
Perfection in miniature
HIVAC
THE SCIENTIFIC
VALVE
Hivac Limited

HIVAC LIMITED

A General Instrument Company

Stonefield Way, Victoria Road,
South Ruislip, Middlesex,
England, HA4 0JT.

Telephone : 01-845 1288 Telex : 22623

Authorised Distributor in U.K. : Townsend-Coates Ltd., Coleman Road, Leicester, LE5 4LP.

PRODUCT RANGE :

Electrometer Valves	Spark Gap Tubes	Filamentary Lamps
Cold Cathode Tubes	Numicators	Neon Indicator Lamps
Barretters	Flash Tubes	Dekatrons

ELECTRO-OPTICAL PRODUCTS GROUP

Hivac Limited **Nore Electric Company Limited** **Vitality Bulbs Limited**
Chicago Miniature Lamp Works **Signalite Incorporated**

GENERAL INSTRUMENT

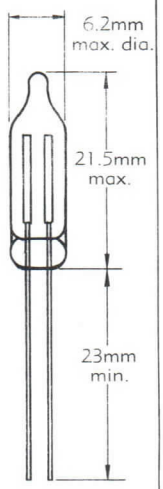
COLD
CATHODE TUBES

Glow Diodes

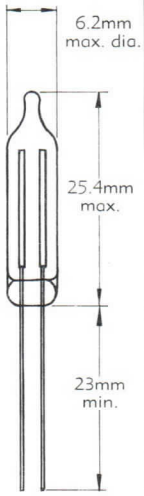
Cold cathode discharge tubes designed for operation in a wide range of electronic applications.

A Series

Type	A039A	A059	A329	A230	A240F
Breakdown Voltage	66—72V	65—75V	135V max.	80V max.	360—440V
Maintaining Voltage at Design Current	50—60V	52—60V	60—75V	62V max.	180V min.
Design Current	0.3mA	0.3mA	2.0mA	5.0mA	—
Average Life	5,000 hrs.	7,500 hrs.	5,000 hrs.	5,000 hrs.	—
* Typical Application	Timers	Binary Decoding	Photochoppers	Proportional Controls	Transient Suppression
Notes	1, 7, 8	3, 7, 8, 10	4, 5, 7, 8, 9	2, 6, 7, 8	—
Outline	A	A	A	B	B



Outline A



Outline B

Notes :

1. Leakage resistance 10^{12} ohm min.
2. End of life is a 5V increase in max. breakdown or maintaining voltage.
3. End of life is a 6V increase in max. breakdown or maintaining voltage.
4. End of life is a 10V increase in max. breakdown or maintaining voltage
5. Extinction voltage, 58V.
6. Extinction voltage, 45V.
7. Dark effect reduced.
8. Anode identified by coloured spot.
9. A version of the A329 in which half the glass bulb is coated with reflective material to increase the light output through the uncoated side to approximately 0.3 lumens at 2mA is available. Order as "A329 Half White". This type supersedes the type A083.
10. These tubes are supplied with the characteristics shown, but are categorized into groups having a maintaining voltage spread of 2V.

* Although the function for which each tube was originally designed is shown, they may be used in many other applications.

JULY
1971

HIVAC LIMITED

STONEFIELD WAY, RUISLIP, MIDDLESEX, ENGLAND, HA4 OJT
TELEPHONE : 01-845 1288 TELEX : 22623

GENERAL INSTRUMENT

Glow Diodes

A Series

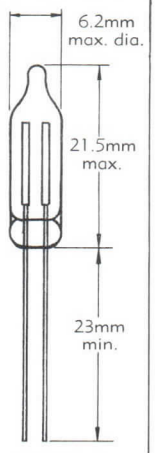
Type	A243	A257	A258	A280	A287
Breakdown Voltage	68—76V	125—145V	200—230V	205V min.	58—80V
Maintaining Voltage at Design Current	—	65—80V	80V	—	60V max.
Design Current	3.0mA	2.0mA	—	—	0.3mA
Average Life	5,000 hrs.	5,000 hrs.	—	—	5,000 hrs.
* Typical Application	Timers	Difference Diode	Flash Tube Triggering	Transient Suppression	Memory Circuits
Notes	2, 4	3, 4	—	4	1
Outline	C	A	B	B	A

Notes :

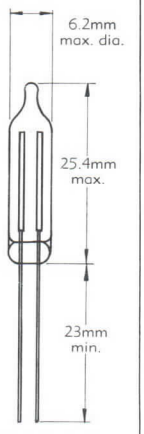
1. Leakage resistance 10^{12} ohm min.
2. Leakage resistance 10^{10} ohm min.
3. End of life is a 10V increase in max. breakdown or maintaining voltage.
4. Anode identified by coloured spot.

* Although the function for which each tube was originally designed is shown, they may be used in many other applications.

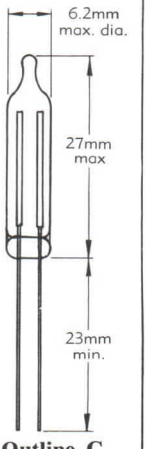
Further information and Applications Notes on the use of Glow Diodes is available on request from our Technical Services Department.



Outline A



Outline B

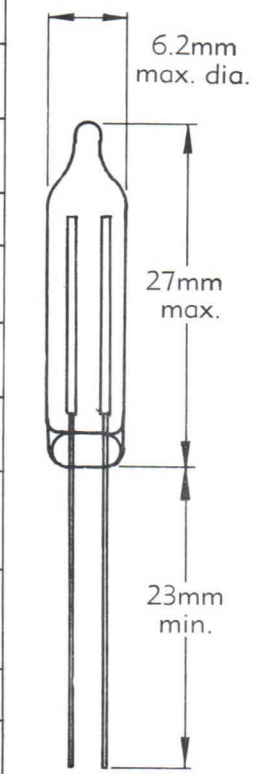


Outline C

Glow Diodes

A range of voltage regulator and reference tubes.

Z Series

Type	Z82R7	Z83R4	Z91R7	Z100R12	Dimensions
Max. Breakdown Voltage	110V	110V	130V	150V	
Typical Breakdown Voltage	102V	100V	110V	140V	
Reference Voltage at Design Current	82 ± 1V	83 ± 1V	91 ± 1V	100 ± 1V	
Design Current	2.0mA	1.5mA	1.5mA	3.0mA	
*Current Range for Regulator	0.25—7.0mA	0.25—4.0mA	0.25—7.0mA	0.6—12.0mA	
Temperature Coefficient	− 2mV/°C	− 2mV/°C	− 3.5mV/°C	−9mV/°C	
† Max. Operating Current	10.0mA	6.0mA	10.0mA	14.0mA	
Min. Operating Current as Shunt Regulator	0.25mA	0.25mA	0.25mA	0.7mA	
Min. Operating Current in parallel with a Capacitor	0.45mA	0.4mA	0.4mA	1.8mA	
Life Expectancy	30,000 hrs.	30,000 hrs.	30,000 hrs.	30,000 hrs.	
Typical Variation at 250 hours	< 0.2%	< 0.2%	< 0.3%	< 0.6%	

Notes :

* Limits for less than one volt variation.

† Maximum continuous current without permanent damage to tube.
Anode identified by red spot.
Equilibrium conditions reached within 2 minutes' operation.

Further information and Applications Notes on the use of Glow Diodes is available on request from our Technical Services Department.

SEPTEMBER
1969

HIVAC LIMITED

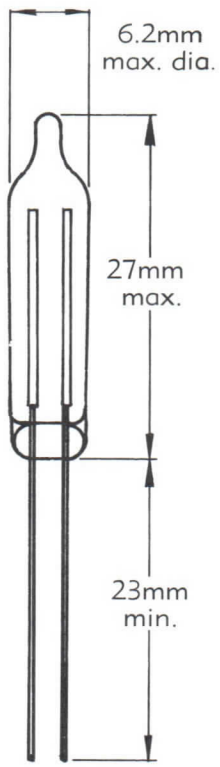
STONEFIELD WAY, SOUTH RUISLIP, MIDDLESEX, ENGLAND
TELEPHONE : 01-845 1288 TELEX : 22623

GENERAL INSTRUMENT

Glow Diodes

Z Series

Deleted.

Type	Z105R7	Z116R2	Z133R6	Z143R1.9	Dimensions
Max. Breakdown Voltage	160V	145V	230V	220V	
Typical Breakdown Voltage	150V	138V	—	195V	
Reference Voltage at Design Current	105 ± 1V	116 ± 1V	133 ± 3V	143 ± 3V	
Design Current	2.5mA	0.6mA	2.0mA	0.5mA	
* Current Range for Regulator	0.6—7.0mA	0.12—2.0mA	0.8—4.8mA	0.3—1.9mA	
Temperature Coefficient	− 9mV/°C	− 15mV/°C	—	− 10mV/°C	
† Max. Operating Current	10mA	3.0mA	6.0mA	3.0mA	
Min. Operating Current as Shunt Regulator	0.6mA	0.15mA	0.8mA	0.3mA	
Min. Operating Current in parallel with a Capacitor	1.3mA	0.3mA	1.6mA	0.6mA	
Life Expectancy	30,000 hrs.	20,000 hrs.	20,000 hrs.	20,000 hrs.	
Typical Variation at 250 hours	< 0.6%	< 0.3%	—	< 0.2%	

Notes :

* Limits for less than one volt variation (three volts for Z133R6).

† Maximum continuous current without permanent damage to tube.
Anode identified by red spot.
Equilibrium conditions reached within 2 minutes' operation.

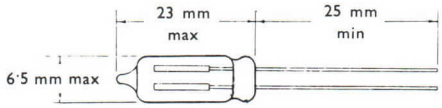
Further information and Applications Notes on the use of Glow Diodes is available on request from our Technical Services Department.

Subminiature cold cathode diode

For use in gating, and simple stabilising circuits.

NT2

DIMENSIONS



RATINGS

	Minimum	Average	Maximum	
Breakdown voltage	62	72	85*	V
Maintaining voltage at 0.5mA ...	49*	60	65*	V
Continuous cathode current	—	—	1	mA
Ionisation time—anode pulsed to :				
10% above maximum breakdown voltage	—	30	40	us
25% above maximum breakdown voltage	—	20	30	us
Regulation 0.2mA — 1mA	—	+5	+6	V
0.3mA — 0.5mA ...	—	—	+3*	V

* Standard test limits (other limits not subject to 100% testing)

NOTE : The NT2 can be supplied to the services specification CV2213.
The NT2T, a tritiated version of the NT2, is available for use in total darkness.

