TETRODE THYRATRON

EN32

Tetrode inert gas-filled thyratron 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. negative control-grid voltage		
Before conduction	250	V
During conduction	10	V
Max. average positive control-grid current for anode voltage more positive than −10V (averaging time 1 cycle)	20	mA
Max. control-grid resistance		
$I_a < 200mA$	10	MΩ
$I_a > 200mA$	2.0	MΩ
Max. negative shield-grid voltage		
Before conduction	100	V
During conduction	10	V
Max. average positive shield-grid current for anode voltage more positive than −10V (averaging time 1 cycle)	20	mA
Max. screen-grid resistor	1.0	MΩ
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.

EN32

TETRODE THYRATRON

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

CHARACTERISTICS

Electrical

Heater voltage	6.3	V
Heater current at 6.3V	950	mA
Capacitances		
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
Control ratio		
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
Recovery (deionisation) time		
$V_a=650V$, $i_{a(pk)}=2A$, $R_{g1}=100k\Omega$		
$V_{g1}=-100V$	240	µs
$V_{g1}=-50V$	1.0	ms

Mechanical

Type of cooling	Convection
Mounting position	Any

CONTROL CHARACTERISTIC (See page 5).

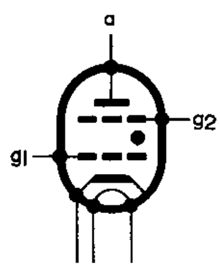
The curves given indicate the spread in characteristics due to:

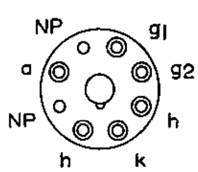
(a) Variations in characteristics due to changes in heater voltage.

(b) Variations in characteristics during life.

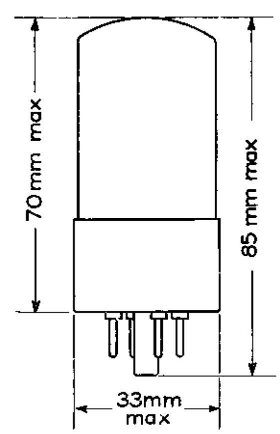
(c) Variation in grid resistor.

4718





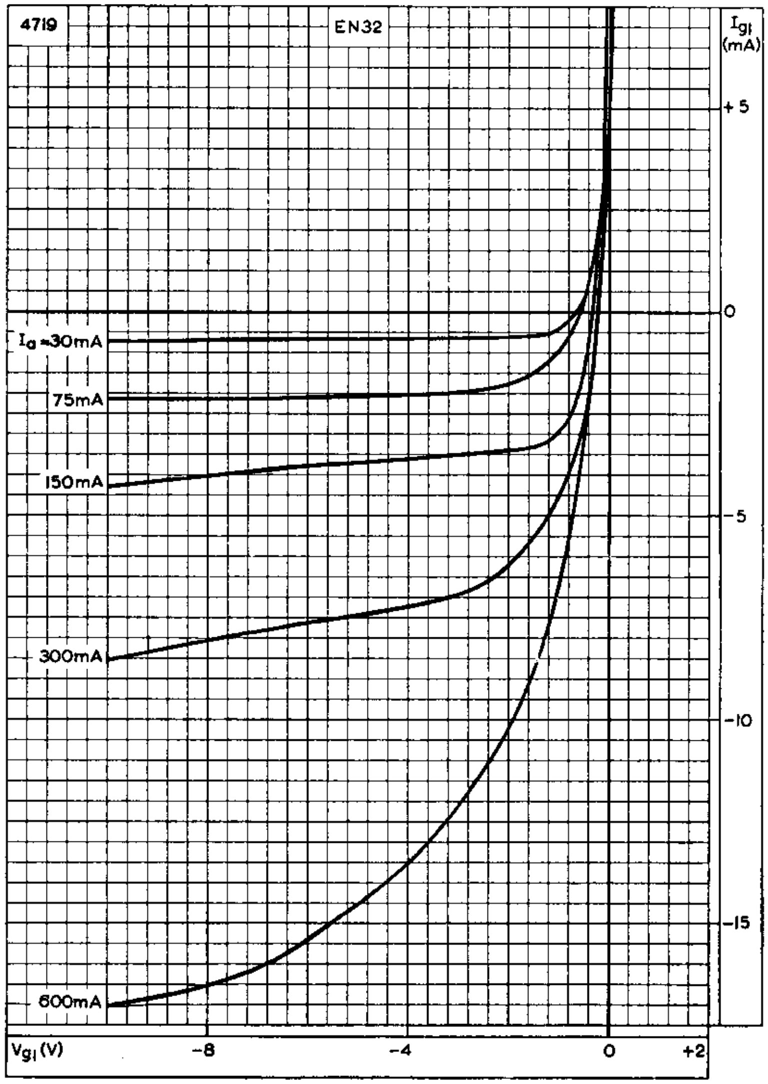
Octal Base



TETRODE THYRATRON

EN32

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

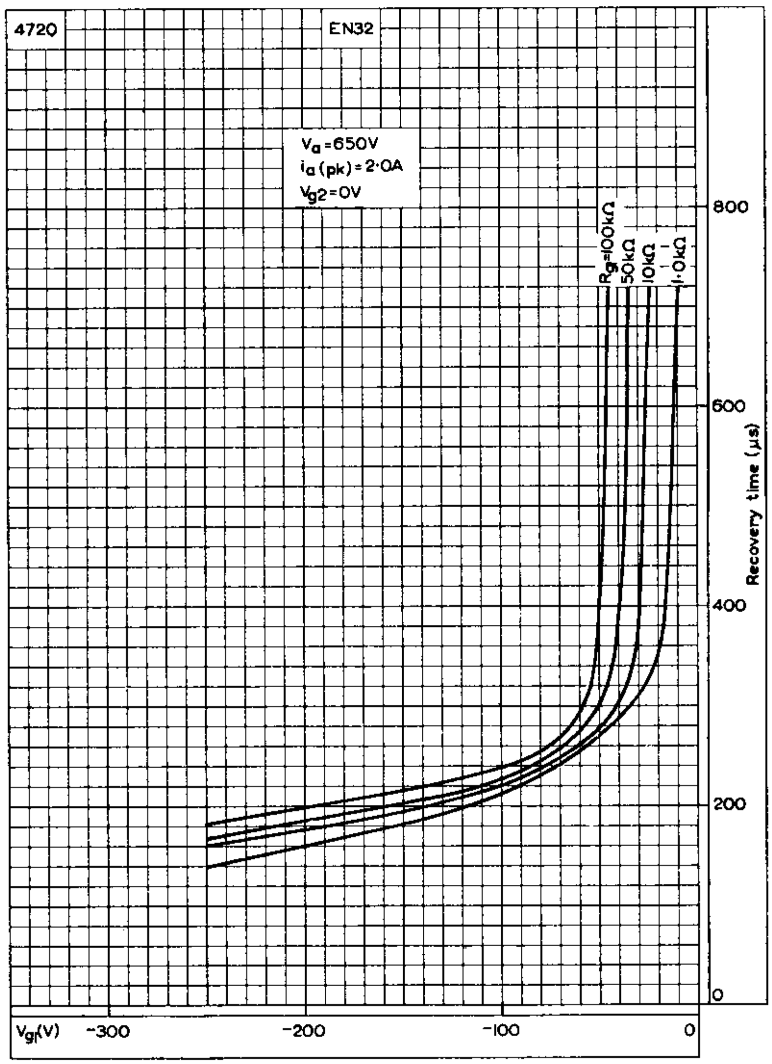


GRID ION CURRENT CHARACTERISTICS

EN32

TETRODE THYRATRON

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

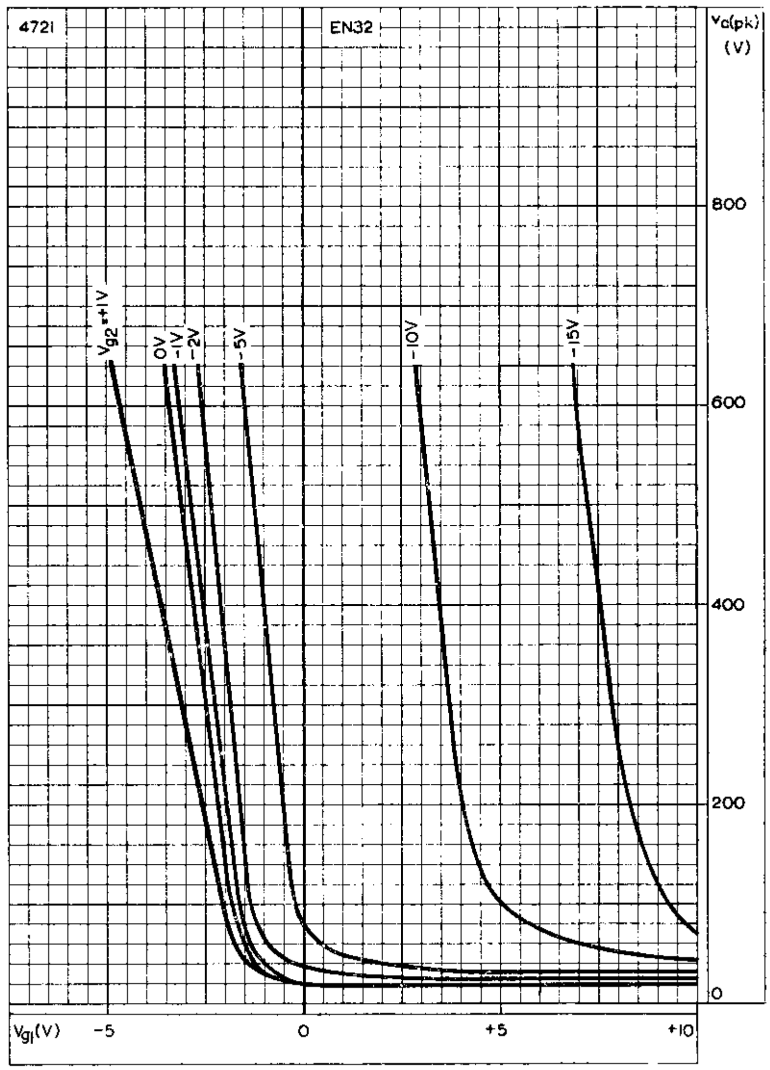


RECOVERY TIME PLOTTED AGAINST CONTROL-GRID VOLTAGE

TETRODE THYRATRON

EN32

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

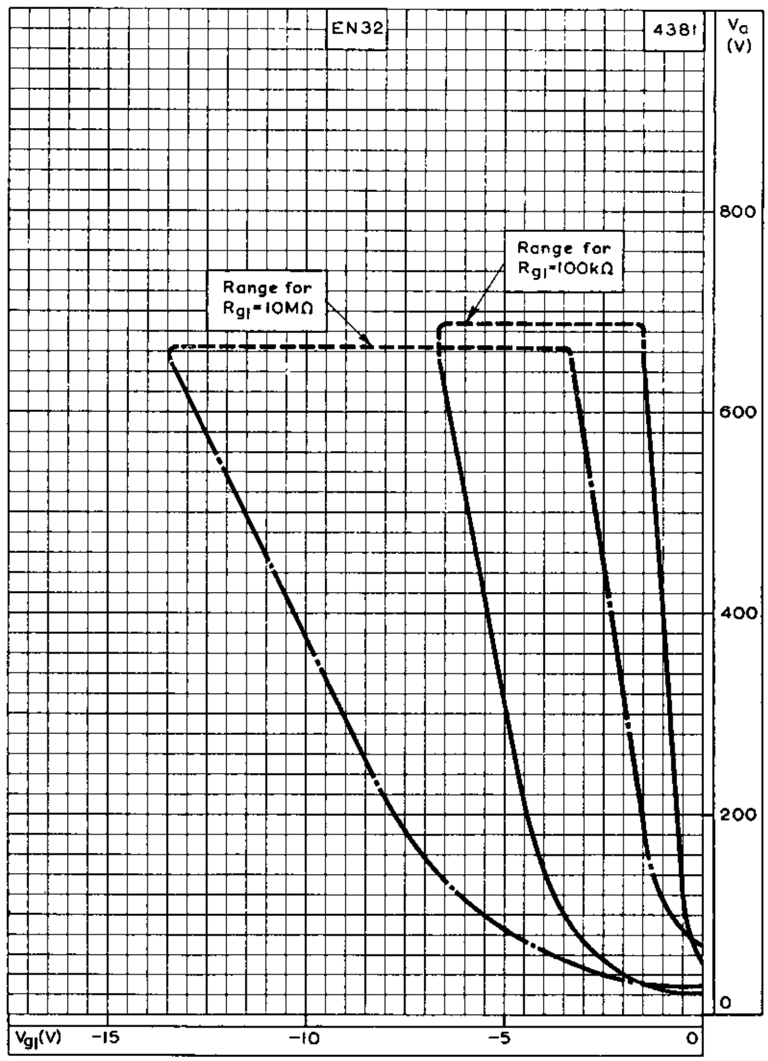


CONTROL CHARACTERISTIC (see page 2)

EN32

TETRODE THYRATRON

Tetrode inert gas-filled thyratron 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 thyratron 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[3] (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.

	Relay service and grid-controlled rectifier	*Pulse modulator service*	
*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

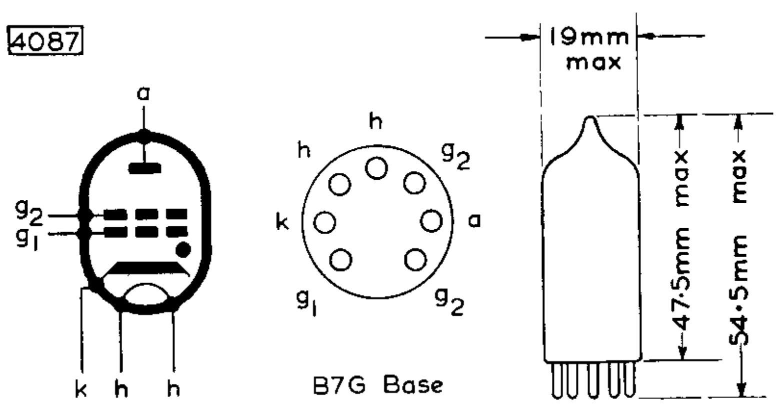
SPECIAL QUALITY TETRODE THYRATRON

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%	$6.3V^{+10}_{-5}\%$	
Min. valve heating time	20	20	s
Ambient temperature limits	−75 to +90	−75 to +90	°C
Max. pulse duration	—	5.0	µs
*Max. pulse repetition frequency	—	500	c/s
Max. duty cycle	—	0.001	
Max. rate of rise of current pulse	—	100	A/µs

*After completion of a pulse a 20µs delay is required before a positive voltage of more than 10V is applied to the anode.

