

## TETRODE THYRATRON

# EN32

*Tetrode inert gas-filled thyatron with negative control characteristic. Primarily designed for industrial control applications.*

This data should be read in conjunction with DEFINITIONS AND GENERAL OPERATIONAL RECOMMENDATIONS—THYRATRONS, preceding this section of the handbook.

### LIMITING VALUES (absolute ratings, not design centre)

It is important that these limits are never exceeded and such variations as mains fluctuations, component tolerances and switching surges must be taken into consideration in arriving at actual valve operating conditions.

Max. peak anode voltage		
Inverse	1.3	kV
Forward	650	V
Max. cathode current		
Peak	2.0	A
Average (max. averaging time 15s)	300	mA
Surge (fault protection max. duration 0.1s)	10	A

Max. peak anode-cathode voltage

Max. peak heater-cathode voltage		
Cathode negative	25	V
Cathode positive	100	V
Min. valve heating time (for $i_{k(pk)}$ max = 2.0A)	20	s
Ambient temperature limits	-75 to +90	°C

**Note**—Where circuit conditions permit, the shield-grid should be connected directly to the cathode.



**Electrical**

Heater voltage	6.3	V
Heater current at 6.3V	950	mA
<b>Capacitances</b>		
Anode to grid	0.25	pF
Anode to cathode	0.06	pF
Grid to cathode	0.2	pF
Anode to shield-grid	3.0	pF
<b>Control ratio</b>		
$g_2$ to k and $R_{g1} = 0\Omega$	275	
$g_1$ to k and $R_{g2} = 0\Omega$	370	
Anode voltage drop	10	V
<b>Recovery (deionisation) time</b>		
$V_a = 650V, I_{a(pk)} = 2A, R_{g1} = 100k\Omega$		
$V_{g1} = -100V$	240	$\mu s$
$V_{g1} = -50V$	1.0	ms

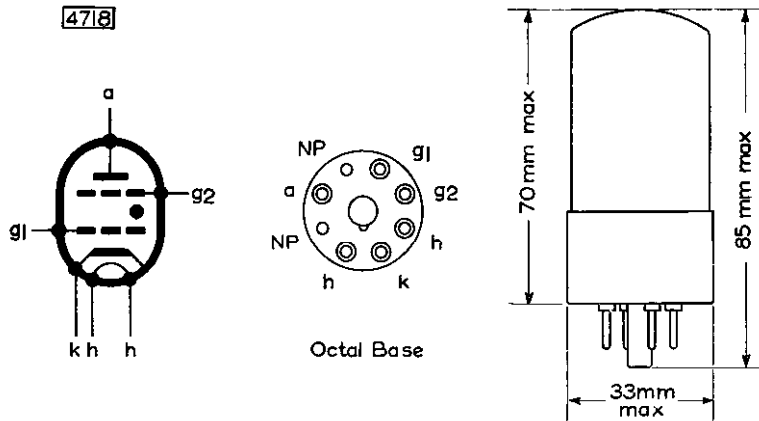
**Mechanical**

Type of cooling	Convection
Mounting position	Any

**CONTROL CHARACTERISTIC** (See page 5).

The curves given indicate the spread in characteristics due to:

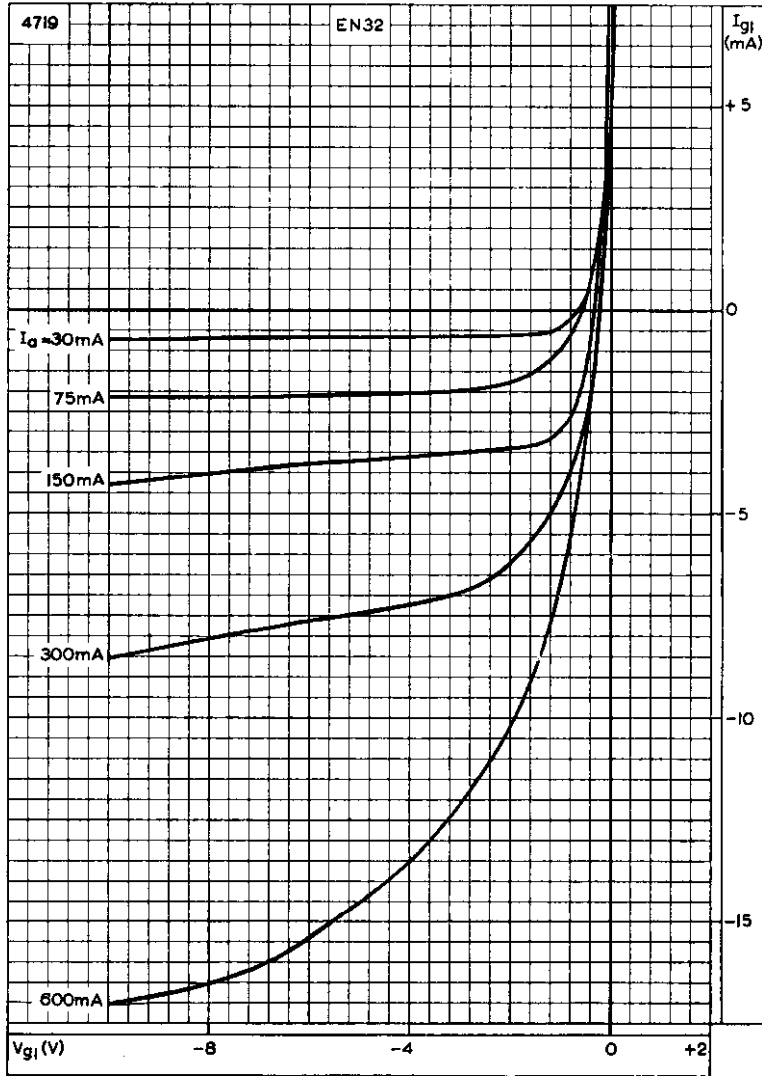
- (a) Variations in characteristics due to changes in heater voltage.
- (b) Variations in characteristics during life.
- (c) Variation in grid resistor.



# TETRODE THYRATRON

# EN32

Tetrode inert gas-filled thyatron with negative control characteristic. Primarily designed for industrial control applications.



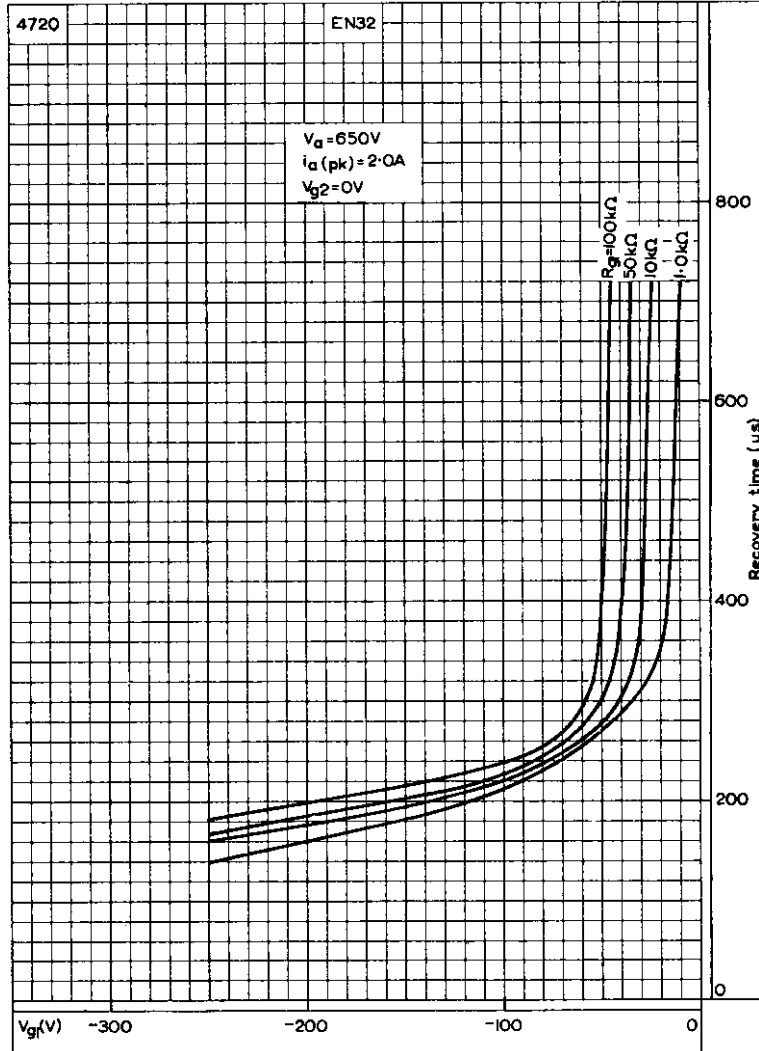
GRID ION CURRENT CHARACTERISTICS



# EN32

## TETRODE THYRATRON

Tetrode inert gas-filled thyatron with negative control characteristic. Primarily designed for industrial control applications.

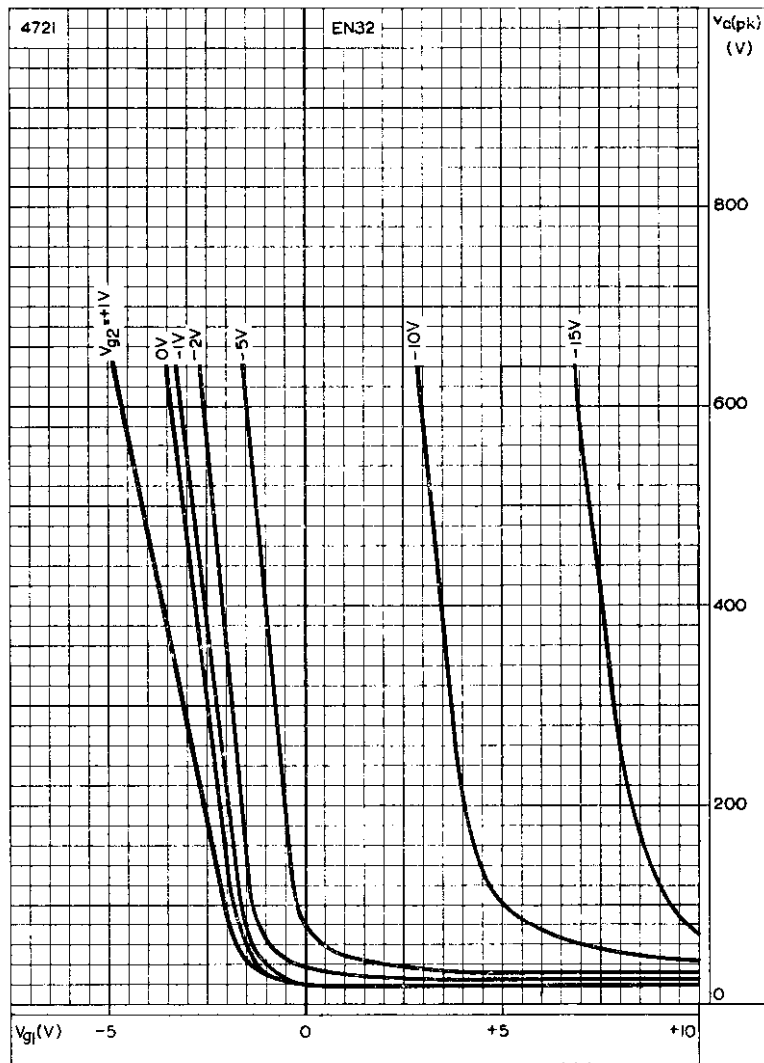


RECOVERY TIME PLOTTED AGAINST CONTROL-GRID VOLTAGE

# TETRODE THYRATRON

# EN32

Tetrode inert gas-filled thyatron with negative control characteristic. Primarily designed for industrial control applications.



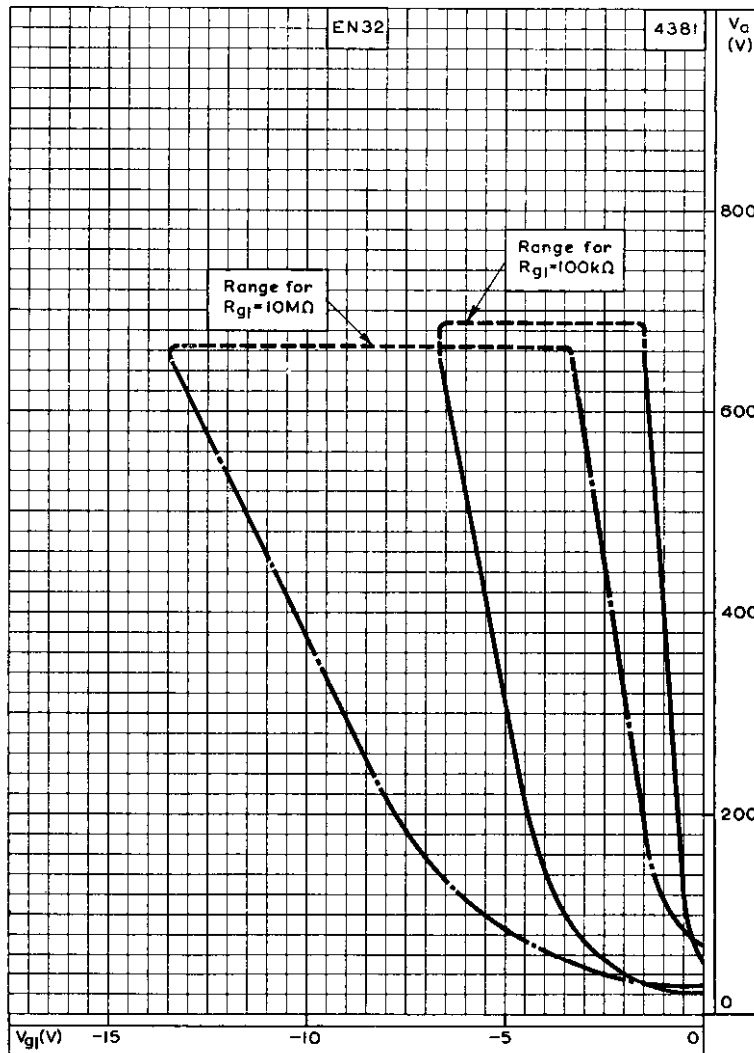
CONTROL CHARACTERISTIC (see page 2)



# EN32

## TETRODE THYRATRON

Tetrode inert gas-filled thyatron with negative control characteristic. Primarily designed for industrial control applications.



OPERATING RANGE OF CRITICAL GRID VOLTAGE

**SPECIAL QUALITY  
TETRODE THYRATRON**

**M8204**

*100mA special quality tetrode xenon thyatron with negative control characteristic for use in equipment where mechanical vibration and shocks are unavoidable and where statistically controlled major electrical characteristics are required.*

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS - THYRATRONs and GENERAL NOTES - SPECIAL QUALITY THYRATRONs which precede this section of the handbook, and the index numbers are used to indicate where reference should be made to a specific note.

**LIMITING VALUES<sup>3</sup>** (absolute ratings, not design centre)

It is important that these limits are never exceeded and such variations as mains fluctuations, component tolerances and switching surges must be taken into consideration in arriving at actual valve operating conditions.

	<i>Relay service and grid-controlled rectifier</i>	<i>Pulse modulator service</i>	
*Max. anode supply voltage	—	500	V
Max. peak anode voltage			
Inverse	1300	100	V
Forward	650	500	V
Max. cathode current			
Peak	0.5	10	A
Average (max. averaging time 30s)	100	10	mA
Surge (fault protection max. duration 0.1s)	10	10	A
Max. negative control-grid voltage			
Before conduction	100	100	V
During conduction	10	10	V
Max. average positive control-grid current for anode voltage more positive than -10V (averaging time 30s)	10	—	mA
Max. peak positive control-grid current during the time that the anode voltage is more positive than -10V	50	20	mA
Max. peak positive control-grid current during the time that the anode voltage is more negative than -10V	30	—	μA
Max. control-grid resistor	10	0.5	MΩ
Recommended min. control-grid resistor	100	—	kΩ
Max. negative shield-grid voltage			
Before conduction	100	50	V
During conduction	10	10	V



# M8204

## SPECIAL QUALITY TETRODE THYRATRON

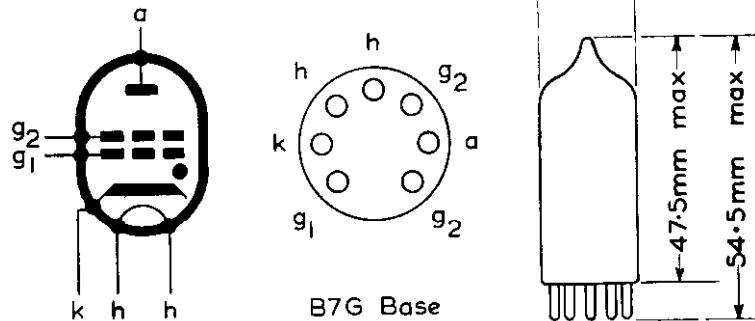
Max. average positive shield-grid current for anode voltage more positive than -10V (averaging time 30s)	10	—	mA
Max. shield-grid resistor	—	25	kΩ
Max. peak heater-to-cathode voltage			
Cathode negative	25	0	V
Cathode positive	100	0	V
Heater voltage	6.3V ± 10%	6.3V ± 10%	-5%

Ambient temperature limits	-75 to +90	-75 to +90	°C
Max. pulse duration	—	5.0	μs

### CAPACITANCES<sup>2</sup>

Anode to control grid	—	30	mpF
Control grid to cathode and shield grid	—	2.5	pF

4087



The bulb and base dimensions of this valve are in accordance with BS 448, Section B7G

**SPECIAL QUALITY  
TETRODE THYRATRON**

**M8204**

**TEST CONDITIONS** (unless otherwise specified)

$V_h$  (V) .....  
 $V_{g2}$  (V) .....  
 6.3 .....  
 0 .....

