'ENGLISH ELECTRIC' VALVES

ENGLISH ELECTRIC VALVE CO. LTD
CHELMSFORD ENGLAND

RECORD OF SUPPLEMENTARY ISSUES

ENGLISH ELECTRIC

Issue No.	Date Filed	Filed by
21	25/3/64	
22		
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27	1/9/65	
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37	"	
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39	"	
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ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

VALVE DATA BOOK

VOLUME ONE

(See overleaf for Volumes 2 and 3)

March 1966

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Printed in England

SEE VOLUME 2 FOR

KLYSTRONS

MAGNETRONS

TRAVELLING WAVE TUBES

BACKWARD WAVE OSCILLATORS

SEE VOLUME 3 FOR

STORAGE TUBES

IMAGE INTENSIFIERS

TELEVISION CAMERA TUBES

PHOTOMULTIPLIERS

CATHODE RAY TUBES

HYDROGEN THYRATRONS

TR AND TB CELLS

VACUUM CAPACITORS

COLD CATHODE TUBES

OTHER PRODUCTS

ENGLISH ELECTRIC VALVE CO. LTD.

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LIST OF CONTENTS
VOLUME ONE

The following provides a complete list of the contents of Volume 1 and gives the correct sequence in which the sheets should be filed. It will be reissued periodically to incorporate any changes and may be used to check the contents of the volume. The page numbers refer to the front of each sheet only.

It should be noted that certain types listed herein may not be available from current production and their supply may be subject to a suitable quantity being ordered.

Any correspondence relating to the Valve Data Book should quote the serial numbers inside the front covers of the volumes and should be addressed to:

English Electric Valve Company Limited,
Technical Publications Department,
Chelmsford, Essex.

Divider Card: Natural Cooled Triodes		June 1965
3C24	1,3,5	February 1958
5867	1	September 1965
B142	1	September 1965
B1152	1,3,5	December 1962
	7	March 1964
B1153	1,3,5,7	March 1964

Divider Card: Forced-air Cooled Triodes		June 1965
5736	1,3,5,7	September 1959
5762	1	June 1959
	3,5,7	February 1958
	9	December 1963
BR140	1	March 1959
	3,5,7,9	February 1958
BR153	1	September 1965
BR155	1	September 1965
BR161	1	September 1966
	3,5,7,9	September 1961
BR175	1	December 1967
BR179	1	September 1966
	3,5,7	December 1961
	9	March 1967
BR189	1	September 1966
	3	June 1961
	5,7,9	December 1960
	11	September 1965
BR194	1,3	March 1967
	5,7,9	December 1960
BR1102	1	September 1966
	3,5,7,9	December 1960
BR1103	1	September 1965
BR1106	1	September 1966
	3,5,7	June 1961
	9	March 1967
BR1115	1	September 1965
BR1121	1	December 1966
	3,5,7	June 1964
	9	September 1967
BR1122	1	December 1966
	3,5,7,9	December 1960

EQUIVALENTS INDEX

The following index lists valves of various manufacturers for which EEV valves may be used as replacements. The types listed in the column 'EEV Type' may be used as direct replacements for those under the heading 'Type to be replaced' except where indicated by an asterisk *. Types so indicated may have mechanical or slight electrical differences which can usually be accommodated by minor modifications to an equipment.

Type to be replaced	EEV Type	Type to be replaced	EEV Type
0A2	0A2	2J55	2J55
0A2WA	0A2WA	2J56	2J56
0B2	0B2	2V/531E	869B*
0B2WA	0B2WA	3-25D3	3C24*
0C2	0C2	3B24W	3B24W
0G3	QS1209/5651*	3B28	3B28
1B35A	BS412	3B29	3B24W*
1B37A	BS414	3C24	3C24
1B59	1B59	3C45	FX227
1G35P	4C35*	3C45/6130	FX227
1G45P	FX227*	3C45/PL345	FX227*
1K24	3B24W*	3F10TA	BW179*
1P21	27M1A	3F10TR	BR179*
2-25A	A235	3F15TR	BR161*
2B52	C1134*	3G15	AFX203*
2B94	C178A/5894*	3J/121E	BR152B
2G/473C	AX228	3J/122E	BR1138
2G22P	5C22*	3J/162J	BR1129
2H28	3B28*	3J/192E	BR1165*
2J30	2J30	3J/202E	BR1162*
2J31	2J31	3K3000LQ	3K3000LQ
2J32	2J32	3KM3000LA	3KM3000LA
2J33	2J33	3L5T	BR1162*
2J34	2J34	3T1100	B1153*
2J42	2J42	3V/340B	BT19
2J42A	6027	3V/390B	BT5
2J42H	2J42H	3V/490A	BT17*

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EQUIVALENTS INDEX

ENGLISH ELECTRIC

Type to be replaced	EEV Type	Type to be replaced	EEV Type
3V/500A	BT95*	4J44	4J44
3V5T	BW1162*	4J50	4J50A*
4-125	C1108*	4J50A	4J50A
4-125A	C1108*	4J52A	4J52A
4-250	C1112*	4J53	4J53
4-250A	C1112*	4KM100LA	K376
4-250A/5D22	C1112*	4KM100LF	K377
4-400A	C1136*	4KM50,000LA	4KM50,000LA
4B/550E	C1148*	4KM50,000LA3	K365*
4B/551E	C1166*	4KM50,000LQ	4KM50,000LQ
4B/602E	C1149/1	4KM50,000LR	4KM50,000LR
4B/603E	C1150/1	4PR60A	C1149/1*
4B13	813*	4PR60B	C1149/1*
4B32	4B32	5C22	5C22
4C35	4C35	5C22/HT415	5C22
4C35/PL435	4C35	5C22/PL522	5C22
4C35A	FX2505	5D22	C1112*
4CX1000A	4CX1000A	5D22/4-250A	C1112*
4CX1000K	4CX1000K	5F22	C1112*
4CX5000A	4CX5000A	5F23A	C1136*
4CX10,000D	4CX10,000D	5H69A	869B*
4CX35,000C	4CX35,000C	6D4	6D4
4D21	C1108*	6F66R	CR192*
4D32	4D32	6V202	K366E*
4F3TA	CW1100*	6V203	K366G*
4F3TR	CR1100*	6V431	K366E*
4F21	C1108*	6V432	K366E*
4H32	4B32*	7C23	BR1165
4J31	4J31	7C24	5762
4J32	4J32	7H57	AH205/857B*
4J33	4J33	7T24R	5762*
4J34	4J34	7V204	K366D*
4J35	4J35	7V205	K366C*
4J43	4J43	7V206	K366B*

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Type to be replaced	EEV Type	Type to be replaced	EEV Type
7V434	K366D*	12E12	C1150/1*
7V435	K366C*	12L01A	T922Z
7V436	K366B*	12L03A	T922Z
8B/08LB	T954Y	13C16	T960W
8B/08L2B	T954S	13E1	C1158
8B/08LM	T969Y	14D12	B1152
8B/08L2M	T969S	15D12	B1153
8B/08ZB	T954T	21/03TB	T952W
8B/08ZM	T969T	21/03ZB	T952T
8F66R	CR192*	22M1	1B59
8T11R	CR192A*	25T	3C24*
8T71R	BR189*	25TG	3C24*
8T92R	BR175*	27M1	27M1
8V207	K366A*	27M1A	27M1A
8V437	K366A*	27M2	27M2
9/02HM	T921Z	27M12A	27M12A
9C25	BR1102*	27M13	27M13
9L01A	T921Z	55B/200A	C1134
11E15	C1134	75B1	QS75/20
11E16	C178A/5894	85A2	QS1209/5651
11TA31	0A2*	90C1	QS1215
12/02HM	T922Z	95A1	QS95/10
12/03HB	T957Z	108C1	0B2
12/03LB	T957Y	150B2	QS1200
12/08L3M	T977D	150B3	QS150/15
12/10HB	T957Z	150C2	0A2
12/10LB	T957Y	150C3	0D3
12/44HM	T953Z	150C4	0A2*
12/44L2M	T953S	210–0069	BT19*
12/44L3M	T953S*	676	BT17*
12/48H2M	T963Z	715C	C1150/1*
12/48LM	T963Y	813	813
12/48L2M	T963S	857B	AH205/857B*
12/48L3M	T963D	869B	869B

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ENGLISH ELECTRIC

Type to be replaced	EEV Type	Type to be replaced	EEV Type
892R	BR175*	5822A	BK168/5822A
931A	27M1	5830	BT69*
1255FIM	7038*	5867	5867
1255IND	P810*	5894	C178A/5894*
1255NOR	7038*	5923	BW1165
1650/03HB	T958Z	5924	BR1165
1650/10HB	T958Z	6027	6027
2255	8626*	6027H	6027H
2255IND	P849*	6073	0A2
2255ROE	8541	6074	0B2
3069Q	T957Z	6075	CW1100
3069R	T986Z	6076	CR1100
3073Q	T957Y	6130	FX227*
4049D	AH221	6155	C1108*
4478	P810	6156	C1112*
5550	BK66/5550	6166	CR192*
5551A	BK42/5551A	6166A	CR192A*
5552A	BK24/5552A	6181	6181
5553B	BK146/5553B	6198	P810
5554	BK44/5554	6252	C1134*
5555	BK46/5555	6268/4C35	4C35
5557	BT19*	6279/5C22	5C22
5586	5586	6326	P813
5651	QS1209/5651*	6346	BK42/5551A
5651WA	QS1212	6347	BK24/5552A
5657	5657	6348	BK146/5553B
5671	BR189*	6354	QS1200
5736	5736	6421	BR1124*
5762	5762	6511	BK168/5822A
5762/7C24	5762	6512	BK44/5554
5762A	5762	6513	BK46/5555
5771	BW165*	6587	6587
5820	5820A/E	6626	0A2WA*
5820A	5820A/E	6627	0B2WA*

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Type to be replaced	EEV Type	Type to be replaced	EEV Type
6696	BW194*	8168/4CX1000A	4CX1000A
6777	6777	8170	4CX5000A
6849	6849	8170/4CX5000A	4CX5000A
6861	6861	8171	4CX10,000D
6866	E702B*	8171/ 4CX10,000D	4CX10,000D
6961	BR1162	8349	4CX35,000C
6972	M575*	8352	4CX1000K
7028	M599B	8356	8356
7038	7038	8357	8357
7182	7182	8438	C1136
7293	7293B	8503	8503
7293A	7293B	8507	8507
7293A/E	7293B	8541	8541
7293B	7293B	8566	8626
7294	8093B	8572	8572
7295	7295C	8625	8625
7295B	7295C	8626	8626
7295B/E	7295C	8684	BM25L
7295C	7295C	9549	5820A/E
7384	7384	9564	7295C
7389	7389C	9565	7389C
7389B	7389C	9661A	27M1A
7389B/E	7389C	9661B	27M1
7389C	7389C	9677	8626
7475	QS92/10*	9812PA	P849
7527	C1136	9814PA	P831
7669	BK442/7669	9817	P862
7671	BK444/7671	9817PA	8626
7672	BK468/7672	10667G	P810
7673	BK446/7673	55085	M519*
7735A	7735A	55100	M501* or M501A*
7972	C1158		
8093A	8093B		
8168	4CX1000A	55850	7038*

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ENGLISH ELECTRIC

Type to be replaced	EEV Type	Type to be replaced	EEV Type
A239	3B24W	ATL10-3	BR128B*
ACM3	BR1167*	AX4-125A/4D21	C1108*
ACS4	CR1100*	AX4-250A/5D22	C1112*
ACS5	4CX5000A	AX224	3B28
ACT9	BR152B	AX230	4B32
ACT14	BR140*	AX9903	C178A/5894*
ACT16	BR153*	AX9903/5894	C178A/5894*
ACT29	BR1138*	AX9904R	BR1165
ACT70	BR1160	AX9907	CW1100*
AF21-12	T964Z	AX9907R	CR1100*
AF31-10	T957Z	AX9910	C1134*
AF31-12	T965Z	AX9911	4C35*
AFX212	6D4	AX9912	5C22
AG3B28	3B28	B1109	3C24
AG869B	869B	B1135	5867
AG5209	QS1209/5651	BA9-20	N1010
AG5210	OB2	BR191B	5762
AG5211	OA2	BR1151	BR1161*
AH205	AH205/857B	BT79	FX227
AH211	AH211A*	BTL3-1	5762*
AH213	869B	BTL6-1	BR1106* BR1124*
AL21-12	T964Y		
AL31-10	T957Y	BTL15-2	BR161* BR1102*
AL31-12	T965Y		
AR10T	BK24/5552A	BW1115	BW1126
AR14T	BK42/5551A	BY1151	BY1161*
AR31	BK66/5550	C1A	AFX203*
ASG5017	BT19*	C143	813
ATC10-50	U50/15/30* U50/20/40*	C178A	C178A/5894
		C932	P810
		C933	7038
ATC15-75	U80/15/40* U75/15/40*	C960	5820A/E
		C962	8093B
ATCS10-200	U200/10*	C1111	C1150/1*

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Type to be replaced	EEV Type	Type to be replaced	EEV Type
C1123	4D32	E125A	C1108*
C1133	C1149/1*	E250A	C1112*
CAT3	BW173	E3033	4CX10,000D
CAT6	BW140	ECS3-30	U30/15/20*
CAT9	BW153	EE869B	869B
CAT29	BW1139	EM15LS	BM25L
CE869B	869B	EN93	6D4
CFHE6·5	UFC6/30/140J	ESA891	BR175*
CFHE12	UFC12/30/140J	ESA892	BR175*
CFHE18·5	UFC18/30/140J	ESA1500	BR1126*
CFHE34	UFC34/30/140J	ESU77	A207*
CO43	N1010*	ESU103	3B28
CO119	N1034*	ESU111	869B*
CR1101	6181	ESU150	AH238*
CVEP2000	UC2000/12/150J	ESU200	AH221*
CVHP250	UC250/30/150J	F21-10LC	T964Z
CVHP450	UC450/30/150J	F21-10LD	T964Y
CX1119	7384	F31-10LC	T965Z
D13-22GH	T979H*	F31-10LD	T965Y
D13-22GL	T979N*	F31-11LD	T957Y
DCG4/5000	AH221* or AH238*	F41-10LC	T958Z
		F-857B	AH205/857B*
DCG7/100	AH205/857B*	F-869B	869B
DCG9/20	869B*	F-892R	BR175*
DCX4/1000	3B28	FG17	BT19*
DCX4/5000	4B32	FG81A	BT89*
DQ4	AH238*	FG98A	BT89*
DQ4a	AH221*	FG235	BK24/5552A
DQ6	869B	FG238B	BK46/5555
DQ7	AH205/857B*	FG271	BK42/5551A
DR813	813	FTL3-2	5762*
DR857B	AH205/857B*	FTL8-1	BR1124*
DR869B	869B	FX42	XL615/7/3
DX2	3B28	FX47A	XL615/13/6·5

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Type to be replaced	EEV Type	Type to be replaced	EEV Type
FX47B	XL615/13/6·5	GXU2	4B32*
FX219	5C22	GXU3	AX228
FX225	4C35	GXU4	AX228*
FX290	8503	HK24G	3C24*
G10/1dV	3B28*	HT415	5C22*
G40	869B*	JCSL800	UF800/3/50J
G100A	AH205/857B*	JCSL900	UF900/3/50J
G180/2M	QS150/45	JP9–2·5D	M599A
GCS50-150	U150/15/40*	JP9–2·5E	M599B
GD85M/S	QS1209/5651	JP9-7	2J42
GD85PR/S	QS1212	JP9-7A	M508
GD90M	QS1215	JP9-7D	M503A
GD100A/S	QS92/10	JP9-15	M513B
GD100B/S	QS92/10*	JP9–18	M598B
GD150M/S	0A2	JP9-50	2J56
GD150P/S	QS1200	JP9–50A	2J55
GHT1	FX215*	JP9-75	M575
GL-4-250A/5D22	C1112*	JP9-80	4J52A
GL-4D21/4-125A	C1108*	JP9–180	M502A
GL–678	BT95*	JP9-250	4J50A
GL-813	813	JP9–250B	M529
GL-857B	AH205/857B*	JP9–250D	M539
GL-869B	869B	JP9–250E	M549
GL-892R	BR175*	JP9–250F	M538A
GL-5762	5762	K336	K350
GL-5894	C178A/5894*	K345 Series	K366 Series
GL-6181	6181	K347	K347A
GTR95M/S	QS95/10	K352	K390
GTR150M/S	QS150/15	KS6-1000 D,E,G	K366 D,E,G
GU18	AH238	KS7-1000 A,B,C	K366 A,B,C
GU20/21	AH221* / AH238*	KS9–40B	K3020*
		KS9–40D	K3003*
GU23	AH221*	KU28	FX2501
GXU1	3B28	KU72	CX1157

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Type to be replaced	EEV Type	Type to be replaced	EEV Type
KU99	FX227	MC567	M554*
L3219	M596	MD2901	BS452
LD577	T965Z	ME1101	2J42
LD605	N1055*	ME1101D	M503A
LD657	T964Y	ME1503	4C35
M502	4J50A	MG13-38	T940G*
M503	M503A	ML-7C24	5762
M506	M506A	ML-813	813
M510	2J30 to 2J34	ML-857B	AH205/857B*
M513	M513A	ML-869B	869B
M518A	4J31 to 4J35 & 4J53	ML-5736	5736
		ML-5894	C178A/5894*
M526	2J42	ML-6198	P810
M536	4J43 & 4J44	ML-6421	BR1124*
M537	M537A	MU13–38	T940B*
M538	M538A	MW13-38	T940W*
M542	5586	MX58	T979H*
M543	7182	MY13-38	T940R*
M551	4J52A	N1022M	6861
M559	8356	NL1051A	BK42/5551A*
M577	M577B	NL1052A	BK24/5552A*
M577A	M577B	NL1053A	BK146/5553B*
M578	M578B	NL1061	BK442/7669*
M578A	M578B	NL1062	BK444/7671*
M589	8357	NU813	813
M8098	QS1212	OS20F	8093B
M8142	QS1213	OS20H	8093B
M8223	0A2WA	OS40F	7293B
M8224	0B2WA	OS40H	7293B
MA3162	BS450	P120-1a	813*
MA3167	BS450*	P535/1E	C1150/1*
MA3167A	BS452*	P552/1E	C1149/1*
MAG3	2J42	P807	7293B
MAG11	M506A	P807/E	7293B

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Type to be replaced	EEV Type	Type to be replaced	EEV Type
P811	7295C	QQE06/40	C178A/5894
P811/E	7295C	QQV03-20A	C1134
P816	5820A/E	QQV06-40A	C178A/5894
P816/E	5820A/E	QS83/3	QS1209/5651
P822	7389C	QS1207	0A2
P822/E	7389C	QS1208	0B2
P841	8507	QS1209	QS1209/5651
P842	8541	QS1210	0A2WA
P843	8572	QS1211	0B2WA
P846	8625	QV20-P18	C1150/1*
P847	8626	QV20-P18B	C1149/1*
PE130A	3C24*	QY2-100	813
PL-4D21	C1108*	QY3-65	4D32*
PL-5C22/HT415	5C22	QY3-125	C1108
PL-5D22	C1112*	QY4-250	C1112
PL17	BT19*	QY4-400	C1136
PL165A	4C35*	QY5-3000A	CR1100
PL345	FX227*	QY5-3000W	CW1100
PL435	4C35*	R1130B	1B59
PL522	5C22	R1169	XL601
PMT65	T960W	RDM61	T953Z
Q160-1	C1108*	RDM62	T953S
Q400-1	C1112*	RDM68	T954S
Q450-1	C1136*	RDM71	T969S
QB2/250	813	RDM72	T969Y
QB3/300	C1108	RDM73	T969D
QB3·5/750	C1112	RDM74	T975D
QB4–1100	C1136	RG3-1250	AH238*
QBL5/3500	CR1100	RG4-1250	AH221
QBW5/3500	CW1100	RK4D32	4D32
QF41	BS332	RK813	813
QF41M	BS462	RR3-250	3B28
QF45	BS810	RR3-1250	4B32
QQE03/20	C1134	RR3-1250A	AX228

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Type to be replaced	EEV Type	Type to be replaced	EEV Type
RS630	5867*	T929G	T940G*
RS635	B1153*	T929R	T940R*
RS685	C1108*	T929W	T940W*
RS686	C1112*	T939Y	T957Y
RS726	BR1161	T939Z	T957Z
RS782	CR1100*	T948H	T979H*
RS822	BY189A* or BY1102*	T948N	T979N*
		T967H	T980H*
RS826	BY1161	T967X	T980X*
RS833	BY1122*	TB3/750	5867
RS1002A	C1136	TB4/1500	B1152
RS1007	C1108*	TB5/2500	B1153
RS1009	C178A/5894*	TBL6/6000	BR1165
RS1019	C1134*	TBL6/6000B	BR1160
RS2793	4CX5000A	TBL7/8000	BR1162
SAL39	K329*	TBW6/6000	BW1165
SK220A, B, C, D, E, G	K366A, B, C, D, E, G	TBW7/8000	BW1162
		TD25	C178A/5894
SK222A, B, C, D, E, G	K367A, B, C, D, E, G	TG200	4C35
		TG1000	5C22
SRS455	C1108*	TH2J30-34	2J30-34
SRS456	C1112*	TH3B24W	3B24W
SRS4451	C178A/5894*	TH4J50A	4J50A
SRS4452	C1134	TH4J52A	4J52A
StR85/10	QS1209/5651*	TH1230	2J30
StR108/30	0B2*	TH1231	2J31
StR150/30	0A2*	TH1232	2J32
STV85/10	QS1209/5651	TH1233	2J33
STV108/30	0B2	TH1234	2J34
STV150/30	0A2	TH1586	5586
SZ50	K351*	TH1657	5657
SZ53	K351	TH2220 Series	K366 Series
T813	813	TH5040	869B
T929B	T940B*	TH5221	3B28

EQUIVALENTS INDEX

ENGLISH ELECTRIC

Type to be replaced	EEV Type	Type to be replaced	EEV Type
TH5586	5586	TY7-6000H	BW1162J3
TH5657	5657	TY7-6000W	BW1162
TH6011	BT19*	U2000/2	U2000/3/40
TH6435	4C35	U2000/2P	U2000/3/40B
TH6522	5C22	UCS5-200	U200/10/40*
TH7010	BK66/5550		U200/15/40*
TH7020	BK42/5551A	UCS10-300	U300/10/40*
TH7030	BK24/5552A		U300/15/40*
TH7040	BK146/5553B	UCS10-400	U400/10/40
TH9700	7293B	UCSF12-500	U500/10/40A*
TH9701	8093B	UCSL7-1000 Series	U1000A/3/40J
TH9702	6849*		U1000A/3/40JA
TH9804	7038		U1000A/3/40JB
TH9812PA	P849	UCSL20-2000	U2000/3/40
TH9814PA	P831	UCSL50-3000	U3000/3/40J
TH9817	P860	UCSLPS10-750	U750/5-20/40J
TH9817PA	8626	UCSX25-700	U750/10/40*
TQ1/2	BT19*	UCSX25-1000	U1000/10/75J*
TRW1	BS800	UCSXF12-1000	U1000A/10/75J
TT10	813	UCSXF20-1500	U1500/8/75*
TT16D	C1108	UCSXF50-2000	U2000/8/75J
TT20	C1134	UCSXF750	U750/10/75J
TT25	C178A/5894*	UCSXF1200	U1200/10/75J
TX12-12W	BW140*	USL5-500	U500/5/40J
TY3-250	5867	UE813	813
TY5-500	B1152	V54	K358*
TY6-800	B1153	V154	K353*
TY6-3000A	BR1126	VA201B	K351
TY6-5000A	5762*	VA220 Series	K366 Series
	BR1165	VA222 Series	K367 Series
TY6-5000B	BR1160	VA508N	K397*
TY6-5000W	BW1165	VC507M	K350*
TY7-6000A	BR1162	VS70	QS92/10*

ENGLISH ELECTRIC VALVE CO. LTD.

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EQUIVALENTS INDEX

Type to be replaced	EEV Type	Type to be replaced	EEV Type
VT123	5586	XG5–500	BT19*
VT144	813	XG15–12	BT69
VVC50-42-20	U50/20/40*	XH3-045	FX227
VVC100-42-20	U100/20/40*	XH8-100	4C35
VVC200-42-7·5	U200/10/40	XH16-200	5C22
VVC200-42-15	U200/15/40*	XR1–1600	BT75*
VVC300-42-7·5	U300/10/40*	YD1120	BR1160
VVC300-42-15	U300/15/40*	YJ1040	8356*
VVC400-42-7·5	U400/10/40*	YJ1060	6027H
VVC500-42-10	U500/10/40*	YJ1070	M537A
WF42	BS458	YJ1071	M597
WF43	BS202	YJ1110	M5023
WL-5D22	C1112*	YJ1111	M5025
WL651/656	BK24/5552A	YJ1112	M5024
WL652	BK42/5551A	YJ1120	M515
WL655	BK146/5553B	YJ1121	M5022
WL681	BK66/5550*	YK1000	K365*
WL-813	813	YK1040	K351*
WL-857B	AH205/857B*	YK1071	K367A
WL-869B	869B	YK1072	K367B
WL-892R	BR175*	YK1073	K367C
WL-5736	5736	YK1074	K367D
X6·25	UF6/15/7	YK1075	K367G
X10	UF10/15/7J	YK1076	K367E
X1100	N1029	YK1090	K353
XG2–12	BT29*	YK1091	K358
XG2–500	BT19		

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BRITISH SERVICE TYPES
(CV) INDEX

Service Type	EEV Number	Service Type	EEV Number
CV5	AH221	CV1483	M519
CV26	813	CV1484	M519
CV28	BR152B	CV1485	M519
CV188	QS92/10	CV1486	M519
CV284	QS75/20	CV1600	BW173
CV286	QS95/10	CV1629	AH238
CV287	QS150/15	CV1742	BK44/5554
CV370	M508	CV1747	M505
CV372	FX227	CV1787	4C35
CV395	QS150/45	CV1807	2J31
CV422	QS108/45	CV1808	2J32
CV427	C1150/1	CV1809	2J33
CV434	QS75/60	CV1810	2J34
CV449	QS1209/5651	CV1832	OA2
CV460	BS48	CV1833	OB2
CV461	BS92	CV1835	3B28
CV462	BS84	CV1841	BS52
CV463	BS82	CV1881	BS384
CV464	T921Z	CV1897	4J34
CV482	A237	CV1898	4J35
CV513	4J53	CV1914	4J31
CV532	AH211A	CV1916	4J33
CV789	3C24	CV1927	B142
CV1070	QS92/10	CV1949	6D4
CV1144	BT19	CV1994	BR152B
CV1350	5867	CV2012	QS1209/5651
CV1435	AH221	CV2109	BT89
CV1475	M507	CV2124	BK24/5552A
CV1476	M507	CV2130	C1108
CV1477	M507	CV2131	C1112
CV1478	M507	CV2159	BR153
CV1479	M501	CV2160	A207
CV1480	M501	CV2162	T922Z
CV1481	M501	CV2164	K302
CV1482	M501	CV2181	BS104

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BRITISH SERVICE TYPES (CV) INDEX

ENGLISH ELECTRIC

Service Type	EEV Number	Service Type	EEV Number
CV2186	BM1031	CV2424	M549
CV2203	FX215	CV2425	M539
CV2225	QS1200	CV2426	M529
CV2263	K305	CV2473	M538A
CV2273	K312	CV2494	K351
CV2274	BS114	CV2496	K329
CV2281	M537	CV2518	4B32
CV2282	K308	CV2520	5C22
CV2284	4J50A	CV2673	AH205/857B
CV2304	K324	CV2723	AH213
CV2306	BS156	CV2736	3C24
CV2307	BS158	CV2744	4J34
CV2308	BS116	CV2774	68504
CV2309	BS118	CV2775	68506
CV2311	BS200	CV2797	C178A/5894
CV2312	BS202	CV2799	C1134
CV2322	BR161	CV2852	2J56
CV2323	BR179	CV2858	3B24W
CV2324	CR176	CV2868	AFX203
CV2343	K335	CV2871	BW140
CV2362	M525	CV2872	BW153
CV2363	M525	CV2902	GX402
CV2364	M525	CV3528	M513A
CV2365	M525	CV3540	5C22
CV2366	M525	CV3543	4D32
CV2367	M525	CV3611	5586
CV2368	M525	CV3629	FX227
CV2373	M502A	CV3659	M501A
CV2376	M521	CV3660	M501A
CV2381	N1034A	CV3661	M501A
CV2383	5762	CV3662	M501A
CV2393	N1010A	CV3676	2J42
CV2399	AX228	CV3815	3B22
CV2412	M523	CV3926	BR1165
CV2416	C1149/1	CV3958	5657

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BRITISH SERVICE TYPES
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Service Type	EEV Number	Service Type	EEV Number
CV3982	M506A	CV5877	E702A
CV4020	OA2WA	CV5959	C1136
CV4028	OB2WA	CV5987	E702B
CV4048	QS1212	CV5998	A292
CV4052	QS1202	CV6003	K342
CV4053	QS1203	CV6022	8503
CV4054	QS1213	CV6023	N1034S
CV4515	K337	CV6024	N1010S
CV5018	4J52A	CV6045	C1158
CV5023	AFX234	CV6051	CX1120
CV5031	M548	CV6057	BR1138
CV5083	QS75/20	CV6059	BW1139
CV5085	27M2	CV6070	BS310
CV5130	K337	CV6098	N1016M
CV5141	BT95	CV6106	N1017M
CV5167	BM1040	CV6108	M537A
CV5173	QS1215	CV6113	T963D
CV5218	BR189	CV6130	T977D
CV5219	CR1100	CV6131	C1149/1
CV5235	2J56	CV6132	BS440
CV5239	BR1162	CV6142	K391A
CV5268	7384	CV6167	T963Z
CV5285	QS1212	CV6172	T977Z
CV5289	5762	CV6178	BS816
CV5300	T956Y	CV6184	4CX10,000D
CV5362	6861	CV6192	BS814
CV5386	N1045M	CV6194	K391
CV5401	N1031	CV8131	N1042M
CV5402	N1032	CV8161	OA2
CV5403	N1033	CV8162	OB2
CV5406	N1001	CV8168	OA2WA
CV5407	N1002	CV8244	CR192A
CV5408	N1013	CV8295	4CX5000A
CV5426	K350	CV8505	8356
CV5819	T957Y	CV8506	K364

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BRITISH SERVICE TYPES
(CV) INDEX

ENGLISH ELECTRIC

Service Type	EEV Number	Service Type	EEV Number
CV8563	CX1140	CV9080	CX1159
CV8730	BR1160	CV9343	BR1161
CV8766	OC2	CV9422	E713B
CV8797	P831	CV9423	K3007
CV8904	M577A	CV9424	M5005
CV8905	M595B	CV10210	M577B
CV8908	N1047M		

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EEV VALVE NUMBERING SYSTEM

ENGLISH ELECTRIC

The majority of EEV valve type numbers consist of one or more letters followed by three or four figures. The first letter or group of letters indicates the functional classification of the valve (triode, tetrode, etc.), as shown in the following list; the figures form a serial number.

A	High Vacuum Rectifier
AFX	Rare Gas Filled Thyratron (Triode)
AH	Mercury Vapour Rectifier
AX	Xenon Filled Rectifier
B	Natural Cooled Triode
BD	Mercury Vapour Rectifier
BK	Ignitron
BM	Magnetron
BR	Forced-air Cooled Triode
BS	TR Cell, TB Cell, Solid State Microwave Device
BT	Mercury Vapour, Xenon Thyratron
BW	Water Cooled Triode
BY	Vapour Cooled Triode
C	Natural Cooled Tetrode
CR	Forced-air Cooled Tetrode
CW	Water Cooled Tetrode
CX	Hydrogen Thyratron (Tetrode)
E	Storage Tube
FX	Hydrogen Thyratron (Triode)
GX	Spark Gap
K	Klystron
M	Magnetron
N	Travelling Wave Tube, Backward Wave Oscillator
NFT	Nernst Filament
P	Television Camera Tube, Image Intensifier
QS	Voltage Stabiliser
QT	Trigger Tube
T	Cathode Ray Tube
U*	Vacuum Capacitor
XL	Glow Modulator, Flash Tube, Laser Tube

*In the case of vacuum capacitors, there may be a second letter which is related to the outline of the device. Following the letter or letters are groups of numbers indicating the maximum capacitance in picofarads, the peak r.f. voltage rating

EEV VALVE NUMBERING SYSTEM

ENGLISH ELECTRIC

in kilovolts and, where a third group is included, the r.m.s. current rating in amperes.

Where an EEV valve is an exact equivalent of an American type, the American number is used in order to facilitate recognition of the valve, particularly overseas. Such a valve may also have an EEV number by which it was known formerly and this is given at the top of each page of the data sheet for the sake of completeness. A typical example is shown below:

American Type No. **6861**

Former EEV No. **(N1022M)**

Valves which differ slightly from an American type but are close plug-in equivalents are given a double-barrelled type number. Two valves coming in this category are:

AH205/857B
C178A/5894

Where the EEV valve is not a close plug-in equivalent or the American valve does not have a JEDEC number, the EEV number is used and the American equivalent is stated.

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

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OVERSEAS REPRESENTATIVES AND DISTRIBUTORS

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ARGENTINE REPUBLIC

English Electric Marconi Argentina S.R.L.,
Paraguay 1122, **Buenos Aires.**
Telephone: 42-0490, 42-1358, 40-8894, 45-1508, 46-8772.
Cables: Expanse, Baires.
Telex: BA-12-1168.

AUSTRALIA

Camera Tube Distributors
Amalgamated Wireless (Australasia) Ltd.,
Engineering Products Division, 422 Lane Cove Road,
North Ryde (P.O. Box 96, Ryde 2112).
Telephone: 88 6666.
Cables: Wireless, Sydney.
Telex: 20623

General Distributors (excluding Camera Tubes)
Amalgamated Wireless Valve Company Pty. Ltd.,
348 Victoria Road, **Rydalmere, N.S.W.**
Post: Private Mail Bag, P.O., Ermington.
Telephone: Rydalmere 638 0411.
Cables: Valves, Ermington.

AUSTRIA

William Pattermann,
Rudolfinergasse 18, P.O. Box 101, **1190 Vienna XIX.**
Telephone: 36 36 47, 36 35 95.
Cables: Britubim, Vienna.
Telex: 7-4532.

BELGIUM

SAIT Electronics,
66 Chaussée de Ruisbroek, **Brussels 19.**
Telephone: 76.20.30.
Cables: Wireless, Brussels.
Telex: 21601.

BRAZIL

Brazileira de Comercio Exterior Ltda. (BRASCOM)
Av. Paulista, 960-s/601,
Sao Paulo, S.P.
Cables: Brascom, S. Paulo.

BRUNEI	As for Singapore.
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CANADA	English Electric Valve Company (Canada) Ltd., 24 Ronson Drive, **Rexdale, Ontario.** Telephone: 249-8548. Cables: Enelecan, Toronto. Telex: 02-2762.
CHINA	Marconi (China) Ltd., P.O. Box 186, **Hong Kong.** Telephone: 221189. Cables: Marchilim, Hongkong.
COLOMBIA	Representaciones y Promociones Industriales Ltda., Apartado Aereo 5660, **Bogota, D.E.** Telephone: 34-41-40. Cables: Repro Bogota.
CONGOLESE REPUBLIC	Société Anonyme Internationale de Télégraphie Sans Fil, Boulevard Albert 1er (B.P.8149) **Kinshasa (Leopoldville).** Telephone: Kinshasa 2371. Cables: Wireless, Kinshasa. **Also at** 909 Chaussée de Kasenga (B.P.1501), **Lubumbasi (Elisabethville).** Telephone: Lubumbasi 4687. Cables: Wireless, Lubumbasi. **Also at** 7 Place du Marche (B.P.55), **Matadi.** Telephone: Matadi 73. Cables: Wireless, Matadi.
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DENMARK	Sophus Berendsen A/S, Amaliegade 10, **Copenhagen K.** Telephone: (01) 14 85 00. Cables: Berendsen, Copenhagen. Telex: 2585.
FINLAND	Insinööritoimisto OY ASEKO AB, Vuorikatu, 22, **Helsinki 10.** Telephone: 625 953. Cables: Aseko, Helsinki.

FRANCE	Tranchant Electronique S.A., 19-21, Rue Madame de Sanzillon, Clichy (Seine), **Paris.** Telephone: 270-22-55, 270-26-10. Cables: Tranchantubes, Paris. Telex: 29 529 Paris.
GERMAN DEMOCRATIC REPUBLIC	Friedrich Bernhardt, Isoppgasse 23, Mauer, A-1238, **Vienna XXIII.** Telephone: 86 99 192. Cables: Hankobern, Vienna.
GERMAN FEDERAL REPUBLIC	Willy List, Franz-Rücker-Allee 42, **6 Frankfurt-am-Main-W. 13.** Telephone: 77 30 68. Cables: Listimex, Frankfurt-am-Main.
GREECE	Telectrotec, 18, Voulis Street, **Athens 126.** Telephone: 227 267, 641 075. Cables: Telectrocom, Athens.
HOLLAND	SAIT Electronics Nederland, Carel van Bylandtlaan, 15 - **'S-Gravenhage.** Telephone: 070-11 77 20. Telex: 32057.
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ICELAND	Orka Limited, P.O. Box 360, Laugavegur 178, **Reykjavik.** Telephone: 38000. Cables: Power, Reykjavik.
INDIA	Associated Instrument Manufacturers (India) Private Ltd., B.5 Gillander House, P.O. Box 2136, **Calcutta.** Cables: Aimil, Calcutta. **Also at** India House, Fort Street, P.O. Box 119, **Bombay, 1.** Telephone: 263082. Cables: Aimilbom, Bombay. **Also at** Sunlight Insurance Building, 26-27 Asaf Ali Road, **New Delhi.** Telephone: 26936. Cables: Aimildel, New Delhi. **Also at** Post Box 2756, **Madras 2.** Cables: Aimilmad, Madras.

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Leon Kouyoumdjian and Co.,
Fixit House, Sa'adoon Street, Alwiya, **Baghdad.**
Telephone: 83414, 83417.
Cables: Fixit, Baghdad.

ISRAEL

Alhoutyam Limited,
Zone A, Block 264, Haifa Port, **Haifa** (P.O.B. 1963).
Telephone: 64627, 64628.
Cables: Wireless, Haifa.

Also at Eilath Depot, P.O.B. 11, **Eilath.**
Telephone: 2423.
Cables: Wireless, Eilath.

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Telephone: 47 32 51-5, 47 97 41-4.
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Telex: Marconit 27386.

Also at Via Adige 39, 00198 **Rome.**
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Cables: Expanse, Rome.

Also at Via Comelico 3, 20135 **Milan.**
Telephone: 59 25 13, 59 24 89, 59 23 79.
Cables: Expanse, Milan.
Telex: Eecomarc 32467.

JAPAN

Cornes and Company Ltd.,
Maruzen Building, No. 6, Tori 2-chome, Nihonbashi,
Chuo-ku, (C.P.O. Box 158) **Tokyo.**
Telephone: 272-5571.
Cables: Cornes, Tokyo.
Telex: Cornes Tok 222 2987.

Also at Marden House, No. 110, 2-chome,
Utsubohon-machi, Nishi-ku, (C.P.O. Box 329) **Osaka.**
Telephone: 532-1012/1019.
Telex: Cornes Osa 525-4496.

KATANGA

As for Congolese Republic.

LUXEMBOURG

As for Belgium.

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Associated Instrument Manufacturers (Malaya) Ltd.,
468-7B, Ipoh Road, P.O. Box 767, **Kuala Lumpur.**
Telephone: 68122, 68123.
Cables: Aimil, Kuala Lumpur.

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MALAYSIA (cont.)	**Also at** Overseas Union Bank Building, Beach Street, P.O. Box 368, **Penang.** Telephone: 62912.
	Also at Malayan Finance Building, Jalan Yang Kalsom, **Ipoh.** Telephone: 72939.
	Also at 18, Jonker Street, **Malacca, 4.** Telephone: 2783.
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NEW ZEALAND	Amalgamated Wireless (Australasia) N.Z. Ltd., Commerce House, 126 Wakefield Street, P.O. Box 830, **Wellington, C.1.** Telephone: 43-191. Cables: Expanse, Wellington.
	Also at P.O. Box 1363, **Auckland and** P. O. Box 2084, **Christchurch.**
NORWAY	Norsk Marconikompani A/S, Ryensvingen 5, P.O. Box 50, Manglerud, **Oslo 6.** Telephone: 67 04 86. Cables: Marconi, Oslo. Telex: 6218, Oslo.
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	Also at 2 Gardee Trust Building, Napier Road, P.O. Box 213, **Lahore (West Pakistan).** Telephone: 64768. Cables: Friendship, Lahore.
	Also at Globe Chambers, 104 Motijheel, Ramna, **Dacca (East Pakistan).** Telephone: 80773 Cables: Friendship, Dacca.
PERU	Fernando Ezeta B, Casilla 3061, **Lima.** Cables: Feperu.

PORTUGAL	MEDITROM, Comercial de Equipamentos Técnicos, Lda. Rua Martens Ferrao, 26-5°, **Lisbon 1.** Telephone: 53 67 48, 53 67 67. Cables: Meditrom, Lisbon.
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SPAIN	Europea de Electronica S.A. (Eurotronica S.A.), Don Ramón de la Cruz, 90, **Madrid 6.** Telephone: 2551800. Cables: Eurotronica, Madrid. Telex: Eurot E 27284.
SWEDEN	Svenska Radio AB, Fack, **S-102 20 Stockholm.** Telephone: 22 31 40. Cables: Svenskradio, Stockholm. Telex: 10094 Svenskradio Sth.
SWITZERLAND	Roschi Telecommunication AG, Spitalgasse, 30, **3000 Bern.** Telephone: (031) 22 55 33. Cables: Weroschi Bern. Telex: 32137.
SYRIA	Attar Brothers Co. (Engineering), Brazil Street, P.O. Box 2771, **Damascus.** Telephone: 18100. Cables: Attarco, Damascus.
THAILAND	Vichien Pathana Ltd. Partnership, 428/1 Siphya Road, (G.P.O. Box 1656) **Bangkok.** Telephone: 31793. Cables: Vipat, Bangkok.

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TURKEY	Ratel Radio Telecommunication Co. Ltd., Okcu Musa Caddesi Bankalar Sarayi 23-25, Karaköy, **Istanbul.** (P.O. Box 923 Karaköy, Istanbul). Telephone: 44 14 17, 44 23 93. Cables: Ratelcom, Istanbul.
UNITED STATES of AMERICA	**Resident Representative** Dr. G. F. Brett, 5046 Nevada Street, **Philadelphia 31, Pa.** Telephone: Trinity 8-1047. **Camera Tube Distributors** Visual Electronics Corporation, 356 West 40th Street, **New York 18, N.Y.** Telephone: Pennsylvania 6-5840. Cables: Visualec, New York. **General Distributors** Calvert Electronics Inc., 220 East 23rd Street, **New York 10, N.Y.** Telephone: Oregon 9-1340. Cables: Calvertron, New York. Telex: 223415.
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VIETNAM	International Group Ltd., P.O. Box 1078, **Saigon.** Telephone: 24-305. Cables: Ingroup Saigon.

YUGOSLAVIA

Yugohemija Representatives, Department: Standard.
Terazije 39/I, P.O. Box 254, **Beograd.**
Telephone: 332-616, 332-617 and 334-139.
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Telex: 11390.

Also at Maksimirska 112, P.O.B. 504, **Zagreb.**
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Also at Kumiciceva 6, **Rijeka.**
Telephone: 41-519.
Cables: Standard, Rijeka.

and Dipl. Ing. Mario Jamnik,
Skapinova 8, **Ljubljana.**
Telephone: 20328.

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THERMIONIC RECTIFIERS

High Vacuum

Mercury Vapour

Gas Filled

December 1963

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

TABULATED DATA

THERMIONIC RECTIFIERS

HIGH VACUUM

EEV type	Filament voltage (V)	Filament current (A)	Peak inverse voltage max (kV)	Peak anode current max (A)	Mean anode current max (mA)	Nominal impedance (Ω)
3B24W	5.0	3.0	20	0.3	60	1490
A207	4.0	12	45	1.1	350	600
A237	4.0	12	65	1.5	250	1000
A296	6.3	32.5	25	6.5	1250	130

MERCURY VAPOUR

EEV type	Filament voltage (V)	Filament current (A)	Peak inverse voltage max (kV)	Peak anode current max (A)	Mean anode current max (A)	Max d.c. output 3-phase full wave	
						Voltage (kV)	Current (A)
869B	5.0	19	20	10	2.5	19	7.5
AH200	2.5	40	20	10	2.5	19	7.5
AH205/ 857B	5.0	30	22	40	10	21	30
AH211A	2.5	30	16	8.0	2.0	15.2	6.0
AH221	4.0	11	20	5.0	1.25	19	3.75
AH238	4.0	7.0	13	5.0	1.25	12.4	3.75
AH2511	5.0	11.5	15 2.5	12 20	3.0 5.0	14.4 2.38	9.0 15.0
BD10	5.0	9.0	1.0	25	8.0	0.95	24
BD12‡	5.0	35	1.0	2 x 50	2 x 16.5	0.95	49.5

‡ Full wave rectifier

GAS FILLED

EEV type	Filament voltage (V)	Filament current (A)	Peak inverse voltage max (kV)	Peak anode current max (A)	Mean anode current max (A)	Max d.c. output 3-phase full wave	
						Voltage (kV)	Current (A)
3B22†	2.5	6.25	0.725	2 x 4.0	2 x 0.5	0.69	1.5
4B32	5.0	7.1	10	5.0	1.25	9.5	3.75
68504†	2.3	18	30V, 5.0A d.c. output as full wave rectifier				
68506	2.3	18	75V, 6.0A d.c. output as half wave rectifier				
68530†	2.0	8.0	30V, 6.0A d.c. output as full wave rectifier				
AX228	4.0	11	13 10	6.0 6.0	1.25 1.50	12.3 9.5	3.75 4.50

† Full wave rectifier.

PREAMBLE

ENGLISH ELECTRIC

GENERAL

Absolute Ratings

All the maximum ratings in this section are absolute ratings. This means that the equipment designer is responsible for seeing that they are not exceeded, even momentarily, under any conditions of mains fluctuations, surges or component tolerances. (See British Standard Code of Practice CP 1005 : Parts 1 & 2 : 1954 'The Use of Electronic Valves'.)

Filament Voltage

The voltage applied to rectifier filaments should always be kept *as close as possible to the correct value* given in the data sheets. Any long-term variations from this value, particularly reductions in voltage, are liable to reduce the life of the valve and, unless otherwise indicated in the data for a particular valve, such long term variations from the correct voltage should not exceed $\pm 2{\cdot}5\%$. Temporary variations up to 5% should not seriously affect the life of the valve. In some cases, temporary variations over 5% are permissible and are indicated in the valve data. The voltage at the pins or leads of the valve (not at the transformer) should be checked regularly on a high grade meter.

Warming up time

The warming up time, before h.t. may safely be applied, varies considerably with the type of rectifier. Thus, in high vacuum types with thoriated tungsten filaments the h.t. may be applied immediately after the filament voltage. In rectifiers with xenon or other rare gas fillings the warming up time (given in the valve data) is generally less than 1 minute. In mercury vapour types, however, the temperature of the condensed mercury is of paramount importance and this is discussed separately later.

HIGH VACUUM RECTIFIERS

General purpose high vacuum rectifiers with thoriated tungsten filaments are supplementary to rectifiers with mercury vapour and rare gas fillings. Though generally handling much smaller currents they are capable of withstanding much higher values of peak inverse voltage and will operate satisfactorily under adverse conditions of ambient temperature, which preclude the use of mercury vapour rectifiers. They are not affected by stray r.f. fields or feedback and they do not give rise to high frequency transients often associated with gas discharges. For maximum life the thoriated tungsten filament should be operated as near as possible to the rated voltage throughout its life—temporary fluctuations up to $\pm$ 5% will not generally harm the valve.

Most rectifiers of this type employ refractory metal anodes which run at red heat under normal operating conditions. Nevertheless the anode dissipations of such valves must be kept within ratings if short life is to be avoided.

Although ambient temperature considerations are not nearly so onerous as in mercury vapour rectifiers, it is necessary to keep bulb and seal temperatures below the maximum allowable temperatures, as given on the data sheets, by providing for adequate circulation of air.

ENGLISH ELECTRIC

MERCURY VAPOUR AND XENON FILLED POWER RECTIFIERS

Installation and Operation

Mercury vapour rectifiers must always be mounted vertically with the filament connections at the bottom. Xenon filled rectifiers may be mounted in any position unless otherwise stated. Both types should be shielded from strong r.f. fields which would cause continuous ionisation, and for the same reason any r.f. feedback must be prevented. Rectifiers should be mounted sufficiently far apart to allow free air circulation between them. The published heating and cooling curves are only applicable to valves so mounted.

When a mercury vapour rectifier is first installed it should be run for at least 30 minutes at normal filament voltage before the h.t. is applied. This is to ensure that all mercury deposited on the anode and cathode structure due to movement during transit has been evaporated. The same precaution should be taken if the valve has been out of use or in store for a considerable period.

A xenon filled rectifier may be used immediately after the filament has heated (see the respective data sheets for heating times).

Anode Voltage Drop

One of the features which commends mercury vapour and gas filled rectifiers is the low value of internal voltage drop, which remains very constant throughout the life of the valve under widely varying load conditions. When the rectifier is new this will be of the order of 9 volts to 14 volts and at the end of life will have risen to the region of 20 volts.

In-phase and Quadrature Filament Supplies

Because of the low voltage drop across mercury vapour and gas filled rectifiers the low potential end of the filament at any instant will contribute more than its fair share of the anode current. If the anode and filament supplies are either in-phase or 180° out of phase with each other then throughout each conducting period it will be the same portion of the filament which is overworked. If, however, the filament supply is 90° out of phase with the anode supply then the two ends of the filament will be equally utilised since each in turn becomes negative during conducting periods. For given loading conditions quadrature operation will give longer trouble-free valve life although with small valves or light loading the improvement will not be so readily apparent as in the case of the higher power rectifiers operating in polyphase circuits. Whilst true quadrature operation is preferable, phase differences of 60° to 120° give worthwhile improvement over in-phase operation.

Condensed Mercury Temperature

The condensed mercury temperature is, for all practical purposes, the temperature of the outside of the bulb in the region where the mercury condenses. This region lies $\frac{1}{4}$ to $\frac{1}{2}$ inch above the top of the base. The condensed mercury temperature can best be measured by a thermocouple attached to the envelope at the condensing point. The safe operation and long life of mercury vapour rectifiers depend largely upon the condensed mercury temperature, and the limiting temperature range is published for each type.

If the condensed mercury temperature is too low, and if normal currents are drawn, the voltage drop across the valve will be high enough to damage the cathode surface.

If the condensed mercury temperature is too high, the peak inverse voltage that the valve can withstand will be reduced and arc-backs may occur.

Thus, it is most important to keep the condensed mercury temperature within the specified limits. With some rectifier types, two or even three ratings are given for different temperature ranges, the maximum peak inverse voltage varying with the temperature range.

Warming up time for Mercury Vapour Rectifiers

With mercury vapour rectifiers the heating time before the h.t. may be switched on is dependent upon two factors:

1. The heating time necessary to ensure full emission from the filament. This is usually 1 minute.
2. The temperature of the condensed mercury which must be within the limits given in the individual valve data. The time required to reach this temperature may well be considerably in excess of the filament heating time.

Of the above two heating times, that which is the greater determines the time which must elapse between switching on the filament and applying the h.t.

Where no air blast is employed and heating is by filament power only, the time necessary to reach the minimum condensed mercury temperature from cold may be obtained from the curves of total heating time versus ambient temperature* which are included in the valve data. If the valve is not being started from cold, the heating and cooling curves should be consulted. These curves are given in the data for each mercury vapour rectifier and their use is illustrated in the following example.

Assume that a rectifier type AH200 is to be started up from cold and the ambient temperature is 15°C. The curve of total heating time versus ambient temperature shows that 21·5 minutes must elapse before h.t. is applied.

If the valve then runs under full load until maximum bulb temperature is reached, the heating and cooling curve shows that the final rise of temperature above ambient will be 24·3°. Thus if the ambient temperature remains constant at 15°C the condensed mercury temperature will be 15+24·3 = 39·3°C. This is within the published working temperature limits. If the filament supply and h.t. were then switched off, for say 10 minutes, the cooling curve shows that the rise of temperature above ambient would drop to 15·3°. Since the ambient temperature remains 15°C the condensed mercury temperature would then be 30·3°C. This is again within the working temperature range and hence re-application of h.t. would only need to be delayed 1 minute for filament heating.

In the example quoted above the ambient temperature was such that no external heating or forced-air cooling was necessary to maintain the required condensed mercury temperature. Quite often, however, circumstances require some such

*The ambient temperature is best checked with an alcohol thermometer hung about 6 inches from the valve, with the bulb of the thermometer about ½ inch above the top of the valve base. It should, of course, always be checked under equilibrium conditions.

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additional control of temperature. In this case a thermostatically controlled air blast may be directed on to the rectifier bulb in the condensation region.

A $\frac{1}{2}$ to $\frac{3}{4}$ inch bore pipe with its open end about $\frac{1}{2}$ inch from the bulb is often satisfactory. This pipe should include at least a 3-inch length of insulating material to prevent flashovers. Normally a pressure of about $\frac{1}{2}$ inch water gauge will provide sufficient air flow although the higher the rate of flow the nearer the condensed mercury temperature will approach that of the air blast.

If the air blast is heated in order to raise the condensed mercury temperature then it is desirable to employ a shield tube surrounding the lower part of the valve in order to maintain the whole of this region at or near the air-blast temperature. If no shield is used the mercury will condense at some point diametrically opposite to that being blown due to the lower temperature at that point.

SMOOTHING FILTERS

In many industrial applications, particularly when three phase full wave circuits are used, smoothing of the d.c. output by filters is not necessary.

When filters are used with mercury vapour rectifiers, these are usually of the choke input type in order to limit the peak currents. The filter inductance must have a value at least equal to the critical inductance if conduction is to be continuous. Since the theoretical values of the critical inductance are based on certain assumptions which do not hold in practice (e.g. that there is no ripple at the output from the first section of the filter) it is advisable in practice to multiply them by a factor of about 1·25. Both of these values are given in Table 1 (Columns 3 and 4).

When a valve is used at considerably less than maximum ratings, it may be used (without damage to the valve) with smaller values of inductance than the critical inductance provided that the peak current rating is not exceeded. This would, of course, mean that the conduction would not be continuous—a condition usually avoided where filters are used.

But it is not sufficient merely to ensure that the conduction is continuous—it is also necessary, when operating at or near the maximum ratings, to pay attention to the ratio of peak to mean anode currents. All E.E.V. mercury vapour rectifiers have maximum ratings based on a ratio of 4 : 1 peak to mean anode current. With single phase operation it so happens that, when the critical inductance is used, the ratio is just 4 : 1 so that this is a satisfactory condition of operation. Under these conditions the valve will reach both peak and mean rating limits simultaneously.

When the critical inductance is used with 3 phase operation it results in a peak to mean current ratio of 6 : 1 which is not permissible if the maximum value of mean current is desired.

Column 5 in Table 1 gives the inductance for a peak to mean current ratio of 4 : 1.

The filter inductance should be proportional to the load resistance. With a varying load resistance it is usual to adopt a swinging choke which can generally be designed to give an inductance not less than the desired value at maximum output

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and not less than the critical value at all higher values of the load resistance. In extreme cases where it is impracticable to design a suitable swinging choke, some other load may be added, or a bleed resistor.

The ratio of actual peak to mean anode currents in a valve is given by

$$\text{Ratio } \frac{\text{peak current}}{\text{mean current}} = K_1 K_2$$

where K_1 = theoretical value of peak to mean anode currents with infinite filter inductance as given in Table 2, namely:
2·0 for Circuits A and B and
3·0 for Circuits C and D.

and $K_2 = \dfrac{\text{peak current with actual filter inductance}}{\text{peak current with infinite filter inductance}}$

given in Fig. 1 as a function of K_3

where $K_3 = \dfrac{\text{actual filter inductance}}{\text{critical filter inductance}}$

In Fig. 1 the points corresponding to a 4 : 1 current ratio for both single and three phase operation are marked.

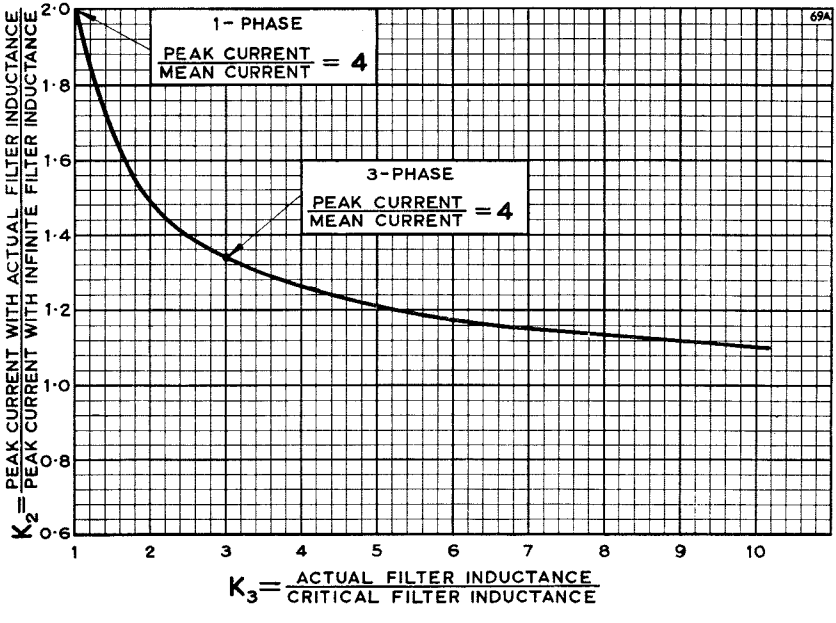

Fig. 1

TABLE 1

Input inductance in choke input filters

Mains Frequency 50c/s. L_{crit} = critical inductance

Column 1	2	3	4	5
Circuit	Diagram	L_{crit} Henrys	$L_{crit.} \times 1{\cdot}25$ Henrys	Inductance for peak/mean anode current = 4 : 1 Henrys
Single Phase Full Wave	A	$R_L/950$	$R_L/760$	$R_L/760$
Single Phase Full Wave Bridge	B	$R_L/950$	$R_L/760$	$R_L/760$
Three Phase Half Wave	C	$R_L/3800$	$R_L/3000$	$R_L/1000$
Three Phase Full Wave	D	$R_L/31000$	$R_L/25000$	$R_L/830$

where R_L = load resistance = output voltage/output current.

The design of smoothing filters is given in detail by Lee (Ref. 1, pp. 133–138). With grid controlled rectifiers the value of the critical inductance is very much increased—see Overbeck (Ref. 2).

References to Rectifiers and Filters

1. REUBEN LEE, 'Electronic Transformers and Circuits', John Wiley & Sons Inc., Chapman & Hall Ltd., 2nd ed. 1955.

2. OVERBECK, W. P., 'Critical inductance and control rectifiers,' **Proc. I.R.E.**, Vol. 10, October 1939, p. 655.

TABLE 2

Voltage, Current and Power Relationships

		Circuit A	Circuit B	Circuit C		Circuit D
				Full Load	Zero Load	
Voltage	($V_{d.c.} = 1$)					
	$V_{r.m.s.}$	1·11	1·11	0·855	*Note* 4	0·428
	V_i	3·14	1·57	2·09	*Note* 4	1·05
	$V_i/V_{r.m.s.}$	2·83	1·42	2·45	2·83	2·45
Current	$\frac{I_L}{I_{mean}}$	2·0	2·0	3·0		3·0
Power	(Output kVA = 1)					
	Primary kVA	1·11	1·11	1·21		1·05
	Secondary kVA	1·57	1·11	1·48		1·05

$V_{d.c.}$ = Output voltage to filter.
$V_{r.m.s.}$ = Transformer secondary voltage per leg.
V_i = Maximum peak inverse voltage across any valve.
I_L = Load current.
I_{mean} = Average anode current per valve.

Notes

1. Above values are for choke input filter with infinite inductance choke.
2. Voltage drops in rectifiers and transformers are neglected.
3. Sinusoidal input waveform.
4. When, in circuits A, B, C and D, the load current falls to zero there is no voltage drop across the choke and the voltage across the capacitor following the choke builds up to the peak value of the transformer voltage. In circuits A, B and D this does not increase the peak inverse voltage across the valves but in circuit C it increases the peak inverse voltage from $2{\cdot}45V_{r.m.s.}$ to $2{\cdot}83V_{r.m.s.}$. For practical purposes the value of $V_i/V_{r.m.s.}$ for intermediate values of load may be obtained by linear interpolation.

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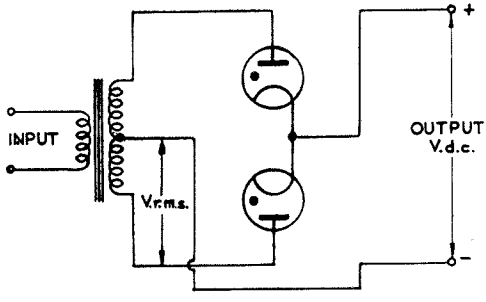
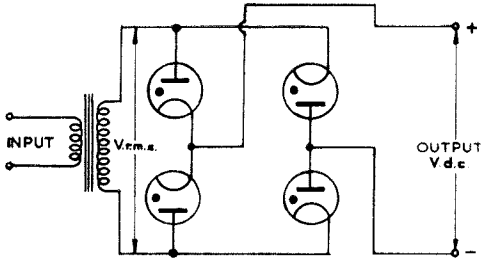
TYPICAL RECTIFIER CIRCUITS FOR CHOKE INPUT FILTERS



Circuit 'A' Single Phase Full Wave



Circuit 'B' Single Phase Full Wave Bridge

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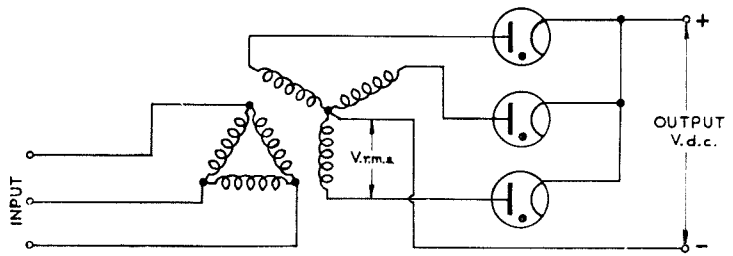
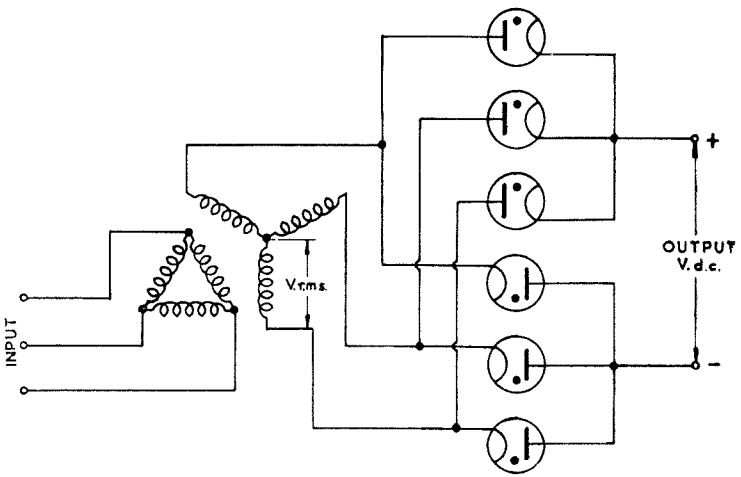
TYPICAL RECTIFIER CIRCUITS FOR CHOKE INPUT FILTERS



Circuit 'C' Three Phase Half Wave



Circuit 'D' Three Phase Full Wave

High Vacuum Rectifiers

June 1965

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

HIGH VACUUM RECTIFIER

3B24W
(A239)

Service Type CV2858 **American Designation 3B24W**

INTRODUCTION

The 3B24W is a High Vacuum Rectifier with maximum ratings of 20kV peak inverse voltage and 300mA peak current. Small size and extremely rugged construction make this valve suitable for use in aircraft applications and other locations where vibration and shock must be met.

GENERAL DATA

(See also Preamble to Rectifier Section of this Catalogue)

Electrical

Filament	Thoriated Tungsten	
Filament Voltage	2·5 or 5·0	V
Filament Current	6·0 or 3·0	A
Max Peak Inverse Voltage	20·0	kV
Max Anode Current:		
Peak	300	mA
Mean	60	mA

Mechanical

Overall Length	4·80 inches (122 mm)	Max
Overall Diameter	1·58 inches (40 mm)	Max
Net Weight	2 ounces (57 gm)	Approx
Base	Medium UX4	
Mounting Position	Vertical, base up or down	
Max Temperature of bulb	200°C	
Cooling	Natural	

If the valve is mounted well clear of other hot bodies and free circulation of cool air is not impeded, then natural cooling should maintain the bulb temperature below the permitted maximum. For this reason the use of a shrouded anode connector is not recommended. If the above conditions cannot be met some form of forced draught should be employed.

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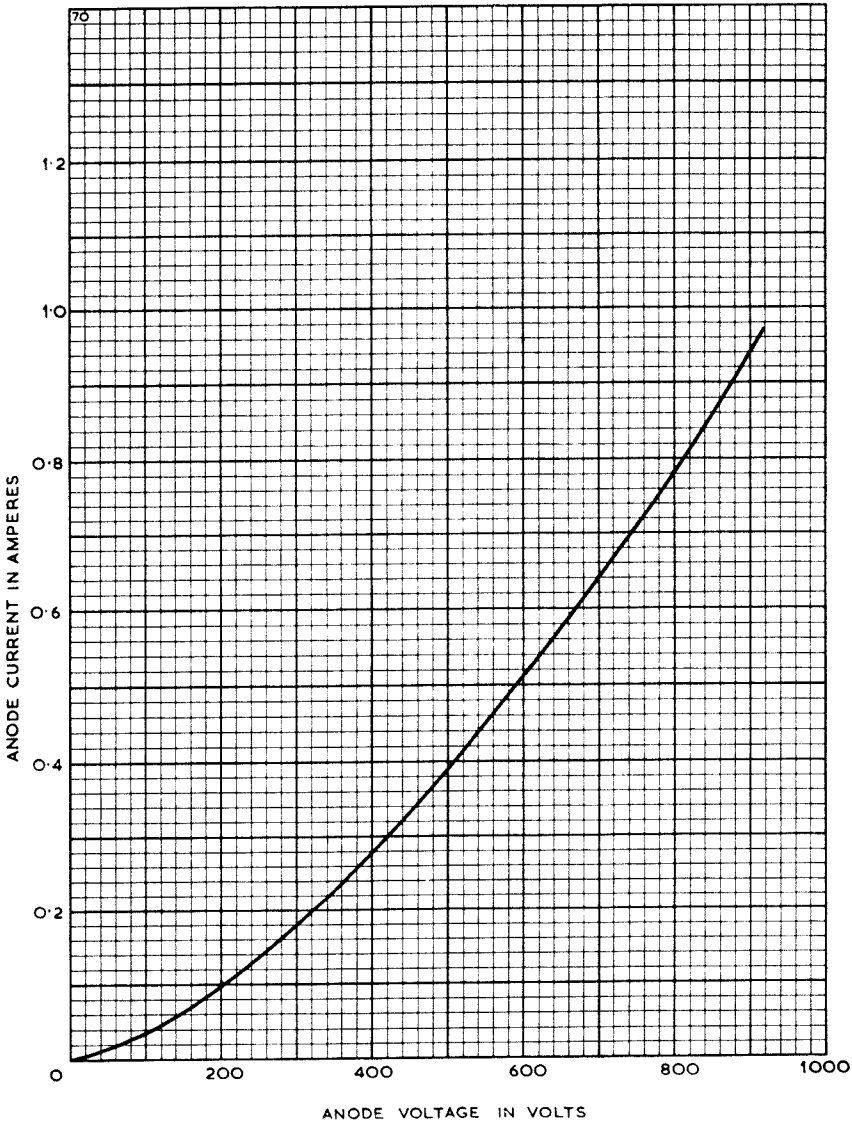
ANODE CHARACTERISTIC



OUTLINE

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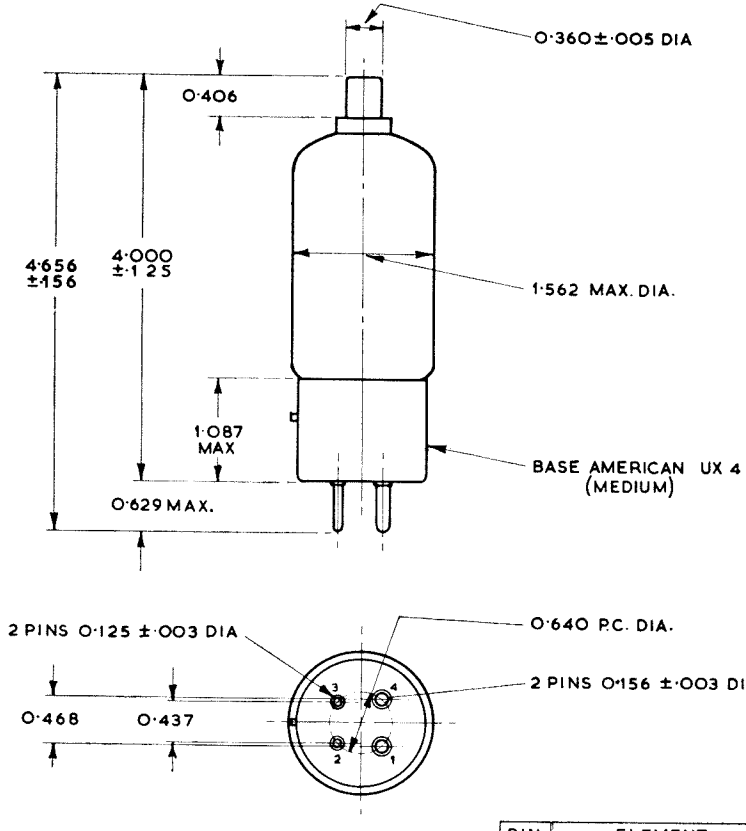

PIN	ELEMENT
1	FILAMENT CENTRE TAP
2	FILAMENT
3	NO CONNECTION
4	FILAMENT
CAP	ANODE

ALL DIMENSIONS IN INCHES

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A207

HIGH VACUUM RECTIFIER

Service Type CV2160

INTRODUCTION

The A207 is a high vacuum rectifier with maximum ratings of 45kV peak inverse ← voltage and 1·1A peak anode current.

GENERAL DATA

(See also Preamble to Rectifier Section of this Catalogue)

Electrical

Filament	Thoriated Tungsten	
Filament Voltage	4·0	V
Filament Current	12·0	A
Max Peak Inverse Voltage	45·0	kV ←
Max Anode Dissipation	130	W
Max Anode Current:		
Peak	1·1	A
Mean	350	mA
Nominal Impedance (at 300mA)	600	Ω

Mechanical

Overall Length	9·85 inches	(250 mm)	Max
Overall Diameter	2·37 inches	(60 mm)	Max
Net Weight	11 ounces	(300 gm)	Approx
Base	Standard Goliath Screw (E40/45A)		
Mounting Position	Vertical, either way up		
Max temperature of bulb	200	°C	

X-RAY WARNING

X-rays are produced when the A207 is operated with a peak inverse anode voltage above 16kV (absolute value). These rays can constitute a health hazard unless the valve is adequately shielded for X-ray radiation. This is entirely a function of high voltage devices and does not reflect upon the design of the valve.

← Indicates a change

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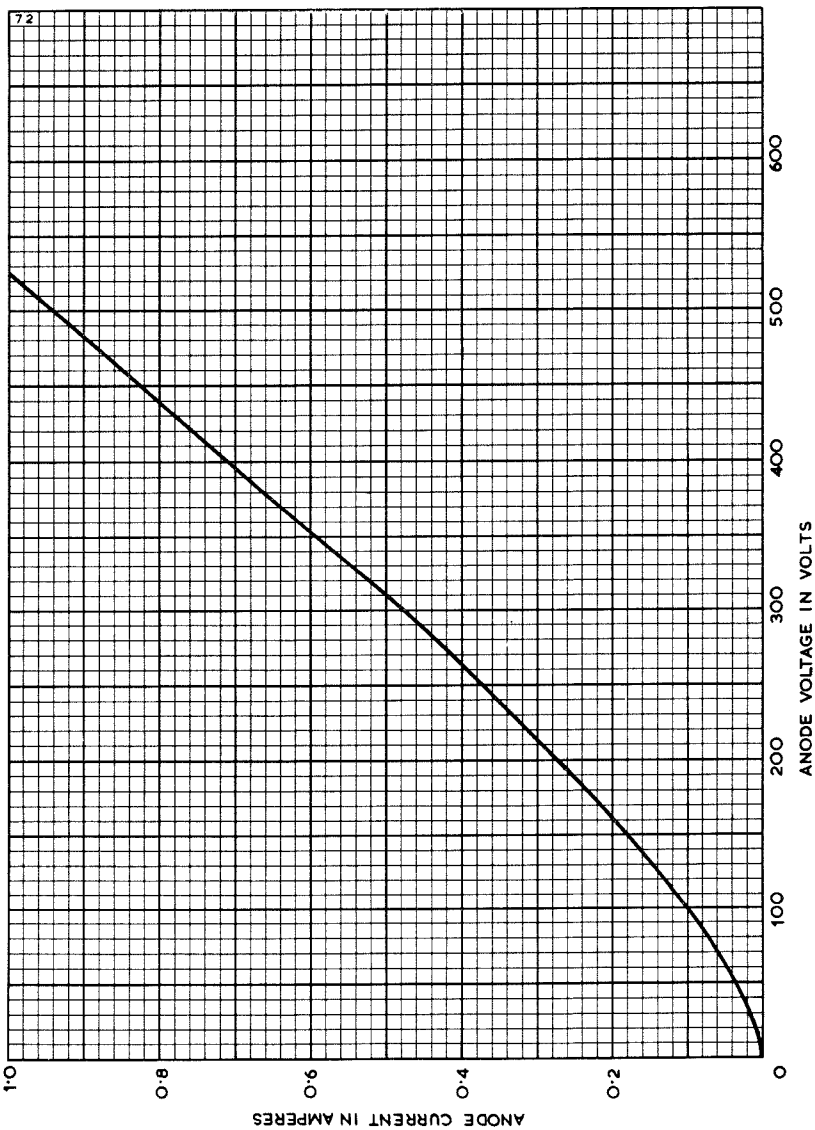
A207

HIGH VACUUM RECTIFIER

ANODE CHARACTERISTIC



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HIGH VACUUM RECTIFIER

OUTLINE

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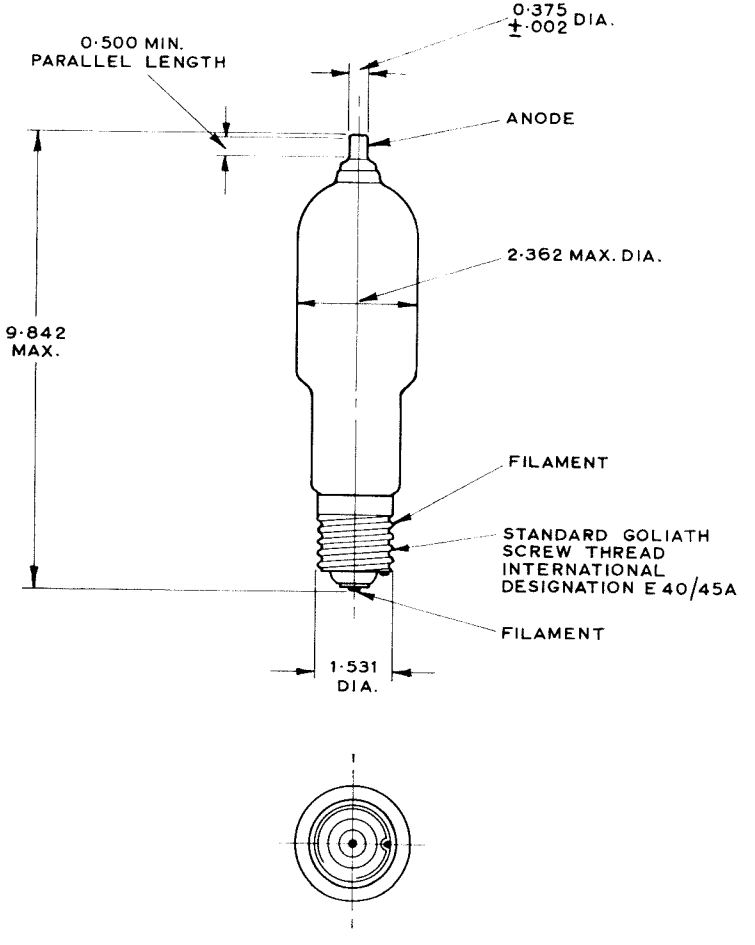

ALL DIMENSIONS IN INCHES

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A235

HIGH VACUUM RECTIFIER

American Equivalent 2-25A

INTRODUCTION

The A235 is a high vacuum rectifier with maximum ratings of 25kV peak inverse voltage and 500mA peak anode current. Small size and low filament power requirements make it suitable for a variety of high voltage applications.

GENERAL DATA

(See also Preamble to Rectifier Section of this Catalogue)

Electrical

Filament	Thoriated Tungsten	
Filament Voltage	6·3	V
Filament Current	3·0	A
Max Peak Inverse Voltage	25	kV
Max Anode Dissipation	15	W
Max Anode Current:		
Peak	500	mA
Mean	50	mA

Mechanical

Overall Length	4·38 inches (111 mm)	Max
Overall Diameter	1·44 inches (36 mm)	Max
Net Weight	1·0 ounce (28 gm)	Approx
Base	Small UX4, metal shell	
Mounting Position	Vertical, base up or down	
Cooling		Natural
Max temperature of anode seal	225	°C

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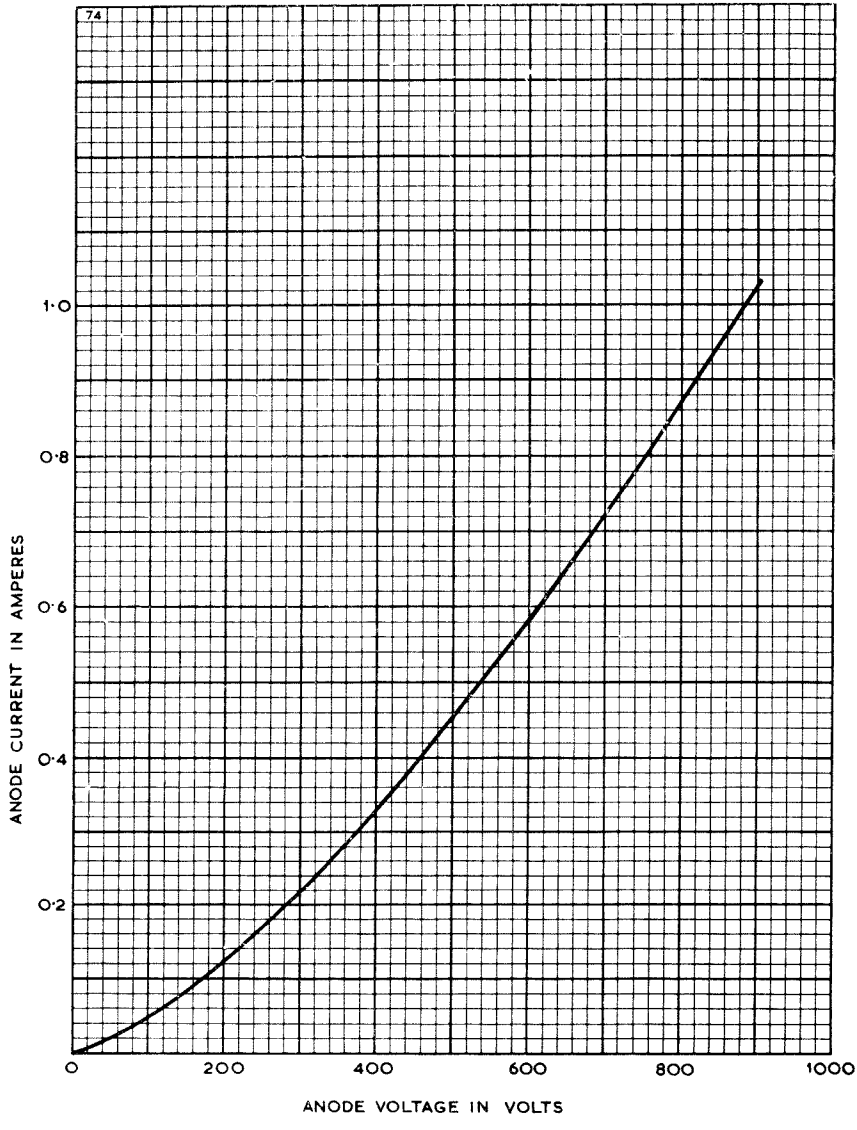
HIGH VACUUM RECTIFIER

ANODE CHARACTERISTIC



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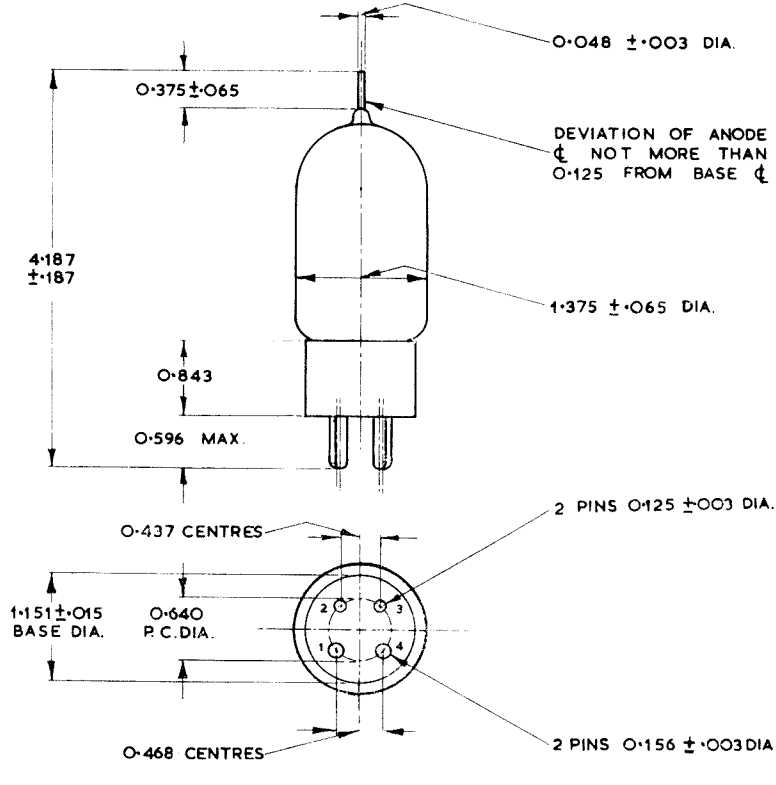

PIN	ELEMENT
1	FILAMENT
2	NO CONNECTION
3	NO CONNECTION
4	FILAMENT
TOP	ANODE

ALL DIMENSIONS IN INCHES

HIGH VACUUM RECTIFIER

A237

Service Type CV482

INTRODUCTION

The A237 is a high vacuum rectifier with maximum ratings (in air) of 65kV peak inverse voltage and 1·5A peak anode current. It is of compact construction and has been designed for very reliable operation at high voltage.

GENERAL DATA

(See also Preamble to Rectifier Section of this Catalogue)

Electrical

Filament	Thoriated Tungsten		
Filament Voltage	4·0		V
Filament Current	12·0		A
Max Peak Inverse Voltage	40	65	kV
Max Continuous Anode Dissipation:			
Natural Cooling	120	100	W
Forced-air Cooling (*See Note* 1)	160	100	W
Max Anode Current:			
Peak	1·5		A
Mean (*See Note* 2)	250		mA
Nominal Impedance (at 350mA)	1000		Ω

Mechanical

Overall Length	9·85 inches	(250 mm)	Max
Overall Diameter	2·37 inches	(60 mm)	Max
Net Weight	9 ounces	(260 gm)	Approx
Base	Goliath Edison Screw		
Mounting Position (*See Installation on page* 2)	Vertical		
Max Temperature of bulb	200		°C

NOTES

1. With forced-air cooling the continuous anode dissipation may be increased up to the absolute maximum of 160W provided that the peak inverse voltage does not exceed 40kV and also provided that the temperature of the glass envelope does not exceed 200°C at any point. Above 40kV the continuous anode dissipation must not exceed 100W under any conditions. The airflow ← must be such that all-round cooling is achieved and no part of the glass envelope must attain a temperature greater than 200°C. Normally the hottest part is the area round the anode, but the anode seal may also require attention.
2. The mean value of the anode current is a function of the waveform. It should ← be determined for each particular application and must be such that the maximum anode dissipation is not exceeded.

← Indicates a change

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HIGH VACUUM RECTIFIER

INSTALLATION

The valve should be operated in a vertical position, with the base screw at the bottom. The reversed position is permitted if overheating of the base can be avoided. The holder of the valve should be sprung to avoid the transmission of sharp shocks which might cause breakage of the thoriated tungsten filament.

In view of the low voltage high current filament supply it is essential that the valve is screwed tightly into the socket and that a very good contact is always maintained.

Sufficient clearance must be allowed to avoid sparking or corona at high voltages. It is also important that the air round the valve is not confined, but allowed to circulate freely to dissipate the heat generated. When working at or near the maximum rating for natural cooling it is advisable to provide channels in order to increase the convection by chimney effect.

→ X-RAY WARNING

X-rays are produced when the A237 is operated with a peak inverse anode voltage above 16kV (absolute value). These rays can constitute a health hazard unless the valve is adequately shielded for X-ray radiation. This is entirely a function of high voltage devices and does not reflect upon the design of the valve.

→ Indicates a change

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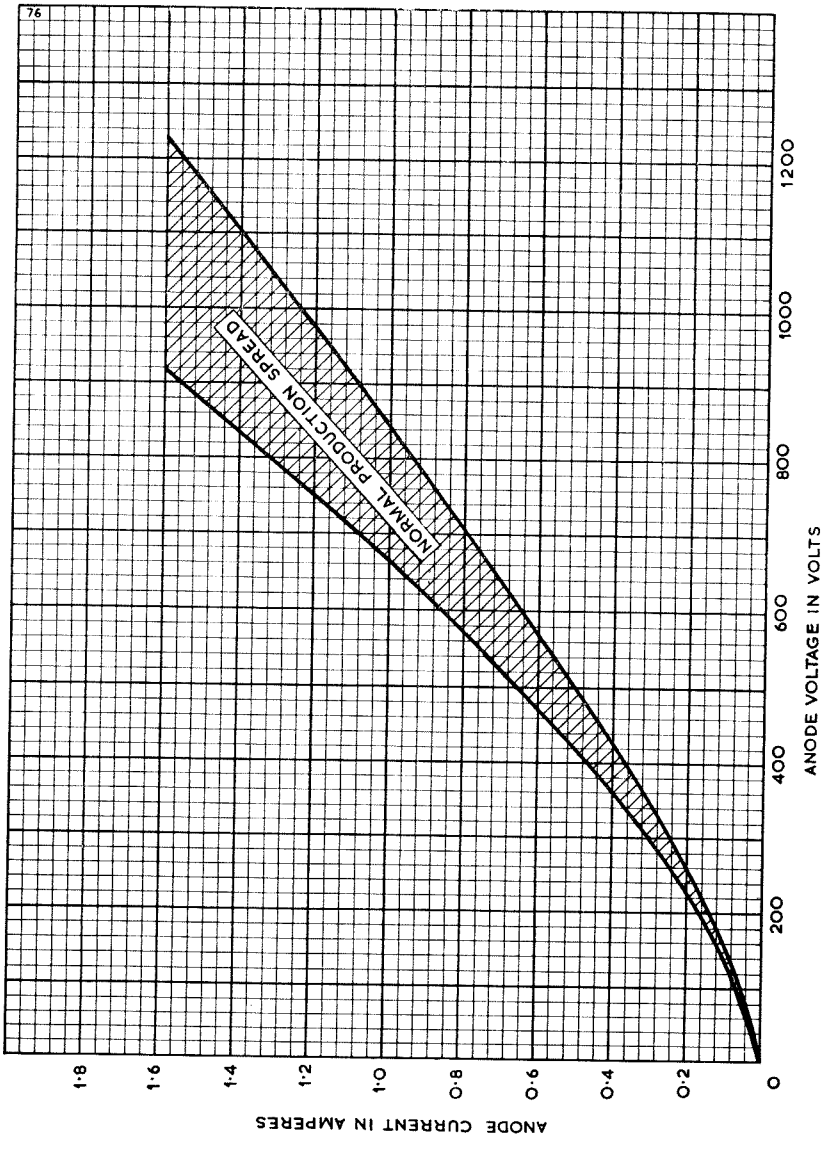
ANODE CHARACTERISTIC



HIGH VACUUM RECTIFIER

OUTLINE

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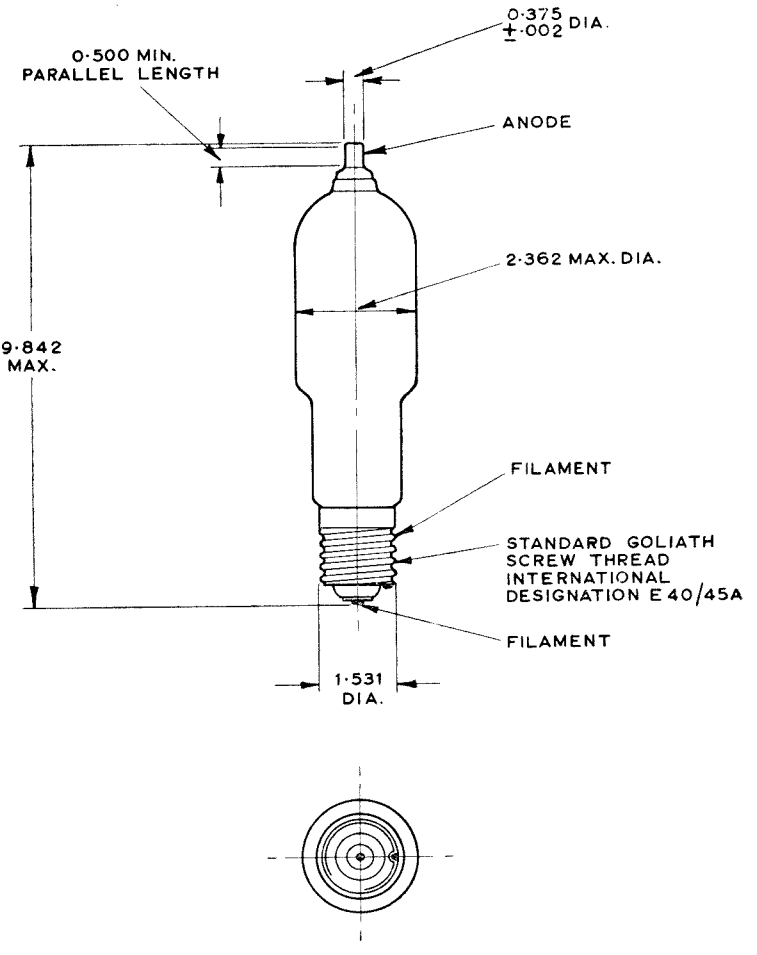

ALL DIMENSIONS IN INCHES

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HIGH VACUUM RECTIFIER

A292

ENGLISH ELECTRIC

Service Type CV5998

ABRIDGED DATA

External-anode Rectifier for charging diode or overswing diode service in high power pulse modulators.

Peak Inverse Anode Voltage	40	kV Max
Peak Anode Current	75	A Max
Mean Anode Current	1·5	A Max

GENERAL

Electrical

Cathode	Indirectly Heated	
Heater Voltage	12	V
Heater Current	14±1	A

Mechanical

Overall Length	16·250 inches	(412·8 mm)	Max
Overall Diameter	2·133 inches	(54·18 mm)	Max
Net Weight	5¼ pounds	(2·4 kg)	Approx
Mounting Position			Any
Cooling (*See Note* 4)			Water or forced-air

MAXIMUM AND MINIMUM RATINGS

(Absolute Values)

	Min	*Max*	
Heater Voltage	11·4	12·6	V
Heater Starting Current (Peak)	—	40	A
Cathode Heating Time	6·0	—	minutes
Peak Inverse Anode Voltage (*See Note* 1)	—	40	kV
Anode Current:			
Peak (*See Note* 2)	—	75	A
Mean (*See Note* 3)	—	1·5	A
Anode Dissipation (*See Note* 4)	—	2·0	kW
Anode Temperature (*See Note* 5)	—	150	°C
Cathode Terminal Temperature (*See Note* 5)	—	150	°C

NOTES

1. The cathode terminal must be fitted with a corona shield as described on page 3.
2. For overswing diode service.
3. For charging diode service.
4. The anode must be fitted in a cooling cylinder as described on page 3.
5. Measured at the point specified on page 3.

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ENGLISH ELECTRIC

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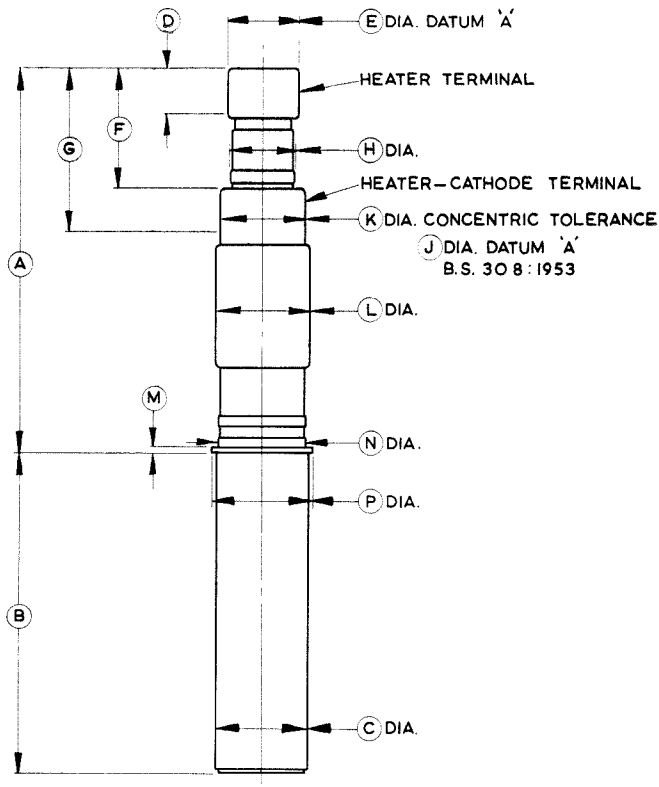

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	9·500 Max	241·3 Max	H	1·550 Max	39·37 Max
B	6·750 Max	171·5 Max	J	0·050	1·27
C	1·946 Max	49·43 Max	K	1·750	44·45
D	0·375 Min	9·53 Min	L	1·937 Max	49·20 Max
E	1·500	38·10	M	0·125 ± 0·005	3·18 ± 0·13
F	3·063 Max	77·80 Max	N	1·820 Max	46·23 Max
G	3·563 Min	90·50 Min	P	2·125 ± 0·008	53·98 ± 0·20

Millimetre dimensions have been derived from inches.

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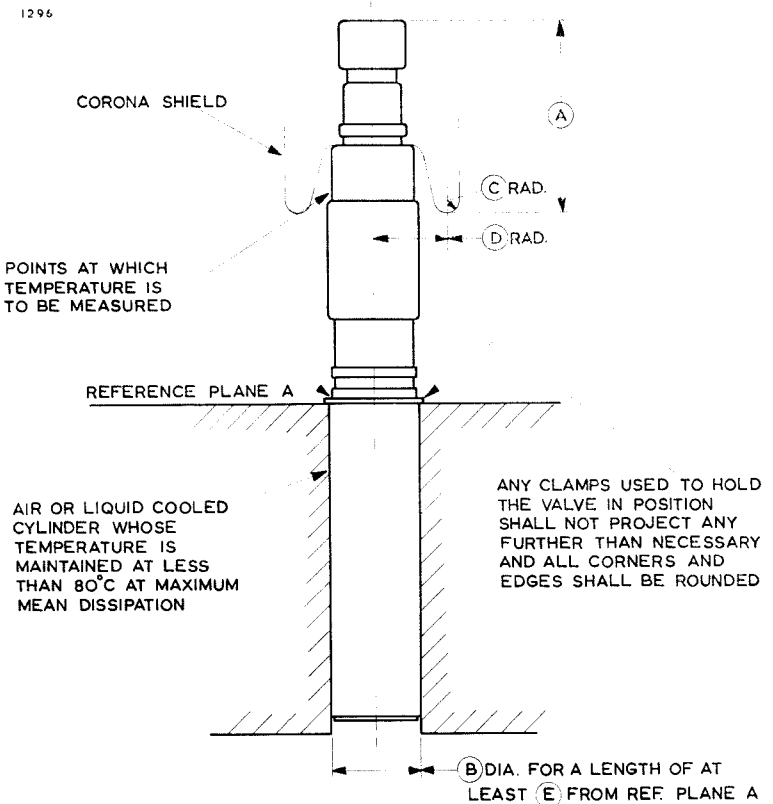
COOLING CYLINDER AND CORONA SHIELD



Ref.	Inches	Millimetres
A	4·000	101·6
B	1·950 Max 1·948 Min	49·53 Max 49·48 Min
C	0·250 Min	6·35 Min
D	1·250 Min	31·75 Min
E	6·750	171·5

Millimetre dimensions have been derived from inches.

HIGH VACUUM RECTIFIER

A296

ENGLISH ELECTRIC

INTRODUCTION

The A296 is a high vacuum rectifier with maximum ratings of 25kV peak inverse voltage and 6·5A peak anode current. It is designed for use in three phase rectifier circuits, giving a d.c. output of 3·0A at 23kV.

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage	6·3	V
Filament Current	32·5	A
Maximum Peak Inverse Voltage	25	kV
Maximum Anode Current:		
Peak	6·5	A
Mean	1·25	A
Maximum Anode Dissipation:		
Natural Cooling	375	W
Forced-air Cooling	500	W
Nominal Impedance (at 3·0A)	130	Ω

Mechanical

Overall Length	9·85 inches	(250 mm)	Max
Overall Diameter	5·20 inches	(132·1 mm)	Max
Net Weight	1·5 pounds	(0·68 kg)	Approx
Base	Flying Leads		
Mounting Position	Vertical, base down Use bulb supporting ring		
Maximum Bulb Temperature	350	°C	
Maximum Anode or Base Seal Temperature	220	°C	

A top cap radiator, with a minimum surface area of 8sq.in. perpendicular to the axis of the valve, should be used. The radiator should make good thermal contact with the entire length of the anode terminal.

X-RAY WARNING

X-rays are produced when the A296 is operated with a peak inverse anode voltage above 16kV (absolute value). These rays can constitute a health hazard unless the valve is adequately shielded for X-ray radiation. This is entirely a function of high voltage devices and does not reflect upon the design of the valve.

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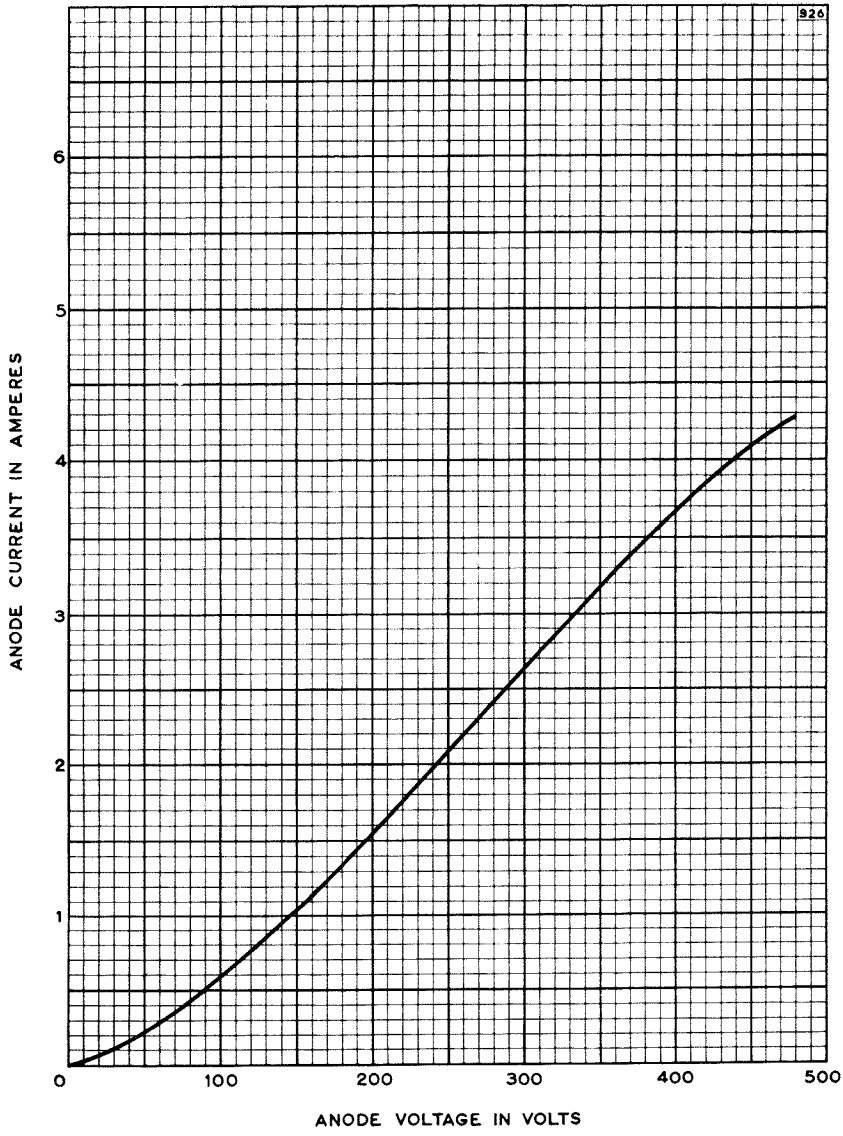
HIGH VACUUM RECTIFIER

A296

ENGLISH ELECTRIC

ANODE CHARACTERISTIC



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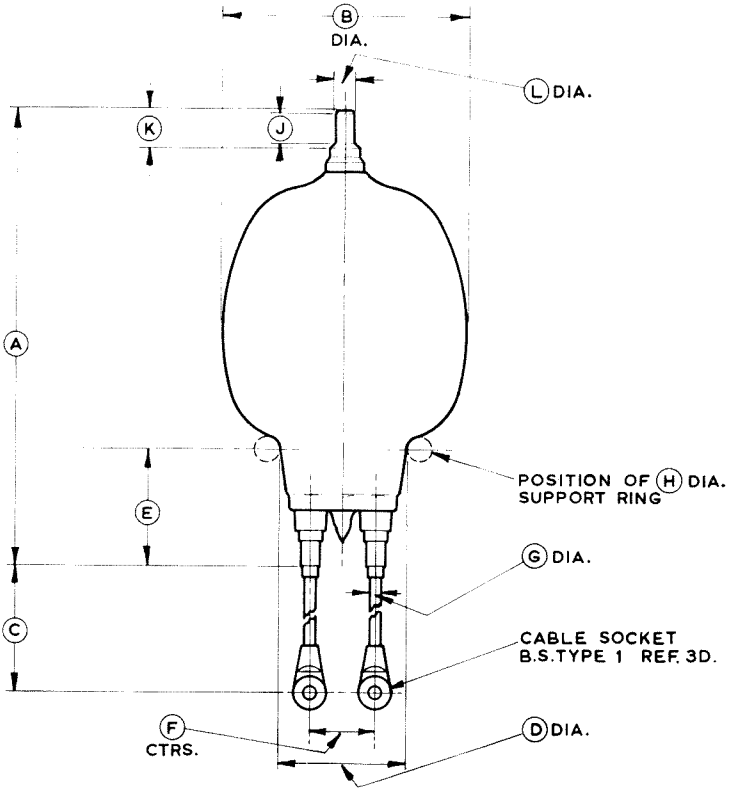
927



Ref.	Inches	Millimetres
A	9·850 Max	250 Max
B	5·200 Max	132·1 Max
C	4·000	101·6
D	2·687 Min	68·25 Min
E	2·500 (ref.)	63·50 (ref.)
F	1·339	34·01
G	0·187	4·750
H	0·500	12·7
J	0·500	12·7
K	0·750	19·05
L	0·375	9·525

Millimetre dimensions have been derived from inches.

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Mercury Vapour Rectifiers

June 1965

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MERCURY VAPOUR RECTIFIER

869B

ENGLISH ELECTRIC

American Designation 869B

INTRODUCTION

The 869B is a hot cathode Mercury Vapour Rectifier with maximum ratings of 20kV peak inverse voltage and 10A peak current. It will provide a d.c. output of 19kV 7·5A in a three phase full wave circuit.

GENERAL DATA

(See also Preamble to Rectifier Section of this Catalogue)

Electrical

Filament	Oxide Coated
Filament Voltage	5·0 V
Filament Current	19 A
Filament Heating Time	1 Minute
Condensed Mercury Temperature	(*See page* 2)
Maximum Peak Inverse Voltage	(*See page* 2)
Maximum Anode Current:	
Peak	(*See page* 2)
Mean (30 secs Max averaging time)	(*See page* 2)
Under fault conditions (0·1 second Max duration)	100 A

Mechanical

Overall Length	14·44 inches (366·7 mm) Max
Overall Diameter	5·125 inches (130·2 mm) Max
Net Weight	$1\frac{3}{4}$ pounds (800 gm) Approx
Mounting Position	Vertical, base down
Cap	JEDEC No. C1-9
Base	3-Pin Jumbo (JEDEC No. A3-20)

CONTROL OF CONDENSED MERCURY TEMPERATURE

On the following pages two curves are given showing:

1. Total heating time for any value of ambient temperature. This is for use when the valve is being switched on from cold.
2. Rise of condensed mercury temperature above ambient plotted against heating and cooling time. This can be used as indicated by the example in the preamble to this section of the catalogue.

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MAXIMUM OPERATING CONDITIONS
(Absolute Values—see Preamble)

Circuit	* Diagram	Condensed Mercury Temp. °C	Peak Inverse Voltage (50-60 c/s) kV	Anode Current in Amperes		Transformer Secondary Voltage (R.M.S.) kV	Max D.C. Output	
				Peak	Mean‡		kV	Amps
Single Phase Full Wave	A	30–40	20	10	2·5	7·0	6·3	5·0
		30–50	15	10	2·5	5·3	4·7	5·0
		30–60	10	10	2·5	3·5	3·1	5·0
Single Phase Full Wave Bridge	B	30–40	20	10	2·5	14·0	12·6	5·0
		30–50	15	10	2·5	10·6	9·5	5·0
		30–60	10	10	2·5	7·0	6·3	5·0
Three Phase Half Wave	C	30–40	20	10	2·5	8·1†	9·5†	7·5
		30–50	15	10	2·5	6·1†	7·1†	7·5
		30–60	10	10	2·5	4·1†	4·7†	7·5
Three Phase Full Wave	D§	30–40	20	10	2·5	8·1	19·0	7·5
		30–50	15	20	5	6·1	14·2	15·0
		30–60	10	20	5	4·1	9·5	15·0

*For diagrams see Typical Rectifier Circuits for Choke Input Filters in the preamble to this section of the catalogue.

†For operation with constant full load. If the load resistance is increased the secondary voltage should be decreased (to avoid excessive peak inverse voltage) until at no load the reduction is 14%. The d.c. output voltage will be correspondingly decreased.

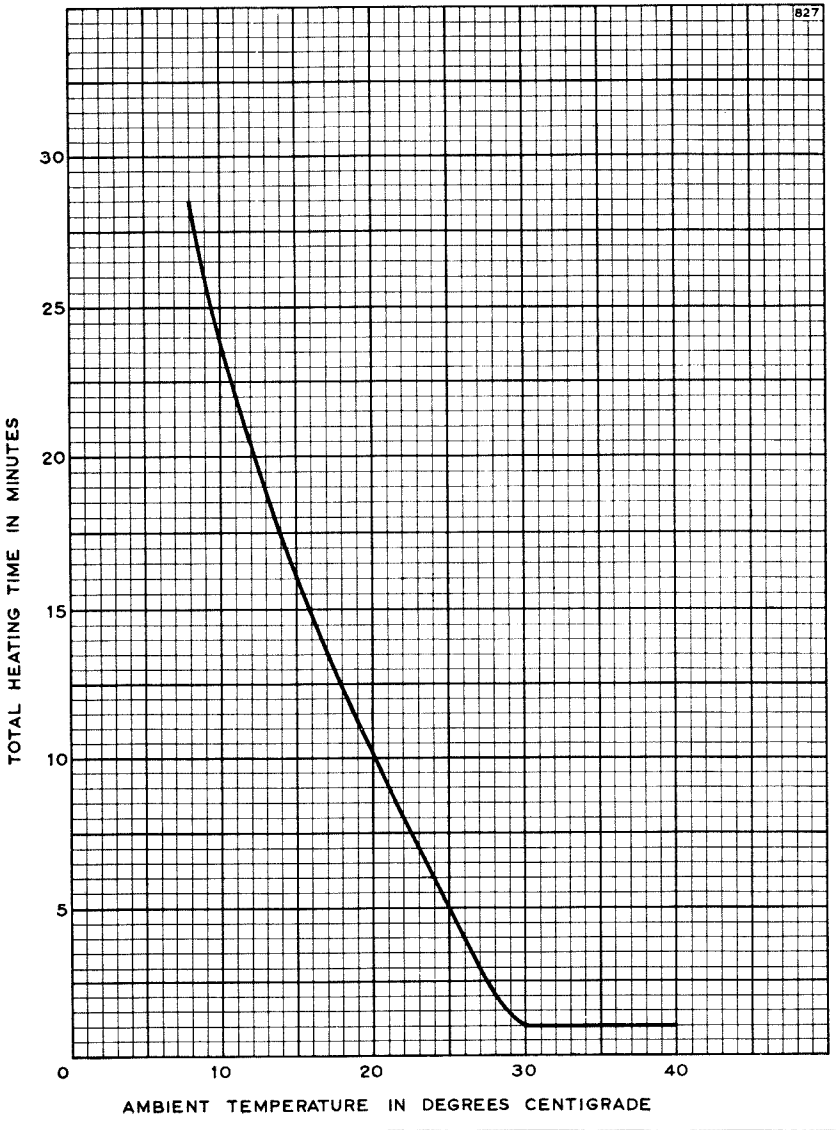
‡Mean anode currents are averaged over any period of 30 seconds maximum.

§With filament and anode supplies out of phase (60°–120°).

X-RAY WARNING

X-rays are produced when the 869B is operated with a peak inverse anode voltage above 16kV (absolute value). These rays can constitute a health hazard unless the valve is adequately shielded for X-ray radiation. This is entirely a function of high voltage devices and does not reflect upon the design of the valve.

TOTAL HEATING TIME CHARACTERISTIC



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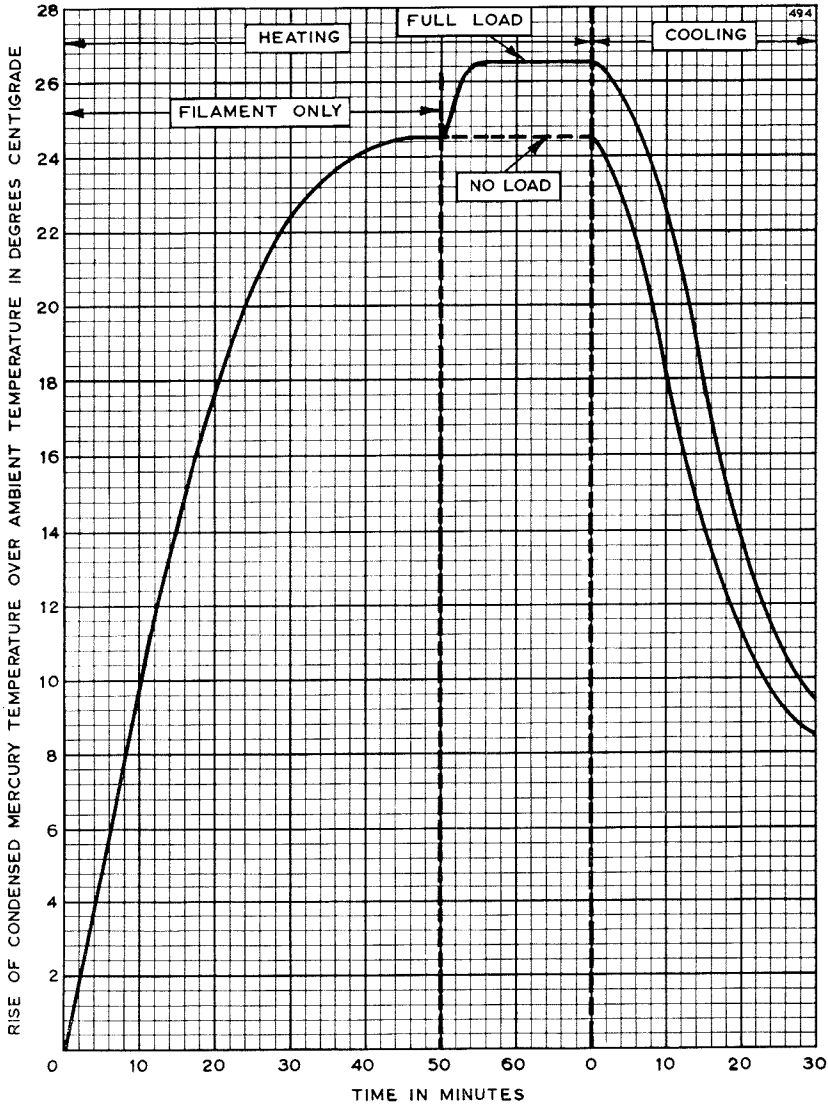
HEATING AND COOLING CHARACTERISTIC



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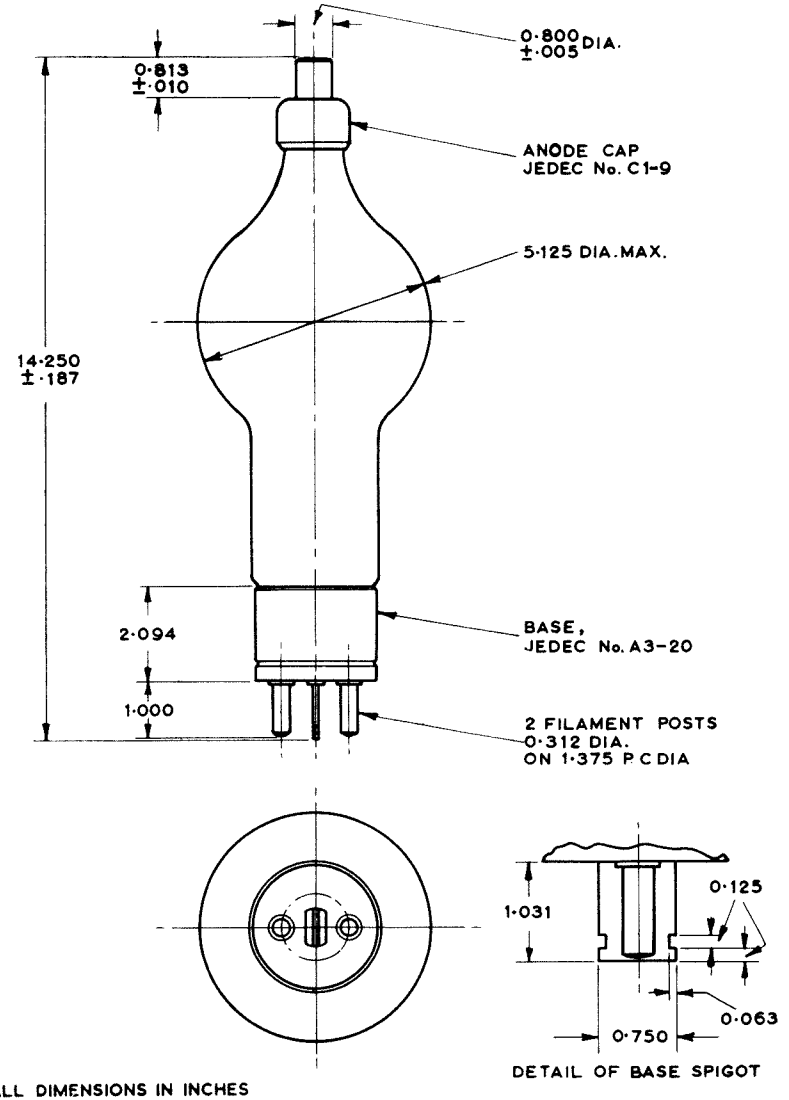
495A



DETAIL OF BASE SPIGOT

ALL DIMENSIONS IN INCHES

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MERCURY VAPOUR RECTIFIER

AH205/857B ←

Service Type CV2673 **American Equivalent 857B**

INTRODUCTION

The AH205/857B is a hot cathode Mercury Vapour Rectifier with maximum ratings of 22kV peak inverse voltage and 40A peak current. It will provide a D.C. output of 21kV 30A in a three phase full wave circuit or 7kV 20A in a single phase full wave circuit. ←

GENERAL DATA
(See also Preamble to Rectifier Section of this Catalogue)

Electrical

Filament	Oxide Coated	
Filament Voltage	5·0	V
Filament Current	30	A
Filament Heating Time	1	Minute
Condensed Mercury Temperature	*(See page 2)*	
Max Peak Inverse Voltage	*(See page 2)*	
Max Anode Current:		
Peak	40	A
Mean (30 seconds Max averaging time)	10	A ←
Under fault conditions (0·2 seconds Max duration)	400	A

Mechanical

Overall Length	19·88 inches	(505 mm)	Max
Overall Diameter	7·63 inches	(194 mm)	Max
Net Weight	4·0 pounds	(1·8 kg)	Approx
Mounting Position	Vertical, base down		
Base	*(See outline drawing)*		

CONTROL OF CONDENSED MERCURY TEMPERATURE

On the following pages two curves are given showing:

1. Total heating time for any value of ambient temperature. This is for use when the valve is being switched on from cold.
2. Rise of condensed mercury temperature above ambient plotted against heating and cooling time. This can be used as indicated by the example in the preamble to this section of the catalogue.

← Indicates a change

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MAXIMUM OPERATING CONDITIONS
(Absolute Values—see Preamble)

Circuit	* Diagram	Condensed Mercury Temp. °C	Peak Inverse Voltage (50-60 c/s) kV	Anode current in Amperes		Transformer Secondary Voltage (R.M.S.) kV	Max. D.C. Output	
				Peak	Mean‡		kV	Amps
Single Phase Full Wave	A	30–40	22	40	10	7·7	7·0	20
		25–60	10	40	10	3·5	3·1	20
Single Phase Full Wave Bridge	B	30–40	22	40	10	15·5	14·0	20
		25–60	10	40	10	7·0	6·3	20
Three Phase Half Wave	C	30–40	22	40	10	9·0†	10·5†	30
		25–60	10	40	10	4·1†	4·7†	30
Three Phase Full Wave	D	30–40	22	40	10	9·0	21·0	30
		25–60	10	40	10	4·1	9·5	30

*For diagrams see Typical Rectifier Circuits for Choke Input Filters in the preamble to this section of the catalogue.

†For operation with constant full load. If the load resistance is increased the secondary voltage should be decreased (to avoid excessive peak inverse voltage) until at no load the reduction is 14%. The D.C. output voltage will be correspondingly decreased.

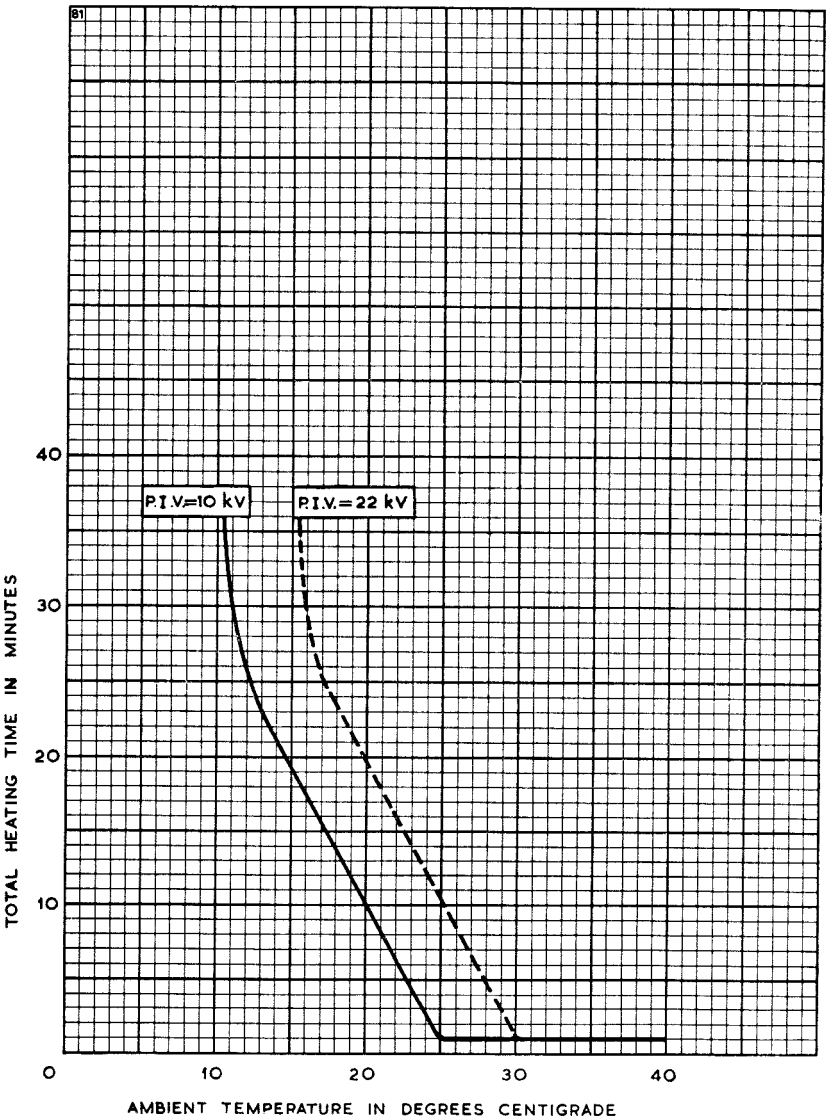
‡Mean anode currents are averaged over any period of 30 seconds maximum.

→ X-RAY WARNING

X-Rays are produced when the AH205/857B is operated with a peak inverse anode voltage above 16 kV (absolute value). These rays can constitute a health hazard unless the valve is adequately shielded for X-ray radiation. This is entirely a function of high voltage devices and does not reflect upon the design of the valve.

→ Indicates a change

TOTAL HEATING TIME CHARACTERISTIC



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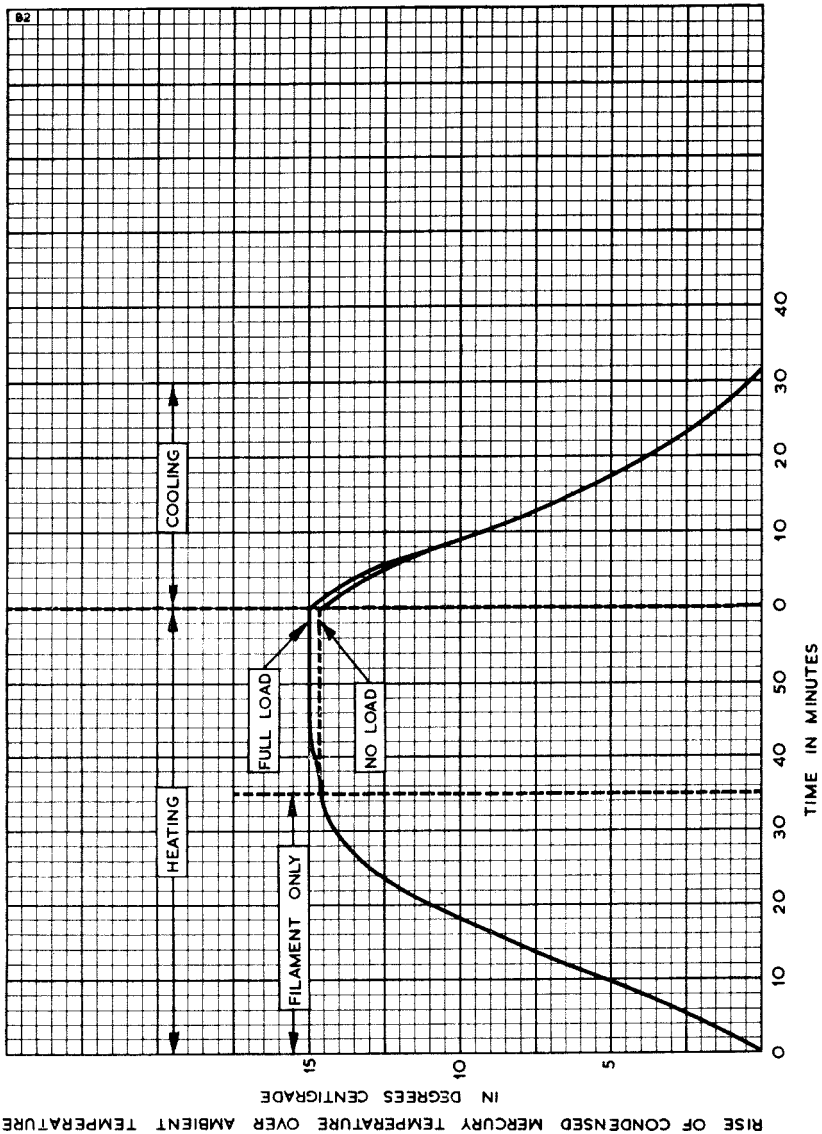
HEATING AND COOLING CHARACTERISTIC



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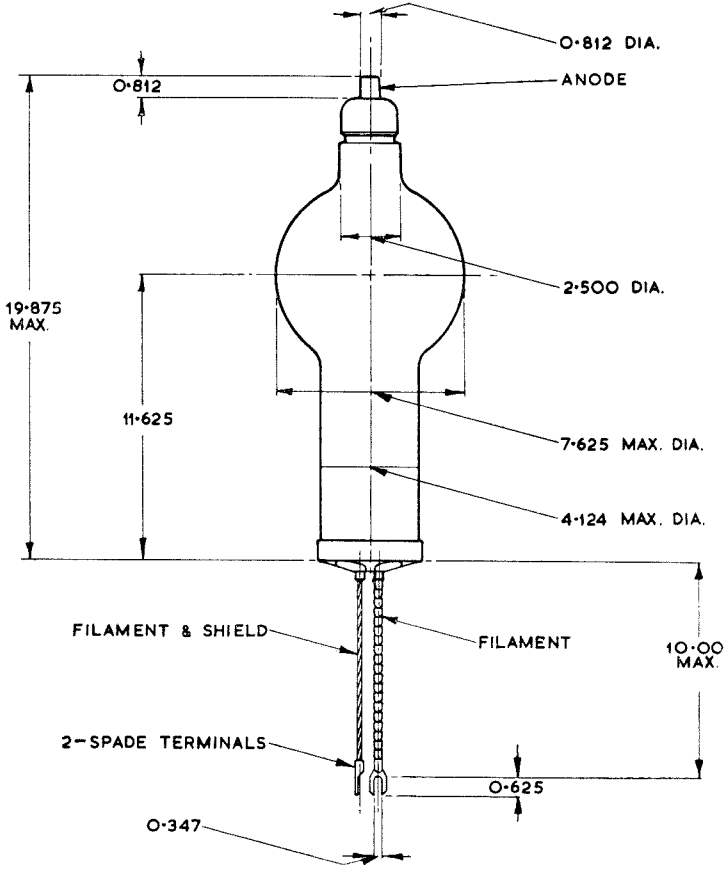

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MERCURY VAPOUR RECTIFIER

AH200

INTRODUCTION

The AH200 is a hot cathode Mercury Vapour Rectifier with maximum ratings of 20kV peak inverse voltage and 10A peak current. It is similar to the AH213, differing only in filament rating and in terminal sizes.

GENERAL DATA

(See also Preamble to Rectifier Section of this Catalogue)

Electrical

Filament	Oxide Coated	
Filament Voltage	2·5	V
Filament Current	40	A
Filament Heating Time	1	Minute
Condensed Mercury Temperature	*(See page 2)*	
Max Peak Inverse Voltage	*(See page 2)*	
Max Anode Current:		
Peak	*(See page 2)*	
Mean‡	*(See page 2)*	
Under fault conditions (0·1 seconds Max duration)	100	A

Mechanical

Overall Length	18·0 inches	(457 mm)	Max
Overall Diameter	5·25 inches	(133 mm)	Max
Net Weight	1·75 pounds	(800 gm)	Approx
Mounting Position	Vertical, base down		
Base	*(See outline drawing)*		

CONTROL OF CONDENSED MERCURY TEMPERATURE

On the following pages two curves are given showing:

1. Total heating time for any value of ambient temperature. This is for use when the valve is being switched on from cold.
2. Rise of condensed mercury temperature above ambient plotted against heating and cooling time. This can be used as indicated by the example in the preamble to this section of the catalogue.

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MAXIMUM OPERATING CONDITIONS
(absolute values—see Preamble)

Circuit	* Diagram	Condensed Mercury Temp. °C	Peak Inverse Voltage (50-60 c/s) kV	Anode current in Amperes		Transformer Secondary Voltage (R.M.S.) kV	Max D.C. Output	
				Peak	Mean‡		kV	Amps
Single Phase Full Wave	A	30–40	20	10	2·5	7·0	6·3	5·0
		30–50	15	10	2·5	5·3	4·7	5·0
		30–60	10	10	2·5	3·5	3·1	5·0
Single Phase Full Wave Bridge	B	30–40	20	10	2·5	14·0	12·6	5·0
		30–50	15	10	2·5	10·6	9·5	5·0
		30–60	10	10	2·5	7·0	6·3	5·0
Three Phase Half Wave	C	30–40	20	10	2·5	8·1†	9·5†	7·5
		30–50	15	10	2·5	6·1†	7·1†	7·5
		30–60	10	10	2·5	4·1†	4·7†	7·5
Three Phase Full Wave	D§	30–40	20	10	2·5	8·1	19·1	7·5
		30–50	15	20	5	6·1	14·2	15·0
		30–60	10	20	5	4·1	9·5	15·0

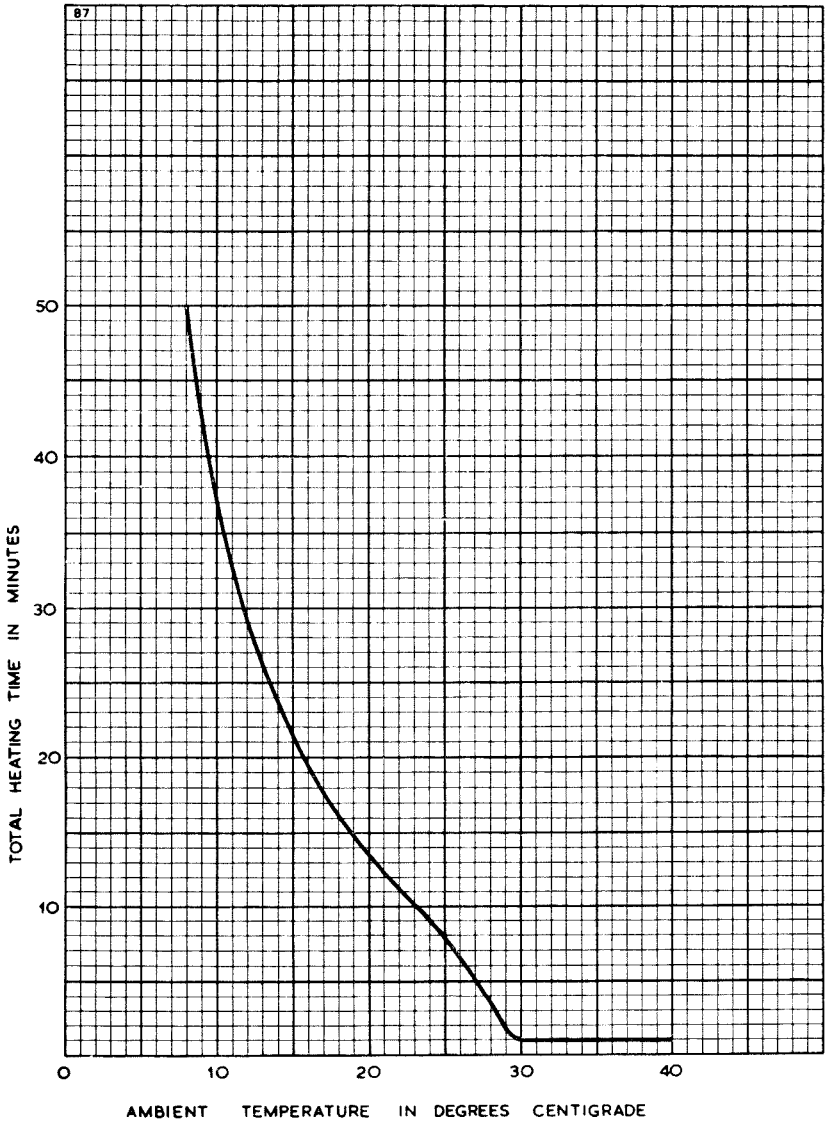
*For diagrams see Typical Rectifier Circuits for Choke Input Filters in the preamble to this section of the catalogue.

†For operation with constant full load. If the load resistance is increased the secondary voltage should be decreased (to avoid excessive peak inverse voltage) until at no load the reduction is 14%. The D.C. output voltage will be correspondingly decreased.

‡Mean anode currents are averaged over any period of 30 seconds maximum.

§With filament and anode supplies out of phase (60°–120°).

TOTAL HEATING TIME CHARACTERISTIC



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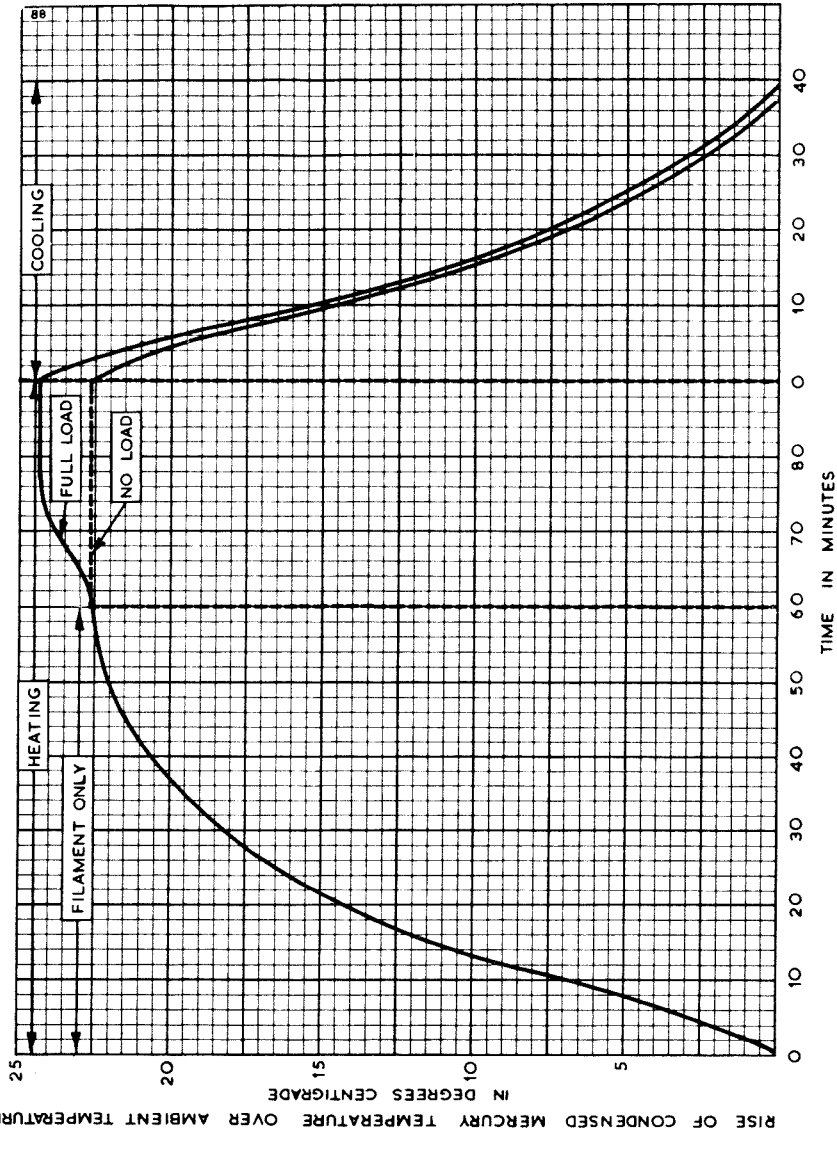
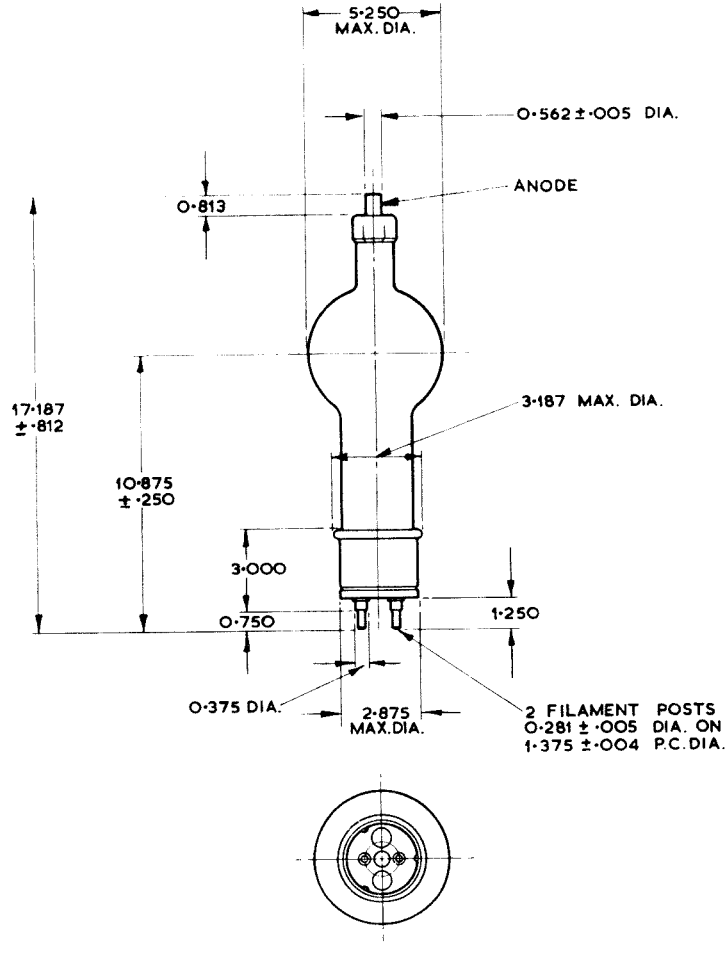
HEATING AND COOLING CHARACTERISTIC



OUTLINE

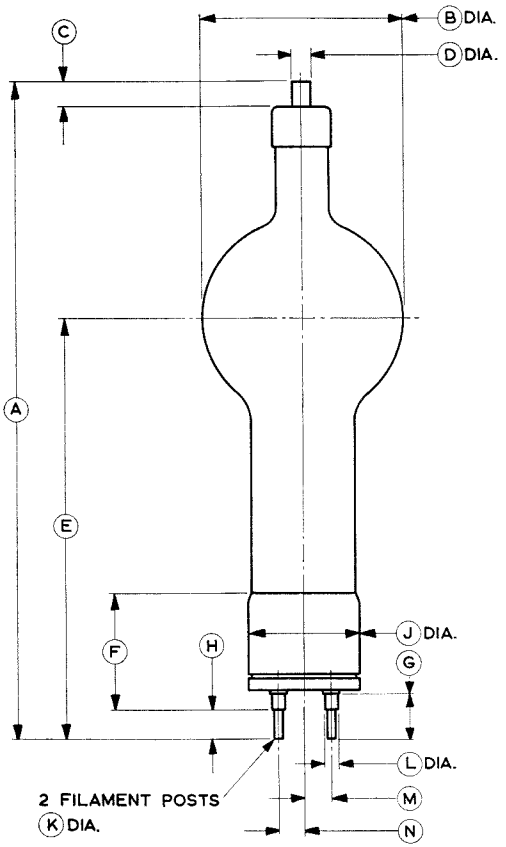
89



ALL DIMENSIONS IN INCHES

OUTLINE

89A



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	17·187 ± 0·812	436·5 ± 20·62	H	0·750	19·05
B	5·250 Max	133·4 Max	J	2·875	73·03
C	0·812	20·62	K	0·281 ± 0·005	7·14 ± 0·13
D	0·562 ± 0·005	14·27 ± 0·13	L	0·375	9·53
E	10·875 ± 0·250	276·2 ± 6·35	M	0·687	17·45
F	3·000	76·20	N	0·687	17·45
G	1·125	28·58			

Millimetre dimensions have been derived from inches.

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MERCURY VAPOUR RECTIFIER

AH211

Service Type CV532

INTRODUCTION

The AH211 is a maintenance type only. For new designs the AH211A is recommended.

GENERAL DATA

(See also Preamble to Rectifier Section of this catalogue)

Electrical

Filament	Oxide Coated	
Filament Voltage	2·5	V
Filament Current	30	A
Filament Heating Time	1	Minute
Condensed Mercury Temperature	25 to 50	°C
Max Peak Inverse Voltage	16	kV
Max Anode Current:		
Peak	8	A
Mean‡	2	A
Under fault conditions (0·1 seconds Max duration)	100	A

Mechanical

Overall Length	12·38 inches	(314 mm)	Max
Overall Diameter	3·19 inches	(81 mm)	Max
Net Weight	1 pound	(460 gm)	Approx
Mounting Position		Vertical, base down	
Base		*(See outline drawing)*	

CONTROL OF CONDENSED MERCURY TEMPERATURE

On the following pages two curves are given showing:

1. Total heating time for any value of ambient temperature. This is for use when the valve is being switched on from cold.
2. Rise of condensed mercury temperature above ambient plotted against heating and cooling time. This can be used as indicated by the example in the preamble to this section of the catalogue.

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MAXIMUM OPERATING CONDITIONS
(Absolute Values—see Preamble)

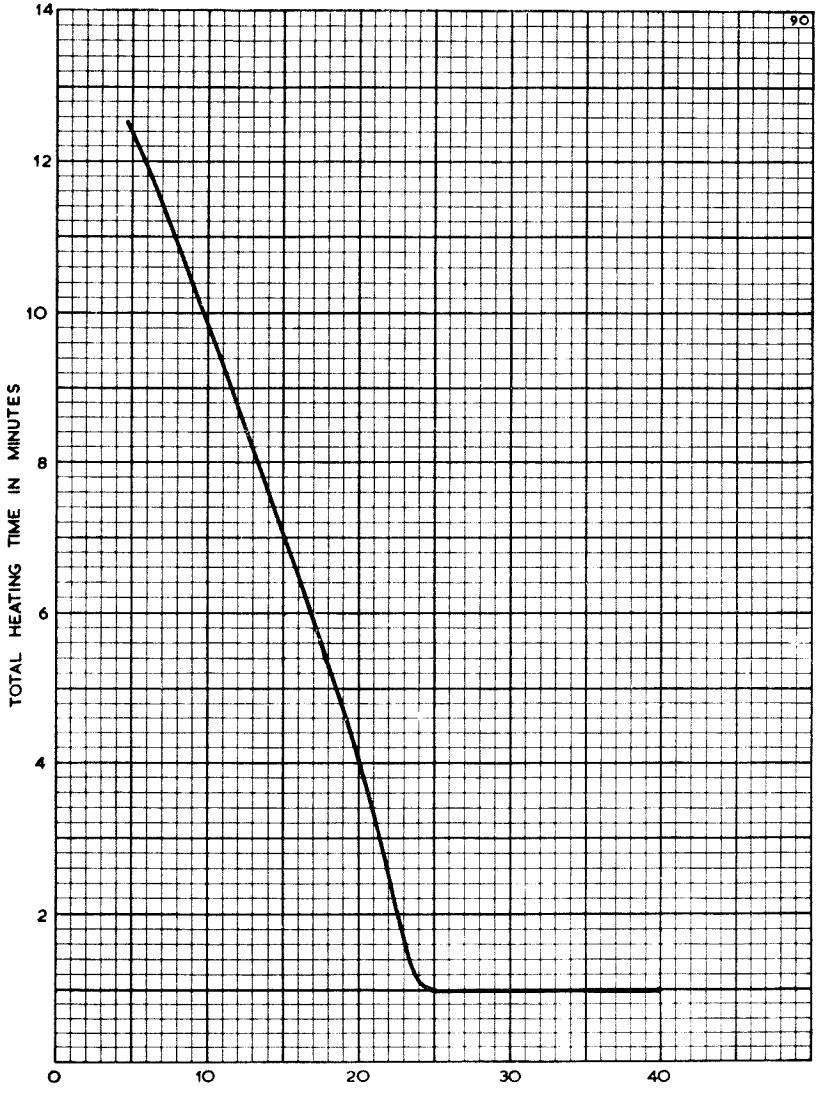
Circuit	* Diagram	Condensed Mercury Temp. °C	Peak Inverse Voltage (50-60 c/s) kV	Anode current in Amperes		Transformer Secondary Voltage (R.M.S.) kV	Max D.C. Output	
				Peak	Mean‡		kV	Amps
Single Phase Full Wave	A	25–50	16	8	2·0	5·6	5·0	4
Single Phase Full Wave Bridge	B	25–50	16	8	2·0	11·2	10·1	4
Three Phase Half Wave	C	25–50	16	8	2·0	6·5†	7·6†	6
Three Phase Full Wave	D	25–50	16	8	2·0	6·5	15·2	6

*For diagrams see Typical Rectifier Circuits for Choke Input Filters in the preamble to this section of the catalogue.

†For operation with constant full load. If the load resistance is increased the secondary voltage should be decreased (to avoid excessive peak inverse voltage) until at no load the reduction is 14%. The D.C. output voltage will be correspondingly decreased.

‡Mean anode currents are averaged over any period of 30 seconds maximum.

TOTAL HEATING TIME CHARACTERISTIC



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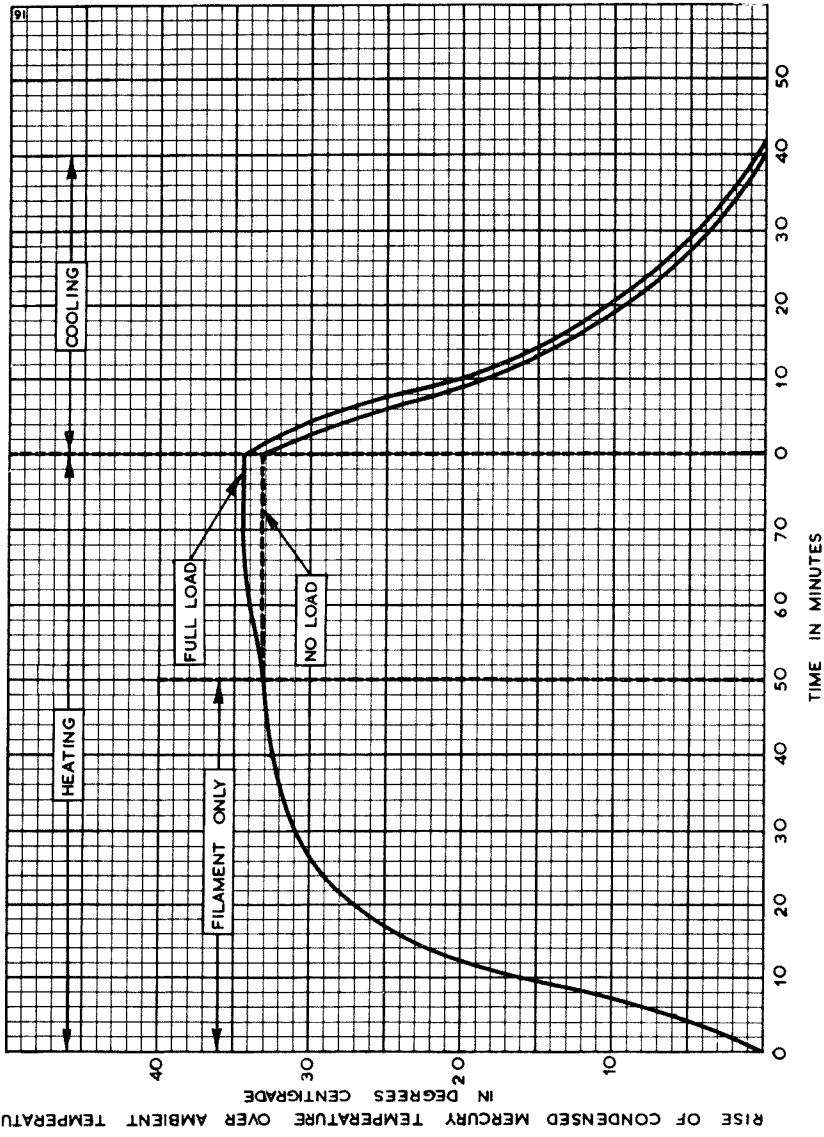
HEATING AND COOLING CHARACTERISTIC

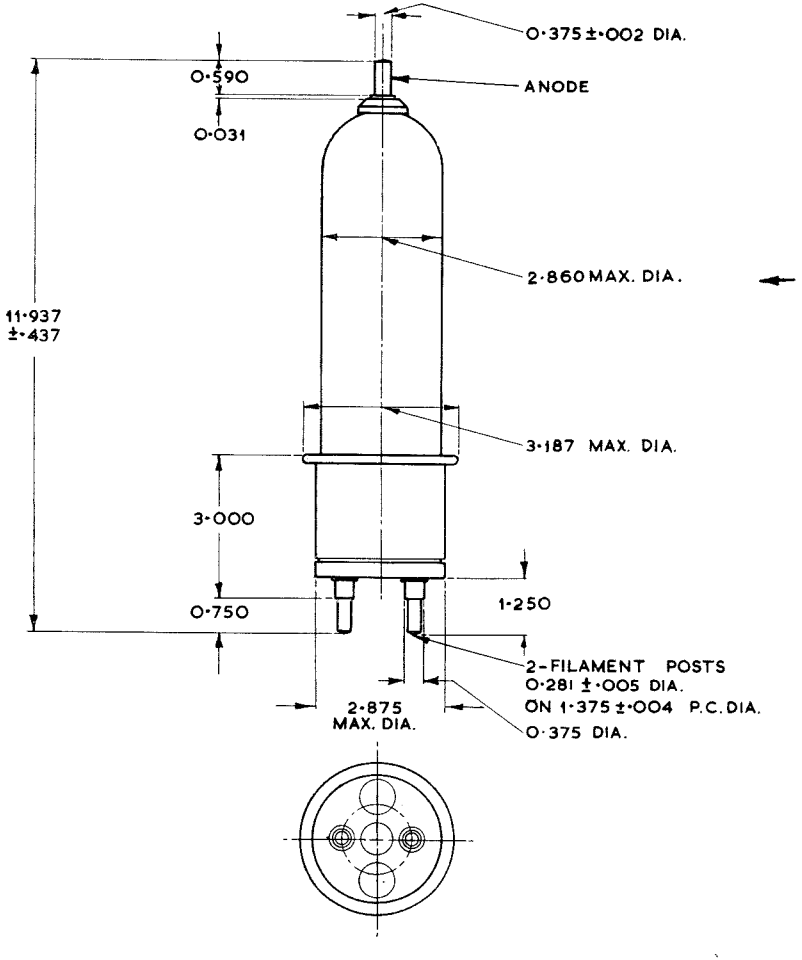


MERCURY VAPOUR RECTIFIER

AH211

OUTLINE

528



ALL DIMENSIONS IN INCHES

INDICATES A CHANGE ←

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MERCURY VAPOUR RECTIFIER

AH211A

Service Type CV532 ←

INTRODUCTION

The AH211A is a hot cathode Mercury Vapour Rectifier with maximum ratings of 16kV peak inverse voltage and 8A peak current. It will provide a D.C. output of 15kV 6A in a three phase full wave circuit.

GENERAL DATA

(See also Preamble to Rectifier Section of this catalogue)

Electrical

Filament	Oxide Coated	
Filament Voltage	2·5	V
Filament Current	30	A
Filament Heating Time	1	Minute
Condensed Mercury Temperature	25 to 50	°C
Max Peak Inverse Voltage	16	kV
Max Anode Current:		
Peak	8	A
Mean (30 seconds Max averaging time)	2	A ←
Under fault conditions (0·1 seconds Max duration)	100	A

Mechanical

Overall Length	13·38 inches	(340 mm)	Max
Overall Diameter	3·19 inches	(81 mm)	Max
Net Weight	1¼ pounds	(0·5 kg)	Approx
Mounting Position		Vertical, base down	
Base		*(See outline drawing)*	

CONTROL OF CONDENSED MERCURY TEMPERATURE

On the following pages two curves are given showing:

1. Total heating time for any value of ambient temperature. This is for use when the valve is being switched on from cold.
2. Rise of condensed mercury temperature above ambient plotted against heating time and cooling time. This can be used as indicated by the example in the preamble to this section of the catalogue.

← Indicates a change.

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MAXIMUM OPERATING CONDITIONS
(Absolute Values—see Preamble)

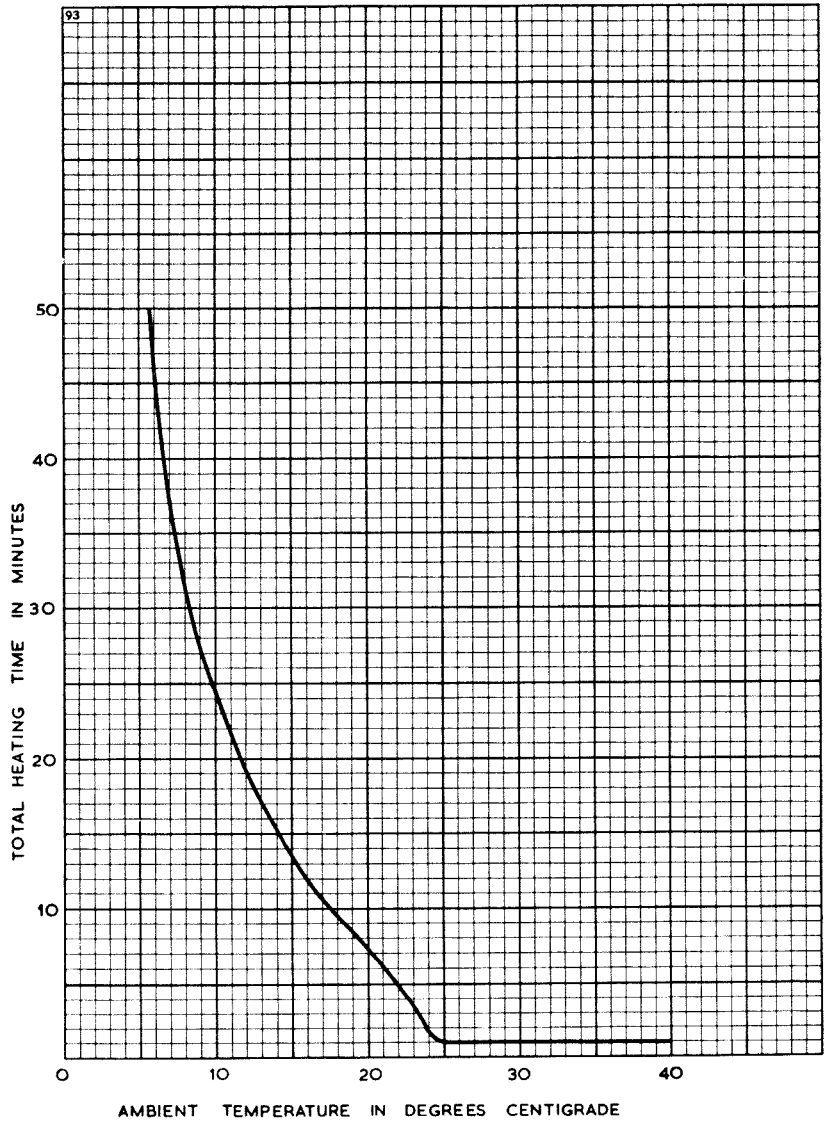
Circuit	* Diagram	Condensed Mercury Temp. °C	Peak Inverse Voltage (50-60 c/s) kV	Anode current in Amperes		Transformer Secondary Voltage (R.M.S.) kV	Max D.C. Output	
				Peak	Mean‡		kV	Amps
Single Phase Full Wave	A	25–50	16	8	2·0	5·6	5·0	4
Single Phase Full Wave Bridge	B	25–50	16	8	2·0	11·2	10·1	4
Three Phase Half Wave	C	25–50	16	8	2·0	6·5†	7·6†	6
Three Phase Full Wave	D	25–50	16	8	2·0	6·5	15·2	6

*For diagrams see Typical Rectifier Circuits for Choke Input Filters in the preamble to this section of the catalogue.

†For operation with constant full load. If the load resistance is increased, the secondary voltage should be decreased (to avoid excessive peak inverse voltage) until at no load the reduction is 14%. The D.C. output voltage will be correspondingly decreased.

‡Mean anode currents are averaged over any period of 30 seconds maximum.

TOTAL HEATING TIME CHARACTERISTIC



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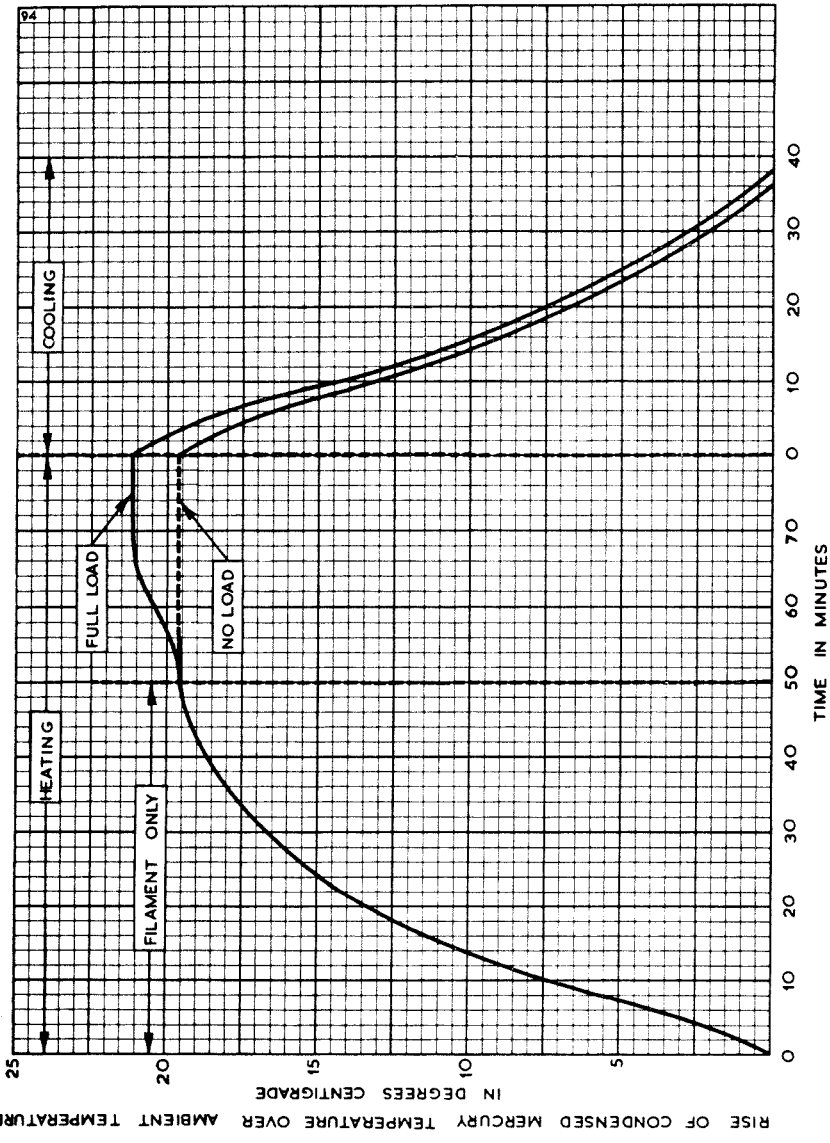
HEATING AND COOLING CHARACTERISTIC

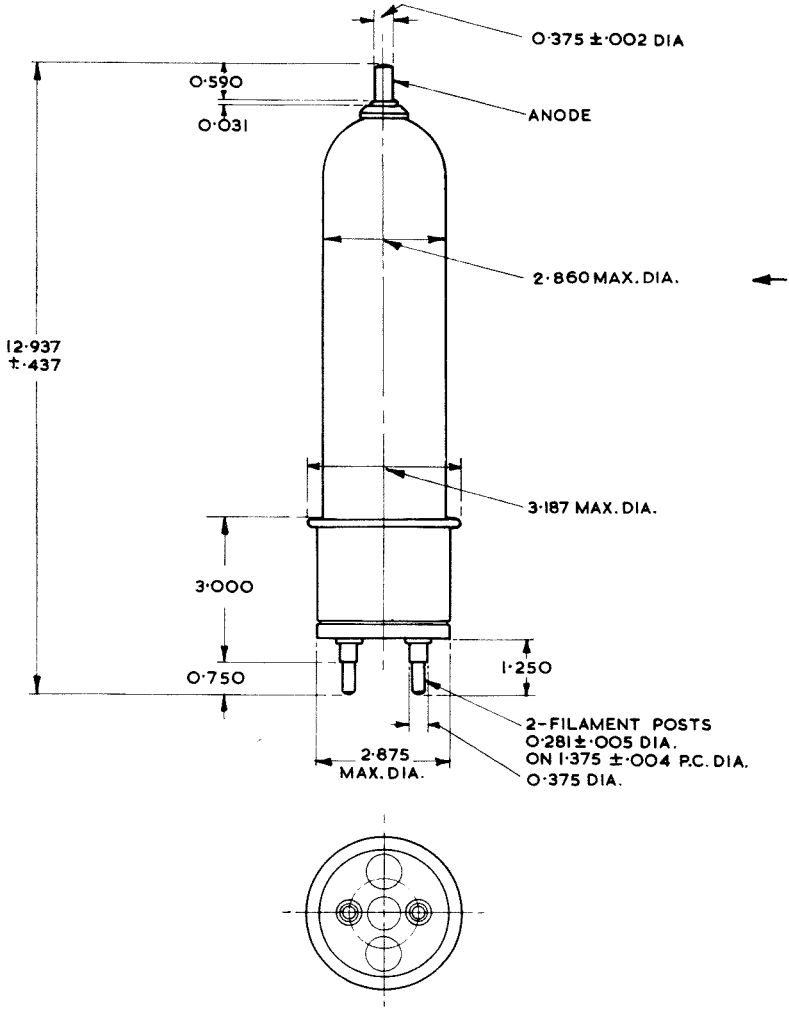


MERCURY VAPOUR RECTIFIER

AH211A

OUTLINE

529



ALL DIMENSIONS IN INCHES

INDICATES A CHANGE ←

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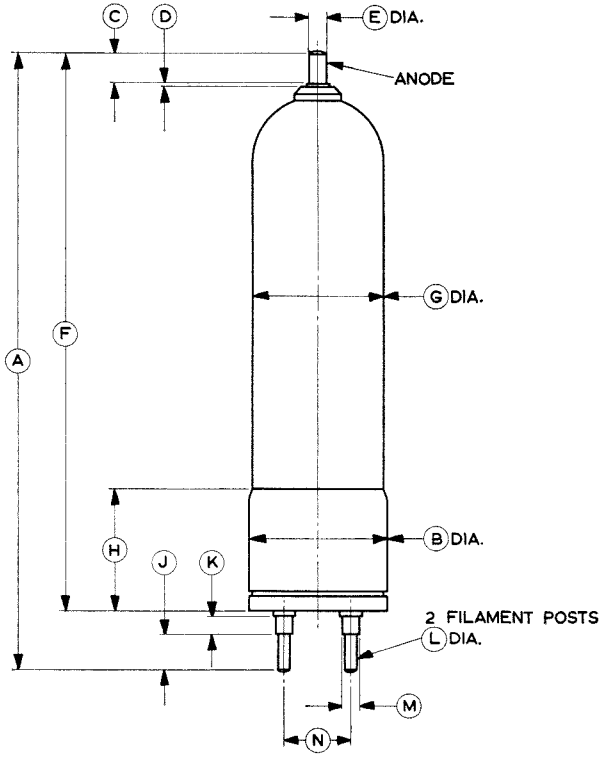
OUTLINE

529A



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	12·937 ± 0·437	328·6 ± 11·10	H	2·563	65·10
B	2·875	73·03	J	0·750	19·05
C	0·590	14·99	K	0·375	9·53
D	0·031	0·79	L	0·281 ± 0·005	7·14 ± 0·13
E	0·375 ± 0·002	9·525 ± 0·051	M	0·375	9·53
F	11·687 ± 0·437	296·8 ± 11·10	N	1·375	34·93
G	2·860 Max	72·64 Max			

Millimetre dimensions have been derived from inches.

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MERCURY VAPOUR RECTIFIER

AH213

Service Type CV2723 **Electrically Equivalent to American 869B**

INTRODUCTION

The AH213 is a hot cathode Mercury Vapour Rectifier with maximum ratings of 20kV peak inverse voltage and 10A peak current. It is similar to the AH200, differing only in filament rating and in terminal sizes.

GENERAL DATA

(See also Preamble to Rectifier Section of this catalogue)

Electrical

Filament	Oxide Coated	
Filament Voltage	5	V
Filament Current	19	A
Filament Heating Time	1	Minute
Condensed Mercury Temperature	*(See page 2)*	
Max Peak Inverse Voltage	*(See page 2)*	
Max Anode Current:		
Peak	*(See page 2)*	
Mean‡	*(See page 2)*	
Under fault conditions (0·1 seconds Max duration)	100	A

Mechanical

Overall Length	18·0 inches	(457 mm)	Max
Overall Diameter	5·25 inches	(133 mm)	Max
Net Weight	1·75 pounds	(800 gm)	Approx
Mounting Position	Vertical, base down		
Base	*(See outline drawing)*		

CONTROL OF CONDENSED MERCURY TEMPERATURE

On the following pages two curves are given showing:

1. Total heating time for any value of ambient temperature. This is for use when the valve is being switched on from cold.
2. Rise of condensed mercury temperature above ambient plotted against heating and cooling time. This can be used as indicated by the example in the preamble to this section of the catalogue.

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MAXIMUM OPERATING CONDITIONS
(Absolute Values—see Preamble)

Circuit	* Diagram	Condensed Mercury Temp. °C	Peak Inverse Voltage (50-60 c/s) kV	Anode Current in Amperes		Transformer Secondary Voltage (R.M.S.) kV	Max D.C. Output	
				Peak	Mean‡		kV	Amps
Single Phase Full Wave	A	30–40	20	10	2·5	7·0	6·3	5·0
		30–50	15	10	2·5	5·3	4·7	5·0
		30–60	10	10	2·5	3·5	3·1	5·0
Single Phase Full Wave Bridge	B	30–40	20	10	2·5	14·0	12·6	5·0
		30–50	15	10	2·5	10·6	9·5	5·0
		30–60	10	10	2·5	7·0	6·3	5·0
Three Phase Half Wave	C	30–40	20	10	2·5	8·1†	9·5†	7·5
		30–50	15	10	2·5	6·1†	7·1†	7·5
		30–60	10	10	2·5	4·1†	4·7†	7·5
Three Phase Full Wave	D§	30–40	20	10	2·5	8·1	19·0	7·5
		30–50	15	20	5	6·1	14·2	15·0
		30–60	10	20	5	4·1	9·5	15·0

*For diagrams see Typical Rectifier Circuits for Choke Input Filters in the preamble to this section of the catalogue.

†For operation with constant full load. If the load resistance is increased the secondary voltage should be decreased (to avoid excessive peak inverse voltage) until at no load the reduction is 14%. The D.C. output voltage will be correspondingly decreased.

‡Mean anode currents are averaged over any period of 30 seconds maximum.

§With filament and anode supplies out of phase (60°–120°).

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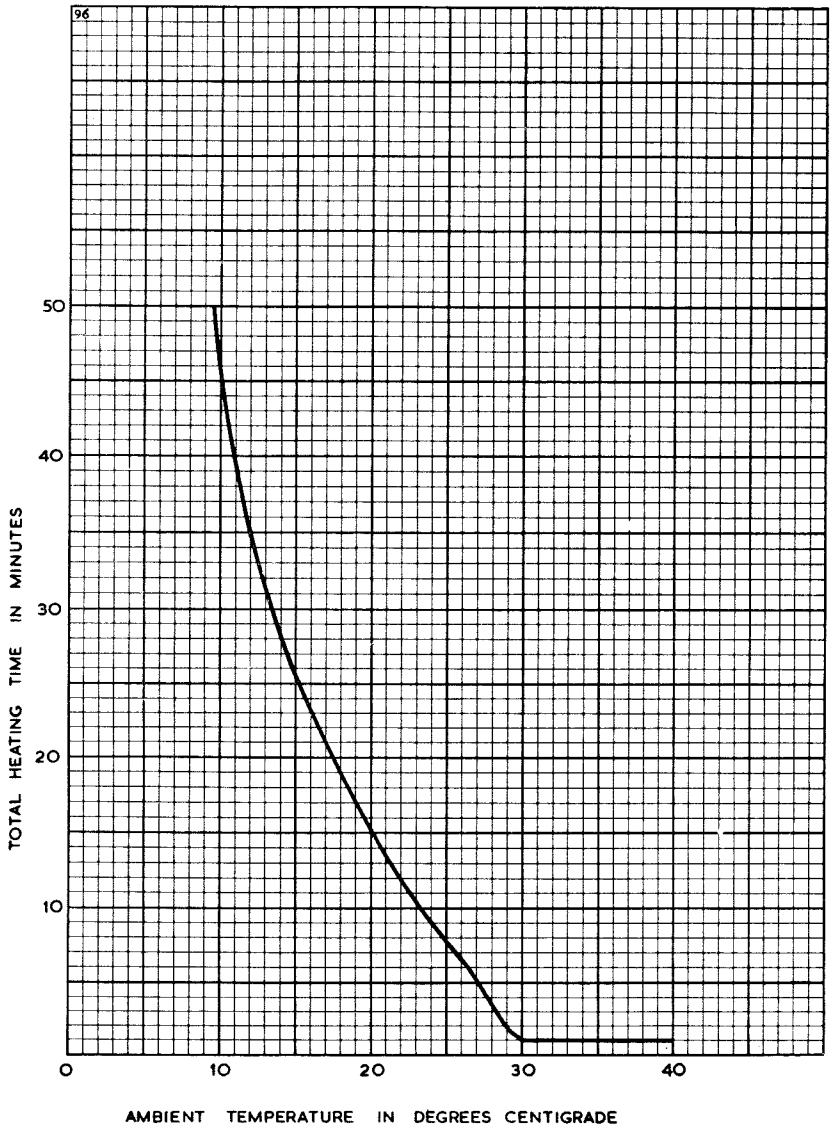
TOTAL HEATING TIME CHARACTERISTIC



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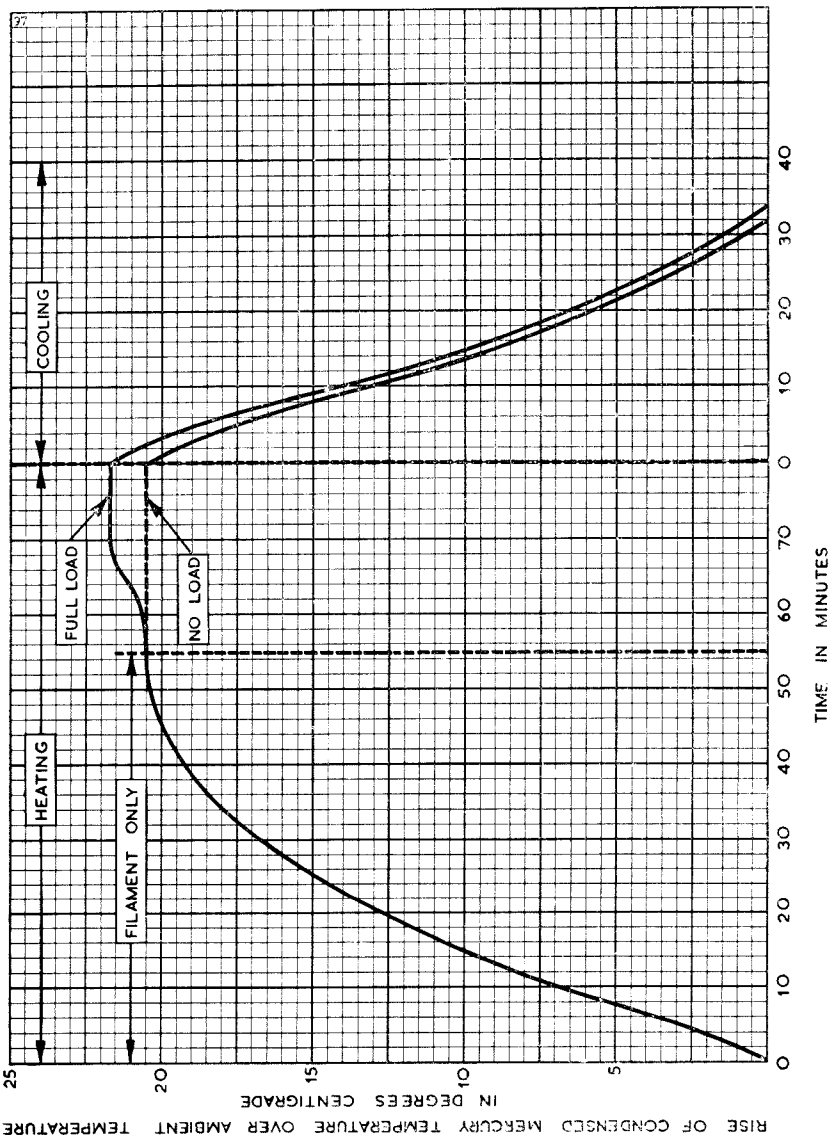
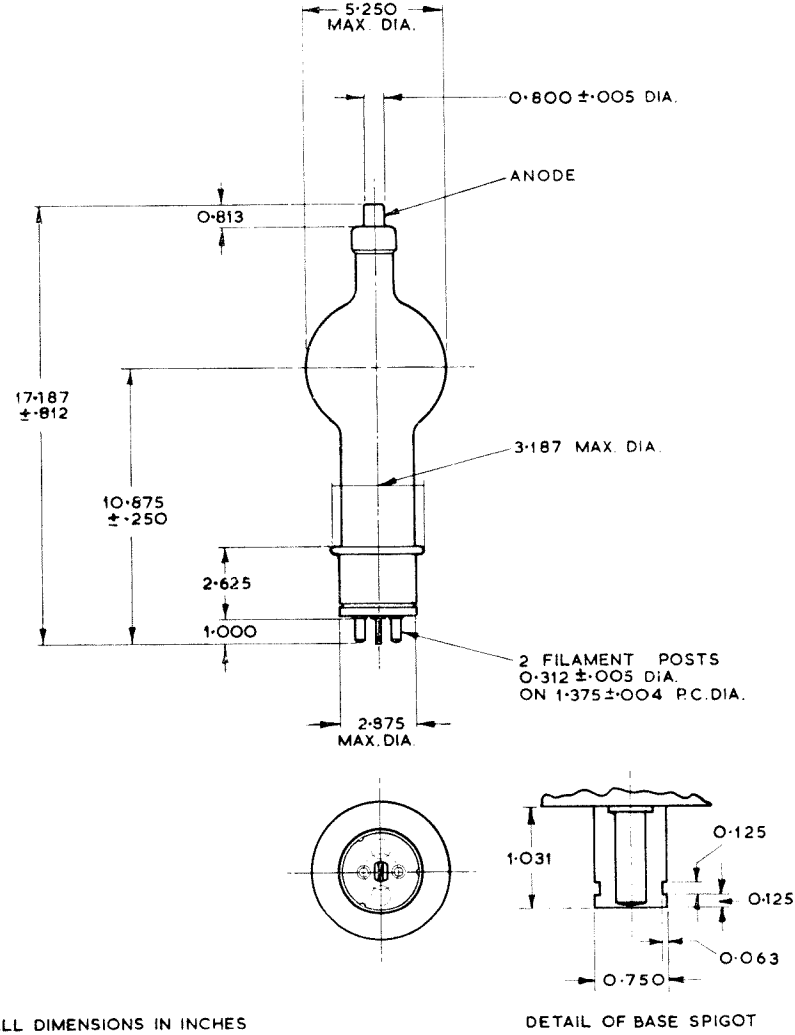
HEATING AND COOLING CHARACTERISTIC



OUTLINE

98



ALL DIMENSIONS IN INCHES

DETAIL OF BASE SPIGOT

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MERCURY VAPOUR RECTIFIER

AH221

Service Types CV5 and CV1435 ←

INTRODUCTION

The AH221 is a hot cathode Mercury Vapour Rectifier with maximum ratings of 20kV peak inverse voltage and 5A peak current. It will provide a D.C. output of 19·0kV 3·75A in a three phase full wave circuit. ←

GENERAL DATA

(See also Preamble to Rectifier Section of this catalogue)

Electrical

Filament	Oxide Coated	
Filament Voltage	4·0	V
Filament Current	11	A
Filament Heating Time	1	Minute
Condensed Mercury Temperature	*(See Page 2)* ←	
Max Peak Inverse Voltage	*(See Page 2)* ←	
Max Anode Current:		
Peak	5·0	A
Mean‡	1·25	A
Under fault conditions (0·2 second Max duration)	50	A

Mechanical

Overall Length	10·63 inches	(270 mm)	Max
Overall Diameter	2·32 inches	(59 mm)	Max
Net Weight	8 ounces	(230 gm)	Approx
Mounting Position			Vertical, base down
Base			Goliath Edison Screw

CONTROL OF CONDENSED MERCURY TEMPERATURE

On the following pages two curves are given showing:

1. Total heating time for any value of ambient temperature. This is for use when the valve is being switched on from cold.

2. Rise of condensed mercury temperature above ambient plotted against heating and cooling time. This can be used as indicated by the example in the preamble to this section of the catalogue.

← Indicates a change.

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MAXIMUM OPERATING CONDITIONS

(Absolute Values—see Preamble)

Circuit	* Diagram	Condensed Mercury Temp. °C	Peak Inverse Voltage (50-60 c/s) kV	Anode Current in Amperes		Transformer Secondary Voltage (R.M.S.) kV	Max D.C. Output	
				Peak	Mean‡		kV	Amps
Single Phase Full Wave	A	20–40 20–50	20 11	5·0 5·0	1·25 1·25	7·0 3·9	6·3 3·5	2·5 2·5
Single Phase Full Wave Bridge	B	20–40 20–50	20 11	5·0 5·0	1·25 1·25	14·0 7·75	12·6 7·0	2·5 2·5
Three Phase Half Wave	C	20–40 20–50	20 11	5·0 5·0	1·25 1·25	8·1† 4·4†	9·5† 5·2†	3·75 3·75
Three Phase Full Wave	D	20–40 20–50	20 11	5·0 5·0	1·25 1·25	8·1 4·4	19·0 10·4	3·75 3·75

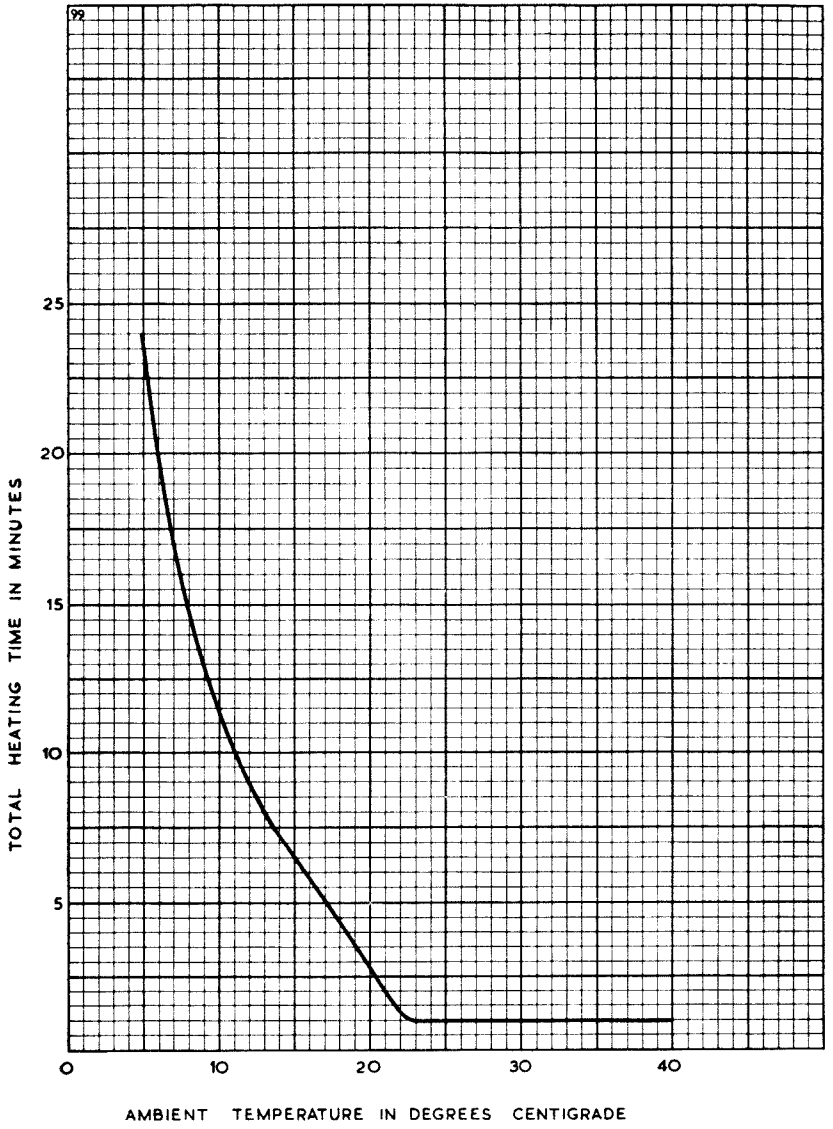
*For diagram see Typical Rectifier Circuits for Choke Input Filters in the preamble to this section of the catalogue.

†For operation with constant full load. If the load resistance is increased the secondary voltage should be decreased (to avoid excessive peak inverse voltage) until at no load the reduction is 14%. The D.C. output voltage will be correspondingly decreased.

‡Mean anode currents are averaged over any period of 15 seconds maximum.

→ Indicates a change.

TOTAL HEATING TIME CHARACTERISTIC



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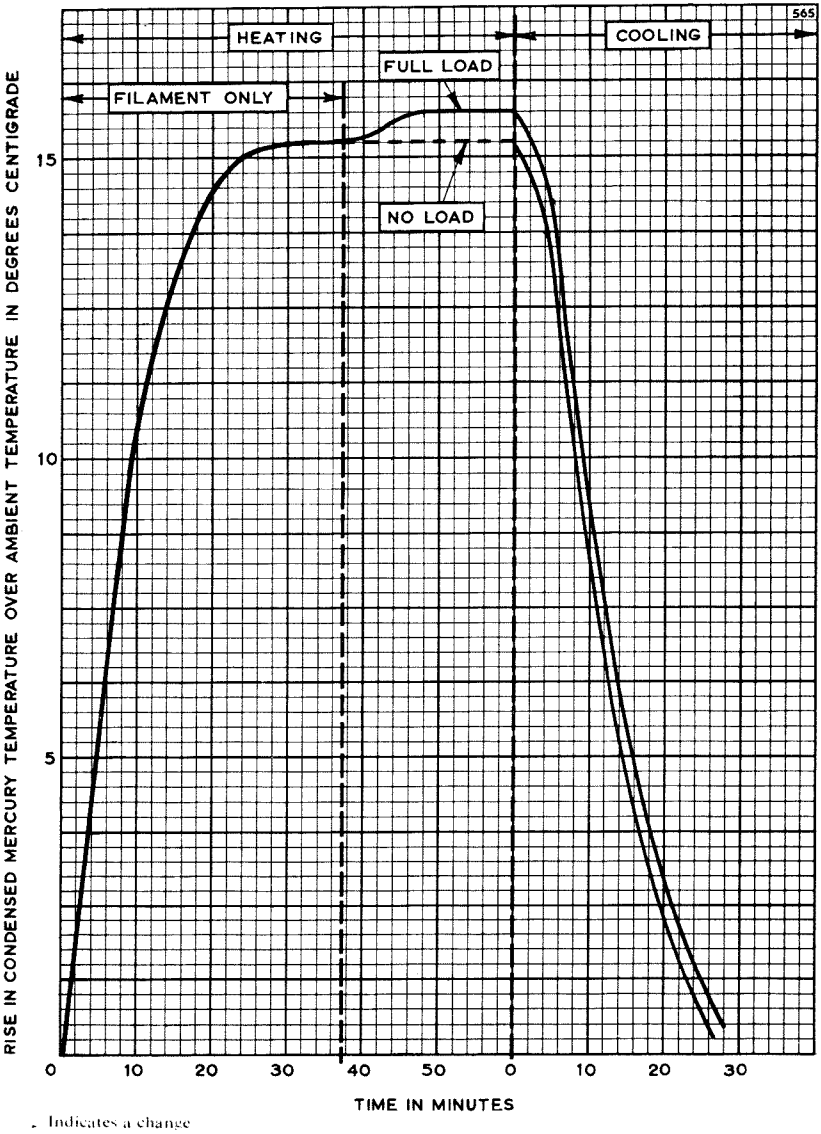
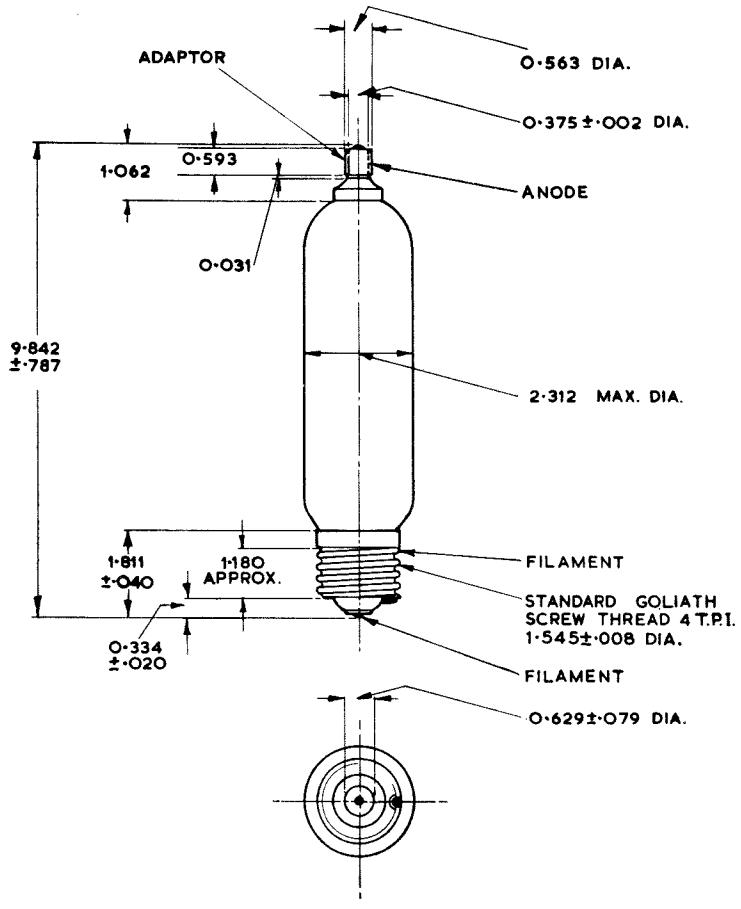
← HEATING AND COOLING CHARACTERISTIC



← Indicates a change

OUTLINE

101A



ALL DIMENSIONS IN INCHES

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MERCURY VAPOUR RECTIFIER

AH238

December 1963

ENGLISH ELECTRIC

Service Type CV1629

INTRODUCTION

The AH238 is a hot cathode Mercury Vapour Rectifier with maximum ratings of 13kV peak inverse voltage and 5·0A peak current. It will provide a d.c. output of 12kV 3·7A in a three phase full wave circuit.

GENERAL DATA

(See also Preamble to Rectifier Section of this catalogue)

Electrical

Filament	Oxide Coated	
Filament Voltage	4·0	V
Filament Current	7·0	A
Filament Heating Time	1	Minute
Condensed Mercury Temperature	*(See page 2)*	
Max Peak Inverse Voltage	*(See page 2)*	
Max Anode Current:		
Peak	5·0	A
Mean‡	1·25	A
Under fault conditions (0·1 second Max duration)	100	A

Mechanical

Overall Length	9·488 inches	(241mm)	Max←
Overall Diameter	2·312 inches	(58·7mm)	Max←
Net Weight	7 ounces	(200gm)	Approx
Mounting Position		Vertical, base down	
Base		Goliath Edison Screw	
Top Cap		B.S.448/CT9 fitted with screw terminal adaptor	←

CONTROL OF CONDENSED MERCURY TEMPERATURE

On the following pages two curves are given showing:

1. Total heating time for any value of ambient temperature. This is for use when the valve is being switched on from cold.
2. Rise of condensed mercury temperature above ambient plotted against heating and cooling time. This can be used as indicated by the example in the preamble to this section of the catalogue.

← Indicates a change

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ENGLISH ELECTRIC

MAXIMUM OPERATING CONDITIONS
(Absolute Values—see Preamble)

Circuit	* Diagram	Condensed Mercury Temp. °C	Peak Inverse Voltage (50-60 c/s) kV	Anode Current in Amperes		Transformer Secondary Voltage (R.M.S.) kV	Max D.C. Output	
				Peak	Mean‡		kV	A
Single Phase Full Wave	A	25–55	13	5	1·25	4·5	4·1	2·5
		25–60	10	5	1·25	3·5	3·1	2·5
		25–65	8	5	1·25	2·8	2·5	2·5
Single Phase Full Wave Bridge	B	25–55	13	5	1·25	9·1	8·2	2·5
		25–60	10	5	1·25	7·0	6·3	2·5
		25–65	8	5	1·25	5·6	5·0	2·5
Three Phase Half Wave	C	25–55	13	5	1·25	5·3†	6·2†	3·75
		25–60	10	5	1·25	4·1†	4·7†	3·75
		25–65	8	5	1·25	3·2†	3·7†	3·75
Three Phase Full Wave	D	25–55	13	5	1·25	5·3	12·4	3·75
		25–60	10	5	1·25	4·1	9·5	3·75
		25–65	8	5	1·25	3·2	7·5	3·75

*For diagrams see Typical Rectifier Circuits for Choke Input Filters in the preamble to this section of the catalogue.

†For operation with constant full load. If the load resistance is increased the secondary voltage should be decreased (to avoid excessive peak inverse voltage) until at no load the reduction is 14%. The d.c. output voltage will be correspondingly decreased.

‡Mean anode currents are averaged over any period of 15 seconds maximum.

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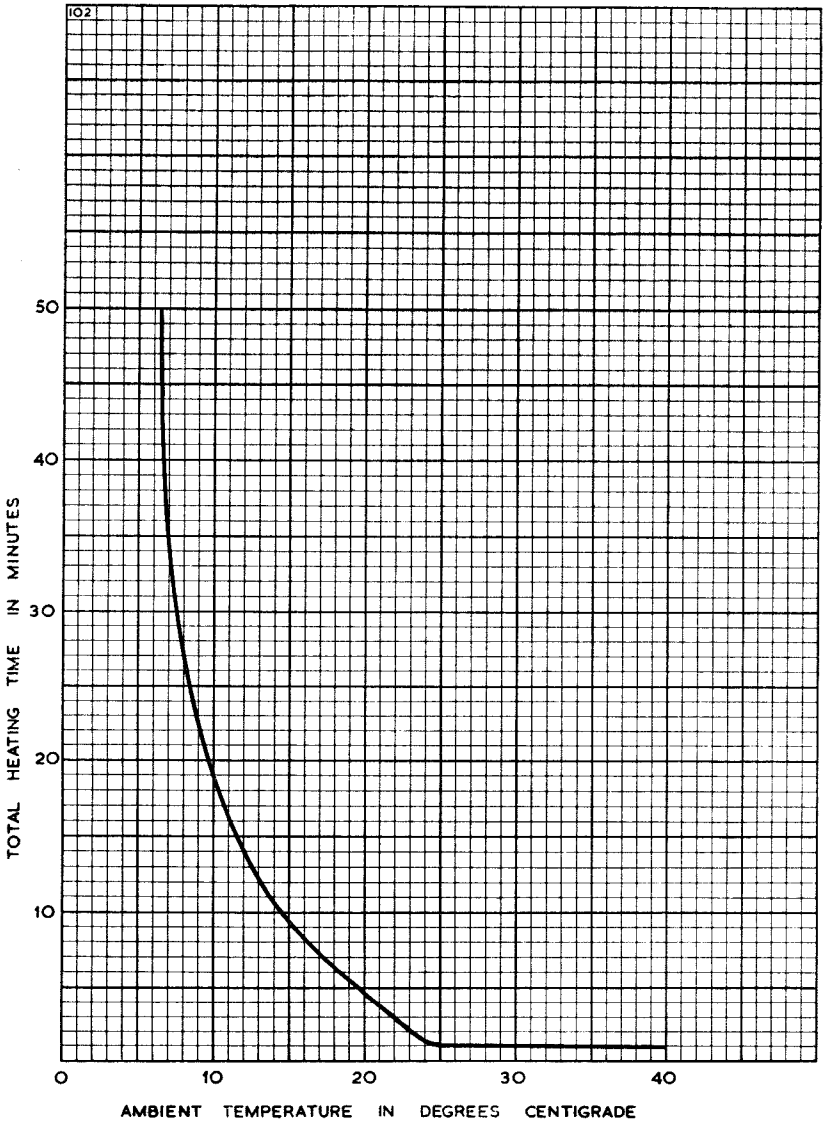
TOTAL HEATING TIME CHARACTERISTIC



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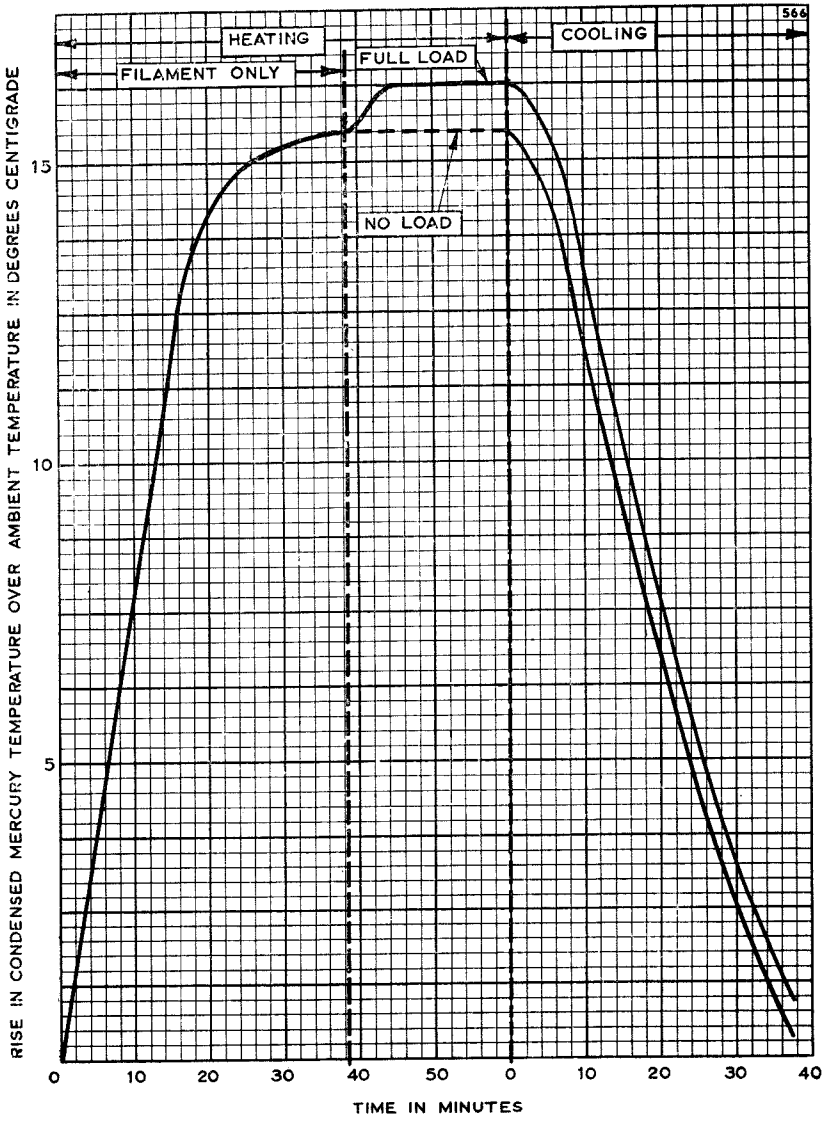
HEATING AND COOLING CHARACTERISTIC



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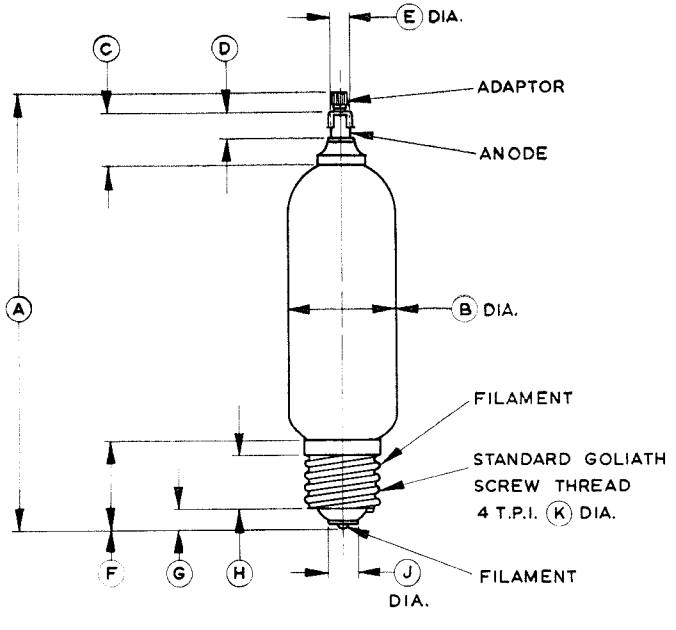
OUTLINE

104C



Ref.	Inches	Millimetres
A	9·488 Max	241 Max
B	2·312 Max	58·72 Max
C	1·062	26·97
D	0·593	15·06
E	0·375 ± 0·002	9·525 ± 0·051
F	1·811 ± 0·040	46·00 ± 1·02
G	0·355 ± 0·040	9·02 ± 1·02
H	1·180	29·97
J	0·630 ± 0·079	16·00 ± 2·01
K	1·546 ± 0·009	39·27 ± 0·23

Millimetre dimensions have been derived from inches.

AH2511

MERCURY VAPOUR RECTIFIER

JEDEC Type 6693

ABRIDGED DATA

Hot cathode mercury vapour rectifier		
Peak inverse anode voltage	15	kV max
Peak anode current (at 15kV p.i.v.)	12	A max
Mean anode current (at 15kV p.i.v.)	3.0	A max
Fault anode current (0.1s max)	120	A max
Frequency	150	Hz max

GENERAL

Electrical

Filament		oxide coated
Filament voltage	5.0	V
Filament current	11.5	A
Filament heating time (minimum)	1.0	min
Voltage drop (approx)	12	V
Condensed mercury temperature rise above ambient (approx):		
at no load	13	°C
at 2.5A load	23	°C

Mechanical

Overall length	308mm (12.126 inches) max
Overall diameter	72mm (2.835 inches) max
Net weight	450g (1 pound) approx
Mounting position	vertical, base down
Base	B4D with bayonet
Top cap	B.S.448/CT9 fitted with screw terminal adaptor

March 1969

MAXIMUM OPERATING CONDITIONS (Absolute values)

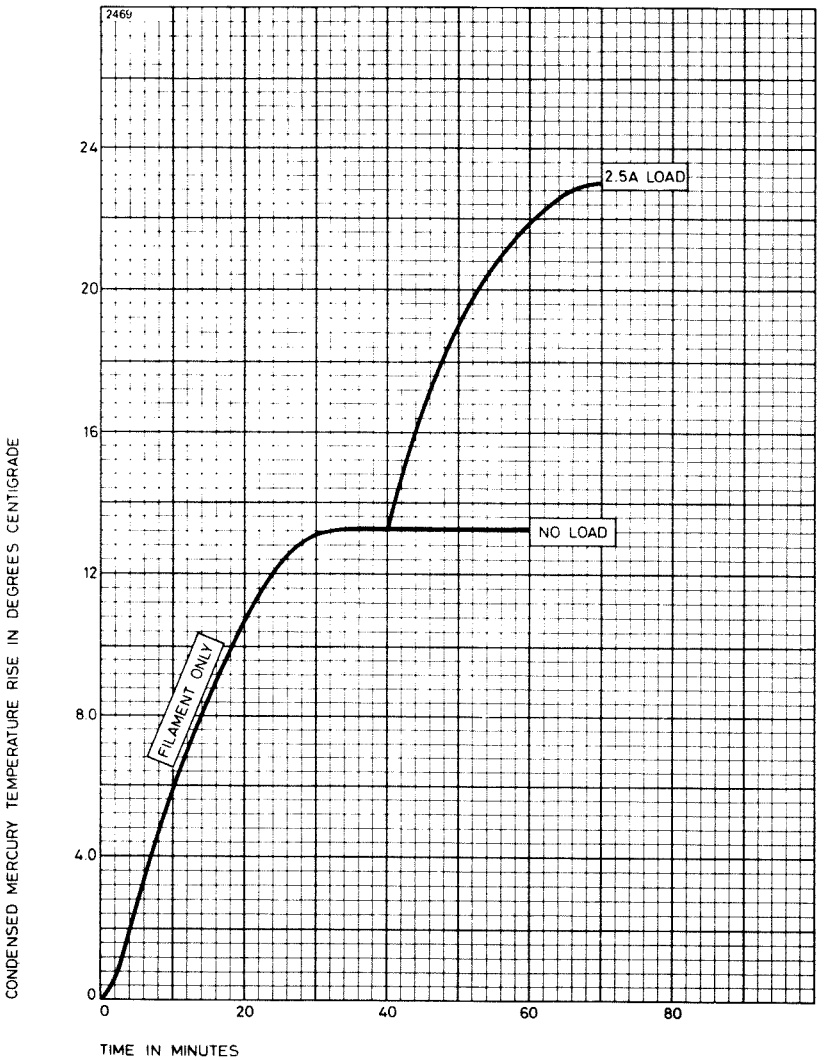
Circuit*	Condensed mercury temp. (°C)	Peak inverse voltage (50–60Hz) (kV)	Anode current in amperes peak	mean♦	Transformer secondary voltage (r.m.s.) (kV)	Maximum d.c. output (kV)	(A)
A	25–55	15	12	3.0	5.3	4.8	6.0
Single phase	25–60	10	12	3.0	3.5	3.2	6.0
full wave	25–75	2.5	20	5.0	0.88	0.8	10
B	25–55	15	12	3.0	10.6	9.6	6.0
Single phase	25–60	10	12	3.0	7.1	6.4	6.0
bridge	25–75	2.5	20	5.0	1.77	1.6	10
C	25–55	15	12	3.0	6.1†	7.2†	9.0
Three phase	25–60	10	12	3.0	4.1†	4.8†	9.0
half wave	25–75	2.5	20	5.0	1.02†	1.2†	15
D	25–55	15	12	3.0	6.1	14.3	9.0
Three phase	25–60	10	12	3.0	4.1	9.5	9.0
full wave	25–75	2.5	20	5.0	1.02	2.4	15

* See Typical Rectifier Circuits for Choke input filters in the preamble to the Rectifier section of the Valve Data Book.

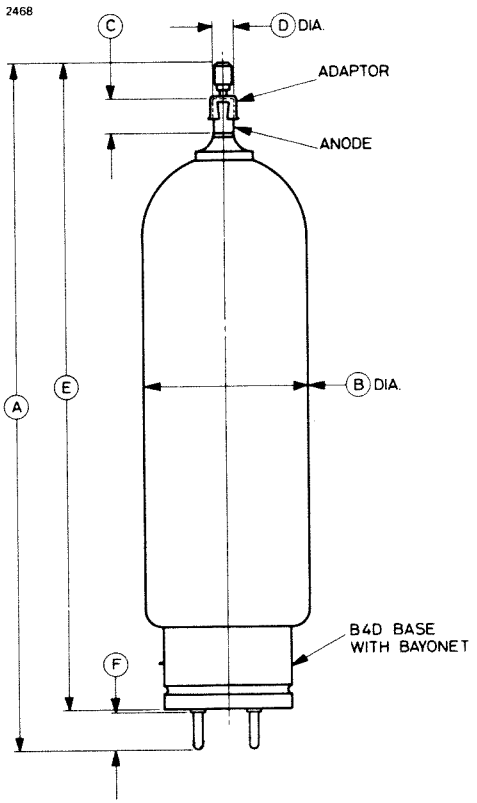
† For operation at constant full load. If the load is reduced, the peak inverse voltage on the valves will exceed the ratings unless the transformer secondary voltage is reduced. The total reduction required is 14% at no load and the d.c. output voltage will be correspondingly reduced.

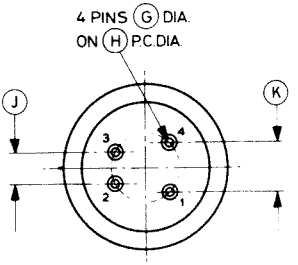
♦ Averaging time 15 seconds maximum.

HEATING CHARACTERISTIC



OUTLINE





VIEW ON BASE

Pin	Element
1	No connection
2	Filament
3	Filament
4	No connection

Ref	Inches	Millimetres	Ref	Inches	Millimetres
A*	11.811 ± 0.315	300.0 ± 8.0	F	0.625	15.88
B*	2.835 max	72.0 max	G	0.187 ± 0.003	4.750 ± 0.076
C	0.593	15.06	H	1.000	25.40
D	0.375 ± 0.002	9.525 ± 0.051	J	0.562	14.27
E*	11.122 ± 0.236	282.5 ± 6.0	K	0.750	19.05

Millimetre dimensions have been derived from inches except where marked *.

MERCURY VAPOUR RECTIFIER

BD12

ENGLISH ELECTRIC

ABRIDGED DATA

Hot Cathode Full Wave Mercury Vapour Rectifier

Peak Inverse Anode Voltage	1·0	kV Max
Peak Anode Current (per anode)	50	A Max
Mean Anode Current (per anode)	16·5	A Max

GENERAL

(See also Preamble to Rectifier Section of this Catalogue)

Electrical

Cathode	Indirectly Heated	
Heater Voltage	5·0	V
Heater Current	35	A
Cathode Heating Time (Minimum)	5·0	min
Voltage Drop (Approx)	12	V
Condensed Mercury Temperature Rise above Ambient (Approx):		
At no load	52	°C
At full load	60	°C

Mechanical

Overall Length (excluding leads)	16·437 inches	(417·5 mm)	Max
Overall Diameter	6·437 inches	(163·5 mm)	Max
Net Weight	3½ pounds	(1·6 kg)	Approx
Mounting Position	Vertical, base down		
Connections	Flexible leads		

MAXIMUM AND MINIMUM RATINGS

(Absolute Values)

Peak Inverse Anode Voltage	1·0	kV Max
R.M.S. Voltage between Anodes	250	V Max
Peak Anode Current (per anode)	50	A Max
Mean Anode Current (per anode) (averaging time 30sec max)	16·5	A Max
Surge Anode Current (per anode) (0·1sec maximum duration)	500	A Max
Condensed Mercury Temperature (on load)	40	°C Min
	100	°C Max

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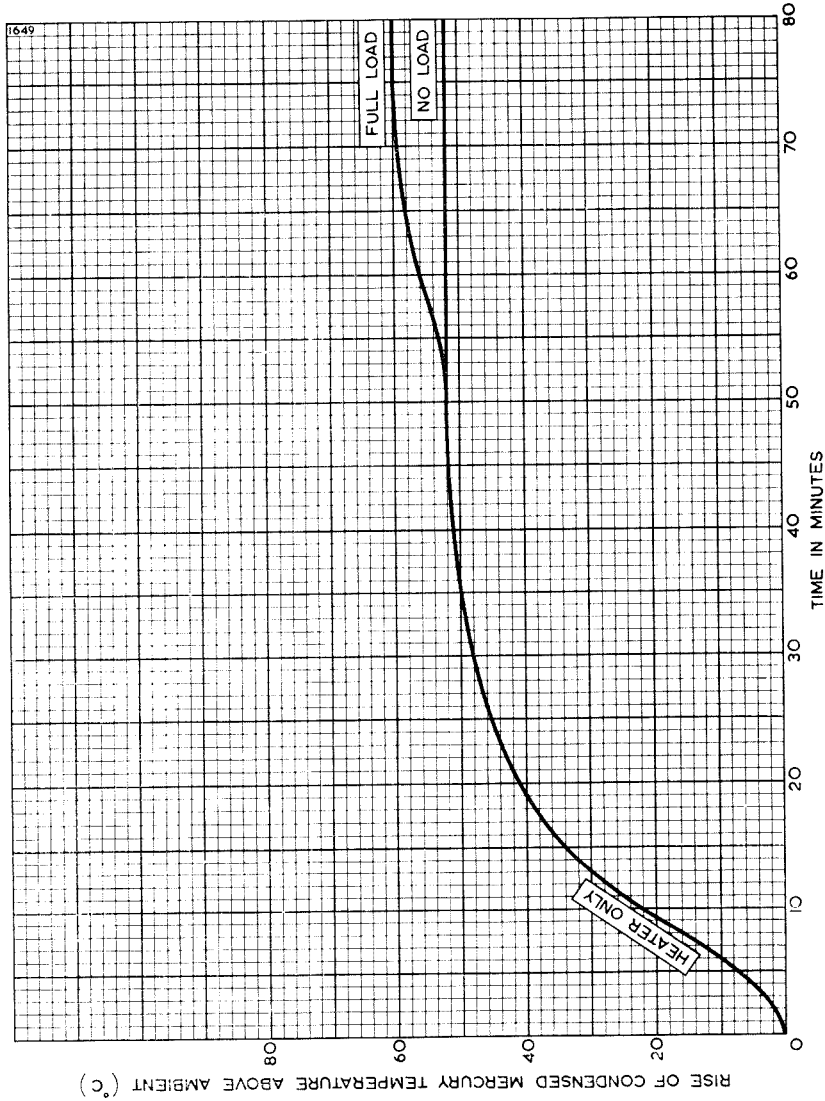
ENGLISH ELECTRIC

HEATING CHARACTERISTIC



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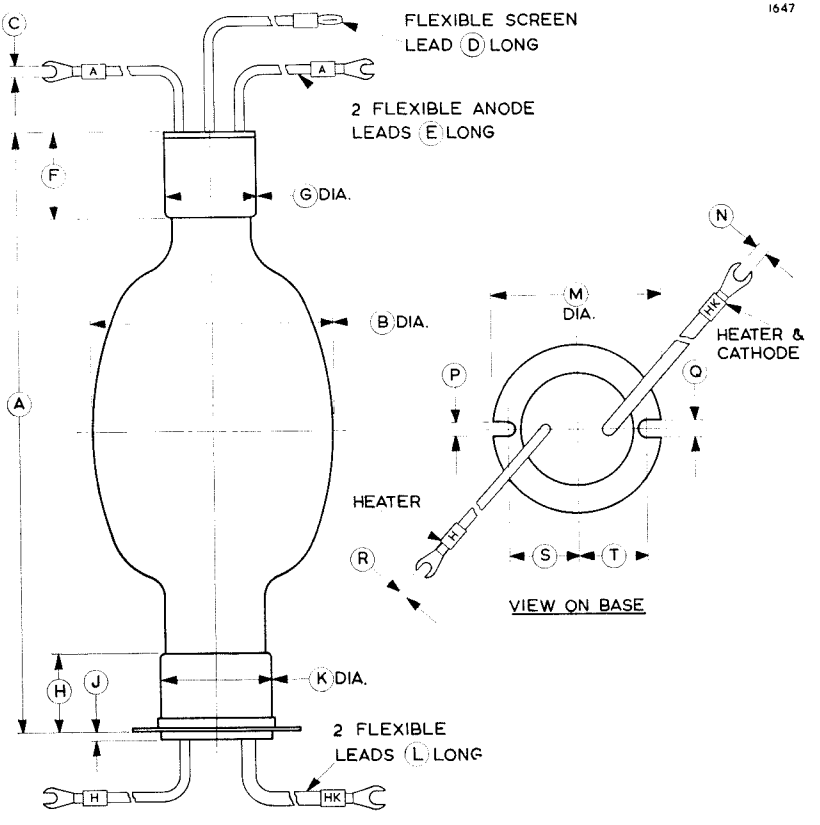
OUTLINE

1647



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	15·625 ± 0·500	396·9 ± 12·70	K	2·875 Max	73·03 Max
B	6·437 Max	163·5 Max	L	7·750 ± 0·250	196·9 ± 6·35
C	0·265	6·73	M	4·375 Max	111·1 Max
D	6·250 ± 0·250	158·8 ± 6·35	N	0·328	8·33
E	7·750 ± 0·250	196·9 ± 6·35	P	0·344	8·74
F	2·250	57·15	Q	0·437	11·10
G	2·875 Max	73·03 Max	R	0·265	6·73
H	2·000	50·80	S	1·813	46·05
J	0·250 ± 0·062	6·35 ± 1·57	T	1·813	46·05

Millimetre dimensions have been derived from inches.

Xenon Filled Rectifiers

June 1965

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

XENON FILLED RECTIFIER

3B22

Service Type CV3815 **American Designation 3B22**

INTRODUCTION

The 3B22 is a hot cathode, full wave, Xenon filled Rectifier with maximum ratings of 725V peak inverse voltage and 4·0A peak current.

GENERAL DATA

(See also Preamble to Rectifier Section of this Catalogue)

Electrical

Filament	Oxide Coated	
Filament Voltage	2·5	V
Filament Current	6·25 A	Approx
Min Filament Heating Time	20	secs
Ambient Temperature Range	−55 to +75	°C
Max Peak Inverse Voltage	725	V
Max Anode Current (per anode):		
Peak	4·0	A
Mean (4·5 secs averaging time)	0·5	A
Under Fault Conditions (0·1 second Max duration)	60	A
Max Power Supply Frequency	250	c/s

Mechanical

Overall Length	6·00 inches (153 mm)	Max
Overall Diameter	1·66 inches (42·1 mm)	Max
Net Weight	3 ounces (90 gm)	Approx
Mounting Position		Any
Base	Medium UX4 with bayonet	
Cooling		Natural

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XENON FILLED RECTIFIER

MAXIMUM OPERATING CONDITIONS

(Absolute Values—see Preamble)

D.C. Output with choke input filter and delayed H.T. switching

Circuit	* Diagram	Peak Inverse Voltage (up to 250c/s) V	Anode Current in Amperes		Transformer Secondary Voltage (R.M.S.) V	Max D.C. Output	
			Peak	Mean‡		V	Amps
Single Phase Full Wave	A	725	4	0·5	255	230	1·0
Single Phase Full Wave Bridge	B	725	4	0·5	510	460	1·0
Three Phase Full Wave	D	725	4	0·5	295	690	1·5

* For diagrams see Typical Rectifier Circuits for Choke Input Filters in the preamble to this section of the catalogue.

‡Mean anode currents are averaged over any period of 4·5 seconds.

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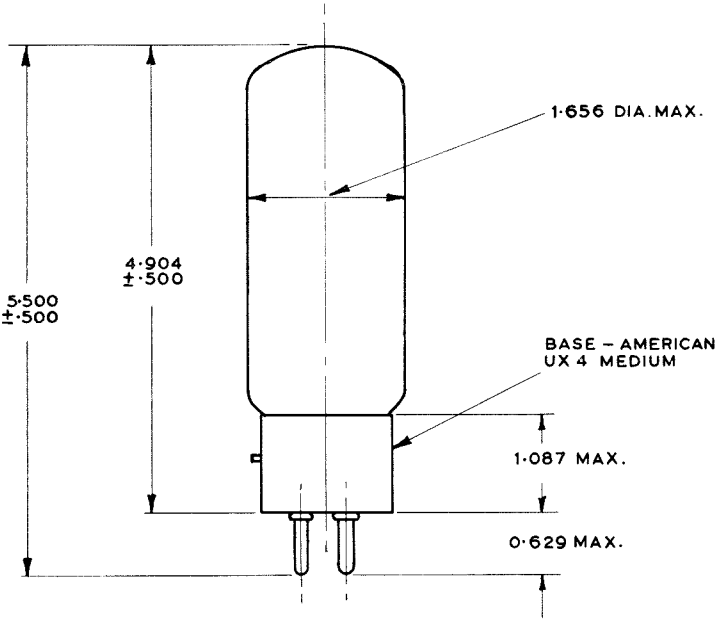
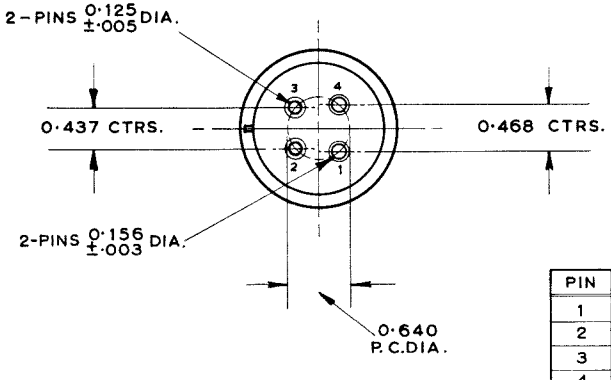
XENON FILLED RECTIFIER

OUTLINE

496





PIN	ELEMENT
1	FILAMENT
2	ANODE
3	ANODE
4	FILAMENT

ALL DIMENSIONS IN INCHES

XENON FILLED RECTIFIER

3B28 (AX224)

Service Type CV1835 **American Designation 3B28**

INTRODUCTION

The 3B28 is a hot cathode, Xenon filled Rectifier with maximum ratings of 1A peak current at 10kV peak inverse voltage and 2A peak current at 5kV peak inverse voltage.

GENERAL DATA

(See also Preamble to Rectifier Section of this Catalogue)

Electrical

Filament	Oxide Coated		
Filament Voltage	2·5		V
Filament Current	5·0		A
Min Filament Heating Time	10		secs
Ambient Temperature Range	−55 to +75		°C
Max Peak Inverse Voltage	5·0	10·0	kV
Max Anode Current:			
Peak	2·0	1·0	A
Mean‡	0·5	0·25	A
Under fault conditions (0·1 second Max duration)	20	20	A
Max Power Supply Frequency	500	150	c/s

Mechanical

Overall Length	6·16 inches	(156 mm)	Max
Overall Diameter	2·07 inches	(53 mm)	Max
Net Weight	2 ounces	(57 gm)	Approx
Mounting Position			Any
Base	Medium UX4 with bayonet		
Cooling			Natural

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MAXIMUM OPERATING CONDITIONS
(Absolute Values—see Preamble)

D.C. Output with choke input filter and delayed H.T. switching

Circuit	* Diagram	Peak Inverse Voltage kV	Anode Current in Amperes		Transformer Secondary Voltage (R.M.S.) kV	Max D.C. Output	
			Peak	Mean‡		kV	Amps
Single Phase Full Wave	A	● 10 △ 5	1 2	0·25 0·5	3·5 1·7	3·1 1·5	0·5 1·0
Single Phase Full Wave Bridge	B	● 10 △ 5	1 2	0·25 0·5	7·0 3·5	6·3 3·1	0·5 1·0
Three Phase Half Wave	C	● 10 △ 5	1 2	0·25 0·5	4·1† 2·0†	4·7† 2·3†	0·75 1·5
Three Phase Full Wave	D	● 10 △ 5	1 2	0·25 0·5	4·1 2·0	9·5 4·7	0·75 1·5

*For diagrams see Typical Rectifier Circuits for Choke Input Filters in the preamble to this section of the catalogue.

†For operation with constant full load. If the load resistance is increased the secondary voltage should be decreased (to avoid excessive peak inverse voltage) until at no load the reduction is 14%. The D.C. output voltage will be correspondingly decreased.

‡Mean anode currents are averaged over any period of 15 seconds maximum.

●For operation up to 150c/s.

△For operation up to 500c/s.

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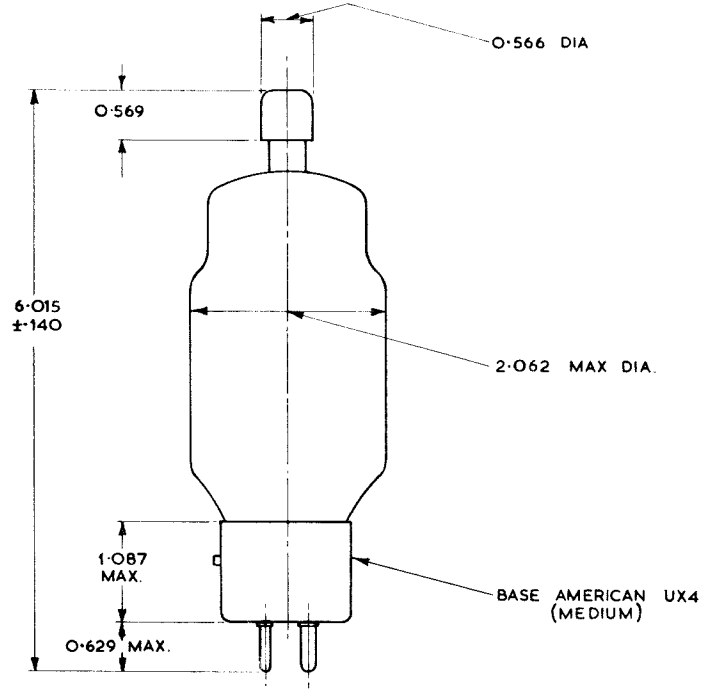
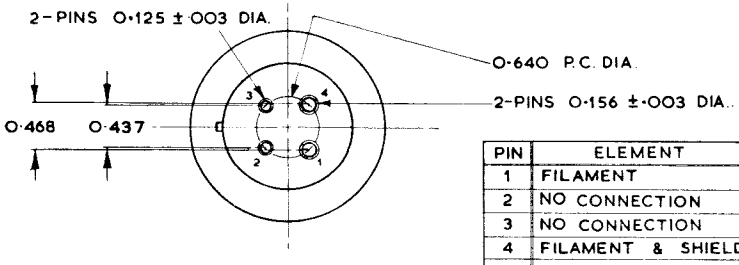
OUTLINE

105





PIN	ELEMENT
1	FILAMENT
2	NO CONNECTION
3	NO CONNECTION
4	FILAMENT & SHIELD
CAP	ANODE

ALL DIMENSIONS IN INCHES

Printed in England

XENON FILLED RECTIFIER

4B32
(AX230)

Service Type CV2518 **American Designation 4B32**

INTRODUCTION

The 4B32 is a hot cathode, Xenon filled Rectifier with maximum ratings of 10kV peak inverse voltage and 5A peak current.

GENERAL DATA
(See also Preamble to Rectifier Section of this catalogue)

Electrical

Filament	Oxide Coated	
Filament Voltage	5·0	V
Filament Current	7·1	A
Min Filament Heating Time	30	secs
Ambient Temperature Range	−55 to +70	°C
Max Peak Inverse Voltage	10·0	kV
Max Anode Current:		
Peak	5·0	A
Mean‡	1·25	A
Under fault conditions (0·1 second Max duration)	50	A
Max Power Supply Frequency	150	c/s

Mechanical

Overall Length	8·5 inches (216 mm)	Max
Overall Diameter	2·32 inches (59 mm)	Max
Net Weight	8 ounces (230 gm)	Approx
Mounting Position		Any
Base		B4F
Cooling		Natural

MAXIMUM OPERATING CONDITIONS

(Absolute Values—see Preamble)

D.C. Output with choke input filter and delayed H.T. switching

Circuit	* Diagram	Peak Inverse Voltage (up to 150c/s) kV	Anode Current in Amperes		Transformer Secondary Voltage (R.M.S.) kV	Max D.C. Output	
			Peak	Mean‡		kV	Amps
Single Phase Full Wave	A	10	5	1·25	3·5	3·1	2·5
Single Phase Full Wave Bridge	B	10	5	1·25	7·0	6·3	2·5
Three Phase Half Wave	C	10	5	1·25	4·1†	4·7†	3·75
Three Phase Full Wave	D	10	5	1·25	4·1	9·5	3·75

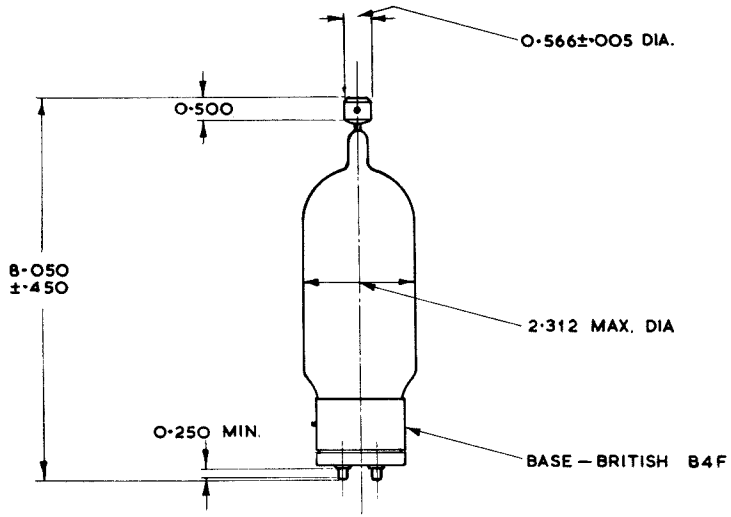
*For diagrams see Typical Rectifier Circuits for Choke Input Filters in the preamble to this section of the catalogue.

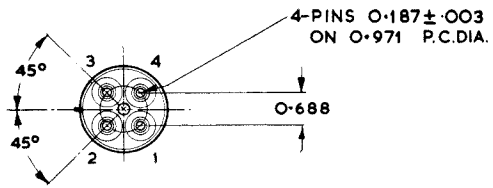
†For operation with constant full load. If the load resistance is increased the secondary voltage should be decreased (to avoid excessive peak inverse voltage) until at no load the reduction is 14%. The D.C. output voltage will be correspondingly decreased.

‡Mean anode currents are averaged over any period of 15 seconds maximum.

OUTLINE

106





PIN	ELEMENT
1	NO CONNECTION
2	FILAMENT
3	NO CONNECTION
4	FILAMENT
CAP	ANODE

ALL DIMENSIONS IN INCHES

Printed in England

TUNGAR RECTIFIER

68504

ENGLISH ELECTRIC

INTRODUCTION

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

GENERAL DATA

(See also Preamble to Rectifier Section of this Catalogue)

Electrical

Cathode	Oxide Coated Filament	
Filament Voltage	2·3	V
Filament Current	18±2	A
Cathode Heating Time (Minimum)	30	s
Voltage Drop (Approx)	10	V
Ambient Temperature Range	−55 to +70	°C
D.C. Output as Full-Wave Rectifier:		
Voltage	30	V Max
Current	5·0	A Max

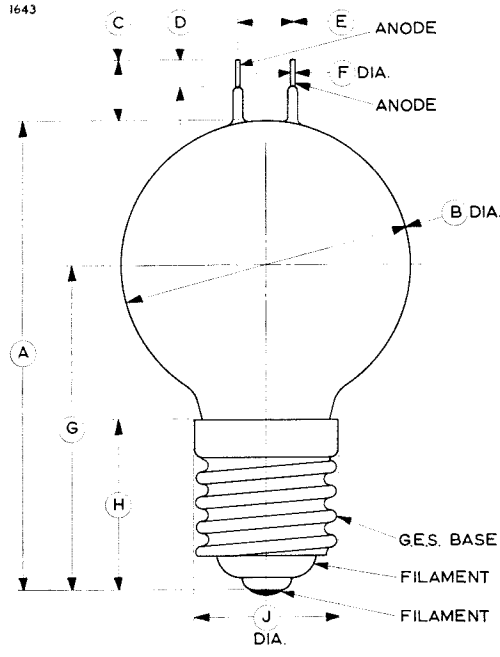
Mechanical

Overall Length	5·71 inches	(145 mm)	Max
Overall Diameter	3·03 inches	(77 mm)	Max
Net Weight	4 ounces	(112 gm)	Approx
Mounting Position			Any
Base			Goliath Edison Screw
Cooling			Convection

Printed in England

ENGLISH ELECTRIC

OUTLINE



Ref.	Inches	Millimetres
A	4·528 ± 0·394	115·0 ± 10·0
B	3·032 Max	77·0 Max
C	0·472 ± 0·197	12·0 ± 5·0
D	0·276 Min	7·0 Min
E	0·492 ± 0·098	12·5 ± 2·5
F	0·059	1·5
G	3·465 ± 0·394	88·0 ± 10·0
H	1·811 Max	46·0 Max
J	1·543 Max	39·2 Max

Inch dimensions have been derived from millimetres

Printed in England

TUNGAR RECTIFIER

68506

ENGLISH ELECTRIC

INTRODUCTION

The 68506 is a hot cathode, half-wave, gas-filled Rectifier designed for use in low voltage battery charging equipment.

GENERAL DATA

(See also Preamble to Rectifier Section of this Catalogue)

Electrical

Cathode	Oxide Coated Filament	
Filament Voltage	2·3	V
Filament Current	18±2	A
Cathode Heating Time (Minimum)	30	s
Voltage Drop (Approx)	10	V
Ambient Temperature Range	−55 to +70	°C
D.C. Output as Half-Wave Rectifier:		
Voltage	75	V Max
Current	6·0	A Max

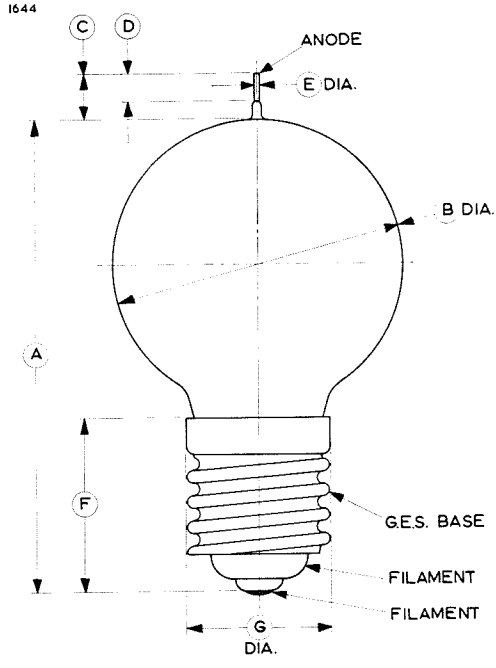
Mechanical

Overall Length	5·71 inches (145 mm)	Max
Overall Diameter	3·03 inches (77 mm)	Max
Net Weight	4 ounces (112 gm)	Approx
Mounting Position		Any
Base	Goliath Edison Screw	
Cooling		Convection

Printed in England

ENGLISH ELECTRIC

OUTLINE



Ref.	Inches	Millimetres
A	4·528 ± 0·394	115·0 ± 10·0
B	3·032 Max	77·0 Max
C	0·472 ± 0·197	12·0 ± 5·0
D	0·276 Min	7·0 Min
E	0·059	1·5
F	1·811 Max	46·0 Max
G	1·543 Max	39·2 Max

Inch dimensions have been derived from millimetres.

TUNGAR RECTIFIER

68530

ENGLISH ELECTRIC

INTRODUCTION

The 68530 is a hot cathode, full-wave, gas-filled Rectifier designed for use in low voltage battery charging equipment.

GENERAL DATA

(See also Preamble to Rectifier Section of this Catalogue)

Electrical

Cathode	Oxide Coated Filament	
Filament Voltage	2·0	V
Filament Current	8±1	A
Cathode Heating Time (Minimum)	30	s
Voltage Drop (Approx)	10	V
Ambient Temperature Range	−55 to +70	°C
D.C. Output as Full-Wave Rectifier:		
Voltage	30	V
Current	6·0	A

Mechanical

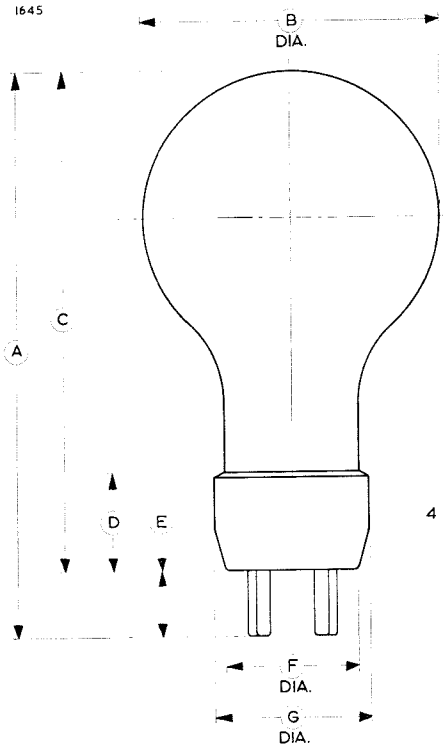
Overall Length	5·94 inches (151 mm)	Max
Overall Diameter	3·19 inches (81 mm)	Max
Net Weight	4 ounces (112 gm)	Approx
Mounting Position		Any
Base		Special 4-pin
Cooling		Convection

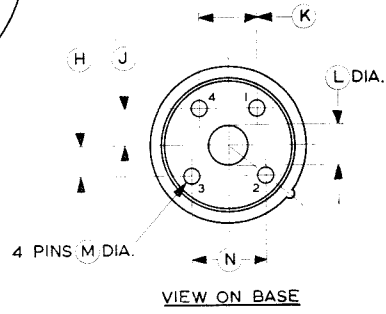
TUNGAR RECTIFIER

68530

ENGLISH ELECTRIC

OUTLINE





VIEW ON BASE

BASE CONNECTIONS

Pin	Element
1	Filament
2	Anode
3	Anode
4	Filament

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	5·688 ± 0·25	144·5 ± 6·35	H	0·312	7·94
B	3·125 ± 0·063	79·38 ± 1·60	J	0·375	9·53
C	5·125 ± 0·125	130·2 ± 3·18	K	0·594	15·09
D	1·062	27·00	L	0·375	9·53
E	0·625	15·88	M	0·156	3·96
F	1·375	34·93	N	0·781	19·84
G	1·625	41·28			

Millimetre dimensions have been derived from inches.

Printed in England

AX228

XENON FILLED RECTIFIER

Service Type CV2399

INTRODUCTION

The AX228 is a hot cathode, Xenon filled Rectifier with maximum ratings of 13kV peak inverse voltage and 6A peak current. The AX228 may be used as a ← replacement for the AH221 in applications where its peak inverse voltage rating is adequate, with the advantage that close control of ambient temperature is not required.

GENERAL DATA

(See also Preamble to Rectifier Section of this catalogue)

Electrical

Filament		Oxide Coated	
Filament Voltage		4·0	V
Filament Current		11·0	A
Min Filament Heating Time		30	sec
Ambient Temperature Range		−55 to +70	°C
Max Peak Inverse Voltage		10	13	kV
Max Anode Current:			
Peak		6·0	6·0	A
Mean‡		1·5	1·25	A
Under fault conditions (0·1 second maximum duration)			50	A
Max Power Supply Frequency			150	c/s

Mechanical

Overall Length	10·16 inches	(258 mm)	Max
Overall Diameter	2·32 inches	(59 mm)	Max
Net Weight	8 ounces	(230 gm)	Approx
Mounting Position			Any
Base			Goliath Edison Screw
Cooling			Natural

→ Indicates a change.

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XENON FILLED RECTIFIER

MAXIMUM OPERATING CONDITIONS
(Absolute Values—see Preamble)

D.C. Output with choke input filter and delayed h.t. switching

Circuit	* Diagram	Peak Inverse Voltage (up to 150c/s) kV	Anode Current in Amperes		Transformer Secondary Voltage (R.M.S.) kV	Max D.C. Output	
			Peak	Mean‡		kV	Amps
Single Phase Full Wave	A	10 13	6·0 6·0	1·5 1·25	3·5 4·6	3·2 4·1	3·0 2·5
Single Phase Full Wave Bridge	B	10 13	6·0 6·0	1·5 1·25	7·0 9·2	6·4 8·2	3·0 2·5
Three Phase Half Wave	C	10 13	6·0 6·0	1·5 1·25	4·1† 5·3†	4·7† 6·2†	4·5 3·75
Three Phase Full Wave	D	10 13	6·0 6·0	1·5 1·25	4·1 5·3	9·5 12·3	4·5 3·75

*For diagrams see Typical Rectifier Circuits for Choke Input Filters in the preamble to this section of the catalogue.

†For operation with constant full load. If the load resistance is increased the secondary voltage should be decreased (to avoid excessive peak inverse voltage) until at no load the reduction is 14%. The d.c. output voltage will be correspondingly decreased.

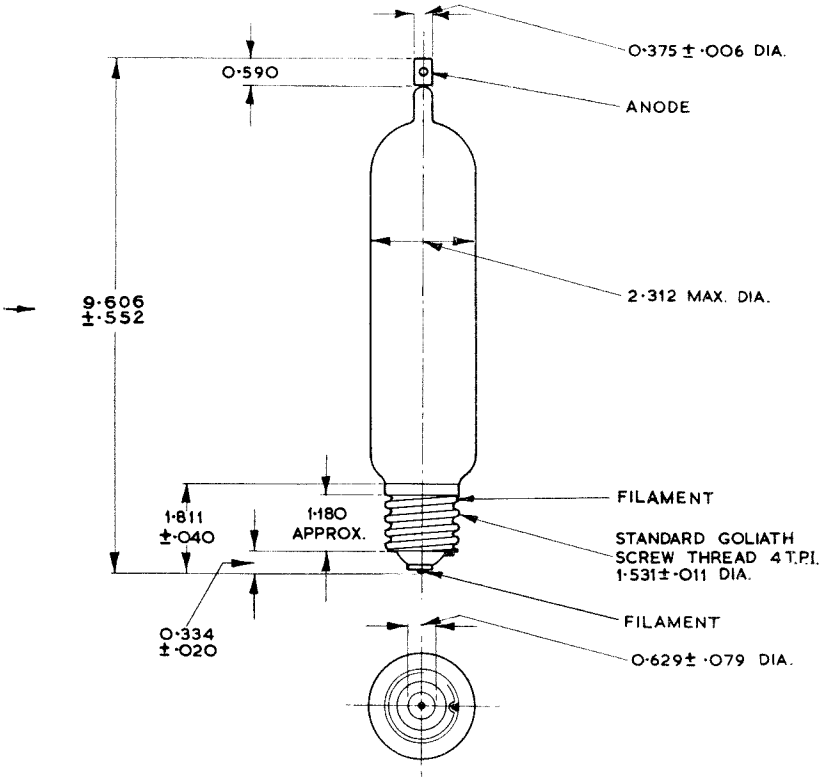
‡Mean anode currents are averaged over any period of 15 seconds maximum

AX228

XENON FILLED RECTIFIER

OUTLINE

497



ALL DIMENSIONS IN INCHES

INDICATES A CHANGE ←

ENGLISH ELECTRIC VALVE CO. LTD.
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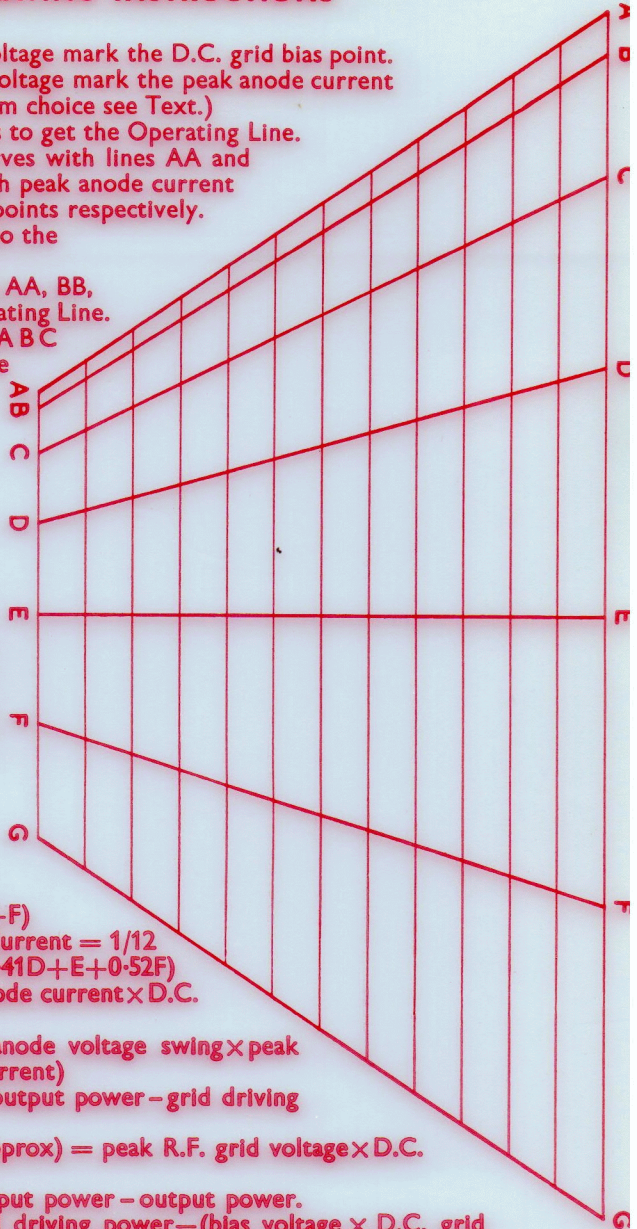
POWER VALVES for Transmitters and R.F. Heaters

ENGLISH ELECTRIC VALVE CO. LTD.
CHELMSFORD ESSEX, ENGLAND TECHNICAL PUBLICATIONS
Printed in England

OPERATING INSTRUCTIONS

1. At the D.C. anode voltage mark the D.C. grid bias point.
2. At minimum anode voltage mark the peak anode current point. (For optimum choice see Text.)
3. Join these two points to get the Operating Line.
4. Set calculator on curves with lines AA and GG passing through peak anode current and D.C. grid bias points respectively. Keep AG parallel to the Operating Line.
5. Read currents where AA, BB, etc. cross the Operating Line.
6. Insert these currents A B C etc. in the formulae below.



CALCULATOR

For OSCILLATORS and CLASS C AMPLIFIERS
For use with Constant Current Curves.
Based on the method and formulae of Robert I. Sarbacher in Electronics, Dec. 1942 and H. P. Thomas in Proc. I.R.E. Aug. 1933.

FORMULAE

D.C. Current = 1/12 (0·5A+B+C+D+E+F)
Peak Fundamental R.F. Current = 1/12 (A+1·93B+1·73C+1·41D+E+0·52F)
Input Power = D.C. anode current × D.C. anode voltage
Output Power = 1/2 (anode voltage swing × peak fundamental anode current)
Osc. Output Power = output power − grid driving power
Grid Driving Power (approx) = peak R.F. grid voltage × D.C. grid current
Anode Dissipation = input power − output power.
Grid Dissipation = grid driving power − (bias voltage × D.C. grid current)
Useful Power Output = output power − equipment losses.
For detailed instructions see text.

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Osc. Output Power = output power − grid driving power
Grid Driving Power (approx) = peak R.F. grid voltage × D.C. grid current
Anode Dissipation = input power − output power.
Grid Dissipation = grid driving power—(bias voltage × D.C. grid current)
Useful Power Output = output power—equipment losses.
For detailed instructions see text.

ENGLISH ELECTRIC VALVE CO. LTD.
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POWER TRIODES

Natural Cooled

Forced-air Cooled

Water Cooled

Vapour Cooled

December 1963

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

TABULATED DATA

POWER TRIODES

NATURAL COOLED

EEV type	Anode dissipation max (W)	Output power (kW)⊕	Anode voltage max (kV)	Frequency (MHz)‡	Amplification factor
3C24	25	0.1	2.0	60/100	25
5867†	250	0.84	3.0	100/150	25
B142†	300 400☆	1.0 1.44☆	3.0 4.0☆	30/75	35
B1152*	1000△ 500	2.4△ 1.5	5.0	50	24
B1153*	1500△ 800	4.6△ 2.7	6.0	50	22

FORCED-AIR COOLED

EEV type	Anode dissipation max (kW)	Output power (kW)⊕	Anode voltage max (kV)	Frequency (MHz)‡	Amplification factor
5736	2.5	4.1	5.0	60/200	22
5762	3.0	6.0	6.2	30/220	29
BR140†	8.0	—	12	15/40	45
BR153†	12	—	15	20/40	45
BR155†	7.5	—	10	30/110	50
BR161	15	50	12	30/50	45
BR175†	4.0	13	12.5	1.6/20	50

Continued on page 2

⊕ ‡ † ☆ △ * **See foot of page 4**

FORCED-AIR COOLED – continued

EEV type	Anode dissipation max (kW)	Output power (kW)⊕	Anode voltage max (kV)	Frequency (MHz)‡	Amplification factor
BR179	8.0	17	8.5	50/110	28
BR189	27	80	15	5/50	34
BR194	40	115	15	5/30	34
BR1102*	20	53	12	50	42
BR1103†	10	–	8.5	100	25
BR1106	10	15.5	6.6	30/220	30
BR1115†	3.0	7.0	6.0	30/110	30
BR1121*	15	50	10	50	38
BR1122	10	29	12	5/110	37
BR1124*	10	20	8.5	100	37
BR1126*	3.0	7.0	6.0	30/110	30
BR1131	3.5	7.9	10	15/80	40
BR1132	4.0	14.5	12.5	1.6/20	50
BR1143*	20	77.5	10	10	37
BR1160	5.0	6.9	6.0	75/220	32
BR1161	35	100	14	10/30	90
BR1162	6.0	10	7.2	30/85	32
BR1165	5.0	6.9	6.0	75/220	32
BR1169*	10	18	7.5	20	11
BR1181	10	26	8.0	100	11

⊕ ‡ † * **See foot of page 4**

WATER COOLED

EEV type	Anode dissipation max (kW)	Output power (kW)⊕	Anode voltage max (kV)	Frequency (MHz)‡	Water jacket
BW140†	12	–	12	15/40	–
BW153†	18	–	15	20/40	–
BW161	20	56	12	30/50	BW4028
BW179	10	17	8.5	50/110	BW4029
BW189	35	80	15	5/50	BW4050
BW194	50	115	15	5/30	BW4027
BW1102*	20	53	12	50	BW4028
BW1102J2*					Integral
BW1121*	15	50	10	50	BW4034
BW1121J*					Integral
BW1121J2*					Integral
BW1122	10	29	12	5/110	BW4070
BW1124*	10	20	8.5	100	BW4029
BW1124J1*					Integral
BW1124J2*					Integral
BW1126 *	3.0	7.0	6.0	30/110	–
BW1143*	30	77	10	10	BW4050
BW1143J2*					Integral
BW1144	100	200	14	27	BW4035
BW1156	175	250	14	27	BW4035
BW1162	6.0	10	7.2	30/85	BW4088
BW1162J3					Integral
BW1165	6.0	7.0	6.0	75/220	BW4088
BW1165J3					Integral
BW1169J3*	10	18	7.5	20	Integral
BW1176J1	20	70	10	50	Integral
BW1176J2					
BW1181J3	12	26	8.0	100	Integral

⊕ ‡ † * **See foot of page 4**

VAPOUR COOLED

EEV type	Anode dissipation max (kW)	Output power (kW)⊕	Anode voltage max (kV)	Frequency (MHz)‡	Boiler unit
BY189A	35	80	15	5/50	BY4037◇ BY4038□ BY4038A▲
BY194*	50	115	15	5/30	BY4039□ BY4049◇
BY1102*	25	53	12	50	BY4030▲ BY4031□
BY1121*	18	50	10	50	BY4032▲ BY4033□ BY4063◇
BY1122	10	29	12	5/110	BY4048A◇ BY4064□
BY1124*	10	20	8.5	100	BY4048A◇ BY4064□
BY1143*	35	77	10	10	BY4037◇ BY4038□ BY4038A▲
BY1144 **BY1144L**	125	200	14	27	BY4036□ BY4060◇
BY1156	125	250	14	27	BY4036□ BY4060◇
BY1161	60	120	14	10/30	BY4059◇ BY4093□

⊕ Under class C unmodulated conditions.
‡ Where two values are given, the lower value is the maximum frequency for full ratings. Derating is necessary for operation at the higher value.
† Maintenance type. Not recommended for new equipment.
* Recommended for industrial heating service.
☆ With forced-air cooling.
△ Intermittent operation.
◇ Single unit, separate condenser required.
□ Single unit with integral condenser.
▲ Double unit with integral condenser.

POWER TRIODE ACCESSORIES

The table below lists the accessories which are available for valves in the power triode range.

Valve Type	Filament Lead	Grid Connector	Other Accessories
5762	—	MA66A	—
BR128B	MA131	—	—
BR140	MA135, MA135A	—	—
BR153	MA135, MA135A	—	—
BR155	MA135, MA135A	MA66A	—
BR161	MA131	MA66	—
BR175	MA135, MA135A	MA66A	—
BR179	MA135, MA135A	MA66A	—
BR189	MA130	MA66	—
BR194	MA130	MA66	—
BR195	MA135, MA135A	MA66A	—
BR1102	MA131	MA66	—
BR1103	MA135, MA135A	MA66A	—
BR1106	MA131	—	—
BR1115	Integral	MA66A	—
BR1121	MA131	MA66	BR4045 Insulating Pedestal
BR1122	MA135, MA135A	MA66A	—
BR1124	MA135, MA135A	MA66A	—
BR1126	Integral	MA66A	—
BR1132	MA135, MA135A	MA66A	—
BR1143	MA130	MA66	—
BR1161	Integral	—	—
BR1162	MA146A, MA146B	MA147A	MA149A Insulating Pedestal

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POWER TRIODE ACCESSORIES

Valve Type	Filament Lead	Grid Connector	Other Accessories
BW140	MA135, MA135A	—	—
BW153	MA135, MA135A	—	—
BW161	MA131	MA66	BW4028 Water Jacket
BW165	MA131	MA66	—
BW173	MA135, MA135A	—	—
BW179	MA135, MA135A	MA66A	BW4029 Water Jacket
BW189	MA130	MA66	BW4050 Water Jacket
BW194	MA130	MA66	BW4027 Water Jacket
BW1102	MA131	MA66	BW4028 Water Jacket
BW1102J2	MA131	MA66	—
BW1103	MA135, MA135A	MA66A	BW4029 Water Jacket
BW1121	MA131	MA66	BW4034 Water Jacket
BW1121J BW1121J2	MA131	MA66	—
BW1122	MA135, MA135A	MA66A	BW4070 Water Jacket
BW1124	MA135, MA135A	MA66A	BW4029 Water Jacket
BW1124J2	MA135, MA135A	MA66A	—
BW1126	Integral	MA66A	—
BW1139	MA135, MA135A	—	—
BW1143	MA130	MA66	BW4050 Water Jacket
BW1144	—	—	BW4035 Water Jacket
BW1162	MA146A, MA146B	MA147A	BW4088 Water Jacket

Printed in England

POWER TRIODE ACCESSORIES

Valve Type	Filament Lead	Grid Connector	Other Accessories
BY189A	MA130	MA66	BY4037 Boiler Unit‡ BY4038 Boiler Unit* BY4038A Boiler Unit†
BY194	MA130	MA66	BY4039 Boiler Unit* BY4049 Boiler Unit‡
BY1102	MA131	MA66	BY4030 Boiler Unit† BY4031 Boiler Unit*
BY1121	MA131	MA66	BY4032 Boiler Unit† BY4033 Boiler Unit* BY4063 Boiler Unit‡
BY1122	MA135, MA135A	MA66A	BY4048A Boiler Unit‡ BY4064 Boiler Unit*
BY1124	MA135, MA135A	MA66A	BY4048A Boiler Unit‡ BY4064 Boiler Unit*
BY1143	MA130	MA66	BY4037 Boiler Unit‡ BY4038 Boiler Unit* BY4038A Boiler Unit†
BY1144	—	—	BY4036 Boiler Unit*
BY1144L	Integral	—	BY4060 Boiler Unit‡
BY1161	Integral	—	BY4059 Boiler Unit‡

*Single Unit, Integral Condenser.
†Double Unit, Integral Condenser.
‡Single Unit, Separate Condenser required.

Thermal fuses, part No. MA85, are used on several of the larger vapour-cooled types and replacements are available if required.

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CHELMSFORD
ENGLAND
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Chelmsford 3491

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GRID TERMINAL CONNECTORS

MA66 MA66A MA66B

INTRODUCTION

MA66, MA66A and MA66B are connectors for use on the grid terminals of the power triodes listed below.

MA66			
BR161	BW161	BW1121	BY189A
BR189	BW165	BW1121J	BY194
BR194	BW189	BW1121J2	BY1102
BR1102	BW194	BW1143	BY1121
BR1121	BW1102	BW1176J1	BY1143
BR1143	BW1102J2	BW1176J2	

MA66A			
5762	BR1103	BR1132	BW1124J
BR155	BR1115	BW179	BW1124J2
BR175	BR1122	BW1103	BW1126
BR179	BR1124	BW1122	BY1122
BR195	BR1126	BW1124	BY1124

MA66B	
BW1144	BW1156
BW1144L	BY1156
BY1144	

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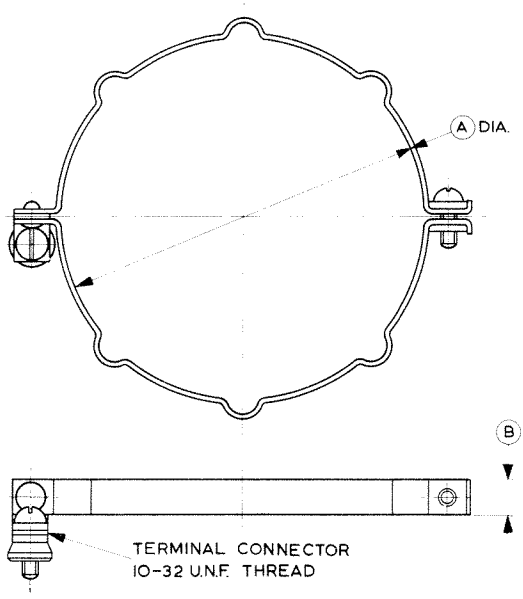
ENGLISH ELECTRIC

OUTLINE

1169A



MA66		
Ref.	Inches	Millimetres
A	4·703	119·5
B	0·375 ± 0·020	9·53 ± 0·51

MA66A		
Ref.	Inches	Millimetres
A	3·750	95·25
B	0·375 ± 0·020	9·53 ± 0·51

MA66B		
Ref.	Inches	Millimetres
A	8·086	205·4
B	0·375 ± 0·020	9·53 ± 0·51

Millimetre dimensions have been derived from inches.

Printed in England

FILAMENT LEADS

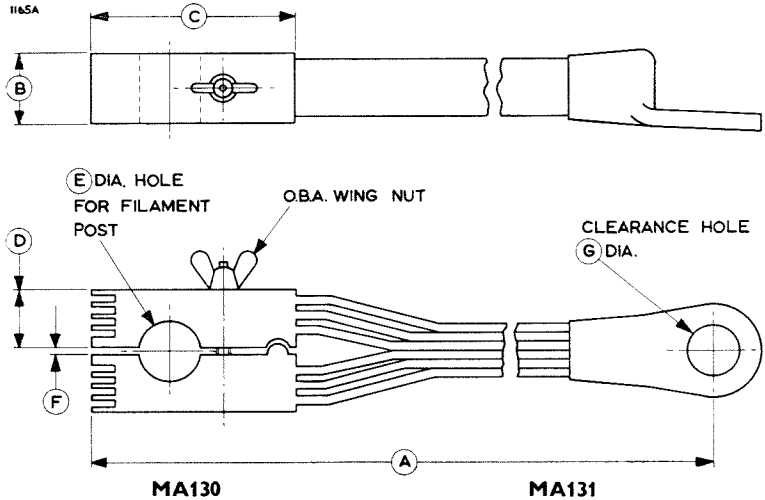
MA130 MA131

INTRODUCTION

MA130 and MA131 are filament lead assemblies intended for use with the power triodes listed below. Versions with other lead lengths can be supplied to suit customers' requirements.

Types using filament leads MA130 or MA131

MA130		MA131	
BR189	BW1143	BR128B	BW1102
BR194	BW1143J2	BR161	BW1102J2
BR1143	BY189A	BR1102	BW1121
BW189	BY194	BR1106	BW1121J
BW194	BY1143	BR1121	BW1121J2
		BW161	BY1102
		BW165	BY1121



MA130

Ref.	Inches	Millimetres
A	25·000	635
B	1·000	25·40
C	2·500	63·50
D	0·625	15·88
E	0·875	22·23
F	0·062	1·57
G	0·875	22·23

MA131

Ref.	Inches	Millimetres
A*	24·000	610
B	0·750	19·05
C	2·125	53·98
D	0·625	15·88
E	0·625	15·88
F	0·062	1·57
G	0·500	12·70

Millimetre dimensions have been derived from inches.

*Also available as MA131A with dimension A 18 inches (457mm).

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FILAMENT LEAD

MA135

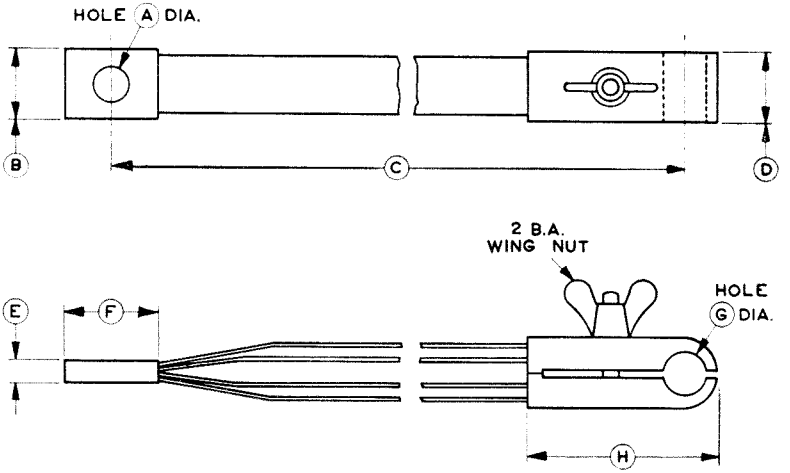
INTRODUCTION

MA135 is a filament lead assembly intended for use with the power triodes listed below. Versions with other lead lengths can be supplied to suit customers' requirements.

Types using filament lead MA135

BR140	BR195	BW140	BW1122
BR153	BR1103	BW153	BW1124
BR155	BR1122	BW173	BW1124J2
BR175	BR1124	BW179	BW1139
BR179	BR1132	BW1103	BY1122
			BY1124

1163



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	0·386	9·80	E	0·250	6·35
B	0·750	19·05	F	1·000	25·40
C*	18·00	457	G	0·437	11·10
D	0·750	19·05	H	2·000	50·80

Millimetre dimensions have been derived from inches.

*Also available as MA135A with dimension C 6 inches (152mm) and MA135B with dimension C 12 inches (305mm).

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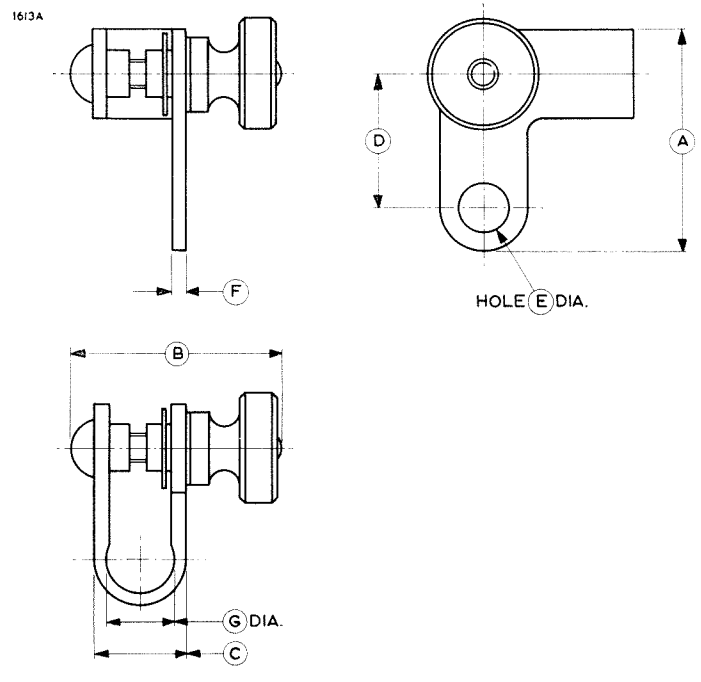
TERMINAL CLAMPS

MA146A MA146B

INTRODUCTION

MA146A and MA146B are terminal clamps designed for use with the power tubes BR1162, BW1162, CR1100 and CW1100. MA146A is used for making connection to the filament pins of the valve; MA146B is used on the filament centre-tap pin and is also a heat dissipating connector.



Ref.	MA146A		MA146B	
	Inches	Millimetres	Inches	Millimetres
A	1·181 ± 0·039	30·0 ± 1·0	1·181 ± 0·039	30·0 ± 1·0
B	1·181 ± 0·039	30·0 ± 1·0	1·181 ± 0·039	30·0 ± 1·0
C	0·484 ± 0·020	12·3 ± 0·5	0·539 ± 0·020	13·7 ± 0·5
D	0·709 ± 0·039	18·0 ± 1·0	0·709 ± 0·039	18·0 ± 1·0
E	0·256 ± 0·008	6·5 ± 0·2	0·256 ± 0·008	6·5 ± 0·2
F	0·080 ± 0·008	2·0 ± 0·2	0·080 ± 0·008	2·0 ± 0·2
G	0·354 ± 0·008	9·0 ± 0·2	0·413 ± 0·008	10·5 ± 0·2

Inch dimensions have been derived from millimetres.

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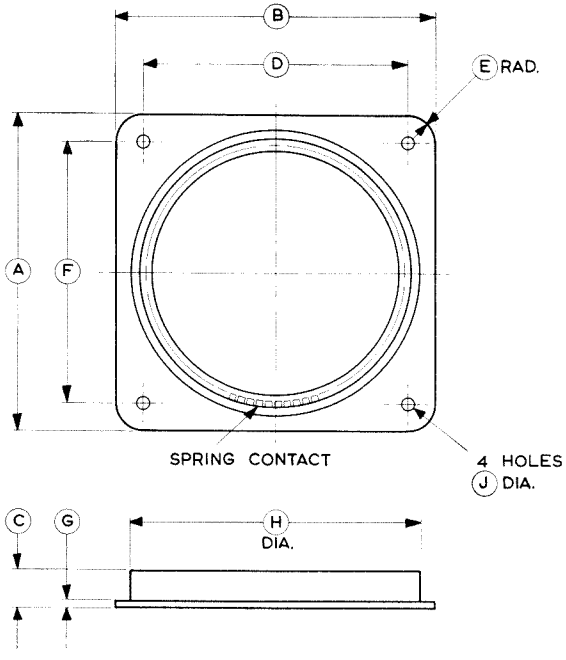
GRID TERMINAL CONNECTOR

MA147A

INTRODUCTION

MA147A is a grid terminal connector designed for use with the power triodes BR1162 and BW1162. It is suitable for use at frequencies above 30Mc/s.

1614



Ref.	Inches	Millimetres
A	3·346±0·020	85·0±0·5
B	3·346±0·020	85·0±0·5
C	0·394±0·010	10·0±0·25
D	2·756±0·020	70·0±0·5
E	0·315 Approx	8·0 Approx
F	2·756±0·020	70·0±0·5
G	0·080±0·008	2·0±0·2
H	3·043±0·010	77·3±0·25
J	0·138±0·004	3·5±0·1

Inch dimensions have been derived from millimetres.

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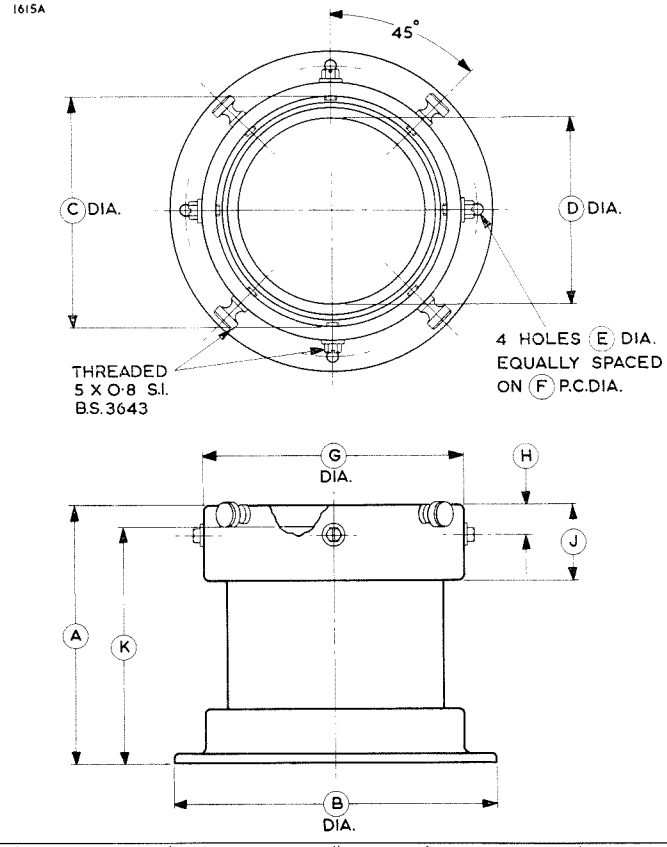
INSULATING PEDESTAL

MA149A

INTRODUCTION

MA149A is an insulating pedestal designed for use with the forced-air cooled triode BR1162.



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	5·433 ± 0·118	138·0 ± 3·0	F	6·102	155·0
B	6·772 Max	172·0 Max	G	5·472 Max	139·0 Max
C	4·843	123·0	H	0·571	14·5
D	4·449 Max	113·0 Max	J	1·575	40·0
E	0·276	7·0	K	5·039	128·0

Inch dimensions have been derived from millimetres.

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SEALING RINGS

INTRODUCTION

The sealing rings listed are intended for use with EEV water or vapour cooled triodes. A sealing ring is supplied with each valve and also with the associated cooling unit but should replacements be required they may be ordered under the EEV number indicated below.

GENERAL DATA

EEV Number	Previously known as	Used with Valve	Cross Section (*See p. 2*)	Nominal Internal Diameter
MA202	—	BW1162 BW1165	Fig. 2	1½in 38mm
MA243	I5857A	BW1144 BW1156	Fig. 1	8½in 215·9mm
MA245	—	BY1161	Fig. 1	8in 203·2mm
MA246	I5810A	BY1102 BY1121	Fig. 2	5¾in 146mm
MA248	I8480A	BW140	Fig. 3	1 29/32in 48·5mm
MA249	I5798A	BW153 BW1139	Fig. 2	3in 76·2mm
MA251	I5799A	BW161 BW1102 BW1121	Fig. 2	4in 101·6mm
MA252	I5797A	BW179 BW1103 BW1122 BW1124	Fig. 2	2⅞in 69·9mm
MA253	I5801A	BY1122 BY1124	Fig. 1	4½in 114·3mm

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GENERAL DATA—*continued*

EEV Number	Previously known as	Used with Valve	Cross Section	Nominal Internal Diameter
MA254	I5802A	BW189 BW194 BW1143	Fig. 1	$5\frac{1}{4}$in 133·4mm
MA255	I5856A	BY189A BY194 BY1143	Fig. 1	$6\frac{3}{4}$in 171·5mm
MA260	I5858A	BY1144	Fig. 1	$9\frac{3}{4}$in 247·7mm

CROSS SECTIONS OF SEALING RINGS

1039

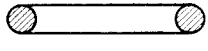

Fig. 1

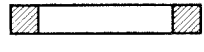

Fig. 2

Fig. 3

Natural Cooled Triodes

June 1965

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

3C24
(B1109)

R.F. POWER TRIODE

Service Type CV789
CV2736 (matched pairs)

American Designation 3C24

INTRODUCTION

The 3CV24 is a transmitting triode with a maximum anode dissipation of 25W and can be operated at full ratings up to 60Mc/s.

