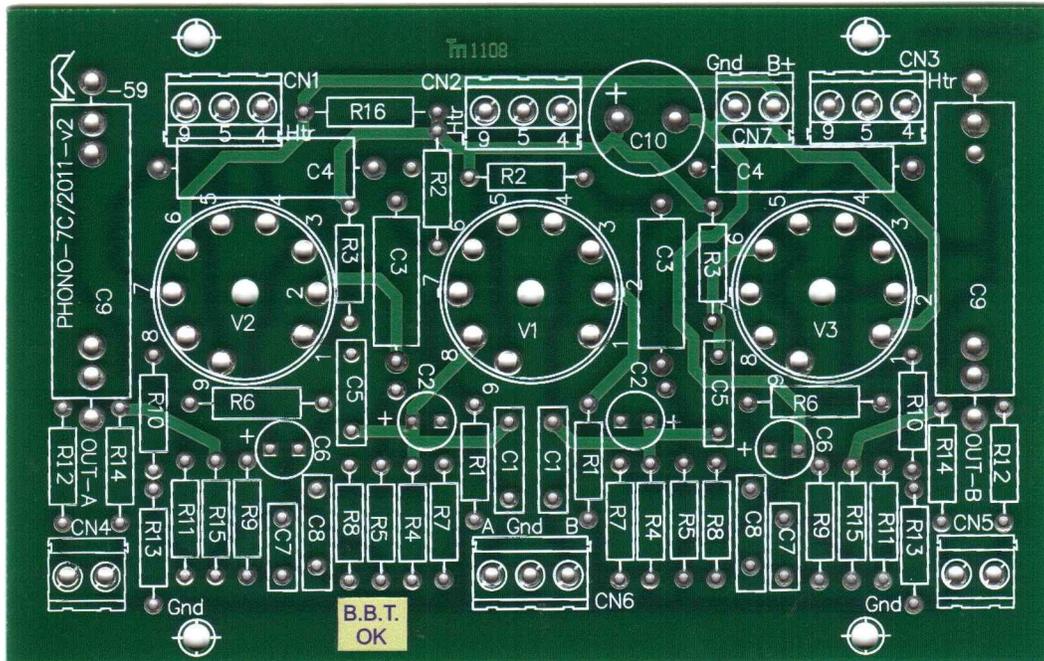


# 7C Phono Stage

for the  
**Dynaco® PAS2, PAS3, PAS3X**

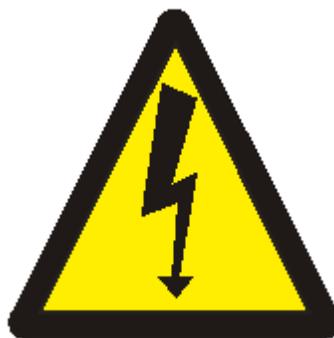


*Classic Valve Design*



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This product is designed for and use around **LETHAL VOLTAGES**. We assume the user has a reasonably competent grasp of line operated electronics at the time of sale.



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\* 7C design is © Marantz. This is a clone with modifications \*

The Dynaco PAS series of preamplifiers has been one of the most successful and popular preamplifiers in history. They are reliable, hold their resale value and are incredibly popular “blank slates” to modify.

