

# DATA

INDUSTRIAL HEATING TRIODES

COMPONENTS **ITT**

## SPECIAL VALVES

Radiation Cooled  
Triode

Code: 833A (CV635)

This is a high mu triode particularly suitable for use as a r.f. power amplifier, oscillator or Class B modulator. The special construction of the valve makes it exceptionally efficient at the higher radio frequencies. It can be operated under Class C C.W. conditions with a maximum input of 1.8 kW at frequencies up to 30 Mc/s with forced-air-cooling. At reduced input ratings the valve may be operated up to 75 Mc/s.

## CATHODE

Thoriated tungsten filament

Filament voltage	10	V
Filament current	10	A
Maximum usable emission	3	A

## CHARACTERISTICS

Amplification factor	$\left. \begin{array}{l} \text{At } V_g = -10V \\ I_a = 200mA \end{array} \right\}$	35
Mutual conductance		4 mA/V

## DIRECT INTERELECTRODE CAPACITANCES

Grid to anode	6.3	pF
Grid to filament	12.3	pF
Anode to filament	8.5	pF

## MECHANICAL DATA

Dimensions	As shown in outline drawing		
Mounting position	Vertical		
Net weight	1.5 lb	545	g

## COOLING

The maximum temperature of the anode and grid seals must not exceed 145°C.

When forced-air-cooling is required, an air flow of 40ft<sup>3</sup>/min (1,13m<sup>3</sup>/min) should be directed through a 2-inch (50,8mm) nozzle on to the bulb between the anode and grid seals.

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3C/402E—1

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C O M P O N E N T S G R O U P

## Code: 833A (CV635)

CONTINUED

## MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

## AUDIO FREQUENCY

## Class B. A.F. Power Amplifier or Modulator

(For balanced two-valve operation)

## Maximum Ratings

	Natural Cooling	Forced Cooling	
Maximum direct anode voltage	3	4	kV
Maximum direct anode current	500	500	mA
Maximum anode input power	1 125	1 600	W
Maximum anode dissipation	300	400	W

## Typical Operating Conditions

Direct anode voltage	3	4	kV
Direct anode current, zero signal	2 × 50	2 × 50	mA
Direct anode current, maximum signal	2 × 375	2 × 400	mA
Direct grid voltage	-70	-100	V
A.F. grid-to-grid r.m.s. voltage	280	340	V
Effective load resistance (a-a)	9.5	12	k Ω
Drive power, maximum signal, approx.	20	29	W
Output power	1.65	2.4	kW

## RADIO FREQUENCY

## Class C. R.F. Power Amplifier or Oscillator. Unmodulated

## Maximum Ratings

	Natural Cooling	Forced Cooling	
Maximum direct anode voltage	3	4	kV
Maximum direct anode current	500	500	mA
Maximum direct grid voltage	-500	-500	V
Maximum grid resistor	15	15	k Ω
Maximum direct grid current, approx.	100	100	mA
Maximum grid dissipation	20	20	W
Maximum anode input power	1.25	1.8	kW
Maximum anode dissipation	300	400	W

## Typical Operating Conditions

Direct anode voltage	3	4	kV
Direct anode current	415	450	mA
Direct grid voltage	-200	-200	V
Grid resistor	3.6	2.65	k Ω
Direct grid current, approx*	55	75	mA
Peak r.f. grid voltage	360	375	V
Input (drive) power, approx.	20	26	W
Direct anode dissipation	245	360	W
Output power	1	1.44	kW
Power into load at 85% transfer	0.85	1.22	kW

\*Subject to wide variations dependent upon impedance of the load circuit.

Code: 833A (CV635)

CONTINUED

**Class C. R.F. Power Amplifier or Oscillator. Anode Modulated**

(Carrier conditions per valve for use with 100% modulation)

**Maximum Ratings**

	Natural Cooling	Forced Cooling	
Maximum direct anode voltage	2.5	3	kV
Maximum direct anode current	400	450	mA
Maximum direct grid voltage	-500	-500	V
Maximum grid resistor	15	15	k $\Omega$
Maximum grid dissipation	20	20	W
Maximum direct grid current, approx.	100	100	mA
Maximum anode input power	835	1 250	W
Maximum anode dissipation	200	270	W

**Typical Operating Conditions**

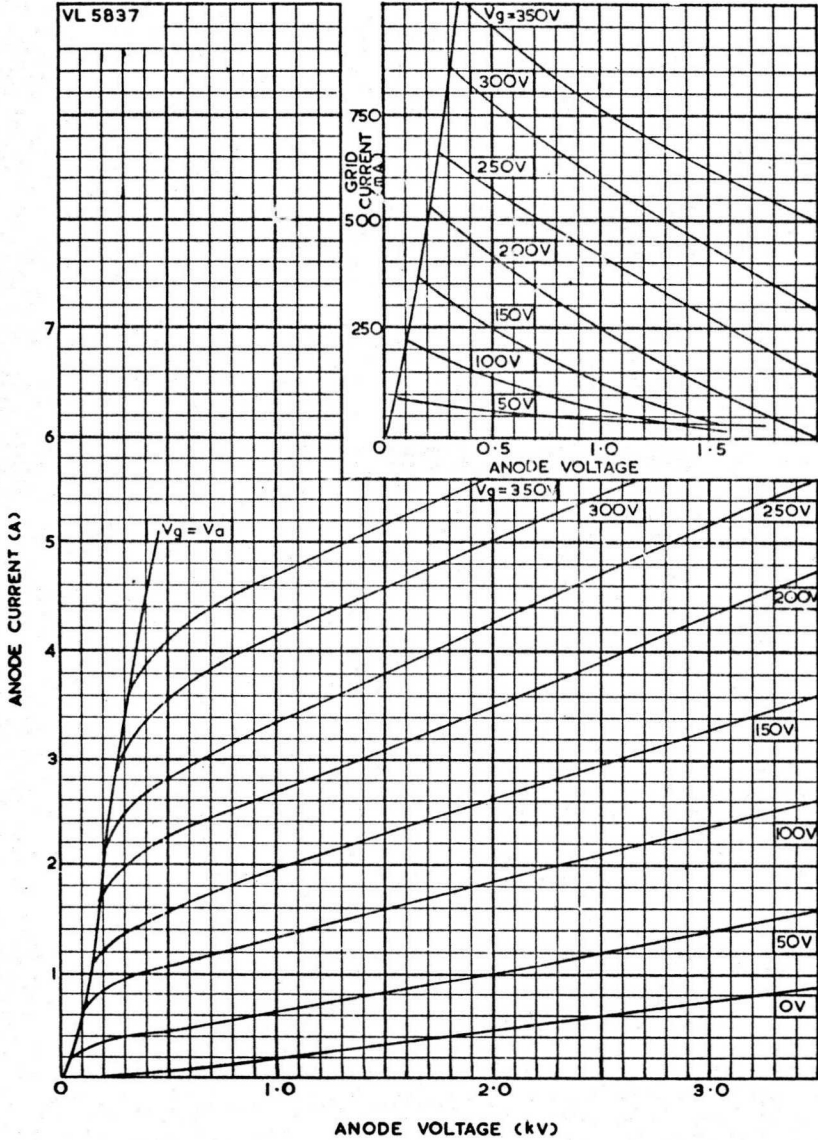
Direct anode voltage	2.5	3	kV
Direct anode current	335	415	mA
Direct grid voltage	-300	-300	V
Grid resistor	4	3.6	k $\Omega$
Peak r.f. grid voltage	460	490	V
Direct grid current*	75	85	mA
Grid drive power, approx.	30	37	W
Anode dissipation	200	245	W
Output power	635	1 000	W
Power into load†	540	850	W

\*Subject to wide variations dependent upon impedance of the load circuit.

†Transfer efficiency 85%.

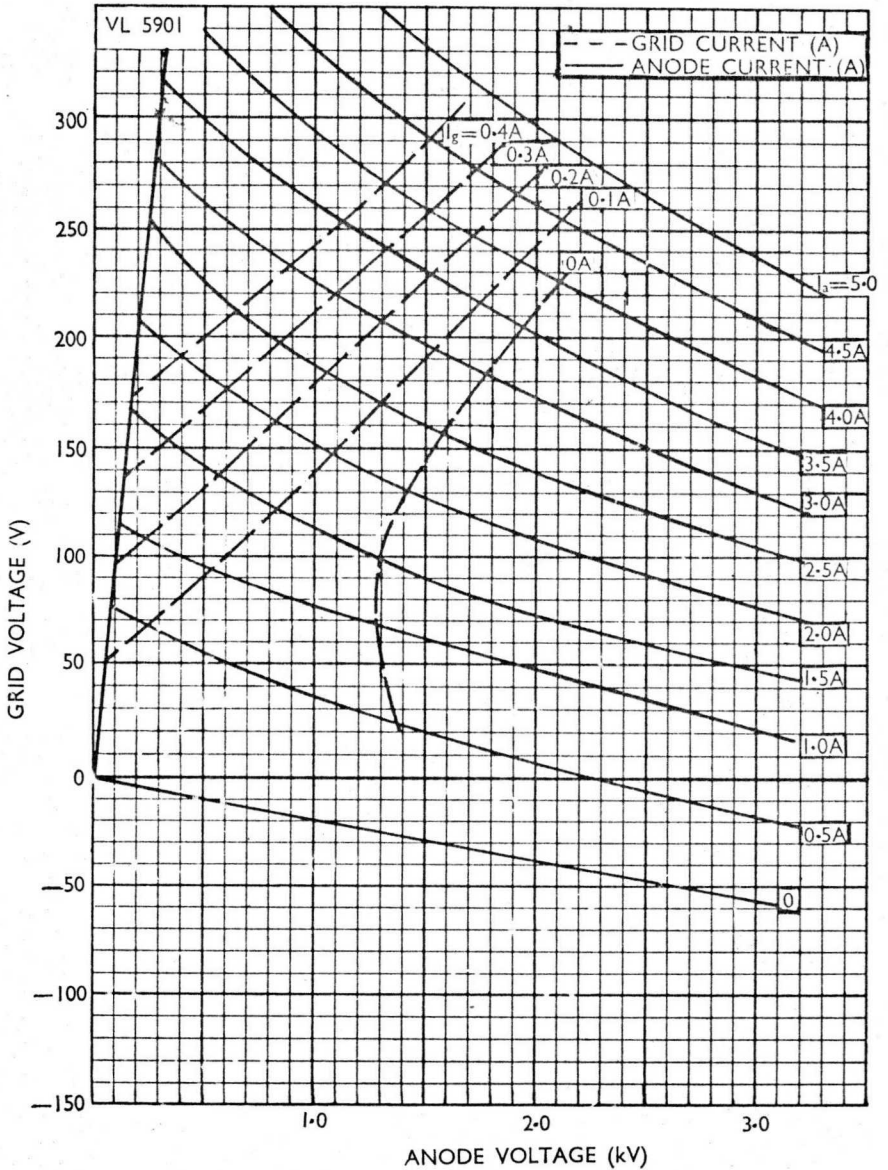
Code: 833A (CV635)

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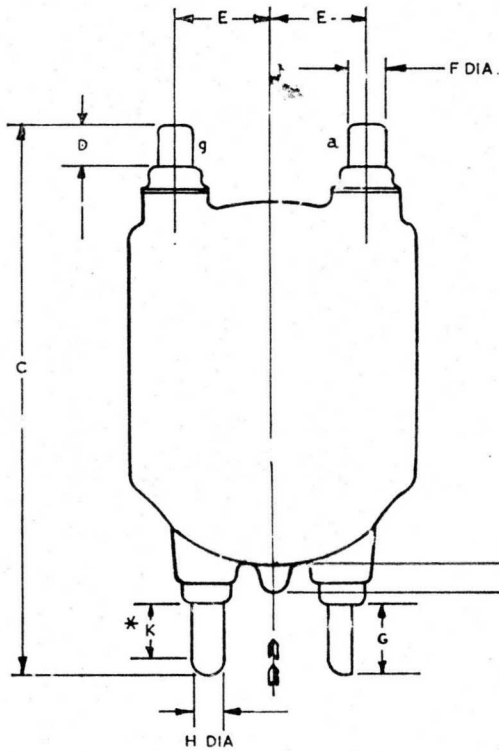
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## Code: 833A (CV635)

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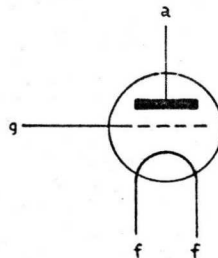
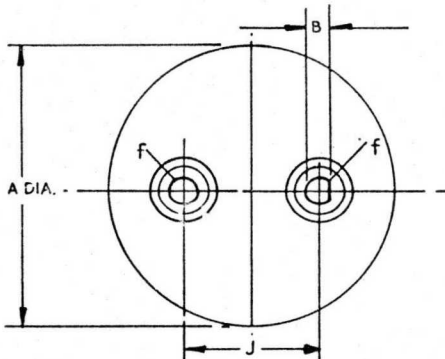
## 833A Outline



DIM	INCHES	MILLIMETRES
A	$4 \frac{19}{32}$ MAX.	116,7 MAX.
B	$0.375 \pm 0.005$	$9,53 \pm 0,13$
C	$8 \frac{5}{8} \pm \frac{3}{16}$	$219,1 \pm 4,8$
D	0.610 MIN.	15,49 MIN.
E	$1 \frac{1}{2} \pm \frac{1}{32}$	$38,1 \pm 0,8$
F	$0.567 \pm 0.005$	$14,40 \pm 0,13$
G	$1 \frac{3}{32} \pm \frac{1}{32}$	$27,8 \pm 0,8$
H	$0.437 \pm 0.005$	$11,11 \pm 0,13$
I	$2 \frac{1}{8} \pm \frac{1}{16}$	$54,0 \pm 1,6$
J	$2 \frac{7}{32}$ MIN.	21,4 MIN.
L	$\frac{1}{2}$ MAX.	12,7 MAX.

BASIC DIMENSIONS ARE INCHES

\* DENOTES:- CONTACT LENGTH



## SPECIAL VALVES

## Radiation-cooled R.F. Triode

Code: 3C/800E

The 3C/800E is designed for use in r.f. heating applications and may be operated up to 50 MHz.

## CATHODE

Directly heated thoriated tungsten filament

Filament voltage	6.3	V
Filament current (Note 1)	32.5	A
Maximum usable emission	4.0	A

Note 1—The filament is suitable for direct switching without additional current limitations and will withstand voltage fluctuations of  $\pm 5\%$ .

## CHARACTERISTICS

Mutual conductance	$\left. \begin{array}{l} \text{At } V_a = 4.0kV \\ I_a = 190mA \end{array} \right\}$	5.0	mA/V
Amplification factor		22	

## INTERELECTRODE CAPACITANCES

Anode to grid	6.5	pF
Grid to filament	2.0	pF
Anode to filament	0.25	pF

## AIR-COOLING REQUIREMENTS

Forced-air cooling is recommended for all conditions of service.

An air-flow of 50 ft<sup>3</sup>/min (1.42 m<sup>3</sup>/min) directed vertically upwards on to the filament and grid pins is adequate.

Maximum temperature of seals	220	°C
Maximum temperature of bulb	350	°C

## MECHANICAL DATA

Dimensions	As shown in outline drawing
Mounting position	Vertical, base downwards (Note 2)

Note 2.—When the valve is operating at the higher frequencies it is essential that connection be made to both grid pins to reduce current taken by each pin. The valve should be protected against excessive vibration and shock.

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3C/800E—1

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C O M P O N E N T S                      G R O U P



## Code: 3C/800E

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**MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS  
RADIO FREQUENCY**

## Class C. Power Oscillator (with d.c. anode supply)

## Maximum Ratings

Maximum direct anode voltage	6.0	kV
Maximum direct anode current	750	mA
Maximum direct anode dissipation	800	W
Maximum direct grid voltage	-1.25	kV
Maximum direct grid current	300	mA
Maximum direct grid dissipation	120	W
Maximum grid to filament resistor	10	k $\Omega$
Maximum duty factor	1.0	
Maximum frequency for above ratings	50	MHz

## Typical Operating Conditions

Direct anode voltage	3.0	5.0	kV
Direct anode current (Note 3)	700 (220)	700 (220)	mA
Direct anode dissipation	546	788	W
Direct grid current (Note 3)	240 (400)	225 (370)	mA
Grid to filament resistor	1.5	2.5	k $\Omega$
Anode efficiency	74	77.5	%
Power output	1.55	2.7	kW
Duty factor	1.0	1.0	

## Class C. Power Oscillator (anode supply from single-phase, full-wave rectifier without smoothing filter)

## Maximum Ratings

Maximum direct anode voltage	5.4	kV
Maximum direct anode current	670	mA
Maximum direct anode dissipation	800	W
Maximum direct grid voltage	-1.25	kV
Maximum direct grid current (Note 3)	270	mA
Maximum direct grid dissipation	120	W
Maximum grid to filament resistor	10	k $\Omega$
Maximum duty factor	1.0	
Maximum frequency for above ratings	50	MHz

## Code: 3C/800E

CONTINUED

## Typical Operating Conditions

Direct anode voltage	3.15	4.5	kV
Direct anode current (Note 3)	600 (190)	600 (190)	mA
Direct anode dissipation	620	750	W
Direct grid current (Note 3)	180 (300)	150 (250)	mA
Grid to filament resistor	1.5	2.5	k $\Omega$
Anode efficiency	73	77	%
Power output	1.7	2.55	kW
Duty factor	1.0	1.0	

## Class C. Power Oscillator (anode supply from three-phase half-wave rectifier)

## Maximum Ratings

Maximum direct anode voltage	6.0	kV
Maximum direct anode current	750	mA
Maximum direct anode dissipation	800	W
Maximum direct grid voltage	-1.25	kV
Maximum direct grid current	300	mA
Maximum direct grid dissipation	120	W
Maximum grid to filament resistor	10	k $\Omega$
Maximum duty factor	1.0	
Maximum frequency for above ratings	50	MHz

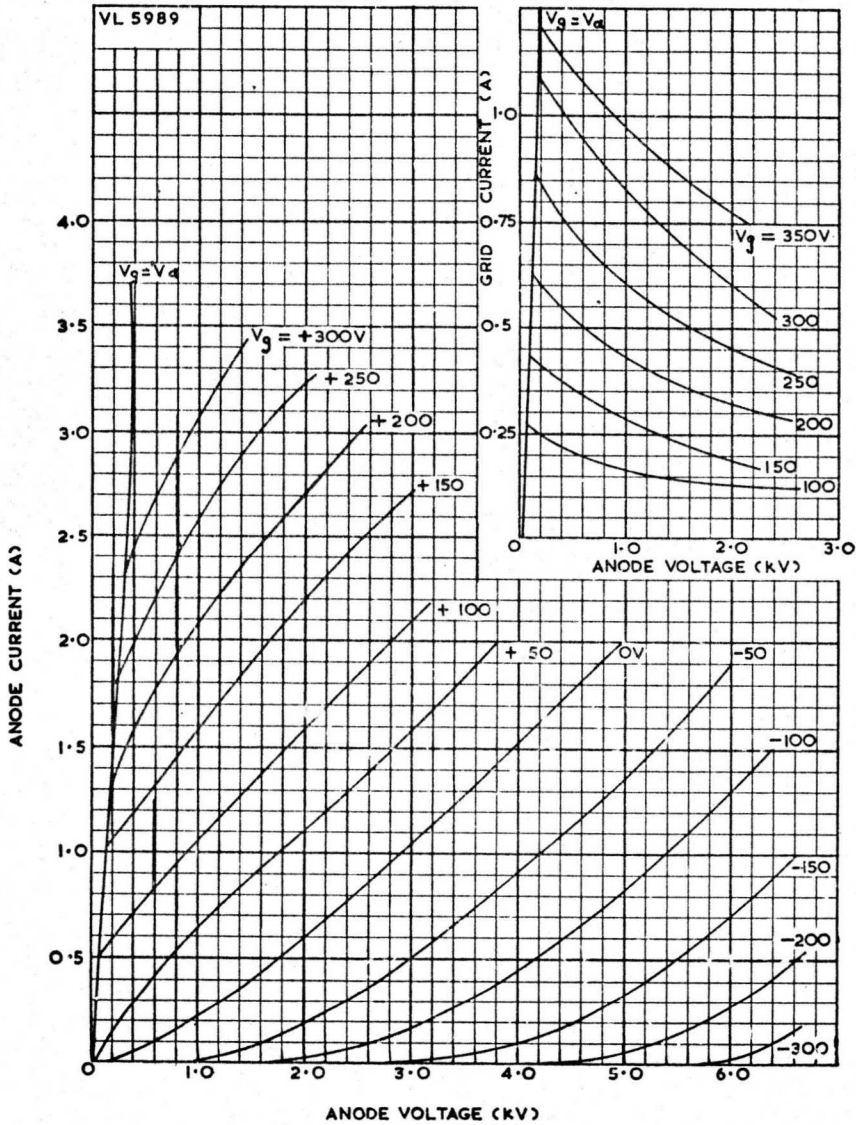
## Typical Operating Conditions

Direct anode voltage	5.0	kV
Direct anode current (Note 3)	700 (220)	mA
Direct anode dissipation	780	W
Direct grid current (Note 3)	160 (270)	mA
Grid to filament resistor	2.5	k $\Omega$
Anode efficiency	78	%
Power output	2.7	kW
Duty factor	1.0	

Note 3.—Subject to wide variation dependent upon the impedance of the load circuit.  
Typical off-load figures are shown in brackets.

Code: 3C/800E

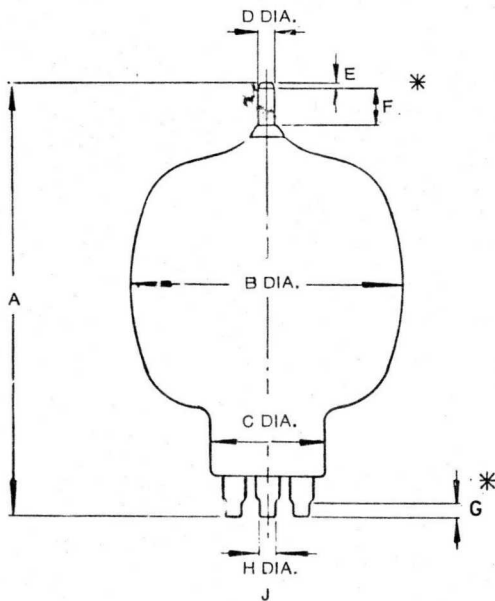
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Code: 3C/800E

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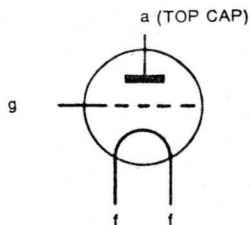
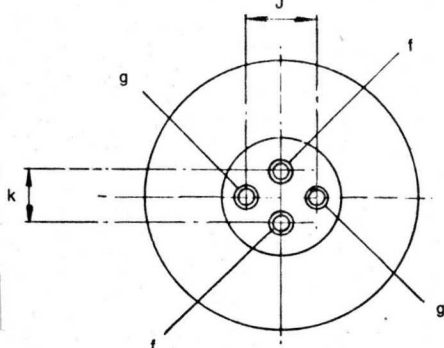
## 3C/800E Outline



DIM.	INCHES	MILLIMETRES
A	1.0 MAX.	254,0 MAX.
B	6.1/8 MAX.	155,6 MAX.
C	2.3/4 MAX.	69,9 MAX.
D	0.375 ± 0.005	9,52 ± 0,13
E	1/8 MAX.	3,2 MAX.
F	0.840 MIN.	21,33 MIN.
G	0.475 MIN.	12,06 MIN.
H	0.356 ± 0.012	9,04 ± 0,05
J	1.575 ± 0.010	40,0 ± 0,25
K	1.180 ± 0.010	29,97 ± 0,25

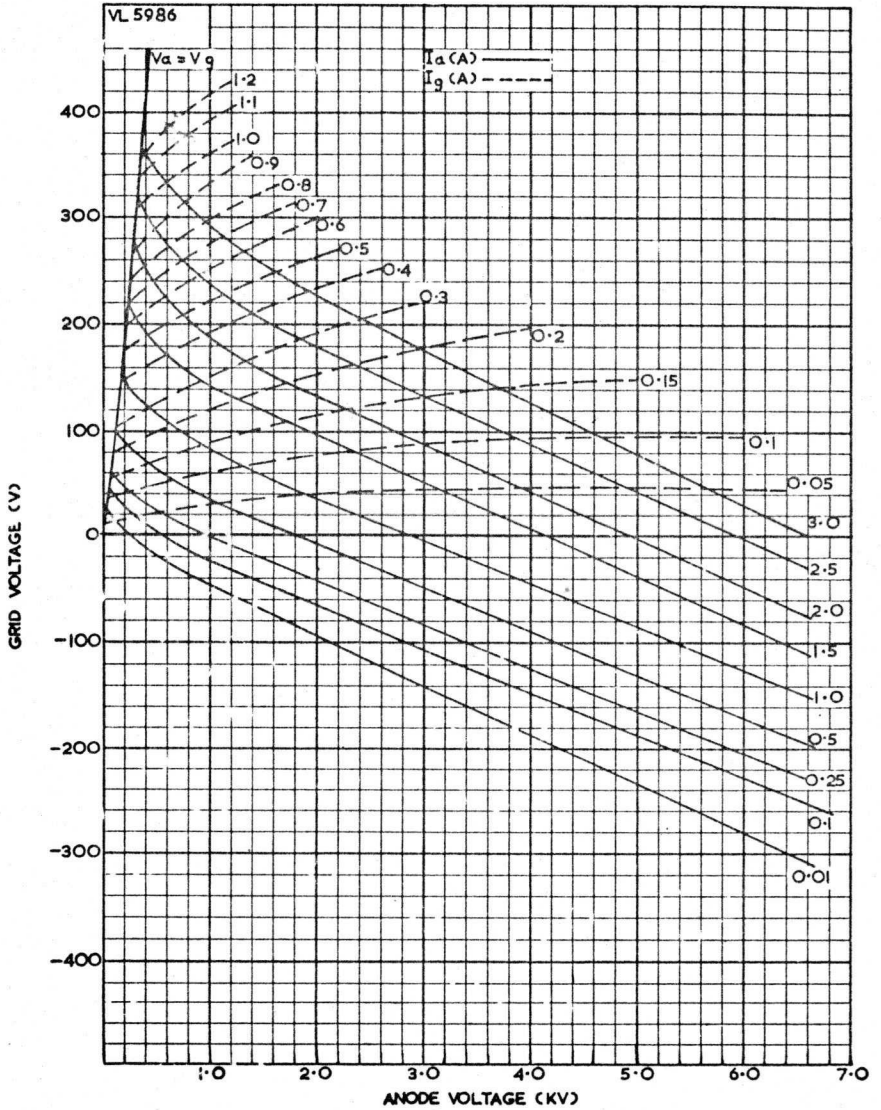
BASIC DIMS ARE INCHES

\* DENOTES:- CONTACT LENGTH



Code: 3C/800E

CONTINUED



## SPECIAL VALVES

Forced-Air-Cooled  
Industrial Triode

Code: ESA1500

This valve is designed for induction and dielectric heating applications and is capable of operation at frequencies up to 40 MHz.

## CATHODE

Directly heated thoriated tungsten

Filament voltage

8 V

Filament current (Note 1)

26 A

Maximum usable emission

6 A

Note 1.—The filament is suitable for direct switching without additional current limitation to the circuit.

## CHARACTERISTICS

Amplification factor { at  $V_a = 5kV$  }

24

Mutual conductance {  $I_a = 400mA$  }

7.5 mA/V

Perveance

0.56 mA/V<sup>3/2</sup>

Anode impedance

3.2 k $\Omega$ 

## DIRECT INTERELECTRODE CAPACITANCES

Grid to anode

11.5 pF

Grid to filament

14.5 pF

Anode to filament

0.8 pF

## MECHANICAL DATA

Dimensions As shown in outline drawing

Mounting position Vertical, anode downwards (Note 2)

Note 2.—Special glass support tubes, details of which are given on pages 6, 7 and 8, can be supplied under codes GC1, GC2 and GC7 as separate accessories.

## COOLING

This is by forced-air blast, and should be employed for all conditions of valve service, including filament dissipation only.

It is recommended that a minimum air flow of 300 ft<sup>3</sup>/min (85 m<sup>3</sup>/min) at maximum power output be used. Direction of flow is through the anode cooler and over the glass bulb.

At the higher frequencies grid connectors should be designed to assist cooling, and both connections should be made to reduce the current taken by each pin.

Care should be taken to ensure all connections to the valve make good electrical contact to avoid overheating pins and seals.

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3J/167E—1

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C O M P O N E N T S G R O U P

## Code: ESA1500

CONTINUED

**MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS**

Class C. Industrial Heating R.F. Oscillator

**MAXIMUM RATINGS**

Maximum direct anode voltage (peak value of direct voltage plus ripple)	6	kV
Maximum direct anode current	1.5	A
Maximum direct anode dissipation (continuous)	3	kW
Maximum direct grid dissipation (continuous)	200	W
Maximum direct grid current (Note 3)	330	mA
Maximum negative grid bias	-1 000	V
Maximum frequency for above ratings	40	MHz

Note 3.—This figure is given for guidance. Grid dissipation is absolute figure.

**TYPICAL OPERATING CONDITIONS**

Direct anode voltage	4	5	6	kV
Direct grid voltage	-275	-250	-350	V
Direct anode current	1.25	1.55	1.5	A
Peak r.f. grid voltage	730	710	810	V
Direct grid current (Note 4)	200 (300)	145 (250)	135 (230)	mA
Grid dissipation (Note 4)	65	70	65	W
Grid resistor	1.4	1.75	2.6	k $\Omega$
Power input	7.5	7.75	9	kW
Power output (oscillator)	3.5	5.3	6.3	kW
Power into load at 85% transfer efficiency	3	4.5	5.35	kW

Note 4.—Subject to wide variation dependent upon the impedance of the load circuit. The values of current shown in brackets are typical of off-load conditions but are given for guidance only: practical figures are dependent upon compensatory devices in the grid circuit.

**NOTES**

The typical operating conditions given are for valve service at a class C self-oscillator and are calculated assuming a d.c. or three-phase full-wave rectified anode voltage. Where conditions of service make the valve liable to excessive mains variation, poor regulation of supplies, or power supplies with a high peak to mean ratio, care should be taken to see that the limiting values are not exceeded.

It is recommended that a protective resistance of 10  $\Omega$ /kV be connected between the h.t. supply and the valve anode to avoid damage to the valve in the event of intermittent flash-over.

Code: ESA1500

CONTINUED

Class B. A.F. Power Amplifier or Modulator  
(For balanced 2-valve operation)

**MAXIMUM RATINGS**

Maximum direct anode voltage	6	kV
Maximum direct anode current	1.5	A
Maximum direct anode dissipation	3	kW
Maximum direct grid voltage	-1	kV
Maximum direct grid dissipation	200	W

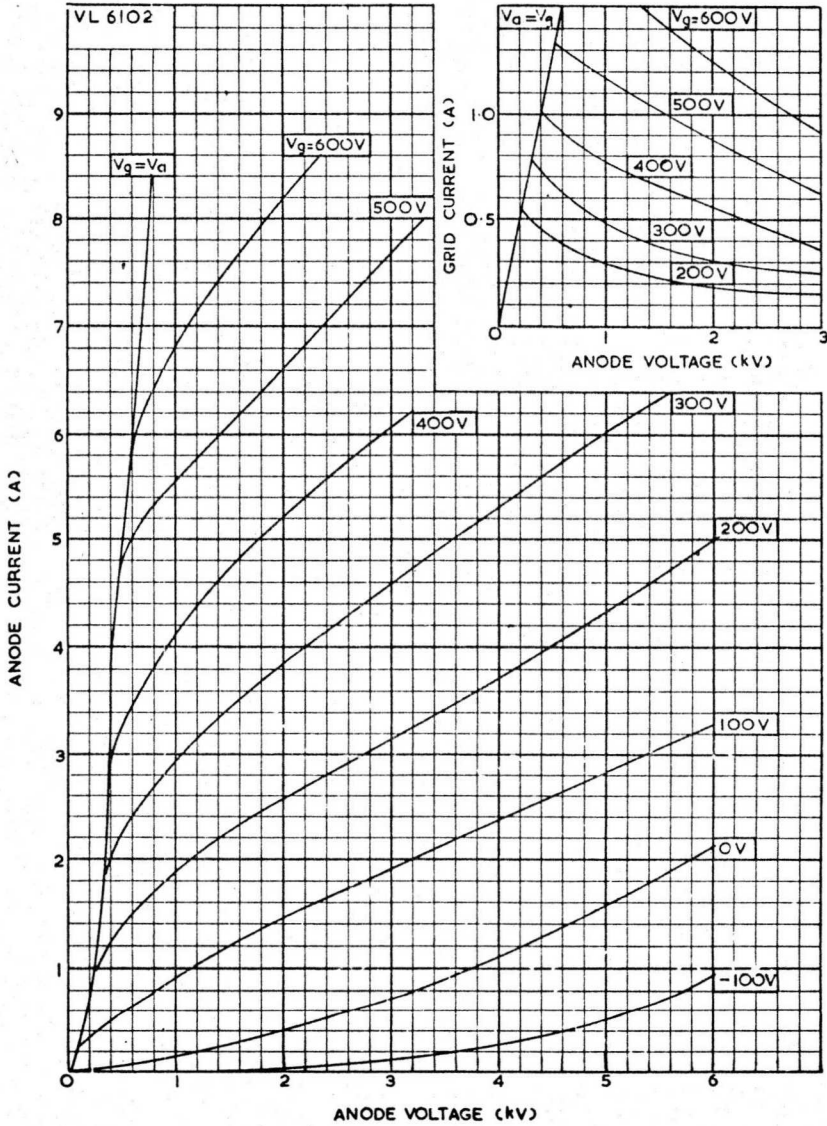
**TYPICAL OPERATING CONDITIONS**

Direct anode voltage	5	kV
Direct grid voltage	-200	V
Direct anode current (maximum drive), per valve	1	A
Direct anode current (zero drive), per valve	0.1	A
Load resistor, anode-to-anode	5.1	k $\Omega$
Peak a.f. grid to grid voltage	1 040	V
Grid drive power, approximately 2 valves	75	W
Direct grid current, per valve	76	mA
Direct grid dissipation, per valve	22	W
Direct anode dissipation, per valve	2	kW
Power output (2 valves)	6	kW



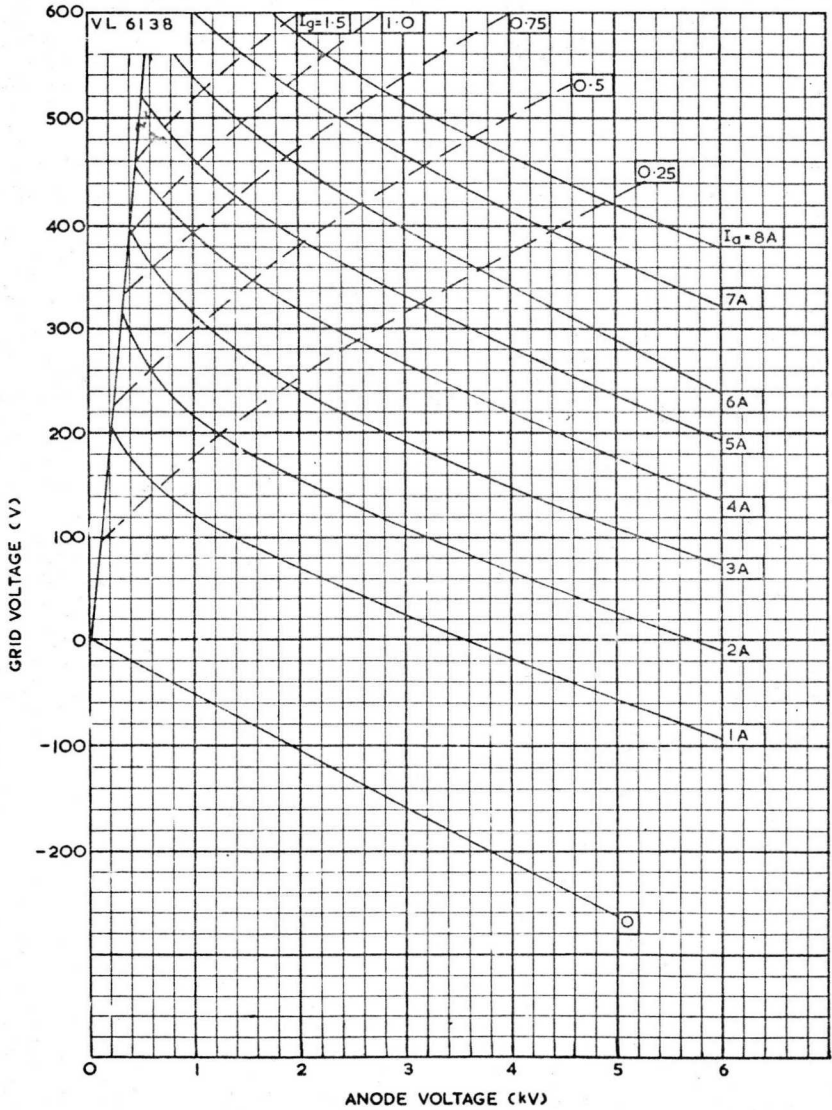
Code: ESA1500

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Code: ESA1500

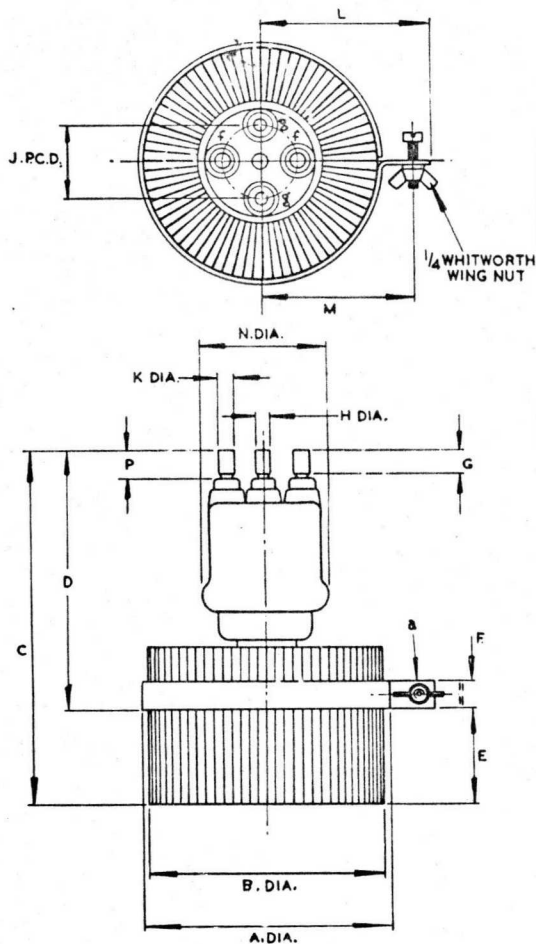
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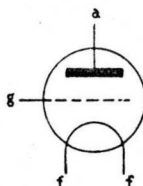
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## ESA1500 Outline



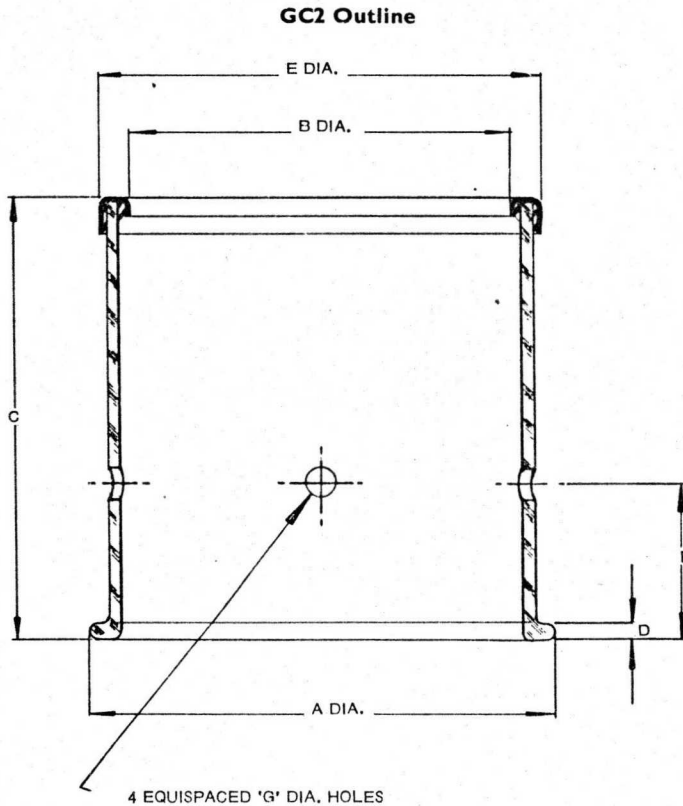
DIM.	INCHES	MILLIMETRES
A	$6\frac{3}{8}$ MAX.	161,9 MAX.
B	6 MAX.	152,4 MAX.
C	$8\frac{3}{4}$ MAX.	222,3 MAX.
D	$5\frac{15}{16} \pm \frac{1}{4}$	$150,8 \pm 6,4$
E	$2\frac{7}{16} \pm \frac{1}{8}$	$61,9 \pm 3,2$
F	$\frac{3}{4} \pm \frac{1}{32}$	$19,1 \pm 0,8$
G	$\frac{19}{32}$ MIN.	15,0 MIN.
H	$0,312 \pm 0,005$	$7,94 \pm 0,13$
J	$1,890 \pm 0,010$	$48,00 \pm 0,25$
K	$0,375 \pm 0,005$	$9,53 \pm 0,13$
L	$4\frac{3}{8}$ MAX.	111,1 MAX.
M	$3\frac{29}{32} \pm \frac{1}{16}$	$99,2 \pm 1,6$
N	3,150 MAX.	80,00 MAX.
P	$\frac{3}{4}$ MAX.	19,0 MAX.

