VHSystems

All-In-One II Test and Calibrate Unit
Hickok 539B-C Models

In 2010 I designed and fabricated the Load and Main Meter Test Boxes that were used until late in 2011 when I teamed up with Jeff Kiser of TubesLab to re-package the Main Meter Test with the Test and Calibrate unit. We agreed to name it the **All-In-One Test and Calibration Box**. Jeff was to fabricate and market these units through his **TubesLab eBay store.** Thanks to Jeff this resulted in an attractive unit and manual that sold reasonably well through 2014. Jeff had also re-designed the prototype Manual. Unfortunately the design was labor intensive creating production issues that interrupted sales through most of 2015 and 2016 and a change was needed..

In late 2016 our group that had been fabricating Digital Meters for these Hickok's decided to design a new enhanced All-In-One II unit and revise the manual with errors and omissions corrected to better serve the user. Mike Eccher heads up this group along with Marcel Grenier assisting. This design will allow a CNC Machine to drill the front panel, then it can be anodized and laser etched resulting in reduced fabrication time. It will be marketed as the **All-In-One II Test and Calibrate Unit.** Bill Eccher will provide technical support for the group and the users.

Jeff Kiser understands and supports this change in direction. Units that were sold through his TubesLab store will continue to be supported through **VHSystems.**

We will continue to fabricate Digital replacement Meters along with other enhancements that users can purchase and install. Some mod's and enhancements are show in the manual for do it yourself users. We will service, calibrate and install modifications here in the Denver, CO area.

NOTICE

DISCLAIMER & WARNING

REQUIRED USER HAS A BASIC UNDERSTANDING OF ELECTRONICS.

The user of this manual and the associated components hereby agrees that in choosing to use the procedures herein and choosing to work with and on their equipment, he/she alone is liable for any damage to the equipment, themselves, or others, occurring as a result of their own actions.

CAUTION – HIGH VOLTAGES – TAKE NECESSARY PRECAUTIONS

USE A ISOLATION TRANSFORMER TO POWER THE 539B/C

RECOMMENDED

Fabricate a wood box to mount the tester in that will give access to the bottom with holes for adjusting R8 and R15 along with cutouts for better access.
Read through the manual before starting and ask questions if necessary.
Each Step should be read and understood before proceeding.

Hard copy of this page and the 539B/C schematics, but the manual is on the USB Drive

HICKOK
MODEL 539B/C TUBE TESTERS
All-In-One II
TEST AND CALIBRATE PROCEDURES

As a retired Electronics Technician I began buying, repairing, calibrating and selling test equipment primarily as a hobby. Along the way I observed a renewed interest for vacuum tube audio equipment and the need for good tube testers. I found the Hickok tube testers, especially the 539B/C Models, well suited for users and sellers of tube equipment. After purchasing a few for restoration, it soon became apparent that all of them needed some degree of calibration and/or repairs.

As a result, I developed these procedures along with a Calibration Box and Gm Meter Tester. In addition to providing the various loads and test points, it eliminates the need for a Variac and Isolation Transformer. The result is a quicker, simpler and safer method of calibration for both the tester and the operator. The All-In-One II is a passive device except for the AAA battery that powers the Main Meter Test. It interfaces with the tester to perform the tests and adjustments. Included is 9 pin 10Meg resistor plug for the Gas Test and a pair of clip leads for the Main Meter Test. Most of the tests can be made without removing the tester from the case.

GENERAL INFORMATION

Check the calibration periodically or after either of the rectifier tubes are replaced. After the calibration is completed I would recommend testing a power tube such as a 6L6 and a small signal tube, then record the Gm and Plate Current results. These tubes can become the Reference Tubes to verify calibration at any time.

The later production 539B's with the round Bias and AC meters and 539C Models are essentially the same except for the additional tube sockets and switching to accommodate them in the 539C.

The early 539B's can be identified by the square Bias and AC Meters. These meters seem prone to failure. As far as I know, they did not have ferrite beads on the socket wires to control oscillation and this can be a problem with high gain tubes, such as the 6DJ8. The ferrite beads can be added, but it is a difficult task. The selector switches had multiple sections unlike the single section of the later units.

You may have read that these units were individually tweaked by Hickok to obtain the desired results, but I respectively disagree. Likely a result of calibration or repairs as the units aged. The Hickok specifications were +/- 10% for these testers. Its possible to get these testers within +/- 5% with careful calibration. I recently found a couple of very late production units where Hickok did make a resistive change in the bridge circuit. It was a selected 2k resistor in parallel with R39, which I removed to restore balance for the resistor half of the bridge, then the bridge was balanced with the Power Transformer DC Balance Mod. that's included in this manual..

With a basic knowledge of electronics, following these procedures should not be difficult. Digital Multimeters are now inexpensive, therefore I ruled out using analog meters. These procedures assume the unit can be powered up, but has questionable accuracy when testing tubes. Optional procedures are provided to balance the Plate/Bridge and Screen/Bias without an oscilloscope, by temporarily connecting a jumper. These procedures, along with the supplementary information provided, can also be very useful in repairing these testers.

PREPERATION

RECOMMENDED FIXTURES, TEST EQUIPMENT AND MISC.ITEMS

1. All-In-One II Test and Calibrate Unit.

2. 10 Meg resistor 9 pin plug included with the All-In-One II.

3. A pair of hook clip test leads for the Main Meter Test included with the All-In-One II .

4. Digital Multimeter preferably with 3 ¾ or 4 ½ digits.

5. 6L6 tube, which is or will become the Reference Tube.

6. TEST STAND optional, but highly recommended to safely operate outside of the case.

7. Oscilloscope with triggered sweep optional, but recommended.

8. Insulated screwdriver to adjust R8 and R15. High Voltage is on the controls.

9. Screwdrivers both Phillips and Slotted.

10. Extra Digital Multimeter or metered Variac. To monitor the 100VAC during calibration. Soldering iron, solder and hand tools if repairs or mod's are to be installed.

NOTE:

Hickok was using 1000 ohms per volt analog meters when the testers were designed and service documents were written..

It has been recommended that parallel load resistors equal to the meter range times 1000 be used with the high input resistance digital meters to emulate the old analog meters.

Actually the only circuit that requires any external load is the Plate circuit as all the other circuits are loaded within the tester.

The All-In-One II loads the Plate circuit with a 10K resistor during the voltage test procedure and the expected range of voltages are listed.

Hickok listed using a AC VTVM for the AC voltage tests that had an input resistance of 10 meg ohms just like your Digital Multimeter.

METERS: Verify the meters will zero with power off. The Main Meter has a slotted zero adjust at the bottom center. The Bias Meter only had zero adjustments in very late models. These meters must zero or it will not be possible to calibrate the tester. Except for early models the AC Meter will have a slotted zero adjust. You may find it necessary to use the zero adjust in order to isure its accurate at 100VAC. This will be checked during the calibration.

SHUNT CONTROL: Verify it is zero in the full counterclockwise position and correct if necessary, but do not over tighten the set screw.

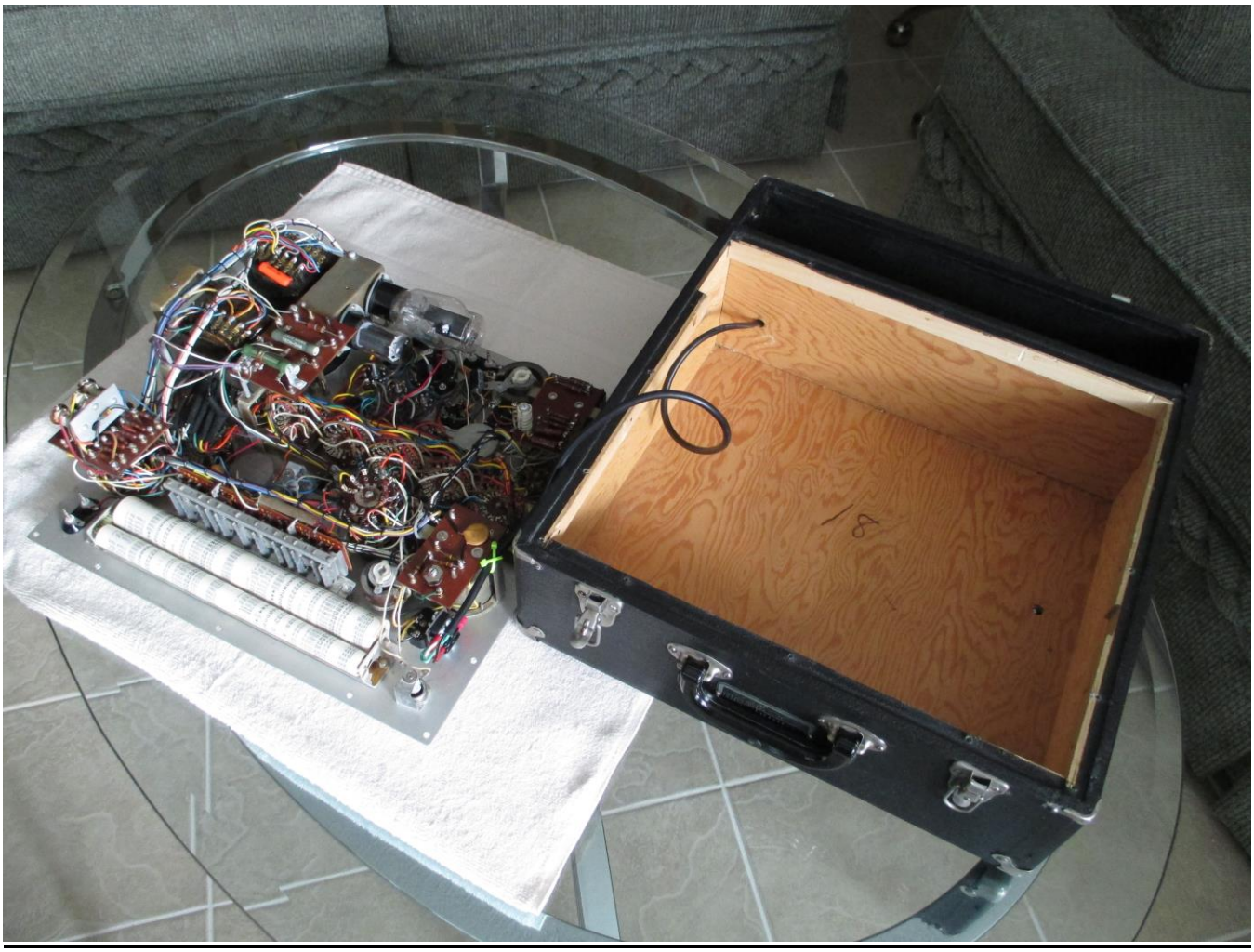
REMOVING THE TESTER FROM ITS CASE

Make sure the bottom screw is secure, then remove all of the screws around the outside edge of the tester panel. For the 539B and early 539C's, gently push about 10-12 inches of the power cord into the unit to allow enough play for the case to be removed. Later 539C's have the cord coming out of the face of the tester. Picture shows a late model 539B removed from its case.

Carefully turn the tester face down on a soft surface while holding the tester in the case. Now remove the 10-32 machine screw from the bottom of the case and carefully lift the case from the tester. Some components, such as the Function Switch, are mounted very close to the edge and could be damaged. You may want to remove the roll chart rather than chance damaging it, but be careful not to damage the clear plastic piece.

I recommend replacing the C1 and C4 electrolytic capacitors. C4 is the Main Meter filter is rated at 100uF 6VDC and I recommend replacing it with a 220uF 10VDC capacitor attached directly to the shorts switch. In some cases testing high current tubes like the 6550/KT88's the 100uF capacitor is inadequate. It will also help dampen the Main Meter in an over range situation.

OPTIONS: Page 23 for the Power Transformer DC balance Procedure. Page 26 for the Bias Fuse Modification. Page 28 for the Plate Current Modification.



CAUTION HIGH VOLTAGES - TAKE THE NECESSARY PRECAUTIONS

The testing steps are in black with **bold black and red used for emphasis.**

Solutions, if any, are given in green with bold black for emphasis.

