Issue No.	Date of Issue	Date of Filing
1	September, 1962	October, 1962
2	May 1963	May 1963.
	February 1964	16th March 1964
3	March 1964	16th March 1964
4	May. 1964	9th. June 1964

T. P. D.

AEI

INDUSTRIAL and MICROWAVE VALVES

DATA HANDBOOK

No. 4400-50

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

AEI Industrial and Microwave Valves

CONTENTS

When complete, the two volumes of this handbook will cover the following range of valves. Following this issue, the remaining data sheets, which are being prepared, will be mailed to you automatically.

VOLUME I

VOLUME 2

MAGNETRONS

General Information

Pulsed, S-band

BM1000	
BM1001	T
BM1003-1005	
BM1006	
BM1007-1013	
BM1014-1016	
BM1017-1022	
BM1042-1046	

(T=tunable)

Pulsed, X-band

BM1002	
BM1023-1025	
BM1026-1030	
BM1031	
BM1032	T
BM1033-1037	T
BM1038-1039	T
BM1040	T
BM1041	T

(T=tunable)

CW Magnetrons

BM25L
BM1047
BM6787

TR AND TB CELLS

General Information

TR, S-band

Notes

BS104	BS286
BS198	BS306
BS204	BS316
BS272	BS318
BS280	BS324
BS282	

TR, X-band

Notes

BS52	BS156
BS120	BS158
BS122	BS328
BS140	BS332
BS154	

TB, X-band

Notes

BS48	BS116
BS82	BS118
BS84	BS148
BS92	BS248
BS114	BS310

MICROWAVE SWITCHES

General Information

BS336 BS338

VOLUME 2 (continued)

SPARK GAPS

General Information

Style A

BS4A
BS5
BS54
BS62
BS68
BS72
BS80
BS90
BS112
BS190

Style B

BS142
BS290

Style E

BS136
BS180
BS208

Style F

BS192
BS212
BS234
BS344

Style G

BS172A
BS174A
BS294
BS298

Style H

BS210
BS214
BS216
BS218
BS220
BS222
BS224
BS226
BS228
BS242
BS244
BS246
BS250
BS252
BS254
BS258
BS260
BS266
BS268
BS270
BS322
BS326

Style J

BS128
BS240

Style K

BS232

Style L

BS292
BS296
BS320

MISCELLANEOUS

Nernst Filaments

NFT1-2

Ozotrons

Windonuts

S26-31

Vacuum Switch

BS378

Noise Tube

BS384

Flame Detector

27F12

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Ignitrons

4400/51

DEFINITIONS

The following short list of definitions covers expressions which may not be immediately obvious.

Peak

Peak voltage or current ratings are absolute maxima.

Maximum Average Current

The arithmetic average current. The rated maximum average anode current for ignitrons is based on full cycle conduction regardless of whether phase control is used or not, and must be averaged over a time not greater than the rated Maximum Averaging Time.

Fault Current

The maximum current the valve can withstand for a limited time without immediate serious damage. Repeated applications of fault current may shorten the ignitron life.

Line Demand Current

The r.m.s. current passed by a pair of ignitrons in inverse parallel connection during a single cycle at supply frequency. For rating purposes full cycle conduction must be assumed.

Demand kVA

The product of the Line Demand Current and the r.m.s. voltage applied to the ignitrons.

Per Cent Duty Cycle

The percentage of supply cycles in which the ignitrons are conducting, during a period not greater than the Maximum Averaging Time, and irrespective of whether phase control is used or not.

Maximum Averaging Time

The longest time over which the average current may be calculated.

Voltage Drop

The potential difference between anode and cathode during normal conduction.

Maximum Forward Ignitor Voltage

For rating purposes the maximum ignitor voltage is the voltage of the firing circuit. In practice a limiting resistor is usually inserted so that the actual ignitor voltage will be less.

Ignitor Voltage Required to Fire

The smallest voltage which will fire the ignitor consistently within a specified Ignitor Starting Time. The voltage shall be constant over the specified time as is the case for Anode Firing.

Ignitor Current Required to Fire

The smallest current which will fire the ignitor consistently within a specified Ignitor Starting Time. The current shall be constant over the specified time as is the case for Anode Firing.

Ignitor Starting Time

The time for which either the ignitor current or the ignitor voltage needs to be maintained at the required value to ensure consistent firing.

continued

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

DESCRIPTION

The ignitron is a single anode rectifier with a mercury pool cathode; it is usually enclosed in a water-cooled, steel envelope. The mercury pool cathode is capable of supplying emission currents of many thousands of amperes with very small losses because of the low voltage drop of the mercury vapour arc. Current flow is initiated as required by means of a fixed ignitor electrode whose tip is immersed in the mercury-pool cathode. Some ignitrons may also have auxiliary anodes and grid baffles. A sectioned view of a rectifier ignitron is shown in figure 1. For a detailed study of ignitrons and of ignitron circuits the following book from the AEI series is recommended: "The Arc Discharge" by H. de B. Knight (Chapman and Hall).

Ignitron designs vary according to the service for which they are intended. A brief description of the main types is given here.

Welder Ignitron

In the most common circuit for welding control two ignitrons are connected in inverse-parallel in a single phase a.c. circuit. The ignitron may be of simple design consisting of an anode, a mercury pool cathode and an ignitor. In some applications, such as three phase welding, the ignitrons may have to withstand considerable inverse voltages directly after conduction. In such cases use is made of ignitrons designed for rapid deionisation, having a baffle at cathode potential inserted between the anode and the mercury pool.

Rectifier Ignitron

Rectifier ignitrons are generally more highly baffled to withstand the voltage and current conditions encountered during commutation; consequently the arc voltage drop is about 2 volts higher than in corresponding welder ignitrons of similar size. An auxiliary anode is provided, as in many rectifier circuits it is useful to establish an arc to the auxiliary anode from a separate low voltage a.c. supply. A more robust type of ignitor suitable for continuous operation is fitted.

Pulse Ignitron

Ignitrons for this service are designed to pass heavy currents for short pulse periods; their most common application is in high-voltage capacitor-discharge service, such as for the pulsing of large magnetic fields. Baffles are generally omitted so that the maximum current may be passed with minimum loss.

Grid-Controlled Ignitron

For special duties grids are added to the usual ignitron structure to provide additional control and to assist deionisation. These valves may be used for high voltage rectification and inversion; they are also used in some capacitor-discharge applications.

Temperature Controlled Ignitron

Most of the above types can be supplied with means for temperature control, which is effected by a thermostat operated by the envelope temperature.

Size Classification

Ignitrons have by custom been given a letter to designate their physical size as follows. The table below gives the approximate diameters for each size. The size letter for each type is given on the individual data sheets.

Size A	2 in. dia.
Size B	2¾ in. dia.
Size C	4 in. dia.
Size D	5½ in. dia.
Size E	9 in. dia.

continued

AEI Ignitrons

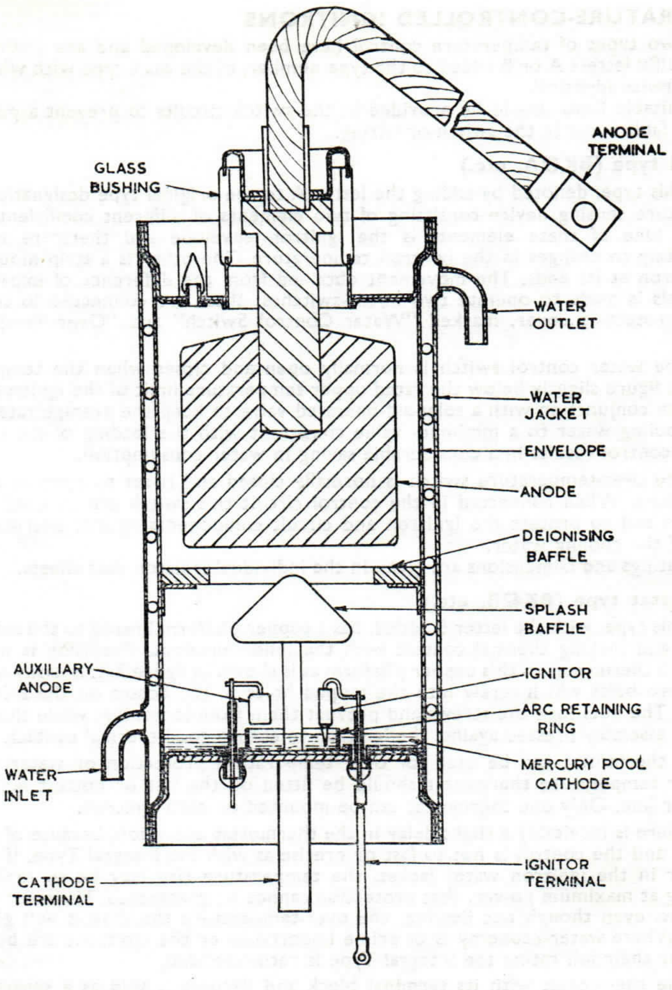


Fig. 1. Section view of a Rectifier Ignitron

continued

TEMPERATURE-CONTROLLED IGNITRONS

Two types of temperature control have been developed and are distinguished by the suffix letters A or B added to the type number, of the basic type with which they are otherwise identical.

Suitable fuses should be provided in the switch circuits to prevent a power arc should a fault occur in the switch or wiring.

Integral type (BK42A, etc.)

This type, denoted by adding the letter A to the original type designation, has a temperature sensing device consisting of two elements of different coefficients of expansion. One of these elements is the ignitron envelope and therefore responds immediately to changes in the ignitron temperature. The other is a strip mounted on the ignitron at its ends. The movement obtained from the difference of expansion of the metals is made to operate two micro-switches; these are connected to terminals on the protecting cover, marked "Water Control Switch" and "Over Temperature Switch."

The water control switch is normally open and closes when the temperature rises to a figure slightly below the rated upper temperature limit of the ignitron. It can be used in conjunction with a solenoid-operated valve to keep the average rate of flow of the cooling water to a minimum value consistent with the loading of the ignitron, and this control results in a considerable saving in water consumption.

The over-temperature switch is normally closed and is set to open at a higher temperature. When connected in the control circuit this switch can be used to stop operation and so protect the ignitron and circuit components against overloading or failure of the cooling water.

Ratings and Dimensions are given in the individual ignitron data sheets.

Thermostat type (BK42B, etc.)

This type, with the letter B added, has a copper platform brazed to the side of the ignitron and making thermal contact with the inner envelope. Provision is made for clamping a thermostat to this copper platform as is shown in figure 2. It is easily mounted by the two bolts which screw into the tapped holes in the bosses on the side of the ignitron. The nuts lock the screws and prevent them from loosening, while the springs keep the assembly pressed against the ignitron to ensure good thermal contact.

A thermostat can be used for over temperature protection or water control. The over temperature thermostat should be fitted on the last or hottest ignitron in the water line. Only one thermostat can be mounted on each ignitron.

There is inevitably a slight delay in the thermostat operation, because of thermal time lag, and the control is not so fast or precise as with the Integral Type. If there is no water in the ignitron water jacket, the temperature rise may be so rapid when operating at maximum power, that protection cannot be guaranteed. However if water is present, even though not flowing, the over-temperature thermostat will give protection. Where water economy is of prime importance or the ignitrons are being run at or near their full rating the Integral Type is recommended.

The thermostat with its terminal block and fixtures is sold as a separate unit ready for mounting.

The two thermostats are available as below:—

1. For water control—Klixon type C4391-7-51.
2. For over-temperature protection—Klixon type C4391-7-52.

The thermostat ratings are given in the individual ignitron data sheets.

continued

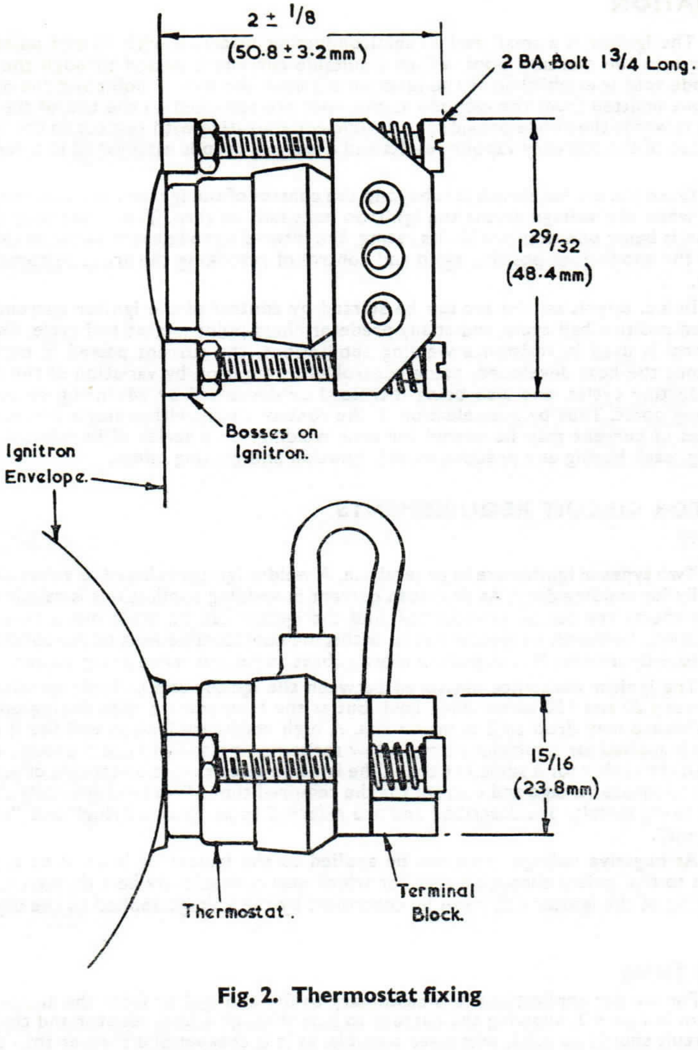


Fig. 2. Thermostat fixing

continued

OPERATION

The ignitor is a small rod of semiconducting material, with its end pointed and dipping into the mercury pool. When a suitable current is passed through the ignitor a cathode spot is established at the junction between the ignitor point and the mercury. Electrons emitted from the cathode at this spot are attracted to the top of the ignitor and on towards the anode provided it is sufficiently positive with respect to the cathode. Ionisation of the mercury vapour results and a low arc drop is established in a very short time.

Once the arc has struck it is beyond the control of the ignitor, but it automatically ceases when the voltage across the ignitron next falls to zero. Then, assuming that the ignitron is being operated within its rating, the inter-electrode space becomes deionised before the anode goes positive again and control of restriking the arc is restored to the ignitor.

In a.c. operation the arc can be started by control of the ignitor current in any required positive half cycle, and at any predetermined point in that half cycle. This form of control is used in resistance welding applications, the current passed in each weld, and hence the heat developed, being controlled in duration by variation of the number of conducting cycles, and also being increased or decreased by advancing or retarding the firing point. Thus by pre-selection in the control circuit either single non-recurring impulses of current may be passed for spot welding, or a series of impulses for seam welding, each having any predetermined duration and heating effect.

IGNITOR CIRCUIT REQUIREMENTS

General

Two types of ignitor are in general use. A welder ignitor is fitted to valves designed primarily for welding duty. As the mean current in welding applications is relatively low, heating effects are not so pronounced, and the ignitor can be made more sensitive. In rectification, however, an ignitor has to withstand considerable heat under conditions of continuous operation; it is therefore more robust and needs more firing power.

The ignitor resistance measured between the ignitor and cathode terminals may be between 20 and 150 ohms when cold, but as the temperature rises during operation the resistance may drop to 5 ohms or less. A high resistance ignitor will fire if enough voltage is applied for a sufficient time; a low resistance ignitor will fire if enough current is driven through it for a sufficient time. The ignition circuit must be capable of providing both an adequate voltage and current for the required time. Two fundamentally different ignitor firing circuits are described and are referred to as "anode firing" and "separate excitation".

As negative voltage must not be applied to the ignitor, it is usual to apply the current to the ignitor through a rectifier which may conveniently be a thyratron so that the timing of the ignitor firing can be controlled by the voltage applied to the thyratron grid.

Anode Firing

For welder applications it is customary to fire the ignitor from the anode supply as shown in figure 3, allowing the current to pass through a fuse, resistor and thyratron. This circuit should be used, wherever possible, as it is cheaper and simpler than that for separate excitation.

continued

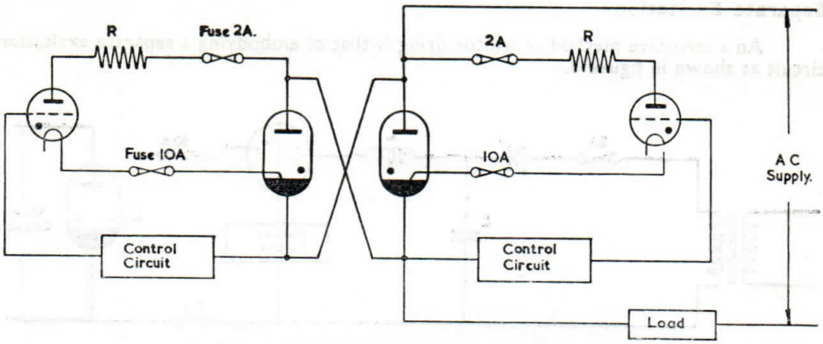


Fig. 3. Ignitor Circuit (Anode firing)

On triggering the thyratron, the ignitor is fired providing the supply is adequate, and then, as soon as the ignitron anode is conducting, the thyratron and ignitor are virtually short-circuited by the main arc and ignitor current ceases. The value of the resistor R is chosen to limit the voltage and current applied to the ignitor and varies with the supply voltage. Commonly used values are given below.

Supply voltage r.m.s.	250	440	600	1000	2000	2500
Resistance R. Ohms.	2	3	4	10	35	50

It should be noted that this system cannot be operated unless the supply voltage and the current available to the ignitron anode are adequate. As an example of a limiting case, suppose the load current is 40 amperes r.m.s., and a BK42 is to be used. The BK42 data sheet shows that for anode firing the current required to fire the ignitor is 30 amperes. If the a.c. supply is of sine wave form, the current will only be above 30 amperes between 32° and 148° and firing would therefore be uncertain outside this range. A similar argument also applies if the voltage is low. The practical limits are 250 volts and 40 amperes. Anode firing can be used at lower currents provided a by-pass resistance is added across the load to increase the total current to 40 amperes. Welder circuits are clearly ideal for anode firing because the circuit impedance is low therefore allowing high peak currents, and as the power factor is low the ignitor is fired when the applied voltage is reasonably near the peak value.

Anode firing has the advantage that the ignitor current will persist until ignition occurs, and this will happen within 100 microseconds if the ignitor is good and adequate voltage and current are applied. The circuit rating for anode firing therefore demands a steady voltage and current maintained for at least 100 microseconds, as will occur in many welding applications.

For three-phase frequency-changer welding, however, the supply voltage is usually higher and the current correspondingly lower; in this case anode firing may not always be suitable.

continued

Separate Excitation

An alternative method of ignitor firing is that of embodying a separate excitation circuit as shown in figure 4.

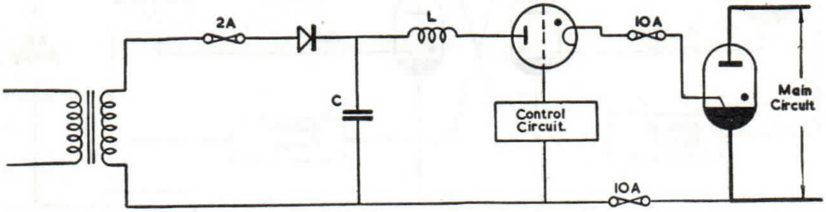


Fig. 4. Ignitor Circuit (separate excitation)

In this form of excitation a capacitor C is charged to a given voltage, and then discharged through the ignitor by means of a thyratron, using grid control to give precise timing. An inductance L is included in the circuit to prolong the discharge and ensure pick up of the main arc. The discharge current from the capacitor will be approximately sinusoidal due to the inductance L. The length of the current pulse is important and is given in the ratings for each ignitron. The values of L and C should be chosen so that the surge impedance $\sqrt{(L/C)}$ limits the current to the prescribed range, and the half-cycle pulse width $\pi(\sqrt{LC})$ at least equals the specified time.

Typical circuit values are: $C=15$ µF charged to 600 volts, $L=1{\cdot}6$ mH. These will give a theoretical short circuit current of 60 amps and a pulse width of 500 microseconds.

The practical considerations of a typical firing circuit are represented by figure 5. The abscissa is the peak short circuit current and the ordinate is the open circuit voltage of the circuit. The actual ignitor voltage and current will vary with the ignitor resistance, and the line AB represents the minimum boundary of the output characteristic of the circuit. The lines drawn through the origin represent ignitors of particular resistances. The intersection of these lines with the output characteristic boundary line gives the minimum values of peak current and voltage which the circuit must be capable of delivering to an ignitor of the resistance value shown.

The upper rating limit (750V 75A) given in the valve data sheets is set by considerations of economy. This limit will only be exceeded where rapid precise firing of the ignitron is required, as may be the case in some capacitor discharge applications, when the ignitron anode current rises rapidly to a high value. A shorter ignitor pulse can then be used and a correspondingly higher voltage is applied to ensure precise firing. For this use a capacitor of 0·25 µF charged to 1500 volts can be discharged into the ignitor through a limiting resistance of 2 to 6 ohms.

continued

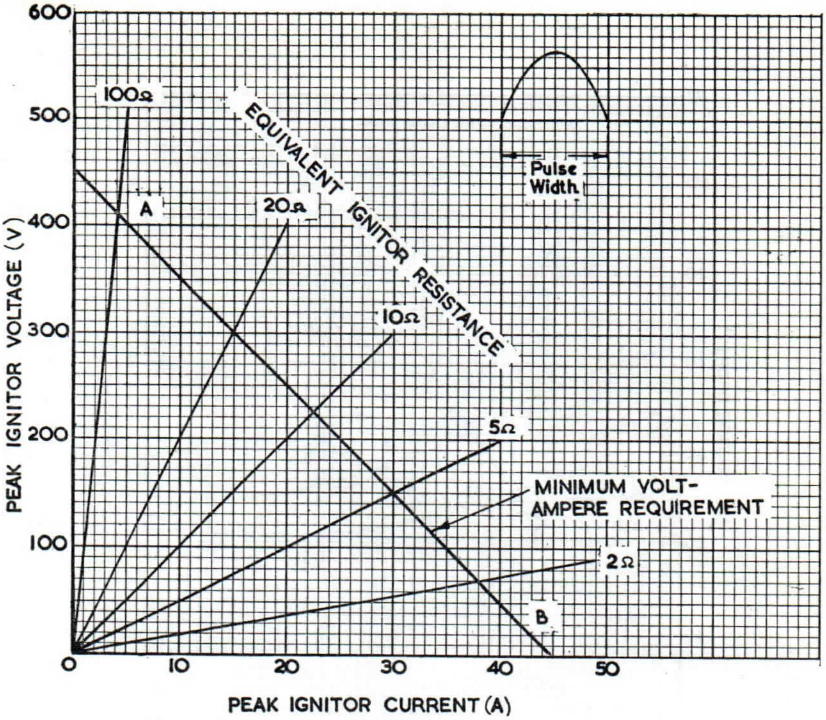


Fig. 5. Separate excitation circuit—output characteristics

AUXILIARY ANODE

Ignitrons for rectification or pulse duty are often fitted with an auxiliary anode which is mounted close to the cathode pool. An auxiliary arc assists in the establishment of the main arc since, although its intensity is generally lower than the peak intensity of the ignitor arc, it can persist longer and extend the period for the main arc to pick up. Also it serves to maintain a stable cathode-spot and assist main arc conduction at low current values.

The voltage and current supply to the auxiliary anode must be adequate to establish a stable arc. A certain minimum current is required in order to maintain the cathode spot. At low currents the arc voltage drop may fluctuate considerably and high peak values are observed. The supply must therefore be capable of providing a voltage at least equal to the sum of the maximum peak arc voltage drop likely to be encountered and the voltage drop in any limiting resistor in the auxiliary anode lead, at the instant

continued

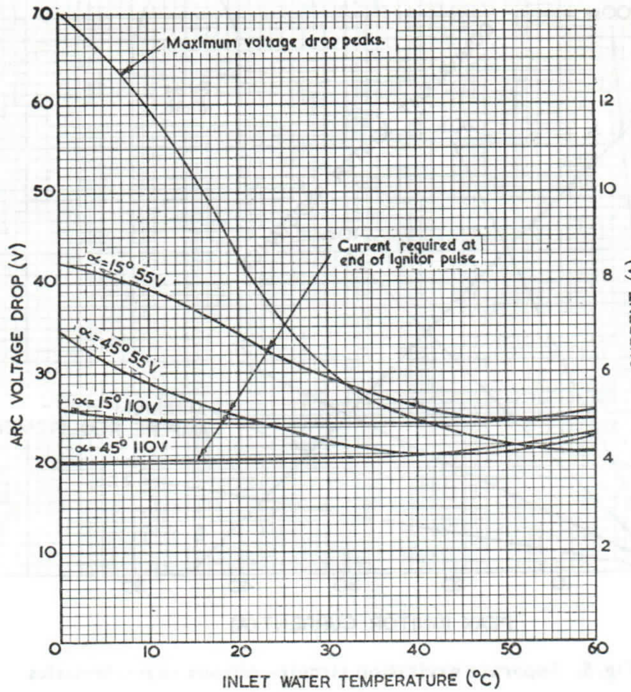


Fig. 6. Auxiliary anode requirements

$E\sqrt{2}\sin(\alpha+\beta) = iR + \text{voltage drop}$

where E = supply voltage r.m.s.
i = instantaneous auxiliary anode current required at end of ignitor pulse.
R = circuit resistance
α = phase angle of ignitor firing with respect to auxiliary anode voltage
β = width of ignitor pulse

when an auxiliary arc is required. Figure 6 gives the values of peak auxiliary anode current required at the end of the ignitor pulse and the maximum peak arc voltage drop, against inlet water temperature. The curves are given for two supply voltages and for two firing points.

As the auxiliary anode is mounted close to the cathode, its voltage rating is limited by the danger of premature firing or backfiring. In practice a supply of 55 to 110 volts r.m.s. is satisfactory, the upper value (160V peak) being the limit set by considerations of premature backfiring and the lower value being the limit imposed by the peak voltage drop in the arc.

RATINGS

All ratings are absolute maxima which must never be exceeded at any time. Allowance must be made for any possible surges or mains variations which might overload the valves.

In welder applications, full-cycle conduction must always be assumed in calculating mean current and duty cycle, even when phase control is used and conduction takes place over only portions of cycles. The reason for this is that phase delay of firing of ignitrons in inductive circuits (such as in resistance welding applications) imposes arduous conditions at commutation. When one valve ceases to conduct a high inverse voltage is applied to its anode since the other valve (of two in inverse parallel) does not immediately conduct owing to the deliberate delay in firing. This condition is conducive to arc-back and to compensate for this the mean current to be assumed in the calculations is that which would flow if conduction took place over the full half-cycle in each valve, although the true mean current may be less than this. Similarly the duty cycle is calculated on the basis of the number of supply cycles during which current is passed irrespective of how long the current may flow during each cycle.

Practical Example of Ratings (single phase welder control)

It is supposed that two BK24 ignitrons are installed in a welding equipment operating on a 50 cycle, 440 volt supply. If the demand from the line is 400 kVA, what is the maximum duty-cycle and the maximum welding time (conducting time) at which the ignitrons can be operated?

The r.m.s. current in this case is

$$\frac{400 \times 1000}{440} = 910 \text{ amp r.m.s.}$$

Reference to the BK24 graphs show that with two ignitrons, operating on 440 volts, a demand current of 910 ampere is within the permissible limits, and that the maximum permissible duty-cycle is 35%. At 440 volts, the time of averaging the anode current for BK24 ignitrons is given as 8 seconds (400 cycles); in other words, in any period of 8 seconds the maximum welding time (number of conducting cycles) must not exceed 35% of 400 cycles, that is, 140 cycles. Thus, if the welding time required for each individual spot-weld is 14 cycles, then in any period of 8 seconds, ten such welds, preferably evenly spaced, may be made. The "welding time plus off time" for each spot weld will then be 40 cycles, and the "off" time will be 40—14=26 cycles. The current conduction sequence in this case is 14 cycles "on", 26 cycles "off".

continued

OPERATING NOTES

All ignitrons must be mounted vertically. They are supported by means of their cathode terminals, except where special mounting is required for a particular type (e.g. BK22, BK56).

The cooling water must be reasonably clean and it is often advisable to fit a filter in the water supply. Normally tap water that is suitable for drinking is satisfactory, but it is not uncommon for pipes to become blocked due to an accumulation of sludge. If required, ignitron water jackets can be cleaned with any of the usual cleaning solutions. The ignitron water jackets and pipes are made of stainless steel and so are extremely resistant to corrosion, but may be attacked by water containing chlorides. If the chloride ion concentration exceeds 20 parts per million the water should be regarded as suspect, and tested to determine its corrosiveness.

At the end of the operation the anode may be very hot. If the flow of cooling water is stopped the whole ignitron will overheat and damage may be done particularly to the glass seals. The water must therefore be left running, after switching off, for a certain minimum time which varies according to the size of the ignitron and is given on the individual data sheets.

AEI

Ignitrons

SELECTION CHART

The chart below indicates some of the chief applications for which any particular ignitron is intended. Temperature Control is available on most types.

Duty	Glass	IGNITRON SIZE A	B	C	D	E
Single Phase welding	BK22	BK66	BK42	BK24	BK34	
Three-phase welding			BK42	BK168	BK146	
Welding at 2400V				BK44	BK46	
Pulse welding			BK300	BK302		
High voltage capacitor discharge					BK178	BK56 / BK194
Rectification				BK44	BK46	BK56
Special Duties	BK238			BK98		

EQUIVALENTS LIST

AEI Type	American Equivalent	AEI Type	American Equivalent
BK22		BK56	6228
BK24	5552	BK66	5550
BK24A	6347	BK98B	
BK24B	5552A	BK146	5553A
BK34	5553	BK146A	6348
BK34A		BK146B	5553B
BK34B		BK168	5822
BK42	5551	BK168A	6511
BK42A	6346	BK168B	5822A
BK42B	5551A	BK178	
BK44	5554	BK194	
BK44A	6512	BK238	5779
BK44B		BK300	7670
BK46	5555	BK302	
BK46A	6513		

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

AEI Ignitrons

SELECTION CHART

The chart below indicates some of the chief applications for which any particular ignitron is intended. Temperature Control is available on most types.

Duty	Glass	IGNITRON SIZE A	B	C	D	E
Single Phase welding	BK22	BK66	BK42	BK24	BK34	
Three-phase welding			BK42	BK168	BK146	
Welding at 2400V				BK44	BK46	
Pulse welding			BK300	BK302		
High voltage capacitor discharge					BK178	BK56 / BK194
Rectification				BK44	BK46	BK56
Special Duties	BK238			BK98		

EQUIVALENTS LIST

AEI Type	American Equivalent	AEI Type	American Equivalent
BK22		BK56	6228
BK24	5552	BK66	5550
BK24A	6347	BK98B	
BK24B	5552A	BK146	5553A
BK34	5553	BK146A	6348
BK34A		BK146B	5553B
BK34B		BK168	5822
BK42	5551	BK168A	6511
BK42A	6346	BK168B	5822A
BK42B	5551A	BK178	
BK44	5554	BK194	
BK44A	6512	BK238	5779
BK44B		BK300	7670
BK46	5555	BK302	
BK46A	6513		

AEI Ignitron BK22

The BK22 is a glass envelope ignitron primarily designed for control of resistance welding applications. It is air cooled and requires to be blown with a small fan.

GENERAL

Number of electrodes		
Main anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc voltage drop (approx)		
At 100A instantaneous	13	V
At 2500A instantaneous	25	V
Weight (approx)		
Net weight	4¾	lb
Shipping weight	18½	lb
Cooling		
Minimum bulb temperature	10	°C
Maximum condensed mercury temperature	60	°C

MAXIMUM RATINGS

Welder Control Service

Ratings are for two valves in inverse parallel, and for full cycle conduction irrespective of whether phase control is used or not.

Supply voltage (r.m.s.)	250 to 600	V
Maximum demand	450	kVA
Corresponding average anode current	10	A
Maximum average anode current	15	A
Corresponding demand	230	kVA
Maximum averaging time of current		
At 600V r.m.s.	7·6	s
At 440V r.m.s.	10·2	s
At 250V r.m.s.	18·0	s
Maximum peak fault current		
At 600V r.m.s.	2100	A
At 250V r.m.s.	5040	A
Maximum duration of fault current	0·15	s

IGNITOR RATINGS

Maximum peak inverse voltage	5·0	V
Maximum ignitor current		
peak	100	A
r.m.s.	10	A
average	1·0	A
maximum averaging time	5·0	s

IGNITOR CIRCUIT REQUIREMENTS

Anode Firing

Maximum voltage	Anode voltage	
Ignitor voltage required to fire	200	V
Ignitor current required to fire	30	A
Starting time at required voltage or current	100	μs

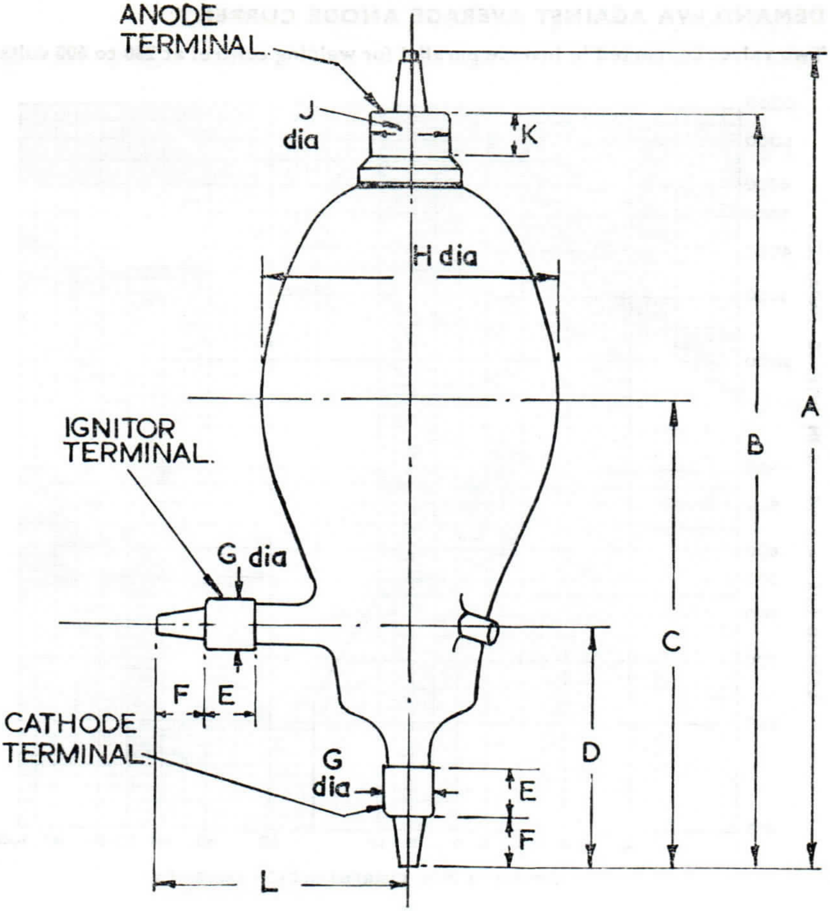
Separate Excitation

Open circuit voltage of excitation circuit		
maximum	750	V
minimum	450	V
Short circuit current of excitation circuit		
maximum	75	A
minimum	45	A
Length of firing pulse (approx sine wave)		
recommended	500	μs
minimum (for average anode currents greater than 20A)	150	μs

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

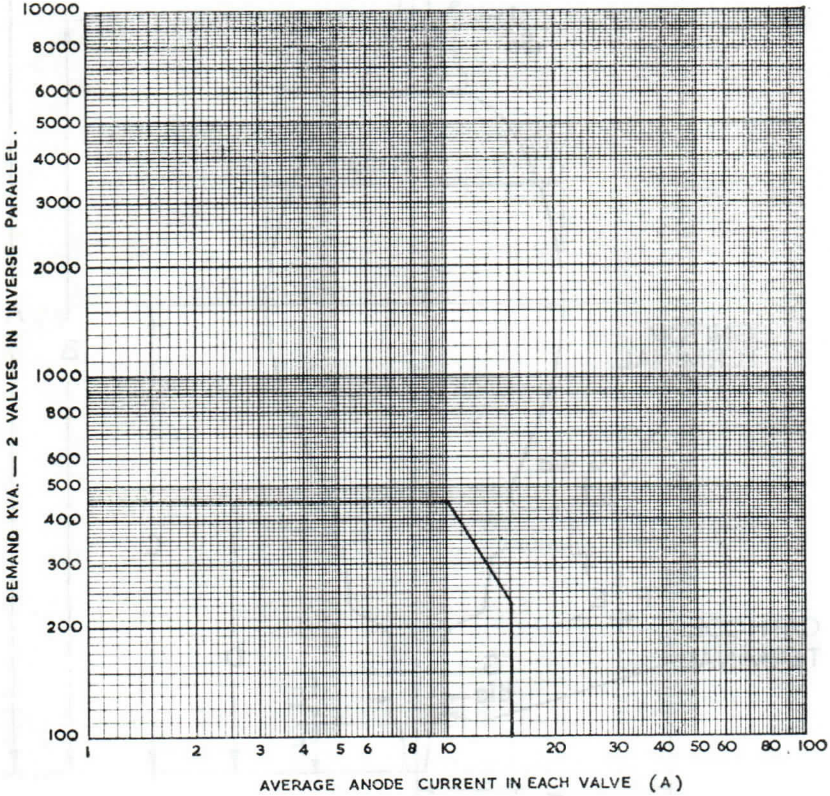
Dimension	Inches	Millimetres
A	20 ± ½	508 ± 13
B	18½ ± ½	470 ± 13
C	11½ ± ½	292 ± 13
D	6 ± ½	152 ± 13
E	1·250 ± 0·062	31·8 ± 1·5
F	1·188 ± 0·062	30·2 ± 1·5
G	1·250 ± 0·010	31·75 ± 0·25
H	7·312 ± 0·125	186 ± 3
J	1·938 ± 0·010	49·21 ± 0·25
K	1·125 ± 0·032	28·5 ± 0·8
L	6¼ ± ¼	159 ± 6·5

All dimensions in inches.
Millimetre dimensions derived.


ANODE
TERMINAL.
J
dia
K
H dia
A
B
IGNITOR
TERMINAL.
G dia
C
F
E
CATHODE
TERMINAL.
G
dia
D
E
F
L

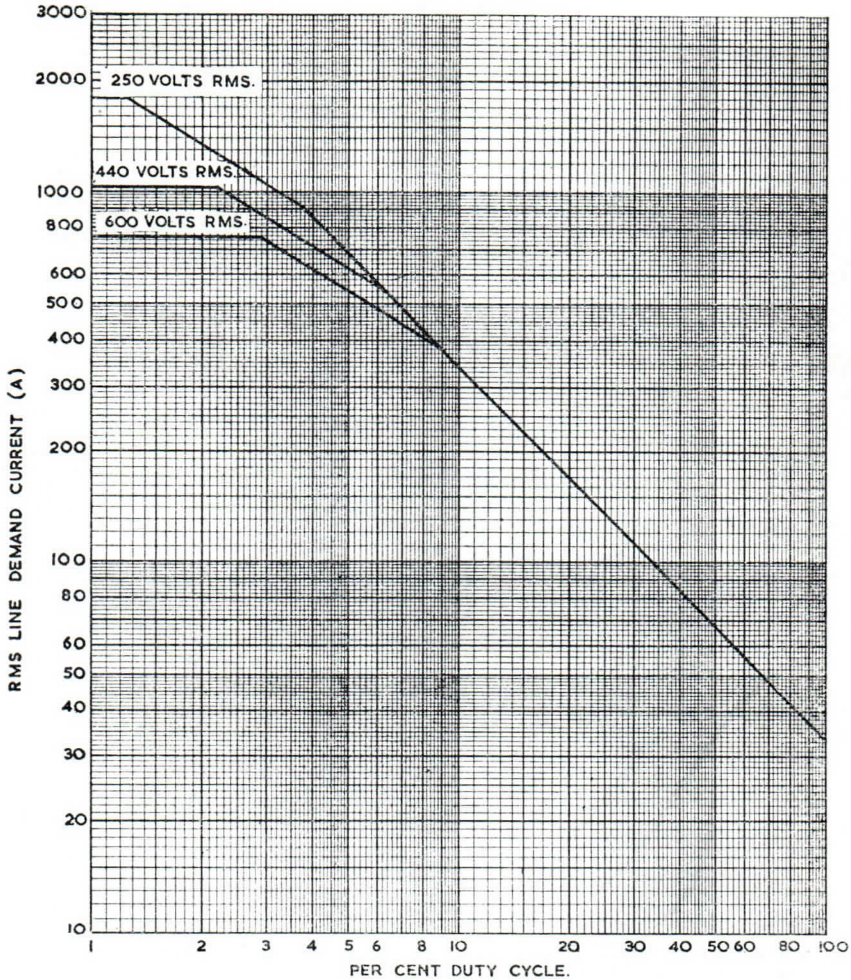
DEMAND kVA AGAINST AVERAGE ANODE CURRENT

Two valves connected in inverse parallel for welding control at 250 to 600 volts.



LINE DEMAND CURRENT AGAINST DUTY CYCLE

Two valves connected in inverse parallel for welding control at 250 to 600 volts.



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

AEI Ignitrons

BK24 BK24A BK24B

The BK24 is a size C stainless-steel-jacketed water-cooled ignitron primarily designed for control of resistance welding applications. It is equivalent to the American 5552. For three-phase applications the BK168 is recommended.

The BK24A has integral type temperature control with built in temperature switches. It is equivalent to the American 6347.

The BK24B has provision for mounting a detachable thermostat for temperature control, as described in the Preamble. It is equivalent to the American 5552A.

GENERAL

Number of electrodes		
Main anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc voltage drop (approx)		
At 440A instantaneous	14	V
At 6800A instantaneous	28	V
Weight (approx)		
Net weight	$8\frac{1}{2}$	lb
Shipping weight (home pack)	$13\frac{1}{2}$	lb
Shipping weight (overseas)	24	lb
Cooling water		
Minimum flow	$1\frac{1}{2}$	gal/min
Minimum inlet temperature	10	°C
Maximum outlet temperature	40	°C
Pressure drop at $1\frac{1}{2}$ gal/min	4·5	lb/in²
Maximum water temperature rise	6	°C
Time for which water flow must be maintained after switching off	15	min

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

MAXIMUM RATINGS

Welder Control Service

Ratings are for two valves in inverse parallel, and for full cycle conduction irrespective of whether phase control is used or not.

Supply voltage (r.m.s.)	250 to 600	V
Maximum demand	1200	kVA
Corresponding average anode current	75·6	A
Maximum average anode current	140	A
Corresponding demand	400	kVA
Maximum averaging time of current		
At 600V r.m.s.	5·9	s
At 440V r.m.s.	8·0	s
At 250V r.m.s.	14·0	s
Maximum peak fault current		
At 600V r.m.s.	5600	A
At 250V r.m.s.	13450	A
Maximum duration of fault current	0·15	s

IGNITOR RATINGS

Maximum peak inverse voltage	5·0	V
Maximum ignitor current		
peak	100	A
r.m.s.	10	A
average	1·0	A
maximum averaging time	5·0	s

IGNITOR CIRCUIT REQUIREMENTS

Anode firing

Maximum voltage	Anode voltage	
Ignitor voltage required to fire	200	V
Ignitor current required to fire	30	A
Starting time at required voltage or current	100	µs

Separate excitation

Open circuit voltage of excitation circuit		
maximum	750	V
minimum	450	V
Short circuit current of excitation circuit		
maximum	75	A
minimum	45	A
Length of firing pulse (approx sine wave		
recommended	500	µs
minimum (for average anode currents greater than 20A)	150	µs

TEMPERATURE CONTROLLED TYPES

BK24A

Water control switch (normally open)		
Closes at (approx)	36	°C
Over-temperature switch (normally closed)		
Opens at (approx)	45	°C
Electrical rating		
Voltage (a.c.) 125 250 440 600V		
Current (a.c.) 3·0 1·5 1·0 0·5A		
Maximum peak voltage between switch contacts and ignitron envelope	1000	V

BK24B

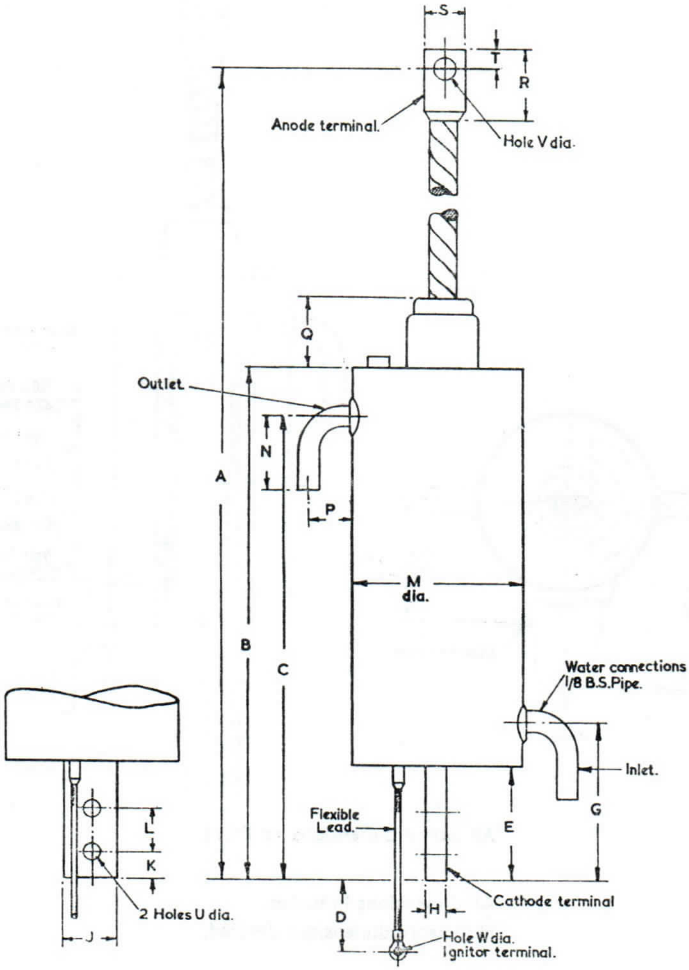
Water control thermostat (normally open)		
Klixon type C4391-7-51 Closes at (approx)	36	°C
Over-temperature thermostat (normally closed)		
Klixon type C4391-7-52 Opens at (approx)	52	°C
Electrical rating		
Voltage (a.c.) 125 250 440 600V		
Current (a.c.) 3·0 1·5 1·0 0·5A		
Maximum peak voltage between switch contacts and ignitron envelope	1000	V

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

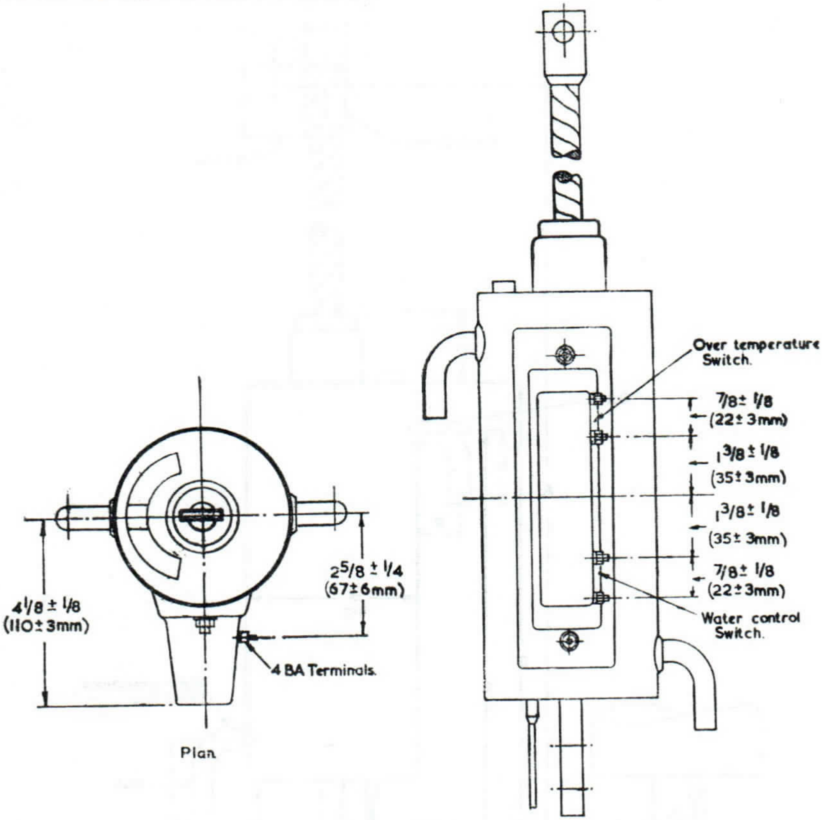
Dimension	Inches			Millimetres		
A	25	±	¾	635	±	19
B	11¾	±	¾	298	±	19
C	10·⅝	±	¼	270	±	6
D	5½	±	¼	140	±	6
E	2⅝	±	¼	67	±	6
G	3⅝	±	¼	92	±	6
H	0·500	±	0·031	12·7	±	0·8
J	1·250	±	0·062	31·7	±	1·5
K	0·625	±	0·062	16·9	±	1·5
L	1·000	±	0·031	25·4	±	0·8
M	4	±	⅛	102	±	3
N	1¾	±	¼	44	±	6
P	1	±	⅛	25	±	3
Q	1⅝	±	¼	41	±	6
R	1⅝	±	⅛	41	±	3
S	1·000	±	0·062	25·4	±	1·5
T	0·500	±	0·062	12·7	±	1·5
U	7/16			11·1		
V	½			12·7		
W	0·265			6·73		

All dimensions in inches.
Millimetre dimensions derived.

OUTLINE DRAWING OF BK24.



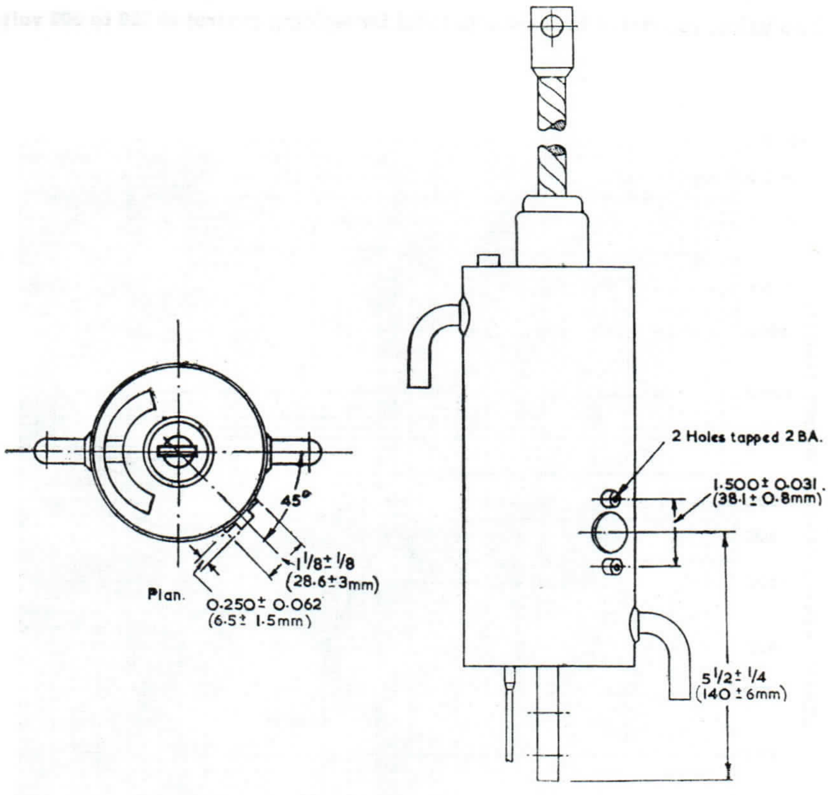
OUTLINE DRAWING OF BK24A.



All other dimensions as BK24.

All dimensions in inches.
Millimetre dimensions derived.

OUTLINE DRAWING OF BK24B.

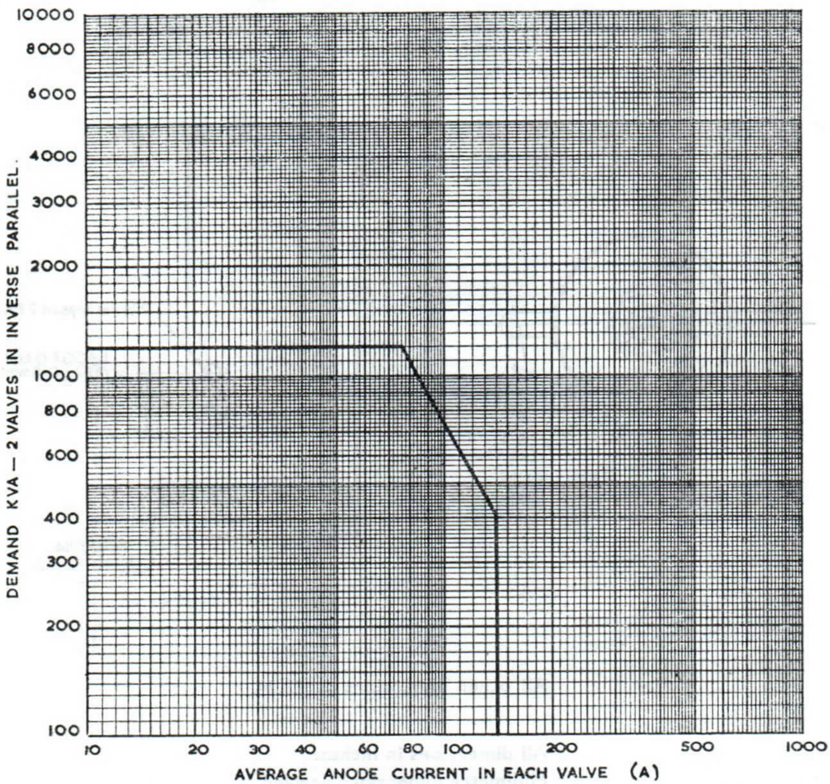


All other dimensions as BK24.

All dimensions in inches.
Millimetre dimensions derived.

