1. Summary

AWA 1G7053 35W PA valve amplifier. S.N. 203.

Radio/P.U. Volume and Line/MIC Volume front panel pots. Stepped switch BASS-TREBLE Attenuate control.

MIC input with balanced 200Ω configuration to MIC transformer primary, with secondary to 6J7G pentode preamp on rubber grommet-isolated mount with stage output to MIC volume pot. Preamp stage with plate feedback, and alternate HI level input and Line level input. Radio/PU input through front panel select switch in to 6J7G triode PU preamp to PU volume pot. Barne's phase inverter with fixed biased inputs and common cathode resistor, and screens bootstrapped to PP plates. 807 in fixed bias PP stage with screens connected to resistor set level from B+. Tone circuitry connected between 807 grids, and between PI screens.

Mains fused both poles. PT secondary rectified with paralleled 5V4G plates, and CT through resistor to generate RC filtered back-bias.

Power Transformer	AWA Type ITK14136. 0-110V, 0-5-130V; 400-0-400V @ ?mA ; 6V3 ~3A; 5V ~4A.
Output Transformer	Missing
Driver choke	AWA Type 2TU6981
MIC Transformer	1TW14012. 50Ω, 50Ω, 70kΩ windings. 8-pin octal. Can and earth screen connections.
Resistors	Old dot-style tube; some Erie, old spray coloured cc; IRC 50W and 20W WW
Caps	Ducon electro can & tube 128 ; UCC electro can Ducon wax 0334, 0234, 0234 UCC 43 AWA black wax and some with outside label;
Valves	807 x2: Radiotron brown base L1 6J7G x4: Philips Miniwatt M56 M44 M50 , 6?? Radiotron 5V4G x2: Mullard A A 15xx Jx (possibly 1573 J3), Radiotron K11 D↑D

Fair condition – part of bundle from Josh. Top cover given to Josh. No base plate.

Issues: OT removed, and likely had 2 previous OTs due to extra mounting holes. Mostly old dot-style tube resistors. Top-cap grid wiring and power wiring brittle. Marked up terminal board. 807 top cap fixed rod assembly with insulated feed-through and RFC chokes. 807 TC loose. 5V4G mullard base loose. 807 top cover missing one tab. 50W resistor damaged. Filter cap wrongly wired to short out back-bias. PT primary wire with cracked insulation. No base or top cover.

Earliest serial number batch used 6L6G. The chassis required changes to fit the 807's, including recessed valve sockets, two insulated rods to bring the high voltage plate connections to the 807 top-caps, and a diy looking perforated cage to fit over the top of the 807's.
RCA had a number of licensing arrangements with Amalgamated Wireless Australasia (AWA), so many RCA products had Australian made equivalents. This included valves, which were branded AWV - Amalgamated Wireless Valve. AWV also had the rights to the "Radiotron" brand in Australia.

Modify to use ss rectifiers and fixed bias with AWA PA1002 output transformer and 807 PP pentode mode with 515V B+ supply and separate choke input filter 350V screen supply.

2. Measurements

PT primary: 0, 110V (3R2) ; 0, 5V, 130V (3R7)
PT secondary: 400-0-400V (55+58R)
Windings megger > 100-200M
Primary magnetising current ~89mA at 237Vac

Input transformer 1TW14012. See-other AWA

Output stage grid choke 2TU6981 - 800 + 830 DCR
Impedance plots indicate each half winding has ~410-460H (at 100Hz), and ~600Hz first resonance with ~240pF shunt, followed by resonances at ~16kHz and 30kHz.

807 anode RFCs - Impedance plot shows ~ 5.2 to 5.5uH at 100Hz to 60kHz with 0.5Ω DCR.

150Ω 20W IRC has ~65uH series inductance.

2.1 Modified amp

807 pair selected for nominal balance of 42-43mA idle cathode current with -32.5V fixed bias.

16Ω load clean 1kHz sinewave to 25Vrms (40W), with VS1=493V, VS2=330V and 38+38mA cathode currents for 240Vac mains. Gross square waveform overload to 34Vrms (72W) with mains current 0.71A.

40W clean with 40mVrms input and Pres=CW; 67mVrms and Pres=CCW; mains current 0.56A

Metal shields on glass 6J7's suppress some higher 50Hz harmonics.

50Hz dominant hum of 28mVrms (60dB below clip level). Output stage cathode currents are pretty balanced. OPT is pretty close to PT but turned 90deg to minimise coupling – a steel shield may be appropriate.