MAY
1969

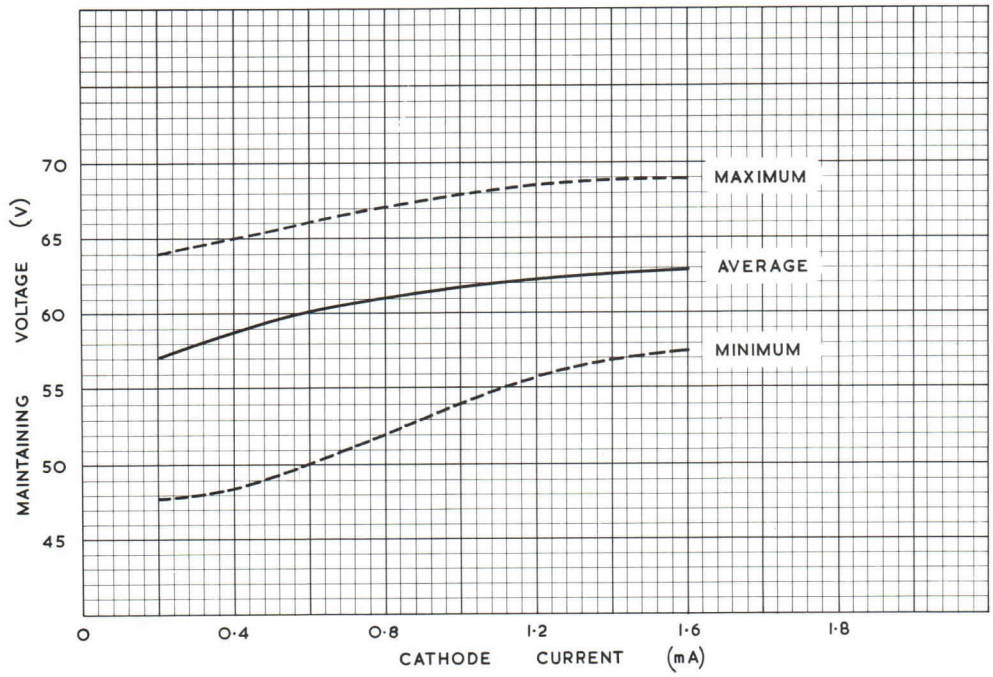
HIVAC LIMITED

STONEFIELD WAY, SOUTH RUISLIP, MIDDLESEX, ENGLAND
TELEPHONE : 01-845 1288 TELEX : 22623

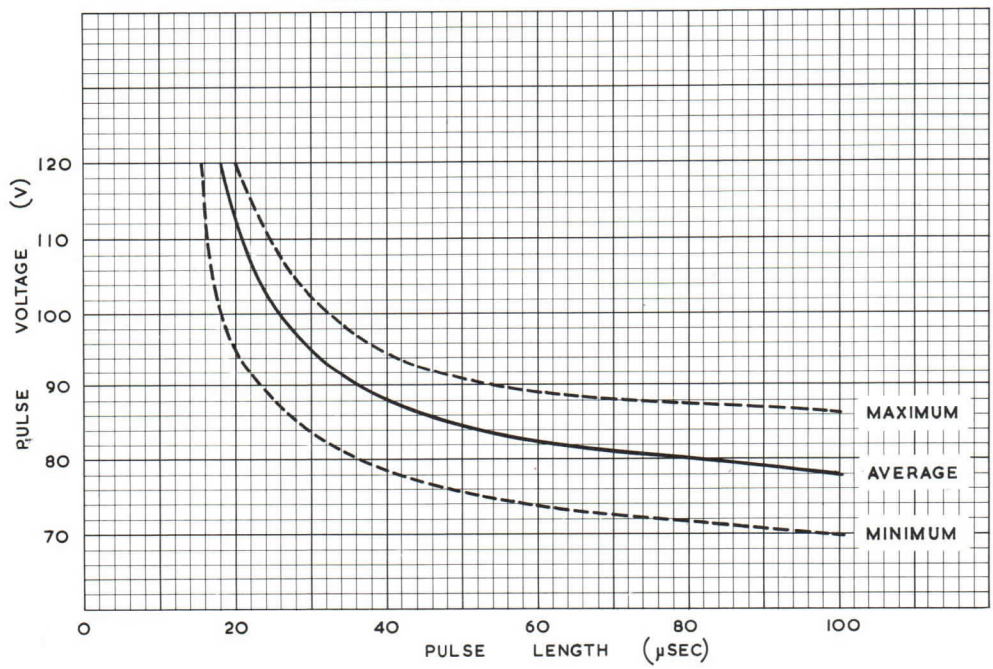
GENERAL INSTRUMENT

NT2

MAINTAINING VOLTAGE AS A FUNCTION OF CATHODE CURRENT



IONISATION CHARACTERISTICS

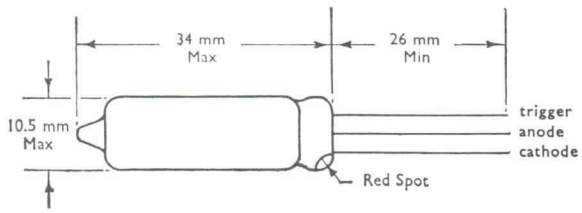


Subminiature cold cathode triode

for use in counting and automatic control circuits at speeds up to 1kHz.

XC18

DIMENSIONS



STATIC CHARACTERISTICS
(See test circuit)

	Minimum	Average	Maximum	
Continuous cathode current	—	—	1	mA
Pulsed cathode current (duty cycle 1 : 5)	—	—	5	mA
Main gap breakdown voltage (trigger connected to cathode via 470 KΩ)	210*	—	—	V
Main gap maintaining voltage at 1mA	68*	73	78*	V
Cathode regulation between 0.2—1.0mA	—	1	5	V
Control gap breakdown voltage	60*	68	72*	V
Control gap maintaining voltage	55	58	62	V
Anode take-over voltage (Trigger current = 30μA, Ct = 0, Rt = 0)	106	120	140*	V

DYNAMIC CHARACTERISTICS
(See test circuit)

Trigger Pulse amplitude to cause transfer to anode (pulse width 75μS Rb = 1MΩ, Rt = 100K, Ct = 1,000pF. Ra = 68KΩ, Va = 140V, Vb = 0)	—	76	82*	V
Deionisation time (1k = 1mA, Va = 180V, clip level = 50V, Rb = 1MΩ, Rt = 100KΩ, Ct = 1000pF, Vb = 0)	—	400	970*	μS

* Standard test limits (other limits not subject to 100% testing)

RECOMMENDED OPERATING CONDITIONS

Anode supply voltage	140	—	180	V
Total pulse + bias to cause transfer at anode voltage = 140V	100	—	—	V
Trigger resistance	100	—	220	KΩ
Deionisation pulse duration at anode supply voltage 180V, cathode current 1mA	1000	—	—	μS

The XC18 can be supplied to the Services Specification C.V. 2486.

SEPTEMBER
1969

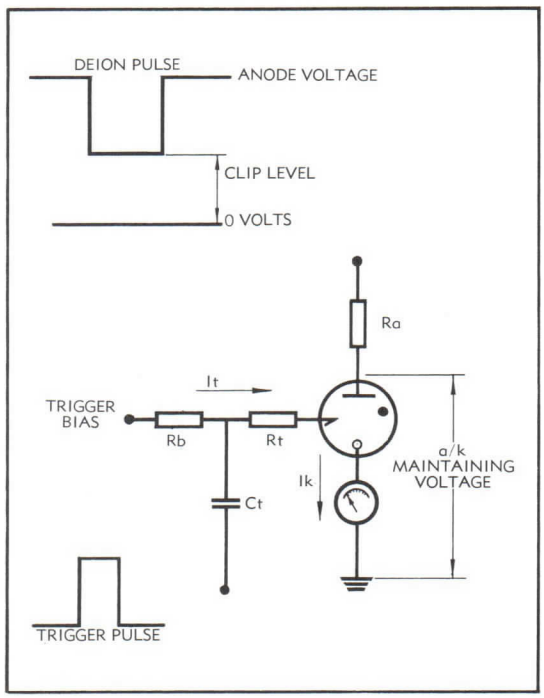
HIVAC LIMITED

STONEFIELD WAY, SOUTH RUISLIP, MIDDLESEX, ENGLAND
TELEPHONE : 01-845 1288 TELEX : 22623

GENERAL INSTRUMENT

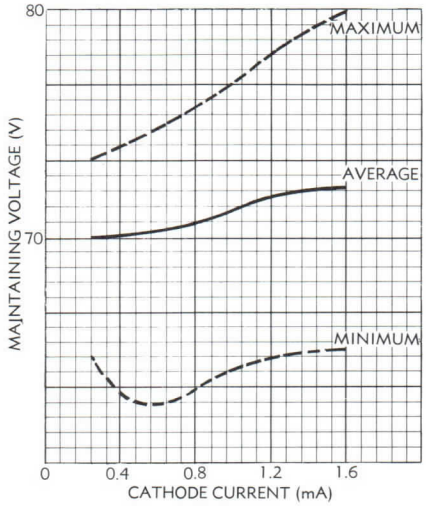
XC18

TRIGGER CIRCUIT*

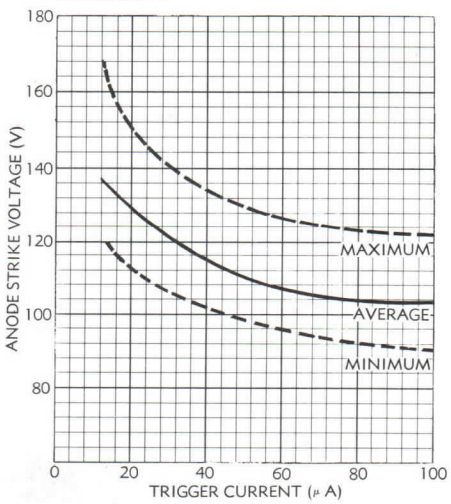


* Note: Illumination level 165 lux.
When the tube is used under low ambient lighting conditions or in darkness, additional photon priming should be provided by means of a small neon or filamentary lamp.
If the tube is exposed to a very high level of illumination, such as direct sunlight, some reduction in the main gap breakdown voltage may occur due to excessive photon priming.

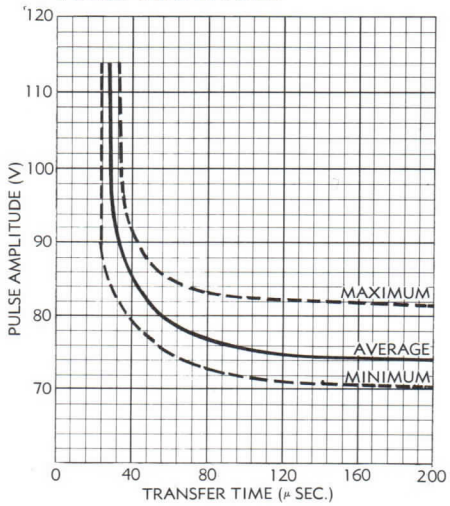
MAINTAINING VOLTAGE AS A FUNCTION OF CATHODE CURRENT



ANODE STRIKE VOLTAGE AS A FUNCTION OF TRIGGER CURRENT



TRANSFER TIME AS A FUNCTION OF THE APPLIED PULSE AMPLITUDE



Cold cathode touch button tube

A cold cathode triode designed for use as an electronic touch button, acting both as a switch and as its own indicator.

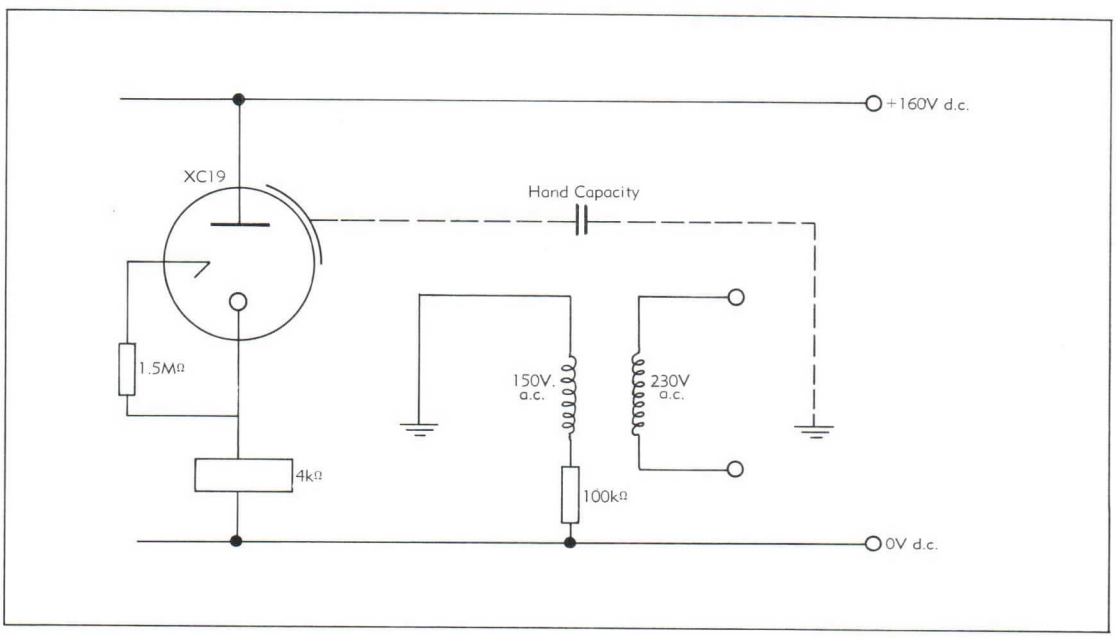
XC19

RATINGS

Minimum anode-cathode breakdown voltage (Trigger bias = 0V)	180V d.c.
Minimum anode-trigger breakdown voltage	180V d.c.
Maximum trigger-cathode breakdown voltage	80V d.c.
Anode-cathode maintaining voltage at 18mA	71-75V d.c.
Maximum continuous cathode current	25mA
Maximum peak cathode current	100mA
Maximum anode-cathode breakdown voltage with 80V a.c. applied to the bulb conductive coating	150V d.c.
Capacitance between conductive coating and all other electrodes	Approx. 4pF

TYPICAL OPERATING CONDITIONS

The dome of the glass bulb is covered externally with a transparent conductive coating, and when used as a touch button the tube is caused to fire by the application of an alternating voltage between this conductive coating and the electrodes of the tube. In practice, the cathode of the tube is maintained at an a.c. potential relative to earth and the conductive coating is earthed through hand capacity (see circuit below). The tube is in other respects an orthodox cold cathode trigger tube, and may also be operated in normal cold cathode tube circuits.



