INDICATOR TUBE

Long life cold cathode ten digit numeral indicator tube for top viewing.

QUICK REFERENCE DATA			
Numeral height		15	mm
Numerals	1 2 3 4 5 6 7 8 9 0		
Supply voltage	min.	170	V
Anode current		2	mA

GENERAL

The numerals are 15 mm high and appear on the same base line allowing in-line read out. The ZM1020 is provided with a red contrast filter.

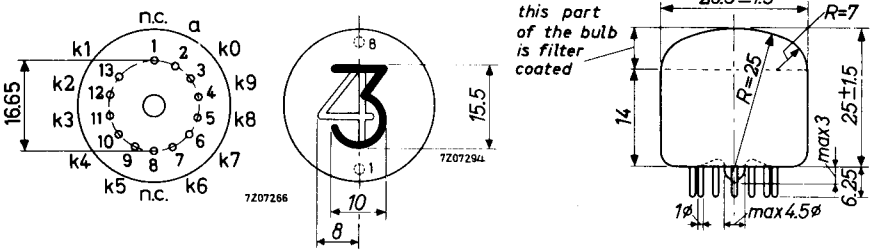
PRINCIPLE OF OPERATION

The tube contains ten cathodes in the form of ten figures and one common anode. By applying a suitable voltage between the anode and one of the ten cathodes the corresponding numeral will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: B13B



Mounting position: any

The numerals are viewed through the dome of the envelope. The numerals will appear upright (within 1.5°) when the tube is mounted with the line through pins 1 and 8 vertical, pin 8 being uppermost.

Accessories

Socket	type	2422 505 00001 or 2422 505 00002

CHARACTERISTICS AND OPERATING CONDITIONS

(Valid over life and full temperature range)

Ignition voltage	V_{ign}	max. 170 V
Maintaining voltage	V_m	see sheet 4
Anode current for coverage, averaged during any conduction period	I_a	min. 1 mA
Anode current,		
average (T_{av} = max. 20 ms)	I_a	max. 3 mA
peak	I_{ap}	max. 6 mA
Cathode selecting voltage	V_{kk}	see sheet 5
Extinguishing voltage	V_{ext}	min. 118 V

Typical operation [1]

D.C. operation

See sheets 5 and 6

A.C. operation

See sheets 5 and 7

[1] Bulb temperatures below 10 °C result in a reduced life expectancy and changes in characteristics (see sheet 4).
In designing equipment to be used over a wide temperature range the use of "constant current operation" (high supply voltage with a high anode series resistor) is recommended.

LIFE EXPECTANCY AND RELIABILITY (at I_a = 2 mA)

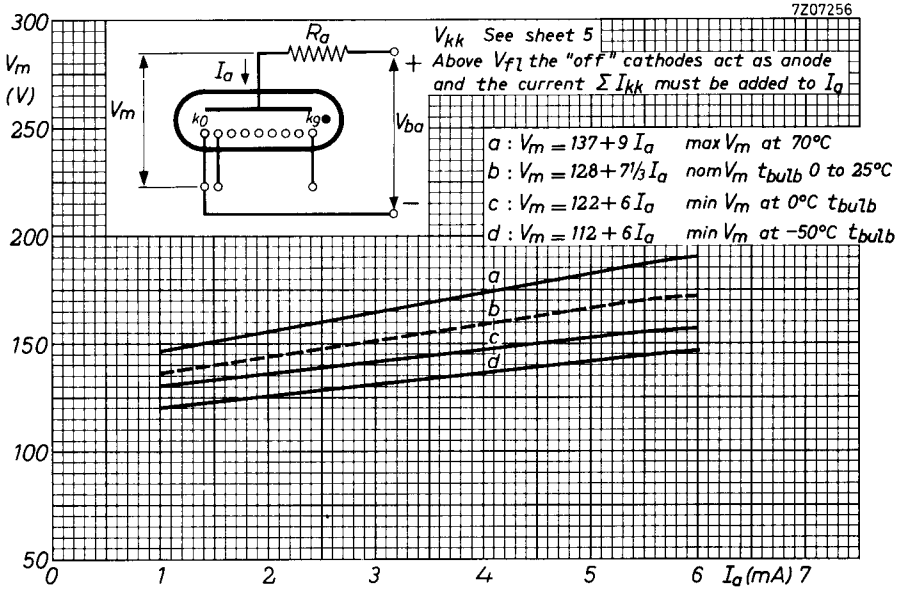
Sequentially changing the display from one digit to the others every 1000 h. or less	100.000 h

