DF 21 R.F. Pentode

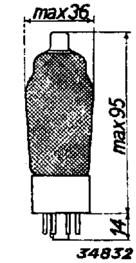
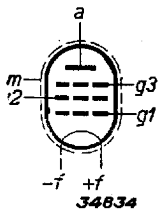


Fig. 1
Dimensions in mm.



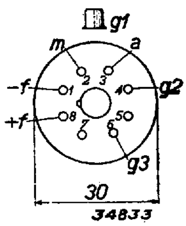


Fig. 2
Arrangement and sequence of contacts.

The DF 21 is a directly heated pentode with a 1.4 V filament, taking a current of 25 mA. As explained in the Introduction, this extremely low current consumption has been made possible by reducing the thickness of the emissive layer and using high tensile material for the filament, to produce the thinnest possible wire, together with a reduction of the space between the cathode surface and the grid.

The result is a valve which as far as current consumption is concerned is very economical in use and yet has exceptionally good electrical properties. In conjunction with the DK 21, DAC 21, DL 21, this valve enables a receiver to be built of which the total filament current is only 150 mA.

The DF 21 is suitable for R.F., I.F. and A.F.amplification. Although the control grid is of the constant pitch type, the valve, when employed as R.F. or I.F.amplifier, can be controlled by varying the grid bias. It can thus be included in the A.G.C. system, although the cross modulation curve is naturally not so good as in the case of a valve having a variable-pitch grid. Used as resistance-capacitance coupled A.F.amplifier, the DF 21 gives a gain factor of 85. The filament may be series—or parallel—fed and the valve is therefore suitable for use in AC/DC-battery receivers.

FILAMENT RATINGS

Filament supply: direct, by means of a battery, rectified alternating current or D.C. Series or parallel supply.

Filament voltage	V_f	= 1.4	V
Filament current	I_f	= 0.025	A

CAPACITANCES

Anode-grid	C_{ag_1}	< 0.006	pF
Control grid-all other electrodes	C_{g_1}	= 5.3	pF
Anode-all other electrodes	C_a	= 7.1	pF

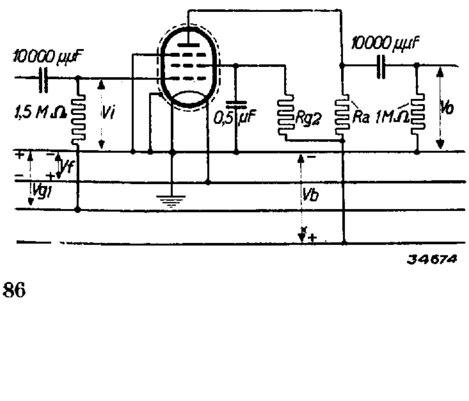


Fig. 3
Circuit diagram illustrating the symbols employed in the Operating Data

OPERATING DATA, valve employed as R.F. and I.F. amplifier

Anode voltage	V_a	= 90 V			
Screen voltage	V_{g2}	= 90 V			
Suppressor grid voltage	V_{g3}	= 0 V			
Grid bias	V_{g1}	= 0 V[1]	—3.5 V[2]	—0.5 V[1]	—3.6 V[2]
Anode current	I_a	= 1.2 mA	—	0.85 mA	—
Screen grid current	I_{g2}	= 0.25 mA	—	0.18 mA	—
Mutual conductance	S	= 700	7 μA/V	620	6.2 μA/V
Internal resistance	R_i	= 2	> 10 M Ohms	3	> 10 M Ohms
Gain factor in respect of screen grid	μ_{g2g1}	= 30	—	30	—

Anode voltage and supply voltage to screen grid resistance	$V_a = V_b$	= 120 V			
Suppressor grid voltage	V_{g3}	= 0 V			
Screen grid resistance	R_{g2}	= 0.12 M Ohms			
Grid bias	V_{g1}	= 0 V[1]	— 4.5 V[2]	—0.5 V[1]	—4.6 V[2]
Anode current	I_a	= 1.2 mA	—	1 mA	—
Screen grid current	I_{g2}	= 0.25 mA	—	0.21 mA	—
Screen grid voltage	V_{g2}	= 90	120 V	95	120 V
Mutual conductance	S	= 700	7μA/V	660	6.6μA/V
Internal resistance	R_i	= 2.5	> 10 M Ohms	3	> 10 M Ohms
Gain factor in respect of screen grid	μ_{g2g1}	= 30	—	30	—

[1]) Valve not controlled.
[2]) Mutual conductance controlled to 1/100.

OPERATING DATA, valve employed as A.F. amplifier, resistance-capacitance coupled.

