



Special Toroidal Output Transformer Designs

PAT-4141-00 Ratings

PAT 4141-00 Application: 6550 400 W
This design is similar to the 300 Watt Bass guitar output transformer design (above), but only pentode configuration is possible, and the secondary impedances are 4 Ohms and 8 Ohms. The primary impedance is 1250 Ohms. The power bandwidth starts at 14 Hz. The transformer can handle 400 Watts. This will enable eight 6550 or KT88 or equivalent tubes to be used with an anode voltage of 560 Volts. The frequency range extends up to 117 kHz without feedback. This full range transformer provides clear bass guitar sounds like attacks, slaps and other modern sounds.

Toroidal Output Transformer for Tube Amplifiers

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Type & Application	2 OHM	4 OHM	8 OHM	
Primary Impedance	Raa = 1.25	Raa = 1.253	Raa = 1.25	[kΩ]
Secondary Impedance	Rls = 2	Rls = 4	Rls = 8	[Ω]
Turns Ratio Np/Ns	Ratio = 25	Ratio = 17.699	Ratio = 12.5	[]
Ultra Linear Tapping at	tap = 0	tap = 0	tap = 0	[%]
-1 dB Frequency Range [Hz to KHz] ⁽³⁾	f1f = 0.794 fhf = 78.847	f1f = 0.791 fhf = 71.189	f1f = 0.792 fhf = 67.865	
-1 dB Frequency Range [Hz to KHz] ⁽³⁾	f11 = 0.339 fh1 = 101.658	f11 = 0.338 fhf = 100.638	f11 = 0.338 fhf = 88.009	
-3 dB Frequency Range [Hz to KHz] ⁽³⁾	f13 = 0.172 fh3 = 133.561	f13 = 0.172 fhf = 137.556	f13 = 0.172 fhf = 115.944	
Nominal Power ⁽¹⁾	Pn = 400	Pn = 400	Pn = 400	[W]
-3 dB Power Bandwidth starting at	fu = 14	fu = 14	fu = 14	[Hz]
Total Primary Inductance ⁽²⁾	Lp = 736.8	Lp = 736.8	Lp = 736.8	[H]
Primary Leakage Inductance	lsp = 2.109	lsp = 1.681	lsp = 2.371	[mH]
Effective Primary Capacitance	cip = 1.296	cip = 1.406	cip = 1.518	[nF]
Total Primary DC Resistance	Rip = 51.8	Rip = 51.8	Rip = 51.8	[Ω]
Total Secondary DC Resistance	Ris = 0.089	Ris = 0.145	Ris = 0.319	[Ω]
Tubes Plate Resistance per section	ri = 1	ri = 1	ri = 1	[kΩ]
Insertion Loss	lloss = 0.358	lloss = 0.325	lloss = 0.34	[dB]
Q-factor 2nd order HF roll-off ⁽⁵⁾	Q = 0.761	Q = 0.726	Q = 0.759	[]
HF roll-off Specific Frequency ⁽⁵⁾	Fo = 124.73	Fo = 133.989	Fo = 108.601	[kHz]
Quality Factor ⁽⁵⁾	QF = 3.494·10 ⁵	QF = 4.383·10 ⁵	QF = 3.108·10 ⁵	[]
Quality Decade Factor = log(QF) ⁽⁵⁾	QDF = 5.543	QDF = 5.642	QDF = 5.492	[]
Tuning Factor ⁽⁵⁾	TF = 2.218	TF = 1.827	TF = 2.171	[]
Tuning Decade Factor = log(TF) ⁽⁵⁾	TDF = 0.346	TDF = 0.262	TDF = 0.337	[]
Frequency Decade Factor ^(4,5)	FDF = 5.889	FDF = 5.904	FDF = 5.829	[]

(1): calculated under the conditions of balancing the DC-currents and the AC-anode voltages of the powertubes driving the transformer

(2): maximum value, measured over secondary, transfered to primary

(3): calculation at 1 mWatt in Rls; ri and Rls are pure Ohmic

(4): defined as FDF = log(fh3/f13) = number of frequency decades transfered

(5): ir. Menno van der Veen; Theory and Practise of Wide Bandwidth Toroidal Output Transformers; preprint 3887, 97th AES Convention San Fransico

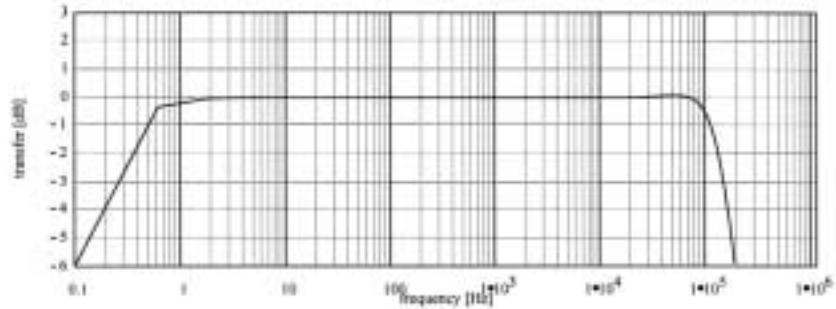
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PAT-4141-00 Response Curves

