SCREEN SUPPLY AND NEGATIVE BYPASS FOR THE 4CX250B H.F. AMPLIFIER.

FOR MY SCREEN & GRID POWER SUPPLIES, I DECIDED TO ADOPT SOME OF GEORGE T. DAUGHTERS, K6GT IDEAS AND INCORPORATE THEM INTO MY OWN AMPLIFIER. HIS AMPLIFIER & SUPPLY, THE SUNNYVALE/SAINT PETERSBURG KW PLUS IS FEATURED IN CHAPTER 18 OF THE 2005 ARRL HANDBOOK, AND PROVIDES AN EXCELLENT SOURCE OF REFERENCE FOR GOOD, PRACTICAL POWER SUPPLY CIRCUITRY.

ALTHOUGH I CHOSE TO USE A PAIR of 4CX250B's INSTEAD of A 4CX1600B, THE GRID BIAS ARRAINGEMENT STILL REQUIRES NEGATIVE CONTROL GRID AND POSITIVE SCREEN GRID SUPPLIES. FINDING AN APPROPRIATE TRANSFORMER AT A REASONABLE PRICE WAS THE CHALLENGE AND CHEAP PLUS DEPENDABLE EQUALS GOOD.

A FIXED, REGULATED SCREEN SUPPLY OF +300 VOLTS AT ABOUT 20 mA AND AN ADJUSTABLE CONTROL GRID SUPPLY (UP TO) -90 VOLTS AT ABOUT 5 mA WAS CHOSEN.

My JUNK BOX REVEILED A NEW TRIAD N-47OA ISOLATION XFMR WITH TWO- 220 VOLT PRIMARIES AND ONE-115 VOLT SECONDARY RATED AT 150 VA. THIS TRANSFORMER COULD EASILY BE RECONFIGURED TO PROVIDE BOTH SCREEN & CONTROL GRID VOLTAGES BY USING ONLY ONE OF THE PRIMARY WINDINGS AT A REDUCED VOLTAGE (120 VOLTS INSTEAD of 220 VOLTS) FOR THE INPUT. THE OTHER PRIMARY WOULD BE CONNECTED TO A VOLTAGE DOUBLER CIRCUIT FOR THE SCREEN SUPPLY. NO LOAD VOLTAGE BEFORE REGULATION WAS MEASURED AT +330 VOLTS; RESISTOR R_x

IS CURRENT LIMITING FOR THE FILTER CAPACITORS. THE 115VAC WINDING IS CONNECTED TO A HALF-WAVE RECTIFIER FOR THE NEGATIVE GRID SUPPLY:

fig 1a

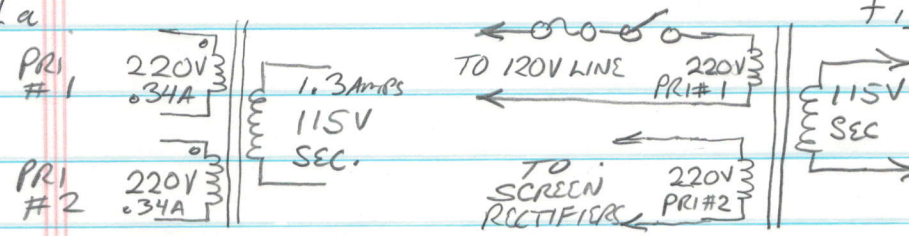


fig 1b

fig 1a SHOWS THE ISOLATION XFMR AND ITS WINDING. PRIMARY # 1 CAN BE CONNECTED TO PRI # 2 WINDING IN EITHER PARALLEL CONFIGURATION FOR 220 VOLT INPUT OR SERIES CONNECTED FOR 440 VOLT INPUT. OUT PUT WOULD REMAIN 115VAC @ 150 VA.

