SPECIAL QUALITY, LONG LIFE, SHOCK AND VIBRATION RESISTANT PENTODE for use as wide band amplifier in professional equipment

HEATING

Indirect by A.C. or D.C.; parallel supply

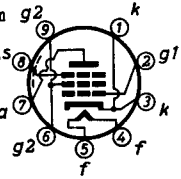
Heater voltage V_f = 6.3 V

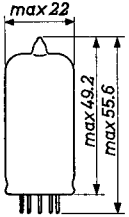
Heater current I_f = 340 mA

In order to obtain a prolonged tube life, the deviation of the heater voltage should not exceed 5 % of the nominal value

Dimensions in mm

Base: NOVAL





CHARACTERISTICS

Column I: Setting of the tube and typical (average) measuring results of new tubes
II: Characteristics range values for equipment design
III: Data indicating the end point of life

			I	II
Heater current				
Heater voltage	V_f	=	6.3	V
Heater current	I_f	=	340	320-360 mA
Capacitances				
A. Without external shield			I	II
Grid No.1 to all other elements except anode	C_{g1}	=	14.5	13-16 pF
The same at I_k = 40 mA and f = 100 Mc/s	C_{g1}	=	24	22-26 pF
Anode to all other elements except grid No.1	C_a	=	3.5	3.2-3.8 pF
Anode to grid No.1	C_{ag_1}	=		< 0.036 pF
Anode to cathode	C_{ak}	=	0.060	0.053-0.067 pF
Anode to heater	C_{af}	=	0.031	0.026-0.036 pF
Grid No.1 to heater	C_{g1f}	=	0.060	0.040-0.080 pF

CHARACTERISTICS (continued)

Capacitances (continued)

B. With external shield (Inner diameter 22.2 mm, length 44.5 mm)

		I	II	
Grid No.1 to all other elements except anode	C_{g_1} =	14.5	13-16	pF
The same at I_k = 40 mA and f =100 Mc/s	C_{g_1} =	24	22-26	pF
Anode to all other elements except grid No.1	C_a =	4.1	3.9-4.3	pF
Anode to grid No.1	C_{ag_1} =		< 0.032	pF
Anode to cathode	C_{ak} =	0.033	0.026-0.040	pF
Anode to heater	C_{af} =	0.020	0.012-0.028	pF
Grid No.1 to heater	C_{g1f} =	0.055	0.035-0.075	pF
Cathode to heater	C_{kf} =	5.2	4.2-6.2	pF

Typical characteristics

		I	II	III	
Anode supply voltage	V_{ba} =	135			V [1]
Grid No.3 voltage	V_{g3} =	0			V [1]
Grid No.2 supply voltage	V_{bg_2} =	165			V [1]
Grid No.1 supply voltage	V_{bg_1} =	+12.5			V [1]
Cathode resistor	R_k =	360			Ω [1]
Anode current	I_a =	35	[2]		mA
Grid No.2 current	I_{g_2} =	5.0	4.4-5.6		mA
Mutual conductance	S =	50	42-58	35	mA/V
Internal resistance	R_i =	42			kΩ
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$ =	57			
Negative grid current	$-I_{g_1}$ =		< 0.1	0.2	μA
Equivalent noise resistance at f = 45 Mc/s	R_{eq} =	110			Ω
Input conductance at f =100 Mc/s	g_{g_1} =	2400			μA/V
Quality factor					
A. Without shield $\frac{S}{2\pi(C_{g_1}+C_a+5)}$	=	250			Mc/s
B. With shield [3] $\frac{S}{2\pi(C_{g_1}+C_a+5)}$	=	245			Mc/s

[1]) Recommended operating conditions

[2]) The spread of anode current is negligible

[3]) Inner diameter 22.2 mm, length 44.5 mm

CHARACTERISTICS (continued)

Typical characteristics (continued)

