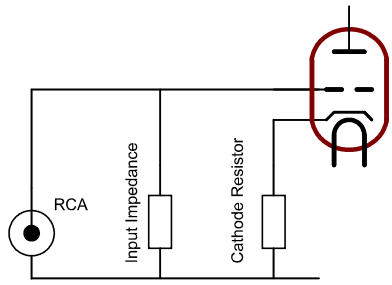
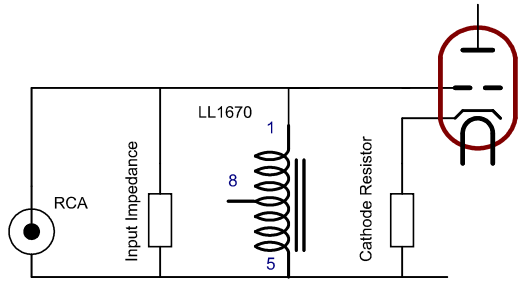


Standard Auto Bias Circuit

This is the classical bias scheme. It works good, because the transconductance of the tube (mA/Volt) is used to stabilize the bias, regardless of aging, and individual tube data variation. There are some disadvantages too. At overdrive, the tube grid becomes a rectifier, generating DC Voltage on the input resistor. This can severely off-bias the tube, or in extreme cases damage the pre amplifier. Another problem with off-bias is grid current of the tube, which is simply DC current coming from the grid, going to ground. This will generate a certain voltage over the input resistor, in the range of 0.5 to 5 Volts. This changes the bias.

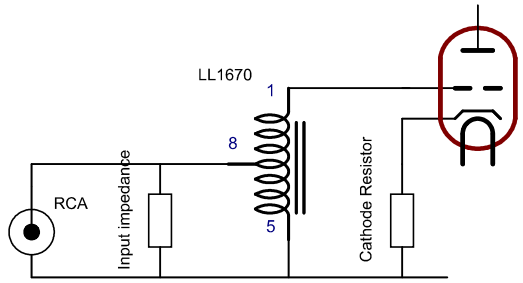


Normal application for ultra stabile bias

This is the standard Choke circuit. The grid choke, like all coils, has low DC resistance, and high AC resistance. The AC resistance will make the choke "invisible" for the signal. However the low DC resistance will ground the grid nicely, so any bias current from the grid will not affect the bias of the tube. The result is a very stabile, predictable bias. Any risk of bias shift in case of overload, or by grid current, is strongly reduced, as the grid is always at zero Volt for DC.

Note1) the input impedance at the RCA connector must be defined. This was recommended at 47k by the old DIN standard. Yet it has become obsolete, and now everybody does as he likes. We recommend 10k instead, but if you want 47k, this can be used as well. Without resistor, the LL1670 coil has overshoot. The resistor value is not critical, it is only important to use a resistor, and overshoot is gone. Value can be 47k, or any lower value.

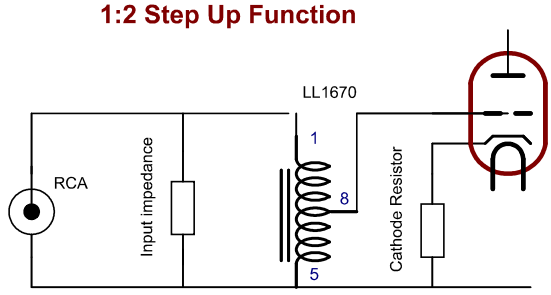
Note 2) 47k was only choosen to match crystal record players to Phono inputs of amplifiers. These need typical 47k. Today, nobody uses crystal cartridges any more. However 47k is hum sensitive, and 10k will reduce the hum sensitivity by a factor five, which is very significant, whereas all HiFi pre-amps can easily drive 10k.



1:2 Step Up Function

Good Step Up function depends very much on low source impedance of the driver amplifier, and needs ideally a four coils winding, whereas LL1670 is a two coil transformer. So please regards this as an interesting idea only. I think this will work, but from case to case you need to try it out. Note, the grid capacity of the tube will appear at the RCA connector with a factor 4x higher. This may cause frequency roll off, depending on the input impedance of the amplifier, and output impedance of the signal source. Moreover, LL1670 windings capacitance in step up mode is relatively high. (Though it is very low in 1:1 mode and 2:1 attenuator)

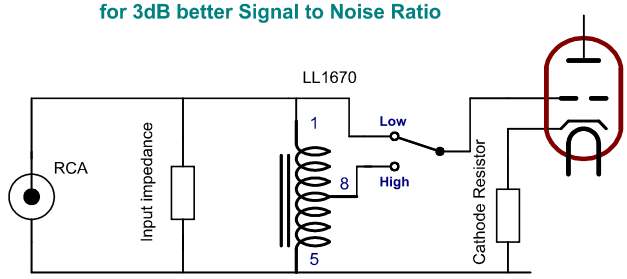
For predictable step up you should use a step up input transformer. Such as LL1570-XL, or other. These are wound from four coils, and work nicely up to 100kHz or better.



Inductive Attenuator Function
for 3dB better Signal to Noise Ratio

Yet as pure grid choke (or 2:1 attenuator) LL1670 and LL1667 are the best choices possible. Reason is, the very high inductance, combined DC capability, which DC current is really higher than grid current of every possible tube. Also risk of core magnetisation by accident, is virtually zero, with DC capable coils.

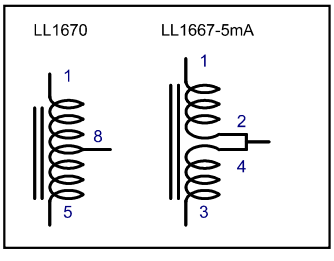
The attenuator function works with all tube circuits. This can be useful, when you have too much input signal. Actually this is most often the case. Reason is, by the old DIN standard, input sensitivity was defined at 1Volt, but this standard is obsolete. So now everybody does what he likes. Some signal sources give 2 Volt (or up to 4Volt) and some amplifiers have 1 Volt still, or 0.25Volt. This is a big mess now, and the solution is, to build inputs with multi sensitivity. Otherwise the volume control becomes sometimes difficult to use, and hum sensitivity (Signal to Noise Ratio) increases unnecesary 3...6dB, which can not be changed by using better cables or anything like that.



Inductive Attenuator Function
with a "high" or "low" Input

A good solution, is to create a "high" and a "low" sensitivity option to the input circuit. Same as Yamamoto Soundcraft is doing for their pre amps. Very elegantly, the LL1670 can be used for this. Giving at first the grid choke function, but also a switched attenuator option for the cost of only a switch. In the "High" position Signal to Noise Ratio is improved 3dB. "High" Stands for high input voltage.

A coincidental advantage is, a gric choke improves electrical safety, as any high DC Voltage coming from the tube grid, in case of electrical fault, will be shorted to ground by the grid choke, for as much as the choke can take. Furthermore, the grid choke will become a load for for unwanted, very low frequency signals in the sub audio range, like below 1..2Hz. Also just called rumble, so signals that are rather a changing DC voltage, instead of AC. Such signals, though inaudible, may cause distortion in the amplifier, or bass speakers, as neither amplifiers or speakers are made for this, and distortion products can mix into the audio range.



Document Title:	**Applications of Lundahl LL1670 and LL1667 Grid Choke**				
Date created:	**22.12.2008**		Last Revision:	M	**29.06.16**
Pages:	1	of 1			
Created by:	Dipl. Ing. Jac van de Walle www.jacmusic.com (Copyright)				