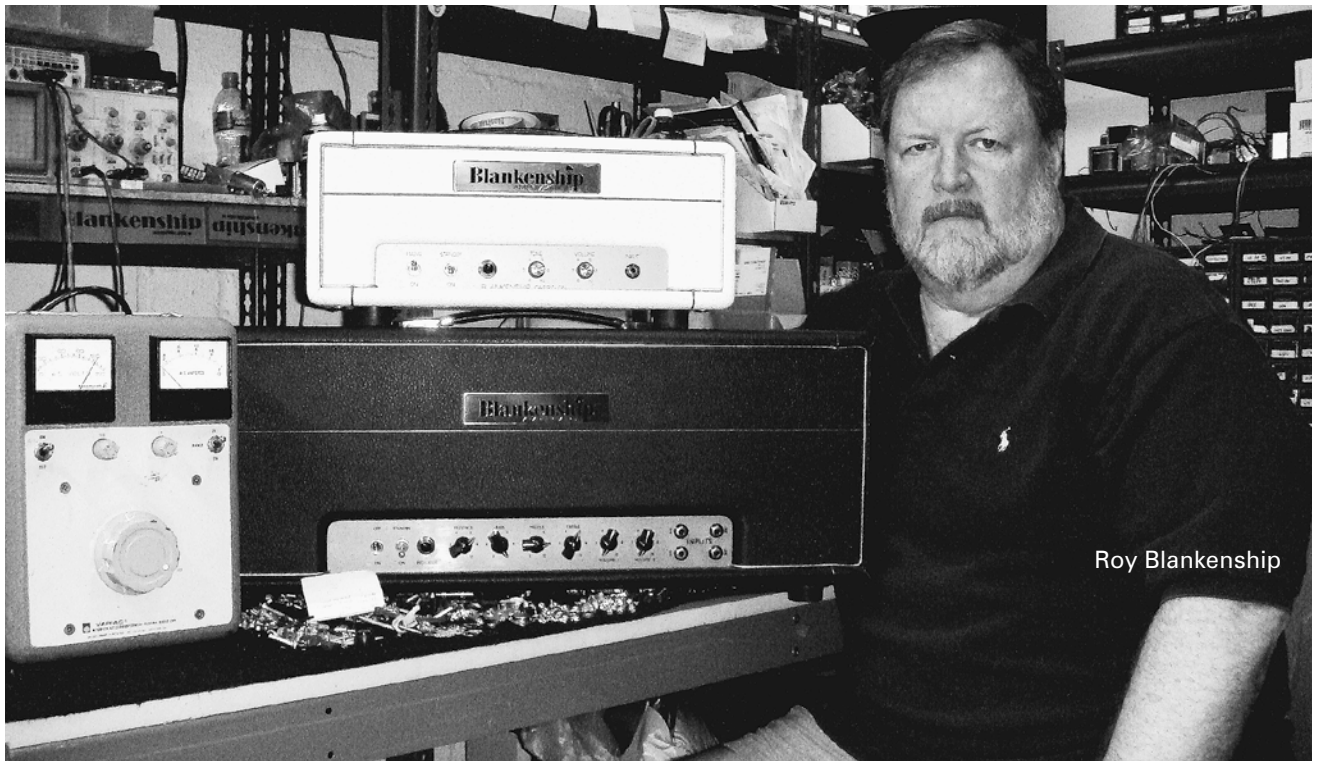
By David Jung



Roy Blankenship

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Regulating Power to Your Amp

YOU PLUG YOUR PRIZED mint-condition '51 Fender Deluxe into the wall socket and crank it up. Next thing you know, you've blown the transformer, the caps have puked, or you've toasted an original speaker. And you think to yourself, "Okay, the amp is 50 years old. It was bound to go sooner or later." But maybe it wasn't... and maybe age had nothing to do with it.

If you plug a vintage amplifier directly into a wall socket, chances are you're not hearing what that amp sounded like back in the day. And that's not because the amp is old and worn out; most old amps will run forever and sound great if treated well and maintained. But they don't, because while that old amp may have sat in a closet for 50 years untouched, something else has changed over time – wall voltages.

Amplifiers from the 1940s, '50s, and '60s were meant to run on 110 to 115 volts AC, while amps made in the '70s are mostly rated at 117 volts. The back of an amp should indicate the wall voltage for which the amp is designed. The closer to new an amp is, the higher its optimal operating voltage. Depending on where you live, wall voltages fluctuate on a daily basis, and range from 100 to 130 volts! And that's not taking into account the daily spikes in power experienced on almost every line – power surges, transient voltage spikes, and of course that weird static sound that comes out of your amp, or the occasional radio station.

So, what does an extra 20 volts mean to a vintage amp? More bone-crushing power? More *whump*? Or is it a recipe for disaster? And is there anything you can do about that nasty static that sounds like you're playing in Dr. Frankenstein's lab?

