Grid Voltage Measurement Methods, AC and DC heated

With Directly heated tubes, the heater acts as a cathode. So the question is, hat will electrically be "the" cathode, for reference measurements. Unfortunately, all methods that are possible, are found in various tube testers.

When you buy Emission Labs tubes, you may come into a situation where you want to compare the test results on the tube box, with what you are measuring. This could be a tube tester, or a live circuit. The results of the EML factory test should repeat EXACTLY. For any difference, there is always an explanation. First you need to know, we test the tubes at the rated dissipation, in a thermally stabile condition, so after the tube base has warmed up. This requires minimum 5 minutes of operation. So any tube tester which tests the tube by only warming up the heater, will show a lower result.

Alternatively you can heat up the tubes in a test circuit, and then test them quickly on a more simply kind of tube tester, simulating a hot condition.

The EML tubes are tested at the rated plate current, so we always have the same plate dissipation. This makes it easier to verify the tube tests done. Furthermore, transconduction must always be measured at the rated plate current. It would be a mistake to measure transconduction at a fixed grid voltage, since transconduction is a function of the plate current, not a function of the grid voltage. The test result is the grid voltage needed to get the rated plate current.

The Scheme 1 and 2 on the left, produce the same results, and are normally used for tube curves. (Not so with most digital testers)

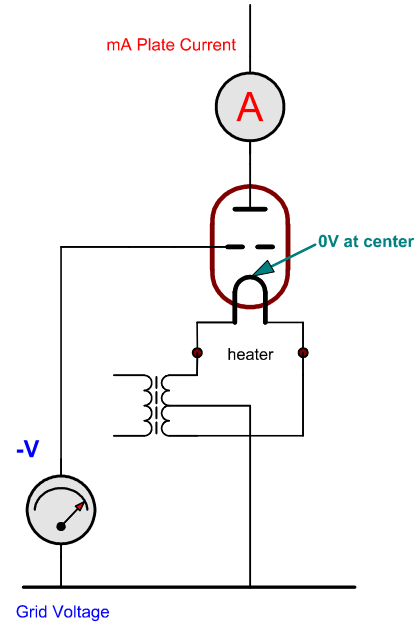
The Scheme 3 has one power supply less, and is often used for that reason. For Hifi, this scheme can not be used, because of low hum rejection, but for measurements this method is possible. Test results are identical for transconductance, however the cathode center is lifted 2.5 Volts. So when set for the same plate current, the grid voltage needed is 2.5V less negative.

It is important to know we test the tubes at EML by SCHEME 3. More information is found in Application Note AN7.

To compare a measurement from Scheme 1+2 with Scheme3, you need to compensate the measured results with half the heater voltage.

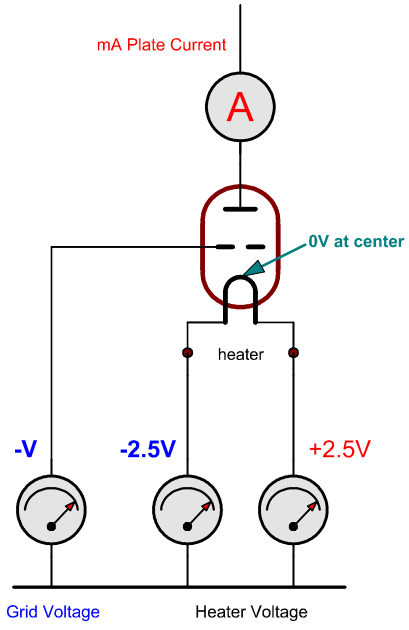
For instance the same 300B tube at 300Volts 60mA, will need -58V Grid in Scheme 1, but -55.5V in Scheme 3. This is a small difference for tubes with a relatively large grid Voltage, such as 300B, or even 300B-XLS at -100V. However, this becomes a large difference for tubes such as 20B, and even more for tubes as 30B which have only a few Volt grid bias. So if you experience another bias of the tube, as expected by the factory test data, often the explanation is found in the different test schemes.

Balanced AC Heated Measurement



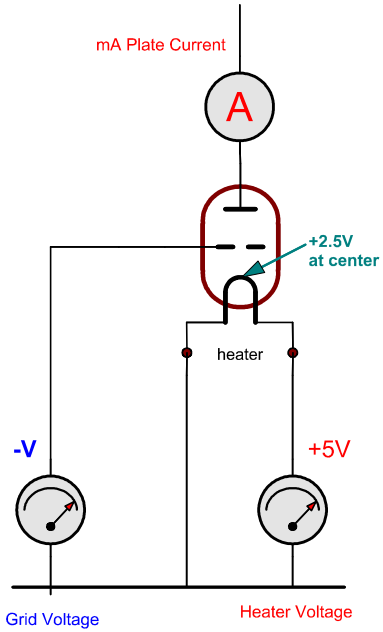
SCHEME 1

Balanced DC heated Measurement



SCHEME 2

Unbalanced DC heated Measurement



SCHEME 3

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Revisions	
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