**TESTS  
GROUP A**

- Heater current .....
- Heater-to-cathode leakage current  
 $V_{h-k} = 25V$  cathode negative  
 $V_{h-k} = 100V$  cathode positive
- \*Grid 1 voltage  $V_a = 460V_{r.m.s.}$ ,  $R_{g1} = 100k\Omega$ ,  
 $R_a = 3.0k\Omega$
- \*Grid 1 voltage  $V_a = 460V_{r.m.s.}$ ,  $R_{g1} = 10M\Omega$ ,  
 $R_a = 3.0k\Omega$
- \*Anode voltage  $V_{g1} = 0V$ ,  $R_{g1} = 100k\Omega$ ,  $R_a = 1.0k\Omega$
- Anode voltage  $V_h = 0V$ ,  $V_{g1} = -100V$ ,  $R_a = 10k\Omega$
- No breakdown must occur

Operation.  $i_{load}$  (pulse)  
 Measured at  $V_{a(b)} = 500V$ ,  $V_{a(pk)} = 1.0kV$ ,  
 $V_{g1(pk)} = 100V$ ,  $V_{g1} = -50V$ ,  $R_{g1} = 10k\Omega$ ,  
 $R_{g2} = 25k\Omega$ .

P.R.F. = 500pps,  $t_p = 2 \pm 0.2\mu s$ .  
 Modulator line impedance  $Z_0 = 25\Omega$ .  
 Load resistance = 20 $\Omega$ , min. P.I.V. = 100V.  
 Pulse rise time = 0.2 $\mu s$  max.  
 Pulse fall time = 0.4 $\mu s$  max.

A.Q.L. <sup>4</sup> (%)	Individuals <sup>5</sup>		Lot average <sup>6</sup>		Units
	Bogey <sup>8</sup>	Min.	Max.	Min.	
{ 0.65	600	540	660	567	mA
—	—	—	—	633	mA
0.65	—	—	15	—	$\mu A$
0.65	—	—	15	—	$\mu A$
{ 0.65	-3.7	-2.9	-4.5	-3.4	V
—	—	—	—	-4.0	V
0.65	-4.2	—	-5.6	—	V
{ 0.65	22	—	38	—	V
—	—	—	—	33	V
0.65	—	650	—	—	V
0.65	—	16	—	—	A



# M8204

## SPECIAL QUALITY TETRODE THYRATRON

	A.Q.L. <sup>4</sup> (%)		Individuals <sup>5</sup>		Lot average <sup>6</sup>	
	Bogey <sup>8</sup>	Min.	Max.	Min.	Max.	
Pulse emission $V_h = 6.3V$ , $V_a = V_{g2} = V_{g1} = 180 \pm 9V$ , min. P.I.V. = 100V, $t_p = 5 \pm 0.25\mu s$ , pulse rise time = $0.5\mu s$ max., pulse fall time = $1.0\mu s$ max., p.r.f. = $100 \pm 5$ pps. Pulse applied across valve and $10\Omega$ resistor in series.	0.65	—	76	—	65	V
Voltage measured across valve	—	—	—	—	—	V
Group quality level <sup>9</sup>	1.0	—	—	—	—	
*Adjust voltage to initiate conduction.						
<b>GROUP B</b>						
Inoperatives <sup>14</sup>	0.4	—	—	—	—	
<b>GROUP C</b>						
Insulation	2.5	760	—	—	—	MΩ
$g_2$ -a measured at $V_{a-g2} = \pm 380V$	2.5	—	—	—	—	V
*Anode voltage. $V_h = 5.7V$ , $V_{g1} = 0V$ , $R_{g1} = 100k\Omega$ , $R_a = 1.0k\Omega$	2.5	—	50	—	45	V
*Grid 1 voltage. $V_h = 7.0V$ , $V_a = 460V_{r.m.s.}$ , $R_{g1} = 10M\Omega$ , $R_g = 3.0k\Omega$	—	—	—	—	—	V
(Following special pre-heat condition)	6.5	-4.6	-6.4	—	—	
*Grid 2 voltage. $V_a = 150V_{r.m.s.}$ , $R_a = 1.0k\Omega$ , $R_{g1} = 2.5k\Omega$ $V_{g1}$ supply in phase with $V_a$ supply, $V_{g2}$ in antiphase: r.m.s. voltage	6.5	2.45	1.85	3.05	—	V
Vibration. No applied voltages. Vibrate for 60s at 25c/s 2.5g then repeat group B test	6.5	—	—	—	—	
*Adjust voltage to initiate conduction.						





# M8204

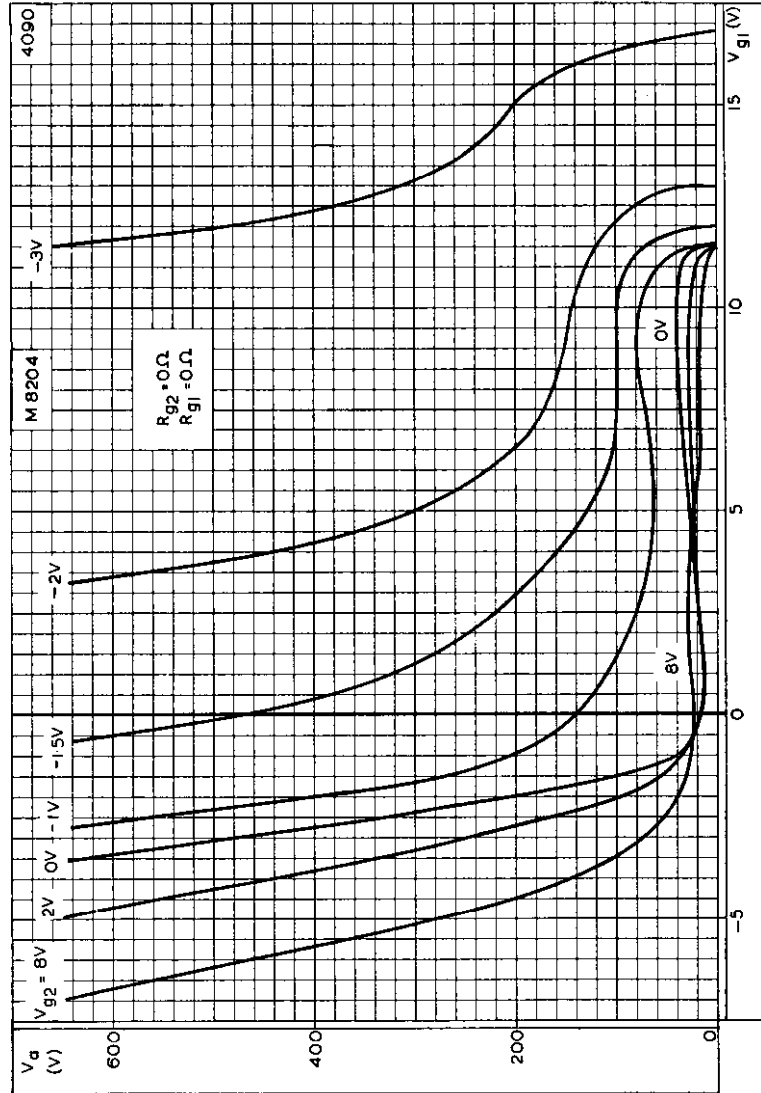
## SPECIAL QUALITY TETRODE THYRATRON

	A.Q.L. <sup>4</sup> (%)	Individuals <sup>5</sup>	
		Min.	Max.
<b>GROUP E</b>			
<b>Heater cycling life test</b> $V_h = 7.5V$ , 1 minute on, 1 minute off, 2000 cycles. $V_{h-k} = 100V$ cathode positive. No other applied voltages	1.0	—	—
<b>Heater cycling life test end points</b>			
Heater to cathode leakage current	—	—	20 $\mu A$
$V_{h-k} = 25V$ cathode negative	—	—	20 $\mu A$
$V_{h-k} = 100V$ cathode positive	—	—	—
<b>Intermittent life<sup>12</sup></b>			
Running conditions as grid controlled rectifier 500 hours			
$V_a = 460V$ r.m.s., $I_k = 80mA$ (d.c.) $R_{g1} = 50k\Omega$ , $i_{k(pk)} = 0.5A$ , Cathode heating time $20^{+0}_{-1}s$			
Room temperature			
<b>Intermittent life test end points</b>			
Inoperatives <sup>14</sup>			
Heater to cathode leakage current	—	—	20 $\mu A$
$V_{h-k} = 25V$ cathode negative	—	—	20 $\mu A$
$V_{h-k} = 100V$ cathode positive	—	—	50 V
Anode voltage as in Group A ( $V_{g1} = 0V$ )	—	—	100 V
Pulse emission as in Group A	—	—	—
Insulation $g_2$ as in Group C	—	380	$M\Omega$
<b>Continuous life, 200 hours' duration<sup>13</sup></b>			
Adjust $V_{a(pk)}$ for $I_{load\ pulse} = 20A$ initially			
Running conditions, pulse modulator service			
$V_a^{(b)} = 250V$ , $V_{a(pk)} = 500V$ , $V_{g1(pk)} = 100V$			
$V_{g1} = -50V$ , $V_{g2} = 0V$ , $R_{g1} = 10k\Omega$ , $R_{g2} = 25k\Omega$ , p.r.f. = 1000pps., modulator line impedance			
$Z_o = 12.5\Omega$ , load resistance = $7.5\Omega$ , $t_p = 2 \pm 0.2\mu s$			
<b>Life test end points</b>			
$I_{load\ pulse}$	—	16	A
Average life	—	180	hrs
Pulse emission as in Group A	—	—	100 V



SPECIAL QUALITY  
TETRODE THYRATRON

# M8204

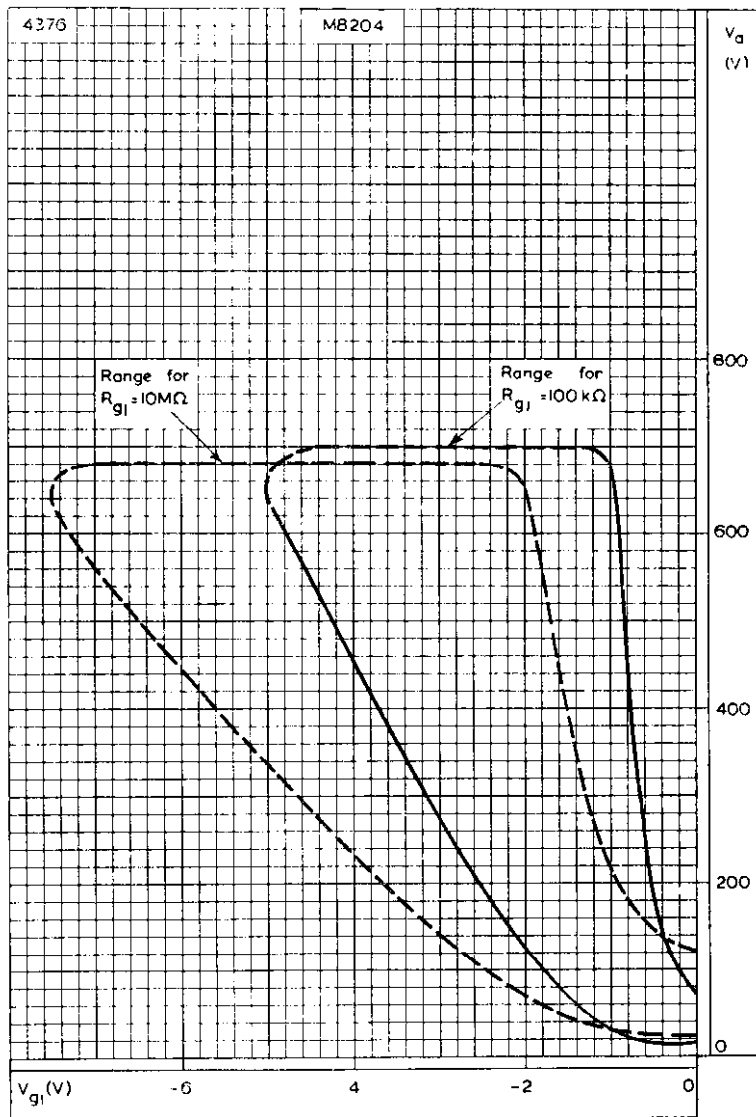


CONTROL CHARACTERISTIC



# M8204

SPECIAL QUALITY  
TETRODE THYRATRON

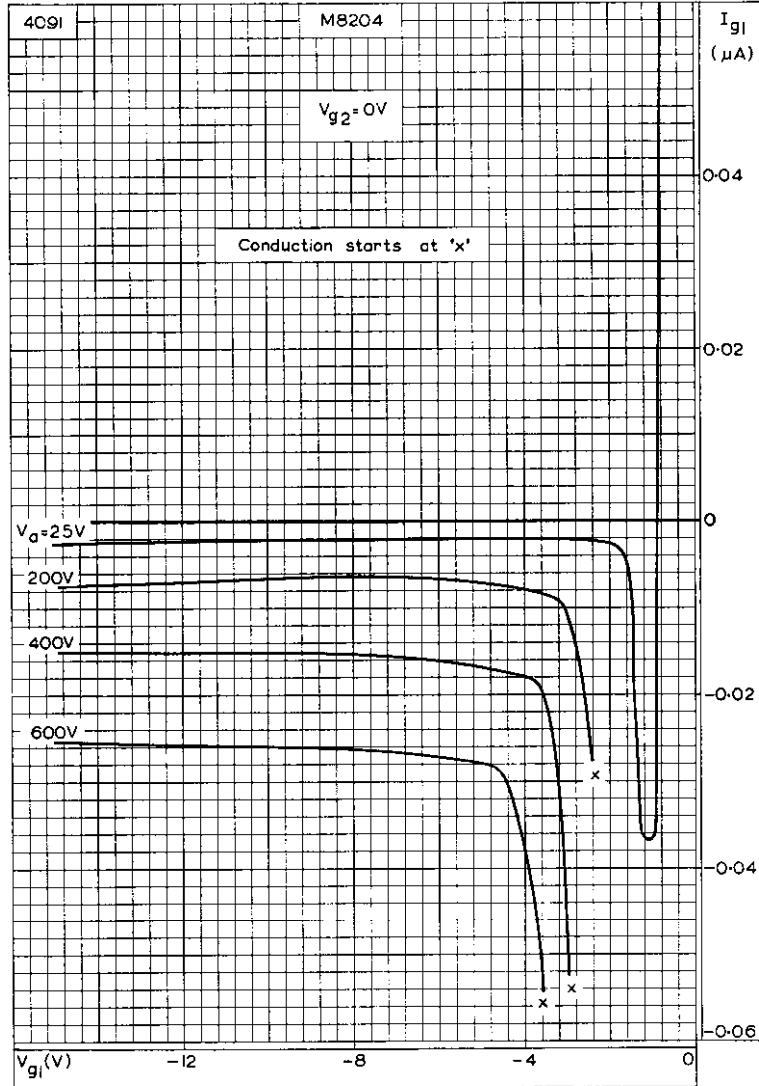


OPERATING RANGE OF CRITICAL CONTROL-GRID VOLTAGE



SPECIAL QUALITY  
TETRODE THYRATRON

# M8204

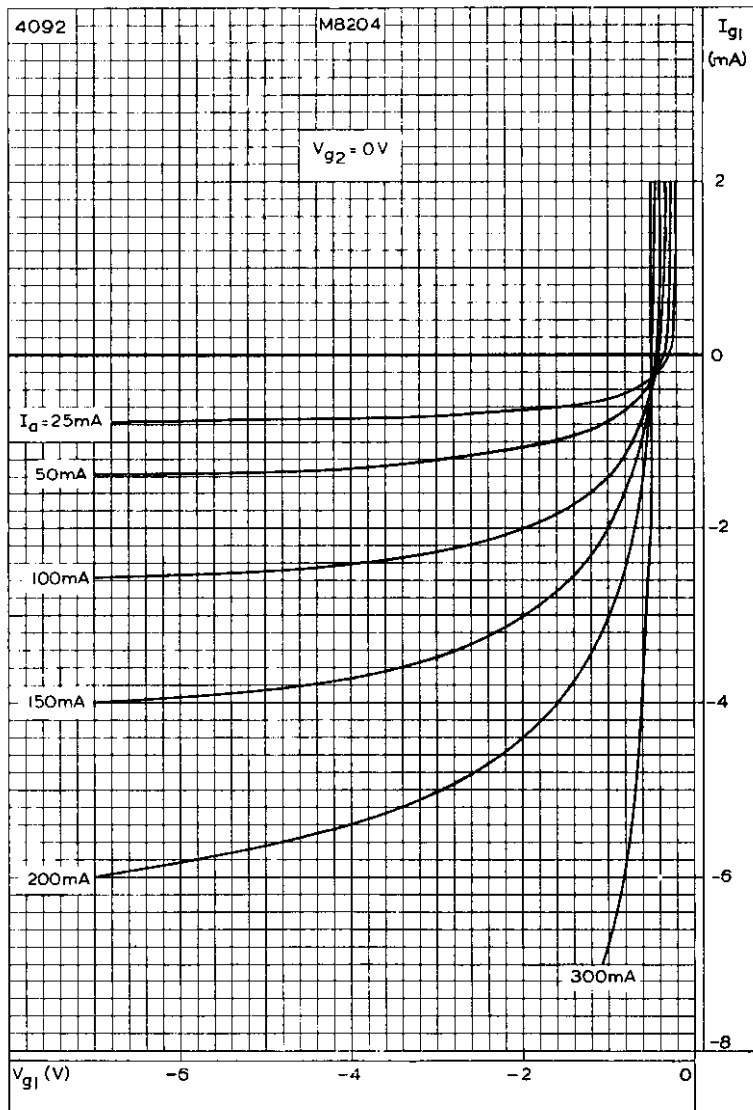


CONTROL-GRID CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE BEFORE CONDUCTION