BASIC DIMENSIONS ARE INCHES



## GLASS SUPPORT TUBE

Code: GC2



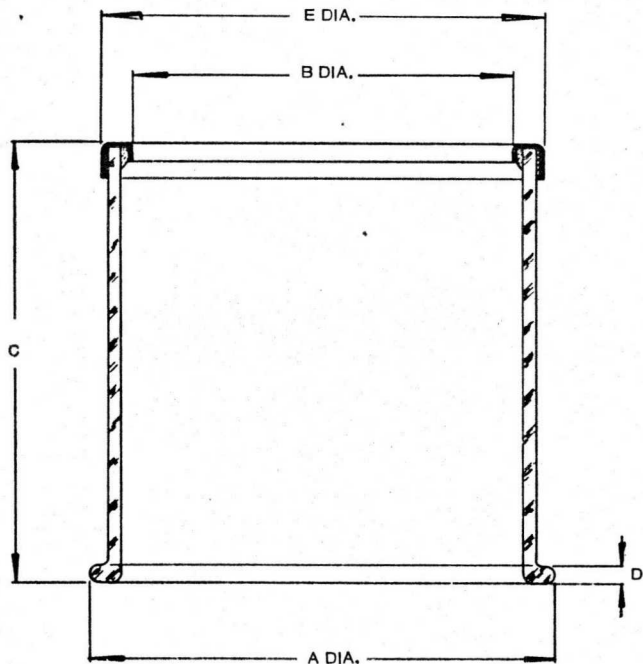
DIM.	INCHES	MILLIMETRES
A	7.1/4 MIN. 7.5/8 MAX.	184,1 MIN. 193,7 MAX.
B	6.1/16 ± 1/32	154,0 ± 0,8
C	7.1/32 ± 5/32	178,6 ± 4,0
D	1/4 MIN. 3/8 MAX.	6,3 MIN. 9,5 MAX.
E	7 MAX.	177,8 MAX.
F	2.1/2 ± 1/16	63,5 ± 1,6
G	1/2 ± 1/32	12,7 ± 0,8

BASIC DIMS. ARE IN INCHES.

## GLASS SUPPORT TUBE

Code: GC1

GC1 Outline

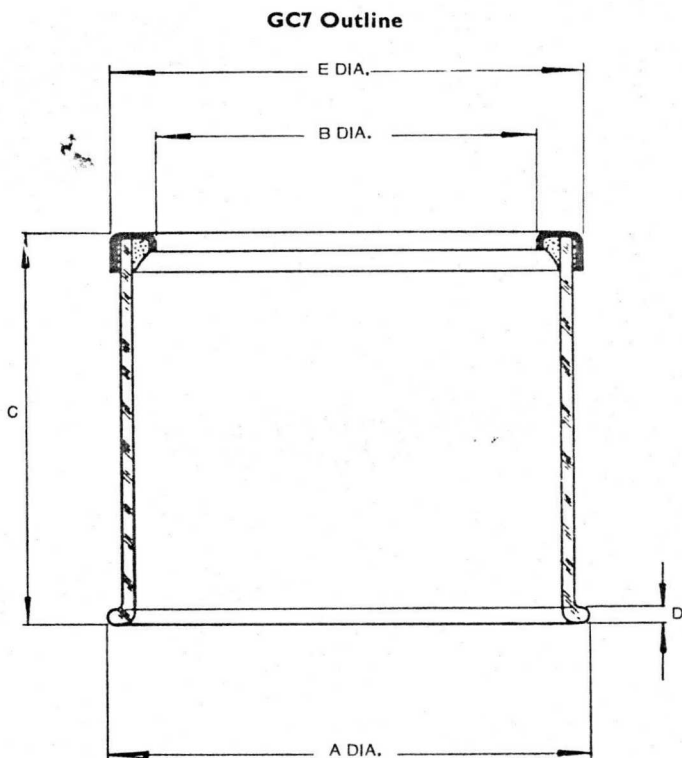


DIM.	INCHES	MILLIMETRES
A	7.1/4 MIN. 7.5/8 MAX.	184,1 MIN. 193,7 MAX.
B	6.1/16 ± 1/32	154,0 ± 0,8
C	7.1/32 ± 5/32	178,6 ± 4,0
D	1/4 MIN: 3/8 MAX.	6,3 MIN. 9,5 MAX.
E	7 MAX.	177,8 MAX.

BASIC DIMS. ARE INCHES

## GLASS SUPPORT TUBE

Code: GC7



DIM.	INCHES	MILLIMETRES
A	7.1/4 MIN. 7.5/8 MAX.	184,2 MIN. 193,7 MAX.
B	6.1/16 ± 1/32	154,0 ± 0,8
C	6.7/32 ± 5/32	158,0 ± 4,0
D	1/4 MIN. 3/8 MAX.	6,3 MIN. 9,5 MAX.
E	7 MAX.	177,8 MAX.

BASIC DIMS ARE IN INCHES.

## SPECIAL VALVES

Forced-Air-Cooled

Industrial Triode

Code: 3J/187E (Glass/metal envelope)  
3JC/187E (Ceramic/metal envelope)

The 3J/187E and 3JC/187E, designed specifically for industrial heating applications, are capable of operation at frequencies up to 120 and 300 MHz respectively. Design features give a high mutual conductance, resulting in high efficiency with the low grid dissipation and large safety factor which are desirable when the valves are operated under variable-load conditions.

## CATHODE

Thoriated-tungsten filament

Filament voltage	5	V
Nominal current	78	A
Maximum usable emission (Note 1)	10	A
Cold filament resistance	0.0075	$\Omega$

Note 1.—For a filament supply regulated to  $\pm 5$  per cent.

It is recommended that some resistance or reactance be introduced into the filament supply to limit the surge peak current to about two and a half times the normal r.m.s. working value. This impedance may be short circuited as soon as the surge has decayed.

For operation at high frequencies (above 30 MHz) it is recommended that the r.f. return path to the cathode makes connection to the larger filament terminal.

## CHARACTERISTICS

Amplification factor	$\left\{ \begin{array}{l} V_a = 2kV : I_a = 0.25A \\ V_a = 2kV : V_g = -75V \end{array} \right\}$	12	
Mutual conductance		22	mA/V

## DIRECT INTERELECTRODE CAPACITANCES

Grid to anode	29	pF
Grid to filament	54	pF
Anode to filament	1.5	pF

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3J/187E } -1  
3JC/187E }

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C O M P O N E N T S G R O U P

Code: 3J/187E (Glass/metal envelope)  
3JC/187E (Ceramic/metal envelope)

CONTINUED

Class B. A.F. Power Amplifier or Modulator  
(for balanced two-valve operation)**MAXIMUM RATINGS**

Maximum direct anode voltage	6	kV
Maximum direct anode current	2	A
Maximum direct anode dissipation (intermittent)	5	kW
Maximum direct anode dissipation (continuous)	4	kW
Maximum direct grid dissipation (continuous)	200	W
Maximum direct grid voltage	-1 500	V

**TYPICAL OPERATING CONDITIONS**

Direct anode voltage	5	kV
Direct grid voltage	-350	V
Direct anode current (zero signal) per valve	0.2	A
Direct anode current (maximum signal) per valve	1.9	A
Load resistor, anode to anode	2.7	k $\Omega$
Peak a.f. grid to grid voltage	1 040	V
Grid drive power, approximately (2 valves)	85	W
Direct grid current, per valve	80	mA
Direct grid dissipation, per valve	14	W
Output power (2 valves)	12	kW

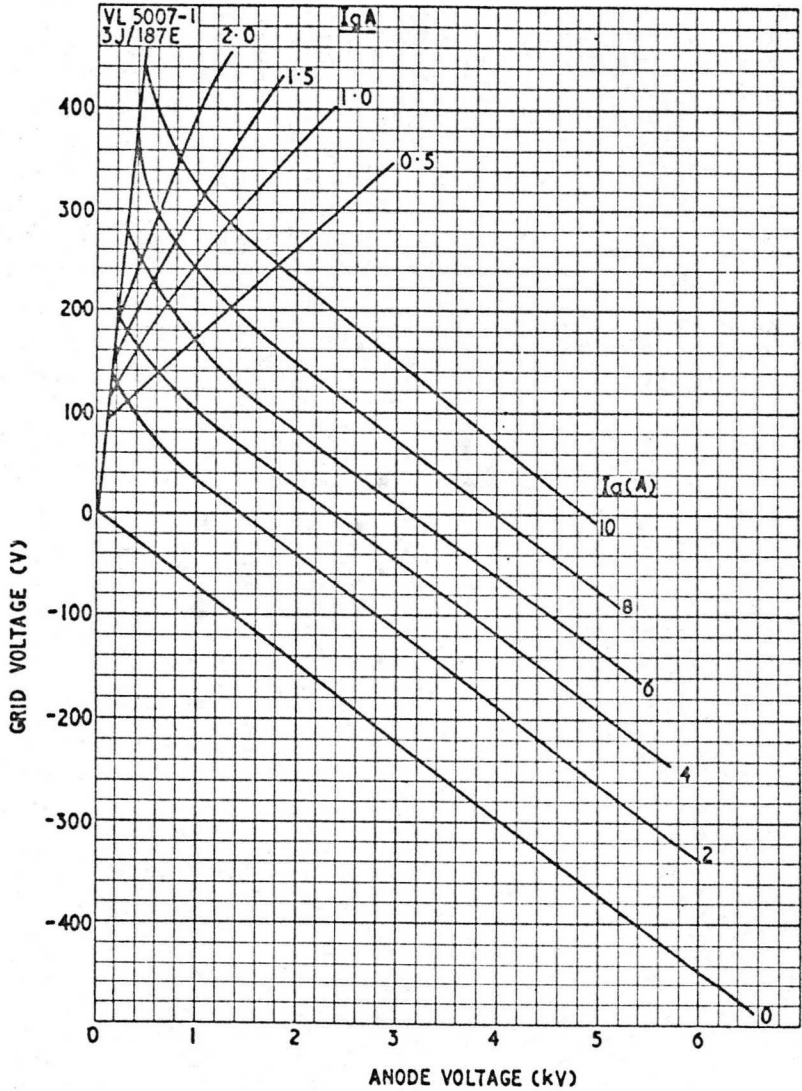


# STC

3J/187E  
3JC/187E

Code: 3J/187E (Glass/metal envelope)  
3JC/187E (Ceramic/metal envelope)

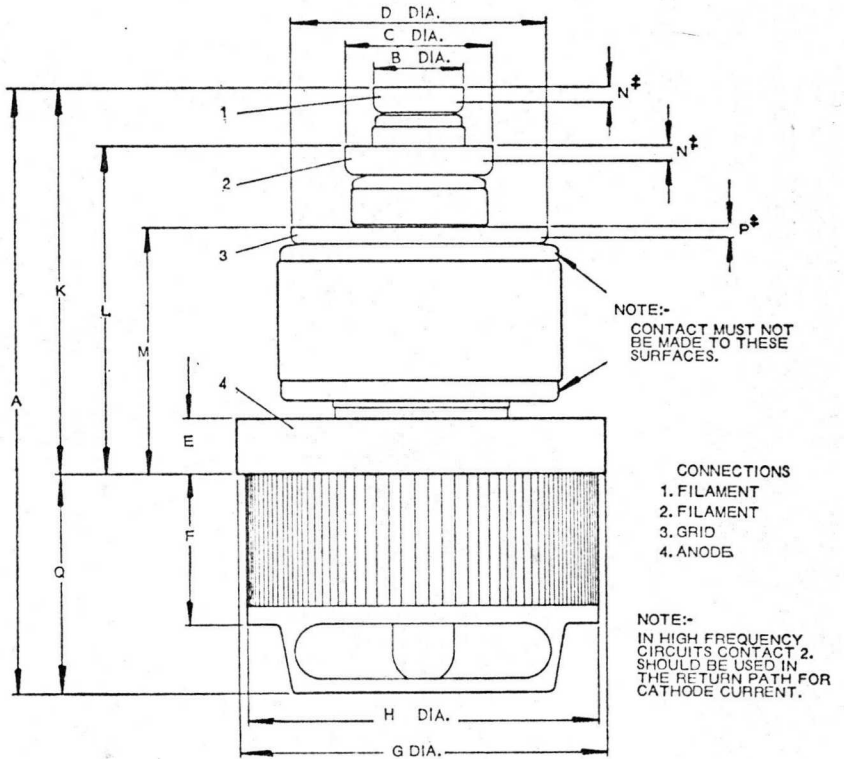
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Code: 3J/187E (Glass/metal envelope)

CONTINUED

3J/187E Outline



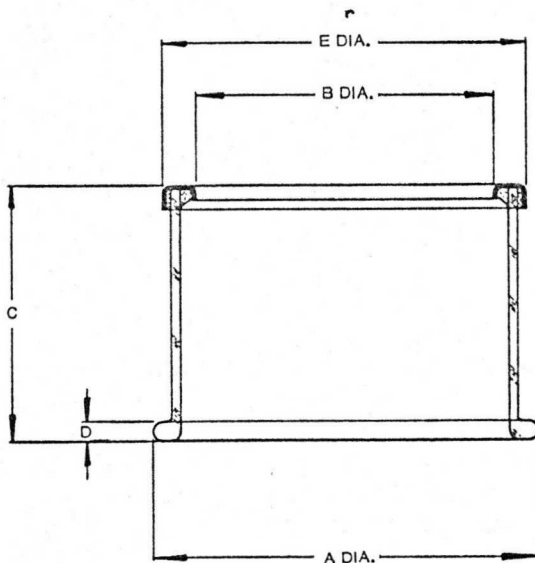
DIM.	MILLIMETRES	INCHES	DIM.	MILLIMETRES	INCHES
A	227,0 MAX.	8.15/16 MAX.	H	120,7 ± 0,8	4.3/4 ± 1/32
B	31,8 ± 0,4	1.1/4 ± 1/64	K	145,3 ± 4,8	5.23/32 ± 3/16
C	50,8 ± 0,4	2 ± 1/64	L	122,2 ± 4,8	4.13/16 ± 3/16
D	88,9 ± 0,4	3.1/2 ± 1/64	M	88,9 ± 3,2	3.1/2 ± 1/8
E	19,1 ± 1,6	3/4 ± 1/16	N	4,7 MIN. 6,4 MAX.	3/16 MIN. 1/4 MAX.
F	50,8 ± 1,6	2 ± 1/16	P	3,1 MIN. 4,8 MAX.	1/8 MIN. 3/16 MAX.
G	127,0 ± 0,8	5 ± 1/32	Q	74,6 ± 1,6	2.15/16 ± 1/16

NOTE:—BASIC FIGURES ARE IN INCHES  
‡ DENOTES:—CONTACT LENGTH

## GLASS SUPPORT TUBE

Code: GC10

GC10 Outline



DIM	INCHES	MILLIMETRES
A	6 MIN. 6.3/8 MAX.	152,4 MIN. 161,9 MAX.
B	4.782 + 0.015 - 0.000	121,46 + 0,38 - 0,00
C	4.1/16 ± 3/16	103,2 ± 4,8
D	1/4 MIN. 3/8 MAX.	6,3 MIN. 9,5 MAX.
E	5.7/8 MAX.	149,2 MAX.

BASIC DIMS. ARE INCHES

# FORCED AIR COOLED V.H.F. POWER TRIODE

Code: 5924

The 5924 is intended for use as a v.h.f. amplifier, in which application it is particularly suitable for handling television signals; or as an a.f. amplifier. It may be used at frequencies up to 220MHz.

## CATHODE

Thoriated tungsten filament

Filament voltage (Note 1) 12,6 V

Filament current, nominal 33 A

The connection to the filament mid-point is intended for cathode connection but should not be used to carry filament current. At frequencies above 30MHz the filament pins should be decoupled to the centre tap with suitable capacitors.

Note 1. The filament has been designed to tolerate temporary fluctuations of supply voltage of +5% to -10%.

## CHARACTERISTICS

Mutual conductance { Measured at  $V_a = 4kV$  } 17 mA/V  
Amplification factor {  $I_a = 1A$  } 32

## DIRECT INTERELECTRODE CAPACITANCES

Grid to anode 11 pF

Grid to filament 16 pF

Anode to filament 0,3 pF

## MECHANICAL DATA

Dimensions As shown in outline drawing, Figure 5.

Mounting position Vertical, anode upwards or downwards.

November 1969

3J/188E-1

**ITT Components Group Europe**  
**Standard Telephones and Cables Limited**

Valve Product Division, Brixham Road, Paignton, Devon  
Telephone: Paignton 50762 (STD Code 0803) Telex: 42830

**ITT**  
**COMPONENTS**

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## MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

## CLASS C. AMPLIFIER FOR TELEVISION SERVICE - GRID MODULATED

(Negative modulation, synch. positive)

## Maximum Ratings

	Up to 75MHz	Up to 220MHz	
Direct anode voltage	5	4	kV
Direct anode current	1,9	1,6	A
Direct anode dissipation	5	4	kW
Direct grid dissipation	120	120	W
Negative grid bias	1	1	kV
Peak cathode current	10	8,1	A
Input power, average	9,5	6,5	kW

## Typical Operating Conditions (2 tubes in push-pull)

	Up to 75MHz	Up to 220MHz	
Bandwidth			
-1,5dB	5,25	6,5	MHz
-3dB	8	10	MHz
Direct anode voltage	5	4	kV
Grid voltage			
synch.	-200	-150	V
black	-300	-225	V
white	-550	-500	V
Anode current			
synch.	2 x 1,9	2 x 1,6	A
black	2 x 1,3	2 x 1,3	A
R.F. input voltage (grid-to-grid peak)	1	1	kV
Grid current			
synch.	2 x 250	2 x 200	mA
black	2 x 175	2 x 110	mA
Power output, synch.	9	6	kW
Power in load, synch.	6,3	4,2	kW
Drive power	250	350 to 450	W

CLASS C. AMPLIFIER FOR TELEVISION SERVICE - GRID MODULATED  
(Positive modulation, synch. negative)

Maximum Ratings

Direct anode voltage	5	kV
Direct anode current	1,9	A
Direct anode dissipation	5	kW
Direct grid dissipation	120	W
Negative grid bias	1	kV
Peak cathode current	10	A
Input power, average	9,5	kW
Frequency for above ratings	75	MHz

Typical Operating Conditions (2 tubes in push-pull)

Frequency	Up to 75	MHz
Bandwidth		
-1,5dB	5,25	MHz
-3dB	8	MHz
Direct anode voltage	5	kV
Grid voltage		
synch.	-580	V
black	-460	V
white	-200	V
Anode current		
white	2 x 1,9	A
black	2 x 400	mA
R.F. input voltage, grid-to-grid peak	1	kV
Grid current		
white	2 x 250	mA
black	0	mA
Power output, white	9	kW
Power in load, white	6,3	kW
Drive power	250	W

## CLASS B. LINEAR POWER AMPLIFIER FOR TELEVISION SERVICE

Applied signal to be negatively modulated (synch. positive)

## Maximum Ratings

	Up to 75MHz	Up to 220MHz	
Direct anode voltage	5	4	kV
Direct anode current	1,9	1,6	A
Direct anode dissipation	5	4	kW
Direct grid dissipation	120	120	W
Negative grid bias	1	1	kV
Peak cathode current	10	8,1	A
Input power, average d.c.	9,5	6,5	kW

## Typical Operating Conditions (2 tubes in push-pull)

	Up to 75MHz	Up to 220MHz	
Bandwidth			
-1,5dB	5,25	6,5	MHz
-3dB	8	10	MHz
Direct anode voltage	5	4	kV
Direct grid voltage	-200	-150	V
Anode current			
synch.	2 x 1,9	2 x 1,6	A
black	2 x 1,5	2 x 1,3	A
white	2 x 100	2 x 100	mA
R.F. input voltage, grid-to-grid peak			
synch.	1	1	kV
black	800	750	V
white	250	200	V
Grid current			
synch.	2 x 250	2 x 200	mA
black	2 x 110	2 x 110	mA
white	0	0	mA
Power output, synch.	9	6	kW
Power in load, synch.	6,3	4,2	kW
Drive power, synch.	250	350 to 450	W

## CLASS C. R.F. POWER AMPLIFIER. TELEGRAPHY OR F.M. TELEPHONY

## Maximum Ratings

Direct anode voltage		6	kV
Direct anode current		1,5	A
Direct anode dissipation		5	kW
Direct grid dissipation		120	W
Direct grid current		350	mA
Negative grid bias		1	kV
Peak cathode current		8,5	A
Frequency for above ratings		75	MHz

## Typical Operating Conditions (Frequency 75MHz)

Direct anode voltage	4	5	6	kV
Direct grid voltage	-200	-300	-400	V
Direct anode current	1,37	1,5	1,5	A
Peak r.f. grid voltage	500	640	740	V
Direct grid current	350	330	310	mA
Anode dissipation	1,5	1,9	2,1	kW
Efficiency	73	75	77	%
Power output	4	5,6	6,9	kW
Power into load	3,2	4,5	5,5	kW
Drive power	190	240	275	W

## Typical Operating Conditions (2 tubes in grounded-grid push-pull)

Frequency	75	110	110	220	MHz
Direct anode voltage	6	4	5	4	kV
Direct cathode voltage	400	200	300	200	V
Direct anode current	2 x 1,5	2 x 1,37	2 x 1,5	2 x 1,25	A
Peak r.f. input voltage (f-f)	1,48	1	1,28	0,9	kV
Direct grid current	2 x 310	2 x 350	2 x 330	2 x 200	mA
Anode dissipation	2 x 2,1	2 x 1,7	2 x 2,2	2 x 2,5	kW
Efficiency	77	69	71	50	%
Power output (Note 2)	15,62(1,82)	8,6(1,0)	12,06(1,46)	5,6(0,6)	kW
Power into load	12,5	6,9	9,6	4,5	kW
Drive power	2,38	1,41	1,93	1,79	kW

Note 2. Figures in brackets denote power transferred through from the driver.



## CLASS C. TELEPHONY (Carrier conditions for use with 100% anode modulation)

## Maximum Ratings

Direct anode voltage	5	kV
Direct anode current	1,3	A
Direct anode dissipation	3,4	kW
Direct grid dissipation	120	W
Direct grid current	350	mA
Negative grid bias	1	kV
Peak cathode current	7,5	A
Frequency for above ratings	75	MHz

## Typical Operating Conditions (Frequency 75MHz, carrier only)

Direct anode voltage	3	3,5	4	4,5	5	kV
Direct grid voltage	-250	-300	-300	-350	-400	V
Direct anode current	1	1,2	1,2	1,2	1,2	A
Peak r.f. grid voltage	510	600	600	650	690	V
Direct grid current	300	300	300	300	300	mA
Anode dissipation	0,8	1,2	1,3	1,3	1,3	kW
Efficiency	73	72	73	76	78	%
Power output	2,2	3	3,5	4,1	4,7	kW
Power into load at 80% transfer efficiency	1,76	2,4	2,8	3,3	3,75	kW
Drive power	170	205	205	230	205	W
Modulation power for 100% modulation depth	1,5	2,1	2,4	2,7	3	kW

CLASS B. LINEAR R.F. AMPLIFIER (Applied signal to be 100% modulated.  
Carrier conditions listed)

## Maximum Ratings

Direct anode voltage	6	kV
Direct anode current	1,1	A
Direct anode dissipation	5	kW
Direct grid dissipation	120	W
Direct grid current	350	mA
Negative grid bias	1	kV
Peak cathode current	4,6	A
Frequency for above ratings	75	MHz

## CLASS B. LINEAR R.F. AMPLIFIER (continued)

## Typical Operating Conditions (Frequency 75MHz)

Direct anode voltage	5	6	kV
Direct grid voltage	-145	-180	V
Direct anode current	900	990	mA
Peak r.f. grid voltage	225	250	V
Anode dissipation	3	4	kW
Efficiency	32	32	%
Power output	1,45	1,9	kW
Power into load for 100% modulation	1,16	1,52	kW
Drive power	160	170	W
Direct grid current	320	300	mA

## CLASS B. A.F. AMPLIFIER (for balanced 2-tube operation)

## Maximum Ratings (per tube)

Direct anode voltage	6	kV
Direct anode current	1,5	A
Direct anode dissipation	5	kW
Direct grid dissipation	120	W
Direct grid current	350	mA
Peak cathode current	5,7	A
Grid-to-filament resistance	15	k $\Omega$

## Typical Operating Conditions (2 tubes in push-pull)

Direct anode voltage	3	3,5	4	4,5	5	6	kV
Direct grid voltage	-90	-100	-112	-125	-138	-165	V
Direct grid current	2x200	2x180	2x190	2x90	2x140	2x280	mA
Direct anode current							
zero signal	2x65	2x75	2x100	2x100	2x110	2x125	mA
max. signal	2x800	2x950	2x940	2x920	2x910	2x1 500	mA
Peak grid-to-grid voltage	400	440	450	465	470	645	V
Anode dissipation	2x0,75	2x1,0	2x1,1	2x1,15	2x1,25	2x2,35	kW
Efficiency	69	70	71	72	73	74	%
Power output	3,3	4,6	5,3	6	6,6	13,3	kW
Drive power	104	100	108	54	84	230	W
Anode-to-anode resistance	4,4	4,2	4,9	6,1	6,4	4,9	k $\Omega$
Total distortion	3,3	2,9	2,6	3,7	3,3	4,3	%

## COOLING REQUIREMENTS

The tube must not be operated without a heat dissipating connector or the filament mid-point pin.

Maximum filament seal temperature 210°C

Maximum anode and grid seal temperature 180°C

In order to keep within the temperature limits, it may be necessary to direct a flow of air on to the filament and grid seals.

The amount of forced-air-cooling required by the 5924 tube depends upon its height above sea level, the ambient air temperature and the anode dissipation. Typical data are given in the following table:

Anode dissipation  (kW)	Height above sea level		Max. inlet temperature  (°C)	Min. rate of air flow		Pressure drop between inlet and outlet	
	(m)	(ft)		m <sup>3</sup> /min.	ft <sup>3</sup> /min.	mm. water	in. water
1	0	0	35	3	105	8	0,32
1	0	0	45	3,1	110	8	0,32
1	1 500	4 920	35	3,7	130	9	0,35
1	3 000	9 840	25	4,1	145	10	0,39
3	0	0	35	5,2	185	23	0,9
3	0	0	45	6,1	215	29	1,14
3	1 500	4 920	35	6,2	220	26	1,02
3	3 000	9 840	25	6,6	235	26	1,02
5	0	0	35	9,2	325	68	2,7
5	0	0	45	10,7	380	90	3,5
5	1 500	4 920	35	11,2	395	81	3,2
5	3 000	9 840	25	11,6	410	71	2,8

Fig. 1. Typical Anode and Grid Characteristics

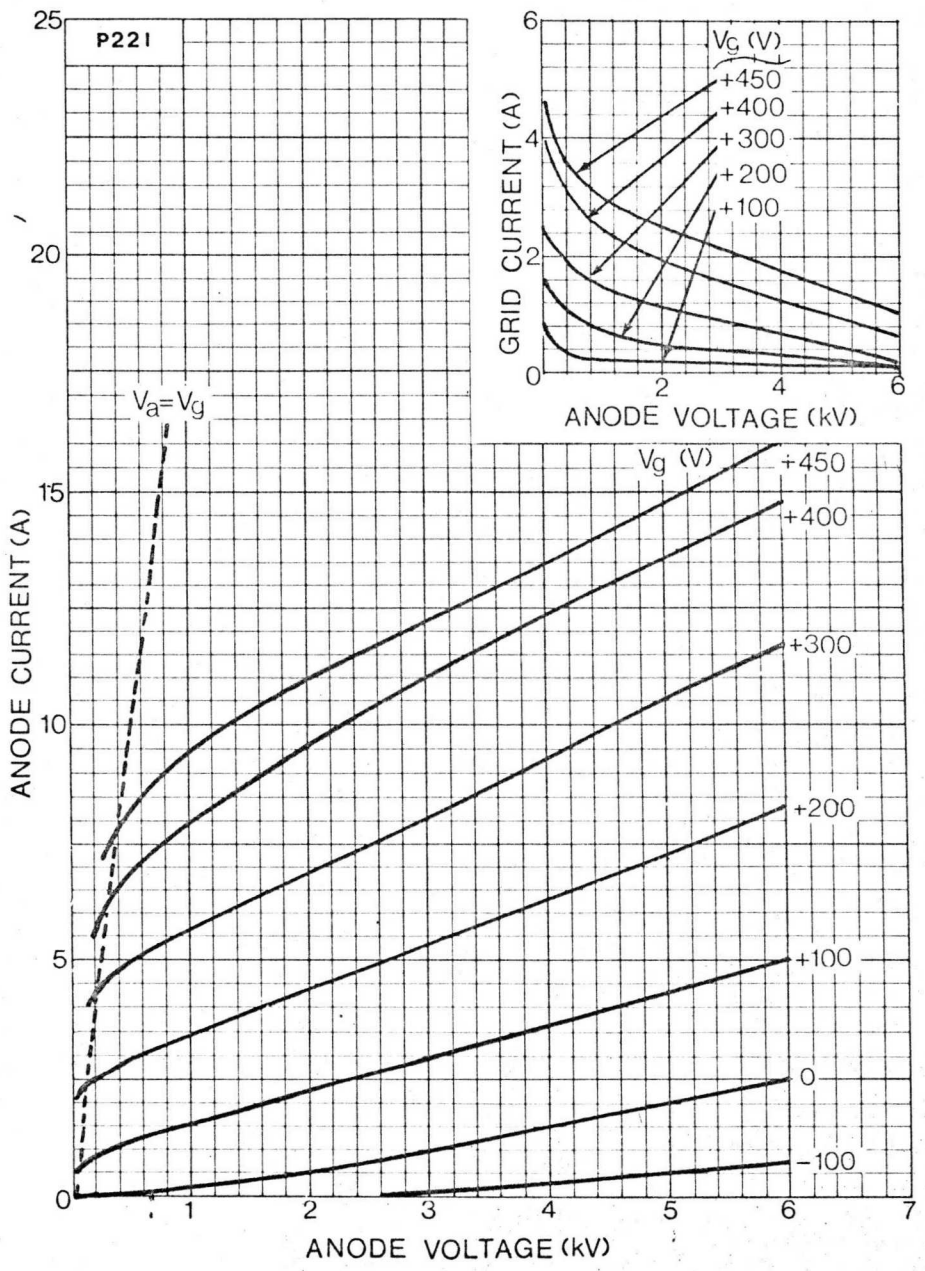


Fig. 2. Typical Constant Current Characteristics

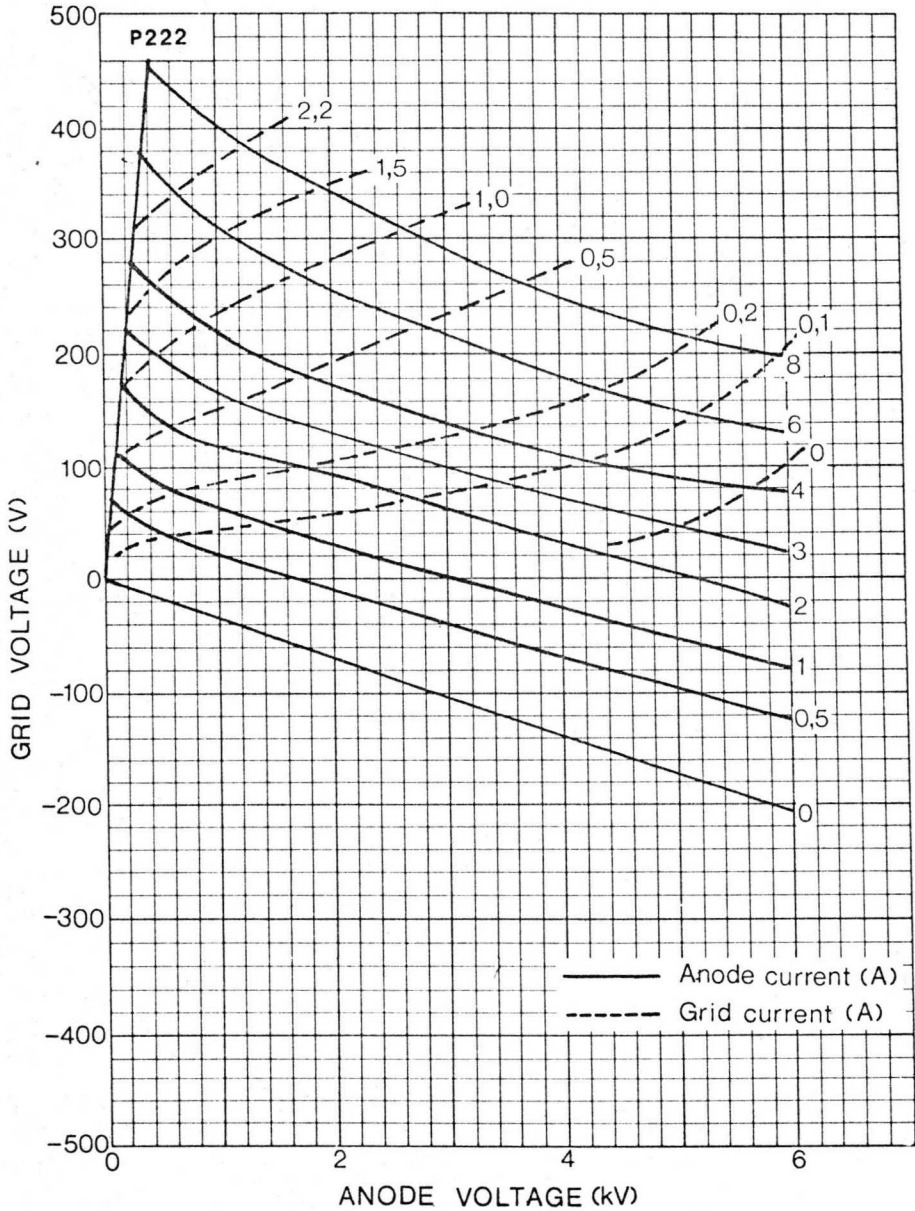


Fig. 3. Typical Anode Current versus Grid Voltage

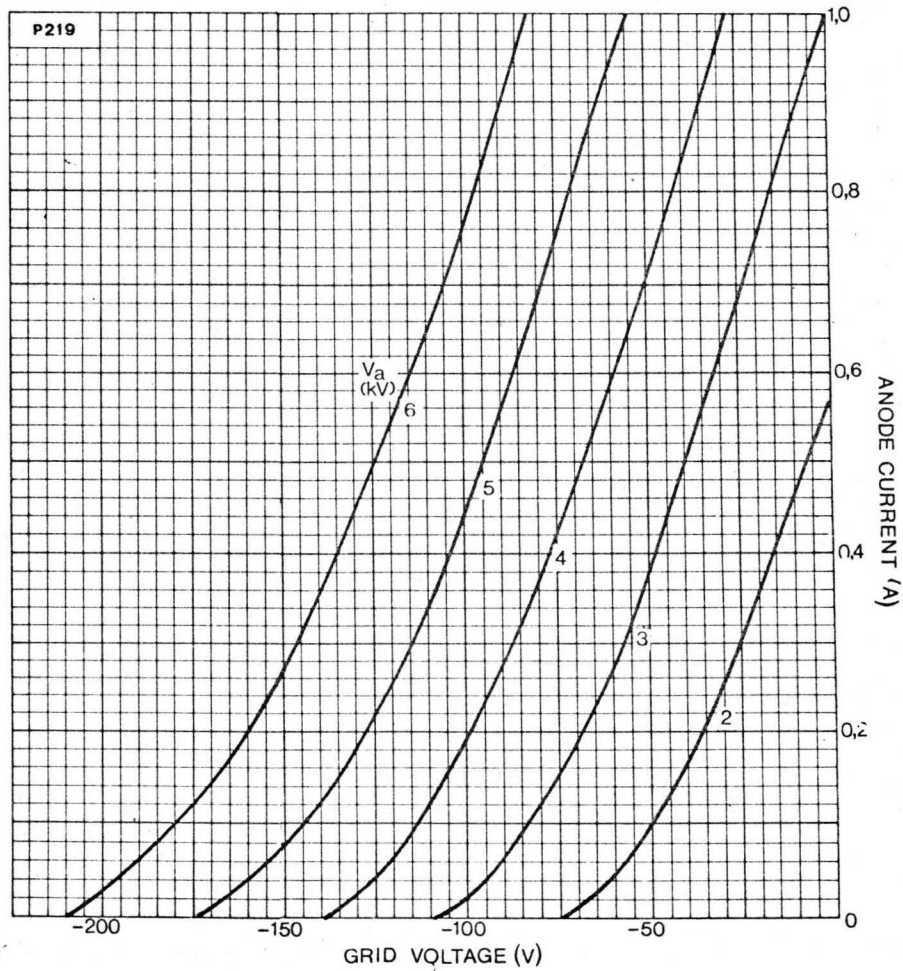
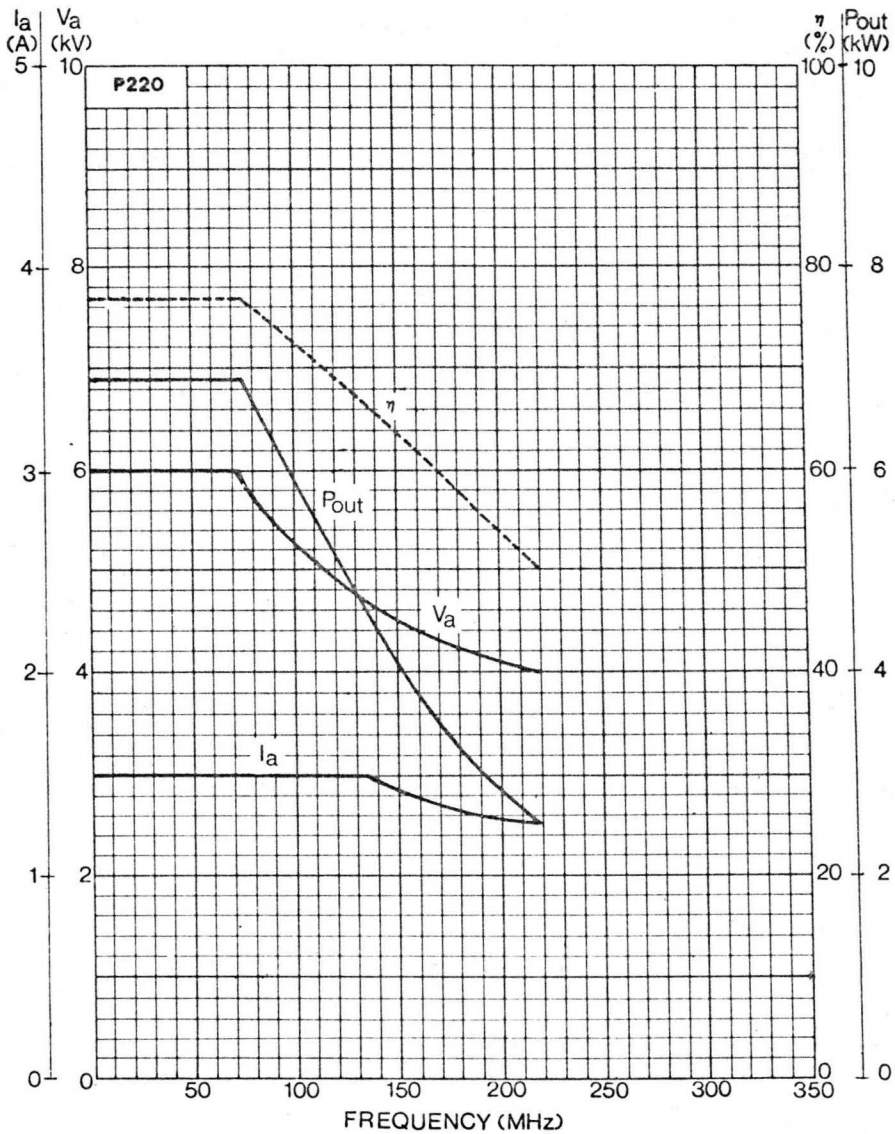


Fig. 4. Typical Power Output, Anode Current, Anode Voltage and Efficiency versus Frequency.







