

Sergio Hamernik

Don't Blow that Tranny! Part 2 (unedited version)

by DAVID JUNG

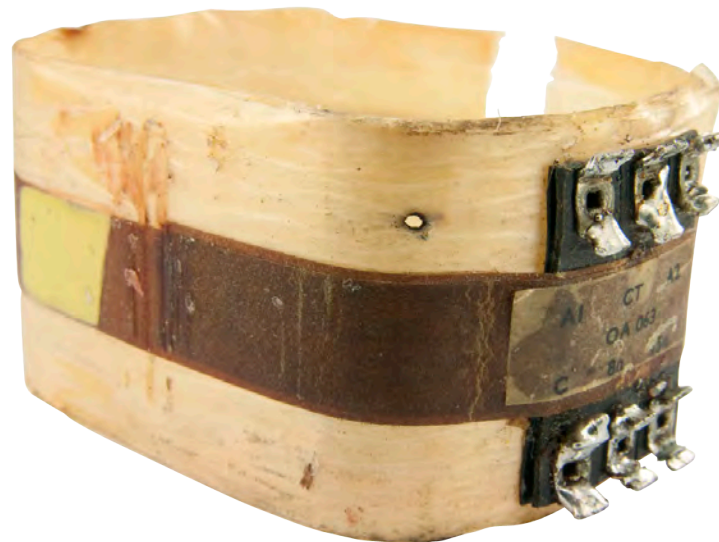
Last month, we dropped off a toasted output transformer from a 1950 *Vox AC15* with Sergio Hamernik and the team at **Mercury Magnetics**. From a suspicious pin-sized burn in the transformer's outer paper insulation, they were able to determine probable causes for the transformers untimely demise. Then it was onto the rewind process! So, is it over for this amp's output transformer?

VG: What goes into the process of rewinding a transformer?

We begin the restoration process with a thorough testing of the transformer's electrical performance. Then we put the transformer's insulation system through its paces – checking its integrity, making sure the voltages inside the transformer stay where they belong and not going wonky by arcing over to neighboring windings.

Consider these steps a weeding out process to find the proper candidates for restoration. If the transformer in question passes, then we return the transformer back to its owner or tech. Believe it or not, about 1-in-4 transformers we receive pass our testing! We offer free-of-charge transformer testing to anyone – all they have to do is cover the shipping costs. Some of

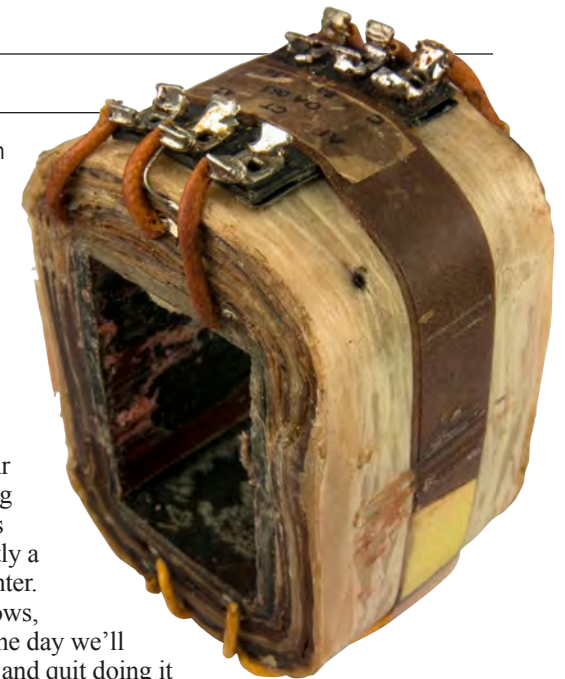
these transformers are sent to us simply to make sure that all is operating well within specs – essentially for a second opinion.



The perforated insulation is shown here. The good news is that it's salvageable, so **Mercury** will reuse it for the restoration – but with an appropriate amount of new insulation under it.

