

SPECIAL QUALITY PENTODE for use in telephone equipment (life longer than 10 000 hours)

PENTHODE À HAUTE SÉCURITÉ pour utilisation dans l'équipement téléphonique (durée plus longue que 10 000 heures)

ZUVERLÄSSIGE PENTODE zur Verwendung in Telephonanlagen (Lebensdauer länger als 10 000 Stunden)

Heating : indirect by A.C. or D.C.; series or parallel supply

Chauffage: indirect par C.A. ou C.C.; alimentation parallèle ou série

Heizung : indirekt durch Wechsel- oder Gleichstrom; Serien- oder Parallelspeisung

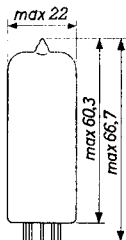
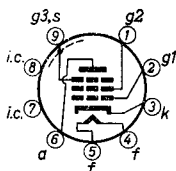
$$V_f = 6,3 \text{ V } ^1)$$

$$I_f = 0,3 \text{ A } ^1)$$

Dimensions in mm

Dimensions en mm

Abmessungen in mm



Base, culot, Sockel: NOVAL

Capacitances	C_a	=	3,6 pF
Capacités	C_a	= max.	4,2 pF
Kapazitäten	C_{g1}	=	8,0 pF
	C_{g1}	= max.	8,7 pF
	C_{ag1}	<	0,015 pF
	C_{g1f}	<	0,15 pF
	C_{kf}	=	4 pF
	$C_{g1} (I_k = 12,1 \text{ mA})$	=	10,8 pF
	$C_{ra} ^2)$	<	0,025 pF
	$C_{rg1} ^2)$	<	0,025 pF

¹⁾²⁾ See page 2
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SPECIAL QUALITY, LONG LIFE PENTODE for use in telephone equipment

HEATING

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

Heater voltage $V_f = 6.3 \text{ V}$

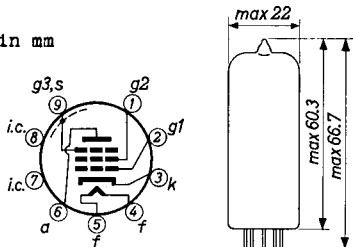
Heater current $I_f = 0.3 \text{ A}$

The maximum deviation of the heater current at $V_f = 6.3 \text{ V}$ is $\pm 15 \text{ mA}$.

In order to obtain a useful life of 10 000 hours in the case of parallel supply, the maximum variation of the heater voltage should be less than $\pm 5 \%$ (absolute limits)

In order to obtain a useful life of 10 000 hours in the case of series supply, the maximum variation of the heater current due to voltage fluctuations and tolerances in the parts should be less than 1.5 % (absolute limits)

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

Heater current

	I	II
Heater voltage	$V_f = 6.3$	V
Heater current	$I_f = 300$	285-315 mA

- 1) The maximum deviation of I_f at $V_f = 6.3$ V is ± 0.015 A. In order to obtain a useful tube life of 10 000 hours in the case of parallel supply, the maximum variation of V_f must be less than $\pm 5\%$ (absolute limits). In order to obtain a useful tube life of 10 000 hours in the case of series supply, the maximum variation of I_f due to voltage fluctuations and tolerances in the parts must be less than $\pm 1.5\%$ (absolute limits).

La déviation de I_f à $V_f = 6,3$ V est de $\pm 0,015$ A aux max. Afin d'obtenir une durée du tube de 10 000 heures en cas d'alimentation parallèle la variation max. de V_f sera moins de $\pm 5\%$ (limites absolues). Afin d'obtenir une durée du tube de 10 000 heures en cas d'alimentation série la variation max. de I_f par suite de fluctuations de la tension et tolérances des accessoires sera moins de $\pm 1,5\%$ (limites absolues).

Die Höchstabweichung von I_f bei $V_f = 6,3$ V ist $\pm 0,015$ A. Zur Erhaltung einer nützlichen Lebensdauer der Röhre von 10 000 Stunden bei Parallelbetrieb muss die max. Schwankung von V_f weniger als $\pm 5\%$ betragen (absolute Grenzen). Zur Erhaltung einer nützlichen Lebensdauer der Röhre von 10 000 Stunden bei Serienbetrieb muss die max. Schwankung von I_f infolge Spannungsschwankungen und Streuungen der Einzelteile weniger als $\pm 1,5\%$ betragen (absolute Grenzen).

- 2) Radiation capacitance. Capacitance of the concerning electrode to a surrounding metal box with an inner diameter of 52 mm and a height of 98 mm, the other electrodes being earthed.

Capacité de rayonnement. Capacité de l'électrode concernante à l'égard d'une boîte métallique entourante avec un diamètre intérieur de 52 mm et une hauteur de 98 mm. Les autres électrodes sont mises à la terre.

Strahlungskapazität. Kapazität zwischen der betreffenden Elektrode und einer Metallbuchse um die Röhre mit einem inneren Durchmesser von 52 mm und einer Höhe von 98 mm. Die übrigen Elektroden der Röhren müssen geerdet sein.

