S.H.F. DISC-SEAL TRIODES EC 56 and EC 57

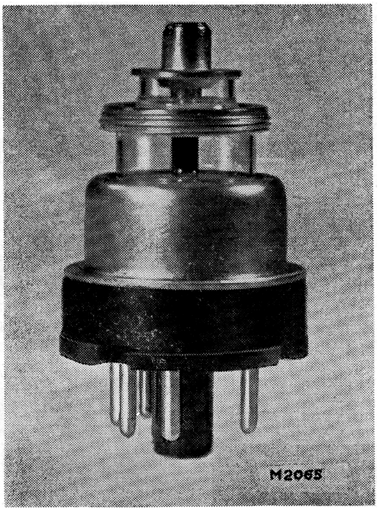

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Fig. 36. Photograph of the tubes EC 56 and EC 57 (actual size).

The EC 56 and EC 57 are indirectly heated disc-seal triodes, intended for use as oscillators or broad-band amplifiers in microwave relay stations at frequencies up to about 4000 Mc/s.

Both types are mechanically identical; they only differ in electrical properties.

Special features of these tubes are:

a. low operating voltages, obtained with a common power supply;
b. high efficiency compared with klystrons operating at the same frequency.

Owing to their special construction, the tubes are very suitable for insertion in coaxial lines and waveguide circuits, in which the grid serves as a separation between the anode and cathode circuit.

The grid disc is threaded to ensure solid mounting and good r.f. contact. Consequently the tube should be screwed into its circuit.

The application of a planar 'L'-cathode allows a great current density. The clearance between the grid and the heated cathode is 40 μ approx. The cathode is directly connected with the corresponding disc, which provides the cathode r.f. connection.

The EC 56 is suitable for use as a general-purpose low-level amplifier, delivering a max. output of 1 watt aprrox. at 4000 Mc/s, at a bandwidth of 50 Mc/s. At frequencies up to about 2500 Mc/s, the EC 56 can be used advantageously as a low-noise pre-amplifier.

The EC 57 is specially intended for use as a power amplifier, as such delivering a power output of 3 watts approx. at 4000 Mc/s, at a bandwidth of 50 Mc/s.

The combined use of the EC 56 and EC 57 provides the possibility of constructing microwave link systems in the 4000 Mc/s band, the EC 57 being used as an output tube and the EC 56 as its driver. A two-stage amplifier of this kind has a low level gain (100 mW output power) of 29 dB (25 dB resp.) at an overall flat transmission bandwidth of 35 Mc/s (50 Mc/s resp.) between the 0.1 dB points. When the output is increased to 1.5 watt (1 watt resp.), the total gain drops to about 25 dB (21 dB resp.) and the bandwidth is slightly increased.

GENERAL DATA OF THE EC 56 and EC 57 (tentative data)

Heating: indirect by a.c. or d.c.; parallel supply only

Heater voltage	6.3 V [1]
Heater current	0.65 A

CAPACITANCES

Inter-electrode capacitances

Anode to grid	1.6 pF
Anode to cathode	20 mpF
Grid to cathode	2.2 pF

MAXIMUM RATINGS (absolute maxima)

Anode voltage at zero anode current	500 V
Anode voltage	300 V
Anode dissipation	10 W
Cathode current EC 56	35 mA
Cathode current EC 57	70 mA
Grid current	10 mA
Grid positive bias	0 V
Grid negative bias	—50 V
Heater to cathode voltage (cathode positive)	50 V
Anode seal temperature	200 °C [2]
Grid seal temperature	75 °C [2]
Cathode seal temperature	75 °C [2]

INSULATION *k/f*

Heater-cathode current with a heater-cathode voltage of 50 V and a heater voltage of 6.3 V is maximum 100 μA.

INVERSE GRID CURRENT

At a heater voltage of 6.3 V and an anode dissipation of 10 W, the inverse grid current is maximum 0.6 μA.

DIMENSIONS: See outline

BASE CONNECTIONS

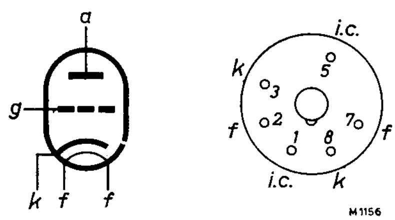

Fig. 37. Electrode arrangement and base connections (modified octal base).

[1] [2] See page 35.

