

NUMERICAL INDICATOR TUBE

ZMI 162

TENTATIVE DATA

QUICK REFERENCE DATA

Cold cathode, neon-argon filled rectangular end viewing numerical indicator tube with long life expectancy. The rectangular envelope allows for close tube-to-tube spacing, both in the horizontal and vertical axes.

Numeral height	15.5 mm	
	0.6 in	
Minimum distance between mounting centres	20 mm	
	0.79 in	
Viewing angle	90 deg	
Numerals	1 2 3 4 5 6 7 8 9 0	
Cathode current	2.5 mA	
Minimum supply voltage	170 V	

CHARACTERISTICS AND OPERATING CONDITIONS (Measured at 20 to 50°C)

Minimum anode-to-cathode voltage necessary for ignition	170	V
Ignition delay time		See page 3
Anode-to-cathode maintaining voltage		See page 4
Anode-to-cathode voltage below which all tubes will extinguish	115	V
Recommended cathode current, d.c.	2.5	mA
Minimum cathode current, d.c. (during any conduction period)	1.5	mA
D.C. operation		See pages 5 to 9

LIFE EXPECTANCY at recommended operating conditions and room temperature (see operating note)

Continuous display of one numeral	> 5000	h
Sequentially changing the display from one numeral to another, every 100 hours or less	> 20 000	h



RATINGS (ABSOLUTE MAXIMUM SYSTEM)

Cathode current (each digit)

Maximum average (maximum averaging time = 20ms)	3.0	mA
Maximum peak (for 20ms maximum)	3.5	mA
Minimum (during any conduction period)	1.5	mA

Bulb temperature

Maximum	+70	°C
Minimum (see operating note)	-10	°C

MOUNTING POSITION

Any. The numerals are viewed through the top of the envelope. The numerals will appear upright (within $\pm 3^\circ$) when the tube is mounted with the line through pins 6 and 12 vertical, pin 6 uppermost.

OPERATING NOTE

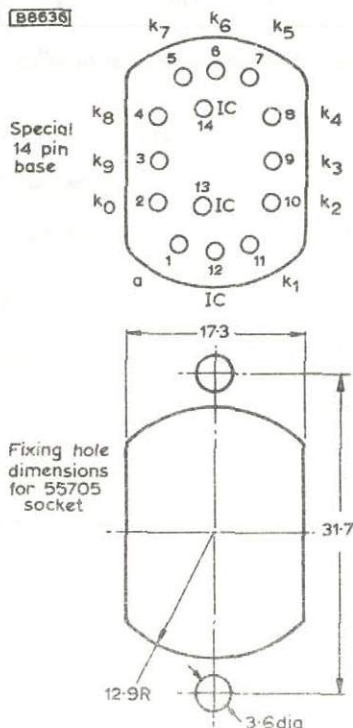
For bulb temperatures below $+10^\circ\text{C}$ the life expectancy of the tube is substantially reduced.

ACCESSORY (supplied as additional item)

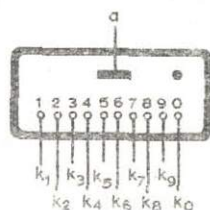
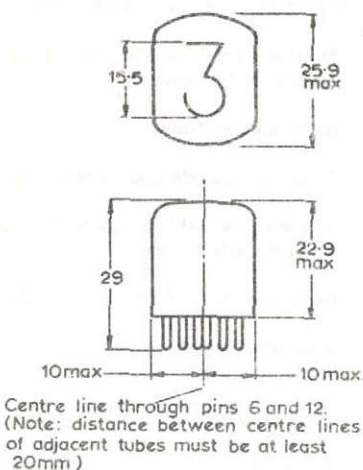
Socket