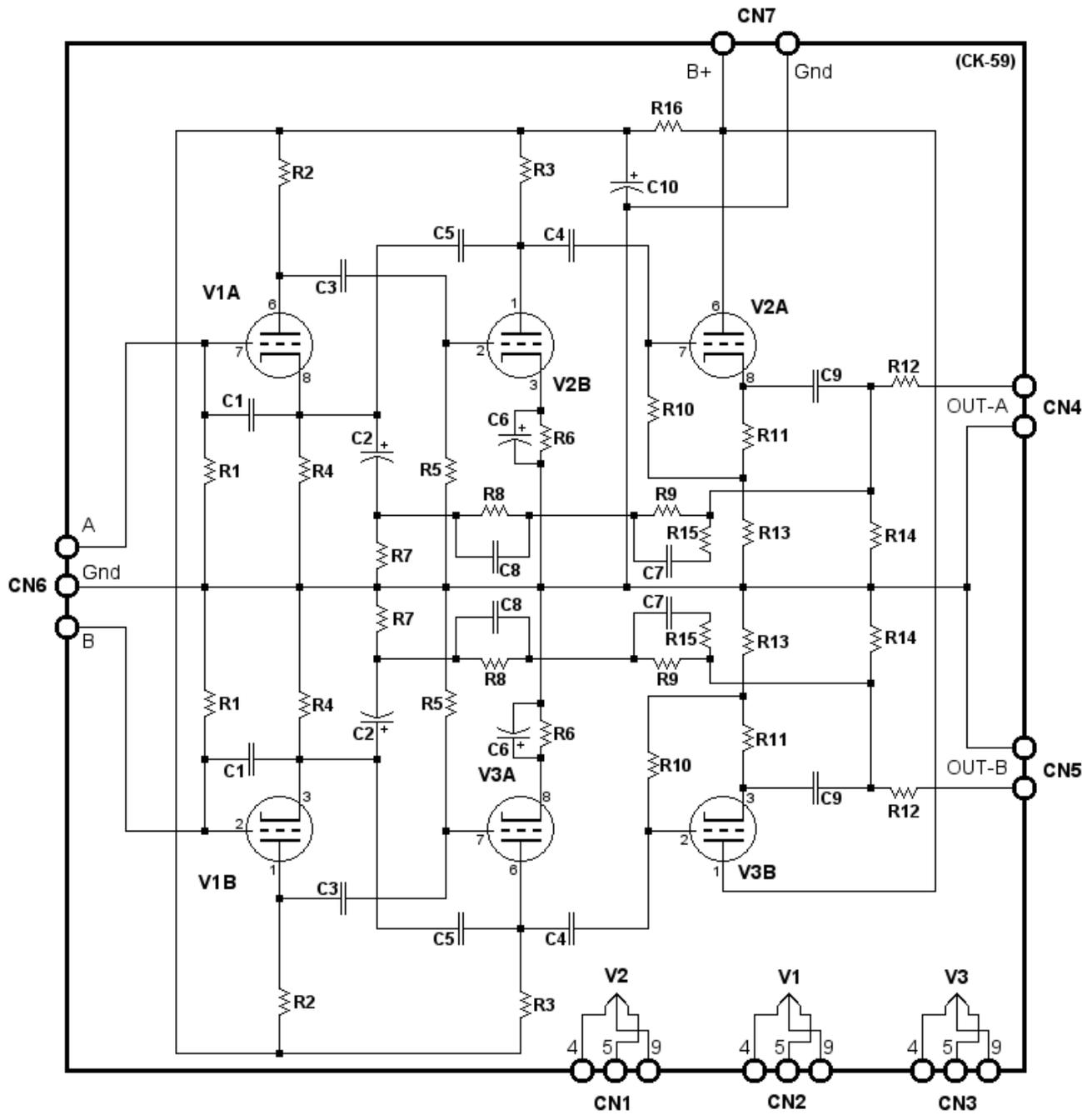
The Marantz 7C phono design continues to have a loyal following to this day. Now you can combine two popular vintage designs in one box.

Due to the fact this board uses three instead of two tubes, it is also highly recommended that if you use your 12X4 rectifier, that you install a secondary (12.6V, 500mA - Hammond 166G12) transformer to power its heater and the pilot lamp, if you do not convert to a LED power indicator. If you convert to an LED one (order CK-57), the recommended auxiliary transformer is 12.6V @ 300mA (Hammond 166F12 or 166F12C/D is fine).

The 166F12 transformer can be mounted across the hole left by the can capacitor if you use our PAS Regulator PCB (order CK-54), or one of the many capacitor boards available on the internet. If you wish to keep the stock can capacitor, mount it on the back near the existing PA-211 power transformer (but do not block the vent holes). The 166G12 must be mounted externally (unless you're good at making fancy brackets).

The old selenium rectifier and tubular capacitor heater power supply can NOT handle the extra tubes of these board. You will need to at least upgrade the rectifiers to modern silicon rectifiers for that. The 3A rated 1N540x series (like 1N5408) are commonly available and lend themselves to that duty well (the 1A, 1N400x series (like 1N4007) can't handle the cold-heater surge of a 3+3 arrangement and would soon fail, perhaps damaging the PA-211 power transformer).

We will discuss more on heater arrangements later on in this manual, as well as some options for powering an odd-number of tube heaters.