		I	II	III	
Anode supply voltage	V_{ba}	= 120			V
Grid No.3 voltage	V_{g3}	= 0			V
Grid No.2 supply voltage	V_{bg2}	= 150			V
Cathode resistor	R_k	= 47			Ω
Anode current	I_a	= 35	31-39	25	mA

Hum voltage measured with centre tap of heater transformer earthed

		I	II	
Anode supply voltage	V_{ba}	= 120		V
Grid No.3 voltage	V_{g3}	= 0		V
Grid No.2 supply voltage	V_{bg2}	= 150		V
Cathode resistor	R_k	= 47		Ω
Cathode capacitor	C_k	= 1000		μF
Grid No.1 resistor	R_{g1}	= 0.5		MΩ
Hum voltage	V_{g1hum}	=	< 150	μV

Vibrational noise [1])

		I	II	
Anode supply voltage	V_{ba}	= 155		V
Grid No.3 voltage	V_{g3}	= 0		V
Grid No.2 supply voltage	V_{bg2}	= 160		V
Grid No.1 supply voltage	V_{bg1}	= +7		V
Cathode resistor	R_k	= 220		Ω
Anode resistor	R_a	= 680		Ω
Vibrational acceleration		= 10		g
Frequency	f	= 50		c/s
Vibrational noise output	V_{noise}	=	< 25	mV(RMS)
Frequency	f	=50-2000		c/s
Vibrational noise output	V_{noise}	=	< 500	mV(RMS)

[1]) These test conditions are only given for evaluation of the ruggedness of the tube and should by no means be interpreted as suitable operating conditions.

CHARACTERISTICS (continued)

Distortion in class A operation

			I	II	
Anode supply voltage	V_{ba}	=	155		V
Grid No.3 voltage	V_{g3}	=	0		V
Grid No.2 supply voltage	V_{bg2}	=	165		V
Grid No.1 supply voltage	V_{bg1}	=	+12.5		V
Cathode resistor	R_k	=	360		Ω
Cathode capacitor	C_k	=	1000		μF
Anode resistor	R_a	=	560		Ω
Anode current	I_a	=	35		mA
Anode peak to peak current	I_{app}	=	40		mA
Harmonic distortion	d_{tot}	=	7.5		%

Insulation between heater and cathode

			I	II	III	
Heater voltage	V_f	=	6.3			V
Voltage between heater and cathode	V_{kf}	=	100			V
Leakage current	I_{kf}	=		< 10	20	μA

Insulation between electrodes (except between cathode and grid No.1)

			I	II	III	
Heater voltage	V_f	=	6.3			V
Voltage between two electrodes	V	=	250			V
Insulation resistance	R_{isol}	=		>100	40	MΩ

SHOCK RESISTANCE: about 500 g [1])

Forces as applied by the NRL impact machine for electronic devices caused by 5 blows of the hammer lifted over an angle of 30° in each of four different positions of the tube

VIBRATION RESISTANCE: 2.5 g [1])

Vibrational forces for a period of 32 hours at a frequency of 50 c/s in each of three directions

[1]) These test conditions are only given for evaluation of the ruggedness of the tube and should by no means be interpreted as suitable operating conditions

LIFE EXPECTANCY: 10 000 hours under the following life-test conditions:

Heater voltage	V_f	= 6.3 V ± 5 %
Anode supply voltage	V_{b_a}	= 165 V
Anode resistor	R_a	= 820 Ω
Grid No.3 voltage	V_{g_3}	= 0 V
Grid No.2 supply voltage	$V_{b_{g_2}}$	= 165 V
Grid No.1 supply voltage	$V_{b_{g_1}}$	= +14 V
Cathode resistor	R_k	= 390 Ω
Voltage between heater and cathode	V_{kf}	= 100 V
Anode current	I_a	= 35 mA

The data indicating the end point of life are given in column III under the heading "Characteristics"

