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Subject: Re: Class A, AB1, B, C Operation/Modes

Posted by [BreakneckRedneck](#) on Sun, 24 Sep 2023 05:42:10 GMT

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Hi guys, I haven't posted on here in years, though I lurk and read often. I apologize if I sound uncouth to post out of nowhere with something like this; I just wanted to throw in a clarification concerning operating class, as there are many misconceptions concerning it (especially on guitar amp-specific forums), which then are sometimes repeated by good, well-meaning people.

"Notice, each tube in the Push Pull output stage operates Class A until each output tube just reaches the point of cutoff. That means each output tube conducts the entire musical waveform."

Class AB amplifiers are never Class A at any point or time, instead, they operate in a region with conditions similar to Class A up until a certain output level. Operating class is always determined at an amplifier's full, unclipped output, rather than the quiescent operating point or anywhere in between.

Also, Class AB never reaches cutoff at any time, else it would instead be Class B. Class AB always conducts for more than 180 degrees of the AC cycle at its full output, but significantly less than 360 degrees. This keeps the output devices' conduction high enough at the peak of the input signal's negative half-cycle to avoid the highly non-linear region of the characteristic curves near cutoff, while also avoiding exceeding their thermal dissipation limit.

Operating class is also independent of output stage topology, whether single ended or push pull, and is also independent of the biasing method used. A common misconception is that cathode biased tube amps are always automatically Class A, and grid biased tube amps are always Class AB. The reality is that a Class A amplifier can be grid biased, and a Class AB amp can be cathode biased. However, a cathode biased Class AB amp is indeed limited to 'high' AB operation, close to Class A. The reason is simple: Ohm's Law.

As the average AB plate current increases correspondingly with output level, the same current increase across the cathode resistor in turn produces a higher bias voltage, thereby counteracting and limiting the maximum plate current excursion. This effectively prevents using cathode bias to achieve the higher efficiency 'low AB' operation (moving closer to Class B condition).

Hope this makes sense. For those interested, some especially great reading on the topic (and many others!) can be found in Audio Cyclopaedia by Howard Tremain, and The Radiotron Designer's Handbook, 4th Edition.