitors the horizontal circuit's operation at full voltage so you can be sure that it is working properly with the H.O.T. installed.

1. Install a good H.O.T. and reconnect the Dynamic Tests leads as described above.

**Note: Be sure the HORIZ OUTPUT DEVICE SUB & DRIVE knob is in the OFF position.**

2. Apply AC power to the chassis.
3. With the HORIZ OUTPUT TESTS selector, check DCV, PULSE PPV, and PULSE TIME μS for correct values.

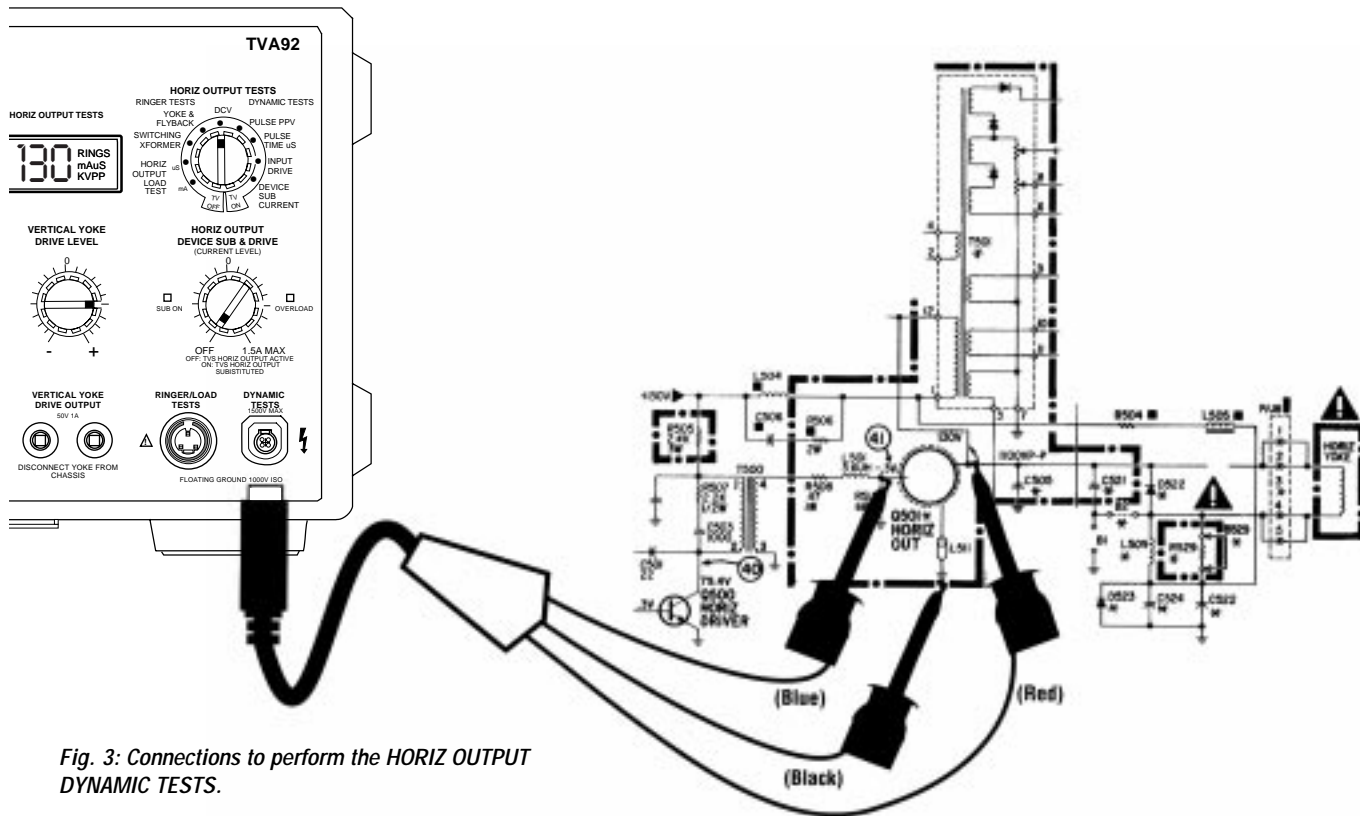


Fig. 3: Connections to perform the HORIZ OUTPUT DYNAMIC TESTS.

SYMPTOM	PROBABLE CAUSES
B+ = 0 Volts	• Open Fuses • Bad B+ Supply • Shorted B+ Path
Low B+ Volts	• B+ Power Supply Regulation • Low AC Voltage
High B+ Volts	• B+ Power Supply Regulation • Open Loads On B+ Supply
Pulse PPV = 0 V	• No B+ • No Input Drive • Open HOT • Open Flyback Primary
Low Pulse PPV	• Leaky Retrace Capacitor or HOT • Flyback Loading • Reduced Value Of Yoke Capacitor • Bad Yoke • Low B+ • Insufficient Input Drive
High Pulse PPV	• Retrace Capacitors • Flyback Shorted Turn • High B+ (regulator)
Pulse Time = 0 $\mu$ S	• No B+ • No Input Drive • Open HOT • Open Flyback Primary
Pulse Time < 11.3 $\mu$ S	• Flyback Loading • Flyback Shorted Turn • Retrace Capacitors
Pulse Time > 15.9 $\mu$ S	• Yoke • Yoke Series Capacitor
Multiple Pulse Times	• Flyback Loading • Flyback Shorted Turn • Leaky HOT • Damper Diode, Yoke, Retrace Capacitors, Yoke Or • Yoke Capacitor
Input Drive "ON"	• Drive present to base of HOT
Input Drive "OFF"	• No Drive To Base Of HOT

HOT = Horizontal Output Transistor

Fig. 4: Possible HORIZ OUTPUT DYNAMIC TEST indications and their possible causes.

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