MARCH
1969

HIVAC LIMITED

STONEFIELD WAY, SOUTH RUISLIP, MIDDLESEX, ENGLAND
TELEPHONE : 01-845 1288 TELEX : 22623

GENERAL INSTRUMENT

XC19

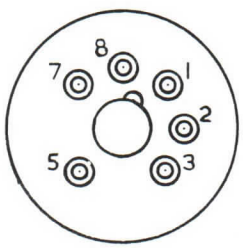
MECHANICAL DATA

Mounting position ..... Any

Base ..... International Octal

BASE CONNECTIONS

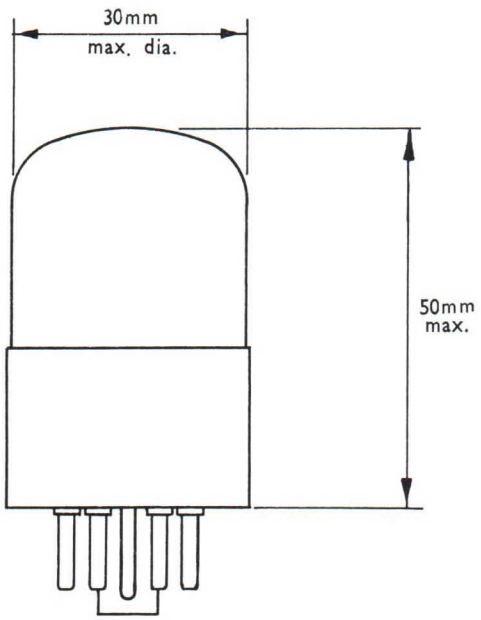
(Underside View)



Pin 2 ..... Cathode
Pin 5 ..... Anode
Pin 7 ..... Trigger

Other pins to be left unconnected.

DIMENSIONS

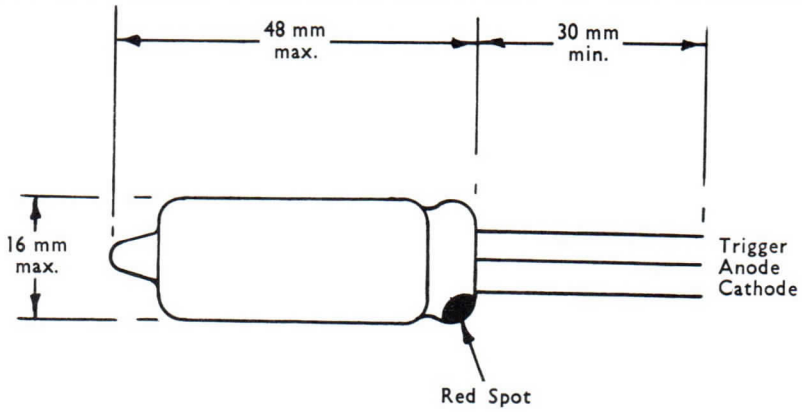


Miniature cold cathode triode

A medium current tube suitable for switching relays and other electromechanical devices

XC23

DIMENSIONS



STATIC CHARACTERISTICS

(See test circuit)

	Minimum	Average	Maximum	
Continuous cathode current	5	—	15	mA
Pulsed cathode current (duty cycle 1 : 5)	—	—	75	mA
Main gap breakdown voltage	210*	—	—	V
Main gap maintaining voltage at 7.5 mA	62*	68	72*	V
Cathode regulation between 2 - 15 mA	—	—	5	V
Control gap breakdown voltage	63*	69	75*	V
Control gap maintaining voltage	52	56	60	V
Transfer current (Va = 140V, Ra = 15KΩ, Rt = 330KΩ)	—	—	90*	μA

DYNAMIC CHARACTERISTICS

(See test circuit)

Trigger Pulse amplitude to cause transfer to anode (pulse width = 75μ sec., Rb = 1MΩ, Rt = 47KΩ, Ct = 1000pF, Ra = 10KΩ, Va = 140V, Vb = 0V)	—	91	98	V
Recovery time (Ik = 10mA, Va = 180V, Clip level = 50V, Rt = 330KΩ to earth)	—	—	1.8	m. sec.

* Standard test limits (other limits not subject to 100% testing)

RECOMMENDED OPERATING CONDITIONS

Anode supply voltage	140	—	180	V
Total pulse + bias to cause transfer at anode voltage = 140V	100	—	—	V
Trigger resistance	47	—	—	KΩ
Deionisation pulse duration at anode supply voltage 180V, cathode current 10 mA	2.0	—	—	m. sec.

The XC23 can be supplied to the Services Specification C.V. 5217.

NOVEMBER 1969

HIVAC LIMITED

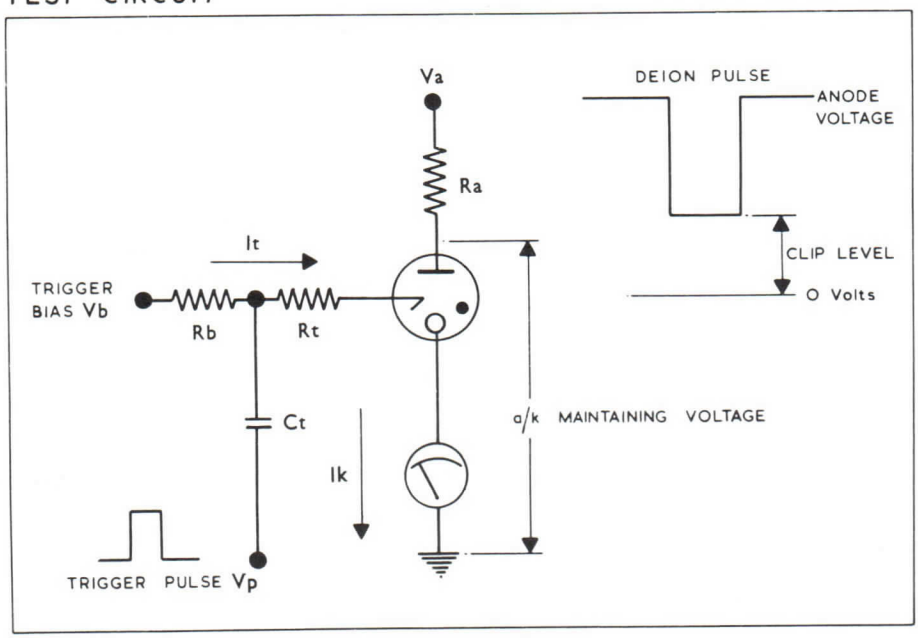
STONEFIELD WAY, RUISLIP, MIDDLESEX, ENGLAND, HA4 OJT

TELEPHONE : 01-845 1288 **TELEX : 22623**

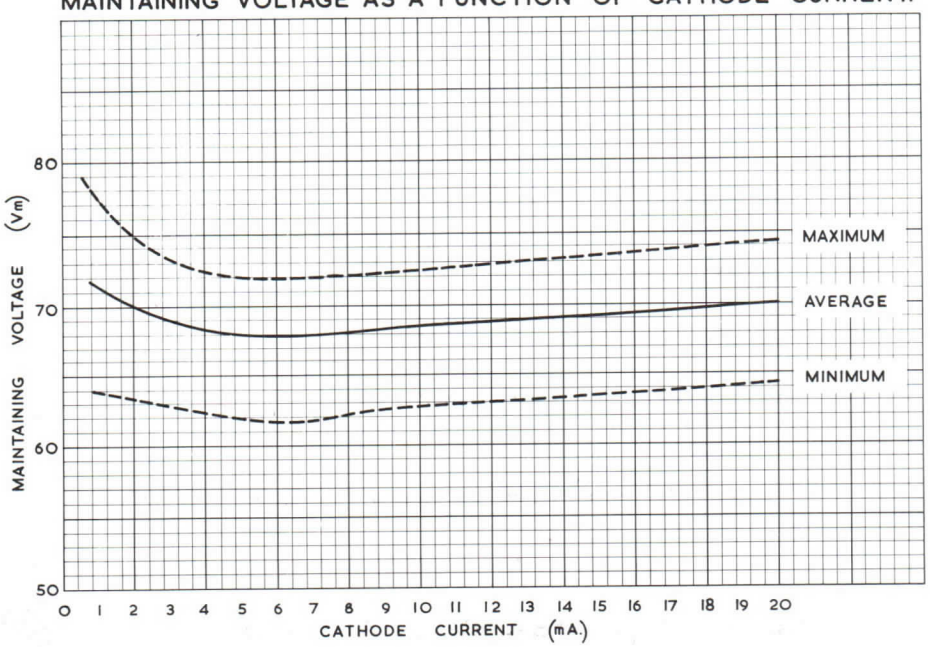
GENERAL INSTRUMENT

XC23

TEST CIRCUIT



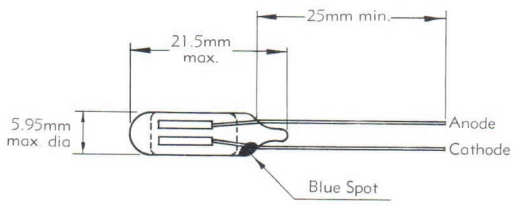
MAINTAINING VOLTAGE AS A FUNCTION OF CATHODE CURRENT.



Self-indicating cold cathode difference diode with lens-end

XC33

DIMENSIONS



RATINGS	Minimum	Maximum
Breakdown voltage	125	155 V
Maintaining voltage at 2.5mA	65	85 V
Continuous cathode current	2.0	3.0 mA
Pulsed cathode current		8.0 mA
Average cathode current (averaging time 20m sec).		3.0 mA

MARCH
1969

HIVAC LIMITED

STONEFIELD WAY, SOUTH RUISLIP, MIDDLESEX, ENGLAND
TELEPHONE : 01-845 1288 TELEX : 22623

GENERAL INSTRUMENT

HIVAC XC24

Only tentative data has so far been issued for this valve.

Minimum Main Gap Breakdown	210V
Nominal Main Gap voltage drop at 1mA	73V
Nominal Control Gap Breakdown	68V
Minimum Break Down Voltage between triggers	90V
Maximum Continuous Cathode Current	1mA
Maximum Pulsed Cathode Current with duty cycle of 1:5	5mA

R. Snelling

SPECIAL
TYPES

XB1

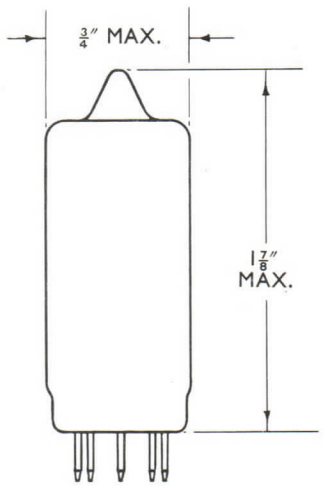
BRITISH HIVAC THE SCIENTIFIC VALVE MADE

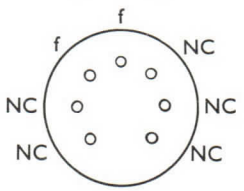
Miniature Barretter

The XB1 is an efficient miniature barretter with an operating voltage range from 9 V to 16 V at a rated current of 300 mA.

It can be used, for example, to regulate the heater current of a number of 6.3 V, 0.3 A valves operated from a suitable supply.