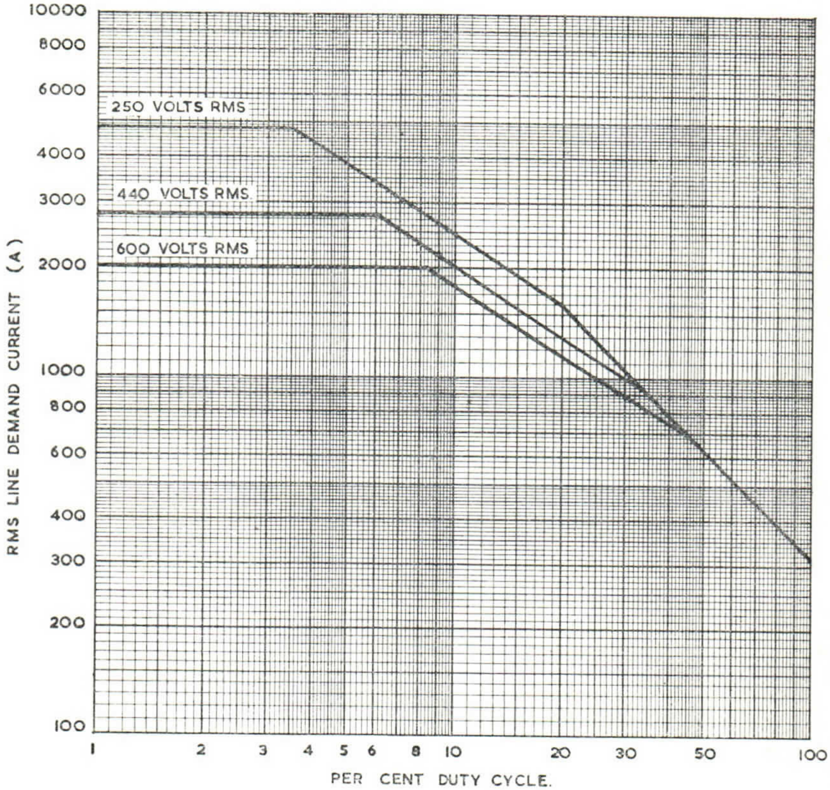
DEMAND kVA AGAINST AVERAGE ANODE CURRENT

Two valves connected in inverse parallel for welding control at 250 to 600 volts.



LINE DEMAND CURRENT AGAINST DUTY CYCLE

Two valves connected in inverse parallel for welding control at 250 to 600 volts.



Provisional Information

The BK24C has been developed for applications using anode firing in welder equipments which may be operated at low currents. To meet this requirement the BK24C is fitted with an ignitor which will fire more easily. A thermostat platform is fitted.

RATINGS AND DIMENSIONS

Except as detailed below all ratings and dimensions are the same as for the BK24B.

IGNITOR CIRCUIT REQUIREMENTS

Anode firing

Maximum voltage	Anode voltage	
Ignitor voltage required to fire	200	V
Ignitor current required to fire	12	A
Starting time at required voltage or current	100	µs

The BK34 is a size D stainless-steel-jacketed water-cooled ignitron primarily designed for control of resistance welding applications. It is equivalent to the American 5553. For three-phase applications the BK146 is recommended.

The BK34A has integral type temperature control with built in temperature switches.

The BK34B has provision for mounting a detachable thermostat for temperature control, as described in the Preamble.

GENERAL

Number of electrodes		
Main anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc voltage drop (approx)		
At 1115A instantaneous	17	V
At 13600A	36	V
Weight (approx)		
Net weight	21	lb
Shipping weight (home pack)	33	lb
Shipping weight (overseas)	54	lb
Cooling water		
Minimum flow	3	gal/min
Minimum inlet temperature	10	°C
Maximum outlet temperature	40	°C
Pressure drop at 3 gal/min	5	lb/in²
Maximum water temperature rise	9	°C
Time for which water flow must be maintained after switching off	30	min

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

MAXIMUM RATINGS

Welder Control Service

Ratings are for two valves in inverse parallel and for full cycle conduction irrespective of whether phase control is used or not.

Supply voltage (r.m.s.)	250 to 600	V
Maximum demand	2400	kVA
Corresponding average anode current	192	A
Maximum average anode current	355	A
Corresponding demand	800	kVA
Maximum averaging time of current		
At 600V r.m.s.	4·6	s
At 440V r.m.s.	6·3	s
At 250V r.m.s.	11	s
Maximum peak fault current		
At 600V r.m.s.	11200	A
At 250V r.m.s.	27000	A
Maximum duration of fault current	0·15	s

IGNITOR RATINGS

Maximum peak inverse voltage	5·0	V
Maximum ignitor current		
peak	100	A
r.m.s.	10	A
average	1·0	A
Maximum averaging time	5·0	s

IGNITOR CIRCUIT REQUIREMENTS

Anode firing

	Anode voltage	
Maximum voltage		
Ignitor voltage required to fire	200	V
Ignitor current required to fire	30	A
Starting time at required voltage or current	100	μs

Separate excitation

Open circuit voltage of excitation circuit		
Maximum	750	V
Minimum	450	V
Short circuit current of excitation circuit		
Maximum	75	A
Minimum	45	A
Length of firing pulse (approx sine wave)		
recommended	500	μs
minimum (for average anode currents greater than 20A)	150	μs

TEMPERATURE CONTROLLED TYPES

BK34A

Water control switch (normally open) Closes at (approx)	36	°C
Over-temperature switch (normally closed) Opens at (approx)	45	°C

Electrical rating

Voltage (a.c.)	125	250	440	600V
Current (a.c.)	3·0	1·5	1·0	0·5A

Maximum peak voltage between switch contacts and ignitron envelope	1000	V

BK34B

Water control thermostat (normally open) Klixon type C4391-7-51 Closes at (approx)	36	°C
Over-temperature thermostat (normally closed) Klixon type C4391-7-52 Opens at (approx)	52	°C

Electrical rating

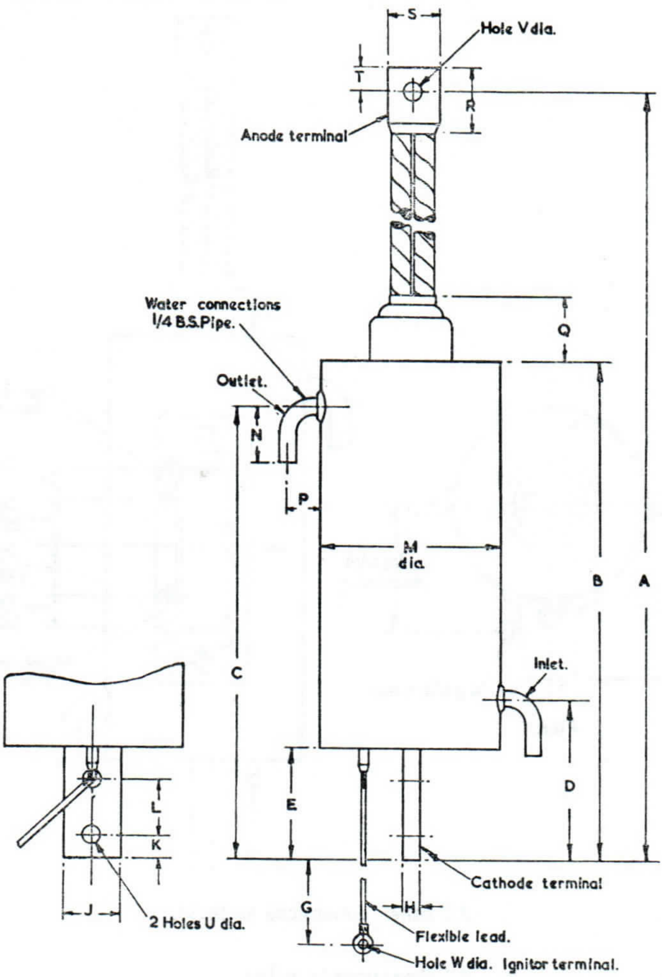
Voltage (a.c.)	125	250	440	600V
Current (a.c.)	3·0	1·5	1·0	0·5A

Maximum peak voltage between switch contacts and ignitron envelope	1000	V

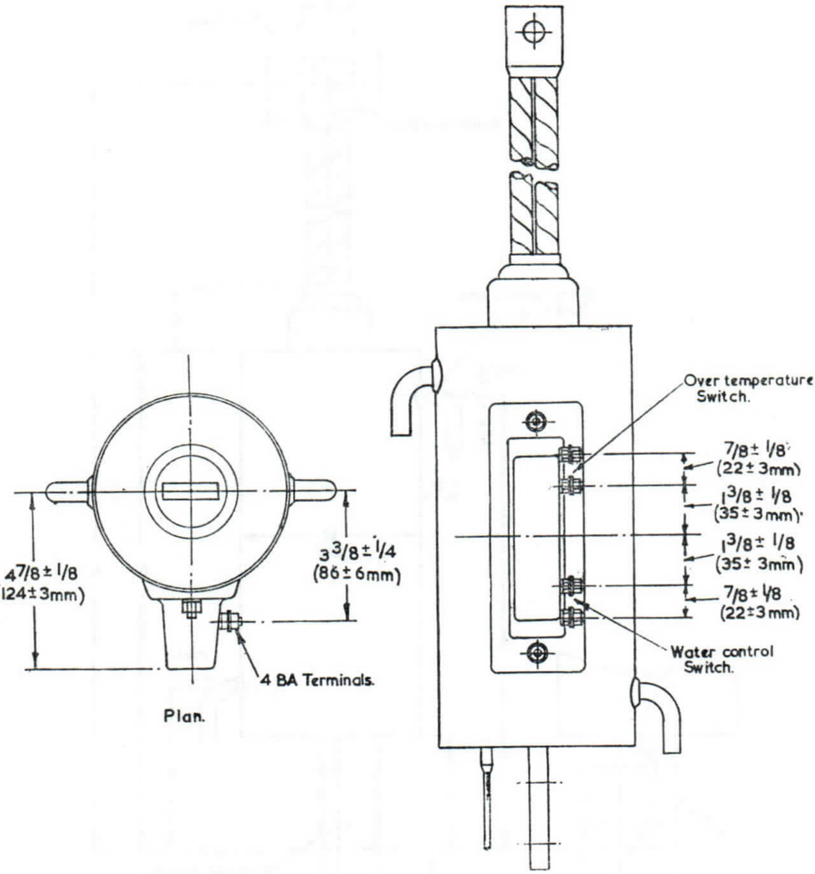
Dimension	Inches	Millimetres
A	26⅛ ± ¾	664 ± 19
B	15⅜ ± ¾	391 ± 19
C	14 ± ¼	356 ± 6
D	5 ± ¼	127 ± 6
E	3½ ± ⅜	89 ± 10
G	4 ± ¼	102 ± 6
H	0·500 ± 0·031	12·7 ± 0·8
J	1·750 ± 0·062	44·5 ± 1·5
K	0·750 ± 0·062	19·0 ± 1·5
L	1·750 ± 0·031	44·5 ± 0·8
M	5½ ± ⅛	140 ± 3
N	1¾ ± ¼	44 ± 6
P	1 ± ⅛	25 ± 3
Q	2 ± ⅜	51 ± 10
R	2 ± ¼	51 ± 6
S	1·625 ± 0·062	41·3 ± 1·5
T	0·750 ± 0·062	19·0 ± 1·5
U	9/16	14·3
V	9/16	14·3
W	0·265	6·73

All dimensions in inches.
Millimetre dimensions derived.

OUTLINE DRAWING OF BK34.



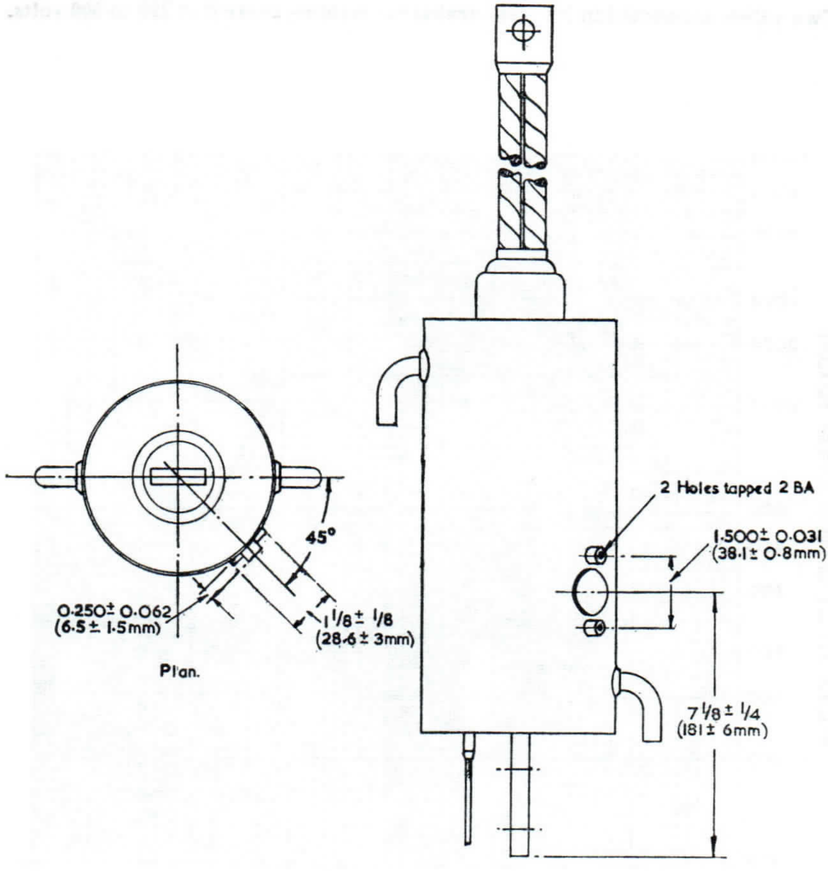
OUTLINE DRAWING OF BK34A.



All other dimensions as BK34.

All dimensions in inches.
Millimetre dimensions derived.

OUTLINE DRAWING OF BK34B.

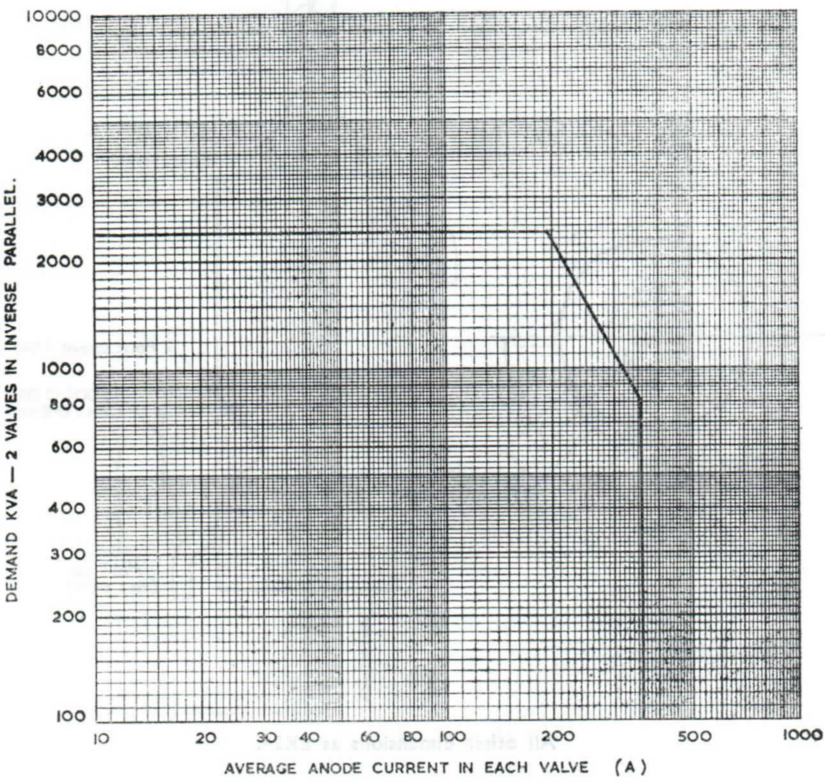


All other dimensions as BK34.

All dimensions in inches.
Millimetre dimensions derived.

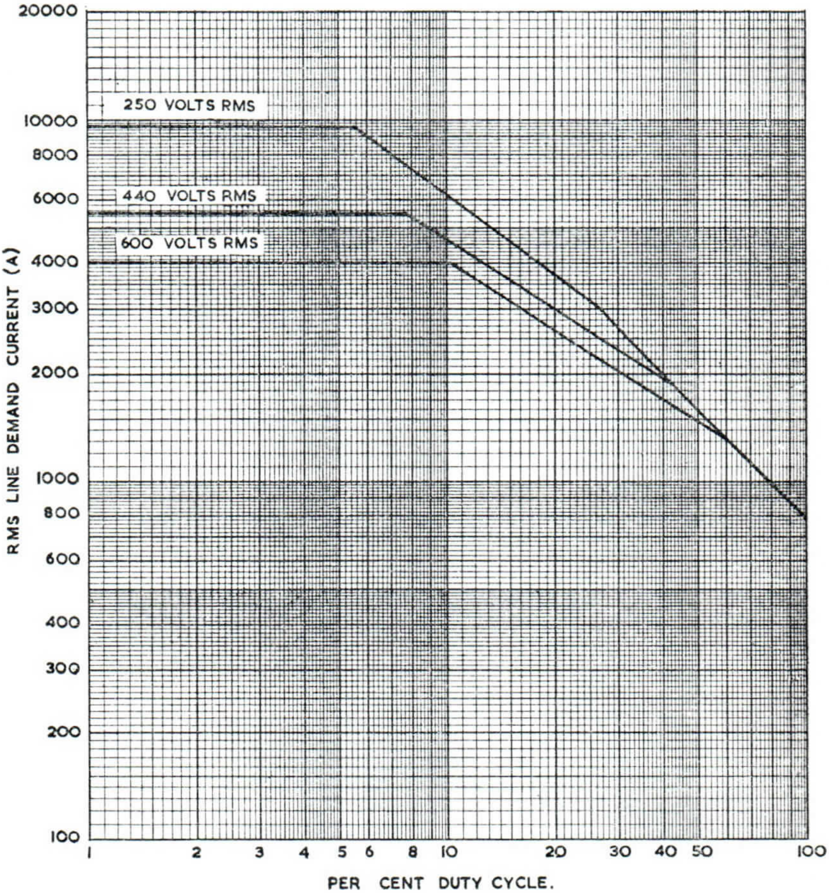
DEMAND kVA AGAINST AVERAGE ANODE CURRENT

Two valves connected in inverse parallel for welding control at 250 to 600 volts.



LINE DEMAND CURRENT AGAINST DUTY CYCLE

Two valves connected in inverse parallel for welding control at 250 to 600 volts.



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

AEI Ignitrons

BK42
BK42A
BK42B

The BK42 is a size B stainless-steel-jacketed water-cooled ignitron primarily designed for control of resistance welding applications. It may also be used for three-phase (frequency changing) welding control. It is equivalent to the American 5551.

The BK42A has integral type temperature control with built in temperature switches. It is equivalent to the American 6346.

The BK42B has provision for mounting a detachable thermostat for temperature control, as described in the Preamble. It is equivalent to the American 5551A.

GENERAL

Number of electrodes		
Main Anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc voltage drop (approx)		
At 150A instantaneous	13	V
At 3400A	26	V
Weight (approx)		
Net weight	3¾	lb
Shipping weight (home pack)	7	lb
Shipping weight (overseas)	17	lb
Cooling water		
Minimum flow	1	gal/min
Minimum inlet temperature	10	°C
Maximum outlet temperature	40	°C
Pressure drop at 1 gal/min	1·8	lb/in²
Maximum water temperature rise	4	°C
Time for which water flow must be maintained after switching off	10	min

MAXIMUM RATINGS

Welder Control Service.

Ratings are for two valves in inverse parallel, and for full cycle conduction irrespective of whether phase control is used or not.

Supply voltage (r.m.s.)	250 to 600	V
Maximum demand	600	kVA
Corresponding average anode current	30·2	A
Maximum average anode current	56	A
Corresponding demand	200	kVA
Maximum averaging time of current		
At 600V r.m.s.	7·5	s
At 440V r.m.s.	10·2	s
At 250V r.m.s.	18	s
Maximum peak fault current		
At 600V r.m.s.	2800	A
At 250V r.m.s.	6720	A
Maximum duration of fault current	0·15	s

Frequency Changer Resistance Welding Service or Power Rectifier Service (Intermittent Duty).

Peak anode voltage (forward or inverse)	1200	1500	V
Maximum anode current			
Peak	600	480	A
Corresponding average	5·0	4·0	A
Average	22·5	18	A
Corresponding peak	135	108	A
Maximum averaging time	10	10	s
Maximum peak fault current	7500	6000	A
Maximum duration of fault	0·15	0·15	s

IGNITOR RATINGS

Maximum peak inverse voltage	5·0	V
Maximum ignitor current		
peak	100	A
r.m.s.	10	A
average	1·0	A
maximum averaging time	5·0	s

IGNITOR CIRCUIT REQUIREMENTS

Anode firing		
Maximum voltage	Anode voltage	
Ignitor voltage required to fire	200	V
Ignitor current required to fire	30	A
Starting time at required voltage or current	100	µs
Separate excitation		
Open circuit voltage of excitation circuit		
maximum	750	V
minimum	450	V
Short circuit current of excitation circuit		
maximum	75	A
minimum	45	A
Length of firing pulse (approx sine wave)		
recommended	500	µs
minimum (for average anode currents greater than 20A)	150	µs

TEMPERATURE CONTROLLED TYPES

BK42A

Water control switch (normally open) Closes at (approx)	36	°C
Over-temperature switch (normally closed) Opens at (approx)	45	°C

Electrical rating

Voltage (a.c.)	125	250	440	600V
Current (a.c.)	3·0	1·5	1·0	0·5A

Maximum peak voltage between switch contacts and ignitron envelope	1000	V

BK42B

Water control thermostat (normally open) Klixon type C4391-7-51 Closes at (approx)	36	°C
Over-temperature thermostat (normally closed) Klixon type C4391-7-52 Opens at (approx)	52	°C

Electrical Rating

Voltage (a.c.)	125	250	440	600V
Current (a.c.)	3·0	1·5	1·0	0·5A

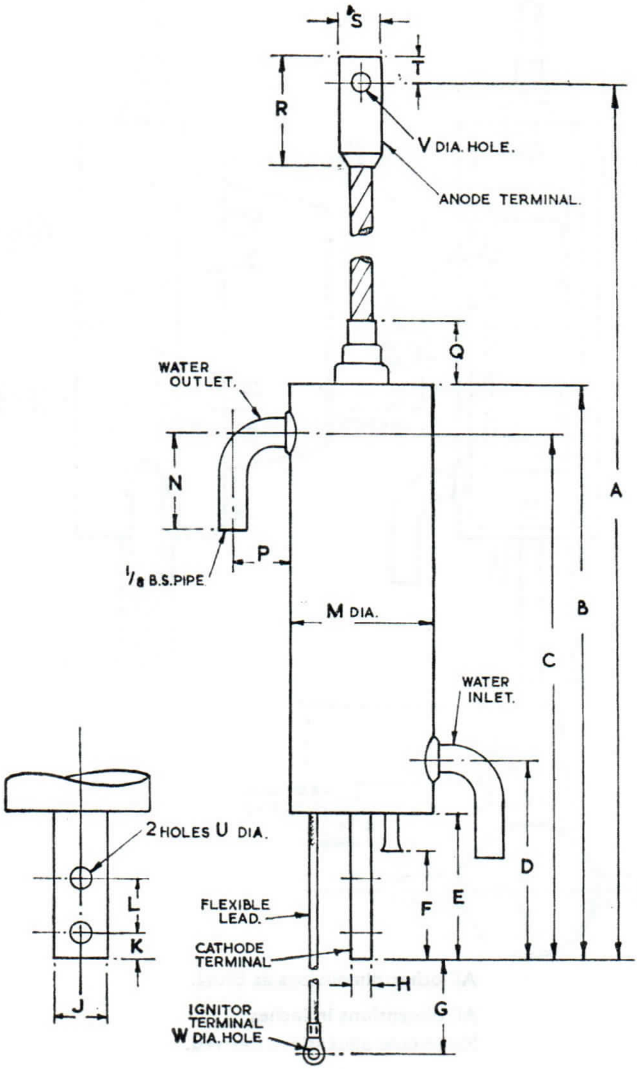
Maximum peak voltage between switch contacts and ignitron envelope	1000	V

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

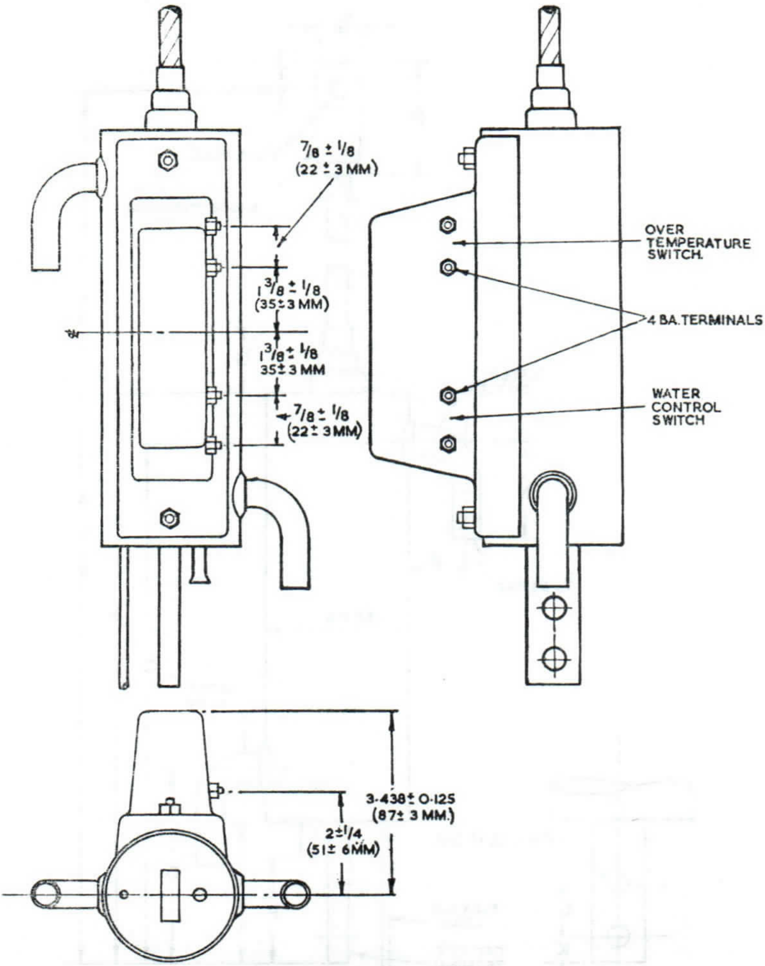
Dimension	Inches	Millimetres
A	$23\frac{1}{8} \pm \frac{5}{8}$	587 ± 16
B	$10\frac{3}{8} \pm \frac{1}{2}$	264 ± 13
C	$9\frac{1}{2} \pm \frac{1}{4}$	241 ± 6
D	$3\frac{5}{8} \pm \frac{1}{4}$	92 ± 6
E	$2\frac{5}{8} \pm \frac{1}{4}$	67 ± 6
F	2 min	51 min
G	$4\frac{5}{8} \pm \frac{1}{4}$	117 ± 6
H	0·375 ± 0·031	9·5 ± 0·8
J	1·000 ± 0·062	25·4 ± 1·5
K	0·500 ± 0·062	12·7 ± 1·5
L	1·000 ± 0·031	25·4 ± 0·8
M	$2\frac{5}{8} \pm \frac{1}{8}$	67 ± 3
N	$1\frac{3}{4} \pm \frac{1}{4}$	44 ± 6
P	$1 \pm \frac{1}{8}$	25·4 ± 3
Q	$1\frac{1}{8} \pm \frac{1}{4}$	28·5 ± 6
R	2 max	51 max
S	0·750 ± 0·062	19 ± 1·5
T	0·500 ± 0·062	12·7 ± 1·5
U	$\frac{7}{16}$	11·1
V	$\frac{13}{32}$	10·3
W	0·265	6·73

All dimensions in inches.
Millimetre dimensions derived.

OUTLINE DRAWING OF BK42



OUTLINE DRAWING OF BK42A

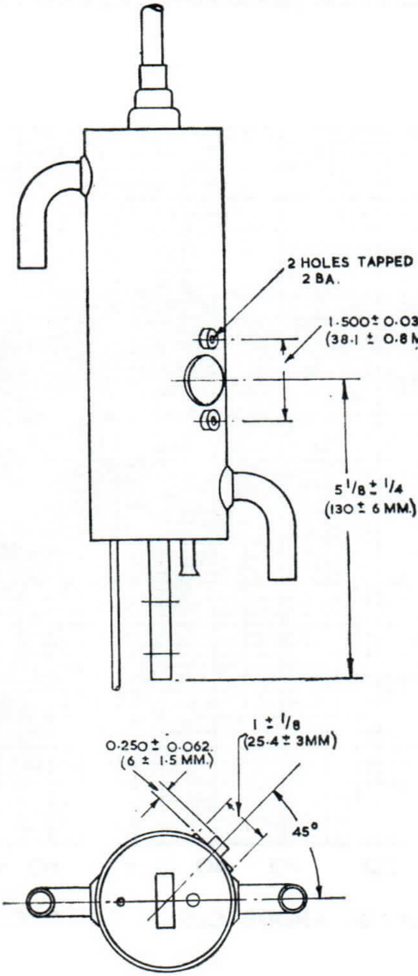


All other dimensions as BK42.

All dimensions in inches.

Millimetre dimensions derived.

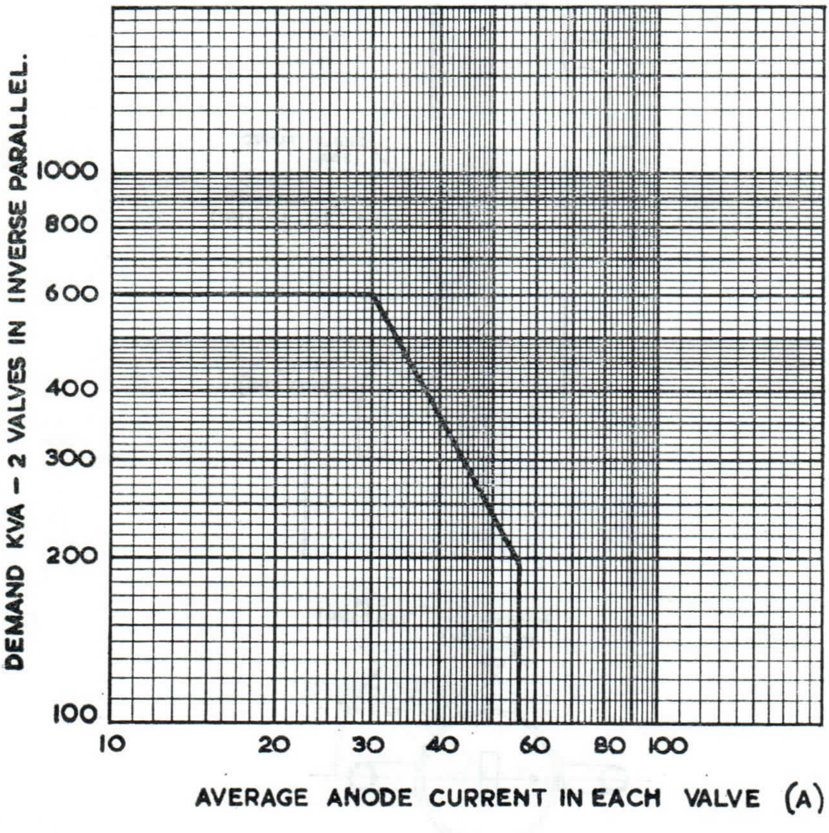
OUTLINE DRAWING OF BK42B



All other dimensions as BK42.
All dimensions in inches.
Millimetre dimensions derived.

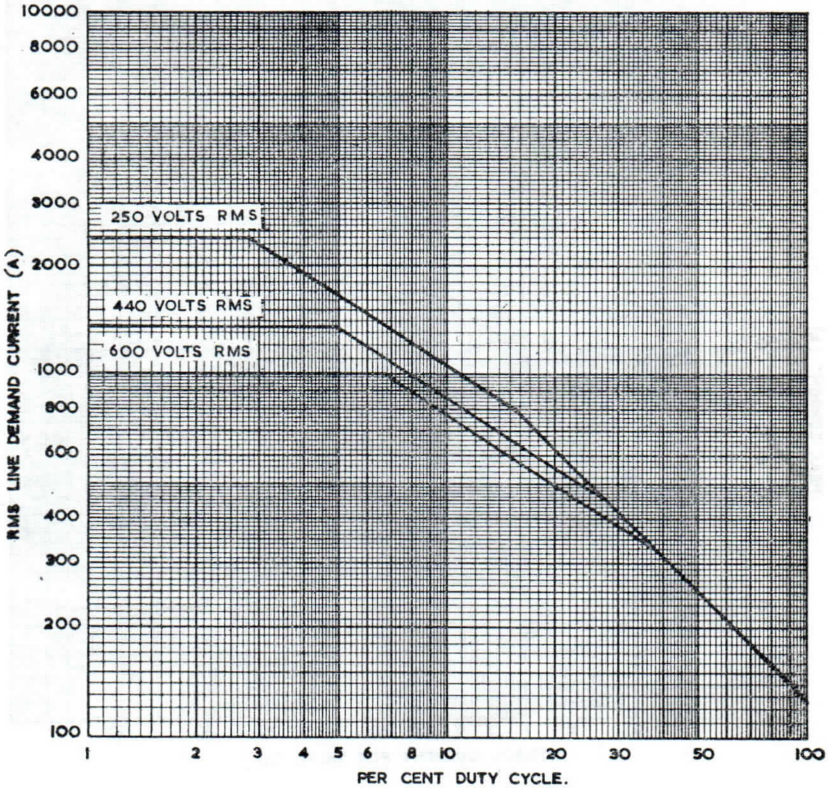
DEMAND kVA AGAINST AVERAGE ANODE CURRENT

Two valves connected in inverse parallel for welding control at 250 to 600 volts.

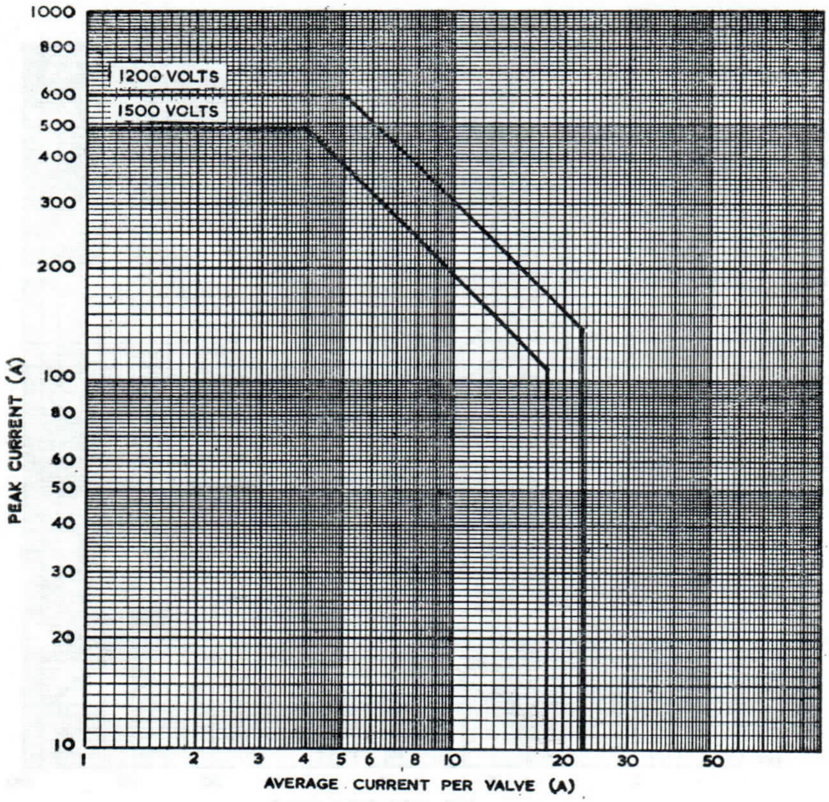


LINE DEMAND CURRENT AGAINST DUTY CYCLE

Two valves connected in inverse parallel for welding control at 250 to 600 volts.



THREE PHASE WELDER CONTROL SERVICE



Provisional Information

The BK42C has been developed for applications using anode firing in welder equipments which may be operated at low currents. To meet this requirement the BK42C is fitted with an ignitor which will fire more easily. A thermostat platform is fitted.

RATINGS AND DIMENSIONS

Except as detailed below all ratings and dimensions are the same as for the BK42B.

IGNITOR CIRCUIT REQUIREMENTS

Anode firing

Maximum voltage	Anode voltage	
Ignitor voltage required to fire	200	V
Ignitor current required to fire	12	A
Starting time at required voltage or current	100	μs

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

July 1962
4400-51/BK42C

AEI Ignitrons

BK44
BK44A
BK44B

The BK44 is a size C stainless-steel-jacketed water-cooled ignitron primarily designed for rectifier service. It is also rated for resistance welder control at 2400V. It is equivalent to the American 5554.

The BK44A has integral-type temperature control with built-in temperature switches. It is equivalent to the American 6512.

The BK44B has provision for mounting a detachable thermostat for temperature control as described in the Preamble.

GENERAL

Number of electrodes		
Main anode	1	
Cathode (mercury pool)	1	
Ignitors	2	
Auxiliary anode	1	
Arc voltage drop (approx)		
At 600A instantaneous	16	V
Weight (approx)		
Net weight	13	lb
Shipping weight (home pack)	20	lb
Shipping weight (overseas)	30	lb
Cooling water		
Minimum flow	$1\frac{1}{2}$	gal/min
Minimum inlet temperature	6	°C
Maximum outlet temperature		
Rectifier service (anode 900V)	60	°C
Rectifier service (anode 2100V)	45	°C
Welder service (anode 2400V)	30	°C
Pressure drop at $1\frac{1}{2}$ gal/min	5	lb/in²
Maximum water temperature rise	6	°C
Time for which water flow must be maintained after switching off	15	min

MAXIMUM RATINGS
Power Rectifier Service

Peak anode voltage (forward or inverse)	900	2100	V
Maximum anode current			
Peak	900	600	A
Average			
Continuous	100	75	A
Two hours	150	113	A
averaging time	2	2	min
One minute	200	150	A
averaging time	1	1	min
Maximum peak fault current	6000	4500	A
Maximum duration of fault	0·15	0·15	s
Frequency range	25-60	25-60	c/s

Welder Control Service

Ratings are for two valves in inverse parallel and for full cycle conduction irrespective of whether phase control is used or not.

Supply voltage (r.m.s.)	2400	V
Maximum demand	1200	kVA
Corresponding average anode current	75	A
Maximum average anode current	113	A
Corresponding demand	600	kVA
Maximum averaging time at 2400V	1·5	s
Maximum peak fault current	3000	A
Maximum duration of fault	0·15	s
Frequency range	25-60	c/s

AUXILIARY ANODE

Voltage		
peak forward	200	V
peak inverse		
anode conducting	25	V
anode not conducting	160	V
Current		
peak	30	A
r.m.s.	15	A
average	9	A
averaging time	10	s

IGNITOR RATINGS

Maximum peak inverse voltage	5·0	V
Maximum ignitor current		
peak	100	A
r.m.s.	15	A
average	2·0	A
maximum averaging time	5·0	s

IGNITOR CIRCUIT REQUIREMENTS

Anode firing

Maximum voltage	Anode voltage	
Ignitor voltage required to fire	450	V
Ignitor current required to fire	45	A
Starting time at required voltage or current	100	µs

Separate excitation

Open circuit voltage of excitation circuit		
maximum	750	V
minimum	450	V
Short circuit current of excitation circuit		
maximum	75	A
minimum	45	A
Length of firing pulse (approx sine wave)		
recommended	800	µs
minimum (for average anode currents greater than 20A)	500	µs

TEMPERATURE CONTROLLED TYPES

BK44A

Water control switch (normally open)		
Closes at (approx)	36	°C
Over-temperature switch (normally closed)		
Opens at (approx)	45	°C

Electrical rating

Voltage (a.c.)	125	250	440	600V
Current (a.c.)	3·0	1·5	1·0	0·5A

Maximum peak voltage between switch contacts and ignitron envelope — 1000 V

BK44B

Water control thermostat (normally open)		
Klixon type C4391-7-51 Closes at (approx)	36	°C
Over-temperature thermostat (normally closed)		
Klixon type C4391-7-52 Opens at (approx)	52	°C

Electrical rating

Voltage (a.c.)	125	250	440	600V
Current (a.c.)	3·0	1·5	1·0	0·5A

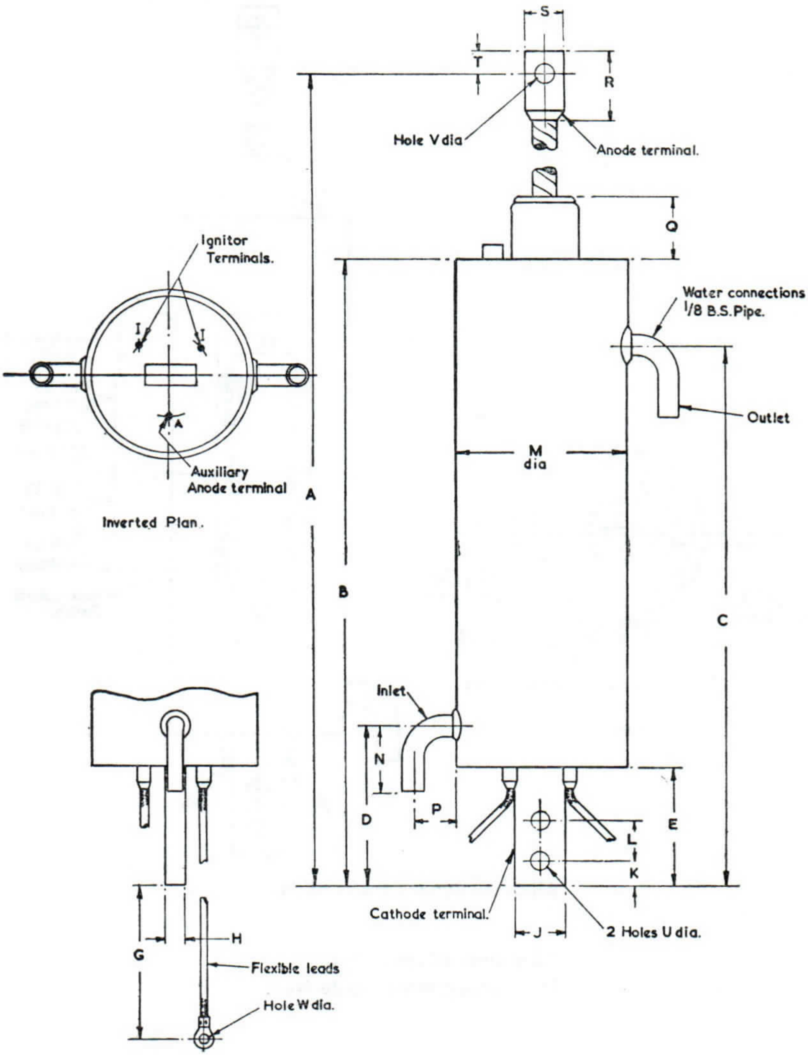
Maximum peak voltage between switch contacts and ignitron envelope — 1000 V

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Dimension	Inches	Millimetres
A	27¼ ± ¾	692 ± 19
B	15¼ ± ½	394 ± 13
C	13 ± ¼	330 ± 6
D	4 ± ¼	102 ± 6
E	3 ± ¼	76 ± 6
G	5⅜ ± ¼	137 ± 6
H	0·500 ± 0·031	12·7 ± 0·8
J	1·250 ± 0·062	31·7 ± 1·5
K	0·625 ± 0·062	16·9 ± 1·5
L	1·000 ± 0·031	25·4 ± 0·8
M	4 ± ⅛	102 ± 3
N	1¾ ± ¼	44 ± 6
P	1 ± ⅛	25 ± 3
Q	1⅝ ± ¼	41 ± 6
R	1⅝ ± ⅛	41 ± 6
S	1·000 ± 0·062	25·4 ± 1·5
T	0·500 ± 0·062	12·7 ± 1·5
U	7/16	11·1
V	½	12·7
W	0·265	6·73

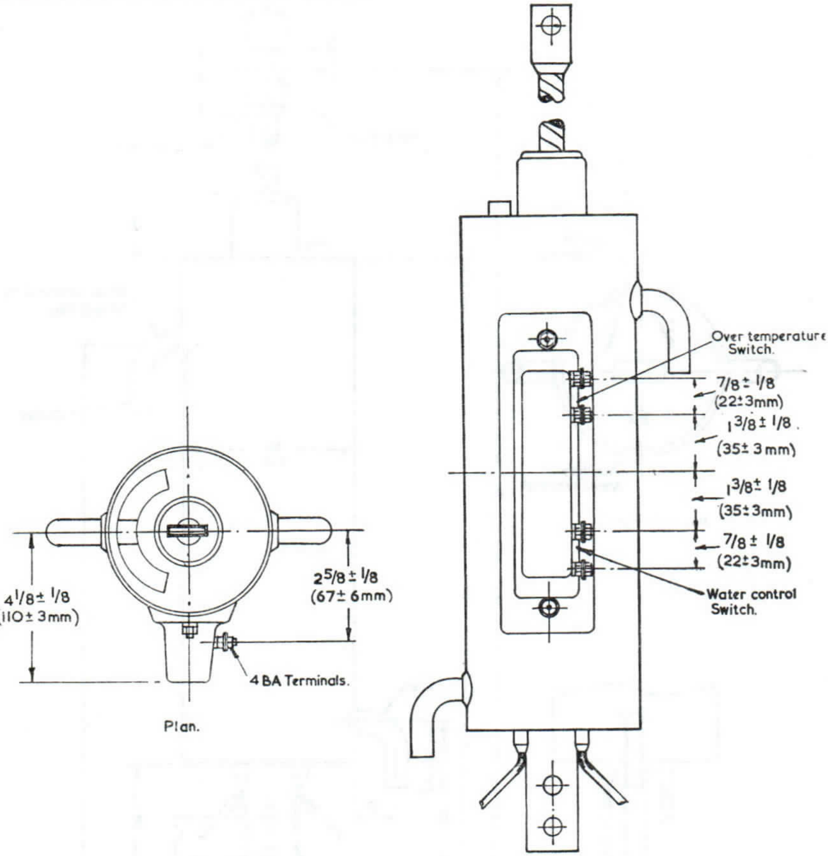
All dimensions in inches.
Millimetre dimensions derived.

OUTLINE DRAWING OF BK44



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

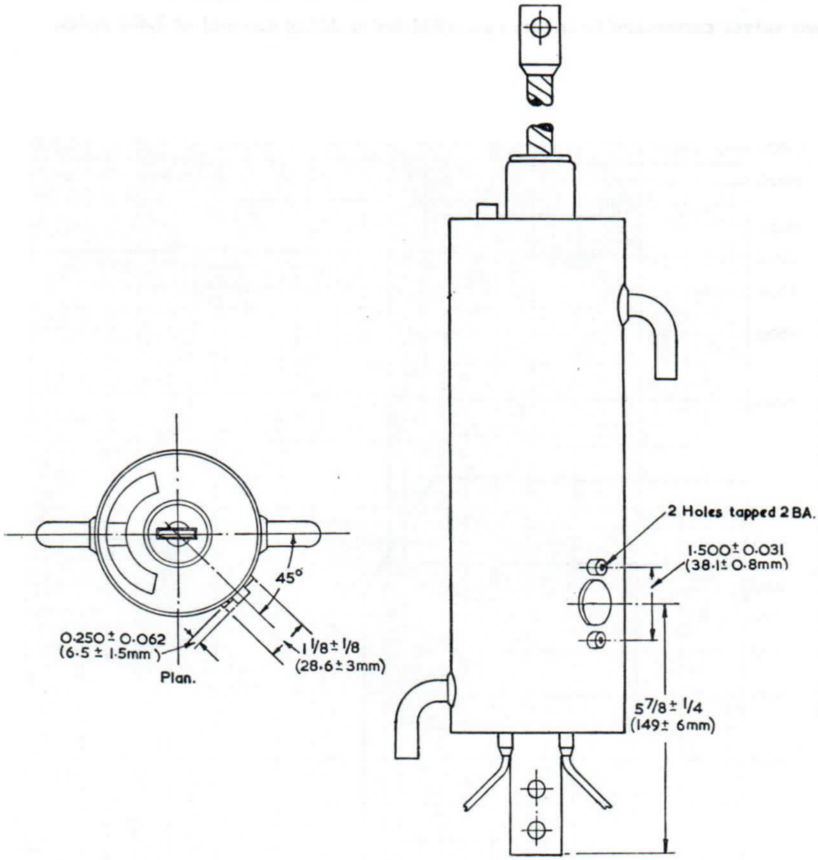
OUTLINE DRAWING OF BK44A



All other dimensions as BK44.

All dimensions in inches.
Millimetre dimensions derived.

OUTLINE DRAWING OF BK44B

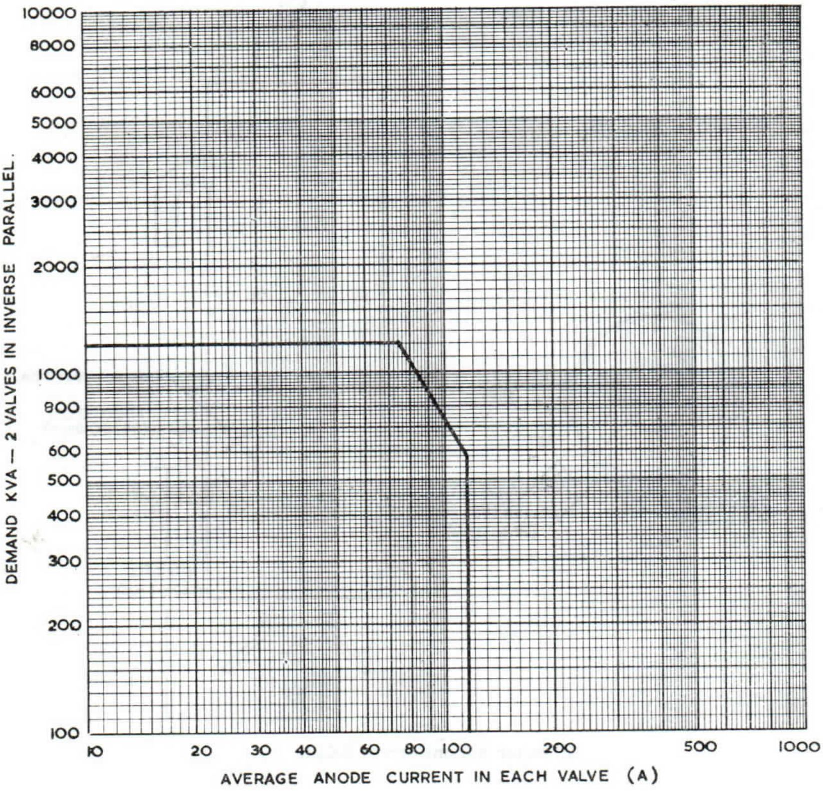


All other dimensions as BK44.

All dimensions in inches.
Millimetre dimensions derived.

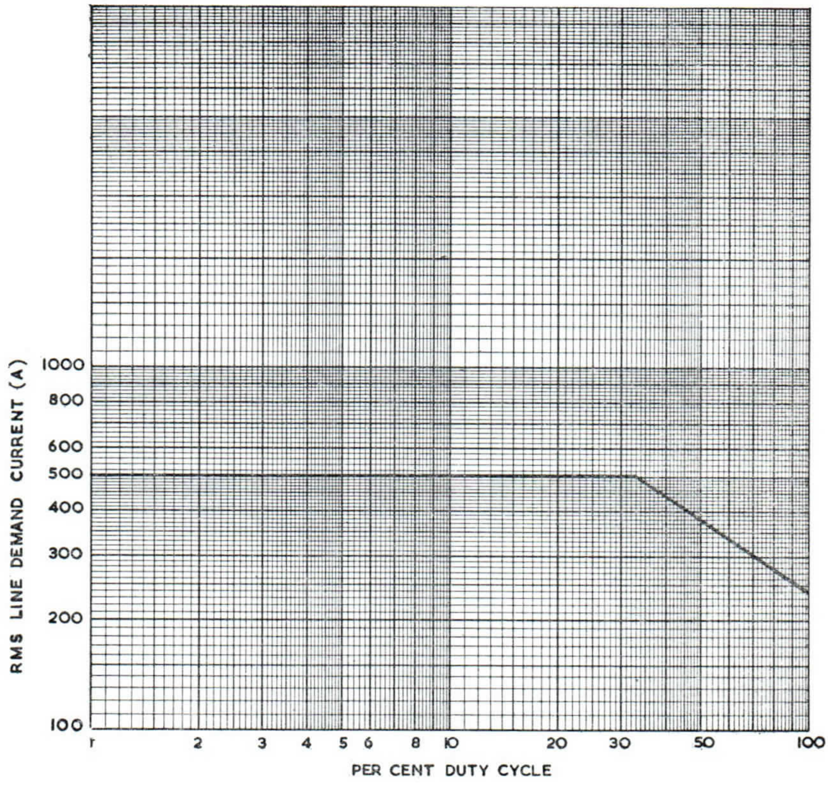
DEMAND kVA AGAINST AVERAGE ANODE CURRENT

Two valves connected in inverse parallel for welding control at 2,400 volts.



LINE DEMAND CURRENT AGAINST DUTY CYCLE

Two valves connected in inverse parallel for welding control at 2,400 volts.



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

AEI Ignitrons

BK46
BK46A

The BK46 is a size D stainless-steel-jacketed water-cooled ignitron primarily designed for rectifier service. It is also rated for resistance welder control at 2400V. It is equivalent to the American 5555.

The BK46A has integral-type temperature control with built-in temperature switches. It is equivalent to the American 6513.