# FORCED AIR COOLED V.H.F. POWER TRIODE

Code: 6961 (CV5239)

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The 6961 is designed for use as a v.h.f. amplifier, industrial heating oscillator or a.f. amplifier. It is capable of operation up to 85MHz.

## CATHODE

Thoriated tungsten filament

Filament voltage (Note 1)	12,6	V
Filament current, nominal	33	A

The connection to the mid-point of the filament is intended for cathode connection but should not be used to carry filament current. At frequencies above 30MHz the filament pins should be decoupled to the centre tap by suitable capacitors.

Note 1. The filament has been designed to tolerate temporary fluctuations of supply voltage of +5% and -10%.

## CHARACTERISTICS

Mutual conductance	{ Measured at $V_a = 6kV$ $I_a = 1A$ }	15	mA/V
Amplification factor		32	

## DIRECT INTERELECTRODE CAPACITANCES

Grid to anode	11	pF
Grid to filament	16	pF
Anode to filament	0,3	pF

## MECHANICAL DATA

Dimensions	As shown in outline drawing, Figure 3.
Mounting position	Vertical, anode upwards or downwards.

November 1969

3J/199E-1

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**ITT Components Group Europe**  
**Standard Telephones and Cables Limited**

Valve Product Division, Brixham Road, Paignton, Devon  
Telephone: Paignton 50762 (STD Code 0803) Telex: 42830

**ITT**

**COMPONENTS**

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## MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

## CLASS C. TELEGRAPHY OR F.M. TELEPHONY

## Maximum Ratings

Direct anode voltage		7,2	kV
Direct anode current		2,2	A
Direct anode dissipation		6	kW
Direct grid dissipation		250	W
Direct grid current		600	mA
Negative grid bias		1,25	kV
Peak cathode current		14	A
Frequency for above ratings		30	MHz

## Typical Operating Conditions (Frequency 30MHz)

Direct anode voltage	5	5	6	6	6,5	6,5	kV
Direct grid voltage	-300	-300	-400	-400	-450	-450	V
Direct anode current	2	2	2	2	2	2	A
Peak r.f. grid voltage	660	700	780	820	820	850	V
Direct grid current	500	600	500	600	500	600	mA
Anode dissipation	2,9	2,7	3,5	2,8	3,5	3,0	kW
Power output	7,1	7,3	8,5	9,2	9,5	10	kW
Power into load	5,7	5,8	7,0	7,4	7,6	8	kW
Drive power	297	378	350	443	370	460	W

## CLASS C. TELEPHONY (Carrier conditions for use with 100% modulation)

## Maximum Ratings

Direct anode voltage		5,5	kV
Direct anode current		1,8	A
Direct anode dissipation		4	kW
Direct grid dissipation		250	W
Direct grid current		600	mA
Negative grid bias		1,25	kV
Peak cathode current		12	A
Frequency for above ratings		30	MHz

## CLASS C. TELEPHONY (continued)

## Typical Operating Conditions (Frequency 30MHz)

Direct anode voltage	4	5	5	kV
Direct grid voltage	-300	-400	-400	V
Direct anode current	1,6	1,4	1,6	A
Peak r.f. grid voltage	680	730	800	V
Direct grid current	600	500	500	mA
Anode dissipation	1,4	1,4	1,6	kW
Power output	5	5,6	6,4	kW
Power into load at 80% transfer efficiency	4	4,5	5,1	kW
Drive power	367	328	432	W
Modulator power for 100% modulation depth	3,2	3,5	4,0	kW

## CLASS C. INDUSTRIAL OSCILLATOR

(Anode supply from 3-phase half-wave rectifier without filter)

## Maximum Ratings

	Up to 55MHz	Up to 85MHz	
Direct anode voltage	7	6,5	kV
Direct anode current	2	2	A
Direct anode dissipation	6	6	kW
Direct grid dissipation	250	250	W
Direct grid current			
loaded	500	500	mA
unloaded	700	700	mA
Negative grid bias	1,25	1,25	kV
Peak cathode current	11	11	A
Grid-filament resistance	10	10	k $\Omega$

## Typical Operating Conditions

Maximum frequency	55	85	85	MHz
Direct anode voltage	6,5	6	5	kV
Direct anode current	1,7	1,5	1,7	A
Direct grid current				
loaded	500	400	450	mA
unloaded	700	700	700	mA
Grid resistor	900	1 000	850	$\Omega$
Drive power, approx.	350	300	350	W
Anode dissipation	2,4	2,7	2,4	kW
Power output	8,6	6,5	6,1	kW
Power into load (Note 2)	7	5,5	5	kW

Note 2. Load power =  $(P_{out} - P_{drive}) \times$  transfer efficiency (approx. 85%).

## CLASS B. A.F. AMPLIFIER (for balanced 2-tube operation)

## Maximum Ratings (per tube)

Direct anode voltage	7,2	kV
Direct anode current	2,8	A
Direct anode dissipation	6	kW
Direct grid dissipation	250	W
Direct grid current	600	mA
Peak cathode current	10	A
Grid-filament resistance	15	kΩ

## Typical Operating Conditions (2 tubes in push-pull)

Direct anode voltage	4	5	5	7	kV
Direct grid voltage	-135	-165	-165	-250	V
Direct anode current					
zero signal	2 x 100	2 x 150	2 x 150	2 x 200	mA
max. signal	2 x 1,25	2 x 1,1	2 x 1,25	2 x 2	A
Peak grid-to-grid voltage	630	483	588	854	V
Direct grid current	2 x 360	2 x 220	2 x 330	2 x 530	mA
Anode dissipation	2 x 1,45	2 x 1,5	2 x 1,7	2 x 4	kW
Efficiency	71	72,5	72,5	71,5	%
Power output	7,1	8	9	20	kW
Drive power	2 x 140	2 x 65	2 x 130	2 x 310	W
Anode-to-anode resistance	3,8	5,5	4,8	4,15	kΩ

## COOLING REQUIREMENTS

The tube must not be operated without a heat dissipating connector on the filament mid-point pin.

Maximum filament seal temperature is 210°C

Maximum anode and grid seal temperature 180°C

In order to keep within the temperature limits it may be necessary to direct a flow of air on to the filament and grid seals.

The amount of forced-air-cooling required by the 6961 tube depends upon its height above sea level, the ambient air temperature and the anode dissipation. Typical data are given in the following table.

Anode dissipation (kW)	Height above sea level		Max. inlet temperature (°C)	Min. rate of air flow		Pressure drop between inlet and outlet	
	(m)	(ft)		m <sup>3</sup> /min	ft <sup>3</sup> /min	mm. water	in. water
2	0	0	35	4,8	169	20	0,79
2	0	0	45	5,7	201	25	0,98
2	1 500	4 920	35	5,7	201	23	0,9
2	3 000	9 840	25	6,1	215	23	0,9
3,5	0	0	35	6,2	219	32	1,26
3,5	0	0	45	7,3	258	42	1,65
3,5	1 500	4 920	35	7,3	258	36	1,42
3,5	3 000	9 840	25	7,8	275	36	1,42
6	0	0	35	9,2	325	68	2,68
6	0	0	45	10,7	378	91	3,58
6	1 500	4 920	35	11,2	396	81	3,19
6	3 000	9 840	25	11,7	413	80	3,15

Fig. 1. Typical Anode and Grid Characteristics

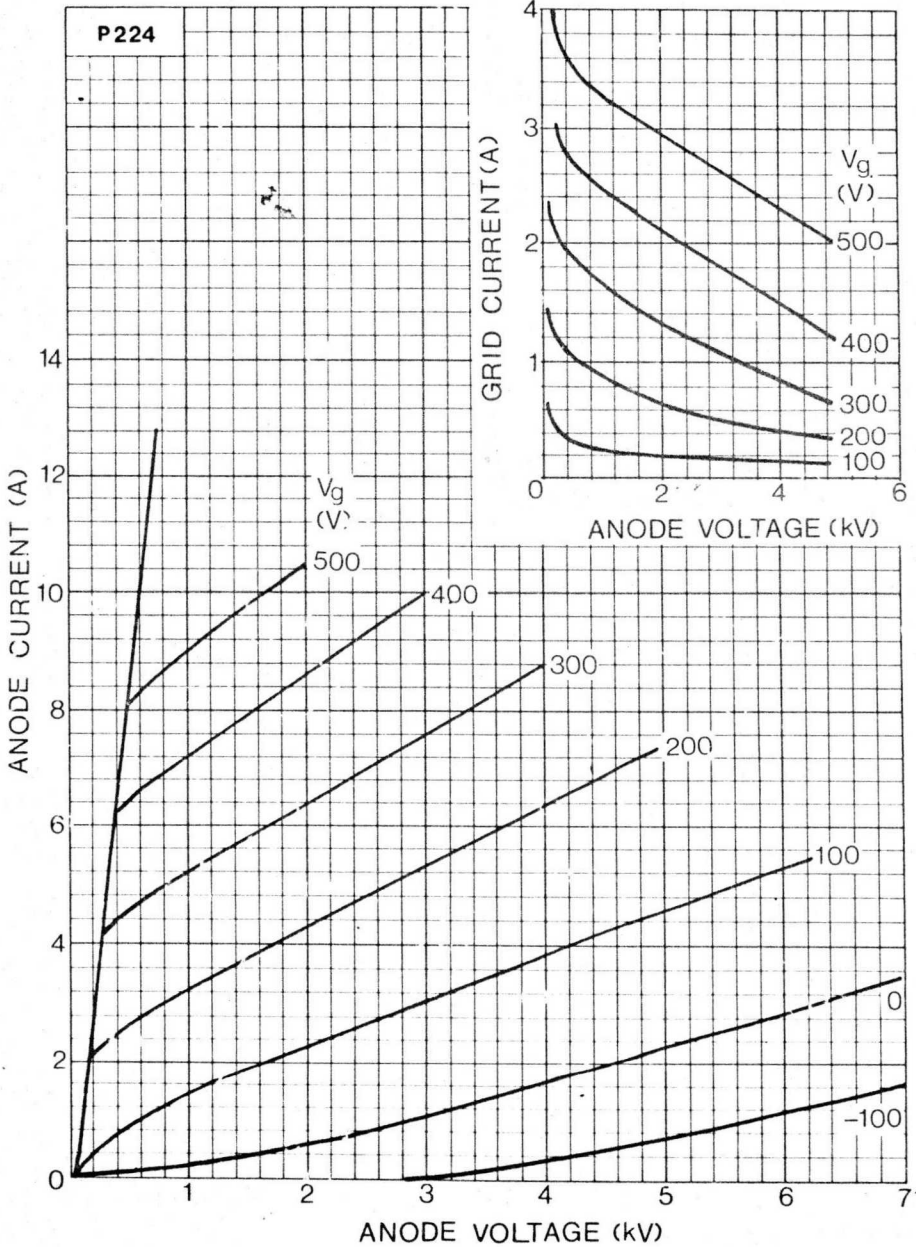


Fig. 2. Typical Constant Current Characteristics

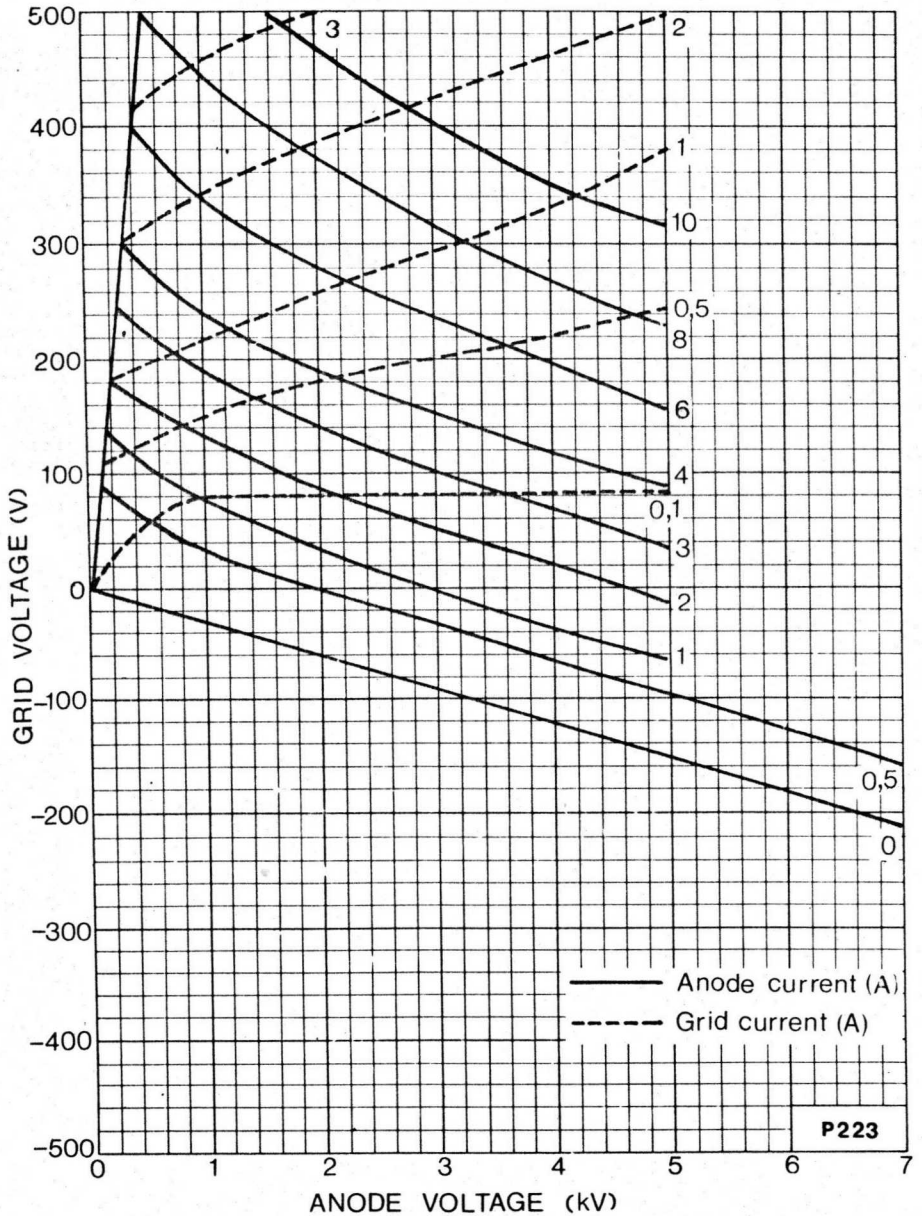
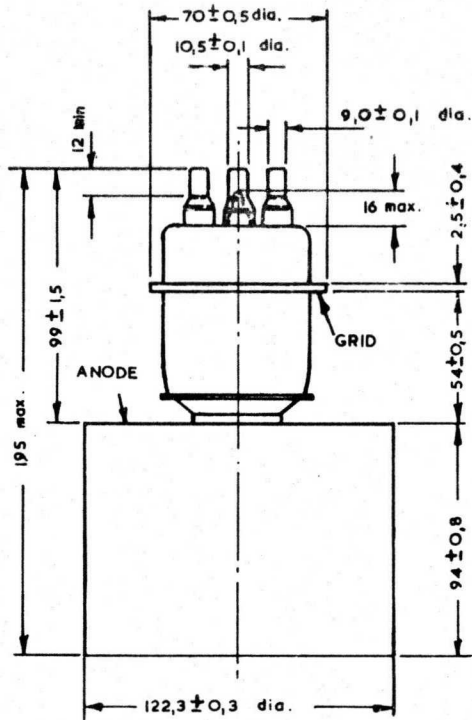
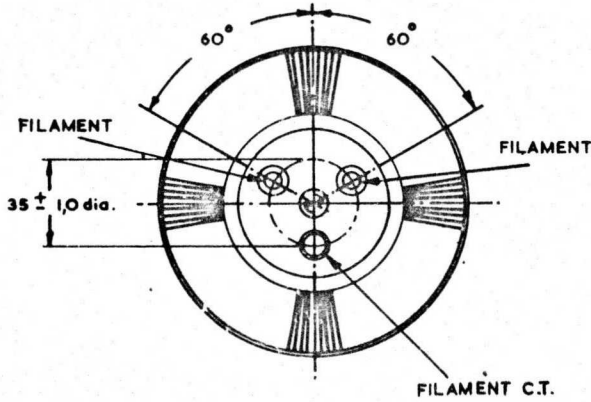
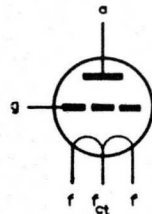


Fig. 3. Outline of 6961 Tube



DIMENSIONS ARE MILLIMETRES





# Forced-Air-Cooled Industrial Triode

Ref.: 3J/202E

Code: 3J/202E

## CATHODE

Thoriated-tungsten filament			
Filament voltage	$5 \pm 2\%$	$5 \pm 5\%$	V
Filament current (nominal)		112	A
Maximum usable emission	18	12	A
Filament cold resistance		0.007	$\Omega$

It is recommended that some resistance or reactance should be introduced into the filament supply to limit the switch or surge current to about two and a half times the normal working value. This impedance may be short circuited if desired as soon as the surge has decayed.

## PIRANI TEST\*

$I_f$		12	A
$V_f$ range		0.07 to 10.1	V
Approx. measuring time		60	min

\* See card supplied with individual valve for actual test figures.

## CHARACTERISTICS

Amplification factor	{ at $V_a$ 2kV, $I_a$ 0.25A }	16	
Mutual conductance	{ at $V_a$ 2kV, $V_g -75V$ }	32	mA/V

## DIRECT INTERELECTRODE CAPACITANCES

Grid to anode	30	pF
Grid to filament	60	pF
Anode to filament	1.5	pF

June 1971

3J/202E-1

**ITT Components Group Europe**  
**Standard Telephones and Cables Limited**

Valve Product Division, Brixham Road, Paignton, Devon  
Telephone: Paignton 50762 (STD Code 0803) Telex: 42830

**ITT**  
**COMPONENTS**

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## COOLING REQUIREMENTS

For air-cooling requirements see graphs on page 6.

Maximum radiator core temperature	220	°C
Maximum seal temperature (Note 1)	180	°C

Note 1.—To ensure that the stern seals are kept below the stated temperatures, it is necessary to direct into the grid flange a flow of cooling air of the order of 10 to 50 ft<sup>3</sup>/min (0.28 to 1.42 m<sup>3</sup>/min) dependent upon the circuit and frequency conditions.

## MECHANICAL DATA

Dimensions	As shown in outline drawings		
Mounting position	Vertical, anode upwards or downwards		
Shipping weight, approximately	40 lb	18	kg

### Accessories

The following approved items are supplied separately under the codes indicated:

214-LVA-001A	Filament connector, smaller
214-LVA-001B	Filament connector, larger
214-LVA-001C	Grid connector
GC8	Glass support tube

## MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Class C. Industrial Heating R.F. Oscillator

### MAXIMUM RATINGS

Maximum anode voltage (peak value of direct voltage plus ripple)	7	kV
Maximum direct anode current	3	A
Maximum direct anode dissipation (continuous)	6	kW
Maximum direct grid dissipation (continuous)	280	W
Maximum direct grid current (Note 2)	700	mA
Maximum negative grid bias	-1 500	V
Maximum frequency for above ratings	50	MHz

Note 2.—This figure is given for guidance. Grid dissipation is absolute rating.

### TYPICAL OPERATING CONDITIONS

Direct anode voltage	6	6.5	kV
Direct grid voltage	-670	-770	V
Direct anode current	2.5	3	A
Peak r.f. grid voltage	950	1 050	V
Direct grid current (Note 3)	450 (650)	350 (500)	mA
Grid dissipation (Note 3)	140	115	W
Grid resistor	1.5	2.2	kΩ
Power input	15	19.5	kW
Output power (oscillator)	11.5	14.1	kW
Power into load at 85% transfer efficiency	10	12	kW

Note 3.—Subject to wide variation dependent upon the impedance of the load circuit. The values of current shown in brackets are typical of off-load conditions and are given for guidance only; practical figures are dependent upon compensatory devices in the grid circuit.

---

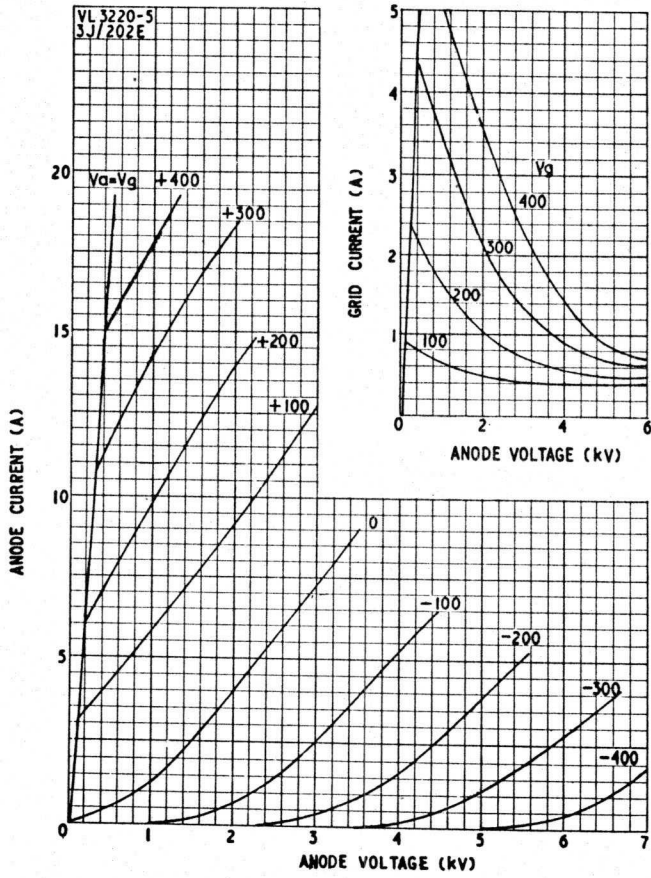
Class B. A.F. Power Amplifier or Modulator  
(for balanced two-valve operation)

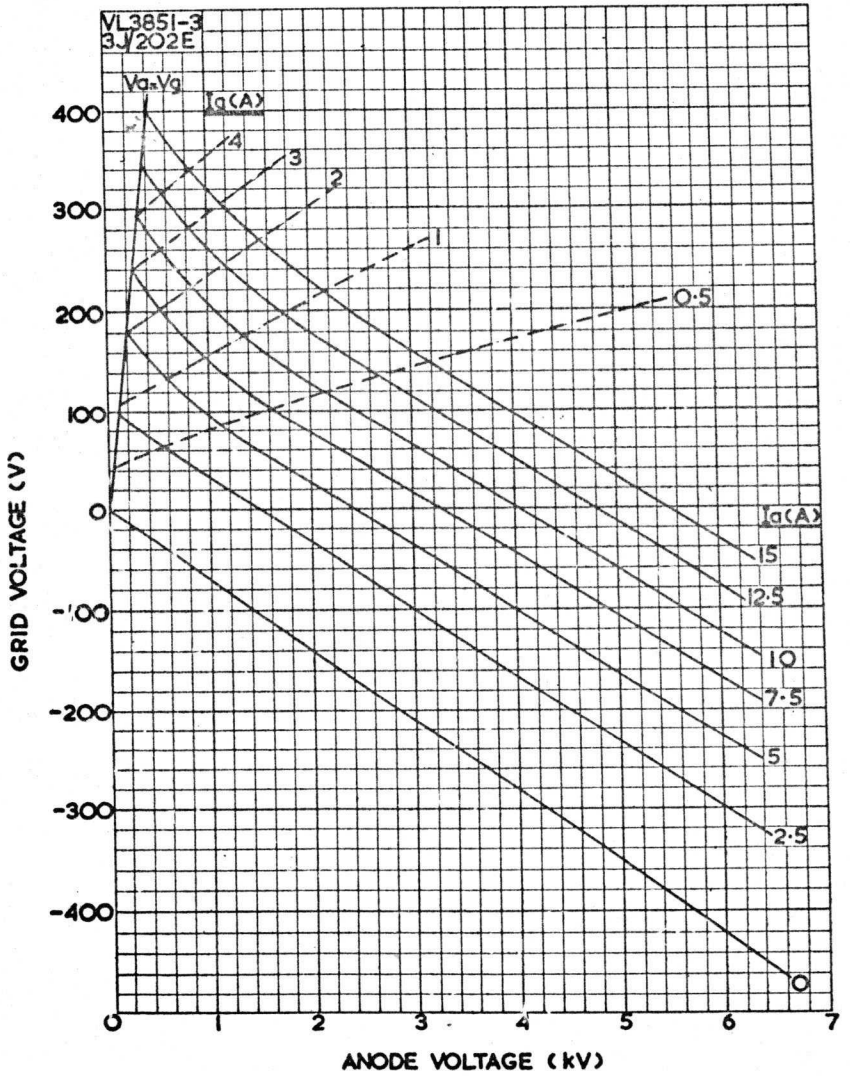
**MAXIMUM RATINGS**

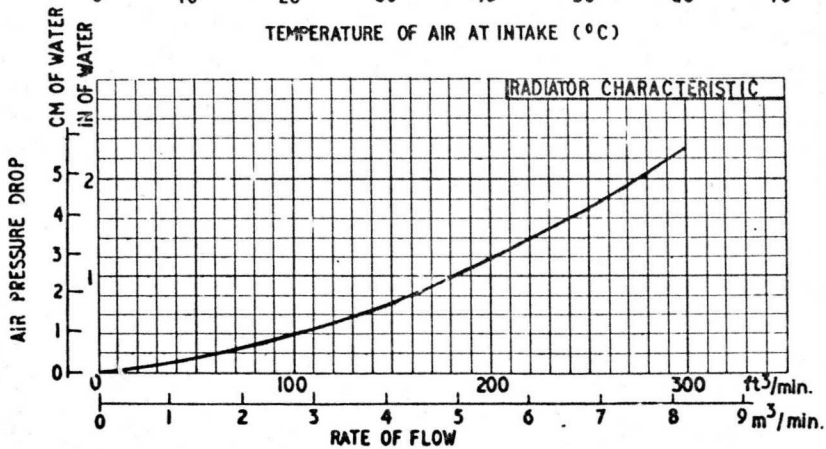
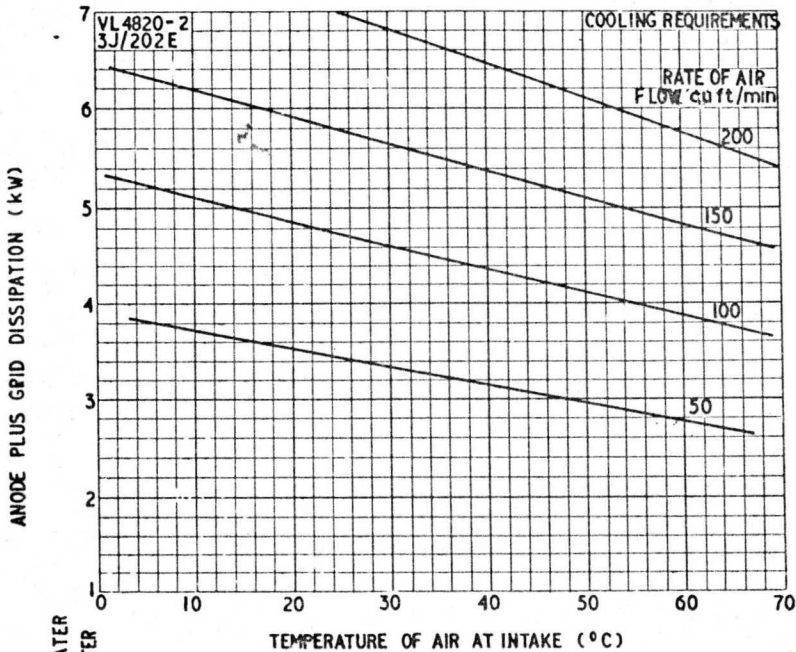
Maximum direct anode voltage	7	kV
Maximum direct anode current	3	A
Maximum direct anode dissipation (intermittent)	7	kW
Maximum direct anode dissipation (continuous)	6	kW
Maximum direct grid dissipation (continuous)	280	W
Maximum direct grid voltage	-1.5	kV

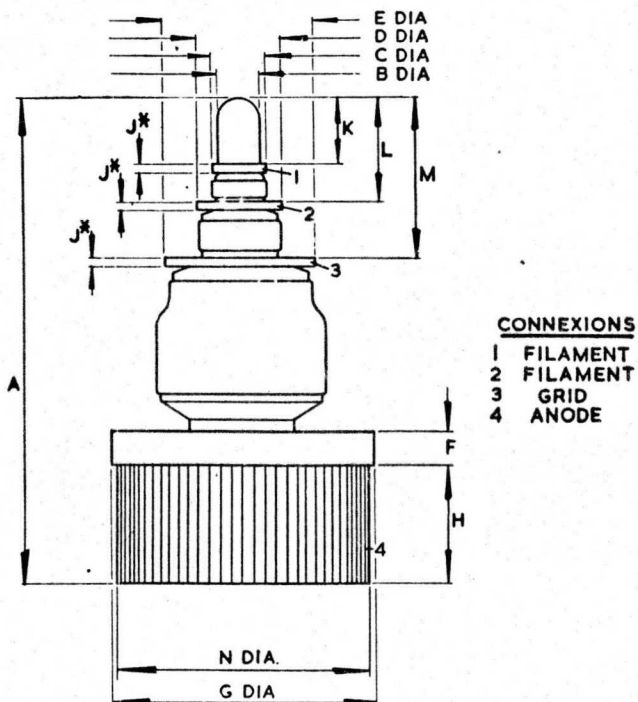
**TYPICAL OPERATING CONDITIONS**

Direct anode voltage	5	kV
Direct grid voltage	-350	V
Direct anode current (zero signal), per valve	0.5	A
Direct anode current (maximum signal), per valve	1.9	A
Load resistor, anode-to-anode	2.7	k $\Omega$
Peak a.f. grid to grid voltage	920	V
Grid drive power, approximately (2 valves)	75	W
Direct grid current, per valve	84	mA
Direct grid dissipation, per valve	7.6	W
Output power (2 valves)	12	kW









\*DENOTES:- CONTACT LENGTH

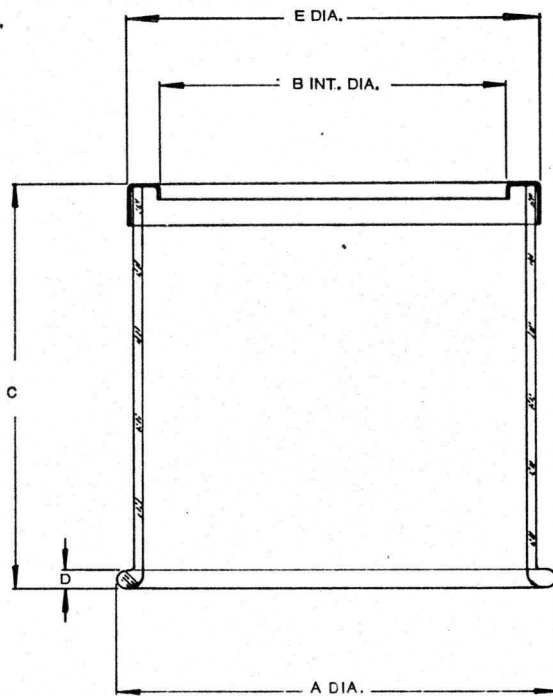
DIM.	MILLIMETRES	INCHES	DIM.	MILLIMETRES	INCHES
A	282,6 MAX.	11 $\frac{1}{8}$ MAX.	H	69,9 ± 1,6	2 $\frac{3}{8}$ ± $\frac{1}{16}$
B	.25,4 MAX.	1 MAX.	J	4,7 MIN. 6,4 MAX.	$\frac{3}{16}$ MIN. $\frac{1}{2}$ MAX.
C	31,7 ± 0,4	1 $\frac{1}{4}$ ± $\frac{1}{16}$	K	38,1 ± 1,6	1 $\frac{1}{2}$ ± $\frac{1}{16}$
D	50,8 ± 0,4	2 ± $\frac{1}{16}$	L	60,3 ± 4,8	2 $\frac{3}{8}$ ± $\frac{3}{16}$
E	88,9 ± 0,4	3 $\frac{1}{2}$ ± $\frac{1}{16}$	M	95,3 ± 4,8	3 $\frac{3}{8}$ ± $\frac{1}{16}$
F	19,1 ± 1,6	$\frac{3}{8}$ ± $\frac{1}{16}$	N	147,6 ± 1,6	5 $\frac{1}{8}$ ± $\frac{1}{16}$
G	154,0 ± 0,8	6 $\frac{1}{16}$ ± $\frac{1}{32}$			

NOTE: BASIC FIGURES ARE INCHES

# GLASS SUPPORT TUBE

Code: GC8

GC8 Outline



DIM.	INCHES	MILLIMETRES
A	7.1/4 MIN. 7.5/8 MAX.	184,1 MIN. 193,7 MAX.
B	5.29/32 ± 1/32	150,0 ± 0,8
C	7.1/32 ± 5/32	178,6 ± 4,0
D	1/4 MIN. 3/8 MAX.	6,3 MIN. 9,5 MAX.
E	7 MAX.	177,8 MAX.

BASIC DIMS. ARE INCHES



906282

# Forced-Air-Cooled Industrial Triode

Ref.: 3J/222E

Code: 3J/222E

The 3J/222E triode has been designed specifically for industrial heating applications and is capable of operation at frequencies up to 100 Mc/s. Design features give a high mutual conductance, resulting in high efficiency with the low grid dissipation and large safety factor which are desirable when the valve is operated under variable-load conditions.

### CATHODE

Thoriated-tungsten filament			
Filament voltage	$8 \pm 2\%$	$8 \pm 5\%$	V
Filament current (nominal)		125	A
Maximum usable emission	36	24	A
Filament cold resistance (nominal)		0.0085	$\Omega$

It is recommended that some resistance or reactance should be introduced into the filament supply to limit the switch or surge current to about two and a half times the normal working value. This impedance may be short circuited if desired as soon as the surge has decayed.

### PIRANI TEST\*

$I_f$		12	A
$V_f$ range		0.12 to 0.15	V
Approx. measuring time		60	min

\* See card supplied with individual valve for actual test figures.

