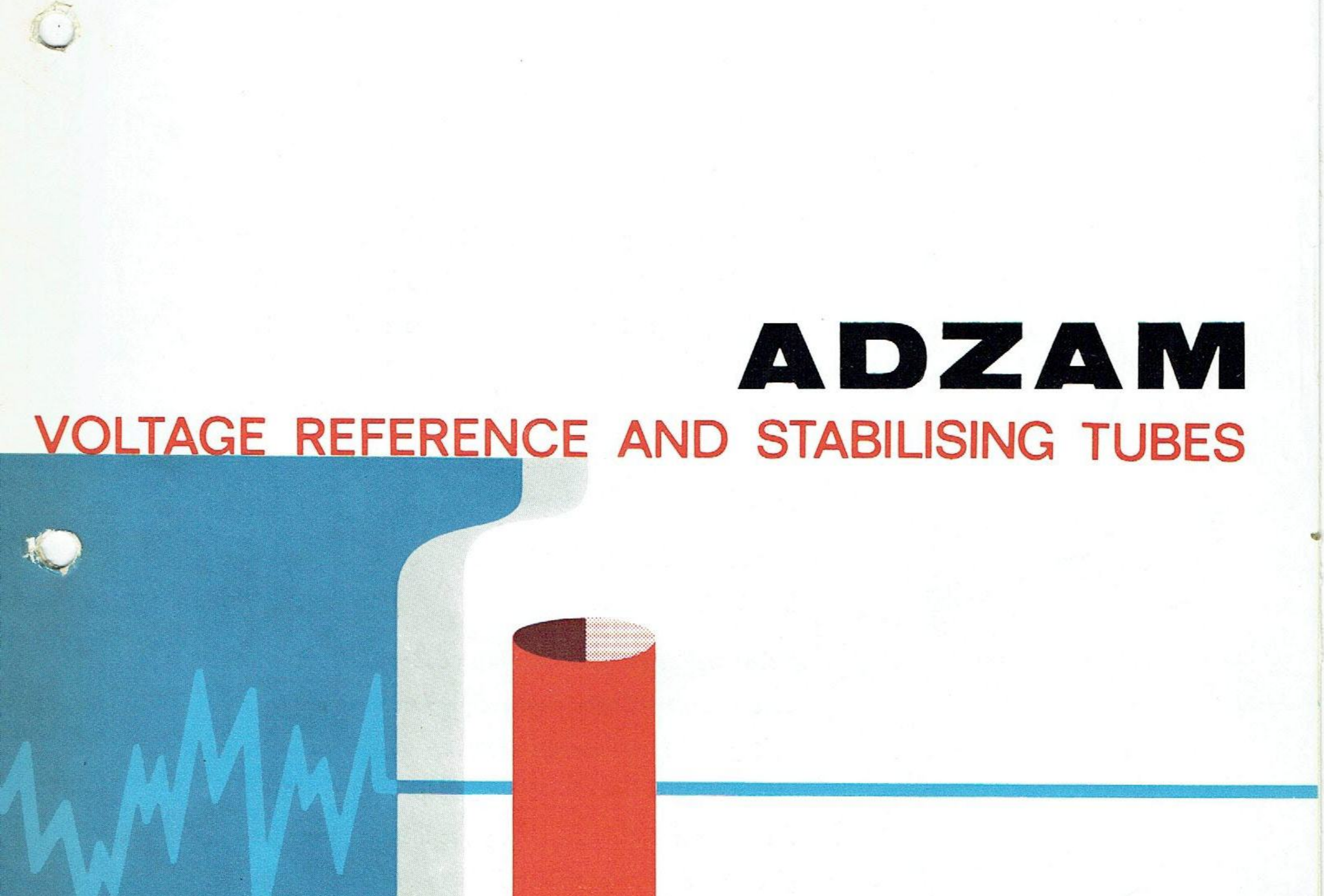
ADZAM

VOLTAGE REFERENCE AND STABILISING TUBES



mble ELECTRONICS

voltage reference and voltage stabilising tubes

Voltage stabilising tubes are used in a wide variety of apparatus in which a direct voltage must be kept constant independently of mains-voltage fluctuations or changes in the load. Typical applications are found in various kinds of measuring equipment, standard signal generators, public address and other amplifiers, transmitters, communication receivers, control and regulating devices, etc.

