

QUICK REFERENCE DATA (nominal values)

For use in equipment where mechanical vibration and shocks are unavoidable.

Maintaining voltage	78	V
Cathode current range	2 to 60	mA
Regulation voltage	5	V
Ignition delay time	10	ms

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—VOLTAGE STABILISER AND REFERENCE LEVEL TUBES and the GENERAL NOTES—SPECIAL QUALITY VOLTAGE STABILISER AND REFERENCE TUBES which precede this section of the handbook. The index numbers are used to indicate where reference should be made to a specific note.

CHARACTERISTICS AND RANGE VALUES FOR EQUIPMENT DESIGN measured at an ambient temperature of between 20 and 30°C unless otherwise stated.

The values given state the range over which the tube will operate both initially and during life. No allowance has been made for supply voltage and component variations. (Note A)

Initial values

Minimum voltage necessary for ignition (Note B)	110	V
Ignition delay time	See page C1	
Maintaining voltage at 30mA		
Maximum	81	V
Minimum	75	V
Increase in maintaining voltage as cathode current is increased from 2 to 60mA (regulation voltage)		
Note C		
Maximum	8.0	V
Average	5	V
Temperature coefficient of maintaining voltage	See page C2	
Typical maximum voltage jumps in the current range		
2 to 20mA	100	mV
20 to 60mA	15	mV
Cathode current above which the incremental resistance is positive	7	mA
Incremental resistance in the current range 10 to 60mA (approx.) Note C	130	Ω

Life performance (Note D)

	$I_k = 30\text{mA}$	$I_k = 60\text{mA}$	
Minimum voltage necessary for ignition (Note B)	115	115	V
Typical maximum percentage variation of maintaining voltage at cathode current (room temperature)			
In 1,000 hrs	-0.2 to +0.9	-0.7 to +0.2	%
In 10,000 hrs	-0.2 to +1.0	-0.7 to +1.4	%
In 30,000 hrs	-0.2 to +1.2	-0.7 to +2.0	%
Typical maximum increase in maintaining voltage as cathode current is increased over the range 2 to 60mA (Note C)	6.5	6.5	V

ABSOLUTE MAXIMUM RATINGS¹

Cathode current		
Maximum for continuous operation	60	mA
Maximum surge (Note E)	100	mA
Minimum	2.0	mA
Maximum negative anode voltage	50	V
Minimum bulb temperature ($I_k = 0\text{mA}$)	-55	°C
Maximum ambient temperature		
For operation (Note F)	+90	°C
For storage	+70	°C
Maximum vibrational acceleration (page D5)	2.5	g
Maximum shock (short duration) page D5	450	g

OPERATING NOTES

- Thermal equilibrium is reached within 3 minutes of igniting the tube.
- This value holds good over life in light or darkness. See graph on page C1.
- Following a sudden large change in the tube current the change in maintaining voltage may be up to 2.5 volts greater than that given until tube thermal equilibrium is re-established (within 3 minutes).
- These figures apply only when the tube is operated continuously at the currents stated.
- To be restricted for long life to approximately 30 seconds in each 8 hours use.
- This tube will operate satisfactorily at ambient temperatures up to 90°C, providing the tube is not used at either extreme of the current range.

TEST CONDITIONS (unless otherwise specified)

R_{lim} (k Ω)	I_k (mA)
1.0	30

After an initial warming-up period of 3 minutes at a cathode current of 30mA.

GROUP A

Condition	Frequency	Amplitude	Phase	Waveform	Notes
Ignition voltage. Illumination 5 to 50ft. cd.	110	V	—	+	
Maintaining voltage	81	V	—	+	
Change in maintaining voltage for cathode current change of 2 to 60mA.	8.0	V	—	+	
Voltage jumps. Cathode current varied from 2 to 10mA	300	mV	—	+	
10 to 60mA	100	mV	—	+	
Oscillation. Cathode current varied from 2 to 60mA	20	mV	—	+	

†This test is carried out on a 100% basis.