CHARACTERISTICS (continued)

Capacitances

		I	II	III
Grid No.1 to all other elements except anode	C_{g1}	= 8.0	< 8.7	pF
The same at $I_k = 12.1$ mA	C_{g1}	= 10.8		pF
Anode to all other elements except grid No.1	C_a	= 3.5	< 4.1	pF
Anode to grid No.1	C_{ag1}	=	< 0.015	pF
Grid No.1 to heater	C_{g1f}	=	< 0.15	pF
Cathode to heater	C_{kf}	= 4		pF
Radiation capacitance grid No.1	C_{rg1}	=	< 0.025	pF ¹⁾
Radiation capacitance anode	C_{ra}	=	< 0.025	pF ¹⁾

Typical characteristics

		I	II	III
Anode voltage	V_a	= 210		V
Grid No.3 voltage	V_{g3}	= 0		V
Grid No.2 voltage	V_{g2}	= 120		V
Cathode resistor	R_k	= 165		Ω
Anode current	I_a	= 10	8.7-11.3	7 mA
Grid No.2 current	I_{g2}	= 2.1	1.7-2.5	1.25 mA
Mutual conductance	S	= 9	7.8-10.2	6.4 mA/V
Internal resistance	R_i	= 0.5	> 0.3	M Ω
Amplification factor of grid No.2 with respect to grid No.1	μ_{g2g1}	= 38		
Equivalent noise resistance (R.F.)	R_{eq}	= 750	< 1000	Ω
Equivalent noise resistance ($f = 0-10\ 000$ c/s)	R_{eq}	=	< 36	k Ω

		I	II	III
Anode voltage	V_a	= 210		V
Grid No.3 voltage	V_{g3}	= 0		V
Grid No.2 voltage	V_{g2}	= 120		V
Anode current	I_a	= 0.5		mA
Grid No.1 voltage	$-V_{g1}$	= 5	< 5.25	V

¹⁾ Capacitance of the concerning electrode to a surrounding metal box with an inner diameter of 52 mm and a height of 98 mm, the other electrodes being earthed

Typical characteristics
Caractéristiques types
Kenndaten

V_f	=	6,3 V ¹⁾
V_a	=	210 V ¹⁾
V_{g3}	=	0 V ¹⁾
V_{g2}	=	120 V ¹⁾
R_k	=	165 Ω ¹⁾
I_a	=	10 \pm 1,3 mA
I_{g2}	=	2,1 \pm 0,4 mA
S	=	9 \pm 1,2 mA/V
R_1	=	0,5 M Ω
R_i	=	min. 0,3 M Ω
μ_{g2g1}	=	34
R_{eq} (R.F.)	=	750 Ω
R_{eq} (R.F.)	=	max. 1000 Ω
R_{eq} (f = 0-10 kc/s)	=	max. 36 k Ω
$-I_{g1}$ ($R_{g1} = 0,1$ M Ω)	=	max. 0,5 μ A
$-V_{g1}$ ($I_a = 0,5$ mA, $R_k = 0$)	=	5 V
$-V_{g1}$ ($I_a = 0,5$ mA, $R_k = 0$)	=	max. 5,25 V

¹⁾ With a life test under these conditions the life expectancy is 10 000 hours.

The end point of life is reached when one or more of the characteristics have changed to the following values:

En cas d'un essai de durée sous ces conditions la durée prévue est de 10 000 heures.

Le tube est arrivé à la fin de sa durée si une ou quelques-unes des caractéristiques sont changées jusqu'aux valeurs suivantes:

Bei einer Lebensdauerprobe unter diesen Bedingungen ist die erwartete Lebensdauer 10 000 Stunden.

Das Ende der Lebensdauer ist erreicht, wenn eine oder mehrere der Kennwerte bis folgende Werte geändert sind:

I_a	\leq	7 mA
I_{g2}	\leq	1,25 mA
S	\leq	6,4 mA/V
$-I_{g1}$ ($R_{g1} = 0,1$ M Ω)	\geq	1,0 μ A

CHARACTERISTICS (continued)

Negative grid current

		I	II	III
Anode voltage	$V_a = 210$			V
Grid No.3 voltage	$V_{g3} = 0$			V
Grid No.2 voltage	$V_{g2} = 120$			V
Grid No.1 resistor	$R_{g1} = 0.1$			MΩ
Cathode resistor	$R_k = 165$			Ω
Negative grid current	$-I_{g1} =$		< 0.5	1.0 μA

Grid current starting point

		I	II	III
Anode voltage	$V_a = 210$			V
Grid No.3 voltage	$V_{g3} = 0$			V
Grid No.2 voltage	$V_{g2} = 120$			V
Positive grid current	$+I_{g1} = 0.3$			μA
Negative grid voltage	$-V_{g1} =$		< 1.1	V

Hum voltage

		I	II
Anode voltage	$V_a = 210$		V
Grid No.3 voltage	$V_{g3} = 0$		V
Grid No.2 voltage	$V_{g2} = 120$		V
Grid No.1 resistor	$R_{g1} = 0.5$		MΩ
Cathode resistor	$R_k = 165$		Ω
Hum voltage	$V_{g1hum} =$		< 0.5 mV(RMS)

Insulation between heater and cathode

		I	II
Voltage between heater and cathode	$V_{kf} = 100$		V
Series resistor	$R = 1$		MΩ
Current from cathode to heater	$I_{kf} =$		< 15 μA

Insulation between the electrodes

		I	II
Insulation resistance between two arbitrary electrodes	$R_{isol} =$		> 100 MΩ

