

How to Bias a Hot Rod Deluxe/Deville

DISCLAIMER: You shouldn't attempt this unless you have a good working knowledge of electronics safety. If you don't, PLEASE take it to a tech! I do my best to warn of the dangers, but if you injure yourself it's NOT my fault.



Biasing for Dummies

Version 3.1.8

Note that these instructions were written exclusively for owners of the Fender Hot Rod Deluxe and Hot Rod Deville amplifiers. While I'm sure almost every guitarist can learn something here, the step-by-step instructions can only be applied to these amps. What precedes the biasing instructions is some information that I think everyone who wants to bias should know. If you've already read and know this information, and want to get on with the biasing part, then [click here](#). Otherwise, I highly recommend you continue reading.

What is Biasing?

We bias so (1.) our tubes are operating safely and (2.) because we want our amp to sound its best. When we 'bias' we're setting the working condition of our tubes. 'Setting the bias' on your amp is a lot like setting the idle on your car. If it's set too high (or "hot") the car's running away with you, but if it's too low (or "cold") it will choke when you give it some gas. To put that into guitar terms, too high (or "hot") and your tubes may sound good, but will burn out quicker; too low (or "cold") and your tubes may sound sterile, but will last a long time. We don't want to be at one extreme or the other, but preferably at a nice spot in the middle. We want our car to run its best just like we want our tubes to last long and sound their best. In that sense, when biasing we're trying to find the perfect in-between point.

Is it Necessary?

"You do not need to bias your amp, no matter what ANYONE tells you. *So-and-so* expert told me so."
-anonymous internet user

Most of us have seen comments like this made on various internet message boards. Others argue that biasing is important, but don't give specific reasons why. This can become very confusing for the layman. "Well is it, or isn't it?"

The answer depends on your point of view.

People who say things similar to the above quote look at biasing from a *functionality* standpoint, (i.e. "Does the amplifier work? Does it not work?"). If you look at tube amps this way, then these people are correct. Yes, if you stick in a new pair of power tubes, and neglect to rebias, chances are your amp won't self-destruct—this is a fact.

Others, on the other hand, look at biasing from a *performance* standpoint (i.e. "Does the amp sound good? Does it not sound good? Are the power tubes optimized for tone and longevity in this amp?"). If you look at tube amps from this perspective, then you're correct—biasing *is* important. The bias point affects tone and tube life—this is an undisputed fact.

Personally, I agree with the arguments of the latter group. After all, it's all about the tone, *isn't it*? It makes no sense for someone to spend cash trying to improve their sound with better speakers and tubes, yet they refuse to adjust the bias. It's like hooking NO₂ tanks up to your car, but refusing to check your oil. It doesn't make sense to me.

If the bias is set too high, don't expect the power tubes to have longevity. Our clean channel will also start breaking up into distortion earlier too, maybe before we want it to. If the bias is set too cold our amp will sound lifeless, while low frequencies buzz annoyingly—these are all symptoms of nasty *crossover distortion*. (It's amazing when I hear people complain that the tone of their amp is too "ice picky" or "thin," or "harsh" or "sterile" or "flabby," then hear the same persons sing praises after discovering all they needed was a quick rebias. In my short experience with tubes, it doesn't take very many milliamps, or millivolts in our case, to make or break a good tone.

Reliability and tone are the only concerns. If you care about neither, then you do not need to bias your amp; but if getting the best sound possible is of any importance to you, then you should learn how to bias your amp or pay some one who knows how.

What if you continue using the same type and brand of power tubes? Lets say we need to replace our power tubes. The tubes are not guaranteed to idle even remotely close to each other. Don't believe me? Just check the endless posts on the FDP where two people bought the same type and brand of tube: it's common for one person's tubes to idle so low they can't bias hot enough, and the other person's tubes to idle so high they can't bias cool enough. If we go switching from 5881WXTs to 6L6GCs, or from Sovtek to JJ, then rebiasing also becomes an important issue in my opinion. Sticking in random tubes will give unpredictable results.

Hot Rods seem to be biased overly cold from the factory, and need a little tweaking to come alive. From a manufacturer's prospective it's better to be too cold than too hot—for reliability reasons of course—but I've also heard of people finding their tubes smoking hot straight from the factory. So you aren't even "safe" if you leave the original tubes in! Biasing your Hot Rod is easy and takes little time or effort. Seriously, read on.

What Do I Need?

You will need a multimeter (also called a VOM [Volt-Ohm Meter] or DMM [Digital Multi-Meter]) that reads DC voltage. You do NOT need a Weber Bias Rite, or a Bias King if you have a multimeter and matched power tubes from a reliable source—Groove Tubes isn't one of them. So save your money! You can find multimeters at your local hardware store, usually behind glass in the electrical section.

For the beginner a digital multimeter is recommended, as an analog takes a skill to properly use that's been lost over time. The best bang-for-buck I've found was at [Antique Electronic Supply](#), search for part S-Z3220. That meter has a ton of great features for only US\$50, though it may be an overkill if you'll only use it for biasing. If you plan on doing circuit mods, and repairing your own amp, buy it now! The high-end multimeters at Radioshack are good (ex. Extech), though you'll rarely find a meter more rugged and reliable than a Fluke. Unfortunately, they all cost a lot more. In any case, a US\$15 Radioshack 15-Range Digital Multimeter ([pic](#)) should be adequate.