TECHNICAL DATA of the EC 56 (tentative data)

Typical characteristics as amplifier

Anode voltage		180 V
Anode current		30 mA
Grid voltage		—3.5 V
Mutual conductance		16 mA/V
Amplification factor		35

Operating conditions as amplifier at 4000 Mc/s

Anode supply voltage		220 V
Grid supply voltage		+40 V
Cathode bias resistor		[3]
Anode current		30 mA
Bandwidth (between half-power points)	100	50 Mc/s[4]
Power gain at 1 mW output power	13	17 dB
Output power at 8 dB power gain	0.6	1.2 W

TECHNICAL DATA of the EC 57 (tentative data)

Typical characteristics at amplifier

Anode voltage	180 V
Anode current	60 mA
Grid voltage	—1.8 V
Mutual conductance	19 mA/V
Amplification factor	35

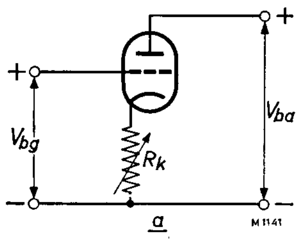

Fig. 38. Recommended d.c. circuit for the EC 56 and EC 57.

[1]) To prolong the life of the tube, the maximum variation of the heater voltage should be less than ± 2% (absolute limits).

[2]) Low velocity air flow may be required.

[3]) To obtain good stability, a variable resistor of maximum 2000 ohms is necessary. It should be adjusted so as to obtain the desired anode current. In this way negative direct current feedback is introduced (see fig. 38).

[4]) The given bandwidth is obtained by adjusting the coupling between the anode circuit and the output waveguide. The anode circuit impedance, referred to the output waveguide, presents a voltage standing-wave ratio, which varies from 3 to 15, depending on the tube and the bandwidth.

Operating conditions as amplifier at 4000 Mc/s

Anode supply voltage				220	V
Grid supply voltage				+40	V
Cathode bias resistor					3)
Anode current	45		60		mA
Bandwidth (between half-power points)	100	50	100	50	4)
Power gain at 1 mW output	13.8	17.5	14.0	17.6	dB
Output power at 8 dB power gain	1.2	2.4	1.6	3.2	W

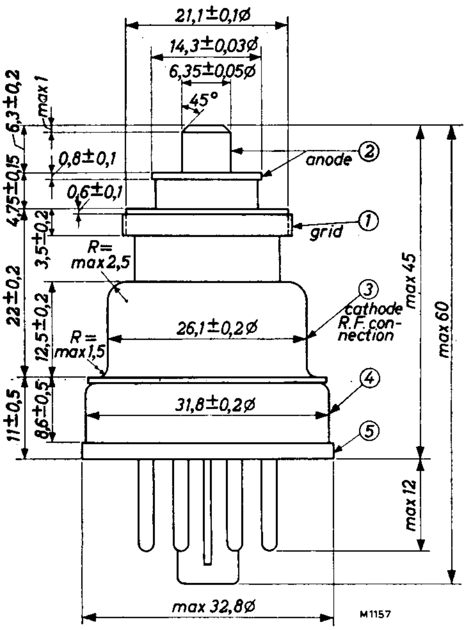

Fig. 39. Dimensional drawing); dimensions in mm.*
Data of thread of the grid disc:
32 turns per inch; thread angle 60°

minor diameter: 21.22		+ 0 *mm* / — 0.15 *mm*
major diameter: 22.2		+ 0 *mm* / — 0.15 *mm*
effective diameter:	*21.68*	+ 0 *mm* / — 0.09 *mm*

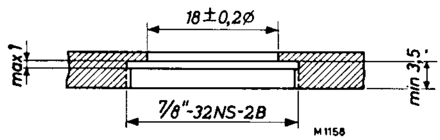

Fig. 40. Recommended mount); dimensions in mm.*
Data of thread:
32 turns per inch; thread angle 60 °

minor diameter: 21.51		+ 0 *mm* / — 0.15 *mm*
major diameter: min 22.23 mm		
effective diameter:	*21.83*	+ 0 *mm* / — 0.12 *mm*

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3) 4) See page 35.

*) The following points should be considered with respect to the maximum eccentricities, referring to the figures 1 to 5 within the small circles in fig. 39.

(1) The eccentricities are given with respect to the axis of the threaded hole shown in fig. 40, the grid disc of the tube being screwed firmly against the flange (with inner diameter of 17 mm).

(2) Maximum eccentricity of the anode 0.15 mm.

(3) Maximum eccentricity of the cathode R.F. connection 0.20 mm.

(4) The tolerance of the eccentricity of the base is such that this base fits into a hole with a diameter of 32.5 mm, provided this hole is correctly centred with respect to the axis of the hole specified in fig. 40.