GENERAL

Number of electrodes		
Main anode	1	
Cathode (mercury pool)	1	
Ignitors	2	
Auxiliary anode	1	
Arc voltage drop (approx)		
At 600A instantaneous	16	V
At 1200A instantaneous	19	V
Weight (approx)		
Net weight	25	lb
Shipping weight (home pack)	40	lb
Shipping weight (overseas)	60	lb
Cooling water		
Minimum flow	3	gal/min
Minimum inlet temperature	6	°C
Maximum outlet temperature		
Rectifier service (anode 900V)	60	°C
Rectifier service (anode 2100V)	45	°C
Welder service (anode 2400V)	30	°C
Pressure drop at 3 gal/min	6	lb/in^2
Maximum water temperature rise	7	°C
Time for which water flow must be maintained after switching off	30	min

MAXIMUM RATINGS

Power Rectifier Service

	BK46	BK46A	
Peak anode voltage (forward or inverse)	900	2100	V
Maximum anode current			
Peak	1800	1200	A
Average			
Continuous	200	150	A
Two hours	300	225	A
averaging time	2	2	min
One minute	400	300	A
averaging time	1	1	min
Maximum peak fault current	12000	9000	A
Maximum duration of fault	0·15	0·15	s
Frequency range	25-60	25-60	c/s

Welder Control Service

Ratings are for two valves in inverse parallel and for full cycle conduction irrespective of whether phase control is used or not.

Supply voltage (r.m.s.)	2400	V
Maximum demand	2400	kVA
Corresponding average anode current	135	A
Maximum average anode current	207	A
Corresponding demand	1105	kVA
Maximum averaging time at 2400V	1·66	s
Maximum peak fault current	6000	A
Maximum duration of fault	0·15	s
Frequency range	25-60	c/s

AUXILIARY ANODE

Voltage		
peak forward	200	V
peak inverse		
anode conducting	25	V
anode not conducting	160	V
Current		
peak	30	A
r.m.s.	15	A
average	9	A
averaging time	10	s

IGNITOR RATINGS

Maximum peak inverse voltage	5·0	V
Maximum ignitor current		
peak	100	A
r.m.s.	15	A
average	2·0	A
maximum averaging time	5·0	s

IGNITOR CIRCUIT REQUIREMENTS

Anode firing

Maximum voltage	Anode voltage	
Ignitor voltage required to fire	450	V
Ignitor current required to fire	45	A
Starting time at required voltage or current	100	µs

Separate excitation

Open circuit voltage of excitation circuit		
maximum	750	V
minimum	450	V
Short circuit current of excitation circuit		
maximum	75	A
minimum	45	A
Length of firing pulse (approx sine wave)		
recommended	800	µs
minimum (for average anode currents greater than 20A)	500	µs

TEMPERATURE CONTROLLED TYPE

BK46A

Water control switch (normally open)		
Closes at (approx)	36	°C
Oven temperature switch (normally closed)		
Opens at	45	°C

Electrical rating

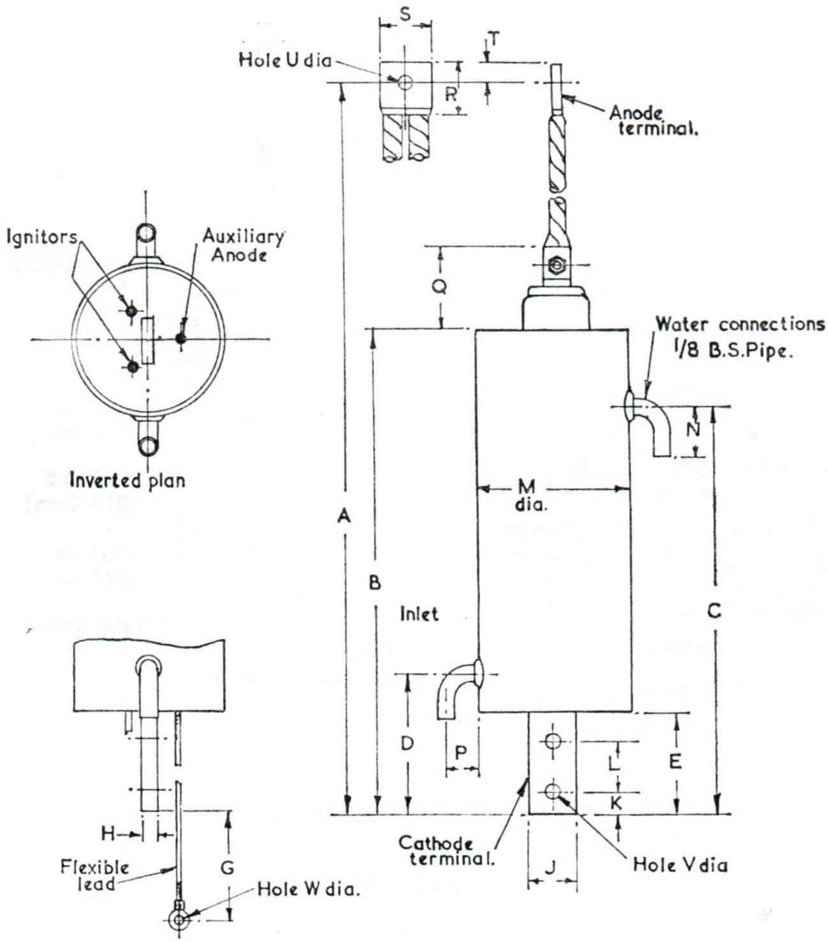
Voltage (a.c.)	125	250	440	600V
Current (a.c.)	3·0	1·5	1·0	0·5A

Maximum peak voltage between switch contacts and ignitron envelope	1000	V

Dimension	Inches	Millimetres
A	29 ± ¾	737 ± 19
B	17 ± ¾	432 ± 19
C	14·44 ± 0·25	367 ± 6
D	5⅛ ± ¼	130 ± 6
E	3½ ± ⅜	89 ± 10
G	4 ± ¼	102 ± 6
H	0·500 ± 0·031	12·7 ± 0·8
J	1·750 ± 0·062	44·5 ± 1·5
K	0·750 ± 0·062	19·0 ± 1·5
L	1·750 ± 0·031	44·5 ± 0·8
M	5½ ± ⅛	140 ± 3
N	1¾ ± ¼	44 ± 6
P	1 ± ⅛	25 ± 3
Q	3·188 ± 0·375	81 ± 10
R	2 ± ¼	51 ± 6
S	1·625 ± 0·062	41·3 ± 1·5
T	0·750 ± 0·062	19·0 ± 1·5
U	9/16	14·3
V	9/16	14·3
W	0·265	6·73

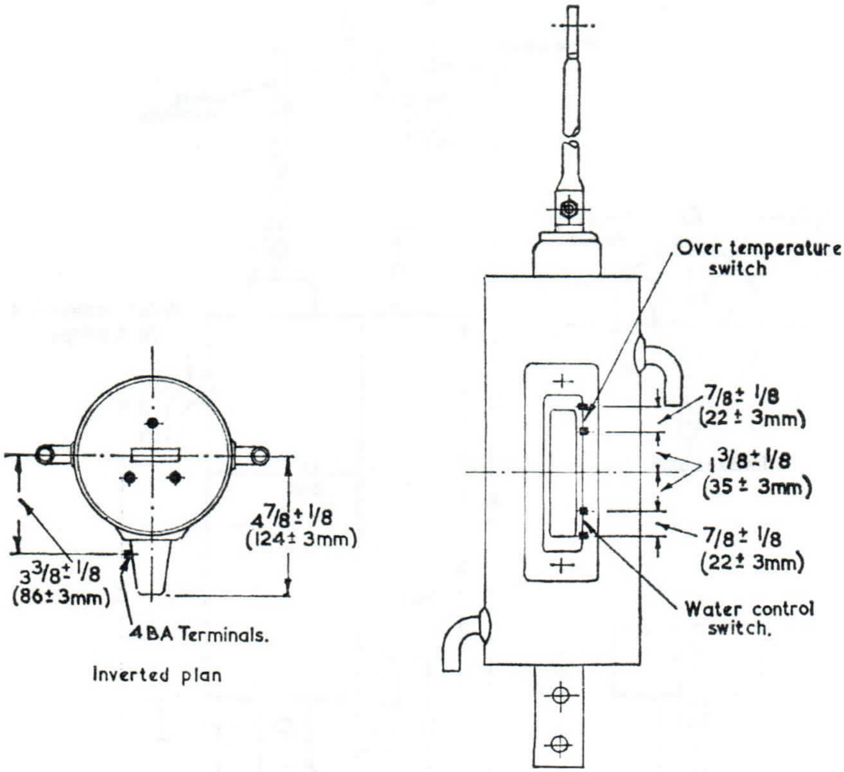
All dimensions in inches.
Millimetre dimensions derived.

OUTLINE DRAWING OF BK46.



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

OUTLINE DRAWING OF BK46A.



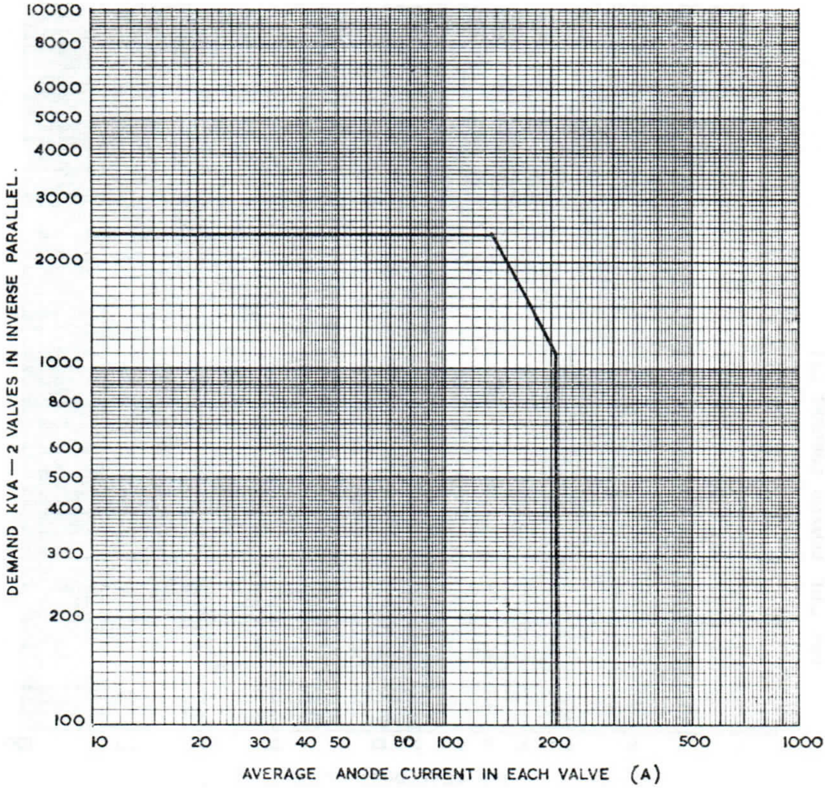
All other dimensions as BK46.

All dimensions in inches.

Millimetre dimensions derived.

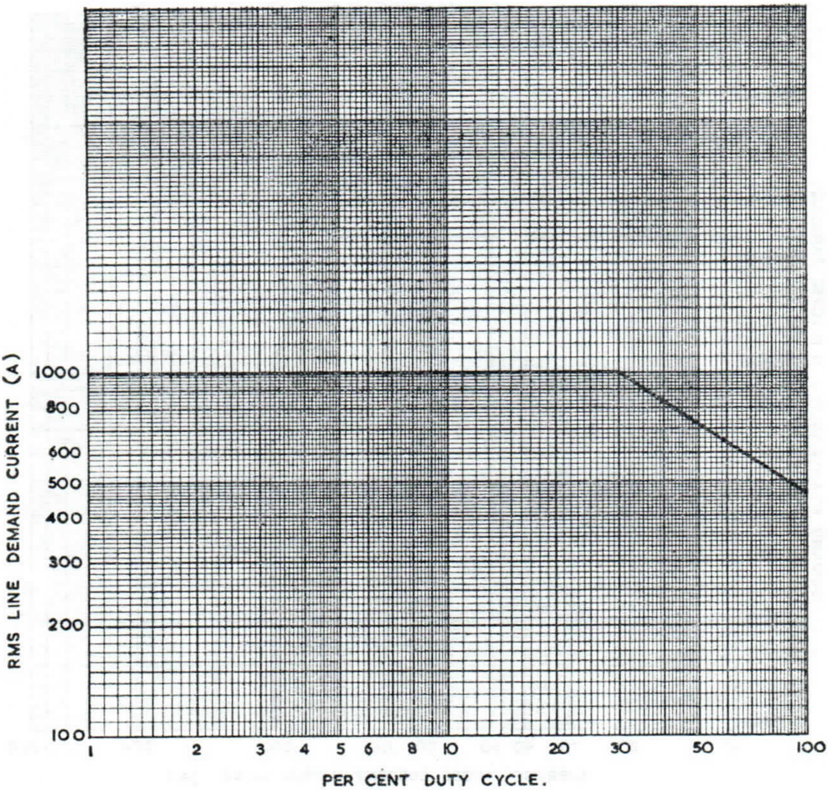
DEMAND kVA AGAINST AVERAGE ANODE CURRENT

Two valves connected in inverse parallel for welding control at 2,400 volts.



LINE DEMAND CURRENT AGAINST DUTY CYCLE

Two valves connected in inverse parallel for welding control at 2,400 volts.



AEI Ignitron BK56

The BK56 is a sealed, stainless-steel-jacketed water-cooled ignitron. It contains three grids, and can be used as a high voltage rectifier, or as a capacitor discharge switch for pulse applications.

GENERAL

Number of electrodes		
Main anodes	1	
Auxiliary anodes	2	
Cathode (mercury pool)	1	
Ignitors	3	
Shield grid	1	
Control grid	1	
Gradient grid	1	
Arc voltage drop (approx)		
At 600A instantaneous	22	V
At 2000A instantaneous	30	V
Weight (approx)		
Net weight	100	lb
Shipping weight	190	lb
Cooling water		
Minimum flow	5	gal/min
Minimum inlet temperature	35	°C
Maximum outlet temperature	45	°C
Pressure drop at 5 gal/min (approx)	4	lb/in^2

MAXIMUM RATINGS

Power Rectifier Service

Peak anode voltage (forward or inverse)	20	kV
Anode current—peak	900	A
average		
continuous	150	A
2 hours	200	A
1 minute	300	A
fault	6000	A
duration of fault	0·15	s

AC Control or Capacitor Discharge Service

Peak anode voltage (forward or inverse)	20	kV
Anode current		
peak	2000	A
average	200	A
r.m.s.	500	A
maximum averaging time—one conduction pulse plus one nonconducting period.		
fault	6000	A
duration of fault	0·15	s
Product of forward or inverse voltage and averaging current	3	MVA

Equivalent frequency 25—60 c/s
Above 60 c/s use commutating reactors

Maximum current at start of commutation period	60	A
Current at end of commutation period	0	A
Minimum length of commutation period	200	μs

AUXILIARY CIRCUITS

Control Grid

	min	max	
Voltage forward (peak)	200	500	V
inverse (peak)	100	200	V
Current forward (peak)		5·0	A
inverse (peak)		0·4	A

Shield Grid

	min	max	
Voltage forward (peak)	200	500	V
inverse (peak)	50	200	V
Current forward (peak)		5·0	A
inverse (peak)		0·2	A

Gradient Grid

	min	max	
Voltage forward and inverse (peak)	½	½	anode voltage
Current forward and inverse (peak)	0·010	0·020	A

Auxiliary Anode

Voltage			
	peak forward	200	V
	peak inverse		
	anode conducting	25	V
	anode not conducting	160	V
Current			
	peak	30	A
	r.m.s.	15	A
	mean	9	A
	averaging time	10	s

IGNITOR RATINGS

Maximum peak inverse voltage		5·0	V
Maximum ignitor current			
	peak	100	A
	r.m.s.	15	A
	average	2·0	A
	maximum averaging time	5·0	s

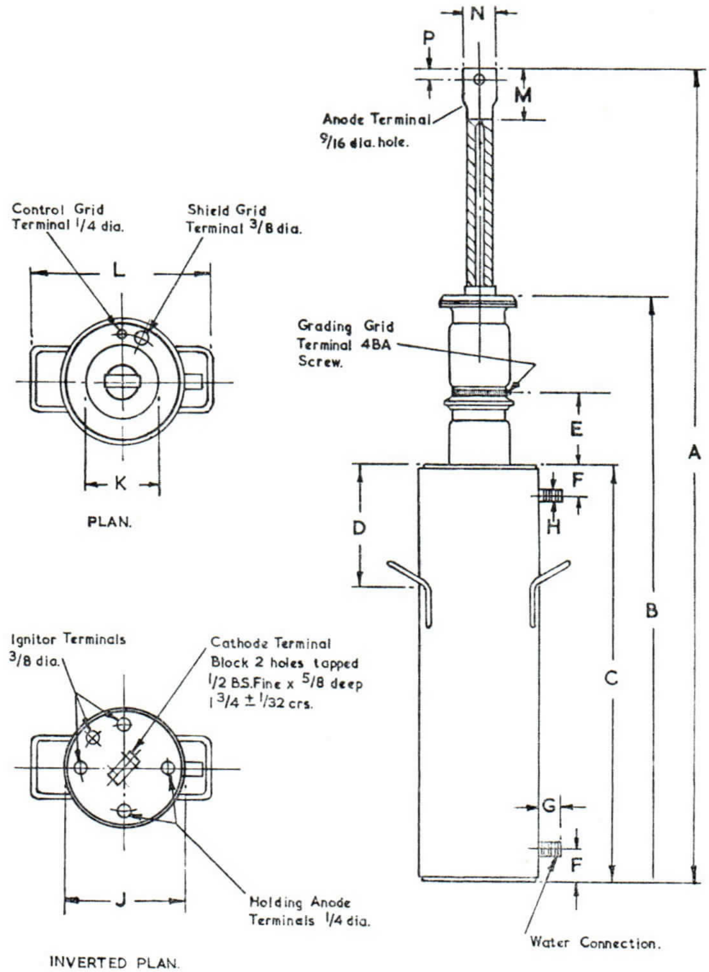
IGNITOR CIRCUIT REQUIREMENTS

Separate excitation	min	max	
Open circuit voltage of excitation circuit	450	750	V
Short circuit current of excitation circuit	45	75	A
Length of firing pulse (approx sine wave)			
recommended	800		μs
minimum (for average anode currents greater than 20A)	500		μs

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Dimension	Inches	Millimetres
A	56½ ± 1½	1435 ± 38
B	41¾ ± ¾	1060 ± 19
C	30 ± ¾	762 ± 19
D	8⅝ ± ½	219 ± 13
E	6 ± 2	150 ± 50
F	2¼ ± ¼	57 ± 6
G	1¾ ± ⅛	44 ± 3
H	1·000 ± 0·005	25·40 ± 0·13
J	8·938 ± 0·125	227 ± 3
K	4·750 ± 0·062	121 ± 1·5
L	13½ ± ½	343 ± 13
M	2 ± ¼	51 ± 6
N	1·625 ± 0·062	41·3 ± 1·5
P	0·750 ± 0·062	19·0 ± 1·5

All dimensions in inches.
Millimetre dimensions derived.


N
P
M
Anode Terminal
9/16 dia. hole.
Control Grid
Terminal 1/4 dia.
Shield Grid
Terminal 3/8 dia.
L
Grading Grid
Terminal 4BA
Screw.
E
A
F
H
D
K
PLAN.
B
Ignitor Terminals
3/8 dia.
Cathode Terminal
Block 2 holes tapped
1/2 BS.Fine x 5/8 deep
1 3/4 ± 1/32 crs.
C
G
F
J
Holding Anode
Terminals 1/4 dia.
Water Connection.
INVERTED PLAN.

AEI Ignitron BK66

The BK66 is a size A stainless-steel envelope ignitron primarily designed for control of resistance welding applications. It is cooled by means of a removable water cooled clamp which also acts as a cathode terminal and means for mounting the ignitron. It is equivalent to the American 5550.

GENERAL

Number of electrodes		
Main anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc voltage drop (approx)		
At 70A (instantaneous)	12	V
At 1700A (instantaneous)	25	V
Weight (approx)		
Net weight	1½	lb
Shipping weight	3¼	lb
Cooling Water		
Recommended flow	1	gal/min
Minimum clamp temperature	10	°C
Maximum clamp temperature	50	°C
Time for which water flow must be maintained after switching off	5	min

Caution

Care should be taken to ensure that good thermal contact is made between the cooling clamp and the ignitron envelope. Accidental damage to the inside of the clamp may produce small high spots, as for instance round an indentation or severe scratch. The ignitron and clamp should both be wiped clean before assembly, as small particles of dirt can prevent proper cooling and allow severe local heating to occur.

MAXIMUM RATINGS

Welder Control Service

Ratings are for two valves in inverse parallel, and for full cycle conduction irrespective of whether phase control is used or not.

Supply voltage (r.m.s.)	250 to 600	V
Maximum demand	300	kVA
Corresponding average anode current	12·1	A
Maximum average anode current	22·4	A
Corresponding demand	100	kVA
Maximum averaging time of current		
At 600V r.m.s.	9·2	s
At 440V r.m.s.	11·0	s
At 250V r.m.s.	22·0	s
Maximum peak fault current		
At 600V r.m.s.	1400	A
At 250V r.m.s.	3360	A
Maximum duration of fault current	0·15	s

IGNITOR RATINGS

Maximum peak inverse voltage	5·0	V
Maximum ignitor current		
peak	100	A
r.m.s.	10	A
average	1·0	A
maximum averaging time	5·0	s

IGNITOR CIRCUIT REQUIREMENTS

Anode firing

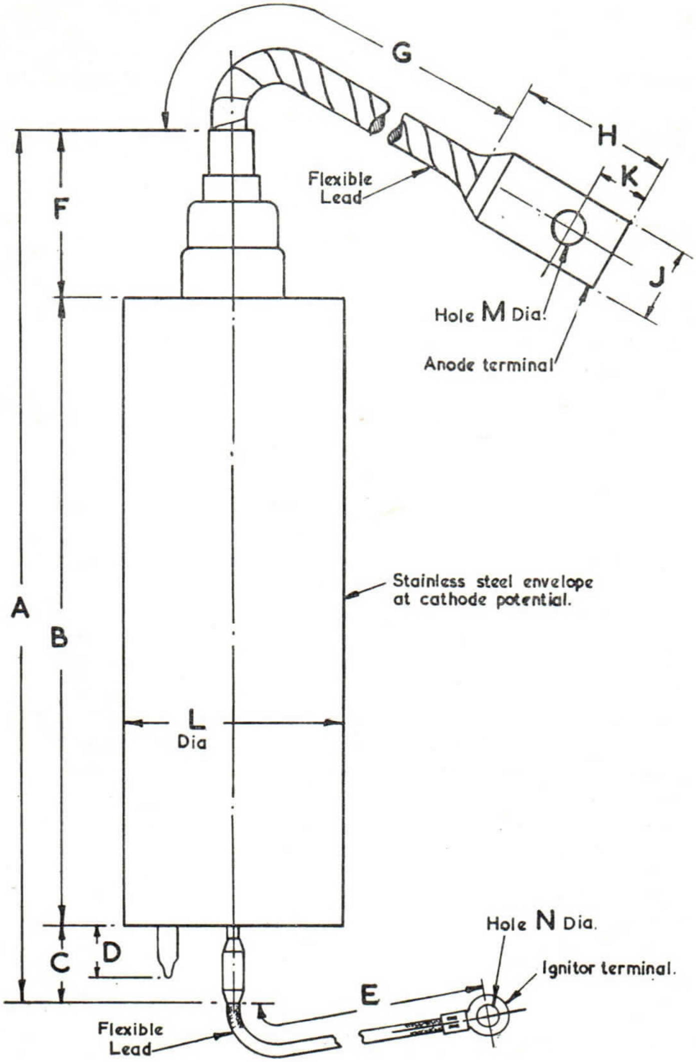
Maximum voltage	Anode voltage	
Ignitor voltage required to fire	200	V
Ignitor current required to fire	30	A
Starting time at required voltage or current	100	µs

Separate excitation

Open circuit voltage of excitation circuit		
maximum	750	V
minimum	450	V
Short circuit current of excitation circuit		
maximum	75	A
minimum	45	A
Length of firing pulse (approx sine wave)		
recommended	500	µs
minimum (for average anode currents greater than 20A)	150	µs

Dimension	Inches	Millimetres
A	$8\frac{5}{8} \pm \frac{1}{4}$	219 ± 6
B	6·062 max	154 max
C	$\frac{3}{4}$ min	19 min
D	$\frac{5}{8}$ max	16 max
E	$7\frac{3}{4} \pm \frac{1}{4}$	197 ± 6
F	$1\frac{5}{8}$ min	41 min
G	$11\frac{5}{8} \pm \frac{1}{4}$	295 ± 6
H	2 max	51 max
J	0·750 ± 0·062	19·0 ± 1·5
K	0·500 ± 0·062	12·7 ± 1·5
L	2·130 ± 0·010	54·10 ± 0·25
M	0·407	10·32
N	0·265	6·73

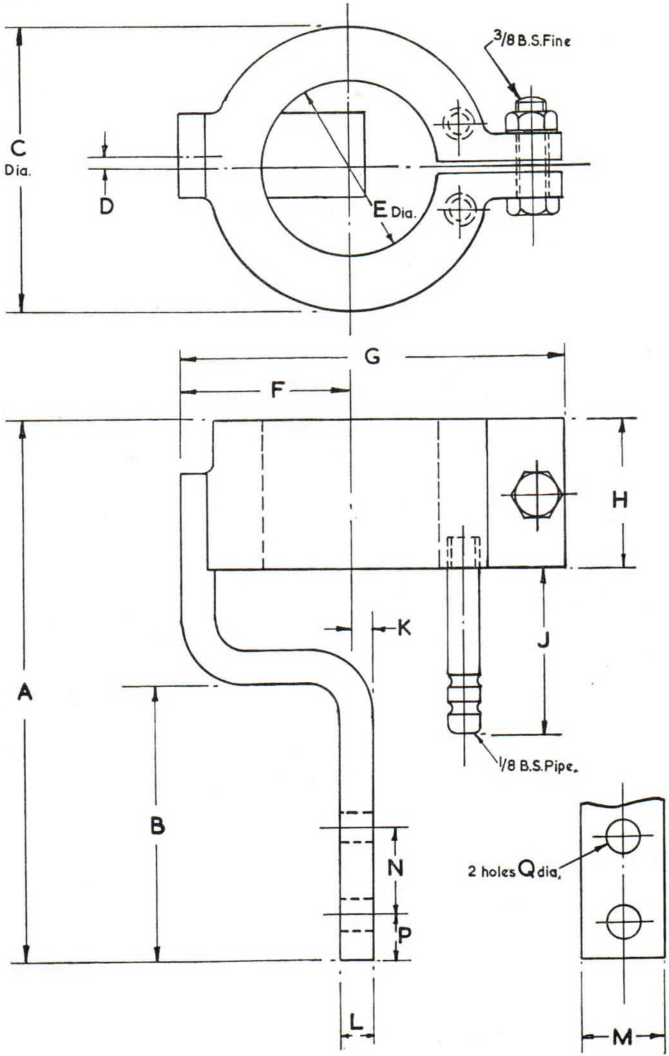
All dimensions in inches.
Millimetre dimensions derived.


G
H
K
Flexible Lead
F
J
Hole M Dia.
Anode terminal
Stainless steel envelope at cathode potential.
A
B
L Dia
Hole N Dia.
C
D
Ignitor terminal.
E
Flexible Lead

Dimension	Inches	Millimetres
A	6⅜ ± ¼	162 ± 6
B	3 ± ⅛	76 ± 3
C	3·375 ± 0·062	86 ± 1·5
D	0·125 ± 0·062	3·2 ± 1·5
E	2·130 ± 0·005	54·10 ± 0·13
F	2 ± 0·062	51 ± 1·5
G	4·438 ± 0·062	113 ± 1·5
H	1·750 ± 0·062	44·5 ± 1·5
J	1⅞ ± ⅛	48 ± 3
K	0·188 ± 0·062	4·8 ± 1·5
L	0·313 ± 0·031	7·9 ± 0·8
M	1·000 ± 0·062	25·4 ± 1·5
N	1·000 ± 0·031	25·4 ± 0·8
P	0·563 ± 0·062	14·3 ± 1·5
Q	0·438	11·1

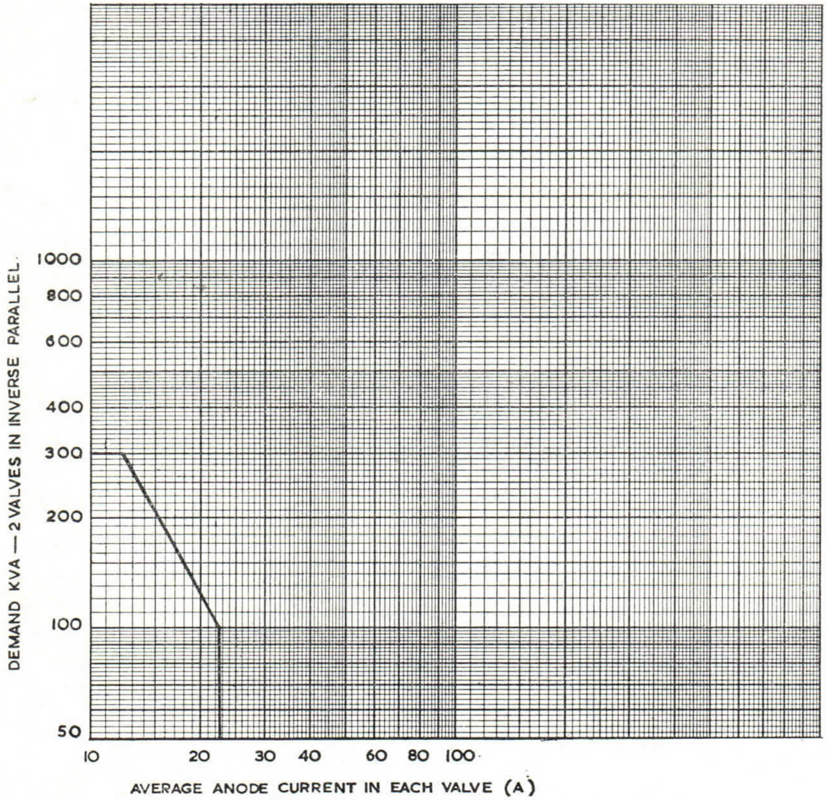
All dimensions in inches.
Millimetre dimensions derived.

OUTLINE DRAWING OF BK66 CLAMP



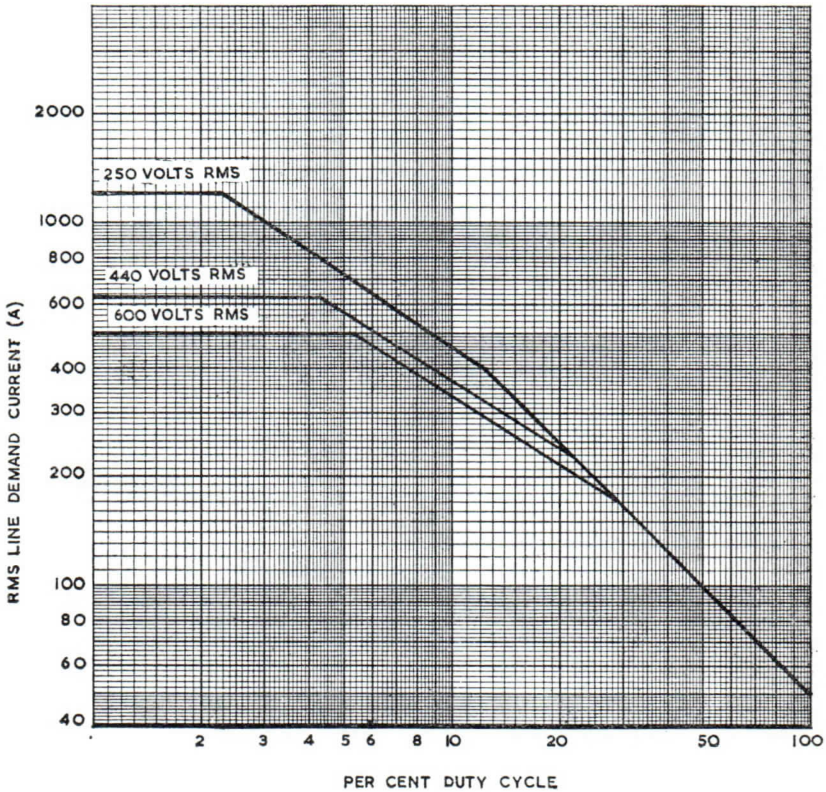
DEMAND kVA AGAINST AVERAGE ANODE CURRENT

Two valves connected in inverse parallel for welding control at 250 to 600 volts.



LINE DEMAND CURRENT AGAINST DUTY CYCLE

Two valves connected in inverse parallel for welding control at 250 to 600 volts



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

AEI Ignitron **BK66D**

Provisional Information

The BK66D has been developed for applications using anode firing in welder equipments which may be operated at low currents. To meet this requirement the BK66D is fitted with an ignitor which will fire more easily.

RATINGS AND DIMENSIONS

Except as detailed below all ratings and dimensions are the same as for the BK66.

IGNITOR CIRCUIT REQUIREMENTS

Anode firing

Maximum voltage	Anode voltage	
Ignitor voltage required to fire	200	V
Ignitor current required to fire	12	A
Starting time at required voltage or current	100	μs

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

AEI Ignitron

BK98B

The BK98B is a size C stainless-steel ignitron designed for standby use where occasional d.c. pulses of up to one second duration are required. It was developed for controlling voltage surges which occur when regenerative breaking is used on electric trains. For this purpose the average current is small and therefore the BK98B has no water jacket. It has provision for mounting a detachable thermostat for temperature control, as described in the Preamble.

GENERAL

Number of electrodes		
Main anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc voltage drop		
At 150A (instantaneous)	13	V
Weight (approx)		
Net weight	7½	lb
Shipping weight (home pack)	12½	lb
Shipping weight (overseas pack)	23	lb
Cooling (free air)	Convection	
Ambient temperature	−10 to + 40	C°

MAXIMUM RATINGS

Intermittent Pulse Operation

Anode voltage (forward or inverse)	4000	V
Anode current		
Average		
continuous	2·0	A
5 minutes	10	A
10 seconds	150	A
1 second	150	A
Maximum d.c. current pulse length	1·0	s

IGNITOR RATINGS

Maximum peak inverse voltage	5·0	V
Maximum ignitor current		
peak	100	A
r.m.s.	10	A
average	1·0	A
maximum averaging time	5·0	s

IGNITOR CIRCUIT REQUIREMENTS

Anode firing

Maximum voltage	Anode voltage	
Ignitor voltage required to fire	200	V
Ignitor current required to fire	30	A
Starting time at required voltage or current	100	μs

Separate excitation

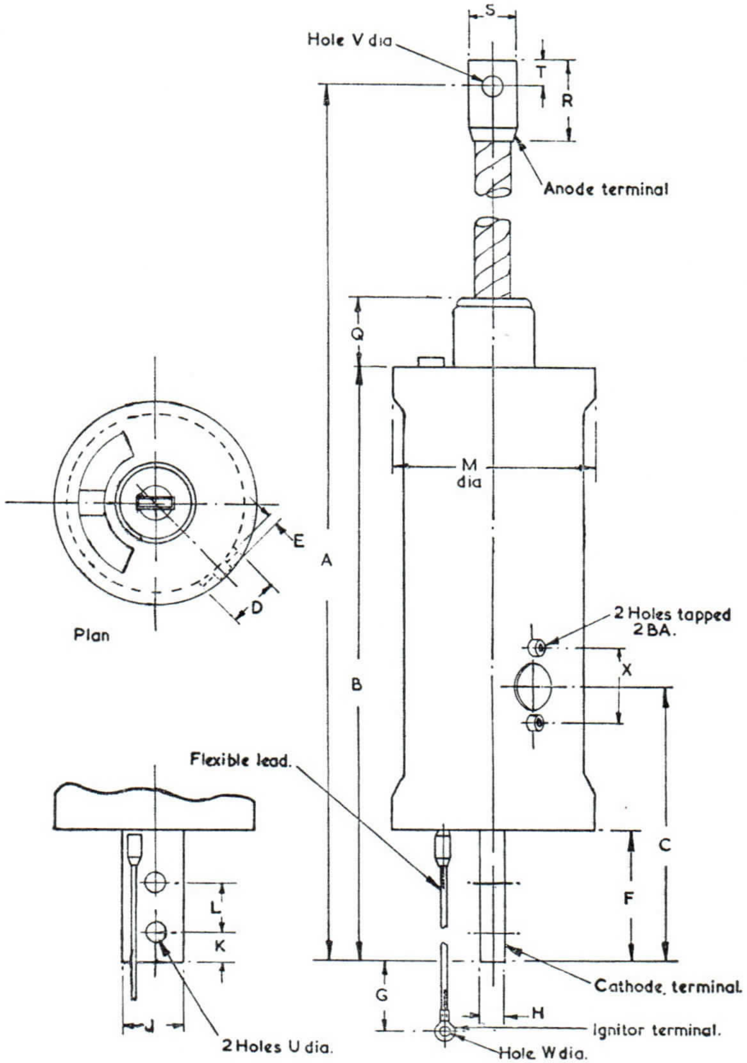
Open circuit voltage of excitation circuit		
maximum	750	V
minimum	450	V
Short circuit current of excitation circuit		
maximum	75	A
minimum	45	A
Length of firing pulse (approx sine wave)		
recommended	500	μs
minimum (for average anode currents greater than 20A)	150	μs

THERMOSTAT RATINGS

Over-temperature thermostat (normally closed)		
Klixon type C4391-7-52 opens at (approx)	52	°C
Electrical rating		
Voltage (a.c.) 125 250 440 600V		
Current (a.c.) 3·0 1·5 1·0 0·5A		
Maximum peak voltage between switch contacts and ignitron envelope	1000	V

Dimension	Inches	Millimetres
A	$25 \pm \frac{3}{4}$	635 ± 19
B	$11\frac{3}{4} \pm \frac{3}{4}$	298 ± 19
C	$5\frac{1}{2} \pm \frac{1}{4}$	140 ± 6
D	$1 \pm \frac{1}{8}$	$25{\cdot}4 \pm 3{\cdot}2$
E	$0{\cdot}250 \pm 0{\cdot}062$	$6{\cdot}5 \pm 1{\cdot}5$
F	$2\frac{5}{8} \pm \frac{1}{4}$	67 ± 6
G	$5\frac{1}{2} \pm \frac{1}{4}$	140 ± 6
H	$0{\cdot}500 \pm 0{\cdot}031$	$12{\cdot}7 \pm 0{\cdot}8$
J	$1{\cdot}250 \pm 0{\cdot}062$	$31{\cdot}7 \pm 1{\cdot}5$
K	$0{\cdot}625 \pm 0{\cdot}062$	$16{\cdot}9 \pm 1{\cdot}5$
L	$1{\cdot}000 \pm 0{\cdot}031$	$25{\cdot}4 \pm 0{\cdot}8$
M	$3\frac{7}{8} \pm \frac{1}{8}$	98 ± 3
Q	$1\frac{5}{8} \pm \frac{1}{4}$	41 ± 6
R	$1\frac{5}{8} \pm \frac{1}{8}$	41 ± 3
S	$1{\cdot}000 \pm 0{\cdot}062$	$25{\cdot}4 \pm 1{\cdot}5$
T	$0{\cdot}500 \pm 0{\cdot}062$	$12{\cdot}7 \pm 1{\cdot}5$
U	$\frac{7}{16}$	11·1
V	$\frac{1}{2}$	12·7
W	0·265	6·73
X	$1{\cdot}500 \pm 0{\cdot}031$	$38{\cdot}1 \pm 0{\cdot}8$

All dimensions in inches.
Millimetre dimensions derived.



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

AEI Ignitrons

BK146
BK146A
BK146B

The BK146 is a size D stainless-steel-jacketed water-cooled ignitron primarily designed for use in three phase frequency changing resistance welders. It is equivalent to the American 5553A.

The BK146A has integral type temperature control with built in temperature switches. It is equivalent to the American 6348.

The BK146B has provision for mounting a detachable thermostat for temperature control, as described in the Preamble. It is equivalent to the American 5553B.

GENERAL

Number of electrodes		
Main anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc voltage drop (approx)		
At 1115A instantaneous	17	V
At 13600A	36	V
Weight (approx)		
Net weight	21	lb
Shipping weight (home pack)	33	lb
Shipping weight (overseas)	54	lb
Cooling water		
Minimum flow	3	gal/min
Minimum inlet temperature	10	°C
Maximum outlet temperature	40	°C
Pressure drop at 3 gal/min	5	lb/in^2
Maximum water temperature rise	9	°C
Time for which water flow must be maintained after switching off	30	min

MAXIMUM RATINGS

Frequency Changer Resistance Welding Service or Power Rectifier Service (Intermittent Duty)

Peak anode voltage (forward or inverse)	600	1200	1500	V
Maximum anode current				
Peak	4000	3000	2400	A
Corresponding average	54	40	32	A
Average	190	140	112	A
Corresponding peak	1140	840	672	A
Maximum averaging time	6·25	6·25	6·25	s
Maximum peak fault current	50,000	37,500	30,000	A
Maximum duration of fault	0·15	0·15	0·15	s

IGNITOR RATINGS

Maximum peak inverse voltage	5·0	V
Maximum ignitor current		
peak	100	A
r.m.s.	10	A
average	1·0	A
maximum averaging time	5·0	s

IGNITOR CIRCUIT REQUIREMENTS

Anode firing

Maximum voltage	Anode voltage	
Ignitor voltage required to fire	200	V
Ignitor current required to fire	30	A
Starting time at required voltage or current	100	µs

Separate excitation

Open circuit voltage of excitation circuit		
maximum	750	V
minimum	450	V
Short circuit current of excitation circuit		
maximum	75	A
minimum	45	A
Length of firing pulse (approx sine wave)		
recommended	500	µs
minimum (for average anode currents greater than 20A)	150	µs

TEMPERATURE CONTROLLED TYPES

BK146A

Water control switch (normally open)		
Closes at (approx)	36	°C
Over-temperature switch (normally closed)		
Opens at (approx)	45	°C
Electrical rating		
Voltage (a.c.) 125 250 440 600V		
Current (a.c.) 3·0 1·5 1·0 0·5A		
Maximum peak voltage between switch contacts and ignitron envelope	1000	V

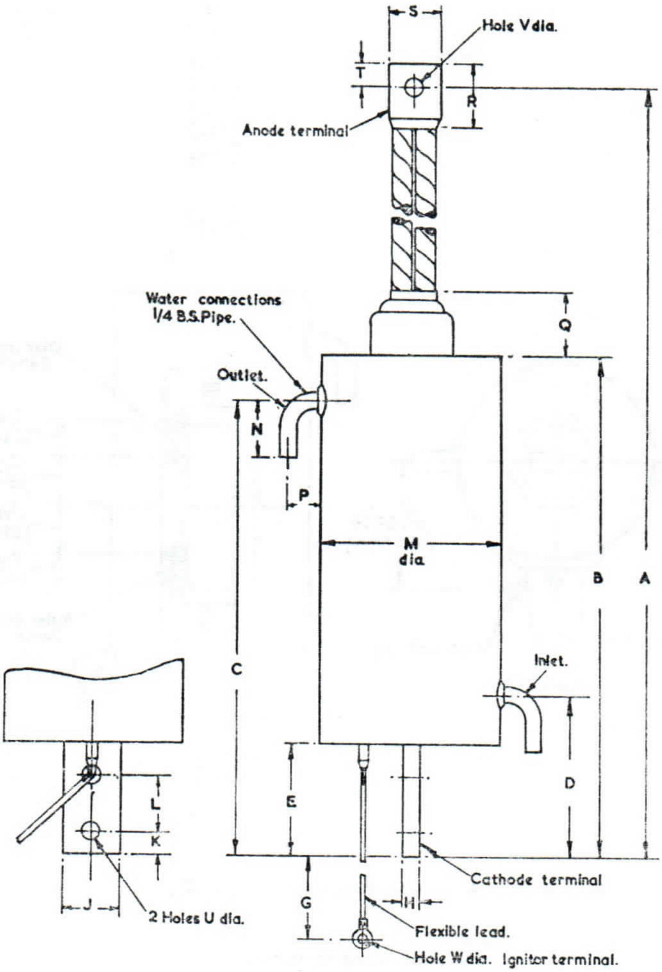
BK146B

Water control thermostat (normally open)		
Klixon type C4391-7-51 Closes at (approx)	36	°C
Over-temperature thermostat (normally closed)		
Klixon type C4391-7-52 Opens at (approx)	52	°C
Electrical rating		
Voltage (a.c.) 125 250 440 600V		
Current (a.c.) 3·0 1·5 1·0 0·5A		
Maximum peak voltage between switch contacts and ignitron envelope	1000	V

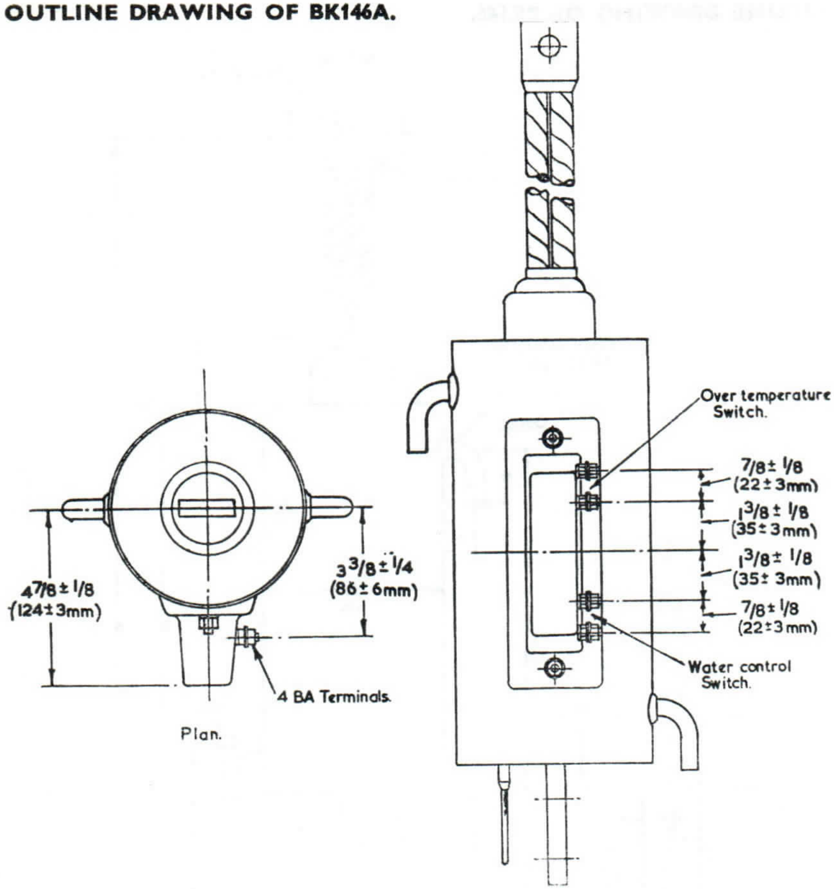
Dimension	Inches	Millimetres
A	26⅛ ± ¾	664 ± 19
B	15⅜ ± ¾	391 ± 19
C	14 ± ¼	356 ± 6
D	5 ± ¼	127 ± 6
E	3½ ± ⅜	89 ± 10
G	4 ± ¼	102 ± 6
H	0·500 ± 0·031	12·7 ± 0·8
J	1·750 ± 0·062	44·5 ± 1·5
K	0·750 ± 0·062	19·0 ± 1·5
L	1·750 ± 0·031	44·5 ± 0·8
M	5½ ± ⅛	140 ± 3
N	1¾ ± ¼	44 ± 6
P	1 ± ⅛	25 ± 3
Q	2 ± ⅜	51 ± 10
R	2 ± ¼	51 ± 6
S	1·625 ± 0·062	41·3 ± 1·5
T	0·750 ± 0·062	19·0 ± 1·5
U	9/16	14·3
V	9/16	14·3
W	0·265	6·73

All dimensions in inches.
Millimetre dimensions derived.

OUTLINE DRAWING OF BK146.



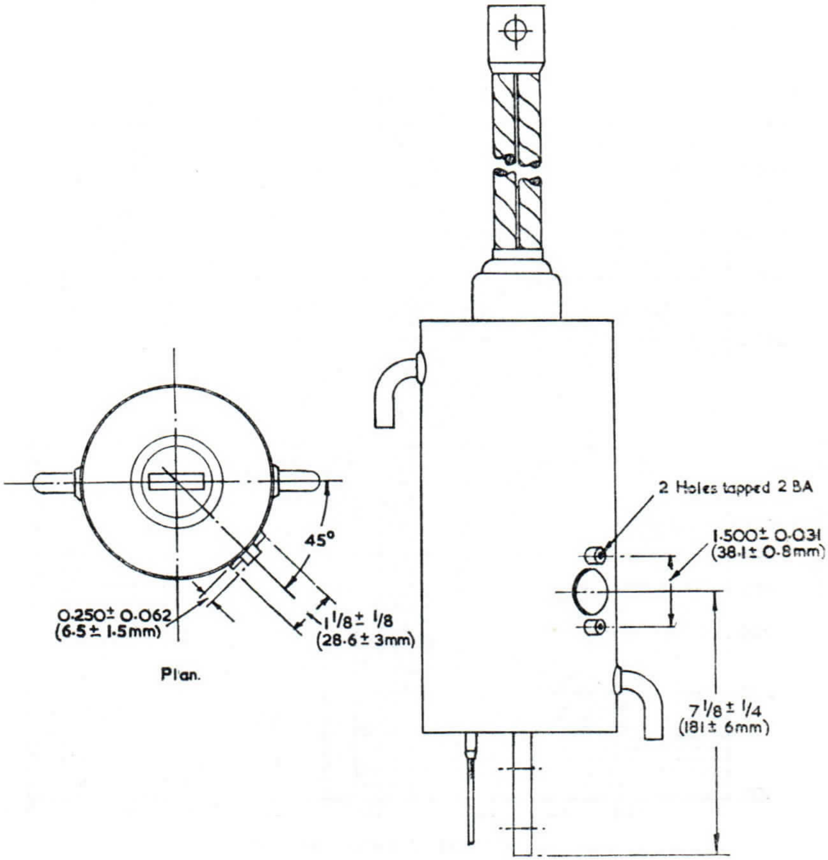
OUTLINE DRAWING OF BK146A.



All other dimensions as BK146.

All dimensions in inches.
Millimetre dimensions derived.

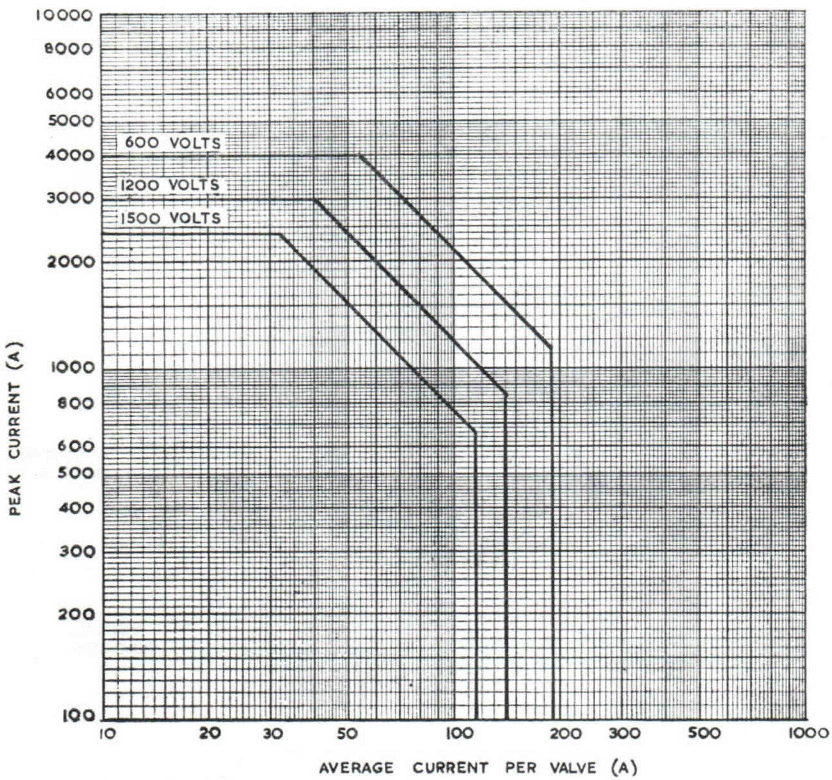
OUTLINE DRAWING OF BK146B.



All other dimensions as BK146.

All dimensions in inches.
Millimetre dimensions derived.

THREE-PHASE WELDER CONTROL SERVICE



AEI Ignitrons

BK168
BK168A
BK168B

The BK168 is a size C stainless-steel-jacketed water-cooled ignitron primarily designed for use in three-phase frequency changing resistance welders. It is equivalent to the American 5822.

The BK168A has integral type temperature control with built in temperature switches. It is equivalent to the American 6511.

The BK168B has provision for mounting a detachable thermostat for temperature control, as described in the Preamble. It is equivalent to the American 5822A.