How Often Should I Do It?

The bias will also drift over time. Many merchants follow the guidelines in the *Radiotron Designer's Handbook*, which recommends operating a tube for at least 48 straight hours under normal operating conditions to stabilize it—this is commonly referred to as "burning in." How much drift over what period of time depends on how well our tubes were "burned in" prior to us receiving them. This is most useful for preparing tubes for the matching process, which insures that they stay matched for as long as possible. The vast majority of the drifting takes place over the first few hours during the "burn in," and while the tube will stabilize it won't be permanent. Over the course of months, or years, the bias will continue to slowly drift.

If the tubes are not properly burned in by the merchant, you may find the bias to be drastically different from day to day; or even worse, a new power tube dying shortly after installation. Most merchants will give details of their matching (and burn in) process somewhere on their website. Look for it.

IMPORTANT: Note that "burn in" is an *expression*, and shouldn't be taken literally! If you stick new tubes in, and smell something burning, immediately turn off the amp and remove the tubes! Something is wrong with the tubes—they probably have an internal short which can ruin your output transformer! If we buy our tubes from [a reliable source](#), they will weed out any bad tubes with their burning in process.

After installing a new set of tubes its ideal to check them periodically. For instance, I prefer to check every few months while performing regular maintenance or making adjustments. If they were bought off ebay I'll watch them closer—maybe once a week or

so for a month, as ebay tubes are always a gamble IMO. If I had just installed a new set of tubes, I always recheck the bias prior to taking the amp to a gig, as how the amp is biased will have a larger impact at gig volumes than when sitting in your living room. (That reminds me: buy an outlet tester from Radioshack and check the outlets of every place you play. Many dives have unbelievably subpar wiring.) If the bias is slightly off it may just be fluctuations in the electrical line for that day, and shouldn't be taken too seriously.

Which Tubes Do I Bias?

We only bias the power tubes (the big tubes) in guitar amplifiers. We do not need to bias the preamp tubes (little tubes) because they are "self biased."

Does changing preamp tubes affect bias?

No. The preamp tubes (V1, V2) and the phase inverter (V3) do not affect how the amp biases. Having to change out the phase inverter every time you change power tubes is an "old wives' tale." Also, putting in a 12AT7, 12AY7, etc instead of a 12AX7 will NOT affect bias. Fact: the power tube's bias supply is completely isolated from, and independent of, the phase inverter!

Can I bias my Fender *Blues Deluxe/Deville*?

The Blues Deluxe/Deville were made prior to the Hot Rod Deluxe/Deville. They were discontinued in 1996 after the release of the Hot Rods. To answer the original question: Sorry, you can not. These amps do not have an adjustable bias control, they have a fixed resistor that sets the bias range. You'd need to have a tech install a bias pot, and use a bias probe like a Weber Bias Rite or Bias King.

Which Tubes Can, and Can't, I Use?

If you're reading through this in a hurry so that you can start biasing, allow me to quickly summarize this topic: *ONLY buy 6L6GC power tubes! Only!* You can now [skip the rest of this question](#), which may get boring at times. If you want me to go into more detail as to why, and discuss other "possible" substitutes, then read on..

In order to determine which tubes we can and can not use, we must ask ourselves two basic questions.

Can the tube handle the amp?

Sometimes an amp will have a plate voltage that is higher, or much higher, than the tube's *maximum rated plate voltage*. For instance, the max plate voltage of a tube could be 300DCV, while the amp puts 500DCV on the plates. This is not particularly good for the tube, but some of the more robust and conservatively rated tubes could handle it. Most techs agree that you should observe the maximum plate voltage, or V_a for short (pronounced "V sub A"), but if you *do* run tubes outside of their max V_a rating, be sure to bias the tube so that it still falls within an acceptable *plate dissipation*—which is explained thoroughly in the section after the biasing instructions.

The tubes we're interested in also have a max screen voltage, max screen dissipation, and max and min heater voltage. While we can usually exceed the maximum rated plate voltage, and then adjust the bias so that the plate dissipation is good, the screens are often overlooked! If the screens can only take 270DCV, and you have tiny screen resistors on there, the screens are going to melt and the tube is going to short. Often times, because the screens have shorted, one or more screen resistors will be cooked to a char. Putting in larger screen resistors will keep screen current down, and therefore keep the screens running cooler, but ideally we want a fixed voltage on the screens and using larger screen resistors will not help that. If you're running some questionable tubes you should check that they are operating *completely* in spec, but pay particularly close attention to the plate dissipation—which is adjusted by the bias pot—and the screen dissipation.

Can the amp handle the tube?

Electrical current, measured in amperes, isn't a very good friend of electronics—even though they couldn't work without it. You see, when a transformer blows it's because someone done something silly like install power tubes that the amp wasn't designed for. For example, some power tubes (KT-66, EL34) draw more heater current than the 6L6GC. Anytime you have an increase in current you're also going to have an increase in heat—which must be dissipated by the transformers. Sometimes this heat will get so bad that it'll melt the internal insulation of the power transformer, and poof, you've got to replace the single most expensive component in the amp.