CAPACITANCES[2]

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



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

TEST CONDITIONS (unless otherwise specified)

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

TESTS
GROUP A

Test	A.Q.L.[4] (%)	Individuals[5] Bogey[8]	Individuals[5] Min.	Individuals[5] Max.	Lot average[6] Min.	Lot average[6] Max.	
Heater current	0.65	600	540	660	—	—	mA
	—	—	—	—	567	633	mA
Heater-to-cathode leakage current							
V_{h-k} = 25V cathode negative	0.65	—	—	15	—	—	μA
V_{h-k} = 100V cathode positive	0.65	—	—	15	—	—	μA
*Grid 1 voltage $V_a = 460V_{r.m.s.}$, $R_{g1} = 100k\Omega$, $R_a = 3.0k\Omega$	0.65	−3.7	−2.9	−4.5	—	—	V
	—	—	—	—	−3.4	−4.0	V
*Grid 1 voltage $V_a = 460V_{r.m.s.}$, $R_{g1} = 10M\Omega$, $R_a = 3.0k\Omega$	0.65	−4.2	—	−5.6	—	—	V
*Anode voltage $V_{g1} = 0V$, $R_{g1} = 100k\Omega$, $R_a = 1.0k\Omega$	0.65	22	—	38	—	—	V
	—	—	—	—	—	33	V
Anode voltage $V_h = 0V$, $V_{g1} = -100V$, $R_a = 10k\Omega$							
No breakdown must occur	0.65	—	650	—	—	—	V
Operation. $I_{load\ (pulse)}$	0.65	—	16	—	—	—	A

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 $Z_o = 25\Omega$.

Load resistance = 20Ω, min. P.I.V. = 100V.

Pulse rise time = 0.2μs max.

Pulse fall time = 0.4μs max.

	A.Q.L.[4] (%)	Individuals[5] Bogey[8]	Individuals[5] Min.	Individuals[5] Max.	Lot average[6] Min.	Lot average[6] 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 = 0.5μs max., pulse fall time = 1.0μs max., p.r.f. = 100 ± 5pps. Pulse applied across valve and 10Ω resistor in series.							
Voltage measured across valve	0.65	—	—	76	—	—	V
	—	—	—	—	—	65	V
Group quality level[9]	1.0	—	—	—	—	—	
*Adjust voltage to initiate conduction.							
GROUP B							
Inoperatives[14]	0.4	—	—	—	—	—	
GROUP C							
Insulation g_2–a measured at $V_{a-g2} = \pm 380V$	2.5	—	760	—	—	—	MΩ
*Anode voltage. $V_h = 5.7V$, $V_{g1} = 0V$, $R_{g1} = 100k\Omega$, $R_a = 1.0k\Omega$	2.5	—	—	50	—	—	V
	—	—	—	—	—	45	V
*Grid 1 voltage. $V_h = 7.0V$, $V_a = 460V_{r.m.s.}$, $R_{g1} = 10M\Omega$, $R_a = 3.0k\Omega$ (Following special pre-heat condition)	6.5	−4.6	—	−6.4	—	—	V
*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.

GROUP D

***Shock*[13]**

No applied voltages, 750g.

Post shock tests							
Heater to cathode leakage current							
V_{h-k} = 25V cathode negative	—	—	—	40	—	—	µA
V_{h-k} = 100V cathode positive	—	—	—	40	—	—	µA
Anode voltage as in Group A (V_{g1}=0V)	—	—	—	50	—	—	V
Pulse emission as in Group A	—	—	—	76	—	—	V
Grid 1 voltage as in Group A (R_{g1}=100kΩ)	—	—	−2.9	−4.5	—	—	V
Sub-group quality level [9]	20						

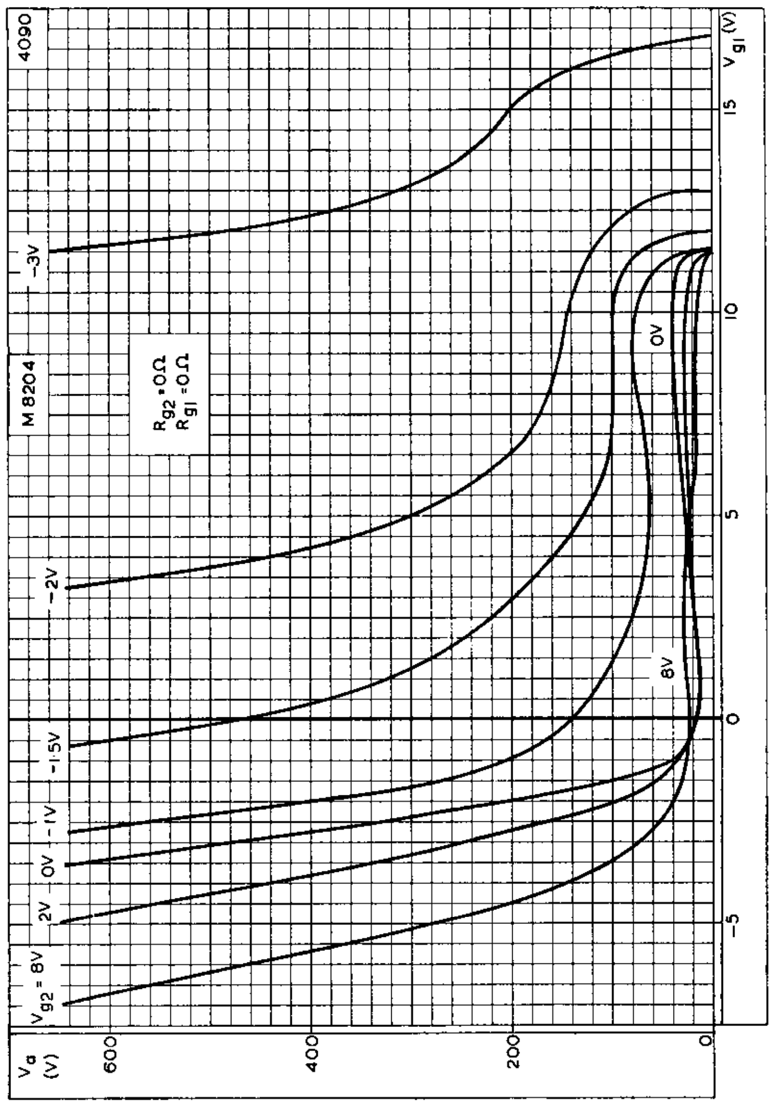
***Fatigue*[14]**

V_h = 6.3V, no other applied voltages, 2.5g acceleration, f = 25±2c/s for 32 hours in each of three mutually perpendicular planes

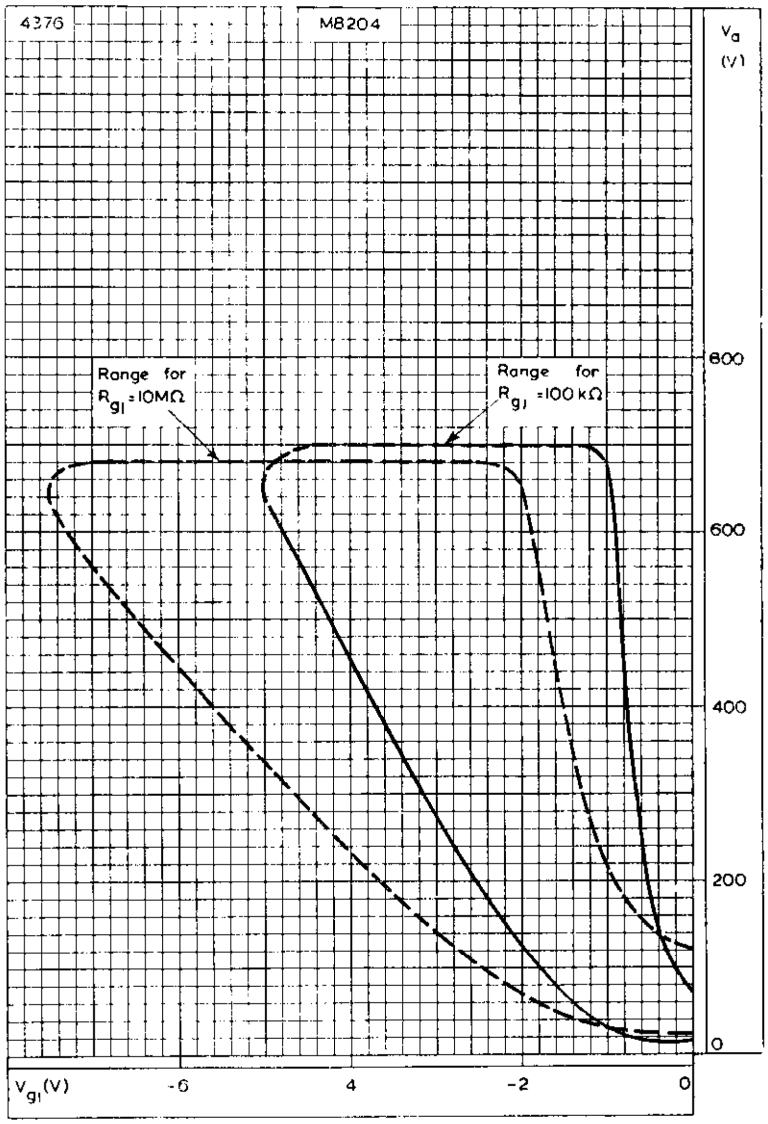
Post fatigue tests							
Heater to cathode leakage current							
V_{h-k} = 25V cathode negative	—	—	—	40	—	—	µA
V_{h-k} = 100V cathode positive	—	—	—	40	—	—	µA
Anode voltage as in Group A (V_{g1}=0V)	—	—	—	50	—	—	V
Pulse emission as in Group A	—	—	—	76	—	—	V
Grid 1 voltage as in Group A (R_{g1}=100kΩ)	—	—	−2.9	−4.5	—	—	V
Sub-group quality level [9]	20	—	—	—	—	—	
Base strain test[11]	6.5	—	—	—	—	—	

GROUP E

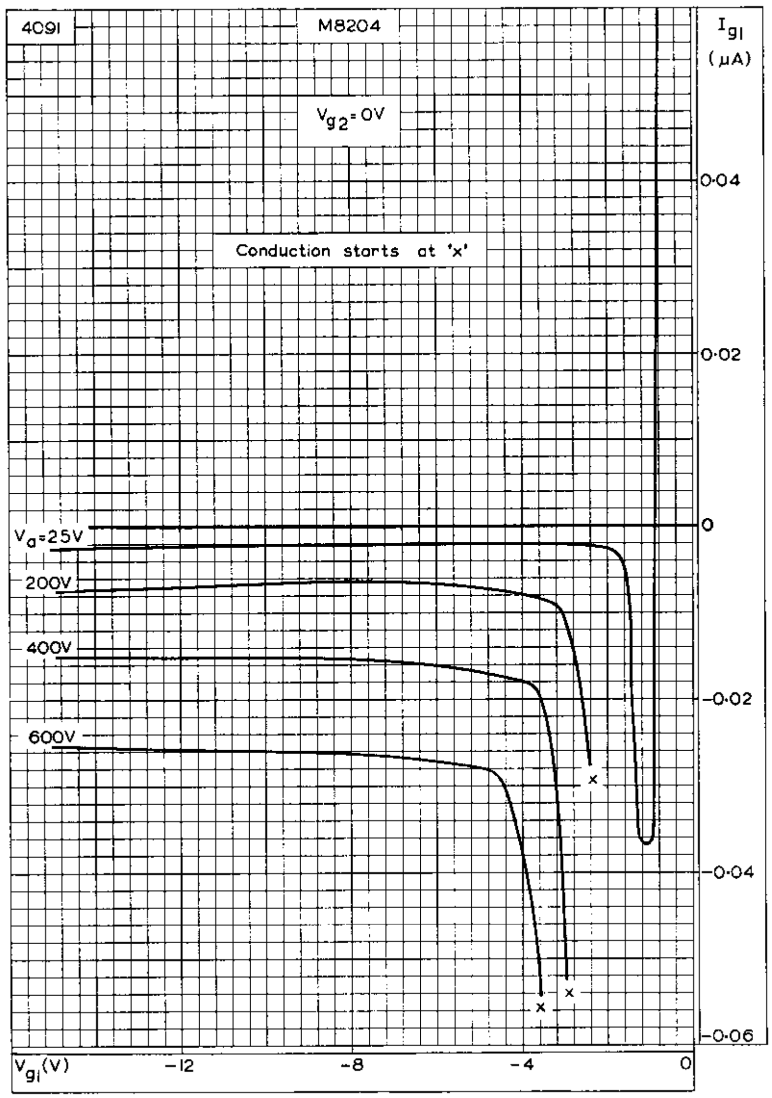
	A.Q.L.[4] (%)	Individuals[5] Min.	Individuals[5] Max.	
Heater cycling life test $V_h = 7.5V$, 1 minute on, 1 minute off, 2000 cycles. $V_{h-k} = 100V$ cathode positive. No other applied voltages	1.0	—	—	
Heater cycling life test end points				
Heater to cathode leakage current				
$V_{h-k} = 25V$ cathode negative	—	—	20	µA
$V_{h-k} = 100V$ cathode positive	—	—	20	µA
Intermittent life[12]				
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				
Intermittent life test end points				
Inoperatives[14]				
Heater to cathode leakage current				
$V_{h-k} = 25V$ cathode negative	—	—	20	µA
$V_{h-k} = 100V$ cathode positive	—	—	20	µA
Anode voltage as in Group A ($V_{g1} = 0V$)	—	—	50	V
Pulse emission as in Group A	—	—	100	V
Insulation g_2 a as in Group C	—	380	—	MΩ
Continuous life, 200 hours' duration[12]				
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 $= 7.5\Omega$, $t_p = 2\pm0.2\mu s$				
Life test end points				
$I_{load\ pulse}$	—	16	—	A
Average life	—	180	—	hrs
Pulse emission as in Group A	—	—	100	V



