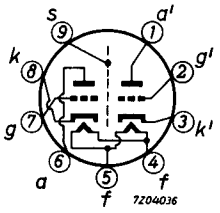
S.Q. TUBE

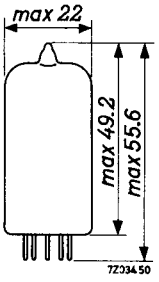
Special quality double triode designed for use as cascode amplifier, cathode follower etc. in R.F. and A.F. circuits.

QUICK REFERENCE DATA				
Life test	10 000 hours			
Low interface resistance				
Mechanical quality	Shock and vibration resistant			
Base	Noval. Gold plated pins			
Heating	Indirect A.C. or D.C.; parallel supply			
Heater voltage	V_f		6.3	V
Heater current	I_f		335	mA
Anode current	I_a		15	mA
Mutual conductance	S		12.5	mA/V
Equivalent noise resistance	R_{eq}		250	Ω
Noise factor (f = 200 MHz)	F		4.6	dB
Hum voltage	V_g	max.	50	μV_{RMS}

DIMENSIONS AND CONNECTIONS Dimensions in mm

Base: Noval





CHARACTERISTICS

Column I Nominal value or setting of the tube
II Range values for equipment design: Initial spread
III Range values for equipment design: End of life

		I	II	III	
Heater voltage	V_f	6.3			V
Heater current	I_f	335	318 - 352		mA
Anode supply voltage	V_{ba}	100			V
Grid supply voltage	$+V_{bg}$	9			V
Cathode resistor	R_k	680			Ω
Anode current	I_a	15	14.2-15.8	min.13.5	mA
Mutual conductance	S	12.5	10.5-14.5	min. 9	mA/V
Amplification factor	μ	33			
Negative grid current	$-I_g$		max. 0.1	max. 1.0	μA
Equivalent noise resistance Frequency f = 45 MHz	R_{eq}	250			Ω
Noise factor in cascode circuit, adapted to minimum noise Frequency f = 200 MHz	F	4.6.			dB
Input resistance Frequency f = 100 MHz	r_g	3			kΩ
Cut off voltage	$-V_{g_1}$	15			V
Anode voltage	V_a	150			V
Anode current	I_a		max. 5		mA
Anode supply voltage	V_{ba}	90			V
Cathode resistor	R_k	120			Ω
Anode current	I_a	12			mA
Mutual conductance	S	11.5			mA/V

CHARACTERISTICS (continued)

		I	II	III	
Leakage current between cathode and heater	I_{kf}		max. 6	max. 12	μA
Voltage between cathode and heater V_{kf} = 60 V (k neg) or = 120 V (k pos)					
Insulation resistance between two electrodes	R		min. 100	min. 20	MΩ
Voltage between electrodes V = 200 V					
Hum voltage	V_g		max. 50		μV_{RMS}
Grid resistor R_{g_1} = 0.5 MΩ					
Vibrational noise output	V_g		max. 100		mV
Anode supply voltage V_{ba} = 100 V					
Anode resistor R_a = 2 kΩ					
Grid supply voltage $+V_{bg}$ = 9 V					
Cathode resistor R_k = 680 Ω (by passed)					
Vibration frequency f = 10-50 Hz					
Acceleration = 2.5 g					
Vibrational noise output	V_g		max. 140		mV
Anode supply voltage V_{ba} = 270 V					
Anode resistor R_a = 18 kΩ					
Grid resistor R_g = 1 MΩ					
Cathode resistor R_k = 180 Ω					
By pass capacitor C_k = 50 μF					
Vibration frequency f = 50-5000 Hz					
Acceleration = 0.5 g					

CAPACITANCES. Both sections if not otherwise indicated.

		I	II	
Anode to cathode, heater and screen	$C_{a/kfs}$	1.75	1.55 - 1.95	pF
	$C_{a'/k'fs}$	1.65	1.45 - 1.85	pF
Anode to cathode and heater	$C_{a/kf}$	0.5	0.4 - 0.6	pF
	$C_{a'/k'f}$	0.4	0.3 - 0.5	pF
Grid to cathode, heater and screen	$C_{g/kfs}$	3.3	2.7 - 3.9	pF
Grid to cathode and heater	$C_{g/kf}$	3.3	2.7 - 3.9	pF
Anode to grid	C_{ag}	1.4	1.2 - 1.6	pF
Anode to cathode	C_{ak}	0.18	0.14 - 0.22	pF
Cathode to heater	C_{kf}	2.6		pF
	$C_{k'f}$	2.7		pF
Anode to screen	C_{as}	1.3	1.1 - 1.5	pF
Anode to grid, heater and screen	$C_{a/gfs}$	3.0	2.7 - 3.3	pF
	$C_{a'/gfs}$	2.9	2.6 - 3.2	pF
Cathode to grid, heater and screen	$C_{k/gfs}$	6.0	5.1 - 6.9	pF
Anode to anode other section	$C_{aa'}$	0.025	max. 0.045	pF
Grid to grid other section	$C_{gg'}$		max. 0.005	pF
Anode to grid other section	$C_{ag'}$		max. 0.005	pF
Grid to anode other section	$C_{ga'}$		max. 0.005	pF
Grid to cathode other section	$C_{gk'}$		max. 0.005	pF
Cathode to grid other section	$C_{kg'}$		max. 0.005	pF

