S.Q. TUBE

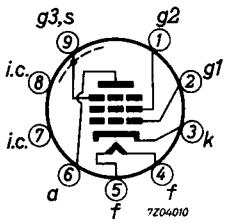
Pentode designed for use in telephone equipment.

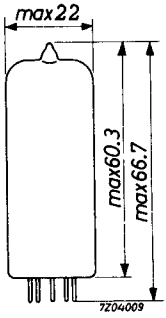
QUICK REFERENCE DATA			
Life test	10 000 hours		
Low interface resistance			
Base	Noval		
Heating	Indirect A.C. or D.C. Series or parallel supply		
Heater voltage	V_f	18	V
Heater current	I_f	100	mA
Anode current	I_a	10	mA
Mutual conductance	S	9	mA/V

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	18			V
Heater current	I_f	100	95 - 105		mA
Anode voltage	V_a	210			V
Grid No.3 voltage	V_{g_3}	0			V
Grid No.2 voltage	V_{g_2}	120			V
Cathode resistor	R_k	165			Ω
Anode current	I_a	10	8.7 - 11.3	min. 7	mA
Grid No.2 current	I_{g_2}	2.1	1.7 - 2.5	min.1.25	mA
Mutual conductance	S	9	7.8 - 10.2	min. 6.4	mA/V
Internal resistance	R_i	0.5	min. 0.3		MΩ
Amplification factor	$\mu_{g_2g_1}$	38			
Equivalent noise resistance					
R.F.	R_{eq}	750	max.1000		Ω
A.F. (0 - 10 kHz)	R_{eq}		max. 36		kΩ
Negative grid current	$-I_{g_1}$		max. 0.5	max. 1.0	μA
Cut-off voltage	$-V_g$		max.5.25		V
Anode voltage	V_a	210			V
Grid No.3 voltage	V_{g_3}	0			V
Grid No.2 voltage	V_{g_2}	120			V
Anode current	I_a	0.5			mA
Hum voltage	V_{g_1}		max. 0.5		mV_{RMS}
Grid No.1 resistor R_{g_1} = 0.5 MΩ					
Leakage current between cathode and heater	I_{kf}		max. 20		μA
Voltage between cathode and heater V_{kf} = 100 V					

CAPACITANCES

		I	II	
Anode to grid No.2, grid No.3, cathode and heater	C_{a/g_2g_3kfs}	3.5	max. 4.1	pF
Grid No.1 to grid No.2, grid No.3, cathode, heater and screen	C_{g_1/g_2g_3kfs}	8.0	max. 8.7	pF
Anode to grid No.1	C_{ag_1}		max. 0.015	pF
Grid No.1 to heater	C_{g_1f}		max. 0.15	pF
Cathode to heater	C_{kf}	4		pF
Grid No.1 to grid No.2, grid No.3, cathode, heater and screen	C_{g_1/g_2g_3kfs}	11.3		pF
Cathode current = 12.1 mA				
Radiation capacitance:				
Anode to surrounding box, inner diam. 52 mm, height 98 mm	C_{ra}		max. 0.025	pF
Grid No.1 to surrounding box, inner diam. 52 mm, height 98 mm	C_{rg_1}		max. 0.025	pF

LIFE

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

LIMITING VALUES Design centre rating system

Anode voltage	V_{a_o}	max.	550	V
	V_a	max.	210	V
Anode dissipation	W_a	max.	2.1	W
Grid No.2 voltage	$V_{g_{2_o}}$	max.	550	V
	V_{g_2}	max.	210	V
Grid No.2 dissipation	W_{g_2}	max.	0.35	W
Cathode current	I_k	max.	16	mA
Grid No.1 resistor (automatic bias)	R_{g_1}	max.	1	MΩ
Voltage between cathode and heater	V_{kf}	max.	100	V
Bulb temperature	t_{bulb}	max.	170	°C