- related to output stage grid choke resonance at 42Hz.
- Lowered to 12mVrms when resonance pushed to <10Hz with 470nF + 22nF//120k

Frequency response shows LF extended more than expected – an expected -3dB roll-off by 100Hz and slowly falling to 50-60Hz - but a 2dB peak at 33Hz before final 30dB/octave fall – likely due to output stage grid choke (640H-22nF has 42Hz resonance). HF roll-off as expected with -3dB at circa 12kHz and smooth roll-off out to circa 70kHz.

- Choke model is circa 600H//500kΩ at 40Hz
- Lower Q of resonance by shunting choke halves with circa 1MΩ
  - Dampens 40Hz peaking to flat
- Increase 22nF to 122nF
  - Lowers resonance to ~15Hz and allows RC roll off to get to -15dB
- Shunt 22nF with 120k, and add series 470nF
  - to lower 35Hz resonance down to under 5Hz. Best approach.
- Add 4-6dB of global feedback and see if ok as an option to suppress hum.

Presonance circuit operation showed up a +6dB 30kHz peak in the full CCW pot position – no issue in the audio band.

- Instability assessment with no load showed up a +25dB 15kHz peak in the full CCW position, and a broader +25dB 3.3kHz peak in the full CW position. Effectively the same response with a 220nF only load.
- Effectively no dampening or change in frequency response and peaks when a 100k 82pF RC was across the choke halves.
- A ~6dB peak at 10Hz was present.

No dominant pole within GNF loop, so:

- Adding 33pF shunt across PI outputs drops -3dB at 10kHz, and -6dB at 20kHz.
- 16kHz resonance from grid choke half-winding shunt capacitance (~200pF) resonating with its leakage inductance (a few hundred mH), where impedance drops back to nearly 15kohm.
  - A shunt RC across each half winding with approx. 10kHz corner frequency (160pF) and 100kΩ may dampen the 16kHz resonance and the following 30kHz resonance.

3. General comments.

Output stage grid choke provides dc grid leak with low 800Ω series resistance, and provides a reasonably high impedance (300kΩ at 100Hz) to not significantly load the driver stage in the audio range (807 max grid leak of 100kΩ for fixed bias). The driver stage coupling cap and grid choke introduce a low frequency resonance at circa 15Hz (for 400H and 250nF), and the impedance of the choke starts to fall above 1kHz and likely introduces a roll off beyond about 5kHz, with noticeable higher frequency resonances as indicated by the choke impedance plot. This would be a difficult frequency response if the amp included feedback.

6V heater loading: 0.9 x2 + 0.3 x 4 = 3.0A

PSUD2 indicates B+ of 435V at 56+56+30 = 140mA load, minus about 30Vav across the 150Ω back-bias resistor (GZ34 used to emulate 5V4G parallel plates, and measured winding resistances increased by 47//47 to 93Ω). The screen voltage is not well defined, although the tap position on the 50W resistor indicates a voltage of circa 300-350V, and the 15k adds about 30mA load. The 807 datasheet indicates a 400V PP setup with 300V screen would use 56+56mA idle with a 30V fixed bias for a 36W audio output into 6k8 primary impedance.

4. Modification options

Layout of parts:

- Swap front panel radio/PU switch for guitar input isolated socket.
- Swap Bass-treble switch for Presonance pot.

Frequency response:

- Input stage -3dB at 100Hz and 22kHz with pot at min. HF corner reduces to 14kHz with pot at max.
- Input and 2nd stage -3dB at 120Hz and 18kHz with input pot at 1/3rd.
- Input, 2nd and PI stage -3dB at 150Hz. Gain x6.3 for V4 and x6.5 for V3 after anode resistor adjusted.
- PI and output stages with +6dB feedback: feedback extends LF response more than required but feedback reduces below about 120Hz. No concern seen.
    - Presonance control variation with no load can cause peaking in the audio range, but phase shift is not excessive, so no concern.

Monitoring octal:

- VS1/100 reads bout 2V high on meter assembly [4k7//10k]
- VS2/100 reads within 1V on meter assembly [4k7//8k2]
- Meter assembly loads the octal voltage by about 1.5V at 350V.

Output transformer:

- AWA 52483 -1 (spare from PA1002BY) 50W, 6k PP, 12R
    - 16R speaker increases 6k to 8k PP
    - Test both orientations for coupling level from energised PT
    - Height and footprint and mounting ok
- Likely to get >40W if using ss rectifier, and using alternative to back-bias
- OT orientation for least coupling to PT measured – OT terminals pointing to PT – OT with longest edge as height.
- Use existing chassis holes. Add mounting and cable holes in U bracket to align. Remove unused captive nuts from U bracket.