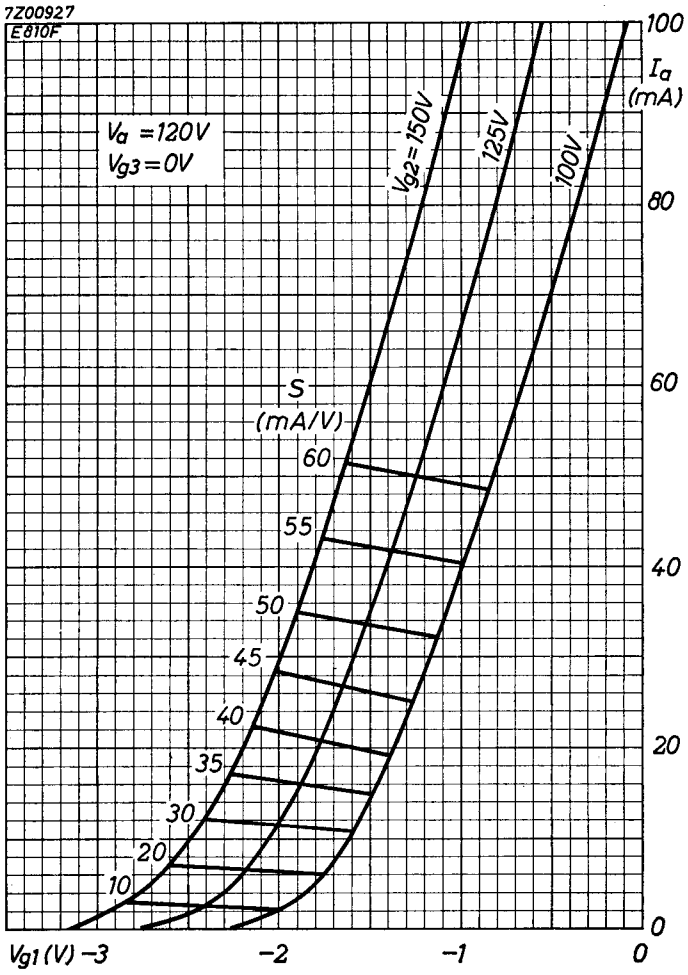
LIMITING VALUES (Absolute limits)

Anode voltage in cold condition	V_{a_o}	= max. 400 V
Anode voltage	V_a	= max. 250 V
Anode dissipation	W_a	= max. 5 W
Grid No.2 voltage in cold condition	$V_{g_{2_o}}$	= max. 400 V
Grid No.2 voltage	V_{g_2}	= max. 200 V
Grid No.2 dissipation	W_{g_2}	= max. 1 W [1]
Negative grid No.1 voltage	$-V_{g_1}$	= max. 25 V
Peak negative grid No.1 voltage	$-V_{g_{1p}}$	= max. 50 V
Peak positive grid No.1 voltage	$+V_{g_{1p}}$	= max. 50 V
Grid No.1 circuit resistance with fixed bias	R_{g_1}	= max. 0.2 MΩ
Grid No.1 circuit resistance with cathode resistor of 47 Ω	R_{g_1}	= max. 0.6 MΩ
cathode resistor of 360 Ω	R_{g_1}	= max. 3.5 MΩ
Grid No.1 dissipation	W_{g_1}	= max. 10 mW [2]
Cathode current	I_k	= max. 50 mA
Cathode current	I_k	= max. 65 mA [3]
Voltage between heater and cathode	V_{kf}	= max. 100 V
Bulb temperature	t_{bulb}	= max. 200 °C
Bulb temperature	t_{bulb}	= max. 220 °C [3]

[1]) Care should be taken not to exceed the rated value due to switching of positive supply voltages

[2]) Averaged over any period of 1 sec

[3]) When a life expectancy of 1000 hours suffices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V_a =120V
V_{g3}=0V
V_{g2}=150V
125V
100V
S
(mA/V)
60
55
50
45
40
35
30
20
10
100
I_a
(mA)
80
60
40
20
0
V_{g1}(V) −3
−2
−1
0