Usually, as long as the heater current is acceptable and you biased your power tubes so that they aren't working any harder than the amp was designed, your amp should be okay. But, if you install a set of 7581A power tubes, and bias them to *their* maximum plate dissipation (35W), as opposed to the 6L6GC's (30W), then there's a chance you might find yourself in trouble. Where there's watts there's heat, and where there's heat there's current, and where there's current there's danger. Just because the tube can handle the extra stress does not mean the rest of the amp can also. So before buying any power tube other than a 6L6GC be sure to refer to the manufacture's spec sheet.

So you're probably wondering, "Hey! Wasn't this for 'beginners?' Can't you just tell me which tubes I can use and which I can't?" Okay, I definitely will in a moment, but the reason I brought this up was because I think it's important to know *why* I'm drawing limits. I don't know about you, but whenever someone tells me I can't do something I want to know why.

I. Power tubes you can certainly use:

Any 6L6GC These tubes are built to handle 500 volts at 30 watts on the plates, and 450 volts at 5 watts on the screens.

Any 7581/7581A This industrial strength version of the 6L6GC has the exact same specs as the 6L6GC with one exception, the plate dissipation in 35 watts instead of 30 watts. As far as increasing clean headroom goes, these tubes are the best secret today. If you're

looking for max clean, you won't be able to get much more from a perfectly matched pair of NOS JAN Philips 7581A power tubes with a balanced 12AT7 phase inverter—the only time matching really becomes an issue is when you're trying to get as clean as possible. To get even more clean headroom you could replace all the preamp tubes with 12AT7s. Check out this quote from a Deville user..

"The Phillips 7581a's are a great choice to dramatically improve the headroom on the devilles. I bought a matched set from [KCA Nos tubes](#) for about \$70 and WOW...what a difference. The groove tubes in the amp just got too gritty down low for me. These 7581a's are incredible. I turned my amp up to TWELVE one day to see how loud 12 really was....and DAMN those tubes hardly even broke up. I later changed the preamp tubes but only noticed a marginal difference. 7581a it is!!"

After reading many singing reviews it's amazing more people haven't heard about these tubes.

Some modern tube companies name their products whatever they please, instead of what they really are, making tube swapping more confusing--Groove Tubes and Ruby Tubes probably being the most notorious examples. It's also no wonder that most of these companies' tubes are Chinese or Russian made imports that they slap their logo over. Unfortunately, Ruby and Groove Tubes do not have spec sheets for their tubes, which might explain the "odd" names.

All tubes should be able to handle at least 450VDC plate voltage for the Deluxe, or 500VDC for the Deville, in pentode push-pull configuration. If you do not know how to read spec sheets, then stick strictly to what was mentioned above. To understand more about how tubes work, and how to take care of them, read my page on [vacuum tubes](#).

II. Power tubes in the "grey area":

What I mean by "grey area" is that these tubes will probably work in your amp as long as you heed any warnings I give you—the key word here being "*probably*." Also note that using the tubes here will probably throw your bias into a frenzy—some more than others. So not only are you required to rebias, but you'll also probably have to physically mod the bias supply to get it where you need it.

Any 5881/6L6WGB The 5881 and 6L6WGB are the exact same tube. Even though Fender okayed them on the tube sheet, which is located on the inside of the Hot Rod Deluxe's cabinet, I decided to place them here. The reason they're included in the grey area is because of their specs; a maximum of 360 volts and 23 watts on the plates, and a maximum screen rating of 270 volts at 3 watts. [vacuumtubes.com](#) warns "DO NOT USE IN AMPS CALLING FOR 6L6GC's. They will likely melt down and damage your amp." So, they'll remain in this category under "proceed at your own risk."

6V6GTA/JJ 6V6S The original specs for these tubes was 350 volts at 14 watts on the plates, and 315 volts at 2.2 watts on the screen. For a long time people in the tube business have been telling me not to use 6V6GT power tubes in the Hot Rod Deluxe,

even though the blackface Deluxe Reverb has a similar plate voltage. One of the reasons was because our amp uses a solid state rectifier. I've heard stories of 6V6s dying immediately after being installed into a 6L6GC amp, but this probably had more to do with the plate dissipation than the plate voltage. Either way, it's not recommended to use NOS 6V6s unless you know what you're doing.

The New JJ 6V6S power tube, on the other hand, can reportedly handle up to [500V on the plates](#). I've tried the 6V6S power tubes, and I must say that I like their sound better than the 6L6GCs that I had. To my ears these tubes are much brighter than 6L6GCs, which I think is good for a dark amp like this. For example, an even tone with SED 6L6GC tubes: Treble on 12, Bass on 4, Mids on 5. For an even tone with the JJ 6V6S tubes: Treble on 9, Bass on 12, Mids on 12. (Note: I removed the NFB, so I no longer use the Presence control.) The transition to distortion in the clean channel is now smoother, and the overdrive isn't as flabby. The power amp distortion in the clean channel sounds far better than anything I've ever heard out of the drive channels. When the clean channel was overdriven with 6L6GCs it sounded muddy because most of the emphasis was on the low end, this is gladly not the case with the JJ 6V6S! The emphasis is on the mids and upper mids, which is good for cutting through the mix on stage. It's also worth mentioning that my HRDx is about as loud as a Blues Junior, and is probably putting out around 20W. So if you want less clean headroom, a quieter amp on stage, and more controllable bass I highly recommend trying the JJ 6V6S.