5650Ω PP split primary (anode and cathode loading windings) for 12.0Ω secondary. Primary DC resistance: 80+80Ω
8 output winding sections in 4 groups of 2. All groups in parallel (each group is series connection) = 12 ohm loading. Terminals 1-2-3 are 5+5 turns. Terminals 4-5-6 are 2+8 turns. Terminals 7-8-9 are 8+2 turns. Terminals 10-11-12 are 5+5 turns.
Turns ratios: 56-56-56-56 / 5-5,2-8,2-8,5-5
Feedback winding is nominal 1360Ω winding.

Output stage:

- Ss rectifier with cap input can give 500V B+ (560V initial – 1W 300k).
- Separate ss or tube rectifier with choke input can give nominal 360V screen supply.
- Any fuse would need to take out both B+ and screen supplies together. No issue if screen supply start-up is delayed.

PI stage:

- Use long-tailed pair (2x 6J7G)
- Need to keep coupling cap to output stage reasonably high due to grid leak choke
- Need up to 70Vpp drive
- Don’t exceed 250V idle from anode to cathode
- Don’t exceed 90V from cathode to ground unless heater is elevated.
- Keep grid leak below 1Meg.
- Assume VS3~350V, and tail voltage is 42V and bias is 2.2mA per triode, and use 56k anode loads. Idle bias of pair is about 4.2mA at 1k8 (7.5V), and anode voltage swing should be capable of swinging at least 100Vpk.

Bias supply:

- Use 5V secondary with redundant step-up modules (with LED indicators) or relay protection
  - XL6009 limited to 40V by diode – may be a bit low for >300V screen and moderate bias current.
  - Relay protection using current through optomos led to drive a 12Vdc relay on rectified 5Vac.

Power supply fusing:

1.25A primary side fuse used – measured idle current is 0.37A at 240Vac, so could bring down to 800mA T.

PSUD2 can’t simulate both rectified outputs at once, so they are separately assessed for CT rms current and then added.

- VS1 with 50mA per tube (25W plate diss) is 515V minus (80+10)*.05=5V.
- VS2 with 20mA is 400V.

IEC60127-2 0.25A T fuse chosen, as 807’s likely run cooler.

Simulate period in PSUD2	**20ms**	**150ms**	**600ms**	**continuous**
Simulated RMS current	1.90+0.27A	0.81+0.21A	0.42+0.10A	0.22+0.027A
Multiplier (based on 0.25A fuse rating)	8.7	4.1	2.1	1.0
IEC60127-2 Time-lag T min limit multiplier	10	4	2.75	1

B+ distribution:

- VS2 B+ load = 10+1.3+4.2+4.6 = 20.1mA (400V 20k)
- Output stage screens VS2 400V 5+5=10mA, 400/300k=1.3mA
- PI stage VS3 350V 4.2mA 45V/(4.2+4.6)mA = 4k7
- 2nd stage triode VS4 300V 1.4mA 50V/(1.4+3.2)mA = 10k
- Input stage VS5 250V 1.2mA 50V/(1.2+2)mA = 15k
- Elevation 250V /112k = 2mA 12/112 x 250 = 27V