# M8204

SPECIAL QUALITY  
TETRODE THYRATRON



CONTROL-GRID CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE  
DURING CONDUCTION



**COLD CATHODE GAS-FILLED TRIODE**

**Z300T**

*Cold cathode inert gas-filled triode designed for use as a general purpose trigger tube.*

(1267)

**CATHODE**

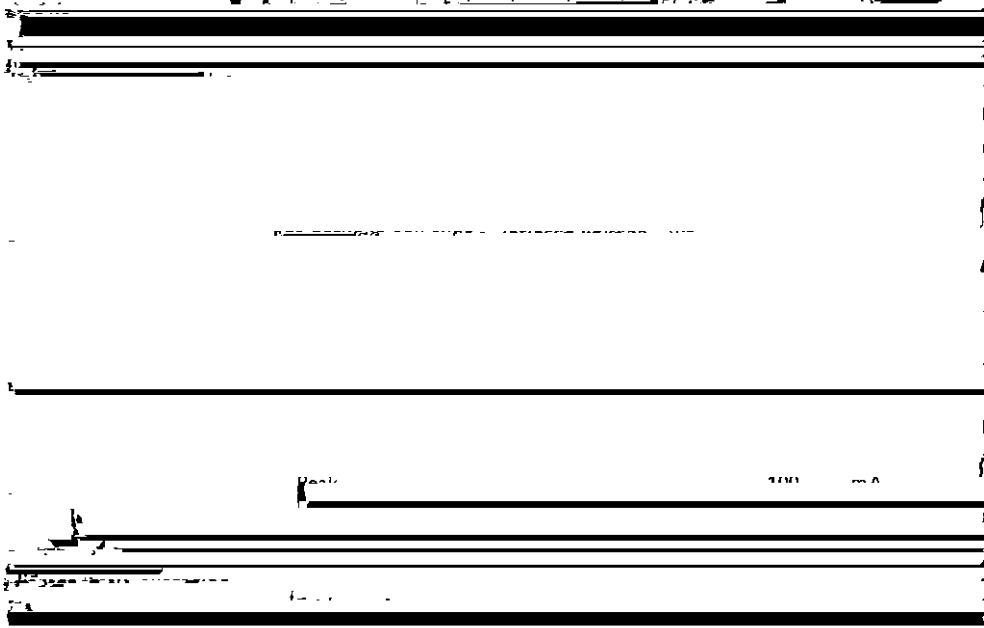
Cold

**CHARACTERISTICS**

Typical anode to cathode breakdown voltage with trigger connected to cathode

255

V



if the tube is to remain unstruck, the applied voltages must be represented by a point inside the characteristic. Any excursion of the working point into the region outside the characteristic will result in ignition.

- (c) This tube is recommended for operation only in quadrant I of the breakdown characteristic, i.e. with anode and trigger both positive. The limits within which all tubes fall in the first quadrant are shown under "Limiting Values".



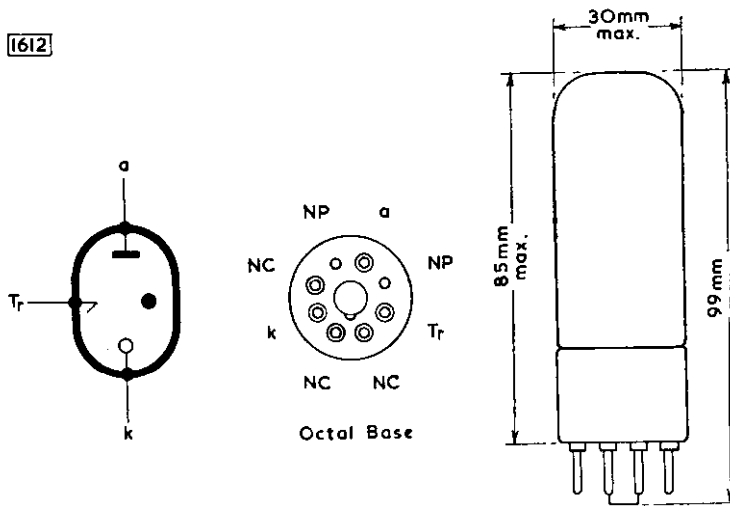
# Z300T

(1267)

## COLD CATHODE GAS-FILLED TRIODE

Cold cathode inert gas-filled triode designed for use as a general purpose trigger tube.

1612

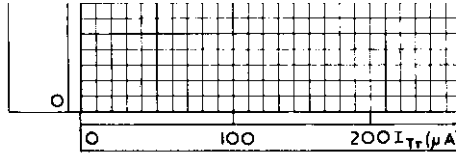
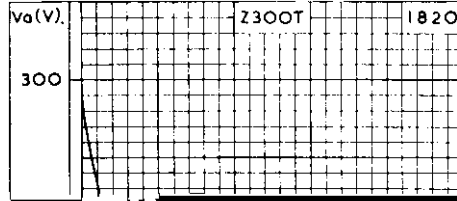


# COLD CATHODE GAS-FILLED TRIODE

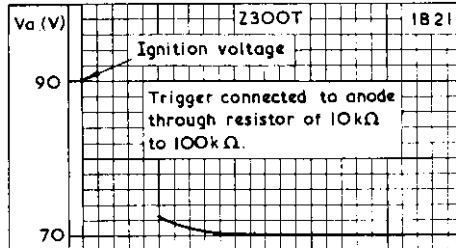
# Z300T

Cold cathode inert gas-filled triode designed for use as a general purpose trigger tube.

(1267)



AVERAGE TRANSITION CHARACTERISTIC  
(Trigger current required to initiate anode-to-cathode ignition)

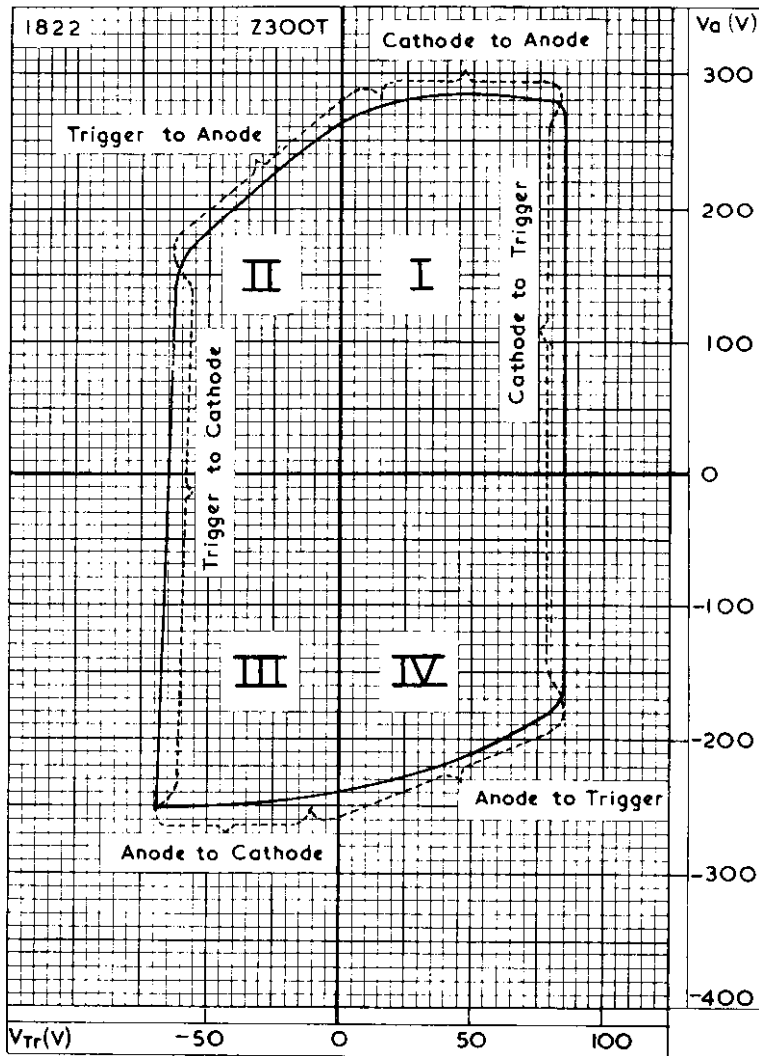


# Z300T

(1267)

## COLD CATHODE GAS-FILLED TRIODE

Cold cathode inert gas-filled triode designed for use as a general purpose trigger tube.



TYPICAL BREAKDOWN CHARACTERISTIC  
FOR DIFFERENT ELECTRODE POLARITIES



**SUBMINIATURE COLD CATHODE  
TRIGGER TUBE**

**Z700U**

**QUICK REFERENCE DATA**

For use in counting and switching circuits. When conducting this tube gives a redneon glow, which may be viewed through the base.

Anode supply voltage	250	V
Anode maintaining voltage	116	V
Maximum average cathode current	5	mA
Trigger ignition voltage	145	V
Trigger transfer requirements		
Capacitance	100	pF

This data should be read in conjunction with COLD CATHODE TRIGGER TUBE NOTES which precede this section of the handbook.

**CHARACTERISTICS AND RANGE VALUES FOR EQUIPMENT DESIGN**

With continuous priming discharge at an ambient temperature 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 or component variations.

This trigger tube has electrical priming and is designed for operation with positive voltages on anode and trigger, but will withstand negative voltages within the limits given.

**ANODE - TO - CATHODE GAP (d.c. and pulse triggering)**

**Anode voltage**

Positive for trigger-controlled ignition (note 1)

Maximum ( $V_{Tr} > 0V$ ) (note 2)	310	V
Minimum	200	V

**Anode - to - cathode maintaining voltage**

( $I_k = 3.5mA$ , see note 3 and page C2)

Initial

Maximum	120	V
Minimum	111	V



Life performance

Typical maximum	122	V
Typical minimum	111	V

In this tube a noise voltage may occur, superimposed upon the maintaining voltage.

TRIGGER - TO - CATHODE GAP

D. C. TRIGGERING ( $I_{Tr}$  positive or between 0 and  $-10\mu A$ )

	Initial values	Typical life performance (Note 4)
Trigger-to-cathode Ignition		
$(V_a = 250V, \text{ see page C1 and note 5})$		
Minimum voltage above which all tubes will ignite	153V	155V
Maximum voltage below which no tube will ignite	137V	137V
Typical maximum change		$\pm 3V$
Typical maximum temperature coefficient (bulb temperature range $-55$ to $+100^\circ C$ )	$-25$	$mV/^\circ C$
Trigger-to-cathode maintaining voltage		
$(I_{Tr} = 30\mu A, I_a = 0mA)$		
Typical maximum	125V	128V
Typical minimum	105V	105V
Recommended maximum trigger series resistor	20	$M\Omega$

PULSE TRIGGERING ( $I_{Tr}$  between  $-10\mu A$  and  $-120\mu A, t_p = 20\mu s, C_{Tr} = 100pF$ )

(Notes 1, 5 and 6)

Trigger-to-cathode ignition		
Minimum voltage above which all tubes will ignite	172V	Page C6
Maximum voltage below which no tube will ignite	135V	Page C6
Typical maximum temperature coefficient (bulb temperature range $-55$ to $100^\circ C$ )	$-25mV/^\circ C$	

**SUBMINIATURE COLD CATHODE  
TRIGGER TUBE**

**Z700U**

**PRIMING GAP Note 5.**

Minimum anode - to - priming cathode supply voltage	200	V
Anode - to - priming cathode maintaining voltage (over life), see page C5		
Maximum	180	V
Minimum	140	V
Maximum anode-to-priming cathode breakdown voltage (over life)	200	V
Priming cathode current to ensure other stated characteristics.		
Maximum	12	$\mu$ A
Minimum	1.0	$\mu$ A

**TRANSFER REQUIREMENTS**

Minimum trigger capacitance for transfer ( $V_a > 200V$ , $R_{lim} = 0\Omega$ note 11)	100	pF
Minimum $V_{Tr}$ (pulse + bias) for transfer ( $C_{Tr} = 100pF$ , $t_p = 20\mu s$ see curve on page C6)	207	V

**TYPICAL MINIMUM COMPONENTS TO ENSURE ANODE-TO-CATHODE SELF-EXTINCTION**

( $R_{Tr} = 1.2M\Omega$ )			
R	1.8	1.2	$M\Omega$
C	330	470	pF

**IONISATION AND RECOVERY (DEIONISATION)**

Typical maximum ionisation time ( $V_{Tr} = V_{Tr(ign)} + 50V$ , $C_{Tr} = 100pF$ , $R_{Tr} = 1.2M\Omega$ , $V_{ba} = 200$ to $300V$ )	5	$\mu s$
Nominal recovery (deionisation) time constant (Note 7)	170	$\mu s$



ABSOLUTE MAXIMUM RATINGS

Maximum negative anode voltages		
$I_{Tr} > 0\mu A$	0	V
$I_{Tr} = 0\mu A, V_{Tr} = -50 V \text{ to } +100V$	-50	V
Maximum cathode current (see curve on page C7)		
Maximum average	5	mA
Peak	200	mA
Minimum average cathode current during any conduction period		
	2	mA
Maximum negative trigger-to-cathode pulse voltage (Note 6) ( $I_k = I_{Tr} = 0mA$ )		
at $V_a = 300V$	30	V
at $V_a = 200V$	50	V
Maximum peak trigger current		
Positive	100	mA
Negative during any anode-cathode conduction period		
Anode-to-cathode gap conducting	120	$\mu A$
Anode-to-cathode gap non-conducting	0	$\mu A$
Bulb temperature Operation		
Maximum	+ 100	$^{\circ}C$
Minimum	-55	$^{\circ}C$
Standby and Storage		
Maximum	+ 70	$^{\circ}C$
Minimum	-55	$^{\circ}C$

LIMITING VALUES FOR REDUCED LIFE EXPECTANCY (4,000 operating hours)

If reduced life expectancy can be tolerated the following limiting values apply  
(maximum averaging time 20ms).