I've heard a tech complain that his JJ 6V6S power tubes had a higher than normal screen failure rate, so he recommended that the 6V6S only be used with a larger screen resistance. Kevin O'Connor, author of *The Ultimate Tone* series of books, recommends replacing the 470Ω screen resistors with at least 1KΩ, and preferably 1.5KΩ. The following O'Connor quote was taken off the alt.guitar.amps newsgroup..

"Contrary to what the data books indicate (or at least, how people mis-interpret what they read), the 6V6GT can handle LOTS of voltage—and actually, the data DOES indicate that. The key to having reliability is the same as for any other power tube—you have to be nice to the screens. This merely means using at least a 1k screen resistor per tube—a higher value provides better protection to the screens. If you do this, then you can use very high voltages. If you get the heat out of the tube—fan cooling—then you can exceed two parameters.

Tubes will take voltage stress a lot more readily than current of heat stress. Ask any tube applications engineer. The 6V6 was used by many people in the States and elsewhere at B+ up to 470V. This is also applied to the screens through 1k or greater. Reliability is NOT a problem."
-Kevin O'Connor

In [The Ultimate Tone Vol. 3](#) (pg. 5-13, par. 6) he reports that using a larger screen resistance has sonic benefits as well—increasing touch sensitivity at lower volumes and introducing a compression or a "sag" effect. The screen voltage affects output power, so using a larger resistance may slightly decrease the total volume of the amp. Fender used 470Ω resistors to maximize power, but at the expense of tube reliability. If you're

planning on using 6V6s, then a volume reduction is probably something you want anyway.

Changing the screen resistors isn't a must, but it *is* recommended.

What follows is a review of the JJ 6V6S by Lord Valve. I am unable to find the original source, but I found it so interesting that I decided to include it here. Judge for yourself.

"I just got finished doing the matching on my first batch of JJ 6V6s. Just for fun, I decided to see if I could kill the last tube in the batch. A good batch, BTW - only 2 croaked out of 150 during the 48-hour stabilization burn. And something odd - **all** of the 148 tubes that survived the burn fell between 13 and 21 mA during matching. I've never seen a batch of **any** power tube fall into a range that narrow. Somebody's doing something right at JJ. This is a BEEFY-looking tube - it's built in the same bottle as the JJ GZ-34, which makes it larger than any non-Cokebottle 6V6 I've seen before. The plates are also considerably larger than other 6V6s. Meaty!

Anyway...I decided to see how much current I could pull through the last tube before it red-plated. My test voltages for 6V6s are 425 plate, 425 screen, -40 G1. This particular tube read 15.6 mA at those voltages. I increased the current to 30 mA. No sweat. 40 mA. No signs of distress at 17 watts static, which is beyond ratings for this tube. 50 mA - no problemo. Still no red, not even a stripe. At 21.25 watts, we're well into 6L6 territory. (BTW, I let the tube cook for around 10 minutes at each level.) 60 mA - 25.5 watts static, passing max EL34 ratings now. No stripe. Jeeze...cue X-files music? SEVENTY mA. Beyond max spec for a 6L6GC...and **finally** a narrow red stripe on either side of the plate. I let it sit for ten minutes - whacked it with a nutdriver handle a few times. Happy as a clam. OK, I cranked the bias down as far as it would go...81.4 mA through the tube. The red stripes got wider, but nothing else changed. I let it sit ten minutes, then shut it down and let it cool off. After a half hour, I powered it back up and took readings from it at my standard test voltages. How' bout dat...15.7 mA, within 1/10th mA of the original reading. Aside from the fact that part of the logo burned off, the tube showed no signs of misuse.

I have no idea how these tubes sound yet, but I do know **one** thing: they are **damn** hard to kill. I sent two quads to Doug Roccaforte today; we'll see what he has to say about 'em. And if Jim Kelley is reading this, give me a call. **Your** amps are the most notorious 6V6 killers on the planet, and I think I may have something for ya. ;-) Interested in your take on the tone."
-Lord Valve

Bob at Eurotubes said he's put them in many Hot Rod Deluxes and Devilles with no problems. So if you're looking for a different sound, with earlier break up, I recommend checking out these tubes.

6V6s also have a greater plate resistance than 6L6GCs, so there will be an impedance mismatch. It won't be enough to cause damage, because 6V6s draw a lot less current than all 6L6s, but if you plan on permanently using 6V6s you ought to install an appropriate output transformer. A high pass filter is created between the plate resistance of the tube and the inductance of the output transformers primary. In other words, installing 6V6s is going to cut a fair amount of low end. Any OT designed for a blackface Deluxe Reverb will work. You can get one that'll work from [WeberVST](#), [Mercury Magnetics](#), or a [Hammond](#) from Mouser.