### CHARACTERISTICS

Amplification factor	{ at $V_a$ 2kV, $I_a$ 0.5A }	16	
Mutual conductance	{ at $V_a$ 2kV, $V_g - 87V$ }	60	mA/V

### DIRECT INTERELECTRODE CAPACITANCES

Grid to anode	50	pF
Grid to filament	80	pF
Anode to filament	3	pF

June 1971

3J/222E-1

**ITT Components Group Europe**  
**Standard Telephones and Cables Limited**

Valve Product Division, Brixham Road, Paignton, Devon  
Telephone: Paignton 50762 (STD Code 0803). Telex: 42830

**COMPONENTS**

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## COOLING REQUIREMENTS

For air-cooling requirements see Figure 3.

Maximum radiator core temperature	220	°C
Maximum seal temperature	180	°C

Forced-air-cooling of grid and filament seals is required to limit their temperature to below the maximum permissible value of 180°C

If the rate of air flow through the radiator is less than 350 ft<sup>3</sup>/min care should be taken to ensure that the maximum grid seal temperature is not exceeded especially at high operating frequencies.

## MECHANICAL DATA

Dimensions	As shown in Figure 4		
Net weight, approximately	18 lb	8,2	kg
Mounting position.	Vertical, anode downwards		

### Accessories

The following approved items are supplied separately under the codes indicated:

214-LVA-001A	Filament connector, smaller
214-LVA-001B	Filament connector, larger
214-LVA-001C	Grid connector
GC11	Glass support tube

## MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Class C. Industrial Heating R.F. Oscillator

### Maximum Ratings

Maximum anode voltage (peak value of direct voltage plus ripple)	7	kV
Maximum direct anode current	6	A
Maximum direct anode dissipation (continuous)	10	kW
Maximum direct grid dissipation (continuous)	500	W
Maximum direct grid current (Note 2)	1.4	A
Maximum negative grid bias	-1 500	V
Maximum frequency for above ratings	30	MHz

Note 2.—This figure is given for guidance. Grid dissipation is absolute rating.

### Typical Operating Conditions

Direct anode voltage	6	kV
Direct grid voltage	-660	V
Direct anode current	5.6	A
Peak r.f. grid voltage	930	V
Direct grid current (Note 3)	750 (1 200)	mA
Grid dissipation (Note 3)	260	W
Grid resistor	900	Ω
Power input	33.6	kW
Output power (oscillator)	26	kW
Power into load at 85% transfer efficiency	21	kW

Note 3.—Subject to wide variation dependent upon the impedance of the load circuit. The value of current shown in brackets is typical of off-load conditions and is given for guidance only: a practical figure is dependent upon compensatory devices in the grid circuit.

Fig. 1.—Anode Current and Grid Current versus Anode Voltage

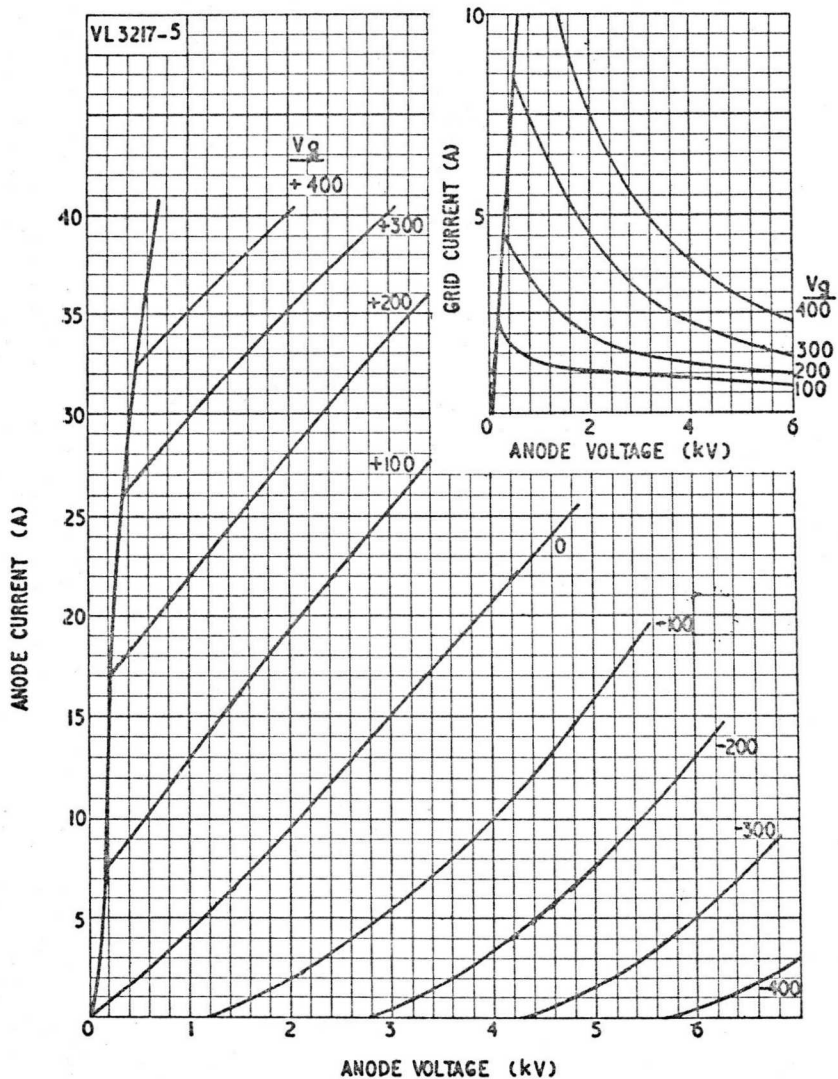


Fig. 2.—Grid Voltage versus Anode Voltage

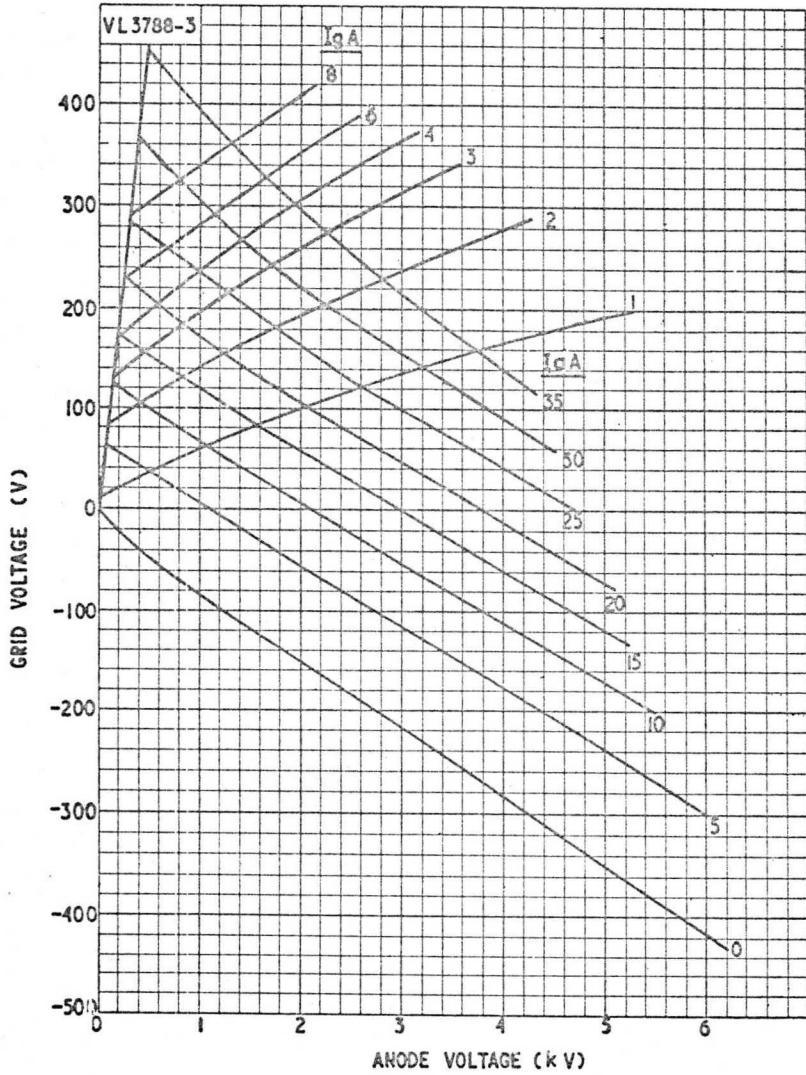
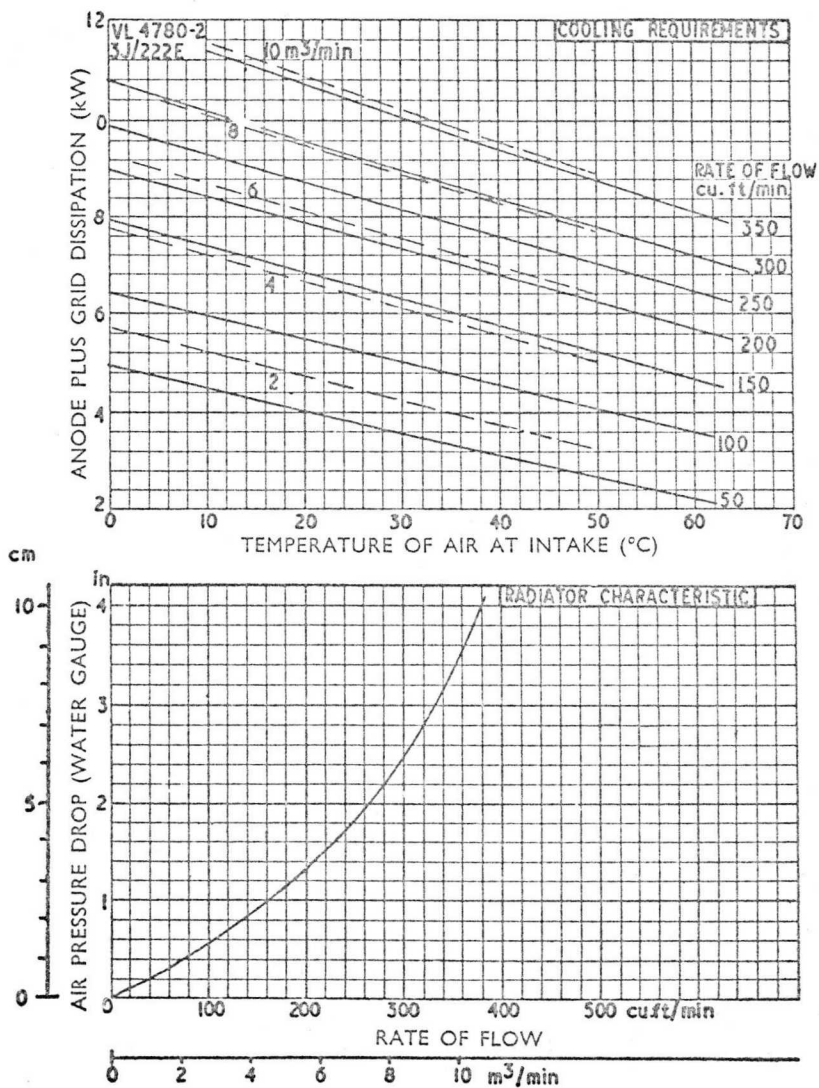
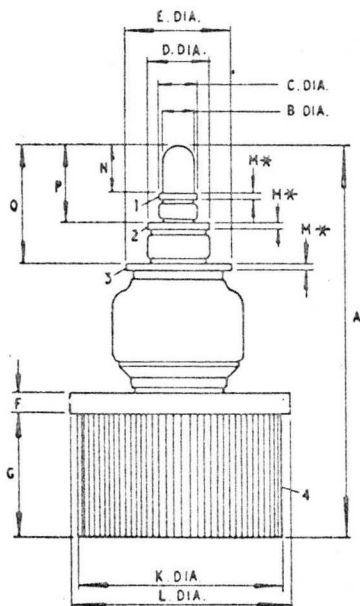


Fig. 3.—Cooling Requirements and Radiator Characteristics





**CONNEXIONS**

1. FILAMENT
2. FILAMENT
3. GRID
4. ANODE

DIM.	MILLIMETRES	INCHES	DIM.	MILLIMETRES	INCHES
A	311,2 MAX.	12 $\frac{1}{2}$ MAX.	J		
B	25,4 MAX.	1 MAX.	K	169,9 $\pm$ 1,6	6 $\frac{11}{16}$ $\pm$ $\frac{1}{8}$
C	31,8 $\pm$ 0,4	1 $\frac{1}{4}$ $\pm$ $\frac{1}{32}$	L	182,6 $\pm$ 0,8	7 $\frac{7}{16}$ $\pm$ $\frac{1}{32}$
D	50,8 $\pm$ 0,4	2 $\pm$ $\frac{1}{64}$	M*	4,76 MIN. 6,35 MAX.	$\frac{3}{16}$ MIN. $\frac{1}{4}$ MAX.
E	88,9 $\pm$ 0,4	3 $\frac{1}{2}$ $\pm$ $\frac{1}{64}$	N	38,1 $\pm$ 1,6	1 $\frac{1}{2}$ $\pm$ $\frac{1}{16}$
F	19,0 $\pm$ 1,6	$\frac{3}{4}$ $\pm$ $\frac{1}{16}$	P	60,3 $\pm$ 4,8	2 $\frac{3}{8}$ $\pm$ $\frac{3}{16}$
G	95,3 $\pm$ 1,6	3 $\frac{3}{8}$ $\pm$ $\frac{1}{16}$	Q	95,3 $\pm$ 4,8	3 $\frac{3}{8}$ $\pm$ $\frac{3}{16}$
H					

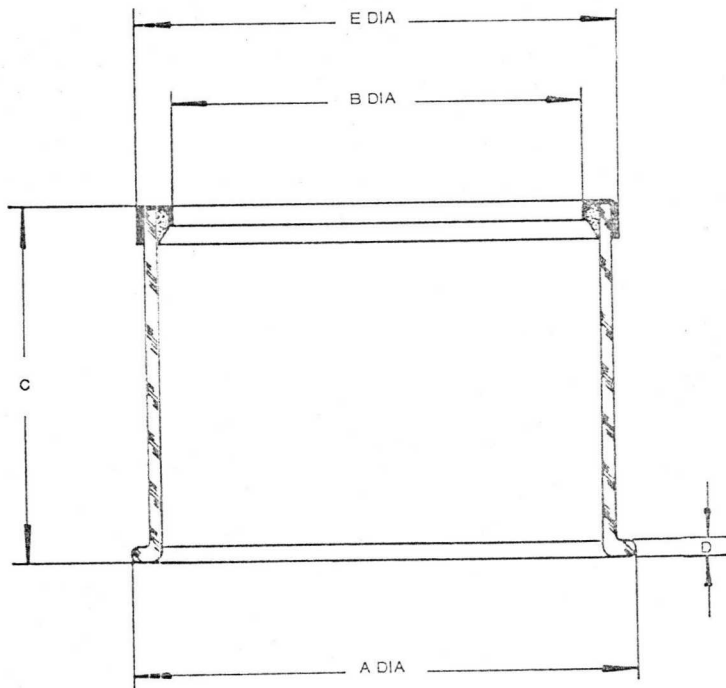
NOTE: BASIC FIGURES ARE IN INCHES

\* DENOTES: CONTACT LENGTH

# GLASS SUPPORT TUBE

Code: GC11

GC11 Outline



DIM	INCHES	MILLIMETRES
A	8 MIN 8.3/8 MAX	203,2 MIN 212,7 MAX
B	6.13/16 ± 1/32	173,0 ± 0,8
C	5.25/32 ± 5/32	146,8 ± 4,0
D	1/4 MIN 3/8 MAX	6,3 MIN 9,5 MAX
E	7.3/4 MAX	196,9 MAX

BASIC DIMENSIONS ARE INCHES

# STC

# SPECIAL VALVES

3R/167S  
3R/167E  
3R/167W

## Water-Cooled Industrial Triodes

PROVISIONAL DATA

Codes: 16P12  
16P13  
16P14

These valves are intended for use in industrial heating equipment. Their filaments are suitable for direct switching. Anode cooling is effected by an integral coil around the anode which obviates the need for a separate water jacket and provides efficient cooling with an economy in water consumption. The difference between the three types of valves is in the position and types of water connectors.

### CATHODE

Directly heated thoriated tungsten

Filament voltage	8.0	V
	( $\pm 5\%$ )	
Filament current—nominal	26.0	A
Maximum usable emission	6.0	A

### CHARACTERISTICS

Amplification factor	{ At $V_a = 5.0$ kV } $I_a = 400$ mA }	24	
Mutual conductance		7.5	mA/V

### DIRECT INTERELECTRODE CAPACITANCES

Grid to anode	11.5	pF
Grid to filament	14.5	pF
Anode to filament	3.8	pF

### MOUNTING POSITION

Vertical—base upwards

May 1964

3R/167S }  
3R/167E } —1  
3R/167W }

## *Standard Telephones and Cables Limited*

COMPONENTS GROUP

VALVE DIVISION, PAIGNTON, DEVON

Tel.: Paignton 58685

Telex: 4251

LONDON SALES OFFICE, FOOTSCRAY, SIDCUP, KENT

Tel.: Footscray 3333

Telex: 21836



3R/167S  
3R/167E  
3R/167W

PROVISIONAL DATA

STC

Codes: 16P12  
16P13  
16P14

CONTINUED

### MAXIMUM RATINGS

D.C. anode voltage (peak value of direct voltage plus ripple)	8.0	kV
Direct grid voltage	-1.0	kV
Anode dissipation	3.0	kW
Operating frequency		
Limited by water connexion	10	Mc/s
Limited by valve	40	Mc/s

### TYPICAL OPERATING CONDITIONS

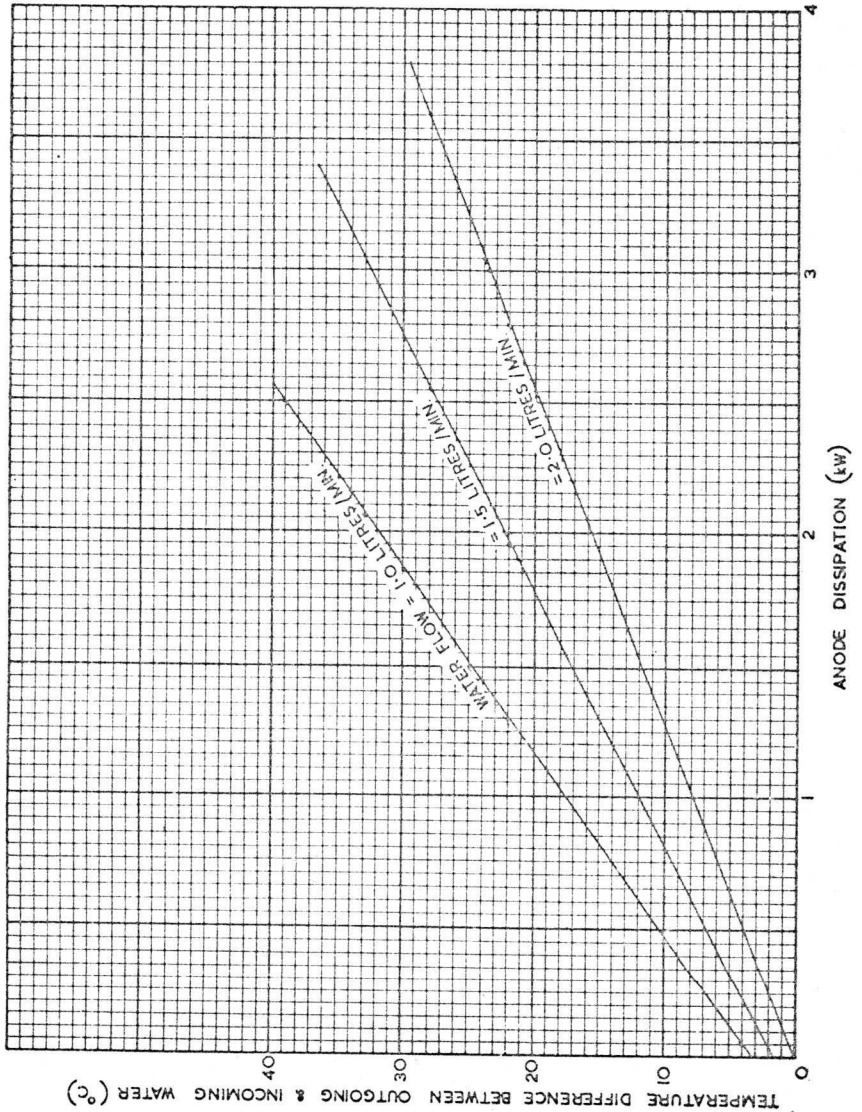
Anode voltage	5.0	6.0	kV
Mean anode current	1.55	1.5	A
Mean grid current	145	135	mA
Bias voltage	-250	-350	V
Bias resistor	1.75	2.6	k $\Omega$
Peak cathode current	6.0	6.0	A
Peak anode current	5.0	5.0	A
Peak grid current	1.0	1.0	A
Anode dissipation	2.5	2.5	kW
Grid dissipation	70	65	W
Anode efficiency	69	72	%
Power output—oscillator	5.3	6.3	kW
Power output (at 85% transfer efficiency)	4.5	5.35	kW

### NOTES ON TYPICAL OPERATION

The typical operating conditions given are for service as a Class C self-oscillator and are calculated for an assumed d.c. anode voltage. Where conditions of service render the valve liable to excessive mains variation, poor regulation of supplies or power supplies with a high peak to mean ratio, care should be taken to see that the limiting values are not exceeded.

Codes: 16P12  
16P13  
16P14

CONTINUED



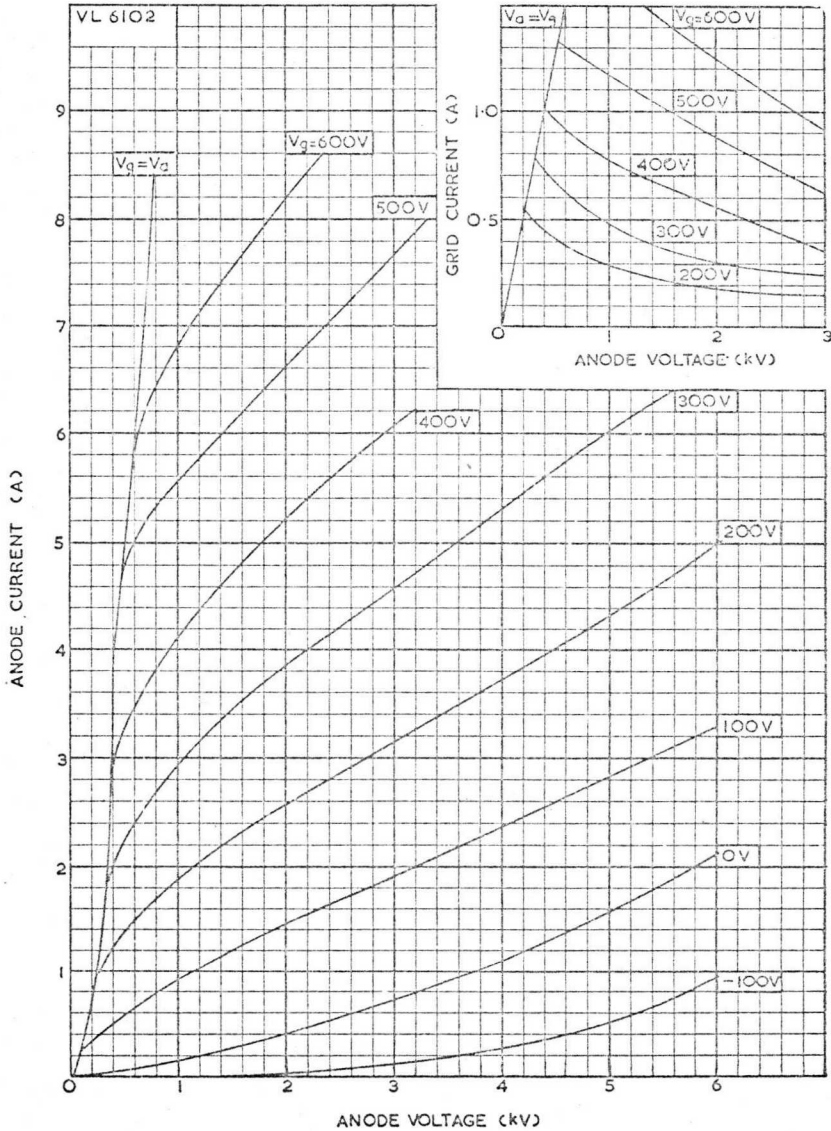
3R/167S  
3R/167E  
3R/167W

PROVISIONAL DATA

STC

Codes: 16P12  
16P13  
16P14

CONTINUED

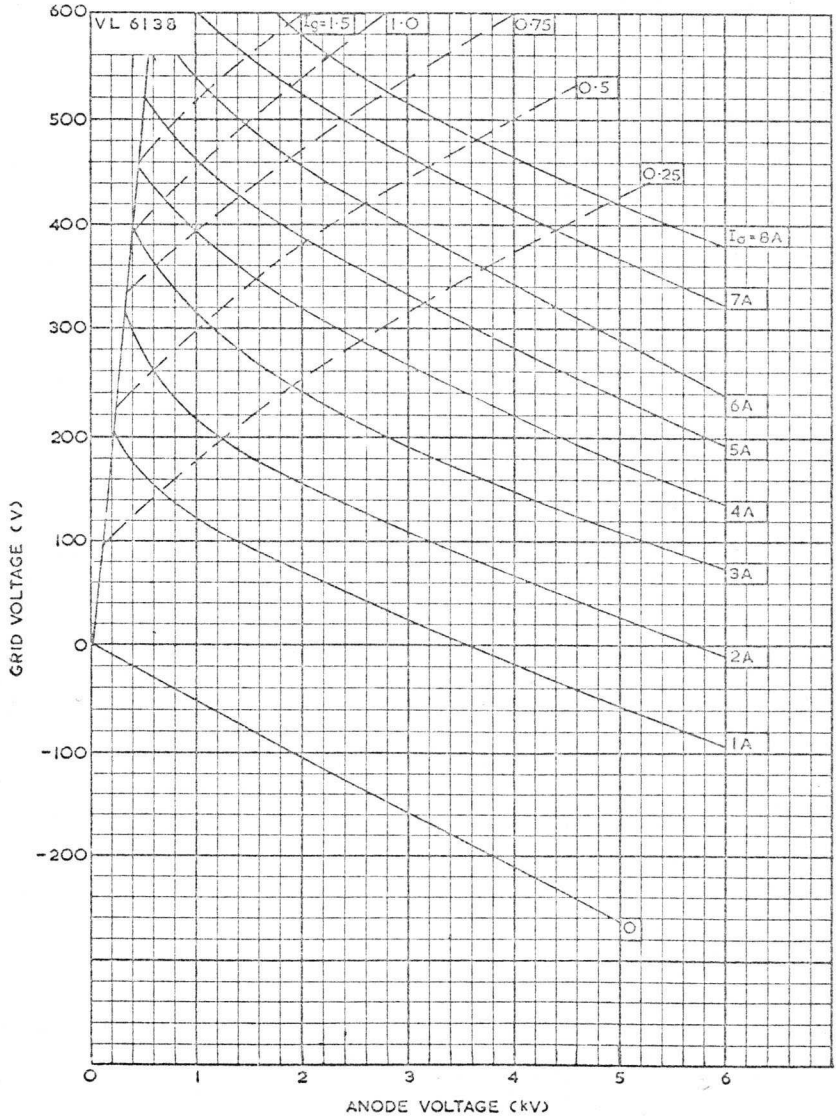


June 1965

3R/167S }  
3R/167E } 4  
3R/167W }

Codes: 16P12  
16P13  
16P14

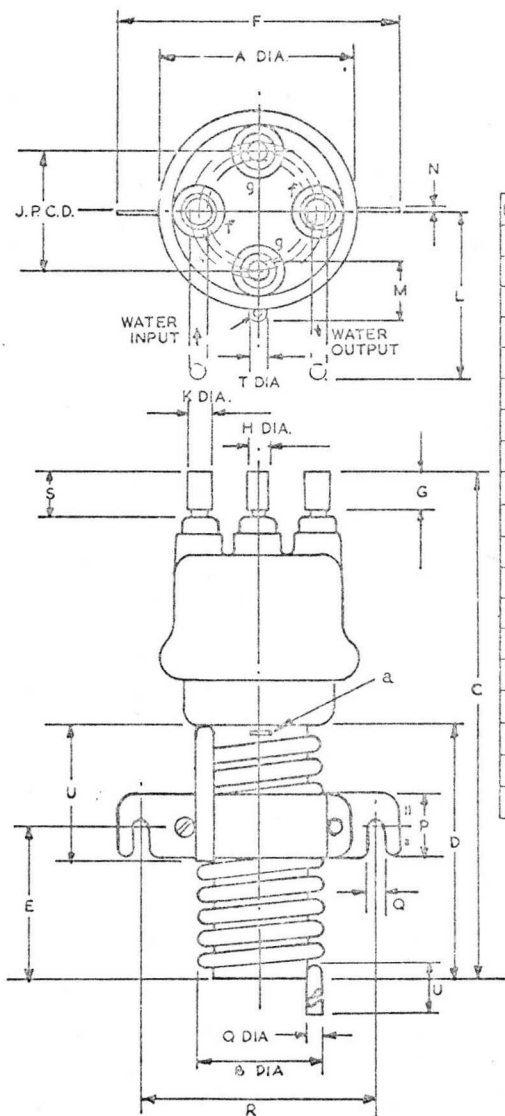
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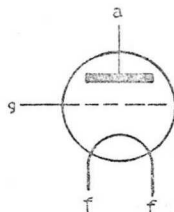
CONTINUED

16P12 Outline



DIM.	INCHES	MILLIMETRES
A	3.150 MAX.	80,00 MAX.
B	2 1/16 MAX.	52,4 MAX.
C	8 3/8 MAX.	212,7 MAX.
D	4 13/64 ± 1/16	106,8 ± 1,6
E	2 1/2 ± 1/32	63,5 ± 0,8
F	4 9/16 MAX.	115,9 MAX.
G	1 9/32 MIN.	15,0 MIN.
H	0.312 ± 0.005	7,94 ± 0,13
J	1.890 ± 0.010	48,00 ± 0,25
K	0.375 ± 0.005	9,53 ± 0,13
L	2 3/4 APPROX.	69,9 APPROX.
M	1 APPROX.	25,4 APPROX.
N	0.064 ± 0.005	1,63 ± 0,13
P	1 ± 1/32	25,4 ± 0,8
Q	1/4 ± 1/64	6,4 ± 0,4
R	3 3/4 ± 1/32	95,3 ± 0,8
S	3/4 MAX.	19,0 MAX.
T	5/16 APPROX.	7,9 APPROX.
U	2 1/8 APPROX.	54,0 APPROX.

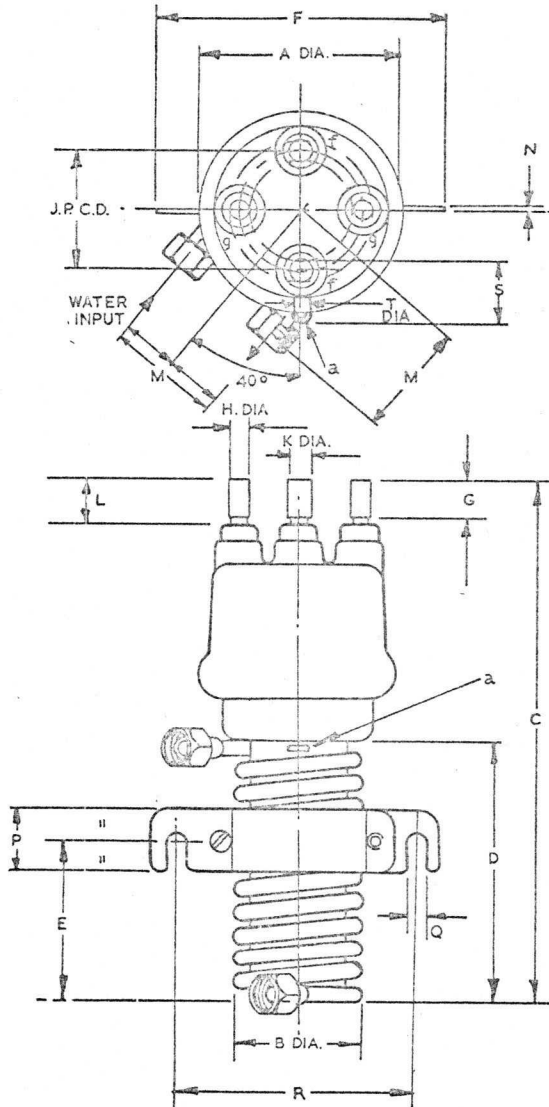
BASIC DIMS ARE INCHES



## Code: 16P13

CONTINUED

### 16P13 Outline



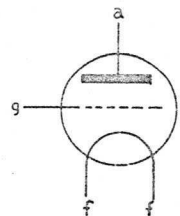
BASIC DIMS. ARE INCHES

DIM.	INCHES	MILLIMETRES
A	3.150 MAX.	80,00 MAX.
B	2 1/16 MAX.	52,4 MAX.
C	6 3/8 MAX.	212,7 MAX.
D	4 13/64 ± 1/16	106,8 ± 1,6
E	2 1/2 ± 1/32	63,5 ± 0,8
F	4 9/16 MAX.	115,9 MAX.
G	19/32 MIN.	15,0 MIN.
H	0.312 ± 0.005	7,94 ± 0,13
J	1.890 ± 0.010	48,00 ± 0,25
K	0.375 ± 0.005	9,53 ± 0,13
L	3/4 MAX.	19,0 MAX.
M	1 3/4 APPROX.	44,45 APPROX.
N	0.064 ± 0.002	1,63 ± 0,13
P	1 ± 1/32	25,4 ± 0,8
Q	1/4 ± 1/64	6,4 ± 0,4
R	3 3/4 ± 1/32	95,3 ± 0,8
S	1 APPROX.	25,4 APPROX.
T	5/16 APPROX.	7,9 APPROX.

INTEGRAL WATER JACKET  
CONNEXIONS

ENOTS 1/4" DIA. UNION NIPPLES  
REF No. B1746D

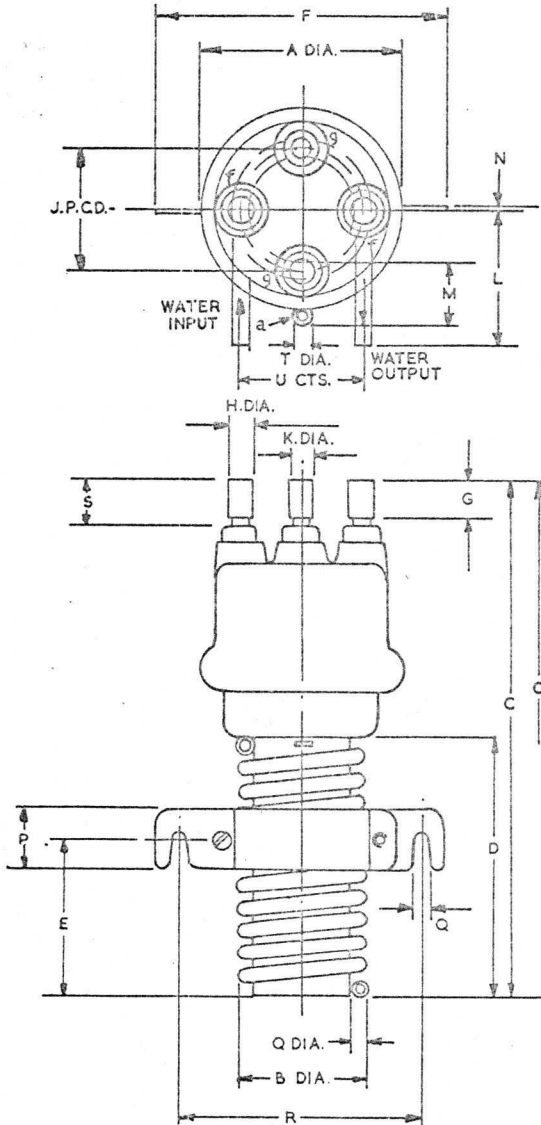
ENOTS 1/4" BSP UNION NUTS  
REF No. B1745D



Code: 16P14

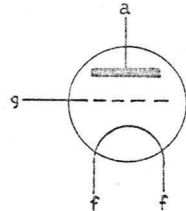
CONTINUED

16P14 Outline



DIM.	INCHES.	MILLIMETRES
A	3.150 MAX.	80,00 MAX.
B	2 1/16 MAX.	52,4 MAX.
C	8 3/8 MAX.	212,7 MAX.
D	4 13/64 ± 1/16	106,8 ± 1,6
E	2 1/2 ± 1/32	63,5 ± 0,8
F	4 9/16 MAX.	115,9 MAX.
G	19/32 MIN.	15,0 MIN.
H	0.312 ± 0.005	7,94 ± 0,13
J	1.890 ± 0.010	48,00 ± 0,25
K	0.375 ± 0.005	9,53 ± 0,13
L	2 1/8 ± 1/8	54,0 ± 3,2
M	1 APPROX	25,4 APPROX
N	0.064 ± 0.005	1,63 ± 0,13
F	1 ± 1/32	25,4 ± 0,8
Q	1/4 ± 1/64	6,4 ± 0,4
R	3 3/4 ± 1/32	95,3 ± 0,8
S	3/4 MAX.	19,0 MAX.
T	5/16 APPROX	7,9 APPROX
U	1 3/4 NOM.	44,45 NOM.

BASIC DIMS. ARE INCHES



## SPECIAL VALVES

Water-Cooled Industrial Triode  
with Integral Water Jacket

Code: 3R/187E

This valve is electrically identical to 3J/187E but, for anode cooling, a helical copper tube has been fixed around the anode to obviate the need for a separate water jacket. This arrangement provides efficient cooling with economy in water consumption.

## CATHODE

Thoriated tungsten filament		
Filament voltage	5	V
Filament current, nominal	78	A
Maximum usable emission	10	A

It is recommended that some resistance or reactance be introduced into the filament supply to limit the surge peak current to about two and a half times the normal r.m.s. working value. This impedance may be short-circuited if desired as soon as the surge has decayed.

