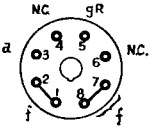
Ferranti

GRD7

GUARD RING DIODE

Type GRD7 is a directly heated diode with cylindrical co-axial electrodes and a tungsten filament. The guard rings ensure a homogeneous anode-cathode field and eliminate 'fringe' effect.
Although primarily designed for educational deomnstration purposes it is equally suitable in applicatons requiring a saturated diode of high stability, such as in stabilised AC. supply circuits.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

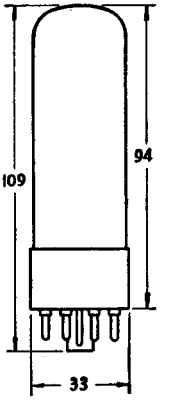
Base	... ...	International Octal.
Max. Overall Length	... ...	109 mm. (4$\frac{1}{4}$in.).
Max. Seated Height	... ...	94 mm. (3$\frac{11}{16}$in.).
Max. Diameter	... ...	33 mm. (1$\frac{5}{16}$in.).
Mounting Position	... ...	Vertical, base down.

The Anode and Guard Rings are of non-magnetic material.

A hole in the anode alows the filament to be sighted for the approximate assessment of temperature by optical method.*

BASE CONNECTIONS.

†Pin 1 } Filament.
†Pin 2 }
Pin 3—Anode.
Pin 4—No connection.
Pin 5—Guard Rings.
Pin 6—No connection.
†Pin 7 } Filament.
†Pin 8 }



Dimensions shown are in millimetres (max.).

RATINGS.

Continuous Operation:

Max. Filament Voltage	6 volts.
Max. Anode Voltage	300 volts.
Max. Anode Dissipation... ...	2 watts.

‡Intermittent Operation:

Max. Filament Voltage	7 volts.
Max. Anode Voltage	300 volts.
Max. Anode Dissipation... ...	5 watts.

CHARACTERISTICS.

Electrical.

Filament Voltage (for I_f=2·2 amps.) ...	6·3 volts approx.
Filament Current	Variable. (See I_f/Temp. graph on Page 3).

Physical.

Anode Length	14·5 mm.
Anode Internal Diameter ...	6·5 mm.
Filament Diameter	0·125 mm.
Effective Filament Length ...	14·5 mm.

*Due allowance should be made for transmission losses due to the glass envelope. There may also be losses due to film deposited on the glass.

†It is advisable that one filament lead shall be connected to both Pins 1 and 2 and the other lead to both Pins 7 and 8.

‡Short period operation, for example, as required for demonstration purposes.

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BRIEF NOTES
ON EDUCATIONAL DEMONSTRATIONS

Richardson's Law.

Total Electron Emission = aAT^2 exp. $(-11600\phi/T.)$

Where a is the effective area of electron emission

T is the absolute temperature of the Electron emitting surface of the cathode.

A and ϕ are thermionic constants determined by the chemical nature of the cathode.

The GRD7 cathode is a tungsten filament with diameter (d) = 0·125 mm. and an effective length (l) = 14·5 mm.

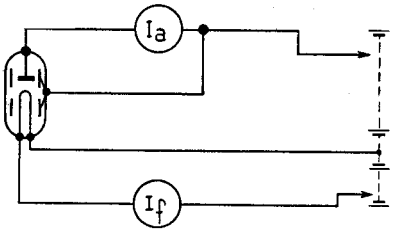
For Tungsten the generally accepted value of A is approximately 600 and the value of ϕ is 4·52.

The expression above therefore becomes

$= \pi dl \times 600 \times T^2$ Exp. $(-11600 \times 4 \cdot 52/T)$.

$= 3400 \times T^2$ Exp. $(-52500/T)$ approximately.

A typical circuit for demonstration is shown below:



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Child-Langmuir Three-halves Power Law.

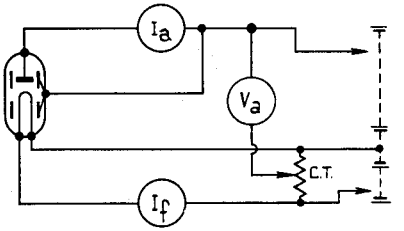
For a vacuum diode:—

I_a (mA) $= 14 \cdot 65 \frac{l}{R} 10^{-3} V_a^{1 \cdot 5}$

Where l is the length of the anode

R is the inside radius of the anode.

A circuit for experimental verification:—



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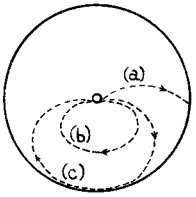
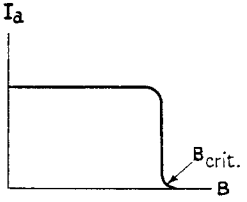
Hull's Law (Basic Magnetron Effect).