The XB1 may be mounted in any position, but free air circulation should be permitted round the bulb.



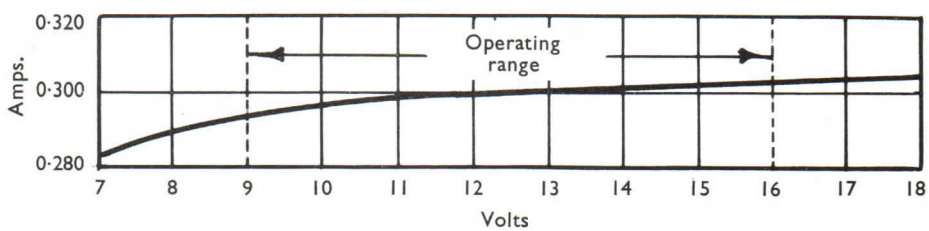


NC — no connection to be made to these pins.

Miniature B7G base.

RATINGS:

Mean current	0.3 A
Voltage range	9—16 V



Hivac Limited

STONEFIELD WAY, VICTORIA ROAD, SOUTH RUISLIP, MIDDLESEX, ENGLAND

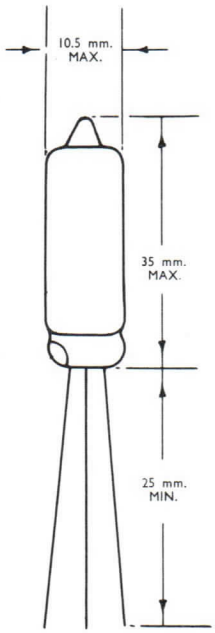
TELEGRAMS : HIVAC, RUISLIP TELEPHONE : RUISLIP 3366

June, 1956

Centre-Tapped Resistance Lamp

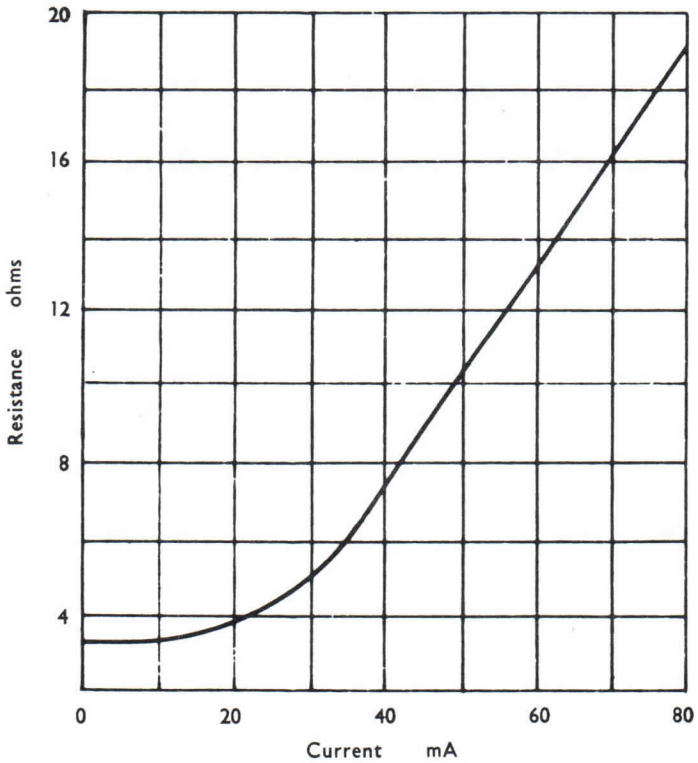
XB3

The XB3 (P.O. Bulb Resistance No. 15) is a sub-miniature centre-tapped resistance bulb specially designed for use in the most modern type of regulator circuit as employed in the British Post Office Telephone Type 706.



RATINGS :

Resistance at 76 mA	....	18 $\pm$ 1½ ohms.
Resistance at 30 mA	...	< 6 ohms.



NOVEMBER
1968

HIVAC LIMITED

STONEFIELD WAY, VICTORIA ROAD, SOUTH RUISLIP, MIDDLESEX, ENGLAND
TELEPHONE : 01-845 1288
TELEX : 22623

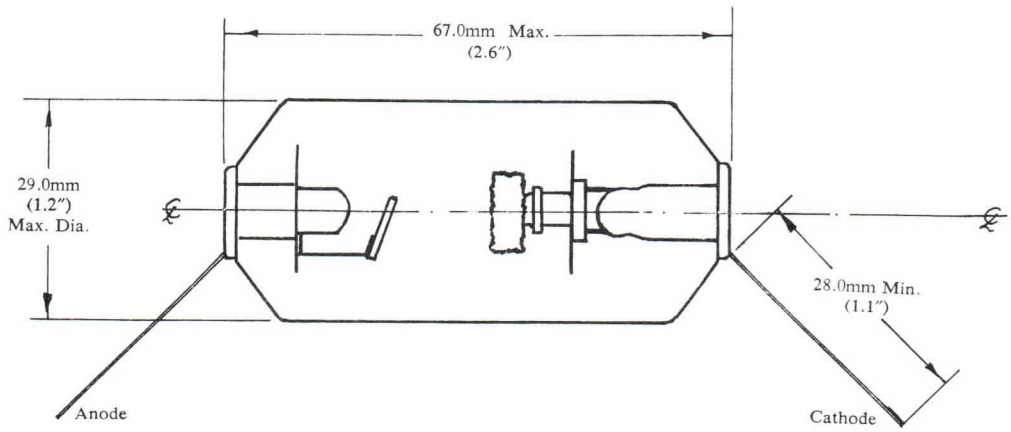
SPARK GAP TUBES

Spark Gap Tube

GD550W

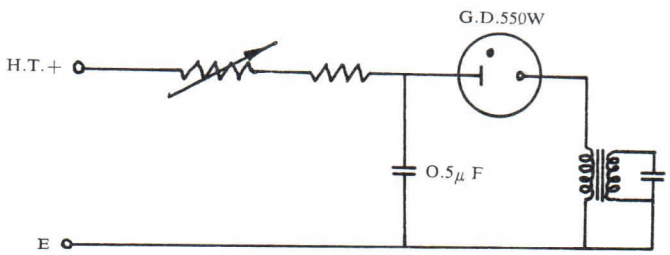
A diode spark gap having a nominal breakdown voltage of 550V.

DIMENSIONS



CHARACTERISTICS AND OPERATING DATA

Breakdown voltage	500-630V
Leakage current at 450V	$< 1\mu$ A
Maximum discharge energy	1.5 Joules
Maximum storage capacitor	8μ F
Maximum repetition rate	10 per sec.
Typical life (in circuit below with discharge energy of 0.07J and a repetition rate of 1 per sec.)	40×10^6 discharges



JANUARY
1970

HIVAC LIMITED

STONEFIELD WAY, RUISLIP, MIDDLESEX, ENGLAND, HA4 OJT
TELEPHONE : 01-845 1288 **TELEX : 22623**

GENERAL INSTRUMENT

Spark Gap Tubes

A range of diode spark gaps in glass envelopes.

GD-V Range

Type	GD2V	GD2VA	GD2VC	GD2.5VA	GD3.85V
Nominal Breakdown Voltage, Vs	2kV	2kV	2kV	2.5kV	3.85kV
Breakdown Voltage over Life	1.9—2.1kV	1.9—2.1kV	1.9—2.1kV	2.4—2.6kV	3.55—4.05kV
Insulation Resistance at Vs—100V	10MΩ min.	10MΩ min.	10MΩ min.	10MΩ min.	10MΩ min.
Max. Discharge Energy, repetitive	16J	16J	16J	16J	16J
Max. Discharge Energy, protective	100J	100J	100J	100J	100J
Max. Storage Capacitor, repetitive op.	8μF	8μF	8μF	4.7μF	2μF
Typical Life at 100J	5×10^3 Discharges	5×10^3 Discharges	5×10^3 Discharges	5×10^3 Discharges	5×10^3 Discharges
Typical Life at 16J	10^5 Discharges	10^5 Discharges	10^5 Discharges	10^5 Discharges	10^5 Discharges
Typical Life at 12J	2.5×10^5 Discharges	2.5×10^5 Discharges	2.5×10^5 Discharges	2.5×10^5 Discharges	2.5×10^5 Discharges
Typical Life at 3J	10^6 Discharges	10^6 Discharges	10^6 Discharges	10^6 Discharges	10^6 Discharges
Outline (See Overleaf)	A	B	A	B	A
Dimension 'a' (maximum)	48.4mm	55.3mm	48.4mm	55.3mm	48.4mm
Dimension 'b' (maximum)	41.6mm	41.6mm	41.6mm	41.6mm	41.6mm
Dimension 'c' (max. dia.)	30.5mm	30.5mm	28.2mm	30.5mm	30.5mm
Tapped Hole 'd'	6BA	—	6BA	—	4BA

Notes :

(1) When the applied voltage has a very fast rise time, it is essential that some light reaches the tube. For slow capacitor charging waveforms, the tube may be used in complete darkness.

(2) As supplied, the gap is symmetrical. Discharges introduce asymmetry, and the life will be shortened if the polarity is changed after some discharges have taken place.

(3) Tubes in this range can be supplied to special order having breakdown voltages from 1kV to 15kV.

JANUARY
1970

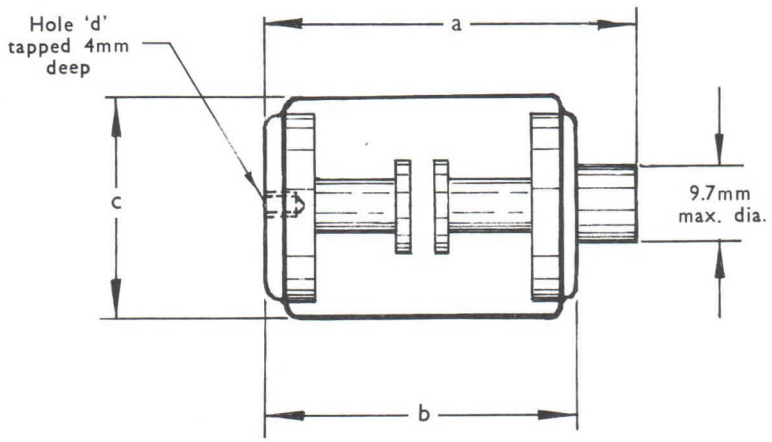
HIVAC LIMITED

STONEFIELD WAY, RUISLIP, MIDDLESEX, ENGLAND, HA4 OJT
TELEPHONE : 01-845 1288 **TELEX : 22623**

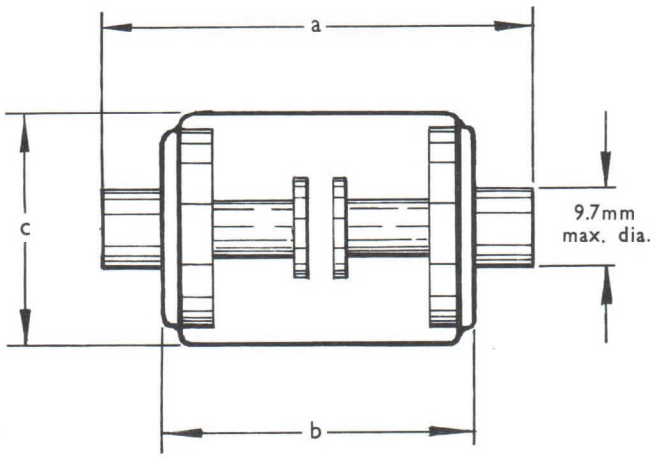
GENERAL INSTRUMENT

Spark Gap Tubes

GD-V Range



Outline A



Outline B

FLASH
TUBES

Pulse Transformer

A small wax-impregnated pulse transformer designed to supply the triggering voltage for xenon flash tubes.

ZTC1

DIMENSIONS

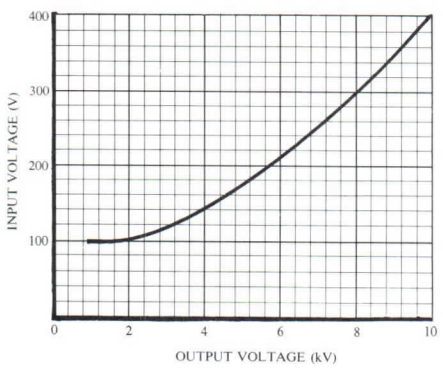
Length	20 mm nom.
Diameter	10 mm nom.