## CHARACTERISTICS

Amplification factor	$\left\{ \begin{array}{l} \text{at } V_a = 2\text{kV}; I_a = 0.25\text{A} \\ \text{at } V_a = 2\text{kV}; V_g = -75\text{V} \end{array} \right\}$	12	
Mutual conductance		22	mA/V

## DIRECT INTERELECTRODE CAPACITANCES

Grid to anode	29	pF
Grid to filament	54	pF
Anode to filament	1.5	pF

July 1967

3R/187E—1

## Standard Telephones and Cables Limited

Valve Division, Brixham Road, Paignton, Devon

Telephone: Paignton 50762 Telex: 4230

London Sales Office, Telephone: 01-300 3333

Telex: 21836

C O M P O N E N T S G R O U P



## Code: 3R/187E

CONTINUED

**COOLING REQUIREMENTS**

For details of cooling requirements see Figure 3.

It is important to observe the correct connection of water inlet and outlet.

Maximum temperature of outflowing water 70 °C

Forced-air-cooling of the grid and filament seals is required to limit their temperature to below the maximum permissible value of 180°C.

An air flow of 50 ft<sup>3</sup>/min (1.42 m<sup>3</sup>/min) directed vertically downwards on to the seals is sufficient to meet these requirements.

**MECHANICAL DATA**

Dimensions As shown in Figure 4

Mounting position Vertical, anode downwards

**Accessories**

The following approved items are supplied separately under the codes indicated:

214-LVA-001A Filament connector, smaller

214-LVA-001B Filament connector, larger

214-LVA-001C Grid connector

**MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS**

Class C. Industrial Heating R.F. Oscillator

**Maximum Ratings**

Maximum direct anode voltage (peak value of direct voltage plus ripple)	5.5	6.5	kV
Maximum direct anode current	2	2	A
Maximum direct anode dissipation (continuous)	3	3	kW
Maximum direct grid dissipation (continuous)	200	200	W
Maximum direct grid current (Note 1)	500	500	mA
Maximum negative grid bias	-1 500	-1 500	V
Maximum frequency for the above ratings	120	100	MHz

Note 1.—This figure is given for guidance. Grid dissipation is absolute rating.

**Typical Operating Conditions**

Direct anode voltage	5	6	6.5	kV
Direct grid voltage	-560	-650	-720	V
Direct anode current	1.6	1.5	1.8	A
Peak r.f. grid voltage	760	890	970	V
Direct grid current (Note 2)	100 (140)	130 (190)	150 (200)	mA
Grid dissipation (Note 2)	25	55	55	W
Grid resistor	5.6	5	4.8	kΩ
Power input	8	9	11.7	kW
Output power (oscillator)	5.4	6.9	8.9	kW
Power into load at 85 per cent transfer efficiency	4.6	5.8	7.5	kW

Note 2.—Subject to wide variation dependent upon the impedance of the load circuit. The values of current shown in brackets are typical of off-load conditions but are given for guidance only: practical figures are dependent upon compensatory devices in the grid circuit.

Code: 3R/187E

CONTINUED

Class B. A.F. Power Amplifier or Modulator  
(for balanced two-valve operation)

**MAXIMUM RATINGS**

Maximum direct anode voltage	6	kV
Maximum direct anode current	2	A
Maximum direct anode dissipation (intermittent)	5	kW
Maximum direct anode dissipation (continuous)	4	kW
Maximum direct grid dissipation (continuous)	200	W
Maximum direct grid voltage	-1 500	V

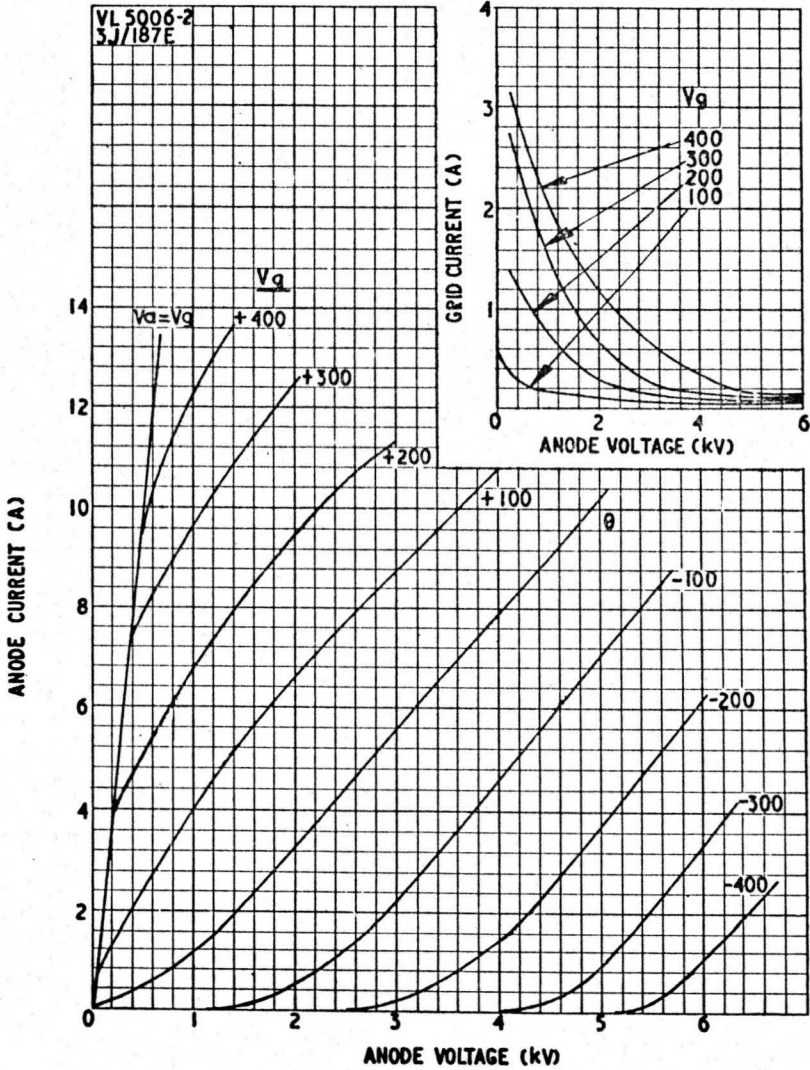
**TYPICAL OPERATING CONDITIONS**

Direct anode voltage	5	kV
Direct grid voltage	-350	V
Direct anode current (zero signal)	0.2	A
Direct anode current (maximum signal)	1.9	A
Load resistor, anode to anode	2.7	k $\Omega$
Peak a.f. grid to grid voltage	1 040	V
Grid drive power, approximately	85	W
Direct grid current	80	mA
Direct grid dissipation	14	W
Output power	12	kW

Code: 3R/187E

CONTINUED

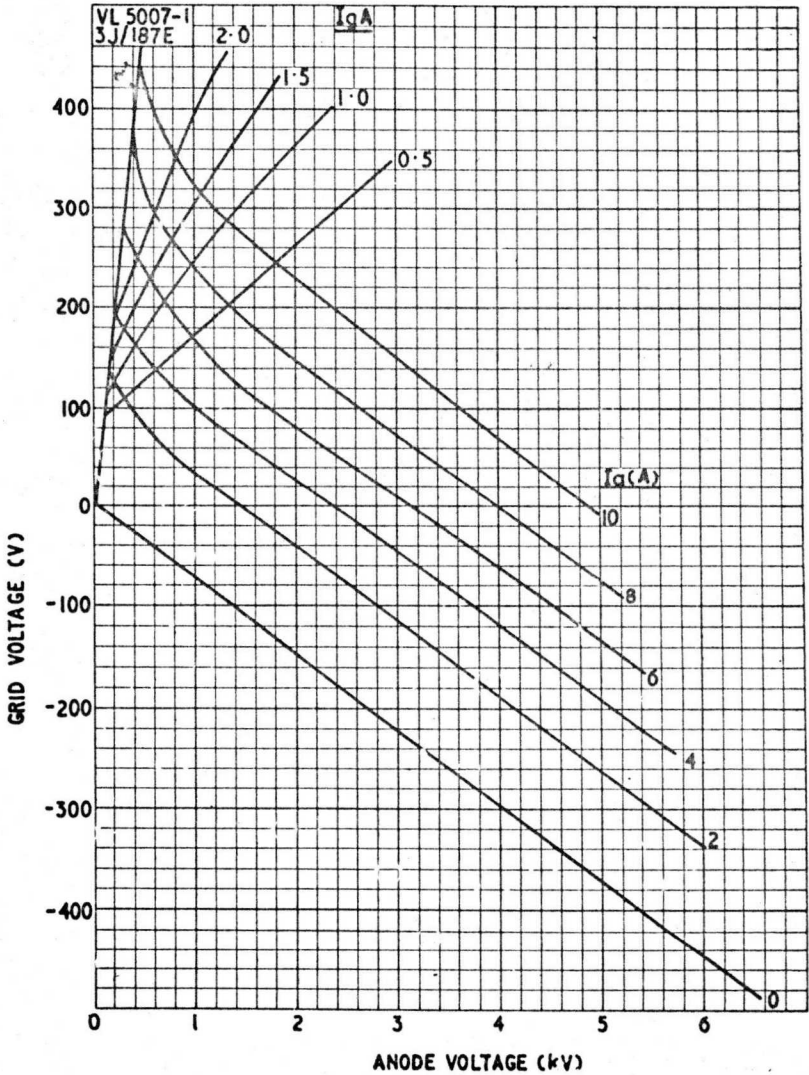
Fig. 1.—Anode Current and Grid Current versus Anode Voltage



Code: 3R/187E

CONTINUED

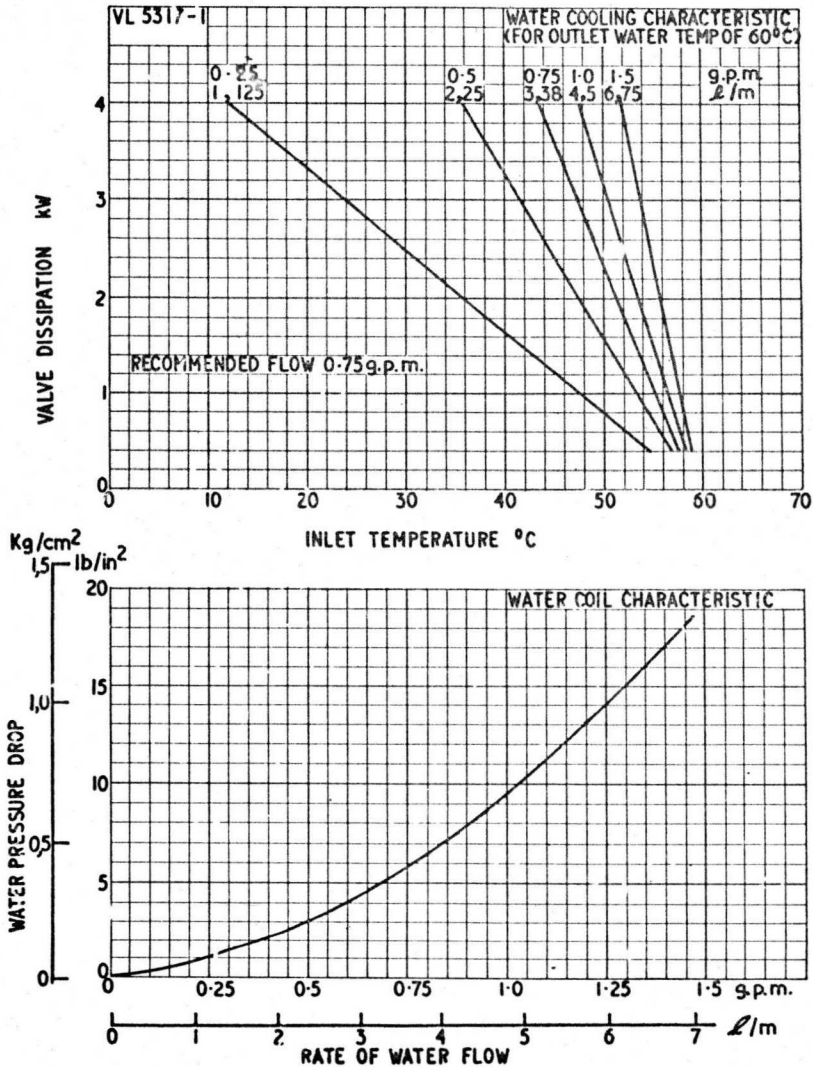
Fig. 2.—Constant Current Characteristics



Code: 3R/187E

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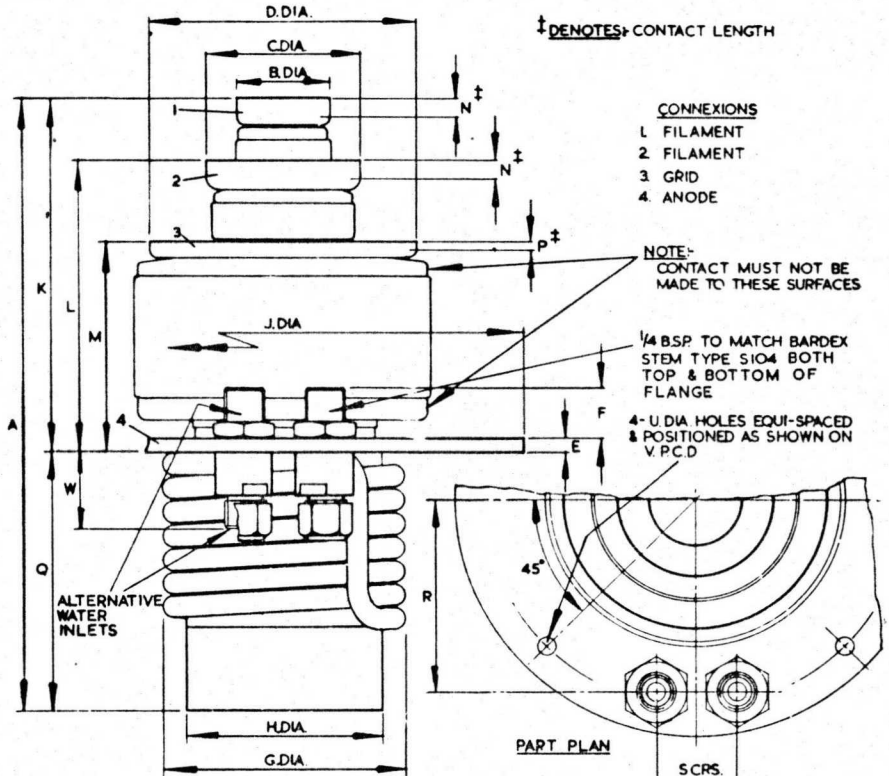
Fig. 3.—Cooling Characteristics



## Code: 3R/187E

CONTINUED

Fig. 4.—3R/187E Outline



**NOTE:-** IN HIGH FREQUENCY CIRCUITS, CONTACT 2 SHOULD BE USED IN THE RETURN PATH FOR CATHODE CURRENT.

**NOTE:-** BASIC FIGURES ARE IN INCHES

DIM.	MILLIMETRES	INCHES	DIM.	MILLIMETRES	INCHES
A	227.0 MAX.	8 15/16 MAX.	L	108.7 ± 4.8	4 9/32 ± 3/16
B	31.8 ± 0.4	1 1/4 ± 1/64	M	75.4 ± 3.2	2 31/32 ± 1/8
C	50.8 ± 0.4	2 ± 1/64	N	4.7 MIN. 6.4 MAX.	3/16 MIN. 1/4 MAX.
D	88.9 ± 0.4	3 1/2 ± 1/64	P	3.1 MIN. 4.8 MAX.	1/8 MIN. 3/16 MAX.
E	4.8 ± 0.4	3/16 ± 1/64	Q	86.5 ± 3.2	3 3/32 ± 1/8
F	15.9 ± 0.8	5/8 ± 1/32	R	65.1 ± 0.8	2 9/16 ± 1/32
G	82.6 MAX.	3 1/8 MAX.	S	27.0 ± 0.8	1 1/16 ± 1/32
H	65.1 MAX.	2 9/16 MAX.	U	6.53 ± 0.18	0.257 ± 0.007
J	158.8 ± 0.8	6 1/4 ± 1/32	V	139.70 ± 0.25	5.500 ± 0.010
K	131.8 ± 4.8	5 3/16 ± 3/16	W	25.4 ± 1.6	1 ± 1/16

# Water-Cooled Industrial Triode with Integral Water Jacket

Code: 3R/202S (Glass-metal envelope)

This triode has been specially designed for industrial heating applications. Design features give a high mutual conductance resulting in high efficiency with a low grid dissipation and large safety factor which are desirable when the valve is operated under variable-load conditions.

## CATHODE

Thoriated tungsten filament

Filament voltage

$5 \pm 5\%$  V

Filament current (nominal)

115 A

Maximum usable emission

18 A

It is recommended that some resistance or reactance be introduced into the filament supply to limit the surge peak current to about two and a half times the normal r.m.s. working value. This impedance may be short circuited if desired as soon as the surge has decayed.

For operation at high frequencies (above 30 MHz) it is recommended that the r.f. return path to the cathode should make connection to the larger filament terminal.

## CHARACTERISTICS

Amplification factor (at  $V_a = 2\text{kV}$ ,  $I_a = 0.25\text{A}$ )

12

Mutual conductance (at  $V_a = 2\text{kV}$ ,  $V_g = -75\text{V}$ )

32 mA/V

## DIRECT INTERELECTRODE CAPACITANCES

Grid to anode

30 pF

Grid to filament

60 pF

Anode to filament

1.5 pF

## COOLING REQUIREMENTS

For water cooling requirements see Figure 1.

Forced-air-cooling of grid and filament seals is required to limit their temperature to below the maximum permissible value of  $180^\circ\text{C}$ . An air flow of  $50\text{ ft}^3/\text{min}$  ( $1.42\text{ m}^3/\text{min}$ ) directed vertically downwards on to the seals is sufficient to meet these requirements.

Note.—It is important to observe the correct connection of water inlet and outlet points.

## MECHANICAL DATA

Dimensions

As shown in outline drawing

Mounting position

Vertical, anode upwards or downwards.

### Accessories

The following approved items are supplied separately under the codes indicated:

214-LVA-001A Filament connector, smaller

214-LVA-001B Filament connector, larger

214-LVA-001C Grid connector

November 1969

3R/202S—1

## ITT Components Group Europe Standard Telephones and Cables Limited

Valve Division, Brixham Road, Paignton, Devon

Telephone: Paignton 50762 (STD Code 0803) Telex: 42830

London Sales Office, Telephone: 01-300 3333 Telex: 21836

# ITT

**COMPONENTS**

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**MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS**

Class C. Industrial Heating R.F. Oscillator

**Maximum Ratings**

Maximum anode voltage (peak value of direct voltage plus ripple)	7	kV
Maximum direct anode current	3	A
Maximum direct anode dissipation (continuous)	6	kW
Maximum direct grid dissipation (continuous)	280	W
Maximum direct grid current (Note 1)	700	mA
Maximum negative grid bias	-1 500	V
Maximum frequency for above ratings	50	MHz

Note 1.—This figure is given for guidance. Grid dissipation is absolute rating.

**Typical Operating Conditions**

Direct anode voltage	6	6.5	kV
Direct grid voltage	-670	-770	V
Direct anode current	2.5	3	A
Peak r.f. grid voltage	950	1 050	V
Direct grid current (Note 2)	450 (650)	350 (500)	mA
Grid dissipation (Note 2)	140	115	W
Grid resistor	1.5	2.2	kΩ
Power input	15	19.5	kW
Output power (oscillator)	11.5	14.1	kW
Power into load at 85 per cent transfer efficiency	10	12	kW

Note 2.—Subject to wide variation dependent upon the impedance of the load circuit. The values of current shown in brackets are typical of off-load conditions and are given for guidance only: practical figures are dependent upon compensatory devices in the grid circuit.

**Class B. A.F. Power Amplifier or Modulator**  
 (for balanced two-valve operation)
**Maximum Ratings**

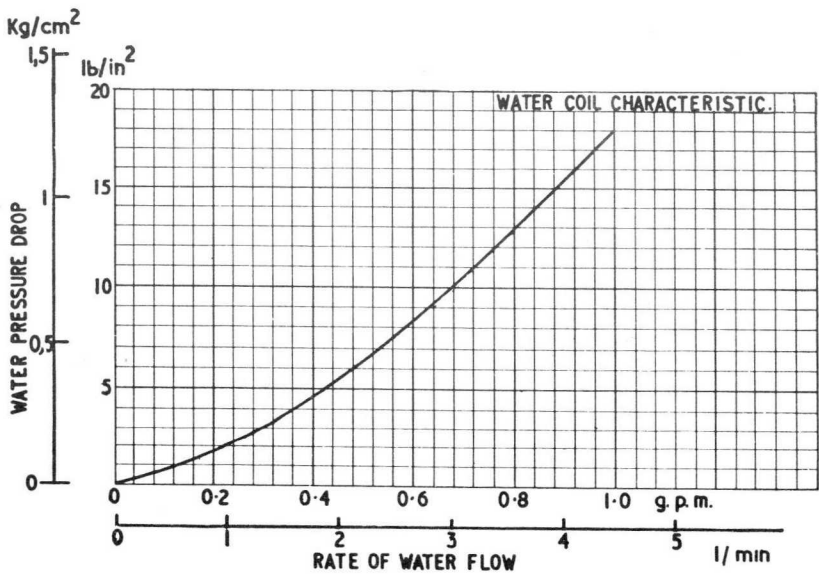
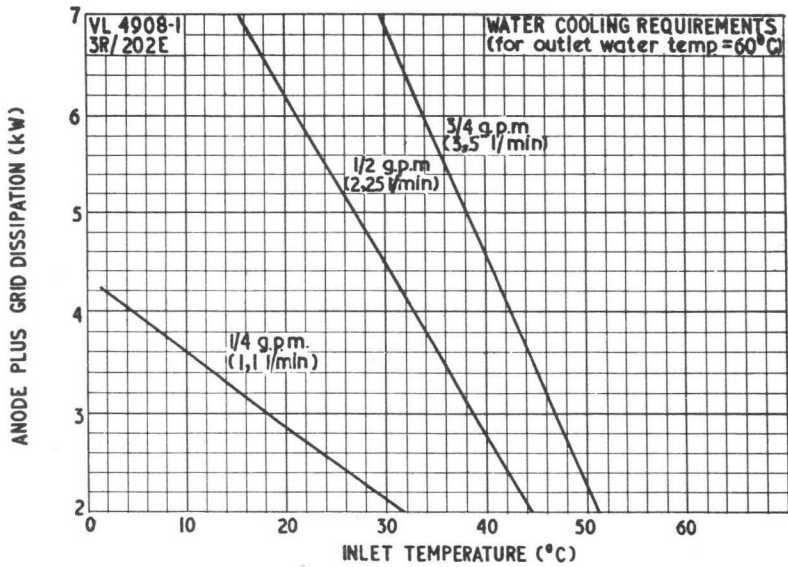
Maximum direct anode voltage	7	kV
Maximum direct anode current	3	A
Maximum direct anode dissipation (intermittent)	7	kW
Maximum direct anode dissipation (continuous)	6	kW
Maximum direct grid dissipation (continuous)	280	W
Maximum direct grid voltage	-1.5	kV

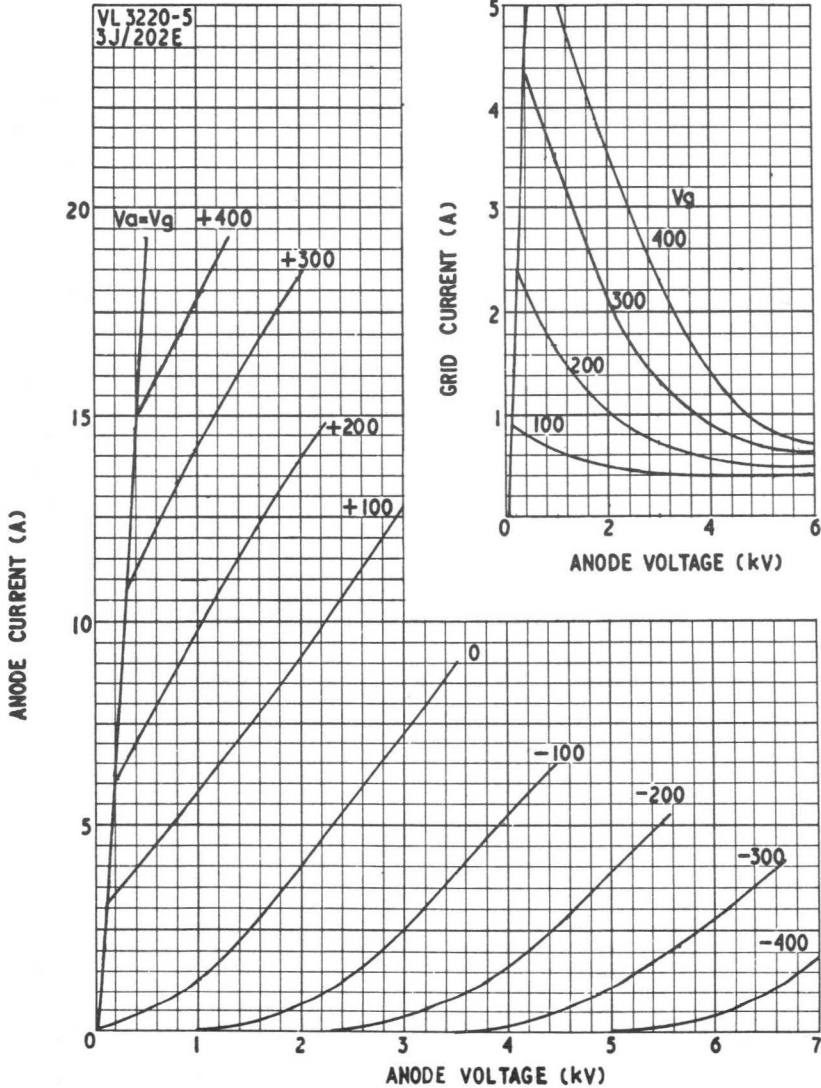
**Typical Operating Conditions**

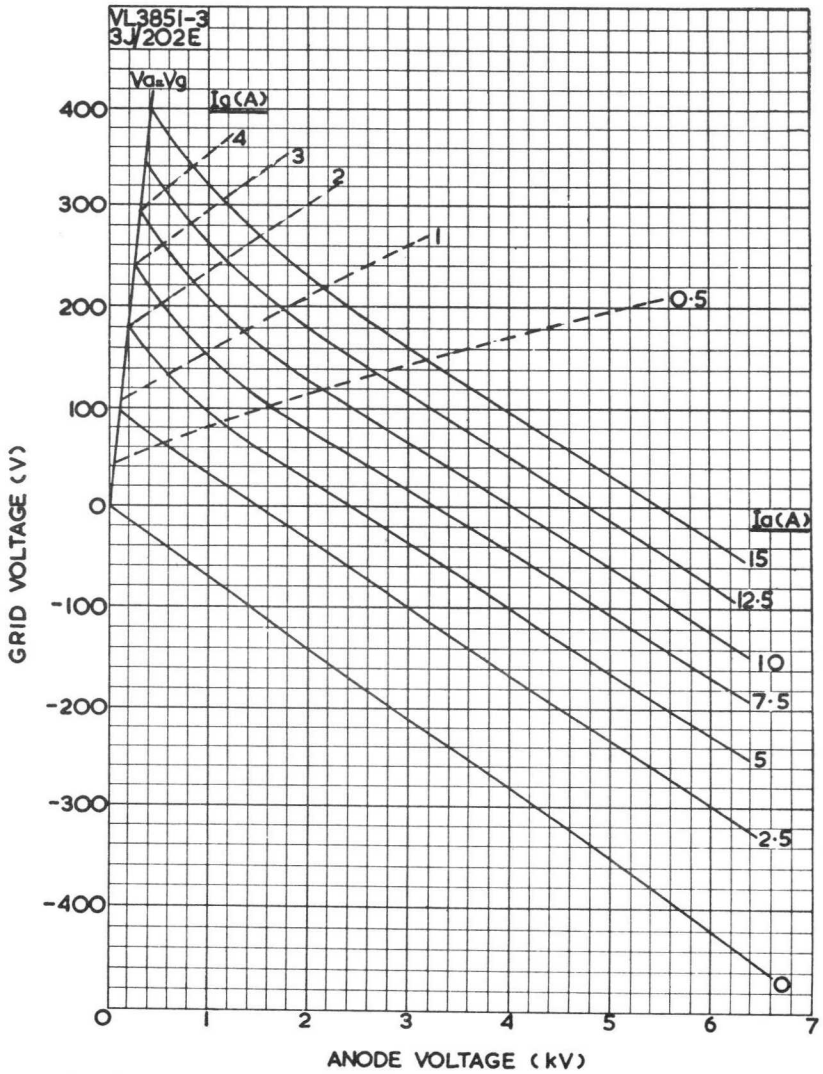
Direct anode voltage	5	kV
Direct grid voltage	-350	V
Direct anode current (zero signal)	0.5	A
Direct anode current (maximum signal)	1.9	A
Load resistor, anode-to-anode	2.7	kΩ
Peak a.f. grid to grid voltage	920	V
Grid drive power, approximately	75	W
Direct grid current	84	mA
Direct grid dissipation	7.6	W
Output power	12	kW



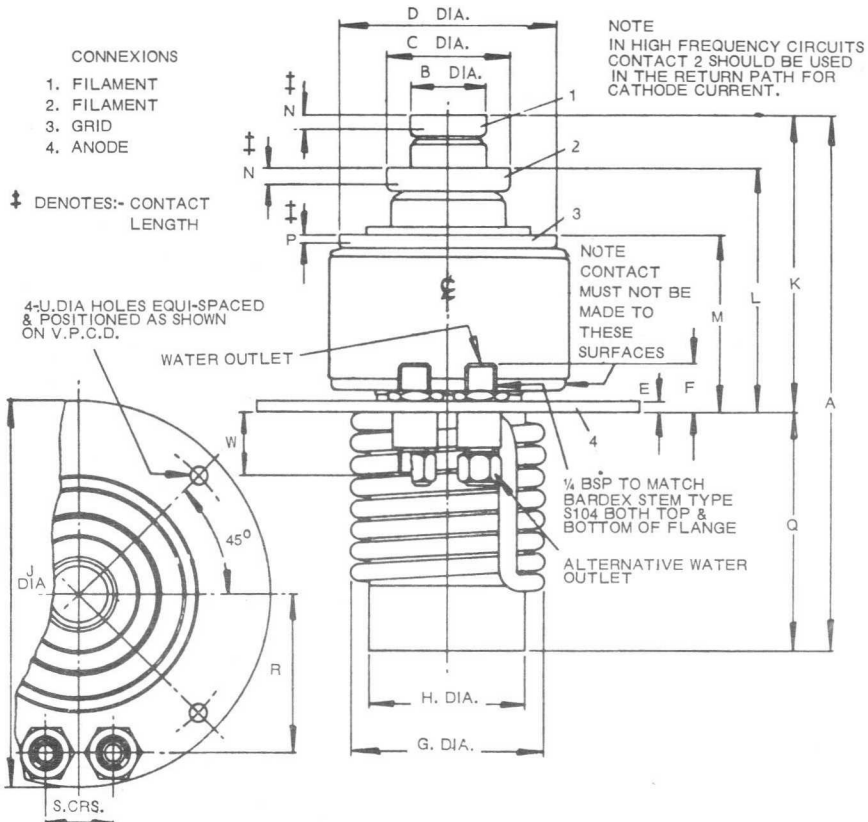
Fig. 1







3R/202S Outline



DIM.	MILLIMETRES	INCHES	DIM.	MILLIMETRES	INCHES
A	242,9 MAX.	9.9/16 MAX.	L	107,2 ± 4,8	4.7/32 ± 3/16
B	31,8 ± 0,4	1.1/4 ± 1/64	M	73,8 ± 3,2	2.29/32 ± 1/8
C	50,8 ± 0,4	2 ± 1/64	N	4,7 MIN. 6,4 MAX.	3/16 MIN. 1/4 MAX.
D	88,9 ± 0,4	3.1/2 ± 1/64	P	3,1 MIN. 4,8 MAX.	1/8 MIN. 3/16 MAX.
E	4,8 ± 0,4	3/16 ± 1/64	Q	105,6 ± 2,4	4.5/32 ± 3/32
F	15,9 ± 0,8	5/8 ± 1/32	R	65,1 ± 0,8	2.9/16 ± 1/32
G	82,6 MAX.	3.1/4 MAX.	S	27,0 ± 0,8	1.1/16 ± 1/32
H	65,1 MAX.	2.9/16 MAX.	U	6,53 ± 0,18	0.257 ± 0.007
J	158,8 ± 0,8	6.1/4 ± 1/32	V	139,70 ± 0,25	5-500 ± 0.010
K	130,2 ± 4,8	5.1/8 ± 3/16	W	25,4 ± 1,6	1 ± 1/16

The 3R/2225 has an integral water jacket and is intended primarily for r.f. heating applications.

MAXIMUM RATINGS

Anode voltage (peak value of direct voltage plus ripple)	7,0	kV
Direct anode current	6,0	A
Anode dissipation, continuous	10	kW
Grid dissipation, continuous	500	W
Grid current (Note 1)	1,4	A
Direct negative grid voltage	-1 500	V
Maximum frequency for above ratings	30	MHz

Note 1. This figure is given for guidance. Grid dissipation is absolute rating.

TYPICAL OPERATING CONDITIONS

Class C. Industrial Heating R.F. Oscillator

Filament voltage	8,0V ± 5%	
Filament current, nominal	125	A
Direct anode voltage	6,0	kV
Direct grid voltage	-660	V
Direct anode current	5,6	A
Peak r.f. grid voltage	930	V
Direct grid current (Note 2)	750 (1 200)	mA
Anode dissipation	7,6	kW
Grid dissipation (Note 2)	260	W
Grid resistor	900	Ω
Power output	26	kW
Power output, less drive	25	kW
Power into load at 85% transfer efficiency	21	kW

Note 2. Subject to wide variation dependent upon the impedance of the load circuit. The value of current shown in brackets is typical of off-load conditions and is given for guidance only: a practical figure is dependent upon compensatory devices in the grid circuit.

December 1970

**ITT Components Group Europe**  
**Standard Telephones and Cables Limited**

Valve Product Division, Brixham Road, Paignton, Devon  
Telephone: Paignton 50762 (STD Code 0803) Telex: 42830

**ITT**

**COMPONENTS**

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## CATHODE

Thoriated tungsten filament		
Maximum usable emission	36	A
Cold filament resistance	0,0045	$\Omega$

It is recommended that some resistance or reactance be introduced into the filament supply to limit the surge current to about two and a half times the normal r.m.s. working value. This impedance may be short-circuited as soon as the surge has decayed.

For tube operation at frequencies above 30MHz, it is recommended that the r.f. path to the cathode makes connection to the large filament terminal.

## CHARACTERISTICS

Amplification factor (at $V_a = 2kV : I_a = 0,5A$ )	12	
Mutual conductance (at $V_a = 2kV : V_g = -87V$ )	60	mA/V

## DIRECT INTERELECTRODE CAPACITANCES

Grid to anode	56	pF
Grid to filament	100	pF
Anode to filament	3,0	pF

## COOLING

The anode must be cooled by an adequate water flow (see Figures 3 and 4). It is essential that the water enters the water jacket at its lowest point in relation to the attitude of the tube when mounted. Forced-air cooling of the grid and filament seals is required to limit their temperature to below the maximum permissible value of 180°C. An air flow of 50 ft<sup>3</sup>/min (1,42 m<sup>3</sup>/min) directed vertically downwards on to the seals from a 4 inch (10 cm) diameter orifice is sufficient for operation at frequencies up to 30MHz. At higher frequencies, additional cooling of the grid seal may be required.