Maximum average cathode current	20	mA
Maximum average cathode current, half wave rectified a. c.	8	mA
Maximum peak cathode current half wave rectified a. c.	32	mA

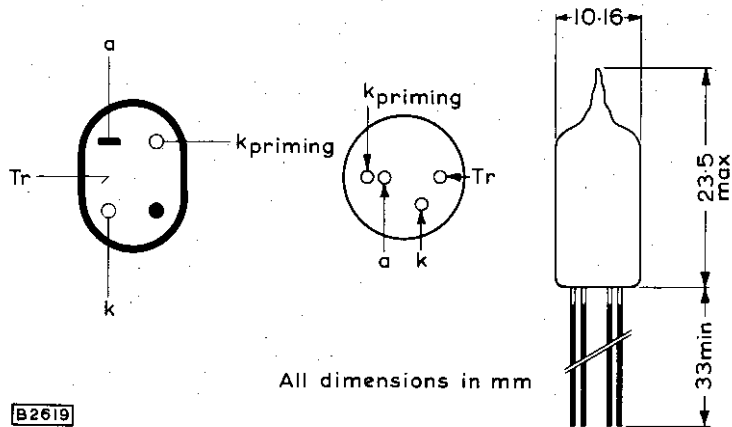
**SUBMINIATURE COLD CATHODE  
TRIGGER TUBE**

**Z700U**

NOTES

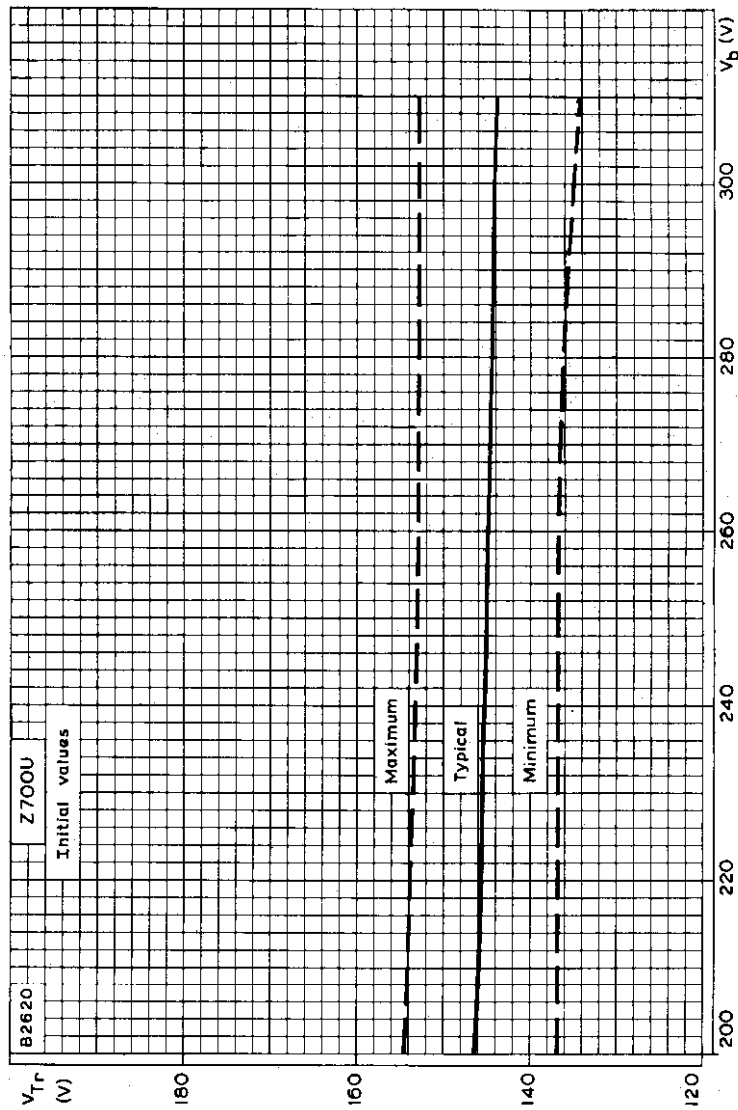
1. At anode supply voltages higher than 270V, spurious ignition may occur if a large amplitude pulse, (higher than 100V) with a steep leading edge which is not intended to ignite the tube, reaches the trigger. The tube may ignite spontaneously when mounted in an electric field, the probability of ignition being dependent on the field strength (direction and magnitude) and its rate of change. An electrostatic shield connected to earth can be mounted round the tube if necessary.  
Touching the envelope by live components should be avoided and it is recommended to maintain a separation between components and any part of the envelope of at least a few millimetres.
2. The value quoted relates to a tube which has been conducting with an average current of 6mA. For currents above 6mA the average value for the breakdown voltage depression (hysteresis) is 4V/mA. The normal value will be restored within 30s after cessation of conduction.
3. Immediately after ignition a voltage considerably lower than the published maintaining voltage may occur across the tube. Thus the output pulse may be higher than the difference between supply voltage and maintaining voltage.
4. To achieve the maximum stability in electrical characteristics the following operation notes should be observed.
  - i. Repetitive ignition via the trigger-to-cathode gap is recommended. The frequency of these ignitions should preferably be greater than once per minute. At these low frequencies a trigger capacitor larger than the specified minimum should be used.
  - ii. It is recommended that peak currents should be allowed to flow immediately after breakdown, this can be achieved by the use of a by-pass capacitance: however such peak currents must lie within the stated limits.
  - iii. In general cathode current pulses are preferable to d.c.
5. Care should be taken to sustain the priming discharge during operation
6. In some circuits differentiation may give rise to negative pulses on the trigger, care must be taken not to exceed the limiting values for  $-V_{Tr}$ .

7. The anode recovery time is the time required after the interruption of the anode current for the trigger to regain control. The figure quoted is the value of the time constant  $RC$  determining the rate of rise of the anode voltage.
8. Any bending of the leads must be at least 2mm from the seal.
9. The leads may be dip soldered to a minimum of 5mm from the seals at a solder temperature of 240°C for a maximum of 10 seconds.
10. The trigger and priming cathode resistors and capacitors should be mounted close to the tube.
11. In the case of the d.c. ignition of the trigger it is recommended that higher values of  $C_{Tr}$  should be used at low anode supply voltages e.g. 1nF at  $V_{ba} = 200V$ .



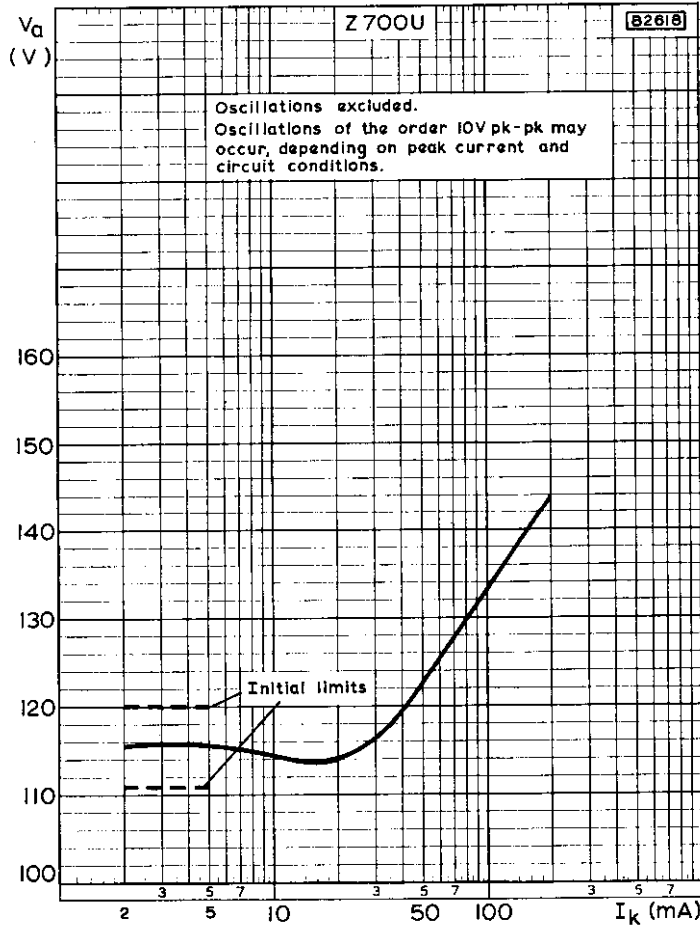
**SUBMINIATURE COLD CATHODE  
TRIGGER TUBE**

**Z700U**



SPREAD OF TRIGGER BREAKDOWN CHARACTERISTIC

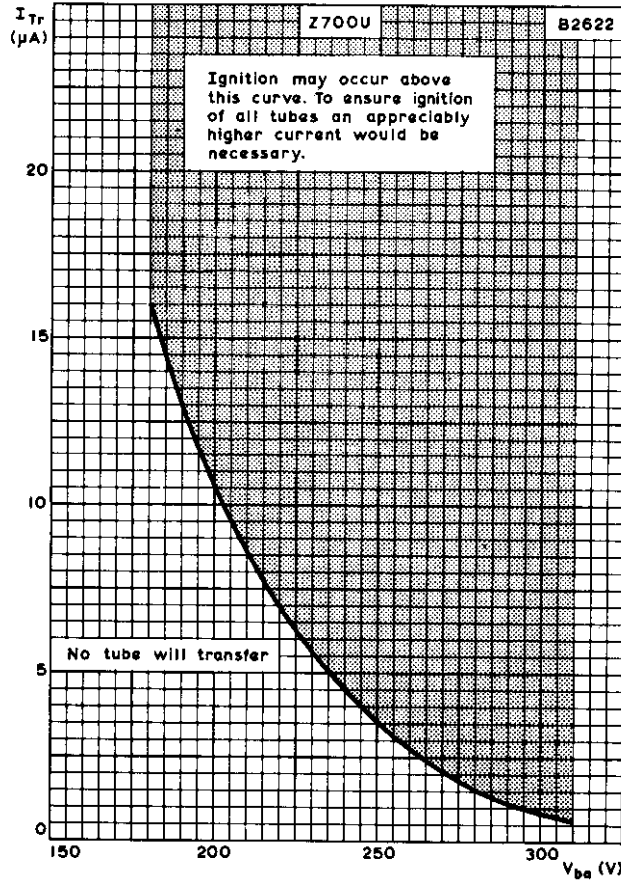




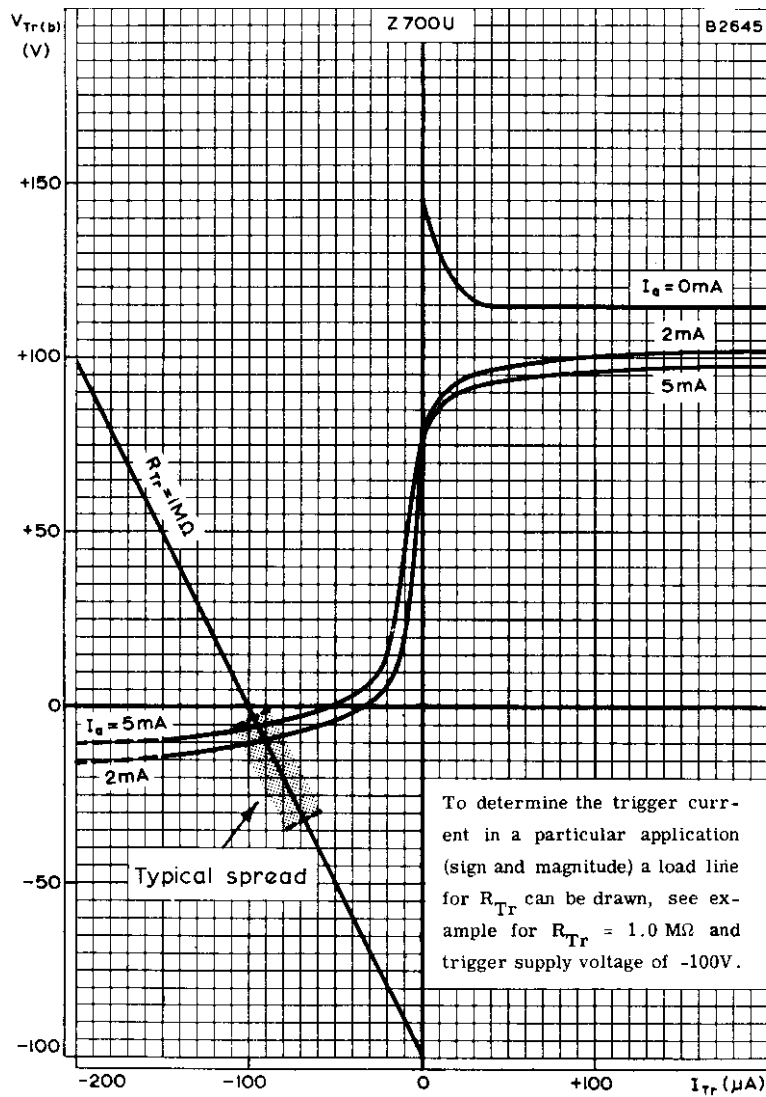
TYPICAL ANODE-TO-CATHODE MAINTAINING VOLTAGE CHARACTERISTICS

**SUBMINIATURE COLD CATHODE  
TRIGGER TUBE**

**Z700U**



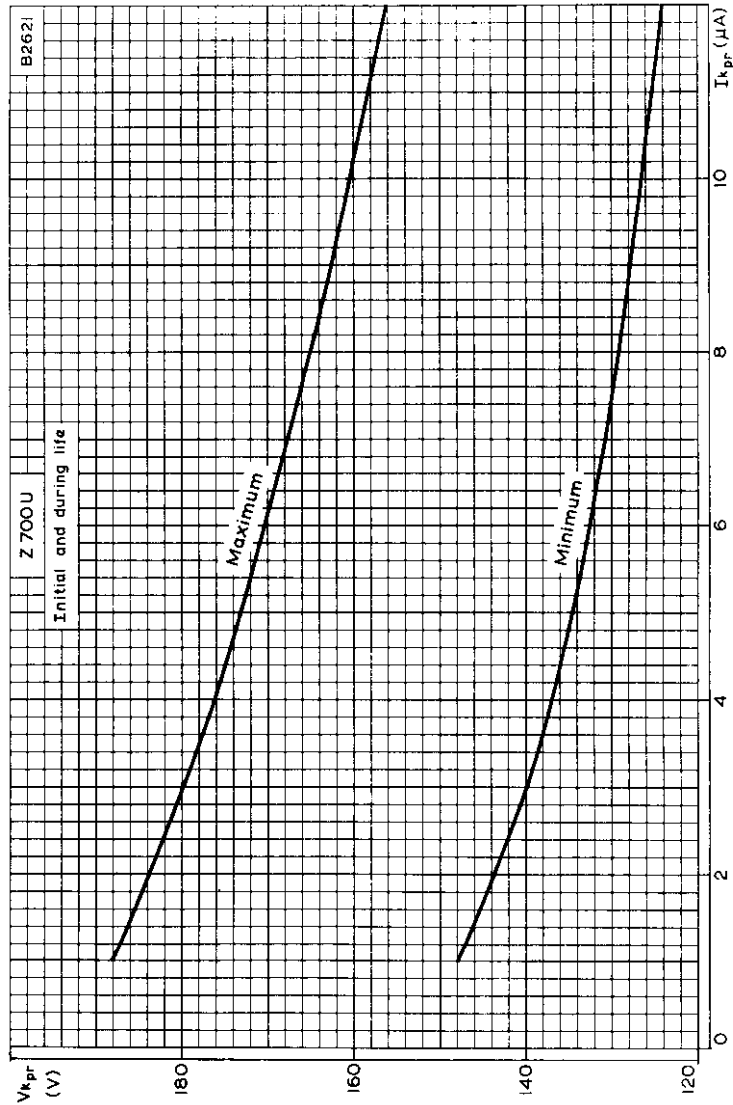
TRIGGER CHARACTERISTIC FOR NON TRANSFER



TYPICAL TRIGGER VOLTAGE AS A FUNCTION OF TRIGGER CURRENT, AFTER BREAKDOWN.

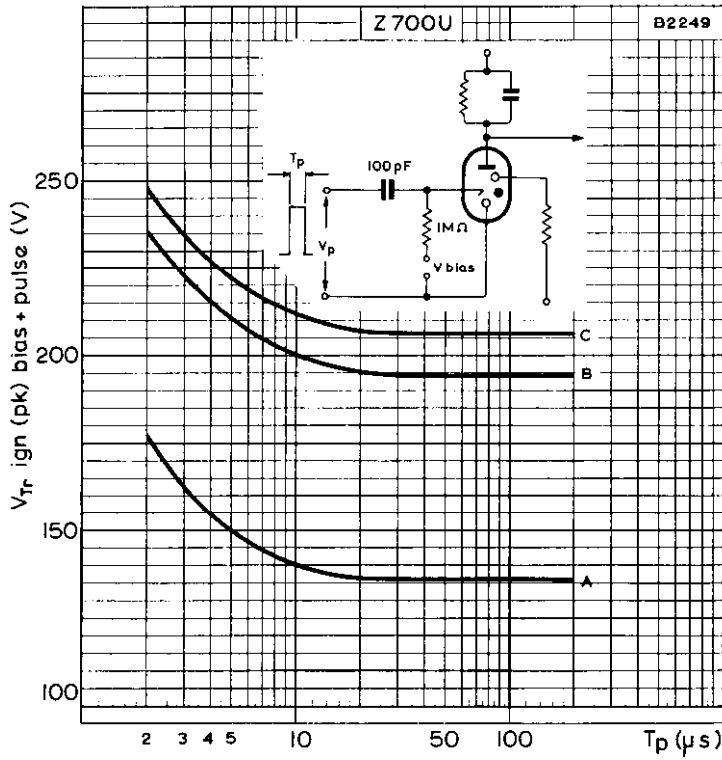
**SUBMINIATURE COLD CATHODE  
TRIGGER TUBE**

**Z700U**



PRIMING CATHODE VOLTAGE CHARACTERISTIC.





Curve A

Below curve A no tube will ignite initially and during life.

