

the ToneQuest Report™

The Player's Guide to Ultimate Tone

Mercury Magnetics

TQR: How did you get involved with the entire realm of transformers and guitar amplifiers?

I have always had a passion for music and audio. Guitar tone through an amplifier aroused my curiosity early on because many of the design rules for hi-fi equipment didn't apply to producing great guitar tone. In the case of vacuum tube amplifiers,



transformer design has a significant influence on the characteristics of tonality. Unfortunately, there is not a lot of reference material available and many of the original designers have either retired or passed away. In the early

1980s my partner and I purchased **Mercury Magnetics**, a transformer design and manufacturing company, from one of the early pioneers who founded this company in 1954. Our close proximity to the Los Angeles recording industry gave us access to studio technicians and many well-known musicians. Out of necessity, and to meet the demands of this level of clientele, we had to develop precise, "no compromise" methods of documentation and assembly techniques to rebuild and replicate these transformers to exacting specifications. A past example of this was when a legendary guitarist sought our services to help solve a frustrating problem. A technician had replaced the original *output transformer* in his amp with a generic copy, which resulted in completely changing the character of the amp. Several breakthrough albums from the late 1960s and early 1970s were recorded using this particular amplifier, and the sound of that amplifier really had helped define his signature tone. Needless to say, most musicians are very concerned about maintaining the character and unique tonality of their amplifiers. We ended up rebuilding his original *output transformer* and we provided two additional clones as backup.



TQR: Are you referring to all types of guitar amps, or more specifically British amps rather than, say, vintage Fenders?

I think that in all guitar amps, regardless of origin or brand, you

can find better sounding specimens. Inconsistency in the same models of amplifiers isn't all that unusual. During the course of rebuilding transformers, we have noticed manufacturing anomalies and variations in impedance, inductance and other values with tolerances ranging up to 50%.

TQR: We've heard about variations in components found in vintage amps typically running +/-20%, but a 50% variance in transformer specs is news to us. That's an alarming stat if you're considering buying an expensive vintage amp based solely on the reputation of that model and year.

There is no cause for alarm. Most vintage amps will perform just fine. Nevertheless, I would not be surprised to find a variant in the transformer of a tonally exceptional specimen amplifier.

I'm not implying that all vintage amps have transformers that are slopped together – I have a lot of respect for the people who designed and manufactured transformers in the '50s and '60s. However, they were building high production, affordable transformers with roughly 10% of the budget of today's fabrication cost. They also had a limited choice in materials and they used primitive winding methods. They never imagined that they were building "classics." Today, we are rebuilding and cloning these vintage transformers with meticulous, painstaking detail. Leakage reactance, dielectric constants and many other characteristics are carefully scrutinized. Imagine disassembling the laminations in a core and numbering each one so we can re-laminate them back in the same sequence.

TQR: No thank you! And this all began in the mid '80s?

Yes, around that time, practically by default, we became an insider's source to artists and vintage amp collectors for our rewinding services and our clone spare transformers. We were

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The Tone Tubby

W... You read it... most often before in these pages... Speakers are the final manufacturer in the chain that defines your tone. Both using your credibility and with us for our... can have reports on what may be the most significant developments in guitar speaker design to have occurred in decades, and it's based on an original "technology" that is over 2,000 years old.

COMMITTED TO TONE
The Tone Tubby
A BROWN SOUND, INC.

John Harrison of A Brown Sound (see page 9) is based in San Francisco and has been recording studios in San Rafael, California for nearly 30 years, and his client list is a Who's Who of respected bands and musicians, including Carlos Santana, Pearl Jam, Blindfold, WEAR, Van Halen, Robert Cray, Bruce Mountain, Steve Kimock, Mark Knopfler, Ben Sneezy, Steve Marie, Neil Young, and many more. Harrison has been refining his winding techniques and selection of superior speaker components for decades, and he has earned a reputation for building out a high-end market in recording.

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also supplying custom *transformers* to amplifier manufacturers. Our extensive collection of vintage *transformer* designs really began to take off at that point in time. The ongoing accumulation of the finest sounding examples we could find inspired our line of **ToneClone® transformers**.



TQR: What is it about those particular *transformers* that make them so special, and how do you evaluate them? Do you install them in an amplifier and A/B them, or is it done more or less on paper?