Our range of stabilising tubes covers operating voltages of from 75 V to 150 V.

Voltage reference tubes have been designed for use in those cases where a voltage of extremely high constancy is required. Owing to the molybdenum sputtering technique, the operating voltage of these tubes can be kept constant within less than 0.1 per cent. as an average, so that they can often replace a standard cell. The difference in operating voltage from tube to tube is also very small.

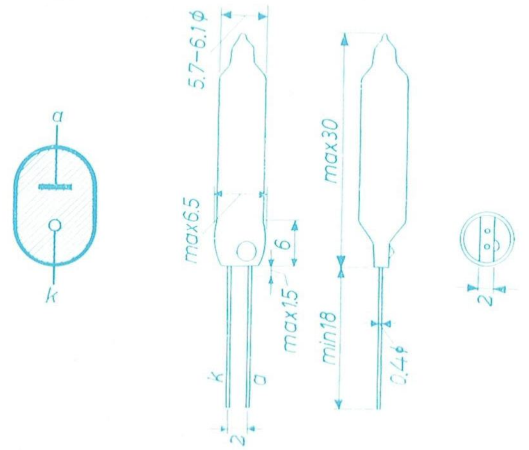
This pamphlet offers a survey of the technical data of our preferred types of voltage reference and stabilising tubes.

voltage reference tubes

	quick-reference data				characteristics and range values at 25 °C					life performance at preferred current and at 25 °C		limiting values (absolute maximum rating system)							
					limits applicable to all tubes (initial)				typical limits (initial)	typical maximum drift in maintaining voltage									
	nominal maintaining voltage V_m (V)	preferred current I_k (mA)	temperature coefficient of V_m $\triangle V_m/\triangle t_{bulb}$ (mV/°C)	incremental resistance (at pref. curr.) r_a (Ω)	ignition voltage V_{ign} (V)	preferred operating current (mA)	initial spread in maintaining voltage (V)	incremental resistance r_a (Ω)	voltage jumps over current range (mV)	during first 300 hours $\triangle V_m$ (%)	during subsequent 2000 hours $\triangle V_m$ (%)	cathode current I_k (mA)	max. starting current I_{kp} (mA) (T_{max} = 20 s)	minimum supply voltage V_b (V)	maximum negative peak anode voltage $V_{a\,inv\,p}$ (V)	bulb temp. limits t_{bulb} (°C)	max. shunt capacitor C_p (μF)	dimensions and connections see figure:	base
ZZ1000*	81	3.2	−1.2	200	≤ 115	3.2	80.1-82.5	≤ 400	< 100**	0.3	0.8	2 to 4	20	120	− 100	−55 to +125	0.03	A	flying leads
83A1	83	4.5	−2.5	250	≤ 120	4.5	83.0-84.5	110-350	< 1	0.4	0.24	3.5 to 6	10	130	− 50	−55 to +150	0.1	C	B7G miniature
85A2	85	5.5	−2.7	300	≤ 115	5.5	83-87	≤ 450	≤ 50 (4-10 mA)	0.3	0.3	1 to 10	40	120	− 75	−55 to + 90	0.1	B	B7G miniature

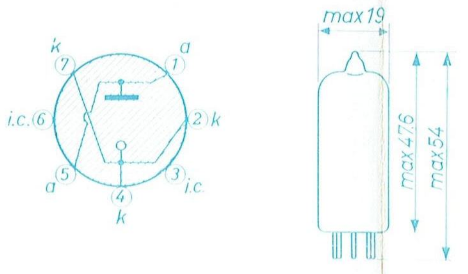
A

(dimensions in mm)



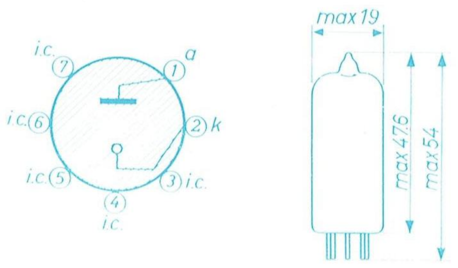
B

(dimensions in mm)