SHOCK AND VIBRATION RESISTANCE

The following test conditions are applied to assess the mechanical quality of the tube. These conditions are not intended to be used as normal operating conditions.

Shock

The tube is subjected 5 times in each of 4 positions to an acceleration of 500 g supplied by an NRL shock machine with the hammer lifted over an angle of 30°.

Vibration

The tube is subjected during 32 hours in each of 3 positions to a vibration frequency of 50 Hz with an acceleration of 2.5 g.

LIFE

Production samples are tested to be within the end of life values (column III) under the following conditions during 10 000 hours.

Anode supply voltage	V_{ba}	100	V
Grid supply voltage	$+V_{bg}$	9	V
Cathode resistor	R_k	680	Ω
Grid resistor	R_g	47	kΩ
Cathode to heater voltage (k neg)	V_{kf}	60	V

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_{a_o}	max.	550	V
	V_a	max.	250	V
Anode voltage (Zero anode current)	$V_a(I_a = 0)$	max.	400	V
Anode dissipation	W_a	max.	1.65	W
	W_a	max.	2.0	W
Both sections	$W_{a+a'}$	max.	2.2	W
Grid dissipation	W_g	max.	30	mW
Grid voltage	$-V_g$	max.	110	V
Grid peak voltage	$-V_{g_p}$	max.	200	V
Pulse duration max. 200 μs				
Duty factor max. 0.1				
Cathode current	I_k	max.	22	mA
Cathode peak current	I_{k_p}	max.	110	mA
Pulse duration max. 200 μs				
Duty factor max. 0.1%				
Voltage between cathode and heater				
cathode positive	V_{kf}(k pos)	max.	150	V
cathode negative	V_{kf}(k neg)	max.	100	V
Bulb temperature	t_{bulb}	max.	165	°C
Grid resistor with fixed bias	R_g	max.	0.5	MΩ
with automatic bias	R_g	max.	1.0	MΩ

LIMITING VALUES (continued)

Heater voltage: The average heater voltage should be 6.3 V.
Variations of the heater voltage exceeding the range of 6.0 V to 6.6 V will shorten the tube life.
The tolerance of heater current (column II) should be taken into account.

OPERATING CHARACTERISTICS

Additive mixer

Anode supply voltage	V_{ba}	60	90	150	V
Anode resistor	R_a	0	1	3.9	kΩ
Grid resistor	R_g	1	1	1	MΩ
Grid oscillator voltage	V_{osc}	2	2.5	3	V_{RMS}
Anode current	I_a	4.7	7.7	11	mA
Conversion conductance	S_c	2.9	3.5	4.1	mA/V
Internal resistance	R_i	8.3	7	6.1	kΩ

Output tube class A

Anode voltage	V_a		220		V
Load resistance	$R_{a\sim}$		20		kΩ
Negative grid voltage	$-V_g$		6.5		V
Input voltage	V_i	0	1.5	4.5	V_{RMS}
Anode current	I_a	6.5	–	9.2	mA
Output power	W_o	–	0.05	0.5	W
Total distortion	d_{tot}			7	%