Roy Blankenship, founder and president of Blankenship Amplification, recently sat down to offer some answers. Blankenship has worked as an amp repairman, production manager at Groove Tubes, and more recently – at the prodding of incessant customers – he began building a line of amplifiers. Today, he is one of the preeminent boutique builders (his Leeds 21 was one of the amps scrutinized in *VG*'s "5x18 = British Crunch Bliss" feature, December '07).

Is there a risk plugging a vintage amp meant to run on 110 volts into today's standard 125- to 130-volt all current?

Yes and no. Your power transformer doesn't really care all that much, because all it's doing is taking the voltage coming in and creating secondary voltages to send out. You're probably not going to blow it by loading it with 20 to 30 more volts than it was rated for, depending on how much current is being drawn on the other side of it. Fortunately, most amps, like Fenders, had enough reserve built in that you will not be exceeding their specifications.

The problem is with an amp's capacitors and filament voltages. The caps were rated for a certain value, usually about 450 volts. Most amps use 500-volt capacitors, so if you've got an old amp with original caps, you risk over-voltaging them. The collectors with pristine, all-original amps aren't playing them, anyway. They sit in a closet or a glass case.

An amp's electrolytics were designed for a shelf life of 15 to 20 years. So if you want to play your old amp – and you want it to sound *good* and not endanger your trannies – you need a cap job. Once you put new 500-volt caps in it, you're going to be okay.

Some boutique makers now are doing what they call "voltage correction," utilizing components so the amp will run at the original voltages. A certain percentage of my clients are concerned with authenticity, and this follows that vein.

The other thing you can do is just run the amp down a bit on a variac, which can accomplish a couple of things; it provides a safety margin, and lets the amp produce tube saturation at a lower volume.

A lot of guys are using variacs to control output power, and your Variplex has one built in. Why the sudden boom?

One of the original uses of a variac was as a diagnostic tool. When an amplifier is repaired, you turn it on using the variac starting at 0 volts. As you increase the voltage, the current draw on the "Amperes" meter (or ammeter) on the variac lets you know if there is a short within the amplifier. On a tube amp with a tube rectifier, it'll give an indication of current draw relating to the bias/voltage relationship. If your ammeter is slowly going through the roof, you have a bias problem. If you advance from 0 volts and the ammeter pegs itself, you have a shorted tranny, capacitor, or power tube.

When Edward Van Halen came on the scene, he spoke of using a variac to alter his sound. Everyone wanted to sound like Eddie, so the variac became a fixture in a lot of people's minds. While he initially claimed he *increased* the voltage on his amps, it was soon discovered he actually dropped the voltage to get his "brown" sound. Because musicians are so impressionable, I think it was a really bad idea to say this, because cranking an amp up to 140 volts can distress components to potential failure. As this information evolved, however, a lot of guys were discovering they could use the variac to *reduce* the line voltage, which causes an amp to break up sooner while otherwise retaining its sound.

Everybody knows that with tube amps, you've got to crank them to make them sound like they should. The sound of a guitar plugged straight into a naturally cranked up amp cannot be duplicated with a pedal. The variac allows you to get that same overdrive – that same touch sensitivity you get when the amp is dimed, but at a lower power level.

My friend, Bobby Carlos, who is a tech for Don Henley, uses a variac for small venues and says the amps sound fine down to 80 to 85 volts, then they lose integrity. When he was playing one of my amps with a Mercury tranny, he was down to 70 volts and it was hanging in there, illustrating that the quality of the transformer is also a consideration.

Can a variac damage an amp if it's run it at a lower power?

That's a widely held belief, and one of those issues that does not have a simple answer. The problem is with the tubes, which were designed to operate on a 6.3-volt filament voltage. You can drop it *some*, but when you get too low, electron flow is disrupted; tubes work because of electron flow. So when you get below 80 or 85 volts, the amp sounds like crap. So that's about as far down as you can go in most situations.

Now, when you use a really robust transformer, you can take the amp down further. Mercury transformers make my amps work, in particular the Variplex, which stabilizes the filament voltage and varies the bias and the B+. Mercury trannies track perfectly as the

variac is turned down – the sine wave on the oscilloscope does not change in character as you go from 60 watts to five watts.

I know people who've been using variacs for years and they're still running the same tubes in their amps, and they still sound fine. My opinion is that you're potentially going to have problems running the tubes down below 6.3 volts, but in the final analysis, when a preamp tube lasts 10,000 hours, if you get a sound that turns you on and makes you play, who cares if you have to replace a tube every 10,000 hours or so?

Some guys like running regulated filament supplies to make sure tube voltage stays at 6.3 volts, because that's what the tube wants to see. Certain tubes may react differently to changes in the filament voltage.