The reliability has been assessed in a life test programme totalling 4.5×10^6 tube hours. The longest test period was 50.000 hrs on 47 tubes. No failures have been found. The Mean Time between Failures is better than 10^6 hrs which corresponds with a failure rate of less than 0.1 % per 1000 hrs at a confidence level of 95 %.

LIMITING VALUES (Absolute max. rating system)

Anode voltage necessary for ignition	V_a	min. 170	V
Anode current, D.C.	I_a	min. 1	mA
rectified A.C. and pulse	I_{a_p}	min. 2	mA
average (T_{av} = max. 20 ms)	I_a	max. 3	mA
peak	I_{a_p}	max. 10	mA [1]
Cathode selecting voltage	V_{kk}	see lines N and W on sheet 5	
Bias voltage between anode and "off" cathodes (see sheet 5)	V_{bias}	max.	$V_{floating}$
Ambient temperature	t_{amb}	min. -50 max. +70	°C °C

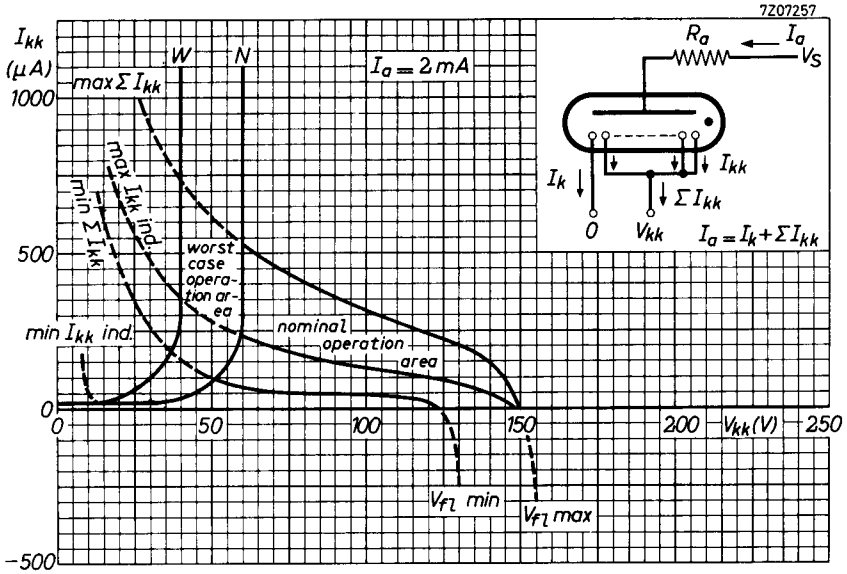
[1]) Above I_a = 6 mA the connecting wires and eyelets may be covered by the glow.


7Z07256
V_{kk} See sheet 5
Above V_{fl} the "off" cathodes act as anode and the current ΣI_{kk} must be added to I_a
R_a
I_a
V_m
V_{ba}
k0
kg
+
−
a : $V_m = 137 + 9\ I_a$ max V_m at 70°C
b : $V_m = 128 + 7\frac{1}{3}\ I_a$ nom V_m t_{bulb} 0 to 25°C
c : $V_m = 122 + 6\ I_a$ min V_m at 0°C t_{bulb}
d : $V_m = 112 + 6\ I_a$ min V_m at −50°C t_{bulb}
V_m (V)
300
250
200
150
100
50
0
1
2
3
4
5
6
I_a (mA) 7
a
b
c
d