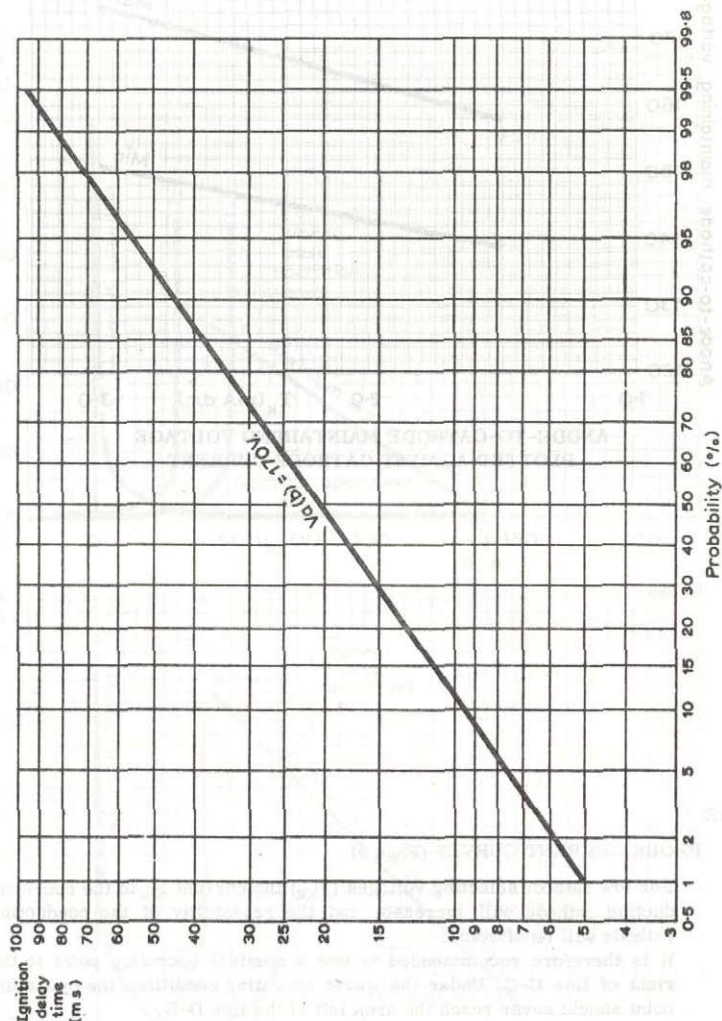
55705

BB636



All dimensions in mm

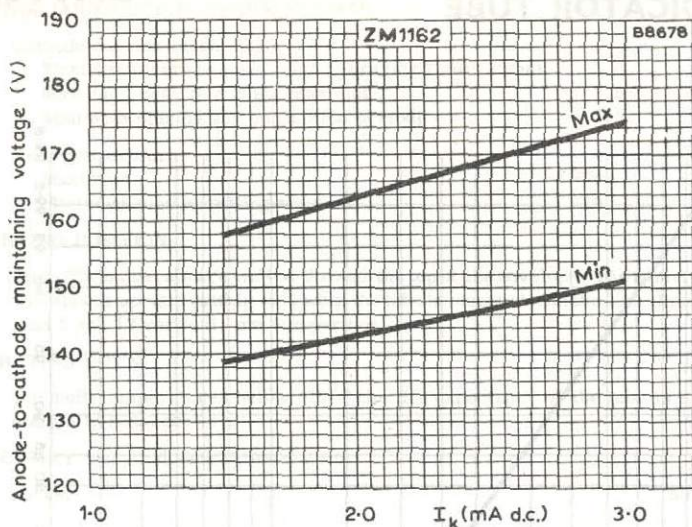




CUMULATIVE DISTRIBUTION OF IGNITION DELAY TIME

This curve shows the probability that a tube will ignite in less than the time shown after a non-conduction period of a few seconds. The ignition delay time will be appreciably reduced when the interval between conduction periods is less than 100 milliseconds. In general, an increase in the supply voltage will reduce the ignition delay time.