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage	6·3	V
Filament Current	3·0	A
Amplification Factor	25	
Mutual Conductance (V_a = 1kV, I_a = 25mA)	2·5	mA/V
Inter-electrode Capacitances:		
Grid to Anode	1·5	pF
Grid to Filament	1·7	pF
Anode to Filament	0·3	pF

Mechanical

Overall Length	4·38 inches (111 mm)	Max
Overall Diameter	1·44 inches (37 mm)	Max
Net Weight	1½ ounces (39 gm)	Approx
Mounting Position	Vertical, either way up	
Base	Small UX4	
Cooling	Natural	

Heat dissipating connections of large area are necessary for anode and grid.

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR
(Class B and Class AB)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	2000	V Max
Anode Current (Maximum Signal)	75	mA Max
Anode Dissipation	25	W Max
Grid Dissipation	7	W Max

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TYPICAL OPERATING CONDITIONS
(Class AB_2 – two valves)

Anode Voltage	750	1000	1250	V
Grid Voltage (*See Note* 1)	−20	−30	−42	V
Anode Current (Zero Signal)	43	32	24	mA
Anode Current (Maximum Signal)	127	127	130	mA
Effective Load (Anode to Anode)	12000	17000	21400	Ω
Peak A.F. Grid Voltage (per valve)	110	120	135	V
Peak Driving Power (Maximum Signal)	5·5	6·0	6·8	W
Nominal Driving Power (Maximum Signal)	2·8	3·0	3·4	W
Output Power (Maximum Signal)	60	85	112	W

NOTES

1. The grid voltage should be adjusted to give the stated zero-signal anode current.

ANODE MODULATED R.F. POWER AMPLIFIER
(Class C Telephony, carrier conditions per valve for use with a max modulation factor of 1·0)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	1600	V Max
Anode Current	60	mA Max
Anode Dissipation	17	W Max
Grid Dissipation	7	W Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	1000	1250	1600	V
Grid Voltage	−120	−140	−170	V
Anode Current	60	60	52	mA
Grid Current (Approx)	14	13	11	mA
Anode Dissipation	13	15	17	W
Grid Dissipation	1·6	1·5	1·2	W
Driving Power	3·3	3·3	3·1	W
Peak R.F. Grid Voltage	235	255	280	V
Output Power	47	60	68	W

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R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	2000	V Max
Anode Current	75	mA Max
Anode Dissipation	25	W Max
Grid Dissipation	7	W Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	1000	1500	2000	V
Grid Voltage	−70	−95	−130	V
Anode Current	72	67	63	mA
Grid Current (Approx)	9	13	18	mA
Anode Dissipation	25	25	25	W
Grid Dissipation	0·9	1·3	3·1	W
Driving Power	1·3	2·2	4·0	W
Peak R.F. Grid Voltage	170	195	245	V
Output Power	47	75	100	W

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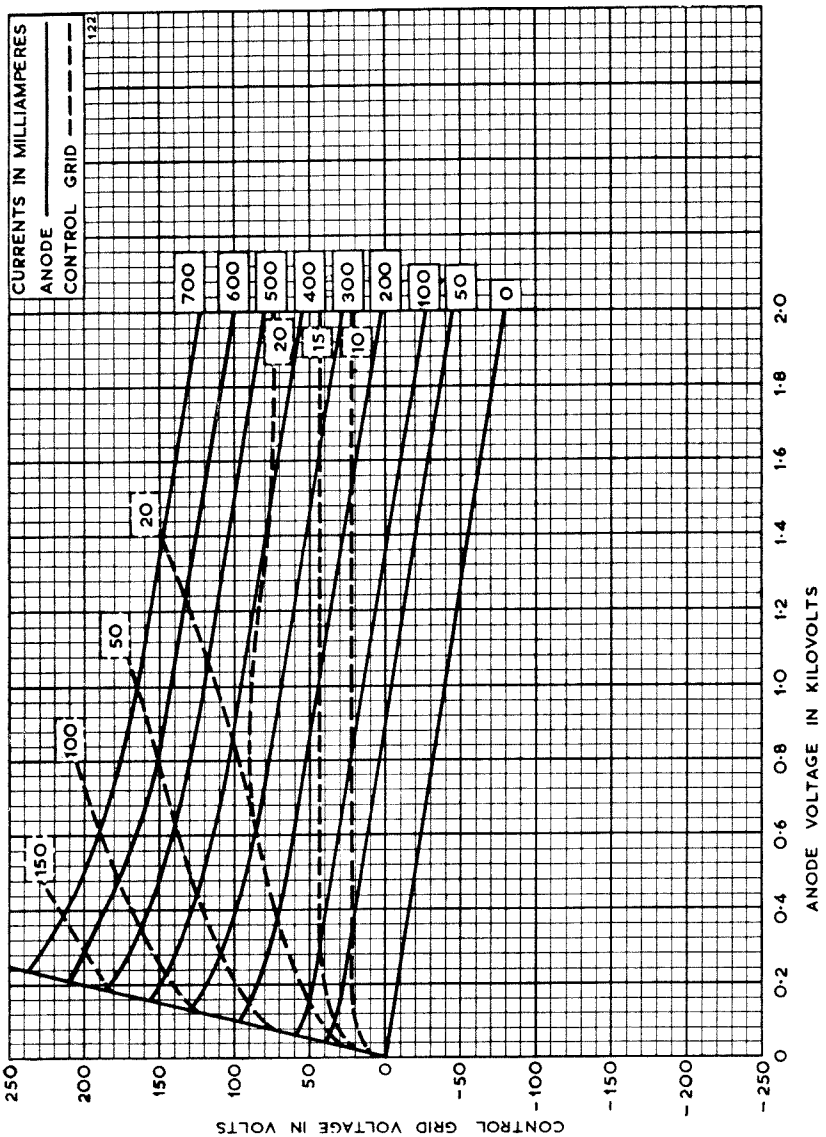
CONSTANT CURRENT CHARACTERISTICS



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OUTLINE

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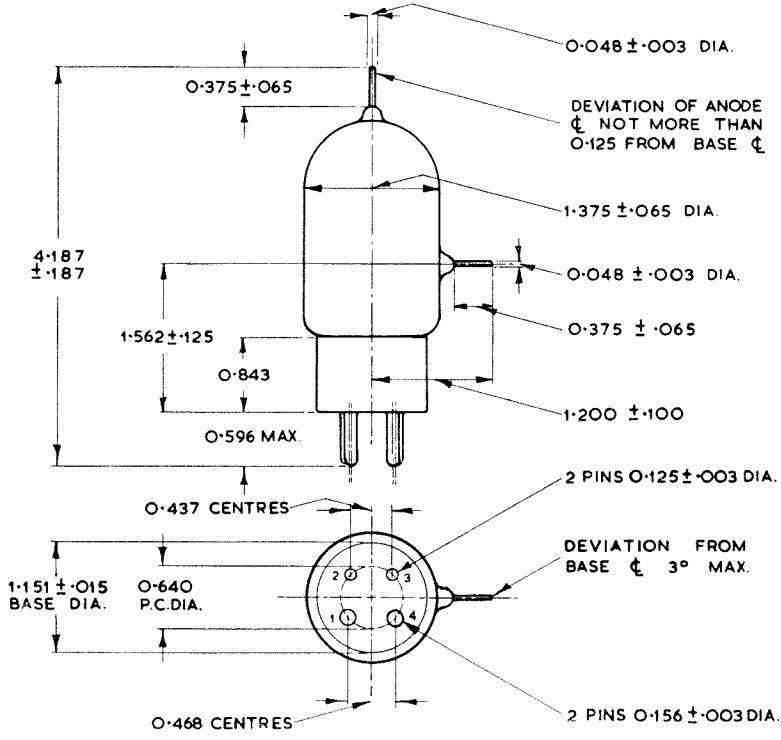

PIN	ELEMENT
1	FILAMENT
2	NO CONNECTION
3	NO CONNECTION
4	FILAMENT
SIDE	GRID
TOP	ANODE

ALL DIMENSIONS IN INCHES

Printed in England

R.F. POWER TRIODE

833A

Service Type CV635 **JEDEC Designation 833A**

INTRODUCTION

The 833A is a transmitting Triode with ratings for both forced-air cooling and natural cooling. It has a maximum anode dissipation of 400W and can be → operated at maximum ratings up to 30Mc/s and at reduced ratings up to 75Mc/s. It is electrically identical with type B142.

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage	10	V
Filament Current	10	A
Peak Usable Cathode Current	2·2	A
Perveance	0·9	$mA/V^{3/2}$
Amplification Factor (I_a = 200mA, V_g = −10V)	35	
→ Mutual Conductance (I_a = 200mA, V_g = −10V)	4	mA/V
Inter-electrode Capacitances:		
Grid to Anode	6·3	pF
Grid to Filament	12·3	pF
Anode to Filament	8·5	pF

Mechanical

Overall Length	8·82 inches	(225 mm)	Max
Overall Diameter	4·60 inches	(117 mm)	Max
Net Weight	1·5 pounds	(680 gm)	Approx
Mounting Position:			
Vertical	Base up or down		
Horizontal	Ribbed anode surface in vertical plane		

COOLING

The bulb temperature in the vicinity of the anode and grid seals must not exceed 145°C.

When forced-air cooling is required, an air flow of 40cu.ft/min from a two inch diameter nozzle directed vertically downwards on the anode and grid seals is necessary.

→ Indicates a change.

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AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR
(Class B)

MAXIMUM RATINGS
(Absolute Values)

	Natural Cooling	*Forced-Air Cooling*	
Anode Voltage	3000	4000	V Max
Anode Current (Maximum Signal)	500	500	mA Max
Anode Input Power (Maximum Signal)	1125	1600	W Max
Anode Dissipation	300	400	W Max

TYPICAL OPERATING CONDITIONS
(Class B, 2 valves)

	Natural Cooling	*Forced-Air Cooling*	
Anode Voltage	3000	4000	V
Grid Voltage	−70	−100	V
Peak A.F. Grid Voltage (per valve)	200	240	V
Anode Current (Zero Signal)	2×50	2×50	mA
Anode Current (Maximum Signal)	2×375	2×400	mA
Effective Load (Anode to Anode)	9500	12 000	Ω
Nominal Driving Power (Maximum Signal)	20	29	W
Output Power (Maximum Signal)	1650	2400	W

RADIO FREQUENCY POWER AMPLIFIER
(Class B Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS
(Absolute Values)

	Natural Cooling	*Forced-Air Cooling*	
Anode Voltage	3000	4000	V Max
Anode Current	300	300	mA Max
Anode Input Power	450	600	W Max
Anode Dissipation	300	400	W Max

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TYPICAL OPERATING CONDITIONS

	Natural Cooling	*Forced-Air Cooling*	
Anode Voltage	3000	4000	V
Grid Voltage	−70	−120	V
Peak R.F. Grid Voltage	90	120	V
Anode Current	150	150	mA
Grid Current (Approx)	2	2	mA
Nominal Driving Power (*See Note* 1)	10	14	W
Output Power	150	225	W

ANODE MODULATED R.F. POWER AMPLIFIER

(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

	Natural Cooling	*Forced-Air Cooling*	
Anode Voltage	2500	3000	V Max
Anode Current	400	450	mA Max
Anode Input Power	835	1250	W Max
Anode Dissipation	200	270	W Max
Grid Voltage (negative value)	500	500	V Max
Grid Current	100	100	mA Max

TYPICAL OPERATING CONDITIONS

	Natural Cooling	*Forced-Air Cooling*	
Anode Voltage	2500	3000	V
Grid Voltage:			
from a fixed supply of	−300	−300	V
from a grid resistor of	4000	3600	Ω
Peak R.F. Grid Voltage	460	490	V
Anode Current	335	415	mA
Grid Current (Approx)	75	85	mA
Nominal Driving Power	30	37	W
Output Power	635	1000	W

R.F. POWER TRIODE

R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

	Natural Cooling	*Forced-Air Cooling*	
Anode Voltage	3000	4000	V Max
Anode Current	500	500	mA Max
Anode Input Power	1250	1800	W Max
Anode Dissipation	300	400	W Max
Grid Voltage	−500	−500	V Max
Grid Current	100	100	mA Max

TYPICAL OPERATING CONDITIONS

	Natural Cooling	*Forced-Air Cooling*	
Anode Voltage	3000	4000	V
Grid Voltage:			
from a fixed supply of	−200	−200	V
from a grid resistor of	3600	2650	Ω
from a cathode resistor of	425	380	Ω
Peak R.F. Grid Voltage	360	375	V
Anode Current	415	450	mA
Grid Current (Approx)	55	75	mA
Driving Power (Approx)	20	26	W
Output Power (Approx)	1000	1440	W

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 10V	9·4	10·6	A
Amplification Factor (I_a = 200mA, V_g = −10V)	31·5	38·5	
Anode Current (V_a = 2500V, V_g = −50V)	60	140	mA
Inter-electrode Capacitances:			
Grid to Anode	4·9	6·3	pF
Grid to Filament	11·7	16·3	pF
Anode to Filament	7·2	10·4	pF

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MAXIMUM PERMISSIBLE ANODE VOLTAGES AND INPUTS

expressed as a percentage of maximum values quoted

NATURAL COOLING

Frequency	30Mc/s	50Mc/s	75Mc/s
Class B Telephony	100%	98%	94%
Class C Telegraphy	100%	90%	72%
Class C Telephony	100%	90%	72%

FORCED-AIR COOLING

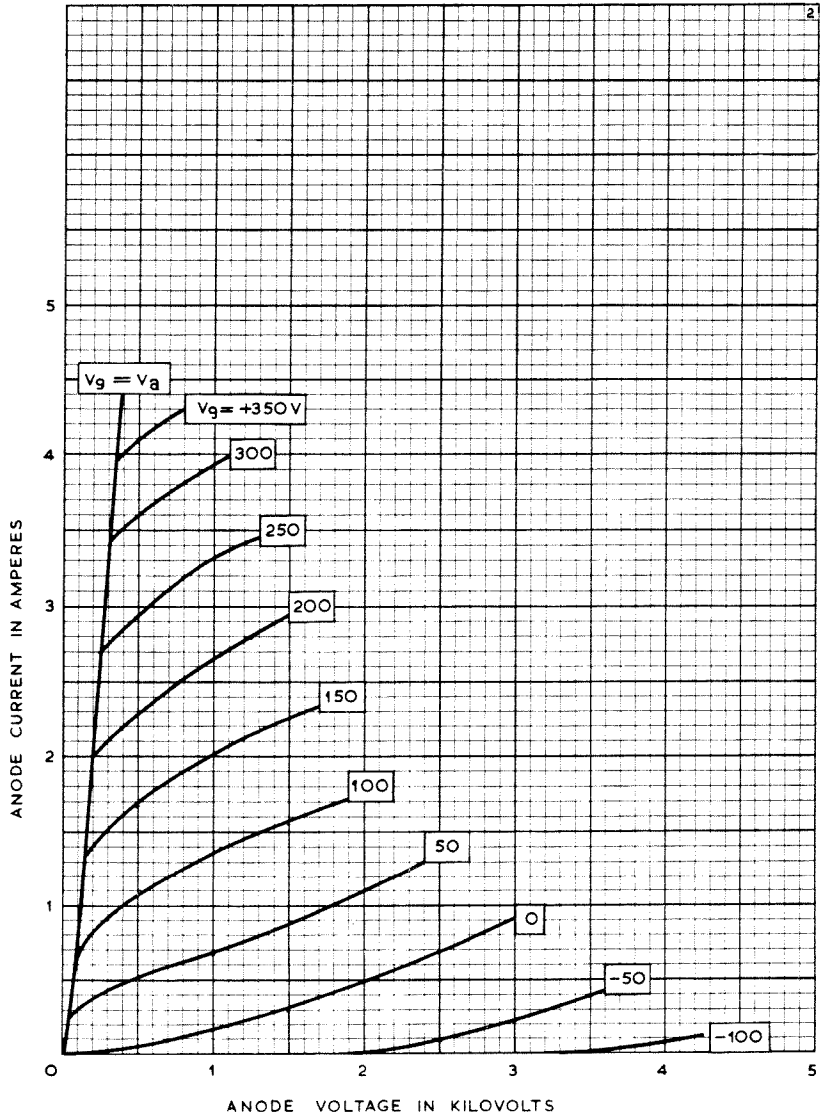
Frequency	20Mc/s	50Mc/s	75Mc/s
Class B Telephony	100%	97%	93%
Class C Telegraphy	100%	83%	65%
Class C Telephony	100%	83%	65%

NOTES

1. At the peak of the audio frequency cycle with a modulation factor of 1·0.

R.F. POWER TRIODE

ANODE CHARACTERISTICS



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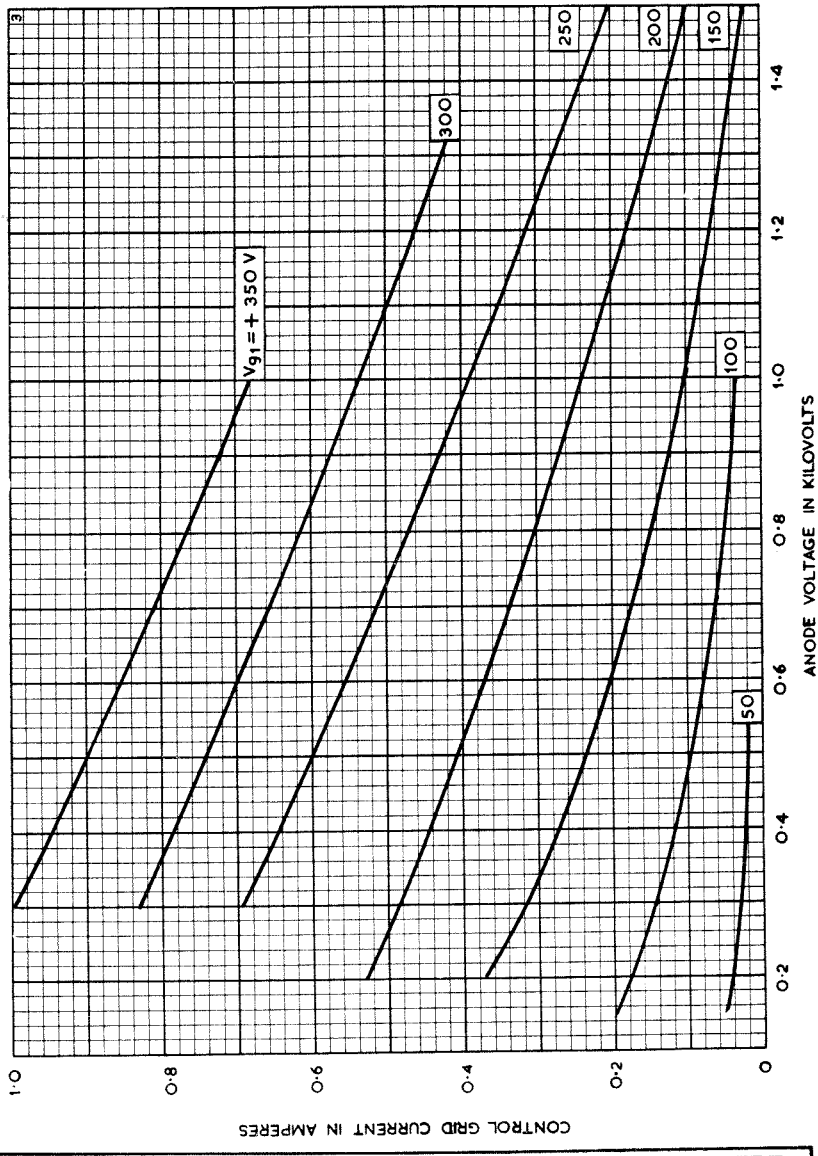
CONTROL GRID CHARACTERISTICS



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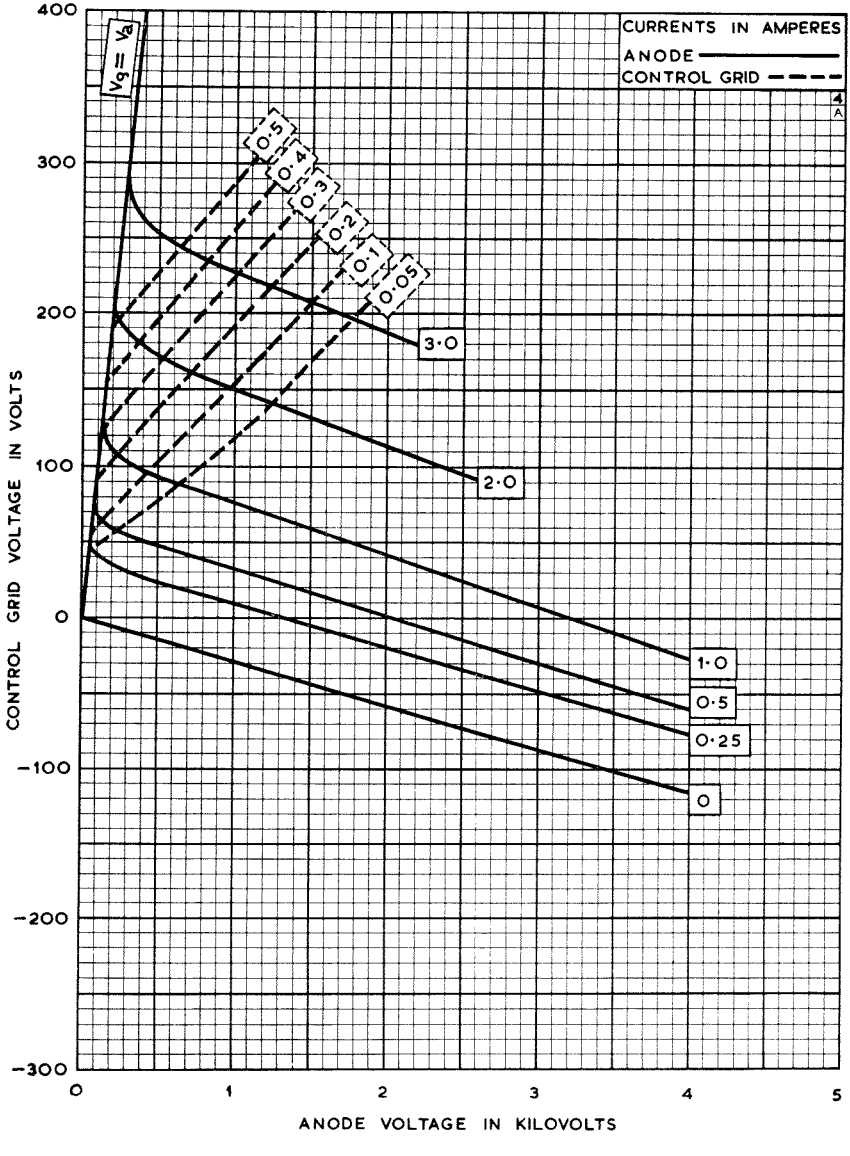
CONSTANT CURRENT CHARACTERISTICS



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833A

OUTLINE

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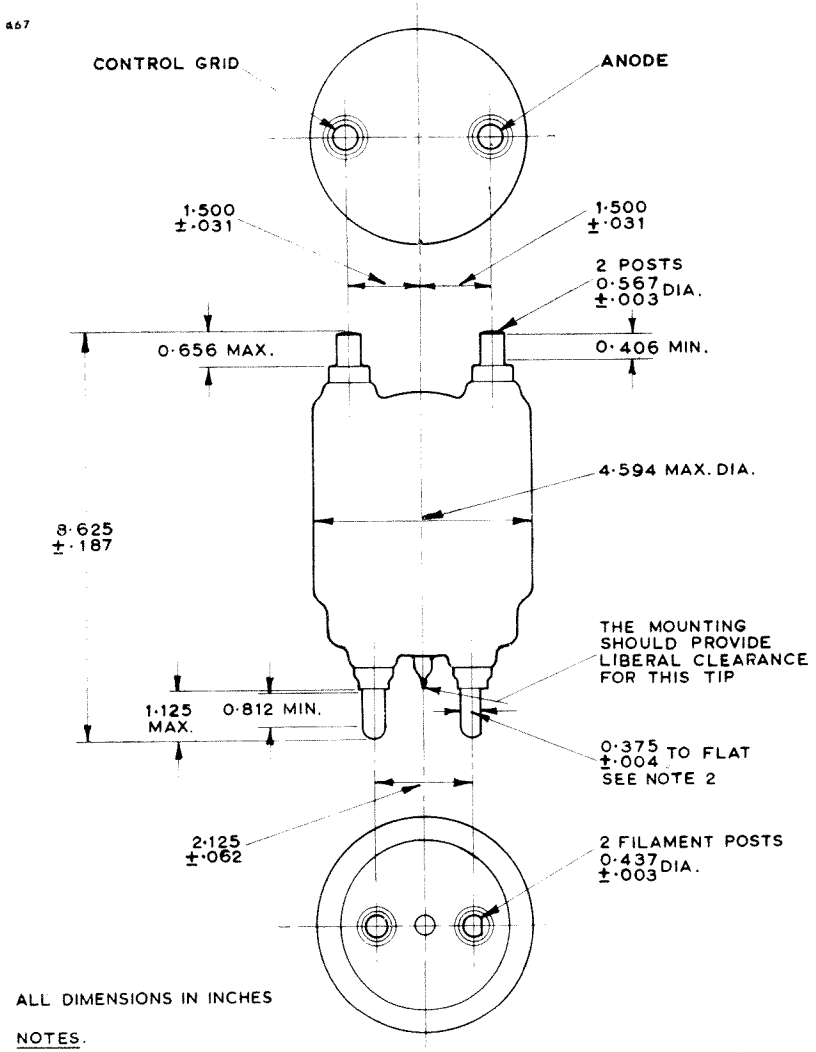

ALL DIMENSIONS IN INCHES

NOTES.

1. THE ANGLE FORMED ON A PLANE NORMAL TO THE VALVE AXIS BY THE INTERSECTION OF THE PLANE DETERMINED BY THE AXIS OF THE FILAMENT TERMINALS WITH THE PLANE DETERMINED BY THE AXIS OF THE GRID AND ANODE TERMINALS WILL NOT BE MORE THAN 5°
2. THE PLANE THROUGH THE FLAT SIDE OF THE FILAMENT TERMINAL WILL BE 90° ± 7° WITH RESPECT TO PLANE THROUGH THE AXES OF FILAMENT TERMINALS

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V.H.F. POWER TRIODE

5867

(B1135)

ENGLISH ELECTRIC

Service Type CV1350 **JEDEC Designation 5867**

GENERAL

The 5867 is a maintenance type and therefore only abridged data are given on this sheet. **Full information is available on request.**

Filament	Thoriated Tungsten	
Filament Voltage	5·0	V
Filament Current	14	A
Amplification Factor (I_a = 90mA)	25	
Mounting Position	Vertical, base up or down	
Base	B.S.448–B5F	

MAXIMUM RATINGS
(Absolute Values)

	Class B Audio or Class C Telegraphy	*Class B Telephony*	*Class C Telephony (Anode Mod)*	
Anode Voltage	3·0	3·0	2·5	kV Max
Anode Dissipation	250	250	250	W Max
Grid Dissipation	30	30	30	W Max
Grid Circuit Resistance	100	100	100	kΩ Max
Cathode Current (Peak)	3·0	1·5	3·0	A Max
Cathode Current (Mean)	480	300	350	mA Max
Frequency for full ratings	100	100	100	Mc/s Max
Frequency at reduced ratings	150	150	150	Mc/s Max

TYPICAL OPERATING CONDITIONS
(at frequencies up to 100Mc/s)

	Class B Telephony	*Class C Telephony (Anode Mod)*	*Class C Telegraphy*	
Anode Voltage	3·0	2·5	3·0	kV
Grid Voltage	−110	−300	−250	V
Peak R.F. Grid Voltage	91	440	430	V
Anode Current	130	250	365	mA
Grid Current (Approx)	62	70	69	mA
Nominal Driving Power	10·2	28	27	W
Output Power	140	482	840	W

COOLING

The temperature of the seals must not exceed the values given below:

Anode Seal Temperature	220	°C Max
Base Pin Seal Temperature	180	°C Max

A heat dissipating anode connector of large surface area is necessary. Natural cooling is normally adequate at frequencies up to 30Mc/s. At higher frequencies forced-air cooling may be necessary.

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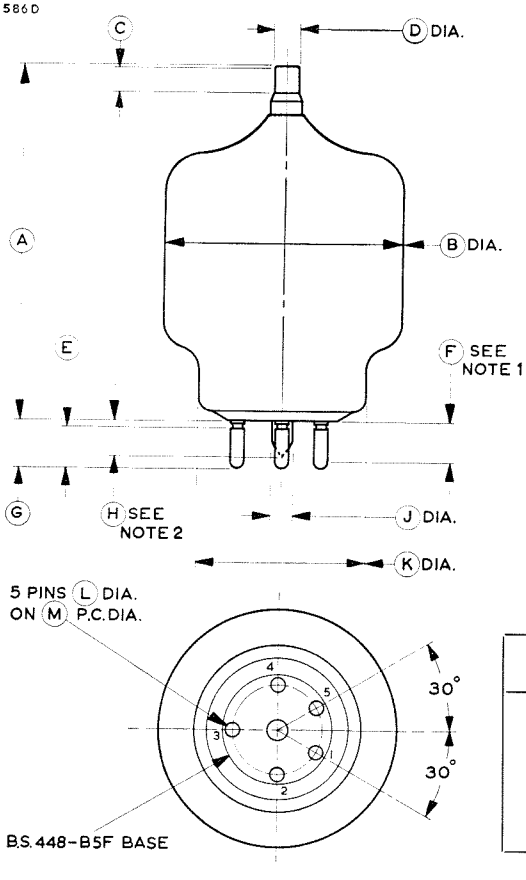
V.H.F. POWER TRIODE

5867

(B1135)

ENGLISH ELECTRIC

OUTLINE



NOTES.
1. LIMIT OF PARALLEL PORTION OF PINS
2. SEAL-OFF LENGTH

Pin	Element
1	Filament
2	Control Grid
3	Control Grid
4	Control Grid
5	Filament
Cap	Anode

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	5·000 ± 0·236	127·0 ± 6·0	G	0·708 Max	18·00 Max
B	3·425 Max	87·00 Max	H	0·590 Max	15·00 Max
C	0·354 Min	9·00 Min	J	0·295 Max	7·50 Max
D	0·354 ± 0·005	9·00 ± 0·13	K	2·440 Max	62·00 Max
E	0·588 ± 0·010	14·94 ± 0·25	L	0·187 ± 0·003	4·750 ± 0·076
F	0·590 Min	15·00 Min	M	1·250	31·75

Inch dimensions have been derived from millimetres

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R.F. POWER TRIODE

B142

ENGLISH ELECTRIC

Service Type CV1927

GENERAL

The B142 is a maintenance type and therefore only abridged data are given on this sheet. **Full information is available on request.** For new designs the EEV type 833A is recommended; it differs from B142 only in outline, base and inter-electrode capacitances.

	Thoriated Tungsten	
Filament Voltage	10	V
Filament Current	10	A
Peak Usable Cathode Current	2·2	A
Amplification Factor (I_a = 200mA, Vg = −10V)	35	
Mutual Conductance (I_a = 200mA, Vg = −10V)	4	mA/V

R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

	Natural Cooling	*Forced-Air Cooling*	
Anode Voltage	3·0	4·0	kV Max
Anode Current	500	500	mA Max
Anode Input Power	1250	1800	W Max
Anode Dissipation	300	400	W Max
Grid Voltage	−500	−500	V Max
Grid Current	100	100	mA Max
Frequency for full ratings	30	20	Mc/s Max
Frequency at reduced ratings	75	75	Mc/s Max

TYPICAL OPERATING CONDITIONS

	Natural Cooling	*Forced-Air Cooling*	
Anode Voltage	3·0	4·0	kV
Grid Voltage:			
from a fixed supply of	−200	−200	V
from a grid resistor of	3500	2650	Ω
from a cathode resistor of	425	380	Ω
Peak R.F. Grid Voltage	360	375	V
Anode Current	415	450	mA
Grid Current (Approx)	55	75	mA
Driving Power (Approx)	20	26	W
Output Power (Approx)	1000	1440	W

COOLING

The bulb temperature in the vicinity of the anode seal must not exceed 145°C. When forced-air cooling is required, an air flow of 40cu.ft/min from a two inch diameter nozzle directed vertically downwards on the anode seal is necessary.

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OUTLINE

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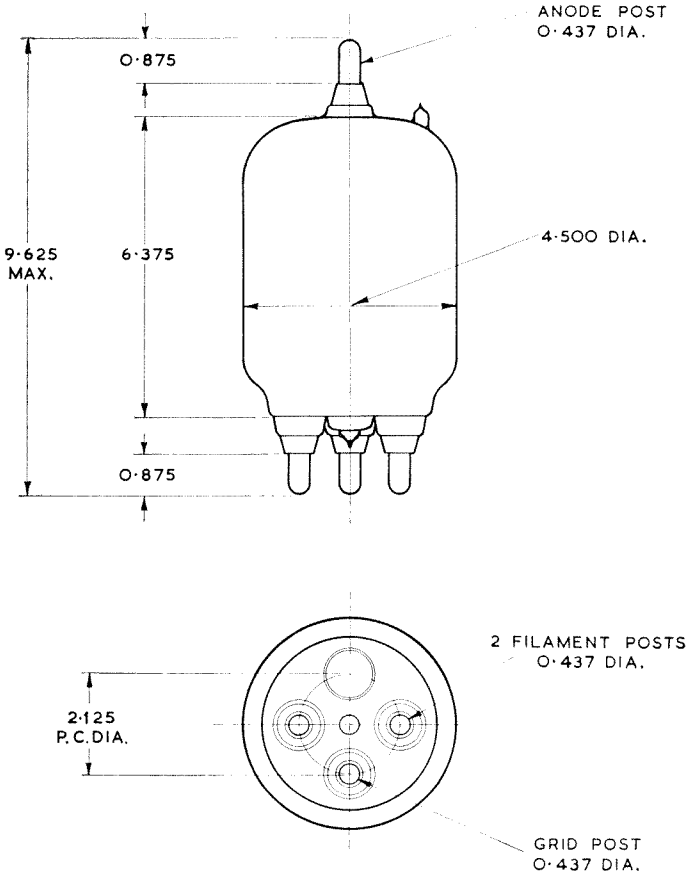

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R.F. POWER TRIODE

B1152

ENGLISH ELECTRIC

INTRODUCTION

The B1152 is an r.f. power triode of glass construction with a radiation cooled anode, designed especially for industrial service. It has a maximum anode dissipation of 500W for continuous operation and under these conditions forced-air cooling of the glass envelope is required. For intermittent operation, natural cooling is adequate and with low duty cycles the anode dissipation may be increased to 1000W. The valve can be operated at maximum ratings up to 50Mc/s.

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	5·0	V
Filament Current	32·5	A
Amplification Factor (V_a = 4·0kV, I_a = 120mA)	24	
Mutual Conductance (V_a = 1·0kV, I_a = 2·3A)	10	mA/V
Mutual Conductance (V_a = 3·3kV, I_a = 120mA)	3·3	mA/V
Inter-electrode Capacitances:		
Grid to Anode	5·6	pF
Grid to Filament	9·3	pF
Anode to Filament	0·35	pF

Mechanical

Overall Length	9·45 inches (240mm)	Max
Overall Diameter	5·12 inches (130mm)	Max
Net Weight	1·1 pounds (0·5kg)	Approx
Base (*See Note* 2)		Special
Mounting Position	Vertical only, base down	

COOLING

The temperature of the bulb and seals must not exceed the values given below:

Bulb Temperature	350	°C
Seal Temperature	220	°C

For continuous operation a low velocity air flow is necessary to limit the bulb and seal temperatures. Natural cooling is normally adequate when the valve is operated intermittently or with reduced input (see Typical Operating Conditions).

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ENGLISH ELECTRIC

R.F. POWER OSCILLATOR
(Class C, d.c. anode supply)

MAXIMUM RATINGS
(Absolute Values)

Duty Factor	1·0	0·5	0·2	Max
Averaging Time	—	10	5·0	sec Max
Anode Voltage	5·0	5·0	5·0	kV Max
Anode Current	560	780	1100	mA Max
Anode Dissipation	500	700	1000	W Max
Grid Voltage (negative value)	1·25	1·25	1·25	kV Max
Grid Current (at maximum anode dissipation)	210	290	420	mA Max
Grid Dissipation	85	95	110	W Max
Grid to Filament Resistance	15	15	15	kΩ Max
Operating Frequency	50	50	50	Mc/s Max

TYPICAL OPERATING CONDITIONS

	Forced-air Cooling	*Natural Cooling*		
Duty Factor	1·0	0·5	0·2	
On Period	—	5·0	1·0	sec
Off Period	—	5·0	4·0	sec
Anode Voltage	4·0	4·0	4·0	kV
Grid Voltage	−380	−380	−410	V
from Grid Resistor	2·7	2·0	1·7	kΩ
Anode Current	490	650	825	mA
Grid Current (approx)	140	190	240	mA
Anode Dissipation	450	630	900	W
Anode Load Resistance	4·7	3·4	2·7	kΩ
Feedback Ratio (*See Note* 3)	0·2	0·22	0·24	
Output Power	1·5	2·0	2·4	kW
Efficiency	77	76	73	%
Effective Output Power to Load (*See Note* 4)	1·2	1·6	1·9	kW

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R.F. POWER OSCILLATOR

(Class C, anode supply from unfiltered single phase, full-wave rectifier)

MAXIMUM RATINGS

(Absolute Values)

Duty Factor	1·0	0·5	0·2	
Averaging Time	—	10	5·0	sec Max
Anode Voltage	4·5	4·5	4·5	kV Max
Anode Current	450	630	900	mA Max
Anode Dissipation	500	700	1000	W Max
Grid Voltage (negative value)	850	850	850	V Max
Grid Current (at maximum anode dissipation)	190	195	380	mA Max
Grid Dissipation	85	95	110	W Max
Grid to Filament Resistance	15	15	15	kΩ Max
Operating Frequency	50	50	50	Mc/s Max

TYPICAL OPERATING CONDITIONS

	Forced-air Cooling	*Natural Cooling*		
Duty Factor	1·0	0·5	0·2	
On Period	—	5·0	1·0	sec
Off Period	—	5·0	4·0	sec
Output Voltage (r.m.s.) from Transformer	4·5	4·5	4·5	kV
Anode Voltage	4·05	4·05	4·05	kV
Grid Voltage	−340	−365	−355	V
from Grid Resistor	2·7	2·2	1·7	kΩ
Anode Current	400	530	675	mA
Grid Current (approx)	125	165	210	mA
Anode Dissipation	450	630	900	W
Anode Load Resistance	5·9	4·3	3·5	kΩ
Feedback Ratio (*See Note* 3)	0·16	0·17	0·18	
Output Power	1·53	2·0	2·46	kW
Efficiency	77	76	73	%
Effective Output Power to Load (*See Note* 4)	1·25	1·5	2·0	kW

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R.F. POWER OSCILLATOR

(Class C, anode supply from unfiltered three phase, half-wave rectifier)

MAXIMUM RATINGS

(Absolute Values)

Duty Factor	1·0	0·5	0·2	
Averaging Time	—	10	5·0	sec Max
Anode Voltage	5·0	5·0	5·0	kV Max
Anode Current	560	780	1100	mA Max
Anode Dissipation	500	700	1000	W Max
Grid Voltage (negative value)	1·25	1·25	1·25	kV Max
Grid Current (at maximum anode dissipation)	210	290	420	mA Max
Grid Dissipation	85	95	110	W Max
Grid to Filament Resistance	15	15	15	kΩ Max
Operating Frequency	50	50	50	Mc/s Max

TYPICAL OPERATING CONDITIONS

	Forced-air Cooling	*Natural Cooling*		
Duty Factor	1·0	0·5	0·2	
On Period	—	5·0	1·0	sec
Off Period	—	5·0	4·0	sec
Output Voltage (r.m.s.) from Transformer	3·4	3·4	3·4	kV
Anode Voltage	4·0	4·0	4·0	kV
Grid Voltage	380	380	410	V
from Grid Resistor	2·7	2·0	1·7	kΩ
Anode Current	480	640	820	mA
Grid Current (approx)	140	190	240	mA
Anode Dissipation	450	630	900	W
Anode Load Resistance	4·7	3·4	2·7	kΩ
Feedback Ratio (*See Note* 3)	0·2	0·22	0·24	
Output Power	1·5	2·0	2·4	kW
Efficiency	77	76	73	%
Effective Output Power to Load (*See Note* 4)	1·2	1·6	1·9	kW

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R.F. POWER OSCILLATOR
(Class C, anode supply unrectified a.c.)

MAXIMUM RATINGS
(Absolute Values)

Duty Factor	1·0	0·5	0·2	
Averaging Time	—	10	5·0	sec Max
Output Voltage (r.m.s.) from Transformer	5·0	5·0	5·0	kV Max
Anode Current	320	450	640	mA Max
Anode Dissipation	500	700	1000	W Max
Grid Voltage (negative value)	−850	−850	−850	V Max
Grid Current (at maximum anode dissipation)	110	155	220	mA Max
Grid Dissipation	85	95	110	W Max
Grid to Filament Resistance	15	15	15	kΩ Max
Operating Frequency	50	50	50	Mc/s Max

TYPICAL OPERATING CONDITIONS

	Forced-air Cooling	*Natural Cooling*		
Duty Factor	1·0	0·5	0·2	
On Period	—	5·0	1·0	sec
Off Period	—	5·0	4·0	sec
Output Voltage (r.m.s.) from Transformer	4·5	4·5	4·5	kV
Grid Voltage	−215	−215	−220	V
from Grid Resistor	2·7	1·8	1·3	kΩ
Anode Current (*See Note* 5)	280	420	600	mA
Grid Current (approx) (*See Note* 5)	80	120	170	mA
Anode Dissipation	380	500	800	W
Anode Load Resistance	4·3	2·9	2·0	kΩ
Feedback Ratio (*See Note* 3)	0·18	0·22	0·25	
Output Power	1·08	1·6	2·2	kW
Efficiency	77	76	73	%
Effective Output Power to Load (*See Note* 4)	0·9	1·3	1·7	kW

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NOTES

1. Temporary fluctuations up to +5% or −10% in filament voltage are permissible.
2. The design of the base socket must ensure that no strain is applied to the glass to metal seals. Where clamps are used for connecting to the base pins or top cap, the leads must be flexible.
3. The feedback ratio is defined as $\frac{V_{g(pk)}}{V_{a(pk)}}$
   where $V_{g(pk)}$ = peak r.f. grid voltage
   and $V_{a(pk)}$ = peak r.f. anode voltage.
4. Effective output power to load = $\eta_a (P_{out} - P_{drive})$
   where η_a = efficiency of anode circuit = 85%
   P_{out} = output power of valve to anode circuit
   P_{drive} = drive power fed back to grid circuit.
5. Averaged over one cycle of supply frequency.

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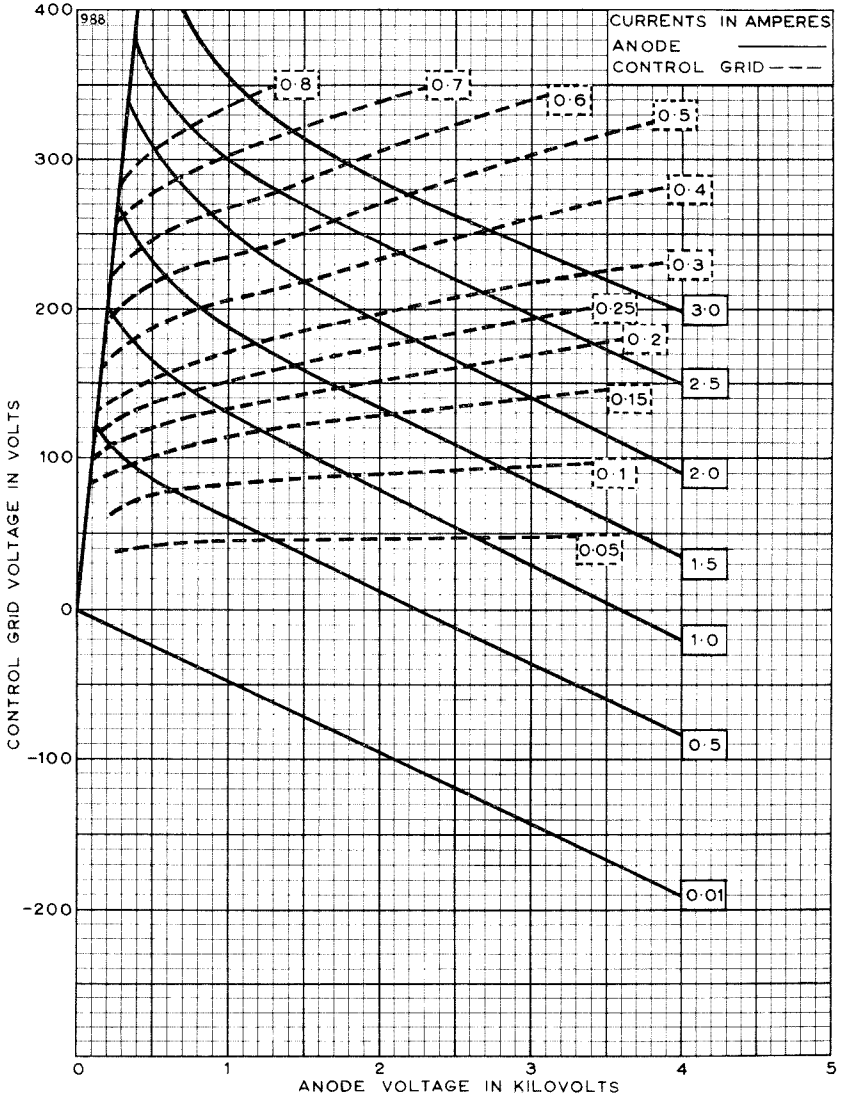
CONSTANT CURRENT CHARACTERISTICS



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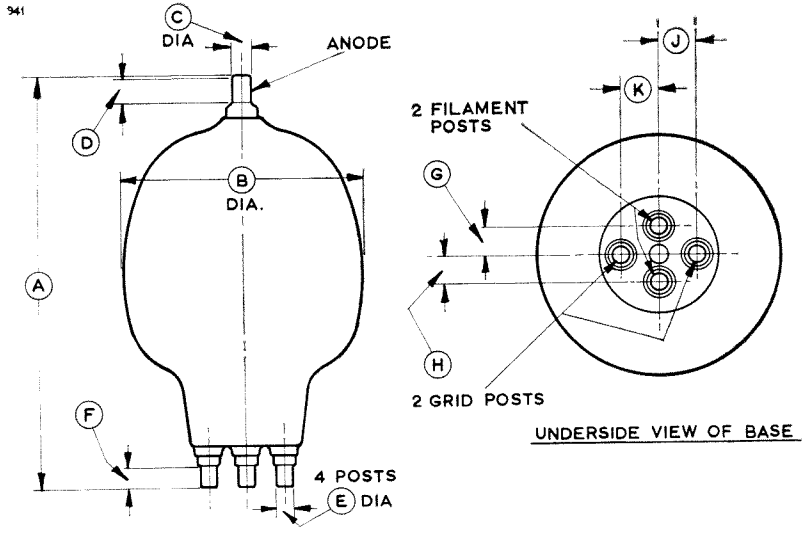

Ref.	Inches	Millimetres
A	9·450 Max	240·0 Max
B	5·118 Max	130·0 Max
C	0·374	9·5
D	0·500 Min	12·7 Min
E	0·354	9·0
F	0·472	12·0
G	0·591	15·0
H	0·591	15·0
J	0·787	20·0
K	0·787	20·0

Inches dimensions have been derived from Millimetres.

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Forced-air Cooled Triodes

June 1965

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5736

R.F. POWER TRIODE

American Designation 5736

INTRODUCTION

The 5736 is a forced-air cooled transmitting Triode. It has a maximum anode dissipation of 2·5kW and can be operated at maximum ratings up to 60Mc/s and reduced ratings up to 200Mc/s. It is fitted with a low back-pressure radiator.

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	6·0	V
Filament Current	60	A
Maximum Filament Starting Current	(*See Note* 2)	
Filament Cold Resistance	0·016	Ω
Peak Usable Cathode Current	10	A
Amplification Factor (average)	22	
Inter-electrode Capacitances (average):		
Grid to Anode	16	pF
Grid to Filament	19	pF
Anode to Filament	0·8	pF

Mechanical

Overall Length	7·38 inches (188 mm)	Max
Overall Diameter	3·57 inches (90·6 mm)	Max
Net Weight	3¾ pounds (1·8 kg)	Approx
Mounting Position	Vertical, either way up	

COOLING

Type of Cooling	Forced Air				
Incoming Air Temperature	45				°C Max
Minimum Air Flow Required on Anode (except television ratings):					
Anode Dissipation, percentage of maximum	100	80	60		%
Air Flow	150	100	70		cu. ft/min
Air Pressure, manometer reading	2·7	1·3	0·9		in. of water
The air flow through the radiator is normally sufficient to cool the filament and grid seals.					
Bulb Temperature (at the hottest part)	160				°C Max

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R.F. POWER TRIODE

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

(Class B)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	3·0 kV Max
Anode Current (Maximum Signal)	1·75 A Max
Anode Input Power (Maximum Signal)	4·2 kW Max
Anode Dissipation (Maximum Signal)	2·5 kW Max

TYPICAL OPERATING CONDITIONS

(Class B - two valves)

Anode Voltage	3	kV
Grid Voltage	−160	V
Anode Current (Zero Signal)	0·66	A
Anode Current (Maximum Signal)	2·8	A
Effective Load (Anode to Anode)	3060	Ω
Peak A.F. Grid Voltage (per valve)	410	V
Nominal Driving Power (Maximum Signal)	140	W
Output Power (Maximum Signal)	4350	W

RADIO FREQUENCY POWER AMPLIFIER

(Class B Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	3·5 kV Max
Anode Current	1·75 A Max
Anode Input Power	3·5 kW Max
Anode Dissipation	2·5 kW Max

TYPICAL OPERATING CONDITIONS

(Class B - two valves)

Anode Voltage	3·0	kV
Grid Voltage	−160	V
Anode Current	1·1	A
Grid Current (Approx)	50	mA
Peak R.F. Grid Voltage (per valve)	280	V
Nominal Driving Power (*See Note* 3)	15	W
Output Power	800	W

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R.F. POWER TRIODE

R.F. POWER AMPLIFIER

(Class B Television Service, U.S.A. System)

(Synchronising level conditions per valve unless otherwise specified. Voltages are referred to cathode unless otherwise specified)

MAXIMUM RATINGS

(Absolute Values)

	Up to 88 *Mc/s*	
Anode Voltage	3·5	kV Max
Anode Current	1·75	A Max
Anode Input Power	4	kW Max
Anode Dissipation (See Air Flow Characteristic)	2·8	kW Max
Air Flow through Radiator:		
Minimum, with air inlet temperature 45°C	180	cu. ft/min
Air Pressure, manometer reading	4	in. of water

TYPICAL OPERATION IN CATHODE-DRIVE CIRCUIT

Anode Voltage	2·6	kV
Grid Voltage	−160	V
Peak R.F. Grid Voltage:		
Synchronising Level	535	V
Pedestal Level	400	V
Anode Current:		
Synchronising Level	2·32	A
Pedestal Level	1·47	A
Grid Current (approx):		
Synchronising Level	430	mA
Pedestal Level	136	mA
Driving Power (approx):		
Synchronising Level	1160	W
Pedestal Level	535	W
Output Power (approx):		
Synchronising Level	3680	W
Pedestal Level	1690	W

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

	At 60 *Mc/s*	*At* 110 *Mc/s*	
Anode Voltage	5·0	3·5	kV Max
Grid Voltage (negative value)	1000	700	V Max
Anode Current	1·4	1·4	A Max
Grid Current	0·5	0·5	mA Max
Anode Input Power	5·0	3·5	kW Max
Anode Dissipation	2·5	2·5	kW Max

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R.F. POWER TRIODE

TYPICAL OPERATING CONDITIONS

	At 60 *Mc/s*	*At* 110 *Mc/s*		
Anode Voltage	5·0	3·5	3·5	kV
Grid Voltage	—850	—600	—300	V
Peak R.F. Grid Voltage	1200	940	555	V
Anode Current	1·0	1·0	1·0	A
Grid Current (Approx)	210	250	155	mA
Driving Power (Approx)	250	235	85	W
Output Power (Approx)	4·1	2·8	2·55	kW

ANODE MODULATED R.F. POWER AMPLIFIER

(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	3·5 kV Max
Anode Current	1·4 A Max
Anode Input Power	4·0 kW Max
Anode Dissipation	1·65kW Max
Grid Voltage (negative value)	1000 V Max
Grid Current	500 mA Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	3·5	kV
Grid Voltage	—600	V
Anode Current	1·14	A
Grid Current (Approx)	280	mA
Driving Power	270	W
Peak R.F. Grid Voltage	950	V
Output Power	3·2	kW

Maximum Anode Voltage against Frequency

Frequency Mc/s	Max Anode Voltage Class B	Max Anode Voltage CW	Max Anode Voltage With Anode Modulation
60	3·5 kV	5·0 kV	3·5 kV
100	2·9 kV	4·0 kV	2·8 kV
200	2·1 kV	2·5 kV	1·75 kV

See also the special television service ratings

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuations in filament voltage must not exceed 5%.
2. The filament current must not exceed 120A, even momentarily, at any time.
3. At the peak of the A.F. cycle with a modulation factor of 1·0.

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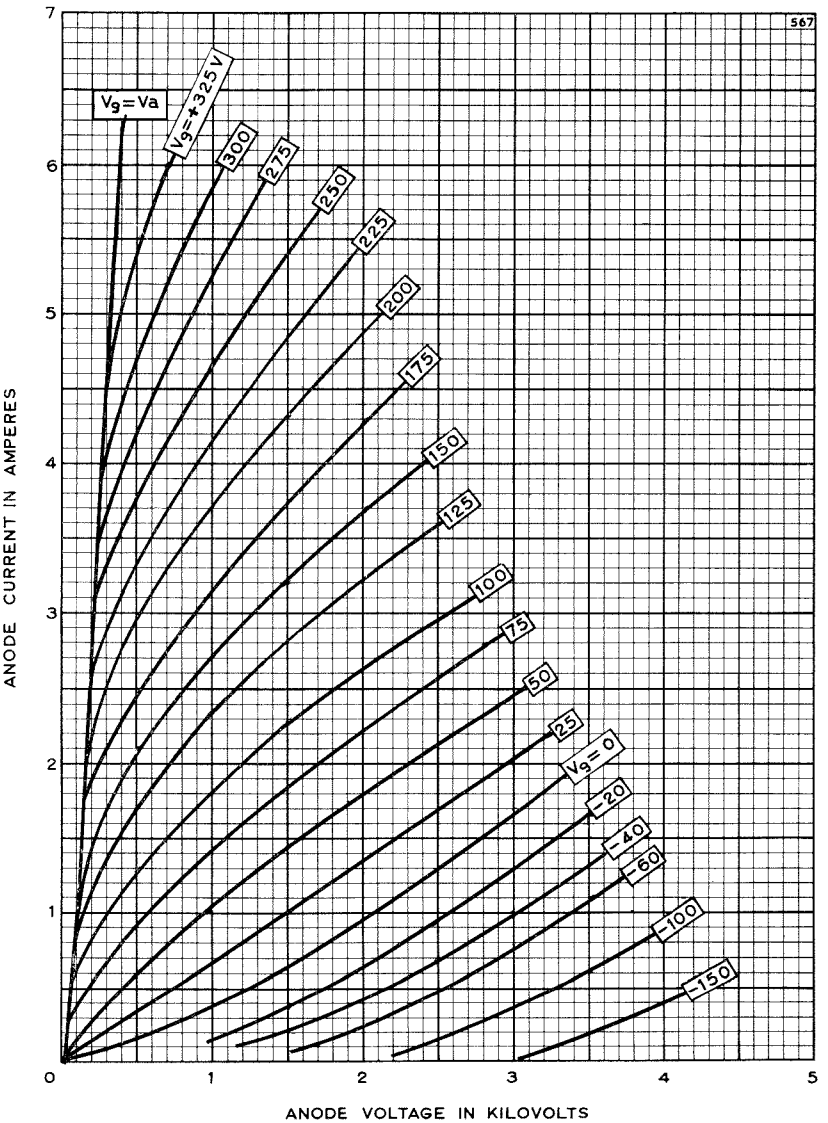
ANODE CHARACTERISTICS



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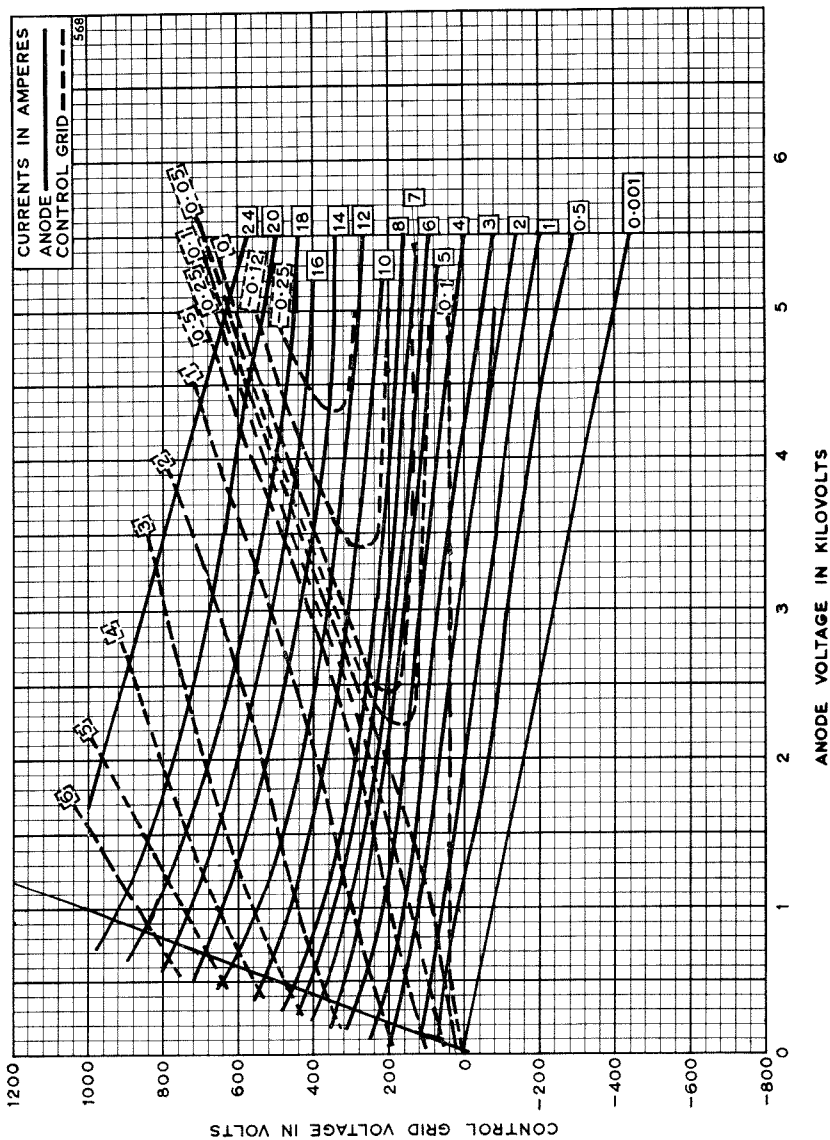
CONSTANT CURRENT CHARACTERISTICS



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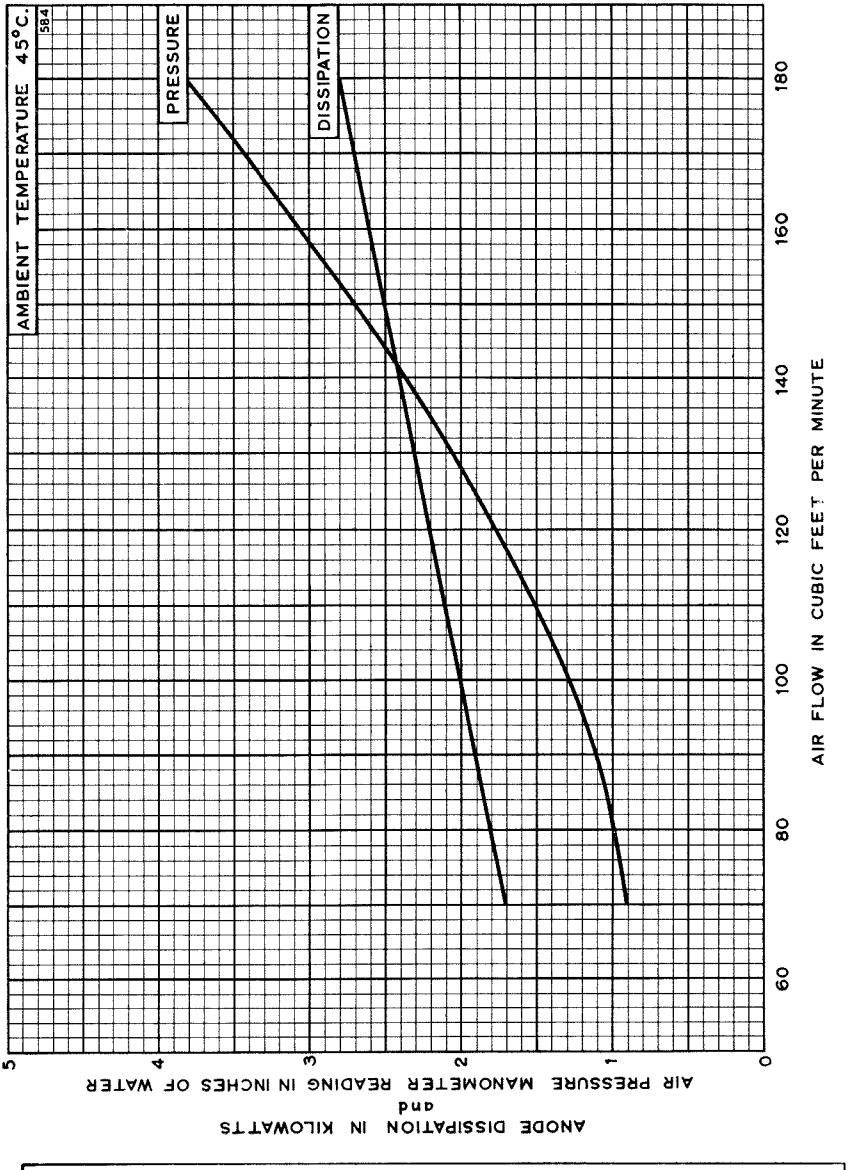
RADIATOR CHARACTERISTICS



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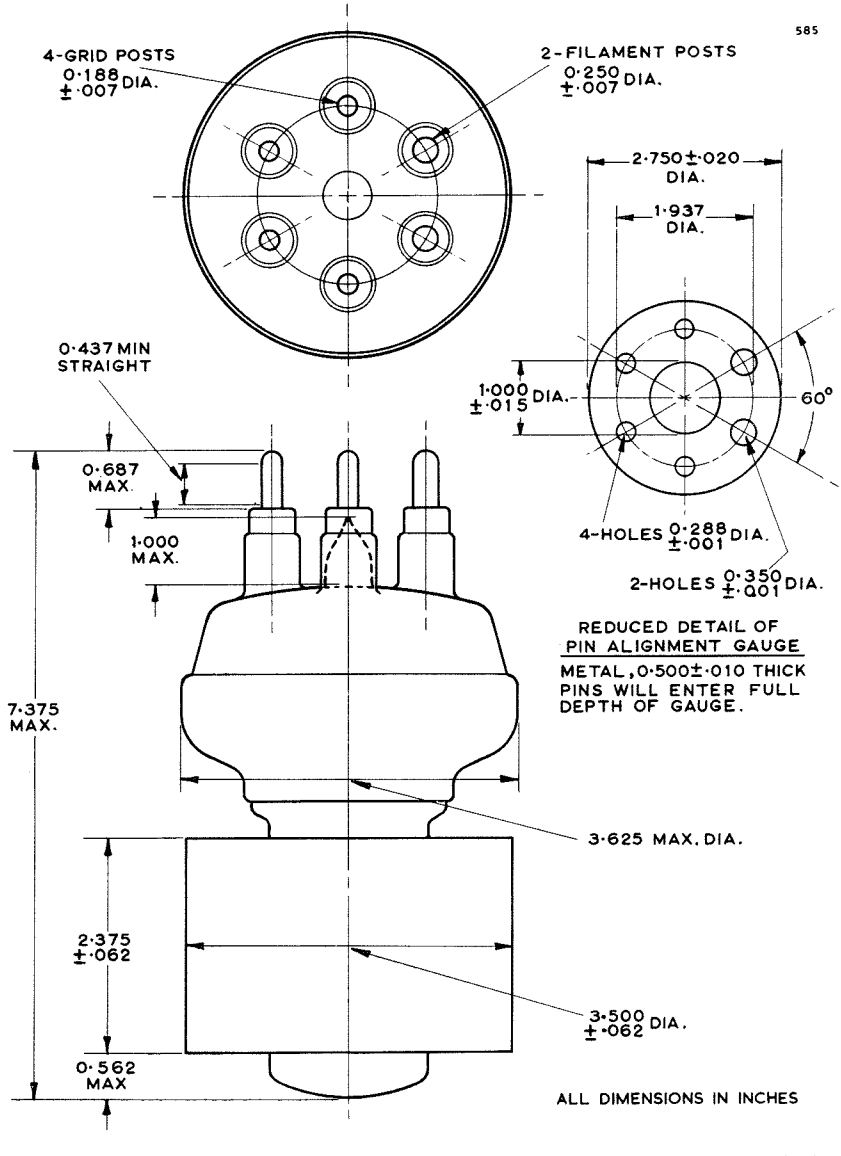

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5762
(BR191B)

R.F. POWER TRIODE

Service Type CV2383 **American Designation 5762**

INTRODUCTION

The 5762 is a forced-air cooled transmitting Triode. It has a maximum anode dissipation of 3kW and can be operated at 6·2kV up to 30Mc/s, 5·2kV up to 110Mc/s and 3·2kV up to 220Mc/s. Under grounded-grid class C telegraphy conditions an output power of 5·5kW is obtainable up to 110Mc/s.

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1) at frequencies up to 70 Mc/s	12·6	V ←
at frequencies above 70 Mc/s	11·8	V ←
Filament Current	29	A
Maximum Filament Starting Current	(*See Note* 2)	
Filament Cold Resistance	0·052	Ω
Peak Usable Cathode Current	10	A
Amplification Factor	29	
Inter-electrode Capacitances:		
Grid to Anode	18·5	pF
Grid to Filament	19	pF
Anode to Filament	0·5	pF

Mechanical

Overall Length (excluding flexible leads)	7·13 inches (187 mm)	Max
Length of Flexible Leads	3·5 inches (89 mm)	Min
Overall Diameter	4·69 inches (119 mm)	Max
Net Weight	7 pounds (3·2 kg)	Approx
Mounting Position	Vertical, either way up	

COOLING

The required quantity of air through the radiator for cooling is indicated on the graph (page 8) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously.

A flow of air of 10cu.ft/min must be provided via a 1-inch diameter nozzle and directed into the filament header before and during the application of any voltages in order to limit the temperature of the filament and grid seals.

Inlet Air Temperature	45°C Max
Radiator Temperature (measured on the core at end away from incoming air)	180°C Max
Bulb Temperature (at the hottest part)	180°C Max
Seal Temperature:	
Filament, grid and anode	180°C Max

← Indicates a change.

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ANODE MODULATED R.F. POWER AMPLIFIER

(Class C Telephony, carrier conditions per valve for use with a max modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

	Up to 30 *Mc/s*	*Up to* 110 *Mc/s*
Anode Voltage	5·0	4·2 kV Max
Grid Voltage (negative value)	1·0	1·0 kV Max
Anode Current	1·0	1·0 A Max
Grid Current	0·3	0·3 A Max
Anode Input	5·0	4·2 kW Max
Anode Dissipation	2·0	2·0 kW Max

TYPICAL OPERATION IN GROUNDED-FILAMENT CIRCUIT

	Up to 30 *Mc/s*	*At* 110 *Mc/s*	
Anode Voltage	4·7	4·0	kV
Grid Voltage	−400	−350	V
Grid Resistor	1425	1460	Ω
Peak R.F. Grid Voltage (*See Note* 3)	675	600	V
Anode Current	0·96	0·93	A
Grid Current (Approx)	0·28	0·24	A
Driving Power (Approx)	170	130	W
Output Power (Approx)	3·7	2·8	kW

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C Telegraphy, *see Note* 4, and Class C F.M. Telephony)

MAXIMUM RATINGS

(Absolute Values)

	Up to 30 *Mc/s*	*At* 110 *Mc/s*	*At* 220 *Mc/s*
Anode Voltage	6·2	5·2	3·2 kV Max
Grid Voltage	−1·0	−1·0	−0·6 kV Max
Anode Current	1·4	1·4	1·4 A Max
Grid Current	0·3	0·3	0·25 A Max
Anode Input	8·7	7·3	4·5 kW Max
Anode Dissipation	3·0	3·0	3·0 kW Max

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TYPICAL OPERATION IN GROUNDED-FILAMENT CIRCUIT

	Up to 30 *Mc/s*	*At* 110 *Mc/s*	
Anode Voltage	6·0	5·0	kV
Grid Voltage	−550	−525	V
Grid Resistor	1900	1725	Ω
Cathode Resistor	360	340	Ω
Peak R.F. Grid Voltage	875	850	V
Anode Current	1·25	1·25	A
Grid Current (Approx)	0·29	0·29	A
Driving Power (Approx)	225	225	W
Output Power (Approx)	6·0	4·8	kW

TYPICAL OPERATION IN GROUNDED-GRID CIRCUIT

	Up to 30 *Mc/s*	*At* 110 *Mc/s*	*At* 220 *Mc/s*	
Anode Voltage	6·0	5·0	3·0	kV
Grid Voltage	−550	−1000	−160	V
Grid Resistor	1900	4100	670	Ω
Cathode Resistor	360	740	110	Ω
Peak R.F. Grid Voltage	875	1350	410	V
Anode Current	1·25	1·1	1·25	A
Grid Current (Approx)	0·290	0·245	0·240	A
Driving Power (Approx)	1·225	1·68	0·51	W
Output Power (Approx)	7·0	5·5	2·65	kW

R.F. POWER AMPLIFIER – CLASS B TELEVISION SERVICE U.S.A. SYSTEM

(Synchronising level conditions unless otherwise stated)

MAXIMUM RATINGS
(Absolute Values)

	54 *to* 216 *Mc/s*	
Anode Voltage	3·7	kV Max
Anode Current	1·9	A Max
Grid Current (Pedestal Level)	0·225	A Max
Anode Input	6·5	kW Max
Anode Dissipation	3·0	kW Max

TYPICAL OPERATION IN GROUNDED-GRID CIRCUIT

Bandwidth	10 *Mc/s*	8·5 *Mc/s*	
Anode Voltage	3·0	3·2	kV
Grid Voltage	105	110	V
Peak R.F. Grid Voltage:			
Synchronising Level	380	435	V
Pedestal Level	290	310	V
Anode Current:			
Synchronising Level	1·8	1·8	A
Pedestal Level	1·36	1·35	A
Grid Current:			
Synchronising Level	0·265	0·4	A
Pedestal Level	0·115	0·130	A
Driving Power (*See Note* 5):			
Synchronising Level	625	770	W
Output Power:			
Synchronising Level	3·150	4·0	kW
Pedestal Level	1·8	2·3	kW

GRID MODULATED R.F. POWER AMPLIFIER – CLASS C TELEVISION SERVICE—U.S.A. SYSTEM

(Synchronising level conditions unless otherwise stated)

MAXIMUM RATINGS
(Absolute Values)

	54 *to* 216 *Mc/s*	
Anode Voltage	3·7	kV Max
Grid Voltage (White Level)	−800	V Max
Anode Current	1·9	A Max
Grid Current (Pedestal Level)	0·225	A Max
Anode Input	6·3	kW Max
Anode Dissipation	3·0	kW Max

TYPICAL OPERATION IN GROUNDED-GRID CIRCUIT

Bandwidth	8·5 *Mc/s*	
Anode Voltage	3·2	kV
Grid Voltage:		
Synchronising Level	−110	V
Pedestal Level	220	V
White level	−520	V
Peak R.F. Grid Voltage	435	V
Anode Current:		
Synchronising Level	1·8	A
Pedestal Level	1·25	A
Grid Current (Approx):		
Synchronising Level	0·40	A
Pedestal Level	0·13	A
Driving Power (*See Note* 5):		
Synchronising Level	770	W
Output Power (Approx):		
Synchronising Level	4·00	kW
Pedestal Level	2·3	kW

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.
2. The filament current must not exceed 175A, even momentarily, at any time.
3. Driver modulated approximately 30%.
4. Key-down conditions per valve without amplitude modulation. Modulation essentially negative may be used if the positive peak of the audio frequency envelope does not exceed 115% of the carrier conditions.
5. Computed value to supply grid losses and feed-through power. Additional power will be required to supply circuit losses.

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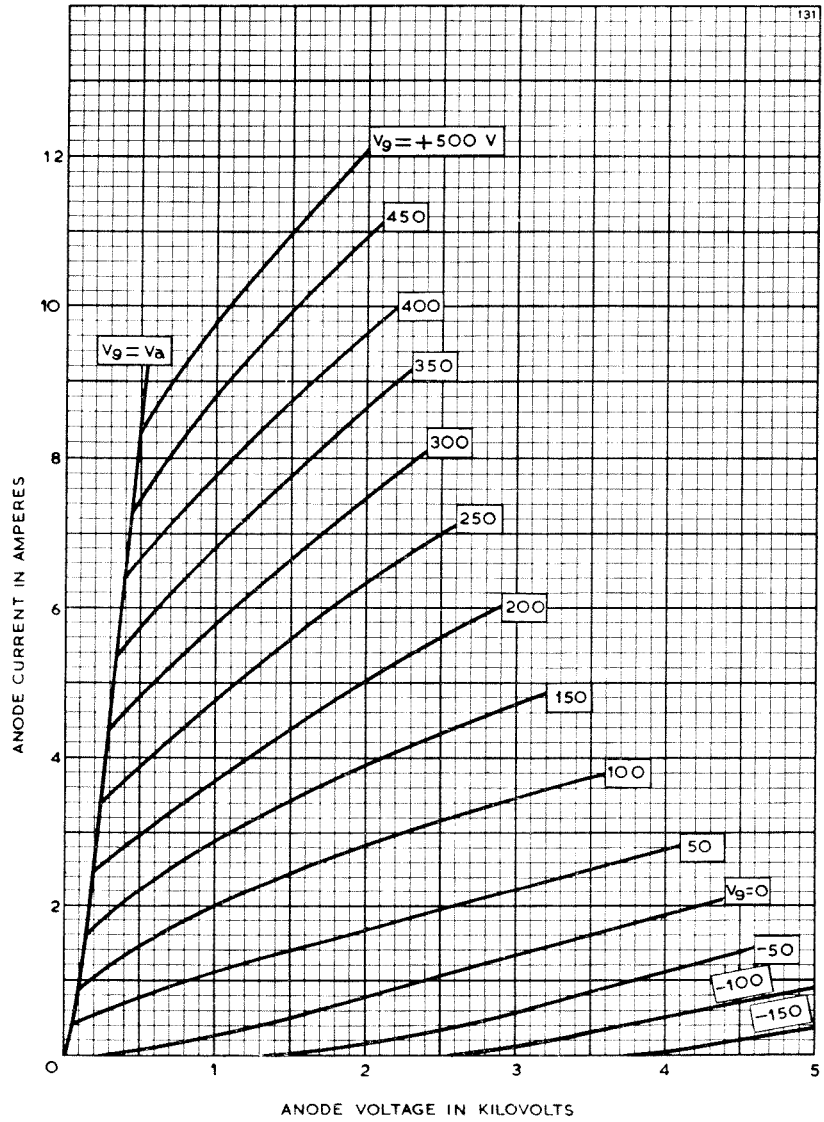
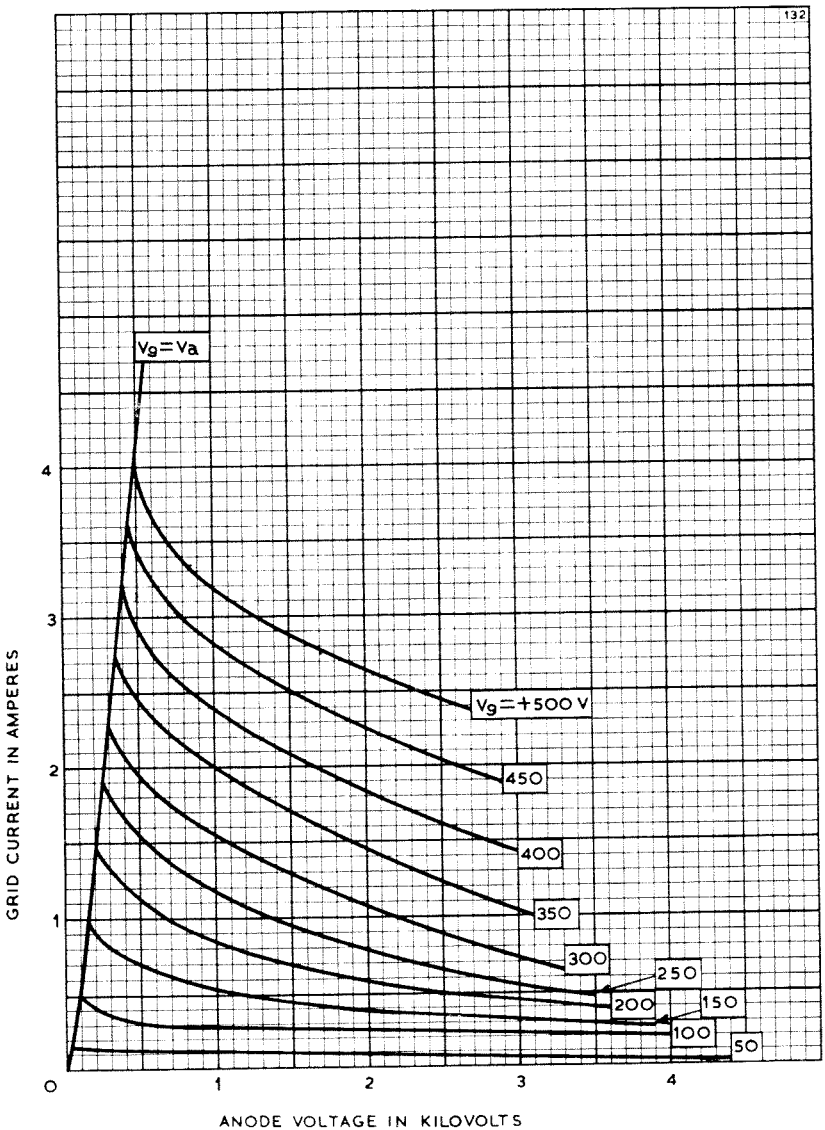
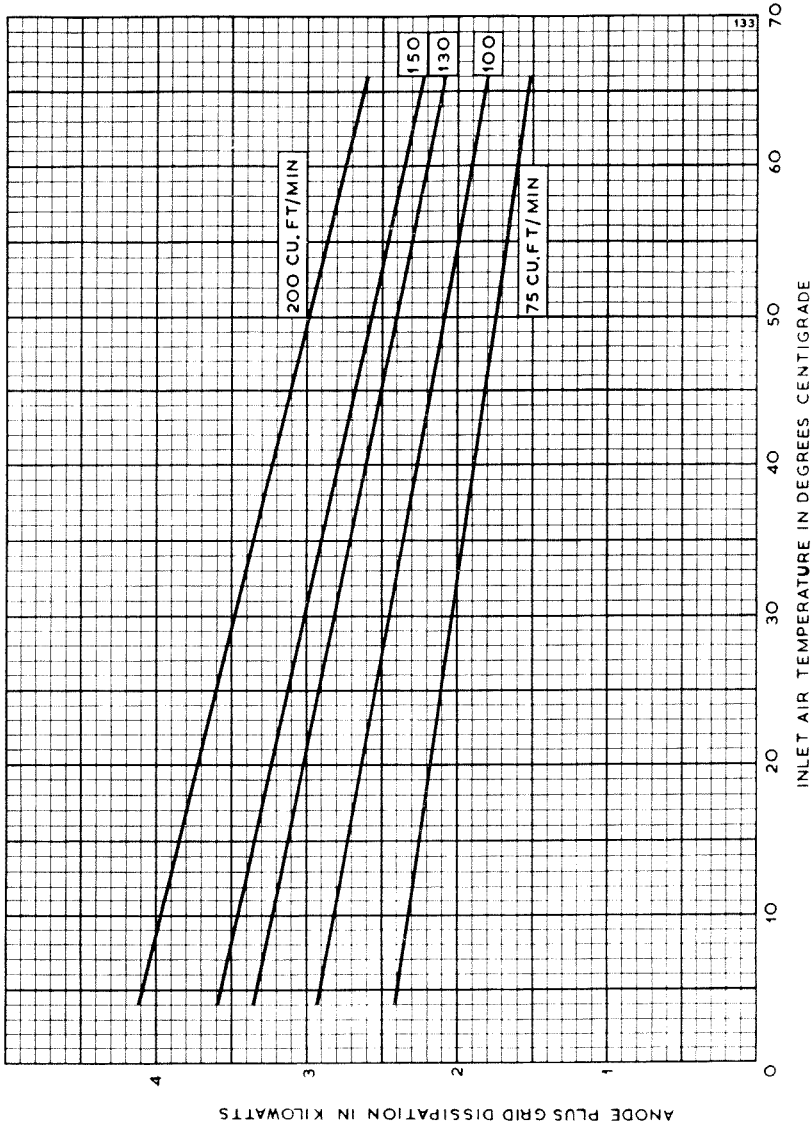
ANODE CHARACTERISTICS



CONTROL GRID CHARACTERISTICS



AIR COOLING CHARACTERISTICS



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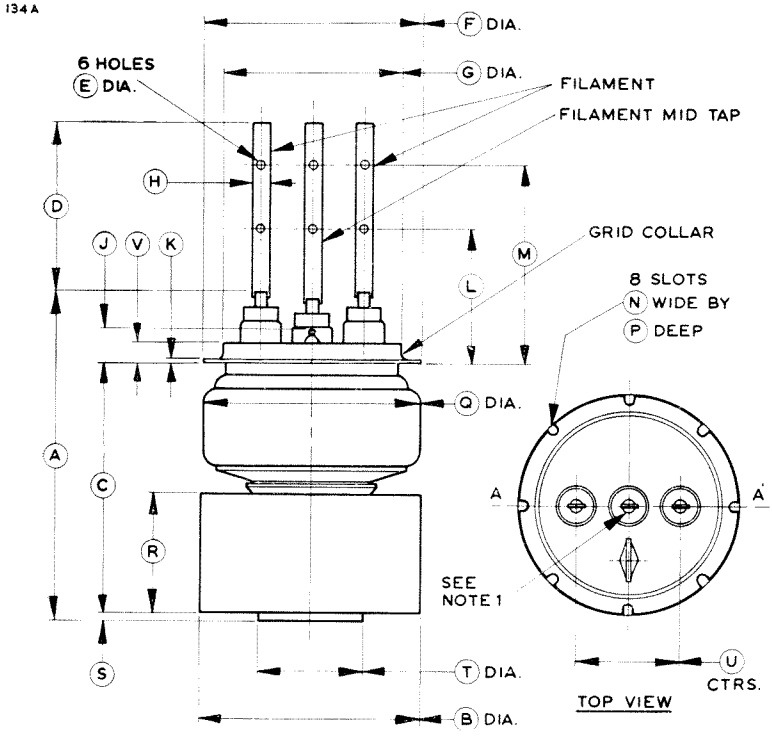
5762 (BR191B)

OUTLINE



Note 1 Plane of filament leads will be parallel to plane A—A′ to within 3·5°.

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	7·125 Max	181·0 Max	L	2·500 ± 0·375	63·50 ± 9·53
B	4·625 ± 0·062	117·48 ± 1·57	M	3·875 ± 0·375	98·42 ± 9·53
C	5·250 ± 0·125	133·35 ± 3·18	N	0·182	4·62
D	3·500 Min	88·90 Min	P	0·205	5·21
E	0·144	3·66	Q	4·562 Max	115·9 Max
F	4·562 ± 0·031	115·87 ± 0·79	R	2·750 Max	69·85 Max
G	3·750	95·25	S	0·187 Max	4·75 Max
H	0·312 ± 0·062	7·92 ± 1·57	T	2·250 Max	57·15 Max
J	1·250 Max	31·75 Max	U	2·500 Max	63·50 Max
K	0·080 ± 0·015	2·03 ± 0·38	V	0·437 ± 0·020	11·10 ± 0·50

Millimetre dimensions have been derived from inches.

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BR128B

GENERAL

The BR128B is a forced-air cooled transmitting triode. It is a maintenance type and therefore only abridged data are given on this sheet. **Full information is available on request.**

Filament	Thoriated Tungsten	
Filament Voltage	7·2	V
Filament Current	170	A
Filament Starting Current (Peak)	450	A Max
Filament Cold Resistance	0·0052	Ω
Peak Usable Cathode Current	35	A
Amplification Factor (V_a = 10kV, I_a = 2·0A)	26	
Mutual Conductance (V_a = 10kV, I_a = 1·75A)	24	mA/V
Filament Leads	MA131	

MAXIMUM RATINGS

Anode Dissipation	12·5 kW Max
Grid Dissipation	1·0 kW Max

Maximum Anode Voltage against Frequency		
Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
30	12 kV	10 kV
70	9·0kV	7·0kV
110	6·5kV	5·0kV

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OUTLINE

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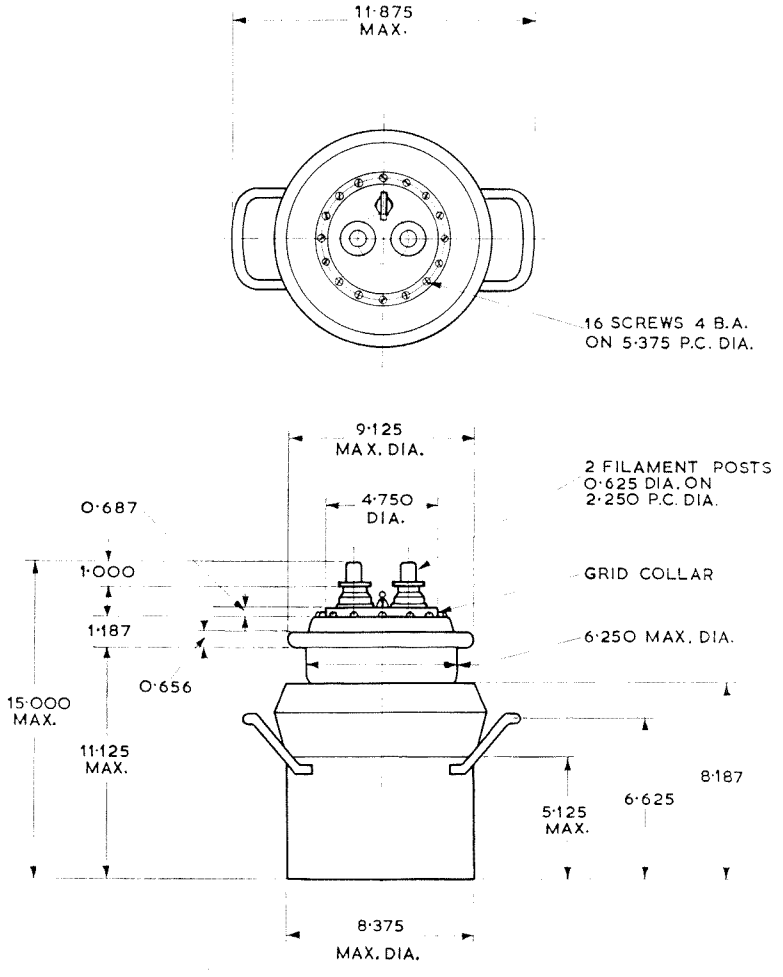

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BR140

R.F. POWER TRIODE

INTRODUCTION

The BR140 is a forced-air cooled transmitting Triode. It has a maximum anode dissipation of 8kW and can be operated at 12kV up to 15Mc/s or at reduced ← ratings up to 40Mc/s.

GENERAL DATA

Electrical

Filament	Tungsten	
Filament Voltage (*See Note* 1)	19	V
Filament Current	75	A
Maximum Filament Starting Current	(*See Note* 2)	
Filament Cold Resistance	0·0225	Ω
Peak Usable Cathode Current	(*See Note* 1)	
Amplification Factor (at V_a = 9 kV, I_a = 1 A)	45	
Mutual Conductance (at V_a = 8 kV, I_a = 1·5 A)	9	mA/V
Inter-electrode Capacitances:		
Grid to Anode	30	pF
Grid to Filament	27	pF
Anode to Filament	2·5	pF

Mechanical

Overall Length	24·38 inches (620 mm)	Max
Overall Diameter (over handles)	11·63 inches (295 mm)	Max
Net Weight	46 pounds (21 kg)	Approx
Mounting Position	Vertical, filament end up	

COOLING

The required quantity of air through the radiator for cooling is indicated on the graphs (pages 7 and 8) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously.

The temperature of the anode must not exceed 180°C. The temperature of the ← grid and filament seals must not exceed 140°.

In some cases it has been found necessary to blow air on to the header to maintain the seal temperatures within this limit. A suitable arrangement for this is to blow 10 to 30 cu. ft./min. of air through a 1 inch diameter nozzle directed on to the header before and during the application of any voltages.

← Indicates a change.

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MAXIMUM RATINGS

Anode Dissipation	8·0 kW Max
Grid Dissipation	0·8 kW Max

Maximum Anode Voltage against Frequency		
Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
15	12·0 kV	10·0 kV
20	10·2 kV	8·5 kV
25	7·8 kV	6·5 kV
40	4·2 kV	3·5 kV

NOTES

1. 'Marked volts.' Each valve is marked with the filament voltage required to give 10A peak emission at 90% saturation. Longer filament life may be obtained if the filament is run at reduced temperature and a correspondingly reduced anode current (see Emission Characteristic on page 6) but care must be taken to keep the anode dissipation within the maximum rating.
2. The filament current must not exceed 113A, even momentarily, at any time.

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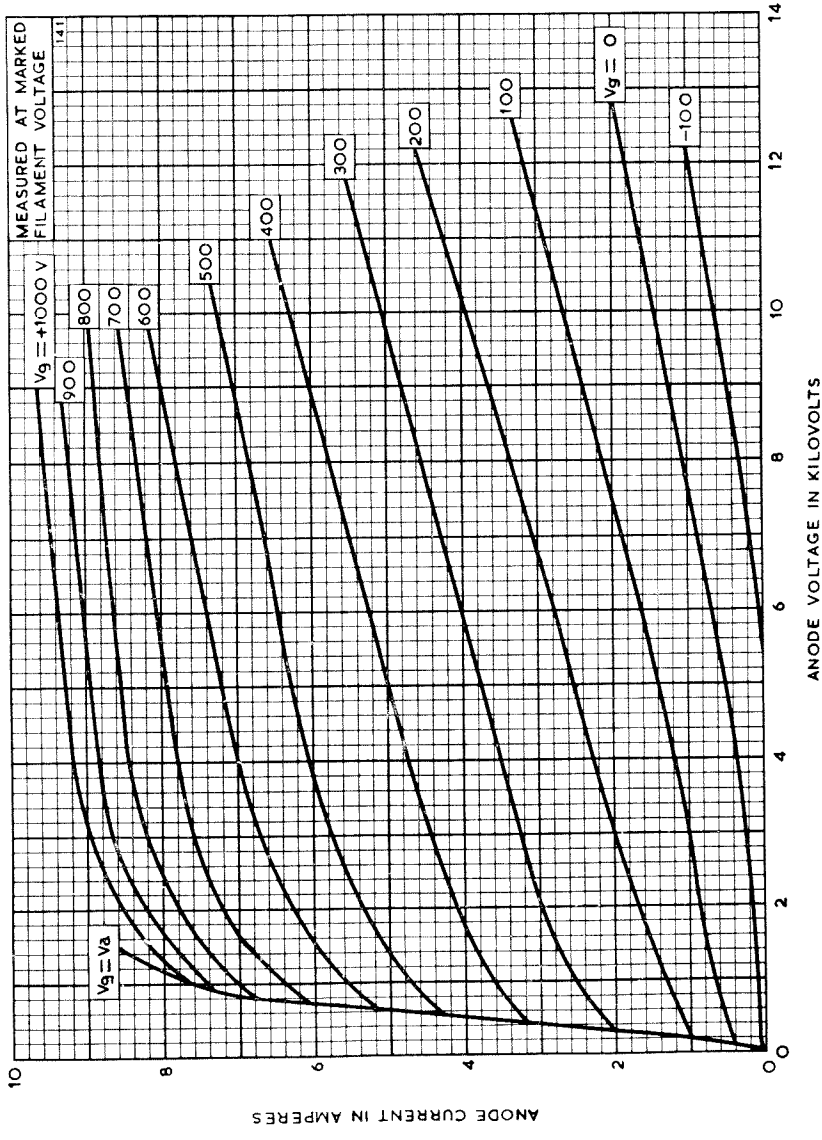
ANODE CHARACTERISTICS



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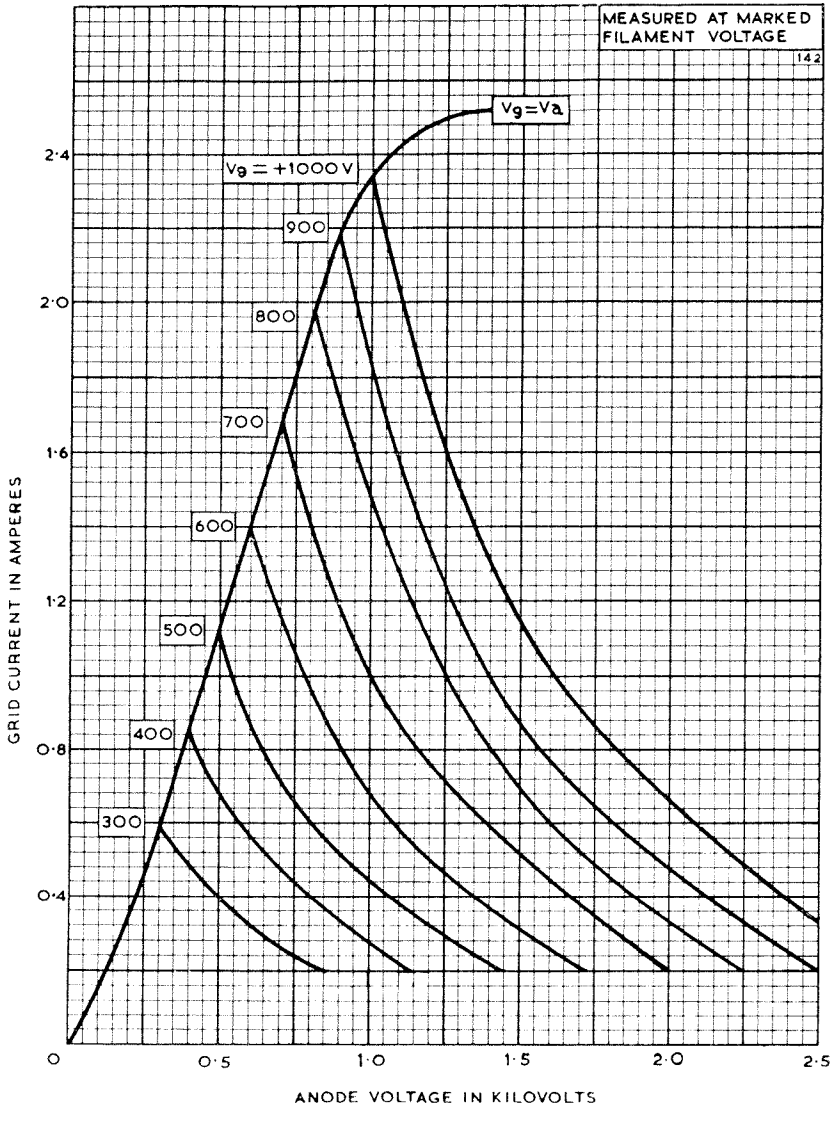
CONTROL GRID CHARACTERISTICS



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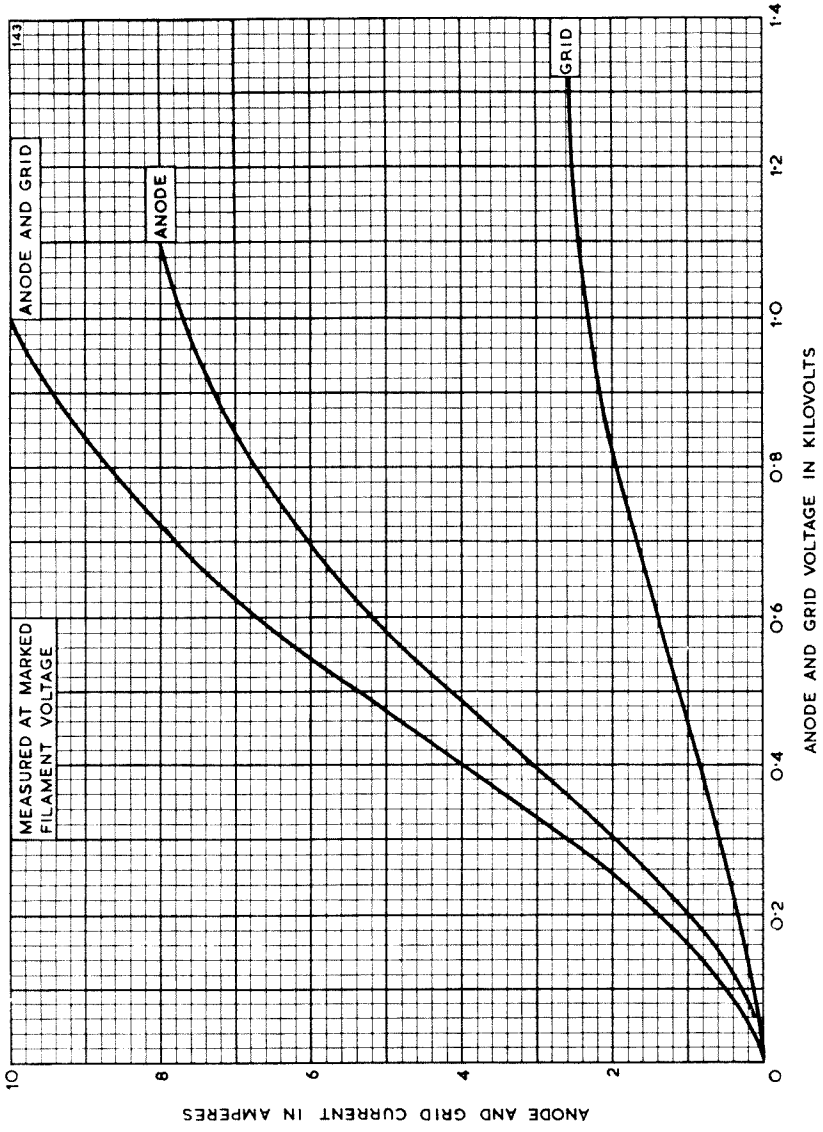
STRAPPED CHARACTERISTICS



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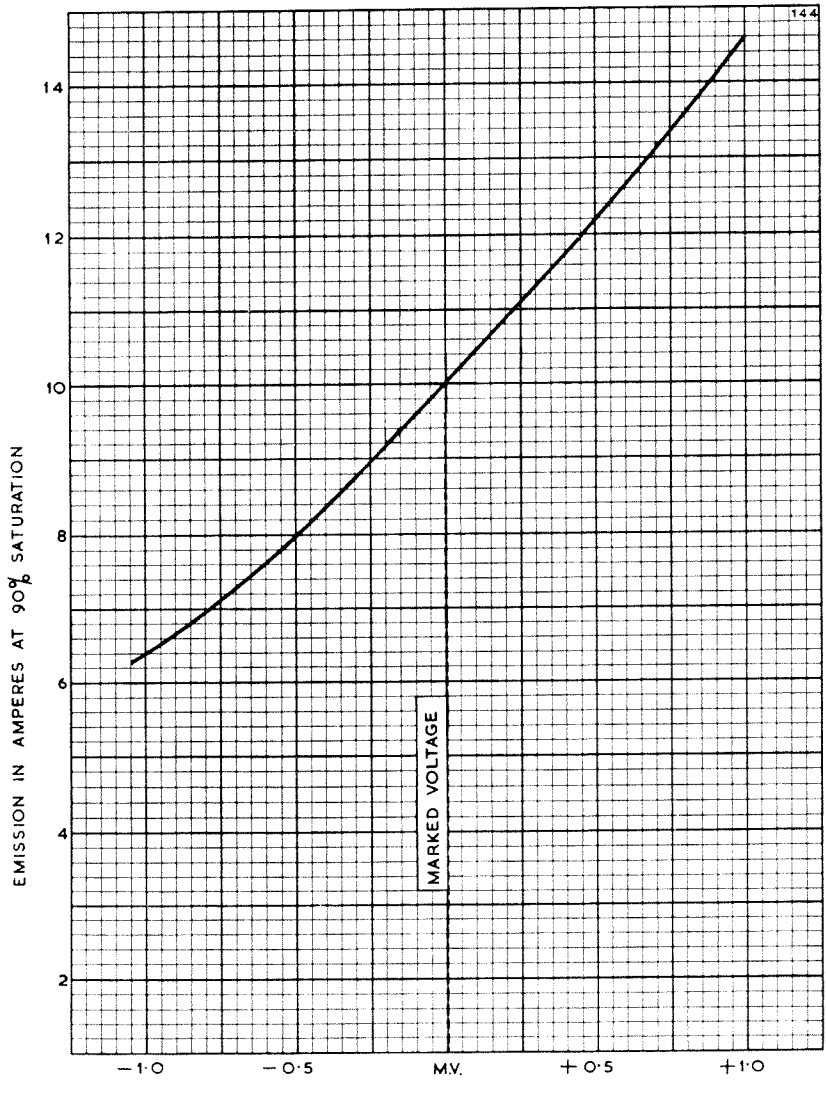
EMISSION CHARACTERISTIC



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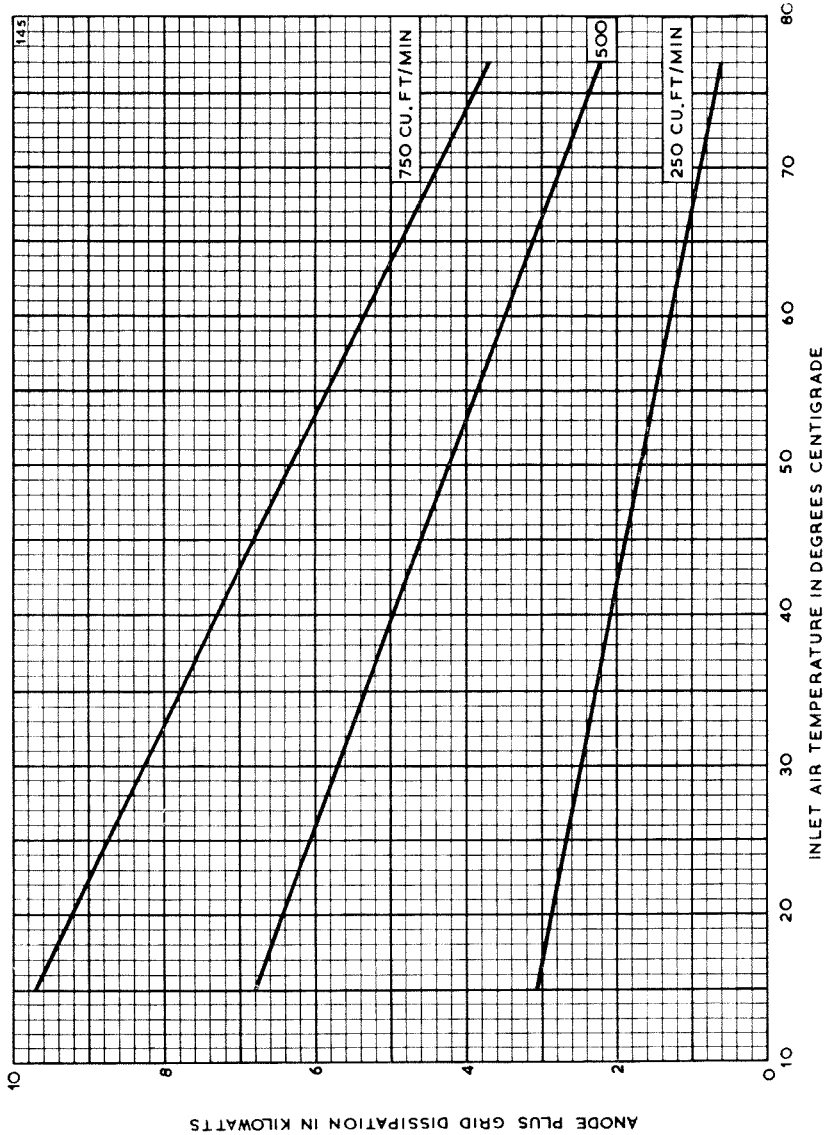
AIR COOLING CHARACTERISTICS



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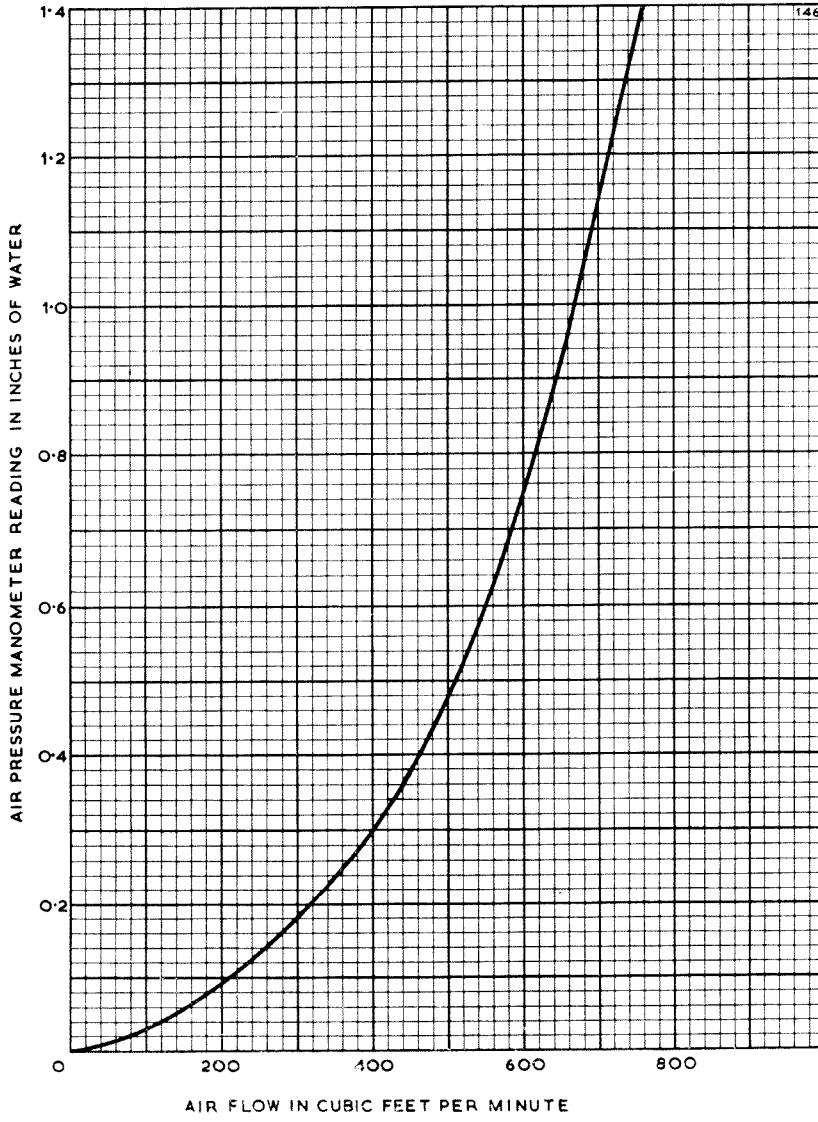
AIR FLOW CHARACTERISTIC



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OUTLINE

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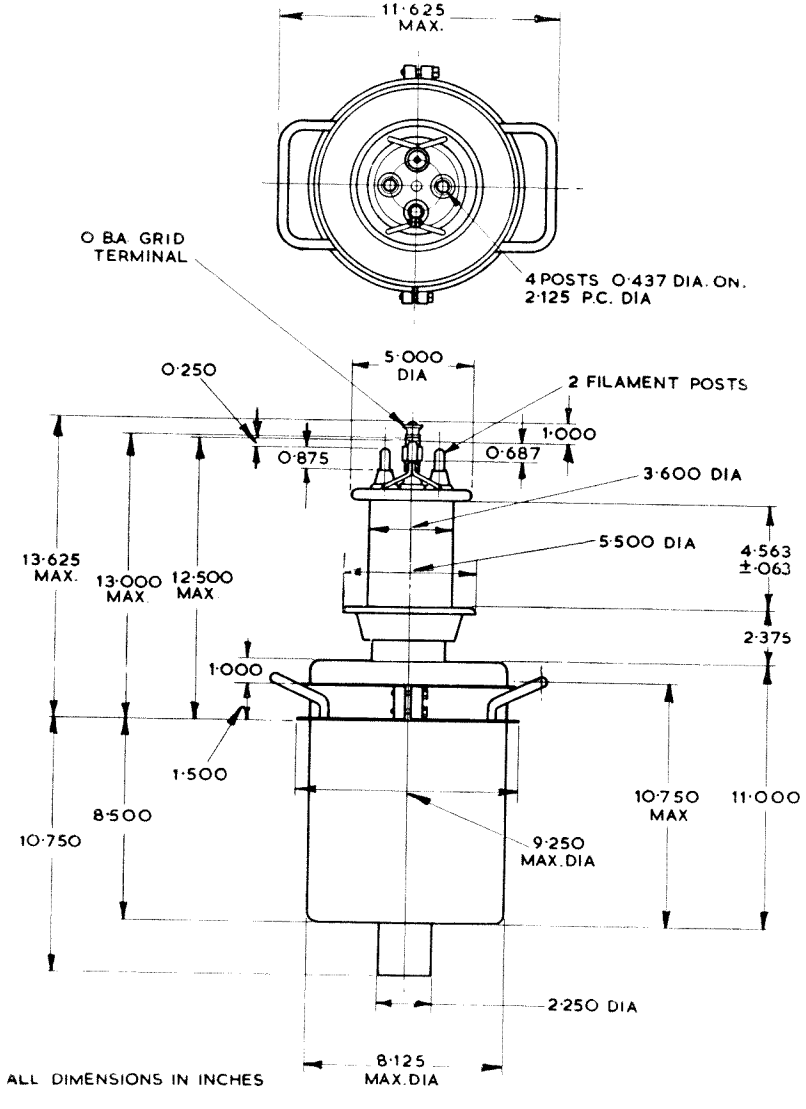

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BR152B

Service Type CV28

GENERAL

The BR152B is a forced-air cooled transmitting triode with ratings for both forced-air cooling and natural cooling. It is a maintenence type and therefore only abridged data are given on this sheet. **Full information is available on request.**

Filament		Tungsten
Filament Voltage (*See Note*)	16	V
Filament Current	22	A
Filament Starting Current (Peak)	33	A Max
Filament Cold Resistance	0·055	Ω
Peak Usable Cathode Current		*See Note*
Amplification Factor (V_a = 5·0kV, I_a 0·2A)	40	
Mutual Conductance (V_a = 5·0kV, I_a 0·2A)	3·1	mA/V

MAXIMUM RATINGS

Anode Dissipation (forced-air cooling)	1·1	kW Max
Anode Dissipation (natural cooling)	0·8	kW Max
Grid Dissipation	200	W Max

Maximum Anode Voltage against Frequency

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
15	10 kV	8·0kV
30	5·0kV	4·0kV
80	2·0kV	1·6kV

NOTE

'Marked volts'. Each valve is marked with the filament voltage required to give 2·0A peak emission at 90% saturation. Longer filament life may be obtained if the filament is run at reduced temperature and a correspondingly reduced anode current, but care must be taken to keep the anode dissipation within the maximum rating.

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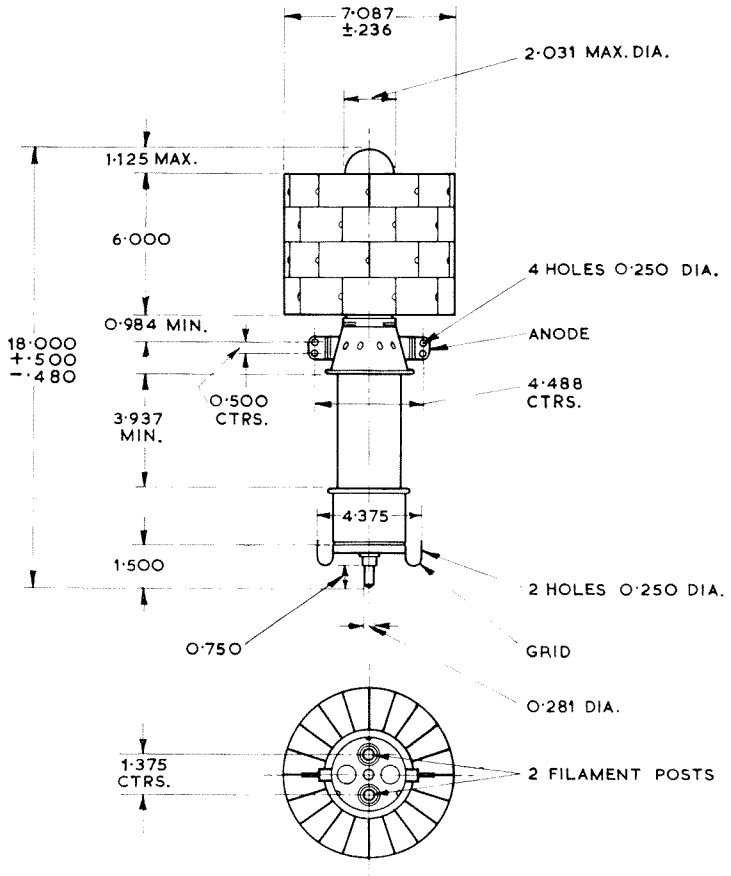

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R.F. POWER TRIODE

BR153

February 1958 Page 1

Service Type CV2159

INTRODUCTION

The BR153 is a forced-air cooled transmitting Triode. It has a maximum anode dissipation of 12kW and can be operated at 15kV up to 20Mc/s.

GENERAL DATA

Electrical

Filament		Tungsten
Filament Voltage (*See Note* 1)	19	V
Filament Current	100	A
Maximum Filament Starting Current		(*See Note* 2)
Filament Cold Resistance	0·017	Ω
Peak Usable Cathode Current		(*See Note* 1)
Amplification Factor (at V_a = 9 kV, I_a = 1 A)	45	
Mutual Conductance (at V_a = 10 kV, I_a = 1·5 A)	10	mA/V
Inter-electrode Capacitances:		
Grid to Anode	21·5	pF
Grid to Filament	29·6	pF
Anode to Filament	2·3	pF

Mechanical

Overall Length	24·63 inches (626 mm)	Max
Overall Diameter (over handles)	10·38 inches (264 mm)	Max
Net Weight	54 pounds (25 kg)	Approx
Mounting Position	Vertical, filament end up	

COOLING

The required quantity of air through the radiator for cooling is indicated on the graphs (pages 7 and 8) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously.

A flow of air of 20 to 30cu.ft/min must be provided via a 1-inch diameter nozzle and directed into the filament header before and during the application of any voltages in order to limit the temperature of the filament and grid seals.

The temperature of the anode must not exceed 180 C; that of the filament and grid seals must not exceed 140 C.

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MAXIMUM RATINGS

Anode Dissipation	12·0 kW Max
Grid Dissipation	1·0 kW Max

Maximum Anode Voltage against Frequency		
Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
20	15·0 kV	12·0 kV
25	11·3 kV	9·0 kV
30	7·5 kV	6·0 kV
40	5·25 kV	4·2 kV

NOTES

1. 'Marked volts.' Each valve is marked with the filament voltage required to give 12A peak emission at 90% saturation. Longer filament life may be obtained if the filament is run at reduced temperature and a correspondingly reduced anode current (see Emission Characteristic on page 6) but care must be taken to keep the anode dissipation within the maximum rating.

2. The filament current must not exceed 150A, even momentarily, at any time.

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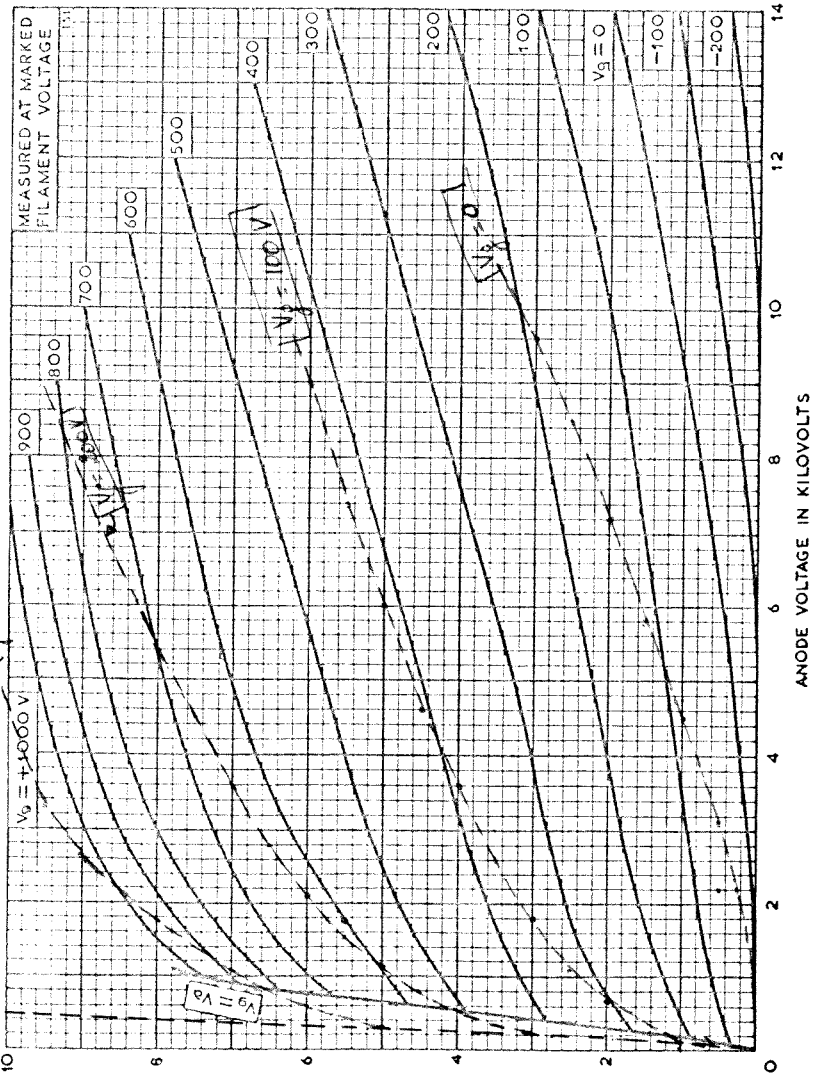
ANODE CHARACTERISTICS



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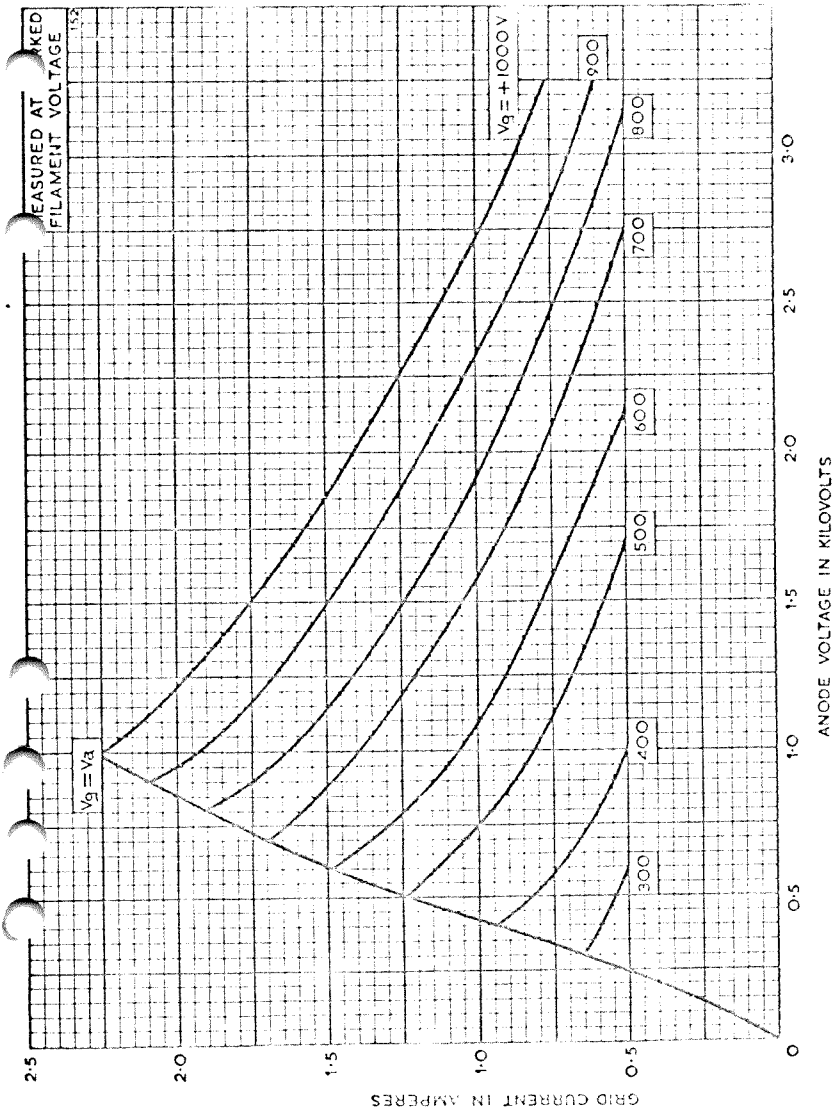
BR143

CONTROL GRID CHARACTERISTICS



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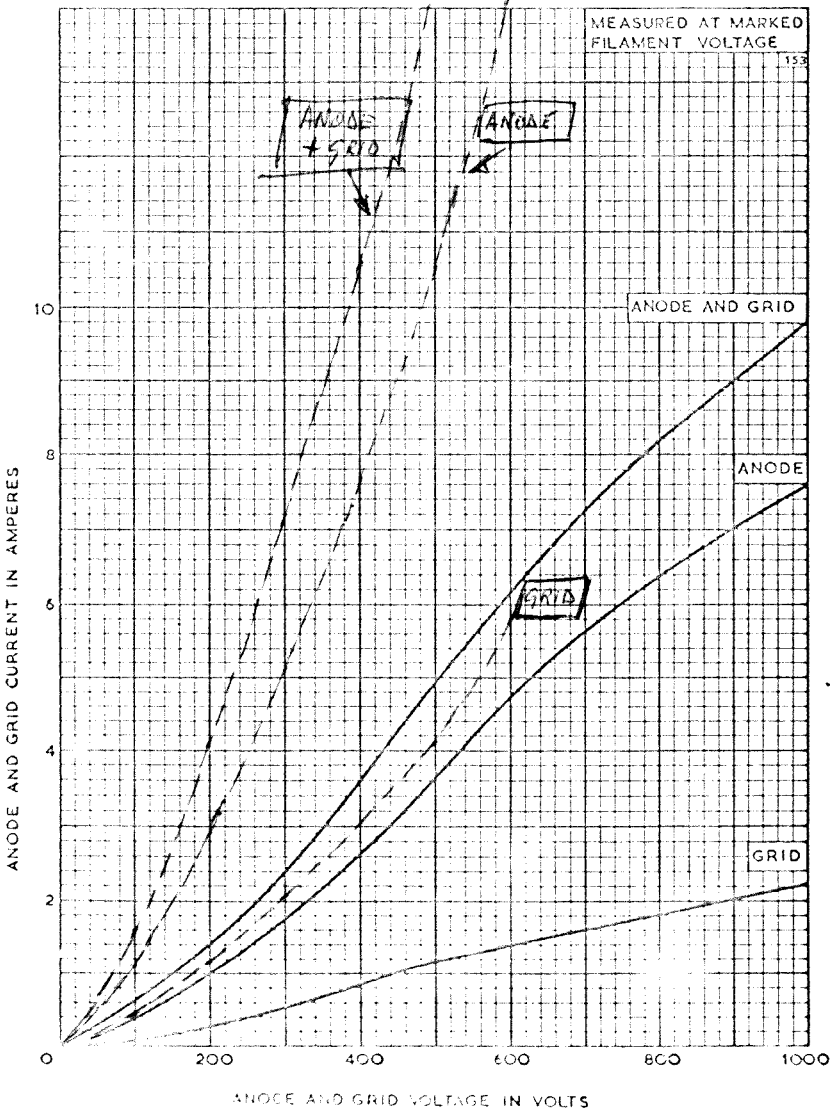
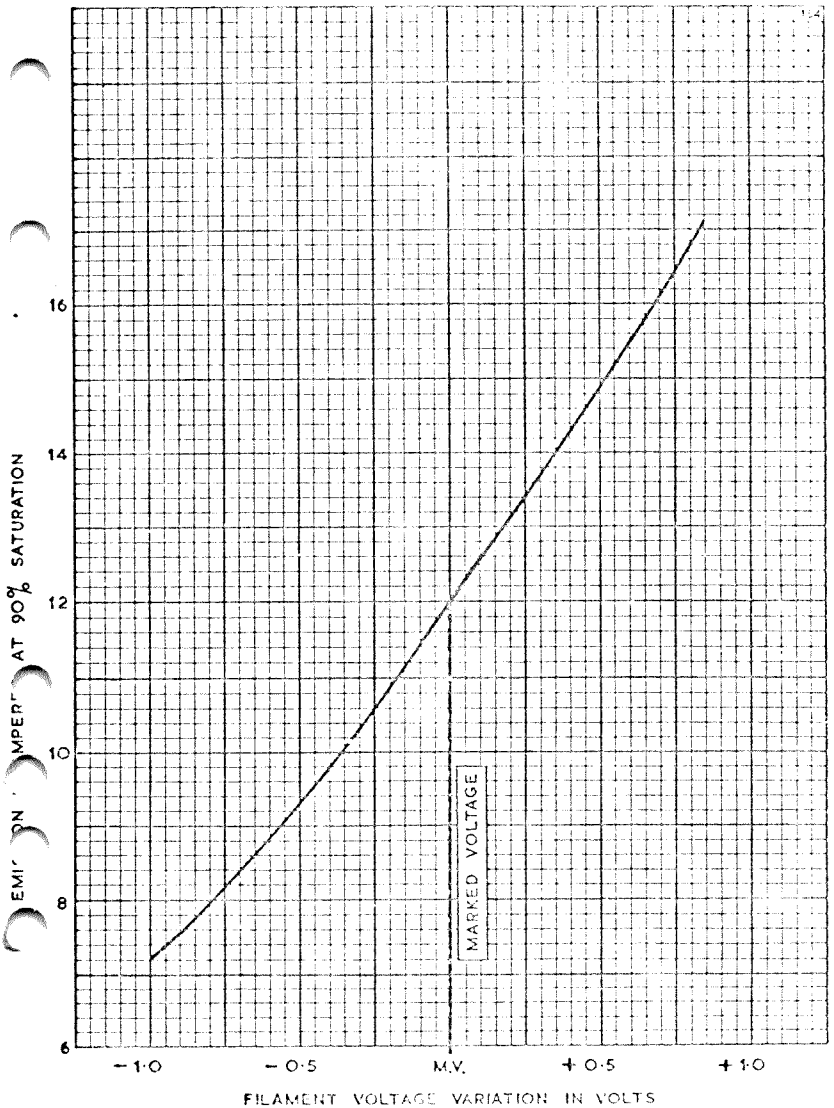
BR 1122

STRAPPED CHARACTERISTIC



EMISSION CHARACTERISTIC



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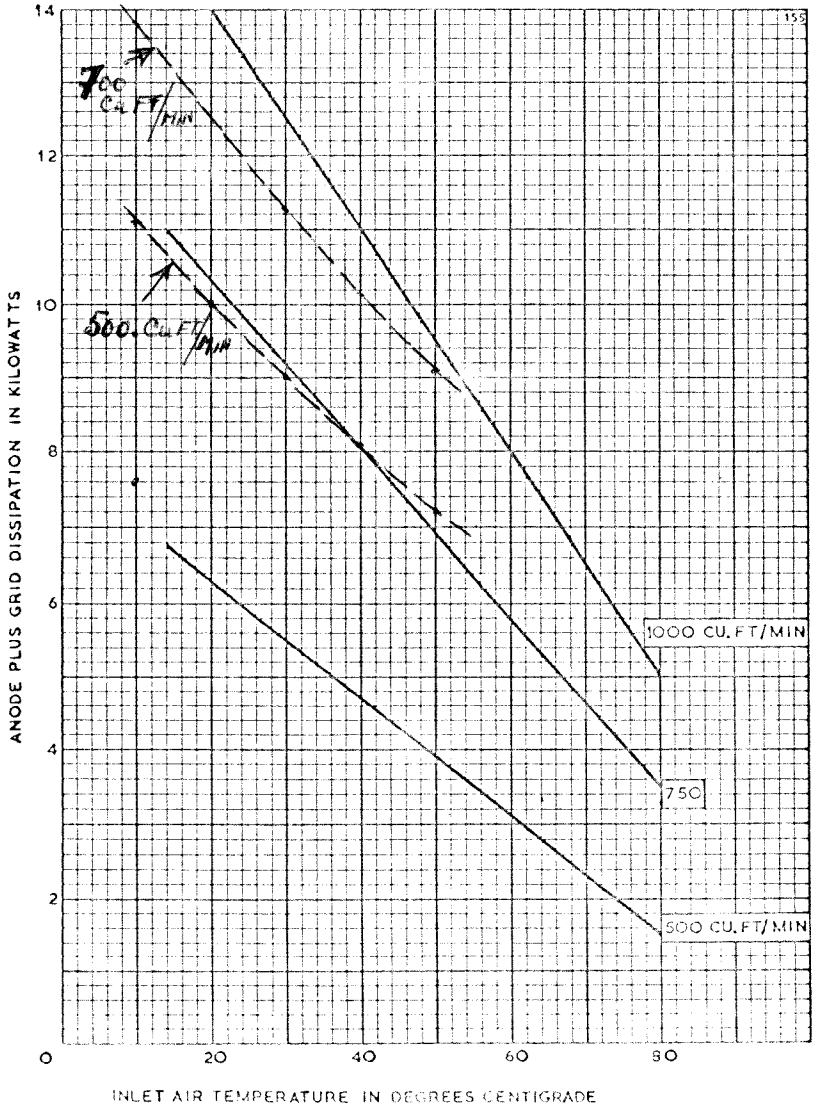
BR 1122

AIR COOLING CHARACTERISTICS



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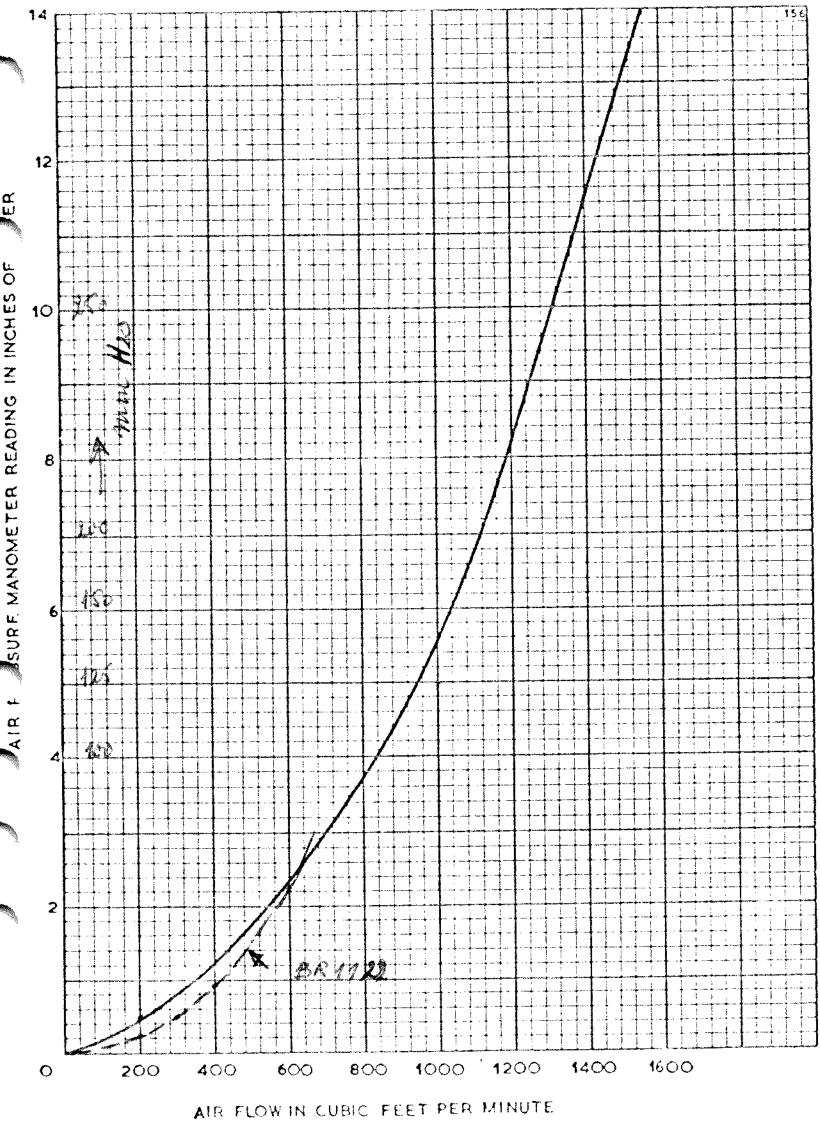
AIR FLOW CHARACTERISTIC



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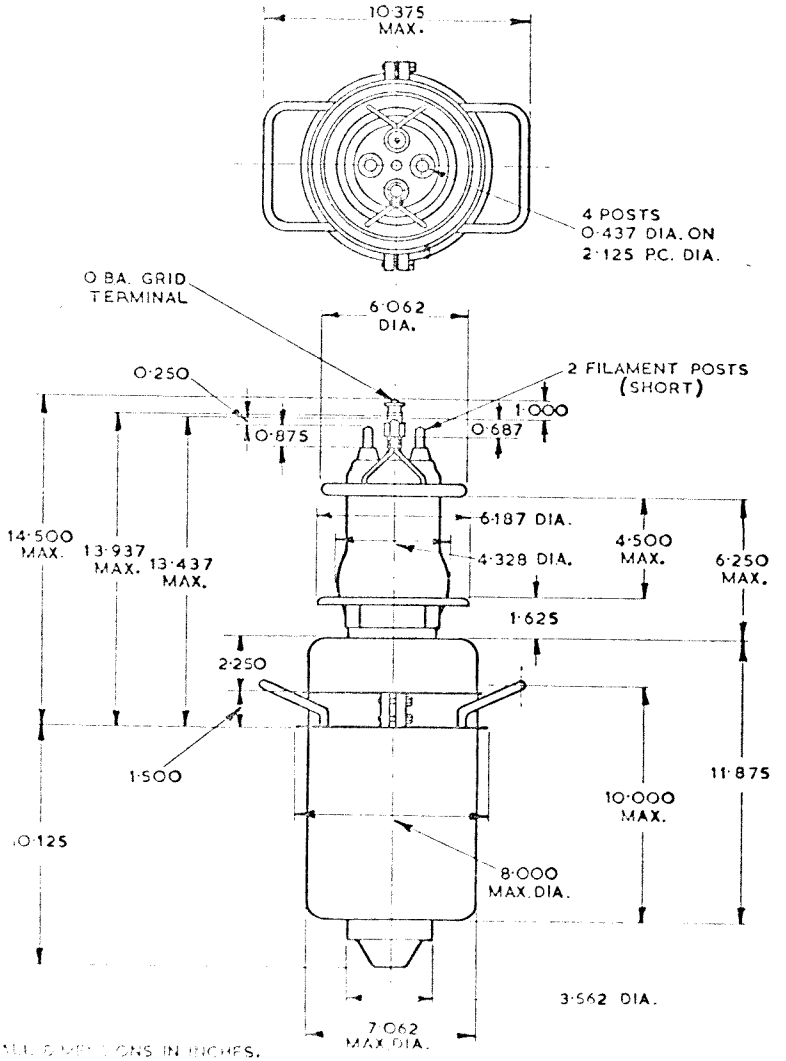

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BR153

Service Type CV2159

GENERAL

The BR153 is a forced-air cooled transmitting triode. It is a maintenance type and therefore only abridged data are given on this sheet. **Full information is available on request.**

Filament		Tungsten
Filament Voltage (*See Note*)	19	V
Filament Current	100	A
Filament Starting Current (Peak)	150	A Max
Filament Cold Resistance	0·017	Ω
Peak Usable Cathode Current		*See Note*
Amplification Factor (V_a = 9·0kV, I_a 1·0A)	45	
Mutual Conductance (V_a = 10kV, I_a 1·5A)	10	mA/V
Filament Leads	MA135 or MA135A	

MAXIMUM RATINGS

Anode Dissipation	12	kW Max
Grid Dissipation	1·0	kW Max

Maximum Anode Voltage against Frequency

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
20	15 kV	12 kV
25	11·3kV	9·0kV
30	7·5kV	6·0kV
40	5·25kV	4·2kV

NOTE

'Marked volts'. Each valve is marked with the filament voltage required to give 12A peak emission at 90% saturation. Longer filament life may be obtained if the filament is run at reduced temperature and a correspondingly reduced anode current but care must be taken to keep the anode dissipation within the maximum rating.

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OUTLINE

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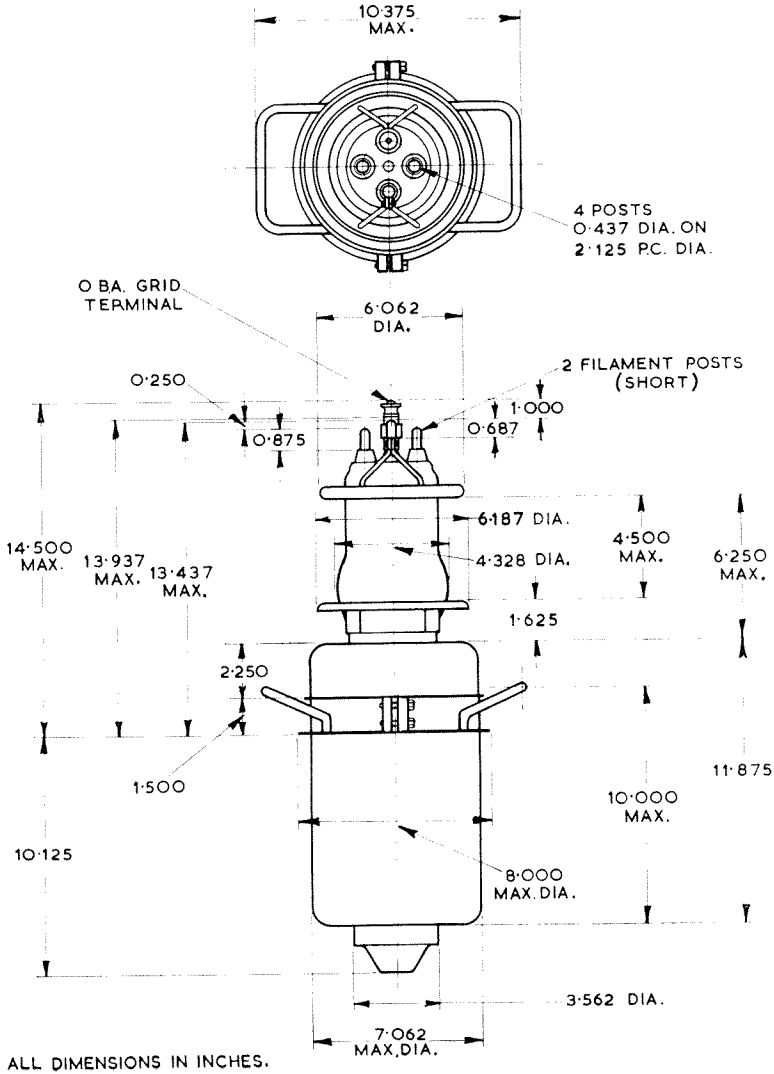

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R.F. POWER TRIODE

BR155

GENERAL

The BR155 is a forced-air cooled transmitting Triode. It is a maintenance type and therefore only abridged data are given on this sheet. **Full information is available on request.**

Filament		Tungsten
Filament Voltage (*See Note*)	17	V
Filament Current	130	A
Filament Starting Current (Peak)	195	A Max
Filament Cold Resistance	0·012	Ω
Peak Usable Cathode Current		*See Note*
Amplification Factor (V_a = 5·0kV, I_a = 1·5A)	50	
Mutual Conductance (V_a = 5·0kV, I_a = 1·5A)	15·5	mA/V
Filament Leads	MA135 or MA135A	
Grid Connector	MA66A	

MAXIMUM RATINGS

Anode Dissipation	7·5 kW Max
Grid Dissipation	0·35kW Max

Maximum Anode Voltage against Frequency

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
30	10 kV	8·0kV
50	8·0kV	6·4kV
110	6·0kV	4·8kV

NOTE

'Marked volts.' Each valve is marked with the filament voltage required to give 14A peak emission at 90% saturation. Longer filament life may be obtained if the filament is run at reduced temperature and a correspondingly reduced anode current but care must be taken to keep the anode dissipation within the maximum rating.

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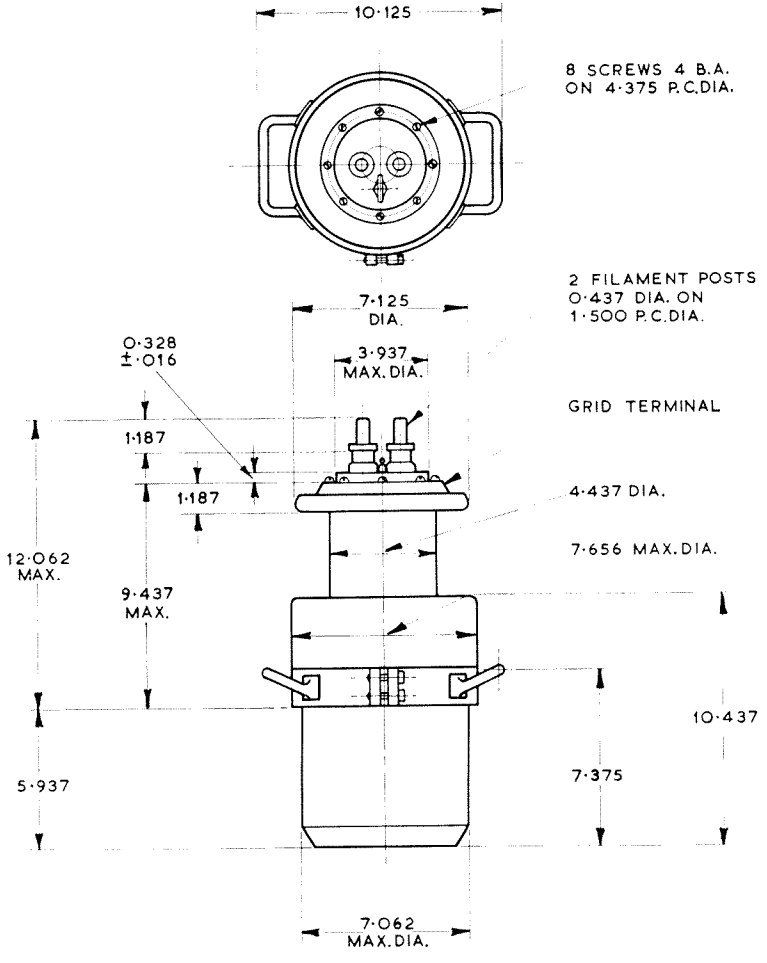

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R.F. POWER TRIODE

BR161

Service Type CV2322

ABRIDGED DATA

Forced-air Cooled Transmitting Triode with grid terminal suitable for cathode drive operation.

Anode Dissipation	15	kW Max
Anode Voltage	12	kV Max
Frequency for full ratings	30	Mc/s Max
Frequency at reduced ratings	50	Mc/s Max
Output Power (Class C Telegraphy)	50	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	9·0	V
Filament Current	175	A
Filament Starting Current (Peak) (*See Note* 2)	450	A Max
Filament Cold Resistance	0·0059	Ω
Peak Usable Cathode Current	45	A
Perveance	2·1	$mA/V^{3/2}$
Amplification Factor (V_a = 9·0kV, I_a = 2·0A)	45	
Mutual Conductance (V_a = 10kV, I_a = 1·5A)	23	mA/V
Inter-electrode Capacitances:		
Grid to Anode	37	pF
Grid to Filament	57	pF
Anode to Filament	1·5	pF

Mechanical

Overall Length	19·000 inches	(482·6 mm)	Max
Overall Width (over handles)	14·000 inches	(355·6 mm)	Max
Net Weight	77 pounds	(35 kg)	Approx
Mounting Position	Vertical, filament end up		

Accessories

Filament Leads	MA131
Grid Connector	MA66

COOLING

The required quantity of air through the radiator for cooling is indicated on the graphs (pages 8 and 9) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 20ft³/min (0·57m³/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

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

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R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	12 kV Max
Anode Dissipation	15 kW Max
Grid Dissipation	1·0 kW Max
Operating Frequency (for full ratings)	30 Mc/s Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	10	12	kV
Grid Voltage	−530	−575	V
Peak R.F. Grid Voltage	1090	1135	V
Anode Current	5·2	5·25	A
Grid Current (Approx)	1·5	1·45	A
Anode Dissipation	12	13	kW
Grid Dissipation	700	700	W
Driving Power	1500	1530	W
Output Power	40	50	kW
Efficiency	77	79	%

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 9·0V	163	192	A
Amplification Factor (V_a = 9·0kV, I_a = 2·0A)	37	48	
Mutual Conductance (V_a = 10kV, I_a = 1·5A)	21·5	29	mA/V
Grid Voltage (negative value) (V_a = 10kV, I_a = 2·0A)	120	164	V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	275	V
Anode Current (V_a = 2·0kV, V_g = +250V)	7·0	12	A
Anode Current (V_a = 4·0kV, V_g = +250V)	9·5	14·5	A
Grid Current (V_a = 2·0kV, V_g = +250V)	0·5	4·0	A
Grid Current (V_a = 4·0kV, V_g = +250V)	0	2·5	A
Inter-electrode Capacitances:			
Grid to Anode	32	42	pF
Grid to Filament	50	62	pF

MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
30	12·0 kV	9·6 kV
50	9·0 kV	7·2 kV

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.
2. The filament current must not exceed 450A, even momentarily, at any time.

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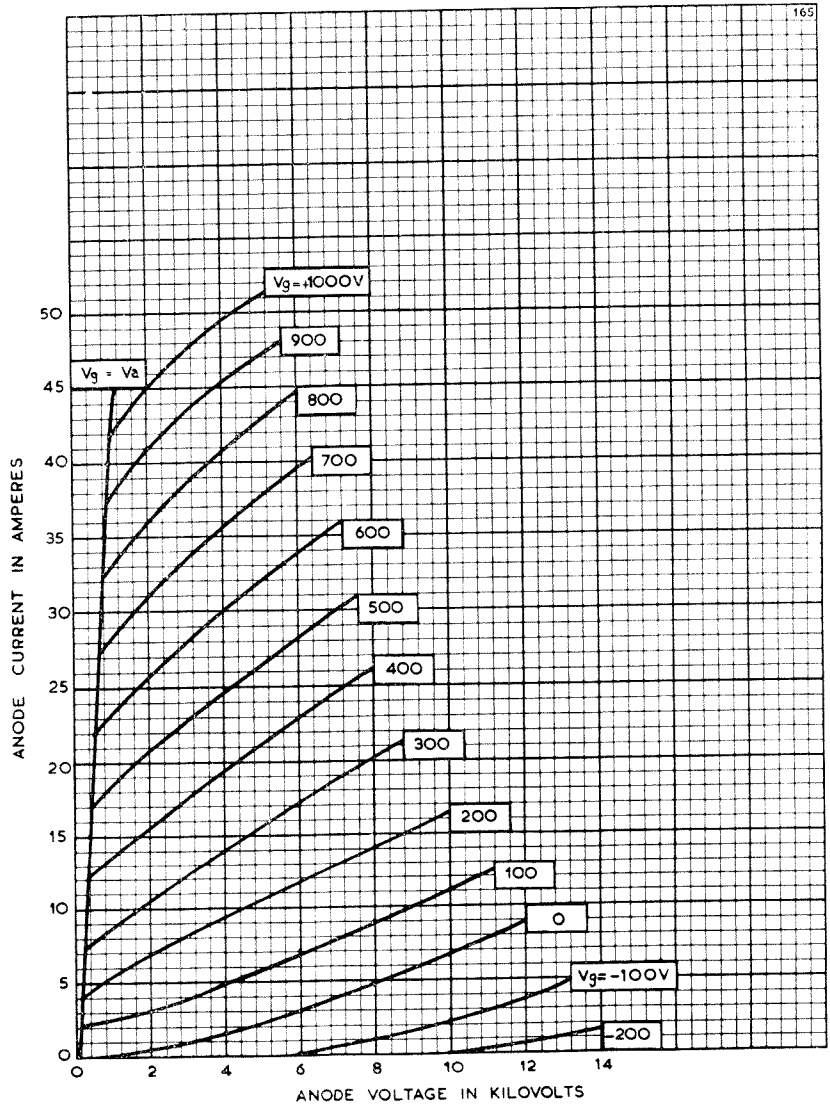
ANODE CHARACTERISTICS



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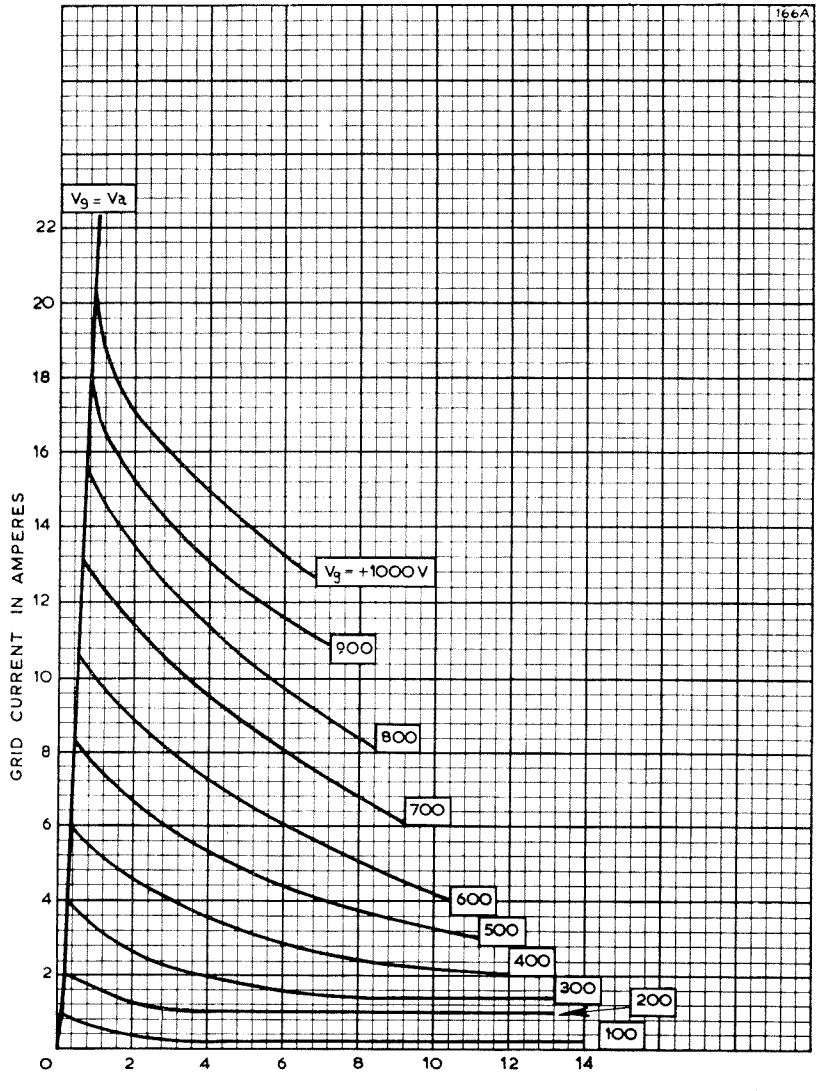
CONTROL GRID CHARACTERISTICS



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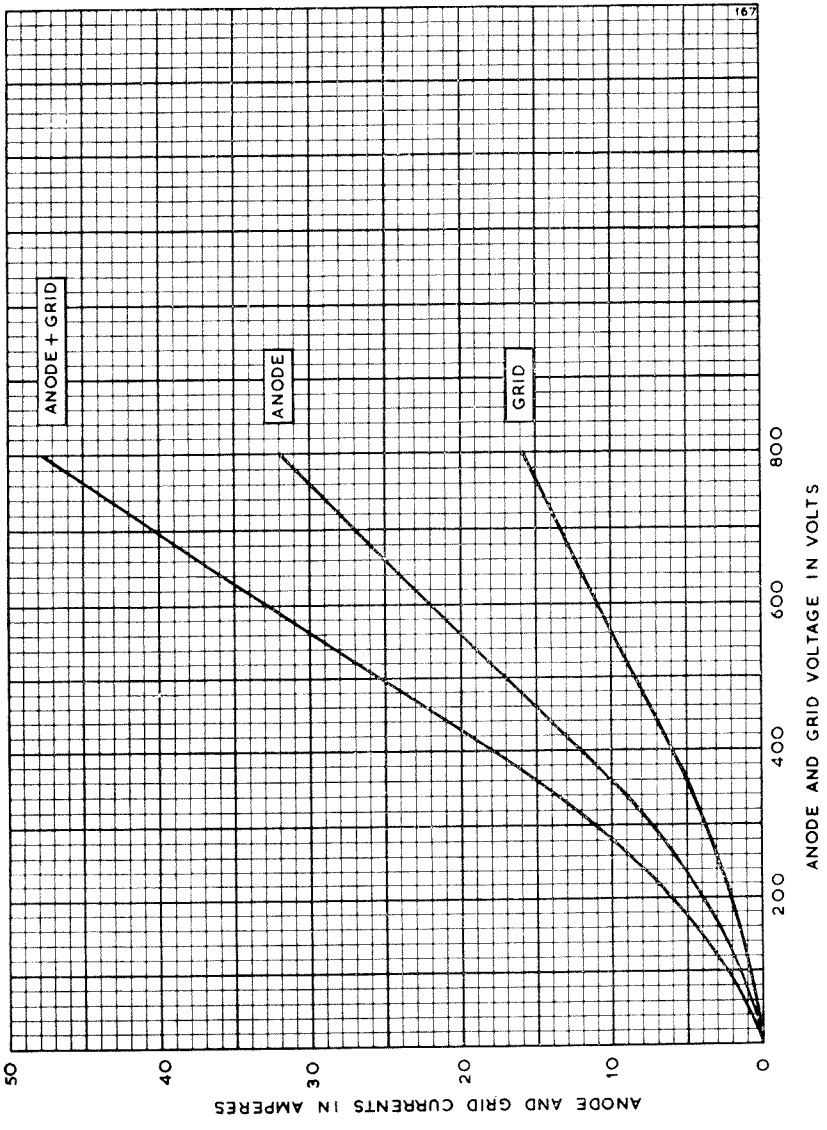
STRAPPED CHARACTERISTICS



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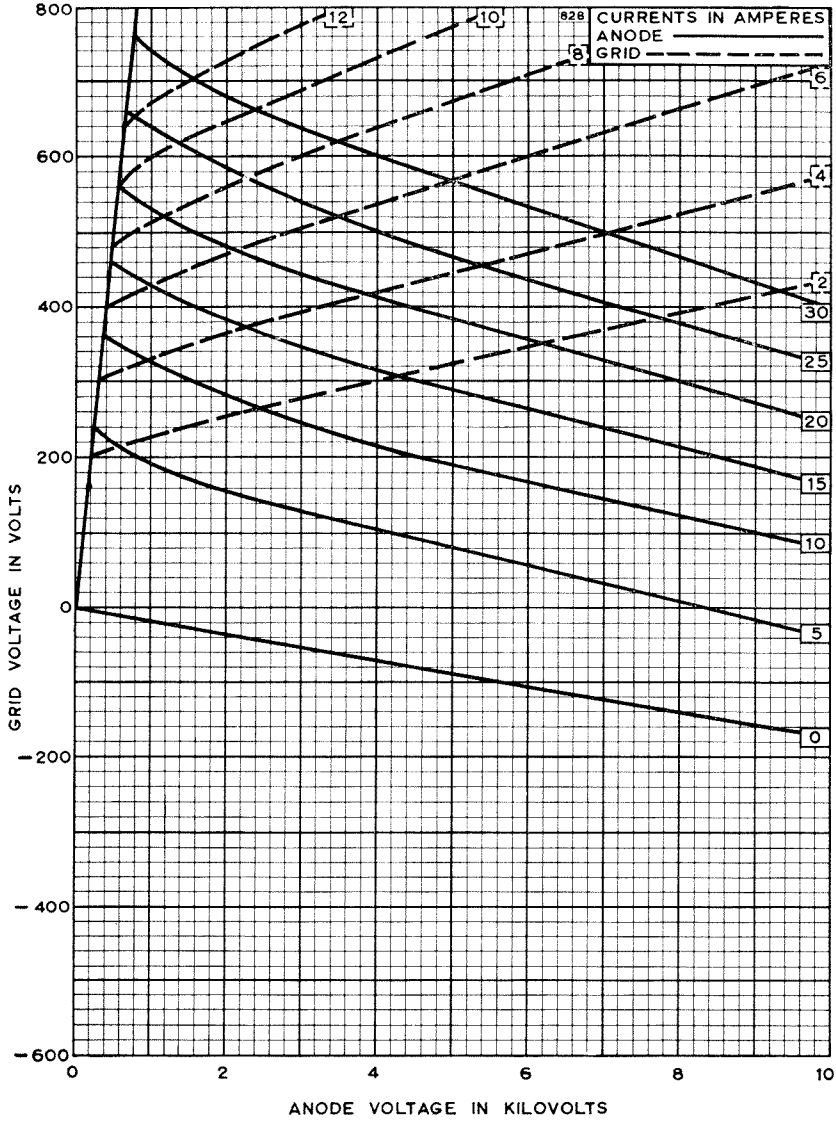
CONSTANT CURRENT CHARACTERISTICS



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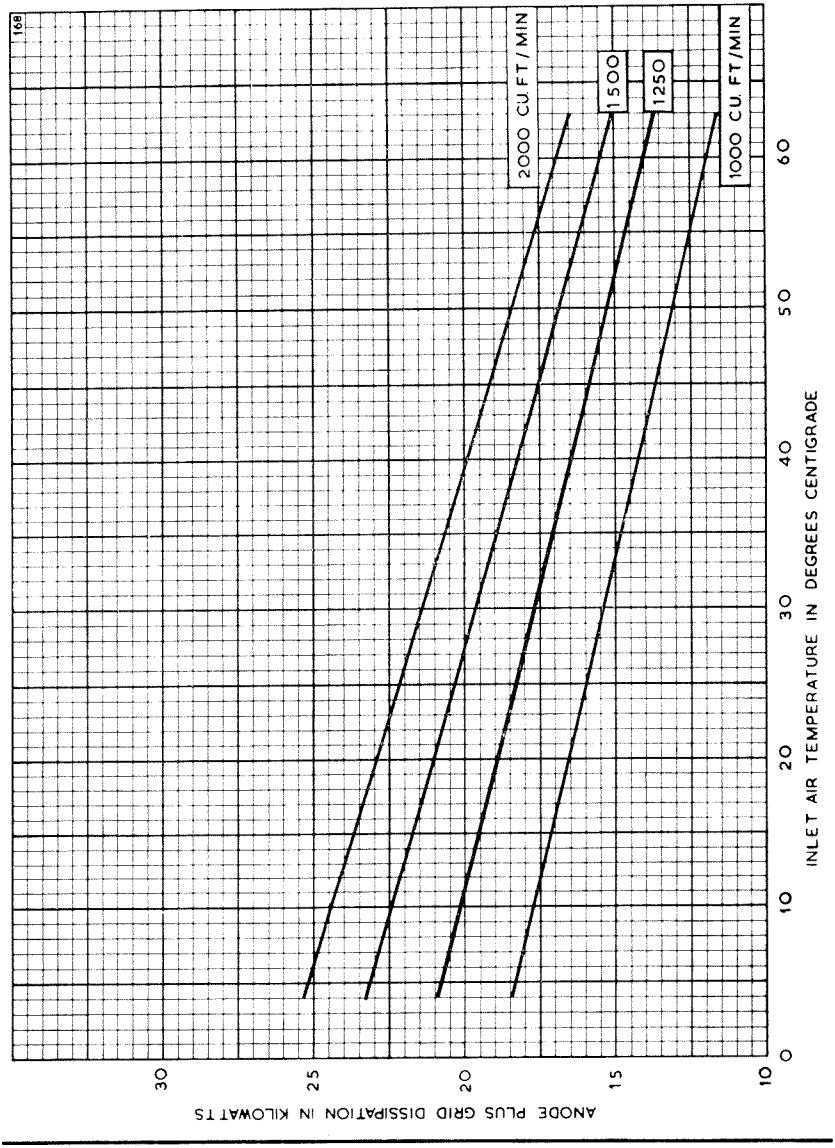
AIR COOLING CHARACTERISTICS



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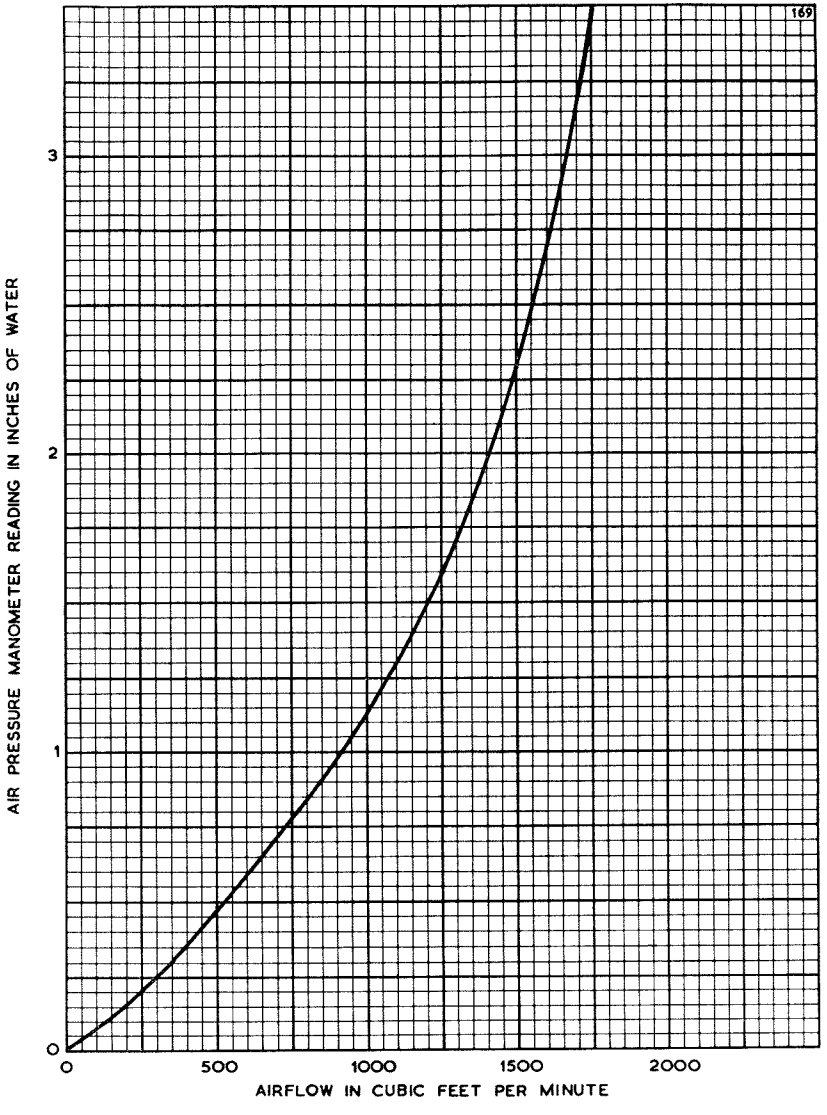
AIR FLOW CHARACTERISTIC



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OUTLINE

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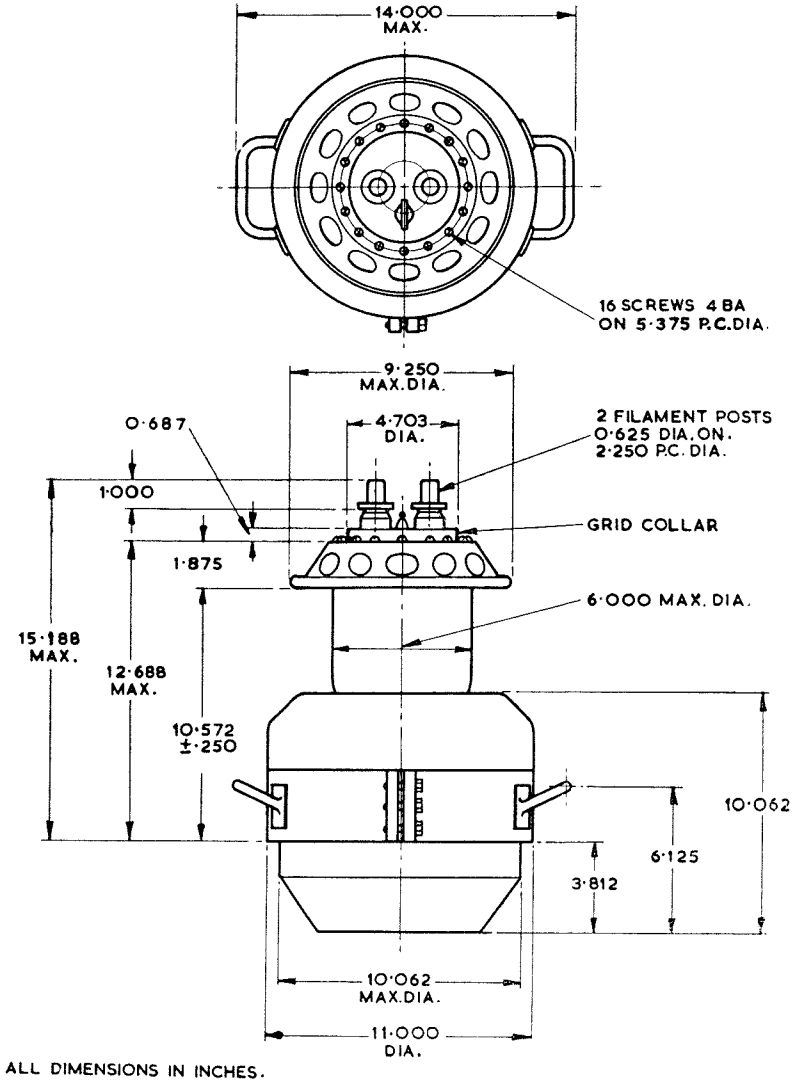

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R.F. POWER TRIODE

BR175

GENERAL

The BR175 is a forced-air cooled transmitting Triode. It is a maintenance type and therefore only abridged data are given on this sheet. **Full information is available on request.**

Filament (two sections)		Tungsten
Filament Voltage, sections in series (*See Note*)	22	V
Filament Current	60	A
Filament Starting Current (Peak)	120	A Max
Filament Cold Resistance	32	mΩ
Peak Usable Cathode Current	8·5	A
Perveance	0·45	$mA/V^{3/2}$
Amplification Factor (V_a = 8·0kV, I_a = 0·5A)	50	
Mutual Conductance (V_a = 8·0kV, I_a = 0·5A)	6·0	mA/V
Filament Leads		MA135
Grid Connector		MA66A

R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	12·5	kV Max
Anode Dissipation	4·0	kW Max
Grid Dissipation	600	W Max
Operating Frequency (for full ratings)	1·6	MHz Max
Anode Voltage for 20MHz operation	6·25	kV Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	9·0	12	kV
Grid Voltage	−635	−670	V
Peak R. F. Grid Voltage	1485	1470	V
Anode Current	1·44	1·4	A
Grid Current (Approx)	0·36	0·29	A
Anode Dissipation	3·4	3·7	kW
Grid Dissipation	270	200	W
Output Power	9·6	13·1	kW
Efficiency	74	78	%

NOTE

'Marked volts'. Each valve is marked with the filament voltage required to give 8·5A peak emission at 90% saturation. Longer filament life may be obtained if the filament is run at reduced temperature and a correspondingly reduced anode current but care must be taken to keep the anode dissipation within the maximum ratings.

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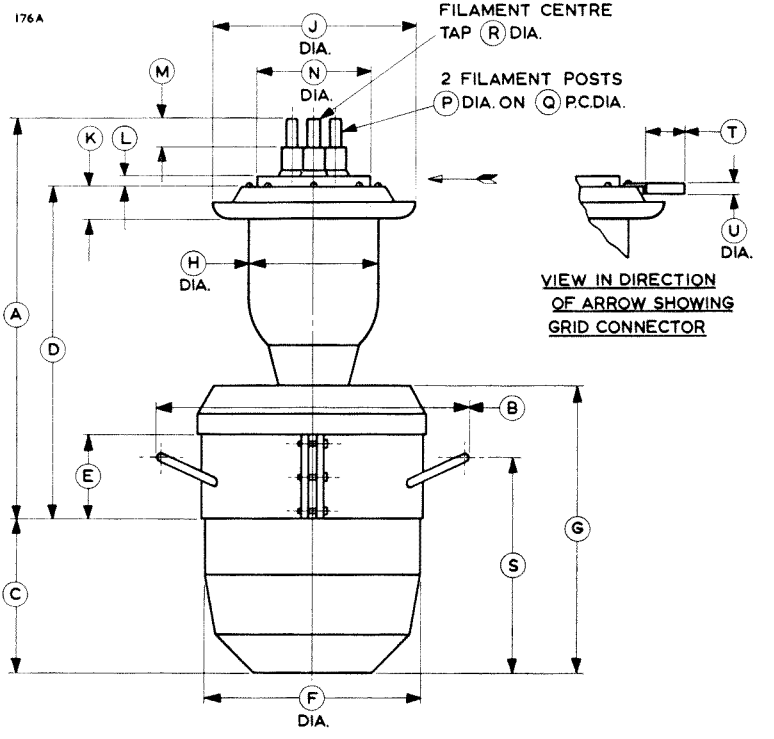
OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	14·688 Max	373·1 Max	L	0·375	9·53
B	10·625 Max	269·9 Max	M	1·125	28·58
C	5·312	134·9	N	3·937	100·0
D	12·187 Max	309·5 Max	P	0·437	11·10
E	2·937	74·60	Q	1·500	38·10
F	7·500 ± 0·062	190·5 ± 1·57	R	0·500	12·70
G	10·000	254·0	S	7·500	190·5
H	4·500	114·3	T	1·375	34·93
J	7·125	181·0	U	0·437	11·10
K	1·187	30·15			

Millimetre dimensions have been derived from inches.

BR175

R.F. POWER TRIODE

American Equivalent 892-R (near)

ABRIDGED DATA

Forced-air Cooled Transmitting Triode with grid terminal suitable for cathode drive operation.

Anode Dissipation	4·0	kW Max
Anode Voltage	12·5	kV Max
Frequency for full ratings	1·6	Mc/s Max
Frequency at reduced ratings	20	Mc/s Max
Output Power (Class C Telegraphy)	13	kW

GENERAL

Electrical

Filament: Two Sections		Tungsten
Filament Voltage (*See Note* 1), Sections in Series	22	V
Filament Current	60	A
Filament Starting Current (Peak) (*See Note* 2)	120	A Max
Filament Cold Resistance	0·032	Ω
Peak Usable Cathode Current	(*See Note* 1)	
Perveance	0·45	$mA/V^{3/2}$
Amplification Factor (V_a = 8·0kV, I_a = 0·5A)	50	
Inter-electrode Capacitances:		
Grid to Anode	27	pF
Grid to Filament	39	pF
Anode to Filament	1·5	pF

Mechanical

Overall Length	20·000 inches (508 mm)	Max
Overall Width (over handles)	10·625 inches (270 mm)	Max
Net Weight	37 pounds (17 kg)	Approx
Mounting Position	Vertical, filament end up	

Accessories

Filament Leads	MA135 or MA135A
Grid Connector	MA66A

COOLING

The required quantity of air through the radiator for cooling is indicated on the graph (page 9) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 20 to 30ft³/min (0·57 to 0·85m³/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

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

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R.F. POWER TRIODE

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	12·5 kV Max
Anode Dissipation	4·0 kW Max
Grid Dissipation	600 W Max
Operating Frequency (for full ratings)	1·6Mc/s Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	9·0	12	kV
Grid Voltage	−635	−670	V
Peak R.F. Grid Voltage	1485	1470	V
Anode Current	1·44	1·4	A
Grid Current (Approx)	0·36	0·29	A
Anode Dissipation	3·4	3·7	kW
Grid Dissipation	270	200	W
Output Power	9·6	13·1	kW
Efficiency	74	78	%

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 22V	57	62	A
Anode Voltage (I_a = 0·42A, V_g = −50V)	7·0	10·3	kV
Anode Voltage (I_a = 0·42A, V_g = 0)	5·0	7·4	kV
Amplification Factor (from above conditions)	42·5	57·5	
Mutual Conductance (V_a = 7·4kV, V_g = −25V)	4·5	7·5	mA/V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·05A)	—	240	V
Anode Current (V_a = 4·0kV, V_g = +400V)	3·2	5·2	A
Grid Current (V_a = 4·0kV, V_g = +400V)	—	0·35	A
Inter-electrode Capacitances:			
Grid to Anode	24	32	pF
Grid to Filament	35	44	pF

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R.F. POWER TRIODE

MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
1·6	12·5 kV	10·0 kV
7·5	9·4 kV	7·5 kV
20	6·25 kV	5·0 kV

NOTES

1. 'Marked volts.' Each valve is marked with the filament voltage required to give 8·5A peak emission at 90% saturation. Longer filament life may be obtained if the filament is run at reduced temperature and a correspondingly reduced anode current (*see* Emission Characteristic on page 8), but care must be taken to keep the anode dissipation within the maximum ratings.
2. The filament current must not exceed 120A, even momentarily, at any time.

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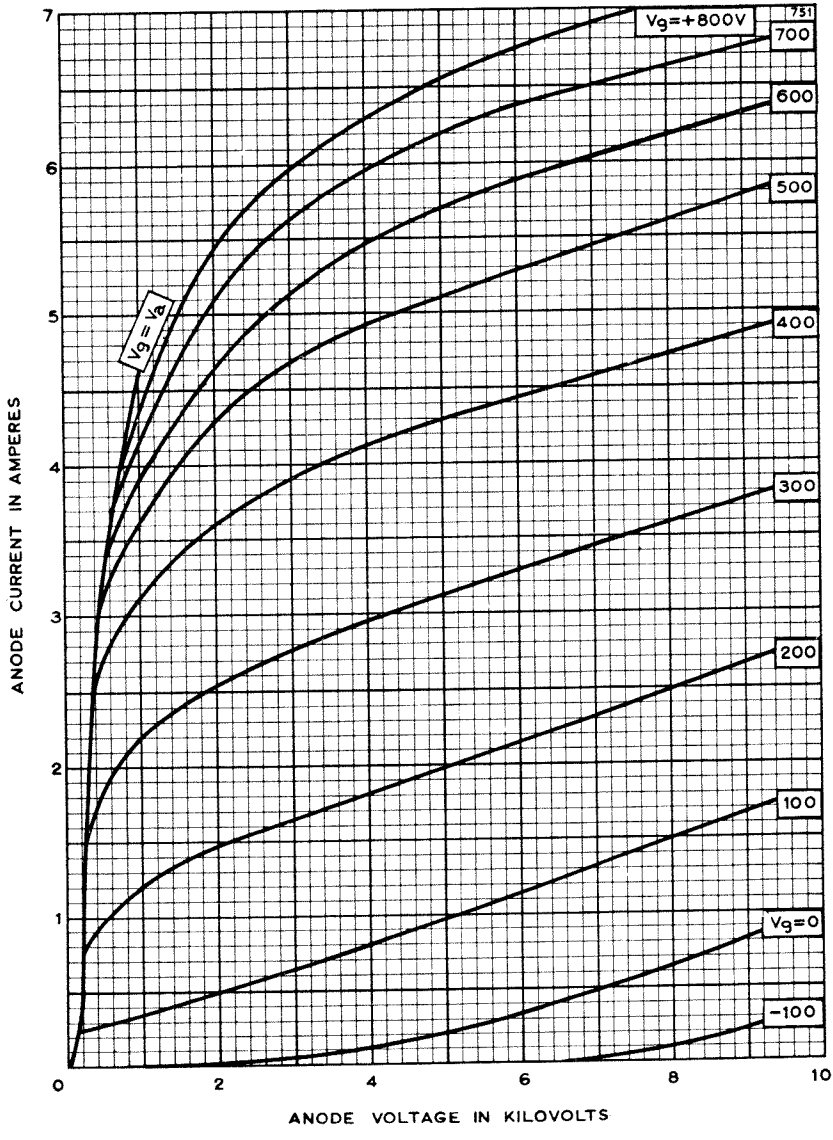
R.F. POWER TRIODE

ANODE CHARACTERISTICS



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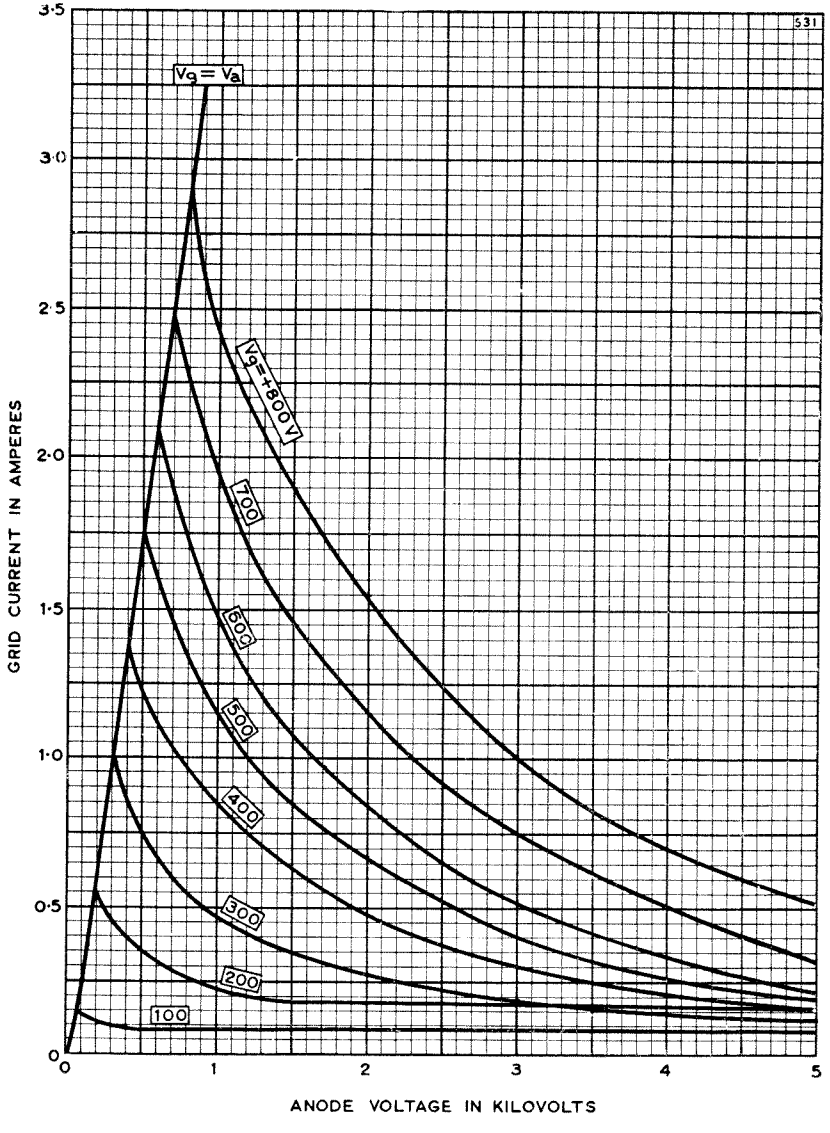
CONTROL GRID CHARACTERISTICS



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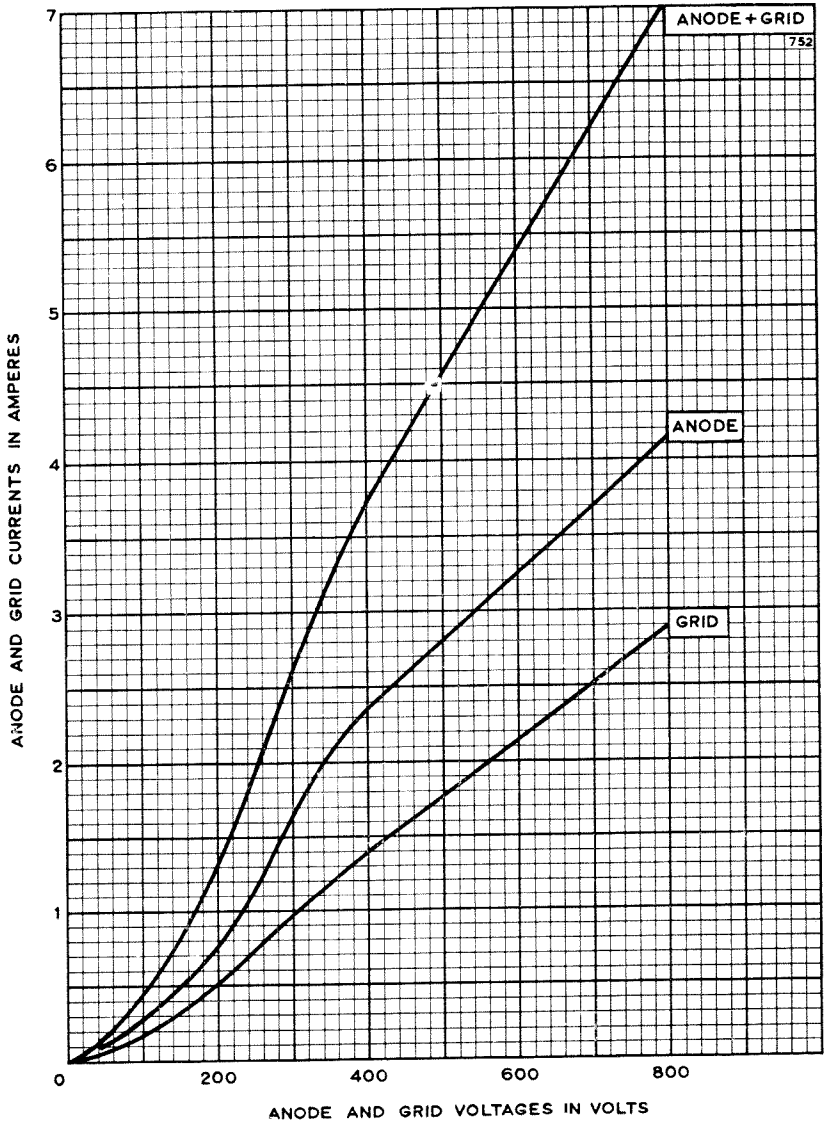
R.F. POWER TRIODE

STRAPPED CHARACTERISTICS



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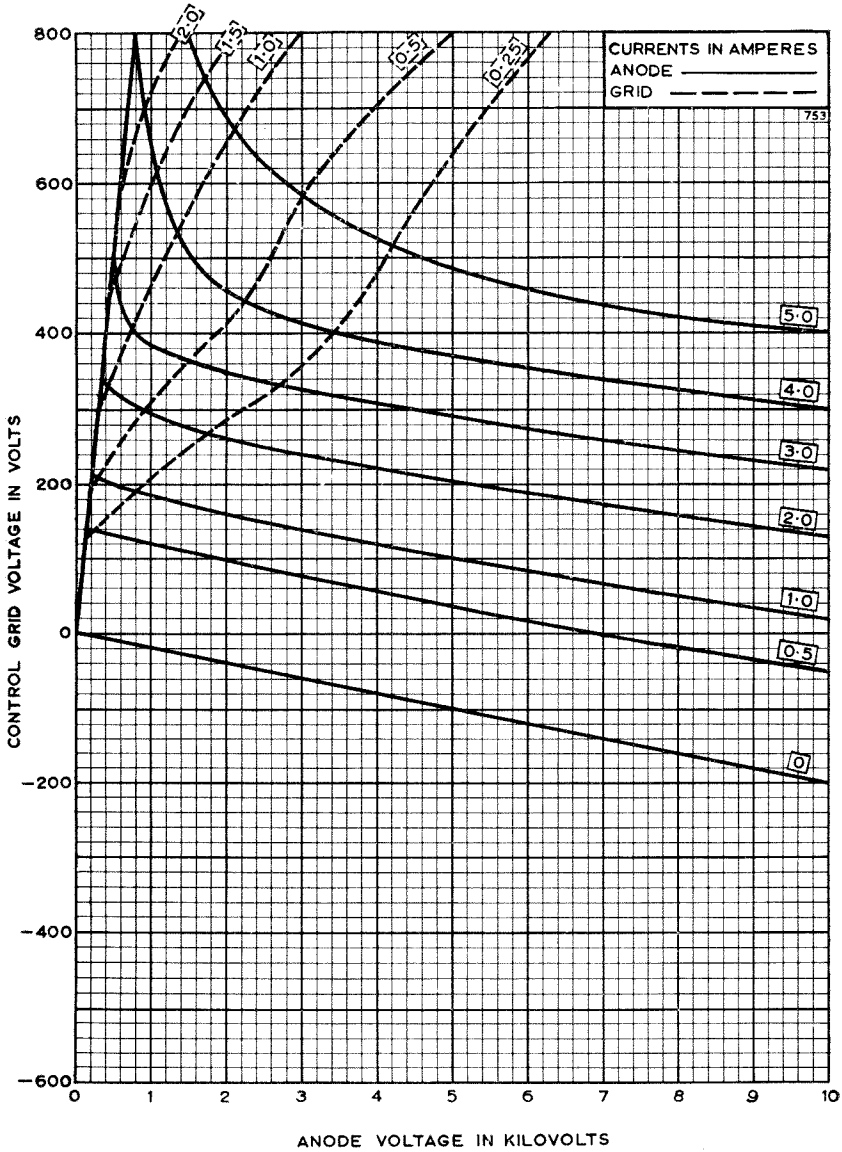
R.F. POWER TRIODE

CONSTANT CURRENT CHARACTERISTICS



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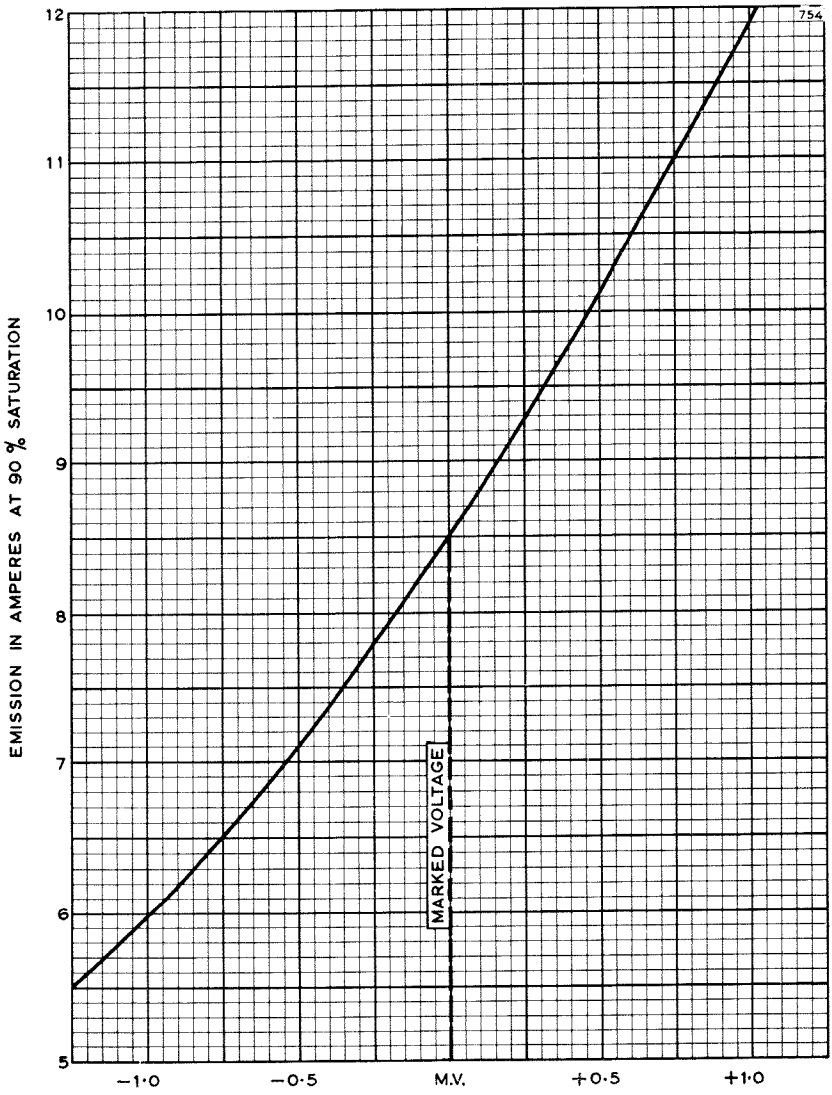
R.F. POWER TRIODE

EMISSION CHARACTERISTIC



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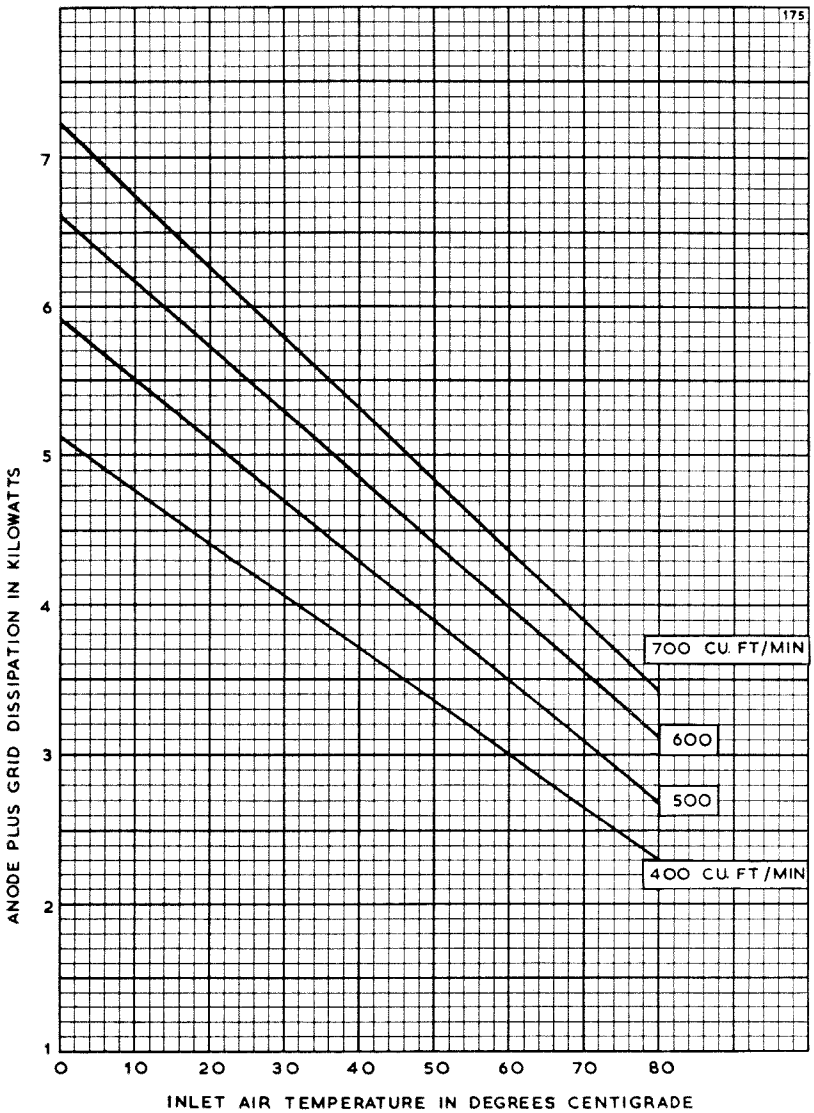
R.F. POWER TRIODE

AIR COOLING CHARACTERISTICS



OUTLINE

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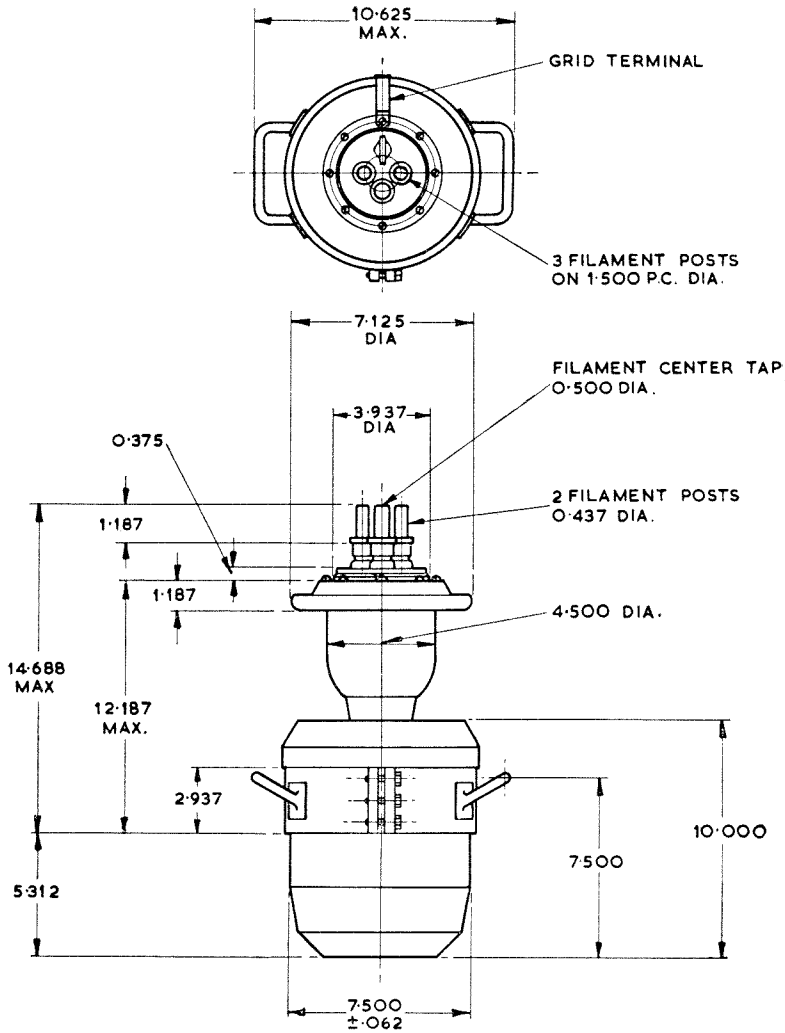

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R.F. POWER TRIODE

BR179

Service Type CV2323

ABRIDGED DATA

Forced-air Cooled Transmitting Triode with grid terminal suitable for cathode drive operation.

Anode Dissipation	8·0 kW Max
Anode Voltage	8·5 kV Max
Frequency for full ratings	50 Mc/s Max
Frequency at reduced ratings	110 Mc/s Max
Output Power (Class C Telegraphy)	17 kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	6·6	V
Filament Current	90	A
Filament Starting Current (Peak) (*See Note* 2)	195	A Max
Filament Cold Resistance	0·0084	Ω
Peak Usable Cathode Current	16	A
Amplification Factor (V_a = 5·0kV, I_a = 1·0A)	28	
Mutual Conductance (V_a = 5·0kV, I_a = 1·0A)	10	mA/V
Inter-electrode Capacitances:		
Grid to Anode	32	pF
Grid to Filament	33	pF
Anode to Filament	1·0	pF

Mechanical

Overall Length	13·875 inches (352·4 mm)	Max
Overall Width (over handles)	10·125 inches (257·2 mm)	Max
Net Weight	25 pounds (11·5 kg)	Approx
Mounting Position	Vertical, filament end up	

Accessories

Filament Leads	MA135 or MA135A
Grid Connector	MA66A

COOLING

The required quantity of air through the radiator for cooling is indicated on the graphs (pages 8 and 9) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 15ft³/min (0·43m³/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

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

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R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	8·5 kV Max
Anode Dissipation	8·0 kW Max
Grid Dissipation	600 W Max
Operating Frequency (for full ratings)	50 Mc/s Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	6·0	8·0	kV
Grid Voltage	−705	−775	V
Peak R.F. Grid Voltage	1605	1675	V
Anode Current	2·92	2·94	A
Grid Current (Approx)	0·42	0·38	A
Anode Dissipation	5·5	6·2	kW
Grid Dissipation	350	325	W
Driving Power	650	620	W
Output Power	12	17·3	kW
Efficiency	69	73·5	%

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 6·6V	83	97	A
Amplification Factor (I_a = 1·0A, V_g = −50V)	25	32	
Mutual Conductance (V_a = 5·0kV, I_a = 1·0A)	7·5	12·5	mA/V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	400	V
Grid Voltage (negative value) (V_a = 5·0kV, I_a = 1·0A)	15	55	V
Anode Current (V_a = 2·0kV, V_g = +200V)	2·2	3·0	A
Grid Current (V_a = 2·0kV, V_g = +200V)	0	0·3	A
Inter-electrode Capacitances:			
Grid to Anode	28	36	pF
Grid to Filament	28	38	pF

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MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
50	8·5 kV	6·0 kV
110	6·5 kV	5·2 kV

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.

2. The filament current must not exceed 195A, even momentarily, at any time.

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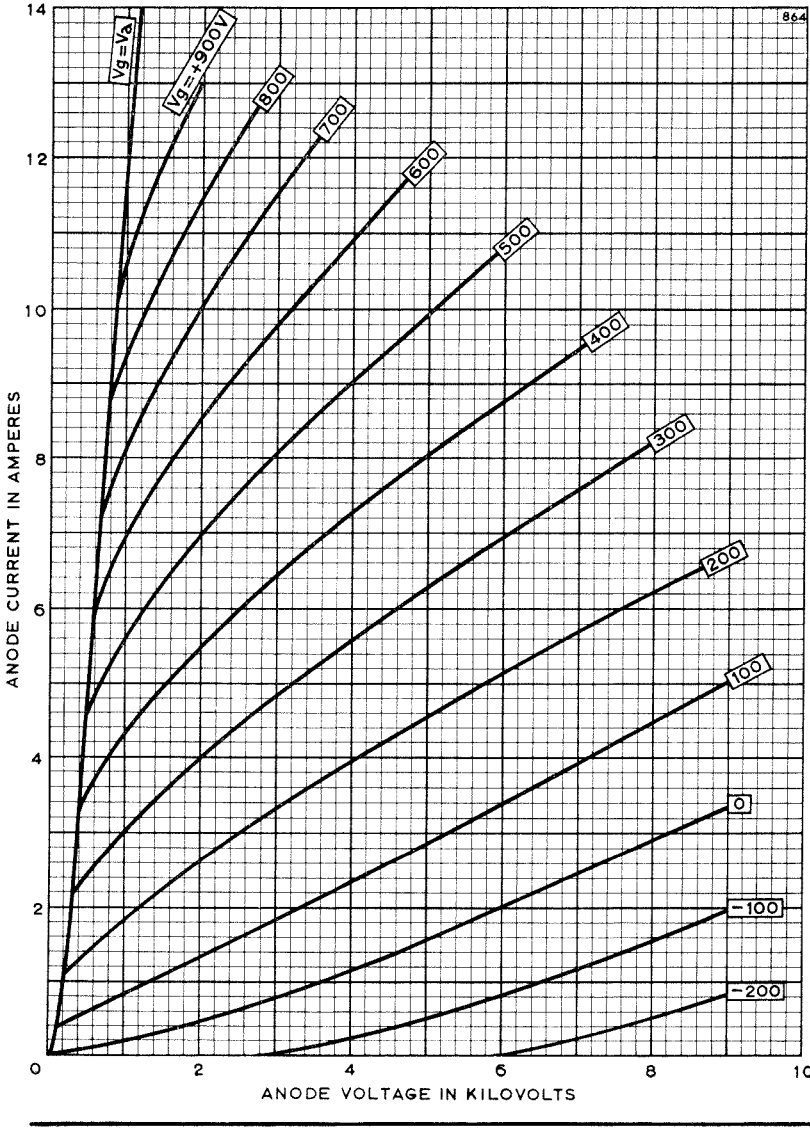
ANODE CHARACTERISTICS



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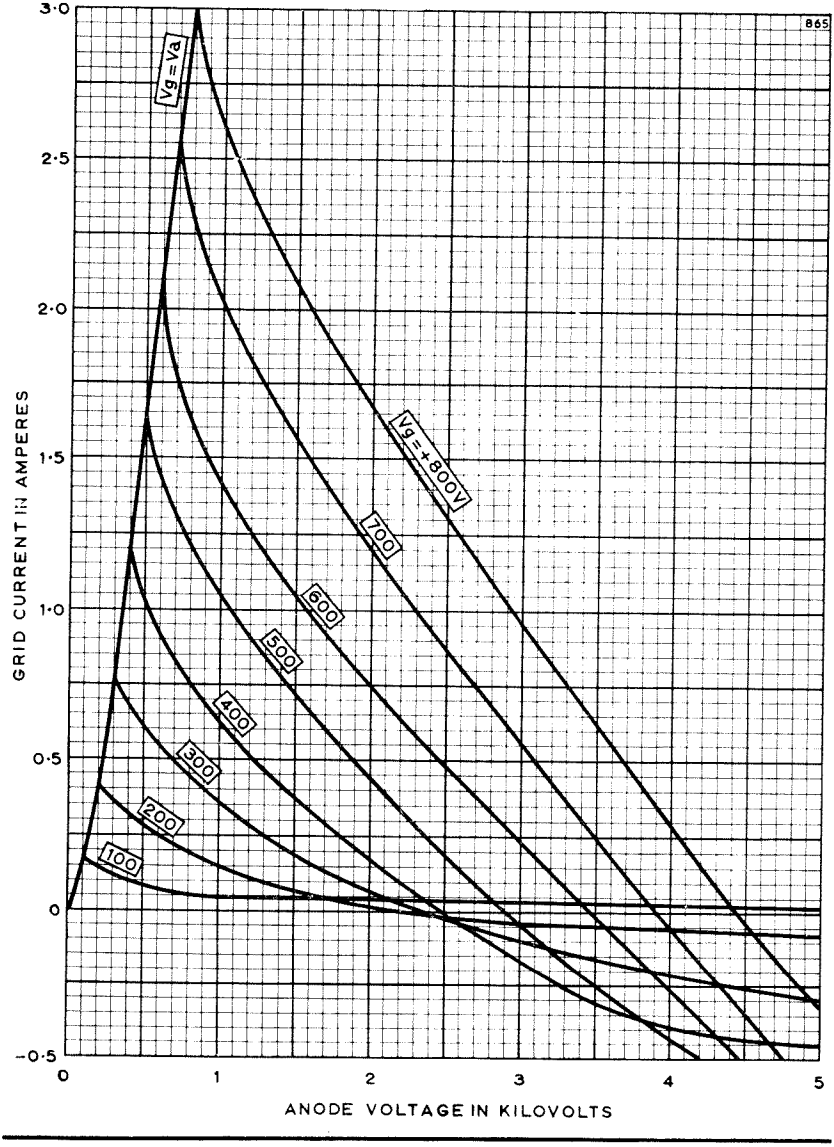
CONTROL GRID CHARACTERISTICS



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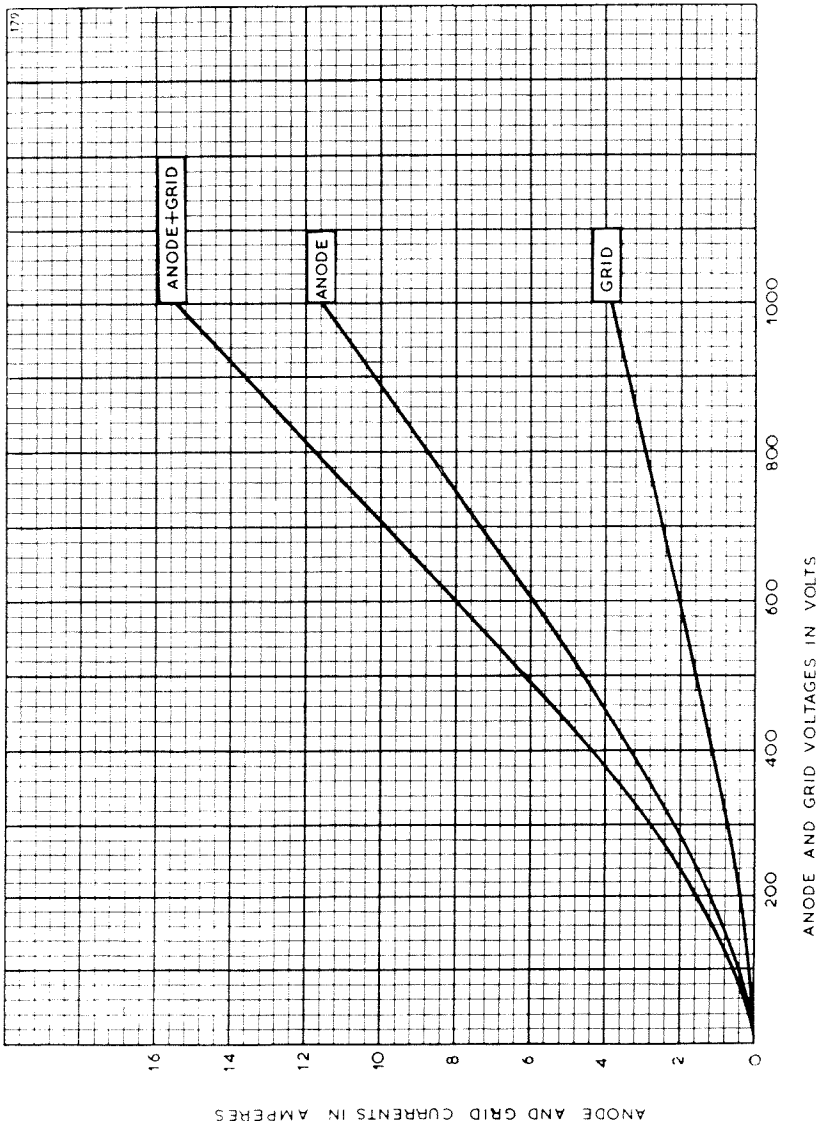

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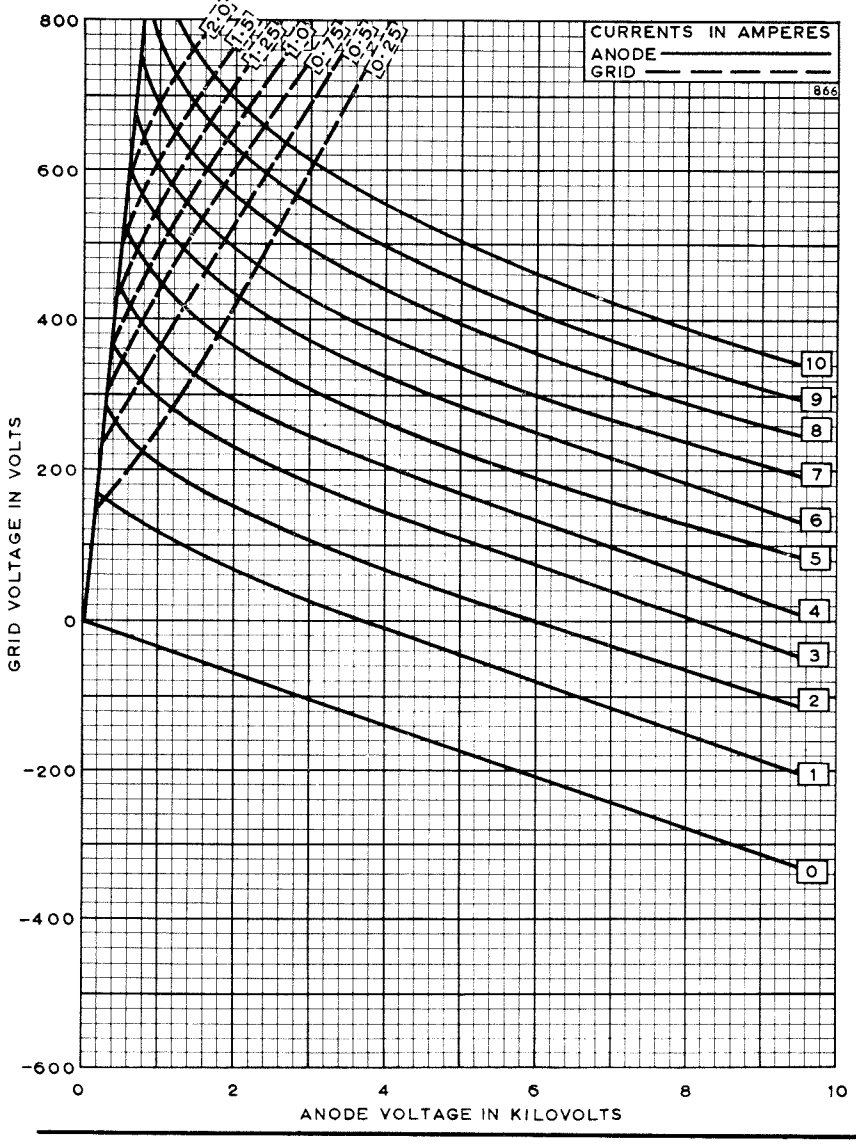
CONSTANT CURRENT CHARACTERISTICS



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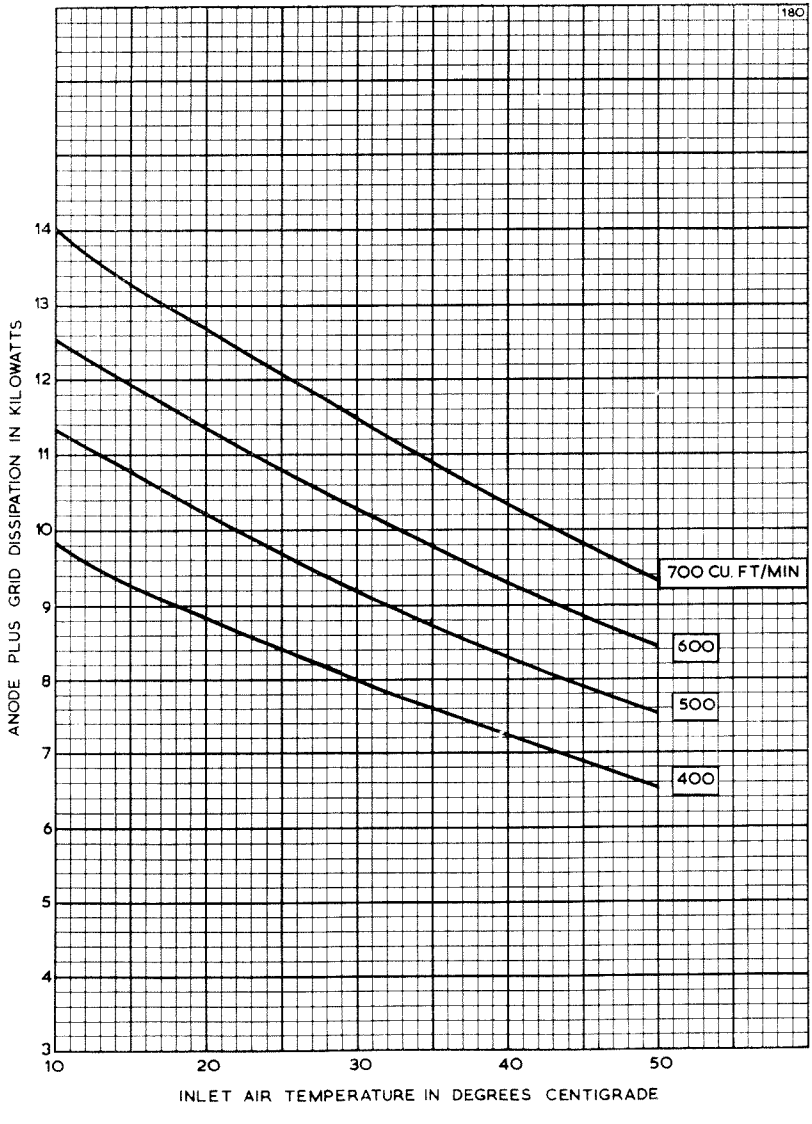
AIR COOLING CHARACTERISTICS



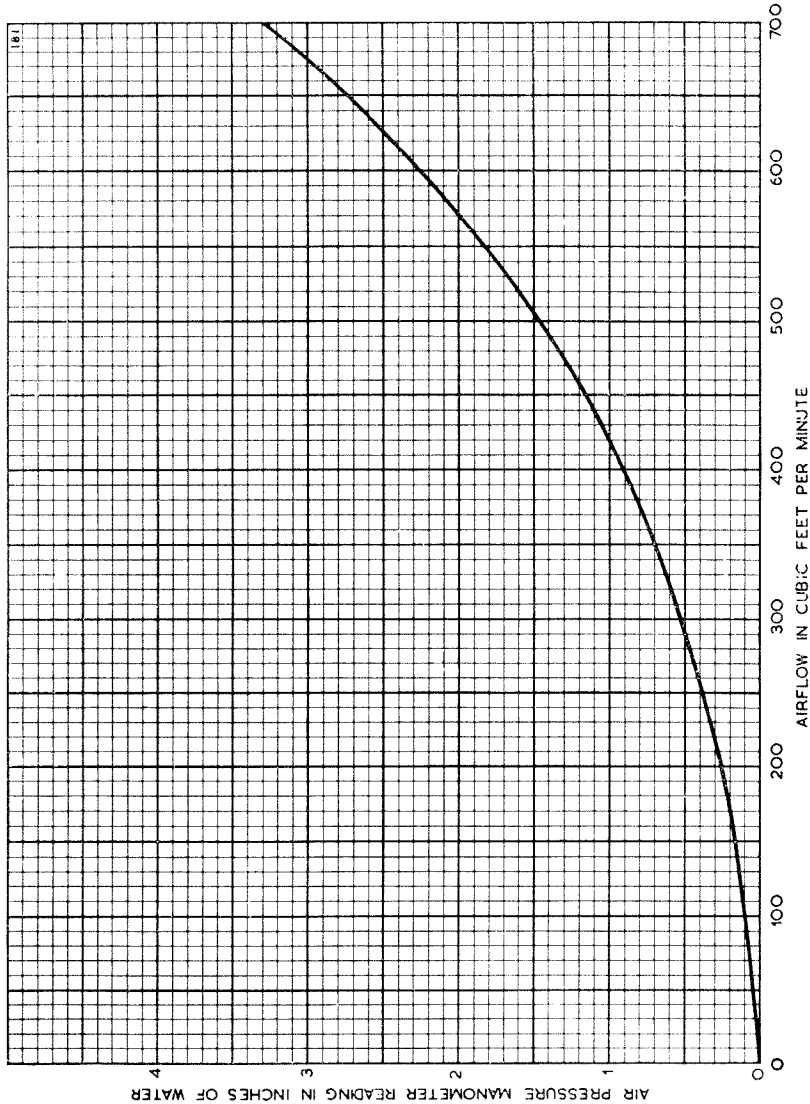
ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

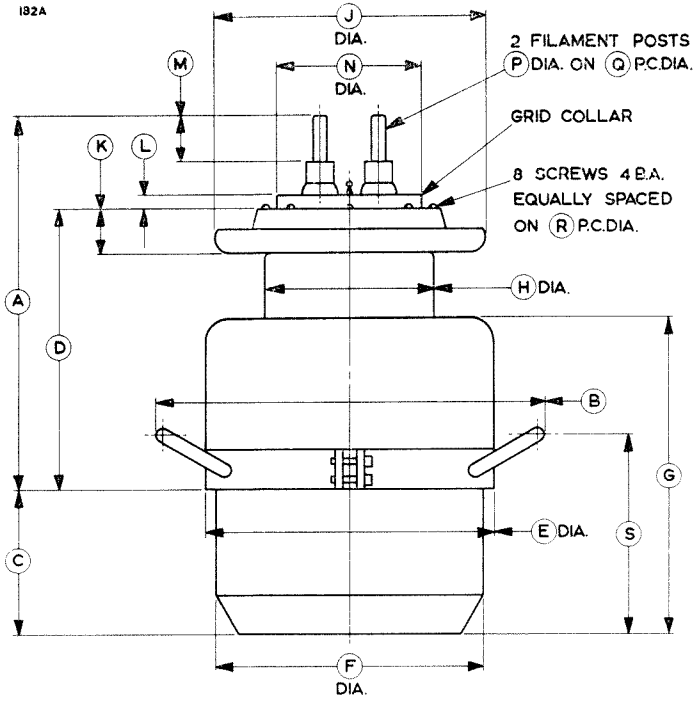
Printed in England

AIR FLOW CHARACTERISTIC



ENGLISH ELECTRIC

OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	10·000 Max	254·0 Max	K	1·187	30·15
B	10·125	257·2	L	0·328	8·33
C	3·812	96·82	M	1·187	30·15
D	7·531 Max	191·3 Max	N	3·750	95·25
E	7·625 Max	193·7 Max	P	0·437	11·10
F	7·062 Max	179·4 Max	Q	1·500	38·10
G	8·312	211·1	R	4·375	111·1
H	4·437	112·7	S	5·250	133·4
J	7·125	181·0			

Millimetre dimensions have been derived from incnes.

R.F. POWER TRIODE

BR189

Service Type CV5218

ABRIDGED DATA

Forced-air Cooled Transmitting Triode with grid terminal suitable for cathode drive operation.

Anode Dissipation	27	kW Max
Anode Voltage	15	kV Max
Frequency for full ratings	5·0	Mc/s Max
Frequency at reduced ratings	50	Mc/s Max
Output Power (Class C Telegraphy)	80	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	9·0	V
Filament Current	240	A
Filament Starting Current (Peak) (*See Note* 2)	600	A Max
Filament Cold Resistance	0·0046	Ω
Peak Usable Cathode Current	70	A
Perveance	1·6	$mA/V^{3/2}$
Amplification Factor (V_a = 9·0kV, I_a = 2·0A)	34	
Mutual Conductance (V_a = 9·0kV, I_a = 2·0A)	27·5	mA/V
Inter-electrode Capacitances:		
Grid to Anode	61	pF
Grid to Filament	68	pF
Anode to Filament	1·5	pF

Mechanical

Overall Length	21·500 inches (546·1 mm)	Max
Overall Width (over handles)	14·000 inches (355·6 mm)	Max
Net Weight	109 pounds (50 kg)	Approx
Mounting Position	Vertical, filament end up	

Accessories

Filament Leads	MA130
Grid Connector	MA66

COOLING

The required quantity of air through the radiator for cooling is indicated on the graphs (pages 9 and 10) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 20ft³/min (0·57m³/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

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

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Printed in England

R.F. POWER TRIODE

R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	15 kV Max
Anode Current	7·0 A Max
Anode Dissipation	27 kW Max
Grid Dissipation	1·25kW Max
Operating Frequency (for full ratings)	5·0Mc/s Max

TYPICAL OPERATING CONDITIONS (FOR AMPLIFIER)

Anode Voltage	12	15	kV
Grid Voltage	−900	−900	V
Peak R.F. Grid Voltage	1650	1650	V
Anode Current	6·4	6·6	A
Grid Current (Approx)	0·83	0·7	A
Anode Dissipation	15	18	kW
Grid Dissipation	640	530	W
Driving Power	1370	1150	W
Output Power	62	80	kW
Efficiency	80	80	%

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 9·0V	217	256	A
Amplification Factor (V_a = 9·0kV, I_a = 2·0A)	30	38	
Mutual Conductance (V_a = 9·0kV, I_a = 2·0A)	22·5	29·5	mA/V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	380	V
Grid Voltage (negative value) (V_a = 9·0kV, I_a = 2·0A)	125	193	V
Anode Current (V_a = 4·0kV, V_g = +400V)	18	24	A
Grid Current (V_a = 4·0kV, V_g = +400V)	−1·2	—	A

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R.F. POWER TRIODE

MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
5	15 kV	13·5 kV ←
30	13·5 kV	12 kV ←
50	8·0 kV	6·5 kV

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.
2. The filament current must not exceed 600A, even momentarily, at any time.

← Indicates a change.

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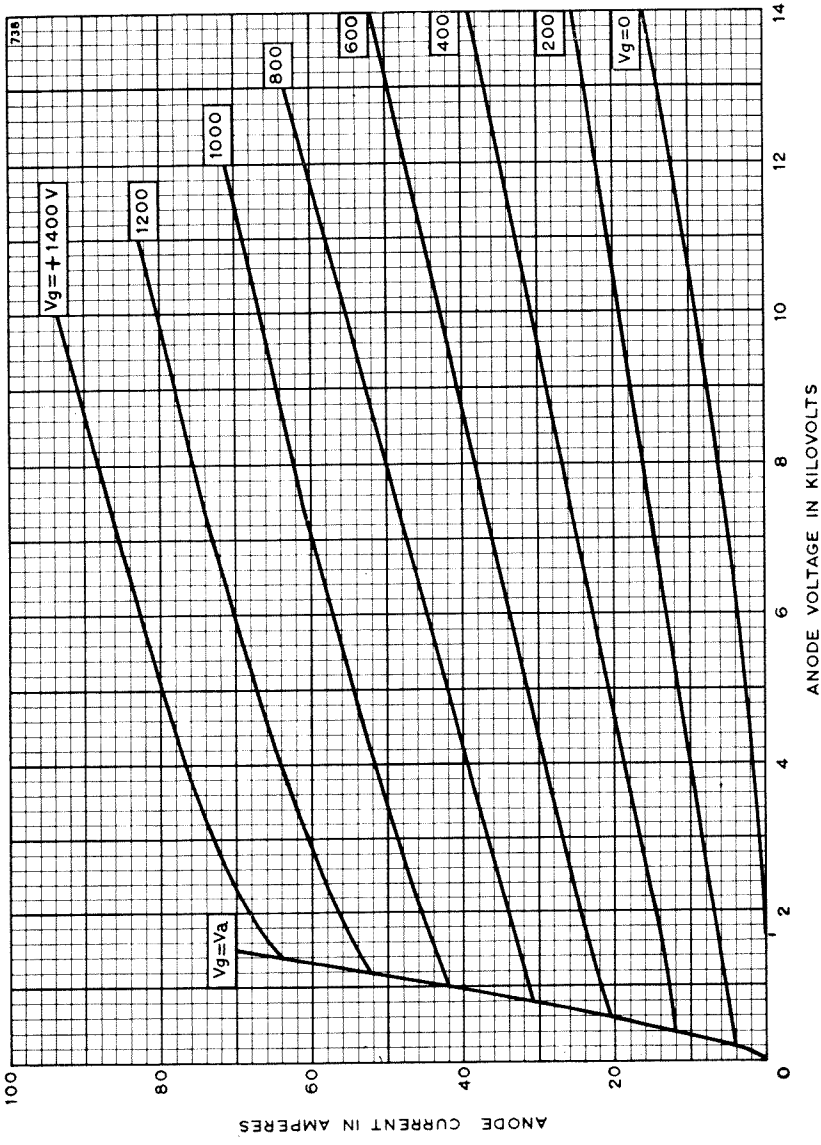
R.F. POWER TRIODE

ANODE CHARACTERISTICS



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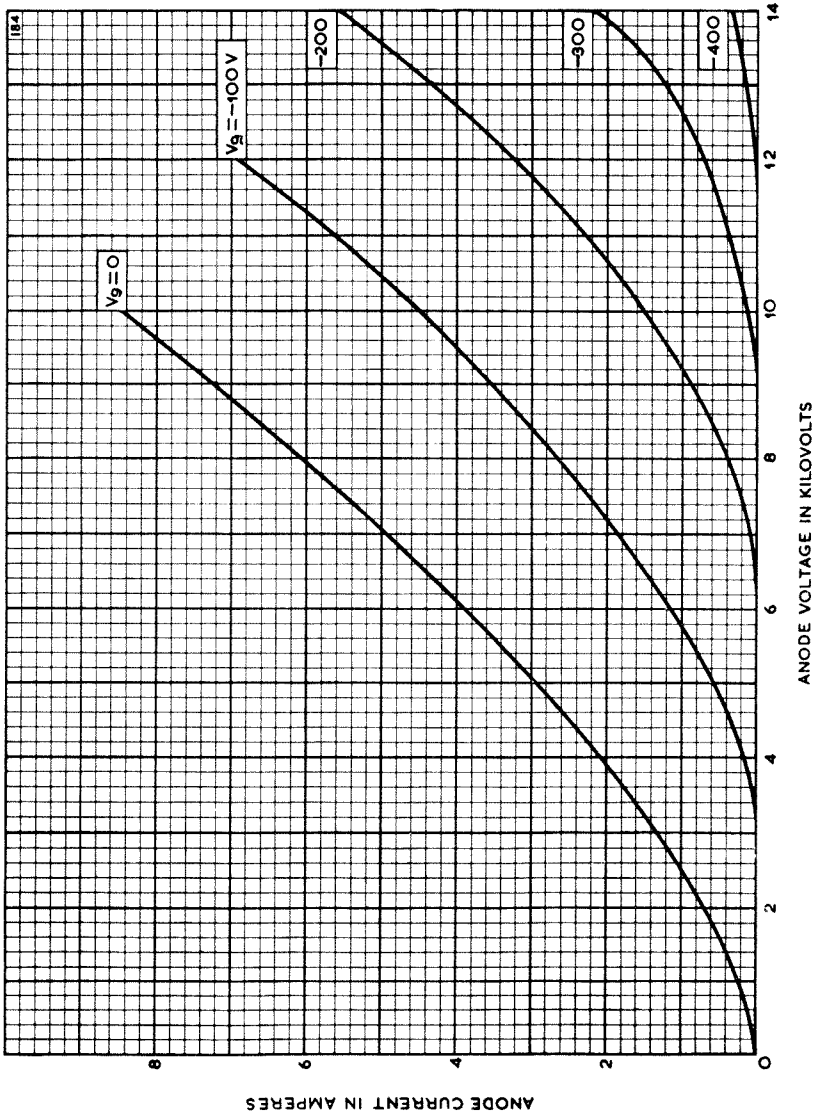
R.F. POWER TRIODE

ANODE CHARACTERISTICS (Negative Grid)



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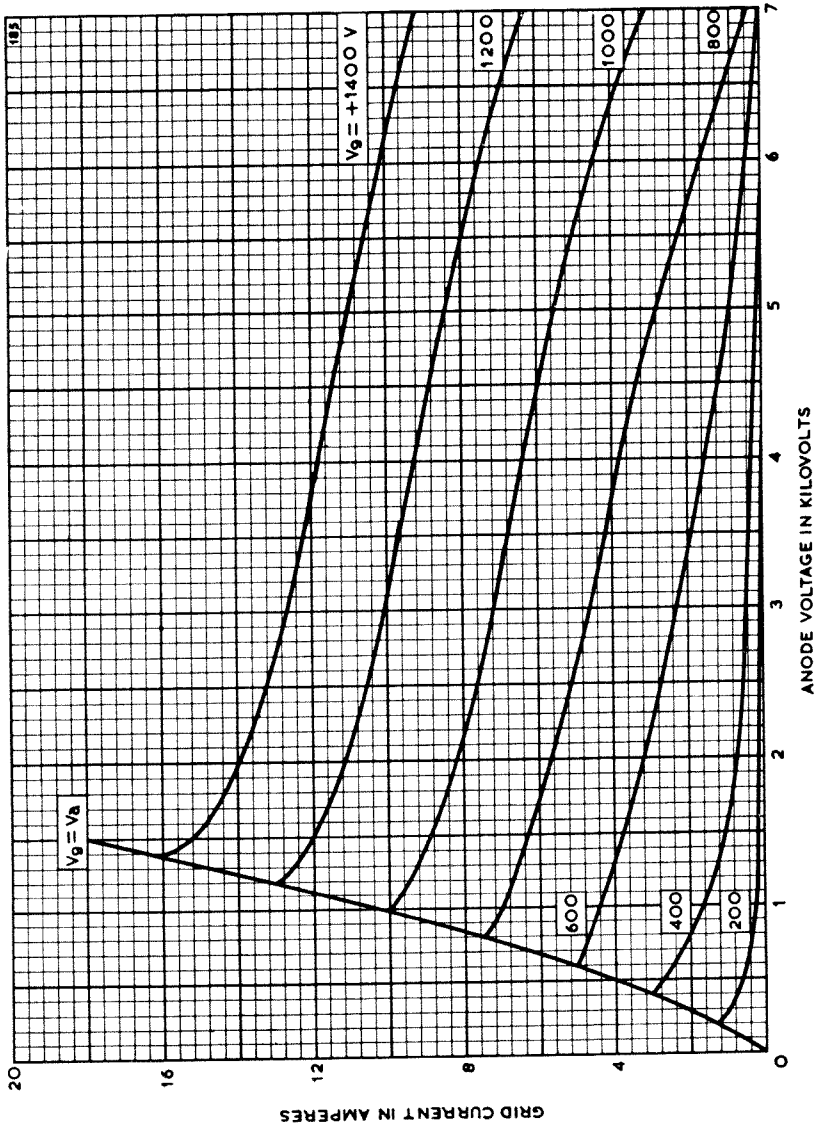
R.F. POWER TRIODE

CONTROL GRID CHARACTERISTICS



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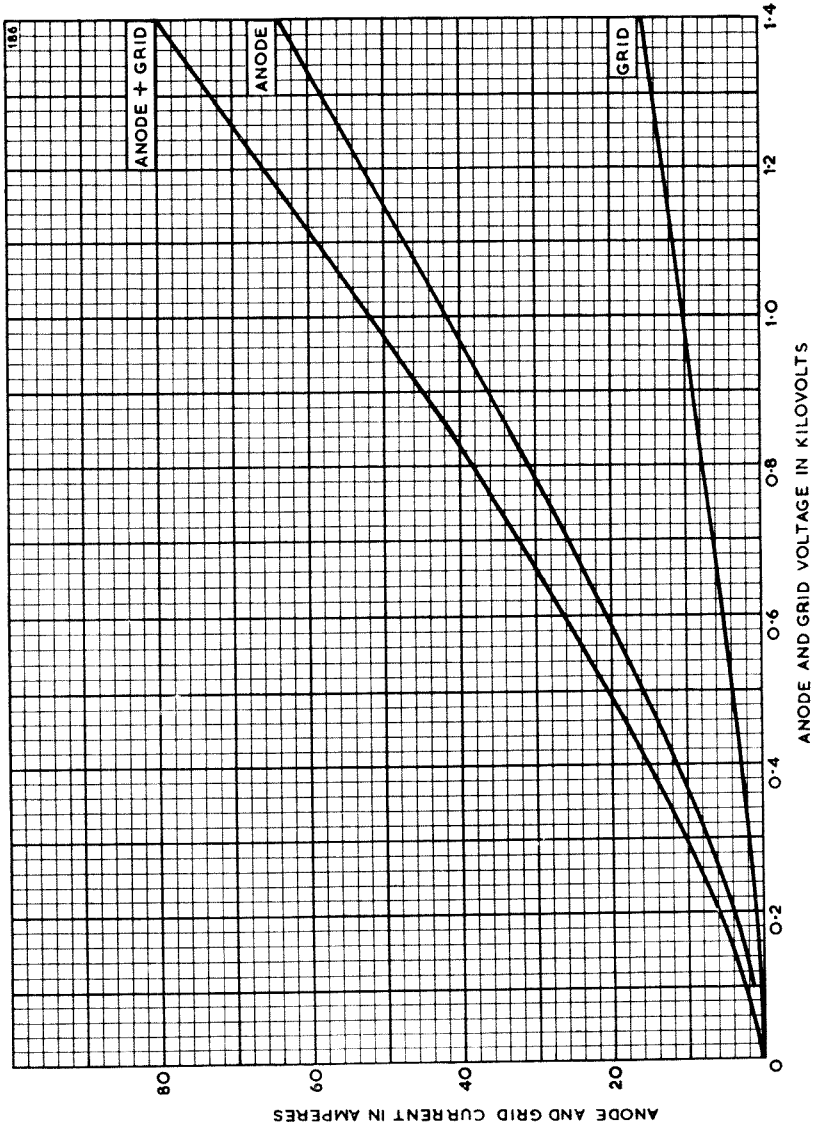
R.F. POWER TRIODE

STRAPPED CHARACTERISTICS



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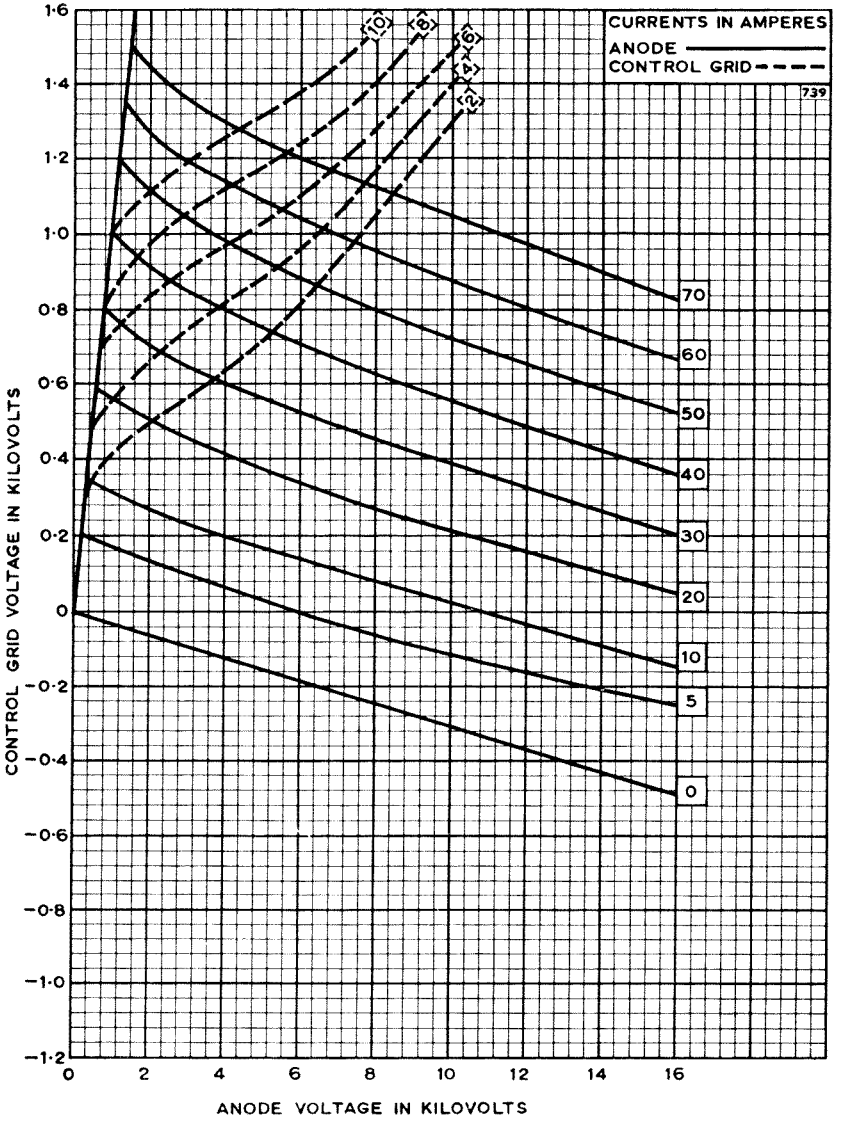
CONSTANT CURRENT CHARACTERISTICS



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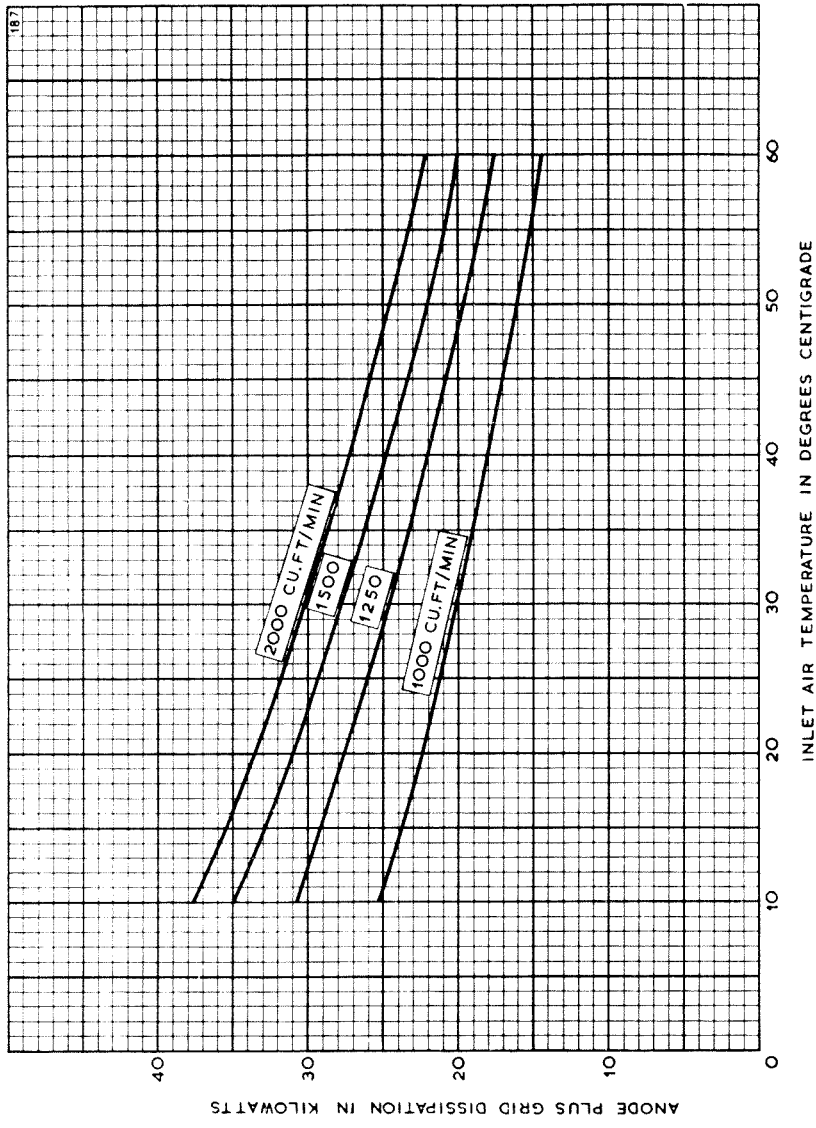
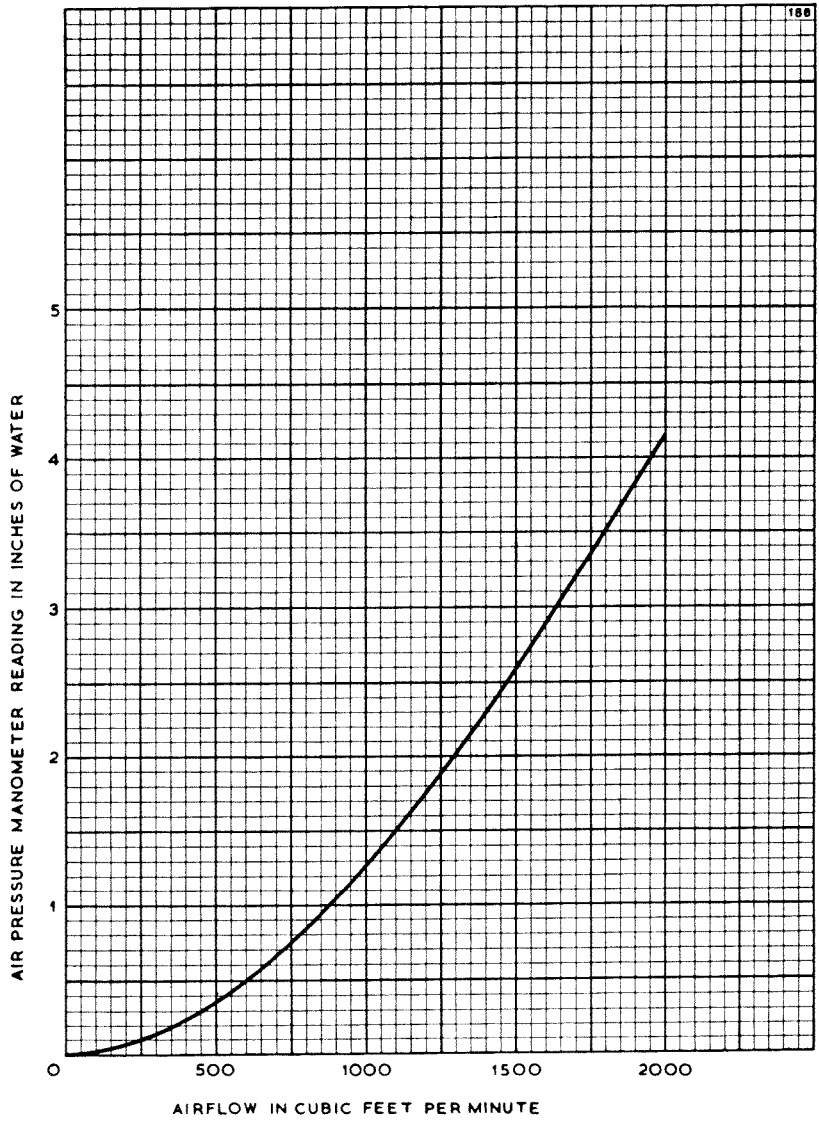
R.F. POWER TRIODE

AIR COOLING CHARACTERISTICS



R.F. POWER TRIODE

AIR FLOW CHARACTERISTIC



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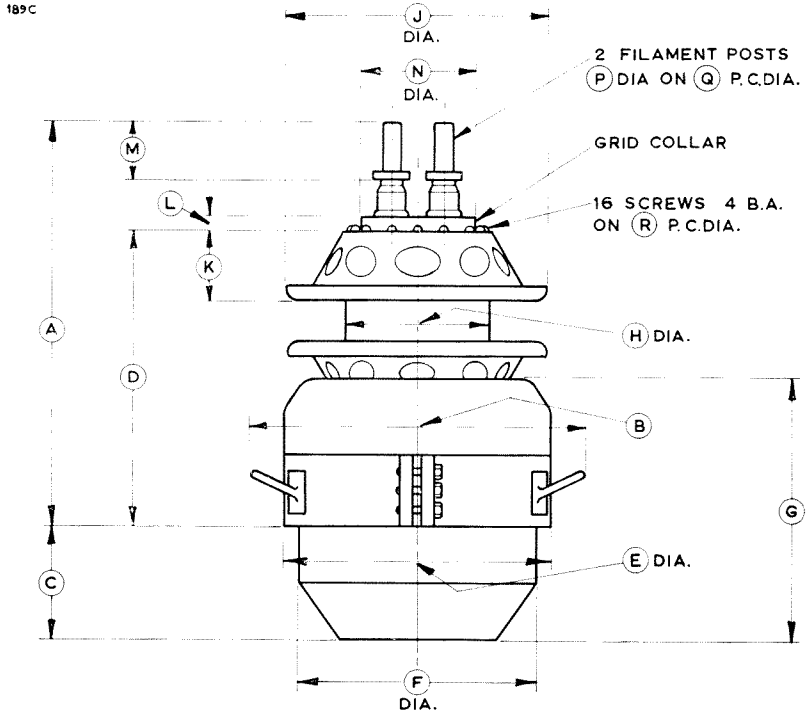

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	16·750 Max	425·45 Max	J	11·000 Max	279·40 Max
B	14·000 Max	355·60 Max	K	2·906 Max	73·81 Max
C	4·750	120·65	L	0·687	17·45
D	12·875 Max	327·03 Max	M	2·000	50·80
E	11·000	279·40	N	4·703	119·46
F	10·062 Max	255·57 Max	P	0·875	22·23
G	11·000	279·40	Q	2·250	57·15
H	6·000	152·40	R	5·375	136·53

Millimetre dimensions have been derived from inches

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R.F. POWER TRIODE

BR194

ABRIDGED DATA

Forced-air Cooled Transmitting Triode with grid terminal suitable for cathode drive operation.

Anode Dissipation	40	kW Max
Anode Voltage	15	kV Max
Frequency for full ratings	5·0	MHz Max
Frequency at reduced ratings	30	MHz Max
Output Power (Class C Telegraphy)	115	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	13	V
Filament Current	240	A
Filament Starting Current (Peak) (*See Note* 2)	600	A Max
Filament Cold Resistance	0·006	Ω
Peak Usable Cathode Current	100	A
Perveance	2·17	mA/V$^{3/2}$
Amplification Factor (V_a = 7·5kV, I_a = 3·0A)	34	
Mutual Conductance (V_a = 9·0kV, I_a = 4·0A)	43	mA/V
Inter-electrode Capacitances:		
Grid to Anode	60	pF
Grid to Filament	95	pF
Anode to Filament	1·5	pF

Mechanical

Overall Length	25·562 inches	(649·3 mm)	Max
Overall Diameter	11·00 inches	(279·4 mm)	Max
Net Weight	64 pounds	(29 kg)	Approx
Mounting Position	Vertical, filament pins up		

Accessories

Filament Leads	MA130
Grid Connector	MA66

COOLING

The radiator of the BR194 is designed for use in conjunction with a specially designed air duct ensuring correct distribution of cooling air. The required quantity of air is indicated on the graphs (pages 8 and 9) and this must be supplied not only during but also before the application of any voltages to the valve.

The external grid and filament seals also require to be cooled by air, the flow necessary being 20ft^3/min (0·57m^3/min) directed vertically downwards onto the valve from a 1-inch (25mm) diameter nozzle. The temperature of the anode must not exceed 180°C; that of the filament and grid seals must not exceed 140°C.

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R.F. POWER TRIODE

R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	15	kV Max
Anode Current	10	A Max
Anode Dissipation	40	kW Max
Grid Dissipation	1·8	kW Max
Operating Frequency (for full ratings)	5·0	MHz Max

TYPICAL OPERATING CONDITIONS (FOR AMPLIFIER)

Anode Voltage	10	15	kV
Grid Voltage	−900	−900	V
Peak R.F. Grid Voltage	1620	1620	V
Anode Current	8·8	9·6	A
Grid Current (Approx)	1·2	1·2	A
Anode Dissipation	18	26	kW
Grid Dissipation	870	850	W
Output Power	70	115	kW
Efficiency	78	80	%

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
→Filament Current at filament voltage 13V	225	255	A
Amplification Factor (V_a = 7·5kV, I_a = 3·0A)	31	37	
Mutual Conductance (V_a = 9·0kV, I_a = 4·0A)	38	48	mA/V
Grid Voltage (negative value) (V_a = 10kV, I_a = 3·0A)	173	195	V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	345	V
Anode Current (V_a = 2·0kV, V_g = +200V)	7·0	11	A
Anode Current (V_a = 4·0kV, V_g = +400V)	22	32	A
Grid Current (V_a = 2·0kV, V_g = +200V)	−0·15	+0·25	A
Grid Current (V_a = 4·0kV, V_g = +400V)	−2·0	+0·5	A
Inter-electrode Capacitances			
Grid to Anode	60	78	pF
Grid to Filament	84	96	pF
Anode to Filament	—	2·0	pF

→Indicates a change

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R.F. POWER TRIODE

MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency MHz	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
5	15 kV	12 kV
30	10 kV	8·0 kV

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuations in filament voltage must not exceed 5%.
2. The filament current must not exceed 600A, even momentarily, at any time.

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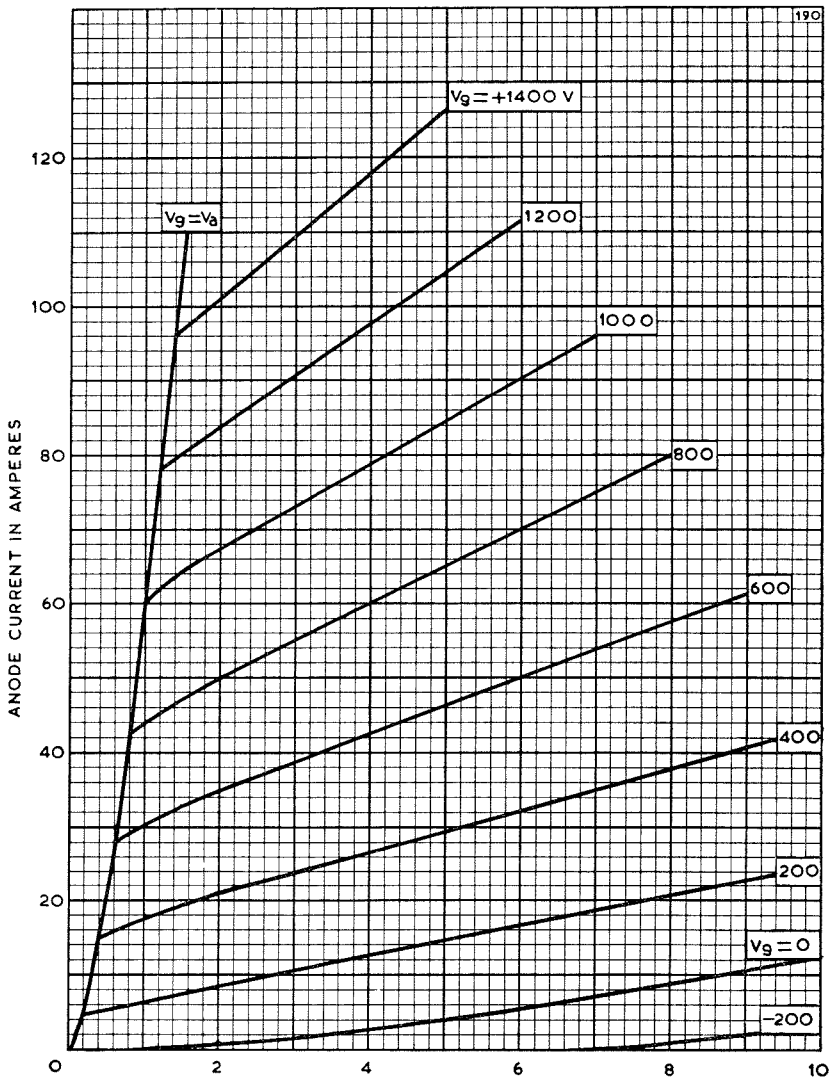
ANODE CHARACTERISTICS



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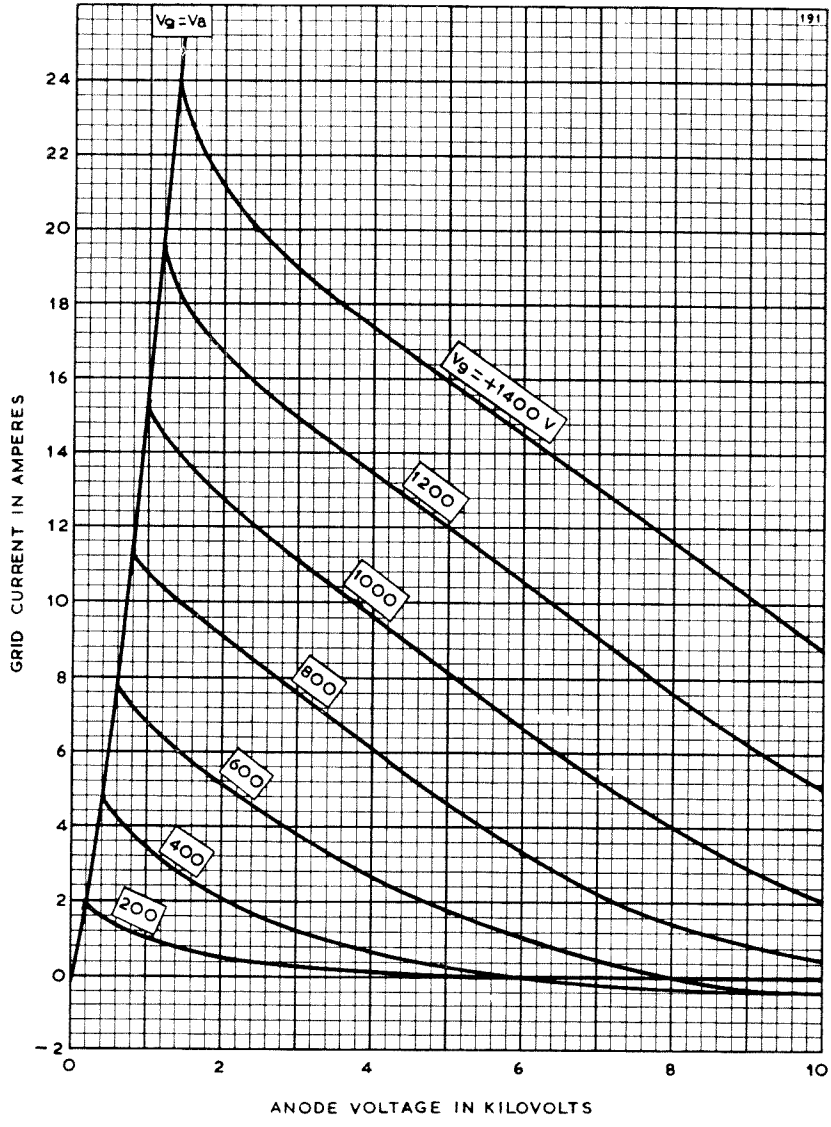
R.F. POWER TRIODE

CONTROL GRID CHARACTERISTICS



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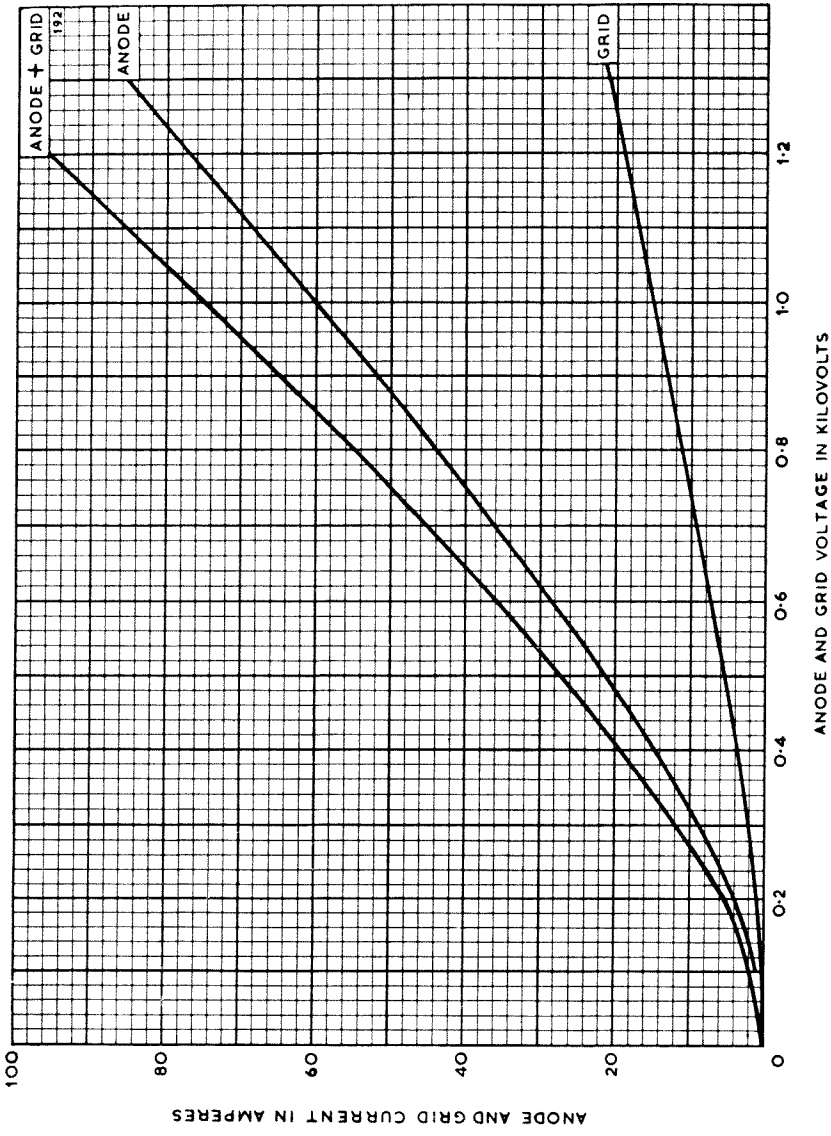
R.F. POWER TRIODE

BR194

STRAPPED CHARACTERISTICS



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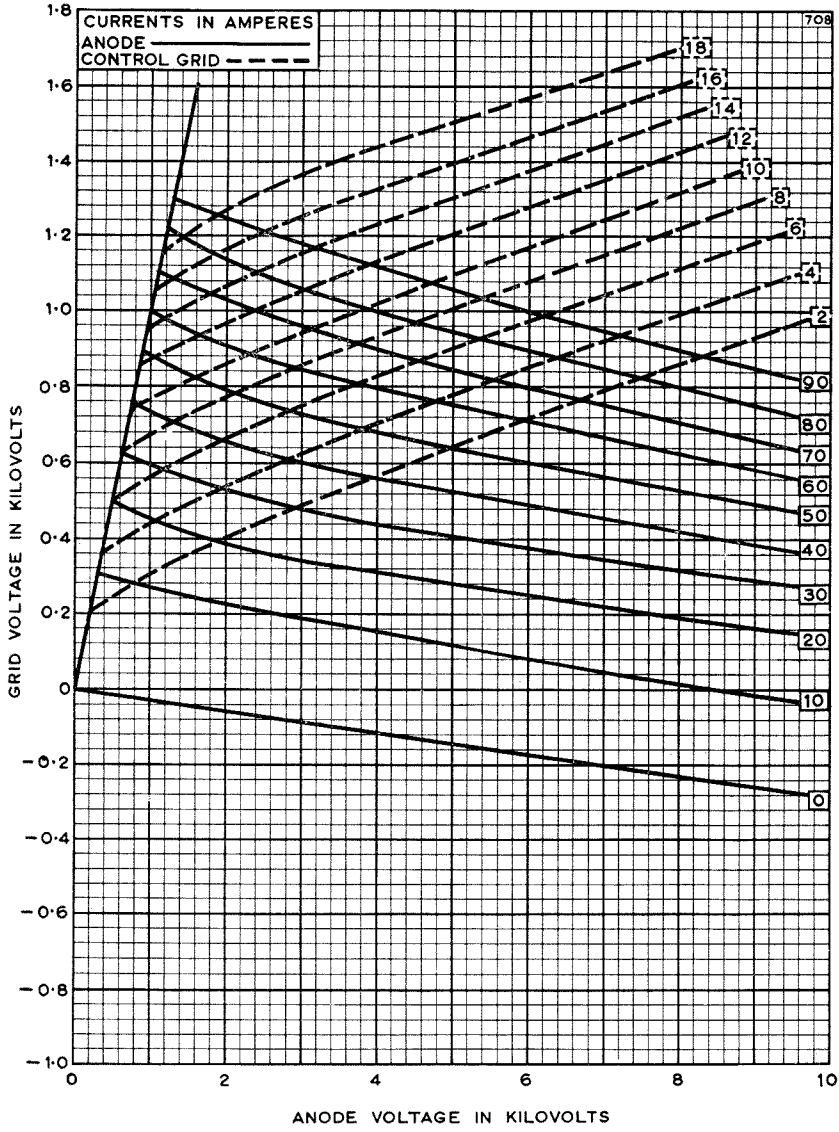
CONSTANT CURRENT CHARACTERISTICS



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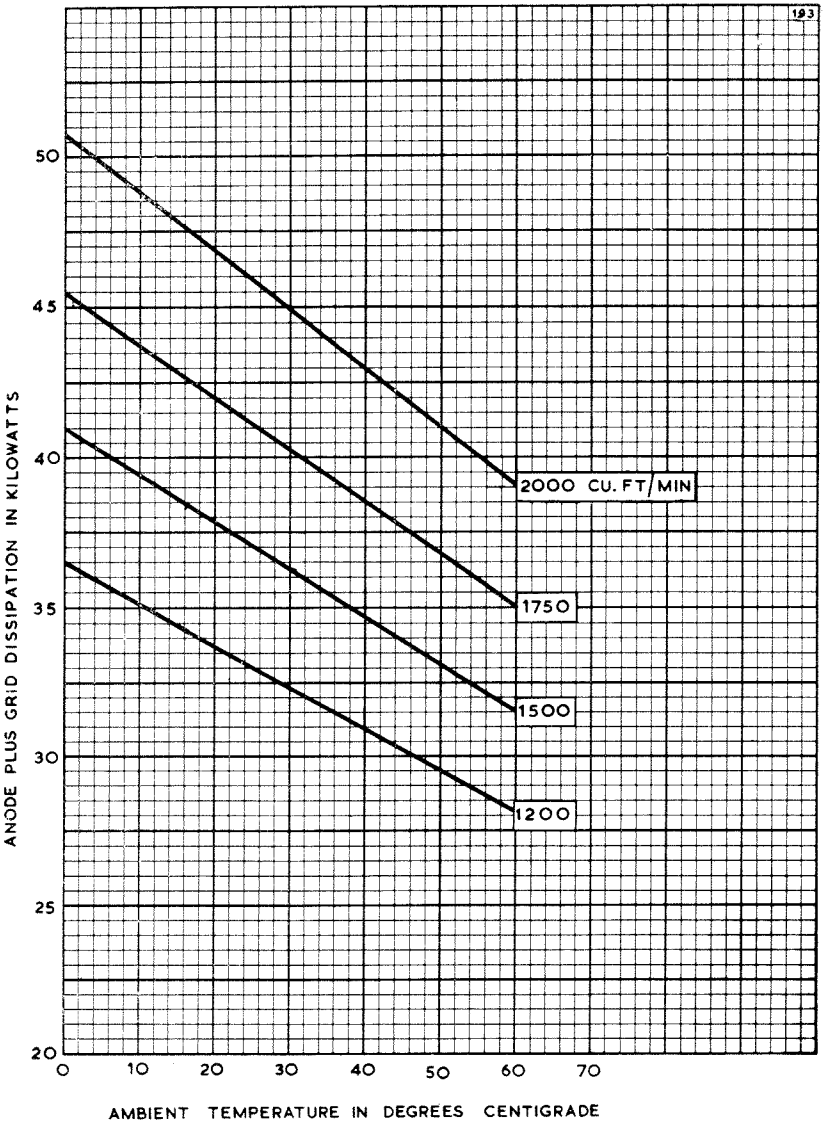
AIR COOLING CHARACTERISTICS



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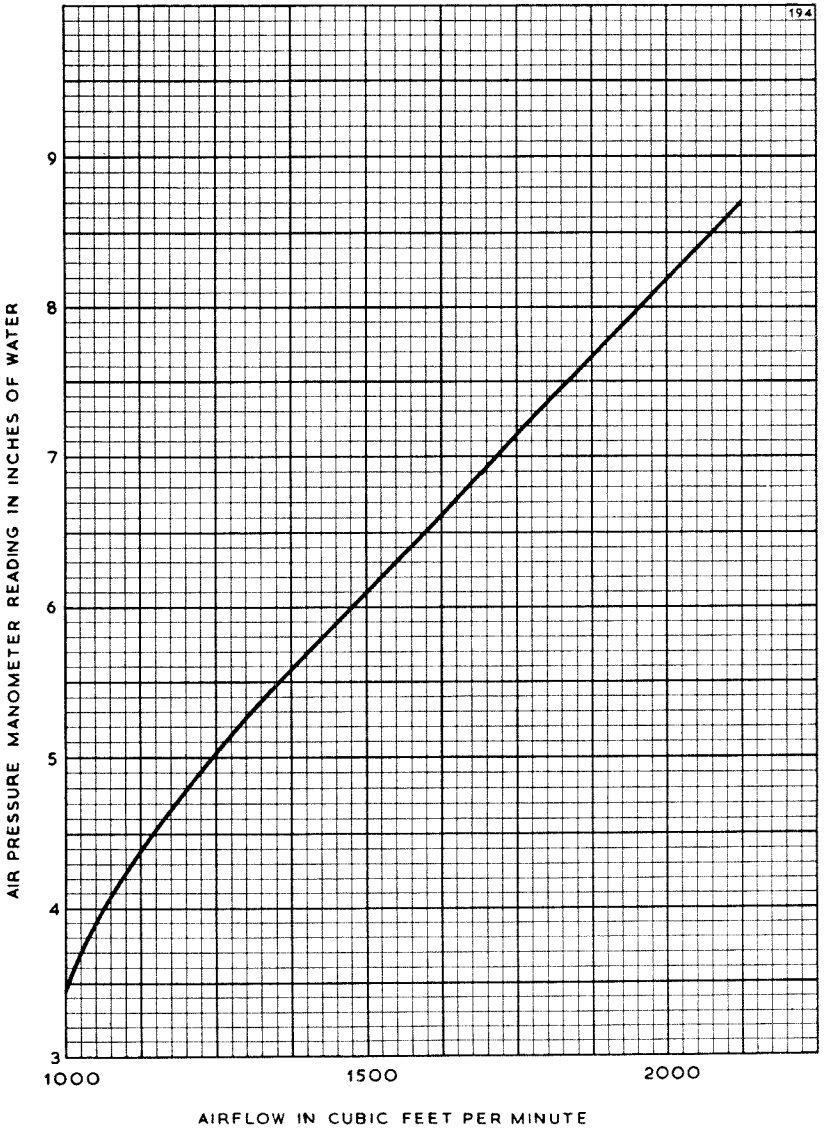
AIR FLOW CHARACTERISTIC



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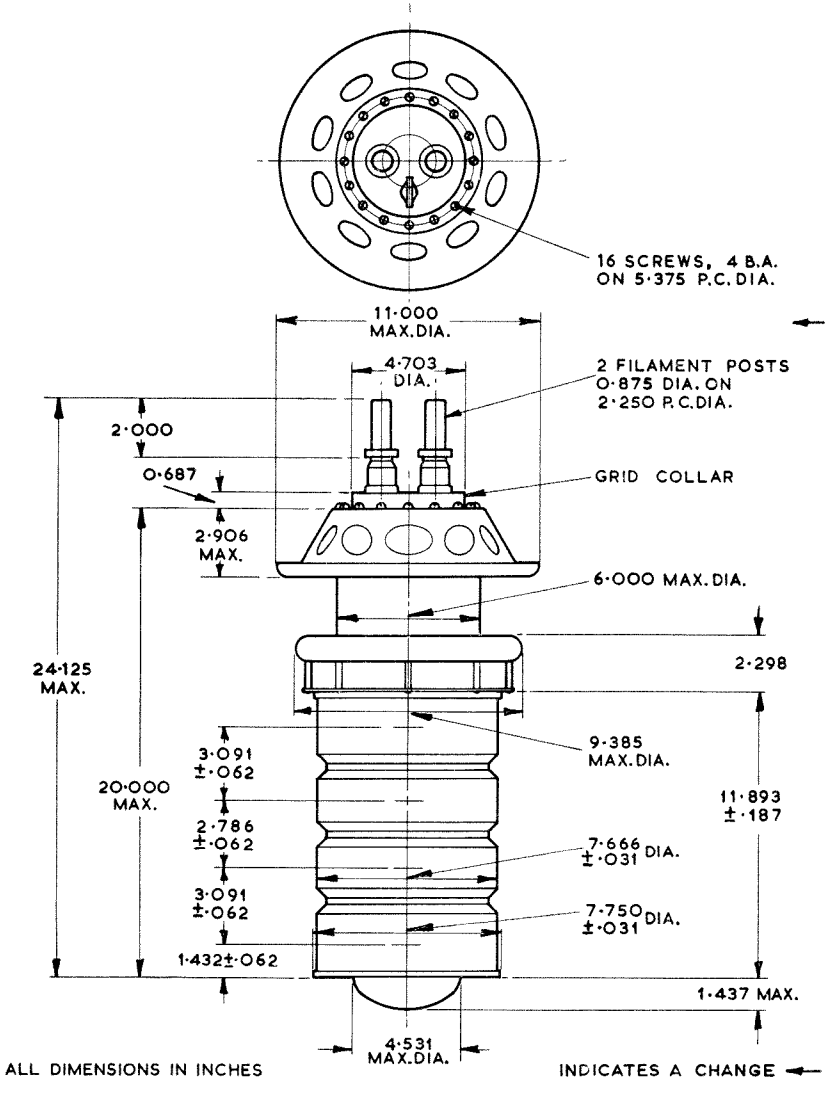
OUTLINE

195A



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R.F. POWER TRIODE

BR195

GENERAL

The BR195 is a forced-air cooled transmitting triode. It is a maintenance type and therefore only abridged data are given on this sheet. **Full information is available on request.**

Filament	Thoriated Tungsten	
Filament Voltage	6·0	V
Filament Current	67	A
Filament Starting Current (Peak)	100	A Max
Filament Cold Resistance	0·011	Ω
Peak Usable Cathode Current	10	A
Perveance	1·27mA/V$^{3/2}$	
Amplification Factor (V_a = 2·5kV, I_a = 1·0A)	25	
Mutual Conductance (V_a = 2·5kV, I_a = 1·0A)	18	mA/V
Filament Leads	MA135 or MA135A	
Grid Connector	MA66A	

MAXIMUM RATINGS

Anode Dissipation	4·0 kW Max	
Grid Dissipation	250	W Max

Maximum Anode Voltage against Frequency		
Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
30	6·0kV	4·8kV
110	5·0kV	4·0kV
220	3·2kV	2·6kV

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

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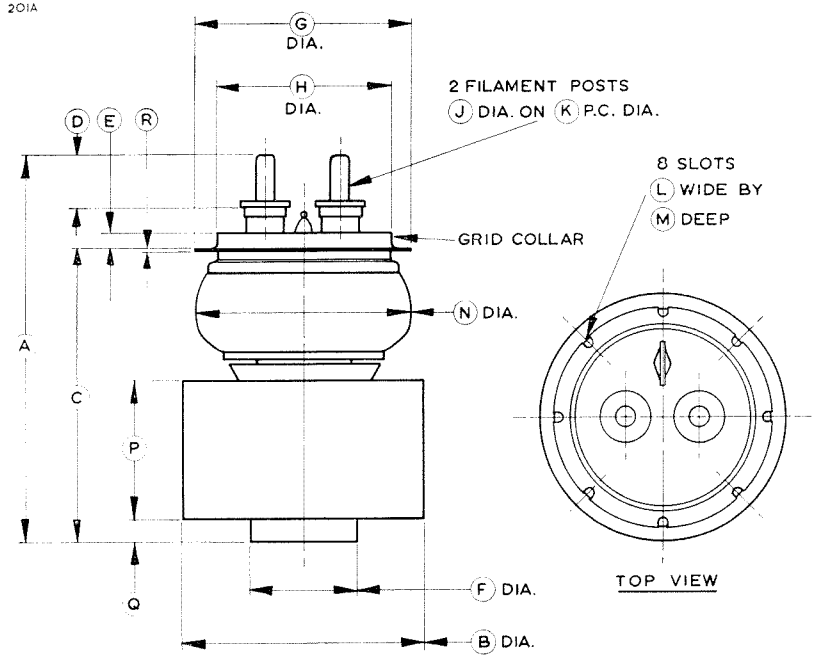
OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	8·625 Max	219·1 Max	J	0·437	11·10
B	5·125 Max	130·2 Max	K	1·500	38·10
C	6·344 Max	161·1 Max	L	0·182	4·62
D	1·187	30·15	M	0·205	5·21
E	0·357	9·07	N	4·750 Max	120·7 Max
F	2·254 Max	57·25 Max	P	2·875	73·03
G	4·562	115·9	Q	0·500	12·70
H	3·750	95·25	R	0·080 ± 0·015	2·03 ± 0·38

Millimetre dimensions have been derived from inches.

