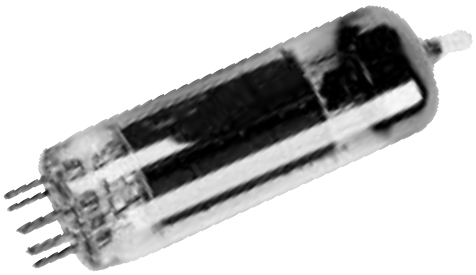
Biased information



How have valve amps survived over 30 years of change? Derek Rocco explains why they are still a vital ingredient in music making, and talks you through the mysteries of biasing

IN THE LAST DECADE WE HAVE seen huge advances in technology which have profoundly changed the way we work. Despite the rise in solid-state and digital modelling technology, virtually every high-profile guitarist and even recording studios still rely on good ol' fashioned valves.

What is a valve?

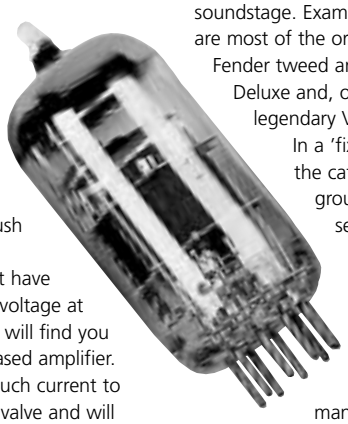
Hopefully, a brief explanation will give you a full understanding of what is happening inside your amp and the enigma that engulfs the term known as biasing. A valve is made up of a minimum of four component parts: the heater, cathode, grid and plate. They are all housed in a sealed, airless vacuum and this is why the Americans call them vacuum tubes.

The heater warms the cathode, which when heated allows the electrons to flow from the cathode (negatively charged) to the plate (which is positively charged). The grid is situated between the cathode and the plate. By applying a signal to the grid it causes a current to flow from the cathode to the plate. The grid is also known as the control grid, as by varying the voltage on the grid you can control how much current is passed from the cathode to the plate. This is known as the grid bias of your amp – the correct bias level is vital to the operation and tone of the amplifier.

By varying the negative grid bias the technician can correctly set up your amp for maximum performance, thus ensuring that the valve is operating correctly. The valve therefore operates literally as a 'valve' regulating the current flow from the cathode to the plate – that's why in England we call it a valve.

What is bias?

The amplifier bias, and the problems associated with it, confuses many musicians If you think of a kitchen tap as a valve and the water as an electrical current, you will never be confused again. When your tap is turned off you get no water flowing through. With your amp if you have too much negative voltage on the grid you will stop the electrical current from flowing. This is known as 'over-biased' and the amp will produce an unbearable distortion at all volume levels.



If you turn your tap full on you get a huge rush of water. If your amplifier does not have enough negative voltage at the grid then you will find you have an under-biased amplifier. This allows too much current to pass through the valve and will cause it to burn out quickly and you will lose punch and clarity in your sound.

Types of bias

You can now see that the bias of the amplifier affects its tone. More interestingly, the type of bias arrangement that the amplifier manufacturer chooses also affects the sound. Generally there are two types of bias arrangement used in guitar amplifiers. A 'cathode bias' amplifier has a resistor going from the cathode to ground. This resistor is set to provide the correct current draw of the valve by setting the negative voltage. This enables the tech to alter the negative grid voltage by replacing the resistor to gain the current draw required. Cathode bias amplifiers have become very sought after. They have a sweet organic sound that has a rich harmonic sustain and they produce a powerful soundstage. Examples of these are most of the original 1950's Fender tweed amps such as the Deluxe and, of course, the legendary Vox AC30.

In a 'fixed bias' amplifier the cathode is grounded and a separate negative voltage is applied to the grid of the output valve. Some amplifier manufactures, such as Marshall, fit a little trim-pot on the negative power supply. This allows for easy resetting of bias when the output valves are changed.

In Mesa/Boogie amps no such trim-pots are fitted but, contrary to popular belief, by changing a few resistors, bias on these amps can be adjusted. I would always fit a trim pot where possible on these amplifiers as it will give you more valve choice in the longer term and also make it easier for a tech to set the bias. These amps generally have high outputs and more headroom than cathode bias amplifiers; examples being Marshall and 'Boogie.