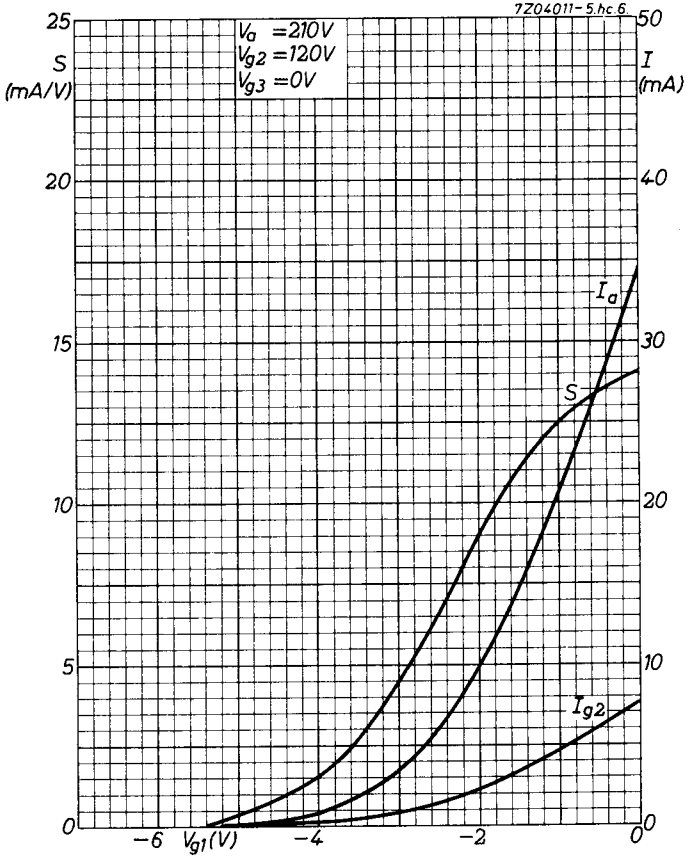
LIMITING VALUES (continued)

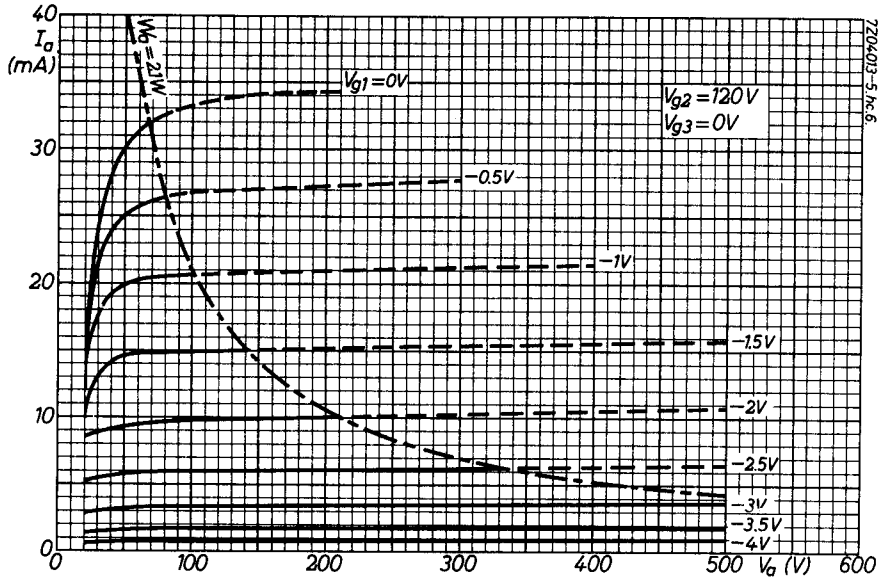
Heater voltage: The average heater voltage should be 18 V.
Variations of the heater voltage exceeding the range of 17.1 to 18.9 V will shorten the tube life.
The tolerance of heater current (column II) should be taken into account.