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

R.F. POWER TRIODE

BR1102

ABRIDGED DATA

Forced-air Cooled Triode intended primarily for industrial service.

Anode Dissipation	20	kW Max
Anode Voltage	12	kV Max
Frequency for full ratings	50	Mc/s Max
Output Power (Class C unmodulated)	53	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	8·2	V
Filament Current	230	A
Filament Starting Current (Peak) (*See Note* 2)	525	A Max
Filament Cold Resistance	0·0043	Ω
Peak Usable Cathode Current	45	A
Perveance	1·25	$mA/V^{3/2}$
Amplification Factor (V_a = 9·0 kV, I_a = 2·0 A)	42	
Mutual Conductance (V_a = 10 kV, I_a = 1·5 A)	20	mA/V
Inter-electrode Capacitances:		
Grid to Anode	37	pF
Grid to Filament	49	pF
Anode to Filament	0·6	pF

Mechanical

Overall Length	19 inches	(483 mm)	Max
Overall Diameter (over handles)	11·82 inches	(300 mm)	Max
Net Weight	41 pounds	(19 kg)	Approx
Mounting Position	Vertical, filament end up		

Accessories

Filament Leads	MA131
Grid Connector	MA66

COOLING

The required quantity of air through the radiator for cooling is indicated on the graphs (pages 8 and 9) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 20 to 30ft³/min (0·57 to 0·85m³/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

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

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R.F. POWER TRIODE

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage (*See Note* 3)	12 kV Max
Anode Current	7·5 A Max
Anode Dissipation (*See Note* 4)	20 kW Max
Grid Dissipation	1·0 kW Max
Operating Frequency (for full ratings)	50 Mc/s Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	9·0	12	kV
Grid Voltage	−655	−720	V
Grid Resistor	625	720	Ω
Peak R.F. Grid Voltage	1455	1520	V
Anode Current	5·85	5·85	A
Grid Current (Approx)	1·05	1·0	A
Anode Dissipation	15·6	17·2	kW
Grid Dissipation	735	720	W
Output Power	37	53	kW
Efficiency	70	75·5	%
Load Resistance	700	1020	Ω

R.F. POWER TRIODE

→ RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 8·2V ..	207	253	A
Amplification Factor (V_a = 9·0kV, I_a = 2·0A)	35·5	48·5	
Mutual Conductance (V_a = 10kV, I_a = 1·5A)	15·5	24·5	mA/V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	340	V
Grid Voltage (negative value) .. .. (V_a = 10kV, I_a = 2·0A)	95	135	V
Anode Current (V_a = 2·0kV, V_g = +250V) ..	3·8	8·8	A
Grid Current (V_a = 2·0kV, V_g = +250V) ..	0·25	—	A
Anode Current (V_a = 4·0kV, V_g = +250V) ..	6·2	10·4	A
Grid Current (V_a = 4·0kV, V_g = +250V) ..	−0·1	0·5	A
Inter-electrode Capacitances:			
Grid to Anode	32	42	pF
Grid to Filament	44	54	pF

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.
2. The filament current must not exceed 525A, even momentarily, at any time.
3. This is the highest nominal operating voltage to be used. It makes allowance for the normal mains voltage fluctuations as well as tolerances in the equipment.
4. The valve can dissipate higher powers for periods up to 15 seconds provided that the average over a long period does not exceed the maximum stated.

→Indicates a change

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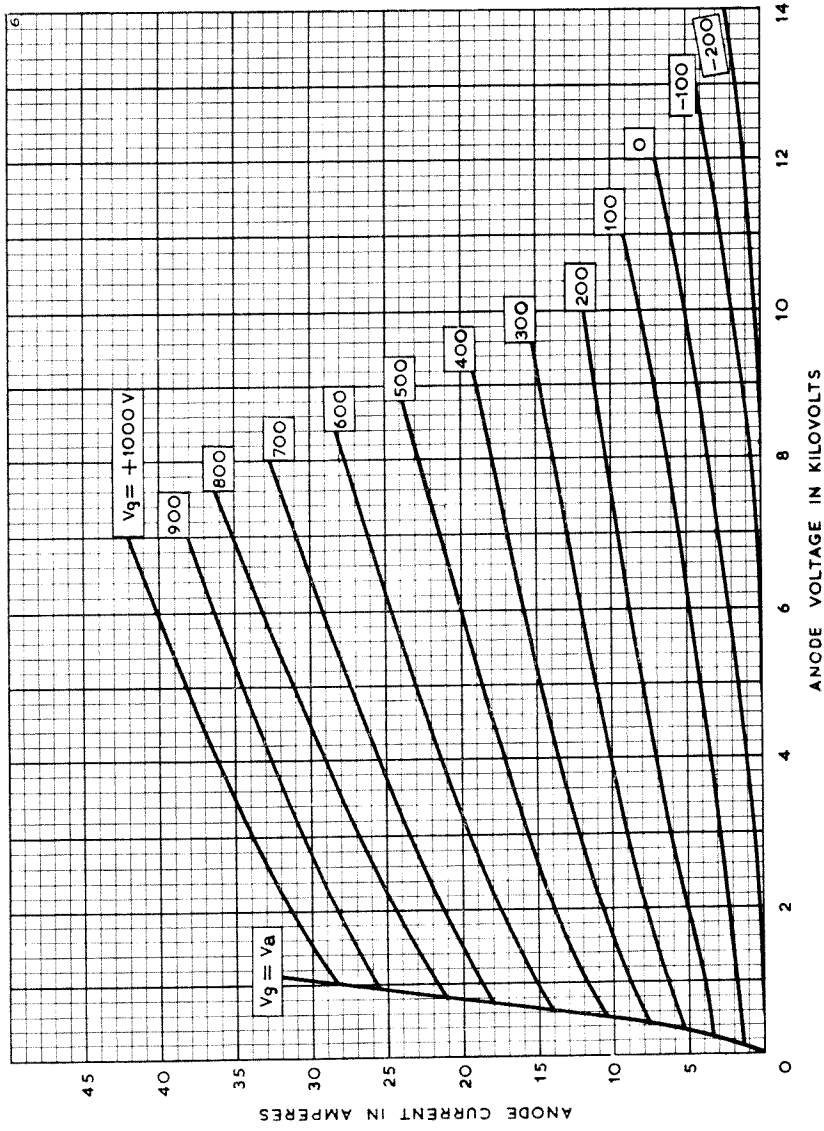
ANODE CHARACTERISTICS



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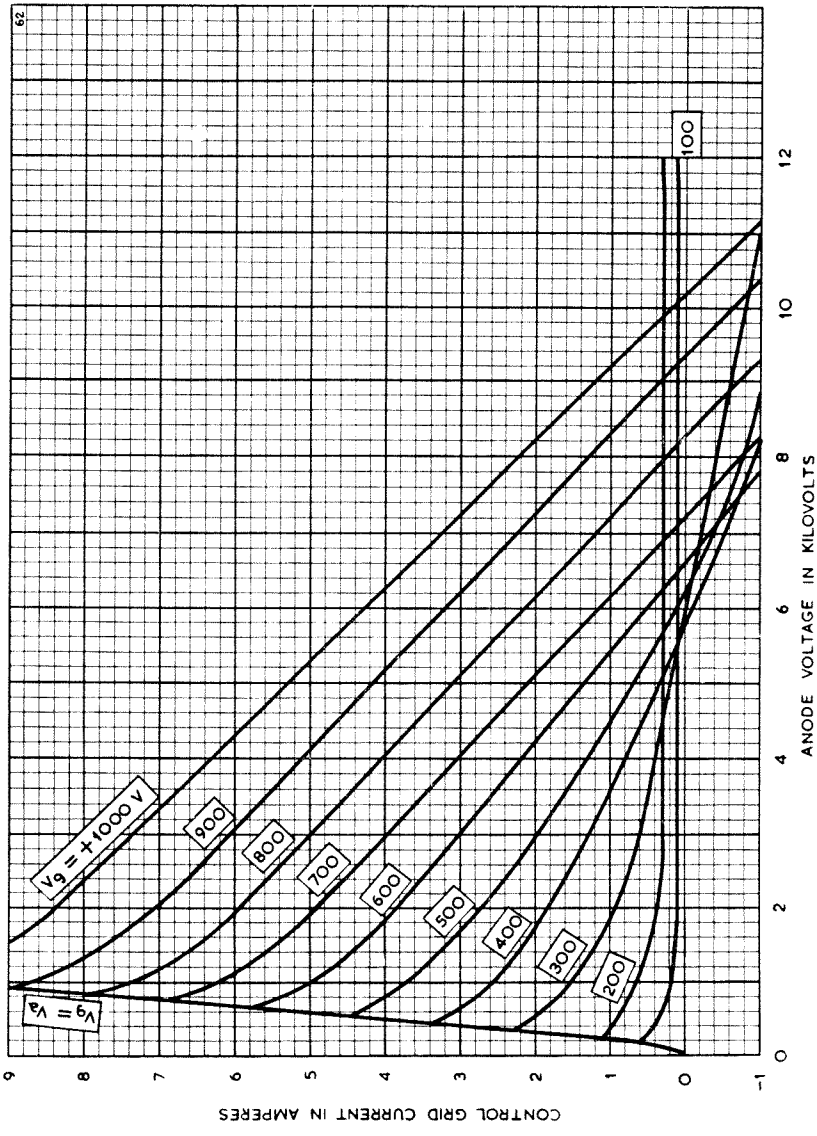

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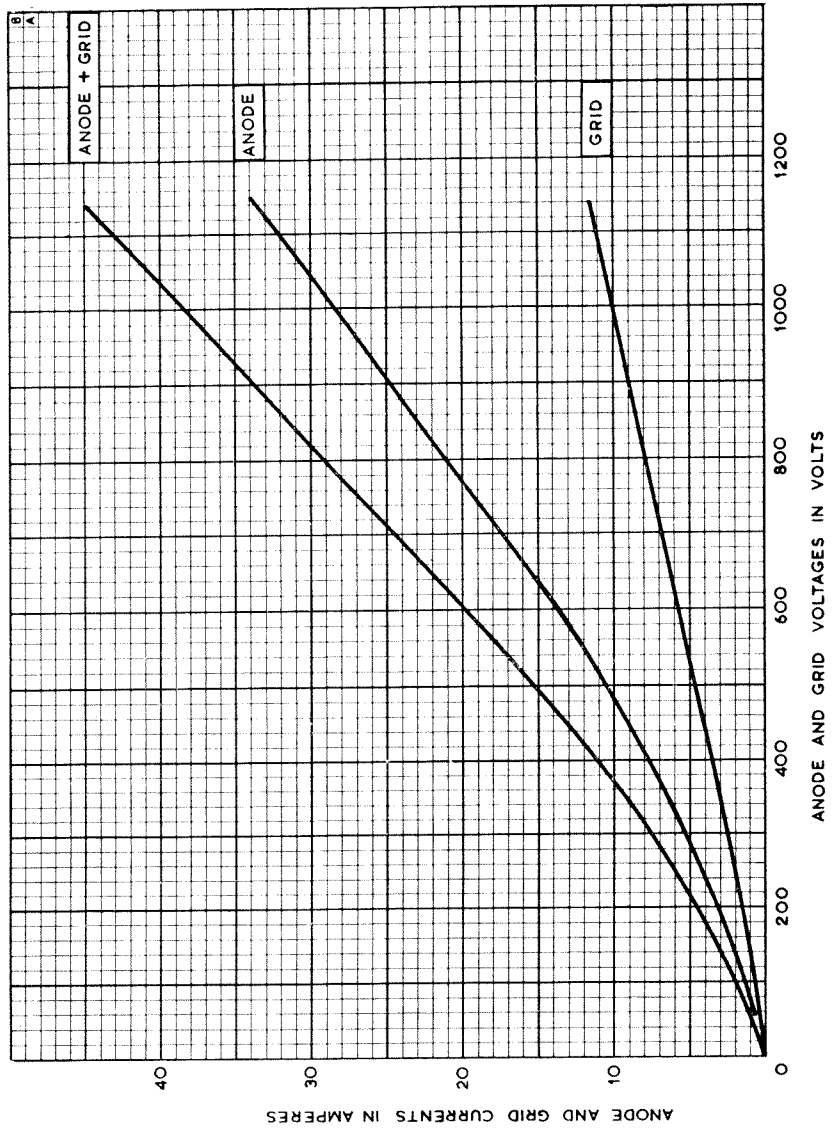

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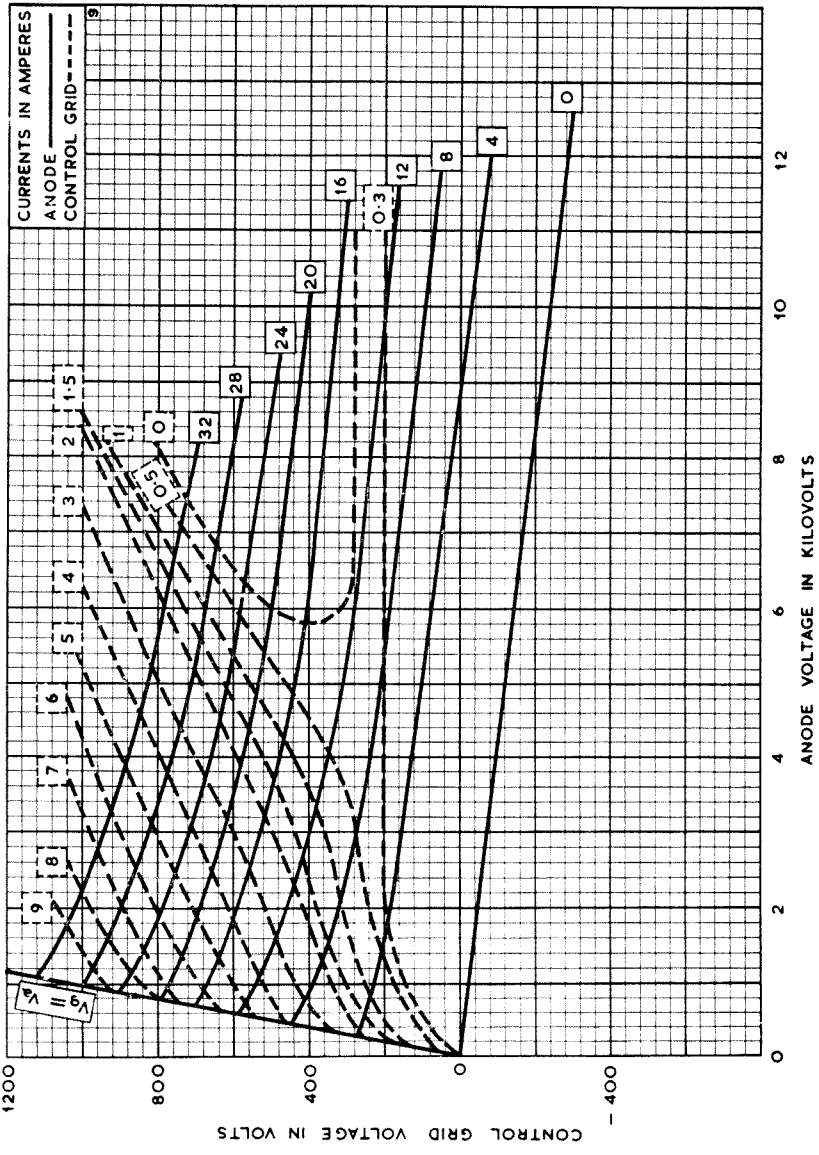

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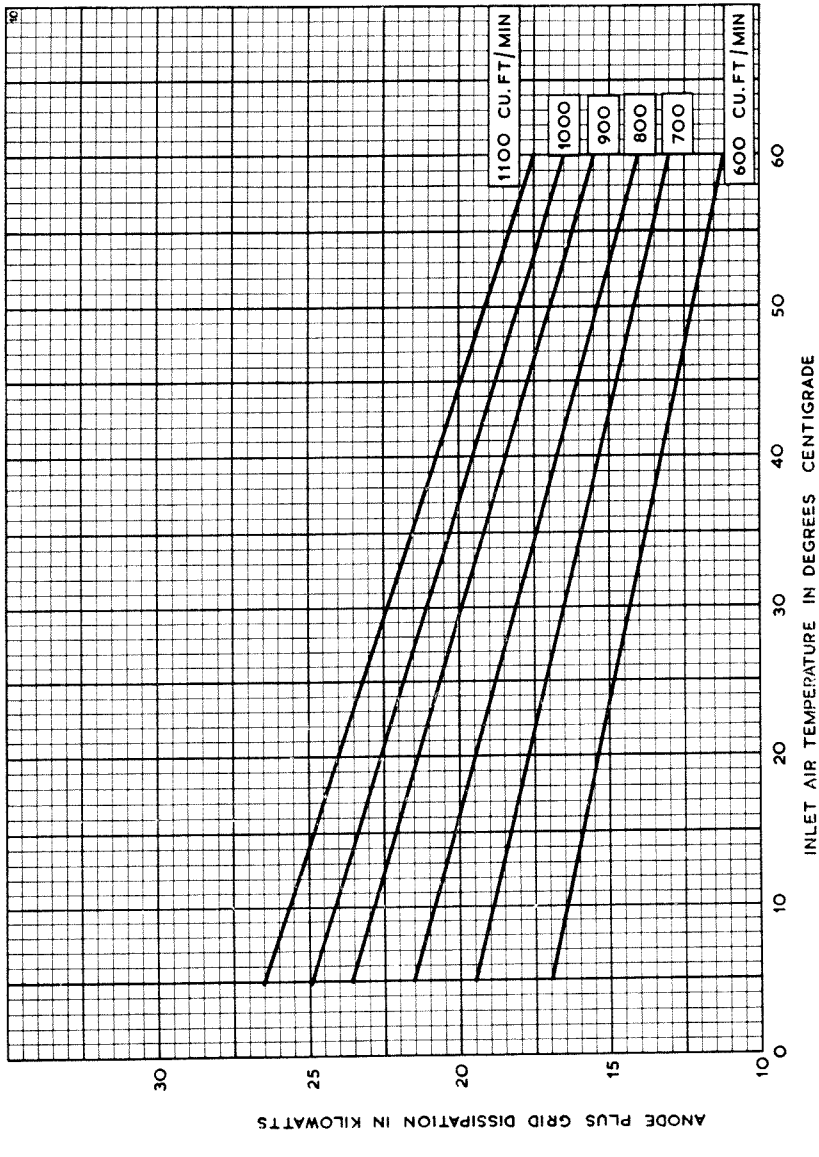
AIR COOLING CHARACTERISTICS



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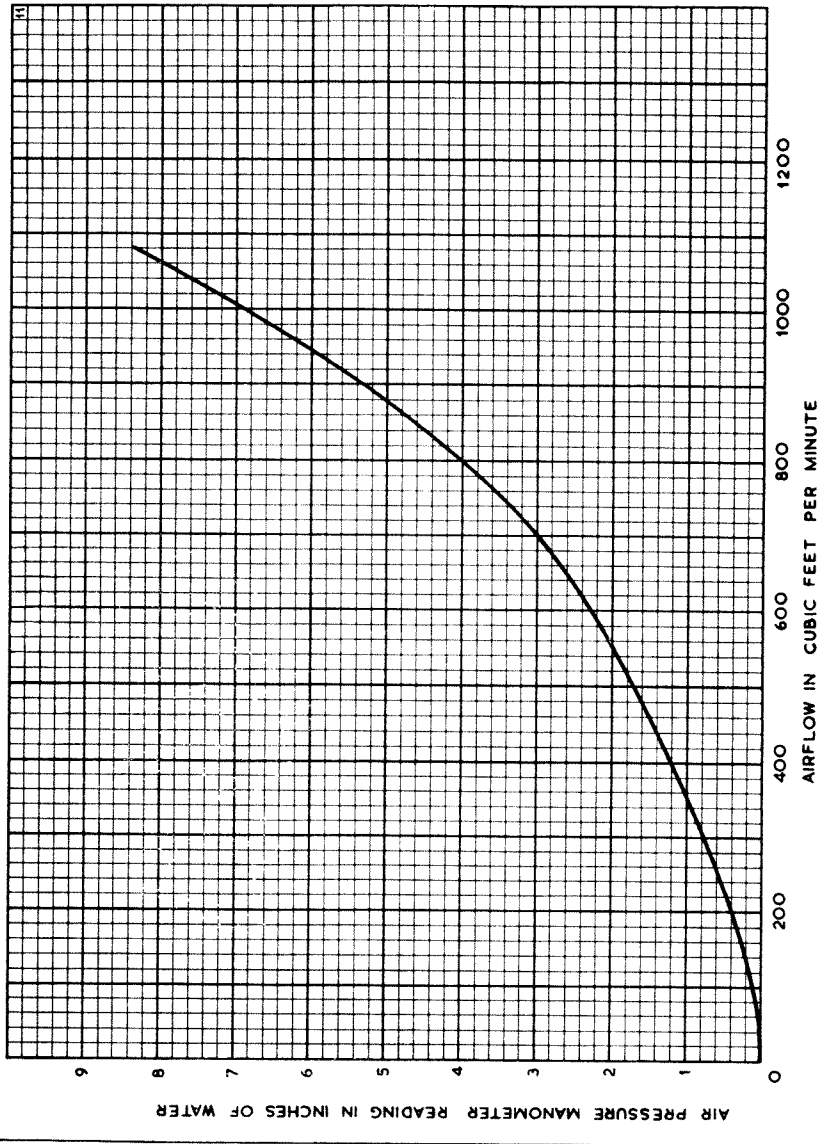
AIR FLOW CHARACTERISTIC



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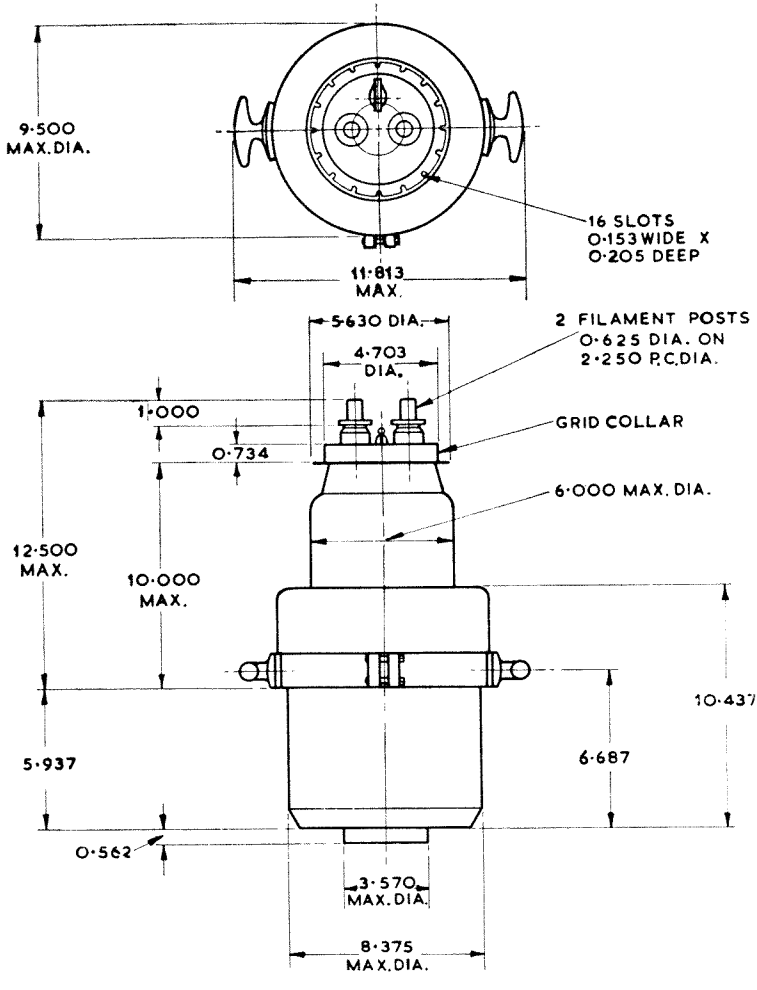
OUTLINE

12



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R.F. POWER TRIODE

BR1103

GENERAL

The BR1103 is a forced-air cooled transmitting triode. It is a maintenance type and therefore only abridged data are given on this sheet. **Full information is available on request.** For new designs the BR1124 is recommended.

Filament	Thoriated Tungsten	
Filament Voltage	6·0	V
Filament Current	120	A
Filament Starting Current (Peak)	260	A Max
Peak Usable Cathode Current	16	A
Amplification Factor (V_a = 5·0kV, I_a = 1·0A)	25	
Mutual Conductance (V_a = 5·0kV, I_a = 1·0A)	9·5	mA/V
Filament Leads	MA135 or MA135A	
Grid Connector	MA66A	

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage (*See Note* 1)	8·5	kV Max
Anode Dissipation (*See Note* 2)	10	kW Max
Grid Dissipation	600	W Max
Frequency (for full ratings)	100	Mc/s Max

NOTES

1. This is the highest nominal operating voltage to be used. It makes allowance for the normal mains voltage fluctuations as well as tolerances in the equipment.

2. The valve can dissipate higher powers for periods up to 15 seconds provided that the average over a long period does not exceed the maximum stated.

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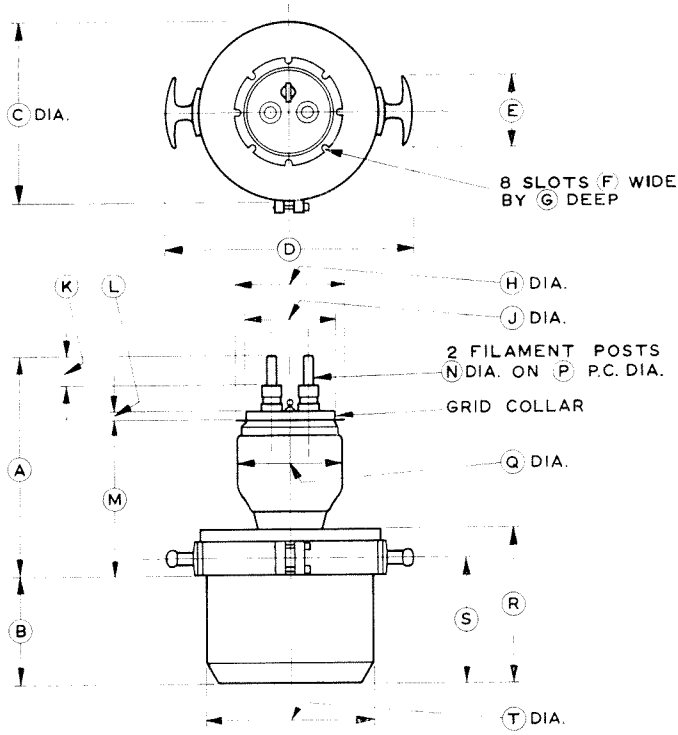
18 A



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	9·500 Max	241·3 Max	K	1·187	30·15
B	4·500	114·3	L	0·375	9·53
C	8·000 Max	203·2 Max	M	6·600 ± 0·200	167·6 ± 5·1
D	10·500 Max	266·7 Max	N	0·437	11·10
E	3·000	76·2	P	1·500	38·10
F	0·182	4·62	Q	4·437	112·7
G	0·205	5·21	R	6·500	165·1
H	4·562	115·9	S	5·250	133·4
J	3·750	95·25	T	7·062 Max	179·4 Max

Millimetre dimensions have been derived from inches.

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BR1106

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ABRIDGED DATA

Forced-air Cooled Transmitting Triode with grid terminal suitable for cathode drive operation.

Anode Dissipation	10 kW Max
Anode Voltage	6·6 kV Max
Frequency for full ratings	30 Mc/s Max
Frequency at reduced ratings	220 Mc/s Max
Output Power (Class C Telegraphy)	15·5 kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	5·0	V
Filament Current	175	A
Filament Starting Current (Peak) (*See Note* 2)	400	A Max
Filament Cold Resistance	0·0038	Ω
Peak Usable Cathode Current	20	A
Perveance	2·0	$mA/V^{3/2}$
Amplification Factor (V_a = 6·5kV, I_a = 1·0A)	30	
Mutual Conductance (V_a = 5·0kV, I_a = 1·5A)	28	mA/V
Inter-electrode Capacitances:		
Grid to Anode	24	pF
Grid to Filament	44	pF
Anode to Filament	0·75	pF

Mechanical

Overall Length	11·062 inches (281 mm)	Max
Overall Diameter	6·406 inches (162·7 mm)	Max
Net Weight	18 pounds (8·2 kg)	Approx
Mounting Position	Vertical, either way up	

Accessories

Filament Leads	MA131

COOLING

The required quantity of air through the radiator for cooling is indicated on the graphs (pages 8 and 9) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 20ft³/min (0·57m³/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

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

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R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage (*See page* 3)	6·6 kV Max
Anode Dissipation	10 kW Max
Grid Dissipation	300 W Max
Operating Frequency	*See page* 3

TYPICAL OPERATING CONDITIONS

Anode Voltage	6·0	kV
Grid Voltage	−430	V
Peak R.F. Grid Voltage	830	V
Anode Current	3·72	A
Grid Current (Approx)	0·44	A
Anode Dissipation	6·82	kW
Grid Dissipation	150	W
Output Power	15·5	kW
Efficiency	69·5	%

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 5·0V	162	185	A
Amplification Factor (V_a = 6·5kV, I_a = 1·0A)	26	34	
Mutual Conductance (V_a = 5·0kV, I_a = 1·5A)	24	32	mA/V
Anode Current (V_a = 2·0kV, V_g = +200V)	7·9	9·1	A
Grid Current (V_a = 2·0kV, V_g = +200V)	0	0·6	A
Inter-electrode Capacitances:			
Grid to Anode	22	26·5	pF
Grid to Filament	41·75	45·75	pF
Anode to Filament	0·45	0·9	pF

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MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
30	6·6 kV	5·3 kV
220	6·0 kV	4·8 kV

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.
2. The filament current must not exceed 400A, even momentarily, at any time.

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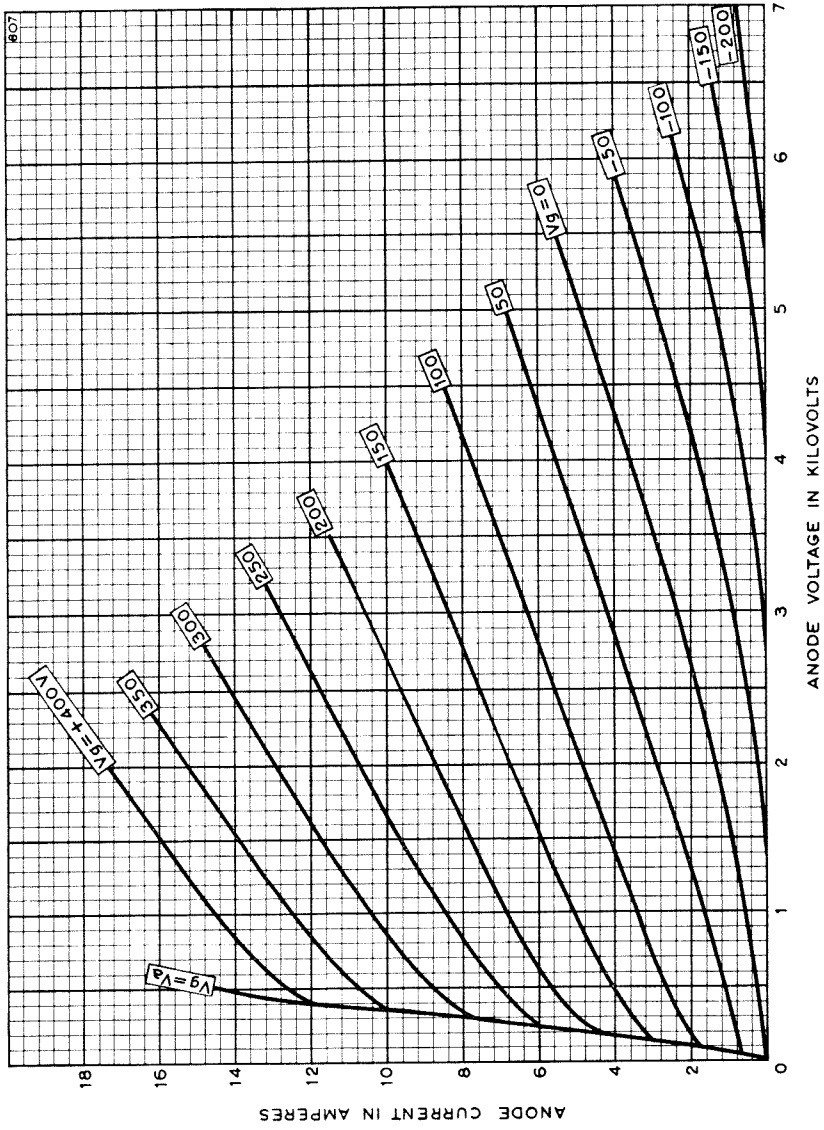

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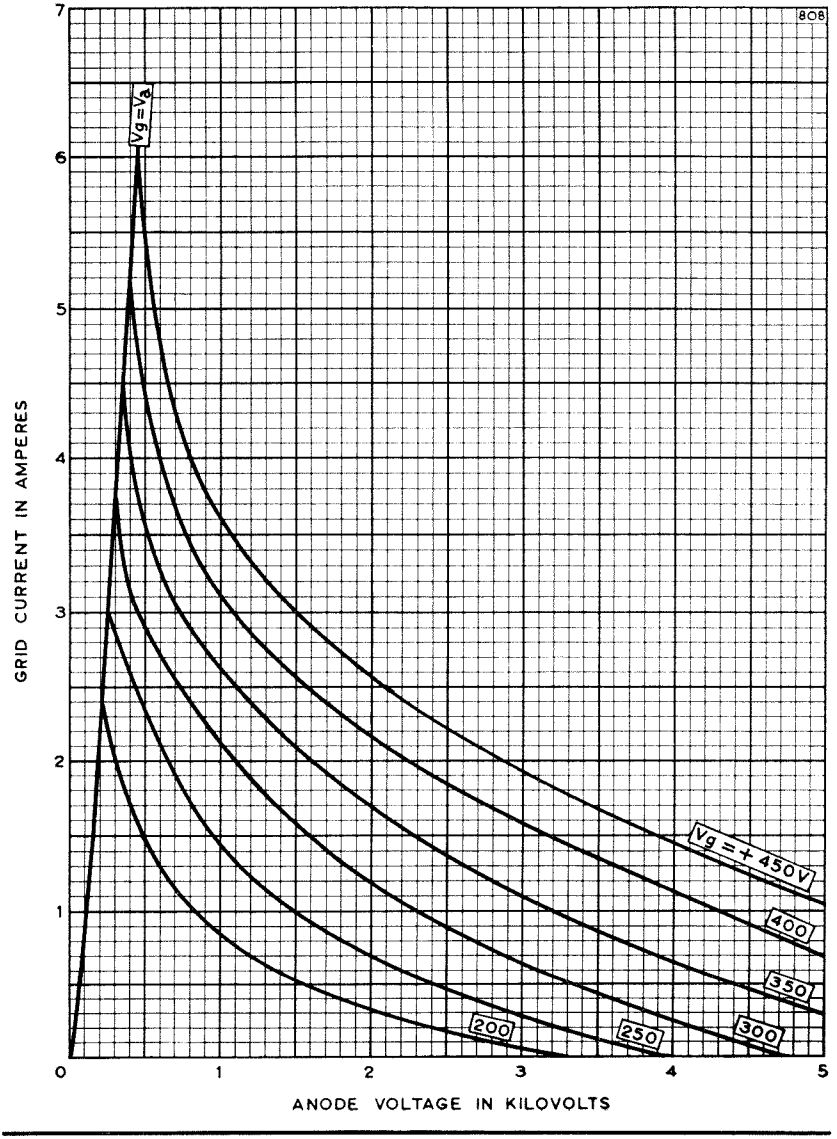

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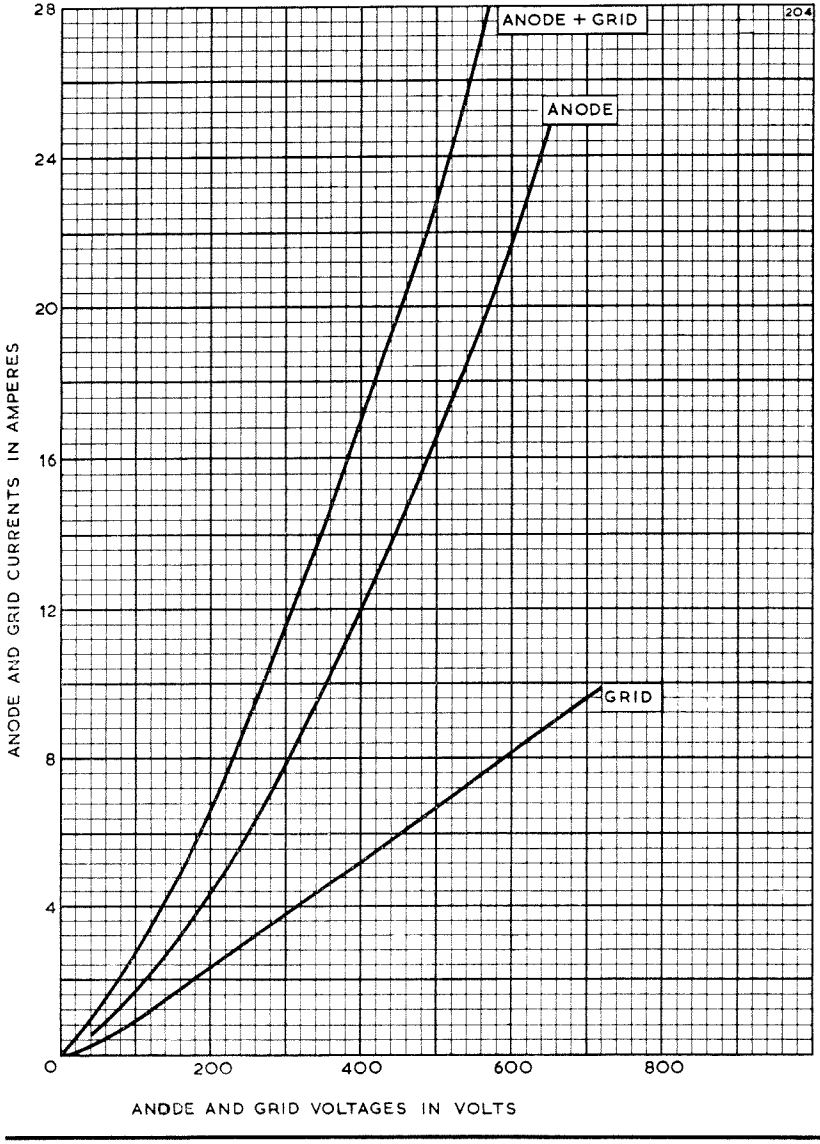

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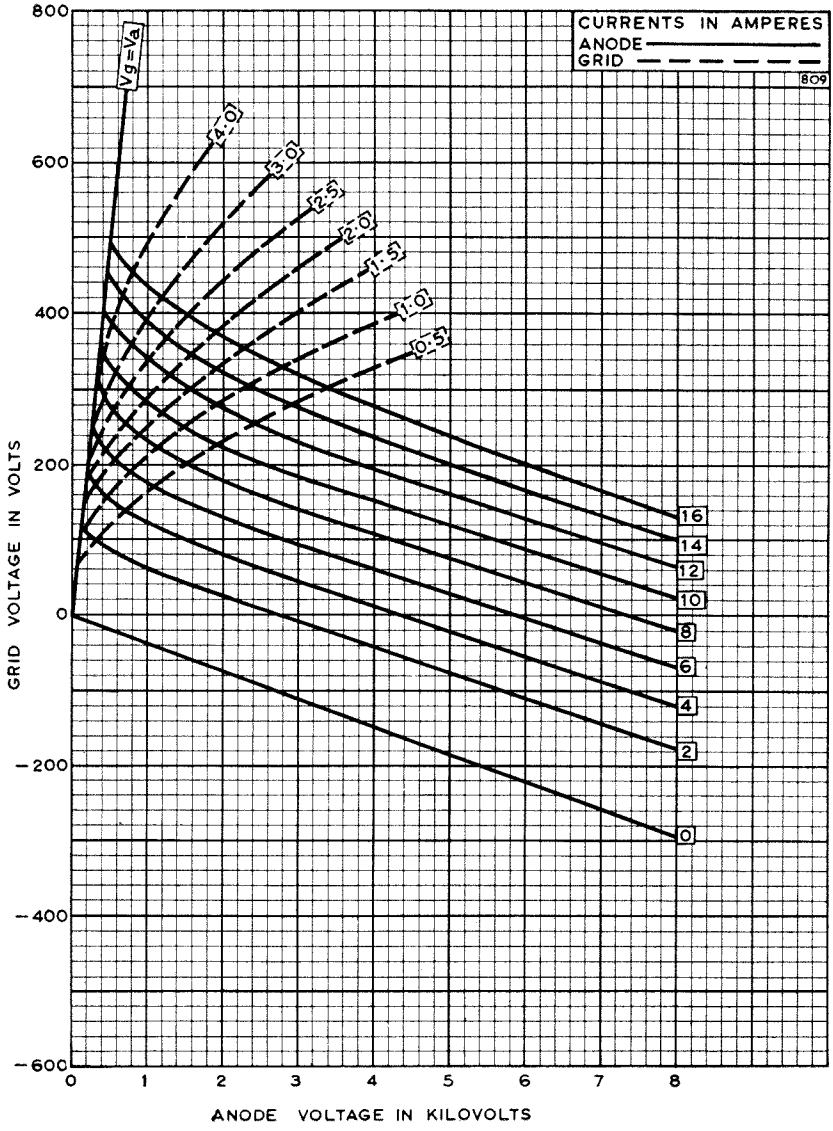

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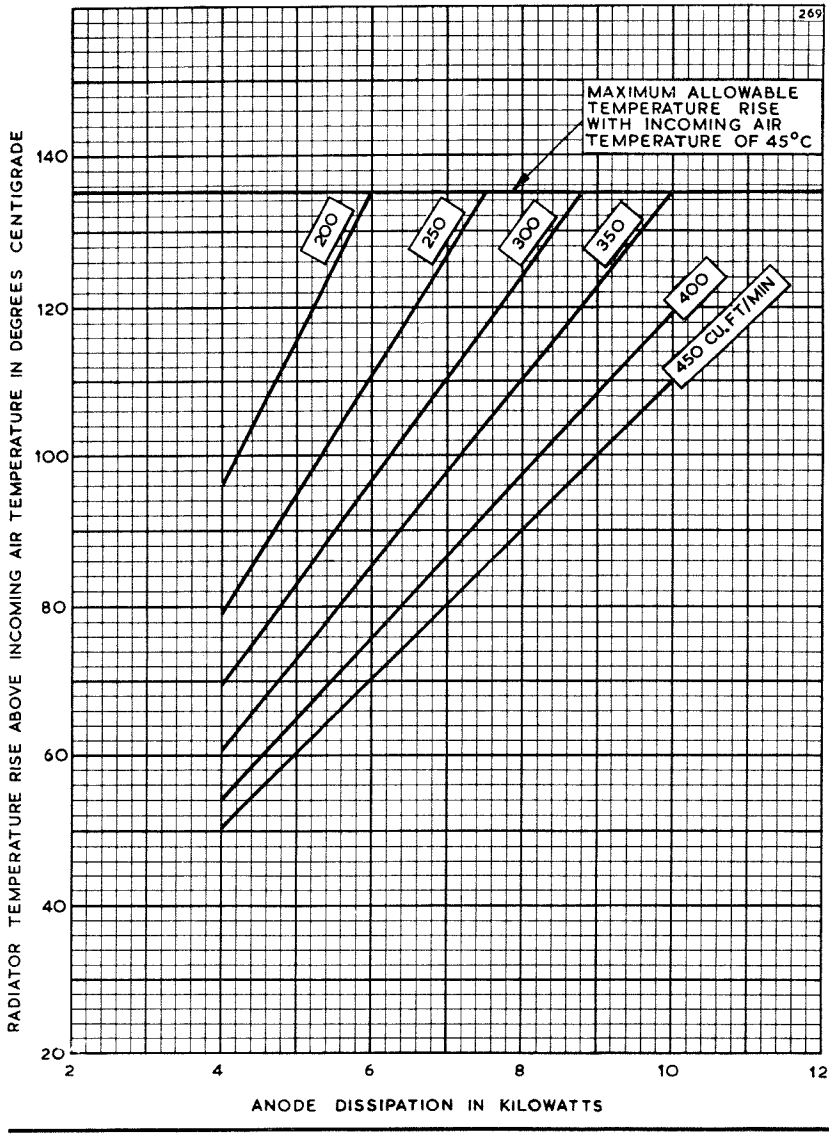
AIR COOLING CHARACTERISTICS



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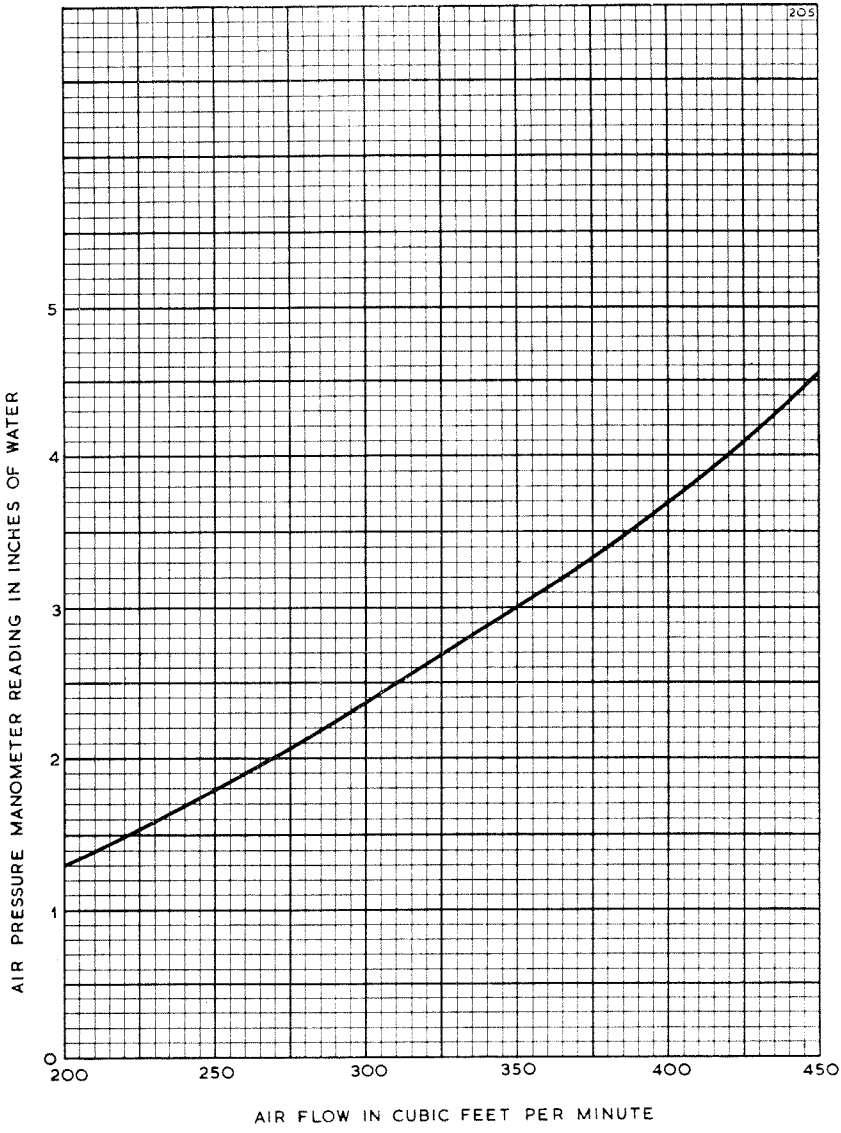
AIR FLOW CHARACTERISTIC



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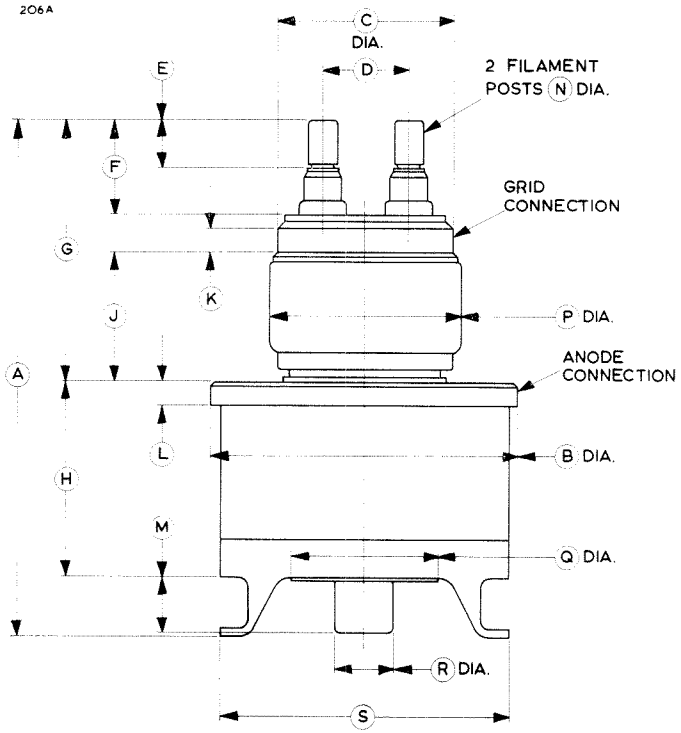

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	11·062 Max	281·0 Max	K	0·500 Min	12·70 Min
B	6·375 ± 0·031	161·9 ± 0·79	L	0·500 ± 0·031	12·70 ± 0·79
C	3·685 ± 0·025	93·60 ± 0·64	M	1·150 Max	29·21 Max
D	1·710 ± 0·040	43·43 ± 1·02	N	0·625 ± 0·002	15·875 ± 0·051
E	0·812 Min	20·62 Min	P	4·125 Max	104·8 Max
F	1·907 Min	48·44 Min	Q	3·375 Max	85·73 Max
G	5·421 ± 0·140	137·7 ± 3·56	R	1·187	30·15
H	4·094 Max	104·0 Max	S	6·000 ± 0·094	152·4 ± 2·39
J	2·656 ± 0·093	67·46 ± 2·36			

Millimetre dimensions have been derived from inches.

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R.F. POWER TRIODE

BR1115

GENERAL

The BR1115 is a forced-air cooled triode designed primarily for industrial service. It is a maintenance type and therefore only abridged data are given on this sheet. **Full information is available on request.**

Filament	Thoriated Tungsten	
Filament Voltage	15	V
Filament Current	39	A
Filament Starting Current (Peak)	230	A Max
Filament Cold Resistance	0·042	Ω
Peak Usable Cathode Current	14	A
Perveance	2·0	$mA/V^{3/2}$
Amplification Factor (V_a = 4·0kV, I_a = 1·0A)	30	
Mutual Conductance (V_a = 4·0kV, I_a = 1·0A)	20	mA/V
Grid Connector		MA66A

R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage (*See Note* 1)	6·0 kV Max
Anode Current	1·75 A Max
Anode Dissipation (*See Note* 2)	3·0 kW Max
Grid Voltage	−1·0 kV Max
Grid Current	0·35 A Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	4·0	6·0	kV
Grid Voltage	−300	−400	V
Grid Resistor	880	1150	Ω
Peak R.F. Grid Voltage	550	660	V
Anode Current	1·54	1·64	A
Grid Current (Approx)	0·342	0·347	A
Anode Dissipation	2·22	2·7	kW
Grid Dissipation	85	90	W
Driving Power	188	229	W
Output Power	3·94	7·15	kW
Efficiency	64	72	%
Load Resistance	1065	1150	Ω

NOTES

1. This is the highest nominal operating voltage to be used. It makes allowance for the normal mains voltage fluctuations as well as tolerances in the equipment.
2. The valve can dissipate higher powers for periods up to 15 seconds provided that the average over a long period does not exceed the maximum stated.

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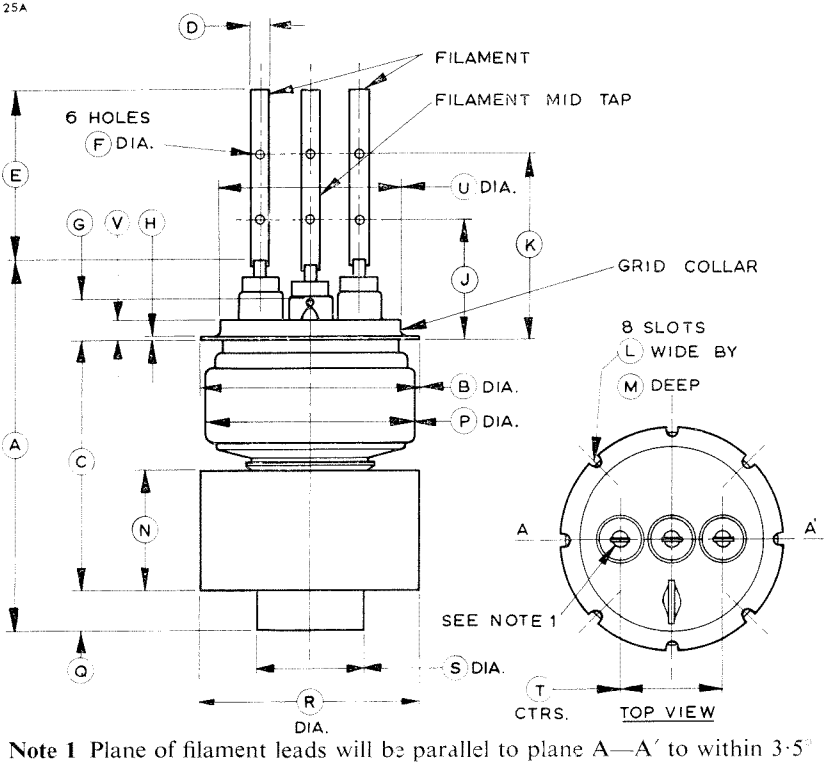
OUTLINE

25A



Note 1 Plane of filament leads will be parallel to plane A—A′ to within 3·5°

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	8·070 Max	205·0 Max	L	0·182	4·62
B	4·562 ± 0·031	115·87 ± 0·79	M	0·205	5·21
C	5·250 ± 0·125	133·35 ± 3·18	N	2·750 Max	69·85 Max
D	0·312 ± 0·062	7·92 ± 1·57	P	4·562 Max	115·9 Max
E	3·500 Min	88·90 Min	Q	0·937 Max	23·80 Max
F	0·144	3·66	R	4·625 ± 0·062	117·48 ± 1·57
G	1·250 Max	31·75 Max	S	2·250 Max	57·15 Max
H	0·080 ± 0·015	2·03 ± 0·38	T	2·500 Max	63·50 Max
J	2·500 ± 0·375	63·50 ± 9·53	U	3·750	95·25
K	3·875 ± 0·375	98·42 ± 9·53	V	0·437 ± 0·020	11·10 ± 0·50

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R.F. POWER TRIODE

BR1121

ABRIDGED DATA

Forced-air Cooled Triode intended primarily for industrial service.

Anode Dissipation	15	kW Max
Anode Voltage	10	kV Max
Frequency for full ratings	50	MHz Max
Output Power (Class C unmodulated conditions)	50	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	6·6	V
Filament Current	230	A
Maximum Filament Starting Current	(*See Note* 2)	
Filament Cold Resistance	0·0035	Ω
Peak Usable Cathode Current	45	A
Perveance	2·3	$mA/V^{3/2}$
Amplification Factor (V_a = 6·0kV, I_a = 3·0A)	38	
Mutual Conductance (V_a = 7·0kV, I_a = 3·0A)	45	mA/V
Inter-electrode Capacitances:		
Grid to Anode	54	pF
Grid to Filament	85	pF
Anode to Filament	0·8	pF

Mechanical

Overall Length	15·500 inches	(393·7 mm)	Max
Overall Width (over handles)	10·500 inches	(266·7 mm)	Max
Net Weight	35 pounds	(16 kg)	Approx
Mounting Position	Vertical, filament end up		

Accessories

Filament Leads	MA131
Grid Connector	MA66

COOLING

The required quantity of air through the radiator for cooling is indicated on the graphs (pages 8 and 9) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 20 to 30ft^3/min (0·57 to 0·85m^3/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperatures of the seals.

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

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BR1121

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R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage (*See Note* 3)	10 kV Max
Anode Current	6·5 A Max
Anode Dissipation (*See Note* 4)	15 kW Max
Grid Dissipation	1·0 kW Max
Frequency (for full ratings)	50 MHz Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	8·0	10	kV
Grid Voltage	−420	−470	V
from Grid Resistor	510	746	Ω
Anode Current	6·4	6·4	A
Grid Current (Approx)	0·82	0·63	A
Anode Dissipation	11·2	13	kW
Grid Dissipation	386	290	W
Driving Power	730	585	W
Peak R.F. Grid Voltage	890	930	V
Output Power	40	51	kW
Efficiency	78	80	%
Load Resistance	665	830	Ω

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 6·6V	216	244	A
Amplification Factor (V_a = 6·0kV, I_a = 3·0A)	33	45	
Mutual Conductance (V_a = 7·0kV, I_a = 3·0A)	40	50	mA/V
Grid Voltage (negative value) (V_a = 6·0kV, I_a = 0·1A)	—	200	V
Anode Current (V_a = 1·5kV, V_g = +600V)	31	40	A
Grid Current (V_a = 1·5kV, V_g = +600V)	5·0	8·0	A

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NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%.
2. The filament current must not exceed 600A, even momentarily, at any time.
3. This is the highest nominal operating voltage to be used. It makes allowance for the normal mains voltage fluctuations as well as tolerances in the equipment.
4. The valve can dissipate higher powers for periods up to 15 seconds provided that the average over a long period does not exceed the maximum stated.

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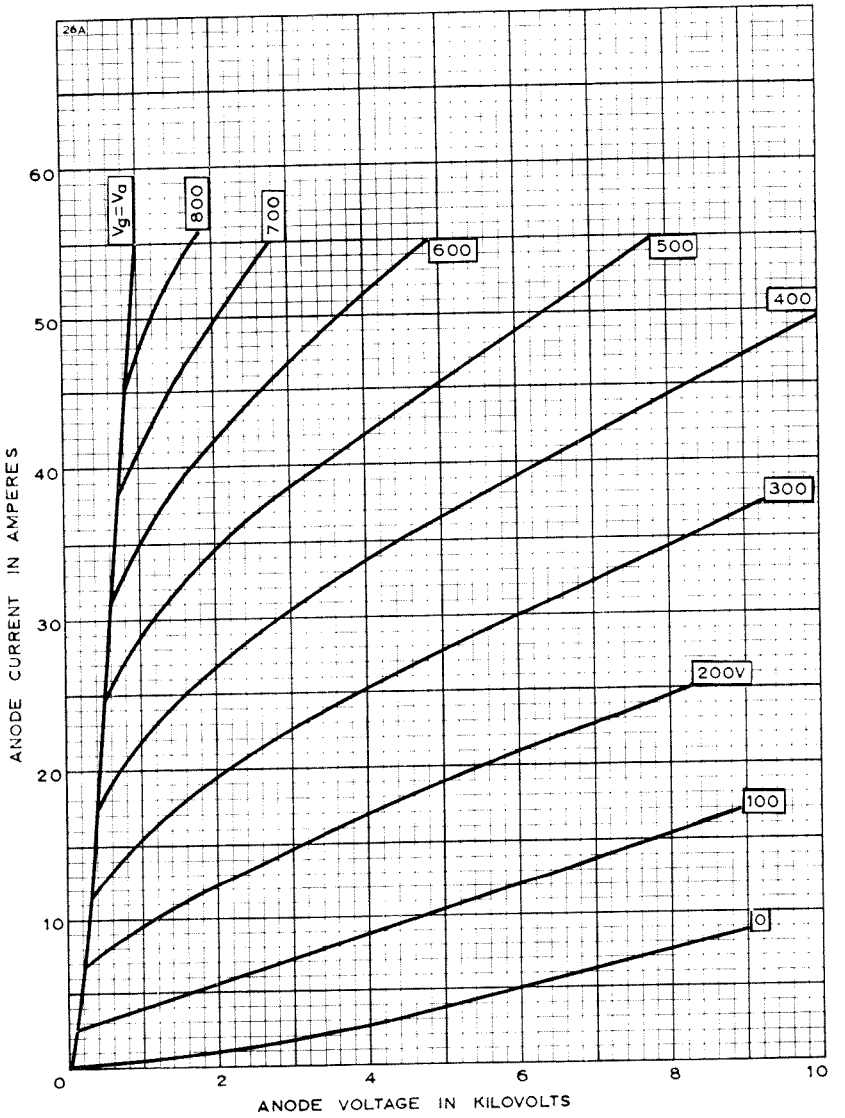
ANODE CHARACTERISTICS



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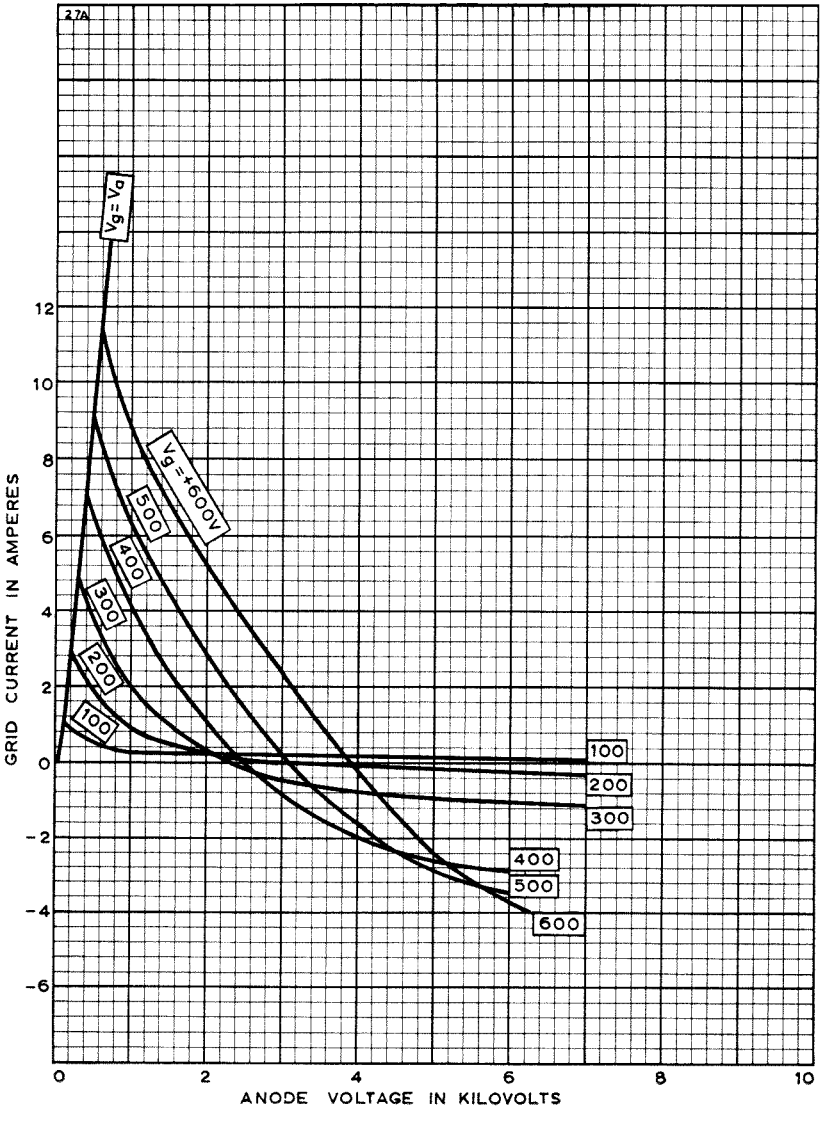
CONTROL GRID CHARACTERISTICS



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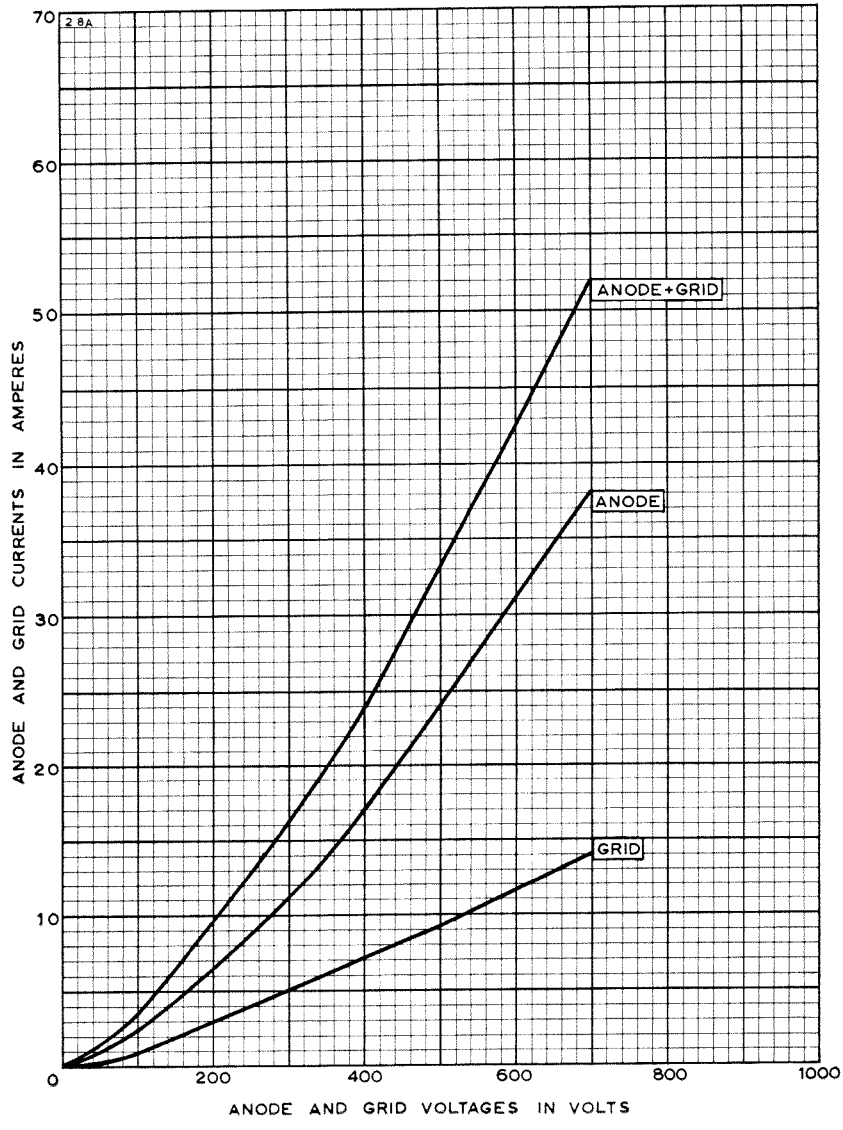
STRAPPED CHARACTERISTICS



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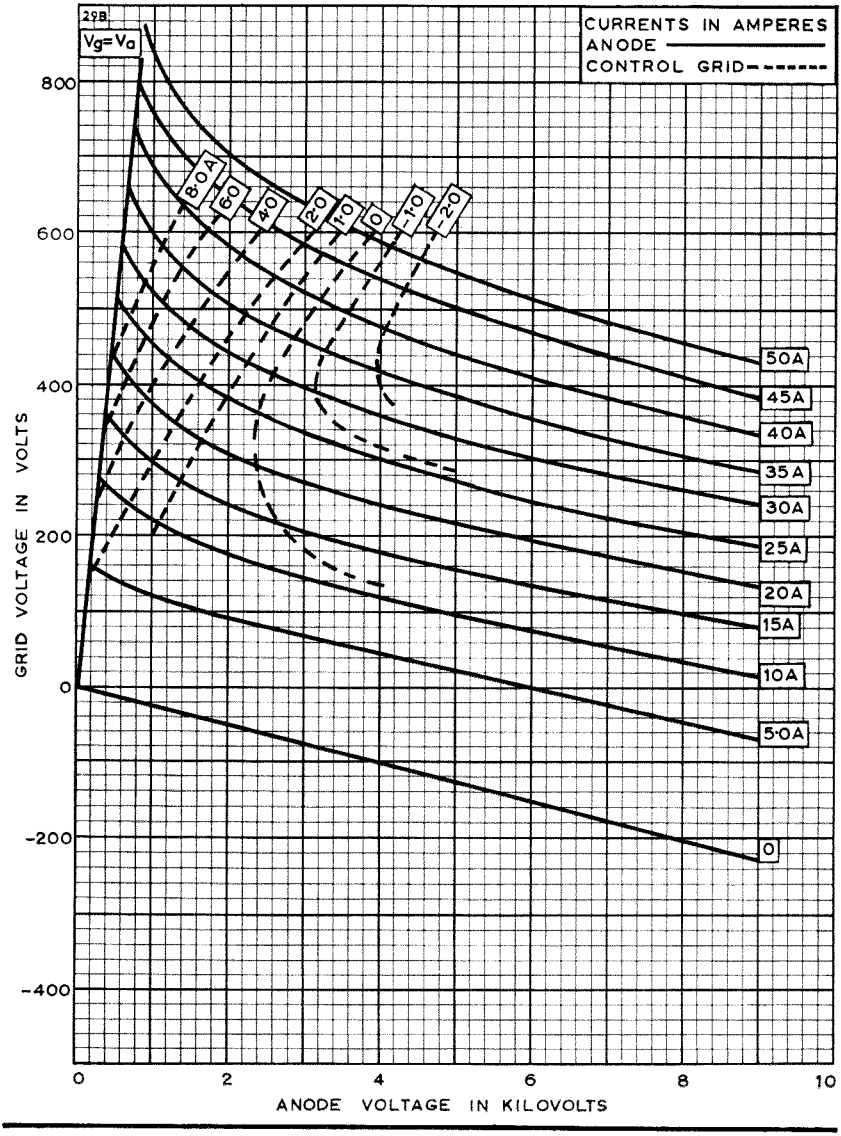
CONSTANT CURRENT CHARACTERISTICS



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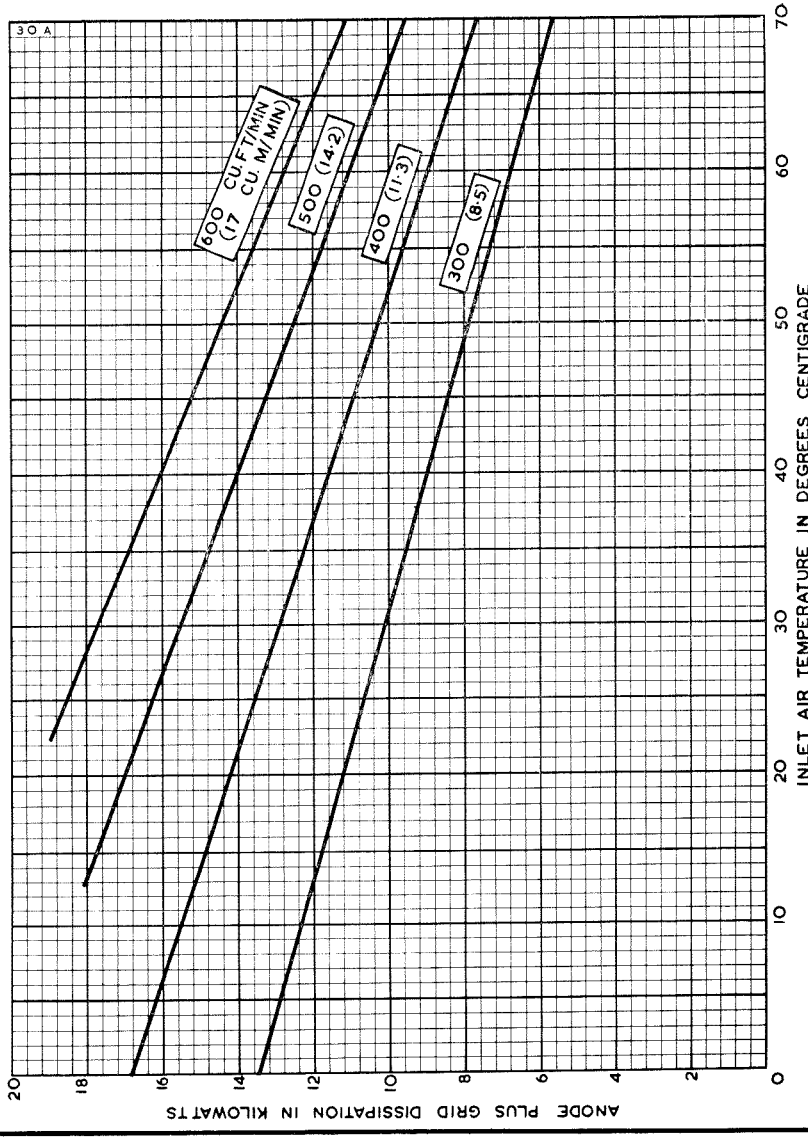
AIR COOLING CHARACTERISTICS



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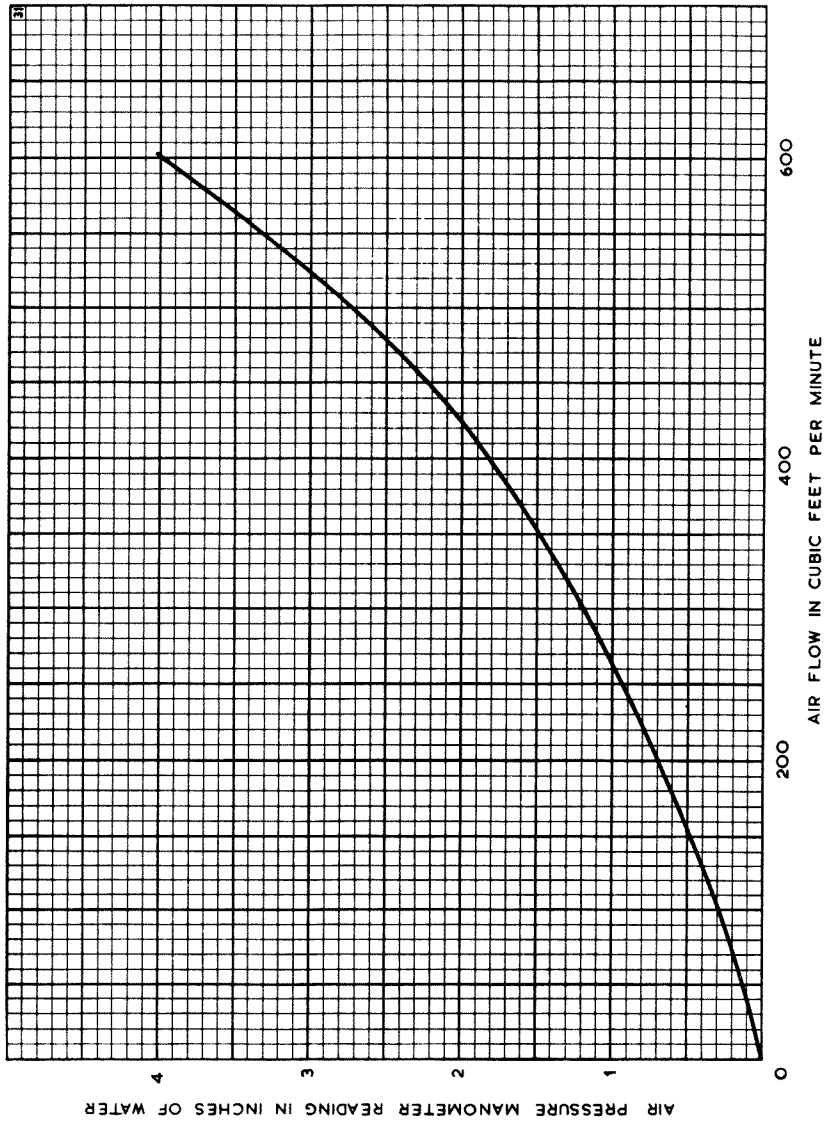
AIR FLOW CHARACTERISTIC



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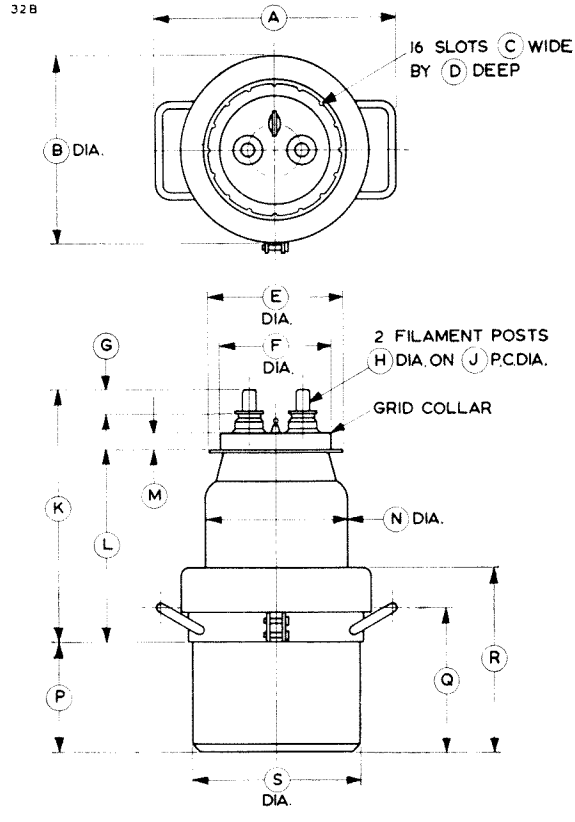
OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	10·500 Max	266·7 Max	K	11·000 Max	279·4 Max
B	8·000 Max	203·2 Max	L	8·375 Max	212·7 Max
C	0·153	3·89	M	0·734	18·64
D	0·205	5·21	N	6·000 Max	152·4 Max
E	5·630	143·0	P	4·500	114·3
F	4·703	119·5	Q	5·937	150·8
G	1·000	25·40	R	7·625	193·7
H	0·625	15·88	S	7·062 Max	179·4 Max
J	2·250	57·15			

Millimetre dimensions have been derived from inches.

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BR1122

R.F. POWER TRIODE

ABRIDGED DATA

Forced-air Cooled Transmitting Triode with grid terminal suitable for cathode drive operation.

Anode Dissipation	10	kW Max
Anode Voltage	12	kV Max
Frequency for full ratings	5·0	MHz Max
Frequency at reduced ratings	110	MHz Max
Output Power (Class C Telegraphy)	29	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	6·0	V
Filament Current	115	A
Maximum Filament Starting Current	(*See Note* 2)	
Filament Cold Resistance	0·006	Ω
Peak Usable Cathode Current	20	A
Perveance	1·4	$mA/V^{3/2}$
Amplification Factor (V_a = 5·0kV, I_a = 1·0A)	37	
Mutual Conductance (V_a = 5·0kV, I_a = 1·0A)	19	mA/V
Inter-electrode Capacitances:		
Grid to Anode	31	pF
Grid to Filament	38	pF
Anode to Filament	0·5	pF

Mechanical

Overall Length	13·875 inches	(352·4 mm)	Max
Overall Width (over handles)	10·125 inches	(257·2 mm)	Max
Net Weight	25 pounds	(11·5 kg)	Approx
Mounting Position	Vertical, filament end up		

Accessories

Filament Leads	MA135 or MA135A
Grid Connector	MA66A

COOLING

The required quantity of air through the radiator for cooling is indicated on the graphs (pages 8 and 9) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 15ft³/min (0·43m³/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperatures of the seals.

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

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R.F. POWER TRIODE

R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	12	kV Max
Anode Current	3·5	A Max
Anode Dissipation	10	kW Max
Grid Dissipation	500	W Max
Operating Frequency (for full ratings)	5·0	MHz Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	6·0	8·5	10	12	kV
Grid Voltage	−300	−450	−550	−650	V
Peak R.F. Grid Voltage	820	950	1060	1150	V
Anode Current	3·4	3·1	3·2	3·0	A
Grid Current (Approx)	0·47	0·44	0·3	0·21	A
Anode Dissipation	5·4	6·4	7·0	7·0	kW
Grid Dissipation	245	220	155	105	W
Output Power	15	20	25	29	kW
Efficiency	73·5	76	78	80	%

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 6·0V	107	121	A
Amplification Factor (V_a = 5·0kV, I_a = 1·0A)	34	42	
Mutual Conductance (V_a = 5·0kV, I_a = 1·0A)	15	23	mA/V
Grid Voltage (negative value) (V_a = 5·0kV, I_a = 1·0A)	41	71	V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	380	V
Anode Current (V_a = 2·0kV, V_g = +200V)	5·1	6·9	A

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R.F. POWER TRIODE

MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
5	12 kV	10 kV
20	10 kV	8 kV
50	8·5 kV	6·7 kV
110	6·5 kV	5·3 kV

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.

2. The filament current must not exceed 260A, even momentarily, at any time.

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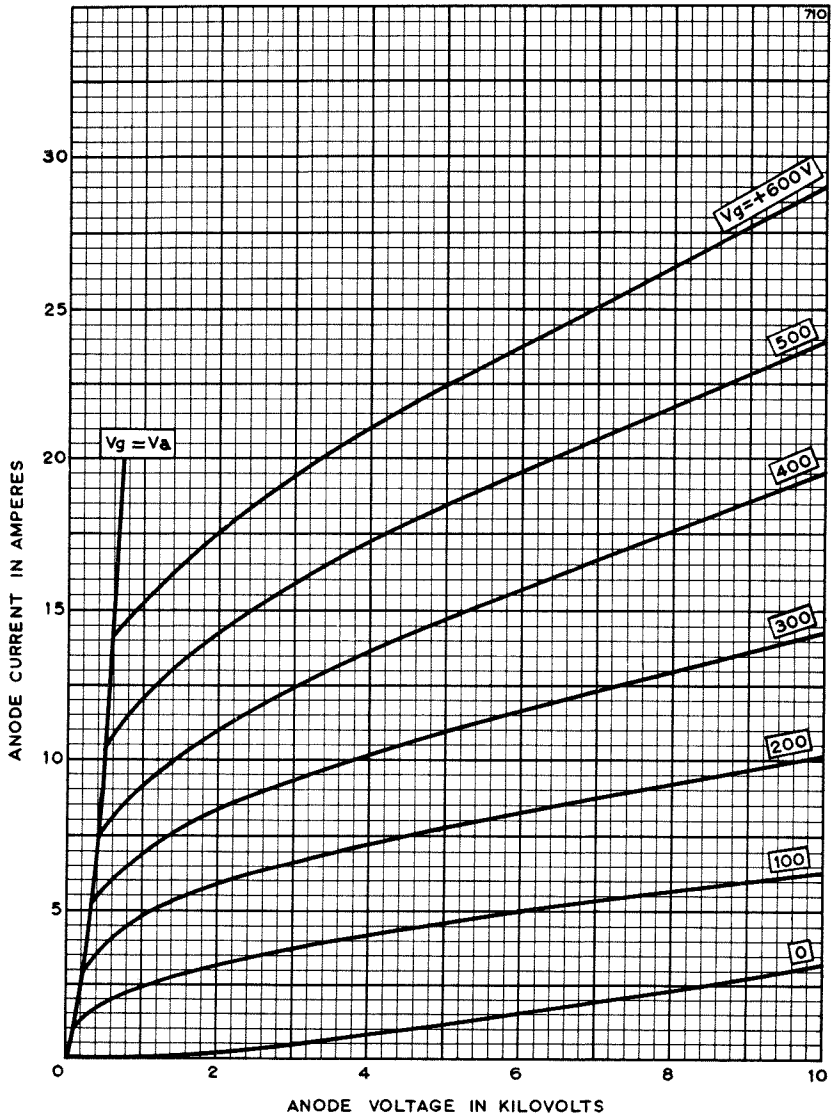
R.F. POWER TRIODE

ANODE CHARACTERISTICS



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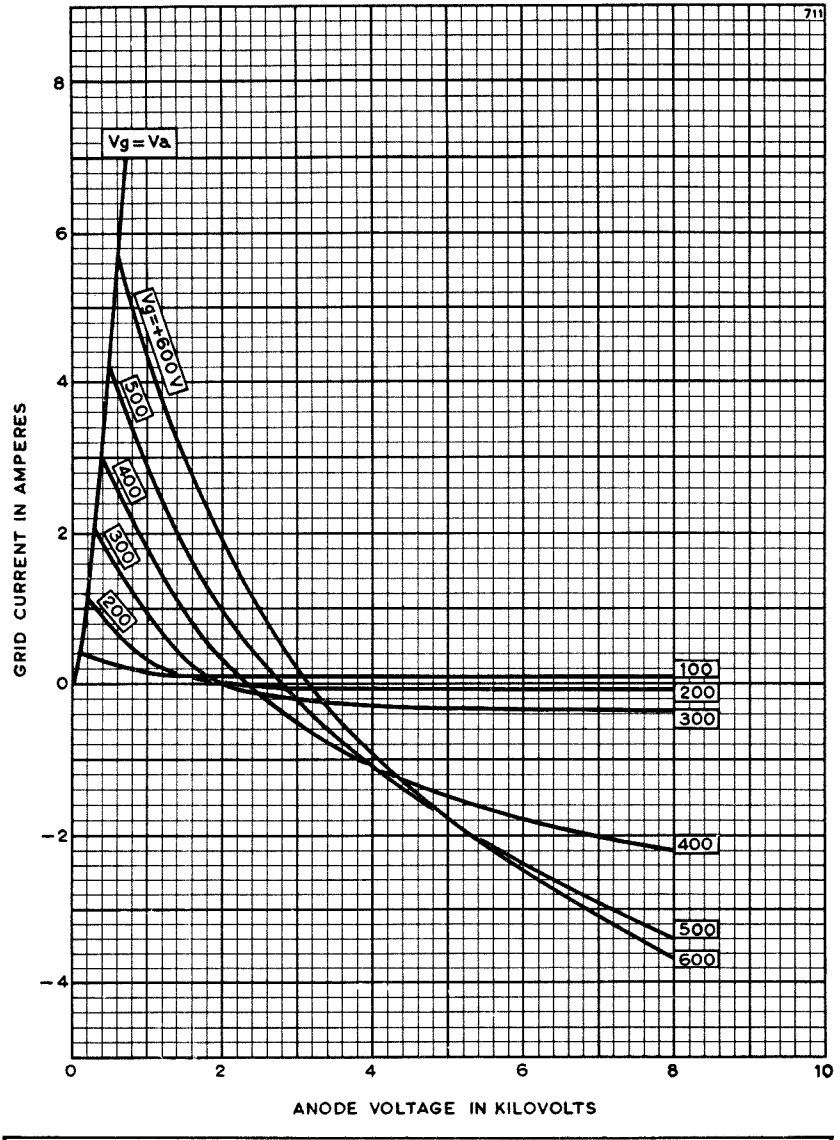
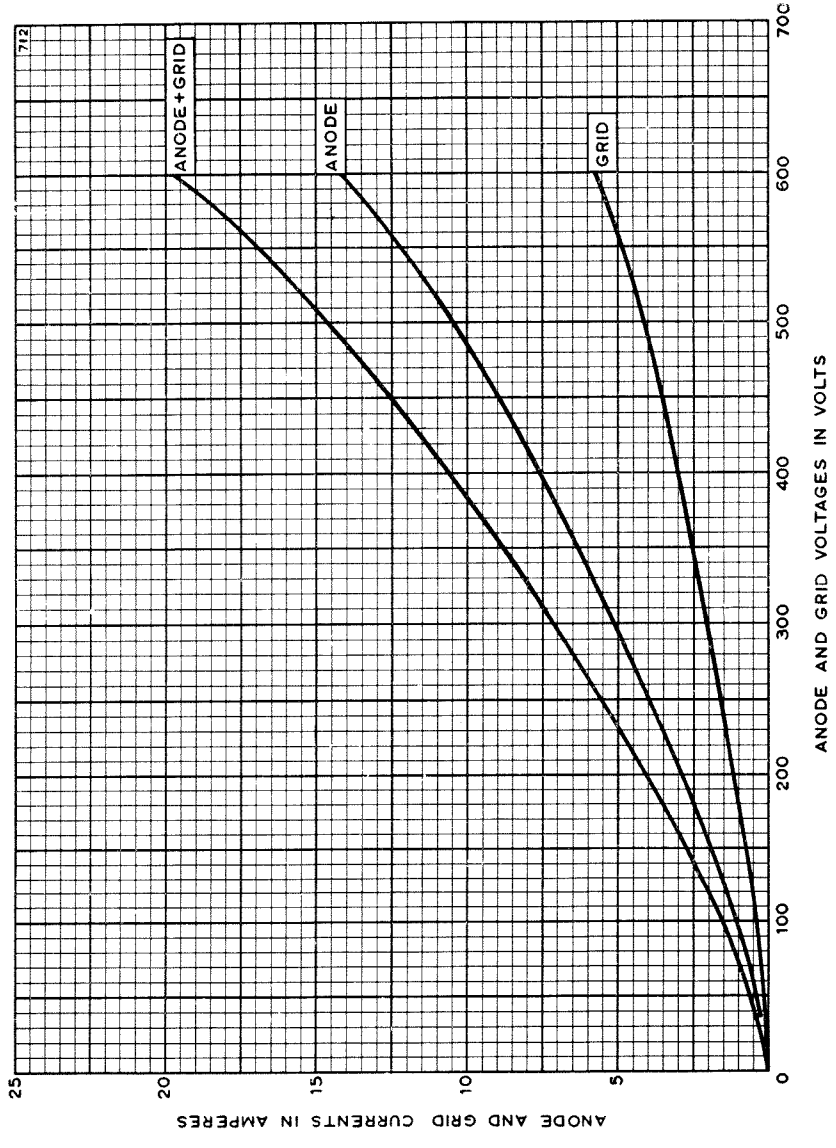
R.F. POWER TRIODE

CONTROL GRID CHARACTERISTICS



R.F. POWER TRIODE

STRAPPED CHARACTERISTICS



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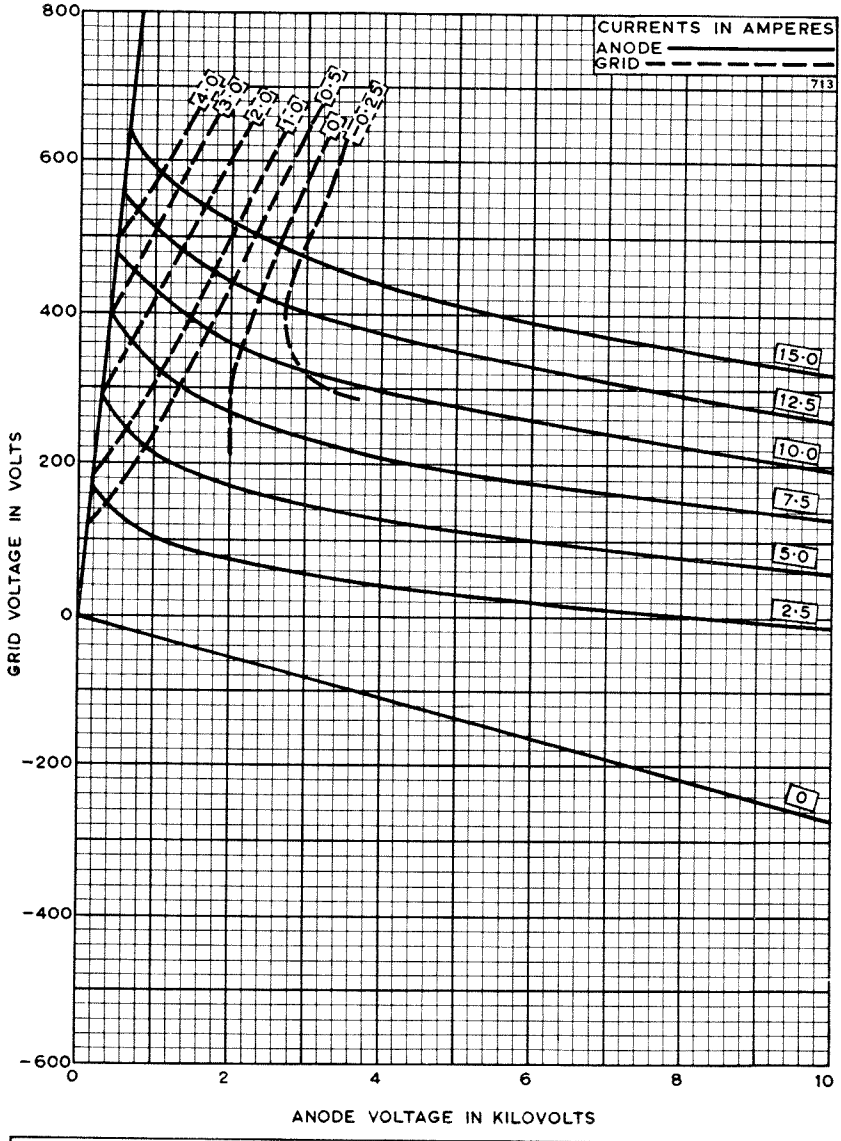
R.F. POWER TRIODE

CONSTANT CURRENT CHARACTERISTICS



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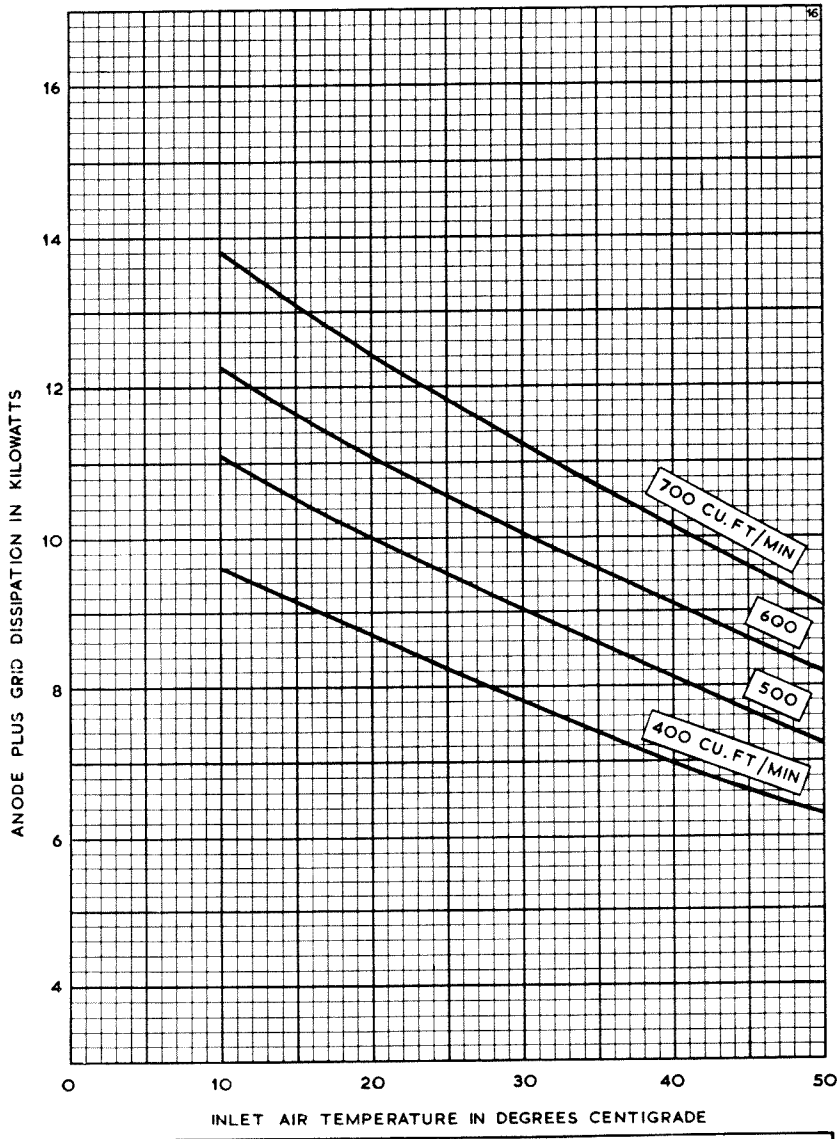
R.F. POWER TRIODE

AIR COOLING CHARACTERISTICS



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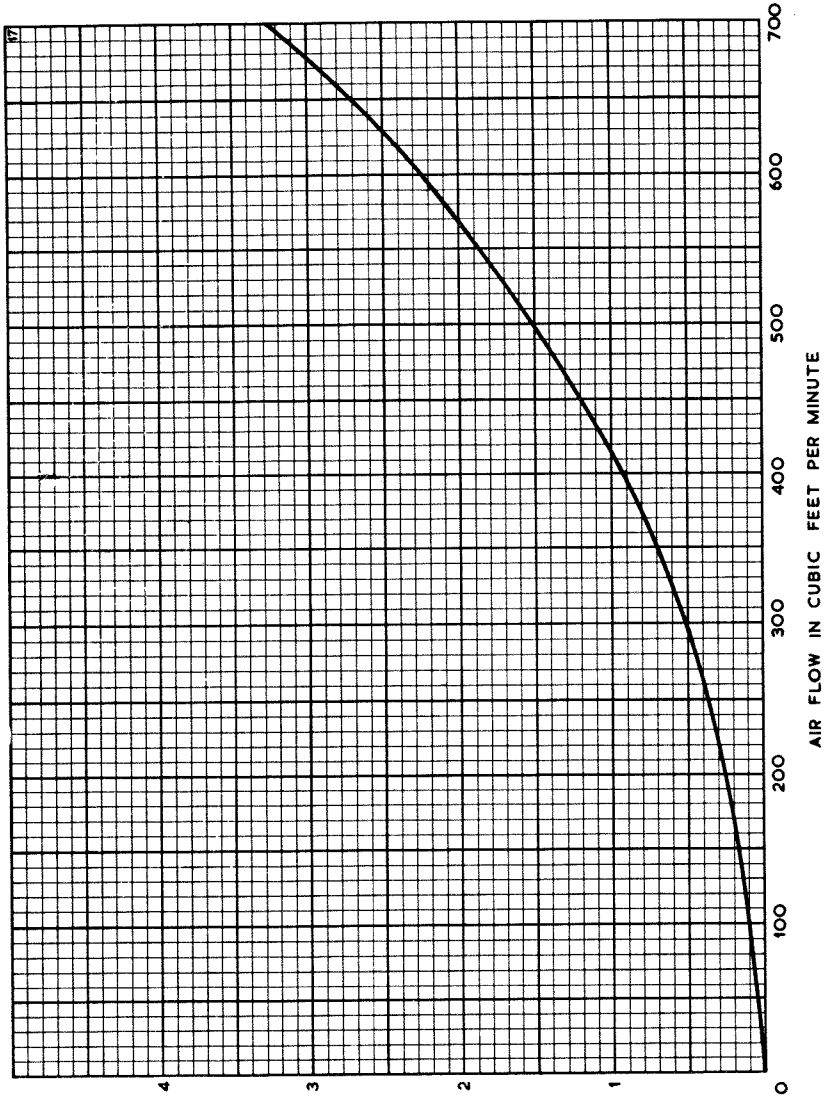
R.F. POWER TRIODE

AIR FLOW CHARACTERISTIC



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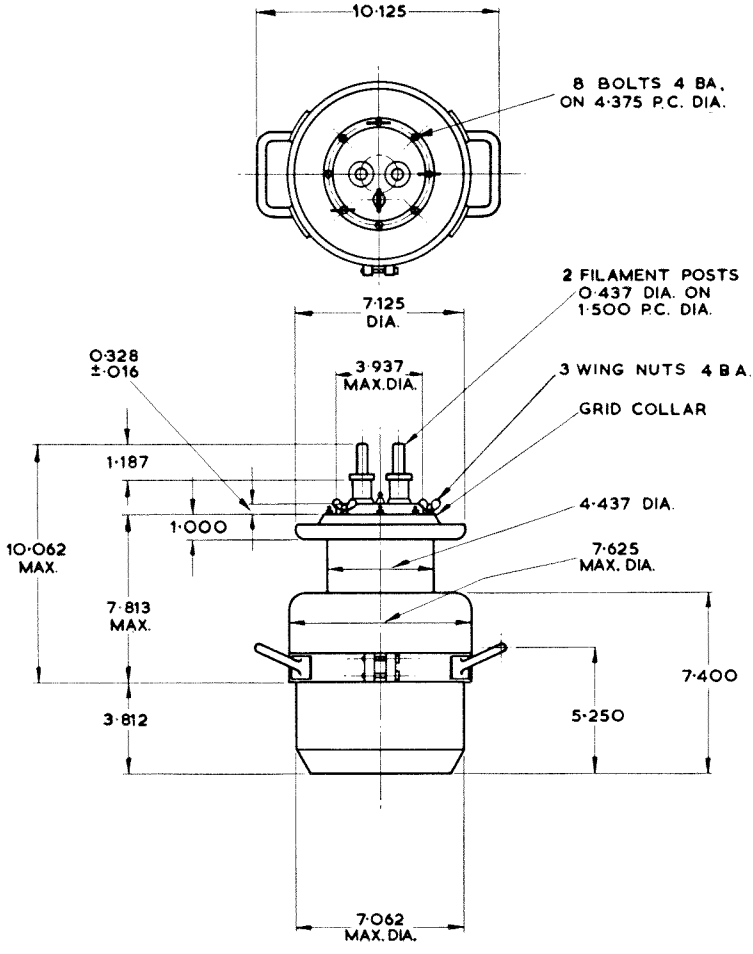
OUTLINE

498



ALL DIMENSIONS IN INCHES

R.F. POWER TRIODE

BR1124

ABRIDGED DATA

Forced-air Cooled Triode designed primarily for industrial service.

Anode Dissipation	10 kW Max
Anode Voltage	8·5 kV Max
Frequency for full ratings	100 Mc/s Max
Output Power (Class C unmodulated)	20 kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	6·0	V
Filament Current	115	A
Filament Starting Current (Peak) (*See Note* 2)	260	A Max
Filament Cold Resistance	0·006	Ω
Peak Usable Cathode Current	20	A
Perveance	1·4	$mA/V^{3/2}$
Amplification Factor (V_a = 5·0kV, I_a = 1·0A)	37	
Mutual Conductance (V_a = 5·0kV, I_a = 1·0A)	19	mA/V
Inter-electrode Capacitances:		
Grid to Anode	31	pF
Grid to Filament	41	pF
Anode to Filament	0·5	pF

Mechanical

Overall Length	14·000 inches	(355·6 mm)	Max
Overall Width (over handles)	10·500 inches	(266·7 mm)	Max
Net Weight	22 pounds	(10 kg)	Approx
Mounting Position	Vertical, filament end up		

Accessories

Filament Leads	MA135 or MA135A←
Grid Connector	MA66A

COOLING

The required quantity of air through the radiator for cooling is indicated on the graphs (pages 8 and 9) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 15cu.ft/min (0·43cu.m/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

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

← Indicates a change

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R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage (*See Note* 3)	8·5 kV Max
Anode Current	3·5 A Max
Anode Dissipation (*See Note* 4)	10 kW Max
Grid Dissipation	500 W Max
Frequency (for full ratings)	100 Mc/s Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	6·0	8·5	kV
Grid Voltage	−300	−450	V
Grid Resistor	640	1025	Ω
Peak R.F. Grid Voltage	820	950	V
Anode Current	3·4	3·1	A
Grid Current (Approx)	0·47	0·44	A
Anode Dissipation	5·4	6·4	kW
Grid Dissipation	245	220	W
Driving Power	385	420	W
Output Power (*See Note* 5)	15	20	kW
Efficiency	73·5	76	%
Load Resistance	900	1400	Ω

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 6·0V	107	121	A
Amplification Factor (V_a = 5·0kV, I_a = 1·0A)	34	42	
Mutual Conductance (V_a = 5·0kV, I_a = 1·0A)	15	23	mA/V
Grid Voltage (negative value) (V_a = 5·0kV, I_a = 1·0A)	41	71	V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	380	V
Anode Current (V_a = 2·0kV, V_g = +200V)	5·1	6·9	A

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NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ± 5%.
2. The filament current must not exceed 260A, even momentarily, at any time.
3. This is the highest nominal operating voltage to be used. It makes allowance for the normal mains voltage fluctuations as well as tolerances in the equipment.
4. The valve can dissipate higher powers for periods up to 15 seconds provided that the average over a long period does not exceed the maximum stated.
5. The output power specified does not take into account the anode circuit efficiency.

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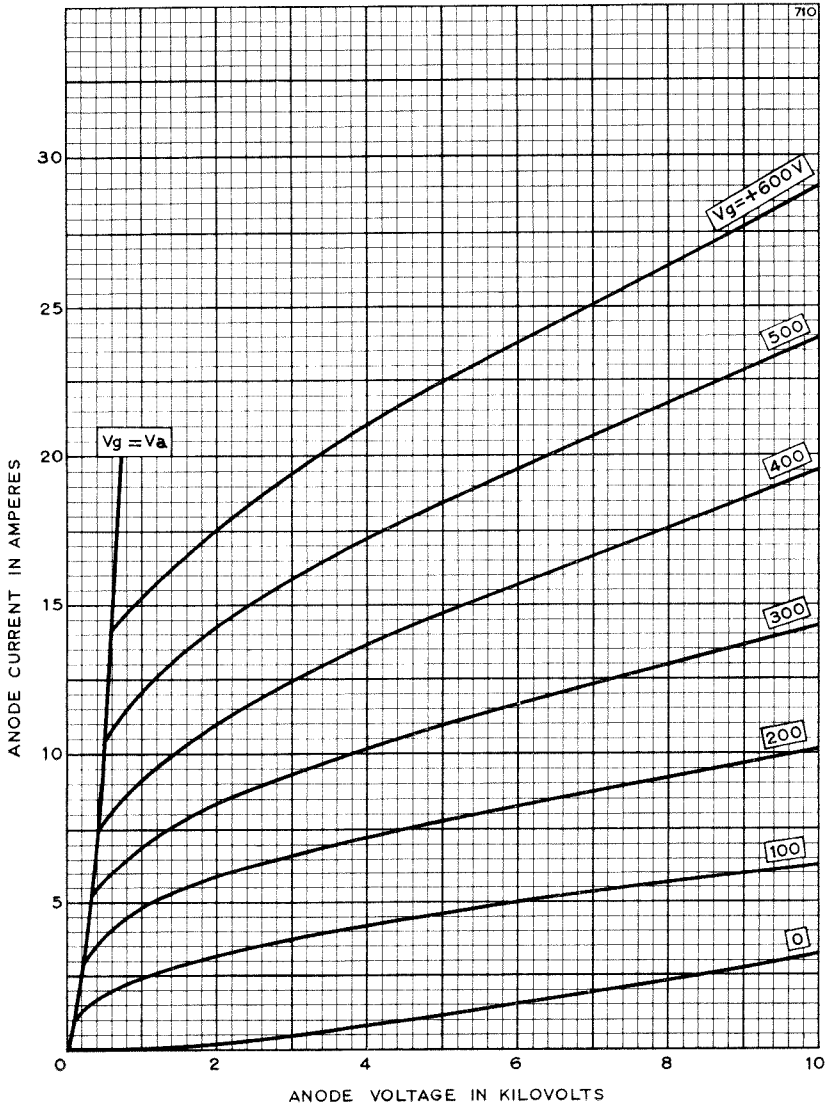
ANODE CHARACTERISTICS



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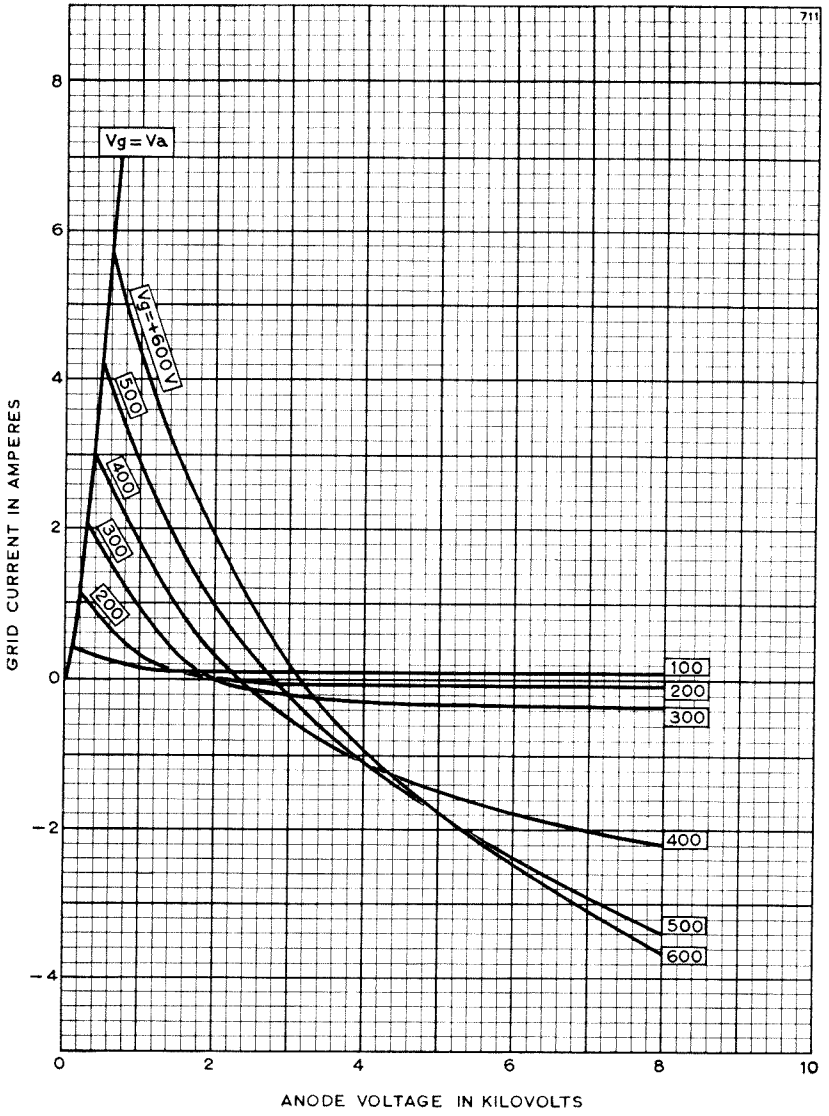
CONTROL GRID CHARACTERISTICS



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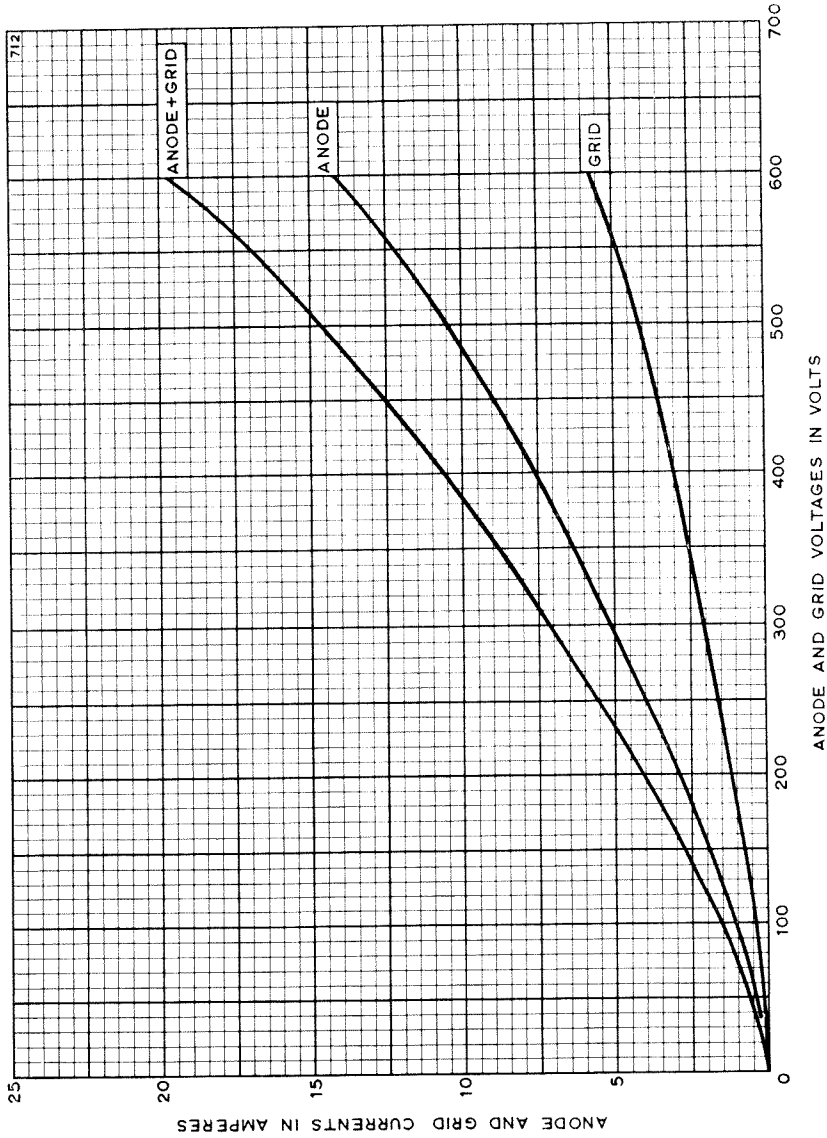
STRAPPED CHARACTERISTICS



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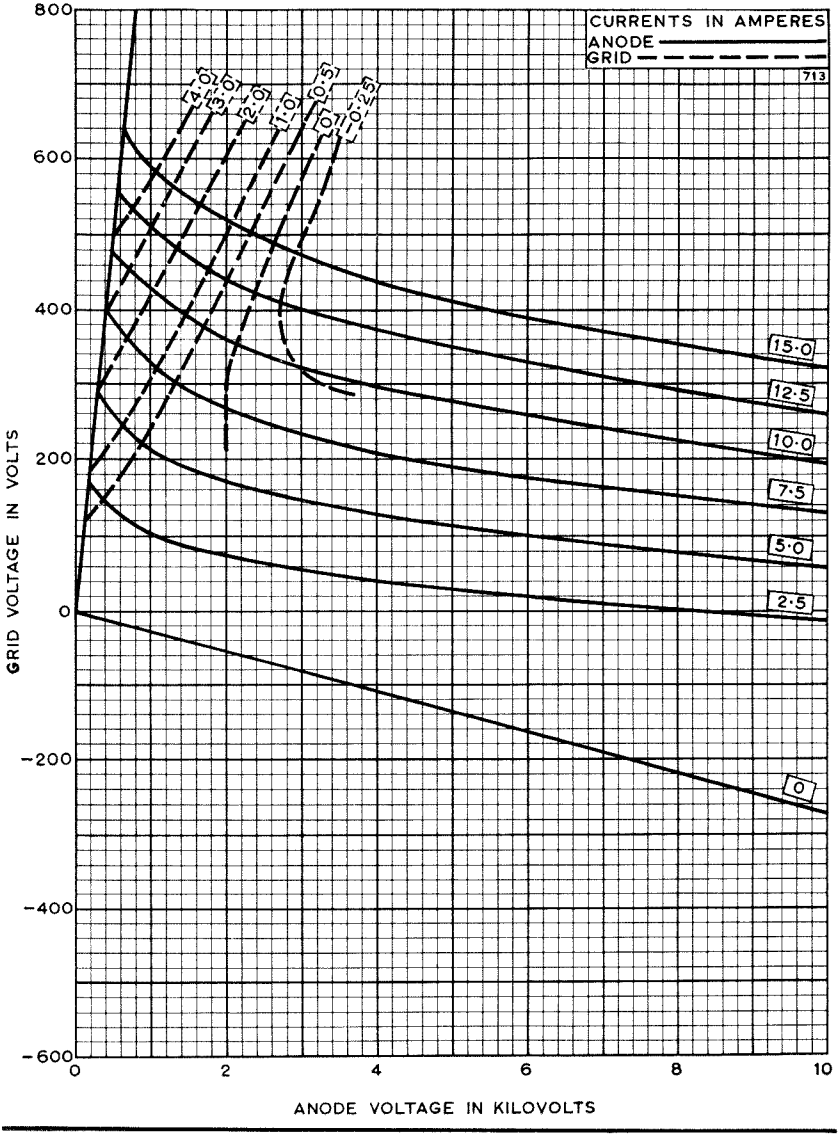
CONSTANT CURRENT CHARACTERISTICS



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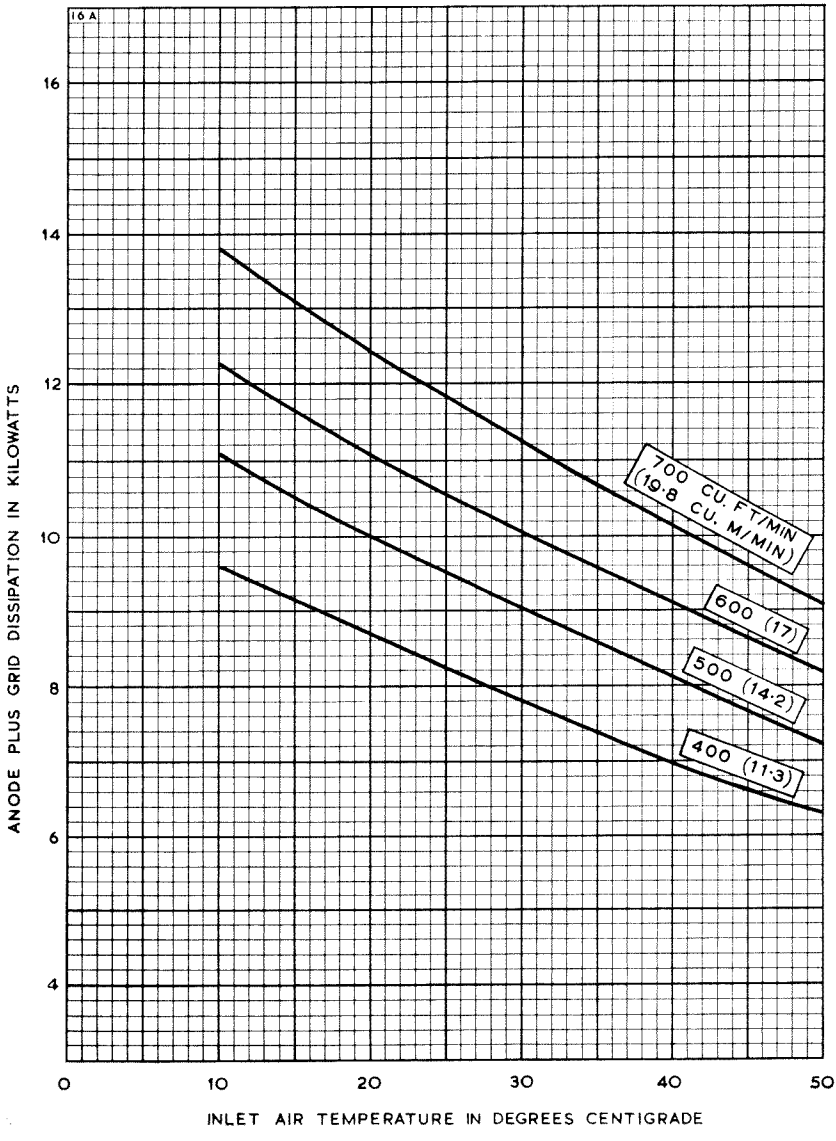
AIR COOLING CHARACTERISTICS



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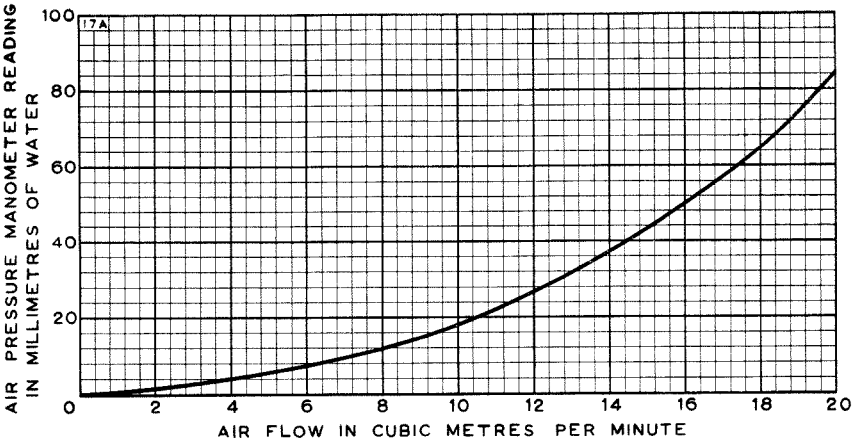
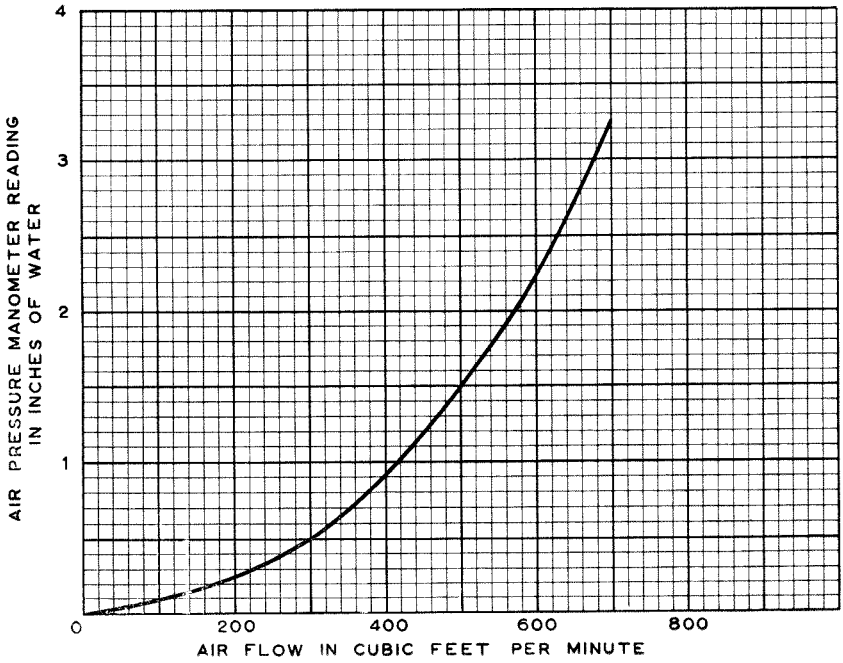
AIR FLOW CHARACTERISTIC





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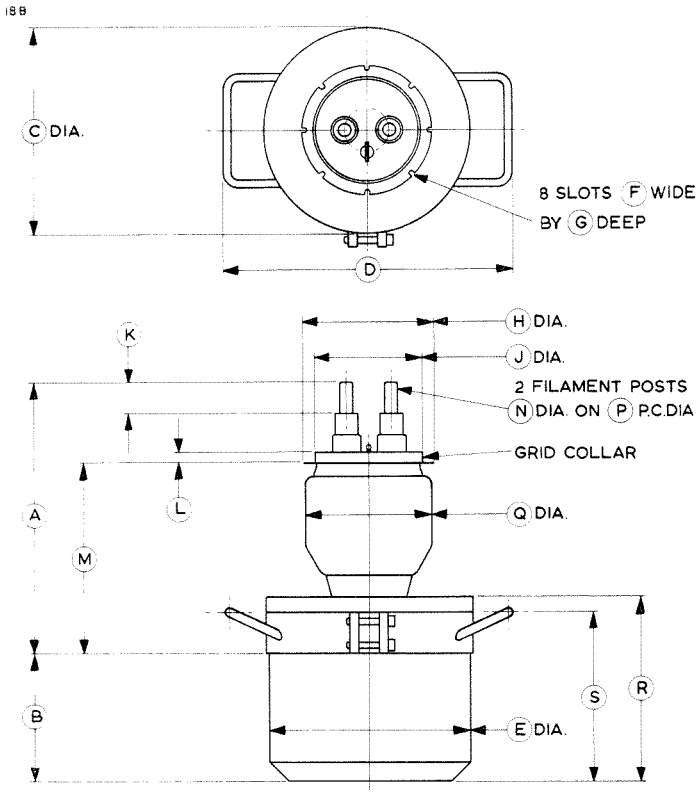
OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	9·500 Max	241·3 Max	K	1·125	28·58
B	4·500	114·3	L	0·375	9·53
C	8·000 Max	203·2 Max	M	6·600 ± 0·200	167·6 ± 5·1
D	10·500 Max	266·7 Max	N	0·437	11·10
E	7·062 Max	179·4 Max	P	1·500	38·10
F	0·182	4·62	Q	4·437	112·7
G	0·205	5·21	R	6·500	165·1
H	4·562	115·9	S	5·937	150·8
J	3·750	95·25			

Millimetre dimensions have been derived from inches.

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R.F. POWER TRIODE

BR1126

ENGLISH ELECTRIC

ABRIDGED DATA

Forced-air Cooled Triode intended primarily for industrial service. Identical with BR1115 apart from radiator.

Anode Dissipation	3·0 kW Max
Anode Voltage	6·0 kV Max
Frequency for full ratings	30 MHz Max
Frequency at reduced ratings	110 MHz Max
Output Power (Class C unmodulated)	7·1 kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	15	V
Filament Current	39	A
Filament Starting Current (Peak) (*See Note* 2)	230	A Max
Filament Cold Resistance	0·042	Ω
Peak Usable Cathode Current	14	A
Perveance	2·0	$mA/V^{3/2}$
Amplification Factor ($V_g = -25V$, $I_a = 0·75A$)	30	
Mutual Conductance ($V_a = 2·5kV$, $I_a = 0·9A$)	20	mA/V
Inter-electrode Capacitances:		
Grid to Anode	23	pF
Grid to Filament	22·5	pF
Anode to Filament	0·5	pF

Mechanical

Overall Length (excluding flexible connectors)	7·937 inches	(201·6 mm)	Max
Overall Diameter	6·531 inches	(165·9 mm)	Max
Net Weight	9·75 pounds	(4·45 kg)	Approx
Mounting Position		Vertical, either end up	

Accessories

Grid Connector	MA66A

COOLING

The required quantity of air through the radiator for cooling is indicated on the graphs (pages 8 and 9) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of $10ft^3/min$ ($0·28m^3/min$) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperatures of the seals.

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MAXIMUM TEMPERATURES

Incoming Air Temperature	45	°C Max
Radiator Temperature (measured on the core at the end away from the incoming air)	180	°C Max
Bulb Temperature (at hottest part)	150	°C Max
Seal Temperatures:		
Filament	175	°C Max
Grid and Anode	150	°C Max

R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage (*See Note* 3)	6·0	kV Max
Anode Current	1·75	A Max
Anode Dissipation (*See Note* 4)	3·0	kW Max
Grid Voltage	−1·0	kV Max
Grid Current (*See Note* 5)	0·35	A Max
Operating Frequency (for full ratings)	30	MHz Max
Anode Voltage for operation up to 110MHz	5·0	kV Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	4·0	6·0	kV
Grid Voltage	−280	−350	V
Grid Resistor	835	1130	Ω
Anode Current	1·54	1·63	A
Grid Current (Approx)	0·336	0·310	A
Anode Dissipation	2·0	2·7	kW
Grid Dissipation	69	66	W
Driving Power	163	174	W
Peak R.F. Grid Voltage	525	600	V
Output Power	4·1	7·1	kW
Efficiency	66·5	72·5	%
Load Resistance	1100	1750	Ω

Printed in England

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 15V ..	36·6	41·3	A
Amplification Factor (I_a = 0·75A, V_g = −25V)	25	35	
Mutual Conductance (V_a = 2·5kV, I_a = 0·9A)	18	24	mA/V
Grid Voltage (negative value) (V_a = 6·0kV, I_a = 50mA)	140	280	V
Grid Voltage (negative value) (V_a = 6·0kV, I_a = 0·55A)	120	240	V
Anode Current (V_a = 0·3kV, V_g = +150V) ..	2·13	3·24	A
Grid Current (V_a = 0·3kV, V_g = +150V) ..	—	1·44	A
Inter-electrode Capacitances:			
Grid to Anode	19·5	26·5	pF
Grid to Filament	18	27	pF
Anode to Filament	0·25	0·75	pF

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.
2. The filament current must not exceed 230A, even momentarily, at any time.
3. This is the highest nominal operating voltage to be used. It makes allowance for the normal mains voltage fluctuations as well as tolerances in the equipment.
4. The valve can dissipate higher powers for periods up to 15 seconds provided that the average over a long period does not exceed the maximum stated.
5. The customer should consult English Electric Valve Company Limited if the valve is to be used in r.f. oscillators operating at frequencies of 30MHz or more and where the direct grid current is likely to exceed 250mA.

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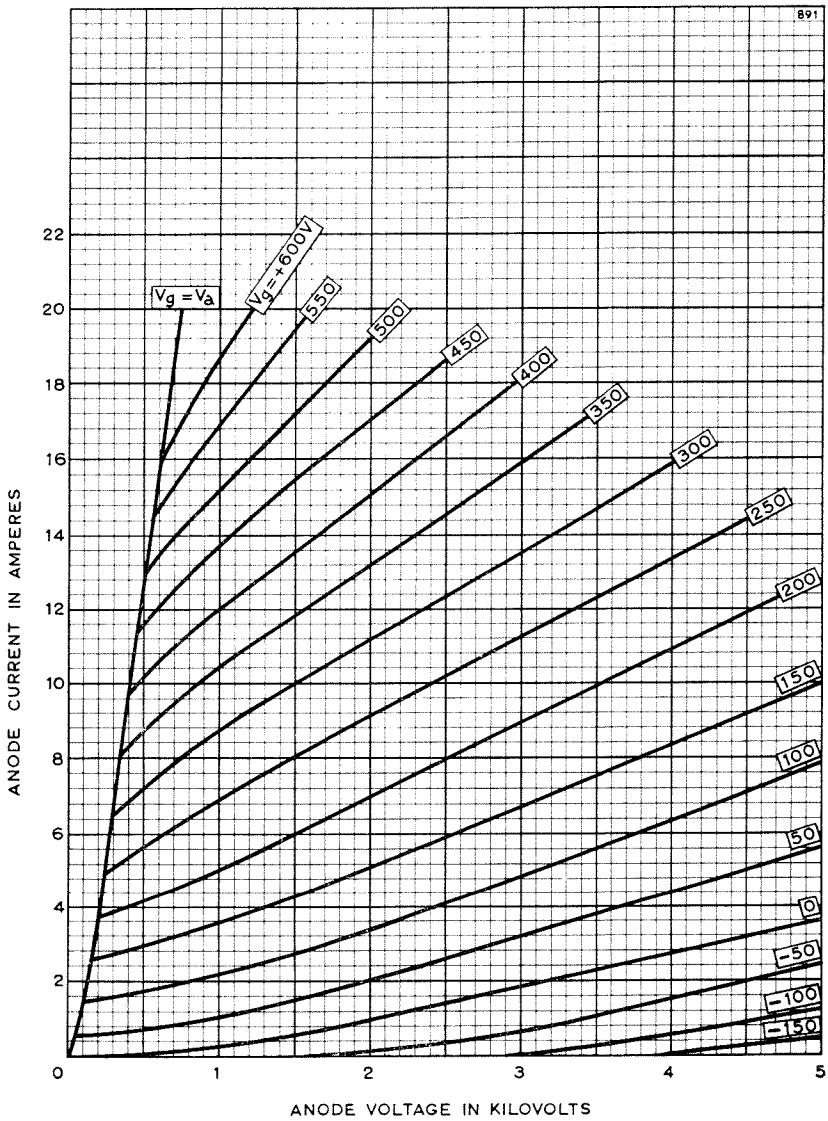
ANODE CHARACTERISTICS



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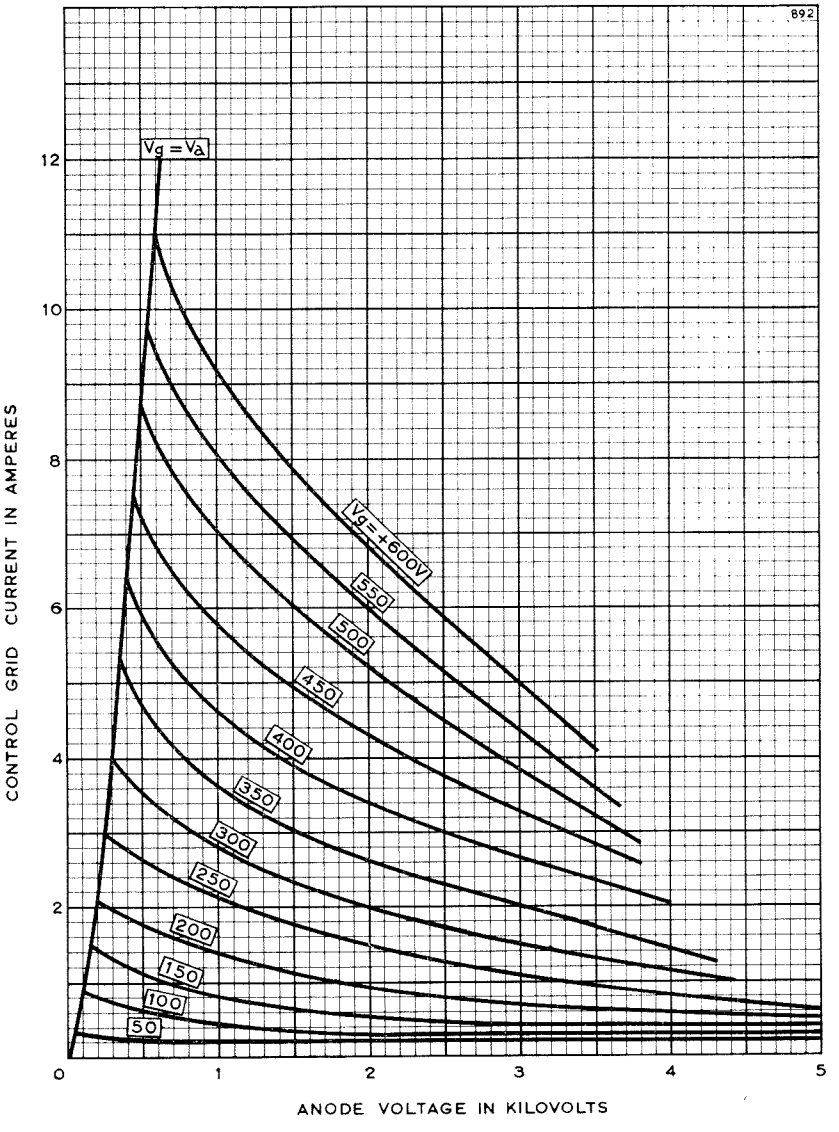
CONTROL GRID CHARACTERISTICS



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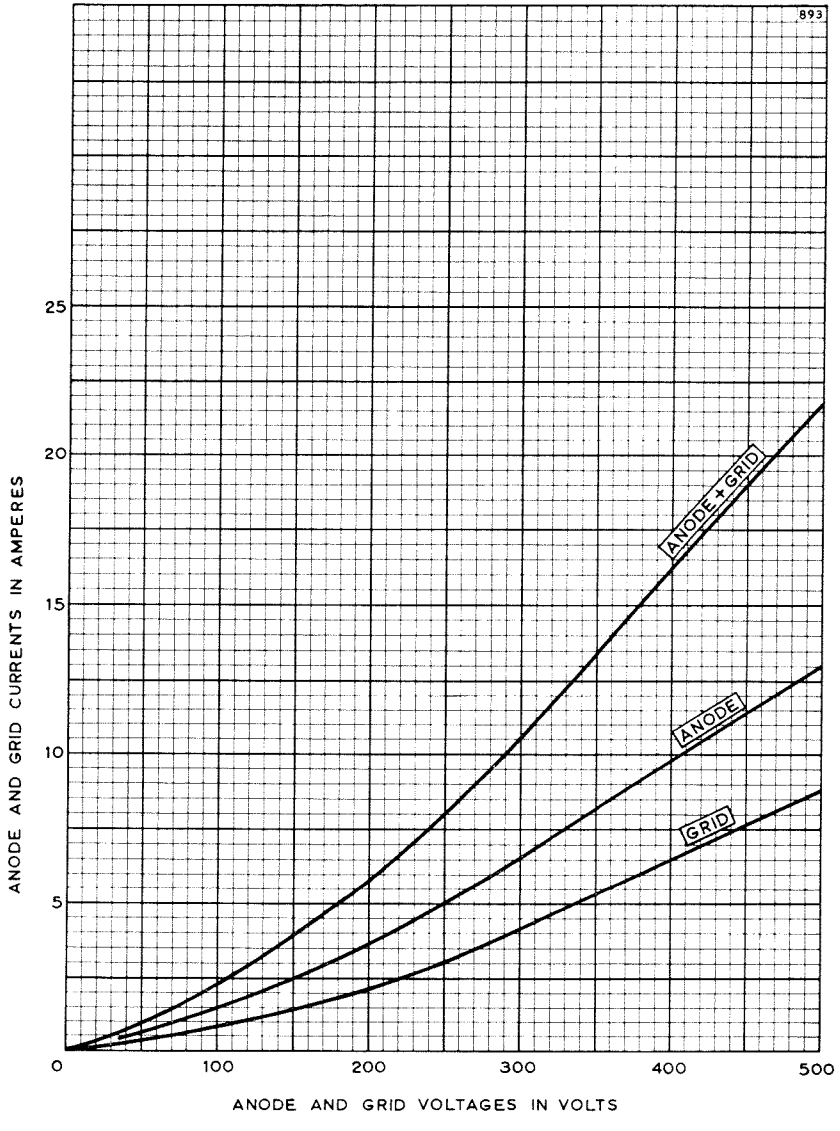
STRAPPED CHARACTERISTICS



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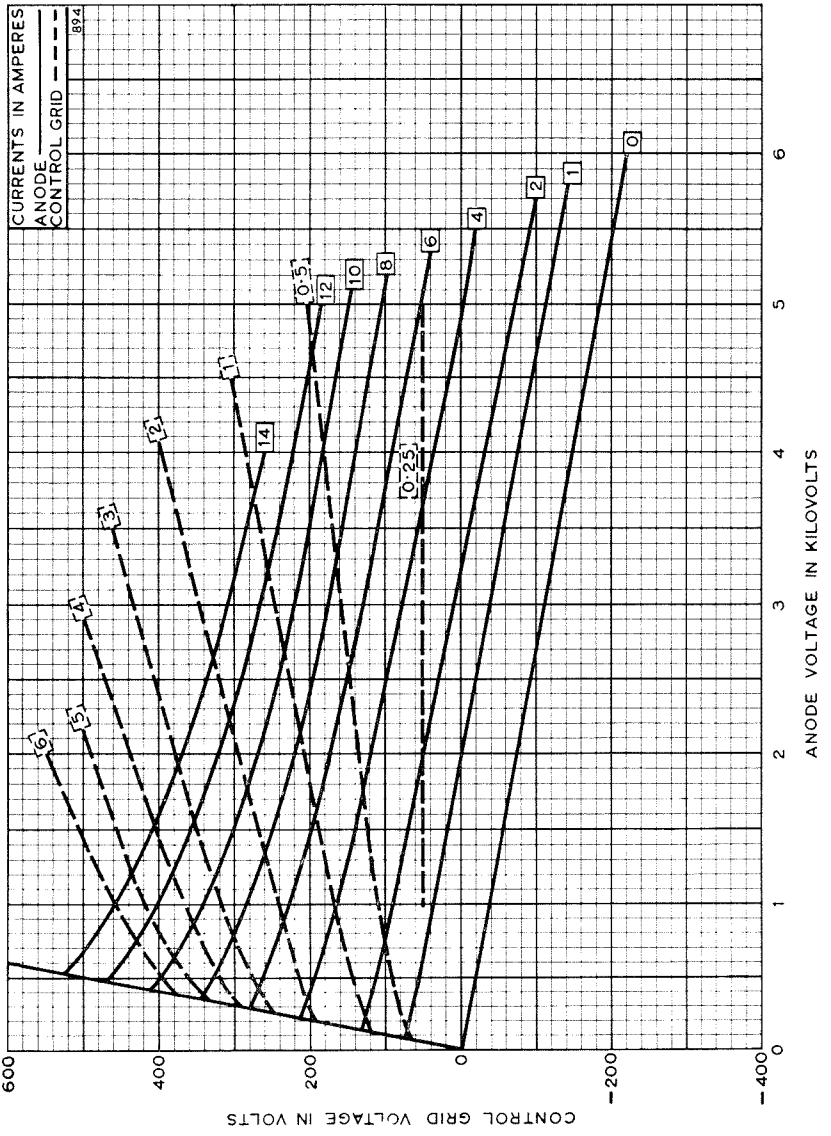
CONSTANT CURRENT CHARACTERISTICS



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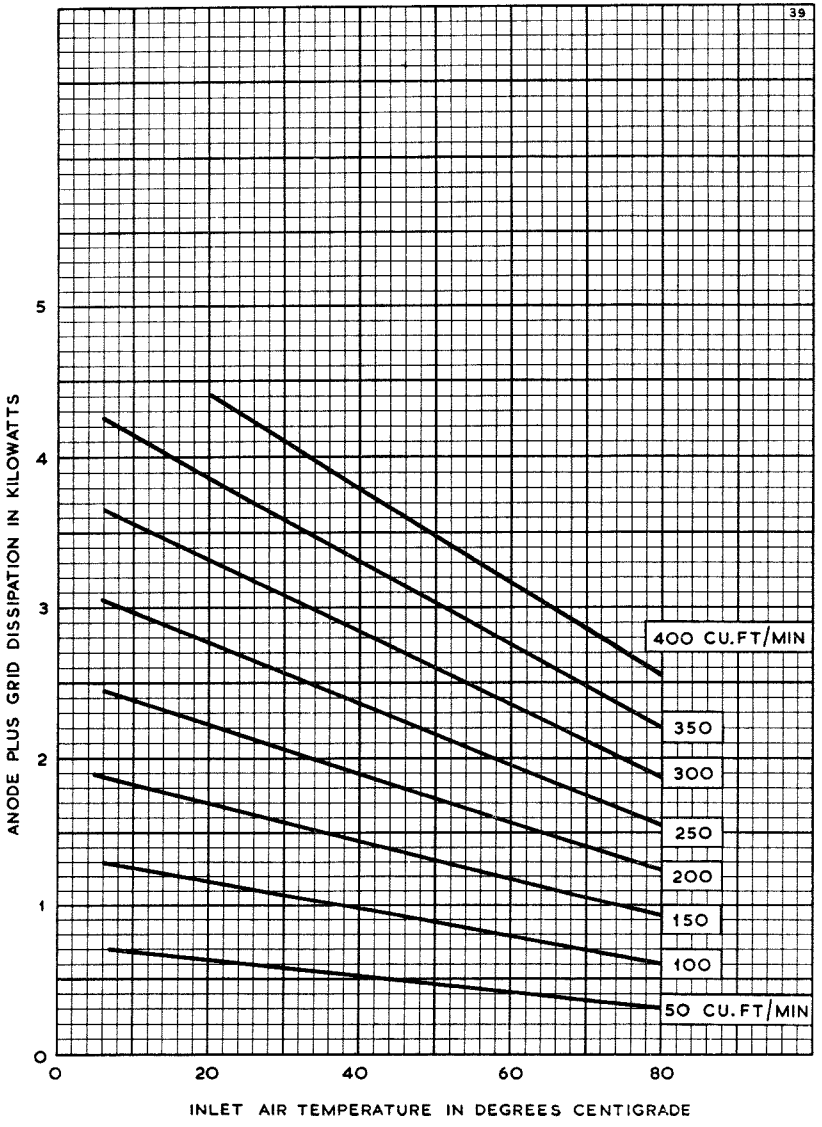
AIR COOLING CHARACTERISTICS



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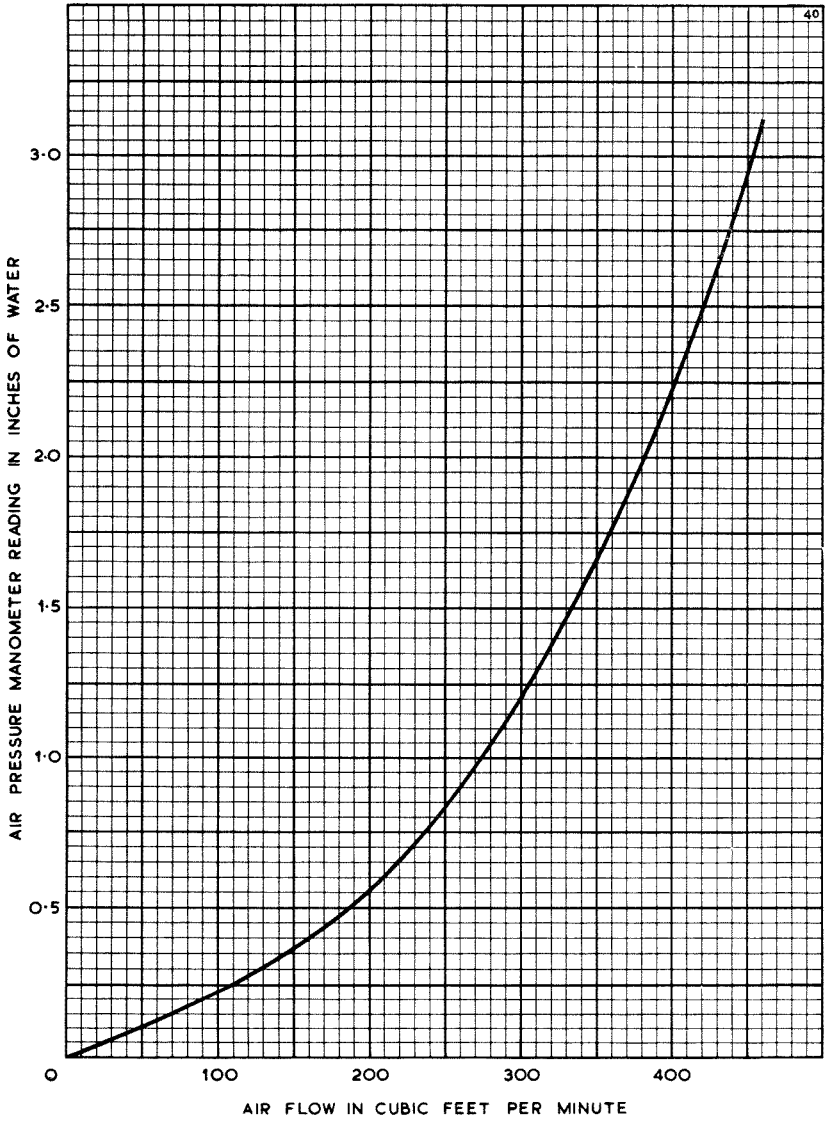
AIR FLOW CHARACTERISTIC



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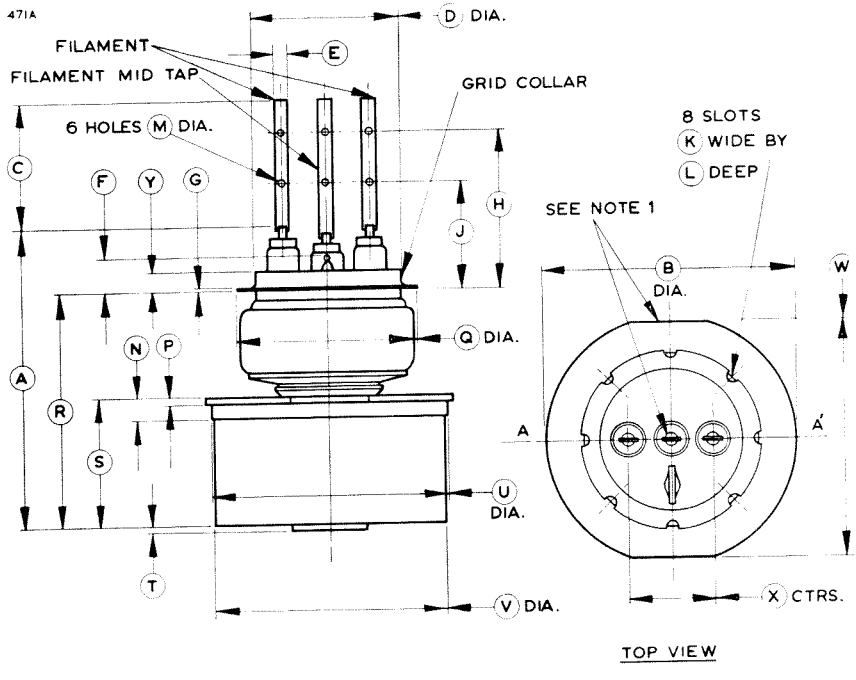

Note 1 Plane of filament leads will be parallel to flats to within 5°, and to plane A—A′ to within 3·5°

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	7·750 Max	196·9 Max	N	0·500 ± 0·020	12·70 ± 0·51
B	6·500 ± 0·031	165·10 ± 0·79	P	0·125 ± 0·010	3·18 ± 0·25
C	3·500 Min	88·90 Min	Q	4·562 ± 0·031	115·87 ± 0·79
D	3·750	95·25	R	6·047 ± 0·125	153·59 ± 3·18
E	0·312 ± 0·062	7·92 ± 1·57	S	3·500 Max	88·90 Max
F	1·250 Max	31·75 Max	T	0·187 Max	4·75 Max
G	0·080 ± 0·015	2·03 ± 0·38	U	6·250 ± 0·015	158·45 ± 0·38
H	3·875 ± 0·375	98·42 ± 9·53	V	6·000 Max	152·4 Max
J	2·500 ± 0·375	63·50 ± 9·53	W	6·250	158·8
K	0·182	4·62	X	2·500 Max	63·50 Max
L	0·205	5·21	Y	0·437 ± 0·020	11·10 ± 0·50
M	0·144	3·66			

Millimetre dimensions have been derived from inches.

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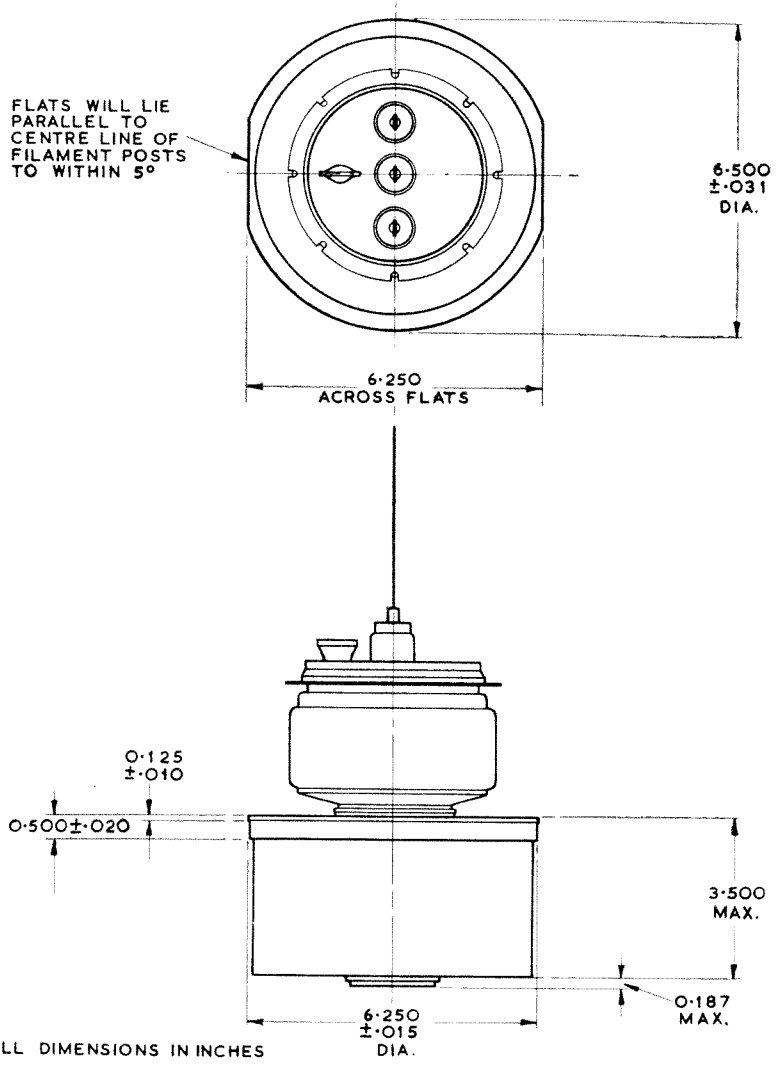
OUTLINE

42



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R.F. POWER TRIODE

BR1129

December 1967

ENGLISH ELECTRIC

GENERAL

The BR1129 is a forced-air cooled transmitting Triode designed primarily for use as an amplifier or oscillator in cathode-drive circuits operating at frequencies up to 175MHz. It is a maintenance type and therefore only abridged data are given on this sheet. **Full information is available on request.**

Filament	Thoriated Tungsten	
Filament Voltage	5·0	V
Filament Current	43·5	A
Maximum Filament Starting Current	98	A Max
Filament Cold Resistance	13	mΩ
Peak Usable Cathode Current	7·5	A
Amplification Factor (V_a = 2·0kV, I_a = 0·5A)	20	
Mutual Conductance (V_a = 2·0kV, I_a = 0·5A)	12	mA/V

MAXIMUM RATINGS

Anode Voltage	3·0	kV Max
Anode Current	1·5	A Max
Anode Dissipation	2·0	kW Max
Grid Dissipation	120	W Max
Frequency for above ratings	175	MHz Max

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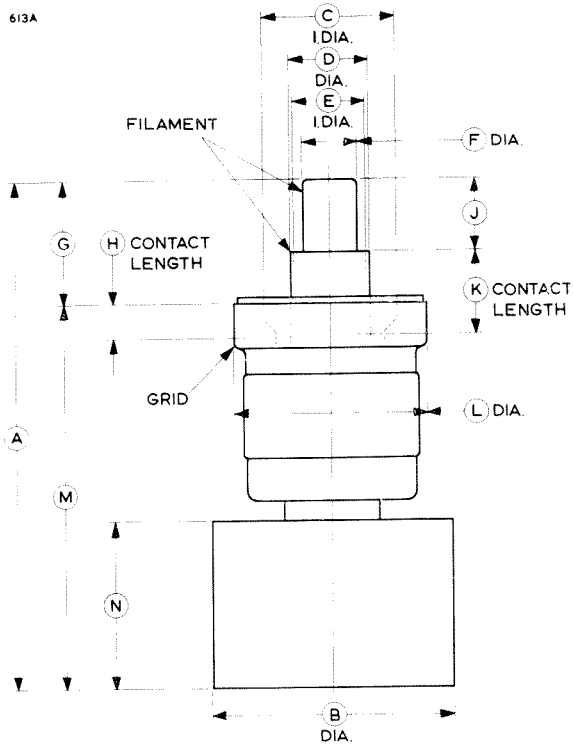
OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	5·406 Max	137·3 Max	H	0·312 Min	7·92 Min
B	2·500 ± 0·010	63·50 ± 0·25	J	0·750 ± 0·031	19·05 ± 0·79
C	1·375 Min	34·93 Min	K	0·812 Min	20·62 Min
D	0·834 ± 0·005	21·18 ± 0·13	L	2·006 ± 0·005	50·95 ± 0·13
E	0·750 Min	19·05 Min	M	3·969 ± 0·031	100·8 ± 0·79
F	0·578 ± 0·004	14·681 ± 0·102	N	1·750 ± 0·062	44·45 ± 1·57
G	1·281 ± 0·125	32·54 ± 3·18			

Millimetre dimensions have been derived from inches.

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POWER TRIODE

BR1129

INTRODUCTION

The BR1129 is a forced-air cooled transmitting Triode designed primarily for use as an amplifier or oscillator in cathode-drive circuits operating at frequencies up to 175Mc/s. It has a maximum anode dissipation of 2kW.

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	5·0	V
Filament Current	43·5	A
Maximum Filament Starting Current	(*See Note* 2)	
Filament Cold Resistance	0·013	Ω
Peak Usable Cathode Current	7·5	A
Amplification Factor (at V_a = 2·0kV, I_a = 0·5A)	20	
Mutual Conductance (at V_a = 2·0kV, I_a = 0·5A)	12	mA/V
Inter-electrode Capacitances:		
Grid to Anode	13·0	pF
Grid to Filament	17·5	pF
Anode to Filament	0·4	pF

Mechanical

Overall Length	5·41 inches (138 mm)	Max
Overall Diameter	2·51 inches (63·8 mm)	Max
Net Weight	1·7 pounds (800 gm)	Approx
Mounting Position	Vertical, either end up	
Radiator	Integral part of valve	

COOLING

The required quantity of air through the radiator for cooling is indicated on the graphs (pages 6 and 7) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously. An adequate flow of air must be directed between the coaxial filament terminals before and during the application of any voltages in order to limit the temperature of the filament and grid seals.

The temperature of the anode must not exceed 250°C; that of the filament, grid, and anode seals must not exceed 180°C.

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POWER TRIODE

BR1129

MAXIMUM RATINGS

Anode Dissipation		2kW Max
Grid Dissipation	120	W Max

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 5·0V	41·0	45·0	A
Amplification Factor (V_a = 2kV, I_a = 0·5A)	18	24	
Mutual Conductance (V_a = 2kV, I_a = 0·5A)	10	15	mA/V
Grid Voltage (negative value) (V_a = 2kV, I_a = 0·05A)	—	120	V
Anode Current (V_a = 0·5kV, V_g = +200V)	2·8	3·8	A
Grid Current (V_a = 0·5kV, V_g = +200V)	1·75	2·75	A
Peak Cathode Current (V_a = V_g = 1kV)	7·5	—	A
Inter-electrode Capacitances:			
Grid to Anode	12	14	pF
Grid to Filament	16·5	19·0	pF
Anode to Filament	—	0·5	pF

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.

2. The filament current must not exceed 98A, even momentarily, at any time.

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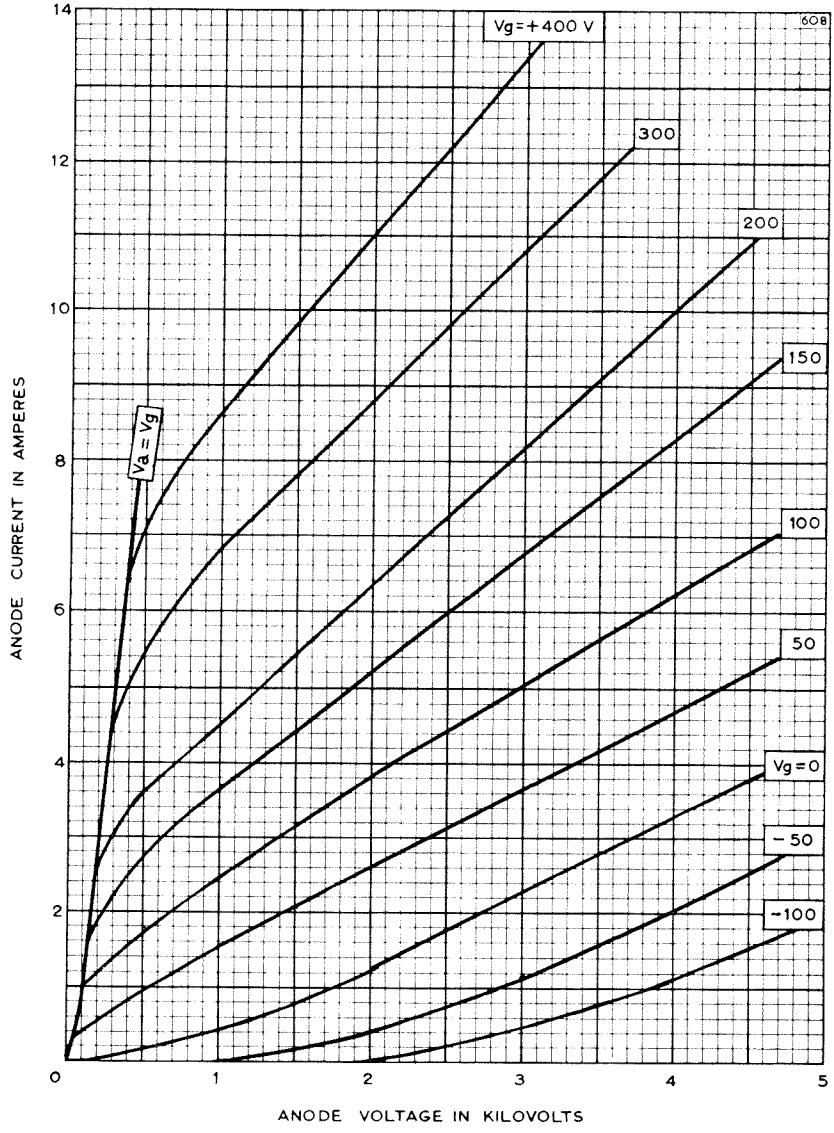
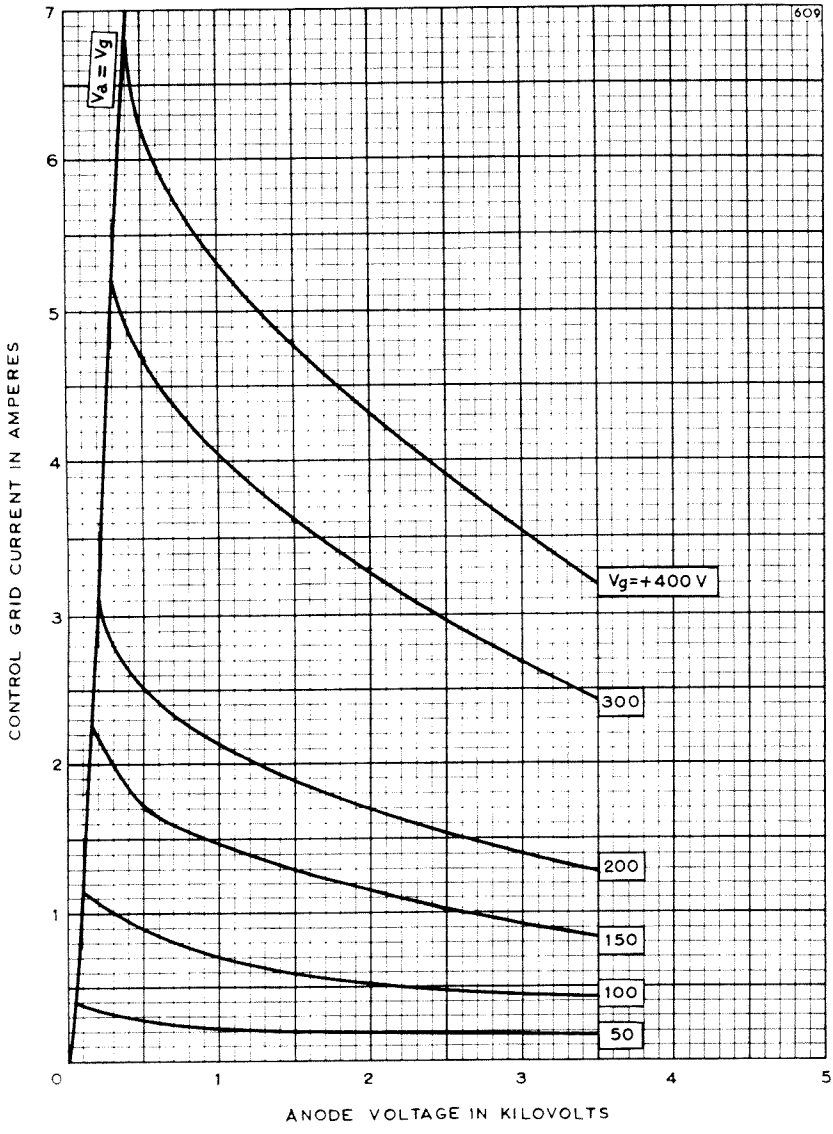
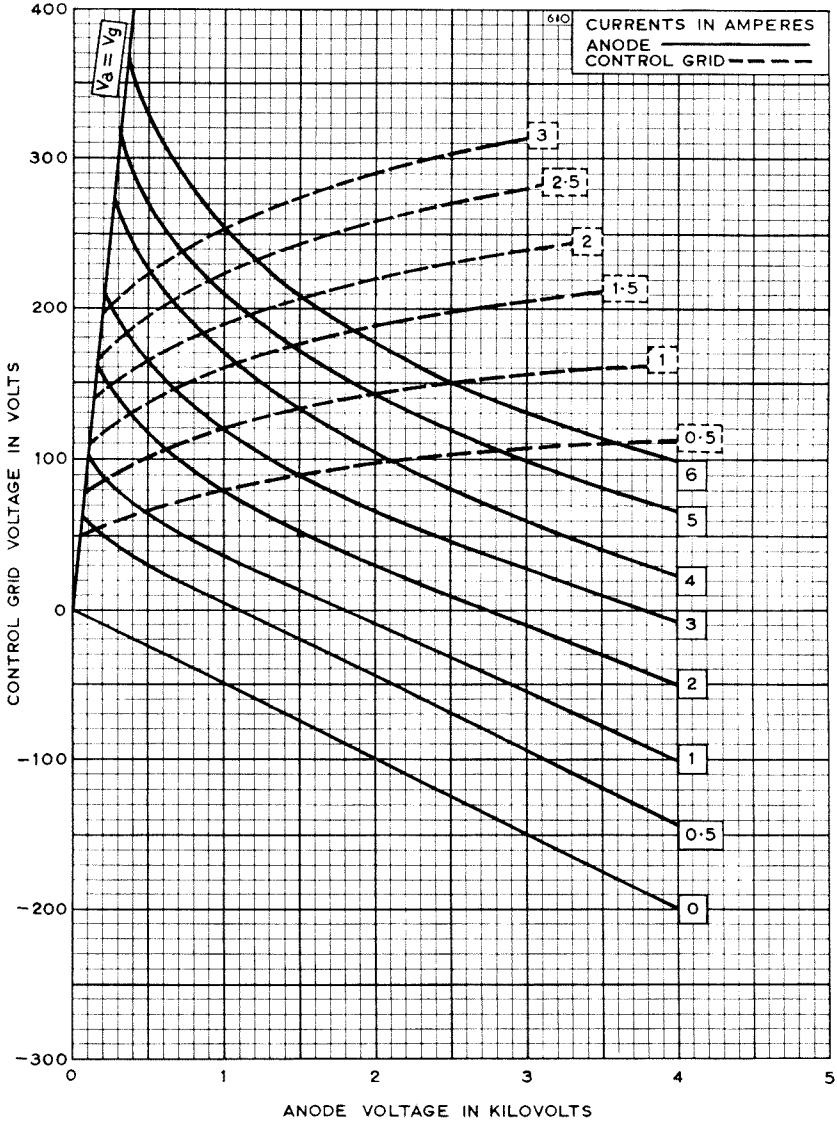
ANODE CHARACTERISTICS



CONTROL GRID CHARACTERISTICS

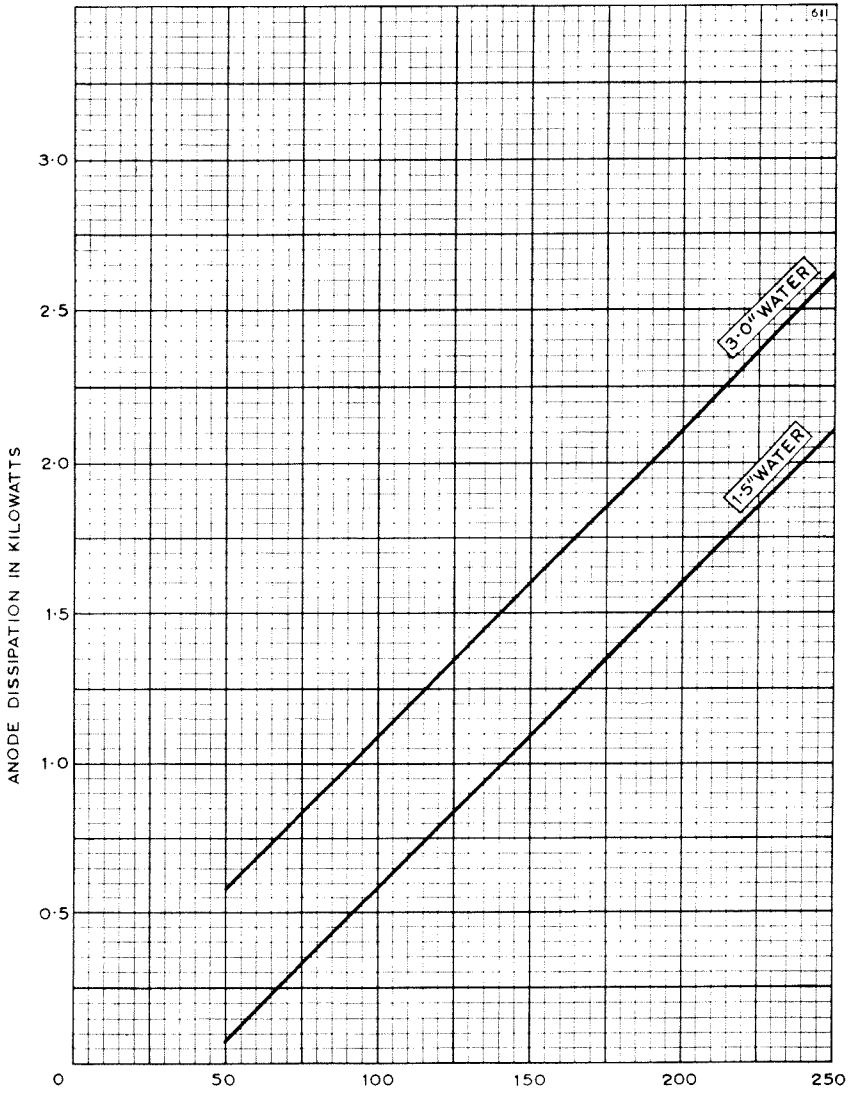


CONSTANT CURRENT CHARACTERISTICS



POWER TRIODE

RADIATOR CHARACTERISTICS



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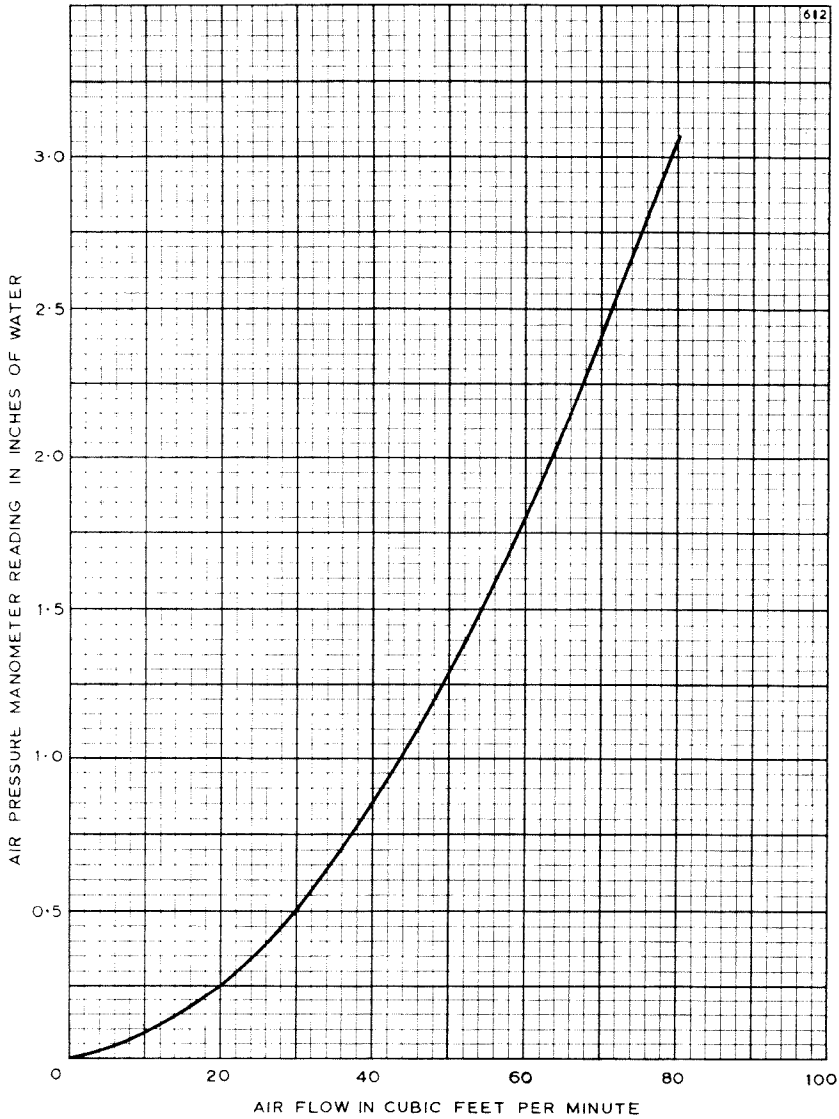
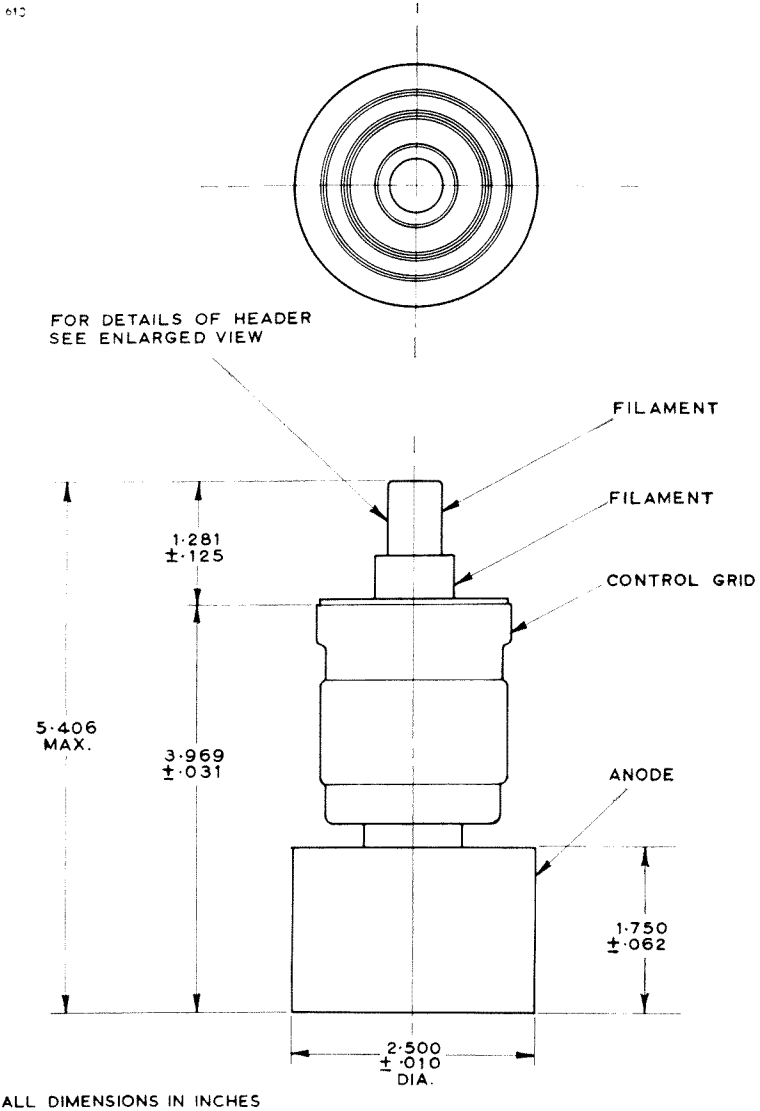
AIR FLOW CHARACTERISTIC



POWER TRIODE

OUTLINE



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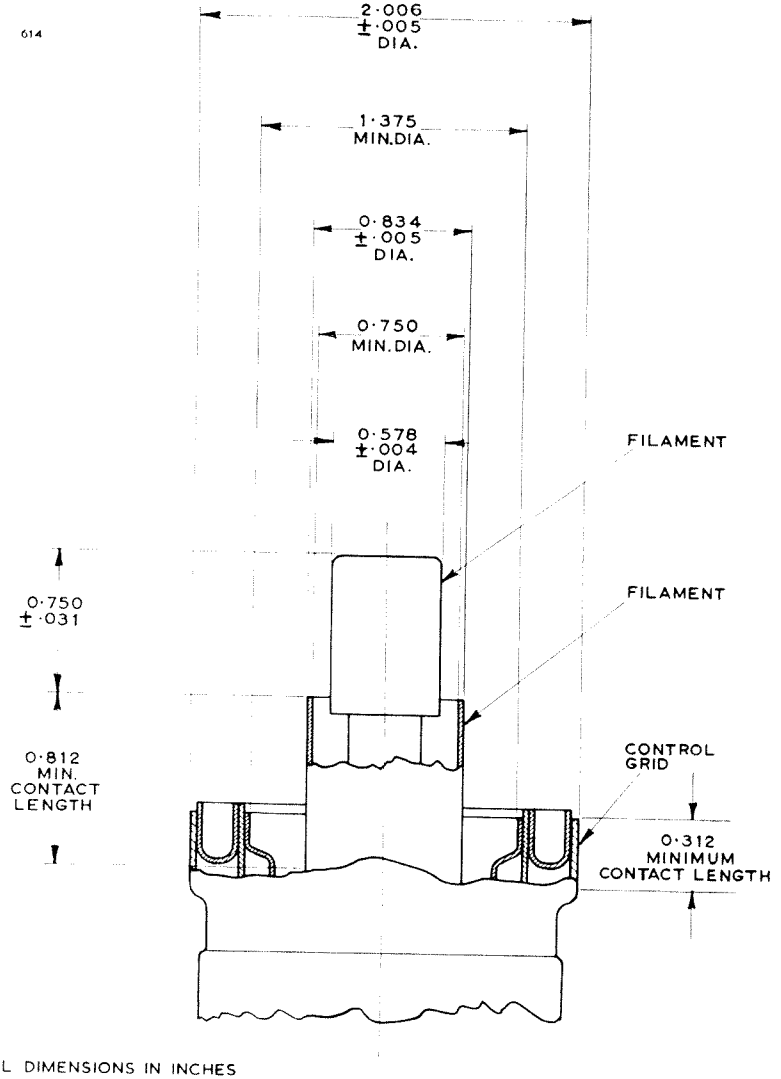
OUTLINE DETAILS



ALL DIMENSIONS IN INCHES

R.F. POWER TRIODE

BR1131

INTRODUCTION

The BR1131 is a forced-air cooled transmitting Triode. It has a maximum anode dissipation of 3·5kW and can be operated at 10kV up to 15Mc/s and at reduced ratings up to 80Mc/s.

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	8·5	V
Filament Current	22	A
Maximum Filament Starting Current	(*See Note* 2)	
Filament Cold Resistance	0·042	Ω
Peak Usable Cathode Current	5·0	A
Perveance	0·27mA/V $^{3/2}$	
Amplification Factor (V_a = 5·0kV, I_a = 0·2A)	40	
Mutual Conductance (V_a = 5·0kV, I_a = 0·2A)	3·1	mA/V
Inter-electrode Capacitances:		
Grid to Anode	15·8	pF
Grid to Filament	19·7	pF
Anode to Filament	0·9	pF

Mechanical

Overall Length	18·75 inches	(477mm)	Max
Overall Diameter	6·57 inches	(167mm)	Max
Net Weight	12½ pounds	(5·7 kg)	Approx
Mounting Position	Vertical, filament end up		

COOLING

The required quantity of air through the radiator for cooling is indicated on the graphs (pages 8 and 9) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously. The temperature of the anode must not exceed 180°C; that of the filament and grid seals must not exceed 140°C.

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R.F. POWER TRIODE

BR1131

ENGLISH ELECTRIC

R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	10 kV Max
Anode Dissipation	3·5 kW Max
Grid Dissipation	80 W Max
Operating Frequency (for full ratings)	15 Mc/s Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	8·0	10	kV
Grid Voltage	−530	−580	V
Peak R.F. Grid Voltage	1130	1180	V
Anode Current	1·0	1·0	A
Grid Current (Approx)	93	85	mA
Anode Dissipation	2·0	2·1	kW
Grid Dissipation	53	45	W
Driving Power	100	95	W
Output Power	6·0	7·9	kW
Efficiency	75	79	%

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 8·5V	20	23	A
Amplification Factor (V_a = 5·0kV, I_a = 0·2A)	34	46	
Grid Voltage (negative value) (V_a = 5·0kV, I_a = 0·01A)	—	200	V
Anode Current (V_a = 1·25kV, V_g = +470V)	2·4	3·5	A
Grid Current (V_a = 1·25kV, V_g = +470V)	—	450	mA
Grid Current (negative value) (V_a = 4·0kV, V_g = +220V)	20	—	mA

This page has been completely revised

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MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
15	10·0 kV	8·0 kV
30	5·0 kV	4·0 kV
80	2·0 kV	1·6 kV

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.

2. The filament current must not exceed 33A, even momentarily, at any time.

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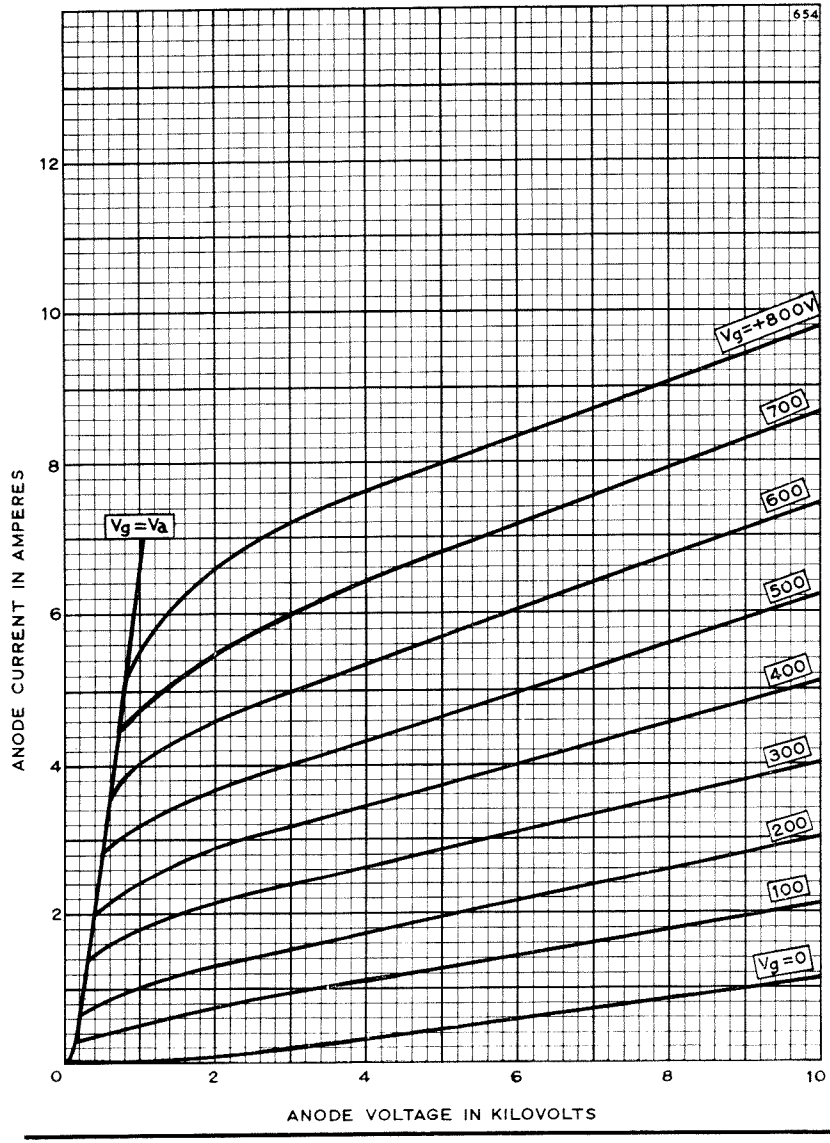
ANODE CHARACTERISTICS



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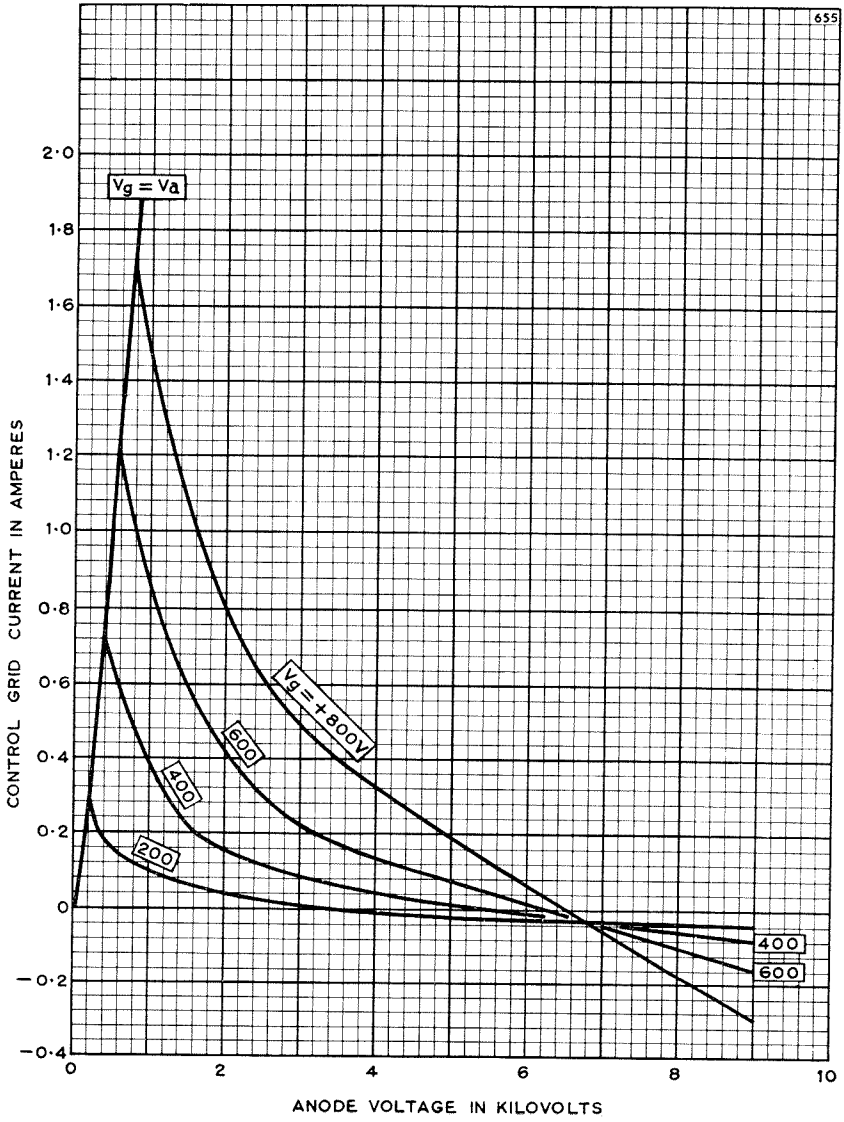
CONTROL GRID CHARACTERISTICS



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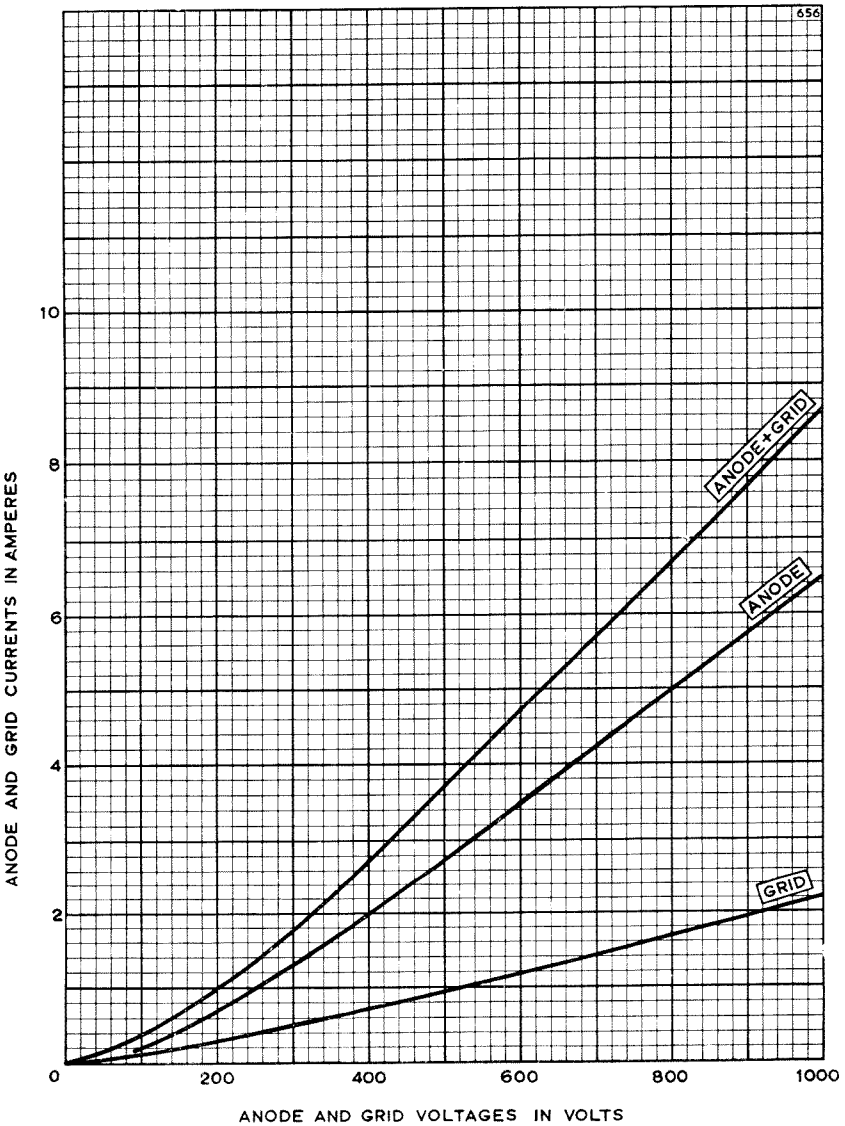
STRAPPED CHARACTERISTICS



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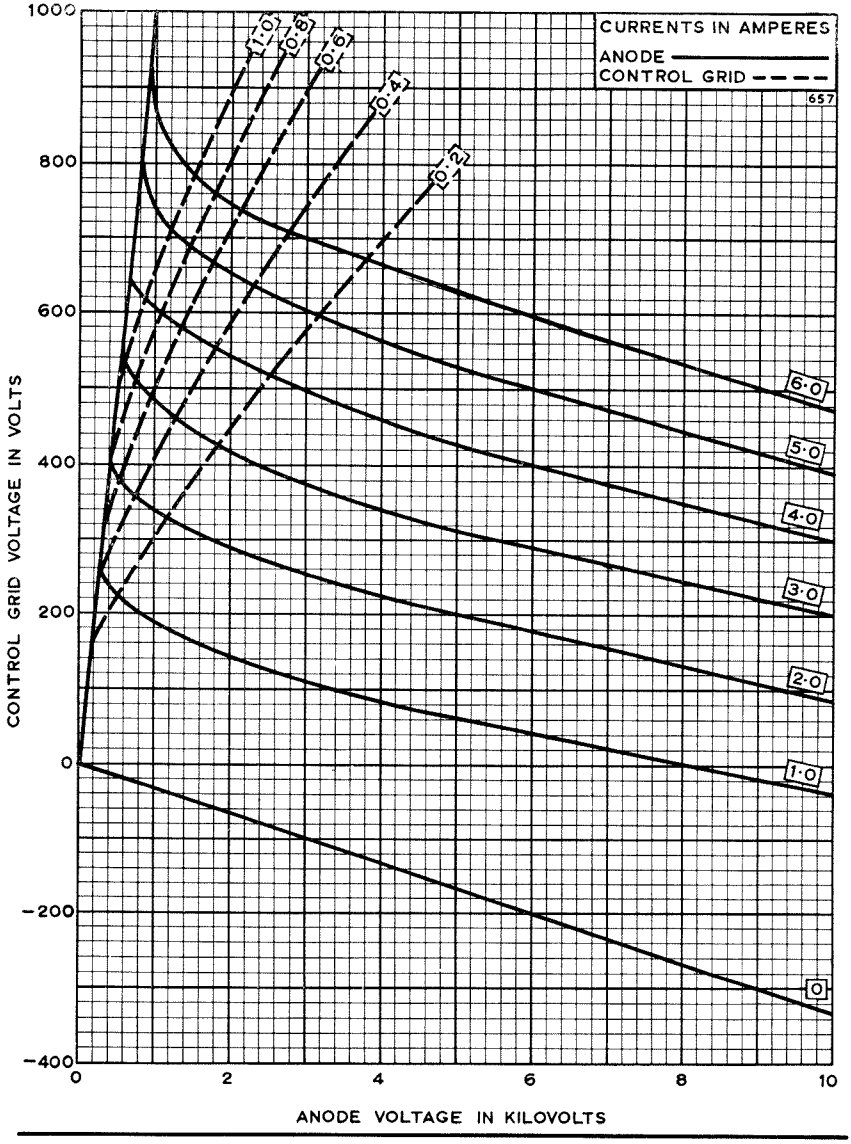
CONSTANT CURRENT CHARACTERISTICS



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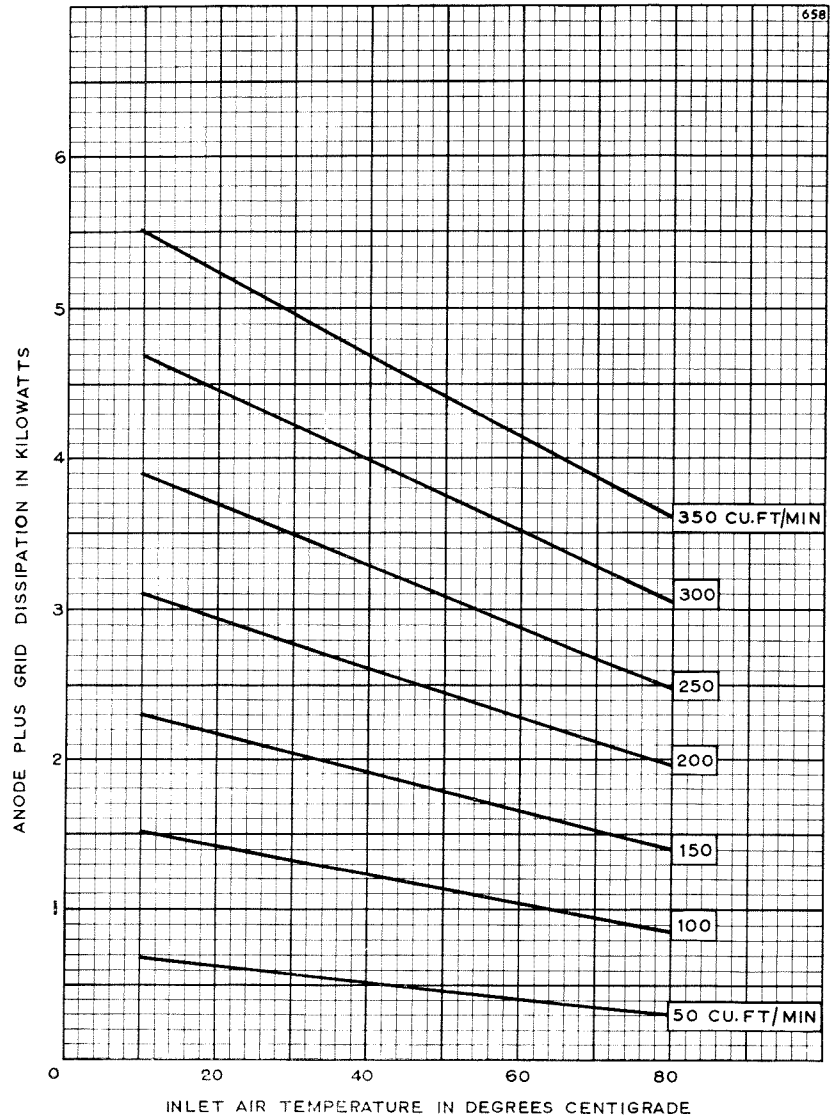
AIR COOLING CHARACTERISTICS



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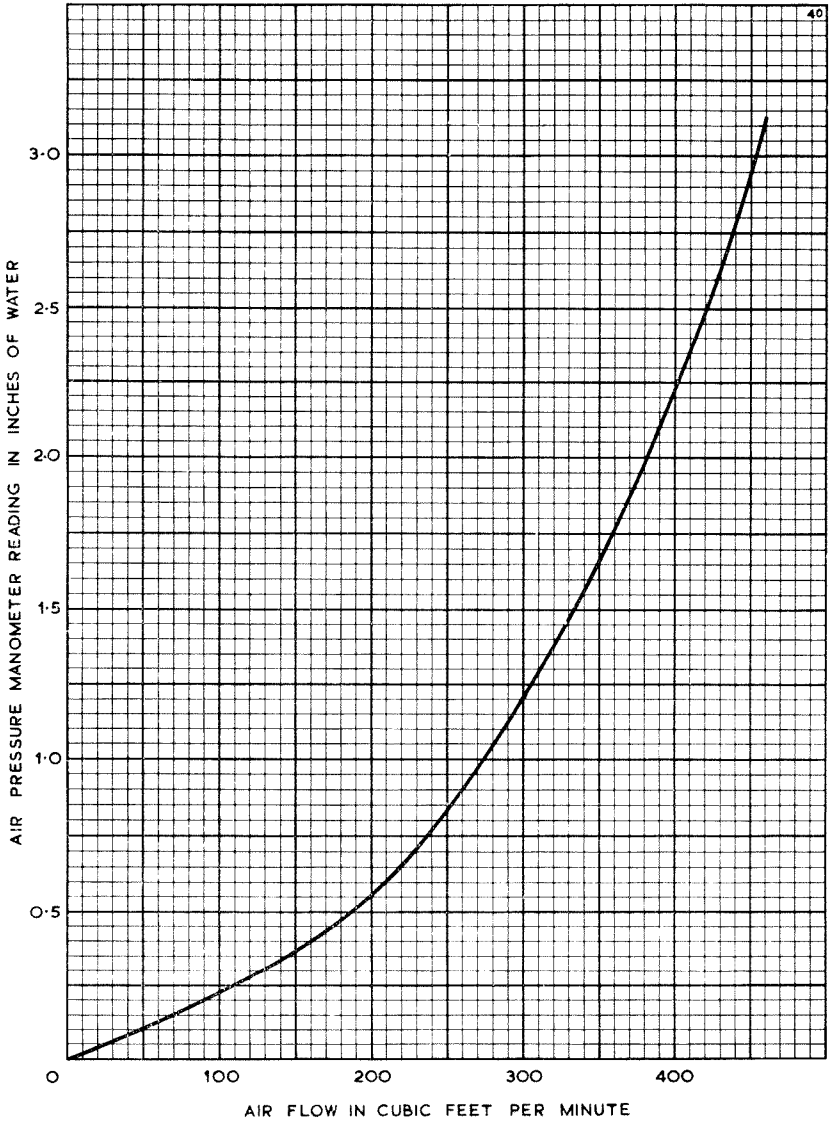
AIR FLOW CHARACTERISTIC



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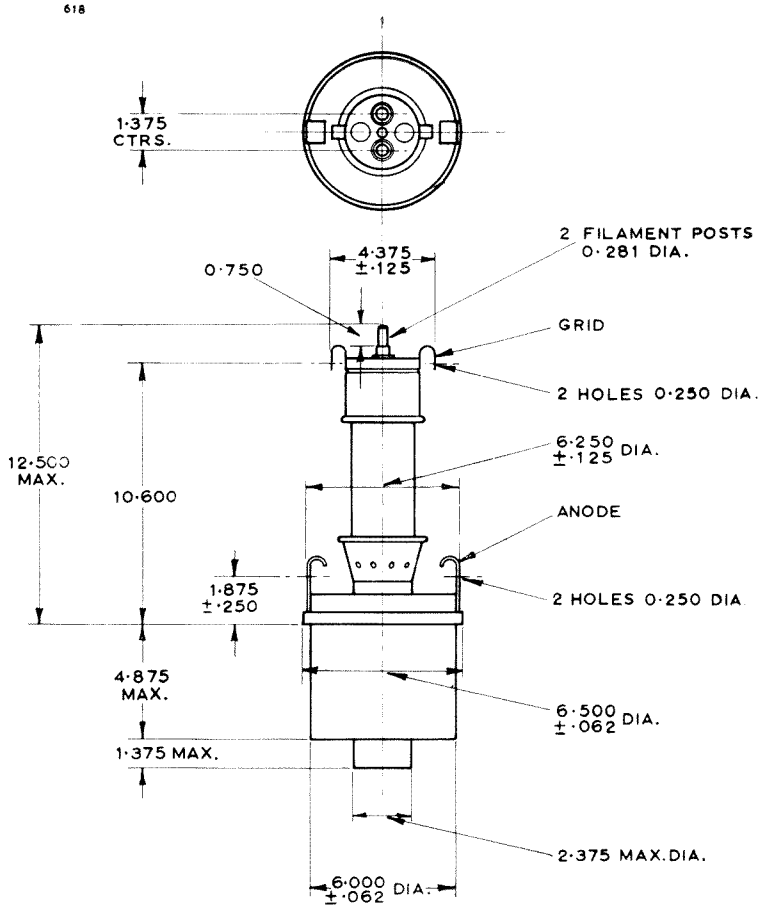

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BR1132

R.F. POWER TRIODE

INTRODUCTION

The BR1132 is a forced-air cooled transmitting Triode. It has a maximum anode dissipation of 4kW and can be operated up to 20Mc/s. A feature of this valve over the older BR175 and American 892-R is the low consumption, long life thoriated tungsten filament.

GENERAL DATA

Electrical

Filament: Two Sections	Thoriated Tungsten	
Excitation: Single or 2-phase A.C. or D.C. (*See Note* 1)		
Filament Voltage per Section (*See Note* 2)	6·0	V
Filament Current	36	A
Maximum Filament Starting Current	(*See Note* 3)	
Filament Cold Resistance	0·041	Ω
Peak Usable Cathode Current	10	A
Perveance	0·46mA/V$^{3/2}$ ←	
Amplification Factor (V_a = 8 kV, I_a = 0·5 A)	50	
Inter-electrode Capacitances:		
Grid to Anode	27	pF
Grid to Filament	39	pF
Anode to Filament	1·5	pF

Mechanical

Overall Length	20 inches (508 mm)		Max
Overall Diameter (over handles)	10·63 inches (270 mm)		Max
Net Weight	37 pounds (17 kg)		Approx
Mounting Position	Vertical, filament end up		

COOLING

The required quantity of air through the radiator for cooling is indicated on the graph (page 8) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously.

A flow of air of 20 to 30cu.ft/min must be provided via a 1-inch diameter nozzle and directed into the filament header before and during the application of any voltages in order to limit the temperature of the filament and grid seals.

The temperature of the anode must not exceed 180°C; that of the filament and grid seals must not exceed 140°C.

← Indicates a change

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R.F. POWER TRIODE

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C Telegraphy, key-down condition, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	12·5 kV Max
Anode Current	2·5 A Max
Anode Dissipation	4·0 kW Max
Grid Dissipation	600 W Max
Operating Frequency (for full ratings)	1·6Mc/sMax

TYPICAL OPERATING CONDITIONS

Anode Voltage	9	12	kV
Grid Voltage	−550	−590	V
Peak R.F. Grid Voltage	1250	1240	V
Anode Current	1·6	1·5	A
Grid Current (Approx)	340	260	mA
Anode Dissipation	3·4	3·5	kW
Grid Dissipation	220	160	W
Output Power	11	14·5	kW
Efficiency	76	80	%

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 12·0V	32·5	38·5	A
Amplification Factor (V_a = 8kV, I_a = 0·5A)	42·5	57·5	
Grid Voltage (negative value) (V_a = 10kV, I_a = 50mA)	—	250	V
Anode Current (V_a = 4kV, V_g = +400V)	3·4	5·0	A
Grid Current (V_a = 4kV, V_g = +400V)	0	−0·35	A
Inter-electrode Capacitances:			
Grid to Anode	24	32	pF
Grid to Filament	35	44	pF
Anode to Filament	—	1·5	pF

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MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
1·6	12·5 kV	10·0 kV
7·5	9·4 kV	7·5 kV
20	6·25 kV	5·0 kV

NOTES

1. When a single phase a.c. or d.c. supply is used, the two filament sections must not be connected in parallel. Such action would overheat the common filament lead (large terminal) and damage the valve.
2. The valve must be operated at the stated filament voltage. Fluctuations in filament voltage must not exceed 5%.
3. The filament current must not exceed 90A, even momentarily, at any time.

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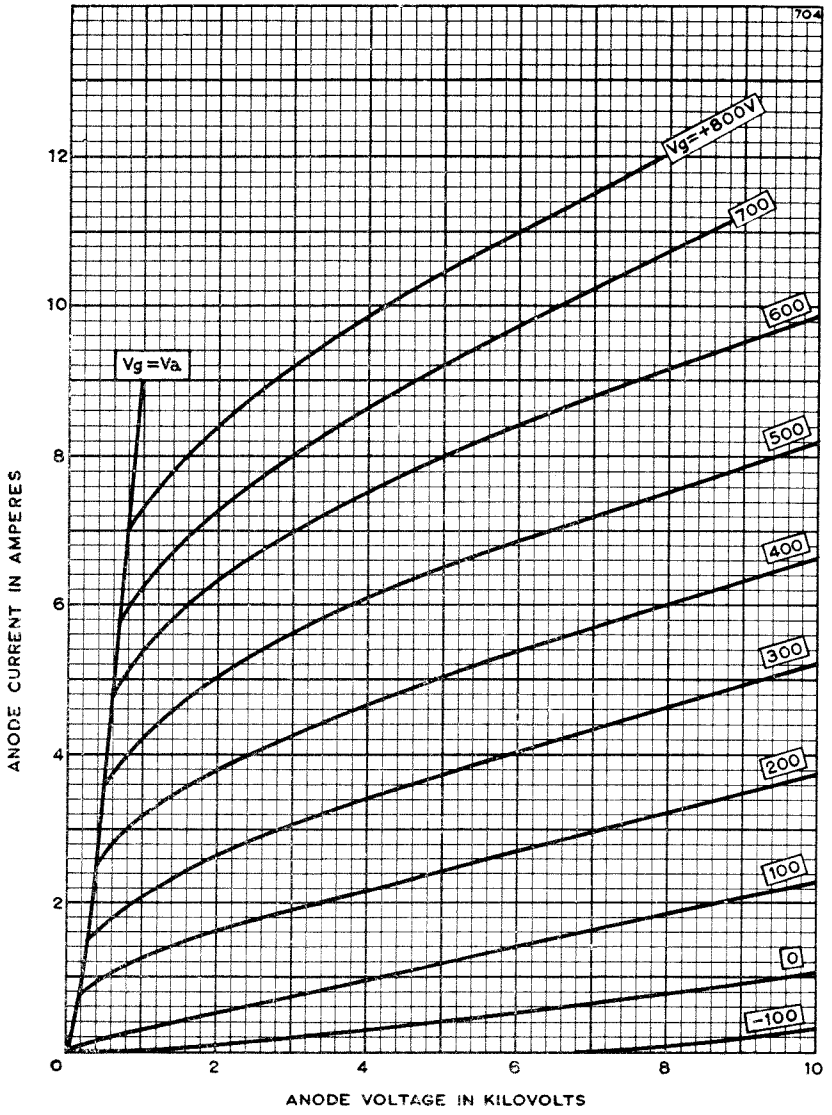
ANODE CHARACTERISTICS



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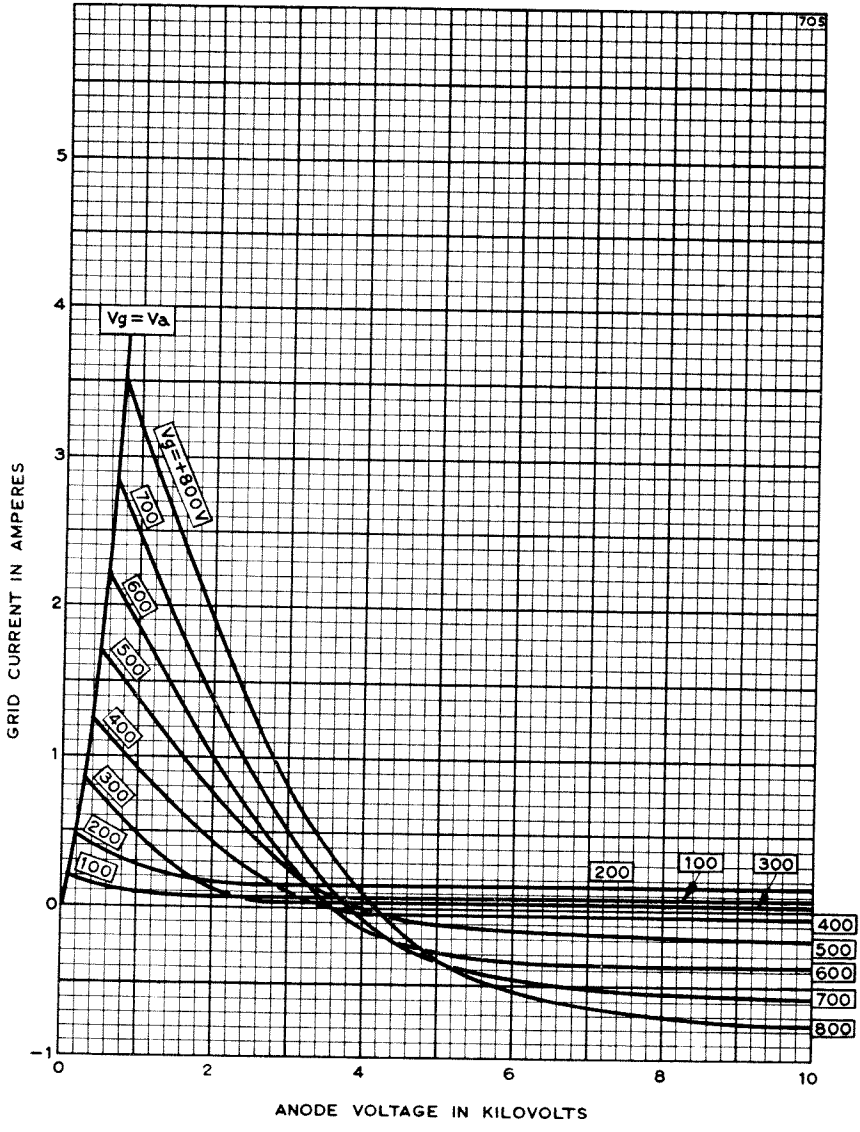
CONTROL GRID CHARACTERISTICS



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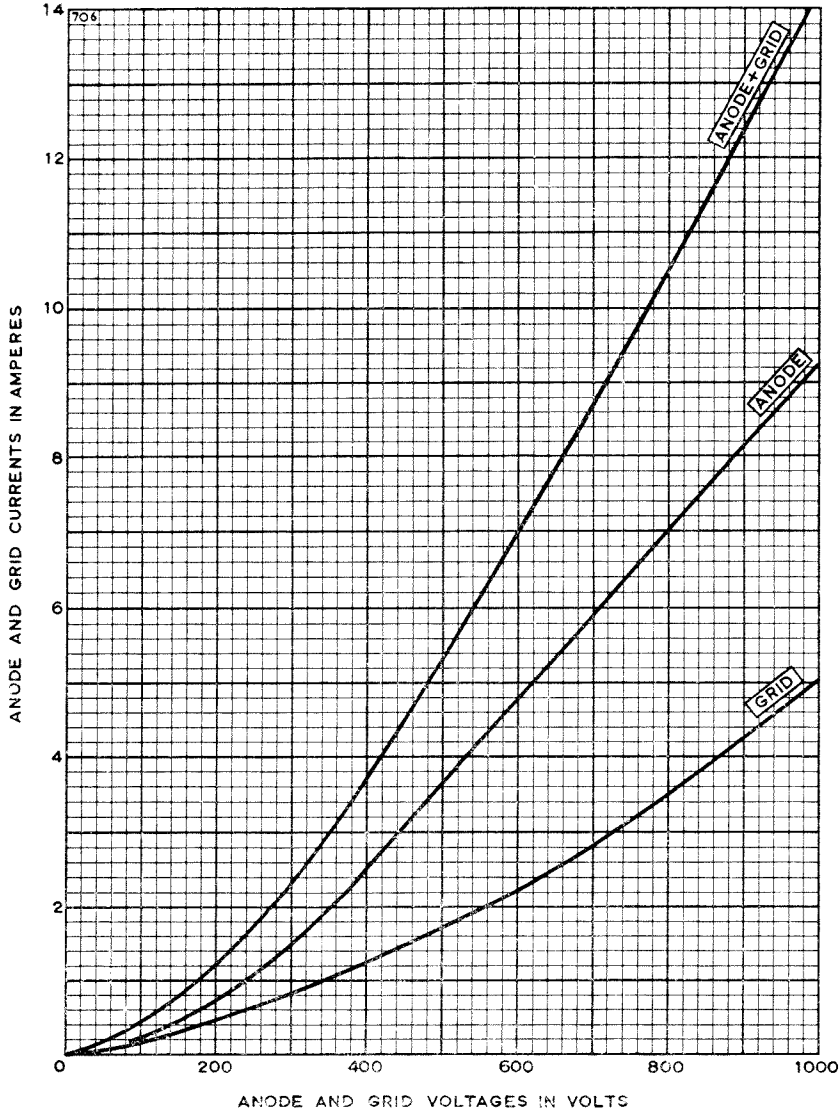
STRAPPED CHARACTERISTICS



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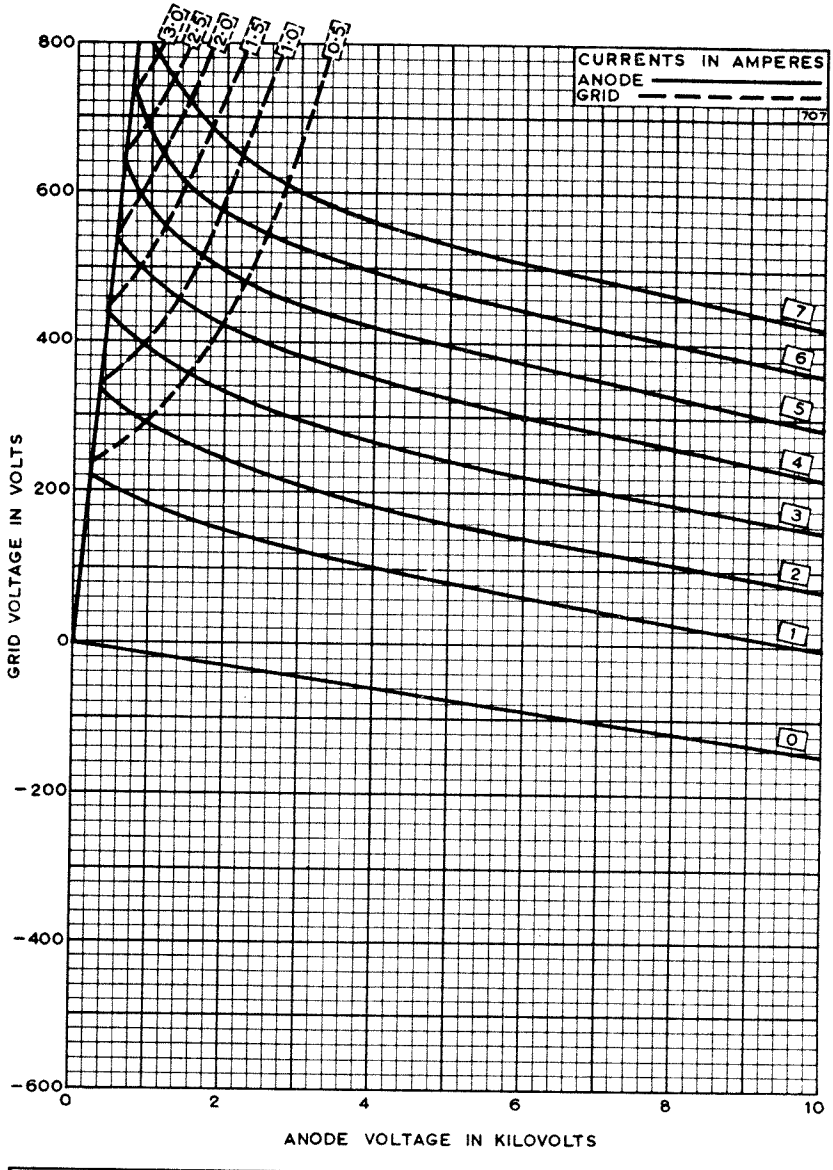
CONSTANT CURRENT CHARACTERISTICS



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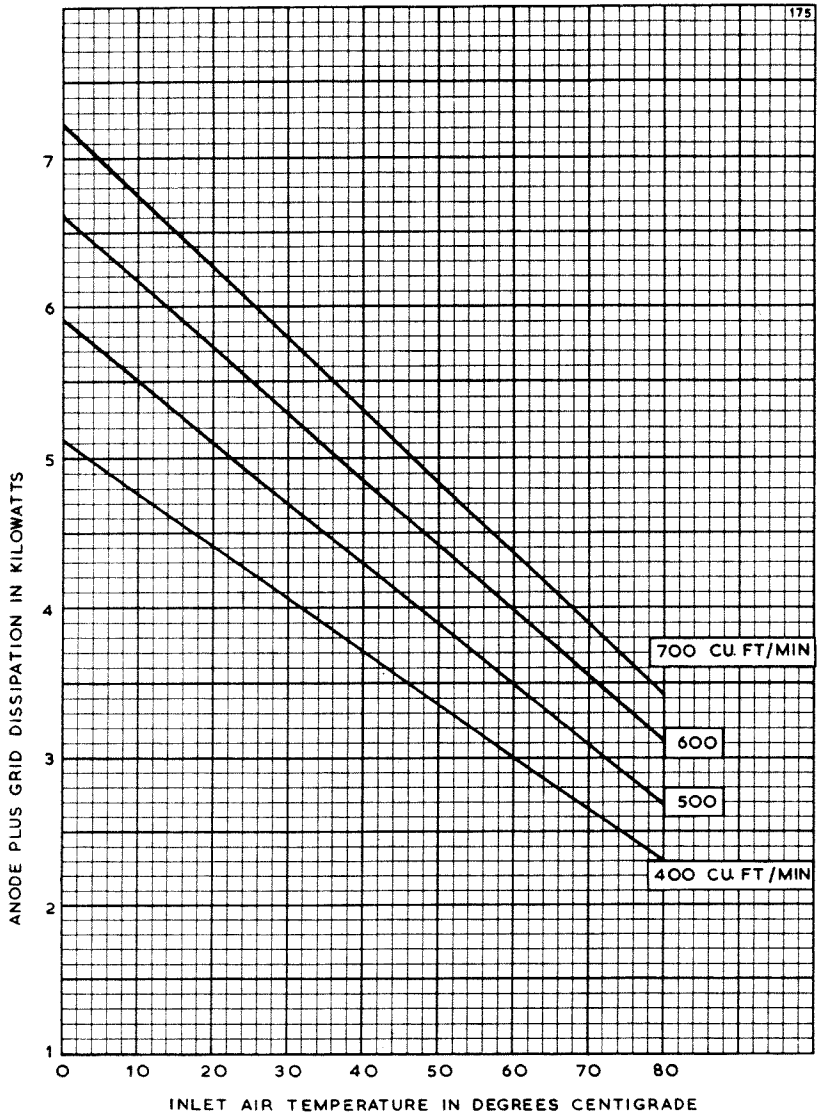
AIR COOLING CHARACTERISTICS



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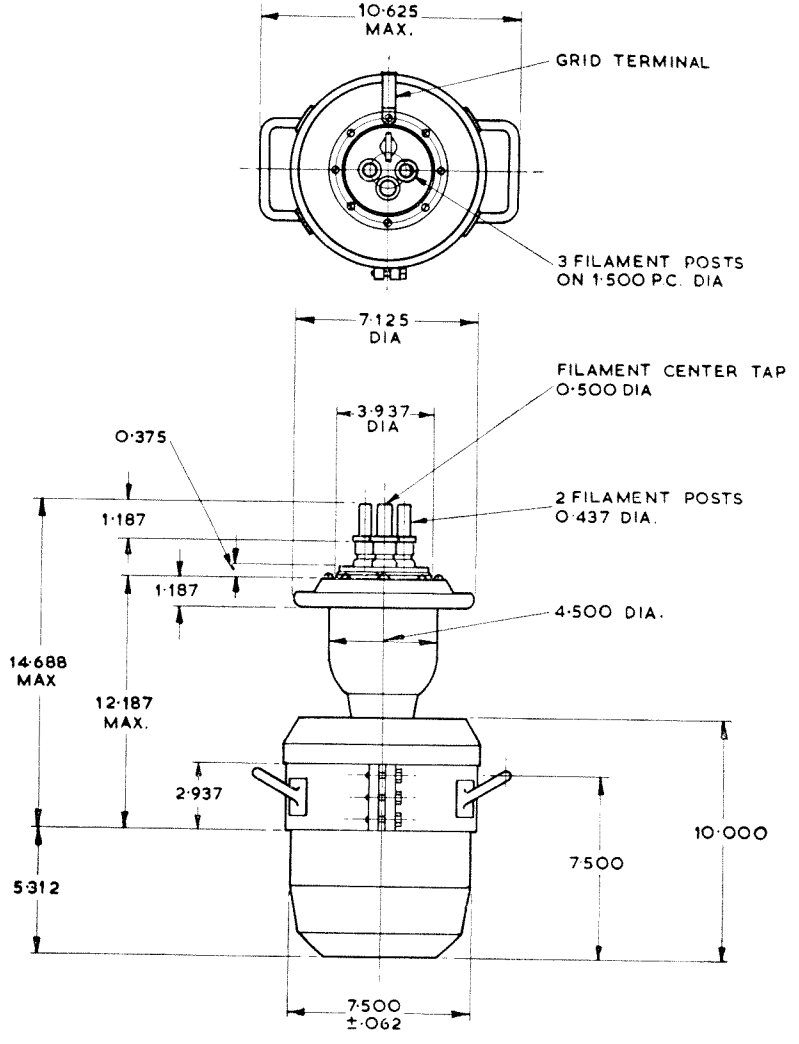
OUTLINE

176



ALL DIMENSIONS IN INCHES

BR1138

R.F. POWER TRIODE

INTRODUCTION

The BR1138 is a forced-air cooled transmitting Triode with ratings for both forced-air cooling and natural cooling. It has a maximum anode dissipation of 1·25kW and can be operated at 10kV up to 15Mc/s and at reduced ratings up to 80Mc/s.

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	8·5	V
Filament Current	22	A
Maximum Filament Starting Current	(*See Note* 2)	
Filament Cold Resistance	0·042	Ω
Peak Usable Cathode Current	5	A
Perveance	0·27	$mA/V^{3/2}$
Amplification Factor (V_a = 5kV, I_a = 0·2A)	40	
Mutual Conductance (V_a = 5kV, I_a = 0·2A)	3·1	mA/V
Inter-electrode Capacitances:		
Grid to Anode	15·9	pF
Grid to Filament	23·2	pF
Anode to Filament	1·6	pF

Mechanical

Overall Length	18·5 inches	(470 mm)	Max
Overall Diameter	7·33 inches	(187 mm)	Max
Net Weight	7 pounds	(3·2 kg)	Approx
Mounting Position	Vertical, either way up		

COOLING

When natural cooling is employed adequate space must be allowed for free circulation of cool air. With forced-air cooling, the volume required is 5 cu. ft. per minute, at a pressure of 3 inches of water, obtained through a standard cooling ring. The temperature of the anode must not exceed 180°C; that of the grid and filament seals must not exceed 140°C.

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BR1138

R.F. POWER TRIODE

MAXIMUM RATINGS

Anode Dissipation (forced-air cooling)	1·25 kW Max
Anode Dissipation (natural cooling)	1·0 kW Max
Grid Dissipation	200 W Max

Maximum Anode Voltage against Frequency		
Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
15	10·0 kV	8·0 kV
30	5·0 kV	4·0 kV
80	2·0 kV	1·6 kV

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 8·5V	20	23	A
Amplification Factor (V_a = 5kV, I_a = 0·2A)	34	46	
Anode Impedance (V_a = 5kV, I_a = 0·2A)	8	12	kΩ
Grid Voltage (V_a = 5kV, I_a = 0·01A)		−200	V

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.
2. The filament current must not exceed 33A, even momentarily, at any time

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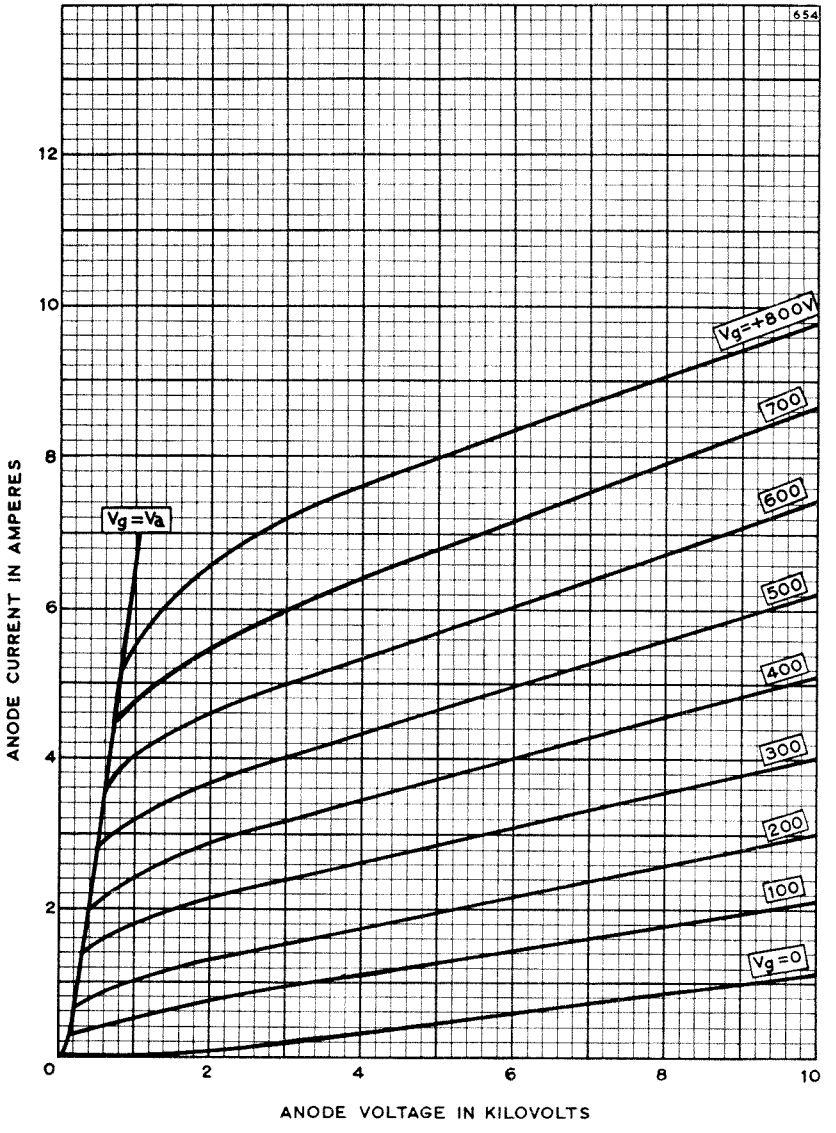
R.F. POWER TRIODE

ANODE CHARACTERISTICS



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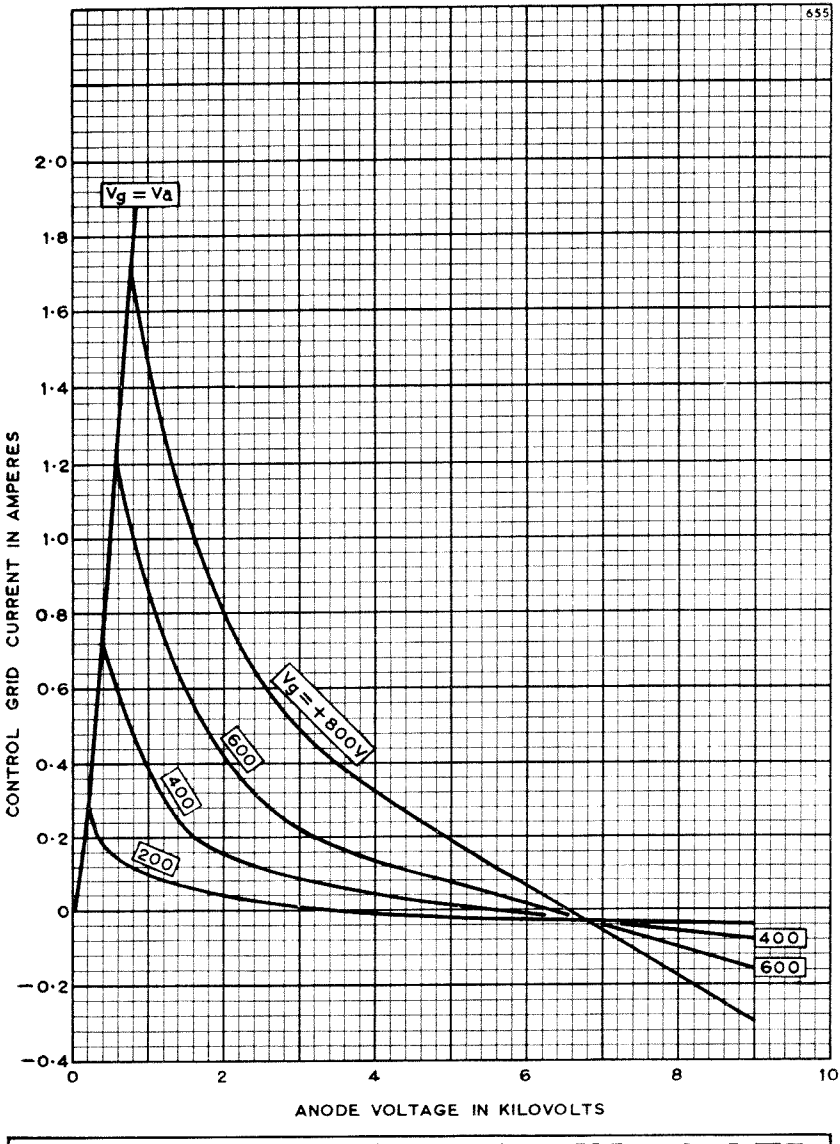
CONTROL GRID CHARACTERISTICS



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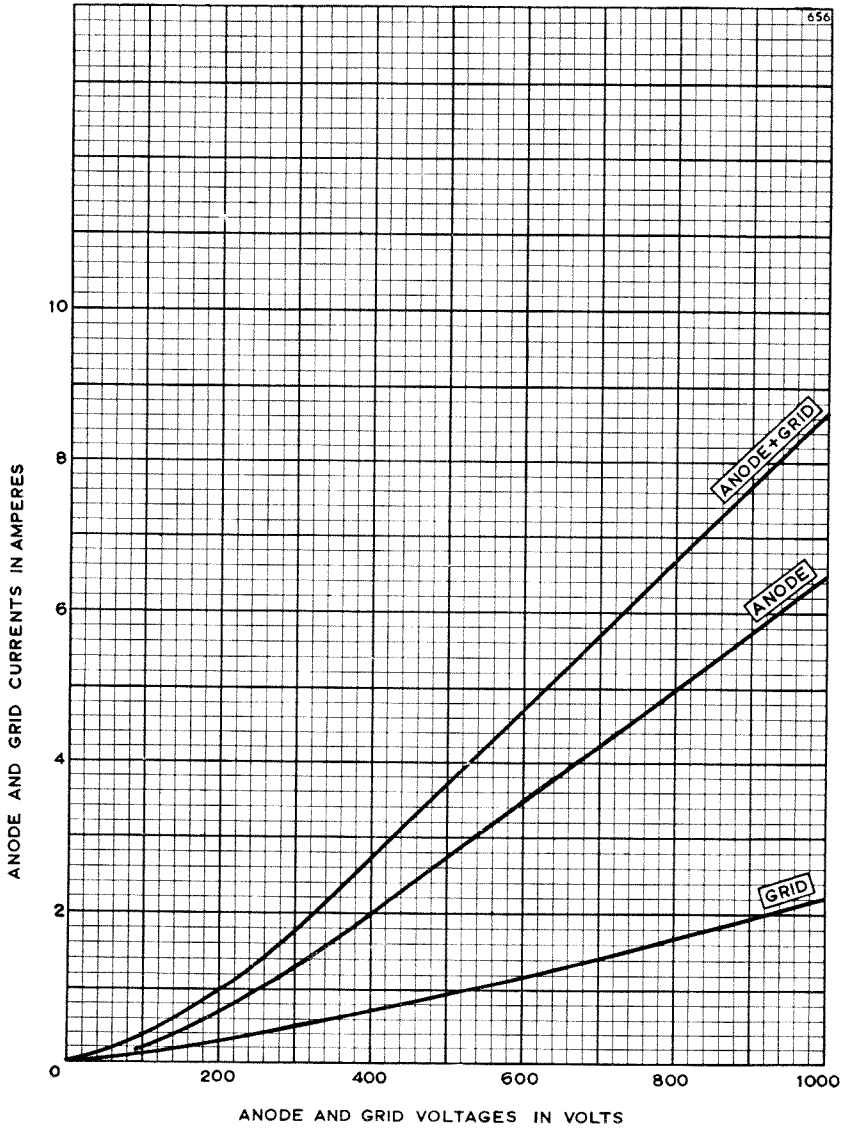
STRAPPED CHARACTERISTICS



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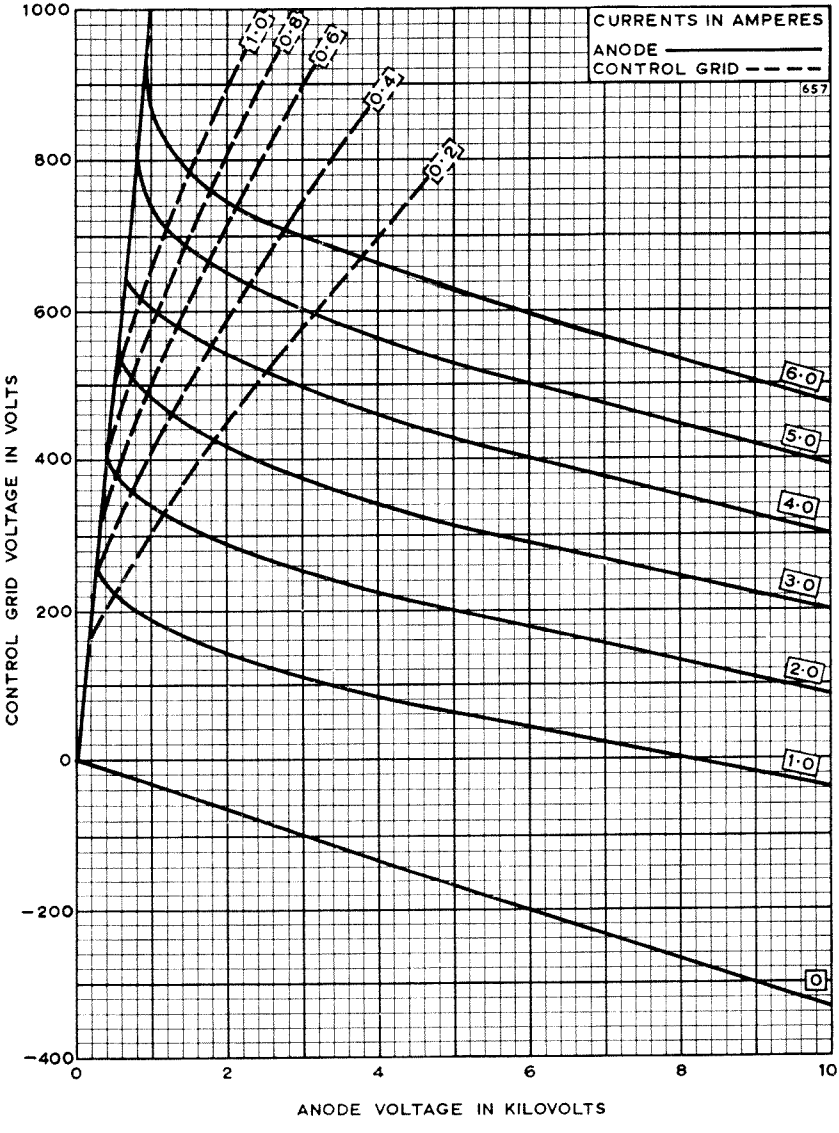
R.F. POWER TRIODE

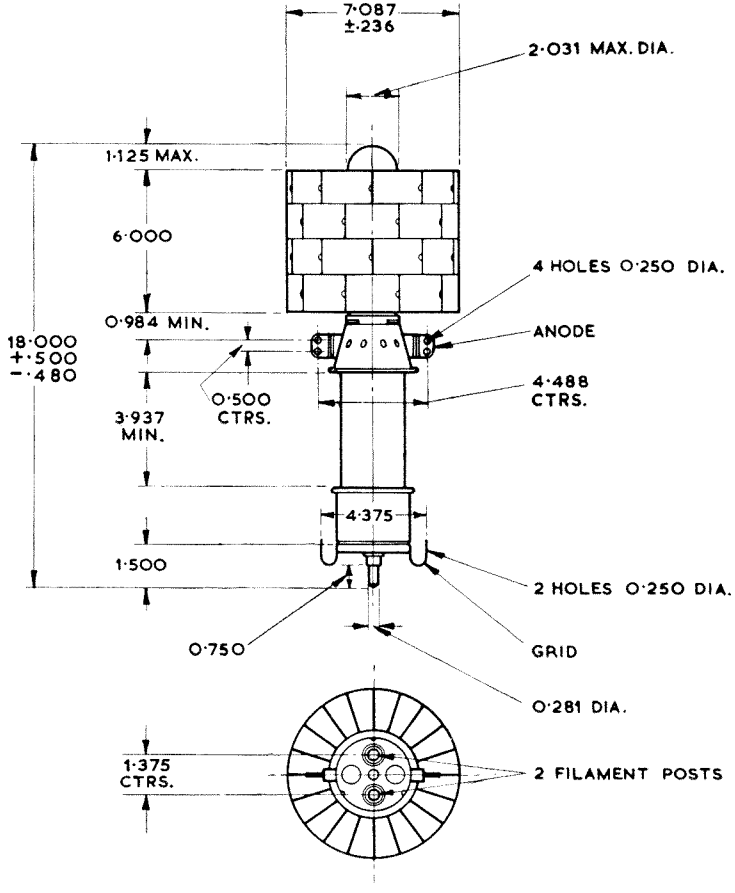
CONSTANT CURRENT CHARACTERISTICS



R.F. POWER TRIODE

OUTLINE

150A



ALL DIMENSIONS IN INCHES

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R.F. POWER TRIODE

BR1143

ABRIDGED DATA

Forced-air Cooled Triode intended primarily for industrial service.

Anode Dissipation	20	kW Max
Anode Voltage	10	kV Max
Frequency for full ratings	10	MHz Max
Output Power (Class C unmodulated)	77·5	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	12·0	V←
Filament Current	240	A←
Filament Starting Current (Peak) (*See Note* 2)	625	A Max
Filament Cold Resistance	0·0059	Ω
Peak Usable Cathode Current	95	A
Amplification Factor (V_a = 5·0kV, I_a = 5·0A)	37	
Mutual Conductance (V_a = 6·0kV, I_a = 3·5A)	85	mA/V
Perveance	5·8	$mA/V^{3/2}$
Inter-electrode Capacitances:		
Grid to Anode	105	pF
Grid to Filament	185	pF
Anode to Filament	2·7	pF

Mechanical

Overall Length	21·500 inches (546·1 mm)	Max
Overall Width (over handles)	14·000 inches (355·6 mm)	Max
Net Weight	109 pounds (50 kg)	Approx
Mounting Position	Vertical, filament end up	

Accessories

Filament Leads	MA130
Grid Connector	MA66

COOLING

The required quantity of air through the radiator for cooling is indicated on the graphs (pages 7 and 8) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 20ft³/min (0·57m³/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperatures of the seals.

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

← Indicates a change

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R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS

(Absolute values)

Anode Voltage	10	kV Max
Anode Current	12	A Max
Anode Input Power	100	kW Max
Anode Dissipation	20	kW Max
Grid Dissipation	1·75	kW Max
Operating Frequency (for full ratings)	10	MHz Max

TYPICAL OPERATING CONDITIONS (FOR OSCILLATOR)

Anode Voltage	6·0	10	kV
Grid Voltage	−320	−540	V
Peak R.F. Grid Voltage	750	940	V
Anode Current	11·2	9·4	A
Grid Current (Approx)	1·78	1·67	A
Anode Dissipation	14·4	14·8	kW
Grid Dissipation (Approx)	760	670	W
Driving Power (Approx)	1330	1570	W
Output Power (*See Note* 3)	51·5	77·5	kW
Efficiency	78·5	84	%

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%.
2. The filament current must not exceed 625A, even momentarily, at any time.
3. Power in anode circuit after the grid circuit driving power has been deducted. This does not take into account the anode circuit efficiency.

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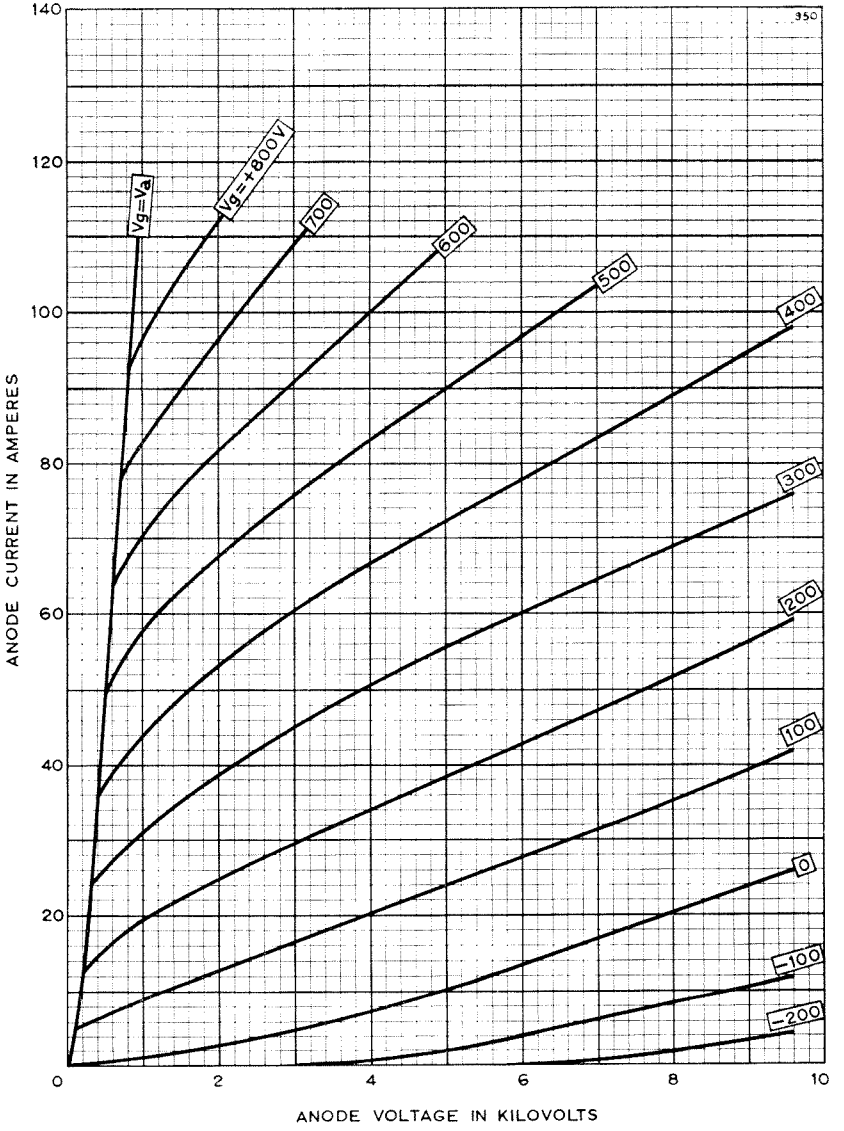
ANODE CHARACTERISTICS



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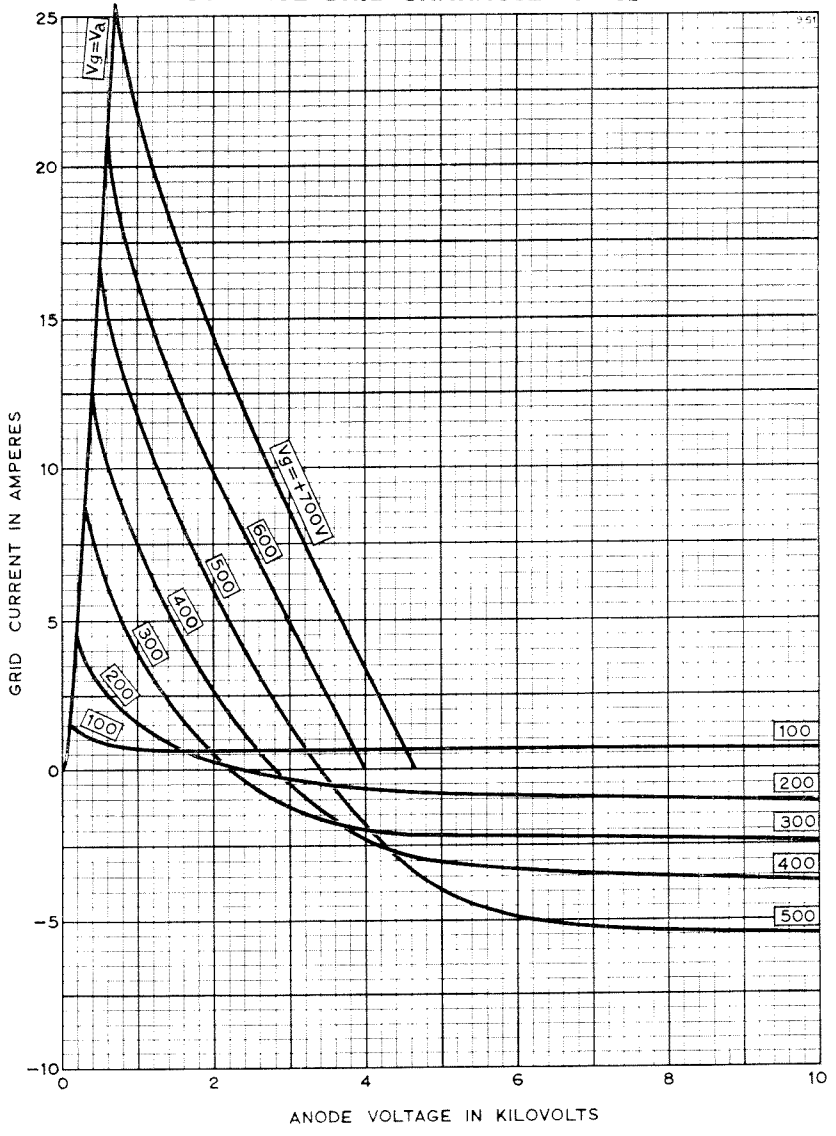
CONTROL GRID CHARACTERISTICS



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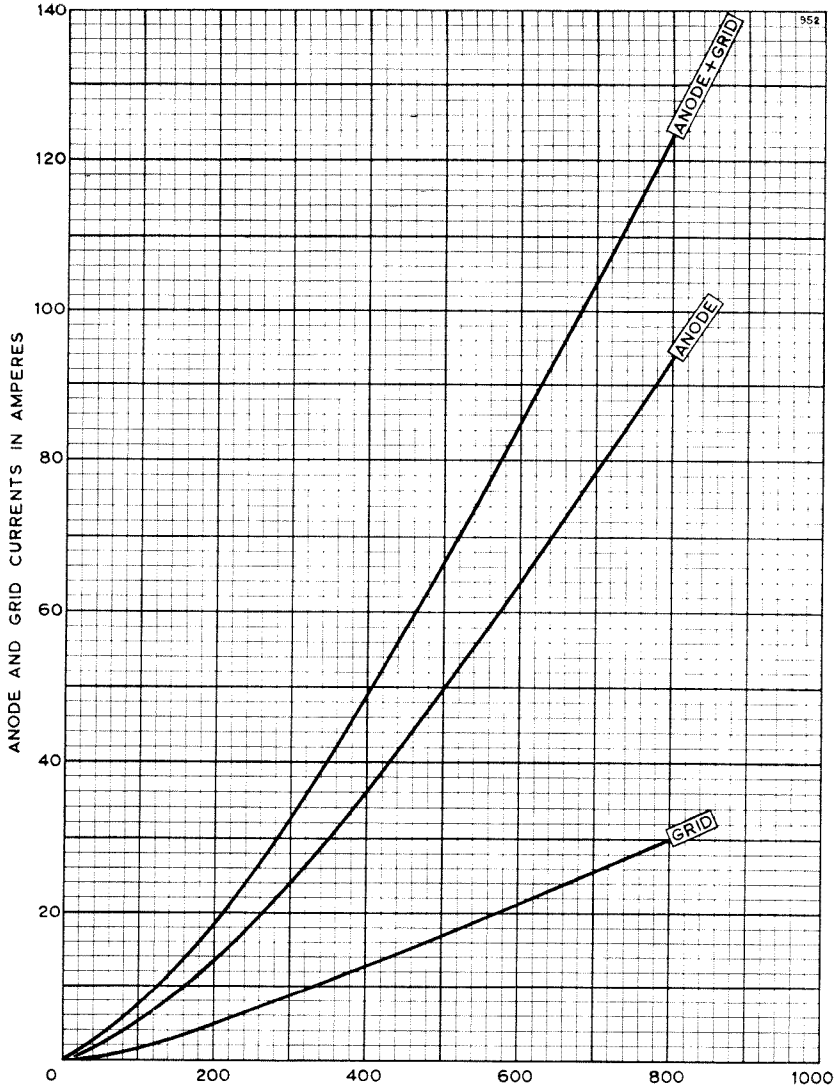
STRAPPED CHARACTERISTICS



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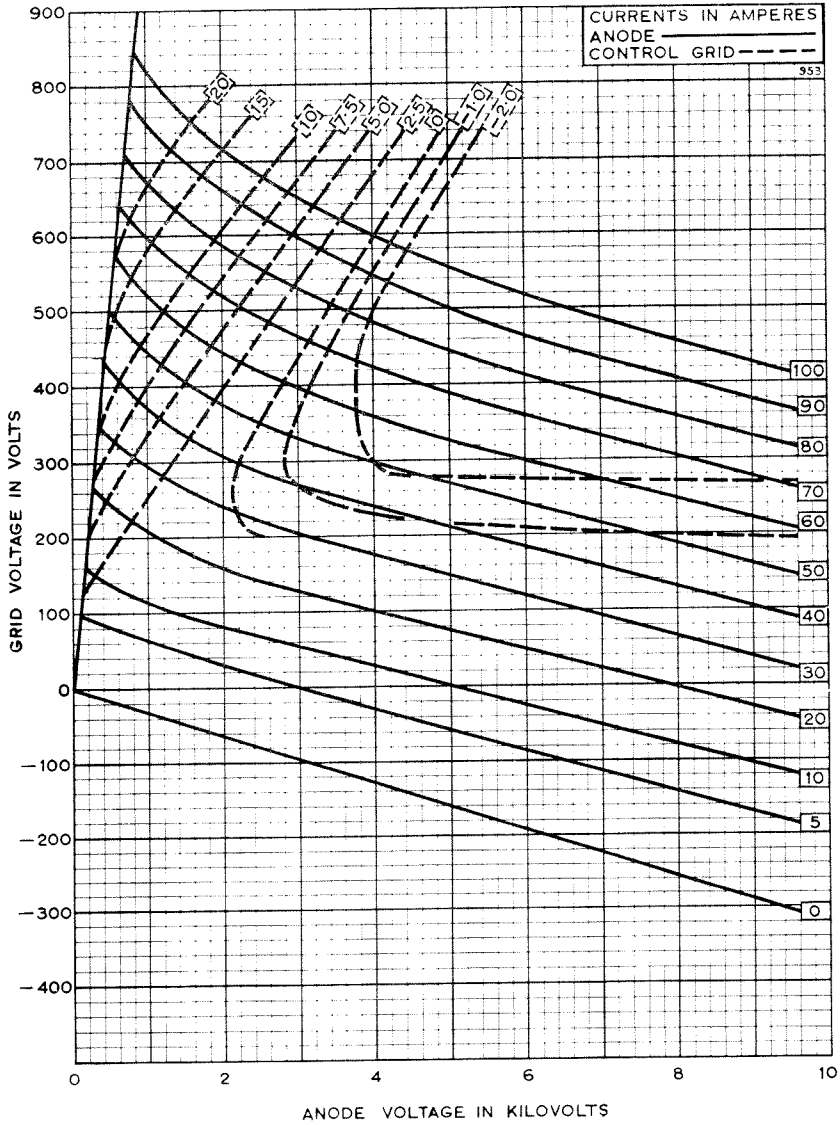
CONSTANT CURRENT CHARACTERISTICS



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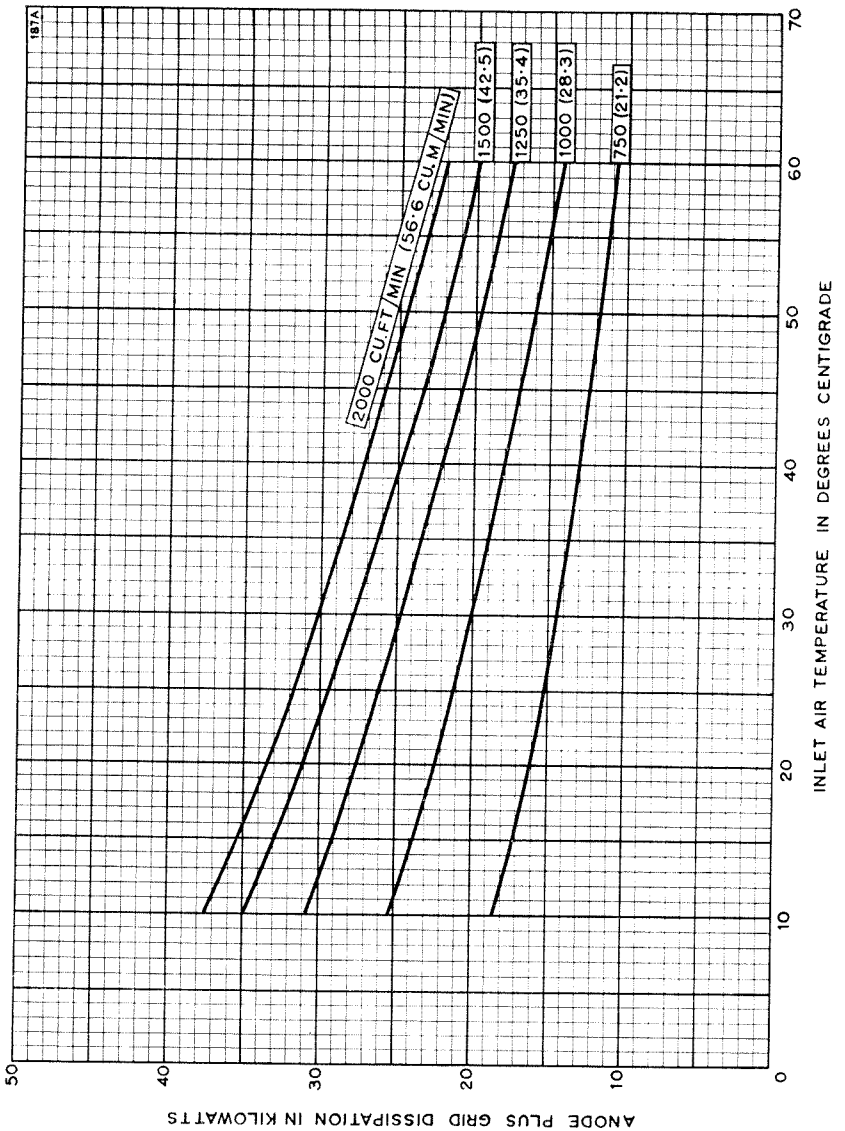
AIR COOLING CHARACTERISTICS



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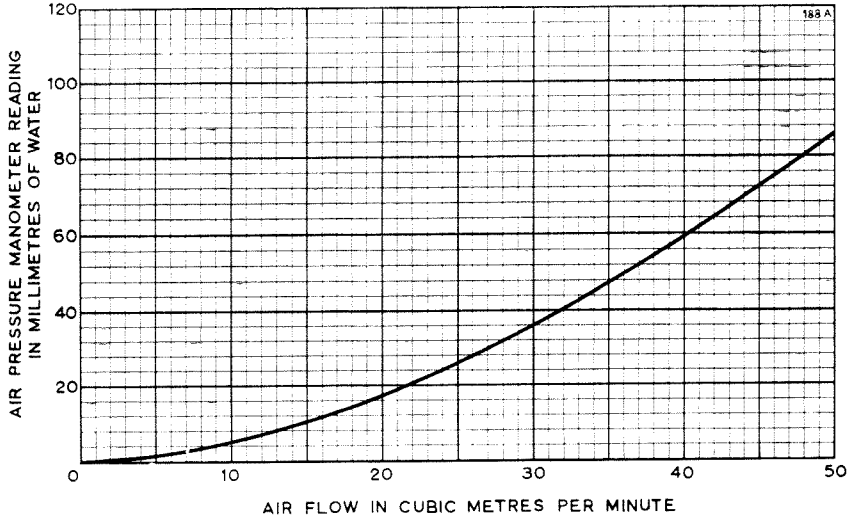
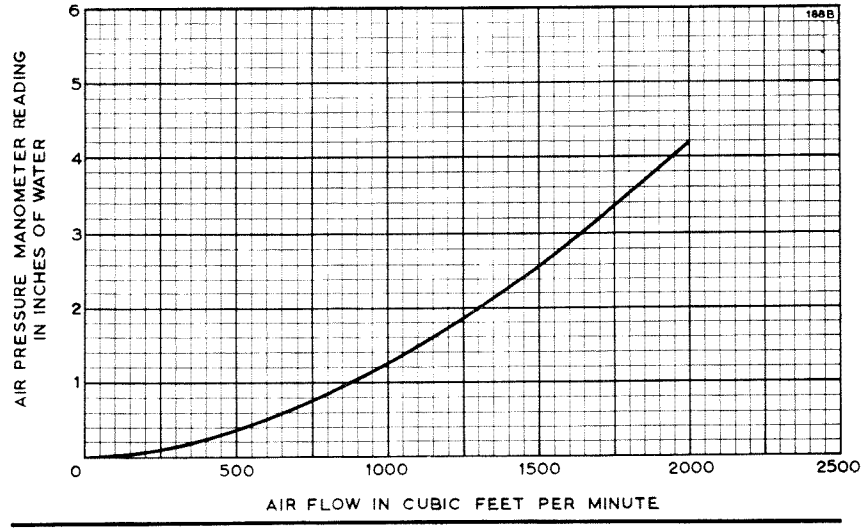
AIR FLOW CHARACTERISTICS





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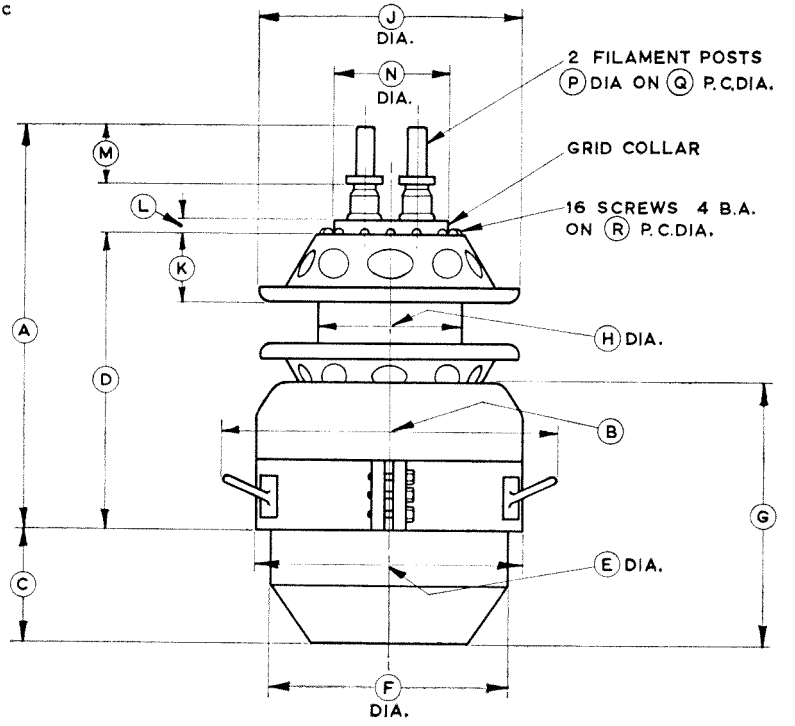

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	16·750 Max	425·45 Max	J	11·000 Max	279·40 Max
B	14·000 Max	355·60 Max	K	2·906 Max	73·81 Max
C	4·750	120·65	L	0·687	17·45
D	12·875 Max	327·03 Max	M	2·000	50·80
E	11·000	279·40	N	4·703	119·46
F	10·062 Max	255·57 Max	P	0·875	22·23
G	11·000	279·40	Q	2·250	57·15
H	6·000	152·40	R	5·375	136·53

Millimetre dimensions have been derived from inches

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V.H.F. POWER TRIODE

BR1160

ENGLISH ELECTRIC

Service Type CV8730

ABRIDGED DATA

Forced-air Cooled V.H.F. Triode for A.M., F.M. or television transmitters and for industrial applications.

	Class B Audio Amplifier	*Class C Telegraphy or F.M. Telephony*	*Class C Telephony*	*Class C Television*	
Anode Dissipation	5·0	5·0	3·4	5·0	kW Max
Anode Voltage	6·0	6·0	5·0	5·0	kV Max
Operating Frequency	—	220	220	220	Mc/s Max
Output Power	6·65 per valve	6·9	4·7	4·5 per valve	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	12·6	V
Filament Current	33	A
Peak Usable Cathode Current	8·5	A
Amplification Factor (V_a = 4·0kV, I_a = 1·0A)	32	
Mutual Conductance (V_a = 4·0kV, I_a = 1·0A)	17	mA/V
Inter-electrode Capacitances:		
Grid to Anode	11	pF
Grid to Filament	16	pF
Anode to Filament	0·3	pF

Mechanical

Overall Length (excluding flexible leads)	7·680 inches	(195 mm)	Max
Overall Diameter	4·685 inches	(119 mm)	Max
Net Weight	7·5 pounds	(3·4 kg)	Approx
Mounting Position	Vertical, either way up		

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COOLING

The required flows of air through the radiator for cooling at various anode dissipations and heights above sea level are given in the following table. The air flow should be delivered by a blower through the radiator before and during the application of any voltages.

