This is all grey matter from a half century ago.

The genesis for the low inductance chokes dates to the 30L1, which Gene Senti designed. The 30S1 and 30L1 were brilliantly designed amplifiers, far ahead of their time. The entire story follows in a couple of segments. It is a long story, highlighting the conceptual understanding that has been lost to history.

Collins sold these amps to military, commercial, and ham interests. The specifications required them to cover all frequencies between 3.5 MHz and 30 MHZ, deliver an IMD of -40db, and be simple to operate. The 32S series drivers had already met those objectives with both transmitter and amplifier delivering -40 MDS numbers.

It began with the 30S1 which was designed by Warren Bruene, long revered for his writing and contributions to the radio era. The 30S1 design points were carried over from the 30S1 to the follow on 30L1 and most other vendors. The 30S1 used negative feedback to achieve two things, reach -40db IMD numbers and second to decrease the gain so that the 32S series transmitters could be operated at more natural output levels.

The 30S1 used a 4cx1000 tetrode which came in two versions, the original, and a radical new design that used the EIMAC Focus Cathode which worked by funneling the cathode beam between the grid wires, the same as the 8877. The screen was run at RF ground which many thought blocked the effect from the plate to control grid and plate to cathode coupling. Blocking the P to CG coupling disabled the tubes natural negative feedback. A 5 pf capacitor was inserted from plate to control grid, bypassing the screen in order to reestablish the natural negative feedback. This was ignored by most if not all people on these lists. This simple oversight would lead to decades of mindless false conclusions denigrating the design of the 30L1 and proponent Bill Orr. **Remember that point** --- it will be important later.

Then came the 30L1 designed by Gene Senti. The design had to meet the same objectives and more, while costing far less than the 30S1. It was to deliver a -40db IMD number and be safe and easy to operate by a diverse intellectual group.

It used four 811A tubes that were selected to be a reasonable match in PLATE and GRID current with the same voltages applied.
View http://k9axn.com/attachments/811A_463_AB2_FOR_WEB_ALTERED_1.pdf Pay special attention to the areas that are highlighted in yellow noting the 2:1 variation in plate and 3:1 in grid current. This information explains why the Collins engineers used grid and plate current matched tubes.

Plate and filament choke design has been misunderstood since the electronic CAD design tools emerged in 1970.

Does it block AC? No, AC does not flow in a properly designed choke --- just pulsating DC! It has a far more important function, think about this: The conduction cycle in a single ended GG amp is 180 degrees primarily class B2 with an unremarkable AB2 component. What happens during the off cycle; No current flows in the tube. Does this leave the flywheel effect in the tank **alone** to complete and form the 360° sine wave? No it does not, the other 1/2 is provided by the plate choke. The engineers of that era knew that the properties of a helix included induced

as well as distributed current. These properties were well understood 50 years ago, but now relegated to history.

In a properly designed plate choke, the inductive reactance must be higher than the load impedance on all bands. During the conduction cycle, 1/2 the plate current is sent to the tank and 1/2 is sent to the choke to be stored for use during the off cycle where the energy is returned to assist the flywheel function. That is why the load impedance of the amp is twice that of the tube, half of the current goes to the tank and half to be stored in the choke for use during the off - half cycle.

No AC flows in the plate choke, it is pulsating DC. The amps that use the low value plate and filament chokes sometimes display an enigmatic behavior. They seem to lack enough plate tune capacity to function at the low end of 80 Metres. What has happened --- they tried to operate the amp with one tube removed or the tubes are soft and unable to carry adequate current to develop the desired plate impedance. This forces the amp to attempt to match a higher plate impedance which exceeds the reactance of the choke causing some of the current to reverse becoming AC which results in the choke participating in the tank circuit. The symptom appears as the tank having inadequate plate tune capacity.

The reasoning for these chokes with low value inductance is a bit complicated. The **first** and most damaging SRF of a plate choke is not caused by some mysterious anomaly from a séance, it is simply the distributed properties of the inductor. You will find the choke in the 30L1 to be 44uH, wound with approximately 14 feet of wire. It's shorted to ground by the .001 uF bypass capacitor. It is a 1/2 wave shorted stub at approximately 35 MHz leaving the entire 3.5 to 30 MHZ range undisturbed. At 44uH it is a bit marginal because the impedance of four 811A's is close to the impedance of the RFC. If one is pulled or they go soft, the impedance of the tubes will exceed the impedance of the choke resulting in current reversal and the inductance of the choke participating in the output tuned circuit. (Not enough tuning capacity when operating at the bottom of 80 Metres).

There is a modification that will increase the inductance while leaving the SRF fixed. Simply insert a bit of permeability into the coil form using the same wire length.

Part 2 follows. It will speak to the effects of choke inductance when modulation is applied. The effects that the per/cycle GG cathode impedance variations have on linearity, the unexpected effect that these variations cause for the driver, why the seemingly low impedance cathode chokes used in these designs improve linearity, and why the strange coax lengths were recommended for the driver to amp connection for the Collins amps.

Regards Jim