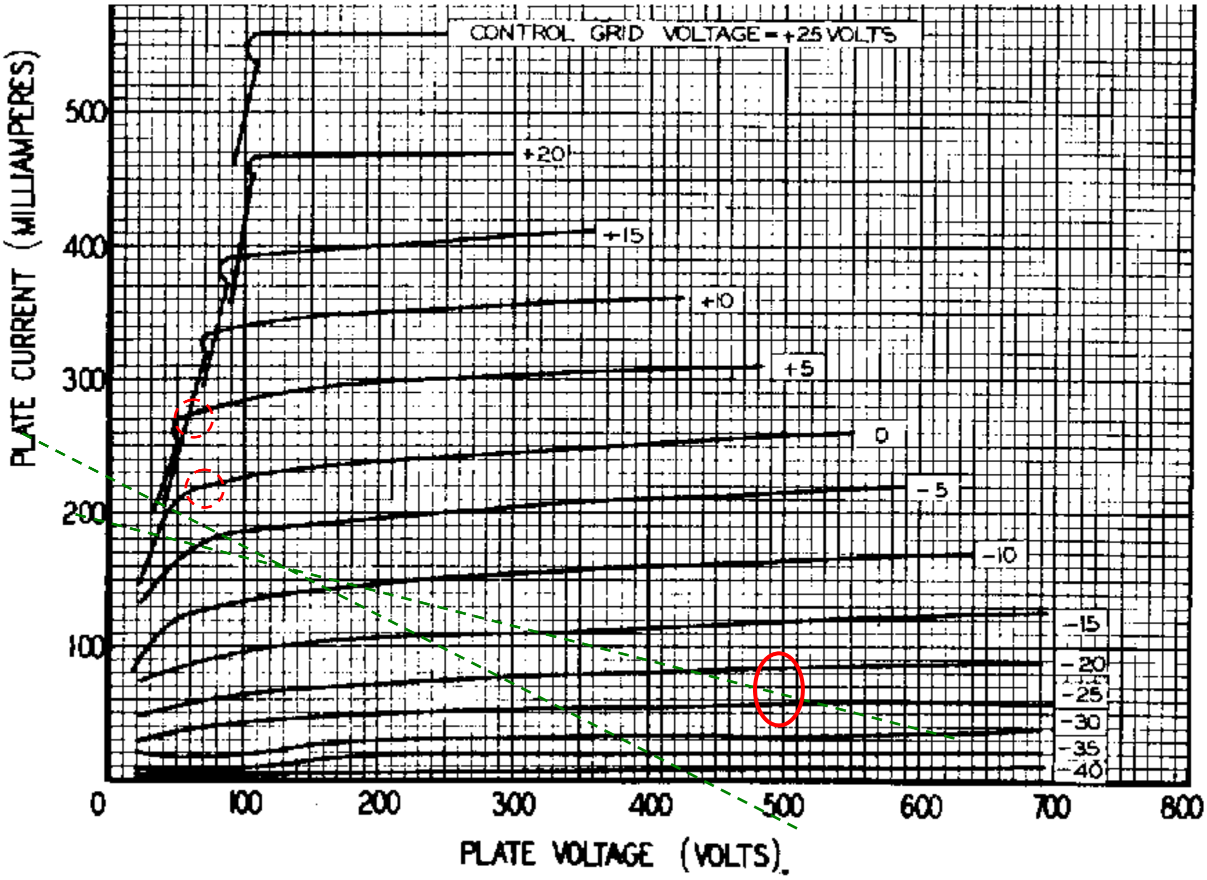
No load current = 1.3 + 400V/141k = 4.1mA (98kohm).

With VS2 loaded by 45k, the initial rise gets to ~ 450V at 10mA. 300k load = 1.5mA (0.7W).