Anode Dissipation (kW)	Height above Sea Level (ft)	(m)	Inlet Temperature Max (°C)	Rate of Flow of Air (Min) (cu.ft/min)	(cu.m/min)	Pressure Drop (in. water)	(mm water)
1·0	0	0	35	105	3·0	0·31	8·0
1·0	0	0	45	110	3·1	0·31	8·0
1·0	4920	1500	35	130	3·7	0·35	9·0
1·0	9840	3000	25	145	4·1	0·39	10
3·0	0	0	35	185	5·2	0·91	23
3·0	0	0	45	215	6·1	1·14	29
3·0	4920	1500	35	220	6·2	1·02	26
3·0	9840	3000	25	235	6·6	1·02	26
5·0	0	0	35	325	9·2	2·68	68
5·0	0	0	45	380	10·7	3·54	90
5·0	4920	1500	35	395	11·2	3·19	81
5·0	9840	3000	25	410	11·6	3·11	79

It may be necessary to direct a flow of air on to the filament and grid seals in order to maintain their temperatures within the following limits:

Temperature of filament seals .. .. 220 °C Max
Temperature of grid and anode seals .. .. 180 °C Max

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR
(Class B)
MAXIMUM RATINGS
(Absolute Values)

Anode Voltage .. .. 6·0 kV Max
Anode Current .. .. 1·5 A Max
Anode Input Power .. .. 9·0 kW Max
Anode Dissipation .. .. 5·0 kW Max
Grid Dissipation .. .. 120 W Max
Grid Circuit Resistance .. .. 15 kΩ Max
Cathode Current (Peak) .. .. 5·7 A Max

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TYPICAL OPERATING CONDITIONS
(Class B, 2 valves)

Anode Voltage	3·0	3·5	4·0	kV
Grid Voltage	−90	−100	−112	V
Peak A.F. Grid Voltage (per valve)	285	310	318	V
Anode Current (Zero Signal)	2×65	2×75	2×100	mA
Anode Current (Maximum Signal)	2×0·80	2×0·95	2×0·94	A
Grid Current (Maximum Signal)	2×0·20	2×0·18	2×0·19	A
Effective Load (Anode to Anode)	4·4	4·2	4·9	kΩ
Nominal Driving Power (Maximum Signal)	2×52	2×50	2×54	W
Anode Dissipation	2×0·75	2×1·0	2×1·1	kW
Output Power (Maximum Signal)	3·3	4·6	5·3	kW
Efficiency	69	70	71	%
Total Distortion	3·3	2·9	2·6	%

Anode Voltage	4·5	5·0	6·0	kV
Grid Voltage	−125	−138	−165	V
Peak A.F. Grid Voltage (per valve)	327	330	455	V
Anode Current (Zero Signal)	2×100	2×110	2×125	mA
Anode Current (Maximum Signal)	2×0·92	2×0·91	2×1·50	A
Grid Current (Maximum Signal)	2×0·19	2×0·14	2×0·28	A
Effective Load (Anode to Anode)	6·1	6·4	4·9	kΩ
Nominal Driving Power (Maximum Signal)	2×27	2×42	2×115	W
Anode Dissipation	2×1·15	2×1·25	2×2·35	kW
Output Power (Maximum Signal)	6·0	6·6	13·3	kW
Efficiency	72	73	74	%
Total Distortion	3·7	3·3	4·3	%

RADIO FREQUENCY POWER AMPLIFIER

(Class B Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	6·0 kV Max
Anode Current	1·1 A Max
Anode Input Power	6·6 kW Max
Anode Dissipation	5·0 kW Max
Grid Dissipation	120 W Max
Cathode Current (Peak)	4·6 A Max

TYPICAL OPERATING CONDITIONS

(frequency 75Mc/s)

Anode Voltage	5·0	6·0	kV
Grid Voltage	−145	−180	V
Peak R.F. Grid Voltage	225	250	V
Anode Current	900	990	mA
Grid Current (100% modulation)	320	300	mA
Driving Power (100% modulation)	160	170	W
Anode Dissipation	3·0	4·0	kW
Output Power	1·45	1·90	kW
Efficiency	32	32	%

RADIO FREQUENCY POWER AMPLIFIER

(Class C Telegraphy, key down conditions, or F.M. Telephony, per valve)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	6·0 kV Max
Anode Current	1·5 A Max
Anode Input Power	9·0 kW Max
Anode Dissipation	5·0 kW Max
Grid Voltage (negative value)	1·0 kV Max
Grid Current	0·35 A Max
Grid Dissipation	120 W Max
Cathode Current (Peak)	8·5 A Max

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TYPICAL OPERATING CONDITIONS
(Grounded Cathode)

Frequency	75	75	75	110	Mc/s
Anode Voltage	4·0	5·0	6·0	5·0	kV
Grid Voltage	−200	−300	−400	−300	V
Peak R.F. Grid Voltage	500	640	740	640	V
Anode Current	1·37	1·50	1·50	1·25	A
Grid Current	350	330	310	300	mA
Nominal Driving Power	190	240	275	250	W
Anode Dissipation	1·5	1·9	2·1	1·45	kW
Output Power	4·0	5·6	6·9	4·8	kW
Efficiency	73	75	76·5	70	%

TYPICAL OPERATING CONDITIONS
(Grounded Grid, 2 valves)

Frequency	75	110	110	220	Mc/s
Anode Voltage	6·0	4·0	5·0	4·0	kV
Filament-Grid Voltage	400	200	300	200	V
Peak R.F. Voltage, filament to filament	1480	1000	1280	900	V
Anode Current	2×1·5	2×1·37	2×1·5	2×1·25	A
Grid Current	2×310	2×350	2×330	2×220	mA
Nominal Driving Power	2×1190	2×705	2×965	2×395	W
Anode Dissipation	2×2·1	2×1·7	2×2·2	2×2·5	kW
Output Power (*See Note* 2)	15·6	8·6	12	5·6	kW
Efficiency	77	69	71	50	%

Printed in England

ANODE MODULATED R.F. POWER AMPLIFIER

(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	5·0 kV Max
Anode Current	1·3 A Max
Anode Input Power	6·5 kW Max
Anode Dissipation	3·4 kW Max
Grid Voltage (negative value)	1·0 kV Max
Grid Current	0·35 A Max
Grid Dissipation	120 W Max
Cathode Current (Peak)	5·7 A Max

TYPICAL OPERATING CONDITIONS

Frequency	75	75	75	Mc/s
Anode Voltage	3·0	3·5	4·0	kV
Grid Voltage	−250	−300	−300	V
Peak R.F. Grid Voltage	510	600	600	V
Anode Current	1·0	1·2	1·2	A
Grid Current	0·3	0·3	0·3	A
Nominal Driving Power	170	205	205	W
Anode Dissipation	0·8	1·2	1·3	kW
Output Power	2·2	3·0	3·5	kW
Efficiency	73	71·5	73	%

Frequency	75	75	110	Mc/s
Anode Voltage	4·5	5·0	4·0	kV
Grid Voltage	−350	−400	−350	V
Peak R.F. Grid Voltage	650	690	600	V
Anode Current	1·2	1·2	0·93	A
Grid Current	0·3	0·3	0·24	A
Nominal Driving Power	230	205	130	W
Anode Dissipation	1·3	1·3	0·92	kW
Output Power	4·1	4·7	2·8	kW
Efficiency	76	78	75	%

Printed in England

CLASS C TELEVISION SERVICE, GRID-MODULATED

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage:	
up to 75Mc/s	5·0 kV Max
up to 220Mc/s	4·0 kV Max
Anode Current	1·9 A Max
Anode Input Power	9·5 kW Max
Anode Dissipation (sync. level)	5·0 kW Max
Grid Voltage (negative value) (sync. level)	1·0 kV Max
Grid Current	0·25 A Max
Grid Dissipation (sync. level)	120 W Max
Cathode Current (Peak)	10 A Max

TYPICAL OPERATING CONDITIONS
(Negative modulation, positive synchronisation)
(Two valves)

Frequency	48 to 75	170 to 220	Mc/s
Anode Voltage	5·0	4·0	kV
Grid Voltage:			
peak sync.	−200	−250	V
black level	−300	−225	V
white level	−550	−500	V
Peak R.F. Grid to Grid Voltage (sync. level)	1·0	1·0	kV
Anode Current:			
peak sync.	2×1·9	2×1·6	A
black level	2×1·3	2×1·3	A
Grid Current:			
peak sync.	2×0·250	2×0·20	A
black level	2×0·175	2×0·11	A
Nominal Driving Power (sync. level)	2×250	2×400	W
Output Power (sync. level)	9·0	6·0	kW
Power into Load (sync. level) (*See Note* 3)	6·3	4·2	kW
Bandwidth (*See Note* 4):			
to −3db points	8·00	10	Mc/s
to −1·5db points	5·25	6·5	Mc/s

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TYPICAL OPERATING CONDITIONS

(Positive modulation, negative synchronisation)
(Two valves)

Frequency	48 to 75	Mc/s
Anode Voltage	5·0	kV
Grid Voltage:		
white level	−200	V
black level	−460	V
peak sync.	−580	V
Peak R.F. Grid to Grid Voltage (white level)	1·0	kV
Anode Current:		
white level	2×1·9	A
black level	2×0·4	A
Grid Current:		
white level	2×250	mA
black level	0	mA
Nominal Driving Power (white level)	2×250	W
Output Power (white level)	9·0	kW
Power into Load (white level) (*See Note* 3)	6·3	kW
Bandwidth (*See Note* 4):		
to −3db points	8·0	Mc/s
to −1·5db points	5·25	Mc/s

RADIO FREQUENCY OSCILLATOR FOR INDUSTRIAL SERVICE

(Class C, anode supply from unfiltered two-phase half-wave rectifier)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	5·4 kV Max
Anode Current	1·35 A Max
Anode Input Power	9·0 kW Max
Anode Dissipation	5·0 kW Max
Grid Voltage (negative value)	900 V Max
Grid Current	0·31 A Max
Grid Dissipation	120 W Max

TYPICAL OPERATING CONDITIONS

Output Voltage (r.m.s.) from Transformer ..	5·1	6·0	kV
Anode Voltage	4·6	5·4	kV
Anode Current	1·15	1·35	A
Grid Current	0·27	0·31	A
Anode Dissipation	1·84	2·3	kW
Grid Resistor	1·1	1·3	kΩ
Nominal Driving Power	160	210	W
Output Power	4·5	6·5	kW
Efficiency	70	72	%

RADIO FREQUENCY OSCILLATOR FOR INDUSTRIAL SERVICE
(Class C, anode supply unrectified a.c.)

MAXIMUM RATINGS
(Absolute Values)

Output Voltage (r.m.s.) from Transformer	6·8 kV Max
Anode Current	0·8 A Max
Anode Input Power	9·0 kW Max
Anode Dissipation	5·0 kW Max
Grid Voltage (negative value)	640 V Max
Grid Current	190 mA Max
Grid Dissipation	120 W Max
Operating Frequency	75 Mc/s Max

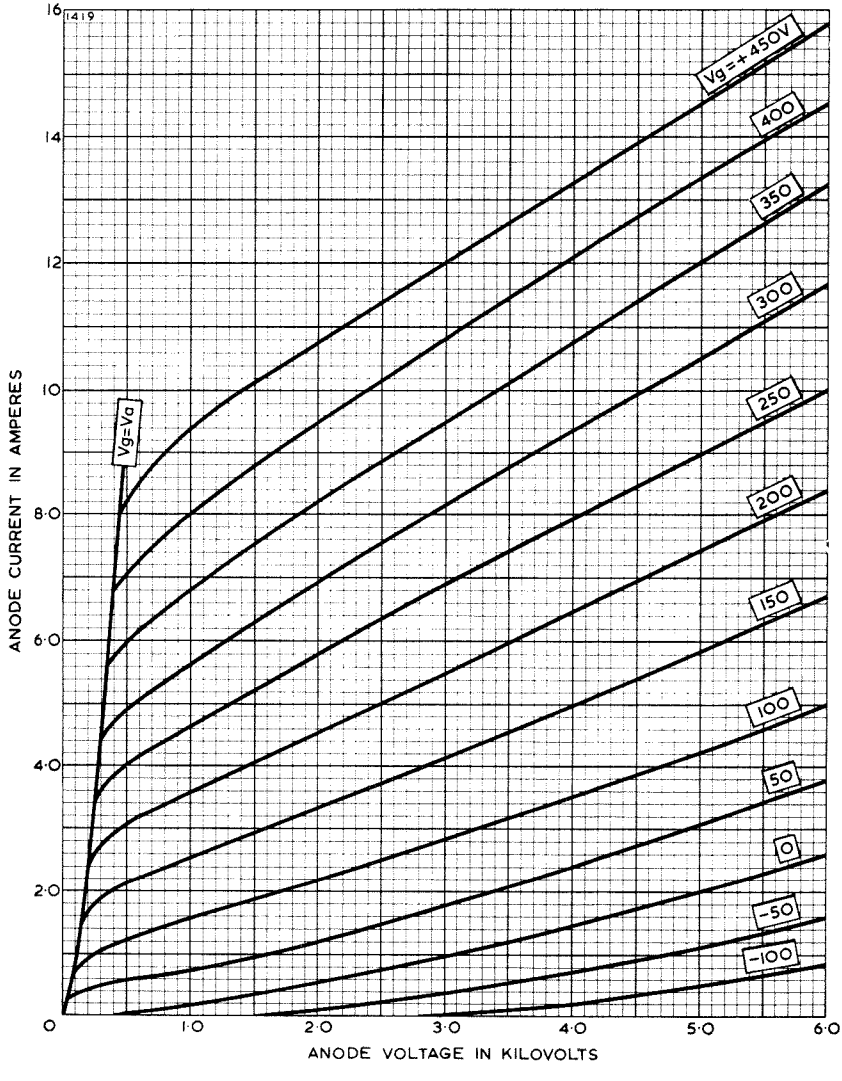
TYPICAL OPERATING CONDITIONS

Output Voltage (r.m.s.) from Transformer ..	5·9	6·8	kV
Grid Voltage	−173	−200	V
from Grid Resistor	1050	1050	Ω
Anode Current	0·7	0·8	A
Grid Current (approx)	165	190	mA
Anode Dissipation	1·24	1·5	kW
Output Power	3·36	4·55	kW
Efficiency	73	75	%

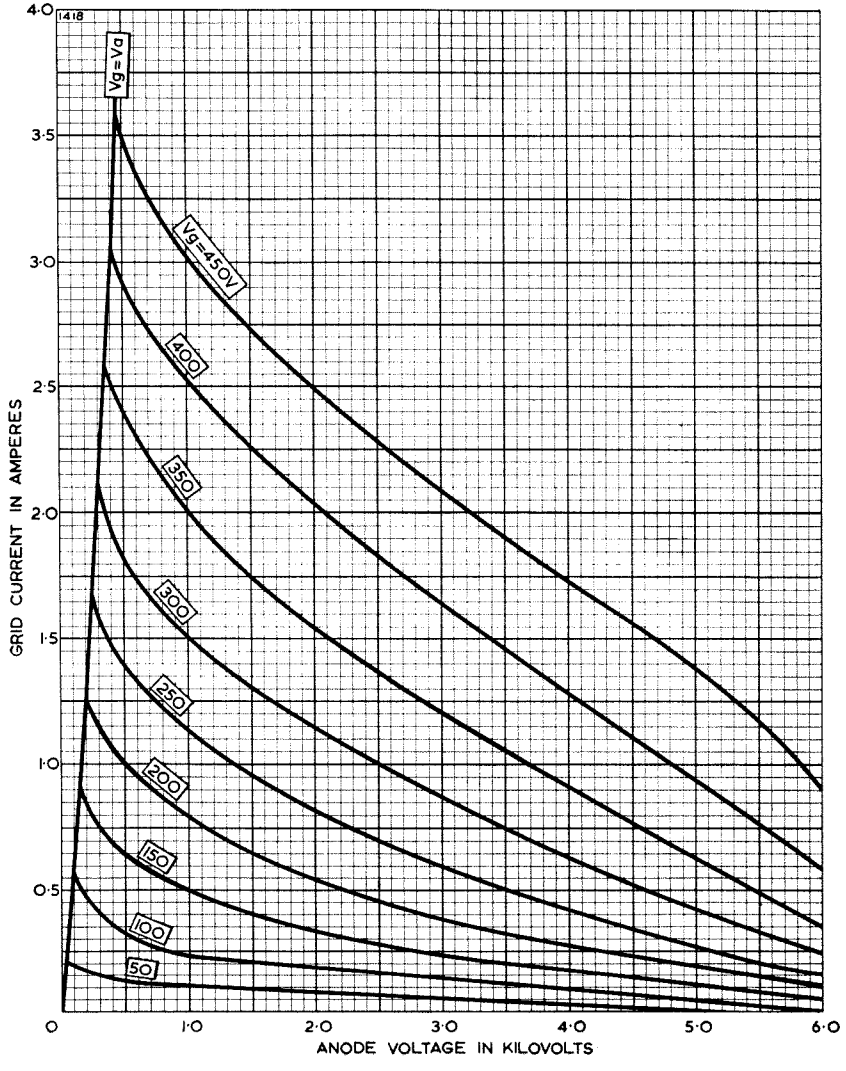
NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed +5% or −10%. The centre-tap lead is not an electrical centre-tap and must not be used for the filament current supply. At frequencies above 30Mc/s, all three filament leads should be interconnected with suitable capacitors.
2. This includes the power transferred from the drive circuit.
3. Assuming circuit transfer efficiency of 70%.
4. For a bandwidth based on one inductor-capacitor circuit.

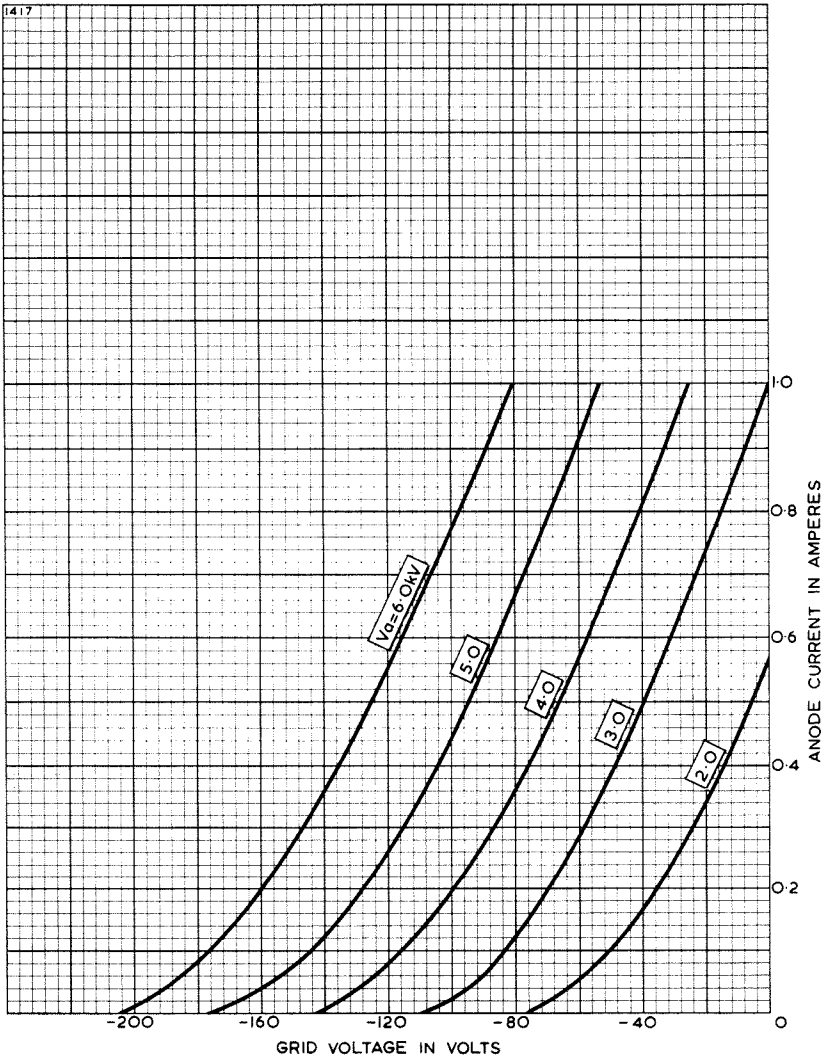
ANODE CHARACTERISTICS



GRID CHARACTERISTICS



ANODE CURRENT—GRID VOLTAGE CHARACTERISTICS



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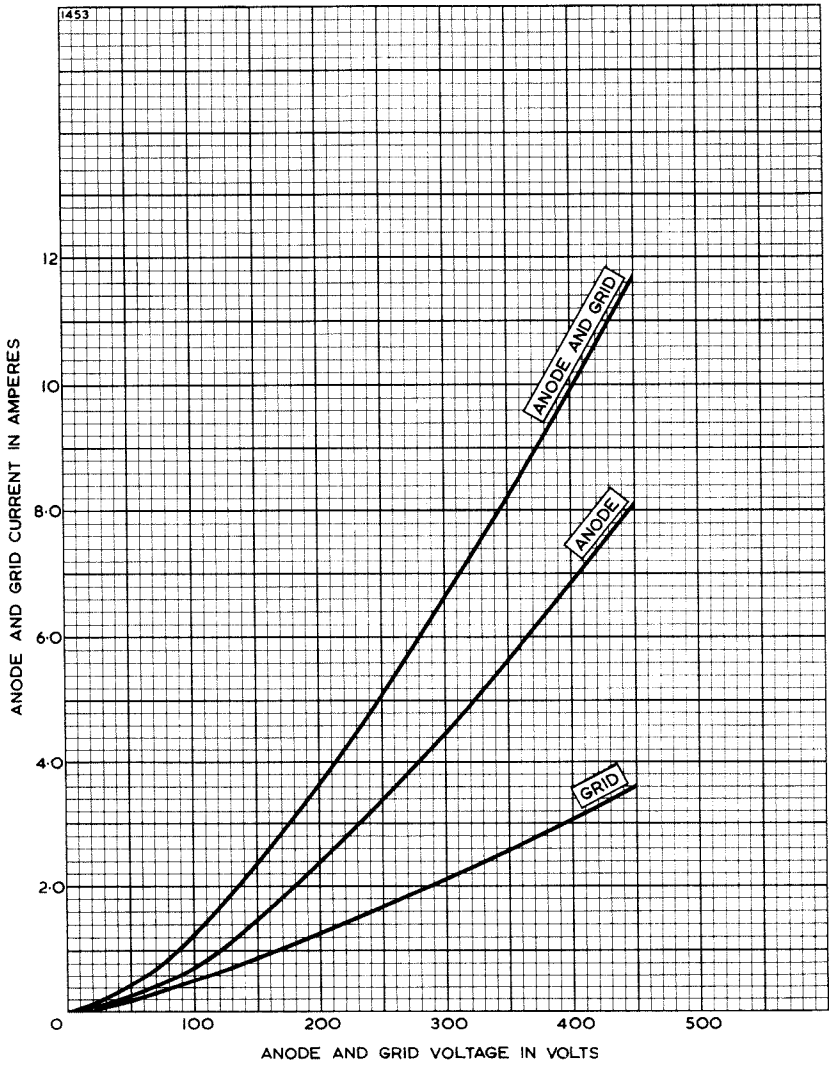
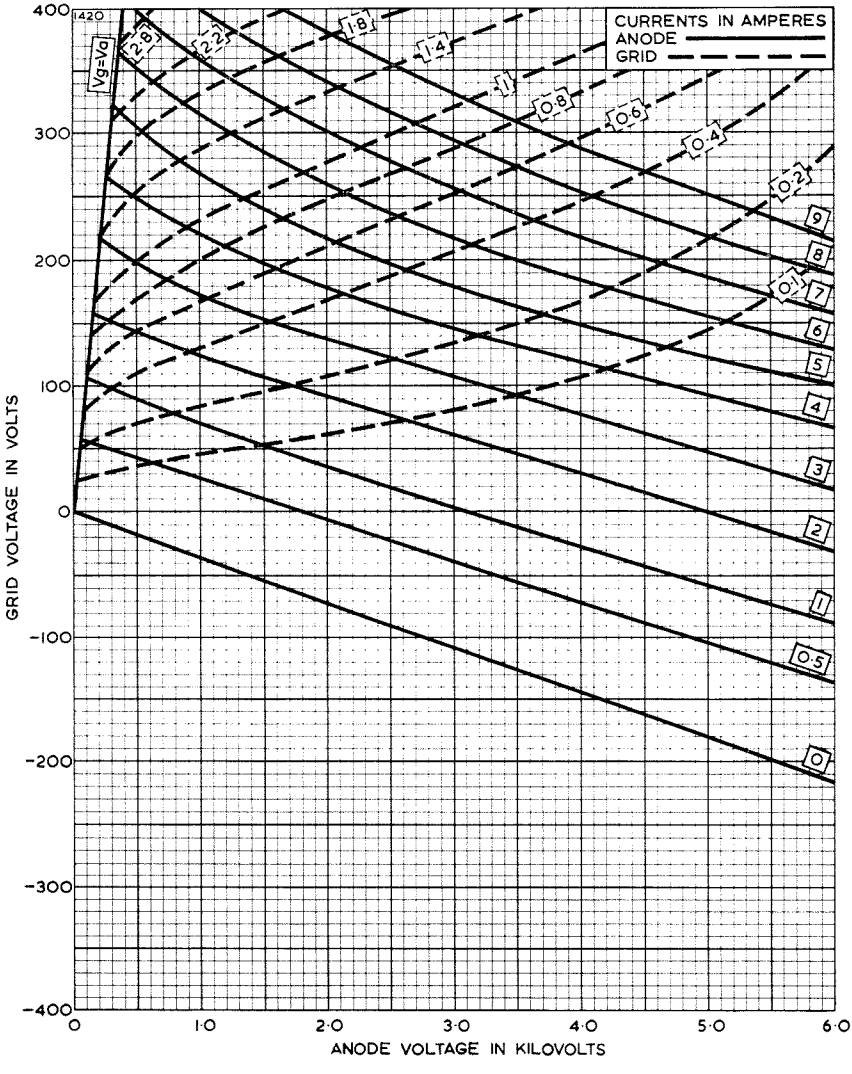
STRAPPED CHARACTERISTICS



CONSTANT CURRENT CHARACTERISTICS



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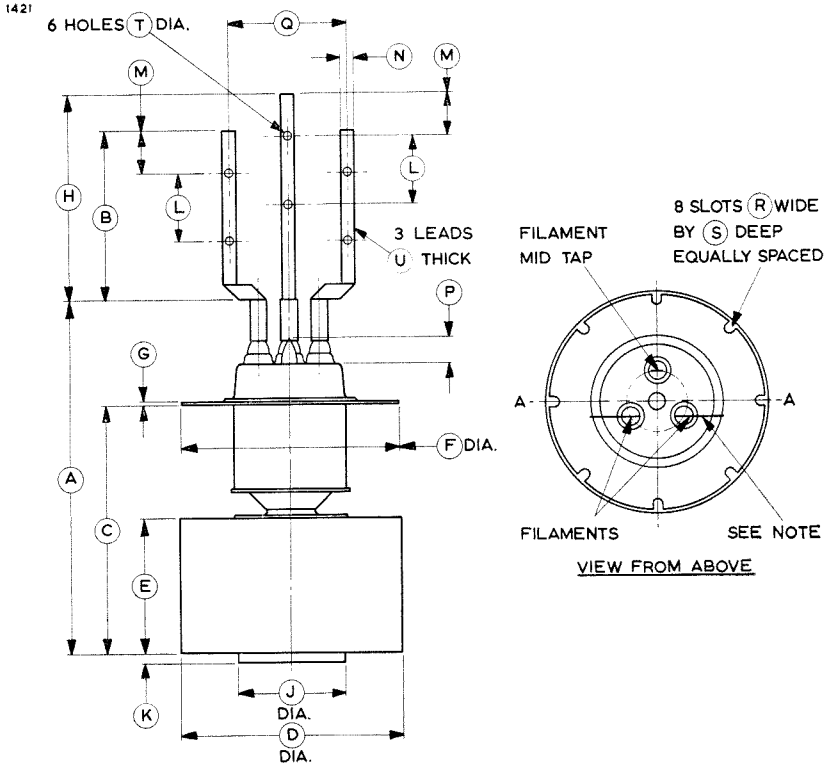
V.H.F. POWER TRIODE

BR1160

OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	7·402 ± 0·079	188·0 ± 2·0	L	1·378 ± 0·079	35·0 ± 2·0
B	3·504 ± 0·079	89·0 ± 2·0	M	0·866 ± 0·079	22·0 ± 2·0
C	5·256 ± 0·138	133·5 ± 3·5	N	0·315 ± 0·020	8·0 ± 0·5
D	4·626 ± 0·059	117·5 ± 1·5	P	0·787 ± 0·197	20·0 ± 5·0
E	2·835 ± 0·039	72·0 ± 1·0	Q	2·461 ± 0·098	62·5 ± 2·5
F	4·567 ± 0·020	116·0 ± 0·5	R	0·177 ± 0·008	4·5 ± 0·2
G	0·059 ± 0·008	1·5 ± 0·2	S	0·207 ± 0·008	5·25 ± 0·20
H	4·252 ± 0·079	108·0 ± 2·0	T	0·142 ± 0·004	3·6 ± 0·1
J	2·205 ± 0·059	56·0 ± 1·5	U	4 × 0·010	4 × 0·25
K	0·177 ± 0·020	4·5 ± 0·5			

Inch dimensions have been derived from millimetres.

Note Plane of filament leads will be parallel to A–A to within $3\frac{1}{2}°$.

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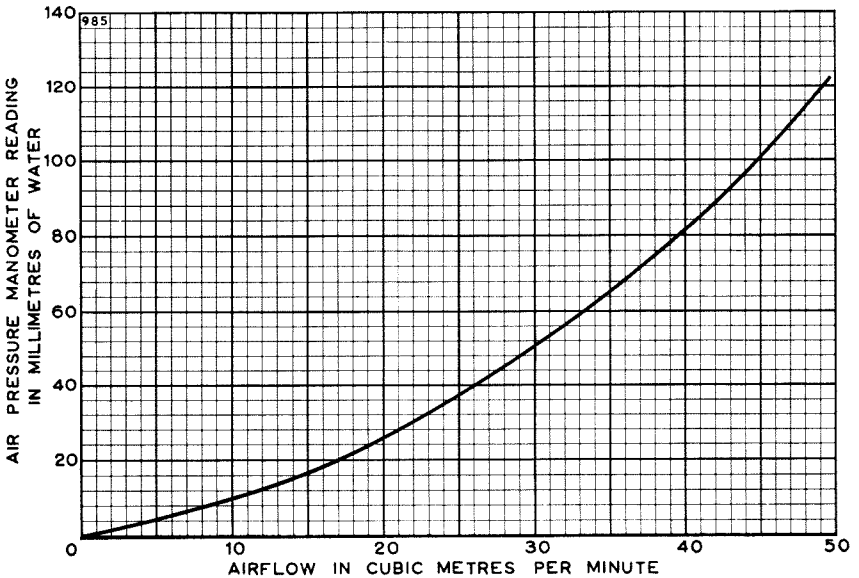
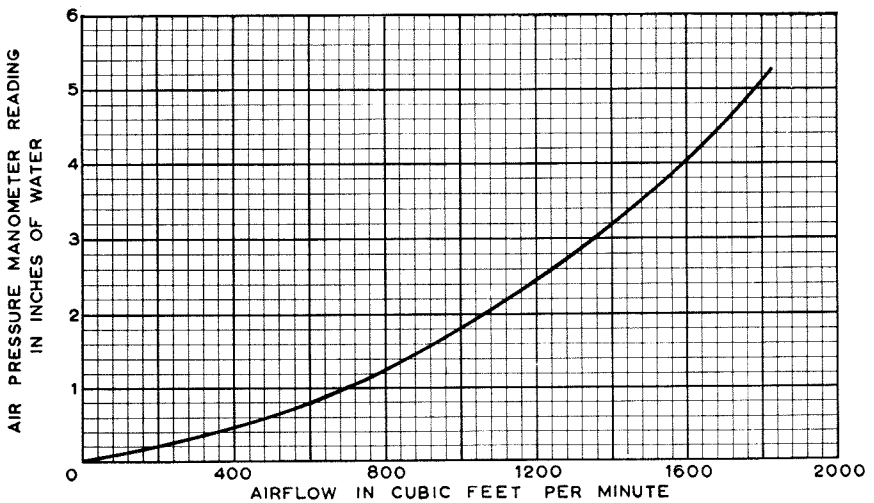
AIR FLOW CHARACTERISTICS





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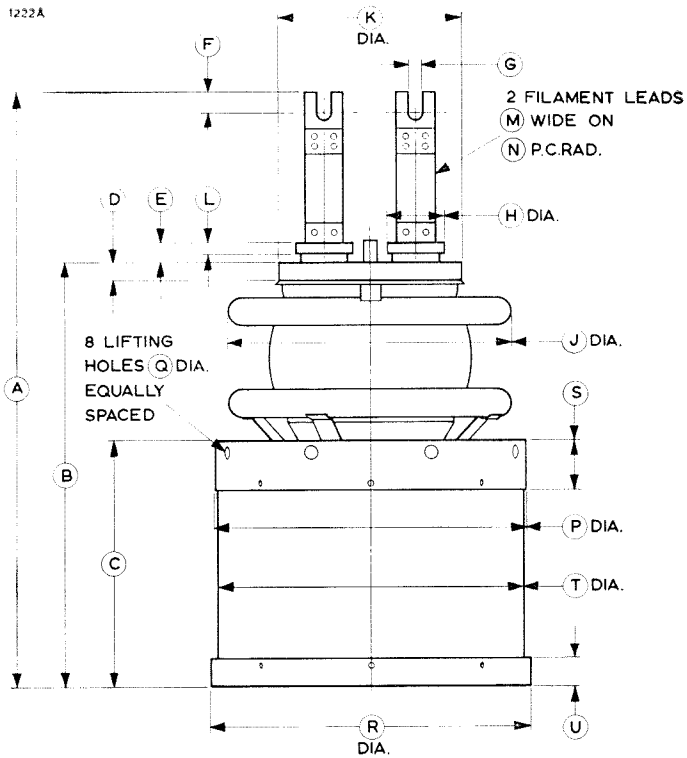
OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	20·710	526·0	L	0·472	12·0
B	14·764 ± 0·040	375·0 ± 1·0	M	1·378	35·0
C	8·543	217·0	N	1·575 ± 0·040	40·0 ± 1·0
D	0·670	17·0	P	$10{\cdot}787^{+0{\cdot}040}_{-0{\cdot}020}$	$274{\cdot}0^{+1{\cdot}0}_{-0{\cdot}5}$
E	0·750 ± 0·040	19·0 ± 1·0	Q	0·472	12·0
F	0·750	19·0	R	11·102 ± 0·040	282·0 ± 1·0
G	0·433	11·0	S	1·772	45·0
H	1·969 ± 0·016	50·0 ± 0·4	T	10·630	270·0
J	9·902 Max	251·5 Max	U	0·984	25·0
K	6·476 ± 0·020	164·5 ± 0·5			

Inch dimensions have been derived from millimetres.

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V.H.F. POWER TRIODE

BR1162

Service Type CV5239

ABRIDGED DATA

Forced-air Cooled Triode for transmitter and industrial applications.

Anode Dissipation	6·0 kW Max
Anode Voltage	7·2 kV Max
Operating Frequency:	
Class C Telegraphy	30 Mc/s Max
Class C Industrial Oscillator	85 Mc/s Max
Output Power:	
Class C Telegraphy	10 kW
Class C Industrial Oscillator	8·6 kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	12·6	V
Filament Current	33	A
Amplification Factor (V_a = 6·0kV, I_a = 1·0A)	32	
Mutual Conductance (V_a = 6·0kV, I_a = 1·0A)	15	mA/V
Inter-electrode Capacitances:		
Grid to Anode	11	pF
Grid to Filament	16	pF
Anode to Filament	0·3	pF

Mechanical

Overall Length	7·677 inches	(195 mm)	Max
Overall Diameter	4·827 inches	(122·6 mm)	Max
Net Weight	10·1 pounds	(4·6 kg)	Approx
Mounting Position	Vertical, either way up		

Accessories

Filament Connectors	MA146A
Centre-tap Dissipating Connector	MA146B
Grid Connector (above 30Mc/s)	MA147A
Insulating Pedestal	MA149A

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COOLING

The required flows of air through the radiator for cooling at various anode dissipations and heights above sea level are given in the following table. The air flow should be delivered by a blower through the radiator before and during the application of any voltages.

Anode Dissipation (kW)	Height above Sea Level (ft)	(m)	Inlet Temperature Max (°C)	Rate of Flow of Air (Min) (cu.ft/min)	(cu.m/min)	Pressure Drop (in. water)	(mm water)
2·0	0	0	35	169	4·8	0·79	20
2·0	0	0	45	201	5·7	0·98	25
2·0	4920	1500	35	201	5·7	0·90	23
2·0	9840	3000	25	215	6·1	0·90	23
3·5	0	0	35	219	6·2	1·26	32
3·5	0	0	45	258	7·3	1·65	42
3·5	4920	1500	35	258	7·3	1·42	36
3·5	9840	3000	25	275	7·8	1·42	36
6·0	0	0	35	325	9·2	2·68	68
6·0	0	0	45	378	10·7	3·58	91
6·0	4920	1500	35	396	11·2	3·19	81
6·0	9840	3000	25	413	11·7	3·15	80

It may be necessary to direct a flow of air on to the filament and grid seals in order to maintain their temperatures within the following limits:

Temperature of filament seals .. .. 210 °C Max
Temperature of grid and anode seals .. .. .. 180 °C Max

A heat dissipating connector such as MA146B must be used on the filament centre-tap pin.

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR
(Class B)
MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	7·2 kV Max
Anode Current	2·2 A Max
Anode Input Power	14 kW Max
Anode Dissipation	6·0 kW Max
Grid Dissipation	250 W Max
Grid Circuit Resistance	15 kΩ Max
Cathode Current (Peak)	10 A Max

TYPICAL OPERATING CONDITIONS
(Class B, 2 valves)

Anode Voltage	4·0	5·0	5·0	7·0	kV
Grid Voltage	−120	−145	−145	−210	V
Peak A.F. Grid Voltage (per valve)	445	342	415	605	V
Anode Current (Zero Signal)	2×0·10	2×0·15	2×0·15	2×0·20	A
Anode Current (Maximum Signal)	2×1·25	2×1·10	2×1·25	2×2·00	A
Grid Current (Maximum Signal)	2×0·32	2×0·22	2×0·35	2×0·56	A
Effective Load (Anode to Anode)	3·8	5·5	4·8	4·15	kΩ
Nominal Driving Power (Maximum Signal)	2×140	2×65	2×130	2×310	W
Anode Dissipation	2×1·45	2×1·50	2×1·70	2×4·00	kW
Output Power (Maximum Signal)	7·1	8·0	9·0	20	kW
Efficiency	71	72·5	72·5	71·5	%

ANODE MODULATED R.F. POWER AMPLIFIER
(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	5·5 kV Max
Anode Current	1·8 A Max
Anode Dissipation	4·0 kW Max
Grid Voltage (negative value)	1·25 kV Max
Grid Current	0·6 A Max
Grid Dissipation	250 W Max
Cathode Current (Peak)	12 A Max
Frequency for above ratings	30 Mc/s Max

TYPICAL OPERATING CONDITIONS
(frequency 30Mc/s)

Anode Voltage	4·0	5·0	5·0	kV
Grid Voltage	−300	−400	−400	V
Peak R.F. Grid Voltage	680	730	800	V
Anode Current	1·6	1·4	1·6	A
Grid Current	0·6	0·5	0·5	A
Nominal Driving Power	367	328	432	W
Anode Dissipation	1·4	1·4	1·6	kW
Output Power	5·0	5·6	6·4	kW
Efficiency	78	80	80	%

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RADIO FREQUENCY POWER AMPLIFIER
(Class C Telegraphy, key down conditions, or F.M. Telephony, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	7·2 kV Max
Anode Current	2·2 A Max
Anode Input Power	14 kW Max
Anode Dissipation	6·0 kW Max
Grid Voltage (negative value)	1250 V Max
Grid Current	0·6 A Max
Grid Dissipation	250 W Max
Cathode Current (Peak)	14 A Max
Frequency for above ratings	30 Mc/s Max

TYPICAL OPERATING CONDITIONS
(frequency 30Mc/s)

Anode Voltage	5·0	6·0	6·5	kV
Grid Voltage	−300	−400	−450	V
Peak R.F. Grid Voltage	700	820	850	V
Anode Current	2·0	2·0	2·0	A
Grid Current	0·6	0·6	0·6	A
Nominal Driving Power	378	443	460	W
Anode Dissipation	2·7	2·8	3·0	kW
Output Power	7·3	9·2	10	kW
Efficiency	73	76·7	77	%

RADIO FREQUENCY POWER OSCILLATOR
(Class C, anode supply from unfiltered three phase half-wave rectifier)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	7·0 kV Max
Anode Current	1·8 A Max
Anode Input Power	11 kW Max
Anode Dissipation	6·0 kW Max
Grid Voltage (negative value)	1250 V Max
Grid Current (unloaded)	0·7 A Max
Grid Current (loaded)	0·5 A Max
Grid Dissipation	250 W Max
Grid Circuit Resistance	10 kΩ Max
Cathode Current (Peak)	11 A Max
Operating Frequency for full ratings	55 Mc/s Max
Anode Voltage for operation at 85Mc/s max	6·5 kV Max

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TYPICAL OPERATING CONDITIONS

Frequency	55	85	85	Mc/s
Output Voltage (r.m.s.) from Transformer	5·55	5·13	4·27	kV
Anode Voltage	6·5	6·0	5·0	kV
Anode Current	1·7	1·5	1·7	A
Grid Current (unloaded)	0·7	0·7	0·7	A
Grid Current (loaded)	0·5	0·4	0·45	A
Anode Dissipation	2·4	2·5	2·4	kW
Anode Load Resistance	2·0	2·3	1·6	kΩ
Grid Resistor	0·9	1·0	0·85	kΩ
Feedback Ratio (*See Note* 2)	0·15	0·15	0·19	
Nominal Drive Power	350	300	350	W
Output Power	8·6	6·5	6·1	kW
Effective Output Power to Load (*See Note* 3)	7·0	5·5	5·0	kW
Efficiency	78	72	72	%

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed +5% or −10%. The centre-tap pin is not an electrical centre-tap and must not be used for the filament current supply. At frequencies above 30Mc/s, all three filament pins should be interconnected with suitable capacitors.

2. The feedback ratio is defined as $\frac{V_{g\ (pk)}}{V_{a\ (pk)}}$

   where $V_{g\ (pk)}$ = peak r.f. grid voltage in volts
   and $V_{a\ (pk)}$ = peak r.f. anode voltage in volts.

3. Effective output power to load = $\eta_a\ (P_{out} - P_{drive})$
   where η_a = efficiency of anode circuit = 85% (typical value)
   P_{out} = output power of valve to anode circuit
   P_{drive} = drive power fed back to grid circuit.

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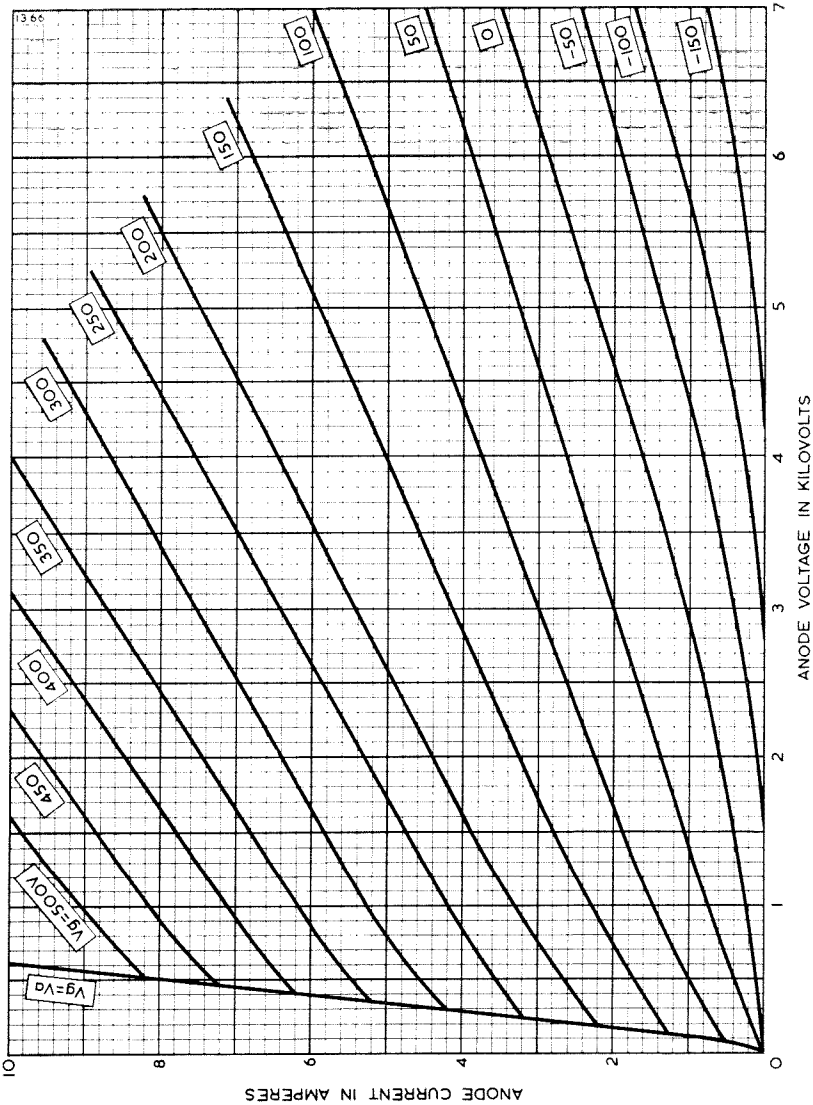
ANODE CHARACTERISTICS



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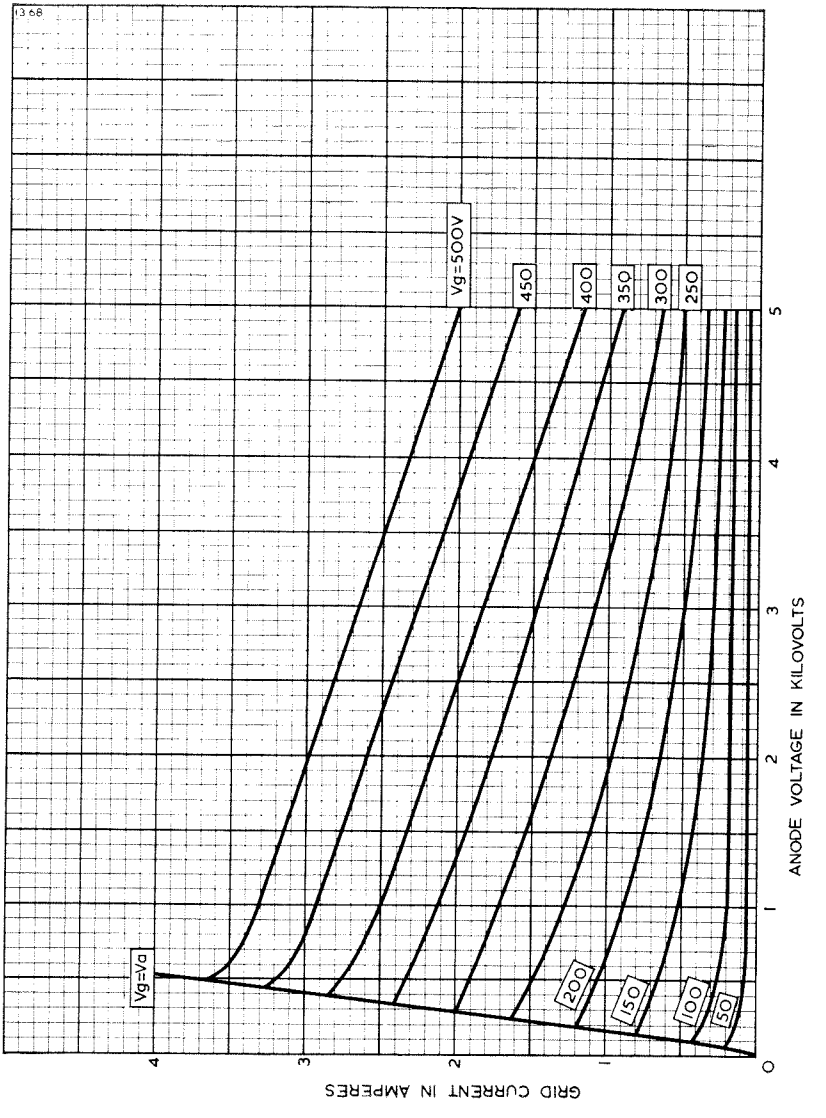
GRID CHARACTERISTICS



ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

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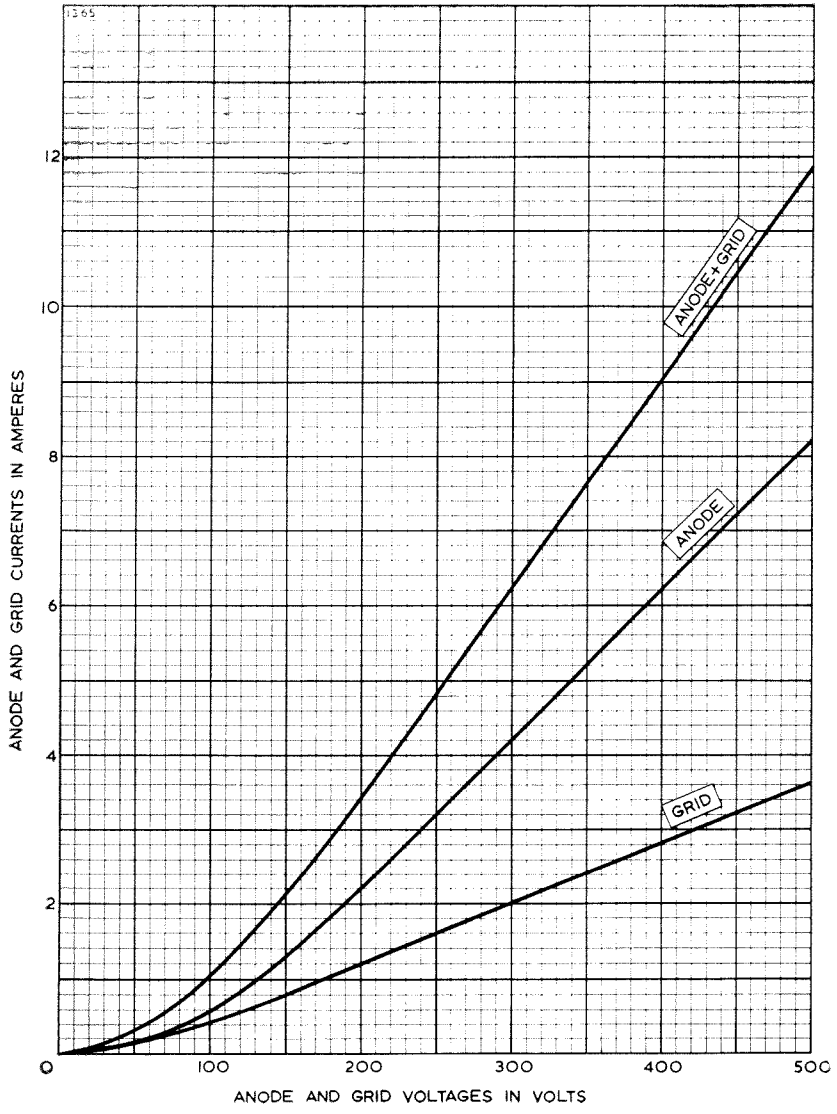
STRAPPED CHARACTERISTICS



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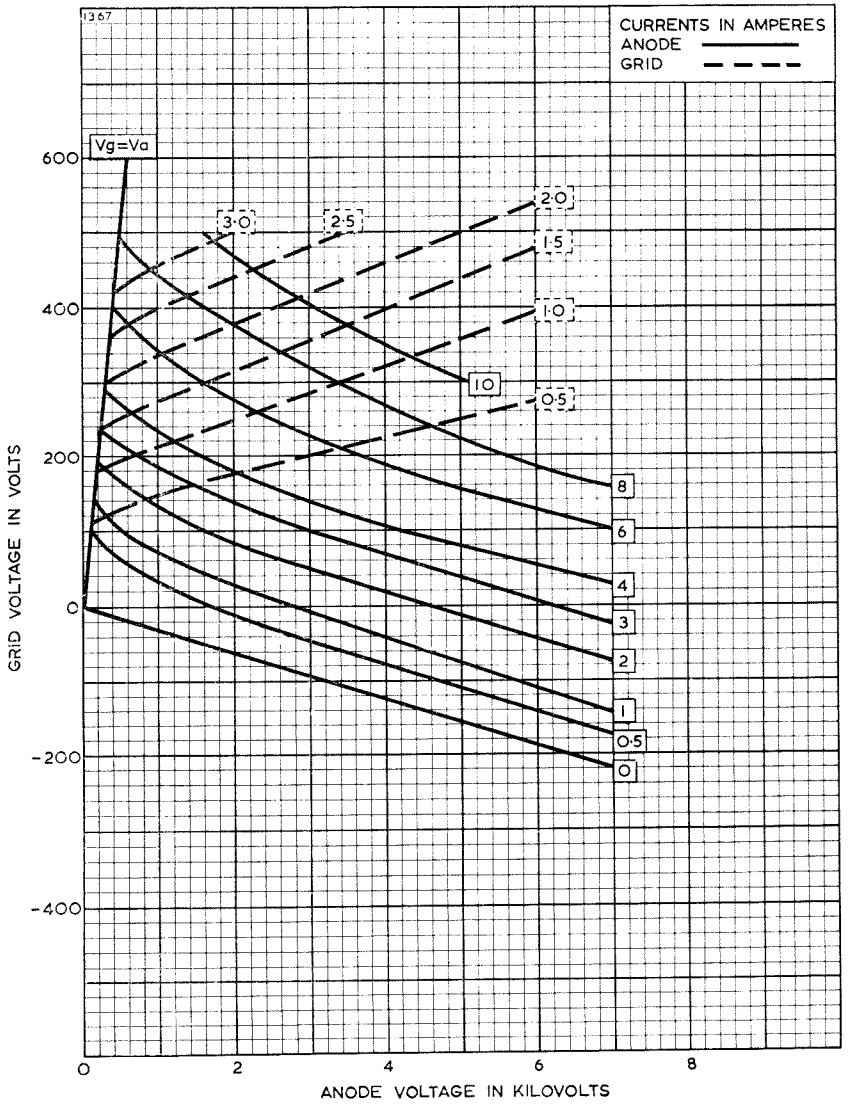
CONSTANT CURRENT CHARACTERISTICS



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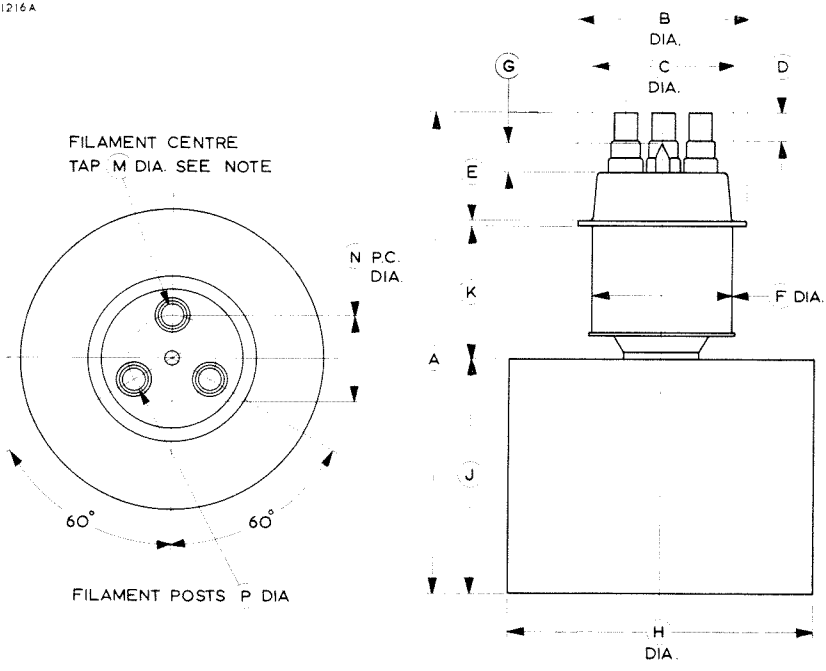
OUTLINE

1216A



Ref.	Inches	Millimetres
A	7·677 Max	195·0 Max
B	2·756 ± 0·020	70·00 ± 0·50
C	2·323 Max	59·00 Max
D	0·472 Min	12·00 Min
E	0·098	2·50
F	2·323	59·00
G	0·630 Max	16·00 Max
H	4·815 ± 0·012	122·3 ± 0·3
J	3·701	94·00
K	2·126 ± 0·020	54·00 ± 0·50
M	0·413	10·50
N	1·378 ± 0·040	35·00 ± 1·00
P	0·358	9·10

Inch dimensions have been derived from millimetres.

Note The filament centre tap post is marked 'O'.

V.H.F. POWER TRIODE

BR1165

ENGLISH ELECTRIC

ABRIDGED DATA

Forced-air Cooled V.H.F. Triode for A.M., F.M. or television transmitters and for industrial applications.

	Class B Audio Amplifier	*Class C Telegraphy or F.M. Telephony*	*Class C Telephony*	*Class C Television*	
Anode Dissipation	5·0	5·0	3·4	5·0	kW Max
Anode Voltage	6·0	6·0	5·0	5·0	kV Max
Operating Frequency	—	220	220	220	Mc/s Max
Output Power	6·65 per valve	6·9	4·7	4·5 per valve	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	12·6	V
Filament Current	33	A
Peak Usable Cathode Current	8·5	A
Amplification Factor (V_a = 4·0kV, I_a = 1·0A)	32	
Mutual Conductance (V_a = 4·0kV, I_a = 1·0A)	17	mA/V
Inter-electrode Capacitances:		
Grid to Anode	11	pF
Grid to Filament	16	pF
Anode to Filament	0·3	pF

Mechanical

Overall Length	7·680 inches (195 mm)	Max
Overall Diameter	4·827 inches (122·6 mm)	Max
Net Weight	10·1 pounds (4·6 kg)	Approx
Mounting Position	Vertical, either way up	

Accessories

Filament Connectors	MA146A
Centre-tap Dissipating Connector	MA146A
Grid Connector (above 30Mc/s)	MA147A
Insulating Pedestal	MA149A

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

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ENGLISH ELECTRIC

COOLING

The required flows of air through the radiator for cooling at various anode dissipations and heights above sea level are given in the following table. The air flow should be delivered by a blower through the radiator before and during the application of any voltages.

Anode Dissipation (kW)	Height above Sea Level (ft)	(m)	Inlet Temperature Max (°C)	Rate of Flow of Air (Min) (ft^3/min)	(m^3/min)	Pressure Drop (in. water)	(mm water)
1·0	0	0	35	105	3·0	0·31	8·0
1·0	0	0	45	110	3·1	0·31	8·0
1·0	4920	1500	35	130	3·7	0·35	9·0
1·0	9840	3000	25	145	4·1	0·39	10
3·0	0	0	35	185	5·2	0·91	23
3·0	0	0	45	215	6·1	1·14	29
3·0	4920	1500	35	220	6·2	1·02	26
3·0	9840	3000	25	235	6·6	1·02	26
5·0	0	0	35	325	9·2	2·68	68
5·0	0	0	45	380	10·7	3·54	90
5·0	4920	1500	35	395	11·2	3·19	81
5·0	9840	3000	25	410	11·6	3·11	79

It may be necessary to direct a flow of air on to the filament and grid seals in order to maintain their temperatures within the following limits:

Temperature of filament seals .. .. 220 °C Max
Temperature of grid and anode seals .. .. 180 °C Max

A heat dissipating connector such as MA146A must be used on the filament centre-tap pin.

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR
(Class B)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	6·0 kV Max
Anode Current	1·5 A Max
Anode Input Power	9·0 kW Max
Anode Dissipation	5·0 kW Max
Grid Dissipation	120 W Max
Grid Circuit Resistance	15 kΩ Max
Cathode Current (Peak)	5·7 A Max

TYPICAL OPERATING CONDITIONS
(Class B, 2 valves)

Anode Voltage	3·0	3·5	4·0	kV
Grid Voltage	−90	−100	−112	V
Peak A.F. Grid Voltage (per valve)	285	310	318	V
Anode Current (Zero Signal)	2×65	2×75	2×100	mA
Anode Current (Maximum Signal)	2×0·80	2×0·95	2×0·94	A
Grid Current (Maximum Signal)	2×0·20	2×0·18	2×0·19	A
Effective Load (Anode to Anode)	4·4	4·2	4·9	kΩ
Nominal Driving Power (Maximum Signal)	2×52	2×50	2×54	W
Anode Dissipation	2×0·75	2×1·0	2×1·1	kW
Output Power (Maximum Signal)	3·3	4·6	5·3	kW
Efficiency	69	70	71	%
Total Distortion	3·3	2·9	2·6	%

Anode Voltage	4·5	5·0	6·0	kV
Grid Voltage	−125	−138	−165	V
Peak A.F. Grid Voltage (per valve)	327	330	455	V
Anode Current (Zero Signal)	2×100	2×110	2×125	mA
Anode Current (Maximum Signal)	2×0·92	2×0·91	2×1·50	A
Grid Current (Maximum Signal)	2×0·19	2×0·14	2×0·28	A
Effective Load (Anode to Anode)	6·1	6·4	4·9	kΩ
Nominal Driving Power (Maximum Signal)	2×27	2×42	2×115	W
Anode Dissipation	2×1·15	2×1·25	2×2·35	kW
Output Power (Maximum Signal)	6·0	6·6	13·3	kW
Efficiency	72	73	74	%
Total Distortion	3·7	3·3	4·3	%

RADIO FREQUENCY POWER AMPLIFIER

(Class B Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	6·0 kV Max
Anode Current	1·1 A Max
Anode Input Power	6·6 kW Max
Anode Dissipation	5·0 kW Max
Grid Dissipation	120 W Max
Cathode Current (Peak)	4·6 A Max

TYPICAL OPERATING CONDITIONS

(frequency 75Mc/s)

Anode Voltage	5·0	6·0	kV
Grid Voltage	−145	−180	V
Peak R.F. Grid Voltage	225	250	V
Anode Current	900	990	mA
Grid Current (100% modulation)	320	300	mA
Driving Power (100% modulation)	160	170	W
Anode Dissipation	3·0	4·0	kW
Output Power	1·45	1·90	kW
Efficiency	32	32	%

RADIO FREQUENCY POWER AMPLIFIER

(Class C Telegraphy, key down conditions, or F.M. Telephony, per valve)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	6·0 kV Max
Anode Current	1·5 A Max
Anode Input Power	9·0 kW Max
Anode Dissipation	5·0 kW Max
Grid Voltage (negative value)	1·0 kV Max
Grid Current	0·35 A Max
Grid Dissipation	120 W Max
Cathode Current (Peak)	8·5 A Max

TYPICAL OPERATING CONDITIONS
(Grounded Cathode)

Frequency	75	75	75	110	Mc/s
Anode Voltage	4·0	5·0	6·0	5·0	kV
Grid Voltage	−200	−300	−400	−300	V
Peak R.F. Grid Voltage	500	640	740	640	V
Anode Current	1·37	1·50	1·50	1·25	A
Grid Current	350	330	310	300	mA
Nominal Driving Power	190	240	275	250	W
Anode Dissipation	1·5	1·9	2·1	1·45	kW
Output Power	4·0	5·6	6·9	4·8	kW
Efficiency	73	75	76·5	70	%

TYPICAL OPERATING CONDITIONS
(Grounded Grid, 2 valves)

Frequency	75	110	110	220	Mc/s
Anode Voltage	6·0	4·0	5·0	4·0	kV
Filament-Grid Voltage	400	200	300	200	V
Peak R.F. Voltage, filament to filament	1480	1000	1280	900	V
Anode Current	2×1·5	2×1·37	2×1·5	2×1·25	A
Grid Current	2×310	2×350	2×330	2×220	mA
Nominal Driving Power	2×1190	2×705	2×965	2×395	W
Anode Dissipation	2×2·1	2×1·7	2×2·2	2×2·5	kW
Output Power (*See Note* 2)	15·6	8·6	12	5·6	kW
Efficiency	77	69	71	50	%

ANODE MODULATED R.F. POWER AMPLIFIER

(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	5·0 kV Max
Anode Current	1·3 A Max
Anode Input Power	6·5 kW Max
Anode Dissipation	3·4 kW Max
Grid Voltage (negative value)	1·0 kV Max
Grid Current	0·35 A Max
Grid Dissipation	120 W Max
Cathode Current (Peak)	5·7 A Max

TYPICAL OPERATING CONDITIONS

Frequency	75	75	75	Mc/s
Anode Voltage	3·0	3·5	4·0	kV
Grid Voltage	−250	−300	−300	V
Peak R.F. Grid Voltage	510	600	600	V
Anode Current	1·0	1·2	1·2	A
Grid Current	0·3	0·3	0·3	A
Nominal Driving Power	170	205	205	W
Anode Dissipation	0·8	1·2	1·3	kW
Output Power	2·2	3·0	3·5	kW
Efficiency	73	71·5	73	%

Frequency	75	75	110	Mc/s
Anode Voltage	4·5	5·0	4·0	kV
Grid Voltage	−350	−400	−350	V
Peak R.F. Grid Voltage	650	690	600	V
Anode Current	1·2	1·2	0·93	A
Grid Current	0·3	0·3	0·24	A
Nominal Driving Power	230	205	130	W
Anode Dissipation	1·3	1·3	0·92	kW
Output Power	4·1	4·7	2·8	kW
Efficiency	76	78	75	%

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CLASS C TELEVISION SERVICE, GRID-MODULATED

MAXIMUM RATINGS
(Absolute Values)

	Up to 75Mc/s	*Up to 220Mc/s*	
Anode Voltage	5·0	4·0	kV Max
Anode Current	1·9	1·6	A Max
Anode Input Power	9·5	6·5	kW Max
Anode Dissipation (sync. level)	5·0	4·0	kW Max
Grid Voltage (negative value) (sync. level)	1·0	1·0	kV Max
Grid Current	0·25	0·25	A Max
Grid Dissipation (sync. level)	120	120	W Max
Cathode Current (Peak)	10	10	A Max

TYPICAL OPERATING CONDITIONS
(Negative modulation, positive synchronisation)
(Two valves)

Frequency	48 to 75	170 to 220	Mc/s
Anode Voltage	5·0	4·0	kV
Grid Voltage:			
peak sync.	−200	−150	V
black level	−300	−225	V
white level	−550	−500	V
Peak R.F. Grid to Grid Voltage (sync. level)	1·0	1·0	kV
Anode Current:			
peak sync.	2×1·9	2×1·6	A
black level	2×1·3	2×1·3	A
Grid Current:			
peak sync.	2×0·250	2×0·20	A
black level	2×0·175	2×0·11	A
Nominal Driving Power (sync. level)	2×250	2×400	W
Output Power (sync. level)	9·0	6·0	kW
Power into Load (sync. level) (*See Note* 3)	6·3	4·2	kW
Bandwidth (*See Note* 4):			
to −3db points	8·00	10	Mc/s
to −1·5db points	5·25	6·5	Mc/s

TYPICAL OPERATING CONDITIONS

(Positive modulation, negative synchronisation)
(Two valves)

Frequency	48 to 75	Mc/s
Anode Voltage	5·0	kV
Grid Voltage:		
white level	−200	V
black level	−460	V
peak sync.	−580	V
Peak R.F. Grid to Grid Voltage (white level)	1·0	kV
Anode Current:		
white level	2×1·9	A
black level	2×0·4	A
Grid Current:		
white level	2×250	mA
black level	0	mA
Nominal Driving Power (white level)	2×250	W
Output Power (white level)	9·0	kW
Power into Load (white level) (*See Note* 3)	6·3	kW
Bandwidth (*See Note* 4):		
to −3db points	8·0	Mc/s
to −1·5db points	5·25	Mc/s

RADIO FREQUENCY OSCILLATOR FOR INDUSTRIAL SERVICE

(Class C, anode supply from unfiltered two-phase half-wave rectifier)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	5·4 kV Max
Anode Current	1·35 A Max
Anode Input Power	9·0 kW Max
Anode Dissipation	5·0 kW Max
Grid Voltage (negative value)	900 V Max
Grid Current	0·31 A Max
Grid Dissipation	120 W Max

TYPICAL OPERATING CONDITIONS

Output Voltage (r.m.s.) from Transformer ..	5·1	6·0	kV
Anode Voltage	4·6	5·4	kV
Anode Current	1·15	1·35	A
Grid Current	0·27	0·31	A
Anode Dissipation	1·84	2·3	kW
Grid Resistor	1·1	1·3	kΩ
Nominal Driving Power	160	210	W
Output Power	4·5	6·5	kW
Efficiency	70	72	%

RADIO FREQUENCY OSCILLATOR FOR INDUSTRIAL SERVICE

(Class C, anode supply unrectified a.c.)

MAXIMUM RATINGS

(Absolute Values)

Output Voltage (r.m.s.) from Transformer	6·8 kV Max
Anode Current	0·8 A Max
Anode Input Power	9·0 kW Max
Anode Dissipation	5·0 kW Max
Grid Voltage (negative value)	640 V Max
Grid Current	190 mA Max
Grid Dissipation	120 W Max
Operating Frequency	75 Mc/s Max

TYPICAL OPERATING CONDITIONS

Output Voltage (r.m.s.) from Transformer ..	5·9	6·8	kV
Grid Voltage	−173	−200	V
from Grid Resistor	1050	1050	Ω
Anode Current	0·7	0·8	A
Grid Current (approx)	165	190	mA
Anode Dissipation	1·24	1·5	kW
Output Power	3·36	4·55	kW
Efficiency	73	75	%

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed +5% or −10%. The centre-tap lead is not an electrical centre-tap and must not be used for the filament current supply. At frequencies above 30Mc/s, all three filament leads should be interconnected with suitable capacitors.
2. This includes the power transferred from the drive circuit.
3. Assuming circuit transfer efficiency of 70%.
4. For a bandwidth based on one inductor-capacitor circuit.

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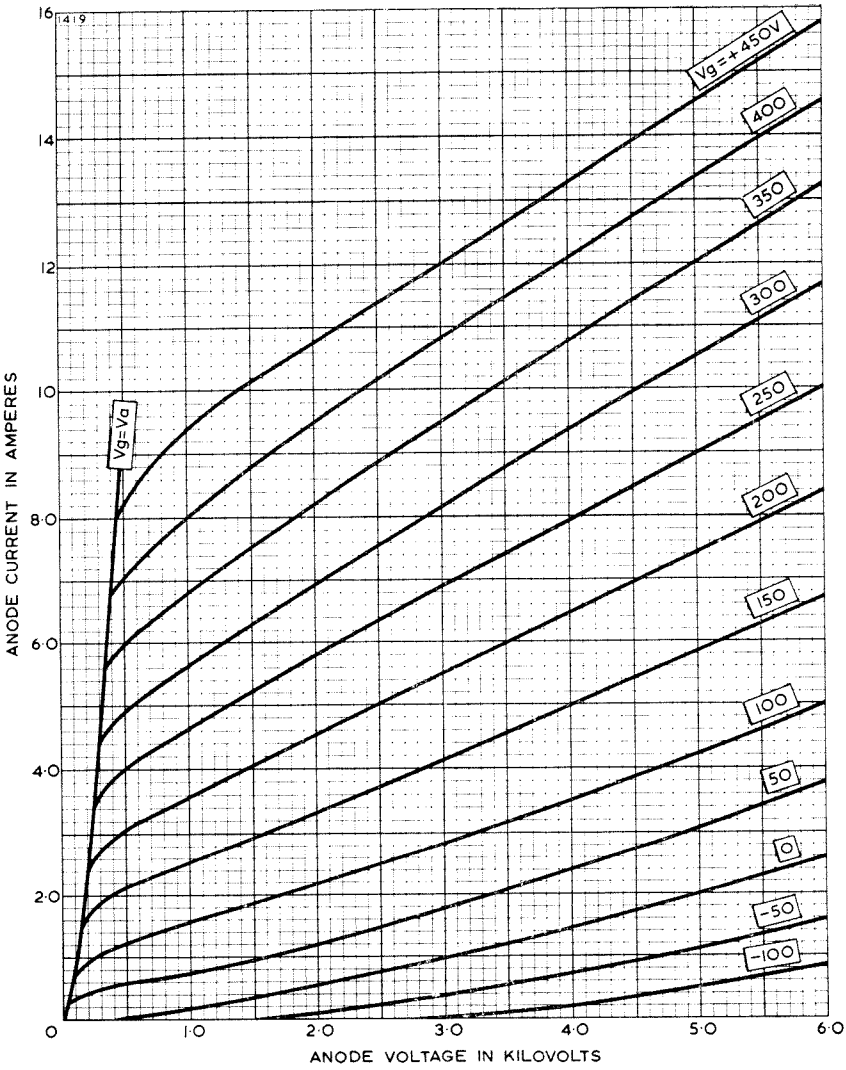
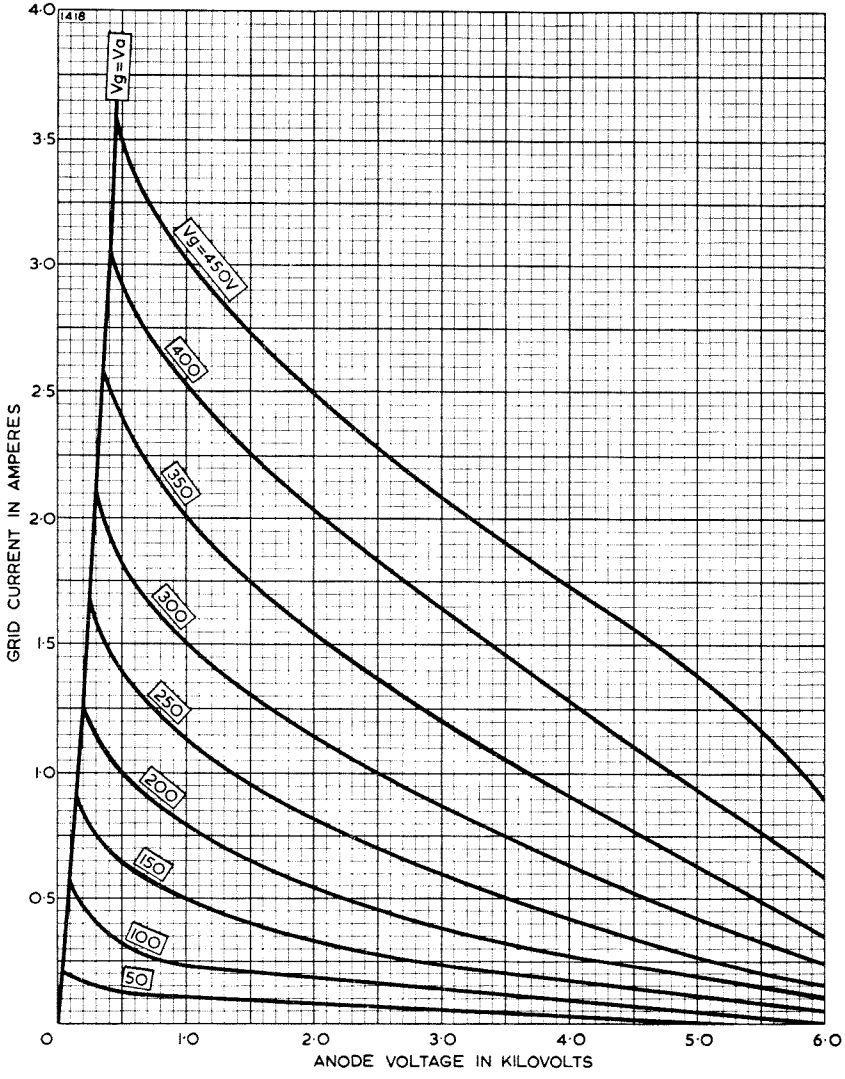
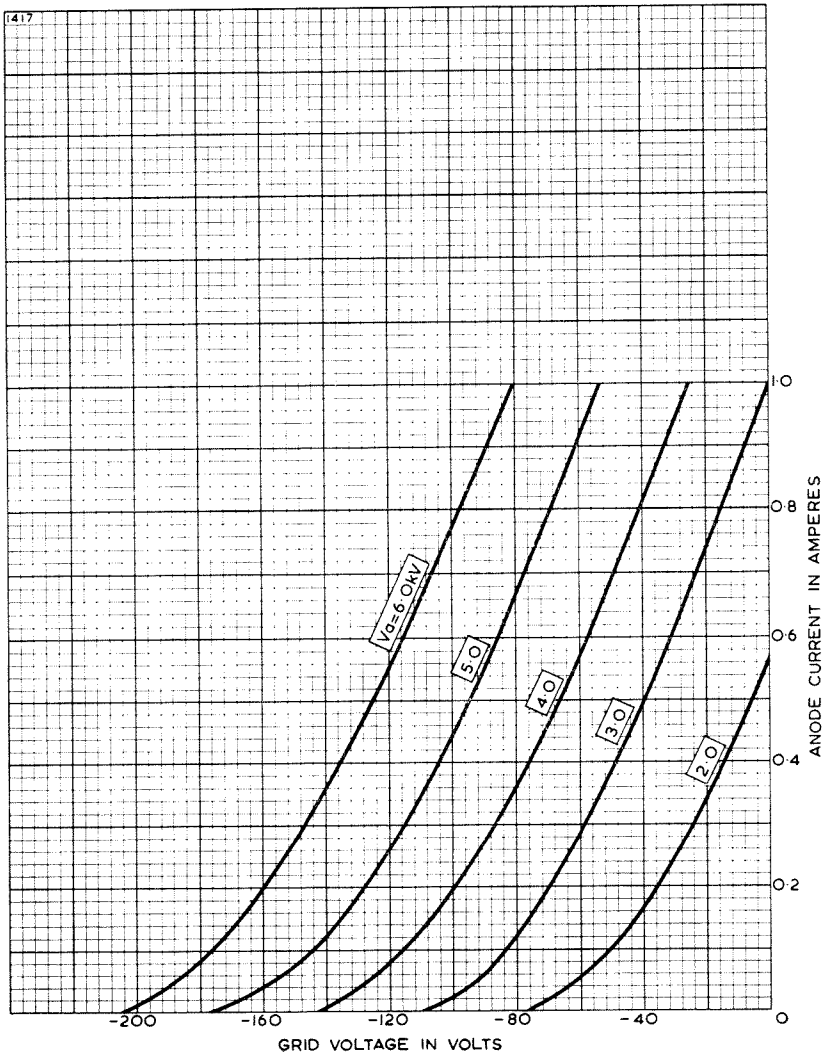
ANODE CHARACTERISTICS



GRID CHARACTERISTICS



ANODE CURRENT—GRID VOLTAGE CHARACTERISTICS



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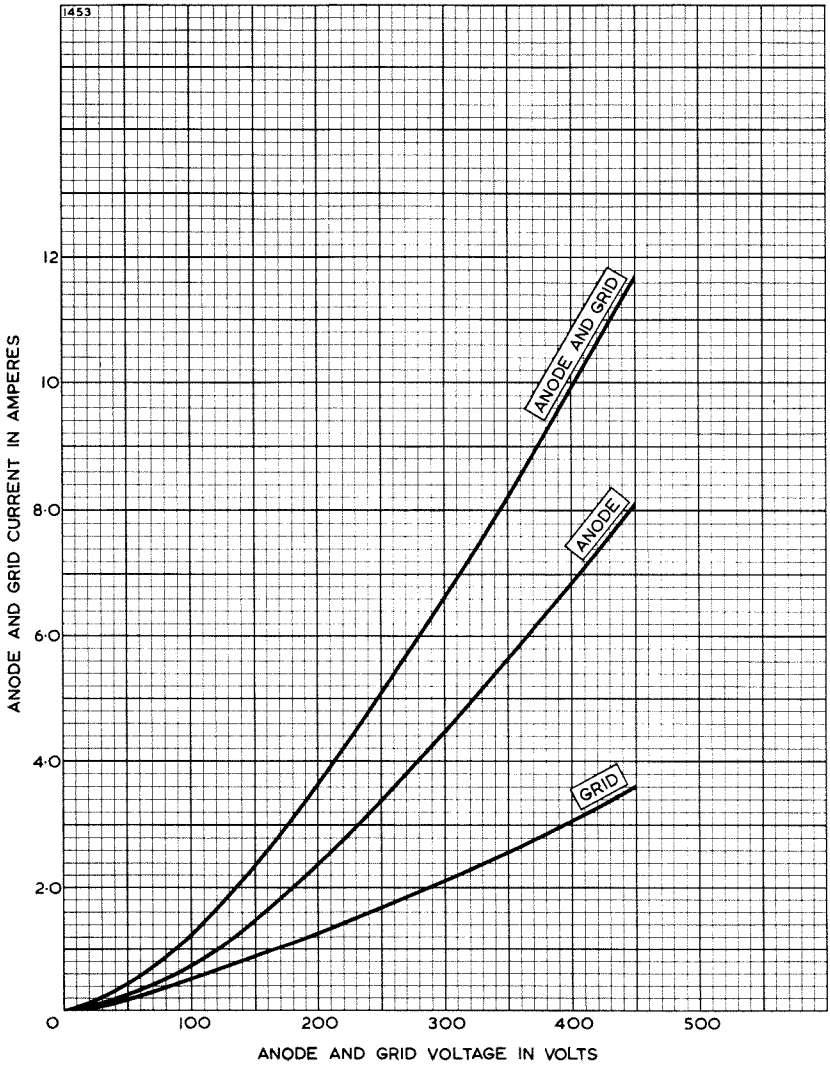
STRAPPED CHARACTERISTICS



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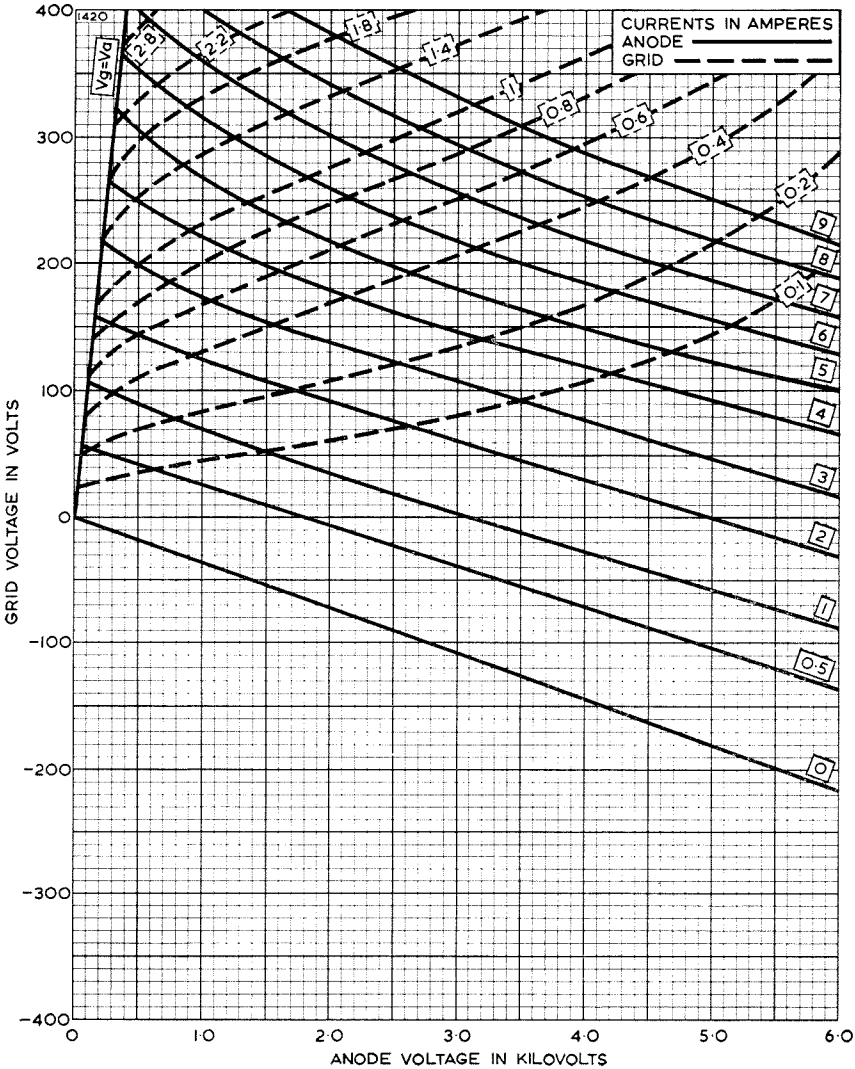
CONSTANT CURRENT CHARACTERISTICS



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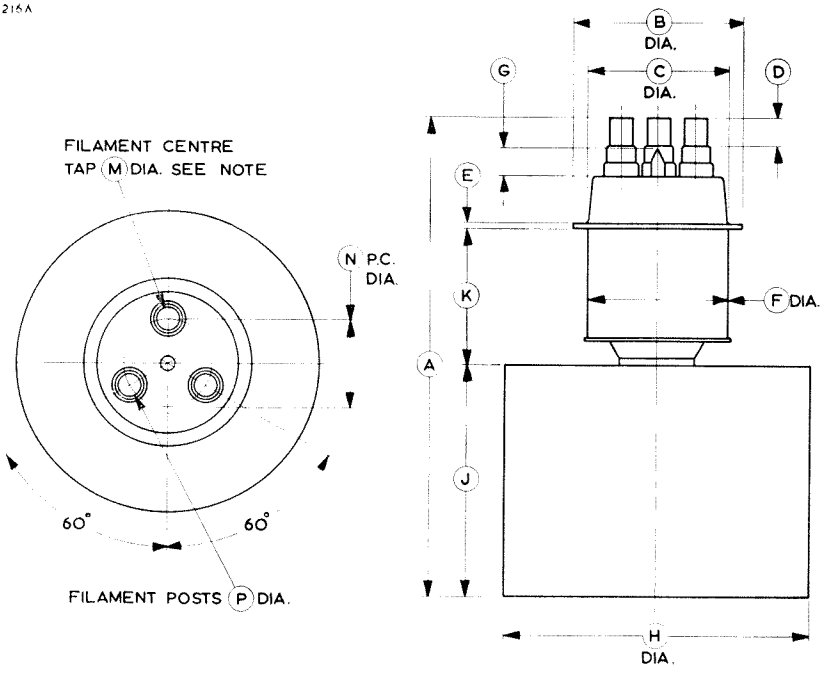
OUTLINE

1216A



Ref.	Inches	Millimetres
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E	0·098	2·50
F	2·323	59·00
G	0·630 Max	16·00 Max
H	4·815 ± 0·012	122·3 ± 0·3
J	3·701	94·00
K	2·126 ± 0·020	54·00 ± 0·50
M	0·358	9·10
N	1·378 ± 0·040	35·00 ± 1·00
P	0·358	9·10

Inch dimensions have been derived from millimetres.

Note The filament centre tap post is marked 'O'.

R.F. POWER TRIODE

BR1169

ABRIDGED DATA

Forced-air Cooled Triode, intended primarily for industrial service.

Anode Dissipation	10 kW Max
Anode Voltage	7·5 kV Max
Frequency for full ratings	20 Mc/s Max
Output Power (Class C unmodulated)	18 kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note*)	6·6	V
Filament Current	103	A
Filament Cold Resistance	0·0075	Ω
Peak Usable Cathode Current	20	A
Perveance	3·6	$mA/V^{3/2}$
Amplification Factor (V_a = 2·0kV, I_a = 1·0A)	11	
Mutual Conductance (V_a = 2·0kV, I_a = 2·75A)	43·5	mA/V
Inter-electrode Capacitances:		
Grid to Anode	36·5	pF
Grid to Filament	47·5	pF
Anode to Filament	2·35	pF

Mechanical

Overall Length	10·500 inches (266·7 mm)	Max
Overall Diameter	6·312 inches (160·3 mm)	Max
Net Weight	9·5 pounds (4·3 kg)	Approx
Mounting Position	Vertical, filament end up or down	

Accessories

Outer Filament Connector	MA208A
Inner Filament Connector	MA208B
Grid Connector	MA208
Radiator Band	MA209

COOLING

The required quantity of air through the radiator for cooling is indicated on the graphs (page 6) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously.

The temperature of the filament and grid seals must not exceed 180°C. A flow of air of 15 to 20ft^3/min (0·43 to 0·57m^3/min) directed onto the filament terminals via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of the seals. The bulb temperature must not exceed 180°C.

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ENGLISH ELECTRIC

R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	7·5 kV Max
Anode Current	3·5 A Max
Anode Dissipation	10 kW Max
Grid Dissipation	250 W Max
Frequency	20 Mc/s Max

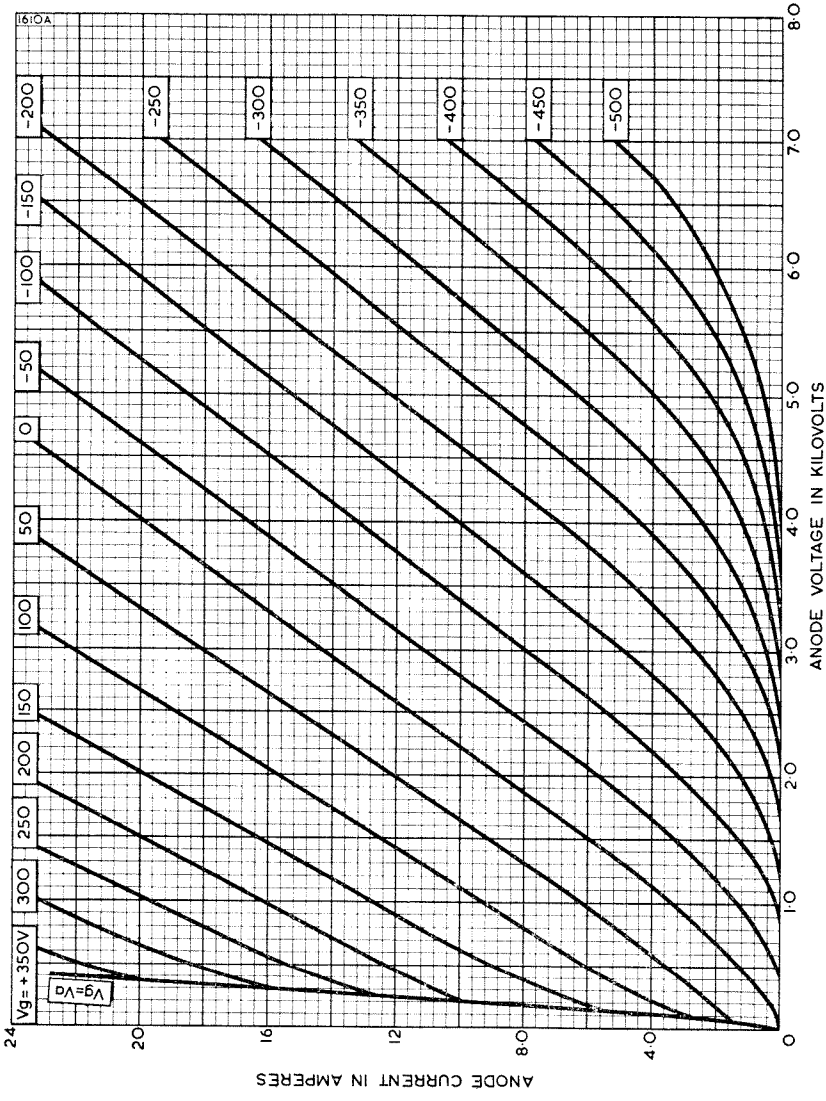
TYPICAL OPERATING CONDITIONS

Anode Voltage	6·5	kV
Grid Voltage	−900	V
from Grid Resistor	2000	Ω
Peak R.F. Grid Voltage	1150	V
Anode Current	3·5	A
Grid Current	0·45	A
Anode Dissipation	4·2	kW
Grid Dissipation	110	W
Driving Power	520	W
Output Power	18	kW
Efficiency	79	%
Load Resistance	940	Ω

NOTE

The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%. The filament may be switched on at its operating voltage and no surge limiting devices need be incorporated in the filament circuit.

ANODE CHARACTERISTICS



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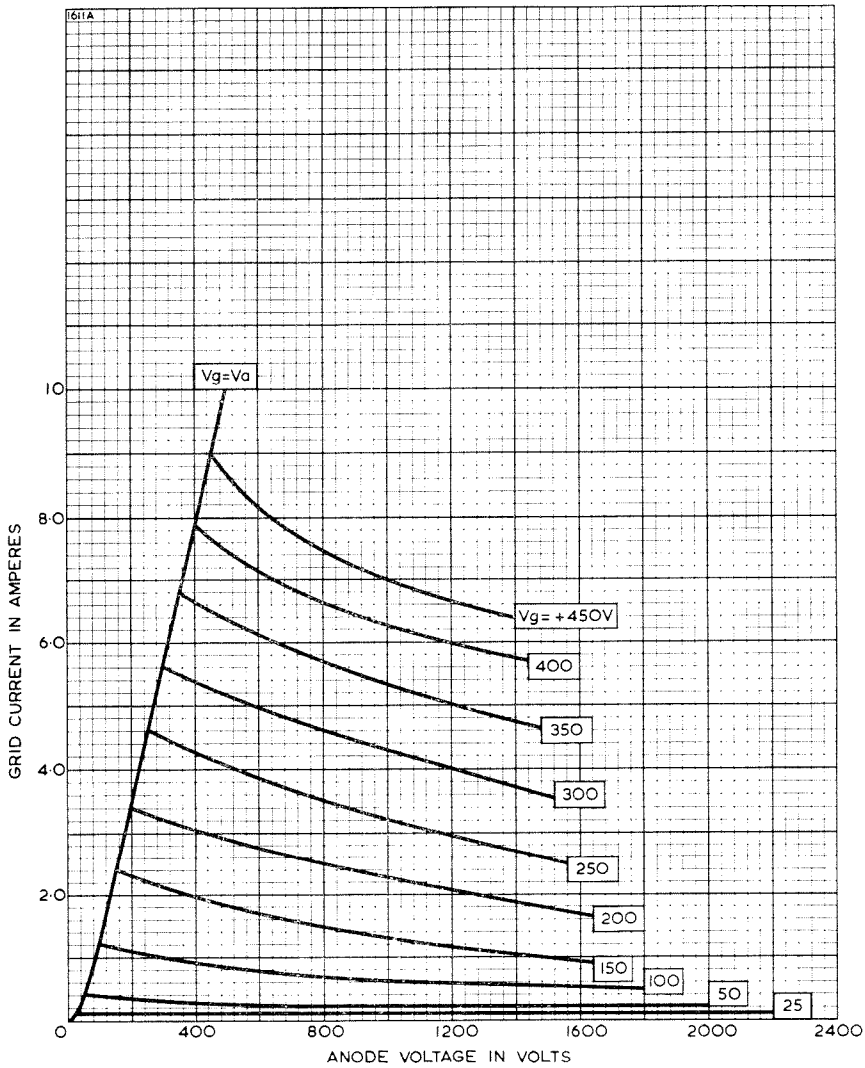

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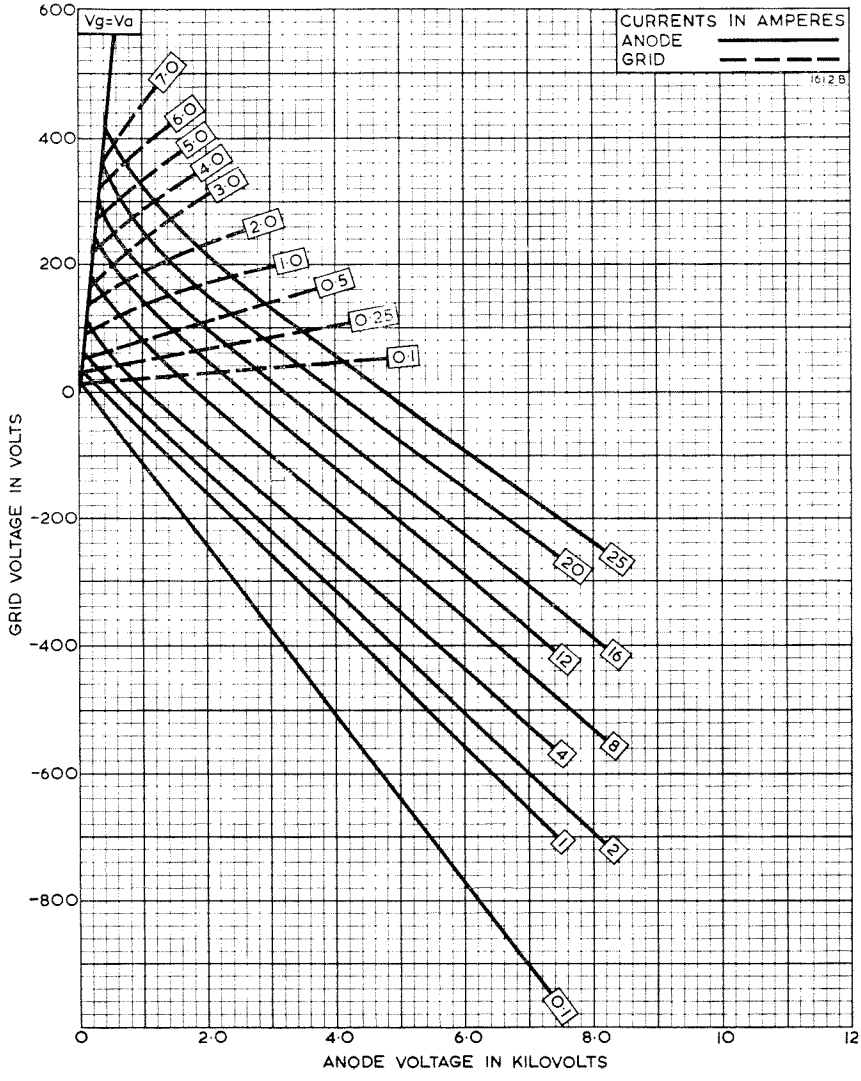
CONSTANT CURRENT CHARACTERISTICS



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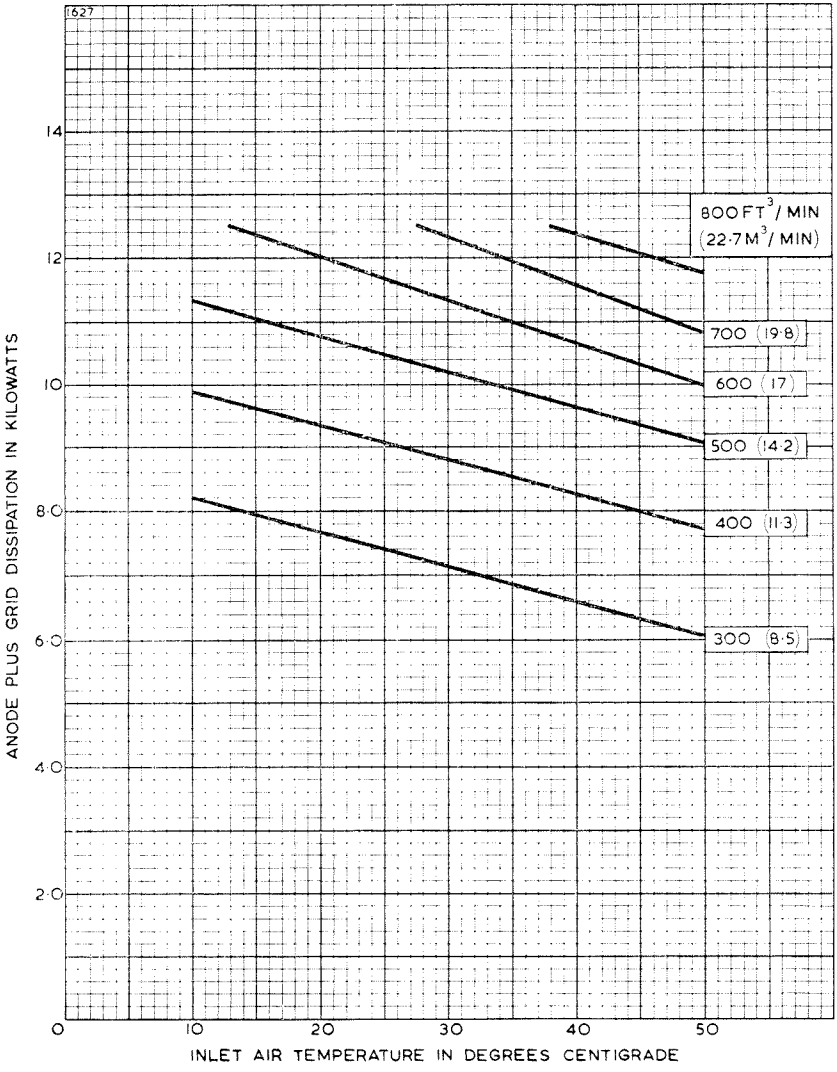
AIR COOLING CHARACTERISTICS



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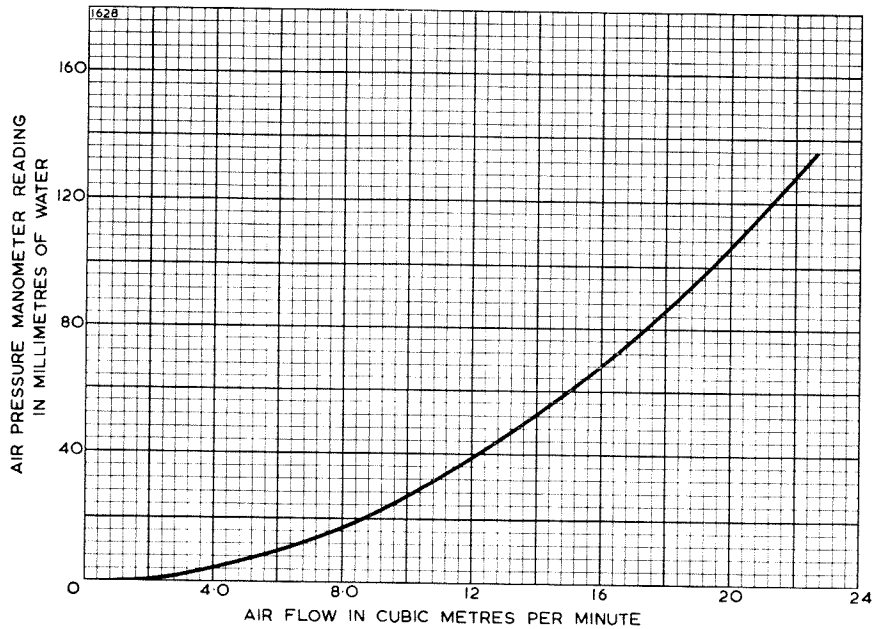
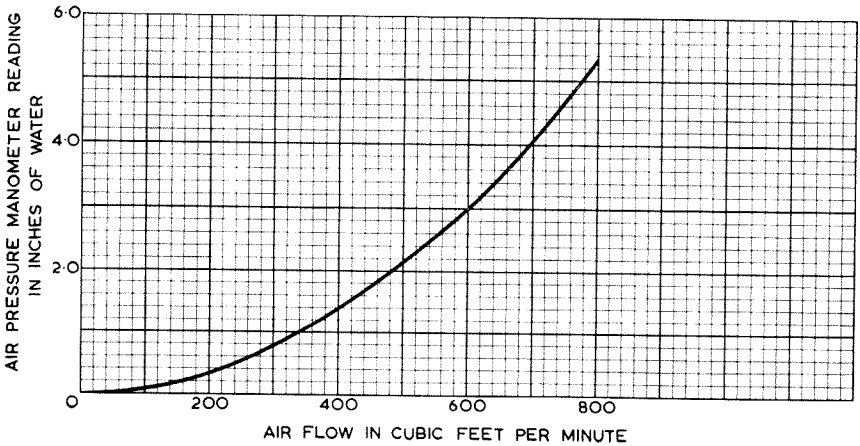
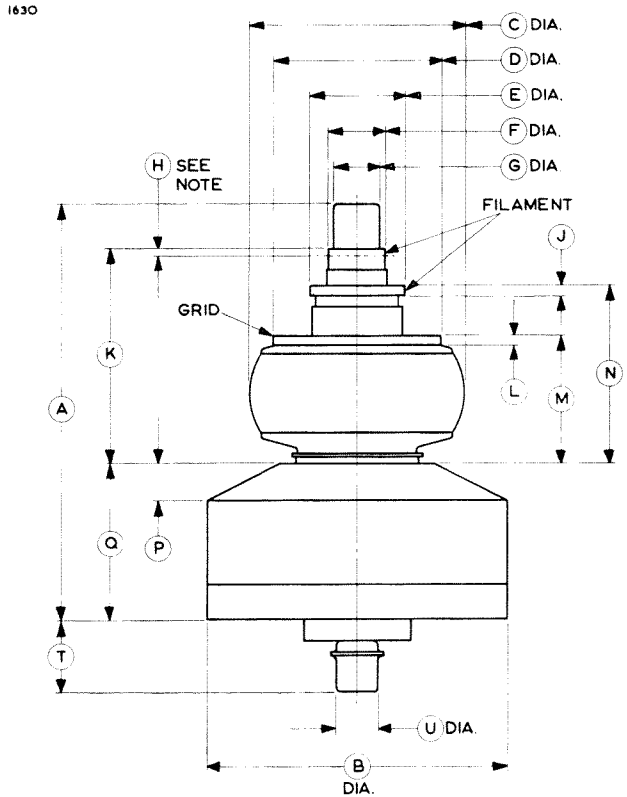
AIR FLOW CHARACTERISTIC





OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	8·782	223·1	K	4·470	113·5
B	6·250	158·8	L	0·218	5·54
C	4·500	114·3	M	2·656	67·46
D	3·500	88·90	N	3·687	93·65
E	2·000	50·80	P	0·750	19·05
F	1·250	31·75	Q	3·312	84·12
G	0·625	15·88	T	1·501	38·13
H	0·219 ± 0·031	5·56 ± 0·79	U	0·875 ± 0·005	22·23 ± 0·13
J	0·250	6·35			

Millimetre dimensions have been derived from inches.

Note. The filament contact surface may be clamped only within this area.

BR1181

R.F. POWER TRIODE

ABRIDGED DATA

Forced-air cooled triode with ceramic/metal envelope, intended primarily for industrial service. The valve is electrically identical with BR1169 apart from its higher anode voltage and current ratings; these enable BR1181 to handle greater powers at high efficiency.

Anode dissipation	10	kW max
Anode voltage	8.0	kV max
Frequency for full ratings	100	MHz max
Output power (class C unmodulated)	26	kW

GENERAL

Electrical

Filament	thoriated tungsten	
Filament voltage (see note 1)	6.6	V
Filament current	103	A
Filament cold resistance	0.0075	Ω
Peak usable cathode current	25	A
Perveance	3.6	$mA/V^{3/2}$
Amplification factor (V_a = 2.0kV, I_a = 1.0A)	11	
Mutual conductance (V_a = 2.0kV, I_a = 2.75A)	43.5	mA/V
Inter-electrode capacitances:		
grid to anode	36.5	pF
grid to filament	47.5	pF
anode to filament	2.35	pF

Mechanical

Overall length	10.500 inches (266.7mm) max
Overall diameter	6.312 inches (160.3mm) max
Net weight	9.5 pounds (4.3kg) approx
Mounting position	vertical, filament end up or down

Accessories

Outer filament connector	MA208A
Inner filament connector	MA208B
Grid connector	MA208
Radiator band	MA209

COOLING

The required quantity of air through the radiator for cooling is indicated on the graphs (page 6) and should be delivered by a blower through the radiator before and during the application of any voltages. Filament power, anode power and air may be removed simultaneously.

The temperature of the filament and grid seals must not exceed 180°C. A flow of air of 15 to 20ft^3/min (0.43 to 0.57m^3/min) directed onto the filament terminals via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of the seals.

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

Anode voltage	8.0	kV max
Anode current	4.5	A max
Anode dissipation	10	kW max
Grid dissipation	250	W max
Frequency	100	MHz max

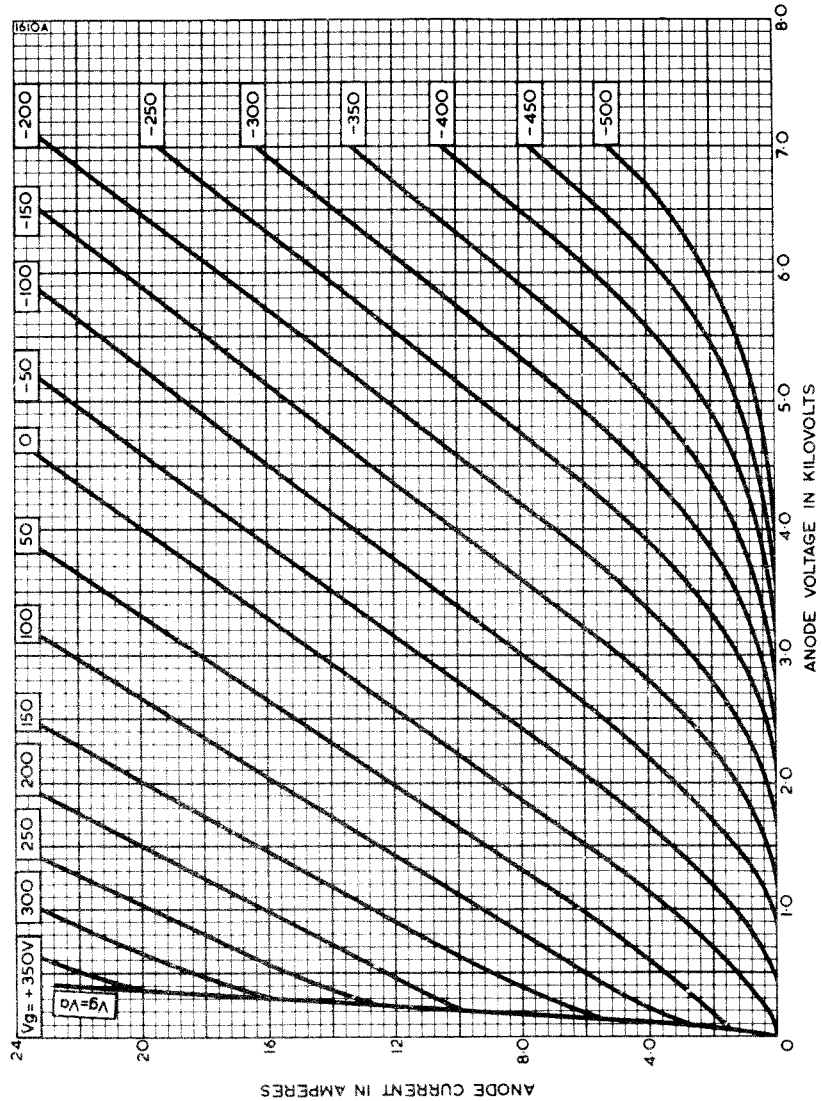
TYPICAL OPERATING CONDITIONS

Anode voltage	8.0	kV
Grid voltage	−1000	V
from grid resistor	2050	Ω
Peak r.f. grid voltage	1290	V
Anode current	4.0	A
Grid current	485	mA
Anode dissipation	5.5	kW
Grid dissipation	145	W
Driving power	630	W
Output power (see note 2)	26	kW
Efficiency	81	%
Load resistance	1000	Ω

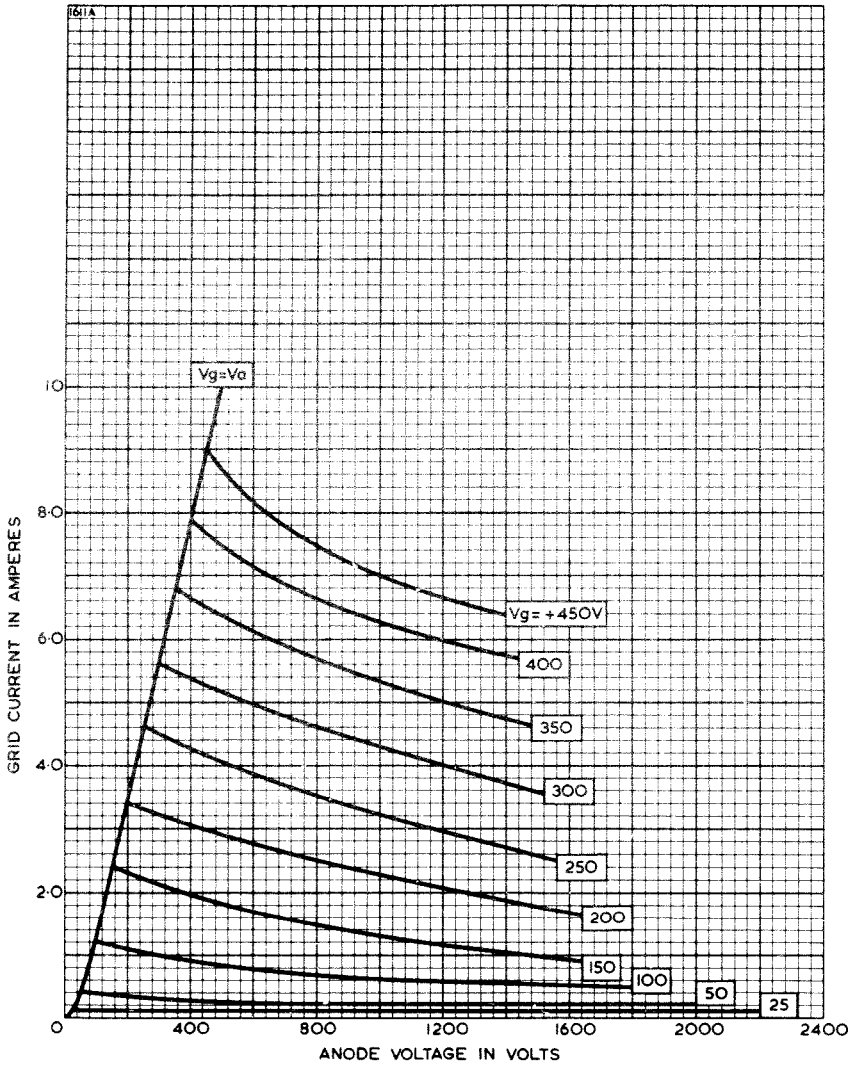
NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%. The filament may be switched on at its operating voltage and no surge limiting devices need be incorporated in the filament circuit.
2. This is the output power from the valve after the grid drive power has been deducted. With 85% circuit efficiency the power to the load is 22kW.

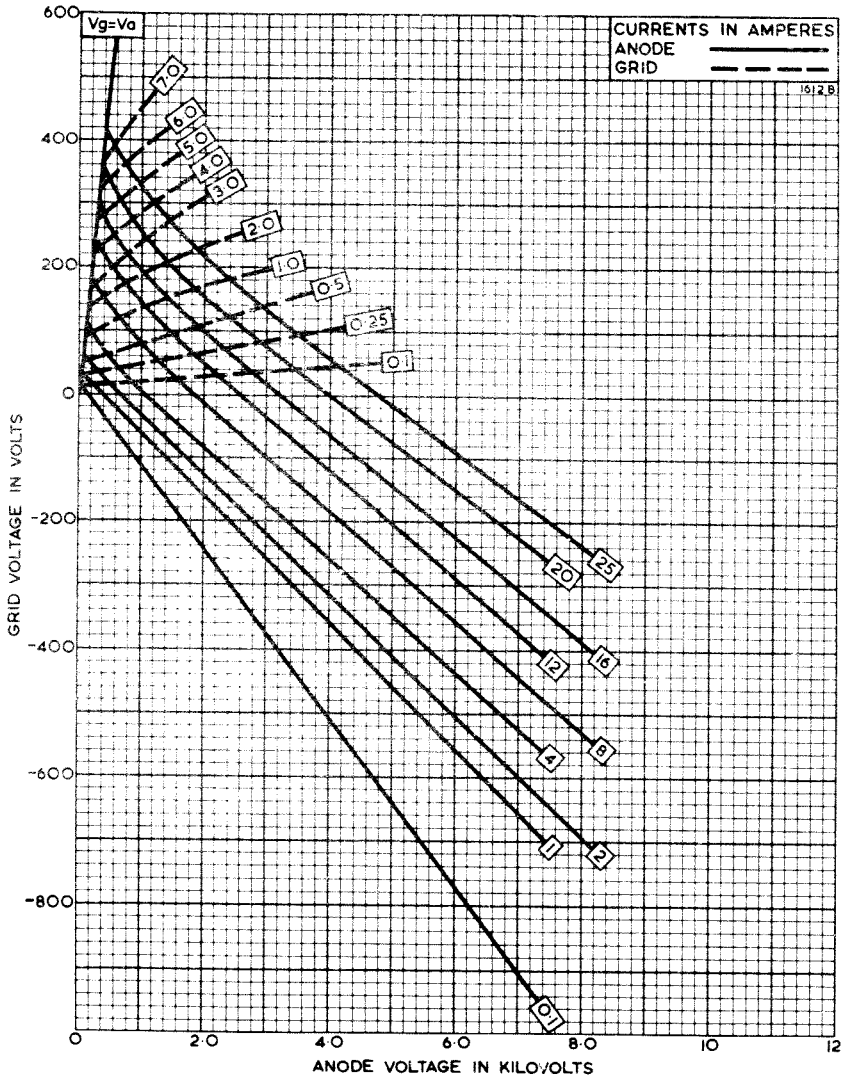
ANODE CHARACTERISTICS



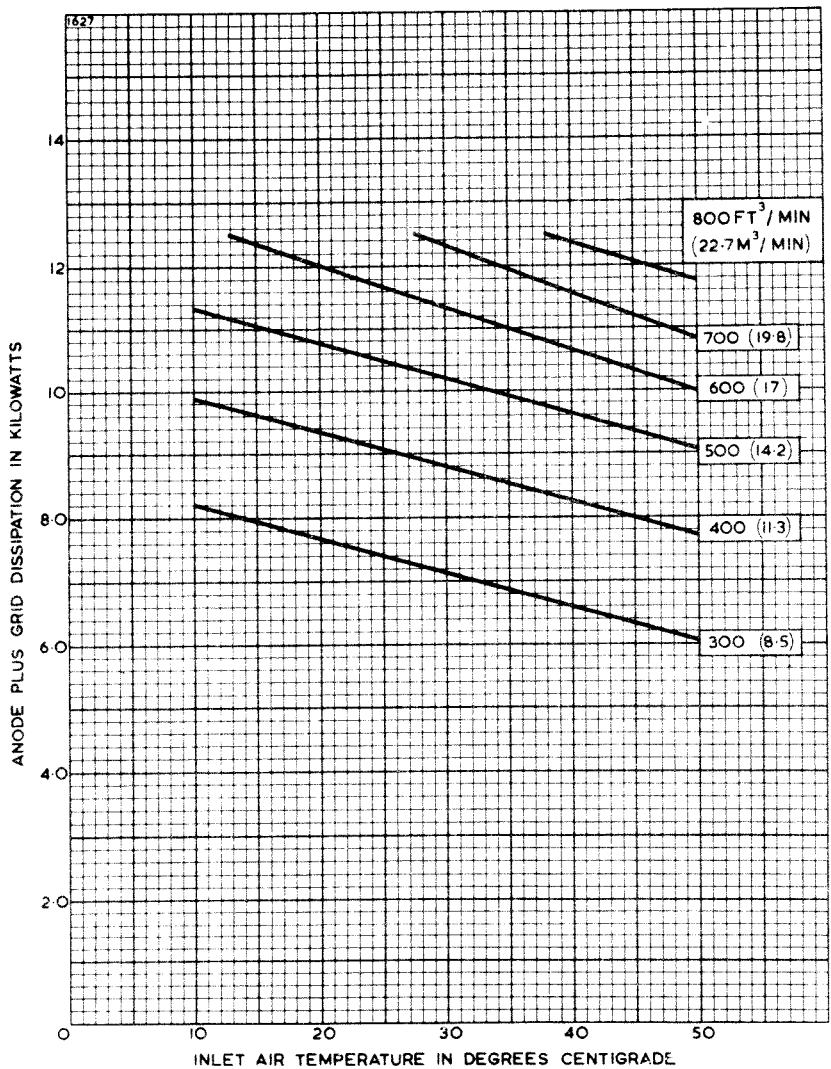
GRID CHARACTERISTICS



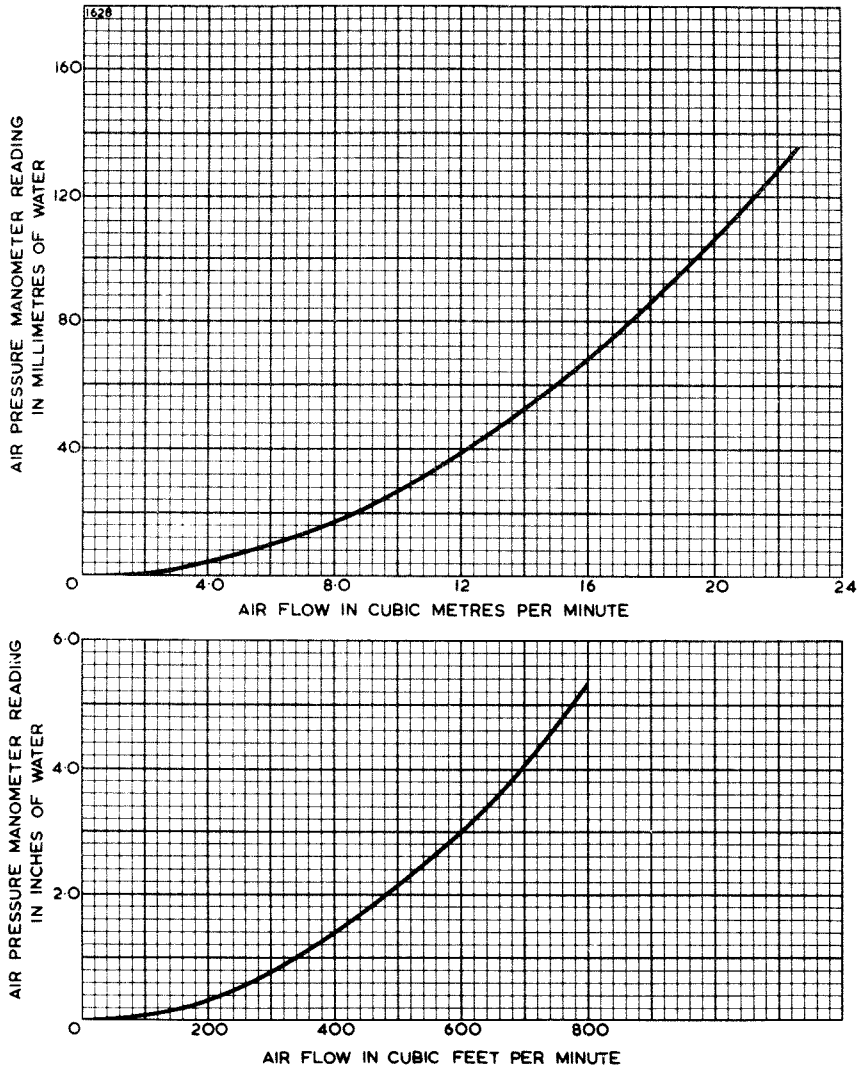
CONSTANT CURRENT CHARACTERISTICS



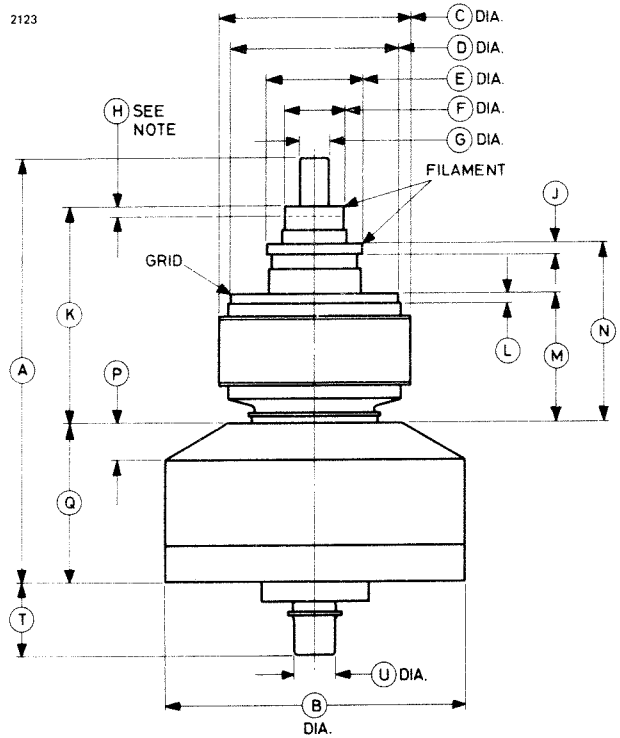
AIR COOLING CHARACTERISTICS



AIR FLOW CHARACTERISTIC



OUTLINE



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B	6.250	158.8	L	0.218	5.54
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E	2.000	50.80	P	0.750	19.05
F	1.250	31.75	Q	3.312	84.12
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H	0.219 ± 0.031	5.56 ± 0.79	U	0.875 ± 0.005	22.23 ± 0.13
J	0.250	6.35			

Millimetre dimensions have been derived from inches.

Outline Note

The filament contact surface may be clamped only within this area.

Water Cooled Triodes

June 1965

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

BW140

R.F. POWER TRIODE

Service Type CV2871

ABRIDGED DATA

Water-cooled Transmitting Triode

Anode Dissipation	12 kW Max
Anode Voltage	12 kV Max
Frequency for full ratings	15 MHz Max
Frequency at reduced ratings	40 MHz Max

GENERAL

Electrical

Filament		Tungsten
Filament Voltage (*See Note* 1)	19	V
Filament Current	75	A
Maximum Filament Starting Current		(*See Note* 2)
Filament Cold Resistance	0·0225	Ω
Peak Usable Cathode Current		(*See Note* 1)
Amplification Factor (V_a = 9·0 kV, I_a = 1·0 A)	45	
Mutual Conductance (V_a = 8·0 kV, I_a = 1·5 A)	9	mA/V
Inter-electrode Capacitances:		
Grid to Anode	30	pF
Grid to Filament	27	pF
Anode to Filament	2·5	pF

Mechanical

Overall Length	23·90 inches (607 mm)	Max
Overall Diameter	5·50 inches (140 mm)	Max
Net Weight	6 pounds (2·8 kg)	Approx
Mounting Position	Vertical, filament end up	

Accessories

The valve is normally supplied complete with a pair of detachable flexible filament leads, type MA135, and a neoprene ring for seating the anode flange in the water jacket.

COOLING

The anode, which is part of the envelope, must be fitted into a water jacket for cooling, the flow necessary being 3 to 4 gallons per minute (13·5 to 18 l./min). The temperature of the cooling water at the outlet must not exceed 65°C nor should the temperature rise across the jacket exceed 15°C. The anode temperature must not exceed 140°C.

The temperature of the grid and filament seals must not exceed 140°C. In some cases it may be necessary to blow air on to the header to maintain the seal temperatures within this limit. A suitable arrangement for this is to blow 10 to 30ft³/min (0·3 to 0·9m³/min approx) of air through a 1-inch (25mm approx) diameter nozzle directed on to the header before and during the application of any voltages.

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MAXIMUM RATINGS

Anode Dissipation .. .. 12·0 kW Max
Grid Dissipation .. .. 0·8 kW Max

Maximum Anode Voltage against Frequency		
Frequency MHz	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
15	12·0 kV	10·0 kV
20	10·2 kV	8·5 kV
25	7·8 kV	6·5 kV
40	4·2 kV	3·5 kV

NOTES

1. 'Marked volts.' Each valve is marked with the filament voltage required to give 10A peak emission at 90% saturation. Longer filament life may be obtained if the filament is run at reduced temperature and a correspondingly reduced anode current (*see* Emission Characteristic on page 6) but care must be taken to keep the anode dissipation within the maximum rating.

2. The filament current must not exceed 113A, even momentarily, at any time.

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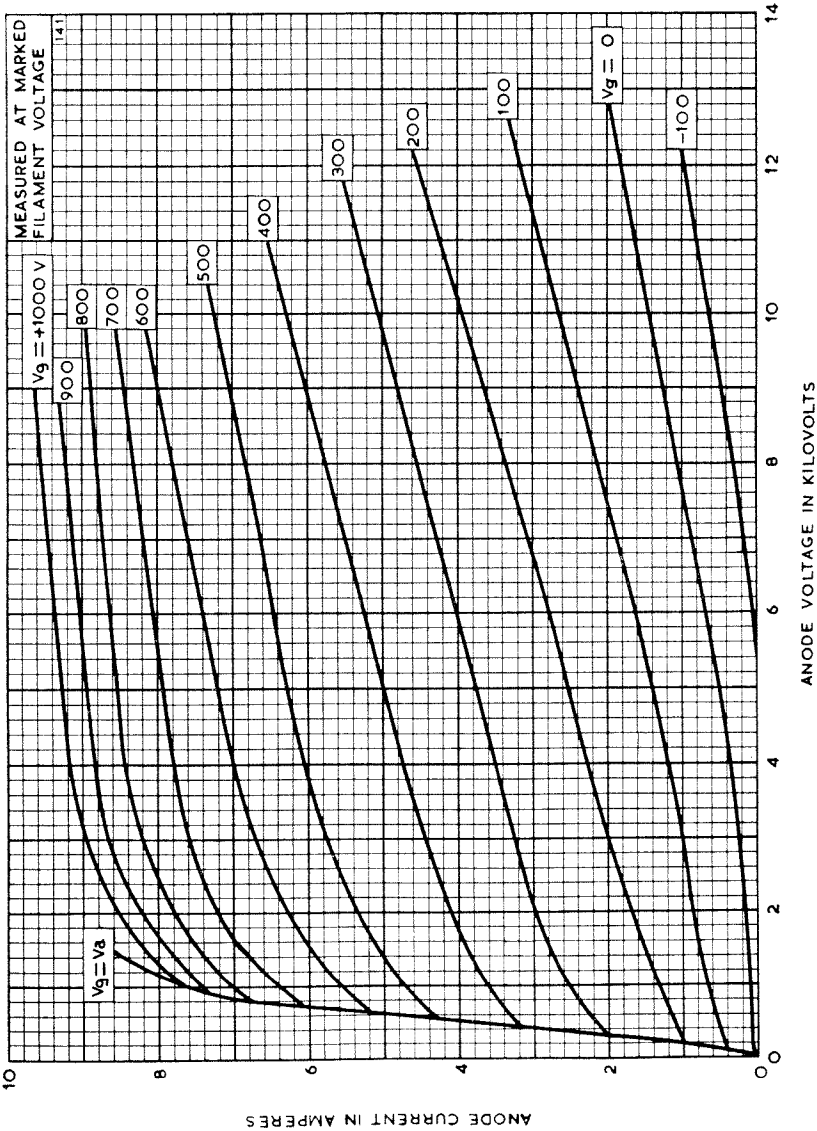
R.F. POWER TRIODE

ANODE CHARACTERISTICS



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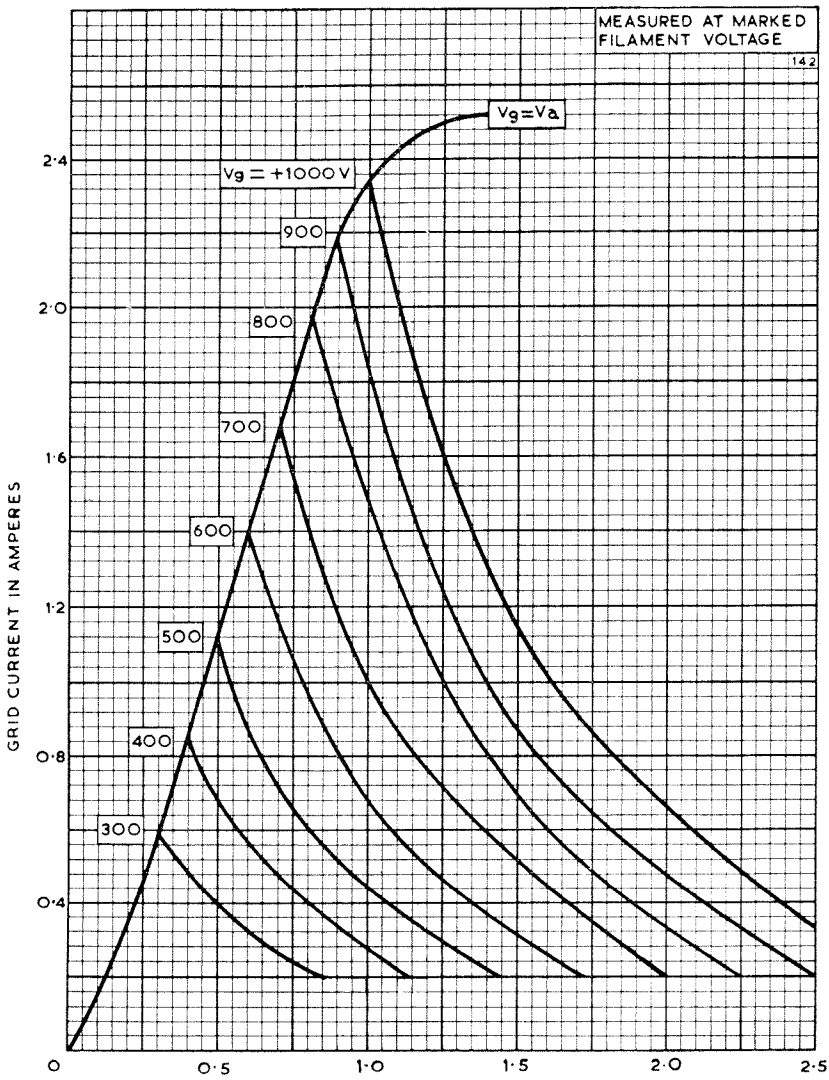
CONTROL GRID CHARACTERISTICS



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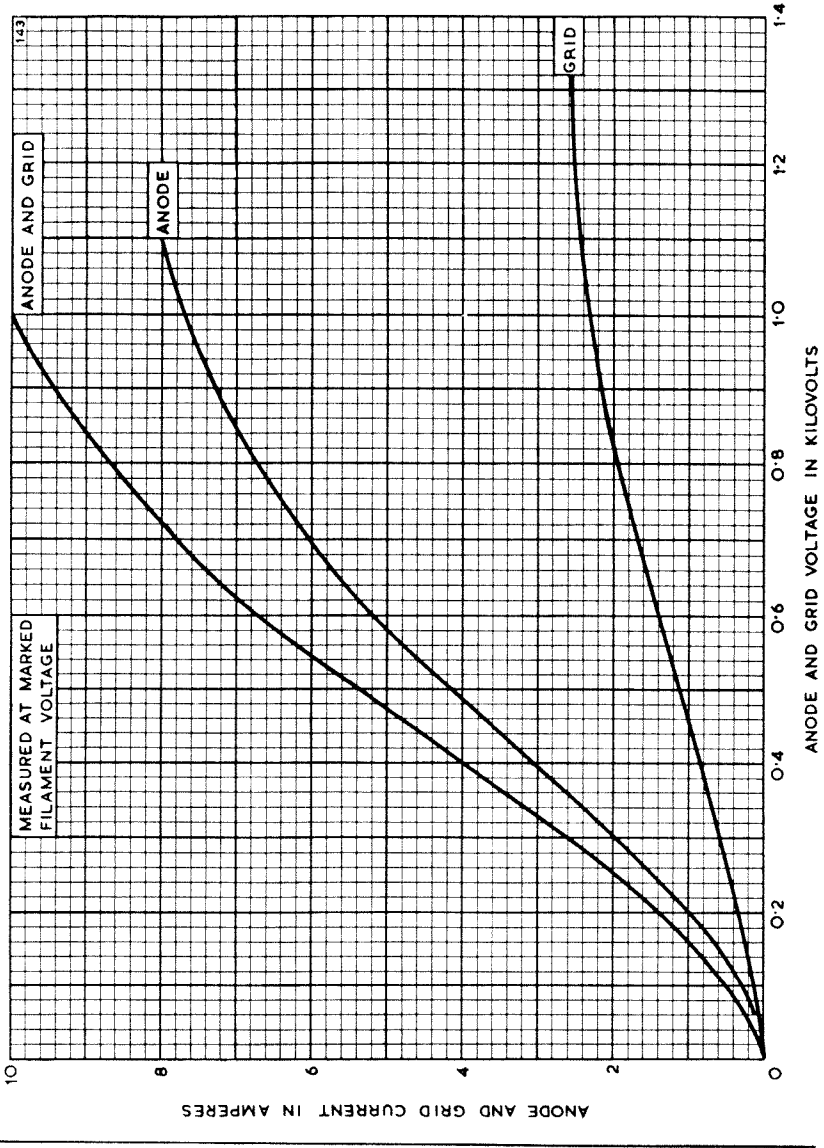
R.F. POWER TRIODE

STRAPPED CHARACTERISTICS



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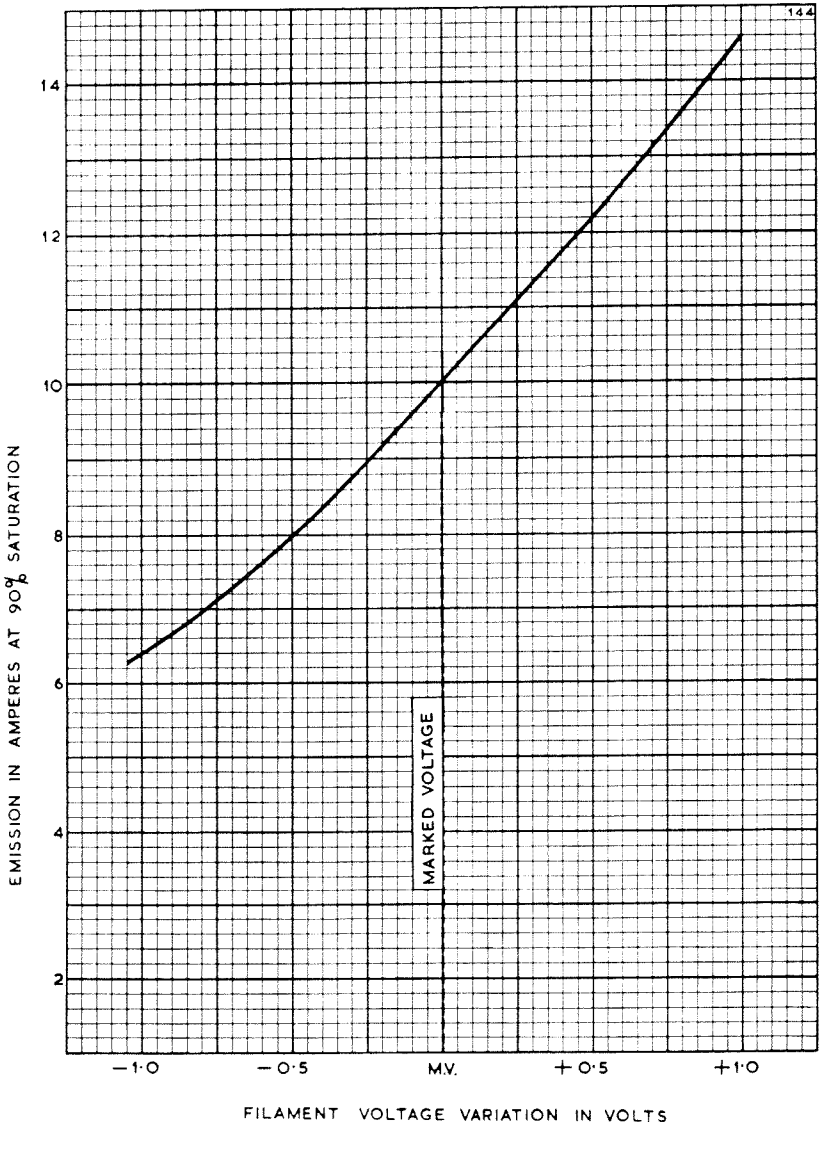
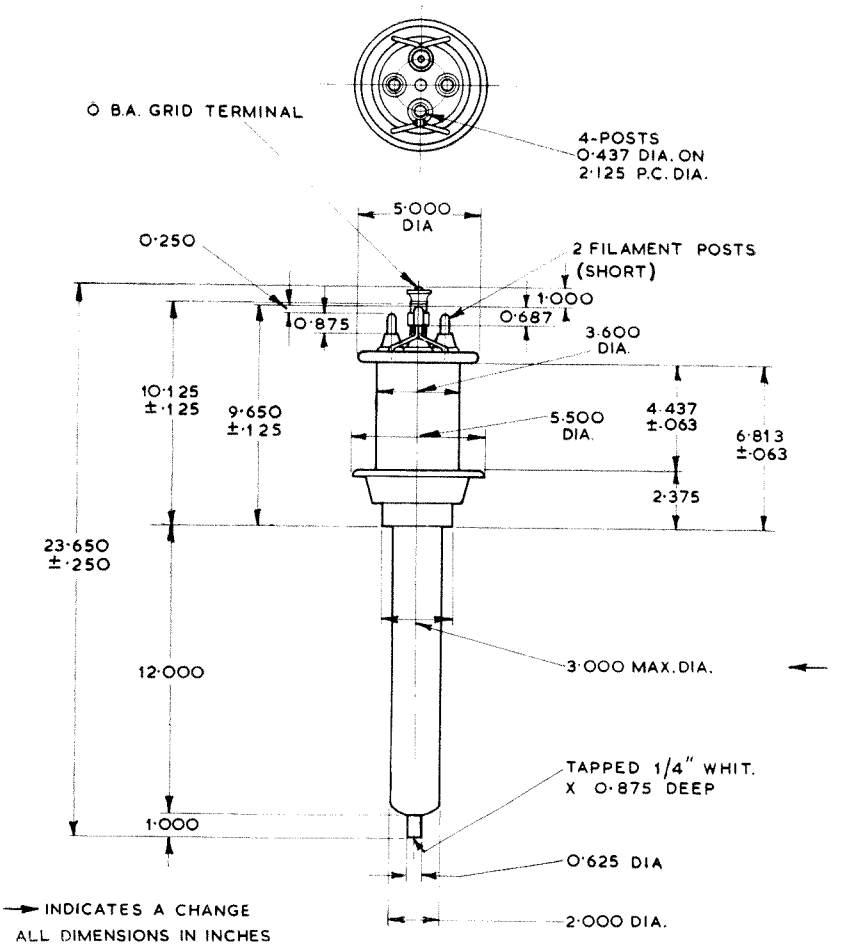
EMISSION CHARACTERISTIC



R.F. POWER TRIODE

OUTLINE

472



→ INDICATES A CHANGE
ALL DIMENSIONS IN INCHES

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R.F. POWER TRIODE

BW153

Service Type CV2872

GENERAL

The BW153 is a water cooled transmitting triode. It is a maintenance type and therefore only abridged data are given on this sheet. **Full information is available on request.**

Filament	Tungsten	
Filament Voltage (*See Note*)	19	V
Filament Current	100	A
Filament Starting Current (Peak)	150	A Max
Filament Cold Resistance	0·017	Ω
Peak Usable Cathode Current	*See Note*	
Amplification Factor (V_a = 9·0kV, I_a = 1·0A)	45	
Mutual Conductance (V_a = 10kV, I_a = 1·5A)	10	mA/V
Filament Leads	MA135 or MA135A	

MAXIMUM RATINGS

Anode Dissipation	18	kW Max
Grid Dissipation	1·0	kW Max

Maximum Anode Voltage against Frequency

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
20	15 kV	12 kV
25	11·3kV	9·0kV
30	7·5kV	6·0kV
40	5·25kV	4·2kV

NOTE

'Marked volts.' Each valve is marked with the filament voltage required to give 12A peak emission at 90% saturation. Longer filament life may be obtained if the filament is run at reduced temperature and a correspondingly reduced anode current but care must be taken to keep the anode dissipation within the maximum rating.

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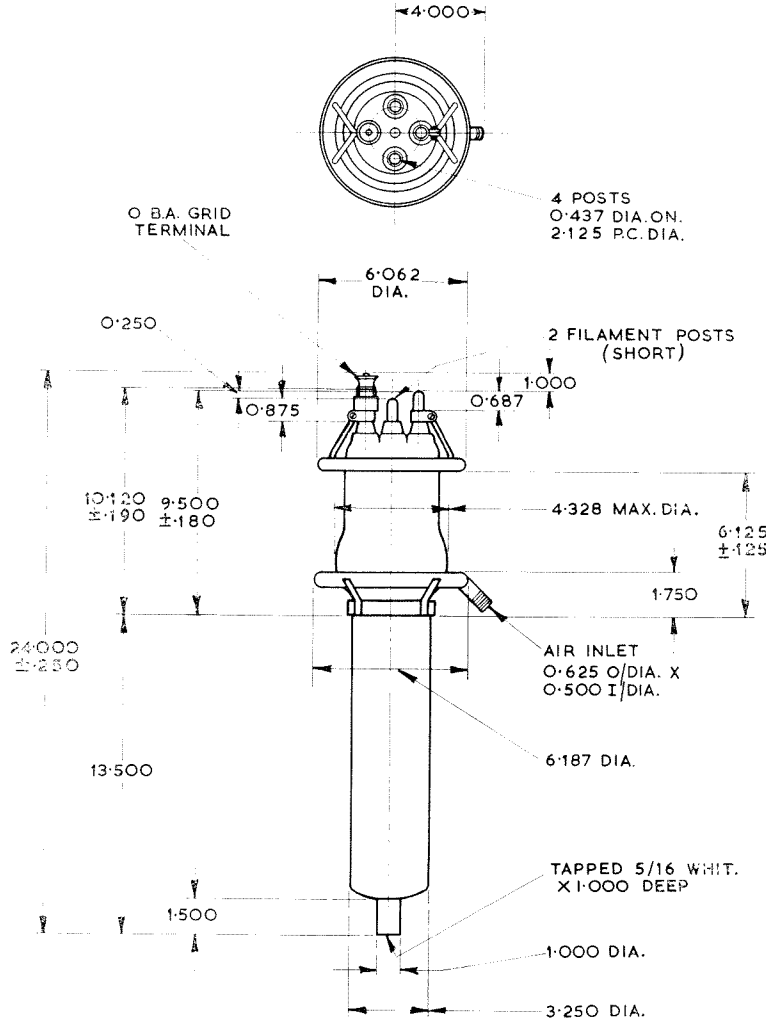
OUTLINE

212



ALL DIMENSIONS IN INCHES

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R.F. POWER TRIODE

BW161

ENGLISH ELECTRIC

ABRIDGED DATA

Water Cooled Transmitting Triode with grid terminal suitable for cathode drive operation.

Anode Dissipation	20	kW Max
Anode Voltage	12	kV Max
Frequency for full ratings	30	Mc/s Max
Frequency at reduced ratings	50	Mc/s Max
Output Power (Class C Telegraphy)	56	kW

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	9·0	V
Filament Current	175	A
Filament Starting Current (Peak) (*See Note* 2)	450	A Max
Filament Cold Resistance	0·0059	Ω
Peak Usable Cathode Current	45	A
Perveance	2·1	$mA/V^{3/2}$
Amplification Factor (V_a = 9·0 kV, I_a = 2·0 A)	45	
Mutual Conductance (V_a = 10 kV, I_a = 1·5 A)	23	mA/V
Inter-electrode Capacitances:		
Grid to Anode	36	pF
Grid to Filament	57	pF
Anode to Filament	1·5	pF

Mechanical

Overall Length	18·750 inches (476 mm)	Max
Overall Diameter	9·250 inches (235 mm)	Max
Net Weight	11½ pounds (5·3 kg)	Approx
Mounting Position	Vertical, filament end up	

Accessories

Water Jacket	BW4028
Filament Leads	MA131
Grid Connector	MA66
Sealing Ring (supplied with valve)	I5799A

COOLING

The anode of this valve must be fitted into a water jacket for cooling, the recommended jacket being type BW4028. A flow of water 8 gallons per minute (36·4 l./min) is required; the temperature of the cooling water at the outlet must not exceed 65°C, nor should the temperature rise across the jacket exceed 15°C.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 10 to 30cu.ft/min (0·28 to 0·85cu.m/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

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

← Indicates a change

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

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R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	12 kV Max
→ Anode Dissipation	20 kW Max
Grid Dissipation	1·0 kW Max
Operating Frequency (for full ratings)	30 Mc/s Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	9·0	12	kV
Grid Voltage	−530	−605	V
Peak R.F. Grid Voltage	1130	1220	V
Anode Current	5·65	6·1	A
Grid Current (Approx)	1·65	1·7	A
Anode Dissipation	13·5	16·7	kW
Grid Dissipation	875	860	W
Driving Power	1750	1890	W
Output Power	37·5	56	kW
Efficiency	74	77	%

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 9·0V	163	192	A
Amplification Factor (V_a = 9·0kV, I_a = 2·0A)	37	48	
Mutual Conductance (V_a = 10kV, I_a = 1·5A)	21·5	29	mA/V
Grid Voltage (negative value)			
→ (V_a = 10kV, I_a = 2·0A)	120	164	V
Grid Voltage (negative value)			
(V_a = 10kV, I_a = 0·1A)	—	275	V
Anode Current (V_a = 2·0kV, V_g = +250V)	7·0	12	A
Anode Current (V_a = 4·0kV, V_g = +250V)	9·5	14·5	A
Grid Current (V_a = 2·0kV, V_g = +250V)	0·5	4·0	A
Grid Current (V_a = 4·0kV, V_g = +250V)	0	2·5	A
Inter-electrode Capacitances:			
Grid to Anode	32	42	pF
Grid to Filament	50	62	pF

→ Indicates a change

MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
30	12·0 kV	9·6 kV
50	9·0 kV	7·2 kV

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.
2. The filament current must not exceed 450A, even momentarily, at any time.

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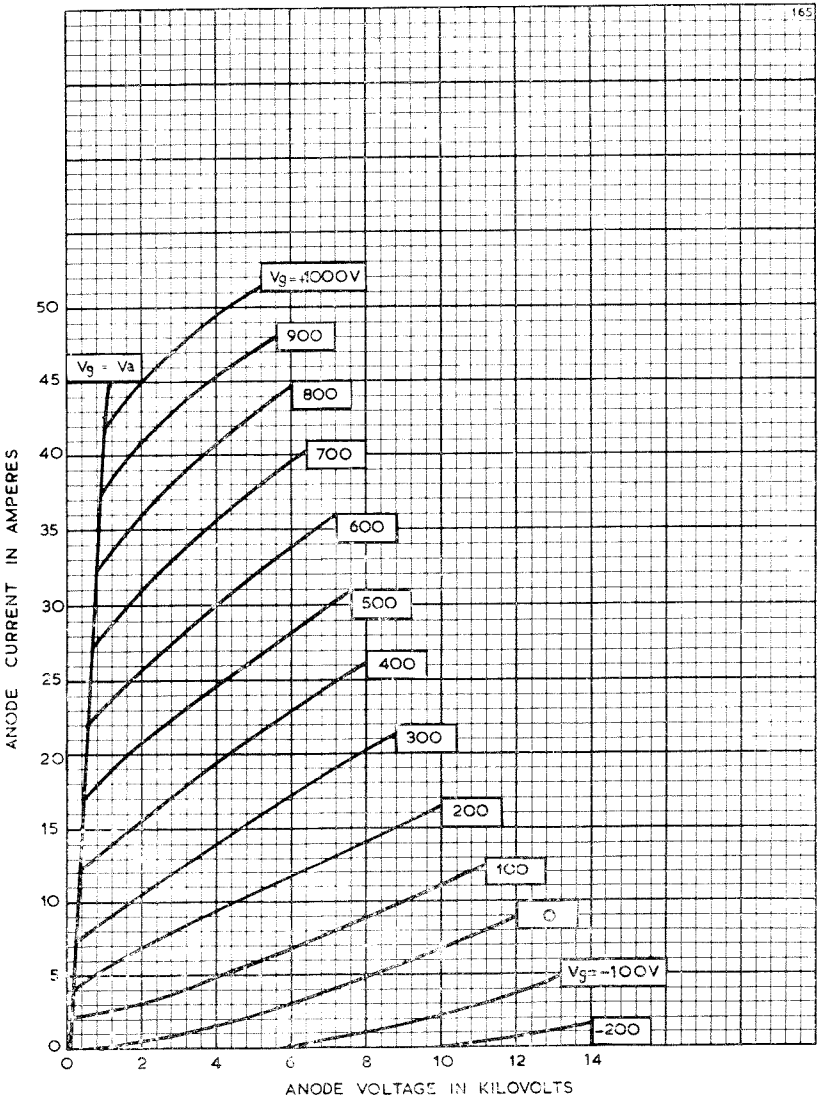
ENGLISH ELECTRIC

ANODE CHARACTERISTICS



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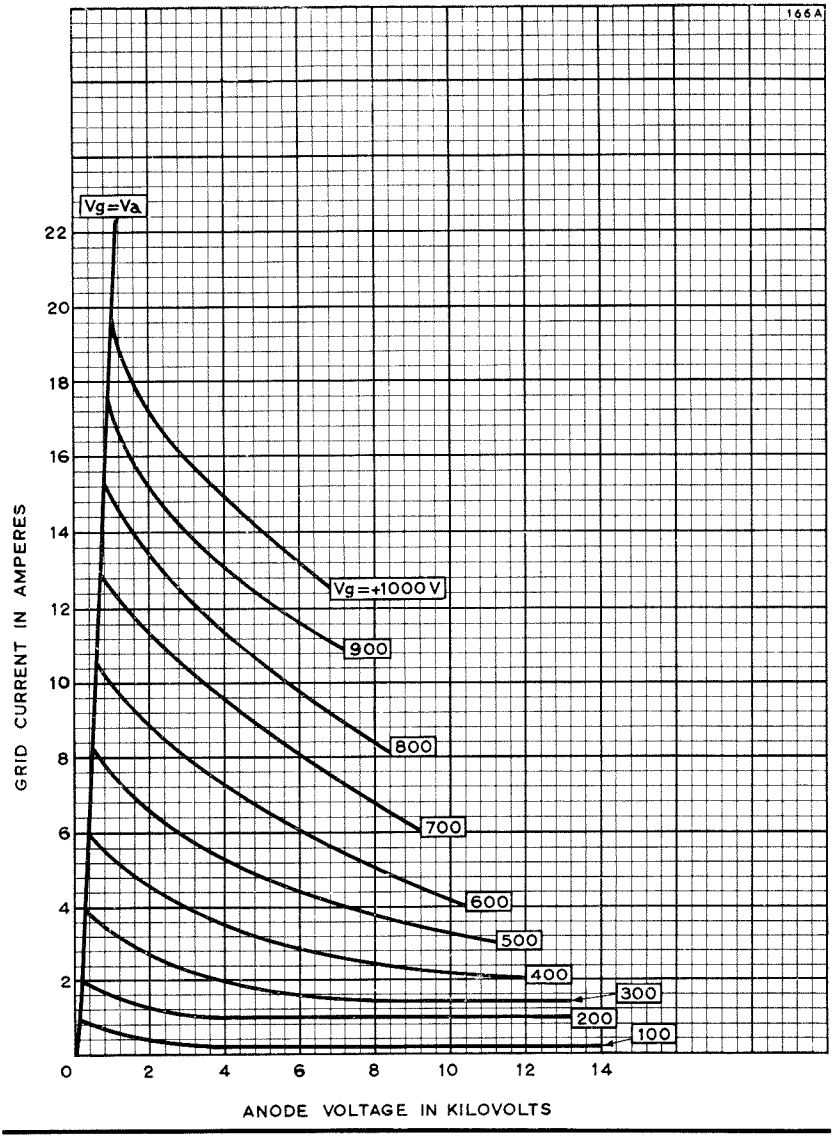
CONTROL GRID CHARACTERISTICS



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ENGLAND

Telephone:
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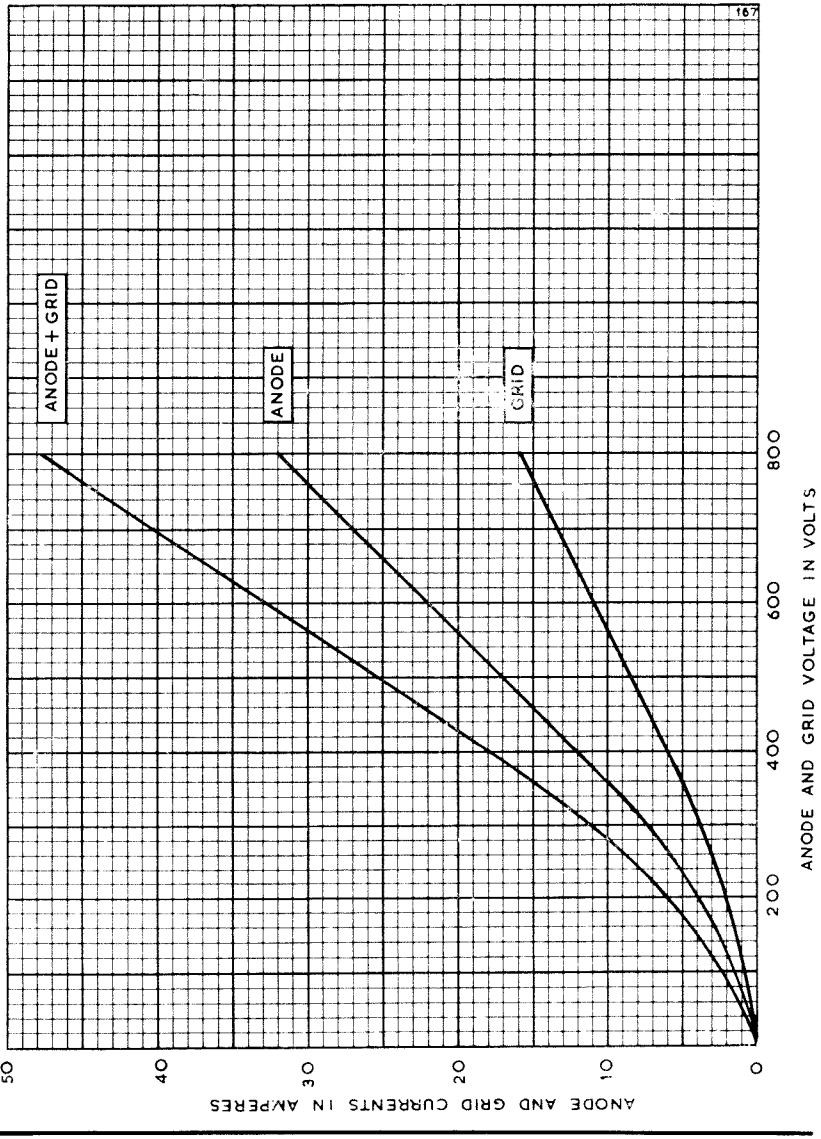
STRAPPED CHARACTERISTICS



ENGLISH ELECTRIC VALVE CO. LTD.

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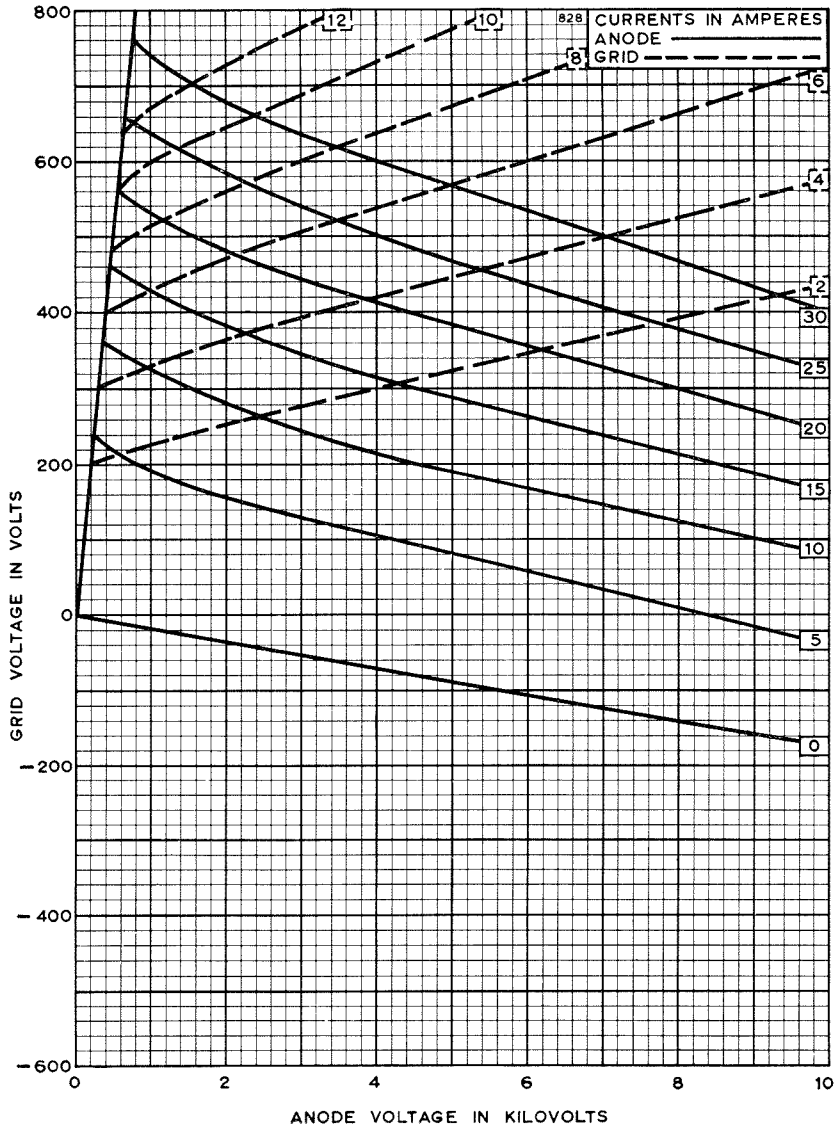
CONSTANT CURRENT CHARACTERISTICS



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Telephone:
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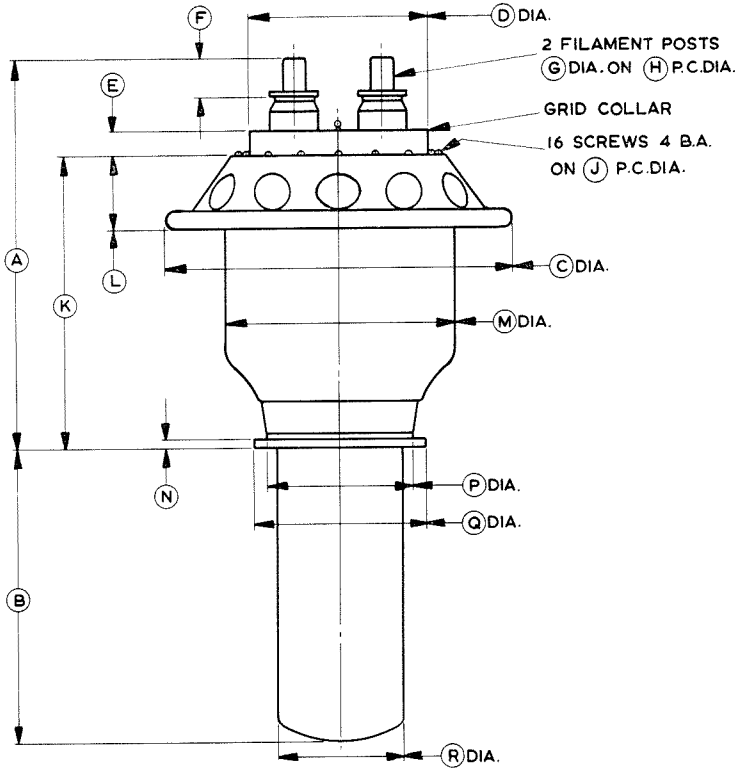
OUTLINE

214A



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	10·500 Max	266·7 Max	J	5·375	136·5
B	8·250	210·0	K	8·000 Max	203·2 Max
C	9·250 Max	235·0 Max	L	1·875	47·63
D	4·703	119·5	M	6·000 Max	152·4 Max
E	0·687	17·45	N	0·250	6·35
F	1·000	25·40	P	3·875	98·43
G	0·625	15·88	Q	4·500	114·3
H	2·250	57·15	R	3·250	82·55

Millimetre dimensions have been derived from inches.

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

R.F. POWER TRIODE

BW165

GENERAL

The BW165 is a water cooled transmitting triode. It is a maintenance type and therefore only abridged data are given on this sheet. **Full information is available on request.**

Filament	Thoriated Tungsten	
Filament Voltage	7·2	V
Filament Current	170	A
Filament Starting Current (Peak)	450	A Max
Filament Cold Resistance	0·006	Ω
Peak Usable Cathode Current	35	A
Perveance	1·4	$mA/V^{3/2}$
Amplification Factor (V_a = 9·0kV, I_a = 2·0A)	26	
Mutual Conductance (V_a = 10kV, I_a = 1·5A)	19	mA/V
Filament Leads	MA131	
Grid Connector	MA66	

MAXIMUM RATINGS

Anode Dissipation	24	kW Max
Grid Dissipation	1·0	kW Max

Maximum Anode Voltage against Frequency

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
30	12 kV	10 kV
70	9·0kV	7·0kV
110	6·5kV	5·0kV

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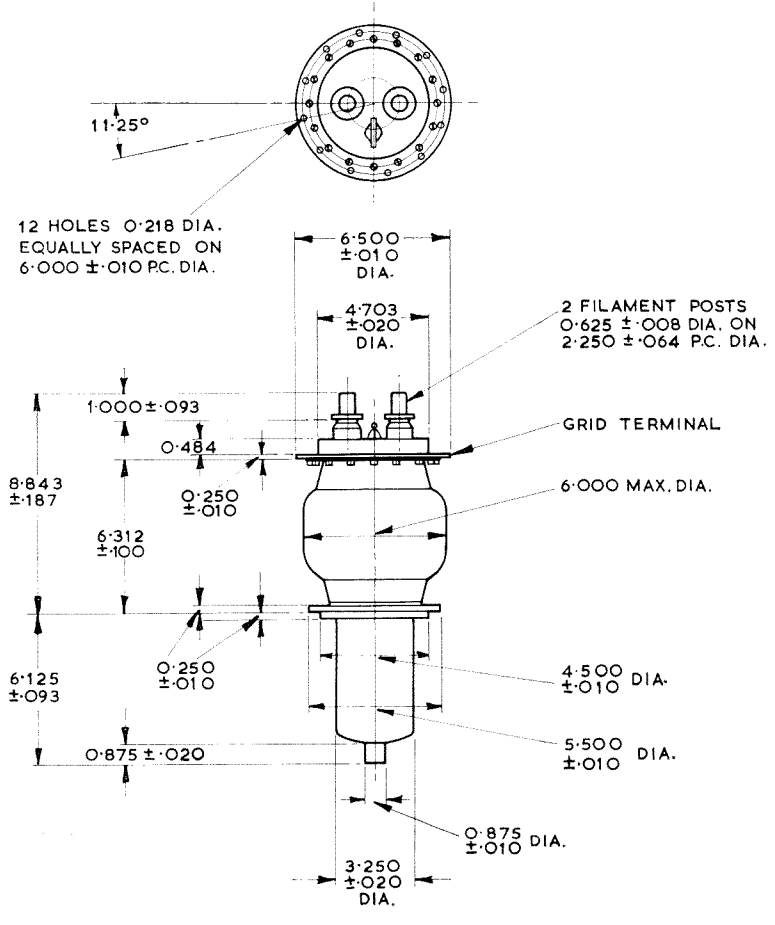
OUTLINE

218



ALL DIMENSIONS IN INCHES

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R.F. POWER TRIODE

BW173

Service Type CV1600

GENERAL

The BW173 is a water cooled transmitting triode. It is a maintenance type and therefore only abridged data are given on this sheet. **Full information is available on request.**

Filament	Tungsten	
Filament Voltage (*See Note*)	19	V
Filament Current	49·5	A
Filament Starting Current (Peak)	75	A Max
Filament Cold Resistance	0·031	Ω
Peak Usable Cathode Current	*See Note*	
Amplification Factor (V_a = 10kV, I_a = 0·8A)	40	
Mutual Conductance (V_a = 10kV, I_a = 1·0A)	5·5	mA/V
Filament Leads	MA135 or MA135A	

MAXIMUM RATINGS

Anode Voltage	10	kV Max
Anode Dissipation	10	kW Max
Grid Dissipation	0·8	kW Max
Frequency (for full ratings)	20	Mc/s Max

NOTE

'Marked volts.' Each valve is marked with the filament voltage required to give 5·4A peak emission at 90% saturation. Longer filament life may be obtained if the filament is run at reduced temperature and a correspondingly reduced anode current but care must be taken to keep the anode dissipation within the maximum rating.

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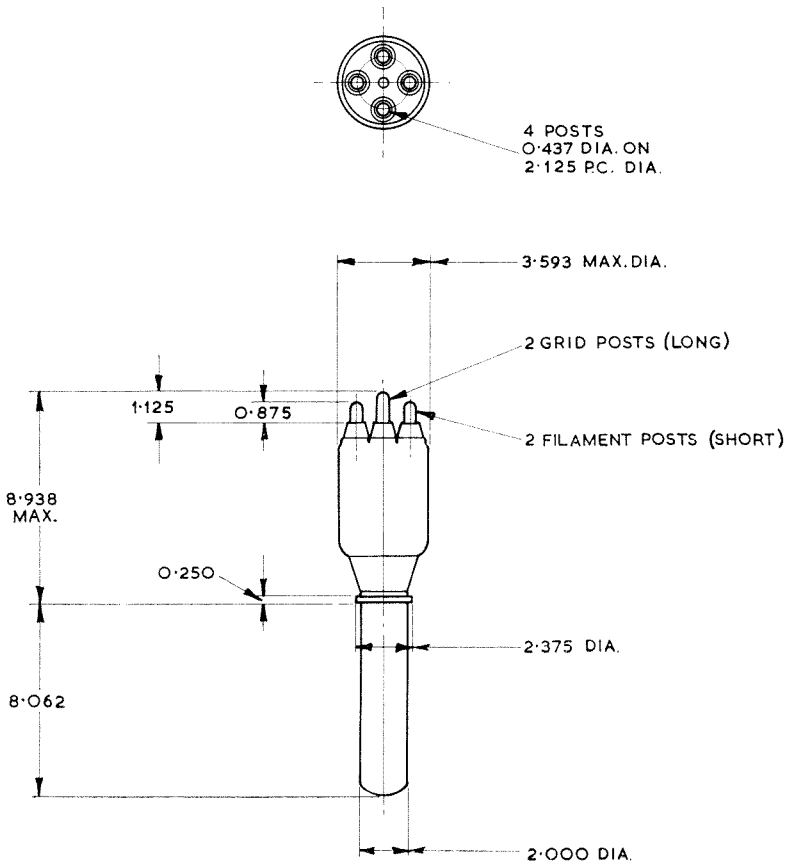
OUTLINE

220



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R.F. POWER TRIODE

BW179

ENGLISH ELECTRIC

ABRIDGED DATA

Water Cooled Transmitting Triode with grid terminal suitable for cathode drive operation.

Anode Dissipation	10 kW Max
Anode Voltage	8·5 kV Max
Frequency for full ratings	50 Mc/s Max
Frequency at reduced ratings	110 Mc/s Max
Output Power (Class C Telegraphy)	17 kW

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	6·6	V
Filament Current	90	A
Filament Starting Current (Peak) (*See Note* 2)	195	A Max
Filament Cold Resistance	0·0084	Ω
Peak Usable Cathode Current	16	A
Amplification Factor (V_a = 5·0kV, I_a = 1·0A)	28	
Mutual Conductance (V_a = 5·0kV, I_a = 1·0A)	10	mA/V
Inter-electrode Capacitances:		
Grid to Anode	30	pF
Grid to Filament	33	pF
Anode to Filament	1·0	pF

Mechanical

Overall Length	13·500 inches (343 mm)	Max
Overall Diameter	7·125 inches (181 mm)	Max
Net Weight	5 pounds (2·3 kg)	Approx
Mounting Position	Vertical, filament end up	

Accessories

Water Jacket	BW4029
Filament Leads	MA135 or MA135A
Grid Connector	MA66A
Sealing Ring (supplied with valve)	I5797A

COOLING

The anode of this valve must be fitted into a water jacket for cooling, the recommended jacket being type BW4029. A flow of water of 4 to 5 gallons per minute (18·2 to 22·7 l./min) is required; the temperature of the cooling water at the outlet must not exceed 65°C, nor should the temperature rise across the jacket exceed 15°C.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 15cu.ft/min (0·43cu.m/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

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

← Indicates a change

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R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	8·5 kV Max
Anode Dissipation	10 kW Max
Grid Dissipation	600 W Max
Operating Frequency (for full ratings)	50 Mc/s Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	6·0	8·0	kV
Grid Voltage	−705	−775	V
Peak R.F. Grid Voltage	1605	1675	V
Anode Current	2·92	2·94	A
Grid Current (Approx)	0·42	0·38	A
Anode Dissipation	5·5	6·2	kW
Grid Dissipation	350	325	W
Driving Power	650	620	W
Output Power	12	17·3	kW
Efficiency	69	73·5	%

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 6·6V	83	97	A
Amplification Factor (I_a = 1·0A, V_g = −50V)	25	32	
Mutual Conductance (V_a = 5·0kV, I_a = 1·0A)	7·5	12·5	mA/V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	400	V
Grid Voltage (negative value) (V_a = 5·0kV, I_a = 1·0A)	15	55	V
Anode Current (V_a = 2·0kV, V_g = +200V)	2·2	3·0	A
Grid Current (V_a = 2·0kV, V_g = +200V)	0	0·3	A
Inter-electrode Capacitances:			
Grid to anode	28	36	pF
Grid to filament	28	38	pF

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MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
50	8·5 kV	6·0 kV
110	6·5 kV	5·2 kV

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.

2. The filament current must not exceed 195A, even momentarily, at any time.

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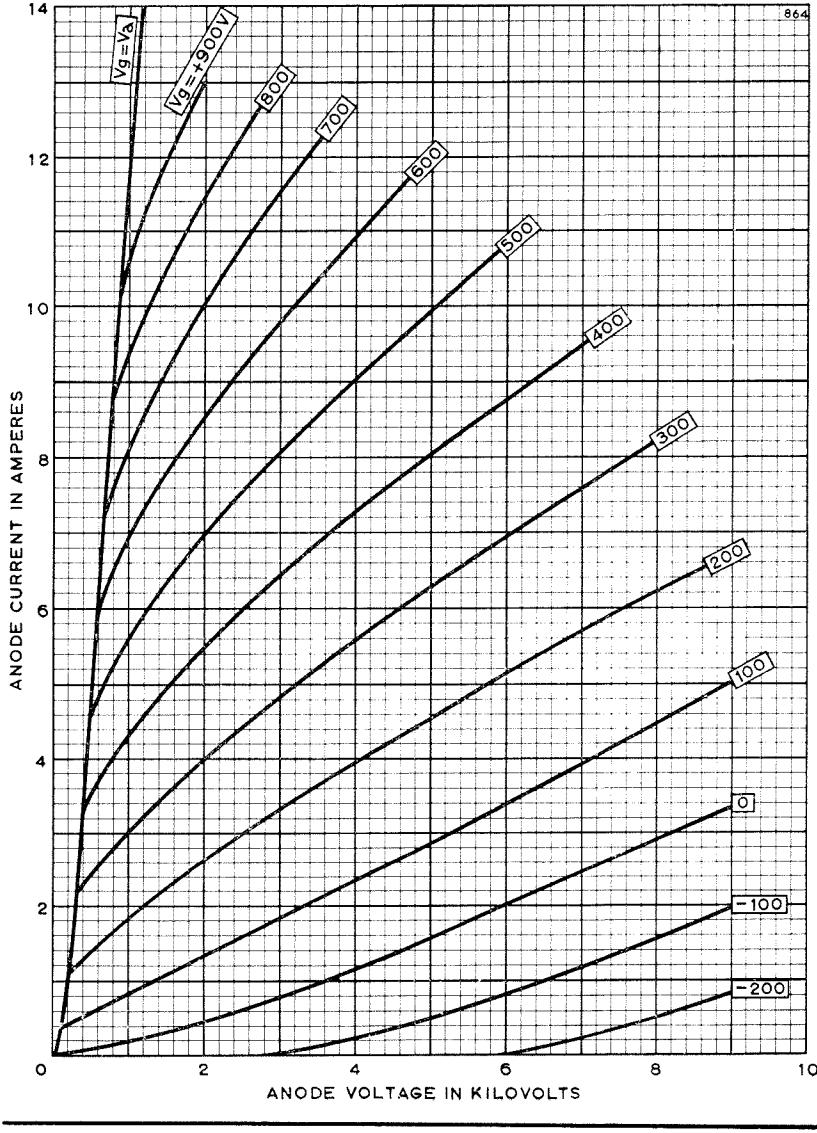
ENGLISH ELECTRIC

ANODE CHARACTERISTICS



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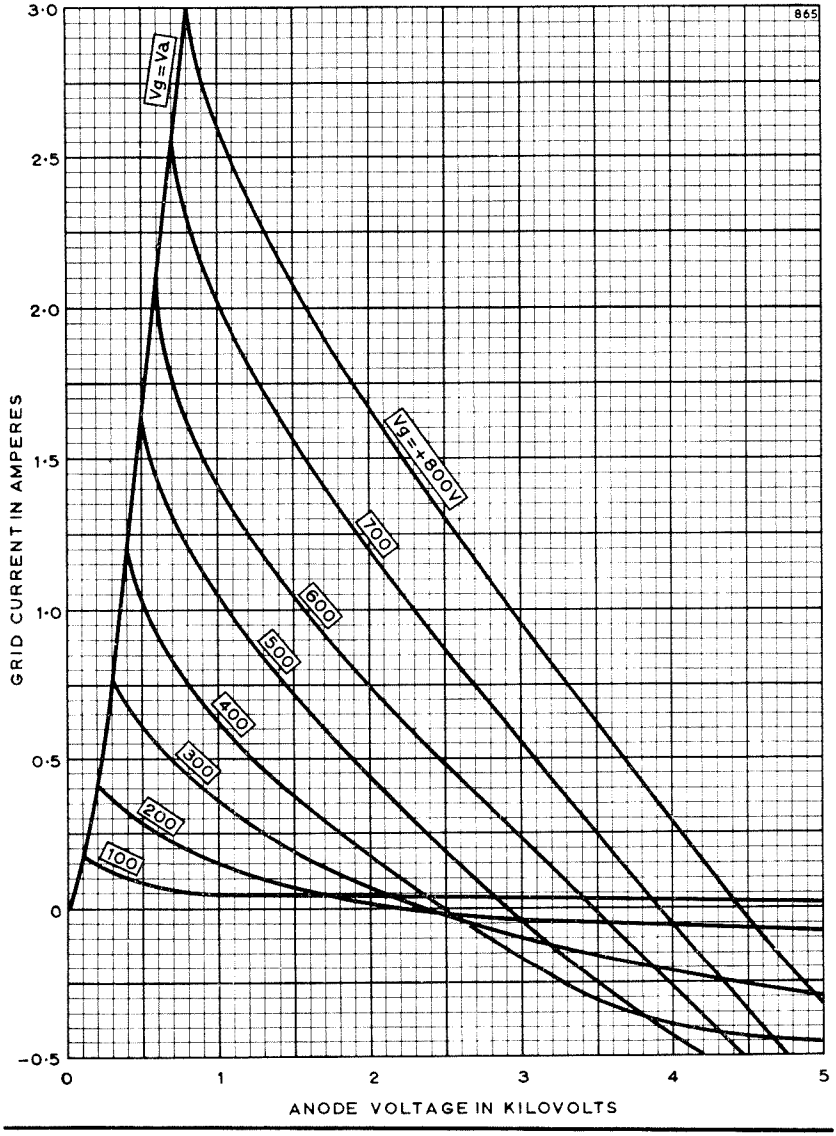
CONTROL GRID CHARACTERISTICS



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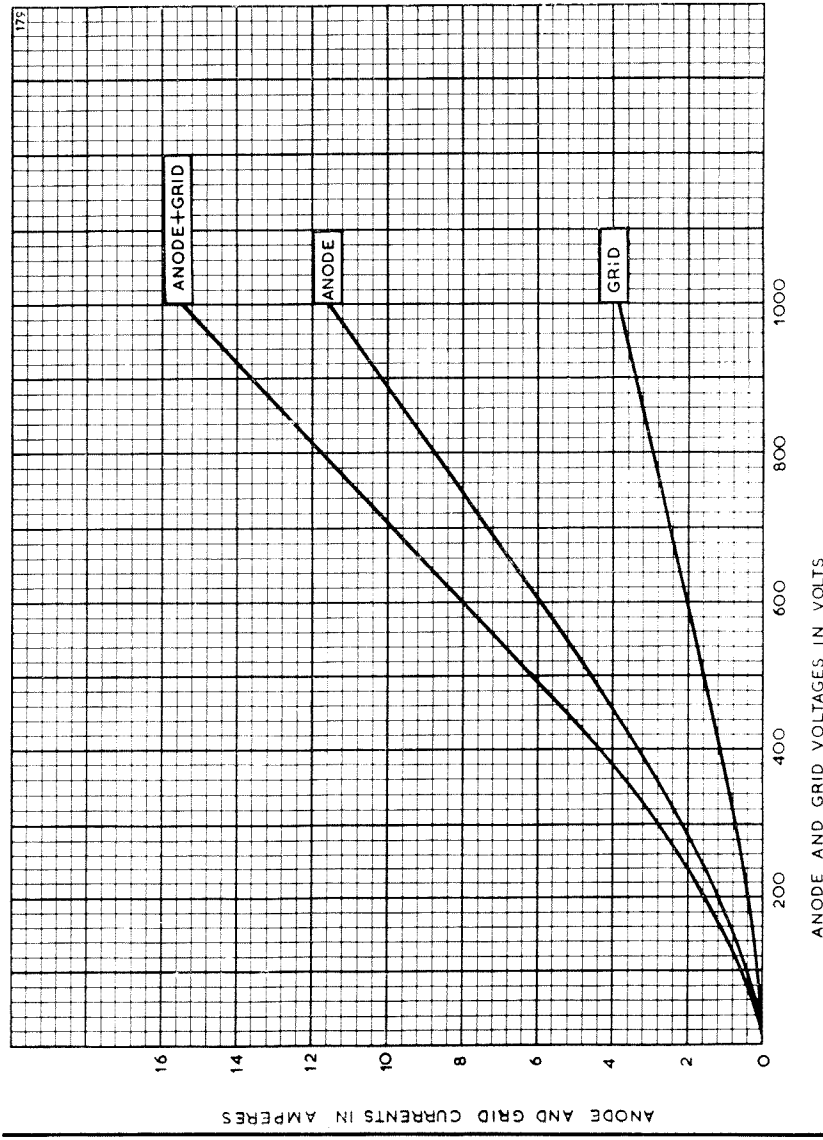
STRAPPED CHARACTERISTICS



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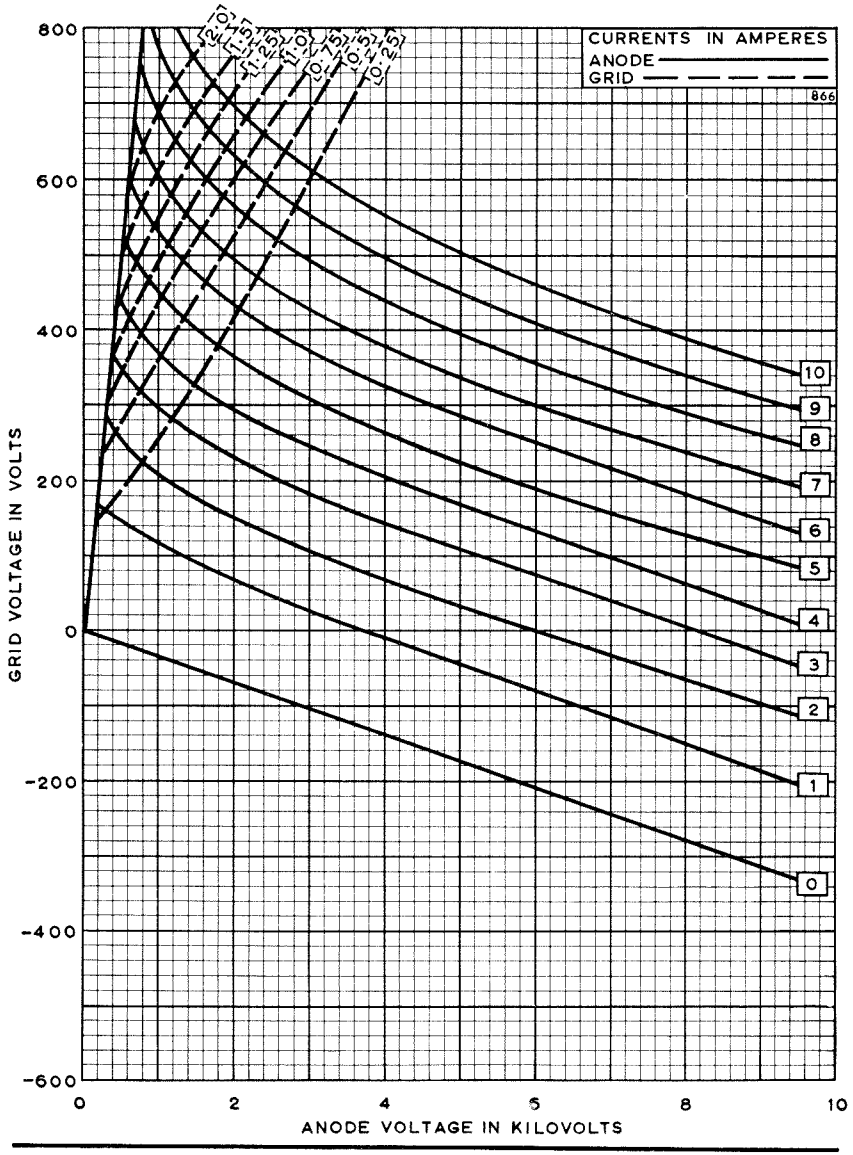
CONSTANT CURRENT CHARACTERISTICS



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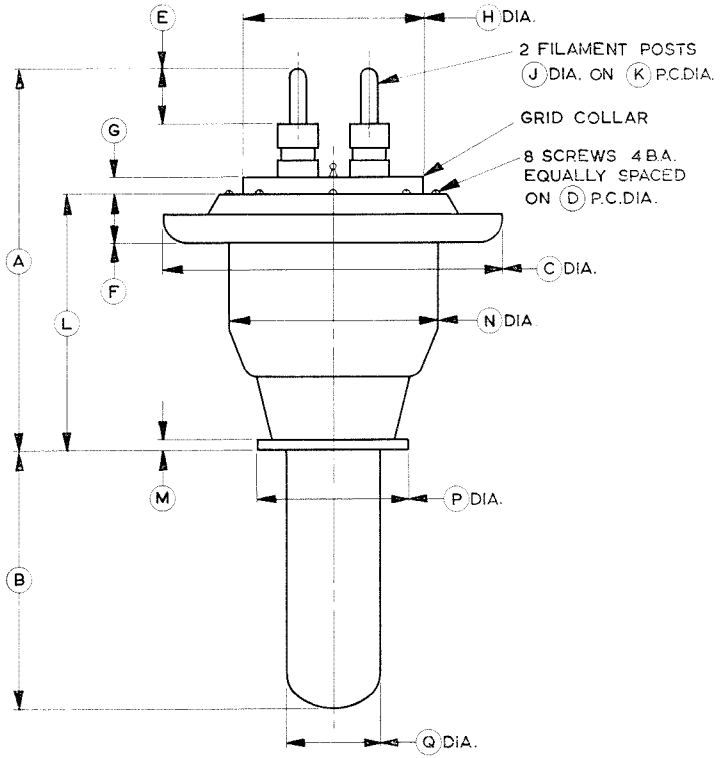
OUTLINE

2216



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	8·125 Max	206·4 Max	J	0·437	11·10
B	5·375	136·5	K	1·500	38·10
C	7·125	181·0	L	5·625 Max	142·9 Max
D	4·375	111·1	M	0·250	6·35
E	1·187	30·15	N	4·437	112·7
F	1·000	25·40	P	3·250	82·55
G	0·328	8·33	Q	2·000	50·80
H	3·750	95·25			

Millimetre dimensions have been derived from inches.

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R.F. POWER TRIODE

BW189

ENGLISH ELECTRIC

ABRIDGED DATA

Water Cooled Transmitting Triode with grid terminal suitable for cathode drive operation.

Anode Dissipation	35	kW Max
Anode Voltage	15	kV Max
Frequency for full ratings	5·0	Mc/s Max
Frequency at reduced ratings	50	Mc/s Max
Output Power (Class C Telegraphy)	80	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	9·0	V
Filament Current	240	A
Filament Starting Current (Peak) (*See Note* 2)	600	A Max
Filament Cold Resistance	0·0046	Ω
Peak Usable Cathode Current	70	A
Perveance	1·6	$mA/V^{3/2}$
Amplification Factor (V_a = 9·0 kV, I_a = 2·0 A)	34	
Mutual Conductance (V_a = 9·0 kV, I_a = 2·0 A)	27·5	mA/V
Inter-electrode Capacitances:		
Grid to Anode	61	pF
Grid to Filament	68	pF
Anode to Filament	1·5	pF

Mechanical

Overall Length	20·625 inches (523·9 mm)	Max
Overall Diameter	11·000 inches (279·4 mm)	Max
Net Weight	23 pounds (10·5 kg)	Approx
Mounting Position	Vertical, filament end up	

Accessories

Water Jacket	BW4050
Filament Leads	MA130
Grid Connector	MA66
Sealing Ring (supplied with valve)	I5802A

COOLING

The anode of this valve must be fitted into a water jacket for cooling, the recommended jacket being type BW4050. A flow of water of 15 to 20 gallons per minute (68 to 91 l./min) is required; the temperature of the cooling water at the

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outlet must not exceed 65 C, nor should the temperature rise across the jacket exceed 15 C.

The temperature of the filament and grid seals must not exceed 140 C. A flow of air of 20cu.ft/min (0·57cu.m/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

The anode seal also requires cooling and this may be done via holes in a corona ring fitted to the water jacket, when an air pressure of 1-inch (25mm) water gauge should provide sufficient flow. The temperature of the anode seal must not exceed 180 C.

R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS
(Absolute values)

Anode Voltage	15	kV Max
Anode Current	7·0	A Max
Anode Dissipation	35	kW Max
Grid Dissipation	1·25	kW Max
Operating Frequency (for full ratings)	5·0	Mc/s Max

TYPICAL OPERATING CONDITIONS (FOR AMPLIFIER)

Anode Voltage	12	15	kV
Grid Voltage	−900	−900	V
Peak R.F. Grid Voltage	1650	1650	V
Anode Current	6·4	6·6	A
Grid Current (Approx)	0·83	0·7	A
Anode Dissipation	15	18	kW
Grid Dissipation	640	530	W
Driving Power	1370	1150	W
Output Power	62	80	kW
Efficiency	80	80	%

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 9·0V ..	217	256	A
Amplification Factor (V_a = 9·0kV, I_a = 2·0A)	30	38	
Mutual Conductance (V_a = 9·0kV, I_a = 2·0A)	22·5	29·5	mA/V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	380	V
Grid Voltage (negative value) (V_a = 9·0kV, I_a = 2·0A)	125	193	V
Anode Current (V_a = 4·0kV, V_g = +400V) ..	17	23	A
Grid Current (V_a = 4·0kV, V_g = +400V) ..	−1·2	—	A

MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
5	15 kV	13·5 kV
30	13·5 kV	12 kV
50	8·0 kV	6·5 kV

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%.
2. The filament current must not exceed this value, even momentarily, at any time.

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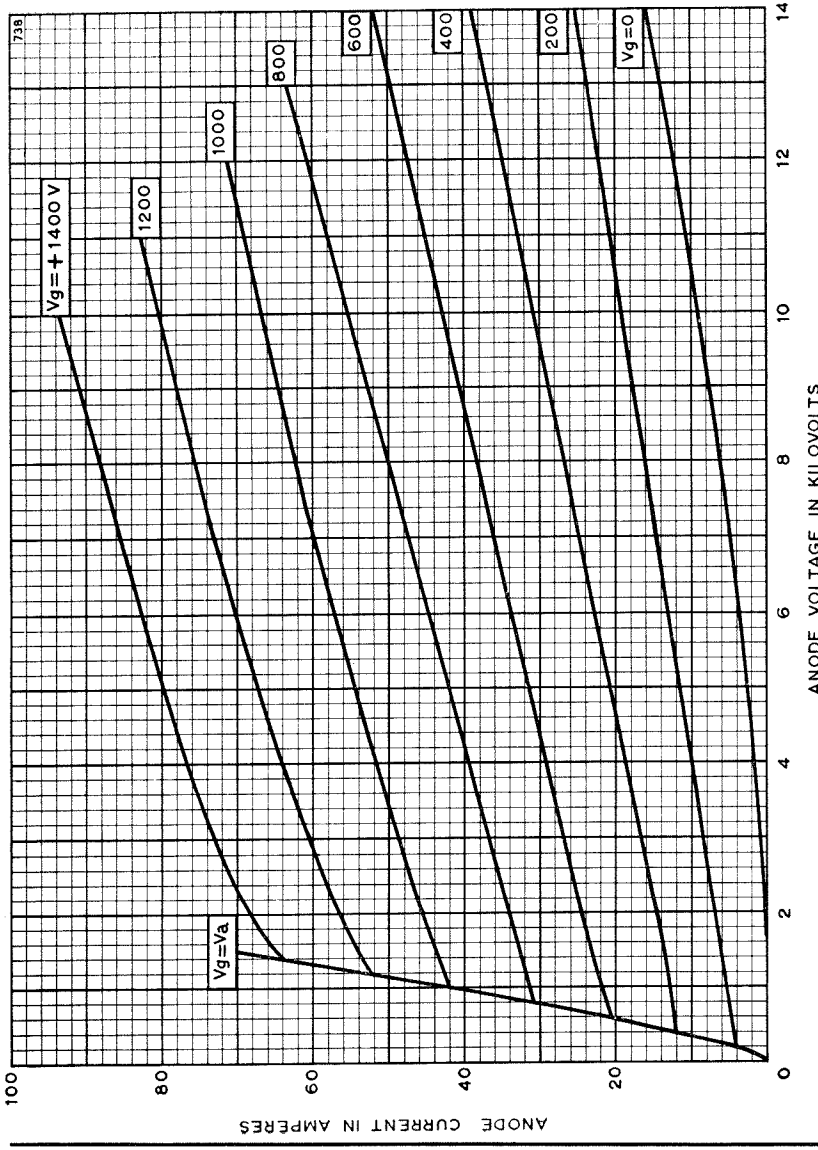
ANODE CHARACTERISTICS



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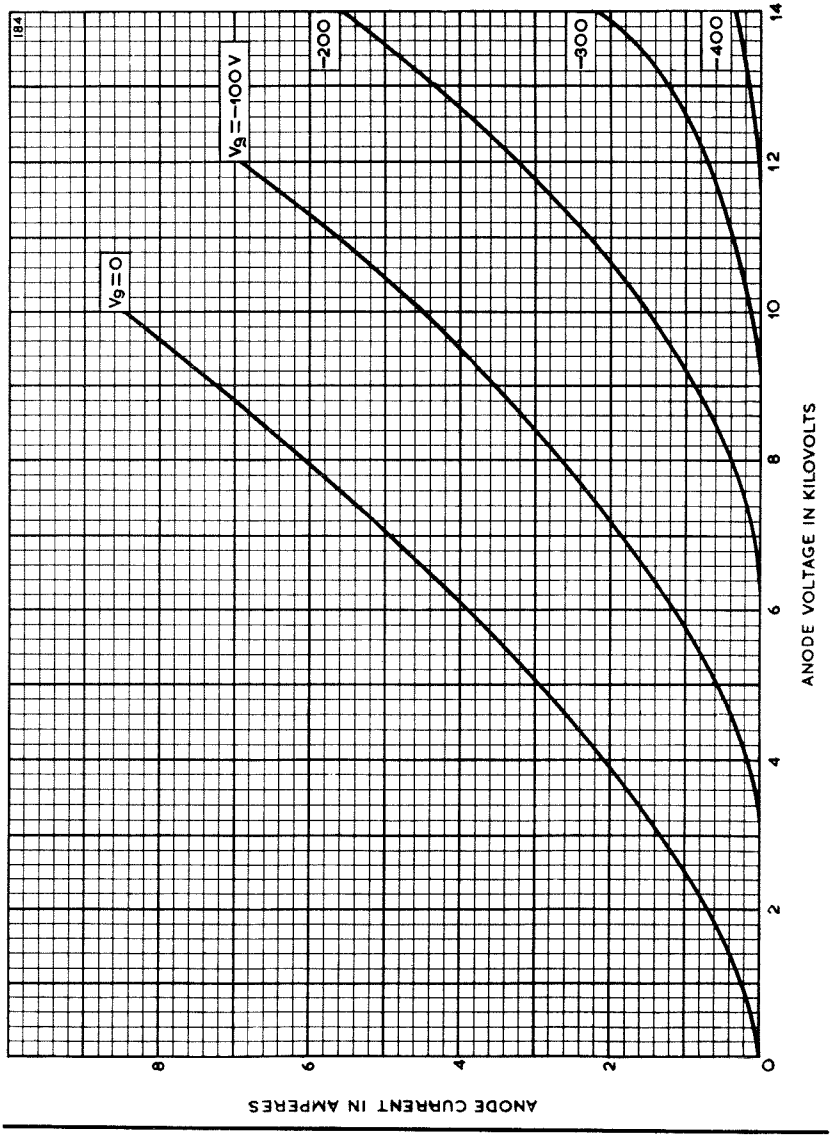
ANODE CHARACTERISTICS (Negative Grid)



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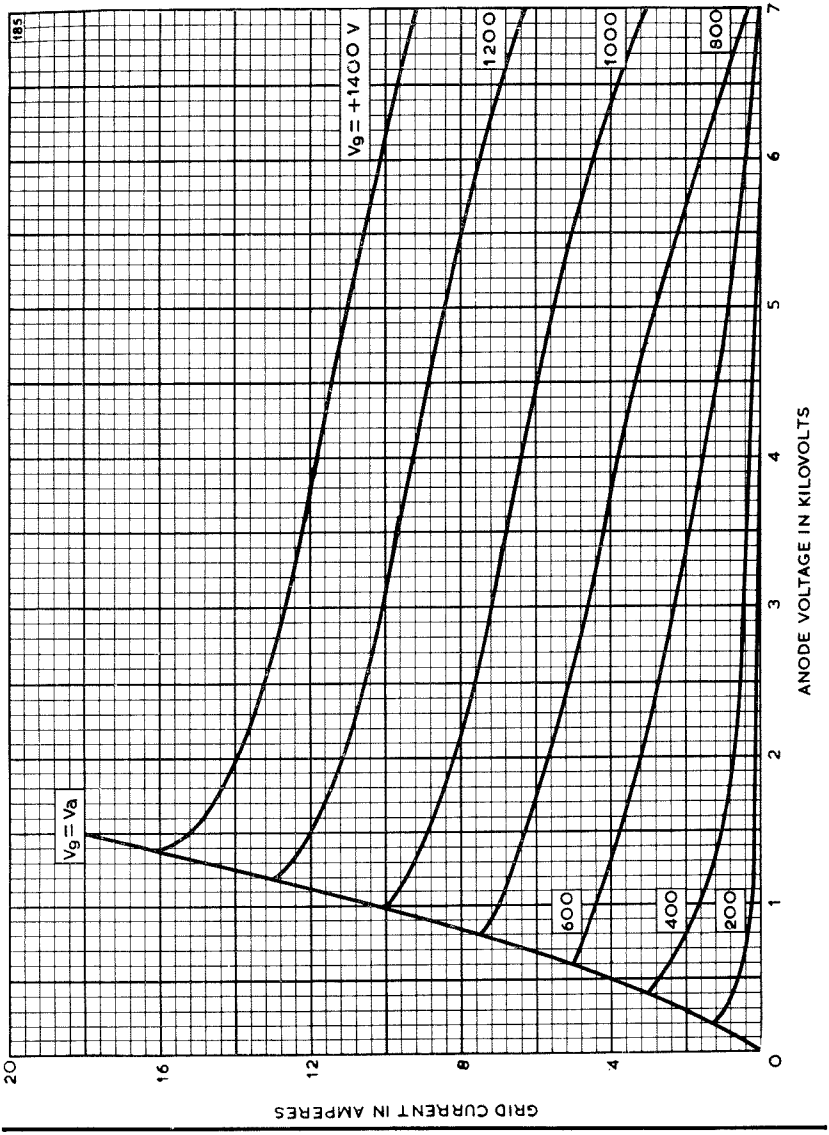
CONTROL GRID CHARACTERISTICS



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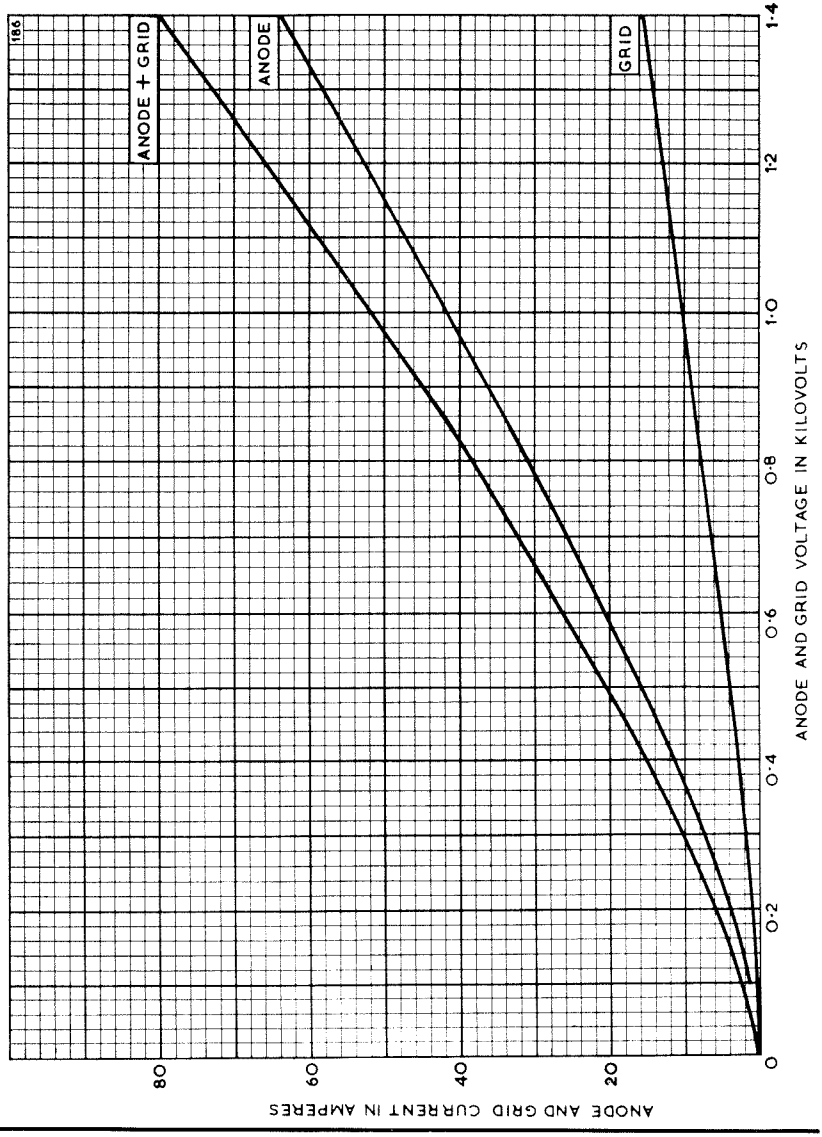
STRAPPED CHARACTERISTICS



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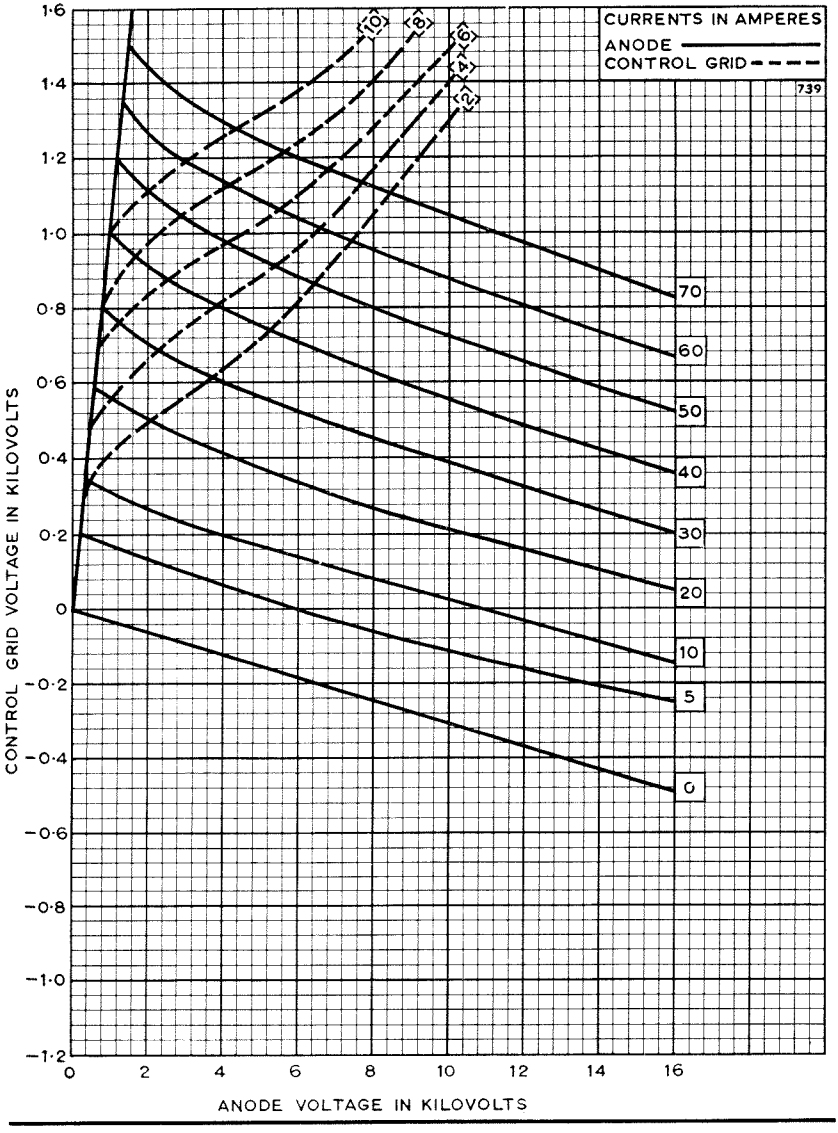
CONSTANT CURRENT CHARACTERISTICS



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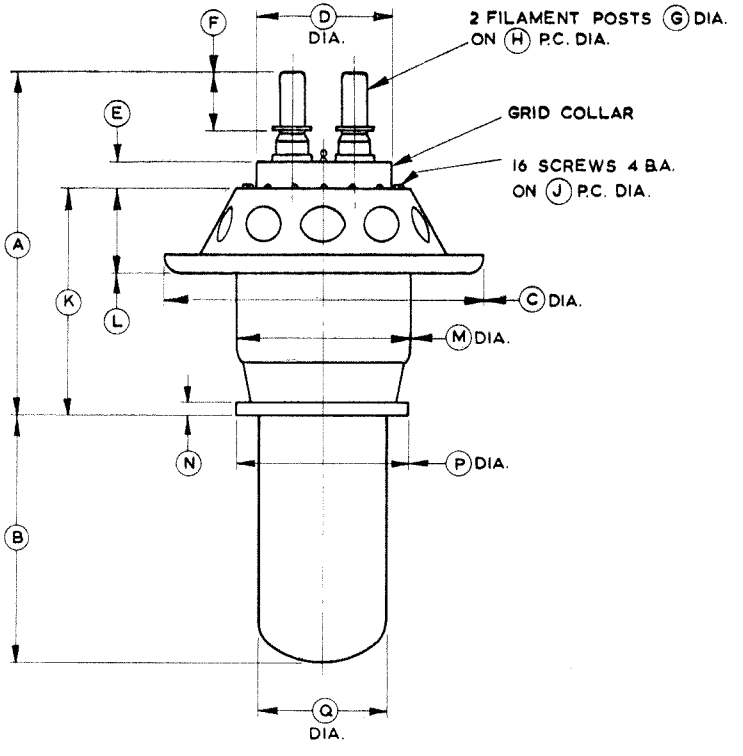

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	12·000 Max	304·8 Max	J	5·375	136·5
B	8·625	219·1	K	7·875 Max	200·0 Max
C	11·000 Max	279·4 Max	L	2·906 Max	73·81 Max
D	4·703	119·5	M	6·000	152·4
E	0·687	17·45	N	0·500	12·70
F	2·000	50·80	P	5·760 Max	146·3 Max
G	0·875	22·23	Q	4·500	114·3
H	2·250	57·15			

Millimetre dimensions have been derived from inches.

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R.F. POWER TRIODE

BW194

ENGLISH ELECTRIC

ABRIDGED DATA

Water Cooled Transmitting Triode with grid terminal suitable for cathode drive operation. This tube is also available to special order with an 11 inch← (280mm) diameter grid corona ring.

Anode Dissipation	50	kW Max
Anode Voltage	15	kV Max
Frequency for full ratings	5·0	MHz Max
Frequency at reduced ratings	30	MHz Max
Output Power (Class C Telegraphy)	115	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	13	V
Filament Current	240	A
Filament Starting Current (Peak) (*See Note* 2)	600	A Max
Filament Cold Resistance	0·006	Ω
Peak Usable Cathode Current	100	A
Perveance	2·17	$mA/V^{3/2}$
Amplification Factor (V_a = 7·5kV, I_a = 3·0A)	34	
Mutual Conductance (V_a = 9·0kV, I_a = 4·0A)	43	mA/V
Inter-electrode Capacitances:		
Grid to Anode	60	pF
Grid to Filament	95	pF
Anode to Filament	1·5	pF

Mechanical

Overall Length	24·625 inches (625·5mm)	Max
Overall Diameter	8·062 inches (204·8mm)	Max←
Net Weight	28 pounds (12·8kg)	Approx
Mounting Position	Vertical, filament pins up	

Accessories

Filament Leads	MA130
Grid Connector	MA66
Water Jacket	BW4027
Sealing Ring (supplied with valve)	I5802A

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COOLING

The anode of the BW194 must be fitted into a water jacket for cooling, the recommended jacket being type BW4027. A flow of water of 20 to 25 Imp. gallons per minute (91 to 114 l./min) is required; the temperature of the cooling water at the outlet must not exceed 65°C, nor should the temperature rise across the jacket exceed 15°C.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 20 to 30ft^3/min (0·57 to 0·85m^3/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	15	kV Max
Anode Current	10	A Max
Anode Dissipation	50	kW Max
Grid Dissipation	1·8	kW Max
Operating Frequency (for full ratings)	5·0	MHz Max

TYPICAL OPERATING CONDITIONS (FOR AMPLIFIER)

Anode Voltage	10	15	kV
Grid Voltage	−900	−900	V
Peak R.F. Grid Voltage	1620	1620	V
Anode Current	8·8	9·6	A
Grid Current (Approx)	1·2	1·2	A
Anode Dissipation	18	26	kW
Grid Dissipation	870	850	W
Output Power	70	115	kW
Efficiency	78	80	%

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R.F. POWER TRIODE

BW194

ENGLISH ELECTRIC

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
→Filament Current at filament voltage 13V ..	225	255	A
Amplification Factor (V_a = 7·5kV, I_a = 3·0A)	31	37	
Mutual Conductance (V_a = 9·0kV, I_a = 4·0A)	38	48	mA/V
Grid Voltage (negative value) (V_a = 10kV, I_a = 3·0A)	173	195	V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	345	V
Anode Current (V_a = 2·0kV, V_g = +200V) ..	7·0	11	A
Anode Current (V_a = 4·0kV, V_g = +400V) ..	22	32	A
Grid Current (V_a = 2·0kV, V_g = +200V) ..	−0·15	+0·25	A
Grid Current (V_a = 4·0kV, V_g = +400V) ..	−2·0	+0·5	A
Inter-electrode Capacitances			
Grid to Anode	60	78	pF
Grid to Filament	84	96	pF
Anode to Filament	—	2·0	pF

MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency MHz	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
5	15kV	12kV
30	10kV	8·0 kV

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.
2. The filament current must not exceed 600A, even momentarily, at any time.

→Indicates a change

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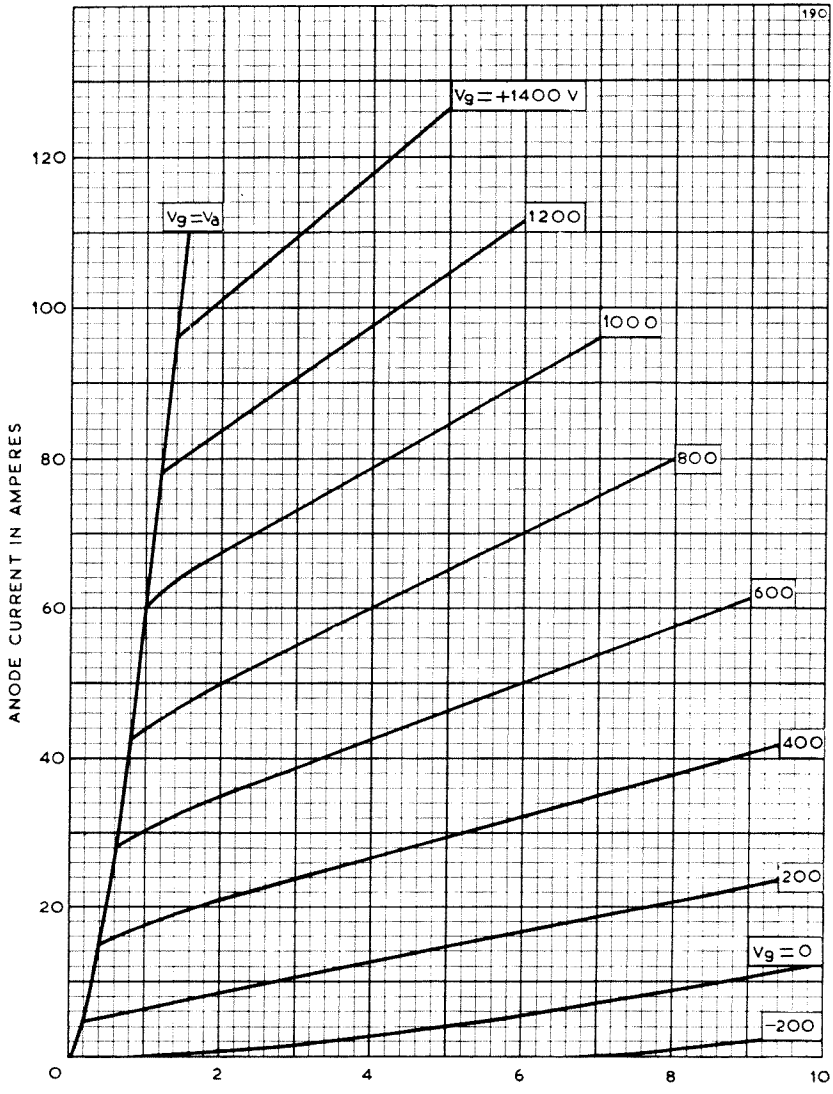
ANODE CHARACTERISTICS



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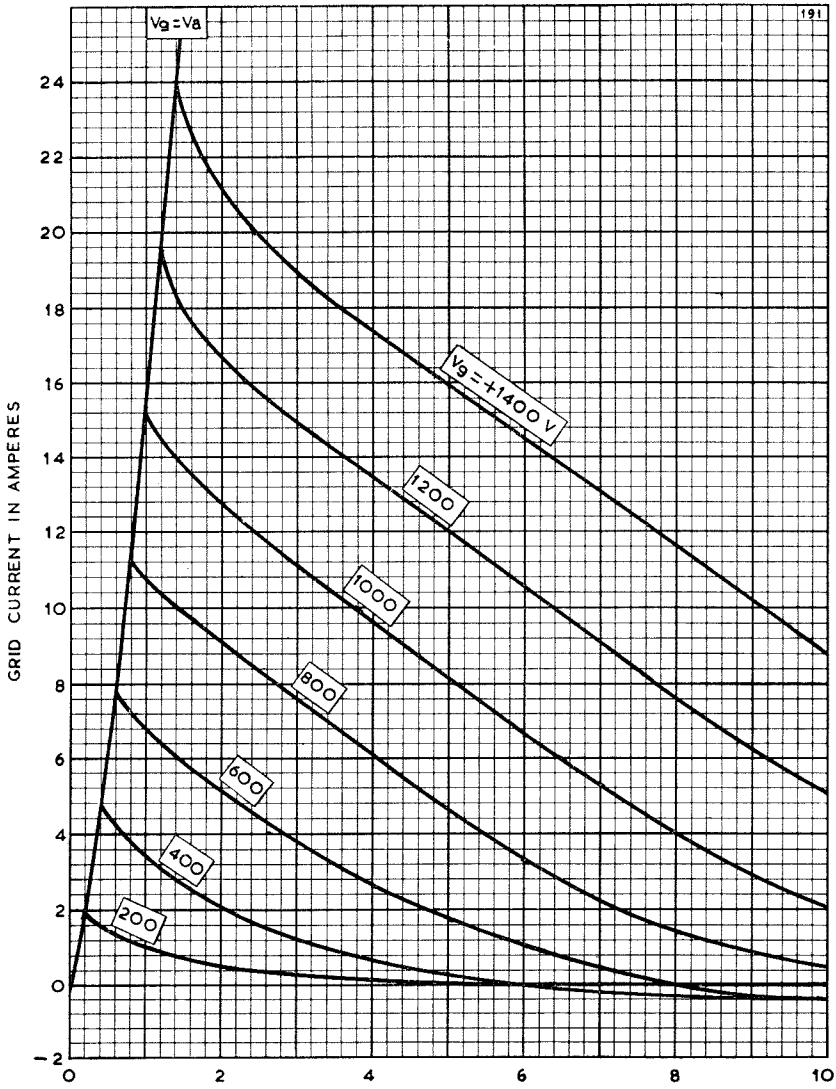
CONTROL GRID CHARACTERISTICS



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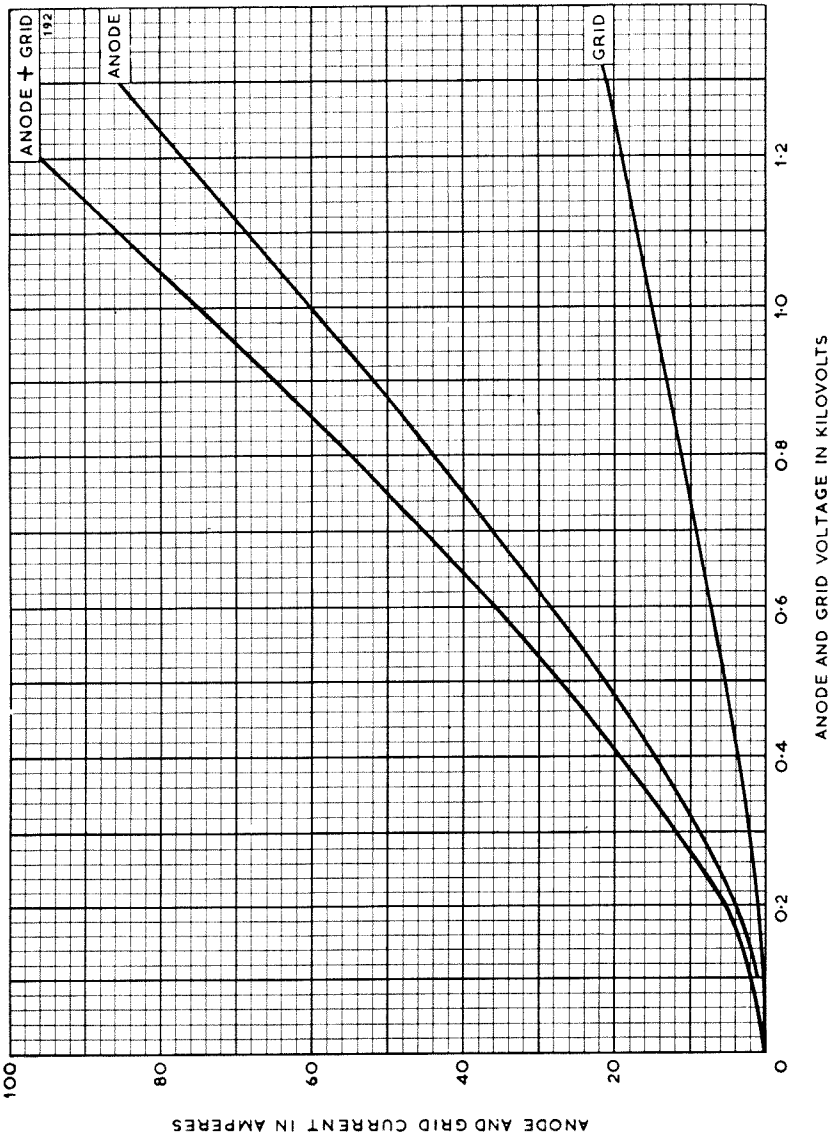
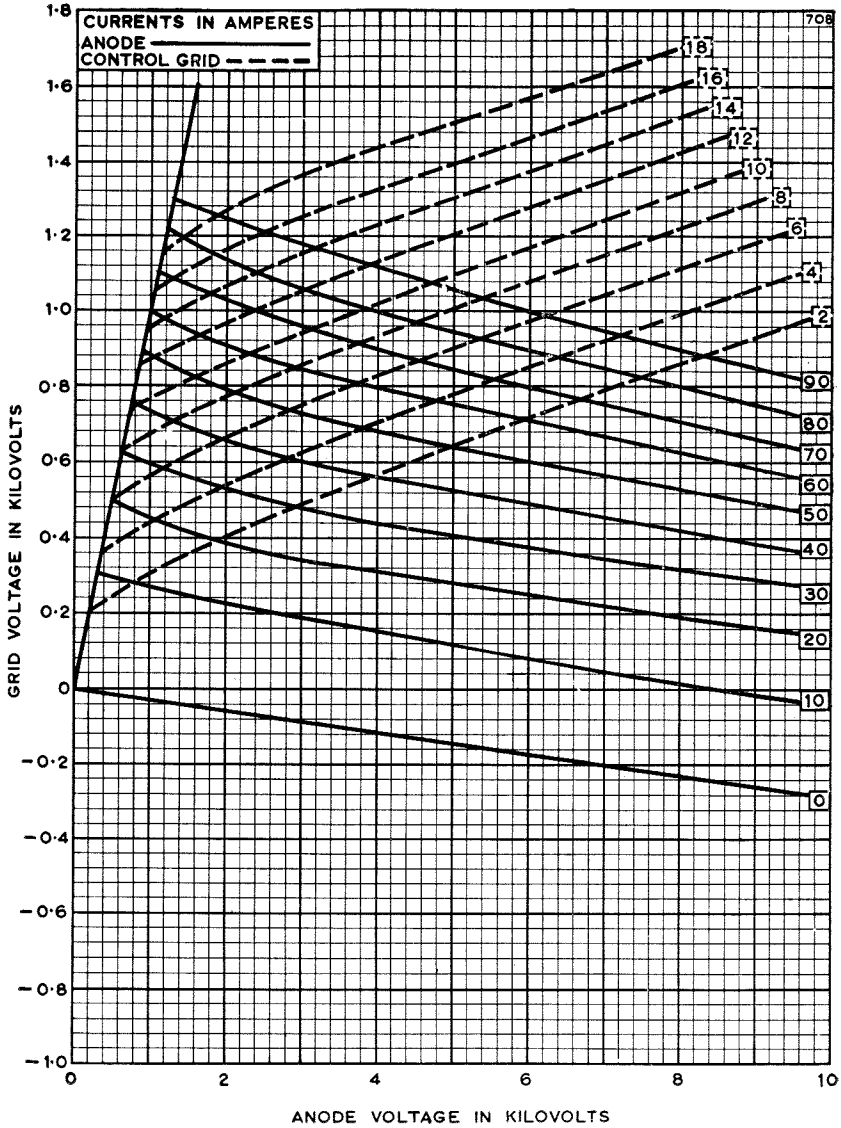
STRAPPED CHARACTERISTICS

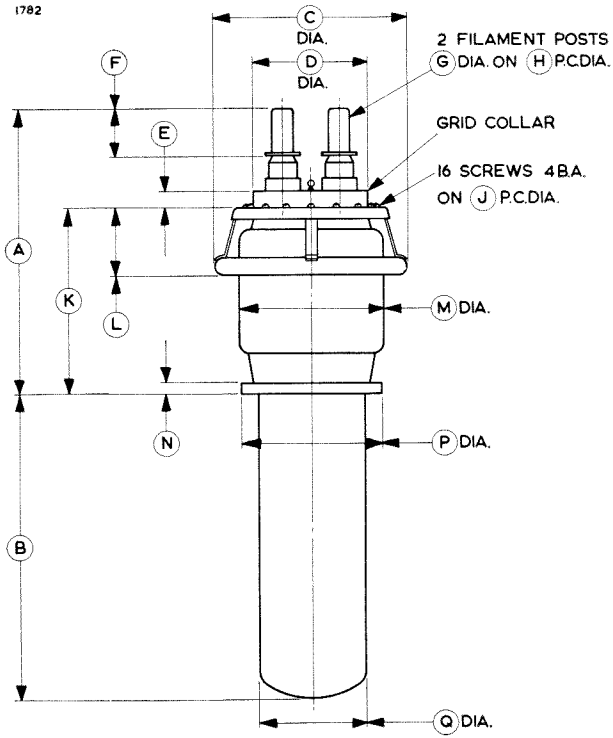


CONSTANT CURRENT CHARACTERISTICS



ENGLISH ELECTRIC

OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	11·875 Max	301·6 Max	J	5·375	136·5
B	12·750 Max	323·9 Max	K	7·750 Max	196·9 Max
C	8·062 Max	204·8 Max	L	2·906 Max	73·81 Max
D	4·703	119·5	M	6·000	152·4
E	0·687	17·45	N	0·500	12·70
F	2·000	50·80	P	5·760 Max	146·3 Max
G	0·875	22·23	Q	4·500	114·3
H	2·250	57·15			

Millimetre dimensions have been derived from inches.

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R.F. POWER TRIODES

BW1102
BW1102J2

ENGLISH ELECTRIC

ABRIDGED DATA

Water Cooled Triodes intended primarily for industrial service. BW1102 employs a separate water jacket; that of BW1102J2 is integral. The tubes are electrically identical.

Anode Dissipation	20	kW Max
Anode Voltage	12	kV Max
Frequency for full ratings	50	MHz Max
Output Power (Class C unmodulated conditions)	53	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	8·2	V
Filament Current	230	A
Filament Starting Current (Peak) (*See Note* 2)	525	A Max
Filament Cold Resistance	4·3	mΩ
Peak Usable Cathode Current	45	A
Perveance	1·25	$mA/V^{3/2}$
Amplification Factor (V_a = 9·0 kV, I_a = 2·0 A)	42	
Mutual Conductance (V_a = 10 kV, I_a = 1·5 A)	20	mA/V
Inter-electrode Capacitances:		
Grid to Anode	37	pF
Grid to Filament	49	pF
Anode to Filament	0·6	pF

Mechanical

Overall Length:		
BW1102	18·630 inches (473 mm)	Max
BW1102J2	20·000 inches (508 mm)	Max
Overall Width:		
BW1102	6·000 inches (152 mm)	Max
BW1102J2	6·500 inches (165 mm)	Max
Net Weight:		
BW1102	10¼ pounds (4·7 kg)	Approx
BW1102J2	15 pounds (6·8 kg)	Approx
Mounting Position	Vertical, filament end up	

Accessories

Water Jacket (BW1102)	BW4028
Filament Leads	MA131
Grid Connector	MA66
Sealing Ring (supplied with BW1102)	MA251

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COOLING

The anode of the BW1102 must be fitted into a water jacket for cooling, the recommended jacket being type BW4028. A flow of water of 8 gallons per minute (36 l./min) is required; the temperature of the cooling water at the outlet must not exceed 65°C, nor should the temperature rise across the jacket exceed 15°C. Type BW1102J2 has an integral water jacket (see outline drawing, page 10). Minimum water cooling requirements are shown on page 8; higher rates of flow should be used where possible.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 20 to 30ft^3/min (0·57 to 0·85m^3/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

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

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage (*See Note* 3)	12 kV Max
Anode Current	7·5 A Max
Anode Dissipation (*See Note* 4)	20 kW Max
Grid Dissipation	1·0 kW Max
Operating Frequency (for full ratings)	50 MHz Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	9·0	12	kV
Grid Voltage	−655	−720	V
Grid Resistor	625	720	Ω
Peak R.F. Grid Voltage	1455	1520	V
Anode Current	5·85	5·85	A
Grid Current (Approx)	1·05	1·0	A
Anode Dissipation	15·6	17·2	kW
Grid Dissipation	735	720	W
Output Power	37	53	kW
Efficiency	70	75·5	%
Load Resistance	700	1020	Ω

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RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 8·2V ..	207	253	A
Amplification Factor (V_a = 9·0kV, I_a = 2·0A)	35·5	48·5	
Mutual Conductance (V_a = 10kV, I_a = 1·5A)	15·5	24·5	mA/V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	340	V
Grid Voltage (negative value) (V_a = 10kV, I_a = 2·0A)	95	135	V
Anode Current (V_a = 2·0kV, V_g = +250V) ..	3·8	8·8	A
Grid Current (V_a = 2·0kV, V_g = +250V) ..	0·25	—	A
Anode Current (V_a = 4·0kV, V_g = +250V) ..	6·2	10·4	A
Grid Current (V_a = 4·0kV, V_g = +250V) ..	−0·1	0·5	A
Inter-electrode Capacitances:			
Grid to Anode	32	42	pF
Grid to Filament	44	54	pF

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%.
2. The filament current must not exceed this value, even momentarily, at any time.
3. This is the highest nominal operating voltage to be used. It makes allowance for the normal mains voltage fluctuations as well as tolerances in the equipment.
4. The valve can dissipate higher powers for periods up to 15 seconds provided that the average over a long period does not exceed the maximum stated.

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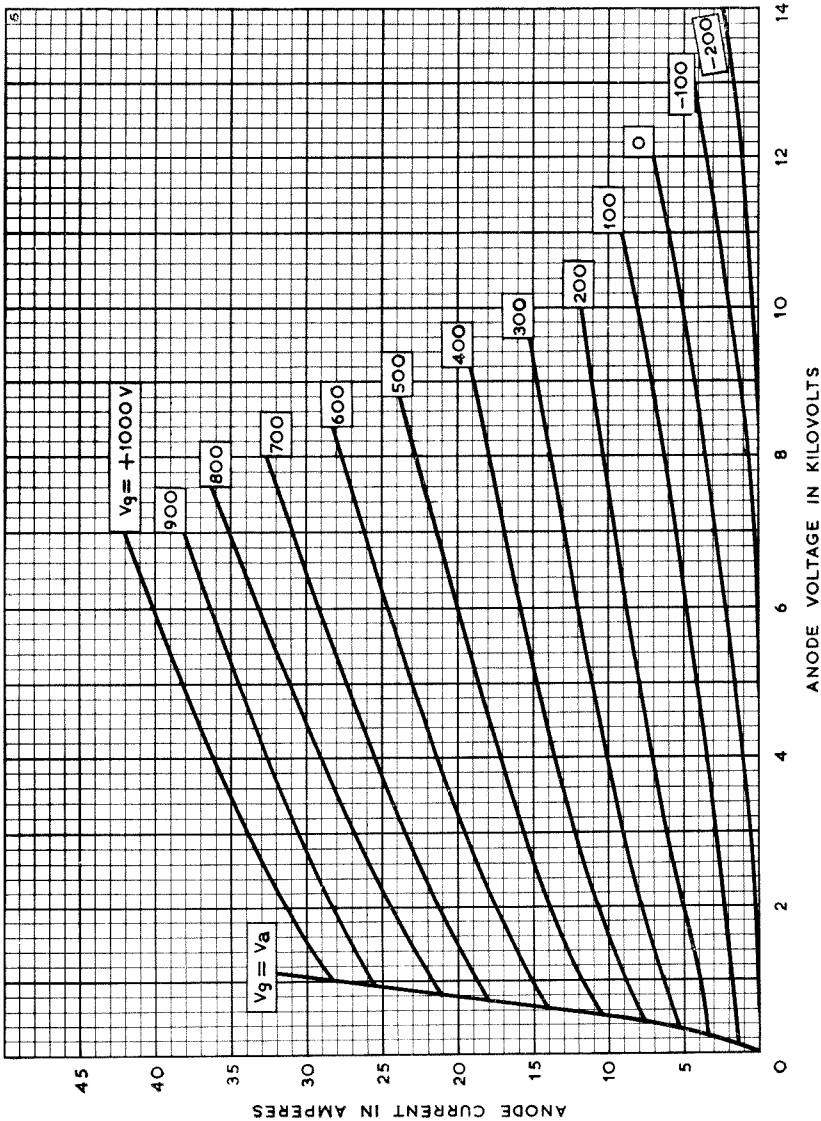
ANODE CHARACTERISTICS



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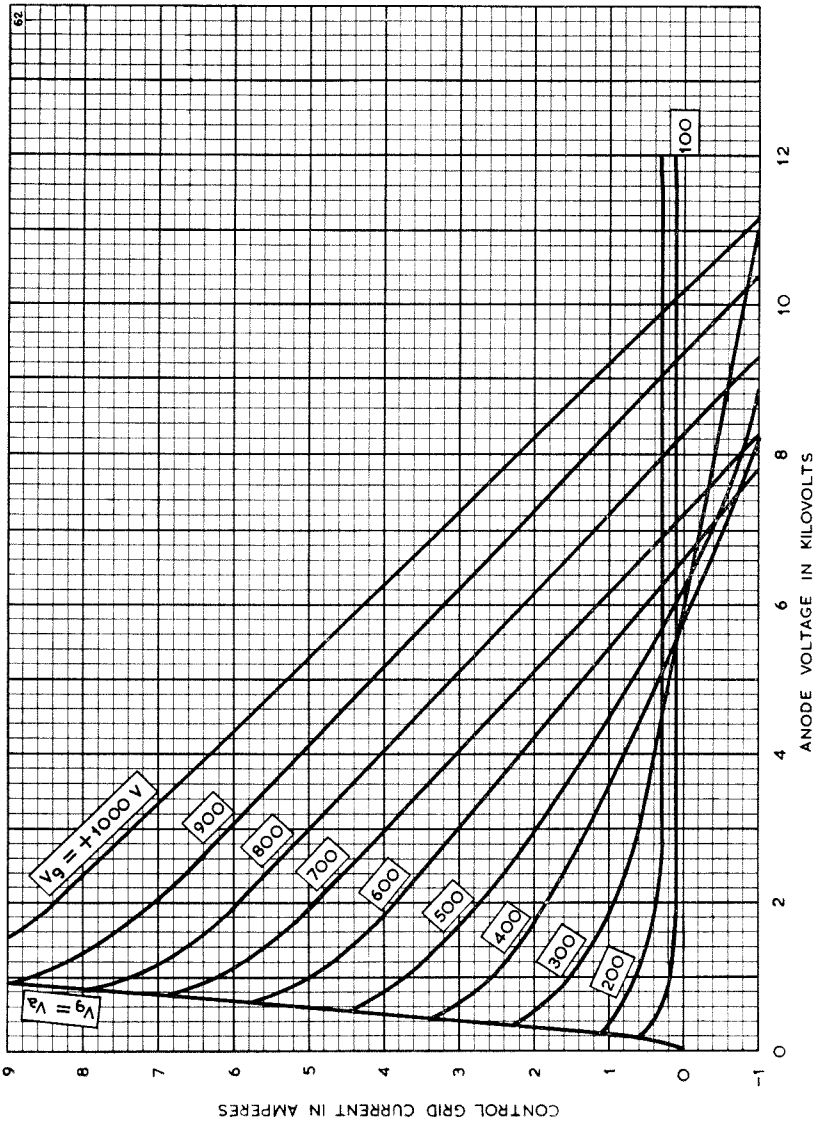
CONTROL GRID CHARACTERISTICS



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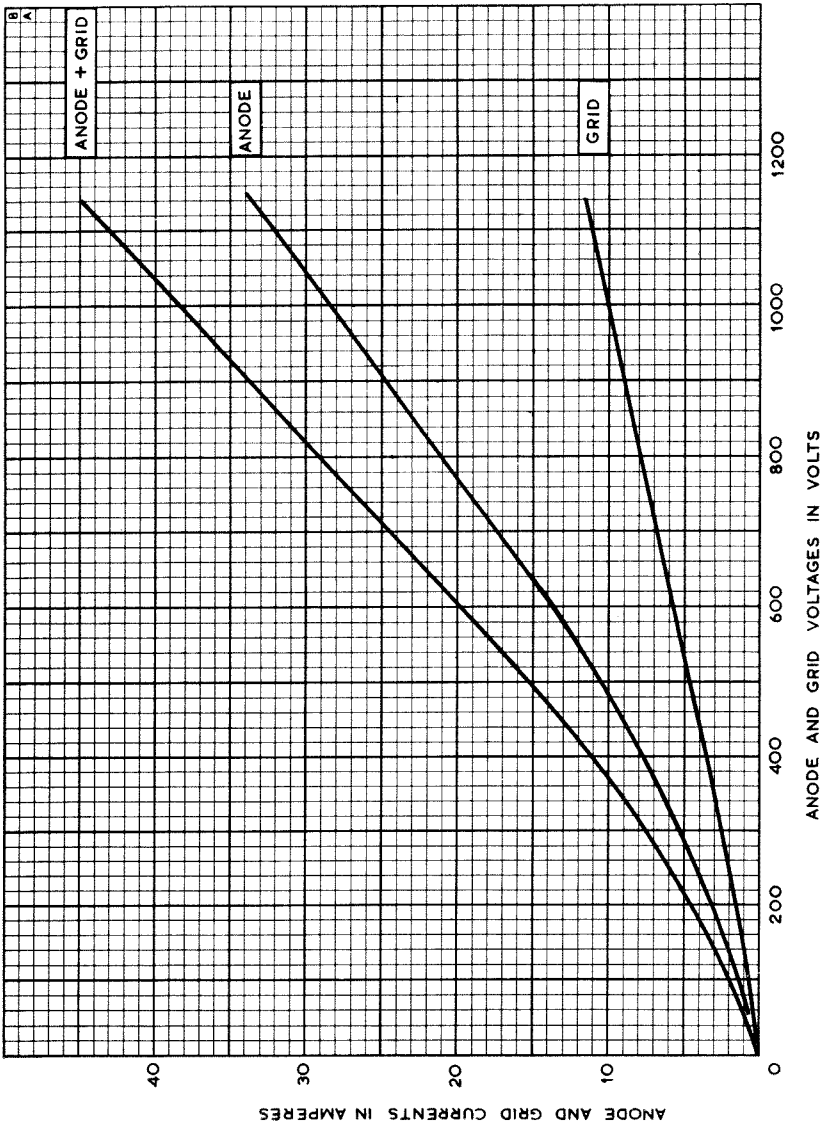
STRAPPED CHARACTERISTICS



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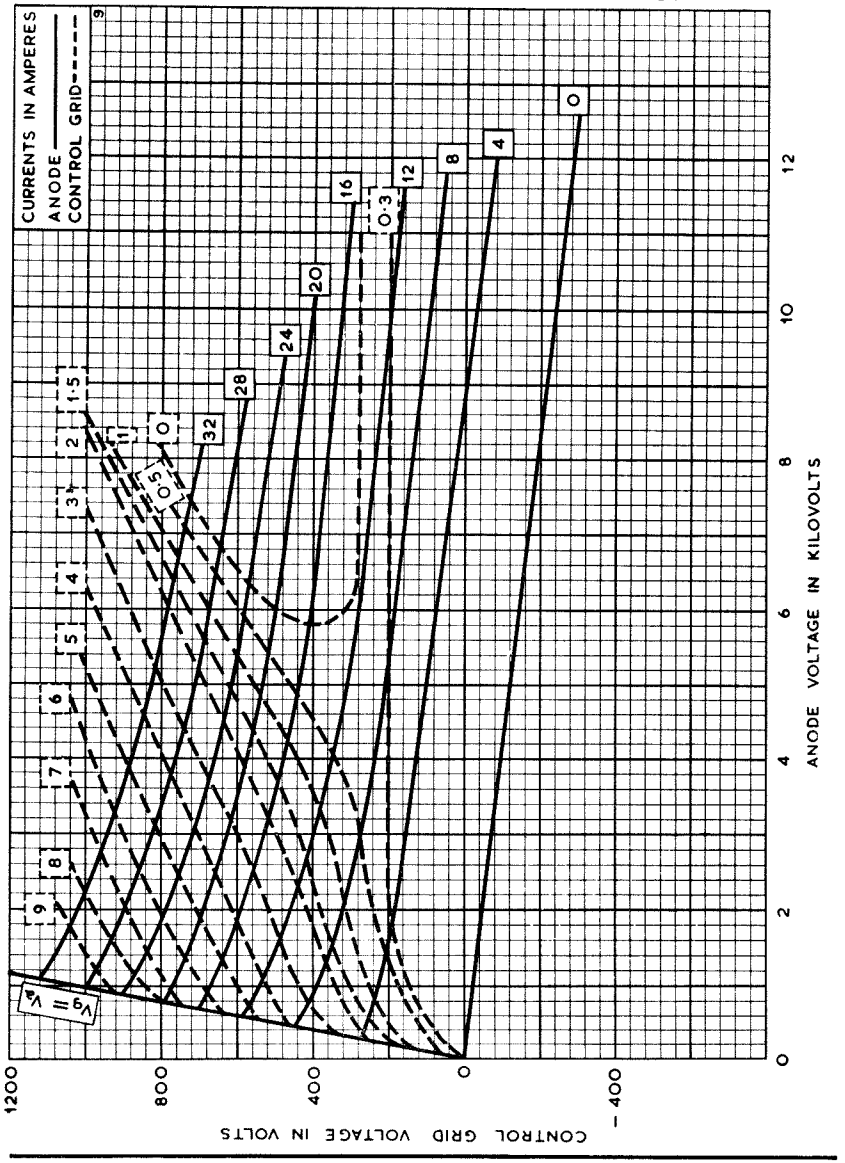
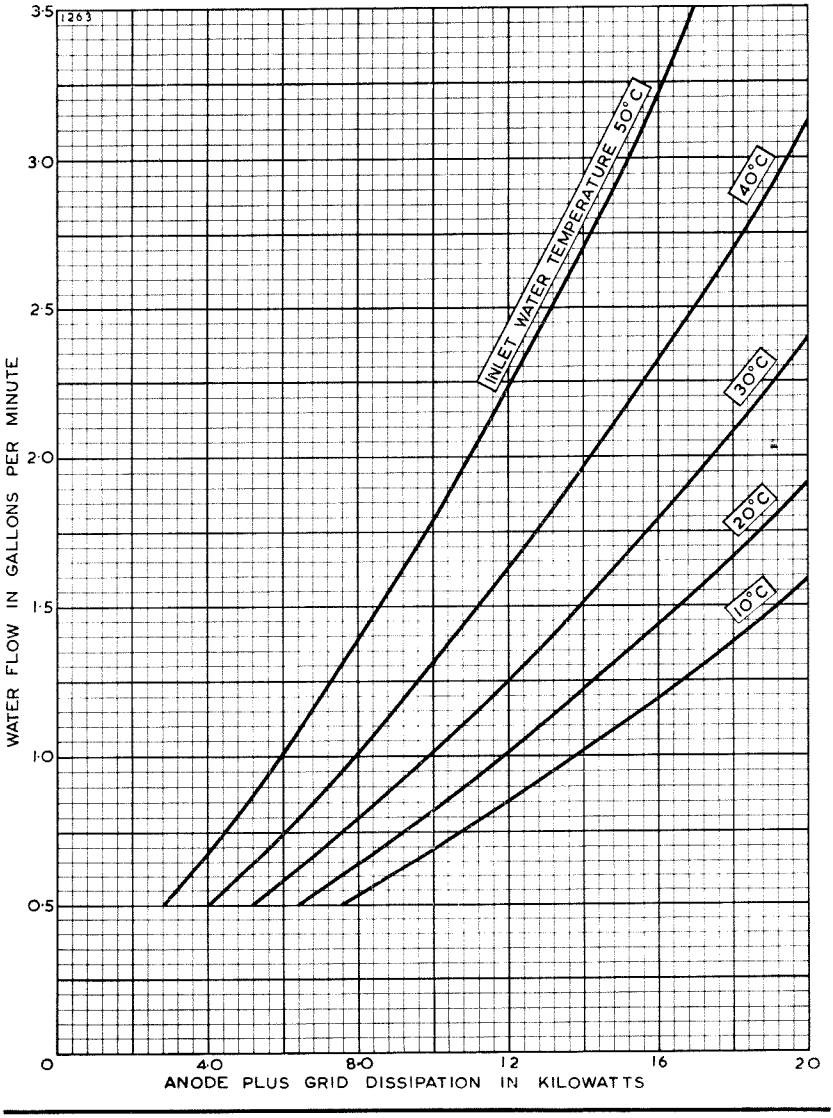
CONSTANT CURRENT CHARACTERISTICS



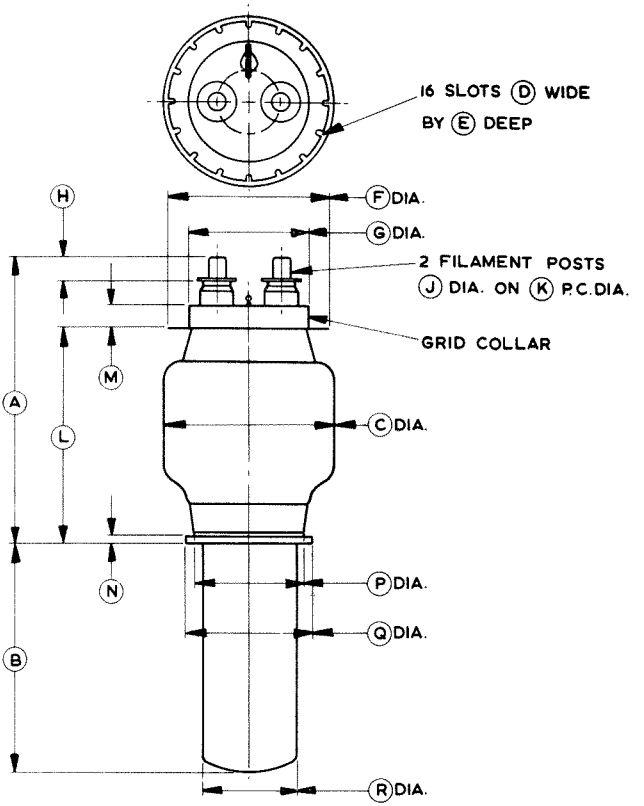
ENGLISH ELECTRIC

MINIMUM WATER COOLING REQUIREMENTS FOR BW1102J2
(Higher rates of flow should be used where possible)



OUTLINE FOR BW1102

43A



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	10·375 Max	263·5 Max	J	0·625	15·88
B	8·250	209·6	K	2·250	57·15
C	6·000 Max	152·4 Max	L	7·875 Max	200·0 Max
D	0·153	3·89	M	0·734	18·64
E	0·205	5·21	N	0·250	6·35
F	5·630	143·0	P	3·875	98·43
G	4·703	119·5	Q	4·500 Max	114·3 Max
H	1·000	25·40	R	3·250	82·55

Millimetre dimensions have been derived from inches.

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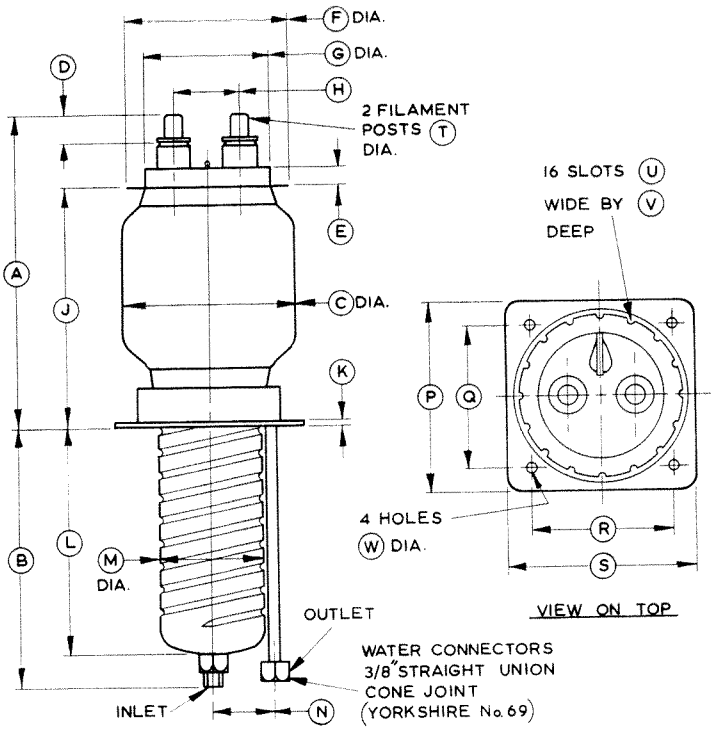
1230

OUTLINE FOR BW1102J2



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	11·000 Max	279·4 Max	M	3·562	90·47
B	9·000 Max	228·6 Max	N	2·000	50·80
C	6·000 Max	152·4 Max	P	6·500	165·1
D	1·000	25·40	Q	5·000	127·0
E	0·734	18·64	R	5·000	127·0
F	5·630	143·0	S	6·500	165·1
G	4·703	119·5	T	0·625	15·88
H	2·250	57·15	U	0·153	3·89
J	8·375	212·7	V	0·205	5·21
K	0·125	3·18	W	0·375	9·53
L	8·000	203·2			

Millimetre dimensions have been derived from inches

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R.F. POWER TRIODE

BW1103

GENERAL

The BW1103 is a water cooled transmitting Triode. It is a maintenance type and therefore only abridged data are given on this sheet. **Full information is available on request.** For new designs the BW1124 is recommended.

Filament	Thoriated Tungsten	
Filament Voltage	6·0	V
Filament Current	120	A
Filament Starting Current (Peak)	260	A Max
Peak Usable Cathode Current	16	A
Amplification Factor (V_a = 5·0kV, I_a = 1·0A)	25	
Mutual Conductance (V_a = 5·0kV, I_a = 1·0A)	9·5	mA/V
Filament Leads	MA135 or MA135A	
Grid Connector	MA66A	
Water Jacket	BW4029	
Sealing Ring (supplied with valve)	15797A	

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage (*See Note* 1)	8·5	kV Max
Anode Dissipation (*See Note* 2)	10	kW Max
Grid Dissipation	600	W Max
Frequency (for full ratings)	100	Mc/s Max

NOTES

1. This is the highest nominal operating voltage to be used. It makes allowance for the normal mains voltage fluctuations as well as tolerances in the equipment.

2. The valve can dissipate higher powers for periods up to 15 seconds provided that the average over a long period does not exceed the maximum stated.

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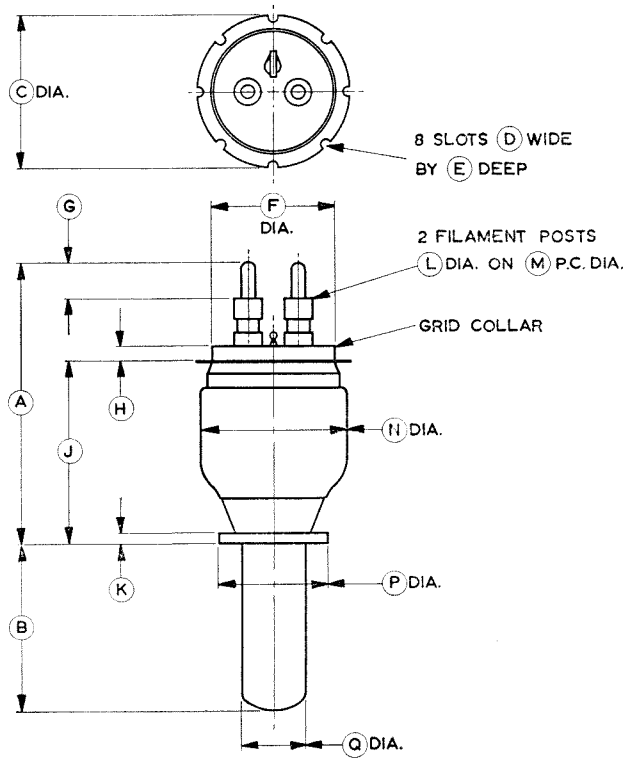
OUTLINE

44B



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	8·125 Max	206·4 Max	J	5·200 ± 0·200	132·1 ± 5·1
B	5·375	136·5	K	0·250	6·35
C	4·562	115·9	L	0·437	11·10
D	0·182	4·62	M	1·500	38·10
E	0·205	5·21	N	4·437	112·7
F	3·750	95·25	P	3·250	82·55
G	1·187	30·15	Q	2·000	50·80
H	0·375	9·53			

Millimetre dimensions have been derived from inches.

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R.F. POWER TRIODES

BW1121 BW1121J BW1121J2

ABRIDGED DATA

Water Cooled Triodes intended primarily for industrial service. They differ only in their cooling arrangements. BW1121 requires a separate water jacket; BW1121J and BW1121J2 have integral water jackets with differing water connection positions.

Anode Dissipation	15	kW Max
Anode Voltage	10	kV Max
Frequency for full ratings	50	MHz Max
Output Power (Class C unmodulated conditions)	50	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	6·6	V
Filament Current	230	A
Filament Starting Current (Peak) (*See Note* 2)	600	A Max
Filament Cold Resistance	0·0035	Ω
Peak Usable Cathode Current	45	A
Perveance	2·3	$mA/V^{3/2}$
Amplification Factor (V_a = 6·0kV, I_a = 3·0A)	38	
Mutual Conductance (V_a = 7·0kV, I_a = 3·0A)	45	mA/V
Inter-electrode Capacitances:		
Grid to Anode	54	pF
Grid to Filament	85	pF
Anode to Filament	0·8	pF

Mechanical

Overall Dimensions	*See outline drawings*	
Net Weight:		
BW1121	10 pounds (4·6kg)	Approx
BW1121J, BW1121J2	14½ pounds (6·6kg)	Approx
Mounting Position	Vertical, filament end up	

Accessories

Water Jacket for BW1121	BW4034
Filament Leads	MA131
Grid Connector	MA66
Sealing Ring (supplied with BW1121)	I5799A

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COOLING

The anode of the BW1121 must be fitted into a water jacket for cooling, the recommended jacket being type BW4034. Minimum water cooling requirements for the BW1121 in a BW4034 water jacket are shown on page 8. The rates of flow given apply to valves with clean anode surfaces; higher values should be used where possible.

Types BW1121J and BW1121J2 have integral water jackets and differ only in the location of the water inlet and outlet connectors (see outline drawings, pages 10 and 11). Minimum water cooling requirements are shown on page 8; higher rates of flow should be used where possible.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 20 to 30ft^3/min (0·57 to 0·85m^3/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperatures of the seals.

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

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage (*See Note* 3)	10 kV Max
Anode Current	6·5 A Max
Anode Dissipation (*See Note* 4)	15 kW Max
Grid Dissipation	1·0 kW Max
Frequency (for full ratings)	50 MHz Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	8·0	10	kV
Grid Voltage	−420	−470	V
from Grid Resistor	510	746	Ω
Anode Current	6·4	6·4	A
Grid Current (Approx)	0·82	0·63	A
Anode Dissipation	11·2	13	kW
Grid Dissipation	386	290	W
Driving Power	730	585	W
Peak R.F. Grid Voltage	890	930	V
Output Power	40	51	kW
Efficiency	78	80	%
Load Resistance	665	830	Ω

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 6·6V	216	244	A
Amplification Factor (V_a = 6·0kV, I_a = 3·0A)	33	45	
Mutual Conductance (V_a = 7·0kV, I_a = 3·0A)	40	50	mA/V
Grid Voltage (negative value) (V_a = 6·0kV, I_a = 0·1A)	—	200	V
Anode Current (V_a = 1·5kV, V_g = +600V)	31	40	A
Grid Current (V_a = 1·5kV, V_g = +600V)	5·0	8·0	A

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%.
2. The filament current must not exceed 600A, even momentarily, at any time.
3. This is the highest nominal operating voltage to be used. It makes allowance for the normal mains voltage fluctuations as well as tolerances in the equipment.
4. The valve can dissipate higher powers for periods up to 15 seconds provided that the average over a long period does not exceed the maximum stated.

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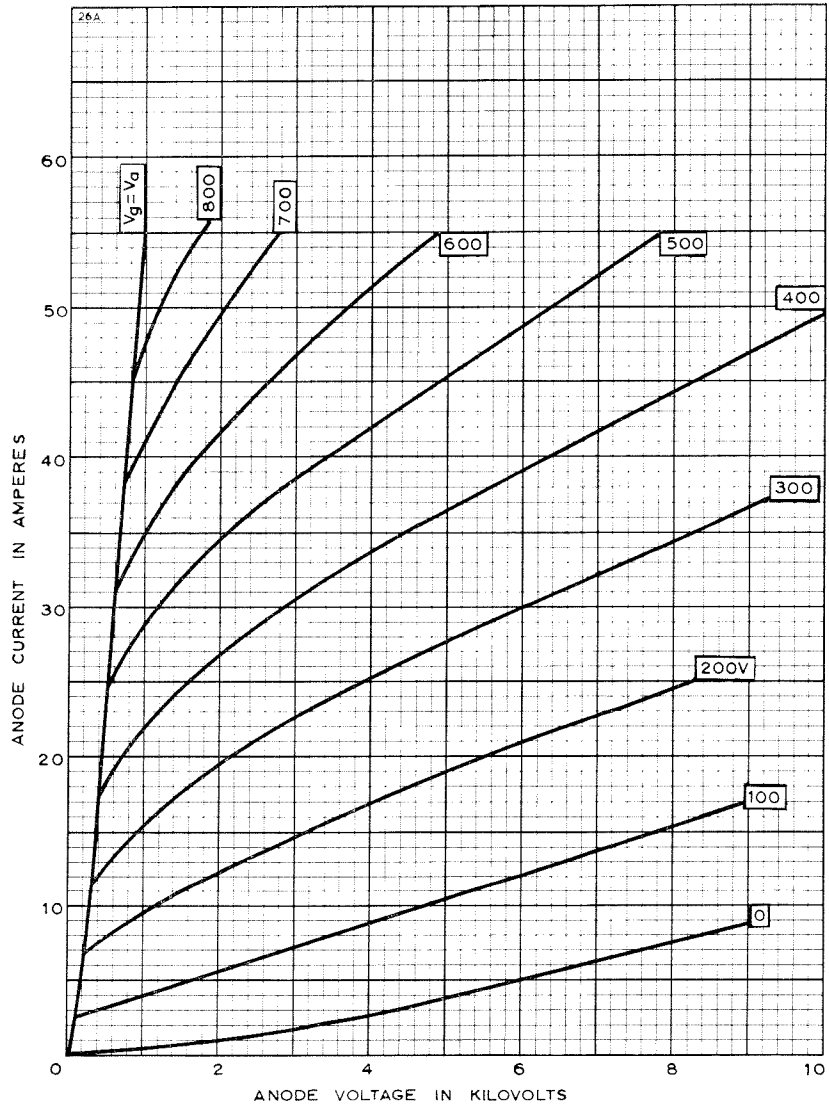
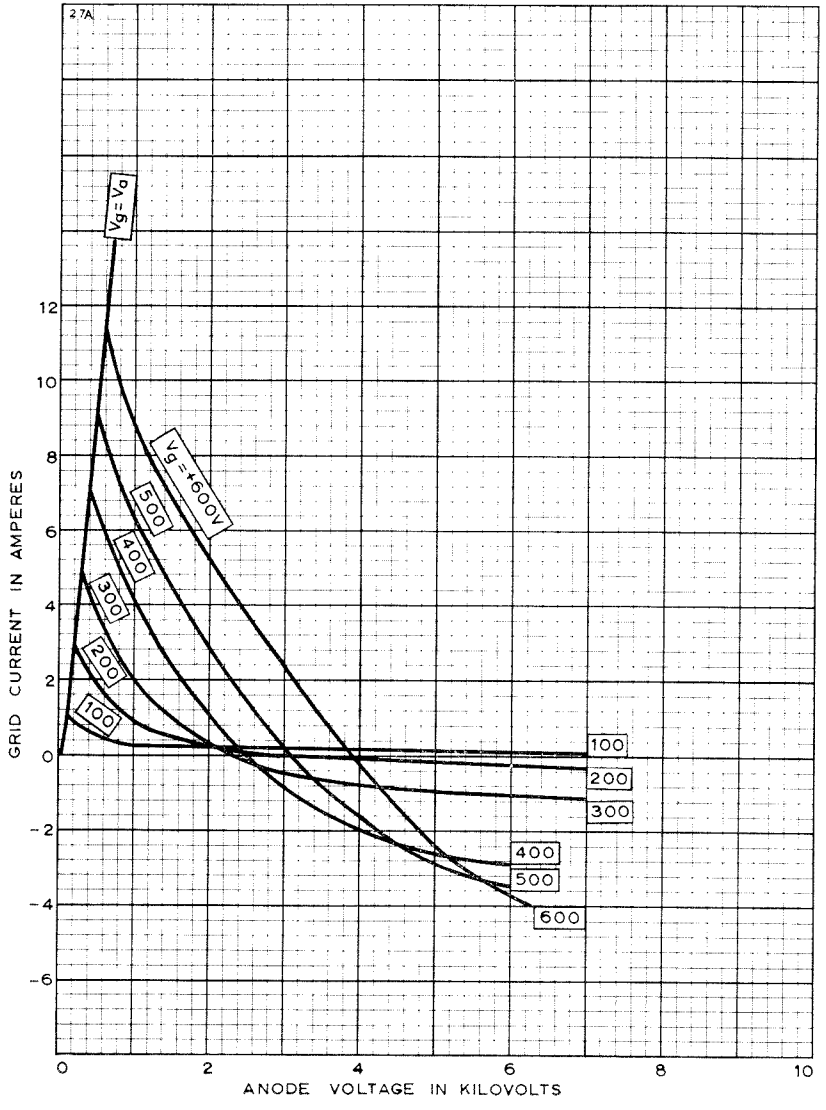
ENGLISH ELECTRIC

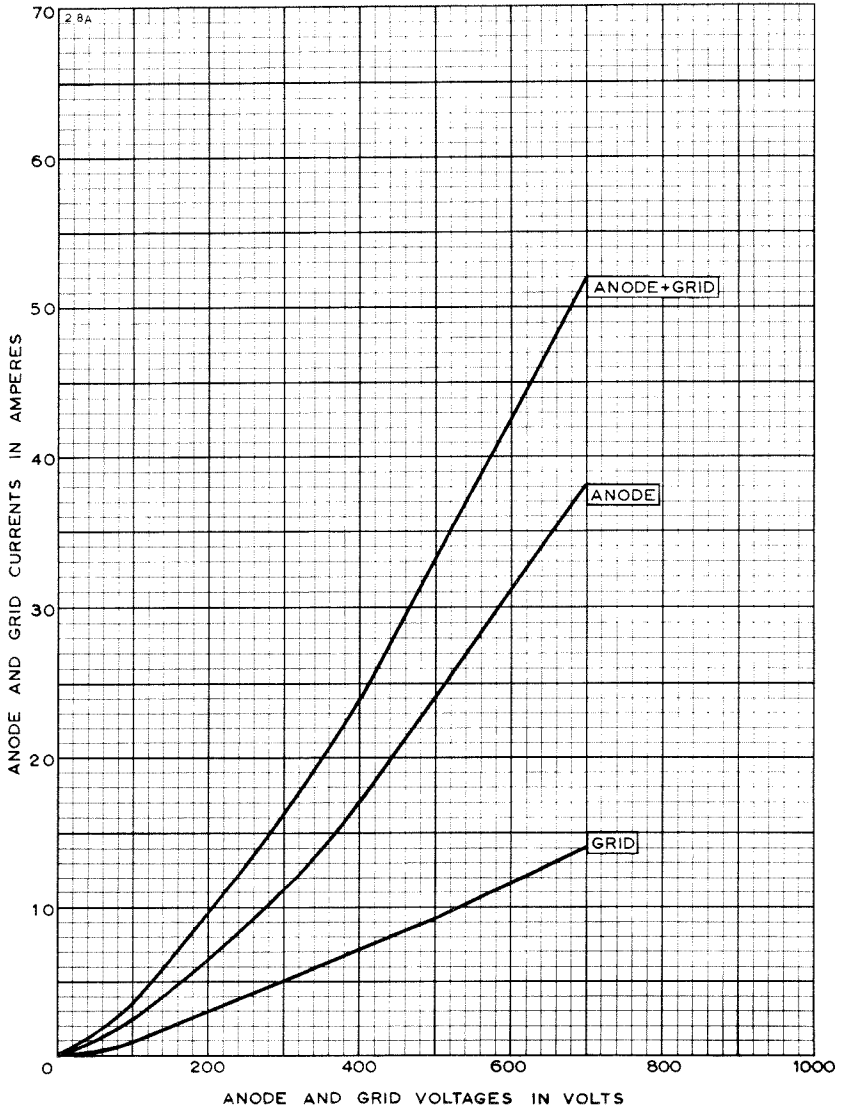
ANODE CHARACTERISTICS



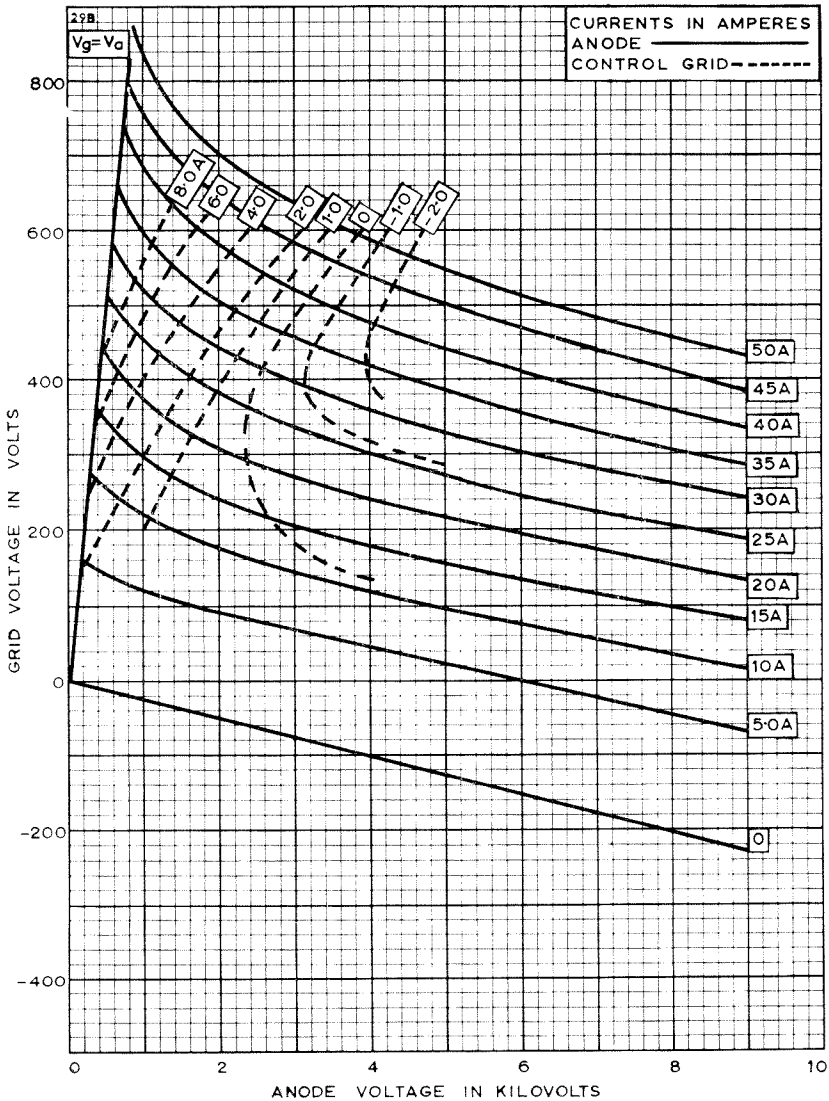
CONTROL GRID CHARACTERISTICS



STRAPPED CHARACTERISTICS

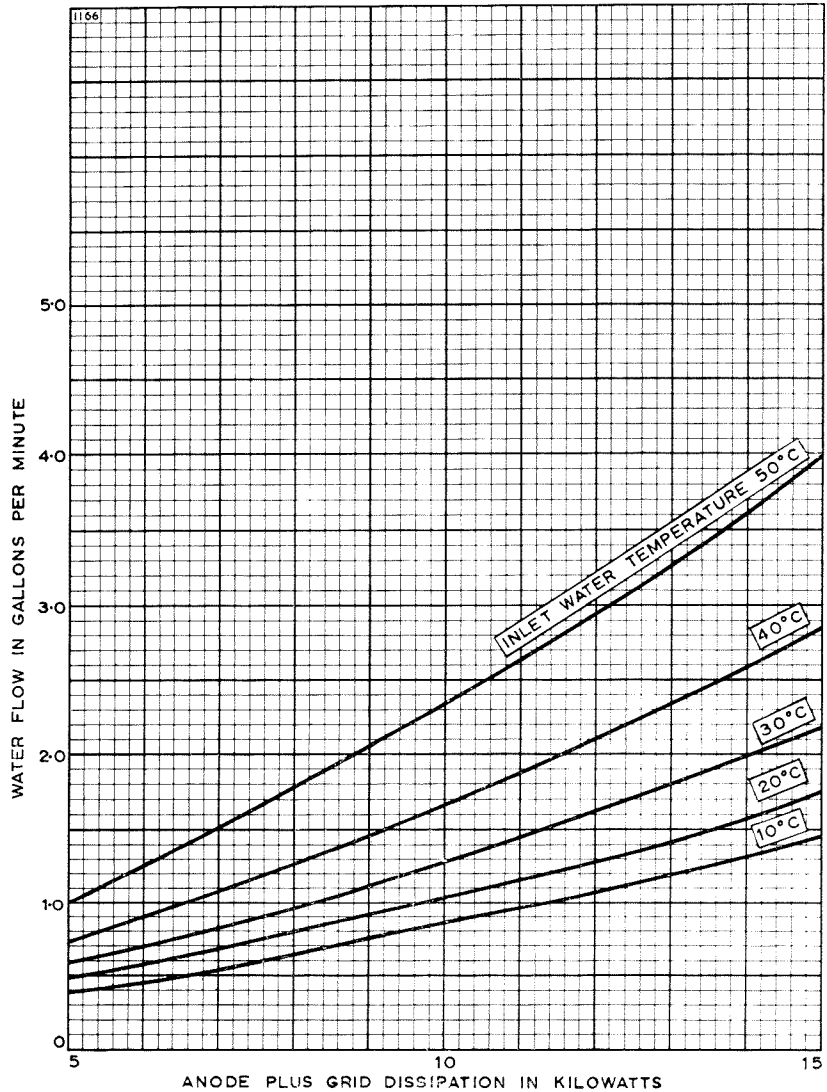


CONSTANT CURRENT CHARACTERISTICS



ENGLISH ELECTRIC

MINIMUM WATER COOLING REQUIREMENTS



The rates of flow given are minima and in the case of BW1121 apply to valves with clean anode surfaces in water jacket BW4034. Higher rates of flow should be used where possible.

