

QUICK REFERENCE DATA (nominal values)

Trigger tube, with stable trigger ignition characteristics, primarily intended for use in timers, voltage control and sensitive relay applications.

Anode supply voltage	240	V
Anode maintaining voltage	105	V
Maximum average cathode current	40	mA
Trigger ignition voltage	132	V
Trigger transfer requirements		
Capacitance	500	pF
Current	45	μ A
Stability of trigger ignition voltage during life	± 2	%

CHARACTERISTICS AND RANGE VALUES FOR EQUIPMENT DESIGN

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.

This tube has been designed to be ignited only with positive voltages on the anode and trigger, but will withstand negative voltages within the limits given. To reduce the ignition time to a minimum, a priming discharge flowing continuously between the priming anode and cathode is necessary. In the absence of a priming discharge, the ignition time may be of the order of seconds. Apart from the priming discharge the tube behaves as a triode ignition tube.

Anode-to-cathode gap

Anode supply voltage (see note 1)

Positive, for trigger-controlled ignition

Maximum ($I_{k(av)} < 25\text{mA}$, $i_{k(pk)} < 100\text{mA}$, see note 2) 290 V

Maximum ($I_{k(av)} > 25\text{mA}$) 250 V

Maximum ($i_{k(pk)} > 100\text{mA}$, see note 3) 250 V

Minimum 170 V

Negative

Maximum ($I_{Tr} = 0\text{mA}$) 90 V

Nominal anode-to-cathode maintaining voltage

($I_a = 10\text{mA}$, see note 4 and curve on page C2) 105 V

Trigger-to-cathode gap

Trigger-to-cathode ignition voltage ($V_a = 280V$)

Initial (see note 5 and curves on page C3)

Maximum

137 V

Minimum

128 V

Maximum variation during life (see page C1)

± 2 %

Maximum decrease of trigger ignition voltage

(V_a changed from 170V to 290V)

1.5 V

Nominal trigger-to-cathode maintaining voltage

95 V

Nominal trigger pre-ignition current

I_a priming = 2 to 25 μA (see note 6)

4×10^{-8} A

I_a priming = 0 μA

5×10^{-10} A

Recommended maximum trigger series resistance

I_a priming = 2 to 25 μA

100 M Ω

I_a priming = 0 μA

1000 M Ω

Priming anode-to-cathode gap

Priming-anode supply voltage (see note 7)

Maximum

290 V

Minimum

150 V

Nominal priming anode-to-cathode maintaining voltage

100 V

Priming-anode current (see note 6)

Maximum

25 μA

Minimum

2 μA

Recommended priming-anode resistor (see note 8)

10 M Ω

Transfer requirements

Minimum value of trigger-to-cathode capacitance for transfer

(limiting resistor = 0 to 2.2k Ω , see note 9)

$V_a = 170V$

2700 pF

$V_a = 200V$

1000 pF

$V_a = 240V$

500 pF

Minimum value of trigger limiting resistor (see note 9)

$C_{Tr} < 4700pF$

0 Ω

$C_{Tr} = 4700$ to 15,000pF

2.2 k Ω

$C_{Tr} > 15,000pF$

5.6 k Ω

Minimum value of trigger current required for transfer

$V_a = 240V$

25 μA

$V_a = 170V$

500 μA

Components for self-extinguishing circuits

Minimum value of anode resistor $V_{a(b)} = 290V$, $R_{lim} = 1k\Omega$

$C_a > 2700pF$

1 M Ω

Minimum value of trigger resistor

$C_{Tr} > 500pF$

1 M Ω



Ionisation and deionisation

Nominal ionisation time (see curve on page C4)

 $I_a \text{ priming} = 2 \text{ to } 25 \mu\text{A}, V_{Tr} = V_{Tr(ign)} + 0.5V$ 2 ms $I_a \text{ priming} = 0 \mu\text{A}, V_{Tr} = V_{Tr(ign)} + 4V$ 5 s

