Notes on the Heathkit C-3
by
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1) For the leakage tests, the voltages at the various switch-positions (labeled 25, 150, 250, 350, 450 VDC.) are not very exact, even if the resistors are still within tolerance. The current through the voltage-divider string SHOULD be about 4.5 mA. (.004545 A). If that is so, and if all the resistors are within tolerance, then the calculated voltages will be about 45, 145, 245, 345, and 445 VDC. However, those resistors were always *WAY* out of tolerance, sometimes by several hundred percent in those units I checked. Obviously, the position labeled "25" volts, should have been labeled "50" volts instead.

2) The 47 K resistor shown on the schematic, which is actually across the 1629 eye-tube, was found to be over 110 K in the units I have checked. This resistor sets a) the voltage across the 1629, and b) the total current in the string. At 4.5 mA, there should be about 210 VDC across the 1629 at "idle". Before I started the restoration, one of my units had 330 VDC on the eye tube! This resistor dissipates about 1 watt, so a 2 watt resistor should be OK here.

3) The filter capacitor closest to the diode only has the voltage across the 1629 on it, which varies, when you are testing leakage, from a low of about 100 volts, to a high of about 430 volts (momentarily), so a capacitor with a working-voltage of 475 VDC, or higher, is not needed here. The other filter capacitor, however, has whatever voltage is left after the 1629's requirements are met. The 1629 will operate properly with voltages as low as 100 VDC. (Don't go over 250 VDC though. Doing so for very long will severely shorten the life of the eye tube.)

4) Calculating the true resistor values that would give the "correct" voltages for the leakage test resulted in: 11 K, 22K, 22K, 22K, and 22K. I adjusted the true value of the "47 K" resistor at the "top" of the voltage-divider so that the actual current drawn by the string was 4.5 mA, and the voltages were accurate or slightly high at no load. If you want the leakage test voltages to be reasonably accurate, make sure that the current through the voltage-divider string is 4.5 mA., and your resistors are close to what I have listed.

5) The last 22 K resistor between the voltage-divider string and the 450 VDC switch position connection is only a current limiter, so its true resistance value is not too important.

6) Replace all the capacitors, except the filters and the micas, with metalized film capacitors. The increase in accuracy and repeatability of the instrument will be amazing! The micas were usually OK, but you may want to test yours anyway, and replace those that are out of tolerance.

7) All resistors in the voltage divider string should be replaced with 2-watt wire-wound units from Mouser of the values calculated above. The power dropped by each 22 K resistor in the voltage-divider string will be around 0.45 watt at no load if the current is "set" to 4.5 mA., but can rise much higher when you are testing bad capacitors for leakage. This is undoubtedly why the ½ watt 22 K ohm resistors were "cooked" in my units. If the unit is left on, those resistors are dissipating nearly ½

watt continuously, which isn't good either.

8) Make sure the two resistors associated with the 1629 are within tolerance. If either one is much lower in resistance than specified, the eye will not open fully, or could overlap when closed. You may have to experiment with the value of the resistor between pins 3 and 4 in order to get the eye to just close when nothing is being measured. My unit required a resistor of around 6 megohms rather than the 1 megohm shown. The "+60 volts" specified on the schematic at pin 3 varies wildly, depending on where the "Main Control" is set during measurements, so it is not to be taken literally.

9) As mentioned above, the maximum voltage that the 1629 should be subjected to is 250 VDC, and less is better. Cathode current should not be more than about 4 mA. That will be OK, as long as the grid resistor is close to 1 megohm or larger and the plate voltage is below 250 VDC.

10) I replaced the line cord on my units with a three-wire grounded type, and added a chassis mounted fuse holder. The repeatability of the instruments was greatly improved, since that, according to the manual, can depend a lot on which way the plug is inserted in the wall socket. With a three-prong plug, it always goes in the same way. The fuse, a 1 amp fast-blow is adequate, saves the power transformer if the diode or filter caps short out.

11) I shunted each power-supply filter cap with a 100 K ohm, 2-watt resistor. This leveled out the power supply variations very noticeably, and made the leakage and other tests much more stable. This should make the filter caps last a lot longer too.

12)If you have to replace your power transformer as I did, you will have to add a resistor between the 47 K resistor and the rectifier to absorb any voltage above that for which the circuit was designed, unless your transformer puts out 460 to 500 VAC. Measure the voltage at the top and bottom of the filter capacitor string, subtract 660 VDC from that, and find a 2 watt resistor of the proper value, i.e. (R = (E – 660)/.0045). Move the ungrounded end of the 47 K 2 watt resistor and the 1629 plate lead from pin 8 of the 1626 socket to an unused pin on that socket. Then connect your new resistor between pin 8 and the junction of the 47 K resistor and the 1629 plate lead. You can also adjust the value of this new resistor to set your leakage test voltages to their exactly correct values if desired.

13) IMPORTANT: If you are testing high value capacitors, i.e. 470 µfd @ 450 VDC for instance, you MUST park the "Main Control" pointer at the far left stop (counter-clockwise) when doing leakage testing. When the "Leakage" knob is released after testing, the capacitor under test is connected to one end of the "Main Control". If the knob is over to the RIGHT, that point is connected to ground, and when you release the knob, the full charge of the capacitor is dumped to ground through one end of the "Main Control" resistance. This can burn out the "Main Control" by essentially blowing one end of it off. If this occurs, the "Main Control" pot must be replaced.