

How to Increase/Decrease Headroom

[Printer Friendly version \(text only\)](#)

What's "Headroom?"

'Headroom' is a term used to describe how loud a clean channel will go before 'breaking up' into distortion. This is often associated with the amp's wattage, but is misleading and rarely accurate. Yes, a 100 watt Fender Twin has much more headroom than a 6 watt Fender Champ, but there are many other factors that contribute to the perceived headroom.

- The amount of gain stages in the preamp.
- How hot the preamp and power tubes are biased.
- The efficiency of the speaker and output transformer.
- Whether the rectifier is tube or solid state.
- The output (or signal strength) of the pickups

Understanding the Compromise

Typically, the clean channel starts distorting between 3 and 5 on the average Hot Rod. It must be realized that these amps were not designed to *stay* clean. The circuit is based on the Blues Deluxe, with a few changes, so the amp is primarily a blues amp. It is, in reality, a "hot rodded" Fender Blues Deluxe.

You may be surprised to learn that the Volume and Drive controls are the same control—not literally but as far as what the circuit "sees" it is. The Hot Rod amps are actually a one channel amp, which reconfigures itself for more gain when a drive "channel" is selected. An amp with real multi-channel selection has independent EQ controls for each channel—this amp does not, which limits its flexibility. What I'm getting to is that this amp wasn't designed to stay clean until 12; if so, the Drive control would also stay clean—though not completely since an [extra gain stage](#) is added. In other words, changing the character of the Clean channel will also change the character of the Drive channel and vice-versa. So, raising the clean headroom will also decrease the amount of distortion in the drive channel(s). This is why it's hard to voice this amp for both a perfect clean and distortion sound—both channels are compromises.

Maybe the Amp Isn't "Okay"

If your amp used to be loud, but had recently lost a lot of volume and now distorts heavily early on the dial, then you have a problem that needs addressing. The only way to verify this problem is to go to your local music store and compare the loudness of the showroom model with your own amp. If there's a problem, then take it to a [tech](#). If you're handy with amps, and want a hint, check the screen resistors—one is probably fried—and replace your power tubes ASAP. Charcoaled screen resistors are caused by internal shorts in the tube. Simply replacing the bad resistor(s) is not enough. Or, if your power tubes and screen resistors are okay, check the voltage drop across R57 as it has been known to come open.

The Stock GT Power Tubes

Next, what type of power tubes are you using? If you have the stock Fender/Groove Tubes in there, what color is the label printed on the tube's glass envelope? If they have a [blue label](#), then they're supposed to break-up early. If there's a sticker around the base of the power tubes, what number does it have on it? It should be from 1 to 10, and if the number is below 4 then the tubes are supposed to break-up early.

How to Increase Headroom

That said, it is possible to increase clean headroom without any major surgery. Here are the easiest ways:

First, try plugging into input #2, especially when using humbuckers.

Second, [rebias your amp](#)! If your tubes are biased too hot they're going to distort very early.

Third, replace all the 12AX7 preamp tubes with 12AT7 preamp tubes—12AT7s have approximately 60% of the gain that 12AX7s have. This will keep the preamp from breaking up so easily. You can usually pick these up at your local music store, but the best ones are not available there and should be purchased [online](#). Some say that putting a "balanced" tube in the phase inverter will help, but I've also read that that's "bunk."

Fourth, replace the 6L6GC power tubes with 7581 or 7581A power tubes. The 7581/A has similar specs as the 6L6GC, but has a little more power capacity and therefore more clean headroom. The JAN Philips 7581A is supposed to be the cleanest. Be sure to bias modestly. You can get a list of popular sources on the [biasing page](#).

Fifth, put in a very clean and efficient [speaker](#) like a [12" Weber California](#). Say that we have two tonally identical speakers, but one is 40W and the other is 80W. The 80W speaker will not break up as easily in a 40W amp as the 40W speaker will. Lastly, you can get an idea of how loud, or efficient, a speaker is by observing its "sensitivity" rating. 100dB @ 1 watt is good, more than 100dB is even better.

Sixth, if you still can't get enough clean there's one more thing you can do which will make a big difference—remove the cathode bypass caps. Their sole function is to add gain to an amp. When they're not used in the gain stage, a form of negative feedback called "degeneration" appears. In HIFI audio, cathode bypass caps sometimes aren't used to give as linear (or clean) a sound as possible. You should properly [drain the filter caps](#), then remove these caps, one by one, until you're satisfied. C1 will make the most difference for the clean channel on the circa '96-'97 models. On the newer models Fender made some changes that are wired by hand. C4 would be the most important in the models since then. You'll know C4 when you see it because it's handwired with a resistor soldered across it. Only clip the capacitor and NOT the resistor or you may find your amp much quieter than usual. ;) In the newer models C1 is the second most important, and might not have much effect since it's the first gain stage. C8 and C9 are only used by the Drive channels, so if the More Drive is too much for you you can remove one of those to tone it down a bit. Note that removing one will give you half as big of a boost, while

removing two will disable the More Drive completely. It doesn't matter which you choose, but C8 will probably have a more dramatic effect than C9.

How to Decrease Headroom

More often than not, when someone is wanting less headroom they're really wanting easier access to [power amp](#) distortion, or saturation, at lower volumes. We can get regular preamp distortion anytime we want by switching to the drive channel, right?

If you'd rather not change anything in your amp, just get an [attenuator](#). If you want earlier break up on stage, you'd just do the opposite of everything in the previous section.

First, always plug into input #1.

Second, [Bias](#) your power tubes hot (i.e. at or close to [70% plate dissipation](#)), but be forewarned that this is may be too hot for the rest of the amp. The life of your tubes will also be shortened.

Third, stick with 12AX7s in the preamp slots. Only use a 12AT7 in the phase inverter (V3) if you need better bass response.

Fourth, if you want early break up and less stage volume, I recommend installing a pair of [JJ 6V6S](#) power tubes. You can get a list of [potential dealers](#) on the [biasing page](#). The 6V6S will break up so early that you won't have much of a clean channel outside of living room volumes, but the distortion will sound much better than anything ever heard out of the drive channels, all IMHO of course. Be sure to bias them between 25mV and 45mV at the bias test point, and NOT at 68mV. Some people find that the highest they can bias after installing the JJ 6V6S is around 10mV, which is very cold. If you run into this modify the range of the bias supply by installing a 100K resistor in parallel with R77. If you ever decide to go back to 6L6GCs then simply remove the 100K. If you use unmatched tubes you'll also find that the amp distorts earlier because of imbalance in the power amp—i.e. one half of the waveform clips before the other, rather than at the same time with matched tubes.

Fifth, use a speaker that isn't efficient and/or is designed to break up early like a [12" Weber Texas](#).

Sixth, disconnect the negative feedback loop in the power amp. This will disable the presence control, but will make the break up into distortion smoother. All you need to do is 1. [Drain the filter caps](#), 2. Clip the tiny grey wire that's soldered to the Ext. Speaker Jack, and 3. tape the end of broken wire off with electrical tape so that it doesn't short on anything—including the chassis.

Seventh, do the [sag mod](#) or have a tech install a real tube rectifier.

By Justin Holton