Nominal deionisation time

 $I_{k(pk)} = 8 \text{ to } 20\text{mA}$ 3.5 ms $I_{k(pk)} = 20 \text{ to } 100\text{mA}$ 12 ms**ABSOLUTE MAXIMUM RATINGS**

Maximum anode voltage

Positive 290 V

Negative ($I_{Tr} = 0\text{mA}$) 90 V

Maximum cathode current

Average

Maximum averaging time = 15s 25 mA

Maximum averaging time = 20ms 40 mA

Peak

50c/s duty or repetitive operation 200 mA

Maximum duration = 1ms 1 A

Minimum average cathode current during any conduction period 8 mA

Maximum negative trigger-to-cathode voltage

 $(I_k = I_{Tr} = 0\text{mA})$ 75 V

Maximum peak trigger current

Positive 8 mA

Negative ($I_k = 0\text{mA}$, see note 10) 0 mAMaximum anode-to-trigger voltage ($I_k = 0\text{mA}$)

Anode positive 290 V

Anode negative 140 V

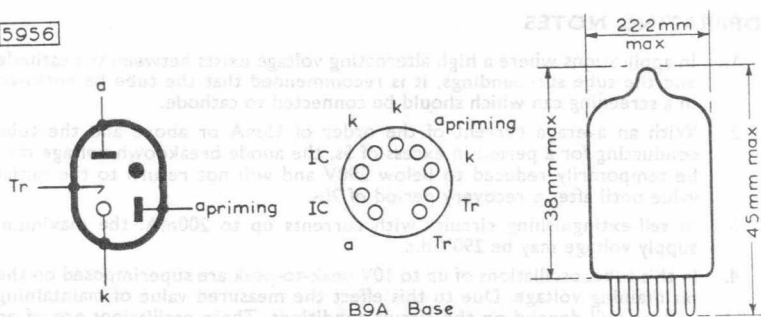
OPERATING NOTES

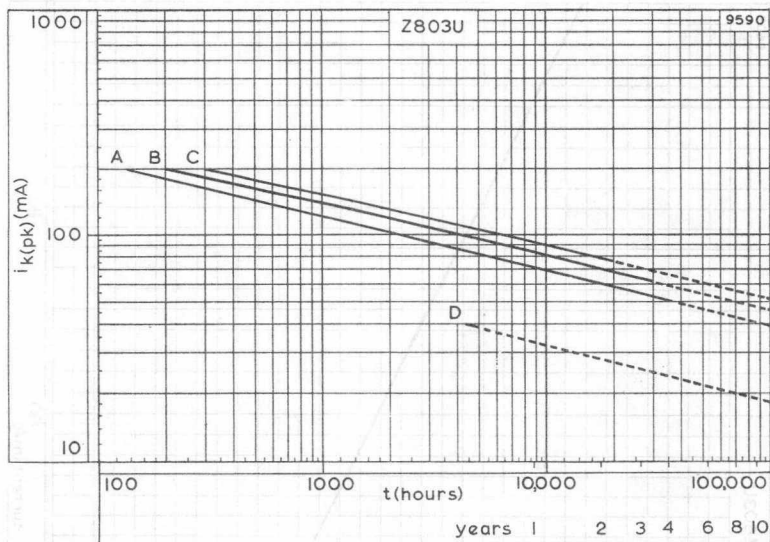
1. In applications where a high alternating voltage exists between the cathode and the tube surroundings, it is recommended that the tube be enclosed in a screening can which should be connected to cathode.
2. With an average current of the order of 15mA or above and the tube conducting for a period in excess of 5s, the anode breakdown voltage may be temporarily reduced to below 290V and will not return to the initial value until after a recovery period of 20s.
3. In self-extinguishing circuits with currents up to 200mA, the maximum supply voltage may be 290V d.c.
4. In this tube, oscillations of up to 10V peak-to-peak are superimposed on the maintaining voltage. Due to this effect the measured value of maintaining voltage will depend on the circuit conditions. These oscillations are of no significance in normal applications.