GENERAL

Number of electrodes		
Main anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc voltage drop (approx)		
At 1500A instantaneous	25	V
Weight (approx)		
Net weight	8½	lb
Shipping weight (home pack)	13½	lb
Shipping weight (overseas)	24	lb
Cooling water		
Minimum flow	1½	gal/min
Minimum inlet temperature	10	°C
Maximum outlet temperature	40	°C
Pressure drop at 1½ gal/min	4·5	lb/in^2
Maximum water temperature rise	6	°C
Time for which water flow must be maintained after switching off	15	min

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

MAXIMUM RATINGS

Frequency Changer Resistance Welding Service or Power Rectifier Service (Intermittent Duty)

Peak anode voltage (forward or inverse)	1200	1500	V
Maximum anode current			
Peak	1500	1200	A
Corresponding average	20	16	A
Average	70	56	A
Corresponding peak	420	336	A
Maximum averaging time	6·25	6·25	s
Maximum peak fault current	18750	15000	A
Maximum duration of fault	0·15	0·15	s

IGNITOR RATINGS

Maximum peak inverse voltage	5·0	V
Maximum ignitor current		
peak	100	A
r.m.s.	10	A
average	1·0	A
maximum averaging time	5·0	s

IGNITOR CIRCUIT REQUIREMENTS

Anode firing

Maximum voltage	Anode voltage	
Ignitor voltage required to fire	200	V
Ignitor current required to fire	30	A
Starting time at required voltage or current	100	μs

Separate excitation

Open circuit voltage of excitation circuit		
maximum	750	V
minimum	450	V
Short circuit current of excitation circuit		
maximum	75	A
minimum	45	A
Length of firing pulse (approx sine wave)		
recommended	500	μs
minimum (for average anode currents greater than 20A)	150	μs

TEMPERATURE CONTROLLED TYPES

BK168A

Water control switch (normally open) Closes at (approx)	36	°C
Over-temperature switch (normally closed) Opens at (approx)	45	°C

Electrical rating

Voltage (a.c.)	125	250	440	600V
Current (a.c.)	3·0	1·5	1·0	0·5A

Maximum peak voltage between switch contacts and ignitron envelope	1000	V

BK168B

Water control thermostat (normally open) Klixon type C4391-7-51 Closes at (approx)	36	°C
Over-temperature thermostat (normally closed) Klixon type C4391-7-52 Opens at (approx)	52	°C

Electrical rating

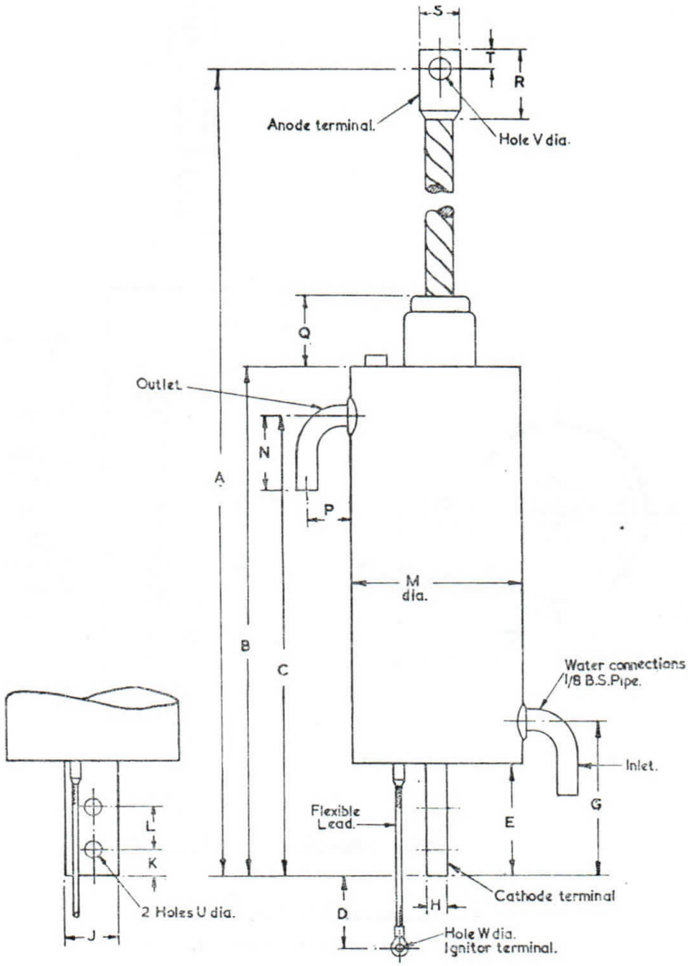
Voltage (a.c.)	125	250	440	600V
Current (a.c.)	3·0	1·5	1·0	0·5A

Maximum peak voltage between switch contacts and ignitron envelope	1000	V

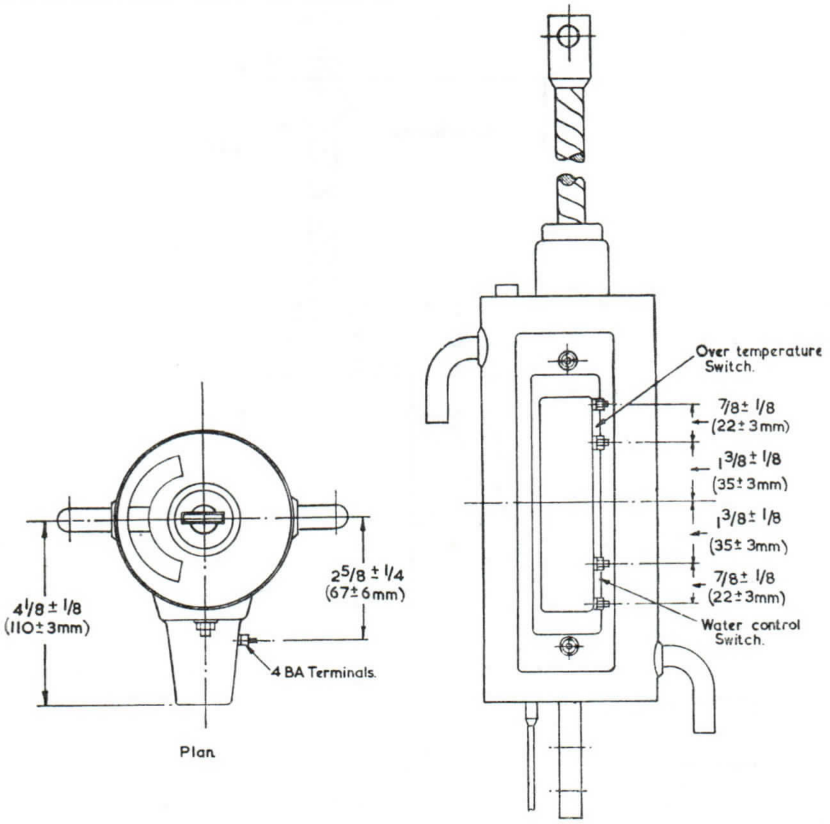
Dimension	Inches	Millimetres
A	25 ± 3/4	635 ± 19
B	11 3/4 ± 3/4	298 ± 19
C	10 5/8 ± 1/4	270 ± 6
D	5 1/2 ± 1/4	140 ± 6
E	2 5/8 ± 1/4	67 ± 6
G	3 5/8 ± 1/4	92 ± 6
H	0·500 ± 0·031	12·7 ± 0·8
J	1·250 ± 0·062	31·7 ± 1·5
K	0·625 ± 0·062	16·9 ± 1·5
L	1·000 ± 0·031	25·4 ± 0·8
M	4 ± 1/8	102 ± 3
N	1 3/4 ± 1/4	44 ± 6
P	1 ± 1/8	25 ± 3
Q	1 5/8 ± 1/4	41 ± 6
R	1 5/8 ± 1/8	41 ± 3
S	1·000 ± 0·062	25·4 ± 1·5
T	0·500 ± 0·062	12·7 ± 1·5
U	7/16	11·1
V	1/2	12·7
W	0·265	6·73

All dimensions in inches.
Millimetre dimensions derived.

OUTLINE DRAWING OF BK168.



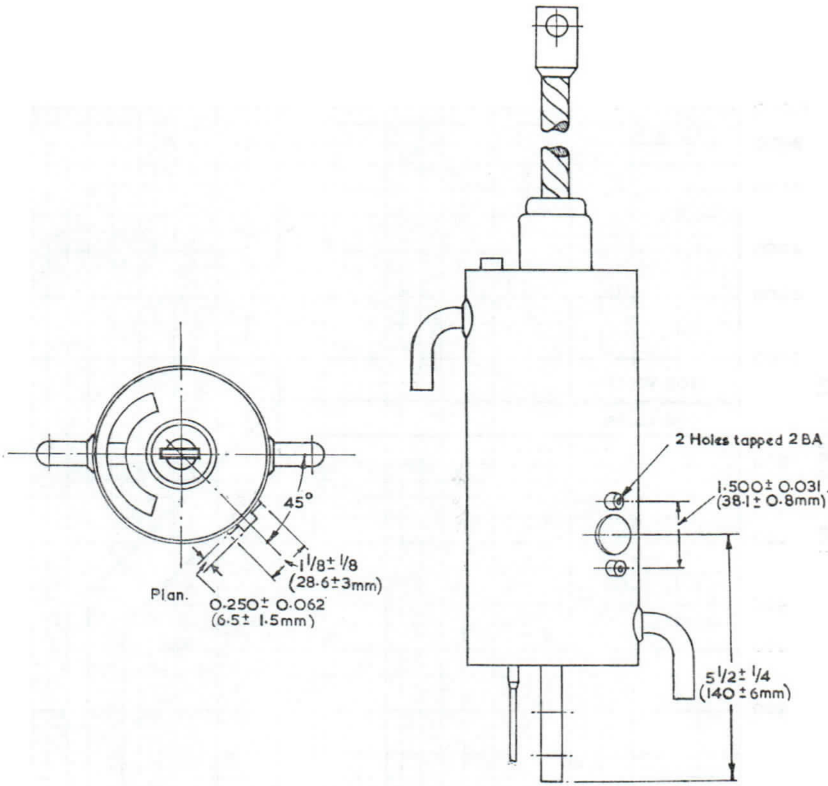
OUTLINE DRAWING OF BK168A.



All other dimensions as BK168.

All dimensions in inches.
Millimetre dimensions derived.

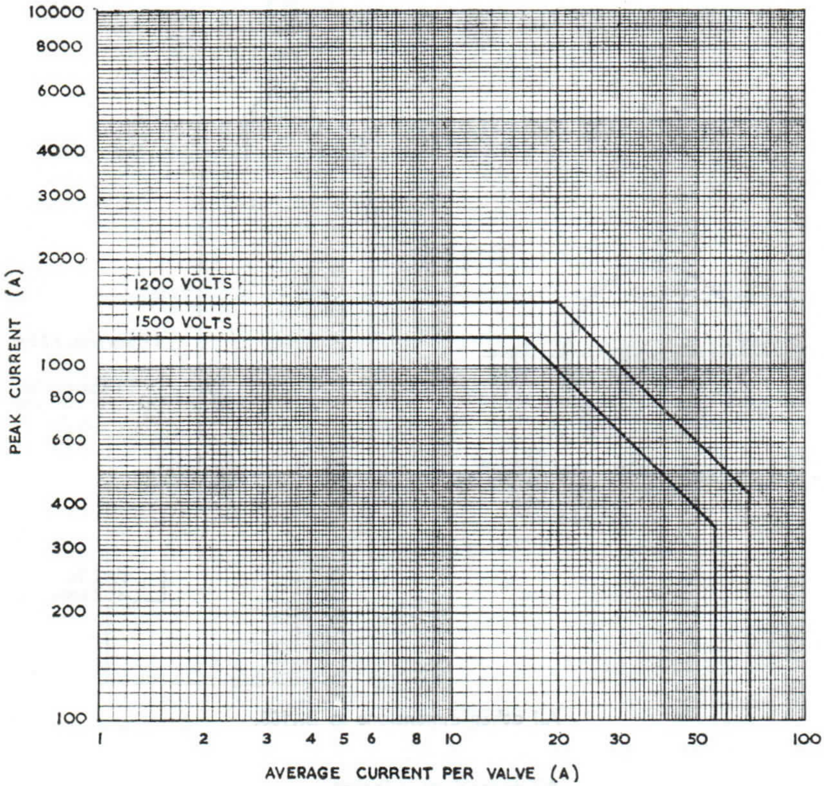
OUTLINE DRAWING OF BK168B.



All other dimensions as BK168.

All dimensions in inches.
Millimetre dimensions derived.

THREE-PHASE WELDER CONTROL SERVICE



AEI Ignitron BK178

The BK178 is a size D stainless-steel-jacketed, water-cooled ignitron. It is designed for use as a switch in capacitor discharge circuits.

GENERAL

Number of electrodes						
Main anode					1	
Auxiliary anode					1	
Cathode (mercury pool)					1	
Ignitors					2	
Arc drop (approx)						
Instantaneous current	5	10	20	30	40	kA
Arc drop (approx)	20	25	35	45	60	V
Weight (approx)						
Net weight					21	lb
Shipping weight (home pack)					33	lb
Shipping weight (overseas)					54	lb
Cooling water						
Minimum flow					0·5	gal/min
Minimum inlet temperature					15	°C
Recommended maximum inlet temperature					25	°C
Maximum outlet temperature					30	°C
Pressure drop at 0·5 gal/min					0·3	lb/in^2

MAXIMUM RATINGS

Capacitor Discharge Service

Peak anode voltage: forward or inverse	25	kV
Anode current		
peak	40,000	A
fault	100,000	A
duration of fault	0·002	s
rate of rise of current	1000	A/μs
Ampere-seconds per pulse	200	A.s
Duration of pulse	150	ms
Pulse frequency—once per	5	s

AUXILIARY ANODE

Voltage		
peak forward	200	V
peak inverse		
anode conducting	25	V
anode not conducting	160	V
Current		
peak	30	A
r.m.s.	15	A
mean	9	A
averaging time	10	s

IGNITOR RATINGS

Maximum peak inverse voltage	5·0	V
Maximum ignitor current		
peak	100	A
r.m.s.	15	A
average	2·0	A
maximum averaging time	5·0	s

IGNITOR CIRCUIT REQUIREMENTS

The following separate excitation circuit is recommended. A 0·25μF capacitor is charged to 1500V and discharged through the ignitor and cathode with a current limiting resistor of 2 to 6 ohms.

RECOMMENDED OPERATING INSTRUCTIONS

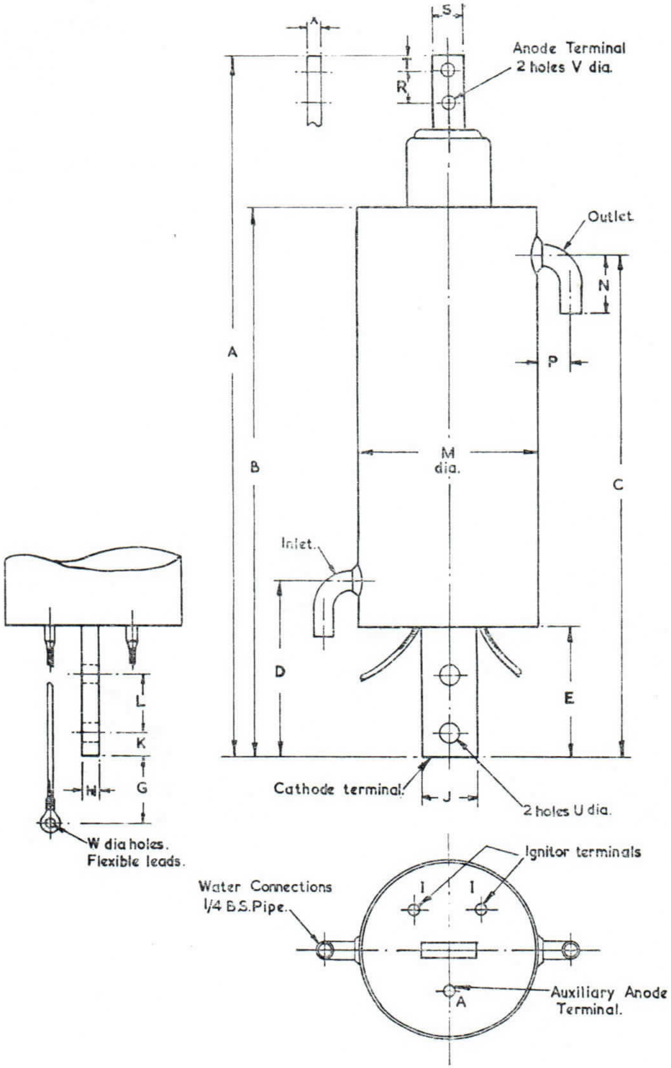
Care should be taken to keep the glass bushing, the anode lead and the stress shields free from mercury. The ignitron should always be kept upright and not tilted far enough to allow mercury to flow into the anode end. Before the ignitron is operated, the bushing and anode terminal assembly should be heated, for example by infra-red lamps, long enough to disperse any mercury condensed on or clinging to them; and it may be desirable to continue the heating throughout the period of operation. During short shut-down periods, it may be advantageous to maintain the heating or to shield the anode bushing from draughts, in order to reduce the possibility of mercury condensation which would necessitate further heating.

It is recommended that before an ignitron is put into service, it should be aged to withstand a peak voltage of 30-35 kV in either direction for one minute without breakdown. This may be accomplished by the application of a variable voltage, either a.c. or d.c. according to convenience, through a current limiting impedance, for example 100,000 to 200,000 ohms. It is useful to connect a capacitor of around 500 pF between anode and cathode, and when the supply is d.c. the series resistance may conveniently be increased to some tens of megohms, to limit the frequency of breakdowns for convenience of observation.

In exceptional circumstances, for example when currents of excessive peak value have been carried, a valve may suffer deterioration in its ability to withstand high voltage. In such cases, it is often possible to restore the high voltage characteristics by operating the ignitron in a low-voltage circuit at supply frequency, so that it carries a mean current of 20-30 A for 10-30 minutes; the flow of cooling water should be maintained at 0·5 gal/min during this process. The ignitron should be allowed to cool to atmospheric temperature before high voltage is applied.

Dimension	Inches	Millimetres
A	20¼ ± ¾	514 ± 19
B	15⅜ ± ¾	391 ± 19
C	14 ± ¼	356 ± 6
D	5 ± ¼	127 ± 6
E	3½ ± ⅜	89 ± 10
G	4 ± ¼	102 ± 6
H	0·500 ± 0·031	12·7 ± 0·8
J	1·750 ± 0·062	44·5 ± 1·5
K	0·750 ± 0·062	19·0 ± 1·5
L	1·750 ± 0·031	44·5 ± 0·8
M	5½ ± ⅛	140 ± 3
N	1¾ ± ¼	44 ± 6
P	1 ± ⅛	25 ± 3
Q	1¾ ± ¼	44 ± 6
R	1·000 ± 0·031	25·4 ± 0·8
S	1·000 ± 0·062	25·4 ± 1·5
T	0·500 ± 0·062	12·7 ± 1·5
U	9/16	14·3
V	½	12·7
W	0·265	6·73
X	0·500 ± 0·031	12·7 ± 0·8

All dimensions in inches.
Millimetre dimensions derived.



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

AEI Ignitron

BK194

The BK194 is a size E stainless-steel-jacketed water-cooled ignitron. It is designed for use as a switch in capacitor discharge circuits.

GENERAL

Number of electrodes					
Main anode				1	
Auxiliary anode				1	
Cathode (mercury pool)				1	
Ignitors				2	
Arc drop (approx)					
Instantaneous current	20	40	60	80	kA
Arc drop (approx)	22	28	42	52	V
Weight (approx)					
Net weight				45	lb
Shipping weight				90	lb
Cooling water					
Minimum flow				0·5	gal/min
Minimum inlet temperature				15	°C
Recommended maximum inlet temperature				25	°C
Maximum outlet temperature				30	°C
Pressure drop at 0·5 gal/min				0·2	lb/in²

MAXIMUM RATINGS

Capacitor Discharge Service

Peak anode voltage: forward or inverse	25	kV
Anode current		
peak	80,000	A
fault	150,000	A
duration of fault	0·002	s
rate of rise of current	2000	A/μs
Ampere-seconds per pulse	400	A.s
Duration of pulse	150	ms
Pulse frequency—once per	5	s

AUXILIARY ANODE

Voltage		
peak forward	200	V
peak inverse		
anode conducting	25	V
anode not conducting	160	V
Current		
peak	30	A
r.m.s.	15	A
mean	9	A
averaging time	10	s

IGNITOR RATINGS

Maximum peak inverse voltage	5·0	V
Maximum ignitor current		
peak	100	A
r.m.s.	15	A
average	2·0	A
maximum averaging time	5·0	s

IGNITOR CIRCUIT REQUIREMENTS

The following separate excitation circuit is recommended. A 0·25μF capacitor is charged to 1500V and discharged through the ignitor and cathode with a current limiting resistor of 2 to 6 ohms.

RECOMMENDED OPERATING INSTRUCTIONS

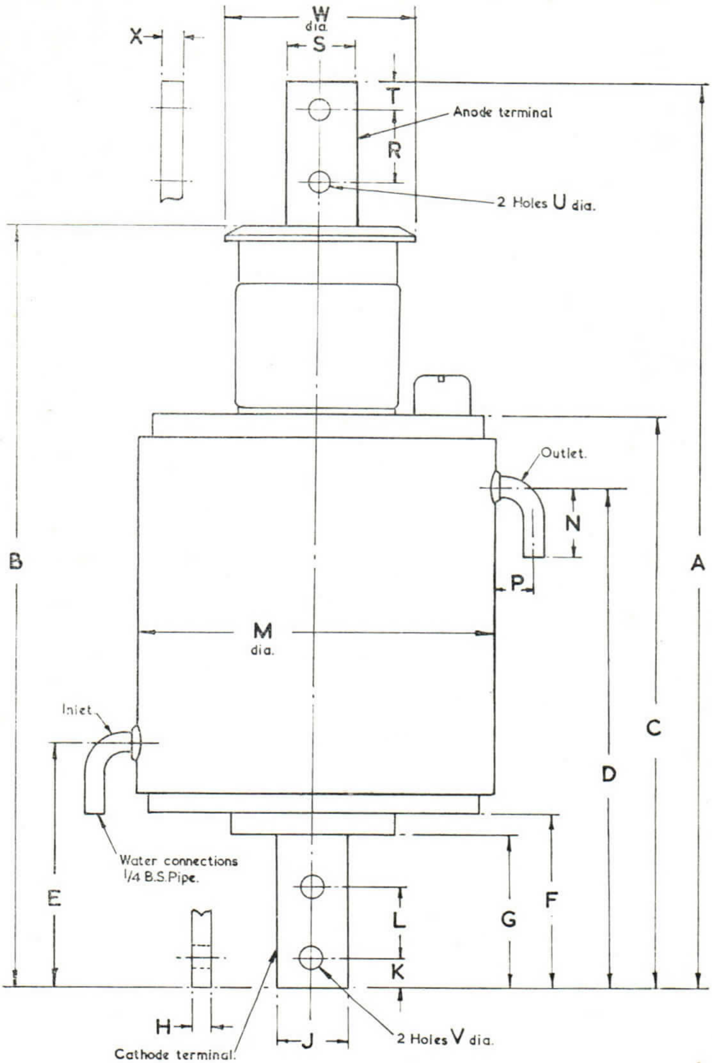
Care should be taken to keep the glass bushing, the anode lead and the stress shields free from mercury. The ignitron should always be kept upright and not tilted far enough to allow mercury to flow into the anode end. Before the ignitron is operated, the bushing and anode terminal assembly should be heated, for example by infra-red lamps, long enough to disperse any mercury condensed on or clinging to them; and it may be desirable to continue the heating throughout the period of operation. During short shut-down periods, it may be advantageous to maintain the heating or to shield the anode bushing from draughts, in order to reduce the possibility of mercury condensation which would necessitate further heating.

It is recommended that before an ignitron is put into service, it should be aged to withstand a peak voltage of 30-35 kV in either direction for one minute without breakdown. This may be accomplished by the application of a variable voltage, either a.c. or d.c. according to convenience, through a current limiting impedance, for example 100,000 to 200,000 ohms. It is useful to connect a capacitor of around 500 pF between anode and cathode, and when the supply is d.c. the series resistance may conveniently be increased to some tens of megohms, to limit the frequency of breakdowns for convenience of observation.

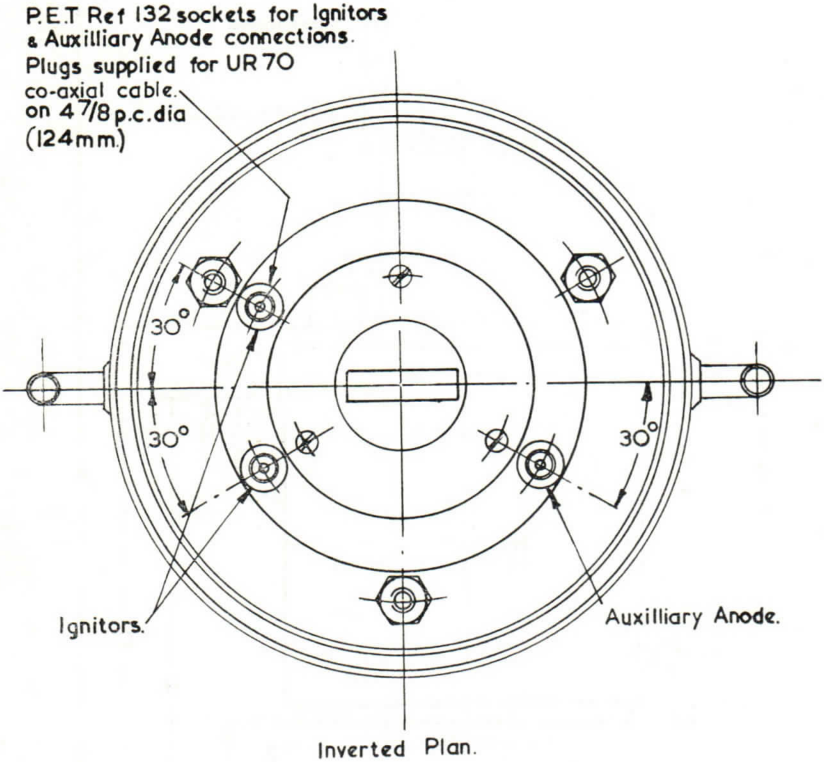
In exceptional circumstances, for example when currents of excessive peak value have been carried, a valve may suffer deterioration in its ability to withstand high voltage. In such cases, it is often possible to restore the high voltage characteristics by operating the ignitron in a low-voltage circuit at supply frequency, so that it carries a mean current of 20-30A for 10-30 minutes; the flow of cooling water should be maintained at 0·5 gal/min during this process. The ignitron should be allowed to cool to atmospheric temperature before high voltage is applied.

Dimension	Inches	Millimetres
A	22 ± ½	559 ± 13
B	18½ ± ½	470 ± 13
C	14 ± ½	356 ± 13
D	12¼ ± ¼	311 ± 6
E	6 ± ¼	152 ± 6
F	4⅛ ± ¼	105 ± 6
G	3¾ ± ¼	95 ± 6
H	0·500 ± 0·031	12·7 ± 0·8
J	1·750 ± 0·062	44·5 ± 1·5
K	0·750 ± 0·062	19·0 ± 1·5
L	1·750 ± 0·031	44·5 ± 0·8
M	8·938 ± 0·125	227 ± 3
N	1¾ ± ¼	44 ± 6
P	1 ± ⅛	25 ± 3
R	1·750 ± 0·031	44·5 ± 0·8
S	1·750 ± 0·062	44·5 ± 1·5
T	0·750 ± 0·062	19·0 ± 1·5
U	9/16	14·3
V	9/16	14·3
W	4·750 ± 0·062	121 ± 1·5
X	0·500 ± 0·031	12·7 ± 0·8

All dimensions in inches.
Millimetre dimensions derived.



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435



Inverted Plan.

AEI Ignitron **BK238**

The BK238 is a small air-cooled glass envelope ignitron, primarily designed or demonstrating the operating principles of ignitors and ignitrons in general, in Technical Colleges and Universities. It can also be used by Service Engineers as a useful tool for checking operation in faulty equipment. It is equivalent to the American 5779.

GENERAL

Number of electrodes		
Main anode	1	
Auxiliary anode	1	
Cathode	1	
Ignitor	1	
Arc voltage drop (approx)		
At 15A instantaneous	13	V
Weight (approx)		
Net weight	20	oz
Shipping weight	45	oz
Cooling Air*		
Maximum average bulb temperature	100	°C
Minimum bulb temperature	10	°C

*A desk fan is usually adequate

MAXIMUM RATINGS

Power Rectifier Service

Peak anode voltage (forward or inverse)	350	V
Maximum anode current		
peak	50	A
average	10	A
maximum averaging time	10	s
fault	300	A
maximum duration of fault	0·03	s
Frequency	25-60	c/s

Cathode

Maximum average current	10	A

Auxiliary anode

Peak voltage		
forward	160	V
inverse		
main anode not conducting	160	V
main anode conducting	25	V
Maximum current		
peak	30	A
average	5	A
maximum averaging time	10	s

IGNITOR RATINGS

Maximum peak inverse voltage	5·0	V
Maximum ignitor current		
peak	100	A
r.m.s.	10	A
average	1·0	A
maximum averaging time	5·0	s

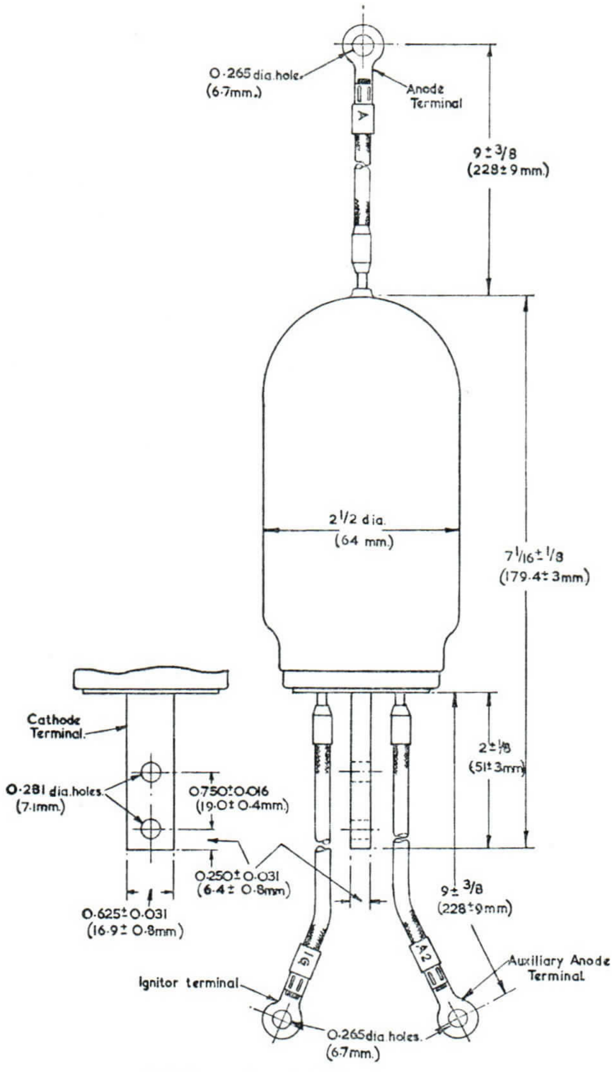
IGNITOR CIRCUIT REQUIREMENTS

Anode firing

Maximum voltage	Anode voltage	
Ignitor voltage required to fire	200	V
Ignitor current required to fire	30	A
Starting time at required voltage or current	100	µs

Separate excitation

Open circuit voltage of excitation circuit		
maximum	750	V
minimum	450	V
Short circuit current of excitation circuit		
maximum	75	A
minimum	45	A
Length of firing pulse (approx sine wave)		
recommended	500	µs



All dimensions in inches.
Millimetre dimensions derived.

AEI Ignitron BK300B

The BK300B is a size B stainless-steel-jacketed water-cooled ignitron designed to control the high current short duration pulses required in pulse welding service. It is of coaxial design in which the current flows down the ignitron from anode to cathode and then up walls to the cathode flange terminal at the top.

The BK300B has provision for mounting a detachable thermostat for temperature control, as described in the Preamble. It is equivalent to the American 7670.

GENERAL

Number of electrodes		
Main anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc voltage drop (approx)		
At 150A	13	V
At 2000A	22	V
Weight (approx)		
Net weight (approx)	3¾	lb
Shipping weight (home pack)	9	lb
Shipping weight (overseas)	20	lb
Cooling water		
Minimum flow	1	gal/min
Minimum inlet temperature	10	°C
Maximum outlet temperature	35	°C
Pressure drop at 1 gal/min	1·8	lb/in²
Maximum water temperature rise	4	°C
Time for which water flow must be maintained after switching off	10	min

MAXIMUM RATINGS

Pulse Welder Service

Peak anode voltage (forward and inverse)	2500	V
Initial inverse voltage (immediately after conduction)	1250	V
Peak anode current	2000	A
Average anode current	10	A
Averaging time	2·0	s
Pulse repetition rate	50-60	p/s
Anode current pulse width	1000	µs

IGNITOR RATINGS

Maximum peak inverse voltage	5·0	V
Maximum ignitor current		
peak	100	A
r.m.s.	10	A
average	1·0	A
maximum averaging time	5·0	s

IGNITOR CIRCUIT REQUIREMENTS

Anode firing

Maximum voltage	Anode voltage	
Ignitor voltage required to fire	200	V
Ignitor current required to fire	30	A
Starting time at required voltage or current	100	µs

Separate excitation

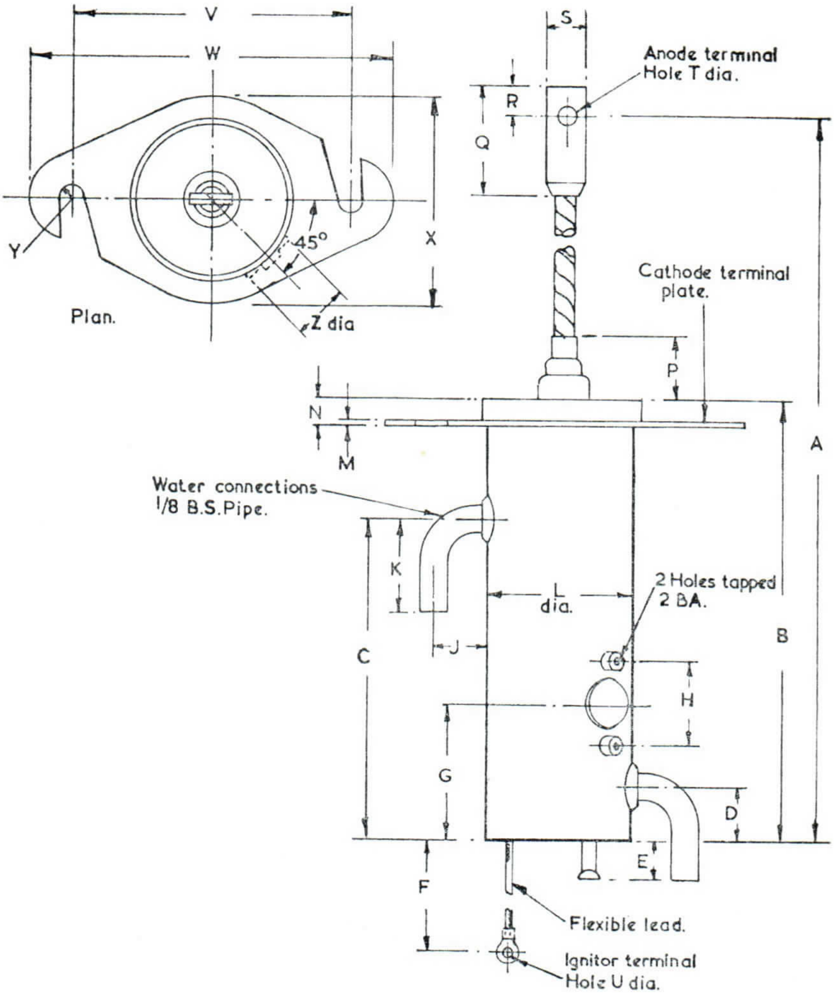
Open circuit voltage of excitation circuit		
maximum	750	V
minimum	450	V
Short circuit current of excitation circuit		
maximum	75	A
minimum	45	A
Length of firing pulse (approx sine wave)		
recommended	500	µs
minimum (for average anode currents greater than 20A)	150	µs

THERMOSTAT RATINGS

Water control thermostat (normally open)		
Klixon type C4391-7-51 Closes at (approx)	36	°C
Over-temperature thermostat (normally closed)		
Klixon type C4391-7-52 Opens at (approx)	52	°C
Electrical rating		
Voltage (a.c.) 125 250 440 600V		
Current (a.c.) 3·0 1·5 1·0 0·5A		
Maximum peak voltage between switch contacts and ignitron envelope	1000	V

Dimension	Inches			Millimetres		
A	20½	±	⅝	521	±	16
B	7¾	±	½	197	±	13
C	5¾	±	¼	146	±	6
D	1	±	¼	25	±	6
E	⅝	max		16	max	
F	7⅜	±	⅜	187	±	10
G	2½	±	¼	64	±	6
H	1·500	±	0·031	38·1	±	0·8
J	1	±	⅛	25	±	3
K	1¾	±	¼	44	±	6
L	2⅝	±	⅛	67	±	3
M	0·125	±	0·031	3	±	0·8
N	⅝	±	⅛	16	±	3
P	1⅛	±	¼	29	±	6
Q	2	max		51	max	
R	0·500	±	0·062	12·7	±	1·5
S	0·750	±	0·062	19·0	±	1·5
T	0·406			10·3		
U	0·265			6·73		
V	5·000	±	0·031	127	±	0·8
W	6½	±	⅛	165	±	3
X	3¾	±	⅛	95	±	3
Y	0·219			5·5		
Z	1⅛	±	⅛	29	±	3

All dimensions in inches.
Millimetre dimensions derived.


V
W
Y
X
45°
Z dia
Plan.
S
R
Q
Anode terminal
Hole T dia.
Cathode terminal
plate.
P
N
M
A
Water connections
1/8 B.S.Pipe.
K
L
dia.
J
2 Holes tapped
2 BA.
B
C
H
G
D
E
F
Flexible lead.
Ignitor terminal
Hole U dia.

AEI Ignitron BK302B

The BK302B is a size C stainless-steel-jacketed water-cooled ignitron designed to control the high current short duration pulses required in pulse welding service. It is of coaxial design in which the current flows down the ignitron from anode to cathode and then up walls to the cathode flange terminal at the top.

The BK302B has provision for mounting a detachable thermostat for temperature control, as described in the Preamble. It is equivalent to the American 7670.

GENERAL

Number of electrodes		
Main anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc voltage drop (approx)		
At 150A	13	V
At 4000A	26	V
Weight (approx)		
Net weight	8½	lb
Shipping weight (home pack)	20	lb
Shipping weight (overseas)	40	lb
Cooling water		
Minimum flow	1½	gal/min
Minimum inlet temperature	10	°C
Maximum outlet temperature	35	°C
Pressure drop at 1½ gal/min	5	lb/in²
Maximum water temperature rise	6	°C
Time for which water flow must be maintained after switching off	15	min

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

MAXIMUM RATINGS

Pulse Welder Service

Peak anode voltage (forward and inverse)	2500	V
Initial inverse voltage (immediately after conduction)	1250	V
Peak anode current	4000	A
Average anode current	20	A
Averaging time	2·0	s
Pulse repetition rate	50-60	p/s
Anode current pulse width	1000	µs

IGNITOR RATINGS

Maximum peak inverse voltage	5·0	V
Maximum ignitor current		
peak	100	A
r.m.s.	10	A
average	1·0	A
maximum averaging time	5·0	s

IGNITOR CIRCUIT REQUIREMENTS

Anode firing

Maximum voltage	Anode voltage	
Ignitor voltage required to fire	200	V
Ignitor current required to fire	30	A
Starting time at required voltage or current	100	µs

Separate excitation

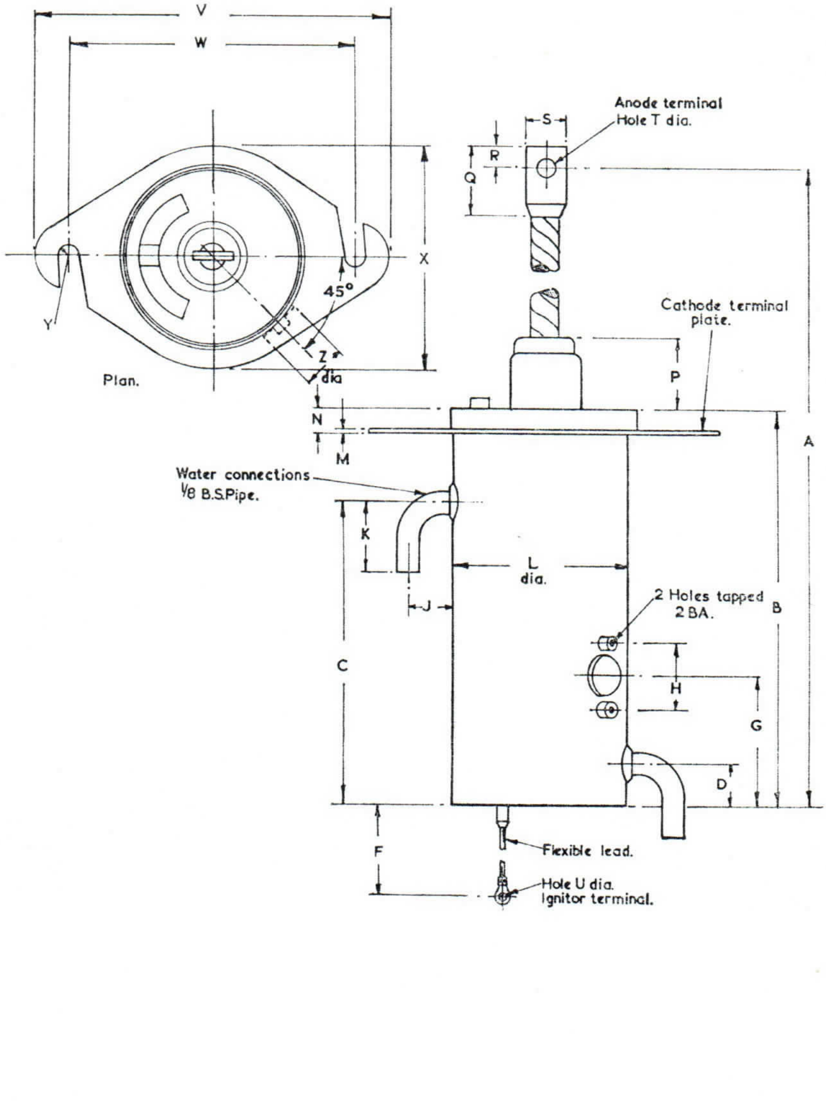
Open circuit voltage of excitation circuit	750	V
maximum	750	V
minimum	450	V
Short circuit current of excitation circuit		
maximum	75	A
minimum	45	A
Length of firing pulse (approx sine wave)		
recommended	500	µs
minimum (for average anode currents greater than 20A)	150	µs

THERMOSTAT RATINGS

Water control thermostat (normally open)		
Klixon type C4391-7-51 Closes at (approx)	36	°C
Over-temperature thermostat (normally closed)		
Klixon type C4391-7-52 Opens at (approx)	52	°C
Electrical rating		
Voltage (a.c.) 125 250 440 600V		
Current (a.c.) 3·0 1·5 1·0 0·5A		
Maximum peak voltage between switch contacts and ignitron envelope	1000	V

Dimension	Inches	Millimetres
A	$22\frac{1}{2} \pm \frac{3}{4}$	572 ± 16
B	$9\frac{1}{4} \pm \frac{1}{4}$	235 ± 6
C	$7\frac{1}{4} \pm \frac{1}{4}$	184 ± 6
D	$1 \pm \frac{1}{4}$	25 ± 6
F	$8 \pm \frac{3}{8}$	203 ± 10
G	$3 \pm \frac{1}{4}$	76 ± 6
H	$1{\cdot}500 \pm 0{\cdot}031$	$38{\cdot}1 \pm 0{\cdot}8$
J	$1 \pm \frac{1}{8}$	25 ± 3
K	$1\frac{3}{4} \pm \frac{1}{4}$	44 ± 6
L	$4 \pm \frac{1}{8}$	102 ± 3
M	$0{\cdot}125 \pm 0{\cdot}031$	$3 \pm 0{\cdot}8$
N	$\frac{5}{8} \pm \frac{1}{8}$	16 ± 3
P	$1\frac{5}{8} \pm \frac{1}{4}$	41 ± 6
Q	$1\frac{5}{8} \pm \frac{1}{8}$	41 ± 3
R	$0{\cdot}500 \pm 0{\cdot}068$	$12{\cdot}7 \pm 1{\cdot}5$
S	$1{\cdot}000 \pm 0{\cdot}062$	$25{\cdot}4 \pm 1{\cdot}5$
T	$\frac{1}{2}$	12·7
U	0·265	6·73
V	$8 \pm \frac{1}{8}$	203 ± 3
W	$6{\cdot}500 \pm 0{\cdot}031$	$165{\cdot}1 \pm 0{\cdot}8$
X	$5 \pm \frac{1}{8}$	127 ± 3
Y	0·219	5·5
Z	$1\frac{1}{8} \pm \frac{1}{8}$	29 ± 3

All dimensions in inches.
Millimetre dimensions derived.



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Thyratrons

4400/52

DEFINITIONS

Valve Heating Time

The time required for the valve to attain the minimum working temperature with the specified voltage applied to the filament. In gas filled valves this is the time necessary for the cathode to reach its operating temperature. In mercury vapour valves it is also necessary for the condensed mercury temperature to reach a specified minimum value.

Condensed Mercury Temperature

The temperature of that part of the bulb where mercury vapour is condensing, which controls the vapour pressure. For a time after energizing the filament, the condensed mercury temperature continues to rise until an equilibrium value is reached. It may be measured by a fine wire thermocouple on the outside of the bulb.

Critical Grid Voltage

The value of negative grid voltage at which conduction begins for a given value of anode voltage. The relation between the two variables is shown graphically on the control characteristic.

Critical Grid Current

The instantaneous value of grid current immediately before conduction begins.

Arc Voltage Drop

The voltage between anode and cathode during conduction.

Recovery Time

The period between anode current extinction and the regaining of control by the grid.

Ionisation Time

The approximate time between applying a grid signal and the establishment of substantially constant arc voltage drop.

Commutation Factor

The product of the rate of decrease of anode current (Amperes/microsecond) immediately prior to current extinction and the rate of increase of inverse voltage (volts/microsecond) immediately after current extinction.

Rating

A condition of operation imposed fundamentally by the design. The following are among the most important:—

continued

Maximum Peak Anode Current

The instantaneous value of anode current which the valve will pass repeatedly without rise of arc voltage drop and reduction of valve life.

Maximum Average Current

The maximum value of average anode current which can be passed continuously over the averaging time.

Maximum Averaging Time

The time over which the anode current is to be averaged (including non-conducting periods). The total ampere-seconds of anode current integrated over this time must not exceed the product of the rated average current and averaging time.

Maximum Surge Current

The value of current which the valve can withstand without immediate damage under fault conditions prevailing for the time specified. Repeated applications of surge current may shorten valve life.

SELECTION OF VALVES

In choosing the type of valve for a particular application consideration should be given to the operating conditions imposed by the type of cathode employed, and the gas or vapour filling.

Cathode Type

The cathode may be either directly or indirectly heated, and before current can be drawn from the valve, must be at full operating temperature. The period required for this is the cathode heating time and is considerably shorter for directly heated cathodes than for indirectly heated cathodes.

Mercury Vapour Filling

In mercury vapour valves the valve heating time includes in addition to the heating time the period required for the vapour pressure to rise to the minimum value necessary to maintain an arc with a low voltage drop. Depending upon the valve type the valve heating time varies considerably. The vapour pressure is also partly determined by the ambient temperature. Most mercury vapour valves operate in a range 15°C to 40°C. Below the lower limit the vapour pressure may be insufficient to sustain the arc with

continued

Mercury Vapour Filling *continued*

low voltage drop. It will be realized that it is necessary to ensure that the valve is not exposed to draughts. Even a small draught may produce severe local cooling and consequent lowering of the mercury vapour pressure. Above the upper temperature limit the vapour pressure may be too high, resulting in breakdown below the rated anode voltage.

Mercury vapour valves may be subject to gas clean up. This however is overcome by ensuring that sufficient free mercury is available for vapourising during operation. For this reason the mercury vapour valve may provide longer operational life than an otherwise equivalent rare gas filled valve.

For pulsed operation there is little to choose between mercury vapour and rare gas filled valves, both being limited to a maximum pulse repetition rate of about 500 c/s on account of recovery time.

Rare Gas Filling

Whereas the pressure of mercury vapour is a function of temperature, the pressure of a rare gas is practically independent of temperature. Consequently the heating time is only that required by the cathode to reach operating temperature, of the order of 30 to 60 seconds and considerably shorter than that required by an otherwise equivalent mercury vapour valve. For the same reason the ambient temperature range is —55°C to +70°C, much wider than that for mercury vapour valves.

Depending upon the application, rare gas filled valves may be subject to shortened working life due to gas clean-up. This depends upon the frequency of operation, the number of positive ions near the anode at current extinction, and the negative voltage accelerating these ions towards the anode, whose surface they penetrate and are thus lost by absorption. As the process continues, eventually insufficient gas is available to sustain an arc with low voltage drop. When the valve is operating with an inductive load the inverse voltage rises rapidly at current extinction. This is a condition favourable to gas clean-up.

The liability to gas clean-up is measured in terms of a commutation factor. With the object of reducing the rate of gas clean-up, it is usual to specify a maximum commutation factor. Operation within this rated value may be achieved by the use of a 'cushioning' or 'snubbing' circuit consisting of a series connected resistor and capacitor connected from anode to cathode and limiting the rate of rise of inverse voltage.

Mixed Gas Filling

A third type of filling consists of a rare gas and mercury vapour, in conjunction with a directly heated cathode. When the cathode reaches its working temperature, initial operation is as for a rare gas filled valve. However at normal ambient temperatures

continued

Mixed Gas Filling *continued*

and when the mercury vapour has attained a suitable pressure, the arc changes over from rare gas to mercury vapour since the latter has a lower ionisation potential than the rare gas.

The advantages are therefore a relatively short valve heating time of some 30 to 60 seconds and an ambient temperature range of $-40°C$ to $+40°C$. Provided that operation is not prolonged in the ambient temperature range of $-40°C$ to $+10°C$, when the arc is maintained by the rare gas, gas clean-up will not be serious.

GENERAL OPERATIONAL RECOMMENDATIONS

The following recommendations should be interpreted in conjunction with British Standard Code of Practice CP.1005 Parts 1 and 2, 1954, "The Use of Electronic Valves".

Filament or Heater Voltage

Should be maintained within $\pm$ 5% of the specified value, measured at the valve pins. In the case of directly heated cathodes improved performance will be obtained by making the cathode connection to the centre tap of the filament transformer secondary winding. Where practicable it is advantageous if the filament supply is in quadrature (90°) with the anode supply.

Ratings

The limiting values shown in the valve data sheets are to be treated as absolute. The designer should ensure that supply voltage fluctuations and component tolerances do not result in the ratings being exceeded at any time.

Ambient Temperature Range

The valve heating time should be regarded as the minimum possible value. Whereas the operation of gas filled valves is substantially independent of ambient temperature, the pressure in mercury vapour types is a function of the condensed mercury temperature and is partly determined by the ambient temperature. Below the minimum value the vapour pressure may be too low to sustain the arc. Above the maximum value the pressure may be such as to cause loss of control. The valve should not be exposed to draughts.

Supply Frequency

As this is increased the time between successive conducting half cycles becomes shorter and consequently the time for de-ionisation. Hence the maximum supply frequency is a function of the recovery time. As the supply frequency is reduced the period for which the valve passes peak anode current is increased. Thus at reduced supply frequencies it is necessary to reduce the normal rated peak anode current. For operation at 25 c/s and less it is advisable to consult the manufacturers.

continued

The Grid Circuit

In gas or vapour filled valves the grid controls only the start of the arc discharge since once ionisation takes place the grid is covered with a sheath of positive ions. Consequently the arc cannot be extinguished by an increase in negative grid potential, but only when the anode voltage falls to zero.

Current flows in the grid circuit immediately before and also during conduction. Prior to conduction and with a negative grid potential, critical grid current is of the order of micro-amperes. During conduction the positive ions collected by the grid cause a current (of the order of milliamperes) to flow. Excessive values of this current may cause sputter and gas clean-up. For this reason it is necessary to limit the negative grid potential during conduction to a maximum value of 10 volts. This is achieved for a given value of arc current by inserting into the grid circuit a resistor of value such that the voltage drop across it, due to grid current, represents the difference between the applied negative grid potential and the maximum permissible negative grid potential of 10 volts. The grid current passed by each type of valve is given in the appropriate grid-ion characteristic.

The value of grid resistor must also be considered with respect to grid current prior to conduction. If the grid resistor is of too high a value, the voltage drop across it may result in the grid potential being less than the critical value, with consequent loss of control. For these reasons it is normal for both a maximum and a minimum value of grid resistor to be specified.

Operational Stability

When voltage surges, particularly those with high frequency components, appear in the supply voltage, a fraction of these are superimposed on the grid voltage by the anode-grid and grid-cathode capacities acting as a potential divider. Under certain conditions loss of control may result. The effect may be greatly reduced by connecting a condenser between the grid and cathode and as close to the valve as possible. The value of the condenser should be as high as possible consistent with the smallest phase shift and attenuation of the grid signal. When the valve is subject to the influence of a high frequency field the possibility of loss of control can be reduced by surrounding the valve with an earthed metal screen.

Installation

On installing a new mercury vapour valve or one which has been out of service for some time it is advisable, prior to operating the valve on load, to allow at least twice the normal heating time in order to ensure correct distribution of the free mercury in the valve; with large valves up to 30 minutes may be desirable.

AEI Mercury Thyratron BT5

The BT5 is a mercury-vapour thyratron intended for industrial control applications and ignitor firing service.