LEAD CONNECTIONS

Pulse input	Brown
Pulse output	Yellow
Common	Bare

RATINGS

Maximum input voltage	400V
Maximum input discharge capacitor	0.25μF
Output voltage	See graph below for typical input/ output characteristics with 0.1μF discharge capacitor.



TYPICAL OPERATING CONDITIONS

Input pulse voltage...	250V
Discharge capacitor	0.1μF
Output pulse voltage	6–7kV

JUNE
1970

HIVAC LIMITED

STONEFIELD WAY, RUISLIP, MIDDLESEX, ENGLAND, HA4 OJT
TELEPHONE : 01-845 1288 **TELEX : 22623**

GENERAL INSTRUMENT

Stroboscopic Flash Tubes

Linear xenon filled flash tubes

ZFT1
ZFT7

RATINGS	ZFT1	ZFT7
Anode supply voltage: maximum	450V	500V
minimum	200V	330V
*Trigger pulse voltage	4–7kV	4–7kV
Trigger discharge energy...	2mJ nom.	2mJ nom.
Maximum dissipation	4W	6W
Maximum discharge energy	20J	30J
Maximum flash rate at maximum discharge energy ...	12 per min.	12 per min.
Maximum operating frequency	300Hz	300Hz
Discharge path length	12 mm	40 mm

TYPICAL OPERATING CONDITIONS		
Anode supply voltage	350V	400V
*Trigger pulse voltage	6kV	6kV
Charging resistance	6.8kΩ	6.8kΩ
Discharge Capacitor: 0–10Hz	2μF	4μF
1–40Hz	1μF	2μF
20–250Hz	0.5μF	0.5μF

LIFE EXPECTANCY (number of discharges)		
Operation at 10Hz, 6W	—	$>10^6$
Operation at 10Hz, 3W	$>10^6$	$>5\times10^6$

DIMENSIONS

See overleaf

* The trigger pulse transformer type ZTC1 is recommended for use with these tubes.

JUNE
1970

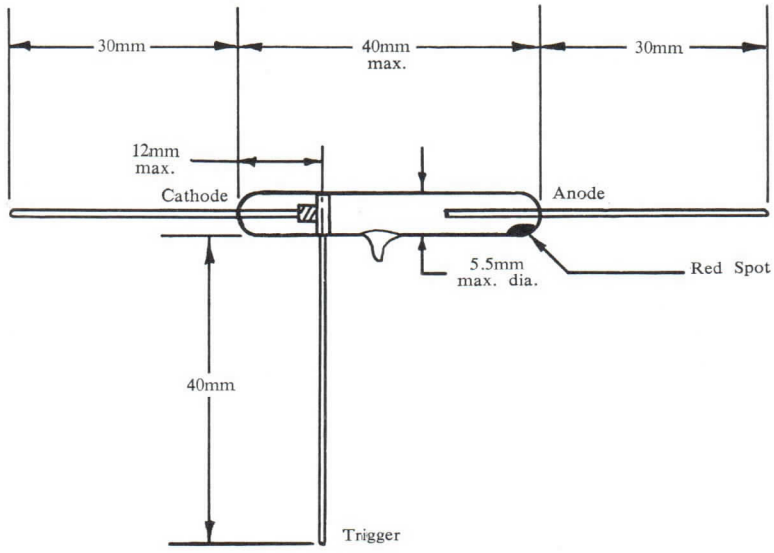
HIVAC LIMITED

STONEFIELD WAY, RUISLIP, MIDDLESEX, ENGLAND, HA4 OJT
TELEPHONE : 01-845 1288 **TELEX : 22623**

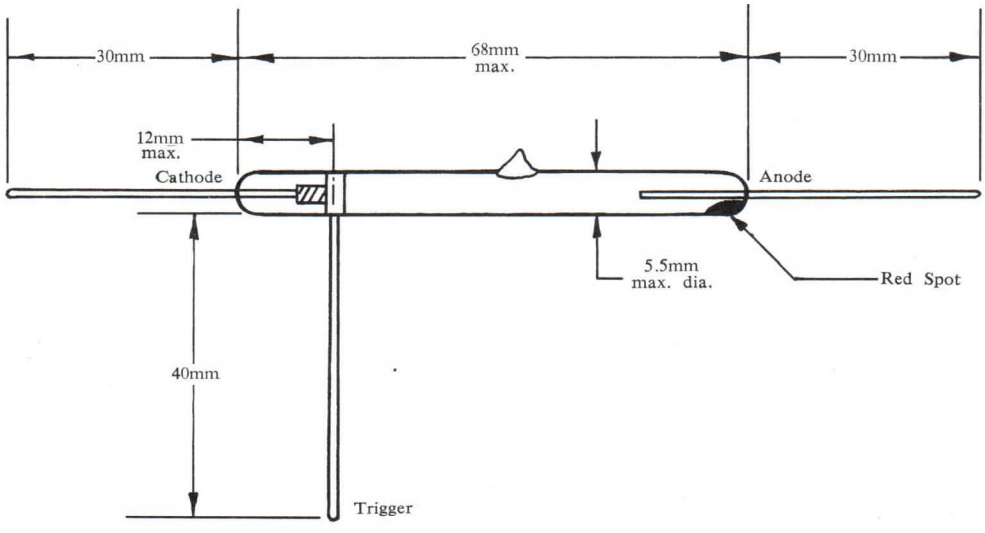
GENERAL INSTRUMENT

ZFT1
ZFT7

DIMENSIONS



ZFT1



ZFT7

Stroboscopic Flash Tubes

Looped U-shaped xenon filled flash tubes.

ZFT2, ZFT2A ZFT8A

RATINGS	ZFT2, ZFT2A	ZFT8A
Anode supply voltage: maximum	600V	650V
minimum	220V	375V
*Trigger pulse voltage	4–7kV	4–7kV
Trigger discharge energy...	3mJ nom.	3mJ nom.
Maximum dissipation	10W	15W
Maximum discharge energy	40J	50J
Maximum flash rate at maximum discharge energy ...	15 per min.	15 per min
Maximum operating frequency	300Hz	300Hz
Discharge path length	95 mm	110 mm

TYPICAL OPERATING CONDITIONS		
Anode supply voltage	300V	500V
*Trigger pulse voltage	6kV	6kV
Charging resistance	6.8kΩ	2.2kΩ
Discharge capacitor: 0–10Hz	3μF	8μF
1–40Hz	2μF	2μF
20–200Hz	0.5μF	0.5μF

LIFE EXPECTANCY (number of discharges)		
Operation at 10Hz, 10W...	$>10^6$	$>10^6$
Operation at 10Hz, 5W...	$>10^7$	$>10^7$

DIMENSIONS

See overleaf

*The trigger pulse transformer type ZTC1 is recommended for use with these tubes.

JUNE
1970

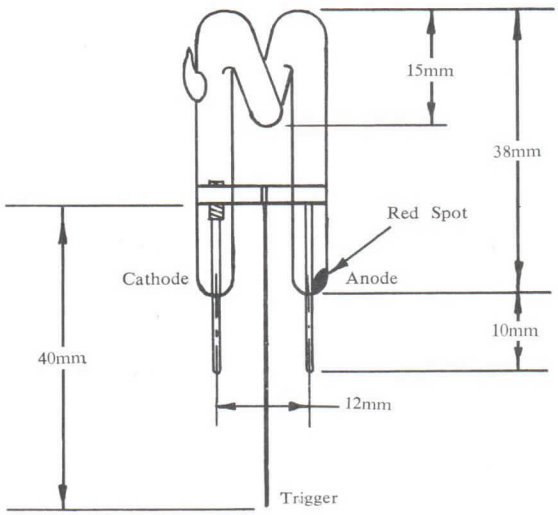
HIVAC LIMITED

STONEFIELD WAY, RUISLIP, MIDDLESEX, ENGLAND, HA4 OJT
TELEPHONE : 01-845 1288 TELEX : 22623

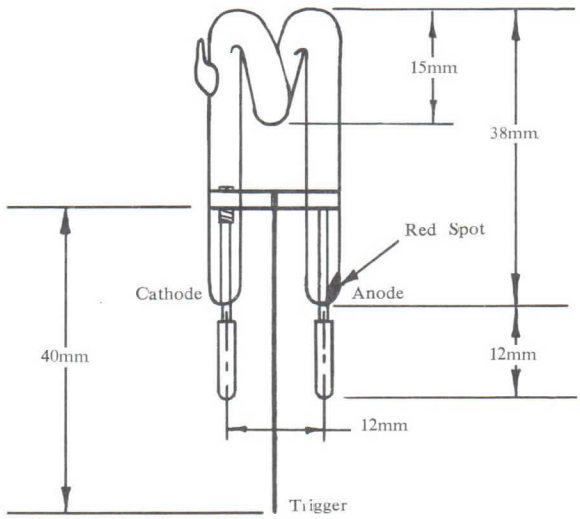
GENERAL INSTRUMENT

ZFT2, ZFT2A
ZFT8A

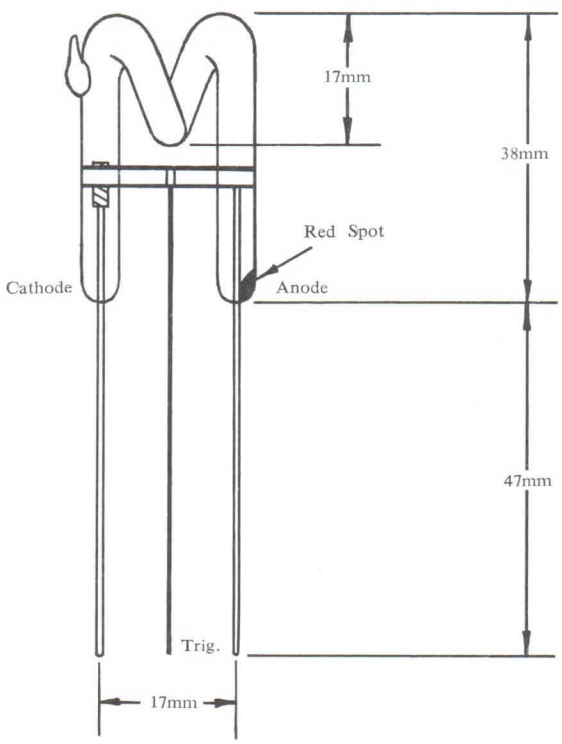
DIMENSIONS



ZFT2A



ZFT2A



ZFT8A

Note:
The type ZFT2 plugs into a standard 2 Amp 2 pin socket.

Stroboscopic Flash Tubes

U-shaped xenon filled flash tubes

ZFT3, ZFT3A
ZFT4, ZFT4A

RATINGS

	ZFT3, ZFT3A	ZFT4, ZFT4A
Anode supply voltage: maximum	500V	450V
minimum	250V	200V
*Trigger pulse voltage	4–7kV	4–7kV
Trigger discharge energy	3mJ nom.	3mJ nom.
Maximum dissipation	8W	6W
Maximum discharge energy	40J	30J
Maximum flash rate at maximum discharge energy	12 per min.	12 per min.
Maximum operating frequency	300Hz	300Hz
Discharge path length	45 mm	45 mm

TYPICAL OPERATING CONDITIONS

Anode supply voltage	300V	250V
*Trigger pulse voltage	6kV	6kV
Charging resistance	6.8kΩ	6.8kΩ
Discharge capacitor: 0–10Hz	3μF	2μF
1–40Hz	2μF	1μF
20–200Hz	0.5μF	0.5μF

LIFE EXPECTANCY (number of discharges)

Operation at 10Hz, 8W	$>10^6$	—
Operation at 10Hz, 6W	—	$>10^6$
Operation at 10Hz, 4W	$>5\times10^6$	$>5\times10^6$
Operation at 10Hz, 2W	$>10^7$	$>10^7$

DIMENSIONS

See overleaf

*The trigger pulse transformer type ZTC1 is recommended for use with these tubes.