5. After a period of conduction, the trigger ignition voltage is depressed: however, the effect is reversible and the ignition voltage will return to its initial value after a recovery period with the tube non-conducting.
The magnitude of the final depression is dependent on the cathode current during the conduction period, and is reached in an exponential manner. The curves on page C3 give the formation and recovery of the depression at various cathode currents for a nominal tube.
In a repetitive circuit where the non-conducting period is short compared with the recovery time constant (e.g. 50c/s operation), the depression can be obtained from the curve by using a direct current equal to the mean current passing through the tube.
Further information on the use of these curves can be obtained from the Special Industrial Valve Department, Mullard Ltd.
6. In applications where pre-ignition current $< 4 \times 10^{-8} \text{A}$ is required the priming anode should be left disconnected. In this case, the trigger-to-cathode gap ionisation time may be of the order of seconds.
7. A period of the order of several seconds may elapse between the application of supply voltage to the priming anode and the establishment of a priming discharge.
8. The resistor between the priming anode and the supply voltage must be soldered directly to pin 6 of the tube socket. Stray circuit capacitance at the priming anode must be kept to less than 4pF.
9. This is the sum of any resistors in the capacitance discharge circuit which may include the cathode resistor.
10. Negative trigger current will flow during anode-to-cathode conduction in any circuit in which the trigger is returned via a resistor to a potential with respect to cathode which is less than the trigger-to-cathode maintaining voltage.
It is preferable that the circuit should be designed to avoid this condition by keeping the trigger supply voltage greater than the trigger maintaining voltage. In those applications where this cannot be achieved, the maximum anode supply voltage must be reduced from 290 to 250V and the magnitude of the negative trigger current must be less than 1% of the cathode current.

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LIFE EXPECTANCY

The curves show the life expectancy when the tube is run continuously at room temperature.

During periods of non-operation at room temperature the characteristics of the tube remain substantially constant. The total life expectancy in any given application is the sum of the non-operating periods and the operating life obtained from the curve.

For a given value of cathode current, it is estimated that 80% of all tubes will remain within the end points concerned for longer than the time shown.

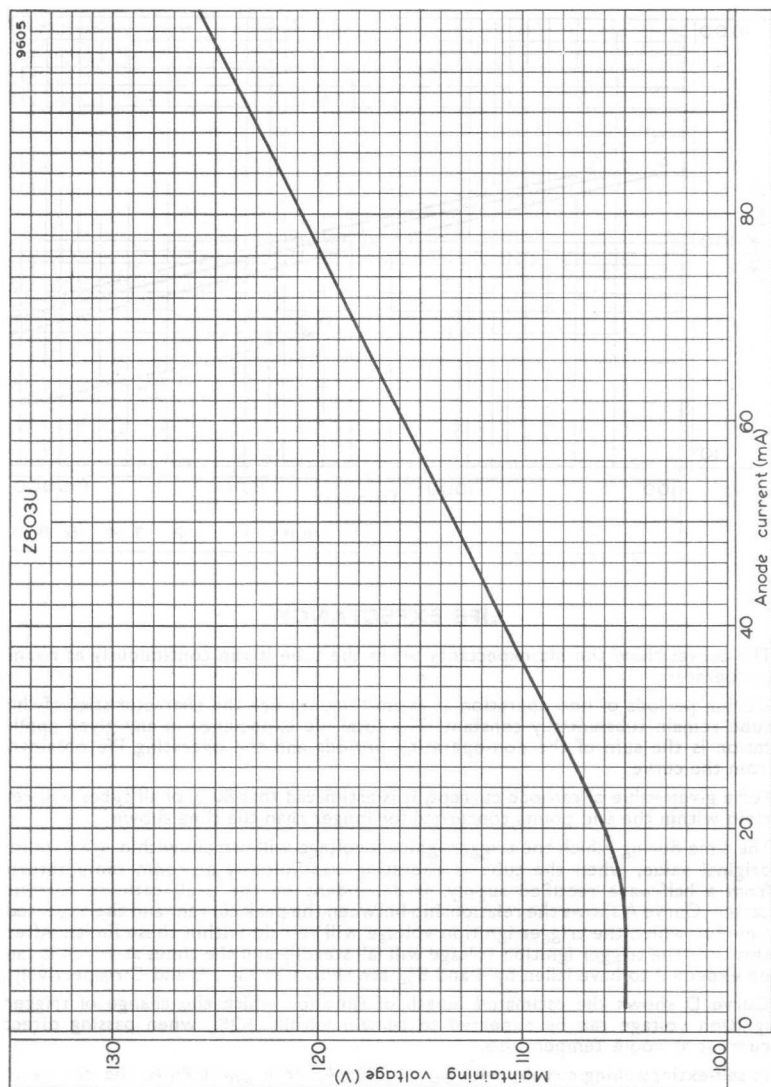
The time during which the trigger ignition voltage will remain within $\pm 2\%$ of its original value, when the tube is operating continuously at room temperature from a half-wave rectified supply, is dependent on the peak cathode current passed. Curve A shows the relationship between the peak current and the expected time for which the trigger ignition voltage will remain within these limits. After this time the trigger ignition voltage will fall steadily and the times at which it can be expected to have fallen by 4 and 8% are shown by lines B and C respectively.