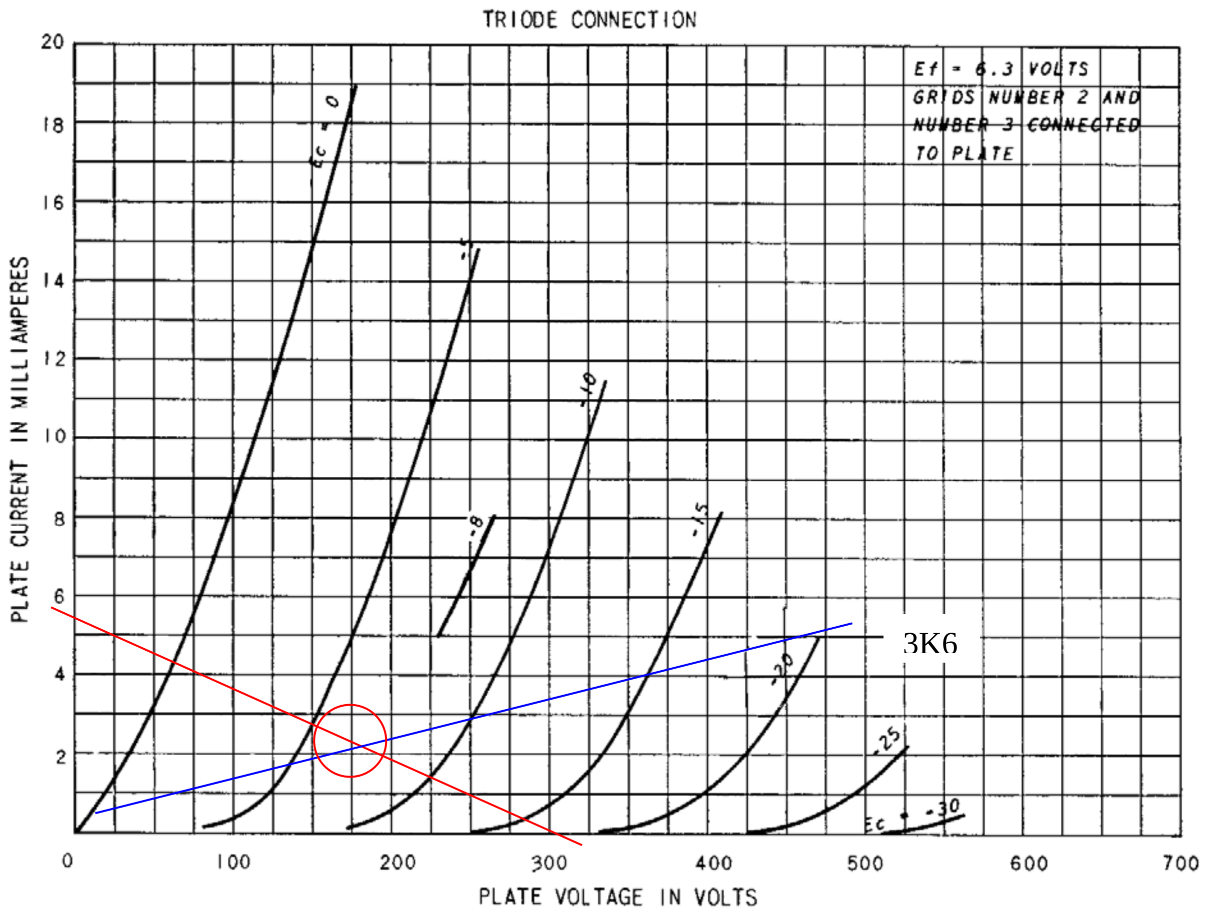
- 8.5mA through 4k7 = 40V drop with 410V Zener across VS3 – titch high but ok.
- 8.5mA through 10k = 85V with 325V Zener across VS4 – ok. 2x150V + 24V=324V zener
- Resistor loading of VS4 = 127k draws 2.5mA. 6mA through each series Zener gives 0.9W max through 150V Zener.