Battery voltage	V_b	= 90 V		120 V	
Anode resistance	R_a	= 0.5	0.2 M Ohms	0.5	0.2 M Ohms
Screen grid resistance	R_{g2}	= 2	1 M Ohm	2	1 M Ohm
Grid bias	V_{g1}	= —0.5	—0.5 V	—0.5	—0.5 V
Anode current	I_a	= 0.10	0.17 mA	0.15	0.28 mA
Screen current	I_{g2}	= 0.02	0.034 mA	0.032	0.056 mA
Required alternating grid voltage for an effective output voltage $V_{o\ eff}$ = 3 V	$V_{i\ eff}$	= 0.043	0.056 V	0.035	0.044 V
Voltage gain	V_o/V_i	= 69	53	85	68
Total distortion at an alternating output voltage $V_{o\ eff}$ = 3 V	d_{tot}	= 1.2	1.6 %	0.8	0.75 %

MAXIMUM RATINGS

Anode voltage	V_a	= max. 135 V
Anode dissipation	W_a	= max. 0.2 W
Screen grid voltage	V_{g2}	= max. 135 V
Screen grid dissipation	W_{g2}	= max. 0.1 W
Cathode current	I_k	= max. 2.5 mA
Grid current commences (I_{g1} = +0.3 μA)	V_{g1}	= max. —0.2 V
Max. external resistance between grid and filament . .	R_{g1f}	= max. 3 M Ohm
Minimum limit of filament voltage	V_f	= min. 1.1 V
Maximum limit of filament voltage.	V_f	= max. 1.5 V

APPLICATIONS

As already stated, the DF 21 can be used for R.F., I.F. and A.F.amplification. The maximum anode voltage is 120 V and screen voltage 90 V. If the battery voltage is in excess of 90 V it is advisable, when employing the valve as R.F. or I.F. amplifier, to feed the screen through a resistance (sliding screen voltage). If the valve is not controlled, no grid bias is necessary, but at higher screen voltages than 90 V grid bias must be applied to avoid exceeding the values specified for anode and screen dissipation and cathode current.

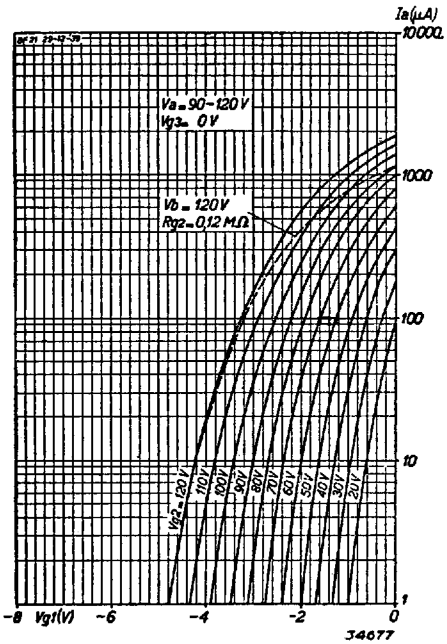


Fig. 4
Anode current as a function of grid bias at Va = 90 — 120 V, with Vg_2 as parameter. The broken line represents the conditions for the controlled valve, with the screen fed from the 120 V source through a resistance of 0.12 M Ohm.

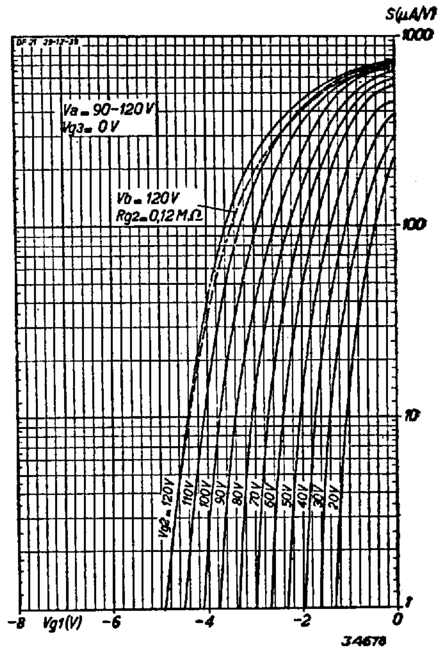


Fig. 5
Mutual conductance as a function of grid bias, at Va = 90 — 120 V, with Vg_2 as parameter. The broken line represents the conditions for the controlled valve, with the screen fed from the 120 V source through a resistance of 0.12 M Ohm.

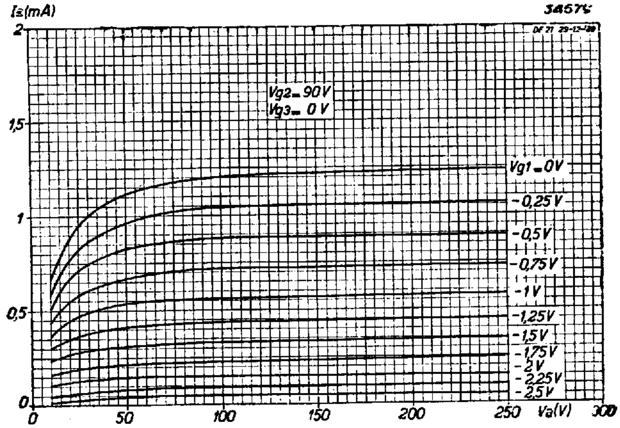


Fig. 6
Anode current as a function of anode voltage, at $Vg_2 = 90$, with Vg_1 as parameter.