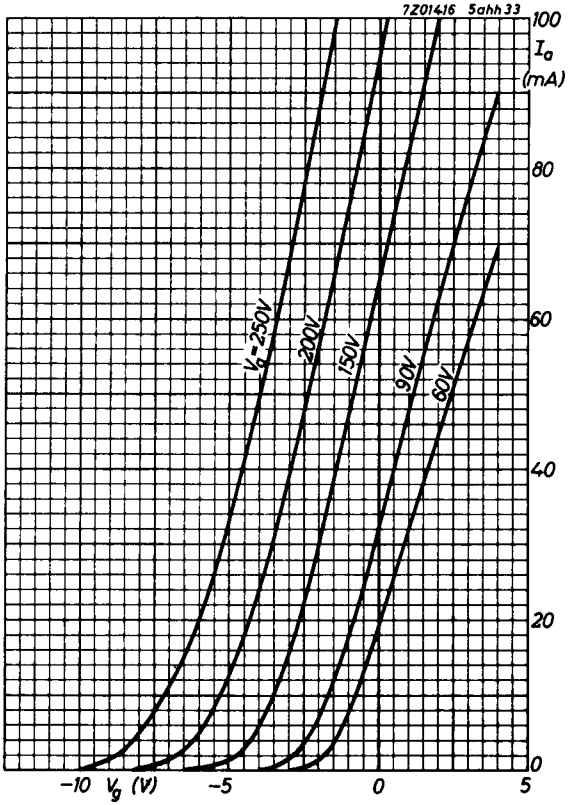
Output tube class B (two units). Constant sinusoidal input voltage (single tone).

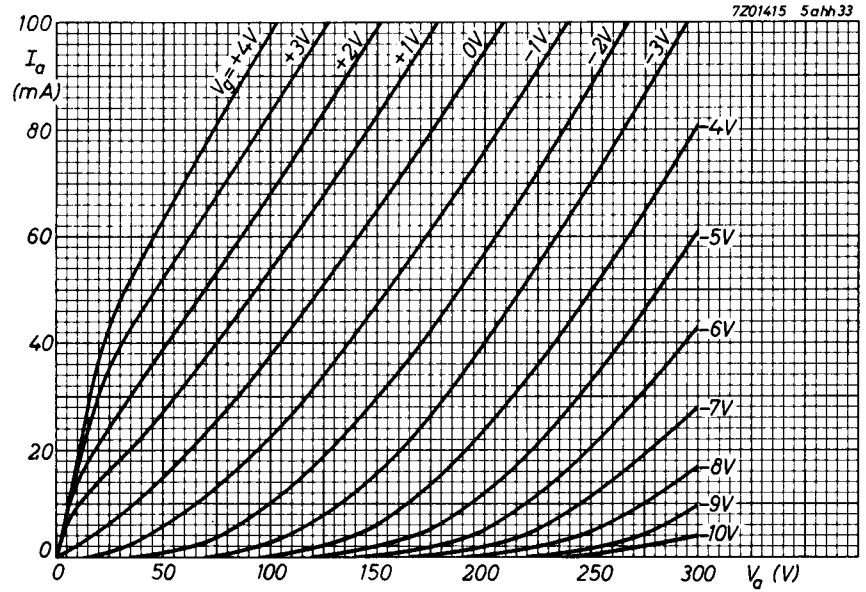
Anode voltage	V_a		200		V
Load resistance	$R_{aa\sim}$		22		kΩ
Negative grid voltage	$-V_g$		6		V
Input voltage	V_i	0	0.9	4.0	V_{RMS}
Anode current	I_a	2x5	–	2x9	mA
Output power	W_o	–	0.05	1.2	W
Total distortion	d_{tot}	–	–	3	%

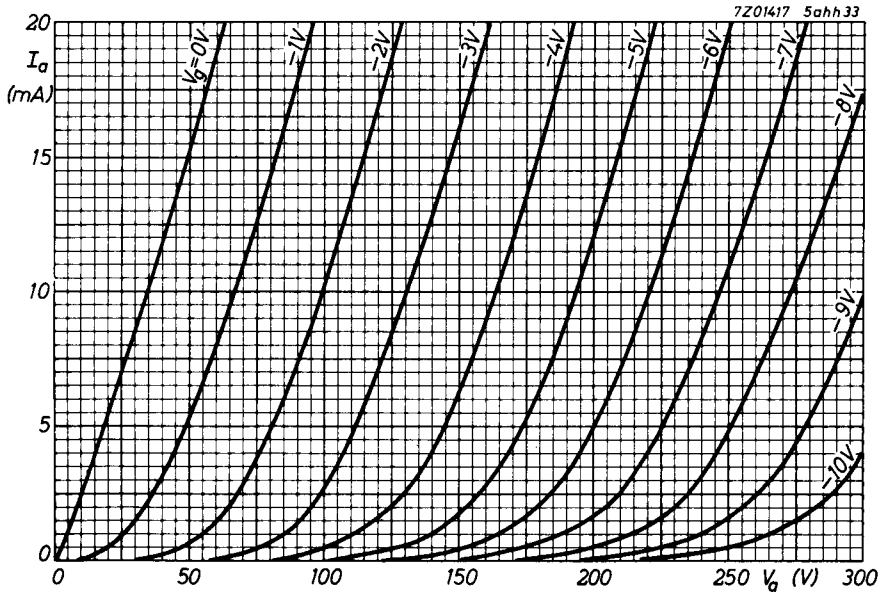
OPERATING CHARACTERISTICS (continued)