With VS2 loaded by 32k, the initial rise gets to ~ 430V at 14mA. 300k load = 1.4mA.

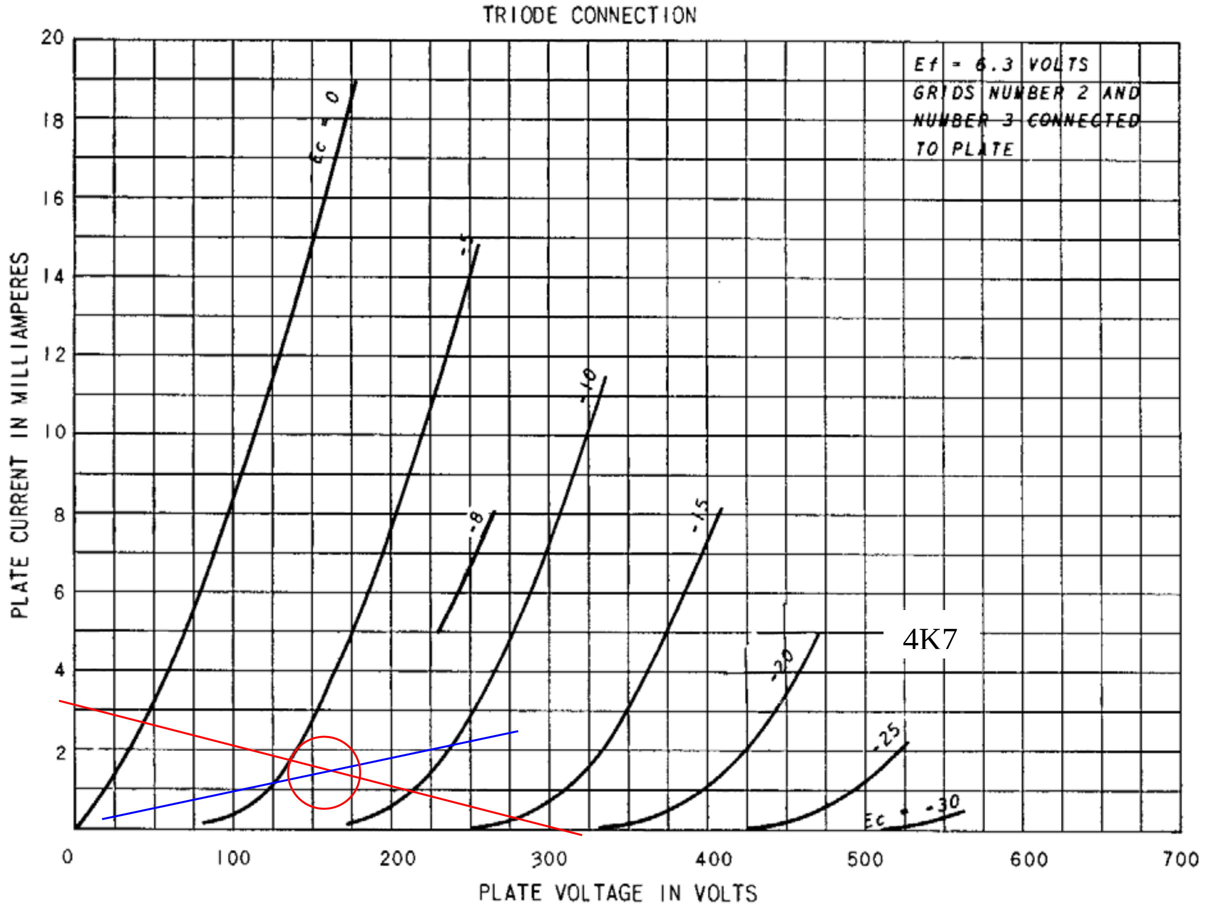
- 13mA through 4k7 = 61V drop (0.8W) with 370V Zener across VS3 - ok. 15x24V = 360V
- 13mA through 10k = 130V (1.7W) with 240V Zener across VS4 – too low.
- Resistor loading of VS3 = 137k draws 2.7mA. 10mA through each series Zener gives 1.5W max through 150V Zener.