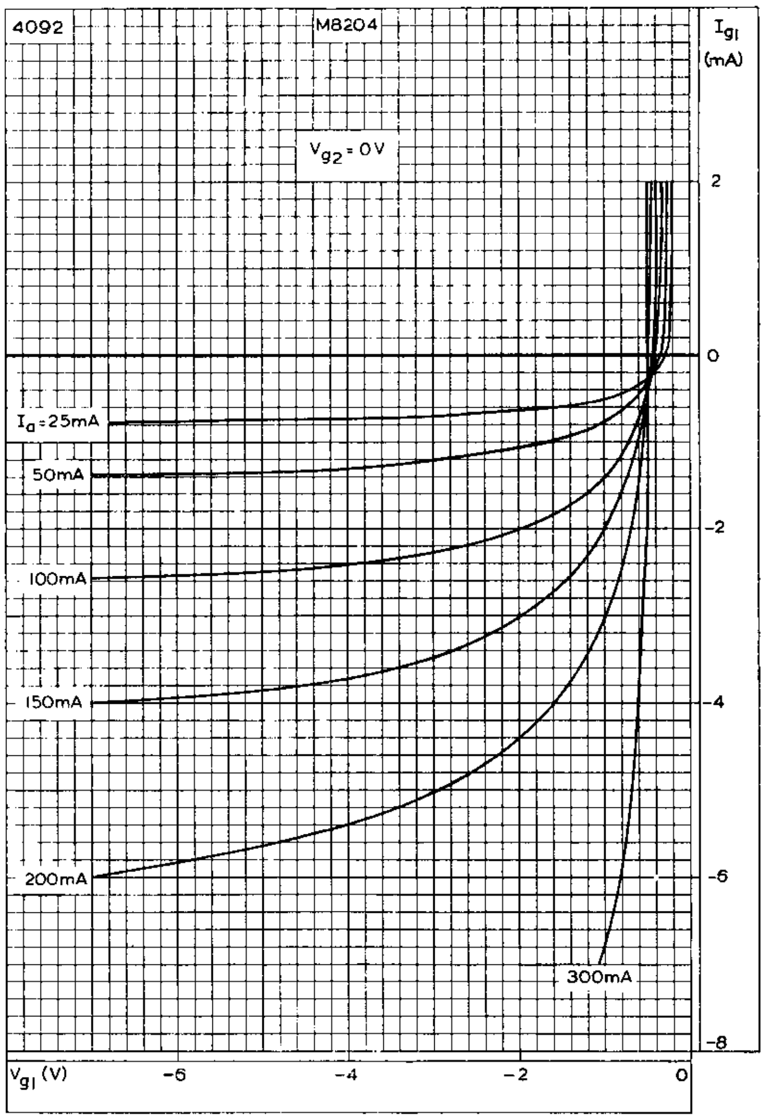
CONTROL CHARACTERISTIC



OPERATING RANGE OF CRITICAL CONTROL-GRID VOLTAGE



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



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

COLD CATHODE GAS-FILLED TRIODE

Z300T

(1267)

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

CATHODE Cold

CHARACTERISTICS

Typical anode to cathode breakdown voltage with trigger connected to cathode	255	V
Typical anode to cathode burning voltage (at 25mA)	70	V
Typical trigger to cathode breakdown voltage	85	V
Typical trigger to cathode burning voltage	60	V

LIMITING VALUES (Absolute Ratings)

With anode and trigger both positive

Maximum anode voltage at which self ignition will not occur in any tube. (trigger voltage = 0V)	225	V
Minimum anode voltage necessary for self ignition of all tubes. (trigger voltage = 0V)	310	V
Minimum trigger voltage necessary to cause trigger breakdown in all tubes	90	V
Maximum trigger voltage at which trigger breakdown will not occur in any tube	70	V
Minimum trigger to cathode current necessary to cause transfer in all tubes ($V_a = 140V$)	100	μA
Maximum permissible cathode current		
Peak	100	mA
Average (max. averaging time 15 secs)	25	mA

OPERATING NOTES

(a) It is recommended that strong light such as direct sunlight should not be allowed to fall on the tube when it is operating.

(b) The typical breakdown characteristic shows the potentials at which breakdown will occur between different electrodes of a typical tube. 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".

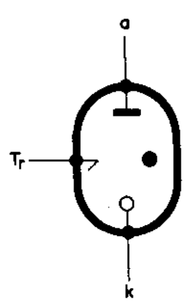
Z300T

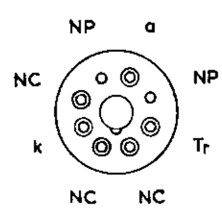
(1267)

COLD CATHODE GAS-FILLED TRIODE

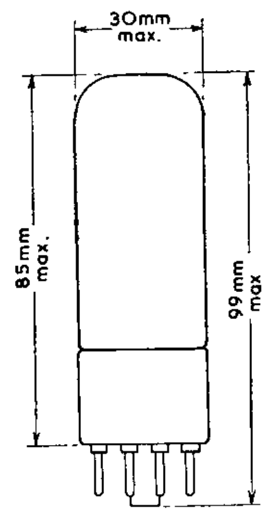
Cold cathode inert gas-filled triode designed for use as a general purpose trigger tube.

1612





Octal Base

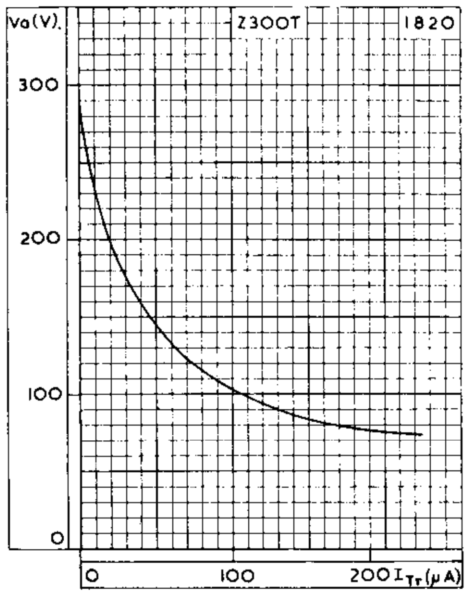


COLD CATHODE GAS-FILLED TRIODE

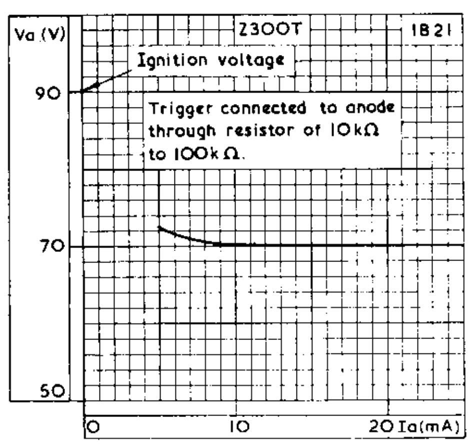
Z300T

(1267)

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



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

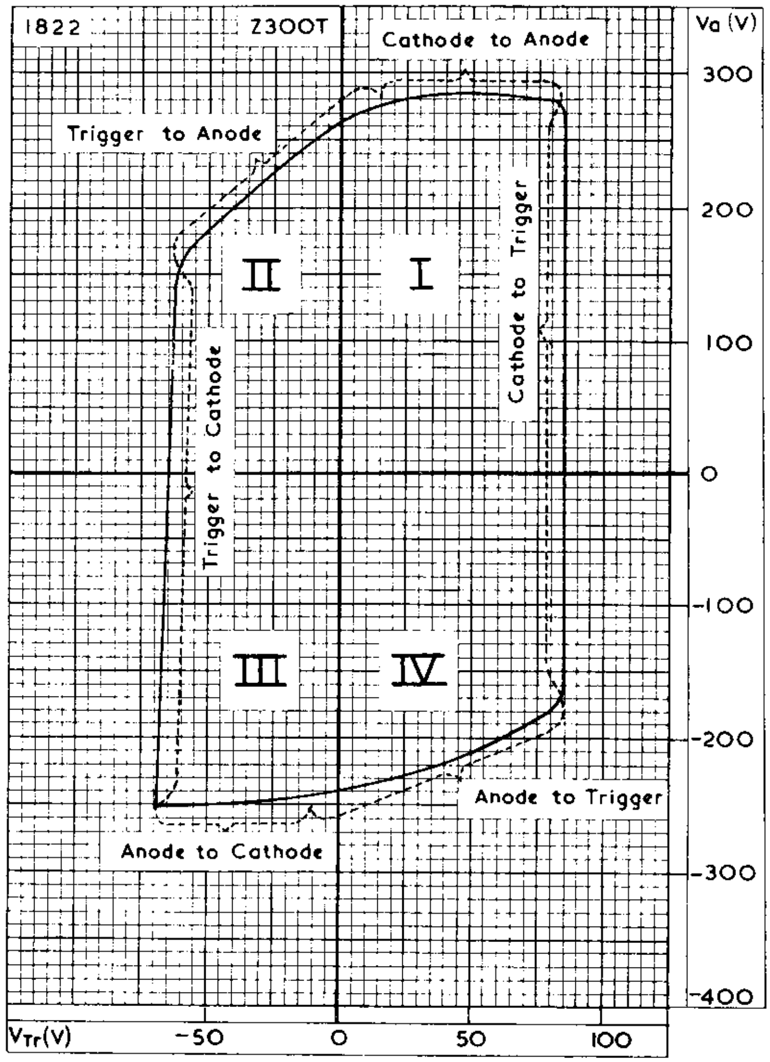


ANODE CURRENT/ANODE VOLTAGE CHARACTERISTIC

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 red neon 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 -10μA)

	Initial values	Typical life performance (Note 4)
Trigger-to-cathode Ignition (V_a = 250V, 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		±3V
Typical maximum temperature coefficient (bulb temperature range -55 to + 100°C)	- 25	mV/°C
Trigger-to-cathode maintaining voltage (I_{Tr} = 30μA, I_a=OmA)		
Typical maximum	125V	128V
Typical minimum	105V	105V
Recommended maximum trigger series resistor	20	MΩ

PULSE TRIGGERING (I_{Tr} between - 10μA and -120μA, t_p=20μs 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°C)	-25mV/°C	

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	μA
Minimum	1.0	μA

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	MΩ
C	330	470	pF

IONISATION AND RECOVERY (DEIONISATION)

Typical maximum ionisation time ($V_{Tr} = V_{Tr}$ (ign) + 30V, $C_{Tr} = 100pF$ $R_{Tr} = 1.2M\Omega$, $V_{ba} = 200$ to 300V)	5	μs
Nominal recovery (deionisation) time constant (Note 7)	170	μs

ABSOLUTE MAXIMUM RATINGS

Maximum negative anode voltages		
$I_{Tr} > 0\mu A$	0	V
$I_{Tr} = 0\mu A$, $V_{Tr} = -50$ V 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)		
($I_k = I_{Tr} = 0$mA)		
at $V_a = 300$V	30	V
at $V_a = 200$V	50	V
Maximum peak trigger current		
Positive	100	mA
Negative during any anode-cathode		
conduction period		
Anode-to-cathode gap conducting	120	μA
Anode-to-cathode gap non-conducting	0	μA
Bulb temperature		
Operation		
Maximum	+ 100	°C
Minimum	-55	°C
Standby and Storage		
Maximum	+ 70	°C
Minimum	-55	°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

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 differentation may give rise to negative pulses on the trigger, care must be taken not to exceed the limiting values for $-V_{Tr}$.

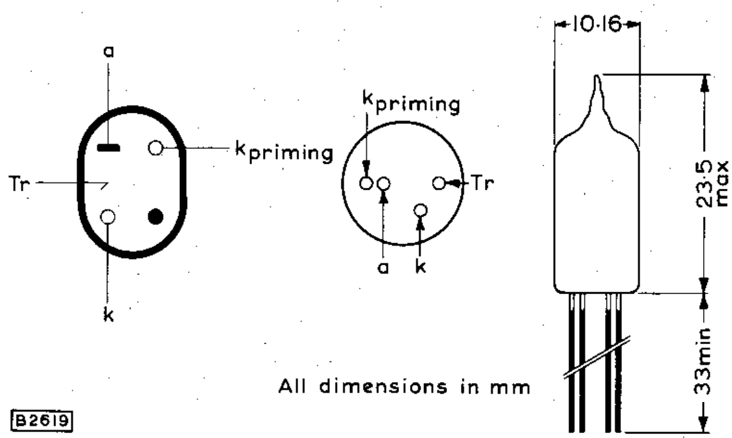
7. The anode recovery time is the time required after the interruption of the anode current for the trigger to regain control. The figure quoted is the value of the time constant RC determining the rate of rise of the anode voltage.

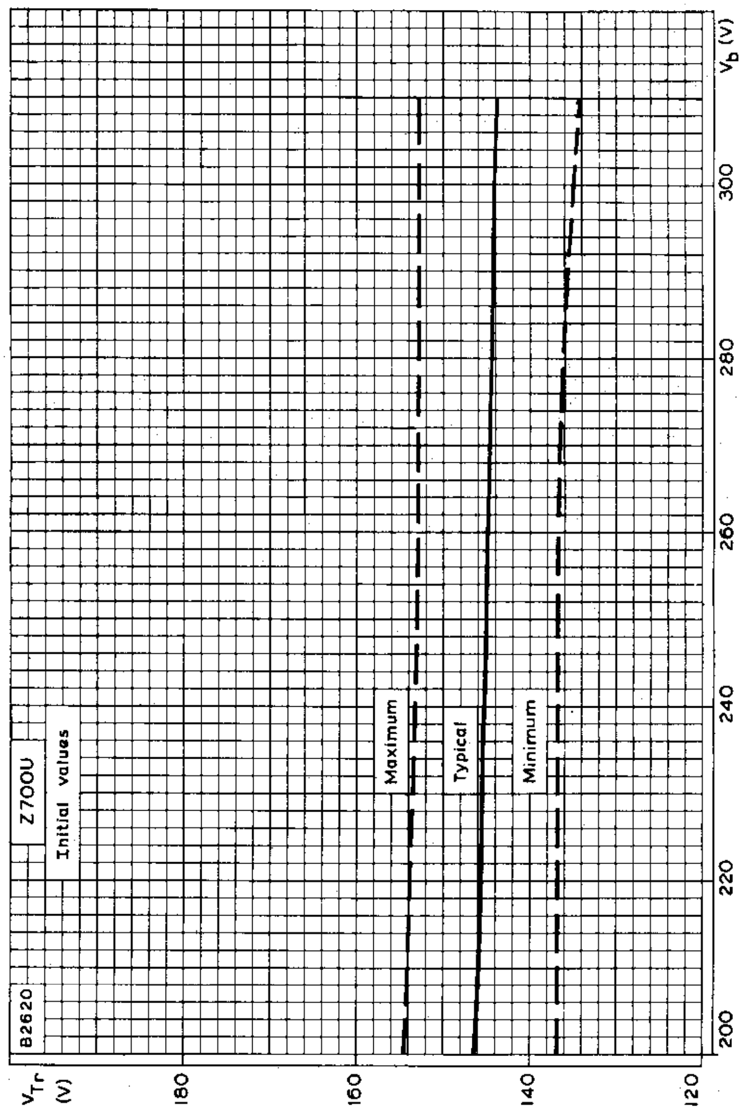
8. Any bending of the leads must be at least 2mm from the seal.