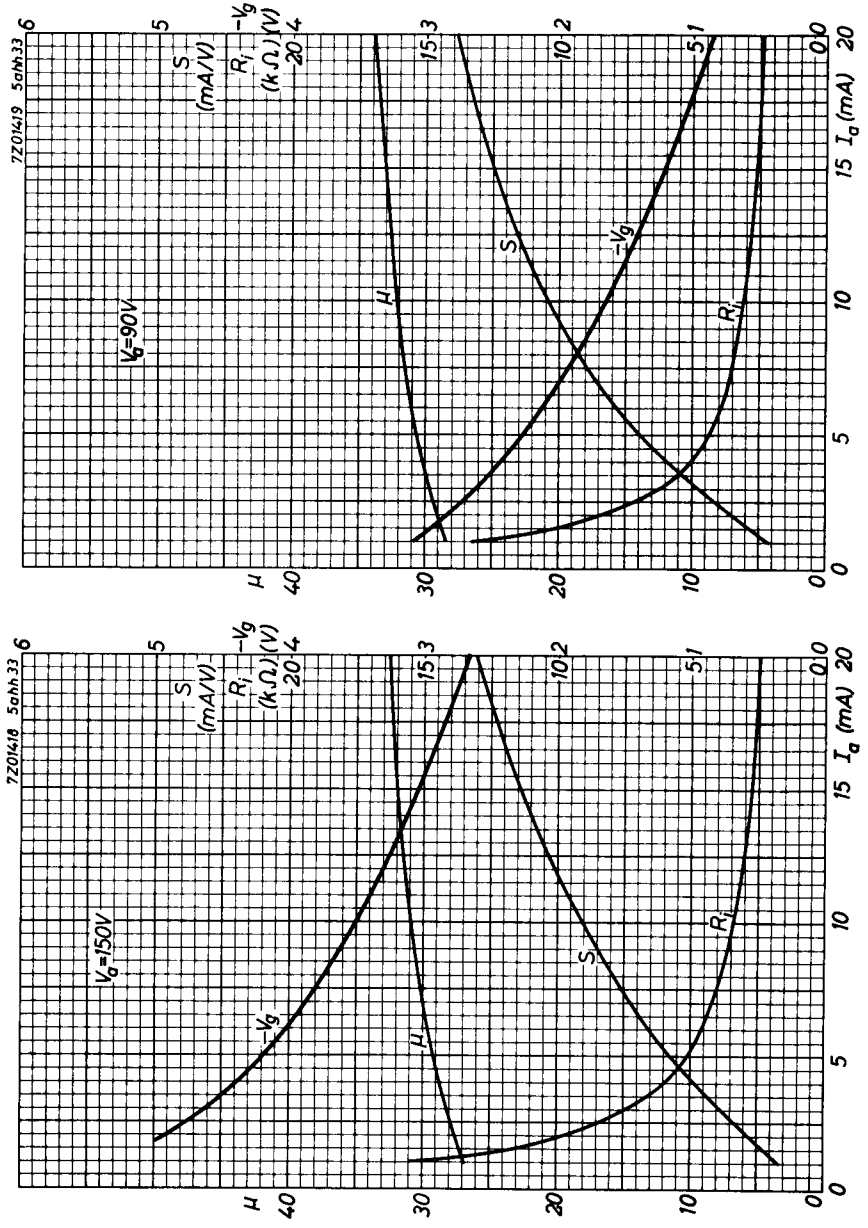
Output tube class B (two units). Speech and music input voltage