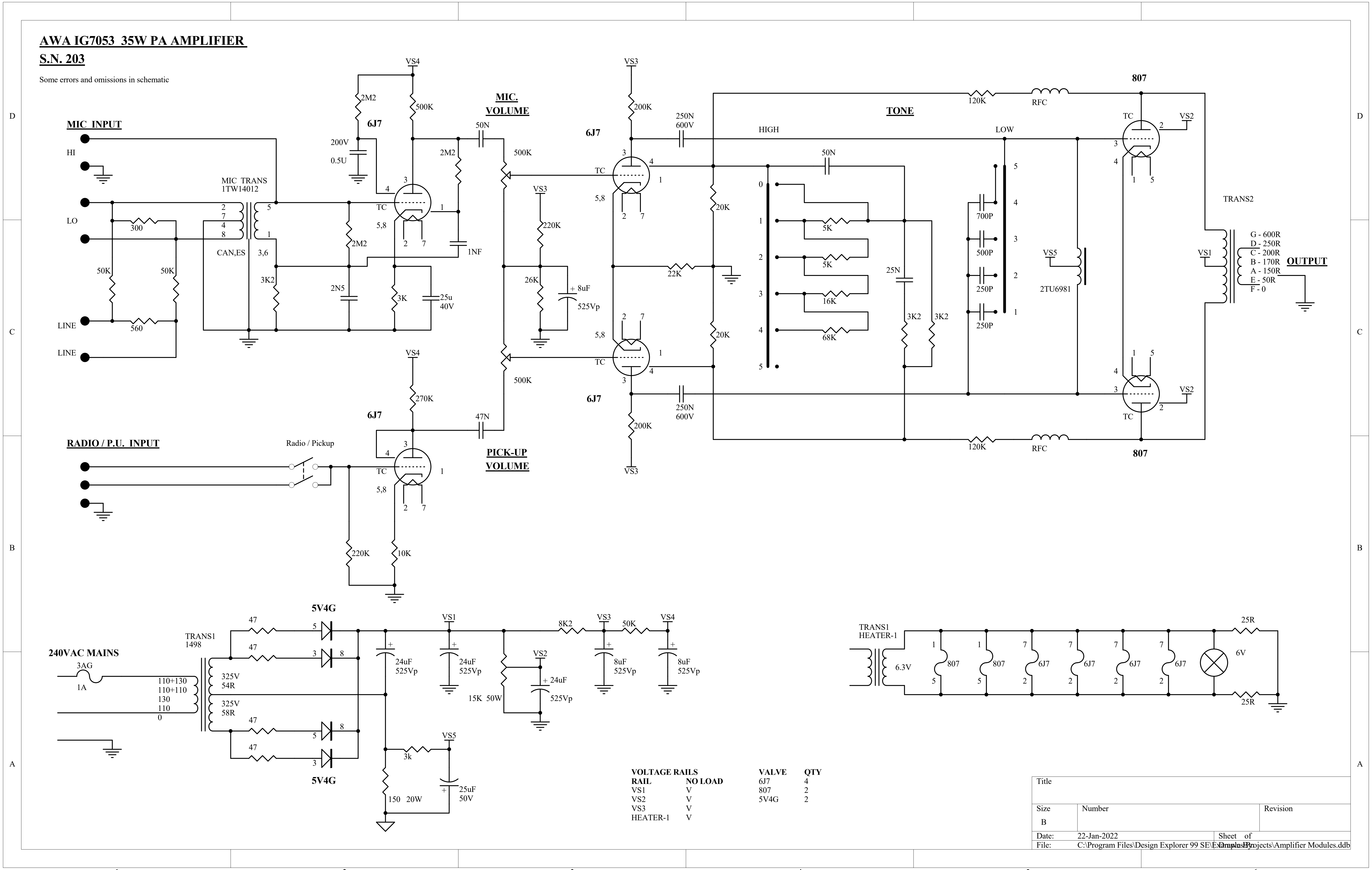
8kPP, so 4k loadline class A, and 2k loadline class B. Graph curves based on 300V screen, so a slightly higher screen voltage level should still allow ok loadline placement for 8k PP.