## MECHANICAL DATA

Dimensions	As shown in outline drawing included
Mounting position	Vertical, anode upwards or downwards
Weight of tube	7,5 lb (3,4 kg)
Accessories	Filament and grid connectors, which are supplied as separate items, are available under following codes: CN-1A Filament connector, small CN-1B Filament connector, large CN-1C Grid connector

Fig. 1. Constant Voltage Characteristic

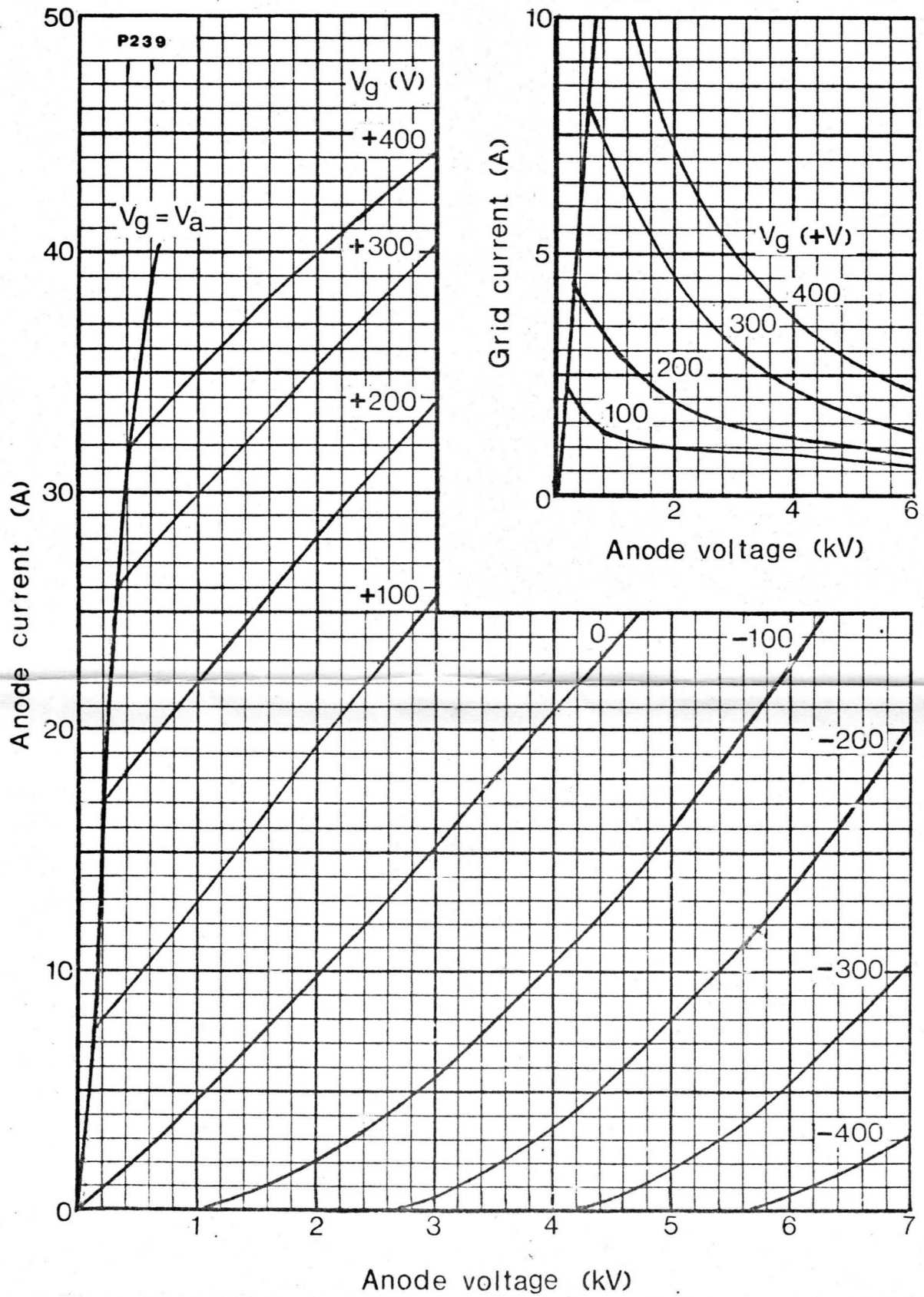


Fig. 2. Constant Current Characteristic

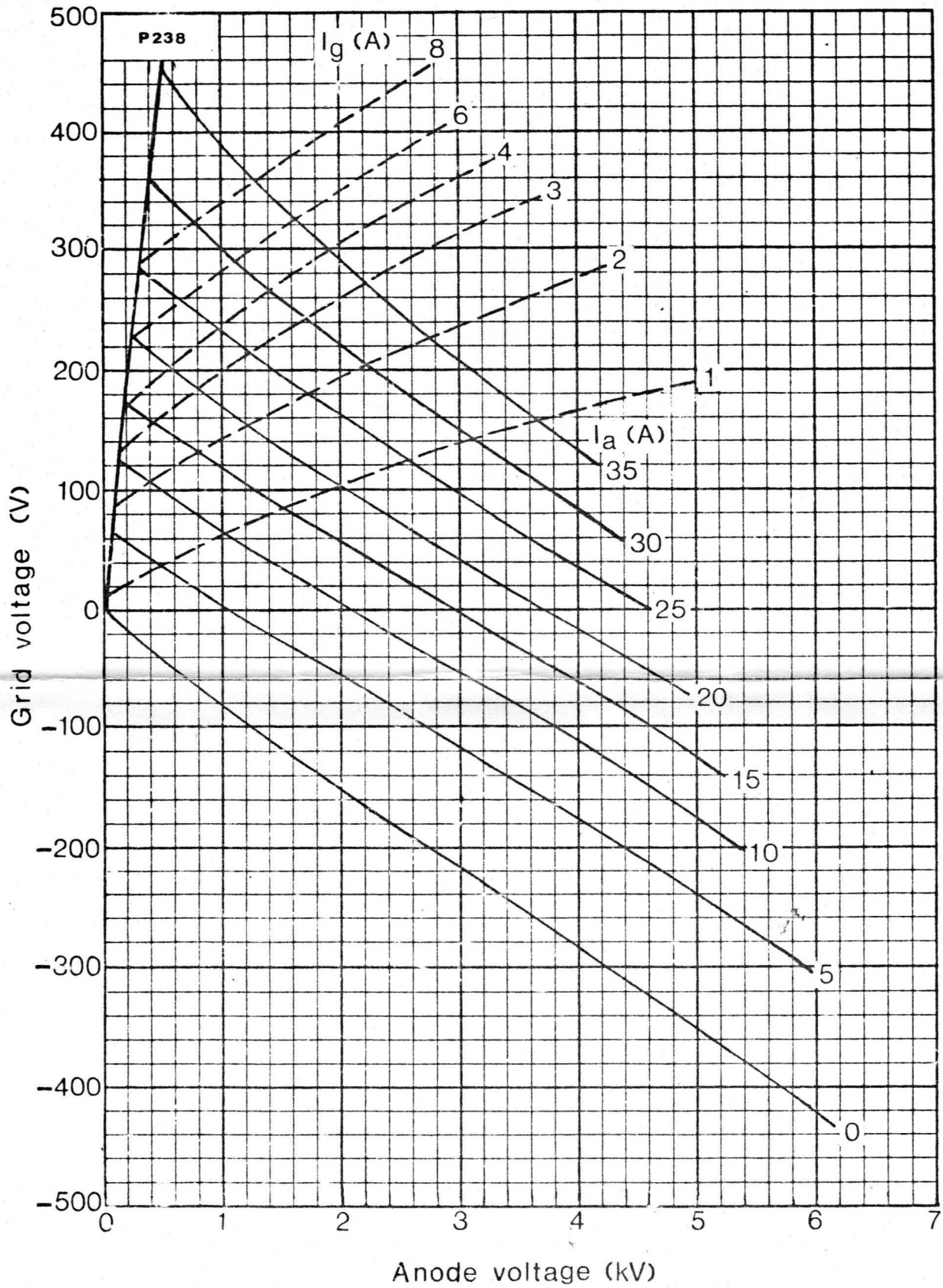




Fig. 3. Cooling Water Requirement for Outlet  
Water Temperature of 60°C

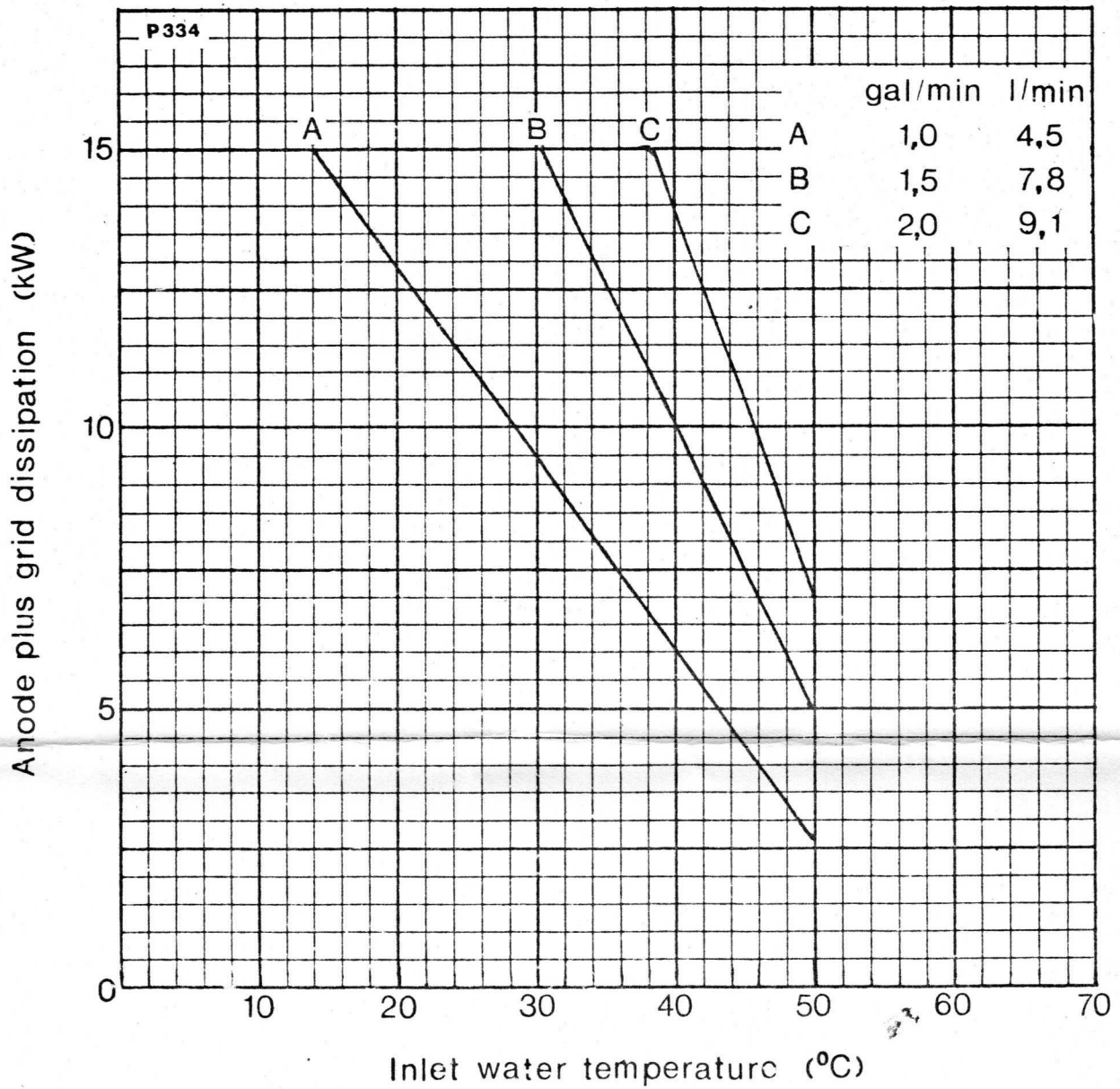


Fig. 4. Water Coil Characteristic

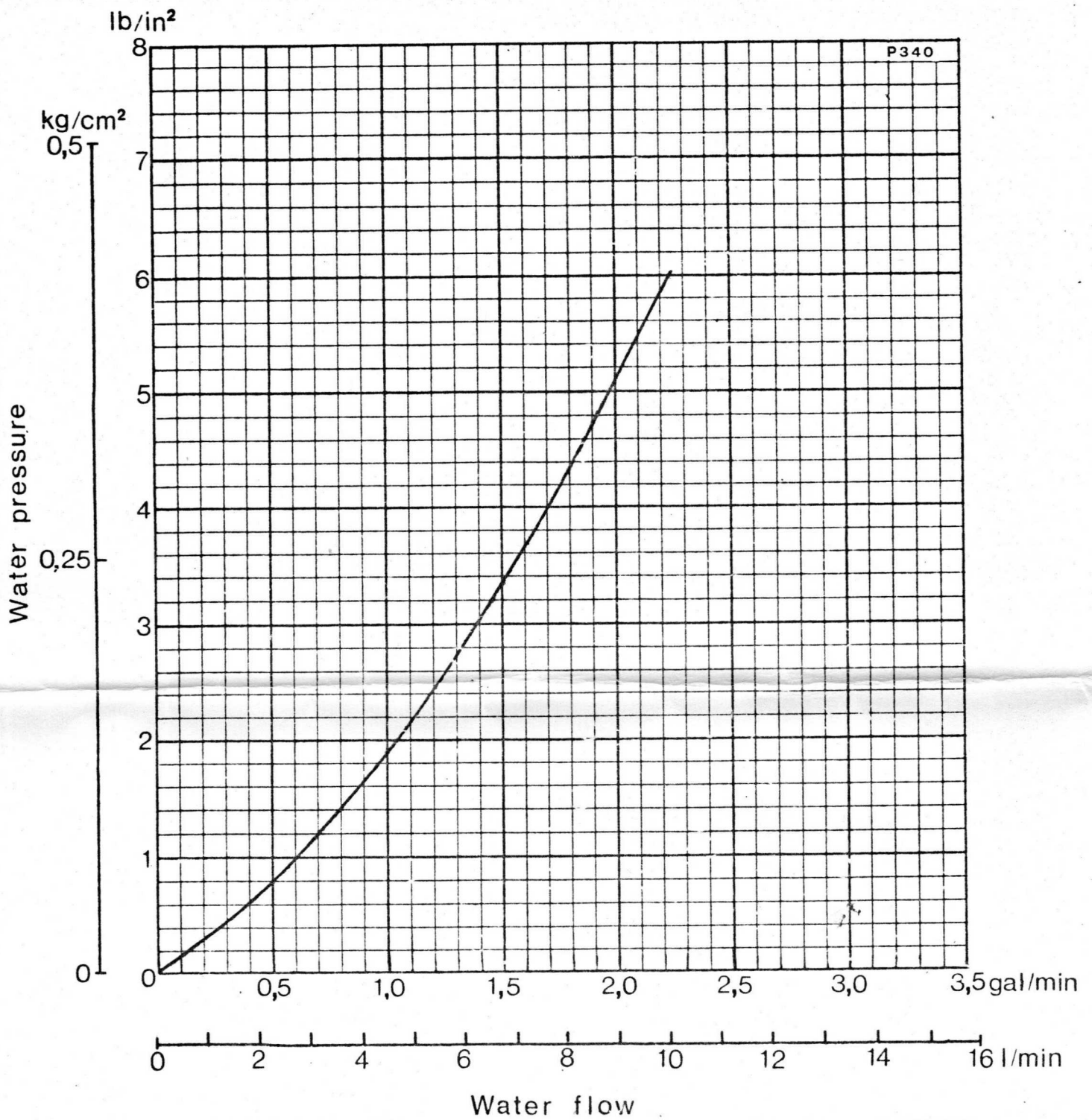
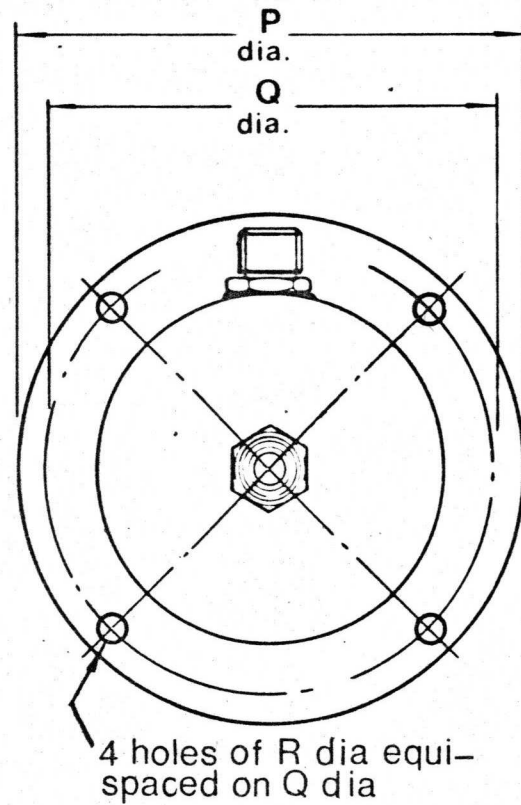
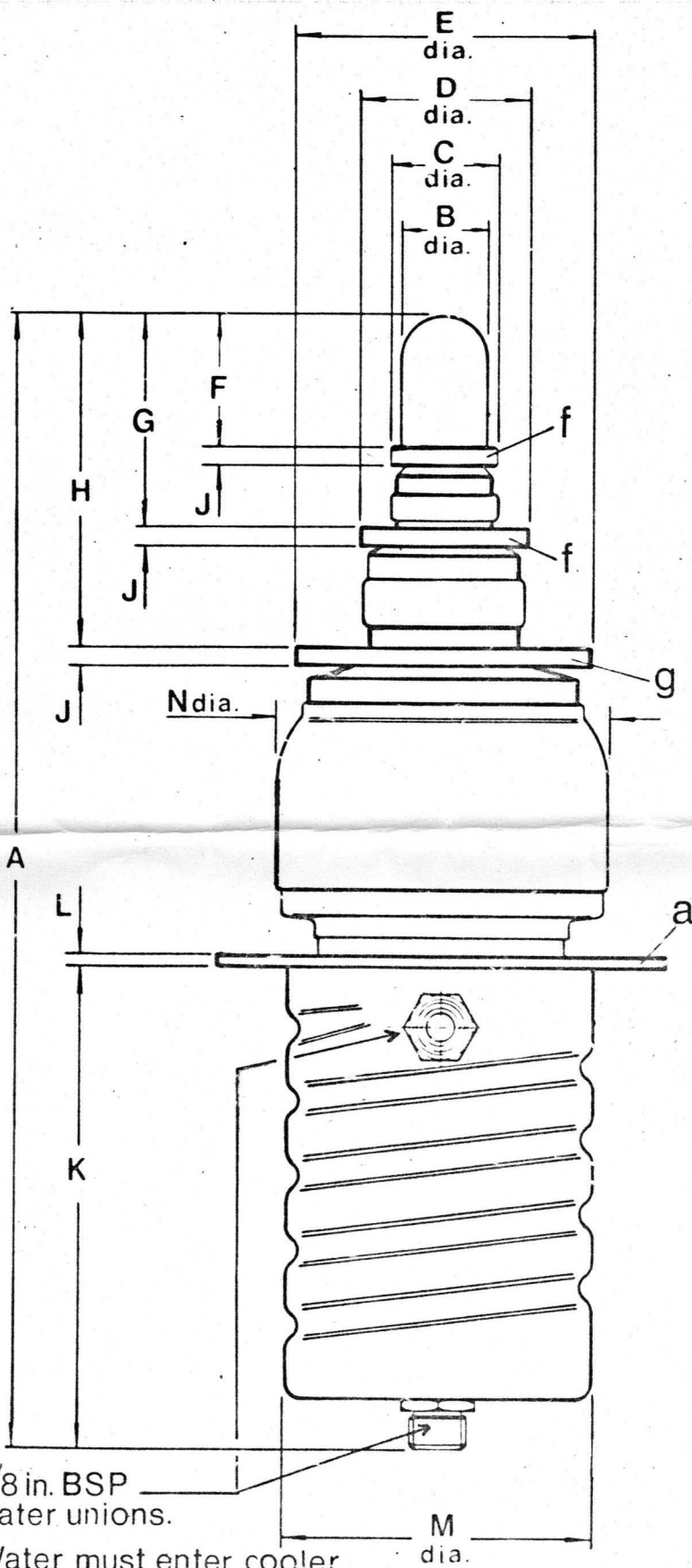


Fig. 5. 3R/2225 Outline



DIM.	MILLIMETRES.	INCHES.
A	343,00 max.	13,500 max.
B	25,4 max.	1,000 max.
C	31,7 ± 0,4	.1,250 ± ,015
D	50,8 ± 0,4	2,000 ± ,015
E	88,9 ± 0,4	3,500 ± ,015
F	38,1 ± 1,6	1,500 ± ,062
G	60,3 ± 4,8	2,375 ± ,187
H	95,3 ± 4,8	3,750 ± ,187
J	6,4 max.	0,250 max.
K	146,05 max.	5,750 max.
L	3,2 ± 0,13	0,125 ± ,005
M	93,65 max.	3,687 max.
N	101,6 max.	4,000 max.
P	133,3 ± 0,8	5,250 ± ,031
Q	119,05 ± 0,13	4,687 ± ,005
R	6,75 ± 0,13	0,266 ± ,005

metric dimensions are derived from original inch dimensions

## SPECIAL VALVES

### Water-Cooled Industrial Triode with Integral Water Jacket

Code: 3R/252E

The 3R/252E has been designed specifically for industrial heating applications and is capable of operation at frequencies up to 100 Mc/s. Design features give a high mutual conductance, resulting in high efficiency with the low grid dissipation and large safety factor which are desirable when the valve is operated under variable-load conditions.

This valve has identical electrical characteristics to those of the type 3Q/252E water-cooled valve which is used with a separate water jacket.

#### CATHODE

Thoriated tungsten filament

Filament voltage	$8 \pm 2\%$	$8 \pm 5\%$	V
*Filament current, nominal		125	A
Maximum usable emission	36	24	A

\*It is recommended that some resistance or reactance be introduced into the filament supply to limit the surge peak current to about two and a half times the normal r.m.s. working value. This impedance may be short-circuited as soon as the surge has decayed.

#### PIRANI TEST†

Filament current		12	A
Filament voltage range		0.13 to 0.14	V
Measuring time, approx.		60	min

†See card supplied with individual valve for actual test figures.

#### CHARACTERISTICS

Amplification factor	}	at $V_a = 4\text{kV}$ , $I_a = 1\text{A}$	24	
Mutual conductance		at $V_a = 4\text{kV}$ , $V_g = -75\text{V}$	60	mA/V

#### DIRECT INTERELECTRODE CAPACITANCES

Grid to anode	30	pF
Grid to filament	80	pF
Anode to filament	1.8	pF

November 1965

3R/252E—1

## Standard Telephones and Cables Limited

Valve Division, Brixham Road, Paignton, Devon

Telephone: Paignton 58685    Telex: 4230

London Sales Office, Telephone: Footscray 3333    Telex: 21836

C O M P O N E N T S                      G R O U P

Code: 3R/252E

CONTINUED

**COOLING REQUIREMENTS**

It is important to observe the correct connection of water inlet and outlet.

Water flow required for full anode dissipation	3 gal/min	13	l/min
Water pressure	13 lb/in <sup>2</sup>	0,8	kg/cm <sup>2</sup>
Maximum temperature of outflowing water		70	°C

Forced-air-cooling of the grid and filament seals is required to limit their temperature to below the maximum permissible value of 180°C.

An air-flow of 50 ft<sup>3</sup>/min (1,42 m<sup>3</sup>/min) directed vertically downwards on to the seals is sufficient to meet these requirements.

**MECHANICAL DATA**

Dimensions	As shown in outline drawing
Mounting position	Vertical, anode downwards

**MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS****RADIO FREQUENCY****Class C. Industrial Heating Oscillator****Maximum Ratings**

Maximum anode voltage (peak value of direct voltage plus ripple)	13	kV
Maximum direct anode current	6	A
Maximum direct anode dissipation (continuous)	24	kW
Maximum direct grid dissipation (continuous)	500	W
Maximum frequency for above ratings	50	Mc/s
Maximum negative grid bias	1 500	V

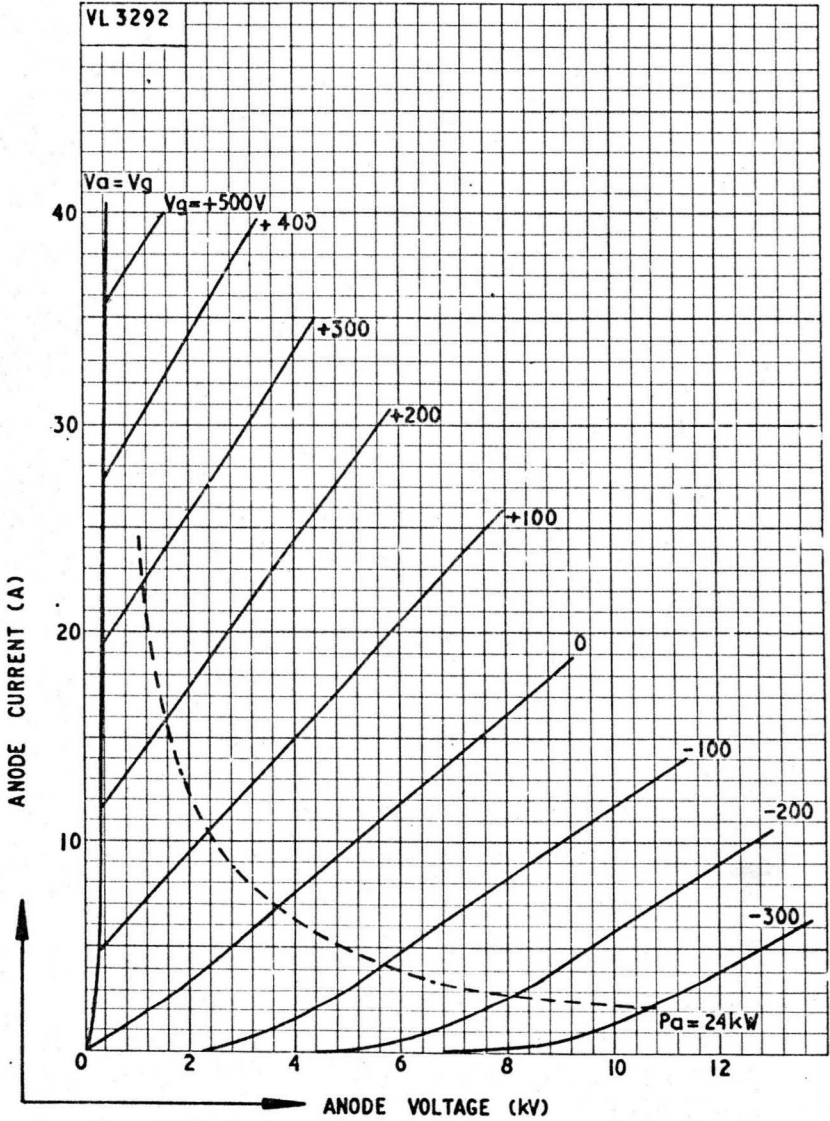
**Typical Operating Conditions**

Direct anode voltage	12	kV
Direct grid voltage	680	V
Direct anode current	5	A
Peak r.f. grid voltage	990	V
*Direct grid current	800	mA
*Grid dissipation	275	W
Power output	48	kW
Efficiency	80	%

\*Subject to wide variation dependent upon the impedance of the load circuit.

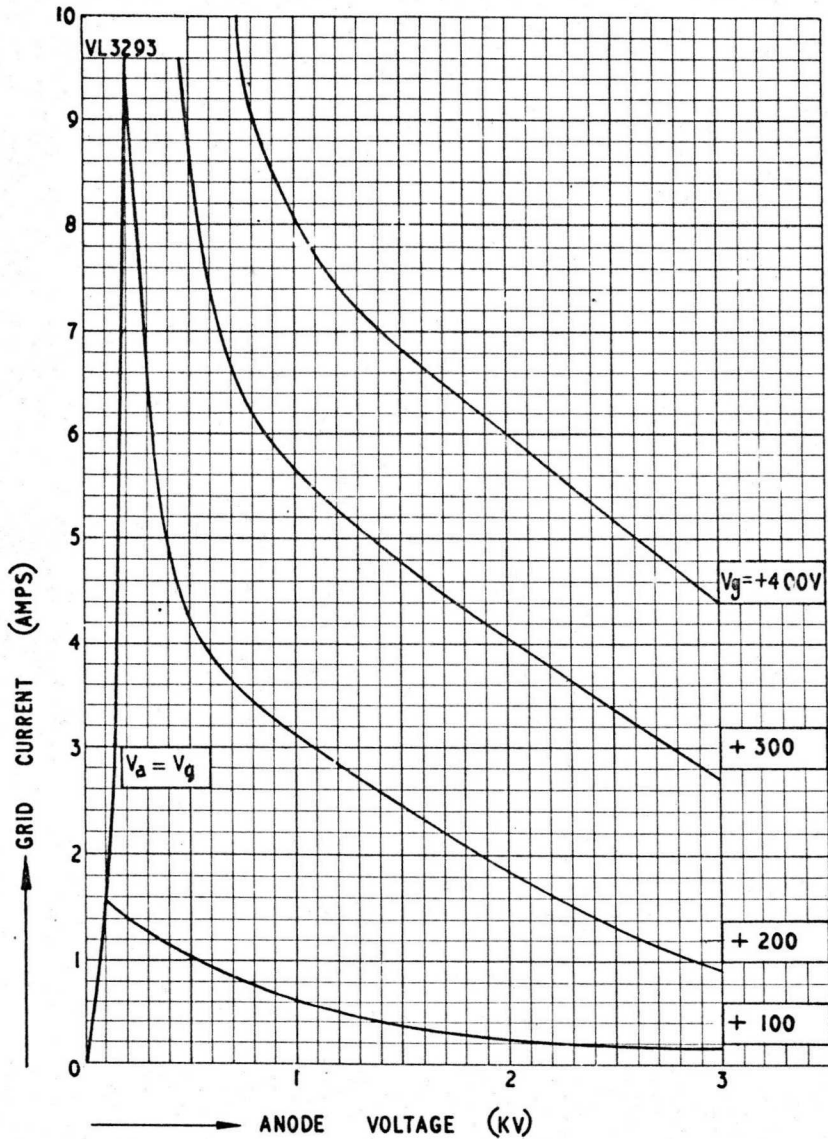
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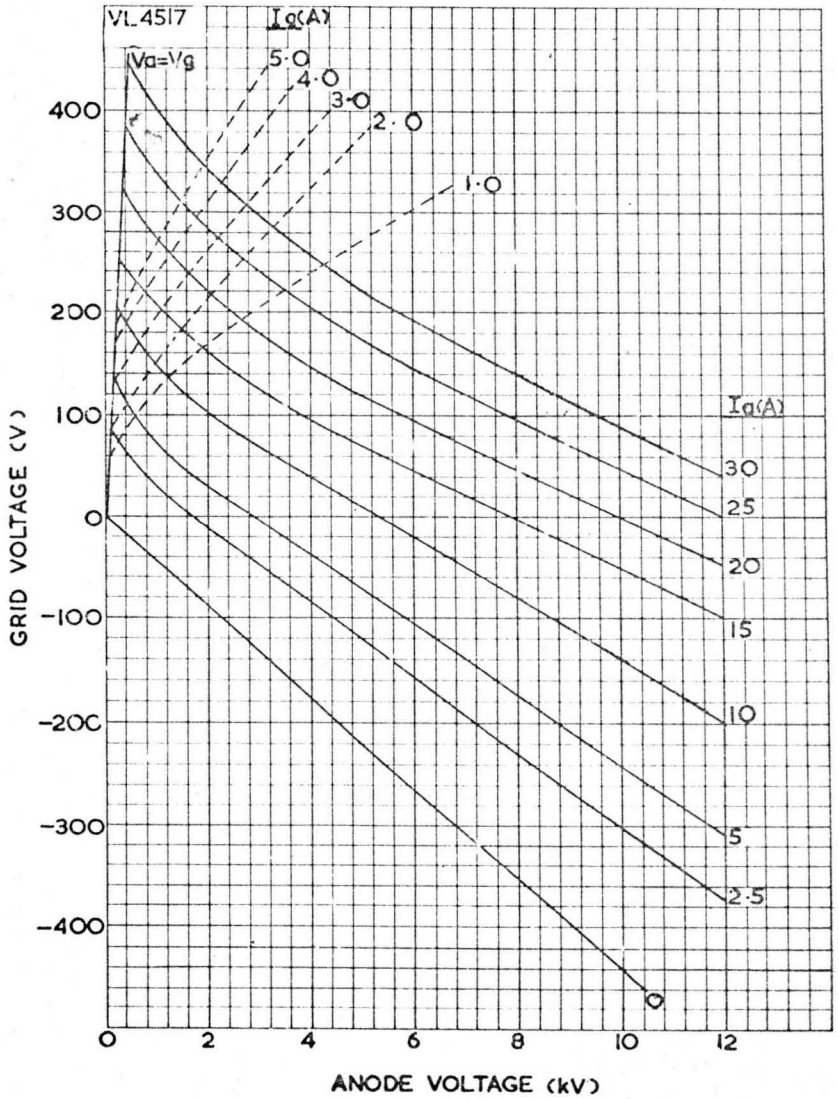
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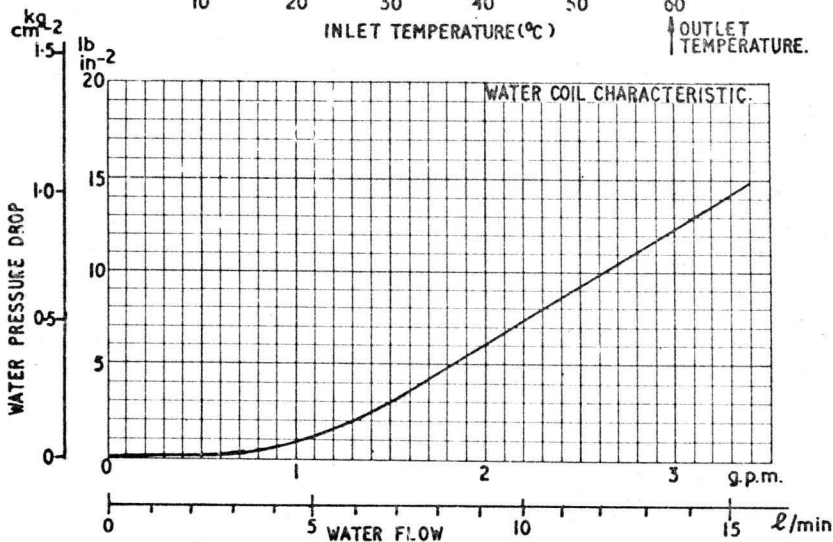
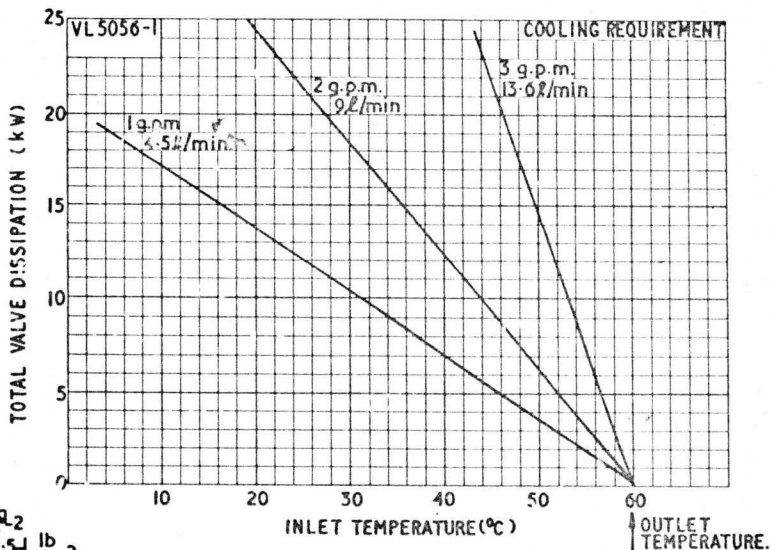
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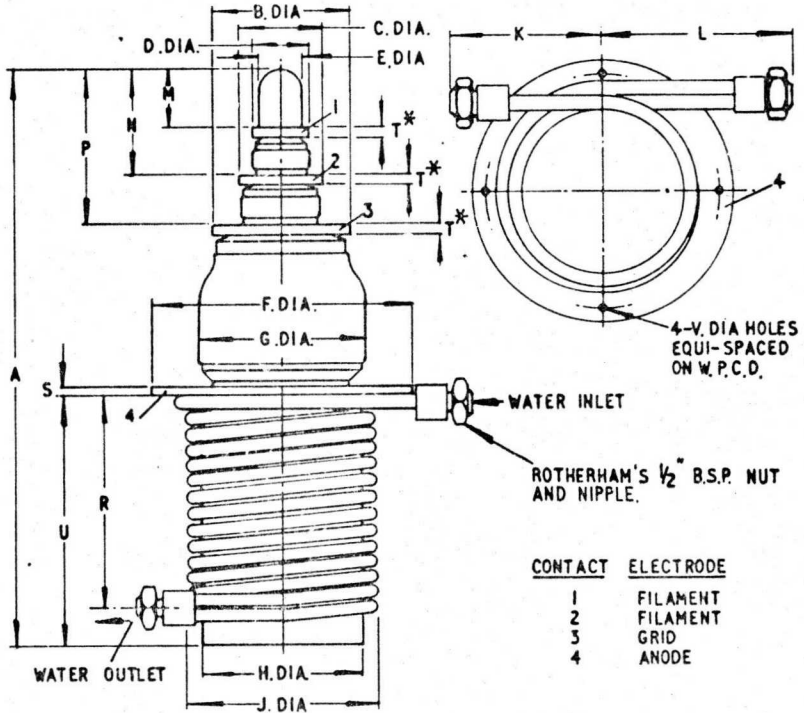
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Code: 3R/252E

CONTINUED

3R/252E Outline



CONTACT	ELECTRODE
1	FILAMENT
2	FILAMENT
3	GRID
4	ANODE

DIM	MILLIMETRES	INCHES	DIM	MILLIMETRES	INCHES
A	344.5 MAX	13 <sup>9</sup> / <sub>16</sub> MAX.	M	38.1 ± 1.6	1 <sup>1</sup> / <sub>2</sub> ± <sup>1</sup> / <sub>16</sub>
B	68.9 ± 0.4	3 <sup>1</sup> / <sub>2</sub> ± <sup>1</sup> / <sub>64</sub>	N	60.3 ± 4.8	2 <sup>3</sup> / <sub>8</sub> ± <sup>3</sup> / <sub>16</sub>
C	50.8 ± 0.4	2 ± <sup>1</sup> / <sub>64</sub>	P	95.3 ± 4.8	3 <sup>3</sup> / <sub>4</sub> ± <sup>3</sup> / <sub>16</sub>
D	31.8 ± 0.4	1 <sup>1</sup> / <sub>4</sub> ± <sup>1</sup> / <sub>64</sub>	R	123.8 ± 1.6	4 <sup>7</sup> / <sub>8</sub> ± <sup>1</sup> / <sub>16</sub>
E	25.4 MAX	1 MAX.	S	4.8 ± 0.4	<sup>3</sup> / <sub>16</sub> ± <sup>1</sup> / <sub>64</sub>
F	155.6 ± 0.8	6 <sup>1</sup> / <sub>8</sub> ± <sup>1</sup> / <sub>32</sub>	T	4.7 MIN. 6.4 MAX.	<sup>3</sup> / <sub>16</sub> MIN. <sup>1</sup> / <sub>4</sub> MAX.
G	101.6 MAX	4 MAX.	U	153.2 MAX.	6 <sup>1</sup> / <sub>32</sub> MAX.
H	96.8 ± 0.8	3 <sup>13</sup> / <sub>16</sub> ± <sup>1</sup> / <sub>32</sub>	V	7.94 ± 0.16	0.312 ± 0.037
J	114.3 MAX.	4 <sup>1</sup> / <sub>2</sub> MAX.	W	139.70 ± 0.25	5.500 ± 0.010
K	79.4 MAX.	3 <sup>1</sup> / <sub>8</sub> MAX.	* DENOTES - CONTACT LENGTH.		
L	104.8 MAX.	4 <sup>1</sup> / <sub>8</sub> MAX.	NOTE - BASIC FIGURES ARE INCHES.		

The 3R/262E has an integral water jacket and is intended primarily for r.f. heating applications.

MAXIMUM RATINGS

Anode voltage (peak value of direct voltage plus ripple)	7,0	kV
Direct anode current	10	A
Anode dissipation, continuous	24	kW
Grid dissipation, continuous	1,0	kW
Direct negative grid voltage	-1 500	V
Maximum frequency for above ratings	30	MHz

TYPICAL OPERATING CONDITIONS

Class C. Industrial Heating R.F. Oscillator

Filament voltage	8,0V $\pm$ 5%	8,0V $\pm$ 5%	
Filament current, nominal	300	300	A
Direct anode voltage	6,0	6,5	kV
Direct grid voltage	-850	-925	V
Direct anode current	9,0	9,9	A
Peak r.f. grid voltage	1 270	1 375	V
Direct grid current (Note 1)	1,37 (2,0)	1,37 (2,0)	A
Anode dissipation	13	16,5	kW
Grid dissipation (Note 1)	590	630	W
Grid resistor	620	680	$\Omega$
Power output	41	48	kW
Power output, less drive	39	46	kW
Power into load at 85% transfer efficiency	33	39	kW

Note 1. Subject to wide variation dependent upon impedance of load circuit. Value of current shown in brackets is typical of off-load conditions and is given for guidance only: a practical figure is dependent upon compensatory devices in the grid circuit.