Curves B and C

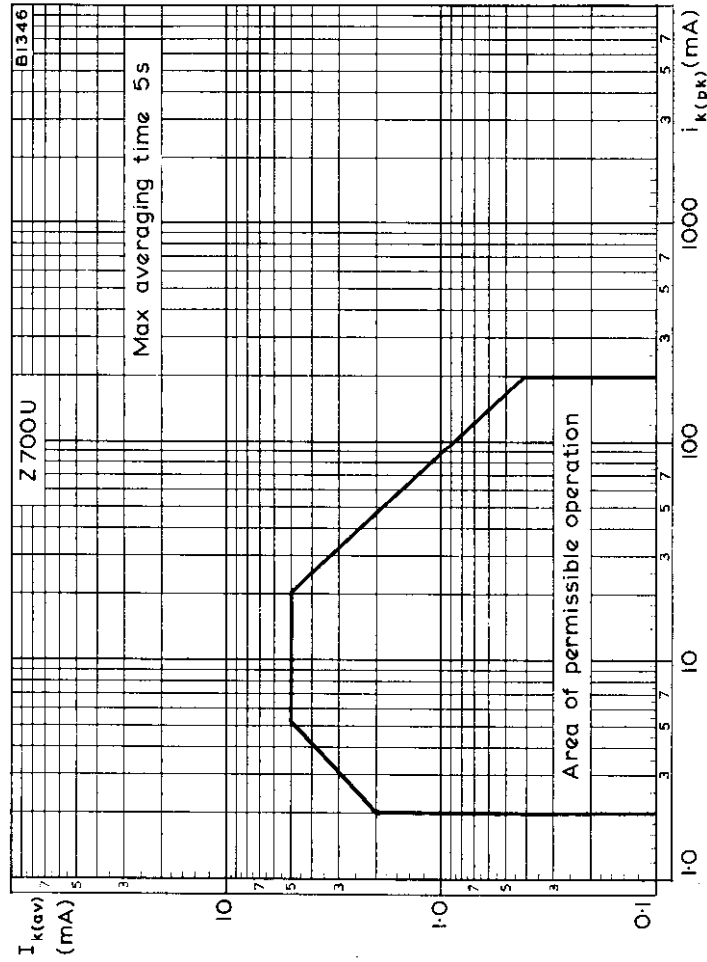
Sum of bias and pulse voltage to ensure breakdown initially and during life.  
For repetitive ignition with  $>1$  pulse/minute.

Curve C

For continuous conduction and repetitive ignition with  $>1$  pulse/minute.  
Valid under most unfavourable conditions within the absolute maximum ratings.

**SUBMINIATURE COLD CATHODE  
TRIGGER TUBE**

**Z700U**



**LIMITING VALUES OF CATHODE CURRENT  
(FOR LONG LIFE EXPECTANCY)**



( )

( )

( )

( )

■

## SUBMINIATURE COLD CATHODE TRIGGER TUBE

# Z700W

Trigger tube with two independent trigger electrodes primarily intended for use in reversible counting and switching circuits. When conducting, this tube gives a visible glow.

### QUICK REFERENCE DATA (nominal values)

The Z700W has two trigger electrodes and is otherwise electrically and mechanically similar to the Z700U, and can be used in conjunction with this tube.

Anode supply voltage	250	V
Anode maintaining voltage	116	V
Maximum average cathode current	4	mA
Trigger ignition voltage (either trigger)	145	V
Trigger transfer current (either trigger)	50	$\mu$ A

### CHARACTERISTICS AND RANGE VALUES FOR EQUIPMENT DESIGN

Anode-to-cathode maintaining voltage (at $I_a = 3$ mA)	See page C1	
Maximum	121	V
Minimum	111	V
Cathode current range	2 to 4	mA
Trigger-to-cathode ignition voltage (either trigger) $V_a = 250$ V	See page C2	
Maximum (Note 2)	153	V
Minimum	137	V
Trigger maintaining voltage (either trigger)	115	V
Temperature coefficient of trigger-to-cathode ignition voltage (either trigger)		
Maximum	-25 mV per °C	
Maximum trigger series resistance (either trigger) (Note 3)	20	M $\Omega$

# Z700W

## SUBMINIATURE COLD CATHODE TRIGGER TUBE

---

Priming cathode-to-anode supply voltage		
Minimum	200	V
Primer maintaining voltage ( $I_{k \text{ priming}} = 3\mu\text{A}$ )	155	V
Primer current		
Maximum	10	$\mu\text{A}$
Minimum	1	$\mu\text{A}$
Recommended priming cathode series resistor (Note 3)	18	$\text{M}\Omega$
Maximum frequency of operation in a counter chain (See Note 4 and fig. 1)	2 to 5	kc/s

### Transfer requirements

Minimum trigger current for transfer (either trigger) $V_a = 250\text{V}$ (See page C3)	50	$\mu\text{A}$
Recommended value of $V_{Tr(\text{pulse} + \text{bias})}$ ( $\tau_{\text{pulse}} = 20\mu\text{s}$ ) (See pages C5 and C6)	200	V

### Typical component values for self-extinguishing circuits

R	1.8	1.2	0.7	$\text{M}\Omega$
C	300	600	2000	pF

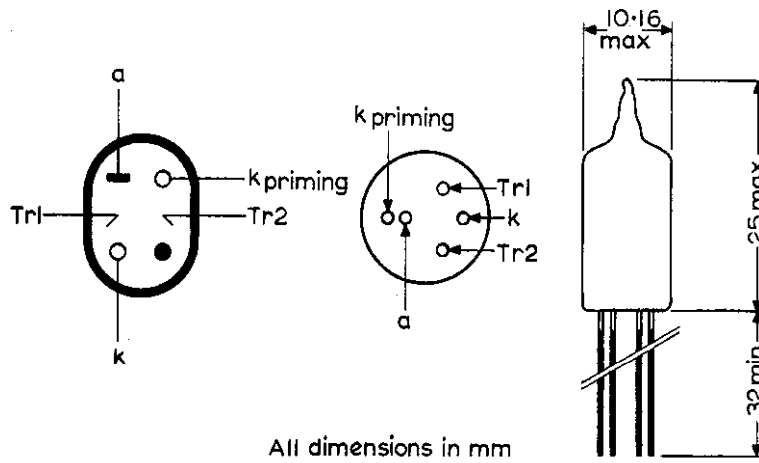
### LIMITING VALUES (absolute ratings)

Maximum anode supply voltage		
Positive	310	V
Negative	0	V
Cathode current		
Minimum instantaneous	2	mA
Maximum average (av. time = 1s)	4	mA
Maximum peak (Note 5)	16	mA
Maximum negative trigger voltage (either trigger), tube not conducting		
At supply voltage = 300V	30	V
At supply voltage = 200V	50	V
Maximum negative trigger current (either trigger) (Note 6)		
Tube conducting	150	$\mu\text{A}$
Tube non-conducting	0	$\mu\text{A}$
Maximum ambient temperature	70	$^{\circ}\text{C}$



# Z700W

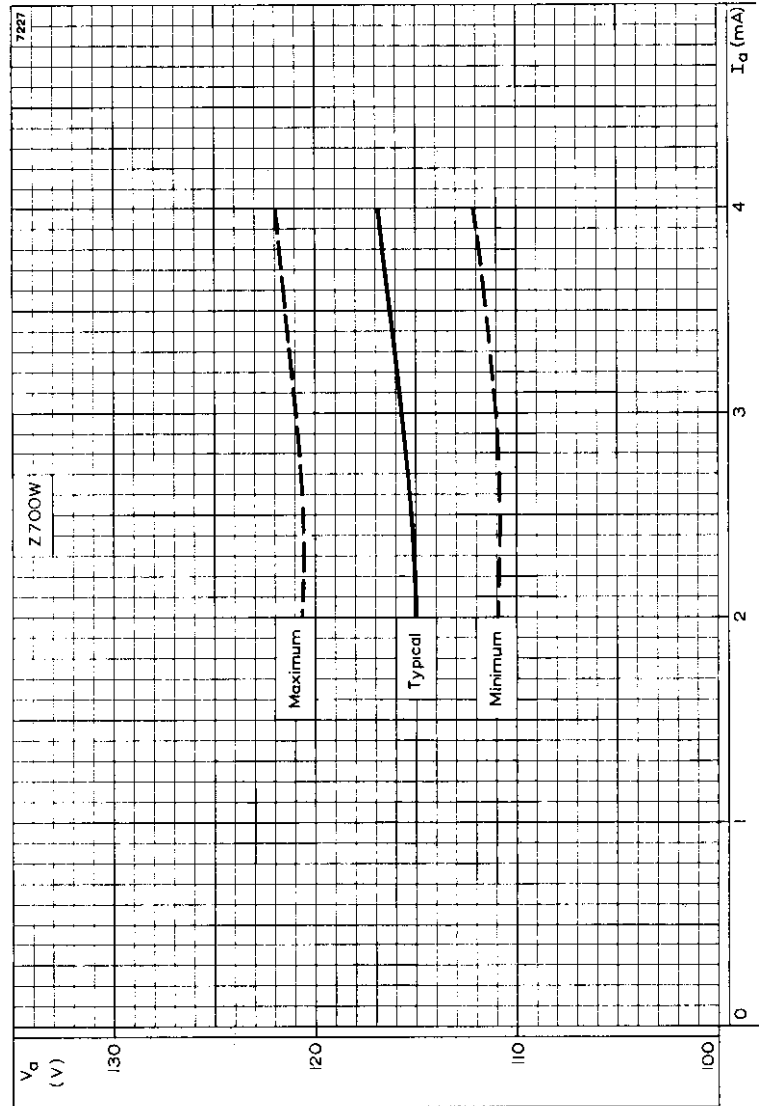
## SUBMINIATURE COLD CATHODE TRIGGER TUBE



All dimensions in mm

SUBMINIATURE COLD CATHODE  
TRIGGER TUBE

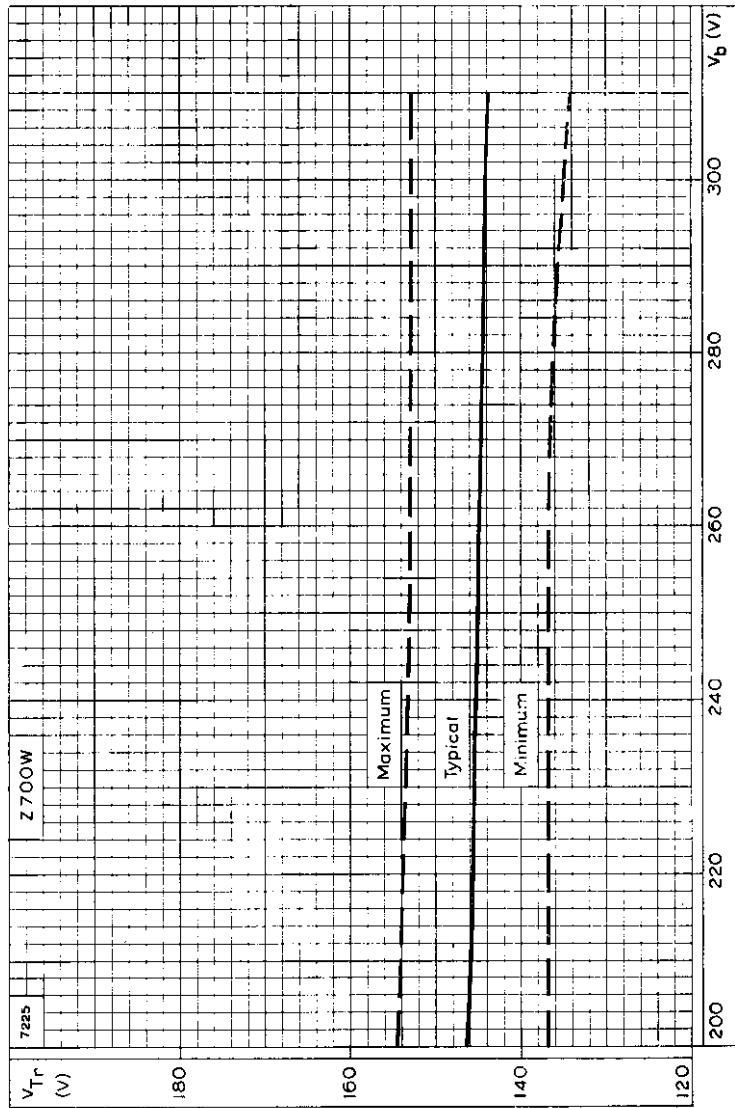
# Z700W



SPREAD OF ANODE MAINTAINING VOLTAGE CHARACTERISTIC

# Z700W

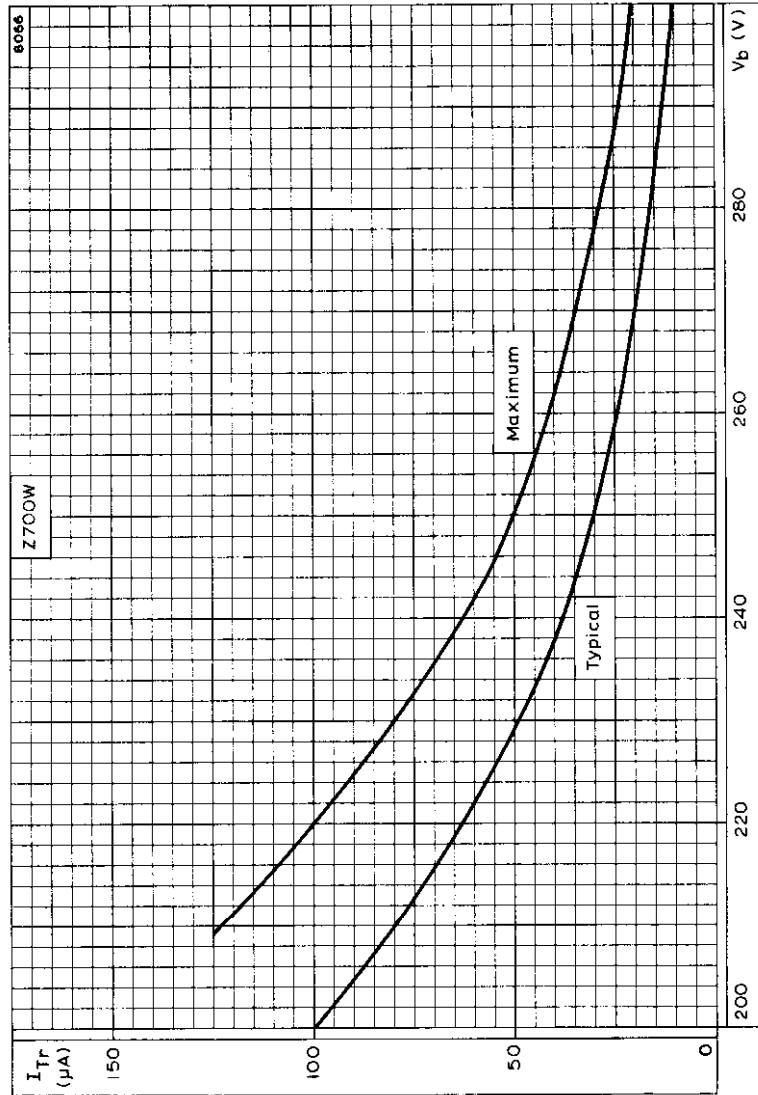
## SUBMINIATURE COLD CATHODE TRIGGER TUBE



SPREAD OF TRIGGER IGNITION CHARACTERISTIC

SUBMINIATURE COLD CATHODE  
TRIGGER TUBE

# Z700W

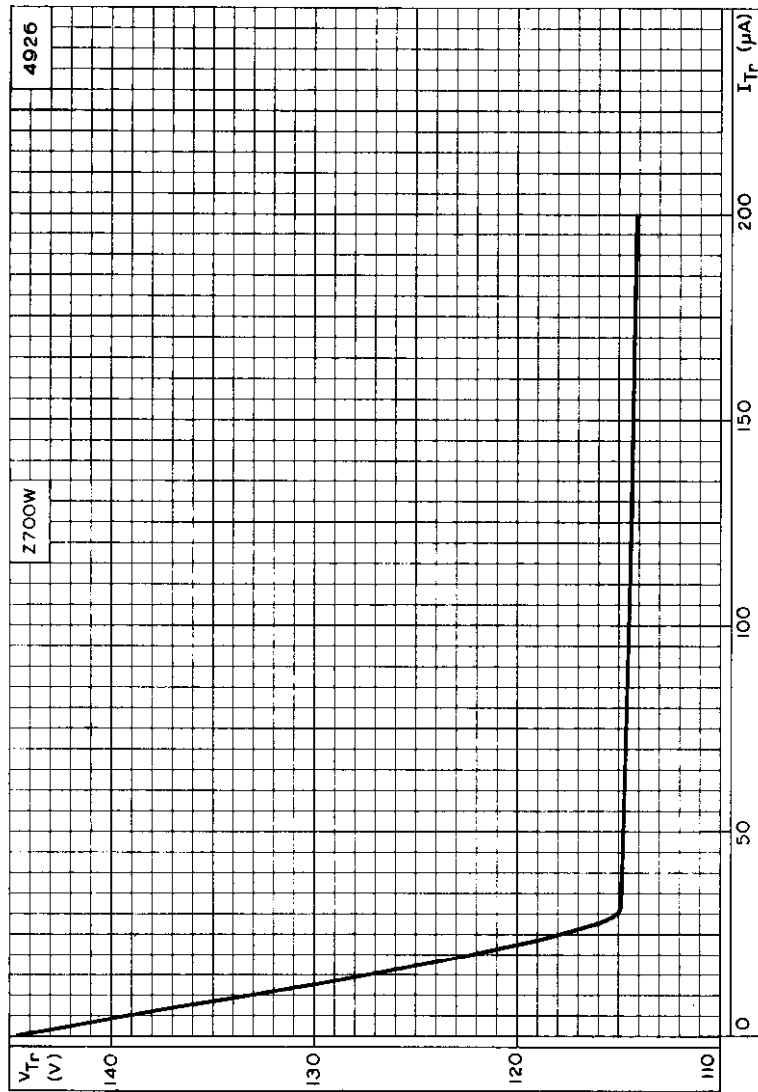


SPREAD OF TRANSFER CHARACTERISTIC



# Z700W

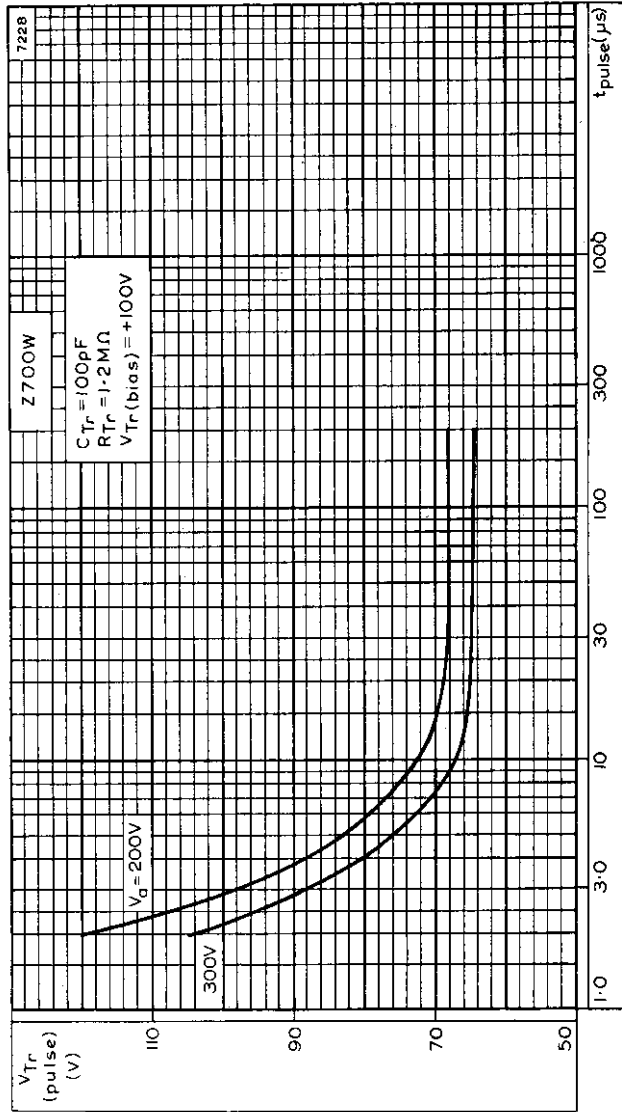
## SUBMINIATURE COLD CATHODE TRIGGER TUBE