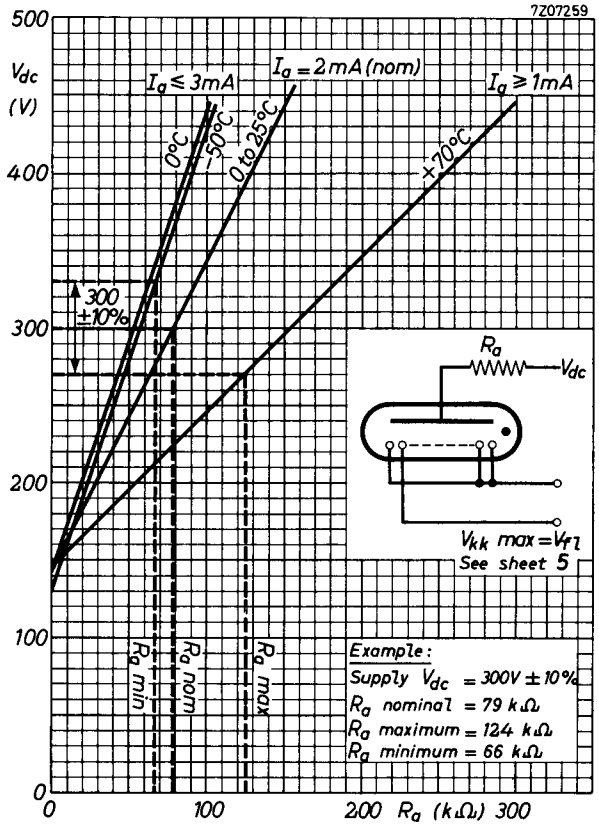
I_{kk} individual and ΣI_{kk} versus cathode selecting voltage V_{kk} at I_a = 2 mA.
I_{kk} and ΣI_{kk} are proportional to anode current in the range V_{kk} = 0 to 100 V.

The range of V_{fl} (I_{kk} = 0) shifts to the right/left at increasing/decreasing anode current (8 V/mA).

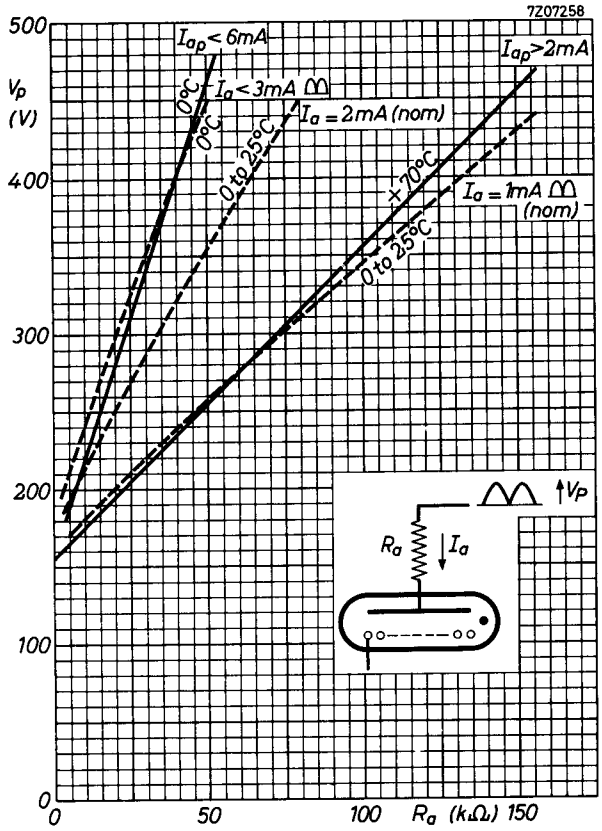
The curves are valid for instantaneous and for average values of anode current.



For low cathode selecting voltages the current I_{kk} to the "off" cathodes will increase and the readability of the "on" cathode will be affected. It is therefore recommended to use a nominal operating point to the right of line N.
Under the worst operating conditions the operating point should never reach the area left of line W.



Graph denoting the relationship of D.C. anode supply voltage and required anode resistor to remain within the recommended operating region.



Graph denoting the relationship of the peak value of full-wave unsmoothed rectified A.C. anode supply voltage and the required anode resistor to remain within the recommended operating area.