Hum voltage

Tension de ronflement ($R_{g1} = 0,5 \text{ M}\Omega$) = max. 0,5 mV

Brummspannung

Heater-cathode insulation $V_f = 6,3 \text{ V}$ Isolement filament-cathode $V_{kf} = 100 \text{ V}$ Katoden-Heizfadenisolation $V_{kf} = 100 \text{ V}$

Series resistor

Résistance série = 1 M Ω

Serienwiderstand

 $I_{kf} = \text{max. } 15 \text{ }\mu\text{A}$

Insulation between two arbitrary electrodes

Isolement entre deux électrodes quelconques

Isolation zwischen zwei beliebigen Elektroden

 $R = \text{min. } 100 \text{ M}\Omega$

Operating characteristics

Caractéristiques d'utilisation classe A

Betriebsdaten Klasse A

V_a	=	120	210 V
V_{g3}	=	0	0 V
V_{bg2}	=	120	120 V
R_{g2}	=	5,6	5,6 k Ω
R_k	=	180	180 Ω
I_a	=	8,3	8,3 mA
I_{g2}	=	1,7	1,7 mA
S	=	8,2	8,2 mA/V
R_1	=	0,42	0,44 M Ω
$R_{a\sim}$	=	10	20 k Ω
W_0 ($d_{tot} = 10 \%$)	=	340	660 mW
V_i ($d_{tot} = 10 \%$)	=	1,1	1,1 V_{eff}
W_0 ($I_{g1} = +0,3 \text{ }\mu\text{A}$)	=	400	870 mW ¹⁾
V_i ($W_0 = 50 \text{ mW}$)	=	0,35	0,25 V_{eff}

¹⁾ Measured with a control-grid series resistor of 0.33 M Ω
 Mesuré avec une résistance série dans la grille de commande de 0,33 M Ω

Gemessen mit einem Steuergitterreihenwiderstand von 0,33 M Ω

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

Heater voltage	$V_f = 6.3 \text{ V}$
Anode voltage	$V_a = 210 \text{ V}$
Grid No.3 voltage	$V_{g3} = 0 \text{ V}$
Grid No.2 voltage	$V_{g2} = 120 \text{ V}$
Cathode resistor	$R_k = 165 \Omega$

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

OPERATING CHARACTERISTICS, class A

Anode voltage	$V_a = 120$	210 V
Grid No.3 voltage	$V_{g3} = 0$	0 V
Grid No.2 supply voltage	$V_{bg2} = 120$	120 V
Grid No.2 resistor	$R_{g2} = 5.6$	5.6 k Ω
Cathode resistor	$R_k = 180$	180 Ω
Anode current	$I_a = 8.3$	8.3 mA
Grid No.2 current	$I_{g2} = 1.7$	1.7 mA
Mutual conductance	$S = 8.2$	8.2 mA/V
Internal resistance	$R_i = 0.42$	0.44 M Ω
Load resistance	$R_{a\sim} = 10$	20 k Ω
Input voltage	$V_i = 1.1$	1.1 V(RMS)
Output power	$W_o = 340$	660 mW
Total distortion	$d_{tot} = 10$	10 %
Grid No.1 resistor	$R_{g1} = 0.33$	0.33 M Ω
Grid No.1 current	$I_{g1} = +0.3$	+0.3 μ A
Output power	$W_o = 400$	870 mW
Input power	$V_i = 0.35$	0.25 V(RMS)
Output power	$W_o = 50$	50 mW

Limiting values (Design centre values)
 Caractéristiques limites (Valeurs moyennes)
 Grenzdaten (Mittlere Entwicklungsdaten)

V_{a0}	= max.	550 V
V_a	= max.	210 V
W_a	= max.	2,1 W
V_{g20}	= max.	550 V
V_{g2}	= max.	210 V
W_{g2}	= max.	0,35 W
$-V_{g1}$ ($I_{g1} = +0,3 \mu A$)	= max.	1,1 V
$-V_{g1}$	= max.	100 V
$-V_{g1p} \left\{ \begin{array}{l} T_{imp} = 200 \mu sec \\ \delta = 10 \% \end{array} \right\}$	= max.	200 V
W_{g1}	= max.	50 mW
R_{g1}	= max.	1 M Ω ¹⁾
I_k	= max.	16 mA
$I_{kp} \left\{ \begin{array}{l} T_{imp} = 200 \mu sec \\ \delta = 10 \% \end{array} \right\}$	= max.	80 mA
V_{kf}	= max.	100 V
R_{kf}	= max.	20 k Ω
Bulb temperature		
Température de l'ampoule	= max.	170 °C ²⁾
Kolbentemperatur		

¹⁾ Automatic grid bias
 Polarisation de grille par résistance cathodique
 Automatische Gittervorspannung

²⁾ Absolute maximum
 Maximum absolue
 Absolutes Maximum

LIMITING VALUES (Design centre limits)

Anode voltage in cold condition	V_{a0}	= max.	550 V
Anode voltage	V_a	= max.	210 V
Anode dissipation	W_a	= max.	2.1 W
Grid No.2 voltage in cold condition	V_{g20}	= max.	550 V
Grid No.2 voltage	V_{g2}	= max.	210 V
Grid No.2 dissipation	W_{g2}	= max.	0.35 W
Negative grid No.1 voltage	$-V_{g1}$	= max.	100 V
Peak negative grid No.1 voltage	$-V_{g1 p}$	= max.	200 V ¹⁾
Grid No.1 dissipation	W_{g1}	= max.	50 mW
Grid No.1 circuit resistance with automatic bias	R_{g1}	= max.	1 M Ω
Cathode current	I_k	= max.	16 mA
Peak cathode current	I_{kp}	= max.	80 mA ¹⁾
Voltage between heater and cathode	V_{kf}	= max.	100 V
Circuit resistance between heater and cathode	R_{kf}	= max.	20 k Ω
Bulb temperature	t_{bulb}	= max.	170 °C ²⁾