ANODE-TO-CATHODE MAINTAINING VOLTAGE
PLOTTED AGAINST CATHODE CURRENT

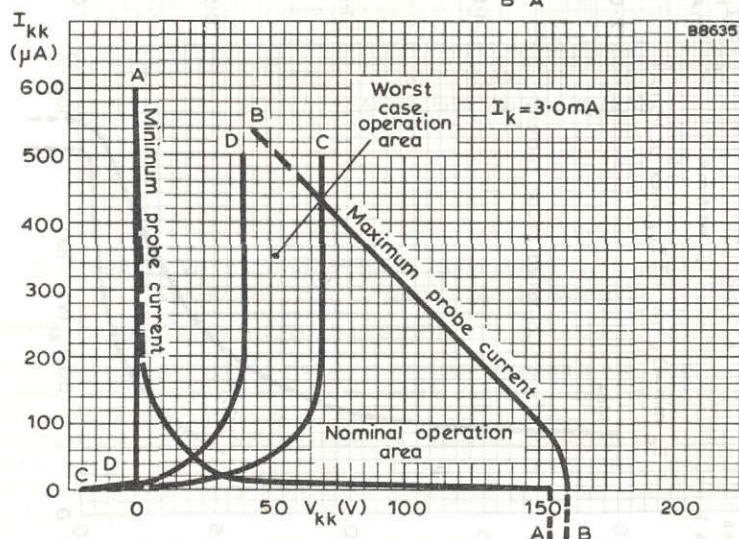
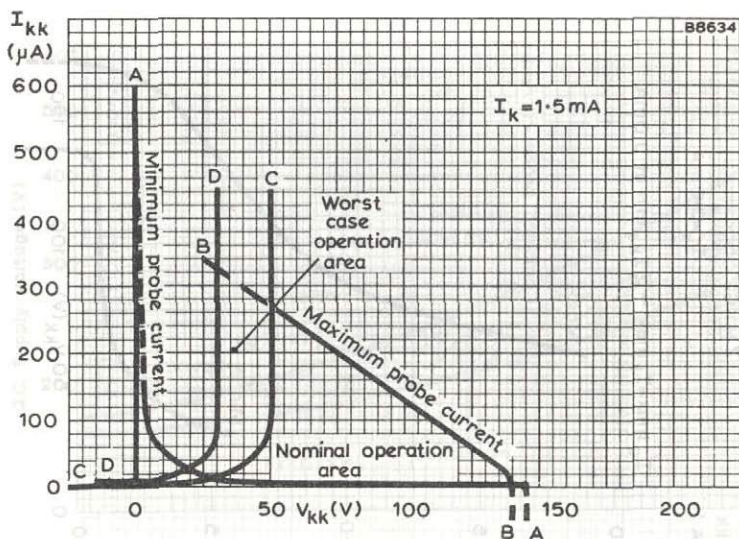
NOTE

PROBE CURRENT CURVES (Page 5)

For low cathode selecting voltages (V_{kk}) the current I_{kk} to the non-conducting cathode will increase, and the readability of the conducting cathode will be affected.

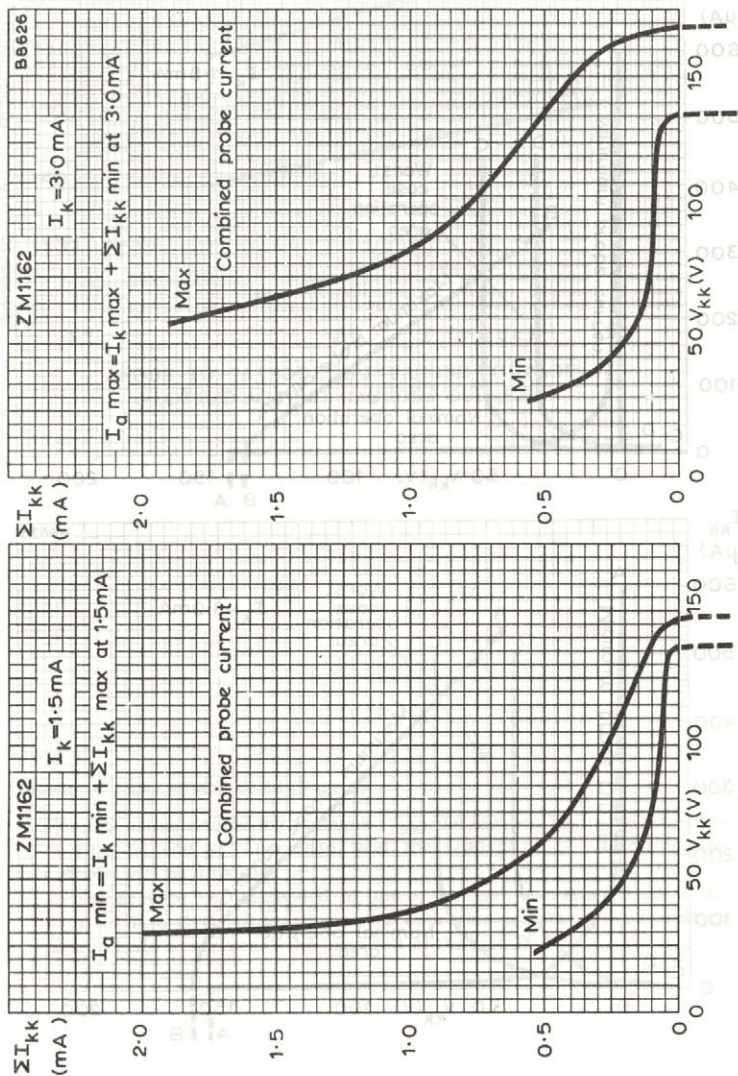
It is therefore recommended to use a nominal operating point to the right of line C-C. Under the worst operating conditions the operating point should never reach the area left of the line D-D.