Any KT66 These have gained a small following in the Hot Rod community due to their "bigger rock n' roll/blues sound," as one person described it. A matched pair of KT66s is more expensive than 6L6GCs, usually costing over US\$50. It has been said that these are the British equivalent to the 7581A, though the specs speak for themselves: 500 volts at 25 watts on the plates, and 400 volts at 3.5 watts on the screen. Normally these tubes draw more heater current (KT66 $I_h = 1.3A$, 6L6GC $I_h = 0.9A$), while the 7581A does not, so they *could* overload the power transformer. I've heard that Groove Tube's GT-KT66-HP draw the same amount of I_h as a 6L6GC, though it's impossible to say for sure since Groove Tubes do not supply spec sheets for their tubes. Still, I haven't heard any problems from the Hot Rod users who use them.

Mullard EL37 This tube is sometimes cited as the British equivalent to the 6L6GC, though hardly true. This tube's maximum plate voltage is 400V, and maximum plate dissipation is 25W. Deluxe users may be able to get away with using this one, but Devilles, which have a V_a of approx. 475V, will be pushing it.

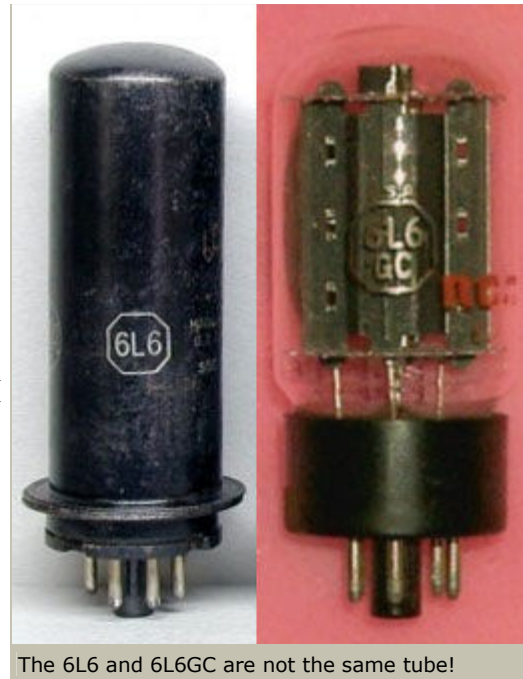
Any EL34 I have heard of one case where these have been successfully installed into a Deluxe, even though they drawn 1.5A of heater current—which is even more than the KT66s! The EL34s maximum plate voltage ranges from 450V to 700V, so they will handle the plate voltage of the Deluxe and the Deville. NOTE: These tubes can NOT be installed without modifying a few things in the power amp. Ideally, they should not be used because of their required heater current, but if one is hell-bent there's an [EL34 mod](#).

Any EL84 The best way to use these is to buy the [adapters](#) rather than chop up your amp.

Any Groove Tubes/Ruby Tubes 6L6(insert random letters here) (With the exception of the GT-6L6B, which you should avoid like the plague.) Basically, when you buy these tubes, you're probably not installing a set of real 6L6GCs. Keep that in mind. Even the GT-6L6GE, modeled after the GE 6L6GC, only has a plate dissipation of 25W while the original was 30W. Other than that, I could not find any other info that GT has released regarding the electrical ratings of their tubes.

III. Power tubes you should NOT use:

Any power tube advertised as a 6L6, 6L6G, 6L6GA, or 6L6GB. Generically, 6L6GCs are usually referred to as "6L6s." *Technically, these are NOT the same tubes!* In fact, they are very different from each other! If you direct your attention directly to the right you'll see blatant proof of this: a comparison of a RCA 6L6 with a RCA 6L6GC. Take note that the differences are far more than just superficial, as I'll soon show. So why do techs and tube dealers refer to 6L6GCs as 6L6s on message boards? Laziness. I guess it's just much easier on the fingers to not include that extra "GC." I, on the other hand, will be very specific on this website and on the internet forums that I frequent. You should be too, as being ambiguous only adds to the confusion that plagues most discussion boards.



The Hot Rod amps have a plate voltage of around 430V (Deluxe) or 475V (Deville). They were designed to be used with 6L6GC tubes, which can handle 500 volts/30 watts on the plates, and 450 volts/5 watts on the screen. Lets take a look at the other 6L6 variations and see exactly how they differ.

6L6 This is the original version placed inside a metal envelope (pictured above on the left). It can handle 360 volts/19 watts on the plates, and 270 volts/2.5 watts on the screen.

6L6G This tube has the same specs as the 6L6, but is placed in a large "Coke Bottle" shaped glass envelope—which is what the "G" stands for.

6L6GA This tube is the same as the 6L6/6L6G, though is in a *smaller* "Coke Bottle" shaped glass envelope. The Groove Tube 6L6-CB, the CB meaning "Coke Bottle," is probably the Chinese remake of this tube.

6L6GB Also has the same specs as the 6L6/6L6G/6L6GA tubes, except its envelope is straight sided glass like the 6L6GC. So visually this tube and the 6L6GC look alike, but internally are completely different.