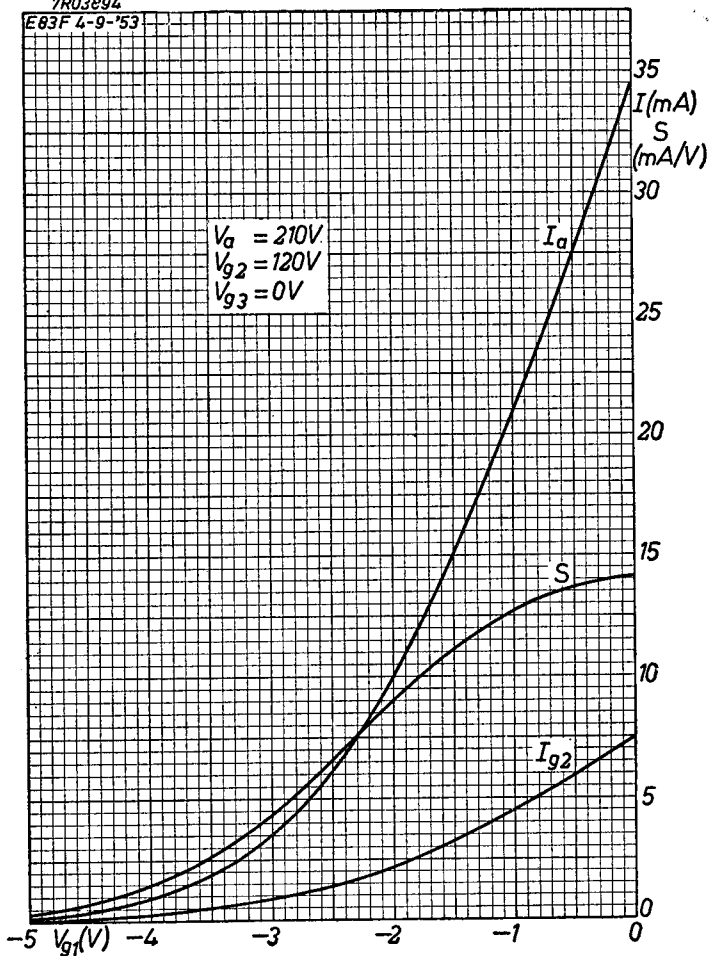
¹⁾ Pulse duration max. 200 μ sec at a duty factor of 10%.

²⁾ Absolute limit

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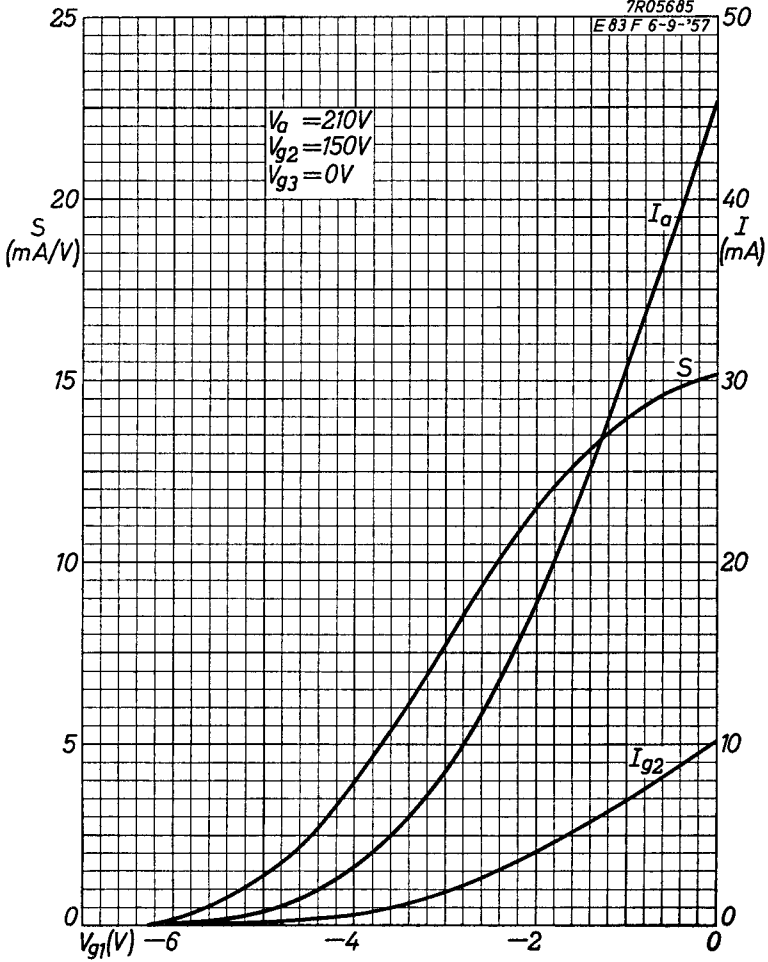
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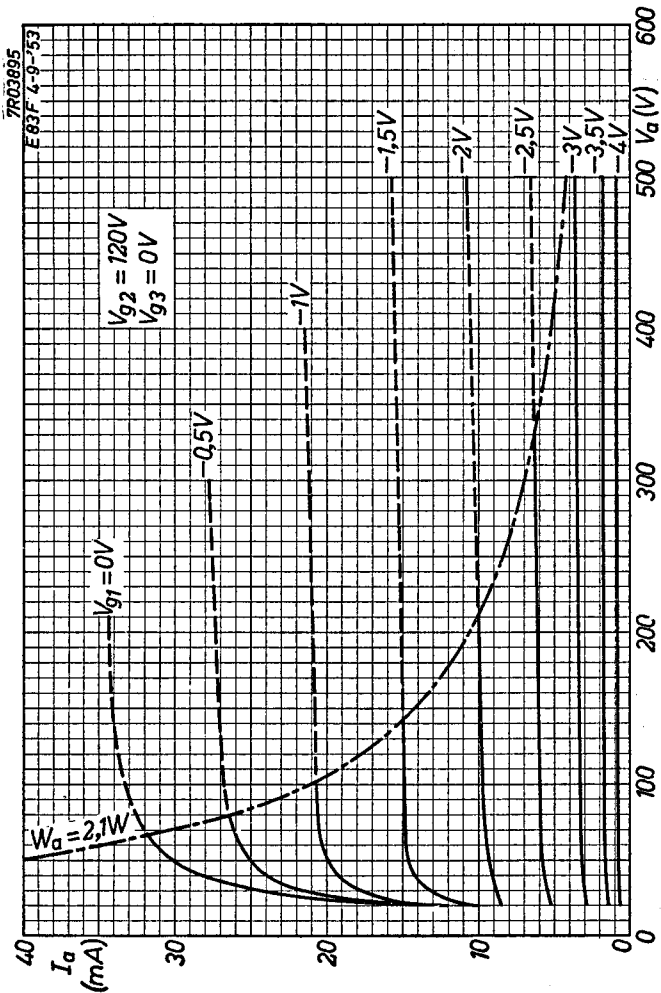
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$V_a = 210V$
 $V_{g2} = 150V$
 $V_{g3} = 0V$