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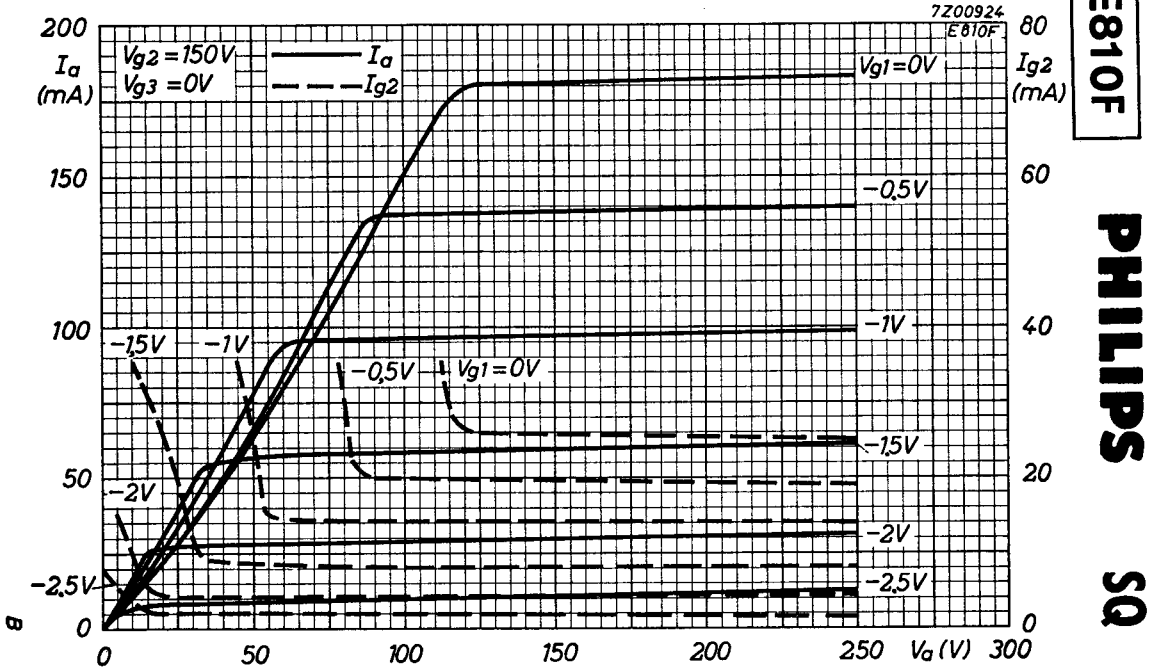