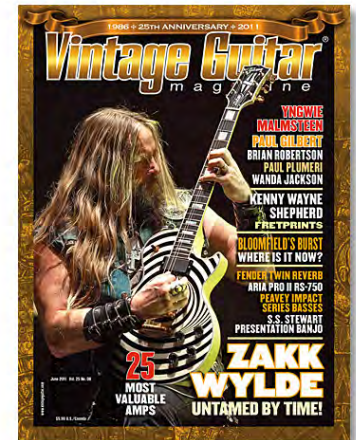
We consider it a “sin,” a violation of our sense of professional ethics, to tamper with a perfectly good transformer. Rewinding or restoring transformers is a service born out of our passion for preserving tone at its highest standards. Properly rewinding transformers is a time-consuming and costly endeavor. The reality

The transformer with its core removed. Note the burn mark.



is that our rewinding service is not exactly a profit center. Who knows, maybe one day we'll sober up and quit doing it altogether. But it does break our hearts when we find vintage transformers ruined by feeble attempts at rewinding by people who do not possess the necessary skills, or who do not have an interest in or knowledge of guitar tone.

If the transformer does fail our testing in any way, then we deem it unsafe to be put back in its amp. Now the process of rewinding begins. A large part of this process is akin to archaeology, or perhaps autopsy. We want to find out precisely how it was made and discover who or what killed



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it. So the first thing we do is remove the core stack and catalog each plate for original position and sequence. Check out the photo of your core completely apart and tagged. We did find some rust and will do our best to preserve it.

We actually talked about that in an article we did back in the August 2009 issue of VG.

Yes that's right. That patina of rust on the core of your transformer is an indicator of better quality iron that is ideally suited for guitar tone. The rust itself is working in league with the iron to assure that level of tonal performance. Modern day technology messes with the original iron processing recipes by adding rust inhibitors and other fillers. They've short-cut the more time-consuming and costly metallurgical processes – just like how auto makers are putting in more plastic than metal in their cars. Iron is an amazing magnetic conductor until it gets diluted or polluted with things that are better suited for non-audio applications. So if I had my choice, I'd prefer to play an amp with rusty transformers delivering the tone I want rather than an amp with pristine rust-free transformers that make the amp sound like it's got a sock stuffed down its throat.

So the original core will go back in the transformer?

Yes. Since you have the right kind of iron core we'll reassemble it the way we found it, then retune it to the original factory specs. If you were stuck with a



An extreme close-up of the burn mark at the first layer of insulation. Notice where the ionized copper left a green-colored mark.

transformer that had inferior core material, then we would suggest swapping it with Mercury upgrade iron.

It's come to our attention that many current production transformers marked with "Made in the U.S.A.," are actually using offshore magnet wire and steel. More accurately they should read "Assembled in the U.S.A." These self-defeating transformers are good candidates for our upgrades rather than rewinds.

Cores are the first component out and the last in during the course of restoration. An interesting fact: cores are never at fault when it comes to a transformer breakdown. The core is removed solely for us to gain access to the coil of the transformer. Taking apart the coil is a surgical process that begins our forensic investigation – like the crime shows on TV. Unpeeling a coil is quite revealing and will tell us the story of what happened. Under interrogation the coil always tell us the truth. A body of a man is wheeled in to the morgue. His wife insists that he shot himself while cleaning his gun – but the autopsy's evidence proves otherwise. Now she's under suspicion.

Well the coil of your transformer quickly spilled the beans. Remember that small black spot we noticed on the outer wrap of the coil? Sometimes there are innocuous blemishes in the form of spots that may appear on the surface of paper and are nothing to worry about. However, what we normally find in fried transformers is that the burn begins somewhere in the middle of the coil and works its way out – causing an exit wound. In your case the failure was not typical. Yours was an entry wound.

This is important because it indicated to us that it was



The AC15's transformer after it was fully disassembled.

killed by a sharp instrument that penetrated the outer insulation that broke through and severed two turns of the fine wire that make up 1/2 of your primary winding. Meaning that only one of the two power tubes was operational. The damage to the entire transformer was limited to that spot and only the very top layer of the magnet wire. Those broken wires were arcing across each other and taking advantage of the oxygen available from the perforation of the outer wrap to form that black spot. Further evidence to support these findings is the fact that the rest of the winding, all the way down to the bobbin, was unharmed.

This type of injury is caused by the usual suspects – the installer or remover of the transformer. The smoking gun possibilities are: the tip of a soldering iron, the tip of a Phillips screw driver... or rough handling (dropping or bumping the transformer against something sharp, etc.) with enough force to puncture it to cause such a failure. And finally, we cannot rule out beer as another possibility.