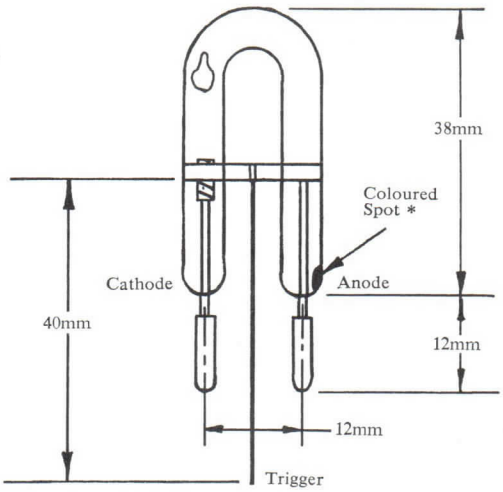
JUNE
1970

HIVAC LIMITED

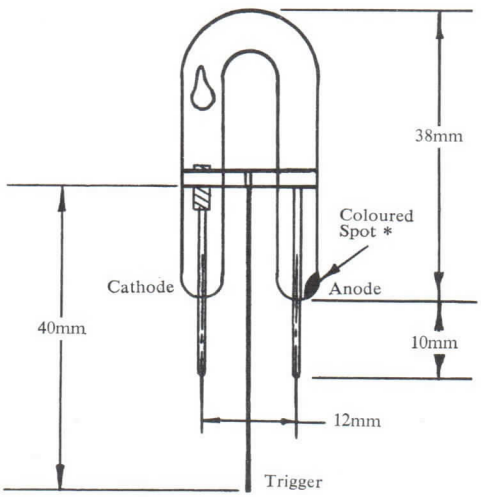
STONEFIELD WAY, RUISLIP, MIDDLESEX, ENGLAND, HA4 OJT
TELEPHONE : 01-845 1288 TELEX : 22623

ZFT3, ZFT3A
ZFT4, ZFT4A

DIMENSIONS



ZFT3, ZFT4



ZFT3A, ZFT4A

*Tubes type ZFT3 and ZFT3A have a RED spot.
Tubes type ZFT4 and ZFT4A have a GREEN spot.

Tubes type ZFT3 and ZFT4 plug into a standard 2 Amp 2 pin Socket.

Flash Tubes

Linear xenon filled flash tubes for low speed stroboscopic and warning light applications.

ZFT10
ZFT11

RATINGS

	ZFT10	ZFT11
Anode supply voltage: maximum	500V	850V
minimum	350V	500V
*Trigger pulse voltage	5–8KV	5–8KV
Trigger discharge energy	3mJ nom.	3mJ nom.
Maximum dissipation	20W	50W
Maximum discharge energy	70J	100J
Discharge path length	70mm	175mm

LIFE EXPECTANCY (number of discharges)

Operation at 16Hz, 50W	—	$>10^6$
Operation at 1Hz, 20W	$>10^6$	—

DIMENSIONS

See overleaf.

*The trigger pulse transformer type ZTC1 is recommended for use with these tubes.

MAY
1971

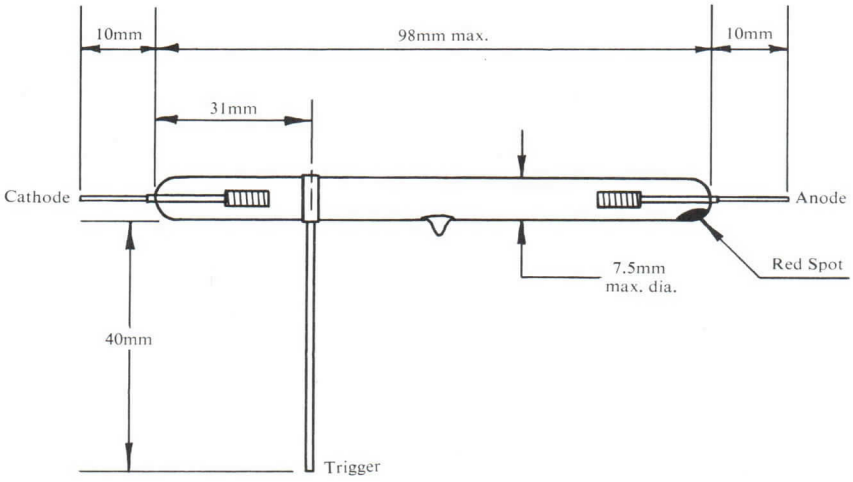
HIVAC LIMITED

STONEFIELD WAY, RUISLIP, MIDDLESEX, ENGLAND, HA4 OJT
TELEPHONE : 01-845 1288 TELEX : 22623

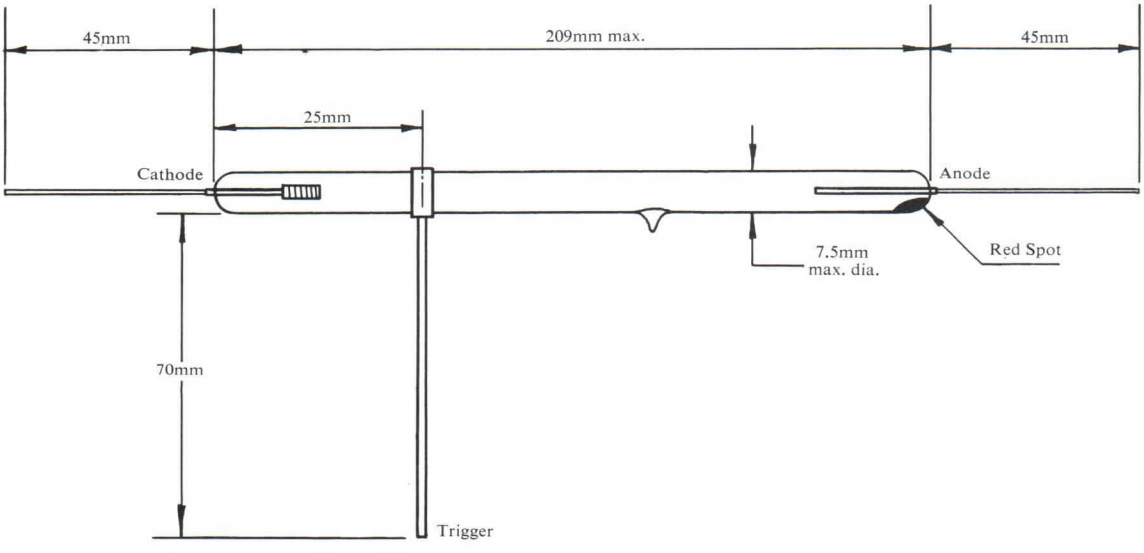
GENERAL INSTRUMENT

ZFT10
ZFT11

DIMENSIONS



ZFT10



ZFT11

Flash Tube

A looped U-shaped xenon filled flash tube for low speed stroboscopic and warning light applications

ZFT12A

RATINGS

Anode supply voltage: maximum	950V
minimum	500V
*Trigger pulse voltage	5–8KV
Trigger discharge energy	5mJ nom.
Maximum dissipation	40W
Maximum discharge energy	100J
Discharge path length	140mm

LIFE EXPECTANCY (number of discharges)

Operation at 10Hz, 40W	$>10^6$

DIMENSIONS

See overleaf

*The trigger pulse transformer type ZTC1 is recommended for use with this tube.

MAY
1971

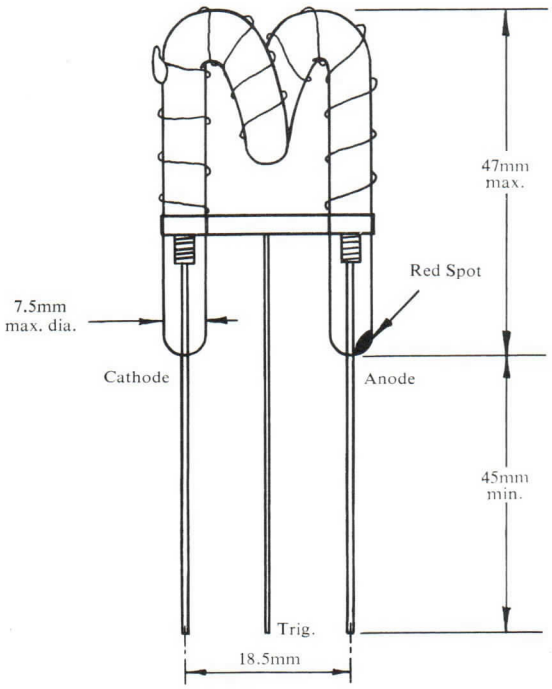
HIVAC LIMITED

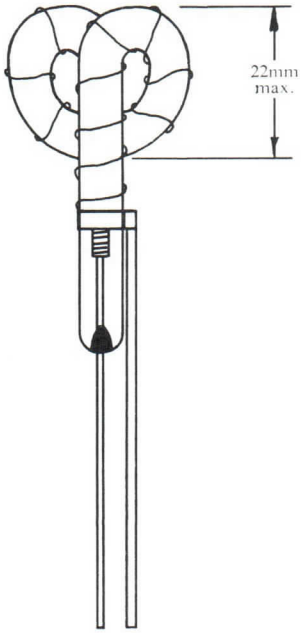
STONEFIELD WAY, RUISLIP, MIDDLESEX, ENGLAND, HA4 OJT
TELEPHONE : 01-845 1288 TELEX : 22623

GENERAL INSTRUMENT

ZFT12A

DIMENSIONS





Glow Discharge Flash Tubes

High voltage low current glow discharge flash tubes with a helical light source to give a uniform distribution of light in any direction at right angles to the helix. These tubes are mounted on a UX4 base.

FTA1 Range

COLOUR OF DISCHARGE

FTA1/A	Amber
FTA1/B	Blue
FTA1/G	Green
FTA1/R	Red
FTA1/W	White

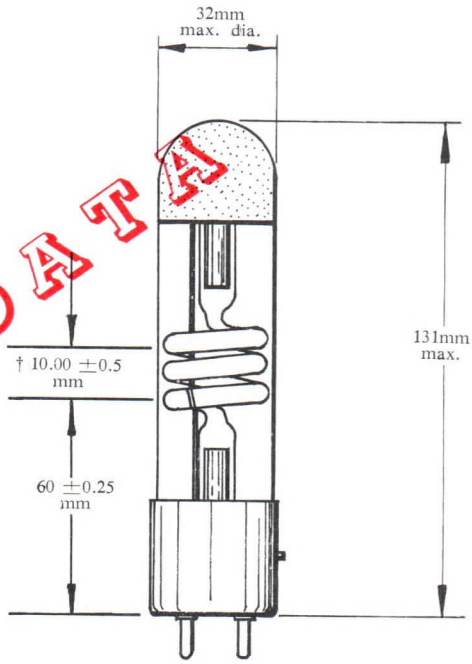
TYPICAL OPERATING CONDITIONS

(when operated from a continuous a.c. supply)

*Minimum striking voltage	1.7kV peak
Nominal maintaining voltage at 1mA ...	600V
Recommended operating current	1mA r.m.s.

*Suitable supplies may be obtained from a low voltage d.c. source by means of a free running blocking oscillator operating at the required flashing frequency. The current taken from a 12V supply is approximately 1A peak, 25mA average.

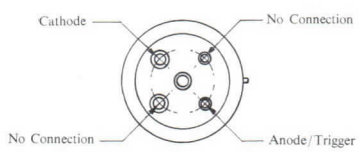
DIMENSIONS



† Minimum Light Zone

BASE CONNECTIONS

(Underside View)



JUNE
1970

HIVAC LIMITED

STONEFIELD WAY, RUISLIP, MIDDLESEX, ENGLAND, HA4 OJT
TELEPHONE : 01-845 1288 **TELEX : 22623**

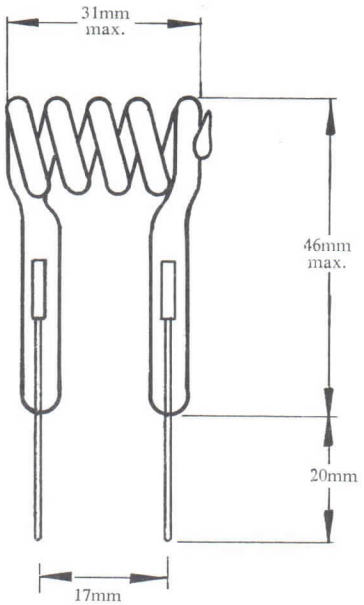
GENERAL INSTRUMENT

Neon Glow Discharge Flash Tube

Intended for use in ignition timing lights and similar applications.