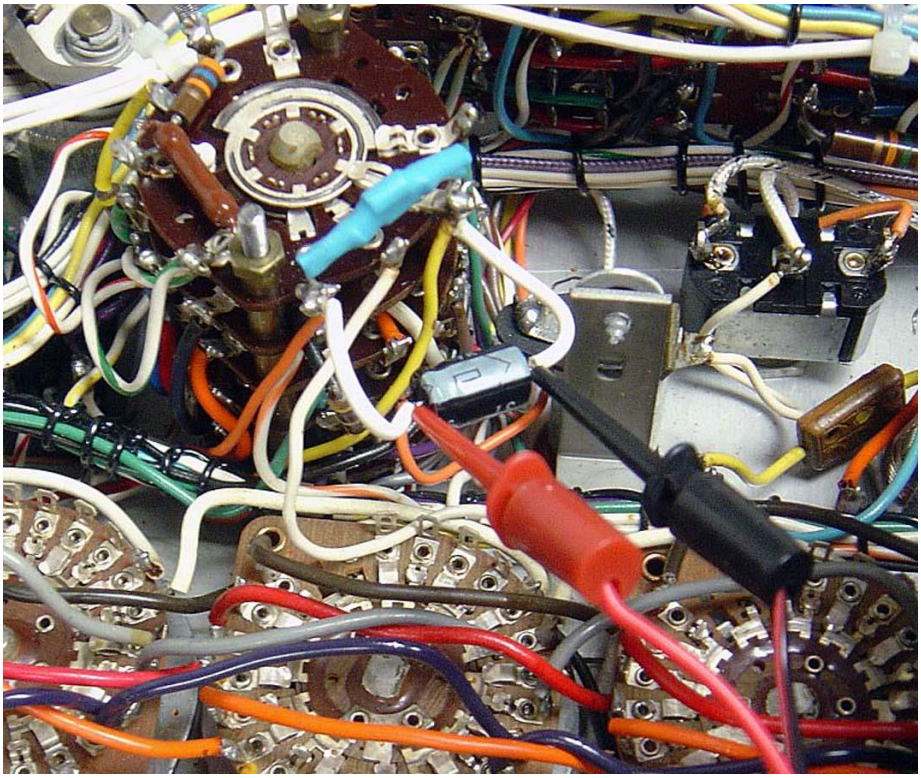
1. MAIN METER TEST:

DO NOT CONNECT AC POWER TO THE TUBE TESTER

The All-In-One uses current for these tests while simultaneously testing for voltage across the meter terminals. Full scale specs are 115uA at 172.5mV for the 1500 ohm meter resistance.

Rotate the **Function Switch** half-way between positions **G and H**, which will isolate the meter from all circuits. Connect the **Main Meter Test** as shown with the test leads to C4, the 100MFD Meter Capacitor located on or connected to the **Shorts Switch.**

The Main Meter is safe with this circuit.



Left picture shows the replacement capacitor C4 with the test leads connected.
Picture on the right shows connections to GM Meter Test terminals.
Polarity is important for the Main Meter to indicate correctly.

Hopefully you have prepared some sort of fixture that will support the tester face up.
Damage will likely occur if it rests on the internal parts.

Now turn the tester face up while being careful not to disconnect the test leads.

Adjust the Meter test control to min and connect the Multimeter (set to measure microamps) to the **Test Current Pin Jacks as shown on the top left of the picture**

This picture shows the Main Meter reading ½ of full scale and with the Digital Multimeter indicating 57.5 microamps

Increase the control on the Main Meter Test and observe following scale points. If the readings are way off, confirm that the Function Switch is still positioned between G & H.

Digital Multimeter to Main Meter readings.

38.33 uA = 1/3 of full scale
57.50 mV

76.67 uA = 2/3 of full scale
115.00 mV

57.50 uA = 1/2 of full scale.
86.25 mV

115.00 uA = full scale
172.50 mV

If you unable to obtain 115.0 microamps the internal battery will need to be replaced.

If the meter reads too high or too low, it may be correctable by adjusting the metal plate mounted on the side of the meter, which is a magnetic shunt. By loosening the mounting screw and sliding the plate back and forth, small adjustments can be made.

Keep in mind that it is better to allow an error at full scale, since Gm readings seldom go over two thirds of full scale. If the meter is still indicating over one small division high for the first two thirds of full scale you may elect to ignore, repair or replace. If the Main Meter is not the later 539C plastic type I do have a procedure that may work, but somewhat risky.
Disconnect the Main Meter Test leads and set the Function switch to position C.

2. LINE ADJUST METER:

Use a Variac to lower the line voltage to 100VAC, then rotate the Power Adj. clockwise all the way. Use an accurate AC meter to verify the Variac voltage is set at 100VAC. The 539B/C meter should now indicate 100VAC (Red Line). **Rotate the Power Adj. clockwise before using. Small variations can be corrected by using the meter zero adjustment, since we are only concerned with the accuracy at the 100 VAC red line. High readings can be lowered by the addition of an appropriate value resistor placed in series with the meter. Low readings cannot be raised except with the meter zero adjustment. A passive mod is available in this manual or on our site to correct for +/- 6VAC.**

The Hickok 539B/C design has P7 to check line voltage on the AC Meter. By pressing P7 LINE TEST the AC meter is now reading the line voltage and it can be compared with an accurate Digital Multimeter measuring line voltage at the outlet. This can be useful for a quick check of the AC Meter without removing the tester from its case.

NOW SET THE SWITCHES AND CONTROLS AS SHOWN FOR A 6L6 TUBE

NORMAL/SELF BIAS	**NORMAL**
VR VOLTS & MILS CONTROL	**COUNTER-CLOCKWISE**
BIAS RANGE	**10V**
BIAS VOLTS/VR VOLTS & MILS	**BIAS VOLTS**
BIAS VOLTS CONTROL	**COUNTER-CLOCKWISE (Zero volts)**
METER	**NORMAL**

SELECTORS:	**H**	**S**	**5**	**3**	**4**	**8**	**1**
FILAMENT	_I	I	I	I	I	I	I
FILAMENT	_____I	I	I	I	I	I	I
GRID	_____	I	I	I	I	I	I
PLATE	_____	I	I	I	I	I	I
SCREEN	_____	I	I	I	I	I	I
CATHODE	_____	I	I	I	I	I	I
SUPPRESSOR	_____	I	I	I	I	I	I

SHORT TEST	**OTHER TUBES**
SHORTS	**TUBE TEST**
CATH. ACT	**NORMAL**
SHUNT	**0**
FILAMENT	**6.3**
PLATE VOLTS	**NORMAL**
FUNCTION SWITCH	**C (15,000)**
BIAS RANGE	**10V**
BIAS*	**0 (*Normally 3.0 for 6L6 Test)**

4. SHORTS TEST:

Set the SHORTS SWITCH to the TUBE TEST POSITION and the SHORT TEST SWITCH to the OTHER TUBES POSITION. Set both the CATHODE and the SUPPRESSOR SWITCHES to the number 1 position. Rotate the SHORTS SWITCH counter-clockwise. The SHORTS LAMP should light in all positions except number 1. Repeat the procedure, setting both the CATHODE and SUPPRESSOR SWITCHES simultaneously in positions 2 through 9 for the Model B, and 2 through Z for the Model C.

Return the SHORTS SWITCH to the TUBE TEST POSITION.

If the shorts lamp will not light in any position, replace the lamp and try again. Failure to read a short on any switch position means the switch contacts are dirty or damaged. Cleaning and de-tarnishing the contacts may help, but do not spray directly.

5. SHORTS LIGHT SENSITIVITY: (Connect CALIBRATION BOX Octal Plug to Tester)
Set the SUPPRESSOR SWITCH to any position EXCEPT Position 8.
Set the CATHODE SWITCH to position 8 and the PLATE SWITCH to position 3.
Switch the **LOAD BOX** to the **300K Position** and **LOADS ON.** Rotate the SHORTS switch counter-clockwise to position 4. You should see a very dim glow of the SHORTS LAMP.

Rotate the SHORTS SWITCH to the TUBE TEST POSITION and switch the LOADS OFF on the CALIBRATION BOX.

If the lamp is off or too bright, adjust R45 until the SHORTS light comes on dim. For the location of R45, reference Page 16.

6. BIAS VOLTAGE RANGE AND VOLTMETER TEST: (Multimeter Set To Read DC)
The negative Multimeter lead into **Pin Jack 8** and the positive lead into **Pin Jack 5** of the **CALIBRATION BOX**. Set the BIAS RANGE switch to the **50V position**. Adjust the BIAS VOLTS control fully clockwise. Verify that the maximum voltage is -**40 volts**. Adjust the BIAS VOLTS to show **-25.0 volts** on the Bias Meter. Verify that the Digital Multimeter reads **-25.0 VDC**.
Now set the BIAS RANGE switch to the 10V position. Adjust the BIAS VOLTS **to 5.0 volts** on the Bias Meter. Verify that the Digital Multimeter now reads **-5.0 VDC +/- 0.1 volt.**

Adjust the Bias Control to the maximum counterclockwise position.

If its necessary to adjust the maximum bias voltage POWER OFF. Loosen the screw on the sliding tap of R18, the 8.5K tapped power resistor (Ref. Page 16). Being very careful slide it a little in either direction to determine the direction it needs to go. POWER ON to see the resulting change. Now that you know which direction to go repeat POWER OFF adjust and POWER ON until you get -40 VDC. If you're unable to get -40 VDC, then go to Page 9 step 10 and check the screen grid voltage. If the Screen voltage is low try replacing the 5Y3GT rectifier tube. Keep in mind that the socket itself could be the problem. The Bias and Screen voltages share the same power supply. Also check R3 located on the side of the shorts switch.

If the bias volts meter calibration is off, check resistors R49 = 40K, R50 = 9.9K and R51 = 200 ohms.

7. LEAKAGE RESISTANCE METER TEST:
Switch the **CALIBRATION BOX** to the **1MEG POSITION** and **LOADS ON.**
Rotate the **SHORTS** switch clockwise to position D. The main meter should be reading approximately 1MEG ohms on the resistance scale.

Set the SHORTS SWITCH to the TUBE TEST position and LOADS OFF on the CALIBRATION BOX.

NOTE: The -40 VDC set in step 6 also powers the resistance function of the Main Meter and is the most common reason. Resistors R46 = 1Meg, R47 = 36K and R48 = 330K are also in this circuit.

8. FILAMENT VOLTAGE TEST: (Multimeter Set To Read AC)
Connect a Digital Multimeter to **Pin Jacks 2 and 7** of the **CALIBRATION BOX**. While observing the readings on the Multimeter, rotate the FILAMENT switch from the **.6 volt** position through to the **117 volt** position and verify that the voltages are within +/-10% of the selected setting. Now set the switch to the **10 volt** position. Set the CATHODE ACTIVITY switch to the TEST position. The filament voltage should drop by about 10%.

Set the CATHODE ACTIVITY switch to NORMAL, and the FILAMENT switch to 6.3 Volts.

These voltages are entirely dependent on the power transformer and the AC line setting. Make sure the AC power is maintained as close to 100VAC as possible.

9. PLATE VOLTAGE TEST: (Multimeter Set To Read DC)
Plug the Negative lead of a Digital Multimeter into **Pin Jack 8** & the Positive lead into **Pin Jack 3** of the **CALIBRATION BOX.** Switch to the **10K POSITION** and switch the **LOADS ON**. This loads the plate supply to about 14 mA of current.
Press P4 and read the plate voltage. It should be between **138-146 VDC**.
Release P4. Set the **PLATE VOLTS** switch to the **LOW** position.
Press P4. This reading should be between **56-62 VDC**.

Release P4 and return the PLATE VOLTS switch to the NORMAL position.
Switch the LOADS OFF on the CALIBRATION BOX.

These voltages are dependent on the power transformer, AC line setting, and the 83 rectifier tube. If the voltage is low, try replacing the type 83 rectifier tube.

10. SCREEN VOLTAGE TEST: (Multimeter Set To Read DC)
Make sure the Bias Range is 10 volts and Bias Control is counter-clockwise giving zero bias, since the screen voltage will go down as the bias voltage goes up.
Plug the Digital Multimeter Negative lead into **Pin Jack 8** and the Positive lead into **Pin Jack 4** on the **CALIBRATION BOX.**
Press P4 and read the screen voltage. Normal is **130-138 VDC**.
Release P4. Set the **PLATE VOLTS** switch to the **LOW** position.
Press P4. This reading should be between 54 **to 60 VDC**.

Release P4 and return the PLATE VOLTS switch to the NORMAL position.

These voltages are dependent on the power transformer, AC line setting, and the 5Y3GT rectifier tube. If the voltage is low, try replacing the type 5Y3GT rectifier tube and keep in mind the socket itself can be the problem. Also R32 located on side of shorts switch.

11. GRID SIGNAL TEST: (Multimeter Set To Read AC)
Set BIAS VOLTS to ZERO. Plug the Digital Multimeter test leads into **Pin Jacks 5 and 8** of the **CALIBRATION BOX**. Its critical that the AC Meter is set to **100VAC (RED LINE)** for these measurements.

Set the **FUNCTION** switch to positions **A** (60,000) through **F** (600) and verify these voltages:

A = .25 B = .25 C = .25 D = .50 E = 2.50 F = 1.0 VAC all +/- .01 VAC.

Signal voltages must be in close tolerance to attain accurate calibration.

Return the FUNCTION switch to position C.

The 5.0 volt winding on the power transformer provides the AC grid signals, but is not used directly. It is dropped through R52 (500ohms) to provide the 2.50 VAC signal. By replacing or trimming the value of R52, small transformer errors can be compensated for. The grid signal voltages are obtained by the fixed divider resistors R9 through R12.

R52 = 500 ohms (2.5 VAC) R9 = 300 ohms (1.0 VAC) R10 = 100 ohms (0.5 VAC)
R11 = 50 ohms (.25 VAC) R12 = 50 ohms (0.0 VAC).
If any resistors are replaced or trimmed, then repeat step 11.

12A. PLATE/ BRIDGE BALANCE: With Oscilloscope See Page 14 for without scope.
Connect the Oscilloscope probe to **Pin Jack 3** and the common to **Pin Jack 8** of the **CALIBRATION BOX**.
Switch the **CALIBRATION BOX to the 10K Position** and **LOADS ON.** This will load the plate power supply to approximately 14 mA of current.
Press P4. Set the **VERTICAL INPUT to DC** and adjust the scope to display the 120Hz positive peaks at max gain with **Horizontal adj. for at least 3 positive peaks**.
Adjust R8 for **equal positive peaks. USE INSULATED SCREWDRIVER**.