RATINGS—Absolute values

Maximum peak forward anode voltage	1·0	kV
Maximum peak reverse anode voltage	1·5	kV
Condensed mercury temperature limits	40 to 80	°C
Maximum peak anode current	12·5	A
Maximum peak anode current (ignitor firing service)	30	A
Maximum mean anode current (max averaging time 15 sec)	2·5	A
Maximum surge anode current (max duration 0·1 sec)	200	A
Maximum negative grid voltage before conduction	−500	V
Maximum negative grid voltage during conduction	−10	V
Maximum mean grid current	250	mA
Recommended maximum grid resistor	220	kΩ
Recommended minimum grid resistor	10	kΩ

CHARACTERISTICS

Cathode type	Indirectly heated	
Heater voltage	5·0	V
Maximum heater current	5·2	A
Mean heater current	4·7	A
Voltage drop (approx)	16	V
Cathode heating time	5	min
Ionisation time (approx)	10	μs
Recovery time (approx)	1000	μs
Anode/grid capacitance	4	pF
Grid/cathode capacitance	9	pF
Condensed mercury temperature rise above ambient		
At no load (approx)	40	°C
At full load (approx)	44	°C

MECHANICAL DATA

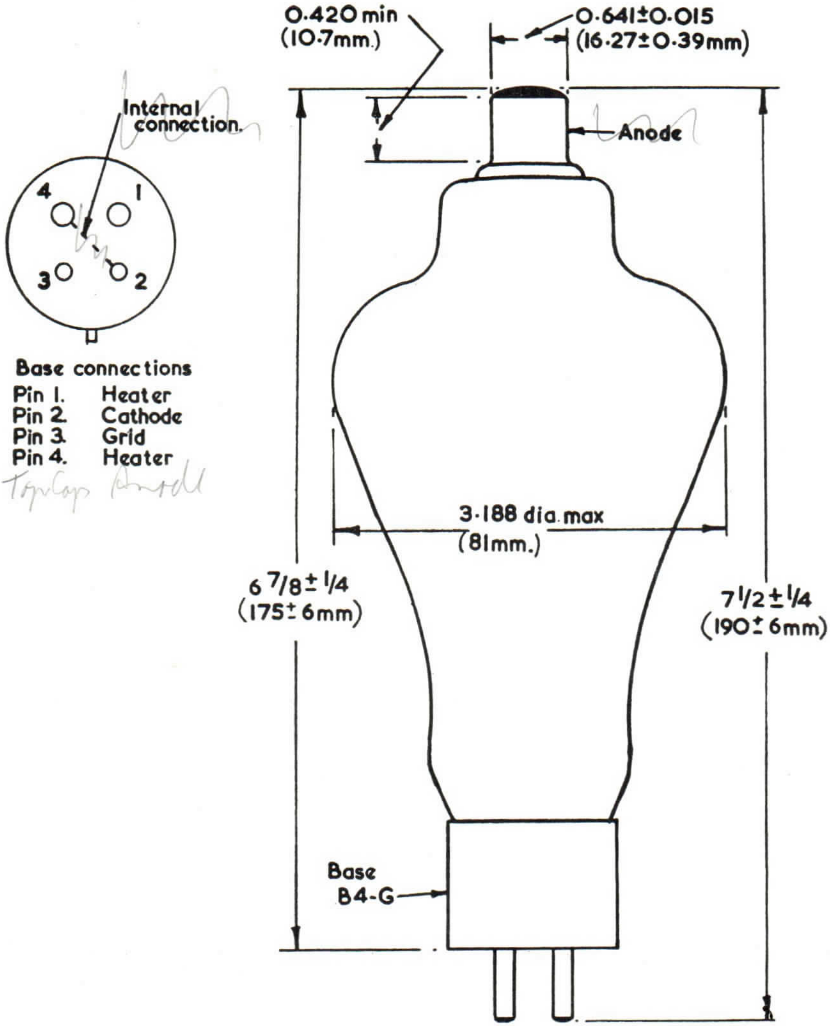
Type of cooling	Convection
Mounting position	Vertical, base down
Net weight (approx)	5 oz (140 gm)

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Issue 1
April 1962
4400-52/BT5

Mercury Thyratron

AEI



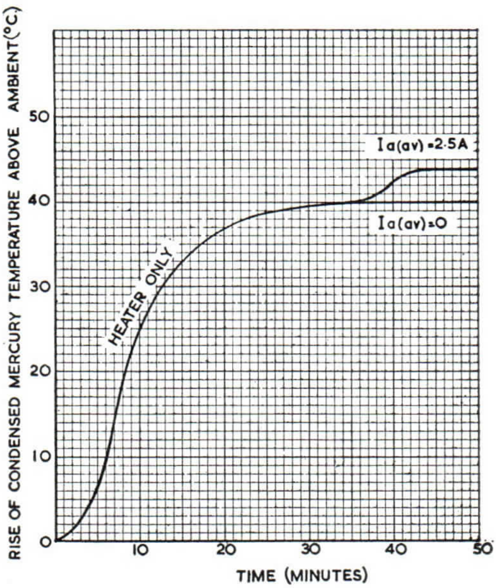
Base connections

Pin 1.	Heater
Pin 2.	Cathode
Pin 3.	Grid
Pin 4.	Heater

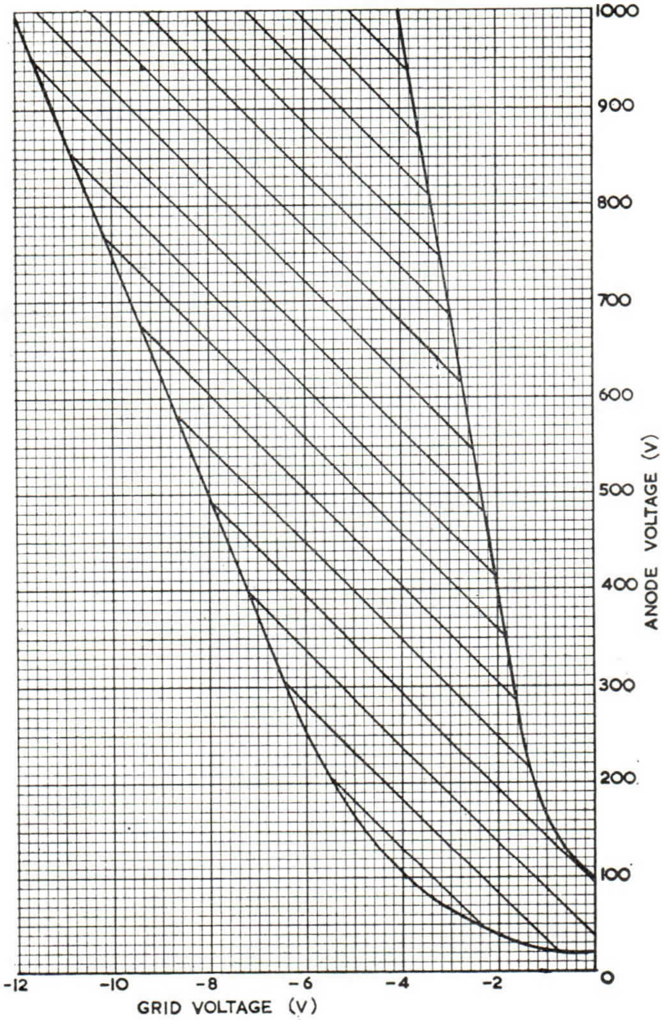
Top Cap Anode

All dimensions in inches.
Millimetre dimensions derived.

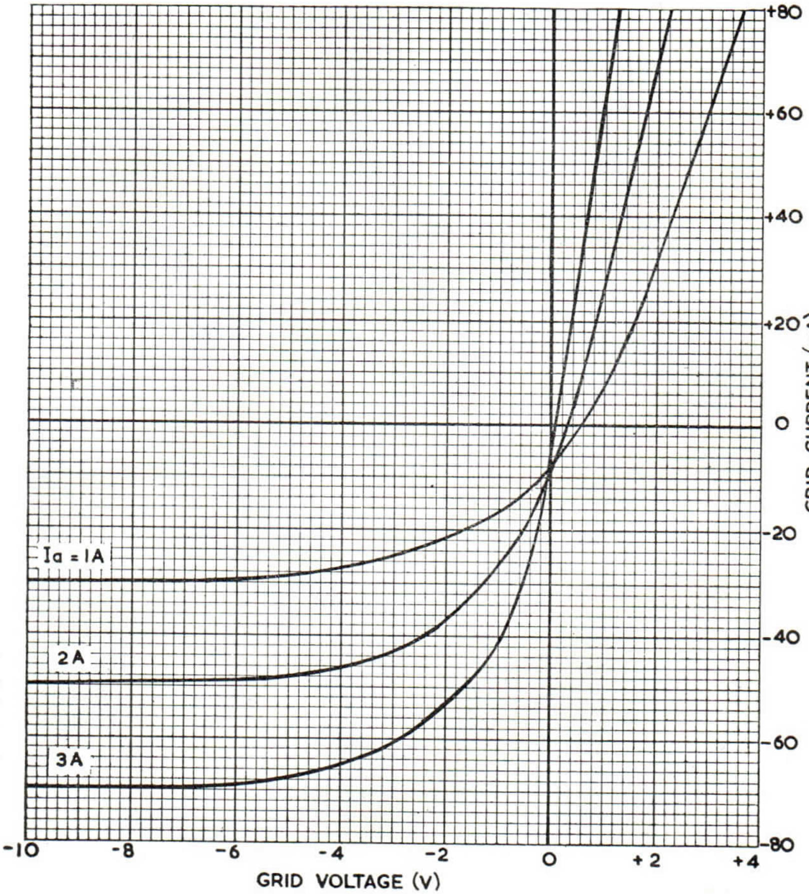
HEATING CHARACTERISTIC



CONTROL CHARACTERISTIC



GRID ION CHARACTERISTIC



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

AEI Mercury Thyratron BT17

The BT17 is a mercury-vapour thyratron intended for industrial control applications.

RATINGS—Absolute values

Maximum peak forward anode voltage	1·0	kV
Maximum peak reverse anode voltage	1·5	kV
Condensed mercury temperature limits	40 to 80	°C
Maximum peak anode current	40	A
Maximum mean anode current (max averaging time 15 sec)	6·0	A
Maximum surge anode current (max duration 0·1 sec)	400	A
Maximum negative grid voltage before conduction	−500	V
Maximum negative grid voltage during conduction	−10	V
Maximum mean grid current	250	mA
Recommended maximum grid resistor	100	kΩ
Recommended minimum grid resistor	10	kΩ

CHARACTERISTICS

Cathode type	Indirectly heated	
Heater voltage	5·0	V
Maximum heater current	11·5	A
Mean heater current	10·5	A
Voltage drop (approx)	16	V
Cathode heating time	5	min
Ionisation time (approx)	10	μs
Recovery time (approx)	1000	μs
Anode/grid capacitance	6	pF
Grid/cathode capacitance	15	pF
Condensed mercury temperature rise above ambient		
At no load (approx)	32	°C
At full load (approx)	39	°C

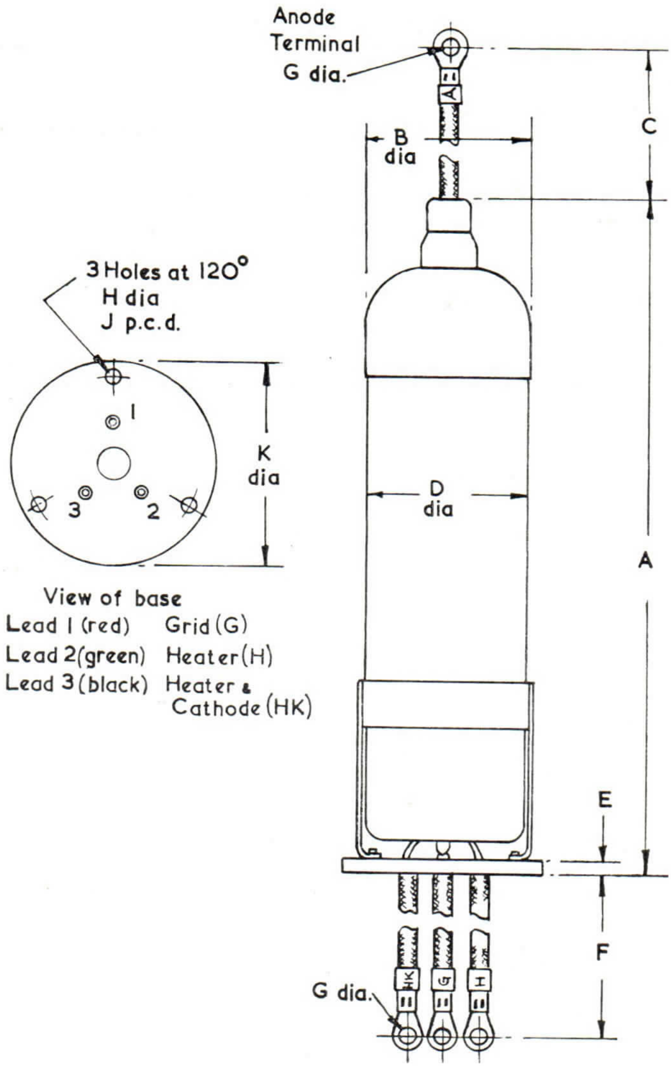
MECHANICAL DATA

Type of cooling	Convection
Mounting position	Vertical, base down
Net weight (approx)	1 lb 3 oz (550 gm)

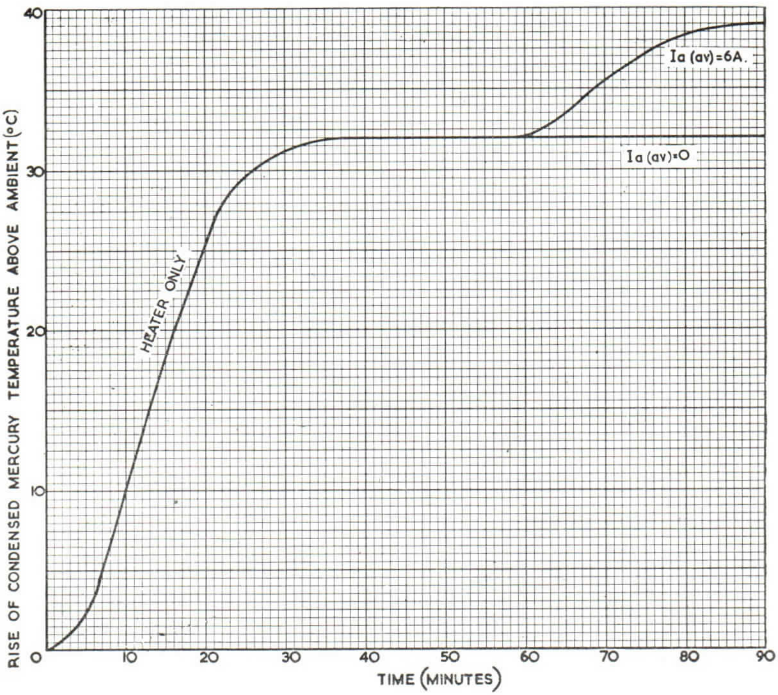
Dimension	Inches	Millimetres
A	$10\frac{1}{2} \pm \frac{1}{4}$	267 ± 6
B	2·688 max	68 max
C	$6 \pm \frac{1}{4}$	152 ± 6
D	$2\frac{1}{2}$	64
E	$\frac{1}{4}$	6
F	$7\frac{1}{2} \pm \frac{1}{4}$	190 ± 6
G	0·265	6·73
H	0·252 ± 0·002	6·40 ± 0·05
J	2·625 ± 0·010	66·68 ± 0·25
K	3·157 max	80 max

All dimensions in inches.

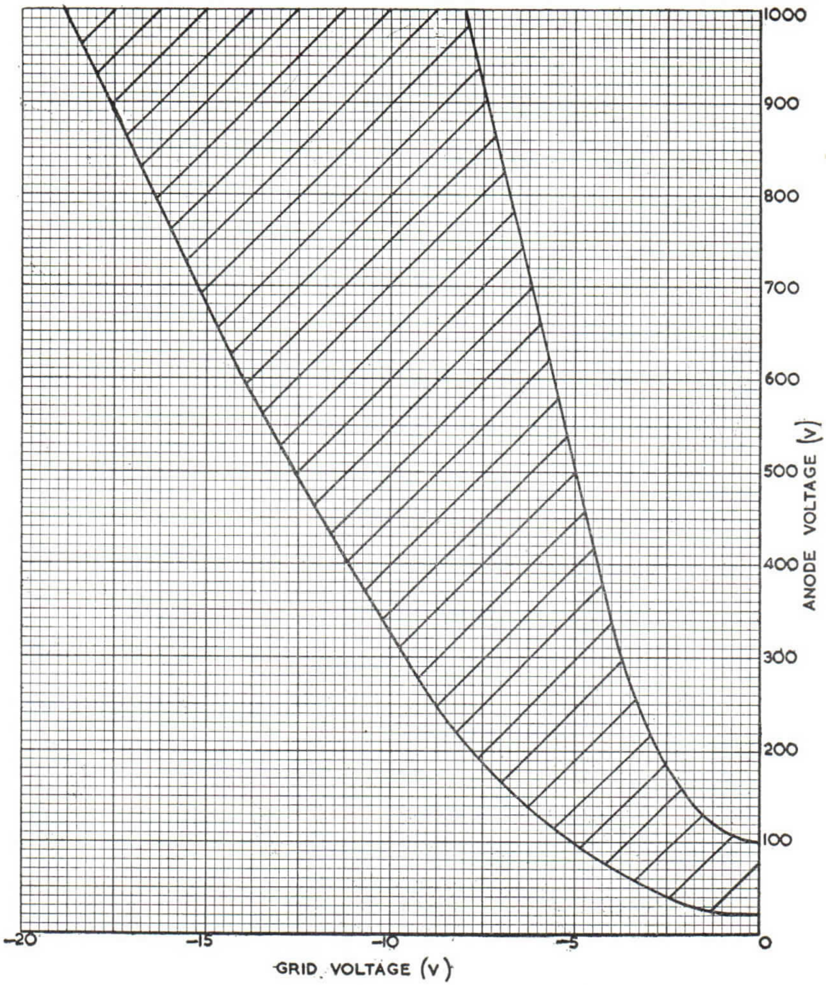
Millimetre dimensions derived.


Anode
Terminal
G dia.
A
B
dia
C
3 Holes at 120°
H dia
J p.c.d.
1
2
3
K
dia
D
dia
A
E
F
G dia.
HK
G
H
View of base
Lead 1 (red) Grid (G)
Lead 2 (green) Heater (H)
Lead 3 (black) Heater & Cathode (HK)

HEATING CHARACTERISTIC

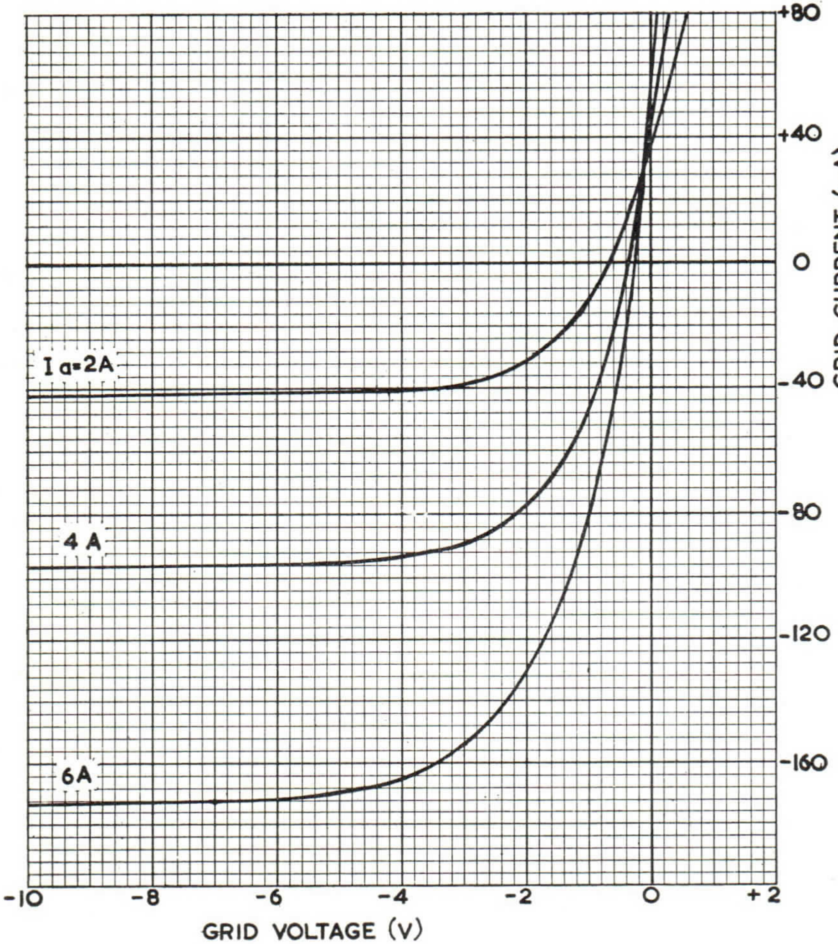


CONTROL CHARACTERISTIC



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

GRID ION CHARACTERISTIC



AEI

Mercury Thyratron

BT19

The BT19 is a mercury-vapour thyratron intended for industrial control applications.

RATINGS—Absolute values

Maximum peak forward anode voltage	2·5	kV
Maximum peak reverse anode voltage	2·5	kV
Condensed mercury temperature limits	35 to 70	°C
Maximum peak anode current	2·0	A
Maximum mean anode current (max averaging time 15 sec)	0·5	A
Maximum surge anode current (max duration 0·1 sec)	40	A
Maximum negative grid voltage before conduction	−500	V
Maximum negative grid voltage during conduction	−10	V
Maximum mean grid current	50	mA
Recommended maximum grid resistor	220	kΩ
Recommended minimum grid resistor	10	kΩ

CHARACTERISTICS

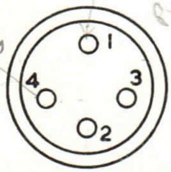
Cathode type	Directly heated	
Filament voltage	2·5	V
Maximum filament current	5·4	A
Mean filament current	5·0	A
Voltage drop (approx)	16	V
Cathode heating time	10	s
Ionisation time (approx)	10	µs
Recovery time (approx)	1000	µs
Anode/grid capacitance	4	pF
Grid/cathode capacitance	8	pF
Condensed mercury temperature rise above ambient		
At no load (approx)	20	°C
At full load (approx)	22	°C

MECHANICAL DATA

Type of cooling	Convection
Mounting position	Vertical, base down
Net weight (approx)	3 oz (85 gm)

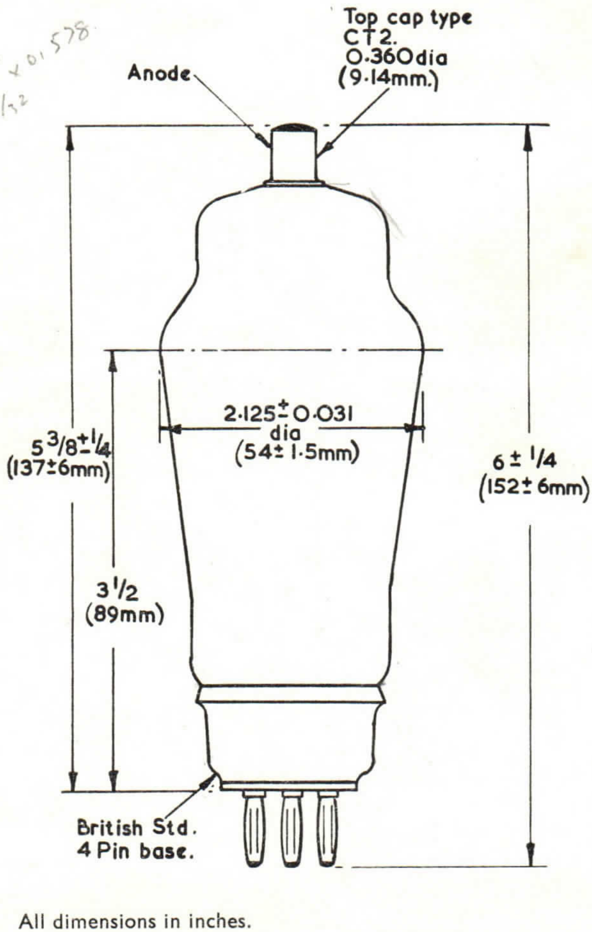
Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Page 1
Issue 1
April 1962
4400-52/BT19



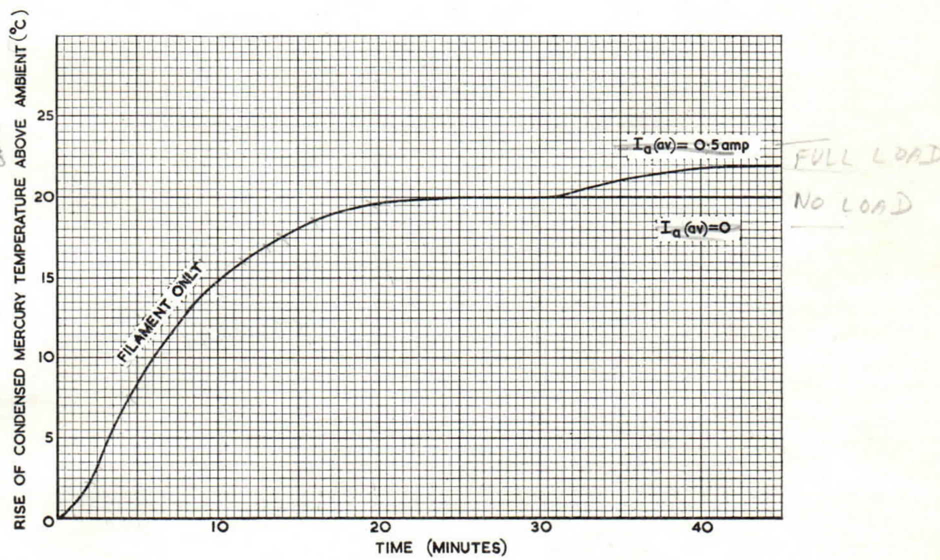
Base connections.

Pin 1	Blank.
Pin 2	Grid.
Pin 3	Filament.
Pin 4	Filament.

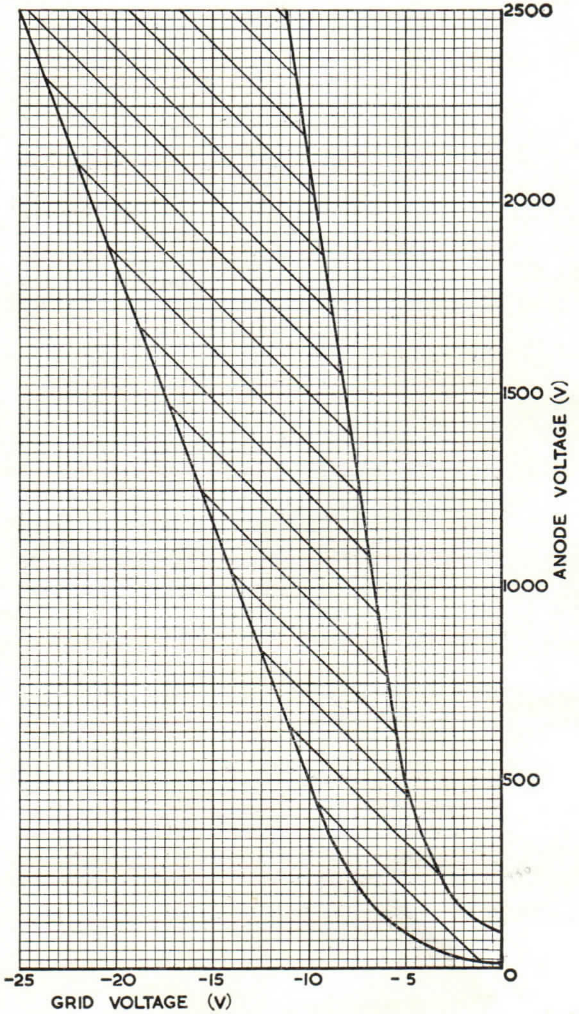


All dimensions in inches.
Millimetre dimensions derived.

HEATING CHARACTERISTIC

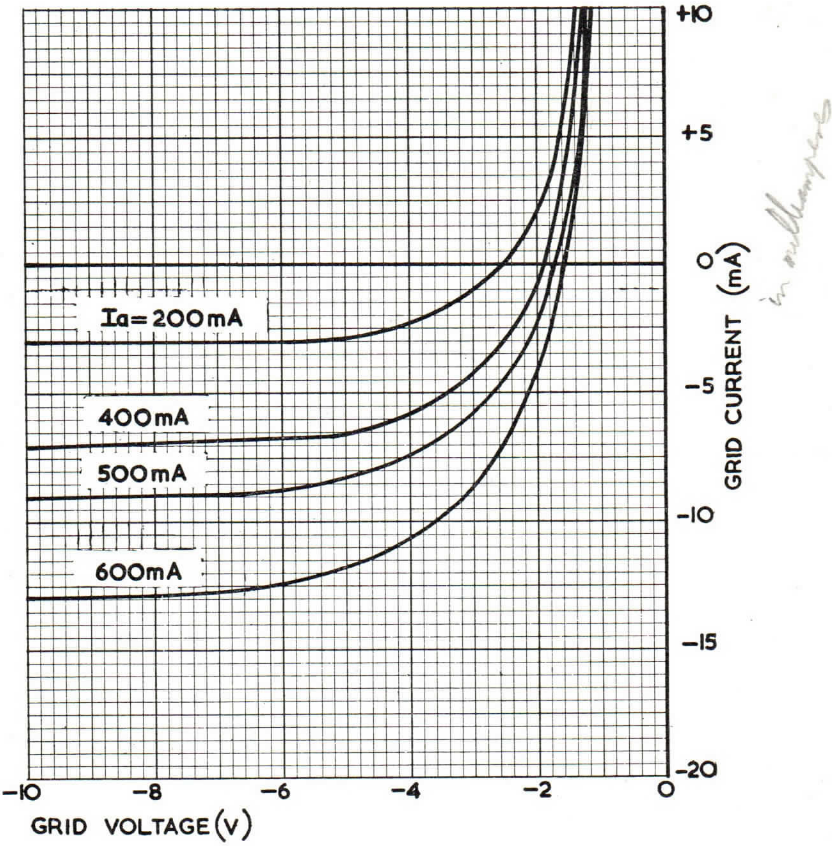


CONTROL CHARACTERISTIC



Mercury Thyratron BT19

GRID ION CHARACTERISTIC



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Issue 1
April 1962
4400-52/BT19

AEI Mercury Thyratron BT29

The BT29 is a shield grid mercury-vapour thyratron intended for industrial control applications.

RATINGS—Absolute values

Maximum peak forward anode voltage	2·0	kV
Maximum peak reverse anode voltage	2·0	kV
Condensed mercury temperature limits	40 to 80	°C
Maximum peak anode current	75	A
Maximum mean anode current (max averaging time 30 sec)	12·5	A
Maximum surge anode current (max duration 0·1 sec)	750	A
Maximum negative control grid voltage before conduction	−500	V
Maximum negative control grid voltage during conduction	−10	V
Maximum mean control grid current	250	mA
Recommended maximum control grid resistor	220	kΩ
Recommended minimum control grid resistor	10	kΩ
Maximum negative shield grid voltage before conduction	−500	V
Maximum negative shield grid voltage during conduction	−10	V
Maximum mean shield grid current	500	mA
Maximum shield grid resistor	10	kΩ

CHARACTERISTICS

Cathode type	Indirectly heated	
Heater voltage	5·0	V
Maximum heater current	21	A
Mean heater current	20	A
Voltage drop (approx)	16	V
Cathode heating time	5	min
Ionisation time (approx)	10	μs
Recovery time (approx)	1000	μs
Anode/control grid capacitance	4	pF
Control grid/cathode capacitance	8	pF
Condensed mercury temperature rise above ambient		
At no load (approx)	37	°C
At full load (approx)	42	°C

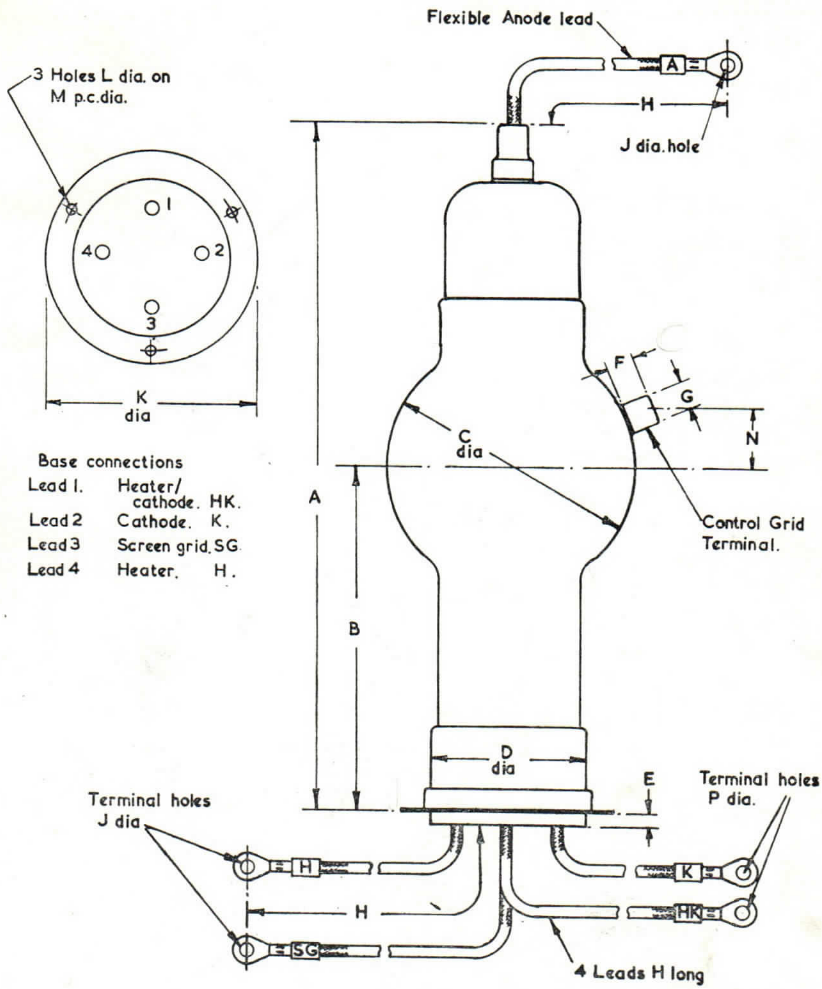
MECHANICAL DATA

Type of cooling	Convection
Mounting position	Vertical, base down
Net weight (approx)	2 lb 2 oz (950 gm)

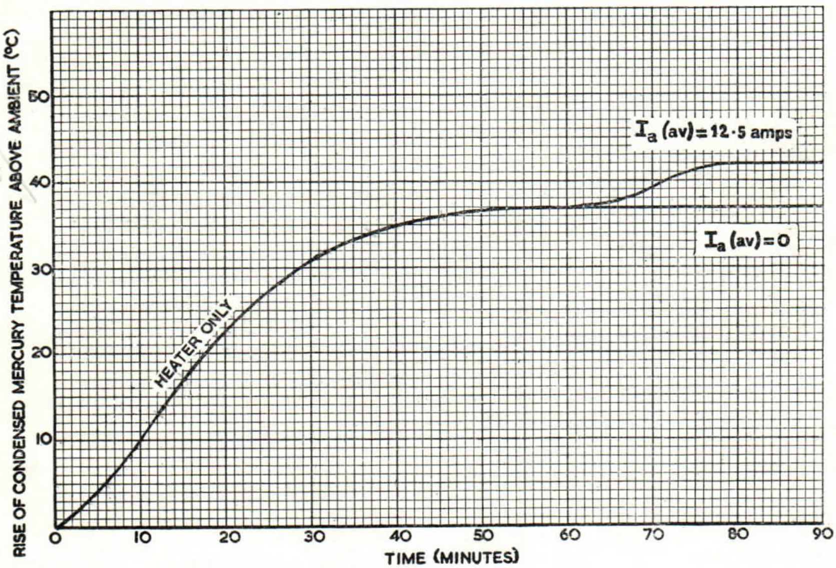
Dimension	Inches	Millimetres
A	$13\frac{3}{4} \pm \frac{1}{4}$	349 ± 6
B	$6\frac{7}{8} \pm \frac{1}{4}$	175 ± 6
C	5·063 max	129 max
D	3·188 max	81 max
E	0·250 ± 0·063	6·4 ± 1·5
F	0·420 min	10·7 min
G	0·641 ± 0·015	16·27 ± 0·39
H	$7 \pm \frac{1}{4}$	178 ± 6
J	0·265	6·73
K	4·281 max	109 max
L	0·203 ± 0·002	5·16 ± 0·05
M	3·75 ± 0·010	95·25 ± 0·25
N	1	25
P	0·200	5·1

All dimensions in inches.
Millimetre dimensions derived.

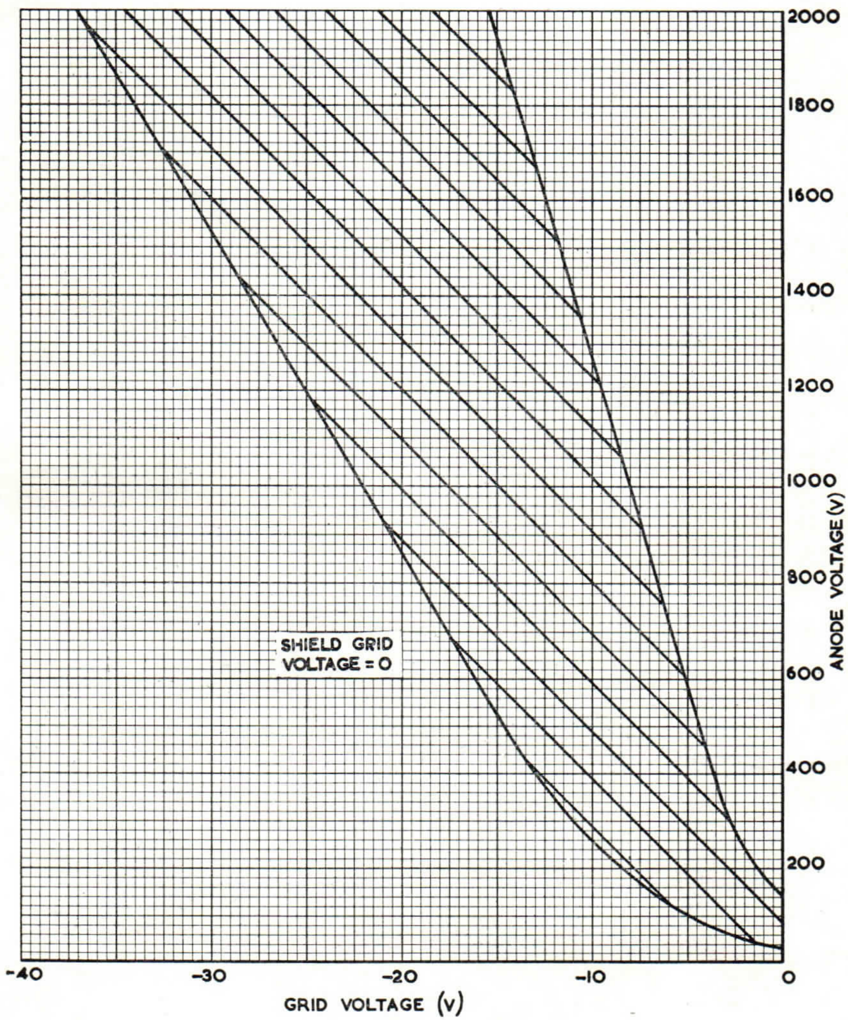
AEI Mercury Thyratron BT29



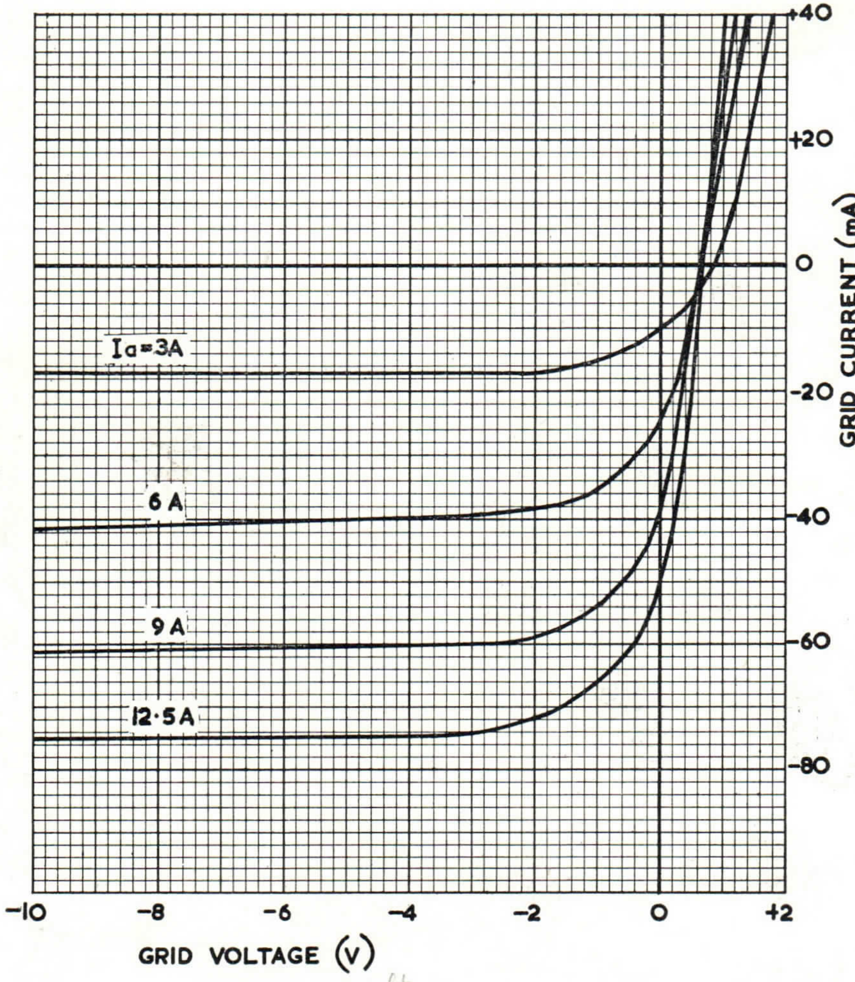
HEATING CHARACTERISTIC



CONTROL CHARACTERISTIC



GRID ION CHARACTERISTIC



AEI Mercury Thyratron BT45

The BT45 is a mercury-vapour thyratron designed for use as a modulator switch in radar applications. For this application temperature control by air blowing is necessary.

RATINGS—Modulator pulse duty

Maximum peak forward anode voltage	20	kV
Maximum peak reverse anode voltage	20	kV
Maximum peak anode current	50	A
Maximum rate of rise of anode current	500	A/μs
Maximum mean anode current (max averaging time 1 cycle)	50	mA
Maximum surge anode current (max duration 0·1 sec)	200	A
Maximum pulse repetition rate	500	p/s
Condensed mercury temperature limits *	45 to 60	°C
Recommended grid firing pulse		
Forward pulse voltage	100	V
Pulse duration	1	μs
Impedance of firing circuit	1000	Ω
Grid bias	150	V

CHARACTERISTICS

Cathode type	Directly heated	
Filament voltage	2·5	V
Maximum filament current	23·5	A
Mean filament current	21	A
Voltage drop (approx)	16	V
Cathode heating time	5	min
Anode/grid capacitance	6	pF
Grid/cathode capacitance	18	pF

MECHANICAL DATA

Type of cooling *	Controlled air blowing
Mounting position	Vertical, base down
Weight	1 lb (450 gm)

* A small jet of air of about 3 ft^3/min (0·085 m^3/min) and at a controlled temperature of 45°C to 60°C should be directed at the glass envelope at the bottom of the valve in order to keep the condensed mercury temperature within the prescribed limits.

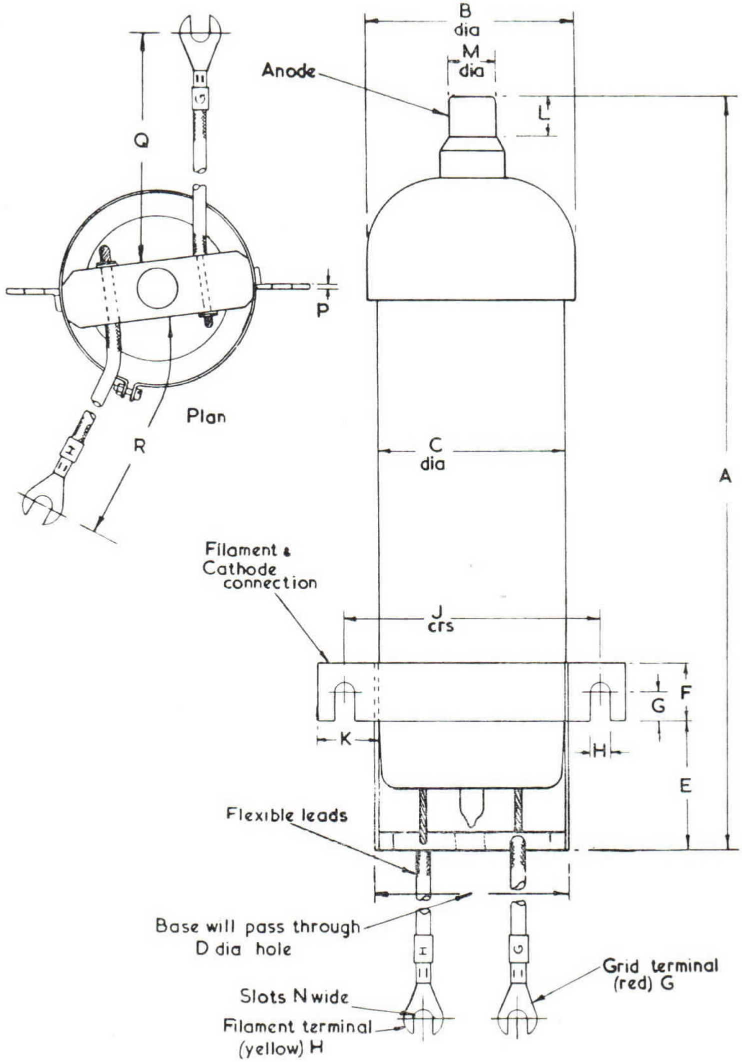
Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Issue 1
April 1962
4400-52/BT45

Dimension	Inches	Millimetres
A	$10\frac{1}{4} \pm \frac{1}{2}$	260 ± 13
B	2·688 max	68 max
C	$2\frac{1}{2}$	64
D	$2\frac{7}{8}$	73
E	1·750 ± 0·062	44·5 ± 1·5
F	0·750 ± 0·031	19 ± 0·8
G	0·375 ± 0·031	9·5 ± 0·8
H	0·250 ± 0·010	6·35 ± 0·25
J	3·406 ± 0·031	86·5 ± 0·8
K	$\frac{3}{4}$	19
L	0·420 min	10·7 min
M	0·641 ± 0·015	16·27 ± 0·39
N	0·265	6·73
P	0·08	2
Q	4·56 ± 0·25	116 ± 6
R	4·31 ± 0·25	110 ± 6

All dimensions in inches.
Millimetre dimensions derived.

AEI Mercury Thyratron BT45



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

AEI Mercury Thyratron BT61A

The BT61A is a mercury-vapour thyratron intended for industrial applications. It differs from the usual thyratron in that the grid structure is permanently at cathode potential. Control is by means of a small auxiliary anode to which a positive voltage is applied when conduction to the main anode is required.

RATINGS—Absolute values

Maximum peak forward anode voltage	1·0	kV
Maximum peak reverse anode voltage	1·0	kV
Condensed mercury temperature limits	35 to 70	°C
Maximum peak anode current	200	A
Maximum mean anode current (max averaging time 30 sec)	33	A
Maximum surge anode current (max duration 0·1 sec)	1200	A
Minimum auxiliary anode firing voltage	100	V
Maximum auxiliary anode reverse voltage	100	V
Maximum peak auxiliary anode current	1	A
Maximum mean auxiliary anode current	50	mA

CHARACTERISTICS

Cathode type	Indirectly heated	
Heater voltage	5·0	V
Maximum heater current	37	A
Mean heater current	35	A
Voltage drop (approx)	16	V
Cathode heating time	5	min
Condensed mercury temperature rise above ambient		
At no load	28	°C
At full load	30	C

MECHANICAL DATA

Type of cooling	Convection
Mounting position	Vertical, base down
Net weight (approx)	3 lb (1350 gm)

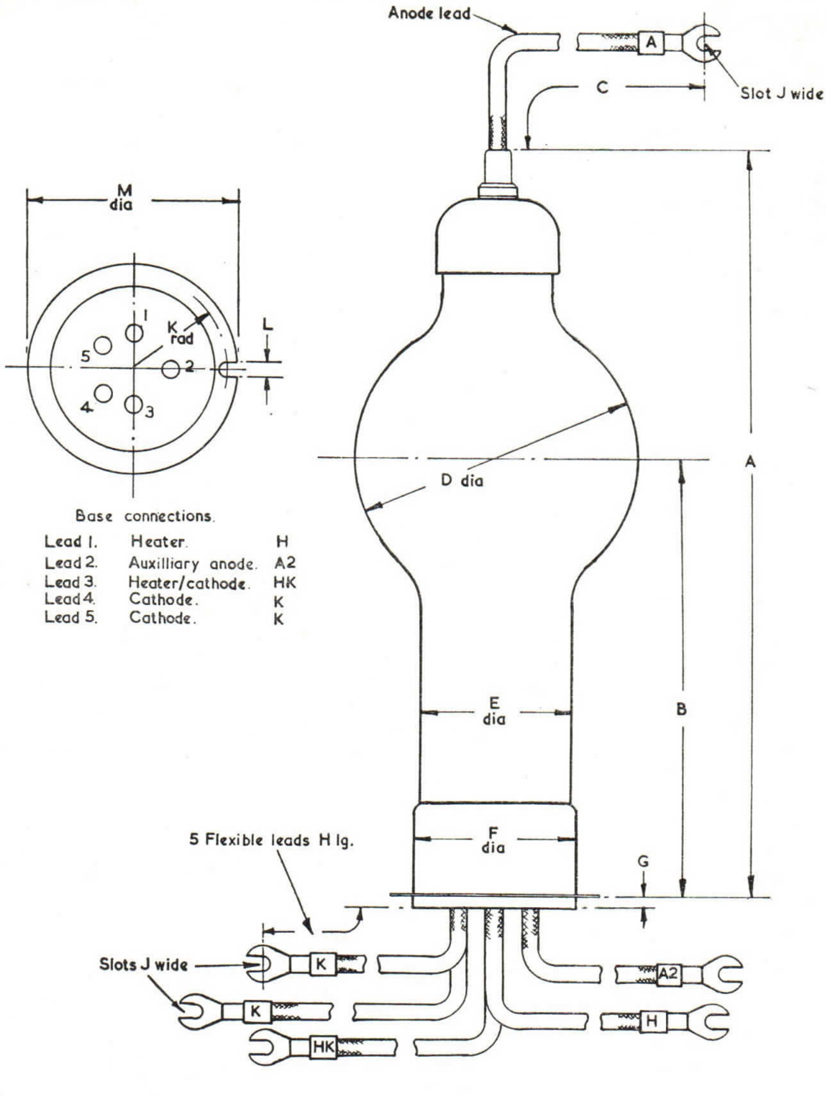
Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Issue 1
April 1962
4400-52/BT61A

Dimension	Inches	Millimetres
A	$16\frac{1}{8} \pm \frac{3}{8}$	410 ± 10
B	$9\frac{1}{2} \pm \frac{3}{8}$	241 ± 10
C	$6 \pm \frac{1}{4}$	152 ± 6
D	$6\frac{1}{8}$ max	156 max
E	$3\frac{1}{4}$	83
F	$3\frac{1}{2}$ max	89 max
G	$\frac{1}{4}$	6
H	$6\frac{5}{8} \pm \frac{1}{4}$	168 ± 6
J	0·265	6·73
K	2·000 ± 0·016	50·8 ± 0·4
L	0·344 ± 0·016	8·73 ± 0·40
M	4·531 max	115 max

All dimensions in inches.
Millimetre dimensions derived.

AEI Mercury Thyratron BT61A

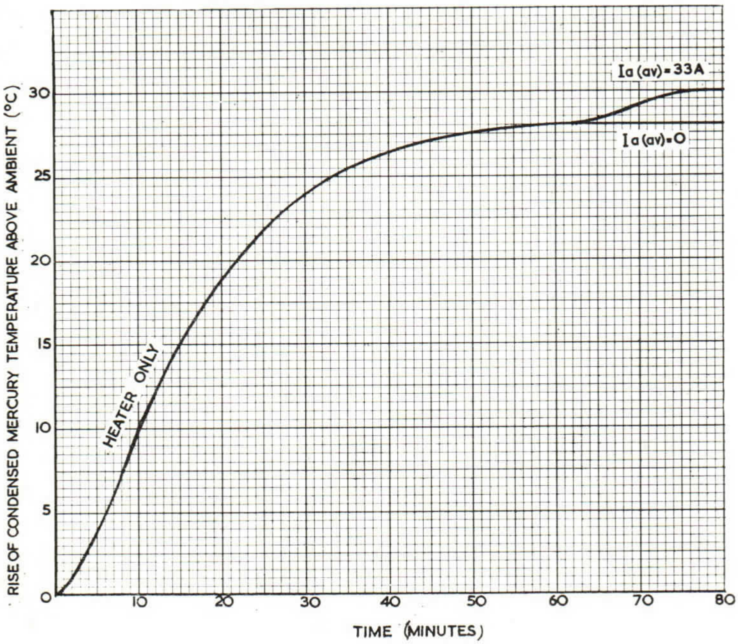


Base connections.

Lead 1.	Heater.	H
Lead 2.	Auxilliary anode.	A2
Lead 3.	Heater/cathode.	HK
Lead 4.	Cathode.	K
Lead 5.	Cathode.	K

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

HEATING CHARACTERISTIC



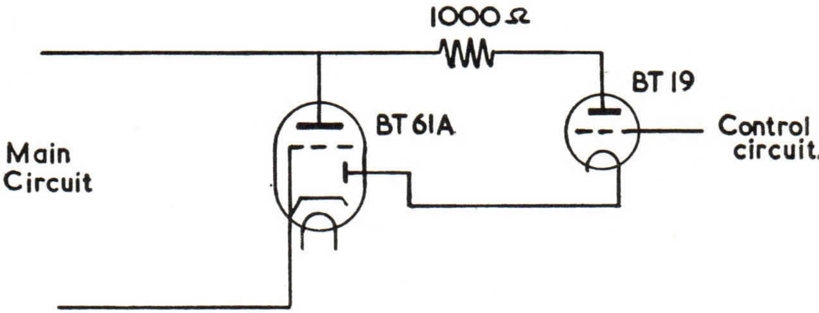


Fig. 1. Anode Firing.