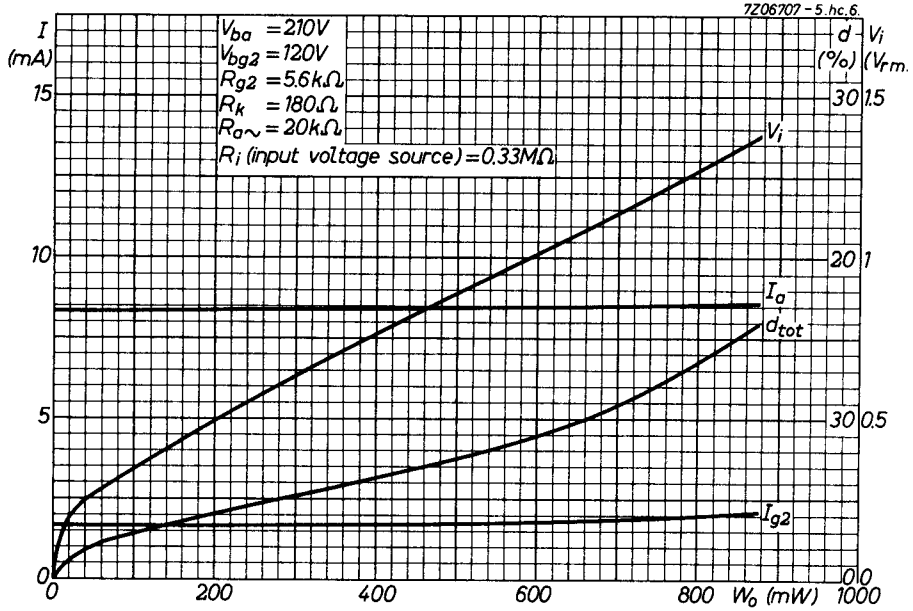
OPERATING CHARACTERISTICS

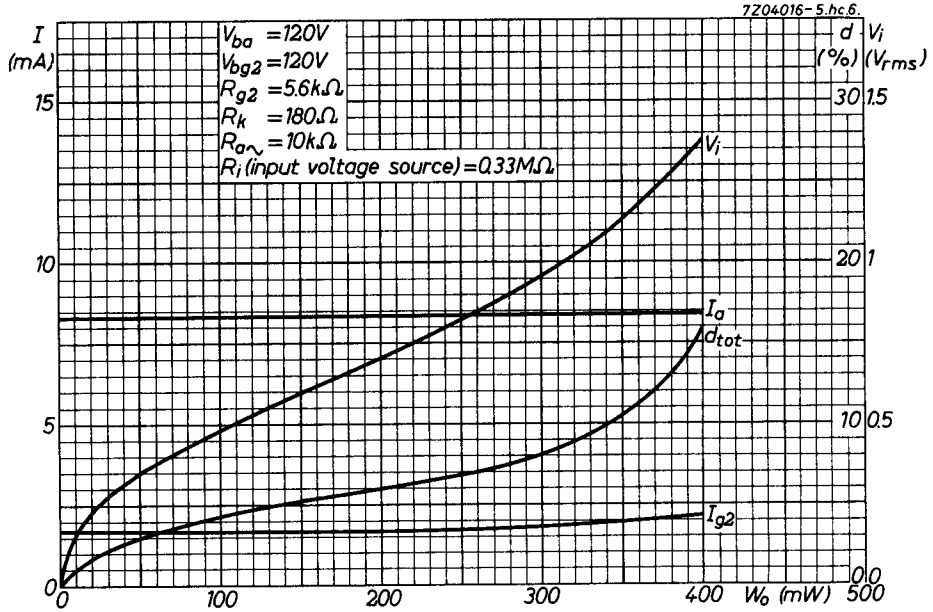
Output tube class A

Anode voltage	V_a		120			210		V
Grid No.3 voltage	V_{g_3}		0			0		V
Grid No.2 supply voltage	V_{bg_2}		120			120		V
Grid No.2 resistor	R_{g_2}		5.6			5.6		kΩ
Cathode resistor	R_k		180			180		Ω
Anode current	I_a		8.3			8.3		mA
Grid No.2 current	I_{g_2}		1.7			1.7		mA
Mutual conductance	S		8.2			8.2		mA/V
Internal resistance	R_i		0.42			0.44		MΩ
Load resistance	$R_{a\sim}$		10			20		kΩ
Output power	W_o	340	400	50	660	870	50	mW
Input voltage	V_i	1.1	–	0.35	1.1	–	0.25	V_{RMS}
Total distortion	d_{tot}	10	–	–	10	–	–	%
Grid No.1 current	$+I_g$	–	0.3	–	–	0.3	–	μA
Grid No.1 resistor	R_{g_1}	–	0.33	–	–	0.33	–	MΩ