If the positive peaks will not balance, try replacing the 83 rectifier tube.

Now observe the GM meter, which should be reading zero. If it is slightly off zero, then observe the positive peaks while adjusting **R8** for zero while making sure the positive peaks are still balanced. Next, switch the **CALIBRATION BOX** to the **2.5K Position**, which will increase the plate current from approximately 14 mA to approximately 50mA. This will likely cause the meter to shift slightly off zero. Split the difference between the reading and zero by adjusting **R8**.

Continue alternating between the 10K and 2.5K load selections on the Calibration Box and making fine adjustments until you obtain results as close to zero for both resistor loads as possible. RELEASE P4 WHEN SWITCHING LOADS. Your final adjustment should be with the 10K resistor load. Keep in mind that the peaks must stay in balance as adjustments are made.
NOTE: See Page 21 for the Power Transformer DC balance Mod. that will alleviate most of the difficulty experienced here.

Release P4 and switch the LOADS OFF on the CALIBRATION BOX

NOTE: If you use a 150 - 180 volt Zener Diode between **Pin Jack 3** and the oscilloscope probe, it will offset the voltage, giving peaks of approximately 60 - 30 volts respectively, which will allow the scope to be set at a much higher sensitivity.

If the meter will not zero when the peaks are balanced, then the meter bridge resistors should be checked and balanced. To check the bridge resistors, we need to isolate them from the Main Meter circuit. Do this by setting the function switch half-way between positions G and H. For Main Meter safety, place a jumper across C4. Reference the Resistor Board drawings on Pages 17 & 18 for the physical location.

BRIDGE RESISTORS:	FUNCTION METER
R38 = 60 & R41 = 60 ohms.	A THROUGH E
R39 = 40 & R40 = 40 ohms.	A THROUGH E
R37 = 500 & R42 = 500 ohms.	F ONLY

13A. SCREEN/ BIAS BALANCE: With Oscilloscope See Page 14 for without scope.

Set FUNCTION switch to POSITION C before proceeding.
Connect Oscilloscope common to **Pin Jack 8** & probe to **Pin Jack 4** of the **CALIBRATION BOX. Press P4.**
Set the **VERTICAL INPUT to DC** and adjust the scope to display the 120Hz positive peaks at max gain with **Horizontal adj. for at least 3 positive peaks**
Adjust R15 for exactly equal positive peaks and you should notice the jitter on the peaks null out when balance is achieved. USE INSULATED SCREWDRIVER.

Release P4.

If the positive peaks will not balance, try replacing the 5Y3GT rectifier tube.

14. MUTUAL CONDUCTANCE TEST: (Multimeter Set To Read AC)
Connect Digital Multimeter test leads to **Pin Jacks 2 & 7** on the **CALIBRATION BOX**. We will be using the Filament Voltages to supply the isolated voltages and it is important to set the **Filament Voltage to the 6.3 volt position** and turn the **Power Adjust control** down a little. The first test is for a full scale reading on the Main Meter.

For each Function Position, Set the Filament Voltage as indicated in the chart. Use the Power Adjust control to obtain the exact voltage needed. Set CATH ACT switch in TEST for A B & E and normal for C & D to keep the AC power close to 100VAC (Red Line).

Press P4(Lock), then Press down on the Gm Test button located on the CALIBRATION BOX and use Power Adjust control to obtain exact Voltage in Chart.

RELEASE P4(Lock) and the Gm Test Button, then go to the next Function Position.

SET FILAMENT	POWER	FUNCTION	VOLTAGE	METER READING	P4 & TEST
6.3	Adjust	F	6.0 VAC	3000 on 3000 Scale	DEPRESS
25.0	Adjust	E	25.0 VAC	1000 on 3000 Scale	DEPRESS
10.0	Adjust	D	10.0 VAC	1000 on 3000 Scale	DEPRESS
12.6	Adjust	C	12.5 VAC	1000 on 3000 Scale	DEPRESS
25.0	Adjust	B	25.0 VAC	1000 on 3000 Scale	DEPRESS
50.0	Adjust	A	50.0 VAC	1000 on 3000 Scale	DEPRESS

Hickok specs are within +/- of 1 small scale division except Range F +/- 2 small divisions.
NOTE: Values of R37 or R42 might have to be altered slightly to correct a Range F error.

FUNCTION SWITCH to C, FILAMENT to the 6.3 POSITION and CATH ACT TO NORMAL.

If Ranges A through E are all high and you are sure the Bridge Resistors are correct set the Function Switch to A. Connect a 10K ohm potentiometer across the Bridge. If you reference the resistor board drawings it's where R41 connects to R42, and R38 connects to R37. Start with maximum resistance and slowly adjust the potentiometer while observing the Gm reading. When you get the correct Gm reading repeat the previous tests. This may require a little compromise between Function ranges. Check the value of the potentiometer and replace it with a fixed, ½ watt resistor of that value.

Disconnect power to check the scaling resistors. Set the Function Switch to position F, which will disconnect the following resistors: R26 = 150, R27 = 750, R28 = 100, R29 = 270, and R33 = 230 ohms. Connect a jumper across C4 to protect the Main Meter.

When finished, remove the jumper from across C4, connect the power and repeat Step 14.

15. REFERENCE TUBE VERIFICATION:

Make sure the Filament Voltage is set to 6.3VAC. Set up for a 6L6 tube and insert the 6L6 reference tube that was previously made on this tester. Plug the tube in and allow it to warm up for a few minutes.
Press P4. Verify that the **Power** is set at **100 Volts, BIAS RANGE** is on **10V** and **BIAS** is set to **3.0 volts**. The Gm reading should be within **+/-** one small division of the reference tube value.

Release P4

If expected values are not obtained, and the preceding adjustments were made accurately, then it raises the question of what's at fault; the 539 or the tube. I would repeat the calibration process to ensure something was not overlooked, paying special attention to steps 12, 13 & 14.

16. GAS TEST:

Obtain a 6L6 tube that is known to be free of gas and put the tube in the tester. Set the tester up for the standard 6L6 test. Set the BIAS VOLTMETER switch to the 50 volt position and the BIAS Control max clockwise. Set the **FUNCTION** switch to the **D** position.
Press P5, the gas 1 test button.
Adjust the BIAS control for a reading of 500 on the 3000 scale.
Hold P5 and press P6 (the gas 2 test button), and verify that the reading moves up by less than one small division.

Release P6 and P5

Now, leaving everything the same:
Insert the **10Meg RESISTOR PLUG** into the **9-pin Miniature socket.**
This emulates a gassy condition for the 6L6 tube being tested.
Press P5, the gas 1 test button.
Adjust the BIAS control for a reading of 500 on the 3000 scale.
Hold P5 and press P6. Verify that the reading goes up 3 or 4 small divisions on the meter.

Release P6 and P5

Remove the RESISTOR PLUG and return the FUNCTION switch to the C position.

The gas testing circuits depend on the meter bridge circuit and several resistor values. If the mutual conductance tests are functioning properly, check for bad switches or dirty contacts on P5 and P6. Also check R2 = 470K and R53 = 220K ohm. R2 is placed in series with the grid for the gas test when P6 is pressed. Any grid current due to gas will cause a voltage drop across R2. The plate current goes up as the grid bias drops, indicating gas in the tube.

17A. DIODE/RECTIFIER TESTS:

Set the BIAS and the SHUNT controls to zero. Set the **FUNCTION** switch to the **G** (diode rectifier) position.
On the **CALIBRATION BOX** switch to **1K Position, LOADS ON,** and **RECTIFIER IN.**
Adjust the **SHUNT** control to **18**.
Press the P1 DIODE test button. Verify that the meter reading is at or slightly above the DIODES OK line on the meter.

Release P1

Adjust the SHUNT control to 78.
Press the P3 RECTIFIER test button. Verify that the meter reads at or slightly above the DIODES OK line on the meter.

Release P3

17B. OZ4 TEST:
Switch the **LOADS ON, 10K Position** and **RECTIFIER IN.** Adjust the **SHUNT** control to **74**. **Press the P2 0Z4 test button.** Verify that the meter reads at or slightly above the DIODES OK line on the meter.
Release P2. Set SHUNT to 0, Switch the LOADS OFF and RECTIFIER OUT on the CALIBRATION BOX.

For incorrect readings of the P1, P2 or P3 tests, check the following resistors: R1 = 150, R6 = 1.2K and R7 = 1.8K ohms

.

18. V.R. VOLTMETER TEST: (Multimeter Set To Read DC)
Set the **FUNCTION** switch to the H (V.R. TEST) position. Connect the Negative lead of a Digital Multimeter to **Pin Jack 8** and the Positive lead to **Pin Jack 3** on the **CALIBRATION BOX.** **Press P4 and read the voltage.** Adjust the V.R. VOLTS & MILS control for a reading of 150 VDC. Verify that the main panel meter reads 150 VDC +/- volts.

Release P4 and set the V.R. VOLTS & MILS control to zero.

If incorrect, check resistors R20 = 1K, R21 = 1K, R22 = 600 and R23 = 470K ohms.

19. V.R. MILLIAMPERE METER TEST:
Set the BIAS VOLTS/VR VOLTS & MILS (toggle switch) to the VR VOLTS & MILS position. Leave the Digital Multimeter connected from the last test.
Switch the **CALIBRATION BOX** to the **2K Position, LOADS ON.**
Press P4 and adjust the V.R. VOLTS & MILS control for a reading of 100 volts. Verify that the V.R. VOLTS & MILS meter is reading 50 mA +/- 1.

Release P4, disconnect the Digital Multimeter. Switch the LOADS OFF on the CALIBRATION BOX.
Return the BIAS VOLTS/VR VOLTS & MILS (toggle switch) to the BIAS VOLTS position. Set the VR VOLTS & MILS control fully counterclockwise.

If incorrect, check resistors R43 = 198 and R44 = 2 ohms.

NOTE: If a special 6L6 tube with know calibration is available, then R15 the screen balance can be tweaked just a little. However except for the Roger Kennedy calibration tubes I would not trust the accuracy and you would likely be better off leaving R15 alone.

You may have seen calibration instructions to adjust the signal for final calibration. With 100 VAC applied to the power transformer the signal winding will be 5 VAC in evry tester I have seen. It is very important that the R52 drops the signal to 2.5 VAC and that the rest of the signal voltages are a close as possible.

END OF CALIBRATION

Switch off the AC power on the tester.

Disconnect the power cord.

Remove the temporary jack arrangement for the Digital Multimeter AC connections if that option was used.

If the roll chart was removed, then reinstall it.

Carefully reinstall the tester in the case.

Secure tester to the case with the bottom and face plate screws.

Pull the excess power cord out of the 539B Model.

Congratulations!

REFERENCES

The HICKOK Company
Roger Kennedy, Mike Higgins, Jeff Kiser, Chris Haedt, & Others

Comments, corrections or questions are always welcome.

Thank you,

VHSystems@Eccher.com

OPTIONAL
BALANCING R8 and R15 without an OSCILLOSCOPE.

12B. PLATE/BRIDGE BALANCE: WITHOUT Oscilloscope

Unplug the tester from the outlet and the calibration box from the tube tester.
In order to balance without an Oscilloscope, the bridge resistors have to be checked first for both resistance and balance. In order to do this, we need to isolate them from the Main Meter circuit. Set the function switch half-way between positions G and H**. For Main Meter safety, place a jumper across C4.** Reference the Resistor Board drawings for the physical location.

BRIDGE RESISTORS:	**FUNCTION METER**
R38 = 60 & R41 = 60 ohms.	**A THROUGH E**
R39 = 40 & R40 = 40 ohms.	**A THROUGH E**
R37 = 500 & R42 = 500 ohms	**F Only & not involved in balancing.**

After balancing remove the jumper across C4.

Plug the tube tester in and connect the calibration box.

Switch the **CALIBRATION BOX to the 10K Position** and **LOADS ON.** This will load the plate power supply to approximately 14 mA of current.
Press P4. Now observe the GM meter while adjusting **R8** for zero.
Release P4: Switch the **CALIBRATION BOX** to the **2.5K Position**, which will increase the plate current from approximately 14 mA to approximately 50mA.
Press P4: This will likely cause the meter to shift slightly off zero. Split the difference between the reading and zero by adjusting **R8**.

Continue alternating between the 10K and 2.5K load selections on the Calibration Box and making fine adjustments until you obtain results as close to zero for both resistor loads as possible. Your final adjustment should be with the 10K resistor load.