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.

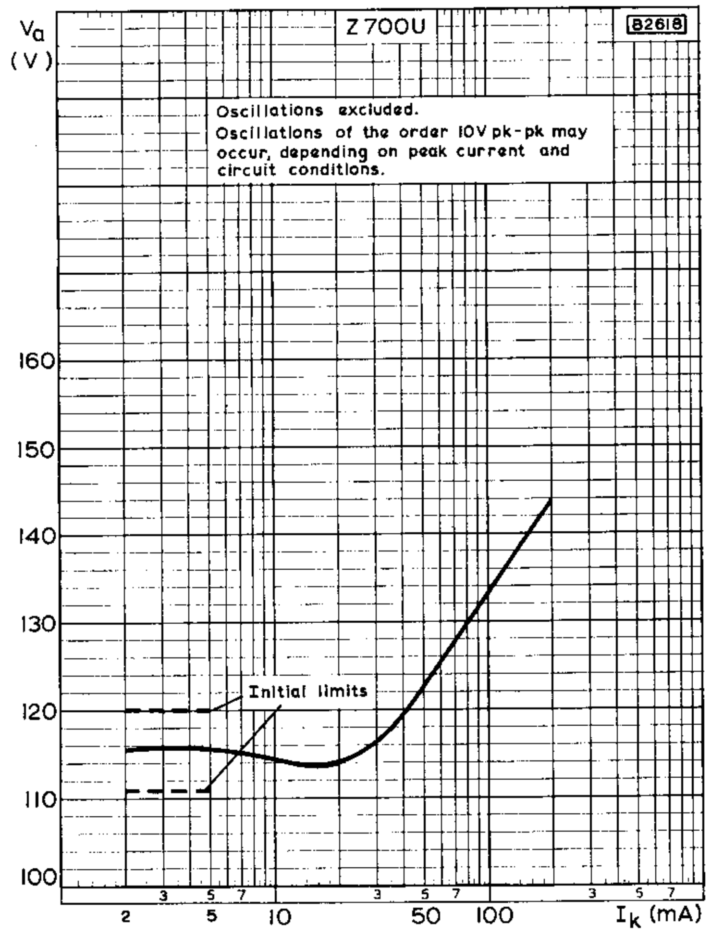
10. The trigger and priming cathode resistors and capacitors should be mounted close to the tube.

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.

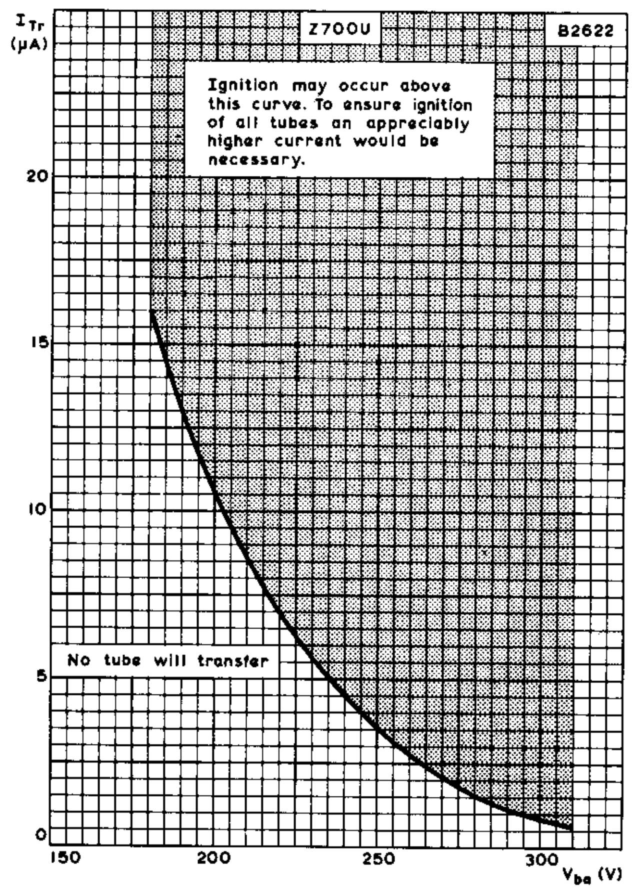




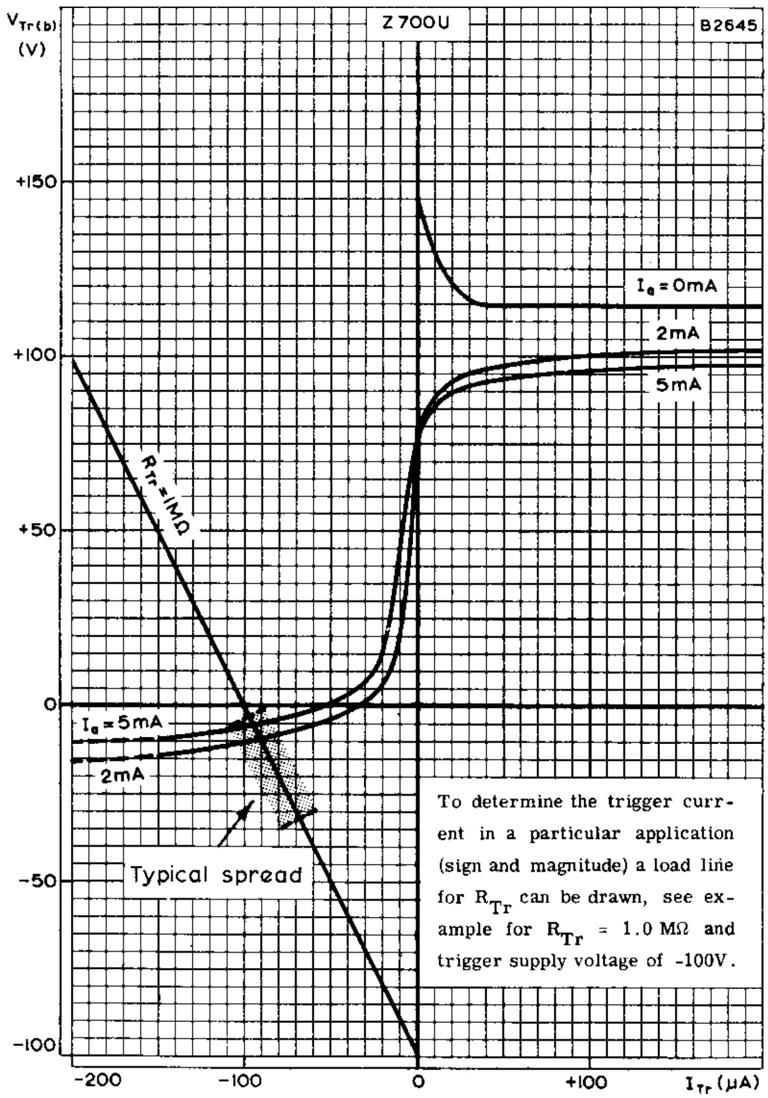
SPREAD OF TRIGGER BREAKDOWN CHARACTERISTIC



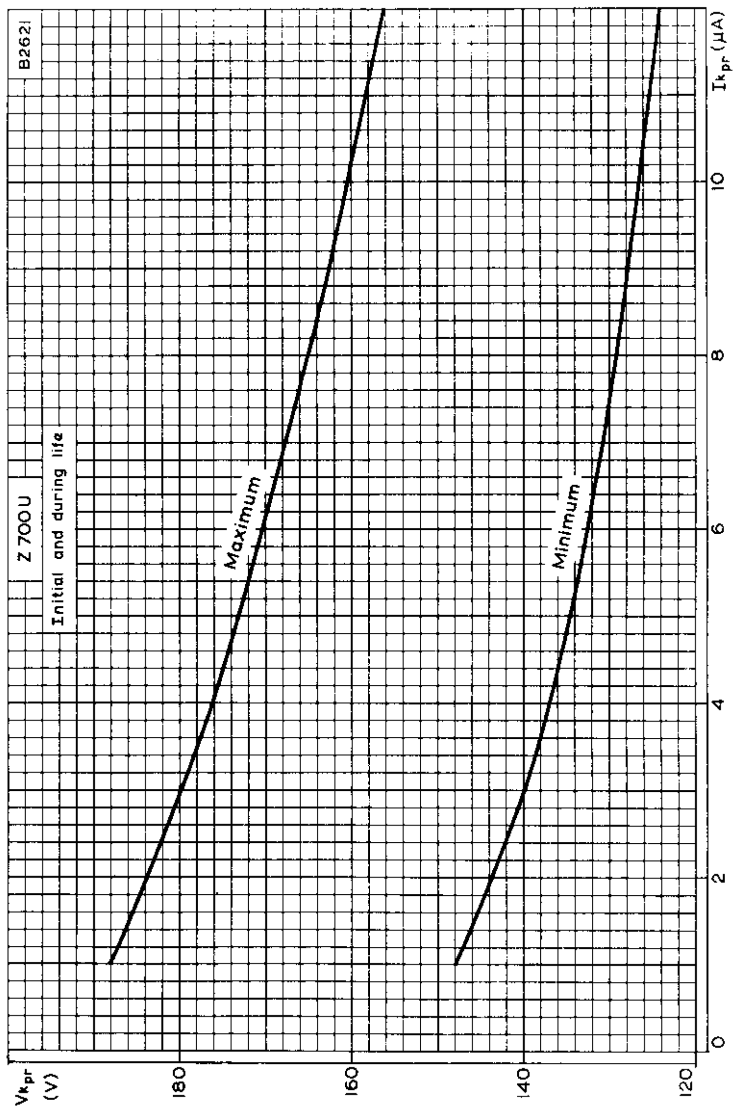
TYPICAL ANODE-TO-CATHODE MAINTAINING VOLTAGE CHARACTERISTICS



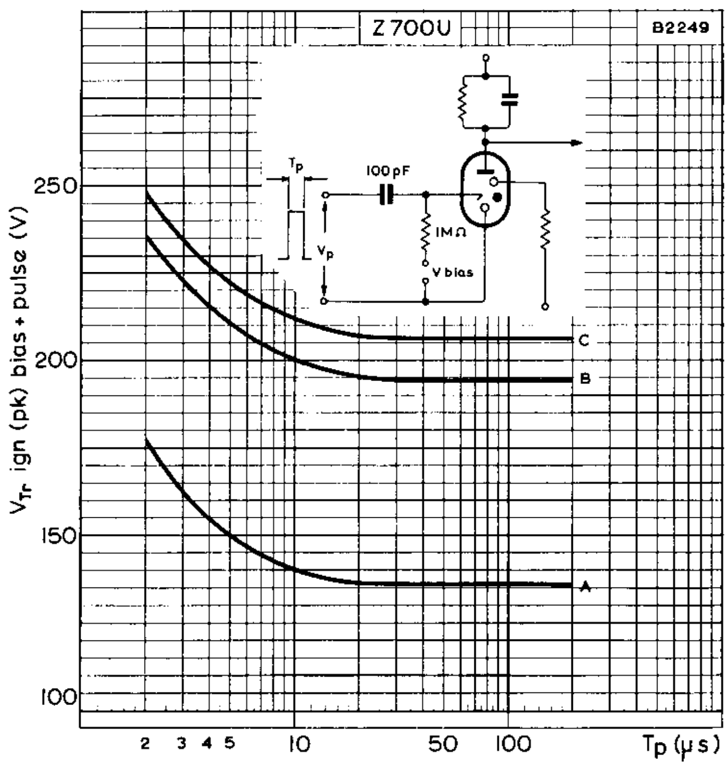
TRIGGER CHARACTERISTIC FOR NON-TRANSFER



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



PRIMING CATHODE VOLTAGE CHARACTERISTIC.



Curve A

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

Curves B and C

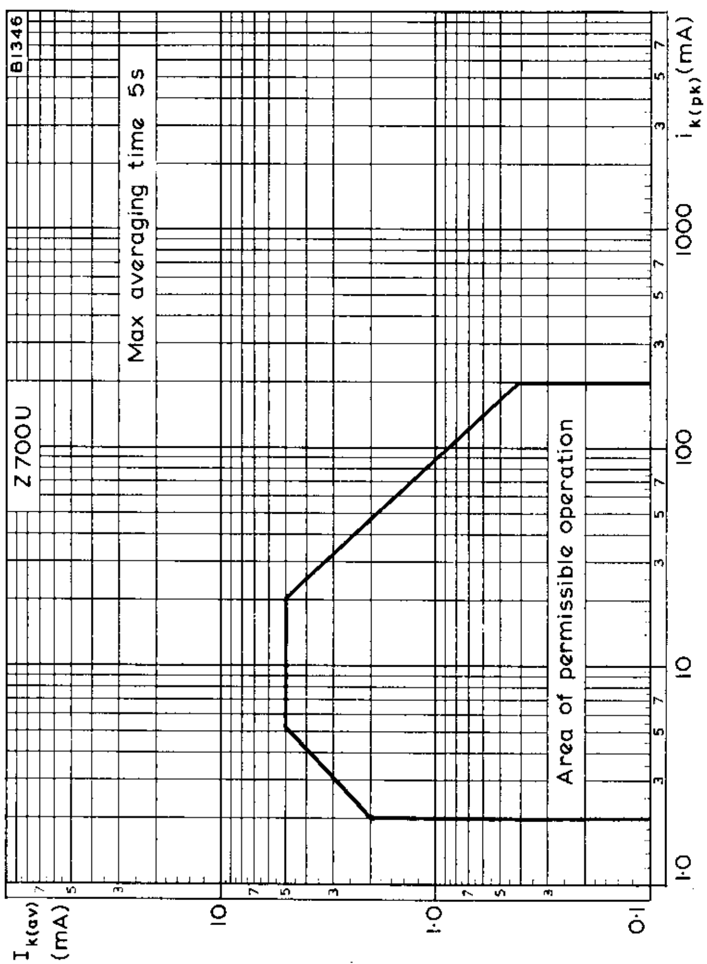
Sum of bias and pulse voltage to ensure breakdown initially and during life.
Recommended bias voltage 80 to 130V.
Pulse form substantially rectangular.