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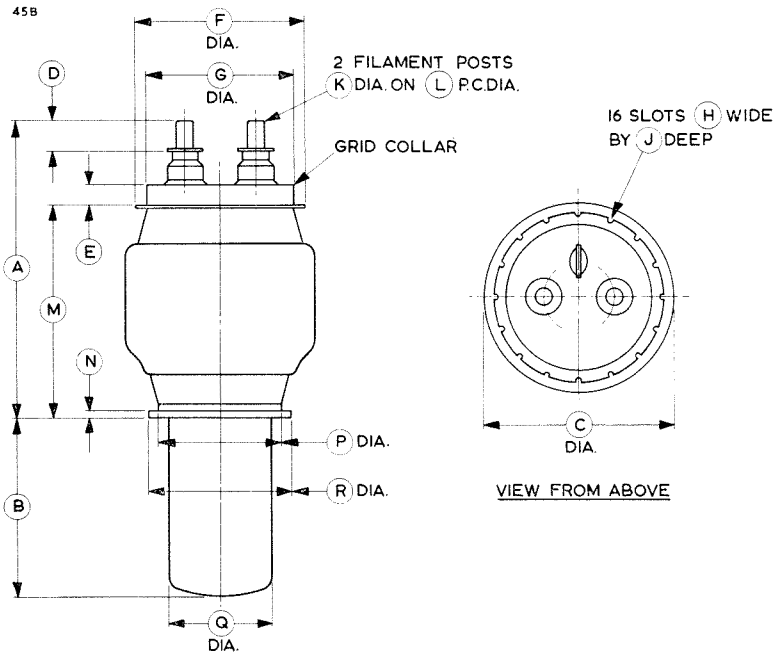
OUTLINE FOR BW1121



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	9·375 Max	238·1 Max	J	0·205	5·21
B	5·625	142·9	K	0·625	15·88
C	6·000 Max	152·4 Max	L	2·250	57·15
D	1·000	25·40	M	6·875 Max	174·6 Max
E	0·734	18·64	N	0·250	6·35
F	5·630	143·0	P	3·875	98·43
G	4·703	119·5	Q	3·250	82·55
H	0·153	3·89	R	4·500 Max	114·3 Max

Millimetre dimensions have been derived from inches.

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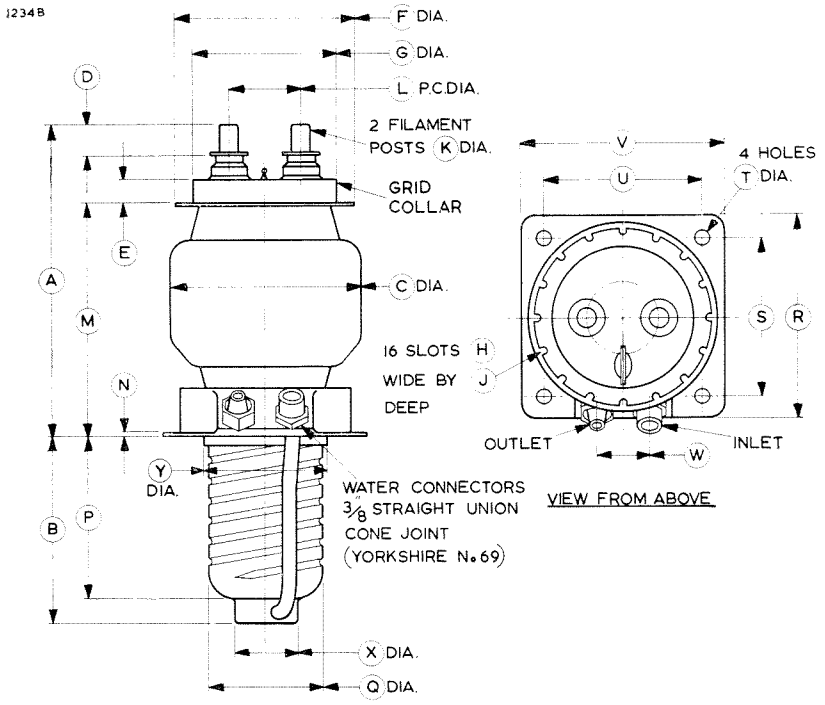
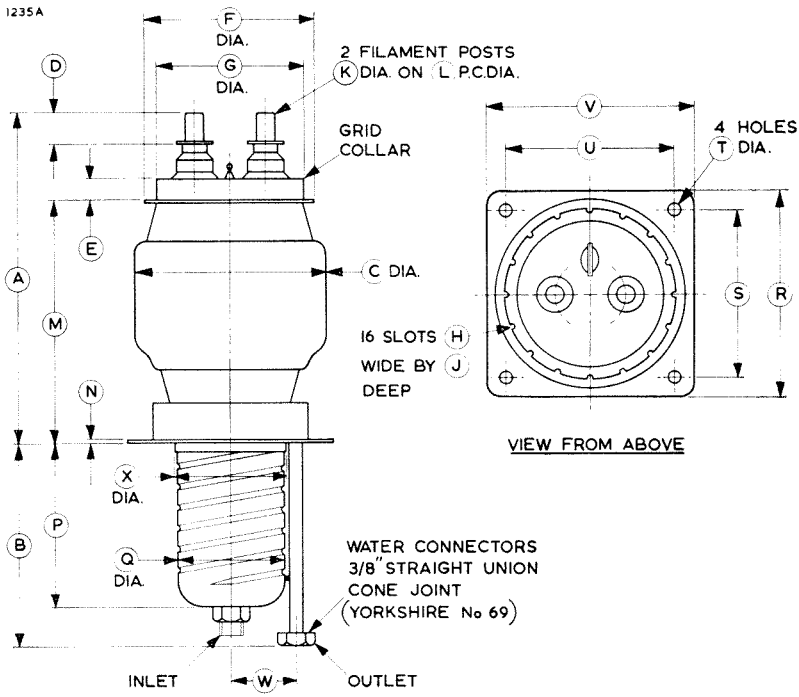
OUTLINE FOR BW1121J



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	10·250 Max	260·4 Max	N	0·125	3·18
B	6·250 Max	158·8 Max	P	5·273	133·9
C	6·000 Max	152·4 Max	Q	3·562	90·47
D	1·000	25·40	R	6·500	165·1
E	0·734	18·64	S	5·000	127·0
F	5·630	143·0	T	0·375	9·53
G	4·703	119·5	U	5·000	127·0
H	0·153	3·89	V	6·500	165·1
J	0·205	5·21	W	1·250	31·75
K	0·625	15·88	X	2·000	50·80
L	2·250	57·15	Y	3·875	98·43
M	7·750 Max	196·9 Max			

Millimetre dimensions have been derived from inches.

OUTLINE FOR BW1121J2



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	10·250 Max	260·4 Max	M	7·750 Max	196·9 Max
B	6·250 Max	158·8 Max	N	0·125	3·18
C	6·032 Max	153·2 Max	P	5·273	133·9
D	1·000	25·40	Q	3·562	90·47
E	0·734	18·64	R	6·500	165·1
F	5·630	143·0	S	5·000	127·0
G	4·703	119·5	T	0·375	9·53
H	0·153	3·89	U	5·000	127·0
J	0·205	5·21	V	6·500	165·1
K	0·625	15·88	W	2·170	55·12
L	2·250	57·15	X	3·875	98·43

Millimetre dimensions have been derived from inches.

R.F. POWER TRIODE

BW1122

ENGLISH ELECTRIC

ABRIDGED DATA

Water Cooled Transmitting Triode with grid terminal suitable for cathode drive operation.

Anode Dissipation	10 kW Max
Anode Voltage	12 kV Max
Frequency for full ratings	5·0Mc/sMax
Frequency at reduced ratings	110 Mc/s Max
Output Power (Class C Telegraphy)	29 kW

GENERAL DATA

Electrical

Filament	Thoriated Tungsten
Filament Voltage (*See Note* 1)	6·0 V
Filament Current	115 A
Filament Starting Current (Peak) (*See Note* 2)	260 A Max
Filament Cold Resistance	0·006 Ω
Peak Usable Cathode Current	20 A
Perveance	1·4 $mA/V^{3/2}$
Amplification Factor (V_a = 5·0kV, I_a = 1·0A)	37
Mutual Conductance (V_a = 5·0kV, I_a = 1·0A)	19 mA/V
Inter-electrode Capacitances (in BW4070 water jacket):	
Grid to Anode	33 pF
Grid to Filament	42 pF
Anode to Filament	0·5 pF

Mechanical

Overall Length	13·500 inches (343 mm) Max
Overall Diameter	7·125 inches (181 mm) Max
Net Weight	5 pounds (2·3 kg) Approx
Mounting Position	Vertical, filament end up

Accessories

Water Jacket	BW4070
Filament Leads	MA135 or MA135A
Grid Connector	MA66A
Sealing Ring (supplied with valve)	15797A

COOLING

The anode of this valve must be fitted into a water jacket for cooling, the recommended jacket being type BW4070. A flow of water of 2 gallons per minute (9·1 l./min) is required; the temperature of the cooling water at the outlet must not exceed 65°C, nor should the temperature rise across the jacket exceed 15°C.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 15cu.ft/min (0·43cu.m/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

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

← Indicates a change

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R.F. POWER TRIODE

BW1122

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R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	12	kV Max
Anode Current	3·5	A Max
Anode Dissipation	10	kW Max
Grid Dissipation	500	W Max
Operating Frequency (for full ratings)	5	Mc/s Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	6·0	8·5	10	12	kV
Grid Voltage	−300	−450	−550	−650	V
Peak R.F. Grid Voltage	820	950	1060	1150	V
Anode Current	3·4	3·1	3·2	3·0	A
Grid Current (Approx)	0·47	0·44	0·3	0·21	A
Anode Dissipation	5·4	6·4	7·0	7·0	kW
Grid Dissipation	245	220	155	105	W
Output Power	15	20	25	29	kW
Efficiency	73·5	76	78	80	%

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 6·0V	107	121	A
Amplification Factor (V_a = 5·0kV, I_a = 1·0A)	34	42	
Mutual Conductance (V_a = 5·0kV, I_a = 1·0A)	15	23	mA/V
Grid Voltage (negative value) (V_a = 5·0kV, I_a = 1·0A)	41	71	V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	380	V
Anode Current (V_a = 2·0kV, V_g = +200V)	5·1	6·9	A

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MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
5	12 kV	10 kV
20	10 kV	8 kV
50	8·5kV	6·7kV
110	6·5kV	5·3kV

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%.
2. The filament current must not exceed 260A, even momentarily, at any time.

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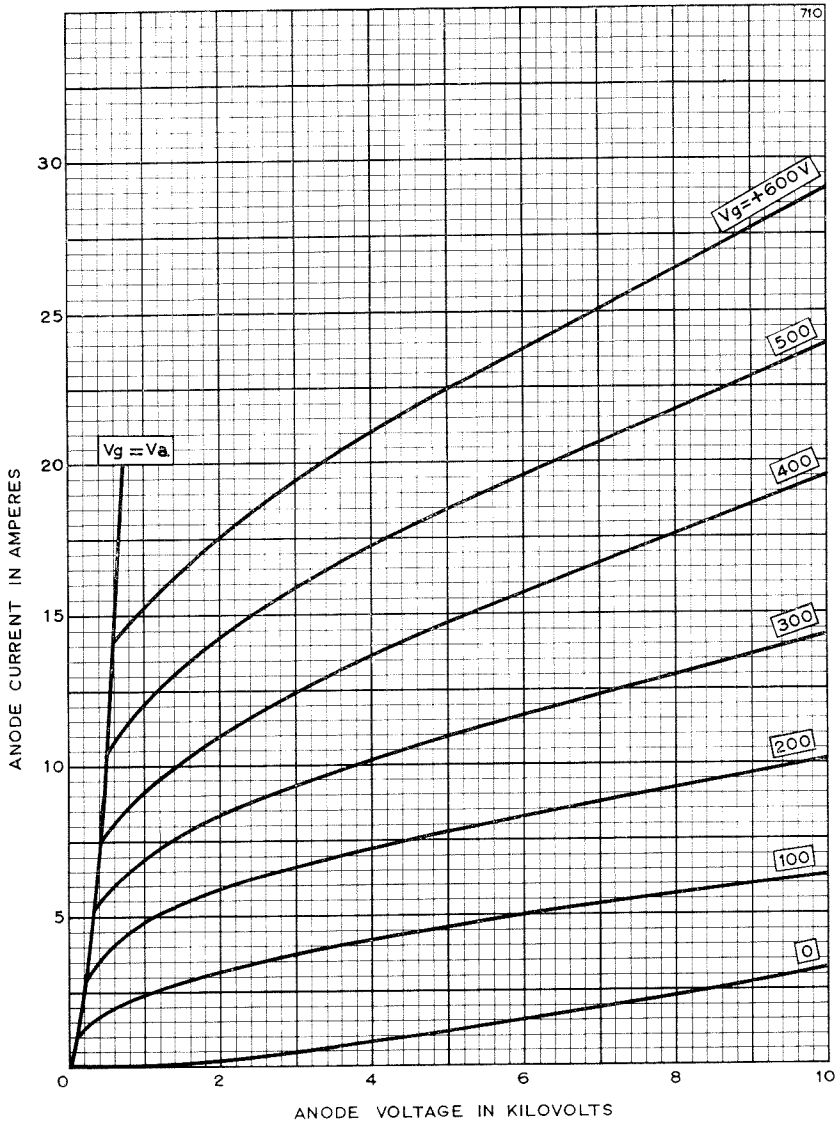
ANODE CHARACTERISTICS



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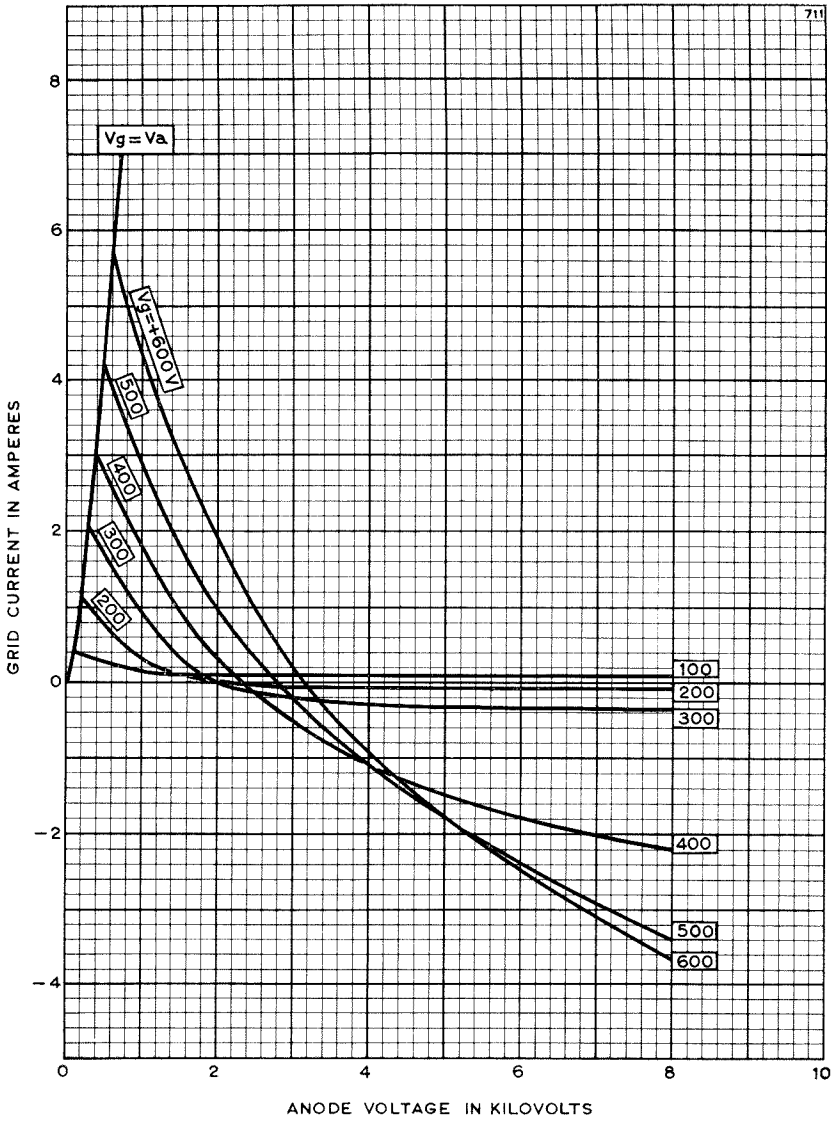
CONTROL GRID CHARACTERISTICS



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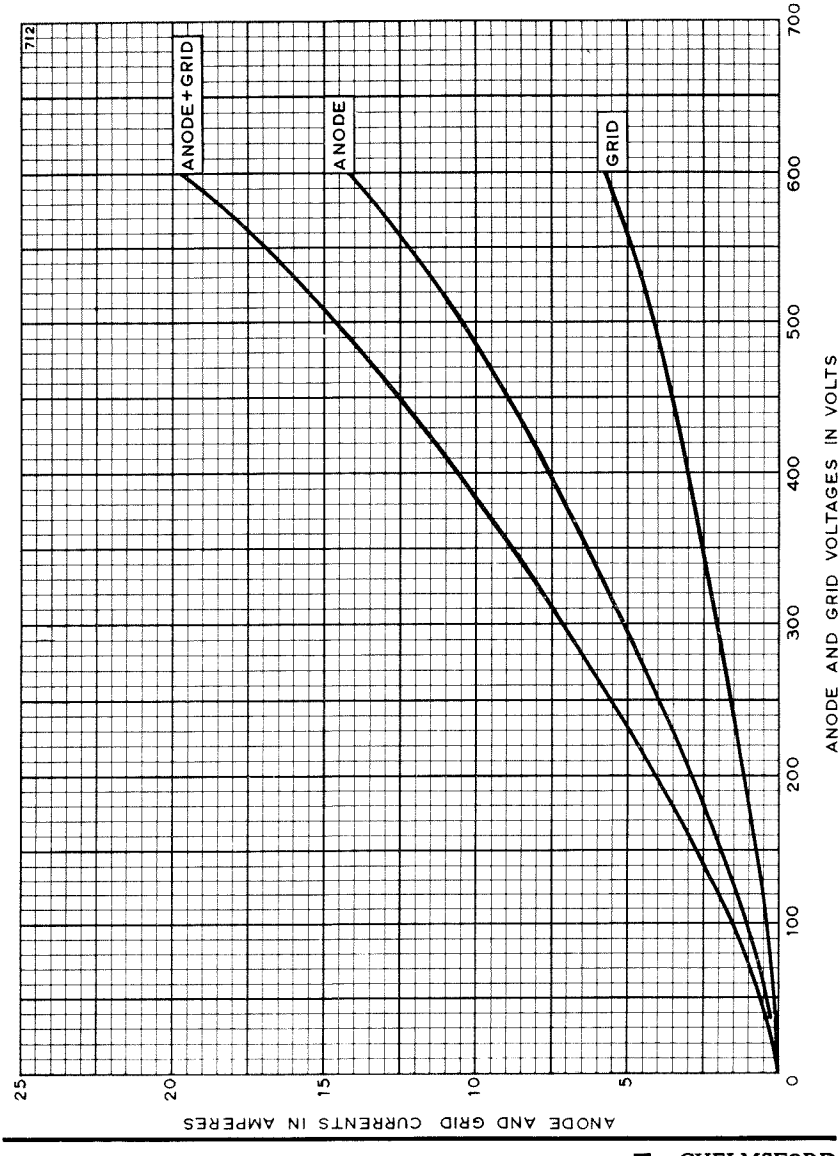
STRAPPED CHARACTERISTICS



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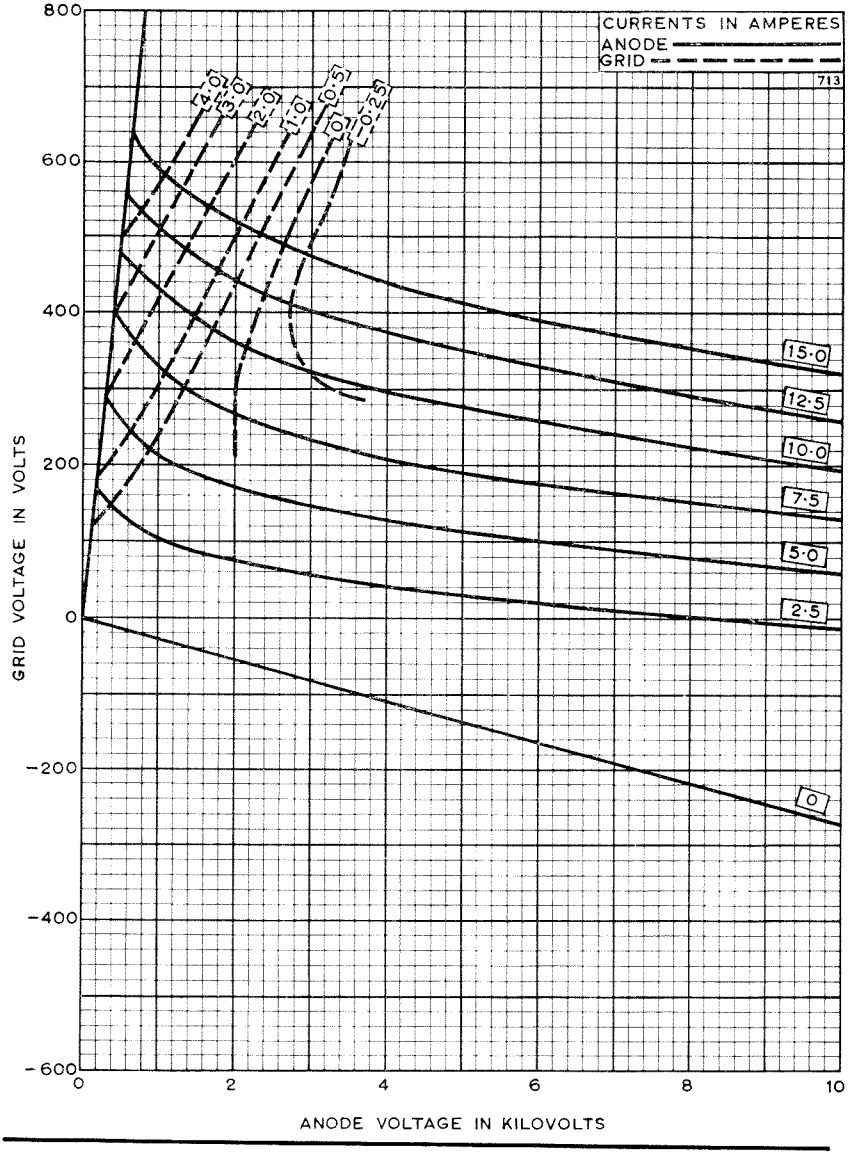
CONSTANT CURRENT CHARACTERISTICS



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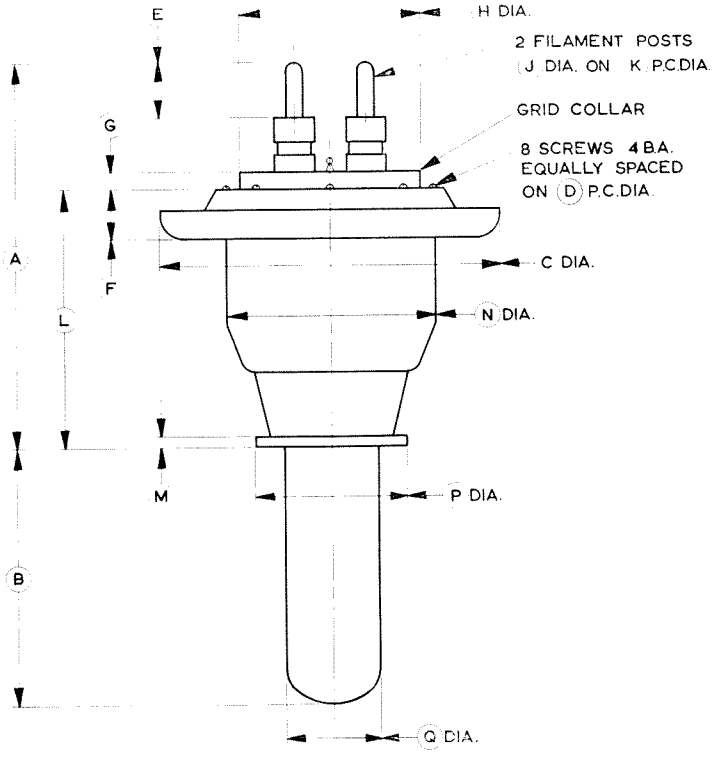
OUTLINE

221B



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	8·125 Max	206·4 Max	J	0·437	11·10
B	5·375	136·5	K	1·500	38·10
C	7·125	181·0	L	5·625 Max	142·9 Max
D	4·375	111·1	M	0·250	6·35
E	1·187	30·15	N	4·437	112·7
F	1·000	25·40	P	3·250	82·55
G	0·328	8·33	Q	2·000	50·80
H	3·750	95·25			

Millimetre dimensions have been derived from inches.

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R.F. POWER TRIODES

BW1124 BW1124J1 BW1124J2

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ABRIDGED DATA

Water Cooled Triodes intended primarily for industrial service. They differ only in their cooling arrangements. BW1124 requires a separate water jacket; BW1124J1 and BW1124J2 have integral water jackets with differing water connection positions.

Anode Dissipation	10 kW Max
Anode Voltage	8·5 kV Max
Frequency for full ratings	100 MHz Max
Output Power (Class C unmodulated conditions)	20 kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	6·0	V
Filament Current	115	A
Filament Starting Current (Peak) (*See Note* 2)	260	A Max
Filament Cold Resistance	0·006	Ω
Peak Usable Cathode Current	20	A
Perveance	1·4	$mA/V^{3/2}$
Amplification Factor (V_a = 5·0kV, I_a = 1·0A)	37	
Mutual Conductance (V_a = 5·0kV, I_a = 1·0A)	19	mA/V
Inter-electrode Capacitances:		
Grid to Anode	31	pF
Grid to Filament	41	pF
Anode to Filament	0·5	pF

Mechanical

Overall Dimensions	*See outline drawings*	
Net Weight:		
BW1124	3½ pounds (1·6kg)	Approx
BW1124J1, BW1124J2	7½ pounds (3·4kg)	Approx

Accessories

Water Jacket for BW1124	BW4029
Filament Leads	MA135
Grid Connector	MA66A
Sealing Ring (supplied with BW1124)	15797A

COOLING

The anode of the BW1124 must be fitted into a water jacket for cooling, the recommended jacket being type BW4029. A flow of water of 2 gallons per minute (9·1 l./min) is required; the temperature of the cooling water at the outlet must not exceed 65°C, nor should the temperature rise across the jacket exceed 15°C.

Types BW1124J1 and BW1124J2 have integral water jackets (see outline drawings, pages 10 and 12). Minimum water cooling requirements are shown on page 8; higher rates of flow should be used where possible.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 15ft³/min (0·43m³/min) directed into the filament header via a 1-inch

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(25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

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

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(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage (*See Note* 3)	8·5 kV Max
Anode Current	3·5 A Max
Anode Dissipation (*See Note* 4)	10 kW Max
Grid Dissipation	500 W Max
Frequency (for full ratings)	100 MHz Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	6·0	8·5	kV
Grid Voltage	−300	−450	V
Grid Resistor	640	1025	Ω
Peak R.F. Grid Voltage	820	950	V
Anode Current	3·4	3·1	A
Grid Current (Approx)	0·47	0·44	A
Anode Dissipation	5·4	6·4	kW
Grid Dissipation	245	220	W
Driving Power	385	420	W
Output Power (*See Note* 5)	15	20	kW
Efficiency	73·5	76	%
Load Resistance	900	1400	Ω

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RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 6·0V ..	107	121	A
Amplification Factor (V_a = 5·0kV, I_a = 1·0A)	34	42	
Mutual Conductance (V_a = 5·0kV, I_a = 1·0A)	15	23	mA/V
Grid Voltage (negative value) (V_a = 5·0kV, I_a = 1·0A)	41	71	V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	380	V
Anode Current (V_a = 2·0kV, V_g = +200V) ..	5·1	6·9	A

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%.
2. The filament current must not exceed 260A, even momentarily, at any time.
3. This is the highest nominal operating voltage to be used. It makes allowance for the normal mains voltage fluctuations as well as tolerances in the equipment.
4. The valve can dissipate higher powers for periods up to 15 seconds provided that the average over a long period does not exceed the maximum stated.
5. The output power specified does not take into account the anode circuit efficiency.

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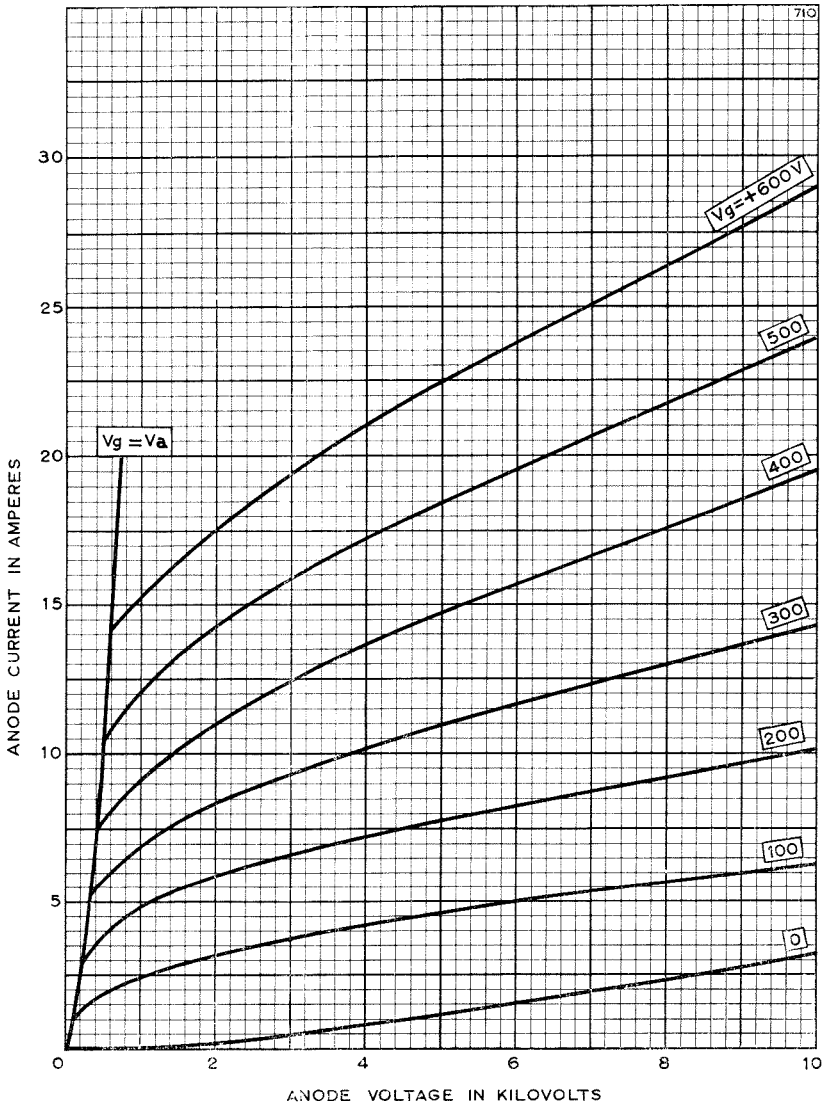
ANODE CHARACTERISTICS



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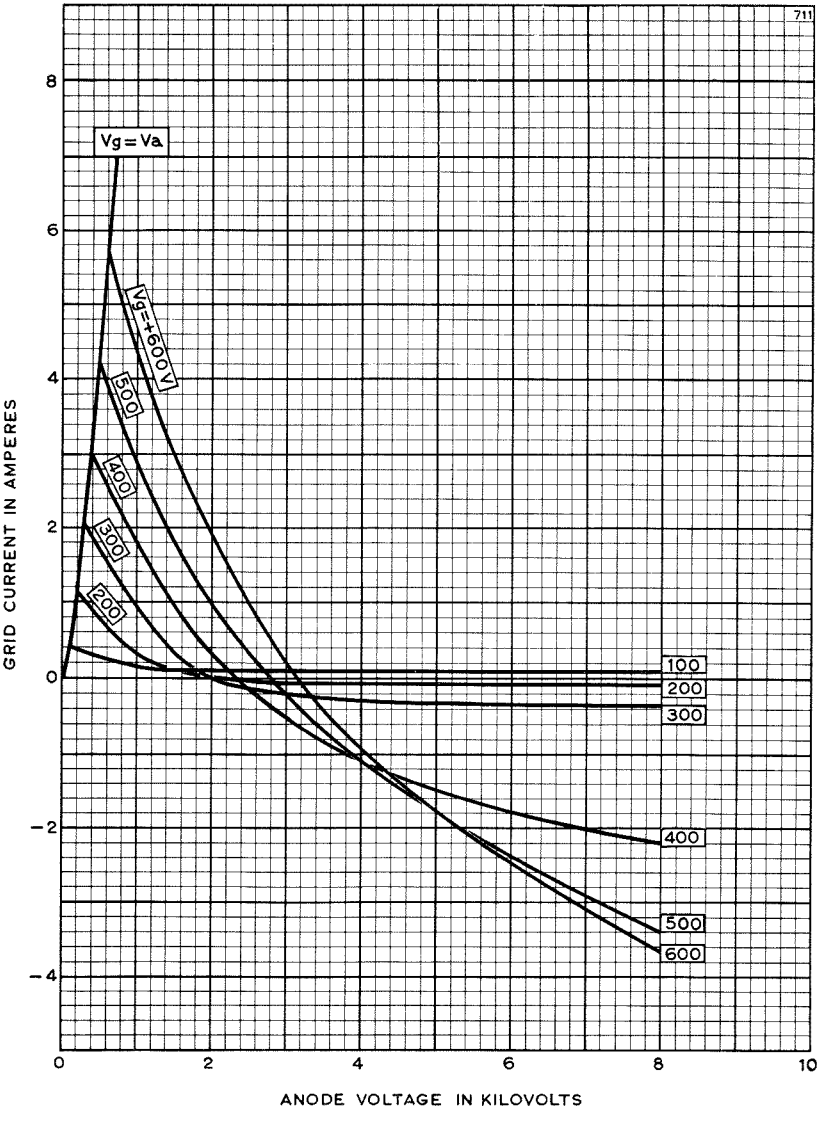
CONTROL GRID CHARACTERISTICS



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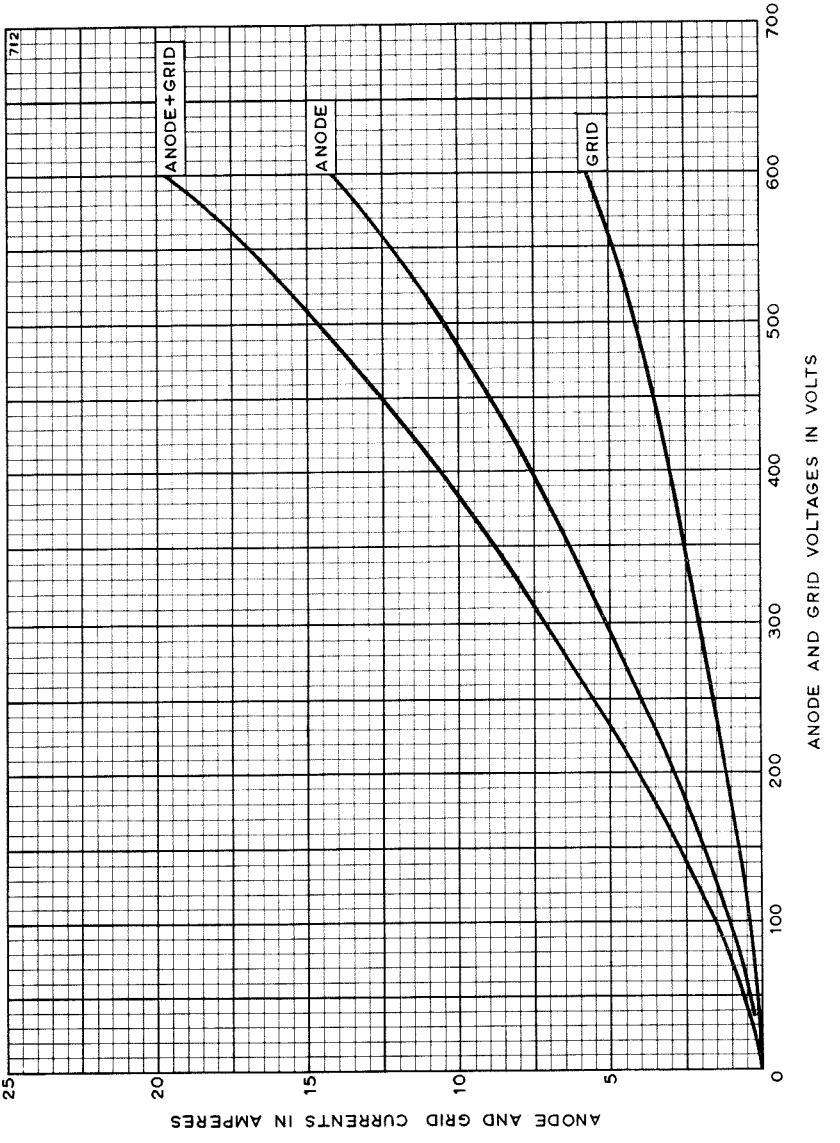
STRAPPED CHARACTERISTICS



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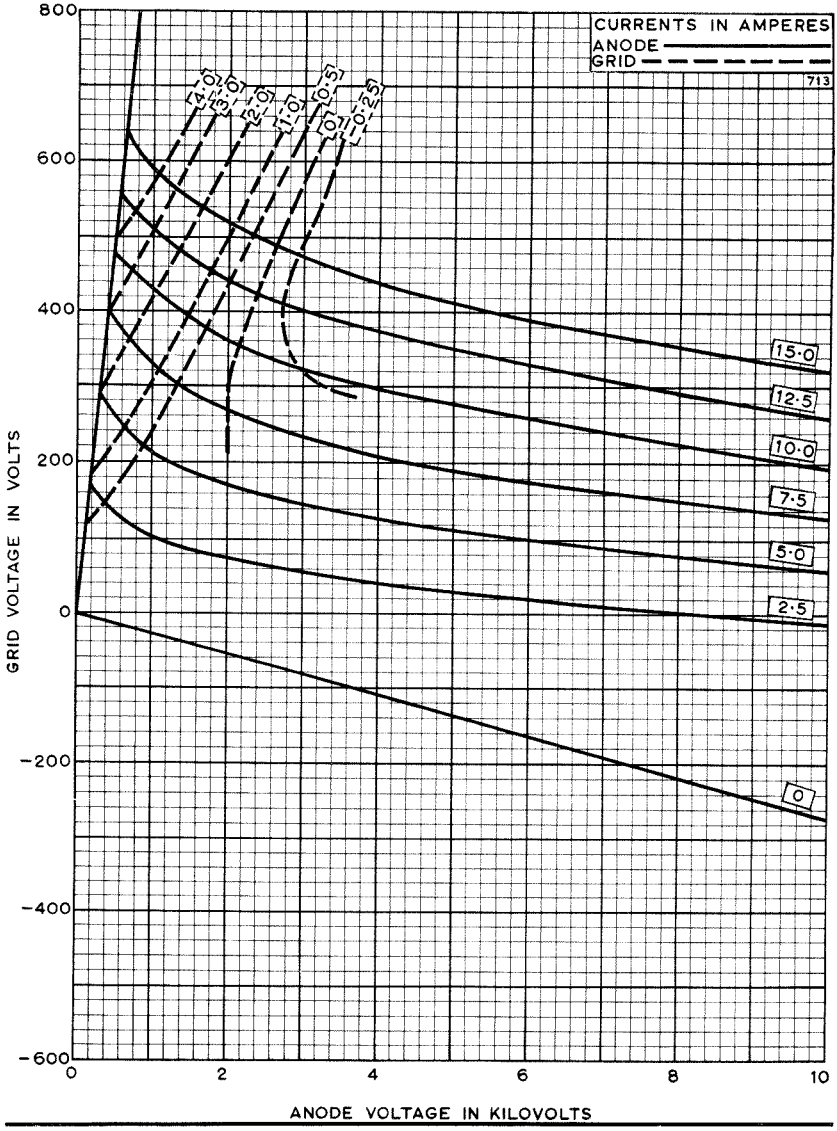
CONSTANT CURRENT CHARACTERISTICS



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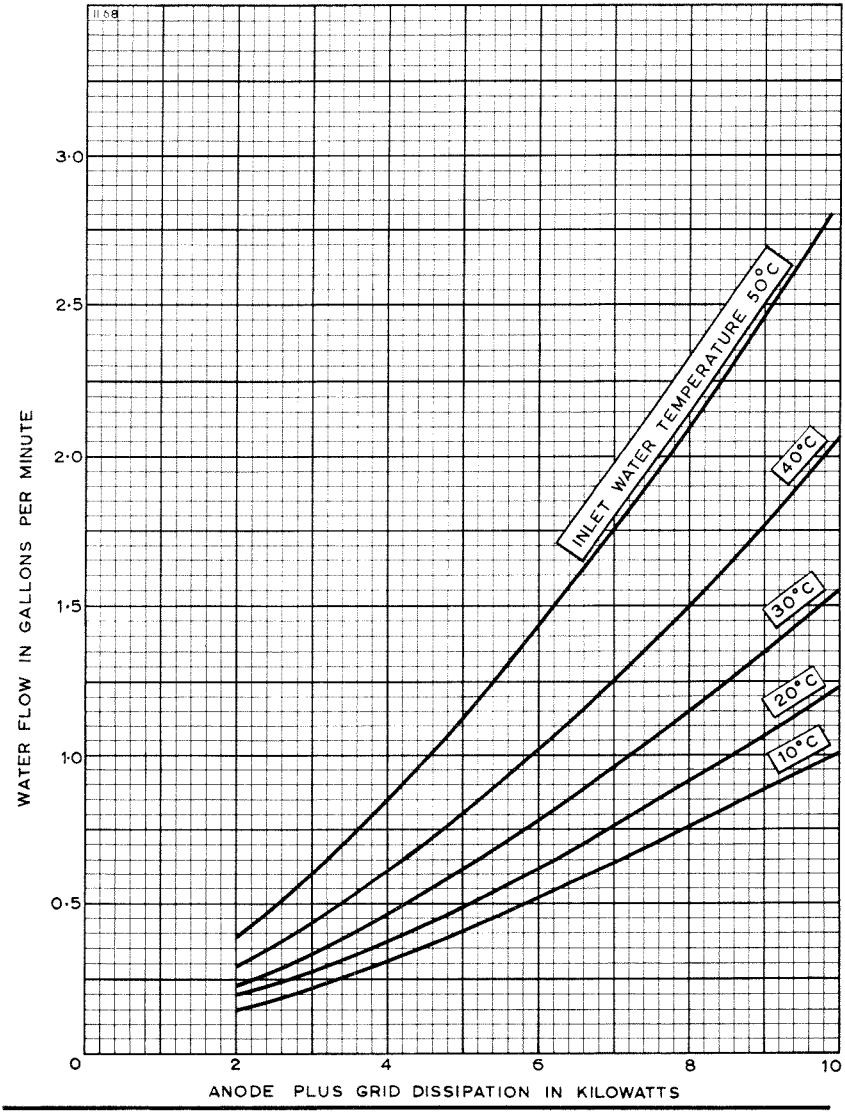
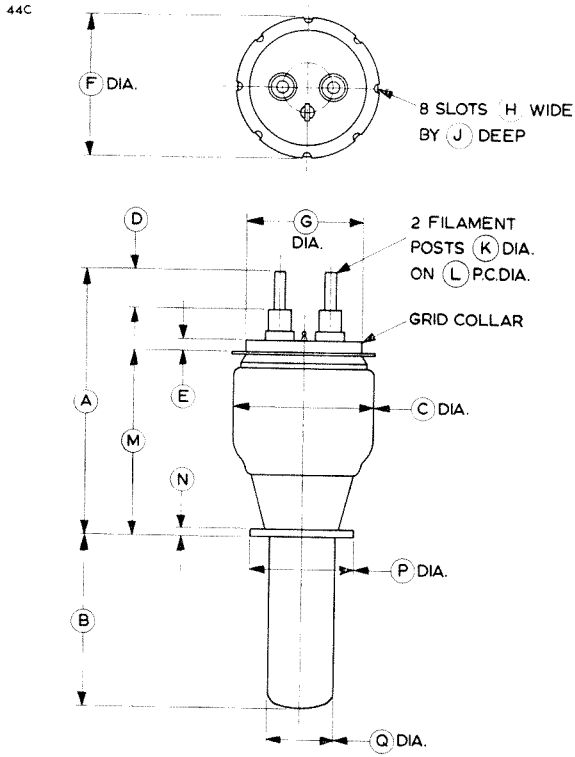
MINIMUM WATER COOLING REQUIREMENTS
FOR BW1124J1, BW1124J2
(Higher rates of flow should be used where possible)



OUTLINE FOR BW1124



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	8·125 Max	206·4 Max	J	0·205	5·21
B	5·375	136·5	K	0·437	11·10
C*	4·527	115·0	L	1·500	38·10
D	1·125	28·58	M	5·200 ± 0·200	132·1 ± 5·1
E	0·375	9·53	N	0·250	6·35
F	4·562	115·9	P	3·250	82·55
G	3·750	95·25	Q	2·000	50·80
H	0·182	4·62			

Millimetre dimensions have been derived from inches except where indicated thus*.

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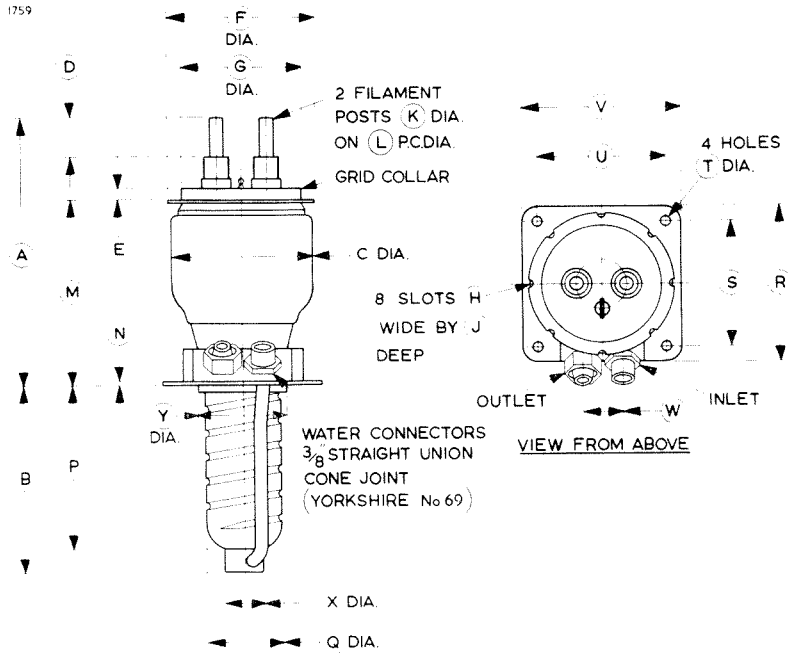
OUTLINE FOR BW1124J1

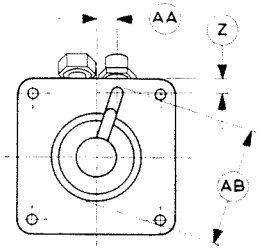


Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	8·625 Max	219·1 Max	P	5·062	128·6
B	5·812	147·6	Q	2·306	58·57
C*	4·527	115·0	R	5·000	127·0
D	1·125	28·58	S	4·000	101·6
E	0·375	9·53	T	0·257	6·53
F	4·562	115·9	U	4·000	101·6
G	3·750	95·25	V	5·000	127·0
H	0·182	4·62	W	1·250	31·75
J	0·205	5·21	X	1·250	31·75
K	0·437	11·10	Y	2·687	68·25
L	1·500	38·10	Z	0·469	11·91
M	5·896	149·8	AA	0·625	15·88
N	0·094	2·39	AB	3·625 Max	92·08 Max

Millimetre dimensions have been derived from inches except where indicated thus*.

OUTLINE DETAIL FOR BW1124J1

1760



VIEW FROM BELOW

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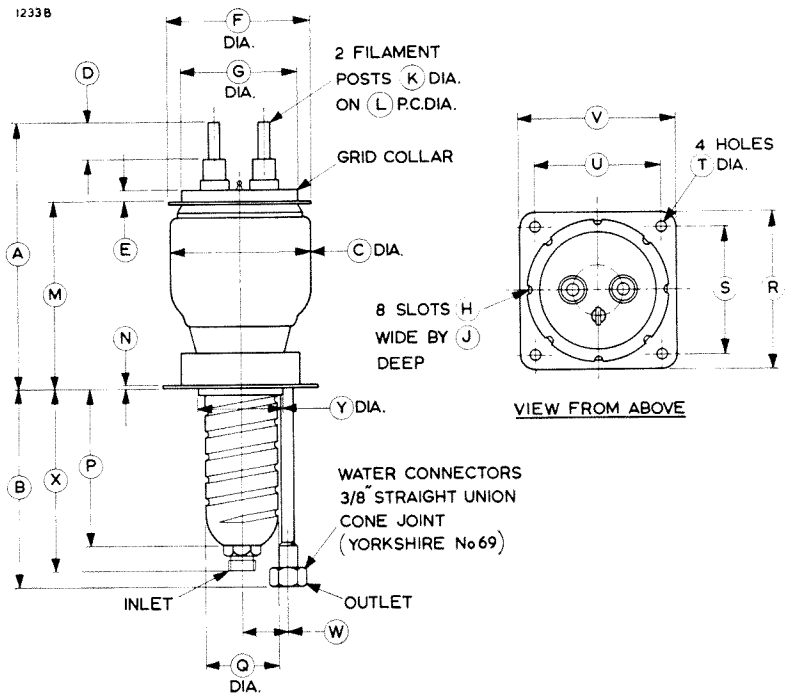
OUTLINE FOR BW1124J2



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	8·625 Max	219·1 Max	N	0·094	2·39
B	6·250	158·8	P	5·000	127·0
C*	4·527	115·0	Q	2·306	58·57
D	1·125	28·58	R	5·000	127·0
E	0·375	9·53	S	4·000	101·6
F	4·562	115·9	T	0·257	6·53
G	3·750	95·25	U	4·000	101·6
H	0·182	4·62	V	5·000	127·0
J	0·205	5·21	W	1·422	36·12
K	0·437	11·10	X	5·750	146·1
L	1·500	38·10	Y	2·687	68·25
M	5·896	149·8			

Millimetre dimensions have been derived from inches except where indicated thus*.

R.F. POWER TRIODE

BW1126

ENGLISH ELECTRIC

ABRIDGED DATA

Water Cooled Triode intended primarily for industrial service.

Anode Dissipation	3·0 kW Max
Anode Voltage	6·0 kV Max
Frequency for full ratings	30 MHz Max
Frequency at reduced ratings	110 MHz Max
Output Power (Class C unmodulated)	7·1 kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	15	V
Filament Current	39	A
Filament Starting Current (Peak) (*See Note* 2)	230	A Max
Filament Cold Resistance	0·042	Ω
Peak Usable Cathode Current	14	A
Perveance	2·0	$mA/V^{3/2}$
Amplification Factor ($V_g = -25V$, $I_a = 0·75A$)	30	
Mutual Conductance ($V_a = 2·5kV$, $I_a = 0·9A$)	20	mA/V
Inter-electrode Capacitances:		
Grid to Anode	23	pF
Grid to Filament	22·5	pF
Anode to Filament	0·5	pF

Mechanical

Overall Length (excluding flexible connectors)	7·437 inches	(188·9 mm)	Max
Overall Diameter	4·593 inches	(116·7 mm)	Max
Net Weight	4·25 pounds	(2·0 kg)	Approx
Mounting Position	Vertical, filament end up		

COOLING

The anode, which is part of the envelope, must be fitted into a water jacket for cooling, the flow necessary being 1·5 to 2 gallons per minute (6·8 to 9·1 l./min). The temperature of the cooling water at the outlet must not exceed 65°C, nor should the temperature rise across the jacket exceed 15°C.

The temperature of the filament and grid seals must not exceed 175°C. A flow of air of $15ft^3/min$ ($0·43m^3/min$) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperatures of the seals.

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R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage (*See Note* 3)	6·0	kV Max
Anode Current	1·75	A Max
Anode Dissipation (*See Note* 4)	3·0	kW Max
Grid Voltage	−1·0	kV Max
Grid Current (*See Note* 5)	0·35	A Max
Operating Frequency (for full ratings)	30	MHz Max
Anode Voltage for operation up to 110MHz	5·0	kVMax

TYPICAL OPERATING CONDITIONS (FOR AMPLIFIER)

Anode Voltage	4·0	6·0	kV
Grid Voltage	−280	−350	V
Grid Resistor	835	1130	Ω
Anode Current	1·54	1·63	A
Grid Current (Approx)	0·336	0·310	A
Anode Dissipation	2·0	2·7	kW
Grid Dissipation	69	66	W
Driving Power	163	174	W
Peak R.F. Grid Voltage	525	600	V
Output Power	4·1	7·1	kW
Efficiency	66·5	72·5	%
Load Resistance	1100	1750	Ω

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 15V ..	36·6	41·3	A
Amplification Factor (I_a = 0·75A, V_g = −25V)	25	35	
Mutual Conductance (V_a = 2·5kV, I_a = 0·9A)	18	24	mA/V
Grid Voltage (negative value) (V_a = 6·0kV, I_a = 50mA)	140	280	V
Grid Voltage (negative value) (V_a = 6·0kV, I_a = 0·55A)	120	240	V
Anode Current (V_a = 0·3kV, V_g = +150V) ..	2·13	3·24	A
Grid Current (V_a = 0·3kV, V_g = +150V) ..	—	1·44	A
Inter-electrode Capacitances:			
Grid to Anode	19·5	26·5	pF
Grid to Filament	18	27	pF
Anode to Filament	0·25	0·75	pF

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.
2. The filament current must not exceed 230A, even momentarily, at any time.
3. This is the highest nominal operating voltage to be used. It makes allowance for the normal mains voltage fluctuations as well as tolerances in the equipment.
4. The valve can dissipate higher powers for periods up to 15 seconds provided that the average over a long period does not exceed the maximum stated.
5. The customer should consult English Electric Valve Company Limited if the valve is to be used in r.f. oscillators operating at frequencies of 30MHz or more and where the direct grid current is likely to exceed 250mA.

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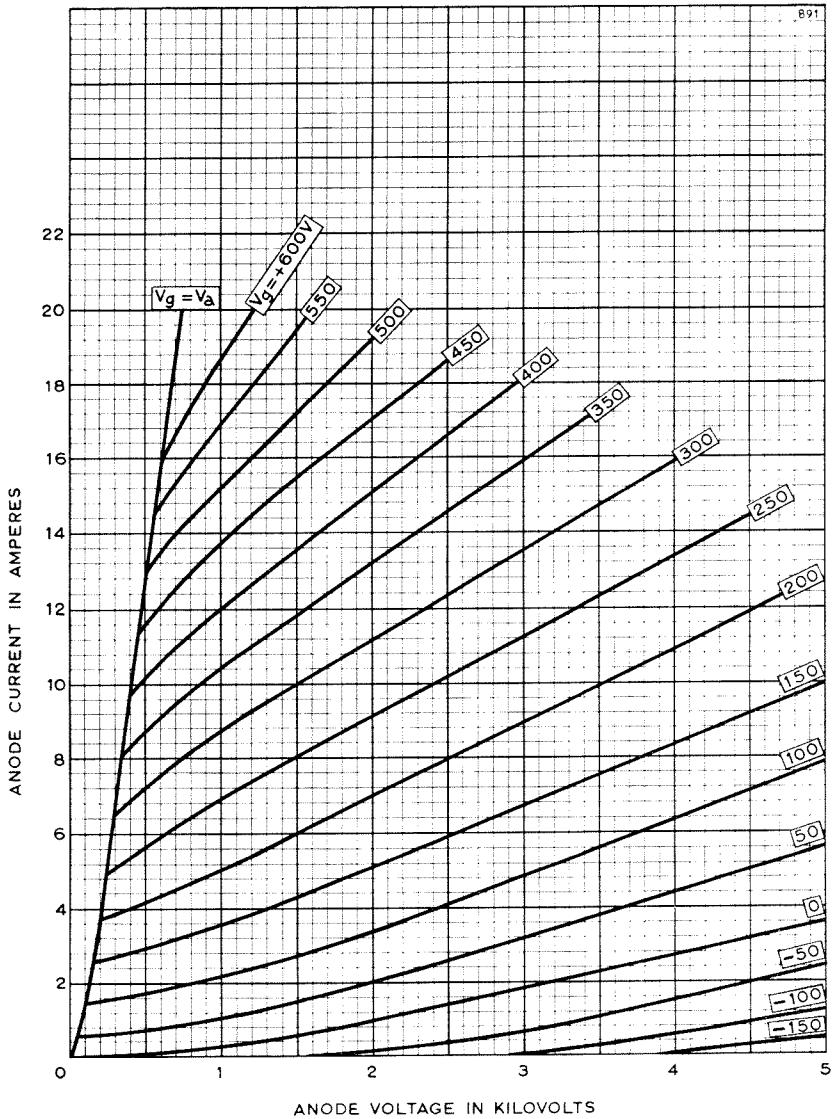
ANODE CHARACTERISTICS



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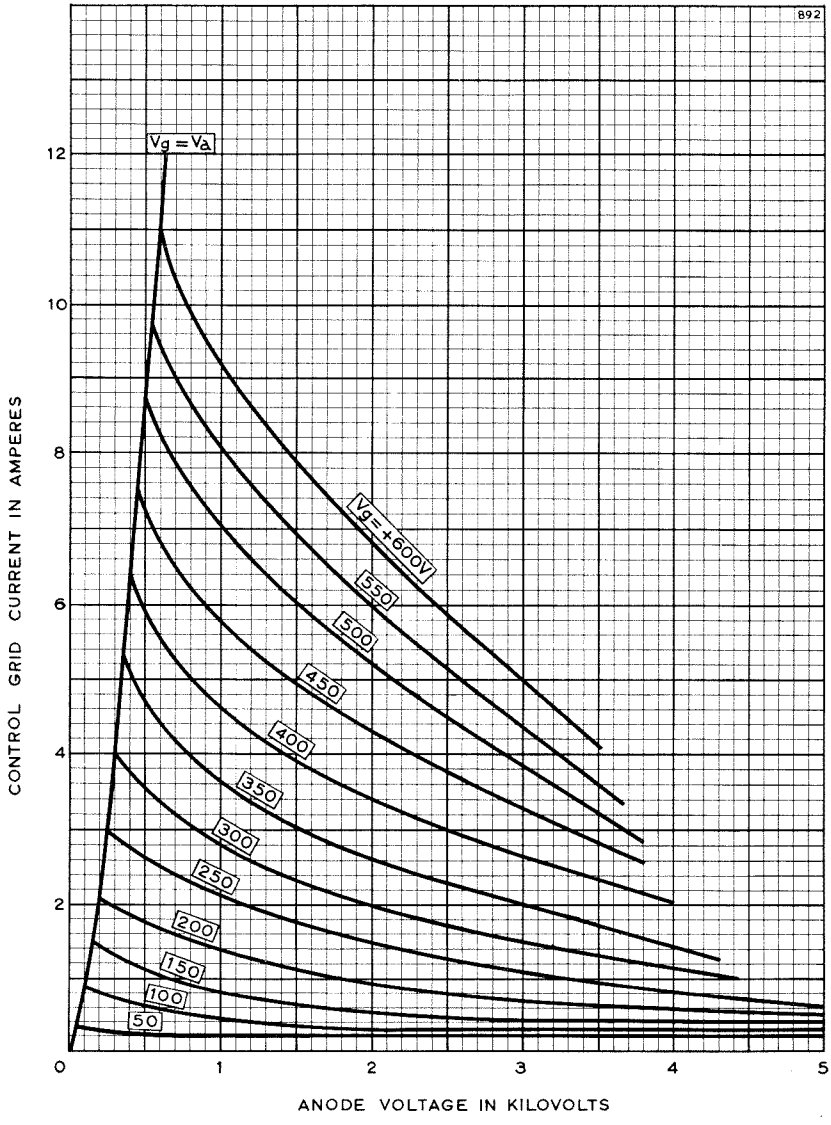
CONTROL GRID CHARACTERISTICS



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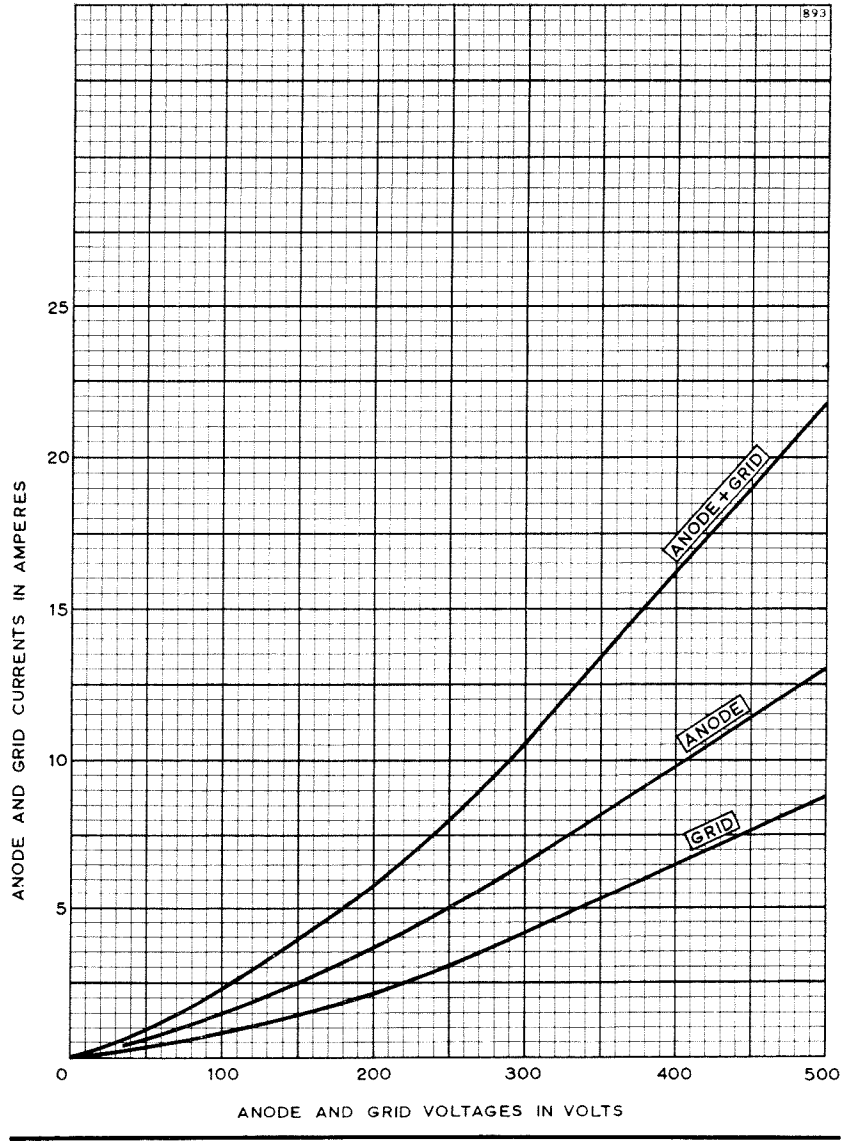
STRAPPED CHARACTERISTICS



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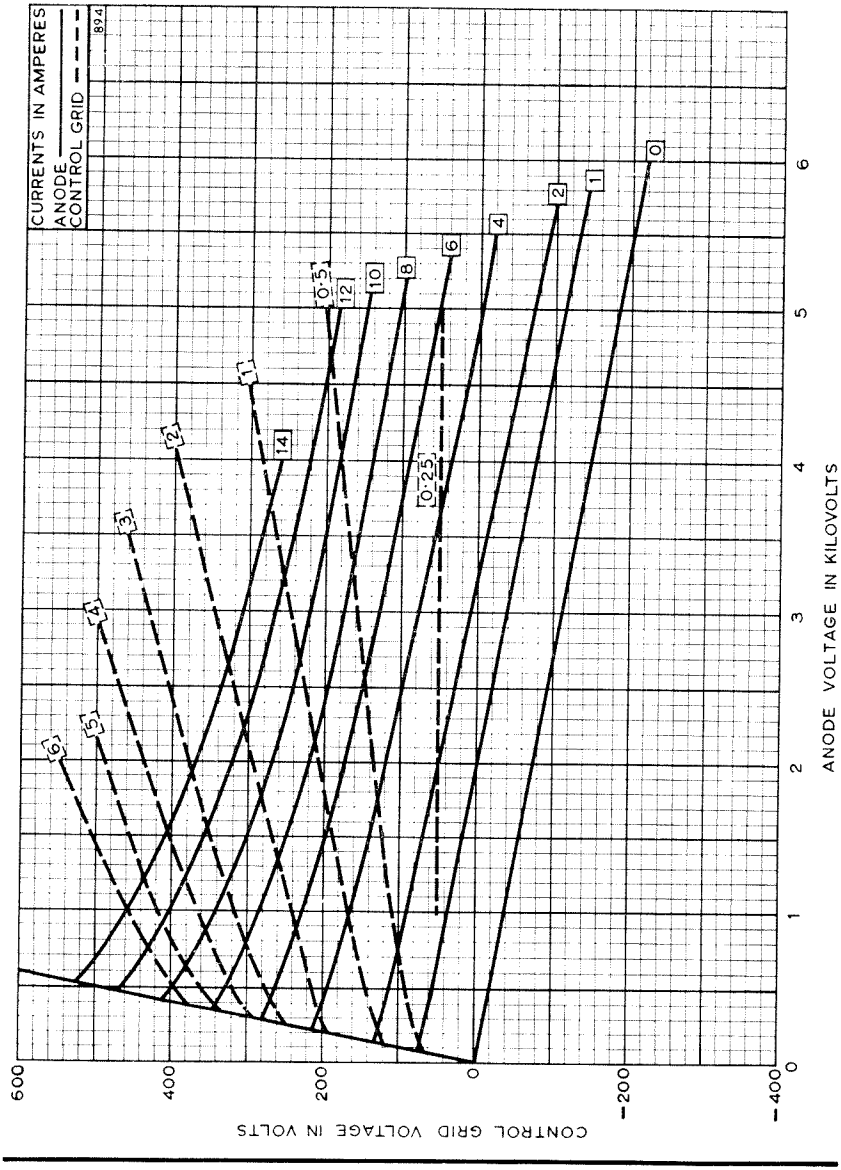
CONSTANT CURRENT CHARACTERISTICS



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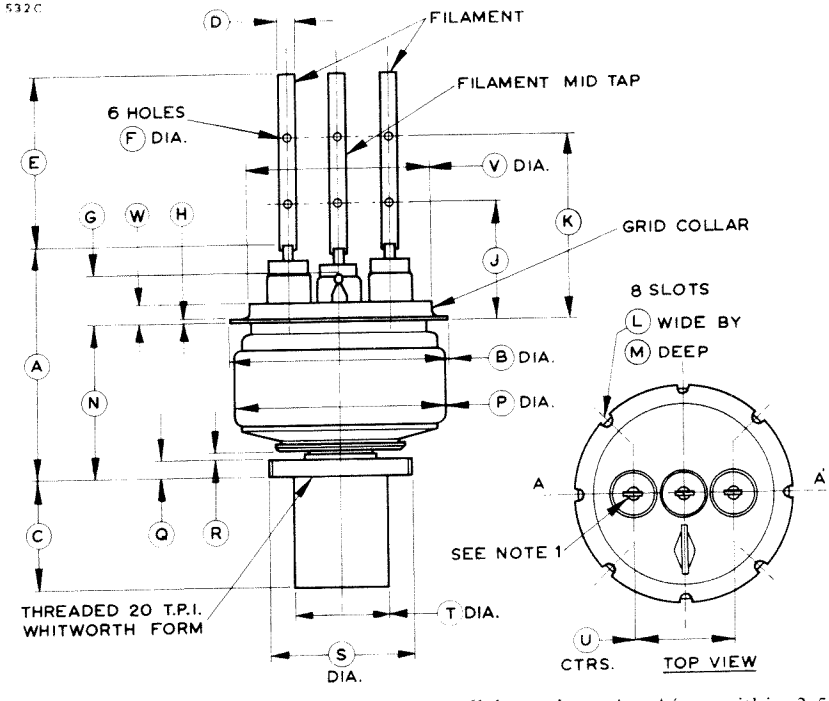
OUTLINE



Note 1 Plane of filament leads will be parallel to plane A—A′ to within 3·5°

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	5·062 Max	128·6 Max	M	0·205	5·21
B	4·562 ± 0·031	115·87 ± 0·79	N	3·250 ± 0·125	82·55 ± 3·18
C	2·375 Max	60·33 Max	P	4·562 Max	115·9 Max
D	0·312 ± 0·062	7·92 ± 1·57	Q	0·375 ± 0·010	9·53 ± 0·25
E	3·500 Min	88·90 Min	R	0·187 ± 0·020	4·75 ± 0·51
F	0·144	3·66	S	3·000	76·20
G	1·250 Max	31·75 Max	T	2·000 Max	50·80 Max
H	0·080 ± 0·015	2·03 ± 0·38	U	2·500 Max	63·50 Max
J	2·500 ± 0·375	63·50 ± 9·53	V	3·750	95·25
K	3·875 ± 0·375	98·42 ± 9·53	W	0·437 ± 0·020	11·10 ± 0·50
L	0·182	4·62			

Millimetre dimensions have been derived from inches.

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

BW1139

R.F. POWER TRIODE

INTRODUCTION

The BW1139 is a water cooled transmitting Triode. It has a maximum anode dissipation of 18kW and can be operated at maximum ratings up to 20Mc/s. The BW1139 is a thoriated tungsten version of type BW153.

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	11·5	V
Filament Current	58	A←
Maximum Filament Starting Current	(*See Note* 2)	
Filament Cold Resistance	0·017	Ω
Peak Usable Cathode Current	12	A
Amplification Factor (V_a = 12kV, V_g = 0V)	45	
Mutual Conductance (V_a = 12kV, V_g = 0V)	10	mA/V
Inter-electrode Capacitances (average):		
Grid to Anode	21·5	pF
Grid to Filament	29·6	pF
Anode to Filament	2·3	pF

Mechanical

Overall Length	24·25 inches	(615 mm)	Max
Overall Diameter (excluding air inlet)	6·19 inches	(157 mm)	Max
Net Weight	10 pounds	(4·6 kg)	Approx
Mounting Position	Vertical, filament end up		

COOLING

The anode, which is part of the envelope, must be fitted into a water jacket for cooling, the flow necessary being 5 gallons (22·7 litres) per minute. The temperature of the cooling water at the outlet must not exceed 65°C nor should the temperature rise across the jacket exceed 15°C.

A flow of air of 10 to 30 cu.ft/min (0·28 to 0·85 cu.m/min) must be provided via a 1-inch (25mm approx) diameter nozzle and directed into the filament header before and during the application of any voltages in order to limit the temperature of the filament and grid seals, which must not exceed 140°C.

The anode seal temperature must not exceed 140°C and must be limited by a flow of air of 4cu.ft/min (0·11cu.m/min) directed onto the seal via the anode corona ring.

← Indicates a change.

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R.F. POWER TRIODE

MAXIMUM RATINGS

Anode Dissipation .. .. 18·0 kW Max
Grid Dissipation .. .. 1·0 kW Max

Maximum Anode Voltage against Frequency		
Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
20	15·0 kV	12·0 kV
25	11·3 kV	9·0 kV
30	7·5 kV	6·0 kV
40	5·25 kV	4·2 kV

NOTES

1 The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.

2. The filament current must not exceed 150A, even momentarily, at any time.

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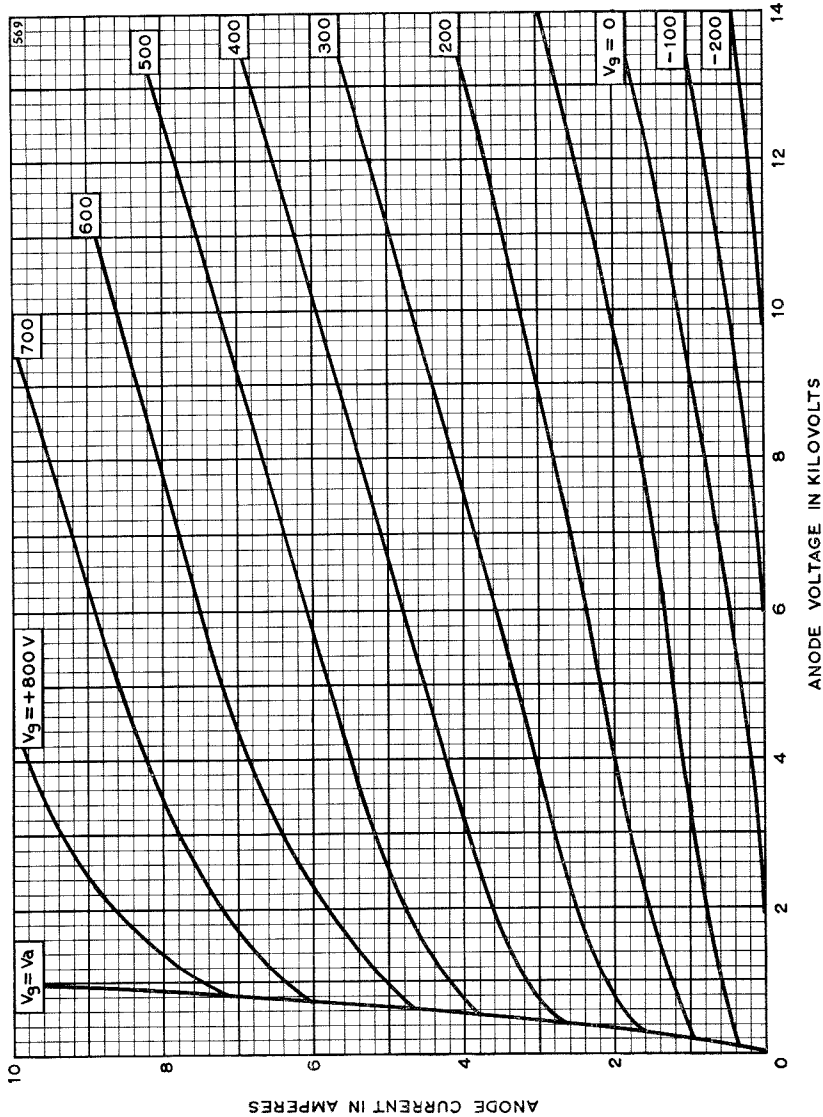
ANODE CHARACTERISTICS



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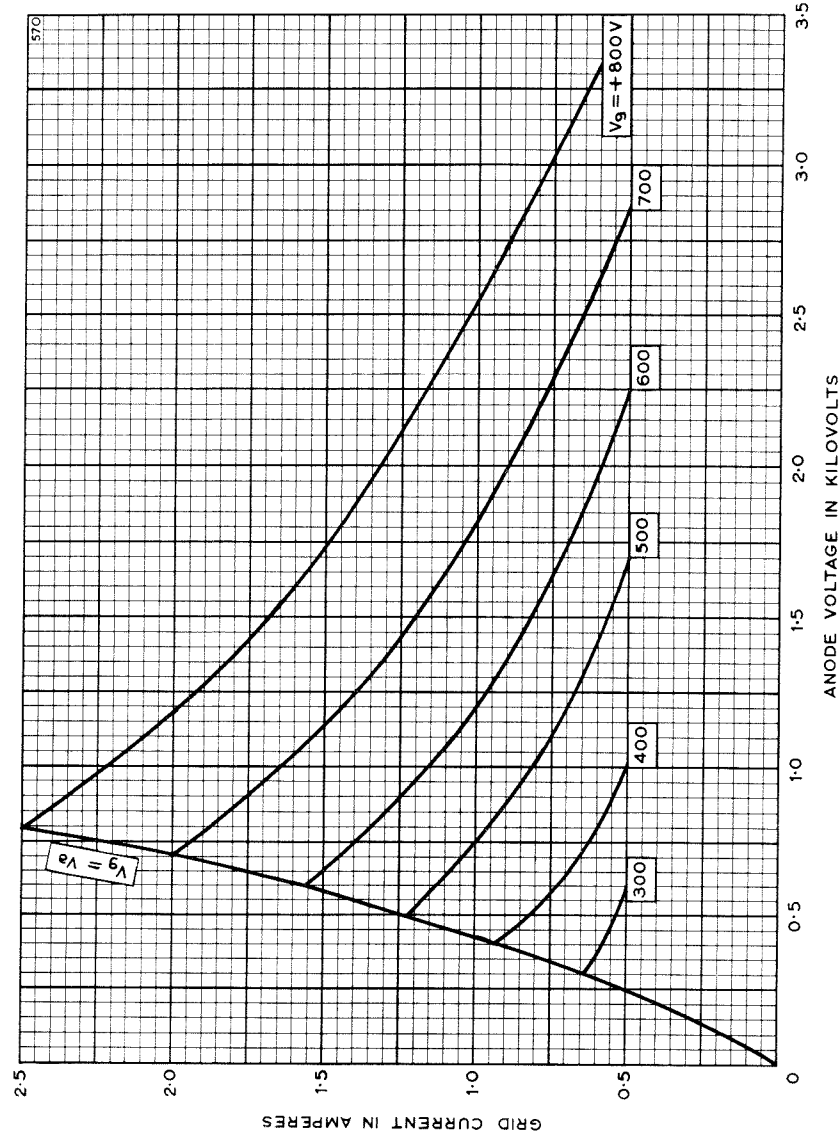
BW1139

R.F. POWER TRIODE

CONTROL GRID CHARACTERISTICS



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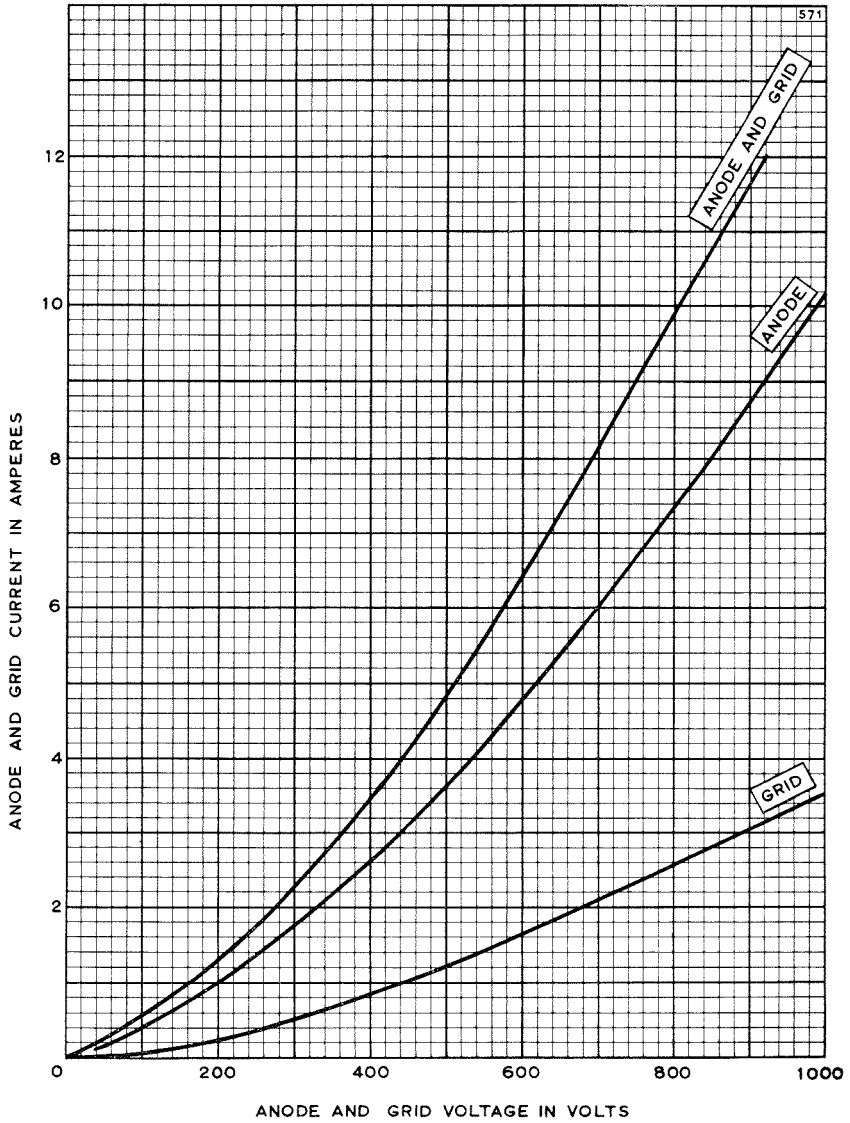
R.F. POWER TRIODE

STRAPPED CHARACTERISTICS



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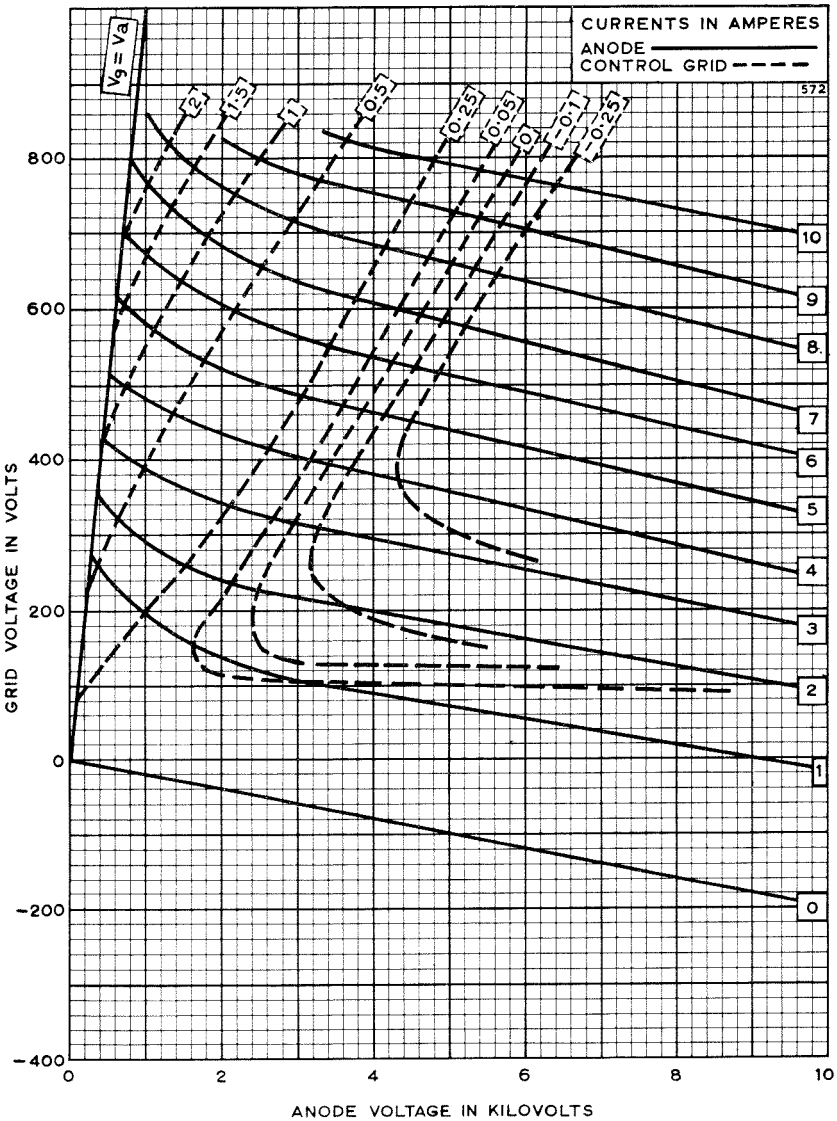
BW1139

R.F. POWER TRIODE

CONSTANT CURRENT CHARACTERISTICS



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R.F. POWER TRIODE

OUTLINE

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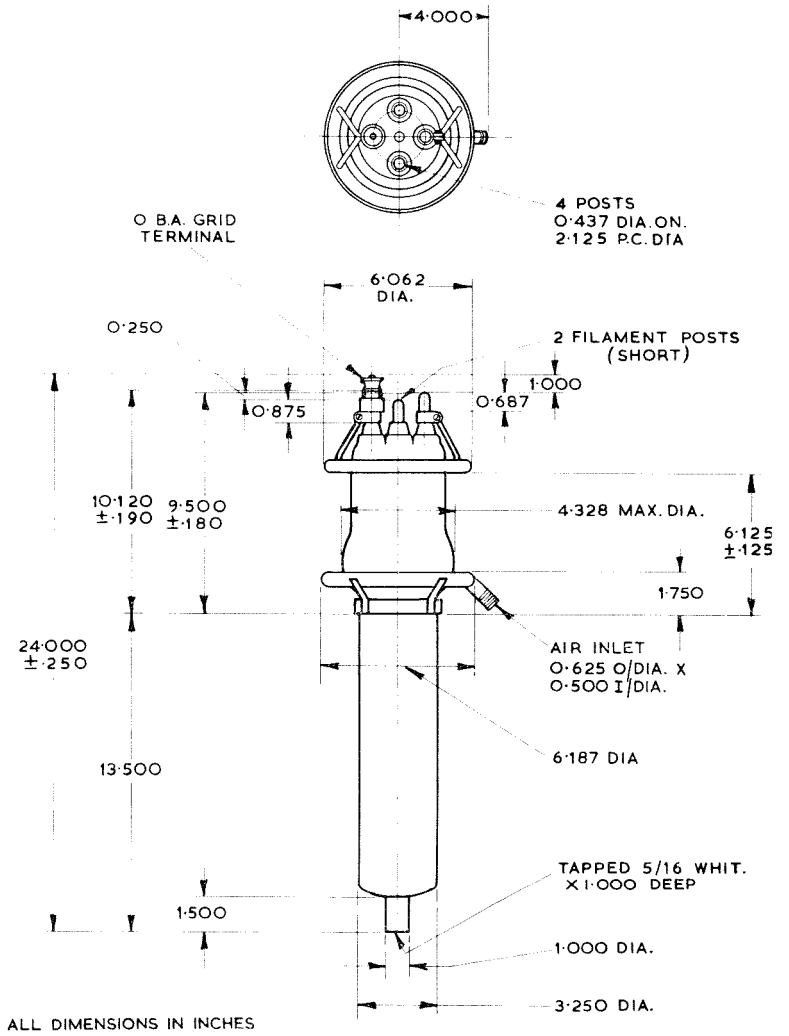

ALL DIMENSIONS IN INCHES

ENGLISH ELECTRIC VALVE CO. LTD.
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R.F. POWER TRIODES

BW1143
BW1143J2

ENGLISH ELECTRIC

ABRIDGED DATA

Water Cooled Triodes, designed primarily for industrial service. BW1143 employs a separate water jacket; that of BW1143J2 is integral. The tubes are electrically identical.

Anode Dissipation	30	kW Max
Anode Voltage	10	kV Max
Frequency for full ratings	10	Mc/s Max
Output Power (Class C unmodulated)	77·5	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	12·0	V
Filament Current	240	A
Filament Starting Current (Peak) (*See Note* 2)	625	A Max
Filament Cold Resistance	0·0059	Ω
Peak Usable Cathode Current	95	A
Perveance	5·8	$mA/V^{3/2}$
Amplification Factor (V_a = 5·0kV, I_a = 5·0A)	37	
Mutual Conductance (V_a = 6·0kV, I_a = 3·5A)	85	mA/V
Inter-electrode Capacitances:		
Grid to Anode	105	pF
Grid to Filament	185	pF
Anode to Filament	2·7	pF

Mechanical

Overall Length:		
BW1143	20·625 inches (523·9 mm)	Max
BW1143J2	22·500 inches (571·5 mm)	Max
Overall Diameter:		
BW1143	11·000 inches (279·4 mm)	Max
BW1143J2	8·062 inches (204·8 mm)	Max
Net Weight:		
BW1143	23 pounds (10·5 kg)	Approx
BW1143J2	32 pounds (14·5 kg)	Approx
Mounting Position	Vertical, filament end up	

Accessories:

Water Jacket (BW1143)	BW4050
Filament Leads	MA130
Grid Connector	MA66
Sealing Ring (supplied with BW1143)	15802A

COOLING

The anode of the BW1143 must be fitted into a water jacket for cooling, the recommended jacket being type BW4050. BW1143J2 has an integral water jacket. Minimum water cooling requirements for both types are shown on page 7.

The rates of flow given are minimum requirements; higher values should be used where possible.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 20ft³/min (0·57m³/min) directed into the filament header via a 1 inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

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

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	10	kV Max
Anode Current	12	A Max
Anode Input Power	100	kW Max
Anode Dissipation	30	kW Max
Grid Dissipation	1·75	kW Max
Frequency (for full ratings)	10	Mc/s Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	6·0	10	kV
Grid Voltage	−320	−540	V
Anode Current	11·2	9·4	A
Grid Current (Approx)	1·78	1·67	A
Anode Dissipation	14·4	14·8	kW
Grid Dissipation (Approx)	760	670	W
Driving Power (Approx)	1330	1570	W
Peak R.F. Grid Voltage	750	940	V
Output Power (*See Note* 3)	51·5	77·5	kW
Efficiency	78·5	84	%

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%.
2. The filament current must not exceed this value, even momentarily, at any time.
3. Power in anode circuit after the grid circuit driving power has been deducted. This does not take into account the anode circuit efficiency.

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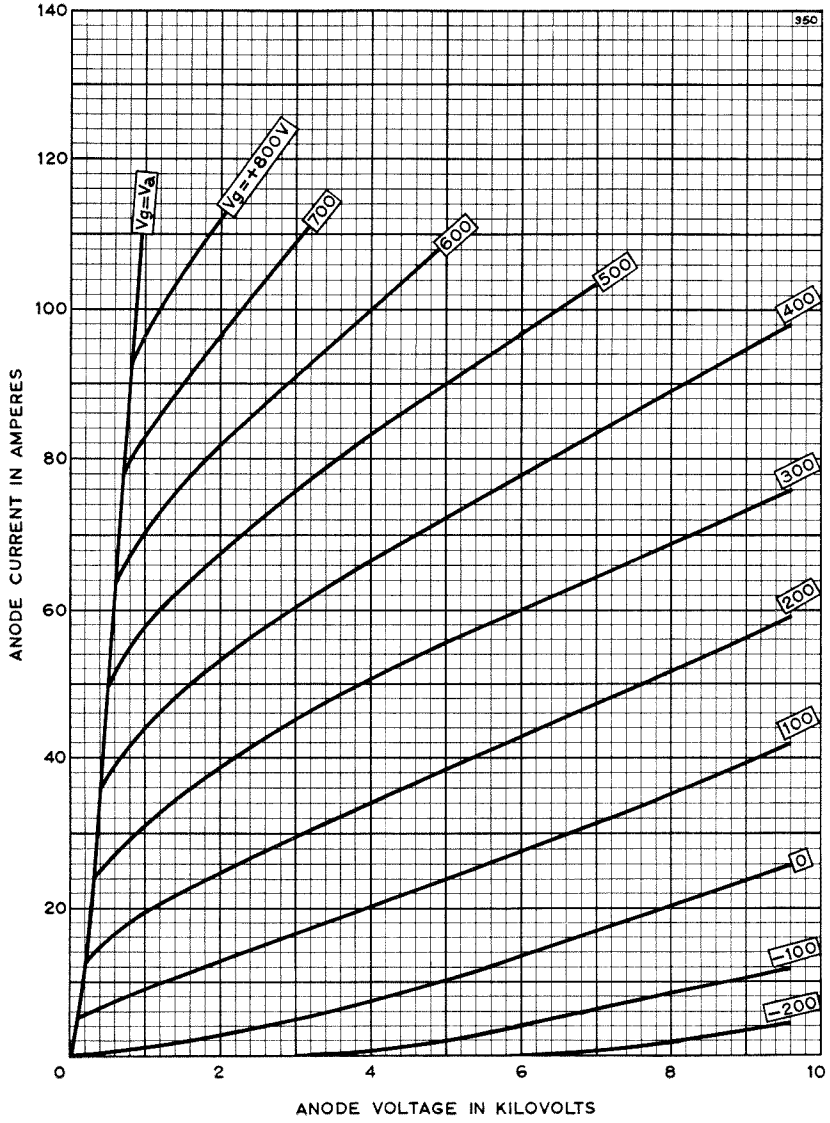
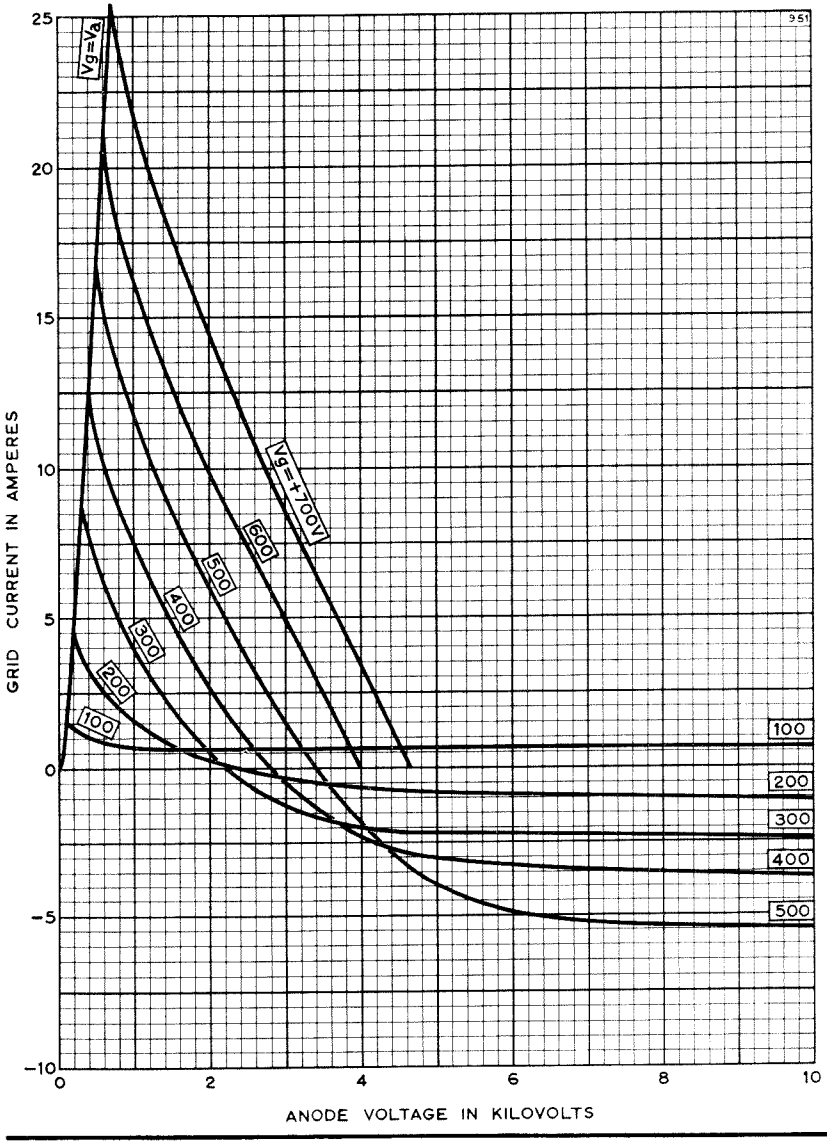
ANODE CHARACTERISTICS



CONTROL GRID CHARACTERISTICS



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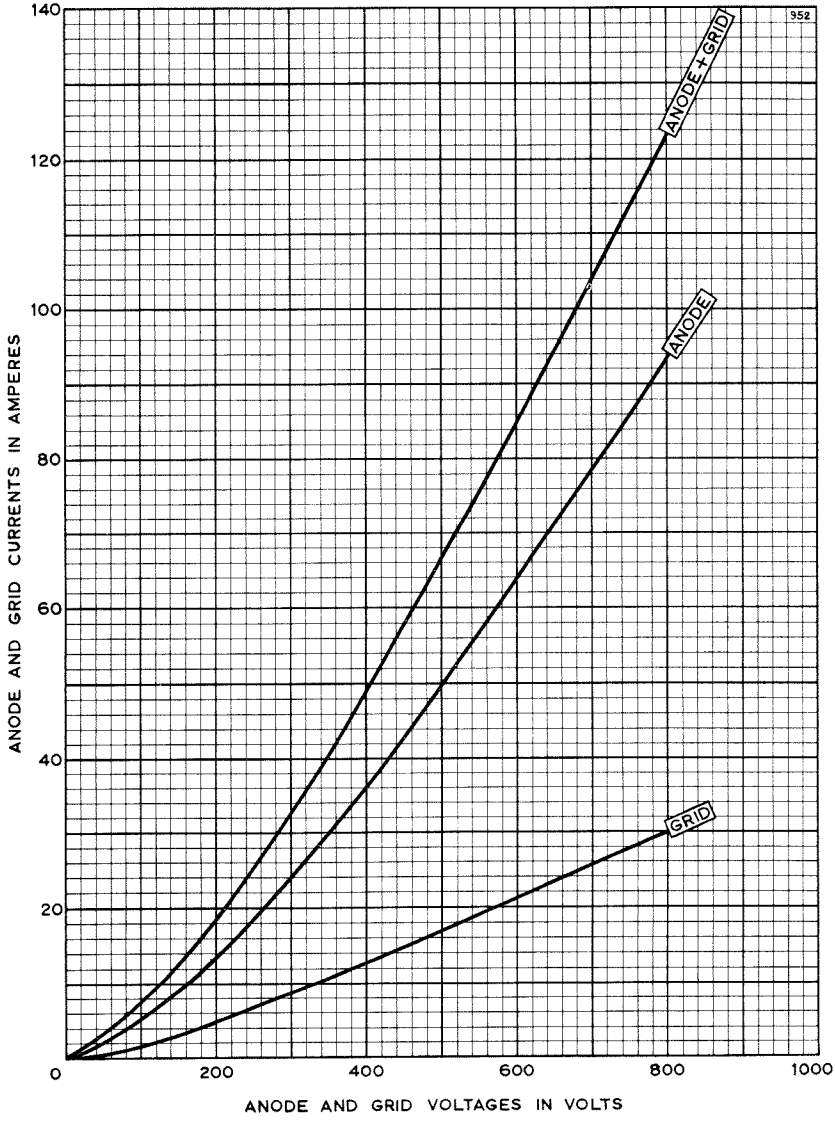
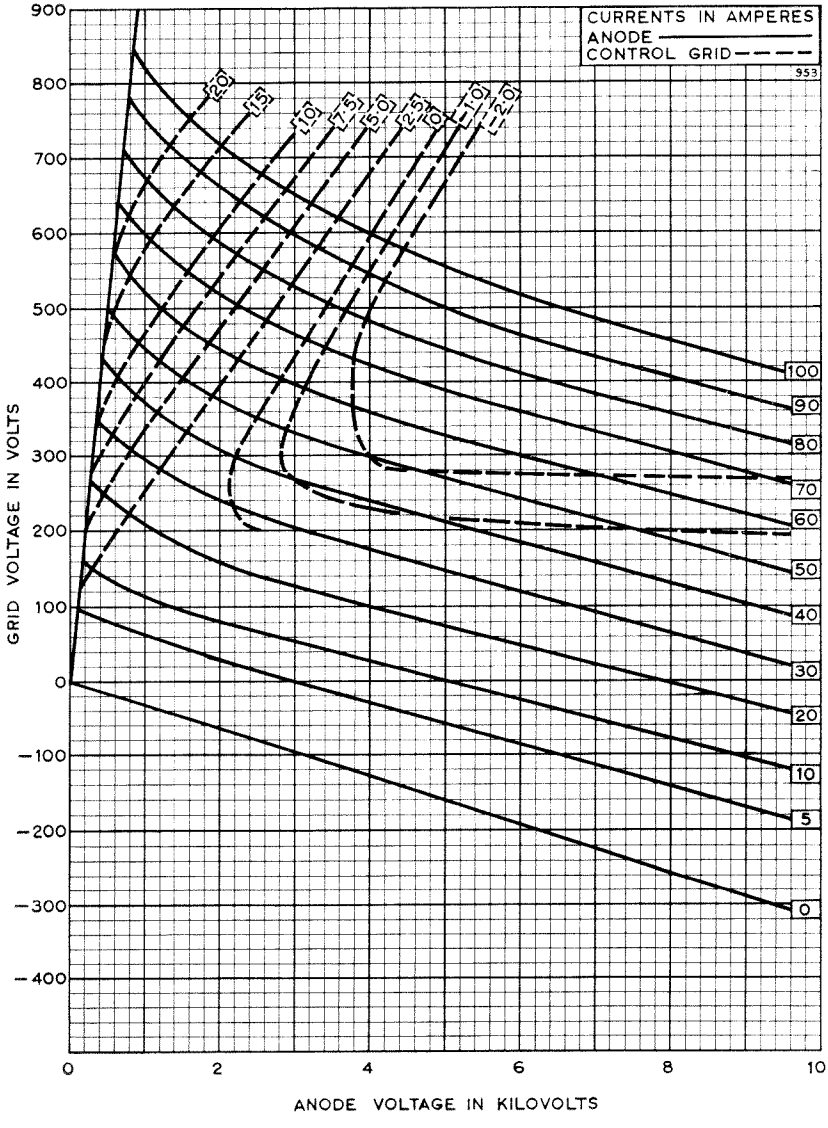
STRAPPED CHARACTERISTICS



ENGLISH ELECTRIC

CONSTANT CURRENT CHARACTERISTICS



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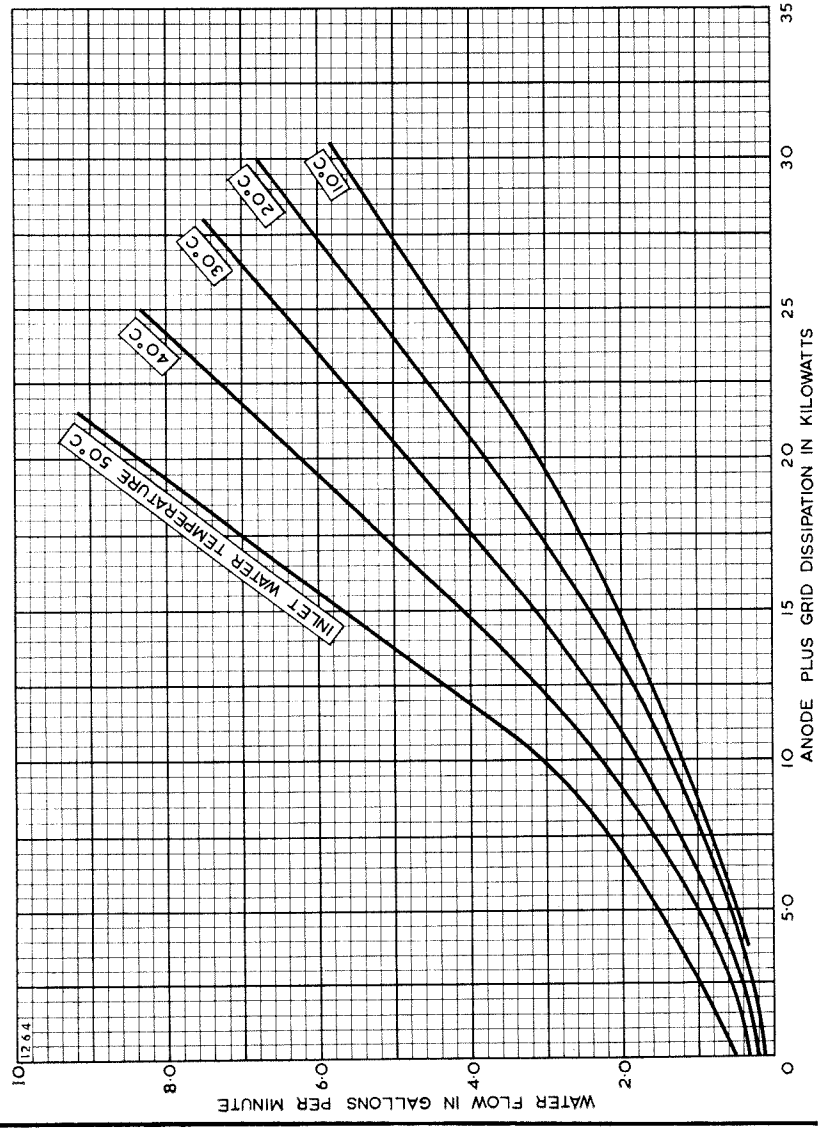
MINIMUM WATER COOLING REQUIREMENTS
(Higher rates of flow should be used where possible)



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OUTLINE FOR BW1143

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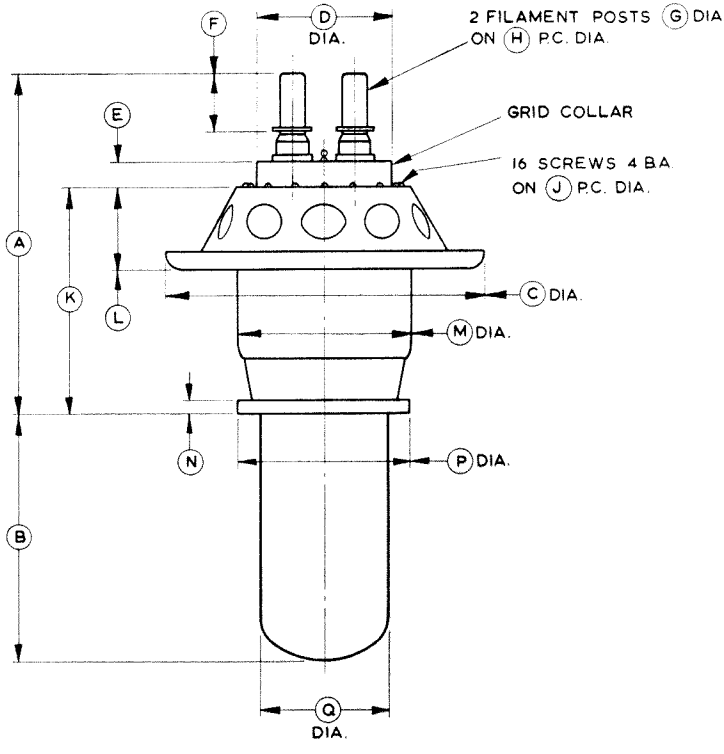
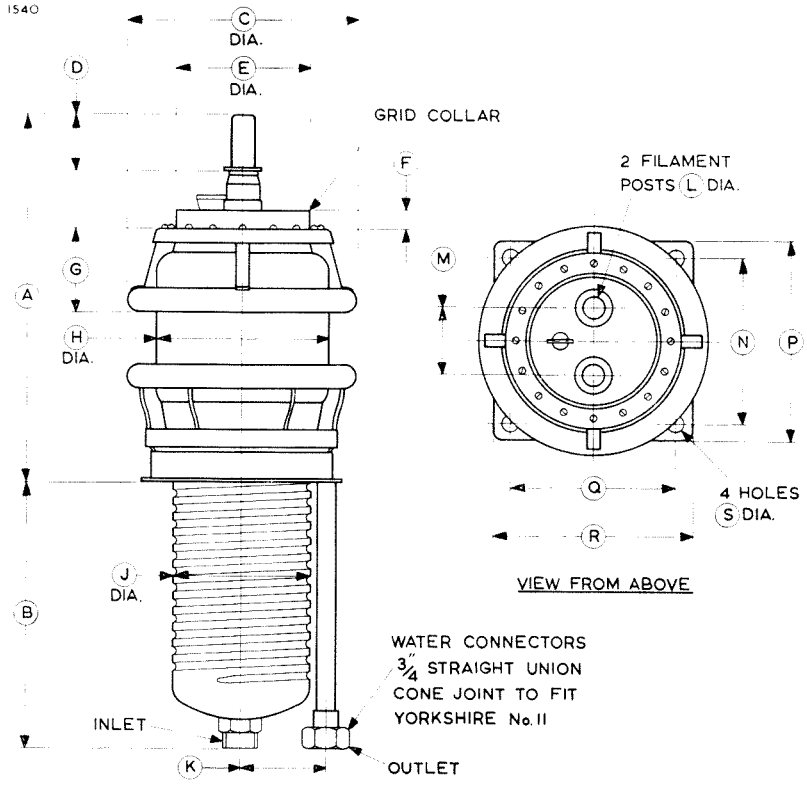


Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	12·000 Max	304·8 Max	J	5·375	136·5
B	8·625	219·1	K	7·875 Max	200·0 Max
C	11·000 Max	279·4 Max	L	2·906 Max	73·81 Max
D	4·703	119·5	M	6·000	152·4
E	0·687	17·45	N	0·500	12·70
F	2·000	50·80	P	5·760 Max	146·3 Max
G	0·875	22·23	Q	4·500	114·3
H	2·250	57·15			

Millimetre dimensions have been derived from inches

Printed in England

OUTLINE FOR BW1143J2



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	12·889 Max	327·4 Max	K	2·937	74·60
B	9·375	238·1	L	0·875	22·23
C	8·062 Max	204·8 Max	M	2·250	57·15
D	2·000	50·80	N	5·750	146·1
E	4·703	119·5	P	7·000	177·8
F	0·687	17·45	Q	5·750	146·1
G	2·906 Max	73·81 Max	R	7·000	177·8
H	6·000	152·4	S	0·375	9·53
J	4·817 Max	122·4 Max			

Millimetre dimensions have been derived from inches.

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R.F. POWER TRIODE

BW1144

ABRIDGED DATA

Water Cooled Transmitting Triode with grid terminal suitable for cathode drive operation.

Anode Dissipation	100	kW Max
Anode Voltage	14	kV Max
Frequency for full ratings	27	Mc/s Max
Output Power (Class C Telegraphy)	200	kW

GENERAL

Electrical

Filament (Two sections) (*See Note* 1)	Thoriated Tungsten	
Filament Voltage per section (*See Note* 2)	9·6	V
Filament Current per section	290	A
Maximum Filament Starting Current	(*See Note* 3)	
Filament Cold Resistance per section	0·004	Ω
Peak Usable Cathode Current	175	A
Perveance	6·0	mA/V$^{3/2}$
Amplification Factor (V_a = 9·0kV, I_a = 5·0A)	34	
Mutual Conductance (V_a = 9·0kV, I_a = 5·0A)	85	mA/V
Inter-electrode Capacitances (average):		
Grid to Anode	108	pF
Grid to Filament	259	pF
Anode to Filament	3·5	pF

Mechanical

Overall Length	23·47 inches	(596·2 mm)	Max
Overall Diameter	13·062 inches	(331·8 mm)	Max
Net Weight	56 pounds	(25·5 kg)	Approx
Mounting Position	Vertical, filament end up		
Water Jacket	BW4035		
Sealing Ring (supplied with valve)	15857A		

COOLING

The anode, which is part of the envelope, must be fitted into a water jacket for cooling, the flow necessary being 22 to 25 gallons per minute (100 to 115 litres per minute approx). The temperature of the cooling water at the outlet must not exceed 65°C nor should the temperature rise across the jacket exceed 15°C.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 60cu.ft/min (1·7cu.m/min) directed into the filament header via a 2-inch (51mm approx) maximum diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

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

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

R.F. POWER TRIODE

BW1144

ENGLISH ELECTRIC

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS

(Absolute values)

Anode Voltage (*See Note* 4)	14	kV Max
Anode Current	18	A Max
Anode Dissipation	100	kW Max
Grid Dissipation	2·75	kW Max
Operating Frequency (for full ratings)	27	Mc/s Max

TYPICAL OPERATING CONDITIONS (FOR AMPLIFIER)

Anode Voltage	14	kV
Grid Voltage	−765	V
Peak R.F. Grid Voltage	1305	V
Anode Current	17·5	A
Grid Current (Approx)	3·1	A
Anode Dissipation	45	kW
Grid Dissipation (Approx)	1·7	kW
Driving Power (Approx)	4·0	kW
Output Power	200	kW
Efficiency	81	%

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

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RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN ←

	Min	*Max*	
Filament Current per section at filament voltage 9·6V	263	311	A
Filament Current difference between sections.. ..	—	15	A
Amplification Factor (V_a = 9·0kV, I_a = 5·0A) ..	31	39	
Mutual Conductance (V_a = 9·0kV, I_a = 5·0A) ..	78	102	mA/V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	370	V
Grid Voltage (V_a = 9·0kV, I_a = 5·0A)	145	222	V
Anode Current (V_a = 1·5kV, V_g = +400V)	48	72	A
Grid Current (V_a = 1·5kV, V_g = +400V)	10	16	A
Anode Current (V_a = 4·0kV, V_g = +400V)	66	98	A
Grid Current (V_a = 4·0kV, V_g = +400V)	2·0	10	A
Anode Current (V_a = 10kV, V_g = +400V)	90	138	A
Grid Current (V_a = 10kV, V_g = +400V)	0	6·0	A

NOTES

1. The filament comprises two separate sections and these should be operated in phase quadrature. Each section is connected across diametrically opposite filament pins.
2. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%.
3. The filament current must not exceed 700A per section, even momentarily, at any time.
4. The maximum anode voltage for class C anode modulated operation (100% modulation) is 12kV.

← Indicates a change

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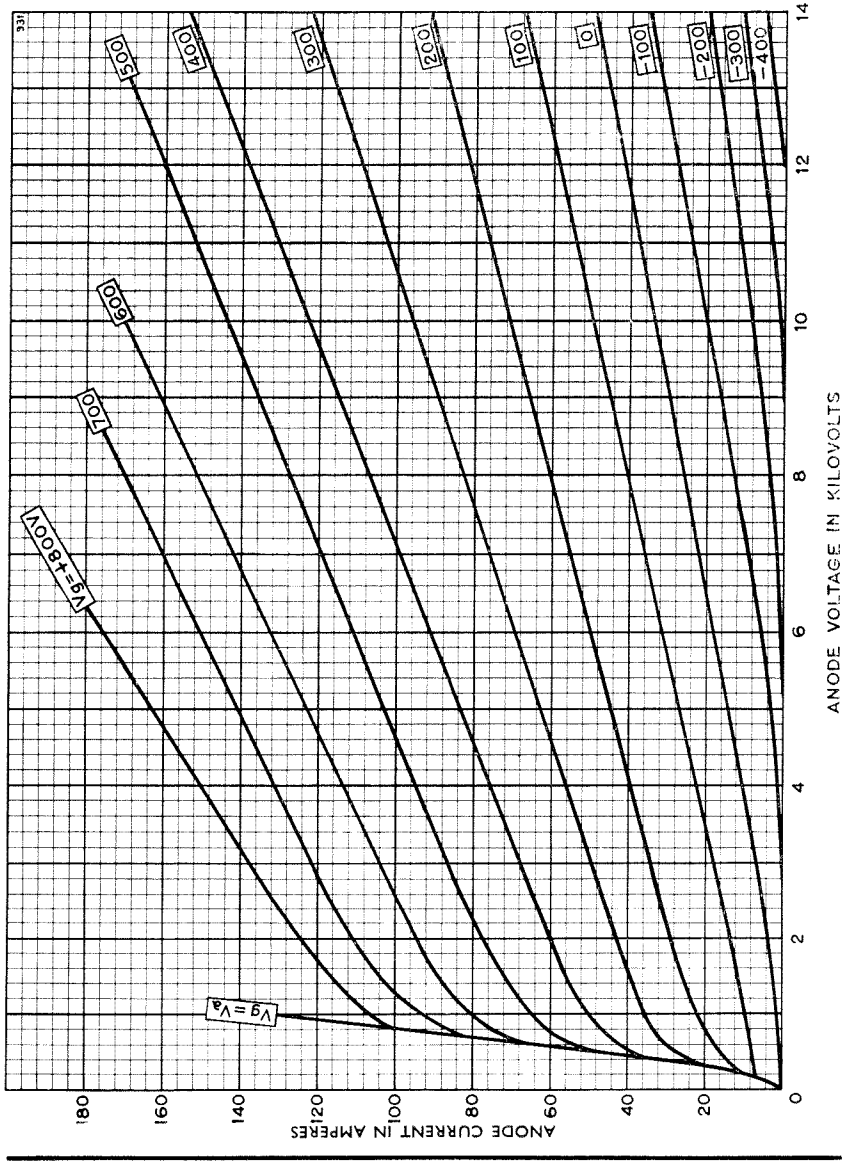
ANODE CHARACTERISTICS



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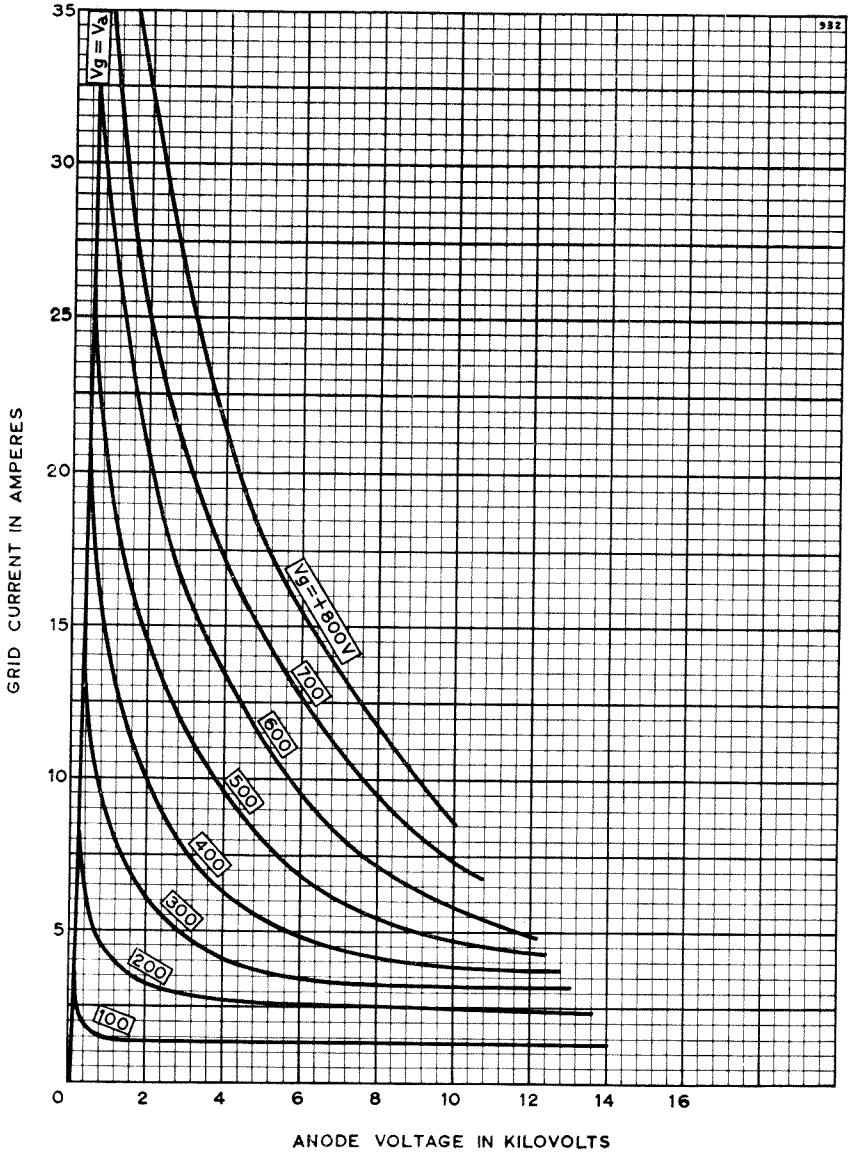
CONTROL GRID CHARACTERISTICS



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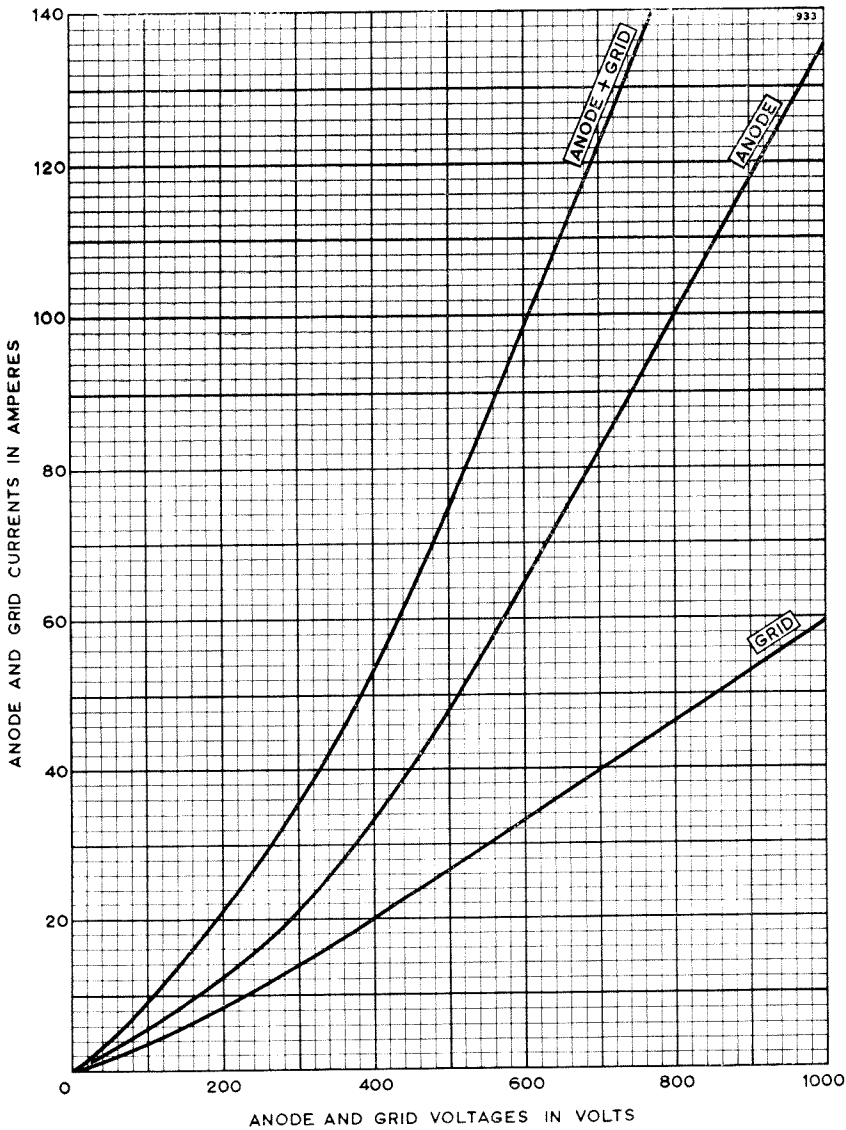
STRAPPED CHARACTERISTICS



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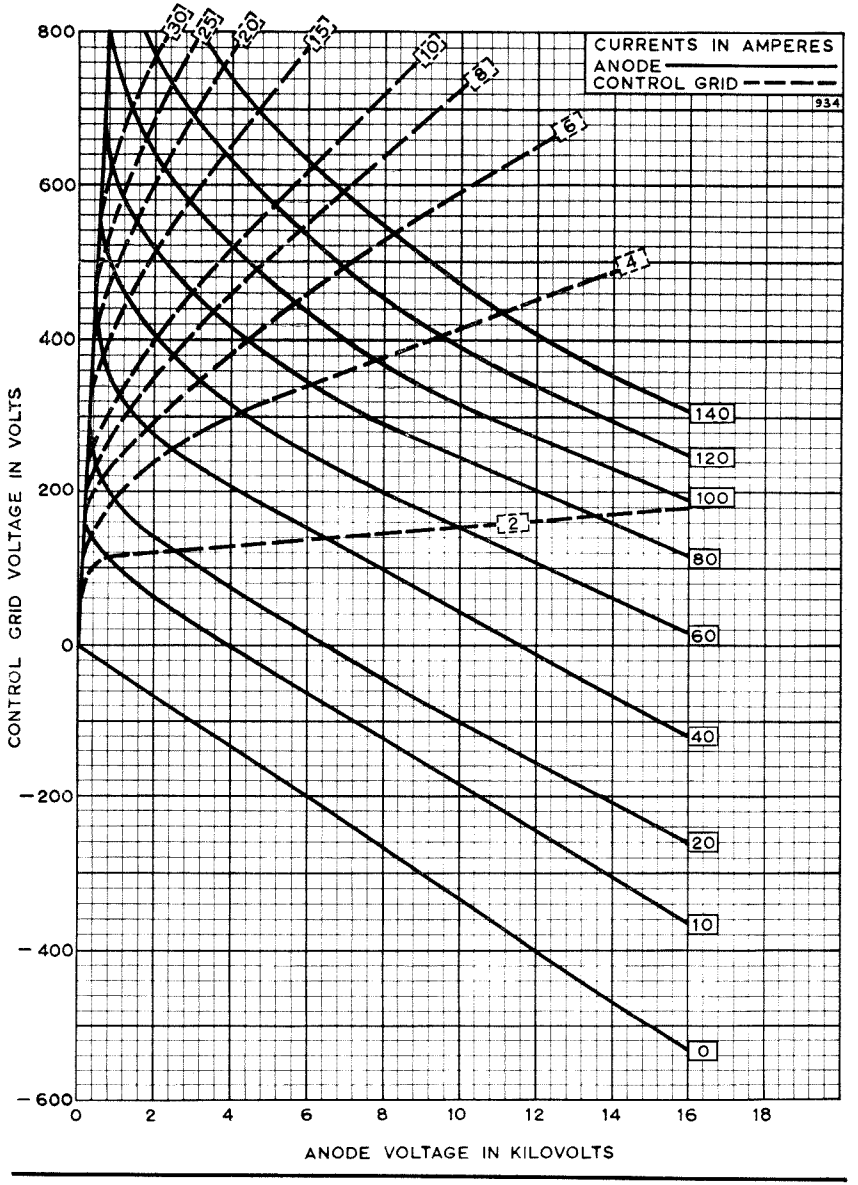
CONSTANT CURRENT CHARACTERISTICS



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ENGLISH ELECTRIC

OUTLINE

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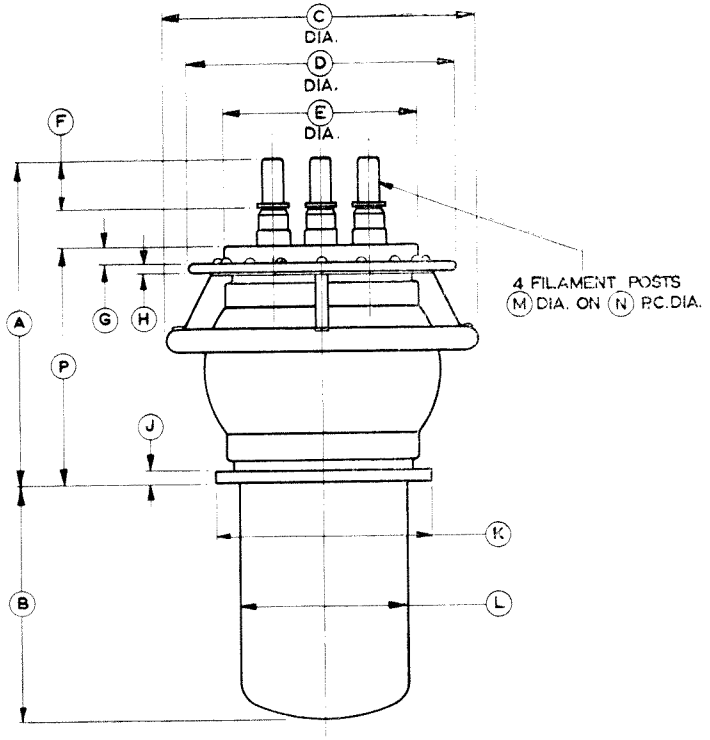


Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	13·500 Max	342·9 Max	H	0·375 ± 0·031	9·53 ± 0·79
B	9·938 ± 0·031	252·43 ± 0·79	J	0·500 ± 0·031	12·70 ± 0·79
C	13·062 Max	331·8 Max	K	9·000	228·6
D	11·125 ± 0·062	282·58 ± 1·57	L	6·915	175·6
E	8·086 ± 0·031	205·38 ± 0·79	M	0·875	22·23
F	2·000	50·80	N	4·000	101·6
G	0·750 Min	19·05 Min	P	9·919 ± 0·250	251·94 ± 6·35

Millimetre dimensions have been derived from inches.

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

R.F. POWER TRIODE

BW1156

ENGLISH ELECTRIC

ABRIDGED DATA

Water Cooled Triode intended primarily for industrial service.

Anode Dissipation	175	kW Max ←
Anode Voltage	14	kV Max
Frequency for full ratings	27	MHz Max
Output Power (Class C unmodulated)	250	kW

GENERAL

Electrical

Filament (Two sections) (*See Note* 1)	Thoriated Tungsten	
Filament Voltage per section (*See Note* 2)	12·2	V
Filament Current per section	290	A
Maximum Filament Starting Current per section (*See Note* 3)	700	A Max
Filament Cold Resistance per section	0·005	Ω
Peak Usable Cathode Current	260	A
Perveance	8·0	mA/V$^{3/2}$
Amplification Factor (V_a = 9·0kV, I_a = 5·0A)	23	
Mutual Conductance (V_a = 9·0kV, I_a = 5·0A)	100	mA/V
Inter-electrode Capacitances (typical):		
Grid to Anode	110	pF
Grid to Filament	290	pF
Anode to Filament	5·0	pF

Mechanical

Overall Length	23·47 inches (596·1 mm)	Max
Overall Diameter	13·062 inches (331·8 mm)	Max
Net Weight	60 pounds (27 kg)	Approx
Mounting Position	Vertical, filament end up	
Water Jacket		BW4035
Sealing Ring (supplied with valve)		MA243

Cooling

The anode, which is part of the envelope, must be fitted into a water jacket for cooling. The recommended jacket is type BW4035 and for 175kW dissipation the water flow necessary is 40 gallons per minute (182 litres/min) ← minimum. The temperature of the cooling water at the outlet must not exceed 65°C nor should the temperature rise across the jacket exceed 15°C.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 60ft^3/min (1·7m^3/min) directed into the filament header via a 2 inch (51mm) diameter nozzle before, during and after the application of any voltages is usually adequate for limiting the temperature of these seals.

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

← Indicates a change

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Printed in England

R.F. AMPLIFIER AND OSCILLATOR

(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	14	kV Max
Anode Current	28	A Max
Anode Dissipation	175	kW Max ←
Grid Dissipation	3·0	kW Max
Operating Frequency (for full ratings)	27	MHz Max

TYPICAL OPERATING CONDITIONS (FOR AMPLIFIER)

Anode Voltage	12	kV
Grid Voltage	−1400	V
Peak R.F. Grid Voltage	2150	V
Anode Current	27	A
Grid Current (Approx)	4·0	A
Anode Dissipation (including filament and grid losses)	85	kW
Grid Dissipation	3·0	kW
Driving Power	9·5	kW
Output Power	250	kW
Efficiency	76	%

NOTES

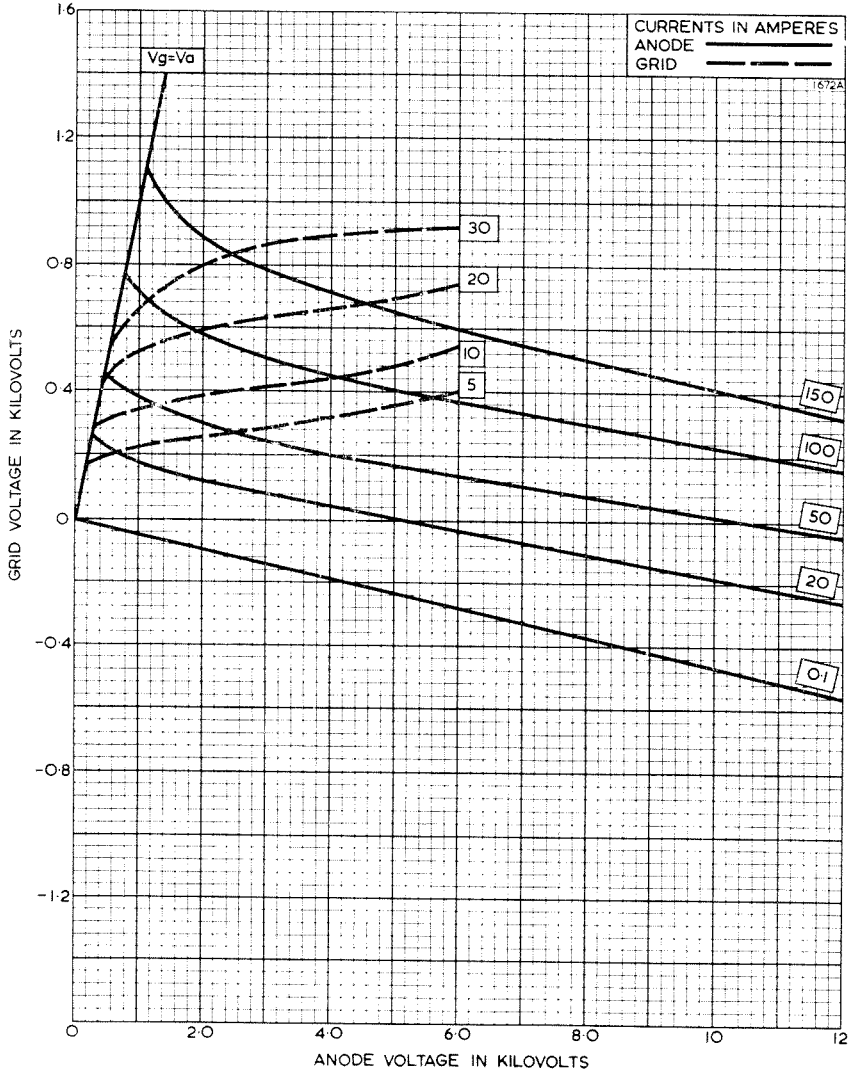
1. The filament comprises two separate sections designed to operate in phase quadrature. Each section is connected across diametrically opposite filament pins. If desired the two sections may be connected in parallel.

2. The valve must be operated at the stated filament voltage. Fluctuations in filament voltage must not exceed ±5%.

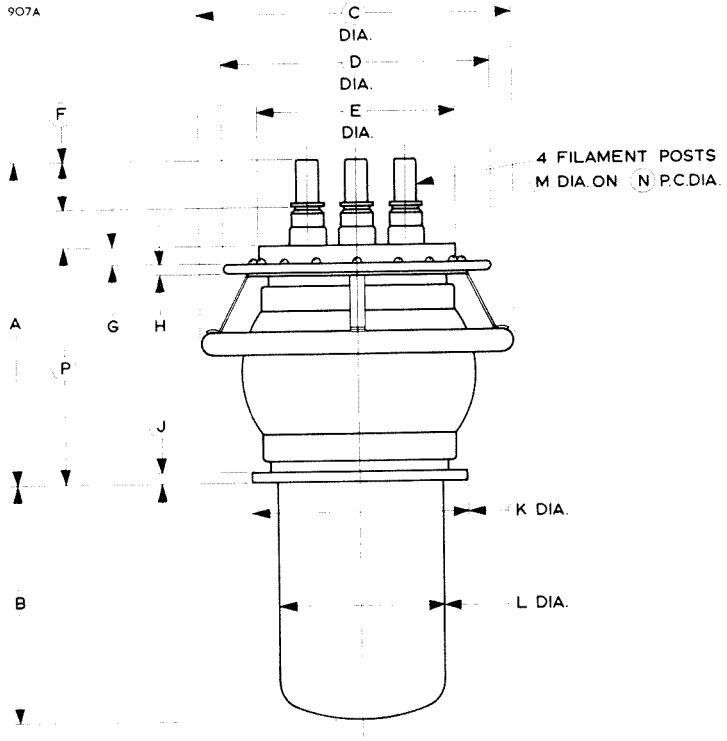
3. The filament current must not exceed 700 amperes per section, even momentarily, at any time during switch on.

← Indicates a change

CONSTANT CURRENT CHARACTERISTICS



OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	13·500 Max	342·9 Max	H	0·375 ± 0·031	9·53 ± 0·79
B	9·938 ± 0·031	252·43 ± 0·79	J	0·500 ± 0·031	12·70 ± 0·79
C	13·062 Max	331·8 Max	K	9·000	228·6
D	11·125 ± 0·062	282·58 ± 1·57	L	6·915	175·6
E	8·086 ± 0·031	205·38 ± 0·79	M	0·875	22·23
F	2·000	50·80	N	4·000	101·6
G	0·750 Min	19·05 Min	P	9·919 ± 0·250	251·94 ± 6·35

Millimetre dimensions have been derived from inches.

Printed in England

V.H.F. POWER TRIODES

BW1162
BW1162J3

ENGLISH ELECTRIC

ABRIDGED DATA

Water Cooled Triodes for transmitter and industrial applications. BW1162 employs a separate water jacket; that of BW1162J3 is integral. The tubes are electrically identical.

Anode Dissipation	6·0 kW Max
Anode Voltage	7·2 kV Max
Operating Frequency:	
Class C Telegraphy	30 Mc/s Max
Class C Industrial Oscillator	85 Mc/s Max
Output Power:	
Class C Telegraphy	10 kW
Class C Industrial Oscillator	8·6 kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	12·6	V
Filament Current	33	A
Amplification Factor (V_a = 6·0kV, I_a = 1·0A)	32	
Mutual Conductance (V_a = 6·0kV, I_a = 1·0A)	15	mA/V
Inter-electrode Capacitances:		
Grid to Anode	11	pF
Grid to Filament	16	pF
Anode to Filament	0·3	pF

Mechanical

Overall Length:		
BW1162	7·480 inches (190 mm)	Max
BW1162J3	8·583 inches (218 mm)	Max
Overall Diameter:		
BW1162	2·776 inches (70·5 mm)	Max
BW1162J3	5·118 inches (130 mm)	Nom
Net Weight:		
BW1162	1 pound (0·45 kg)	Approx
BW1162J3	1·8 pounds (0·7 kg)	Approx
Mounting Position	Vertical, filament pins up	

Accessories

Filament Connectors	MA164A
Centre-tap Dissipating Connector	MA146B
Grid Connector (above 30Mc/s)	MA147A
Water Jacket for BW1162	BW4088

ENGLISH ELECTRIC VALVE CO. LTD.

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COOLING

BW1162 Anode

The anode of this valve must be fitted into a water jacket for cooling, the recommended jacket being type BW4088.

The required flows of water through the water jacket for various anode dissipations and water inlet temperatures are given in the following table.

Anode Dissipation (kW)	Inlet Temperature (°C)	Rate of Flow of Water gal/min	Rate of Flow of Water l./min	Pressure Drop across Jacket (atm)
1·0	20	0·55	2·5	0·08
1·0	50	1·10	5·0	0·10
2·0	20	0·55	2·5	0·08
2·0	50	1·10	5·0	0·10
4·0	20	0·88	4·0	0·18
4·0	50	1·98	9·0	0·90
6·0	20	1·32	6·0	0·4
6·0	50	3·08	14	2·5

BW1162J3 Anode

The BW1162J3 has an integral water jacket. Minimum water cooling requirements are shown on page 10; higher rates of flow should be used where possible.

It may be necessary to direct a flow of air on to the filament and grid seals in order to maintain their temperatures within the following limits:

Temperature of filament seals .. .. 210 °C Max
Temperature of grid and anode seals .. .. .. 180 °C Max

A heat dissipating connector such as MA146B must be used on the filament centre-tap pin.

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR
(Class B)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	7·2 kV Max
Anode Current	2·2 A Max
Anode Input Power	14 kW Max
Anode Dissipation	6·0 kW Max
Grid Dissipation	250 W Max
Grid Circuit Resistance	15 kΩ Max
Cathode Current (Peak)	10 A Max

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TYPICAL OPERATING CONDITIONS
(Class B, 2 valves)

Anode Voltage	4·0	5·0	5·0	7·0	kV
Grid Voltage	−120	−145	−145	−210	V
Peak A.F. Grid Voltage (per valve)	445	342	415	605	V
Anode Current (Zero Signal)	2×0·10	2×0·15	2×0·15	2×0·20	A
Anode Current (Maximum Signal)	2×1·25	2×1·10	2×1·25	2×2·00	A
Grid Current (Maximum Signal)	2×0·32	2×0·22	2×0·35	2×0·56	A
Effective Load (Anode to Anode)	3·8	5·5	4·8	4·15	kΩ
Nominal Driving Power (Maximum Signal)	2×140	2×65	2×130	2×310	W
Anode Dissipation	2×1·45	2×1·50	2×1·70	2×4·00	kW
Output Power (Maximum Signal)	7·1	8·0	9·0	20	kW
Efficiency	71	72·5	72·5	71·5	%

ANODE MODULATED R.F. POWER AMPLIFIER
(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	5·5 kV Max
Anode Current	1·8 A Max
Anode Dissipation	4·0 kW Max
Grid Voltage (negative value)	1·25 kV Max
Grid Current	0·6 A Max
Grid Dissipation	250 W Max
Cathode Current (Peak)	12 A Max
Frequency for above ratings	30 Mc/s Max

TYPICAL OPERATING CONDITIONS
(frequency 30Mc/s)

Anode Voltage	4·0	5·0	5·0	kV
Grid Voltage	−300	−400	−400	V
Peak R.F. Grid Voltage	680	730	800	V
Anode Current	1·6	1·4	1·6	A
Grid Current	0·6	0·5	0·5	A
Nominal Driving Power	367	328	432	W
Anode Dissipation	1·4	1·4	1·6	kW
Output Power	5·0	5·6	6·4	kW
Efficiency	78	80	80	%

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ENGLISH ELECTRIC

RADIO FREQUENCY POWER AMPLIFIER

(Class C Telegraphy, key down conditions, or F.M. Telephony, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	7·2 kV Max
Anode Current	2·2 A Max
Anode Input Power	14 kW Max
Anode Dissipation	6·0 kW Max
Grid Voltage (negative value)	1250 V Max
Grid Current	0·6 A Max
Grid Dissipation	250 W Max
Cathode Current (Peak)	14 A Max
Frequency for above ratings	30 Mc/s Max

TYPICAL OPERATING CONDITIONS
(frequency 30Mc/s)

Anode Voltage	5·0	6·0	6·5	kV
Grid Voltage	−300	−400	−450	V
Peak R.F. Grid Voltage	700	820	850	V
Anode Current	2·0	2·0	2·0	A
Grid Current	0·6	0·6	0·6	A
Nominal Driving Power	378	443	460	W
Anode Dissipation	2·7	2·8	3·0	kW
Output Power	7·3	9·2	10	kW
Efficiency	73	76·7	77	%

RADIO FREQUENCY POWER OSCILLATOR

(Class C, anode supply from unfiltered three phase half-wave rectifier)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	7·0 kV Max
Anode Current	1·8 A Max
Anode Input Power	11 kW Max
Anode Dissipation	6·0 kW Max
Grid Voltage (negative value)	1250 V Max
Grid Current (unloaded)	0·7 A Max
Grid Current (loaded)	0·5 A Max
Grid Dissipation	250 W Max
Grid Circuit Resistance	10 kΩ Max
Cathode Current (Peak)	11 A Max
Operating Frequency for full ratings	55 Mc/s Max
Anode Voltage for operation at 85Mc/s max	6·5 kV Max

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TYPICAL OPERATING CONDITIONS

Frequency	55	85	85	Mc/s
Output Voltage (r.m.s.) from Transformer	5·55	5·13	4·27	kV
Anode Voltage	6·5	6·0	5·0	kV
Anode Current	1·7	1·5	1·7	A
Grid Current (unloaded)	0·7	0·7	0·7	A
Grid Current (loaded)	0·5	0·4	0·45	A
Anode Dissipation	2·4	2·5	2·4	kW
Anode Load Resistance	2·0	2·3	1·6	kΩ
Grid Resistor	0·9	1·0	0·85	kΩ
Feedback Ratio (*See Note* 2)	0·15	0·15	0·19	
Nominal Drive Power	350	300	350	W
Output Power	8·6	6·5	6·1	kW
Effective Output Power to Load (*See Note* 3)	7·0	5·5	5·0	kW
Efficiency	78	72	72	%

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed +5% or −10%. The centre-tap pin is not an electrical centre-tap and must not be used for the filament current supply. At frequencies above 30Mc/s, all three filament pins should be interconnected with suitable capacitors.

2. The feedback ratio is defined as $\frac{V_{g\ (pk)}}{V_{a\ (pk)}}$
   where $V_{g\ (pk)}$ = peak r.f. grid voltage in volts
   and $V_{a\ (pk)}$ = peak r.f. anode voltage in volts.

3. Effective output power to load = $\eta_a\ (P_{out} - P_{drive})$
   where η_a = efficiency of anode circuit = 85% (typical value)
   P_{out} = output power of valve to anode circuit
   P_{drive} = drive power fed back to grid circuit.

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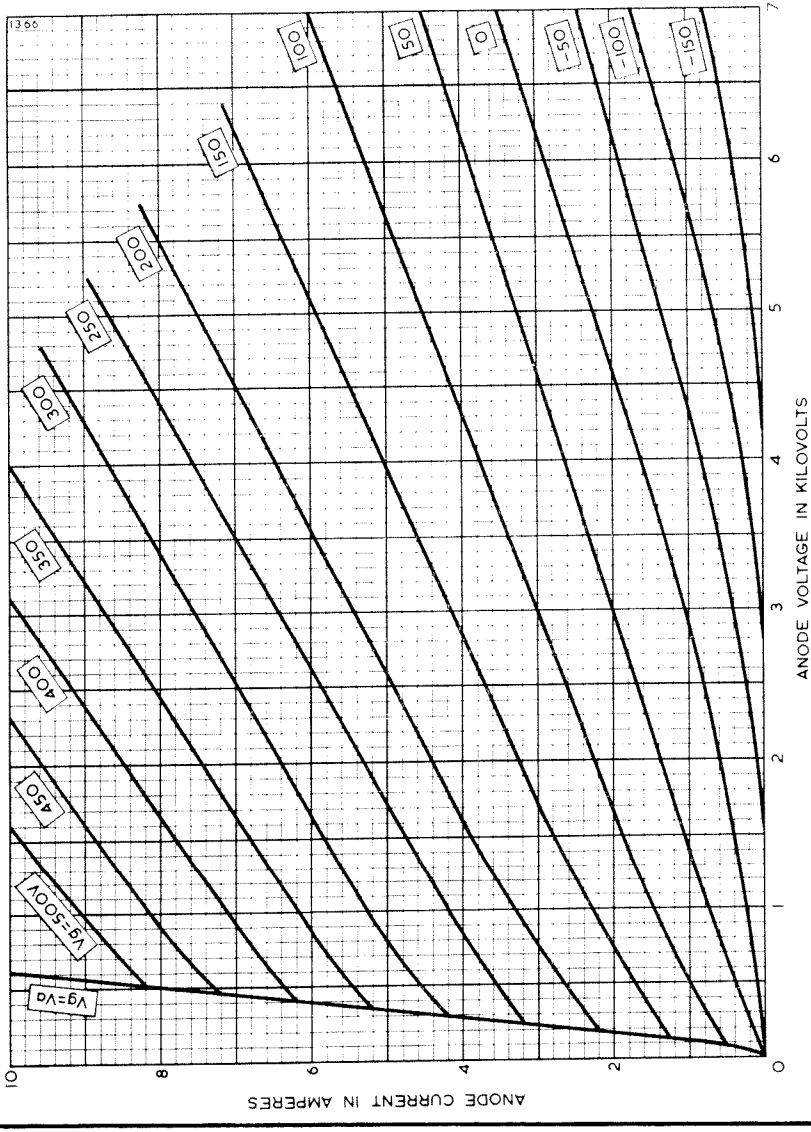
ENGLISH ELECTRIC

ANODE CHARACTERISTICS



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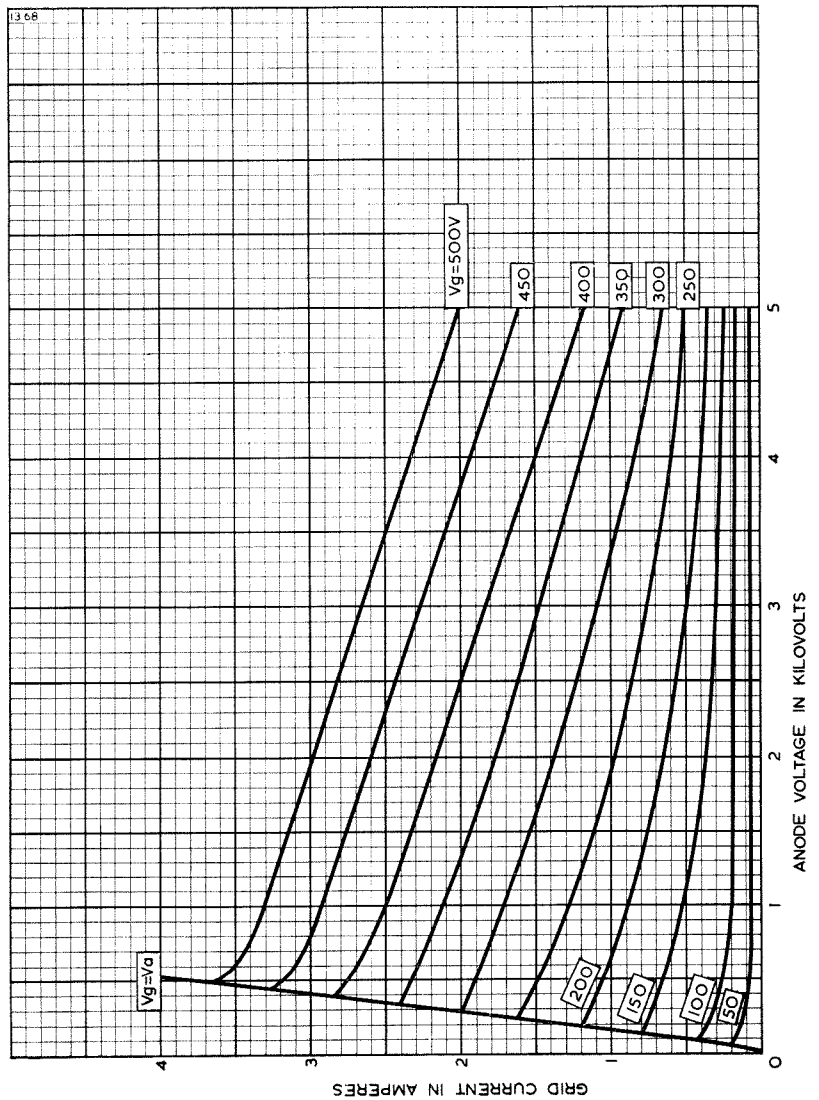
GRID CHARACTERISTICS



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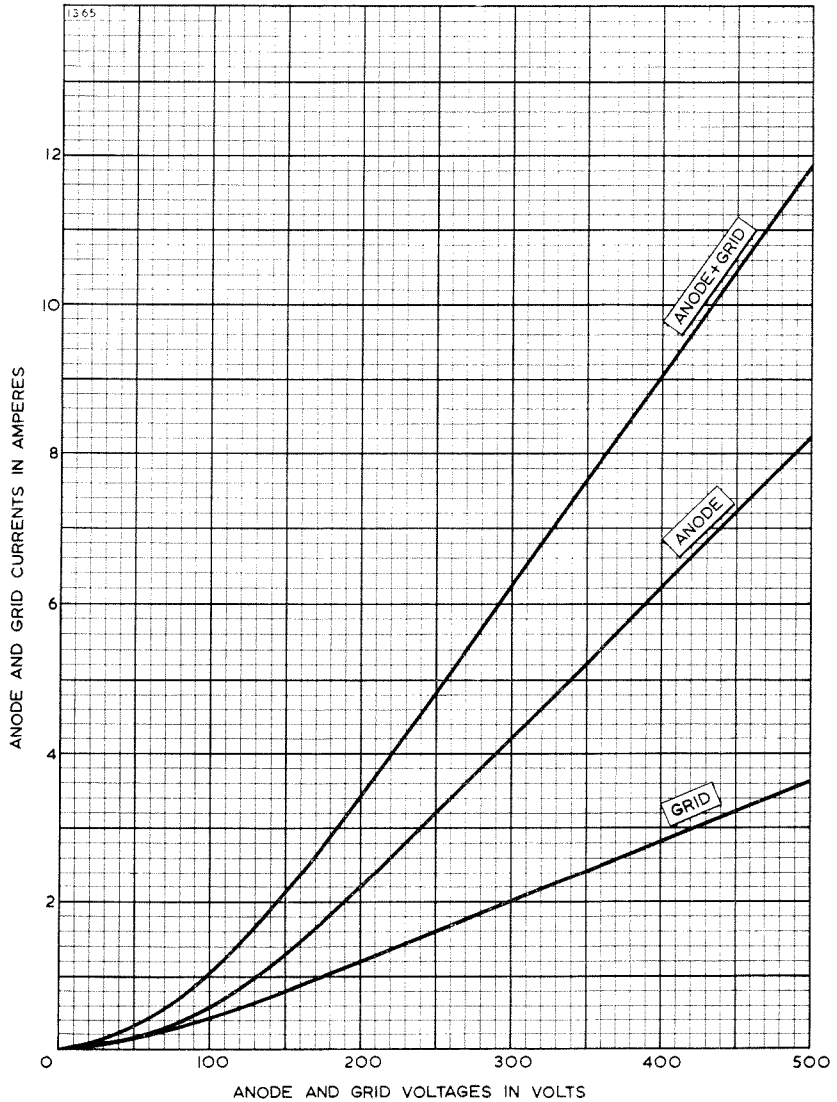
STRAPPED CHARACTERISTICS



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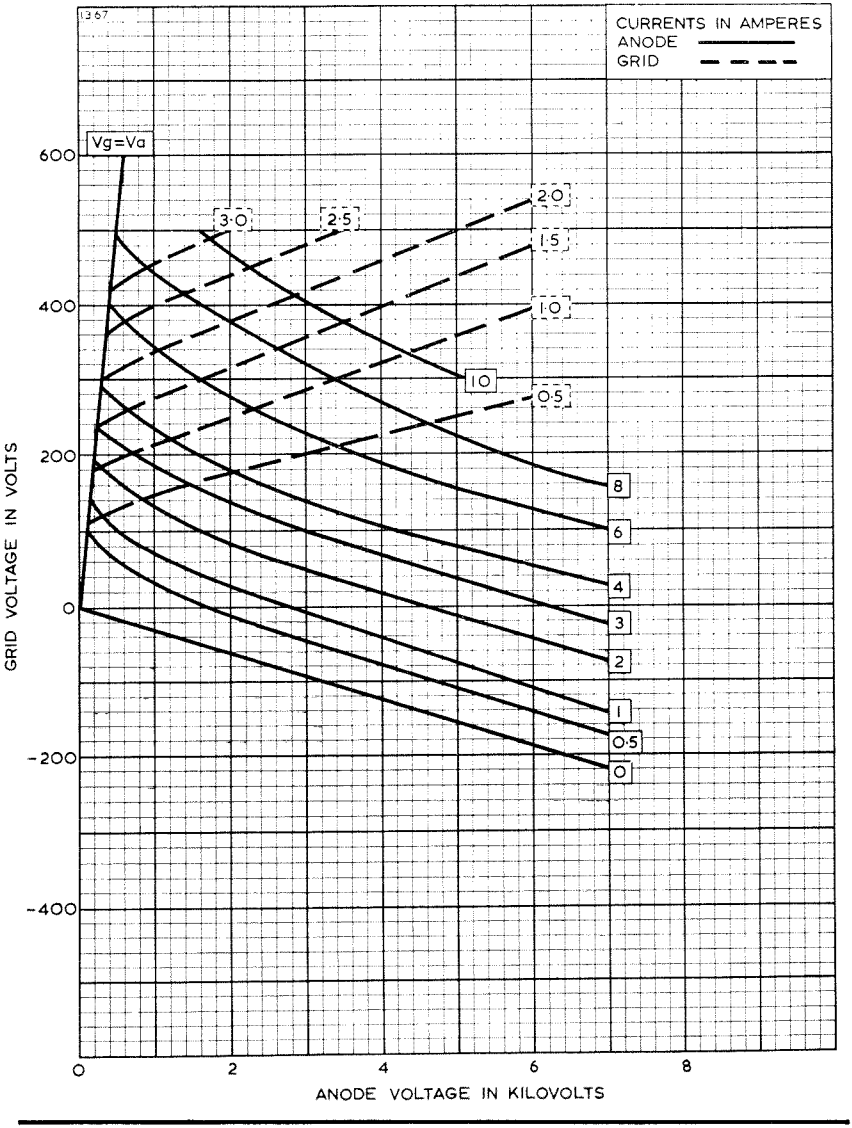
CONSTANT CURRENT CHARACTERISTICS



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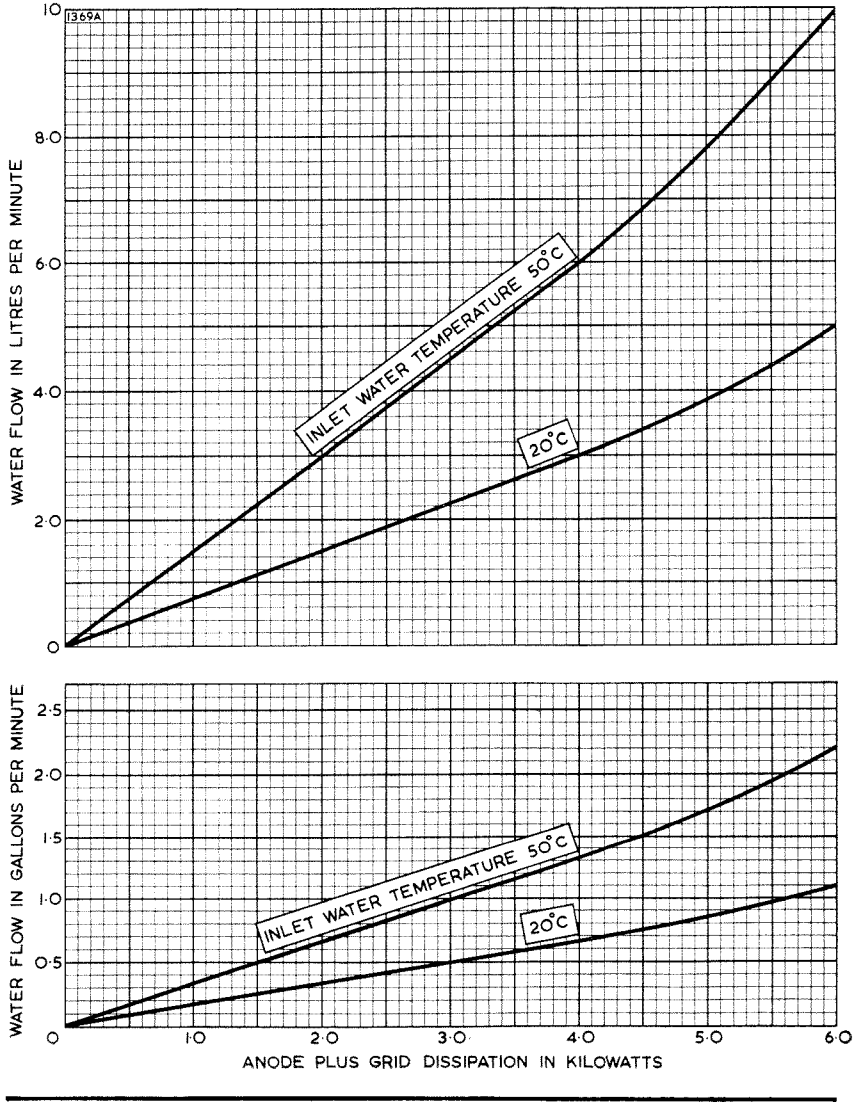
MINIMUM WATER COOLING REQUIREMENTS FOR BW1162J3
(Higher rates of flow should be used where possible)



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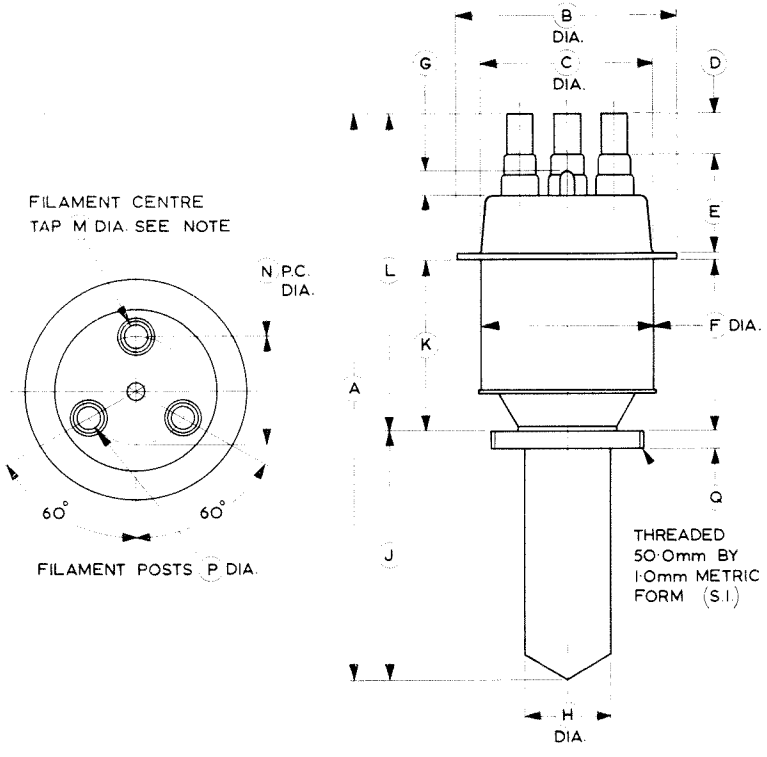
OUTLINE FOR BW1162

1215A

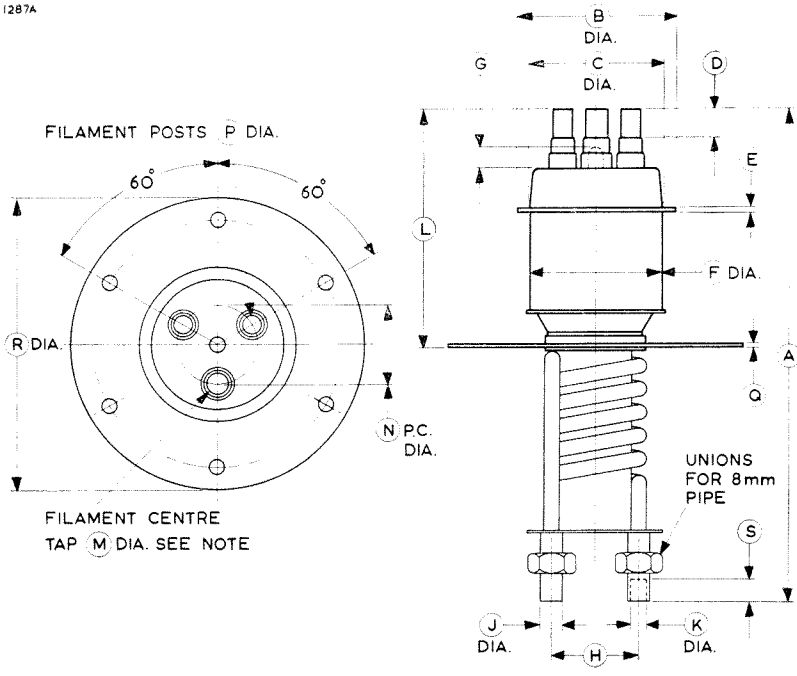


Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	7·480 Max	190·0 Max	J	3·268	83·00
B	2·756 ± 0·020	70·00 ± 0·50	K	2·205	56·00
C	2·323 Max	59·00 Max	L	4·173	106·0
D	0·472 Min	12·00 Min	M	0·413	10·50
E	0·098	2·50	N	1·378 ± 0·040	35·00 ± 1·00
F	2·323	59·00	P	0·358	9·10
G	0·630 Max	16·00 Max	Q	0·246	6·25
H	1·142	29·00			

Inch dimensions have been derived from millimetres.

Note The filament centre tap post is marked 'O'

OUTLINE FOR BW1162J3

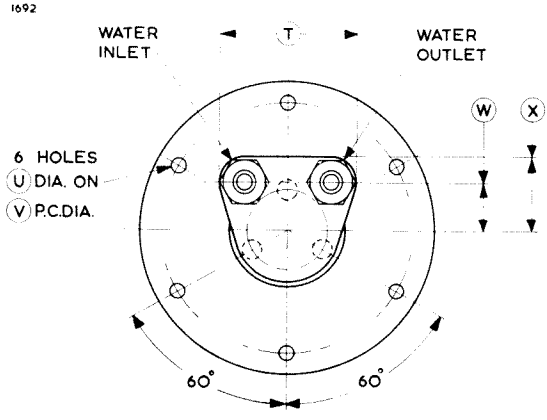


Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	8·583 Max	218·0 Max	K	0·323	8·20
B	2·756 ± 0·020	70·00 ± 0·50	L	4·134	105·0
C	2·323 Max	59·00 Max	M	0·413	10·50
D	0·472 Min	12·00 Min	N	1·378 ± 0·040	35·00 ± 1·00
E	0·098	2·50	P	0·358	9·10
F	2·323	59·00	Q	0·079	2·00
G	0·630 Max	16·00 Max	R	5·118	130·0
H	1·535	39·00	S	0·394	10·0
J	0·394	10·00			

Inch dimensions have been derived from millimetres.

Note. The filament centre tap post is marked 'O'

OUTLINE DETAILS FOR BW1162J3



VIEW FROM BELOW

Ref.	Inches	Millimetres
T	2·402	61·00
U	0·256	6·50
V	4·331 ± 0·040	110·0 ± 1·00
W	0·827	21·00
X	1·260	32·00

Inch dimensions have been derived from millimetres.

Printed in England

V.H.F. POWER TRIODES

BW1165
BW1165J3

ENGLISH ELECTRIC

ABRIDGED DATA

Water Cooled V.H.F. Triodes for A.M., F.M. or television transmitters and for industrial applications. BW1165 employs a separate water jacket; that of BW1165J3 is integral. The tubes are electrically identical.

	Class B Audio Amplifier	*Class C Telegraphy or F.M. Telephony*	*Class C Telephony*	*Class C Television*	
Anode Dissipation	6·0	6·0	4·0	5·0	kW Max
Anode Voltage	6·0	6·0	5·0	5·0	kV Max
Operating Frequency	—	220	220	220	Mc/s Max
Output Power	6·65 per valve	6·9	4·7	4·5 per valve	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	12·6	V
Filament Current	33	A
Peak Usable Cathode Current	8·5	A
Amplification Factor (V_a = 4·0kV, I_a = 1·0A)	32	
Mutual Conductance (V_a = 4·0kV, I_a = 1·0A)	17	mA/V
Inter-electrode Capacitances:		
Grid to Anode	11	pF
Grid to Filament	16	pF
Anode to Filament	0·3	pF

Mechanical

Overall Length:			
BW1165	7·480 inches	(190 mm)	Max
BW1165J3	8·583 inches	(218 mm)	Max
Overall Diameter:			
BW1165	2·776 inches	(70·5 mm)	Max
BW1165J3	5·130 inches	(130·3 mm)	Max
Net Weight:			
BW1165	1 pound	(0·45 kg)	Approx
BW1165J3	1·8 pounds	(0·7 kg)	Approx
Mounting Position	Vertical, filament pins up		

Accessories

Filament Connectors	MA146A
Centre-tap Dissipating Connector	MA146A
Grid Connector (above 30Mc/s)	MA147A
Water Jacket for BW1165	BW4088

ENGLISH ELECTRIC VALVE CO. LTD.

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ENGLISH ELECTRIC

COOLING

BW1165 Anode

The anode of this valve must be fitted into a water jacket for cooling, the recommended jacket being type BW4088. The required flows of water through the water jacket for various anode dissipations and water inlet temperatures are given in the following table.

Anode Dissipation (kW)	Inlet Temperature (°C)	Rate of Flow of Water gal/min	l./min	Pressure Drop across Jacket (atm)
1·0	20	0·55	2·5	0·08
1·0	50	0·66	3·0	0·10
2·0	20	0·55	2·5	0·08
2·0	50	1·10	5·0	0·30
4·0	20	0·88	4·0	0·18
4·0	50	1·98	9·0	0·90
6·0	20	1·32	6·0	0·4
6·0	50	3·08	14	2·5

BW1165J3 Anode

The BW1165J3 has an integral water jacket. Minimum water cooling requirements are shown on page 15; higher rates of flow should be used where possible.

It may be necessary to direct a flow of air on to the filament and grid seals in order to maintain their temperatures within the following limits:

Temperature of filament seals .. .. 210 °C Max
Temperature of grid and anode seals .. .. .. 180 °C Max

A heat dissipating connector such as MA146A must be used on the filament centre-tap pin.

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR (Class B)

MAXIMUM RATINGS (Absolute Values)

Anode Voltage	6·0 kV Max
Anode Current	1·5 A Max
Anode Input Power	9·0 kW Max
Anode Dissipation	6·0 kW Max
Grid Dissipation	120 W Max
Grid Circuit Resistance	15 kΩ Max
Cathode Current (Peak)	5·7 A Max

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TYPICAL OPERATING CONDITIONS

(Class B, 2 valves)

Anode Voltage	3·0	3·5	4·0	kV
Grid Voltage	−90	−100	−112	V
Peak A.F. Grid Voltage (per valve)	285	310	318	V
Anode Current (Zero Signal)	2×65	2×75	2×100	mA
Anode Current (Maximum Signal)	2×0·80	2×0·95	2×0·94	A
Grid Current (Maximum Signal)	2×0·20	2×0·18	2×0·19	A
Effective Load (Anode to Anode)	4·4	4·2	4·9	kΩ
Nominal Driving Power (Maximum Signal)	2×52	2×50	2×54	W
Anode Dissipation	2×0·75	2×1·0	2×1·1	kW
Output Power (Maximum Signal)	3·3	4·6	5·3	kW
Efficiency	69	70	71	%
Total Distortion	3·3	2·9	2·6	%

Anode Voltage	4·5	5·0	6·0	kV
Grid Voltage	−125	−138	−165	V
Peak A.F. Grid Voltage (per valve)	327	330	455	V
Anode Current (Zero Signal)	2×100	2×110	2×125	mA
Anode Current (Maximum Signal)	2×0·92	2×0·91	2×1·50	A
Grid Current (Maximum Signal)	2×0·19	2×0·14	2×0·28	A
Effective Load (Anode to Anode)	6·1	6·4	4·9	kΩ
Nominal Driving Power (Maximum Signal)	2×27	2×42	2×115	W
Anode Dissipation	2×1·15	2×1·25	2×2·35	kW
Output Power (Maximum Signal)	6·0	6·6	13·3	kW
Efficiency	72	73	74	%
Total Distortion	3·7	3·3	4·3	%

Printed in England

ENGLISH ELECTRIC

RADIO FREQUENCY POWER AMPLIFIER
(Class B Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	6·0 kV Max
Anode Current	1·1 A Max
Anode Input Power	6·6 kW Max
Anode Dissipation	6·0 kW Max
Grid Dissipation	120 W Max
Cathode Current (Peak)	4·6 A Max

TYPICAL OPERATING CONDITIONS
(frequency 75Mc/s)

Anode Voltage	5·0	6·0	kV
Grid Voltage	−145	−180	V
Peak R.F. Grid Voltage	225	250	V
Anode Current	900	990	mA
Grid Current (100% modulation)	320	300	mA
Driving Power (100% modulation)	160	170	W
Anode Dissipation	3·0	4·0	kW
Output Power	1·45	1·90	kW
Efficiency	32	32	%

RADIO FREQUENCY POWER AMPLIFIER
(Class C Telegraphy, key down conditions, or F.M. Telephony, per valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	6·0 kV Max
Anode Current	1·5 A Max
Anode Input Power	9·0 kW Max
Anode Dissipation	6·0 kW Max
Grid Voltage (negative value)	1·0 kV Max
Grid Current	0·35 A Max
Grid Dissipation	120 W Max
Cathode Current (Peak)	8·5 A Max

TYPICAL OPERATING CONDITIONS
(Grounded Cathode)

Frequency	75	75	75	110	Mc/s
Anode Voltage	4·0	5·0	6·0	5·0	kV
Grid Voltage	−200	−300	−400	−300	V
Peak R.F. Grid Voltage	500	640	740	640	V
Anode Current	1·37	1·50	1·50	1·25	A
Grid Current	350	330	310	300	mA
Nominal Driving Power	190	240	275	250	W
Anode Dissipation	1·5	1·9	2·1	1·45	kW
Output Power	4·0	5·6	6·9	4·8	kW
Efficiency	73	75	76·5	70	%

TYPICAL OPERATING CONDITIONS
(Grounded Grid, 2 valves)

Frequency	75	110	110	220	Mc/s
Anode Voltage	6·0	4·0	5·0	4·0	kV
Filament-Grid Voltage	400	200	300	200	V
Peak R.F. Voltage, filament to filament	1480	1000	1280	900	V
Anode Current	2 × 1·5	2 × 1·37	2 × 1·5	2 × 1·25	A
Grid Current	2 × 310	2 × 350	2 × 330	2 × 220	mA
Nominal Driving Power	2 × 1190	2 × 705	2 × 965	2 × 395	W
Anode Dissipation	2 × 2·1	2 × 1·7	2 × 2·2	2 × 2·5	kW
Output Power (*See Note* 2)	15·6	8·6	12	5·6	kW
Efficiency	77	69	71	50	%

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ENGLISH ELECTRIC

ANODE MODULATED R.F. POWER AMPLIFIER

(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	5·0 kV Max
Anode Current	1·3 A Max
Anode Input Power	6·5 kW Max
Anode Dissipation	4·0 kW Max
Grid Voltage (negative value)	1·0 kV Max
Grid Current	0·35 A Max
Grid Dissipation	120 W Max
Cathode Current (Peak)	5·7 A Max

TYPICAL OPERATING CONDITIONS

Frequency	75	75	75	Mc/s
Anode Voltage	3·0	3·5	4·0	kV
Grid Voltage	−250	−300	−300	V
Peak R.F. Grid Voltage	510	600	600	V
Anode Current	1·0	1·2	1·2	A
Grid Current	0·3	0·3	0·3	A
Nominal Driving Power	170	205	205	W
Anode Dissipation	0·8	1·2	1·3	kW
Output Power	2·2	3·0	3·5	kW
Efficiency	73	71·5	73	%

Frequency	75	75	110	Mc/s
Anode Voltage	4·5	5·0	4·0	kV
Grid Voltage	−350	−400	−350	V
Peak R.F. Grid Voltage	650	690	600	V
Anode Current	1·2	1·2	0·93	A
Grid Current	0·3	0·3	0·24	A
Nominal Driving Power	230	205	130	W
Anode Dissipation	1·3	1·3	0·92	kW
Output Power	4·1	4·7	2·8	kW
Efficiency	76	78	75	%

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CLASS C TELEVISION SERVICE, GRID-MODULATED
MAXIMUM RATINGS
(Absolute Values)

	Up to 75Mc/s	*Up to 220Mc/s*	
Anode Voltage	5·0	4·0	kV Max
Anode Current	1·9	1·6	A Max
Anode Input Power	9·5	6·5	kW Max
Anode Dissipation (sync. level)	5·0	4·0	kW Max
Grid Voltage (negative value) (sync. level)	1·0	1·0	kV Max
Grid Current	0·25	0·25	A Max
Grid Dissipation (sync. level)	120	120	W Max
Cathode Current (Peak)	10	10	A Max

TYPICAL OPERATING CONDITIONS
(Negative modulation, positive synchronisation)
(Two valves)

Frequency	48 to 75	170 to 220	Mc/s
Anode Voltage	5·0	4·0	kV
Grid Voltage:			
peak sync.	−200	−150	V
black level	−300	−225	V
white level	−550	−500	V
Peak R.F. Grid to Grid Voltage (sync. level)	1·0	1·0	kV
Anode Current:			
peak sync.	2×1·9	2×1·6	A
black level	2×1·3	2×1·3	A
Grid Current:			
peak sync.	2×0·250	2×0·20	A
black level	2×0·175	2×0·11	A
Nominal Driving Power (sync. level)	2×250	2×400	W
Output Power (sync. level)	9·0	6·0	kW
Power into Load (sync. level) (*See Note* 3)	6·3	4·2	kW
Bandwidth (*See Note* 4):			
to −3db points	8·00	10	Mc/s
to −1·5db points	5·25	6·5	Mc/s

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TYPICAL OPERATING CONDITIONS

(Positive modulation, negative synchronisation)
(Two valves)

Frequency	48 to 75	Mc/s
Anode Voltage	5·0	kV
Grid Voltage:		
white level	−200	V
black level	−460	V
peak sync.	−580	V
Peak R.F. Grid to Grid Voltage (white level)	1·0	kV
Anode Current:		
white level	2×1·9	A
black level	2×0·4	A
Grid Current:		
white level	2×250	mA
black level	0	mA
Nominal Driving Power (white level)	2×250	W
Output Power (white level)	9·0	kW
Power into Load (white level) (*See Note* 3)	6·3	kW
Bandwidth (*See Note* 4):		
to −3db points	8·0	Mc/s
to −1·5db points	5·25	Mc/s

RADIO FREQUENCY OSCILLATOR FOR INDUSTRIAL SERVICE

(Class C, anode supply from unfiltered two-phase half-wave rectifier)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	5·4	kV Max
Anode Current	1·35	A Max
Anode Input Power	9·0	kW Max
Anode Dissipation	5·0	kW Max
Grid Voltage (negative value)	900	V Max
Grid Current	0·31	A Max
Grid Dissipation	120	W Max

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TYPICAL OPERATING CONDITIONS

Output Voltage (r.m.s.) from Transformer	5·1	6·0	kV
Anode Voltage	4·6	5·4	kV
Anode Current	1·15	1·35	A
Grid Current	0·27	0·31	A
Anode Dissipation	1·84	2·3	kW
Grid Resistor	1·1	1·3	kΩ
Nominal Driving Power	160	210	W
Output Power	4·5	6·5	kW
Efficiency	70	72	%

RADIO FREQUENCY OSCILLATOR FOR INDUSTRIAL SERVICE

(Class C, anode supply unrectified a.c.)

MAXIMUM RATINGS

(Absolute Values)

Output Voltage (r.m.s.) from Transformer	6·8 kV Max
Anode Current	0·8 A Max
Anode Input Power	9·0 kW Max
Anode Dissipation	5·0 kW Max
Grid Voltage (negative value)	640 V Max
Grid Current	190 mA Max
Grid Dissipation	120 W Max
Operating Frequency	75 Mc/s Max

TYPICAL OPERATING CONDITIONS

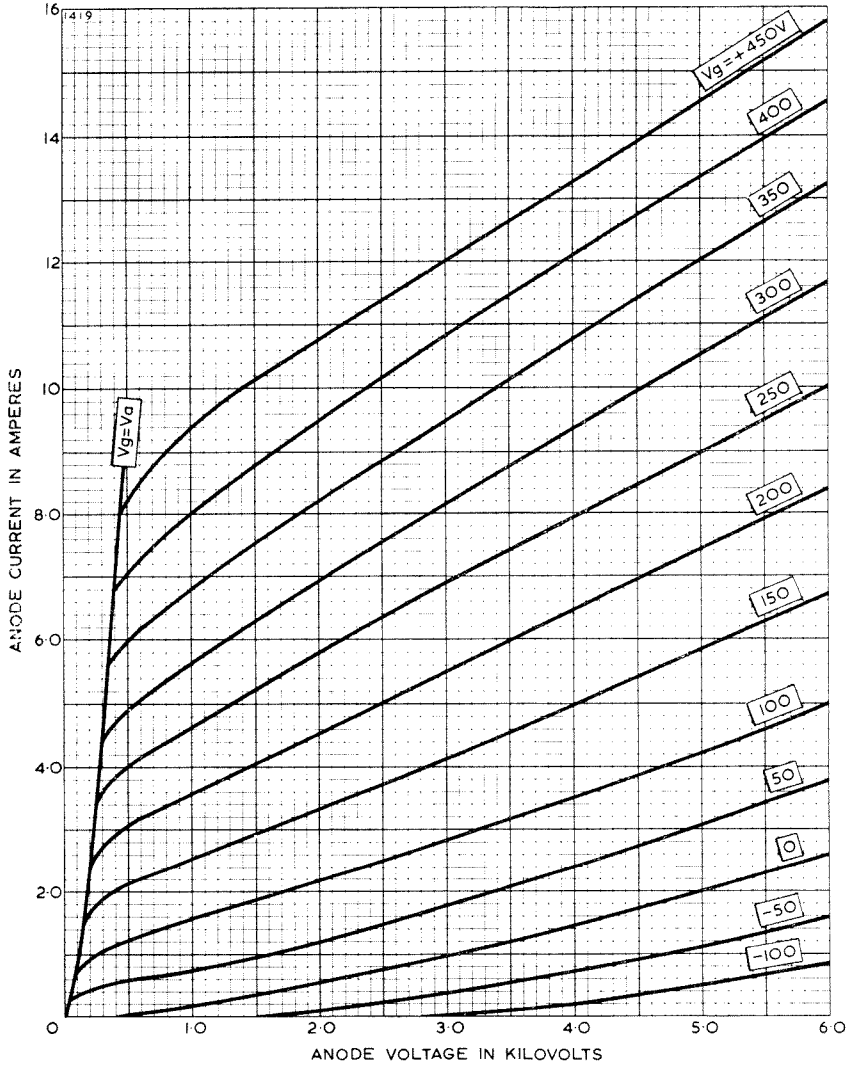
Output Voltage (r.m.s.) from Transformer	5·9	6·8	kV
Grid Voltage	−173	−200	V
from Grid Resistor	1050	1050	Ω
Anode Current	0·7	0·8	A
Grid Current (approx)	165	190	mA
Anode Dissipation	1·24	1·5	kW
Output Power	3·36	4·55	kW
Efficiency	73	75	%

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed +5% or −10%. The centre-tap lead is not an electrical centre-tap and must not be used for the filament current supply. At frequencies above 30Mc/s, all three filament leads should be interconnected with suitable capacitors.
2. This includes the power transferred from the drive circuit.
3. Assuming circuit transfer efficiency of 70%.
4. For a bandwidth based on one inductor-capacitor circuit.

ENGLISH ELECTRIC

ANODE CHARACTERISTICS



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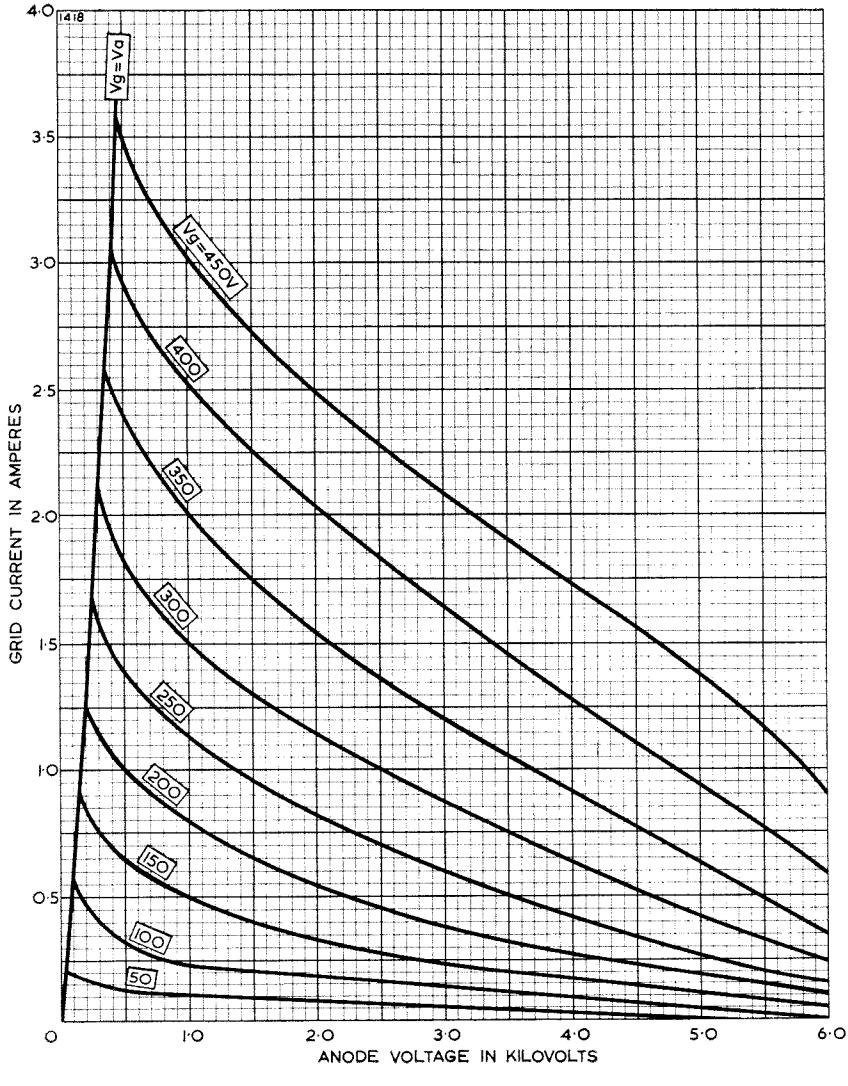
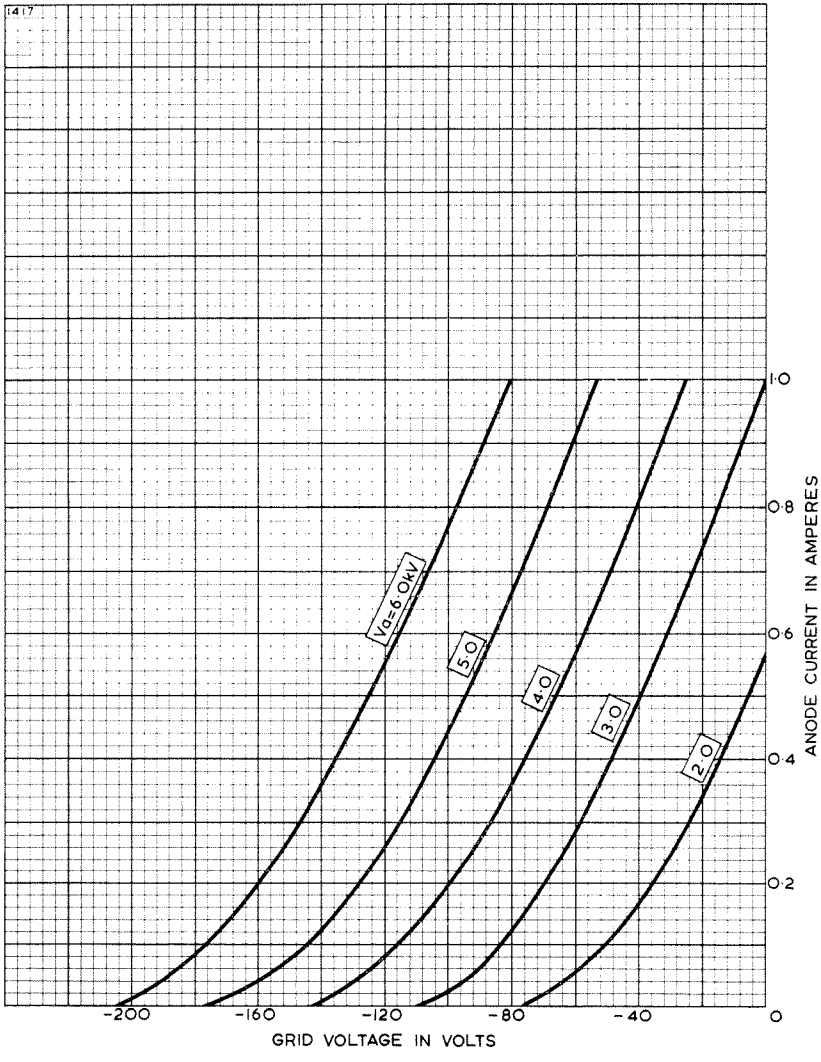
GRID CHARACTERISTICS

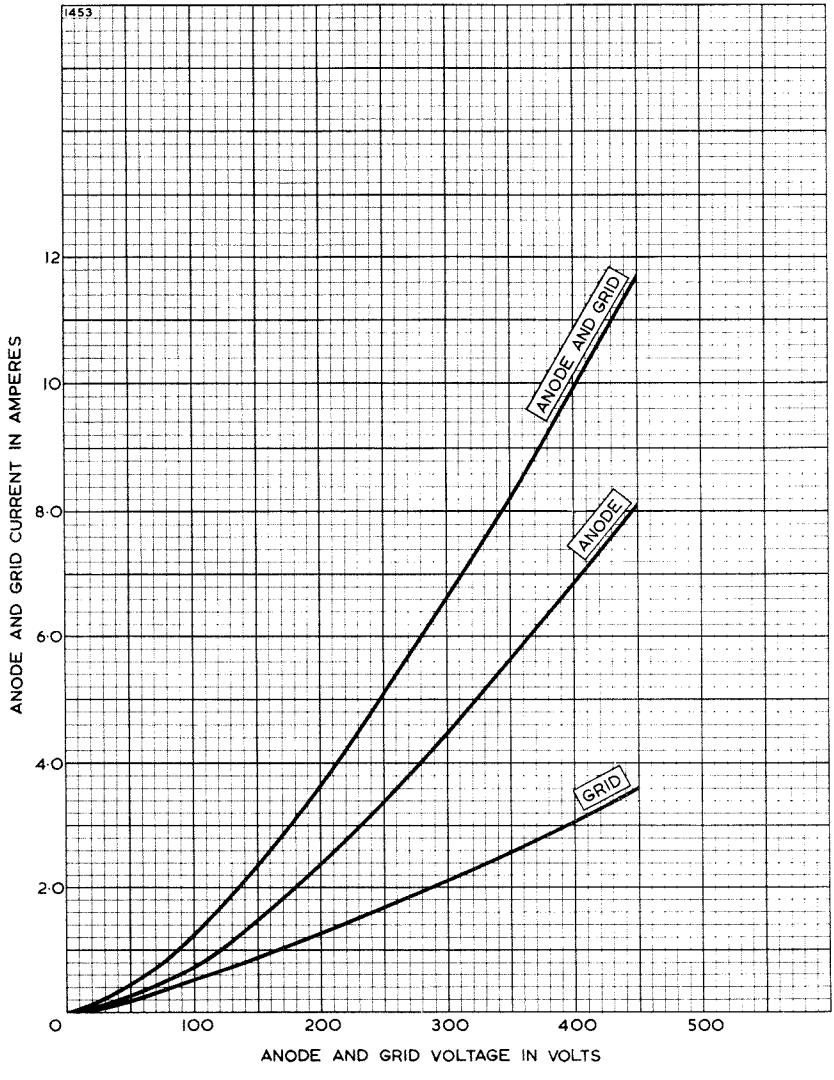


ENGLISH ELECTRIC

ANODE CURRENT—GRID VOLTAGE CHARACTERISTICS



STRAPPED CHARACTERISTICS



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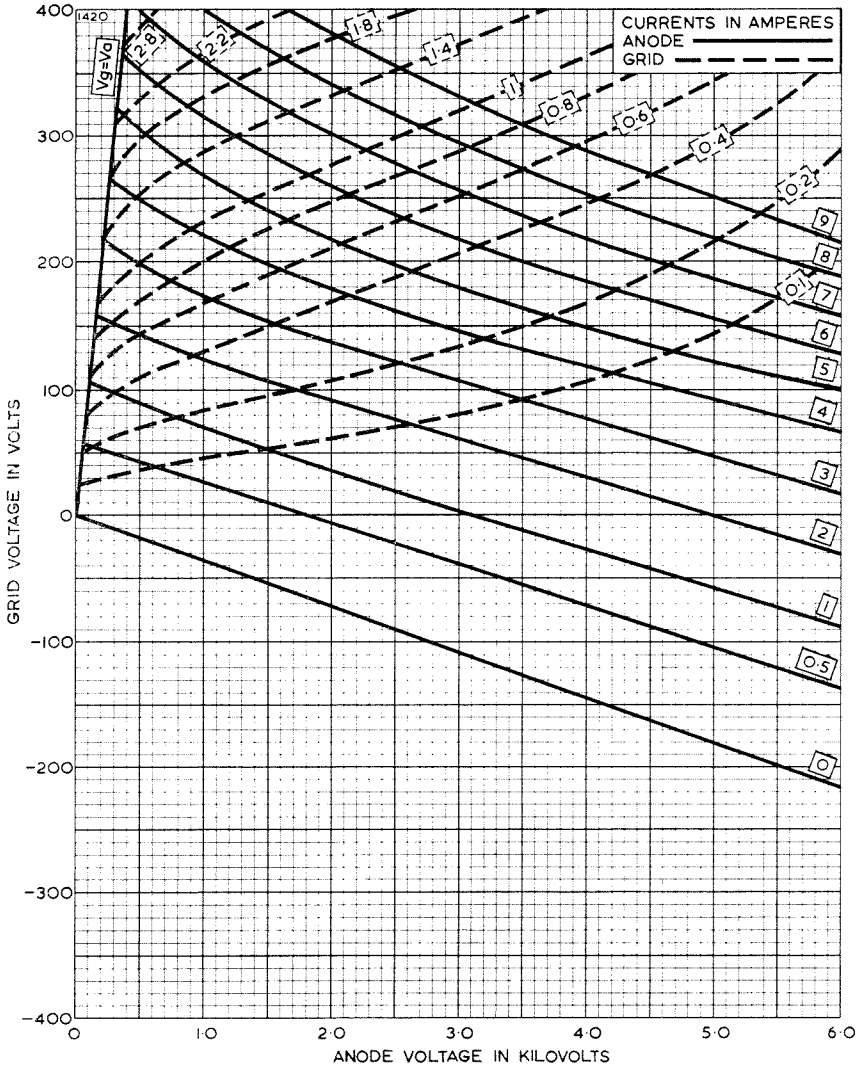
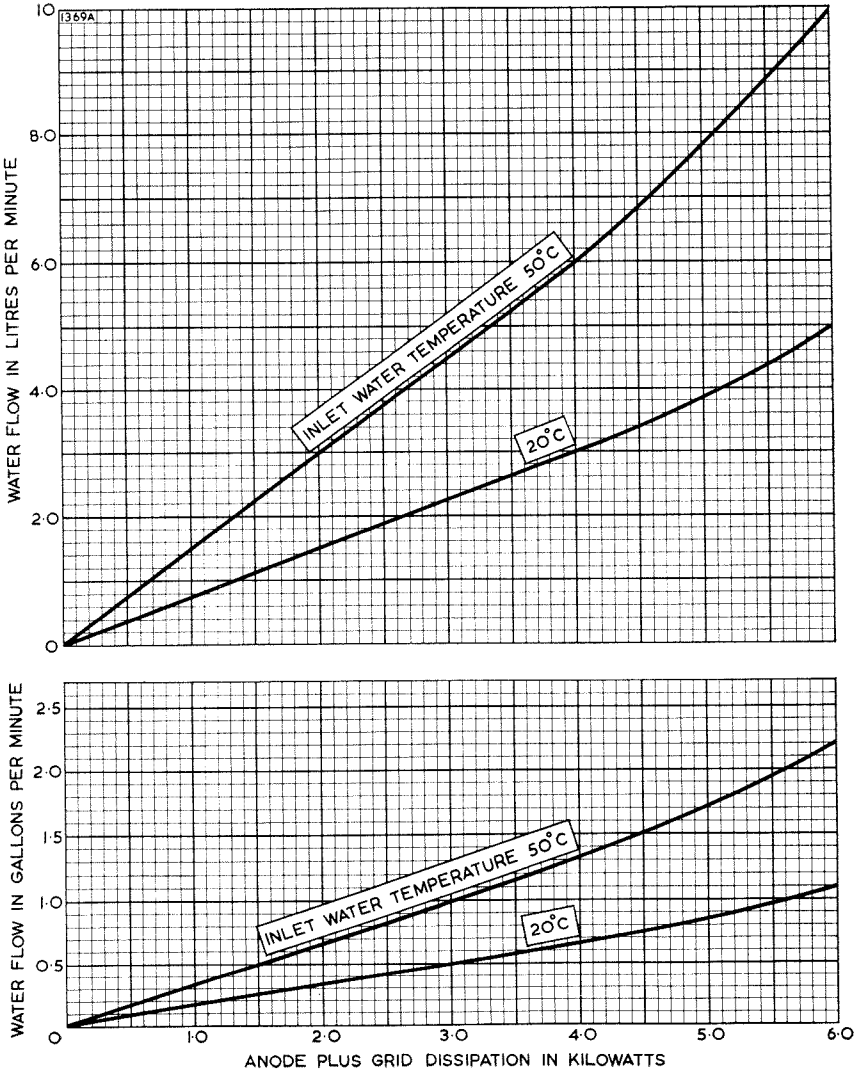
ENGLISH ELECTRIC

CONSTANT CURRENT CHARACTERISTICS



MINIMUM WATER COOLING REQUIREMENTS FOR BW1165J3
(Higher rates of flow should be used where possible)



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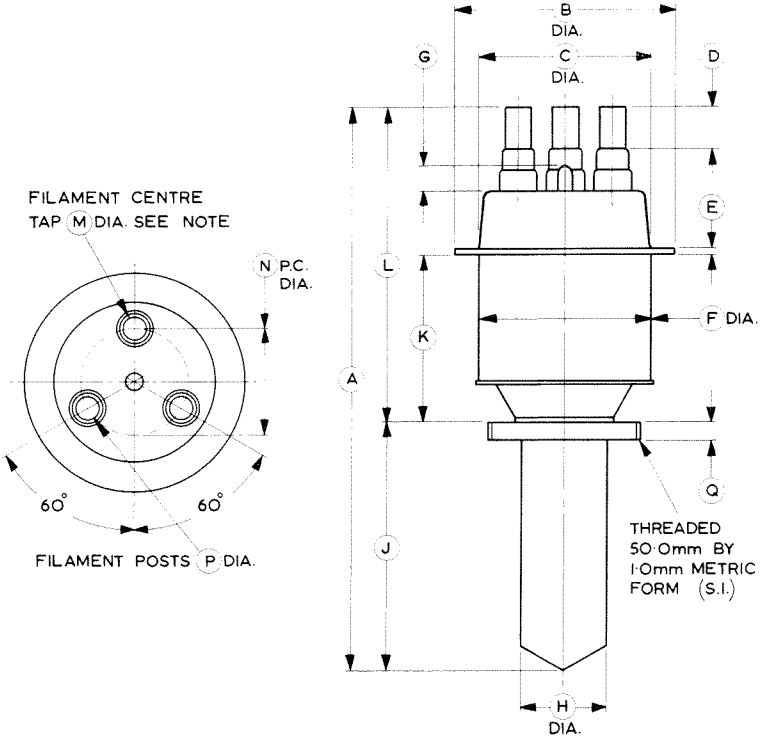
OUTLINE FOR BW1165

1215A



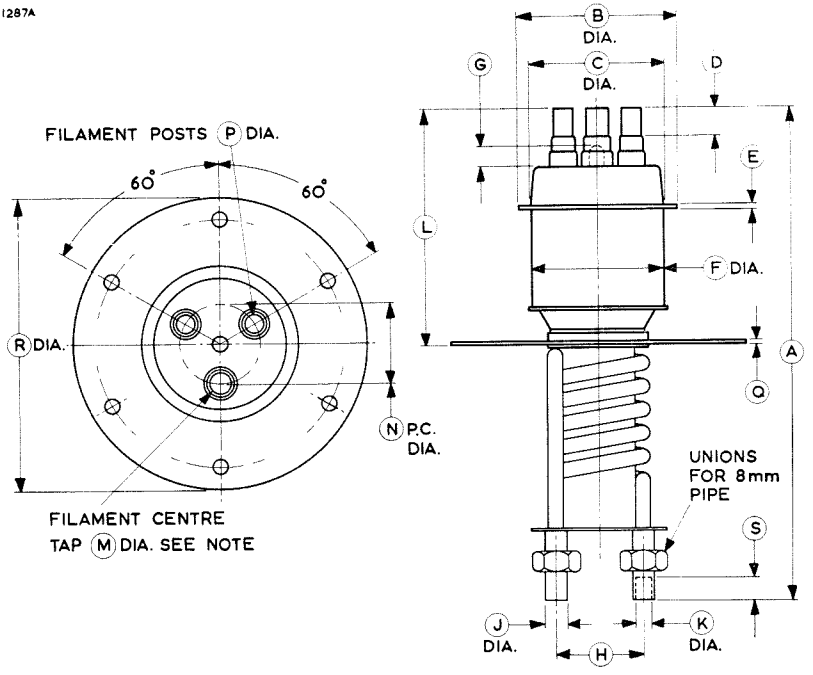
Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	7·480 Max	190·0 Max	J	3·268	83·00
B	2·756 ± 0·020	70·00 ± 0·50	K	2·205	56·00
C	2·323 Max	59·00 Max	L	4·173	106·0
D	0·472 Min	12·00 Min	M	0·358	9·10
E	0·098	2·50	N	1·378 ± 0·040	35·00 ± 1·00
F	2·323	59·00	P	0·358	9·10
G	0·630 Max	16·00 Max	Q	0·246	6·25
H	1·142	29·00			

Inch dimensions have been derived from millimetres.

Note The filament centre tap post is marked 'O'

OUTLINE FOR BW1165J3

(See page 18 for outline details)



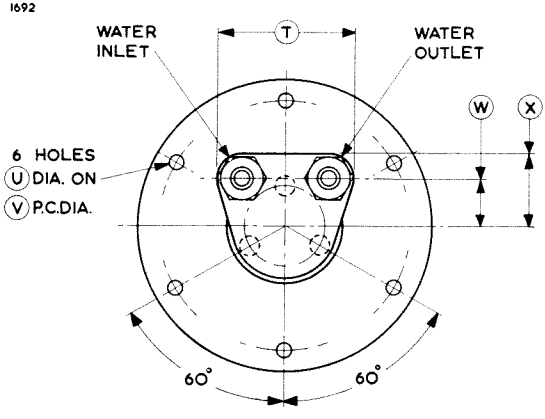
Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	8·583 Max	218·0 Max	K	0·323	8·20
B	2·756 ± 0·020	70·00 ± 0·50	L	4·134	105·0
C	2·323 Max	59·00 Max	M	0·358	9·10
D	0·472 Min	12·00 Min	N	1·378 ± 0·040	35·00 ± 1·00
E	0·098	2·50	P	0·358	9·10
F	2·323	59·00	Q	0·079	2·00
G	0·630 Max	16·00 Max	R	5·118	130·0
H	1·535	39·00	S	0·394	10·0
J	0·394	10·00			

Inch dimensions have been derived from millimetres.

Note The filament centre tap post is marked 'O'

ENGLISH ELECTRIC

OUTLINE DETAILS FOR BW1165J3



VIEW FROM BELOW

Ref.	Inches	Millimetres
T	2·402	61·00
U	0·256	6·50
V	4·331 ± 0·040	110·0 ± 1·00
W	0·827	21·00
X	1·260	32·00

Inch dimensions have been derived from millimetres.

R.F. POWER TRIODE

BW1169J3

ENGLISH ELECTRIC

ABRIDGED DATA

Water Cooled Triode with integral helical water jacket, intended primarily for industrial service.

Anode Dissipation	10 kW Max
Anode Voltage	7·5 kV Max
Frequency for full ratings	20 Mc/s Max
Output Power (Class C unmodulated)	18 kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note*)	6·6	V
Filament Current	103	A
Filament Cold Resistance	0·0075	Ω
Peak Usable Cathode Current	20	A
Perveance	3·6	$mA/V^{3/2}$
Amplification Factor (V_a = 2·0kV, I_a = 1·0A)	11	
Mutual Conductance (V_a = 2·0kV, I_a = 2·75A)	43·5	mA/V
Inter-electrode Capacitances:		
Grid to Anode	36·5	pF
Grid to Filament	47·5	pF
Anode to Filament	2·35	pF

Mechanical

Overall Length	10·500 inches	(266·7 mm)	Max
Overall Diameter	5·250 inches	(133·4 mm)	Max
Net Weight	5·5 pounds	(2·5 kg)	Approx
Mounting Position	Vertical, filament end up or down		

Accessories

Outer Filament Connector	MA208A
Inner Filament Connector	MA208B
Grid Connector	MA208

COOLING

The anode of this valve has an integral helical water jacket. Minimum water cooling requirements are shown on page 6; higher rates of flow should be used where possible. The temperature of the cooling water at the outlet must not exceed 65°C.

The temperature of the filament and grid seals must not exceed 180°C. A flow of air of 15 to 20ft³/min (0·43 to 0·57m³/min) directed onto the filament terminals via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

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

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R.F. POWER TRIODE

BW1169J3

ENGLISH ELECTRIC

R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	7·5 kV Max
Anode Current	3·5 A Max
Anode Dissipation	10 kW Max
Grid Dissipation	250 W Max
Frequency	20 Mc/s Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	6·5	kV
Grid Voltage	900	V
from Grid Resistor	2000	Ω
Peak R. F. Grid Voltage	1150	V
Anode Current	3·5	A
Grid Current	0·45	A
Anode Dissipation	4·2	kW
Grid Dissipation	110	W
Driving Power	520	W
Output Power	18	kW
Efficiency	79	%
Load Resistance	940	Ω

NOTE

The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%. The filament may be switched on at its operating voltage and no surge limiting devices need be incorporated in the filament circuit.

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CHELMSFORD
ENGLAND

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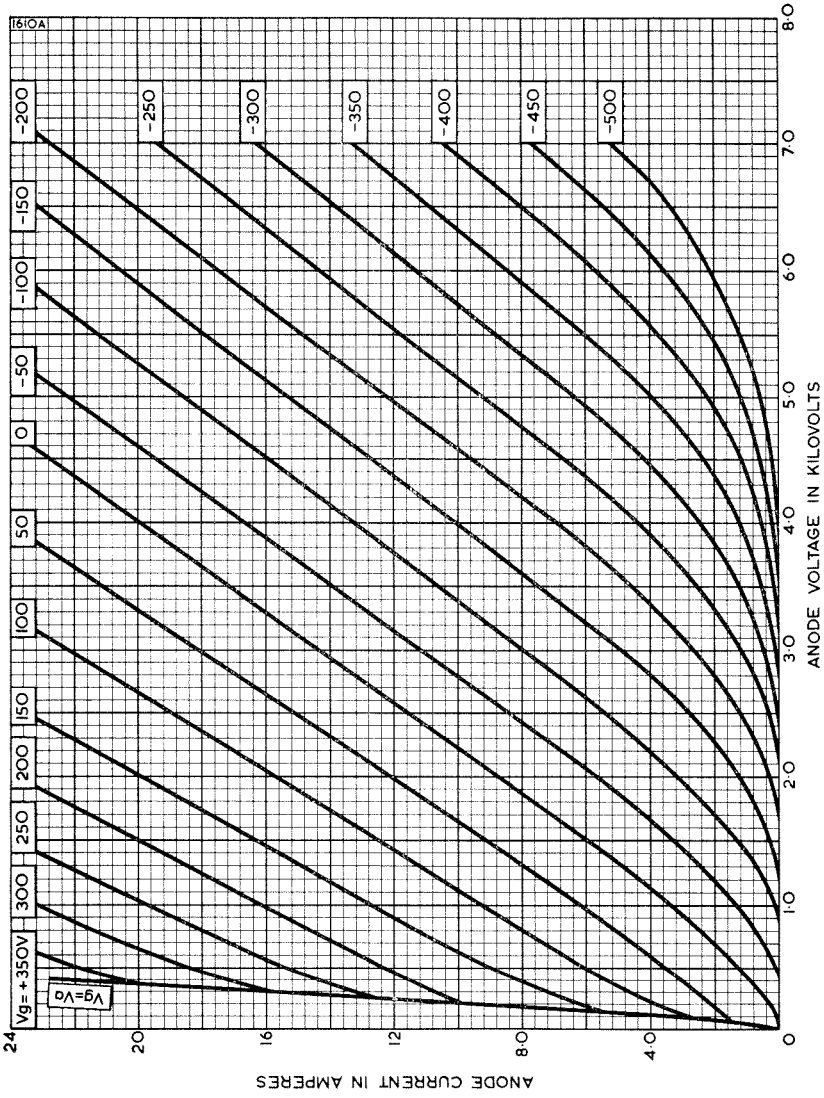
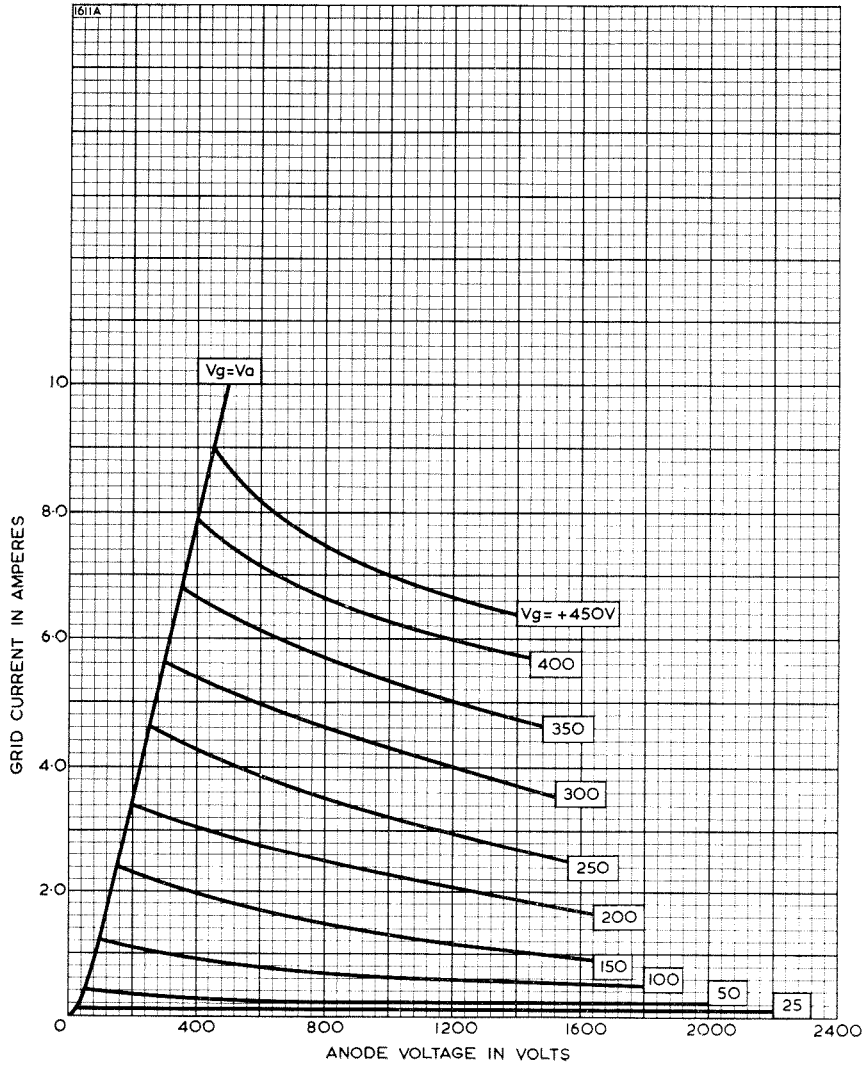
ANODE CHARACTERISTICS



ENGLISH ELECTRIC

GRID CHARACTERISTICS



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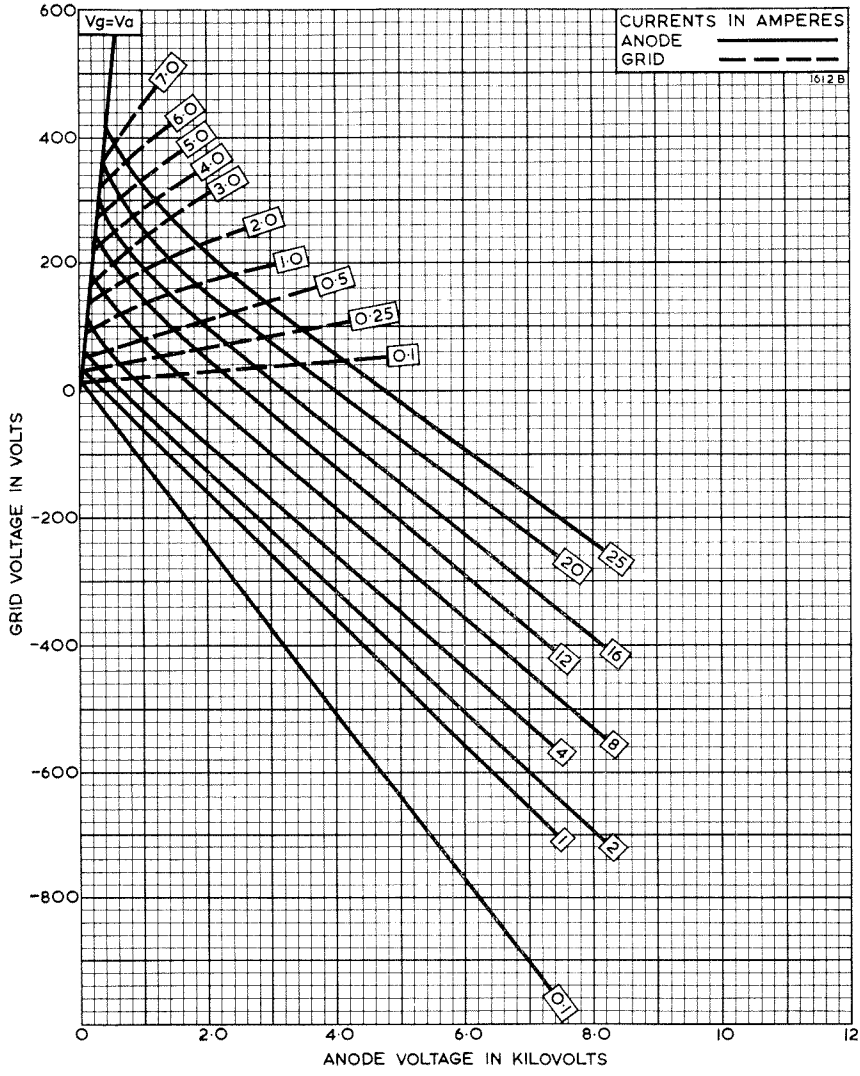
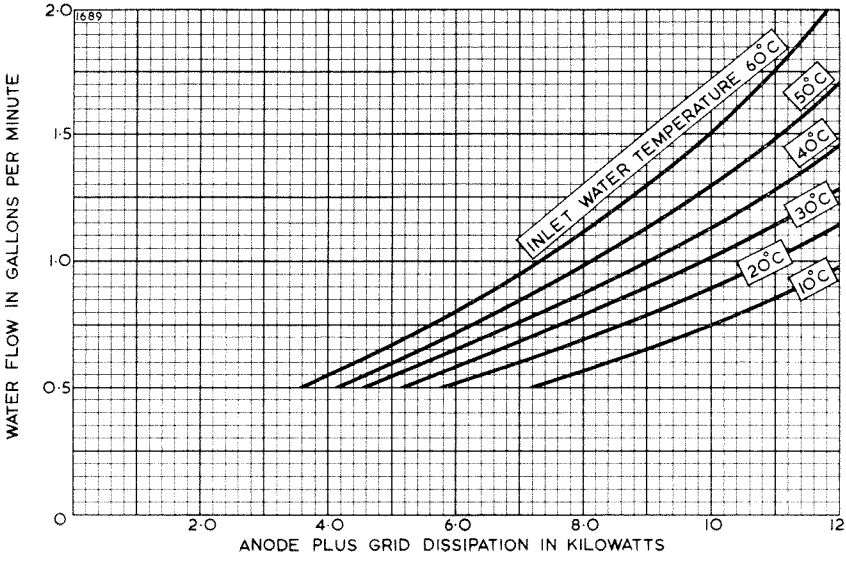
CONSTANT CURRENT CHARACTERISTICS

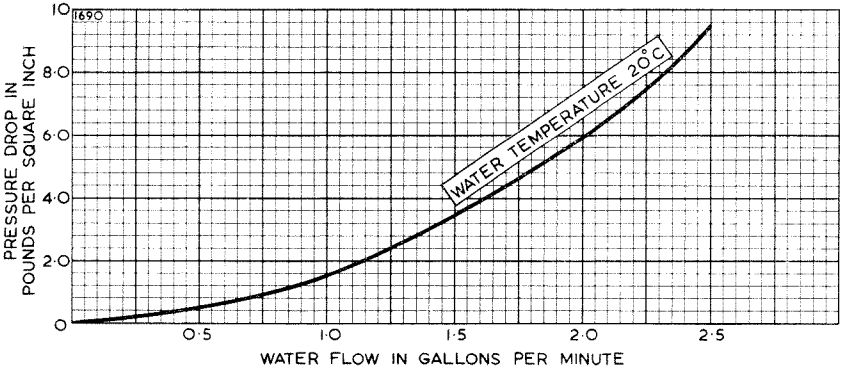


ENGLISH ELECTRIC

MINIMUM WATER COOLING REQUIREMENTS
(Higher rates of flow should be used where possible)



PRESSURE DROP ACROSS WATER JACKET



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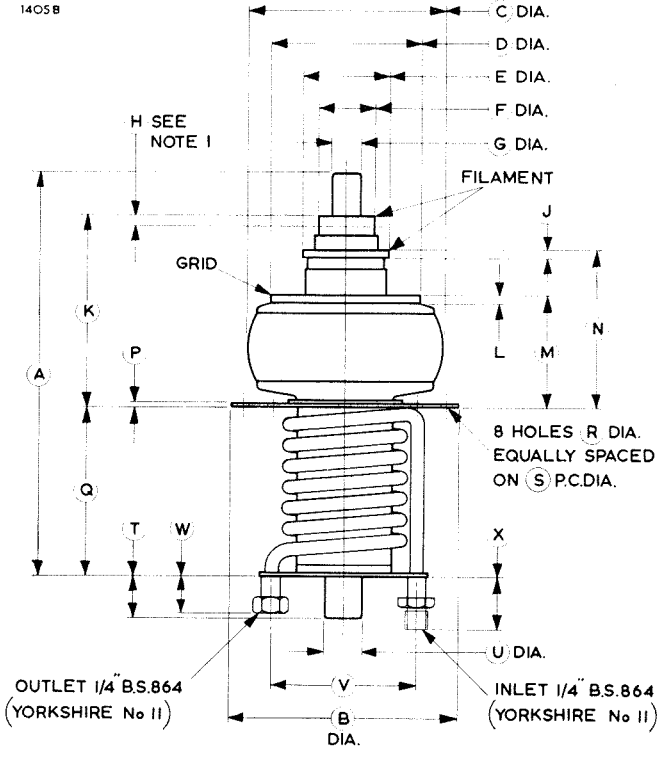
OUTLINE

(See Page 8 for Outline Detail and Outline Notes)

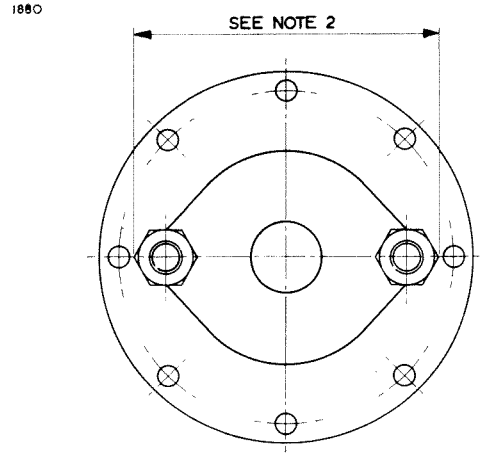


Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	9·300	236·2	M	2·656	67·46
B	5·250	133·4	N	3·687	93·65
C	4·500	114·3	P	0·128	3·25
D	3·500	88·90	Q	3·830	97·28
E	2·000	50·80	R	0·257	6·53
F	1·250	31·75	S	4·687	119·0
G	0·625	15·88	T	1·000	25·40
H	0·219 ± 0·031	5·56 ± 0·79	U	0·870	22·10
J	0·250	6·35	V	3·375	85·73
K	4·470	113·5	W	0·985	25·02
L	0·218	5·54	X	1·250	31·75

Millimetre dimensions have been derived from inches.

ENGLISH ELECTRIC

OUTLINE DETAIL
(Enlarged View from below)



OUTLINE NOTES

1. The filament contact surface may be clamped only within this area.
2. This dimension will pass through a hole of 4·250 inches (108·0mm) minimum diameter.

R.F. POWER TRIODES

BW1176J1 BW1176J2

ENGLISH ELECTRIC

ABRIDGED DATA

Water Cooled Triodes with integral water jackets, intended primarily for industrial service and differing only in the location of the water jacket inlet and outlet connectors.

Anode Dissipation	20	kW Max
Anode Voltage	10	kV Max
Frequency for full ratings	50	MHz Max
Output Power (Class C unmodulated conditions)	70	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	8·2	V
Filament Current	230	A
Filament Starting Current (Peak) (*See Note* 2)	600	A Max
Filament Cold Resistance	4·0	mΩ
Peak Usable Cathode Current	60	A
Perveance	3·0	$mA/V^{3/2}$
Amplification Factor (V_a = 6·0kV, I_a = 4·0A)	38	
Mutual Conductance (V_a = 7·0kV, I_a = 4·0A)	60	mA/V
Inter-electrode Capacitances:		
Grid to Anode	57	pF
Grid to Filament	105	pF
Anode to Filament	1·1	pF

Mechanical

Overall Length	17·785 inches	(451·7 mm)	Max
Overall Width	6·500 inches	(165·1 mm)	Nom
Net Weight	14 pounds	(6·4 kg)	Approx
Mounting Position		Vertical, filament end up	
Accessories:			
Filament Leads			MA131
Grid Connector			MA66

COOLING

Types BW1176J1 and BW1176J2 have integral water jackets and differ only in the location of the water inlet and outlet connectors (see outline drawings).

Minimum water cooling requirements are shown on page 6; higher rates of flow should be used where possible.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 20 to $30ft^3$/min (0·57 to $0·85m^3$/min) directed into the filament header via a 1-inch (25mm) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of the seals. The bulb temperature must not exceed 180°C.

ENGLISH ELECTRIC VALVE CO. LTD. CHELMSFORD ENGLAND

Printed in England

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage (*See Note* 3)	10	kV Max
Anode Current	8·6	A Max
Anode Dissipation (*See Note* 4)	20	kW Max
Grid Dissipation	1·0	kW Max
Operating Frequency (for full ratings)	50	MHz Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	8·0	10	kV
Grid Voltage	−420	−520	V
from Grid Resistor	380	475	Ω
Peak Positive R.F. Grid Voltage	425	435	V
Anode Current	8·5	8·6	A
Grid Current (Approx)	1·1	1·1	A
Anode Dissipation	12·8	15	kW
Grid Dissipation	470	480	W
Driving Power	940	1050	W
Output Power	54	70	kW
Efficiency	79	81	%
Load Resistance	500	625	Ω

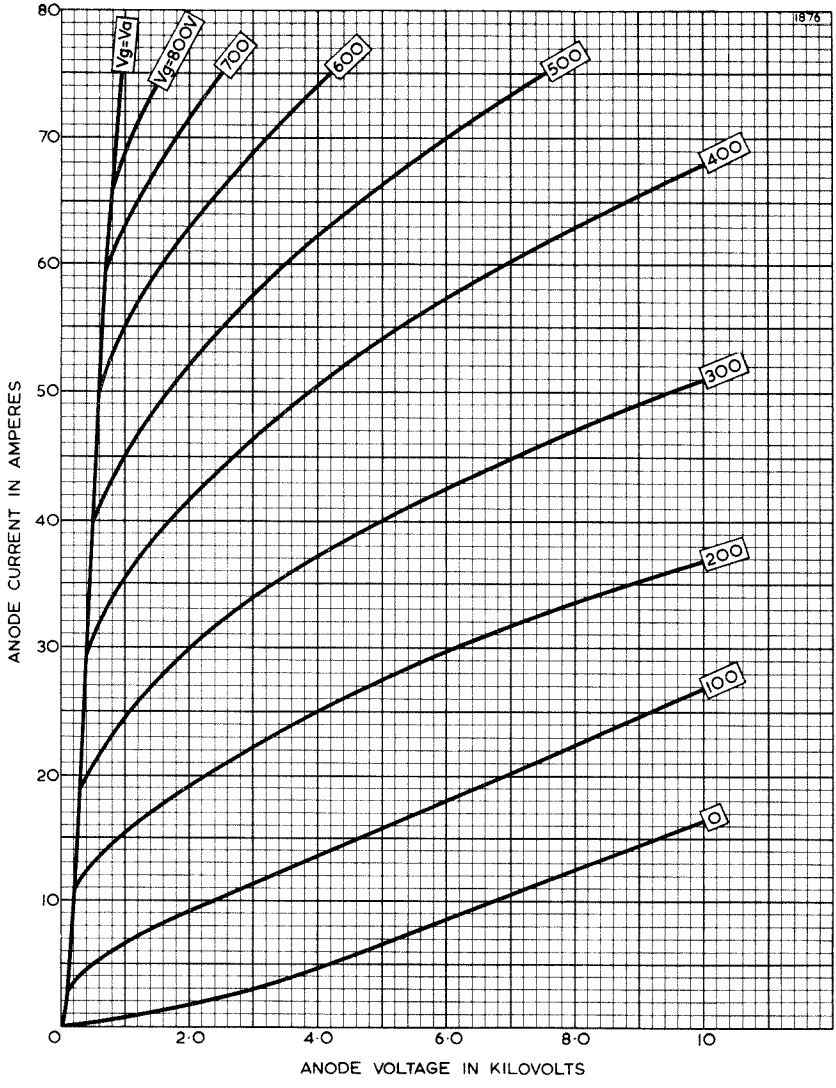
RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 8·2V	207	253	A
Amplification Factor (V_a = 6·0kV, I_a = 4·0A)	32	44	
Mutual Conductance (V_a = 7·0kV, I_a = 4·0A)	54	66	mA/V
Anode Current (V_a = 1·5kV, V_g = +600V)	53	65	A
Grid Current (V_a = 1·5kV, V_g = +600V)	8·0	12	A

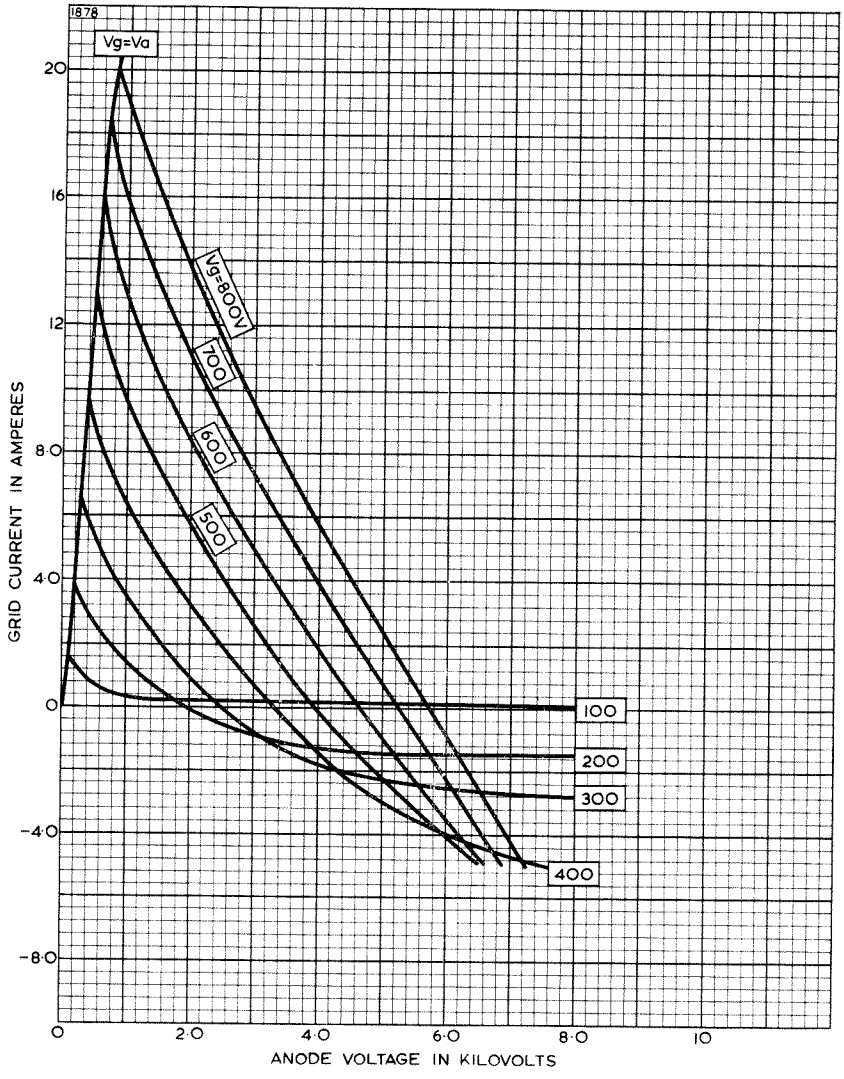
NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%.
2. The filament current must not exceed 600A, even momentarily, at any time.
3. This is the highest nominal operating voltage to be used. It makes allowance for the normal mains voltage fluctuations as well as tolerances in the equipment.
4. The valve can dissipate higher powers for periods up to 15 seconds provided that the average over a long period does not exceed the maximum stated.

ANODE CHARACTERISTICS



GRID CHARACTERISTICS



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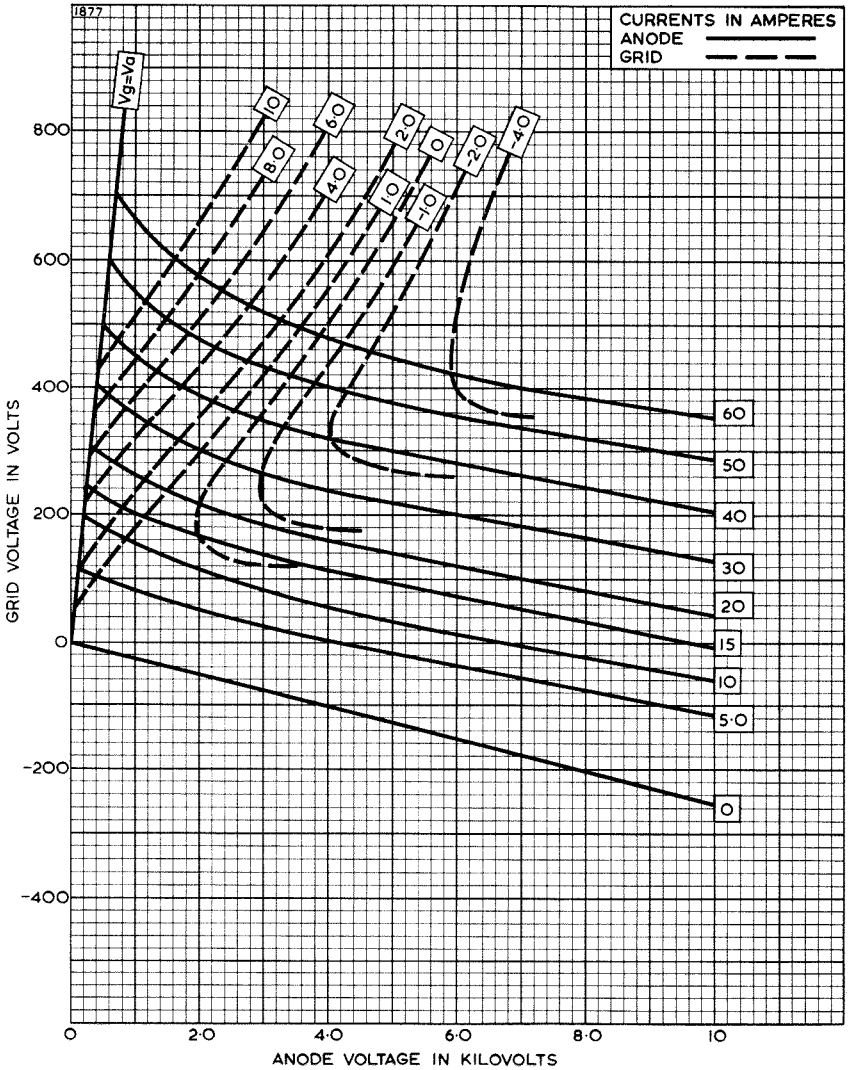
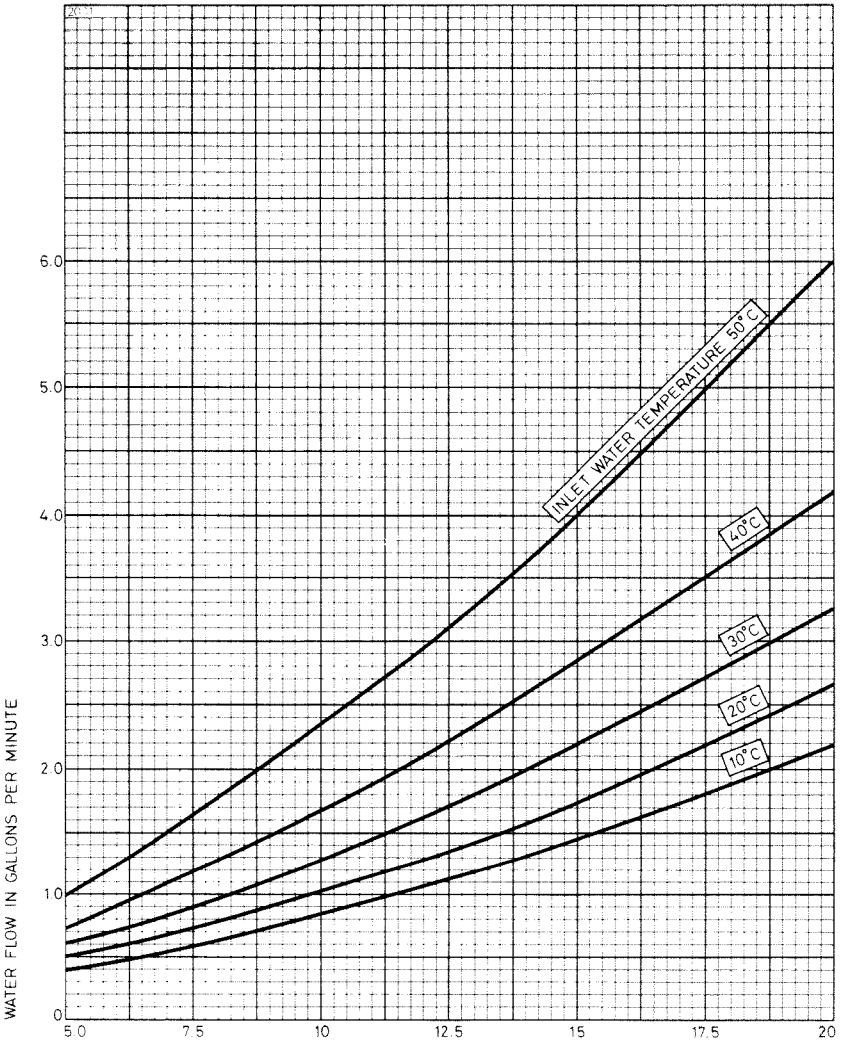
CONSTANT CURRENT CHARACTERISTICS



ENGLISH ELECTRIC

MINIMUM WATER COOLING REQUIREMENTS



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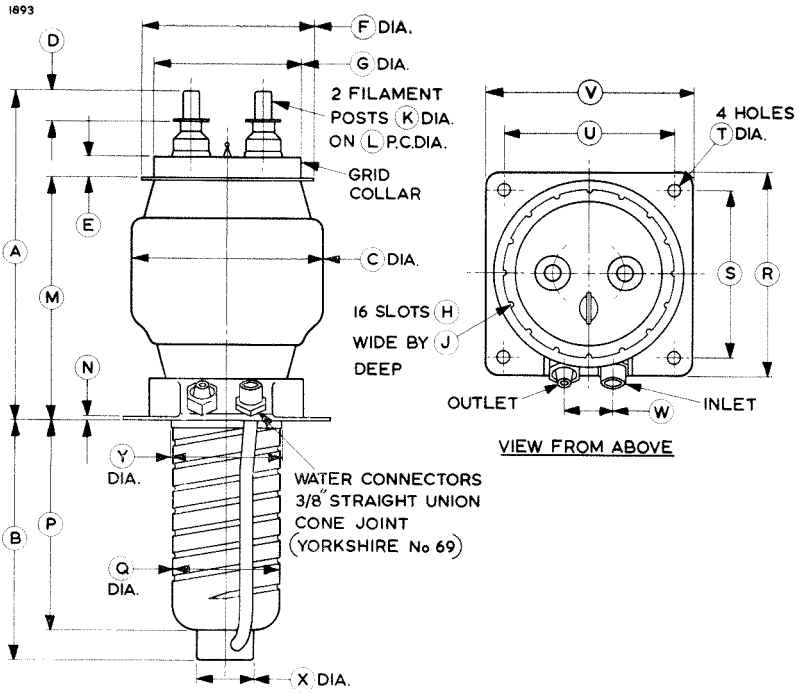
OUTLINE FOR BW1176J1



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	10·250 Max	260·4 Max	N	0·125	3·18
B	7·535 Max	191·4 Max	P	6·555	166·5
C	6·000 Max	152·4 Max	Q	3·562	90·47
D	1·000	25·40	R	6·500	165·1
E	0·734	18·64	S	5·000	127·0
F	5·630	143·0	T	0·375	9·53
G	4·703	119·5	U	5·000	127·0
H	0·153	3·89	V	6·500	165·1
J	0·205	5·21	W	1·250	31·75
K	0·625	15·88	X	2·000	50·80
L	2·250	57·15	Y	3·875	98·43
M	7·750 Max	196·9 Max			

Millimetre dimensions have been derived from inches.

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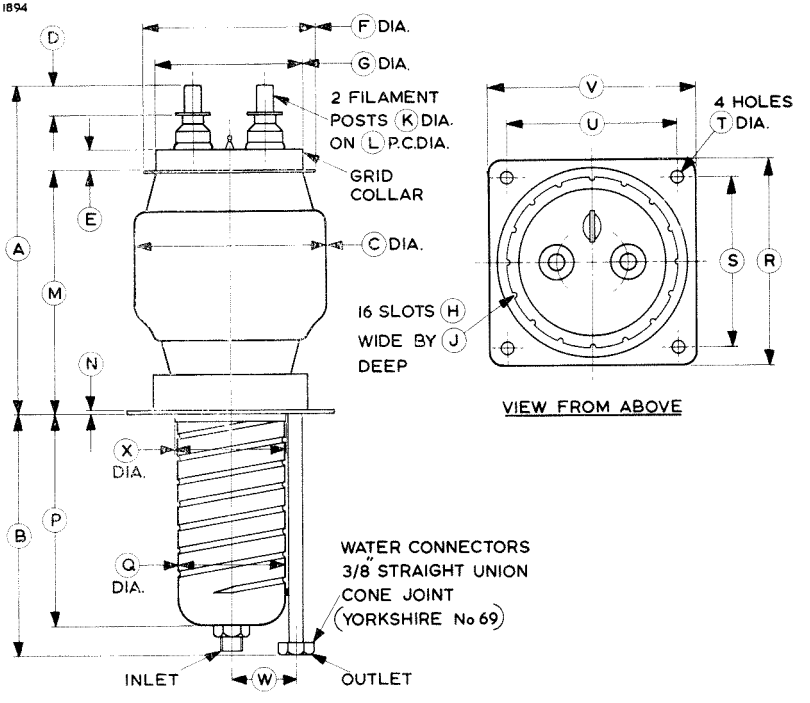
OUTLINE FOR BW1176J2



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	10·250 Max	260·4 Max	M	7·750 Max	196·9 Max
B	7·535 Max	191·4 Max	N	0·125	3·18
C	6·000 Max	152·4 Max	P	6·555	166·5
D	1·000	25·40	Q	3·562	90·47
E	0·734	18·64	R	6·500	165·1
F	5·630	143·0	S	5·000	127·0
G	4·703	119·5	T	0·375	9·53
H	0·153	3·89	U	5·000	127·0
J	0·205	5·21	V	6·500	165·1
K	0·625	15·88	W	2·170	55·12
L	2·250	57·15	X	3·875	98·43

Millimetre dimensions have been derived from inches.

BW1181J3

R.F. POWER TRIODE

ABRIDGED DATA

Water cooled triode with integral helical water jacket and ceramic/metal envelope, intended primarily for industrial service. The valve is electrically identical with BW1169J3 apart from its higher anode voltage and current ratings; these enable BW1181J3 to handle greater powers at high efficiency.

Anode dissipation	12	kW max
Anode voltage	8.0	kV max
Frequency for full ratings	100	MHz max
Output power (class C unmodulated)	26	kW

GENERAL

Electrical

Filament	thoriated tungsten	
Filament voltage (see note 1)	6.6	V
Filament current	103	A
Filament cold resistance	0.0075	Ω
Peak usable cathode current	25	A
Perveance	3.6	$mA/V^{3/2}$
Amplification factor (V_a = 2.0kV, I_a = 1.0A)	11	
Mutual conductance (V_a = 2.0kV, I_a = 2.75A)	43.5	mA/V
Inter-electrode capacitances:		
grid to anode	36.5	pF
grid to filament	47.5	pF
anode to filament	2.35	pF

Mechanical

Overall length	10.500 inches (266.7mm) max
Overall diameter	5.250 inches (133.4mm) max
Net weight	5.5 pounds (2.5kg) approx
Mounting position	vertical, filament end up or down

Accessories

Outer filament connector	MA208A
Inner filament connector	MA208B
Grid connector	MA208

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

Anode voltage	8.0	kV max
Anode current	4.5	A max
Anode dissipation	12	kW max
Grid dissipation	250	W max
Frequency	100	MHz max

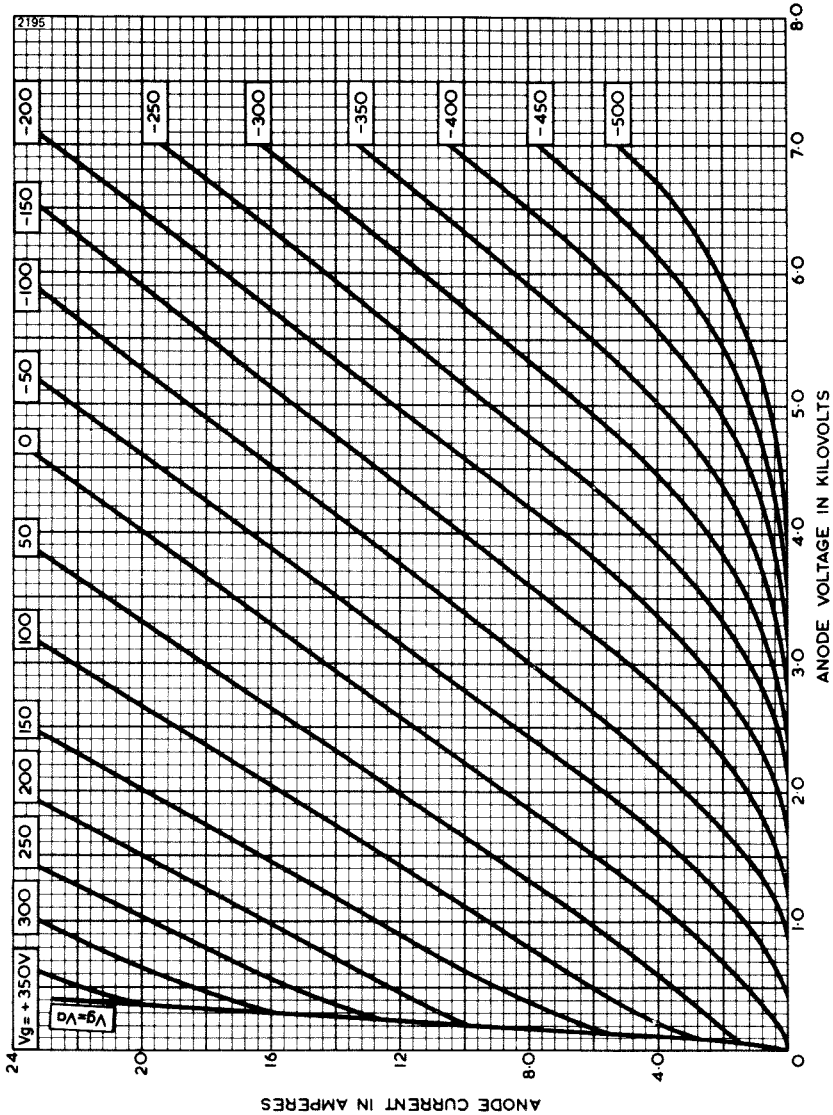
TYPICAL OPERATING CONDITIONS

Anode voltage	8.0	kV
Grid voltage	−1000	V
from grid resistor	2050	Ω
Peak r.f. grid voltage	1290	V
Anode current	4.0	A
Grid current	485	A
Anode dissipation	5.5	kW
Grid dissipation	145	W
Driving power	630	W
Output power	26	kW
Efficiency	81	%
Load resistance	1000	Ω

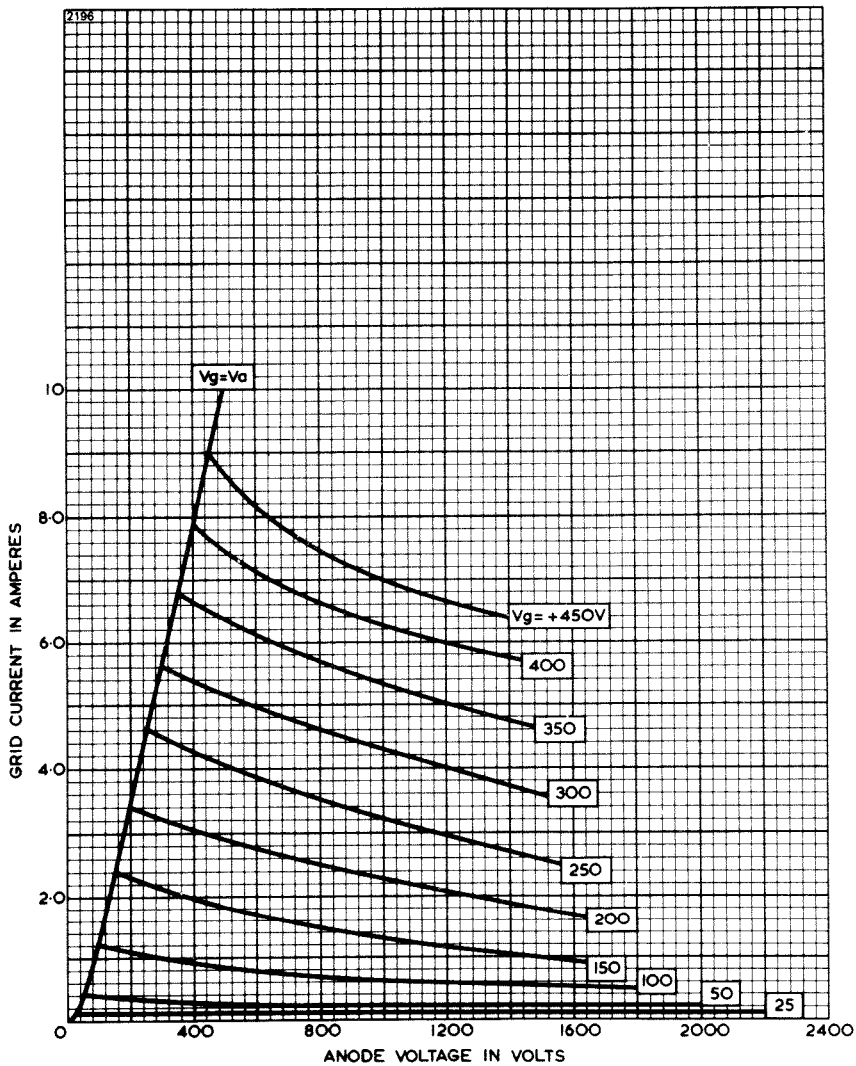
NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%. The filament may be switched on at its operating voltage and no surge limiting devices need be incorporated in the filament circuit.
2. This is the output power from the valve after the grid drive power has been deducted. With 85% circuit efficiency the power to the load is 22kW.

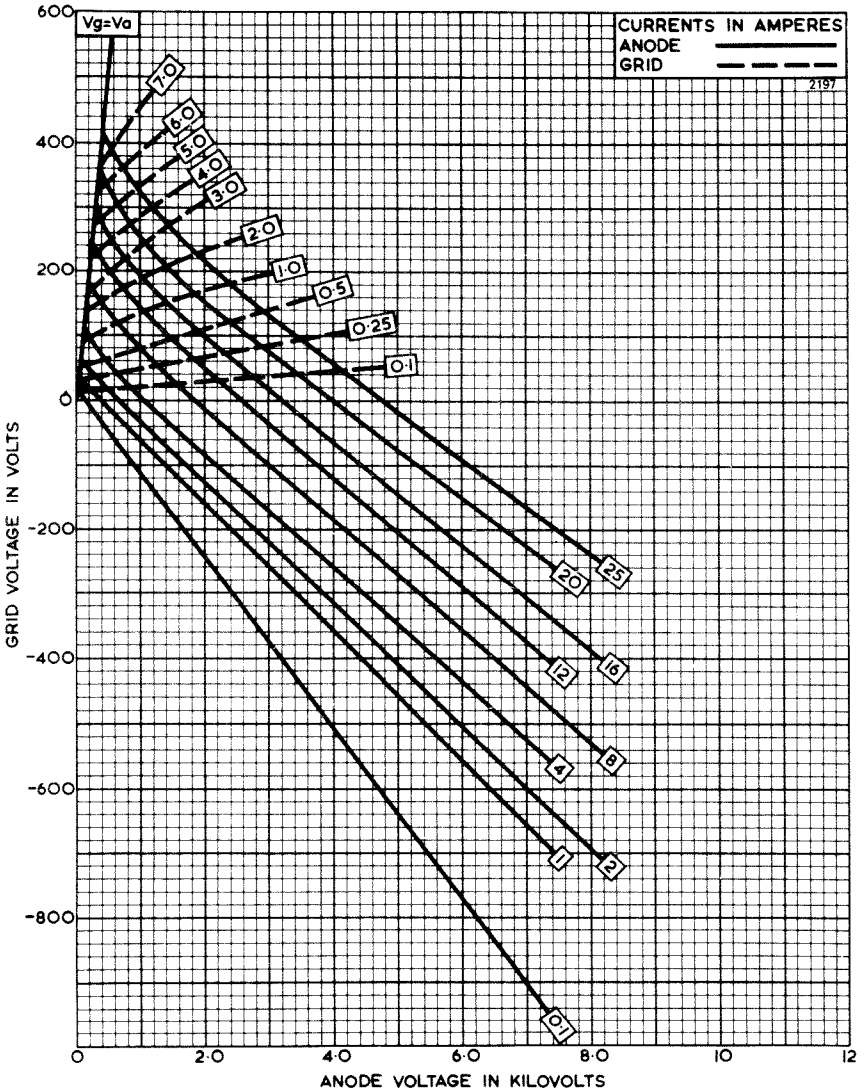
ANODE CHARACTERISTICS



GRID CHARACTERISTICS

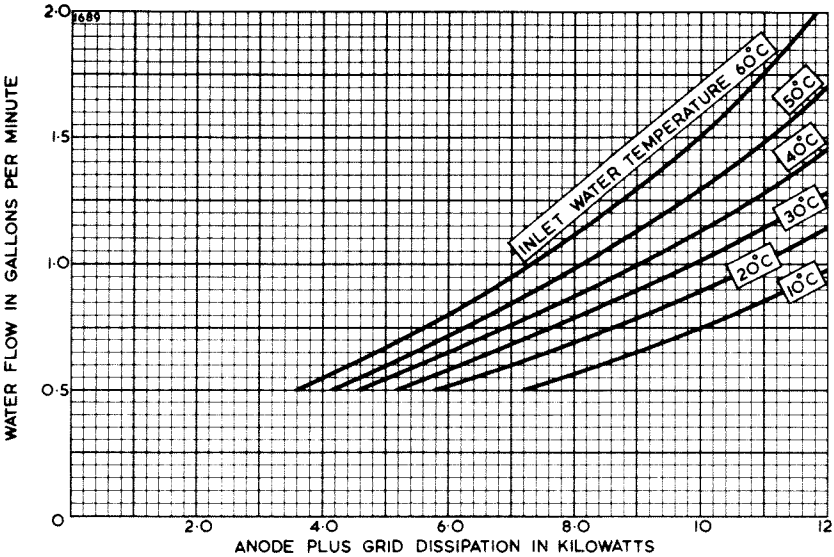


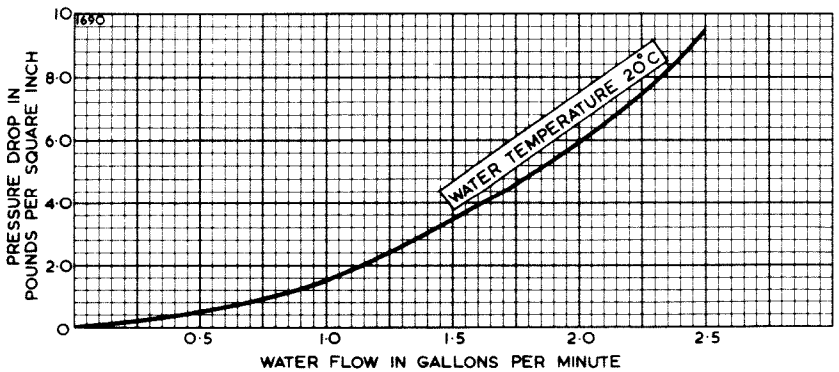
CONSTANT CURRENT CHARACTERISTICS



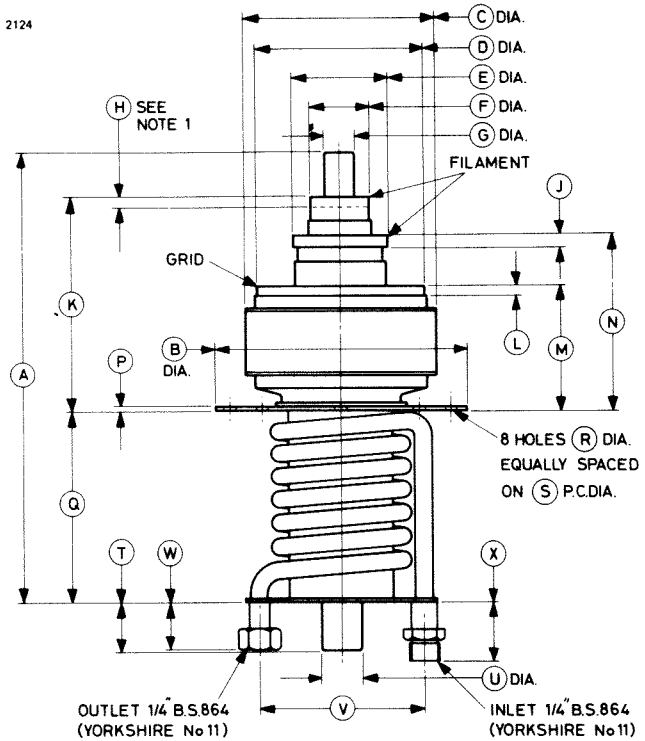
MINIMUM WATER COOLING REQUIREMENTS

(Higher rates of flow should be used where possible)





OUTLINE

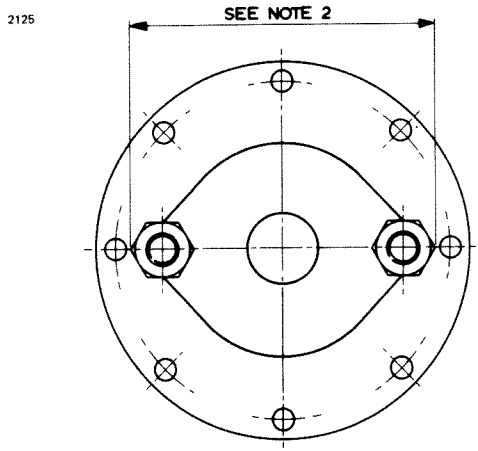


Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	9.300	236.2	M	2.656	67.46
B	5.250	133.4	N	3.687	93.65
C	4.000	101.6	P	0.128	3.25
D	3.500	88.90	Q	3.830	97.28
E	2.000	50.80	R	0.257	6.53
F	1.250	31.75	S	4.687	119.0
G	0.625	15.88	T	1.000	25.40
H	0.219 ± 0.031	5.56 ± 0.79	U	0.870	22.10
J	0.250	6.35	V	3.375	85.73
K	4.470	113.5	W	0.985	25.02
L	0.218	5.54	X	1.250	31.75

Millimetre dimensions have been derived from inches.

OUTLINE DETAIL

(Enlarged View from below)



OUTLINE NOTES

1. The filament contact surface may be clamped only within this area.
2. This dimension will pass through a hole of 4.250 inches (108.0mm) minimum diameter.

WATER JACKET

BW4027

December 1967

ENGLISH ELECTRIC

INTRODUCTION

The BW4027 is a complete Water Jacket assembly designed for use with the water cooled triode type BW194. The assembly incorporates alternative mounting holes and alternative water connections, permitting considerable flexibility in the installation of the water jacket (See outline drawing, page 2).

GENERAL

Overall Length	16·688 inches	(423·9 mm)	Nom
Overall Width	8·000 inches	(203·2 mm)	Nom
Water Connections			*See Note* 1 *and Outline*
Net Weight	40 pounds	(18 kg)	Approx
Mounting			*See Note* 2
Sealing Ring (*See Note* 3)			MA254

NOTES

1. The water jacket has two alternative inlet water connections at the lower end and two alternative outlet connections at the top of the assembly. Any pair of connections may be used and two blanking plugs with sealing washers are supplied with the jacket for sealing the water connections not required.

   Any flow reducing or measuring devices should be incorporated in the system on the outlet side of the water jacket as it is desirable to operate the jacket at the highest possible pressure.
2. The water jacket may be mounted by means of the tapped holes in any two of the four flat surfaces round its circumference.
3. One valve seating ring is supplied with each water jacket.

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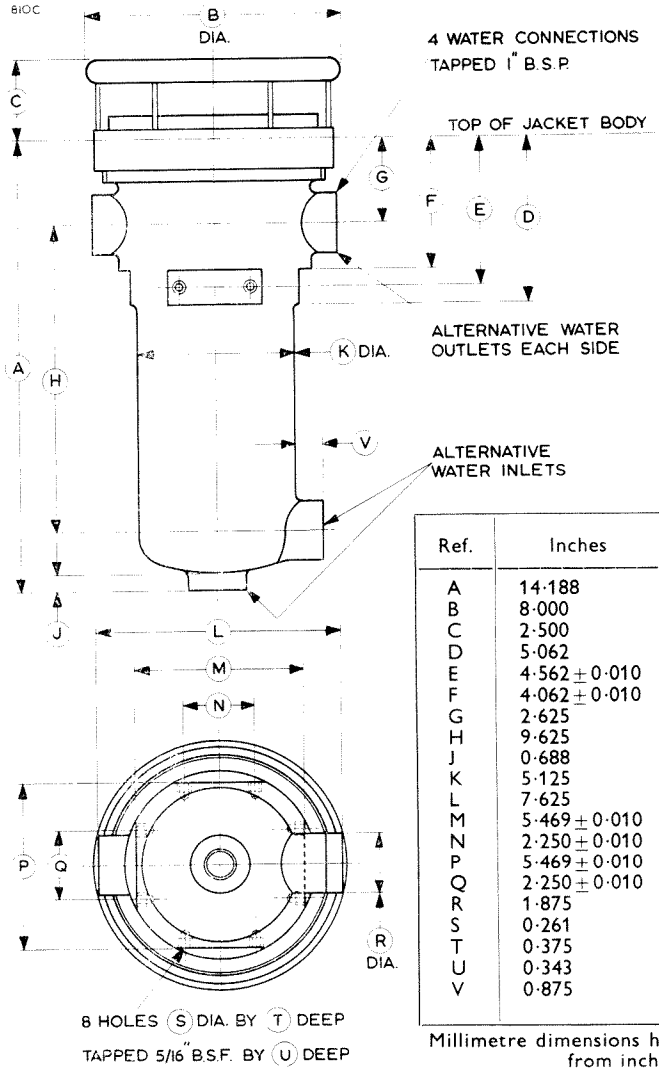
OUTLINE



Ref.	Inches	Millimetres
A	14·188	360·4
B	8·000	203·2
C	2·500	63·50
D	5·062	128·6
E	4·562 ± 0·010	115·88 ± 0·25
F	4·062 ± 0·010	103·17 ± 0·25
G	2·625	66·68
H	9·625	244·5
J	0·688	17·48
K	5·125	130·2
L	7·625	193·7
M	5·469 ± 0·010	138·91 ± 0·25
N	2·250 ± 0·010	57·15 ± 0·25
P	5·469 ± 0·010	138·91 ± 0·25
Q	2·250 ± 0·010	57·15 ± 0·25
R	1·875	47·63
S	0·261	6·63
T	0·375	9·53
U	0·343	8·71
V	0·875	22·23

Millimetre dimensions have been derived from inches.

Printed in England

WATER JACKET

BW4028

ENGLISH ELECTRIC

INTRODUCTION

The BW4028 is a complete Water Jacket assembly designed for use with the water cooled triodes BW161 and BW1102. The assembly incorporates alternative mounting holes and alternative water connections, permitting considerable flexibility in the installation of the water jacket (See outline drawing, page 2).

GENERAL DATA

Overall Length	11·156 inches	(283·4 mm)	Max
Overall Diameter	6·250 inches	(158·8 mm)	Max
Water Connections			*See Note* 1 *and Outline*
Net Weight	20 pounds	(9·1 kg)	Approx
Mounting			*See Note* 2
Sealing Ring (*See Note* 3)			15799A

NOTES

1. The water jacket has two alternative inlet water connections at the lower end and two alternative outlet connections at the top of the assembly. Any pair of connections may be used and two blanking plugs with sealing washers are supplied with the jacket for sealing the water connections not required.

   Any flow reducing or measuring devices should be incorporated in the system on the outlet side of the water jacket as it is desirable to operate the jacket at the highest possible pressure.
2. The water jacket may be mounted by means of the tapped holes in any two of the four flat surfaces round its circumference.
3. One valve seating ring is supplied with each water jacket.

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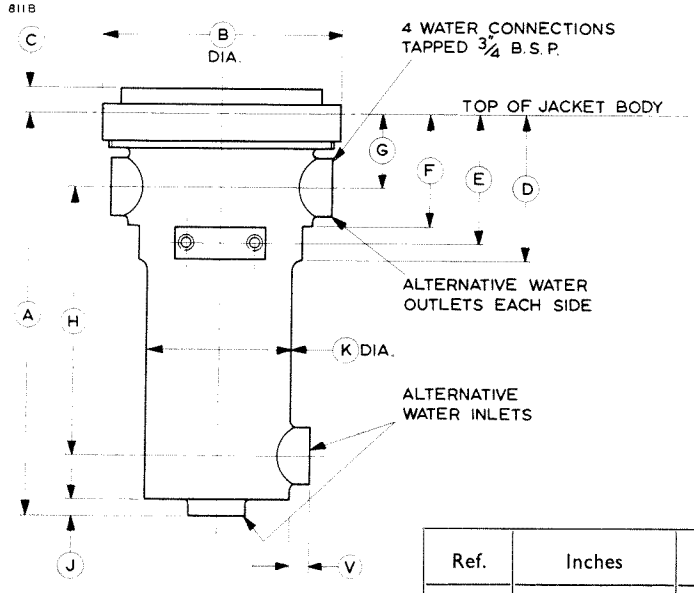
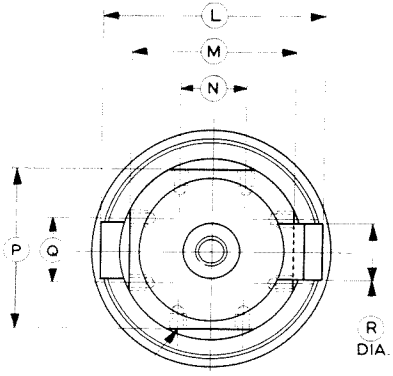
OUTLINE





8 HOLES S DIA. BY T DEEP
TAPPED 5/16 B.S.F. BY U DEEP

Ref.	Inches	Millimetres	
A	10·531	267·5	
B	6·250	158·8	
C	0·625	15·88	
D	3·812	96·82	
E	3·281 ± 0·010	83·34 ± 0·25	
F	2·937 ± 0·010	74·60 ± 0·25	
G	1·937	49·20	
H	7·062	179·4	
J	0·468	11·89	
K	3·875	98·43	
L	5·812	147·6	
M	4·593 ± 0·010	116·7 ± 0·25	←
N	1·750 ± 0·010	44·45 ± 0·25	
P	4·593 ± 0·010	116·7 ± 0·25	←
Q	1·750 ± 0·010	44·45 ± 0·25	
R	1·500	38·10	
S	0·261	6·63	
T	0·343	8·71	
U	0·312	7·92	
V	0·531	13·49	

Millimetre dimensions have been derived from inches.

← Indicates a change

Printed in England

WATER JACKET

BW4029

ENGLISH ELECTRIC

INTRODUCTION

The BW4029 is a complete Water Jacket assembly designed for use with the water cooled triodes BW179, BW1103 and BW1124. The assembly incorporates alternative mounting holes and alternative water connections, permitting considerable flexibility in the installation of the water jacket (See outline drawing, page 2).

GENERAL

Overall Length	7·968 inches	(202·4 mm)	Max
Overall Diameter	4·562 inches	(115·9 mm)	Max
Water Connections			*See Note* 1 *and Outline*
Net Weight	10 pounds	(4·6 kg)	Approx
Mounting			*See Note* 2
Sealing Ring (*See Note* 3)			15797A

NOTES

1. The water jacket has two alternative inlet water connections at the lower end and two alternative outlet connections at the top of the assembly. Any pair of connections may be used and two blanking plugs with sealing washers are supplied with the jacket for sealing the water connections not required.
   Any flow reducing or measuring devices should be incorporated in the system on the outlet side of the water jacket as it is desirable to operate the jacket at the highest possible pressure.
2. The water jacket may be mounted by means of the tapped holes in any two of the four flat surfaces round its circumference.
3. One valve seating ring is supplied with each water jacket.