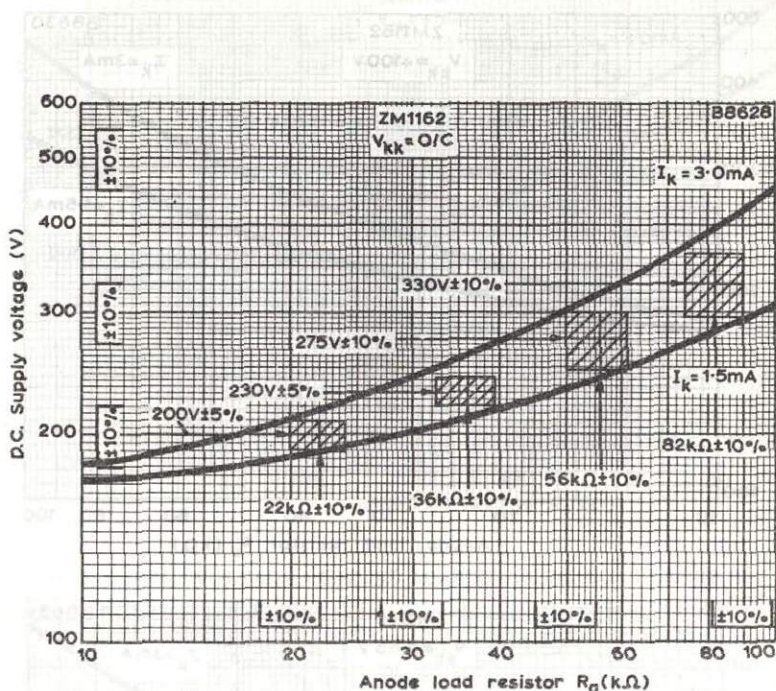
PROBE CURRENTS TO INDIVIDUAL NON-CONDUCTING CATHODES





COMBINED PROBE CURRENT TO ALL NON-CONDUCTING CATHODES





D.C. SUPPLY VOLTAGE PLOTTED AGAINST ANODE LOAD RESISTOR: NON-CONDUCTING CATHODES OPEN CIRCUIT

NOTE - SUPPLY VOLTAGE/LOAD RESISTOR

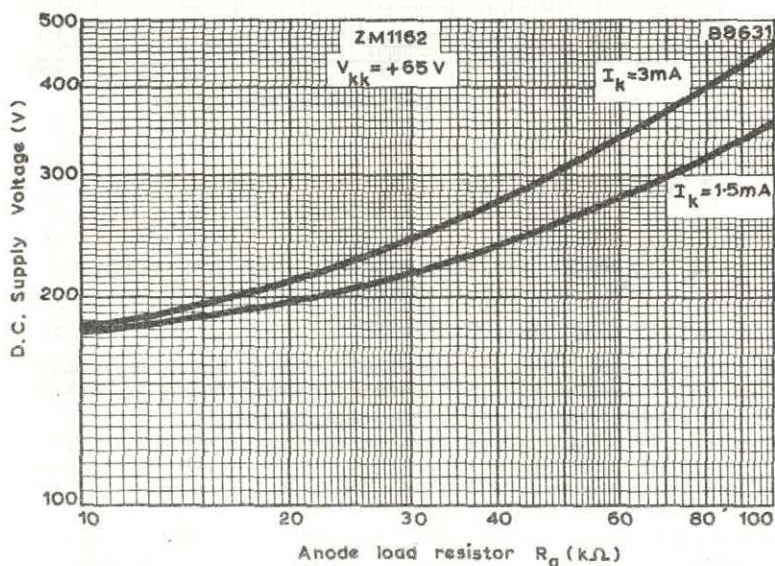
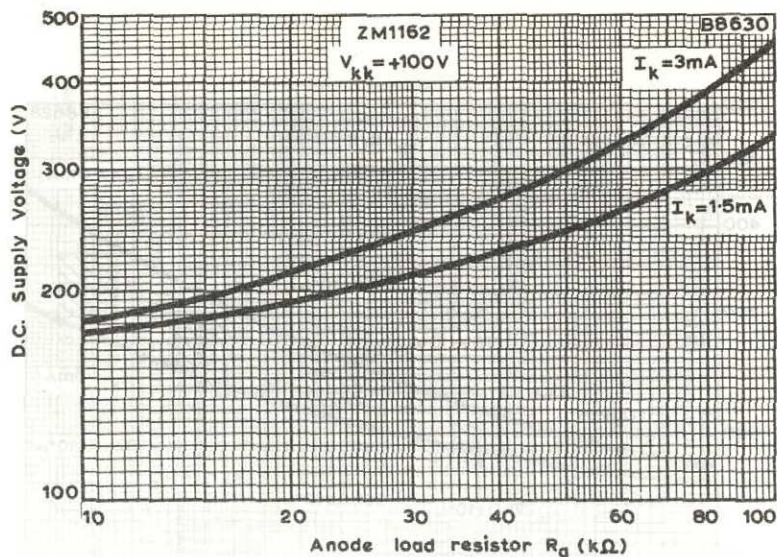
The graphs on pages 7 to 9 give the relationship between the d.c. anode supply voltage and the required anode load resistor for fixed values of V_{kk} (voltage difference between conducting and non-conducting cathodes).

Each graph is plotted on log-log graph paper; therefore a given tolerance expressed as a percentage can be represented as a fixed length at any point on the x and y axis. This is shown on the graph above by taking points on each axis with a fixed tolerance.