FT3

DIMENSIONS



CHARACTERISTICS AND OPERATING DETAILS

Colour of discharge	Red-orange
Striking voltage	2–5kV
Running voltage at 0.5mA	1kV
Extinction voltage	600V

The tube should be connected directly in series with the spark plug when used for ignition strobing.

JUNE
1970

HIVAC LIMITED

STONEFIELD WAY, RUISLIP, MIDDLESEX, ENGLAND, HA4 OJT
TELEPHONE : 01-845 1288 **TELEX : 22623**

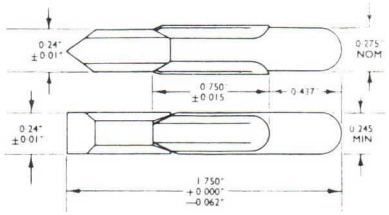
GENERAL INSTRUMENT

FILAMENTARY LAMPS

Filamentary Indicator Lamps

B.P.O. No. 2
SWITCHBOARD LAMPS

DIMENSIONS



DESCRIPTION			AVERAGE INITIAL RATING AT RATED VOLTS						
Base Colour	Ref. No.	Filament	Min. Amps	Rated Amps	Max. Amps	Min. Lumens	Rated Lumens	Max. Lumens	Rated Volts
Green	No. 2 4 V	Metal	0·230	0·250	0·270	3·00	3·70	4·50	4
Grey	No. 2 6 V	Metal	0·037	0·041	0·045	0·55	0·70	0·85	6
Red/Black	12 V 20	Metal	0.017	0·020	0.023	0·40	0·60	0·80	12
Red	No. 2 12 V	Carbon	0·110	0·117	0·125	1·00	1·50	2·00	12
Orange	No. 2 17 V	Metal	0·041	0·045	0·055	1·40	1·80	3·00	17
Yellow	No. 2 24 V	Metal	0·093	0·100	0·108	4·80	6·00	7·20	24
‡Yellow/Black	24V 55	Metal	0.050	0.055	0.060	2.50	3.50	4.50	24
Black	No. 2 36 V	Carbon	0·065	0·075	0·084	3·00	4·00	5·30	36
Blue	No. 2 40 V	Carbon	0·060	0·068	0·076	3·00	4·00	5·30	40
Blue/White	No. 2 45 V	Metal	—	0·038	—	—	3·00	—	45
White	No. 2 50 V	Carbon	0.093	0·107	0·120	4·30	6·50	9·00	50

‡ This type was previously listed as 24A4 and had a yellow base.

These lamps conform in all respects to the latest issue of the British Post Office Specification D 1524 (Metal Filament Lamps except No.2 45V), D 2136 (No.2 45V) and D 1624 (Carbon Filament Lamps) and also British Standards Specification 1050 - 1953.

JULY
1971

HIVAC LIMITED

STONEFIELD WAY, RUISLIP, MIDDLESEX, ENGLAND, HA4 OJT
TELEPHONE : 01-845 1288 **TELEX : 22623**

GENERAL INSTRUMENT

FILAMENTARY INDICATOR LAMPS
SWITCHBOARD TYPES

The following lamps conform in construction to the B.P.O. No. 2 types.

DESCRIPTION			AVERAGE INITIAL RATING AT RATED VOLTS						
Base Colour	Ref. No.	Filament	Min. Amps	Rated Amps	Max. Amps	Min. Lumens	Rated Lumens	Max. Lumens	Rated Volts
Black / White	6A1	Metal	0·037	0·041	0·045	0·30	0·40	0·50	6
Red †	12HE100	Metal	0·093	0·100	0·108	2·40	3·00	3·60	12
Red/Yellow	No. 2 12 V	Metal	0·093	0·100	0·108	0·80	1·00	1·20	12
Yellow*	~~24A2~~ Deleted.	~~Metal~~	~~0·093~~	~~0·100~~	~~0·108~~	~~4·30~~	~~6·00~~	~~7·20~~	~~24~~
White	50A1	Metal	0·050	0·055	0·060	9·60	11·50	—	50
Black	60A1	Metal	0·055	0·060	0·065	12·50	15·00	17·50	60

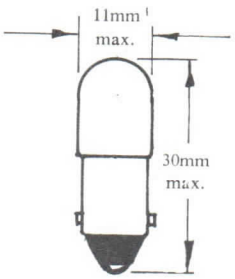
* Rough Service Lamp.

† This lamp type is also listed as the SL 30 signal lamp in British Standards Specification B.S.469; 1960.

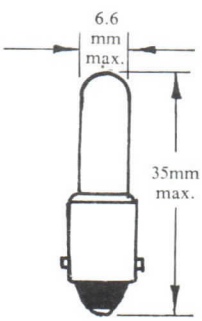
Filamentary Indicator Lamps

MBC TYPES

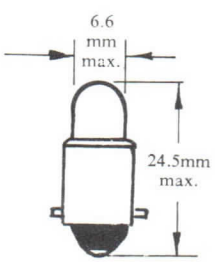
TYPE	VOLTAGE	NOMINAL WATTS	NOMINAL AMPS	NOMINAL LUMENS	SPECIAL FEATURES
6B2	6	0.24	0.040	0.7	
12B2	12	1.2	0.100	3.0	
24B4	24	~~3.5~~ 3.3	~~0.145~~ 0.137	7.0	May be used at 24-28V
24B5	24	1.3	0.055	3.5	May be used at 24-30V
24B7	24	~~3.15~~ 2.8	~~0.125~~ 0.112	~~16.0~~ 12.0	
~~24B8~~	~~24~~ Deleted.	1.3	0.055	3.5	Rough Service Lamp ~~May be used at 24-30V~~
28B1	28	3.1	0.110	10.5	
50B5	50	5.0	0.100	12.5	
50B6	50	~~2.5~~ 2.7	~~0.050~~ 0.055	11.5	
60B1	60	3.6	0.060	15.0	



24B3	24	2.4	0.100	11.5	
24B6	24	2.4	0.100	6.0	Rough Service Lamp
50B3	50	~~2.5~~ 2.7	~~0.050~~ 0.055	11.5	
60B3	60	3.6	0.060	15.0	



12B4	12	0.24	0.020	0.5	



APRIL 1970

HIVAC LIMITED

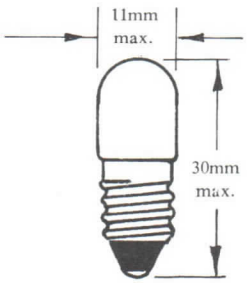
STONEFIELD WAY, RUISLIP, MIDDLESEX, ENGLAND, HA4 OJT

TELEPHONE : 01-845 1288 TELEX : 22623

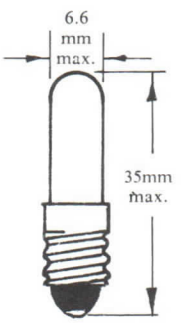
GENERAL INSTRUMENT

FILAMENTARY INDICATOR LAMPS
MES TYPES

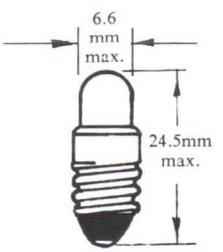
TYPE	VOLTAGE	NOMINAL WATTS	NOMINAL AMPS	NOMINAL LUMENS	SPECIAL FEATURES
6S2	6	0.24	0.040	0.7	
12S2	12	1.2	0.100	3.0	
24S4	24	~~3.5~~ 3.3	~~0.145~~ 0.137	7.0	May be used at 24-28V
24S5	24	1.3	0.055	3.5	May be used at 24-30V
24S7	24	~~3.152~~ 2.8	~~0.1250~~ 0.117	~~16.0~~ 12.0	
28S1	28	3.1	0.110	10.5	
50S5	50	5.0	0.100	12.5	
50S6	50	~~2.52~~ 2.7	~~0.050~~ 0.055	11.5	
60S1	60	3.6	0.060	15.0	



24S3	24	2.4	0.100	11.5	
24S6	24	2.4	0.100	6.0	Rough Service Lamp
50S3	50	~~2.52~~ 2.7	~~0.050~~ 0.055	11.5	
50S4	50	5.0	0.100	6.5	Carbon Filament Lamp 38mm max. Overall Length
60S3	60	3.6	0.060	15.0	



12S4	12	0.24	0.020	0.5	BPO Type 48A

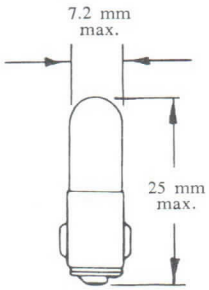


Filamentary Indicator Lamps

TYPE	VOLTAGE	NOMINAL WATTS	NOMINAL AMPS	NOMINAL LUMENS

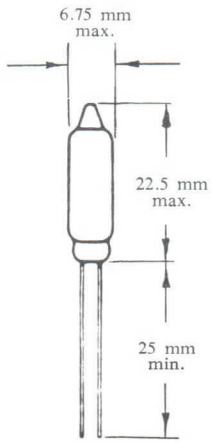
BA7S CAP

Deleted.	**PO43A**	12	0.24	0.020	0.5



WIRE ENDED

6E2	6	0.24	0.040	0.7
PO42A	12	0.24	0.020	0.5



APRIL
1970

HIVAC LIMITED

STONEFIELD WAY, RUISLIP, MIDDLESEX, ENGLAND, HA4 OJT
TELEPHONE : 01-845 1288 TELEX : 22623

GENERAL INSTRUMENT

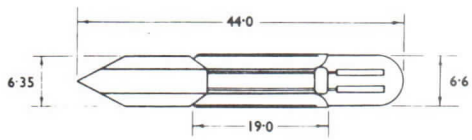
NEON INDICATOR LAMPS

Miniature Neon Indicator Lamps

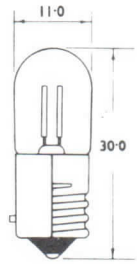
STANDARD BRIGHTNESS TYPES
6L, 7L, 8L, 9L, 10L, 31L, 33L

DIMENSIONS

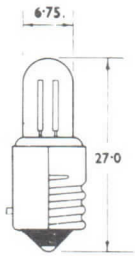
MAXIMUM SIZES ARE SHOWN IN MILLIMETRES



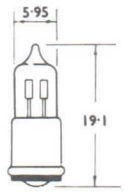
6L



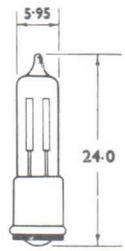
7L/8L



9L/10L



31L



33L

OPERATING DATA

These neon lamps must always be operated with a series resistor to limit the current to within the range shown in the table below. The recommended value of the series resistor for two supply voltage ranges is given ; for other supply voltages the value of the resistor should be calculated to drop the difference between the supply voltage and the maintaining voltage of the neon at a current within the range specified. These neons have nominal striking and maintaining voltages of 80V d.c. and 60V d.c. respectively. The life of the neons when operated under the recommended conditions is generally in excess of 50,000 hours (a.c. operation) or 30,000 hours (d.c. operation).

Type	Services Type	B.P.O. Type	Operating Current Range	Recommended Series Resistor* (A.C. or D.C. Supplies)		Base
				100—120V	200—250V	
6L	996-9214	36A	0.45-0.65mA	82KΩ, $\frac{1}{10}$W	270KΩ, $\frac{1}{4}$W	B.P.O.No.2
7L	996-1109	30B	0.45-0.65mA	82KΩ, $\frac{1}{10}$W	270KΩ, $\frac{1}{4}$W	BA9s/13
8L	996-1110	—	0.45-0.65mA	82KΩ, $\frac{1}{10}$W	270KΩ, $\frac{1}{4}$W	E10/13
9L	996-1103	31A	0.45-0.65mA	82KΩ, $\frac{1}{10}$W	270KΩ, $\frac{1}{4}$W	BA9s/13
10L	996-2110	—	0.45-0.65mA	82KΩ, $\frac{1}{10}$W	270KΩ, $\frac{1}{4}$W	E10/13
31L	996-9215	—	0.25-0.45mA	150KΩ, $\frac{1}{10}$W	470KΩ, $\frac{1}{8}$W	S6s/8
33L	996-9213	—	0.35-0.55mA	100KΩ, $\frac{1}{10}$W	330KΩ, $\frac{1}{4}$W	S6s/8

* Resistor tolerance, ±20% ; resistors having a higher wattage rating than specified may be used.