TYPICAL TRIGGER MAINTAINING VOLTAGE CHARACTERISTIC

**SUBMINIATURE COLD CATHODE  
TRIGGER TUBE**

**Z700W**

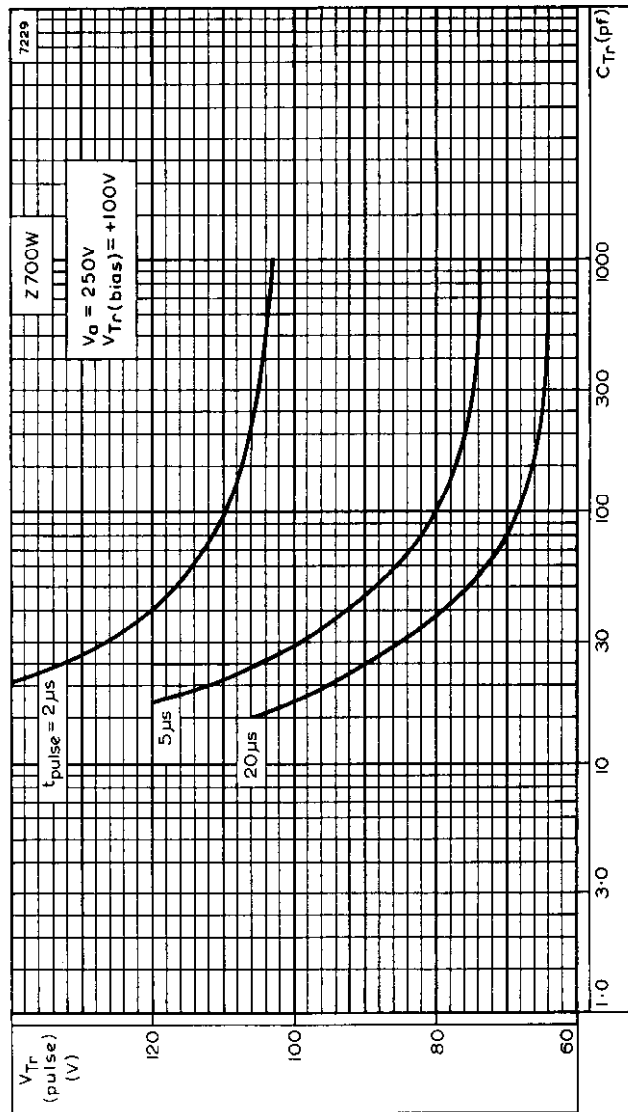


TYPICAL DYNAMIC TRIGGER IGNITION VOLTAGE CHARACTERISTICS



# Z700W

## SUBMINIATURE COLD CATHODE TRIGGER TUBE



DYNAMIC TRIGGER IGNITION VOLTAGE AS A FUNCTION OF CAPACITANCE FOR RECTANGULAR PULSES

# SUBMINIATURE COLD CATHODE TRIGGER TUBE

# Z701U

## QUICK REFERENCE DATA

Cold cathode trigger tube with two triggers having similar characteristics. It is intended for use in counting and switching applications as well as speech passing circuits in telephone exchanges. When conducting, the tube has a low noise level and low impedance to speech frequencies.

Anode supply voltage	150	V
Anode-to-cathode maintaining voltage	60	V
Maximum cathode current		
continuous	7.0	mA
intermittent	9.0	mA
Trigger ignition voltage (either trigger)	80	V
Trigger transfer current (either trigger)	40	$\mu$ A

## CHARACTERISTICS AND RANGE VALUES FOR EQUIPMENT DESIGN (see note 1)

The values given state the range over which the tube will operate. No allowance has been made for supply voltage and component variations. This tube has been designed to be ignited with positive voltages on the triggers and anode.

### Anode supply voltage

maximum	165	V
minimum	120	V

Anode-to-cathode maintaining voltage (at  $I_a = 5.0$  mA)      See page C1

### Cathode current range (see note 2)

for general operation	3.0 to 7.0	mA
for counting circuits	1.5 to 7.0	mA
for speech passing (intermittent service)	7.0 to 9.0	mA



Trigger-to-cathode ignition voltage (at $V_a = 130V$ ) See page C2 and note 3.		
Nominal trigger-to-cathode maintaining voltage	64	V
Maximum trigger series resistance (see note 4)	1.0	M $\Omega$
Tube impedance over the frequency range 300 to 3300Hz (at $I_k = 8.0mA$ )		
typical	400	$\Omega$
maximum	800	$\Omega$
Maximum frequency of operation in a counter chain (see notes 5 and 6 and page A1)	2.0	kHz

#### Transfer requirements

Trigger current for transfer	See page C3	
Minimum capacitance for triggering (see note 7)		
$V_a = 150V$	1.0	nF
$V_a = 120V$	10	nF

#### RATINGS (ABSOLUTE MAXIMUM SYSTEM)

Maximum anode supply voltage	165	V
Maximum cathode current (see note 2)		
Average	9.0	mA
Peak	12	mA
Maximum negative trigger current (see note 8)		
Tube conducting	200	$\mu A$
Tube non-conducting	0	$\mu A$
Maximum bulb temperature	70	$^{\circ}C$

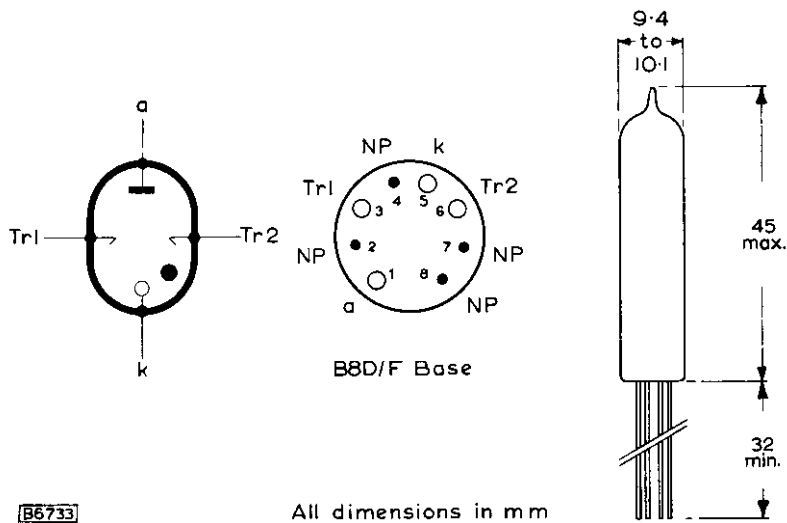
#### OPERATING NOTES

1. These values apply only when the tube is subjected to some ambient illumination (10 lux). Strong light such as direct sunlight should not, however, be allowed to fall on the tube.
2. For cathode currents above 7.0mA the tube can be used only for intermittent duty.
3. If a tube is ignited with pulses of short duration, the total trigger voltage (bias + pulse) should exceed 90V. A recommended minimum value with a 1000pF coupling capacitor and a pulse duration of 25 $\mu s$  is 120V (bias approx. 60V).
4. Higher values of trigger series resistance are permitted, but a value of the trigger pre-strike current during life of 5.0 $\mu A$  maximum has to be taken into account. The trigger pre-strike current causes apparent increase of the trigger ignition voltage.
5. If the tube is used in a circuit where only one trigger is required, both triggers should be connected together.

# SUBMINIATURE COLD CATHODE TRIGGER TUBE

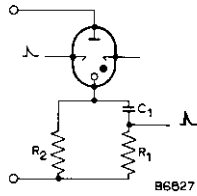
# Z701U

6. The maximum frequency depends on the component tolerances and the stability of the supply voltage.
7. The trigger resistors and capacitors should be mounted close to the tube.
8. Negative trigger current is defined as conventional current flowing from the tube to the trigger circuit (viz. trigger acting as cathode). This current will flow whenever the trigger is returned via a resistor to a potential less than the trigger maintaining voltage.
9. The tube may be soldered directly into the circuit, but heat conducted to the glass should be kept to a minimum by the use of a thermal shunt. The leads may be dip-soldered to a minimum of 5mm from the glass-to-metal seals at a solder temperature of 240°C for a maximum of 10 seconds. Bending of the tube leads must be at least 1.5mm from the seal.



B6733

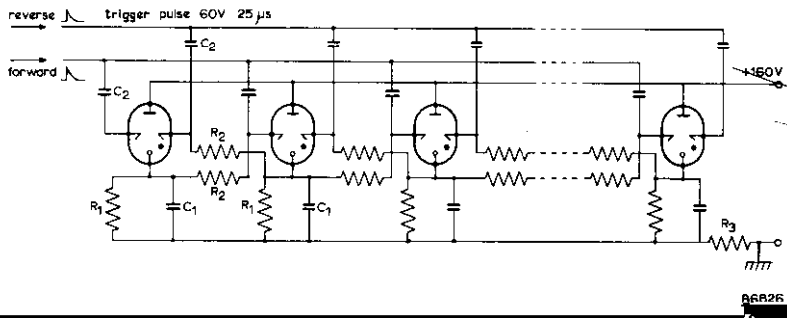
TYPICAL SELF EXTINGUISHING PULSE FORMING CIRCUIT



$R_1 = 5.6k\Omega$   
 $R_2 = 470k\Omega (> 350k\Omega)$   
 $C_1 = 10nF$

In this type of circuit the required trigger voltage is  $>100V$ .

TYPICAL DECADE COUNTER CIRCUIT

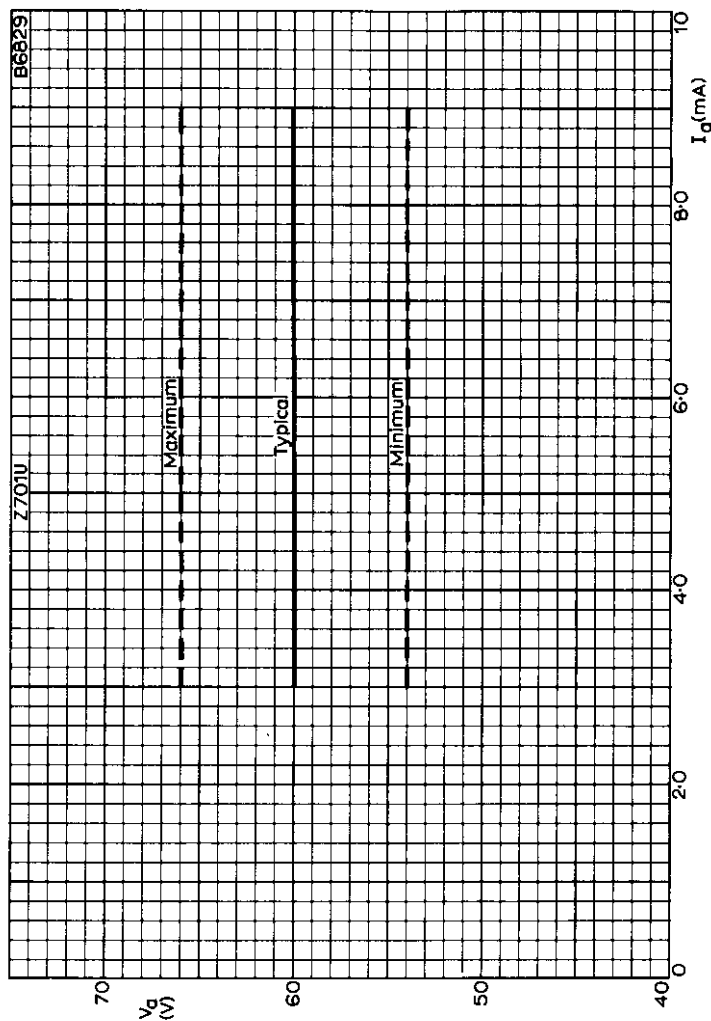


The issue of the information contained in this publication does not imply any authority or licence for the utilisation of any patented feature.



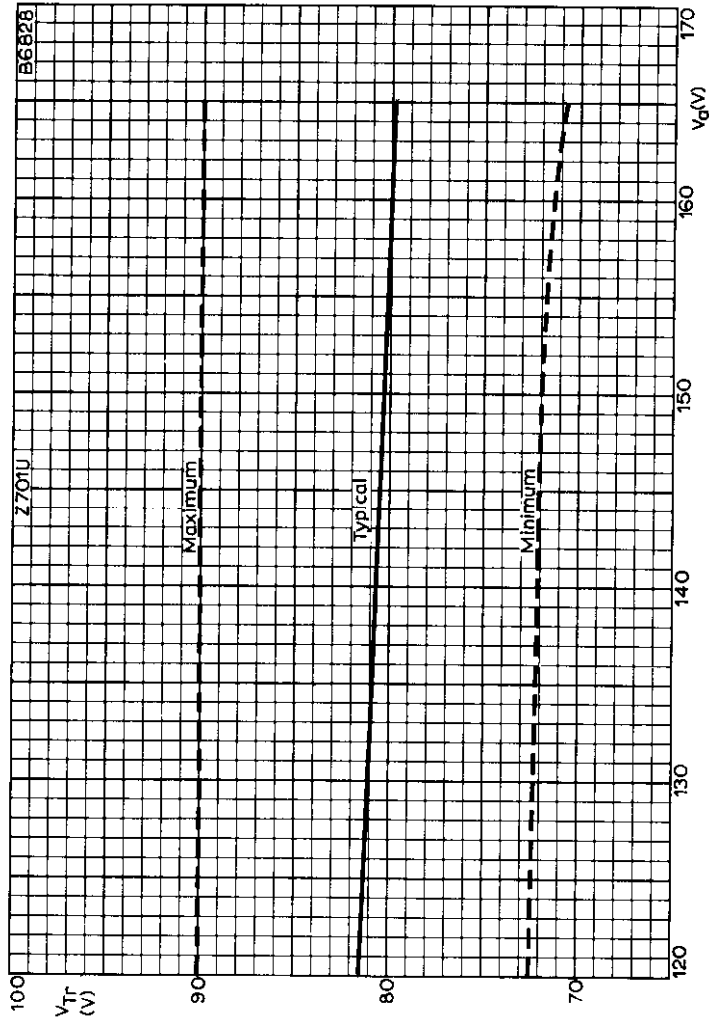
**SUBMINIATURE COLD CATHODE  
TRIGGER TUBE**