## Parts List

(quantities for resistors and capacitors are for **one channel** only)  
(other than C10 and R16, you will need to double the resistors/capacitors below)

### **Resistors:**

**R1, R9, R14:** 47K, ½W (R14 = 1Meg in classic Marantz design)

**R2, R3:** 270K, ½W

**R4, R6:** 4.7K, ½W

**R5:** 330K, ½W

**R7:** 510 ohms, ½W

**R8:** 680K, ½W

**R10:** 1Meg, ½W

**R11:** 680 ohms, ½W

**R12:** 470 ohms, ½W (jumper for classic Marantz design)

**R13:** 27K, ½W

**R15:** 1K, ½W

**R16:** 68K, 1W (if powered from a 330V PAS supply. Adjust for ~240V on the cold side of this resistor)

### **Capacitors:**

**C1:** 100pF, 300V silver mica

**C2:** 220uF, 6.3V electrolytic

**C3:** 10n, 400V polypropylene film

**C4:** 100n, 400V polypropylene film

**C5:** 22pF, 500V silver mica

**C6:** 100uF, 6.3V electrolytic

**C7:** 1.6n, 100V polystyrene film (or 300V silver mica)

**C8:** 6.8n, 100V polystyrene film (or 300V silver mica)

**C9:** 470n, 400V polypropylene film

**C10:** 47uF, 450V electrolytic (350V OK if supply is regulated)

(capacitors with higher voltage ratings here are OK)

## Misc:

**V1, V2, V3:** 12AX7A, 7025 or ECC83

**CN4, CN5, CN7:** Terminal blocks, 5.08mm, 2 position PCB.

**CN1, CN2, CN3, CN6:** Terminal blocks, 5.08mm, 3 position PCB.

### Noval Sockets

**Heater Balancing Resistor:** 68 ohm, 3W resistor if your PAS has an odd-number of signal tubes (like 2 on the phono board, 3 on this one = 5).

Installation/use described in "Heater Wiring".

## Assembly

Assembly is straight forward, though there is a couple items of note to make your life easier:

- 1) If you are powering the unit from the standard PAS doubler, you can use a 2 position terminal block for CN1, 2 and 3 by placing them on positions "4" and "5", ignoring "9" completely.
- 2) Since this is a low-level phono stage, you may wish to consider 1% tight tolerance resistors for the equalization section, R8, R9 and R15. Metal film or metal oxide in the R1 positions can also reduce noise compared to a carbon or carbon composition.
- 3) Audio capacitors, like Nichicon MUSE (KZ) or Elna Silmic-II for C2 and C6 can go a long way towards stability and lower noise, too.

R14 is 1Meg in the classic Marantz design. We have found this a potential **SAFETY ISSUE** when using this board in stand-alone mode and driving an amplifier.

The time constant is long enough with 470n and 1Meg to "slam" a very high voltage ramp on power-up into the following amplifier. Even if your amp can survive it, we have blown some speakers with this R/C constant.

470n + 47K gives an  $F_3$  of ~7Hz and will definitely save downstream components.

## Heater Wiring

The Dynaco PAS uses a voltage doubler circuit to turn the 12V heater winding of the PA-211 into 24V. Dynaco then runs the heaters of the 12AX7's on each board in series and powers them with higher voltage and lower current.