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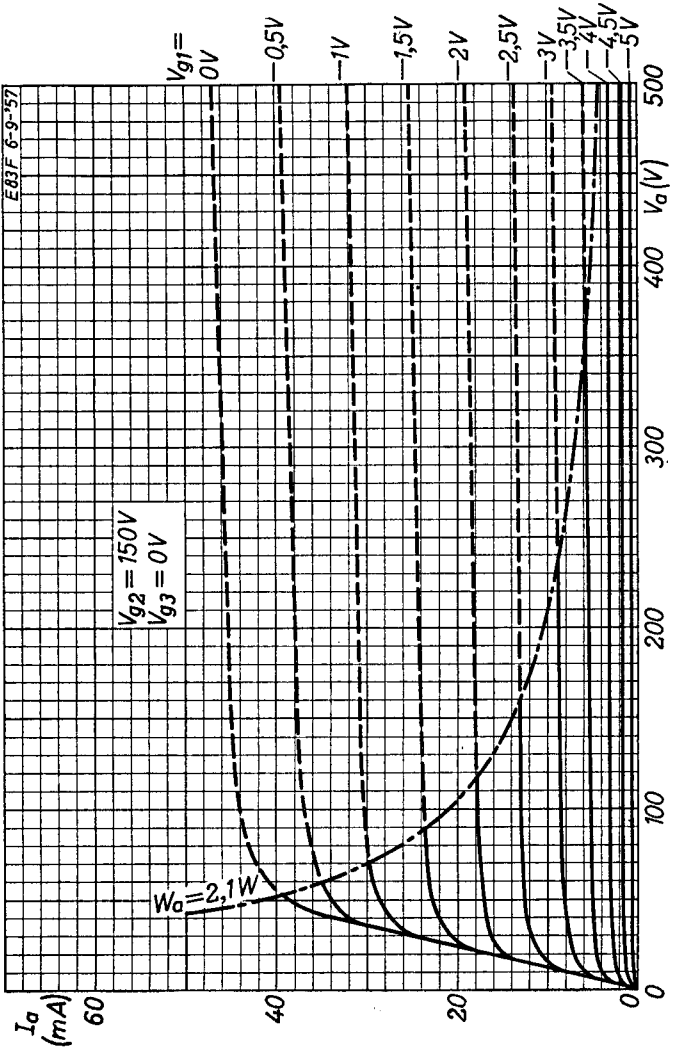
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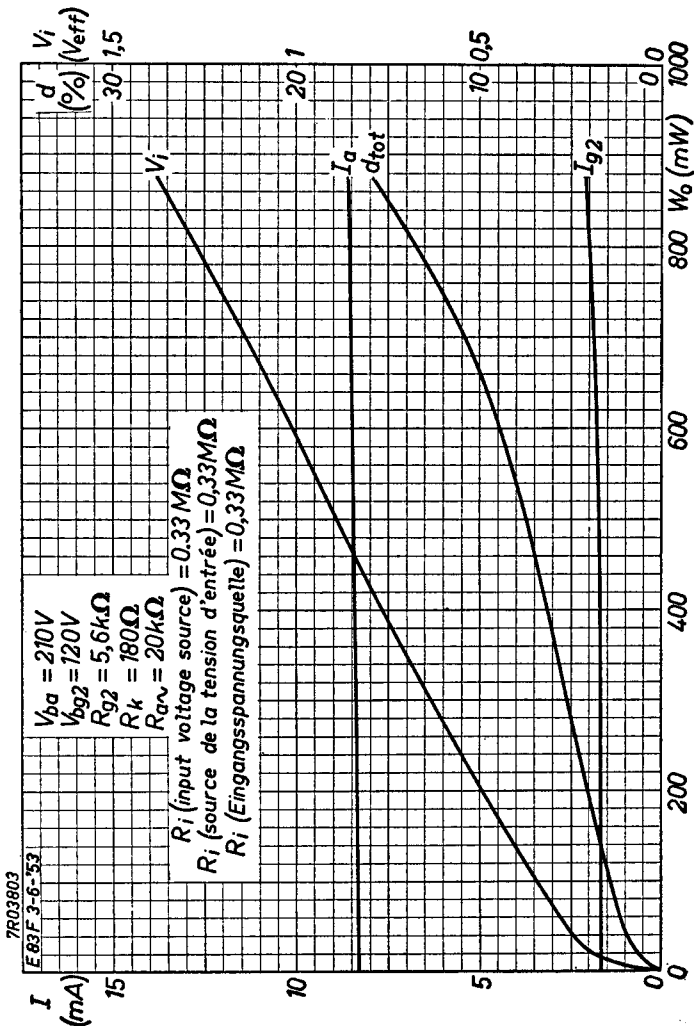