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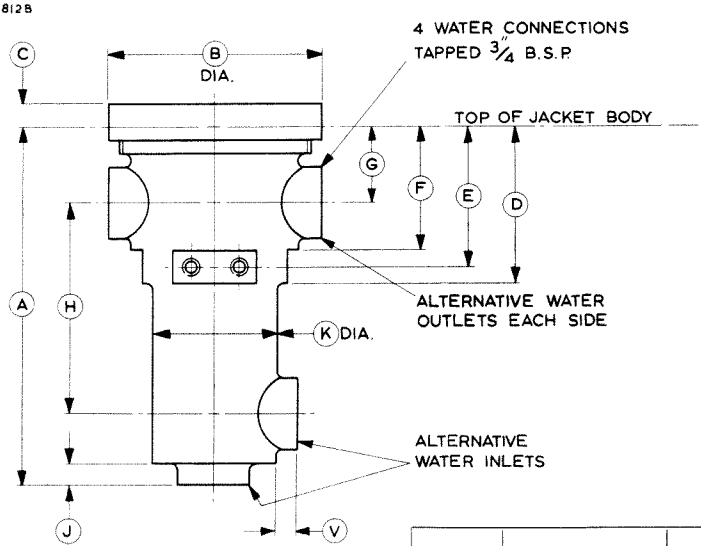
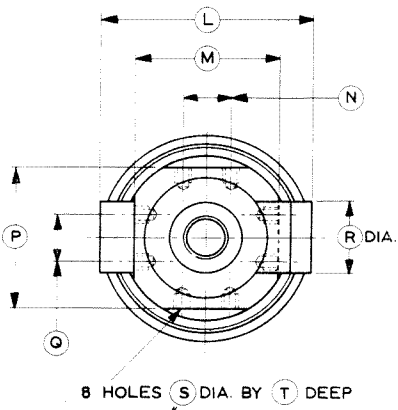
ENGLISH ELECTRIC

OUTLINE

8128





Ref.	Inches	Millimetres
A	7·531	191·3
B	4·562	115·9
C	0·437	11·10
D	3·343	84·91
E	2·968 ± 0·010	75·39 ± 0·25
F	2·625 ± 0·010	66·68 ± 0·25
G	1·625	41·28
H	4·375	111·1
J	0·468	11·89
K	2·625	66·68
L	4·562	115·9
M	3·000 ± 0·010	76·20 ± 0·25
N	1·000 ± 0·010	25·40 ± 0·25
P	3·000 ± 0·010	76·20 ± 0·25
Q	1·000 ± 0·010	25·40 ± 0·25
R	1·500	38·10
S	0·261	6·63
T	0·343	8·71
U	0·312	7·92
V	0·468	11·89

Millimetre dimensions have been derived from inches.

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CHELMSFORD
ENGLAND

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WATER JACKET

BW4034

INTRODUCTION

The BW4034 is a complete Water Jacket assembly designed for use with the water cooled triode BW1121. The assembly incorporates alternative mounting holes and alternative water connections, permitting considerable flexibility in the installation of the water jacket (See outline drawing, page 2).

GENERAL DATA

Overall Length	8·750 inches (222·3 mm)	Max←
Overall Diameter	6·250 inches (158·8 mm)	Max
Water Connections		*See Note* 1 *and Outline*
Net Weight	18 pounds (8·2 kg)	Approx
Mounting		*See Note* 2
Sealing Ring (*See Note* 3)		15799A

NOTES

1. The water jacket has two alternative inlet water connections at the lower end and two alternative outlet connections at the top of the assembly. Any pair of connections may be used and two blanking plugs with sealing washers are supplied with the jacket for sealing the water connections not required.

   Any flow reducing or measuring devices should be incorporated in the system on the outlet side of the water jacket as it is desirable to operate the jacket at the highest possible pressure.

2. The water jacket may be mounted by means of the tapped holes in any two of the four flat surfaces round its circumference.

3. One valve seating ring is supplied with each water jacket.

← Indicates a change

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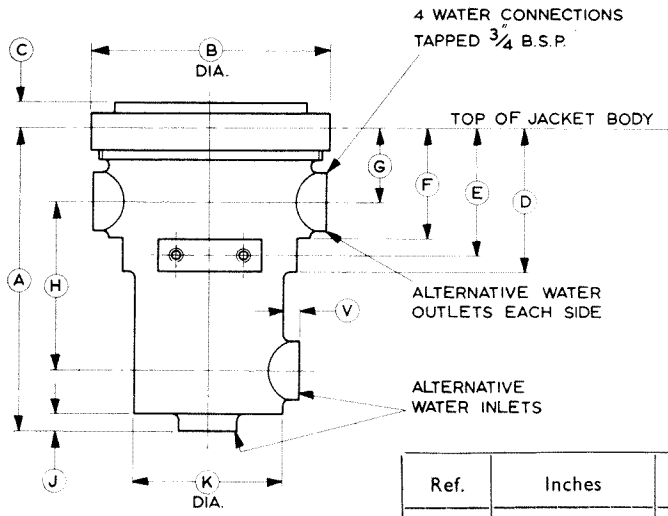
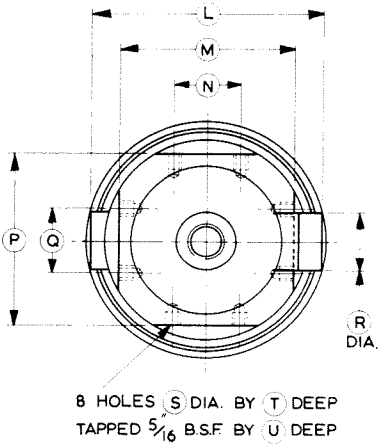
ENGLISH ELECTRIC

OUTLINE

8978





Ref.	Inches	Millimetres
A	8·125	206·4
B	6·250	158·8
C	0·625	15·88
D	3·812	96·82
E	3·281 ± 0·010	83·34 ± 0·25
F	2·937 ± 0·010	74·60 ± 0·25
G	1·937	49·20
H	4·437	112·7
J	0·468	11·89
K	3·875	98·43
L	6·187	157·2
M	4·593 ± 0·010	116·66 ± 0·25
N	1·750 ± 0·010	44·45 ± 0·25
P	4·593 ± 0·010	116·66 ± 0·25
Q	1·750 ± 0·010	44·45 ± 0·25
R	1·500	38·10
S	0·261	6·63
T	0·375	9·53
U	0·312	7·92
V	0·468	11·89

Millimetre dimensions have been derived from inches.

← Indicates a change

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WATER JACKET

BW4035

ENGLISH ELECTRIC

INTRODUCTION

The BW4035 is a complete Water Jacket assembly designed for use with the water cooled triode type BW1144. The assembly incorporates alternative mounting holes and alternative water connections, permitting considerable flexibility in the installation of the water jacket (See outline drawing, page 2).

GENERAL

Overall Length	15·125 inches (384·2 mm)	Nom←
Overall Diameter	13·000 inches (330·2 mm)	Nom←
Water Connections	*See Note* 1 *and Outline*	
Net Weight	60 pounds (27 kg)	Approx
Mounting	*See Note* 2	
Sealing Ring (*See Note* 3)	15857A	

NOTES

1. The water jacket has three inlet water connections at the lower end and two outlet connections at the top of the assembly. Both outlet connections must be used. The inlet connection can be made to the 2-inch tapped hole only, or alternatively to the two side inlet holes used together. Blanking plugs with sealing washers are supplied with the jacket for sealing the water connections not required.

   Any flow reducing or measuring devices should be incorporated in the system on the outlet side of the water jacket as it is desirable to operate the jacket at the highest possible pressure.

2. The water jacket may be mounted by means of the tapped holes in any two of the four flat surfaces round its circumference.

3. One valve seating ring is supplied with each water jacket.

← Indicates a change

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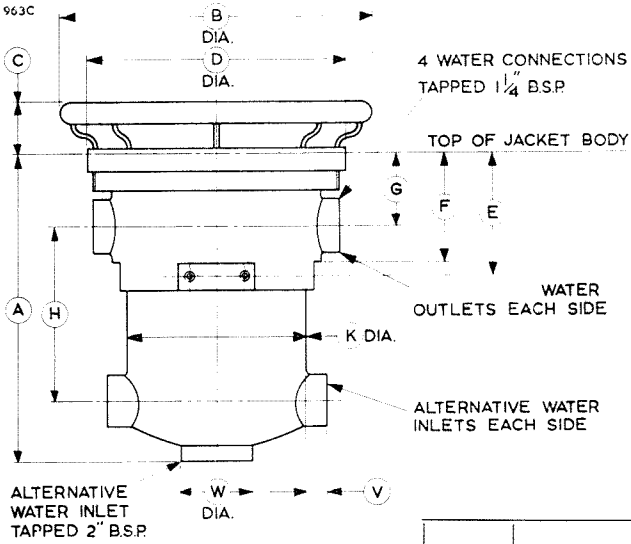
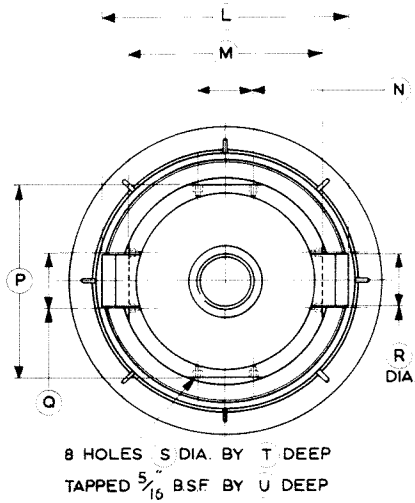
WATER JACKET

BW4035

ENGLISH ELECTRIC

OUTLINE





Ref.	Inches	Millimetres
A	12·875	327·0
B	13·000	330·2
C	2·250	57·15
D	10·750	273·1
E	5·093 ± 0·010	129·4 ± 0·25
F	4·593 ± 0·010	116·7 ± 0·25
G	2·984	75·79
H	7·250	184·2
K	7·500	190·5
L	10·250	260·4
M	8·125 ± 0·010	206·38 ± 0·25
N	2·250 ± 0·010	57·15 ± 0·25
P	8·125 ± 0·010	206·38 ± 0·25
Q	2·250 ± 0·010	57·15 ± 0·25
R	2·218	56·34
S	0·261	6·63
T	0·375	9·53
U	0·344	8·74
V	0·812	20·63
W	2·913	73·99

Millimetre dimensions have been derived from inches.

ENGLISH ELECTRIC VALVE CO. LTD.

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WATER JACKET

BW4050

INTRODUCTION

The BW4050 is a complete Water Jacket assembly designed for use with the water cooled triodes BW189 and BW1143. The assembly incorporates alternative mounting holes and alternative water connections, permitting considerable flexibility in the installation of the water jacket (See outline drawing, page 2).

GENERAL

Overall Length	12·687 inches (322·3 mm)	Nom
Overall Diameter	8·000 inches (203·2 mm)	Nom
Water Connections	*See Note* 1 *and Outline*	
Net Weight	36 pounds (16·4 kg)	Approx
Mounting	*See Note* 2	
Sealing Ring (*See Note* 3)	MA254	

NOTES

1. The water jacket has two alternative inlet water connections at the lower end and two alternative outlet connections at the top of the assembly. Any pair of connections may be used and two blanking plugs with sealing washers are supplied with the jacket for sealing the water connections not required.

   Any flow reducing or measuring devices should be incorporated in the system on the outlet side of the water jacket as it is desirable to operate the jacket at the highest possible pressure.
2. The water jacket may be mounted by means of the tapped holes in any two of the four flat surfaces round its circumference.
3. One valve seating ring is supplied with each water jacket.

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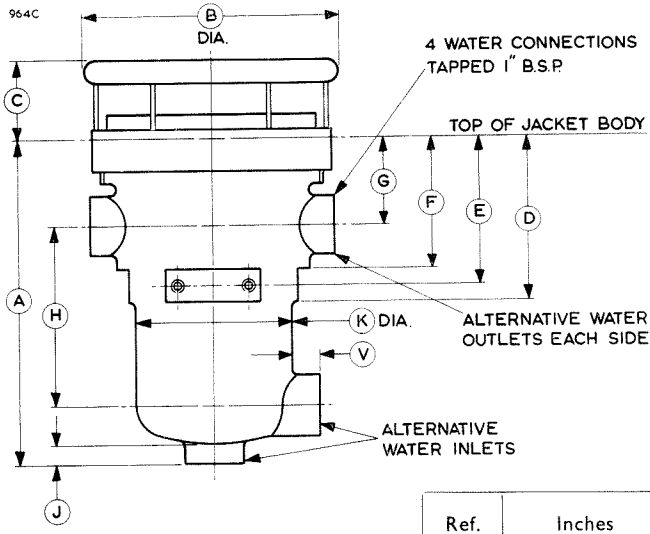
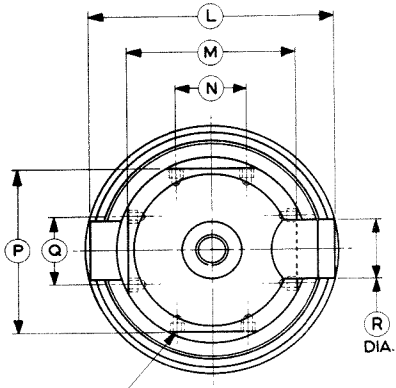
ENGLISH ELECTRIC

OUTLINE





Ref.	Inches	Millimetres
A	10·187	258·8
B	8·000	203·2
C	2·500	63·50
D	5·062	128·6
E	4·562 ± 0·010	115·88 ± 0·25
F	4·062 ± 0·010	103·18 ± 0·25
G	2·625	66·68
H	5·625	142·9
J	0·688	17·46
K	5·125	130·2
L	7·625	193·7
M	5·469 ± 0·010	138·91 ± 0·25
N	2·250 ± 0·010	57·15 ± 0·25
P	5·469 ± 0·010	138·91 ± 0·25
Q	2·250 ± 0·010	57·15 ± 0·25
R	1·875	47·63
S	0·261	6·63
T	0·375	9·53
U	0·343	8·71
V	0·875	22·23

Millimetre dimensions have been derived from inches.

SINGLE BOILER UNIT

BY4060

INTRODUCTION

The BY4060 is a single Boiler Unit for use with the vapour cooled triodes BY1144 and BY1156. A separate condenser is required, with insulating pipes for the steam outlet and water return to the boiler (see Outline Notes on page 4).

The valve is held in position in the boiler unit by its own weight, in conjunction with the spring finger contacts round the anode ring, and is seated on a sealing ring supplied with the BY4060 (a sealing ring is also supplied with the valve).

The boiler unit may be mounted by means of the four bosses on the base, and these may also be used for h.t. supply connection. The unit can be modified in some respects to meet the requirements of particular applications.

Distilled or de-mineralised water should be used in the boiler unit.

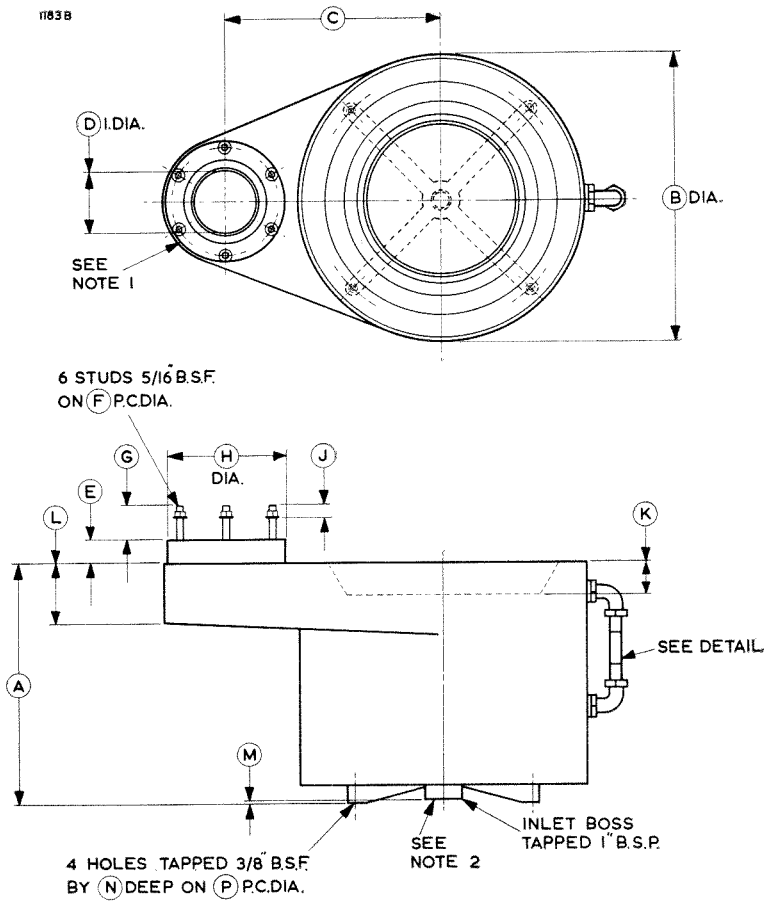
GENERAL DATA

Overall Length	26·563 inches (674·7 mm)	Nom
Overall Width	18·000 inches (457·2 mm)	Nom
Overall Height	18·625 inches (473·1 mm)	Nom
Net Weight (empty)	100 pounds (45 kg)	Approx
Water Capacity of Boiler (to maximum water level)	8 gallons (37 litres)	Approx
Sealing Ring (supplied with boiler)		MA260

ENGLISH ELECTRIC

OUTLINE

(See Page 4 for Outline Notes)



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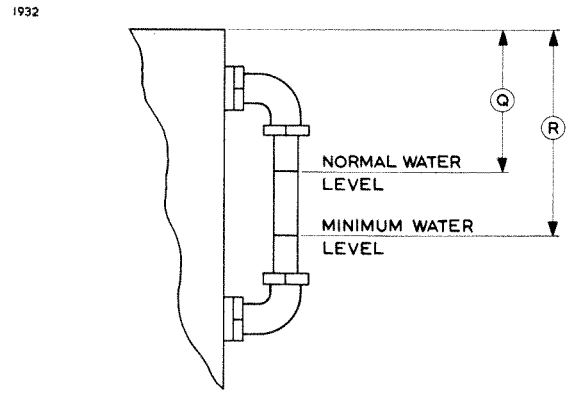
OUTLINE DETAIL

Water Level Indicator

The BY4060 can be supplied with a water level indicator fitted, if this is specified on the customer's order.



OUTLINE DIMENSIONS

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	15·000	381·0	J	0·750	19·05
B	18·000 Max	457·2 Max	K	2·406	61·11
C	13·500	342·9	L	4·000	101·6
D	4·000	101·6	M	0·250	6·35
E	1·500	38·10	N	0·625	15·88
F	7·000	177·8	P	16·000	406·4
G	2·125	53·98	Q	4·500	114·3
H	7·750	196·9	R	6·500	165·1

Millimetre dimensions have been derived from inches.

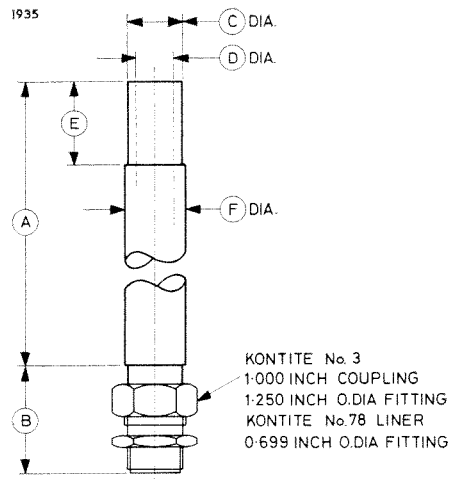
Printed in England

OUTLINE NOTES

1. It is recommended that the following QVF fittings* should be used for the steam outlet section; they are not supplied with the unit:
   (*a*) One Glass Section PS2/24, 24 inches (610 mm) long.
   (*b*) Two Backing Flanges CF4.
   (*c*) One PTFE Bellows FB4 (these are supplied with flanges).
   (*d*) Two Rubber Inserts CNR4.
   (*e*) One Gasket CGB/4 (only required if Bellows FB4 are not used).
   (*f*) Twelve Bolts NB4 (if Bellows FB4 are used).
   (*g*) Six Bolts NB4 (if Bellows FB4 are not used).
2. An inlet water tube, EEV part MA239, can be supplied (see below).

*Available from Q.V.F. Limited, Duke Street, Fenton, Stoke-on-Trent, Staffordshire.

INLET WATER TUBE MA239



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	34·250	870·0	D	0·750	19·05
B	2·250	57·15	E	1·750	44·45
C	$1{\cdot}125^{+0{\cdot}000}_{-0{\cdot}005}$	$28{\cdot}58^{+0{\cdot}00}_{-0{\cdot}13}$	F	1·250	31·75

Millimetre dimensions have been derived from inches.

WATER JACKET

BW4070

ENGLISH ELECTRIC

INTRODUCTION

The BW4070 is a complete Water Jacket assembly designed for use with the water cooled triode BW1122. The assembly incorporates alternative mounting holes and alternative water connections, permitting considerable flexibility in the installation of the water jacket (See outline drawing, page 2).

GENERAL

Overall Length	10·031 inches	(254·8 mm)	Nom
Overall Diameter	7·125 inches	(182 mm)	Nom
Water Connections			*See Note* 1 *and Outline*
Net Weight	10 pounds	(4·6 kg)	Approx
Mounting			*See Note* 2
Sealing Ring (*See Note* 3)			15797A

NOTES

1. The water jacket has two alternative inlet water connections at the lower end and two alternative outlet connections at the top of the assembly. Any pair of connections may be used and two blanking plugs with sealing washers are supplied with the jacket for sealing the water connections not required.

   Any flow reducing or measuring devices should be incorporated in the system on the outlet side of the water jacket as it is desirable to operate the jacket at the highest possible pressure.
2. The water jacket may be mounted by means of the tapped holes in any two of the four flat surfaces round its circumference.
3. One valve seating ring is supplied with each water jacket.

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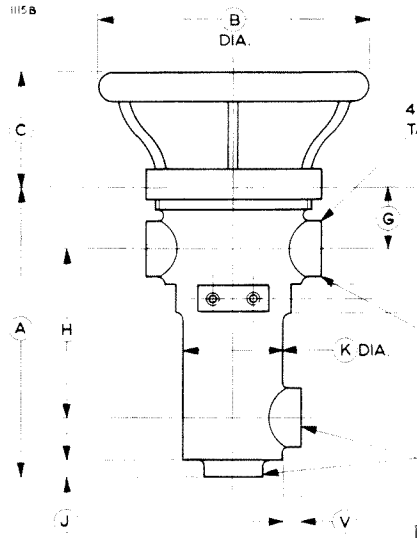
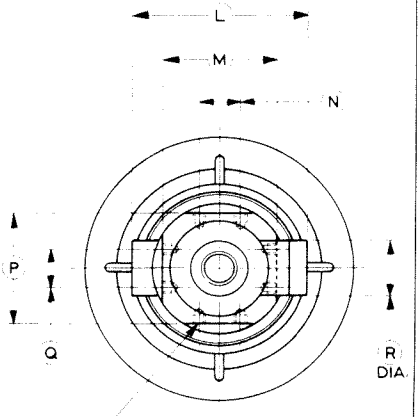
ENGLISH ELECTRIC

OUTLINE





Ref.	Inches	Millimetres
A	7·531	191·3
B	7·125	182·0
C	2·500	63·50
D	3·343	84·91
E	2·968 ± 0·010	75·39 ± 0·25
F	2·625 ± 0·010	66·68 ± 0·25
G	1·625	41·28
H	4·375	111·1
J	0·468	11·89
K	2·625	66·68
L	4·562	115·9
M	3·000 ± 0·010	76·20 ± 0·25
N	1·000 ± 0·010	25·40 ± 0·25
P	3·000 ± 0·010	76·20 ± 0·25
Q	1·000 ± 0·010	25·40 ± 0·25
R	1·500	38·10
S	0·261	6·63
T	0·343	8·71
U	0·312	7·92
V	0·468	11·89

Millimetre dimensions have been derived from inches.

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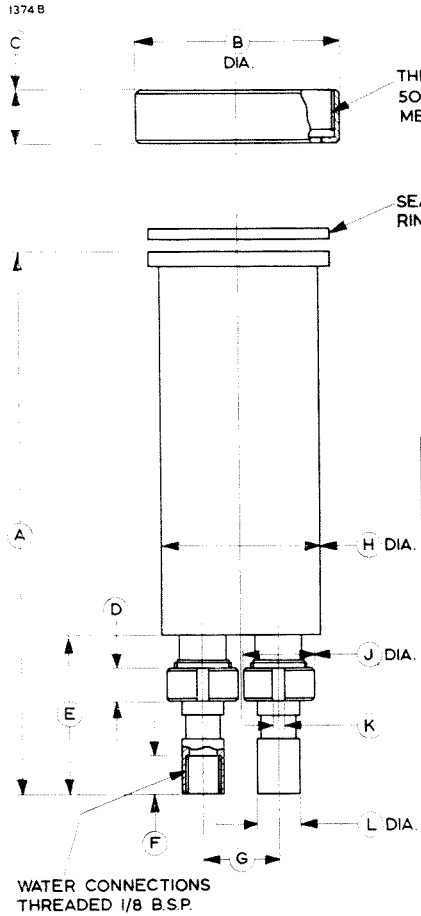
WATER JACKET

BW4088

INTRODUCTION

The BW4088 is a complete Water Jacket assembly intended for use with the power triodes BW1162 and BW1165.

OUTLINE



Ref.	Inches	Millimetres
A	5·709 ± 0·197	145·0 ± 5·0
B	2·126 ± 0·039	54·0 ± 1·0
C	0·571 ± 0·020	14·5 ± 0·5
D	0·354 ± 0·016	9·0 ± 0·4
E	1·673 ± 0·078	42·5 ± 2·0
F	0·394 ± 0·039	10·0 ± 1·0
G	0·787 ± 0·039	20·0 ± 1·0
H	1·634 ± 0·020	41·5 ± 0·5
J	0·748 ± 0·008	19·0 ± 0·2
K	0·118 ± 0·012	3·0 ± 0·3
L	0·453 ± 0·020	11·5 ± 0·5

Inch dimensions have been derived from millimetres.

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CHELMSFORD
ENGLAND

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Vapour Cooled Triodes

June 1965

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

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R.F. POWER TRIODE

BY189A

ENGLISH ELECTRIC

ABRIDGED DATA

Vapour Cooled Transmitting Triode with grid terminal suitable for cathode drive operation.

Anode Dissipation	35	kW Max
Anode Voltage	15	kV Max
Frequency for full ratings	5·0	Mc/s Max
Frequency at reduced ratings	50	Mc/s Max
Output Power (Class C Telegraphy)	80	kW
Boiler Unit	BY4037 or BY4038	

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	9·0	V
Filament Current	240	A
Maximum Filament Starting Current	(*See Note* 2)	
Filament Cold Resistance	0·0046	Ω
Peak Usable Cathode Current	70	A
Perveance	1·6	$mA/V^{3/2}$
Amplification Factor (V_a = 9·0 kV, I_a = 2·0 A)	34	
Mutual Conductance (V_a = 9·0 kV, I_a = 2·0 A)	27·5	mA/V
Inter-electrode Capacitances:		
Grid to Anode	61	pF
Grid to Filament	68	pF
Anode to Filament	1·5	pF

Mechanical

Overall Length	21·06 inches	(534·9 mm)	Max
Overall Diameter	11·00 inches	(279·4 mm)	Max
Net Weight	70 pounds	(32 kg)	Approx

Accessories

Boiler Unit, separate condenser required	BY4037
Boiler Unit, integral condenser	BY4038
Filament Leads	MA130
Grid Connector	MA66

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ENGLISH ELECTRIC

COOLING AND INSTALLATION

The BY189A is designed for cooling by water vapour and is fitted with an integral anode block in which circulation holes are provided for the passage of water and steam. The valve is installed with the anode partly immersed in the liquid coolant (distilled or de-ionised water) inside the boiler unit (see list of accessories, page 1). When the power supplies are switched on the heat dgenerate inside the valve soon evaporates some of the water in the circulation holes and jets of steam issue into the upper part of the boiler. The steam is either condensed directly by means of an internal water cooled condenser (as in BY4038) or led away by suitably insulated tubing for condensation at some convenient point external to the boiler (BY4037).

The services of our design staff are available for advice in matters of suitable condenser design and installation details.

An air stream of 20cu.ft/min (0·57cu.m/min) should be directed, via a 1-inch (25mm) diameter nozzle, into the filament header before and during the application of any voltages in order to limit the temperature of the grid and filament seals to 140°C. The anode seal temperature must not exceed 180°C.

Two thermal fuses (part number MA85) are provided with each valve to give protection against anode overheating; only one fuse at a time need be used. Alternative positions for mounting the thermal fuse are provided by four threaded holes equally spaced round the top surface of the anode ring. It should be screwed into the desired position and connected by a non-conducting cord passing over the anode corona ring to a suitable switching device; a tension of about 1 lb (450gm) should be applied to the fuse via the cord. If the temperature exceeds a safe limit, the fuse core is pulled outwards; this should actuate the switching device and remove all electrical supplies from the valve. Replacement fuses can be supplied to order.

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C Telegraphy, key down conditions, one valve)

MAXIMUM RATINGS

(Absolute values)

Anode Voltage	15 kV Max
Anode Current	7·0 A Max
Anode Dissipation	35 kW Max
Grid Dissipation	1·25kWMax
Operating Frequency (for full ratings)	5·0Mc/sMax

TYPICAL OPERATING CONDITIONS (FOR AMPLIFIER)

Anode Voltage	12	15	kV
Grid Voltage	−900	−900	V
Peak R.F. Grid Voltage	1650	1650	V
Anode Current	6·4	6·6	A
Grid Current (Approx)	0·83	0·7	A
Anode Dissipation	15	18	kW
Grid Dissipation	640	530	W
Driving Power	1370	1150	W
Output Power	62	80	kW
Efficiency	80	80	%

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 9·0V	217	256	A
Amplification Factor (V_a = 9·0kV, I_a = 2·0A)	30	38	
Mutual Conductance (V_a = 9·0kV, I_a = 2·0A)	22·5	29·5	mA/V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	380	V
Grid Voltage (V_a = 9·0kV, I_a = 2·0A)	125	193	V
Anode Current (V_a = 4·0kV, V_g = +400V)	17	24	A
Grid Current (V_a = 4·0kV, V_g = +400V)	−1·2	—	A

MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
5	15 kV	13·5 kV
30	13·5 kV	12 kV
50	8·0 kV	6·5 kV

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%.
2. The filament current must not exceed 600A, even momentarily, at any time.

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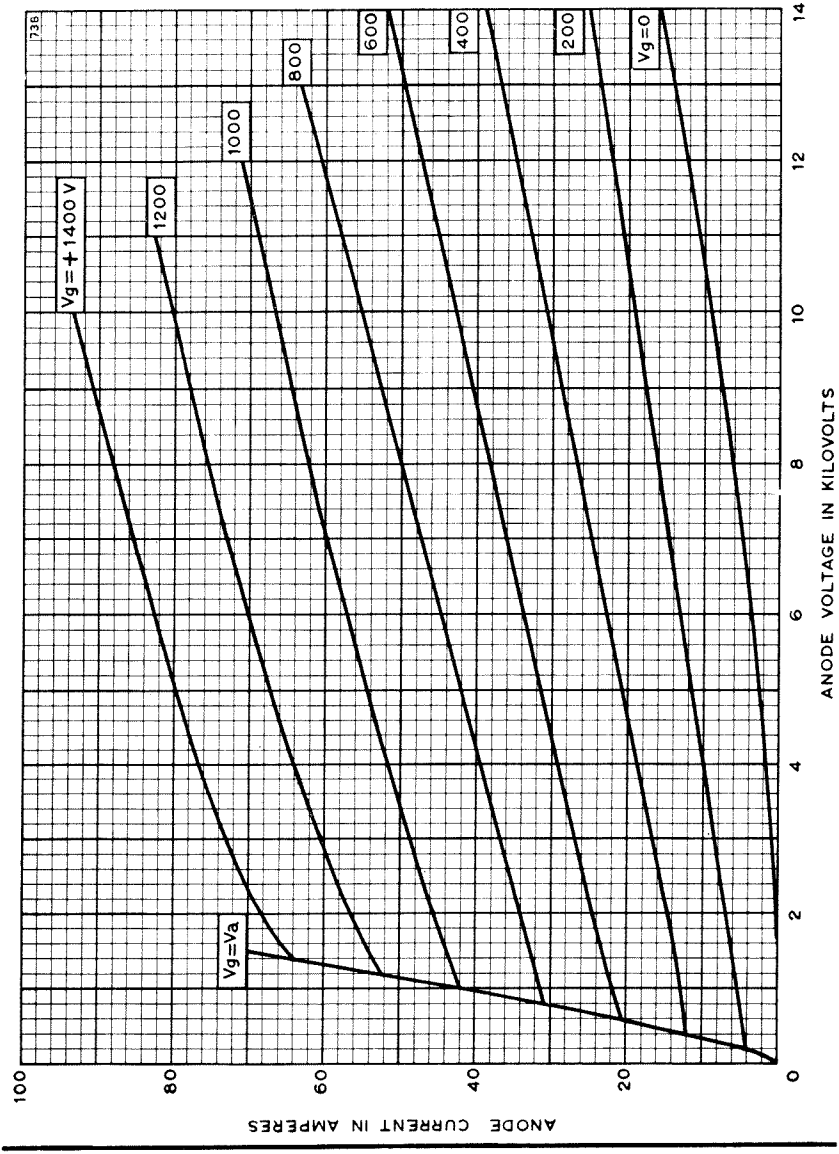
ANODE CHARACTERISTICS



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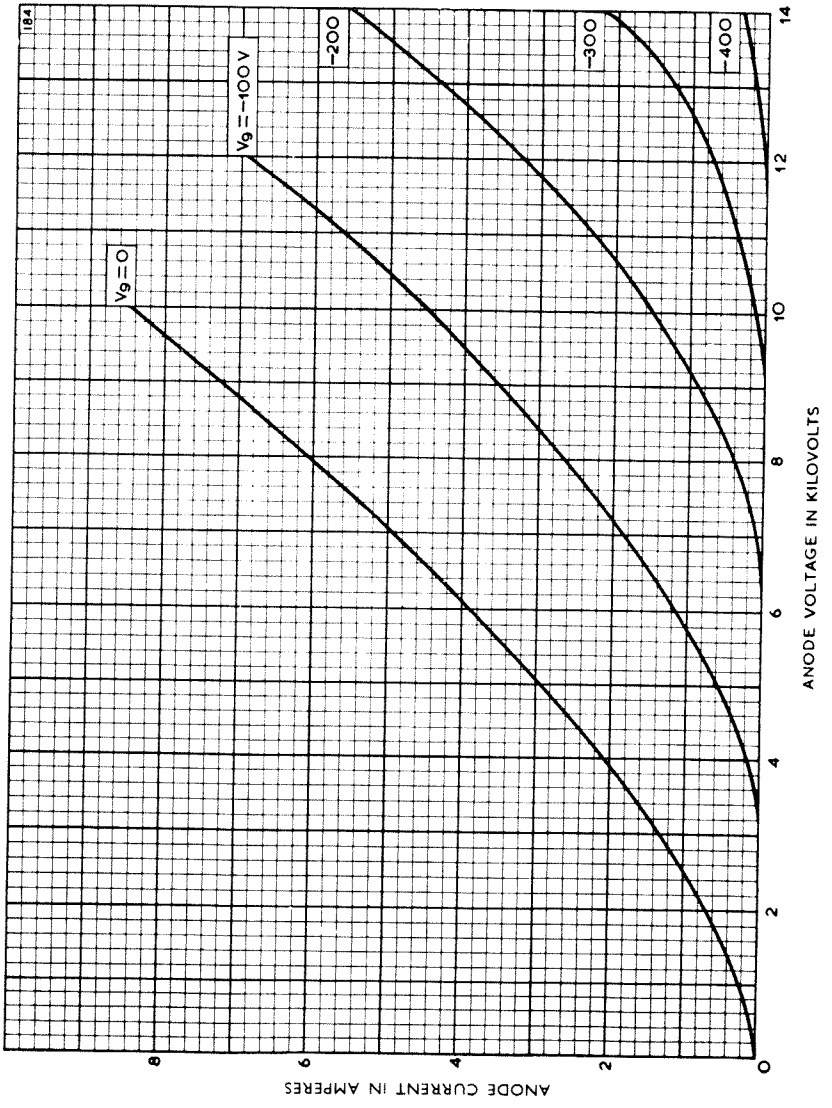
ANODE CHARACTERISTICS (Negative Grid)



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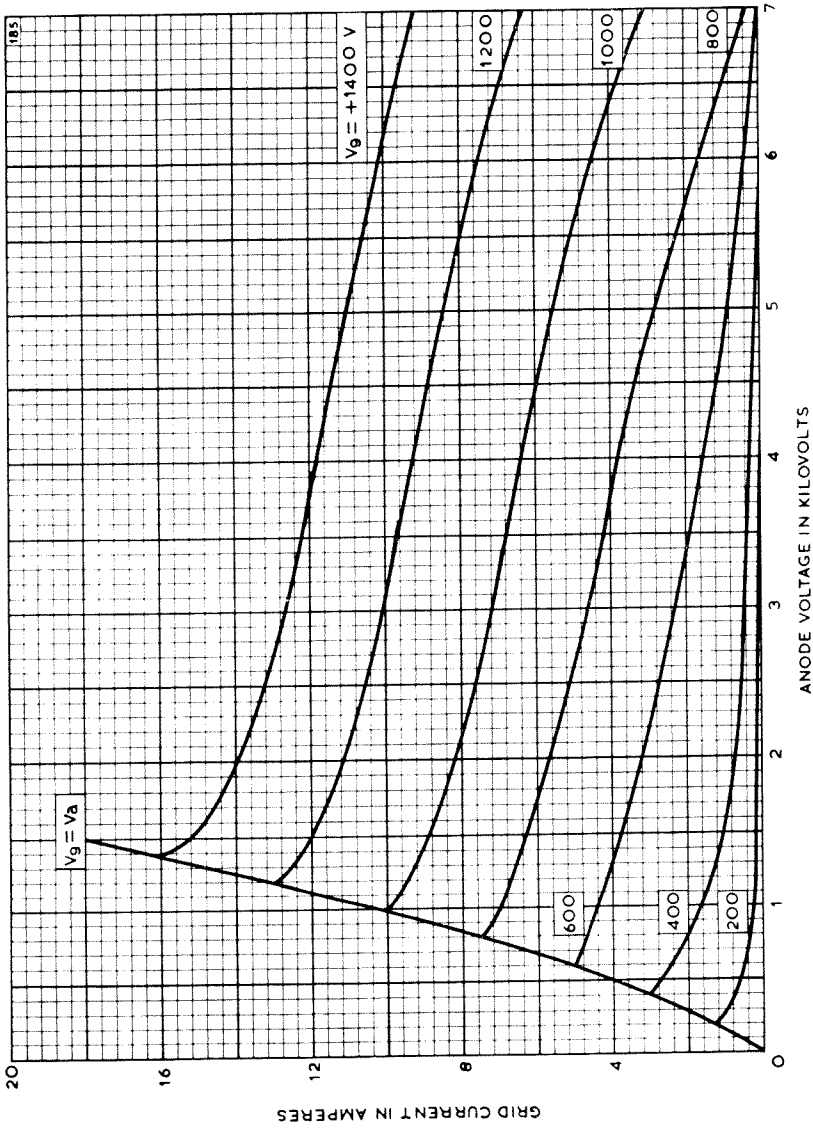
CONTROL GRID CHARACTERISTICS



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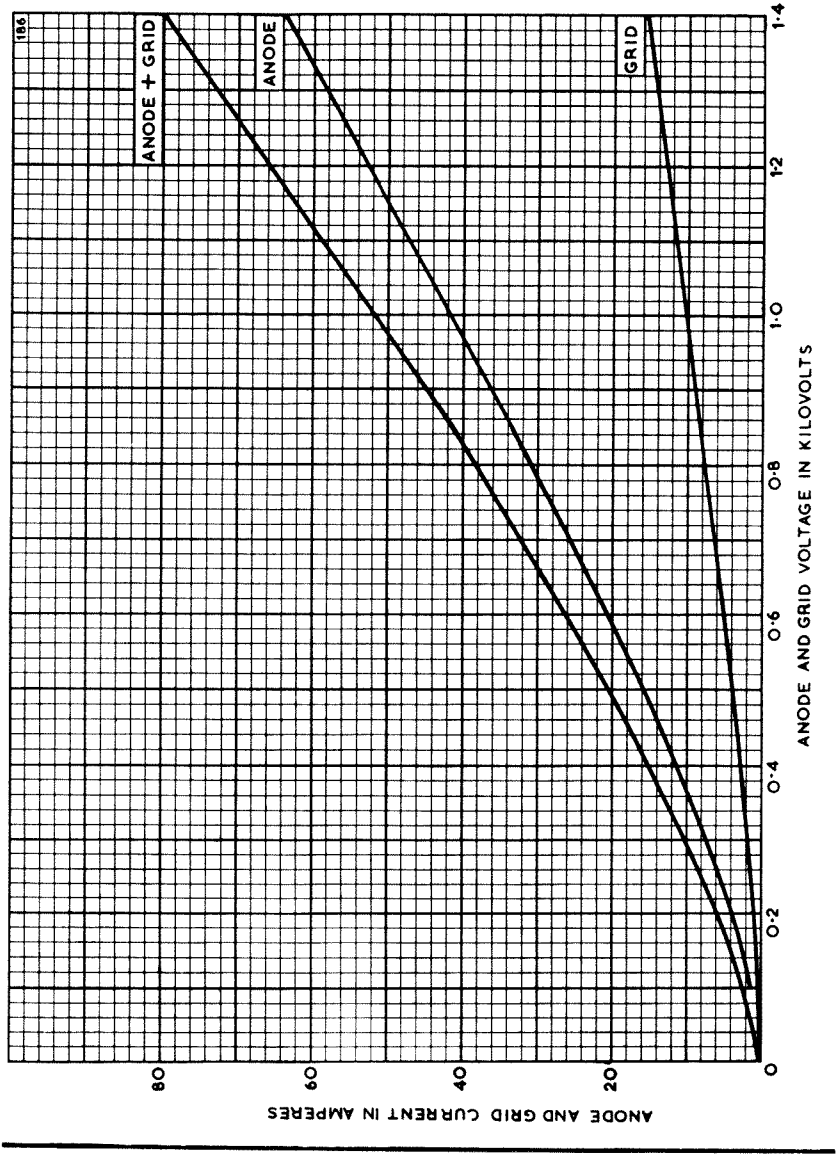
STRAPPED CHARACTERISTICS



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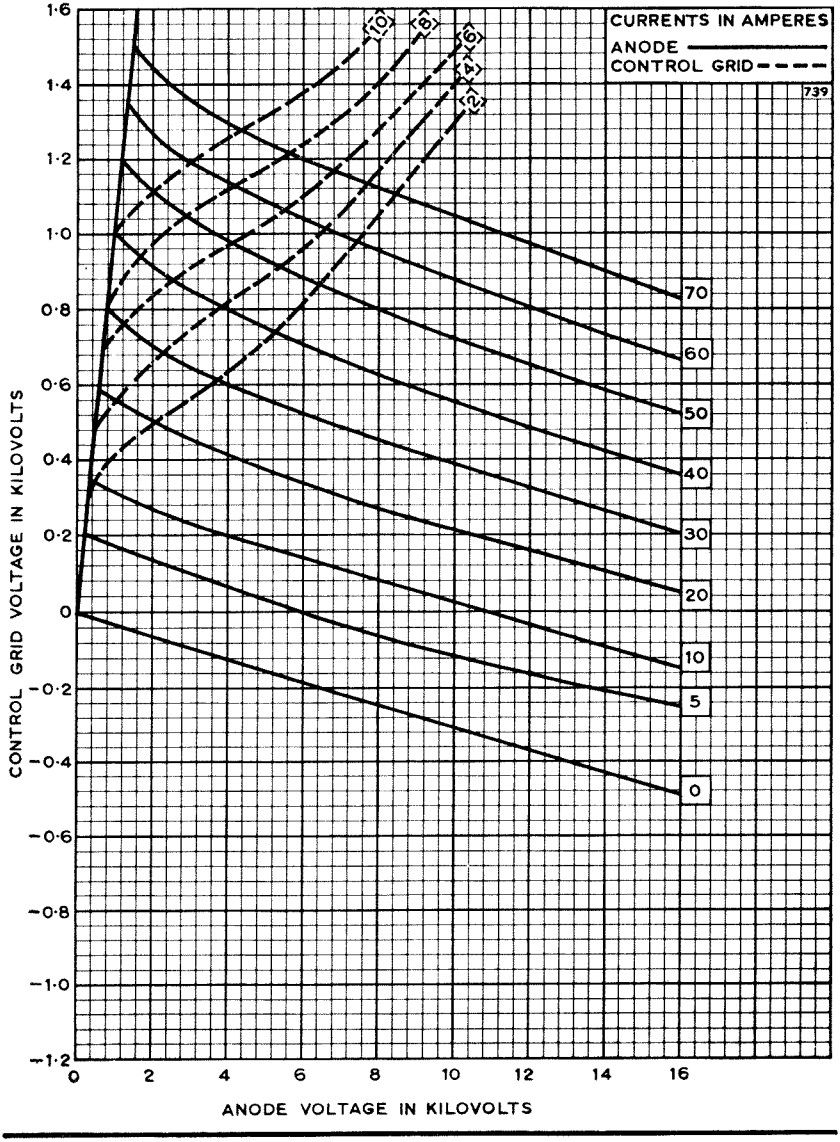
CONSTANT CURRENT CHARACTERISTICS



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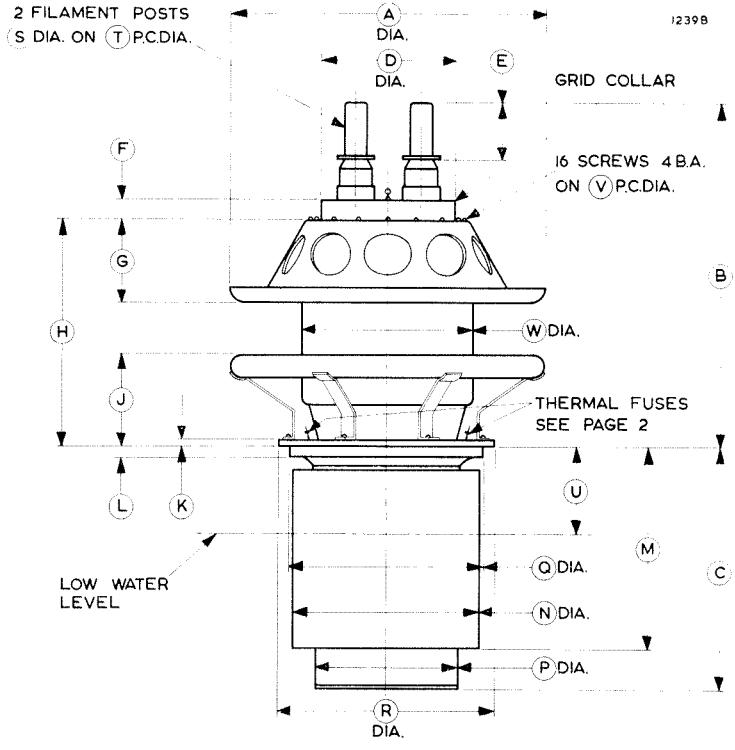
OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	11·000 Max	279·4 Max	M	7·000	177·8
B	12·109 Max	307·6 Max	N	6·562	166·7
C	8·452	214·7	P	5·240	133·1
D	4·703	119·5	Q	6·937	176·2
E	2·000	50·80	R	7·500	190·5
F	0·687	17·45	S	0·875	22·23
G	2·906 Max	73·81 Max	T	2·250	57·15
H	8·053 Max	204·5 Max	U	3·000	76·20
J	3·326 Max	84·48 Max	V	5·375	136·5
K	0·250	6·35	W	6·000	152·4
L	0·375	9·53			

Millimetre dimensions have been derived from inches.

BY194

R.F. POWER TRIODE

ABRIDGED DATA

Vapour Cooled Transmitting Triode with grid terminal suitable for cathode drive operation.

Anode Dissipation	50	kW Max
Anode Voltage	15	kV Max
Frequency for full ratings	5·0	MHz Max
Frequency at reduced ratings	30	MHz Max
Output Power (Class C Telegraphy)	115	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	13	V
Filament Current	240	A
Filament Starting Current (Peak) (*See Note* 2)	600	A Max
Filament Cold Resistance	0·006	Ω
Peak Usable Cathode Current	100	A
Perveance	2·17	$mA/V^{3/2}$
Amplification Factor (V_a = 7·5kV, I_a = 3·0A)	34	
Mutual Conductance (V_a = 9·0kV, I_a = 4·0A)	43	mA/V
Inter-electrode Capacitances:		
Grid to Anode	60	pF
Grid to Filament	95	pF
Anode to Filament	1·5	pF

Mechanical

Overall Length	25·17 inches (639·3 mm)	Max
Overall Diameter	11·00 inches (279·4 mm)	Max
Net Weight	88 pounds (40 kg)	Approx
Mounting Position	Vertical, filament pins up	

Accessories

Boiler unit, separate condenser required	BY4049
Boiler unit, integral condenser	BY4039
Filament Leads	MA130
Grid Connector	MA66
Sealing Ring (supplied with valve)	I5856A

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R.F. POWER TRIODE

COOLING

The BY194 is designed for cooling by water vapour and is fitted with an integral anode block in which circulation holes are provided for the passage of water and steam. The valve is installed with the anode partly immersed in the liquid coolant (distilled or de-ionised water) inside the boiler unit (see list of accessories above). When the power supplies are switched on the heat generated inside the valve soon evaporates some of the water in the circulation holes and jets of steam issue into the upper part of the boiler. The steam is either condensed directly by means of an internal water cooled condenser (as in BY4039) or led away by suitably insulated tubing for condensation at some convenient point external to the boiler (BY4049).

The services of our design staff are available for advice in matters of suitable condenser design and installation details.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 20 to 30ft^3/min (0·57 to 0·85m^3/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	15	kV Max
Anode Current	10	A Max
Anode Dissipation	50	kW Max
Grid Dissipation	1·8	kW Max
Operating Frequency (for full ratings)	5·0	MHz Max

TYPICAL OPERATING CONDITIONS (FOR AMPLIFIER)

Anode Voltage	10	15	kV
Grid Voltage	−900	−900	V
Peak R.F. Grid Voltage	1620	1620	V
Anode Current	8·8	9·6	A
Grid Current (Approx)	1·2	1·2	A
Anode Dissipation	18	26	kW
Grid Dissipation	870	850	W
Output Power	70	115	kW
Efficiency	78	80	%

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 13V ..	225	255	A←
Amplification Factor (V_a = 7·5kV, I_a = 3·0A)	31	37	
Mutual Conductance (V_a = 9·0kV, I_a = 4·0A)	38	48	mA/V
Grid Voltage (negative value) (V_a = 10kV, I_a = 3·0A)	173	195	V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	345	V
Anode Current (V_a = 2·0kV, V_g = +200V)	7·0	11	A
Anode Current (V_a = 4·0kV, V_g = +400V)	22	32	A
Grid Current (V_a = 2·0kV, V_g = +200V)	−0·15	+0·25	A
Grid Current (V_a = 4·0kV, V_g = +400V)	−2·0	+0·5	A
Inter-electrode Capacitances			
Grid to Anode	60	78	pF
Grid to Filament	84	96	pF
Anode to Filament	—	2·0	pF

MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency MHz	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
5	15 kV	12 kV
30	10 kV	8·0 kV

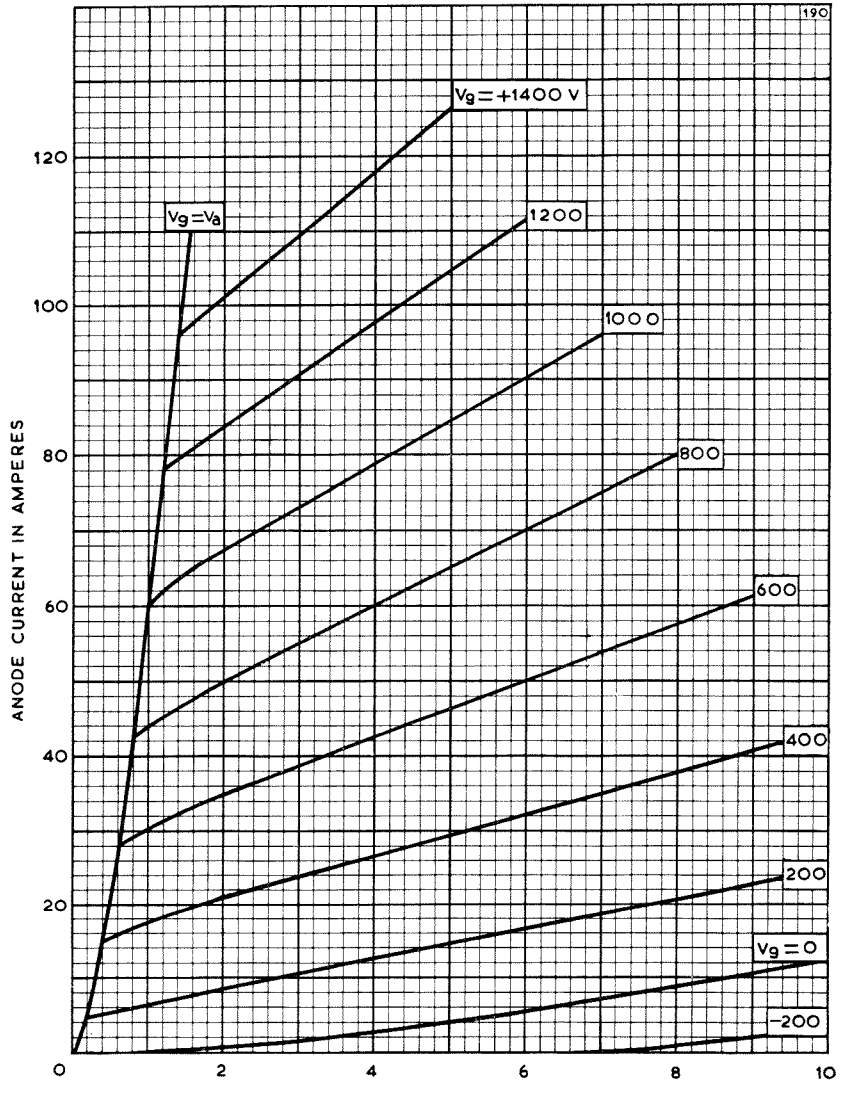
NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.
2. The filament current must not exceed 600A, even momentarily, at any time.

← Indicates a change

R.F. POWER TRIODE

ANODE CHARACTERISTICS



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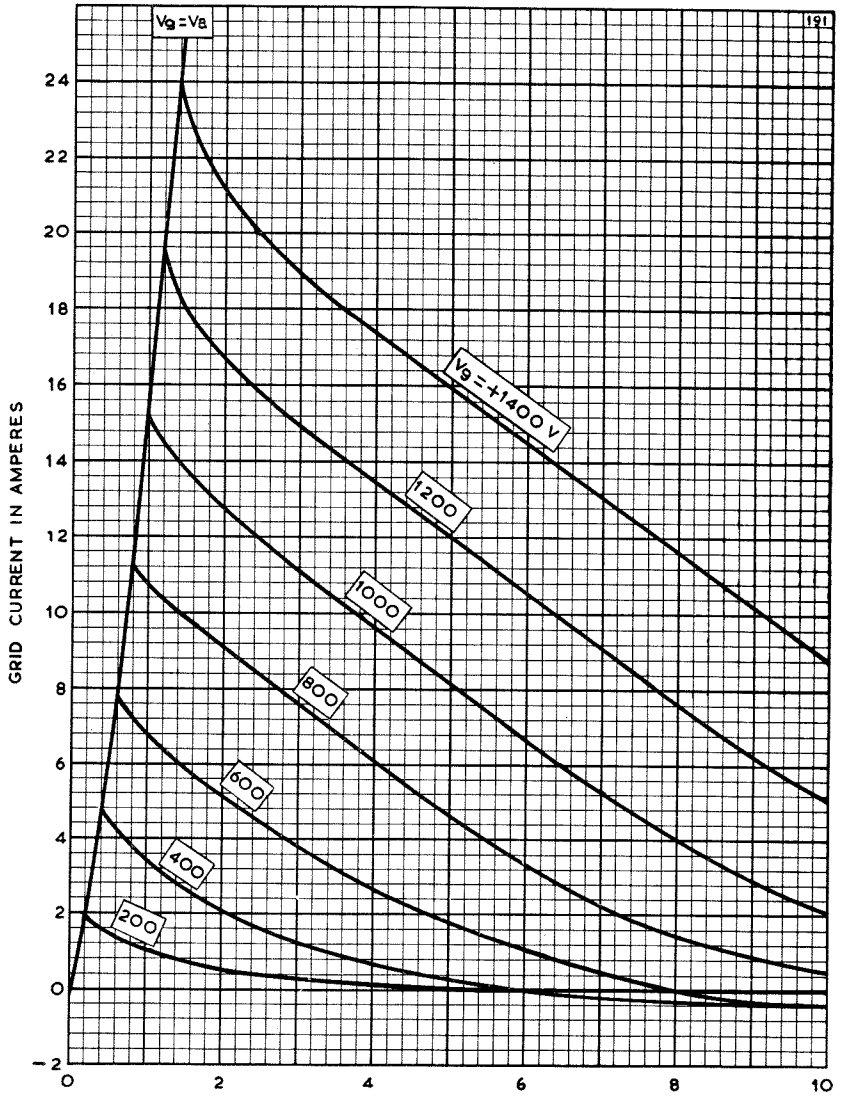
CONTROL GRID CHARACTERISTICS



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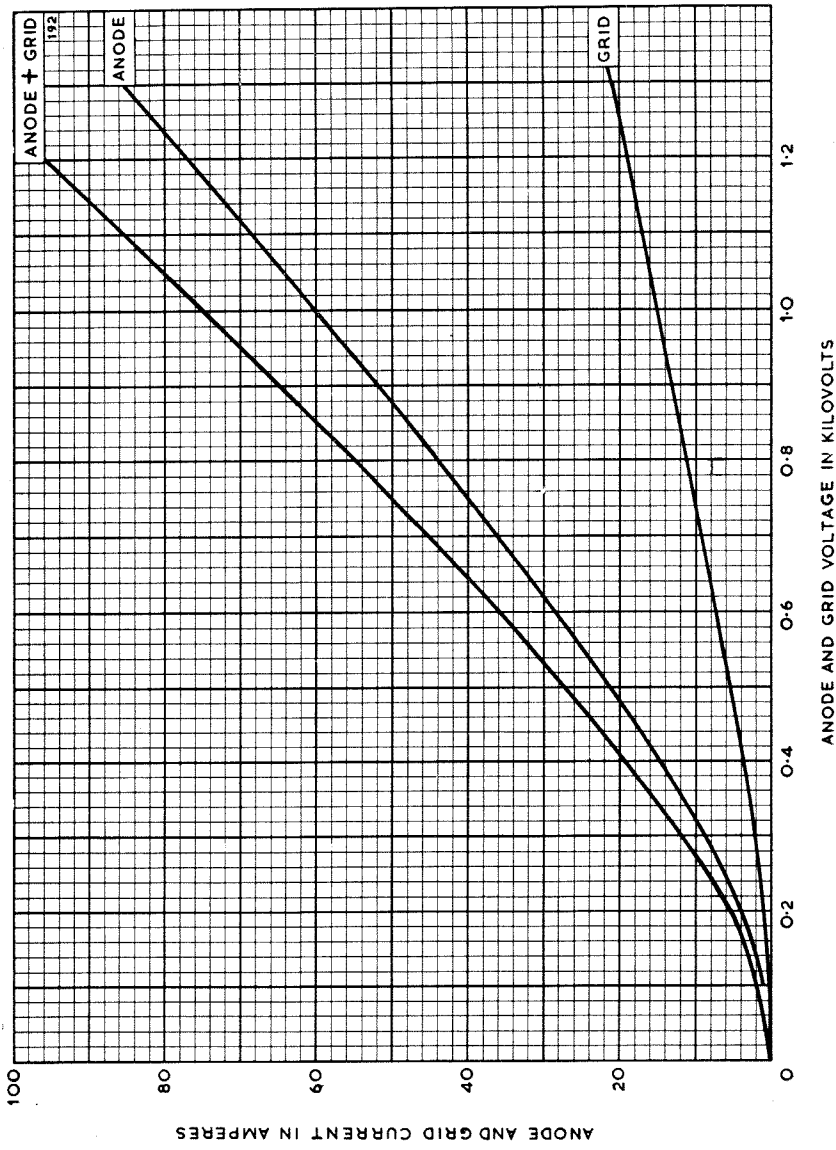
STRAPPED CHARACTERISTICS



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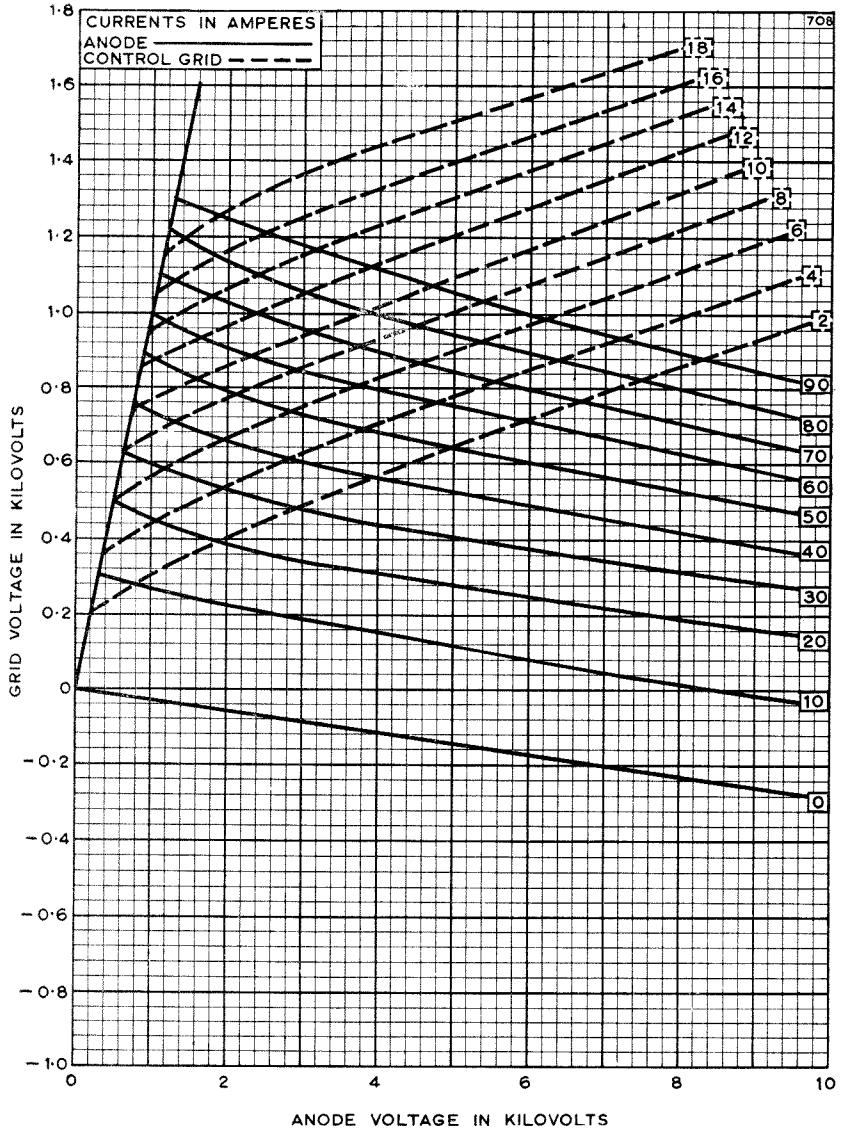
CONSTANT CURRENT CHARACTERISTICS



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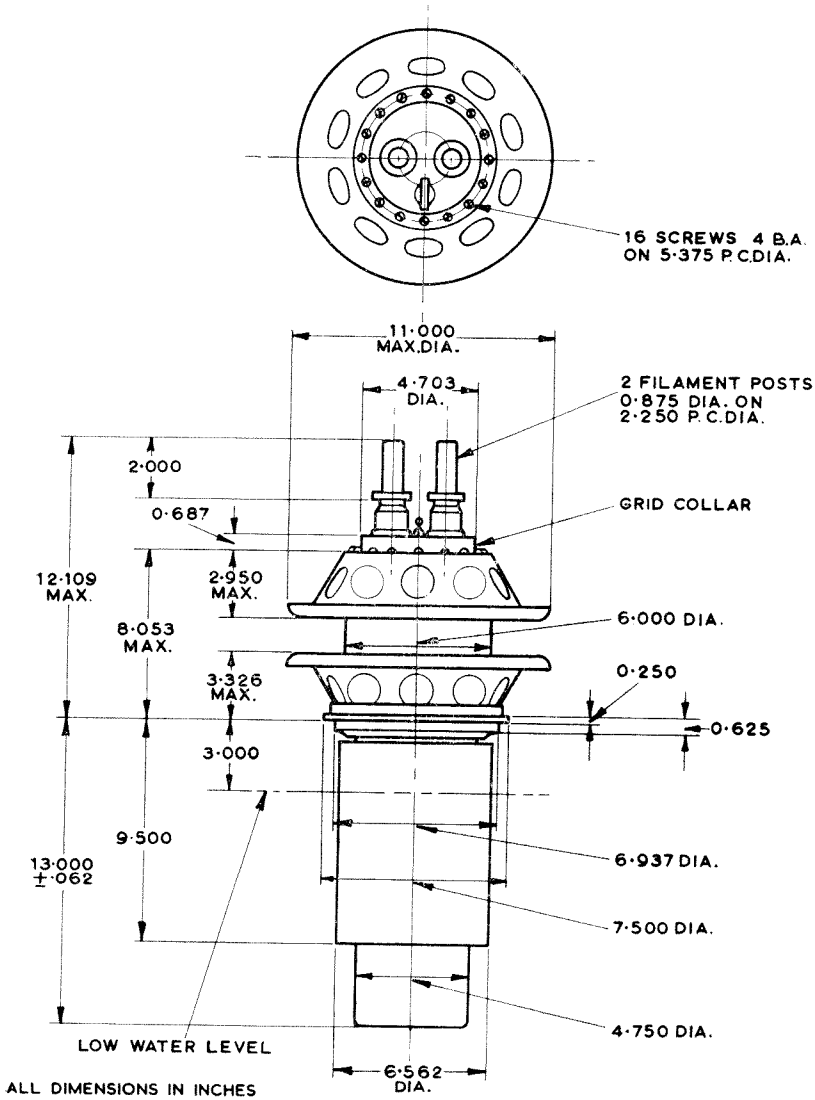
OUTLINE

709



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R.F. POWER TRIODE

BY1102

ABRIDGED DATA

Vapour Cooled Triode, designed primarily for industrial service.

Anode Dissipation	25	kW Max
Anode Voltage	12	kV Max
Frequency for full ratings	50	Mc/s Max
Output Power (Class C unmodulated)	53	kW

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	8·2	V
Filament Current	230	A
Maximum Filament Starting Current	(*See Note* 2)	
Filament Cold Resistance	0·0043	Ω
Peak Usable Cathode Current	45	A
Perveance	1·25mA/V$^{3/2}$	
Amplification Factor (V_a = 9·0kV, I_a = 2·0A)	42	
Mutual Conductance (V_a = 10kV, I_a = 1·5A)	20	mA/V
Inter-electrode Capacitances:		
Grid to Anode	37	pF
Grid to Filament	49	pF
Anode to Filament	0·6	pF

Mechanical

Overall Length	18·88 inches (480 mm)	Max
Overall Diameter	6·38 inches (162 mm)	Max
Net Weight	41 pounds (19 kg)	Approx
Mounting Position	Vertical, filament end up	

Accessories

Single Boiler Unit, integral condenser	BY4031
Double Boiler Unit, integral condenser	BY4030
Filament Leads	MA131
Grid Connector	MA66
Sealing Ring (supplied with valve)	15810A

COOLING AND INSTALLATION

The BY1102 is designed for cooling by water vapour and is fitted with an integral anode block in which circulation holes are provided for the passage of water and steam. The valve is installed with the anode partly immersed in the liquid coolant (distilled or de-ionised water) inside the boiler unit (see list of accessories above). When the power supplies are switched on the heat generated inside the valve soon evaporates some of the water in the circulation holes and jets of steam issue into the upper part of the boiler. The steam is either condensed directly by means of an internal water cooled condenser (as in BY4030 and BY4031) or led away by suitably insulated tubing for condensation at some convenient point external to the boiler.

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The services of our design staff are available for advice in matters of suitable condenser design and installation details.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 20 to 30 cu.ft/min (0·57 to 0·85 cu.m/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of the seals.

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

R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage (*See Note* 3)	12 kV Max
Anode Current	7·5 A Max
Anode Dissipation (*See Note* 4)	25 kW Max
Grid Dissipation	1·0 kW Max
Operating Frequency (for full ratings)	50 Mc/s Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	9·0	12	kV
Grid Voltage	−655	−720	V
Grid Resistor	625	720	Ω
Peak R.F. Grid Voltage	1455	1520	V
Anode Current	5·85	5·85	A
Grid Current (Approx)	1·05	1·0	A
Anode Dissipation	15·6	17·2	kW
Grid Dissipation	735	720	W
Output Power	37	53	kW
Efficiency	70	75·5	%
Load Resistance	700	1020	Ω

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→ RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 8·2V ..	207	253	A
Amplification Factor (V_a = 9·0kV, I_a = 2·0A)	35·5	48·5	
Mutual Conductance (V_a = 10kV, I_a = 1·5A)	15·5	24·5	mA/V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	340	V
Grid Voltage (negative value) (V_a = 10kV, I_a = 2·0A)	95	135	V
Anode Current (V_a = 2·0kV, V_g = +250V) ..	3·8	8·8	A
Grid Current (V_a = 2·0kV, V_g = +250V) ..	0·25	—	A
Anode Current (V_a = 4·0kV, V_g = +250V) ..	6·2	10·4	A
Grid Current (V_a = 4·0kV, V_g = +250V) ..	−0·1	0·5	A
Inter-electrode Capacitances:			
Grid to Anode	32	42	pF
Grid to Filament	44	54	pF

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.
2. The filament current must not exceed 525A, even momentarily, at any time.
3. This is the highest nominal operating voltage to be used. It makes allowance for the normal mains voltage fluctuations as well as tolerances in the equipment.
4. The valve can dissipate higher powers for periods up to 15 seconds provided that the average over a long period does not exceed the maximum stated.

→Indicates a change

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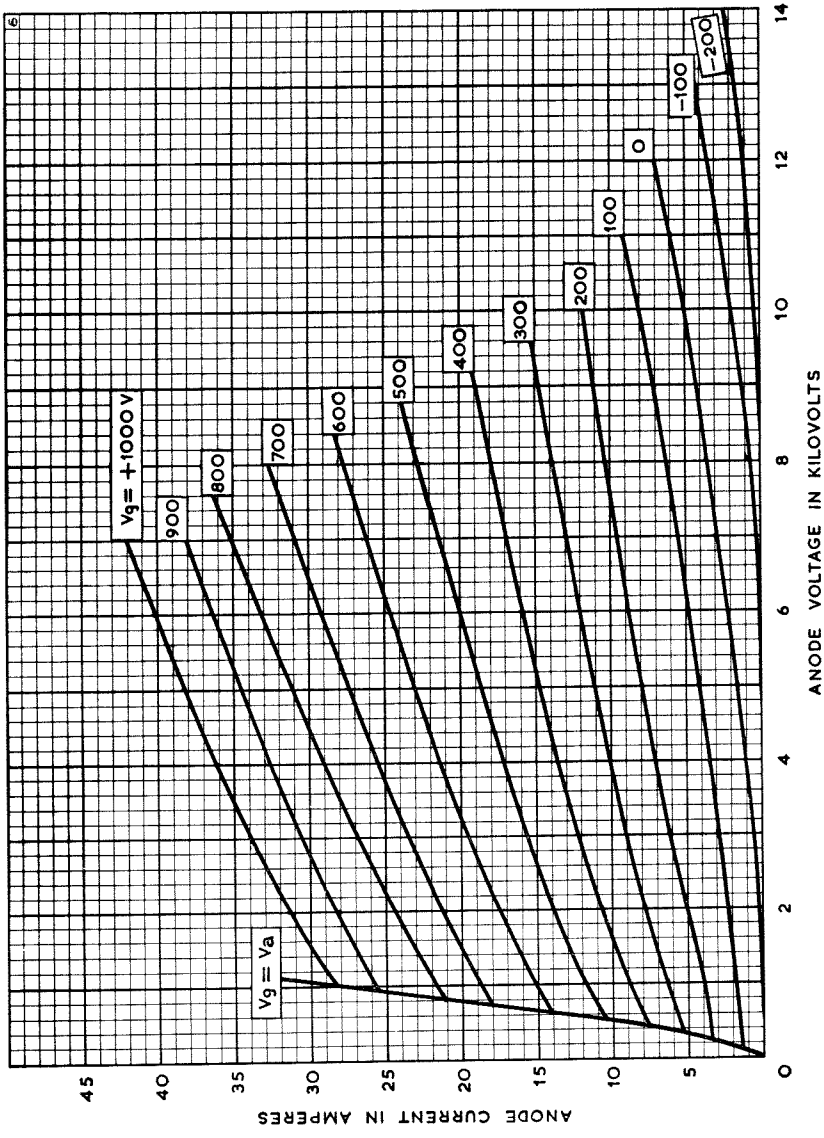
ANODE CHARACTERISTICS



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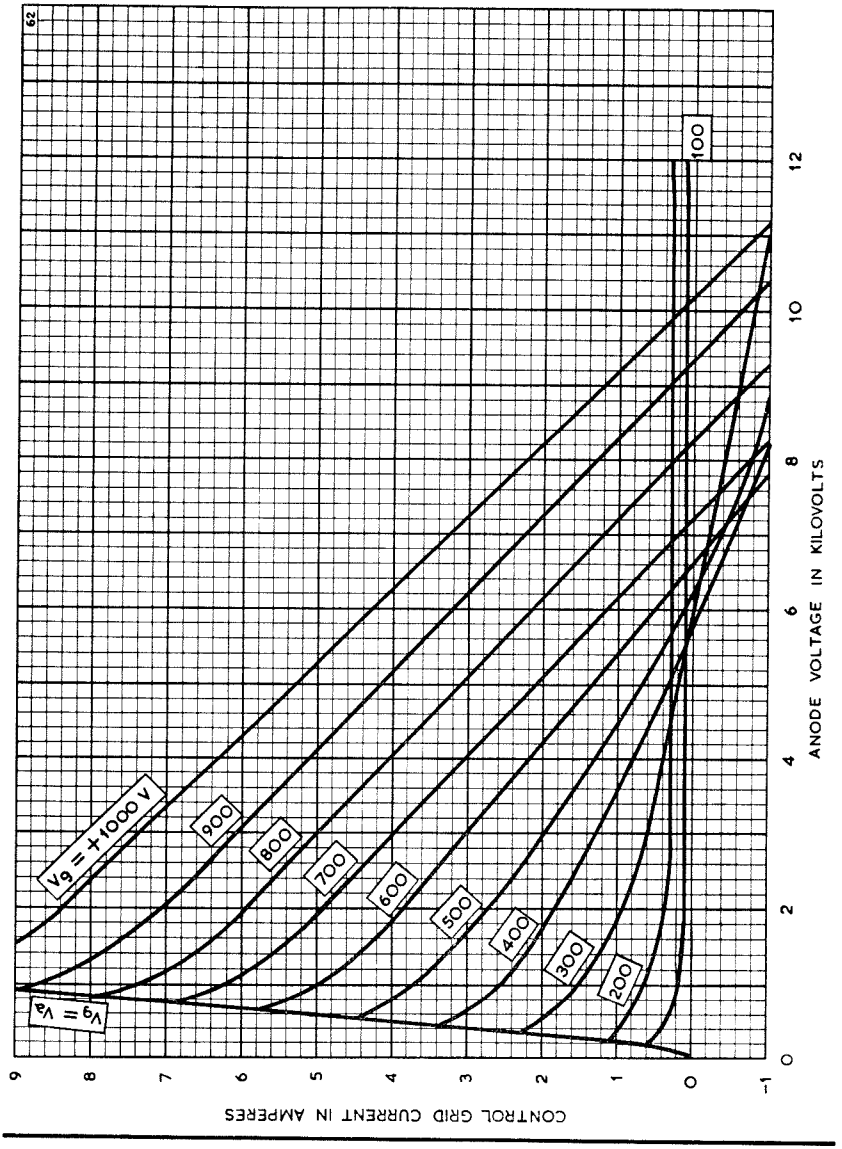
CONTROL GRID CHARACTERISTICS



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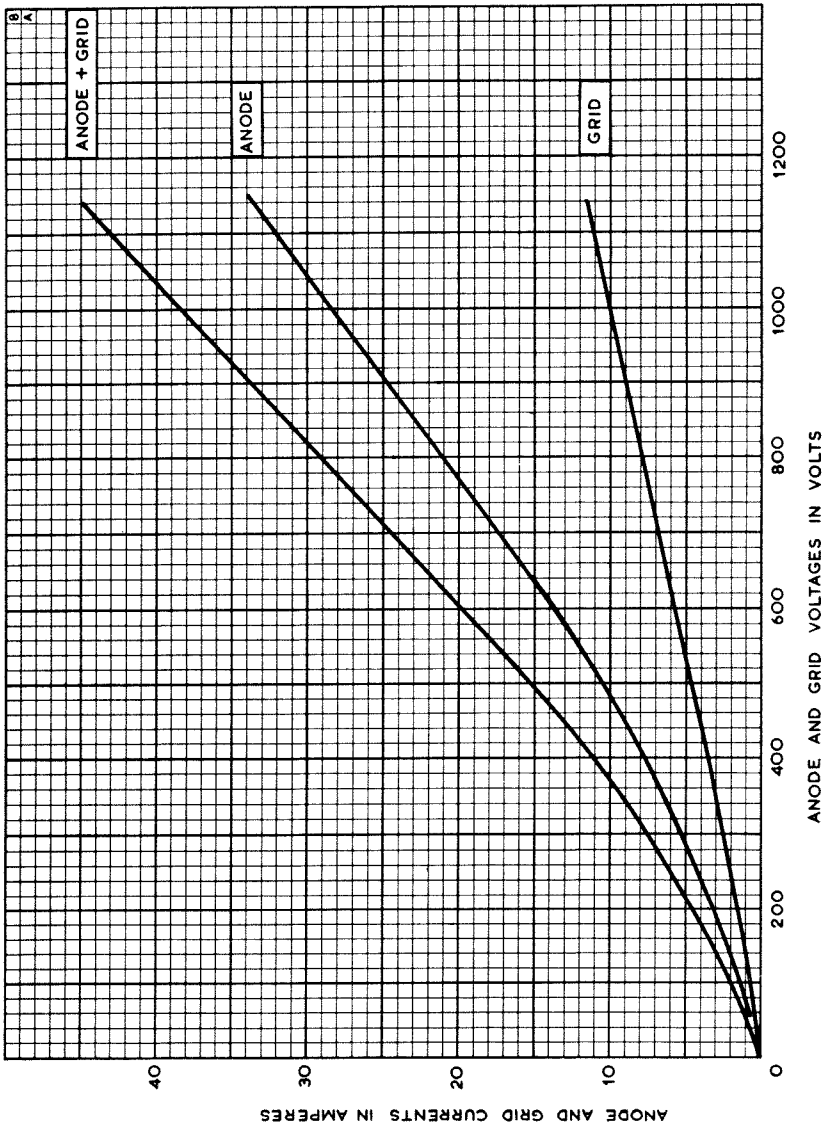
STRAPPED CHARACTERISTICS



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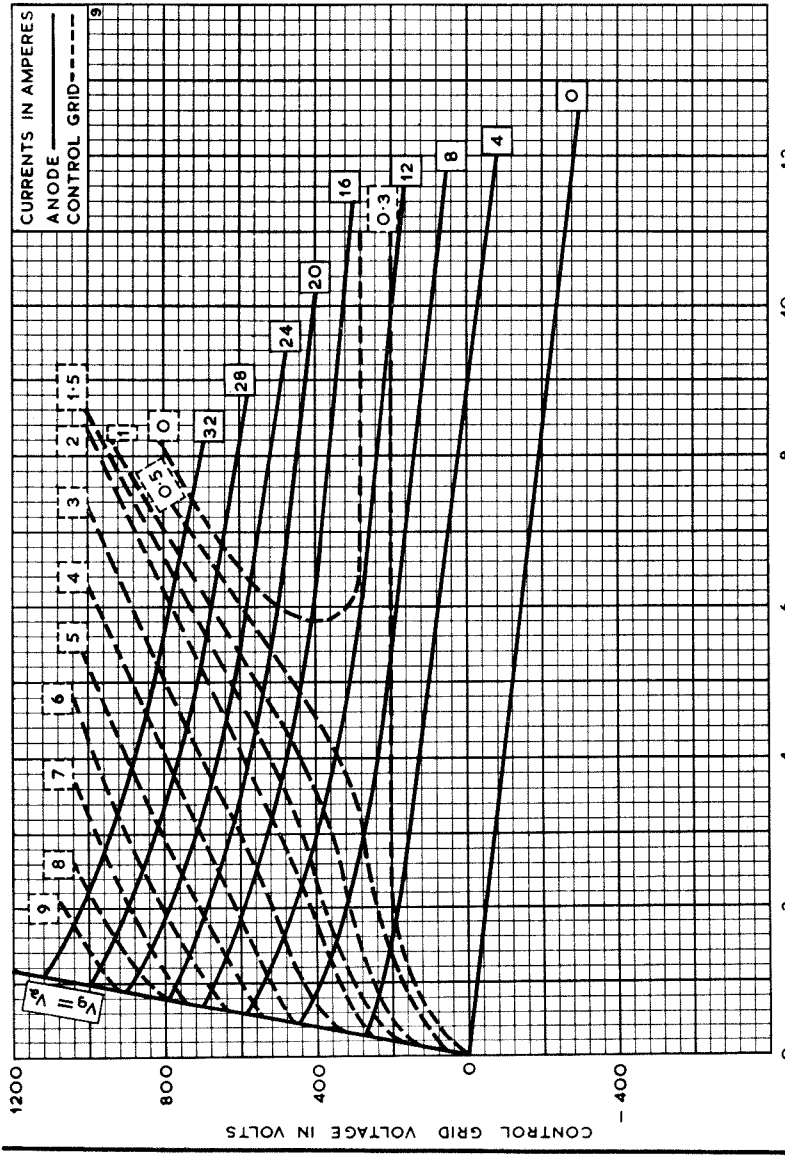
CONSTANT CURRENT CHARACTERISTICS



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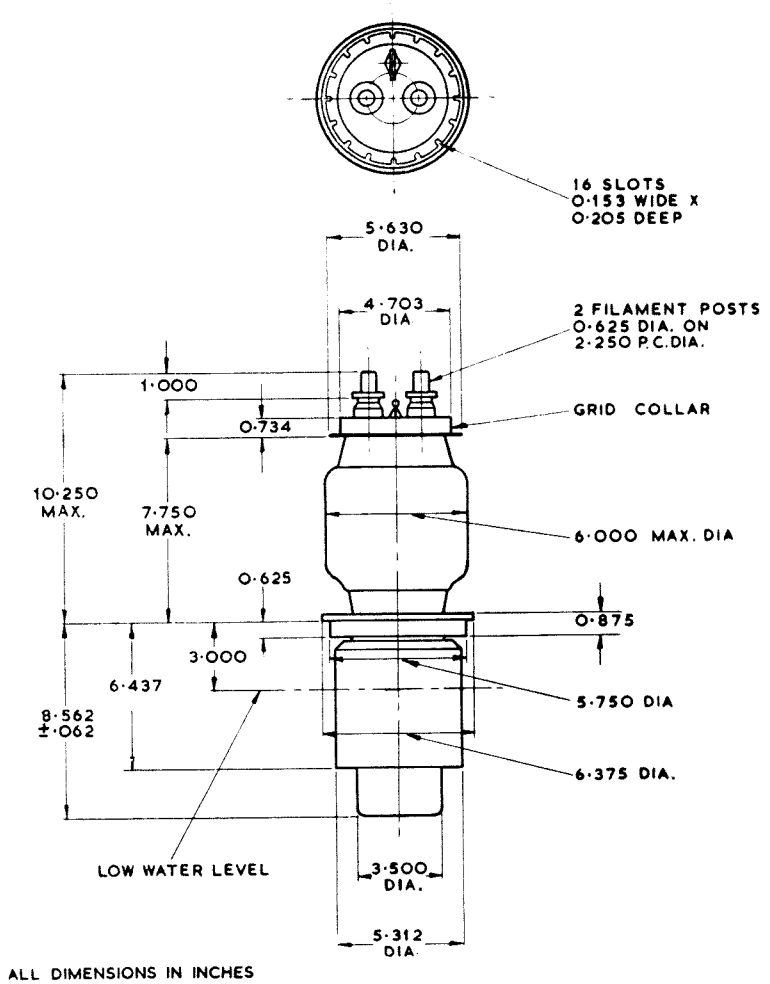
OUTLINE

474



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R.F. POWER TRIODE

BY1121

ABRIDGED DATA

Vapour Cooled Triode designed primarily for industrial service

Anode Dissipation	18	kW Max
Anode Voltage	10	kV Max
Frequency for full ratings	50	Mc/s Max
Output Power (Class C unmodulated conditions)	50	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	6·6	V
Filament Current	230	A
Filament Starting Current (Peak) (*See Note* 2)	600	A Max
Filament Cold Resistance	0·0035	Ω
Peak Usable Cathode Current	45	A
Perveance	2·3	$mA/V^{3/2}$
Amplification Factor (V_a = 6·0kV, I_a = 3·0A)	38	
Mutual Conductance (V_a = 7·0kV, I_a = 3·0A)	45	mA/V
Inter-electrode Capacitances:		
Grid to Anode	54	pF
Grid to Filament	85	pF
Anode to Filament	0·8	pF

Mechanical

Overall Length	15·250 inches (387·4 mm)	Max
Overall Diameter	6·375 inches (161·9 mm)	Max
Net Weight	31 pounds (14·1 kg)	Approx

Accessories

Double Boiler Unit, integral condenser	BY4032
Single Boiler Unit, integral condenser	BY4033
Single Boiler Unit, separate condenser required	BY4063
Filament Leads	MA131
Grid Connector	MA66
Sealing Ring (supplied with valve)	15810A

COOLING AND INSTALLATION

The BY1121 is designed for cooling by water vapour and is fitted with an integral anode block in which circulation holes are provided for the passage of water and steam. The valve is installed with the anode partly immersed in the liquid coolant (distilled or de-ionised water) inside the boiler unit (see list of accessories

above). When the power supplies are switched on the heat generated inside the valve soon evaporates some of the water in the circulation holes and jets of steam issue into the upper part of the boiler. The steam is either condensed directly by means of an internal water cooled condenser (as in BY4032 and BY4033) or led away by suitably insulated tubing for condensation at some convenient point external to the boiler unit (BY4063).

The services of our design staff are available for advice in matters of suitable condenser design and installation details.

The temperature of the filament and grid seals must not exceed 140 C. A flow of air of 20 to 30cu.ft/min (0·57 to 0·85cu.m/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of these seals.

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

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

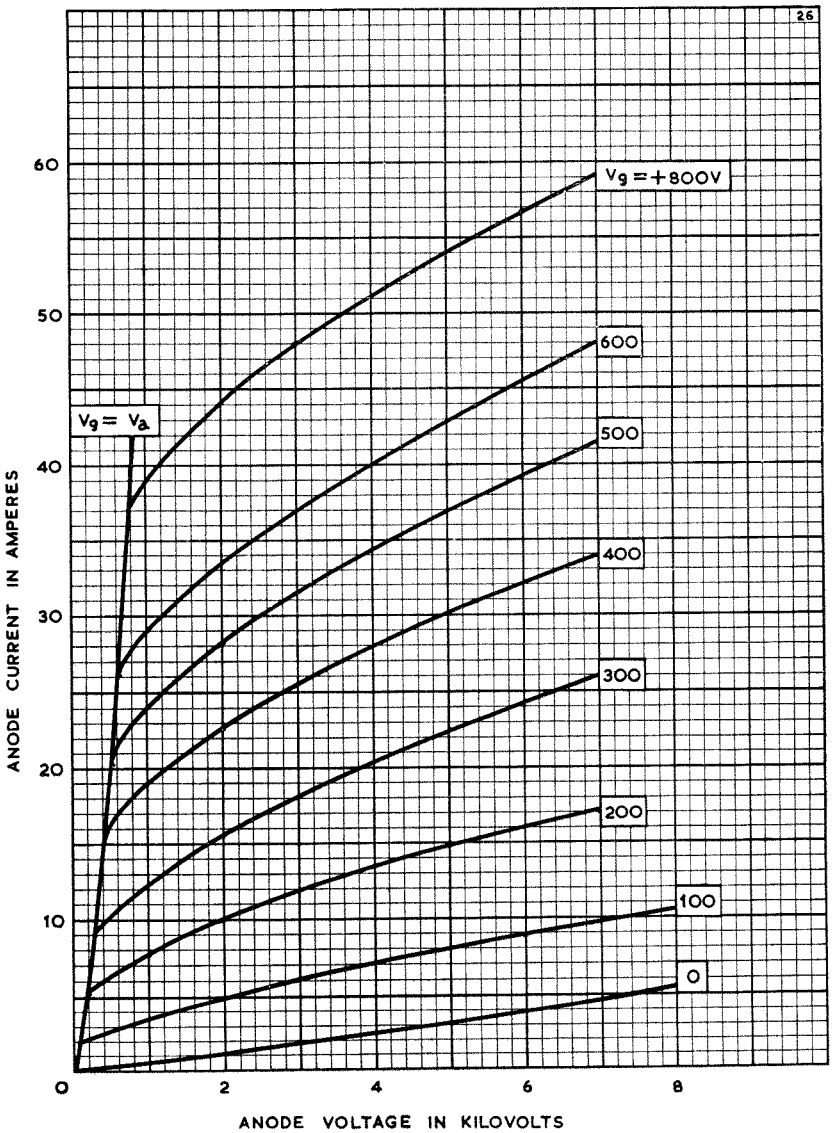
Anode Voltage (*See Note* 3)	10 kV Max
Anode Current	6·5 A Max
Anode Dissipation	18 kW Max
Grid Dissipation	1·0 kW Max
Frequency (for full ratings)	50 Mc/s Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	8·0	10	kV
Grid Voltage	−420	−470	V
from Grid Resistor	510	746	Ω
Anode Current	6·4	6·4	A
Grid Current (Approx)	0·82	0·63	A
Anode Dissipation	11·2	13	kW
Grid Dissipation	386	290	W
Driving Power	730	585	W
Peak R.F. Grid Voltage	890	930	V
Output Power	40	51	kW
Efficiency	78	80	%
Load Resistance	665	830	Ω

R.F. POWER TRIODE

ANODE CHARACTERISTICS



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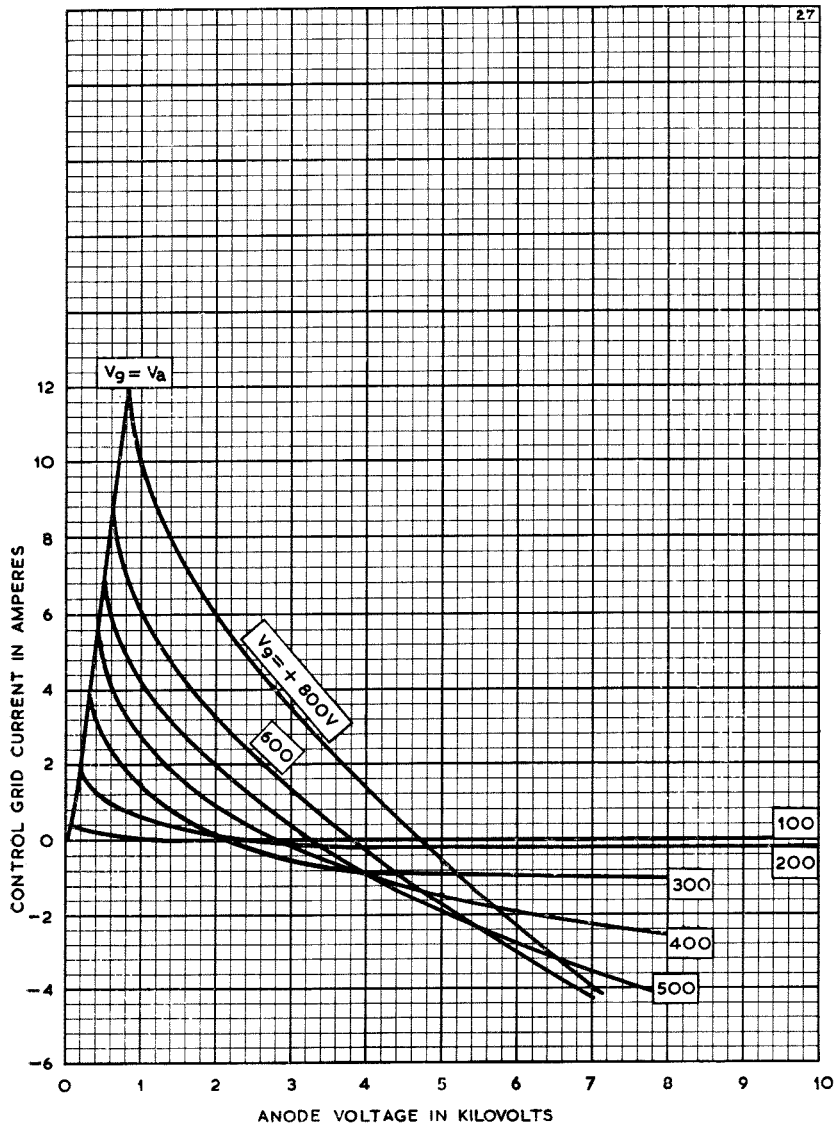
CONTROL GRID CHARACTERISTICS



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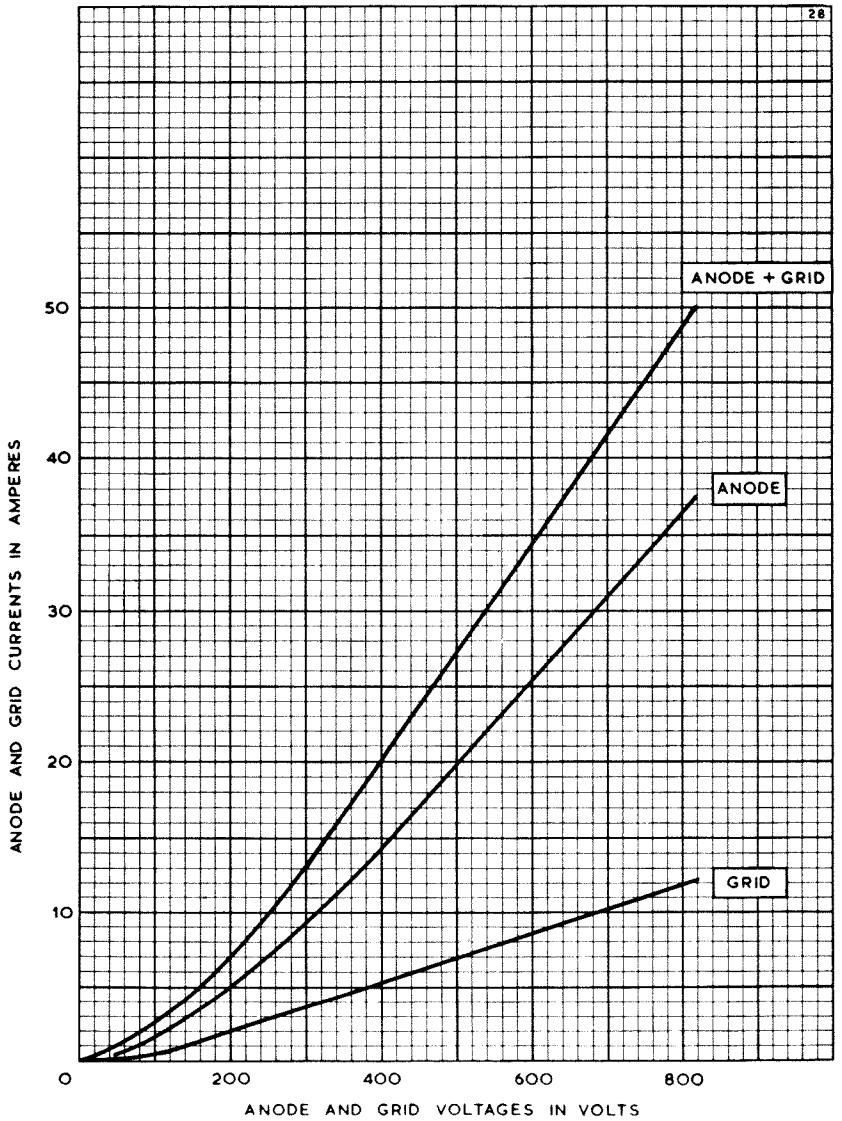
STRAPPED CHARACTERISTICS



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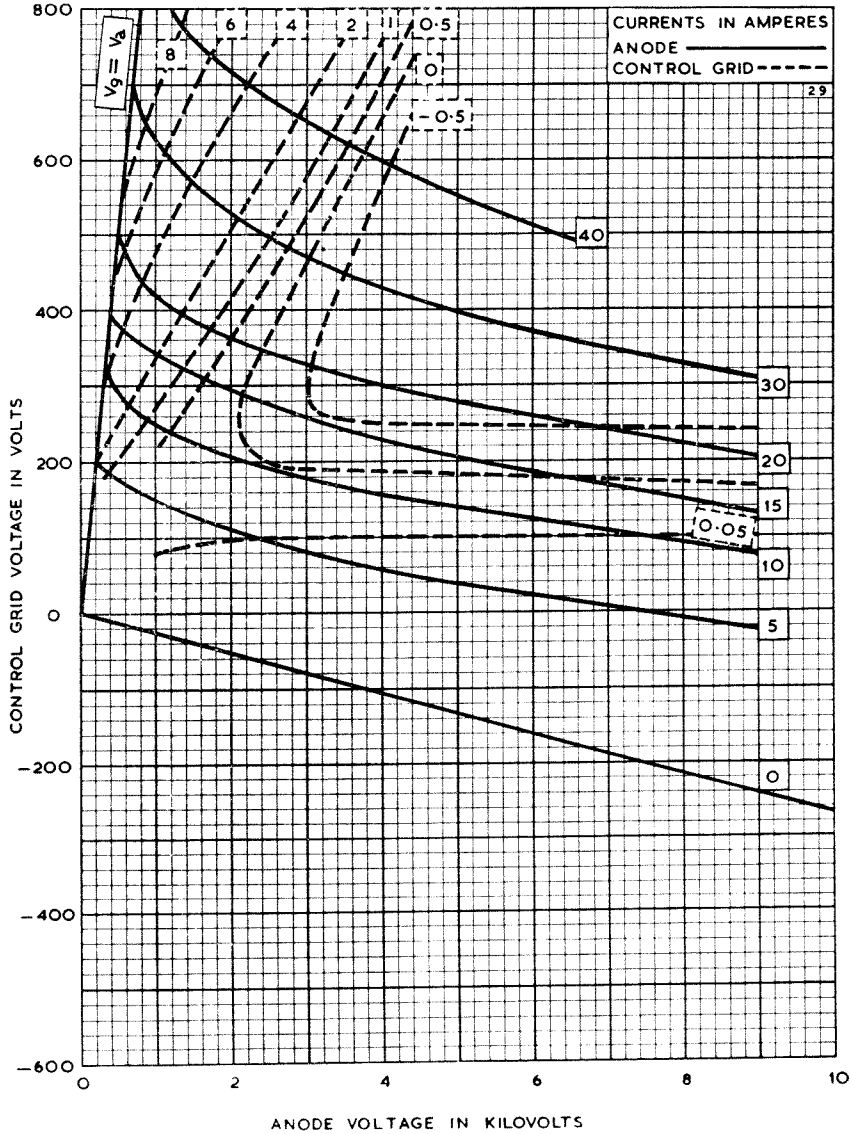
CONSTANT CURRENT CHARACTERISTICS



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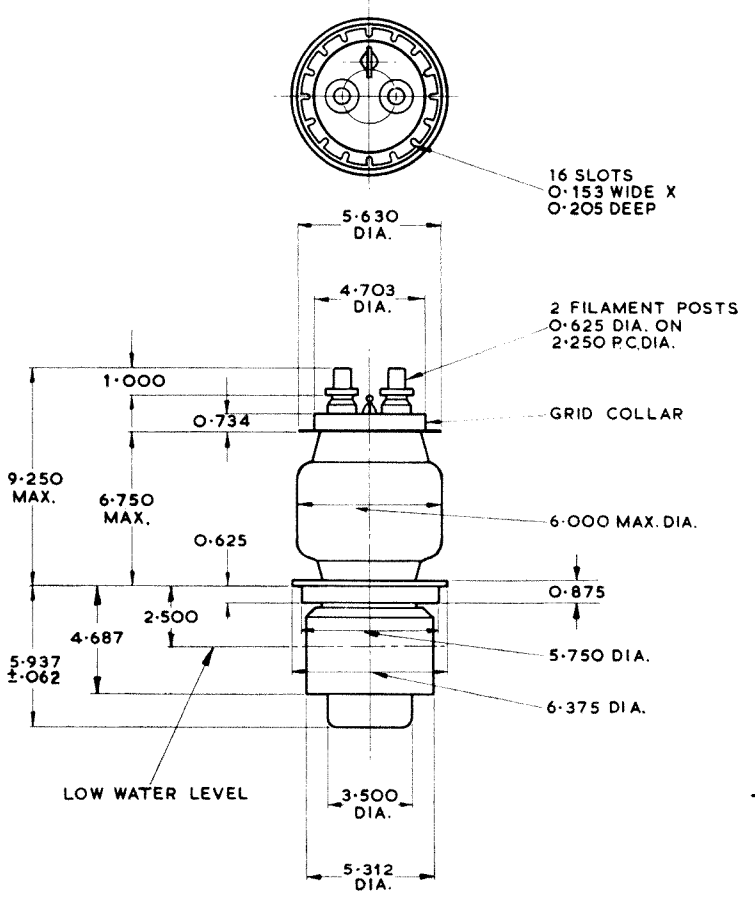
R.F. POWER TRIODE

OUTLINE

475



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INDICATES A CHANGE ←

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R.F. POWER TRIODE

ABRIDGED DATA

Vapour Cooled Triode, suitable for cathode drive operation.

Anode Dissipation	10	kW Max
Anode Voltage	12	kV Max
Frequency for full ratings (*See page* 3)	5·0	Mc/s Max
Output Power (Class C unmodulated)	29	kW

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	6·0	V
Filament Current	115	A
Maximum Filament Starting Current	(*See Note* 2)	
Filament Cold Resistance	0·006	Ω
Peak Usable Cathode Current	20	A
Perveance	1·4	$mA/V^{3/2}$
Amplification Factor (V_a = 5·0 kV, I_a = 1·0 A)	37	
Mutual Conductance (V_a = 5·0 kV, I_a = 1·0 A)	19	mA/V
Inter-electrode Capacitances:		
Grid to Anode	33	pF
Grid to Filament	42	pF
Anode to Filament	0·5	pF

Mechanical

Overall Length	13·75 inches	(350 mm)	Max
Overall Diameter	7·13 inches	(181 mm)	Max
Net Weight	17 pounds	(7·7 kg)	Approx
Mounting Position	Vertical, filament end up		

Accessories

Boiler Unit, separate condenser required	BY4048A
Boiler Unit, integral condenser	BY4064
Filament Leads	MA135 or MA135A
Grid Connector	MA66A
Sealing Ring (supplied with valve)	15801A

COOLING AND INSTALLATION

The BY1122 is designed for cooling by water vapour and is fitted with an integral anode block in which circulation holes are provided for the passage of water and steam. The valve is installed with the anode partly immersed in the liquid coolant (distilled or de-ionised water) inside the boiler unit (see list of accessories above). When the power supplies are switched on the heat generated inside the valve soon evaporates some of the water in the circulation holes and jets of steam issue into the upper part of the boiler. The steam is either condensed directly by means of an internal water cooled condenser (as in BY4064) or led away by suitable insulated tubing for condensation at some convenient point external to the boiler (BY4048A).

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The services of our design staff are available for advice in matters of suitable condenser design and installation details.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 20cu.ft/min (0·57cu.m/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of the seals.

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

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	12	kV Max
Anode Current	3·5	A Max
Anode Dissipation	10	kW Max
Grid Dissipation	500	W Max
Operating Frequency (for full ratings)	5	Mc/s Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	6·0	8·5	10	12	kV
Grid Voltage	−300	−450	−550	−650	V
Peak R.F. Grid Voltage	820	950	1060	1150	V
Anode Current	3·4	3·1	3·2	3·0	A
Grid Current (Approx)	0·47	0·44	0·3	0·21	A
Anode Dissipation	5·4	6·4	7·0	7·0	kW
Grid Dissipation	245	220	155	105	W
Output Power	15	20	25	29	kW
Efficiency	73·5	76	78	80	%

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 6·0V	107	121	A
Amplification Factor (V_a = 5·0kV, I_a = 1·0A)	34	42	
Mutual Conductance (V_a = 5·0kV, I_a = 1·0A)	15	23	mA/V
Grid Voltage (negative value) (V_a = 5·0kV, I_a = 1·0A)	41	71	V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	380	V
Anode Current (V_a = 2·0kV, V_g = +200V)	5·1	6·9	A

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R.F. POWER TRIODE

MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency Mc/s	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
5	12 kV	10 kV
20	10 kV	8 kV
50	8·5 kV	6·7 kV
110	6·5 kV	5·3 kV

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.
2. The filament current must not exceed 260A, even momentarily, at any time.

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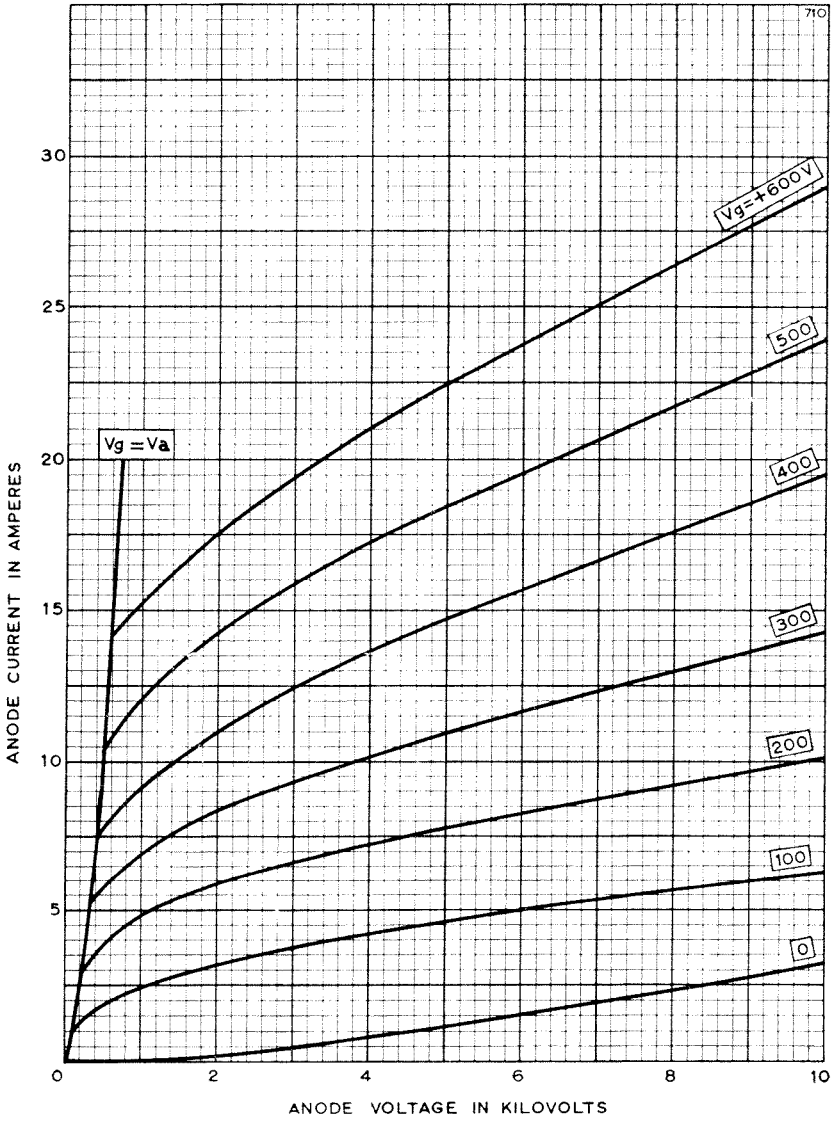
ANODE CHARACTERISTICS



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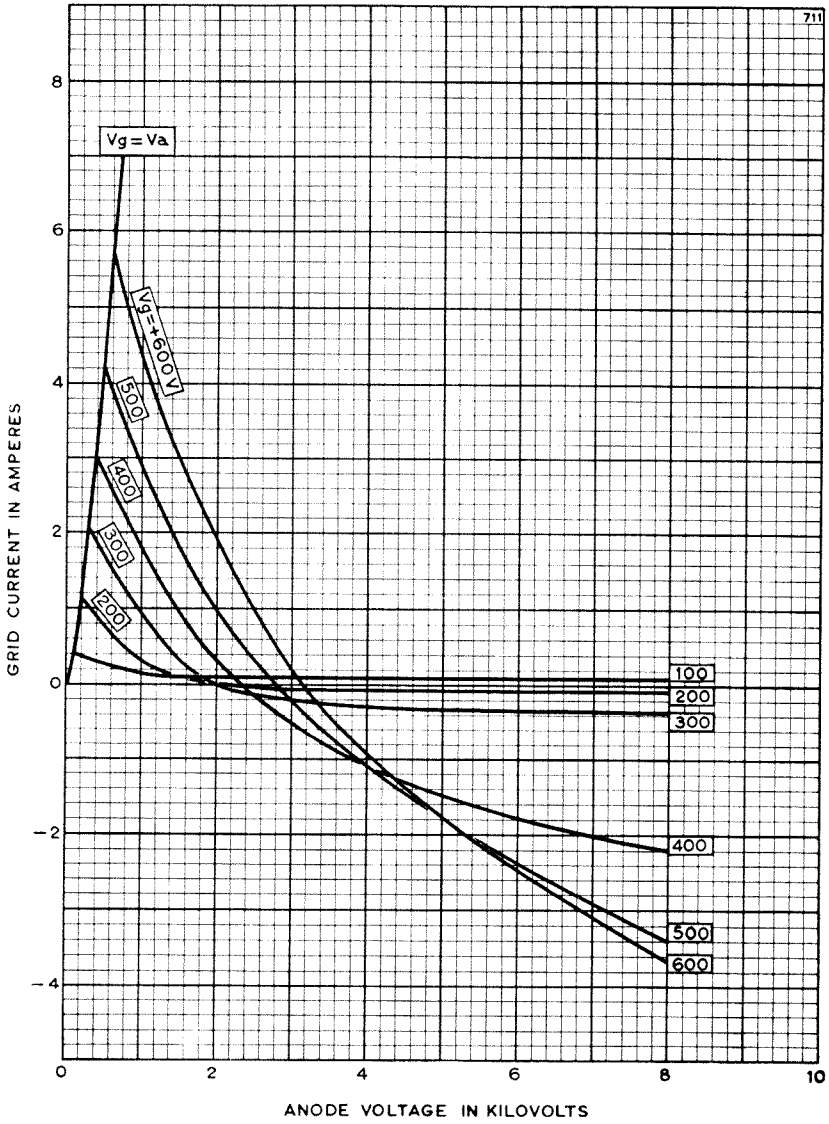
CONTROL GRID CHARACTERISTICS



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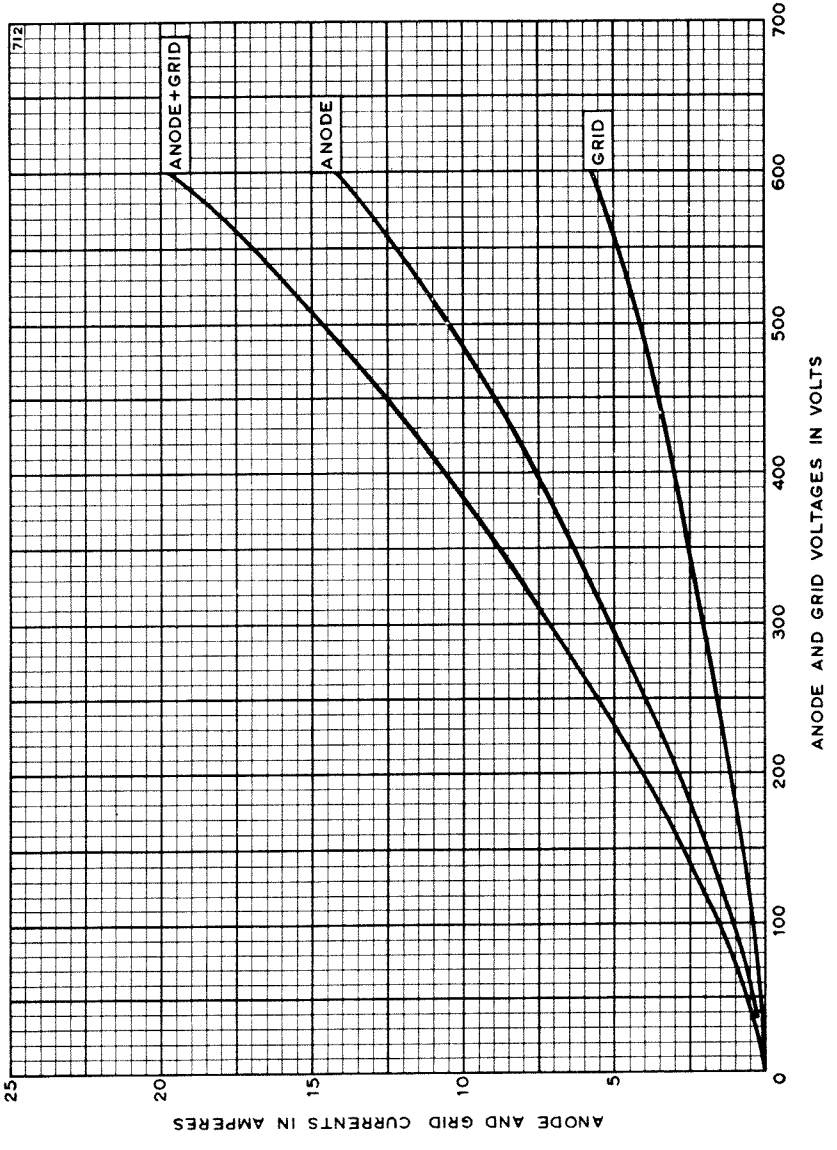

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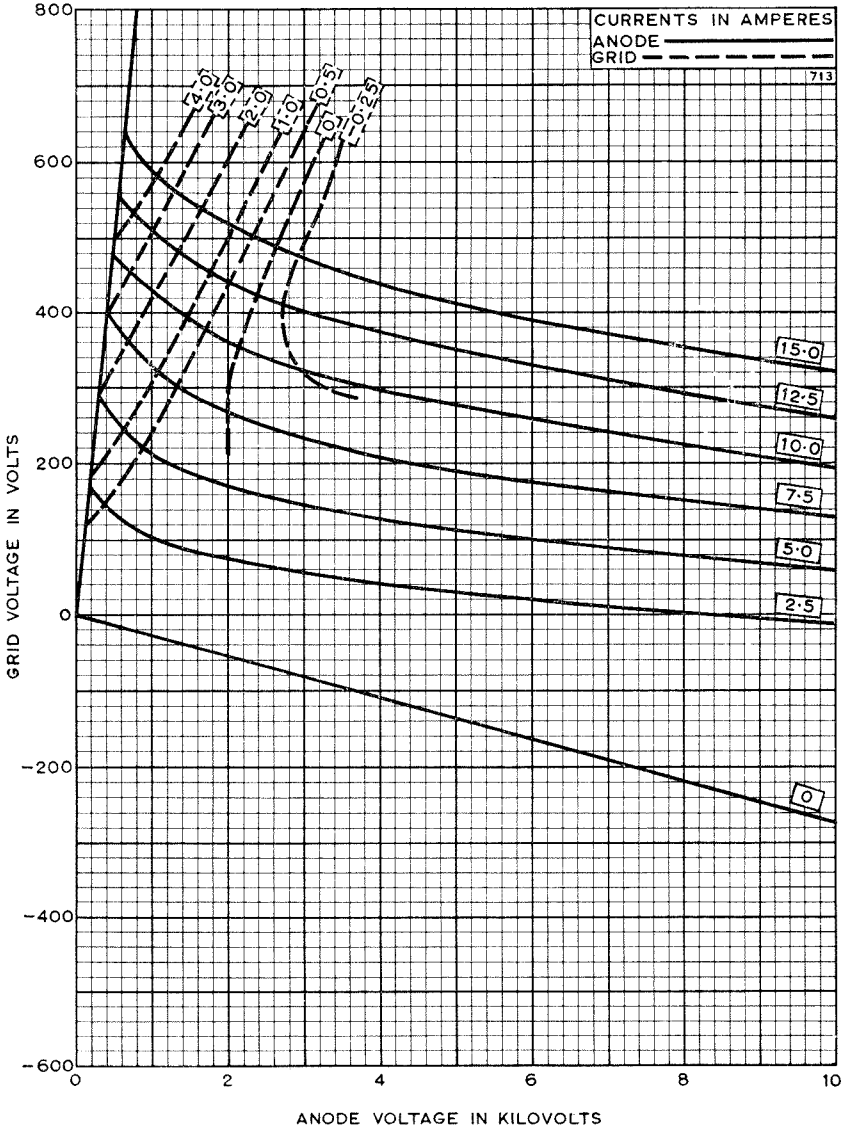
CONSTANT CURRENT CHARACTERISTICS



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OUTLINE

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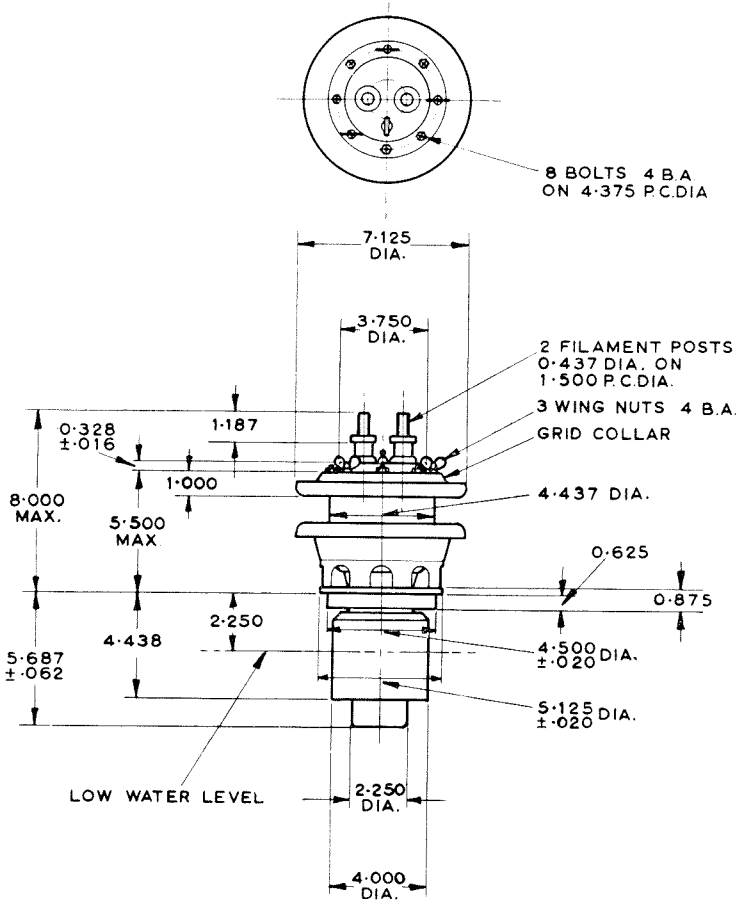

ALL DIMENSIONS IN INCHES

R.F. POWER TRIODE

BY1124

ENGLISH ELECTRIC

ABRIDGED DATA

Vapour Cooled Triode designed primarily for industrial service.

Anode Dissipation	10	kW Max
Anode Voltage	8·5	kV Max
Frequency for full ratings	100	Mc/s Max
Output Power (Class C unmodulated)	20	kW

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	6·0	V
Filament Current	115	A
Maximum Filament Starting Current	(*See Note* 2)	
Filament Cold Resistance	0·006	Ω
Peak Usable Cathode Current	20	A
Perveance	1·4	$mA/V^{3/2}$
Amplification Factor (V_a = 5·0 kV, I_a = 1·0 A)	37	
Mutual Conductance (V_a = 5·0 kV, I_a = 1·0 A)	19	mA/V
Inter-electrode Capacitances:		
Grid to Anode	31	pF
Grid to Filament	41	pF
Anode to Filament	0·5	pF

Mechanical

Overall Length	13·813 inches (351 mm)	Max
Overall Diameter	5·145 inches (130·7 mm)	Max
Net Weight	15 pounds (6·8 kg)	Approx
Mounting Position	Vertical, filament end up	

Accessories

Boiler Unit, separate condenser required	BY4048A
Boiler Unit, integral condenser	BY4064
Filament Leads	MA135 or MA135A
Grid Connector	MA66A
Sealing Ring (supplied with valve)	15801A

COOLING AND INSTALLATION

The BY1124 is designed for cooling by water vapour and is fitted with an integral anode block in which circulation holes are provided for the passage of water and steam. The valve is installed with the anode partly immersed in the liquid coolant (distilled or de-ionised water) inside the boiler unit (see list of accessories above). When the power supplies are switched on the heat generated inside the valve soon evaporates some of the water in the circulation holes and jets of steam issue into the upper part of the boiler. The steam is either condensed directly by means of an internal water cooled condenser (as in BY4064) or led away by suitably insulated tubing for condensation at some convenient point external to the boiler (BY4048A).

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The services of our design staff are available for advice in matters of suitable condenser design and installation details.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 20cu.ft/min (0·57cu.m/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of the seals.

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

R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage (*See Note* 3)	8·5 kV Max
Anode Current	3·5 A Max
Anode Dissipation (*See Note* 4)	10 kW Max
Grid Dissipation	500 W Max
Frequency (for full ratings)	100 Mc/s Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	6·0	8·5	kV
Grid Voltage	−300	−450	V
Grid Resistor	640	1025	Ω
Peak R.F. Grid Voltage	820	950	V
Anode Current	3·4	3·1	A
Grid Current (Approx)	0·47	0·44	A
Anode Dissipation	5·4	6·4	kW
Grid Dissipation	245	220	W
Driving Power	385	420	W
Output Power (*See Note* 5)	15	20	kW
Efficiency	73·5	76	%
Load Resistance	900	1400	Ω

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RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 6·0V	107	121	A
Amplification Factor (V_a = 5·0kV, I_a = 1·0A)	34	42	
Mutual Conductance (V_a = 5·0kV, I_a = 1·0A)	15	23	mA/V
Grid Voltage (negative value) (V_a = 5·0kV, I_a = 1·0A)	41	71	V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	380	V
Anode Current (V_a = 2·0kV, V_g = +200V)	5·1	6·9	A

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.
2. The filament current must not exceed 260A, even momentarily, at any time.
3. This is the highest nominal operating voltage to be used. It makes allowance for the normal mains voltage fluctuations as well as tolerances in the equipment.
4. The valve can dissipate higher powers for periods up to 15 seconds provided that the average over a long period does not exceed the maximum stated.
5. The output power specified does not take into account the anode circuit efficiency.

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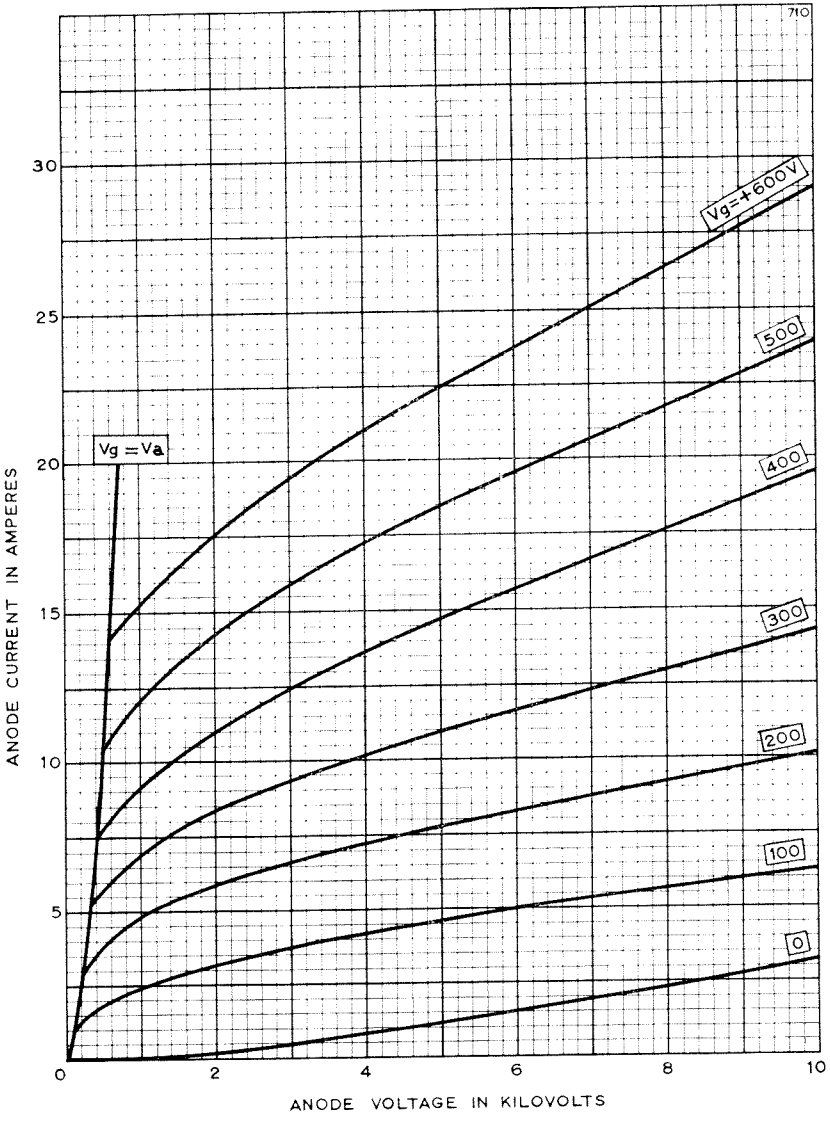
ANODE CHARACTERISTICS



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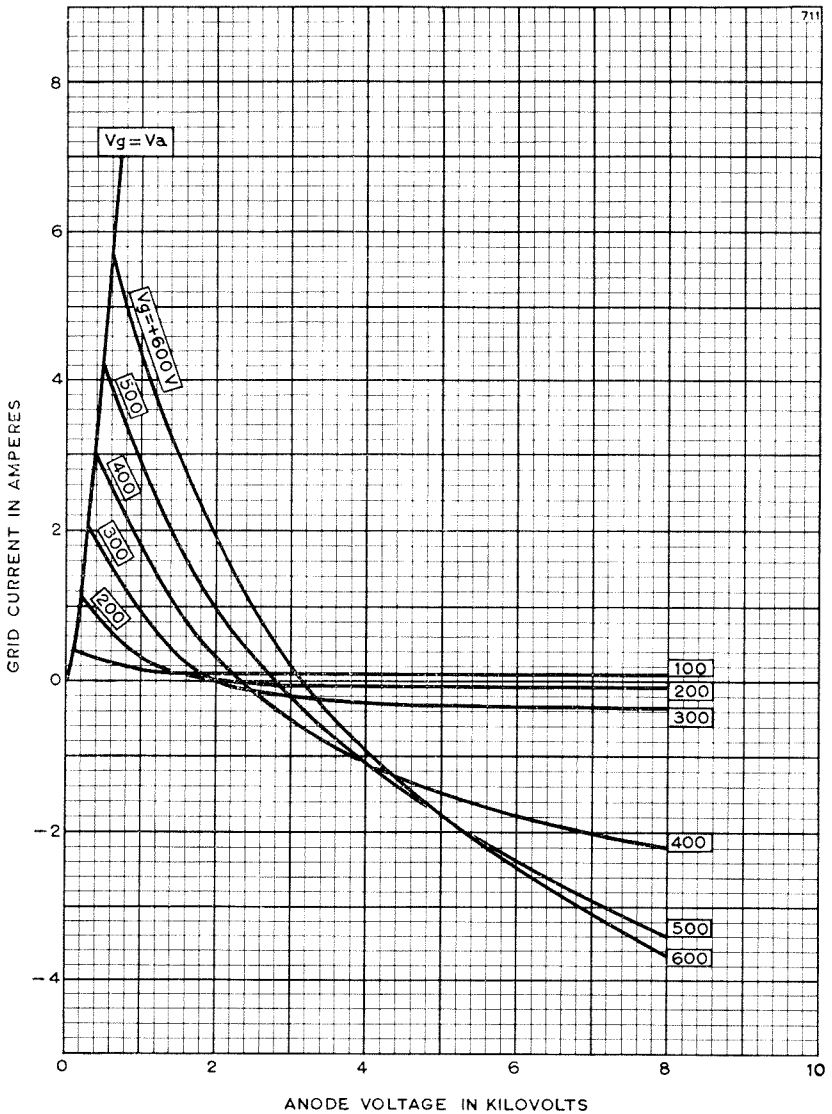
CONTROL GRID CHARACTERISTICS



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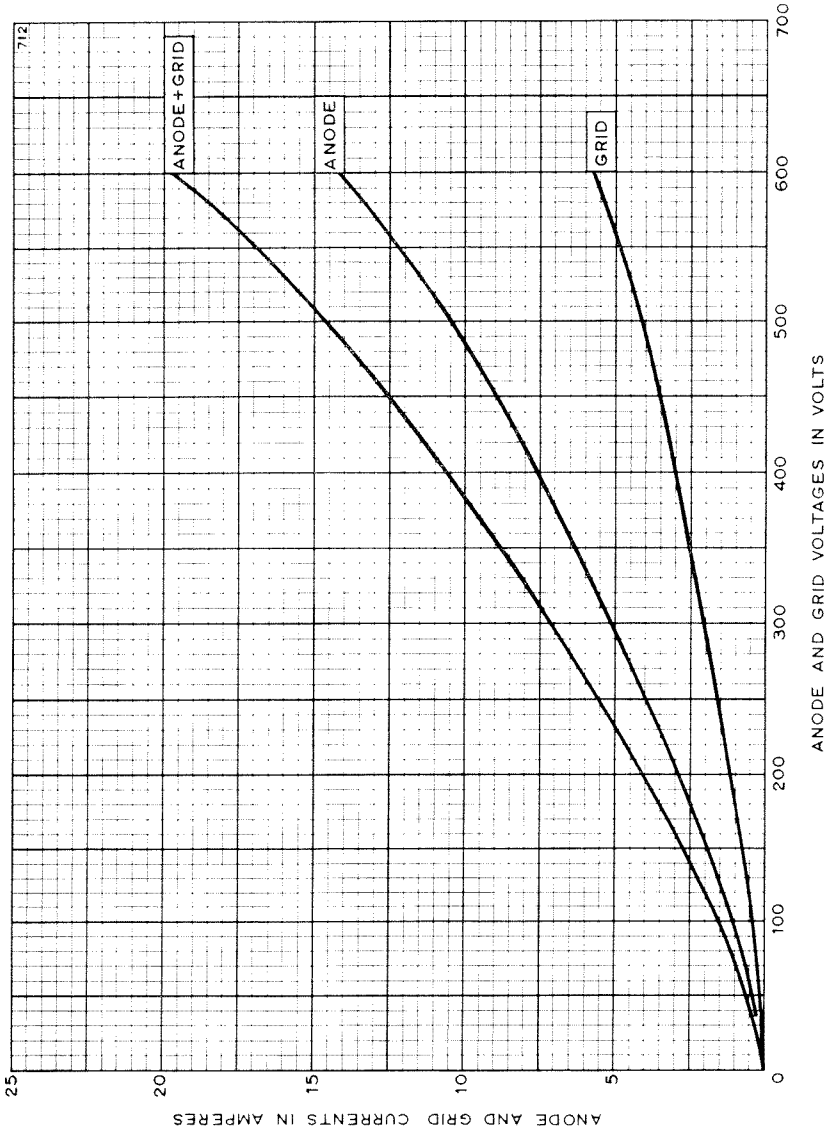
STRAPPED CHARACTERISTICS



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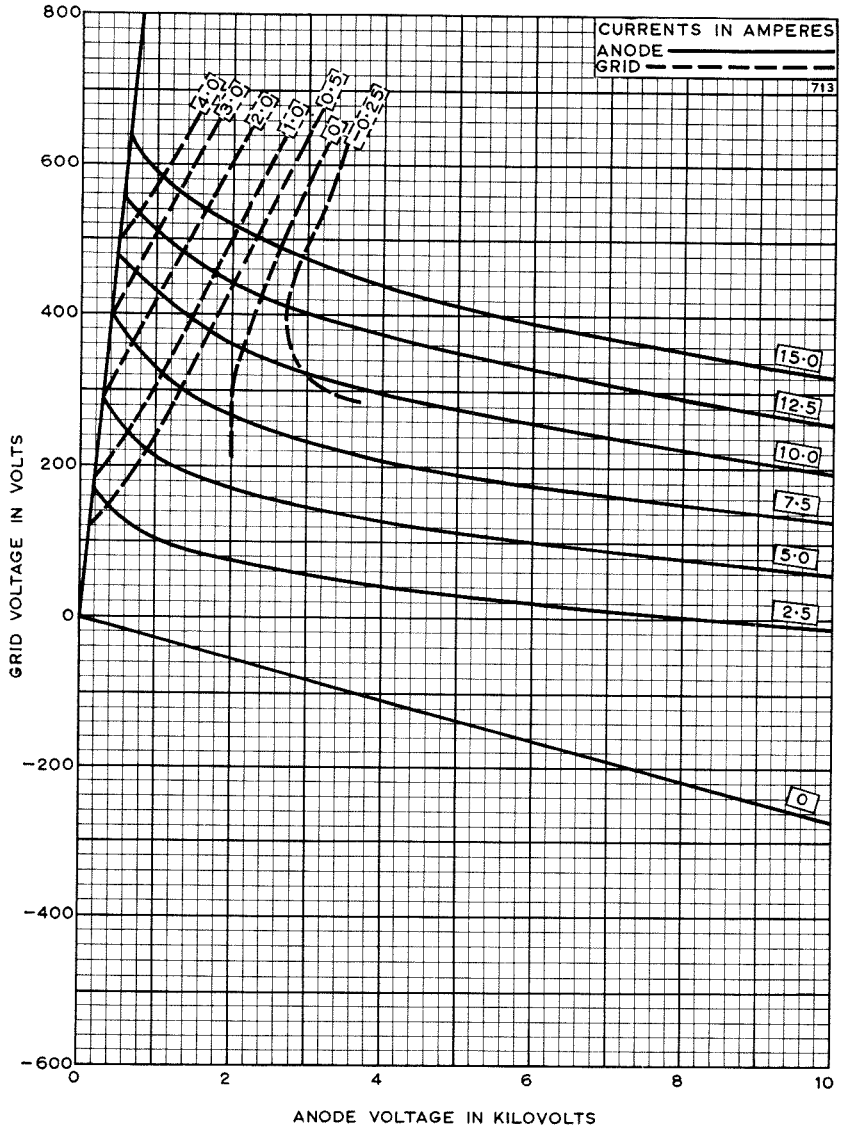
CONSTANT CURRENT CHARACTERISTICS



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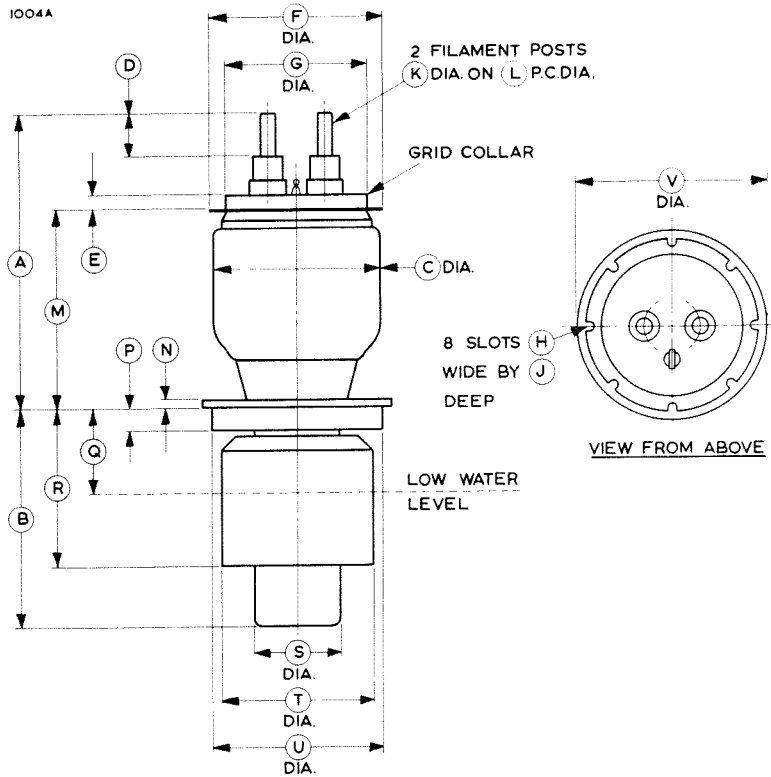
OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	8·000 Max	203·2 Max	L	1·500	38·10
B	5·813 Max	147·7 Max	M	5·350 Max	135·9 Max
C	4·437	112·7	N	0·250	6·35
D	1·125	28·58	P	0·625	15·88
E	0·375	9·53	Q	2·250	57·15
F	4·562	115·9	R	4·437	112·7
G	3·750	95·25	S	2·250	57·15
H	0·182	4·62	T	4·000	101·6
J	0·205	5·21	U	4·500	114·3
K	0·437	11·10	V	5·125	130·2

Millimetre dimensions have been derived from inches.

R.F. POWER TRIODE

BY1143

ABRIDGED DATA

Vapour Cooled Triode, designed primarily for industrial service.

Anode Dissipation	35	kW Max
Anode Voltage	10	kV Max
Frequency for full ratings	10	MHz Max
Output Power (Class C unmodulated)	77·5	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	12·0	V←
Filament Current	240	A←
Maximum Filament Starting Current	(*See Note* 2)	
Filament Cold Resistance	0·0059	Ω
Peak Usable Cathode Current	95	A
Amplification Factor (V_a = 5·0kV, I_a = 5·0A)	37	
Mutual Conductance (V_a = 6·0kV, I_a = 3·5A)	85	mA/V
Perveance	5·8	$mA/V^{3/2}$
Inter-electrode Capacitances:		
Grid to Anode	105	pF
Grid to Filament	185	pF
Anode to Filament	2·7	pF

Mechanical

Overall Length	20·56 inches (522·2 mm)	Max
Overall Diameter	11·00 inches (279·4 mm)	Max
Net Weight	70 pounds (32 kg)	Approx
Mounting Position	Vertical, filament end up	

Accessories

Boiler Unit, separate condenser required	BY4037
Single Boiler Unit, integral condenser	BY4038
Double Boiler Unit, integral condenser	BY4038A
Filament Leads	MA130
Grid Connector	MA66
Sealing Ring (supplied with valve)	15856A
Thermal Fuse (two supplied with valve)	MA85

COOLING AND INSTALLATION

The BY1143 is designed for cooling by water vapour and is fitted with an integral anode block in which circulation holes are provided for the passage of water and steam. The valve is installed with the anode partly immersed in the liquid coolant (distilled or de-ionised water) inside the boiler unit (see list of accessories above). When the power supplies are switched on the heat generated inside the valve soon evaporates some of the water in the circulation holes and jets of steam issue into the upper part of the boiler. The steam is either condensed directly by means of an internal water cooled condenser (as in BY4038 and BY4038A) or led away by suitably insulated tubing for condensation at some convenient point external to the boiler (BY4037).

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The services of our design staff are available for advice in matters of suitable condenser design and installation details.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 20ft³/min (0·57m³/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of the seals.

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

Two thermal fuses (part number MA85) are provided with each valve to give protection against anode overheating; only one fuse at a time need be used. Alternative positions for mounting the thermal fuse are provided by four threaded holes equally spaced round the top surface of the anode ring. It should be screwed into the desired position and connected by a non-conducting cord passing over the anode corona ring to a suitable switching device; a tension of about 1 lb (450g) should be applied to the fuse via the cord. If the temperature exceeds a safe limit, the fuse core is pulled outwards; this should actuate the switching device and remove all electrical supplies from the valve. Replacement fuses can be supplied to order.

R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS
(Absolute values)

Anode Voltage	10	kV Max
Anode Current	12	A Max
Anode Input Power	100	kW Max
Anode Dissipation	35	kW Max
Grid Dissipation	1·75	kW Max
Operating Frequency (for full ratings)	10	MHz Max

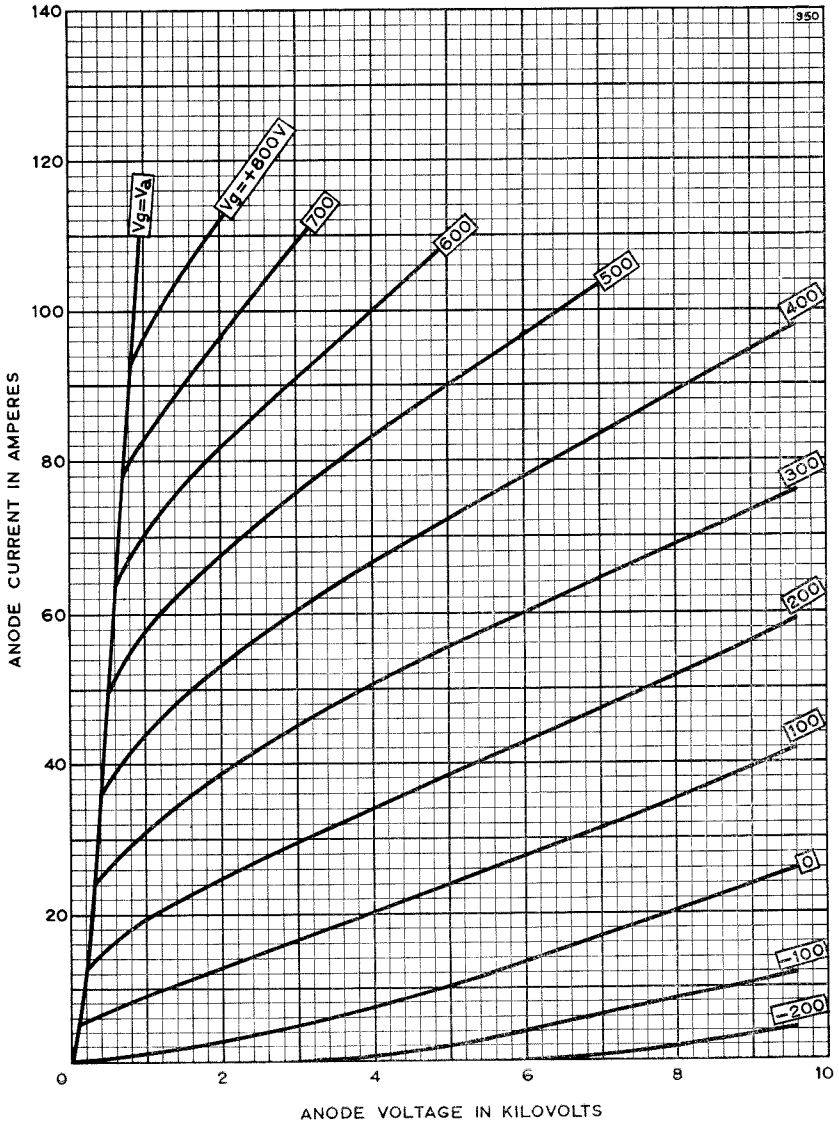
TYPICAL OPERATING CONDITIONS (FOR OSCILLATOR)

Anode Voltage	6·0	10	kV
Grid Voltage	−320	−540	V
Peak R.F. Grid Voltage	750	940	V
Anode Current	11·2	9·4	A
Grid Current (Approx)	1·78	1·67	A
Anode Dissipation	14·4	14·8	kW
Grid Dissipation (Approx)	760	670	W
Driving Power (Approx)	1330	1570	W
Output Power (*See Note* 3)	51·5	77·5	kW
Efficiency	78·5	84	%

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%.
2. The filament current must not exceed 625A, even momentarily, at any time.
3. Power in anode circuit after the grid circuit driving power has been deducted. This does not take into account the anode circuit efficiency.

ANODE CHARACTERISTICS



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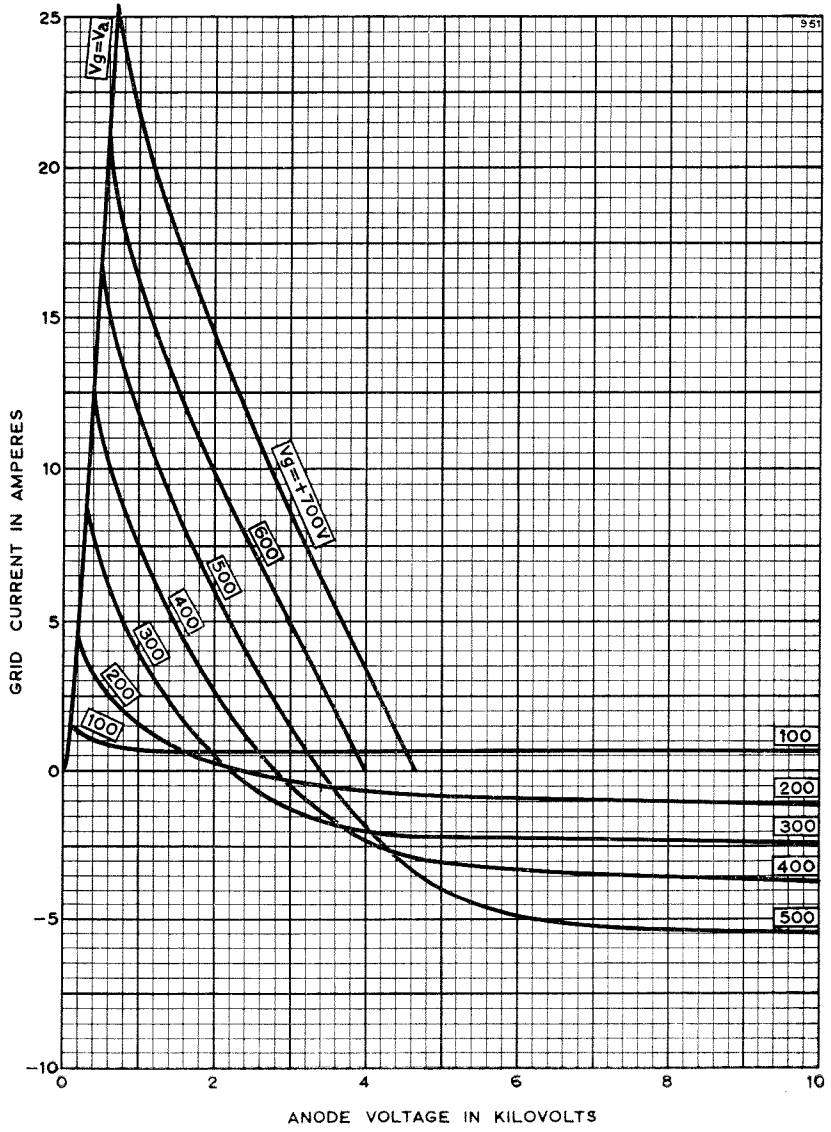
CONTROL GRID CHARACTERISTICS



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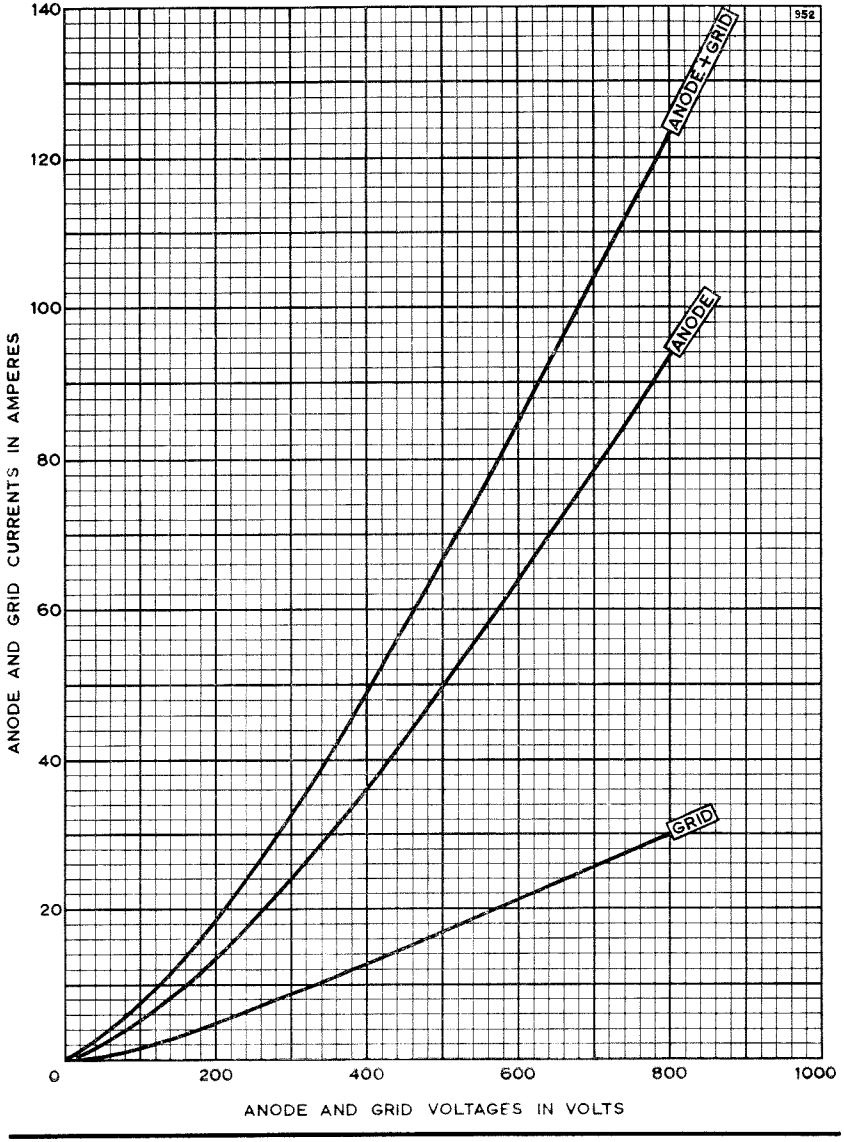
STRAPPED CHARACTERISTICS



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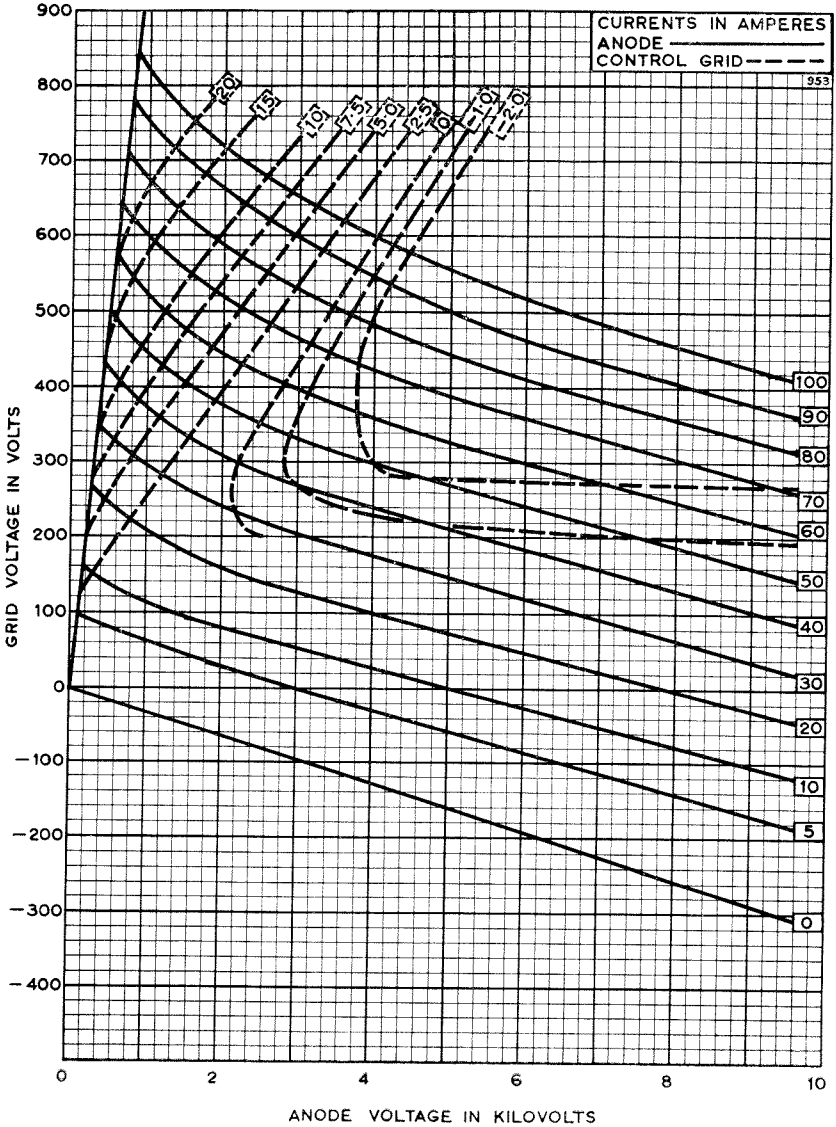
CONSTANT CURRENT CHARACTERISTICS



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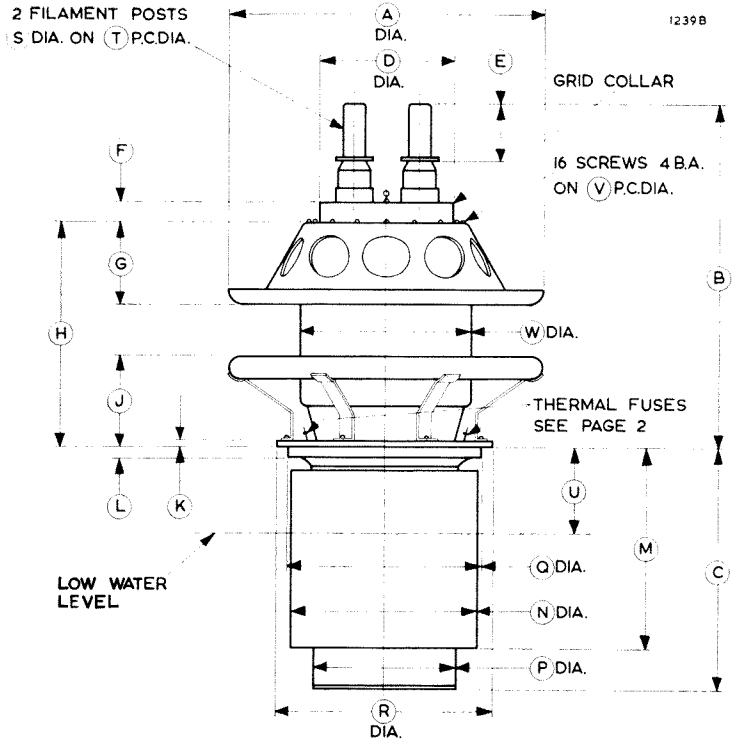
OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	11·000 Max	279·4 Max	M	7·000	177·8
B	12·109 Max	307·6 Max	N	6·562	166·7
C	8·452	214·7	P	5·240	133·1
D	4·703	119·5	Q	6·937	176·2
E	2·000	50·80	R	7·500	190·5
F	0·687	17·45	S	0·875	22·23
G	2·906 Max	73·81 Max	T	2·250	57·15
H	8·053 Max	204·5 Max	U	3·000	76·20
J	3·312 Max	84·12 Max	V	5·375	136·5
K	0·250	6·35	W	6·000	152·4
L	0·375	9·53			

Millimetre dimensions have been derived from inches.

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R.F. POWER TRIODES

BY1144
BY1144L

ABRIDGED DATA

Vapour Cooled Triode, suitable for cathode drive operation.

Anode Dissipation	125	kW Max
Anode Voltage	14	kV Max
Frequency for full ratings	27	Mc/s Max
Output Power (Class C unmodulated)	200	kW

The BY1144L is identical with BY1144 but is equipped with flexible leads on the four filament terminals (see outline drawing on page 9).

GENERAL DATA

Electrical

Filament (Two sections) (*See Note* 1)	Thoriated Tungsten	
Filament Voltage per section (*See Note* 2)	9·6	V
Filament Current per section	290	A
Maximum Filament Starting Current	(*See Note* 3)	
Filament Cold Resistance per section	0·004	Ω
Peak Usable Cathode Current	175	A
Perveance	6·0	$mA/V^{3/2}$
Amplification Factor (V_a = 9·0kV, I_a = 5·0A)	34	
Mutual Conductance (V_a = 9·0kV, I_a = 5·0A)	85	mA/V
Inter-electrode Capacitances (average) :		
Grid to Anode	108	pF
Grid to Filament	259	pF
Anode to Filament	3·5	pF

Mechanical

Overall Length	23·987 inches	(609·3 mm)	Max
Overall Diameter	13·062 inches	(331·8 mm)	Max
Net Weight	125 pounds	(57 kg)	Approx
Mounting Position	Vertical, filament end up		

Accessories

Boiler Unit, separate condenser required	BY4060
Boiler Unit, integral condenser	BY4036
Sealing Ring (supplied with valve)	15858A
Thermal Fuse (two supplied with valve)	MA85

COOLING AND INSTALLATION

The BY1144 and BY1144L are designed for cooling by water vapour and are fitted with an anode block in which circulation holes are provided for the passage of water and steam. The valve is installed with the anode partly immersed in the liquid coolant (distilled or de-ionised water) inside the boiler unit (see list of accessories above). When the power supplies are switched on the heat generated inside the valve soon evaporates some of the water in the circulation holes and jets of steam issue into the upper part of the boiler. The steam is either condensed directly by means of an internal water cooled condenser (as in BY4036) or led away by suitably insulated tubing for condensation at some convenient point external to the boiler (BY4060).

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The services of our design staff are available for advice in matters of suitable condenser design and installation details.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 60cu.ft/min (1·7cu.m/min) directed into the filament header via a 2-inch (50mm approx) maximum diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of the seals.

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

Two thermal fuses (part number MA85) are provided with each valve to give protection against anode overheating; only one fuse at a time need be used. Alternative positions for mounting the thermal fuse are provided by four threaded holes equally spaced round the top surface of the anode ring. It should be screwed into the desired position and connected by a non-conducting cord passing over the anode corona ring to a suitable switching device; a tension of about 1 lb (450gm) should be applied to the fuse via the cord. If the temperature exceeds a safe limit, the fuse core is pulled outwards; this should actuate the switching device and remove all electrical supplies from the valve. Replacement fuses can be supplied to order.

The valve should be lifted by means of four lifting hooks hooked under the anode corona ring (see outline drawing and also page 10 for details of a suitable lifting hook), the hooks being connected by cables to a suitable spreader plate and lifting tackle.

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C Telegraphy, key-down conditions, one valve)

Anode Voltage (*See Note* 4)	14	kV Max
Anode Current	18	A Max
Anode Dissipation	125	kW Max
Grid Dissipation	2·75	kW Max
Operating Frequency (for full ratings)	27	Mc/s Max

TYPICAL OPERATING CONDITIONS (FOR AMPLIFIER)

Anode Voltage	14	kV
Grid Voltage	−765	V
Peak R.F. Grid Voltage	1305	V
Anode Current	17·5	A
Grid Current (Approx)	3·1	A
Anode Dissipation	45	kW
Grid Dissipation (Approx)	1·7	kW
Driving Power (Approx)	4·0	kW
Output Power	200	kW
Efficiency	81	%

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RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN ←

	Min	*Max*	
Filament Current per section at filament voltage 9·6V	263	311	A
Filament Current difference between sections..	—	15	A
Amplification Factor (V_a = 9·0kV, I_a = 5·0A)	31	39	
Mutual Conductance (V_a = 9·0kV, I_a = 5·0A)	78	102	mA/V
Grid Voltage (negative value) (V_a = 10kV, I_a = 0·1A)	—	370	V
Grid Voltage (V_a = 9·0kV, I_a = 5·0A) ..	145	222	V
Anode Current (V_a = 1·5kV, V_g = +400V) ..	48	72	A
Grid Current (V_a = 1·5kV, V_g = +400V) ..	10	16	A
Anode Current (V_a = 4·0kV, V_g = +400V) ..	66	98	A
Grid Current (V_a = 4·0kV, V_g = +400V) ..	2·0	10	A
Anode Current (V_a = 10kV, V_g = +400V) ..	90	138	A
Grid Current (V_a = 10kV, V_g = +400V) ..	0	6·0	A

NOTES

1. The filament comprises two separate sections and these should be operated in phase quadrature. Each section is connected across diametrically opposite filament pins.
2. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%.
3. The filament current must not exceed 700A per section, even momentarily, at any time.
4. The maximum anode voltage for class C anode modulated operation (100% modulation) is 12kV.

← Indicates a change

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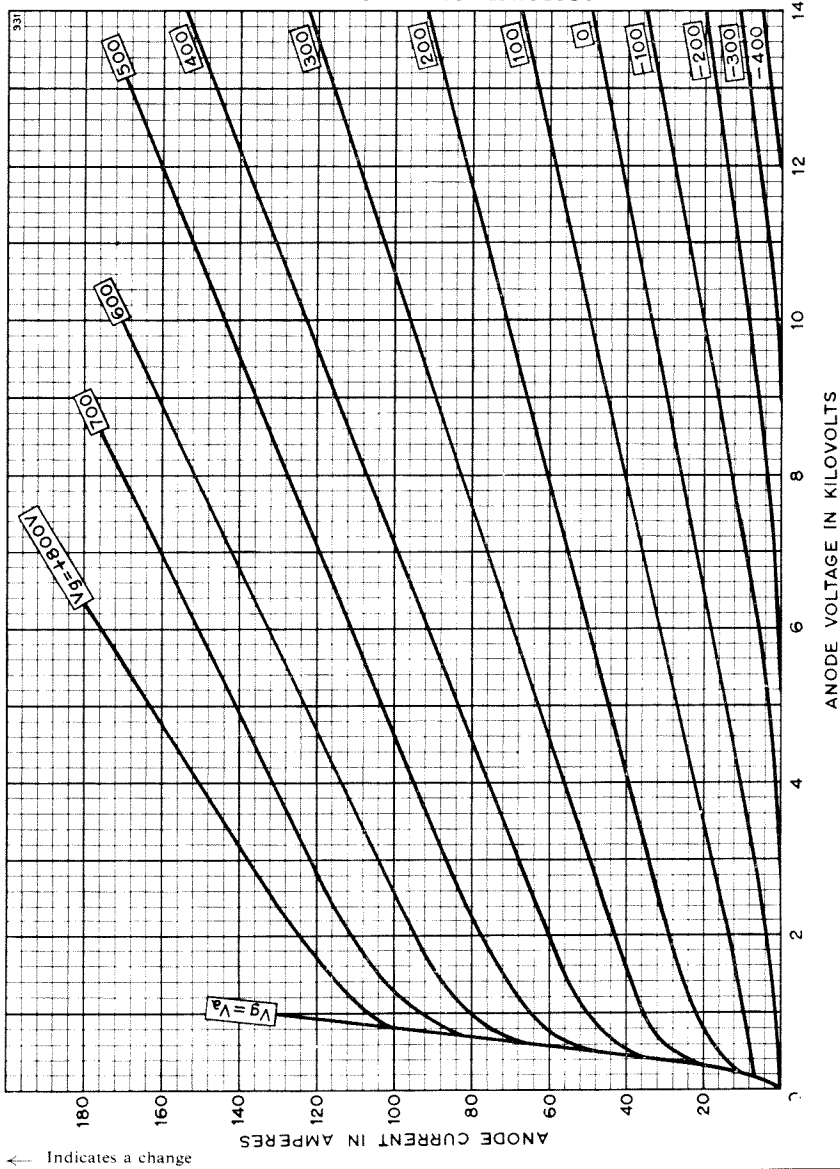
ANODE CHARACTERISTICS



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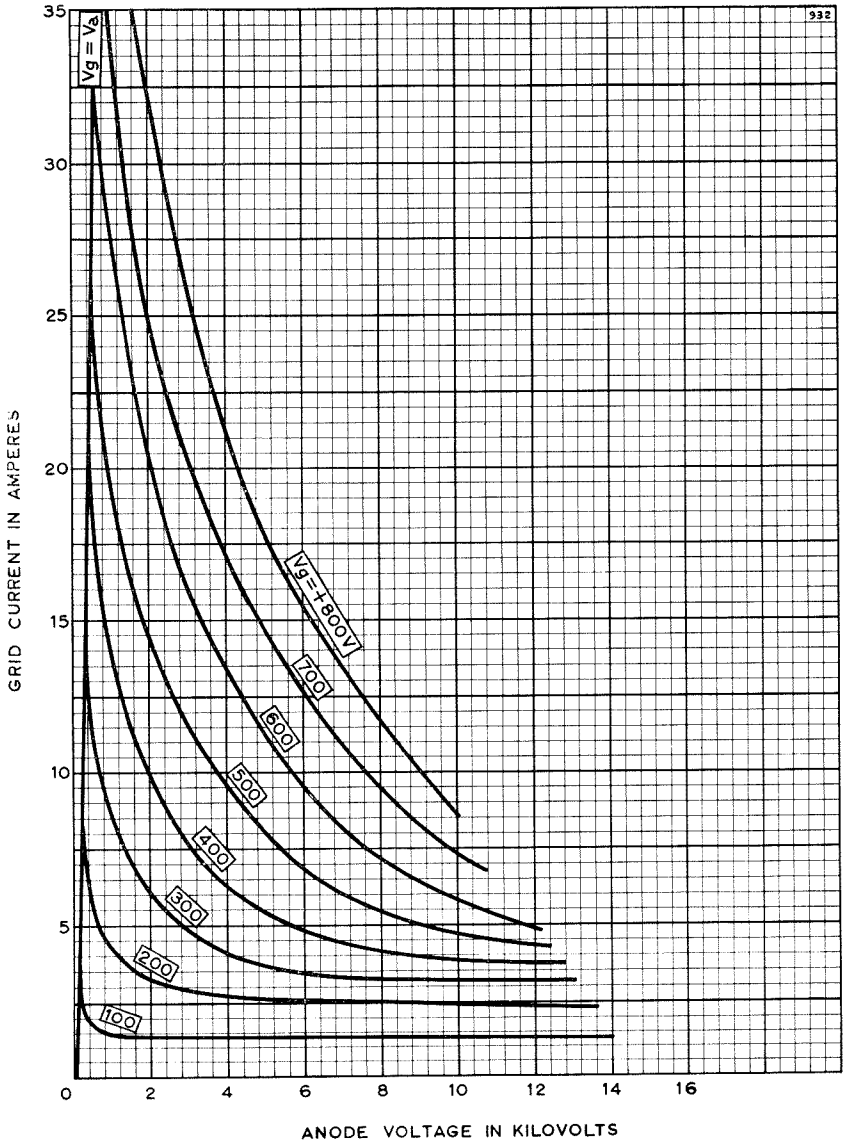
CONTROL GRID CHARACTERISTICS



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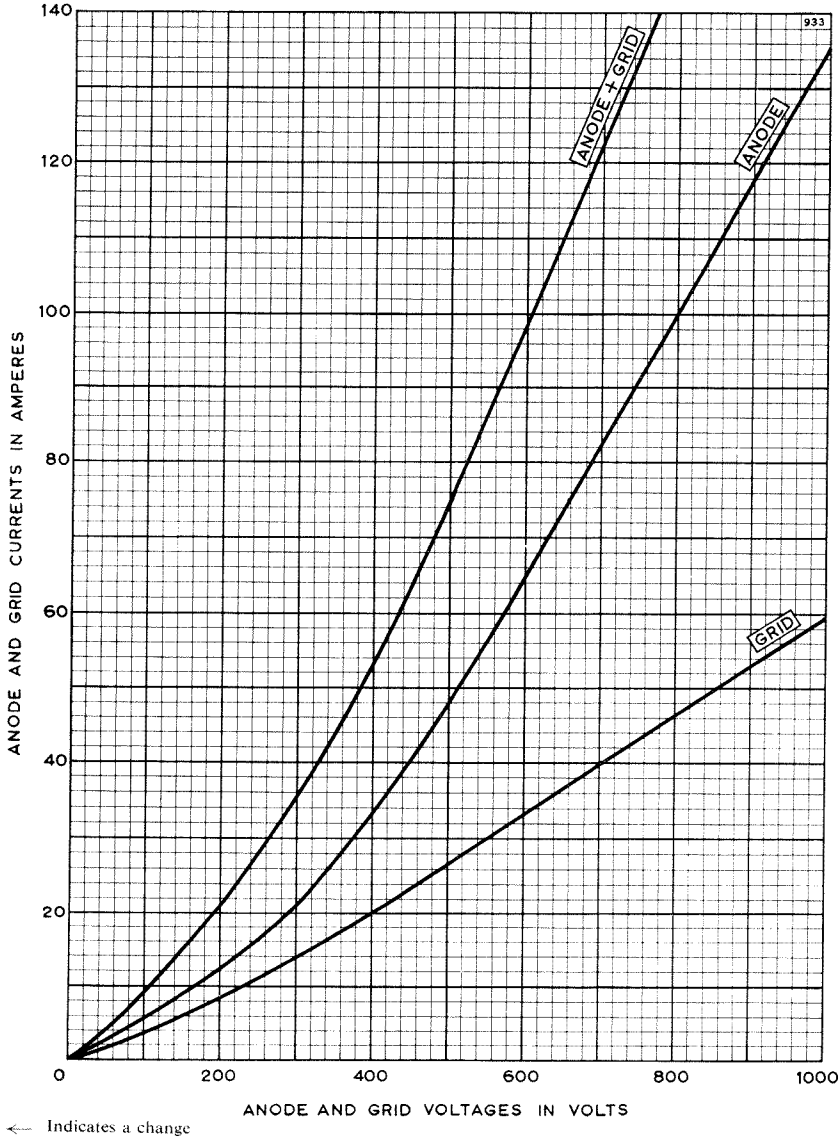
STRAPPED CHARACTERISTICS



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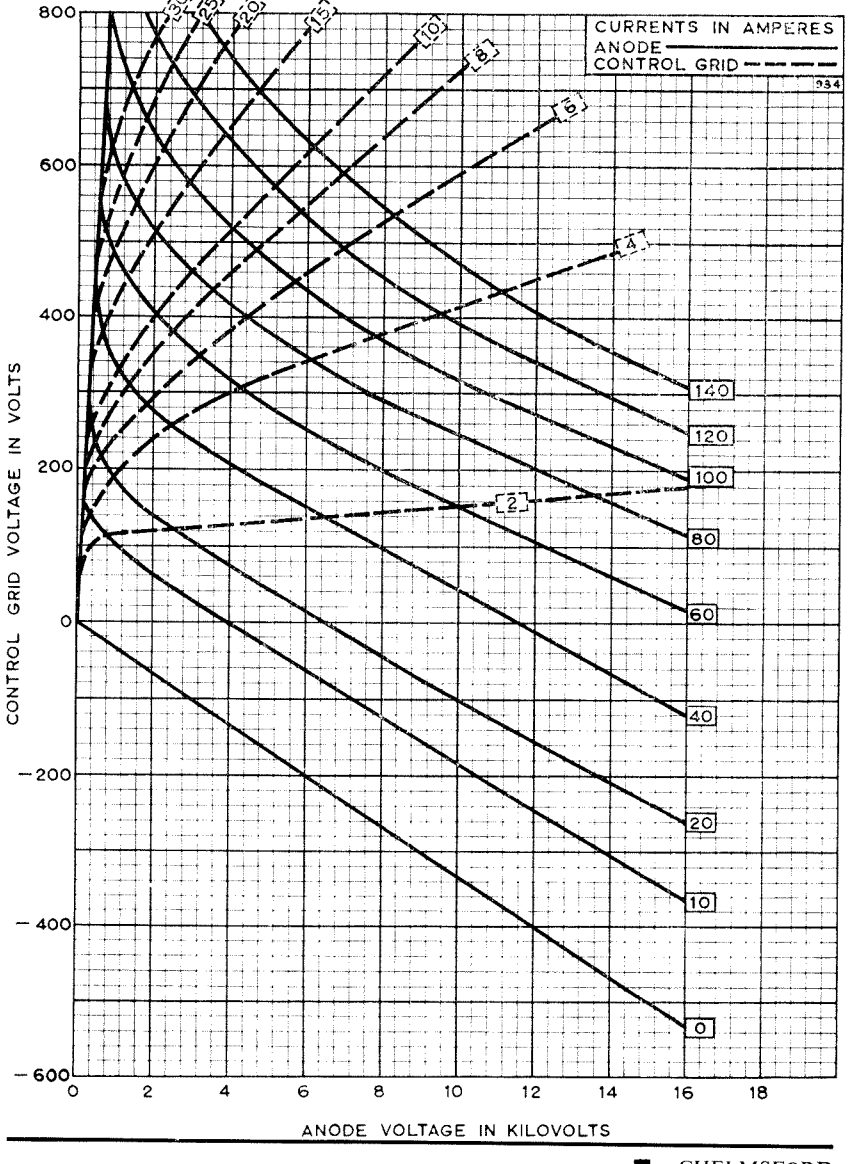
CONSTANT CURRENT CHARACTERISTICS



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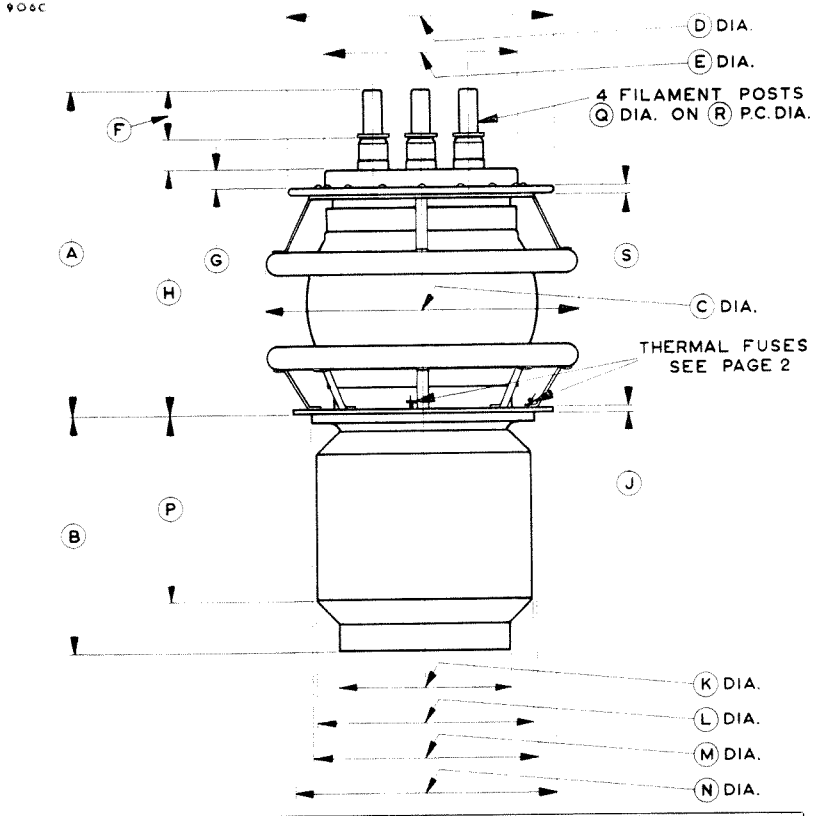
OUTLINE FOR BY1144



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	13·800 Max	350·5 Max	K	6·875	174·6
B	10·187 Max	258·8 Max	L	9·000 Max	228·6 Max
C	13·062 Max	331·8 Max	M	9·312 ± 0·015	236·52 ± 0·38
D	11·125 ± 0·062	282·58 ± 1·57	N	10·875 ± 0·031	276·23 ± 0·79
E	8·086 ± 0·031	205·38 ± 0·79	P	7·781 Max	197·6 Max
F	2·000	50·80	Q	0·875	22·22
G	0·750	19·05	R	4·000	101·6
H	10·217 ± 0·250	259·51 ± 6·35	S	0·375	9·53
J	0·250 ± 0·031	6·35 ± 0·79			

Millimetre dimensions have been derived from inches.

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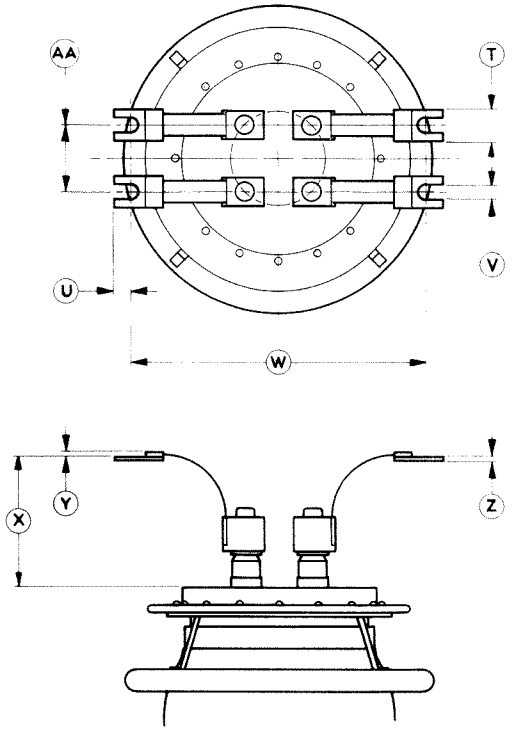
OUTLINE FOR BY1144L

1047



Ref.	Inches	Millimetres
T	1·375	34·92
U	0·750	19·05
V	0·562	14·27
W	11·687	297·0
X	5·437	138·0
Y	0·437	11·10
Z	0·125	3·18
AA	2·828	71·83

Millimetre dimensions have been derived from inches.

ALL OTHER DIMENSIONS IDENTICAL WITH BY1144

← Indicates a change

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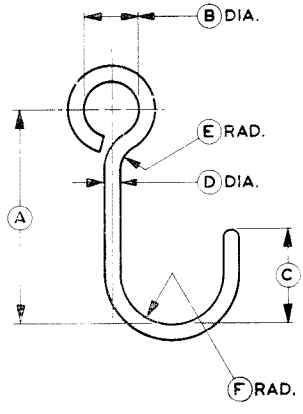
LIFTING HOOK

(See page 2)

9080



Ref.	Inches	Millimetres
A	$2\frac{1}{4}$	57·2
B	$\frac{9}{16}$	14·3
C	1	25·4
D	$\frac{3}{16}$	4·8
E	$\frac{1}{4}$	6·4
F	$\frac{17}{32}$	13·5

Millimetre dimensions have been derived from inches.

← Indicates a change

R.F. POWER TRIODE

BY1156

ABRIDGED DATA

Vapour Cooled Triode intended primarily for industrial service.

Anode Dissipation	125	kW Max
Anode Voltage	14	kV Max
Frequency for full ratings	27	MHz Max
Output Power (Class C unmodulated)	250	kW

GENERAL

Electrical

Filament (Two sections) (*See Note* 1)	Thoriated Tungsten	
Filament Voltage per section (*See Note* 2)	12·2	V
Filament Current per section	290	A
Maximum Filament Starting Current per section (*See Note* 3)	700	A Max
Filament Cold Resistance per section	0·005	Ω
Peak Usable Cathode Current	260	A
Perveance	8·0	$mA/V^{3/2}$
Amplification Factor (V_a = 9·0kV, I_a = 5·0A)	23	
Mutual Conductance (V_a = 9·0kV, I_a = 5·0A)	100	mA/V
Interelectrode Capacitances (typical):		
Grid to Anode	110	pF
Grid to Filament	290	pF
Anode to Filament	5·0	pF

Mechanical

Overall Length	23·987 inches (609·3 mm)	Max
Overall Diameter	13·062 inches (331·8 mm)	Max
Net Weight	125 pounds (57 kg)	Approx
Mounting Position	Vertical, filament end up	

Accessories

Boiler Unit, separate condenser required	BY4060
Boiler Unit, integral condenser	BY4036
Sealing Ring (supplied with valve)	I5858A
Thermal Fuse (two supplied with valve)	MA85A

COOLING AND INSTALLATION

The BY1156 is designed for cooling by water evaporation and is fitted with an anode block in which circulation holes are provided for the passage of water and steam. The valve is installed with the anode partly immersed in the liquid coolant (distilled or de-ionised water) inside the boiler unit (see list of accessories above). When the power supplies are switched on the heat generated inside the valve soon evaporates some of the water in the circulation holes and jets of steam and water issue into the upper part of the boiler. The steam is either condensed directly by means of an internal water cooled condenser (as in BY4036) or

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led away by suitably insulated tubing for condensation at some convenient point external to the boiler (BY4060).

The services of our design staff are available for advice in matters of suitable condenser design and installation details.

The temperature of the filament and grid seals must not exceed 140°C. A flow of air of 60ft³/min (1·7m³/min) directed into the filament header via a 2-inch (50mm approx) maximum diameter nozzle before, during and after the application of any voltages is usually adequate for limiting the temperature of the seals.

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

Two thermal fuses (part number MA85A) are provided with each valve to give protection against anode overheating; only one fuse at a time need be used. Alternative positions for mounting the thermal fuse are provided by four threaded holes equally spaced round the top surface of the anode ring. It should be screwed into the desired position and connected by a non-conducting cord passing over the anode corona ring to a suitable switching device; a tension of about 1 pound (450g) should be applied to the fuse via the cord. If the temperature exceeds a safe limit, the fuse cord is pulled outwards; this should actuate the switching device and remove all electrical supplies from the valve. Replacement fuses can be supplied to order.

The valve should be lifted by means of four lifting hooks hooked under the anode corona ring (see outline drawing), the hooks being connected by cables to a suitable spreader plate and lifting tackle.

R.F. AMPLIFIER AND OSCILLATOR
(Class C unmodulated conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	14	kV Max
Anode Current	28	A Max
Anode Dissipation	125	kW Max
Grid Dissipation	3·0	kW Max
Operating Frequency (for full ratings)	27	MHz Max

TYPICAL OPERATING CONDITIONS (FOR AMPLIFIER)

Anode Voltage	12	kV
Grid Voltage	−1400	V
Peak R.F. Grid Voltage	2150	V
Anode Current	27	A
Grid Current (Approx)	4·0	A
Anode Dissipation (including filament and grid losses)	85	kW
Grid Dissipation	3·0	kW
Driving Power	9·5	kW
Output Power	250	kW
Efficiency	76	%

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NOTES

1. The filament comprises two separate sections designed to operate in phase quadrature. Each section is connected across diametrically opposite filament pins. If desired the two sections may be connected in parallel.
2. The valve must be operated at the stated filament voltage. Fluctuations in filament voltage must not exceed $\pm 5\%$.
3. The filament current must not exceed 700 amperes per section, even momentarily, at any time during switch on.

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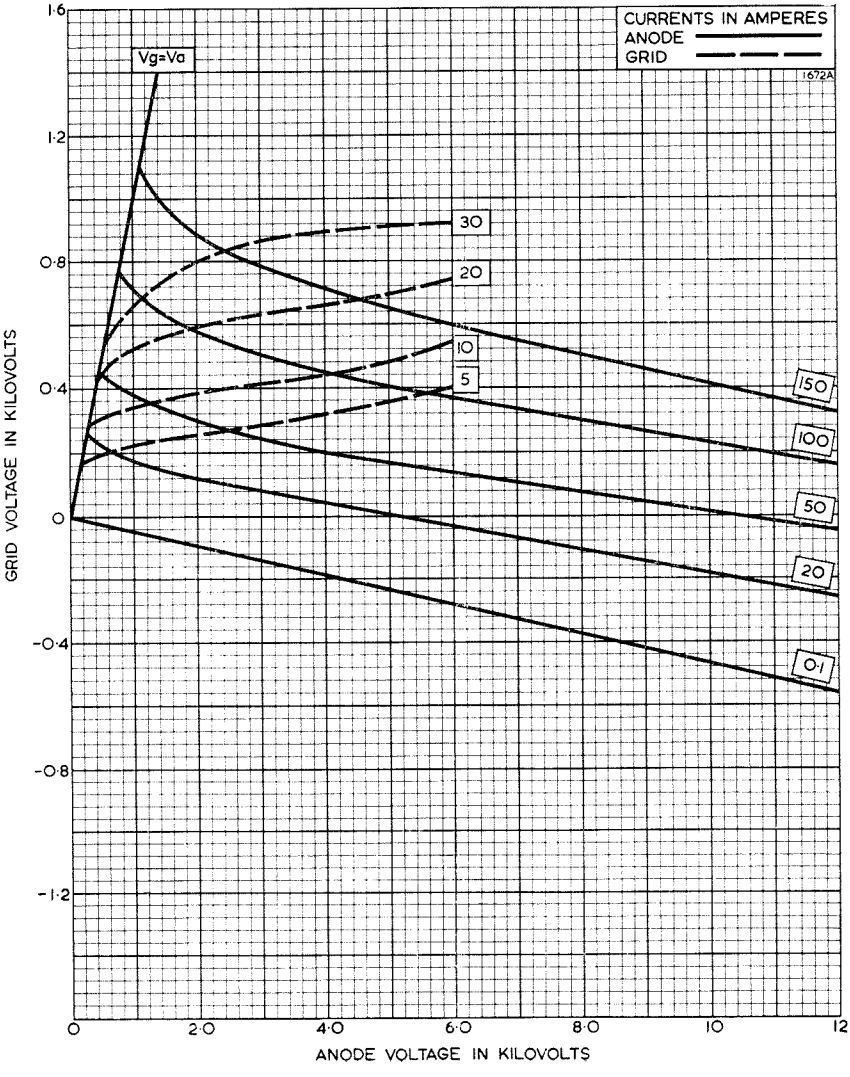
CONSTANT CURRENT CHARACTERISTICS



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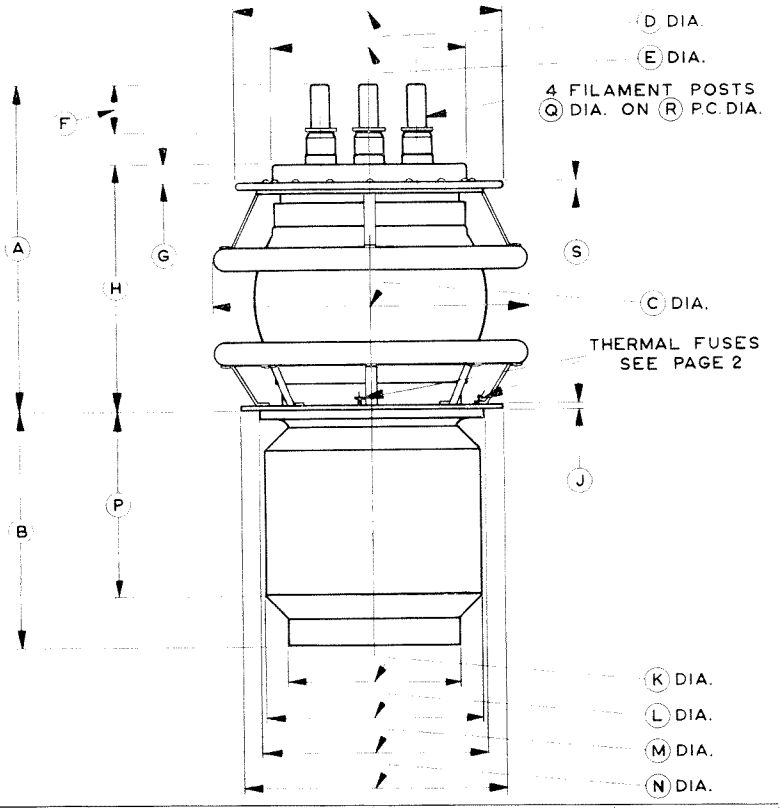
OUTLINE

9060



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	13·800 Max	350·5 Max	K	6·875	174·6
B	10·187 Max	258·8 Max	L	9·000 Max	228·6 Max
C	13·062 Max	331·8 Max	M	9·312 ± 0·015	236·52 ± 0·38
D	11·125 ± 0·062	282·58 ± 1·57	N	10·875 ± 0·031	276·23 ± 0·79
E	8·086 ± 0·031	205·38 ± 0·79	P	7·781 Max	197·6 Max
F	2·000	50·80	Q	0·875	22·22
G	0·750	19·05	R	4·000	101·6
H	10·217 ± 0·250	259·51 ± 6·35	S	0·375	9·53
J	0·250 ± 0·031	6·35 ± 0·79			

Millimetre dimensions have been derived from inches.

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R.F. POWER TRIODE

BY1161

ENGLISH ELECTRIC

ABRIDGED DATA

Vapour Cooled Transmitting Triode.

Anode Dissipation	60	kW Max
Anode Voltage	14	kV Max
Frequency for full ratings	10	Mc/s Max
Frequency at reduced ratings	30	Mc/s Max
Output Power (Class C unmodulated conditions)	120	kW

GENERAL

Electrical

Filament (*See Note* 1)	Thoriated Tungsten	
Filament Voltage (*See Note* 2)	11	V
Filament Current	155	A
Filament Starting Current (Peak) (*See Note* 3)	300	A Max
Filament Cold Resistance	0·008	Ω
Peak Usable Cathode Current	60	A
Amplification Factor (V_a = 11kV, I_a = 3·0A)	90	
Mutual Conductance (V_a = 10kV, I_a = 2·5A)	55	mA/V
Perveance	4·0	$mA/V^{3/2}$
Inter-electrode Capacitances:		
Grid to Anode	76	pF
Grid to Filament	130	pF
Anode to Filament	1·1	pF

Mechanical

Overall Length (including leads)	20·67 inches (525 mm)	Max
Overall Diameter	9·902 inches (251·5 mm)	Max
Net Weight	53 pounds (24 kg)	Approx
Mounting Position	Vertical, filament end up	
Boiler Unit (for use with external condenser)		BY4059
Boiler Unit (integral condenser)		BY4093←

COOLING AND INSTALLATION

The BY1161 is designed for cooling by water vapour and is fitted with an integral anode block in which circulation holes are provided for the passage of water and steam. The valve is installed with the anode partly immersed in the liquid coolant (distilled or de-ionised water) inside the boiler unit. When the power supplies are switched on the heat generated inside the valve soon evaporates some of the water in the circulation holes and jets of steam issue into the upper part of the boiler. The steam is either condensed directly by means of an internal water cooled condenser (as with BY4093) or lead away by suitably insulated tubing for condensation at some convenient point external to the boiler (as with BY4059).

← Indicates a change

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The services of our design staff are available for advice in matters of suitable condenser design and installation details.

The temperature of the glass envelope and seals must not exceed 170°C. A flow of air of 35cu.ft/min (1·0cu.m/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of the filament and grid seals. The air flow should be maintained for at least 10 minutes after switching off the filament supply to the tube.

Two thermal fuses (part number MA85) are provided with each valve to give protection against anode overheating; only one fuse at a time need be used. Alternative positions for mounting the thermal fuse are provided by four threaded holes equally spaced round the anode ring. It should be screwed into the desired position and connected by a non-conducting cord to a suitable switching device; a tension of about 1 lb (450gm) should be applied to the fuse via a cord. If the temperature exceeds a safe limit, the fuse core is pulled outwards; this should actuate the switching device and remove all electrical supplies from the valve. Replacement fuses can be supplied to order.

ANODE MODULATED R.F. POWER AMPLIFIER
(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage (*See Page* 3)	11	kV Max
Anode Current (Mean) (*See Note* 4)	15	A Max
Anode Dissipation	60	kW Max
Grid Voltage (negative value)	750	V Max
Grid Dissipation	1·5	kW Max
Frequency for above ratings (*See Page* 3)	10	Mc/s Max

TYPICAL OPERATING CONDITIONS

Frequency	10	30	Mc/s
Anode Voltage	11	10	kV
Grid Voltage (fixed)	−150	−150	V
Grid Resistor	250	250	Ω
Peak R.F. Grid Voltage	1200	1200	V
Anode Current	6·0	6·0	A
Grid Current (Approx)	2·3	2·3	A
Anode Dissipation	11	10	kW
Grid Dissipation (Approx)	1·1	1·1	kW
Driving Power (Approx)	2·8	2·8	kW
Output Power	55	50	kW
Efficiency	83	83	%

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R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage (*See below*)	14	kV Max
Anode Current (Mean) (*See Note* 4)	15	A Max
Anode Dissipation	60	kW Max
Grid Voltage (negative value)	750	V Max
Grid Dissipation	1·5	kW Max
Frequency for above ratings (*See below*)	10	Mc/s Max

TYPICAL OPERATING CONDITIONS (FOR AMPLIFIER)

Frequency	10	30	Mc/s
Anode Voltage	14	12	kV
Grid Voltage	−350	−300	V
Peak R.F. Grid Voltage	910	820	V
Anode Current	11·3	11	A
Grid Current (Approx)	2·4	2·4	A
Anode Dissipation	38	32	kW
Grid Dissipation (Approx)	1·36	1·28	kW
Driving Power (Approx)	2·2	2·0	kW
Output Power	120	100	kW
Efficiency	76	76	%

MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency (Mc/s)	Max Anode Voltage C.W.	Max Anode Voltage with Anode Modulation
10	14kV	11kV
30	12kV	10kV

NOTES

1. Connections to the filament are normally made via the flexible leads fitted to the valve. Should r.f. connections be required, these should be made with flexible conductors to the terminals below the filament leads.
2. The valve must normally be operated at the stated filament voltage. When the operating grid dissipation is less than 400 watts the filament voltage should be increased to 11·5V. Fluctuation in filament voltage must not exceed ±5%.
3. The filament current must not exceed 300A, even momentarily, at any time.
4. It is recommended that a resistor of at least 25Ω should be connected in series with the anode to limit the surge current in case of flashover (unless adequate protection is already given by other circuit elements).

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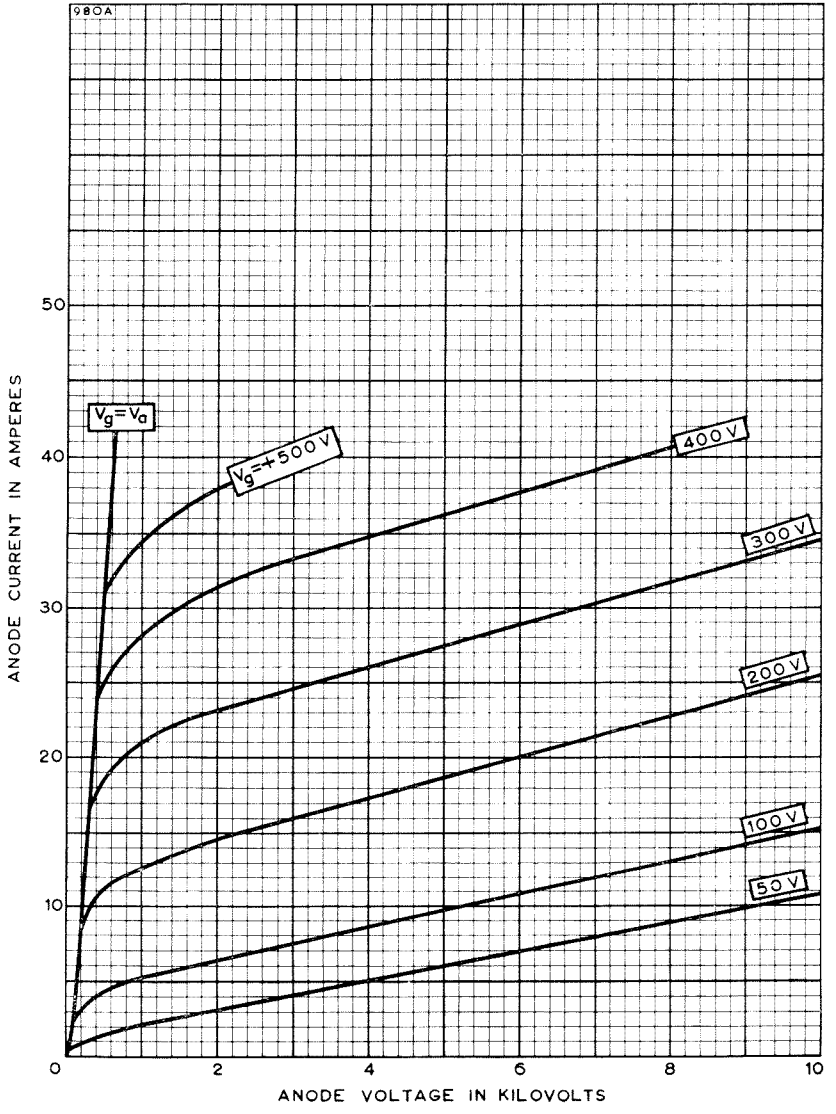
ANODE CHARACTERISTICS



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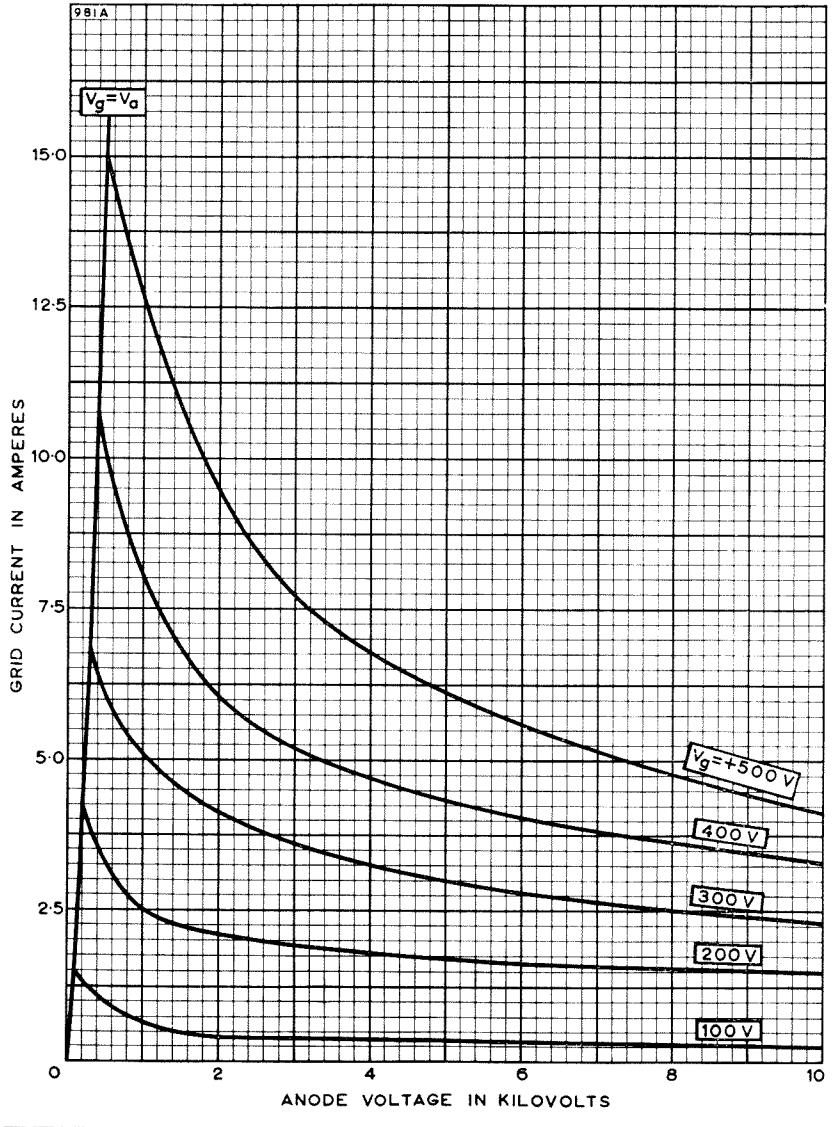
CONTROL GRID CHARACTERISTICS



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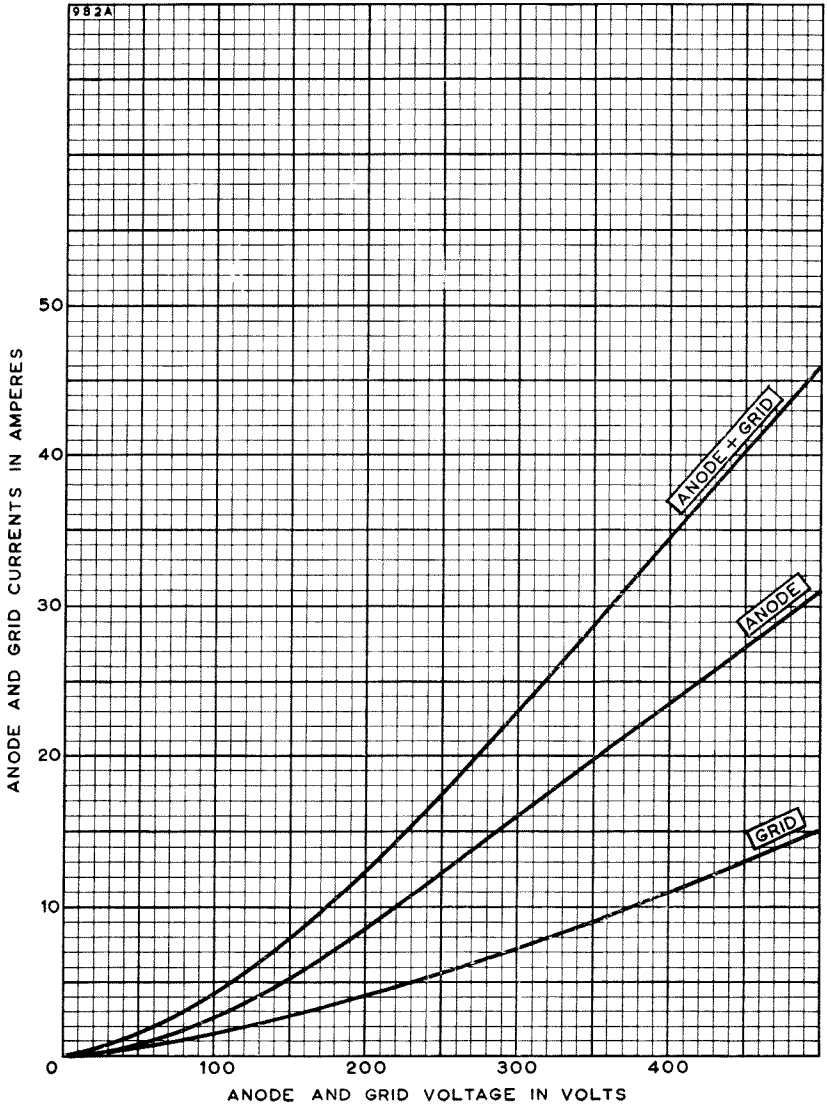
STRAPPED CHARACTERISTICS



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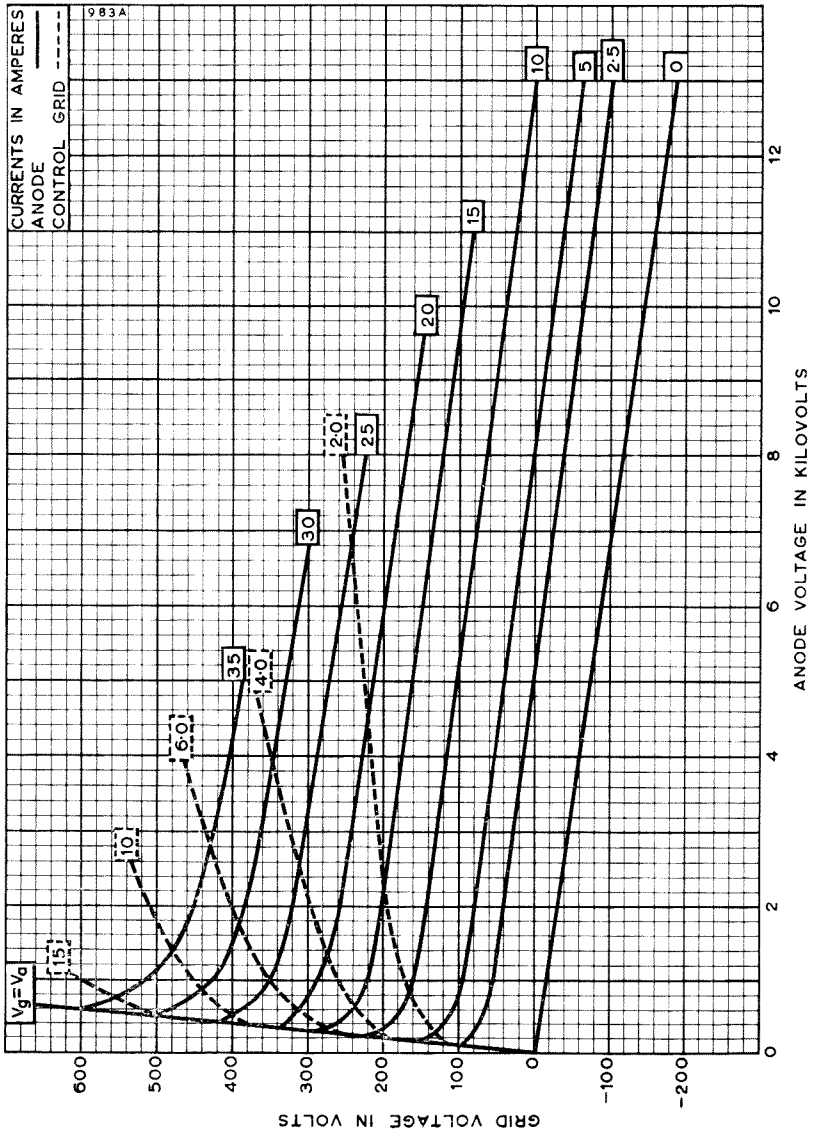
CONSTANT CURRENT CHARACTERISTICS



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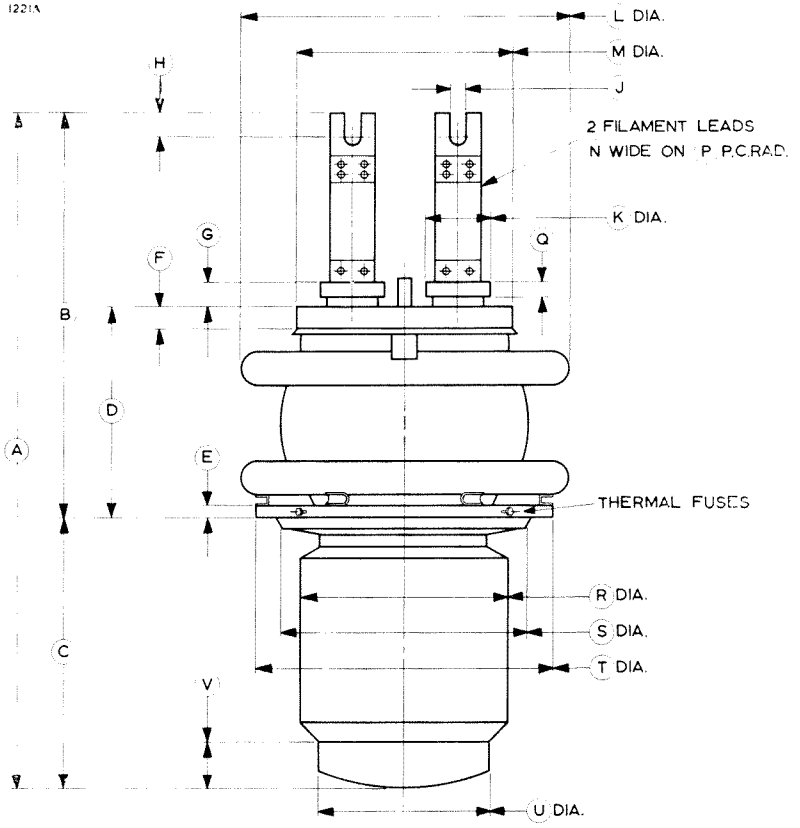
OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	20·670 Max	525·0 Max	L	9·902 Max	251·5 Max
B	12·205	310·0	M	6·476 ± 0·020	164·5 ± 0·5
C	8·268	210·0	N	1·378	35·0
D	6·378 ± 0·080	162·2 ± 2·0	P	1·575 ± 0·040	40·0 ± 1·0
E	0·394 ± 0·008	10·0 ± 0·2	Q	0·472	12·0
F	0·670	17·0	R	6·220	158·0
G	0·750 ± 0·040	19·0 ± 1·0	S	7·559 ± 0·008	192·0 ± 0·2
H	0·750	19·0	T	8·858 ± 0·008	225·0 ± 0·2
J	0·433	11·0	U	5·118	130·0
K	1·969 ± 0·016	50·0 ± 0·4			

Inch dimensions have been derived from millimetres.

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DOUBLE BOILER-CONDENSER UNITS

BY4030 BY4032

INTRODUCTION

The BY4030 and BY4032 are double Boiler Units with integral condenser systems, for use with vapour cooled triodes BY1102 and BY1121 respectively.

The valves are held in position in the boiler unit by clamping rings, each with six bolts, and are seated on sealing rings supplied with the boiler unit (a sealing ring is also supplied with each valve). A glass water-level indicator is incorporated and the water in the boiler unit must not be allowed to fall below the minimum level. To prevent damage to the valves, a cut-out switch is mounted above the boiler and by making suitable connections to the switch, power to the valves can be cut-off automatically should the water level fall below the minimum level. A part of the cut-out assembly also acts as a steam pressure relief valve and switches off power to the valves should an excessive pressure build up inside the unit.

The water connections to the internal condenser system terminate in Kontite fittings suitable for use with $\frac{1}{2}$-inch bore rubber hoses. The unit can be supplied with alternative water connections or can be adapted readily to suit the particular requirement of individual applications.

Distilled or de-mineralised water should be used in the boiler unit; any suitable supply of clean water may be used for the condenser system.

GENERAL DATA

Overall Length	24 inches	(609·6 mm)	Max
Overall Width (excluding pipes)	16 inches	(406·4 mm)	Max
Overall Height (excluding valve):			
BY4030	19·5 inches	(495·3 mm)	Max
BY4032	17·5 inches	(444·5 mm)	Max
Net Weight (empty):			
BY4030	95 pounds	(43 kg)	Approx
BY4032	90 pounds	(41 kg)	Approx
Water Capacity of Boiler (to maximum water level):			
BY4030	$3\frac{1}{2}$ Imp. gallons		Approx
BY4032	3 Imp. gallons		Approx
Condenser Water Flow:			
BY4030	$5\frac{1}{2}$ Imp. gallons/minute		
BY4032	5 Imp. gallons/minute		
Sealing Ring (supplied with boiler)			15810A

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OUTLINE

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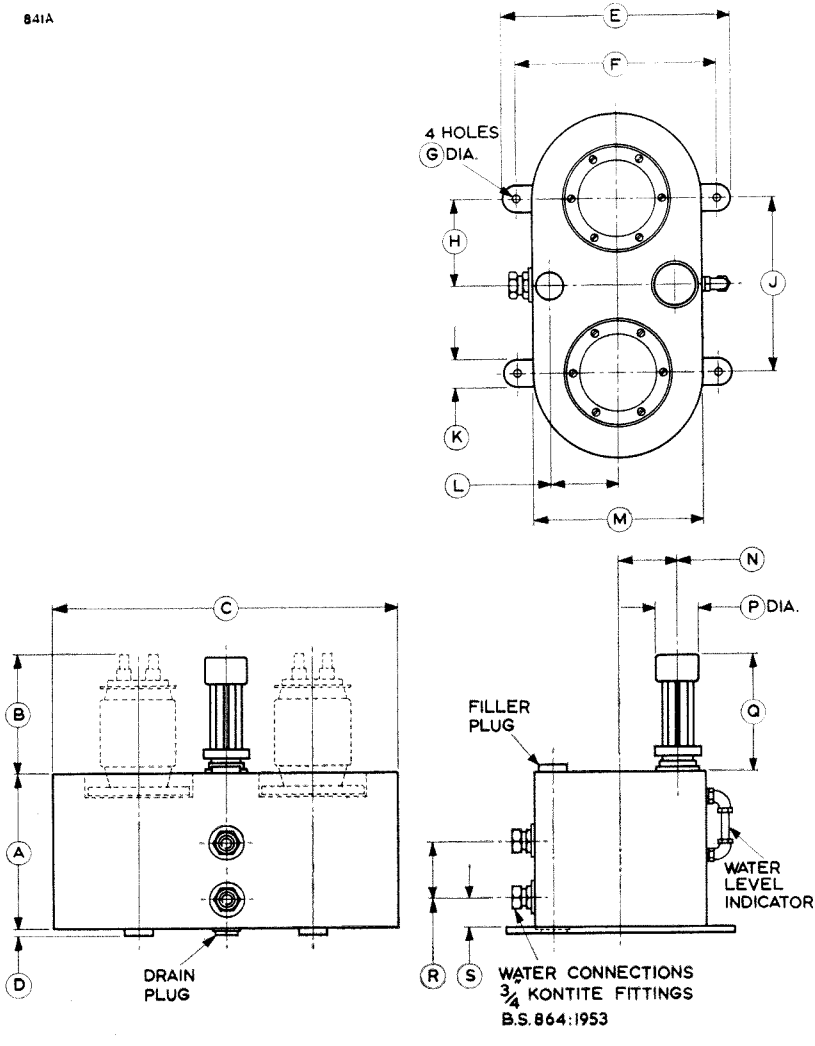

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OUTLINE DIMENSIONS

Ref.	BY4030		BY4032	
	Inches	Millimetres	Inches	Millimetres
A	11·000	279·4	9·000	228·6
B	8·125 Max	206·4 Max	8·125 Max	206·4 Max
C	24·000	609·6	24·000	609·6
D	0·500	12·70	0·500	12·70
E	16·000	406·4	16·000	406·4
F	14·000	355·6	14·000	355·6
G	0·500	12·70	0·500	12·70
H	6·000	152·4	6·000	152·4
J	12·000	304·8	12·000	304·8
K	2·000	50·80	2·000	50·80
L	4·750	120·7	4·750	120·7
M	12·000	304·8	12·000	304·8
N	4·250	108·0	4·250	108·0
P	3·000	76·20	3·000	76·20
Q	8·000 Max	203·2 Max	8·000 Max	203·2 Max
R	4·000	101·6	4·000	101·6
S	2·000	50·80	2·000	50·80

Millimetre dimensions have been derived from inches.

SINGLE BOILER-CONDENSER UNITS

BY4031 BY4033

ENGLISH ELECTRIC

INTRODUCTION

The BY4031 and BY4033 are single Boiler Units, with integral condenser systems, for use with the vapour cooled triodes BY1102 and BY1121 respectively.

The valve is held in position in the boiler unit by a clamping ring with six bolts and is seated on a sealing ring supplied with the boiler unit (a sealing ring is also supplied with the valve). A glass water-level indicator is incorporated and the water in the boiler unit must not be allowed to fall below the minimum level. To prevent damage to the valve, a cut-out switch is mounted above the boiler and by making suitable connections to the switch, power to the valve can be cut off automatically should the water level fall below the minimum level. A part of the cut-out assembly also acts as a steam pressure relief valve and switches off power to the valve should an excessive pressure build up inside the unit.

The water connections to the internal condenser system terminate in Kontite fittings suitable for use with $\frac{1}{2}$-inch bore rubber hoses. The unit can be supplied with alternative water connections or can be adapted readily to suit the particular requirements of individual applications.

Distilled or de-mineralised water should be used in the boiler unit; any suitable supply of clean water may be used for the condenser system.

GENERAL DATA

Overall Length	19 inches (482·6 mm)	Max
Overall Width (excluding pipes)	19 inches (482·6 mm)	Max
Overall Height (excluding valve):		
BY4031	19 inches (482·6 mm)	Max
BY4033	17 inches (431·8 mm)	Max
Net Weight (empty):		
BY4031	84 pounds (38 kg)	Approx
BY4033	80 pounds (36 kg)	Approx
Water Capacity of Boiler (to maximum water level):		
BY4031	$1\frac{1}{4}$ Imp. gallons	Approx
BY4033	$1\frac{1}{4}$ Imp. gallons	Approx
Condenser Water Flow:		
BY4031	$3\frac{1}{2}$ Imp. gallons/minute	
BY4033	3 Imp. gallons/minute	
Sealing Ring (supplied with boiler)		I5810A

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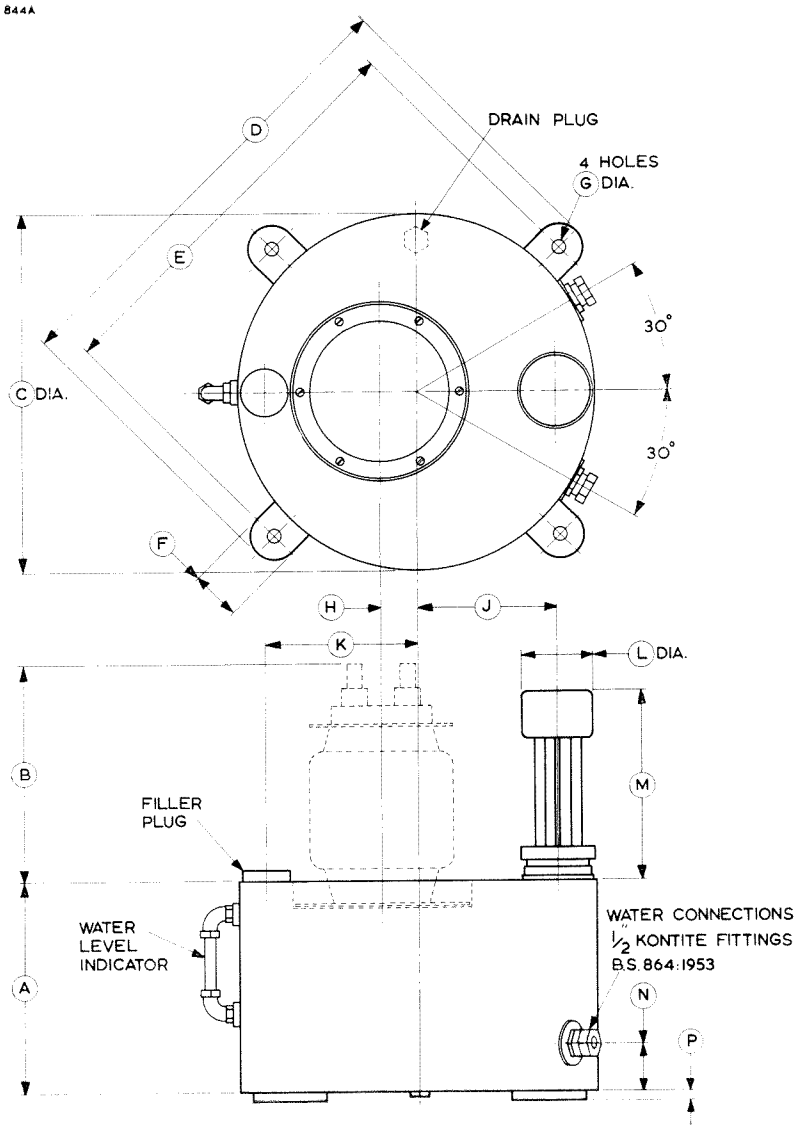
OUTLINE



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OUTLINE DIMENSIONS

Ref.	BY4031		BY4033	
	Inches	Millimetres	Inches	Millimetres
A	11·000	279·4	9·000	228·6
B	9·125 Max	231·8 Max	9·125 Max	231·8 Max
C	15·000	381·0	15·000	381·0
D	19·000	482·6	19·000	482·6
E	17·000	431·8	17·000	431·8
F	2·000	50·80	2·000	50·80
G	0·500	12·70	0·500	12·70
H	1·500	38·10	1·500	38·10
J	5·875	149·2	5·875	149·2
K	6·375	161·9	6·375	161·9
L	3·000	76·20	3·000	76·20
M	8·000 Max	203·2 Max	8·000 Max	203·2 Max
N	2·000	50·80	2·000	50·80
P	0·375	9·53	0·375	9·53

Millimetre dimensions have been derived from inches.

SINGLE BOILER-CONDENSER UNIT

BY4036

ENGLISH ELECTRIC

INTRODUCTION

The BY4036 is a single Boiler Unit with an integral condenser system for use with the vapour cooled triode BY1144.

The valve is held in position in the boiler unit by its own weight, in conjunction with the spring finger contacts round the anode ring, and is seated on a neoprene ring supplied with the BY4036 (a neoprene ring is also supplied with the valve). A glass water-level indicator is incorporated and the water in the boiler unit must not be allowed to fall below the minimum level. To prevent damage to the valve, a cut-out switch is mounted above the boiler and by making suitable connections to the switch, power to the valve can be cut-off automatically should the water level fall below the minimum level. A part of the cut-out assembly also acts as a steam pressure relief valve and switches off power to the valve should an excessive pressure build up inside the unit.

The water connections to the internal condenser system terminate in copper pipes suitable for use with 1-inch (25·4mm) bore rubber hoses. The unit can be supplied with alternative water connections or can be adapted readily to suit the requirements of particular applications.

Distilled or de-mineralised water should be used in the boiler unit; any suitable supply of clean water may be used for the condenser system.

GENERAL DATA

Overall Length	27·594 inches	(701 mm)	Max
Overall Width (excluding pipes)	24·375 inches	(619 mm)	Max
Overall Height (excluding valve)	21·625 inches	(549 mm)	Max
Net Weight (empty)	100 pounds	(45·5 kg)	Approx
Water Capacity of Boiler (to maximum water level)	13 gallons	(59 litres)	Approx
Condenser Water Flow	7 gallons/minute	(32l./min)	Approx

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

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Chelmsford 3491

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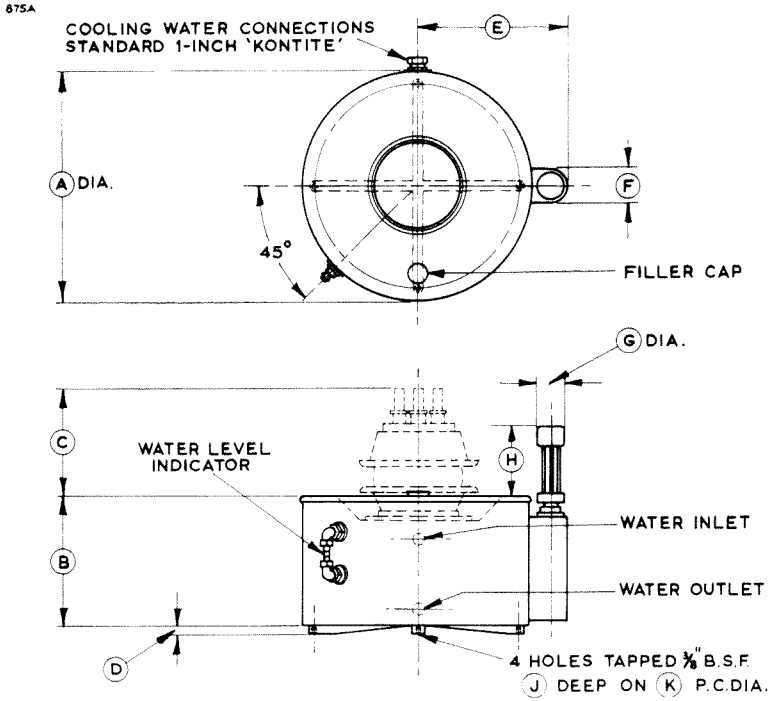
ENGLISH ELECTRIC

OUTLINE



Ref.	Inches	Millimetres
A	24·375 Max	619·13 Max
B	14·000 Max	355·60 Max
C	11·500 Max	292·10 Max
D	0·750	19·05
E	15·406 Max	391·32 Max
F	3·250	82·55
G	3·000	76·20
H	6·875 Max	174·63 Max
J	0·625	15·88
K	22·000	558·80

Millimetre dimensions have been derived from inches

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SINGLE BOILER-CONDENSER UNIT

BY4038

INTRODUCTION

The BY4038 is a single Boiler Unit with an integral condenser system for use with the vapour cooled triode BY189.

The valve is held in position in the boiler unit by its own weight, in conjunction with the spring finger contacts round the anode ring, and is seated on a neoprene ring supplied with the BY4038 (a neoprene ring is also supplied with the valve). A glass water-level indicator is incorporated and the water in the boiler unit must not be allowed to fall below the minimum level. To prevent damage to the valve, a cut-out switch is mounted above the boiler and by making suitable connections to the switch, power to the valve can be cut-off automatically should the water level fall below the minimum level. A part of the cut-out assembly also acts as a steam pressure relief valve and switches off power to the valve should an excessive pressure build up inside the unit.

The water connections to the internal condenser system terminate in copper pipes suitable for use with $\frac{3}{4}$-inch (19·05mm) bore rubber hoses. The unit can be supplied with alternative water connections or can be adapted readily to suit the requirements of particular applications.

Distilled or de-mineralised water should be used in the boiler unit; any suitable supply of clean water may be used for the condenser system.

GENERAL DATA

Overall Length	21·09 inches	(535·7 mm)	Max
Overall Width (excluding pipes)	17·88 inches	(454·1 mm)	Max
Overall Height (excluding valve)	20·50 inches	(520·7 mm)	Max
Net Weight (empty)	85 pounds	(39 kg)	Approx
Water Capacity of Boiler (to maximum water level)	$1\frac{1}{2}$ gallons	(6·8 litres)	Approx
Condenser Water Flow	$3\frac{1}{2}$ gallons/minute	(15·9 l./min)	Approx

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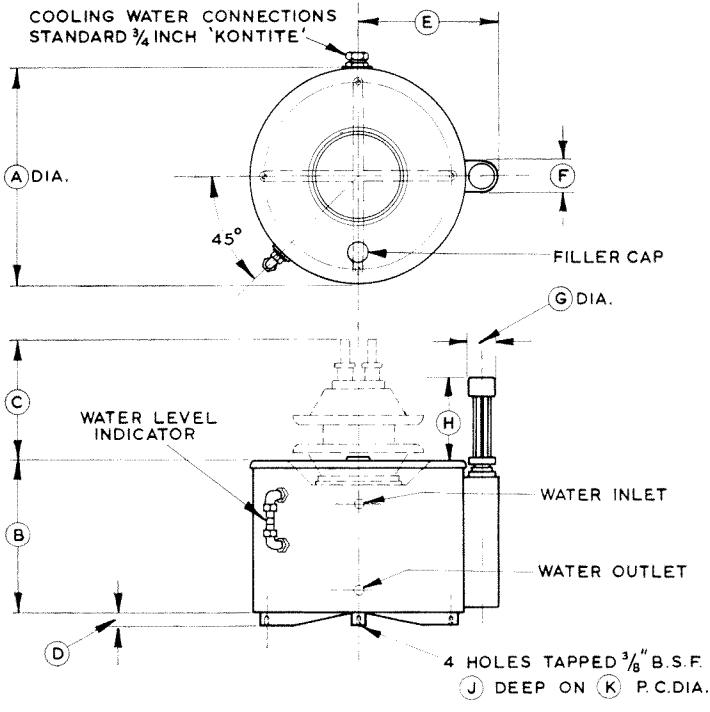
OUTLINE

959



Ref.	Inches	Millimetres
A	17·875 Max	454·03 Max
B	12·875 Max	327·03 Max
C	9·750 Max	247·65 Max
D	0·750	19·05
E	12·156 Max	308·77 Max
F	3·250	82·55
G	3·000	76·20
H	6·875 Max	174·63 Max
J	0·625	15·88
K	15·500	393·70

Millimetre dimensions have been derived from inches

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SINGLE BOILER-CONDENSER UNIT

BY4039

INTRODUCTION

The BY4039 is a single Boiler Unit with an integral condenser system for use with the vapour cooled triode BY194.

The valve is held in position in the boiler unit by its own weight, in conjunction with the spring finger contacts round the anode ring, and is seated on a neoprene ring supplied with the BY4039 (a neoprene ring is also supplied with the valve). A glass water-level indicator is incorporated and the water in the boiler unit must not be allowed to fall below the minimum level. To prevent damage to the valve, a cut-out switch is mounted above the boiler and by making suitable connections to the switch, power to the valve can be cut-off automatically should the water level fall below the minimum level. A part of the cut-out assembly also acts as a steam pressure relief valve and switches off power to the valve should an excessive pressure build up inside the unit.

The water connections to the internal condenser system terminate in copper pipes suitable for use with $\frac{3}{4}$-inch (19·05mm) bore rubber hoses. The unit can be supplied with alternative water connections or can be adapted readily to suit the requirements of particular applications.

Distilled or de-mineralised water should be used in the boiler unit; any suitable supply of clean water may be used for the condenser system.

GENERAL DATA

Overall Length	21·09 inches (535·7 mm)	Max
Overall Width (excluding pipes)	17·88 inches (454·1 mm)	Max
Overall Height (excluding valve)	24·50 inches (622·3 mm)	Max
Net Weight (empty)	88 pounds (40 kg)	Approx
Water Capacity of Boiler (to maximum water level)	$1\frac{1}{2}$ gallons (6·8 litres)	Approx
Condenser Water Flow	4 gallons/minute (18·2 l./min)	Approx

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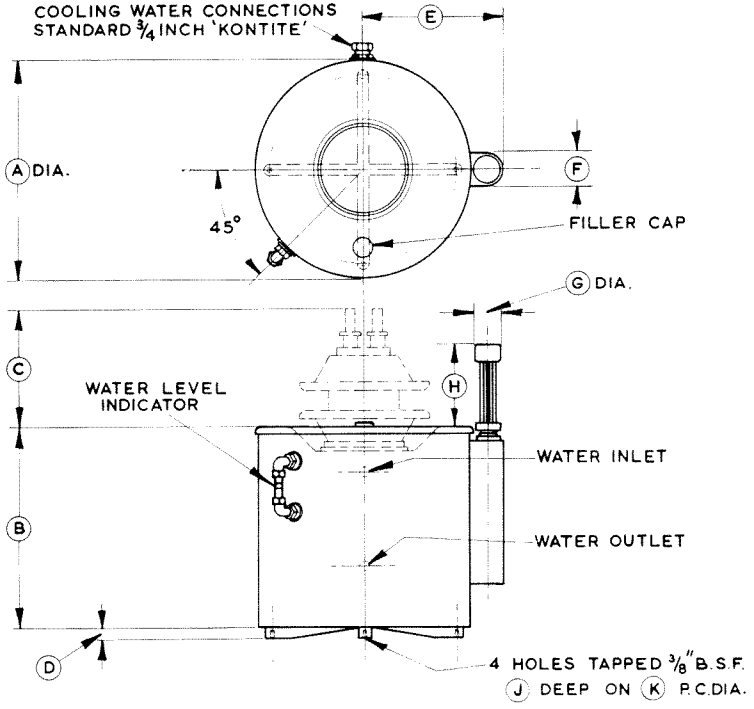
OUTLINE

960



Ref.	Inches	Millimetres
A	17·875 Max	454·03 Max
B	16·875 Max	428·63 Max
C	9·750 Max	247·65 Max
D	0·750	19·05
E	12·156 Max	308·77 Max
F	3·250	82·55
G	3·000	76·20
H	6·875 Max	174·63 Max
J	0·625	15·88
K	15·500	393·70

Millimetre dimensions have been derived from inches

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CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

SINGLE BOILER UNIT

BY4048A

INTRODUCTION

The BY4048A is a single Boiler Unit for use with the vapour cooled triode BY1122. A separate condenser is required, with insulating pipes for the steam outlet and water return to the boiler.

The valve is held in position in the boiler unit by its own weight, in conjunction with the spring finger contacts round the anode ring, and is seated on a sealing ring supplied with the BY4048A (a sealing ring is also supplied with the valve).

The boiler unit may be mounted by means of the four lugs provided, and these may also be used for h.t. supply connection. The unit can be modified in some respects to meet the requirements of particular applications.

Distilled or de-mineralised water should be used in the boiler unit.

GENERAL DATA

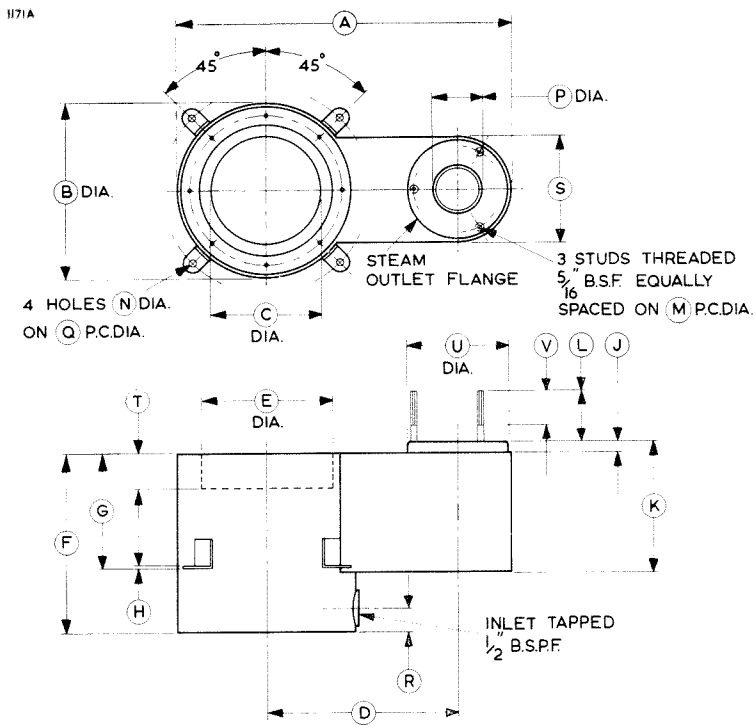
Overall Length	14·000 inches	(355·6 mm)	Nom
Overall Width	7·500 inches	(190·5 mm)	Nom
Overall Height	10·187 inches	(258·7 mm)	Nom
Net Weight (empty)	22 pounds	(10 kg)	Approx
Water Capacity of Boiler (to maximum water level)	0·9 gallon	(4·1 litres)	Approx
Sealing Ring (supplied with boiler)			15801A

SINGLE BOILER UNIT

BY4048A

ENGLISH ELECTRIC

OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	14·000 ± 0·031	355·6 ± 0·8	L	2·187	55·55
B	7·500	190·5	M	3·875	98·43
C	4·562	115·9	N	0·343	8·71
D*	8·000	203·2	P	2·062	52·37
E	5·500	139·7	Q	8·750	222·3
F	7·500	190·5	R	1·000	25·40
G	4·968	126·2	S	4·500	114·3
H	0·187	4·78	T	1·500	38·10
J	0·500	12·70	U	4·375	111·1
K	5·500	139·7	V	1·500	38·10

Millimetre dimensions have been derived from inches.

*Boiler units can be supplied with this dimension to customer's requirements within ±3·000 inches (± 76·2mm) of the value shown. (Dimension A will vary accordingly).

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
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SINGLE BOILER UNIT

BY4049

March 1967

ENGLISH ELECTRIC

INTRODUCTION

The BY4049 is a single Boiler Unit for use with the vapour cooled triode BY194. A separate condenser is required, with insulating pipes for the steam outlet and water return to the boiler.

The valve is held in position in the boiler unit by its own weight, in conjunction with the spring finger contacts round the anode ring, and is seated on a sealing ring supplied with the BY4049 (a sealing ring is also supplied with the valve).

The boiler unit may be mounted by means of the four lugs on the base, and these may be used for h.t. supply connection. The unit can be modified in some respects to meet the requirements of particular applications.

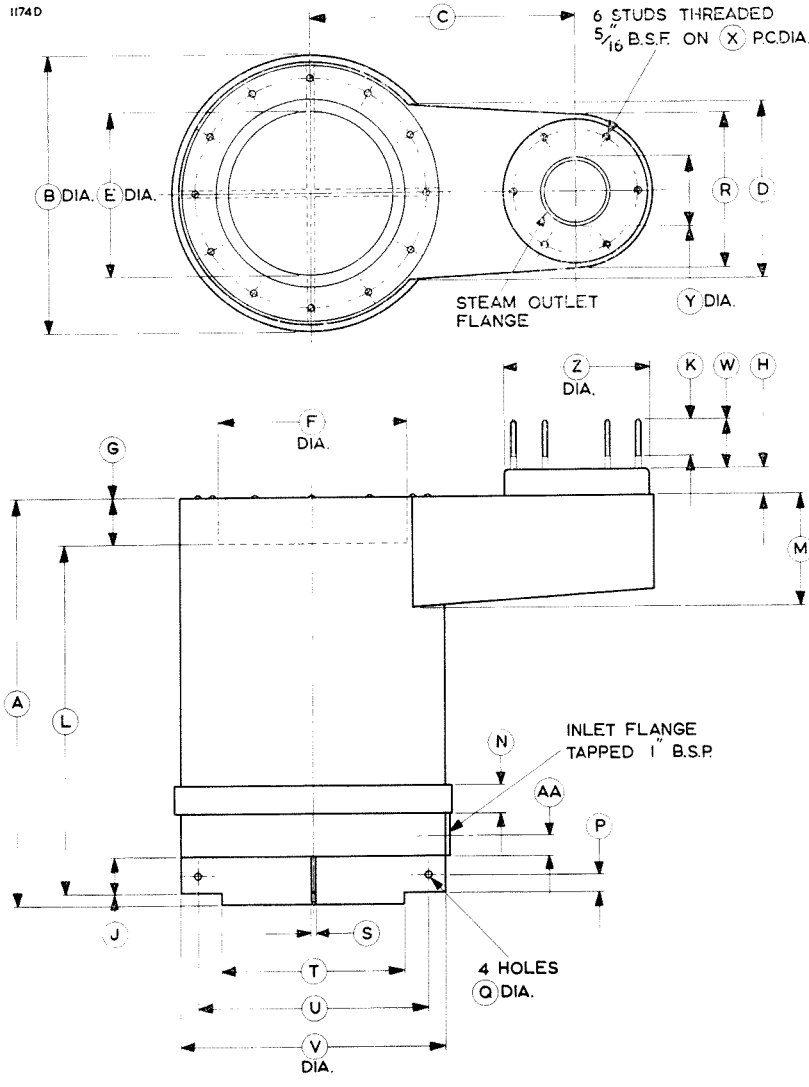
Distilled or de-mineralised water should be used in the boiler unit.

GENERAL DATA

Overall Length	.. 20·125 inches	(511·2 mm)	Max
Overall Width	.. 11·520 inches	(292·6 mm)	Max
Overall Height	.. 21·050 inches	(534·7 mm)	Max
Net Weight (empty)	.. 60 pounds	(27 kg)	Approx
Water Capacity of Boiler (to maximum water level)	3 Imp. gal	(13·6 litres)	Approx
Sealing Ring (supplied with boiler)			15856A

ENGLISH ELECTRIC

OUTLINE



OUTLINE DIMENSIONS

Ref.	Inches	Millimetres
A	17·750 Max	450·9 Max
B	11·500 ± 0·020	292·1 ± 0·51
C	11·000	279·4
D	7·250 Max	184·2 Max
E	7·000 ± 0·010	177·8 ± 0·25
F	8·000 ± 0·010	203·2 ± 0·25
G	2·000	50·80
H	1·156 ± 0·010	29·36 ± 0·25
J	1·500	38·10
K	1·500	38·10
L	15·125 ± 0·062	384·2 ± 1·57
M	4·875 Max	123·8 Max
N	1·250 ± 0·020	31·75 ± 0·51
P	0·750	19·05
Q	0·344	8·75
R	6·625 Max	168·3 Max
S	0·250 ± 0·010	6·35 ± 0·25
T	7·875 ± 0·020	200·0 ± 0·51
U	9·500 ± 0·010	241·3 ± 0·25
V	11·000 ± 0·020	279·4 ± 0·51
W	2·125	53·98
X	5·250	133·4
Y	2·750	69·85
Z	6·000 ± 0·010	152·4 ± 0·25
AA	0·937	23·80

Millimetre dimensions have been derived from inches.

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SINGLE BOILER UNIT

BY4060

INTRODUCTION

The BY4060 is a single Boiler Unit for use with the vapour cooled triode BY1144. A separate condenser is required, with insulating pipes for the steam outlet and water return to the boiler.

The valve is held in position in the boiler unit by its own weight, in conjunction with the spring finger contacts round the anode ring, and is seated on a sealing ring supplied with the BY4060 (a sealing ring is also supplied with the valve).

The boiler unit may be mounted by means of the four lugs on the base, and these may also be used for h.t. supply connection. The unit can be modified in some respects to meet the requirements of particular applications.

Distilled or de-mineralised water should be used in the boiler unit.

GENERAL DATA

Overall Length	26·563 inches (674·7 mm)	Max
Overall Width	18·063 inches (458·8 mm)	Max
Overall Height	18·000 inches (457·2 mm)	Max
Net Weight (empty)	100 pounds (45 kg)	Approx
Water Capacity of Boiler (to maximum water level)	8 gallons (37 litres)	Approx
Sealing Ring (supplied with boiler)		15858A

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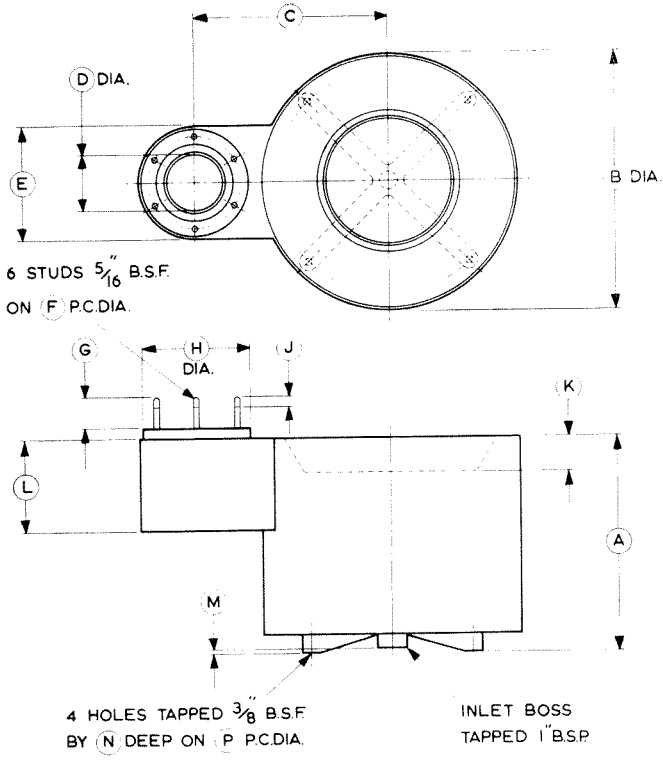
ENGLISH ELECTRIC

OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	15·000	381·0	H	7·750	196·9
B	18·000	457·2	J	0·750	19·05
C	13·500	342·9	K	2·406	61·11
D	4·000	101·6	L	6·500	165·1
E	8·000	203·2	M	0·250	6·35
F	7·000	177·8	N	0·625	15·88
G	2·125	53·98	P	16·000	406·4

Millimetre dimensions have been derived from inches.

Printed in England

SINGLE BOILER UNIT

BY4063

INTRODUCTION

The BY4063 is a single Boiler Unit for use with the vapour cooled triode BY1121. A separate condenser is required, with insulating pipes for the steam outlet and water return to the boiler.

The valve is held in position in the boiler unit by its own weight, in conjunction with the spring finger contacts round the anode ring, and is seated on a sealing ring supplied with the BY4063 (a sealing ring is also supplied with the valve).

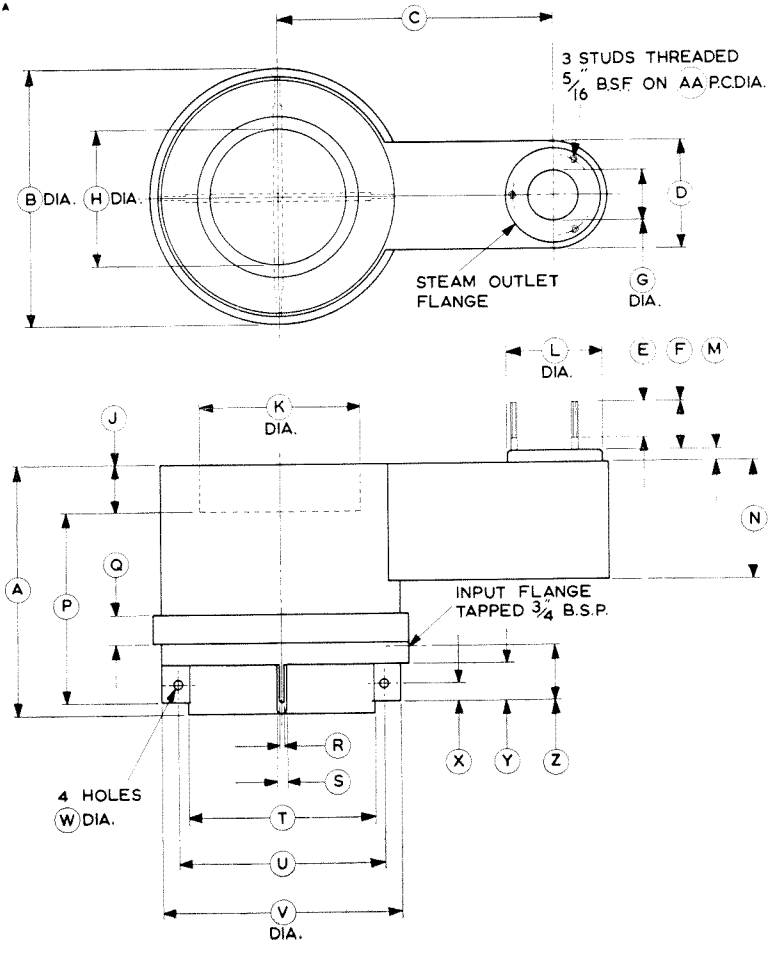
The boiler unit may be mounted by means of the four lugs on the base, and these may also be used for h.t. supply connection. The unit can be modified in some respects to meet the requirements of particular applications.

Distilled or de-mineralised water should be used in the boiler unit.

GENERAL DATA

Overall Length	19·125 inches	(485·8 mm)	Nom
Overall Width	10·750 inches	(273·1 mm)	Nom
Overall Height	13·187 inches	(334·9 mm)	Nom
Net Weight (empty)	42 pounds	(19 kg)	Approx
Water Capacity of Boiler (to maximum water level) ..	1·5 Imp. gal	(6·8 litres)	Approx
Sealing Ring (supplied with boiler)			I5810A

OUTLINE


1473A
C
3 STUDS THREADED 5/16 B.S.F. ON AA P.C.DIA.
B DIA.
H DIA.
D
STEAM OUTLET FLANGE
G DIA.
L DIA.
E
F
M
J
K DIA.
N
A
P
Q
INPUT FLANGE TAPPED 3/4 B.S.P.
X
Y
Z
R
S
T
U
V DIA.
4 HOLES W DIA.

OUTLINE DIMENSIONS

Ref.	Inches	Millimetres
A	10·500	266·7
B	10·750	273·1
C	11·500	292·1
D	4·500	114·3
E	1·500	38·10
F	2·187	55·55
G	2·062	52·37
H	5·812	147·6
J	2·000	50·80
K	6·875	174·6
L	4·375	111·1
M	0·500	12·70
N	5·000	127·0
P	8·000	203·2
Q	1·250	31·75
R	0·250	6·35
S	0·313	7·95
T	7·125	181·0
U	8·750 ± 0·010	222·3 ± 0·25
V	10·250	260·4
W	0·344	8·74
X	0·750	19·05
Y	1·500	38·10
Z	2·250	57·15
AA	3·875	98·43

Millimetre dimensions have been derived from inches.

Printed in England

SINGLE BOILER-CONDENSER UNIT

BY4093

INTRODUCTION

The BY4093 is a single Boiler Unit with an integral condenser system, for use with the vapour cooled triode BY1161.

The valve is held in position in the boiler unit by its own weight, in conjunction with the spring finger contacts round the anode ring, and is seated on a sealing ring supplied with the BY4093 (a sealing ring is also supplied with the valve). A glass water-level indicator is incorporated and the water in the boiler unit must not be allowed to fall below the minimum level. To prevent damage to the valve, a cut-out switch is mounted above the boiler and by making suitable connections to the switch, power to the valve can be cut-off automatically should the water level fall below the minimum level. A part of the cut-out assembly also acts as a steam pressure relief valve and switches off power to the valve should an excessive pressure build up inside the unit.

The water connections to the internal condenser system terminate in Kontite fittings suitable for use with ¾-inch (19·05mm) bore rubber hoses. The unit can be supplied with alternative water connections or can be adapted readily to suit the requirements of particular applications.

Distilled or de-mineralised water should be used in the boiler unit; any suitable supply of clean water may be used for the condenser system.

GENERAL DATA

Overall Length	21·093 inches	(535·8 mm)	Max
Overall Width (excluding pipes)	17·875 inches	(454·0 mm)	Max
Overall Height (excluding valve)	20·500 inches	(520·7 mm)	Max
Net Weight (empty)	85 pounds	(39 kg)	Approx
Water Capacity of Boiler (to maximum water level) ..	6 Imp. gal	(27 litres)	Approx
Condenser Water Flow	5 Imp. gal/min	(23 l./min)	Approx

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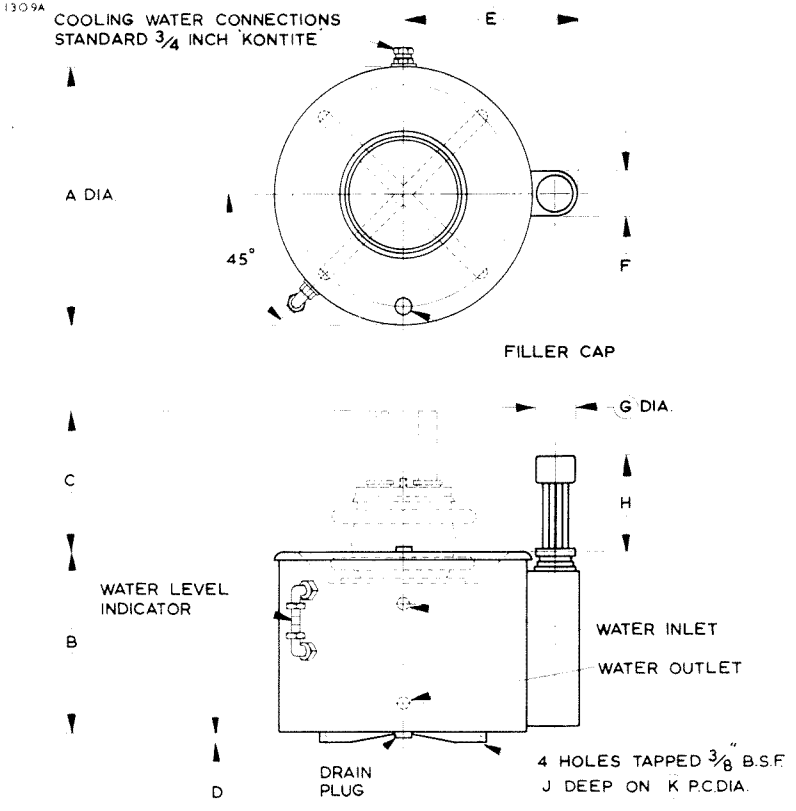
OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	17·875 Max	454·0 Max	F	3·250	82·55
B	12·875 Max	327·0 Max	G	3·000	76·20
C	9·900	251·5	H	6·875 Max	174·6 Max
D	0·750	19·05	J	0·625	15·88
E	12·156 Max	308·8 Max	K	15·500	393·7

Millimetre dimensions have been derived from inches.

Printed in England

POWER TETRODES

Natural Cooled

Forced-air Cooled

Water Cooled

December 1963

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

TABULATED DATA

POWER TETRODES AND PENTODES

NATURAL COOLED TETRODES

EEV type	Anode dissipation max (W)	Output power (W)⊕	Anode voltage max (V)	Frequency (MHz)‡	Screen voltage max (V)
4D32	50	140	750	60	350
C178A/ 5894★	2 x 20	90♦	600	250/500	300
C1108	125	375	3000	120/200	400
C1112	250	1000	4000	75/120	600
C1134★	2 x 10	48♦	600	150/600	300
C1136	400	1100	4000	75/110	600
C1158▲	90	–	800	–	300

PULSE AMPLIFIER TETRODES

EEV type	Anode dissipation max (W)	Pulse output power (kW)	Anode voltage max (kV)	Pulse anode current max (A)	Heater (V)	Heater (A)
C1148	40	130	14	12	6.3	5.0
C1149/1	60	330	20	18	26	2.15
C1150/1	60	205	17.5	15	26	2.15
C1166	60	205	17.5	15	6.3	9.0

⊕ ‡ ★ ▲ ♦ **See foot of page 2**

FORCED-AIR COOLED TETRODES

EEV type	Anode dissipation max (kW)	Output power (kW)⊕	Anode voltage max (kV)	Frequency (MHz)‡	Screen voltage max (kV)
4CX1000A 4CX1000K	1.0	3.2■	3.0	110	0.4
4CX1500B	1.5	2.7■	3.0	30	0.4
4CX5000A	5.0	16	7.5	30/110	1.5
4CX10,000D	10	16	7.5	30/110	1.5
4CX35,000C	35	82	20	30	2.5
CR176	3.5	–	7.5	30	1.5
CR192A	10	9.0	6.9	60/220	2.0

VAPOUR COOLED TETRODES

CY1170J□	75	82	15	30	2.5
CY1172●	150	220	15	30	1.6

FORCED-AIR COOLED PENTODE

5CX1500A	1.5	3.2■	5.0	110	750

⊕ Under class C unmodulated conditions

‡ Where two values are given, the lower value is the maximum frequency for full ratings. Derating is necessary for operation at the higher value

★ Double tetrode

▲ Series regulator; mutual conductance 35mA/V at $V_a = V_{g2} = 150V$, $I_a = 500mA$

◆ With 2 sections in push-pull

■ 2 valves, class AB_1 audio

□ Fitted with integral boiler unit

● Operates in boiler unit CY4120

Natural Cooled Tetrodes

September 1965

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

C178A/5894

V.H.F. POWER DOUBLE TETRODE

Service Type CV2797 **American Equivalent 5894**

INTRODUCTION

The C178A/5894 is an all-glass Double Tetrode with a centre-tapped heater for series or parallel connection. The maximum anode dissipation is 20W and the maximum frequency for full ratings is 250Mc/s. It may be used at reduced ratings up to 500Mc/s.

GENERAL DATA

Electrical

Cathode.. .. .. Indirectly Heated, Oxide Coated

The cathode is internally connected to Pin No. 4 via the bottom shield, to which the beam plates and top shield are welded.

	Series	*Parallel*	
Heater Voltage	12·6	6·3	V
Heater Current..	0·9	1·8	A
Grid-Screen Amplification Factor (each unit) (I_a = 30mA)		8·0	
Mutual Conductance (each unit) (I_a = 30mA)..		4·5	mA/V
Inter-electrode Capacitances (*See Note* 1):			
Grid to Anode*		0·06	pF Max
Input		10·5	pF
Output		3·2	pF
Input (two sections in push-pull)		6·7	pF
Output (two sections in push-pull)		2·1	pF

*Internally neutralised for push-pull operation.

Mechanical

Overall Length..	4·08 inches (104 mm)	Max
Overall Diameter	1·81 inches (46 mm)	Max
Net Weight	3 ounces (85 gm)	Approx
Mounting Position	Vertical, base up or down	

Horizontal operation is permitted with fixed station operation when the anode pins are in a horizontal plane.

Base .. .. B7A (JEDEC No. E7-2)

COOLING

The temperature of the seals must not exceed the values given below:

Anode Seal or Bulb Temperature	200	°C Max
Base Pin Seal Temperature	180	°C Max

A heat dissipating anode connection of large surface area or high heat conduction is necessary.

Natural cooling is normally sufficient at maximum ratings for frequencies up to 150Mc/s. At higher frequencies it may be necessary to direct an air flow on to the anode and base seals (up to 5 cu.ft/min).

ENGLISH ELECTRIC VALVE CO. LTD.
CHELMSFORD ESSEX, ENGLAND TECHNICAL PUBLICATIONS
Printed in England

V.H.F. POWER DOUBLE TETRODE

A.F. POWER AMPLIFIER AND MODULATOR

(Class B, 2 valves)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	600	V Max
Anode Dissipation	2×20	W Max
Screen Voltage	300	V Max
Screen Dissipation	2×3·5	W Max
Grid Dissipation	2×1·0	W Max
Grid Resistor (Fixed Bias)	50	kΩ Max
Grid Resistor (Cathode Bias)	100	kΩ Max
Cathode Current (Peak)	2×450	mA Max
Cathode Current (Mean)	2×140	mA Max
Peak Heater-Cathode Voltage	100	V Max

TYPICAL OPERATING CONDITIONS

(Class B, no grid current)

Anode Voltage	300	450	600	V
Screen Voltage	250	250	250	V
Grid Voltage	−26	−27	−27	V
Peak A.F. Input Voltage (Grid to Grid)	51	54	55	V
Maximum-Signal Anode Current	2×56	2×58	2×62	mA
Zero-Signal Anode Current	2×20	2×20	2×20	mA
Maximum-Signal Screen Current	2×14	2×13·5	2×11·5	mA
Zero-Signal Screen Current	2×1·0	2×0·7	2×0·45	mA
Effective Load (Anode to Anode)	6·5	10	12·5	kΩ
Anode Dissipation	2×5·6	2×8·5	2×12	W
Output Power	22·5	35	50	W
Efficiency	67	67·5	67·5	%
Total Distortion	2·9	3·1	2·4	%

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V.H.F. POWER DOUBLE TETRODE

TYPICAL OPERATING CONDITIONS

(Class B, with grid current)

Anode Voltage	300	450	600	V
Screen Voltage	250	250	250	V
Grid Voltage	−25	−25	−25	V
Peak A.F. Input Voltage (Grid to Grid)	74	76	78	V
Maximum-Signal Anode Current	2×94	2×97	2×100	mA
Zero-Signal Anode Current	2×25	2×25	2×25	mA
Maximum-Signal Screen Current	2×14	2×14	2×13	mA
Zero-Signal Screen Current	2×1·4	2×0·95	2×0·7	mA
Grid Current	2×2·6	2×2·6	2×2·6	mA
Effective Load (Anode to Anode)	4·0	6·0	8·0	kΩ
Anode Dissipation	2×9·7	2×13·5	2×17	W
Output Power	37	60	86	W
Efficiency	65·5	69	71·5	%
Total Distortion	5·0	5·0	5·0	%

R.F. POWER AMPLIFIER—ANODE AND SCREEN MODULATED

(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	600	V Max
Anode Dissipation	2×14	W Max
Screen Voltage	300	V Max
Screen Dissipation	2×2·3	W Max
Grid Voltage (negative value)	175	V Max
Grid Current	2×5·0	mA Max
Grid Dissipation	2×1·0	W Max
Grid Resistor (Fixed Bias)	50	kΩ Max
Grid Resistor (Cathode Bias)	100	kΩ Max
Cathode Current (Peak)	2×1·0	A Max
Cathode Current (Mean)	2×120	mA Max
Peak Heater-Cathode Voltage	100	V Max

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V.H.F. POWER DOUBLE TETRODE

TYPICAL OPERATING CONDITIONS

Frequency	60	200	200	Mc/s
Anode Voltage	600	400	600	V
Screen Voltage	250	250	250	V
Grid Voltage	−80	−70	−80	V
Anode Current	2×75	2×75	2×75	mA
Screen Current	2×10	2×9·0	2×9·0	mA
Grid Current (Approx)	2×4·0	2×2·0	2×2·0	mA
Anode Dissipation	2×9·5	2×9·5	2×11·5	W
Output Power	71	41	67	W
Efficiency	79	69	75	%

Frequency	250	400	475	Mc/s
Anode Voltage	600	400	400	V
Screen Voltage	250	250	250	V
Grid Voltage	−80	−70	−70	V
Anode Current	2×75	2×75	2×75	mA
Screen Current	2×9·0	2×8·0	2×7·5	mA
Grid Current (Approx)	2×1·5	2×1·5	2×1·5	mA
Anode Dissipation	2×13	2×11·5	2×13	W
Output Power	64	37	34	W
Efficiency	71	62	57	%

PUSH-PULL R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	600	V Max
Anode Dissipation	2×20	W Max
Screen Voltage	300	V Max
Screen Dissipation	2×3·5	W Max
Grid Voltage	−100	V Max
Grid Current	2×5	mA Max
Grid Resistor (Fixed Bias)	50	kΩ Max
Grid Resistor (Cathode Bias)	100	kΩ Max
Cathode Current (Peak)	2×700	mA Max
Cathode Current (Mean)	2×120	mA Max
Peak Heater-Cathode Voltage	100	V Max

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V.H.F. POWER DOUBLE TETRODE

TYPICAL OPERATING CONDITIONS

Frequency	200	200	400	400	Mc/s
Anode Voltage	400	600	400	540	V
Screen Voltage (*See Note* 2)	250	250	250	250	V
Grid Voltage	−60	−80	−50	−55	V
Anode Current	2×100	2×100	2×100	2×100	mA
Screen Current	2×8	2×9	2×5	2×7	mA
Grid Current (Approx)	2×3·0	2×3·5	2×2·0	2×1·5	mA
Driving Power (Approx)	3·0	3·0	11	12	W
Output Power (Approx)	56	90	50	70	W

Frequency	475	475	Mc/s
Anode Voltage	350	500	V
Screen Voltage (*See Note* 2)	250	250	V
Grid Voltage	−45	−50	V
Anode Current	2×100	2×100	mA
Screen Current	2×4·5	2×4·5	mA
Grid Current (Approx)	2×2·0	2×2·0	mA
Driving Power (Approx)	10	12	W
Output Power (Approx)	40	60	W

→ RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Heater Current at heater voltage 6·3V	1·6	2·0	A
Change of Grid Voltage (V_a = 600V, V_{g2} = (1) 250V, (2) 200V, I_a = 40mA)	5·2	7·5	V
Anode Current (V_a = 600V, V_{g2} = 250V, V_{g1} = −40V)	—	5·0	mA

NOTES

1. Inter-electrode capacitances are for each unit except where otherwise indicated.
2. Screen voltage may be obtained from a separate source, or from the anode supply with a potential divider or through a series resistor. The screen voltage must not exceed 600V under key-up conditions.

→ Indicates a change.