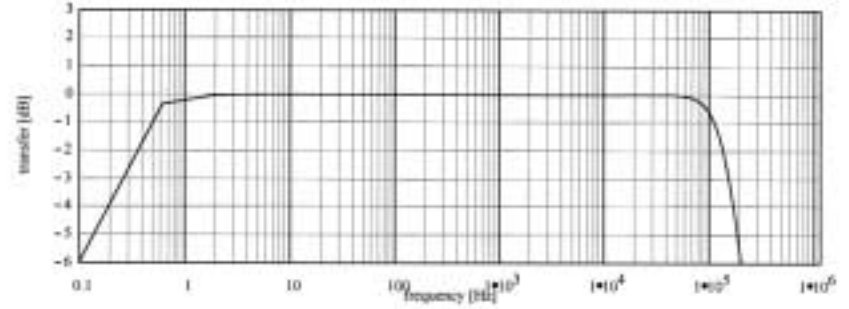
2 OHM

4 OHM

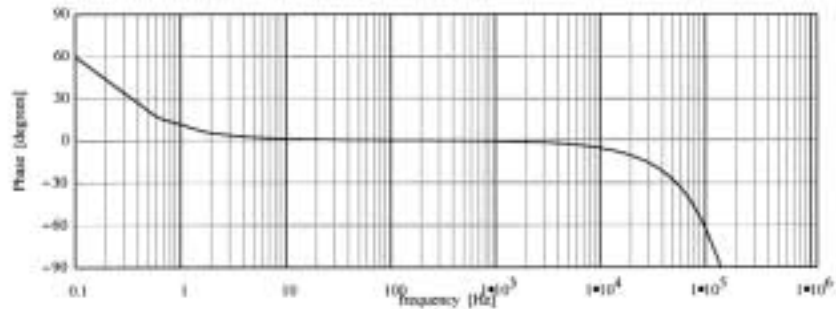
Frequency Response; Vertical 1 dB/div; Horizontal .1 Hz to 1 MHz (3)



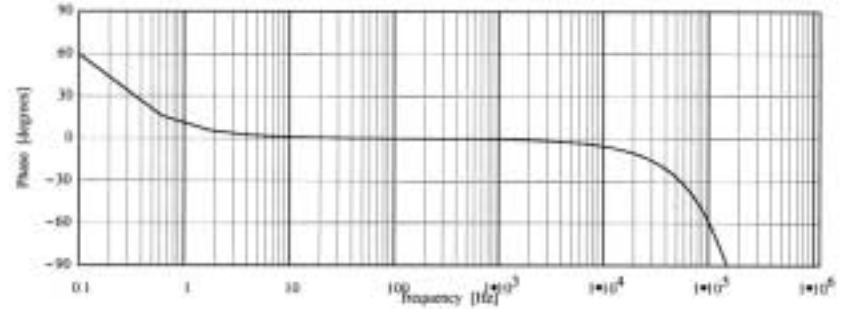
Frequency Response; Vertical 1 dB/div; Horizontal .1 Hz to 1 MHz (3)



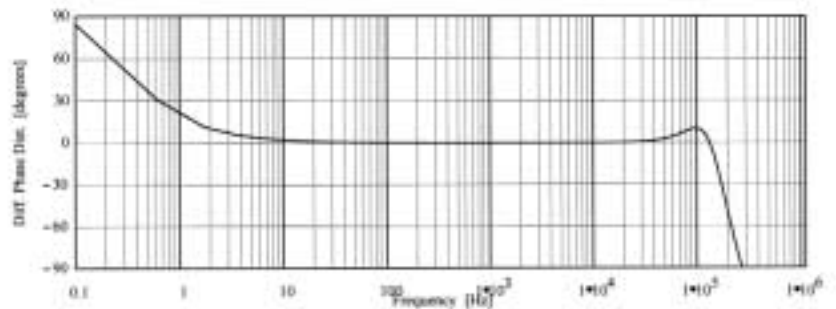
Phase Response; Vertical 30 deg./div; Horizontal .1 Hz to 1 MHz