Examples are shown on the graph above of the supply voltages and load resistors with tolerances expressed as a percentage so as to remain within the recommended operating region.

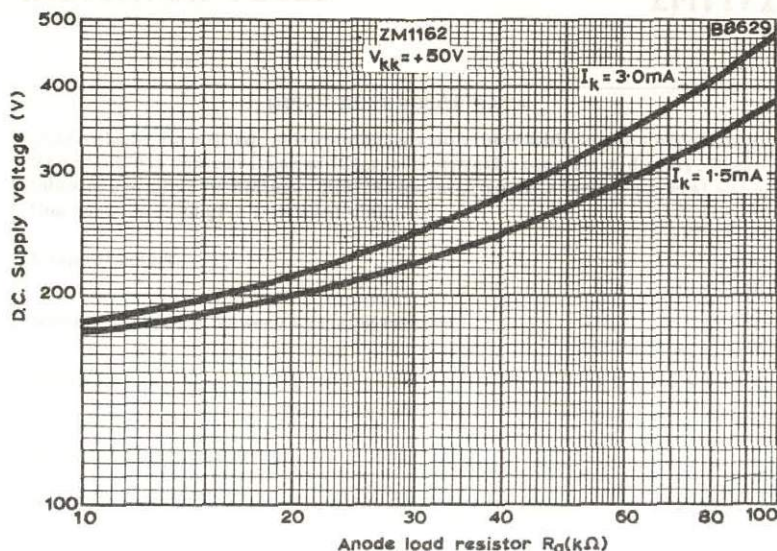
On page 9 details are given of the method of calculating corresponding values of supply voltage and anode load resistor, for fixed values of V_{kk} .





D.C. SUPPLY VOLTAGE PLOTTED AGAINST ANODE LOAD RESISTOR





D.C. SUPPLY VOLTAGE PLOTTED AGAINST ANODE LOAD RESISTOR

NOTE - The supply voltage/load resistor curves are derived from:

$$V_s = I_a \cdot R_a + V_m \text{ (General formula)}$$

$$V_s = [I_k + \Sigma I_{kk}] R_a + V_m$$

The value of ΣI_{kk} will depend on the bias voltage V_{kk} .

Supply voltage required to work above the minimum value of I_k :

$$V_s = [1.5mA + \Sigma I_{kk} \text{ max. at } I_k = 1.5mA] R_a + 158V$$

Supply voltage required to work below the maximum value of I_k :

$$V_s = [3.0mA + \Sigma I_{kk} \text{ min. at } I_k = 3.0mA] R_a + 151V$$

