

Application Note

Using the Lundahl LL1679 transformer in Single Ended Ultra Linear Mode.

Jac van de Walle

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Revised, Version 2.

Use of the LL1679 approved by Per Lundahl

By the UL principle, the second grid of the tube is used as additional signal input, and the tube comes in an operation mode, which holds the middle between triode and pentode operation. There is tighter bass speaker control, so less “muddy” sound. Also, transformer distortion gets less, since this distortion is also tapped from the UL tap, and injected into G2, in negative phase to the G1 signal.

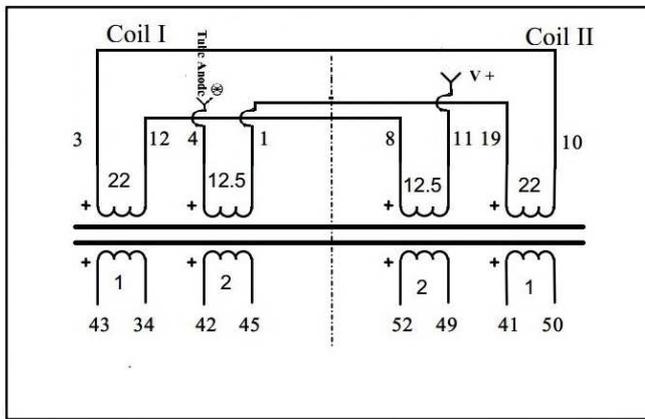
Advantages of UL operation

- 1) Unwanted membrane movements** will (via the transformer) produce an AC signal on the UL tap as well. Such movements are not produced by the music signal, but by self-movements of the bass speaker, and the sound effect is nothing but distortion. There is not less bass, but less bass quality. Some people call high quality bass “fast”, or “dry”, whereas low quality bass sounds muddy, imprecise. If you want see to this directly, connect a DC Voltmeter to a bass speaker, and move the membrane by hand. You will then see a bass loudspeaker is very good voltage generator, effectively translating the membrane movement into a voltage of the same kind. This voltage is capable of producing high current even, so logically if we dump this current into a load, the energy needed for this, is taken from the membrane movement. In other words, once the speaker outputs are loaded, the movement itself will require this energy, which is dumped into the load. So the movement becomes simply damped, it will stop faster. Next is, connect the speaker terminals to an ampere meter. Now instead of being able to freely move the membrane, this requires quite some force, and energy as well. It is impressive to see, how strong a bass speaker resists movements in this condition where you absorb current from it. So suppose now, we apply a voltage to the speaker, which is **opposite** to the movement direction. It should be clear this has even a larger effect as connecting a passive load to it. Where can we get such a voltage from...? Well, we can take it from the UL tap! Though this electrical signal is not in opposite direction with the membrane movement, we can achieve the same effect by connecting it to an inverting signal input, which we have already available. This is the screen grid G2 of the tube! The result will be, any self-generated movements of the bass membrane will now be worked against, by using the screen Grid G2 as signal input.
- 2) Screen Grid protection.** This is a very positive side effect of UL operation, and it works perfect. In pentode operation, by (difficult) mistakes the screen grid G2 voltage can become higher as the anode voltage. If this happens, the screen grid

would take over the plate current. The screen is too fragile for this, and begins to glow orange. If this happens, it evaporates the coating, and the tube would become gassy, or malfunction in some other way. This has always been a great challenge, because not all designers, not all tubes, and not all users do what they are supposed to do. With UL however, because of the copper resistance of the transformer winding, G2 voltage is always below the anode voltage, and simply less things can go wrong.

The LL1679 transformer can be elegantly used in Single Ended Ultra Linear mode by re wiring it the following way. This method was approved by Per Lundhal. The first part is from the Lundahl data sheet, the second part is by the jacmusic company.

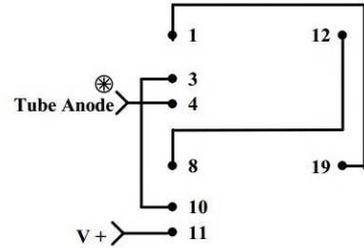
Winding schematics:



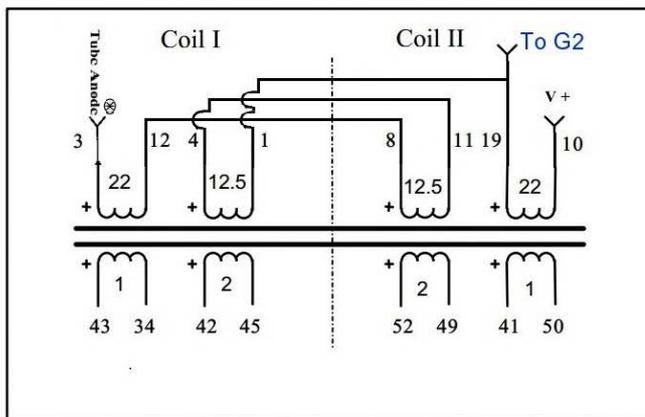
LL1679

Datasheet connections

Primary connections, Single End



Winding schematics:



LL1679

Connections for 33 UL tap

Primary connections, Single End