IN KEEPING IN MIND THAT POWER XFMRS ARE RATED IN VA (VOLTS X AMPS), IF ONE WERE NOT TO EXCEED EITHER VOLTS OR AMPS, ONE COULD RE-CONFIGURE THE SAME TRANSFORMER AS IN fig 1b. NOTE THAT THERE ARE TWO PRIMARY WINDINGS RATED AT 220 VOLTS EACH. THE TRANSFORMER IS RATED FOR A TOTAL of 150 VA.

THEREFORE: PRI VOLTS X PRI AMPS = SEC VOLT X SEC AMPS OR VA

EX: 220 VOLTS X 0.68 AMPS = 150 VA

FOR TWO PARALLEL WINDINGS: PRI VOLTS $\times \frac{\text{LINE AMPS}}{2} = \text{VA}$

EX: 220 VOLTS $\times \frac{0.68}{2} =$ 150VA

EACH PRI. WINDING IS THEREFORE RATED FOR A MAXIMUM of 0.34 AMPS @ 220 VOLTS or 75 VA.

If WE WERE TO REDUCE THE INPUT VOLTAGE from 220V TO 120 VOLTS; AND WERE TO USE ONLY ONE of THE PRIMARY WINDINGS, THE TRANSFORMERS' MAXIMUM

VA RATING WOULD BE AS FOLLOWS:

VOLTS INPUT (NOMINAL) x I_{MAX} = NEW MAX VA RATING

EX: 120V X 0.34AMPS = 40.9VA

IF WE ARE CAREFUL NOT TO EXCEED THE ABOVE NEW VA RATING FOR THE TOTAL of ALL WINDINGS, WE COULD USE THIS XFMR WITHOUT A PROBLEM.

AGAIN, HERE'S WHATS NEEDED:

+300VDC AT 20mA = V x A = 300V x .02A = 6VA

AND -90VDC AT 5mA = V x A = 90V x .005A = 0.45VA

THIS WOULD EQUATE TO A TOTAL of LESS THAN 10VA. PROVIDED WE DON'T EXCEED ANY SINGLE WINDINGS VA or TOTAL RECONFIGURED PRIMARY VA, THIS XFMR WOULD FIT THE BILL WITH VA TO SPARE! BUT WE NEED TO DO THE MATH.

LET'S LOOK AT THE WINDINGS AGAIN:

PRI #1 RATED @ 220V/0.34A = 75VA

WILL BE OPERATED AT 120V/0.34A = 40.9VA (MAX)

PRI #2 RATED @ 220V/0.34A = 75VA

WILL PROVIDE THROUGH VOLTAGE DOUBLER: 300V/0.02A = 6VA

EX $E_{DC} I_{DC} = E_{AC} I_{AC}$ or $300V \times 0.02A = 120V \times ?$

DIVIDE EACH SIDE BY 120V → $\frac{300V \times .02A}{120V} = ? = 0.050A$

NOTE THAT THE PRI #2 WINDING CURRENT EXCEEDS IT'S RATING BY ABOUT 16mA. REMEMBER ALLOWABLE MAX SCREEN DISSIPATION FOR 4CX250B IS 12W PER TUBE = 12W @ 400VDC → THIS IS PEAK CURRENT. TO DETERMINE THE AVG. $\frac{1}{2}$

$P = E \times I = 12W = 400 \times I \quad \frac{12}{400} = I = 30mA$ MAX → DIVIDE BY 1.4 or $\frac{.05A}{1.4}$

I EXPECT THE AVG SCREEN GRID CURRENT TO BE:

$\frac{I_{MAX}}{1.4} = \frac{0.03A}{1.4} = 21mA \times 300$ VOLTS or 6.3 WATTS X 2 TUBES = 42mA

THE AVERAGE SCREEN CURRENT AT FULL OUTPUT WOULD BE:

1) $\frac{\text{DC VOLTAGE \& CURRENT}}{\text{AC WINDING VOLTS RMS}} = \text{AC WINDING CURRENT PEAK}$