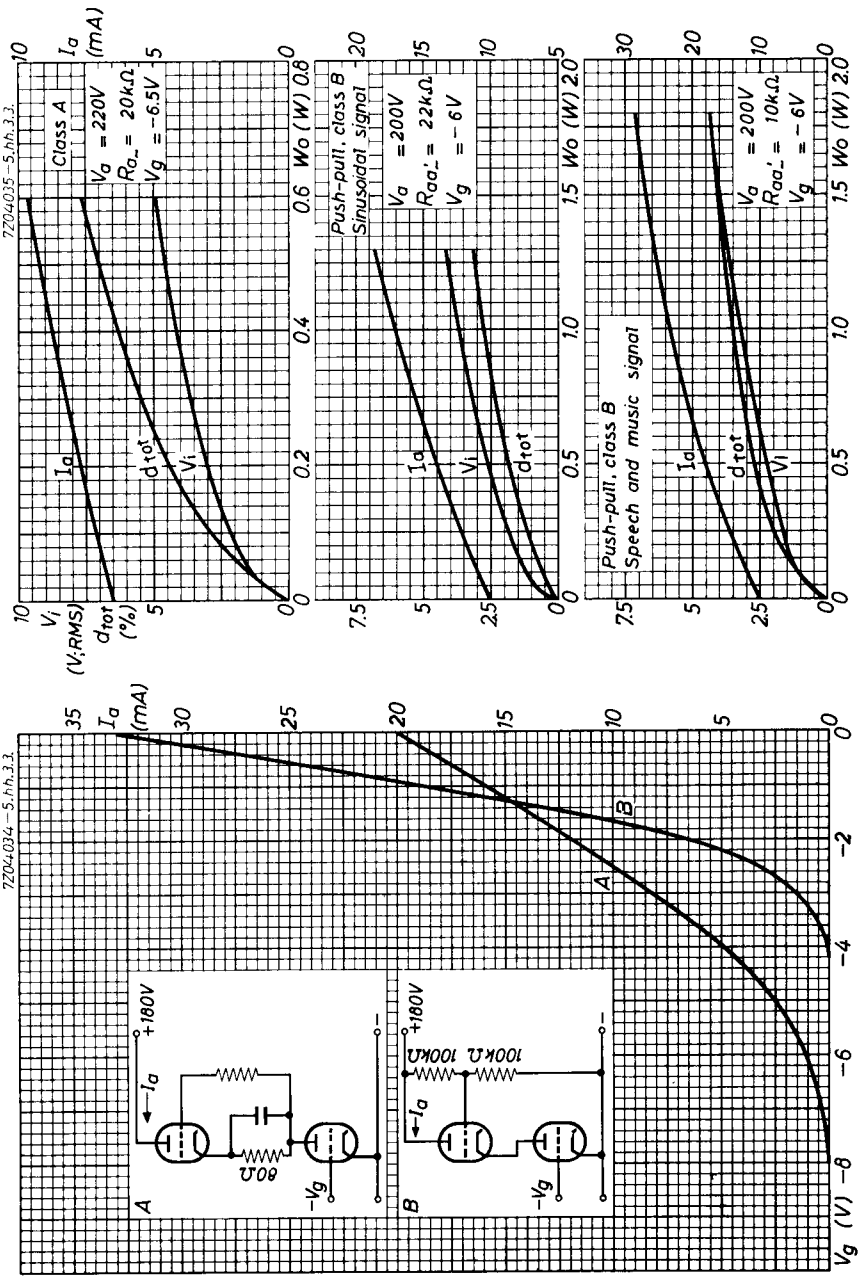
Anode voltage	V_a		200		V
Load resistance	$R_{aa\sim}$		10		kΩ
Negative grid voltage	$-V_g$		6		V
Input voltage	V_i	0	0.9	4.0	V_{RMS}
Anode current	I_a	2x5	–	2x13.5	mA
Output power	W_o	–	0.05	1.5	W
Total distortion	d_{tot}	–	–	4	%




7Z01415 5ahh33
100
I_a
(mA)
80
60
40
20
0
V_g=+4V
+3V
+2V
+1V
0V
-1V
-2V
-3V
-4V
-5V
-6V
-7V
-8V
-9V
-10V
0
50
100
150
200
250
300
V_a (V)


7Z01417 5ahh33
20
I_a
(mA)
15
10
5
0
V_g=0V
-1V
-2V
-3V
-4V
-5V
-6V
-7V
-8V
-9V
-10V
0
50
100
150
200
250
300
V_a (V)


7Z01419 5ohh33
V_b=90V
S (mA/V)
R_i (kΩ) (V) $-V_g$
μ
I_a (mA)
7Z01418 5ohh33
V_b=150V
S (mA/V)
R_i (kΩ) (V) $-V_g$
μ
I_a (mA)


7Z04035-5.hh.3.3
Class A
Ia (mA)
Vo = 220V
Ro~ = 20kΩ
Vg = -6.5V
Ia
d tot
Vi
Vi (V;RMS)
d tot (%)
Wo (W)
Push-pull, class B
Sinusoidal signal
Vo = 200V
Roa~ = 22kΩ
Vg = -6V
Push-pull, class B
Speech and music signal
Voa = 200V
Roa~ = 10kΩ
Vg = -6V
7Z04034-5.hh.3.3
Ia (mA)
Vg (V)
A
B
+180V
-Ia
-Vg
60Ω
100kΩ

PHILIPS

Data handbook

Electronic components and materials

E188CC

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