

EZ 40 Full-wave rectifier

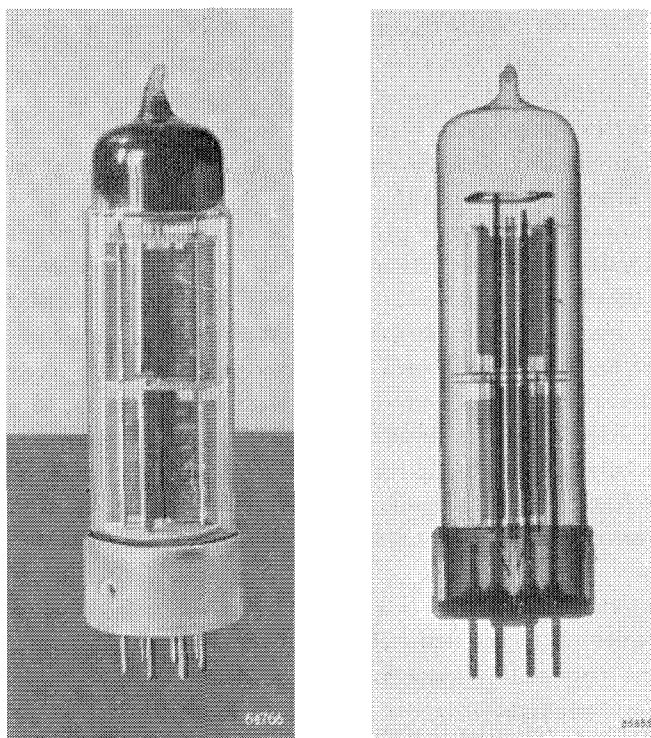


Fig. 1

Normal and X-ray photographs of the EZ 40 (approximately actual size).

The EZ 40 is an indirectly heated full-wave rectifier capable of delivering a maximum of 90 mA D.C. The maximum permissible alternating input voltage for each half of the valve is 350 V_{RMS} . For an appreciation of the advantages which indirectly heated rectifiers have over the directly heated type, the cathode warming-up time should be compared with that of the other valves in the receiver. In directly heated rectifiers, the filament reaches its working temperature very soon after the set has been switched on, so that the valve very soon supplies voltage. The other valves, however, take much longer to warm up and use no current in the meantime, with the result that the D.C. voltage increases until it equals the peak value of the applied alternating voltage. This voltage appears across the electrolytic condensers of the smoothing filter, for which reason these condensers must be capable of withstanding voltages of considerably higher value than the normal working voltage, to which value the D.C. voltage does not drop until the other valves, particularly the output valve, have warmed up sufficiently to pass current. The cathodes of indirectly heated rectifiers, on

the other hand, are so designed that their warming-up time is longer than that of the other valves in the set. Thus the use of indirectly heated rectifiers ensures that the H.T. voltage is supplied only after the other valves are in a condition to take current. Therefore, no surge occurs immediately after the set is switched on, and the electrolytic condensers need be capable of withstanding only the normal working voltage. Since the cost of these condensers is governed by the maximum permissible applied voltage, cheaper condensers can be used with indirectly heated rectifiers than with the directly heated types. In this connection it should be noted that the warming-up time of the EZ 40 is 35 seconds and that of the EL 41 22 seconds. By "warming-up time" is meant the time from the moment of closing the circuit to that at which half the ultimate current is delivered, or consumed.

The heater and cathode of the EZ 40 are so insulated from each other that a voltage having a peak value of 500 V can be applied between them without risk of breakdown. This value corresponds to the peak value of the maximum permissible alternating voltage. If, during use, the maximum permissible voltage is not exceeded, this will be the highest voltage to occur between heater and cathode, corresponding to the no-current condition, with maximum alternating input voltage. In view of this high insulation, the heater can be fed from the same transformer winding as the other heaters in the set, instead of from a separate winding with special insulation, as required for a directly heated rectifier.

In order to avoid sputtering in the EZ 40 (momentary flash-over between anode and cathode), a resistor should be included in each anode circuit. The minimum value for this resistor is dependent on the applied alternating voltage, and is given in the operating data at the end of this section. Part of the required resistance is usually already present in the form of the D.C. resistance of the mains transformer; in order to take this resistance into account, the following formula is employed:

$$R_t = R_s + n^2 R_p + R,$$

where: R_t is the minimum resistance required for each anode circuit,
 R_s the D.C. resistance of half the secondary of the mains transformer,
 R_p the resistance of the primary winding,
 n the turns ratio between the primary winding and half the secondary,
 and R the minimum resistor to be added to each anode circuit to prevent sputtering.

In order to avoid any possible misunderstanding, it should be added that the previously mentioned maximum permissible voltage of 350 V_{RMS} is the voltage on the secondary of the mains transformer in the no-load condition.