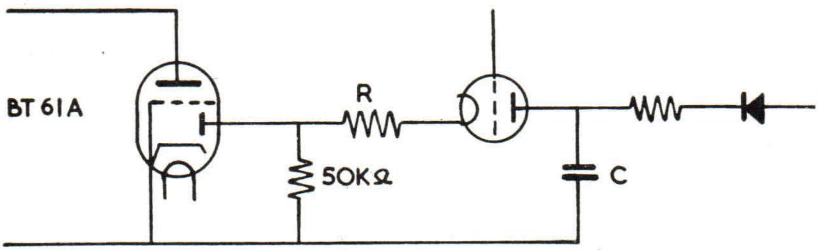
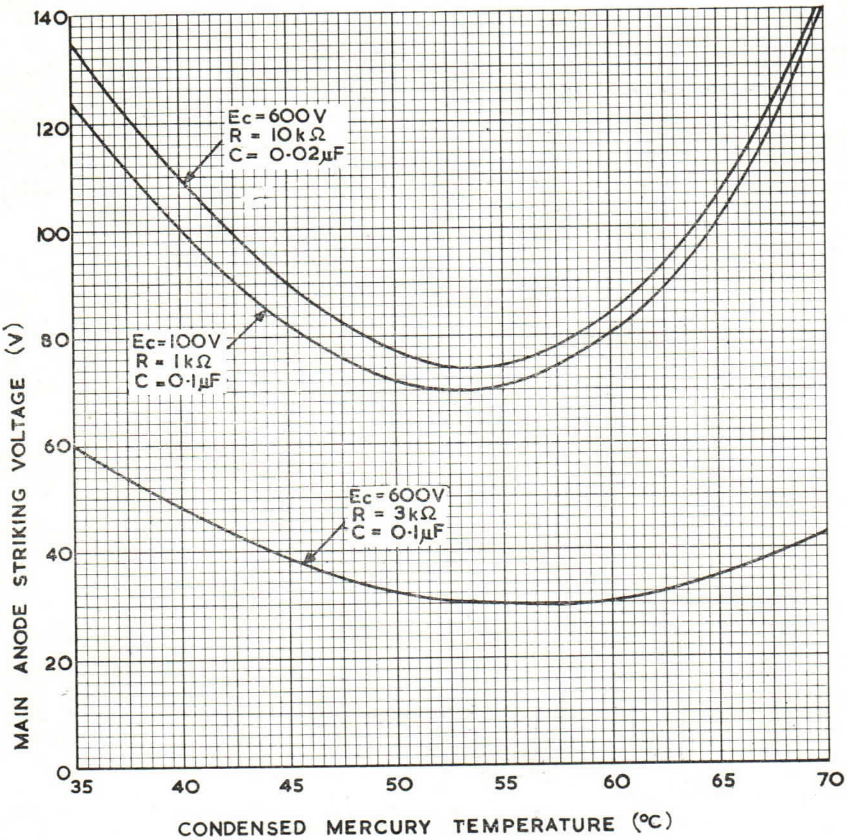


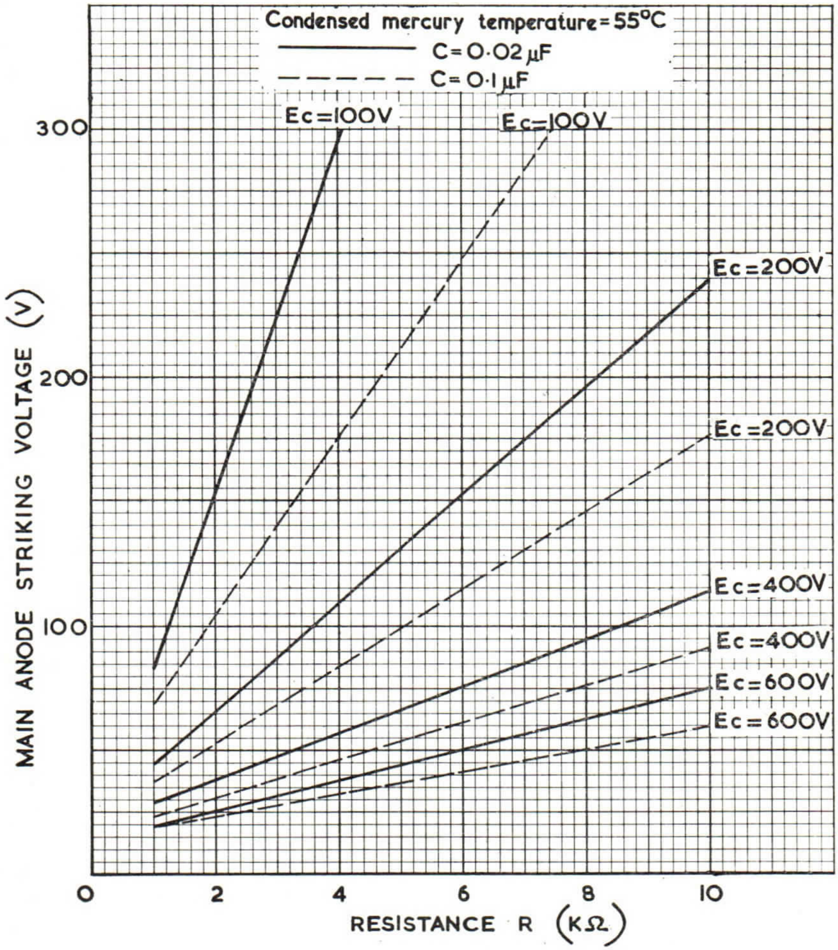
Fig. 2. Separate Excitation.

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

TYPICAL PICK-UP CHARACTERISTIC in circuit of Fig. 2
—VARIATION WITH CONDENSED MERCURY TEMPERATURE



TYPICAL PICK-UP CHARACTERISTIC in circuit of Fig. 2.
—VARIATION WITH RESISTANCE R.



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Issue 1
April 1962
4400-52/BT61A

AEI Mercury Thyratron BT69

The BT69 is a mercury-vapour thyratron intended for high voltage industrial control applications.

RATINGS—Absolute values

Maximum peak forward anode voltage	15	kV
Maximum peak reverse anode voltage	15	kV
Condensed mercury temperature limits	40 to 70	°C
Maximum peak anode current	75	A
Maximum mean anode current (max averaging time 30 sec)	12·5	A
Maximum surge anode current (max duration 0·1 sec)	750	A
Maximum negative grid voltage before conduction	–500	V
Maximum negative grid voltage during conduction	–10	V
Maximum mean grid current	250	mA
Recommended maximum grid resistor	20	kΩ
Recommended minimum grid resistor	5	kΩ

CHARACTERISTICS

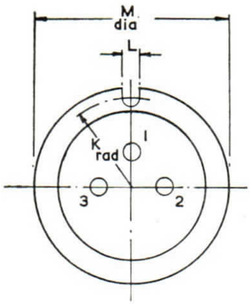
Cathode type	Indirectly heated	
Heater voltage	5·0	V
Maximum heater current	21	A
Mean heater current	20	A
Voltage drop (approx)	16	V
Cathode heating time	5	min
Ionisation time (approx)	10	µs
Recovery time (approx)	1000	µs
Anode/grid capacitance	7	pF
Grid/cathode capacitance	25	pF
Condensed mercury temperature rise above ambient		
At no load (approx)	25	°C
At full load (approx)	35	°C

MECHANICAL DATA

Type of cooling	Convection
Mounting position	Vertical, base down
Net weight (approx)	2 lb 3 oz (1000 gm)

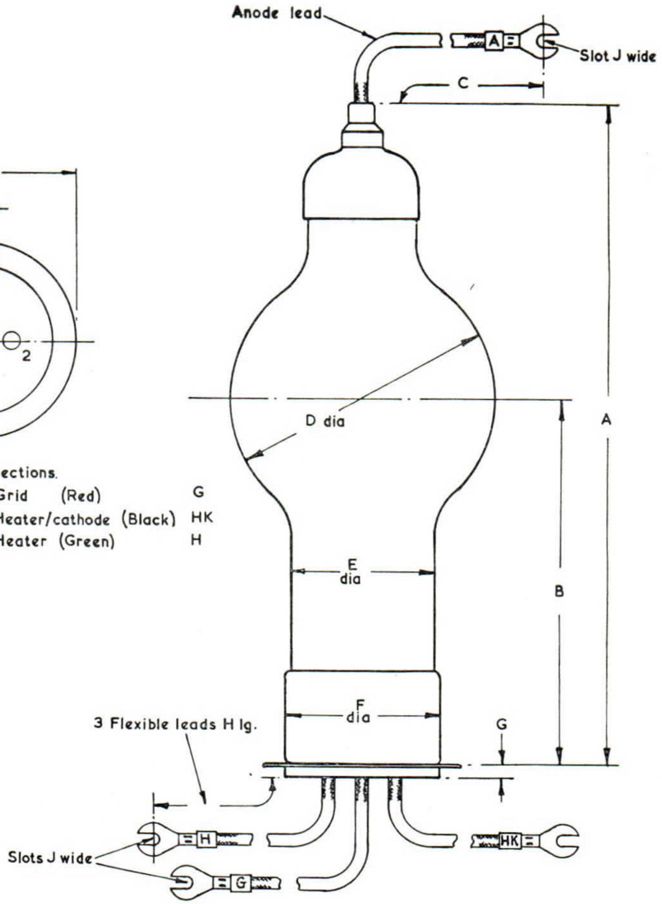
Dimension	Inches	Millimetres
A	$15\frac{1}{8} \pm \frac{3}{8}$	384 ± 10
B	$8\frac{3}{8} \pm \frac{1}{2}$	213 ± 13
C	$5\frac{7}{8} \pm \frac{1}{4}$	149 ± 6
D	$6\frac{1}{8}$ max	156 max
E	$3\frac{1}{4}$	83
F	$3\frac{1}{2}$ max	89 max
G	$\frac{1}{4}$	6
H	$6\frac{1}{2} \pm \frac{1}{4}$	165 ± 6
J	0·265	6·73
K	2·000 ± 0·016	50·8 ± 0·4
L	0·344 ± 0·016	8·73 ± 0·40
M	4·531 max	115 max

All dimensions in inches.
Millimetre dimensions derived.



Base connections.

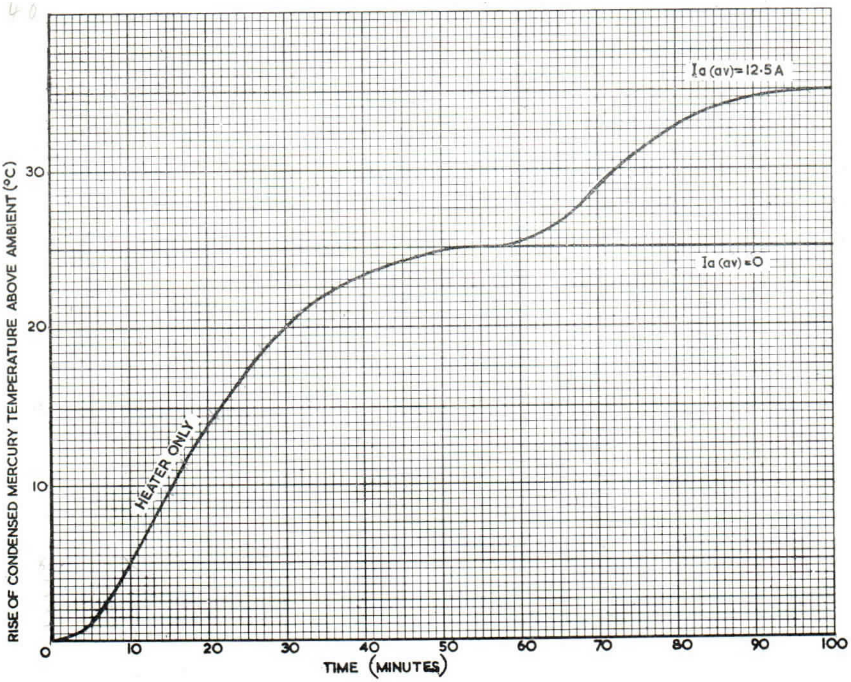
Lead 1.	Grid (Red)	G
Lead 2.	Heater/cathode (Black)	HK
Lead 3.	Heater (Green)	H



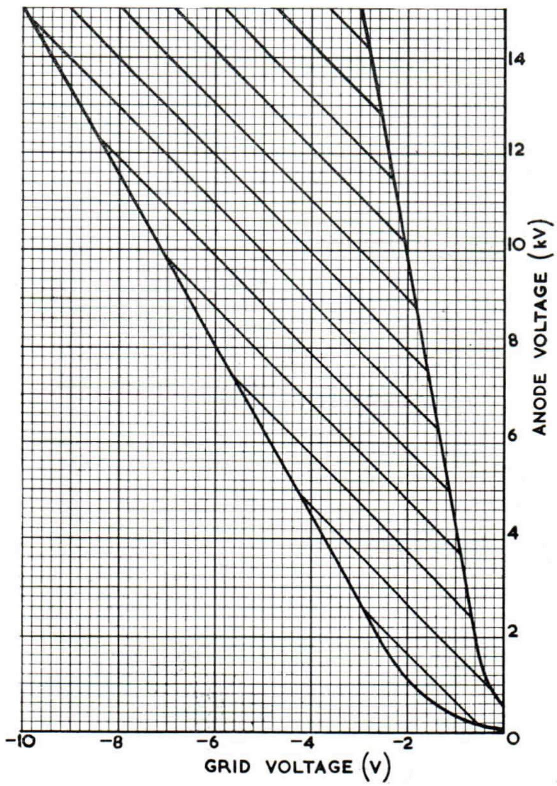
Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Issue 1
April 1962
4400-52/BT69

HEATING CHARACTERISTIC

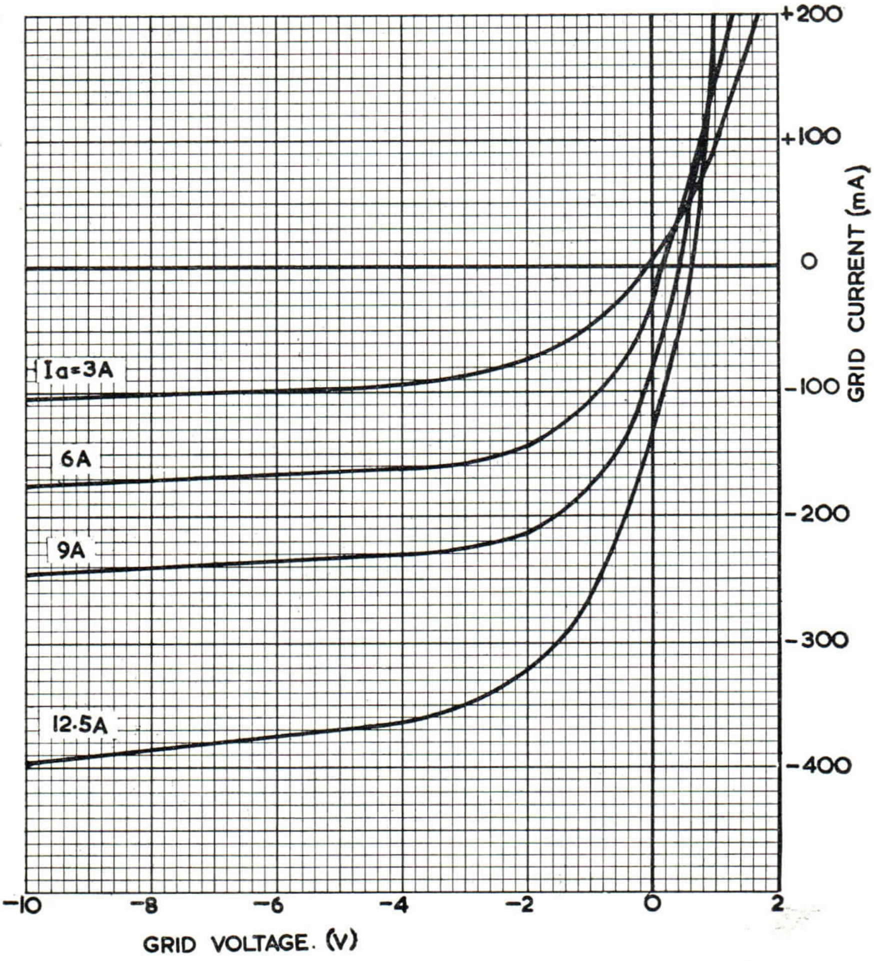


CONTROL CHARACTERISTIC



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

GRID ION CHARACTERISTIC



AEI Xenon Thyratron BT75

The BT75 is a xenon thyratron intended for industrial control applications and ignitor firing service.

RATINGS—Absolute values

Maximum peak forward anode voltage	1·0	kV
Maximum peak reverse anode voltage	1·5	kV
Maximum peak anode current	16	A
Maximum peak anode current (ignitor firing service)	30	A
Maximum mean anode current (max averaging time 15 sec)	2·5	A
Maximum surge anode current (max duration 0·1 sec)	200	A
Maximum negative grid voltage before conduction	−250	V
Maximum negative grid voltage during conduction	−10	V
Maximum mean grid current	200	mA
Recommended maximum grid resistor	100	kΩ
Recommended minimum grid resistor	10	kΩ
Maximum commutation factor	50	
Ambient temperature range	−55 to +70	°C

The shield grid should be connected to the cathode through a 1 kΩ to 10 kΩ resistor.

CHARACTERISTICS

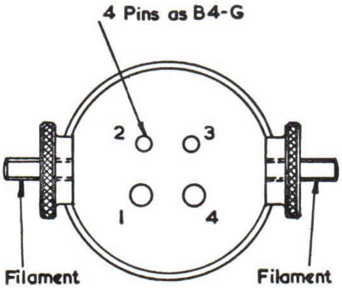
Cathode type	Directly heated	
Filament voltage	2·5	V
Maximum filament current	13	A
Mean filament current	11	A
Voltage drop (approx)	12	V
Cathode heating time	30	s
Ionisation time (approx)	10	μs
Recovery time (approx)	500	μs
Anode/grid capacitance	6	pF
Grid/cathode capacitance	12	pF

MECHANICAL DATA

Type of cooling	Convection
Mounting position	Any
Net weight (approx)	11 oz (310 gm)

Dimension	Inches	Millimetres
A	$6\frac{7}{8} \pm \frac{1}{4}$	175 ± 6
B	$6\frac{1}{4} \pm \frac{1}{4}$	159 ± 6
C	2·09 max	53 max
D	$1\frac{7}{8}$	48
E	1·75 ± 0·015	44·45 ± 0·38
F	2 ± 0·032	50·8 ± 0·8
G	0·500 ± 0·032	12·7 ± 0·8
H	1·500 ± 0·062	38·1 ± 1·5
J	OBA	

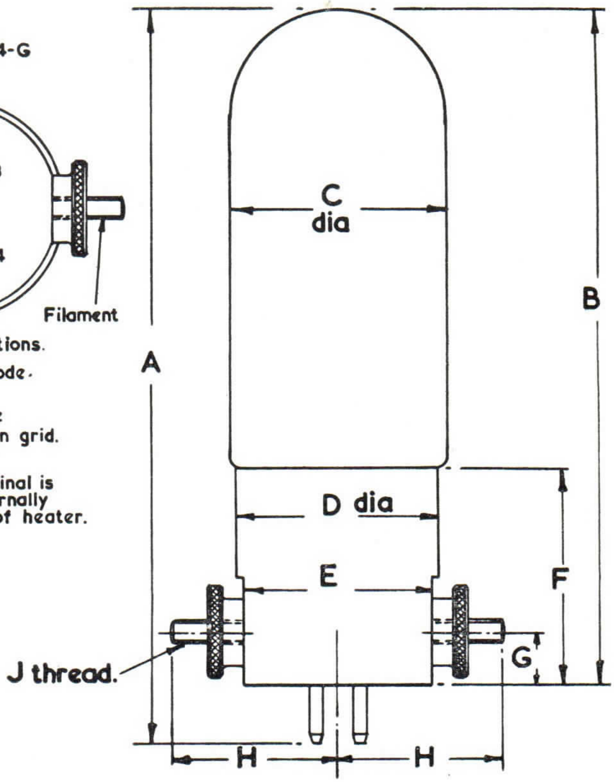
All dimensions in inches.
Millimetre dimensions derived.



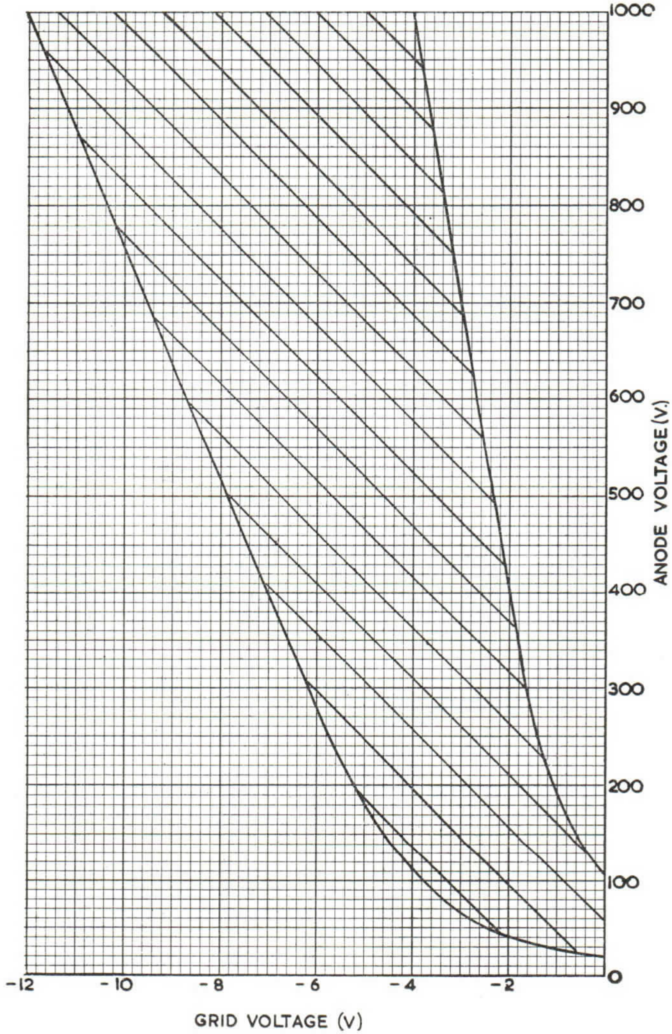
Base connections.

Pin 1 Cathode.
Pin 2 Grid.
Pin 3 Anode
Pin 4 Screen grid.

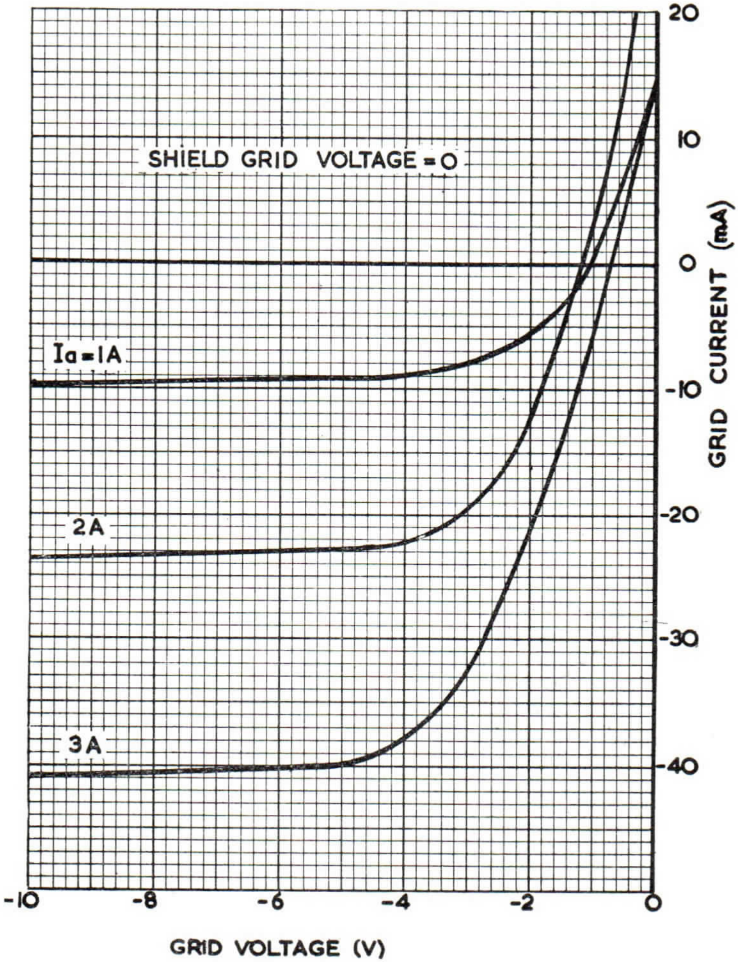
Note: Cathode terminal is connected internally to mid point of heater.



CONTROL CHARACTERISTIC



GRID ION CHARACTERISTIC



AEI Xenon Thyratron BT77

The BT77 is a xenon thyratron intended for industrial control applications.

RATINGS—Absolute values

Maximum peak forward anode voltage	1·5	kV
Maximum peak reverse anode voltage	1·5	kV
Maximum peak anode current	80	A
Maximum mean anode current (max averaging time 15 sec)	6·4	A
Maximum surge anode current (max duration 0·1 sec)	1120	A
Maximum negative grid voltage before conduction	−250	V
Maximum negative grid voltage during conduction	−10	V
Maximum mean grid current	200	mA
Recommended maximum grid resistor	100	kΩ
Recommended minimum grid resistor	1	kΩ
Maximum commutation factor	130	
Ambient temperature range	−55 to +70	°C

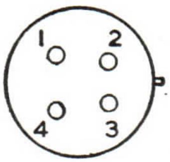
CHARACTERISTICS

Cathode type	Directly heated	
Filament voltage	2·5	V
Maximum filament current	23	A
Mean filament current	21	A
Voltage drop (approx)	12	V
Cathode heating time	60	s
Ionisation time (approx)	10	μs
Recovery time (approx)	500	μs
Anode/grid capacitance	1	pF
Grid/cathode capacitance	45	pF

MECHANICAL DATA

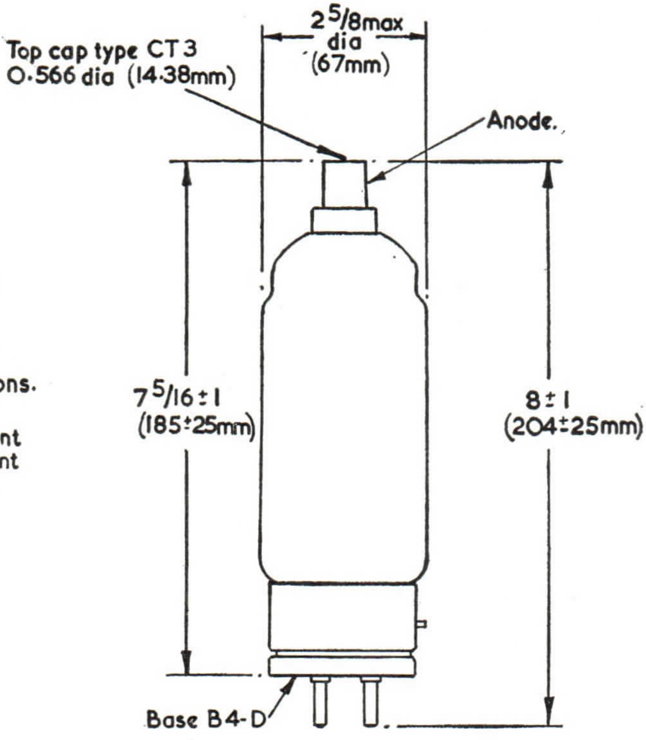
Type of cooling	Convection
Mounting position	Any
Net weight (approx)	12 oz (340 gm)

Xenon Thyratron



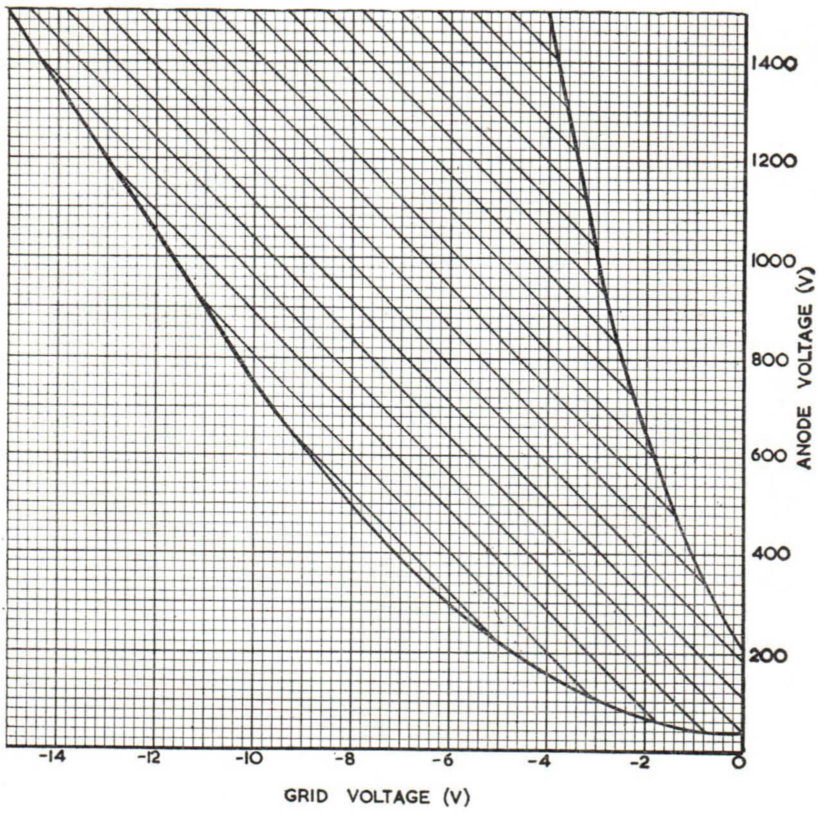
Base connections.

Pin 1	Grid
Pin 2	Filament
Pin 3	Filament
Pin 4	Blank.

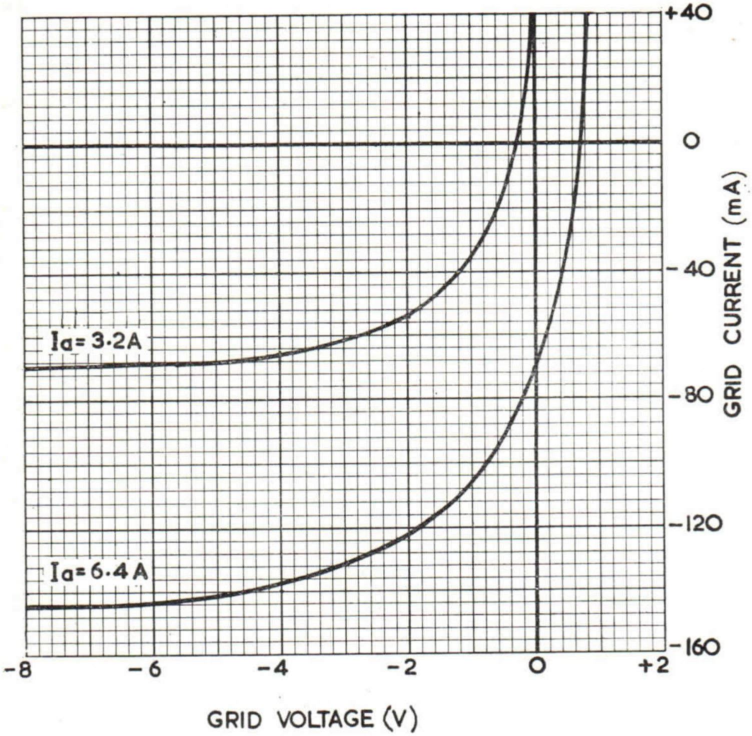


All dimensions in inches.
Millimetre dimensions derived.

CONTROL CHARACTERISTIC



GRID ION CHARACTERISTIC



AEI Xenon Thyratron BT77A

The BT77A is a xenon thyratron intended for industrial control applications.

RATINGS—Absolute values

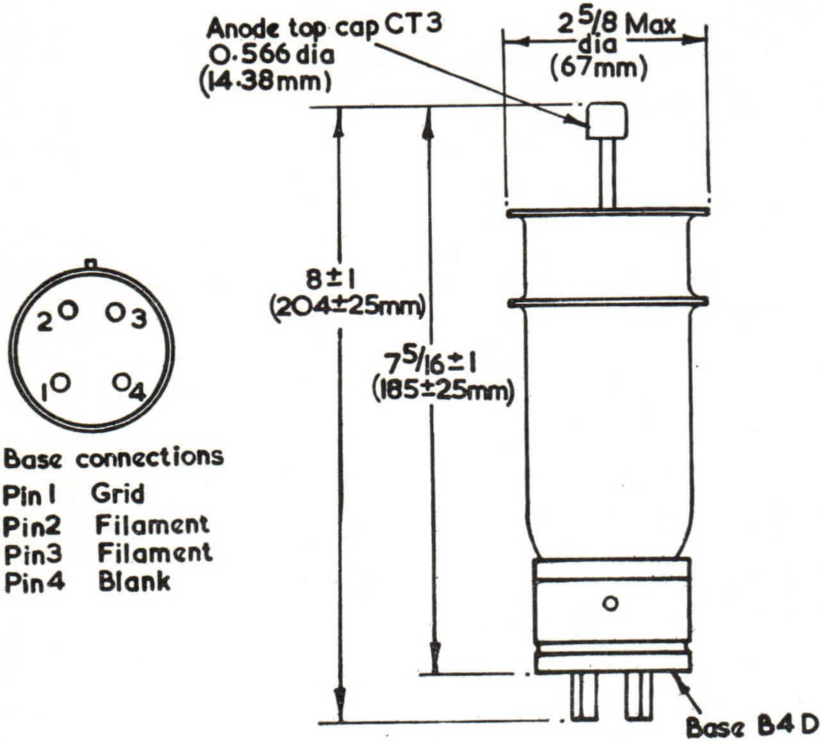
Maximum peak forward anode voltage	1·5	kV
Maximum peak reverse anode voltage	1·5	kV
Maximum peak anode current	80	A
Maximum mean anode current (max averaging time 15 sec)	6·4	A
Maximum surge anode current (max duration 0·1 sec)	1120	A
Maximum negative grid voltage before conduction	−250	V
Maximum negative grid voltage during conduction	−10	V
Maximum mean grid current	200	mA
Recommended maximum grid resistor	100	kΩ
Recommended minimum grid resistor	1	kΩ
Maximum commutation factor	130	
Ambient temperature range	−55 to +70	°C

CHARACTERISTICS

Cathode type	Directly heated	
Filament voltage	2·5	V
Maximum filament current	23	A
Mean filament current	21	A
Voltage drop (approx)	12	V
Cathode heating time	60	s
Ionisation time (approx)	10	µs
Recovery time (approx)	500	µs
Anode/grid capacitance	7	pF
Grid/cathode capacitance	5	pF

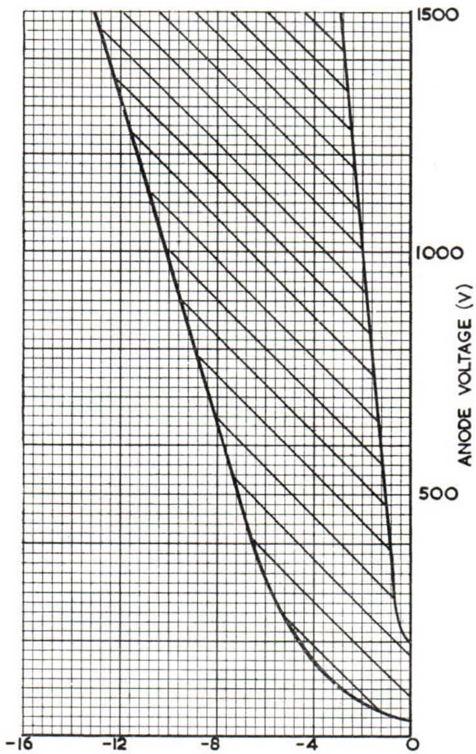
MECHANICAL DATA

Type of cooling	Convection
Mounting position	Any
Net weight (approx)	13 oz (370 gm)



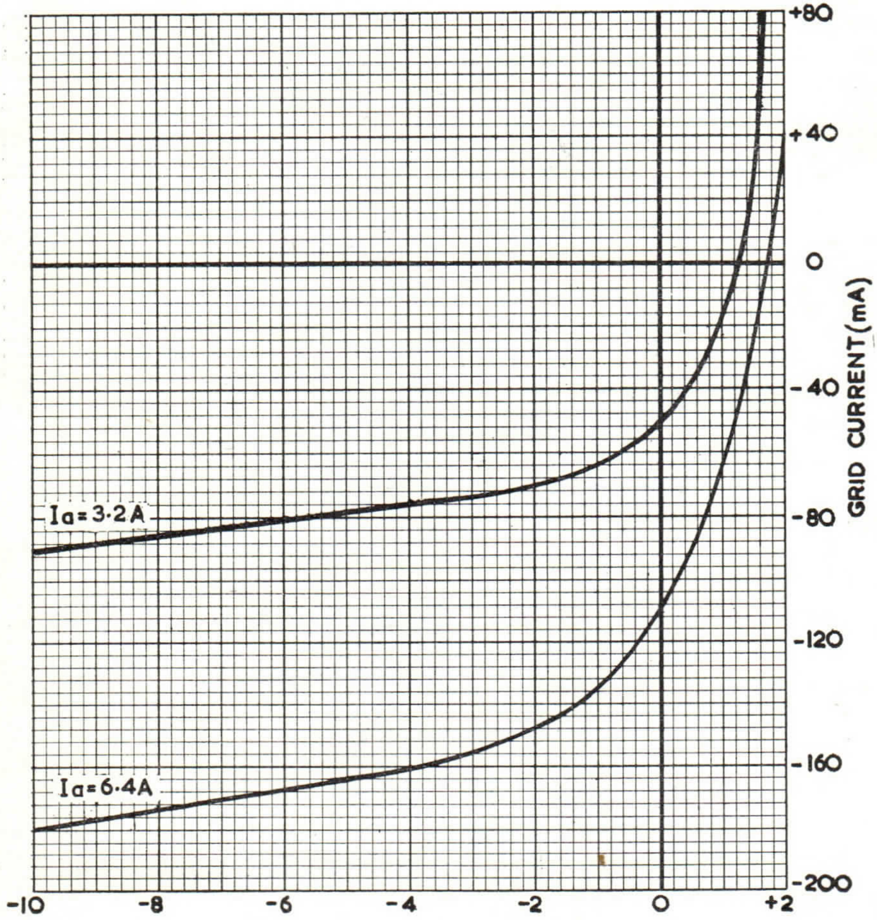
All dimensions in inches.
Millimetre dimensions derived.

CONTROL CHARACTERISTIC



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

GRID ION CHARACTERISTIC



AEI Xenon Thyratron BT89

The BT89 is a xenon thyratron intended for industrial control applications.

RATINGS—Absolute values

Maximum peak forward anode voltage	1·0	kV
Maximum peak reverse anode voltage	1·5	kV
Maximum peak anode current	2·0	A
Maximum mean anode current (max averaging time 15 sec)	0·5	A
Maximum surge anode current (max duration 0·1 sec)	40	A
Maximum negative grid voltage before conduction	−250	V
Maximum negative grid voltage during conduction	−10	V
Maximum mean grid current	50	mA
Recommended maximum grid resistor	100	kΩ
Recommended minimum grid resistor	10	kΩ
Maximum commutation factor	10	
Ambient temperature range	−55 to +70	°C

CHARACTERISTICS

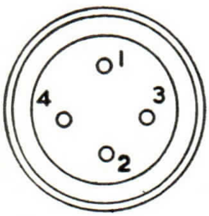
Cathode type	Directly heated	
Filament voltage	2·5	V
Maximum filament current	5·3	A
Mean filament current	5·0	A
Voltage drop (approx)	12	V
Cathode heating time	10	s
Ionisation time (approx)	10	μs
Recovery time (approx)	500	μs
Anode/grid capacitance	4	pF
Grid/cathode capacitance	10	pF

MECHANICAL DATA

Type of cooling	Convection
Mounting position	Any
Net weight (approx)	2 oz (60 gm)

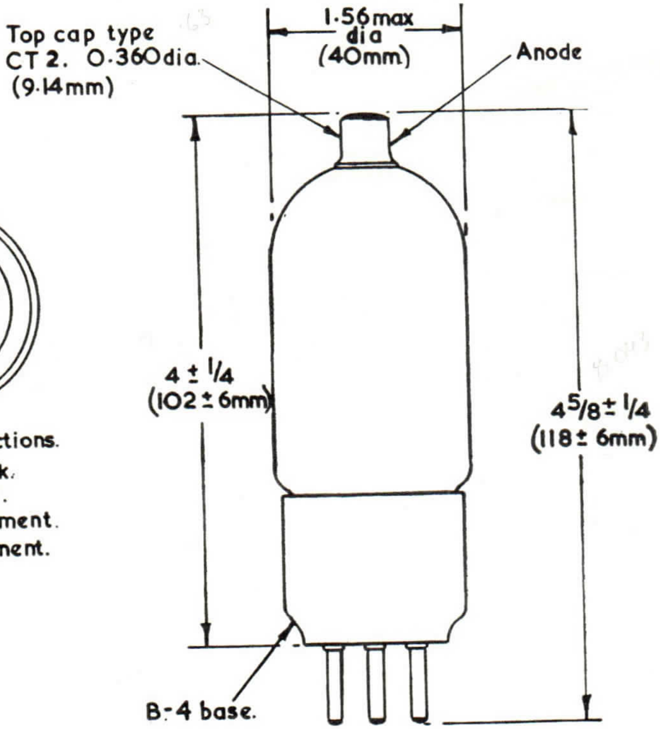
Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Issue 1
April 1962
4400-52/BT89



Base connections.

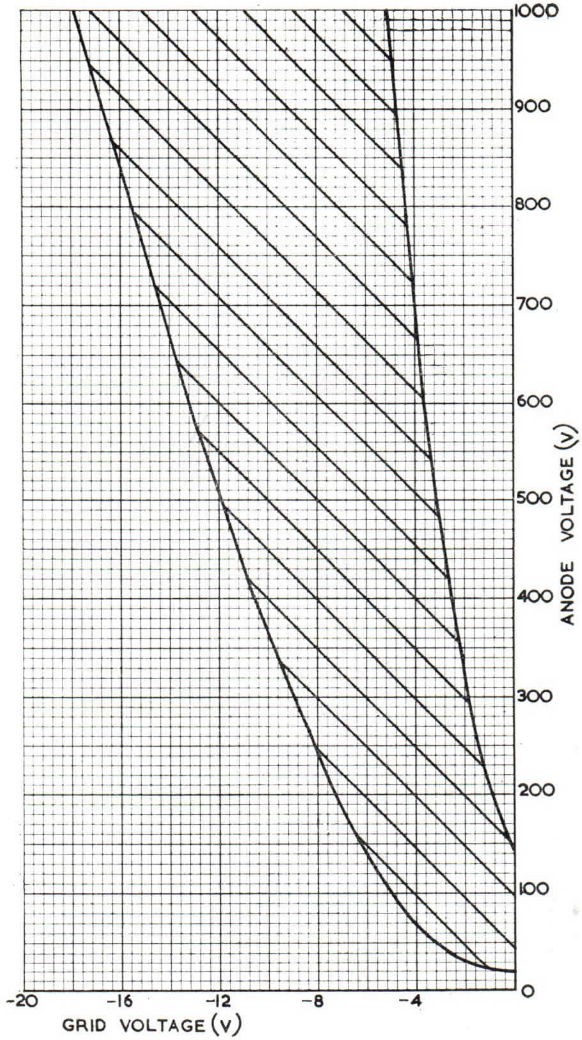
Pin 1.	Blank.
Pin 2.	Grid.
Pin 3.	Filament.
Pin 4.	Filament.



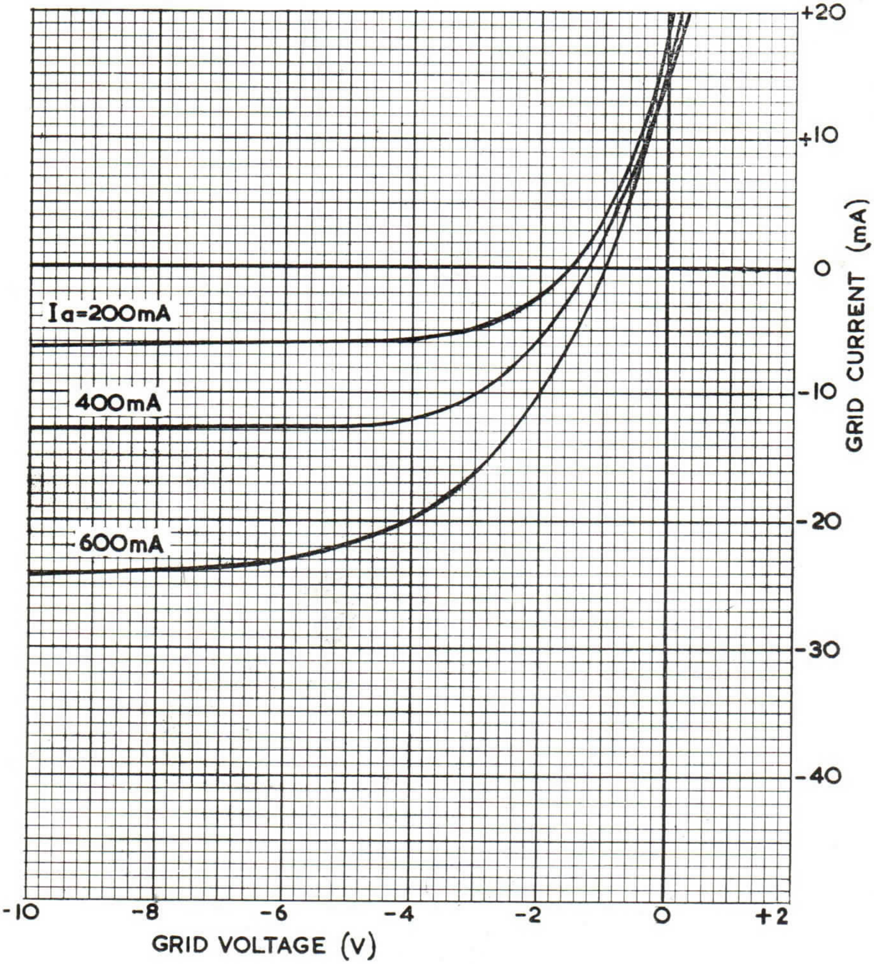
All dimensions in inches.
Millimetre dimensions derived.

AEI Xenon Thyratron BT89

CONTROL CHARACTERISTIC



GRID ION CHARACTERISTIC



AEI Xenon Thyratron BT91

The BT91 is a xenon thyratron intended for industrial control applications.

RATINGS—Absolute values

Maximum peak forward anode voltage	1·5	kV
Maximum peak reverse anode voltage	1·5	kV
Maximum peak anode current	40	A
Maximum mean anode current (max averaging time 15 sec)	3·2	A
Maximum surge anode current (max duration 0·1 sec)	560	A
Maximum negative grid voltage before conduction	−250	V
Maximum negative grid voltage during conduction	−10	V
Maximum mean grid current	200	mA
Recommended maximum grid resistor	100	kΩ
Recommended minimum grid resistor	1	kΩ
Maximum commutation factor	130	
Ambient temperature range	−55 to +70	°C

CHARACTERISTICS

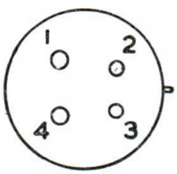
Cathode type	Directly heated	
Filament voltage	2·5	V
Maximum filament current	13·5	A
Mean filament current	12·0	A
Voltage drop (approx)	12	V
Cathode heating time	60	s
Ionisation time (approx)	10	μs
Recovery time (approx)	500	μs
Anode/grid capacitance	1	pF
Grid/cathode capacitance	45	pF

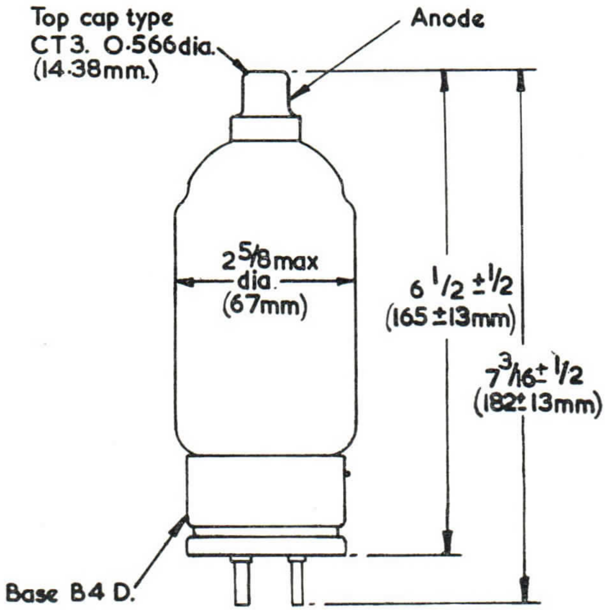
MECHANICAL DATA

Type of cooling	Convection
Mounting position	Any
Net weight (approx)	11 oz (300 gm)

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

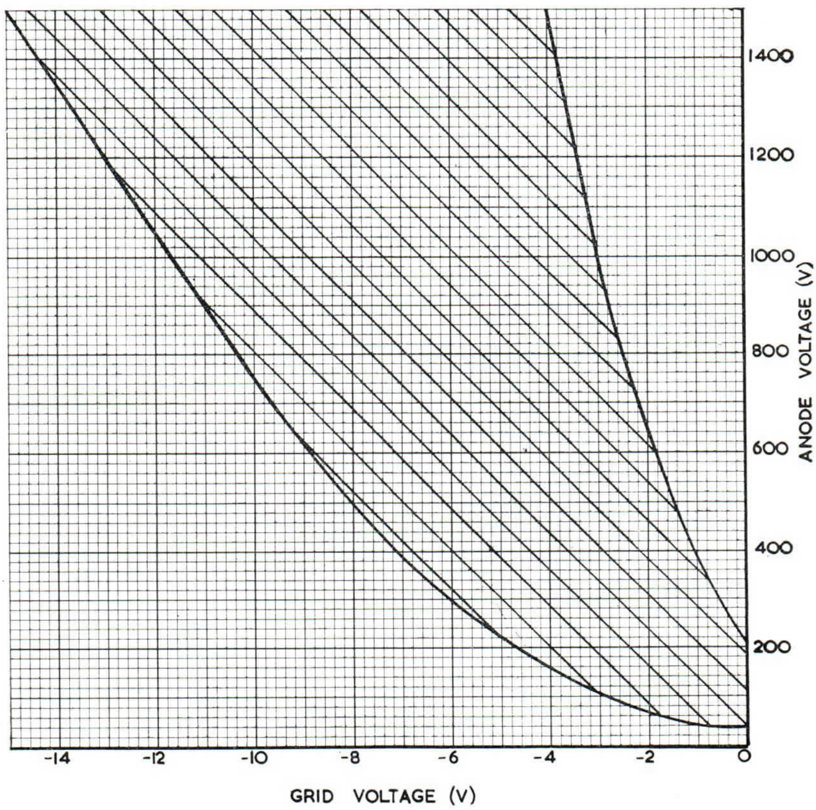
Xenon Thyratron





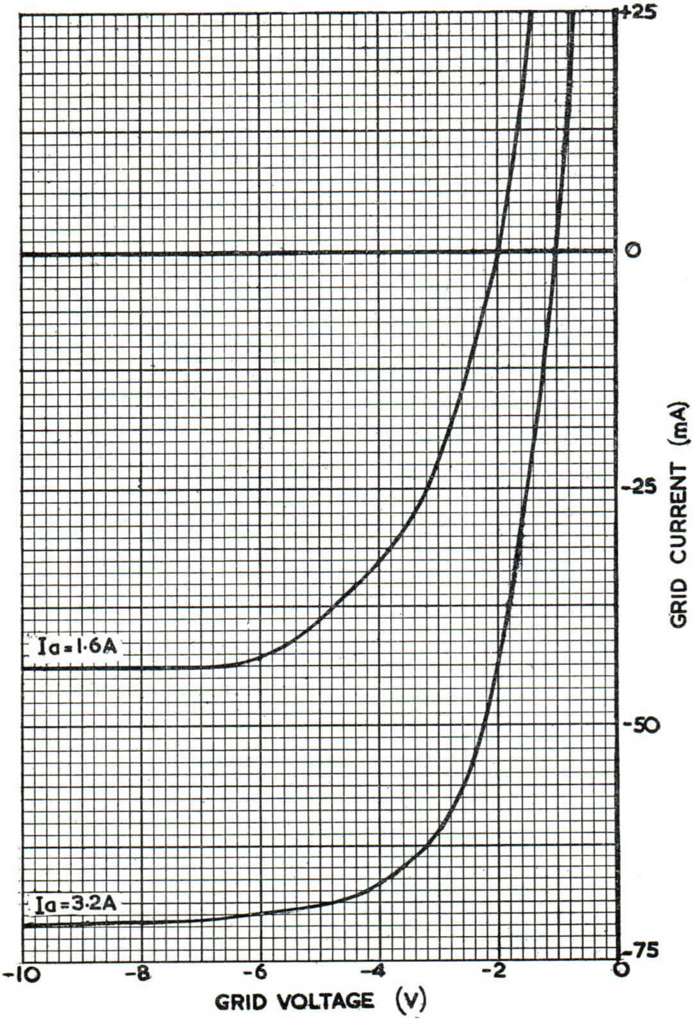
All dimensions in inches.
Millimetre dimensions derived.

CONTROL CHARACTERISTIC



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

GRID ION CHARACTERISTIC



AEI Xenon Thyratron BT91A

The BT91A is a xenon thyratron intended for industrial control applications.