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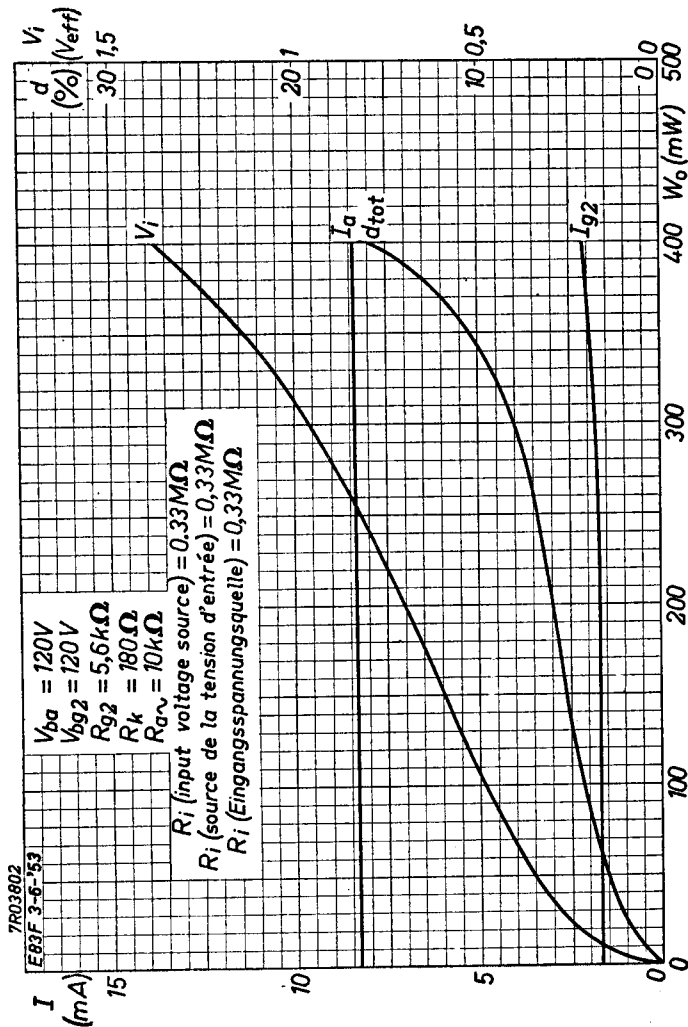
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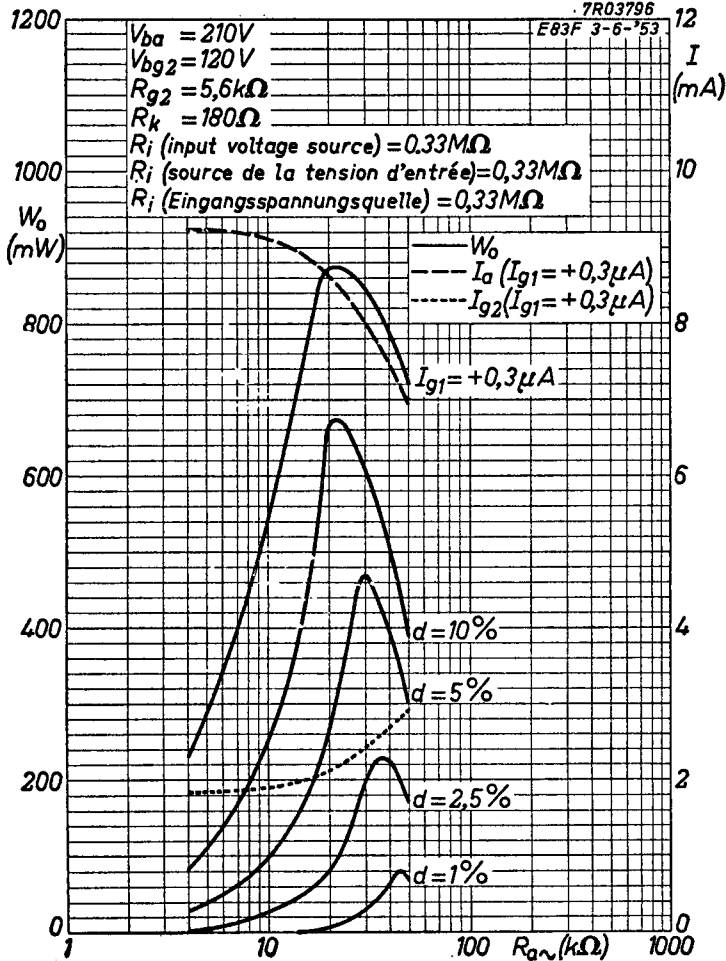
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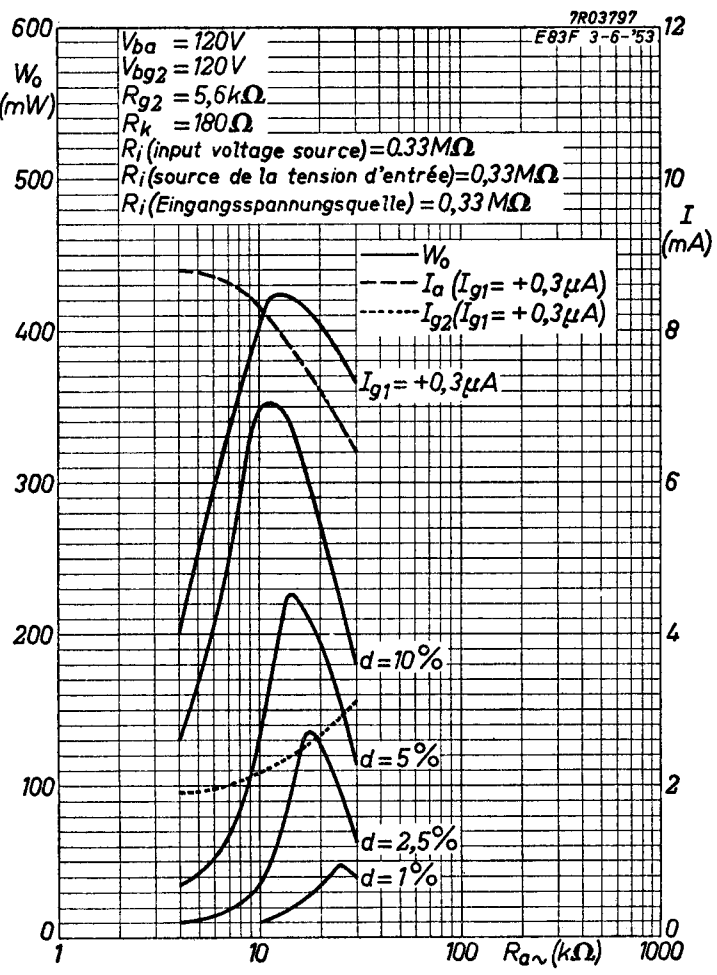