Experimental verification of this law can be effected by surrounding the GRD7 with a solenoid to produce a homogeneous magnetic field parallel to the electrode axis.

It is useful only as a device to conveniently demonstrate the principle of current cut-off in a vacuum diode.

The magnetic field affects the electron path as illustrated below. At a low value of flux density (B) the electrons reach the anode along a slightly curved path (a) whilst at a high value of flux density the curvature of the electron path (b) is such that the electrons return to the cathode. Therefore by varying the flux density it is possible to let anode current (I) pass, or to cut it off. The point at which I is cut off is $B_{crit.}$, a condition corresponding to the electron path (c). The cut off is somewhat gradual because the initial electron velocity is non-uniform and for other reasons.





For a vacuum diode:—

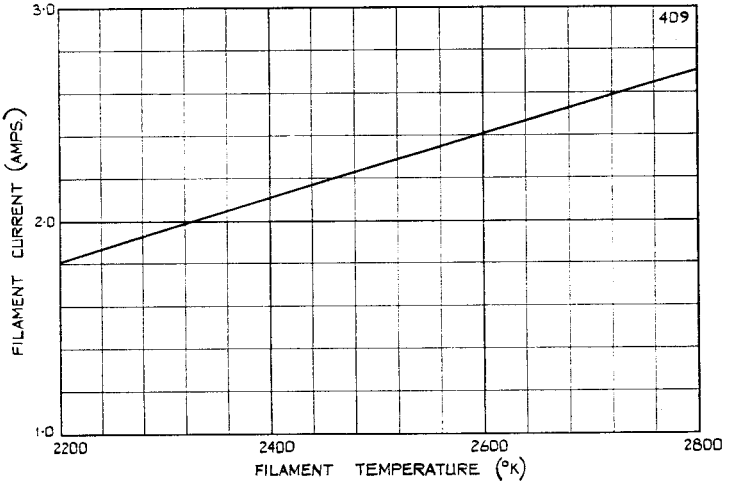
$B_{crit} = k\sqrt{V_a}$

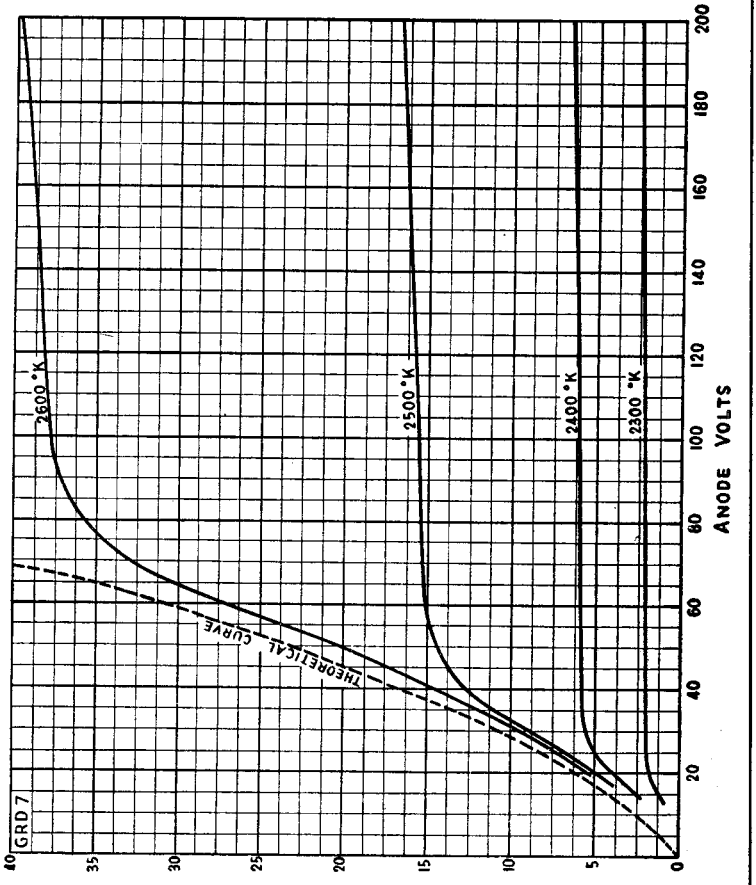
where Bcrit = the flux density of the magnetic field for current cut-off.

V_a = Anode Voltage.

k = a constant with a value dependent on the dimensions of the diode and the configuration of the magnetic field.

FILAMENT TEMPERATURE/FILAMENT CURRENT





ANODE CURRENT mA)