You can now relax. Your tubes and speaker are now ruled out as possible components of interest.

What gets burned out in a transformer that you're

actually replacing?

The magnet wire. When its insulation gets over taxed the fuster-cluck begins as the insulation system of the overall coil progressively loses its integrity (dielectric strength) and begins to arc or burn.

Can you ever rewind a transformer with its original wire?

We certainly wouldn't do it. When the tires of your car are worn out, do you go out and buy used ones to replace them? Unless you're a former stockbroker, what's the point?

Magnet wire is not bare copper wire. There is a micro thin coating of plastic insulation that protects it from shorting. That very thin layer of plastic is susceptible to microscopic spider web-like cracking. And the process of unwinding the magnet wire virtually assures it's going to get damaged.

Check out the photo of what the magnet wire from your transformer looks like after it was unwound. Does this look like something you'd want to put back in your transformer?

Has any of the machinery used for rewinding changed over the years?

Most of our methods and equipment for rewinding transformers we consider proprietary. So I'm going to stay away from specifics. However, the basic concept of winding equipment hasn't really changed for over the last 100 years. Today, of course, we see more computerized machines. But we chose to stick with the gold standard of vintage equipment.

Aside from ours, I'd be surprised if there is any precision equipment available that is dedicated for the sole purpose of unwinding/rewinding. Most attempts at rewinds today just use run-of-the-mill winding machines that produce, at best, haphazard results.

So if someone gives you a prized "mojo" tranny, do you have the capability of rewinding it exactly the way it was before?

You know I'm not a big believer in mojo. I maintain that all things to do with amps and their respective tone can be easily explained and reproduced, and dare I say it... improved!

But yes, we do have the capability. We treat all transformers with the respect and the dignity they deserve. Most people in this business wouldn't treat these transformers with such reverence. Likewise, they may not have any musical background or an appreciation for electric guitar tone. We're more than just a transformer company. If the original transformer included magical "fairy dust" or whatever that made it sound unique and desirable, we wouldn't overlook it or change anything. That's our promise.



A sample of wire we're going to use for the restoration.

We must be doing something right because we receive mountains of mail, email and phone calls from players all over the world who thank us for giving back (or preserving) their amp's mojo.

When you begin rewinding, are you using the same wire that was used in the '50s and '60s?

That brings up a couple of interesting and important points. First, Mercury is probably the only company in this industry that uses high-purity OFC (oxygen free copper) magnet wire made in here the U.S.A. – which we use exclusively because of its guitar tone (as well as our hi-fi audio) properties. This type of wire is clearly sonically superior and more consistent than the wire that was used in the '50s and '60s. Wire technology back then was limited to about half of the temperature and electrical performance of Mercury's standards. As a result, transformers using our materials last longer, take

more abuse, are sonically more revealing, and follow a closer musical path when over driven into harmonics.

The second point is that we, as players, would much prefer the original wire from the '50s and '60s to the offshore and south-of-the-border suppliers of magnet wire. We gave them a chance, thinking we'd save some dough for our customers. The tested results yielded dull tone, inconsistent batches with too many instances of insulation breakdowns. Not even up to the standards of the vintage wire. Further, in real life tests of putting amps through their paces, the sonic differences were quite noticeably inferior to the guitar players here at Mercury and the players working for the recording studios here in southern California.

Have you ever seen a negative effect of age on a transformer?

In some cases yes. Sometimes your ears may pick up on affects of transformer aging before you realize what is happening. Dark, dull and fuzzy tones with a general sense of lower output volume.

If anything suffers from aging it will most likely be core. There are two major contributors that cause a negative effect of aging and affect your tone. Before World War II the science of processing iron was not up to snuff. It seemed that it was difficult then to boil out residual carbon from the iron. We are carbon-based life forms that age. We also rely on carbon for dating or aging organic compounds. Even a minuscule amount of carbon left in the older iron causes it to age. As the iron core ages, the magnetic conductivity begins to poop out, slowing the transformer's responsiveness with increasing losses. The result is less output with only lower mids breaking through.