**Z701U**



SPREAD OF ANODE-TO-CATHODE MAINTAINING VOLTAGE  
CHARACTERISTIC



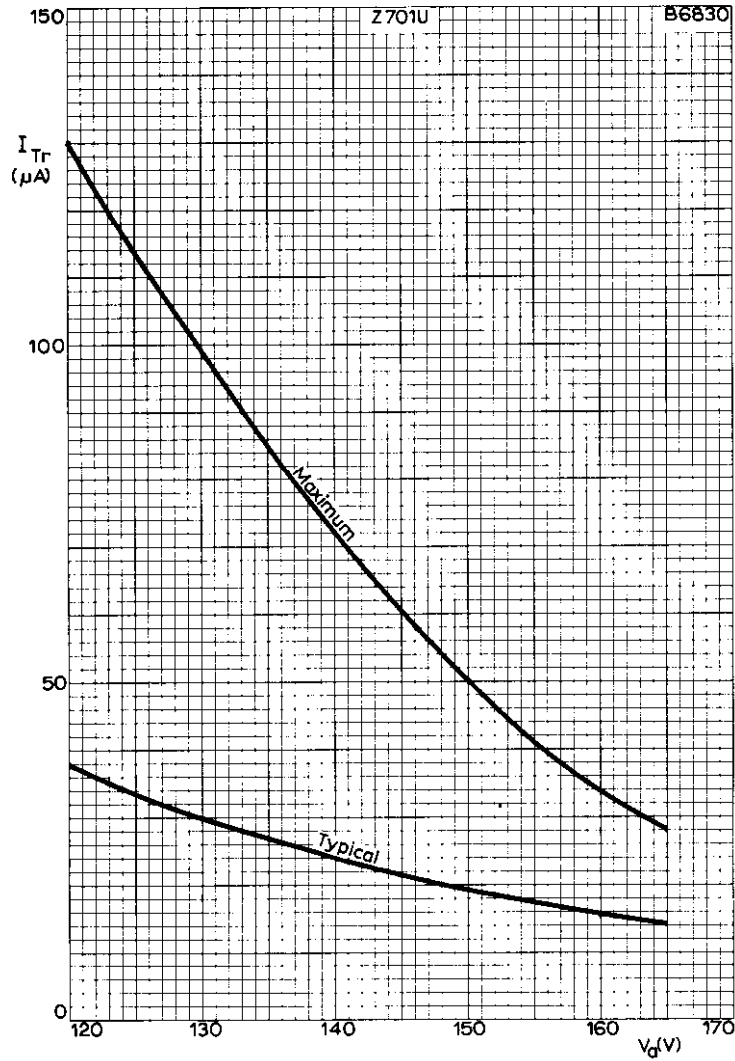


SPREAD OF TRIGGER IGNITION CHARACTERISTIC



**SUBMINIATURE COLD CATHODE  
TRIGGER TUBE**

**Z701U**



SPREAD OF TRANSFER CHARACTERISTIC



(

(

(

(



## COLD CATHODE TRIGGER TUBE

# Z800U

Cold cathode inert gas-filled tube with priming discharge. Primarily intended for use in low current stabiliser circuits, also suitable for use in timers and protection equipment.

### PRELIMINARY DATA

The predominant characteristic of the Z800U is its very stable trigger breakdown voltage. This stability and freedom from photoelectric effects is brought about by a priming discharge of some  $6\mu\text{A}$  flowing between anode and auxiliary cathode. Apart from the priming discharge the tube behaves as a triode trigger tube. This tube is designed for use with unidirectional voltages.

### CATHODE

Cold

### CHARACTERISTICS

Nominal maintaining voltage at 2mA	110	V
Trigger voltage for strike ( $V_a=260\text{V}$ Trigger resistance= $68\text{M}\Omega$ )	141-151	V
Maximum variation of trigger breakdown voltage for any tube ( $V_a=260\text{V}$ )	2.0	%
Recommended priming current	6.0	$\mu\text{A}$

### LIMITING VALUES (Absolute ratings)

*Maximum applied anode voltage at which self ignition will not occur in any tube	285	V
Max. operating anode voltage	275	V
Minimum anode to cathode voltage for transfer with recommended trigger capacitance of $200\mu\text{F}$	220	V
Maximum mean cathode current (averaging time 15 secs)	2.5	mA
Maximum peak cathode current	10	mA
Maximum mean priming current	10	$\mu\text{A}$
Minimum priming current	2.0	$\mu\text{A}$

\*Trigger voltage  $\geq +50\text{V}$ .

**Note.**—The maximum operating speed is largely determined by the circuit and is of the order of 400 c/s.

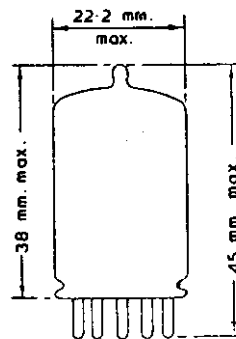
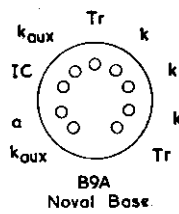
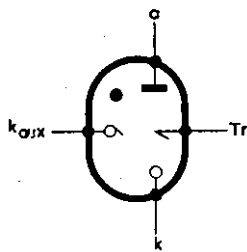


# Z800U

## COLD CATHODE TRIGGER TUBE

Cold cathode inert gas-filled tube with priming discharge. Primarily intended for use in low current stabiliser circuits, also suitable for use in timers and protection equipment.

1609



## COLD CATHODE TRIGGER TUBE

# Z801U

*Cold cathode inert gas-filled tube with priming discharge. Primarily intended for use in conjunction with Geiger-Muller tubes in radiation monitoring equipment and for use in low current stabiliser circuits.*

### PRELIMINARY DATA

The predominant characteristic of the Z801U is its very high charge sensitivity. A high charge sensitivity is obtained when a negative triggering pulse is applied to the auxiliary cathode via a small capacitor. The quoted value of charge sensitivity represents the amount of energy which must be injected into the auxiliary cathode to initiate the main discharge. The tube can also be fired by a positive pulse applied to the trigger but the charge sensitivity with this mode of operation is considerably lower. In self extinguishing operation the tube can be used with a relatively low value of anode resistor. This tube is not subject to photoelectric effects.

The circuit must be arranged to ensure that a current of  $0.4\mu\text{A}$  flows continuously from the trigger electrode to the auxiliary cathode. This tube is designed for use with unidirectional voltages.

### CATHODE

Cold

### CHARACTERISTICS

Nominal maintaining voltage at 2mA	105	V
Recommended priming current	0.4	$\mu\text{A}$

### LIMITING VALUES (Absolute ratings)

Maximum anode voltage at which self ignition will not occur in any tube	170	V
Minimum anode to cathode voltage for transfer with a recommended trigger capacitance of $120\mu\text{F}$	150	V
Maximum peak cathode current	10	mA
Maximum mean cathode current (averaging time 15 secs)	2.5	mA
Maximum peak auxiliary cathode current	4.0	mA
Maximum mean auxiliary cathode current	1.0	mA
Maximum priming current (Trigger to auxiliary cathode)	0.6	$\mu\text{A}$
Minimum priming current	0.25	$\mu\text{A}$
Minimum charge required by auxiliary cathode to ensure triggering in circuit shown in Fig. 1	45	$\mu\text{C}$

**Note.**—The maximum operating speed is largely determined by the circuit used and is of the order of 400 c/s.

The information contained in this data sheet does not imply any authority or licence for the utilisation of any patented feature.



# Z801U

## COLD CATHODE TRIGGER TUBE

Cold cathode inert gas-filled tube with priming discharge. Primarily intended for use in conjunction with Geiger-Muller tubes in radiation monitoring equipment and for use in low current stabiliser circuits.

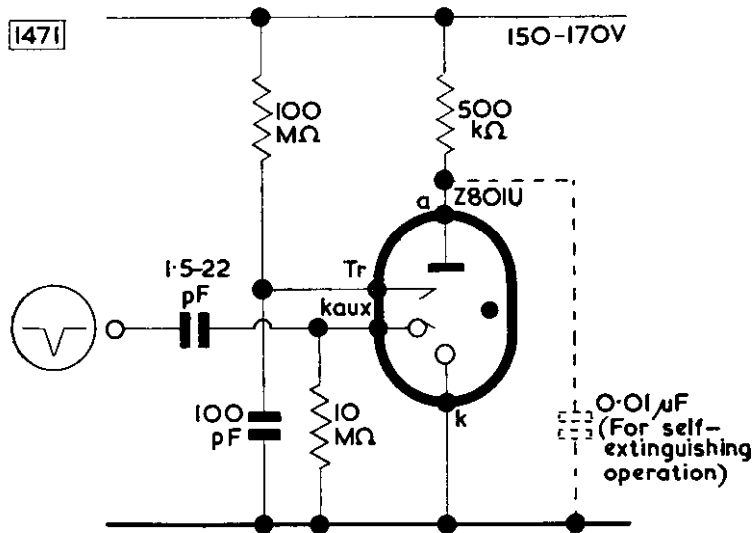
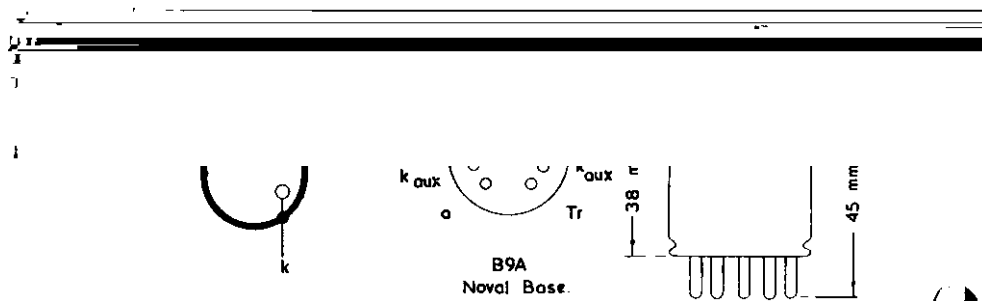


FIG. 1



## COLD CATHODE TRIGGER TUBE

# Z803U

### 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	$\mu$ A
Stability of trigger ignition voltage during life	$\pm 2$	%

### 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 trigger 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

# Z803U

## COLD CATHODE TRIGGER TUBE

### 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)	$\pm 2$	%
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		
$I_{a \text{ priming}} = 2$ to $25\mu A$ (see note 6)	$4 \times 10^{-8}$	A
$I_{a \text{ priming}} = 0\mu A$	$5 \times 10^{-10}$	A
Recommended maximum trigger series resistance		
$I_{a \text{ priming}} = 2$ to $25\mu A$	100	M $\Omega$
$I_{a \text{ priming}} = 0\mu A$	1000	M $\Omega$

### 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	$\mu A$
Minimum	2	$\mu A$
Recommended priming-anode resistor (see note 8)	10	M $\Omega$

### Transfer requirements

Minimum value of trigger-to-cathode capacitance for transfer (limiting resistor = 0 to 2.2k $\Omega$ , 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	$\Omega$
$C_{Tr} = 4700$ to $15,000pF$	2.2	k $\Omega$
$C_{Tr} > 15,000pF$	5.6	k $\Omega$
Minimum value of trigger current required for transfer		
$V_a = 240V$	25	$\mu A$
$V_a = 170V$	500	$\mu A$

### Components for self-extinguishing circuits

Minimum value of anode resistor $V_{a(b)} = 290V$ , $R_{lim} = 1k\Omega$		
$C_a > 2700pF$	1	M $\Omega$
Minimum value of trigger resistor		
$C_{Tr} > 500pF$	1	M $\Omega$

## COLD CATHODE TRIGGER TUBE

# Z803U

### 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 mA

Maximum 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.

# Z803U

## COLD CATHODE TRIGGER TUBE

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.

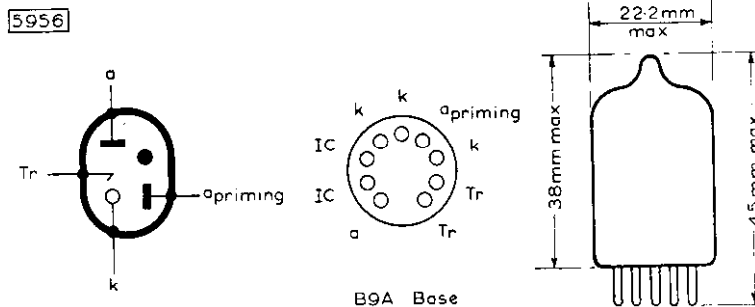
The magnitude of the final depression is dependent on the cathode current during the conduction period, and is reached in an exponential manner. The curves on page C3 give the formation and recovery of the depression at various cathode currents for a nominal tube.

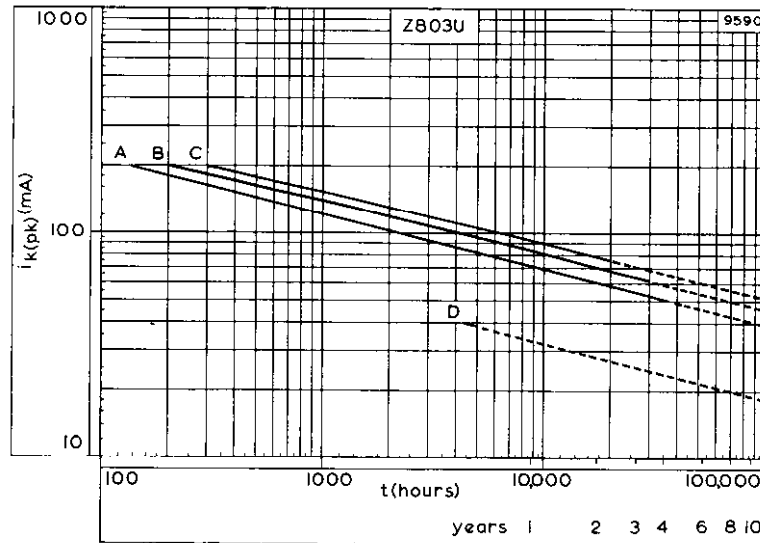
In a repetitive circuit where the non-conducting period is short compared with the recovery time constant (e.g. 50c/s operation), the depression can be obtained from the curve by using a direct current equal to the mean current passing through the tube.

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.





### 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.

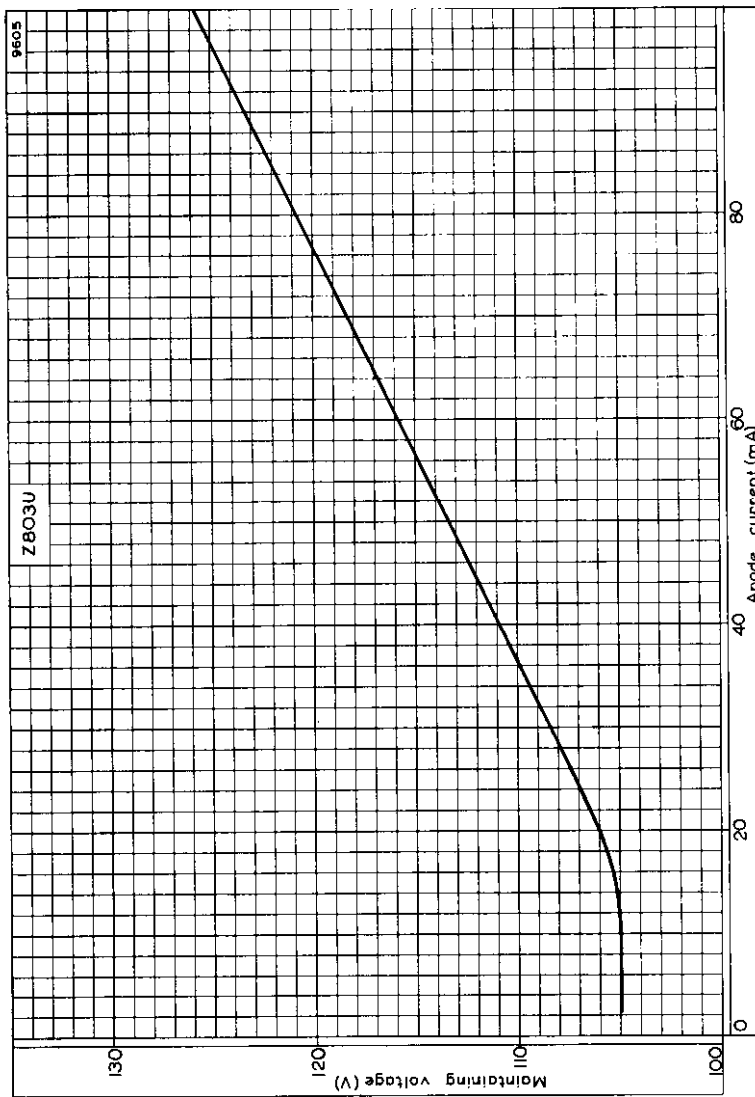
The time during which the trigger ignition voltage will remain within  $\pm 2\%$  of its original value, when the tube is operating continuously at room temperature from a half-wave rectified supply, is dependent on the peak cathode current passed. Curve A shows the relationship between the peak current 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.