RATINGS—Absolute values

Maximum peak forward anode voltage	1·5	kV
Maximum peak reverse anode voltage	1·5	kV
Maximum peak anode current	40	A
Maximum mean anode current (max averaging time 15 sec)	3·2	A
Maximum surge anode current (max duration 0·1 sec)	560	A
Maximum negative grid voltage before conduction	−250	V
Maximum negative grid voltage during conduction	−10	V
Maximum mean grid current	200	mA
Recommended maximum grid resistor	100	kΩ
Recommended minimum grid resistor	1	kΩ
Maximum commutation factor	130	
Ambient temperature range	−55 to +70	°C

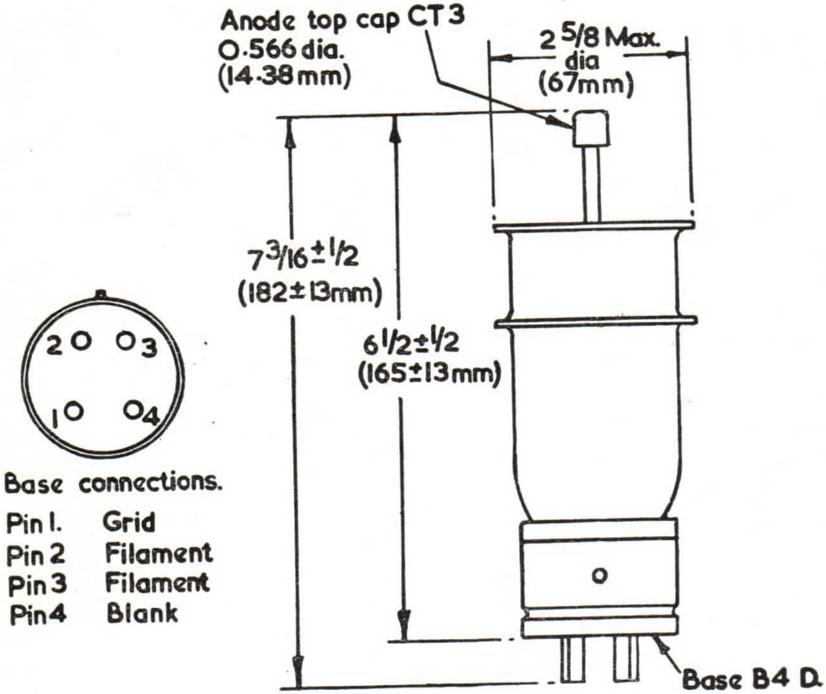
CHARACTERISTICS

Cathode type	Directly heated	
Filament voltage	2·5	V
Maximum filament current	13·5	A
Mean filament current	12·0	A
Voltage drop (approx)	12	V
Cathode heating time	60	s
Ionisation time (approx)	10	µs
Recovery time (approx)	500	µs
Anode/grid capacitance	7	pF
Grid/cathode capacitance	5	pF

MECHANICAL DATA

Type of cooling	Convection
Mounting position	Any
Net weight (approx)	11 oz (300 gm)

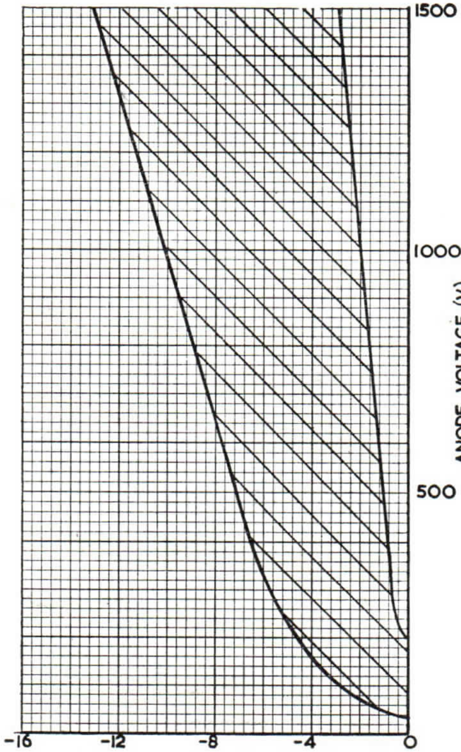
Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435



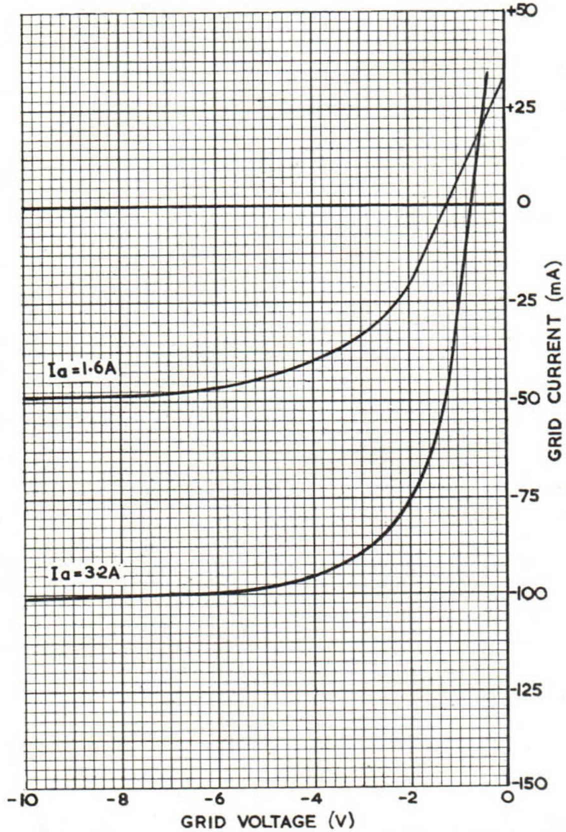
All dimensions in inches.
Millimetre dimensions derived.

AEI Xenon Thyratron BT91A

CONTROL CHARACTERISTIC



GRID ION CHARACTERISTIC



AEI Mercury Thyratron BT95

The BT95 is a mercury-vapour thyratron intended for high voltage industrial control applications.

RATINGS—Absolute values

Maximum peak forward anode voltage	10	15	kV
Maximum peak reverse anode voltage	10	15	kV
Condensed mercury temperature limits	40 to 75	40 to 70	°C
Maximum peak anode current	16	12	A
Maximum mean anode current (max averaging time 15 sec)	2·0	1·5	A
Maximum surge anode current (max duration 0·1 sec)		200	A
Maximum negative grid voltage before conduction		−500	V
Maximum negative grid voltage during conduction		−10	V
Maximum mean grid current		250	mA
Recommended maximum grid resistor		50	kΩ
Recommended minimum grid resistor		5	kΩ

CHARACTERISTICS

Cathode type	Directly heated	
Filament voltage	2·5	V
Maximum filament current	22	A
Mean filament current	20	A
Voltage drop (approx)	16	V
Cathode heating time	5	min
Ionisation time (approx)	10	μs
Recovery time (approx)	1000	μs
Anode/grid capacitance	8	pF
Grid/cathode capacitance	18	pF
Condensed mercury temperature rise above ambient		
At no load (approx)	28	°C
At full load (approx)	31	°C

MECHANICAL DATA

Type of cooling	Convection
Mounting position	Vertical, base down
Net weight (approx)	1 lb 1 oz (480 gm)

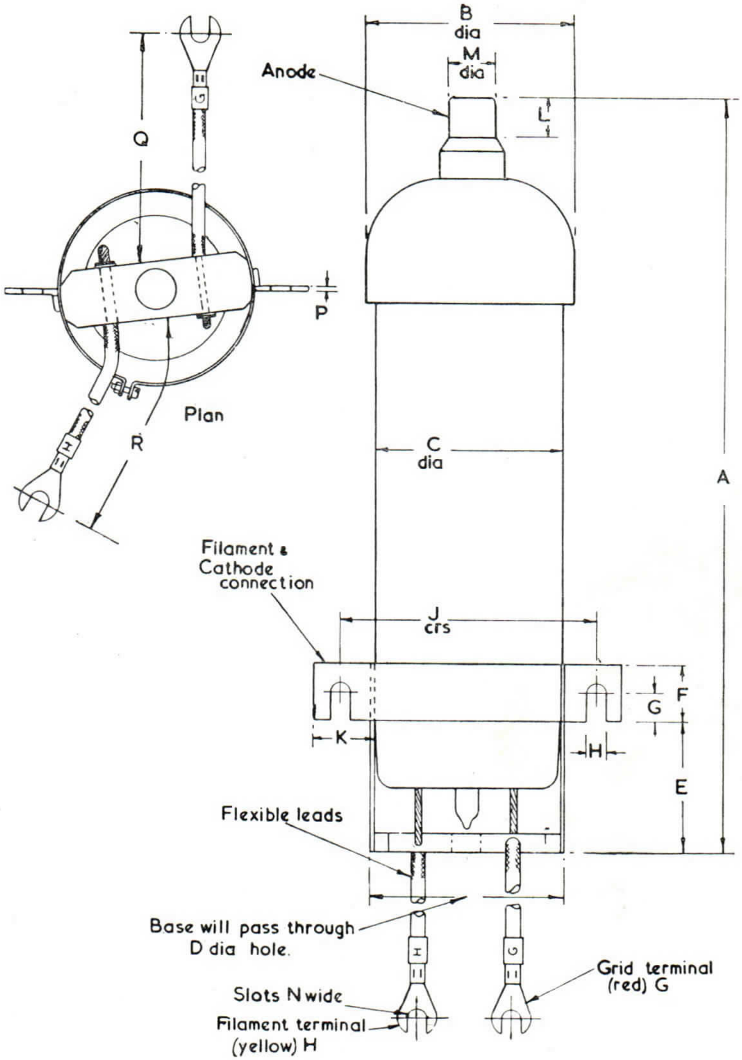
Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Issue 1
April 1962
4400-52/BT95

Dimension	Inches	Millimetres
A	$10\frac{1}{2} \pm \frac{1}{2}$	267 ± 13
B	2·688 max	68 max
C	$2\frac{1}{2}$	64
D	$2\frac{7}{8}$	73
E	1·750 ± 0·062	44·5 ± 1·5
F	0·750 ± 0·031	19 ± 0·8
G	0·375 ± 0·031	9·5 ± 0·8
H	0·250 ± 0·010	6·35 ± 0·25
J	3·406 ± 0·031	86·5 ± 0·8
K	$\frac{3}{4}$	19
L	0·420 min	10·7 min
M	0·641 ± 0·015	16·27 ± 0·39
N	0·265	6·73
P	0·08	2
Q	4·56 ± 0·25	116 ± 6
R	4·31 ± 0·25	110 ± 6

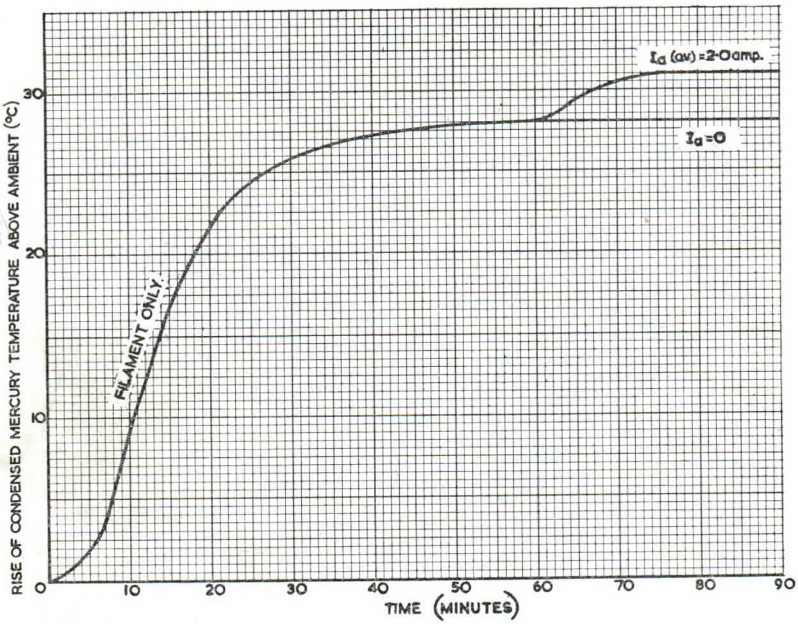
All dimensions in inches.
Millimetre dimensions derived.

AEI Mercury Thyratron BT95

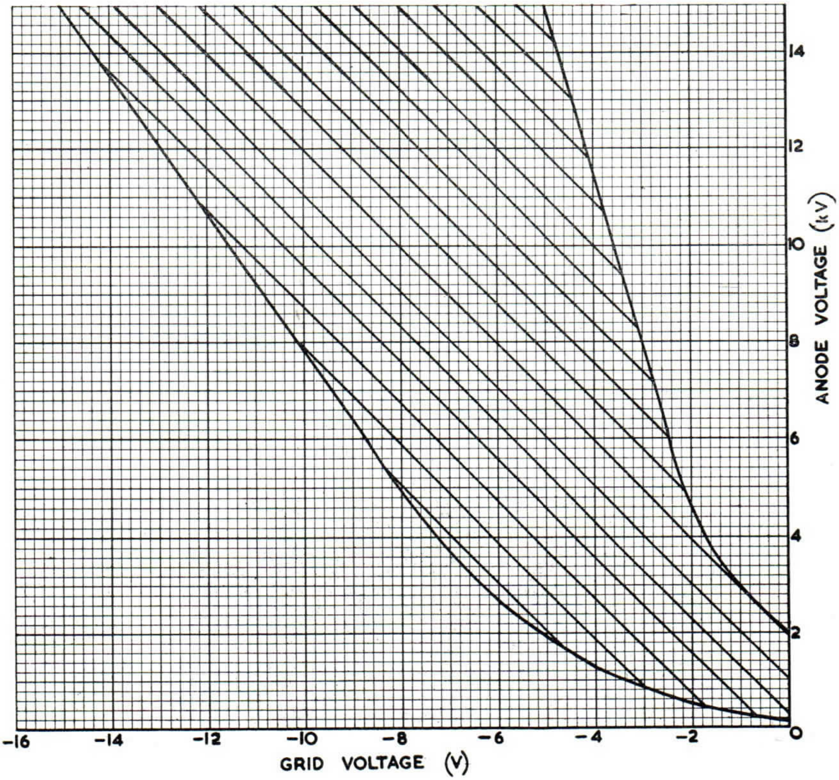


Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

HEATING CHARACTERISTIC



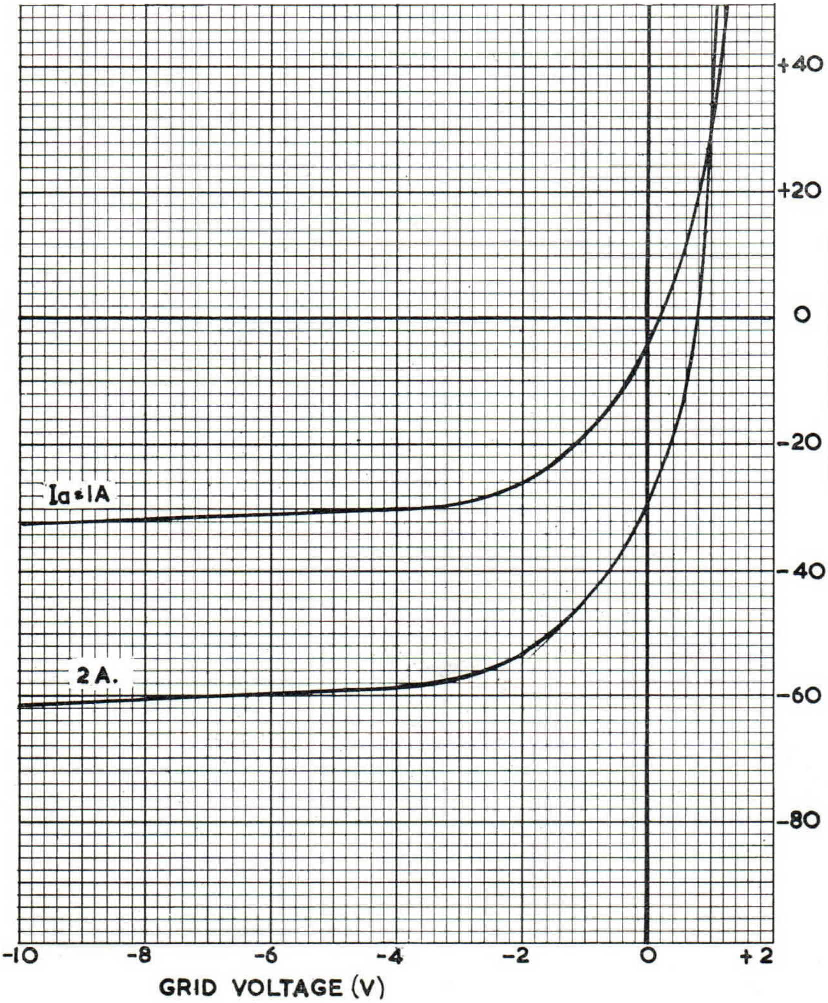
CONTROL CHARACTERISTIC



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Issue 1
April 1962
4400-52/BT95

GRID ION CHARACTERISTIC



AEI Mixed-Gas Thyratrons

BT109
BT109A

The BT109 is an inert-gas/mercury-vapour thyratron intended for industrial control applications. The BT109A is electrically identical to the BT109 but has flexible leads instead of a plug-in-base.

RATINGS—Absolute values

Maximum peak forward anode voltage	1·5	kV
Maximum peak reverse anode voltage	1·5	kV
Maximum peak anode current	77	A
Maximum mean anode current (max averaging time 15 sec)	6·4	A
Maximum surge anode current (max duration 0·1 sec)	770	A
Maximum negative grid voltage before conduction	−250	V
Maximum negative grid voltage during conduction	−10	V
Maximum mean grid current	250	mA
Recommended maximum grid resistor	100	kΩ
Recommended minimum grid resistor	10	kΩ
Ambient temperature range*	−40 to +40	°C

* Still air temperature near the base of the valve.
Although the valve will operate satisfactorily at ambient temperatures of −40°C to +15°C, life will be reduced at these low temperatures. For maximum life the valve should be operated at ambient temperatures in the range +15°C to +40°C.

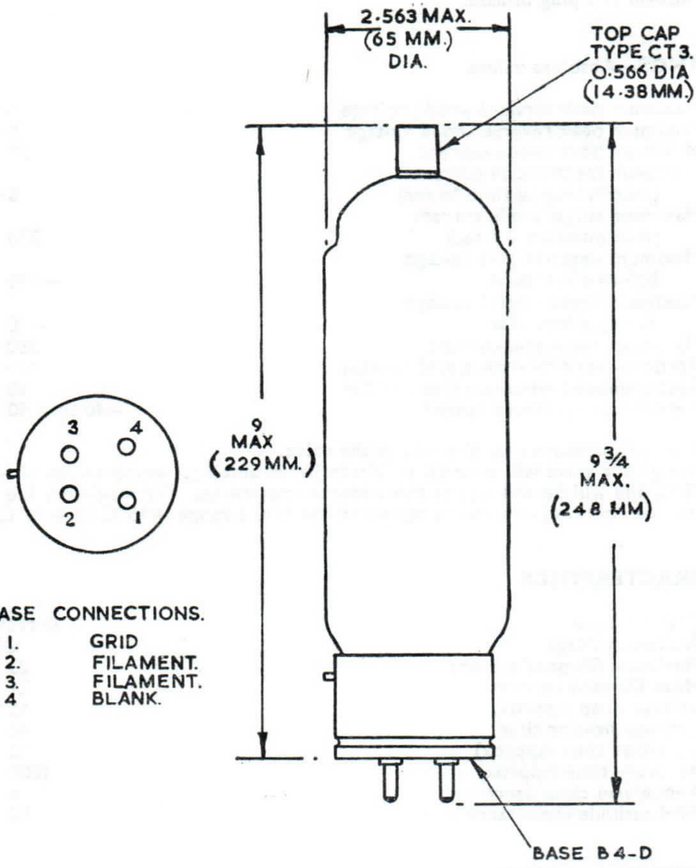
CHARACTERISTICS

Cathode type	Directly heated	
Filament voltage	2·5	V
Maximum filament current	23	A
Mean filament current	21	A
Voltage drop (approx)	15	V
Cathode heating time	60	s
Ionisation time (approx)	10	μs
Recovery time (approx)	1000	μs
Anode/grid capacitance	4	pF
Grid/cathode capacitance	18	pF

MECHANICAL DATA

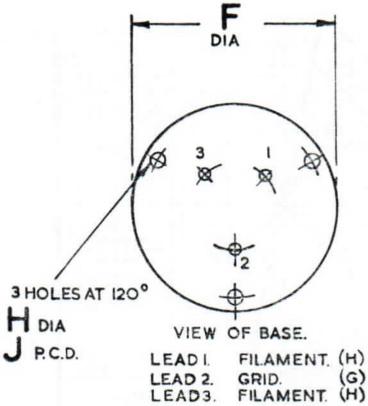
Type of cooling	Convection
Mounting position	Vertical, base down
Net weight (approx)	11½ oz (330 gm)

OUTLINE DRAWING OF BT109

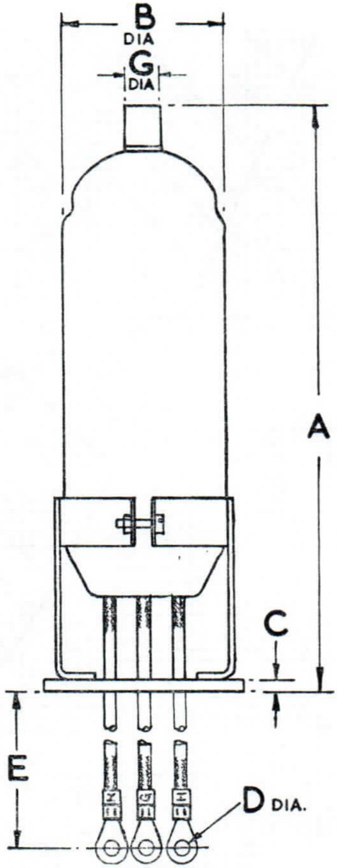


All dimensions in inches.
Millimetre dimensions derived.

OUTLINE DRAWING OF BT109A

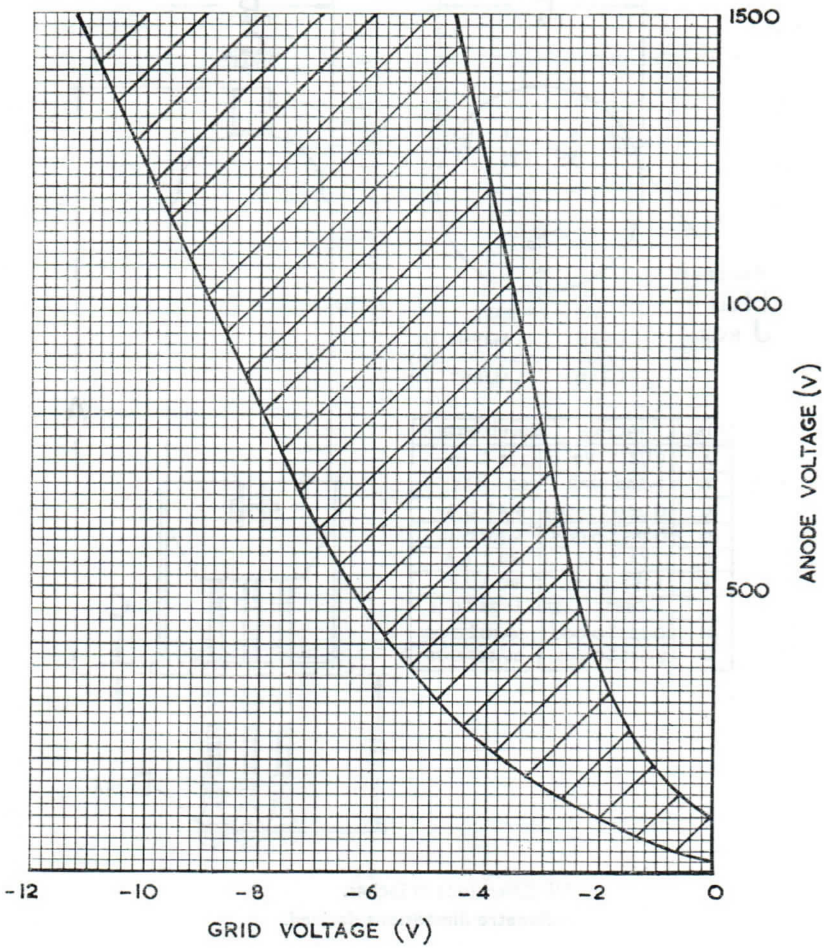


DIM	INCHES.	MILLIMETRES.
A	9 1/4 ± 1/2	235 ± 13
B	2·563 MAX.	65 MAX
C	0·250 ± 0·032	6·4 ± 0·8
D	0·265 ± 0·005	6·73 ± 0·12
E	7 1/4 ± 1/4	184 ± 6·5
F	3·157 MAX	80 MAX.
G	0·566 ± 0·007	14·38 ± 0·16
H	0·252 ± 0·002	6·40 ± 0·05
J	2·625 ± 0·010	66·68 ± 0·25

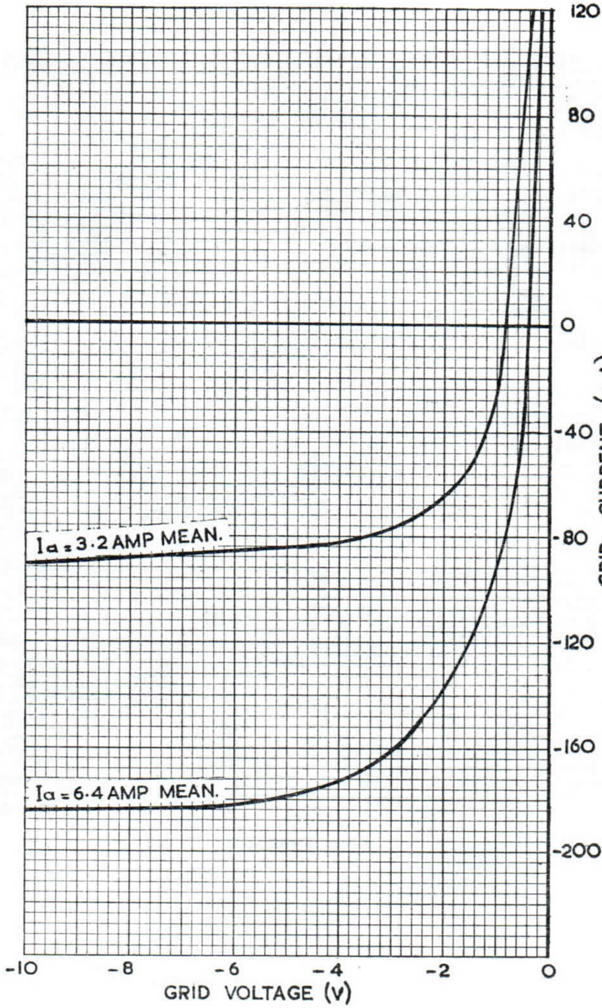


All dimensions in inches.
Millimetre dimensions derived.

CONTROL CHARACTERISTIC

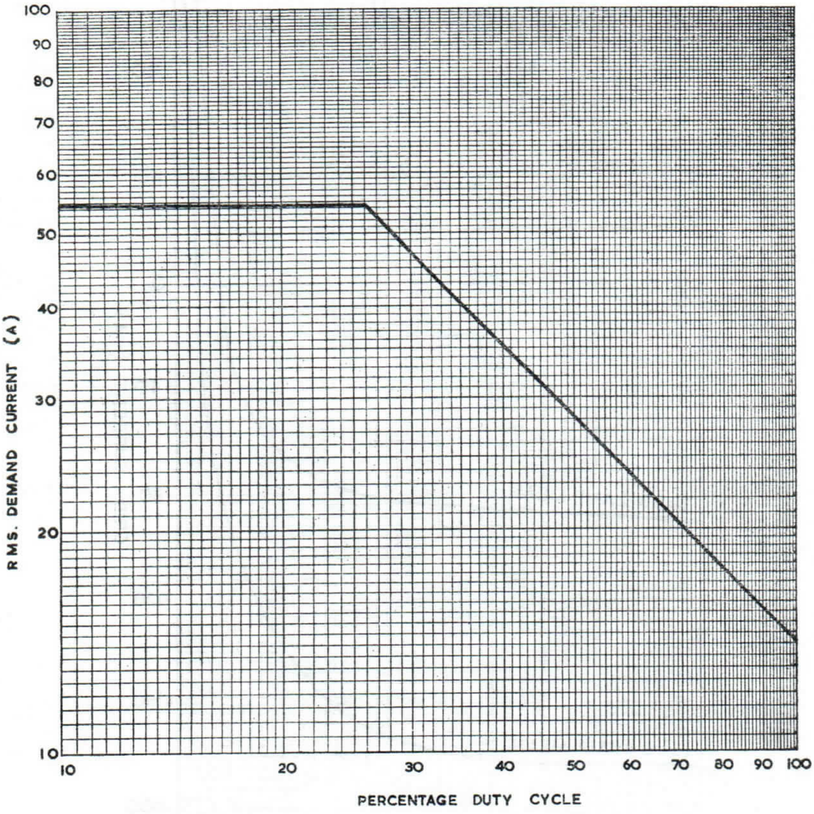


GRID ION CHARACTERISTIC



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

INVERSE PARALLEL OPERATION
FULL CONDUCTION IN EACH HALF CYCLE



AEI Mixed-Gas Thyratron BT111

The BT111 is an inert-gas/mercury-vapour thyratron intended for industrial control applications and ignitor firing service.

RATINGS—Absolute values

Maximum peak forward anode voltage	1·5	kV
Maximum peak reverse anode voltage	1·5	kV
Maximum peak anode current	30	A
Maximum mean anode current (max averaging time 5 sec)	2·5	A
Maximum surge anode current (max duration 0·1 sec)	150	A
Maximum negative grid voltage before conduction	−250	V
Maximum negative grid voltage during conduction	−10	V
Maximum mean grid current	250	mA
Recommended maximum grid resistor	100	kΩ
Recommended minimum grid resistor	10	kΩ
Ambient temperature range*	−40 to +40	°C

* Still air temperature near the base of the valve.
Although the valve will operate satisfactorily at ambient temperatures of −40°C to +15°C, life will be reduced at these low temperatures. For maximum life the valve should be operated at ambient temperatures in the range +15°C to +40°C.

CHARACTERISTICS

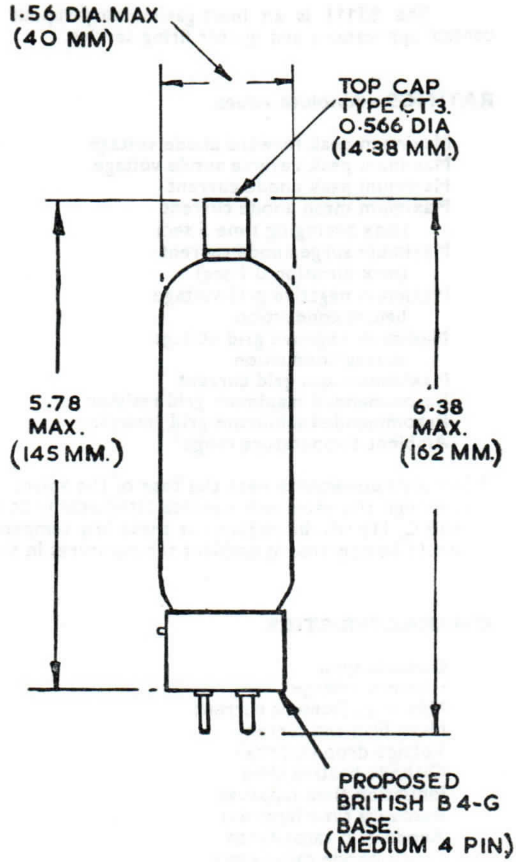
Cathode type	Directly heated	
Filament voltage	2·5	V
Maximum filament current	10	A
Mean filament current	9·0	A
Voltage drop (approx)	15	V
Cathode heating time	30	s
Ionisation time (approx)	10	μs
Recovery time (approx)	1000	μs
Anode/grid capacitance	2	pF
Grid/cathode capacitance	18	pF

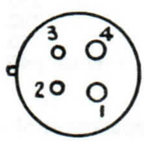
MECHANICAL DATA

Type of cooling	Convection
Mounting position	Vertical, base down
Net weight (approx)	4½ oz (130 gm)

Mixed-Gas Thyratron

AEI



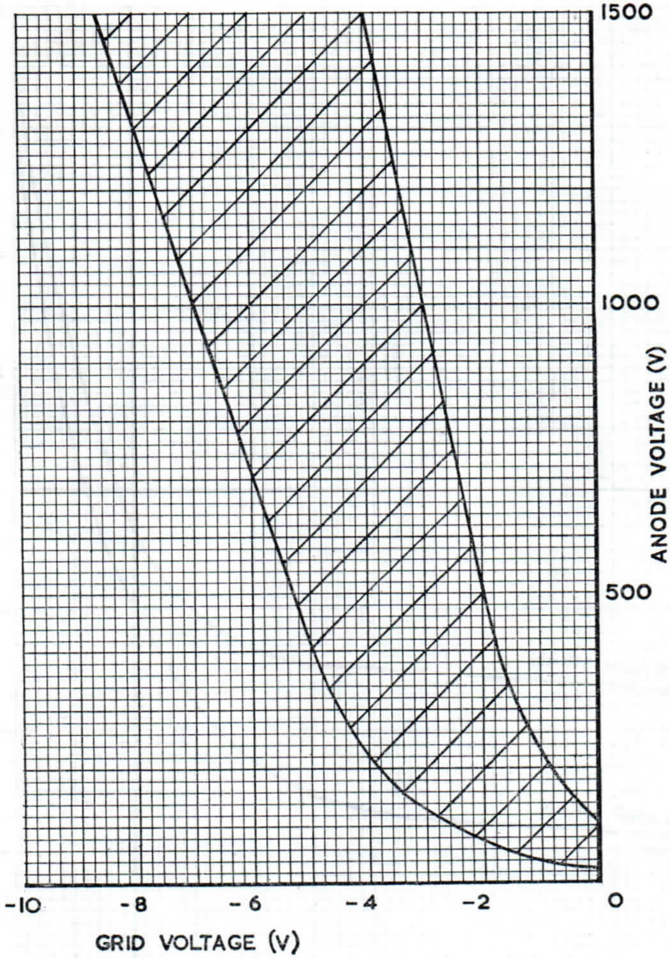


BASE CONNECTIONS.

PIN 1	FILAMENT.
PIN 2	FILAMENT CT.
PIN 3	GRID.
PIN 4	FILAMENT.

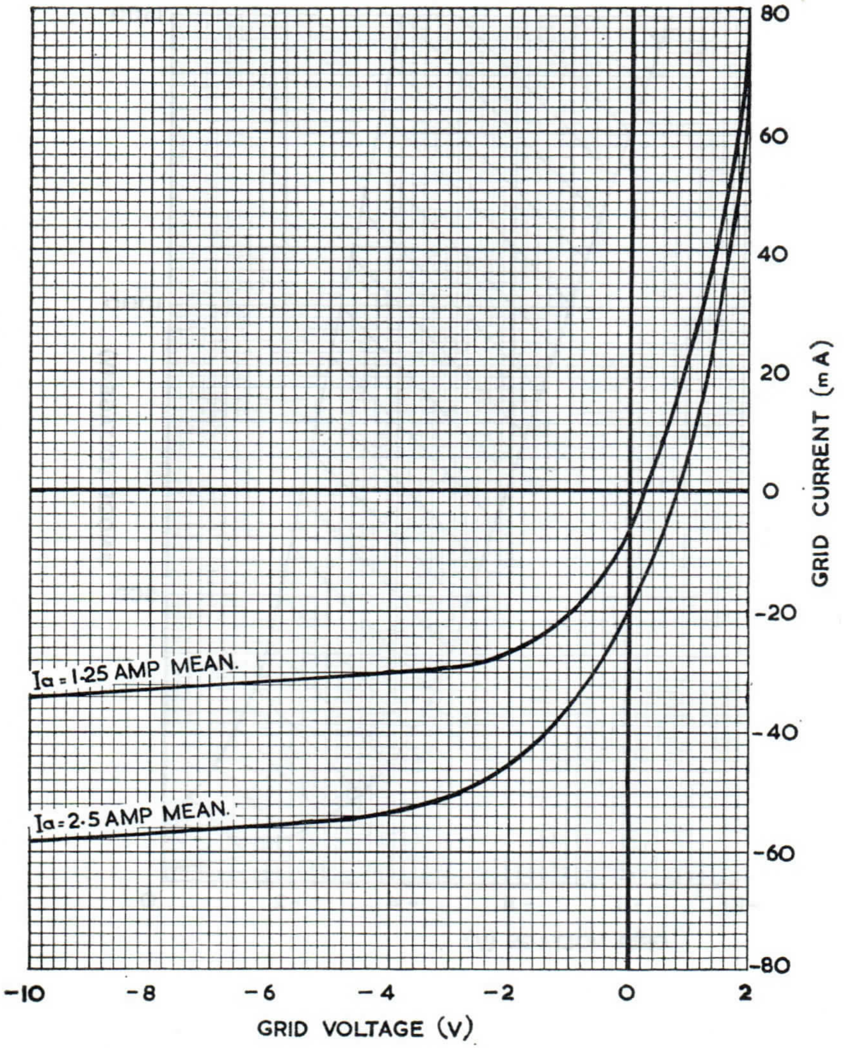
All dimensions in inches.
Millimetre dimensions derived.

CONTROL CHARACTERISTIC



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

GRID ION CHARACTERISTIC



AEI Mixed-Gas Thyratron BT113

The BT113 is an inert-gas/mercury-vapour thyratron intended for industrial control applications. It can be used as a plug-in replacement for the BT19 in applications where the maximum peak anode voltage does not exceed 1,500 volts.

RATINGS—Absolute values

Maximum peak forward anode voltage	1·5	kV
Maximum peak reverse anode voltage	1·5	kV
Maximum peak anode current	2·0	A
Maximum mean anode current (max averaging time 15 sec)	0·5	A
Maximum surge anode current (max duration 0·1 sec)	40	A
Maximum negative grid voltage before conduction	−250	V
Maximum negative grid voltage during conduction	−10	V
Maximum mean grid current	50	mA
Recommended maximum grid resistor	100	kΩ
Recommended minimum grid resistor	10	kΩ
Ambient temperature range*	−40 to +40	°C

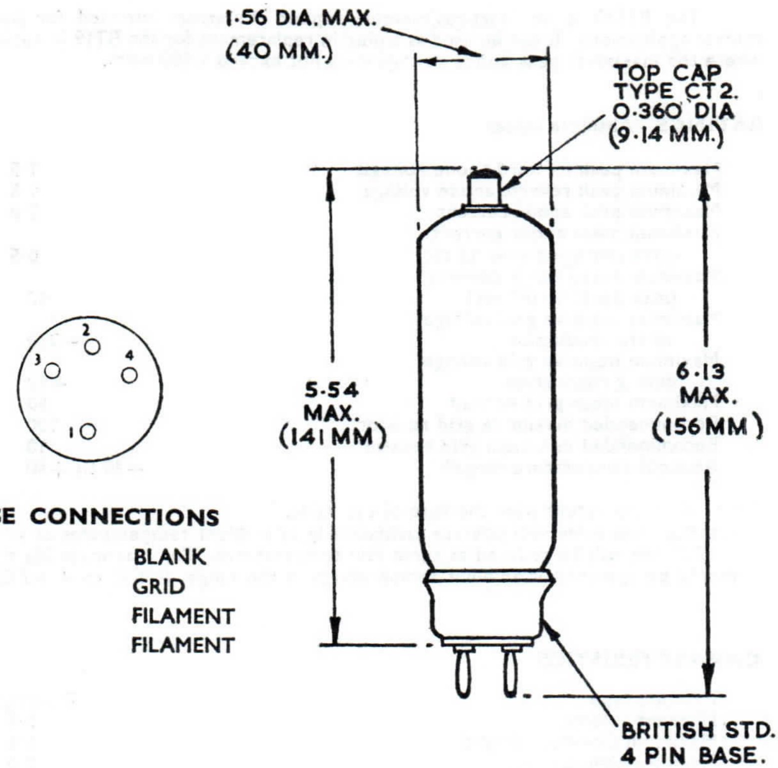
* Still air temperature near the base of the valve.
Although the valve will operate satisfactorily at ambient temperatures of −40°C to +15°C, life will be reduced at these low temperatures. For maximum life the valve should be operated at ambient temperatures in the range +15°C to + 40°C.

CHARACTERISTICS

Cathode type	Directly heated	
Filament voltage	2·5	V
Maximum filament current	5·4	A
Mean filament current	5·0	A
Voltage drop (approx)	15	V
Cathode heating time	10	s
Ionisation time (approx)	10	µs
Recovery time (approx)	1000	µs
Anode/grid capacitance	2	pF
Grid/cathode capacitance	7	pF

MECHANICAL DATA

Type of cooling	Convection
Mounting position	Vertical, base down
Net weight (approx)	2¾ oz (80 gm)

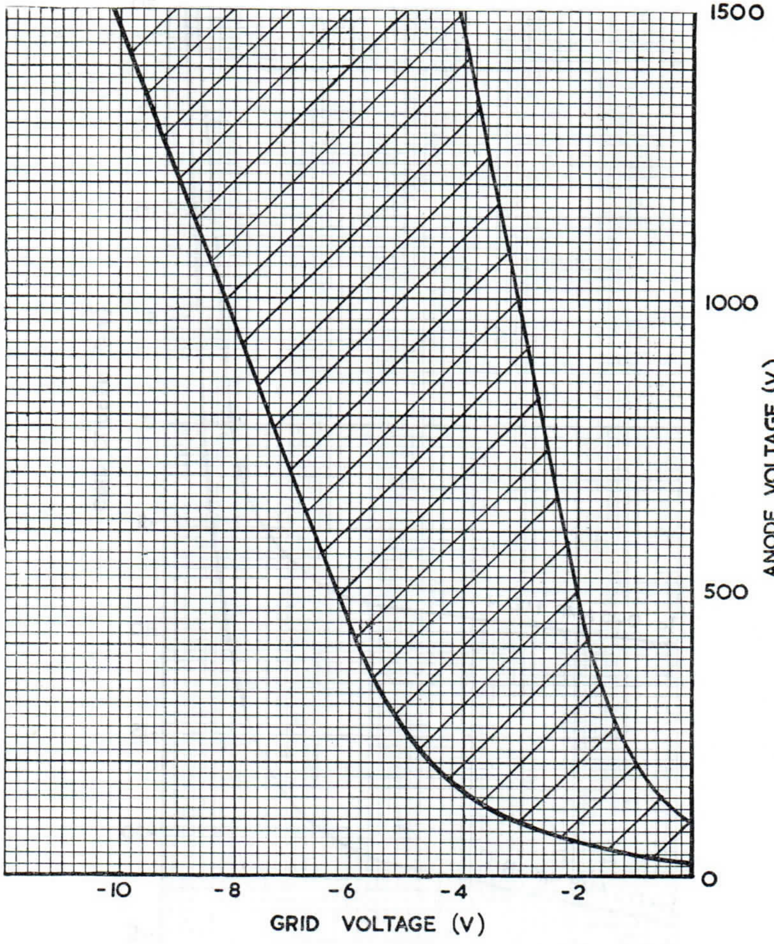


BASE CONNECTIONS

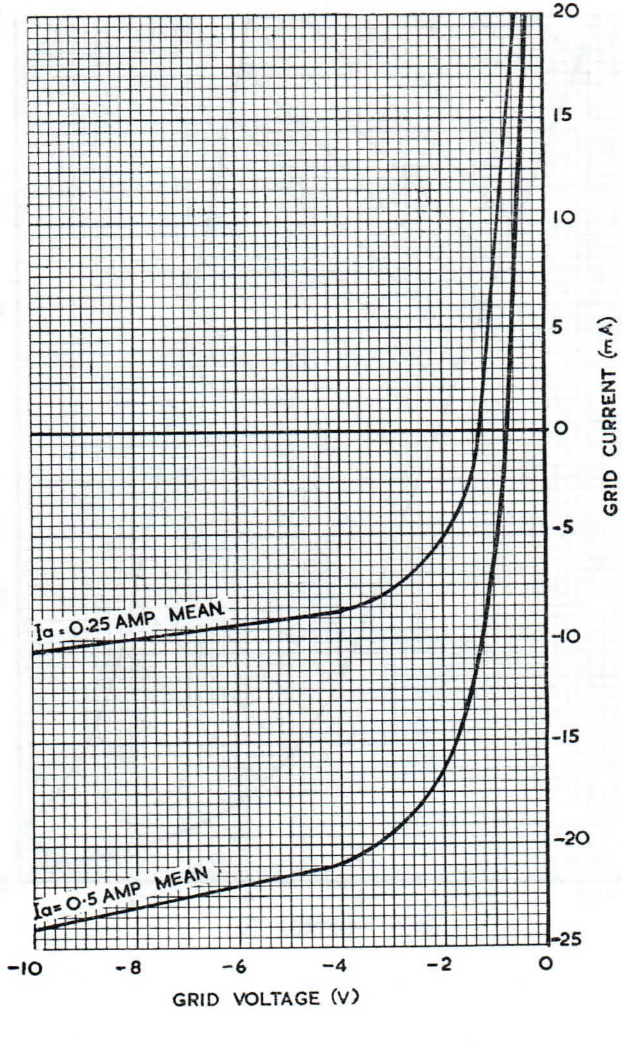
PIN 1	BLANK
PIN 2	GRID
PIN 3	FILAMENT
PIN 4	FILAMENT

All dimensions in inches.
Millimetre dimensions derived.

CONTROL CHARACTERISTIC



GRID ION CHARACTERISTIC



Hydrogen Thyratrons

4400/53

Hydrogen Thyratrons

Introduction

Hydrogen-filled thyratrons are especially suitable for the control and the precise timing of high energy electrical pulses of short duration and high repetition rate ; typically the pulses may have a duration of one microsecond and a repetition rate of many hundreds of pulses per second. The hydrogen filling assists rapid ionisation and deionisation, and the passage of currents of high peak value ; although the mean current rating is limited (by comparison, for example, with that of a mercury-vapour valve of comparable dimensions) because of the relatively high arc drop.

Design

A typical hydrogen thyratron is shown in figure 1. The anode is totally enclosed, as breakdown is liable to occur on long paths and thus the valve will withstand higher voltages if the spacing round the anode and its lead is kept small. Below the anode is a grid assembly designed to give the required control characteristic. Considerable variation in design may be met ; for example, directly-heated cathodes are sometimes used, though these introduce more jitter unless a d.c. heater supply is used.

Applications

Hydrogen thyratrons are widely used in pulse applications such as radar, X-ray therapy, high power stroboscopes and specialised research. The basic pulse circuit is shown in figure 2, and a typical current pulse in figure 3.

Ionisation

Ionisation time is the delay between the instant when conduction starts and the establishment of a stable arc with low voltage drop. The process is very rapid in hydrogen thyratrons, enabling the valve to pass current pulses of very short duration with precise timing. This allows greater accuracy, for example in radar observations, especially in short-range measurements.

Deionisation

While current is passing, the gas in a thyratron is highly ionised. When conduction ceases, the ionised condition persists for a time, but the gas becomes progressively deionised as the ions and electrons diffuse to solid surfaces, where they are neutralised. If a positive anode voltage is reapplied, grid control is not possible until the ionisation has reached a low level ; the level to be reached and the time required to reach it—known as the ' Recovery Time '—vary with the design of the valve and with the conditions of operation. The recovery time is shorter, the higher the speed of diffusion of the particles, and so is less for light gases such as hydrogen than for the heavier gases like xenon and mercury vapour. This makes hydrogen thyratrons more suitable for pulsing at high repetition rates. The recovery time can be reduced by a reduction in the grid d.c. resistance and also by the application of a negative bias voltage.

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Issue 1
Feb. 1964
4400-53/Gen.

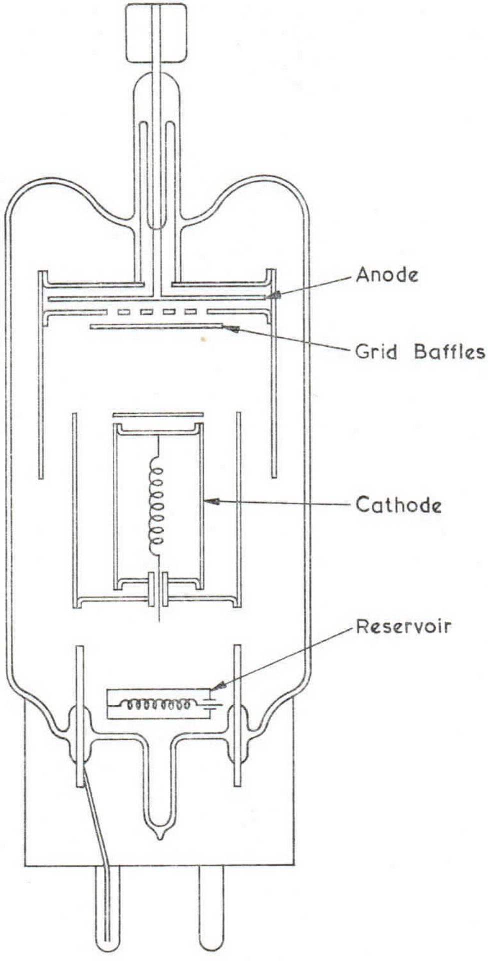


Fig. 1 Diagrammatic sketch of a typical hydrogen thyratron.

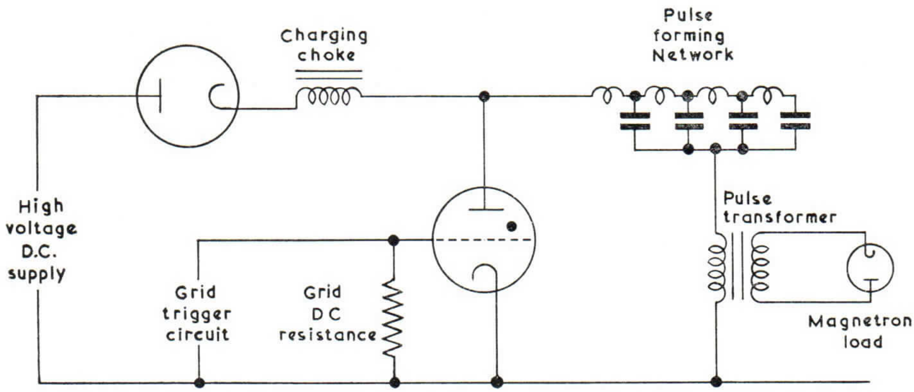


Fig 2. Typical pulse circuit.

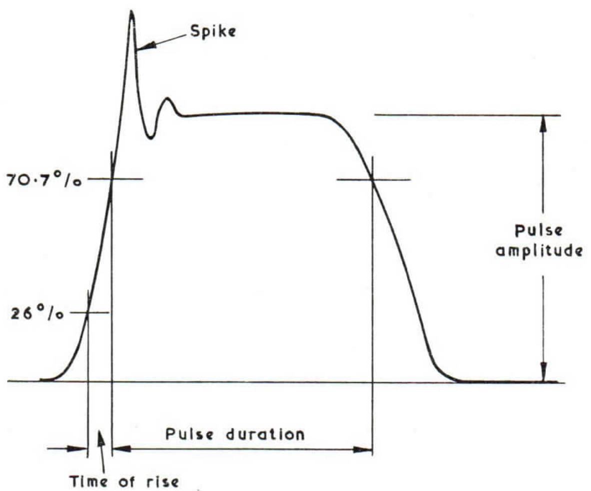


Fig. 3. Pulse characteristics.

Current Capacity

The hydrogen thyratron is generally suitable for applications requiring currents of high peak value but relatively low mean value. The ratio of peak to mean current may typically be 1000 : 1 for a hydrogen valve, whereas in xenon or mercury-vapour thyratrons it is generally not more than about 12 : 1. This is partly due to the relatively high arc drop, which limits the mean rating in hydrogen thyratrons, rendering them less suitable than xenon or mercury-vapour valves for most industrial applications.

Control

The hydrogen thyratron is usually designed to have a positive control characteristic ; and it is generally necessary to establish an arc between grid and cathode before conduction is initiated to the anode. The control characteristic is therefore generally given in terms of the minimum grid triggering pulse needed to start anode conduction. No control curves can be given. With such a valve, grid bias is not usually necessary, although it is sometimes used on large valves to assist deionisation when a high pulse-repetition rate is required.

In the typical hydrogen thyratron shown in figure 1, the positive characteristic is obtained by fitting a solid disc under the perforated grid baffle. The valve is triggered by the application of a grid pulse, such as is shown in figure 4a, which may have an amplitude of a few hundred volts and last a few microseconds. The sequence of events in firing is that the grid voltage increases until an arc is struct between grid and cathode, and the grid-cathode voltage begins to settle down to the level of the arc voltage drop (see figure 4b) ; ions and electrons diffuse outwards from this arc and when they reach the edge of the grid disc electrons are attracted towards the anode and an arc is established between anode and cathode. The oscilloscope may sometimes indicate a time delay while this process is taking place. When the anode arc is struck, the grid potential at first rises rapidly, the grid acting as a potential divider between anode and cathode. The grid potential then falls with that of the anode until conditions of steady voltage drop are reached. The grid voltage, as observed on an oscilloscope, is as shown in figure 4c, which also indicates some oscillations usually set up in the capacitances and inductances associated with the circuit.

The grid drive requirements are specified in the data sheets; a minimum voltage being necessary to ensure grid striking, and the specification of a maximum allowable value of circuit impedance ensures sufficient grid current for rapid anode pick-up. A high rate of rise of grid voltage gives precision and minimises jitter. (See figure 5.)

When very high precision is desired, jitter can be reduced by the use of a grid pulse of higher voltage and with a faster front ; this at the same time reduces both the anode delay-time and the anode delay-time drift. The increase in voltage reduces the liability for the grid to fire on the flat top of the pulse when jitter increases.

Jitter tends to be slightly greater at low gas pressures (i.e. with low reservoir voltages) than at high pressures.

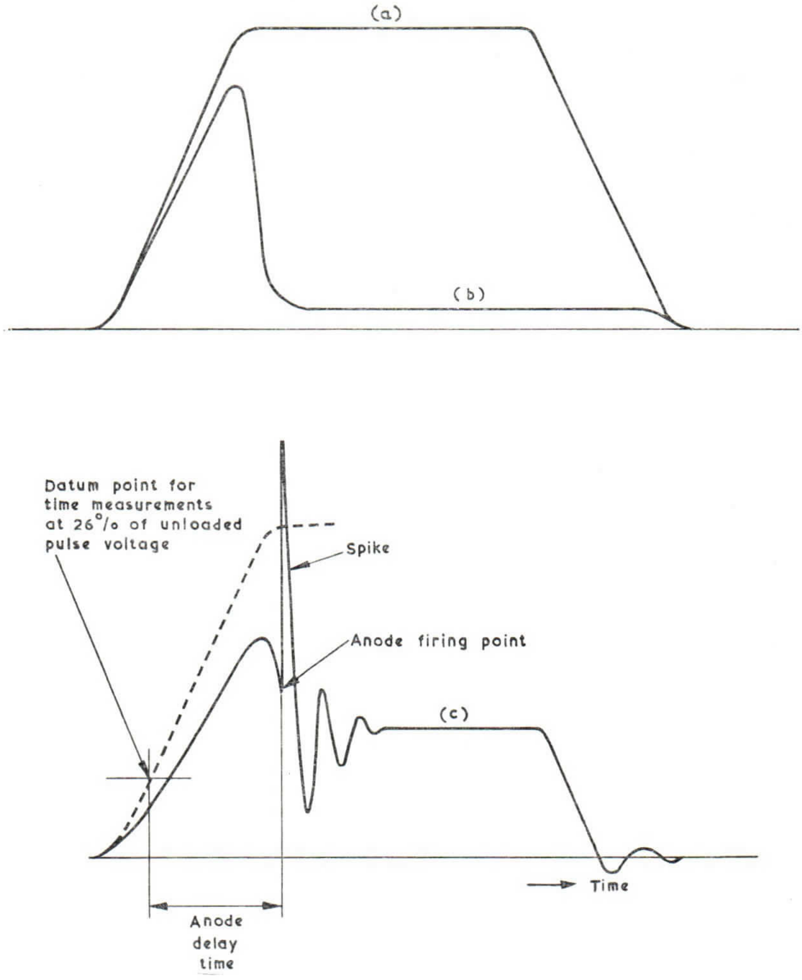


Fig. 4. Grid pulse diagram.

