

Introduction

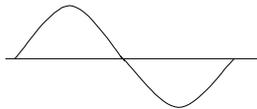
The standard answer about chokes and rise-time and why they are important has always been, "Higher rise-times reduce filament noise at the fixture." For this reason, you quite often see high rise-time dimmers (i.e. 800us or greater) installed in concert halls. This is because musicians hate any perceptible buzz...unless it's from concertgoers praising their performance.

The perennial question then becomes "How does it work." The technical answer is quite simple. But it took me six years of college to appreciate its simplicity. So let's explore it another way that makes sense to the caring public at large.

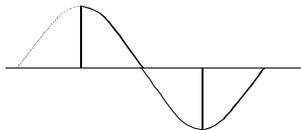
As we have all noticed, or perhaps we haven't, incandescent lamps do not make any noise when plugged into our wall outlets at home. You turn on the reading lamp to peruse the evening paper and nothing happens. That is, the light comes on, but no buzzing sounds occur. This is good; otherwise we might all go a little bonkers from listening to a 120-cycle vibration. Yes, in the US, our power is at 60Hz, but the filament in the lamp moves on every half-cycle. Lost you yet?

A Look at a Sine Wave

The diagram to the right shows an AC waveform, representing the voltage available from the power company to drive all of our appliances. At 60Hz, there are 120 changes in polarity. Think about this waveform as what the lamp sees when it is turned on. The filament in the lamp glows and actually even moves from side to side in the envelope with every rise and fall in the sine wave. This sine wave is very fluid and smooth and the filament follows along like a passenger in a boat on a gently moving ocean. (As most people will tell you, most things in electricity can be related to water...just don't mix them).

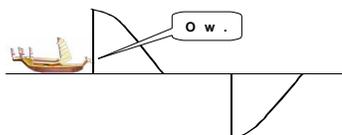


Now we come to dimming. Current SCR technology dictates that to dim a light, we must alter the AC sine wave. SCRs are devices that conduct electricity in one direction only. A back-to-back configuration of SCRs allows us to control power on both the positive and negative cycles. Separate control creates "Dimmer Doubling™," but that's a discussion for next time. When a light needs to be dimmed, the dimmer chops the front end of each half cycle. This reduces the overall power that is sent to a lamp during that cycle. Turn on the SCR halfway through the cycle, and the lamp glows at about half its normal output. Turn on the SCR three quarters of the way through the cycle, and the lamp glows at about 25%.



Filament Noise

Great, now we have control over light; except, the abrupt turn on of power slams the filament to one side - - like a passenger tossed violently in a boat. The filament rides the wave back to the zero-cross line smoothly, but is then hit again in the other direction. As the filament gets battered around in the boat, he complains rather loudly, making the buzzing noise we may hear. In fact, you hear this noise more often with



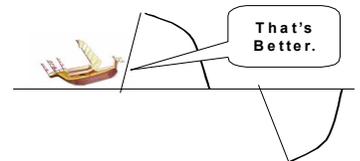
large filament lamps such as those used in scoops than you do with small filaments such as the HPL. This difference is in the mass of the filament. It makes sense that the large filament makes more noise as he hits the side of the boat. Remember though, that he rides the smooth wave back down the other side and makes no noise there.

Chokes and Rise Time

Well, we needed to find a way to reduce the noise. Designers have installed chokes in our dimmers to help. A choke is an electrical storage device, similar to a battery, but it reacts to changes in current. As the SCR is turned on, the choke helps ease the current out to the lamp. So instead of having a very sharp, vertical wave, we slant it forward just enough to reduce the speed at which the filament hits the side of the boat. The filament now screams less and the noise becomes less audible. The more we slant the power, the less loudly the filament objects. As we increase the slant, we are increasing rise time.

Rise time is usually defined as, "The amount of time it takes to get from 10% to 90% of the power wave form when the dimmer is at 50% output."

The larger the rise time, the less noise we get and the happier both the filament is and the musicians are. And remember that slamming the filament around in the boat not only creates buzz, but also reduces his lifespan.



So I assume your last question is, "Well why don't we just put really large chokes in all our dimmers?" There are several reasons not to. For one, as we implement larger rise times, the choke has to get larger. Eventually the choke gets so large as to not be able to fit into the dimmer system. For another, as chokes and rise times get larger, the amount of heat dissipated by the choke gets larger. This can be a problem in high density dimming systems where compact design and heat flow can reach a critical point. The last reason is that, in extreme application, dimmer response becomes sluggish. All this is why, on occasion, you will find rock-n-roll lighting designers specifying low-rise dimmers so that bumps happen faster. The only noise that matters to them is the noise that comes out of the band.

I hope this article has found you in a little better light regarding chokes and rise times and a little less in the dark about the noise surrounding them.