Release P4 and switch the LOADS OFF on the CALIBRATION BOX

13B. SCREEN/ BIAS BALANCE: WITHOUT Oscilloscope

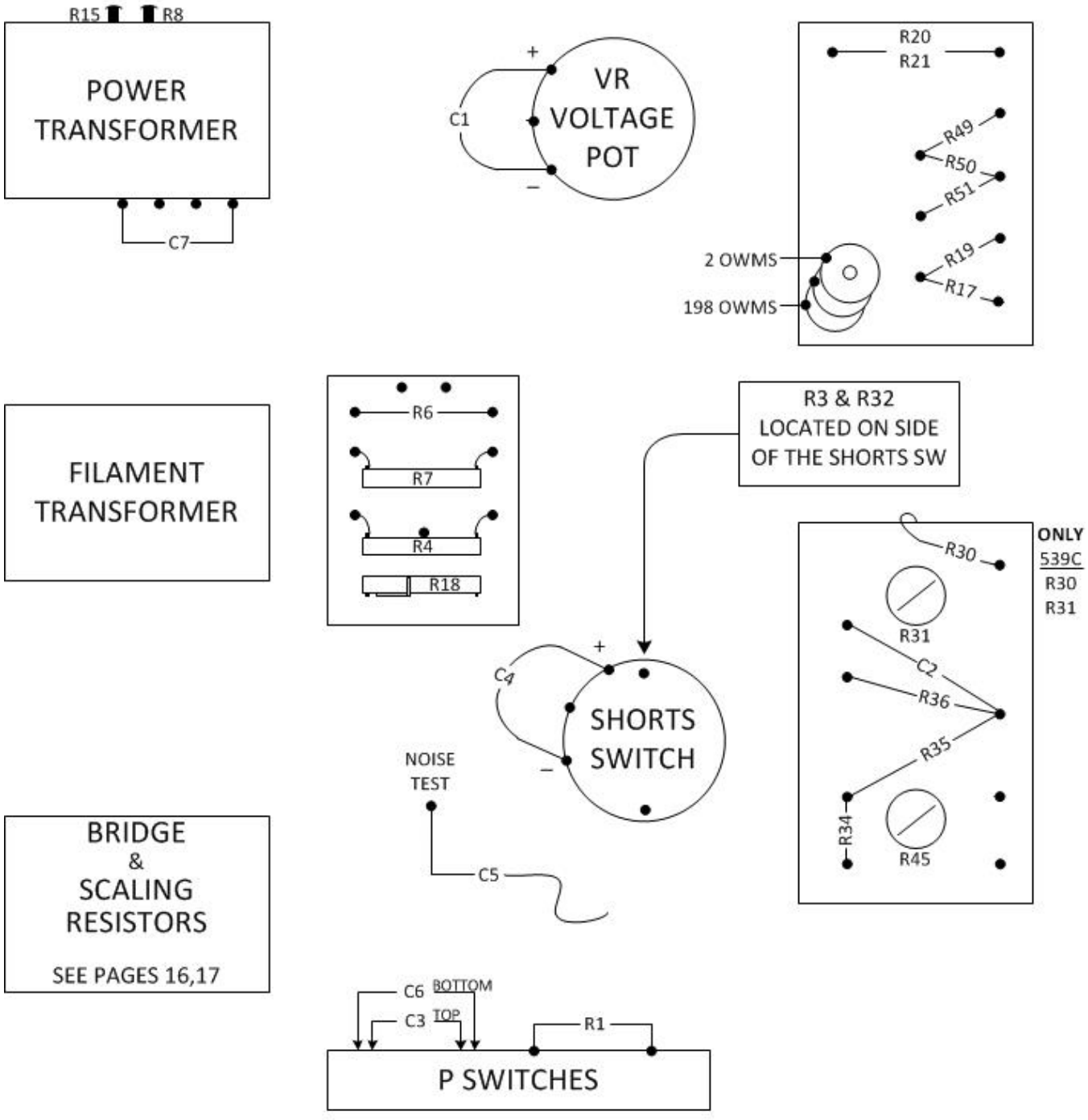
Unplug the tester and calibration box.
Reference The Resistor Board on pages 17 or 18 and connect a jumper wire from the **junction of R52 and R9** to the **open end of R12**. This will remove the 2.5 VAC signal from the divider leaving just the 120Hz pulsating DC at the control grid. Connect the power cord, adjust the bias to 3 volts and plug in a good 6L6 that does not have heater cathode leakage or gas and allow it to warm up. Reset the bias to 3 Volts..

Press P4
Adjust R15 for a zero reading on the Gm Meter. **USE INSULATED SCREWDRIVER**.

Release P4
Repeat the process for several tubes like a 12AU7, 6AU6, 6V6GT and other 6L6 tubes to insure it remains on or very close to zero,

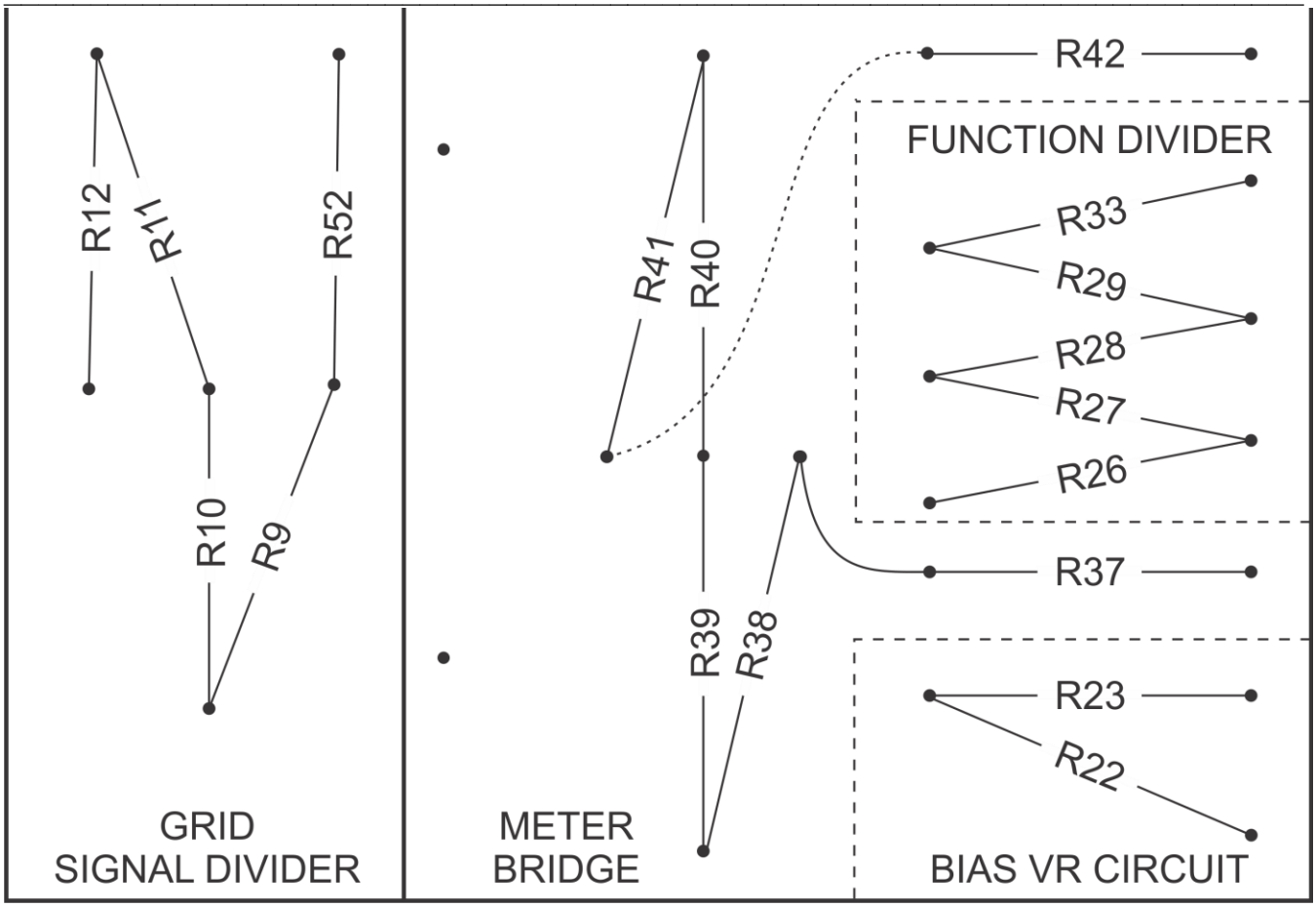
Unplug the power to tester Remove the jumper and 6L6 tube. Plug in the CALIBRATION BOX and the tester power plug. Return to calibration on page step 14 on page 11.

Hickok
539B & 539C
Parts Location



ROLL CHART

POST 1971 RESISTOR BOARD SHOWING LOCATIONS

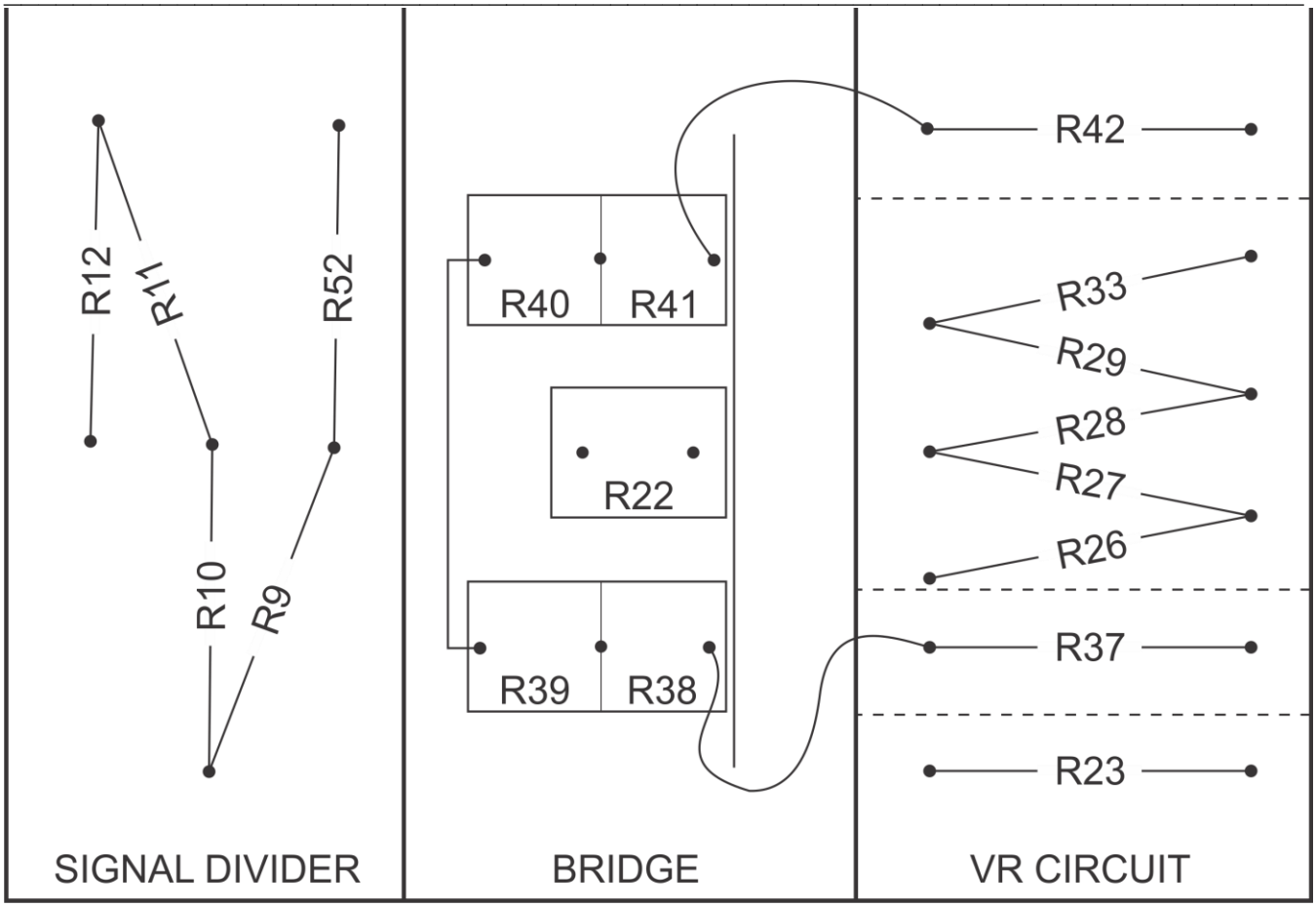


R	OHMS	R	OHMS	R	OHMS
R9	300	R26	150	R38	60
R10	100	R27	750	R39	40
R11	50	R28	100	R40	40
R12	50	R29	270	R41	60
R22	560	R33	230	R42	500
R23	470K	R37	500	**R52**	**500**

NOTE: This resistor board was in the later production units and consisted entirely of standard, precision resistors in the meter bridge and sometimes in parallel to obtain the desired value and wattage.

R52 can be replaced with a 200 ohm, 25-turn potentiometer in series with a 402 ohm resistor to adjust the grid signal voltage. A Mod suggested by Daniel School in an article he wrote and can be very useful when needed.

PRE 1971 RESISTOR BOARD SHOWING LOCATIONS



R	OHMS		R	OHMS		R	OHMS	
R9	300		R26	150		R38	60	SPOOL
R10	100		R27	750		R39	40	SPOOL
R11	50		R28	100		R40	40	SPOOL
R12	50		R29	270		R41	60	SPOOL
R22	560	SPOOL	R33	230		R42	500	
R23	470K		R37	500		**R52**	**500**	

NOTE: This resistor board used wire spool resistors in the meter bridge of 539B's and early production 539C units. The spool resistors physically mount over the signal resistors on a bracket, but are shown here in the center in order to identify the locations of the signal resistors. The spool resistors in the bridge circuit can be a source of problems and replacing them with precision resistors is a viable recommended option.