Curve D shows the estimated length of time for which the change of trigger ignition voltage can be expected to remain within $\pm 2\%$ when passing direct current at room temperature.

In self-extinguishing circuits with $i_{k(pk)} < 200\text{mA}$ and $i_{k(av)} < 0.8\text{mA}$, the change of trigger ignition voltage can be expected to remain within $\pm 2\%$ for more than 30,000 hours.

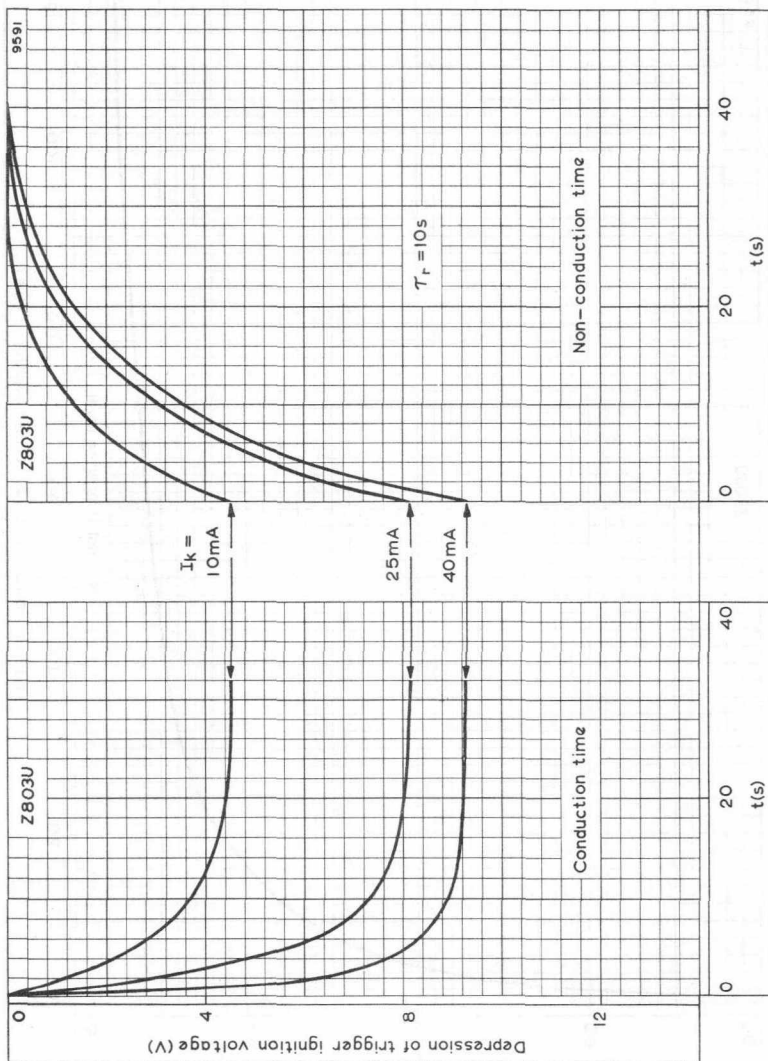
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COLD CATHODE TRIGGER TUBE