December 1970

ITT Components Group Europe  
Standard Telephones and Cables Limited

Valve Product Division, Brixham Road, Paignton, Devon  
Telephone: Paignton 50762 (STD Code 0803). Telex: 42830

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## TYPICAL OPERATING CONDITIONS (continued)

Class AB<sub>1</sub>, AB<sub>2</sub>. A.F. Amplifier - (2 tubes)

	Class AB <sub>1</sub>	Class AB <sub>2</sub>	
Filament voltage	8,0V ± 5%	8,0V ± 5%	
Filament current, nominal	300	300	A
Direct anode voltage	6,5	7,0	kV
Direct anode current	2 x 3,2	2 x 5,8	A
Grid bias	-540	-550	V
Grid voltage swing, peak-to-peak	1 040	1 420	V
Anode-to-anode load	1,8	1,3	kΩ
Anode dissipation	2 x 10	2 x 13	kW
Power input	42	80	kW
Power output	22	54	kW
Grid current		190	mA
Drive power (Note 2)		2 x 135	W
Bias power loss		2 x 104	W
Grid dissipation		2 x 31	W

Note 2. Figures given do not include all circuit losses.

## CATHODE

Thoriated tungsten filament		
Maximum usable emission	60	A
Cold filament resistance	0,0034	Ω

It is recommended that some resistance or reactance be introduced into the filament supply to limit the surge current to about two and a half times the normal r.m.s. working value. This impedance may be short-circuited if desired as soon as the surge has decayed.

For tube operation at frequencies above 30MHz, it is recommended that the r.f. return path to the cathode be capacitively coupled to both filament terminals.

## CHARACTERISTICS

Amplification factor (at $V_a = 4,5kV$ : $i_a = 4A$ )	12	
Mutual conductance (at $V_a = 2,0kV$ : $V_g = -87V$ )	60	mA/V

## DIRECT INTERELECTRODE CAPACITANCES

Grid to anode	86	pF
Grid to filament	106	pF
Anode to filament	6,0	pF

---

**COOLING**

The anode must be cooled by an adequate water flow. (See Figures 3 and 4). It is essential that the water enters the water jacket at its lowest point in relation to the attitude of the tube when mounted.

Forced air cooling of the grid and filament seals is required to limit their temperature to below the maximum permissible value of 180°C. An air flow of 50 ft<sup>3</sup>/min (1,42 m<sup>3</sup>/min) directed vertically downwards on to the seals from a 4 inch (10 cm) diameter orifice is sufficient for operation at frequencies up to 30 MHz. At higher frequencies, additional cooling of the grid seal may be required.

**MECHANICAL DATA**

Dimensions	As shown in outline drawings included
Mounting position	Vertical, anode upwards or downwards
Weight of tube	12,6 lb (5,7 kg)
Accessories	Filament and grid connectors, which are supplied as separate items, are available under following codes: CN-2A Filament connector ring, smaller CN-2B Filament connector ring, larger CN-2C Grid connector ring

Fig. 1. Constant Voltage Characteristics

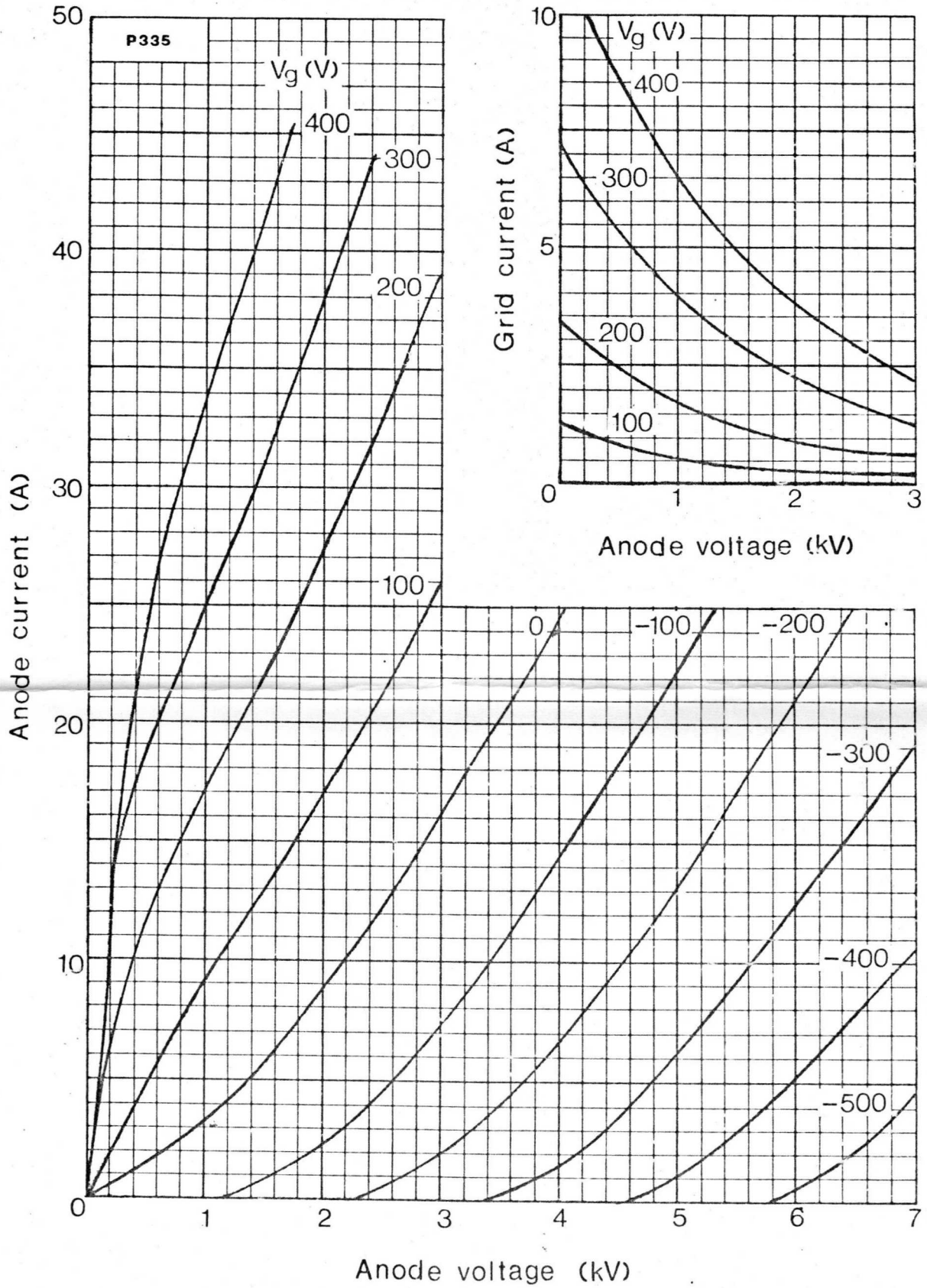


Fig. 2. Constant Current Characteristics

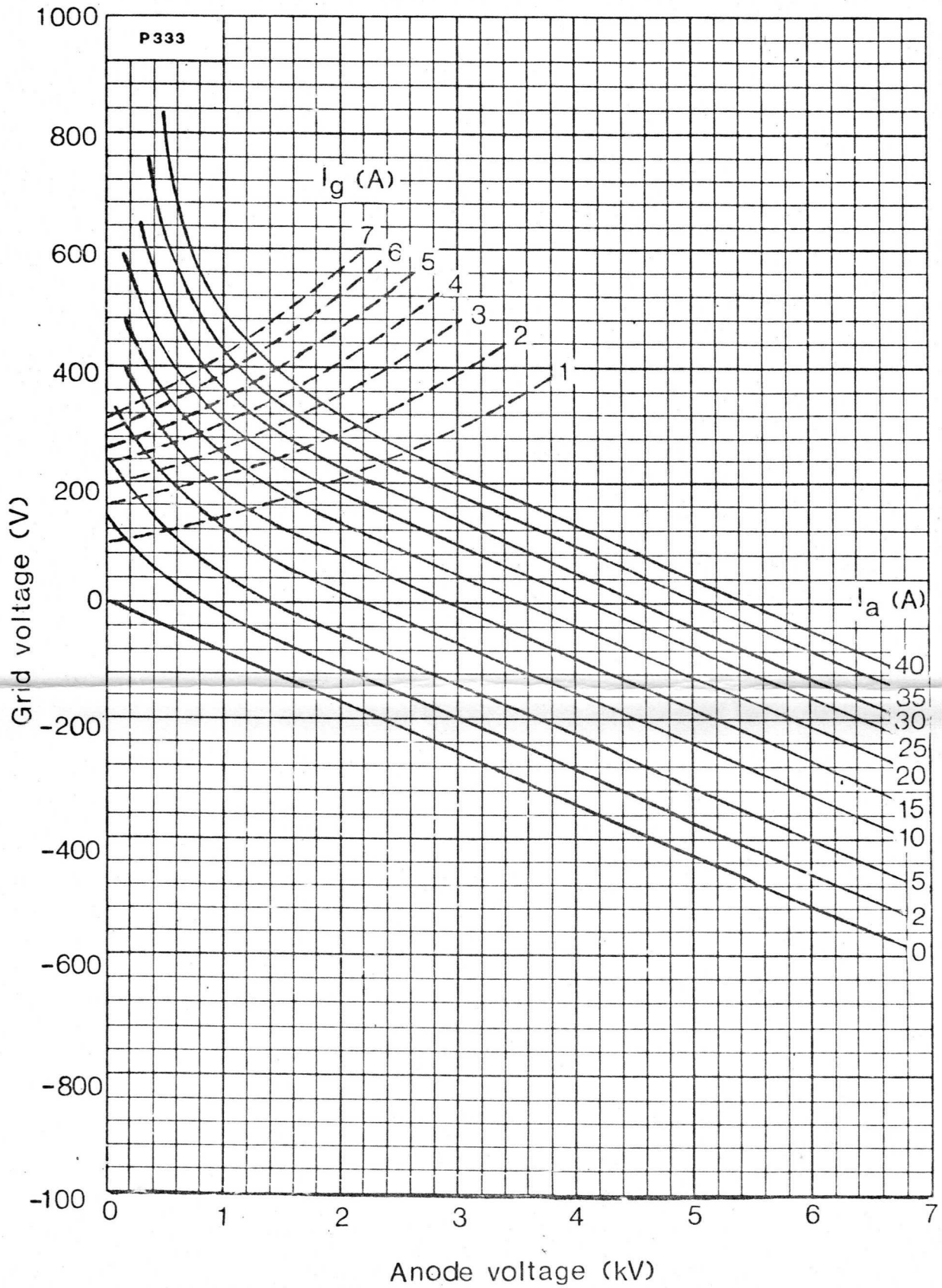


Fig. 3. Cooling Water Requirement for Outlet Water Temperature of 60°C

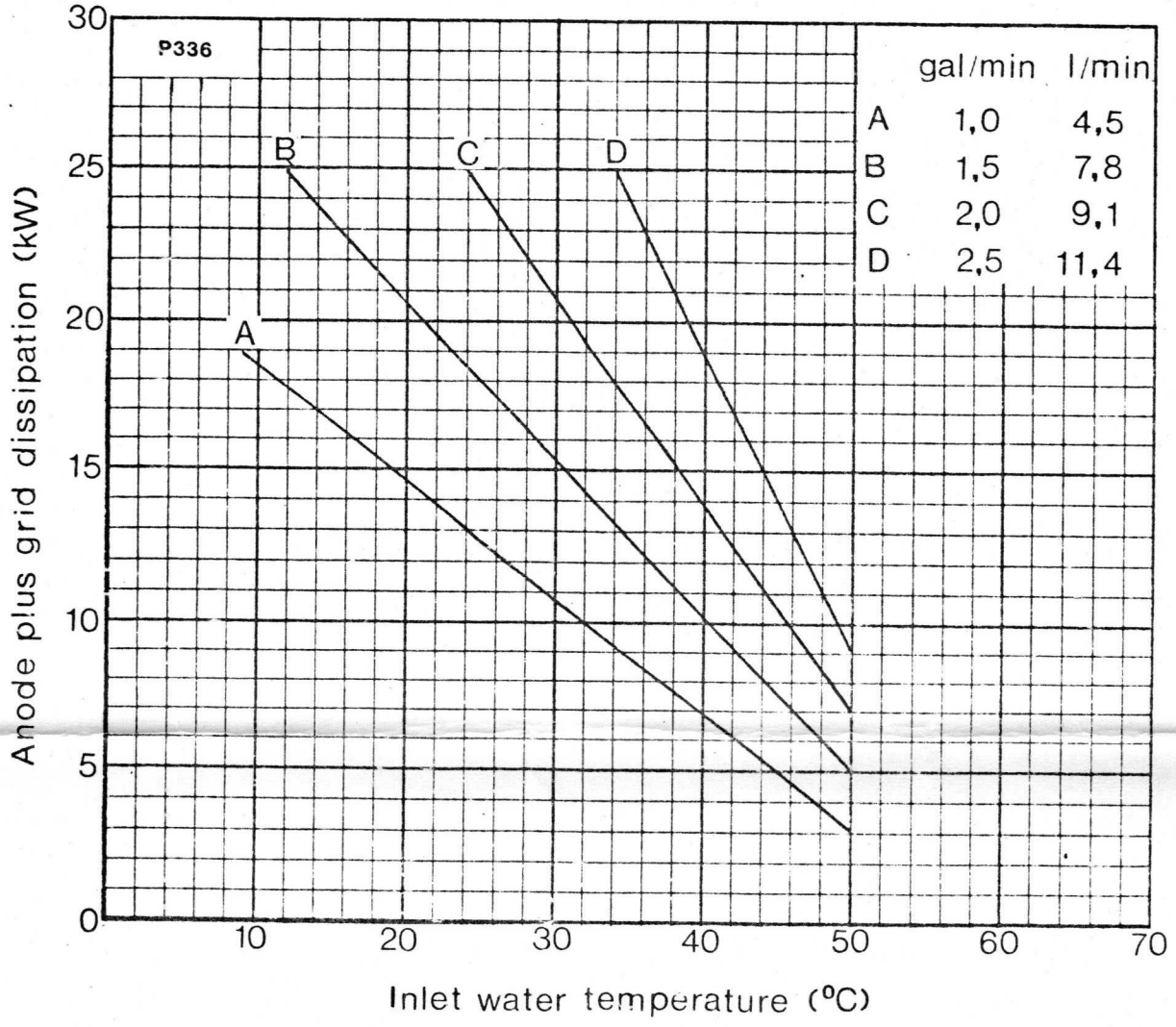
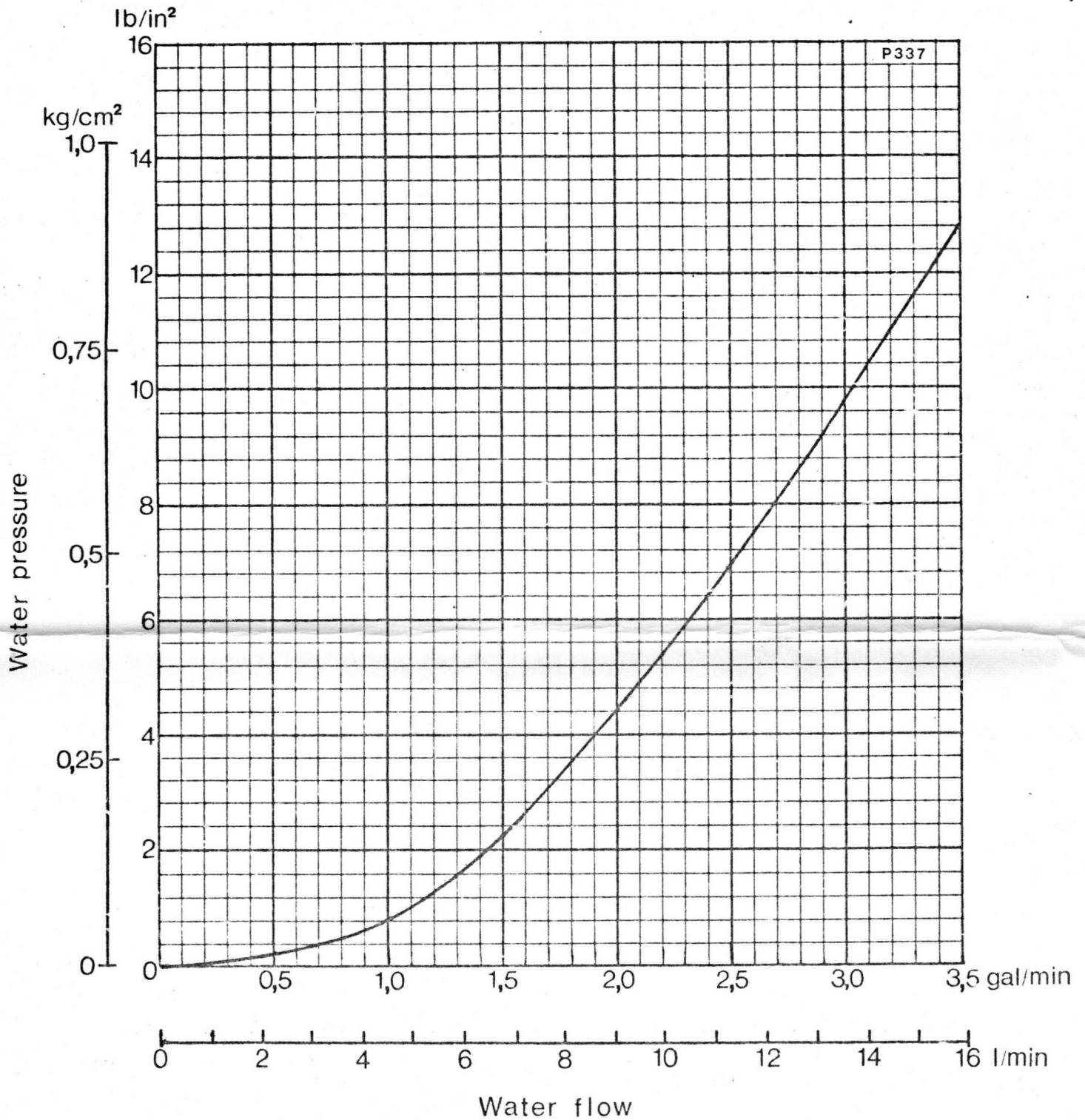
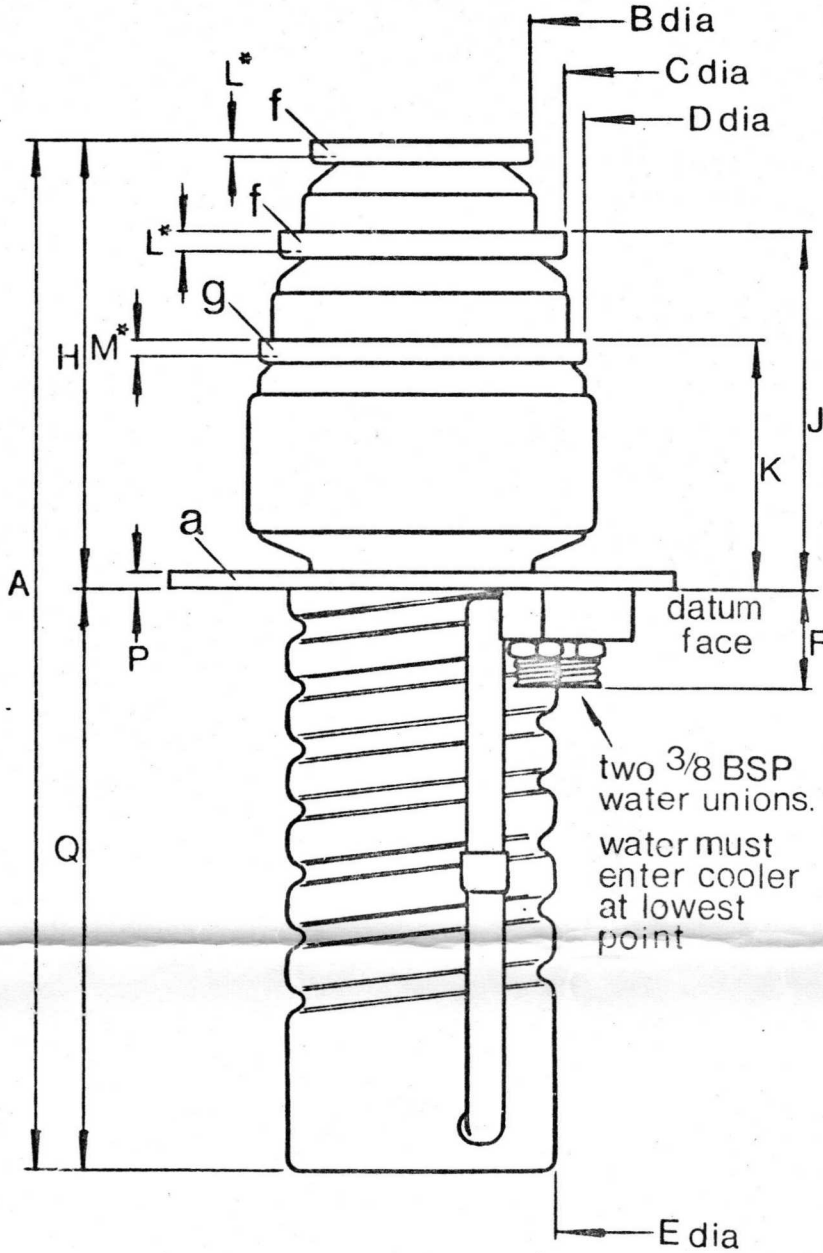




Fig. 4. Water Coil Characteristic



3R/262E Outline



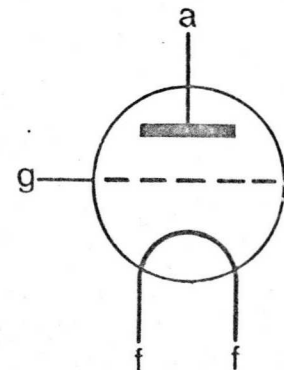
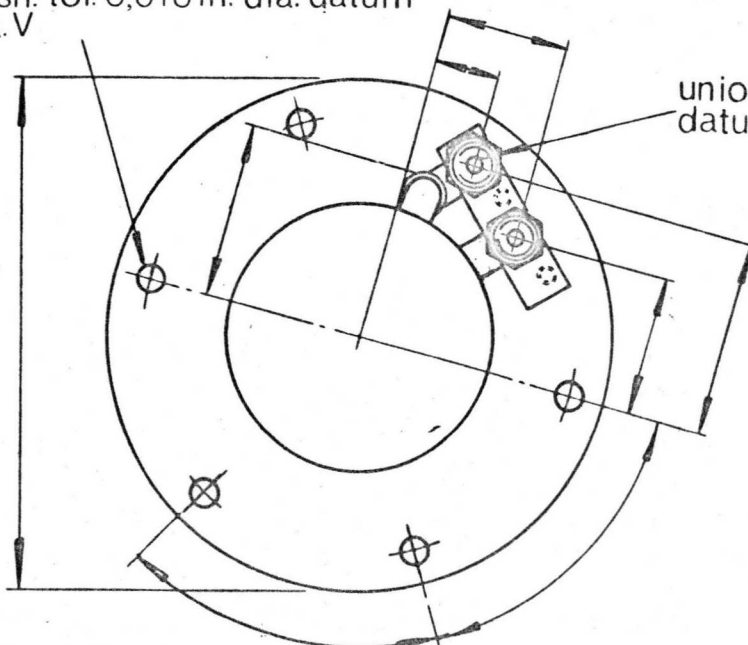
dim.	millimetres	inches
A	370,08 max.	14,57 max.
B	77,85 ± 0,25	3,065 ± ,010
C	100,08 ± 0,25	3,940 ± ,010
D	114,83 ± 0,25	4,521 ± ,010
E	94,0 max.	3,70 max.
F	33,27 ± 1,52	1,31 ± ,06
H	157,23 ± 9,65	6,19 ± ,38
J	126,24 ± 4,83	4,97 ± ,19
K	88,14 ± 2,29	3,47 ± ,09
L	4,57 min. 7,87 max.	,18 min. ,31 max.
M	6,35 min. 9,65 max.	,25 min. ,38 max.
P	6,35 ± 0,38	,25 ± ,015
Q	203,2 max.	8,00 max.
R	65,02 max.	2,56 max.
T	146,05 t.p.	5,750 t.p.
U	9,53 ± 0,18	,375 ± ,007
V	177,8 ± 0,76	7,00 ± ,030
W	46,48 t.p.	1,83 t.p.
X	24,13 t.p.	,95 t.p.
Y	69,09 t.p.	2,72 t.p.
Z	46,48 t.p.	1,83 t.p.

\*denotes contact length

metric dimensions are derived from original inch dimensions

5 holes of U dia. spaced as shown on T p.c.d. t.p.  
posn. tol. 0,010 in. dia. datum dia. V

unions posn. tol. 0,10 in. dia. datum T p.c.d.



# STC

# VALVES

## Water-Cooled Industrial Triode with Integral Water Jacket

Code: 3R/280E

---

The 3R/280E is designed primarily for induction heating applications. Design features give a high mutual conductance resulting in high efficiency with the low grid dissipation and large safety factor which are desirable when the valve is operated under variable-load conditions.

### CATHODE

Thoriated tungsten filament		
Filament voltage	8 ( $\pm 5\%$ )	V
Filament current, nominal (Note 1)	300	A
Maximum usable emission	60	A

NOTE 1.—It is recommended that some resistance or reactance be introduced into the filament supply to limit the surge peak current to about two and a half times the normal r.m.s. working value. This impedance may be short-circuited as soon as the surge has decayed.

### CHARACTERISTICS

Amplification factor	24	
Mutual conductance	75	mA/V

### DIRECT INTERELECTRODE CAPACITANCES

Grid to anode	50	pF
Grid to filament	110	pF
Anode to filament	2	pF

### MECHANICAL DATA

Dimensions	} As shown in Figure 2
Connection detail	
Mounting position	Vertical, anode downwards

Filament and grid connector rings are available separately under the following codes:

CN-2A	Filament connector, smaller
CN-2B	Filament connector, larger
CN-2C	Grid connector

May 1967

3R/280E—1

---

## Standard Telephones and Cables Limited

Valve Division, Brixham Road, Paignton, Devon

Telephone: Paignton 50762      Telex: 4230

London Sales Office, Telephone: Footscray 3333      Telex: 21836

C O M P O N E N T S      G R O U P

## Code: 3R/280E

CONTINUED

**COOLING REQUIREMENTS**

The anode must be cooled by an adequate water flow through the integral water jacket. It is important to ensure that the water inlet and outlet connections to the water jacket are correct.

Forced-air-cooling of the grid and filament seals is required to limit their temperature to below the maximum permissible value of 180°C: an air flow of 50 ft<sup>3</sup>/min (1.42 m<sup>3</sup>/min) directed vertically downwards on to the seals from a 4-inch (10cm) diameter orifice is sufficient for normal operation.

**MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS**

## CLASS C. INDUSTRIAL HEATING OSCILLATOR

**Maximum Ratings**

Maximum direct anode voltage (peak value of direct voltage plus ripple)	13	kV
Maximum direct anode current	10	A
Maximum direct anode dissipation (continuous)	30	kW
Maximum direct grid dissipation (continuous)	1	kW
Maximum negative grid bias	-1.5	kV
Maximum frequency for above ratings	10	MHz

**Typical Operating Conditions**

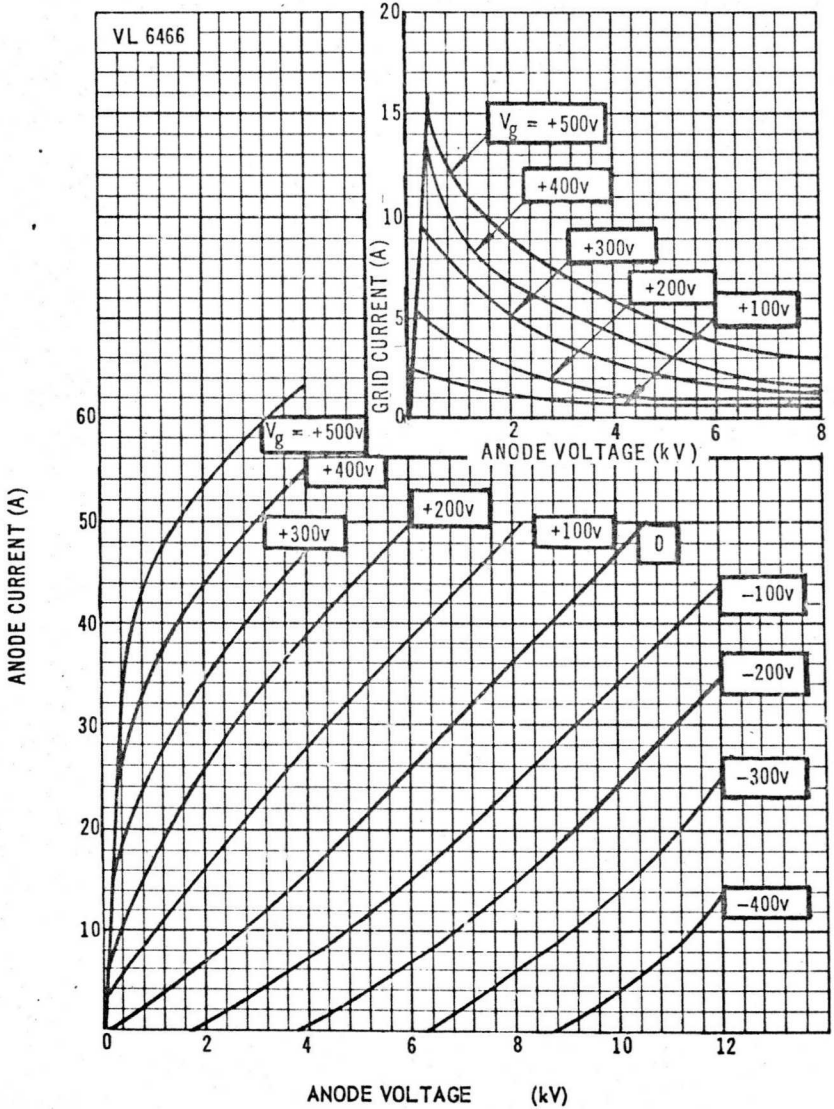
Direct anode voltage	8.5	10	12	kV
Direct grid voltage	-610	-670	-760	V
Direct anode current	10	10	10	A
Peak r.f. grid voltage	1 060	1 120	1 210	V
Direct grid current (Note 2)	1.4	1.37	1.31	A
Grid resistor	435	490	575	Ω
Grid dissipation (Note 2)	600	600	600	W
Anode dissipation	24	26	29	kW
Power input	85	100	120	kW
Power output (oscillator)	61	74	91	kW
Power into load at 85% transfer efficiency	52	63	77.5	kW

NOTE 2.—Subject to wide variation dependent upon the impedance of the load circuit.

Code: 3R/280E

CONTINUED

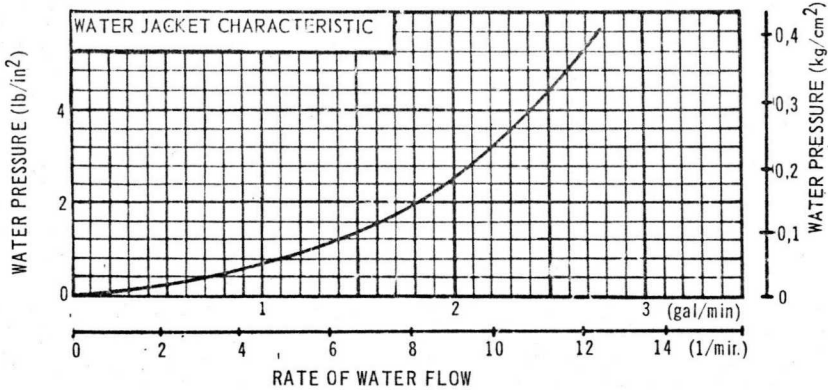
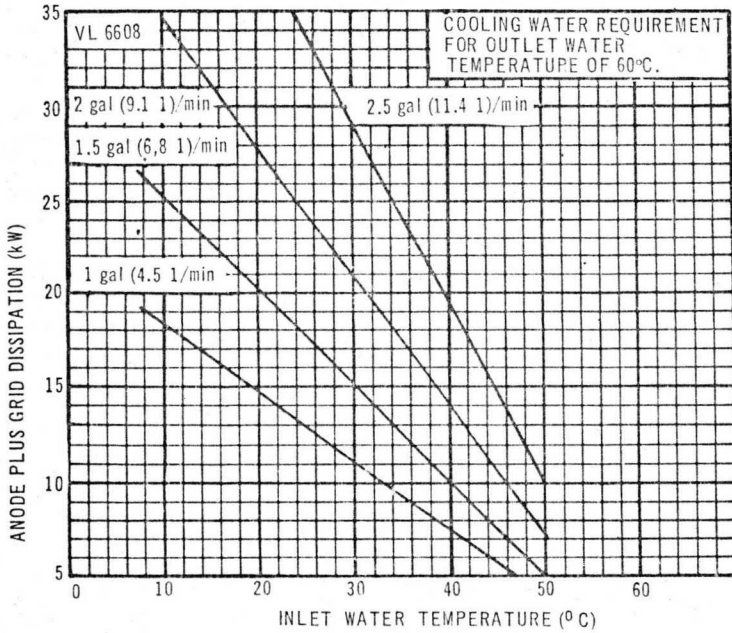
Fig. 1.—Anode Current and Grid Current versus Anode Voltage.



Code: 3R/280E

CONTINUED

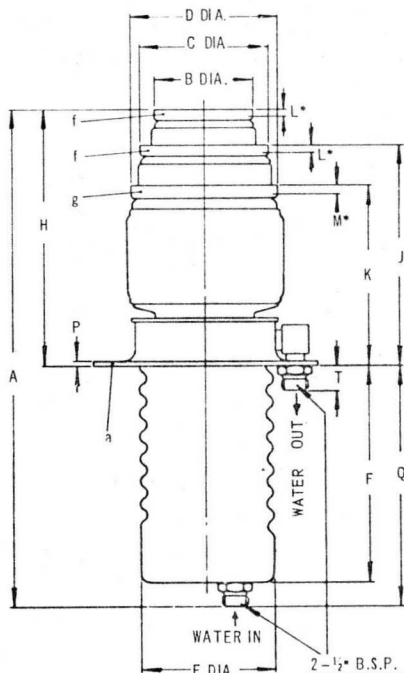
Fig. 2.—Cooling Characteristics



Code: 3R/280E

CONTINUED

Fig. 3.—3R/280E Outline

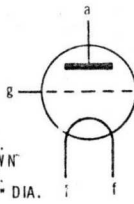
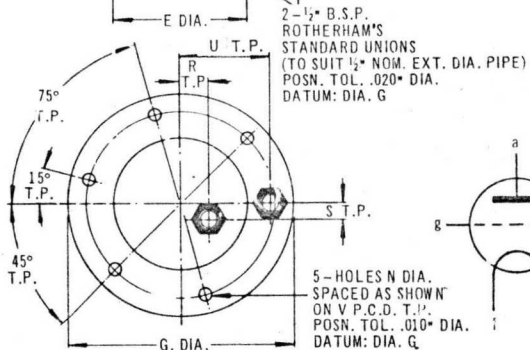


DIM.	MILLIMETRES	INCHES
A	410 MAX.	16.125 MAX.
B	77,85 ± 0,25	3.065 ± 0.010
C	100,08 ± 0,25	3.940 ± 0.010
D	114,83 ± 0,25	4.521 ± 0.010
E	107 MAX	4.200 MAX.
F	171,5 ± 1,6	6.750 ± 0.062
G	177,80 ± 0,8	7.000 ± 0.030
H	206,4 ± 10,2	8.125 ± 0.400
J	178,6 ± 5,6	7.031 ± 0.220
K	145,3 ± 3,2	5.720 ± 0.125
L	4,8 MIN.	0.187 MIN.
	7,9 MAX.	0.313 MAX.
M	6,4 MIN.	0.250 MIN.
	9,5 MAX.	0.375 MAX.
N	9,53 ± 0,18	0.375 ± 0.007
P	3,18 ± 0,25	0.125 ± 0.010
Q	190,50 ± 2,4	7.500 ± 0.094
R	22,23 T.P.	0.875 T.P.
S	12,70 T.P.	0.500 T.P.
T	19,05 ± 0,3	0.750 ± 0.030
U	72,12 T.P.	2.840 T.P.
V	146,05 ± T.P.	5.750 T.P.

TOLERANCES TO CS 308. 1964

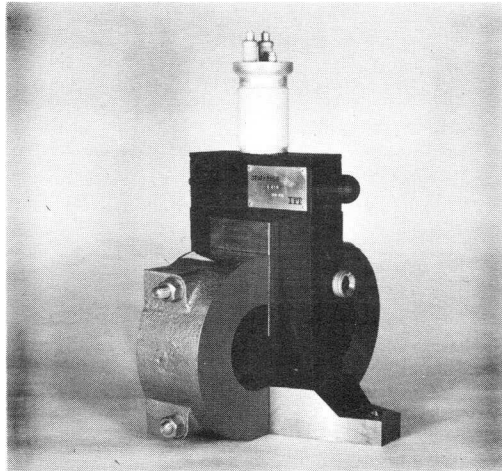
BASIC DIMENSIONS ARE INCHES

\* DENOTES: CONTACT LENGTH



# MAGNETICALLY-BEAMED INDUSTRIAL TRIODE

Code: 3RM/215G



## DESCRIPTION

This new device employs the field of a permanent magnet to guide the electron flow from cathode to anode.

A controlling electrode, designated 'gate', replaces the conventional wound grid with its attendant problems of emission and distortion. The gate, which is of solid and robust construction, is used to modulate the flow of electrons, and is positioned so that very few electrons are intercepted by it.

As the gate dissipation is negligible, the gain of the tube is very high (approximately 30dB), and the driving power required for full output is low compared with that for a conventional triode. However, the drive voltage is as high as with a conventional triode, ensuring as good a rejection of spurious drive signals.

The relatively high impedance of the gate circuit allows the use of additional components of moderate power ratings for power control or switching in this circuit.

The tube may be used with advantage in r.f. amplifiers, oscillators and r.f. heating applications. The efficiency is good at low anode voltage as well as at higher levels.

November 1969

3RM/215G-1

**ITT Components Group Europe**  
**Standard Telephones and Cables Limited**

Valve Product Division, Brixham Road, Paignton, Devon  
Telephone: Paignton 50762 (STD Code 0803) Telex: 42830

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A particular feature of the tube when used for r.f. heating is its ability to withstand interruption of oscillation resulting from circuit or loading faults; this is because the anode dissipation at full h.t. and zero bias is well within the tube rating at anode voltages up to 4kV.