R52 can be replaced with a 25-turn potentiometer to adjust the grid signal voltage as outlined in the Step 20 adjustments. A Mod suggested by Daniel Shoo in an article he wrote. It's somewhat difficult to do on this board, but can be very useful when needed.

PARTS LIST FOR MODEL 539C

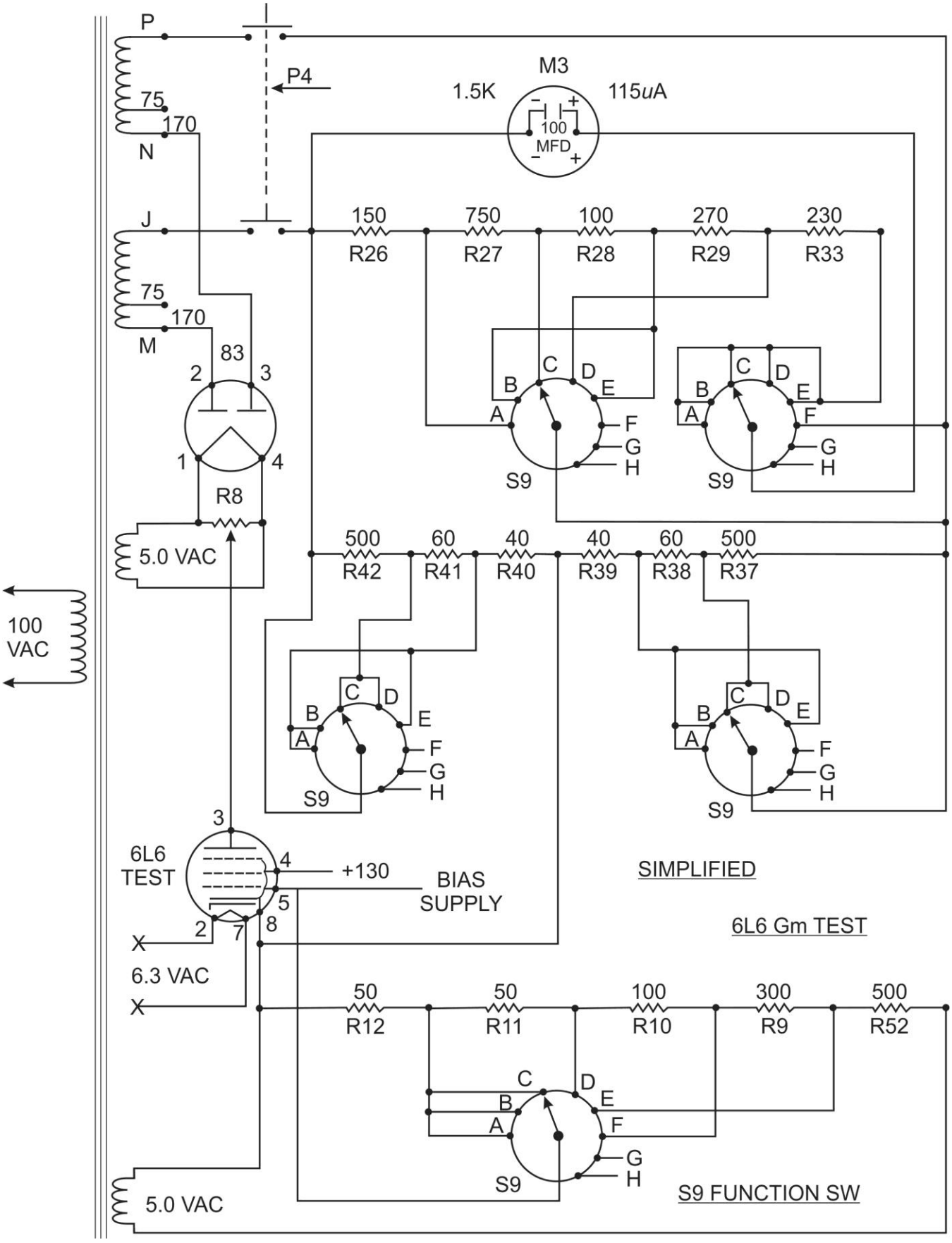
Hickok Code No.	Name and Description	Ref. Symbol or Function
2490-273	BOOKLET: Instructions	
2920-7	BUTTON: Push, Black	
2920-8	BUTTON: Push, Red	
3085-40	CAPACITOR: 100 Mfd, 6 volts	C4
3085-68	CAPACITOR: 8 Mfd, 350 volts	C1
3095-8	CAPACITOR: 470 Mmf, 10%, 500 volts	C5
3105-112	CAPACITOR: .5 mfd, 200 volts	C3
3105-175	CAPACITOR: .05 mfd, 400 volts	C2
3200-55	CHART: Data Roll	
4160-66	DIAL: Shunt	
10300-1	JACK: Pin plug type, red	
10300-2	JACK: Pin plug type, black	
11500-11	KNOB: with pointer	
11505-46	KNOB: with white dot	
11505-49	KNOB: 1"	
12270-2	LAMP: #81	Fuse Lamp
12270-12	LAMP: #47	Pilot Lamp
12270-14	LAMP: NE51	Short Test
12450-145	LEAD: Assembly, plate	
12450-180	LEAD: Assembly, plate	
16925-88	POTENTIOMETER: 1000 ohms	R25
16925-270	POTENTIOMETER: 3000 - 1000 ohms	R14-R16
18413-361	RESISTOR: 36K, 5%, 1/2 watt	R47
18414-121	RESISTOR: 120K, 5%, 1/2 watt	R35-R36
18414-151	RESISTOR: 150K, 5%, 1/2 watt	R34
18415-102	RESISTOR: 1 Meg, 10%, 1/2 watt	R46
18414-472	RESISTOR: 470K, 10%, 1/2 watt	R2
18422-101	RESISTOR: 1000 ohms, 5%, 1 watt	R20-R21
18422-122	RESISTOR: 1200 ohms, 10%, 1 watt	R6
18423-151	RESISTOR: 15K, 5%, 1 watt	R5
18525-685	RESISTOR: 150 ohms, 1%, 1/2 watt	R26
18525-686	RESISTOR: 50 ohms, 1%, 1/2 watt	R11-R12
18525-687	RESISTOR: 470K, 1%, 1/2 watt	R23
18525-700	RESISTOR: 200 ohms, 1%, 1/2 watt	R51
18525-719	RESISTOR: 270 ohms, 1%, 1/2 watt	R29
18525-717	RESISTOR: 40K, 1%, 1/2 watt	R49
18525-722	RESISTOR: 9900 ohms, 1%, 1/2 watt	R50
18550-153	RESISTOR: 1200 ohms, 1%, 1 watt	R19
18525-718	RESISTOR: 100 ohms, 1%, 1/2 watt	R10-R28
18525-720	RESISTOR: 230 ohms, 1%, 1/2 watt	R33
18525-723	RESISTOR: 750 ohms, 1%, 1/2 watt	R27
18525-721	RESISTOR: 300 ohms, 1%, 1/2 watt	R9
18550-154	RESISTOR: 2250 ohms, 1%, 1 watt	R17
18525-681	RESISTOR: 500 ohms, 1%, 1/2 watt	R13-R37-R42
18525-729	RESISTOR: 330K, 1%, 1/2 watt	R48
18575-12	RESISTOR: 1800 ohms, 10%, 10 watt	R7
18575-19	RESISTOR: 100 ohms, 10%, 10 watt, center tapped	R3-R4
18575-89	RESISTOR: 8500 ohms, 10%, 10 watt	R18
18575-126	RESISTOR: 150 ohms, 1%, 2 watt	R1
18750-24	RHEOSTAT: 150 ohms	R13
18750-26	RHEOSTAT: 10K, 50 watt	R24

PARTS LIST FOR MODEL 539C

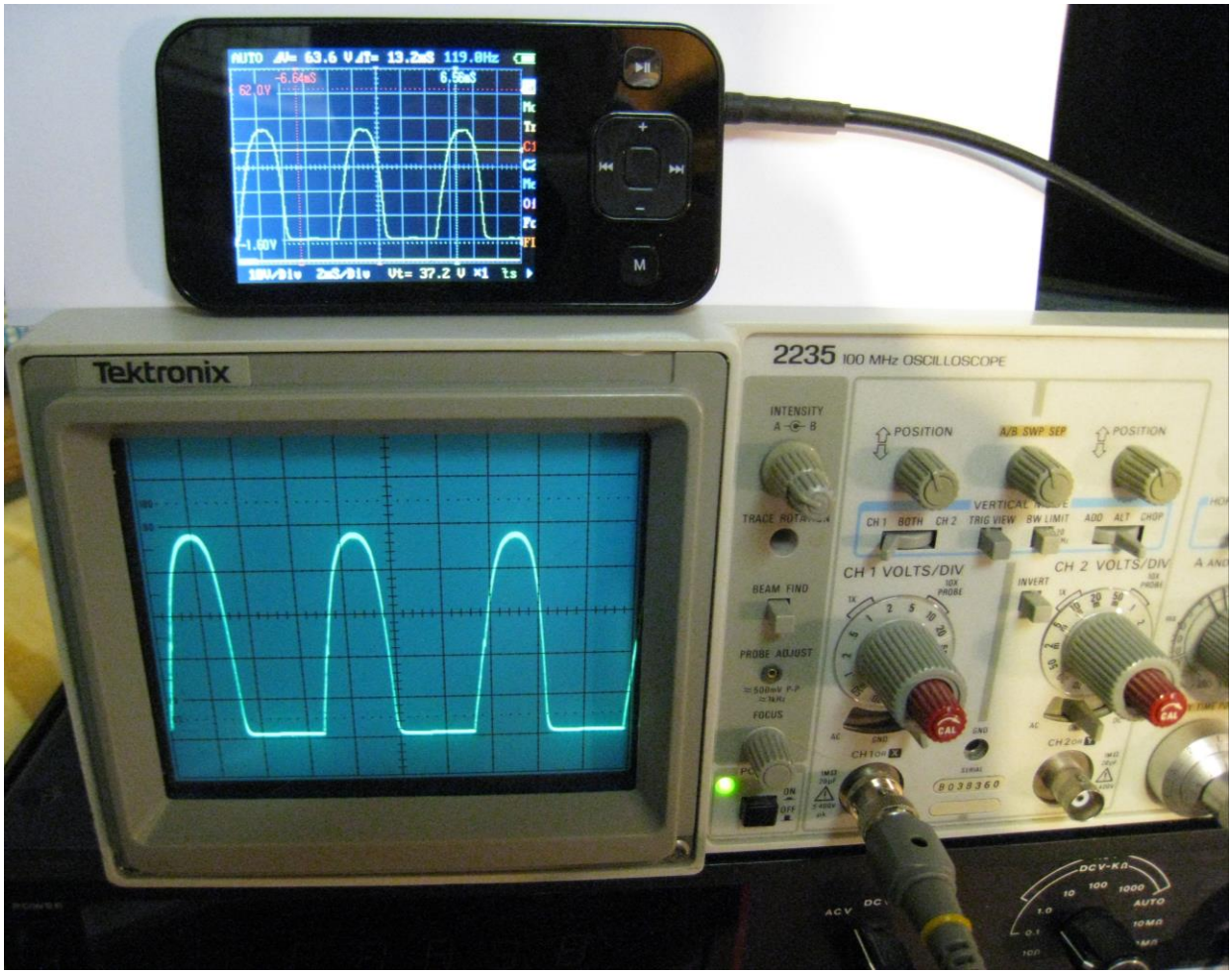
Hickok Code No.	Name and Description	Ref. Symbol or Function
19350-1	SOCKET: Bayonet for 81 Lamp	
19350-113	SOCKET: Bayonet Neon and Pilot Lamp	
19350-364	SOCKET: 10 pin	
19350-367	SOCKET: Novar	
19350-365	SOCKET: Compactron	
19350-381	SOCKET: Nuvistor, 5 pin	
19350-383	SOCKET: Nuvistor, 7 pin	
19350-76	SOCKET: 7 pin miniature	
19350-93	SOCKET: 4 pin	
19350-94	SOCKET: 5 pin	
19350-95	SOCKET: 6 pin	
19350-96	SOCKET: 7 pin	
19350-97	SOCKET: Loktal	
19350-98	SOCKET: Octal	
19350-220	SOCKET: Subminiature, combination 7 and 8 pin	
19910-61	SWITCH: Gang, 8 buttons	
19911-7	SWITCH: Meter reverse	
19911-55	SWITCH: Toggle DP-DT	
19912-480	SWITCH: Suppressor and Cathode	
19912-479	SWITCH: Selectors	
19912-202	SWITCH: Filament Volts	
19912-304	SWITCH: 3 P-DT	
19912-308	SWITCH: Function	
19912-312	SWITCH: Short Test	
20800-103	TRANSFORMER: Filament	
20800-169	TRANSFORMER: Plate	
20875-6	TUBE: 5Y3GT/G	
20875-28	TUBE: 83	

HICKOK 539B/C SIMPLIFIED Gm TEST CIRCUIT

SHOWING 6L6 TUBE TEST – BIAS/SCREEN CIRCUIT NOT SHOWN



BALANCING THE PLATE AND SCREEN SUPPLIES



This picture is showing the 120 Hz plate supply waveform on the scopes for adjusting R8, as described in Steps 13 and 14. The screen supply waveform will be almost identical for adjusting R15 in Step 12.