Curve B

For repetitive ignition with >pulse/minute.

Curve C

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



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	μA

CHARACTERISTICS AND RANGE VALUES FOR EQUIPMENT DESIGN

The values given state the range over which the tube will operate. No allowance has been made for supply voltages and component variations.

To ensure that the characteristics of the tube are maintained in both light and darkness, a priming discharge of some 3μA flowing continuously between the anode and the priming cathode is necessary. The tube is designed for operation with positive voltages on the anode and triggers.

Anode supply voltage		
Maximum (*Note 1*)	310	V
Minimum	200	V
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	MΩ

Priming cathode-to-anode supply voltage		
Minimum	200	V
Primer maintaining voltage ($I_{k\ priming} = 3\mu A$)	155	V
Primer current		
Maximum	10	μA
Minimum	1	μA
Recommended priming cathode series resistor (*Note 3*)	18	MΩ
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)		
$V_a = 250V$ (See page C3)	50	μA
Recommended value of $V_{Tr(pulse\ +\ bias)}$		
($t_{pulse} = 20\mu s$)	200	V
(See pages C5 and C6)		

Typical component values for self-extinguishing circuits

R	1.8	1.2	0.7	MΩ
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	μA
Tube non-conducting	0	μA
Maximum ambient temperature	70	°C

SUBMINIATURE COLD CATHODE TRIGGER TUBE

Z700W

OPERATING NOTES

1. At anode supply voltages greater than 270V spurious ignition may occur in this tube if a large amplitude pulse (>100V) which is not intended to ignite the tube is applied to either trigger. With pulses of more than 100V amplitude, a trailing edge as defined by a time constant of at least 50μs must be used.
2. The drift in trigger ignition voltage per tube is generally less than 3V. However, when the tube is ignited for very long periods, drawing negative trigger current, it is advisable to design the circuit for an ignition voltage of 160V.
3. The priming cathode and trigger series resistors should be mounted close to the tube.
4. The maximum frequency depends on the component tolerances and the stability of the supply voltage.
5. Higher peak cathode currents are permissible in self-extinguishing circuits.
6. 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 to a potential less than the trigger maintaining voltage during anode-to-cathode conduction.
7. Direct soldered connections to the leads of this tube must be at least 5mm from the seal, and any bending of the tube leads must be at least 2mm from the seal.
8. The tube should not be mounted within 2mm of any conductive elements or spurious ignition may occur.

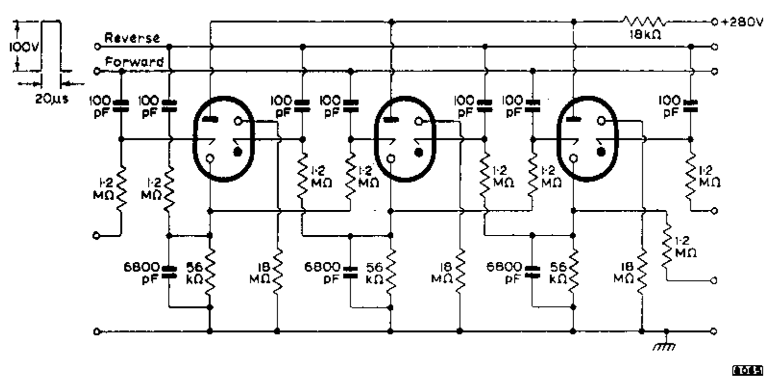
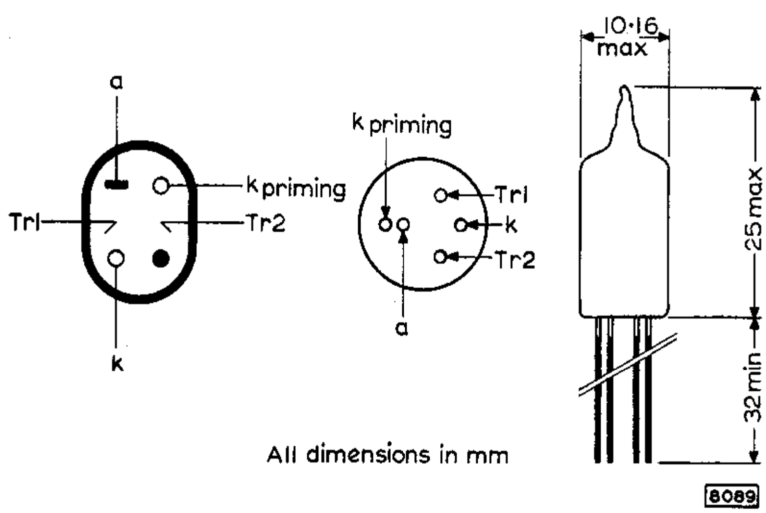
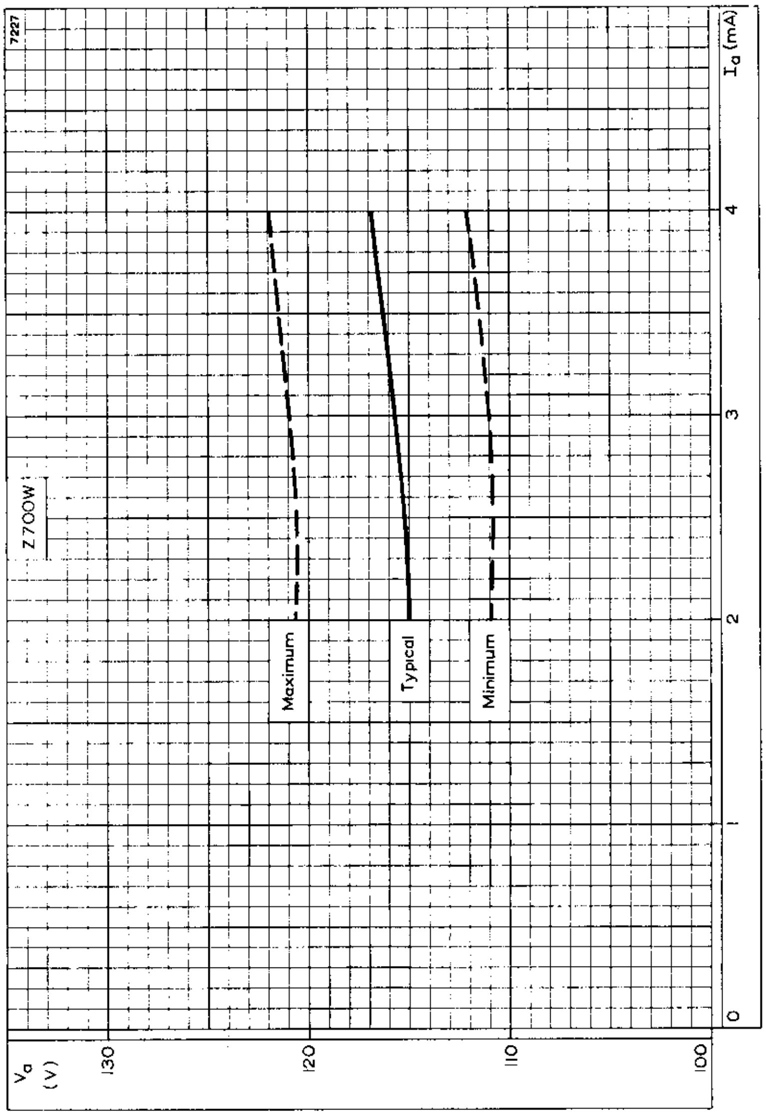