5932/6L6WGA This is a *mechanically* rugged-ized version with a huge brown base and straight sided glass envelope similar to the 6L6GB/6L6GC—it was produced only by Sylvania. It's electrical specs are exactly the same as the 6L6/6L6G/6L6GA/6L6GB.

Groove Tubes 6L6B Practically every time I get an email from someone complaining about how their amp crapped out on them (usually lost almost all its volume), they always mention that their amp worked fine before they installed the GT 6L6B. What

makes this one especially scary is that putting in the old tubes did not fix the problem! Do not use this tube; after all the emails I've received I can only determine that this one is an amp killer. All I know about it is that the "typical power ranges from 20 to 25 watts," which couldn't be more ambiguous. So stay away! I can no longer find this tube on Groove Tubes' website, which means they either renamed it or scrapped it altogether—hopefully the latter. And to think that "the 6L6B is perhaps the most reliable of the currently made types of 6L6s." (Groove Tubes quote) Yikes!

If you use any of these tubes, do not be surprised if the tubes go and the amp goes with them.

Which Tubes Do You Recommend?

This is a hard question as styles and the idea of "good tone" varies considerably from person to person. I often get emails asking which tubes I recommend, and the asker almost always wants the best bang-for-buck. I usually point them to a full set of JJ/Tesla tubes available from [Eurotubes](#), though there are more [great sources](#) below if interested. If you want clean headroom then stick with 7581As or 6L6GCs, but if you want a lower wattage amp with lots of aggressive breakup then try the JJ 6V6S—I love mine. (For other people's recommendations, read the [tube reviews](#).)

If you order a pair of power tubes from the Tube Store be sure to specify a "perfect pair" between 20 and 25. This will ensure that you won't need to return a set of overly (or underly) conductive tubes.

As far as preamp tubes go, there's a lot of good ones out there. I've only come across one type that I absolutely hated: JAN Philips 12AX7WA. They sounded fine at low volumes, but on stage they were tone killers. I was trying to trace what was making my tone fuzzy (in a bad way), and the problem went away once I took these tubes out and put in other ones. I had two of them, and both sounded the same--terrible in every amp I tried them in.

I currently have real NOS Telefunken 12AX7s in V1 & V2, and they sound fantastic. I had EI 12AX7 Elites in there before them, which are made on the same machines that the Telefunken were made on, and they were damn close if not spot on to the real Teles. Unfortunately, they don't seem to be constructed as well: I've never experienced the microphonics that some claim, but I had the glass envelope of one fall apart while pulling it out of its socket. I've also tried Electro Harmonix 12AX7s and they're good, as well as JJ 12AX7s which are also good. I do prefer the tone of the EIs and Teles to them though.

Still, if you want clean headroom you should get at least two 12AT7s, and put one in V2 and V3. Some like 12DW7s, which are half 12AX7 for the clean and half 12AU7 for the drive channel. You can get good ones made by RCA for pretty good prices too.

The best thing to do is experiment. I was told that Chinese and Russian tubes were horrible years ago, so I wrote them all off, but lately I've been hearing many glowing reviews comparing some of them to the greatest tubes ever made. Whatever rules that were once there no longer apply.

Overall, I've learned to take everyone else's opinions with a grain of salt. Experiment and judge which tubes are worth keeping, and which are worth throwing away, for yourself. You'll likely stumble across some lemons along the way, but you're equally likely to stumble across some pleasant toneful surprises as well.

Good luck,

Justin

"You don't need to rebias with *our* tubes!"

Be wary of companies who say you don't "need" to rebias with *their* tubes. This is misleading! *Every time* you put in a different brand of tube, the bias is going to be thrown off. Even the same tube made by a different company will respond differently in the same amp—this is more so true for modern tubes than vintage (NOS) ones. If we buy a certain company's tubes, then rebias those properly, then we can request other tubes with similar specs. Since the company's other tubes are electronically similar to the first set they sent you, the bias should also be similar. So, in truth, you won't "need" to rebias *after* you buy that first set from them and adjust your amp to *that* set.

As an aside: There's someone who always tells Hot Rod owners that they don't need to rebias with his tubes, who I'll refer to as "seller." He reasons that he sells tubes that only fall within the Hot Rod's narrow bias range.

Someone bought a pair of power tubes from him and then emailed a question to me—we'll call this person "buyer." Buyer said he didn't much like the way the tubes sounded, and that seller told him his tubes just needed time to "break in." Buyer wanted to know if tubes really needed to be broken in. I told him that I've also heard that, but wasn't sure if it was true or not (as I'm no tube expert). I told him that I had no tone problems with new tubes that I had bought, then explained that he should properly bias those tubes, even if seller told him he didn't need to. He resisted a little, but decided to give it a try. To make a short story shorter, it turned out that the tubes were biased too cold! After fixing the problem, he commented that the amp did sound much better. The moral is that "seller" might sell tubes that fall within a good bias range some or, at best, most of the time; but not every time.