(*a*) Unloaded grid pulse.

(*b*) Grid alone firing (Ea=OV).

(*c*) Normal firing ; anode conducting.

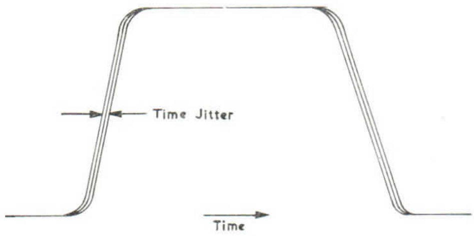


Fig. 5. Anode current pulse showing jitter.

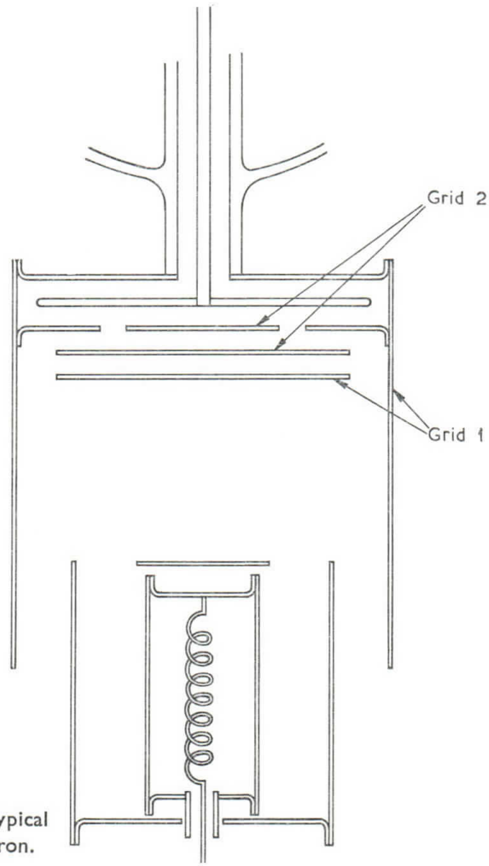


Fig. 6. Electrode structure of a typical tetrode hydrogen thyratron.

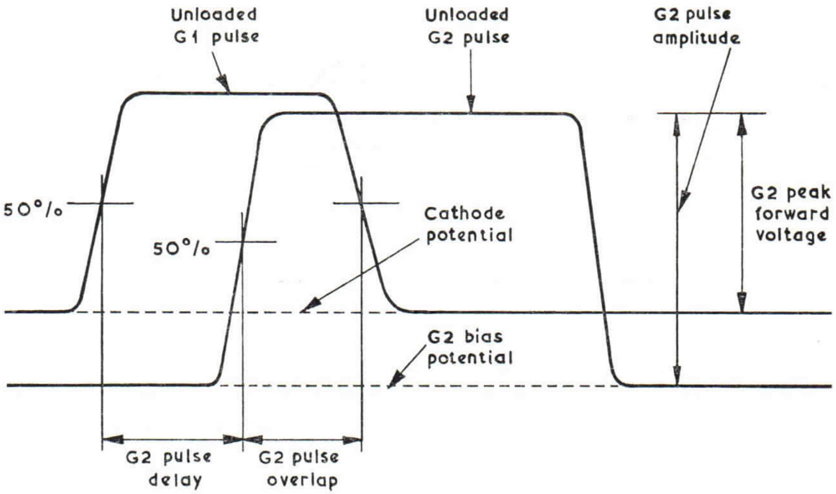


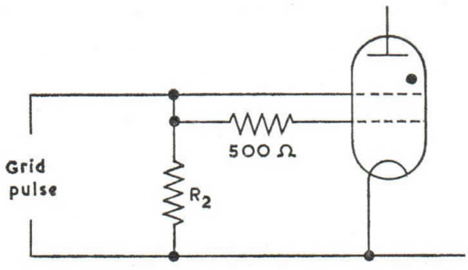
Fig. 7. Grid pulse characteristics

Tetrode Hydrogen Thyratrons

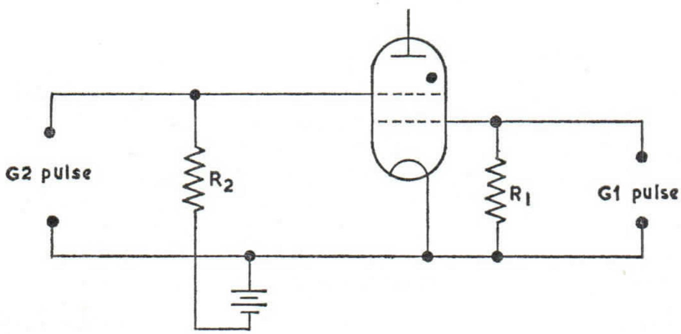
It has been found that a hydrogen thyratron will fire with greater precision if an arc has been established to the cathode in advance of the application of the triggering pulse. This condition is obtained in the tetrode thyratron by the use of an extra electrode G_1 inserted between the control grid G_2 and the cathode, as is shown in figure 6. This figure also illustrates the grid design in which the G_2 baffle adjacent to the anode has a circular-slot aperture. Such a baffle has the advantage, by comparison with the multi-hole baffle of figure 1, of providing a large cross-sectional area for the arc path, thus reducing losses due to arc restriction and permitting a faster pulse front.

The operation of triggering the valve is illustrated by figure 7. A preionising pulse is first applied to G_1, followed by a triggering pulse to G_2, the latter often being superimposed on a negative bias of 50–100 volts. The discharge to G_1 must have reached a condition of stable voltage-drop before the pulse is applied to G_2, and also must persist until the G_2 discharge is stable. No current will flow to the anode if G_1 only is triggered. Details of the pulse voltages and currents required are given in the Valve Data Sheets ; for the measurements involved, see figure 7 and the section on ' Definitions '.

If desired, the tetrode hydrogen thyratron can be used as a triode for single pulse firing by joining G_1 and G_2 through 500 ohms as shown in fig. 8.



(*a*) Single trigger pulse



(*b*) Double trigger pulse
R_1 = G1 d.c. resistance.
R_2 = G2 d.c. resistance.

Fig. 8. Tetrode thyratron grid connections

Gas Clean-up

During operation of the valve, hydrogen gas is lost by chemical combination with and absorption in the valve electrodes and envelope. The rate of loss can be reduced by careful processing of the valve during manufacture. The loss cannot, however, be entirely eliminated and the AEI thyratron therefore incorporates a hydrogen reservoir which maintains an adequate gas pressure throughout life.

Hydrogen Reservoir

The reservoir consists of a capsule filled with titanium hydride and heated to the appropriate temperature by means of a separate heater. When cold, the reservoir absorbs all the available hydrogen and the valve is virtually under high vacuum. When heated, the reservoir emits hydrogen to a pressure depending on the temperature of the reservoir, which in turn depends on the voltage applied to the reservoir heater. If some gas is cleaned up during operation, the reservoir automatically releases more gas, maintaining the temperature-pressure equilibrium. In order to establish the correct hydrogen pressure in the valve, it is essential to maintain the correct reservoir-heater voltage, within the tolerance specified in the rating sheet.

In the smaller valves the reservoir heater is connected internally in parallel with the cathode heater. In larger valves separate connections are made to the reservoir heater so that the voltage can be set to the optimum value, which may vary between individual valves. In such cases the optimum voltage is marked on each valve.

If the reservoir voltage is too high, the gas pressure will be too high and the valve will break down or fail to control at the rated maximum anode voltage, causing the equipment to trip out. If the reservoir voltage is too low the gas pressure also will be low, this resulting in slow ionisation and a high voltage drop ; the effect may be observed first as a slow or ragged front on the anode current trace and then as visible overheating of the anode. Under these conditions the valve may deteriorate rapidly, with a reduction in life, if not immediate failure.

The reservoir voltage does not normally require any adjustment during life and should be left unchanged. However, should it be desired, for any reason, to adjust this voltage, the following procedure should be adopted. Raise the reservoir voltage in steps of 0·1 volt, for 5 minutes at each step, until the equipment trips out ; then lower the voltage in similar steps until either the anode is observed to be just dull red or the anode current pulse shape becomes poor. The correct setting is about mid-way between these two voltages. The exact setting may depend on the conditions of operation, a higher pressure favouring easier firing and more rapid ionisation, a lower pressure increases the anode voltage which can be withstood. The setting should always leave latitude for mains voltage fluctuations.

DEFINITIONS

Pulse amplitude

The maximum value (excluding spikes) of a smooth curve through the average of the fluctuations over the top portion of the pulse (as shown in figure 3). In the case of grid voltage pulses where bias may be used the amplitude is to be measured from the bias level (as in figure 7).

Pulse duration

The time interval between the instants at which the instantaneous value of the parameter, as seen on the oscilloscope trace, equals 70·7% of the pulse amplitude (as shown in figure 3).

Time of rise

The time required for the pulse to rise from 26% to 70·7% of the pulse amplitude (see figure 3).

Spike

A sudden excursion of short duration appearing on the main wave shape (see for example figures 3 and 4c).

Pulse repetition frequency

The average number of pulses in one second when this is independent of the interval of time over which it is measured.

Peak forward anode voltage

The peak positive voltage at the anode with respect to the cathode.

Peak reverse anode voltage

The peak negative voltage including spike at the anode with respect to the cathode.

Peak anode current

The amplitude of the pulses of anode current (as defined above).

Mean anode current

The average value of the current passing through the valve.

Rate of rise of anode current

The average value of the ratio of the current change between the 26% and 70·7% amplitude points of the leading edge of the current pulse, to the rise time for that portion of the pulse.

Peak rate of rise of anode current

The maximum instantaneous value of the rate of rise of the leading edge of the anode current pulse.

Anode take-over voltage

The peak voltage appearing at the anode of the valve which is just sufficient to cause conduction with minimum grid trigger pulse.

Unloaded grid pulse

The voltage pulse appearing at the grid terminal with the thyratron removed from the socket.

Peak forward grid voltage

The peak positive value of the unloaded grid pulse with respect to the cathode and excluding spikes.

Peak reverse grid voltage

The peak negative voltage including spikes with respect to the cathode appearing at the thyratron grid during operation.

Unloaded grid bias voltage

The d.c. bias voltage at the grid terminal with respect to the cathode terminal with the thyratron removed from its socket.

Average rate of rise of grid voltage

The average of the rate of rise between the 26% and 70·0% points on the leading edge of the unloaded grid pulse.

Peak rate of rise of grid voltage

The maximum value of the rate of rise of the leading edge of the unloaded grid pulse.

Forward grid impedance

The output impedance of the grid drive and bias circuit.

Grid d.c. resistance

The d.c. resistance measured between grid and cathode terminals with the thyratron removed from its socket.

Grid 2 pulse delay

The time interval between the voltage pulses on Grid 1 and Grid 2 terminals with the thyratron removed from its socket measured at the 50% level on the leading edge of each pulse (figure 7).

Grid 2 pulse overlap

The time interval during which the voltage pulses on Grid 1 and Grid 2 overlap with the thyratron removed from its socket and measured at the 50% level of pulse amplitude of each pulse (figure 7).

Anode delay time

The time interval between the point on the rising portion of the grid voltage pulse which is 26% of the unloaded pulse amplitude and the point where anode conduction takes place. (In multigrid valves, the grid shall be that which receives the last pulse.) (See figure 4c.)

Anode delay time drift

The change in anode delay time over a specified period of time as a result of continued operation of the thyratron under certain specified conditions.

Recovery time

The time interval between the cessation of forward anode current and the instant when the grid regains control under specified anode and grid circuit conditions.

Ionisation time

The approximate time between the establishment of conditions for an anode to cathode arc to be initiated, and the time when a substantially constant arc voltage drop is established.

Time jitter

The pulse to pulse variation in anode firing time referred to a point which shall be 26% of the unloaded grid pulse amplitude. (In multigrid valves, the grid shall be that which receives the last pulse.) (See figure 5.)

Valve heating time

The time which must elapse between the application of the heater (and reservoir) voltage and the application of the anode voltage.

Operation factor

The product of peak forward voltage, peak anode current and pulse repetition rate.

4400/54

Rectifiers

AEI Rectifiers

The data in this section should be interpreted in conjunction with the information headed "Thyratrons and Rectifiers" inserted at the beginning of the Thyratron section (4400-52).

AEI Mercury Rectifier

BD7

The BD7 is a mercury-vapour hot-cathode rectifier intended for high voltage industrial applications. It must be mounted with the cathode uppermost.

RATINGS—Absolute values

Maximum peak reverse anode voltage	15	kV
Condensed mercury temperature limits	25 to 45	°C
Maximum peak anode current	5·0	A
Maximum mean anode current (max averaging time 15 sec)	1·0	A
Maximum surge anode current (max duration 0·1 sec)	100	A

CHARACTERISTICS

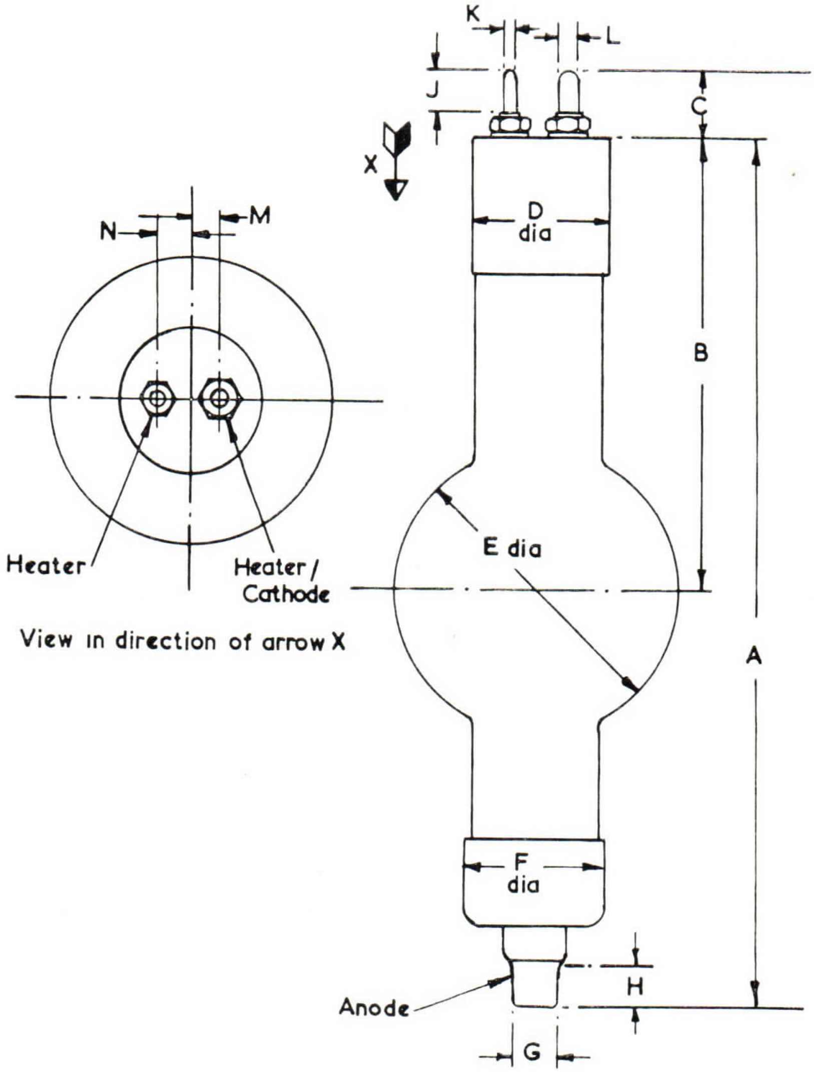
Cathode type	Indirectly heated	
Heater voltage	5·0	V
Maximum heater current	11·5	A
Mean heater current	10·5	A
Voltage drop (approx)	15	V
Cathode heating time	5	min
Condensed mercury temperature rise above ambient		
At no load (approx)	12	°C
At full load (approx)	13	°C

MECHANICAL DATA

Type of cooling	Convection
Mounting position	Vertical, anode down
Net weight (approx)	1 lb (450 gm)

Dimension	Inches	Millimetres
A	$11\frac{1}{4} \pm \frac{3}{4}$	286 ± 19
B	$6\frac{3}{8} \pm \frac{1}{2}$	162 ± 13
C	0·938 ± 0·031	23·8 ± 0·8
D	$1\frac{7}{8} \pm \frac{1}{8}$	47·5 ± 3
E	$4\frac{1}{8}$ max	105 max
F	$2 \pm \frac{1}{8}$	51 ± 3
G	0·641 ± 0·015	16·27 ± 0·39
H	0·429 min	10·7 min
J	$\frac{1}{2}$ min	12·7 min
K	0·187 — 0·003	4·75 — 0·07
L	0·249 — 0·003	6·35 — 0·07
M	0·375 ± 0·015	9·5 ± 0·4
N	0·437 ± 0·015	11·1 ± 0·4

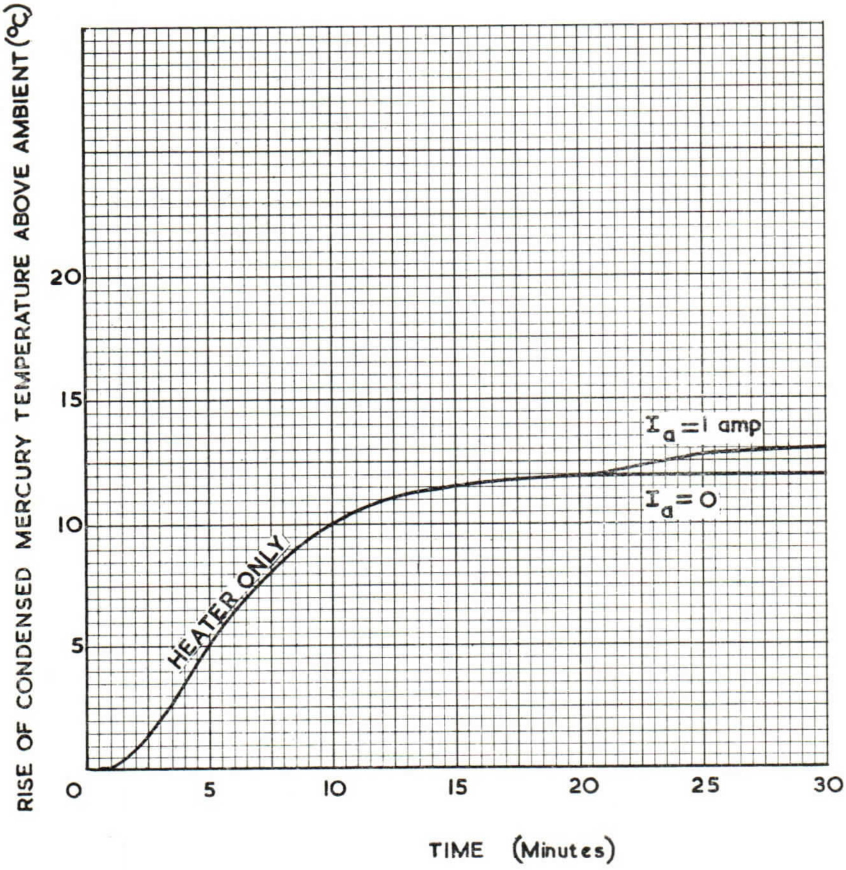
All dimensions in inches.
Millimetre dimensions derived.



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

HEATING CHARACTERISTIC

The condensed mercury temperature is measured at the anode end as the valve should be mounted with the anode end down.



AEI Mercury Rectifier BD10

The BD10 is a mercury-vapour hot-cathode rectifier.

RATINGS—Absolute values

Maximum peak reverse anode voltage	1	kV
Condensed mercury temperature limits	40 to 85	°C
Maximum peak anode current	25	A
Maximum mean anode current (max averaging time 15 sec)	8	A
Maximum surge anode current (max duration 0·1 sec)	400	A

CHARACTERISTICS

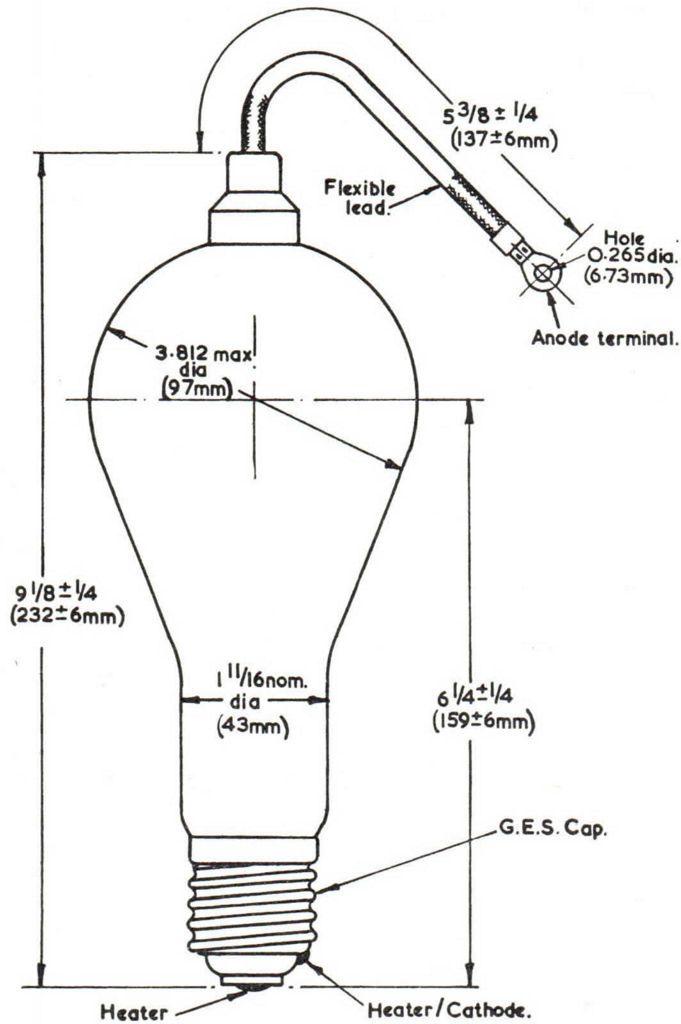
Cathode type	Indirectly heated	
Heater voltage	5·0	V
Maximum heater current	9·5	A
Mean heater current	9·0	A
Voltage drop (approx)	12	V
Cathode heating time	5	min
Condensed mercury temperature rise above ambient		
At no load (approx)	36	°C
At full load (approx)	43	°C

MECHANICAL DATA

Type of cooling	Convection
Mounting position	Vertical, base down
Net weight (approx)	8½ oz (240 gm)

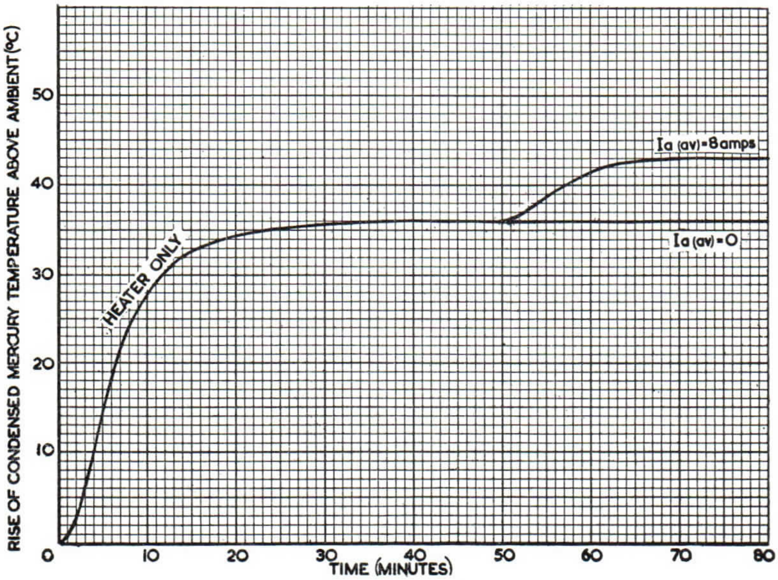
Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Issue 1
April 1962
4400-54/BD10



All dimensions in inches.
Millimetre dimensions derived.

HEATING CHARACTERISTIC



Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

AEI Mercury Rectifier BD12

The BD12 is a two anode mercury-vapour hot-cathode rectifier intended for battery charging and other industrial applications.

RATINGS—Absolute values

Maximum peak reverse anode voltage	1	kV
Maximum r.m.s. voltage between anodes	250	V
Condensed mercury temperature limits	40 to 100	°C
Maximum peak anode current *	100	A
Maximum mean anode current * (max averaging time 30 sec)	33	A
Maximum surge anode current * (max duration 0·1 sec)	1000	A

* Maximum current in each anode must not exceed half the rated anode current.

CHARACTERISTICS

Cathode type	Indirectly heated	
Heater voltage	5·0	V
Maximum heater current	37	A
Mean heater current	35	A
Voltage drop (approx)	12	V
Cathode heating time	5	min
Condensed mercury temperature rise above ambient		
At no load (approx)	52	°C
At full load (approx)	60	°C

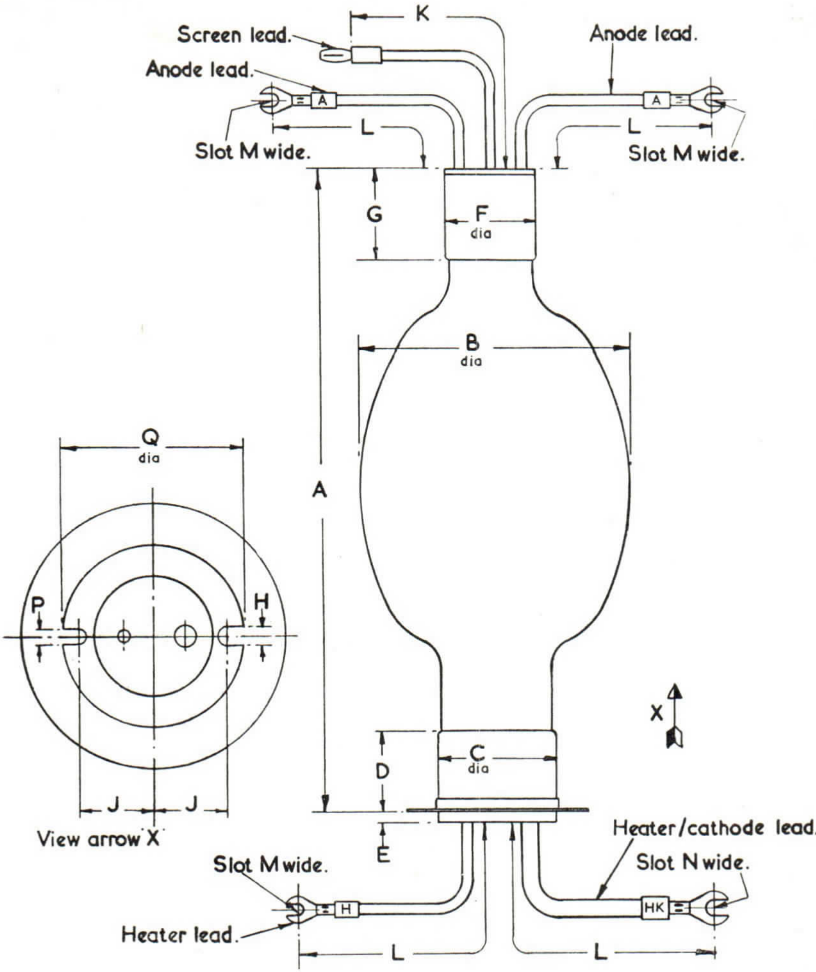
MECHANICAL DATA

Type of cooling	Convection
Mounting position	Vertical, base down
Net weight (approx)	3 lb 8 oz (1600 gm)

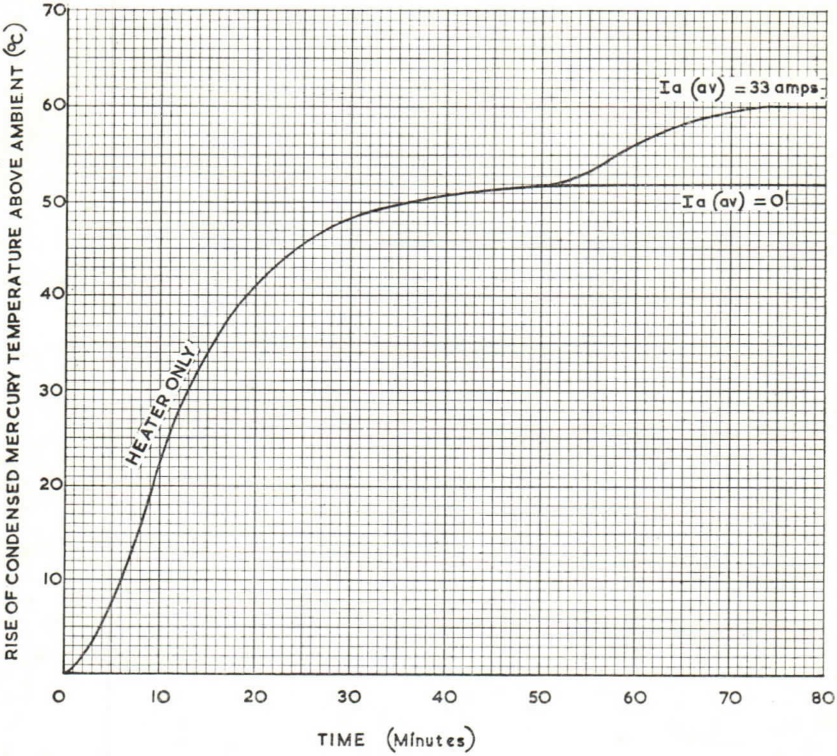
Dimension	Inches	Millimetres
A	$15\frac{5}{8} \pm \frac{1}{2}$	398 ± 13
B	6·438 max	163 max
C	$2\frac{7}{8}$ max	73 max
D	2	51
E	$\frac{1}{4} \pm \frac{1}{16}$	$6{\cdot}4 \pm 1{\cdot}5$
F	$2\frac{7}{8}$ max	73 max
G	$2\frac{1}{4}$	57
H	$\frac{7}{16}$	11·1
J	1·813	46
K	$6\frac{1}{4} \pm \frac{1}{4}$	159 ± 6
L	$7\frac{3}{4} \pm \frac{1}{4}$	197 ± 6
M	0·265	6·73
N	0·328	8·33
P	0·344	8·7
Q	4·375 max	111 max

All dimensions in inches.
Millimetre dimensions derived

AEI Mercury Rectifier BD12



HEATING CHARACTERISTIC



AEI Xenon Rectifier BD78

The BD78 is a xenon-filled hot-cathode rectifier.

RATINGS—Absolute values

Maximum peak reverse anode voltage	2·0	kV
Maximum peak anode current	2·0	A
Maximum mean anode current (max averaging time 15 sec)	0·5	A
Maximum surge anode current (max duration 0·1 sec)	40	A
Maximum operating frequency	500	c/s
Ambient temperature range	−55 to +70	°C

CHARACTERISTICS

Cathode type	Directly heated	
Filament voltage	2·5	V
Maximum filament current	5·3	A
Mean filament current	5·0	A
Voltage drop (approx)	12	V
Cathode heating time	10	s

MECHANICAL DATA

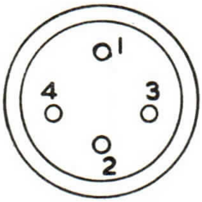
Type of cooling	Convection
Mounting position	Any
Net weight	2 oz (60 gm)

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Issue 1
April 1962
4400-54/BD78

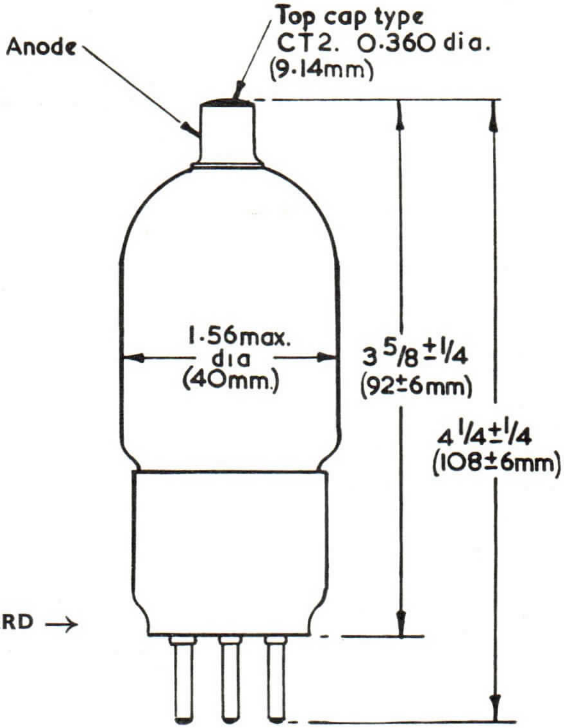
Xenon Rectifier

AEI



Base connections.

Pin 1	Blank.
Pin 2	Blank
Pin 3	Filament/ cathode.
Pin 4	Filament



BRITISH STANDARD 4 PIN BASE →

All dimensions in inches.
Millimetre dimensions derived.

AEI Xenon Rectifier BD166

The BD166 is a xenon-filled hot-cathode rectifier.

RATINGS—Absolute values

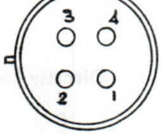
Maximum peak reverse voltage	10	kV
Maximum peak anode current	5·0	A
Maximum mean anode current	1·25	A
Maximum surge anode current (max duration 0·1 sec)	50	A
Maximum operating frequency	150	c/s
Ambient temperature range	—55 to +70	°C

CHARACTERISTICS

Cathode type	Directly heated	
Filament voltage	5·0	V
Maximum filament current	8·0	A
Mean filament current	7·0	A
Voltage drop (approx)	12	V
Cathode heating time	30	s

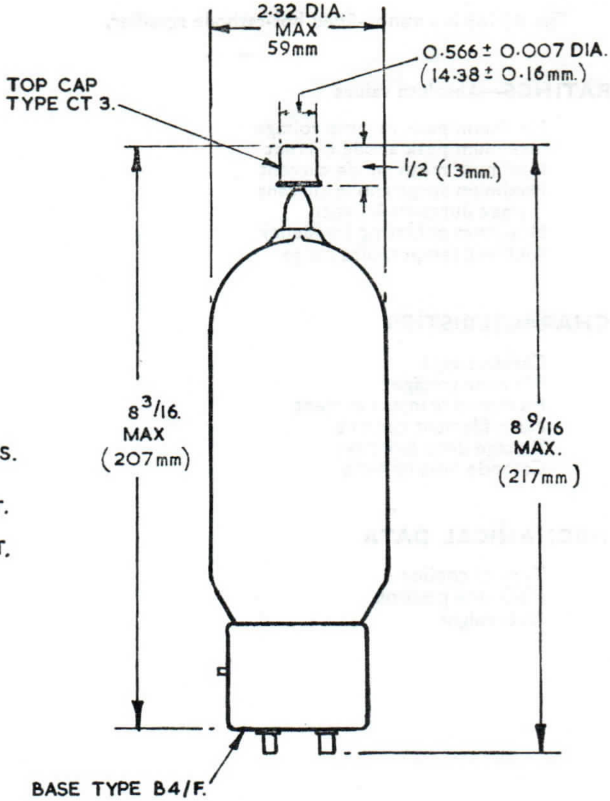
MECHANICAL DATA

Type of cooling	Convection
Mounting position	Any
Net weight	8 oz (230 gm)



BASE CONNECTIONS.

PIN.1. BLANK.
PIN.2. FILAMENT.
PIN.3. BLANK.
PIN.4. FILAMENT.



All dimensions in inches.
Millimetre dimensions derived.

ENGLISH ELECTRIC

Xenon Rectifier

BD236

The BD236 is a xenon-filled hot-cathode rectifier. It can be used as a replacement for the CV5 in all applications where the peak reverse voltage does not exceed 13kV.

RATINGS—Absolute values

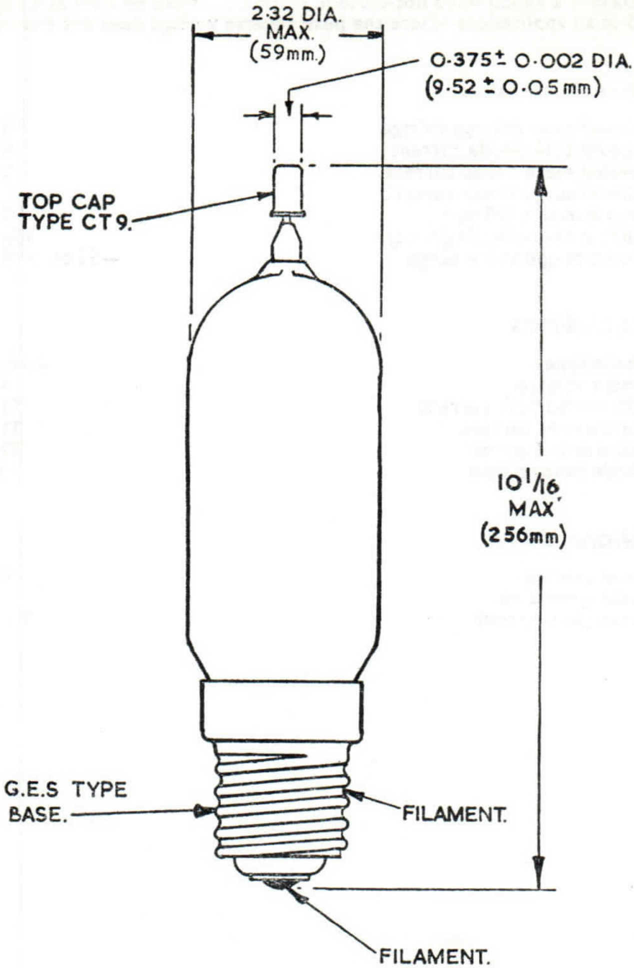
Maximum peak reverse voltage	13	kV
Maximum peak anode current	6·0	A
Maximum mean anode current	1·25	A
Maximum surge anode current (max duration 0·1 sec)	50	A
Maximum operating frequency	150	c/s
Ambient temperature range	−55 to +70	°C

CHARACTERISTICS

Cathode type	Directly heated	
Filament voltage	4·0	V
Maximum filament current	12	A
Mean filament current	11	A
Voltage drop (approx)	12	V
Cathode heating time	30	s

MECHANICAL DATA

Type of cooling	Convection
Mounting position	Any
Net weight (approx)	9 oz (250 gm)



All dimensions in inches.
Millimetre dimensions derived.

AEI Mixed-Gas Rectifier BD340

The BD340 rectifier has an inert gas and mercury filling which combines the advantages of a short heating time and the long life associated with mercury-vapour valves.

RATINGS—Absolute values

Maximum peak reverse voltage	10	kV
Maximum peak anode current	5·0	A
Maximum mean anode current	1·25	A
Maximum surge anode current (max duration 0·1 sec)	50	A
Maximum operating frequency	150	c/s
Ambient temperature range *	−40 to +55	°C

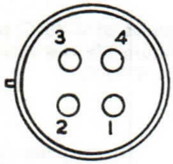
*Still air temperature near the base of the valve.
Although the valve will operate satisfactorily at ambient temperatures of −40°C to +10°C, life will be reduced at these low temperatures. For maximum life the valve should be operated at ambient temperatures in the range +15°C to +55°C.

CHARACTERISTICS

Cathode type	Directly heated	
Filament voltage	5·0	V
Maximum filament current	8·0	A
Mean filament current	7·0	A
Voltage drop (approx)	15	V
Cathode heating time	30	s

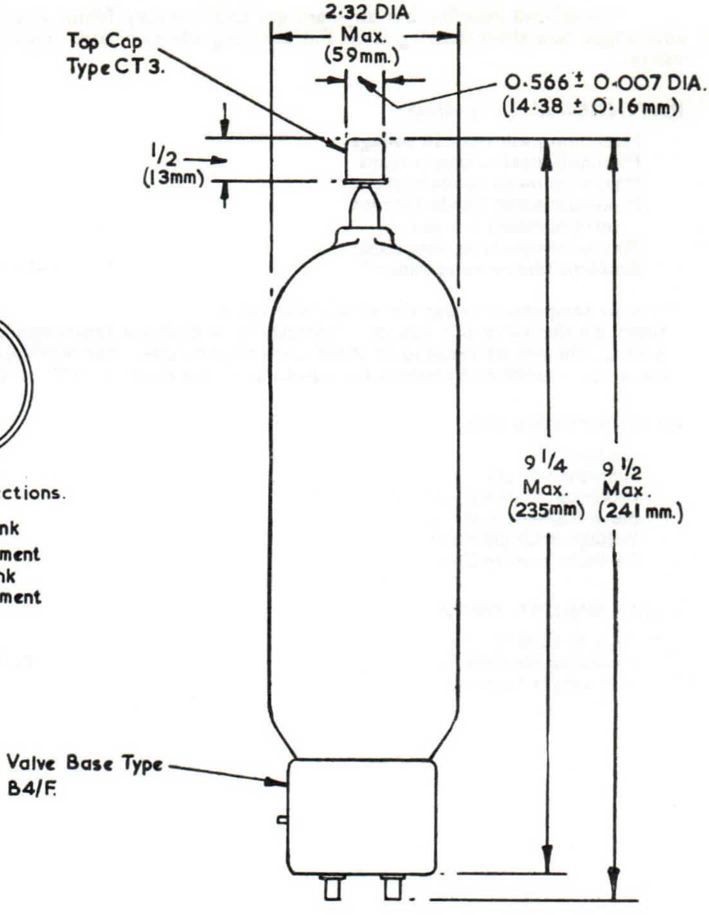
MECHANICAL DATA

Type of cooling	Convection
Mounting position	Vertical, base down
Net weight (approx)	8 oz (230 gm)



Base Connections.

Pin 1.	Blank
Pin 2.	Filament
Pin 3	Blank
Pin 4	Filament



All dimensions in inches.
Millimetre dimensions derived.

Full-wave Tungar Rectifier

68504

GENERAL

Type 68504 is a hot-cathode gas-filled full-wave rectifier designed for use in low voltage battery charging equipment.

CHARACTERISTICS

Cathode type	Directly heated
Filament voltage	2·3V
Filament current (max)	20A
Filament current (min)	16A
Voltage drop (approx)	10V
Cathode heating time	30s
Ambient temperature range	–55°C to +70°C

RATINGS—Absolute values

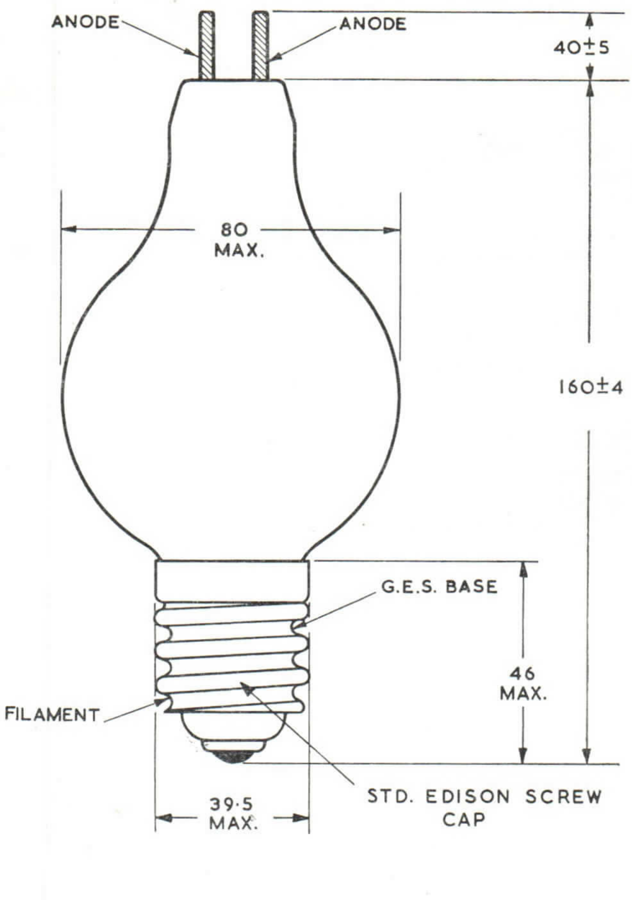
D.C. output as full-wave rectifier	30V
	5A

MECHANICAL DATA

Type of cooling	Convection
Mounting position	vertical
Approximate weight—home packing	8 oz (227 gm)
Approximate weight—export packing	12 oz (340 gm)

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Issue 1
Jan. 1964
4400-54/TU'04



Dimensions are in millimetres.

Half-wave Tungar Rectifier

68506

GENERAL

Type 68506 is a hot-cathode gas-filled half-wave rectifier designed for use in low voltage battery charging circuits.

CHARACTERISTICS

Cathode type	Directly heated
Filament voltage	2·3V
Filament current (max)	20A
Filament current (min)	16A
Voltage drop (approx)	10V
Cathode heating time	30s
Ambient temperature range	–55°C to +70°C

RATINGS—Absolute values

D.C. output as half-wave rectifier	75V 6A

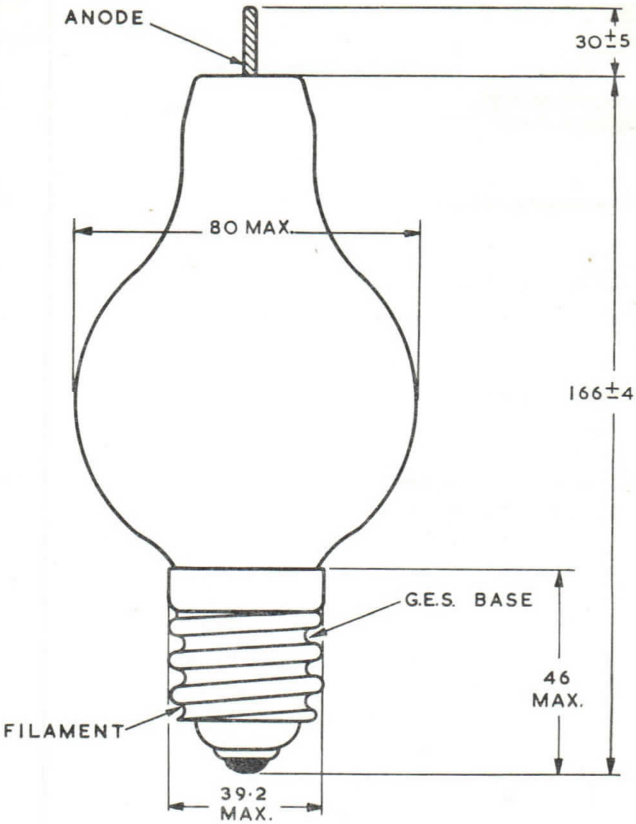
MECHANICAL DATA

Type of cooling	Convection
Mounting position	Vertical
Approximate weight—home packing	8 oz (227 gm)
Approximate weight—export packing	12 oz (340 gm)

Associated Electrical Industries Limited
ELECTRONIC APPARATUS DIVISION
Valve and Semiconductor Sales Department
Carholme Road, Lincoln. Phone Lincoln 26435

Issue 1
Jan. 1964
4400-54/TU'06

Half-wave Tungar Rectifier



Dimensions are in millimetres.

Half-wave Tungar Rectifier

68508

GENERAL

Type 68508 is a hot-cathode gas-filled half-wave rectifier designed for use in low voltage battery charging equipment.

CHARACTERISTICS

Cathode type	Directly heated
Filament voltage	2·5V
Filament current (max)	28A
Filament current (min)	22A
Voltage drop (approx)	10V
Cathode heating time	30s
Ambient temperature range	–55°C to +70°C

RATINGS—Absolute values

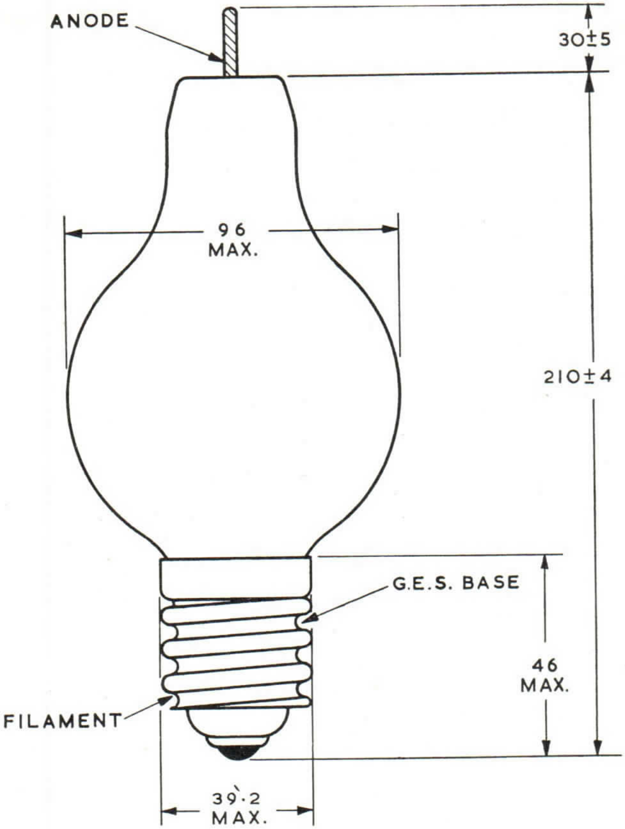
D.C. output as half-wave rectifier	60V
	15A

MECHANICAL DATA

Type of cooling	Convection
Mounting position	Vertical
Approximate weight—home packing	8 oz (227 gm)
Approximate weight—export packing	12 oz (340 gm)

Half-wave Tungar Rectifier

AEI



Dimensions are in millimetres.

AEI Half-wave Tungar Rectifier 68510

GENERAL

Type 68510 is a hot cathode gas-filled half-wave rectifier designed for use in low voltage battery charging equipment.

CHARACTERISTICS

Cathode type	Directly heated
Filament voltage	2·0V
Filament current (max)	14A
Filament current (min)	10A
Voltage drop (approx)	10V
Cathode heating time	30s
Ambient temperature range	–55°C to +70°C

RATINGS—Absolute values

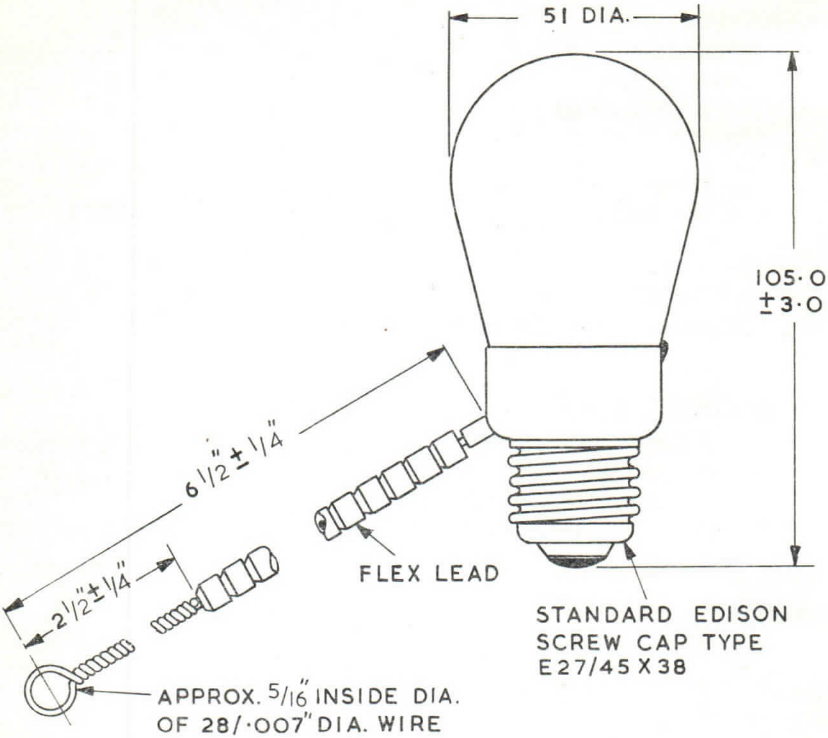
D.C. output as half-wave rectifier	75V 1·5A
	50V 2·0A

MECHANICAL DATA

Type of cooling	Convection
Mounting position	Vertical
Approximate weight—home packing	4½ oz (127 gm)
Approximate weight—export packing	6 oz (170 gm)

Half-wave Tungar Rectifier

AEI



Dimensions are in millimetres except where indicated.

Full-wave Gas Filled Rectifier

AEI **68530**

GENERAL

Type 68530 is a hot cathode gas-filled full-wave rectifier suitable for use in low voltage charging circuits.

CHARACTERISTICS

Cathode type	Directly heated
Filament voltage	2V
Filament current (max)	9A
Filament current (min)	7A
Voltage drop (approx)	10V
Cathode heating time	30s
Ambient temperature range	–55°C to +70°C

RATINGS—Absolute values

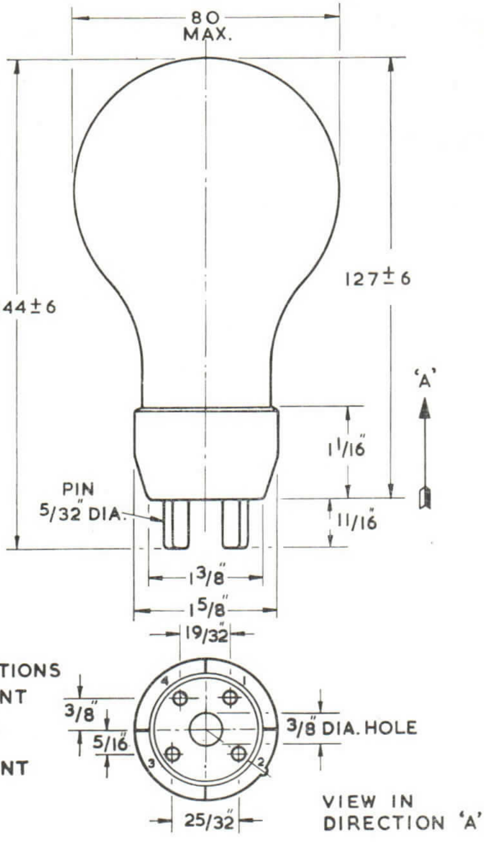
D.C. output as full-wave rectifier	30V
	6A

MECHANICAL DATA

Type of cooling	Convection
Mounting position	Vertical
Approximate weight—home packing	8 oz (227 gm)
Approximate weight—export packing	12 oz (340 gm)

Full-wave Gas Filled Rectifier

AEI



BASE CONNECTIONS
PIN 1 FILAMENT
PIN 2 ANODE
PIN 3 ANODE
PIN 4 FILAMENT

Dimensions are in millimetres except where indicated.