GROUP B

	110 V	10 μ A	5.0 mV	(pk-pk)
Ignition voltage in darkness after 24 hours in darkness	2.5	..	..	..
Leakage current. Supply voltage = 55V, $R_{lim} = 1M\Omega$	2.5	..	..	..
Microphonic noise	2.5	..	..	..
Group quality level ¹⁷	6.5	..	..	..

GROUP C

	Base strain test ^a , No applied voltage ..	..	..	..	6.5	—
	Glass strain test ^{aA} , No applied voltage ..	..	..	..	6.5	—



GROUP D

Resonance search

Vibrated at 2g over the frequency range 25 to 500c/s,
Output voltage at $R_{lim} = 27k\Omega$, $I_k = 10mA$

5.0 mV
(r.m.s.)

GROUP E

Fatigue¹¹

No applied voltage. 5g min. peak acceleration. $f = 170c/s \pm 5c/s$ for
33 hours in each of three mutually perpendicular planes.

Post fatigue tests

Ignition voltage as in group A

Change in maintaining voltage

Microphonic noise

Sub-group quality level⁷

110 V
 ± 1.0 V
10 mV
(pk-pk)

Shock test¹²

No applied voltage, 500g

Post shock tests

Ignition voltage as in group A

Change in maintaining voltage

Microphonic noise

Sub-group quality level⁷

110 V
 ± 1.0 V
10 mV
(pk-pk)

GROUP F

Life test 500 hours

Ignition voltage as in group A

Change in maintaining voltage from 0 to 500 hours

Change in maintaining voltage for cathode current change from 2 to 60mA

Inoperatives¹³

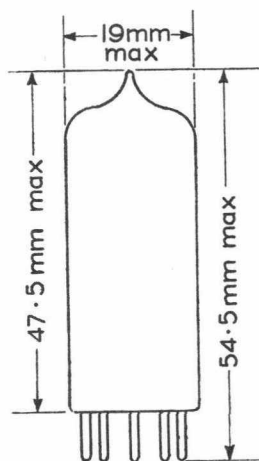
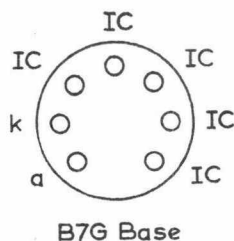
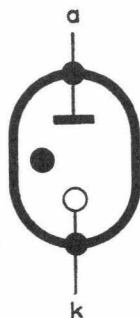
Group quality level⁷

110 V
 ± 1.5 V
8.0
—



GROUP G	AQL ² (%)	Individuals ³	
		Min.	Max.
Valves held for 28 days and retested for			
Inoperatives ¹³	0.5	—	—
Ignition voltage as in group A ..	0.5	—	110
Maintaining voltage	0.5	75	81

4716



The bulb and base dimensions of this tube are in accordance with BS448,
Section B7G.