# Z803U

COLD CATHODE TRIGGER TUBE

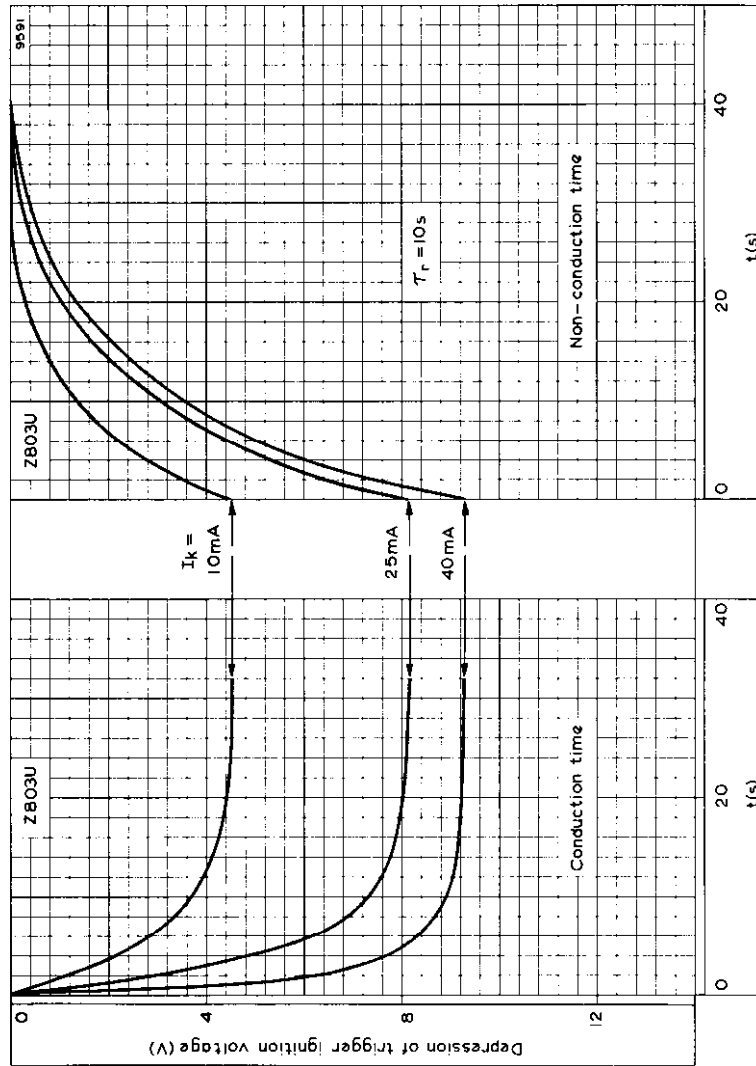


MAINTAINING VOLTAGE PLOTTED AGAINST ANODE CURRENT

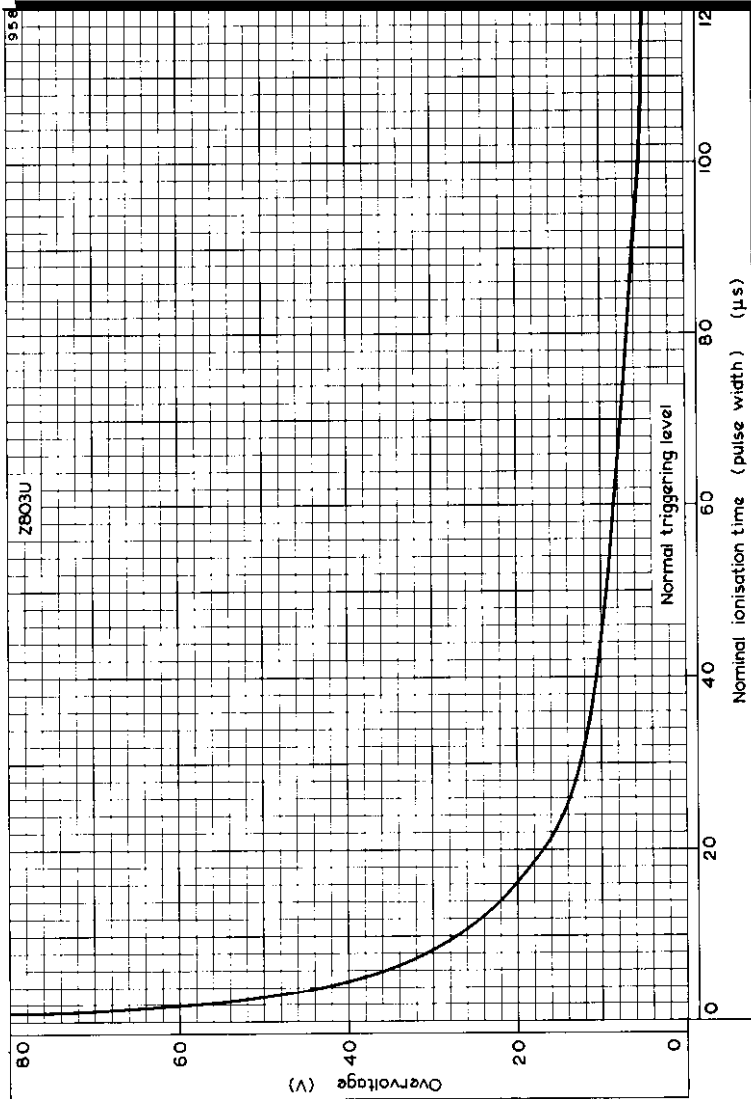


COLD CATHODE TRIGGER TUBE

# Z803U



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



TRIGGER OVERVOLTAGE PLOTTED AGAINST NOMINAL IONISATION TIME



## COLD CATHODE TRIGGER TUBE

# Z900T

Trigger tube primarily intended for relay applications for operation from d.c. or a.c. supplies.

### QUICK REFERENCE DATA (nominal values)

Anode supply voltage		
a.c.(r.m.s.)	117	V
d.c.	175	V
Anode maintaining voltage	62	V
Maximum average cathode current	35	mA
Trigger ignition voltage	80	V
Trigger transfer current	160	$\mu$ A

### CHARACTERISTIC 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 in the data for supply voltage and component variations. This tube has been designed to be ignited with positive voltages on the anode and trigger but will withstand negative voltages within the limits given.

#### Anode supply voltage (see note 2 and page C2)

Positive for trigger-controlled ignition		
Maximum	200	V
Minimum	140	V
Negative		
Maximum ( $V_{Tr} = 0$ to $-65V$ )	200	V

#### Anode-to-cathode maintaining voltage ( $I_a = 50mA$ ) see note 3

Initial		
Nominal	62	V
Maximum	75	V
End of life (see page C1)		
Maximum	85	V

#### Trigger-to-cathode ignition voltage ( $V_a = 0V$ ) see note 2

Initial maximum	95	V
End of life maximum (see note 2 and page C1)	105	V
Minimum	73	V

#### Maximum anode-to-trigger voltage

Anode positive ( $V_{Tr}$ from 0 to $-65V$ )	200	V
Anode negative ( $V_{Tr}$ between 0 and $+73V$ )	180	V

#### Nominal trigger maintaining voltage

	60	V
--	----	---

#### Typical maximum ionisation time (see note 2)

In daylight (approx. $\geq 1$ ft. cd.)	20	$\mu$ s
In darkness	250	$\mu$ s

#### Deionisation time (approx)

	500	$\mu$ s
--	-----	---------

#### Transfer requirements

##### Minimum trigger current for transfer (see page C3)

$V_a = 140V$		
Initial	200	$\mu$ A
End of life (see page C1)	400	$\mu$ A
$V_a = 175V$		
End of life	160	$\mu$ A

#### Minimum value of capacitor for triggering

$V_a = 175V$	400	pF
--------------	-----	----

#### Components for self-extinguishing circuits

Minimum value of anode resistance, $V_{a(b)} = 200V$ , $R_{lim} = 1k\Omega$		
$C_n = 0.001\mu F$	1.2	M $\Omega$
$C_n = 0.005\mu F$	450	k $\Omega$
$C_n = 0.01\mu F$	300	k $\Omega$

# Z900T

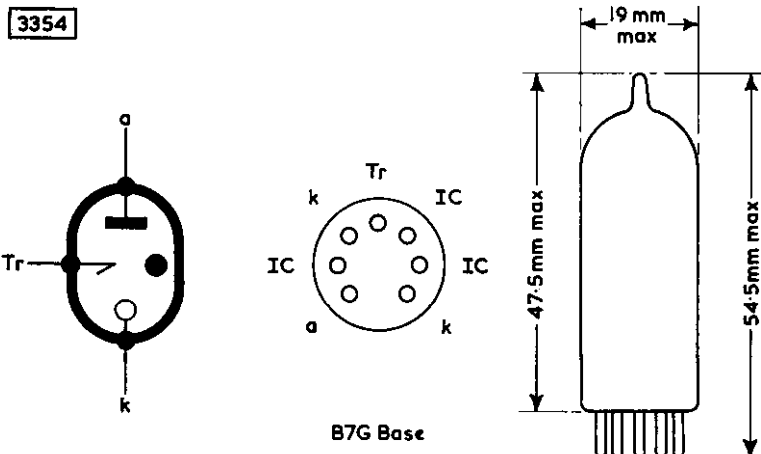
## COLD CATHODE TRIGGER TUBE

### ABSOLUTE MAXIMUM RATINGS

Maximum anode voltage		
Positive	200	V
Negative	200	V
Maximum cathode current (see page C1)		
Average		
Maximum averaging time = 15s	25	mA
Maximum averaging time = 20ms	35	mA
Peak	150	mA
Maximum peak trigger current	100	mA
Maximum anode-to-trigger voltage		
Anode positive ( $V_{Tr}$ from 0 to -65V)	200	V
Anode negative ( $V_{Tr}$ between 0 and +73V)	180	V

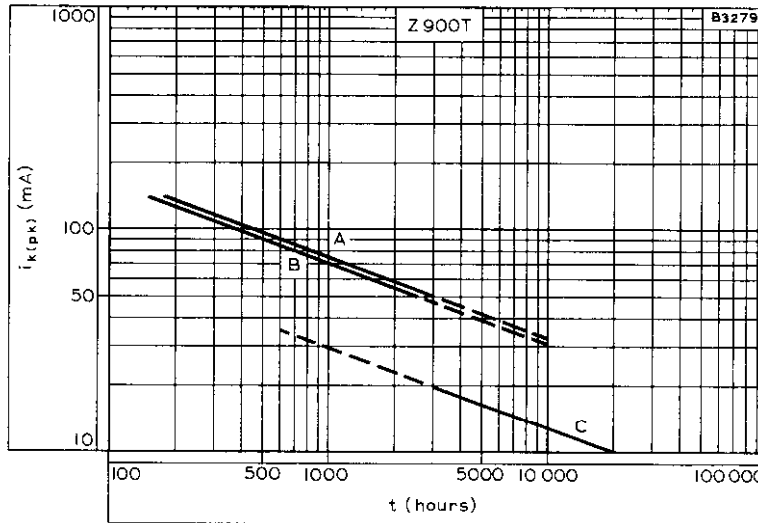
### OPERATING NOTES

1. The tube must not be allowed to pass current when the anode is negative.
2. Bright sunlight should be avoided.  
With instantaneous anode voltage of 185V, trigger bias voltage of +70V, trigger input pulse of 50V and trigger series resistor of 100k $\Omega$ .
3. In this tube, oscillations of up to approximately 14V 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 are of no significance in normal applications.



COLD CATHODE TRIGGER TUBE

# Z900T



**LIFE EXPECTANCY (50c/s relay duty)**

The curves show the times for which at least 80% of all tubes will remain within the end of life limits if the tubes are run continuously.

During non-operation at temperatures up to 50°C the characteristics of the tube will remain constant for several months. At temperatures above this the periods of non-conduction should be restricted, and at 100°C should not exceed one hour. The total life expectancy in any given application is the sum of the non-operating periods and the operating life obtained from the curves.

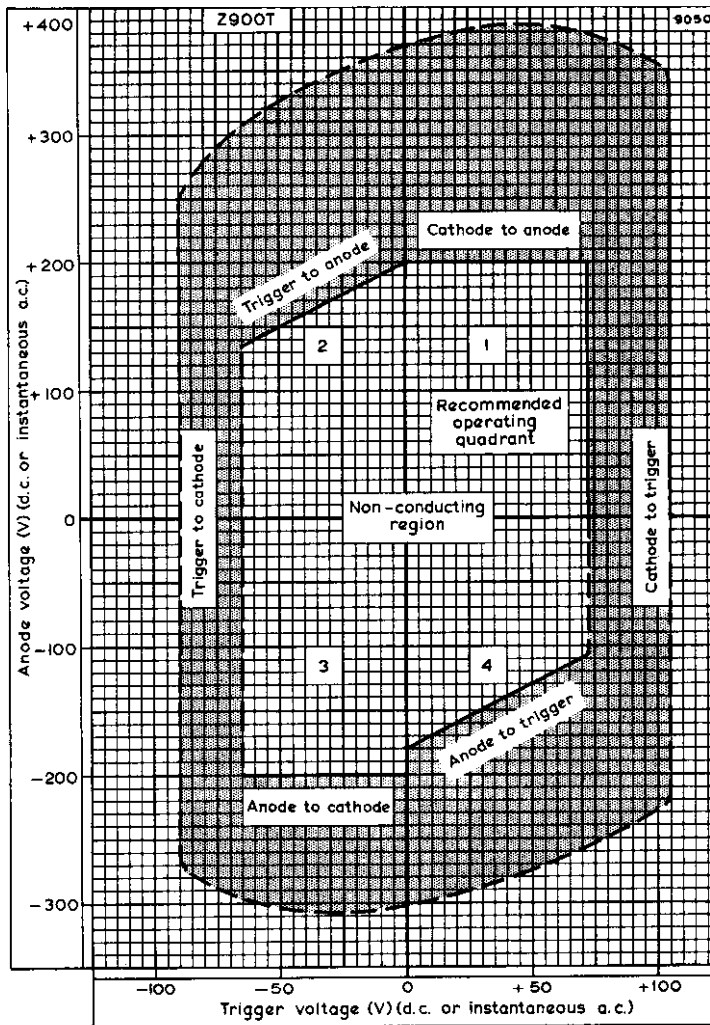
Curves A and B show the life expectancy under a.c. conditions. Curve A shows the time for  $V_{t(ign)}$  to rise to 105V. Curve B shows the time for  $V_{t(ign)}$  to rise to 95V. Other characteristics will remain within values quoted in the data. It should be noted that to obtain the life time represented by Curve B some negative trigger current should be drawn on the inverse half cycle, but its peak value must not exceed 4% of the peak forward current.

Curve C shows the life time to a  $V_{t(ign)}$  limit of 105V when the trigger current is either positive or less than 1% of the cathode current.



# Z900T

## COLD CATHODE TRIGGER TUBE

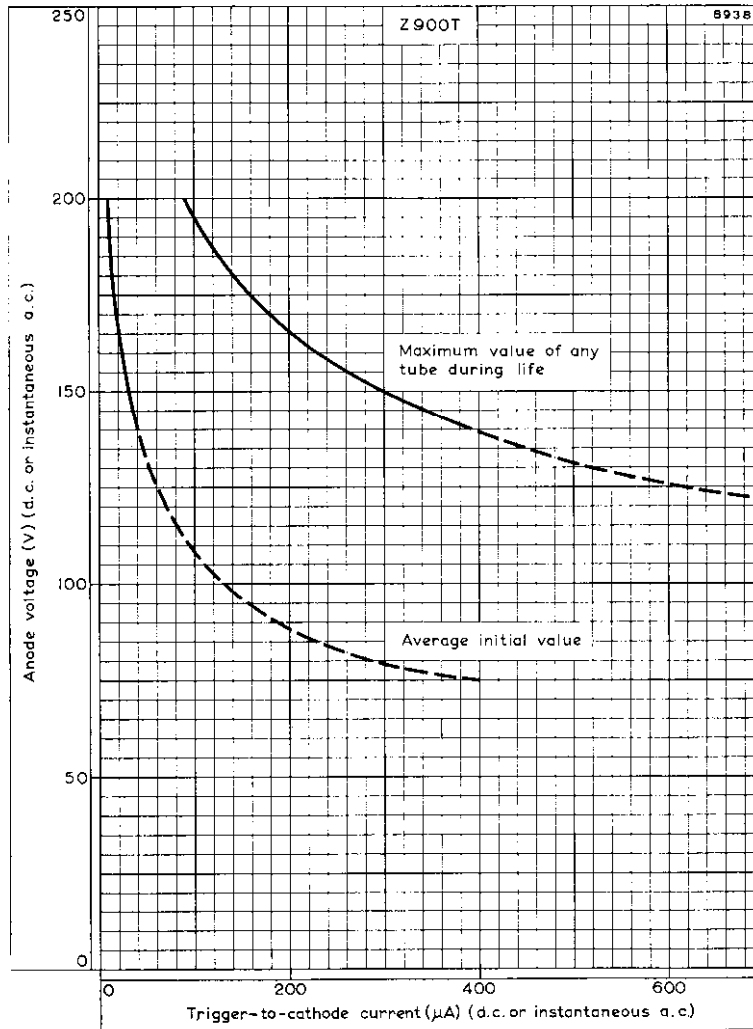


### BREAKDOWN CHARACTERISTICS

Ranges shown between inside and outside curves take into account maximum and minimum, positive and negative values for individual tubes and for changes during tube life. The values shown by dashed sections are approximate.

COLD CATHODE TRIGGER TUBE

# Z900T



TRANSFER CHARACTERISTIC



-

( -

( )

(

(

!