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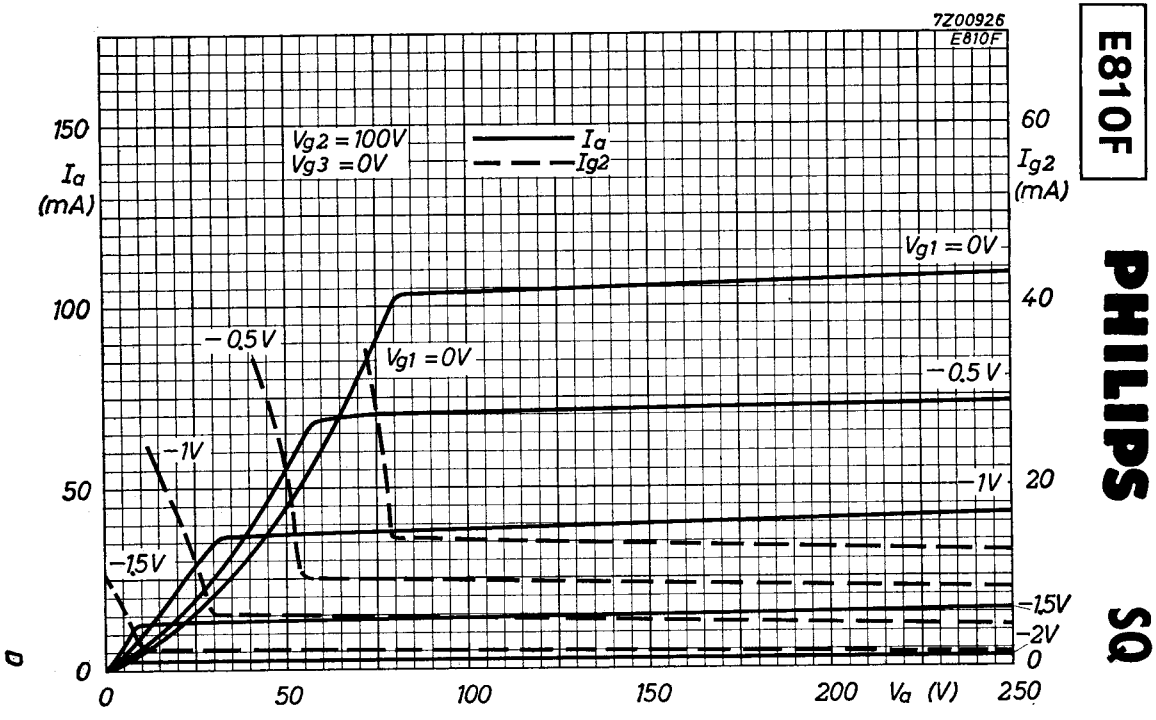
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SQ
150
Ia
(mA)
100
50
0
60
Ig2
(mA)
40
20
0
Vg2 = 100V
Vg3 = 0V
Ia
Ig2
Vg1 = 0V
−0,5 V
−1V
−1,5V
−2V
0
50
100
150
200
Va (V)
250

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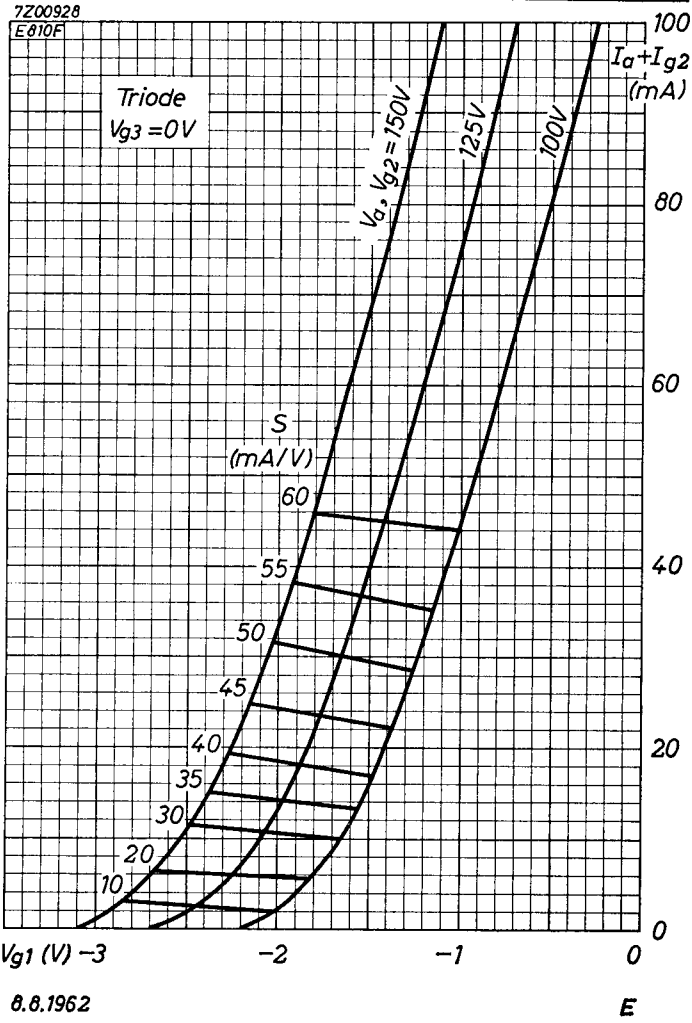

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Electronic Tube

HANDBOOK

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