7Z04011-5.hc.6.
V_a =210V
V_{g2} =120V
V_{g3} =0V
S (mA/V)
I (mA)
25
20
15
10
5
0
50
40
30
20
10
0
I_a
S
I_{g2}
−6
V_{g1}(V)
−4
−2
0


I_a (mA)
V_{bg2} = 210V
V_{g1} = 0V
−0.5V
−1V
−1.5V
−2V
−2.5V
−3V
−3.5V
−4V
V_{g2} = 120V
V_{g3} = 0V
V_a (V)
0
100
200
300
400
500
600
0
10
20
30
40
7Z04013-5.hc.6


7Z06707-5.hc.6
I (mA)
V_{ba} = 210V
V_{bg2} = 120V
R_{g2} = 5.6kΩ
R_k = 180Ω
$R_{a\sim}$ = 20kΩ
R_i (input voltage source) = 0.33MΩ
V_i
I_a
d_{tot}
I_{g2}
W_o (mW)
d (%)
V_i ($V_{rm.}$)
0
5
10
15
200
400
600
800
1000
30
20
30
0
1.5
1
0.5
0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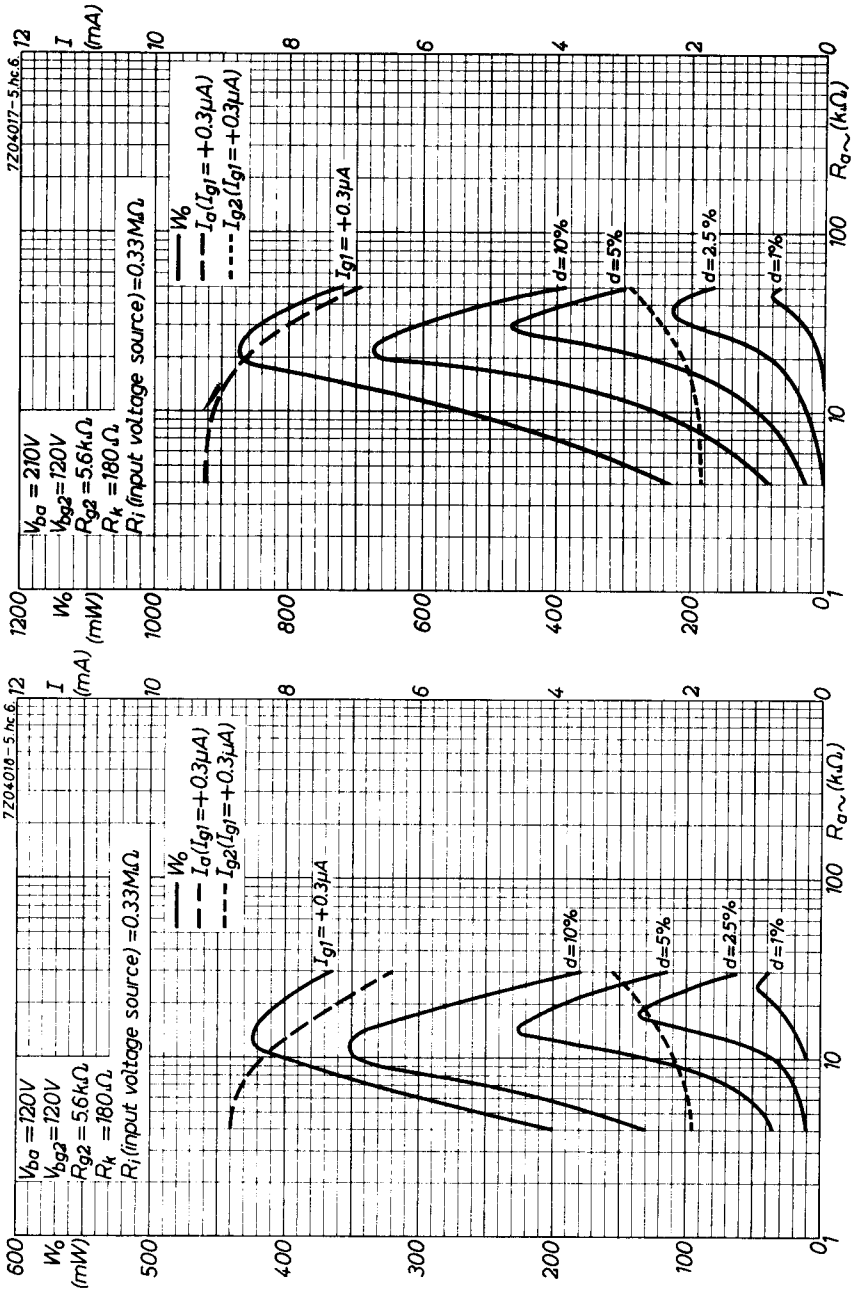
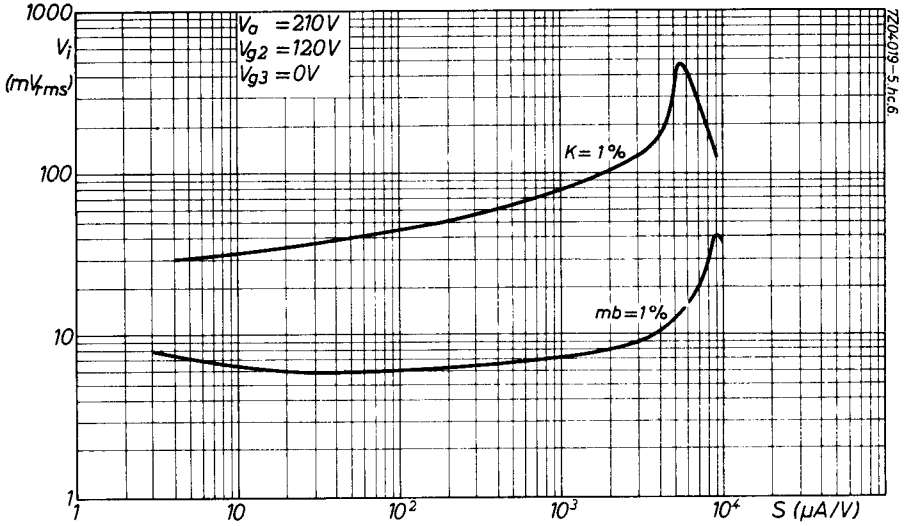
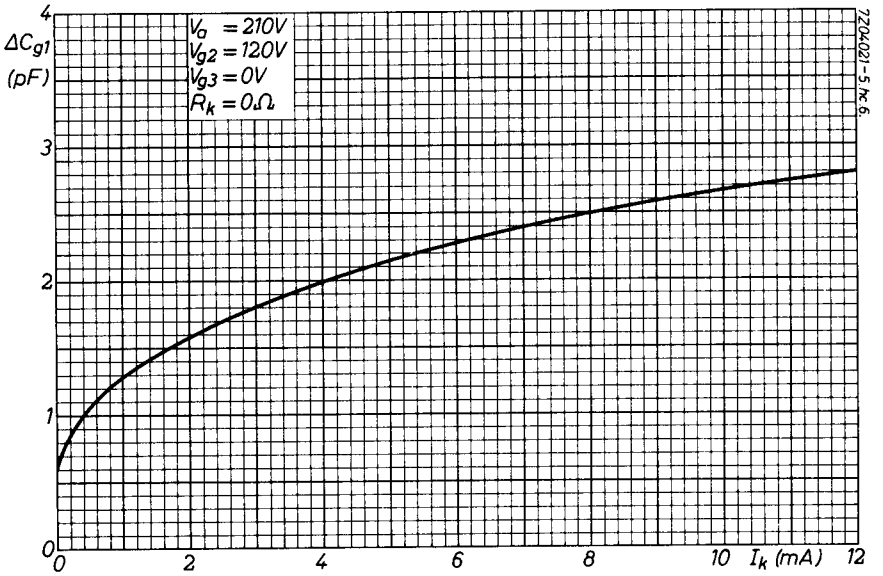
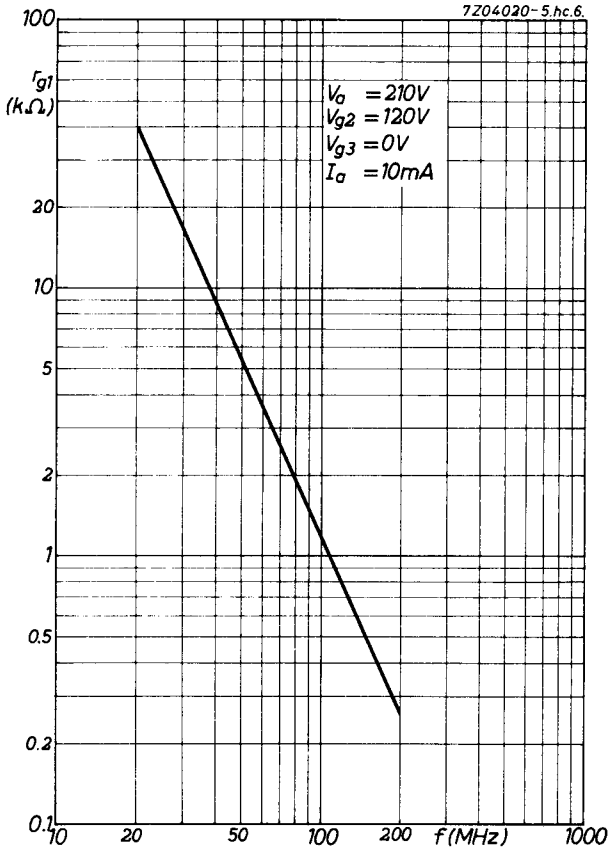
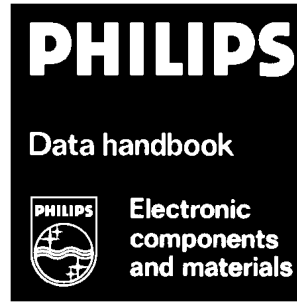
I (mA)
d (%)
Vi (Vrms)
Vba =120V
Vbg2 =120V
Rg2 =5.6kΩ
Rk =180Ω
Ra~ =10kΩ
Ri (input voltage source) =0.33MΩ
Vi
Ia
dtot
Ig2
15
10
5
0
30
20
10
1.5
1
0.5
0.0
0
100
200
300
400
Wo (mW)
500