These are important adjustments for the successful calibration of any Hickok Tube Tester using their trademark Gm circuit. The Military Manuals for the TV7 are excellent for the theory behind these circuits

As you can see, it is possible to use the ARM DSO Nano - Pocket-Sized Digital Oscilloscope. They are now very inexpensive and provide adequate display for balancing the peaks. I would prefer using a triggered sweep analog oscilloscope.

By simply utilizing a zener diode or diodes to provide sufficient offset to just observe the top portion of the pulsating screen and plate waveforms. I used a 150 volt zener diode to offset the pulses by 150 volts, leaving the top 50 or so volts for the scope to display. We have no need to see the lower portion of the waveform for these adjustments. Scope input must be set to DC or add a 1 meg resistor between scope probe and ground for the zener diode to operate correctly.

HICKOK 539B/C TUBE TESTERS

SUPPLEMENTARY INFORMATION

1. Set up for the tube to be tested, then always check the setup again before inserting the tube just to be sure. Ensure the line voltage is set at the red line of 100 VAC during the test.

2. Always test for shorts before attempting any other tests. Shorted tubes should be discarded after making sure the short was not normal in the position it was observed.

3. For Gm testing, always press **P4 non-lock first, while observing the Main Meter**. This allows you to rapidly release it if something is wrong.

4. Reset line voltage to 100VAC and Bias to what is specified for proper results.

5. You might consider using tube set-up charts rather than the roll chart, since replacement charts are difficult to obtain now and they have dropped off many of the older tube types..

6. If you have a good 6L6 reference tube made previously on this tester, use it periodically to confirm the tester's accuracy. If not make one after calibration is complete.

7. Consider installing socket savers in the 7 and 9 pin miniature and the octal tube sockets, since replacing the sockets in the main panel is difficult. Bad connections in the socket savers can sometimes be solved by carefully tightening the connectors with a sharp tool, such as a dental pick. Now the 7 pin savers are difficult to find, but you can make a 7 pin to octal adapter.

8. Remove the Plate Current shorting bar from the jacks and replace it with a 1 ohm 1% 1 watt resistor and mV will equal mA directly. Now, using the 200mV range of your digital multimeter you can get instant readings of the plate current of the tube under test without having to open the circuit for a current meter. I recommend that the removed shorting bar be stored on the Cathode Current Jacks to avoid losing it.

9. A tremendous amount of information is available on the Internet for the Hickok Tube Testers. A lot of it is good, but there is also misinformation that can be misleading. Do yourself a favor and research the information before assuming it is true.

10. Never attempt to clean and lubricate the phenolic switches by spraying as it can be absorbed into the phenolic material with disastrous consequences. You can use a cleaner/lube like Deoxit D5 if you carefully apply it to the metal contacts. Alcohol should never be used.

11. The tolex covering on the tester case can be restored or improved by simply using evenly applied black liquid shoe polish. Of course it does not repair damaged tolex. The KIWI Black Scuff Cover works very well. The stainless steel hardware can be cleaned up using fine steel wool, WD40 and a lot of elbow grease or a Dremel type tool with the wire brush..

13. Be careful when tightening the knob set screws as over tightening can result in breakage.

HICKOK 539B/C
POWER TRANSFORMER DC BALANCE MOD.

There is between 7 and 15 ohms difference between the 2 plate windings of the power transformer. This unbalance is created by the layering of the windings and the need to keep the AC output equal. As you can see this does not create a significant error until the plate current gets to around 40 mA. This can be corrected by installing an appropriate ohm resistor in series with the lower resistance winding. You need to re-balance R8 once this resistor has been installed.

PLATE TO CATHODE LOADING	CURRENT DC mA	Gm METER
10K	**13**	**R8 Adjusted to 0**
5K	26	0
4K	32	Slightly high
3K	42	½ div high
2.5K ***	**52 *****	**1 " "**
2K	62	2 " "

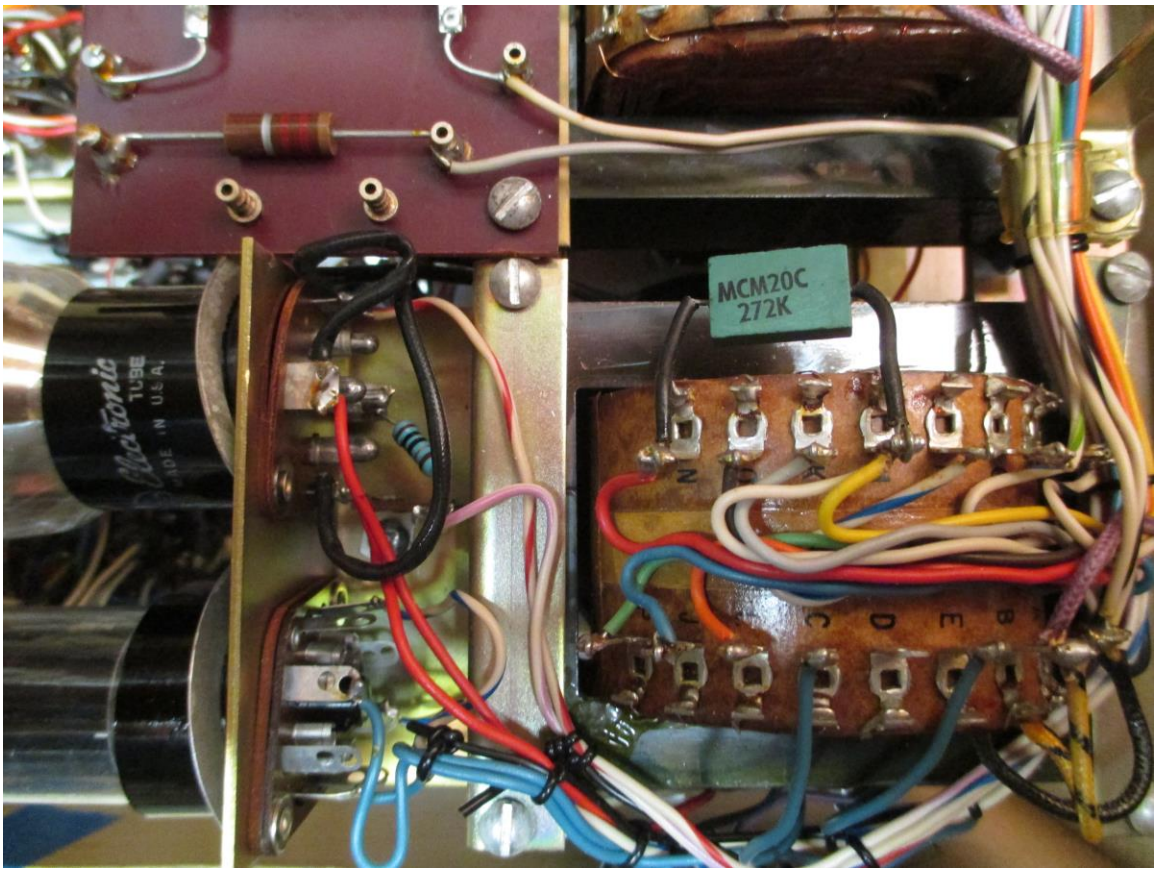
NOTE: * 6L6 PLATE CURRENT = Appx 50 Ma**

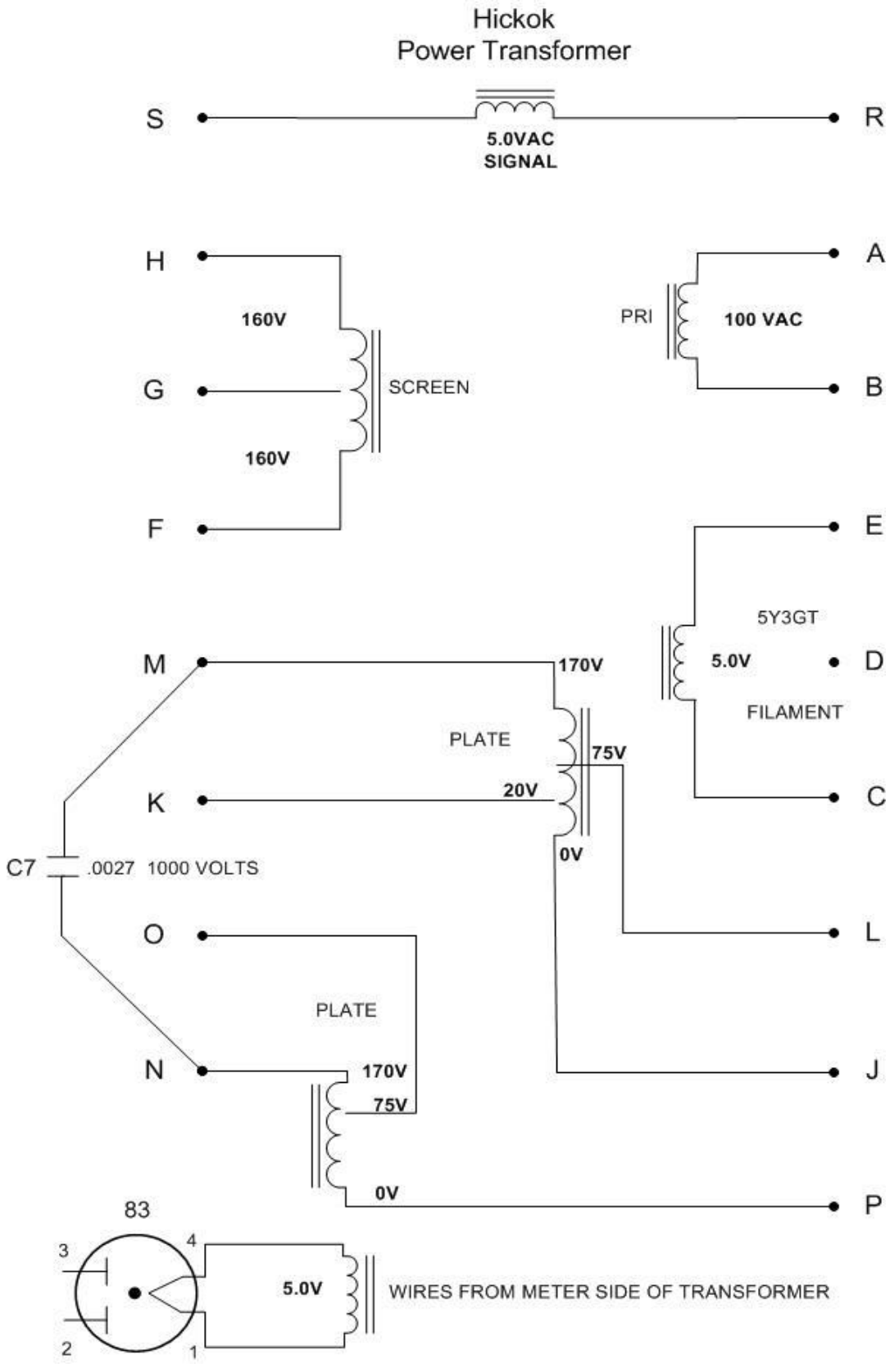
I discovered this error in 2014 and discussed it with Mike Higgins an Electrical Engineer during a trip he made to Colorado. We agreed that adding a compensating resistor would correct this error. Mike has done a great deal of research on the Hickok 539B/C models and you can find him with a Google search.

Reference the attached Power Transformer terminals and measure both of winding resistances. Pick a resistor close to the value needed to make the low winding equal the high resistance winding. I have found these windings to be from 7 to 16 ohms out of balance. Use a 1 watt or even ½ wattresistor as the wattage is very low. I prefer to install the resistor at the 83 tube socket. If this is a later 539C where the 5Y3GT and 83 tubes may be reversed and the socket wiring is exposed, but 539B and early 539C's will require removing the tube assembly. Remove the wire from the appropriate plate, attach a terminal strip to the existing hole in the socket mount and connect the resistor from the terminal strip to the plate, then connect the wire to the terminal strip end of the resistor. This picture shows a late 539C where the resistor is mounted on a terminal strip close to the 83 tube socket.

For the early 539C and 539B models it could connect to either J or P terminals, which are the blue and green wires next to the red, which are the lower left terminals on the power transformer. For these the wire must be removed from the terminal and the ohm resistor inserted in series. Care must be taken to insulate with heat shrinkable and careful positioning to prevent shorts. **CAUTION** its better to cut the wire at the terminal rather than risk twisting the terminal and perhaps causing transformer problems.

This modification allows balancing of the Control/Screen Grid pot R15 without a scope by using a good 6L6GC with no HK leakage, removing the AC signal and zeroing the Main Meter. The All-In-One Test and calibrate manual gives this method as an option, but states its not as accurate, however with this mod I found it to be just about as accurate as using a scope.