NOVEMBER
1969

HIVAC LIMITED

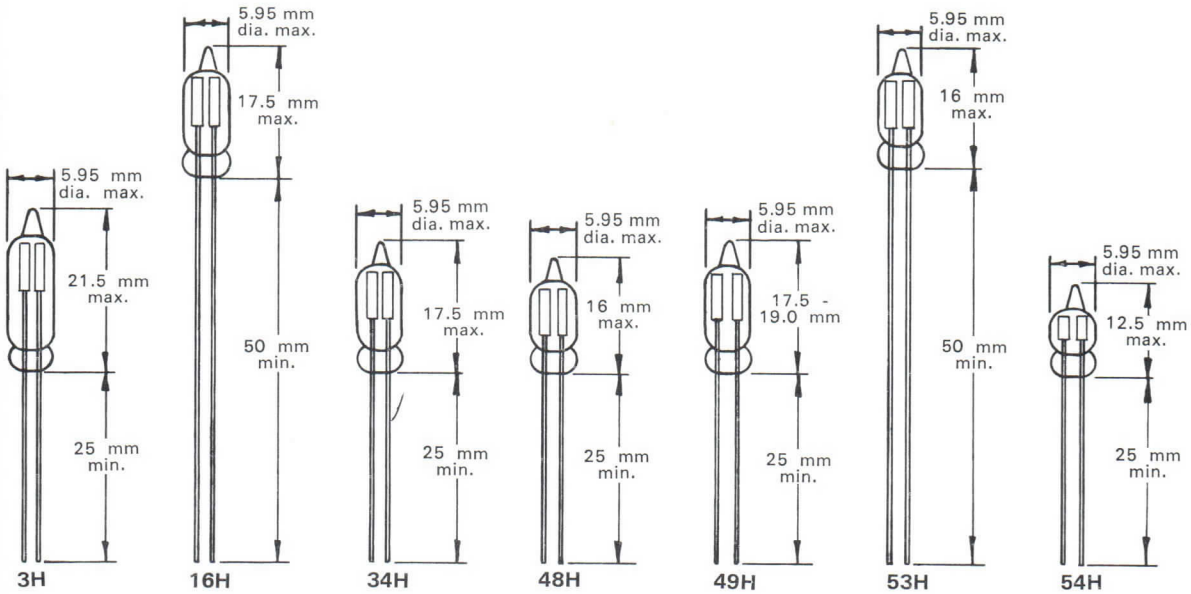
STONEFIELD WAY, RUISLIP, MIDDLESEX, ENGLAND, HA4 OJT
TELEPHONE : 01-845 1288 **TELEX : 22623**

GENERAL INSTRUMENT

Miniature Neon Indicator Lamps

HIGH BRIGHTNESS TYPES
3H, 16H, 34H, 48H, 49H, 53H, 54H

DIMENSIONS



OPERATING DATA

These neon lamps must always be operated with a series resistor to limit the current to within the range shown in the table below. The recommended value of the series resistor for several supply voltage ranges is given; for other supply voltages the value of the resistor should be calculated to drop the difference between the supply voltage and the maintaining voltage of the neon at a current within the range specified. These neons have nominal striking and maintaining voltages of 120V d.c. and 75V d.c. respectively. The life of the neons when operated under the recommended conditions is generally in excess of 5,000 hours (a.c. operation) or 3,000 hours (d.c. operation).

Type	Services Type	Operating Current Range	*Recommended Series Resistor			
			100-120V a.c. only	200-250V a.c. or d.c.	300-350V a.c. or d.c.	400-450V a.c. or d.c.
3H	-	1.8-2.5mA	22KΩ, ¼W	100KΩ, ½W	150KΩ, ½W	220KΩ, 1W
16H	996-4111	1.8-2.5mA	22KΩ, ¼W	100KΩ, ½W	150KΩ, ½W	220KΩ, 1W
34H	996-2124	1.8-2.5mA	22KΩ, ¼W	100KΩ, ½W	150KΩ, ½W	220KΩ, 1W
48H	-	1.8-2.5mA	22KΩ, ¼W	100KΩ, ½W	150KΩ, ½W	220KΩ, 1W
49H	-	1.8-2.5mA	22KΩ, ¼W	100KΩ, ½W	150KΩ, ½W	220KΩ, 1W
53H	-	1.8-2.5mA	22KΩ, ¼W	100KΩ, ½W	150KΩ, ½W	220KΩ, 1W
54H	-	0.8-1.2mA	47KΩ, ¼W	180KΩ, ¼W	270KΩ, ½W	330KΩ, ½W

* Resistors having a higher wattage rating than specified may be used.

JULY
1971

HIVAC LIMITED

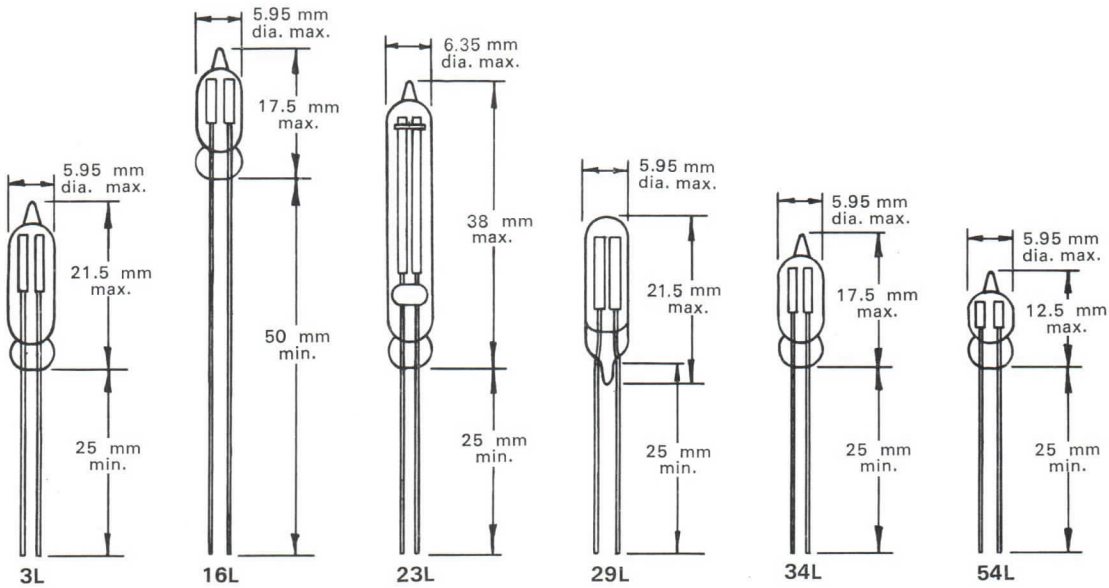
STONEFIELD WAY, RUISLIP, MIDDLESEX, ENGLAND, HA4 OJT
TELEPHONE : 01-845 1288 TELEX : 22623

GENERAL INSTRUMENT

Miniature Neon Indicator Lamps

STANDARD BRIGHTNESS TYPES
3L, 16L, 23L, 29L, 34L, 54L

DIMENSIONS



OPERATING DATA

These neon lamps must always be operated with a series resistor to limit the current to within the range shown in the table below. The recommended value of the series resistor for several supply voltage ranges is given ; for other supply voltages the value of the resistor should be calculated to drop the difference between the supply voltage and the maintaining voltage of the neon at a current within the range specified. These neons have nominal striking and maintaining voltages of 80V d.c. and 60V d.c. respectively. The life of the neons when operated under the recommended conditions is generally in excess of 50,000 hours (a.c. operation) or 30,000 hours (d.c. operation).

Type	Services Type	Operating Current Range	*Recommended Series Resistor			
			100-120V a.c. or d.c.	200-250V a.c. or d.c.	300-350V a.c. or d.c.	400-450V a.c. or d.c.
3L	996-9211	0.45—0.65mA	82KΩ, 1/10W	270KΩ, ¼W	470KΩ, ¼W	680KΩ, ½W
16L	996-4110	0.35—0.55mA	100KΩ, 1/10W	330KΩ, ¼W	560KΩ, ¼W	820KΩ, ½W
†23L	996-9222	1.5 —2.0mA	33KΩ, ¼W	100KΩ, ½W	150KΩ, ½W	220KΩ, 1W
†23L/3	-	1.5 —2.0mA	33KΩ, ¼W	100KΩ, ½W	150KΩ, ½W	220KΩ, 1W
29L	996-9218	0.45—0.65mA	82KΩ, 1/10W	270KΩ, ¼W	470KΩ, ¼W	680KΩ, ½W
34L	-	0.35—0.55mA	100KΩ, 1/10W	330KΩ, ¼W	560KΩ, ¼W	820KΩ, ½W
54L	-	0.25—0.45mA	150KΩ, 1/10W	470KΩ, ¼W	680KΩ, ¼W	1MΩ, ¼W

* Resistors having a higher wattage rating than specified may be used.

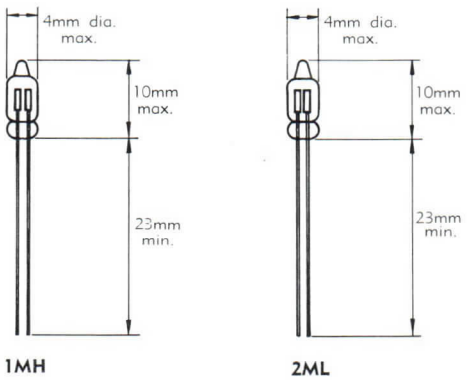
† The type 23L is only suitable for a.c. operation. For d.c. operation the 23L/3 should be used. This tube is d.c. polarised and its anode (positive) electrode is indicated by a red spot adjacent to the lead-out wire.

Subminiature Neon Indicator Lamps

HIGH BRIGHTNESS TYPE
1MH

STANDARD BRIGHTNESS TYPE
2ML

DIMENSIONS



OPERATING DATA

These neon lamps must always be operated with a series resistor to limit the current to within the range shown in the table below. The recommended resistor values are given for several supply voltage ranges.

Type	Operating Current Range	Recommended Series Resistor* (A.C. or D.C. Supplies)		
		100—120V	200—225V	225—250V
1MH	500—700 μA	Not suitable	220KΩ, $\frac{1}{8}$W	270KΩ, $\frac{1}{8}$W
2ML	220—270 μA	220KΩ, $\frac{1}{10}$W	750KΩ, $\frac{1}{10}$W	750KΩ, $\frac{1}{10}$W

* Resistor tolerance ± 10% ; resistors having a higher wattage rating than specified may be used.

MARCH
1969

HIVAC LIMITED
STONEFIELD WAY, SOUTH RUISLIP, MIDDLESEX, ENGLAND
TELEPHONE : 01-845 1288
TELEX : 22623

GENERAL INSTRUMENT

Hivac Looseleaf Catalogue

Index, September 1971

Divider Card: Flash Tubes

ZTC1	June 1970
ZFT1, ZFT7	June 1970
ZFT2, ZFT2A, ZFT8A	June 1970
ZFT3, ZFT3A, ZFT4, ZFT4A	June 1970
ZFT10, ZFT11	May 1971
ZFT12A	May 1971
FTA1 Range	June 1970
FT3	June 1970

Divider Card: Filamentary Lamps

BPO No. 2 Switchboard Lamps	July 1971
MBC Types	April 1970
Miscellaneous Types	April 1970

Divider Card: Neon Indicator Lamps

Standard Brightness Types 6L etc.	November 1969
High Brightness Types 3H, etc.	July 1971
1MH 2ML	March 1969