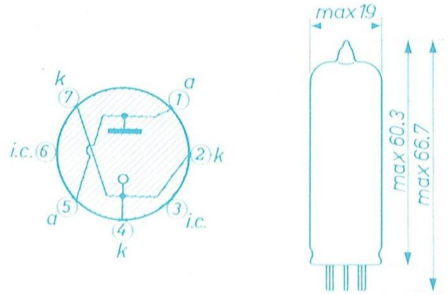
C

(dimensions in mm)



D

(dimensions in mm)



voltage stabilising tubes

	quick-reference data					characteristics and range values at 25 °C				life performance at preferred current and at 25 °C		limiting values (absolute maximum rating system)							
										typical maximum drift in maintaining voltage									
	nominal maintaining voltage V_m (V)	current range I_k (mA)	regulation over current range $I_{k\,min}$ to $I_{k\,max}$ $\triangle V_m$ (V)	incremental resistance r_a (Ω)	temperature coefficient $\triangle V_m/\triangle t_{bulb}$ (mV / °C)	ignition voltage V_{ign} (V)	preferred operating current (mA)	initial spread in maintaining voltage (V)	$V_m = f(I_k)$ characteristic see figure:	0 to 1000 hours $\triangle V_m$ (%)	0 to 10000 hrs. $\triangle V_m$ (%)	cathode current I_k (mA)	max. starting current I_{kp} (mA) (T_{max} = 20 s)	maximum shunt cap. C_p (μF)	minimum supply voltage V_b (V)	maximum negative anode peak voltage $V_{a\,inv\,p}$ (V)	bulb temp. limits t_{bulb} (°C)	dimensions and connections see figure:	base
75C1	78	2 to 60	5 (≤ 8)	130	− 8.3 (at 30mA) − 1.8 (at 10mA)	≤ 115	30	75- 81	1	0.9	1	2 to 60	100	0.1	115	− 50	−55 to + 90	C	B7G miniature
90C1	90	1 to 40	12 (≤ 14)	300	− 2.7	≤ 115	20	86- 94	2	±1	± 2	1 to 40	100	0.1	120	− 75	−55 to +110	B	B7G miniature
OB2(108C1)	108	5 to 30	1.5 (≤ 3.5)	100	–	≤ 127	17.5	106-111	3	±1 (<±4)	–	5 to 30	75	0.1	133	− 75	−55 to +150	D	B7G miniature
OB2WA*	108	5 to 30	≤ 3	–	–	≤ 130	17.5	106-110	–	±1 (<±3)	–	5 to 30	75	0.1	133	− 75	−55 to +150	D	B7G miniature
OA2(150C2)	150	5 to 30	≤ 6	200	–	≤ 180	17.5	144-160	4	≤ 3	–	5 to 30	75	0.1	185	−125	−55 to + 90	D	B7G miniature
OA2WA*	150	5 to 30	3 (≤ 5)	–	–	≤ 165	17.5	143-154	–	≤ ±1	–	5 to 30	75	0.1	165	−125	−55 to +150	D	B7G miniature
150B2	150	5 to 15	3.5 (≤ 5)	350	10	≤ 180	10	146-154	5	≤ ±1	–	5 to 15	40	0.1	180	−130	−55 to +110	C	B7G miniature

* ruggedised

** to avoid jump voltages, current variations around 3.2 mA should be limited to 0.3 mA

Series-connected stabilising tubes can be ignited with a supply voltage lower than the sum of the ignition voltages of two (or more) tubes, by using a bypassing resistor R_p having a value in the order of 0.1 to 1 MΩ (see Fig. A). Due to the load current flowing through R_s and R_L before ignition of the tubes, the voltage at point *a* (Fig. A) can be lower than the sum of the ignition voltages of the two stabilising tubes. The junction of both tubes (point *b*) is kept at the potential of the supply voltage, and, provided V_b exceeds the ignition voltage of the lower tube under worst-case conditions, this tube will always ignite. As a result the voltage across the lower tube drops to the value of the maintaining voltage, thereby lowering the potential of point *b*. The voltage of the upper tube is then high enough for it to be ignited.