7Z04017-5.hc6.12
I (mA)
W₀ (mW)
Vba = 210V
Vbg2 = 120V
Rg2 = 5.6kΩ
Rk = 180Ω
Ri (input voltage source) = 0.33MΩ
W₀
Ia(Ig1 = +0.3μA)
Ig2(Ig1 = +0.3μA)
Ig1 = +0.3μA
d=10%
d=5%
d=2.5%
d=1%
Ra~ (kΩ)
7Z04018-5.hc6.12
I (mA)
W₀ (mW)
Vba = 120V
Vbg2 = 120V
Rg2 = 5.6kΩ
Rk = 180Ω
Ri (input voltage source) = 0.33MΩ
W₀
Ia(Ig1 = +0.3μA)
Ig2(Ig1 = +0.3μA)
Ig1 = +0.3μA
d=10%
d=5%
d=2.5%
d=1%
Ra~ (kΩ)


1000
V_i
(mV$_{rms}$)
100
10
1
V_a = 210V
V_{g2} = 120V
V_{g3} = 0V
K = 1%
mb = 1%
1
10
10^2
10^3
10^4
S (μA/V)
7Z04019-5-hc.6


4
ΔC_{g1}
(pF)
3
2
1
0
V_a = 210V
V_{g2} = 120V
V_{g3} = 0V
R_k = 0Ω
0
2
4
6
8
10
I_k (mA)
12
7Z04021-5-hc.6


7Z04020-5.hc.6.
100
r_{g1} (kΩ)
20
10
5
2
1
0.5
0.2
0.1
10
20
50
100
200
f(MHz)
1000
V_a = 210V
V_{g2} = 120V
V_{g3} = 0V
I_a = 10mA



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