TRIODE CONNECTION
Ef = 6.3 VOLTS
GRIDS NUMBER 2 AND NUMBER 3 CONNECTED TO PLATE
PLATE CURRENT IN MILLIAMPERES
20
18
16
14
12
10
8
6
4
2
0
100
200
300
400
500
600
700
PLATE VOLTAGE IN VOLTS
Ec = 0
-5
-8
-10
-15
-20
-25
Ec = -30
3K6

PI stage 6J7



2nd stage 6J7


AWA IG7053 35W PA AMPLIFIER
S.N. 203
Some errors and omissions in schematic
MIC INPUT
HI
LO
LINE
LINE
300
50K
50K
560
MIC TRANS
1TW14012
CAN,ES
3,6
3K2
2M2
500K
6J7
200V
0.5U
2M2
2M2
2N5
3K
25u
40V
1NF
MIC.
VOLUME
50N
500K
6J7
VS3
VS4
200K
250N
600V
TC
5,8
220K
26K
8uF
525Vp
22K
20K
20K
500K
6J7
200K
250N
600V
270K
47N
6J7
PICK-UP
VOLUME
RADIO / P.U. INPUT
Radio / Pickup
220K
10K
TONE
HIGH
LOW
50N
5K
5K
16K
68K
25N
3K2
3K2
700P
500P
250P
250P
VS5
2TU6981
120K
RFC
807
VS2
TRANS2
VS1
G - 600R
D - 250R
C - 200R
B - 170R
A - 150R
E - 50R
F - 0
OUTPUT
120K
RFC
807
240VAC MAINS
3AG
1A
TRANS1
1498
110+130
110+110
130
110
0
325V
54R
325V
58R
47
47
47
47
5V4G
5V4G
24uF
525Vp
VS1
24uF
525Vp
15K 50W
VS2
24uF
525Vp
8K2
VS3
8uF
525Vp
50K
VS4
8uF
525Vp
3k
VS5
25uF
50V
150 20W
VOLTAGE RAILS
RAIL NO LOAD
VS1 V
VS2 V
VS3 V
HEATER-1 V
VALVE QTY
6J7 4
807 2
5V4G 2
TRANS1
HEATER-1
6.3V
807
807
6J7
6J7
6J7
6J7
6V
25R
25R
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Size
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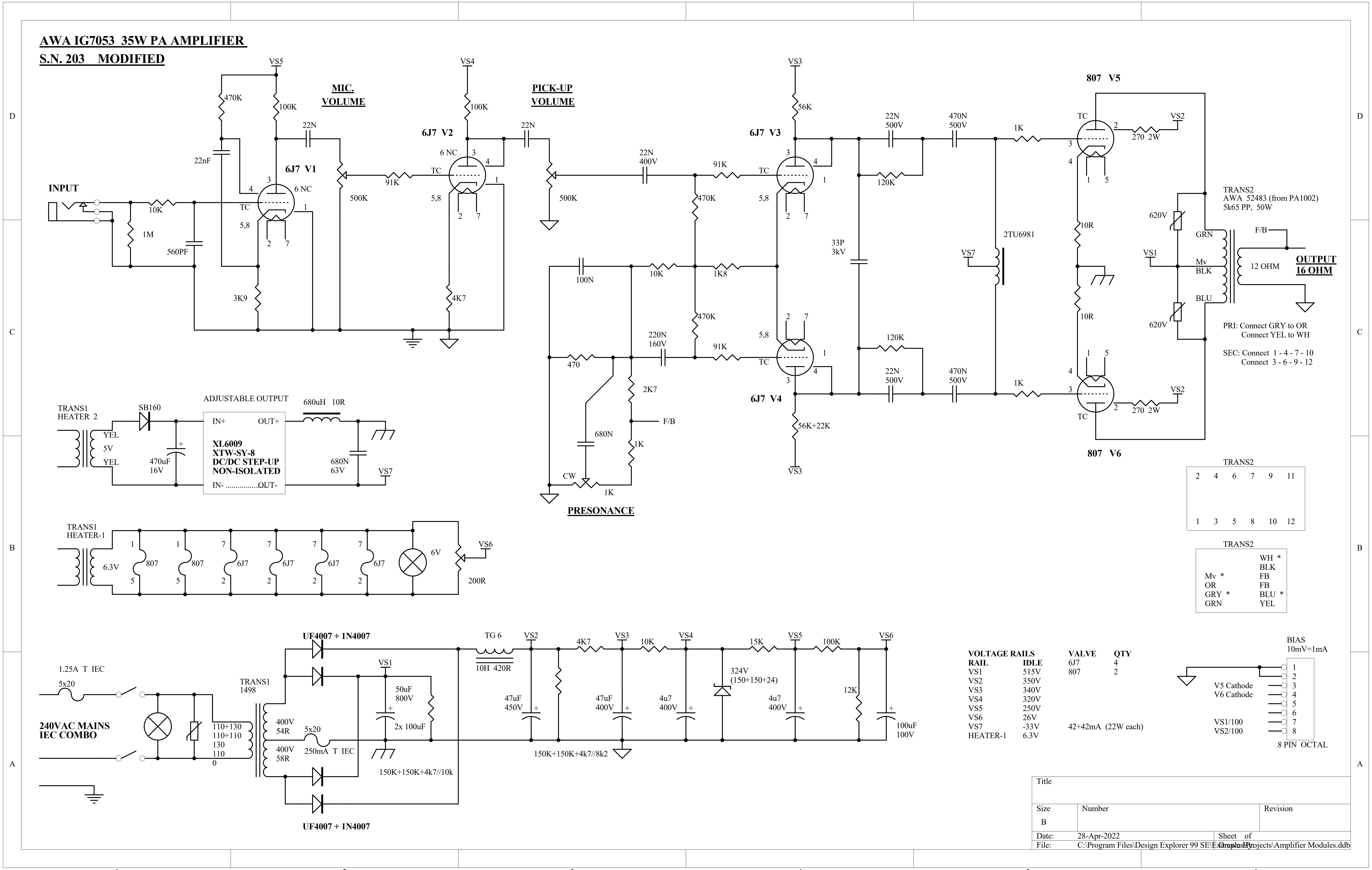
AWA IG7053 35W PA AMPLIFIER
S.N. 203 MODIFIED
INPUT
MIC. VOLUME
PICK-UP VOLUME
6J7 V1
6J7 V2
6J7 V3
6J7 V4
807 V5
807 V6
PRESONANCE
2TU6981
TRANS2
AWA 52483 (from PA1002)
5k65 PP, 50W
OUTPUT 16 OHM
12 OHM
PRI: Connect GRY to OR
Connect YEL to WH
SEC: Connect 1 - 4 - 7 - 10
Connect 3 - 6 - 9 - 12
TRANS1 HEATER 2
ADJUSTABLE OUTPUT
XL6009
XTW-SY-8
DC/DC STEP-UP
NON-ISOLATED
TRANS1 HEATER-1
UF4007 + 1N4007
1.25A T IEC
240VAC MAINS
IEC COMBO
TRANS1
1498
250mA T IEC
150K+150K+4k7//10k
150K+150K+4k7//8k2
324V
(150+150+24)
VOLTAGE RAILS
RAIL IDLE
VS1 515V
VS2 350V
VS3 340V
VS4 320V
VS5 250V
VS6 26V
VS7 -33V
HEATER-1 6.3V
VALVE QTY
6J7 4
807 2
42+42mA (22W each)
BIAS
10mV=1mA
V5 Cathode
V6 Cathode
VS1/100
VS2/100
8 PIN OCTAL
Title
Size
B
Number
Revision
Date: 28-Apr-2022
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