The same method can be applied to ensure the ignition of a single stabilising tube, by connecting it in series with a semiconductor diode (Fig. B).

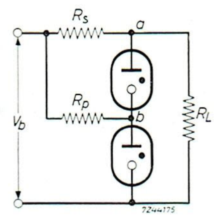


Fig. A

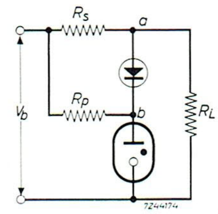


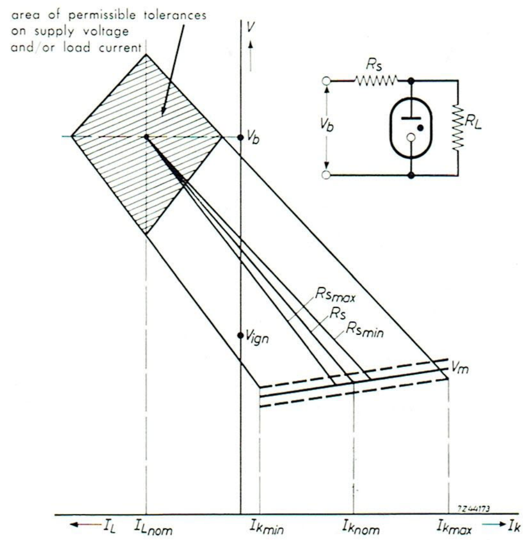
Fig. B

A simple but adequate method of determining whether a given tube type will operate satisfactorily and within the published limits is given in the figure opposite.

The nominal circuit conditions drawn in this figure are:

1. the average maintaining voltage of the tube type at the recommended operating current;
2. the nominal load current;
3. the nominal supply voltage.

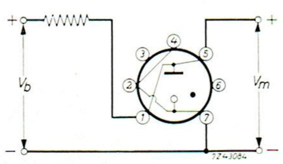
The load line drawn from the point of intersection $V_b.I_L$ to $V_m.I_k$ represents the limiting resistance R_s. The tolerances on this resistance (represented by R_s max and R_s min) indicate a corresponding decrease or increase of the tube current. Parallel to these lines, load lines are drawn from points indicating the maximum maintaining voltage at minimum tube current, and minimum maintaining voltage at maximum tube current respectively. The intersection of these two lines with those of the nominal load current and supply voltage form the corners of a diamond which represents the area of permissible tolerances on load current and/or supply voltage.

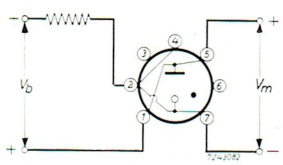


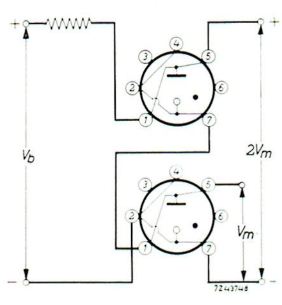
Safety circuit

In most types of voltage stabilising tube the cathode has been connected to the base pins 2, 4 and 7, and the anode to the pins 1 and 5.

This configuration permits a circuit layout in which the load is disconnected from the supply voltage as soon as the stabilising tube is removed (safety circuit). A few examples of such circuits are given here.