FIG. 1

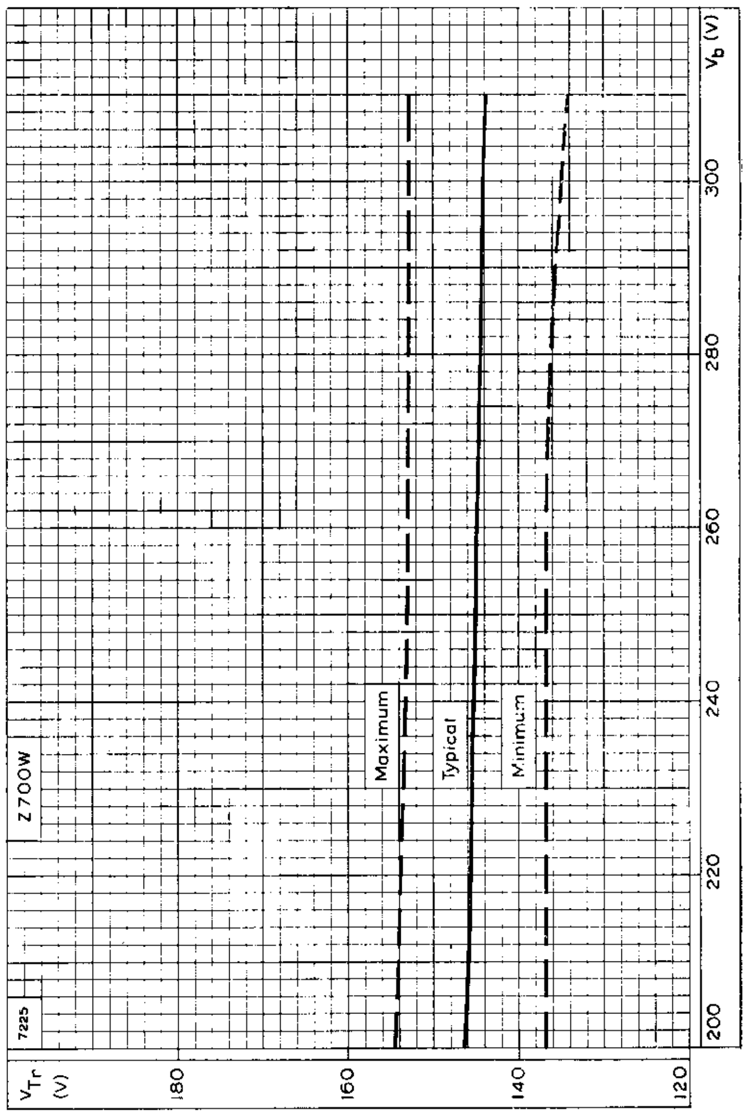
Z700W

SUBMINIATURE COLD CATHODE TRIGGER TUBE

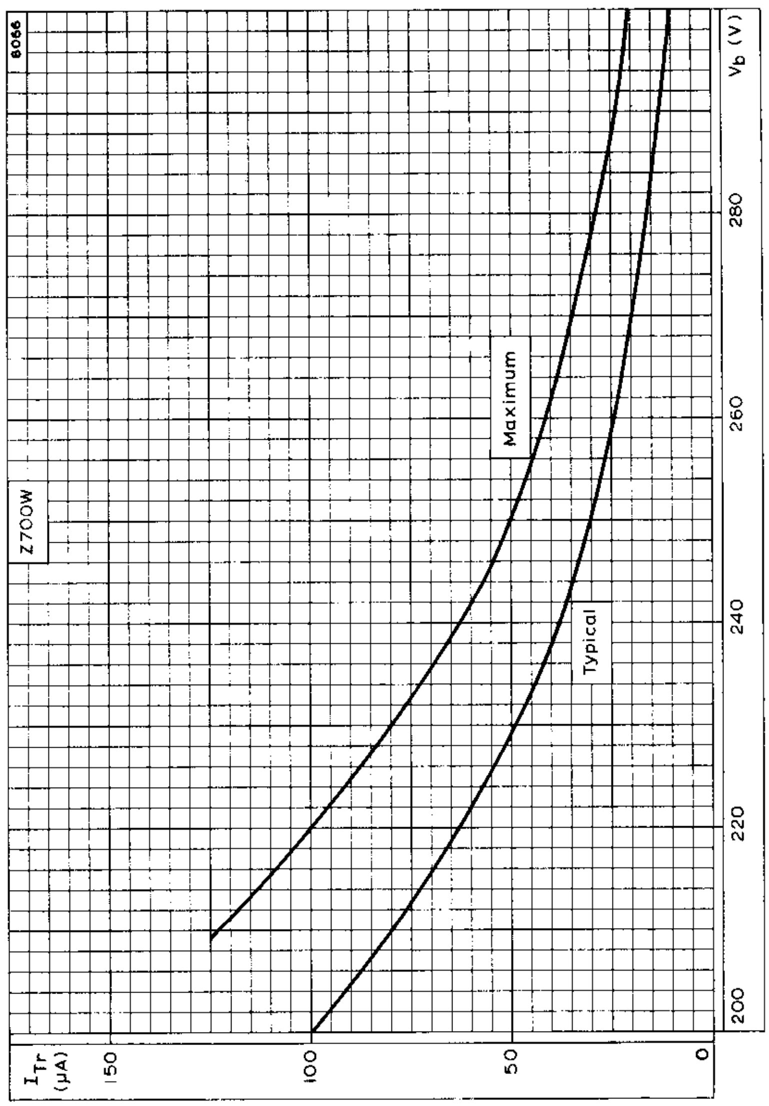




SPREAD OF ANODE MAINTAINING VOLTAGE CHARACTERISTIC

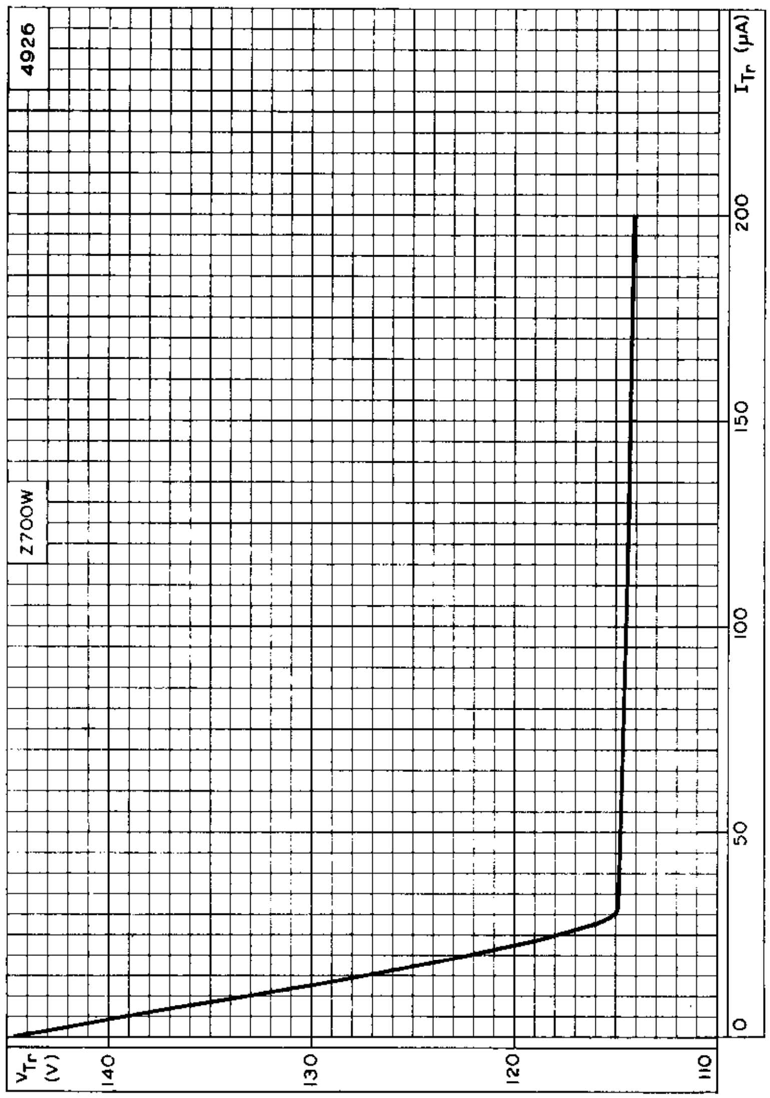


SPREAD OF TRIGGER IGNITION CHARACTERISTIC



SPREAD OF TRANSFER CHARACTERISTIC

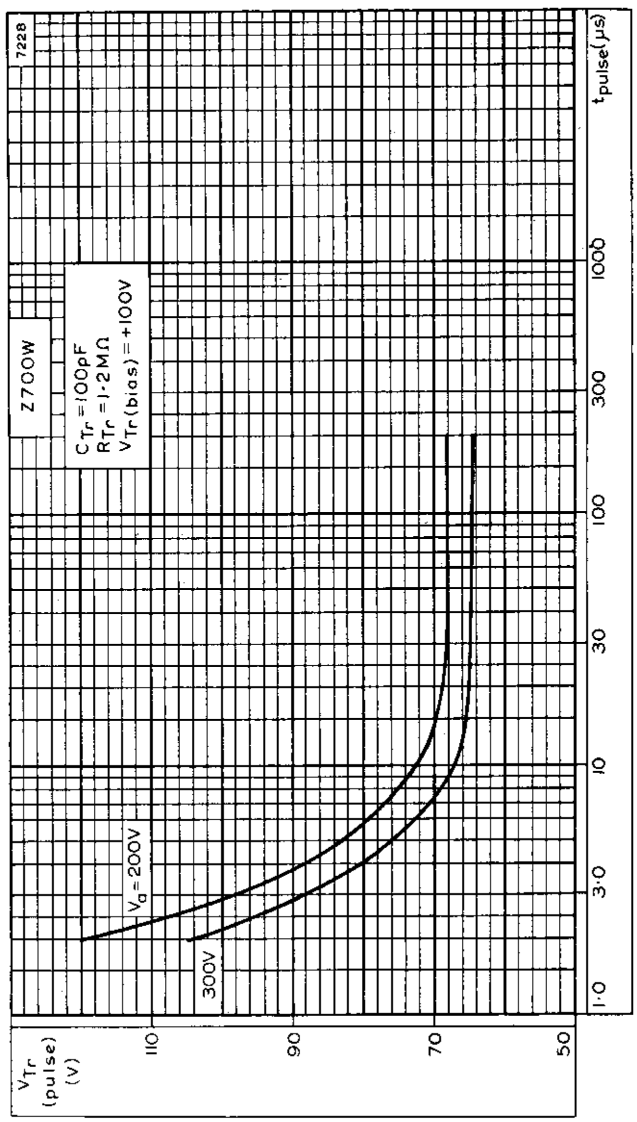
Z700W SUBMINIATURE COLD CATHODE TRIGGER TUBE



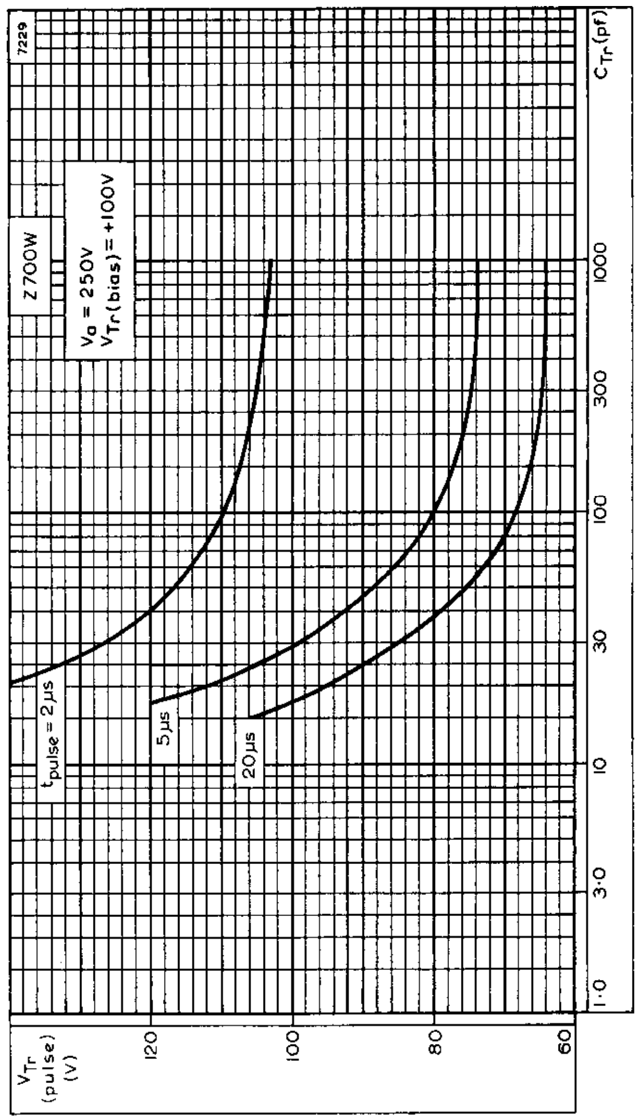
TYPICAL TRIGGER MAINTAINING VOLTAGE CHARACTERISTIC

SUBMINIATURE COLD CATHODE TRIGGER TUBE

Z700W



TYPICAL DYNAMIC TRIGGER IGNITION VOLTAGE CHARACTERISTICS



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	µA

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 = 5.0mA)	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	MΩ
Tube impedance over the frequency range 300 to 3300Hz (at I_k = 8.0mA)		
typical	400	Ω
maximum	800	Ω
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	μA
Tube non-conducting	0	μA
Maximum bulb temperature	70	°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 25μs 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 5.0μA 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

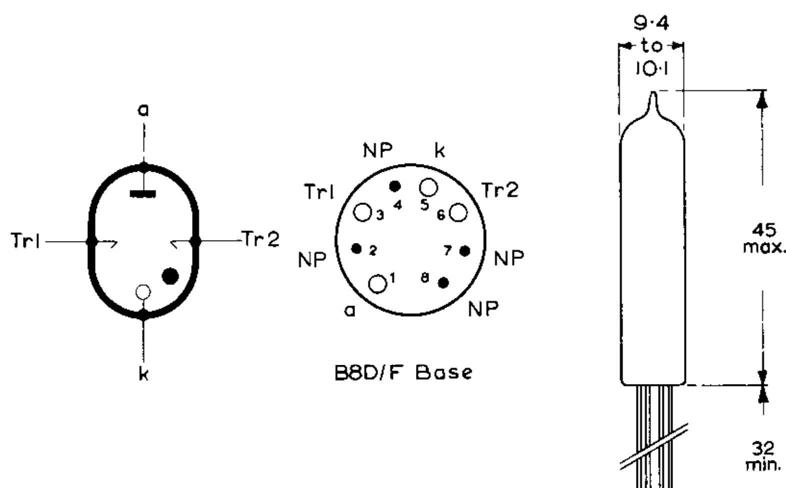
Z701U

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.

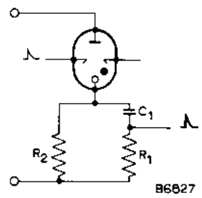
9. The tube may be soldered directly into the circuit, but heat conducted to the glass should be kept to a minimum by the use of a thermal shunt. The leads may be dip-soldered to a minimum of 5mm from the glass-to-metal seals at a solder temperature of 240°C for a maximum of 10 seconds. Bending of the tube leads must be at least 1.5mm from the seal.



B6733

All dimensions in mm

TYPICAL SELF EXTINGUISHING PULSE FORMING CIRCUIT



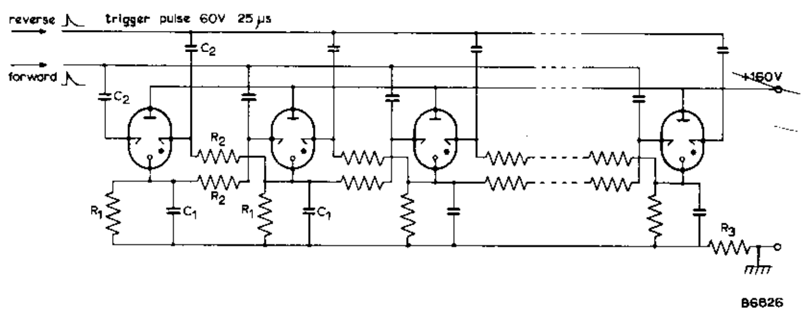
$R_1 = 5.6k\Omega$

$R_2 = 470k\Omega$ ($>350k\Omega$)

$C_1 = 10nF$

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

TYPICAL DECADE COUNTER CIRCUIT



$R_1 = 10k\Omega$ to $33k\Omega$ with $C_1 = 56nF$ to $6.8nF$

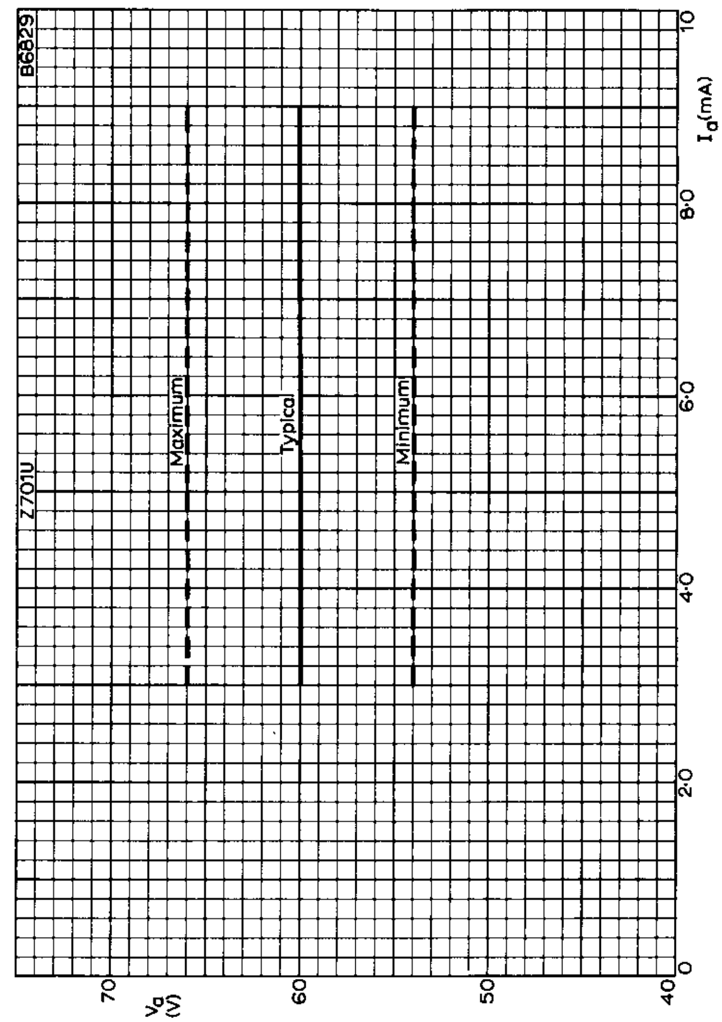
$R_2 = 0.2M\Omega$ to $1.2M\Omega$ with $C_2 = 2.0nF$ to $220pF$

$R_3 = 6.8k\Omega$ to $22k\Omega$

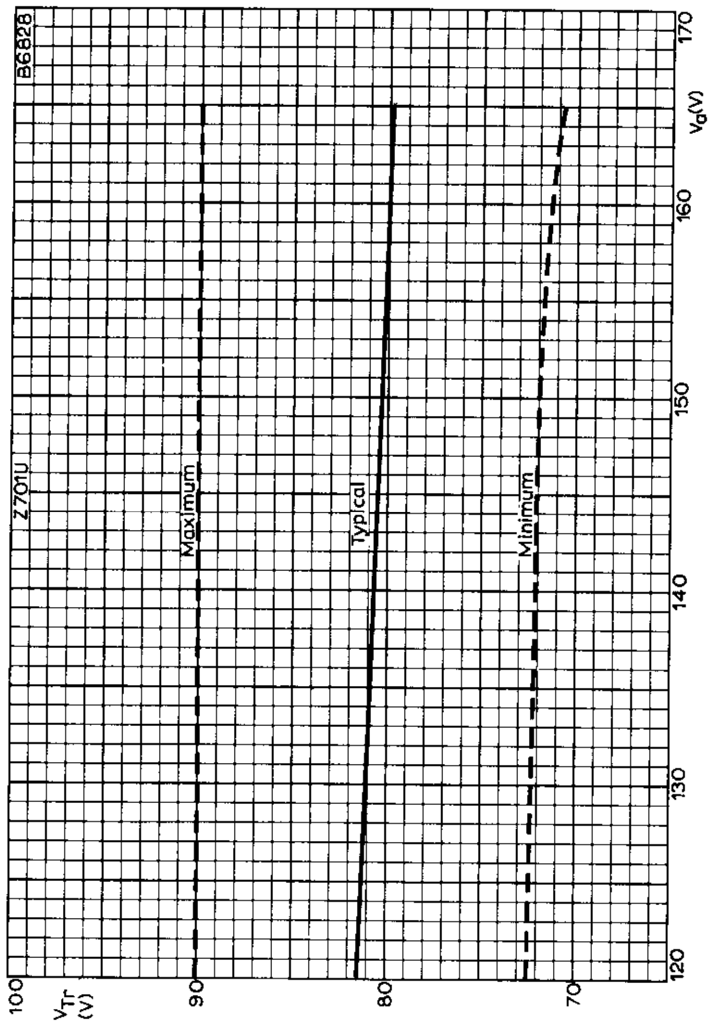
$R_1 \times C_1 > 200\mu s$.