2) $\frac{\text{AC WINDING CURRENT}}{1.4} = \text{AVG CURRENT}$

EX: 1) $\frac{300V \times 0.02A}{120V} = \frac{6}{120} = 0.05A$ PEAK

2) $\frac{.05A}{1.4} = 36mA$ (SECONDARY WINDING CURRENT)

36mA WOULD BE THE AVG CURRENT DRAW AT FULL OUTPUT WITH 50mA PEAKS. THE TRANSFORMER WINDING IS RATED AT 34mA AND WOULD PROBABLY NOT HAVE ANY PROBLEM WITH THIS CIRCUIT CONFIGURATION

AN ALTERNATIVE WOULD BE TO USE A DUAL PRIMARY/DUAL SECONDARY TRANSFORMER (THESE ACTUALLY ARE MORE COMMON) CONNECT THE SECONDARIES IN SERIES AND USE A FULL-WAVE BRIDGE INSTEAD OF A VOLTAGE DOUBLER. THIS WOULD GIVE YOU TWICE THE AVAILABLE POWER. AS IN THE FIRST EXAMPLE.

EX. 1) $\frac{300V \times .02A}{240V\,sec} = \frac{6VA}{240V} = 0.025A$ PK

2) $\frac{.025A}{1.4} = 18mA$ (SECONDARY WINDING CURRENT)

WITH 16mA LEFT TO SPARE!

Your Junk Box could be your best friend, don't be afraid to experiment & do the math!

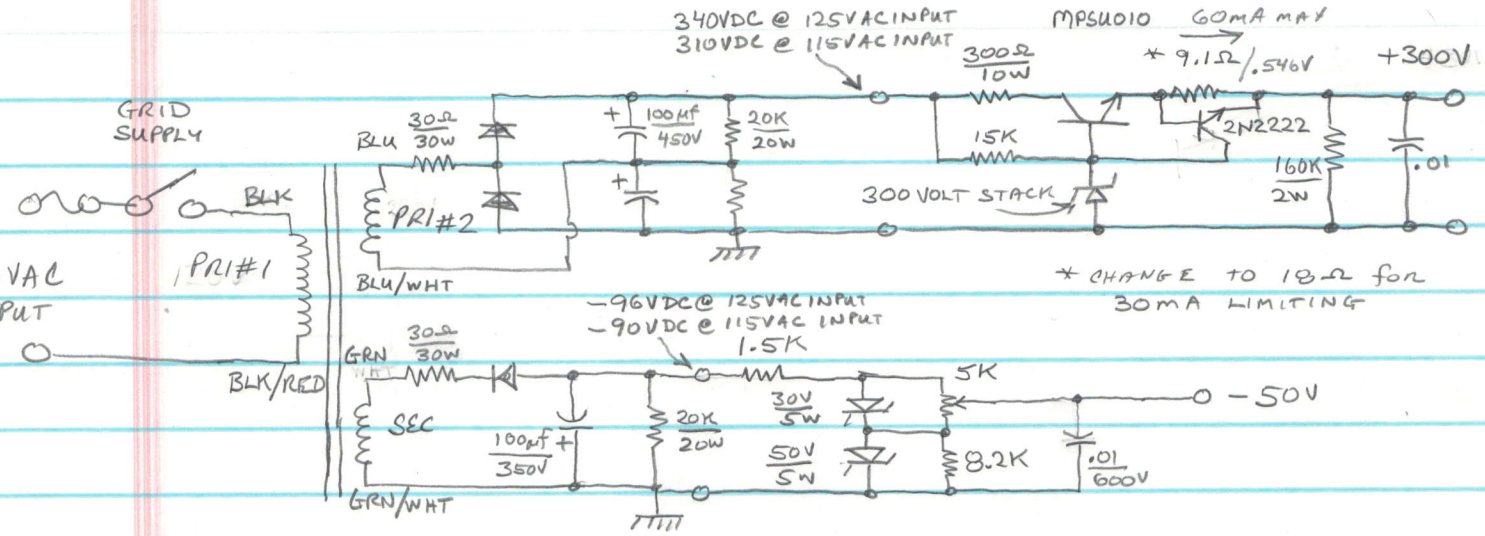
LET'S FINISH-UP WITH THE CONTROL GRID: (SECONDARY #1)