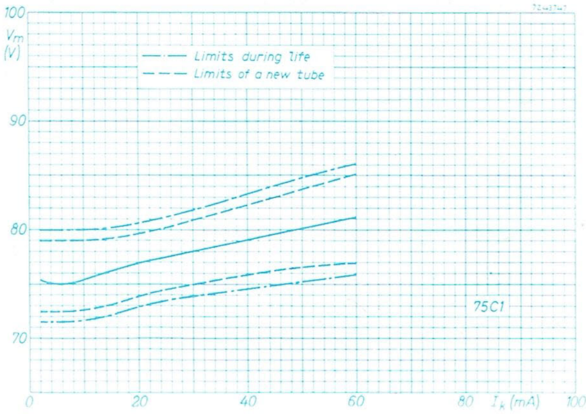


Fig. 1

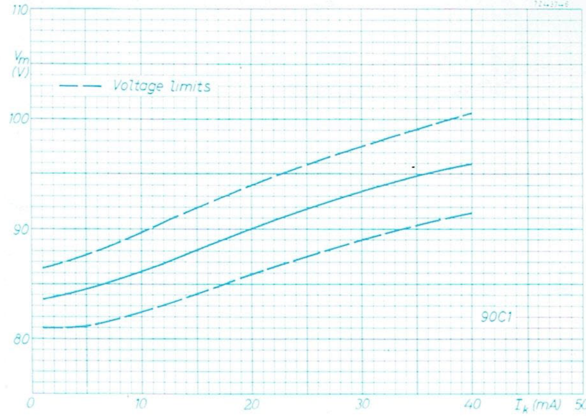


Fig. 2

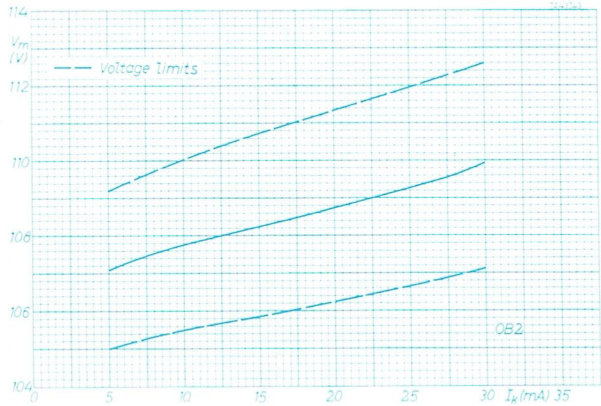


Fig. 3

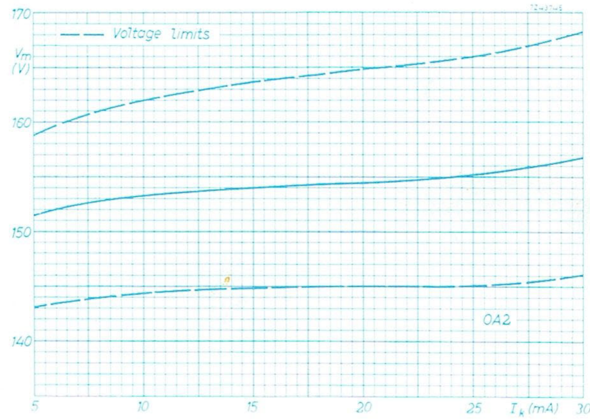


Fig. 4

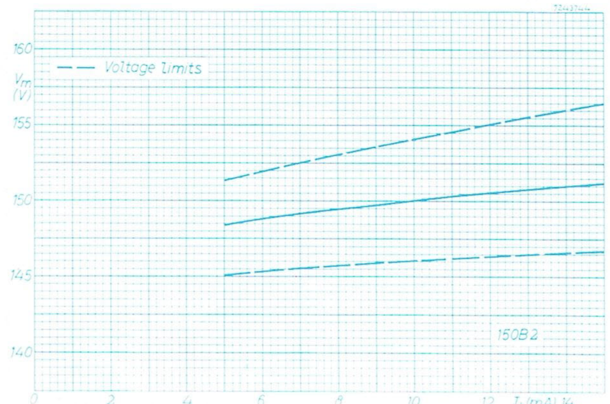
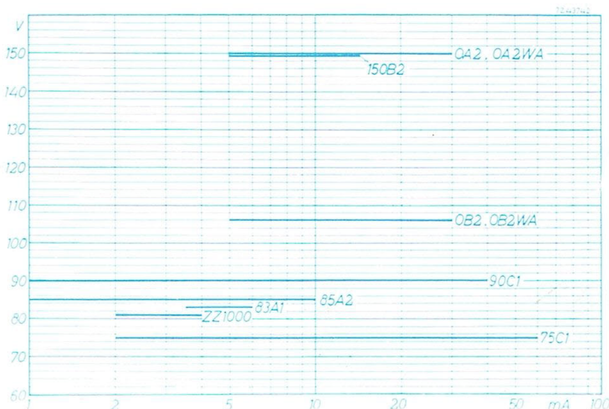


Fig. 5



Tube selection chart

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