SUBMINIATURE COLD CATHODE TRIGGER TUBE

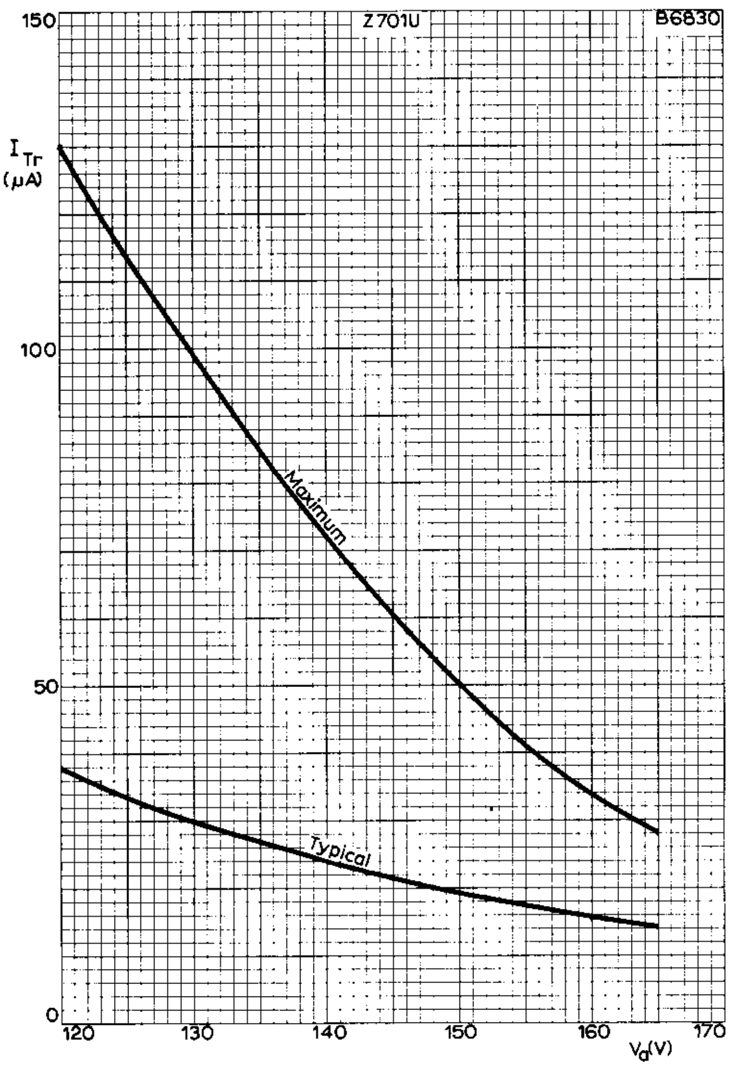
Z701U



SPREAD OF ANODE-TO-CATHODE MAINTAINING VOLTAGE CHARACTERISTIC



SPREAD OF TRIGGER IGNITION CHARACTERISTIC



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 6μA 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=260V Trigger resistance=68M Ω)	141–151	V
Maximum variation of trigger breakdown voltage for any tube (V_a=260V)	2.0	%
Recommended priming current	6.0	μA

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 μμF	220	V
Maximum mean cathode current (averaging time 15 secs)	2.5	mA
Maximum peak cathode current	10	mA
Maximum mean priming current	10	μA
Minimum priming current	2.0	μA

*Trigger voltage $\geqq$+50V.

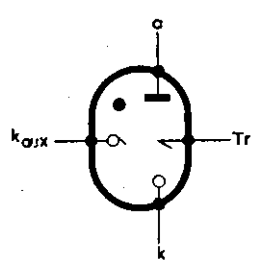
Note.—The maximum operating speed is largely determined by the circuit and is of the order of 400 c/s.

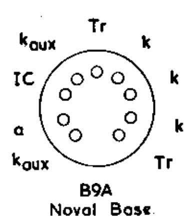
Z800U

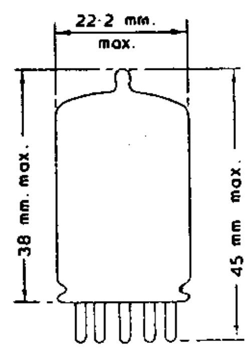
COLD CATHODE TRIGGER TUBE

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 0.4μA 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	μA

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 120μμF	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	μA
Minimum priming current	0.25	μA
Minimum charge required by auxiliary cathode to ensure triggering in circuit shown in Fig. 1	45	μμC

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.

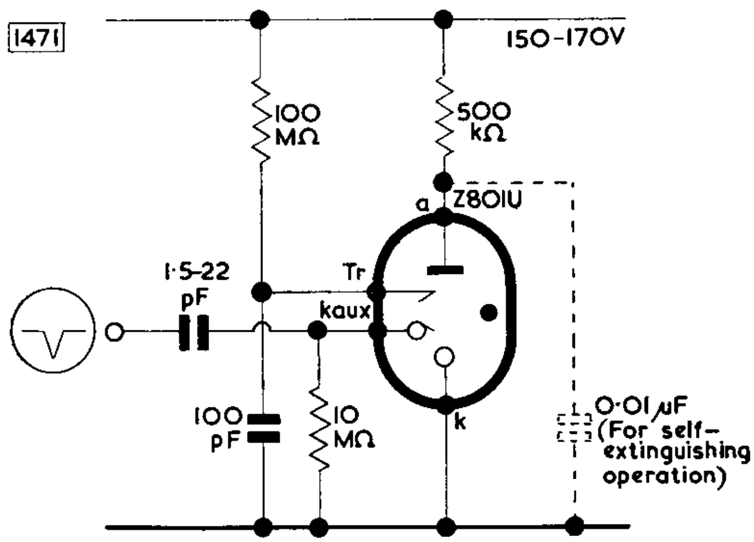
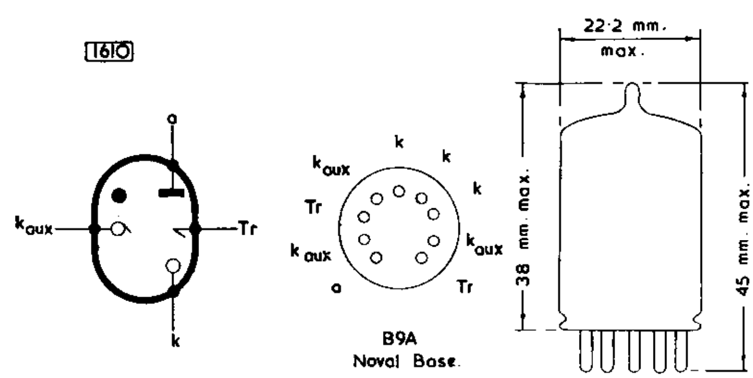


FIG. 1



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	µA
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 trigger tube.

Anode-to-cathode gap

Anode supply voltage (*see note 1*)		
Positive, for trigger-controlled ignition		
Maximum ($I_{k(av)} < 25$mA, $i_{k(pk)} < 100$mA, *see note 2*)	290	V
Maximum ($I_{k(av)} > 25$mA)	250	V
Maximum ($i_{k(pk)} > 100$mA, *see note 3*)	250	V
Minimum	170	V
Negative		
Maximum ($I_{Tr} = 0$mA)	90	V
Nominal anode-to-cathode maintaining voltage		
($I_a = 10$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 25μA (*see note 6*)	4×10^{-8}	A
$I_{a\ priming}$ = 0μA	5×10^{-10}	A
Recommended maximum trigger series resistance		
$I_{a\ priming}$ = 2 to 25μA	100	MΩ
$I_{a\ priming}$ = 0μA	1000	MΩ
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	MΩ
Transfer requirements		
Minimum value of trigger-to-cathode capacitance for transfer (limiting resistor = 0 to 2.2kΩ, *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	kΩ
C_{Tr}>15,000pF	5.6	kΩ
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} = 1kΩ		
C_a>2700pF	1	MΩ
Minimum value of trigger resistor		
C_{Tr}>500pF	1	MΩ

Ionisation and deionisation

Nominal ionisation time (*see curve on page C4*)		
$I_{a\ priming} = 2$ to $25\mu A$, $V_{Tr} = V_{Tr(ign)} + 0.5V$	2	ms
$I_{a\ priming} = 0\mu A$, $V_{Tr} = V_{Tr(ign)} + 4V$	5	s
Nominal deionisation time		
$i_{k(pk)} = 8$ to 20mA	3.5	ms
$i_{k(pk)} = 20$ to 100mA	12	ms

ABSOLUTE MAXIMUM RATINGS

Maximum anode voltage		
Positive	290	V
Negative ($I_{Tr} = 0$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 ($I_k = I_{Tr} = 0$mA)	75	V
Maximum peak trigger current		
Positive	8	mA
Negative ($I_k = 0$mA, *see note 10*)	0	mA
Maximum anode-to-trigger voltage ($I_k = 0$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 $<4\times10^{-8}$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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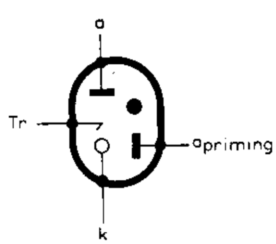
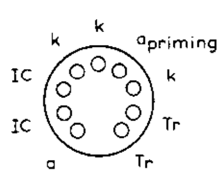
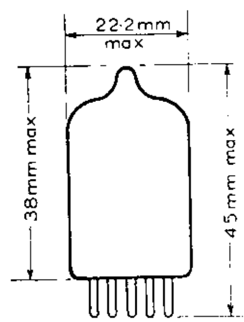
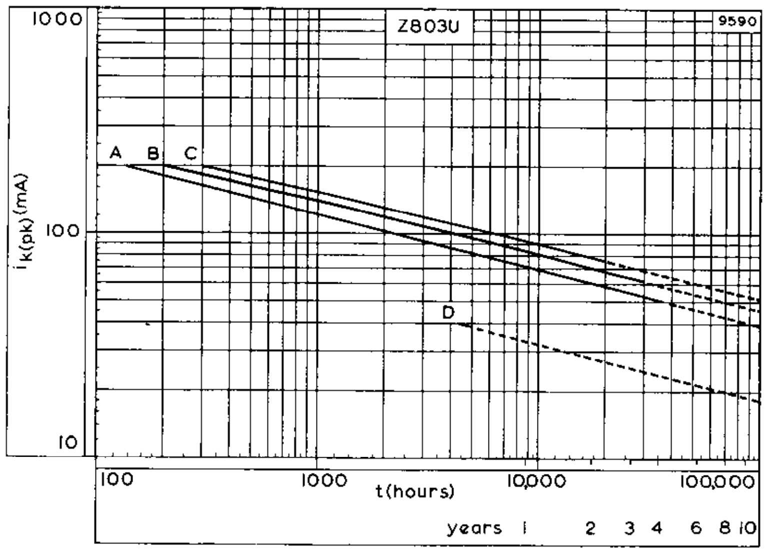




B9A Base





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.

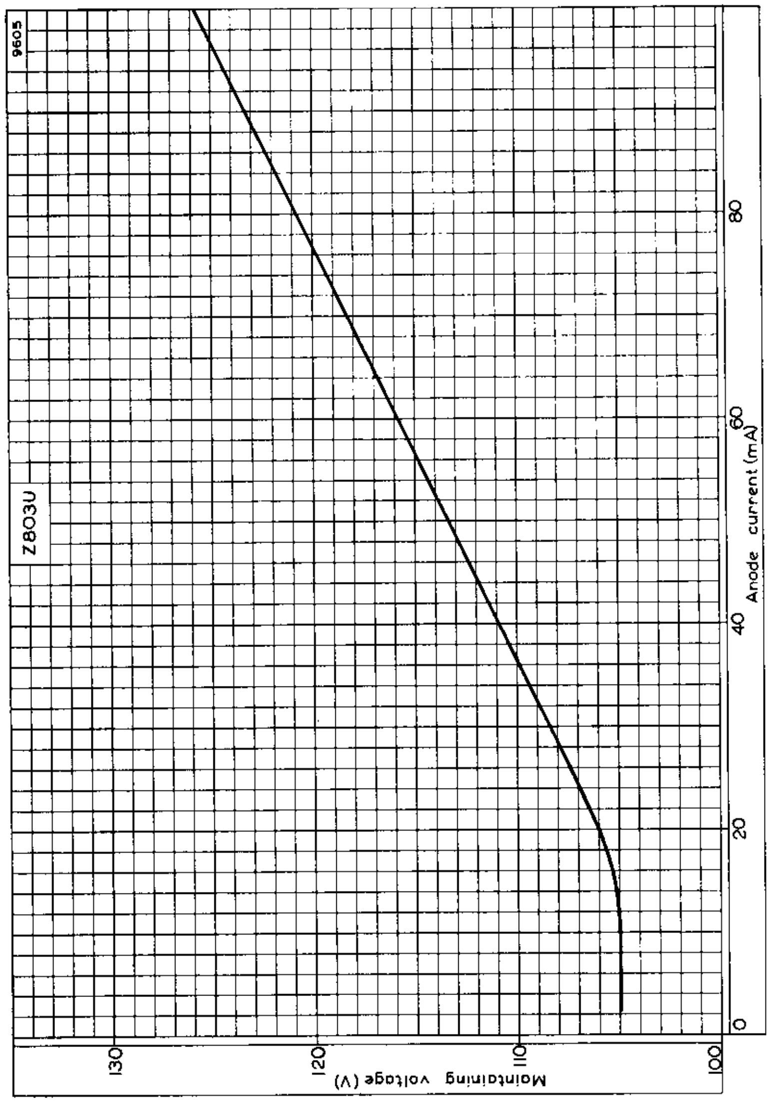
For a given value of cathode current, it is estimated that 80% of all tubes will remain within the end points concerned for longer than the time shown.