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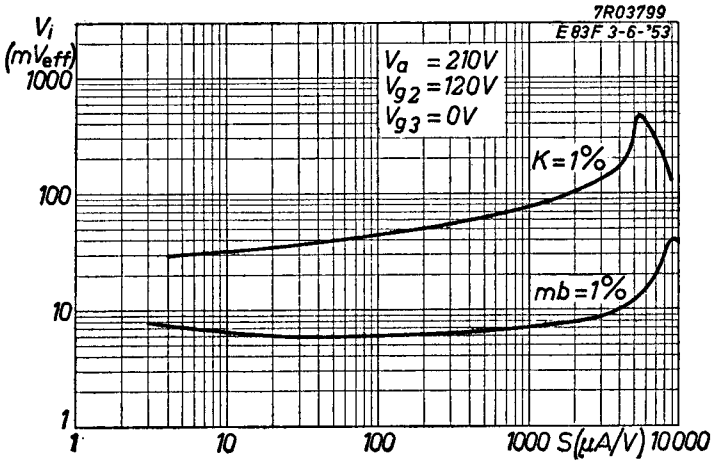
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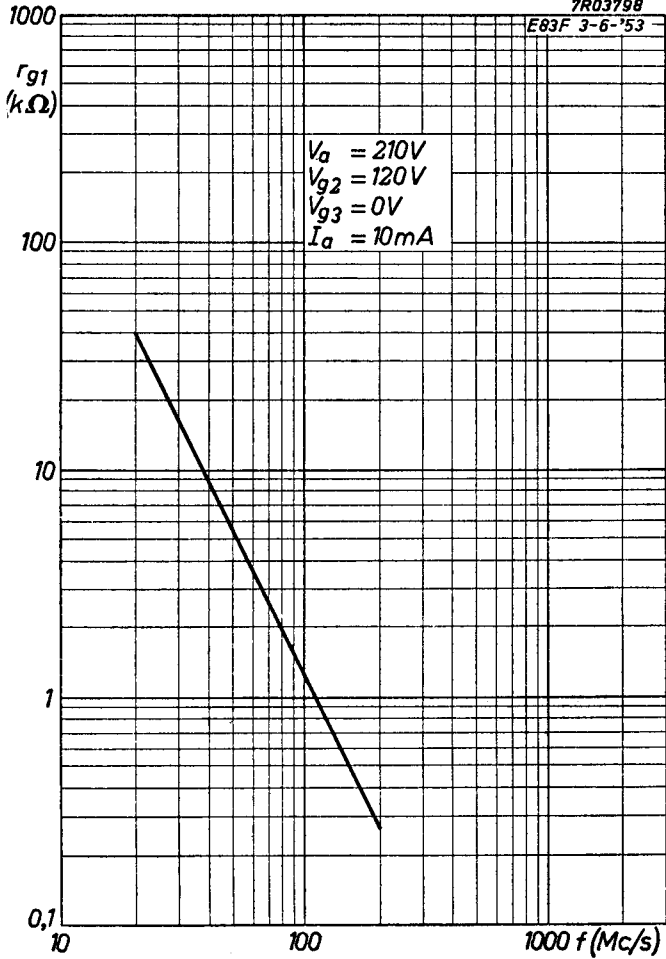