If you want to buy tubes from these companies by all means do so, but don't buy from them just because they make this questionable promise. The Hot Rod's bias range is "narrow," yes, but it's not so narrow that it can't fall somewhere that diminishes tone. Rather than repeating myself, if you want to read my argument on this, then [click here](#).

Some Popular Sources for Valves/Tubes (in no particular ranking)

United States

[Antique Electronic Supply](#) (Arizona)
[Audio Tubes](#) (Illinois)
[Vacuum Tubes](#) (Missouri)
[Doug's Tubes](#) (New York)
[Euro-tubes](#) (Oregon)
[The Tube Depot](#) (Tennessee)
[KCA NOS Tubes](#) (Virginia)

International

[The Tube Shop](#) (Australia)
[The Tube Store](#) (Canada)
[Tube Amp Doctor](#) (Germany)
[The Tube Shop](#) (United Kingdom)
[Watford Valves](#) (United Kingdom)

Let's Do It!

First of all, you're going to have to bias the amp while it's on. So it's important to be very careful. You'll be fine as long as you don't touch something that you're not supposed to, or try to eat C10 because it looks like a cinnamon chicklit. I know, I know they taste sooo good. Don't try it! Just remember, you're dealing with a "live" 420V circuit and this is no joke.

A good rule-of-thumb is the aptly named "One Hand in Pocket Rule." The idea is to only use one hand at a time, leaving the other safely in a pocket. This will help prevent current from passing through our heart and killing us. Also, when our amp is on the power tubes will get very hot. If you accidentally touch them they may burn you! Remember, you can always take it to a tech if you're uncomfortable—just look in the yellow pages under "Musical Instrument Repair."

- 1.** You may lay the amp on it's front, or stand it up—whatever is the most comfortable for you. If you choose to set it on a table make sure it's sturdy. Stand on an insulated mat if you have one, especially if you have to do this in your basement! Wear shoes with rubber soles! **Do not plug in your guitar.** When we bias an amp we're setting the "idle," or the amount of current that flows while our amp doesn't receive a signal.



- 2.** Remove the back panel. Many people think they need to turn all the knobs to 12 o'clock before they bias, this is a myth and doesn't affect the results. In fact, it doesn't matter how your tone controls are set as they only color the preamp and we're setting the working condition of the poweramp. However, since the back panel has been removed the amp will now be more susceptible to any interference—not to mention it's own heater supply. Therefore, the volume controls should be turned off to help minimize hum and interference from being amplified.



3. Turn your amp on and let it warm up. Look for the "Bias Pot," and the "Bias Test Point." **(a.)** The Bias pot (R82) is the blue circle with the notch in it. **(b.)** The Bias Test Point is naturally above the power tubes. It's on the corner of the circuit board, and is clearly marked. Get a screwdriver and turn the bias pot all the way to one side, and then the other. Now you have a feel for the pot. Adjust the pot so that it's right in the middle this is a good starting point.



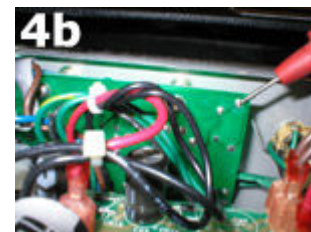
4. (a.) Place the black lead at ground (somewhere on the chassis). If you have probes with the alligator clip ends then clip it to the chassis, this is the safest method. If you don't have any, go to Radioshack or your local hardware store and get some. **(b.)** Flip your Standby switch so that the amp is active (off of standby). You'll probably hear a buzzing sound since the back panel is used to shield the circuit from interference. This is normal. Adjust your meter to read DC voltage, and place the multimeter's red probe on the Bias Test Point (the solder). **(c.)** Set your meter to its highest range. Adjust the meter's range down one range at a time until you can clearly see a reading. **(d.)** Use a small or medium sized flat-head screwdriver to adjust the bias pot. Turn the pot clockwise to bias hotter, counter-clockwise to bias colder. The bias pot should allow us to read roughly 50mV to 100mV at the bias test point. If not refer to the

[trouble shooting section](#). 68mV is considered a good starting point for beginners, and is approximately the point where a lot of people like to bias their tubes. Fender recommends adjusting to 60mV, but that's a little on the cold side based on the plate voltage of these amps. Note that 68mV is for 6L6GCs, and similar power tubes only. If you've installed an odd pair of

power tubes, like 6V6s, use the [biasing calculator](#) to make sure you're not biased too hot.

If we've gone too cold we'll hear an annoying buzz clearly riding on low notes—this is *crossover distortion*. If we go too hot our tube's longevity will be shortened, and in extreme conditions a hole will melt into the glass of the tube.

Remember: The hotter the bias, the shorter the tube's life, the lower the clean's headroom, and the hotter you run the entire poweramp. I personally recommend staying below



80mV for both the Deluxe and Deville. **(e.)** Can you guess what I'm doing wrong in this picture? If you said, I'm sticking both hands inside of a live amp you're correct! As stated earlier, a rule-of-thumb is that we should only stick one hand inside of a live amp, and leave the other hand safely in a pocket. Though it's not as obvious, if you said that I'm leaning over the power supply transformer you're also correct. If I tripped or slipped I could be seriously injured. Avoid these mistakes!