1000

QUALITY
TUBES

1000

1000

1000

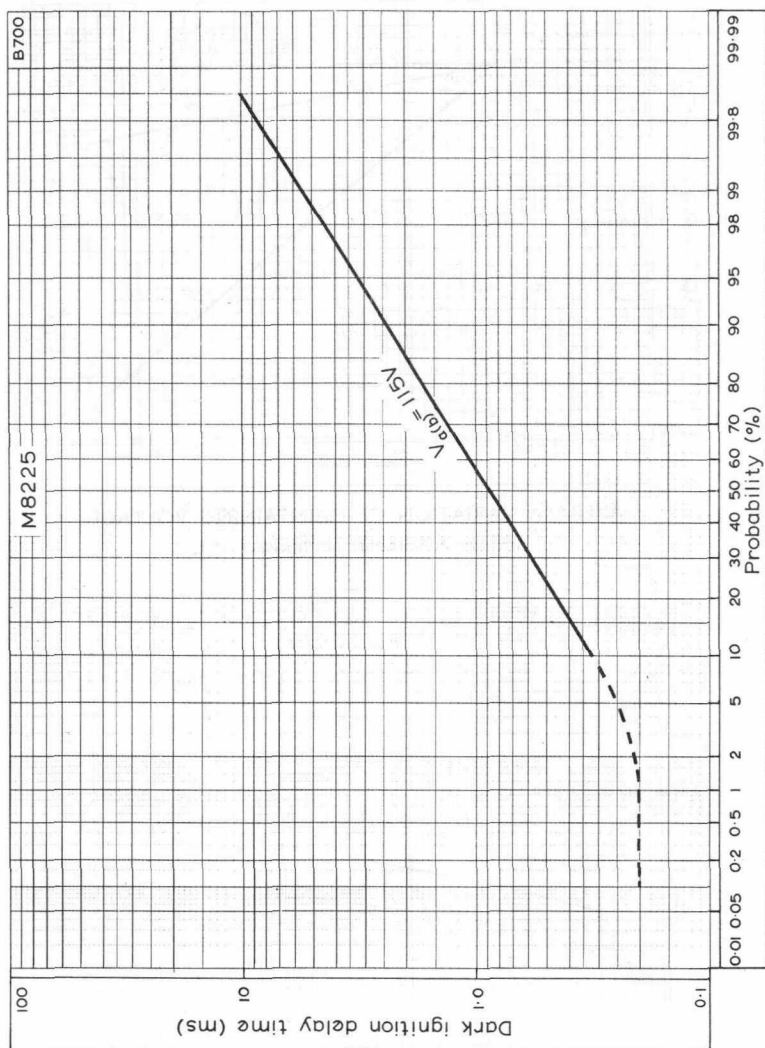


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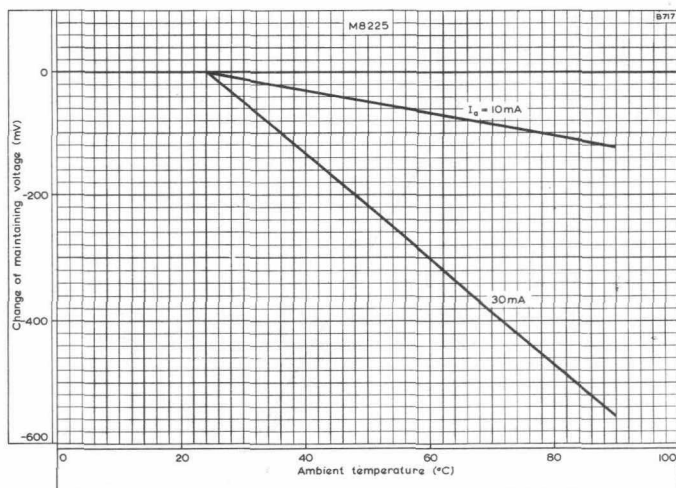
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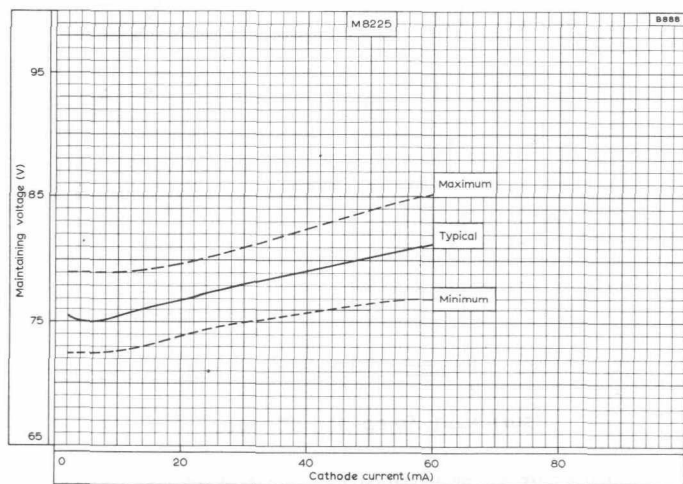


CUMULATIVE DISTRIBUTION OF DARK IGNITION DELAY TIME
These curves show the probability that a tube will ignite in less than the time shown. This will be to some extent dependent on the supply voltage. In general an increase in the supply voltage will reduce the ignition delay time.





AVERAGE VARIATION OF MAINTAINING VOLTAGE
WITH AMBIENT TEMPERATURE



MAXIMUM VARIATION OF MAINTAINING VOLTAGE
WITH CATHODE CURRENT (Initial values)