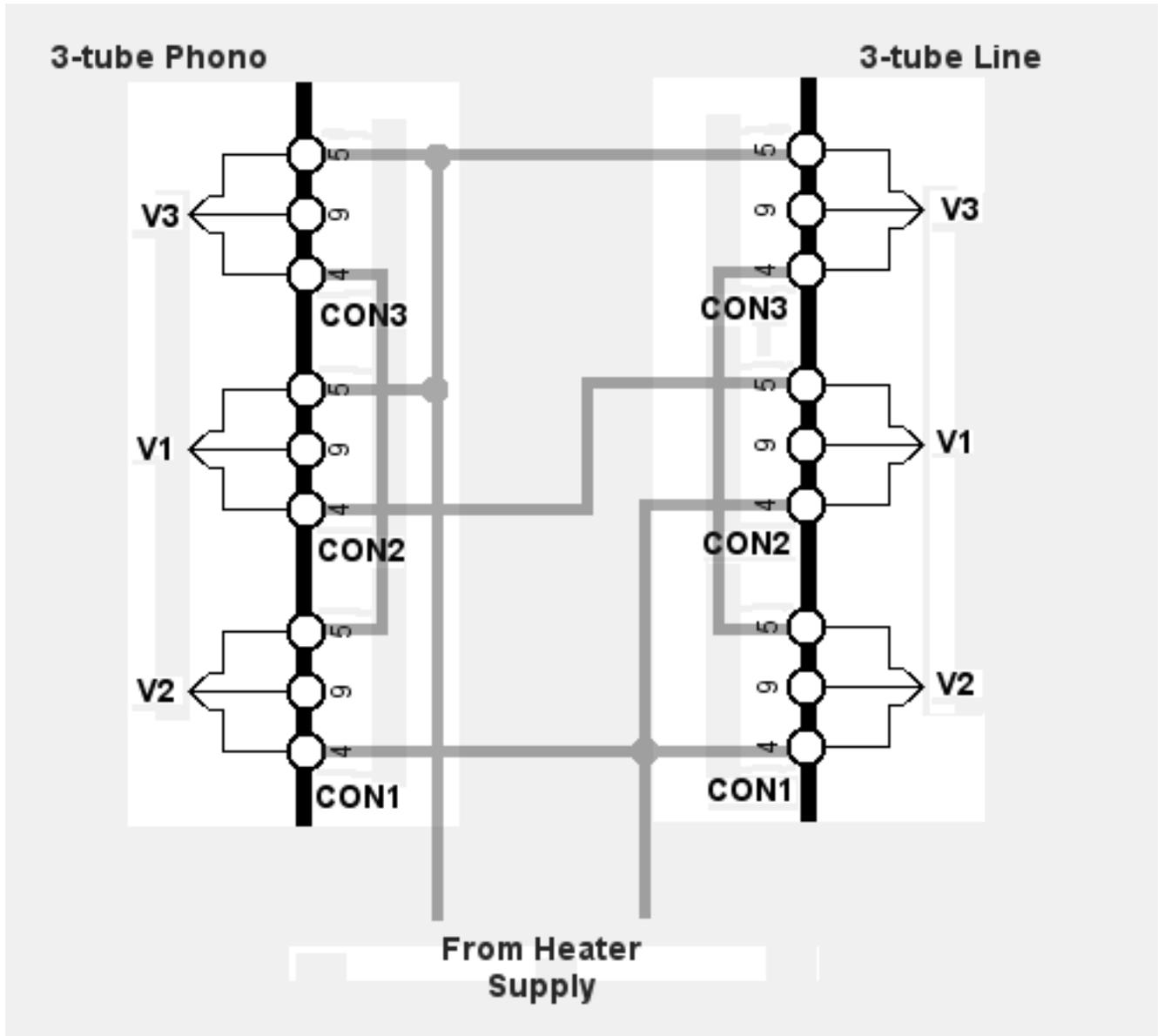
The reason for this is simple – the PAS has limited space and the PA-211 power transformer had to fit in. To have made the 12V winding for the current required by all the tube heaters, would have required a core larger than would have fit in the PAS.

Since the 12AX7 draws 150mA from 12V, putting two in series will also draw only 150mA, but require 24V. It is far easier to wind a small power transformer for higher voltage than it is for higher current.

This works well for an even number of tubes, but what about an odd number? We need to “simulate” another tube heater with a resistor. That's where the 68 ohm, 3W heater balancing resistor comes in handy.