We do have the necessary test equipment and software to check various parameters, but ultimately the ear has to make that decision. We also plug in, play, and conduct A/B testing at our facility. I have a dedicated sound room at home that has been tuned for the purpose of testing and evaluating audio equipment. We are lucky, because the Los Angeles area offers us an amazing amount of guitar playing talent that continues to help us maintain a level of objectivity. Also, some of our best listeners are avid tone enthusiasts who work in and for the local studios. These people understand good tone and give us their experienced opinions.

TQR: And can you describe what it is that makes these *transformers* special? What would we hear, specifically?

Having a detailed *transformer* spec is only the beginning. Breaking down into fine details what materials and assembly techniques were used decades ago helps us assure our customers an accurate reproduction of vintage tone. We have carefully selected the best of new and old technology to put performance and quality ahead of economy. Our *transformers* are hand-wound and the cores are hand stacked. Some materials we fabricate in house, and others, like our steel laminations, are custom ordered. Because we build them one at a time, the **Axiom** and **ToneClone** series are only available in limited quantities. Consequently, there is an audible difference between a budget *transformer* and an **Axiom** or **ToneClone**.



TQR: Can you describe the audible differences?

A good output transformer should go beyond its job of impedance matching, and an amplifier's overall personality depends on it. A desirable *output transformer's* distortion has more detail. The harmonics seem even and smooth. Played clean, the *transformer* should sound natural without harshness, obviously within the boundaries of the authentic tone characteristic the player is

seeking. Better said, we still can't make an apple into an orange.

TQR: What are some of the comments that you hear from players when they hear the **Axiom** or **ToneClone transformers** that you build? Is it a matter of touch dynamics, harmonics, all of that?

Yes, and let's not forget musicians' colorful tone speak, such as: The amplifier sounds more open, glassy, sweet, brown, fat, with more notes perceived. Barred chords are not muddy or squashed. Chimes and bell tones are much more apparent. Good note separation, sustain improved, more definition, *etc....*

TQR: And these things can all be affected by the output *transformer* in some considerable detail....

It is pretty much the last tone filter in a series of components. Other factors like tube quality and speakers can play an important roll as well. Also, if you were to look at an amplifier circuit as a modulated power supply, then the quality of a *power transformer* and *choke*, if a choke is used in the circuit, also affects tonality. The ghost note phenomenon would be an example.

TQR: Like a few amplifier builders we know, you have taken the direct route of precisely replicating the materials and tolerances that comprised the industry standard decades ago....

I remember having a conversation with Leo Fender a number of years ago and getting a chuckle out of him as he told me how amazed he was that so much scrutiny was being given to how things were done in the early days of Fender. He said that they had taken what they were doing in the '50s and '60s so matter of fact back then. They were hardly thinking at the time that they were building future classics. They were trying to make an affordable, good sounding, quality amplifier while still trying to make a buck. Leo also mentioned that for reasons of cash flow and/or inventory problems, they would resort to using alternate vendors from time to time. They kept a careful eye on cost of materials, and their supply, rather than hand picking components with alleged magical tonal qualities.



TQR: They weren't matching tubes, either. All of this can and does get out of hand, but when your rig sounds so good that you can get lost in the magic of it, as a player, wonderful doors can be opened.

Years of research led us to the conclusion that not every aspect of a vintage *transformer* needed to be copied. There were problems and limitations in their day, so why repeat them? We achieved better results by combining old and new technologies. Making the math work for the best tone characteristics together with improved consistency and longevity is the formula we chose to follow. There are a lot of vintage amps today with *transformers*

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that are going bad simply because they have aged. The tonal quality of the amp is deteriorating along with the *transformer*. Paper and certain types of varnishes used in these *transformers* tend to have hygroscopic properties. Moisture is absorbed over time, affecting the insulation system and increasing the chance for high voltage breakdowns. To make matters worse, the primary winding voltage is high enough to produce a corona effect whose ions help oxidize this insulation. Over time, reliability and tonality will suffer. Do you believe in *transformer cancer*?

TQR: That leads us to an interesting situation in which the original output transformer in our '60s Pro Reverb died, and we noticed how much better the amp sounded when we had installed a new transformer, which was a commonly available unit sold by MojoTone. Now, the amp sounded great before the old transformer went out, but it sounded significantly better with the new transformer. I asked our tech and advisory board member Jeff Bakos if it was possible for an output transformer to gradually decay over time, dying a slow death while you continue to lose 'tone' in a very subtle fashion over years of use. Is that possible? It seems as if that was the case with our amp, which we had always considered to have a rather legendary vibe.