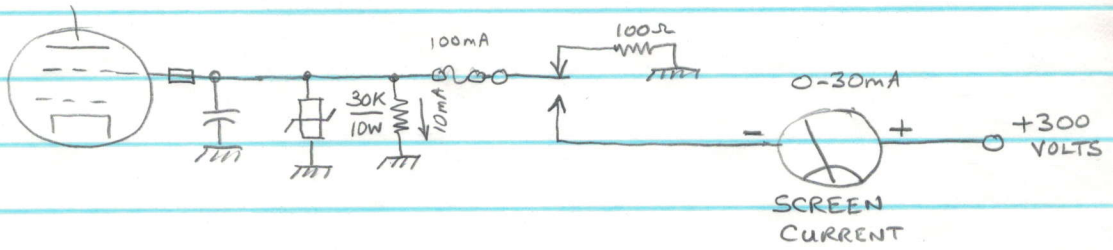
RATIO = $220V \times .68A = 115V \times 1.3A$ = EXI = EXI

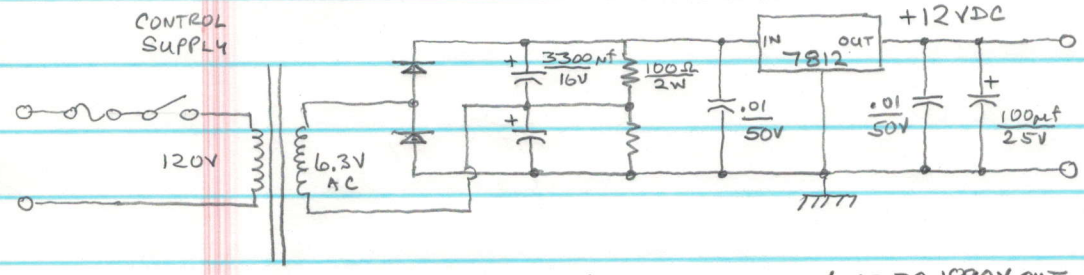
$120V \times 0.68 = ? \times 1.3A$

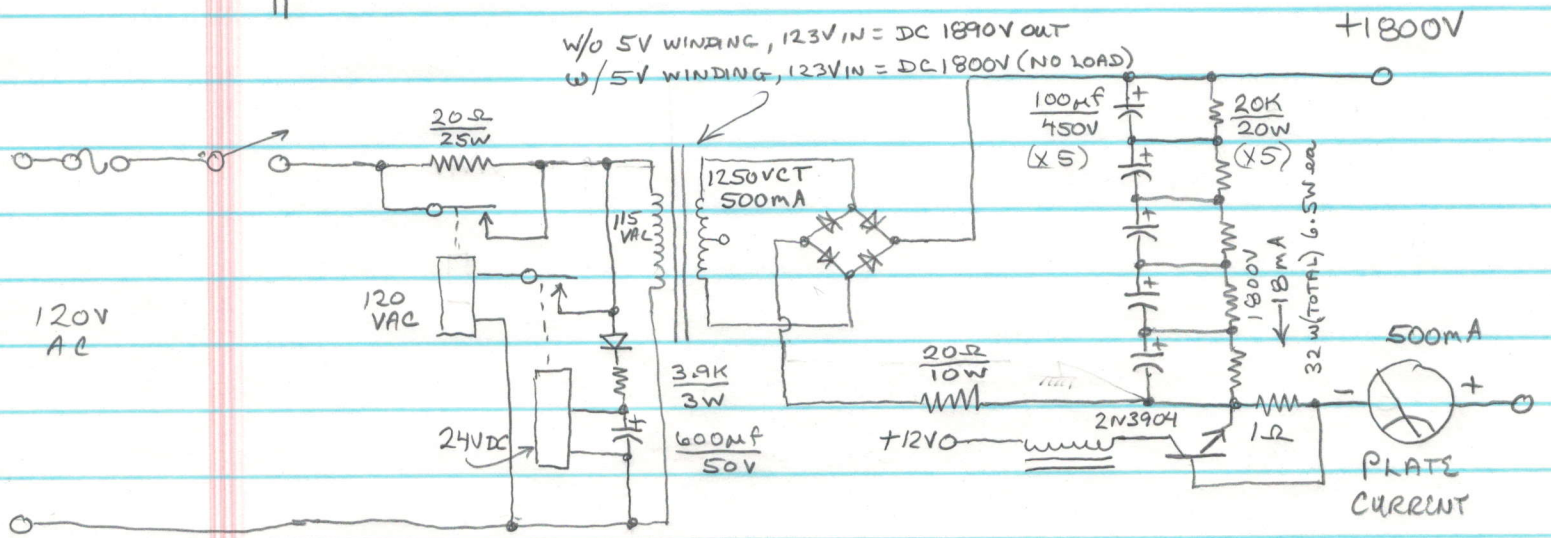
$\frac{81.6VA}{1.3A} =$ 62.8 VAC RMS SEC WINDING VOLTAGE, W/120V AC INPUT

62.8×1.6 (RECTIFIER) $= \approx 100$ VDC


340VDC @ 125VAC INPUT
310VDC @ 115VAC INPUT
MPSU010
60mA MAX
300Ω 10W
* 9.1Ω/.546V
+300V
GRID SUPPLY
BLK
30Ω 30W
BLU
100μf 450V
20K 20W
15K
2N2222
160K 2W
.01
PRI #2
300 VOLT STACK
120VAC INPUT
PRI #1
BLU/WHT
* CHANGE TO 18Ω for 30mA LIMITING
-96VDC @ 125VAC INPUT
-90VDC @ 115VAC INPUT
1.5K
GRN
30Ω 30W
5K
-50V
BLK/RED
SEC
100μf 350V
20K 20W
30V 5W