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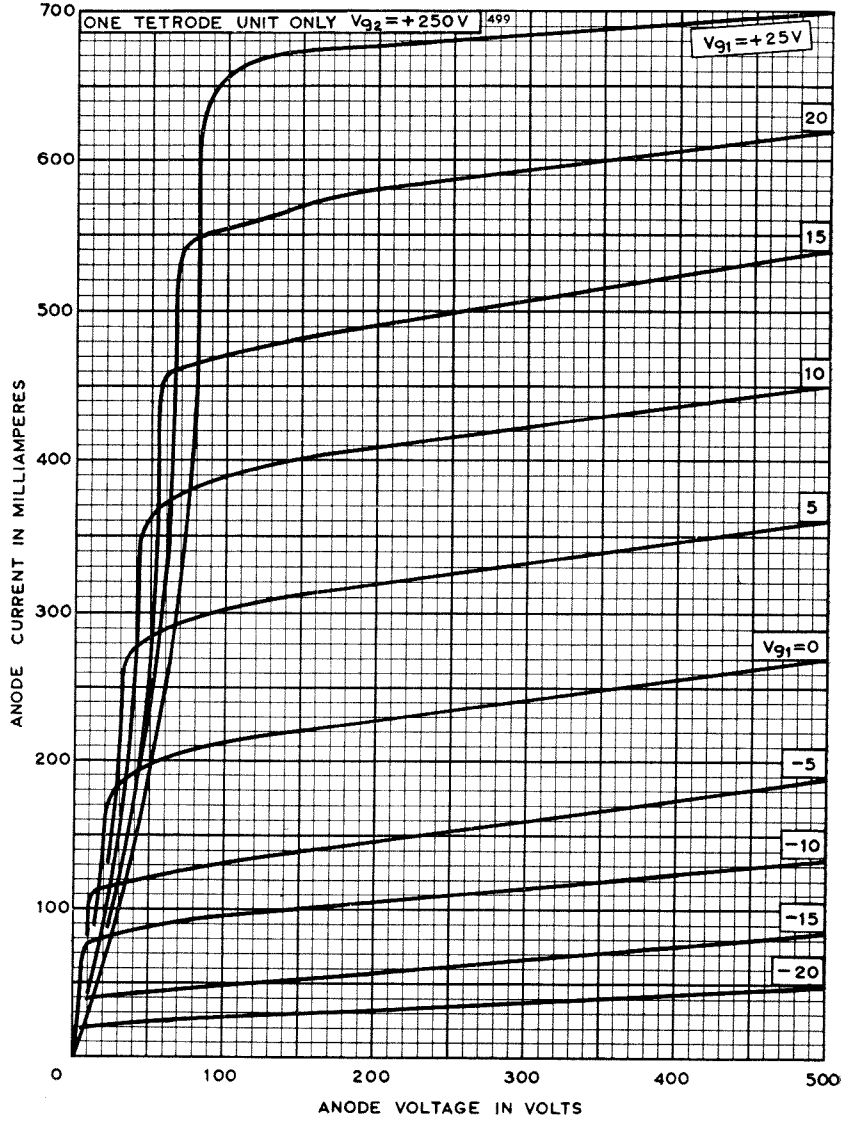
V.H.F. POWER DOUBLE TETRODE

ANODE CHARACTERISTICS



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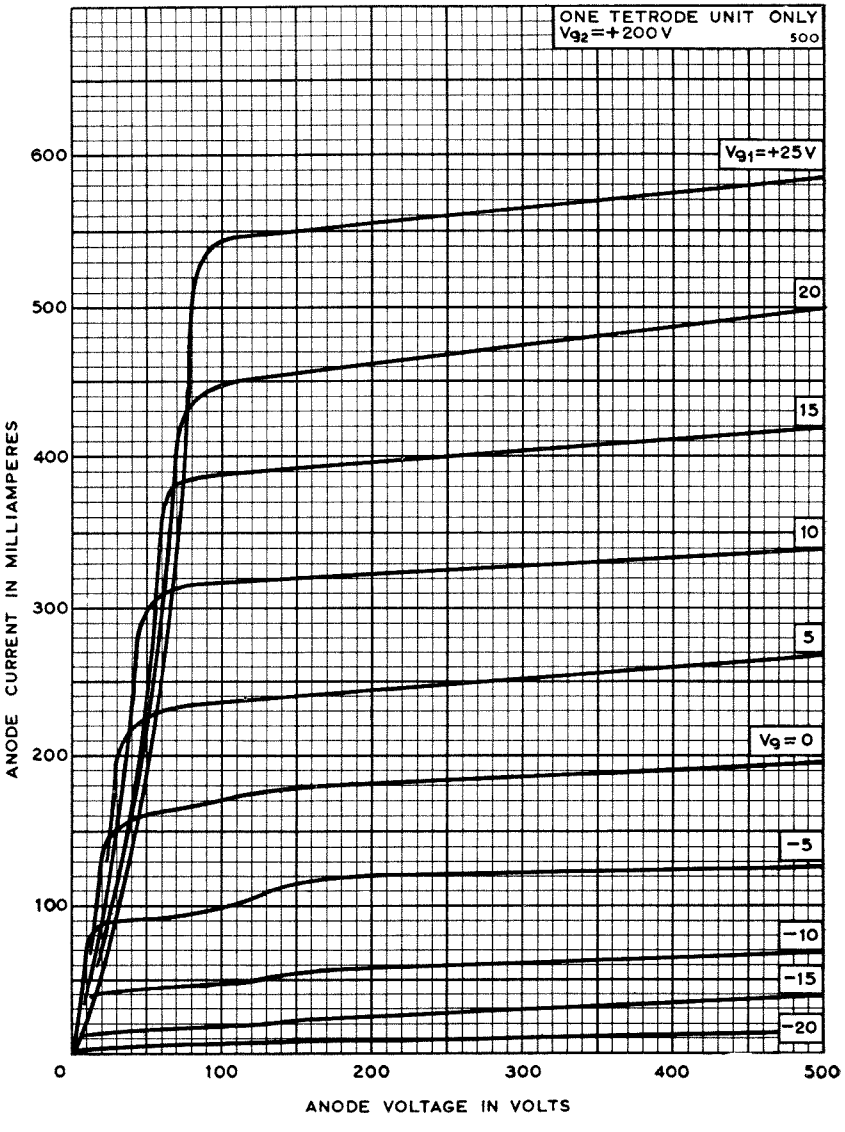
V.H.F. POWER DOUBLE TETRODE

ANODE CHARACTERISTICS



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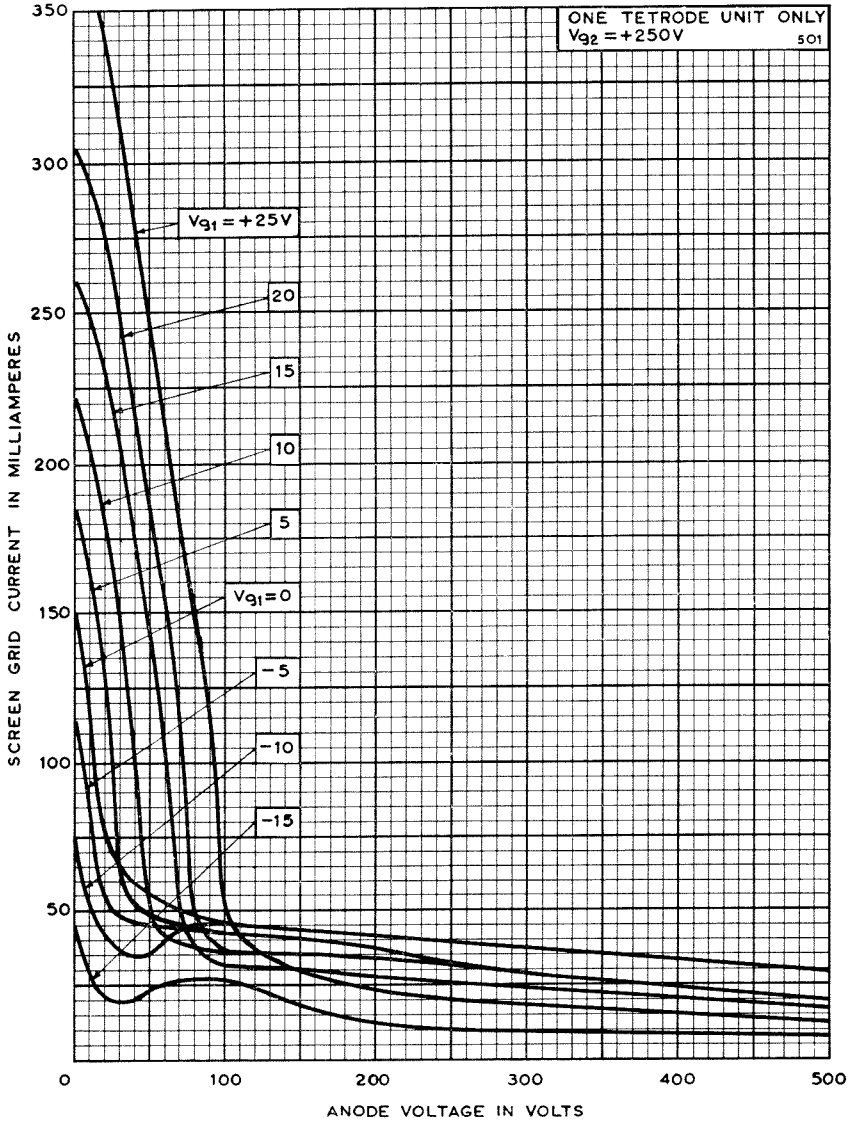
SCREEN GRID CHARACTERISTICS



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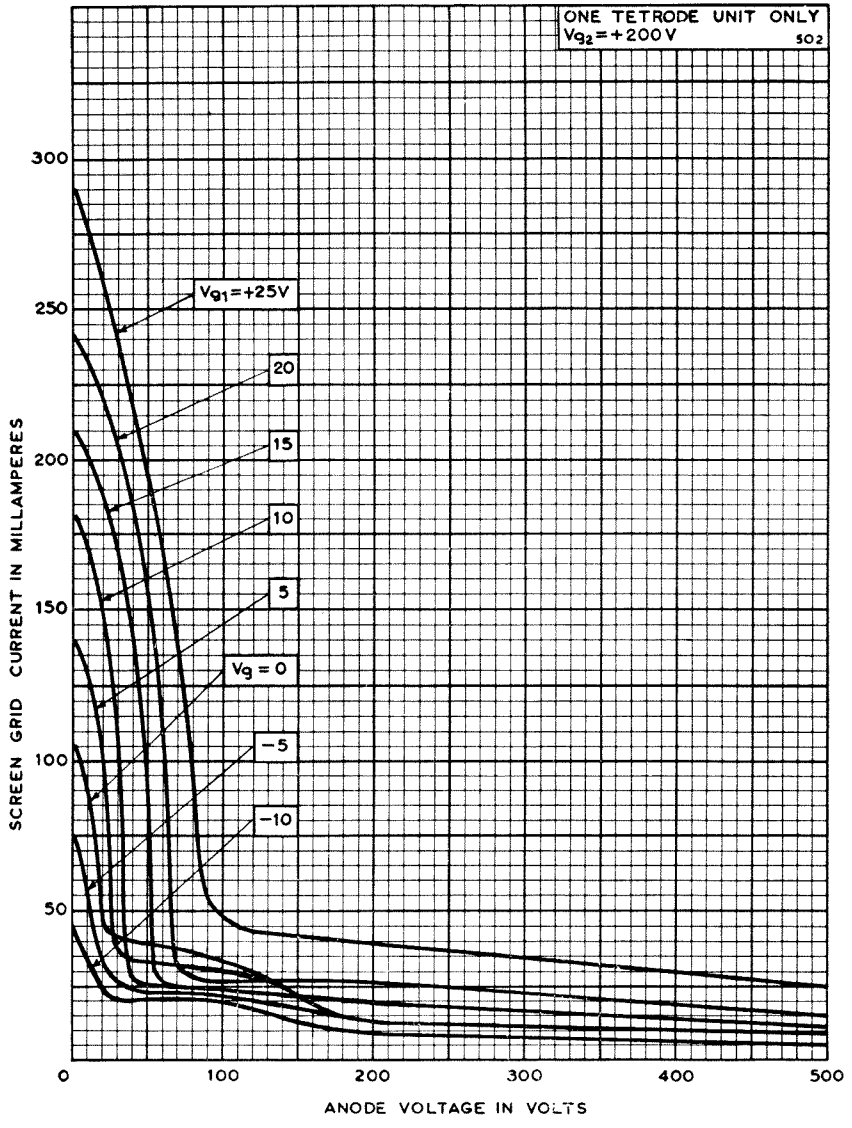
V.H.F. POWER DOUBLE TETRODE

SCREEN GRID CHARACTERISTICS



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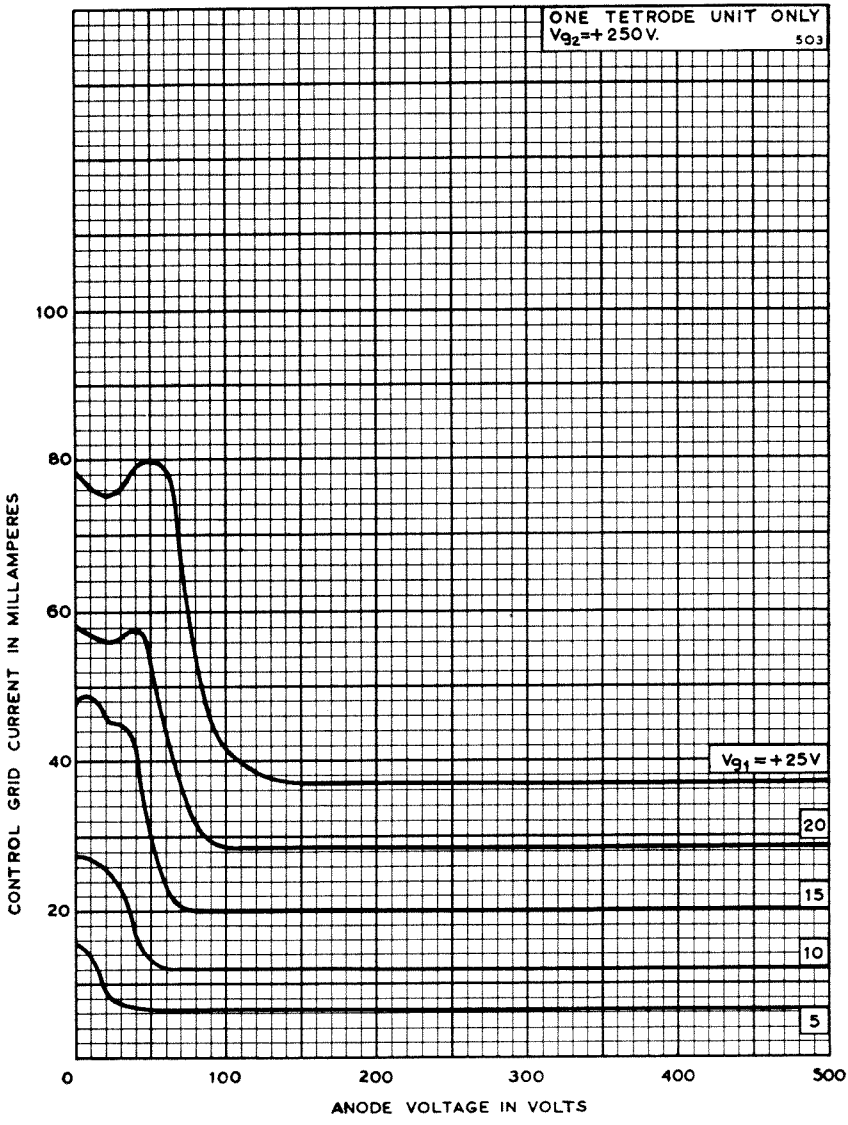
CONTROL GRID CHARACTERISTICS



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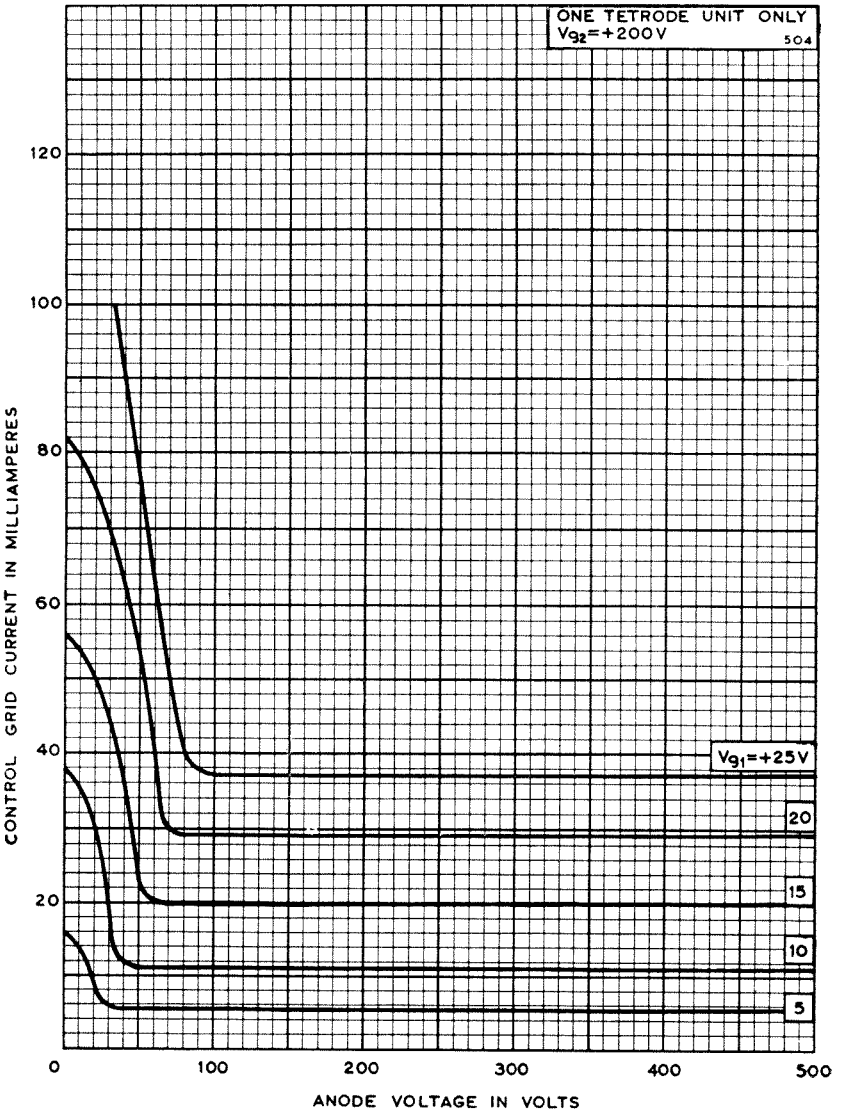
CONTROL GRID CHARACTERISTICS



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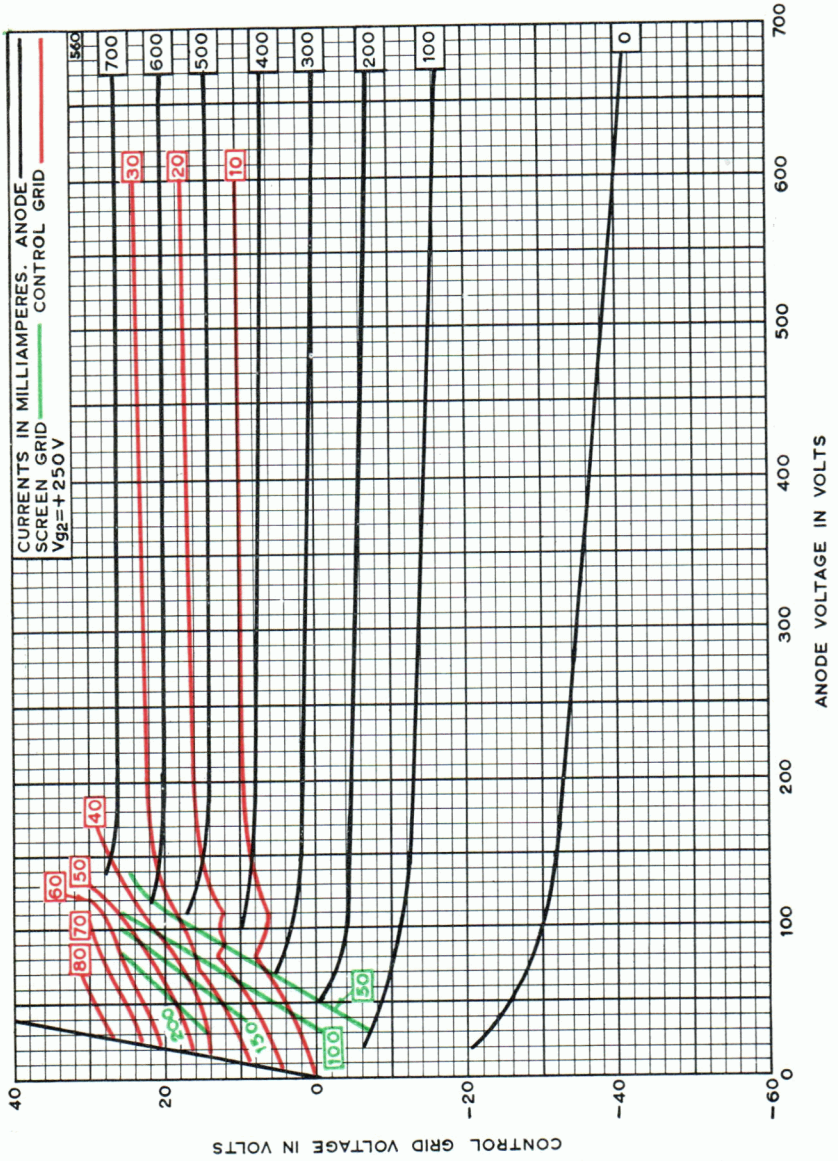
CONSTANT CURRENT CHARACTERISTICS



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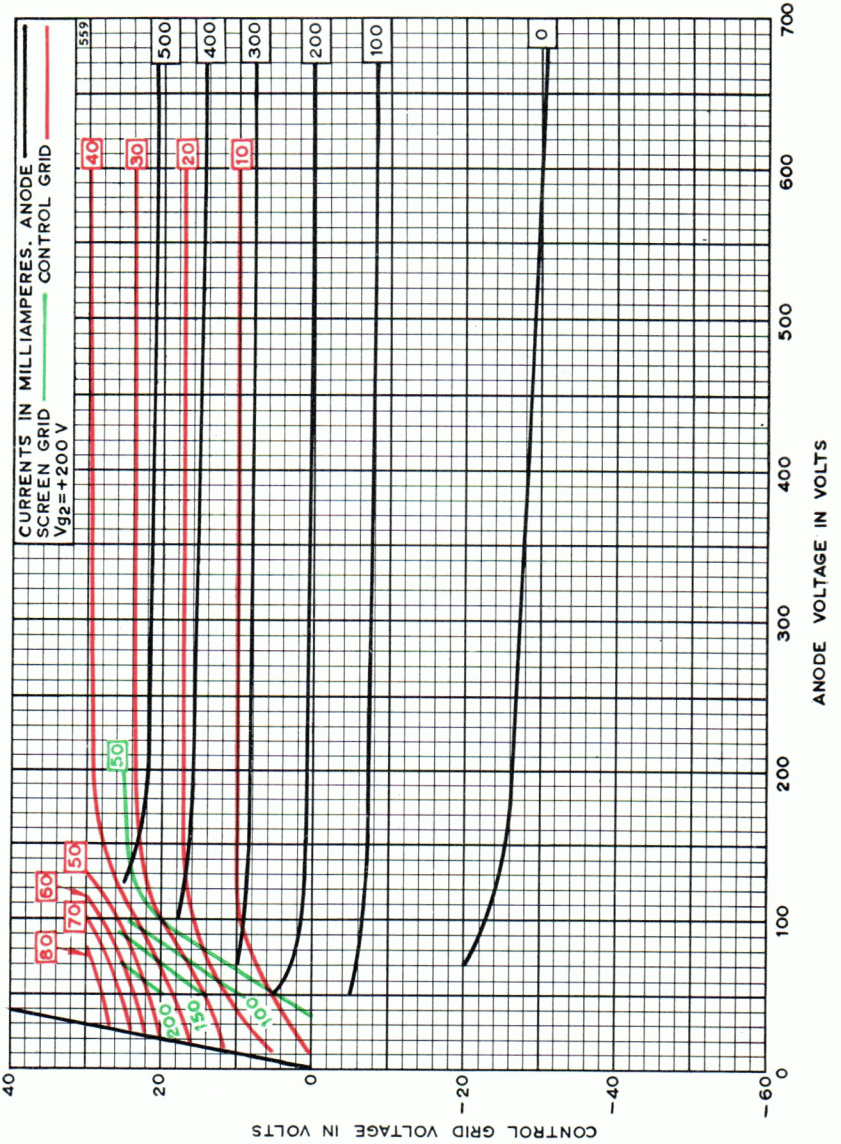

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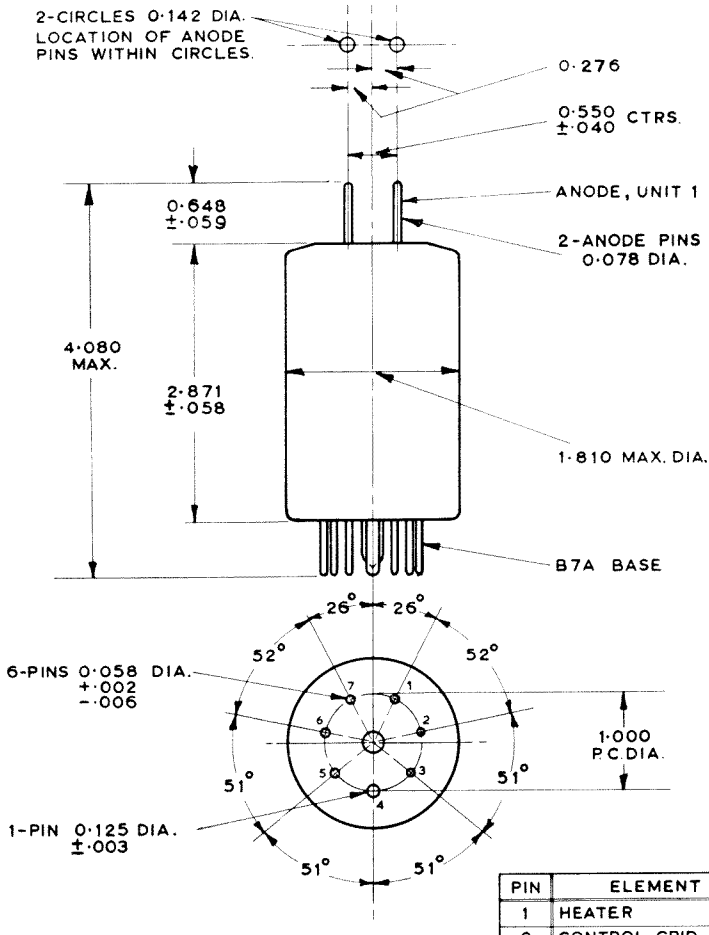
V.H.F. POWER DOUBLE TETRODE

OUTLINE

505



PIN	ELEMENT
1	HEATER
2	CONTROL GRID, UNIT 1
3	SCREEN GRID, COMMON
4	CATHODE BEAM PLATES & SHIELD
5	HEATER CENTRE TAP
6	CONTROL GRID UNIT 2
7	HEATER

ALL DIMENSIONS IN INCHES

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R.F. POWER TETRODE

4D32
(C1123)

Service Type CV3543 **American Designation 4D32**

INTRODUCTION

The 4D32 is a beam power transmitting Tetrode with a maximum anode dissipation of 50W up to 60Mc/s.

GENERAL DATA

Electrical

Cathode	Oxide Coated	
Heater Voltage	6·3	V
Heater Current	3·75	A
Peak Usable Cathode Current	2	A
Grid-Screen Amplification Factor	10	
Inter-electrode Capacitances:		
Input	26	pF
Output	13	pF
Grid to Anode	0·4	pF Max

Mechanical

Overall Length	5·75 inches	(146 mm)	Max
Overall Diameter	2·32 inches	(59 mm)	Max
Weight	6 ounces	(150 gm)	Approx
Mounting Position			Any
Base			B7A
Cooling			Natural

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MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency Mc/s	Class B Telephony	Class C Telephony Anode Modulated	Class C Telegraphy
30	2·0 kV	1·6kV	2·0kV
60	1·76kV	1·2kV	1·5kV
120	1·52kV	0·8kV	1·0kV

NOTES

1. Grid current does not flow during any part of the audio frequency cycle.
2. Preferably obtained from a separate source or from the anode voltage supply with a voltage divider.
3. The driver stage should be capable of supplying the specified driving voltage at low distortion.
4. The use of a fixed supply or bypassed cathode resistor is recommended.
5. At the crest of the audio frequency cycle with a modulation factor of 1·0.
6. This value of driving power is required by the grid and bias source when the 813 is operated at a sufficiently low frequency to avoid high frequency losses. At higher frequencies the driver stage may have to supply from two to ten times the value shown.
7. Obtained from a separate source and modulated with the anode supply, or from the modulated anode supply through a series resistor of the value shown for each operating condition.

R.F. POWER TETRODE

4D32
(C1123)

R.F. POWER AMPLIFIER – ANODE AND SCREEN MODULATED

(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	600	V Max
Screen Voltage	350	V Max
Grid Voltage	−200	V Max
Anode Current	300	mA Max
Grid Current	15	mA Max
Anode Dissipation	50	W Max
Screen Dissipation	10	W Max
Grid Dissipation	0·75	W Max
Frequency (for full ratings)	60	Mc/s Max

TYPICAL OPERATING CONDITIONS

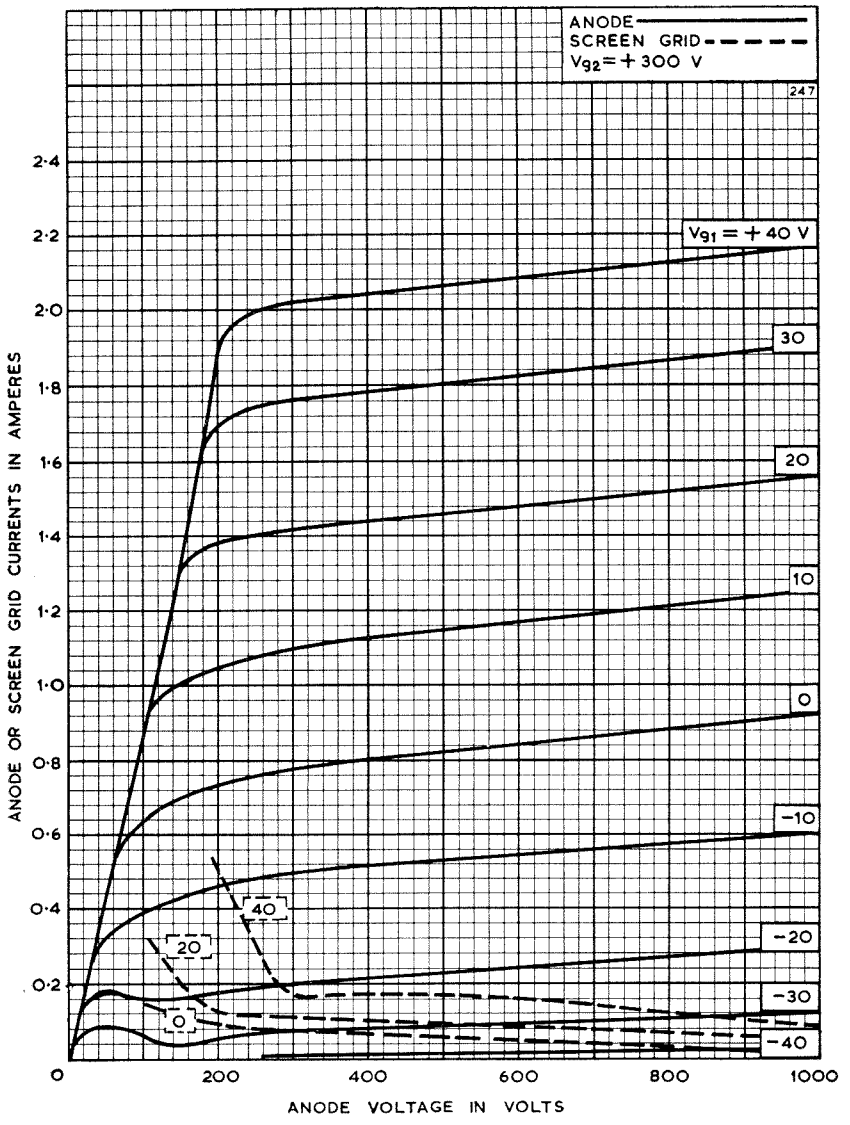
Anode Voltage	600	V
Screen Series Resistor	10 000	Ω
Grid Voltage	−100	V
Anode Current	220	mA
Screen Current (Approx)	28	mA
Grid Current (Approx)	10	mA
Driving Power (Approx)	1·25	W
Output Power (Approx)	100	W

A.F. POWER AMPLIFIER

TYPICAL OPERATING CONDITIONS
(for 2 valves in push-pull unless otherwise stated)

Anode Voltage	600	600	V
Grid Voltage	−37·5	−25	V
Screen Voltage	350	250	V
Peak A.F. Input Voltage (Grid to Grid)	74	70	V
Maximum-Signal Anode Current	350	365	mA
Zero-Signal Anode Current	100	100	mA
Maximum-Signal Screen Current	46	26	mA
Effective Load (Anode to Anode)	3000	3000	Ω
Driving Power (Maximum-signal, Approx)	0	0·45	W
Output Power (Maximum-signal, Approx)	112	125	W
Anode Dissipation (per valve, Approx)	49	47	W
Screen Dissipation (per valve, Approx)	8	3	W

ANODE AND SCREEN GRID CHARACTERISTICS



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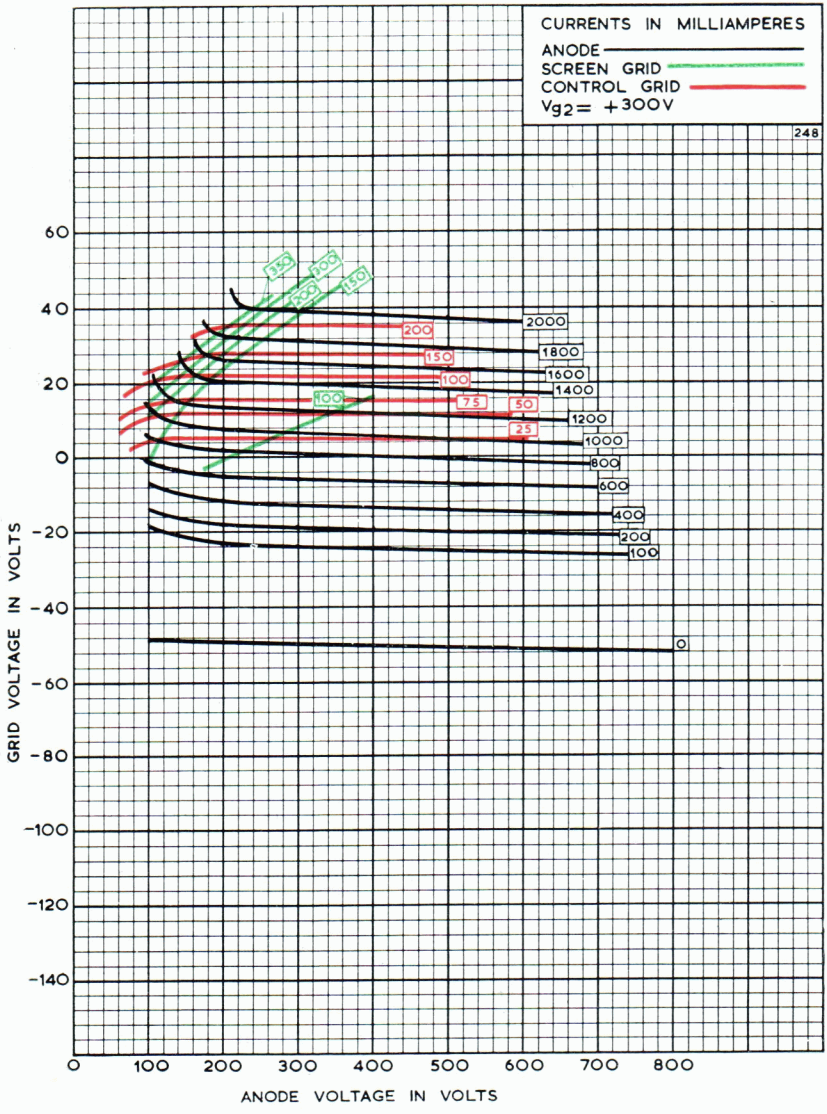
R.F. POWER TETRODE

CONSTANT CURRENT CHARACTERISTICS



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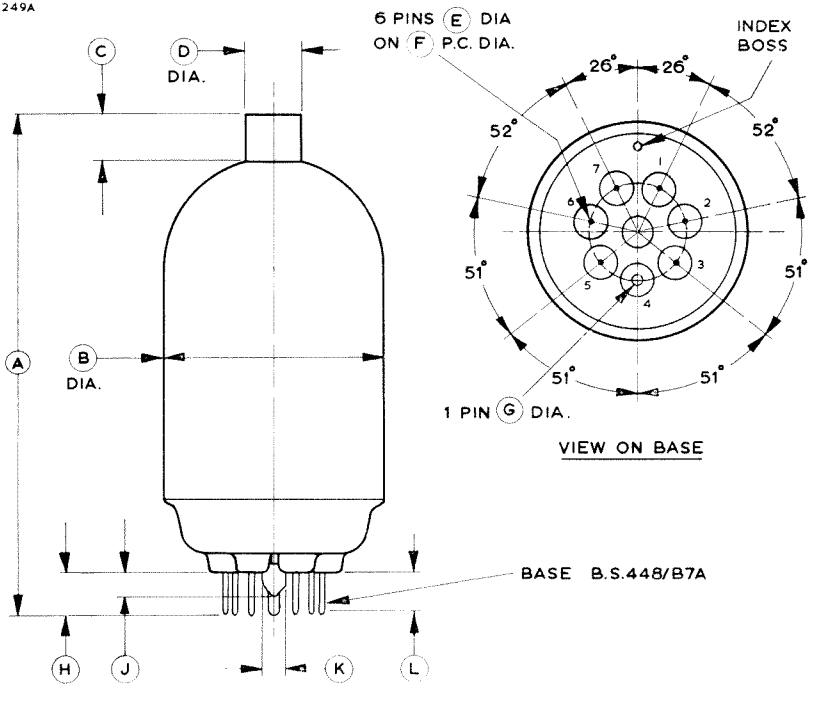

Ref.	Inches	Millimetres
A	5·250 ± 0·500	133·4 ± 12·7
B	2·312 Max	58·72 Max
C	0·500	12·70
D	0·566	14·38
E	0·058 $^{+0·002}_{-0·006}$	1·473 $^{+0·051}_{-0·152}$
F	1·000	25·40
G	0·125 ± 0·003	3·175 ± 0·076
H	0·438 ± 0·062	11·13 ± 1·57
J	0·375 Max	9·53 Max
K	0·375 Max	9·53 Max
L	0·312 Min	7·92 Min

Millimetre dimensions have been derived from inches.

Pin	Element
1	Heater
2	Screen Grid
3	No Connection
4	Cathode and
5	Beam Plates
6	Control Grid
7	Heater
CAP	Anode

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813
(C143)

R.F. POWER TETRODE

Service Type CV26 **JEDEC Designation 813**

INTRODUCTION

The 813 is a beam power transmitting Tetrode with a maximum anode dissipation of 100W. It may be used at full ratings up to 30Mc/s and at reduced ratings up to 120Mc/s.

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage	10	V
Filament Current	5·0	A
Peak Usable Cathode Current	1·0	A
Perveance	0·55	$mA/V^{3/2}$
Grid-Screen Amplification Factor (V_a = 2·0 kV, V_{g2} = 400 V, I_a = 50 mA)	8·5	
Mutual Conductance (V_a = 2·0 kV, V_{g2} = 400 V, I_a = 50 mA)	3·75	mA/V
Inter-electrode Capacitances:		
Input	16·3	pF
Output	14	pF
Grid to Anode	0·25	pF Max

Mechanical

Overall Length	7·5 inches	(190 mm)	Max
Overall Diameter	2·57 inches	(65 mm)	Max
Net Weight	8 ounces	(227 gm)	Approx
Mounting Position:			
Vertical			Base up or down
Horizontal			Pins 2 and 6 in vertical plane
Base			B7D (JEDEC No.A7-17)
Cooling			Natural

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AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

(Class AB1 – *See Note* 1)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	2·25	kV Max
Anode Current (Maximum Signal)	180	mA Max
Anode Input Power (Maximum Signal)	360	W Max
Anode Dissipation (Maximum Signal)	100	W Max
Screen Voltage	1·1	kV Max
Screen Input Power (Maximum Signal)	22	W Max

TYPICAL OPERATING CONDITIONS

(Class AB1, two valves)

Anode Voltage	1·5	2·0	2·25	kV
Screen Voltage (*See Note* 2)	750	750	750	V
Grid Voltage	−85	−90	−95	V
Peak A.F. Grid Voltage (per valve) (*See Note* 3)	80	80	85	V
Anode Current (Zero Signal)	2×25	2×25	2×25	mA
Anode Current (Maximum Signal)	2×153	2×133	2×128	mA
Screen Current (Zero Signal)	2×1·0	2×1·0	2×1·0	mA
Screen Current (Maximum Signal)	2×23	2×22	2×27	mA
Effective Load (Anode to Anode)	9·3	16	20	kΩ
Nominal Driving Power (Maximum Signal)	0	0	0	W
Output Power (Maximum Signal)	260	335	380	W

RADIO FREQUENCY POWER AMPLIFIER

(Class B Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	2·0	kV Max
Anode Current	100	mA Max
Anode Input Power	150	W Max
Anode Dissipation	100	W Max
Screen Voltage	400	V Max
Screen Input Power	15	W Max

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TYPICAL OPERATING CONDITIONS

Anode Voltage	1·5	2·0	kV
Screen Voltage	400	400	V
Grid Voltage (*See Note* 4)	−60	−75	V
Peak R.F. Grid Voltage	70	80	V
Anode Current	100	75	mA
Screen Current	4·0	3·0	mA
Grid Current	near zero	near zero	
Nominal Driving Power: (*See Notes* 5 *and* 6) less than	2·0	2·0	W
Output Power	50	50	W

ANODE MODULATED R.F. POWER AMPLIFIER

(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	1·6	kV Max
Anode Current	150	mA Max
Anode Input Power	240	W Max
Anode Dissipation	67	W Max
Screen Voltage	400	V Max
Screen Input Power	15	W Max
Grid Voltage (negative value)	300	V Max
Grid Current	25	mA Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	1·25	1·6	kV
Screen Voltage (*See Note* 7)	300	300	V
from a series resistor of	27	43	kΩ
Grid Voltage	−160	−160	V
Peak R.F. Grid Voltage	250	250	V
Anode Current	150	150	mA
Screen Current	35	30	mA
Grid Current	13	12	mA
Nominal Driving Power (*See Note* 6)	2·9	2·7	W
Output Power	140	180	W

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R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	2·0	kV Max
Anode Current	180	mA Max
Anode Input Power	360	W Max
Anode Dissipation	100	W Max
Screen Voltage	400	V Max
Screen Dissipation	22	W Max
Grid Voltage (negative value)	300	V Max
Grid Current	25	mA Max

TYPICAL OPERATING CONDITIONS

Anode Voltage	1·25	1·5	2·0	kV
Screen Voltage	300	300	400	V
Grid Voltage	−75	−90	−120	V
from a resistor of	6·0	7·5	12	kΩ
Peak R.F. Grid Voltage	160	175	205	V
Anode Current	180	180	180	mA
Screen Current (Approx)	35	30	45	mA
Grid Current (Approx)	12	12	10	mA
Anode Dissipation	55	60	85	W
Screen Dissipation	10·5	9·0	18	W
Driving Power (Approx) (*See Note* 6)	1·7	1·9	1·9	W
Output Power	170	210	275	W
Efficiency	75	78	77	%

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 10V	4·7	5·3	A
Anode Current: (V_a = 2·0kV, V_{g2} = 400V, V_{g1} = −42V)	35	65	mA
Anode Current: (V_a = 2·0kV, V_{g2} = 400V, V_{g1} = −87V)	—	2·0	mA
Screen Current: (V_a = 2·0kV, V_{g2} = 400V, V_{g1} = −42V)	—	4·0	mA
Inter-electrode Capacitances:			
Input	13	19·6	pF
Output	10·5	17·5	pF
Grid to Anode	—	0·25	pF

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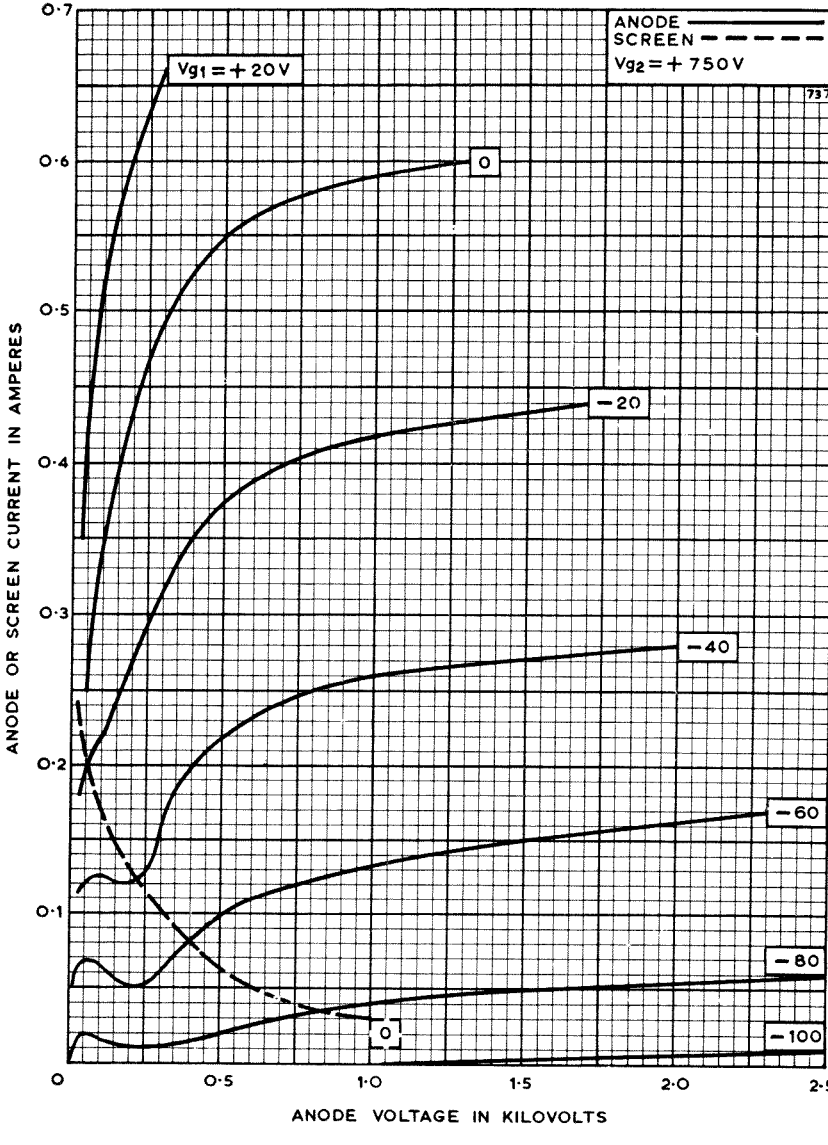
MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency Mc/s	Class B Telephony	Class C Telephony Anode Modulated	Class C Telegraphy
30	2·0 kV	1·6kV	2·0kV
60	1·76kV	1·2kV	1·5kV
120	1·52kV	0·8kV	1·0kV

NOTES

1. Grid current does not flow during any part of the audio frequency cycle.
2. Preferably obtained from a separate source or from the anode voltage supply with a voltage divider.
3. The driver stage should be capable of supplying the specified driving voltage at low distortion.
4. The use of a fixed supply or bypassed cathode resistor is recommended.
5. At the crest of the audio frequency cycle with a modulation factor of 1·0.
6. This value of driving power is required by the grid and bias source when the 813 is operated at a sufficiently low frequency to avoid high frequency losses. At higher frequencies the driver stage may have to supply from two to ten times the value shown.
7. Obtained from a separate source and modulated with the anode supply, or from the modulated anode supply through a series resistor of the value shown for each operating condition.

ANODE AND SCREEN CHARACTERISTICS



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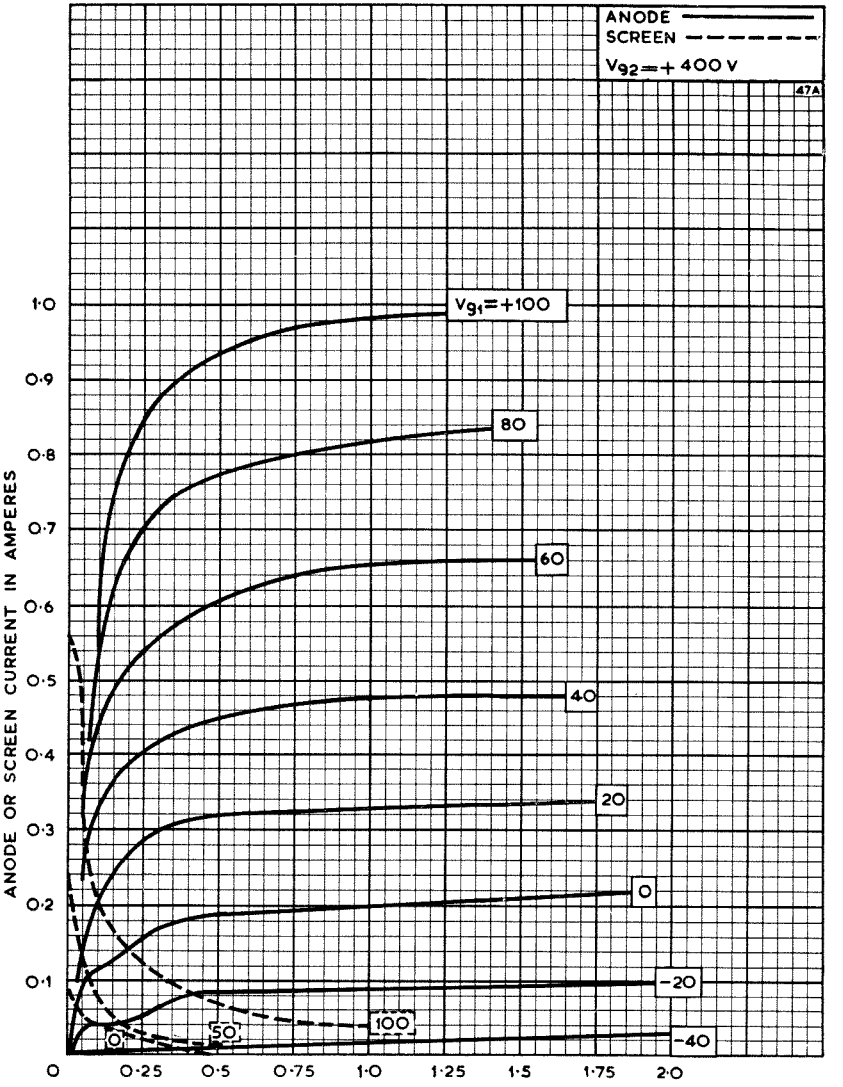
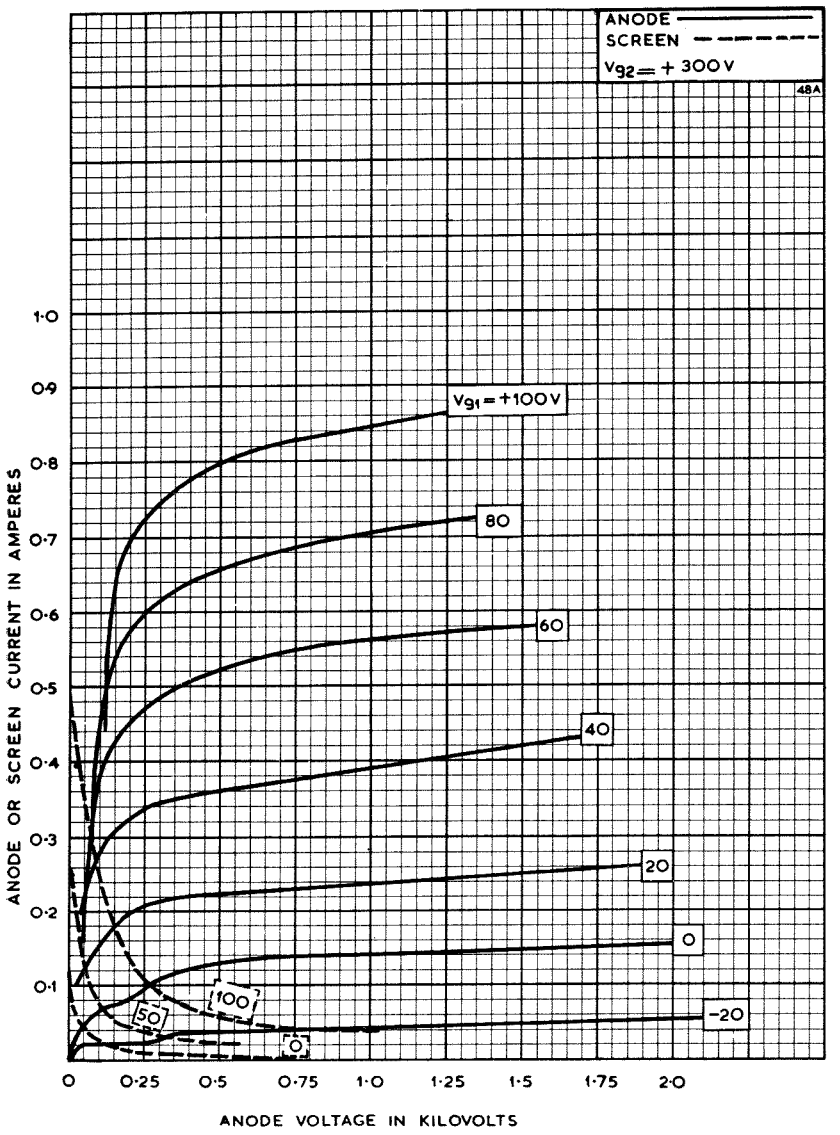
ANODE AND SCREEN CHARACTERISTICS



R.F. POWER TETRODE

ANODE AND SCREEN CHARACTERISTICS



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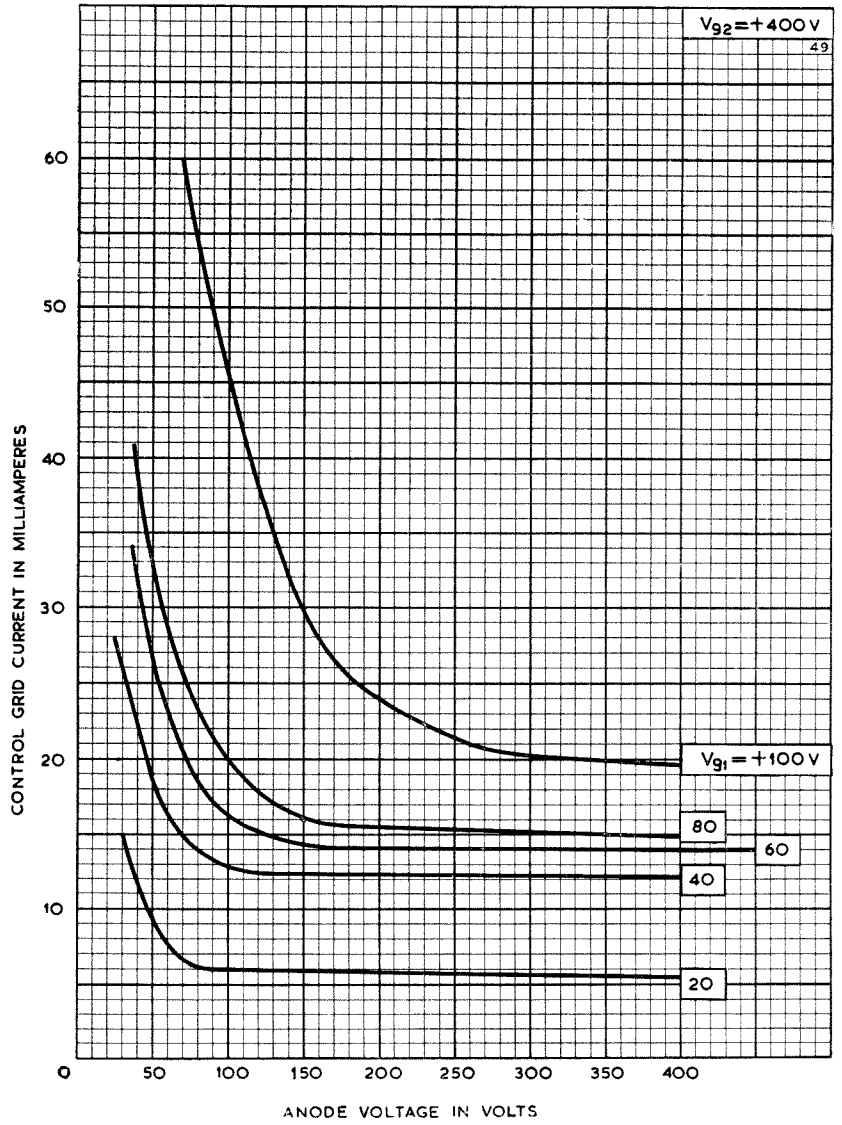
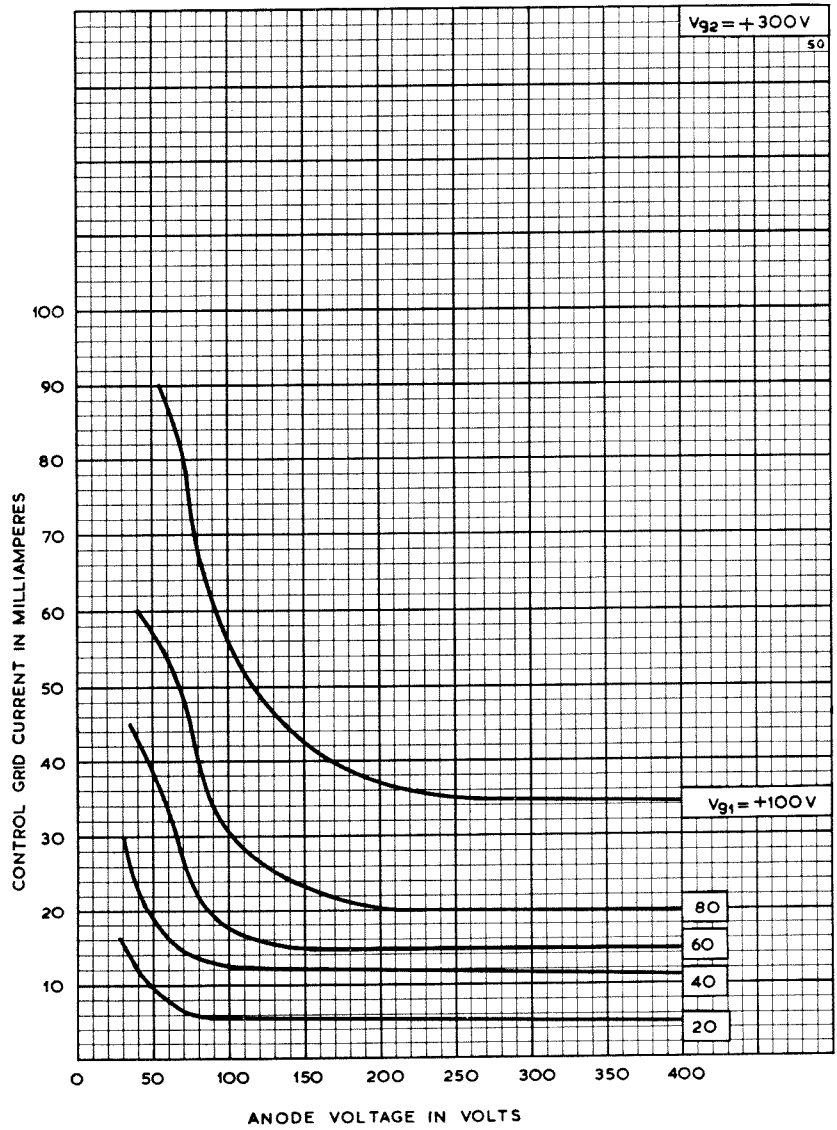
CONTROL GRID CHARACTERISTICS



R.F. POWER TETRODE

CONTROL GRID CHARACTERISTICS



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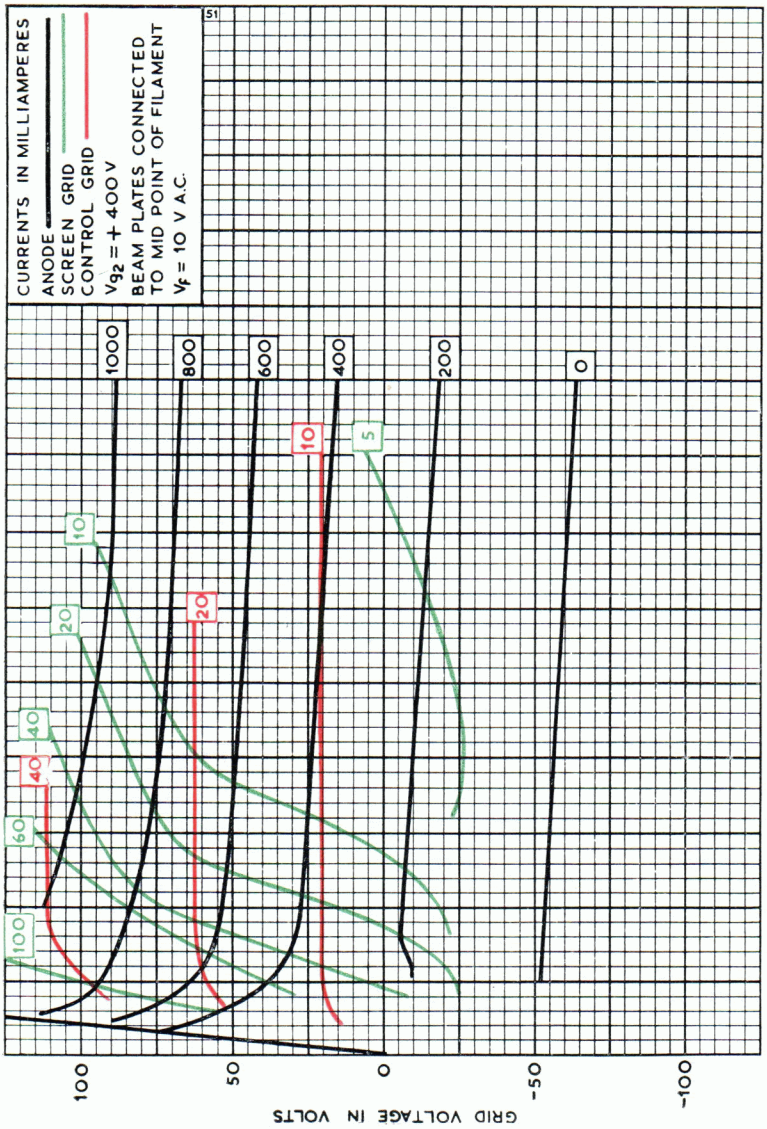
CONSTANT CURRENT CHARACTERISTICS



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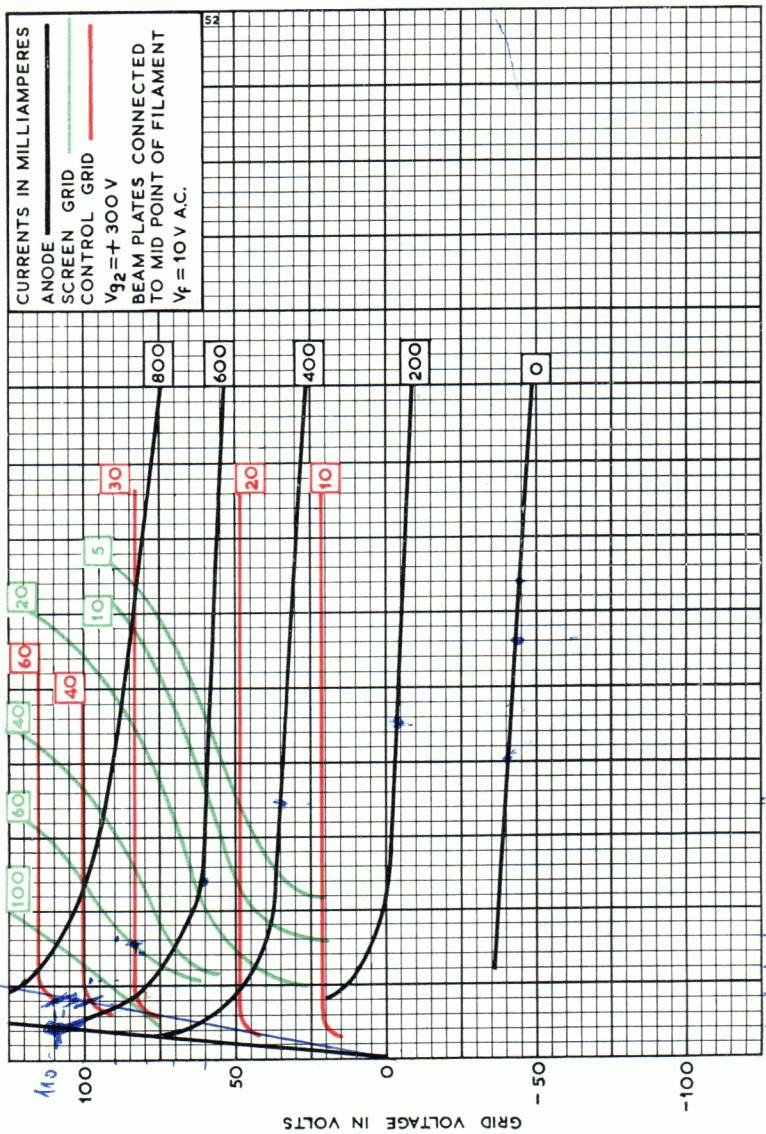
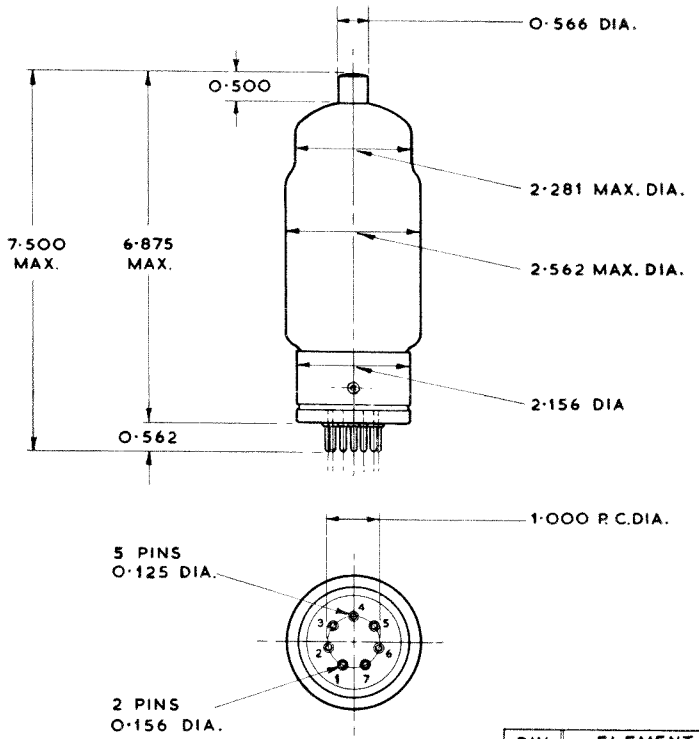
CONSTANT CURRENT CHARACTERISTICS



OUTLINE

38A



BASE – B7D (JEDEC A7-17)

PIN	ELEMENT
1	FILAMENT
2	NO CONNECTION
3	SCREEN
4	CONTROL GRID
5	BEAM PLATES
6	NO CONNECTION
7	FILAMENT
CAP	ANODE

ALL DIMENSIONS IN INCHES

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V.H.F. POWER TETRODE

C1108

ENGLISH ELECTRIC

Service Type CV2130 **American Equivalent 4-125A (near)**

INTRODUCTION

The C1108 is a radial beam transmitting Tetrode with a maximum anode dissipation of 125W. It may be operated at 3·0kV up to 120Mc/s and at reduced ratings up to 200Mc/s.

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage	5·0	V
Filament Current	6·5	A
Peak Usable Cathode Current	1·2	A
Perveance	0·4	$mA/V^{3/2}$
Grid-Screen Amplification Factor (V_a = 2·5kV, V_{g2} = 350V, I_a = 40mA)	6·2	
Mutual Conductance (V_a = 2·5kV, V_{g2} = 350V, I_a = 40mA)	2·2	mA/V
Inter-electrode Capacitances:		
Input	10·8	pF
Output	3·1	pF
Grid to Anode	0·05	pF

Mechanical

Overall Length	5·100 inches (129·5mm)	Max
Overall Diameter	2·440 inches (62·00mm)	Max
Net Weight	4 ounces (113gm)	Approx
Mounting Position	Vertical, base up or down	
Base	B.S.448/B5F	

COOLING

The temperatures given below must not be exceeded. When operating at frequencies above 50Mc/s, an adequate flow of air must be provided to limit the temperature of the envelope and glass to metal seals. Natural cooling is normally adequate for frequencies below 50Mc/s provided that a heat dissipating anode connector of large surface area is used.

Anode Seal Temperature	220	°C Max
Base Pin Seal Temperature	180	°C Max

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V.H.F. POWER TETRODE

C1108

ENGLISH ELECTRIC

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR
(Class B)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	3·0	kV Max
Anode Dissipation	125	W Max
Screen Voltage:		
with no grid current	600	V Max
with grid current	400	V Max
Screen Dissipation	20	W Max
Grid Voltage (negative value)	500	V Max
Grid to Cathode Resistance	150	kΩ Max
Cathode Current (Mean)	0·32	A Max

TYPICAL OPERATING CONDITIONS
(Class B without grid current, 2 valves)

Anode Voltage	1·5	2·0	2·5	kV
Screen Voltage	600	600	600	V
Grid Voltage	−94	−96	−97	V
Peak A.F. Input Voltage (Grid to Grid)	184	187	190	V
Maximum-Signal Anode Current	2×109	2×111	2×108	mA
Zero-Signal Anode Current	2×30	2×30	2×30	mA
Maximum-Signal Screen Current	2×13·5	2×12	2×13	mA
Effective Load (Anode to Anode)	12	17·6	25	kΩ
Anode Dissipation	2×78	2×92	2×95	W
Output Power	170	260	345	W
Efficiency	52	58·5	64	%
Total Distortion	3·5	3·6	4·0	%

TYPICAL OPERATING CONDITIONS
(Class B with grid current, 2 valves)

Anode Voltage	1·5	2·0	2·5	kV
Screen Voltage	350	350	350	V
Grid Voltage	−48	−50	−51	V
Peak A.F. Input Voltage (Grid to Grid)	331	297	240	V
Maximum-Signal Anode Current	2×225	2×197	2×151	mA
Zero-Signal Anode Current	2×30	2×30	2×30	mA
Maximum Signal Screen Current	2×42	2×32	2×18	mA
Grid Current	2×16	2×12	2×8·5	mA
Effective Load (Anode to Anode)	7·2	12	20	kΩ
Anode Dissipation	2×114	2×120	2×103	W
Output Power	455	550	550	W
Efficiency	66·5	69·5	72·5	%
Total Distortion	5·0	5·0	5·0	%

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ENGLISH ELECTRIC

RADIO FREQUENCY POWER AMPLIFIER

(Class B Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	3·0	kV Max
Anode Dissipation	125	W Max
Screen Voltage	400	V Max
Screen Dissipation	14	W Max
Cathode Current (Mean)	120	mA Max

TYPICAL OPERATING CONDITIONS

(for frequencies up to 120Mc/s)

Anode Voltage	2·0	2·5	3·0	kV
Screen Voltage	350	350	350	V
Grid Voltage	−50	−50	−50	V
Peak R.F. Grid Voltage	65	55	50	V
Anode Current	83	70	60	mA
Screen Current	1·5	1·0	1·0	mA
Grid Current (modulation factor 1·0)	4·0	4·0	4·5	mA
Anode Dissipation	112	120	122	W
Screen Dissipation	0·52	0·35	0·35	W
Nominal Driving Power (modulation factor 1·0)	0·52	0·44	0·45	W
Output Power	54	55	58	W
Efficiency	32·5	31·5	32	%

ANODE AND SCREEN MODULATED R.F. POWER AMPLIFIER

(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	2·5	kV Max
Anode Dissipation	83	W Max
Screen Voltage	400	V Max
Screen Dissipation	20	W Max
Grid Voltage (negative value)	500	V Max
Grid Current	15	mA Max
Cathode Current (Mean)	0·2	A Max

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V.H.F. POWER TETRODE

C1108

ENGLISH ELECTRIC

TYPICAL OPERATING CONDITIONS

(for frequencies up to 120Mc/s)

Anode Voltage	2·0	2·5	kV
Screen Voltage	350	350	V
Grid Voltage	−220	−210	V
Peak R.F. Grid Voltage	390	380	V
Peak Screen Modulating Voltage (modulation factor 1·0)	300	300	V
Anode Current	150	152	mA
Screen Current	33	30	mA
Grid Current	5·0	4·5	mA
Anode Dissipation	75	80	W
Screen Dissipation	11·5	10·5	W
Nominal Driving Power	2·0	1·7	W
Output Power	225	300	W
Efficiency	75	79	%

R.F. POWER AMPLIFIER OR OSCILLATOR

(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	3·0 kV Max
Anode Dissipation	125 W Max
Screen Voltage	400 V Max
Screen Dissipation	20 W Max
Grid Voltage (negative value)	500 V Max
Grid Current	15 mA Max
Grid Dissipation	5·0 W Max
Cathode Current (Mean)	0·3 A Max

TYPICAL OPERATING CONDITIONS

(for frequencies up to 120Mc/s)

Anode Voltage	2·0	2·5	3·0	kV
Screen Voltage	350	350	350	V
Grid Voltage	−100	−150	−150	V
Peak R.F. Grid Voltage	260	330	300	V
Anode Current	200	200	167	mA
Screen Current	50	40	30	mA
Grid Current	9·0	9·0	6·5	mA
Anode Dissipation	125	125	125	W
Screen Dissipation	17·5	14	10·5	W
Nominal Driving Power	2·4	3·0	2·0	W
Output Power	275	375	375	W
Efficiency	69	75	75	%

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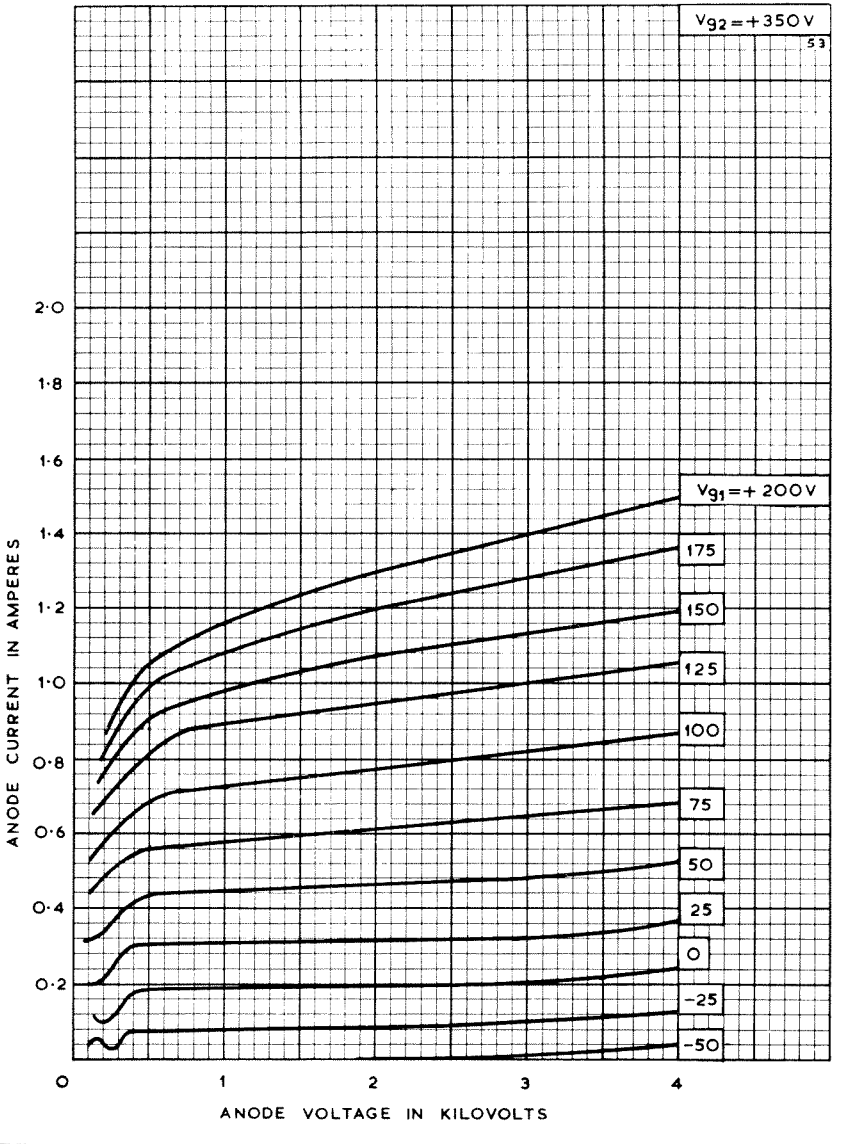
ANODE CHARACTERISTICS



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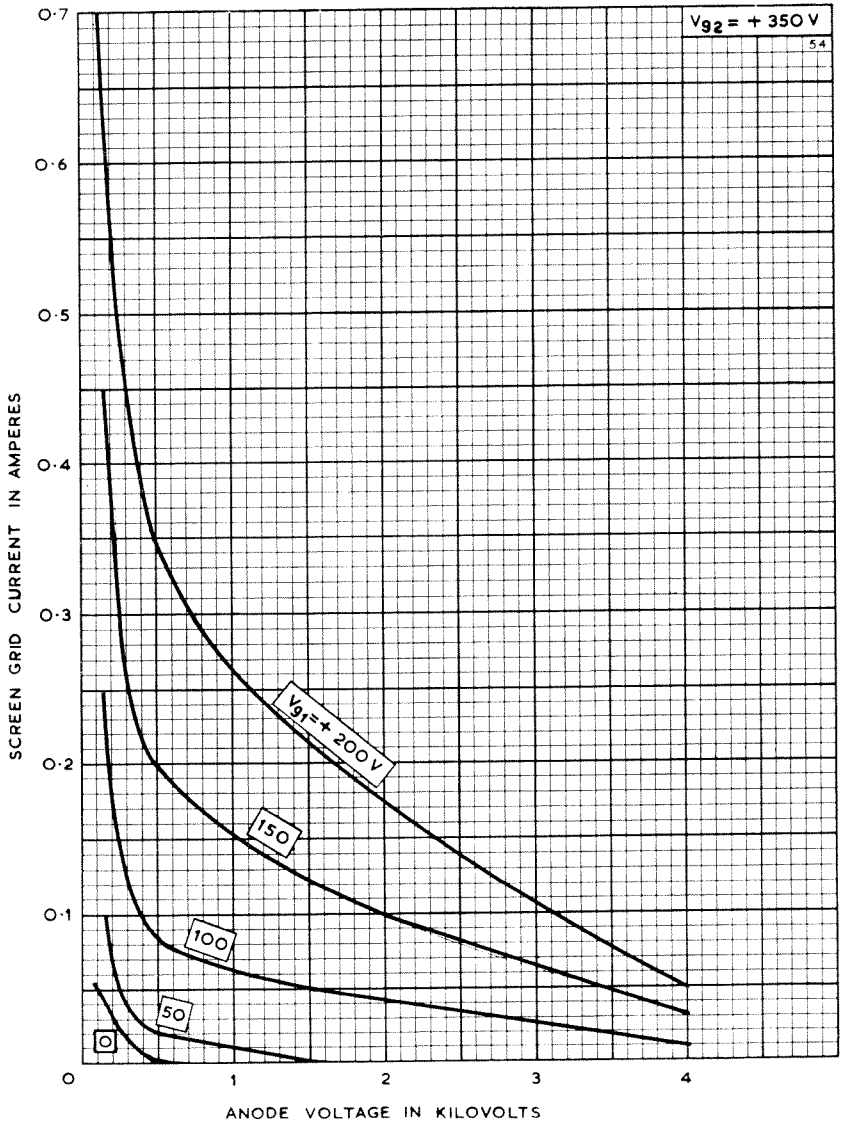
ENGLISH ELECTRIC

SCREEN GRID CHARACTERISTICS



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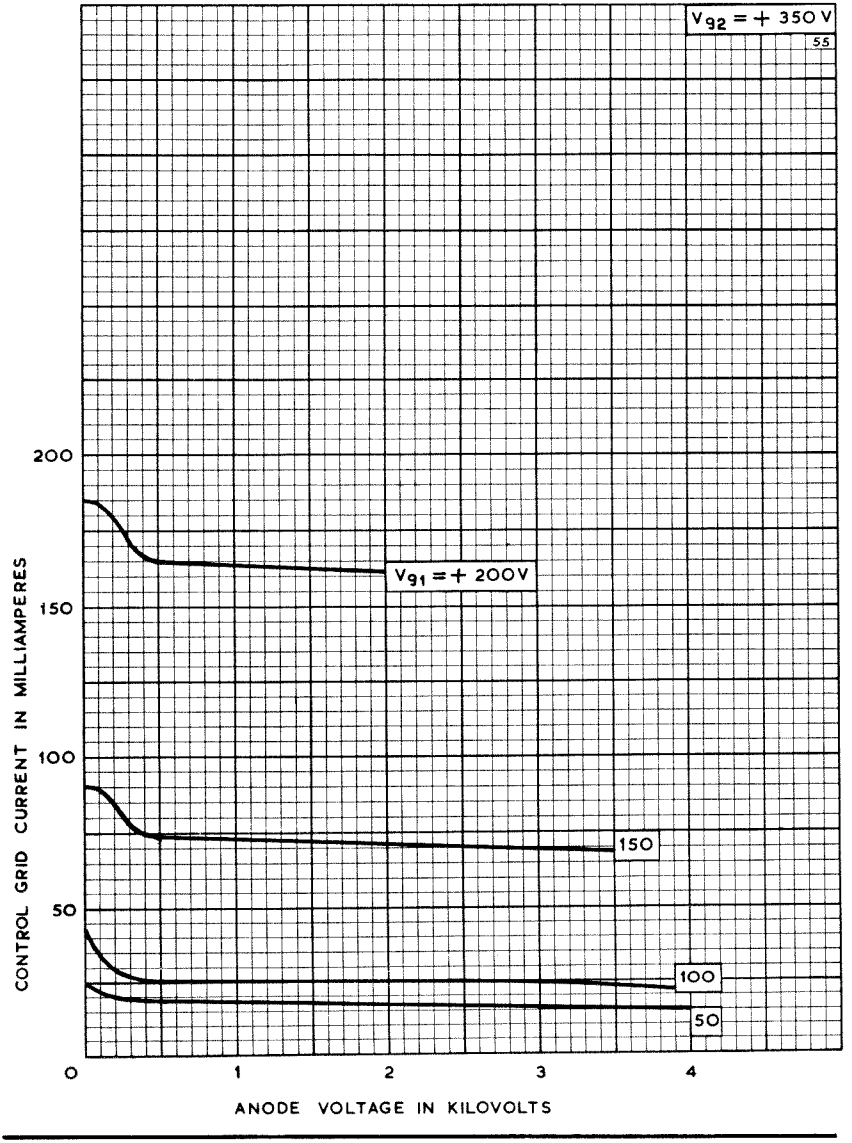
CONTROL GRID CHARACTERISTICS



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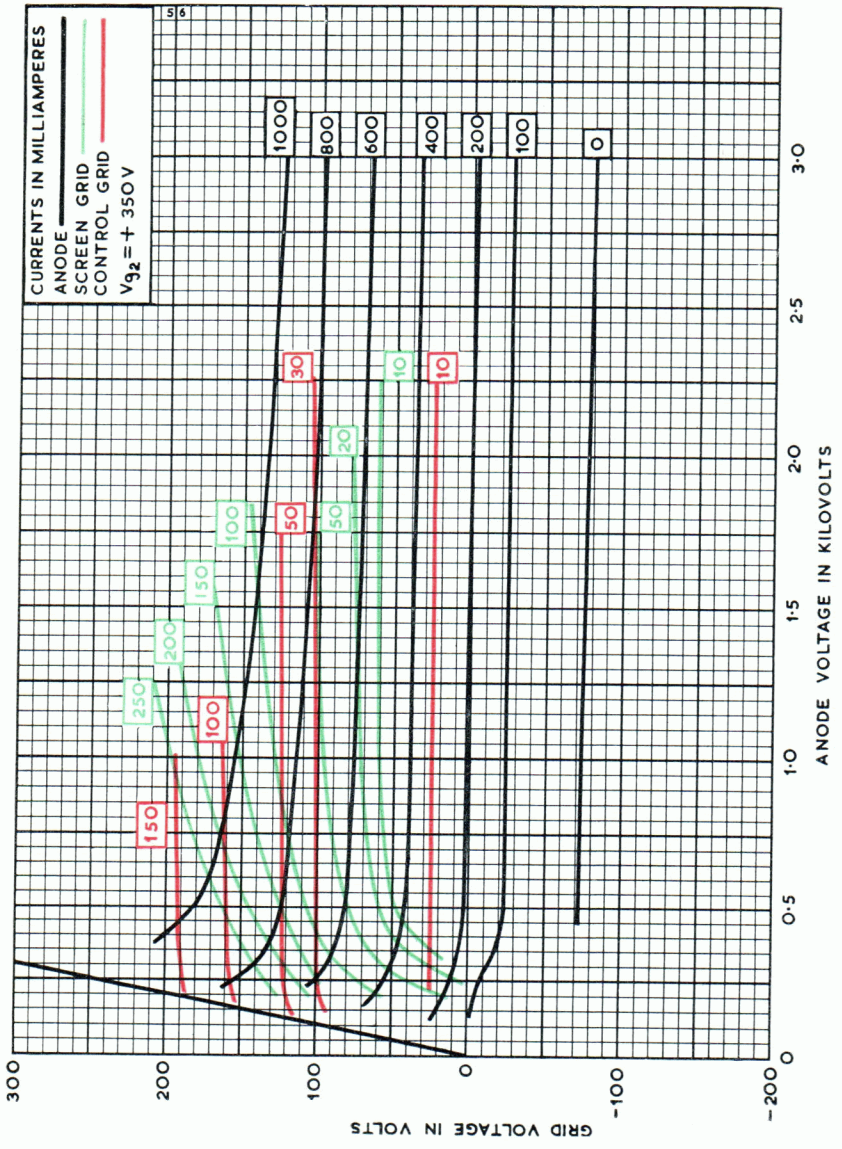
CONSTANT CURRENT CHARACTERISTICS



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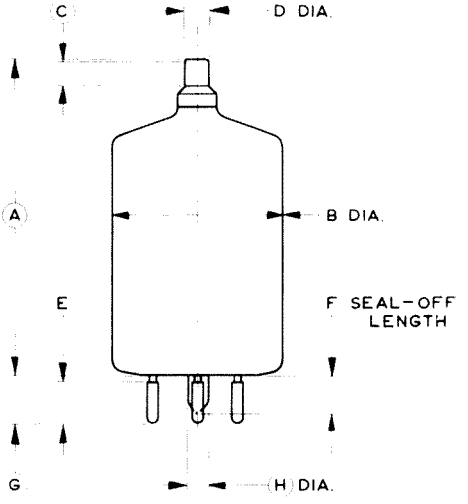
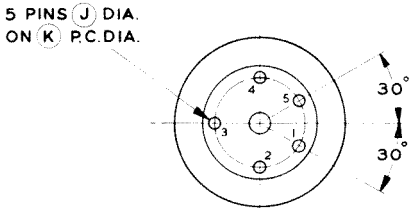
V.H.F. POWER TETRODE

C1108

OUTLINE

57 B





Pin	Element
1	Filament
2	Screen Grid
3	Control Grid
4	Screen Grid
5	Filament
Cap	Anode

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	4·173 ± 0·236	106·0 ± 6·0	F	0·591 Max	15·0
B	2·440 Max	62·0 Max	G	0·670 ± 0·020	17·0 ± 0·5
C	0·354 Min	9·00 Min	H	0·295 Max	7·50 Max
D	0·354 ± 0·005	9·00 ± 0·13	J	0·187 ± 0·003	4·75 ± 0·07
E	0·591 ± 0·007	15·0 ± 0·2	K	1·250	31·75

Inch dimensions have been derived from millimetres.

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V.H.F. POWER TETRODE

C1108

Service Type CV2130 **American Equivalent 4-125A (near)**

INTRODUCTION

The C1108 is a radial beam transmitting Tetrode with a maximum anode dissipation of 125W. It may be operated at 3·0kV up to 120Mc/s and at reduced ratings up to 200Mc/s.

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage	5·0	V
Filament Current	6·5	A
Peak Usable Cathode Current	1·2	A
Perveance	0·4	mA/V$^{3/2}$
Grid-Screen Amplification Factor (V_a = 2·5kV, V_{g2} = 350V, I_a = 40mA)	6·2	
Mutual Conductance (V_a = 2·5kV, V_{g2} = 350V, I_a = 40mA)	2·2	mA/V
Inter-electrode Capacitances:		
Input	10·8	pF
Output	3·1	pF
Grid to Anode	0·05	pF

Mechanical

Overall Length	5·100 inches (129·5mm)	Max
Overall Diameter	2·440 inches (62·00mm)	Max
Net Weight	4 ounces (113gm)	Approx
Mounting Position	Vertical, base up or down	
Base	B.S.448/B5F	

COOLING

The temperatures given below must not be exceeded. When operating at frequencies above 50Mc/s, an adequate flow of air must be provided to limit the temperature of the envelope and glass to metal seals. Natural cooling is normally adequate for frequencies below 50Mc/s provided that a heat dissipating anode connector of large surface area is used.

Anode Seal Temperature	220	°C Max
Base Pin Seal Temperature	180	°C Max

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AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR
(Class B)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	3·0	kV Max
Anode Dissipation	125	W Max
Screen Voltage:		
with no grid current	600	V Max
with grid current	400	V Max
Screen Dissipation	20	W Max
Grid Voltage (negative value)	500	V Max
Grid to Cathode Resistance	150	kΩ Max
Cathode Current (Mean)	0·32	A Max

TYPICAL OPERATING CONDITIONS
(Class B without grid current, 2 valves)

Anode Voltage	1·5	2·0	2·5	kV
Screen Voltage	600	600	600	V
Grid Voltage	−94	−96	−97	V
Peak A.F. Input Voltage (Grid to Grid)	184	187	190	V
Maximum-Signal Anode Current	2×109	2×111	2×108	mA
Zero-Signal Anode Current	2×30	2×30	2×30	mA
Maximum-Signal Screen Current	2×13·5	2×12	2×13	mA
Effective Load (Anode to Anode)	12	17·6	25	kΩ
Anode Dissipation	2×78	2×92	2×95	W
Output Power	170	260	345	W
Efficiency	52	58·5	64	%
Total Distortion	3·5	3·6	4·0	%

TYPICAL OPERATING CONDITIONS
(Class B with grid current, 2 valves)

Anode Voltage	1·5	2·0	2·5	kV
Screen Voltage	350	350	350	V
Grid Voltage	−48	−50	−51	V
Peak A.F. Input Voltage (Grid to Grid)	331	297	240	V
Maximum-Signal Anode Current	2×225	2×197	2×151	mA
Zero-Signal Anode Current	2×30	2×30	2×30	mA
Maximum Signal Screen Current	2×42	2×32	2×18	mA
Grid Current	2×16	2×12	2×8·5	mA
Effective Load (Anode to Anode)	7·2	12	20	kΩ
Anode Dissipation	2×114	2×120	2×103	W
Output Power	455	550	550	W
Efficiency	66·5	69·5	72·5	%
Total Distortion	5·0	5·0	5·0	%

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RADIO FREQUENCY POWER AMPLIFIER

(Class B Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	3·0	kV Max
Anode Dissipation	125	W Max
Screen Voltage	400	V Max
Screen Dissipation	14	W Max
Cathode Current (Mean)	120	mA Max

TYPICAL OPERATING CONDITIONS
(for frequencies up to 120Mc/s)

Anode Voltage	2·0	2·5	3·0	kV
Screen Voltage	350	350	350	V
Grid Voltage	−50	−50	−50	V
Peak R.F. Grid Voltage	65	55	50	V
Anode Current	83	70	60	mA
Screen Current	1·5	1·0	1·0	mA
Grid Current (modulation factor 1·0)	4·0	4·0	4·5	mA
Anode Dissipation	112	120	122	W
Screen Dissipation	0·52	0·35	0·35	W
Nominal Driving Power (modulation factor 1·0)	0·52	0·44	0·45	W
Output Power	54	55	58	W
Efficiency	32·5	31·5	32	%

ANODE AND SCREEN MODULATED R.F. POWER AMPLIFIER

(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	2·5	kV Max
Anode Dissipation	83	W Max
Screen Voltage	400	V Max
Screen Dissipation	20	W Max
Grid Voltage (negative value)	500	V Max
Grid Current	15	mA Max
Cathode Current (Mean)	0·2	A Max

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TYPICAL OPERATING CONDITIONS

(for frequencies up to 120Mc/s)

Anode Voltage	2·0	2·5	kV
Screen Voltage	350	350	V
Grid Voltage	−220	−210	V
Peak R.F. Grid Voltage	390	380	V
Peak Screen Modulating Voltage (modulation factor 1·0)	300	300	V
Anode Current	150	152	mA
Screen Current	33	30	mA
Grid Current	5·0	4·5	mA
Anode Dissipation	75	80	W
Screen Dissipation	11·5	10·5	W
Nominal Driving Power	2·0	1·7	W
Output Power	225	300	W
Efficiency	75	79	%

R.F. POWER AMPLIFIER OR OSCILLATOR

(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	3·0	kV Max
Anode Dissipation	125	W Max
Screen Voltage	400	V Max
Screen Dissipation	20	W Max
Grid Voltage (negative value)	500	V Max
Grid Current	15	mA Max
Grid Dissipation	5·0	W Max
Cathode Current (Mean)	0·3	A Max

TYPICAL OPERATING CONDITIONS

(for frequencies up to 120Mc/s)

Anode Voltage	2·0	2·5	3·0	kV
Screen Voltage	350	350	350	V
Grid Voltage	−100	−150	−150	V
Peak R.F. Grid Voltage	260	330	300	V
Anode Current	200	200	167	mA
Screen Current	50	40	30	mA
Grid Current	9·0	9·0	6·5	mA
Anode Dissipation	125	125	125	W
Screen Dissipation	17·5	14	10·5	W
Nominal Driving Power	2·4	3·0	2·0	W
Output Power	275	375	375	W
Efficiency	69	75	75	%

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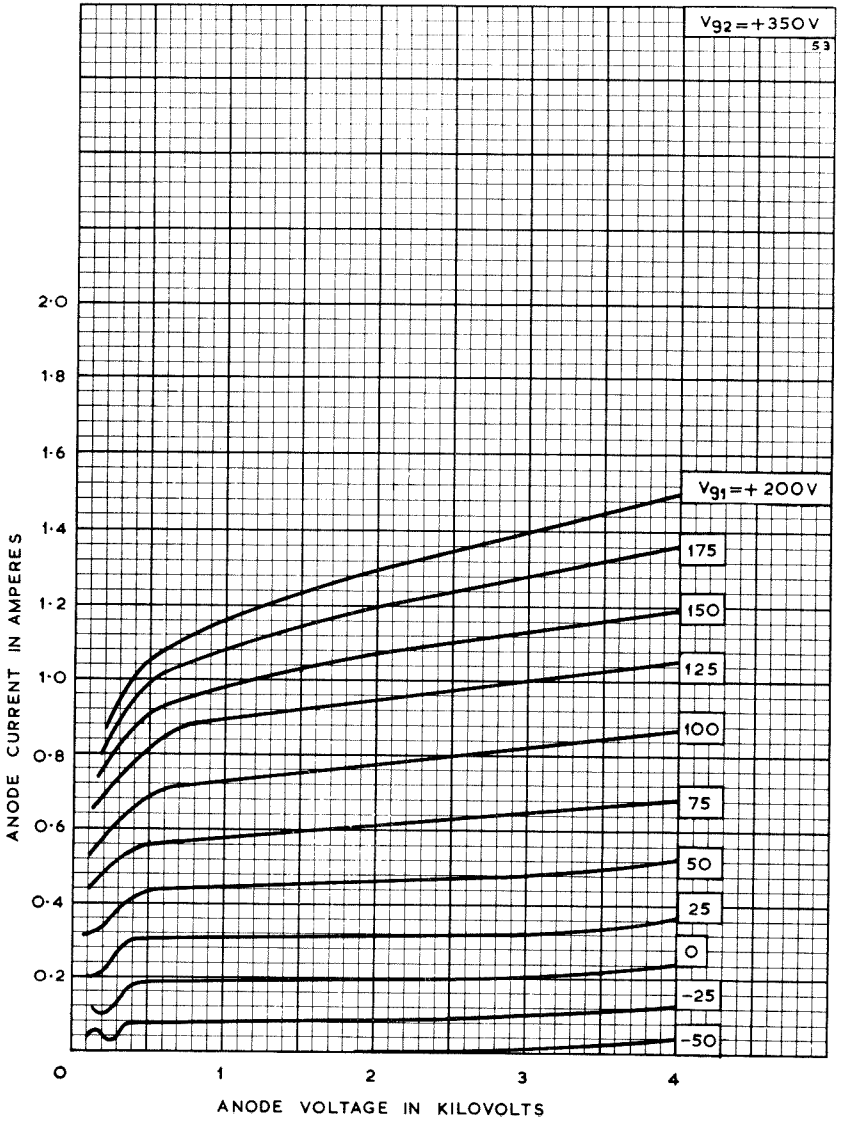
ANODE CHARACTERISTICS



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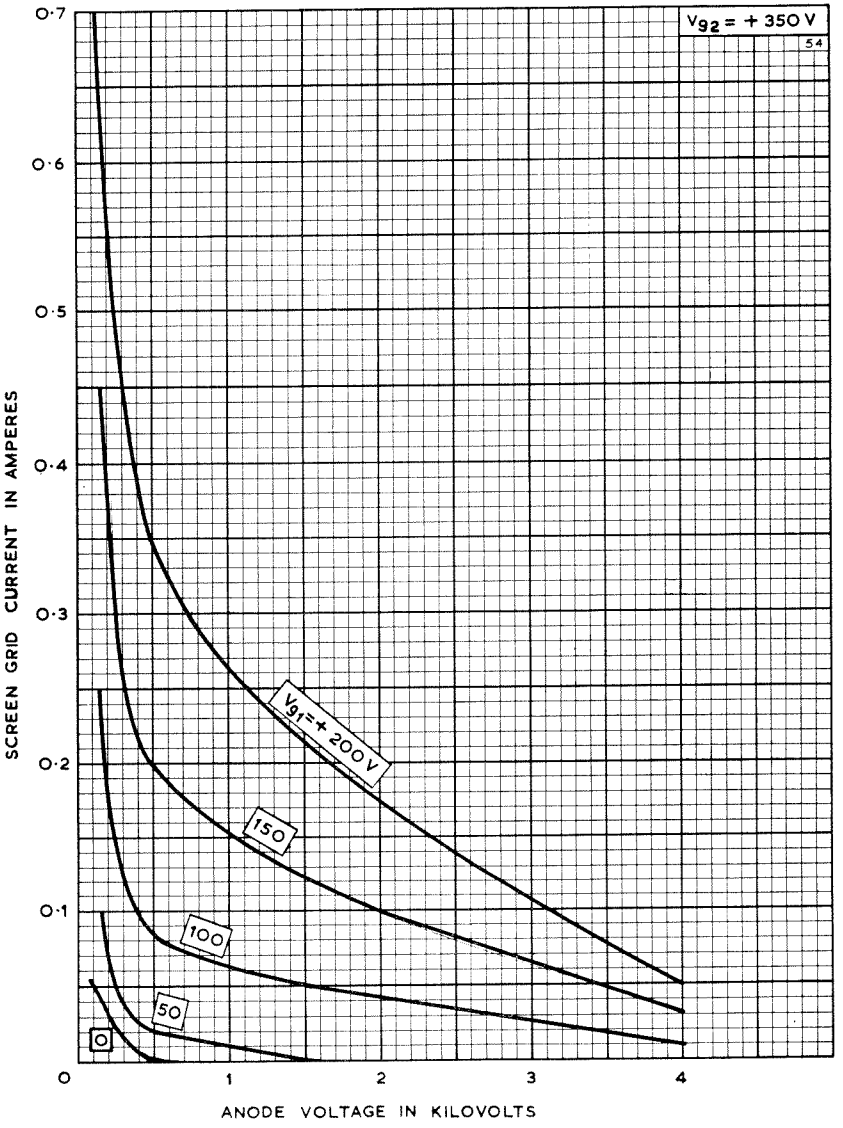
SCREEN GRID CHARACTERISTICS



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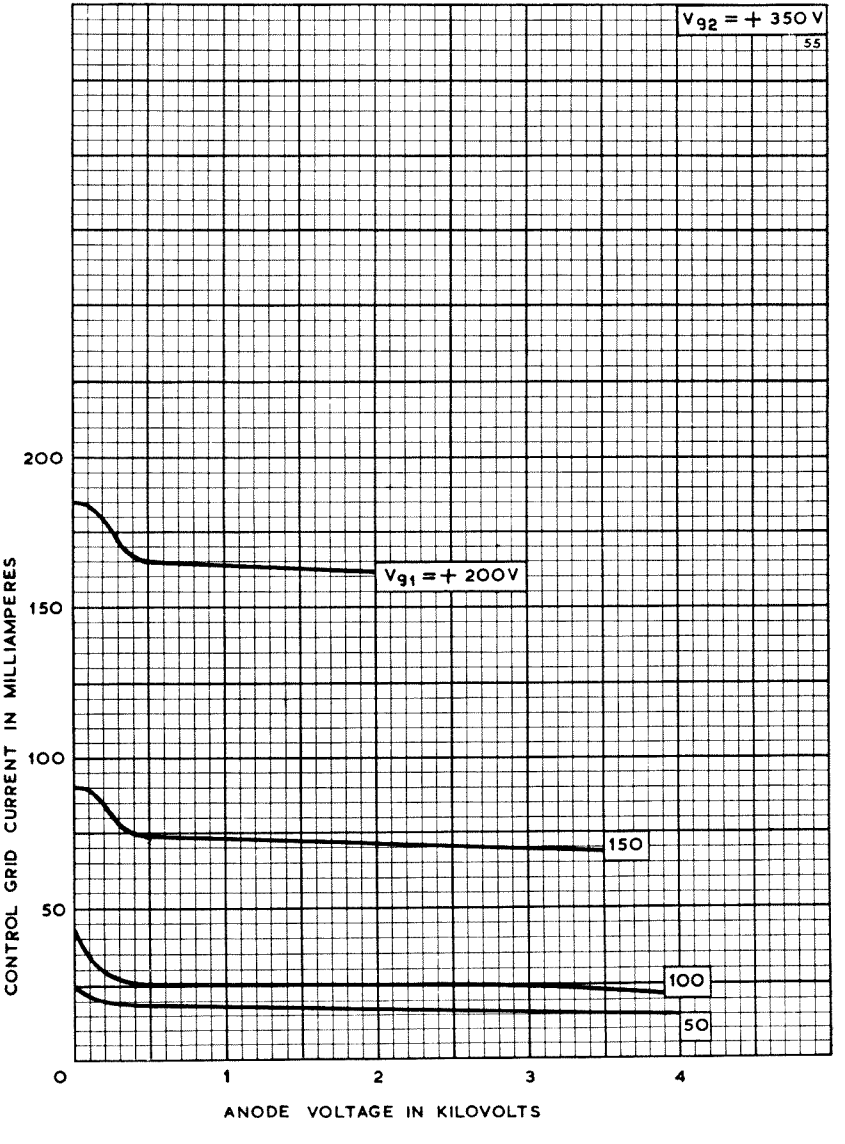
CONTROL GRID CHARACTERISTICS



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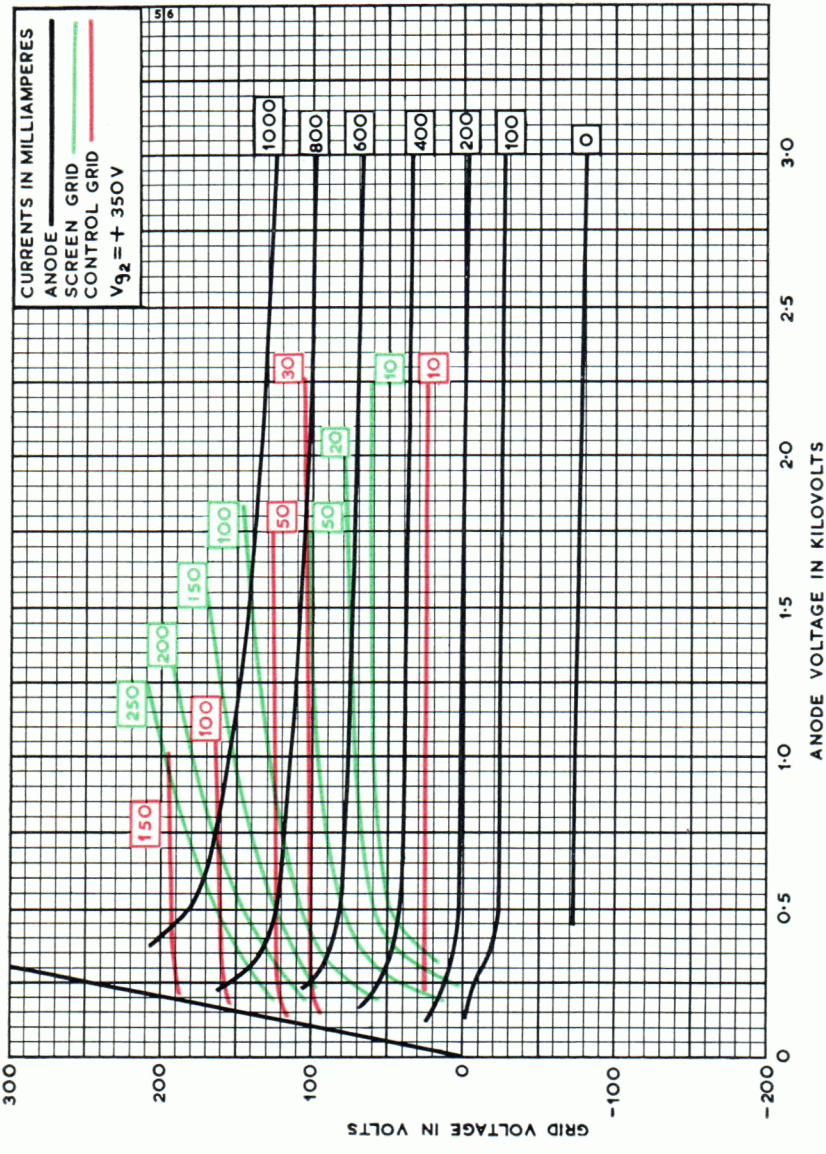
CONSTANT CURRENT CHARACTERISTICS



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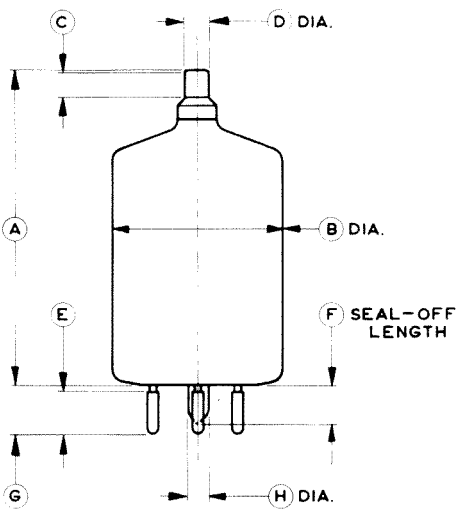
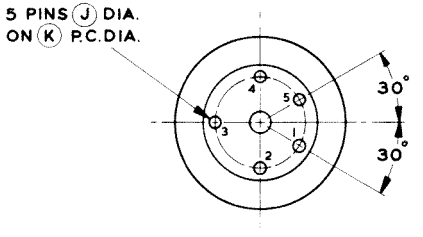
OUTLINE

57 B





Pin	Element
1	Filament
2	Screen Grid
3	Control Grid
4	Screen Grid
5	Filament
Cap	Anode

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	4·173±0·236	106·0±6·0	F	0·591 Max	15·0
B	2·440 Max	62·0 Max	G	0·670±0·020	17·0±0·5
C	0·354 Min	9·00 Min	H	0·295 Max	7·50 Max
D	0·354±0·005	9·00±0·13	J	0·187±0·003	4·75±0·07
E	0·591±0·007	15·0±0·2	K	1·250	31·75

Inch dimensions have been derived from millimetres.

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V.H.F. POWER TETRODE

C1112

ENGLISH ELECTRIC

Service Type CV2131 **American Equivalent 4-250A (near)**

INTRODUCTION

The C1112 is a radial beam transmitting Tetrode with a maximum anode dissipation of 250W. It may be operated at 4·0kV up to 75Mc/s and at reduced ratings up to 120Mc/s.

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage	5·0	V
Filament Current	14·1	A
Peak Usable Cathode Current	2·0	A
Perveance	0·65	$mA/V^{3/2}$
Grid-Screen Amplification Factor (V_a = 2·5kV, V_{g2} = 500V, I_a = 100mA)	5·1	
Mutual Conductance (V_a = 2·5kV, V_{g2} = 500V, I_a = 100mA)	4·0	mA/V
Inter-electrode Capacitances:		
Input	12·7	pF
Output	4·5	pF
Grid to Anode	0·12	pF

Mechanical

Overall Length	5·944 inches	(151 mm)	Max
Overall Diameter	3·425 inches	(87 mm)	Max
Net Weight	6 ounces	(170 gm)	Approx
Mounting Position	Vertical, base up or down		
Base	B.S.448/B5F		

COOLING

An adequate flow of air must be provided to cool the envelope and glass to metal seals of the valve when operating at frequencies above 30Mc/s, or under conditions where the maximum values of temperature given below might be exceeded.

Anode Seal Temperature	220	°C Max
Base Pin Seal Temperature	180	°C Max

A heat dissipating anode connector of large surface area is necessary.

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ENGLISH ELECTRIC

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR
(Class B)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	4·0	kV Max
Anode Dissipation	250	W Max
Screen Voltage	600	V Max
Screen Dissipation	35	W Max
Grid Voltage (negative value)	500	V Max
Grid Dissipation	10	W Max
Grid to Filament Resistance	250	kΩ Max
Cathode Current (Mean)	450	mA Max

TYPICAL OPERATING CONDITIONS
(Class B without grid current, 2 valves)

Anode Voltage	2·0	2·5	3·0	kV
Screen Voltage	500	500	500	V
Grid Voltage	−88	−91	−94	V
Peak A.F. Input Voltage (Grid to Grid)	172	178	184	V
Maximum-Signal Anode Current	2×150	2×155	2×155	mA
Zero-Signal Anode Current	2×50	2×50	2×50	mA
Maximum-Signal Screen Current	2×14	2×10	2×10	mA
Effective Load (Anode to Anode)	14·5	18	22	kΩ
Anode Dissipation	2×105	2×132	2×147	W
Output Power	390	510	635	W
Efficiency	65	66	68	%
Total Distortion	3·2	2·6	2·8	%

TYPICAL OPERATING CONDITIONS
(Class B with grid current, 2 valves)

Anode Voltage	2·0	2·5	3·0	kV
Screen Voltage	300	300	300	V
Grid Voltage	−49	−51	−55	V
Peak A.F. Input Voltage (Grid to Grid)	328	306	280	V
Maximum-Signal Anode Current	2×347	2×312	2×275	mA
Zero-Signal Anode Current	2×50	2×50	2×50	mA
Maximum-Signal Screen Current	2×55	2×44	2×34·5	mA
Grid Current	2×38	2×30	2×21	mA
Effective Load (Anode to Anode)	6·6	9·2	14	kΩ
Anode Dissipation	2×207	2×210	2×205	W
Nominal Driving Power	2×6·0	2×4·0	2×2·7	W
Output Power	974	1140	1240	W
Efficiency	70	73	75	%
Total Distortion	5·0	5·0	5·0	%

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RADIO FREQUENCY POWER AMPLIFIER

(Class B Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	4·0	kV Max
Anode Dissipation	250	W Max
Screen Voltage	600	V Max
Screen Dissipation	23	W Max
Grid Dissipation	6·5	W Max
Grid to Filament Resistance	250	kΩ Max
Cathode Current (Mean)	200	mA Max

TYPICAL OPERATING CONDITIONS

(for frequencies up to 75Mc/s)

Anode Voltage	2·5	3·0	4·0	kV
Screen Voltage	500	500	500	V
Grid Voltage	−84	−90	−100	V
Peak R.F. Grid Voltage	66	61	56	V
Anode Current	150	125	94	mA
Grid Current (modulation factor 1·0)	7·7	2·8	0·7	mA
Anode Dissipation	250	250	250	W
Screen Dissipation (modulation factor 1·0)	6·0	3·8	4·0	W
Nominal Driving Power	1·4	0·6	0·35	W
Output Power	125	125	126	W
Efficiency	33	33	33·5	%

ENGLISH ELECTRIC

ANODE AND SCREEN MODULATED R.F. POWER AMPLIFIER

(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	3·2	kV Max
Anode Dissipation	165	W Max
Screen Voltage	600	V Max
Screen Dissipation	35	W Max
Grid Voltage (negative value)	500	V Max
Grid Dissipation	10	W Max
Grid to Filament Resistance	250	kΩ Max
Cathode Current (Mean)	270	mA Max

TYPICAL OPERATING CONDITIONS

(for frequencies up to 75Mc/s)

Anode Voltage	2·5	3·0	kV
Screen Voltage	400	400	V
Grid Voltage	−200	−310	V
Peak R.F. Grid Voltage	280	400	V
Peak Screen Modulating Voltage (modulation factor 1·0)	350	350	V
Anode Current	200	225	mA
Screen Current	30	30	mA
Grid Current	13	13	mA
Anode Dissipation	125	165	W
Screen Dissipation	12	12	W
Nominal Driving Power	3·8	5·5	W
Output Power	375	510	W
Efficiency	75	75·5	%

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R.F. POWER AMPLIFIER OR OSCILLATOR

(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	4·0	kV Max
Anode Dissipation	250	W Max
Screen Voltage	600	V Max
Screen Dissipation	35	W Max
Grid Voltage (negative value)	500	V Max
Grid Dissipation	10	W Max
Grid to Filament Resistance	250	kΩ Max
Cathode Current (Mean)	420	mA Max

TYPICAL OPERATING CONDITIONS

(for frequencies up to 75Mc/s)

Anode Voltage	2·5	3·0	4·0	kV
Screen Voltage	500	500	500	V
Grid Voltage	−150	−180	−225	V
Peak R.F. Grid Voltage	220	265	303	V
Anode Current	300	345	312	mA
Screen Current	60	60	45	mA
Grid Current	13	15	13	mA
Anode Dissipation	175	235	248	W
Screen Dissipation	30	30	22·5	W
Nominal Driving Power	2·9	3·8	4·2	W
Output Power	575	800	1000	W
Efficiency	77	77	80	%

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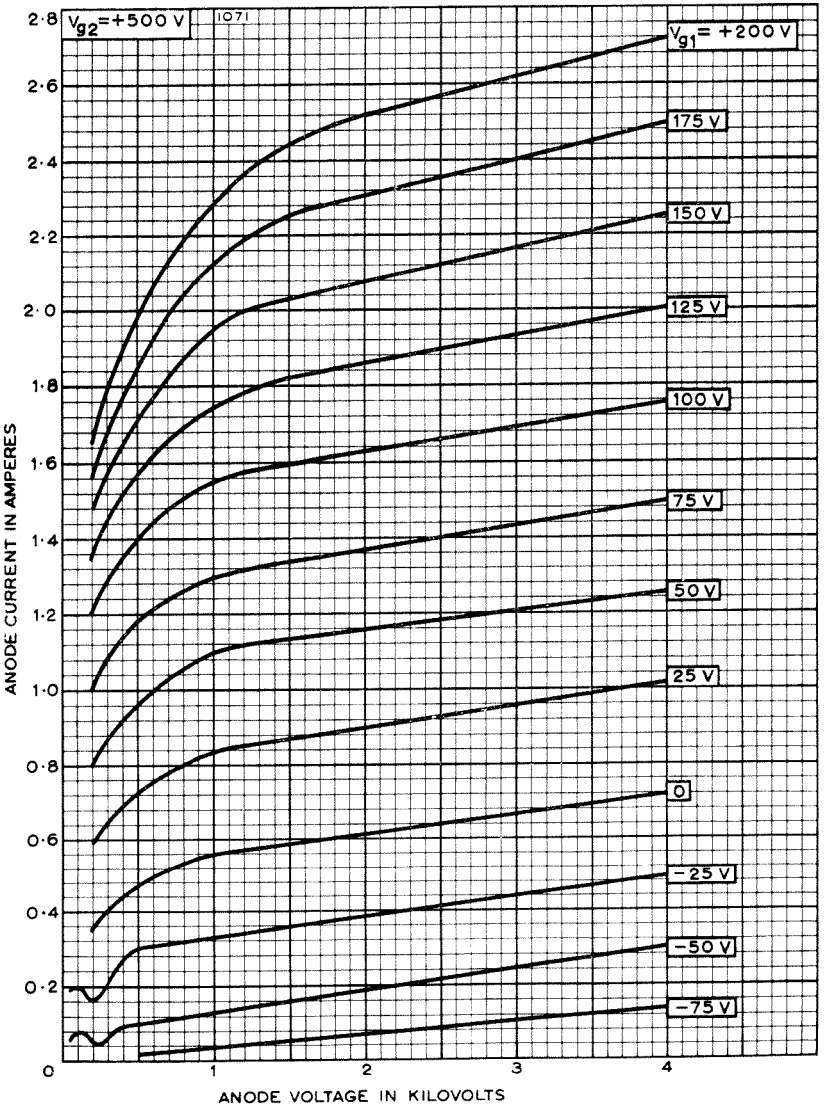
ANODE CHARACTERISTICS



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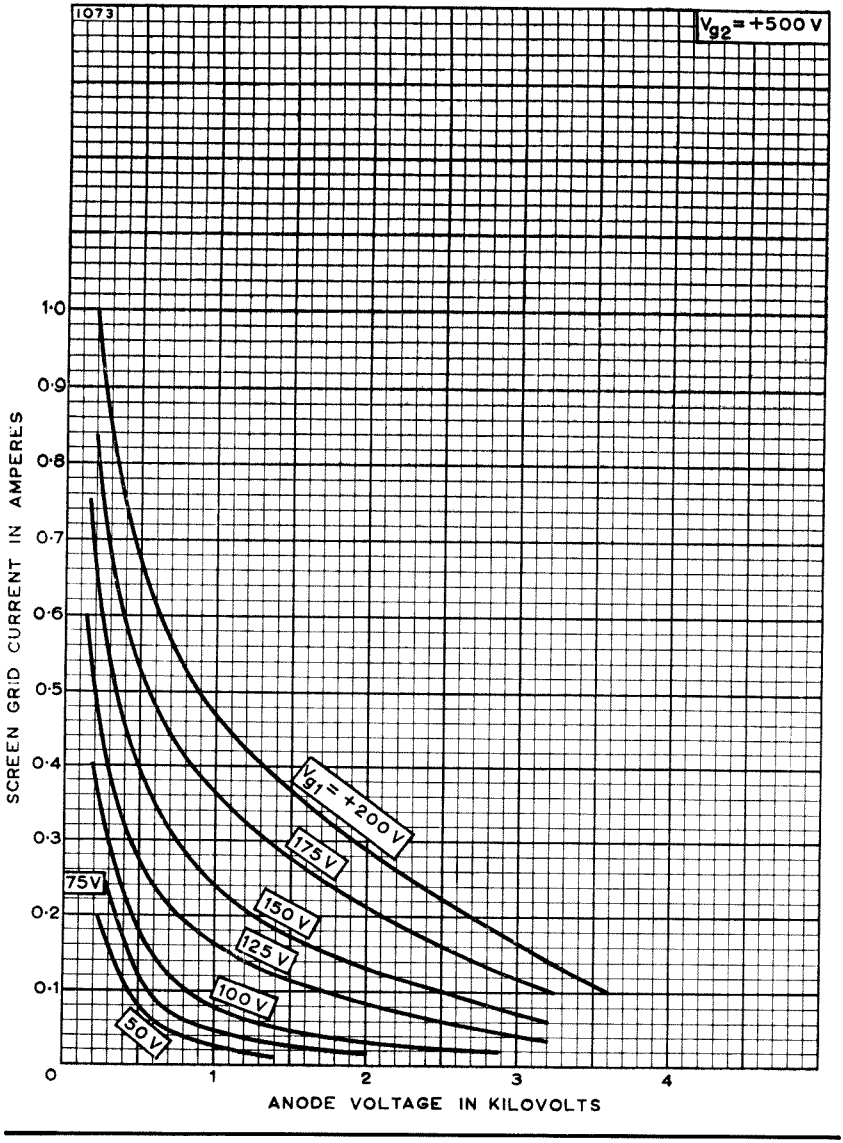
SCREEN GRID CHARACTERISTICS



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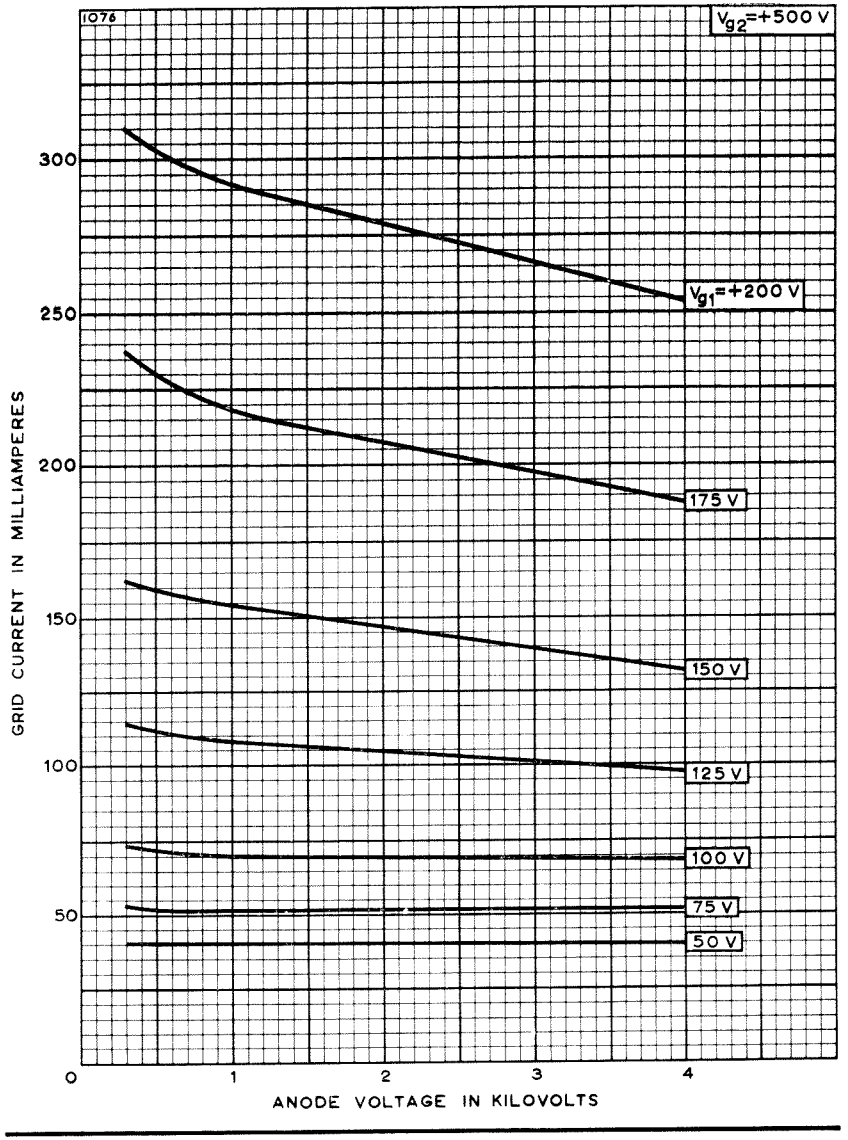
CONTROL GRID CHARACTERISTICS



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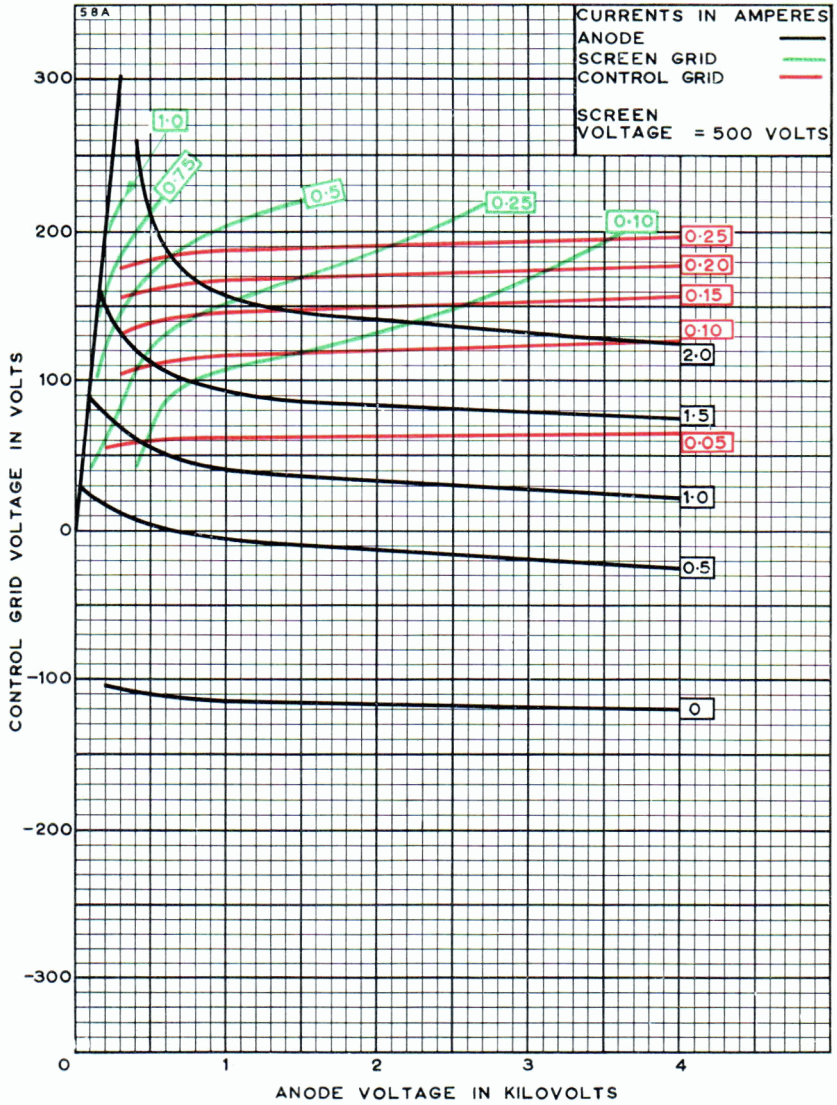
CONSTANT CURRENT CHARACTERISTICS



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V.H.F. POWER TETRODE

C1112

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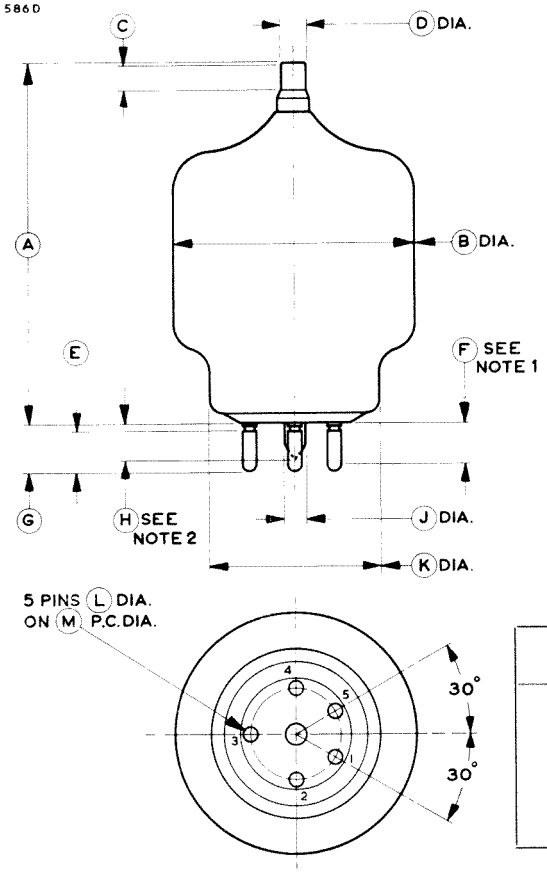
OUTLINE



NOTES.
1. LIMIT OF PARALLEL PORTION OF PINS
2. SEAL-OFF LENGTH

Pin	Element
1	Filament
2	Screen Grid
3	Control Grid
4	Screen Grid
5	Filament
Cap	Anode

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	5·000 ± 0·236	127·0 ± 6·0	G	0·708 Max	18·00 Max
B	3·425 Max	87·00 Max	H	0·590 Max	15·00 Max
C	0·354 Min	9·00 Min	J	0·295 Max	7·50 Max
D	0·354 ± 0·005	9·00 ± 0·13	K	2·440 Max	62·00 Max
E	0·588 ± 0·010	14·94 ± 0·25	L	0·187 ± 0·003	4·750 ± 0·076
F	0·590 Min	15·00 Min	M	1·250	31·75

Inch dimensions have been derived from millimetres.

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V.H.F. POWER DOUBLE TETRODE

C1134

ENGLISH ELECTRIC

Service Type CV2799 **American Equivalent 6252 (near)**

INTRODUCTION

The C1134 is an all-glass Double Tetrode with a centre-tapped heater for series or parallel connection. The maximum anode dissipation is 10W per section and the maximum frequency for full ratings is 150Mc/s. It may be used at reduced ratings up to 600Mc/s.

GENERAL DATA

Electrical

Cathode . . Indirectly Heated, Oxide Coated

The cathode is internally connected to Pin No. 4 via the bottom shield, to which the beam plates and top shield are welded.

	Series	*Parallel*	
Heater Voltage	12·6	6·3	V
Heater Current	0·65	1·3	A
Grid-Screen Amplification Factor (each unit) (average) (I_a = 20mA)		8·0	
Mutual Conductance (each unit) (average) (I_a = 20mA)		2·5	mA/V
Inter-electrode Capacitances (*See Note* 1) (average) :			
Grid to Anode*		0·04	pF
Input		7·5	pF
Output		2·6	pF
Input (two sections in push-pull)		4·4	pF
Output (two sections in push-pull)		1·6	pF

*Internally neutralised for push-pull operation.

Mechanical

Overall Length	3·38 inches (86 mm)	Max
Overall Diameter	1·81 inches (46 mm)	Max
Net Weight	2 ounces (60 gm)	Approx
Mounting Position	Vertical, base up or down	

Horizontal operation is permitted with fixed station operation when the anode pins are in a horizontal plane.

Base . . B.S.448/B7A (JEDEC No. E7-2)

COOLING

The temperature of the seals must not exceed the values given below:

Anode Seal or Bulb Temperature	200	°C Max
Base Pin Seal Temperature	180	°C Max

A heat dissipating anode connection of large surface area or high heat conduction is necessary.

Natural cooling is normally sufficient at maximum ratings for frequencies up to 150Mc/s. At higher frequencies it may be necessary to direct an air flow on to the anode and base seals (up to 5cu.ft/min).

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AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR
(Class B)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	600	V Max
Anode Dissipation	2 × 10	W Max
Screen Voltage	300	V Max
Screen Input Power	2 × 1·5	W Max
Grid Voltage (negative value)	75	V Max
Grid Dissipation	2 × 0·5	W Max
Grid Resistor (fixed bias)	50	kΩ Max
Grid Resistor (cathode bias)	100	kΩ Max
Cathode Current (Peak)	2 × 120	mA Max
Cathode Current (Mean)	2 × 55	mA Max
Peak Heater to Cathode Voltage	100	V Max

TYPICAL OPERATING CONDITIONS
(Class B, 2 valves)

Anode Voltage	300	500	V
Screen Voltage	250	250	V
Grid Voltage	−25	−26	V
Peak A.F. Input Voltage (Grid to Grid)	49	52	V
Effective Load (Anode to Anode)	11	20	kΩ
Maximum-Signal Anode Current	2 × 35	2 × 36·5	mA
Zero-Signal Anode Current	2 × 12·5	2 × 12·5	mA
Maximum-Signal Screen Current	2 × 9·5	2 × 8·1	mA
Zero-Signal Screen Current	2 × 0·6	2 × 0·35	mA
Anode Dissipation	2 × 3·9	2 × 6·5	W
Output Power	13·2	23·5	W
Efficiency	63	64·5	%
Total Distortion	3·5	3·5	%

R.F. POWER AMPLIFIER - ANODE AND SCREEN MODULATED
(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	600	V Max
Anode Dissipation	2 × 6·7	W Max
Screen Voltage	300	V Max
Screen Input Power	2 × 1·2	W Max
Grid Voltage (negative value)	100	V Max
Grid Current	2 × 2·5	mA Max
Grid Dissipation	2 × 0·5	W Max
Cathode Current (Peak)	2 × 400	mA Max
Cathode Current (Mean)	2 × 50	mA Max
Peak Heater to Cathode Voltage	100	V Max

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TYPICAL OPERATING CONDITIONS

Frequency	200	200	200	400	Mc/s
Anode Voltage	300	500	600	300	V
Screen Voltage	250	250	250	250	V
Grid Voltage	−50	−80	−80	−50	V
Anode Current	2×40	2×40	2×40	2×40	mA
Screen Current	2×4·0	2×4·0	2×4·0	2×3·0	mA
Grid Current (Approx) ..	2×1·0	2×1·0	2×1·0	2×1·0	mA
Driving Power (Approx)	1·5	3·0	3·0	2·5	W
Anode Dissipation ..	2×3·5	2×4·0	2×5·0	2×4·5	W
Output Power	17	31	38	15	W
Efficiency	71	78	79	63	%

PUSH-PULL R.F. POWER AMPLIFIER AND OSCILLATOR
(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	600	V Max
Screen Voltage	300	V Max
Grid Voltage (negative value)	75	V Max
Cathode Current (Mean)	2×55	mA Max
Cathode Current (Peak)	2×260	mA Max
Grid Current	2×2·5	mA Max
Grid Resistor (Fixed Bias)	50	kΩ Max
Grid Resistor (Cathode Bias)	100	kΩ Max
Screen Input Power	2×1·5	W Max
Anode Dissipation	2×10	W Max
Peak Heater to Cathode Voltage	100	V Max

TYPICAL OPERATING CONDITIONS

Frequency	200	200	200	200	Mc/s
Anode Voltage	200	300	400	600	V
Screen Voltage (*See Note* 2)	200	250	250	250	V
Grid Voltage	−30	−40	−50	−60	V
Anode Current	2×50	2×50	2×50	2×50	mA
Screen Current	2×4·0	2×4·5	2×4·0	2×4·0	mA
Grid Current (Approx) ..	2×1·0	2×0·7	2×0·7	2×0·7	mA
Driving Power (Approx)..	<1·0	<1·0	1·0	1·5	W
Output Power (Approx)	13	21	30	48	W

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V.H.F. POWER DOUBLE TETRODE

C1134

ENGLISH ELECTRIC

TYPICAL OPERATING CONDITIONS

Frequency	400	400	400	600	Mc/s
Anode Voltage	200	300	400	400	V
Screen Voltage (*See Note* 2)	200	250	250	250	V
Grid Voltage	−30	−40	−50	−50	V
Anode Current	2×50	2×50	2×50	2×50	mA
Screen Current	2×3·0	2×2·5	2×2·5	2×2·5	mA
Grid Current (Approx)	2×0·5	2×0·6	2×0·7	2×0·7	mA
Driving Power (Approx)	1·0	1·5	2·0	6·0	W
Output Power (Approx)	11	17	25	20	W

MAXIMUM ANODE VOLTAGE AGAINST FREQUENCY

Frequency Mc/s	Max. Anode Voltage C.W.	Max. Anode Voltage with Anode Modulation
150	600	600
200	500	500
430	300	300
600	250	250

NOTES

1. Inter-electrode capacitances are for each unit except where otherwise indicated.
2. The screen voltage may be obtained from a separate source, or from the anode supply with a potential divider or through a series resistor. The screen voltage must not exceed 600V under key-up conditions.

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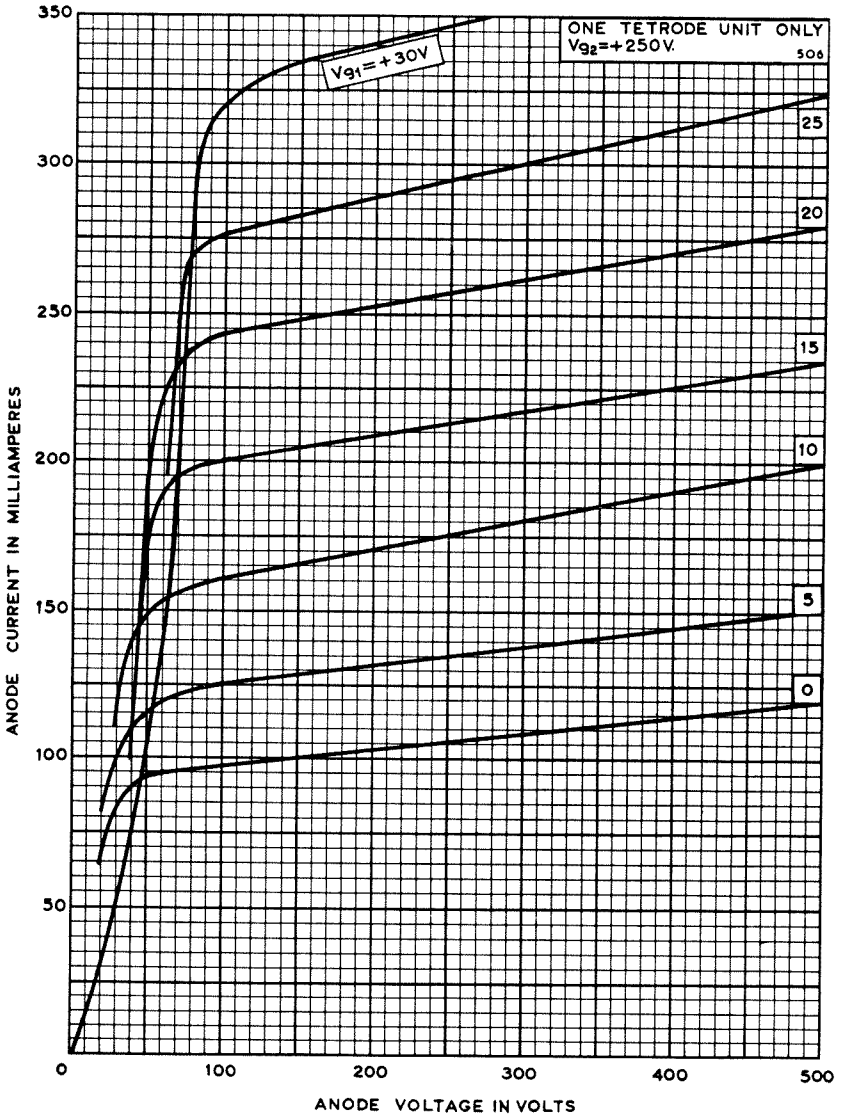
ANODE CHARACTERISTICS



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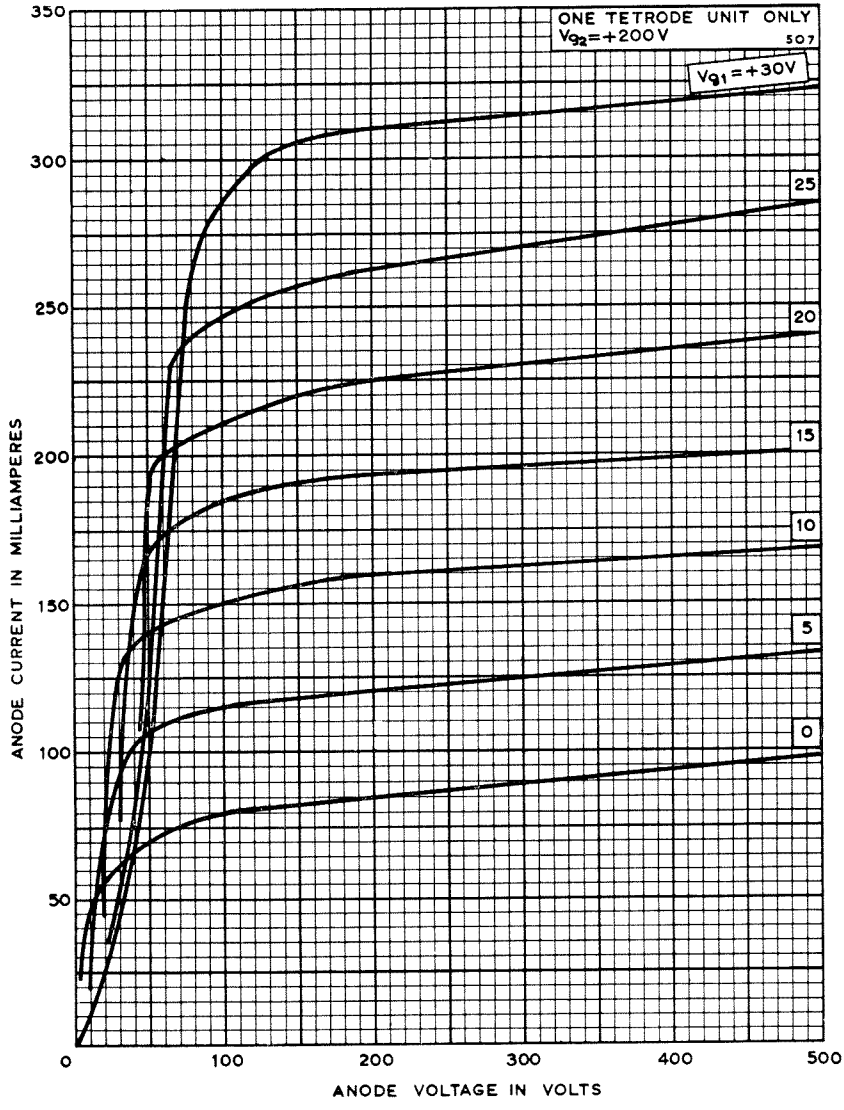
ANODE CHARACTERISTICS



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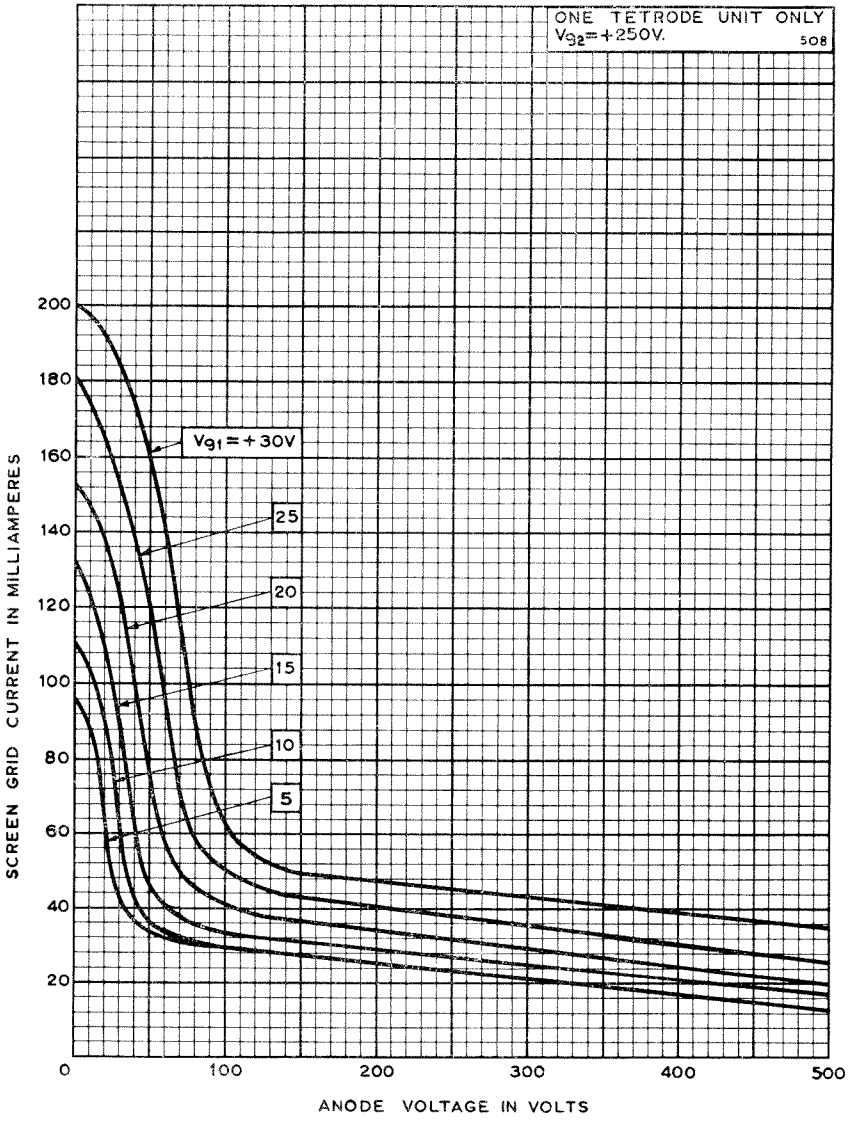
SCREEN GRID CHARACTERISTICS



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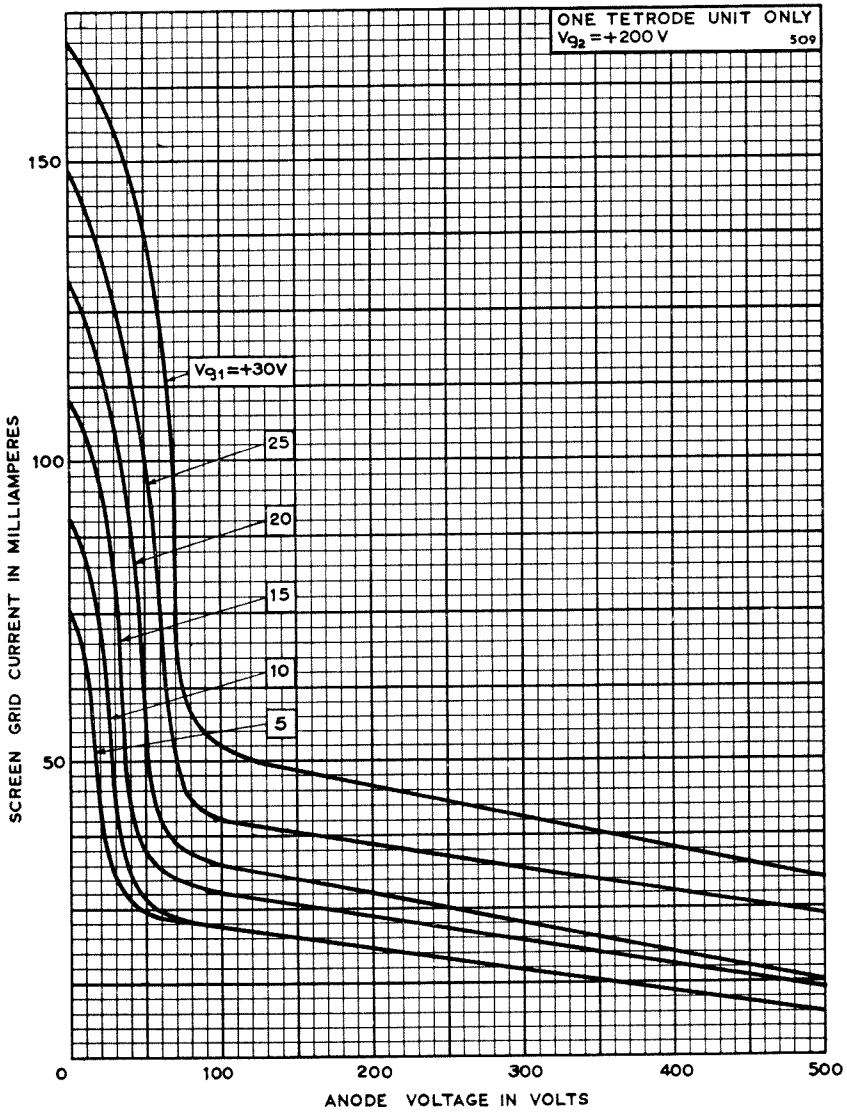
SCREEN GRID CHARACTERISTICS



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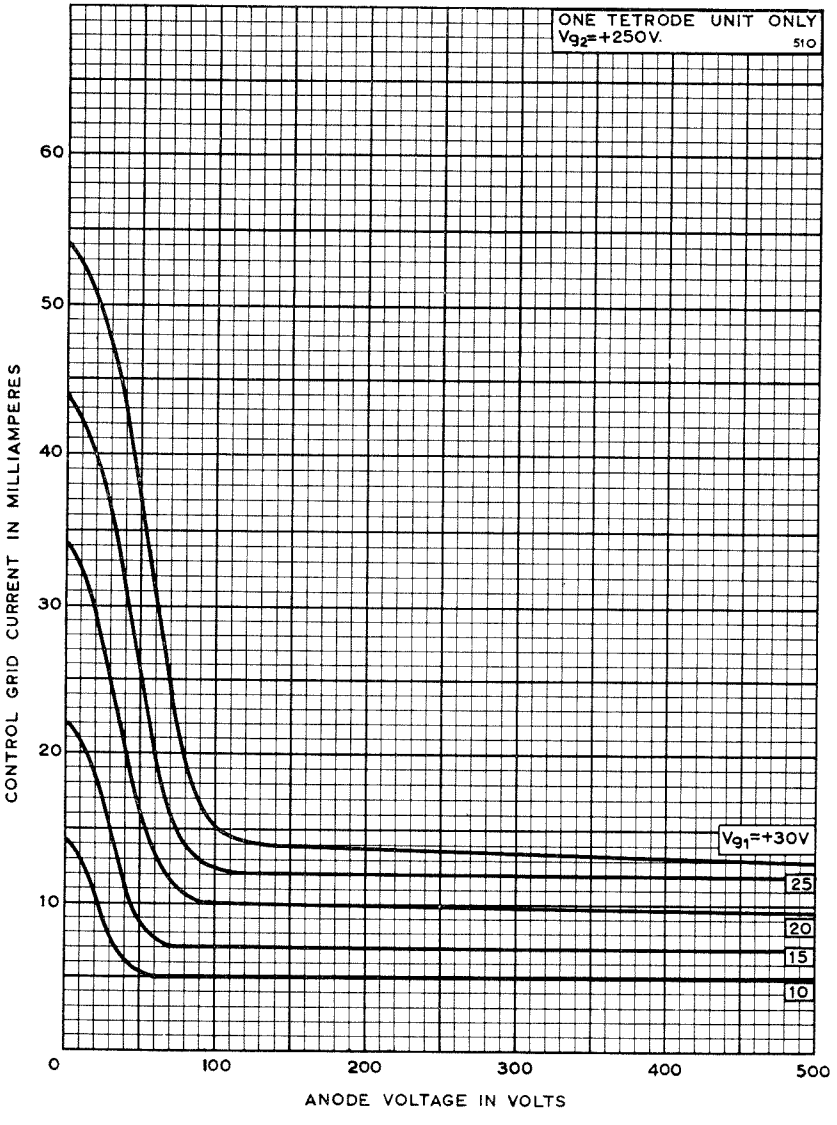
CONTROL GRID CHARACTERISTICS



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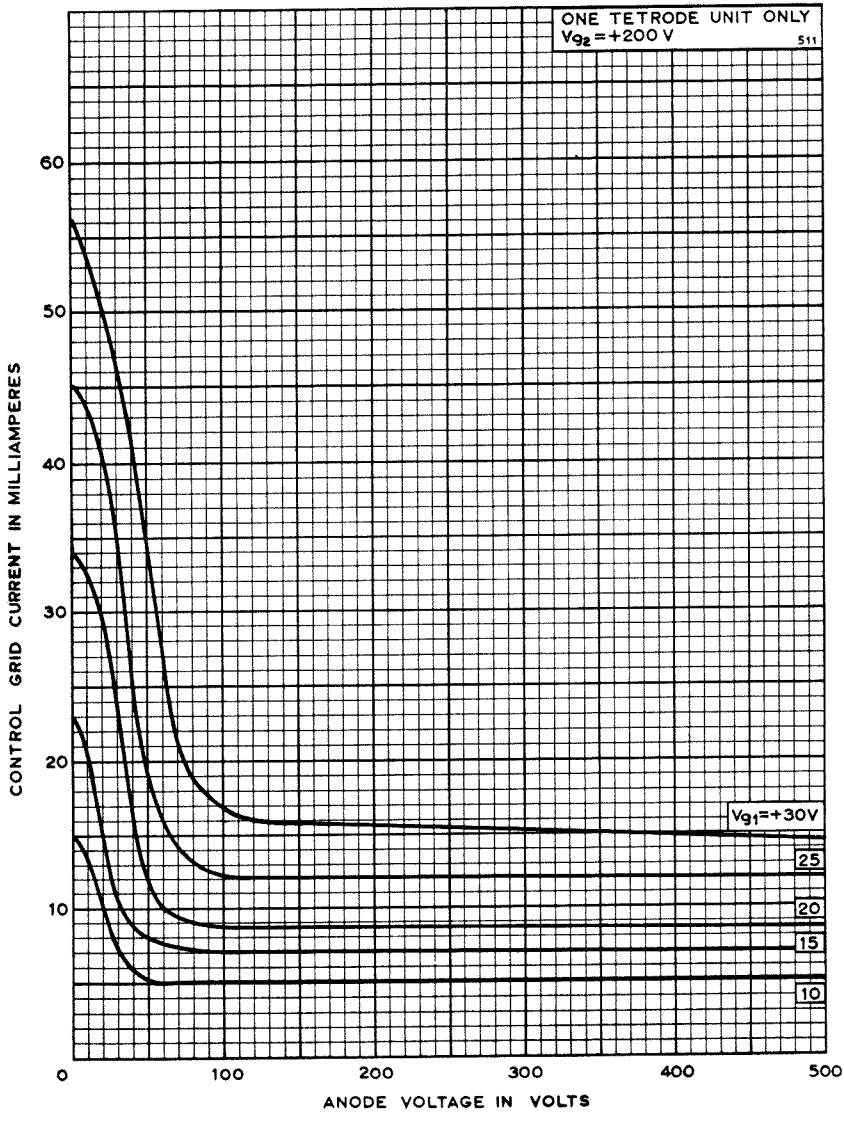
CONTROL GRID CHARACTERISTICS



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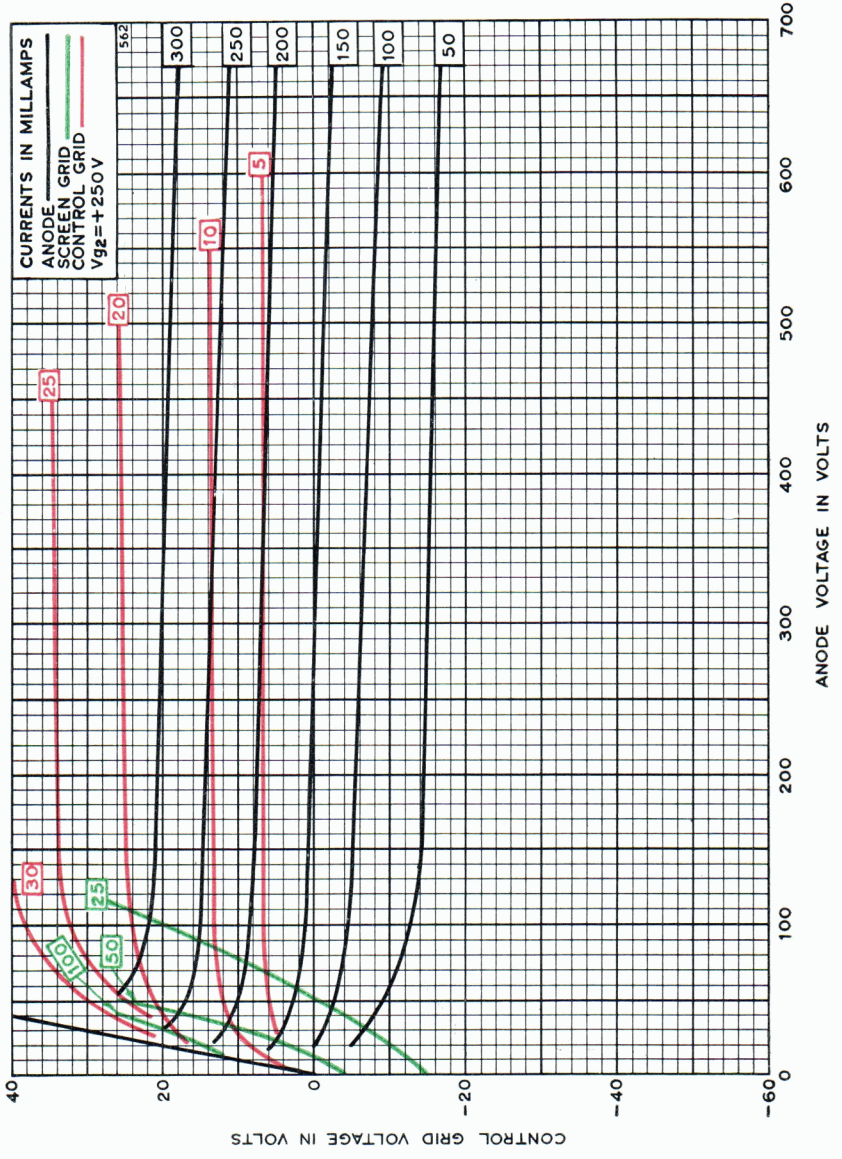
CONSTANT CURRENT CHARACTERISTICS



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V.H.F. POWER DOUBLE TETRODE

C1134

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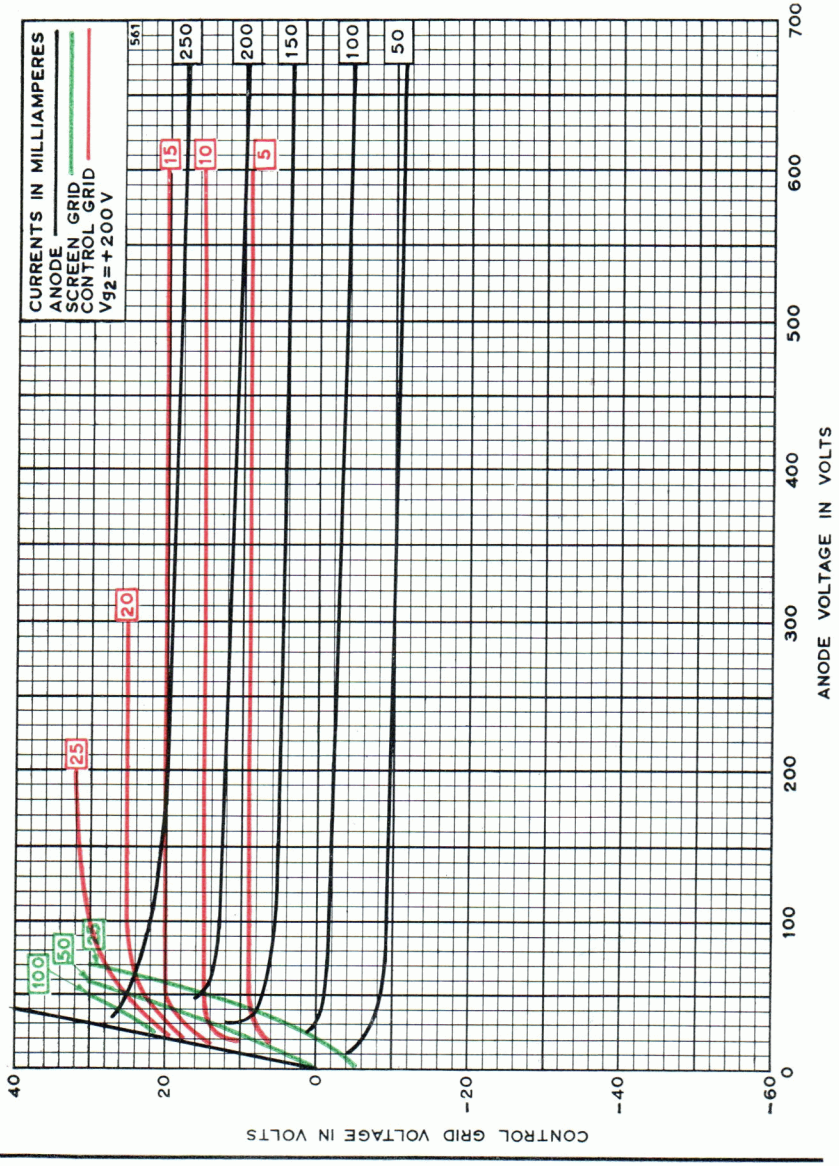
CONSTANT CURRENT CHARACTERISTICS



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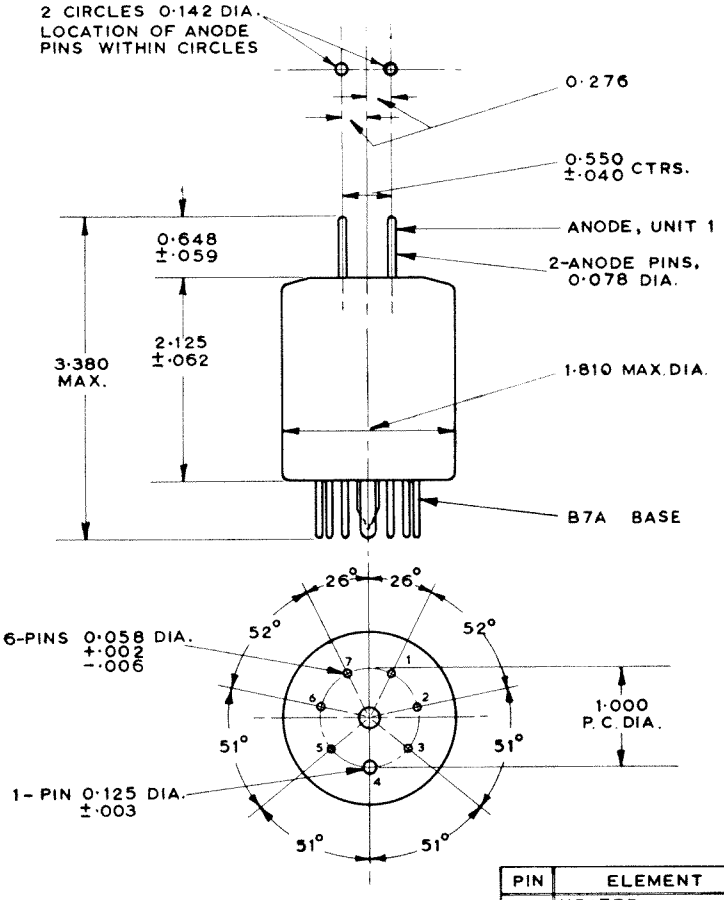
OUTLINE

512



PIN	ELEMENT
1	HEATER
2	CONTROL GRID, UNIT 1
3	SCREEN GRID, COMMON
4	CATHODE BEAM PLATES & SHIELD
5	HEATER CENTRE TAP
6	CONTROL GRID, UNIT 2
7	HEATER

ALL DIMENSIONS IN INCHES

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PULSE AMPLIFIER TETRODE

C1148

INTRODUCTION

The C1148 is a high vacuum, radial beam Tetrode designed primarily for the output stage in power amplifier pulse modulators. It has a maximum anode dissipation of 40W and peak ratings of 14kV, 12A; pulse outputs of the order of 130kW are obtainable.

GENERAL DATA

Electrical

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage	6·3	V
Heater Current	5·0	A
Cathode Heating Time (*See Note* 1)	2	minutes
Inter-electrode Capacitances:		
Grid to Anode	0·45	pF
Input	35	pF
Output	4·75	pF

Mechanical

Overall Length	5·377 inches	(136·6mm)	Max
Overall Diameter	2·440 inches	(61·98mm)	Max
Net Weight	5·3 ounces	(150gm)	Approx
Mounting Position			Vertical
Base			B.S.448/B5F
Top Cap			*See Note* 2
Cooling (*See Note* 2)			Natural

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PULSE AMPLIFIER TETRODE

C1148

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PULSE MODULATOR SERVICE

MAXIMUM RATINGS

(Absolute Values)

Duty Cycle	*See Note* 3	
Anode Voltage (*See Note* 4)	14	kV Max
Screen Voltage (*See Notes* 4 and 5)	1·2	kV Max
Grid Voltage (*See Note* 6)	−500	V Max
Pulse Anode Current (*See Notes* 3 *and* 7)	12	A Max
Peak Anode Voltage	17	kV Max
Anode Dissipation	40	W Max
Screen Dissipation	4·0	W Max
Grid Dissipation	2·0	W Max
Seal Temperature (*See Note* 2)	200	°C Max

TYPICAL OPERATING CONDITIONS

Duty Cycle (*See Note* 3)	0·001	
Pulse Length	2·0	μsec
Anode Voltage	12	kV
Screen Voltage	1·1	kV
Grid Voltage	−400	V
Pulse Positive Grid Voltage	125	V
Pulse Anode Current	12	A
Pulse Screen Current (Approx)	1·75	A
Pulse Grid Current (Approx)	0·4	A
Pulse Input Power	144	kW
Pulse Output Power	130	kW

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NOTES

1. When the pulse current drawn is less than the maximum rated value of 12A, the cathode heating time may be reduced proportionately but in no circumstance shall it be less than 60 seconds.

2. To keep the anode seal at a safe temperature it is necessary to employ an anode connector with good heat dissipation characteristics. The use of a spring type connector is recommended; where a connector using grub screw clamping is employed, care must be taken to avoid over-tightening the screw or applying excessive side thrust to the top cap.

3. For the pulse current given under maximum ratings the duty cycle must not exceed 0·001. At higher duty cycles the pulse current must be reduced in proportion. For pulse currents exceeding 5·0A the product of pulse current in amperes and pulse duration in microseconds must not exceed 25 and the valve must not be operated for longer than 5 microseconds in any 100 microsecond interval. For pulse currents of less than 5·0A the anode dissipation of 40W determines the permissible pulse length.

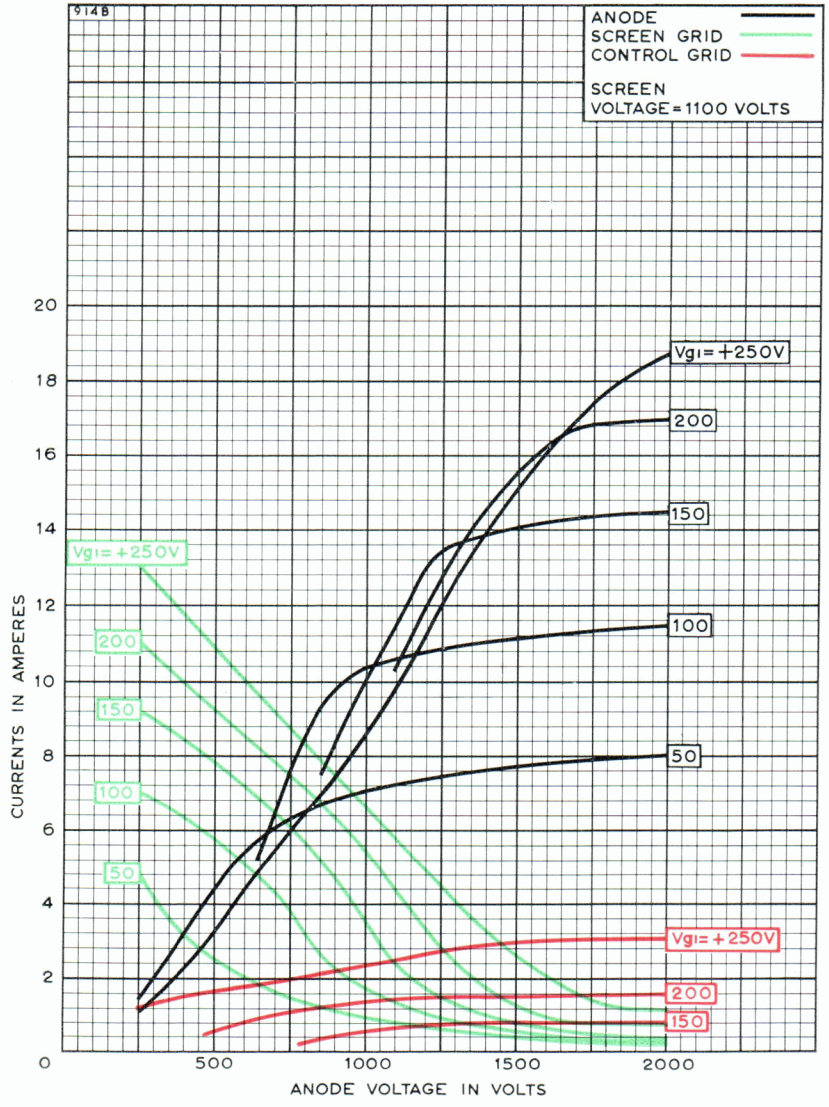
4. Occasional internal discharges may occur during operational life. The power in such discharges should be limited and it is recommended that a series resistor should be included in the anode circuit to limit the short circuit current to 500mA or less. A resistor of about 100Ω value should be connected in series with the screen as close to the pin of the valve as possible. A 0·5μF by-pass capacitor should be connected between the supply side of the 100Ω resistor and earth.

5. The screen grid decoupling resistance must not be less than 20kΩ.

6. The total resistance of the control grid circuit must not exceed 0·1MΩ.

7. The rating specified for pulse anode current refers to the maximum amplitude of the flat portion of the pulse following an initial spike on the leading edge which must not exceed 16A.

ANODE AND GRID CHARACTERISTICS



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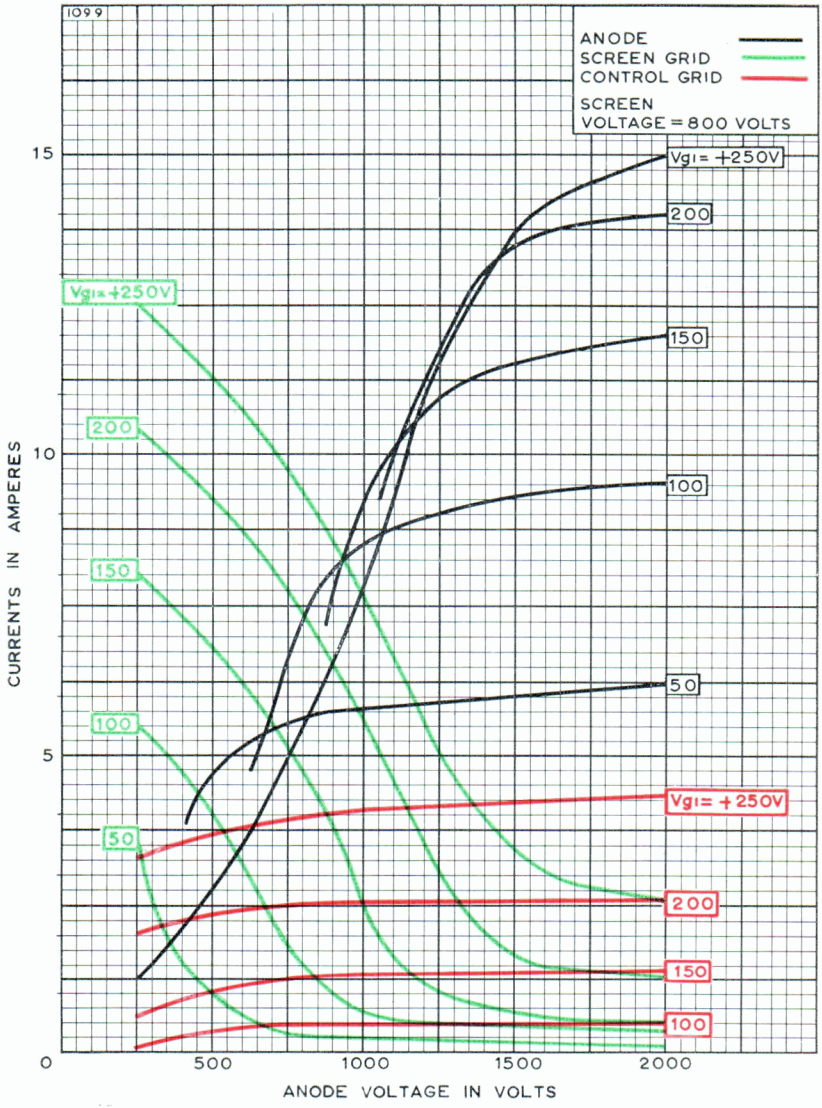
ANODE AND GRID CHARACTERISTICS



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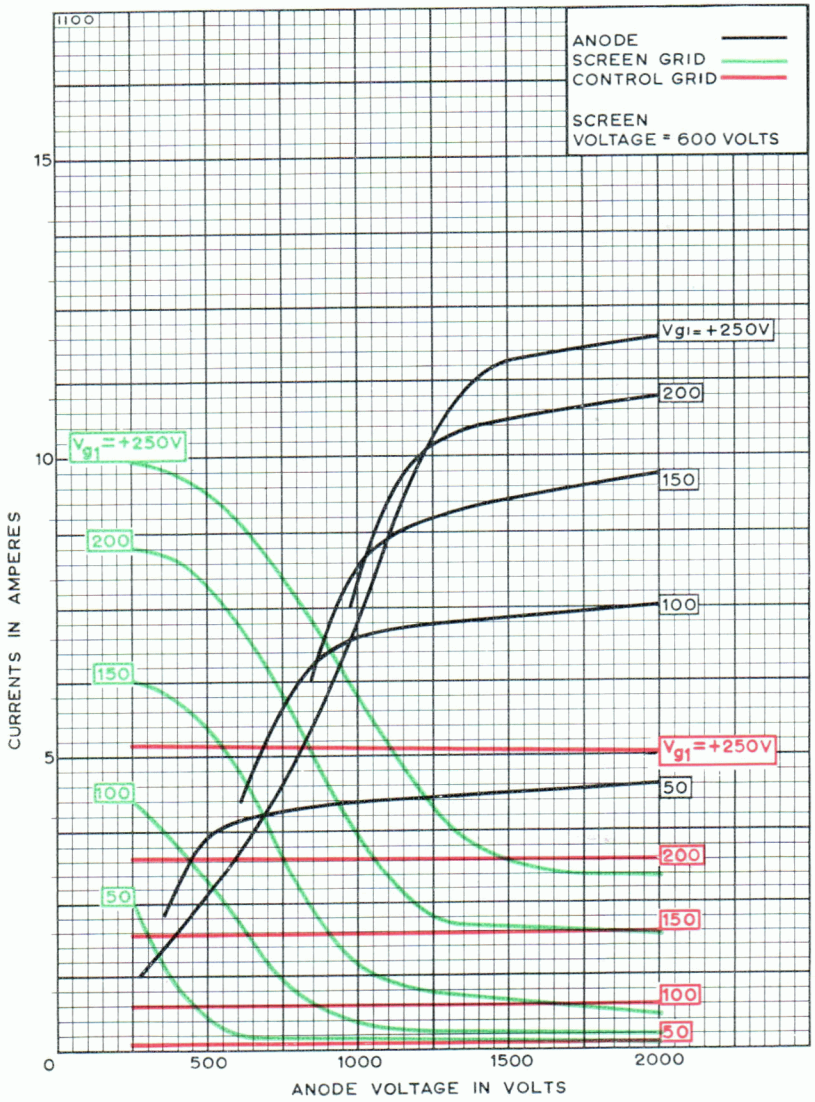
ANODE AND GRID CHARACTERISTICS



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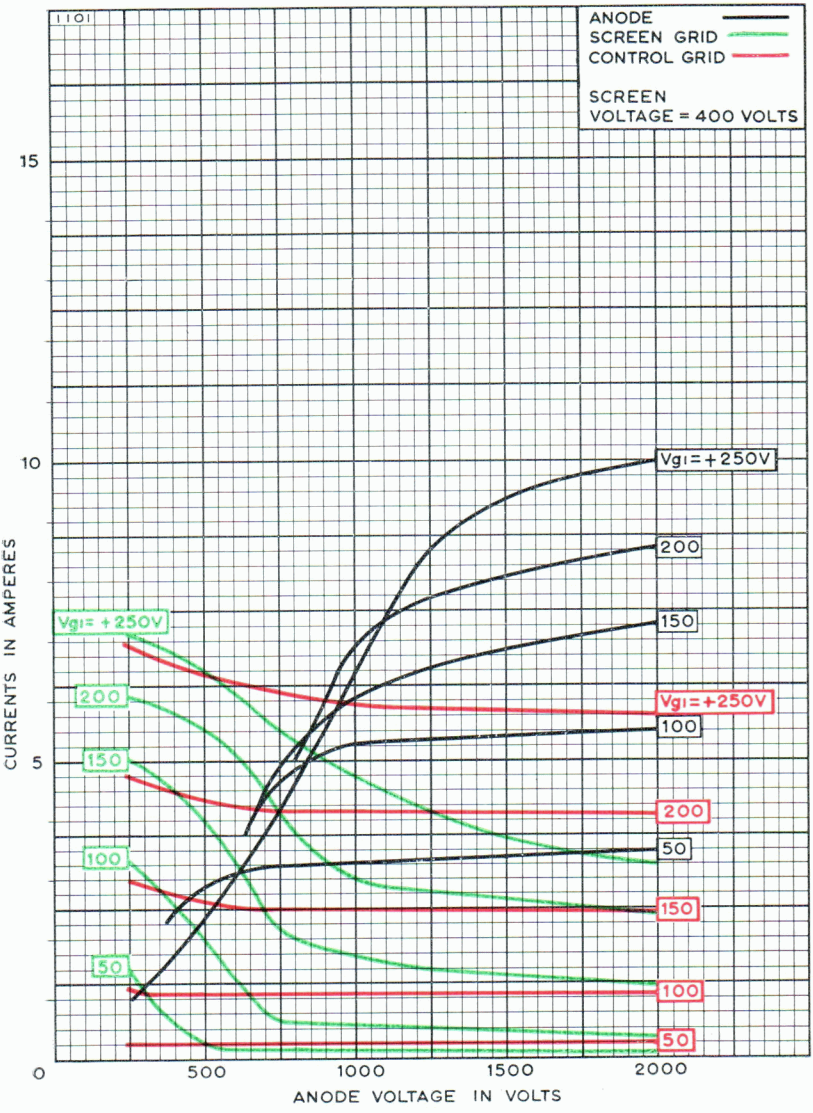
ANODE AND GRID CHARACTERISTICS



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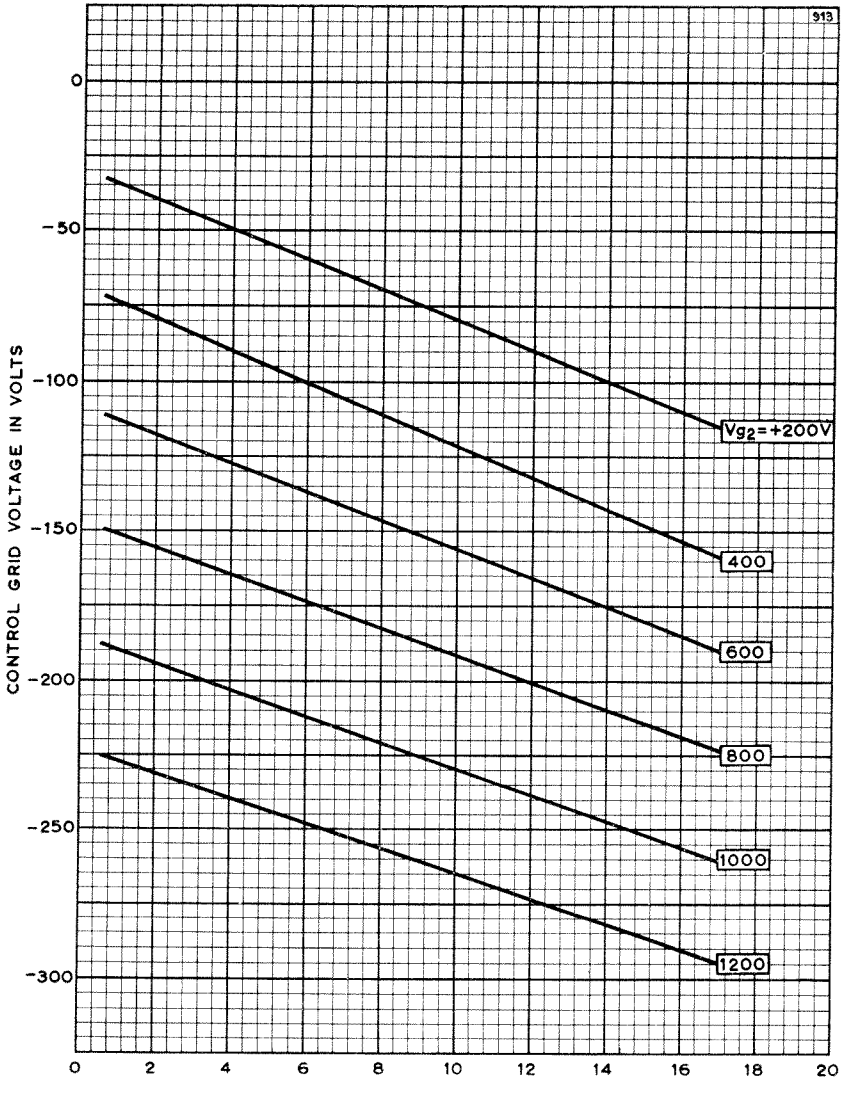
ANODE CURRENT CUT-OFF (500μA) CHARACTERISTICS



To allow for variations between valves and to cover changes during life, it is suggested that the working bias voltage should be 20% in excess of that shown on the curves.

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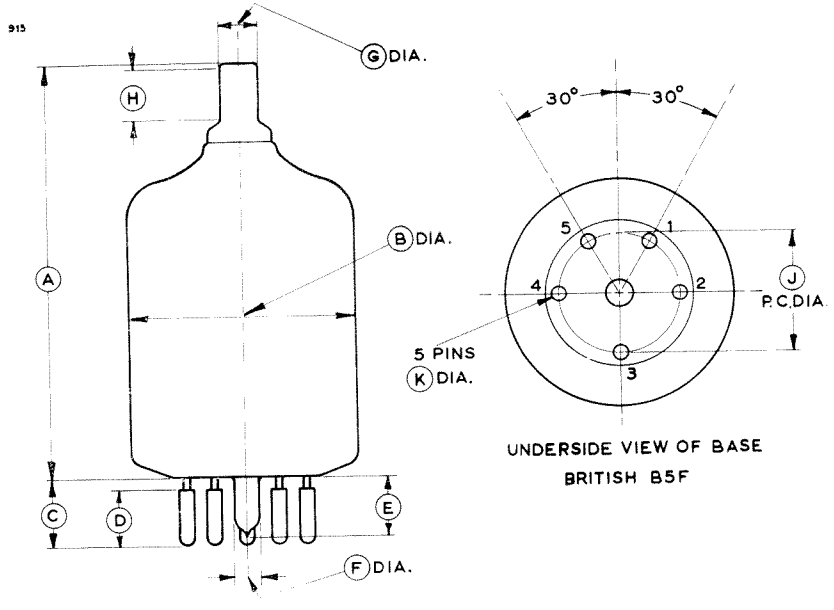
OUTLINE



Ref.	Inches	Millimetres
A	4·687 Max	119·05 Max
B	2·440 Max	61·98 Max
C	0·670 ± 0·020	17·02 ± 0·51
D	0·591 ± 0·007	15·01 ± 0·18
E	0·590 Max	14·99 Max
F	0·275 Max	6·99 Max
G	0·374 ± 0·002	9·500 ± 0·051
H	0·500 Min	12·70 Min
J	1·250	31·75
K	0·187 ± 0·003	4·750 ± 0·076

Millimetre dimensions have been derived from inches.

Pin	Element
1	Cathode, Heater
2	Grid
3	Screen
4	Heater
5	Grid
Cap	Anode

PULSE AMPLIFIER TETRODE

C1149/1

ENGLISH ELECTRIC

American Equivalent 4PR60B*

INTRODUCTION

The C1149/1 is a high vacuum, radial beam Tetrode designed primarily for the output stage in power amplifier pulse modulators. It is of rugged construction and is a development of the C1149, being identical electrically but having a modified envelope design to give improved mechanical characteristics.

The C1149/1 may be used as a replacement for type 4PR60B, having equivalent electrical characteristics, and it also replaces types 715C, 5D21and CV427 with a generous margin of safety. The maximum anode dissipation is 60W and pulse outputs of the order of 300kW are obtainable.

GENERAL DATA

Electrical

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage	26	V
Heater Current	2·15	A
Cathode Heating Time (Minimum)	3	minutes
Inter-electrode Capacitances:		
Grid to Anode	0·36	pF
Input	43·0	pF
Output	6·5	pF

Mechanical

Overall Length	6·000 inches (152·4mm)	Max
Overall Diameter	3·062 inches (77·77mm)	Max
Net Weight	9 ounces (255gm)	Approx
Base		B.S.448/B4A
Top Cap		*See Note* 1
Mounting Position		Any
Cooling (*See Note* 1)		Natural

*Electrical equivalent

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MAXIMUM RATINGS

(Absolute Values)

Duty Cycle	(*See Note* 2)
Anode Voltage (*See Note* 3)	20 kV Max
Screen Voltage (*See Notes* 3 *and* 4)	1·5 kV Max
Grid Voltage (*See Note* 5)	−1·0 kV Max
Peak Positive Grid Voltage	300 V Max
Pulse Anode Current (*See Notes* 2 *and* 6)	18 A Max
Peak Anode Voltage	25 kV Max
Anode Dissipation	60 W Max
Screen Dissipation	8·0 W Max
Seal Temperature (*See Note* 1)	200 °C Max
Vibration	(*See Note* 7)

TYPICAL OPERATING CONDITIONS

Duty Cycle (*See Note* 2)	0·001	
Pulse Length	2·0	μsec
Anode Voltage	20	kV
Screen Voltage	1·25	kV
Grid Voltage	−600	V
Pulse Positive Grid Voltage	150	V
Pulse Anode Current	18	A
Pulse Screen Current (Approx)	1·7	A
Pulse Grid Current (Approx)	0·3	A
Pulse Input Power	360	kW
Pulse Output Power	330	kW

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NOTES

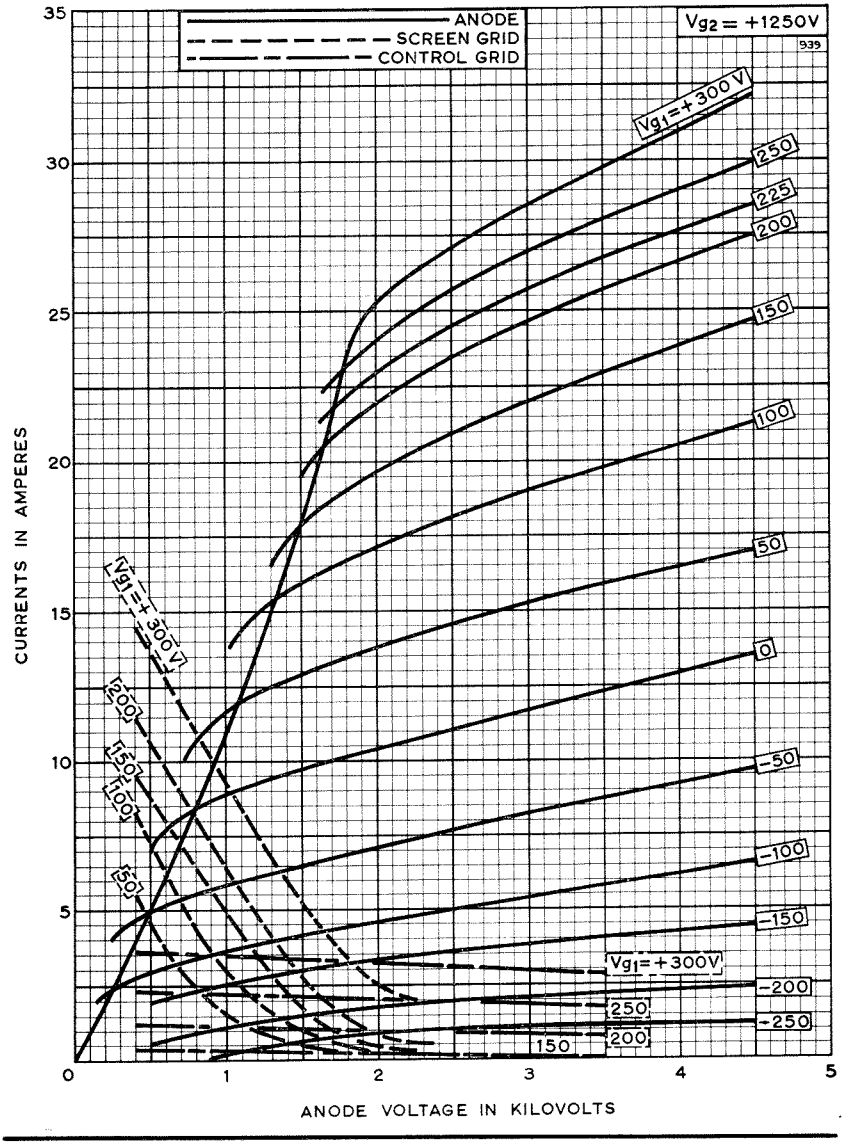
1. To keep the anode seal at a safe temperature, it is necessary to use an anode connector with good heat dissipation characteristics. The use of a spring type anode connector is recommended; where a connector using grub screw clamping is employed, care must be taken to avoid overtightening the screw or applying excessive side thrust to the top cap.
2. For the pulse current given under maximum ratings, the duty cycle must not exceed 0·001. At higher duty cycles the pulse current must be reduced in proportion. For pulse currents exceeding 5·0A, the product of pulse current in amperes and pulse duration in microseconds must not exceed 40 and the valve must not be operated for longer than 5 microseconds in any 100 microsecond interval. For pulse currents of less than 5·0A, the anode dissipation of 60W determines the permissible pulse length.
3. Occasional internal discharges may occur during operational life. The power in such discharges should be limited and it is recommended that a series resistor should be included in the anode circuit to limit the short circuit current to 500mA or less. A resistor of about 100 ohms value should be connected in series with the screen as close to the pin of the valve as possible. A 0·05μF bypass capacitor should be connected between the supply side of the 100 ohm resistor and earth.
4. The screen grid decoupling resistance must not be less than 20kΩ.
5. The total resistance of the control grid circuit must not exceed 0·1MΩ.
6. The rating specified for pulse anode current refers to the maximum amplitude of the flat portion of the pulse following an initial spike on the leading edge which must not exceed 25A.
7. The valve will withstand vibration at 5g from 30 to 1500c/s for short periods but it should not be operated continuously under these conditions. During manufacture it is subjected to a shock test of 200g minimum.

X-RAY WARNING

X-rays are produced when the C1149/1 is operated with a peak anode voltage above 16kV (absolute value). These rays can constitute a health hazard unless the valve is adequately shielded for X-ray radiation.

ENGLISH ELECTRIC

ANODE AND GRID CHARACTERISTICS



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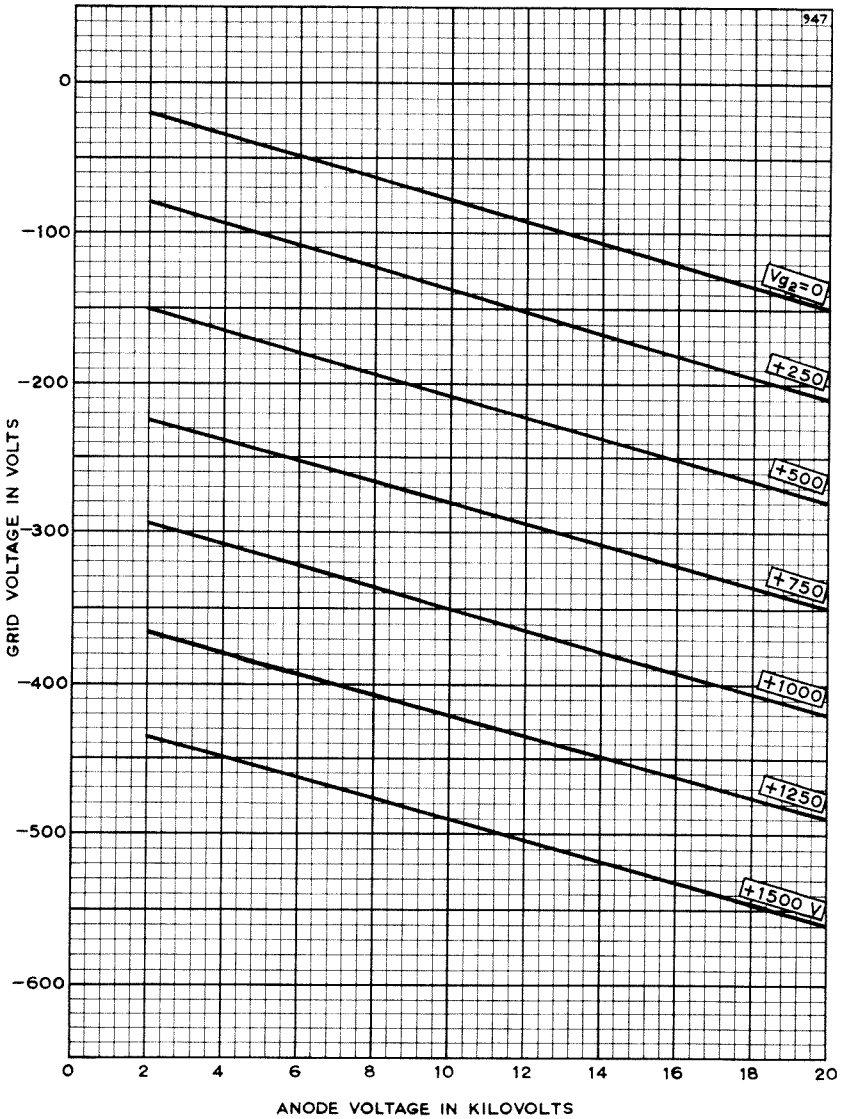
ANODE CURRENT CUT-OFF (500μA) CHARACTERISTICS



To allow for variations between valves and to cover changes during life, it is suggested that the working bias voltage should be 20% in excess of that shown on the curve.

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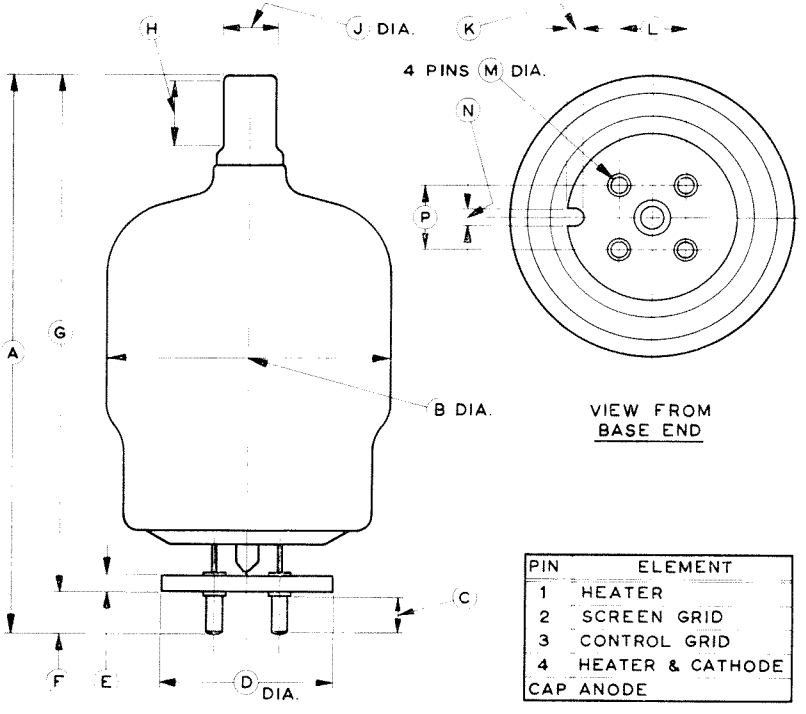

PIN	ELEMENT
1	HEATER
2	SCREEN GRID
3	CONTROL GRID
4	HEATER & CATHODE
CAP	ANODE

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	5·875 ± 0·125	149·23 ± 3·18	H	0·437 Min	11·10 Min
B	3·062 Max	77·77 Max	J	0·567	14·40
C	0·328 Min	8·33 Min	K	0·187	4·75
D	1·813 Max	46·05 Max	L	0·687	17·45
E	0·187	4·75	M	0·187 ± 0·004	4·750 ± 0·102
F	0·500 Max	12·70 Max	N	0·187	4·75
G	5·469 ± 0·125	138·91 ± 3·18	P	0·687	17·45

Millimetre dimensions have been derived from inches.

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PULSE AMPLIFIER TETRODE

C1150/1

ENGLISH ELECTRIC

American Equivalent 715C

INTRODUCTION

The C1150/1 is a high vacuum, radial beam Tetrode designed primarily for the output stage in power amplifier pulse modulators. It is of rugged construction and is a development of the C1150, being identical electrically but having a modified envelope design to give improved mechanical characteristics.

The C1150/1 is similar electrically to types C1149/1 and 4PR60B apart from pulse ratings of 17·5kV, 15A and is a replacement for types 715C, 5D21 and CV427. The maximum anode dissipation is 60W and pulse outputs of the order of 200kW are obtainable.

GENERAL DATA

Electrical

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage	26	V
Heater Current	2·15	A
Cathode Heating Time (Minimum)	3	minutes
Inter-electrode Capacitances:		
Grid to Anode	0·36	pF
Input	43·0	pF
Output	6·5	pF

Mechanical

Overall Length	6·000 inches	(152·4mm)	Max
Overall Diameter	2·598 inches	(65·99mm)	Max
Net Weight	9 ounces	(255gm)	Approx
Base			B.S.448/B4A
Top Cap			(*See Note* 1)
Mounting Position			Any
Cooling (*See Note* 1)			Natural

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MAXIMUM RATINGS
(Absolute Values)

Duty Cycle	(*See Note* 2)
Anode Voltage (*See Note* 3)	17·5 kV Max
Screen Voltage (*See Notes* 3 *and* 4)	1·5 kV Max
Grid Voltage (*See Note* 5)	−1·0 kV Max
Peak Positive Grid Voltage	300 V Max
Pulse Anode Current (*See Notes* 2 *and* 6)	15 A Max
Peak Anode Voltage	20 kV Max
Anode Dissipation	60 W Max
Screen Dissipation	8·0 W Max
Seal Temperature (*See Note* 1)	200 °C Max
Vibration	(*See Note* 7)

TYPICAL OPERATING CONDITIONS

Duty Cycle (*See Note* 2)	0·001	
Pulse Length	2·0	μsec
Anode Voltage	15	kV
Screen Voltage	1·25	kV
Grid Voltage	−600	V
Pulse Positive Grid Voltage	100	V
Pulse Anode Current	15	A
Pulse Screen Current (Approx)	2·0	A
Pulse Grid Current (Approx)	0·2	A
Pulse Input Power	225	kW
Pulse Output Power	205	kW

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NOTES

1. To keep the anode seal at a safe temperature, it is necessary to use an anode connector with good heat dissipation characteristics. The use of a spring type connector is recommended; where a connector using grub screw clamping is employed, care must be taken to avoid overtightening the screw or applying excessive side thrust to the top cap.
2. For the pulse current given under maximum ratings, the duty cycle must not exceed 0·001. At higher duty cycles the pulse current must be reduced in proportion. For pulse currents exceeding 5·0A, the product of pulse current in amperes and pulse duration in microseconds must not exceed 40 and the valve must not be operated for longer than 5 microseconds in any 100 microsecond interval. For pulse currents of less than 5·0A, the anode dissipation of 60W determines the permissible pulse length.
3. Occasional internal discharges may occur during operational life. The power in such discharges should be limited and it is recommended that a series resistor should be included in the anode circuit to limit the short circuit current to 500mA or less. A resistor of about 100Ω value should be connected in series with the screen as close to the pin of the valve as possible. A 0·5μF by-pass capacitor should be connected between the supply side of the 100Ω resistor and earth.
4. The screen grid decoupling resistance must not be less than 20kΩ.
5. The total resistance of the control grid circuit must not exceed 0·1MΩ.
6. The rating specified for pulse anode current refers to the maximum amplitude of the flat portion of the pulse following an initial spike on the leading edge which must not exceed 20A.
7. The valve will withstand vibration at 5g from 30 to 1500c/s for short periods but it should not be operated continuously under these conditions.

X-RAY WARNING

X-rays are produced when the C1150/1 is operated with a peak anode voltage above 16kV (absolute value). These rays can constitute a health hazard unless the valve is adequately shielded for X-ray radiation.

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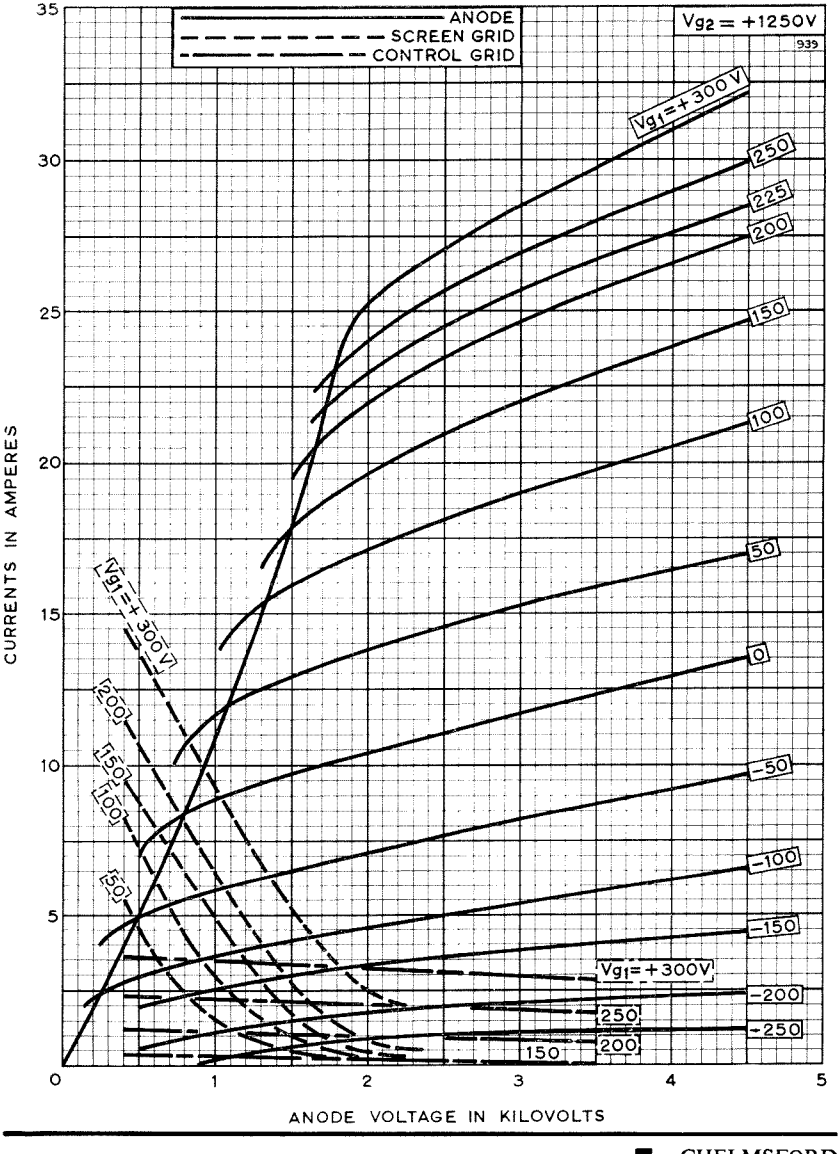
ANODE AND GRID CHARACTERISTICS



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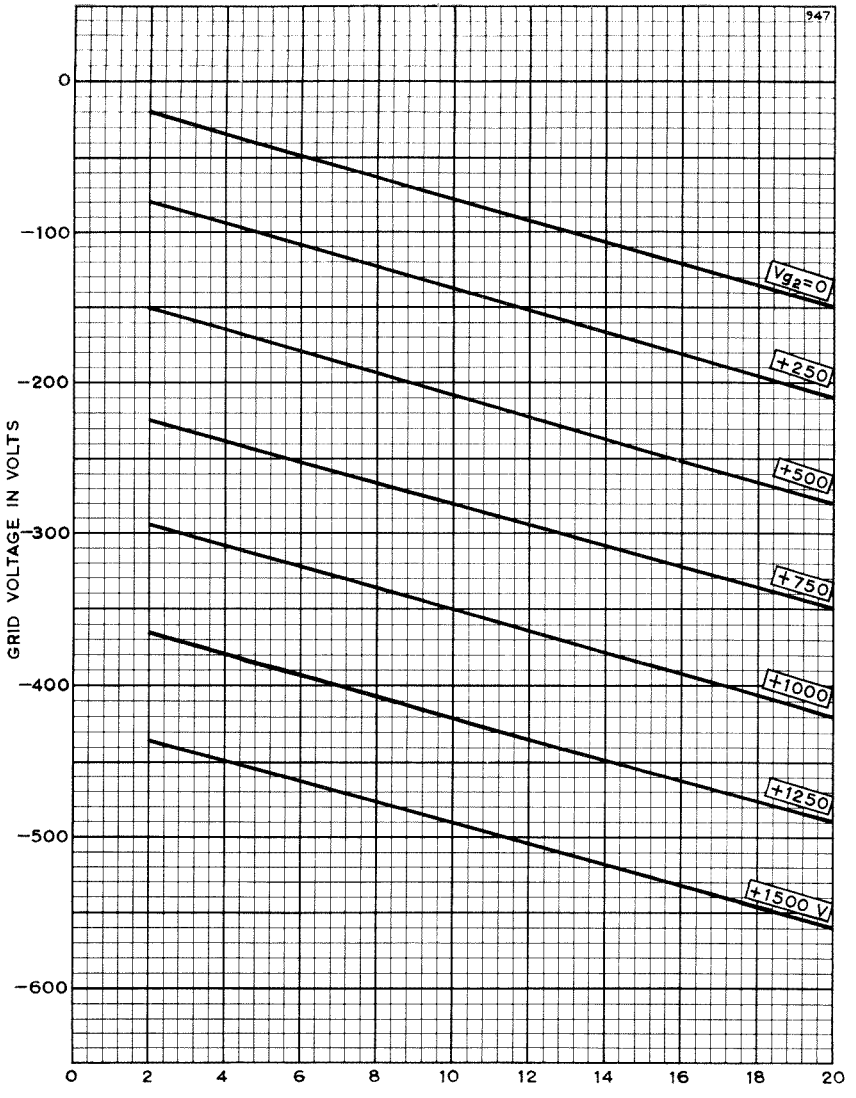
ANODE CURRENT CUT-OFF (500μA) CHARACTERISTICS



To allow for variations between valves and to cover changes during life, it is suggested that the working bias voltage should be 20% in excess of that shown on the curve.

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OUTLINE

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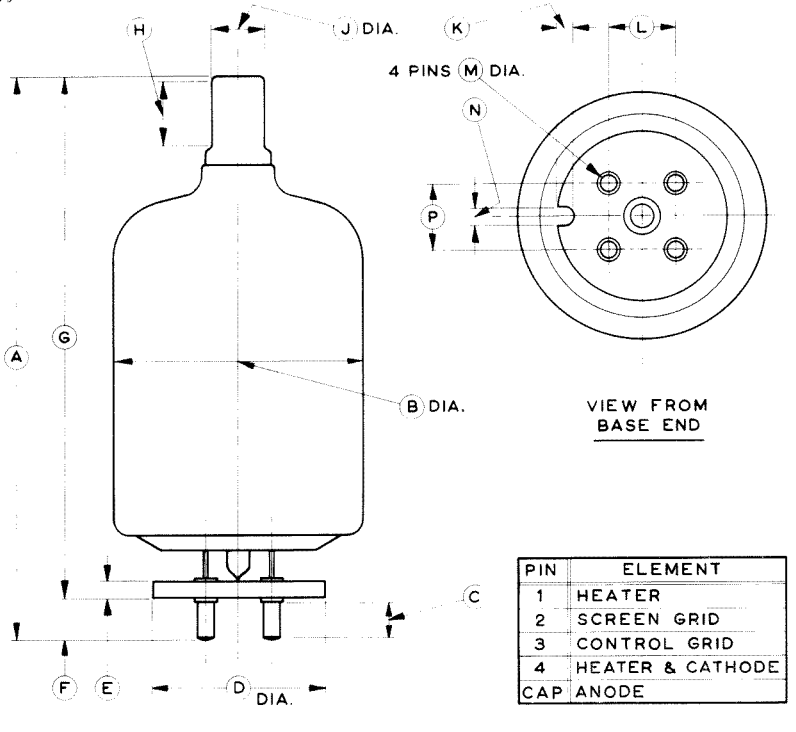

PIN	ELEMENT
1	HEATER
2	SCREEN GRID
3	CONTROL GRID
4	HEATER & CATHODE
CAP	ANODE

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	5·875 ± 0·125	149·23 ± 3·18	H	0·437 Min	11·10 Min
B	2·598 Max	65·99 Max	J	0·567	14·40
C	0·328 Min	8·33 Min	K	0·187	4·75
D	1·813 Max	46·05 Max	L	0·687	17·45
E	0·187	4·75	M	0·187 ± 0·004	4·750 ± 0·102
F	0·500 Max	12·70 Max	N	0·187	4·75
G	5·469 ± 0·125	138·91 ± 3·18	P	0·687	17·45

Millimetre dimensions have been derived from inches.

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POWER TETRODE

C1158

Service Type CV6045 **JEDEC Designation 7972**

INTRODUCTION

The C1158 is a low impedance beam tetrode intended for use in d.c. control equipment. It may be triode connected and is suitable for pulse operation.

GENERAL DATA

Electrical

Cathode	Indirectly Heated, Oxide Coated		
	Parallel Operation	*Series Operation*	
Heater Voltage	13	26	V
Heater Current	2·6	1·3	A
Mutual Conductance (Triode connected) (V_a = 150V, I_a = 0·5A)	35		mA/V
Amplification Factor (Triode connected) (V_a = 150V, I_a = 0·5A)	4·5		
Anode Resistance (Triode connected) (V_a = 150V, I_a = 0·5A)	130		Ω
Inter-electrode Capacitances:			
Grid to Anode	1·3		pF
Input	56		pF
Output	20·4		pF

Mechanical

Overall Length	5·395 inches	(137 mm)	Max
Overall Diameter	2·560 inches	(65 mm)	Max
Net Weight	6 ounces	(170 g)	Approx
Base			B.S.448-B7A
Mounting Position			Vertical

COOLING

Natural cooling is normally adequate but the bulb and base temperatures must not exceed the values given below:

Bulb Temperature	200	°C←
Base Temperature	150	°C←

← Indicates a change

ENGLISH ELECTRIC VALVE CO. LTD. CHELMSFORD ENGLAND

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MAXIMUM RATINGS
(Absolute Values)

D.C. Ratings

Anode Voltage	800	V Max
Anode Dissipation	90	W Max
Anode and Screen Dissipation (Triode connected)	95	W Max
Screen Voltage	300	V Max
Screen Dissipation	10	W Max
Grid Voltage (negative)	100	V Max
Grid Dissipation	1·0	W Max
Cathode Current	800	mA Max
Heater to Cathode Voltage (heater negative)	300	V Max

Pulse Ratings

Anode Voltage (Peak)	1500	V Max
Cathode Current (Peak)	5·0	A Max
Duty Cycle (Averaging time 100μsec)	0·05	Max
Product of Peak Current and Pulse Length (for peak currents exceeding 2·0A)	10	A.μsec Max

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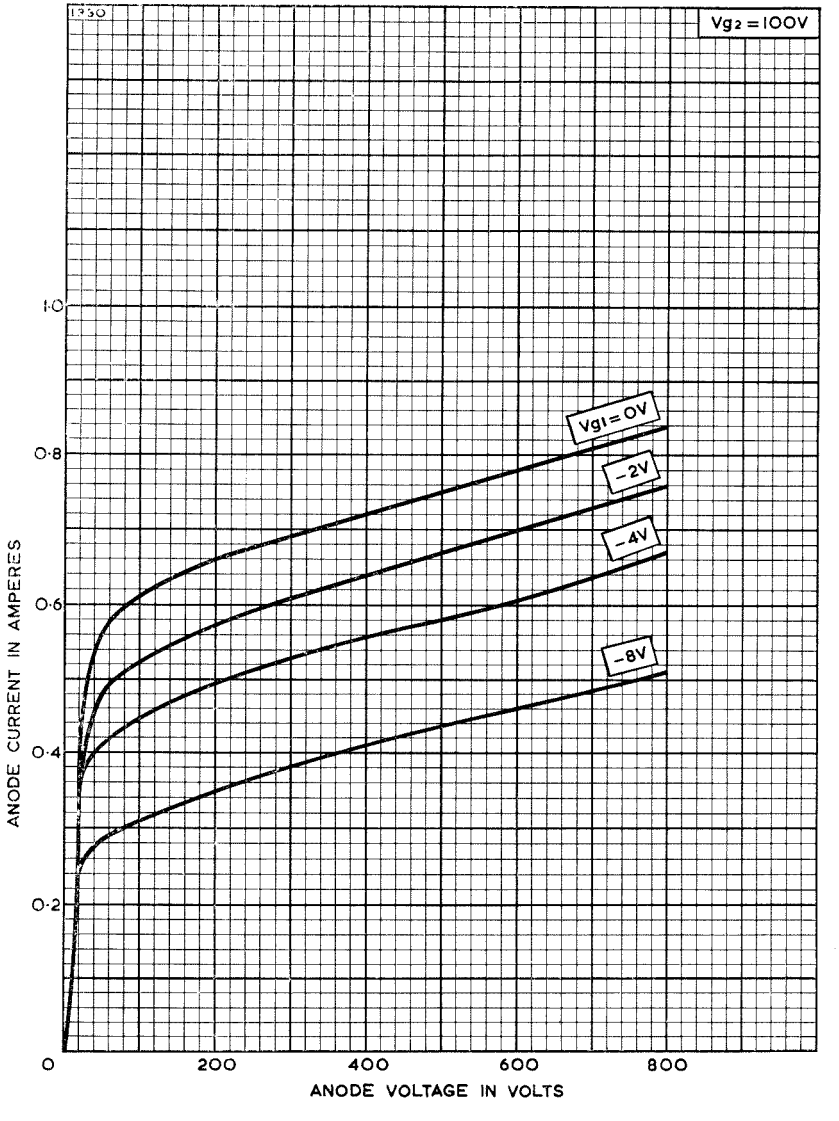
ANODE CURRENT—ANODE VOLTAGE CHARACTERISTICS



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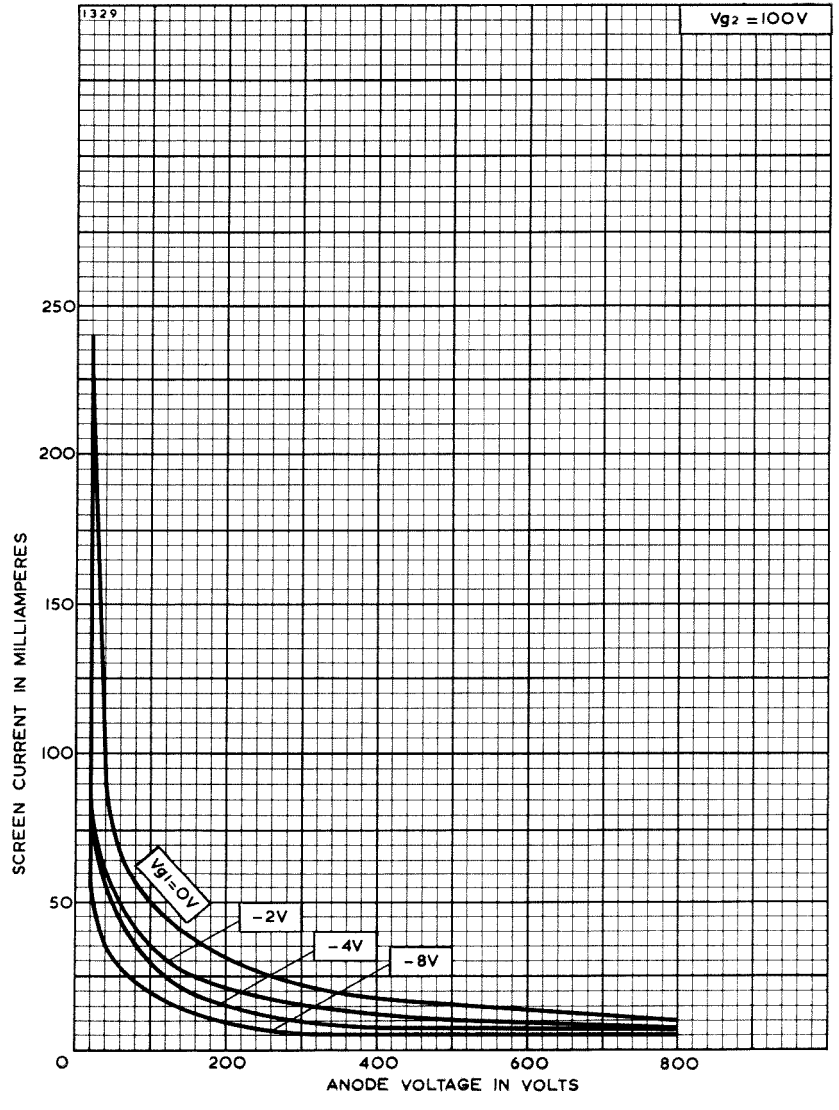
SCREEN CURRENT—ANODE VOLTAGE CHARACTERISTICS



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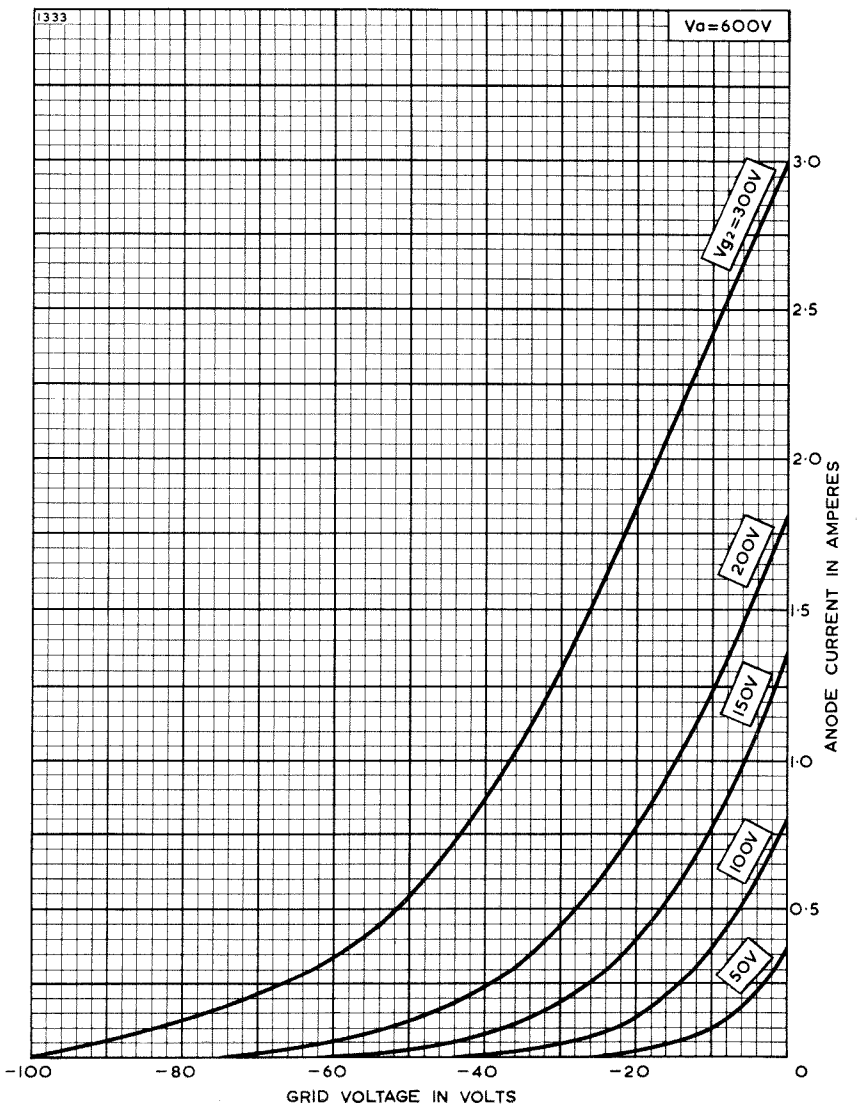
ANODE CURRENT—GRID VOLTAGE CHARACTERISTICS



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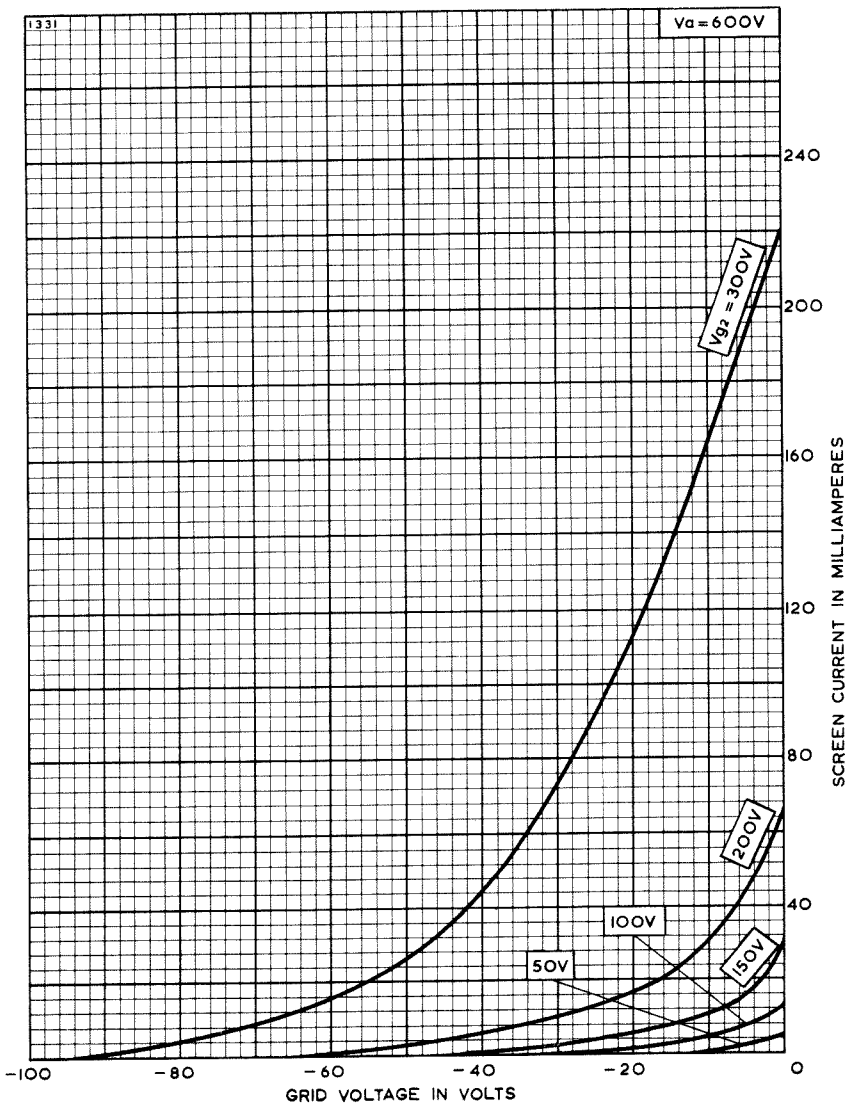
SCREEN CURRENT—GRID VOLTAGE CHARACTERISTICS



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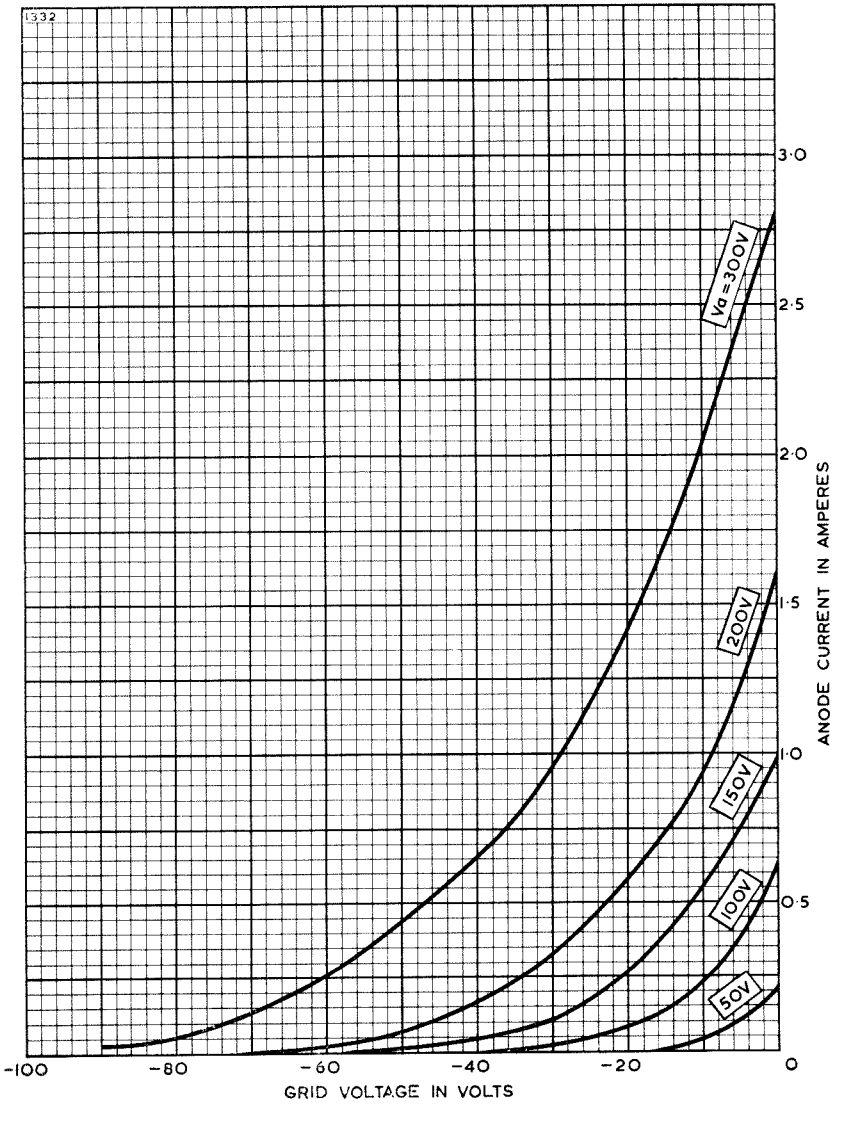
TRIODE CHARACTERISTICS



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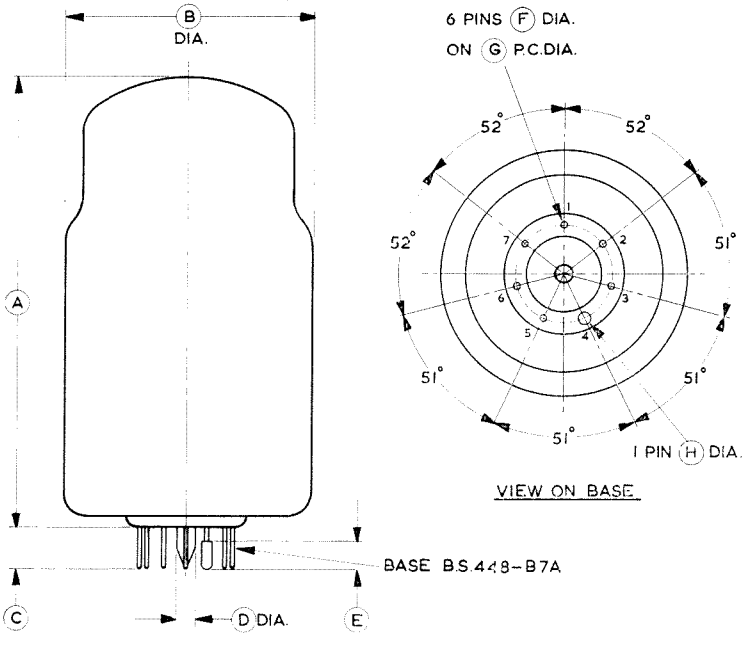
OUTLINE

1252



Ref.	Inches	Millimetres
A*	4·724	120·0
B*	2·560	65·00
C	0·437 ± 0·062	11·10 ± 1·58
D	0·276 Max	7·01 Max
E	0·312	7·93
F	0·060	1·52
G	1·000	25·40
H	0·125	3·18

Pin	Element
1	Heater
2	Heater Centre Tap
3	Grid 1
4	Cathode
5	Grid 2
6	Anode
7	Heater

Millimetre dimensions have been derived from inches except where indicated thus*

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

PULSE AMPLIFIER TETRODE

C1166

ENGLISH ELECTRIC

ABRIDGED DATA

High vacuum, radial beam Tetrode of rugged construction, designed primarily for the output stage of power amplifier pulse modulators.

Anode Voltage	17·5 kV	Max
Pulse Anode Current	15 A	Max
Duty Cycle (at 15A peak anode current)	0·001	Max
Typical Pulse Output Power	205 kW	

GENERAL

Electrical

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage	6·3	V
Heater Current	9·0	A
Cathode Heating Time (Minimum)	3·5	minutes
Inter-electrode Capacitances:		
Grid to Anode	0·43	pF
Input	42·0	pF
Output	6·8	pF

Mechanical

Overall Length	5·750 inches	(146·1 mm)	Max
Overall Diameter	2·625 inches	(66·68 mm)	Max
Net Weight	9 ounces	(255 gm)	Approx
Base			B.S.448–B5F
Top Cap			(*See Note* 1)
Mounting Position			Any
Cooling (*See Note* 1)			Natural

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
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Printed in England

ENGLISH ELECTRIC

PULSE MODULATOR SERVICE

MAXIMUM RATINGS
(Absolute Values)

Duty Cycle	(*See Note* 2)
Anode Voltage (*See Note* 3)	17·5 kV Max
Screen Voltage (*See Notes* 3 *and* 4)	1·5 kV Max
Grid Voltage (*See Note* 5)	−1·0 kV Max
Peak Positive Grid Voltage	300 V Max
Pulse Anode Current (*See Notes* 2 *and* 6)	15 A Max
Peak Anode Voltage	20 kV Max
Anode Dissipation	60 W Max
Screen Dissipation	8·0 W Max
Seal Temperature (*See Note* 1)	200 °C Max
Vibration	(*See Note* 7)

TYPICAL OPERATING CONDITIONS

Duty Cycle (*See Note* 2)	0·001	
Pulse Length	2·0	μsec
Anode Voltage	15	kV
Screen Voltage	1·25	kV
Grid Voltage	−600	V
Pulse Positive Grid Voltage	100	V
Pulse Anode Current	15	A
Pulse Screen Current	2·0	A
Pulse Grid Current (Approx)	0·2	A
Pulse Input Power	225	kW
Pulse Output Power	205	kW

NOTES

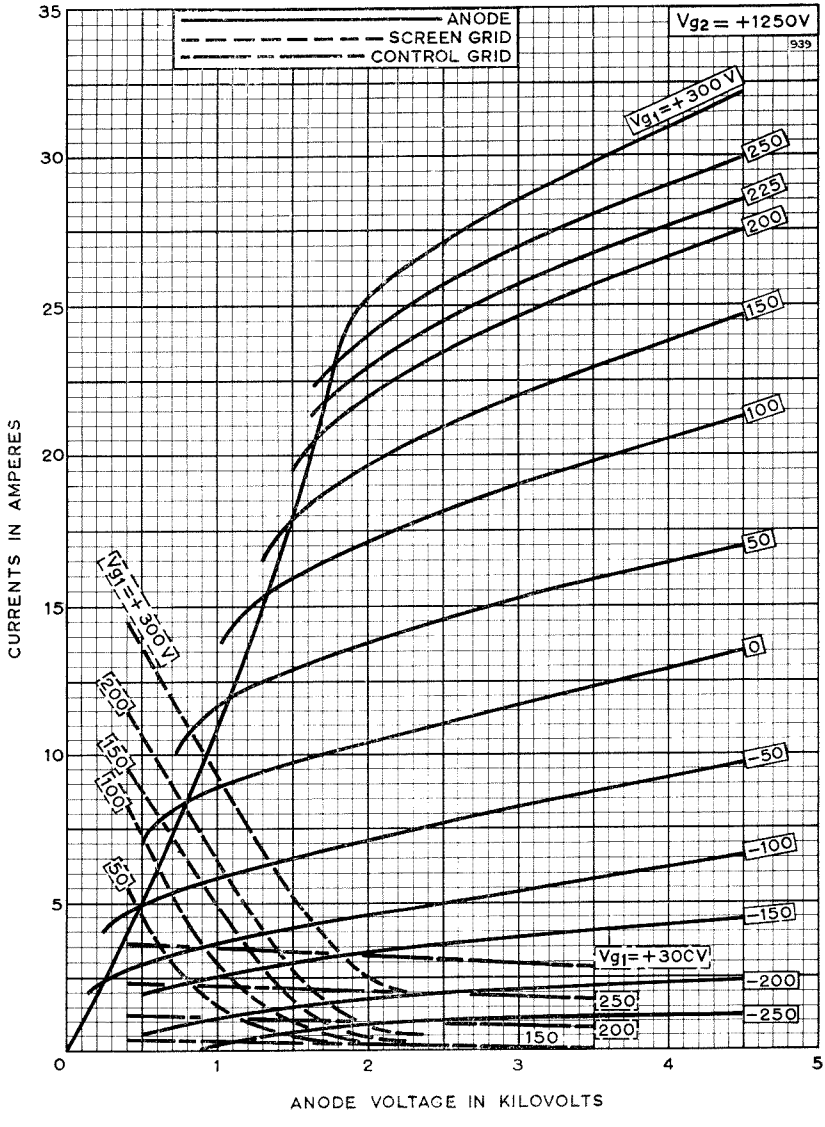
1. To keep the anode seal at a safe temperature, it is necessary to use an anode connector with good heat dissipation characteristics. The use of a spring type connector is recommended; where a connector using grub screw clamping is employed, care must be taken to avoid overtightening the screw or applying excessive side thrust to the top cap.
2. For the pulse current given under maximum ratings, the duty cycle must not exceed 0·001. At higher duty cycles the pulse current must be reduced in proportion. For pulse currents exceeding 5·0A, the product of pulse current in amperes and pulse duration in microseconds must not exceed 40 and the valve must not be operated for longer than 5 microseconds in any 100 microsecond interval. For pulse currents of less than 5·0A, the anode dissipation of 60W determines the permissible pulse length.
3. Occasional internal discharges may occur during operational life. The power in such discharges should be limited and it is recommended that a series resistor should be included in the anode circuit to limit the short circuit current to 500mA or less. A resistor of about 100Ω value should be connected in series with the screen as close to the pin of the valve as possible. A 0·5μF by-pass capacitor should be connected between the supply side of the 100Ω resistor and earth.
4. The screen grid decoupling resistance must not be less than 20kΩ.
5. The total resistance of the control grid circuit must not exceed 0·1MΩ.
6. The rating specified for pulse anode current refers to the maximum amplitude of the flat portion of the pulse following an initial spike on the leading edge which must not exceed 20A.
7. The valve will withstand vibration at 5g from 30 to 1500c/s for short periods but it should not be operated continuously under these conditions.

X-RAY WARNING

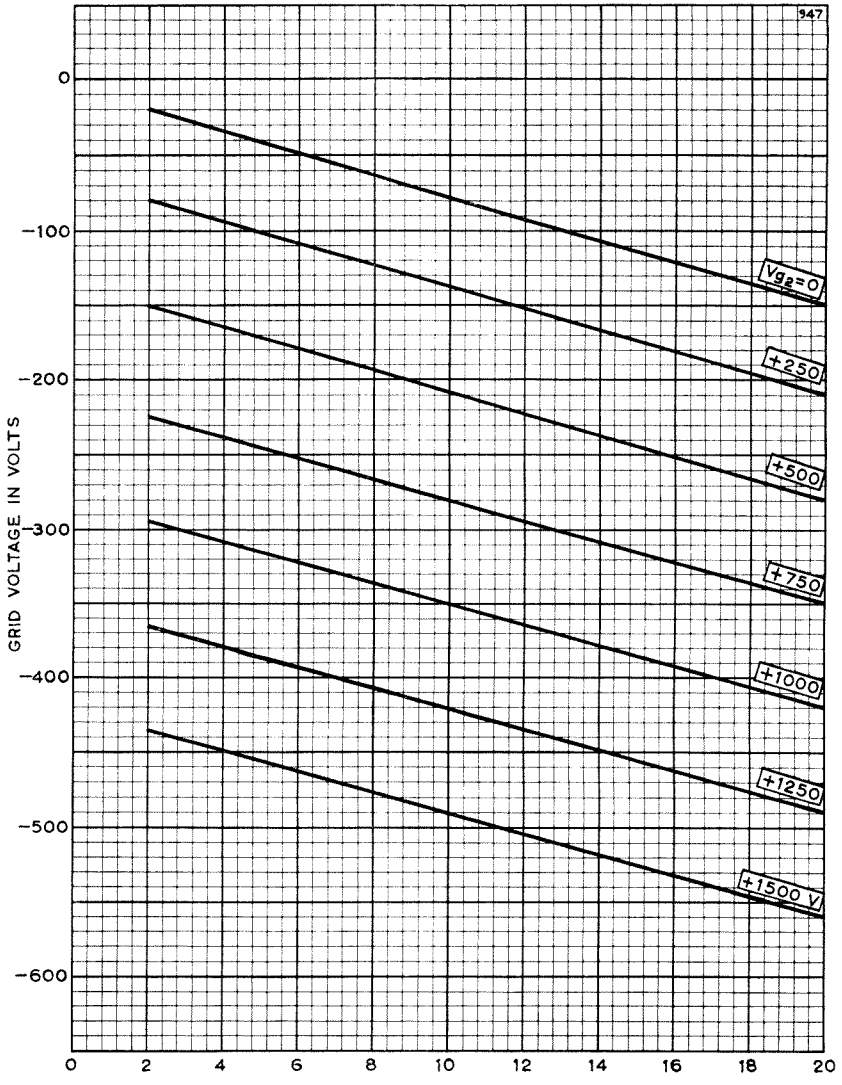
X-rays are produced when the C1166 is operated with a peak anode voltage above 16kV (absolute value). These rays can constitute a health hazard unless the valve is adequately shielded for X-ray radiation.

ENGLISH ELECTRIC

ANODE AND GRID CHARACTERISTICS



ANODE CURRENT CUT-OFF (1·0mA) CHARACTERISTICS



To allow for variations between valves and to cover changes during life, it is suggested that the working bias voltage should be 20% in excess of that shown on the curve.

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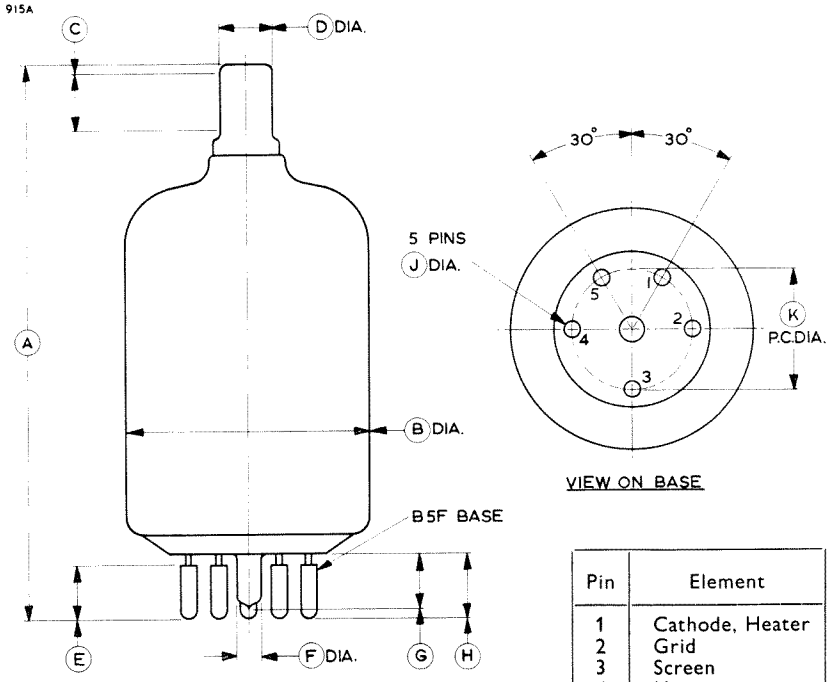
ENGLISH ELECTRIC

OUTLINE



Pin	Element
1	Cathode, Heater
2	Grid
3	Screen
4	Heater
5	Grid
Cap	Anode

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	5·750 Max	146·1 Max	F	0·275 Max	6·99 Max
B	2·625 Max	66·68 Max	G	0·590 Max	14·99 Max
C	0·600 Min	15·24 Min	H	0·670 ± 0·020	17·02 ± 0·51
D	0·567	14·40	J	0·187 ± 0·003	4·750 ± 0·076
E	0·591 ± 0·007	15·01 ± 0·18	K	1·250	31·75

Millimetre dimensions have been derived from inches.

Printed in England

Forced-air Cooled Tetrodes

September 1965

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

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R.F. POWER TETRODES

4CX1000A 4CX1000K

ABRIDGED DATA

Forced-air Cooled Tetrodes, coaxial metal-ceramic envelope, for audio or linear single sideband amplifiers. 4CX1000K is similar to the 4CX1000A but has a solid disc screen contact to permit use up to 400MHz.

Anode Dissipation	1·0 kW Max
Anode Voltage	3·0 kV Max
Frequency for full ratings	110 MHz Max
Output Power (two valves, class AB1 audio)	3·26 kW

GENERAL

Electrical

Cathode	Indirectly Heated, Oxide Coated		
Heater Voltage (*See Note* 1):			
for operation at 30MHz	6·0		V
for operation at 110MHz	5·75		V
for operation at 400MHz	5·5		V
Heater Current at 6·0V	9·0		A
Cathode Heating Time (Minimum)	3·0		minutes
Mutual Conductance (I_a = 1·0 A)	37		mA/V

Inter-electrode Capacitances (in shielded fixture)

	Min	*Max*	
Grounded Cathode:			
Grid to Anode	—	0·022	pF
Input	77	90	pF
Output	11	13	pF
Grounded Grid and Screen:			
Cathode to Anode	—	0·004	pF
Input	32·5	38	pF
Output	11	13	pF

Mechanical

Overall Length	4·800 inches	(121·9 mm)	Max
Overall Diameter	3·365 inches	(85·47 mm)	Max
Net Weight	$1\frac{3}{4}$ pounds	(0·8 kg)	Approx
Mounting Position			Any

COOLING

Sufficient air must be passed through the radiator and over the ceramic to metal seals to maintain the temperatures below the maximum rated values of:

Anode Core	250	°C Max
Ceramic to Metal Seals	250	°C Max

For operation at sea level in an ambient temperature of 40°C and with an

anode dissipation of 1·0kW, an air flow of 25ft³/min (0·71m³/min), corresponding to a pressure drop across the valve of 0·2 inch (0·51cm) of water, is adequate. At an altitude of 10 000 feet (3·05km) a flow of 37ft³/min (1·05 m³/min), corresponding to a pressure drop across the valve of 0·3 inch (0·76cm) of water, is necessary.

The air flow should be maintained during standby periods when only the heater voltage is applied to the tube.

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR
(Class AB1 – See Note 2)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	3·0	kV Max
Anode Current	1·0	A Max
Anode Dissipation	1·0	kW Max
Screen Voltage	400	V Max
Screen Dissipation	12	W Max
Grid Dissipation (*See Note* 3)	0	W Max

TYPICAL OPERATING CONDITIONS
(Class AB1, two valves)

Anode Voltage (*See Note* 4)	2·0	2·5	3·0	kV
Screen Voltage (*See Note* 5)	325	325	325	V
Grid Voltage (*See Note* 6)	−60	−60	−60	V
Anode Current (Zero Signal)	500	500	500	mA
Anode Current (Maximum Signal)	1·78	1·77	1·75	A
Screen Current (Zero Signal) (Approx)	16	12	10	mA
Screen Current (Maximum Signal) (Approx)	70	70	70	mA
Effective Load (Anode to Anode)	2·04	2·85	3·68	kΩ
Nominal Driving Power (Maximum Signal)	0	0	0	W
Output Power (Maximum Signal)	1·86	2·60	3·26	kW

Printed in England

RADIO FREQUENCY LINEAR AMPLIFIER

(Class AB1 – See Note 2)
(Single Side-band Suppressed Carrier Operation)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	3·0	kV Max
Anode Current	1·0	A Max
Anode Dissipation	1·0	kW Max
Screen Voltage	400	V Max
Screen Dissipation	12	W Max
Grid Dissipation (*See Note* 3)	0	W Max

TYPICAL OPERATING CONDITIONS
(at frequencies below 30MHz)

Anode Voltage (*See Note* 4)	2·0	2·5	3·0	kV
Screen Voltage (*See Note* 5)	325	325	325	V
Grid Voltage (*See Note* 6)	−60	−60	−60	V
Anode Current:				
Zero Signal	250	250	250	mA
Single Tone	890	885	875	mA
Two Tone (average)	645	650	635	mA
Screen Current (approx):				
Zero Signal	8·0	6·0	5·0	mA
Single Tone	35	35	35	mA
Two Tone (average)	10	8·0	8·0	mA
Output Power	0·93	1·30	1·63	kW

NOTES

1. The valve must be operated at the stated heater voltage. Fluctuation in heater voltage must not exceed ±5%.
2. Grid current does not flow during any part of the cycle.
3. The grid dissipation rating is zero and positive grid operation must be avoided. Peak grid currents of less than 5·0mA may be permitted to flow for peak signal monitoring purposes. Under certain conditions the negative grid current may rise to as much as 1·0mA and for this reason the grid circuit impedance must not exceed 2·0kΩ in the absence of a cathode resistor. ←
4. The anode voltage must not be less than twice the screen voltage at the bottom of the anode voltage swing. ←
5. Positive or negative screen currents of the order of 30mA may flow under certain operating conditions. The screen voltage must be maintained constant for any positive or negative values of screen current that may flow. ←
6. Adjusted to give the specified zero signal anode current.

← Indicates a change

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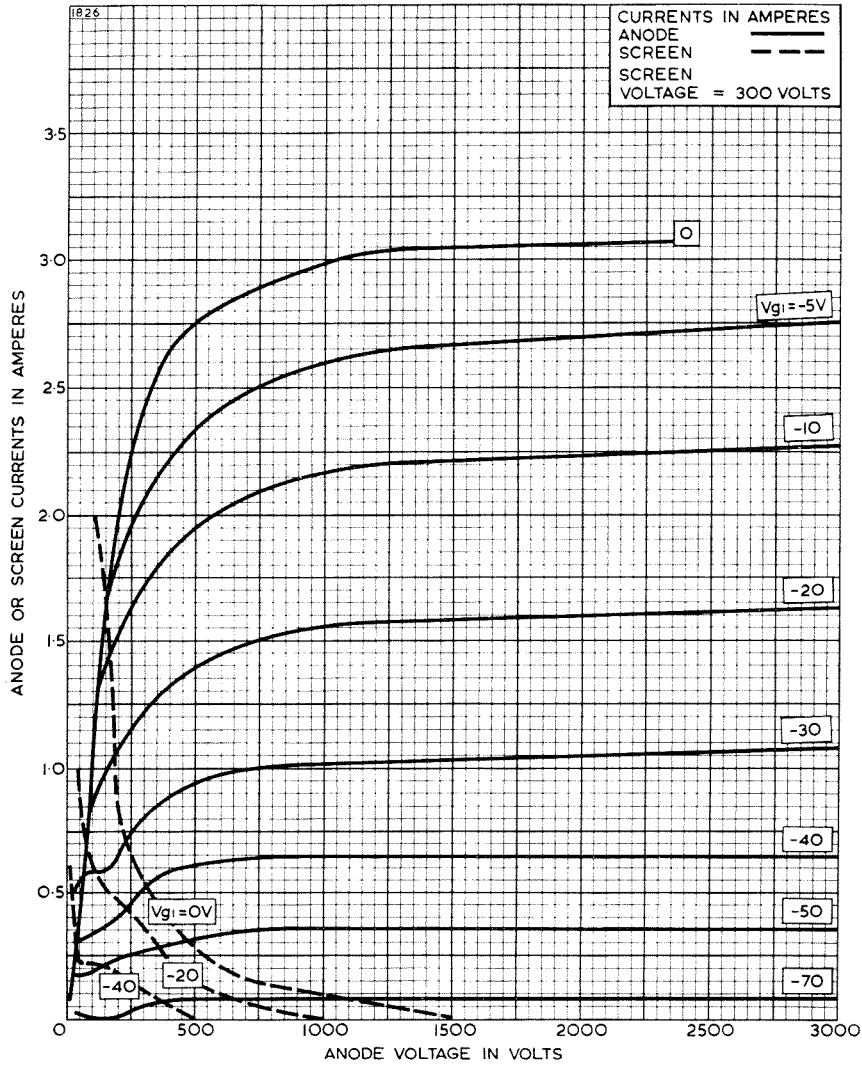
ANODE AND SCREEN CHARACTERISTICS



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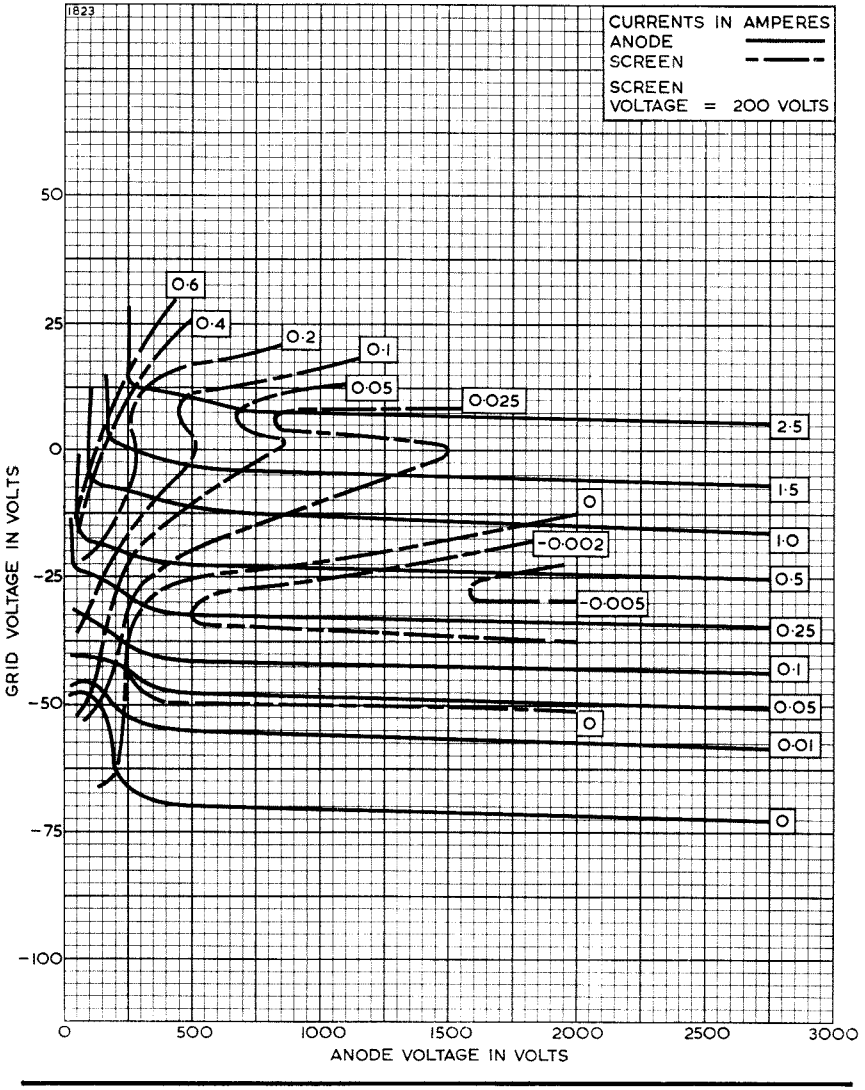
CONSTANT CURRENT CHARACTERISTICS



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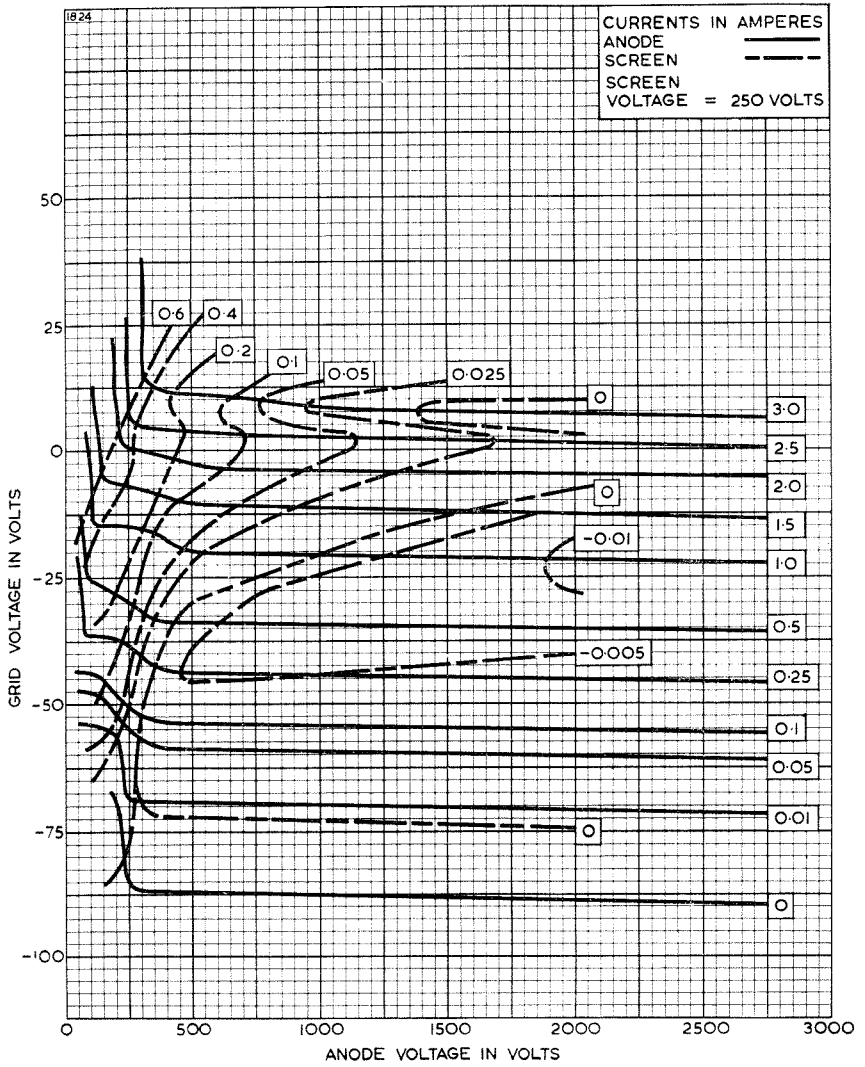
CONSTANT CURRENT CHARACTERISTICS



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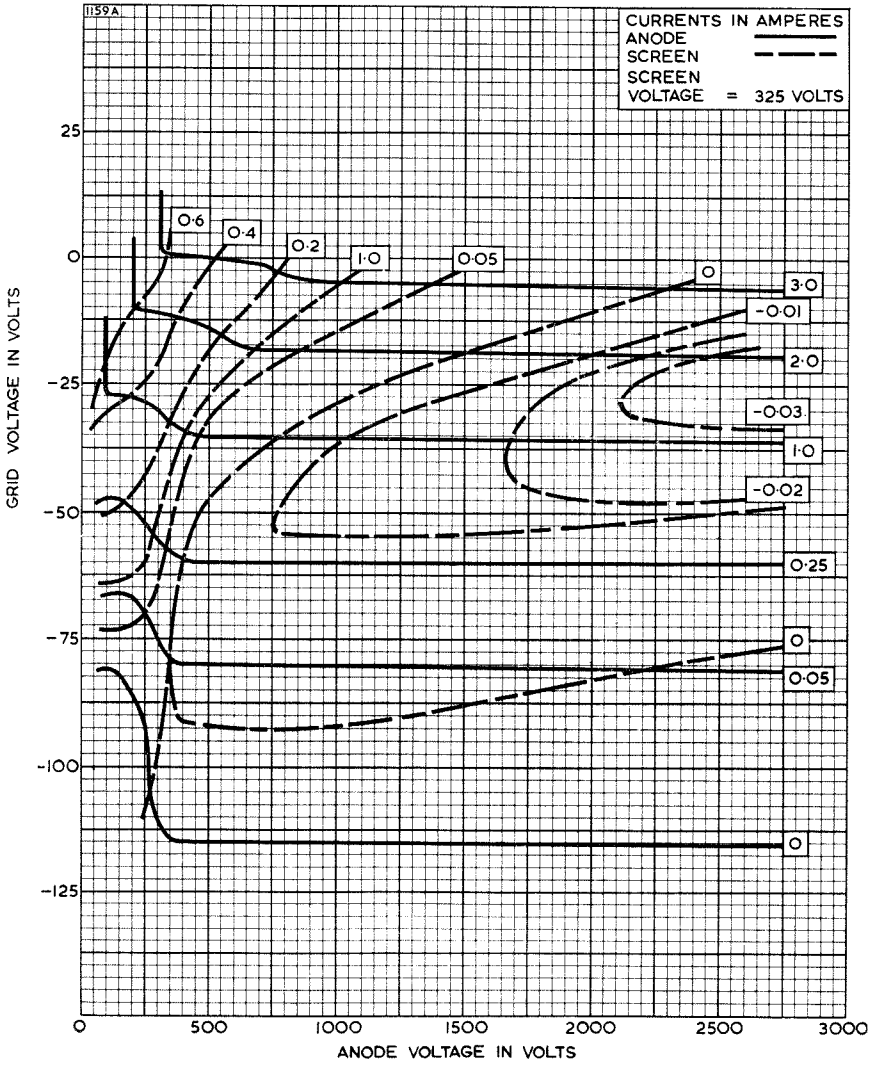
CONSTANT CURRENT CHARACTERISTICS



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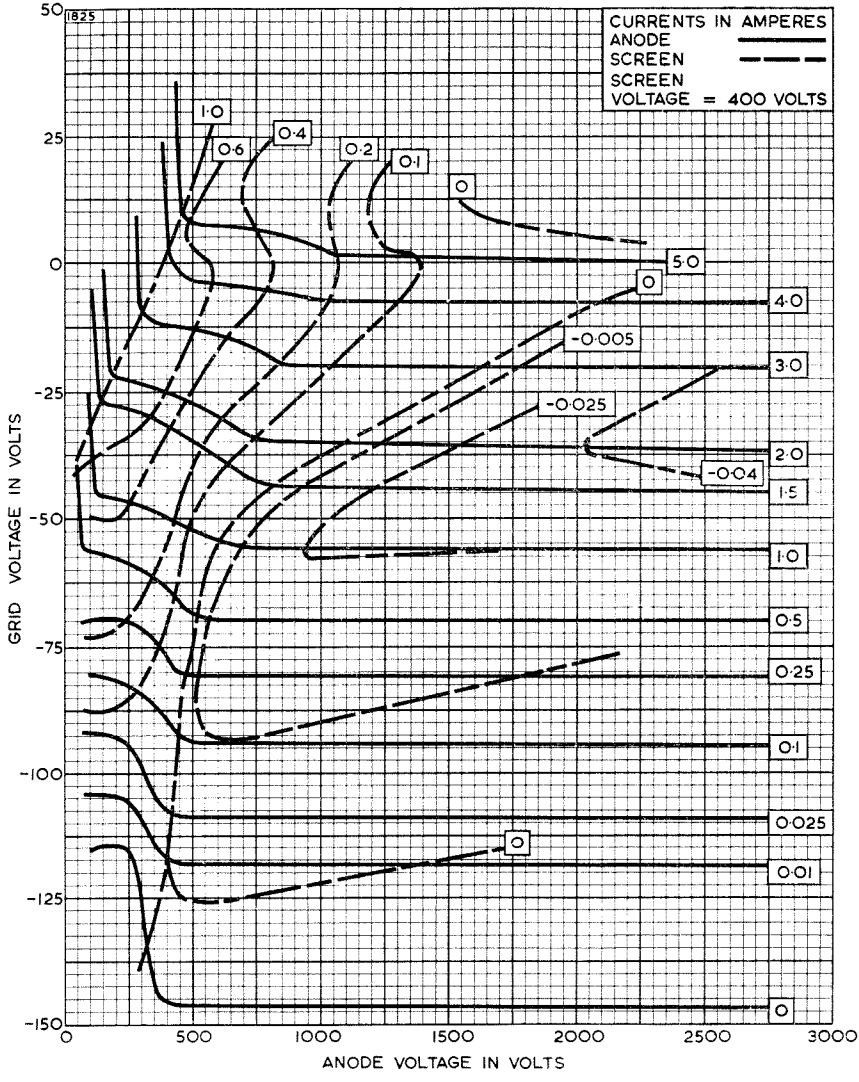
CONSTANT CURRENT CHARACTERISTICS



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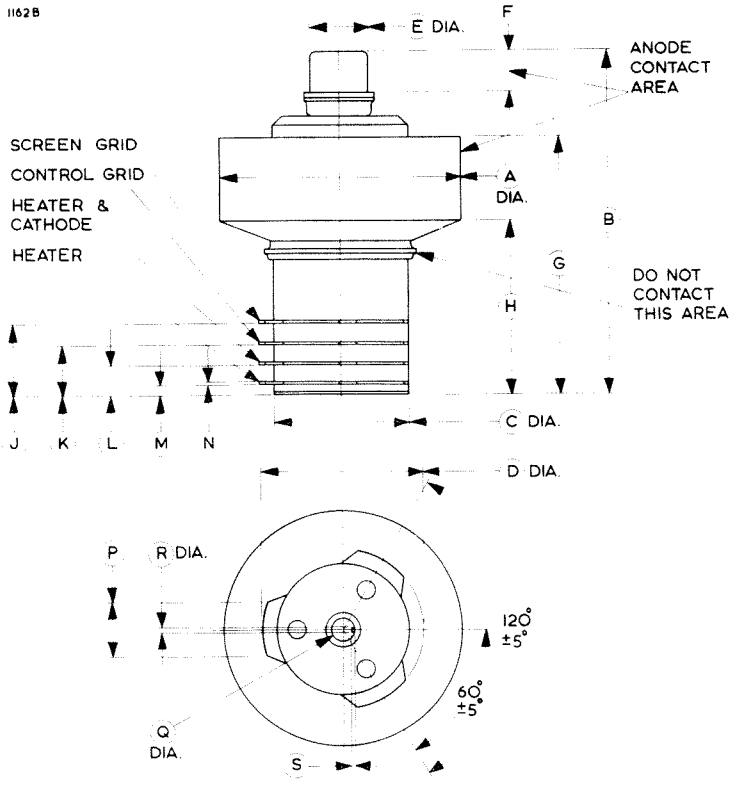
OUTLINE FOR 4CX1000A



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	3·365 Max	85·47 Max	K	0·700 ± 0·025	17·78 ± 0·64
B	4·800 Max	121·9 Max	L	0·425 ± 0·025	10·80 ± 0·64
C	1·885 ± 0·015	47·88 ± 0·38	M	0·155 ± 0·015	3·94 ± 0·38
D	2·275 ± 0·025	57·78 ± 0·64	N	0·025 ± 0·005	0·64 ± 0·13
E	0·812 ± 0·005	20·62 ± 0·13	P	0·750	19·05
F	0·578	14·68	Q	0·320 ± 0·006	8·13 ± 0·15
G	3·550 Max	90·17 Max	R	0·065 ± 0·008	1·65 ± 0·20
H	2·380 Max	60·45 Max	S	0·033 ± 0·010	0·84 ± 0·25
J	0·975 ± 0·025	24·77 ± 0·64			

Millimetre dimensions have been derived from inches.

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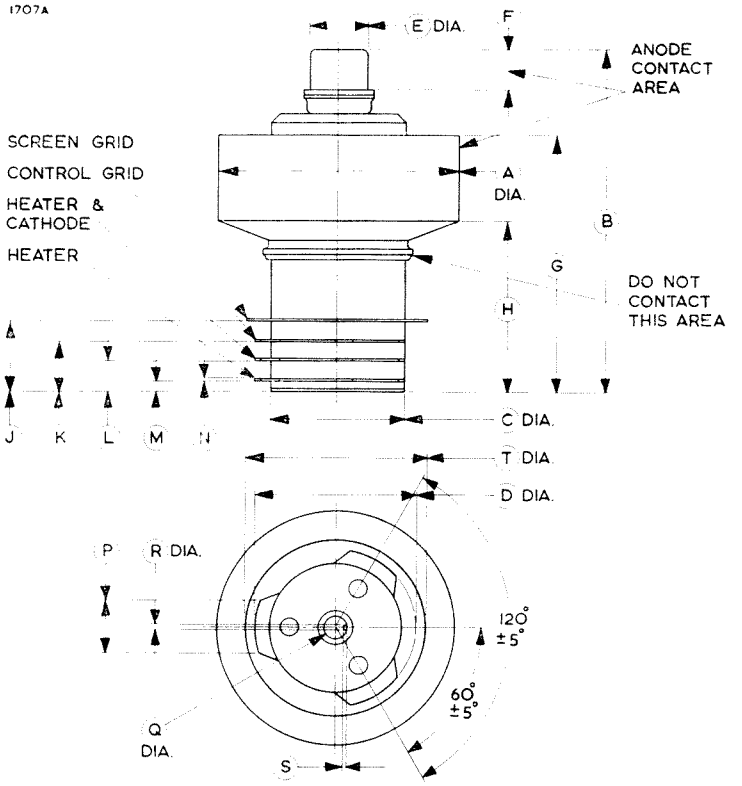
OUTLINE FOR 4CX1000K



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	3·365 Max	85·47 Max	K	0·700 ± 0·025	17·78 ± 0·64
B	4·800 Max	121·9 Max	L	0·425 ± 0·025	10·80 ± 0·64
C	1·885 ± 0·015	47·88 ± 0·38	M	0·155 ± 0·015	3·94 ± 0·38
D	2·275 ± 0·025	57·78 ± 0·64	N	0·025 ± 0·005	0·64 ± 0·13
E	0·812 ± 0·005	20·62 ± 0·13	P	0·750	19·05
F	0·578	14·68	Q	0·320 ± 0·006	8·13 ± 0·15
G	3·550 Max	90·17 Max	R	0·065 ± 0·008	1·65 ± 0·20
H	2·380 Max	60·45 Max	S	0·033 ± 0·010	0·84 ± 0·25
J	0·975 ± 0·025	24·77 ± 0·64	T	2·531 Max	64·29 Max

Millimetre dimensions have been derived from inches.

Printed in England

4CX1500B

(8660)

R.F. POWER TETRODE

ABRIDGED DATA

Forced-air cooled tetrode, coaxial metal-ceramic envelope, for audio or r.f. linear single sideband amplifiers. It features exceptionally low intermodulation distortion and low grid interception.

Anode dissipation	1.5	kW max
Anode voltage	3.0	kV max
Output power (two valves, class AB1 audio)	2.77	kW

GENERAL

Electrical

Cathode		indirectly heated, oxide coated	
Heater voltage (see note 1)		6.0	V
Heater current		9.0	A
Cathode heating time (minimum)		3.0	minutes
Mutual conductance (I_a = 0.5A, V_{g2} = 225V)		30	mA/V
Inter-electrode capacitances (in shielded fixture)			
	Min	**Max**	
Grounded cathode:			
grid to anode	–	0.022	pF
input	77	90	pF
output	11	13	pF
Grounded grid and screen:			
cathode to anode	–	0.005	pF
input	35	41	pF
output	11	13	pF

Mechanical

Overall length	4.800 inches (121.9mm) max
Overall diameter	3.365 inches (85.47mm) max
Net weight	1¾ pounds (0.8kg) approx
Mounting position	any

COOLING

Sufficient air must be passed through the radiator and over the ceramic to metal seals to maintain the temperatures below the maximum rated values of:

Anode core	250	°C max
Ceramic to metal seals	250	°C max

Air flow requirements to maintain the seal temperatures at 225°C with an ambient temperature of 50°C and operating frequency less than 30MHz are given below. The figures specified take into account the grid and heater dissipations.

Anode dissipation (kW)	Sea level		6000 feet	
	Air flow (ft^3/min)	Pressure drop (in. water gauge)	Air flow (ft^3/min)	Pressure drop (in. water gauge)
1.0	22	0.2	26	0.25
1.5	39	0.5	49	0.63

At other altitudes and ambient temperatures, the air flow must be adjusted to give equivalent cooling.

The air flow should be maintained during standby periods when only the heater voltage is applied to the tube.

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR
(Class AB1 - See Note 2)

MAXIMUM RATINGS (Absolute values)

Anode voltage	3.0	kV max
Anode current	0.9	A max
Anode dissipation	1.5	kW max
Screen voltage	400	V max
Screen dissipation	12	W max
Grid dissipation	1.0	W max

TYPICAL OPERATING CONDITIONS
(Class AB1, two valves)

Anode voltage (see note 3)	2.0	2.5	2.9	kV
Screen voltage (see note 4)	325	325	325	V
Grid voltage (see note 5)	−60	−60	−60	V
Anode current (zero signal)	500	500	500	mA
Anode current (maximum signal)	1.68	1.69	1.69	A
Screen current (zero signal)(approx)	−30	−25	−20	mA
Screen current (maximum signal) (approx)	−27	−33	−32	mA
Effective load (anode to anode)	1.95	2.72	3.33	kΩ
Nominal driving power (maximum signal)	0	0	0	W
Output power (maximum signal)	1.60	2.26	2.77	kW

RADIO FREQUENCY LINEAR AMPLIFIER
(Class AB)

MAXIMUM RATINGS (Absolute values)

Anode voltage	3.0	kV max
Anode current	0.9	A max
Anode dissipation	1.5	kW max
Screen voltage	400	V max
Screen dissipation	12	W max
Grid dissipation	1.0	W max

TYPICAL OPERATING CONDITIONS
(at frequencies below 30MHz)

Anode voltage (see note 3)	2.5	2.75	2.9	kV
Screen voltage (see note 4)	225	225	225	V
Grid voltage (see note 5)	−34	−34	−34	V
Peak r.f. grid voltage	46	45	41	V
Anode current:				
zero signal	300	300	300	mA
single tone	720	755	710	mA
two tone	530	555	542	mA
Screen current (approx):				
single tone	−7.0	−14	−15	mA
two tone	−11	−11	−11	mA
Grid current:				
single tone	1.3	0.95	0.53	mA
two tone	0.06	0.20	0.06	mA
Driving power (see note 6)	1.5	1.5	1.5	W
Output power	0.9	1.1	1.1	kW

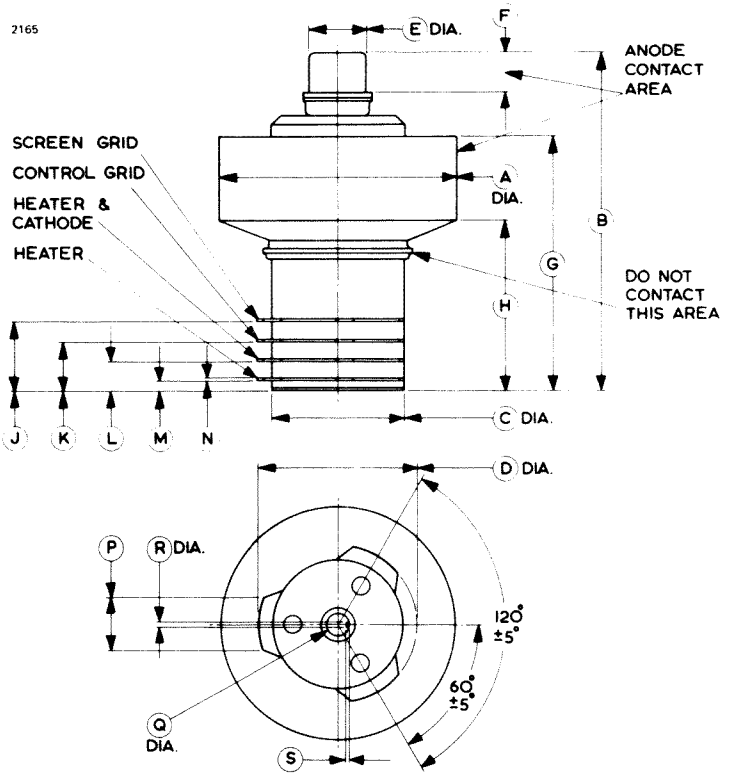
NOTES

1. The valve must be operated at the stated heater voltage. Fluctuation in heater voltage must not exceed ±5%.
2. Grid current does not flow during any part of the cycle.
3. The anode voltage must not be less than twice the screen voltage at the bottom of the anode voltage swing.
4. Positive or negative screen currents of the order of 35mA may flow under certain operating conditions. The screen voltage must be maintained constant for any positive or negative values of screen current that may flow.
5. Adjusted to give the specified zero signal anode current.
6. The driving power specified includes the dissipation in a 1000Ω resistor connected between the control grid and cathode.