Hickok
Power Transformer
S
R
5.0VAC
SIGNAL
H
160V
G
SCREEN
160V
F
PRI
100 VAC
A
B
E
5Y3GT
5.0V
D
FILAMENT
M
170V
PLATE
75V
K
20V
C
0V
C7
.0027 1000 VOLTS
O
L
PLATE
N
170V
75V
J
0V
P
83
3
4
2
1
5.0V
WIRES FROM METER SIDE OF TRANSFORMER

HICKOK 539B/C
BIAS FUSE MODIFICATION
By William Eccher

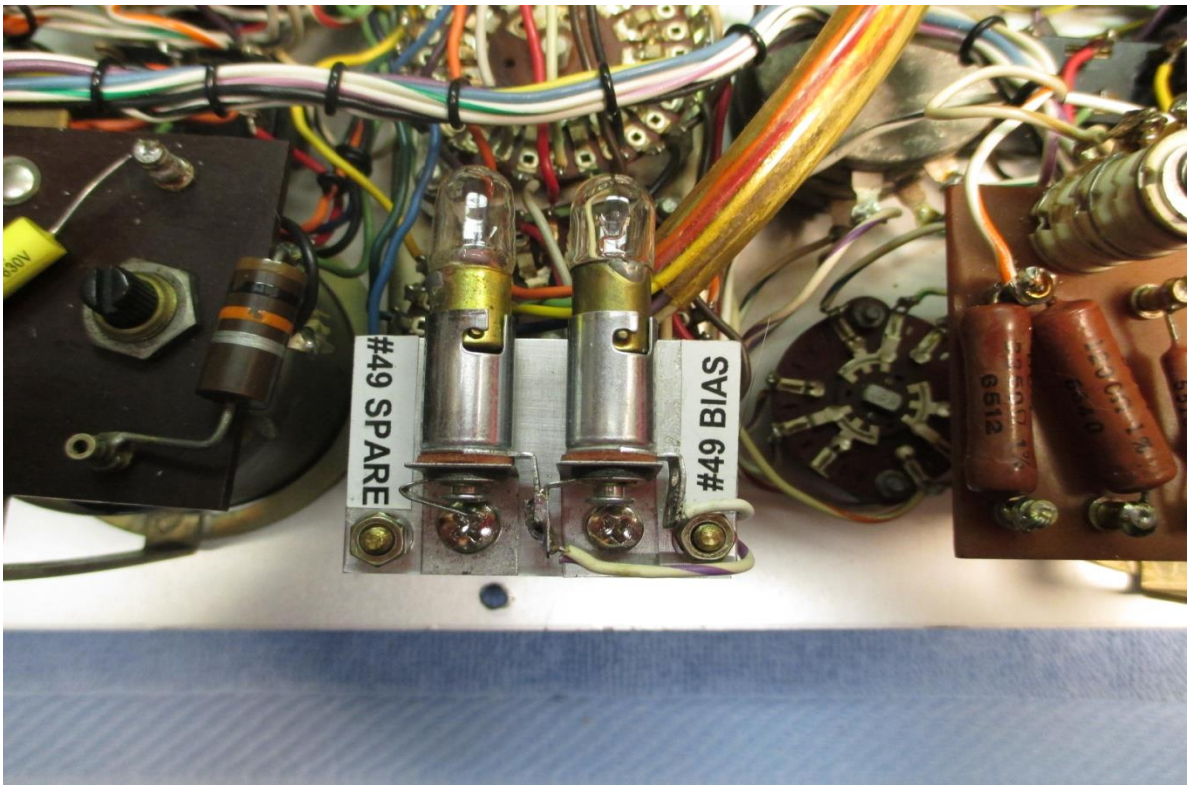
For reasons unknown Hickok omitted the Bias Fuse Bulb in these two models. It was used in models before and again after in both the 752 and 580 models. Many others have installed their own version or had a repair facility do it for them.

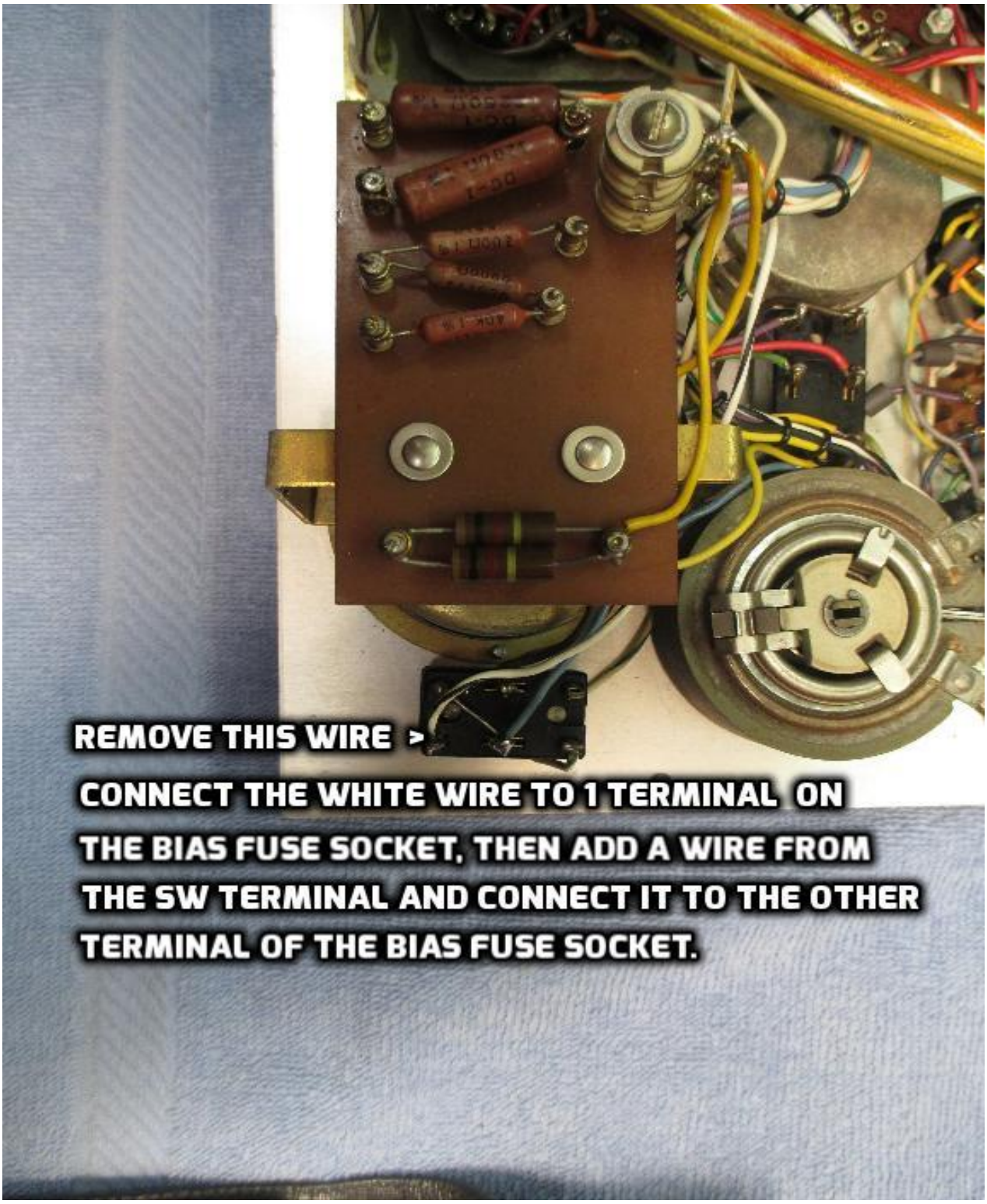
It was designed to protect rhe Bias Control Potentiometer from a shorted tube. This is very important now, since it difficult if not impossible to find a replacement part.

Some have modified the front panel to accept a bayonet socket for the type 49 fuse bulb, but with this fuse seldom failing the decision was made to install it internally.

This version has two bayonet socket mounted on a small plate that attaches to the existing machine screws on standoff's next to the Filament Selector Switch. The type 49 bulbs is installed with one bayonet socket wired in in series with the common bias adjust circuit. The other socket holds the spare #49 bulb.

If the 49 bulb gets burned out there will be zero bias indicated on the bias meter and the tester must be removed from the case for replacement. This modification Includes a spare 49 bulb.




REMOVE THIS WIRE >
CONNECT THE WHITE WIRE TO 1 TERMINAL ON
THE BIAS FUSE SOCKET, THEN ADD A WIRE FROM
THE SW TERMINAL AND CONNECT IT TO THE OTHER
TERMINAL OF THE BIAS FUSE SOCKET.

HICKOK 539B/C
PLATE CURRENT MODIFICATION

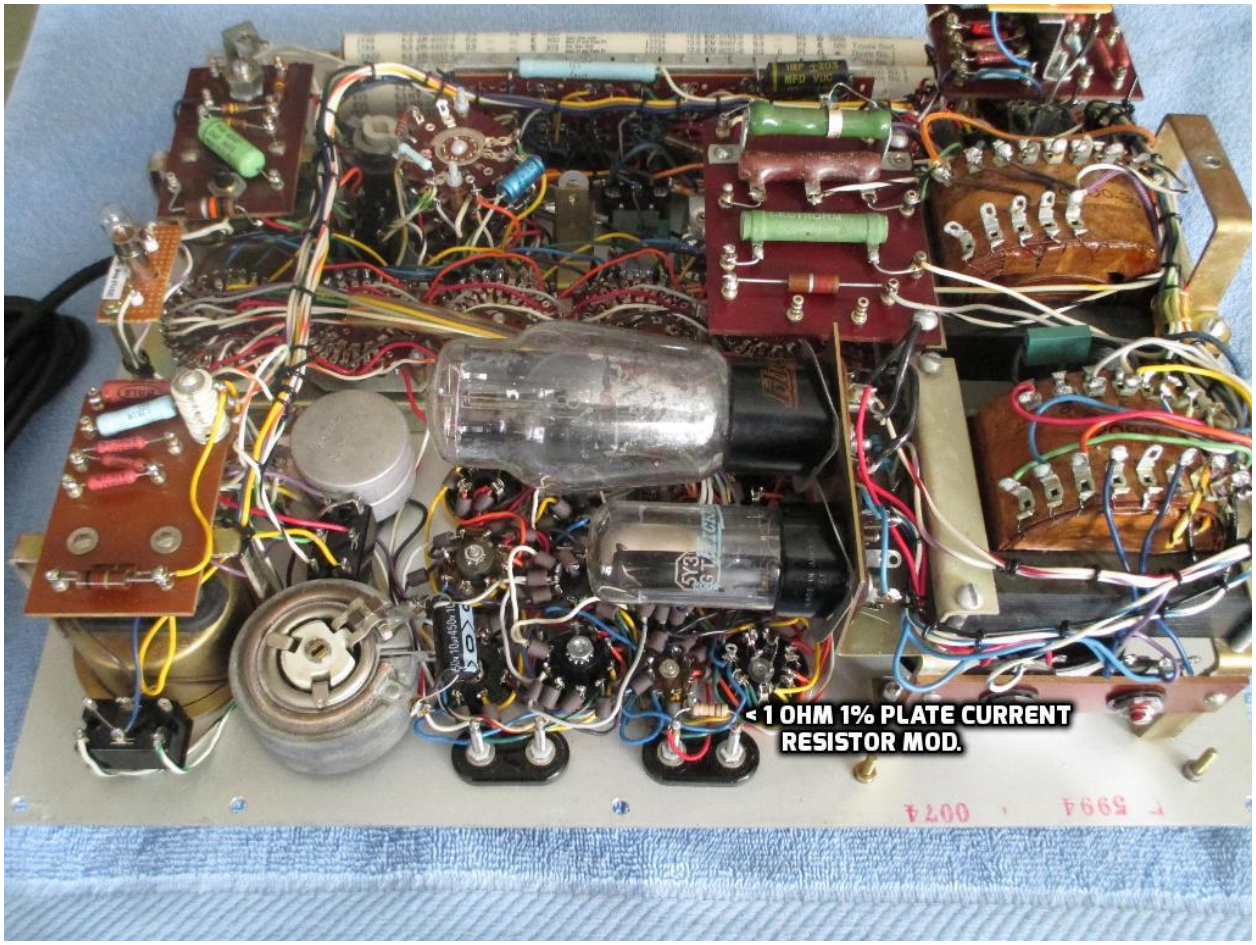
The Plate Current jumper is removed from the jacks and installed on the Cathode Current jacks for safe keeping even thought you will probably never use them again.

A 1.0 ohm 1.0% resistor is soldered across the Plate Current terminals in the tester.

Now connect any Digital Multimeter that has a 200mV range to the Plate Jacks and the reading in **mV will equal mA** of plate current. This application of ohms law gives us a simple way to measure Plate Current without breaking the circuit to insert a Current Meter. You only need to connect the multimeter when testing for Plate Current, since the resistor inside the tester completes the Plate Circuit.

Your Hickok tube tester now gives you a very accurate reading of the Plate Current to balance your output tubes. Of course you can use it as a measurement for any tube tested even the 12AX7 tubes that only draw around 1 mA of Plate Current.