50V 5W
8.2K
.01 600V
GRN/WHT


100mA
100Ω
30K 10W
10mA
0-30mA
+300 VOLTS
SCREEN CURRENT


CONTROL SUPPLY
120V
6.3V AC
3300μf 16V
100Ω 2W
IN
OUT
7812
+12VDC
.01 50V
.01 50V
100μf 25V

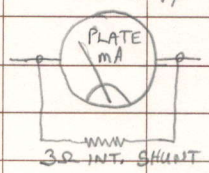

W/O 5V WINDING, 123V IN = DC 1890V OUT
W/5V WINDING, 123V IN = DC 1800V (NO LOAD)
+1800V
20Ω 25W
1250VCT 500mA
115 VAC
120 VAC
120V AC
100μf 450V (X5)
20K 20W (X5)
1800V
18mA
32W (TOTAL) 6.5W ea
500mA
3.9K 3W
20Ω 10W
24VDC
600μf 50V
+12VDC
2N3904
1Ω
PLATE CURRENT

212-00L

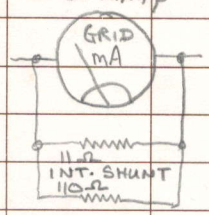
W00 APPARATUS 4CX250A AMPLIFIER

PRELIMINARY EXPERIMENTS

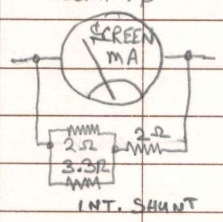
500mA f.s.



10mA f.s.



30mA f.s.



2.0KV f.s.