TECHNICAL DATA OF THE FULL-WAVE RECTIFIER EZ 40

Heater data

Heating: indirect, A.C. or D.C., parallel feed

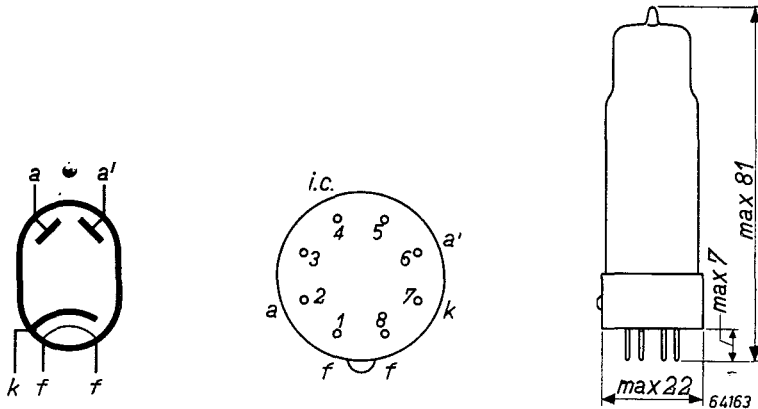
Heater voltage V_f = 6.3 VHeater current I_f = 0.6 A

Fig. 2

Electrode arrangement, electrode connections and dimensions in mm of the EZ 40.

Operating and limiting values

Transformer voltage	V_{tr}	=	2×250	2×275	V_{RMS}
Direct current output	I_o	=	max. 90	max. 90	mA
Anode series resistance	R_t	=	min. 2×125	min. 2×175	Ω
First capacitor of smoothing filter	C_{fill}	=	max. 50	max. 50	μF
Peak voltage between cathode and heater	V_{fk}	=	max. 500	max. 500	V

Transformer voltage	V_{tr}	=	2×300	$2 \times 350^1)$	V_{RMS}
Direct current output	I_o	=	max. 90	max. 90	mA
Anode series resistance	R_t	=	min. 2×215	min. 2×300	Ω
First capacitor of smoothing filter	C_{fill}	=	max. 50	max. 50	μF
Peak voltage between cathode and heater	V_{fk}	=	max. 500	max. 500	V

¹⁾ Max. permissible transformer voltage.

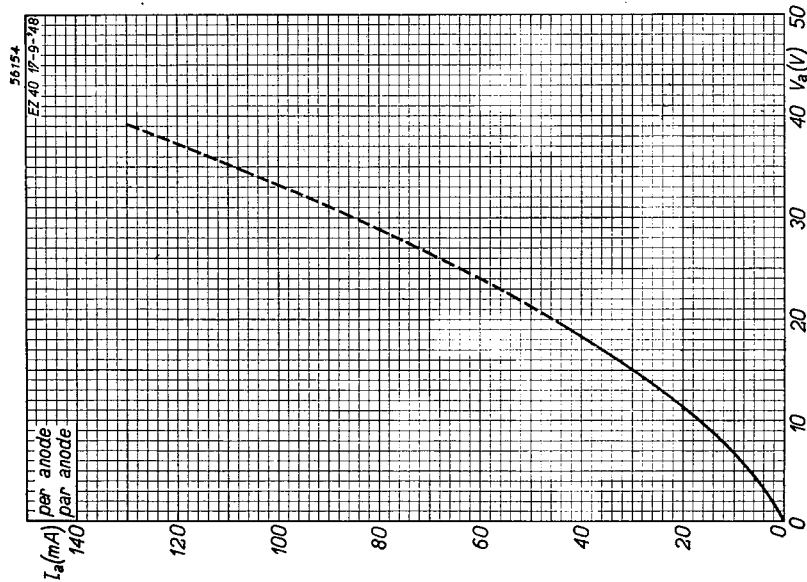


Fig. 3

Anode current (I_a) of the EZ 40 as a function of the applied D.C. voltage (V_a); since the maximum permissible current per anode is 45 mA, the curve above this value is drawn as a dotted line.

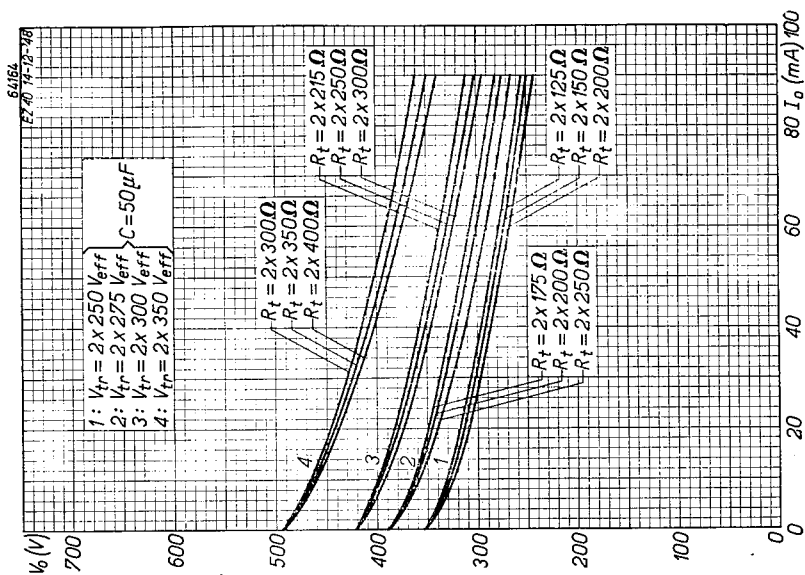


Fig. 4

Load characteristic (D.C. output voltage V_o as a function of the D.C. output current I_o) of the EZ 40, for various values of the transformer voltage V_{tr} and different values of the D.C. resistance R_t in each anode