

Class A Amps: What They Are, And What They Are Not

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If you peruse the ads for new amps online and in guitar magazines, it's likely you'll come across the term "class A" a lot. And it sounds pretty good, right? But by its very nature, this term can be misleading, and might sometimes even be used to intentionally persuade guitarists into making assumptions about the quality of the product which has been given that label. Let's dig into this oft-confusing terminology to see what it really means, what it doesn't mean, and how it all relates to your tone.

Class Acts

Calling anything "class A" makes it sound inherently better than something that is not; like Grade-A beef, or First-Class Mail. After all, you wouldn't be too enthusiastic about buying Grade-AB beef for your family, would you? But when it comes to tube amp classifications, "Class A" isn't intended to define "the best" of a range of amps; rather, it's a technical term used to define a particular operating class, and it's associated with very specific technical—rather than qualitative—parameters. On top of that, it's a lot easier for an amp-maker's marketing department to claim that an amp is Class A than it is for any player, or even reviewer, to prove that it is not. Put the two together, and you've got a boatload of misinformation writhing around out there.

Before proceeding, let's consider these tidbits of essential information: the Fender Tweed Bassman, Blackface Twin Reverb, Deluxe Reverb, and Super Reverb; the Marshall JTM45 and Plexi; the Mesa/Boogie Mark I and Mark II; the Soldano SLO; the Trainwreck Express; and the Dumble Overdrive Special—and many other legendary amps—are not Class-A. Unquestioned classics? Indeed they are! So, as we proceed with this investigation, let's hold on to the simple fact that many of the best sounding and most influential tube amps of all time are not Class A; they are Class AB.

On the other hand, the Fender Champ (Tweed, Blackface, Silverface), Vox AC4, Gibson GA-8, Kalamazoo Model 1, Wards Airline GDR-9012A, Silvertone 1481, and plenty of other similar vintage "practice" or "student" amps with just one output tube are categorically Class A (although they were not promoted as such in the trade ads of their day). Falling between these stools, consider that the '50s Tweed Fender Deluxe—and the many modern and reissue amps inspired by this classic—was never touted as a "Class-A amp," but easily falls into the more colloquial definition of Class A used by many amp makers today.

Despite such confusion, however, the definitions of operating class relevant to tube guitar amplifiers are really pretty simple. Let's take a look.

Class AB

In a push-pull (PP) amp, with two output tubes (or four tubes working in two pairs), one tube or pair of tubes works to amplify the peaks of the signal (the waveform, which most of you will know looks like a rolling pattern of hills and valleys) while the other tube or pair of tubes amplifies the valleys. In other words, one tube "pushes the hills" while the other "pulls the valleys."

Since AC current (alternating current)—which is what passes your guitar signal from stage to stage within the amp—carries constantly alternating hills and valleys, each tube of the PP set up receives a steady stream of each, in reverse-phase of each other after the signal has passed through the phase inverter, which splits it into two opposite-phase strands. In many guitar amps, the majority in fact, each side of the PP setup actually shuts down briefly during some part of the cycle, when the other side is at its peak of current flow. What? One tube shuts down while the other amplifies? That's right, and then they swap.

Looks crazy on paper, but of course it all happens so fast that there's no audible gap in performance. The 360-degree waveforms that are being amplified by each side of the PP set-up are reverse phase to each other, so there's no volume loss as one side dips and the other rises. As mentioned above, the majority of the world's guitar amps function in this way, including classics like all the big Marshalls, Fender Bassmans and Twins, Dumbles, Mesa/Boogies, and so on.

As we have already discovered, amps that perform as I have just described are class-AB amplifiers. By definition, one side of the PP tube pair of a class AB amplifier rests for at least some portion of the cycle (when measured at maximum volume before clipping). In simple terms, that's really all there is to the definition of class AB, or all that you need to worry about at least. It's worth knowing too, however, that sharing the load makes output tubes configured in class AB a little more efficient power-wise, and they tend to help amps sound a little tighter, firmer and punchier, while also producing a little more wattage.

Class A

An output section operating in true class A, on the other hand, has the tubes working the entire cycle of the waveform (when measured at maximum volume before distortion). This is true even of push-pull amplifiers, where both tubes are sending the signal along to the output transformer together at all times: one side is still "pushing the hills" while the other is "pulling the valleys", but they're not alternately resting while doing so, as with class AB. As such, class-A output stages are somewhat less efficient than class AB stages, and they produce a little less wattage.

Players and amp-makers often talk of sweeter distortion in class A amps, but true class A operation actually has less distortion content at any given output level; although it displays a

smoother onset of distortion when it comes, and one that is usually heard as being more harmonically rich. But the fact that definitions of operating class are measured at maximum output before distortion should tell you something: a lot of voodoo is talked about class A, particularly by amp-makers' marketing departments in their eagerness to sell you a particular new model.