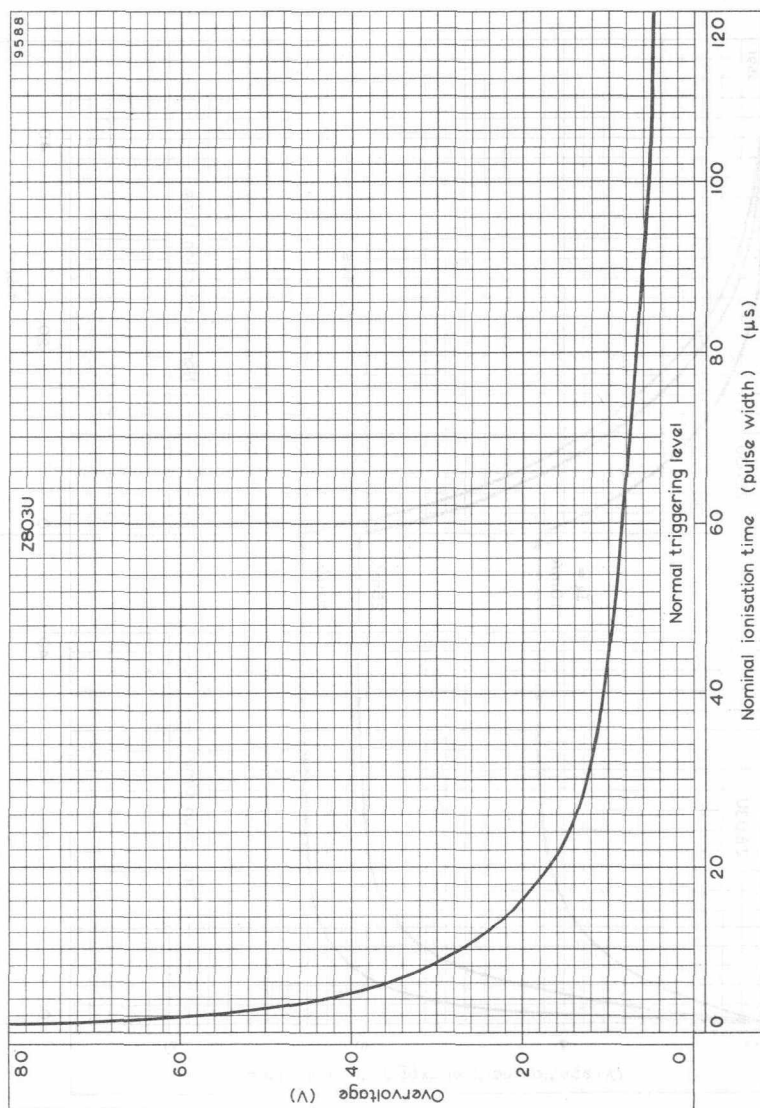


MAINTAINING VOLTAGE PLOTTED AGAINST ANODE CURRENT





FORMATION AND RECOVERY CURVES OF THE TRIGGER IGNITION VOLTAGE FOR A NOMINAL TUBE



TRIGGER OVERVOLTAGE PLOTTED AGAINST NOMINAL IONISATION TIME