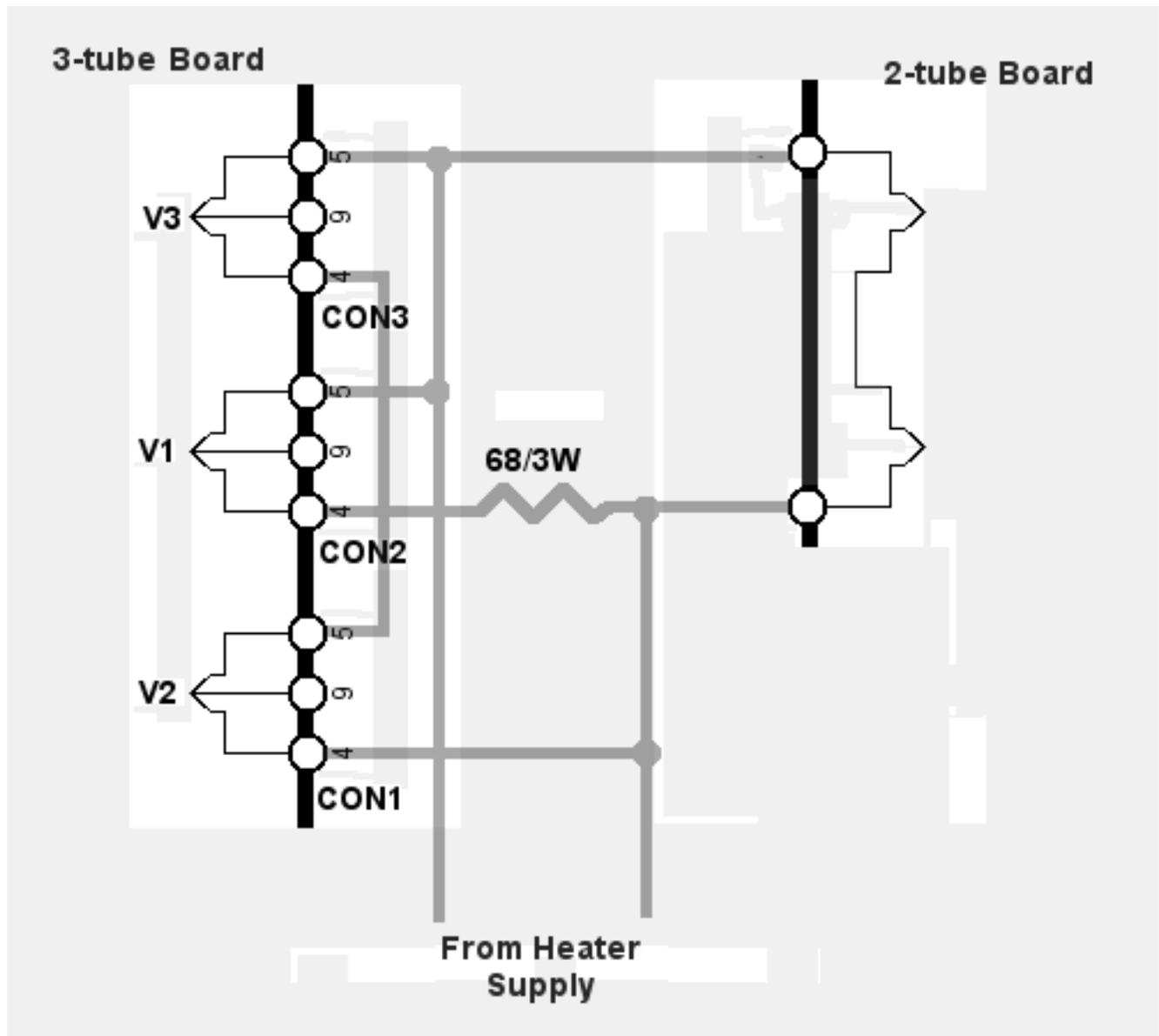
If you are using the this or other 3<sup>rd</sup> party phono board, the even number of signal tubes is maintained. But if you are using a two-tube phono board, you will need the balancing resistor.

## Heater Wiring for Two 3-Tube Boards



Connector designations are for two of our boards, but may vary for your type.

## Heater Wiring for Mixed 2 and 3-Tube Boards



Use of the heater balancing resistor when mixing 2 and 3 tube boards in your upgraded PAS.

Why all this fuss over heaters? Why the need for an auxiliary transformer if you want to keep your stock pilot lamp and 12X4? Let's do some math...

PA-211 12V winding rating: 800mA

Stock Dynaco:

12AX7 x 4 = 300mA (two groups of two in series)

12X4 x 1 = 300mA

#57 bulb = 240mA

**TOTAL = 840mA**

This does not include the  $I^2R$  losses of the heater voltage doubler. As we can see, the heater winding is taxed as it is.

Let us take the 12X4 and pilot lamp and give them their own transformer. Now, we can add more signal tubes.

12AX7 x 6 = 450mA (three groups of two in series)

That's it!

So, why not add the 12X4 again and use a LED pilot? You can, but with even further reduced heater voltage to your 12AX7's. With 450mA being drawn from the doubler, it's typical each heater sees .7 to 1V less than its rated 12.6V. It's just the nature of doubling and losses.

Even if you mix a 3 and a 2 tube board, current draw will remain the same (the extra "tube" power is just burned in the heater balancing resistor)