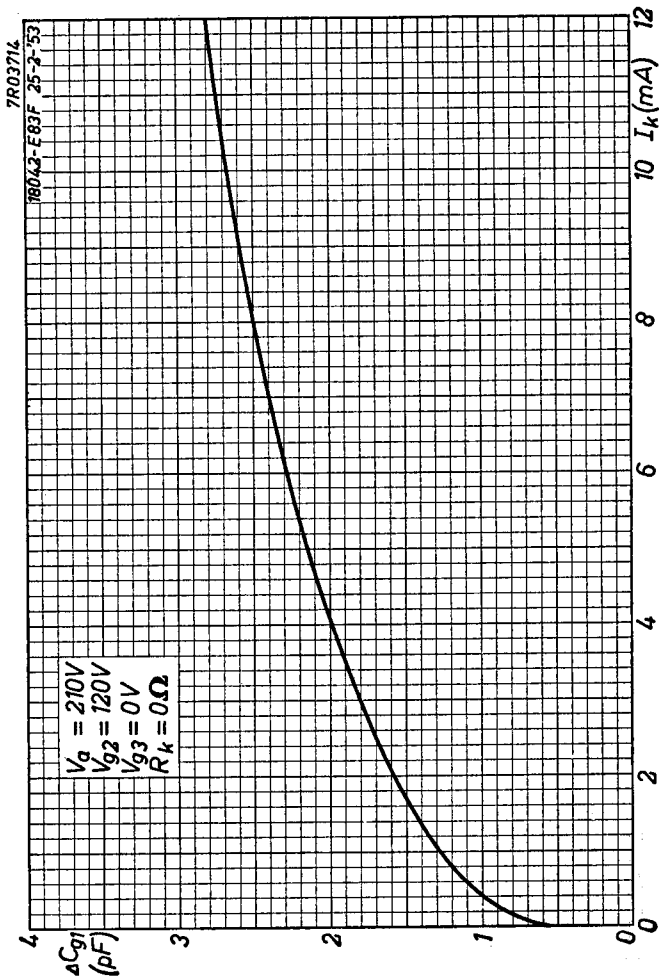
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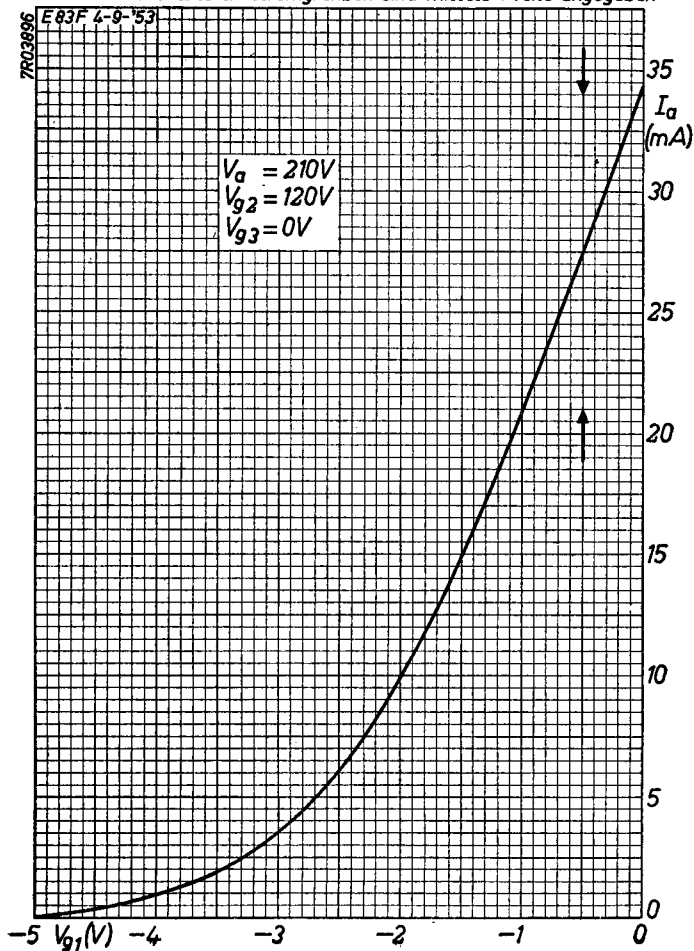
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Upper and lower current limits are indicated by arrows
Les limites supérieures et inférieures du courant sont indiquées par des flèches
Die oberen und unteren Stromgrenzen sind mittels Pfeile angegeben



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*Electronic
Tube*

HANDBOOK

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