(5) The tolerance of the eccentricity of the base flange is such that this base flange fits into a hole with a diameter of 33.5 mm, provided this hole is correctly centred with respect to the axis of the hole specified in fig. 40.

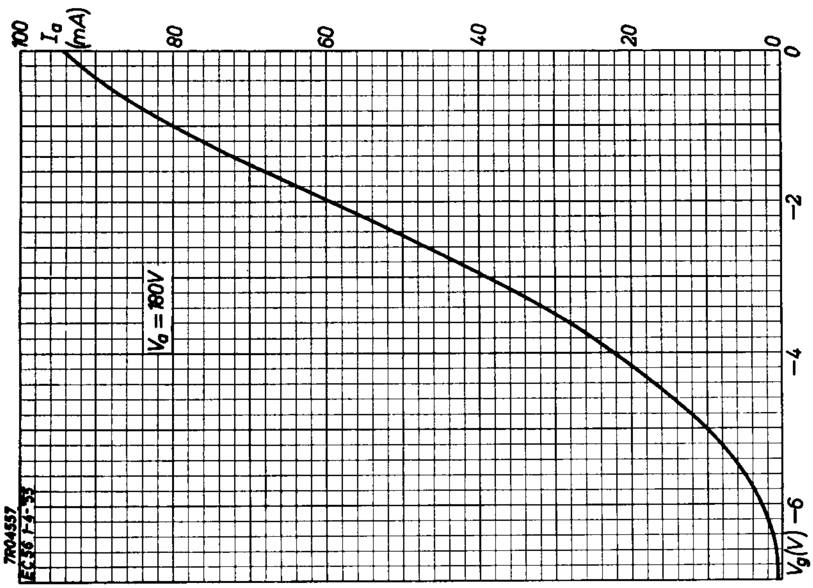

Fig. 41. I_a/V_g *characteristic of the EC 56 at an anode voltage of 180 V.*