The sound of true class A, operating within the realm of its definition, is actually something different than the advertising slogan, "a real class A tube amp," intends to imply. Relatively few amps fit the definition for class A absolutely and beyond debate, which is not something to worry about at this juncture. The characteristic sound of different classic tube guitar amps is determined by far more than their just class definition.

Voltage vs. Bias

Achieving true class-A performance in PP amps requires the careful manipulation of two factors: the DC voltage delivered to the output tubes, and the bias setting thereof. When desired, amp designers can force the tubes into this state of constant operation by carefully setting their bias point, which is a very complex matter (roughly speaking, think of a tube's bias like a car engine's idle). In short, class-A amps are usually biased very "hot," meaning they are run hard at high voltage levels with respect to their bias setting. When done correctly, and for the right reasons, this can make them tonally very "rich," with a high proportion of harmonic overtones present in your guitar signal. But this also makes them less efficient in regard to output level, since the tubes on each side of the output stage aren't sharing the load quite as much to get there.

Such biasing is usually achieved in class-A amps, as well as amps that are purportedly class A, by a method known as "cathode biasing." This will be most familiar to guitarists as heard in the Vox AC30 and AC15, or other amps that follow those templates. Now here's the rub: cathode-biased amps, whether they are class A or class AB in the purest sense, have a discernible sound, which itself has come to be associated with some of the supposed characteristics of a "class-A amp." This sound is harmonically lush, shimmering, sometimes just a hair grainy and loose, and fairly smooth when cranked up into distortion. Often it is not particularly tight, punchy or bold, or at least is less so than a more efficient fixed-bias output stage, in relative terms. And remember, neither is better or worse than the other, it all depends on what you're looking for.

Negative Feedback

In addition to matters of bias, most amps billed as being "class A" also lack something called a "negative feedback loop." Applying a little bit of an amp's output signal in reverse phase back to the front of the output stage in a network known as a negative-feedback loop (usually a loop that runs from the speaker output jack back to a point at the input of the phase inverter) can help to improve the overall tightness and definition of its sound. The reverse of this, therefore, excluding a negative feedback loop, further contributes to some of the tonal qualities that are already being emphasized in the cathode-biased amp, and which we colloquially think of as "class A."

Almost any amp you encounter that's billed as class A will lack a negative-feedback loop. Whether or not anyone's ever going to put it up on the workbench, attach the meter and scope, and determine whether it's truly operating in class A, such an amp will still produce what we commonly consider the "class-A sound," mainly because it is cathode biased and carries no negative feedback loop. So, guess what you'd find inside a Vox AC30. Yep: cathode biasing, and no negative feedback loop. And the same goes for amps like the Matchless DC30, Bad Cat Black Cat 30, TopHat King Royale, Mojave Sidewinder, Dr. Z Stangray, and others that follow the AC30 template (in addition to all the smaller amps that emulate the AC15).

You know what other amps are cathode-biased, with no negative feedback? The 1950's Fender Deluxe and Gibson GA-20, GA-30 and GA-40 Les Paul, early '60s Selmer Selectortone, late '60s Traynor YBA-2 Bass Mate and WEM Dominator, plenty of Valco-made amps...and, well, loads of others.

Single-Ended Amps

In the fourth paragraph of this article I listed a number of smaller practice amps that do qualify as genuine class-A amps, by definition. All of these are what we call "single-ended" amps, which is to say they have just one output tube. When one tube is working all on its lonesome in an output stage, it is categorically operating in class A because, of course, it cannot shut down at any portion of the waveform because it has no partner tube with which to share the load.

As used in guitar amps, single-ended tube output stages only ever stray into the medium-sized amp at best, since one output tube—even a big one—can't produce a lot of wattage working in an inefficient setup like this. Dual-single-ended amps, of which the Gibson GA-8 is the only one in the list, use a pair of output tubes working in parallel (that is, tied together as if they are one tube) to increase their potential output. Rather than working in turns like the PP pair, these are really pretending they are a single tube for operational purposes, both pushing the same signal the entire time. Modern examples of these are extremely rare, and include THD's BiValve and Victoria's Regal II, both of which are about the largest single-ended amps I can think of.

Even with two output tubes, single-ended and dual-single-ended amps are still very inefficient compared to PP amps using the same tube complement. A design such as the GA-8 probably only puts out about 8W to 10W, as compared with the 15W to 18W rating of an amp like the PP Gibson GA-20 or Fender Deluxe; the Victoria Regal II's maximum output is around 30 watts from a pair of EL43s, which could produce 60 watts or more in an efficient class-AB push-pull design. Still, it's one way of getting a little more than a measly 4W of power out of a true class-A design.

Class Consciousness

Ultimately, we should consider that an amp's class definition can provide some clues about its tonal palette, but the potential for misinformation and misdescription means you really should play an amp—rather than merely relying upon promotional descriptions—before forming any hard and fast opinions regarding its sonic properties. Drill down to the heart of your tone, according to which amplifier feels and sounds right to you and works best for your style of music, and let categories and class descriptions take a back seat to your ears and your fingers.