Letter to the editor

Marcel van de Gevel writes:

Dear editor,

Ordinary neon lamps protect the RIAA correction capacitors in my tube-based phono preamplifier when it is driven into clipping, see Linear Audio volume 4, September 2012. Clipping is not likely during normal use, but it may, for example, occur when the input cinch connectors are not properly inserted and the shield doesn't make contact.

One thing I failed to mention because I wasn't aware of it myself, is that if you want to be sure that the voltage never exceeds the 160 V capacitor working voltage, not even momentarily, the neon lamps should be mounted such that there is some ambient light falling on them. The reason is that the lamps need to have some free electrons and ionized neon atoms available to form a glow discharge. When there is a bit of light falling on the electrodes of a normal neon lamp, the photoelectric effect will free more than enough electrons to ensure a fast response when the voltage rises above the ignition voltage. In complete darkness, the ignition becomes much slower and less predictable.

I've measured the ignition delay after a 170 V step on an ordinary neon lamp of the same type that I used in the amplifier. (170 V across the complete RIAA network corresponds to less than 160 V per capacitor.) With some light falling on the lamp, it ignited in about 8 to 10 microseconds, with very little variation from measurement to measurement. Due to the large time constants in the RIAA correction network, this is much shorter than the expected rise time of the amplifier's output voltage.

Measured at night with the curtains closed, light off and the lamp taped in with thick black tape, the delay varied all over the place and had an average value of 21.6 ms. Theoretically, when the statistical delay dominates, the probability of a lamp not igniting in a time t is exp(-t/ts), with ts being the average delay (see section 5.2 of G. F. Weston, Cold cathode glow discharge tubes, ILIFFE Books Ltd., 1968). Hence, with 21.6 ms average delay, there is a 0.1 % chance that ignition may take 150 ms or longer. This is much longer than any of the RIAA time constants. Although I've measured with a stepped DC voltage, the results should be similar for AC voltages with frequencies in the audible range. The recombination of ions and electrons is a relatively slow process, so once the lamp has ignited, there should be enough residual ions available to make it ignite quickly in the next half AC period.

The chance that the overvoltage due to the slow ignition will actually blow up the RIAA correction capacitors is small, because polystyrene capacitors with 160 V rated working voltage are usually production tested at 320 V for one minute. A delay of a few hundreds of milliseconds is still small compared to a minute and due to supply voltage limitations and the voltage that the ECC83 takes, the peak voltage across the capacitors will not go higher than about 200 V.

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