During WWII there was a shortage of iron for the war effort. So many transformer companies, in order to survive the hard times, made their cores out of soup can sheet metal! Transformers made this way were naturally plagued the wrong kind of iron and harboring plenty of carbon to boot. Do not confuse iron with steel. Finally, when silicon was implemented to help force out the carbon from post war iron, transformer iron became much more stable. Stable enough to out last us all.

Another contributor to transformer aging comes from humidity. Amp owners who live in humid climates have noticed their tone changing over the years. This

is especially true if their older amps had transformers built around paper tubes. Paper-bobbins have always run the risk of moisture absorption affecting and changing tone. Conversely, we found that amps built with premium transformers that utilize plastic bobbins weren't likely to suffer tone degradation via moisture saturation. A couple excellent examples would be the original Partridge and Radiospares transformers from England. With all the fog and rain they experience, these transformers have held up quite well.

Maybe this explains why coating paper in wax was attempted early on? To verify that dew point (humidity) affected output transformer tone, we had transformers from amps made in the '60s, that had never left the U.K., flown in. They were provided to us by some of the best legendary players their country had to offer. They knew what their amps sounded like originally.

We put their transformers (all with paper bobbins) through a dehumidifying process, then re-sealed them in a generous varnish dip and a full bake. All these guys freaked out and thanked us for giving them their original tone back! And one of the player's even called with a personal thanks that we had reaffirmed that he had not actually suffered hearing loss! He said that as time passed he noticed less treble tones and a lot less note separation and definition. Note attacks seemed impeded. Other players also had this mistaken belief that their amps were getting too old to play.

Obviously this new transformer won't be dipped in wax like some of the old experimental ones. What will you use to insulate it?

Well, I wouldn't call your transformer new. It's still a 1960. If we had restored a 1960 Corvette for you, does it change the year, make or model? Instead of a fresh coat of paint for the car, your transformer will receive a fresh dip of glorious varnish. A non-flammable sexy coat of see-through clear. Something that may last long enough to pass along to your grandkids.

What can I expect the tonal differences to be between the rewind transformer and the original?

It should sound as good as when it left the showroom floor in 1960.

Your only other option, as far as upgrading the tone, would be to try one of our ToneClones. These are copies taken from some of the finest specimen celebrity-owned and played "pick of the litter" amplifiers. And it's likely that you've heard these transformers in action on your favorite recordings.

Have rewinds come back to you shortly after you've sent them out?

On occasion, yes. Installer error happens, and if you don't find and fix the problem that caused the transformer to blow in the first place, you're just setting yourself up for a repeat performance.



This is what your wire looks like when it's unwound from the transformer.

Another thing that's fairly common is the use NOS tubes. Usually purchased from eBay. We had a situation once where a customer, after installing his rebuilt transformer, decided to re-tube his amp with 40-year-old American-built originals. As luck would have it one of the NOS tubes shorted and caused a different failure in the newly rebuilt output transformer.

Is a rewind in store for every old transformer, or will they go on forever?

No, not every old transformer will need to be rewind if taken care of properly. Perhaps most may outlast the "Iron Age" of guitar amplifiers which we're living in now. The push for solid-state technology is tenacious enough to replace tubes/transformer-based amps in the long term (perhaps within the next 50 years?). Tubes may go but they'll have to pry the transformers from my cold dead fingers before I'll give them up.

We recently put transformers of all kinds, old and new, to the test by volunteering to help out the flood victims in Nashville. We offer to test and restore any flood damaged guitar amp transformer sent to us free of charge. We encountered some pretty nasty stuff. Yet, less than 5% of them needed to be rewind! (Namely, transformers with paper bobbin insulation, or amps that had been turned on before the transformers were tested.) Some of the transformers that came in were from amps that had been submerged in raw sewage for weeks! The odor was so fowl that we had to air them out, and the staff actually had to draw straws to determine who was going to work on them.

Talk about your shit jobs.

Man, you got that right! Ah, but there's nothing like the fresh smell of varnish in the morning to help one deal with that challenge. We did manage to extract the moisture and reseal these transformers with varnish. The sacrifices you have to do to help out fellow musicians.... **VG**

Next month, we'll finish our conversation with Sergio Hamernik, and learn what to expect from transformers in the future.



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