CONSTANT CURRENT CHARACTERISTICS

CONSTANT CURRENT CHARACTERISTICS

OUTLINE



Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	3.365 max	85.47 max	K	0.700 ± 0.025	17.78 ± 0.64
B	4.800 max	121.9 max	L	0.425 ± 0.025	10.80 ± 0.64
C	1.885 ± 0.015	47.88 ± 0.38	M	0.155 ± 0.015	3.94 ± 0.38
D	2.275 ± 0.025	57.78 ± 0.64	N	0.025 ± 0.005	0.64 ± 0.13
E	0.812 ± 0.005	20.62 ± 0.13	P	0.750	19.05
F	0.578	14.68	Q	0.320 ± 0.006	8.13 ± 0.15
G	3.550 max	90.17 max	R	0.065 ± 0.008	1.65 ± 0.20
H	2.380 max	60.45 max	S	0.033 ± 0.010	0.84 ± 0.25
J	0.975 ± 0.025	24.77 ± 0.64			

Millimetre dimensions have been derived from inches.

R.F. POWER TETRODE

4CX5000A

American Designation 4CX5000A

ABRIDGED DATA

Forced-air Cooled Tetrode, coaxial metal-ceramic envelope, for audio, linear single sideband or screen-modulated r.f. amplifiers.

Anode Dissipation (Class C Telegraphy)	5·0	kW Max
Anode Voltage	7·5	kV Max
Frequency for full ratings	30	Mc/s Max
Frequency at reduced ratings	110	Mc/s Max
Output Power (Class C Telegraphy)	16	kW

GENERAL

Electrical

Filament	Thoriated Tungsten		
Filament Voltage (*See Note* 1)	7·5		V
Filament Current	75		A
Grid-Screen Amplification Factor (V_a = 2·0kV, V_{g2} = 750V, I_a = 1·0A)	4·5		
Inter-electrode Capacitances:	*Min*	*Max*	
Grounded Filament:			
Grid to Anode	—	1·0	pF
Input	108	122	pF
Output	18	23	pF
Grounded Grid and Screen:			
Filament to Anode	—	0·16	pF
Input	48	58	pF
Output	18	23	pF

Mechanical

Overall Length	9·125 inches (232 mm)	Max
Overall Diameter	4·940 inches (125·5mm)	Max
Net Weight	9·5 pounds (4·3 kg)	Approx
Mounting Position	Vertical, either way up	

COOLING

Sufficient air must be passed over the concentric base terminals and through the radiator fins to maintain the temperatures of the ceramic to metal seals and the radiator core below the maximum rated value of 250°C. It is recommended that an air distribution socket MA87 and chimney type MA104 be used with the tube (See pages 10, 11 and 12).

The air flows required with the recommended air socket and chimney to maintain the seal temperatures at 200°C in an ambient temperature of 50°C at sea level and with an operating frequency of less than 30Mc/s are given on page 2. At higher ambient temperatures, altitudes or frequencies the rate of

flow must be adjusted to give equivalent cooling and should be determined individually in each case. An allowance of 1000 watts for the power dissipated by the filament and grids has been made in the values given.

Anode Dissipation	Air Flow		Water Pressure Drop	
(kW)	cu.ft/min	cu.m/min	inches	mm
2·0	75	2·1	0·4	10·2
3·0	105	3·0	0·7	17·8
4·0	145	4·1	1·1	28
5·0	190	5·4	1·5	38
6·0	230	6·5	2·0	51

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

(Class AB1—*See Note* 2)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	7·5	kV Max
Anode Current	4·0	A Max
Anode Dissipation	6·0	kW Max
Screen Voltage	1·5	kV Max
Screen Dissipation	250	W Max
Grid Dissipation	75	W Max

TYPICAL OPERATING CONDITIONS

(Class AB1, two valves)

Anode Voltage	4·0	5·0	6·0	7·0	kV
Screen Voltage	1·25	1·25	1·25	1·25	kV
Grid Voltage	−270	−280	−310	−325	V
Peak A.F. Grid Voltage	250	240	270	235	V
Anode Current (Zero Signal)	1·25	1·00	0·83	0·70	A
Anode Current (Maximum Signal)	5·10	4·40	4·25	3·65	A
Screen Current (Zero Signal)	0	0	0	0	A
Screen Current (Maximum Signal)	0·35	0·33	0·30	0·24	A
Anode Dissipation (Maximum Signal)	4·2	4·2	4·2	4·2	kW
Effective Load (Anode to Anode)	1·5	2·37	2·94	4·10	kΩ
Nominal Driving Power (Maximum Signal)	0	0	0	0	W
Output Power (Maximum Signal)	11·5	13·5	17	17·5	kW

RADIO FREQUENCY LINEAR AMPLIFIER

(Class AB1—*See Note* 2)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	7·5	kV Max
Anode Current	4·0	A Max
Anode Dissipation	6·0	kW Max
Screen Voltage	1·5	kV Max
Screen Dissipation	250	W Max
Grid Dissipation	75	W Max

TYPICAL OPERATING CONDITIONS

(Peak envelope or modulation crest conditions, below 30Mc/s)

Anode Voltage	7·5	kV
Screen Voltage	1·25	kV
Grid Voltage (*See Note* 3)	300	V
Peak R.F. Grid Voltage	300	V
Anode Current (Zero Signal)	0·5	A
Anode Current (Maximum Signal)	1·9	A
Screen Current (Maximum Signal)	0·2	A
Anode Dissipation	4·2	kW
Nominal Driving Power	0	W
Output Power (*See Note* 4)	10	kW

SCREEN MODULATED R.F. POWER AMPLIFIER

(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	7·5	kV Max
Anode Current	3·0	A Max
Anode Dissipation	5·0	kW Max
Screen Voltage	750	V Max
Grid Dissipation	75	W Max

ENGLISH ELECTRIC

TYPICAL OPERATING CONDITIONS
(below 30Mc/s)

Anode Voltage	7·5	7·5	kV
Screen Voltage	350	350	V
Grid Voltage	−300	−300	V
Peak A.F. Screen Voltage for 100% modulation	550	550	V
Peak R.F. Grid Voltage	350	375	V
Anode Current	0·9	1·14	A
Screen Current (*See Note* 5)	−10	−10	mA
Grid Current	15	30	mA
Anode Dissipation	4·0	5·0	kW
Effective Load	2·0	1·6	kΩ
Nominal Driving Power	7·0	11	W
Output Power	2·75	3·55	kW

ANODE MODULATED R.F. POWER AMPLIFIER
(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	5·0	kV Max
Anode Current	2·5	A Max
Anode Dissipation (*See Note* 6)	3·5	kW Max
Screen Voltage	1·0	kV Max
Screen Dissipation	250	W Max
Grid Dissipation	75	W Max

TYPICAL OPERATING CONDITIONS
(below 30Mc/s)

Anode Voltage	5·0	kV
Screen Voltage	500	V
Grid Voltage	−400	V
Peak A.F. Voltage (for 100% modulation)	450	V
Peak R.F. Grid Voltage	520	V
Anode Current	1·4	A
Screen Current	0·26	A
Grid Current	0·05	A
Anode Dissipation	1·1	kW
Nominal Driving Power	25	W
Output Power	5·8	kW

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

R.F. POWER AMPLIFIER OR OSCILLATOR

(Class C Telegraphy, key down conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

	Up to 30Mc/s	*30–60Mc/s*	*60–110Mc/s*	
Anode Voltage ..	7·5	7·0	6·5	kV Max
Anode Current ..	3·0	2·8	2·6	A Max
Anode Dissipation ..	5·0	5·0	5·0	kW Max
Screen Voltage ..	1·5	1·5	1·5	kV Max
Screen Dissipation ..	250	250	250	W Max
Grid Dissipation ..	75	75	75	W Max

TYPICAL OPERATING CONDITIONS

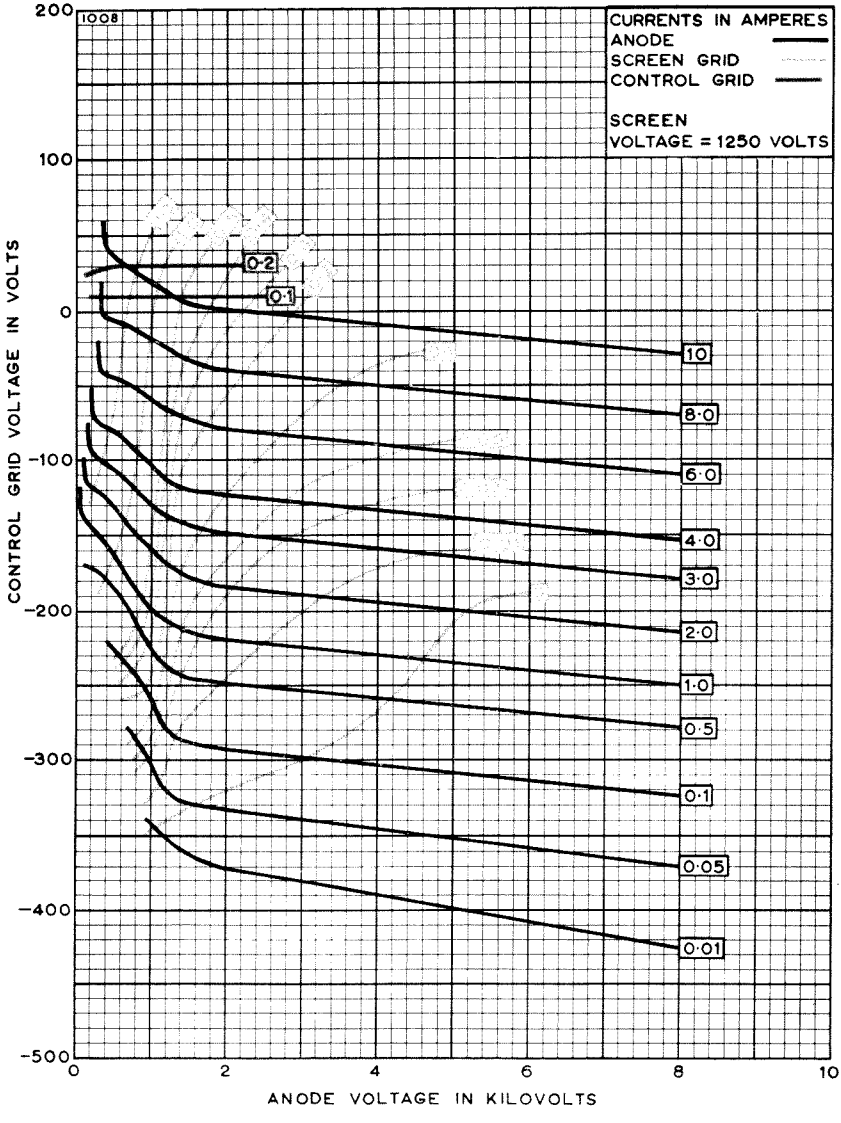
	Up to 30Mc/s	*88–108Mc/s*	
Anode Voltage	7·5	6·5	kV
Screen Voltage	500	750	V
Grid Voltage	−350	−350	V
Peak R.F. Grid Voltage	590	—	V
Anode Current	2·8	2·3	A
Screen Current	0·5	0·2	A
Grid Current	0·25	0·05	A
Anode Dissipation	5·0	—	kW
Nominal Driving Power	150	25	W
Output Power	16	10	kW

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.
2. Grid current does not flow during any part of the audio frequency cycle.
3. The grid voltage is adjusted to obtain the specified zero-signal anode current.
4. The peak envelope or r.f. output power at the crest of the modulation envelope.
5. The screen current is a function of the loading; values from −20mA to +20mA may be considered typical at carrier level.
6. This corresponds to 5·0kW anode dissipation at 100% sine wave modulation.

ENGLISH ELECTRIC

CONSTANT CURRENT CHARACTERISTICS



ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

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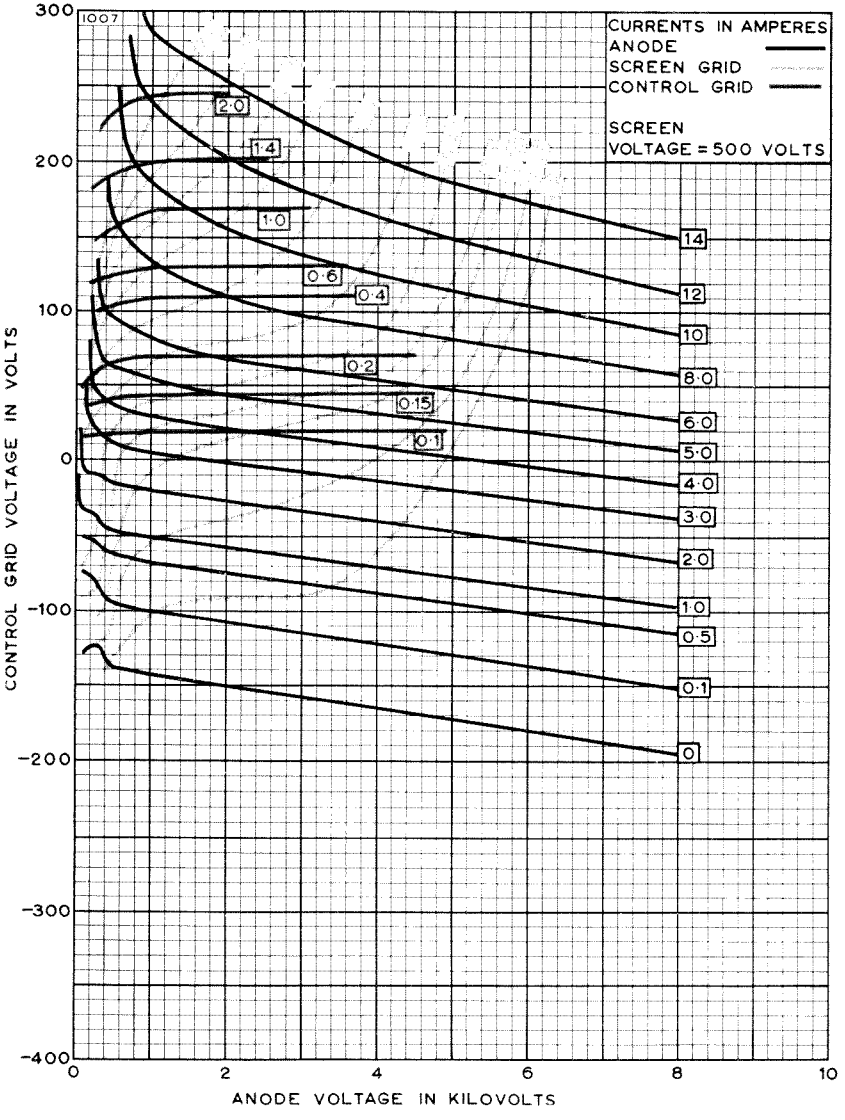
CONSTANT CURRENT CHARACTERISTICS



ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
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Chelmsford 3491

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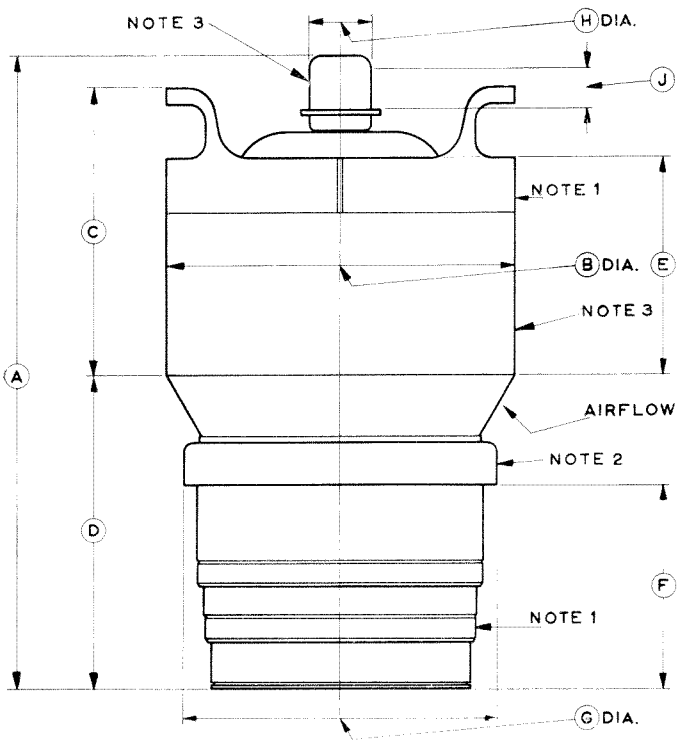
OUTLINE

1005

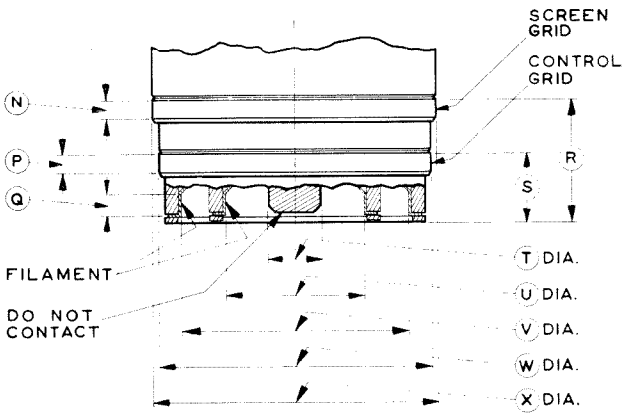


Ref.	Inches	Millimetres
A	8·875 ± 0·250	225·4 ± 6·4
B	4·875 ± 0·062	123·8 ± 1·6
C	4·062 ± 0·188	103·2 ± 4·8
D	4·375 ± 0·188	111·1 ± 4·8
E	3·062 ± 0·188	77·77 ± 4·80
F	2·750 ± 0·188	69·85 ± 4·80
G	4·425 Max	112·4 Max
H	0·875 ± 0·020	22·23 ± 0·51
J	0·375 Min	9·53 Min

Millimetre dimensions have been derived from inches

OUTLINE DETAILS

1006A



Ref.	Inches	Millimetres
N	0·188 Min	4·78 Min
P	0·188 Min	4·78 Min
Q	0·188 Min	4·78 Min
R	1·795 ± 0·031	45·59 ± 0·79
S	1·018 ± 0·032	25·86 ± 0·81
T	0·740 ± 0·020	18·80 ± 0·51
U	1·916 ± 0·020	48·67 ± 0·51
V	3·153 ± 0·020	80·09 ± 0·51
W	3·812 ± 0·020	96·82 ± 0·51
X	4·000 ± 0·020	101·6 ± 0·5

Millimetre dimensions have been derived from inches.

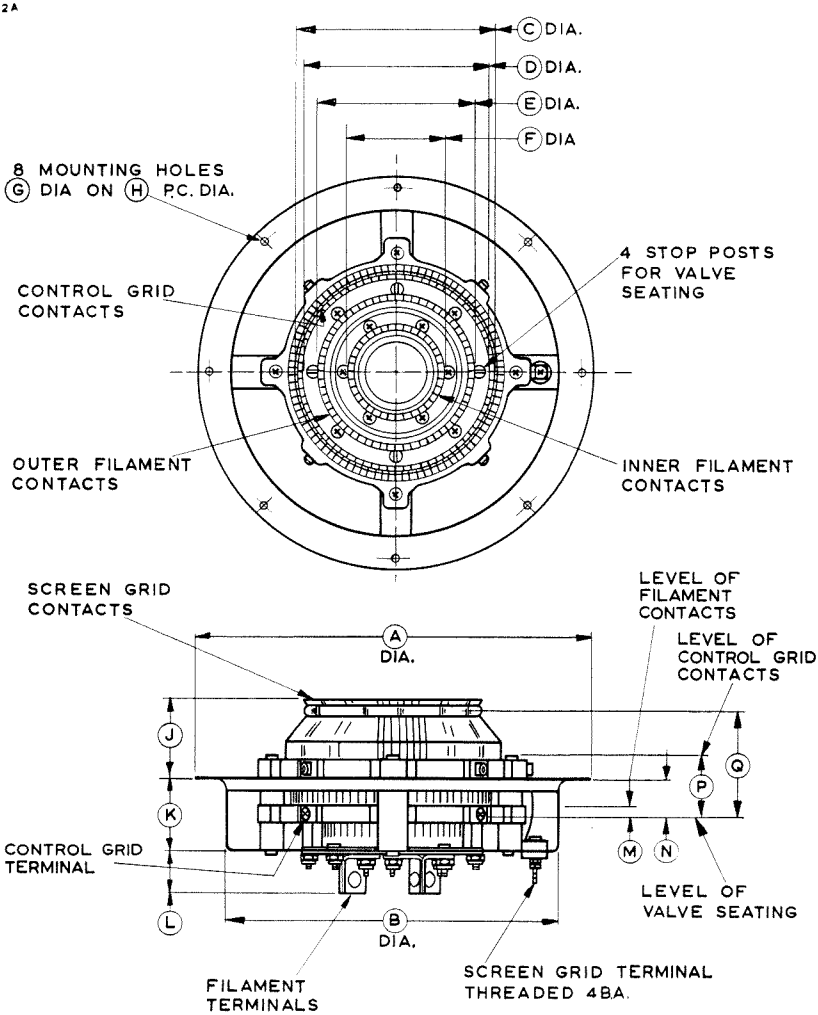
NOTES FOR OUTLINE

1. The eccentricity of the screen and filament contact surfaces will not exceed 0·040 inch (1·02mm) with respect to the anode and control grid contact surfaces when the valve is rotated on rollers at the points indicated by the arrows.
2. This surface must not be used as an electrical contact and it must not be clamped in any way.
3. This surface may be used for making electrical contact to the anode.

ENGLISH ELECTRIC

OUTLINE OF AIR DISTRIBUTION SOCKET MA87

1192A



ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

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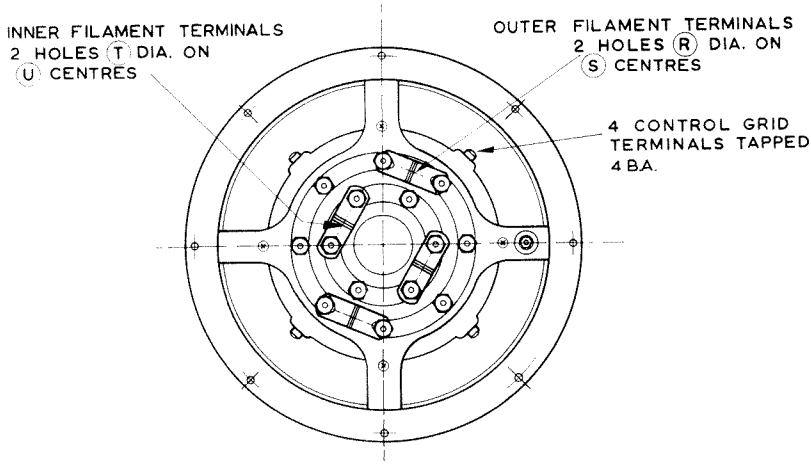
OUTLINE DETAIL OF MA87

(View from underside showing terminals)

1193A



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	8·266 Max	210·0 Max	L	0·894 ± 0·031	22·71 ± 0·79
B	6·766 Max	171·9 Max	M	0·228 ± 0·012	5·79 ± 0·30
C	3·910 ± 0·030	99·31 ± 0·76	N	0·672 ± 0·017	17·07 ± 0·43
D	3·702 ± 0·030	94·03 ± 0·76	P	0·841 ± 0·015	21·36 ± 0·38
E	3·281 ± 0·030	83·34 ± 0·76	Q	1·626 ± 0·031	41·30 ± 0·79
F	2·031 ± 0·030	51·59 ± 0·76	R	0·250 ± 0·015	6·35 ± 0·38
G	0·147	3·73	S	1·562 ± 0·015	39·67 ± 0·38
H	7·750	196·9	T	0·250 ± 0·015	6·35 ± 0·38
J	1·125 ± 0·015	28·58 ± 0·38	U	0·937 ± 0·015	23·80 ± 0·38
K	1·489 ± 0·028	37·82 ± 0·71			

Millimetre dimensions have been derived from inches.

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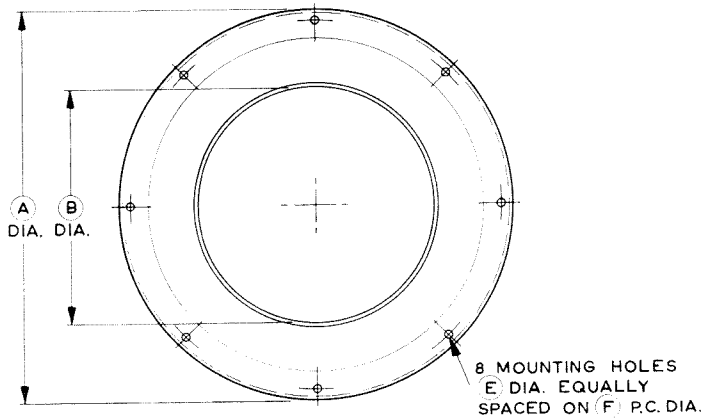
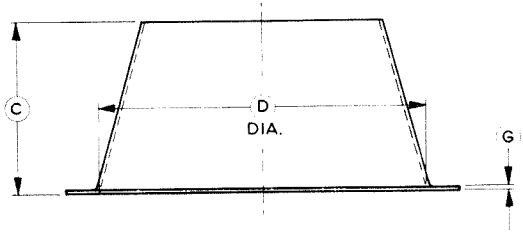
ENGLISH ELECTRIC

OUTLINE OF AIR CHIMNEY MA104

1213A





Ref.	Inches	Millimetres
A	8·250	209·6
B	$4{\cdot}891^{+0{\cdot}062}_{-0{\cdot}000}$	$124{\cdot}2^{+1{\cdot}57}_{-0{\cdot}00}$
C	3·437	87·30
D	6·750	171·5
E	0·157	4·00
F	7·750	196·8
G	0·062	1·57

Millimetre dimensions have been derived from inches except dimension E.

Printed in England

R.F. POWER TETRODE

4CX10,000D

ENGLISH ELECTRIC

American Designation 4CX10,000D

ABRIDGED DATA

Forced-air Cooled Tetrode, coaxial metal-ceramic envelope, for audio, linear single sideband, or screen-modulated r.f. amplifiers.

Anode Dissipation (Class C Telegraphy)	10	kW Max
Anode Voltage	7·5	kV Max
Frequency for full ratings	30	Mc/s Max
Frequency at reduced ratings	110	Mc/s Max
Output Power (Class C Telegraphy)	16	kW

GENERAL

Electrical

Filament	Thoriated Tungsten		
Filament Voltage (*See Note* 1)	7·5		V
Filament Current	75		A
Grid-Screen Amplification Factor (V_a = 2·0kV, V_{g2} = 750V, I_a = 1·0A)	4·5		
Inter-electrode Capacitances:	*Min*	*Max*	
Grounded Filament:			
Grid to Anode	—	1·0	pF
Input	108	122	pF
Output	18	23	pF
Grounded Grid and Screen:			
Filament to Anode	—	0·16	pF
Input	48	58	pF
Output	18	23	pF

Mechanical

Overall Length	9·125 inches	(232 mm)	Max
Overall Diameter	7·050 inches	(179·1 mm)	Max
Net Weight	12·2 pounds	(5·5 kg)	Approx
Mounting Position	Vertical, either way up		

COOLING

Sufficient air must be passed over the concentric base terminals and through the radiator fins to maintain the temperatures of the ceramic to metal seals and the radiator core below the maximum rated value of 250°C. It is recommended that an air distribution socket MA87 and chimney type MA104A be used with the tube (See pages 10, 11 and 12).

The air flows required with the recommended air socket and chimney to maintain the seal temperatures at 200°C in an ambient temperature of 50°C at sea level and with an operating frequency of less than 30Mc/s are given

below. At higher ambient temperatures, altitudes or frequencies the rate of flow must be adjusted to give equivalent cooling and should be determined individually in each case. An allowance of 1000 watts for the power dissipated by the filament and grids has been made in the values given.

Anode Dissipation	Air Flow		Water Pressure Drop	
(kW)	cu.ft/min	cu.m/min	inches	mm
4·0	110	3·1	0·4	10·2
6·0	200	5·7	0·8	20·4
8·0	315	8·9	1·7	43
10	445	12·6	2·8	71
12	600	17·0	4·4	110

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

(Class AB1—*See Note* 2)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	7·5 kV Max
Anode Current	4·0 A Max
Anode Dissipation	12 kW Max
Screen Voltage	1·5 kV Max
Screen Dissipation	250 W Max
Grid Dissipation	75 W Max

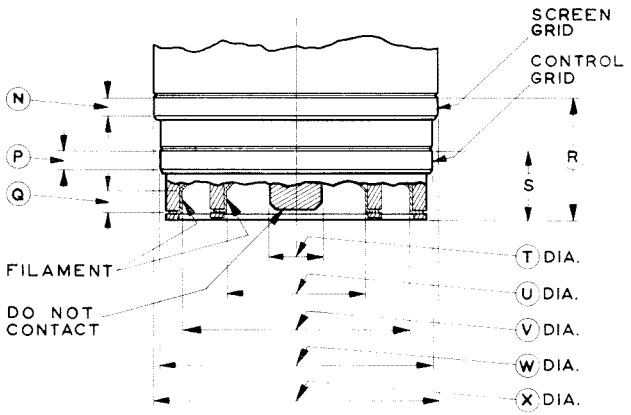
TYPICAL OPERATING CONDITIONS

(Class AB1, two valves)

Anode Voltage	4·0	5·0	6·0	7·5	kV
Screen Voltage	1·5	1·5	1·5	1·5	kV
Grid Voltage	−315	−320	−330	−340	V
Peak A.F. Grid Voltage	305	310	320	330	V
Anode Current (Zero Signal)	1·0	1·0	1·0	1·0	A
Anode Current (Maximum Signal)	6·66	6·66	6·66	6·66	A
Screen Current (Zero Signal)	0	0	0	0	A
Screen Current (Maximum Signal)	0·33	0·32	0·30	0·25	A
Anode Dissipation (Maximum Signal)	6·67	7·95	8·10	9·05	kW
Effective Load (Anode to Anode)	0·94	1·32	1·70	2·28	kΩ
Nominal Driving Power (Maximum Signal)	0	0	0	0	W
Output Power (Maximum Signal)	13·3	17·5	23·8	31·9	kW

OUTLINE DETAILS

1006A



Ref.	Inches	Millimetres
N	0·188 Min	4·78 Min
P	0·188 Min	4·78 Min
Q	0·188 Min	4·78 Min
R	1·795 ± 0·031	45·59 ± 0·79
S	1·018 ± 0·032	25·86 ± 0·81
T	0·740 ± 0·020	18·80 ± 0·51
U	1·916 ± 0·020	48·67 ± 0·51
V	3·153 ± 0·020	80·09 ± 0·51
W	3·812 ± 0·020	96·82 ± 0·51
X	4·000 ± 0·020	101·6 ± 0·5

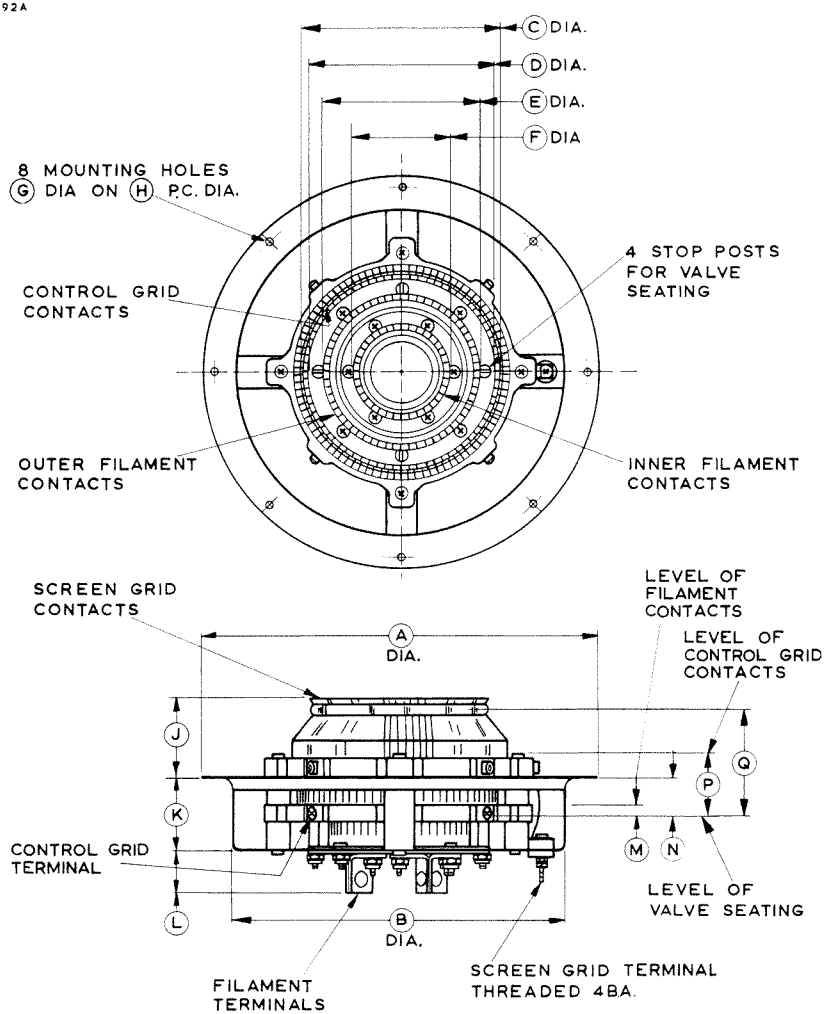
Millimetre dimensions have been derived from inches.

NOTES FOR OUTLINE

1. The eccentricity of the screen and filament contact surfaces will not exceed 0·040 inch (1·02mm) with respect to the anode and control grid contact surfaces when the valve is rotated on rollers at the points indicated by the arrows.
2. This surface must not be used as an electrical contact and it must not be clamped in any way.
3. This surface may be used for making electrical contact to the anode.

OUTLINE OF AIR DISTRIBUTION SOCKET MA87

1192A



ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

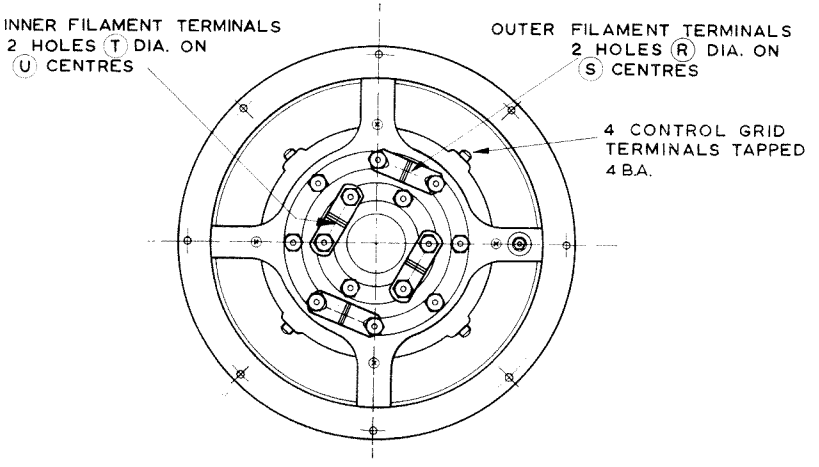
Telephone:
Chelmsford 3491

Printed in England

OUTLINE DETAIL OF MA87

(View from underside showing terminals)

1193A



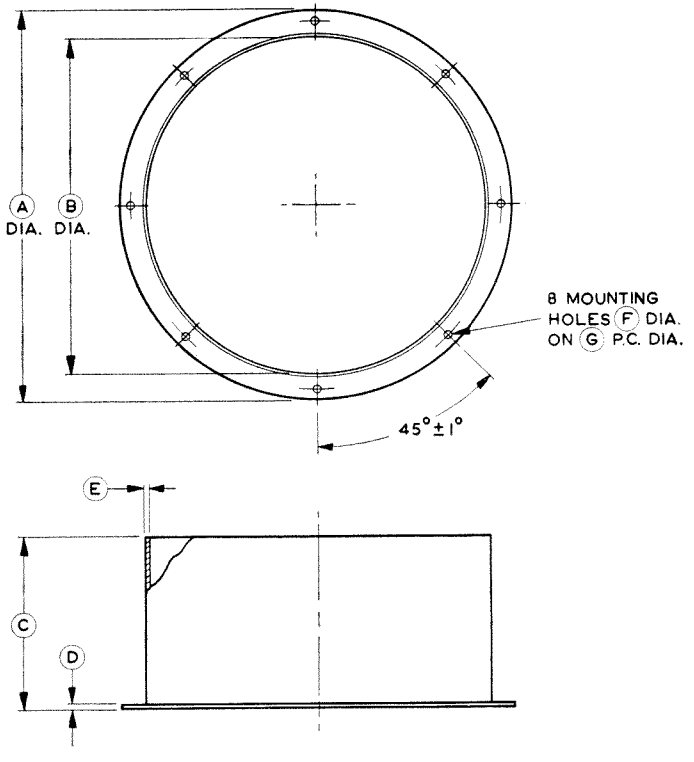
Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	8·266 Max	210·0 Max	L	0·894 ± 0·031	22·71 ± 0·79
B	6·766 Max	171·9 Max	M	0·228 ± 0·012	5·79 ± 0·30
C	3·910 ± 0·030	99·31 ± 0·76	N	0·672 ± 0·017	17·07 ± 0·43
D	3·702 ± 0·030	94·03 ± 0·76	P	0·841 ± 0·015	21·36 ± 0·38
E	3·281 ± 0·030	83·34 ± 0·76	Q	1·626 ± 0·031	41·30 ± 0·79
F	2·031 ± 0·030	51·59 ± 0·76	R	0·250 ± 0·015	6·35 ± 0·38
G	0·147	3·73	S	1·562 ± 0·015	39·67 ± 0·38
H	7·750	196·9	T	0·250 ± 0·015	6·35 ± 0·38
J	1·125 ± 0·015	28·58 ± 0·38	U	0·937 ± 0·015	23·80 ± 0·38
K	1·489 ± 0·028	37·82 ± 0·71			

Millimetre dimensions have been derived from inches.

ENGLISH ELECTRIC

OUTLINE OF AIR CHIMNEY MA104A

1214



Ref.	Inches	Millimetres
A	8·250	209·6
B	$7{\cdot}000^{+0{\cdot}062}_{-0{\cdot}000}$	$177{\cdot}8^{+1{\cdot}57}_{-0{\cdot}00}$
C	3·625	92·08
D	0·093	2·36
E	$0{\cdot}125 \pm 0{\cdot}031$	$3{\cdot}18 \pm 0{\cdot}79$
F	0·157	4·00
G	7·750	196·8

Millimetre dimensions have been derived from inches except dimension F.

Printed in England

R.F. POWER TETRODE

4CX35,000C

American Designation 4CX35,000C (8349)

ABRIDGED DATA

Forced-air Cooled Tetrode, coaxial metal-ceramic envelope, for audio amplifiers, r.f. linear amplifiers or class C amplifiers or oscillators.

Anode Dissipation (Class C Telegraphy)	35	kW Max
Anode Voltage	20	kV Max
Frequency for full ratings	30	Mc/s Max
Output Power (Class C Telegraphy)	82·5	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	10	V
Filament Current	300	A
Grid-Screen Amplification Factor	4·5	
Inter-electrode Capacitances, Grounded Filament:		
Grid to Anode	2·4	pF
Input	465	pF
Output	55	pF

Mechanical

Overall Length	17·500 inches	(444·5 mm)	Max
Overall Diameter	9·750 inches	(247·7 mm)	Max
Net Weight	50 pounds	(23 kg)	Approx
Mounting Position	Vertical, either way up		

COOLING

Sufficient air must be passed over the base terminals and through the radiator fins to maintain the temperatures of the ceramic to metal seals and the radiator core below the maximum rated value of 250°C.

It is recommended that a socket type MA166 be used with the tube, when 60 to 100cu.ft/min (1·70 to 2·83cu.m/min) of air will be required for base cooling. This should be blown horizontally through the socket from two diametrically opposed nozzles. It is also necessary to direct 2cu.ft/min (0·06 cu.m/min) of air into the centre hole of the socket.

The air flows required to maintain the seal and radiator core temperatures at 225°C in an ambient temperature of 40°C at sea level and with an operating frequency of less than 30Mc/s are given on page 2. The values specified are for air flowing in the direction from base to anode. At higher ambient temperatures or altitudes the rate of flow must be adjusted to give equivalent cooling and

should be determined individually in each case. An allowance of 5250 watts for the power dissipated by the filament and grids has been made in the values given.

Anode Dissipation (kW)	Air Flow		Pressure Drop	
	cu.ft/min	cu.m/min	inches water	mm water
15	485	13·7	1·65	4·2
20	710	20·1	2·85	7·25
25	1000	28·3	5·1	13·0
30	1320	37·4	8·9	22·6
35	1650	46·7	14·5	36·8

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

(Class AB1—*See Note* 2)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	20	kV Max
Anode Current	15	A Max
Anode Dissipation	35	kW Max
Screen Voltage	2·5	kV Max
Screen Dissipation	1750	W Max
Grid Dissipation	500	W Max
Grid Circuit Resistance	0·1	MΩ Max

TYPICAL OPERATING CONDITIONS

(Class AB1, two valves)

Anode Voltage	10	15	kV
Screen Voltage	1·5	1·5	kV
Grid Voltage	−290	−340	V
Peak A.F. Grid Voltage	270	310	V
Anode Current (Zero Signal)	4·0	2·0	A
Anode Current (Maximum Signal)	17·4	15·1	A
Screen Current (Zero Signal)	0	0	A
Screen Current (Maximum Signal)	0·77	0·62	A
Anode Dissipation per tube (Maximum Signal)	33	30·5	kW
Effective Load (Anode to Anode)	1·15	2·56	kΩ
Nominal Driving Power (Maximum Signal)	0	0	W
Output Power (Maximum Signal)	110	165	kW

RADIO FREQUENCY LINEAR AMPLIFIER

(Class AB1—*See Note* 2)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	20	kV Max
Anode Current	15	A Max
Anode Dissipation	35	kW Max
Screen Voltage	2·5	kV Max
Screen Dissipation	1750	W Max
Grid Dissipation	500	W Max
Grid Circuit Resistance	0·1	MΩ Max

TYPICAL OPERATING CONDITIONS

(Peak envelope or modulation crest conditions, below 30Mc/s)

Anode Voltage	10	15	kV
Screen Voltage	1·5	1·5	kV
Grid Voltage (*See Note* 3)	—290	—340	V
Peak R.F. Grid Voltage	270	310	V
Anode Current (Zero Signal)	2·0	1·0	A
Anode Current (Maximum Signal)	8·7	7·55	A
Screen Current (Maximum Signal)	0·385	0·310	A
Anode Dissipation	33	30·5	kW
Nominal Driving Power	0	0	W
Output Power (*See Note* 4)	55	82·5	kW

ANODE MODULATED R.F. POWER AMPLIFIER

(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1·0)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	17·5	kV Max
Anode Current	15	A Max
Anode Dissipation (*See Note* 5)	23	kW Max
Screen Voltage	2·0	kV Max
Screen Dissipation	1750	W Max
Grid Dissipation	500	W Max

TYPICAL OPERATING CONDITIONS

(below 30Mc/s)

Anode Voltage	7·5	10	15	kV
Screen Voltage	750	750	750	V
Grid Voltage	−460	−520	−540	V
Peak A.F. Screen Voltage (for 100% modulation)	640	675	630	V
Peak R.F. Grid Voltage	630	680	700	V
Anode Current	7·0	6·6	6·45	A
Screen Current	1·2	0·985	0·890	A
Grid Current	0·375	0·370	0·355	A
Anode Dissipation	10·5	11·0	14·5	kW
Nominal Driving Power	235	250	250	W
Output Power	42	55	82·5	kW

R.F. POWER AMPLIFIER OR OSCILLATOR

(Class C Telegraphy, key down conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	20	kV Max
Anode Current	15	A Max
Anode Dissipation	35	kW Max
Screen Voltage	2·5	kV Max
Screen Dissipation	1750	W Max
Grid Dissipation	500	W Max

TYPICAL OPERATING CONDITIONS

(below 30Mc/s)

Anode Voltage	10	15	kV
Screen Voltage	750	750	V
Grid Voltage	−425	−480	V
Peak R.F. Grid Voltage	575	640	V
Anode Current	6·70	6·45	A
Screen Current	0·925	0·810	A
Grid Current	0·320	0·355	A
Anode Dissipation	12	14	kW
Nominal Driving Power	185	225	W
Output Power	55	82·5	kW

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%.
2. Grid current does not flow during any part of the drive cycle.
3. The grid voltage is adjusted to obtain the specified zero-signal anode current.
4. The peak envelope or r.f. output power at the crest of the modulation envelope.
5. This corresponds to 35kW anode dissipation at 100% sine wave modulation.

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
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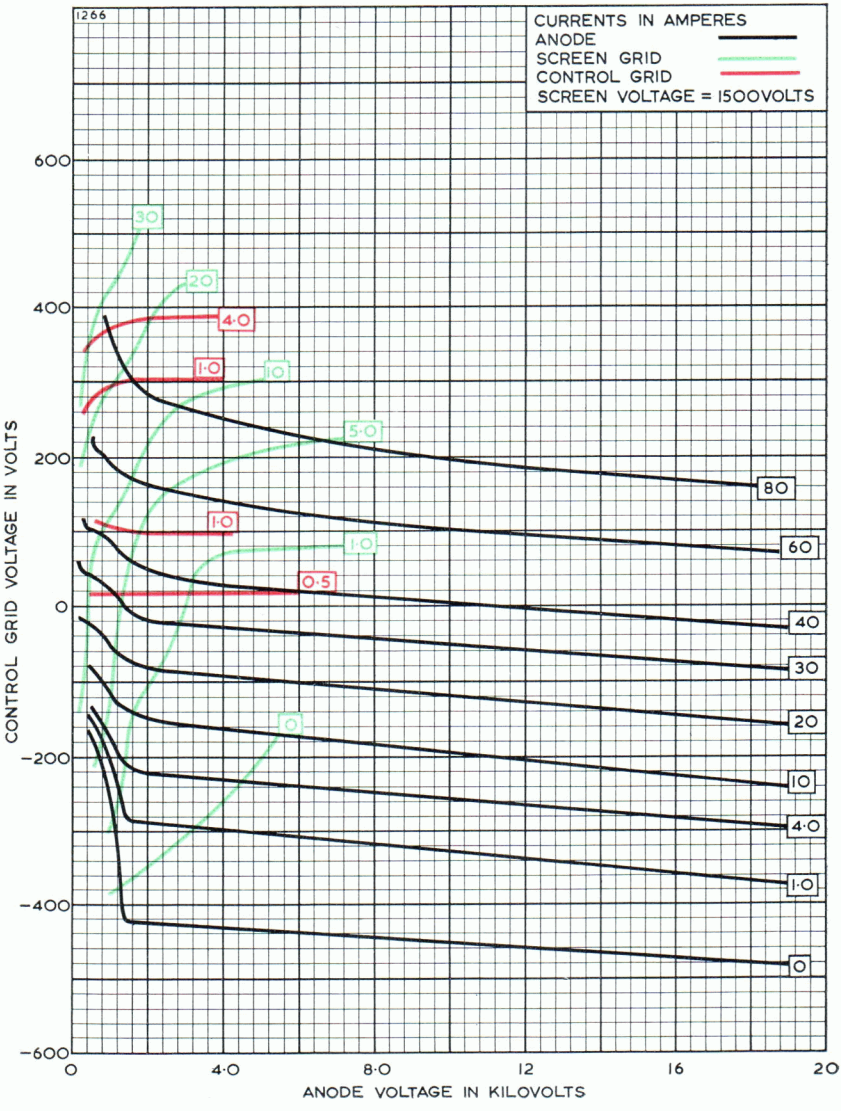
Printed in England

CONSTANT CURRENT CHARACTERISTICS



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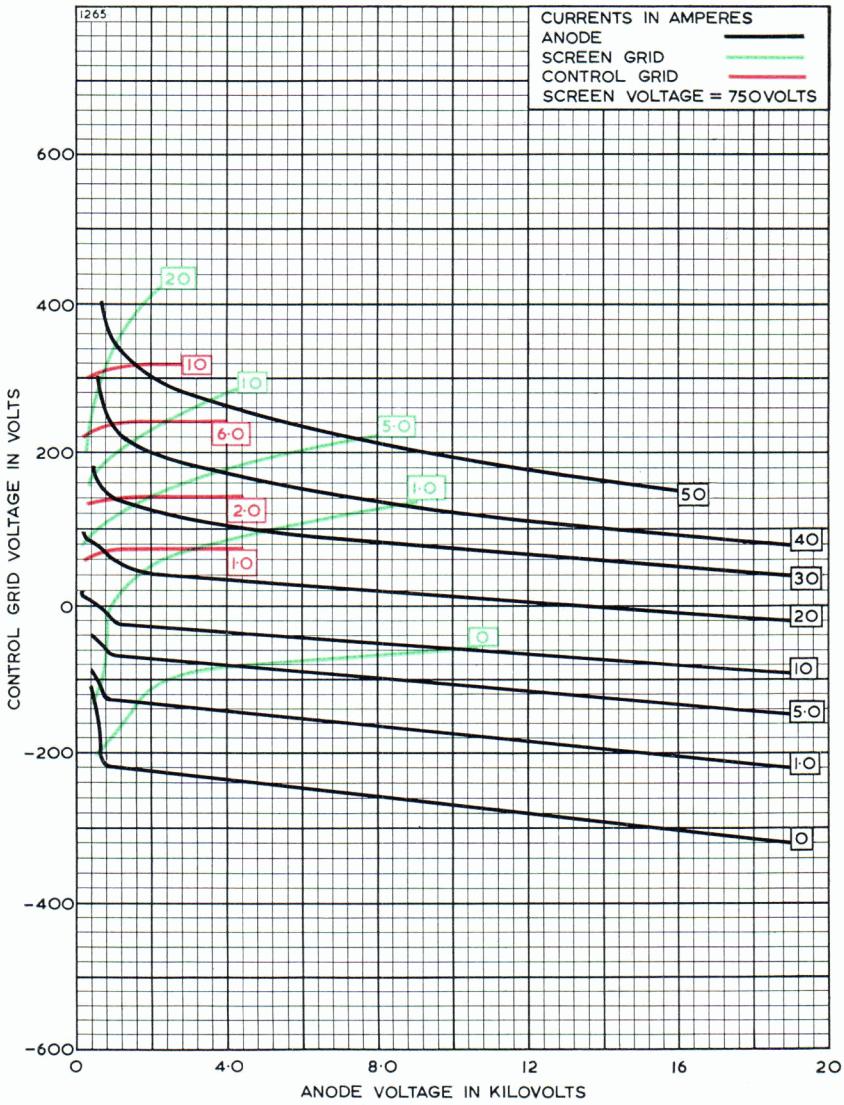

ENGLISH ELECTRIC VALVE CO. LTD.

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ENGLAND

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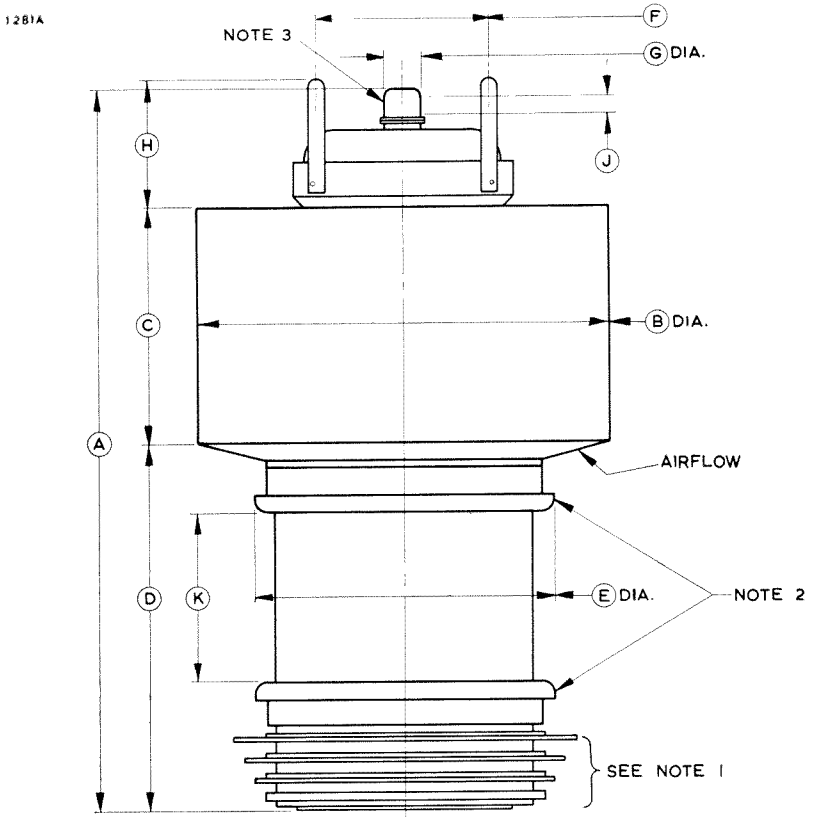
OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	16·855 ± 0·125	428·1 ± 3·18	F	4·000	101·6
B	9·625 ± 0·125	244·5 ± 3·18	G	0·875 ± 0·015	22·23 ± 0·38
C	5·500 ± 0·125	139·7 ± 3·18	H	3·062	77·78
D	8·567 ± 0·125	217·6 ± 3·18	J	0·500 ± 0·015	12·70 ± 0·38
E	7·050 Max	179·1 Max	K	4·000 Min	101·6 Min

Millimetre dimensions have been derived from inches.
(See page 9 for outline notes)

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ENGLAND

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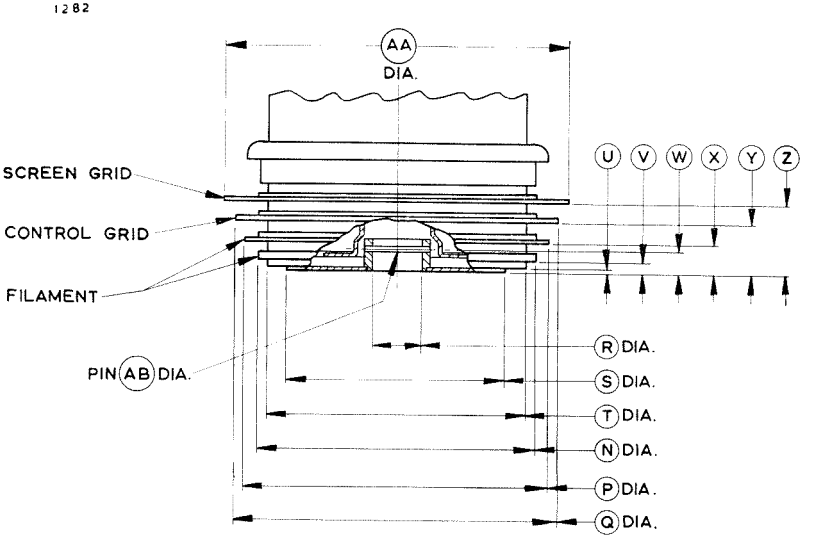
OUTLINE DETAIL



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
N	6·530 ± 0·030	165·86 ± 0·76	V	0·197 ± 0·031	5·00 ± 0·79
P	7·000 ± 0·020	177·80 ± 0·51	W	0·510 ± 0·020	12·95 ± 0·51
Q	7·500 ± 0·020	190·50 ± 0·51	X	0·715 ± 0·025	18·16 ± 0·64
R	1·260 ± 0·010	32·00 ± 0·25	Y	1·245 ± 0·025	31·62 ± 0·64
S	5·000 ± 0·020	127·00 ± 0·51	Z	1·775 ± 0·025	45·08 ± 0·64
T	6·000 ± 0·020	152·40 ± 0·51	AA	7·995 ± 0·020	203·07 ± 0·51
U	0·060 ± 0·015	1·52 ± 0·38	AB	0·135	3·43

Millimetre dimensions have been derived from inches.

NOTES FOR OUTLINE

1. The eccentricity of the filament, control grid and screen grid contact surfaces will not exceed 0·125 inch (3·18mm) with respect to dimension 'R' with the tube mounted on the bottom ceramic.
2. These surfaces must not be used for electrical contacts and must not be clamped in any way.
3. This surface may be used for making electrical contact to the anode.

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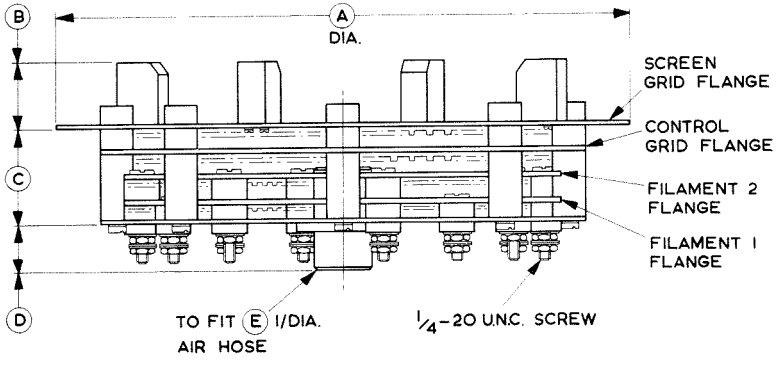
ENGLISH ELECTRIC

OUTLINE OF SOCKETS MA166 AND MA166B

(See pages 11 and 12 for plan views)

1732



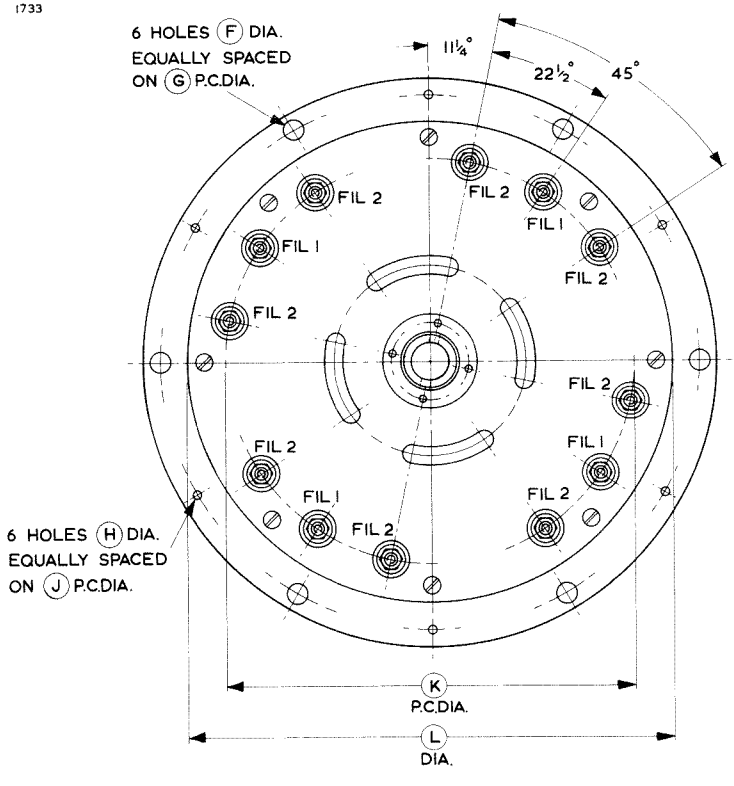
Ref.	Inches	Millimetres
A	12·000 ± 0·015	304·8 ± 0·38
B	1·250 ± 0·156	31·75 ± 3·96
C	2·000 ± 0·020	50·80 ± 0·51
D	1·000 ± 0·020	25·40 ± 0·51
E	1·250	31·75
F	0·437	11·10
G	11·250	285·8
H	0·187	4·75
J	11·250	285·8
K	8·530	216·7
L	10·125 ± 0·031	257·2 ± 0·79
M	4·813	122·3
N	4·813	122·3
P	4·813	122·3

Millimetre dimensions have been derived from inches.

Printed in England

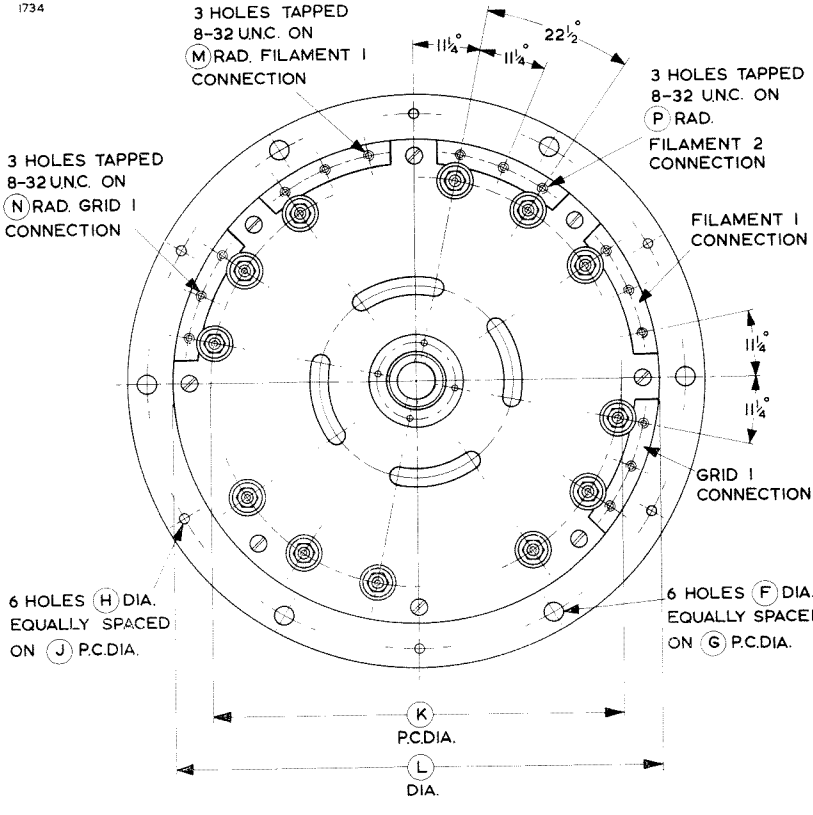
OUTLINE DETAIL OF MA166

(See page 10 for outline dimensions)



OUTLINE DETAIL OF MA166B

(See page 10 for outline dimensions)



5CX1500A

R.F. POWER PENTODE

ABRIDGED DATA

Forced-air cooled pentode, coaxial metal-ceramic envelope, for use in class AB_1 linear amplifiers in audio and radio frequency applications. It is also recommended for use in class C amplifiers.

Anode dissipation	1.5	kW max
Anode voltage	5.0	kV max
Frequency for full ratings	110	MHz max
Output power (two valves, class AB1 audio)	3.2	kW

GENERAL

Electrical

Filament	thoriated tungsten	
Filament voltage (see note 1)	5.0	V
Filament current	40	A
Mutual conductance (V_a = 2.0kV, V_{g2} = 500V, I_a = 1.0A)	24	mA/V
Grid-screen amplification factor	5.5	
Inter-electrode capacitances, grounded cathode:		
grid to anode	0.11	pF
input	77	pF
output	16	pF

Mechanical

Overall length	4.950 inches (125.7mm) max
Overall diameter	3.370 inches (85.60mm) max
Net weight	2 pounds (0.9kg) approx
Mounting position	vertical, either way up

COOLING

Sufficient air must be passed through the radiator and over the ceramic to metal seals to maintain the temperatures below the maximum rated values of:

Anode core	250	°C max
Ceramic to metal seals	250	°C max

Air flow requirements to maintain the seal temperatures at 225°C with an ambient temperature of 50°C and operating frequency less than 30MHz are

given below. The figures specified take into account the grid and filament dissipations.

Anode dissipation (kW)	Sea level		6000 feet	
	Air flow (ft^3/min)	Pressure drop (in. water gauge)	Air flow (ft^3/min)	Pressure drop (in. water gauge)
1.0	27	0.33	33	0.40
1.5	47	0.76	58	0.95

At other altitudes and ambient temperatures, the air flow must be adjusted to give equivalent cooling.

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR (Class AB)

MAXIMUM RATINGS (Absolute values)

Anode voltage	4.0	kV max
Anode current	1.0	A max
Anode dissipation	1.5	kW max
Screen voltage	750	V max
Screen dissipation	75	W max
Grid dissipation	25	W max
Suppressor dissipation	25	W max

TYPICAL OPERATING CONDITIONS (Class AB1, two valves) (See note 2)

Anode voltage	2.8	3.8	kV
Screen voltage	500	500	V
Grid voltage (see note 2)	−81	−83	V
Suppressor voltage	0	0	V
Peak a.f. grid drive voltage	81	83	V
Anode current (zero signal)	500	500	mA
Anode current (maximum signal)	1.30	1.33	A
Screen current (zero signal) (approx)	20	20	mA
Screen current (maximum signal) (approx)	110	106	mA
Effective load (anode to anode)	4.8	6.72	kΩ
Nominal driving power (maximum signal)	0	0	W
Anode dissipation per tube (maximum signal)	720	1130	W
Output power (maximum signal)	2.2	3.22	kW

RADIO FREQUENCY LINEAR AMPLIFIER
(Class AB)

MAXIMUM RATINGS (Absolute values)

Anode voltage	4.0	kV max
Anode current	1.0	A max
Anode dissipation	1.5	kW max
Screen voltage	750	V max
Screen dissipation	75	W max
Grid dissipation	25	W max
Suppressor dissipation	25	W max

TYPICAL OPERATING CONDITIONS
(at frequencies below 30MHz)

Anode voltage	2.5	3.0	4.0	kV
Screen voltage	500	500	500	V
Grid voltage (see note 2)	−87	−89	−90	V
Suppressor voltage	0	0	0	V
Peak r.f. grid drive voltage	87	89	90	V
Anode current:				
zero signal	250	250	250	mA
single tone	660	690	690	mA
two tone (average)	468	482	485	mA
Screen current:				
single tone	79	71	59	mA
two tone	36	32	25	mA
Nominal driving power	0	0	0	W
Load impedance	2.34	2.68	3.50	kΩ
Output power	1.09	1.33	1.78	kW

ANODE MODULATED R.F. POWER AMPLIFIER

(Class C telephony, carrier conditions per valve for use with a maximum modulation factor of 1.0)

MAXIMUM RATINGS (Absolute values)

Anode voltage	3.5	kV max
Anode current	0.8	A max
Anode dissipation (see note 3)	1.0	kW max
Screen voltage	550	V max
Screen dissipation	75	W max
Grid dissipation	25	W max
Suppressor dissipation	25	W max

TYPICAL OPERATING CONDITIONS

Anode voltage	2.5	3.2	kV
Screen voltage	500	500	V
Grid voltage	−260	−260	V
Suppressor voltage	0	0	V
Peak r.f grid voltage	315	315	V
Peak a.f. screen modulating voltage (modulation factor 1.0)	500	500	V
Anode current	800	800	mA
Screen current	90	86	mA
Grid current	32	32	mA
Nominal driving power	10	10	W
Anode dissipation	530	576	W
Load impedance	1.36	1.86	kΩ
Output power	1.47	1.96	kW

R.F. POWER AMPLIFIER OR OSCILLATOR

(Class C telegraphy, key down conditions, one valve)

MAXIMUM RATINGS (Absolute values)

Anode voltage	5.0	kV max
Anode current	1.0	A max
Anode dissipation	1.5	kW max
Screen voltage	750	V max
Screen dissipation	75	W max
Grid dissipation	25	W max
Suppressor dissipation	25	W max

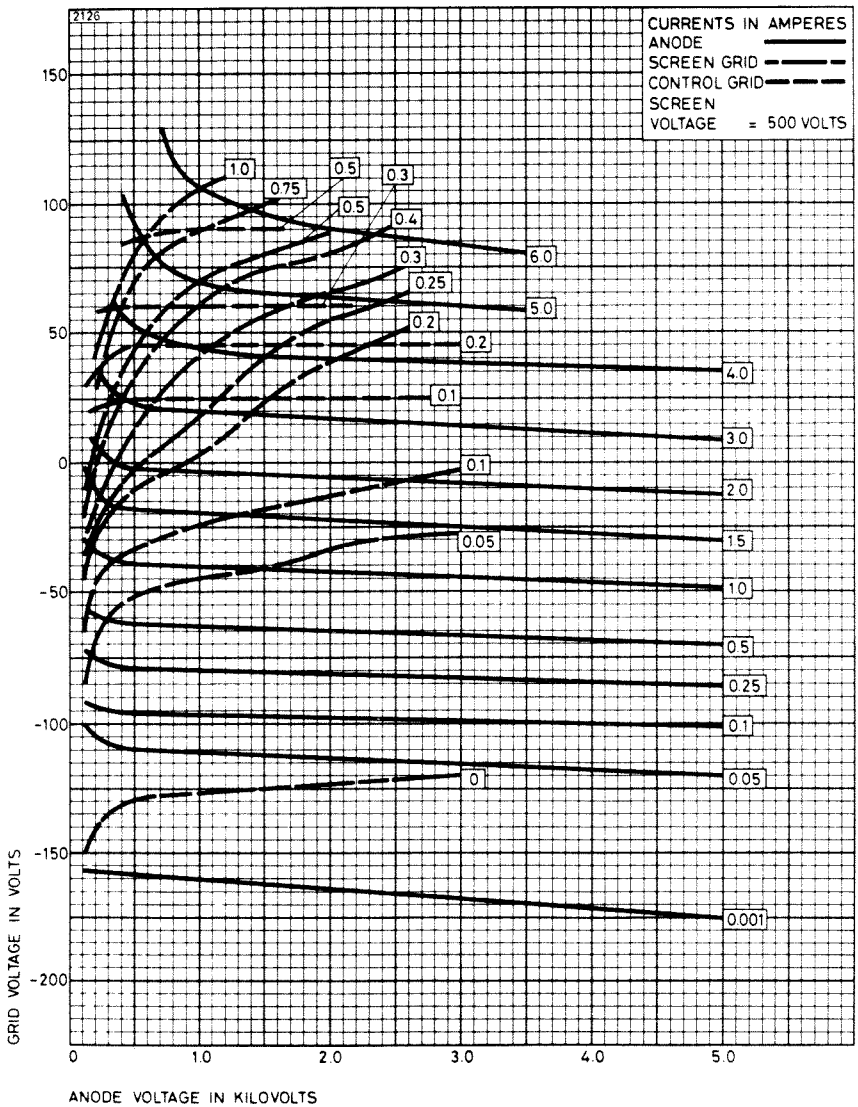
TYPICAL OPERATING CONDITIONS

Anode voltage	3.0	4.0	4.5	kV
Screen voltage	500	500	500	V
Grid voltage	−200	−200	−200	V
Suppressor voltage	0	0	0	V
Peak r.f. grid voltage	255	245	255	V
Anode current	900	800	900	mA
Screen current	94	66	88	mA
Grid current	35	25	34	mA
Anode dissipation	720	850	870	W
Load impedance	1.57	2.24	2.52	kΩ
Nominal driving power	9.0	6.5	9.0	W
Output power	1.98	2.35	3.18	kW

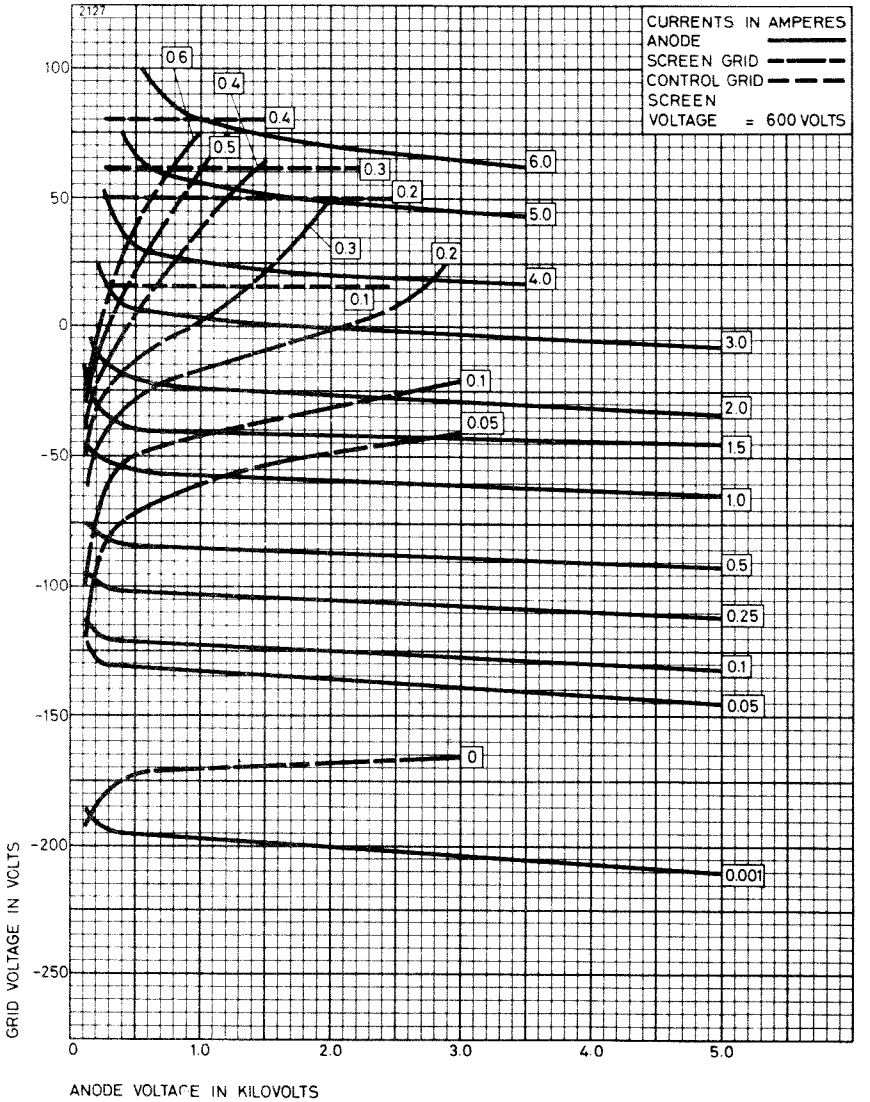
NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%.
2. Adjusted to give the specified zero signal anode current.
3. This value corresponds to 1.5kW at 100 per cent sine-wave modulation.

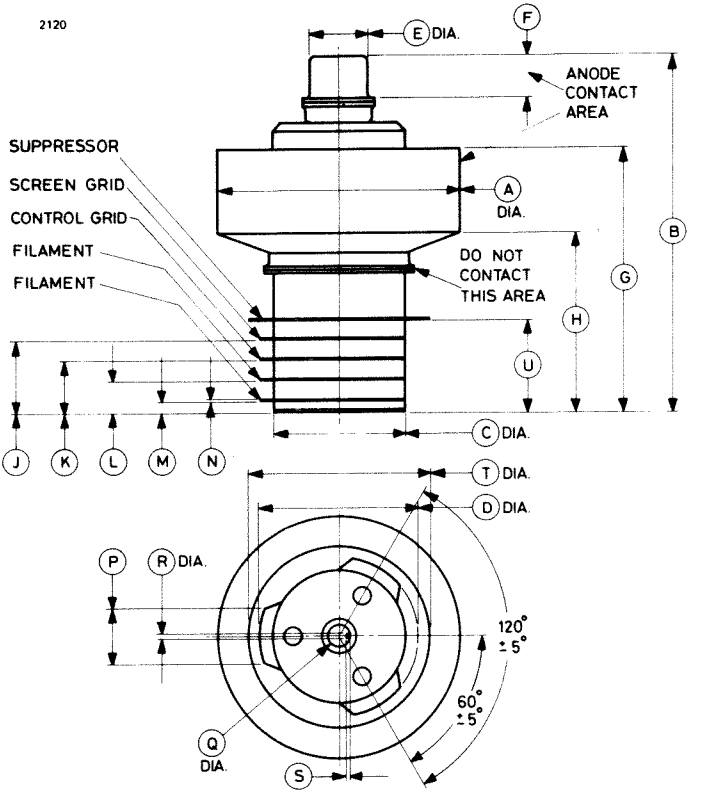
CONSTANT CURRENT CHARACTERISTICS



CONSTANT CURRENT CHARACTERISTICS



OUTLINE



Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	3.370 max	85.60 max	L	0.425 ± 0.025	10.80 ± 0.64
B	4.875 ± 0.075	123.8 ± 1.91	M	0.155 ± 0.015	3.94 ± 0.38
C	1.885 ± 0.015	47.88 ± 0.38	N	0.025 ± 0.005	0.64 ± 0.13
D	2.275 ± 0.025	57.79 ± 0.64	P	0.750 ± 0.050	19.05 ± 1.27
E	0.812 ± 0.005	20.62 ± 0.13	Q	0.320 ± 0.006	8.13 ± 0.15
F	0.500 ± 0.030	12.70 ± 0.76	R	0.065 ± 0.008	1.65 ± 0.20
G	3.630 ± 0.100	92.20 ± 2.54	S	0.033 ± 0.010	0.84 ± 0.25
H	2.435 ± 0.100	61.85 ± 2.54	T	2.531 max	64.29 max
J	0.975 ± 0.025	24.77 ± 0.64	U	1.250 ± 0.025	31.75 ± 0.64
K	0.700 ± 0.025	17.78 ± 0.64			

Millimetre dimensions have been derived from inches.

V.H.F. POWER TETRODE

6181

American Designation 6181

GENERAL

The EEV 6181 is a forced-air cooled tetrode for use in television and other applications at frequencies up to 900Mc/s. It is a maintenance type and therefore only abridged data are given on this sheet. **Full information is available on request.**

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage	120	V Max
Heater Current at 120V	1·6	A
Cathode Heating Time at 117V	5	minutes
Peak Usable Cathode Current	12	A
Grid-Screen Amplification Factor (V_a = 1·0kV, V_{g2} = 400V, I_a = 1·0A) (average)	7·0	

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C Telegraphy, key-down conditions per valve, or Class C Telephony)

MAXIMUM RATINGS

(Absolute Values)

Anode Voltage	2·0	kV Max
Screen Voltage	500	V Max
Grid Voltage (negative value)	300	V Max
Anode Current	1·25	A Max
Anode Input Power	2·5	kW Max
Screen Input Power	40	W Max
Anode Dissipation	2·0	kW Max
Grid Dissipation	15	W Max

TYPICAL OPERATION, F.M. SERVICE WITH CATHODE DRIVE

(at 900Mc/s)

Anode to Grid Voltage	1910	V
Screen to Grid Voltage	550	V
Cathode to Grid Voltage	110	V
Peak R.F. Cathode to Grid Voltage	120	V
Anode Current	900	mA
Screen Current	50	mA
Grid Current (Approx)	15	mA
Driving Power (Approx)	150	W
Output Circuit Efficiency (Approx)	70	%
Useful Output Power (Approx)	600	W

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
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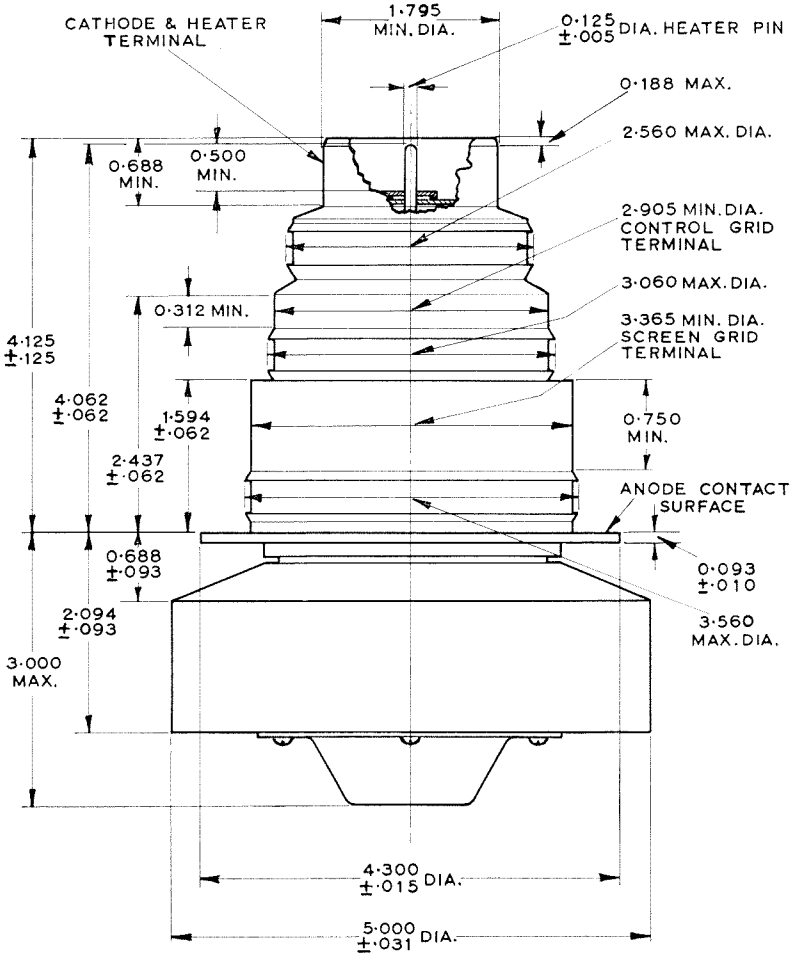
V.H.F. POWER TETRODE

6181

ENGLISH ELECTRIC

OUTLINE

575



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ENGLISH ELECTRIC VALVE CO. LTD.

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CR176

R.F. POWER TETRODE

Service Type CV2324

INTRODUCTION

The CR176 is a forced-air cooled transmitting Tetrode. It has a maximum anode dissipation of 3·5kW and can be used at full ratings up to 30Mc/s.

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	5·0	V
Filament Current	64	A
Maximum Filament Starting Current	(*See Note* 2)	
Filament Cold Resistance	0·0045	Ω
Peak Usable Cathode Current	10	A
Grid-Screen Amplification Factor (V_a = 3 kV, I_a = 1 A, V_{g2} = 1500 V)	4·4	
Mutual Conductance (V_a = 3 kV, I_a = 1 A, V_{g2} = 1500 V)	8·25	mA/V ←
Inter-electrode Capacitances:		
Grid to Anode	0·4	pF
Input	42	pF ←
Output	14	pF

Mechanical

Overall Length	12·64 inches (322 mm)	Max
Overall Diameter	7·25 inches (184 mm)	Max
Net Weight	14 pounds (6·4 kg)	Approx
Mounting Position	Vertical, filament end up	

COOLING

The required quantity of air through the radiator for cooling is indicated on the graphs (pages 6 and 7) and should be delivered by a blower through the radiator before and during the application of any voltages. Power and air supplies may be removed simultaneously. ←

The external grid and filament seals do not generally require to be forced-air cooled, but their temperature must not exceed 140°C.

→ Indicates a change.

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R.F. POWER TETRODE

MAXIMUM RATINGS
(Absolute Values)

Anode Voltage	7·5 kV Max
Screen Voltage	1·5 kV Max
Anode Dissipation	3·5 kW Max
Screen Dissipation	200 W Max
Grid Dissipation	25 W Max
Operating Frequency (for full ratings)	30 Mc/s Max

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN

	Min	*Max*	
Filament Current at filament voltage 5·0V	59	71	A
Grid-Screen Amplification Factor (V_a = 3 kV, V_{g2} = 1·5 kV, I_a = 1 A)	3·7	5·1	
Mutual Conductance (V_a = 3 kV, V_{g2} = 1·5 kV, I_a = 1 A)	7·5	9·0	mA/V
Screen Current (V_a = 4 kV, V_{g2} = 1·5 kV, I_a = 1 A)	—	30	mA
Grid Voltage (negative value) (V_a = 4 kV, V_{g2} = 1·5 kV, I_a = 1 A)	170	260	V
Grid Voltage (negative value) (V_a = 4 kV, V_{g2} = 1·5 kV, I_a = 50 mA)	—	500	V

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.
2. The filament current must not exceed 160A, even momentarily, at any time.

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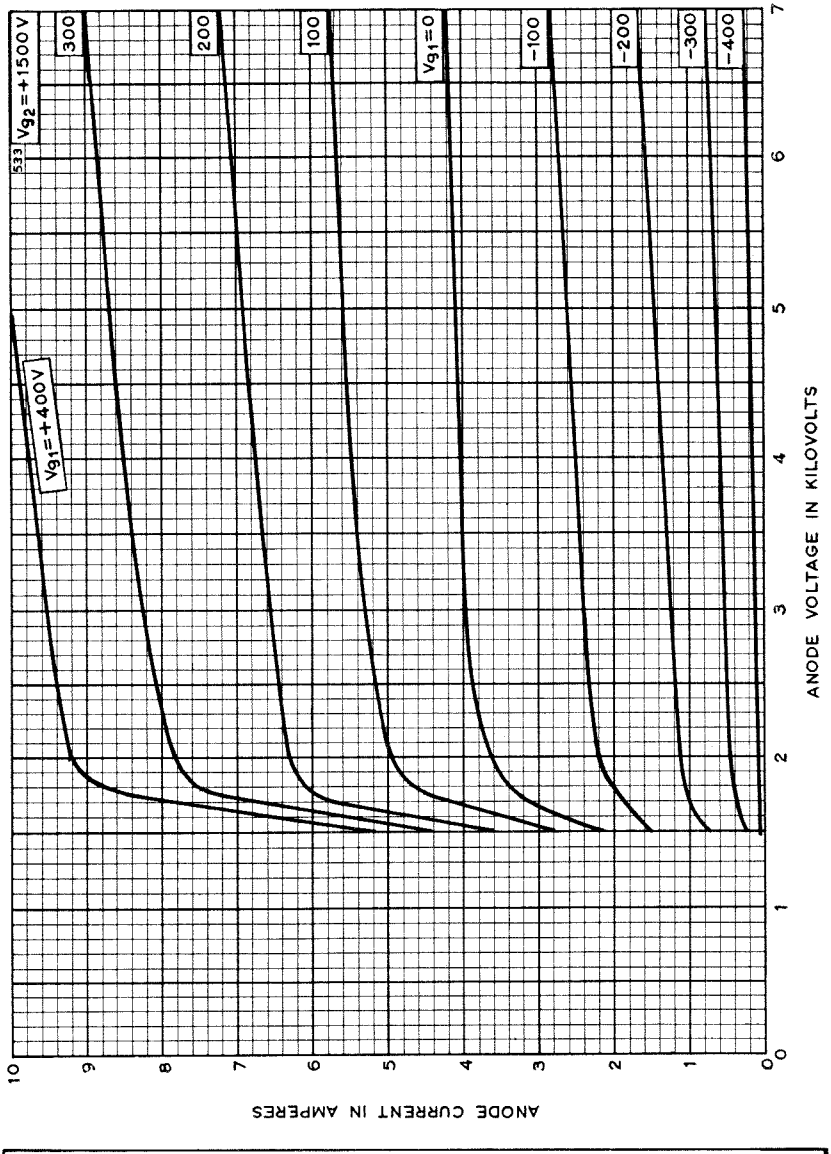
R.F. POWER TETRODE

ANODE CHARACTERISTICS



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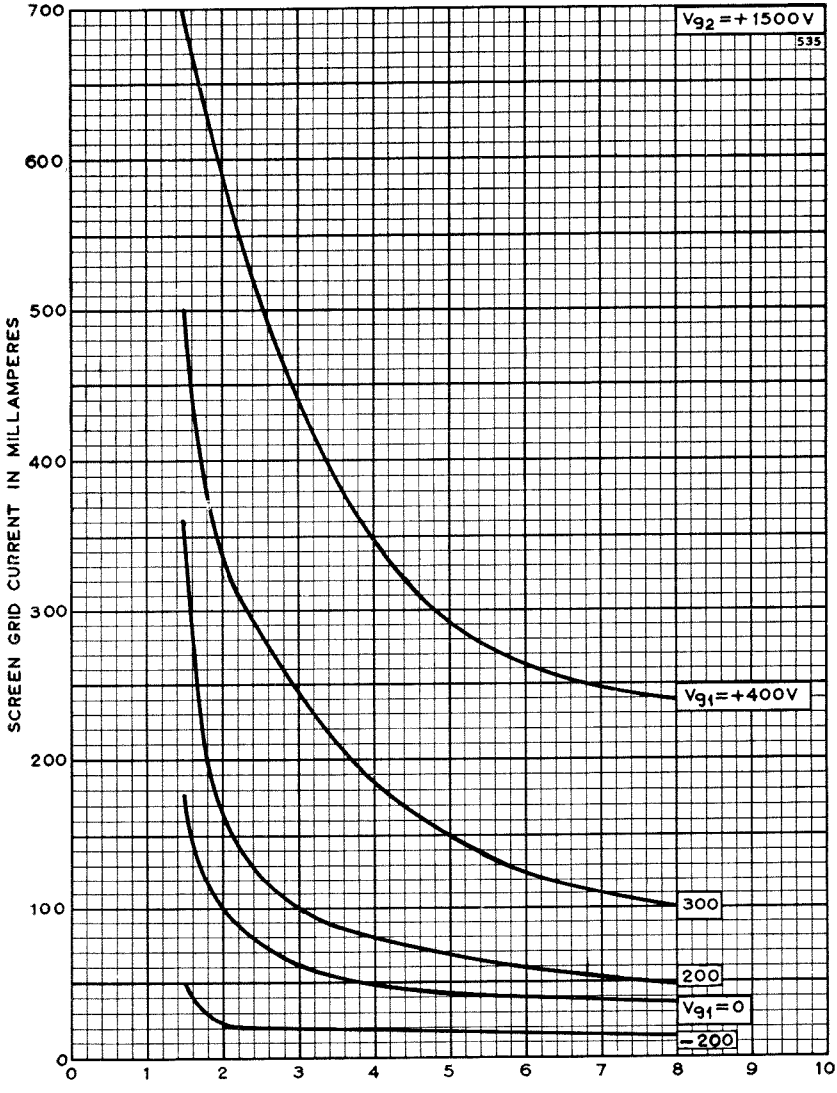
R.F. POWER TETRODE

SCREEN GRID CHARACTERISTICS



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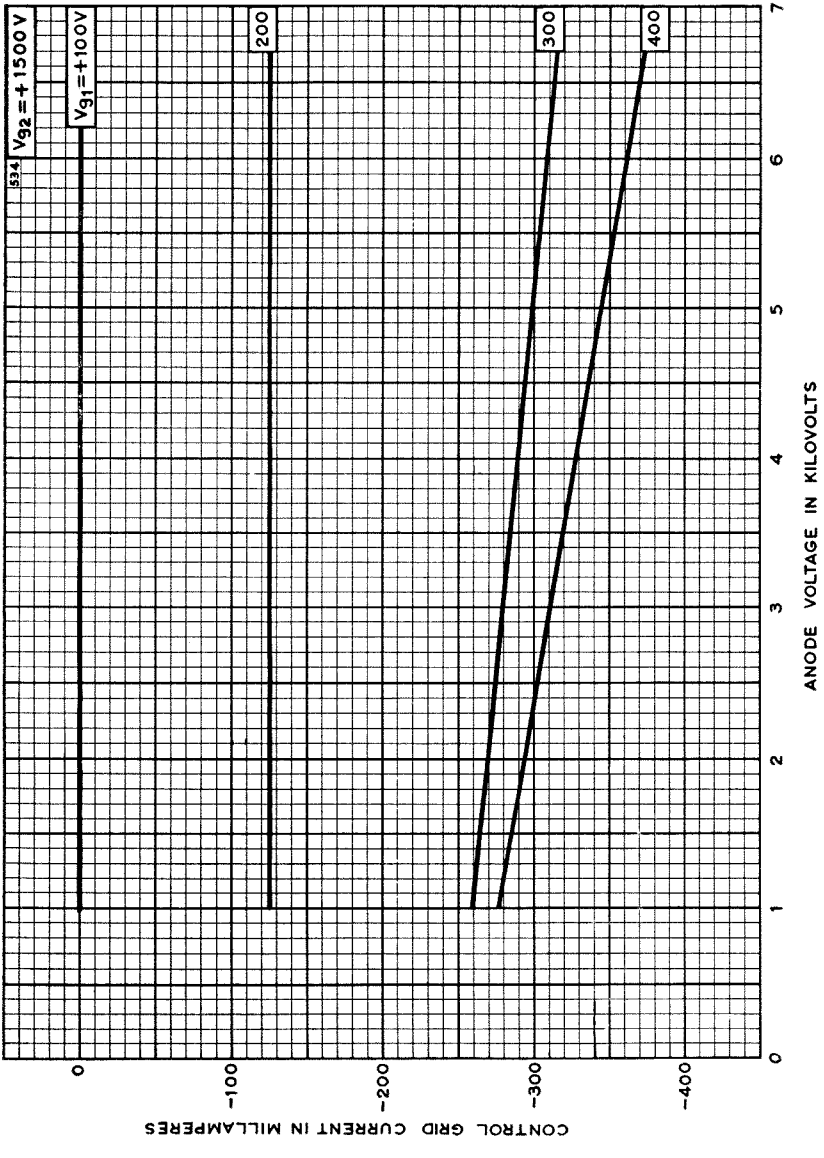
CONTROL GRID CHARACTERISTICS



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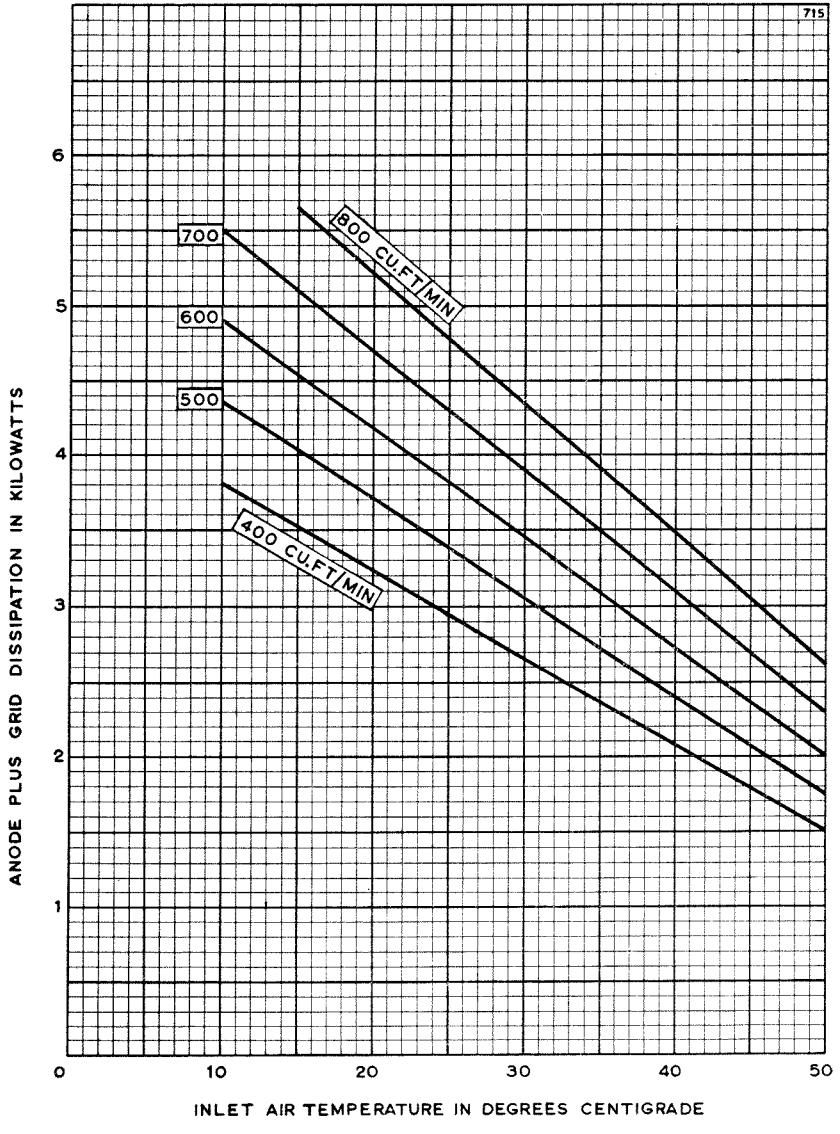
AIR COOLING CHARACTERISTICS



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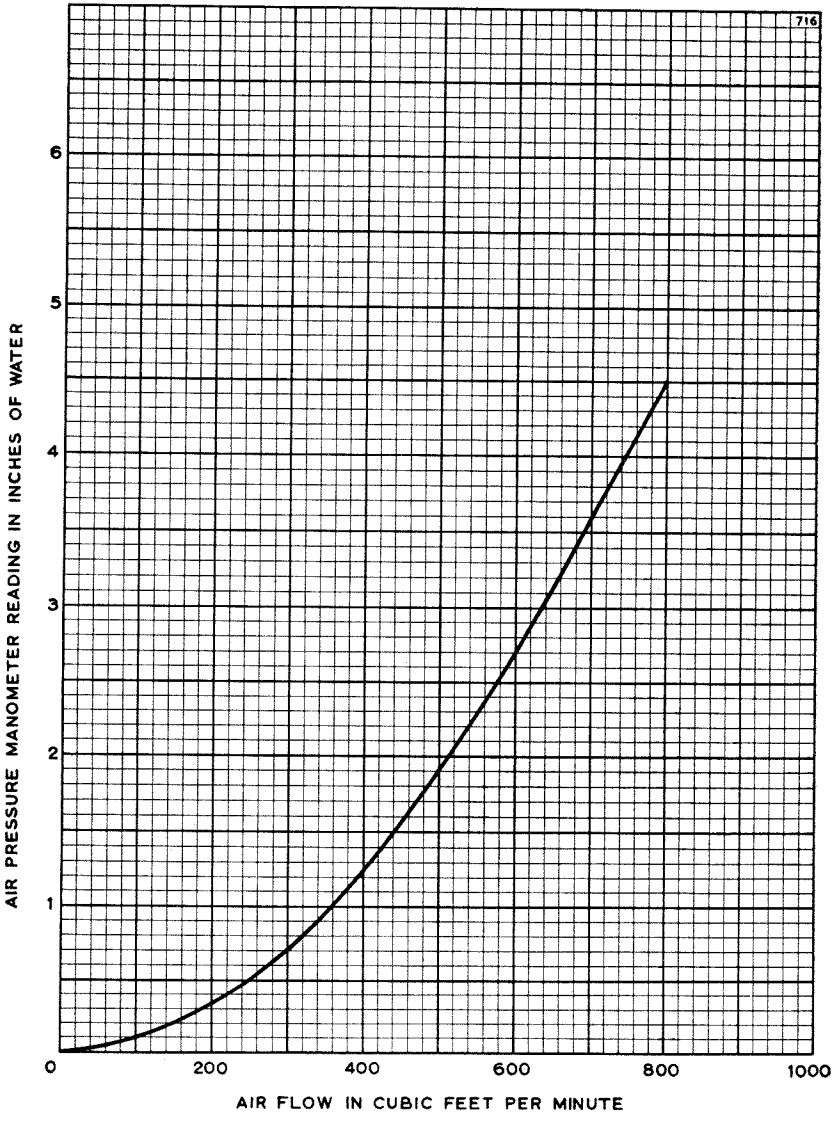
AIR FLOW CHARACTERISTICS



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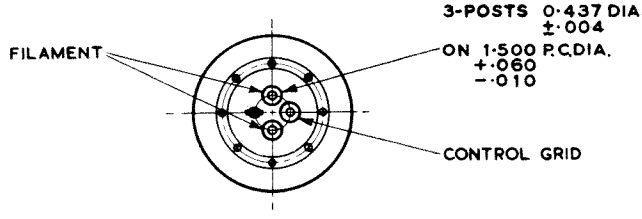
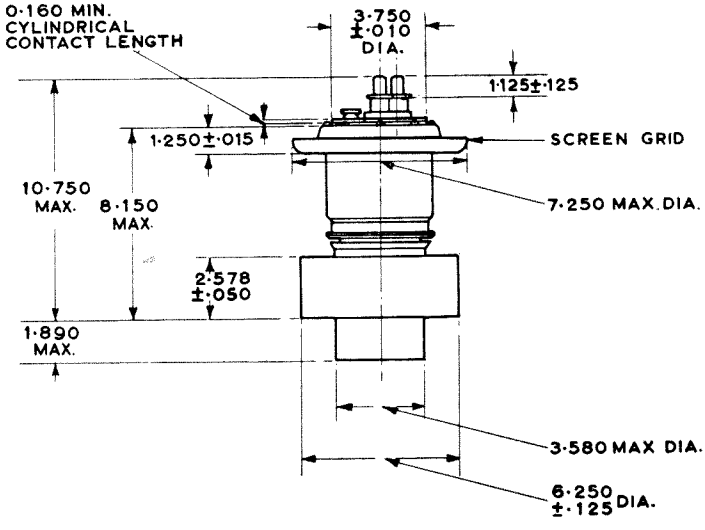
R.F. POWER TETRODE

OUTLINE

5S8A





ALL DIMENSIONS IN INCHES

V.H.F. POWER TETRODES

CR192
CR192A

Service Type CV8244 (CR192A)

American Equivalents:

CR192	**6166**	**(near)***
CR192A	**6166A**	**(near)***

ABRIDGED DATA

Forced-air Cooled Tetrodes, coaxial construction, for television and other applications at frequencies up to 220Mc/s. CR192 has a glass envelope, that of CR192A is ceramic; the two tubes are electrically equivalent.

Anode Dissipation	10	kW Max
Anode Voltage	6·9	kV Max
Frequency for full ratings:		
Class C Telegraphy or F.M. Telephony	60	Mc/s Max
Class B or Class C Television Service	216	Mc/s Max
Output Power:		
Television Service (synchronising level)	12	kW
Class C Telegraphy or F.M. Telephony (216Mc/s)	9·0	kW

GENERAL

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	5·0	V
Filament Current	175	A
Filament Starting Current (Peak) (*See Note* 2)	400	A Max
Filament Cold Resistance	0·0038	Ω
Peak Usable Cathode Current	20	A
Grid-Screen Amplification Factor (V_a = 2·0kV, V_{g2} = 1·0kV, I_a = 2·0A)	10	
Mutual Conductance (V_a = 2·0kV, V_{g2} = 1·0kV, I_a = 2·0A)	25	mA/V
Inter-electrode Capacitances:		
Grid to Anode (*See Note* 3)	0·6	pF Max
Grid to Filament	44	pF
Anode to Filament (*See Note* 3)	0·08	pF Max
Grid to Screen Grid	60	pF
Screen Grid to Anode	21	pF

*CR192 and CR192A are direct replacements for types 6166 and 6166A respectively, except that the filament posts are larger in diameter. Suitable filament adaptors are available to facilitate replacement of types 6166 or 6166A in existing equipments (see page 21).

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CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

ENGLISH ELECTRIC

Mechanical

Overall Length	11·625 inches	(295·3 mm)	Max
Overall Diameter	6·410 inches	(162·8 mm)	Max
Net Weight	17 pounds	(7·8 kg)	Approx
Mounting Position			Vertical, either way up

COOLING

The required quantity of air through the radiator for cooling the anode is indicated on the graphs (pages 17 and 18) and should be delivered by a blower through the radiator before and during the application of any voltages. It should enter at the envelope end and some of the flow should be used to cool the screen-grid seal.

In addition, a flow of about 50cu.ft/min (1·42cu.m/min) should be directed at the filament and grid terminals.

The temperature of anode, screen, grid and filament seals must not exceed 180°C.

Power and air supplies may be removed simultaneously.

R.F. POWER AMPLIFIER
(Class B Television Service, U.S.A. System)

(Synchronising-level conditions per valve unless otherwise specified. Voltages are referred to cathode unless otherwise specified)

MAXIMUM RATINGS
(Absolute Values)
(Frequency 54 to 216Mc/s)

Anode Voltage	6·0 kV Max
Screen Voltage	2·0 kV Max
Anode Current	4·0 A Max
Anode Input Power	22 kW Max
Screen Input Power	400 W Max
Anode Dissipation	10 kW Max
Grid Dissipation	300 W Max

CR192A

V.H.F. POWER TETRODE

Service type CV8244 **American equivalent 6166A***

ABRIDGED DATA

Forced-air cooled tetrode with coaxial metal-ceramic envelope, for television and other applications at frequencies up to 220MHz.

Anode dissipation	10	kW max
Anode voltage	6.9	kV max
Frequency for full ratings:		
class C telegraphy or f.m. telephony	60	MHz max
class B or class C television service	216	MHz max
Output power:		
television service (synchronising level)	12	kW
class C telegraphy or f.m. telephony (216MHz)	9.0	kW

GENERAL

Electrical

Filament	thoriated tungsten	
Filament voltage (see note 1)	5.0	V
Filament current	175	A
Filament starting current (peak) (see note 2)	400	A max
Filament cold resistance	3.8	mΩ
Peak usable cathode current	20	A
Grid-screen amplification factor (V_a = 2.0kV, V_{g2} = 1.0kV, I_a = 2.0A)	10	
Mutual conductance (V_a = 2.0kV, V_{g2} = 1.0kV, I_a = 2.0A)	25	mA/V

Continued on page 2

* CR192A is a direct replacement for types 6166 and 6166A, except that the filament posts are larger in diameter. Suitable filament adaptors are available to facilitate replacement of 6166 or 6166A in existing equipments (see page 20).

Electrical (continued)

Inter-electrode capacitances:		
grid to anode (see note 3)	0.6	pF max
grid to filament	44	pF
anode to filament (see note 3)	0.08	pF max
grid to screen grid	60	pF
screen grid to anode	21	pF

Mechanical

Overall length	11.625 inches (295.3mm) max
Overall diameter	6.410 inches (162.8mm) max
Net weight	17 pounds (7.8kg) approx
Mounting position	vertical, either way up

COOLING

The required quantity of air through the radiator for cooling the anode is indicated on the graphs (pages 17 and 18) and should be delivered by a blower through the radiator before and during the application of any voltages. It should enter at the envelope end and some of the flow should be used to cool the screen-grid seal.

In addition, a flow of about $50ft^3$/min ($1.42m^3$/min) should be directed at the filament and grid terminals.

The temperature of anode, screen, grid and filament seals must not exceed 180°C.

Power and air supplies may be removed simultaneously.

R.F. POWER AMPLIFIER

(Class B Television Service, U.S.A. System)

(Synchronising-level conditions per valve unless otherwise specified. Voltages are referred to cathode unless otherwise specified)

MAXIMUM RATINGS (Absolute values) (Frequency 54 to 216MHz)

Anode voltage	6.0	kV max
Screen voltage	2.0	kV max
Anode current	4.0	A max
Anode input power	22	kW max
Screen input power	400	W max
Anode dissipation	10	kW max
Grid dissipation	300	W max

TYPICAL OPERATION IN GRID-DRIVE CIRCUIT
(at 216MHz and bandwidth 8.5MHz – see note 4)

Anode voltage	5.8	kV
Screen voltage	1.2	kV
Grid voltage	−130	V
Peak r.f. grid voltage:		
synchronising level	375	V
pedestal level	290	V
Anode current:		
synchronising level	3.45	A
pedestal level	2.60	A
Screen current (pedestal level)	207	mA
Grid current (approx):		
synchronising level	350	mA
pedestal level	170	mA
Driving power (approx, see note 5):		
synchronising level (see note 6)	800	W
pedestal level	450	W
Output power (approx):		
synchronising level	12	kW
pedestal level	6.8	kW

TYPICAL OPERATION IN CATHODE-DRIVE CIRCUIT
(at 216MHz and bandwidth 8.5MHz – see note 4)

Anode voltage	5.8	kV
Screen voltage	800	V
Grid voltage	−85	V
Peak r.f. grid voltage:		
synchronising level	330	V
pedestal level	260	V
Anode current:		
synchronising level	3.45	A
pedestal level	2.60	A
Screen current (pedestal level)	152	mA
Grid current (approx):		
synchronising level	405	mA
pedestal level	220	mA
Driving power (approx, see note 7):		
synchronising level (see note 8)	1.3	kW
pedestal level	700	W
Output power (approx):		
synchronising level	12	kW
pedestal level	6.8	kW

GRID-MODULATED R.F. POWER AMPLIFIER
(Class C Television Service, U.S.A. System)
(Synchronising-level conditions per valve unless otherwise specified)

MAXIMUM RATINGS (Absolute Values) (frequency 54 to 216MHz)

Anode voltage	6.0	kV max
Screen voltage	2.0	kV max
Grid voltage (white level)	−1.0	kV max
Anode current	4.0	A max
Anode input power	22	kW max
Screen input power	400	W max
Anode dissipation	10	kW max
Grid dissipation	300	W max

TYPICAL OPERATION IN GRID-DRIVE CIRCUIT
(at 216MHz and bandwidth 8.5MHz, See Note 4)

Anode voltage	5.8	kV
Screen voltage	1.2	kV
Grid voltage:		
synchronising level	−130	V
pedestal level	−195	V
white level	−350	V
Peak r.f. grid voltage	375	V
Anode current:		
synchronising level	3.45	A
pedestal level	2.42	A
Screen current (pedestal level)	148	mA
Grid current (approx):		
synchronising level	350	mA
pedestal level	190	mA
Driving power (approx, see note 5):		
synchronising level (see note 6)	800	W
pedestal level	425	W
Output power (approx):		
synchronising level	12	kW
pedestal level	6.8	kW

ANODE-MODULATED R.F. POWER AMPLIFIER

(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1.0)

MAXIMUM RATINGS (Absolute Values. See Note 9)

Anode voltage	5.0	kV max
Screen voltage	2.0	kV max
Grid voltage	−1.0	kV max
Anode current	2.0	A max
Grid current	600	mA max
Anode input power	10	kW max
Screen input power	270	W max
Anode dissipation	6.6	kW max

TYPICAL OPERATION IN GRID-DRIVE CIRCUIT

(at frequencies up to 60MHz)

Anode voltage	4.7	kV
Screen voltage (modulated 100%, see note 10)	800	V
Grid voltage (see note 11)	−280	V
Peak r.f. grid voltage	485	V
Anode current	1.56	A
Screen current	217	mA
Grid current (approx)	300	mA
Driving power (approx. See note 12)	180	W
Output power (approx)	5.5	kW

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C Telegraphy, key-down conditions per valve, see Note 19) AND R.F. POWER AMPLIFIER (Class C, F.M. Telephony)

MAXIMUM RATINGS (Absolute Values. See Note 9)

Anode voltage	6.9	kV max
Screen voltage	2.0	kV max
Grid voltage	−1.0	kV max
Anode current	2.75	A max
Grid current	600	mA max
Anode input power	18	kW max
Screen input power	400	W max
Anode dissipation	10	kW max

TYPICAL OPERATION IN GRID-DRIVE CIRCUIT

Frequency	up to 60	216	216	MHz
Anode voltage	6.4	5.8	5.8	kV
Screen voltage (see note 13)	1.2	1.2	1.2	kV
Grid voltage (see note 14)	−310	−130	−175	V
Peak r.f. grid voltage	560	230	370	V
Anode current	2.75	1.8	2.6	A
Screen current	300	100	267	mA
Grid current (approx)	280	100	222	mA
Driving power (approx) (see note 5)	75	*300	†750	W
Output power (approx)	11.6	6.0	9.0	kW

* See note 15 † See note 16

MAXIMUM PERMISSIBLE ANODE VOLTAGES AND INPUTS

expressed as a percentage of maximum values quoted

	Frequency	
	60MHz	220MHz
Class C telephony, anode modulated	100%	90%
Class C telegraphy and f.m. telephony		
Class B television service	Full ratings 54 to 216MHz	
Class C television service		

NOTES

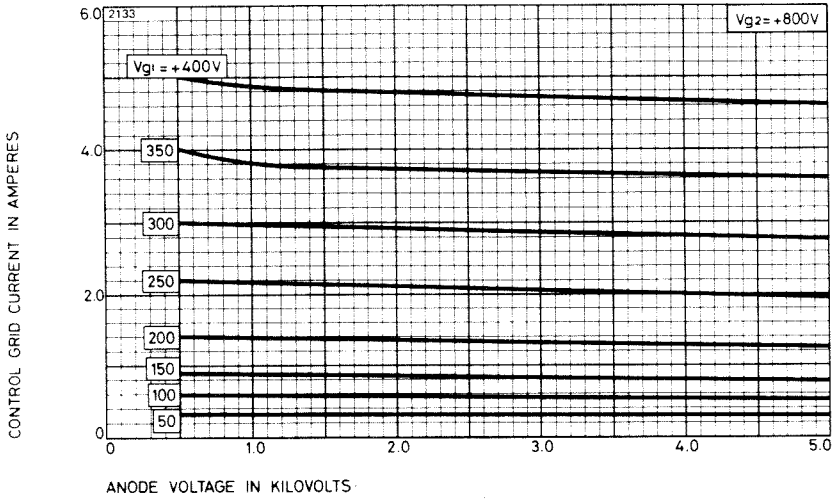
1. The valve must be operated at the stated filament voltage. Fluctuations must not exceed ±5%.
2. The filament current must not exceed 400A, even momentarily, at any time.
3. Measured with external flat metal shield 12 inches (305mm) square having a centre hole 4.312 inches (109.5mm) diameter located in the plane of the screen grid terminal, perpendicular to the valve axis, and connected to the screen grid.
4. Computed between half-power points and based on valve output capacitance only.
5. The driver stage is required to supply valve losses and r.f. circuit losses. The driver stage should be designed to provide an excess of power

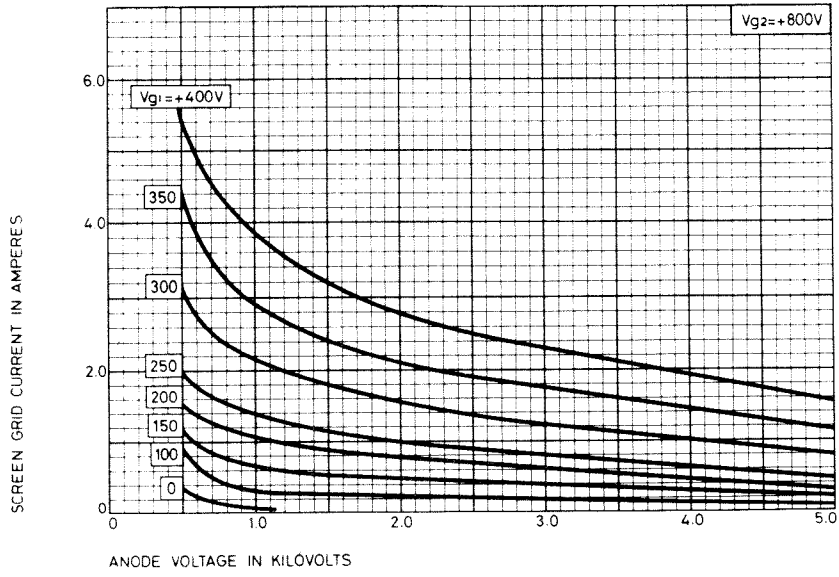
above the indicated value to take care of variations in line voltage, components, initial valve characteristics, and valve characteristics during life.

6. This value includes 700W of r.f. circuit loss at 216MHz.
7. The driver stage is required to supply the r.f. power added to the anode circuit in addition to the losses indicated under Note 5.
8. This value includes 300W of r.f. circuit loss at 216MHz and 900W added to anode circuit.
9. These ratings apply for operation up to 60MHz; for ratings at higher frequencies, see table on page 6.
10. Obtained preferably from a separate source.
11. Obtained preferably from a combination of 365 ohms control grid resistor and −170V fixed bias.
12. This value includes 50W of r.f. circuit loss at 30MHz.
13. Obtained preferably from a separate source, or from the anode supply voltage with a voltage divider, or through a series resistor. A series screen resistor should not be used if the tube or a preceding stage is keyed. In this case, the regulation of the source should be sufficient to prevent the screen voltage from rising above 2000V under key-up conditions and additional fixed grid bias must be provided to limit the anode current.
14. Obtained from fixed supply, by grid resistor, by cathode resistor, or by combination methods.
15. This value includes 270W of r.f. circuit loss.
16. This value includes 675W of r.f. circuit loss.
17. In Class B and Class C television circuits, the valve should be supplied with its grid bias voltage from a source of good regulation – not from a grid resistor. In anode-modulated Class C operation, the grid bias may be obtained from a grid resistor or part from a grid resistor and the balance from either a cathode bias resistor or a fixed voltage. In Class C telegraphy or Class C f.m. telephony operation, the bias may be obtained by any convenient method.
18. With Class B and Class C television circuits, or with Class C f.m. operation the screen should be supplied from a source having good regulation. With anode-modulated Class C operation the screen voltage may preferably be obtained from a separate source and the screen grid should be modulated so as to keep the ratio of screen to anode voltages constant. With Class C telegraphy any convenient method may be used.
19. Modulation essentially negative may be used if the positive peak of the a.f. envelope does not exceed 115% of the carrier conditions.

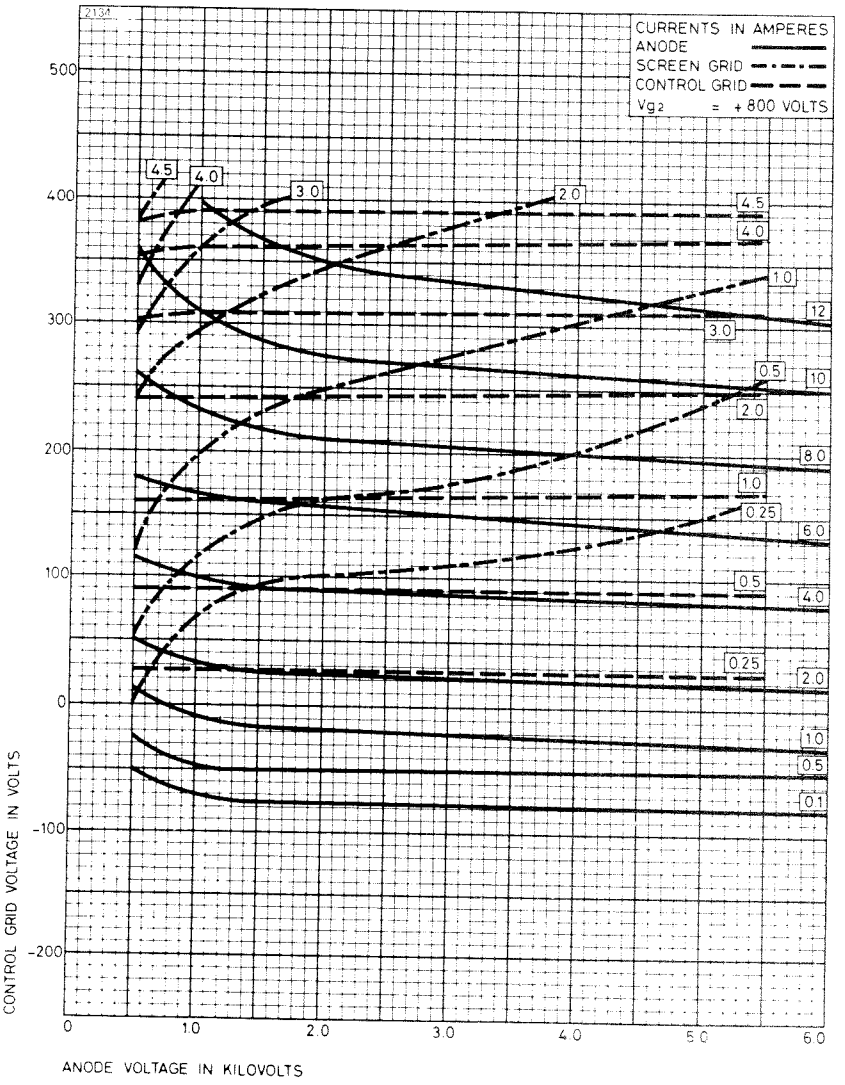
ANODE CHARACTERISTICS

CONTROL GRID AND SCREEN GRID CHARACTERISTICS





CONSTANT CURRENT CHARACTERISTICS



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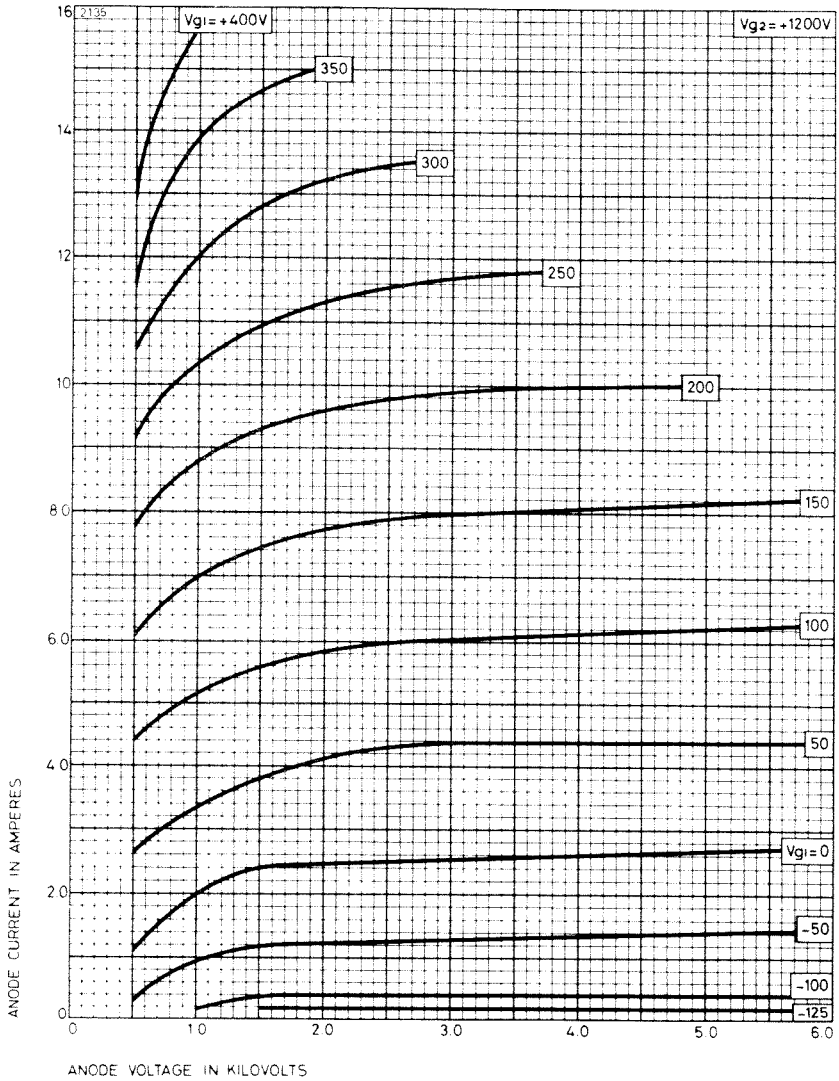
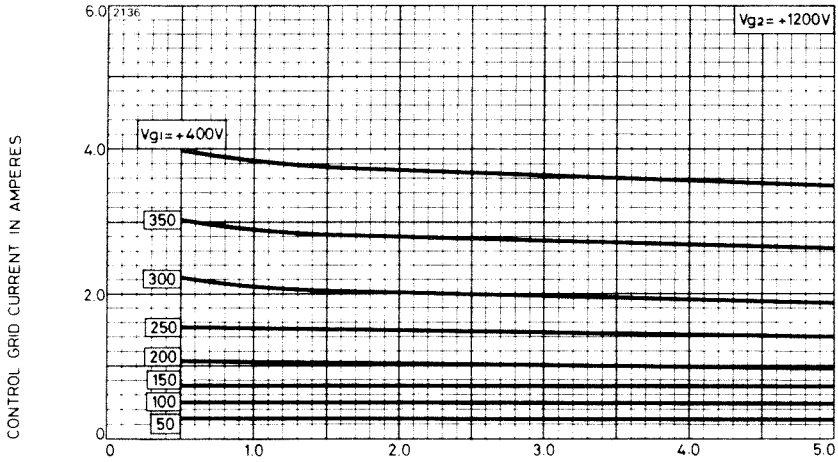
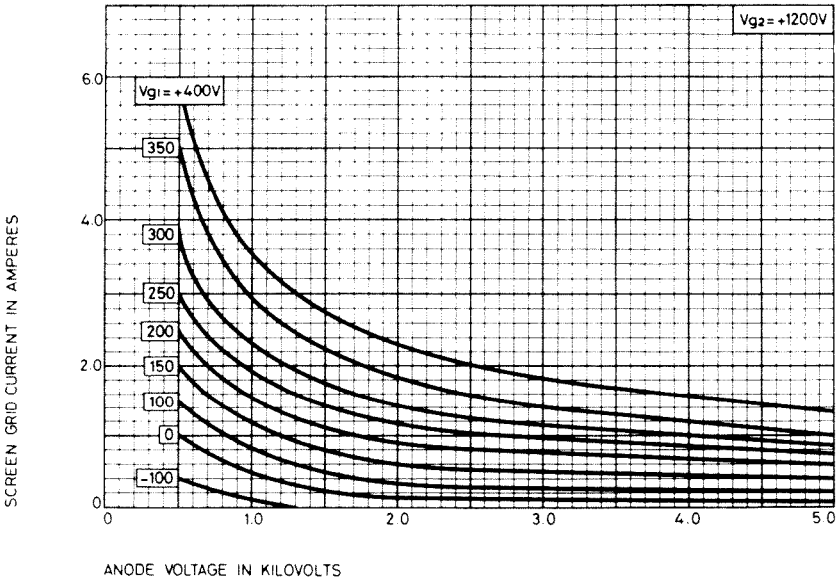


CONTROL GRID AND SCREEN GRID CHARACTERISTICS





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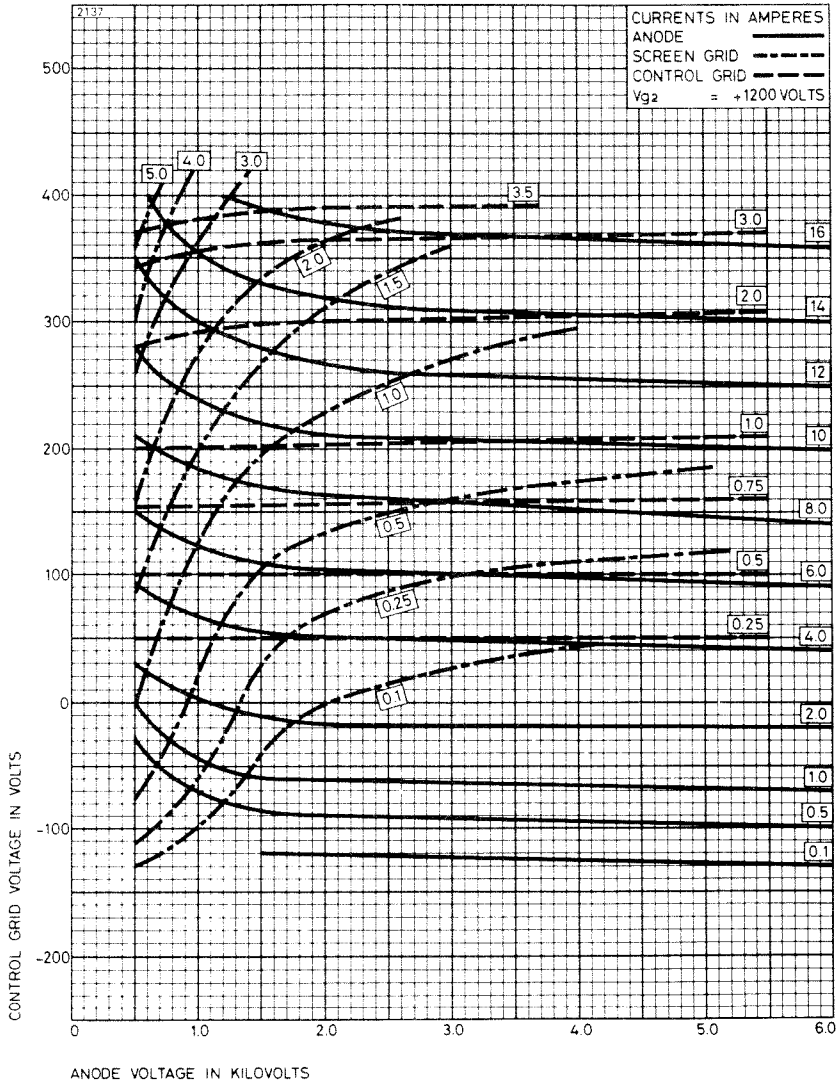

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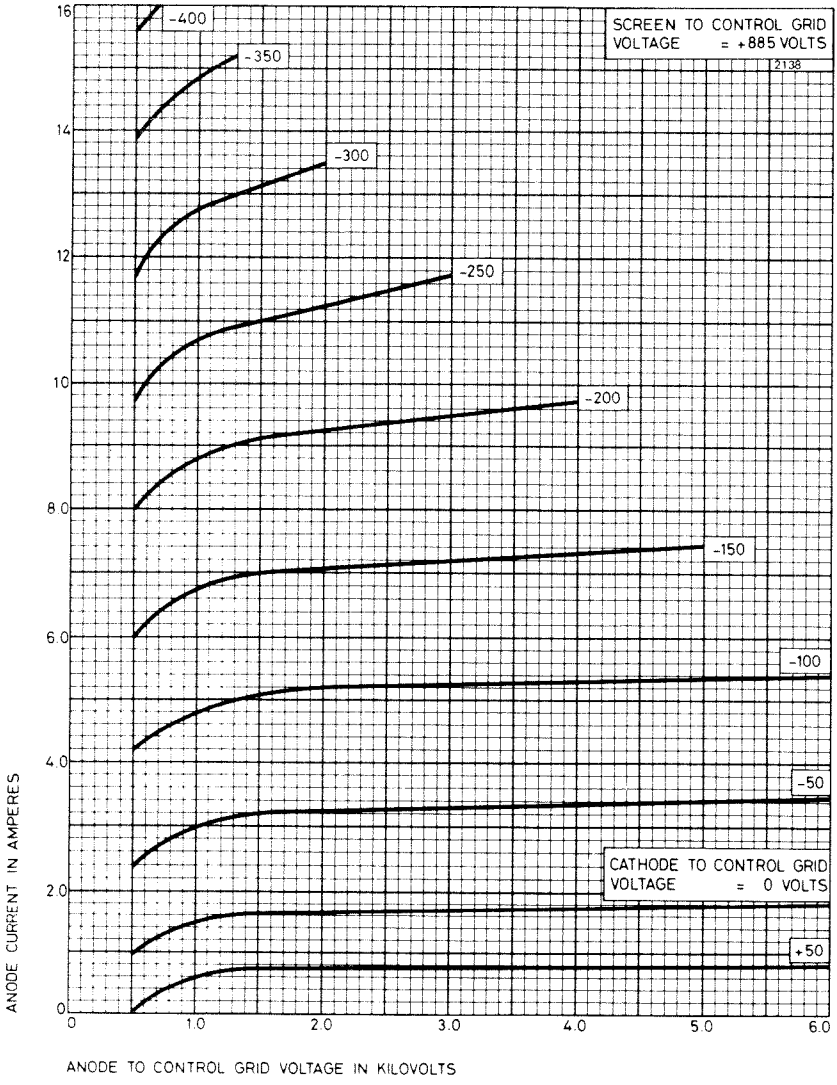
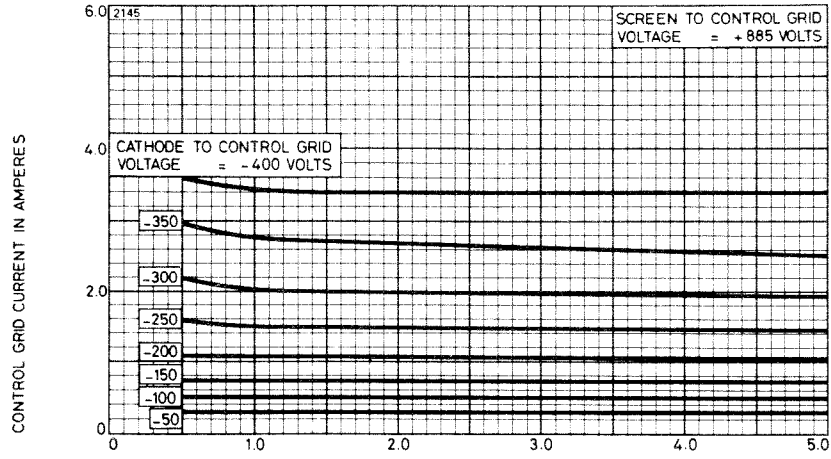
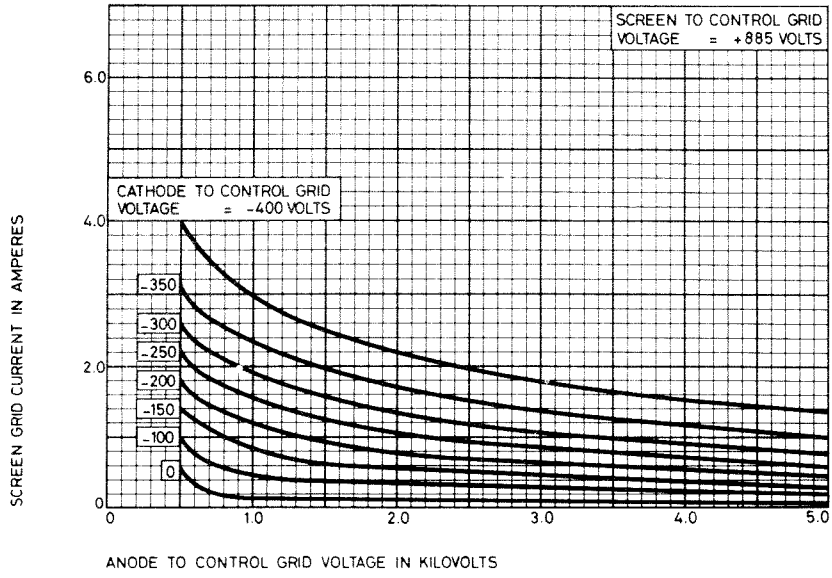
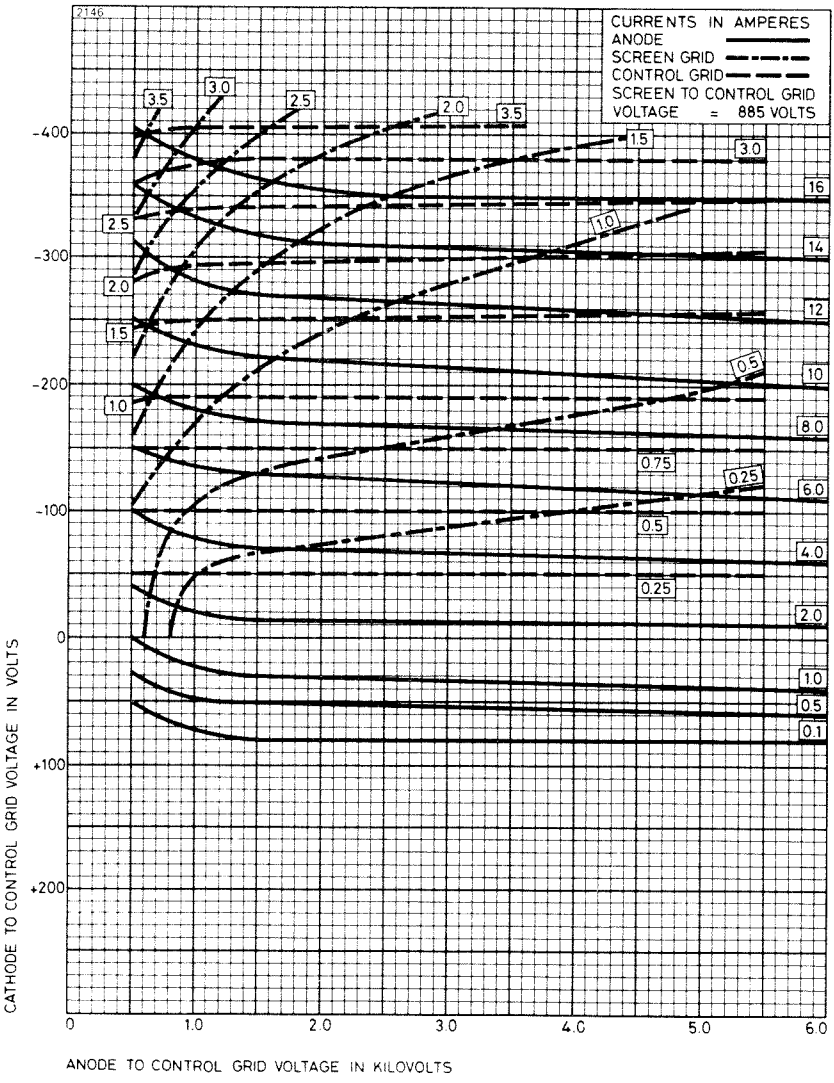


CONTROL GRID AND SCREEN GRID CHARACTERISTICS

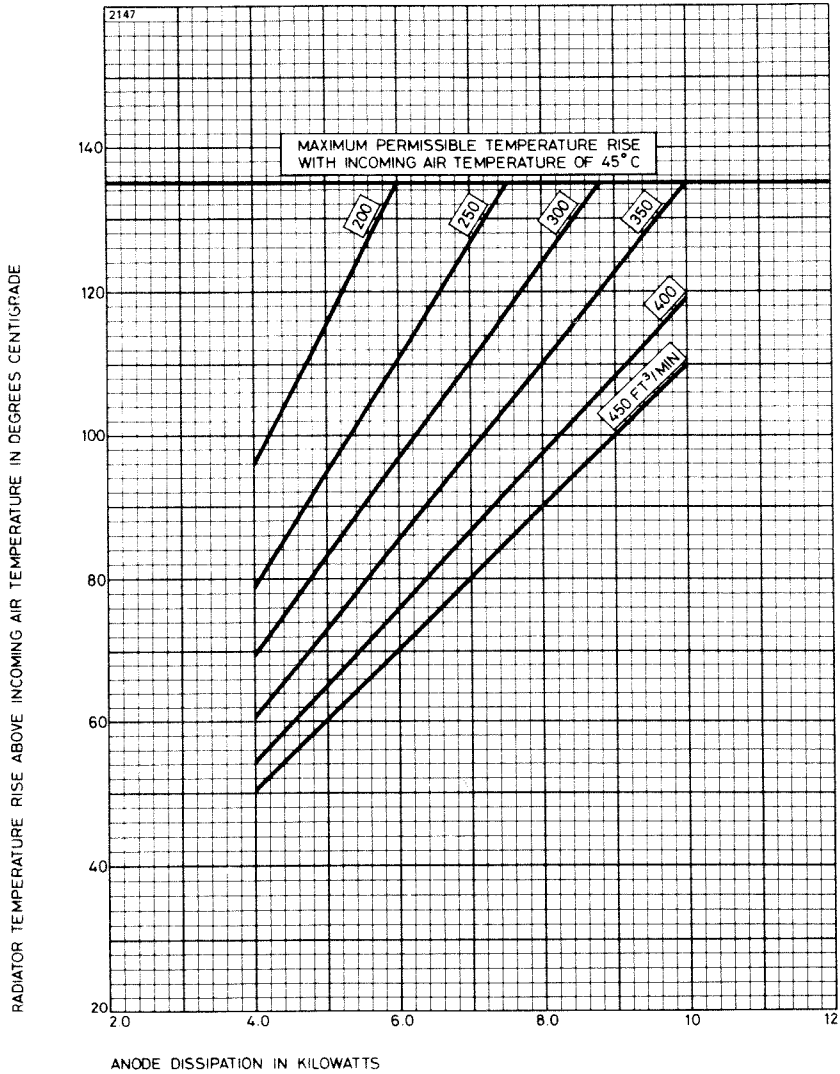




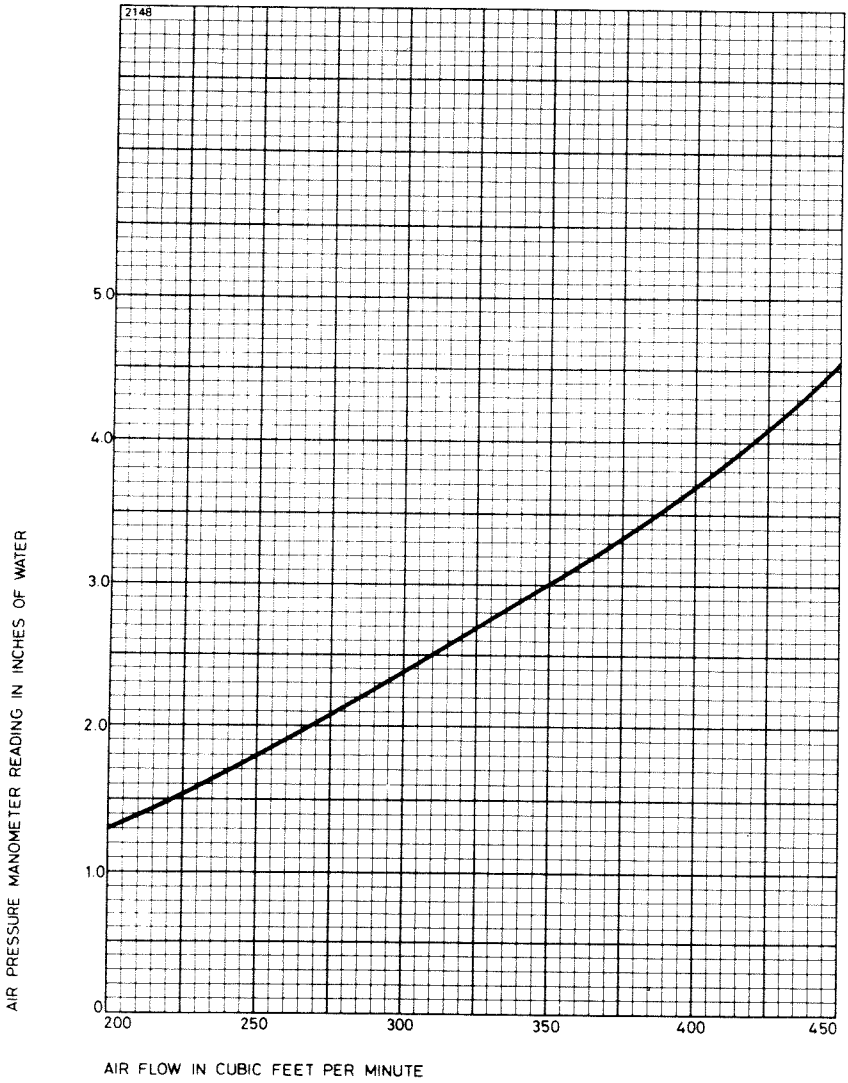
CONSTANT CURRENT CHARACTERISTICS



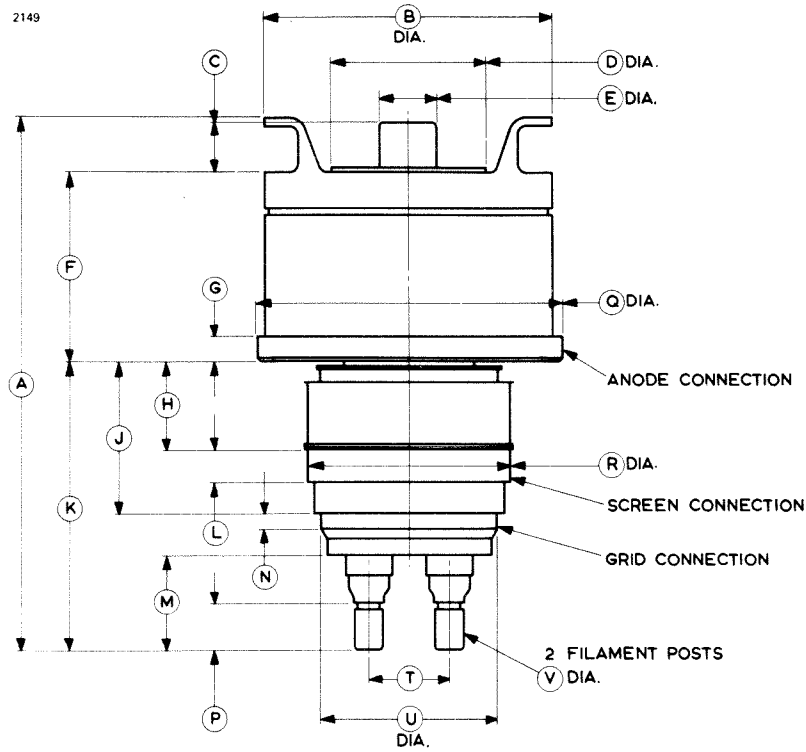
AIR COOLING CHARACTERISTICS



AIR FLOW CHARACTERISTIC



OUTLINE



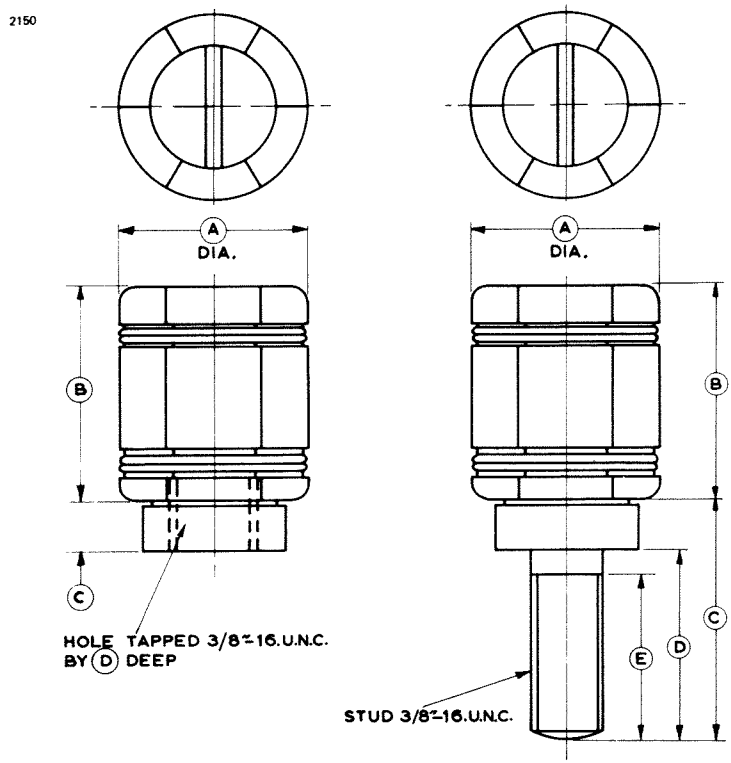
Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	11.625 max	295.3 max	L	0.500 min	12.70 min
B	6.000 ± 0.094	152.4 ± 2.39	M	1.907 min	48.44 min
C	1.150 max	29.21 max	N	0.350 min	8.89 min
D	3.375 max	85.73 max	P	0.812 min	20.62 min
E	1.187	30.15	Q	6.375 ± 0.031	161.9 ± 0.79
F	4.094 max	104.0 max	R	4.248 ± 0.020	107.9 ± 0.51
G	0.500 ± 0.031	12.70 ± 0.79	T	1.710 ± 0.040	43.43 ± 1.02
H	1.846 ± 0.050	46.89 ± 1.27	U	3.685 ± 0.025	93.60 ± 0.64
J	3.151 ± 0.070	80.04 ± 1.79	V	0.625 ± 0.002	15.875 ± 0.051
K	6.094 ± 0.156	154.8 ± 3.96			

Millimetre dimensions have been derived from inches.

PUSH-ON FILAMENT ADAPTORS

MA136

MA137



Ref	Inches	Millimetres
A	0.980	24.89
B	1.125	28.58
C	0.312	7.92
D	0.312	7.92

Ref	Inches	Millimetres
A	0.980	24.89
B	1.125	28.58
C	1.312	33.32
D	1.000	25.40
E	0.875 min	22.22 min

Millimetre dimensions have been derived from inches.

CR1100

R.F. POWER TETRODE

→ **Service Type CV5219**

INTRODUCTION

The CR1100 is a forced-air cooled transmitting Tetrode. It has a maximum anode dissipation of 3kW and can be operated at 5kV up to 110Mc/s and 4kV up to 220Mc/s.

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	6·3	V
Filament Current	32·5	A
Maximum Filament Starting Current	(*See Note* 2)	
Filament Cold Resistance	0·024	Ω
Peak Usable Cathode Current	10	A
Grid-Screen Amplification Factor (V_a = 4kV, I_a = 2A)	8·5	
Mutual Conductance (V_a = 4kV, I_a = 2A)	19·0	mA/V
Inter-electrode Capacitances:		
Grid to Anode	0·35	pF Max
Input	23·5	pF
Output	8·4	pF

Mechanical

Overall Length	6·66 inches (169 mm)	Max
Overall Diameter	3·82 inches (97 mm)	Max
Net Weight	5 pounds (2·3 kg)	Approx
Mounting Position	Vertical, either end up	

COOLING

The required quantity of air through the radiator for cooling the anode is indicated on the graphs (pages 7 and 8) and should be delivered by a blower through the radiator before and during the application of any voltages. It should enter at the glass end and cool the screen-grid connection in passing.

In addition, a flow of about 50 cu.ft/min should be directed at the filament and grid terminals.

The temperature of anode, screen, grid and filament seals must not exceed 180°C.

→ Indicates a change

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R.F. POWER TETRODE

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

	Up to 110Mc/s	*Up to 220Mc/s*	
Anode Voltage	5·0	4·0	kV Max
Screen Voltage	1·2	1·2	kV Max ←
Grid Voltage	−500	−500	V Max
Anode Current	1·1	1·1	A Max
Anode Dissipation	3·0	3·0	kW Max
Screen Dissipation	100	100	W Max
Grid Dissipation	30	30	W Max

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.

2. The filament current must not exceed 75A, even momentarily, at any time

← Indicates a change

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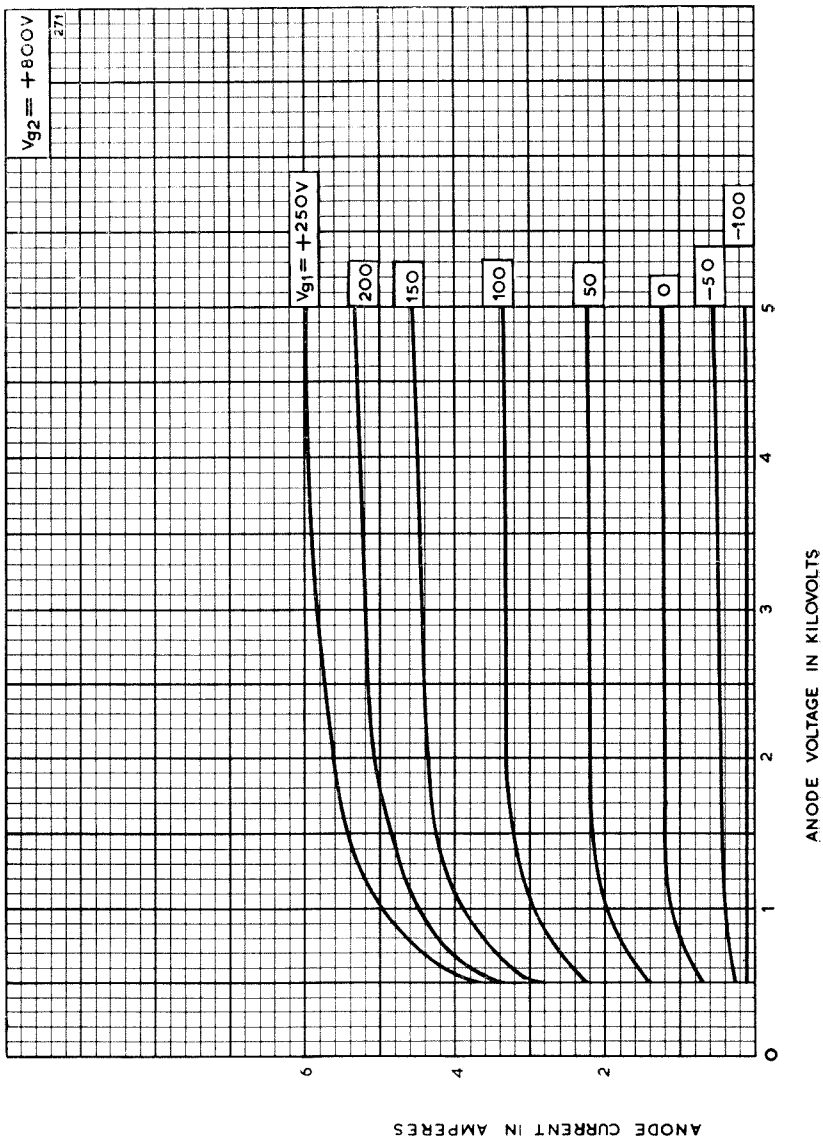
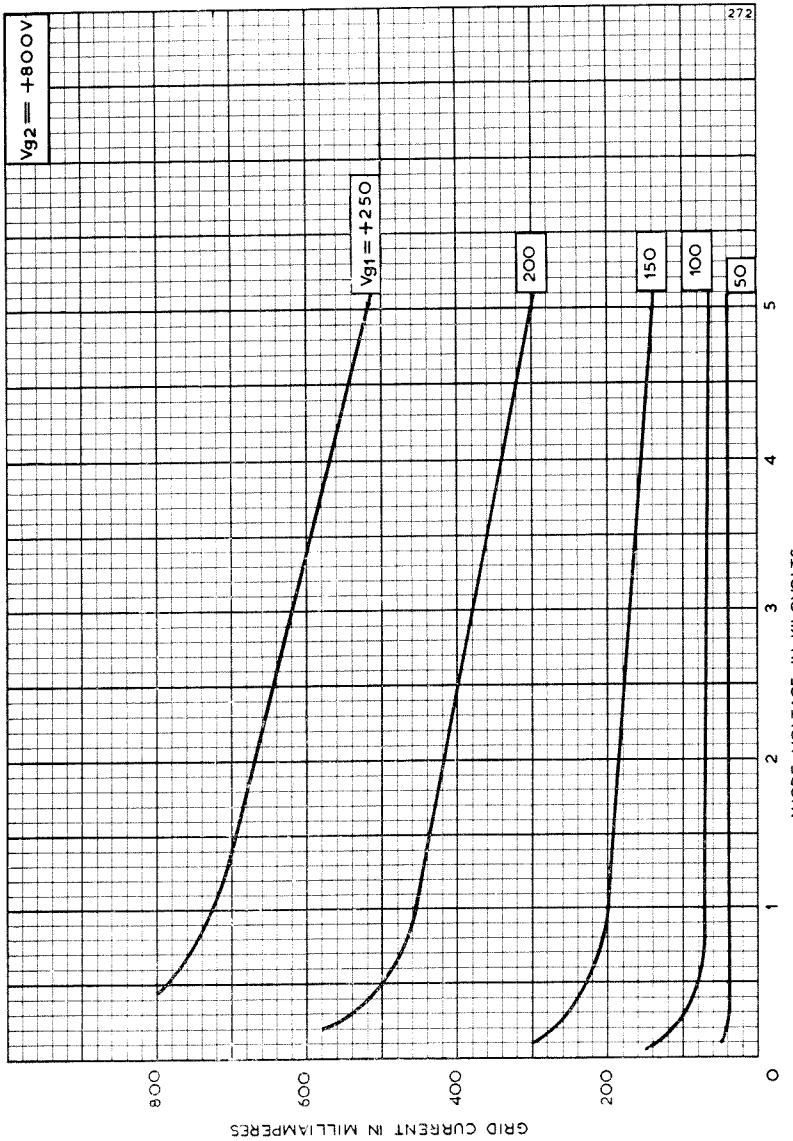
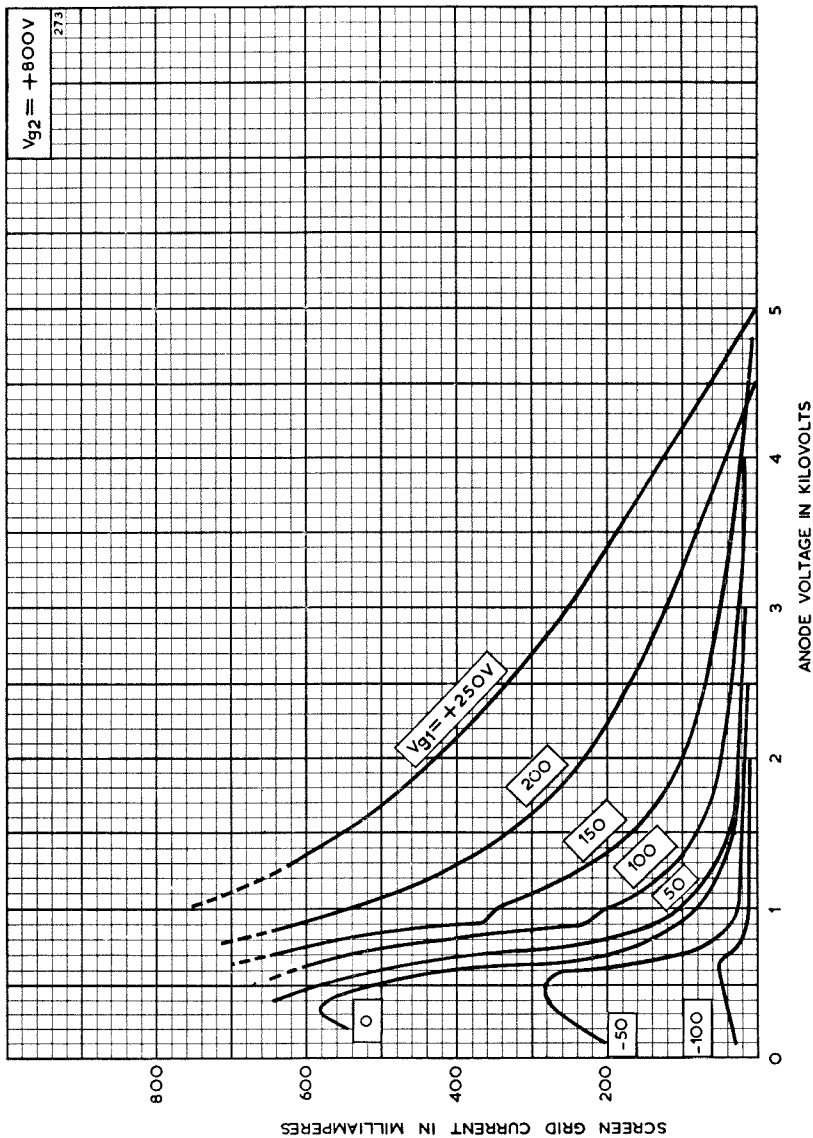
ANODE CHARACTERISTICS



CONTROL GRID CHARACTERISTICS



SCREEN GRID CHARACTERISTICS



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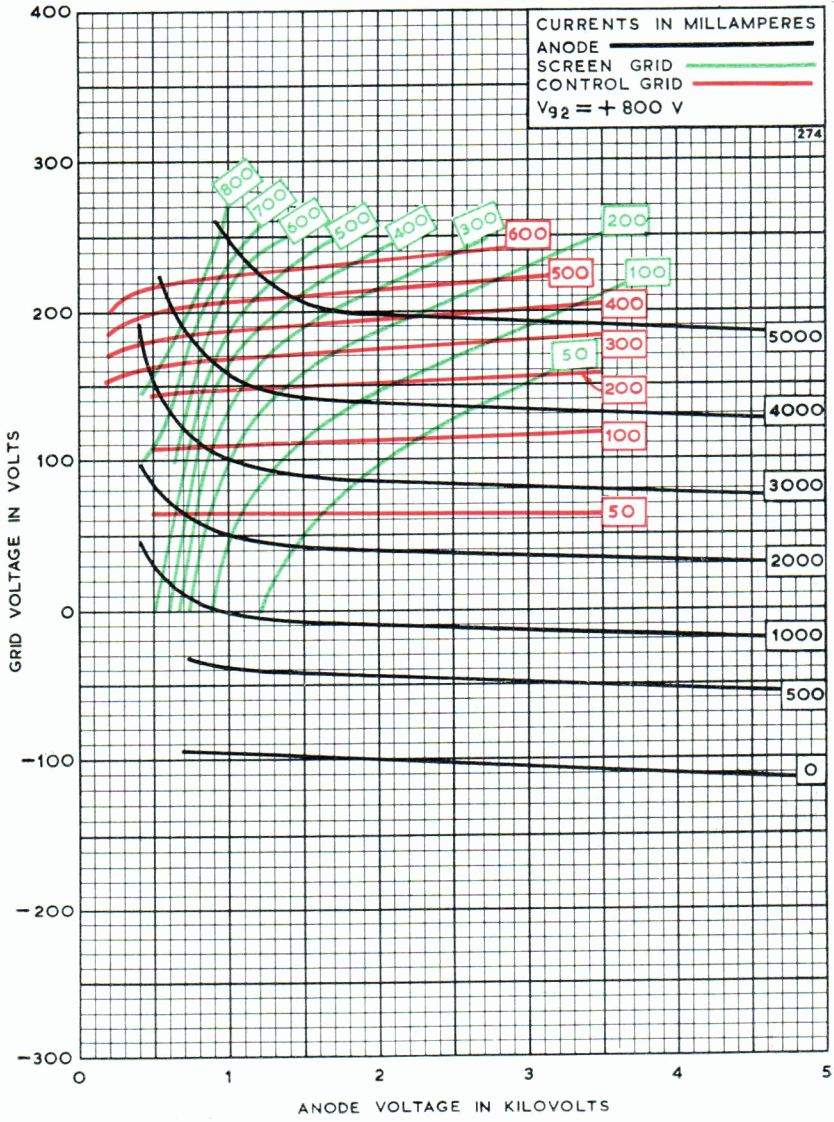
R.F. POWER TETRODE

CONSTANT CURRENT CHARACTERISTICS



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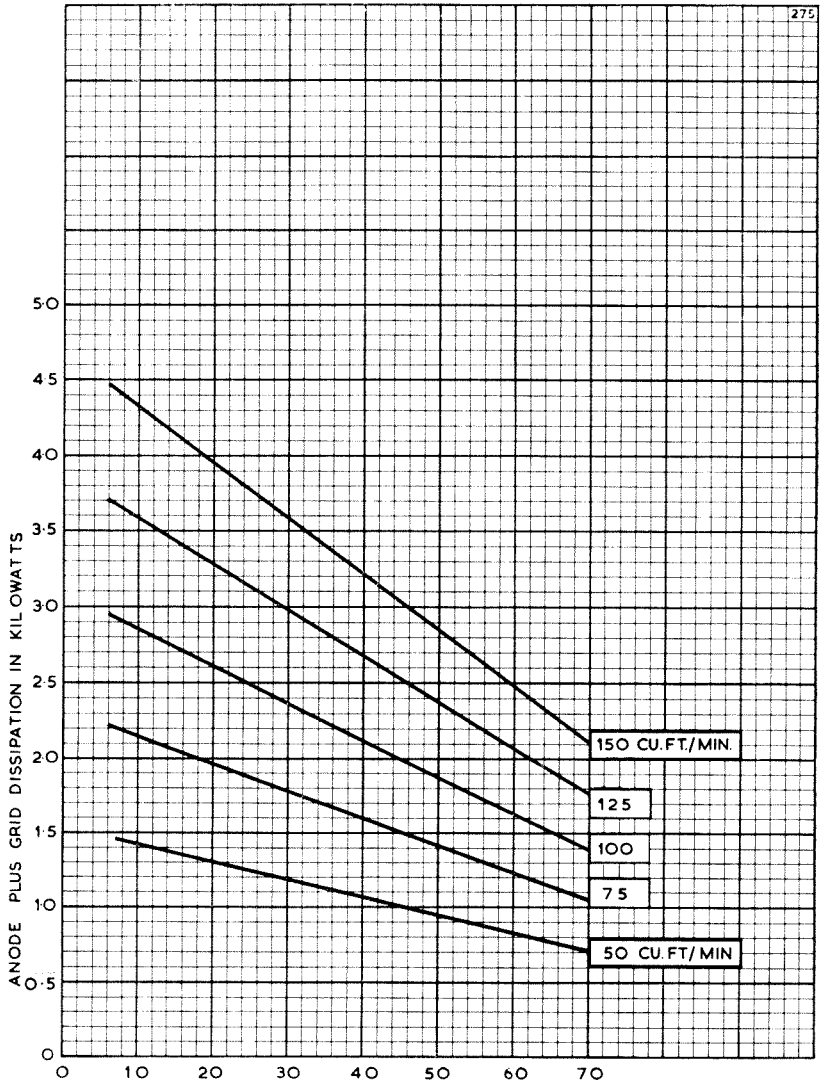
AIR COOLING CHARACTERISTICS



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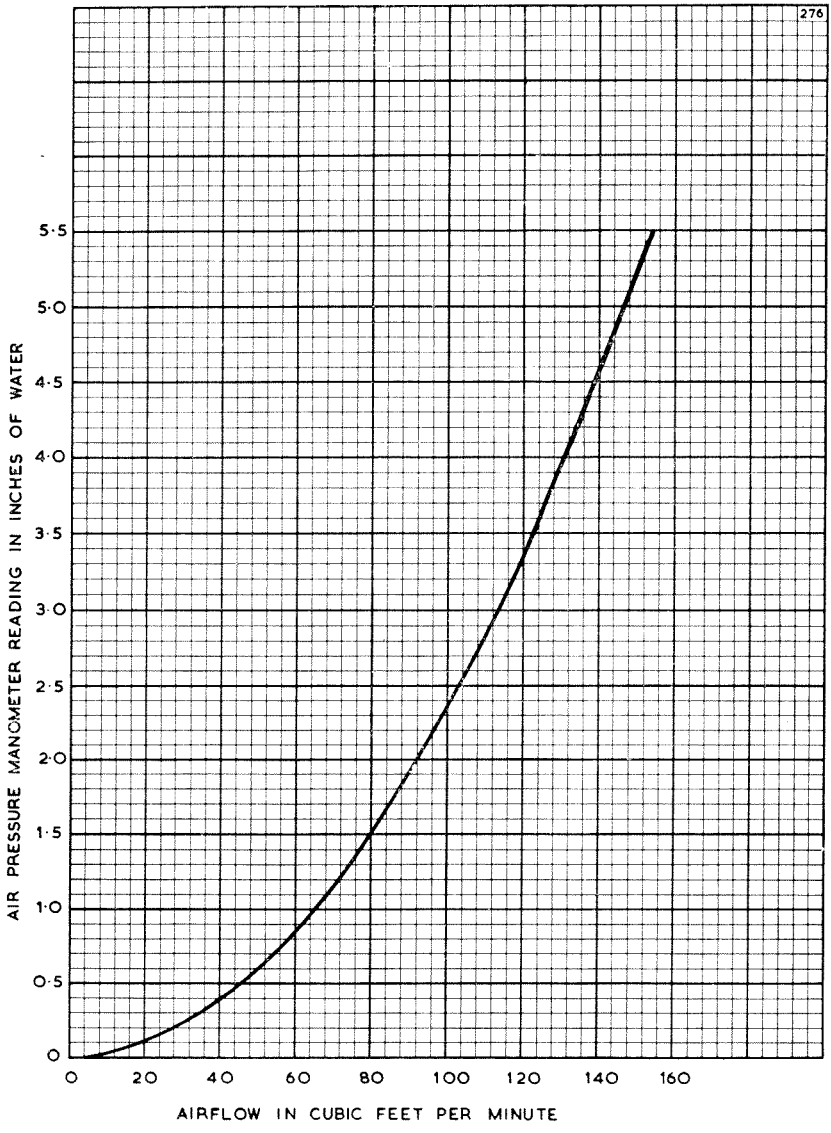
R.F. POWER TETRODE

AIR FLOW CHARACTERISTICS



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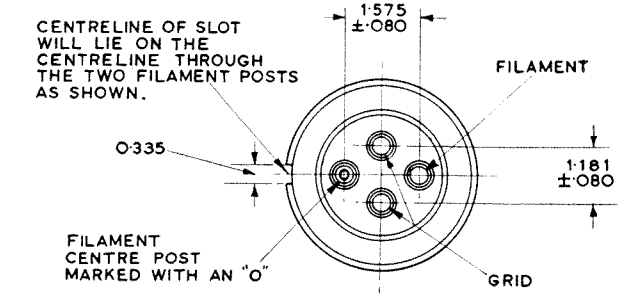
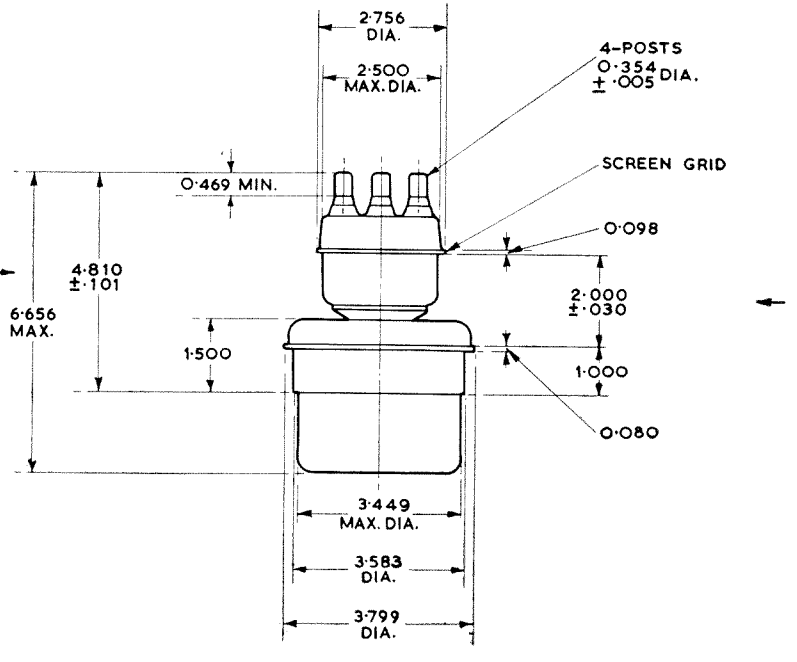
R.F. POWER TETRODE

OUTLINE

5376





ALL DIMENSIONS IN INCHES

INDICATES A CHANGE ←

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Water Cooled Tetrodes

September 1965

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

CW1100

R.F. POWER TETRODE

INTRODUCTION

The CW1100 is a water-cooled transmitting Tetrode. It has a maximum anode dissipation of 3kW and can be operated at 5kV up to 110Mc/s and 4kV up to 220Mc/s.

GENERAL DATA

Electrical

Filament	Thoriated Tungsten	
Filament Voltage (*See Note* 1)	6·3	V
Filament Current	32·5	A
Maximum Filament Starting Current	(*See Note* 2)	
Filament Cold Resistance	0·024	Ω
Peak Usable Cathode Current	10	A
Grid-Screen Amplification Factor (V_a = 4kV, I_a = 2A)	8·5	
Mutual Conductance (V_a = 4kV, I_a = 2A)	19·0	mA/V
Inter-electrode Capacitances:		
Grid to Anode	0·35 pF	Max
Input	23·5	pF
Output	8·4	pF

Mechanical

Overall Length	6·75 inches	(172 mm)	Max←
Overall Diameter	2·76 inches	(70 mm)	Max
Net Weight	1 pound	(450 gm)	Approx
Mounting Position	Vertical, Filament end up		

COOLING

The anode, which is part of the envelope, must be fitted into a water jacket for cooling, the water necessary being 1·5 gallons per minute. The temperature of the cooling water at the outlet must not exceed 65°C, nor should the temperature rise across the jacket exceed 15°C.

The temperature of the filament, grid and screen seals should not exceed 180°C, and in order to keep within these limits, it may be necessary to direct a flow of air on to these seals. With anode voltages up to 4·0kV air cooling will in general not be necessary at frequencies below 75Mc/s, but above 4·0kV air cooling will usually be necessary at all frequencies.

←Indicates a change

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R.F. POWER TETRODE

R.F. POWER AMPLIFIER AND OSCILLATOR

(Class C Telegraphy, key-down conditions, one valve)

MAXIMUM RATINGS

(Absolute Values)

	Up to 110Mc/s	*Up to 220Mc/s*	
Anode Voltage	5·0	4·0	kV Max
Screen Voltage	1·2	1·2	kV Max ←
Grid Voltage	−500	−500	V Max
Anode Current	1·1	1·1	A Max
Anode Dissipation	3·0	3·0	kW Max
Screen Dissipation	100	100	W Max
Grid Dissipation	30	30	W Max

NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed 5%.

2. The filament current must not exceed 75A, even momentarily, at any time.

← Indicates a change

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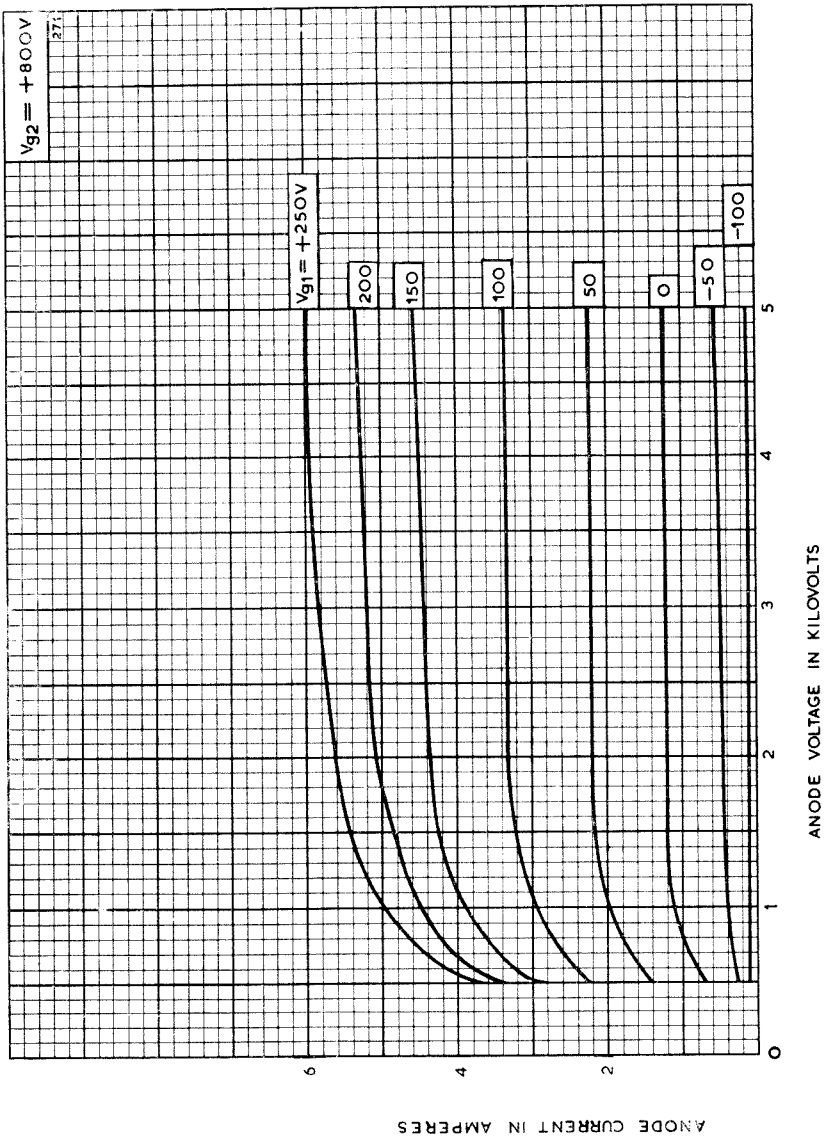
R.F. POWER TETRODE

ANODE CHARACTERISTIC



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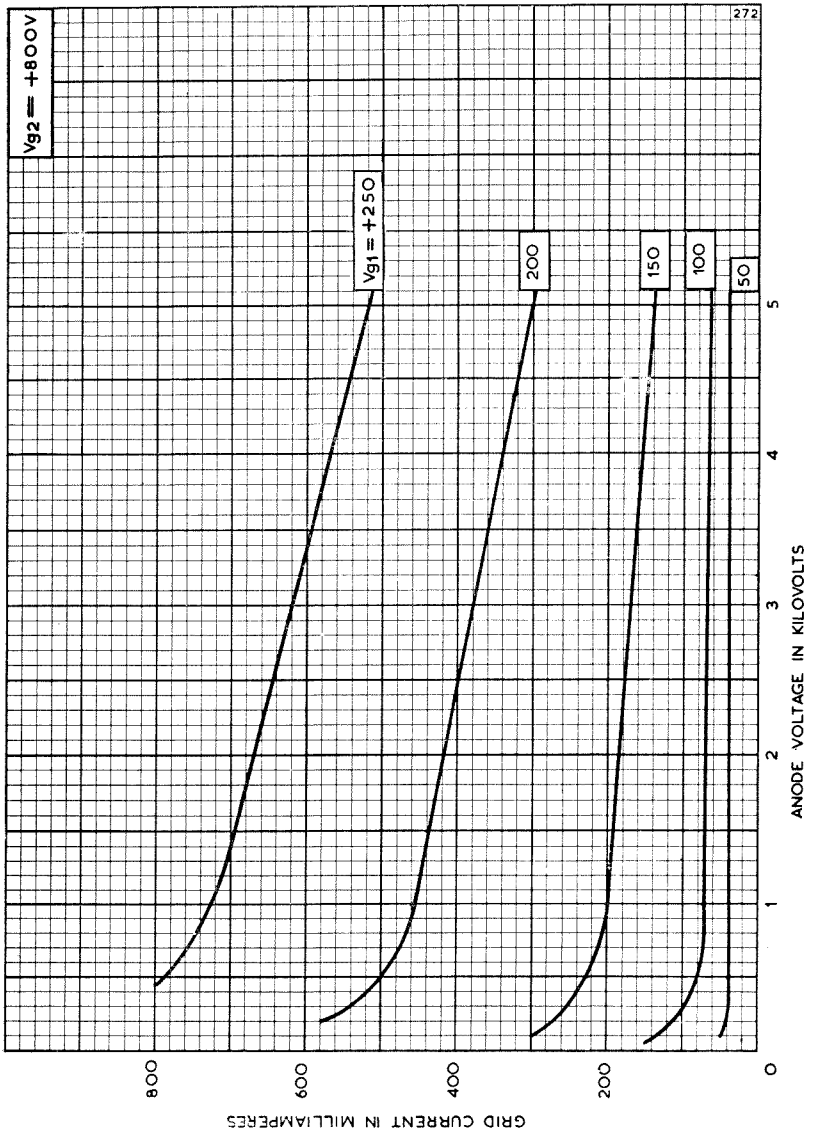
CONTROL GRID CHARACTERISTIC



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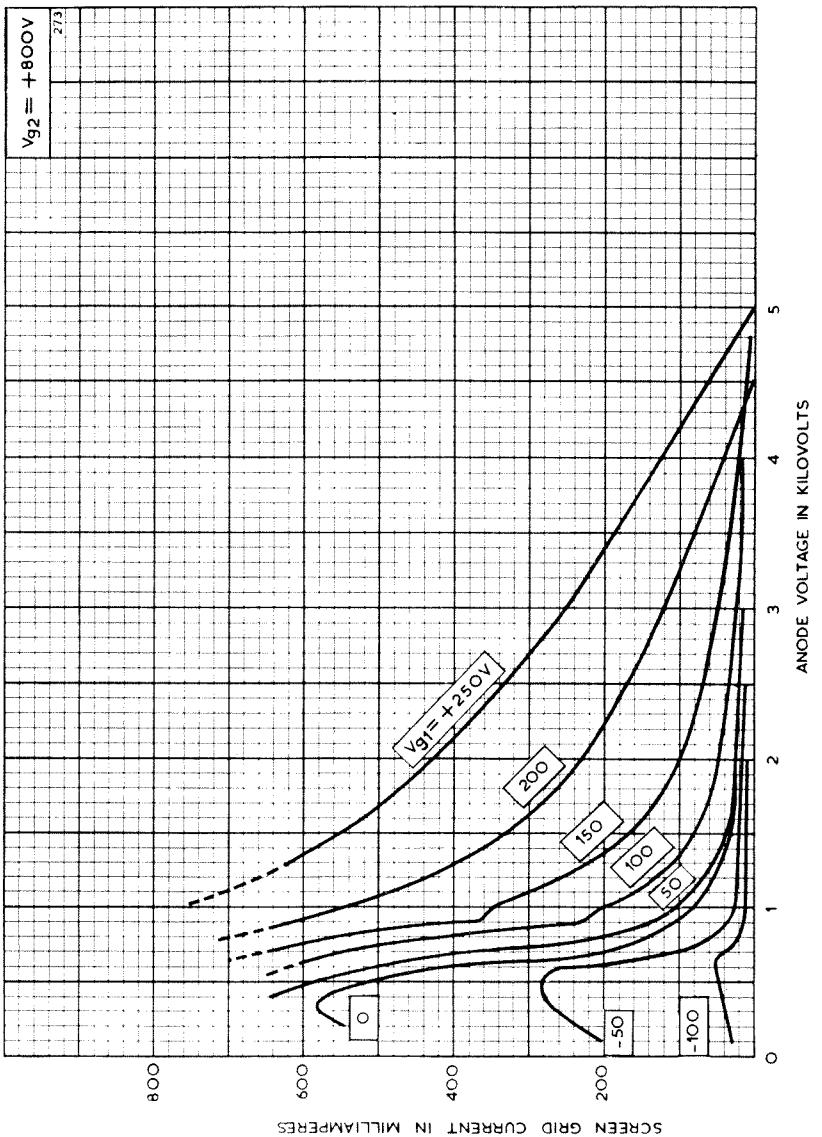
SCREEN GRID CHARACTERISTIC



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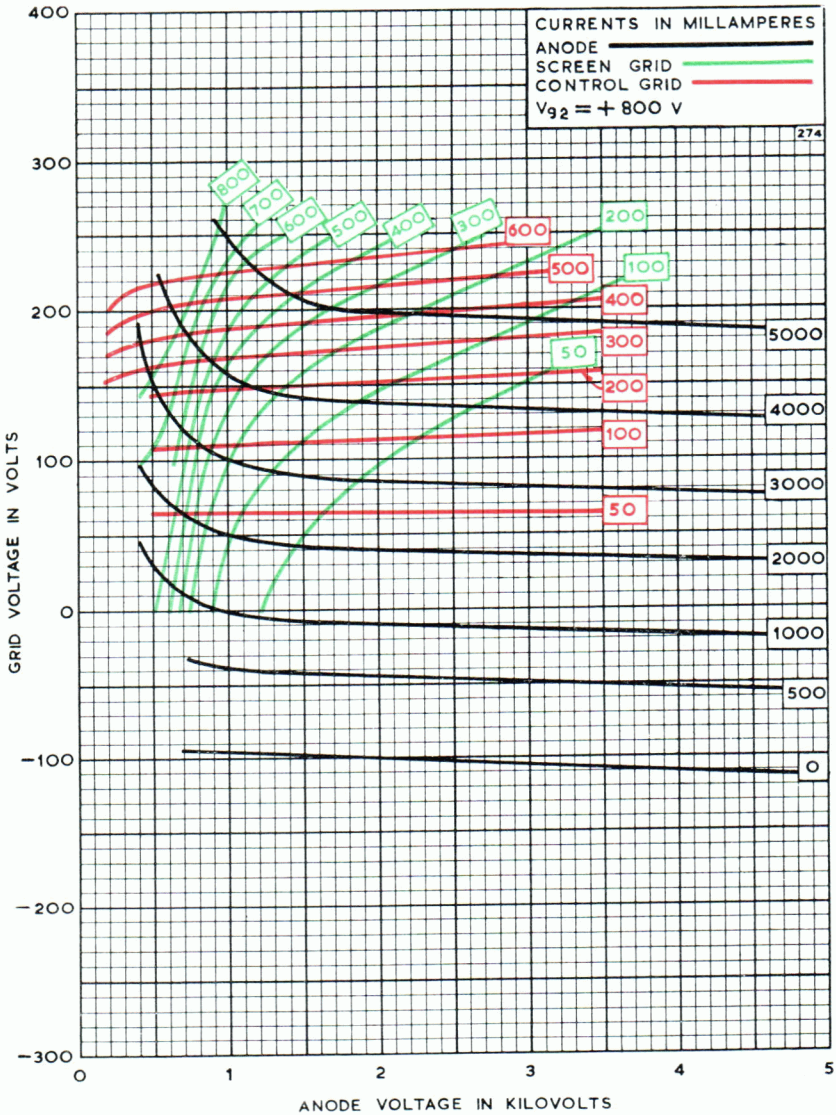
R.F. POWER TETRODE

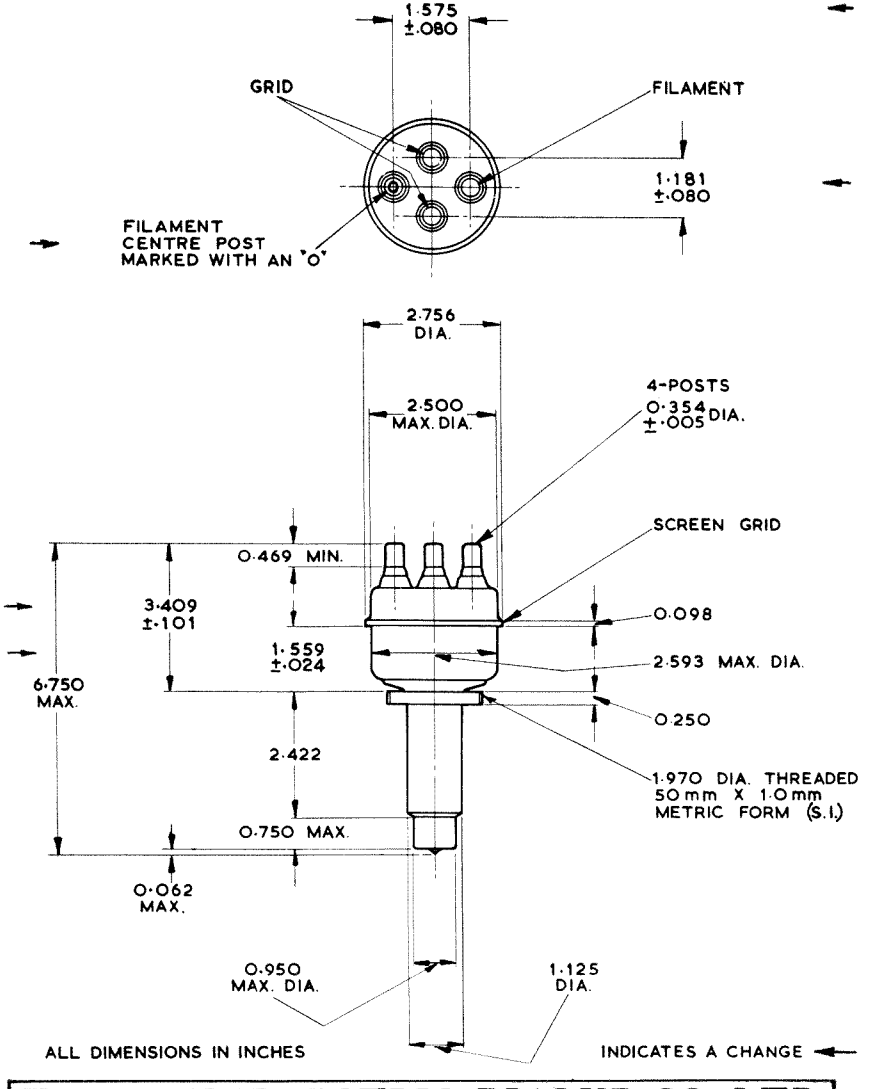
CONSTANT CURRENT CHARACTERISTICS



R.F. POWER TETRODE

OUTLINE

538A



ALL DIMENSIONS IN INCHES

INDICATES A CHANGE

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VAPOUR COOLED TETRODES

March 1966

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Printed in England

CY1170J

R.F. POWER TETRODE

ABRIDGED DATA

Vapour-cooled tetrode with integral boiler, coaxial metal-ceramic envelope, for audio amplifiers, r.f. linear amplifiers or class C amplifiers or oscillators.

Anode dissipation	75	kW max
Anode voltage	15	kV max
Frequency for full ratings	30	MHz max
Output power (class C telegraphy)	82.5	kW

GENERAL

Electrical

Filament	thoriated tungsten	
Filament voltage (see note 1)	10	V
Filament current	300	A
Grid-screen amplification factor	4.5	
Inter-electrode capacitances, grounded filament:		
grid to anode	2.4	pF
input	465	pF
output	55	pF

Mechanical

Overall length	19.317 inches (490.7mm) max
Overall diameter	10.031 inches (254.8mm) max
Net weight	60 pounds (27kg) approx
Mounting position	vertical, anode up

COOLING

The CY1170J has an integral boiler for vapour cooling. The steam generated when the valve is operating is ejected from the top of the boiler and passed through an insulated tube to a separate condenser. The condensate is returned to an inlet on the side of the boiler.

Sufficient air must be passed over the base terminals to maintain the temperatures of the ceramic to metal seals below the maximum rated value of 250°C. It is recommended that socket type MA166 shown on page 11 be used with the tube, when 60 to 100ft^3/min (1.70 to 2.83m^3/min) of air will be required for base cooling. This should be blown horizontally through the socket from two diametrically opposed nozzles. It is also necessary to direct 2ft^3/min (0.06m^3/min) of air into the centre hole of the socket.

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR
(Class AB_1, See Note 2)

MAXIMUM RATINGS (Absolute values)

Anode voltage	15	kV max
Anode current	15	A max
Anode dissipation	75	kW max
Screen voltage	2.5	kV max
Screen dissipation	1750	W max
Grid dissipation	500	W max
Grid circuit resistance	0.1	MΩ max

TYPICAL OPERATING CONDITIONS (Class AB_1, two valves)

Anode voltage	10	15	kV
Screen voltage	1.5	1.5	kV
Grid voltage	−290	−340	V
Peak a.f. grid voltage	270	310	V
Anode current (zero signal)	4.0	2.0	A
Anode current (maximum signal)	17.4	15.1	A
Screen current (zero signal)	0	0	A
Screen current (maximum signal)	0.77	0.62	A
Anode dissipation per tube (maximum signal)	33	30.5	kW
Effective load (anode to anode)	1.15	2.56	kΩ
Nominal driving power (maximum signal)	0	0	W
Output power (maximum signal)	110	165	kW

RADIO FREQUENCY LINEAR AMPLIFIER
(Class AB_1, See Note 2)

MAXIMUM RATINGS (Absolute values)

Anode voltage	15	kV max
Anode current	15	A max
Anode dissipation	75	kW max
Screen voltage	2.5	kV max
Screen dissipation	1750	W max
Grid dissipation	500	W max
Grid circuit resistance	0.1	MΩ max

TYPICAL OPERATING CONDITIONS

(Peak envelope or modulation crest conditions, below 30MHz)

Anode voltage	10	15	kV
Screen voltage	1.5	1.5	kV
Grid voltage (see note 3)	−290	−340	V
Peak r.f. grid voltage	270	310	V
Anode current (zero signal)	2.0	1.0	A
Anode current (maximum signal)	8.7	7.55	A
Screen current (maximum signal)	0.385	0.310	A
Anode dissipation	33	30.5	kW
Nominal driving power	0	0	W
Output power (see note 4)	55	82.5	kW

ANODE MODULATED R.F. POWER AMPLIFIER

(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1.0)

MAXIMUM RATINGS (Absolute values)

Anode voltage	12.5	kV max
Anode current	15	A max
Anode dissipation (see note 5)	50	kW max
Screen voltage	2.0	kV max
Screen dissipation	1750	W max
Grid dissipation	500	W max

TYPICAL OPERATING CONDITIONS (below 30MHz)

Anode voltage	7.5	10	kV
Screen voltage	750	750	V
Grid voltage	−460	−520	V
Peak a.f. screen voltage (for 100% modulation)	640	675	V
Peak r.f. grid voltage	630	680	V
Anode current	7.0	6.6	A
Screen current	1.2	0.985	A
Grid current	0.375	0.370	A
Anode dissipation	10.5	11.0	kW
Nominal driving power	235	250	W
Output power	42	55	kW

R.F. POWER AMPLIFIER OR OSCILLATOR

(Class C Telegraphy, key down conditions, one valve)

MAXIMUM RATINGS (Absolute values)

Anode voltage	15	kV max
Anode current	15	A max
Anode dissipation	75	kW max
Screen voltage	2.5	kV max
Screen dissipation	1750	W max
Grid dissipation	500	W max

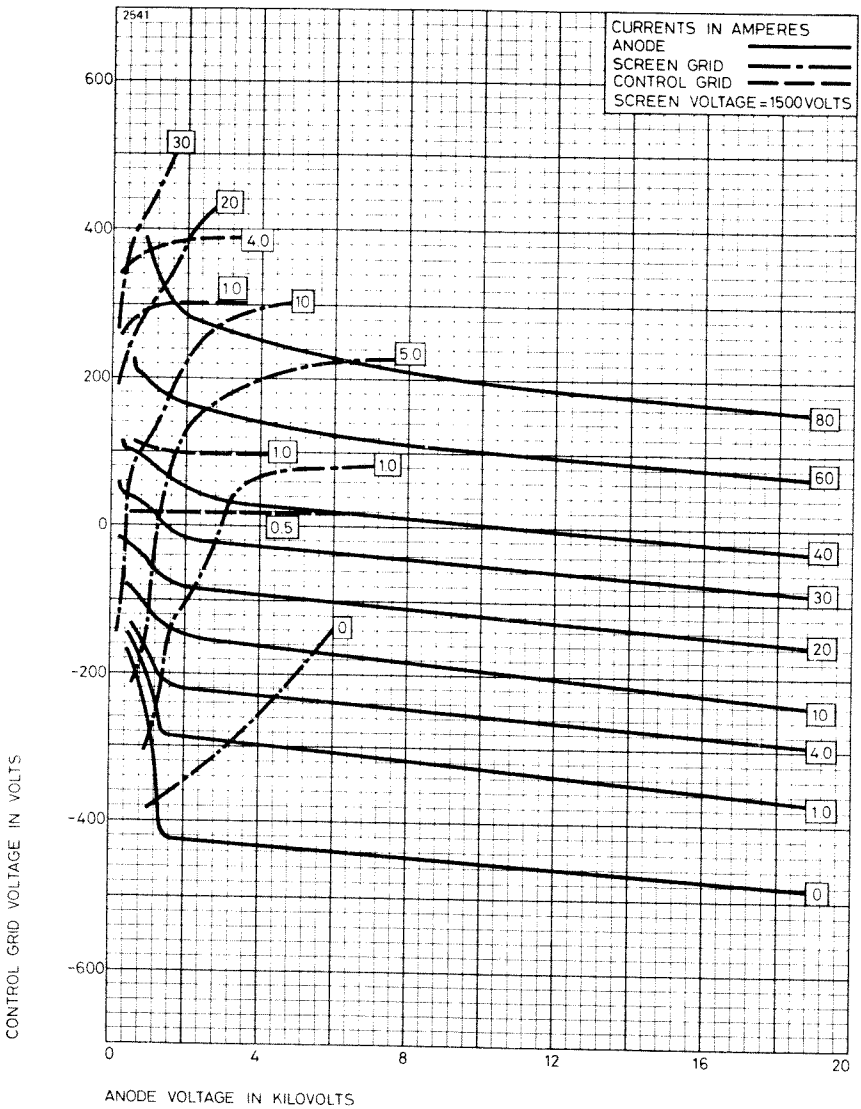
TYPICAL OPERATING CONDITIONS (below 30MHz)

Anode voltage	10	15	kV
Screen voltage	750	750	V
Grid voltage	−425	−480	V
Peak r.f. grid voltage	575	640	V
Anode current	6.70	6.45	A
Screen current	0.925	0.810	A
Grid current	0.320	0.355	A
Anode dissipation	12	14	kW
Nominal driving power	185	225	W
Output power	55	82.5	kW

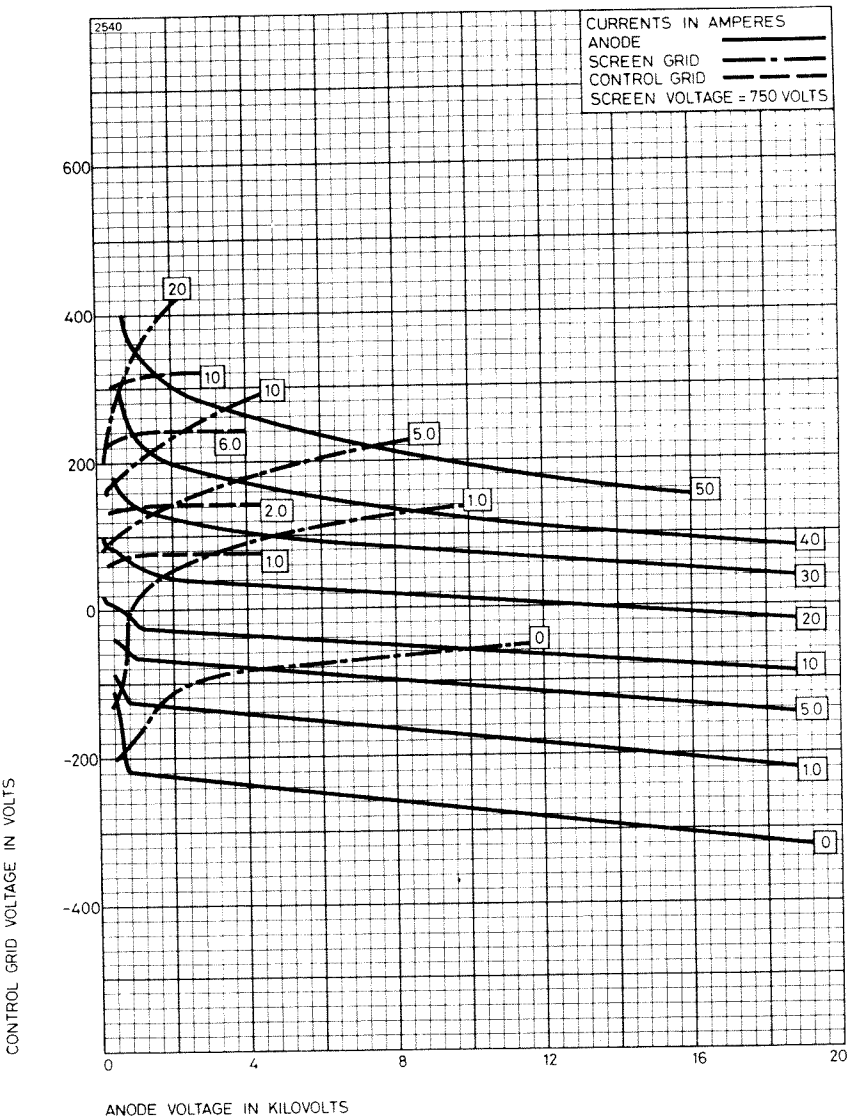
NOTES

1. The valve must be operated at the stated filament voltage. Fluctuation in filament voltage must not exceed ±5%.
2. Grid current does not flow during any part of the drive cycle.
3. The grid voltage is adjusted to obtain the specified zero-signal anode current.
4. The peak envelope or r.f. output power at the crest of the modulation envelope.
5. This corresponds to 75kW anode dissipation at 100% sine wave modulation.

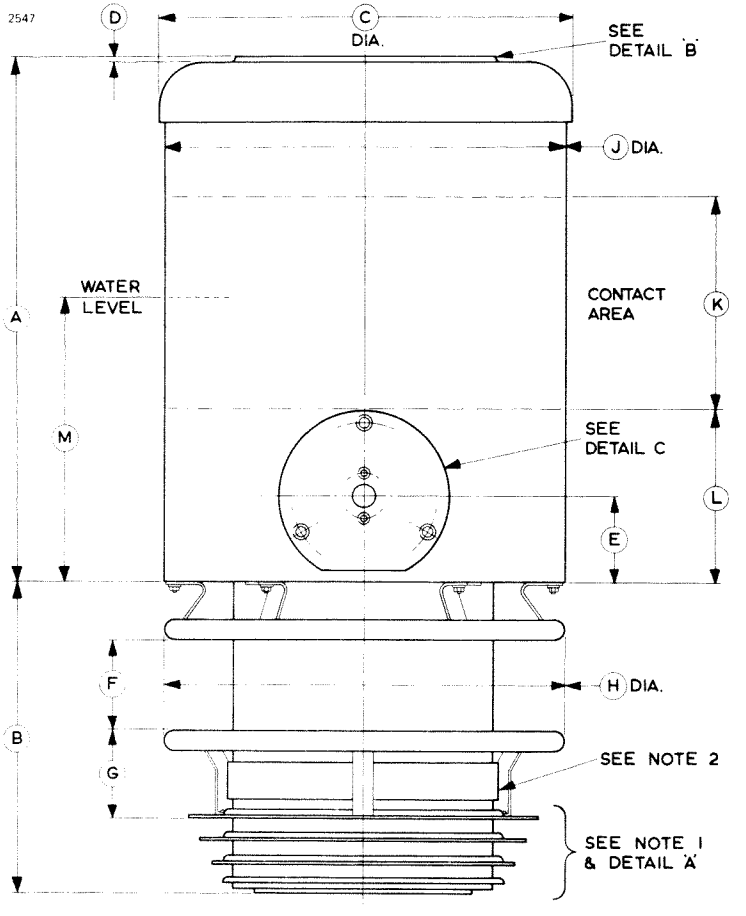
TYPICAL CONSTANT CURRENT CHARACTERISTICS



TYPICAL CONSTANT CURRENT CHARACTERISTICS



OUTLINE (See page 9 for outline notes)

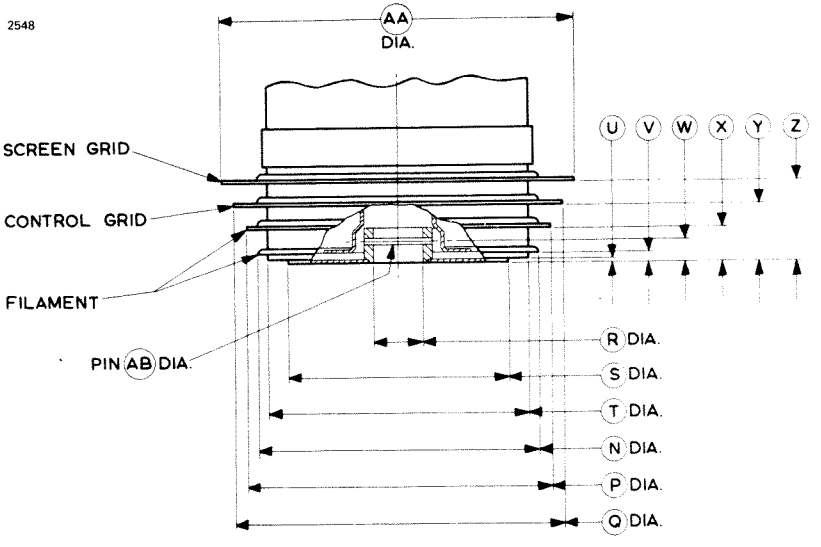


Ref	Inches	Millimetres
A	12.000 ± 0.125	304.8 ± 3.2
B	7.067 ± 0.125	179.5 ± 3.2
C	9.437	239.7
D	0.125	3.18
E	2.000 ± 0.062	50.80 ± 1.57
F	2.000	50.80
G	2.000	50.80

Ref	Inches	Millimetres
H	9.250	235.0
J	9.250	235.0
K	5.000	127.0
L	4.000	101.6
M	6.500 nom 4.500 min	165.1 nom 114.3 min

Millimetre dimensions have been derived from inches.

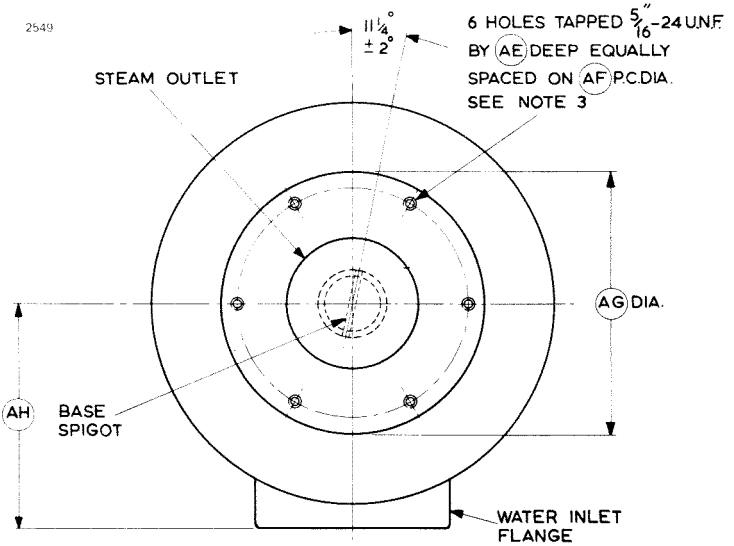
Outline Detail 'A'



Ref	Inches	Millimetres	Ref	Inches	Millimetres
N	6.530 ± 0.030	165.86 ± 0.76	V	0.197 ± 0.031	5.00 ± 0.79
P	7.000 ± 0.020	177.80 ± 0.51	W	0.510 ± 0.020	12.95 ± 0.51
Q	7.500 ± 0.020	190.50 ± 0.51	X	0.715 ± 0.025	18.16 ± 0.64
R	1.260 ± 0.010	32.00 ± 0.25	Y	1.245 ± 0.025	31.62 ± 0.64
S	5.000 ± 0.020	127.00 ± 0.51	Z	1.775 ± 0.025	45.08 ± 0.64
T	6.000 ± 0.020	152.40 ± 0.51	AA	7.995 ± 0.020	203.07 ± 0.51
U	0.060 ± 0.015	1.52 ± 0.38	AB	0.135	3.43

Millimetre dimensions have been derived from inches.

Outline Detail 'B'



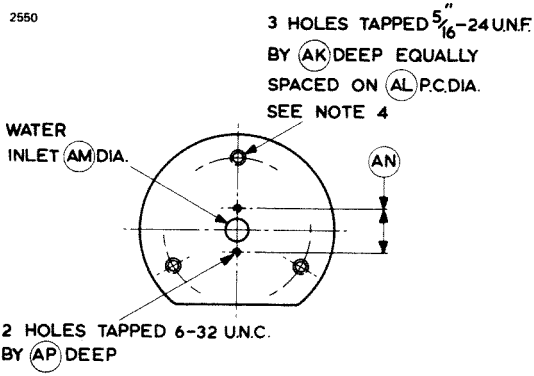
Ref	Inches	Millimetres
AE	0.375 min	9.53 min
AF	5.250	133.4
AG	6.000	152.4
AH	5.062 ± 0.062	128.6 ± 1.57

Millimetre dimensions have been derived from inches.

Outline Notes

1. The eccentricity of the filament, control grid and screen grid contact surfaces will not exceed 0.125 inch (3.18mm) with respect to dimension 'R' (see detail 'A') with the tube mounted on the bottom ceramic.
2. This surface must not be used for electrical contact and must not be clamped in any way.
3. To suit 3.000 inch diameter Q.V.F. 'Quickfit' glass tube PS3 and flange CF3.
4. To suit 1.500 inch diameter Q.V.F. 'Quickfit' glass tube PS1½ and flange CF1½.

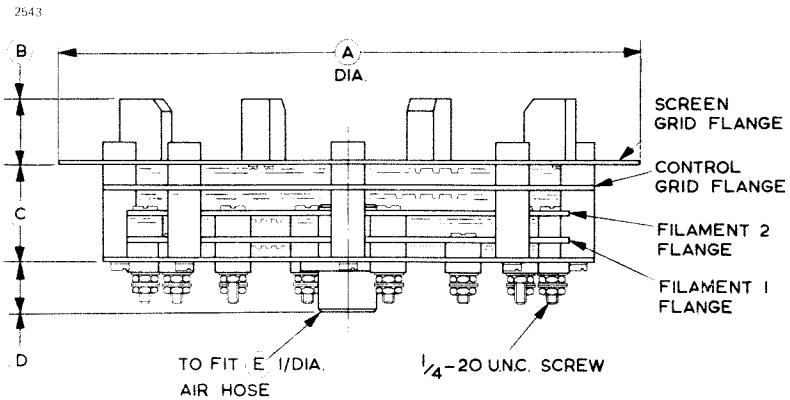
Outline Detail 'C' (See page 9 for note 4)



Ref	Inches	Millimetres
AK	0.375 min	9.53 min
AL	3.375	85.73
AM	0.500	12.70
AN	1.000	25.40
AP	0.250	6.35

Millimetre dimensions have been derived from inches.

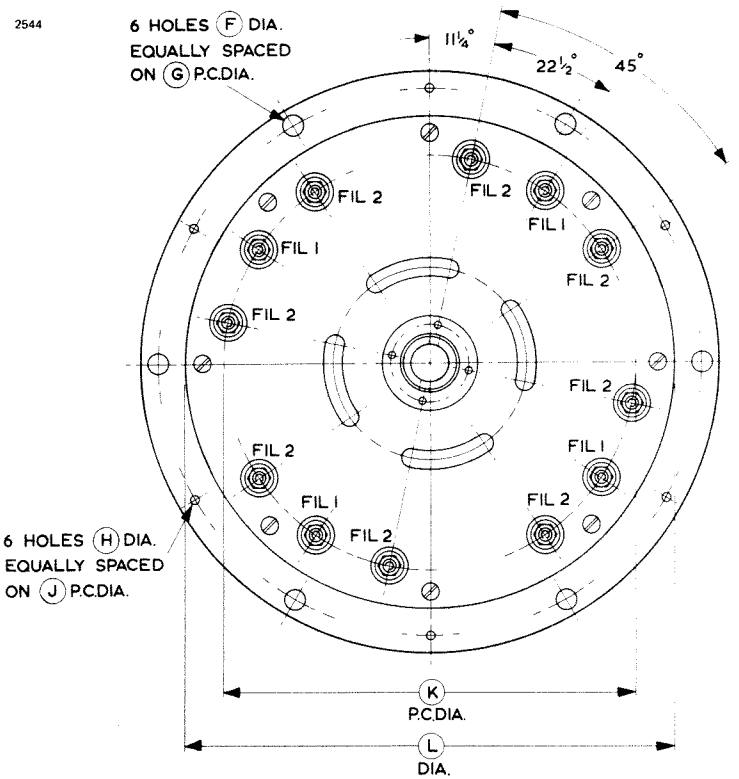
OUTLINE OF SOCKET MA166 (See page 12 for plan view)



Ref	Inches	Millimetres
A	12.000 ± 0.015	304.8 ± 0.38
B	1.250 ± 0.156	31.75 ± 3.96
C	2.000 ± 0.020	50.80 ± 0.51
D	1.000 ± 0.020	25.40 ± 0.51
E	1.250	31.75
F	0.437	11.10
G	11.250	285.8
H	0.187	4.75
J	11.250	285.8
K	8.530	216.7
L	10.125 ± 0.031	257.2 ± 0.79
M	4.813	122.3
N	4.813	122.3
P	4.813	122.3

Millimetre dimensions have been derived from inches.

OUTLINE DETAIL OF MA166 (See page 11 for outline dimensions)



INDUSTRIAL THYRATRONS

September 1965

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

EEV Type	Filling	Peak Inverse Voltage Max(kV)	Peak Forward Voltage Max(kV)	Peak Anode Current Max (A)	Mean Anode Current Max (A)	Tube Drop Approx (V)
BT19	M.V.	2·5	2·5	2·0	0·5	16
BT29	M.V.	2·0	2·0	75	12·5	16
BT69	M.V.	15	15	75	12·5	16
BT89	Xenon	1·5	1·0	2·0	0·5	12
BT95	M.V.	15	15	12	1·5	16

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England




CY1172

R.F. POWER TETRODE

ABRIDGED DATA

Vapour-cooled tetrode of coaxial ceramic/metal construction, for audio amplifiers, r.f. linear amplifiers or class C amplifiers or oscillators.

Anode dissipation	150	kW max
Anode voltage	15	kV max
Frequency for full ratings	30	MHz max
Output power (class C, anode and screen modulated)	220	kW

GENERAL

Electrical

Filament		thoriated tungsten
Filament voltage (see note 1)	21	V
Filament current	350	A
Filament starting current (peak) (see note 2)	3000	A max
Filament cold resistance	12	mΩ
Peak usable cathode current	280	A
Grid-screen amplification factor (V_a = 3.0kV, V_{g2} = 1.0kV, I_a = 10A)	4.0	
Mutual conductance (V_a = 3.0kV, V_{g2} = 1.0kV, I_a = 10A)	130	mA/V
Perveance	8	$mA/V^{3/2}$
Inter-electrode capacitances:		
anode to grid (see note 3)	8.5	pF
anode to cathode (see note 3)	1.7	pF
anode to screen	118	pF
cathode to grid	260	pF
grid to screen	340	pF

Mechanical

Overall length	21.004 inches (533.5mm) max
Overall diameter	12.480 inches (317mm) max
Net weight	112 pounds (51kg) approx
Mounting position	vertical, anode down

March 1969

Accessories

Boiler unit, separate condenser required	CY4120
Socket	MA226
Sealing ring	MA227
Thermal fuse	MA85C

COOLING AND INSTALLATION

The CY1172 is designed for cooling by vaporization of water and is fitted with an integral anode block in which circulation holes are provided for the passage of water and steam. The valve is installed with the anode partly immersed in the liquid coolant (distilled or de-ionised water) inside the boiler unit (see list of accessories above). When the power supplies are switched on the heat generated inside the valve evaporates some of the water in the circulation holes and jets of steam issue into the upper part of the boiler. The steam is either condensed directly by means of an internal water cooled condenser or led away by suitable insulated tubing for condensation at some convenient point external to the boiler (as in CY4120).

The services of our design staff are available for advice in matters of suitable condenser design and installation details.

The temperature of the filament and grid metal-ceramic seals must not exceed 220°C. A flow of air of 60ft^3/min (1.7m^3/min) directed into the filament header via a 1-inch (25mm approx) diameter nozzle before and during the application of any voltages is usually adequate for limiting the temperature of the seals.

The glass seals and bulb temperatures must not exceed 180°C.

A thermal fuse (part number MA85C) is provided with each valve to give protection against anode overheating. A position for mounting the thermal fuse is provided by a threaded hole in the top surface of the anode ring. It should be connected by a non-conducting cord to a suitable switching device; a tension of about 1 lb (450g) should be applied to the fuse via the cord. If the temperature exceeds a safe limit, the fuse core is pulled outwards; this should actuate the switching device and remove all electrical supplies from the valve. Replacement fuses can be supplied to order.

ANODE AND SCREEN MODULATED R.F. POWER AMPLIFIER

(Class C Telephony, carrier conditions per valve for use with a maximum modulation factor of 1.0)

MAXIMUM RATINGS (Absolute values)

Anode voltage	11.5	kV max
Screen voltage	1000	V max
Grid voltage (negative value)	800	V max
Cathode current	60	A max
Anode dissipation (see note 4)	100	kW max
Screen dissipation (see note 5)	2700	W max
Grid dissipation	1200	W max

TYPICAL OPERATING CONDITIONS (below 30MHz)

Anode voltage	11.0	kV
Screen voltage	800	V
Grid voltage	−590	V
Peak r.f. grid voltage	910	V
Anode current	25	A
Screen current	2.2	A
Grid current	1.5	A
Anode dissipation	55	kW
Screen dissipation	1.8	kW
Grid dissipation	480	W
Driving power	1.2	kW
Output power	220	kW
Efficiency	80	%

RADIO FREQUENCY LINEAR AMPLIFIER

(Class AB1 – see note 6)

MAXIMUM RATINGS (Absolute values)

Anode voltage	15	kV max
Screen voltage	1600	V max
Grid voltage (negative)	800	V max
Cathode current	60	A max
Anode dissipation	150	kW max
Screen dissipation	2700	W max
Grid dissipation	1200	W max

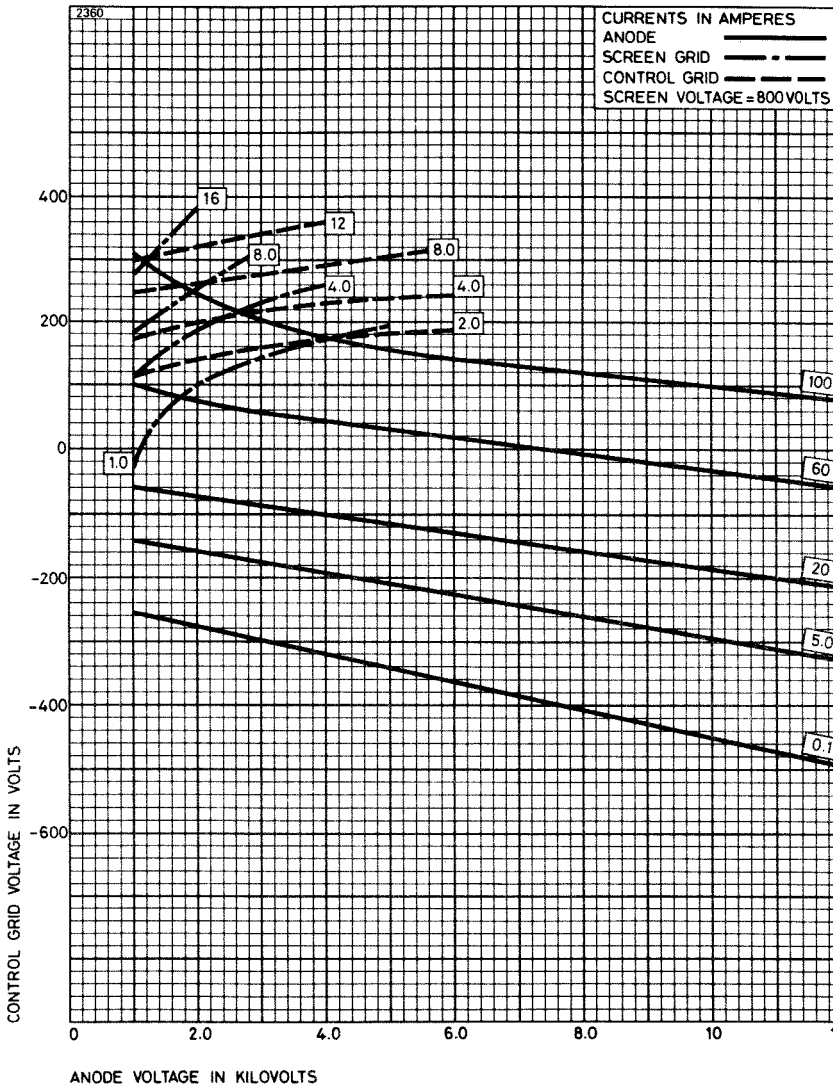
TYPICAL OPERATING CONDITIONS (below 30MHz)

Anode voltage			9	kV
Screen voltage			1500	V
Grid voltage			−450	V
	zero signal	**single tone**	**two tone** (average)	
Peak r.f. grid voltage	0	450	450	V
Anode current	5	21	13.2	A
Screen current	0	0.8	0.5	A
Anode dissipation	45	69	58.5	kW
Screen dissipation	0	1200	750	W
Output power	0	120	60	kW
Efficiency	–	63.5	50.5	%

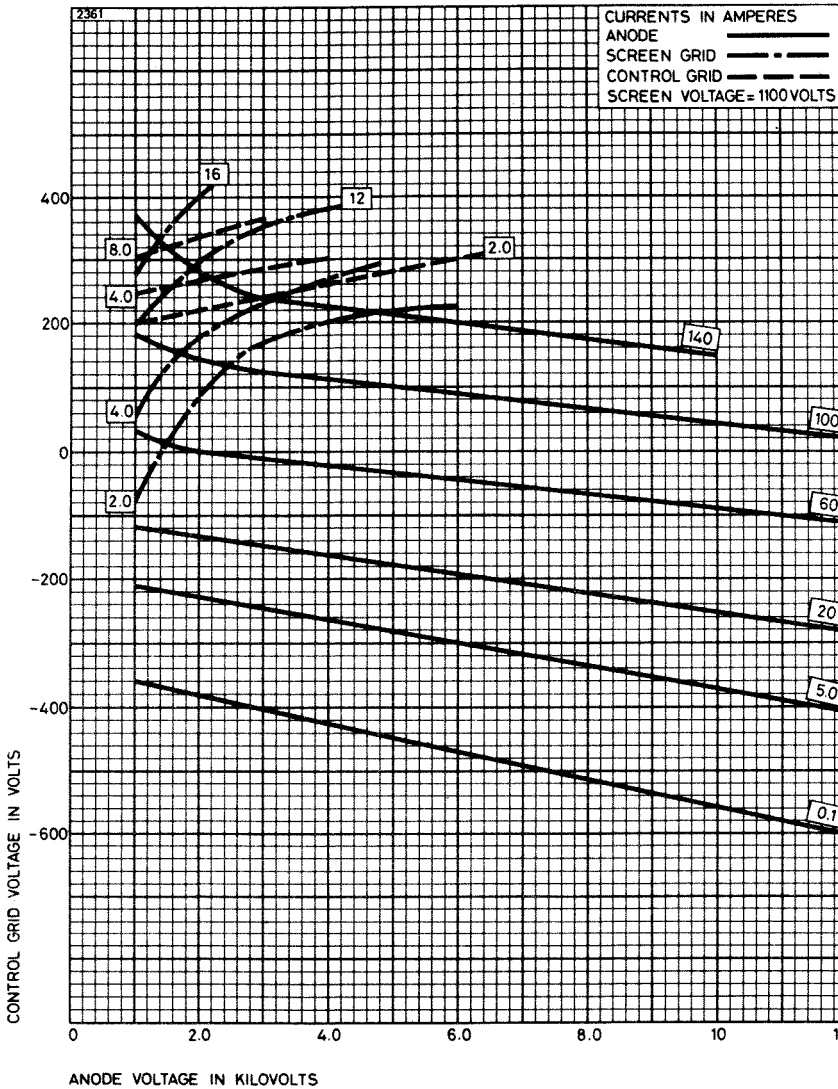
NOTES

1. The valve must be operated at the stated filament voltage within +1% and −3%.
2. The filament current must not exceed 3000A, even momentarily, at any time.
3. Measured with a screening plate 50cm diameter, mounted perpendicular to the valve axis on the screen contact.
4. This value corresponds to 150kW anode dissipation at 100% sine wave modulation.
5. This value must not be exceeded at any level of modulation.
6. Grid current does not flow during any part of the drive cycle.

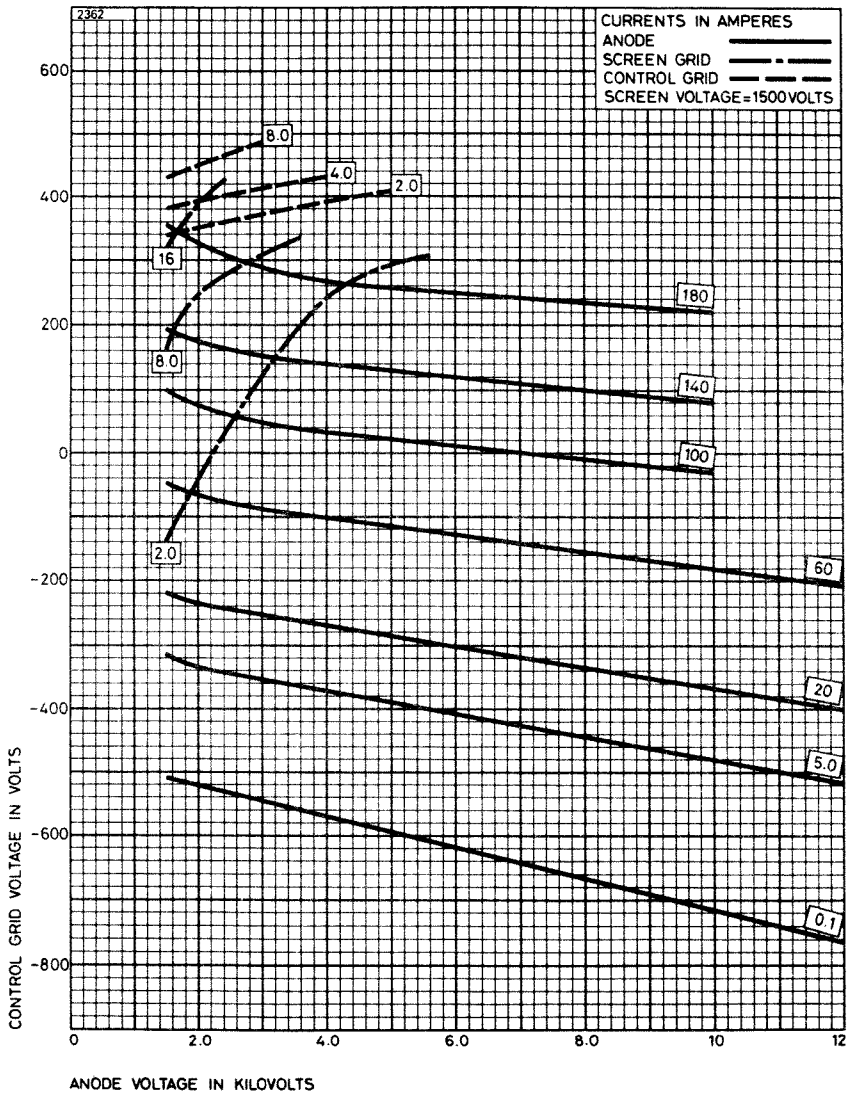
CONSTANT CURRENT CHARACTERISTICS



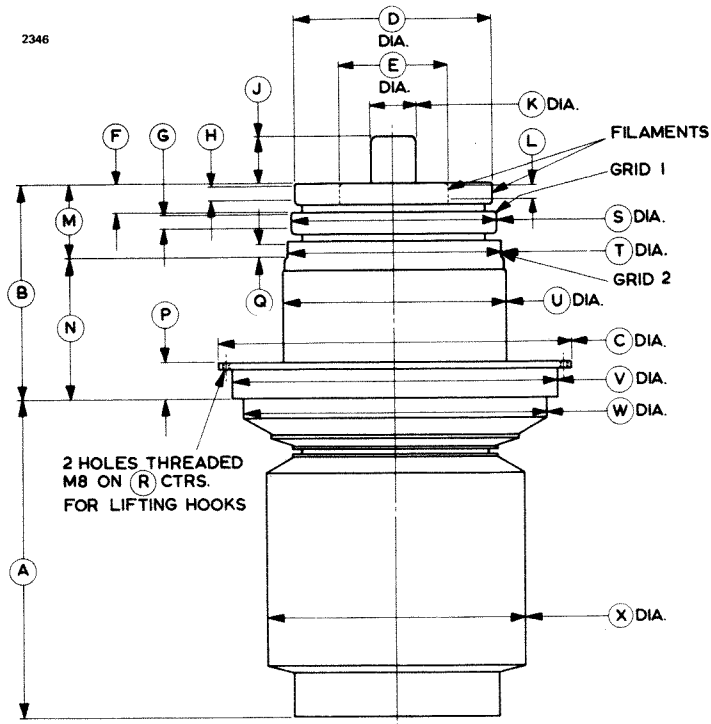
CONSTANT CURRENT CHARACTERISTICS



CONSTANT CURRENT CHARACTERISTICS



OUTLINE



Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	11.378 ± 0.197	289.0 ± 5.0	N	4.933 ± 0.079	125.3 ± 2.0
B	7.591	192.8	P	1.339 $^{+0.020}_{-0.000}$	34.00 $^{+0.5}_{-0.0}$
C	12.402	315.0			
D	7.008 ± 0.020	178.0 ± 0.5	Q	0.591 $^{+0.079}_{-0.138}$	15.0 $^{+2.0}_{-3.5}$
E	3.780 ± 0.020	96.00 ± 0.5	R	11.811	300.0
F	0.953 ± 0.020	24.2 ± 0.5	S	7.284 ± 0.020	185.0 ± 0.5
G	0.591	15.00	T	7.606 ± 0.020	193.2 ± 0.5
H	0.591	15.00	U	8.189 max	208 max
J	1.673 $^{+0.000}_{-0.079}$	42.50 $^{+0.0}_{-2.0}$	V	11.417	290.0
K	1.575	40.00	W	10.630	270.0
L	0.591	15.00	X	9.055	230.0
M	2.657 $^{+0.039}_{-0.079}$	67.5 $^{+1.0}_{-2.0}$			

Inch dimensions have been derived from millimetres.

MERCURY VAPOUR THYRATRON

BT17

ENGLISH ELECTRIC

ABRIDGED DATA

Mercury Vapour Thyratron for industrial control applications.

Peak Forward Anode Voltage	1·0	kV Max
Peak Inverse Anode Voltage	1·5	kV Max
Peak Anode Current	40	A Max
Mean Anode Current	6·0	A Max

GENERAL

Electrical

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage	5·0	V
Heater Current	10·5	A
Cathode Heating Time (Minimum)	5·0	min
Inter-electrode Capacitances:		
Grid to Anode	6·0	pF
Grid to Cathode	15	pF

Mechanical

Overall Length (excluding flexible leads)	10·250 inches (260·4 mm)	Max
Overall Diameter	3·157 inches (80·19 mm)	Max
Net Weight	1·2 pounds (540 g)	Approx
Mounting Position	Vertical, base down	
Connections	Flying Leads	

Cooling Natural

MAXIMUM AND MINIMUM RATINGS

	Min	*Max*	
Peak Forward Anode Voltage	—	1·0	kV
Peak Inverse Anode Voltage	—	1·5	kV
Peak Anode Current	—	40	A
Mean Anode Current (averaging time 15 sec max)	—	6·0	A
Fault Anode Current (Peak)	—	400	A
Duration of Fault Current	—	0·1	sec
Condensed Mercury Temperature	40	80	°C
Negative Grid Voltage:			
Before Conduction	—	500	V
During Conduction	—	10	V
Mean Grid Current	—	250	mA
Recommended Grid Resistor	10	100	kΩ
Cathode Heating Time	5·0	—	min

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CHELMSFORD
ENGLAND

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ENGLISH ELECTRIC

CHARACTERISTICS

Voltage Drop	16	V Approx
Ionisation Time	10	μsec Approx
Recovery Time	1·0	msec Approx
Condensed Mercury Temperature Rise:		
at no load	32	°C Approx
at full load	39	°C Approx

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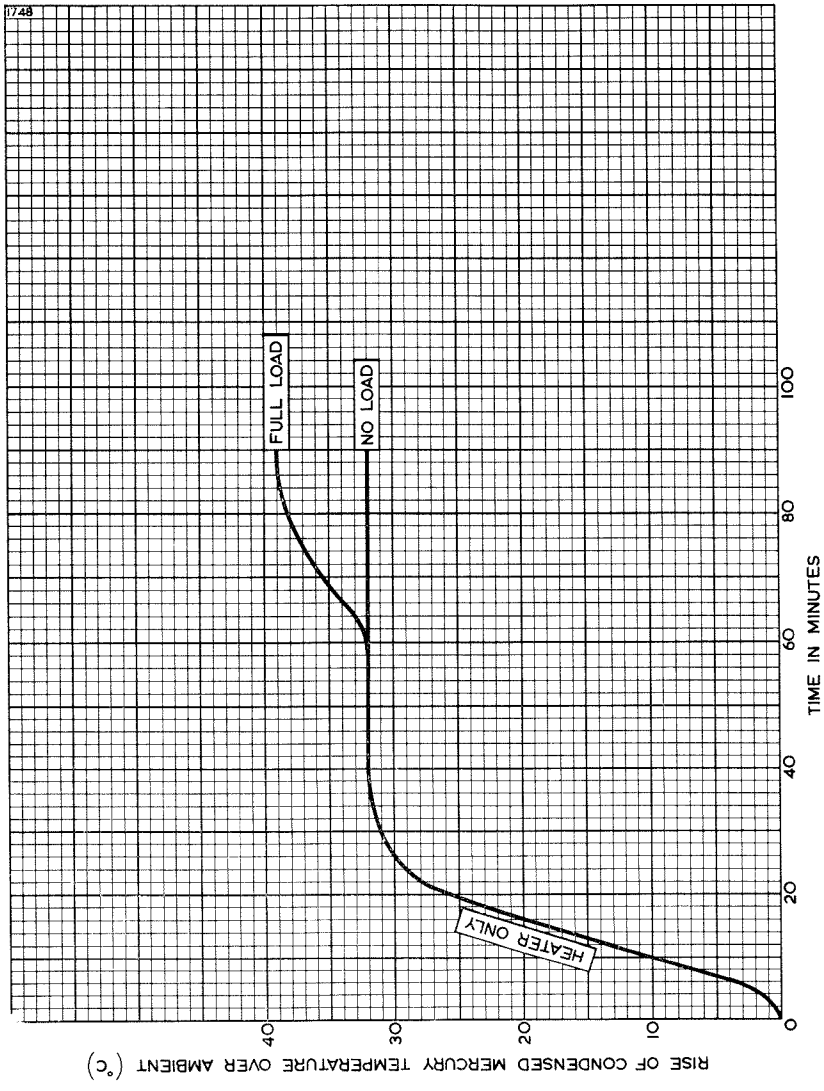
HEATING CHARACTERISTIC



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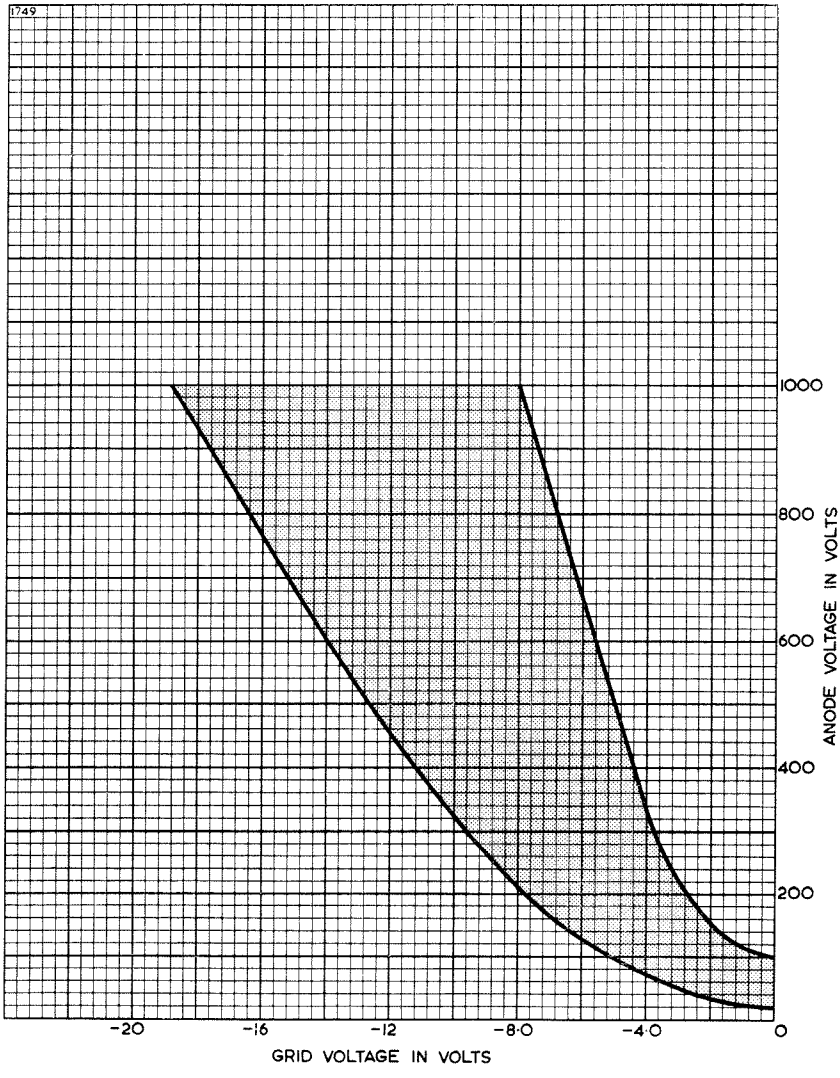
CONTROL CHARACTERISTIC



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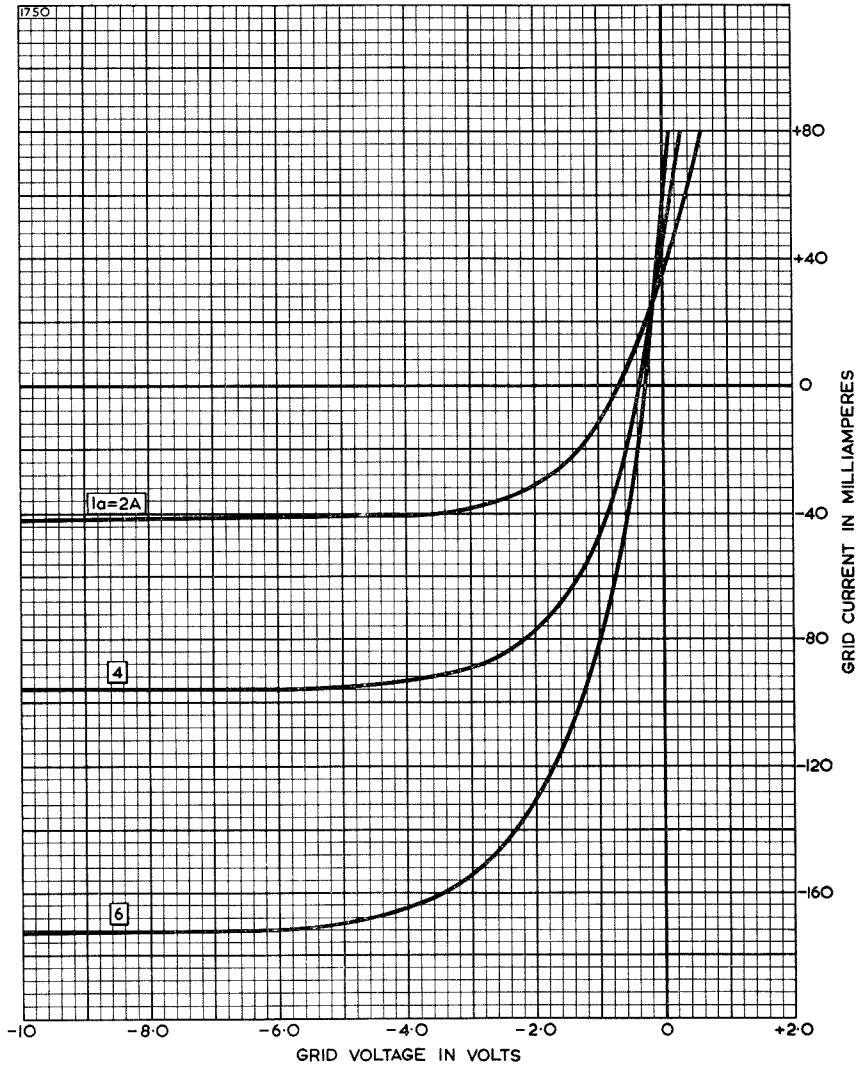
GRID CURRENT CHARACTERISTICS

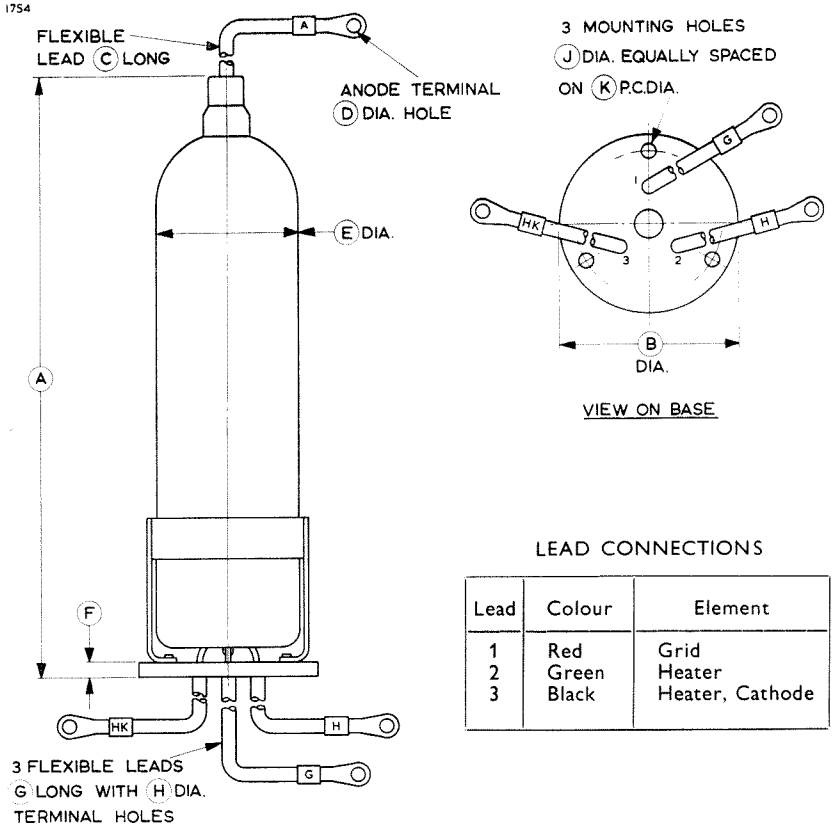


MERCURY VAPOUR THYRATRON

BT17

ENGLISH ELECTRIC

OUTLINE



LEAD CONNECTIONS

Lead	Colour	Element
1	Red	Grid
2	Green	Heater
3	Black	Heater, Cathode

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	10·000 ± 0·250	254·0 ± 6·35	F	0·250	6·35
B	3·157 Max	80·19 Max	G	7·500 ± 0·250	190·5 ± 6·35
C	6·500 ± 0·250	165·1 ± 6·35	H	0·266	6·76
D	0·265	6·73	J	0·250 ± 0·002	6·350 ± 0·051
E	2·500	63·5	K	2·625 ± 0·010	66·68 ± 0·25

Millimetre dimensions have been derived from inches.

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MERCURY VAPOUR THYRATRON

BT19

ABRIDGED DATA

Mercury Vapour Thyratron for industrial control applications.

Peak Forward or Inverse Anode Voltage	2·5 kV Max
Peak Anode Current	2·0 A Max
Mean Anode Current	0·5 A Max

GENERAL

Electrical		
Filament	Oxide Coated	
Filament Voltage	2·5	V
Filament Current	5·0	A
Filament Heating Time (Minimum)	10	sec
Inter-electrode Capacitances:		
Grid to Anode	4·0	pF
Grid to Filament	8·0	pF
Mechanical		
Overall Length	6·250 inches (158·8 mm)	Max
Overall Diameter	2·156 inches (54·76 mm)	Max
Net Weight	3 ounces (85 gm)	Approx
Mounting Position	Vertical, base down	
Base	British 4-pin	
Top Cap	B.S.448–CT2	
Cooling	Natural	

MAXIMUM AND MINIMUM RATINGS

	Min	*Max*	
Peak Forward or Inverse Anode Voltage	—	2·5	kV
Peak Anode Current	—	2·0	A
Mean Anode Current (averaging time 15 sec max)	—	0·5	A
Fault Anode Current (Peak)	—	40	A
Duration of Fault Current	—	0·1	sec
Condensed Mercury Temperature	35	70	°C
Negative Grid Voltage:			
Before Conduction	—	500	V
During Conduction	—	10	V
Mean Grid Current	—	50	mA
Recommended Grid Resistor	10	220	kΩ
Filament Heating Time	10	—	sec

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CHARACTERISTICS

Voltage Drop	16	V Approx
Ionisation Time	10	μsec Approx
Recovery Time	1·0	msec Approx
Condensed Mercury Temperature Rise:		
At no load	20	°C Approx
At full load	22	°C Approx

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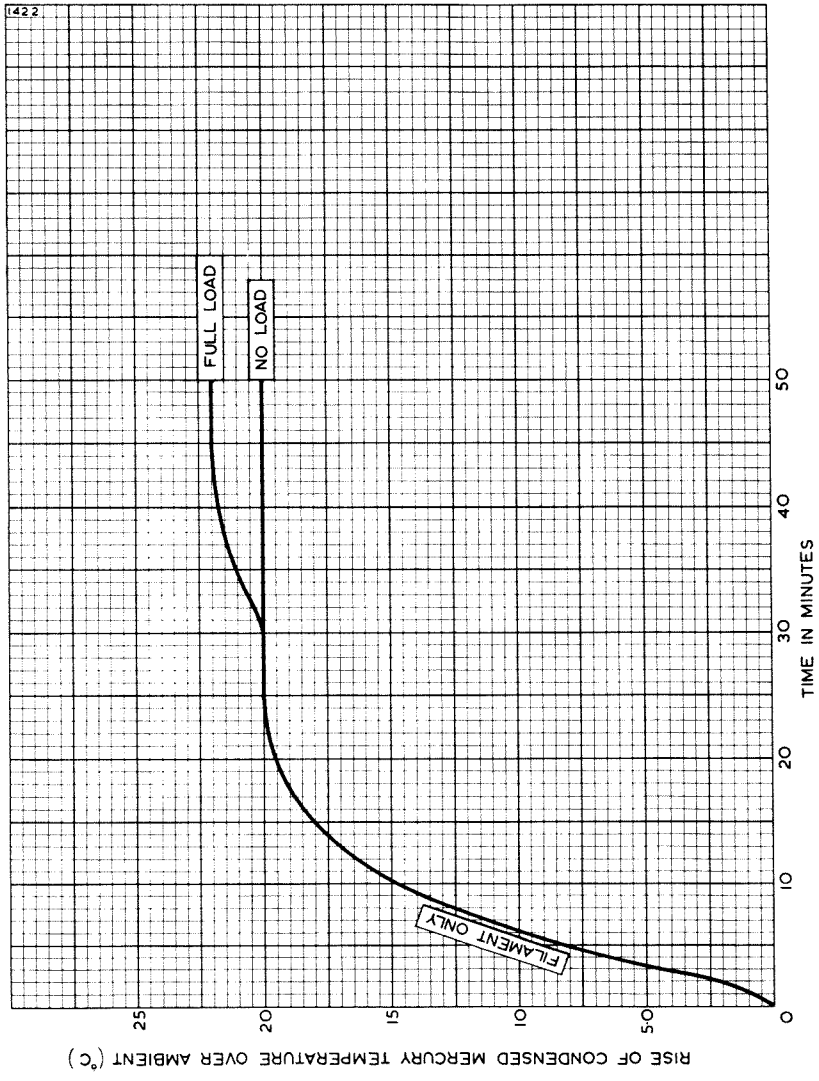
HEATING CHARACTERISTIC



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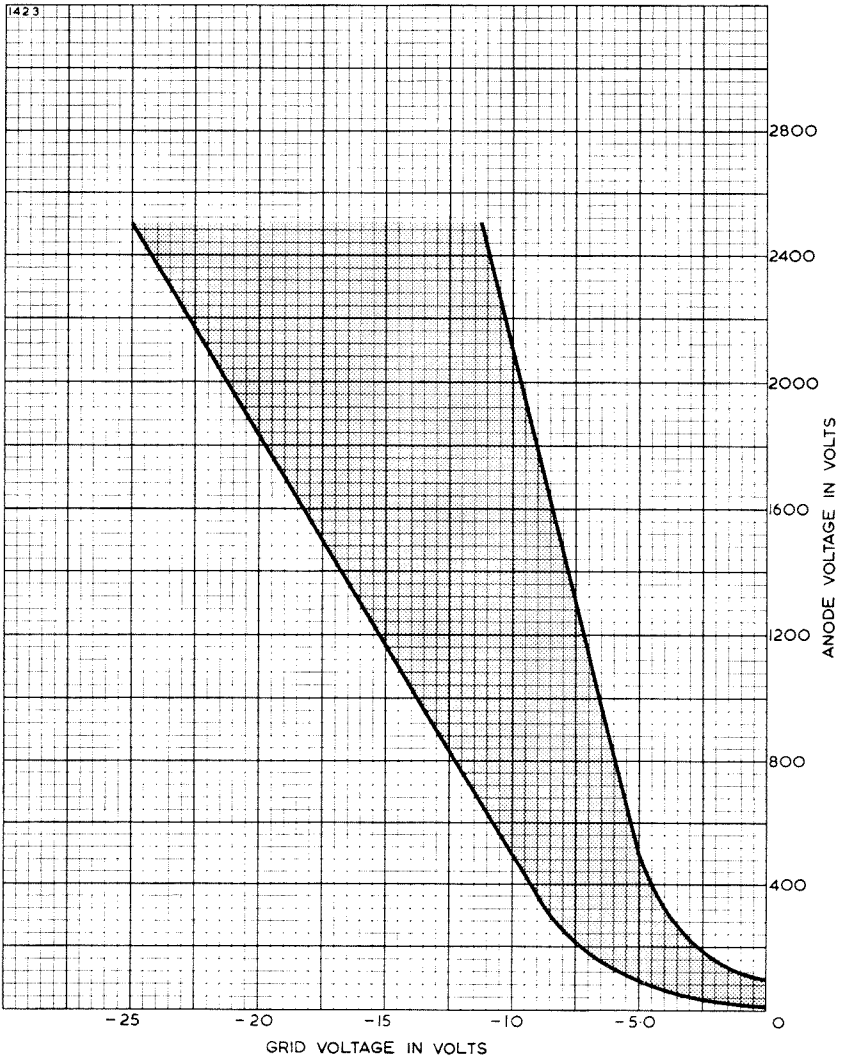
CONTROL CHARACTERISTIC



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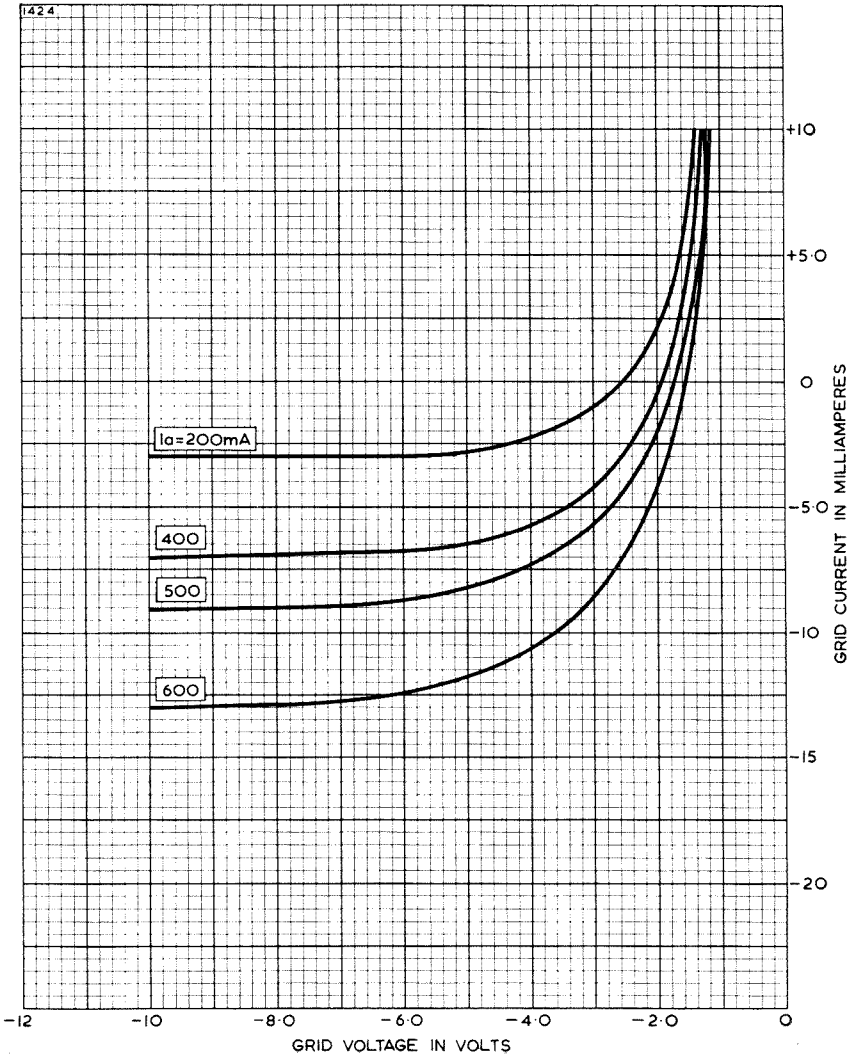
GRID CURRENT CHARACTERISTICS



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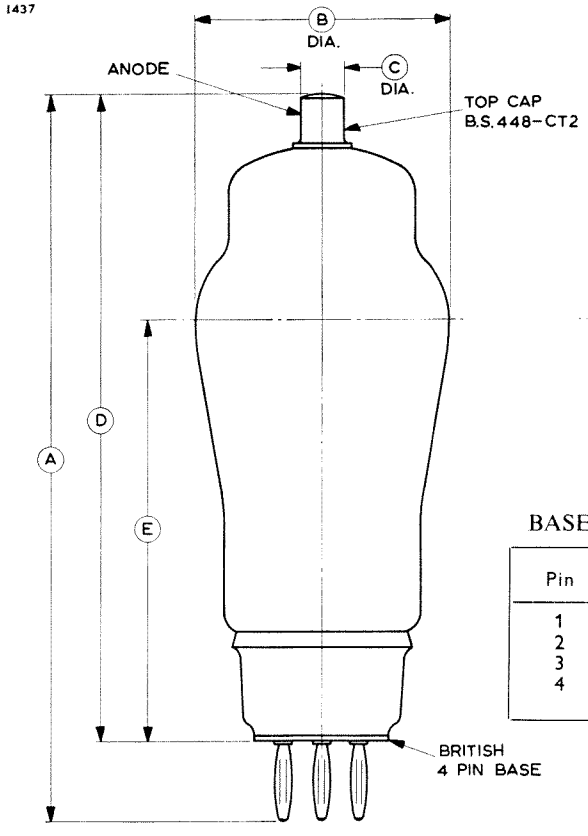
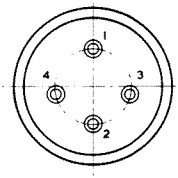
OUTLINE





BASE DETAIL

BASE CONNECTIONS

Pin	Element
1	No connection
2	Grid
3	Filament
4	Filament

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	6·000 ± 0·250	152·4 ± 6·35	D	5·375 ± 0·250	136·5 ± 6·35
B	2·125 ± 0·031	53·98 ± 0·79	E	3·500	88·90
C	0·360	9·14			

Millimetre dimensions have been derived from inches.

ENGLISH ELECTRIC VALVE CO. LTD.

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MERCURY VAPOUR THYRATRON

BT29

ABRIDGED DATA

Mercury Vapour Thyratron with shield grid, for industrial control applications.

Peak Forward or Inverse Anode Voltage	2·0	kV Max
Peak Anode Current	75	A Max
Mean Anode Current	12·5	A Max

GENERAL

Electrical

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage	5·0	V
Heater Current	20	A
Cathode Heating Time (Minimum)	5·0	minutes
Inter-electrode Capacitances:		
Grid to Anode	4·0	pF
Grid to Cathode	8·0	pF

Mechanical

Overall Length (excluding flexible leads)	14·312 inches (363·5 mm)	Max
Overall Diameter	5·063 inches (128·6 mm)	Max
Net Weight	2 pounds (0·9 kg)	Approx
Mounting Position	Vertical, base down	
Connections	Flexible Leads	

Cooling Natural

MAXIMUM AND MINIMUM RATINGS

	Min	*Max*	
Peak Forward or Inverse Anode Voltage	—	2·0	kV
Peak Anode Current	—	75	A
Mean Anode Current (averaging time 30 sec max)	—	12·5	A
Fault Anode Current (Peak)	—	750	A
Duration of Fault Current	—	0·1	sec
Condensed Mercury Temperature	40	80	°C
Negative Control Grid Voltage:			
Before Conduction	—	500	V
During Conduction	—	10	V
Mean Control Grid Current	—	250	mA
Recommended Control Grid Resistor	10	220	kΩ
Negative Shield Grid Voltage:			
Before Conduction	—	500	V
During Conduction	—	10	V
Mean Shield Grid Current	—	500	mA
Shield Grid Resistor	—	10	kΩ
Cathode Heating Time	5·0	—	minutes

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CHARACTERISTICS

Voltage Drop	16	V Approx
Ionisation Time	10	μsec Approx
Recovery Time	1·0	msec Approx
Condensed Mercury Temperature Rise:		
At no load	37	°C Approx
At full load	42	°C Approx

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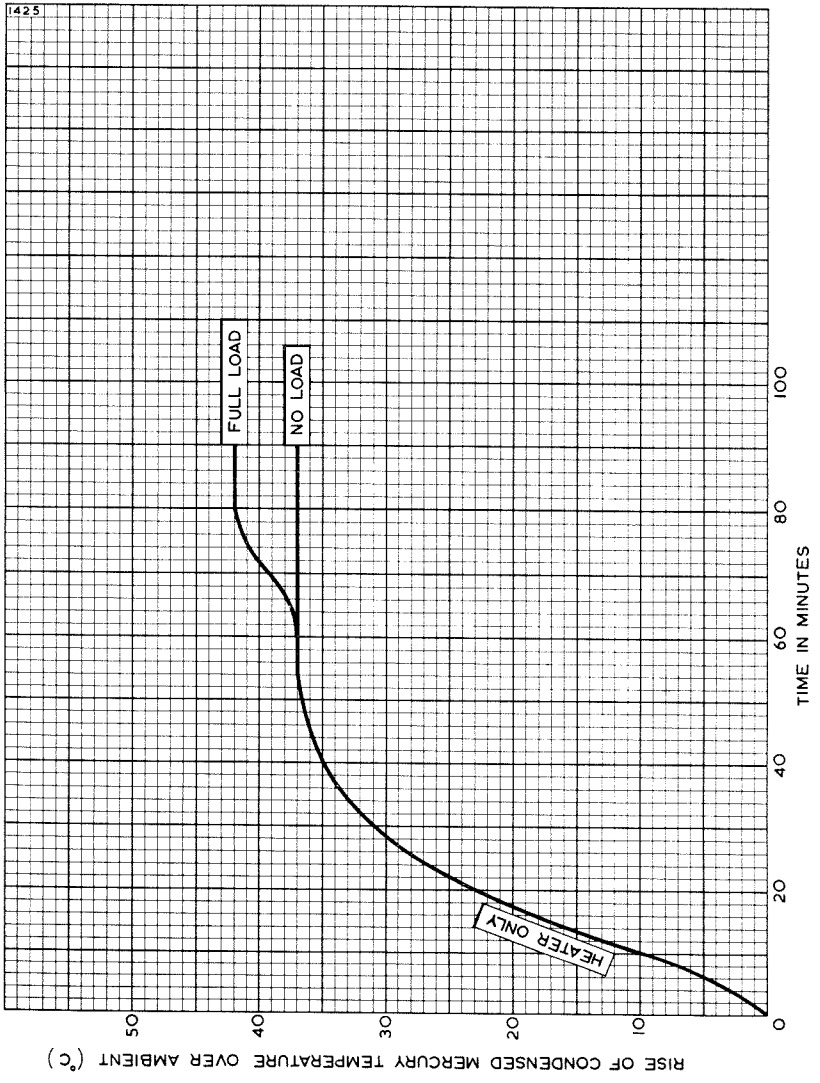
HEATING CHARACTERISTIC



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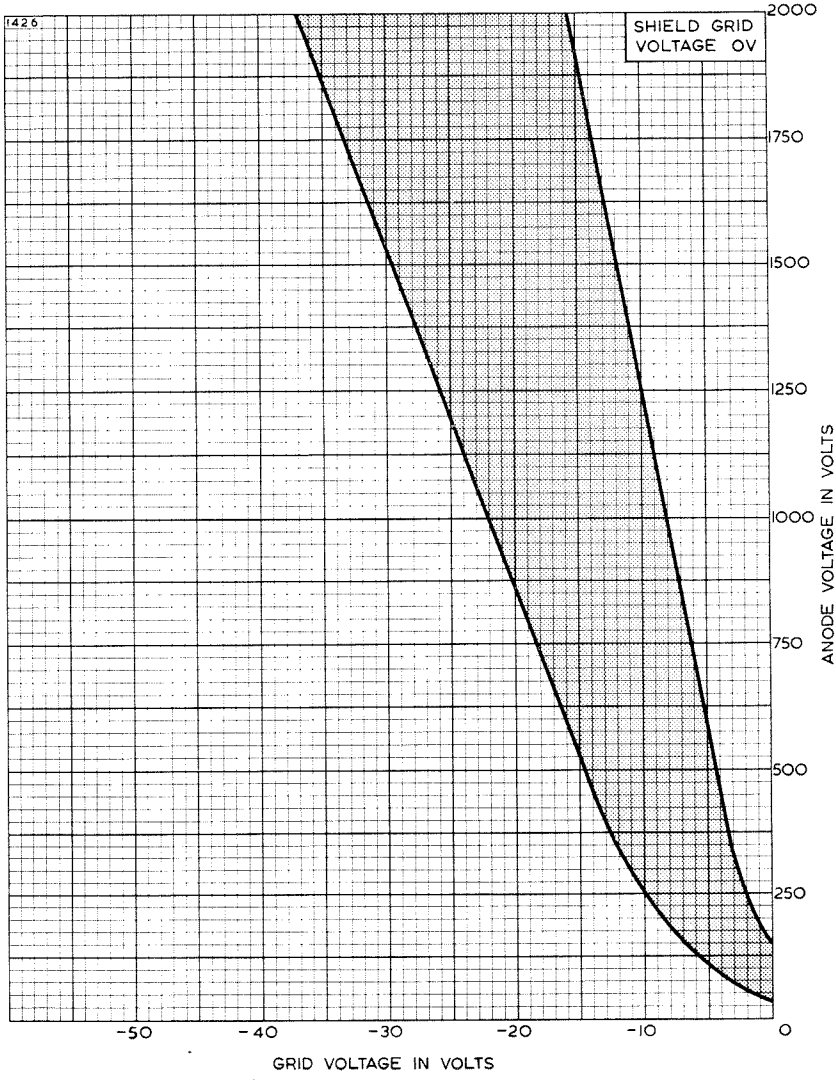
CONTROL CHARACTERISTIC



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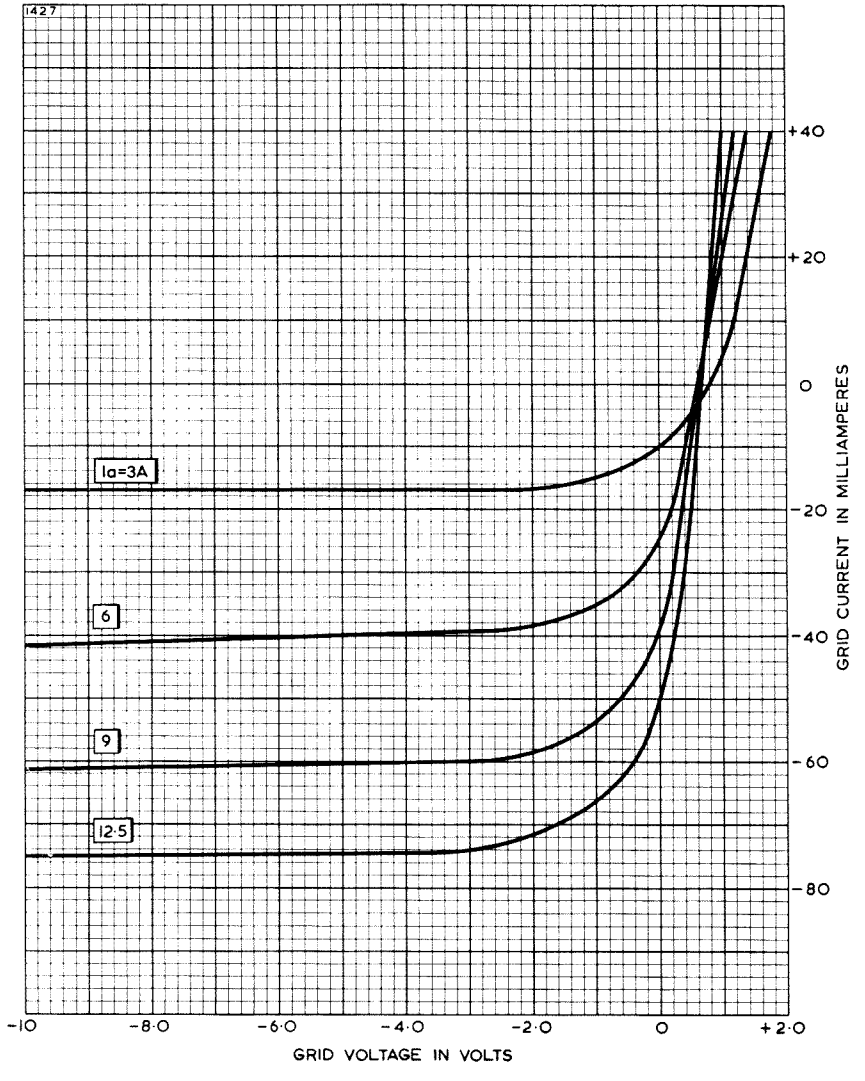
GRID CURRENT CHARACTERISTICS



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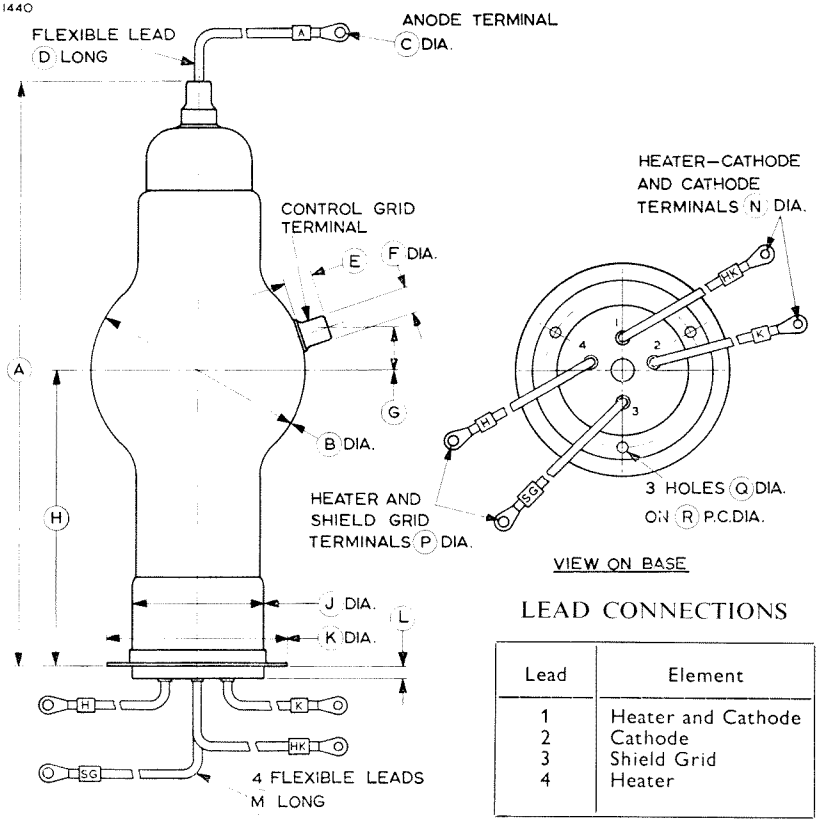
ENGLISH ELECTRIC

OUTLINE



VIEW ON BASE

LEAD CONNECTIONS

Lead	Element
1	Heater and Cathode
2	Cathode
3	Shield Grid
4	Heater

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	13·750 ± 0·250	349·3 ± 6·4	J	3·188 Max	80·98 Max
B	5·063 Max	128·6 Max	K	4·281 Max	108·7 Max
C	0·265	6·73	L	0·250 ± 0·063	6·35 ± 1·60
D	7·000 ± 0·250	177·8 ± 6·4	M	7·000 ± 0·250	177·8 ± 6·4
E	0·420 Min	10·67 Min	N	0·200	5·08
F	0·641 ± 0·015	16·28 ± 0·38	P	0·265	6·73
G	1·000	25·40	Q	0·203 ± 0·002	5·156 ± 0·051
H	6·875 ± 0·250	174·6 ± 6·4	R	3·750 ± 0·010	95·25 ± 0·25

Millimetre dimensions have been derived from inches.

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MERCURY VAPOUR THYRATRON

BT69

ENGLISH ELECTRIC

ABRIDGED DATA

Mercury Vapour Thyratron for high voltage industrial control applications.

Peak Forward or Inverse Anode Voltage	15	kV Max
Peak Anode Current	75	A Max
Mean Anode Current	12·5	A Max

GENERAL

Electrical

Cathode	Indirectly Heated, