

PREAMPLIFICATION

For AAE SE & Push Pull Amplifiers

One of the contributors to either clean or crunchy or highly sustained and/or distorted guitar sound is the method by which the grids of the preamp tubes are driven. Grid clipping distortion is a nuisance in hifi circuits but in guitar preamps contributes to the sound in terms of sustain and overdrive. The 'Miller' capacitance must also be taken into account. Both miller capacitance and grid clipping can be seen as advantages or disadvantages depending on their position in the circuit.

In terms of overdrive my aim is to be able to retain the original sound that comes from the string as much as possible. I try to achieve this at relatively high distortion and sustain levels. Preamp tubes like the 12AX7 produce second harmonic distortion which is proportional to the strength of the signal. This is a traditional preamp tube and depending on how you design the circuit of course it tends to generate this type of harmonic distortion which goes well with the string of the guitar. The EQs in most of my guitar preamplifiers are of the passive type in order to keep the original tone. They also contain an inductor which uniquely contributes to the tone.

For sustained sound, cascading is necessary, where one stage drives another and so on. Some attenuation is necessary between two stages to overcome the problems of excessive grid clipping. Another grid problem is the clamping effect that a high signal has on to the grid. This happens because the grid then becomes a diode and this diode together with the coupling capacitor form a clamping circuit. This reverse biases the tube and makes the sound momentarily disappear. **The designer must ensure that this does not happen.**

Each tube behaves differently as it has its own set of output characteristics. The sound (and the type of harmonics) changes according to the load that each preamp tube drives too. This load can either be resistive, reactive (passive equalizer) or non-linear (the anode of another tube).

If the gain before the EQ is around 40, an equalizer follows, and then another similar gain stage is added after that - **a clean sound is created.**

- If the gain before the EQU can be switched onto a higher value i.e. 100, subjectively the tone becomes more edgy, contains a faster attack but still keeps its definition.
- If the first stage has even more gain the sound then starts becoming fuzzy i.e. starts losing definition.
- A similar thing happens if the first stage is brought back to a gain of 100 but the gain of the second stage increases. **However, you then have better control of the tone and distortion** because of the equaliser and the first gain control. Therefore, you then create a distorted sound with better definition.

By being able to vary the gain of either one of these two stages, you can get a combination of either one of these two types of overdrive. The EQU can then filter out or emphasise the harmonics that suit your taste.

In the 3-1 & 11-1 reverb preamps instead of the 12AX7 I am using the 12AY7 in the front end and if you prefer, the two tubes are interchangeable. This tube was used in older Fender amps and subjectively it sounds a bit more vintage. It has a slightly lower gain but because of its lower plate resistance it can drive a passive equaliser directly without a buffer. One half of the 12AY7 drives the second half of the 12AY7, a small attenuation takes place in-between and the gain of the whole stage is switchable.. A treble booster is included in this stage too.

THE EQU

These controls cover a much higher range of tonal variations than other types of guitar EQs, experimentation is therefore necessary to achieve the desired tone. There is also a midrange switch which focuses the mids onto a slightly higher range and an inductor can be switched in and a tuned circuit if formed if desired. This is good for high distortion guitar solos when the amp drives Celestion type of speakers but it can sound sharp and edgy (extreme if desired) especially with Jensen or Weber type of speakers in high gain settings, especially if the bass control is turned down. However, with the inductor out of the circuit, a fuller more 'bassy' tone is generated and it will probably suit fender guitars with Jensen type speakers for **clean sound**. The *mid* control then, covers both low and high midrange frequencies, and the sound is smoother. In this EQU the midrange can be entirely removed if necessary by the use of the mid range control. A bright type of treble booster is included in this stage too.

After the equalizer, two stages of a 6SN7 tube follow. The signal level that comes from the EQU can be adjusted by a gain control. The 6SN7 (old 8-pin style) is a very interesting tube of a vintage era (40s & 50s) it was used in old Ampegs. Its characteristics are similar to the 12AU7 (the 6SN7 is the predecessor). It has a larger base and structure plus is a much cleaner tube. It is highly regarded in hifi and studio electronics and Sovtec are now making them again. Another level control follows that drives the final tube of the preamplifier (12AT7, a common US amplifier phase splitter), that also mixes the reverberated signal coming from the spring reverb.

The amount of signal that is being sent to the spring can be set by the operator, through the use of the reverb send control – a unique feature of this preamp. By using this control you can create grungy, distorted reverbs because at high spring drive levels the spring also distorts and creates an interesting sound too. The reverberated return signal if desired can become very powerful and even overtake the dry signal for those people who like this extreme, sharp reverberated kind of sound.