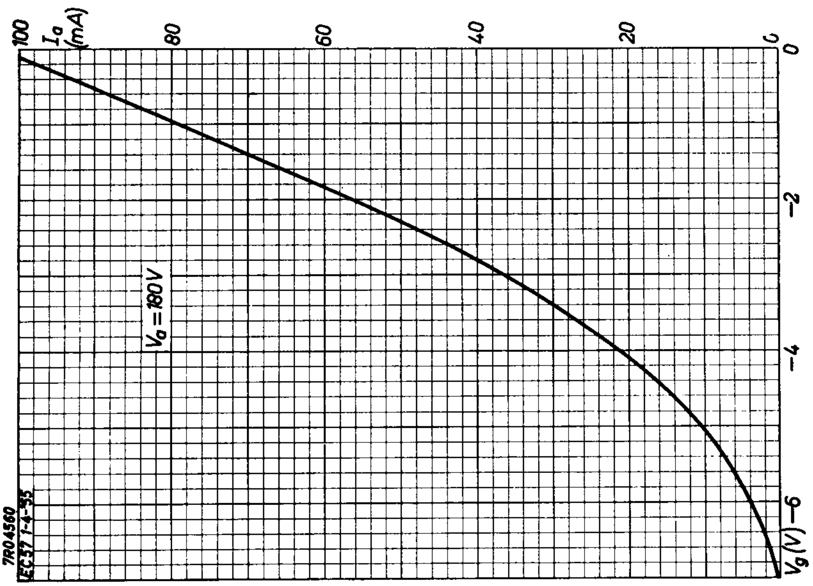

Fig. 42. I_a/V_g *characteristic of the EC 57 at an anode voltage of 180 V.*

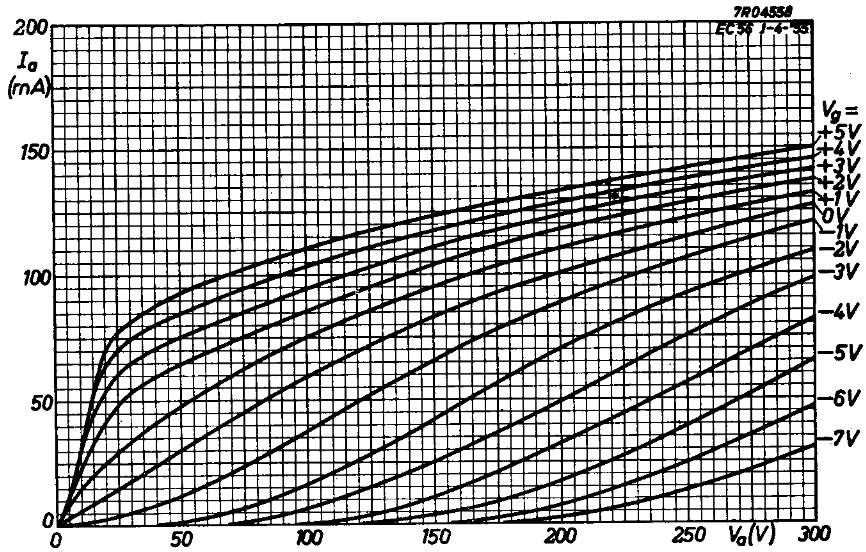

Fig. 43. I_c/V_c *characteristics of the EC 56.*

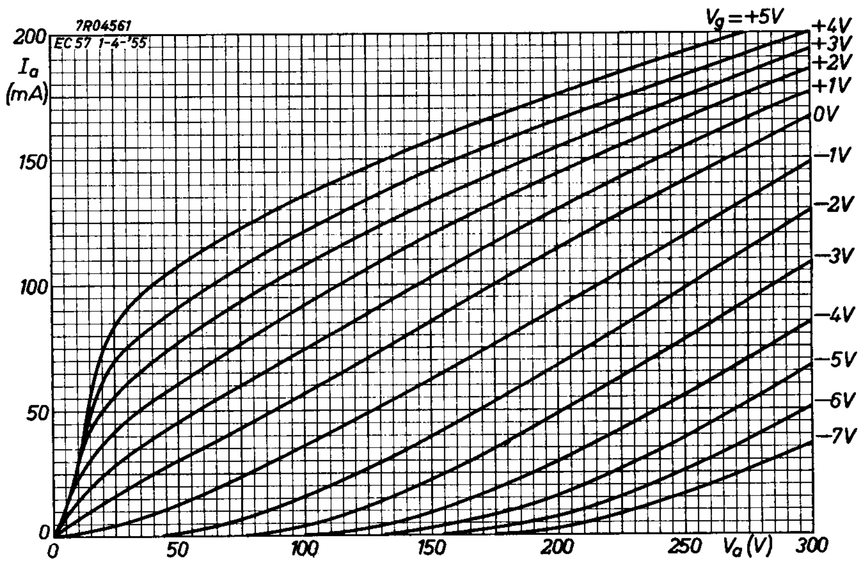

Fig. 44. I_a/V_a *characteristics of the EC 57.*

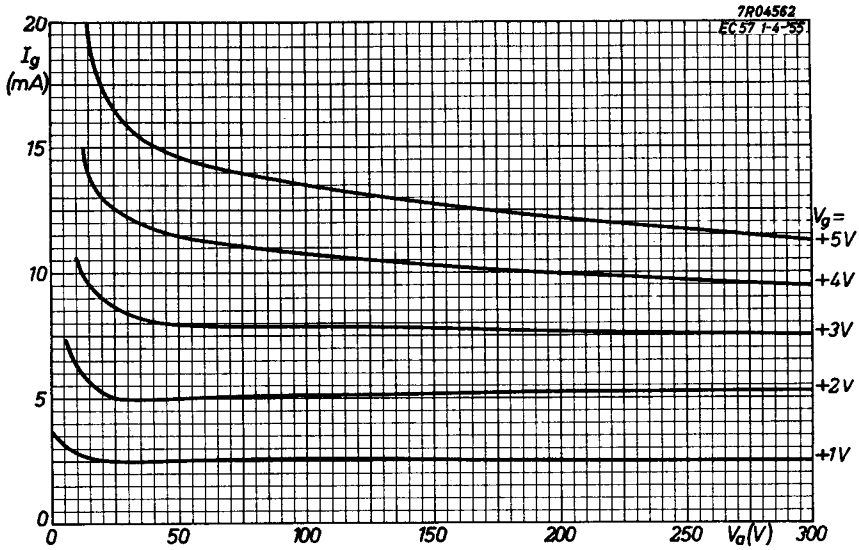

Fig. 45. I_g/V_a characteristics of the EC 57.