5. If you're a tweaker, and comfortable with biasing, try this step. 68mV is a number, not a rule, and is nothing more than a starting point which you should tweak by ear. I prefer to select the clean channel, and adjust the volume to at least "6" before rebiasing. Remember, LISTENING IS CRITICAL! In my opinion, you should turn your amp to whatever volume you use while on stage, and then rebias by ear. I understand that some people live in apartments or have grumpy neighbors, so this isn't an option—nine months out of the year I live in a dorm, and I have the same problem. This is where a \$70 Weber Load Dump attenuator becomes very helpful.

SET YOUR GUITAR DOWN BEFORE READJUSTING THE BIAS! Remember: Your guitar's strings and bridge are **grounded!** If you go poking around the inside of your amp while holding your guitar in the one hand, and the other inside the amp, there's a chance you could have several hundred volts pass through your heart. This could very well mean death. As long as you use an insulated screwdriver to adjust the bias pot, and unplug your guitar from your amp, you'll be fine. Once you've biased by ear be sure to use my [Biasing Calculator](#) to quickly check that your tubes are operating in spec.

6. After you're satisfied, turn the amp off and screw the back panel back on. That's it! As I said, tubes need to be broken in, so if they're new I'd rebias in a week or so.

Trouble Shooting

Q: I can't get a reading on my meter, but the amp sounds fine. What's wrong?

A: Make sure you took the amp off of standby, and that you set your meter in the correct range. The proper way to set the range of your meter is by selecting the highest range first, then lowering the ranges one by one until you can clearly see a reading. If you set your range too low, or too high, you won't get any reading at all. Some of the more expensive models have "auto-ranging," which is a very nice feature.

Q: The highest I can bias is (a very low number). What's wrong?

A: You could have weak tubes, but usually the problem is bad screen resistors (R61, R62) which aren't allowing your tubes to draw enough current. Always check the tubes first! This seems to be fairly common. Bad screen resistors are usually a sign of bad tubes, so be prepared to change your tubes within the next month. You'll occasionally hear of Hot Rod owners complaining about a nasty distortion and a dramatic "loss of volume." This is sometimes their problem. Replace your power tubes, and any toasted resistors and the amp should work fine again. Appropriate resistors can be obtained from Mouser, part # [283-1.0K](#).

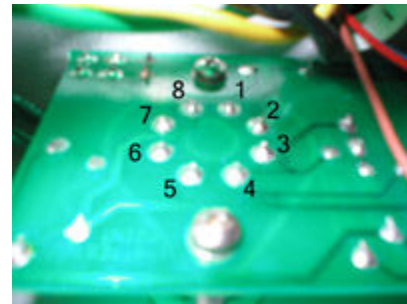
Q: The lowest I can bias is (a very high number). What's wrong?

A: The vast majority of people who experience this have really conductive power tubes. I'd return them and ask for a pair that doesn't conduct as well. If not I would check the screen resistors. Measure the voltage drop across the resistors, then calculate screen current. If the screen resistors seem fine and other tubes still conduct too well (100+mV read at the bias test point), then I would increase the negative voltage applied to the power tube's control grids by raising R77 in increments. This will solve the problem if the previous two do not.

STOP! Do you still have questions concerning biasing? I've moved the ["Biasing Thoughts"](#) section to a separate page. There you'll learn why we bias with "mV" instead of "mA," what plate dissipation really is, how hot is *too* hot, the truths and myths of using "matched" tubes, and much more. [Go there!](#)

Biasing by Ear

Some people say that they can not hear the difference when biasing, while others say they can. Biasing will not change the overall sound of your amp drastically—if you don't know what to listen for you will not be able to hear the difference. What you should listen for is how the amp breaks up into distortion—you're going to need to turn your amp up loud for this.



I like to turn the clean channel all the way up, and adjust the guitar's volume control to go from clean to dirty. If I bias too hot, the breakup into distortion will be immediate and drastic—sort of like a solid state amp. So while some people enjoy biasing very "hot" (i.e. 70% plate dissipation or greater), I prefer to back off the bias pot. For myself, the "sweet spot" is where I can strum and my amp stay clean with no detectable distortion, and then hit the strings hard and get a *smooth* yummy breakup into distortion. In my opinion, you do not have to cook your tubes to get *that tone*. In my opinion, you only need to bias warm enough to get rid of crossover distortion. As far as I'm concerned, frying your tubes for great tone is a myth! I use 6V6s in my HRDx, and while 70% plate dissipation would be 48mV I prefer biasing at about 38mV and no more than 39mV. (I can honestly say that I can detect a 1mV difference in my amp.) To me this spot has the best of both worlds, and has the most dynamic 3-dimensional tone.

Once you've biased by ear and found your own personal "sweet spot," the most important step is calculating plate dissipation. If you don't have a calculator handy, don't worry! You can quickly calculate your tube's plate dissipation by plugging in the values below. Don't forget to set your meter to the correct range, and be sure to observe appropriate scientific notation shorthand (ex. 1mV is actually .001V). All voltages are DC, and plate voltage is measured with respect to chassis ground.

By Justin Holton