Will a variac work with every type of tube amp?

It will, but the results will vary from amp to amp.

What's the best type of variac?

Well, a variac is just a voltage regulator. It's *not* a precision device. All it does is regulate the voltage from the wall to the amp's power transformer. A decent one will probably run $50 to $75. Even the Chinese ones are reliable as long as you don't drop them. What's more important is that you have a good-quality multimeter, which is invaluable for maintaining gear and diagnosing problems. If you want to use a variac, it's important to measure the actual output. Just because a variac says "110 volts" doesn't mean that's what is coming out. In my shop, it varies 5 to 7 volts from what is indicated, sometimes dependent on the time of day. I did some measurements on a '51 tweed Deluxe to give an idea of the differences between 110 volts and what comes out of the wall these days (see chart).

Actual voltage	B+	Filament	Screen	Plate	Current Draw
110v	356	6.05	292	345	34 ma
125v	406	6.88	331	392	39 ma

THE INCREASE OF 15 VOLTS IN THE AC LINE CAUSES SIGnificant voltage increases in the amp. The caps in this amp were rated high enough that there was no distress, but a lot of amps are close to the ratings at 110 volts, and could be endangered by running at 125 volts. The B+ is the main operating voltage coming off the rectifier tube (which converts the AC from the power tranny to DC). The current draw is a milliamp parameter off the cathode of the tube and is what is measured when people talk about "biasing" their amplifier. This being a cathode-biased amp, the number is higher than in a fixed-bias amp.

Was the "brown sound" the premise of the Variplex?

We wanted to create a great-sounding amp that you could turn down to about 5 watts, so when you play a big room, you have the power, but when you play a little room, you're not killing people in the first three rows. Really, we were trying to get a great plexi Marshall sound, not a Van Halen sound.

Now, there *are* other ways to achieve distortion at lower volumes. Attenuators have become popular for achieving a cranked-up sound, as have master volumes and a process called "power scaling" invented by Kevin O'Connor. We liked the sound using the variac and chose that process. A master volume smashes your preamp tubes into square waves, but the power section really isn't working. The great appeal of the variac is that the whole amp is balls-out no matter what volume it's running. It sounds like a cranked amp, not an effect.

What about all those awful static electricity sounds, especially with older amps that don't have grounded cords. And also, radio signals. Is there any way to get rid of them?

There are numerous devices that will get rid of what's called electromagnetic interference (EMI), and radio frequency interference (RFI). These include ETA Systems, Furman, ART, Juice Goose, Tripplite, Atlas, etc. These companies specialize in products that "clean" electrical current. And there are some amplifiers that have an EMI/RFI filter in the AC input. And remember the old Acoustic 270? It had a little resistor/capacitor network on the output as an RF filter. Any of those I've seen that have been in some kind of city environment have burned out from too much "dirty" electricity.

A lot of times, radio signals through your amp means you have a grounding issue in the input section. It needs a ferrite core or a .1 capacitor to the chassis at the input jack. A lot of houses, especially older ones, will get rewired with three-prong plugs in the wall sockets, but they're not grounded. There's a circuit tester that tells you what's going on just by plugging into the wall. They let you know if polarity is reversed, whether there's a ground, etc. Sometimes, this can be a lifesaver. I know guys who have played clubs where one of these tools has saved them a lot of grief because they find out the club owner allowed the bouncer to come in and rewire the place. They would have gotten the shock of their lives if they'd plugged in and played.

Another solution is to call the power company and say, "I'm getting 130 volts out of the wall, and my light bulbs are lasting six weeks." Sometimes they'll send a guy to diagnose and help regulate it. We had big-time noise when we moved into our building, and they came with some cool diagnostic equipment.

What else?

We should talk about old speakers. The formers (the round tube the voice coil is wound on) and the cones in old speakers are almost always dry-rotted and fractured. When you find that collectible old amp, be aware that the original speaker is going to expire within a few minutes when you crank it up. So it's better to replace an original speaker and save it – and its original cone – for when some collector is going to pay you a fortune because the amp is all-original. You may get away with it for a while – but you've been warned! And luckily, there are many great re-coners out there.

A variac.

So, in summary...

Remember that everything coming into and going out of an amp makes a difference in sound and quality of sound. A lot of guys don't think about something as seemingly minor as electricity. But it makes a *huge* difference.

And before you jump to a variac, you might want to get any old amp a tune-up. Sometimes just changing the caps and out-of spec components can make a real difference in sound. The bottom line is finding a sound that turns you on and makes you play, because when you're playing through an amp that really delivers, things come out of your fingers you didn't even know were there!

David Jung is a professional writer/screenwriter and vintage guitar enthusiast living in Los Angeles, where he hangs with some of the best amp techs and collectors in town. VG