High efficiency operation at low anode voltage is obtained because of the low anode bottoming potential, whilst the overall efficiency of the tube is enhanced by the lower heating power associated with the matrix type cathode.

The construction of the whole tube is very robust and the breakage and distortion hazards encountered in high temperature filamentary emitters are eliminated.

Anode cooling is effected by means of a newly developed integral, low pressure drop, transverse flow water jacket. Base cooling is not required at operating frequencies below 1MHz.

## CATHODE

Indirectly heated, matrix type

## HEATER

Heater voltage	12,5	V
Heater current	12	A

## CHARACTERISTICS

Amplification factor	42	
Mutual conductance	40	mA/V

## DIRECT INTERELECTRODE CAPACITANCES

Gate to anode	55	pF
Gate to cathode	63	pF
Anode to cathode (gate earthed)	6,8	pF

## MECHANICAL DATA

Dimensions	} As shown in Figure 4	
Connection detail		
Magnet	A recommended permanent magnet, the outline of which is shown in Figure 4 can be supplied as an additional accessory.	
Mounting position	Unrestricted	
Weight of valve, approx.	10 lb 7 oz	4,75 kg

## COOLING REQUIREMENTS

For an anode dissipation of 10kw, a water flow of 1,5 gal/min (6,8 l/min) is required. No other cooling is required at operating frequencies below 1MHz. At higher frequencies forced-air cooling of the seals may be necessary to keep their temperatures within the maximum rating of 220°C.

## LIMIT RATINGS AND TYPICAL OPERATING CONDITIONS

## CLASS C. INDUSTRIAL HEATING OSCILLATOR

## Limit Ratings

Maximum direct anode voltage (peak value of direct voltage plus ripple)	6,5 kV
Maximum direct anode voltage for fail-safe if oscillation ceases	4 kV
Maximum peak cathode current	24 A
Maximum direct anode current	5,5 A
Maximum direct anode dissipation (continuous)	8 kW
Maximum direct gate voltage	-750 V
Maximum frequency for above ratings	10 MHz

## Typical Operating Conditions (Measured in induction heating generator)

Direct anode voltage*	2,5	3,0	4,0	5,0	6,0	6,0	kV
Direct gate voltage	-470	-440	-445	-415	-520	-500	V
Direct anode current	4,49	5,02	5,15	5,25	5,2	2,7	A
Peak r.f. gate voltage	1007	1004	987	947	1107	870	V
Direct gate current							
on load	90	85	86	80	100	16	mA
off load	170	160	160	150	180	30	mA
Gate bias resistor	5,2	5,2	5,2	5,2	5,2	33	kΩ
Gate dissipation	48,5	48	46,5	42,5	58,7	6	W
Power input	11,2	15	20,6	26,25	31,2	16,2	kW
Anode dissipation	4,1	5,30	6,3	7,25	8,0	3,2	kW
Power output (oscillator)	7,1	9,7	14,3	19,0	23,2	13	kW
Power into load at 90% transfer efficiency	6,4	8,75	12,9	17,1	20,9	11,7	kW

\* In the event of cessation of oscillation the valve remains within  $P_a$  limit at  $V_g = 0$ ,  $V_a \nrightarrow 4kV$ .

Fig. 1. Typical Anode Current and Gate Current versus Anode Voltage

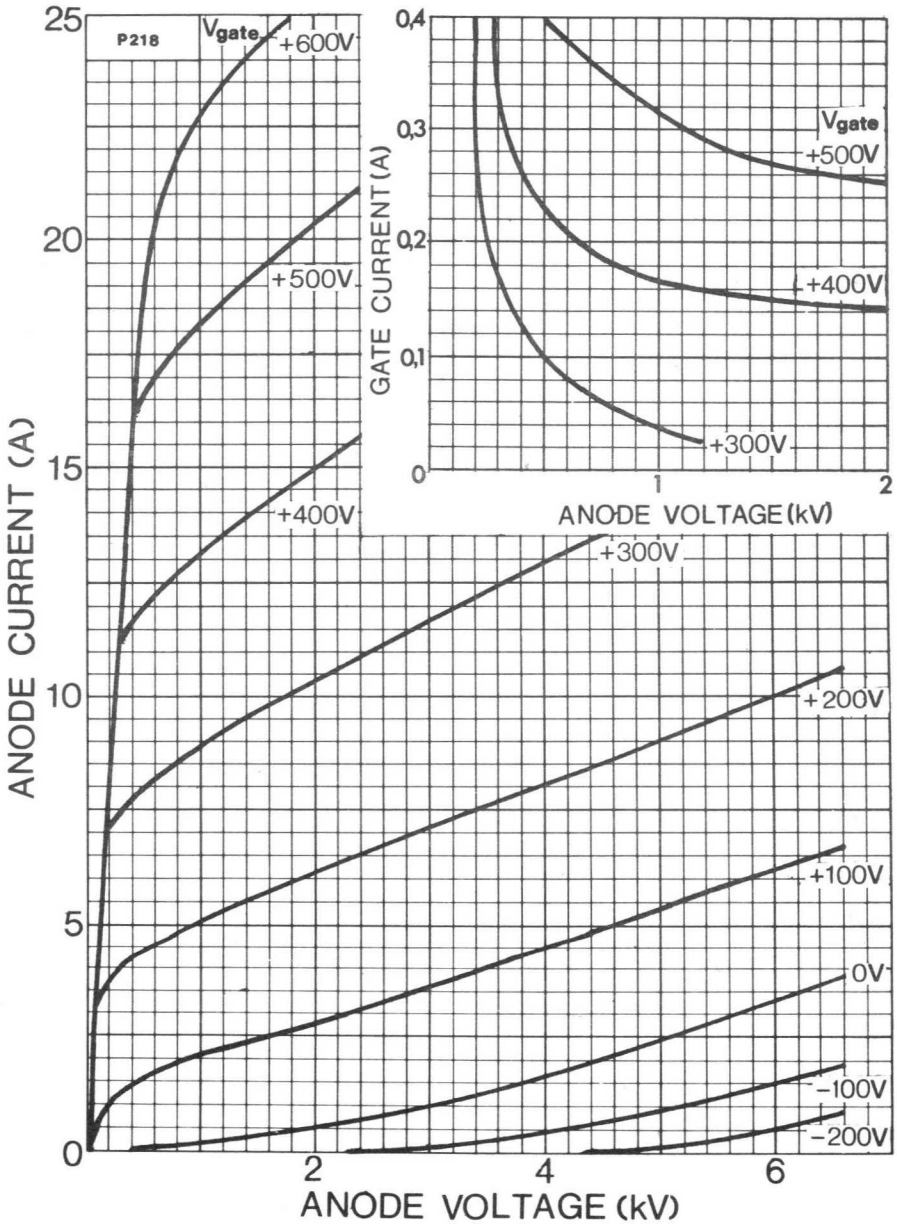


Fig. 2. Typical Constant Current Characteristics

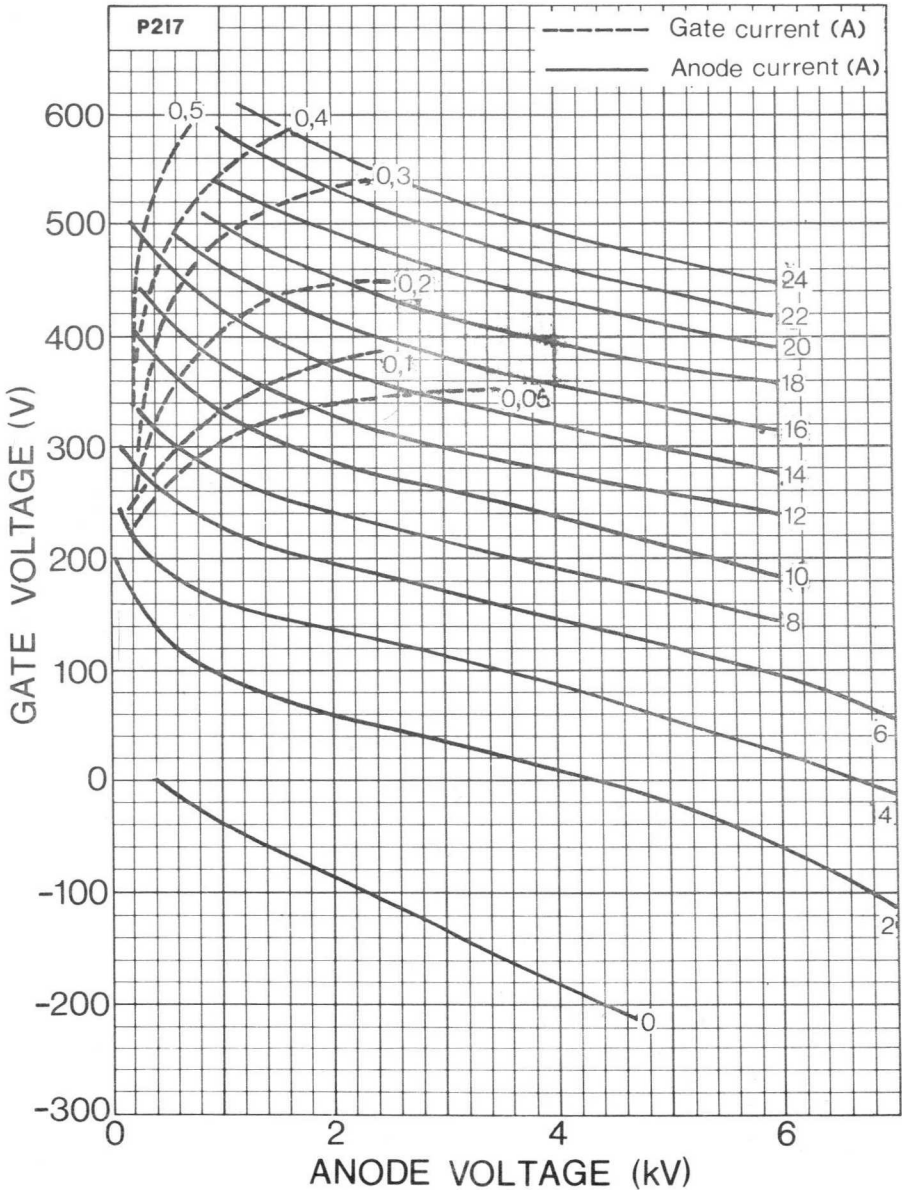


Fig. 3. Typical Anode Current versus Gate Voltage

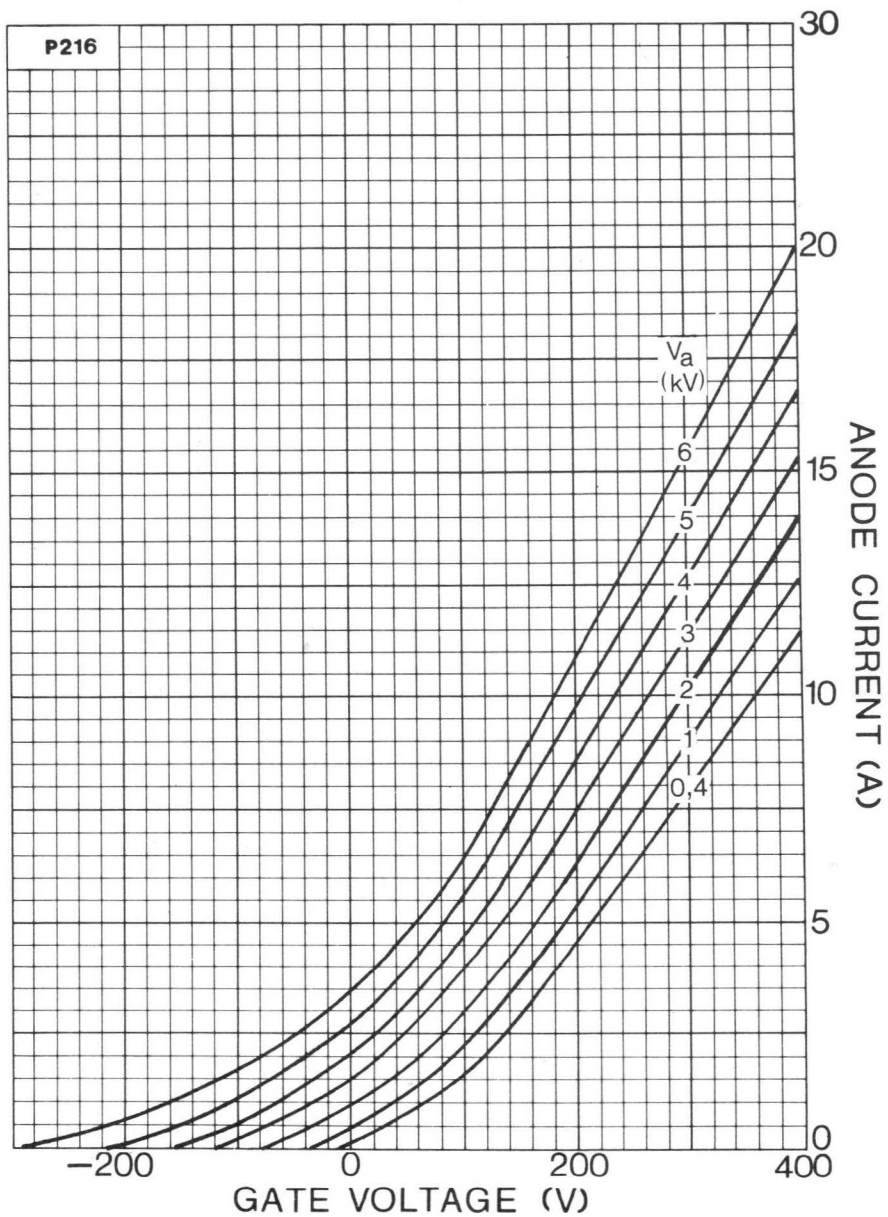
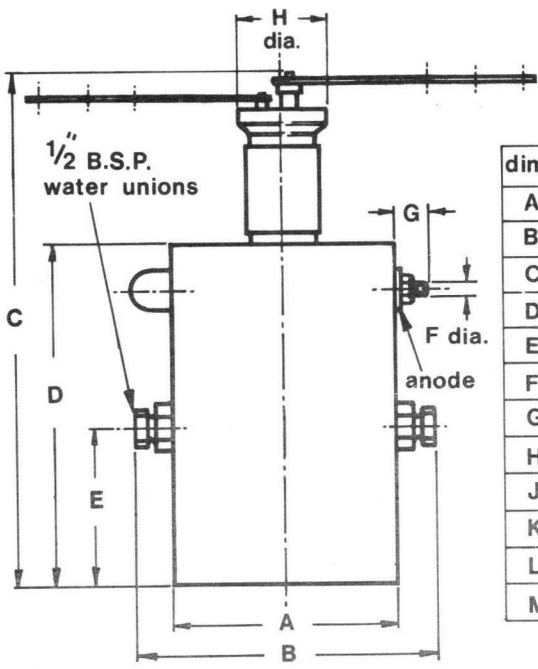
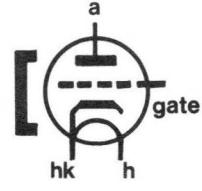
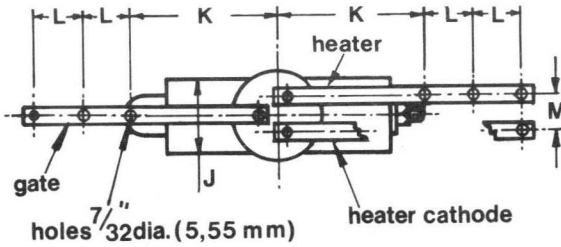
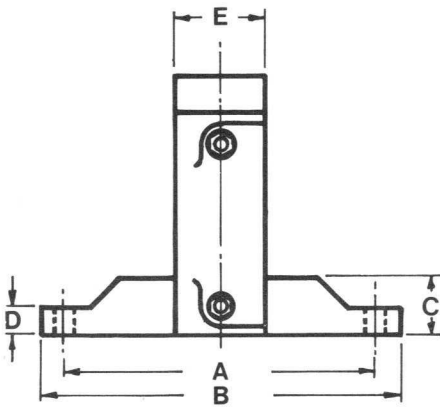
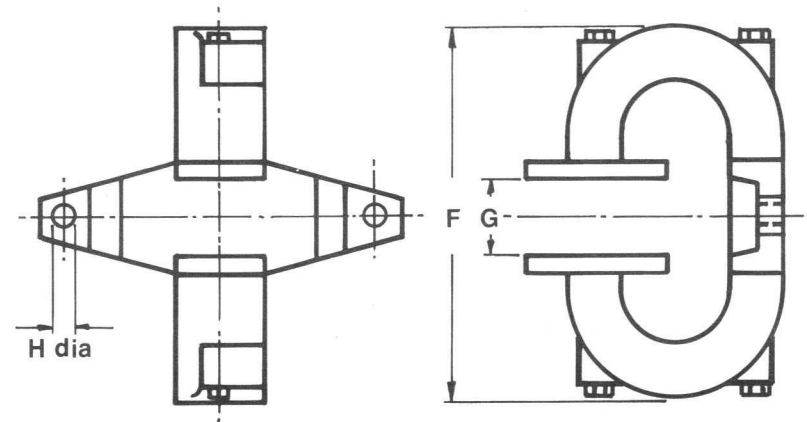


Fig. 4. Tube Outline



dim.	mm.	ins.
A	117,5 max.	4.625 max.
B	162 max.	6 3/8 max.
C	273 max.	10 3/4 max.
D	177,8 ± 0,8	7 ± 1/32
E	81 approx.	3 3/16 approx.
F	7,94	5/16
G	16 approx.	5/8 approx.
H	45,72 ± 0,8	1.80 ± 0.03
J	43 max.	1 11/16 max.
K	76 approx.	3 approx.
L	25,4 approx.	1 approx.
M	18,7 ± 0,4	0.736 ± 0.015

Fig. 5. Magnet Outline



dim	mm	ins
A	196,9 ± 0,8	7 <sup>3</sup> / <sub>4</sub> ± 1/32
B	230 approx.	9 approx.
C	38 max.	1 <sup>1</sup> / <sub>2</sub> max.
D	19 approx.	3/4 approx.
E	57 approx.	2 <sup>1</sup> / <sub>4</sub> approx.
F	238 approx.	9 <sup>3</sup> / <sub>8</sub> approx.
G	48 approx.	1 <sup>7</sup> / <sub>8</sub> approx.
H	13,5 ± 0,4	17/32 ± 1/64

## PROVISIONAL DATA

R.F. POWER TRIODE

3Z/340G

This vapour-cooled triode is designed for use as an r.f. power amplifier or oscillator and is suitable for cathode drive operation.

## MAXIMUM RATINGS

Direct anode voltage (Note 1)	14	kV
Direct anode current	18	A
Anode dissipation	125	kW
Grid dissipation	2,75	kW
Maximum operating frequency for above ratings	27	MHz

Note 1. For Class C anode modulated operation (100% carrier modulation) the maximum anode voltage is 12kV.

## TYPICAL OPERATING CONDITIONS

Class C. R.F. Power Amplifier or Oscillator

Filament voltage, per filament section	9,6	V
Filament current, nominal, per filament section	290	A
Direct anode voltage	14	kV
Direct grid voltage	-765	V
Peak r.f. grid voltage	1 305	V
Anode current	17,5	A
Grid current, approx.	3,1	A
Anode dissipation	45	kW
Grid dissipation, approx.	1,7	kW
Drive power, approx.	4,0	kW
Output power	200	kW
Efficiency	81	%

January 1971

**ITT Components Group Europe**  
**Standard Telephones and Cables Limited**

Valve Product Division, Brixham Road, Paignton, Devon  
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## CATHODE

Thoriated tungsten filament (Note 2)

Filament voltage, per section	9,6V ± 5%	
Filament current, per section, at 9,6V	min. 263	max. 311
Maximum difference between current in each section	15	
Filament cold resistance, per section	0,004	
Maximum filament starting current, per section (Note 3)	700	
Maximum usable emission	175	

Note 2. The filament consists of two sections. Each section is connected across diagonally opposite pairs of filament terminals. The two filament sections should be operated in phase quadrature.

Note 3. This starting current must not be exceeded even momentarily.

## CHARACTERISTICS

Amplification factor (at $V_a = 9,0kV$ : $I_a = 5,0A$ )	min. 31	max. 39	
Mutual conductance (at $V_a = 9,0kV$ : $I_a = 5,0A$ )	min. 78	max. 102	mA/V

## DIRECT INTERELECTRODE CAPACITANCES

Grid to anode	108	pF
Grid to filament	259	pF
Anode to filament	3,5	pF

## COOLING

The anode, which is fitted into an approved type of boiler, is cooled by the evaporation of water. The resulting steam is condensed by either an internal or an external condenser.

The anode seal and bulb temperatures must not exceed 180°C.

To give protection against overheating of the anode, a thermal fuse is fitted in one of four possible positions provided by threaded holes equally spaced around the top surface of the anode ring. The fuse is screwed into position and connected by a non-conducting cord to a suitable switching device. A cord tension of 1 lb (450 g) will ensure that if the anode temperature exceeds the safe limit, the fuse core is pulled out and the safety switch removes all electrical supplies from the tube.

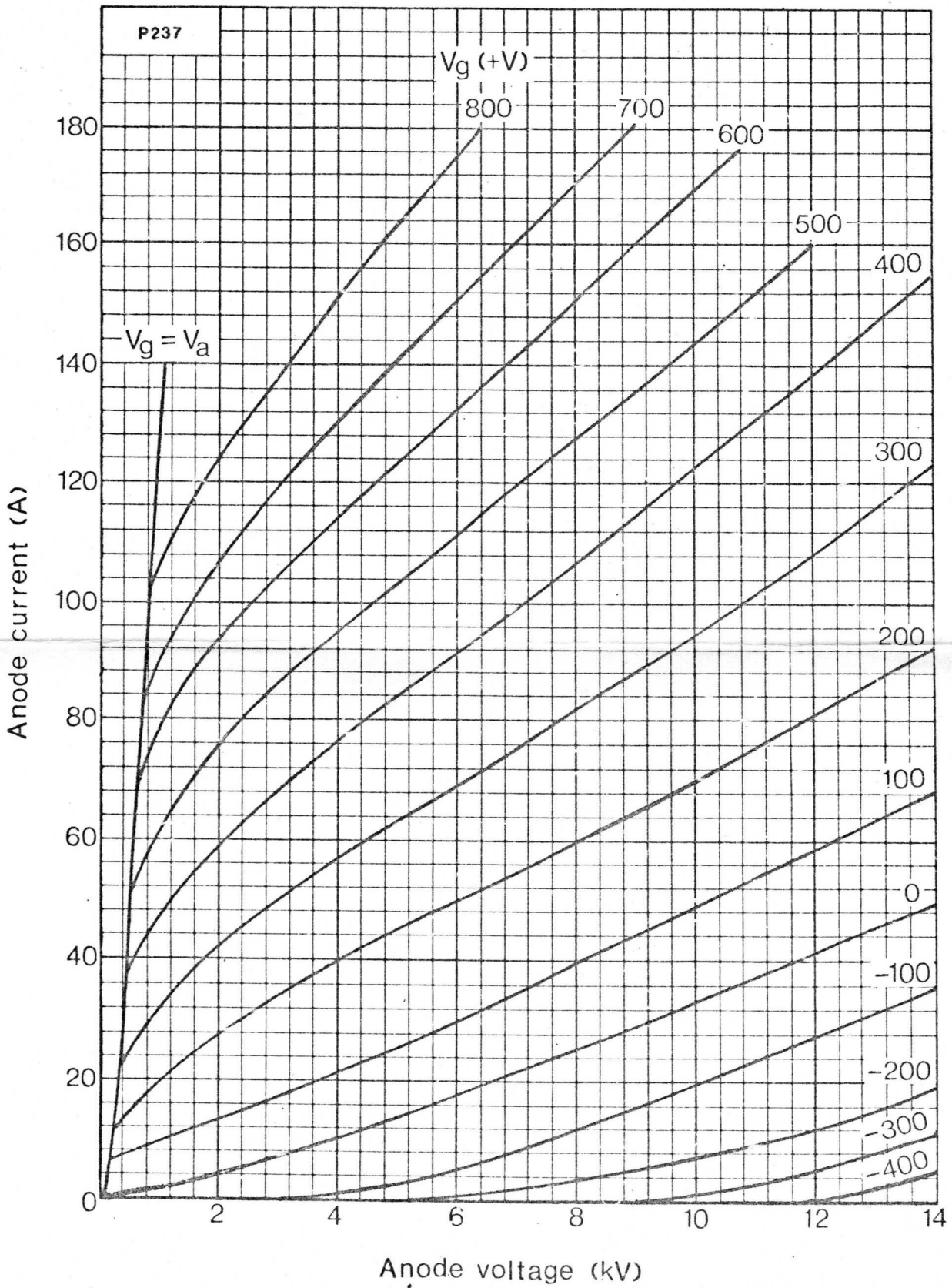
The filament and grid seals are cooled by forced-air. Normally an air flow of 60 ft<sup>3</sup>/min (1,7 m<sup>3</sup>/min) directed into the filament header from a 2 inch (50 mm) diameter orifice is sufficient for the purpose.

The maximum temperature of the filament and grid seals must not exceed 140°C.

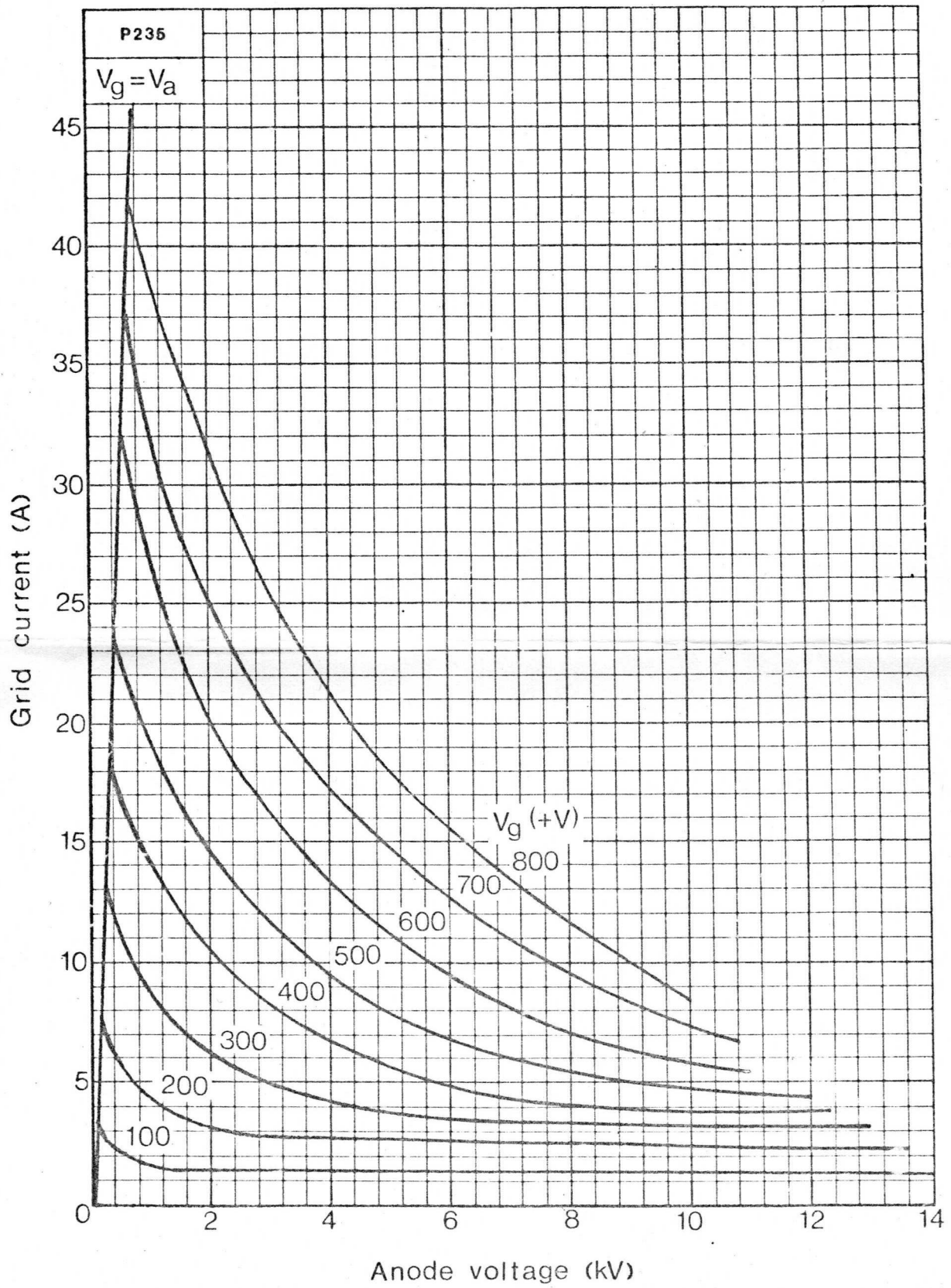
## MECHANICAL DATA

Dimensions	As shown in outline drawing included
Mounting position	Vertical, anode downwards
Net weight	125 lb (57 kg)
Accessories	
Boiler unit	} The tube manufacturer should be consulted as to types required for specific applications
Condenser	
Sealing ring	Type PSL024 supplied with tube
Thermal fuse	Type RSW011A, two supplied with tube
Tube lifting equipment	The tube should be lifted by four lifting hooks applied to the underside of the anode corona ring; the hooks being connected by suitable cables to a spreader plate and lifting tackle.

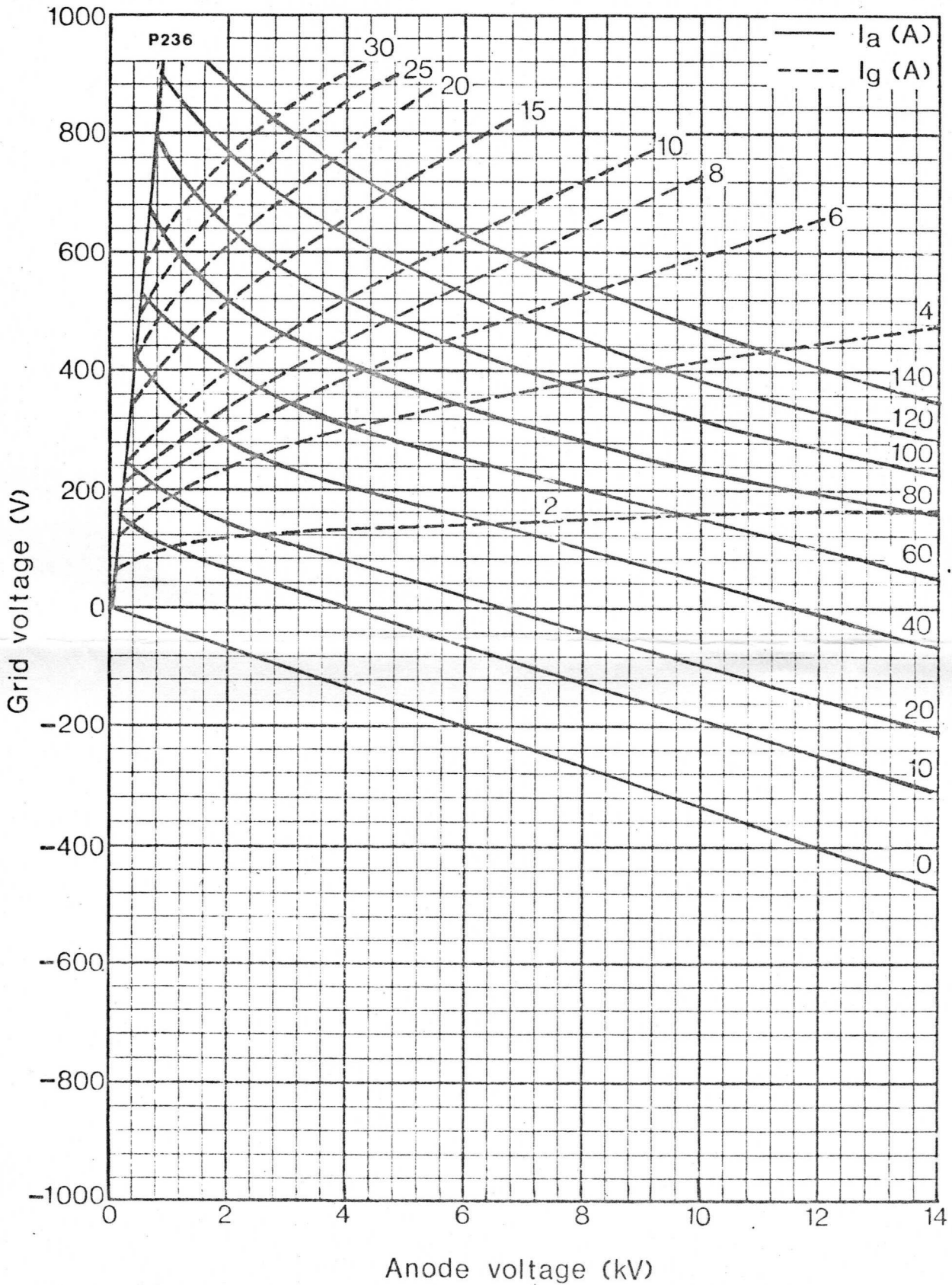
Anode Characteristics



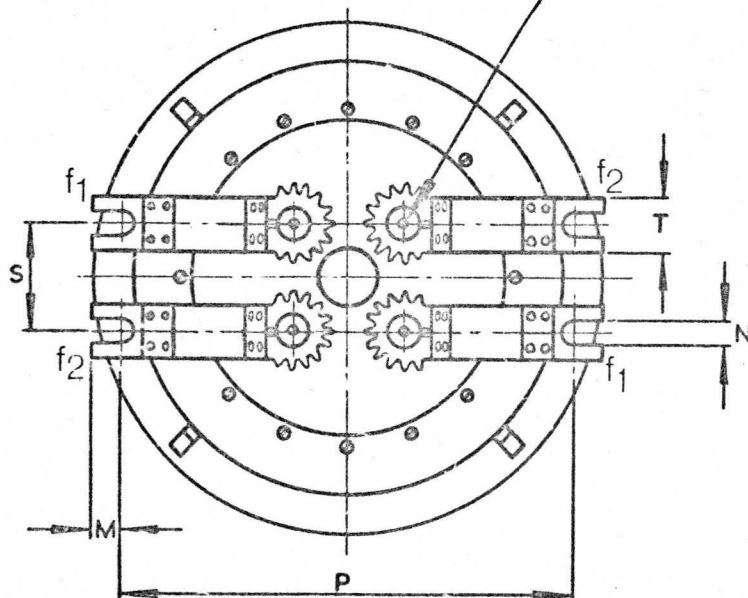
## Grid Characteristics



Constant Current Characteristics

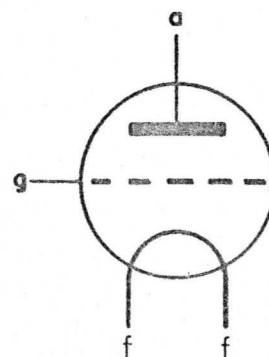
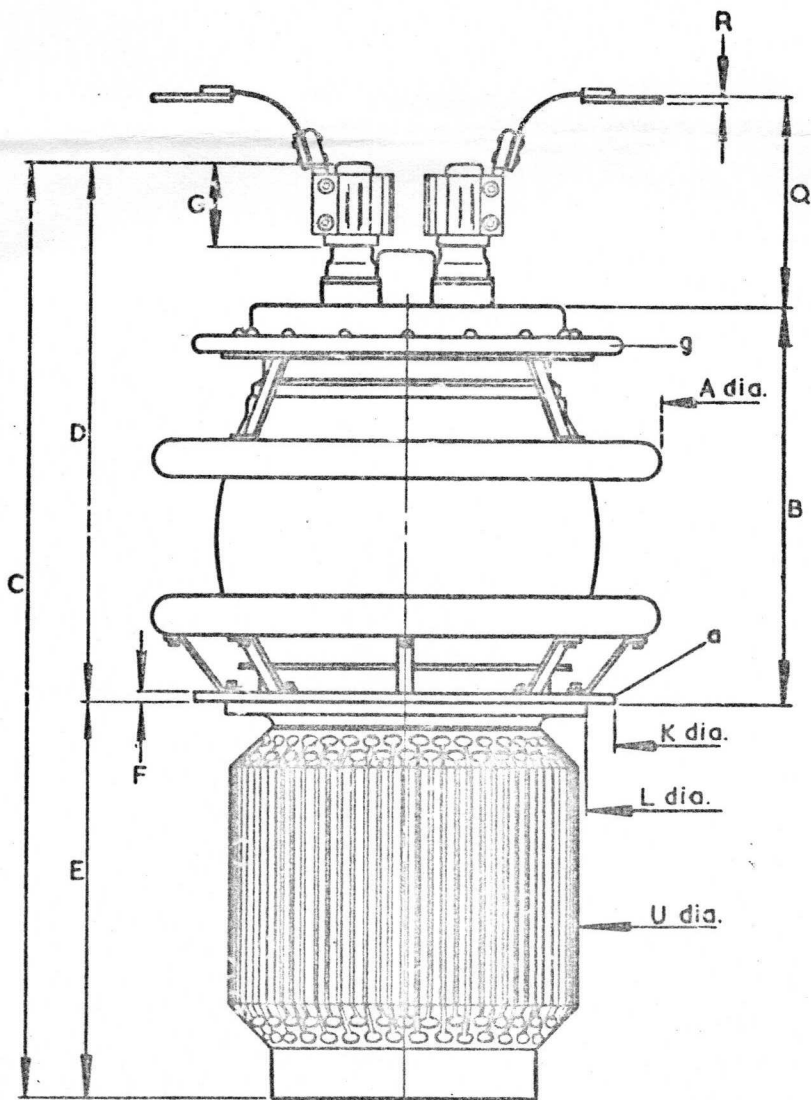


3Z/340G Outline  
4-filament posts  
H dia. on J p.c.d.



dim.	mm	in
A	332 max.	13.06 max.
B	256,8 ± 6,4	10.11 ± .25
C	610 max.	24.0 max.
D	351 max.	13.8 max.
E	259 max.	10.187 max.
F	6,35 ± 0,76	.25 ± .03
G	50,8	2.0
H	22,23 ± 0,13	.875 ± .005
J	101,6	4.0
K	274,64 ± 0,38	10.812 ± .015
L	236,53 ± 0,38	9.312 ± .015
M	19,0	.75
N	14,27	.562
P	296,85	11.687
Q	152	6.0
R	3,18	.125
S	71,83	2.828
T	31,75	1.25
U	228,6 max.	9.00 max.

Metric dimensions derived from original inch dimensions



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