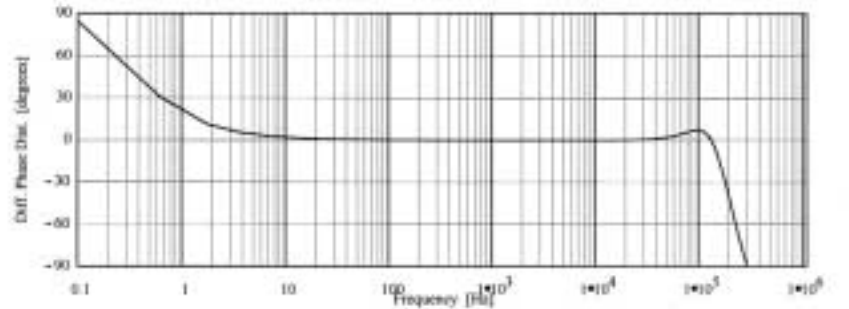
Phase Response; Vertical 30 deg./div; Horizontal .1 Hz to 1 MHz



Differential Phase Distortion; vert. 30 deg./div; hor. .1 Hz to 1 MHz
See: W.M.Leach, Differential Time Delay...; JAES sept.89 pp.709-715



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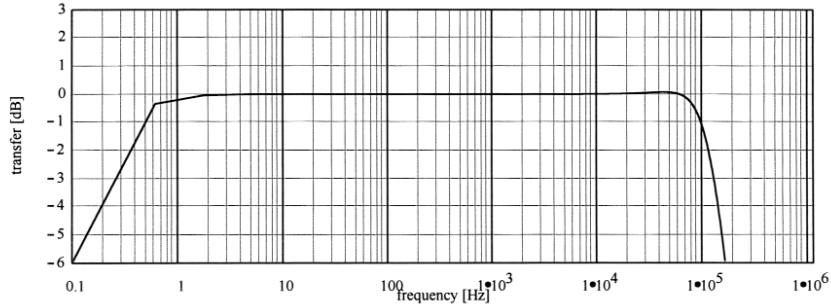
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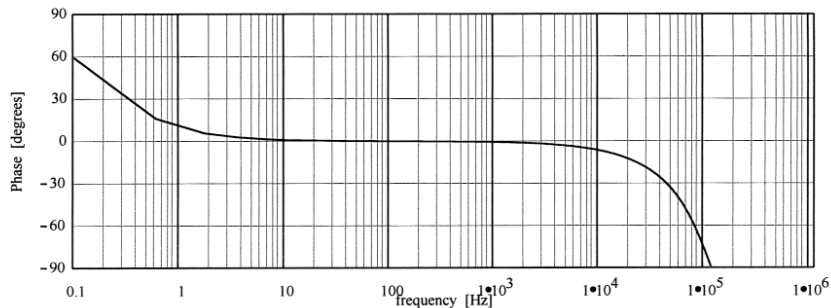
PAT-4141-00 Response Curves

8 OHM

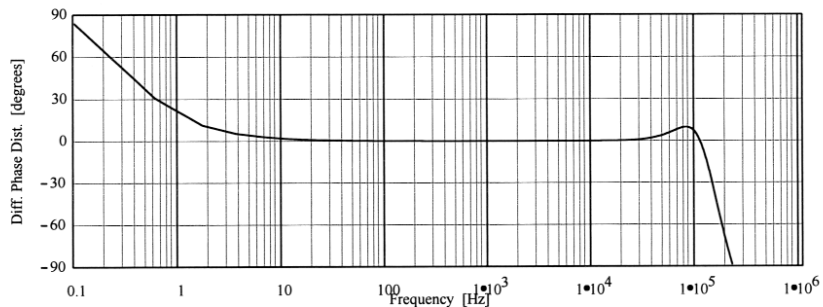
Frequency Response; Vertical 1 dB/div; Horizontal .1 Hz to 1 MHz (3)



Phase Response; Vertical 30 deg./div; Horizontal .1 Hz to 1 MHz

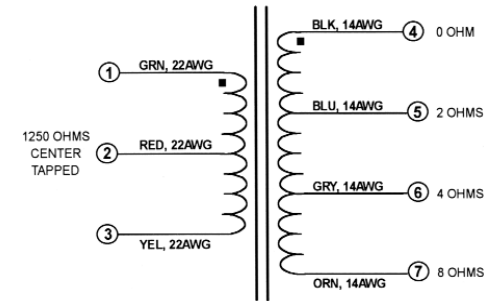


Differential Phase Distortion; vert. 30 deg./div; hor. .1 Hz to 1 MHz
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Schematic



Mechanical

REF	Dimension, in mm
A	203.2 nominal
B	107.95 nominal
C	(2) 5/16-18 T-NUT
D	20 +/- 5 (2 places)
E	85 +/- 5 (2 places)

Weight: 10.65kg
Lead Length: 200mm (+/- 10mm)