Not only is it possible, it is *probable*. Keep in mind that if high voltage insulation breakdown has started, there is no reversing it. Assuming that the *transformers* insulation system is intact, we have in the past reversed some tonal degradation in original *transformers* under controlled laboratory conditions. I've proven that point with my more cynical, high-end customers. One example of this is an amp (a Marshall JTM 45 or a Plexi – I forget which) that had been used in England for years and then brought over to the United States. The owner felt that the tone had decayed over time, seeming darker, lifeless, and the higher frequencies were less pronounced. We asked him to remove the transformer and all we did when he brought it in was to re-bake it in an oven to drive out the moisture. We then vacuum impregnated the *transformer* with our proprietary resin to hermetically seal it before the final bake. He put the *transformer* back into the amp and the results were pretty amazing... it became a lot brighter and more detailed from the upper midrange to the upper frequencies. I'm not recommending that anyone start baking their old *transformers*, however....

TQR: No, but it seems to be a fair statement to say that it's possible that your good sounding old amp might sound significantly better with a new output transformer. At least that was our experience, and in hindsight, we didn't realize what we had been missing.

That's true. The tonal degradation I'm speaking about is very slow and gradual. Your results would be even better if you had used **ToneClone** transformers. Any of our transformers should outlast older vintage transformers because each are put through the same process during production.

TQR: Doesn't it become particularly more problematic with amps like AC30s and Hiwatts, where repro transformers have typically been poor compromises at best?

I believe that Marshall, Vox and Fender, to name a few, are doing an outstanding job of building affordable vintage reissue amplifiers. When an owner of one of these fine amps wants to take his/her tone to the next level, they will usually consult someone like a Don Butler (Toneman) for example. Don is an expert in the field of amplifier upgrades and the art of tonal improvement. Don is also one of the key figures in this mini industry, which is similar to the aftermarket for automobiles and motorcycles. Much like an engine tuner, Don will replace transformers and other components in the signal path to give the customer an upgraded, outstanding sounding amp that comes much closer to capturing the original tone they were seeking.

TQR: Your website seems to be very comprehensive, but can you be contacted over the telephone for customers that either don't see their amp listed or perhaps have additional questions?

Yes! Paul Patronete, an accomplished guitarist who has a good ear for vintage tone and heads our MI division, is happy to help those customers when I am unavailable. Our website is constantly being updated with vintage and modern transformer versions. We will probably always be two or three pages short of having all of the various models listed that people may be interested in. Of course, we can't possibly list every one-off we've done. Another cool thing we offer are modern, updated versions of many of the classic transformers. We have added output impedance taps for many of the classic Fender transformers, which were never originally offered. For any make of amplifier, we offer various mounting styles from the original. We can, in addition, alter tonal characteristics to fit the unique needs of each customer.

TQR: Are you building transformers for many small builders?

Yes. If you own a high end, small production amplifier, there is a chance you will find a **Mercury Magnetics** label on the transformers. Some exceptions are when certain amplifier manufacturers remove labels in an effort to keep us and other vendors a secret. We do maintain a confidentiality agreement with all of our customers if this is their desire.

TQR: Schumacher was a primary supplier to Fender during the tweed era, and they are still operating, although we understand that you generally have to be capable of placing a fairly large order to get geared up. That seems to be a significant barrier to many would-be amp builders.

That company is doing a good job of supplying inexpensive transformers to a high volume market. When a lot of emphasis

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is placed on meeting price points, something has to give. The cost of labor and materials are logically their first consideration. The end result is a compromise, and who could blame them? Ultimately, end users will determine if the resulting tone is adequate. Someone who has paid several thousand dollars of their hard earned money for a “high end” amp is expecting to have something that excites their senses along with a build quality that

justifies their investment. This is where we can assist the amp builder. It goes beyond **Mercury Magnetics** “sending in the clones.” We have made every effort to break those barriers by eliminating minimum buy requirements. We work closely with today’s designers and builders to provide them with a thoughtful, next-level approach to their signature tonal requirements.



Mercury Magnetics

Transformers for Guitar Amps

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