Matching and dual matching

Now we need to understand the terms 'matched' and 'dual

Preamp valves (front) power output valves (rear) next to a rectifier valve

matched' (which are significantly different) when replacing output valves. Output valves will normally last around two years, but higher quality British and American valves can last a least twice as long, due to better components and build quality.

We are often bombarded with science and weird and wonderful methods of how to match valves. Simply, the term 'matched' means that when a fixed amount of negative voltage is applied to the grid, the valve will allow a certain amount of current to flow through it. The amount of current allowed by each individual valve can vary significantly, and therefore by matching, or grouping those with the same current draw readings we can ensure that the amplifier is drawing evenly with a similar current draw from each valve.

So, having the valves matched (all drawing the same current), gives the amp technician the opportunity to correctly set the negative grid voltage so the amplifier functions correctly. If the valves were not matched, as the technician sets the negative grid voltage, they would all draw different amounts of current therefore making it impossible for the amplifier to be set-up correctly.

It is very important to understand, however, that this method of matching, based on the current draw, is only half the task. Because valves also have different output levels, when you fire up your guitar through the amplifier, valves with different outputs will lead to the amplifier sounding unbalanced with uneven distortion.

This is why at Watford Valves, for example, we drive the output valves under working conditions and load to measure the output of the valve. This is measured in milliamps per volt and ensures that the valves also have the same output. This procedure enables us to identify and supply valves with very different characteristics. For example, valves with a higher output will generally distort sooner, and valves with a lower output will take longer to distort. Valves matched on current draw and output levels are termed as dual matched. They will give you a richer harmonic sound, as they all working evenly, and they'll prevent premature component wear.

When do I need to re-bias?

Having the bias checked should always happen when you change your output valves. Valves that are made today are not as consistent as those produced in the early days of valve production. We quite commonly see great variance between valves from the same batch. So to simply buy a matched pair of EL34s, for example, even by the same maker, is no guarantee that they will work correctly as they may draw more or less current and differ from the way in which the amp has been set-up.

The cost of using an amp technician varies; some offer a full-service, others will just check the bias setting. The thing to remember is that these guys see amps day-in and day-out and they can prevent trouble happening – vital for all gigging musicians.

Valve choice

Another often used term in relation to valves is New Old Stock (NOS). This simply means that the stock is new but is not of current production. These valves are generally made by British, German and American factories such as Mullard, Philips, GE and RCA. These factories, sadly, no longer produce valves. But these valves are the highest quality available as they were made with very strict production control and high quality components. They are well worth seeking out. They have a longer life, better tone and superb reliability.

In recent years we've seen the Americans take over the control and distribution of a number of Russian factories, giving rise to the names Svetlana and Sovtek. The Tesla factory has also reformed as JJ. Their valves are very good. The Chinese-made ones, which plagued musicians for many years, now seem in decline.

Why are valve amps so popular?

A valve amp's sound is tremendously flexible and can be tailored to the individual's taste. Many valves like the EL34, 6L6GC, 5881, KT66, KT77, KT88 and 6550A all share the same base configuration, yet they all have different sounds and can be used in the same amplifiers with only slight modifications or simple bias alterations. The classic Marshall JTM 45 with KT66s, and Malcolm Young's Marshalls fitted with 6550A are just a couple of examples.

I believe the main reason so many players still chose valve-driven product is down to tone. A valve has a clipping point that provides that rich distortion and sound which can't be replicated by a transistor. Undoubtedly some manufacturers are now very close to replicating the tone of a valve amp with alternate technology but with minimum impact on the valve market.

The great manufactures of yesteryear, like Mullard, Philips, GE and RCA all used different materials and techniques to produce valves. In the same way that a great guitar shapes the tone and characteristics of your amplifier, so does a valve, so a lot of thought must be put into buying valves and the characteristics desired.

Musicians have kept valves alive over the last 30 years and with the current Russian and Eastern Block valves continuing to improve, the future looks good. Maybe in these days of samples and MP3 files we

Useful numbers

Here are some useful numbers for technicians who undertake amplifier biasing

Bristol
Soundburn Audio
Jessey James, 0117 955 5766

Manchester
The Amp Clinic
Roland Lumby, 0161 787 8082

Eire
P Keenaham amp repairs
Peter Keenahan,
00353 1 671 8886

London
T A Services
Theo, 0208 881 1623