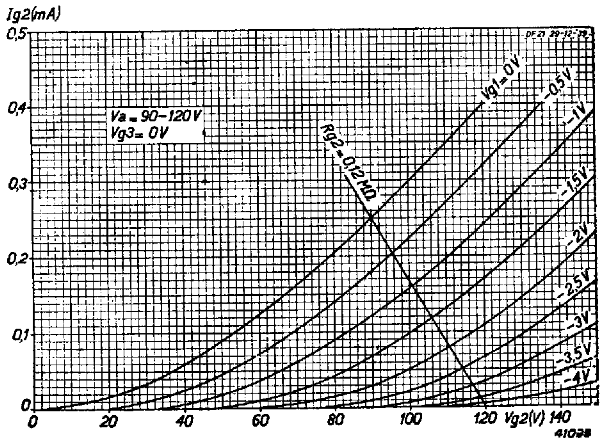


Fig. 7
Screen current as a function of screen voltage, at Va = 90—120 V, with Vg_1 as parameter.

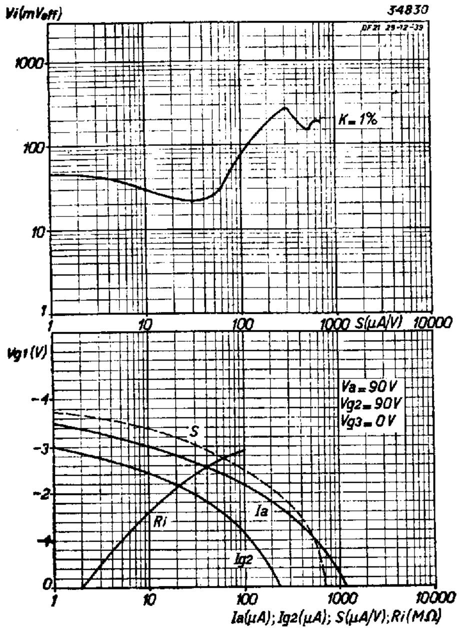


Fig. 8

Upper diagram; Effective value of alternating grid voltage as a function of mutual conductance with 1 % cross modulation, at $Va = Vg_2 = 90$ V.

Lower diagram. Mutual conductance S, anode current Ia, screen current Ig_2 and internal resistance Ri as function of grid bias, at $Va = Vg_2 = 90$ V.

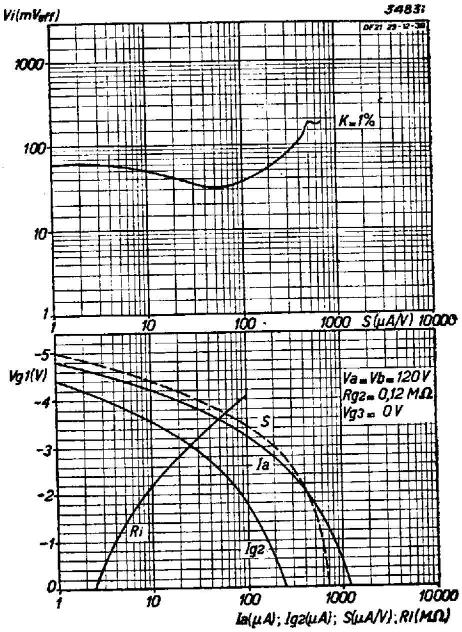


Fig. 9

Upper diagram. Effective value of alternating grid voltage as a function of mutual conductance with 1 % cross modulation, at $Va = Vg_2 = 120$ V.

Lower diagram. Mutual conductance S, anode current Ia, screen current Ig_2, and internal resistance Ri as function of grid bias, at $Va = Vb = 120$ V.

When the valve is employed as R—C coupled A.F.amplifier, it is necessary that the input voltage, to give an output of 50 mW (sensitivity), be not less than 25 mV, if microphony is to be avoided. Standard precautions have to be taken in the case of series-parallel circuits (p. 82).

It should be noted, further, that although the data supplied with respect to R.F. and I.F.amplification includes a setting of the valve with 0 V grid bias in the uncontrolled condition, the possibility of grid current occurring is not wholly absent (the limit value at which grid current commences to flow is —0.2 V). As a general rule, however, the amount of grid current will be negligible and not give rise to any difficulties, since the DF 21 usually has sufficient grid bias by reason of the A.G.C. The advantage of this setting is that the valve, when not controlled, needs no separate source of grid bias (e.g. from a battery).