The time during which the trigger ignition voltage will remain within ±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.

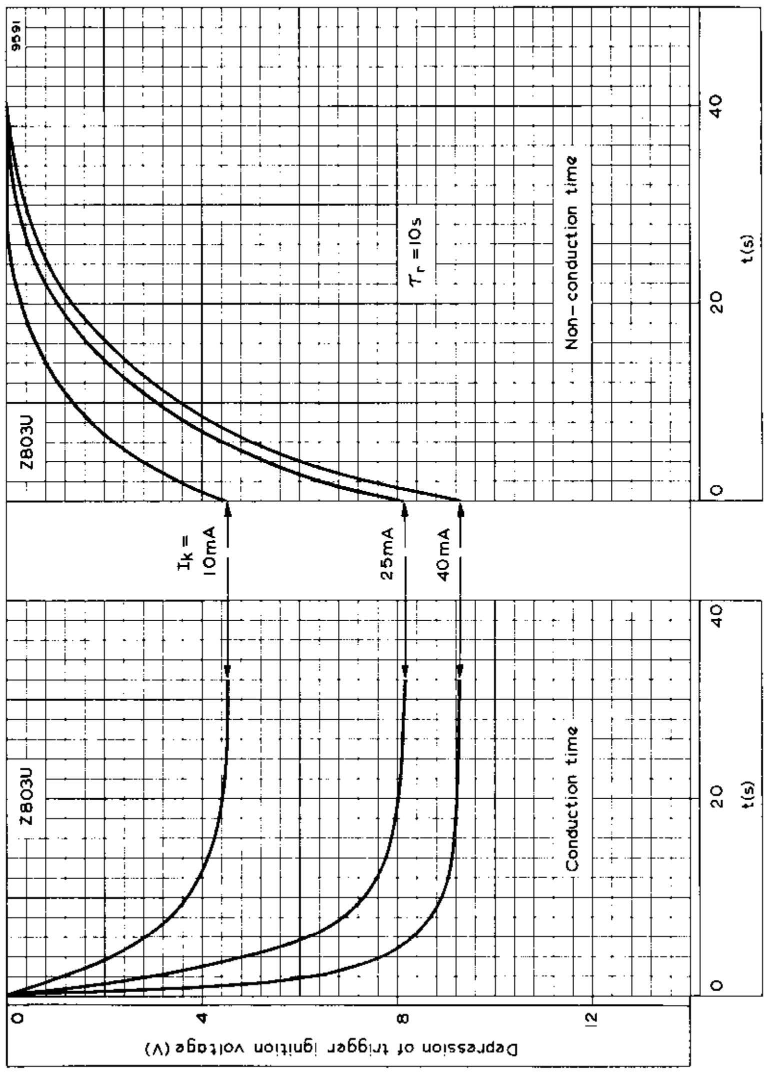
Curve D shows the estimated length of time for which the change of trigger ignition voltage can be expected to remain within ±2% when passing direct current at room temperature.

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

Z803U COLD CATHODE TRIGGER TUBE

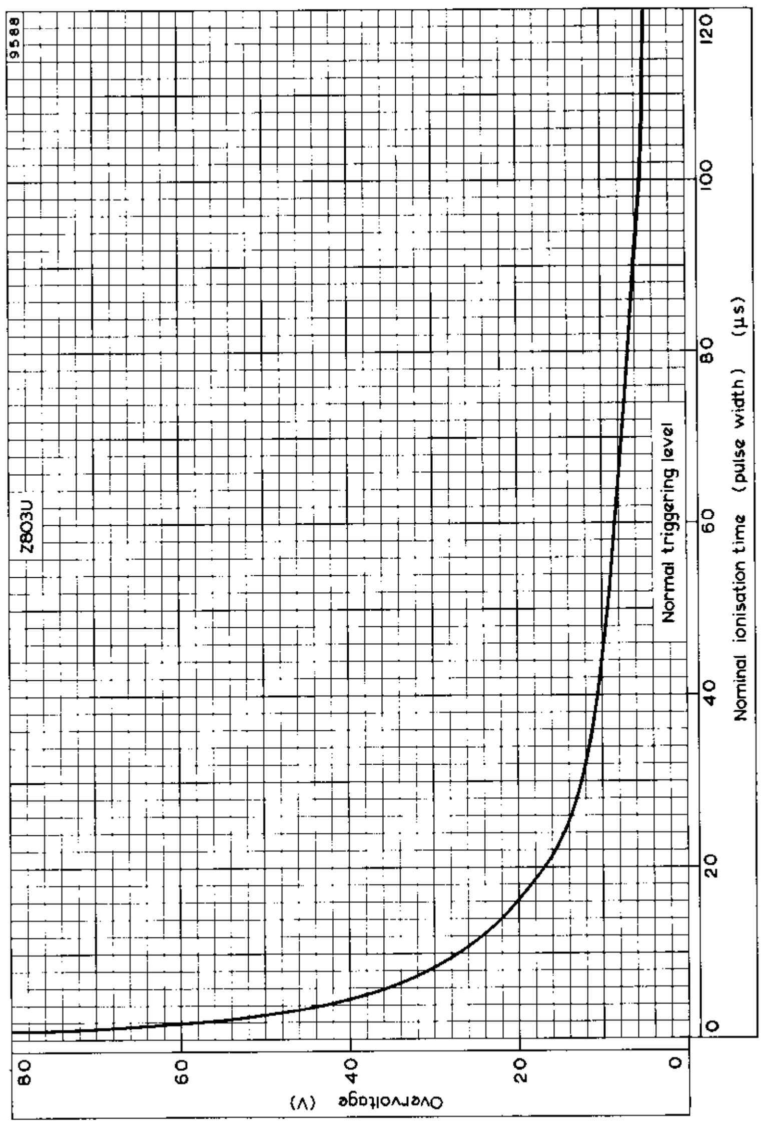


MAINTAINING VOLTAGE PLOTTED AGAINST ANODE CURRENT



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

Z803U COLD CATHODE TRIGGER 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	μA

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. ≥1 ft. cd.)	20	μs
In darkness	250	μs
Deionisation time (approx)	500	μs
Transfer requirements		
Minimum trigger current for transfer (see page C3)		
V_a = 140V		
Initial	200	μA
End of life (see page C1)	400	μA
V_a = 175V		
End of life	160	μA
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} = 1kΩ		
C_a = 0.001μF	1.2	MΩ
C_a = 0.005μF	450	kΩ
C_a = 0.01μF	300	kΩ

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 100kΩ.
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.

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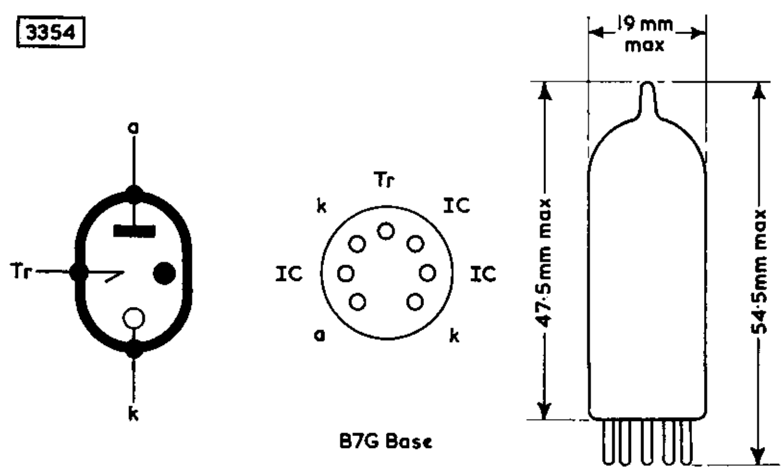
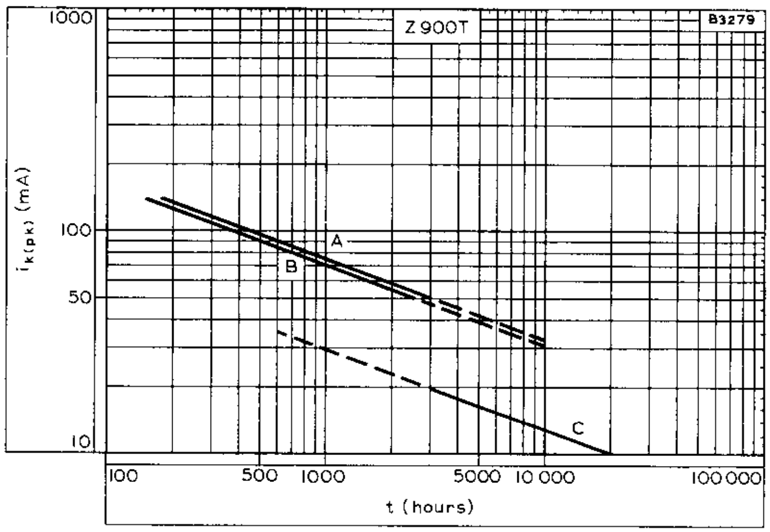


B7G Base



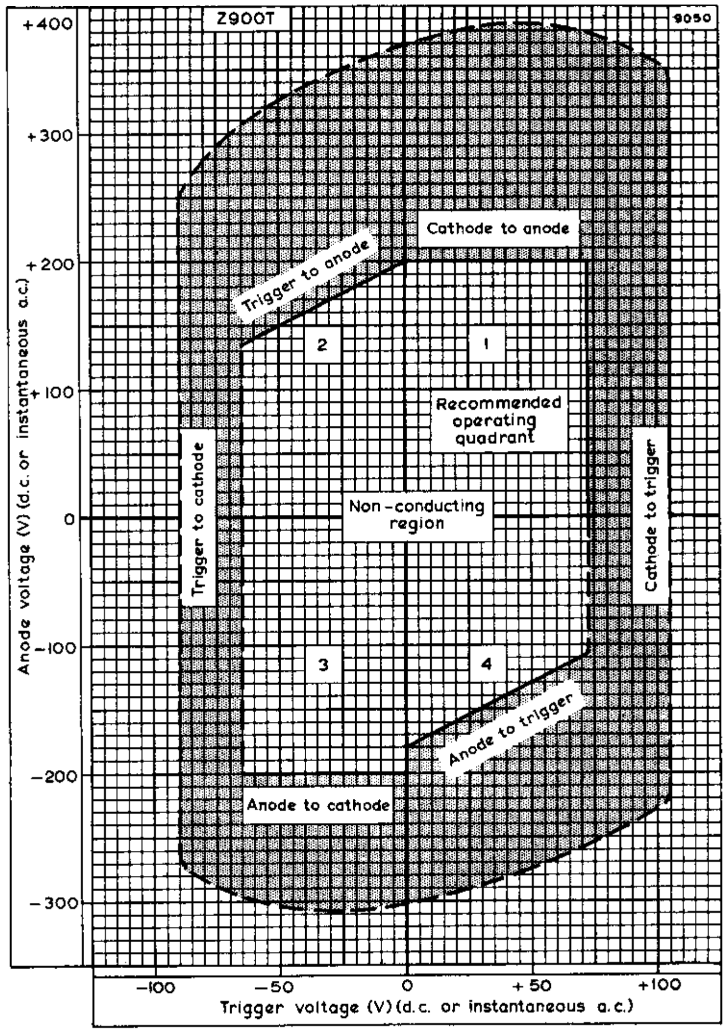
LIFE EXPECTANCY (50c/s relay duty)

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.

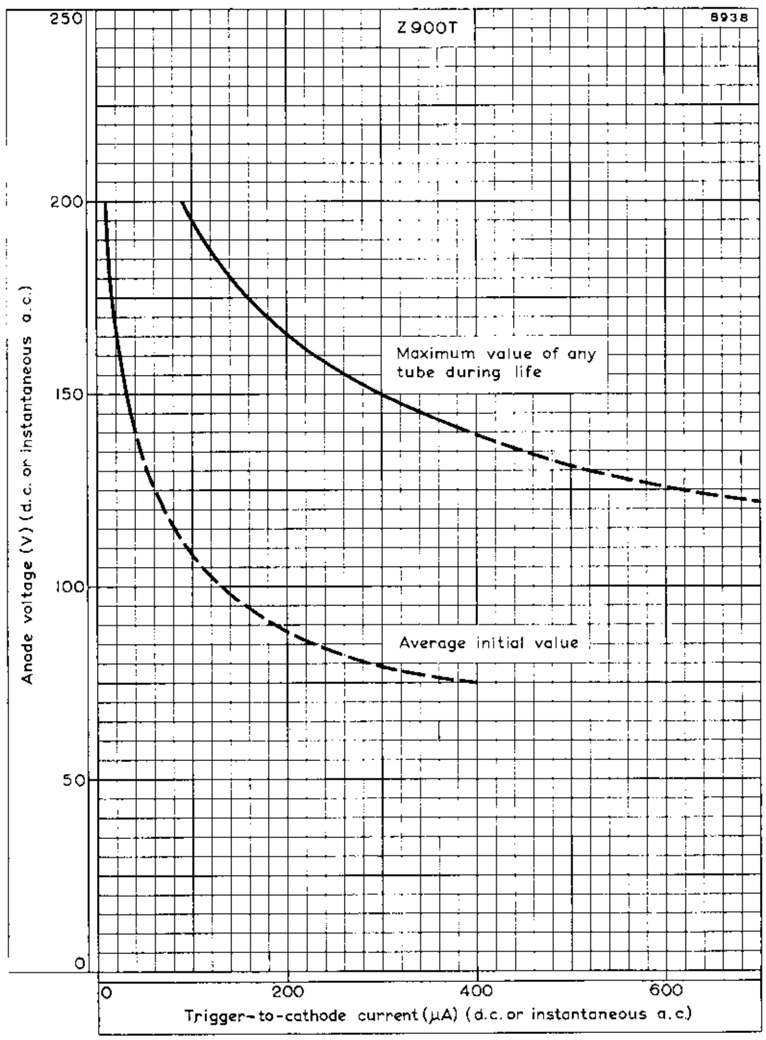
Curves A and B show the life expectancy under a.c. conditions. Curve A shows the time for $V_{t(ign)}$ to rise to 105V. Curve B shows the time for $V_{t(ign)}$ to rise to 95V. Other characteristics will remain within values quoted in the data. It should be noted that to obtain the life time represented 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.



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.



TRANSFER CHARACTERISTIC