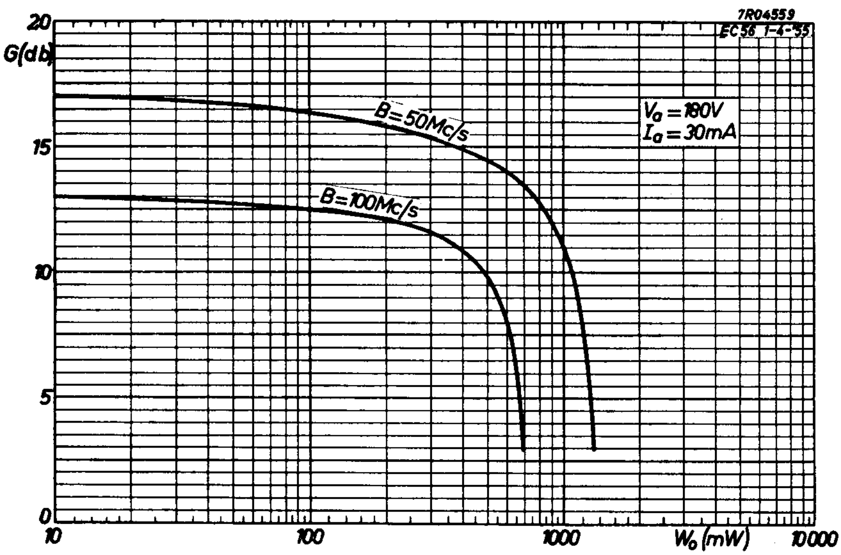

Fig. 46. Power gain G of the EC 56 as a function of the output power W_0 with the bandwidth B as parameter at an anode current $I_a = 30$ mA.

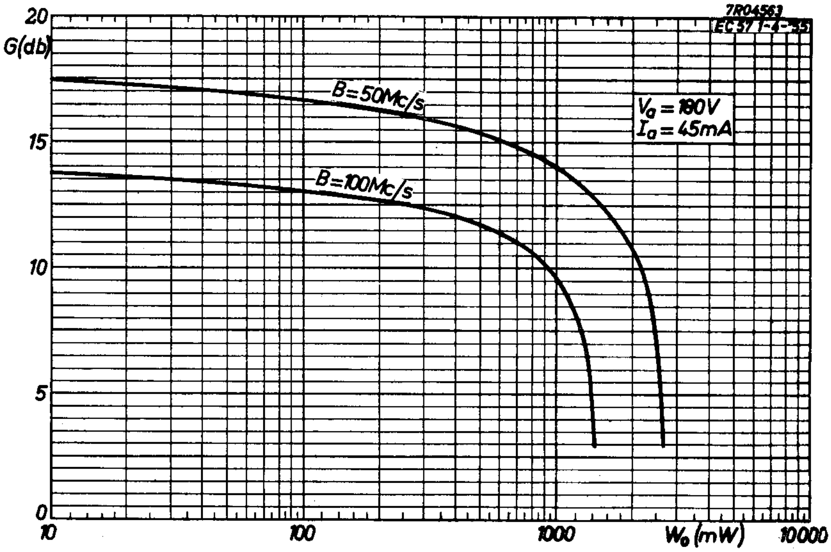

Fig. 47. Power gain G of the EC 57 as a function of the output power W_o with the bandwidth B as parameter at an anode current $I_a = 45$ mA.

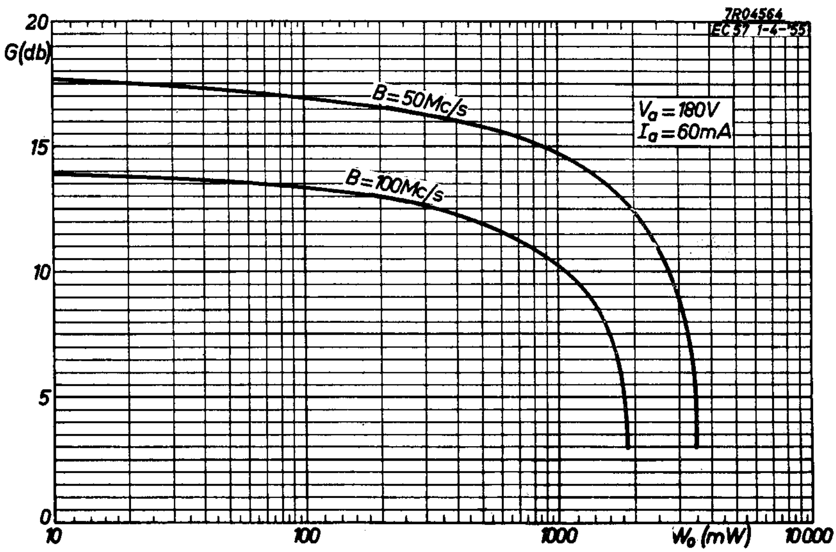

Fig. 48. Power gain G of the EC 57 as a function of the output power W_o with the bandwidth B as parameter at an anode current $I_a = 60$ mA.