PICTURE SHOWS A 6L6 BEING TESTED FOR Gm and PLATE CURRENT.
Digital multimeter is set to read 200mV and is indicating 52.8 mA



This is a 539C showing the resistor placement and that would be the same for a 539B.

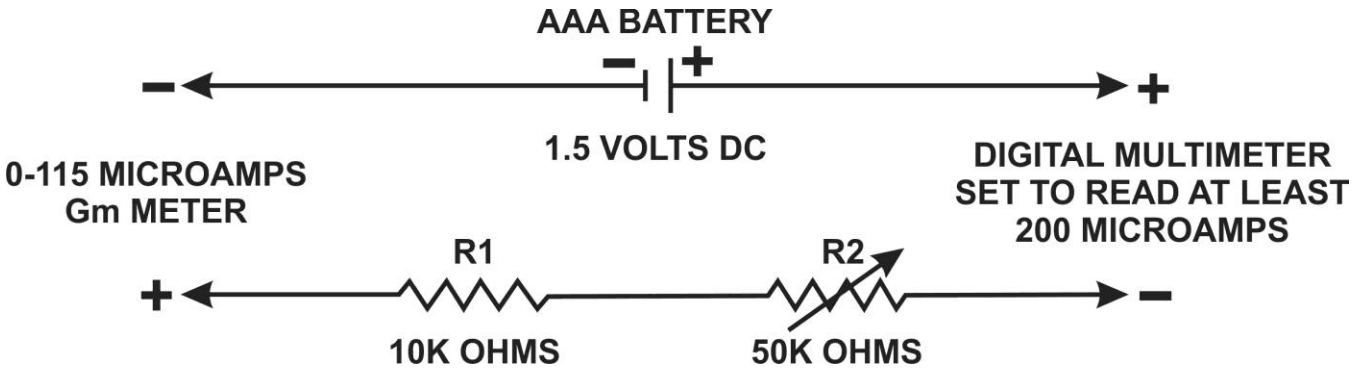
The later 539C models have the tube mounting assembly turned over as shown in this picture.

TEST AND CALIBRATE UNIT WITH SCHEMATICS

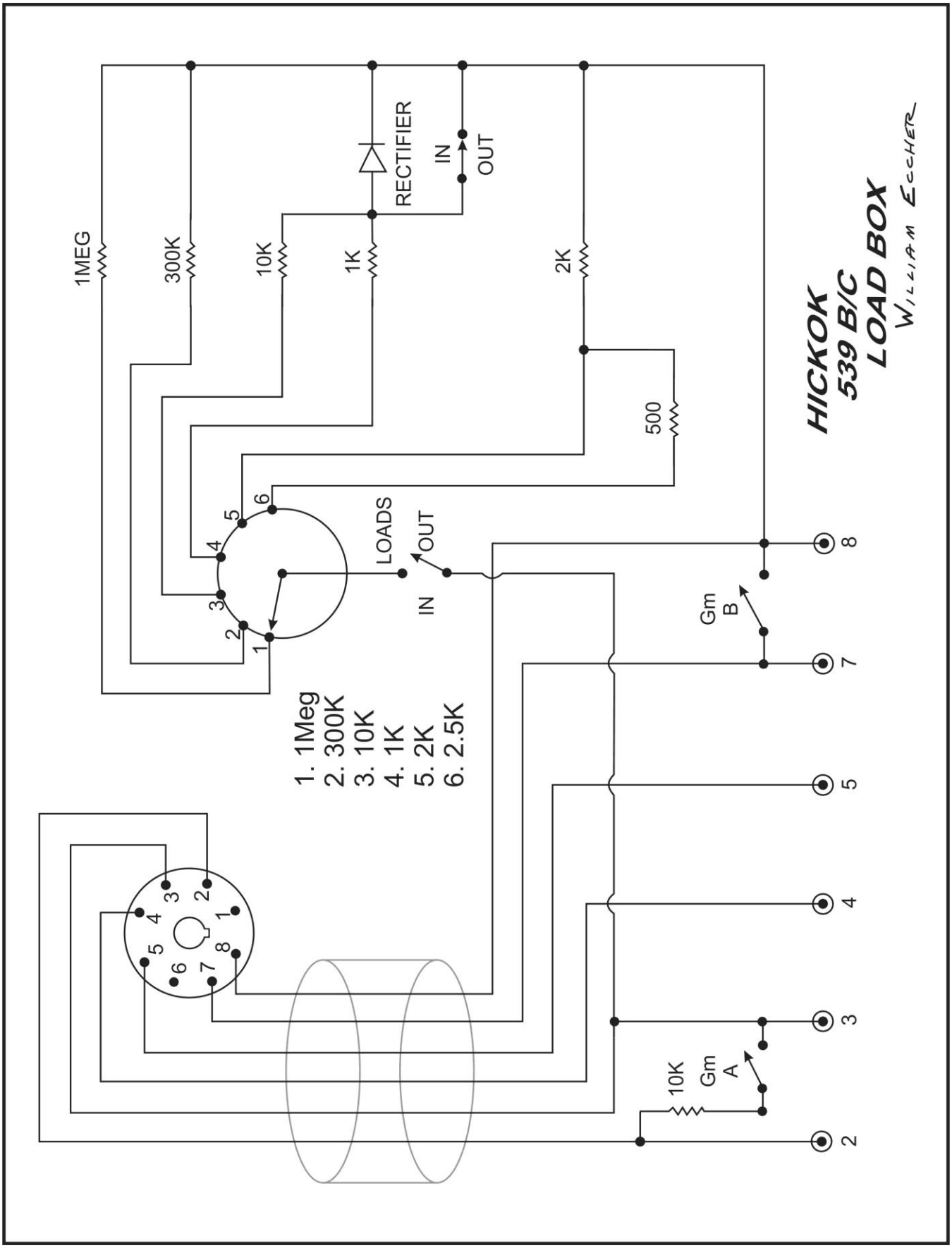
NOTE: Replaceable AAA Battery for Gm Meter Test is in a holder inside front left of unit. Instructions for Testing and Replacement of the battery are at bottom of Page 5.

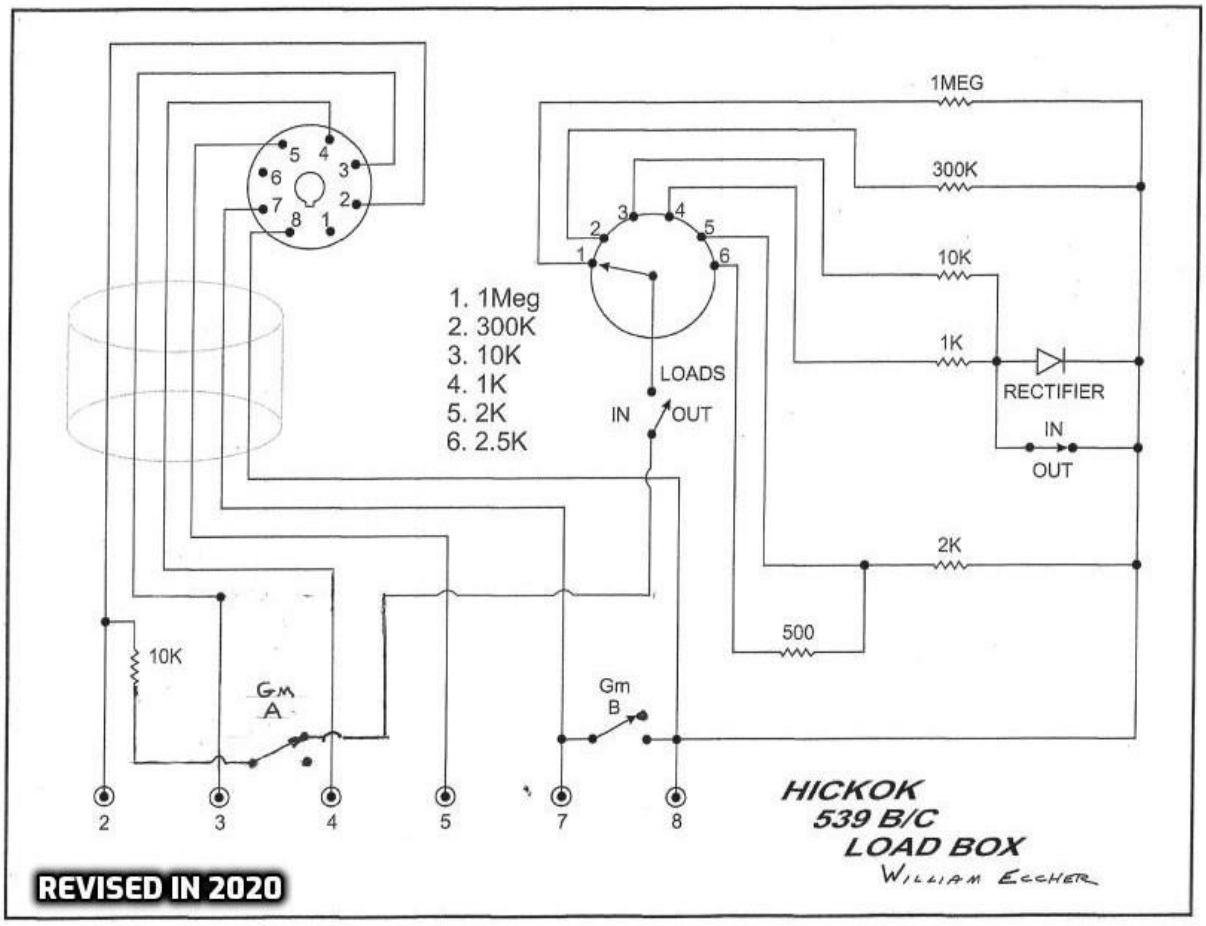
GM METER TEST SCHEMATIC

Meter Test is fully independent of Load Box Electronics



CALIBRATION LOAD BOX SCHEMATIC





CALIBRATION LOAD BOX SCHEMATIC

HICKOK 539B/C CALIBRATION CHECK SHEET

DATE _____ SERIAL # _____

1. MAIN METER CALIBRATION TEST					**SCALE**
115.0	MICROAMPS	=	3000	_____	3000
76.67	MICROAMPS	=	2000	_____	3000
57.50	MICROAMPS	=	1500	_____	3000
38.33	MICROAMPS	=	1000	_____	3000

2. LINE ADJ. METER			_____
3. SHUNT POSITION			_____
4. SHORTS TEST ----------	**Model B**	1 through 9	_____
	or Model C	1 through Z	_____
5. SHORTS LIGHT SENSITIVITY			_____
6. LEAKAGE RESISTANCE - MAIN METER TEST			_____
7. BIAS VOLTAGE TEST	50V RANGE MAX	-40 VDC	_____
	50V RANGE AT	-25 VDC	_____
	10V RANGE AT	-5 VDC	_____
8. FILAMENT AC VOLTAGES		+-10%	_____
CATHODE ACTIVITY LIFE TEST		-10%	_____
9. PLATE VOLTAGE TEST 1OK OHMS LOAD	NORMAL	138-146 VDC	_____
	LOW	56-62 VDC	_____
10. SCREEN VOLTAGE TEST	NORMAL	130-138 VDC	_____
	LOW	54-60 VDC	_____
11. GRID SIGNAL VOLTAGE TEST	A B C =	.25 VAC	_____
	D =	.50 VAC	_____
	E =	2.5 VAC	_____
	F =	1.0 VAC	_____

12A. PLATE/ BRIDGE BALANCE WITH SCOPE R15 _____

12B. PLATE/ BRIDGE BALANCE W/O SCOPE R15 _____

13A. SCREEN/BIAS BALANCE WITH SCOPE R8 _____

13B. SCREEN/BIAS BALANCE W/O SCOPE R8 _____

14. MUTUAL CONDUCTANCE TEST

Using Filament Voltages and Power Adjust. **SCALE**

FUNCTION	F	6.0 VAC	=	3000	_____	3000
	E	25.0 VAC	=	1000	_____	3000
	D	10.0 VAC	=	1000	_____	3000
	C	12.5 VAC	=	1000	_____	3000
	B	25.0 VAC	=	1000	_____	3000
	A	50.0 VAC	=	1000	_____	3000

+/- 1 small div

CAUTION:

SET THE FILAMENT VOLTAGE BACK TO 6.3 VOLTS NOW!

15. MUTUAL CONDUCTANCE VERIFICATION: 6L6 **Gm** _____

Ip _____

16. GAS TEST **FUNCTION**

GAS TEST 6L6	**D**	**ADJ BIAS to 500 P5+P6**	_____
Zero gas tube		**6000 Main Meter Scale**	
Add			
10M RESISTOR	**D**	**ADJ BIAS to 500 P5+P6**	_____
Emulating Gas		**6000 Main Meter scale**	
		Increase 3-4 small Divisions	_____

17A. DIODE TEST G SHUNT 18 P1 _____

RECT. TEST G SHUNT 78 P3 _____

17B. 0Z4 TEST G SHUNT 74 P2 _____

18. V.R. VOLTMETER TEST 150 VDC _____

19. V.R. CURRENT TEST 50 mA _____

PARTS REPLACED:

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

REPAIRS & COMMENTS: _____

_____ _____

_____

_____

_____

_____

_____

_____

_____

_____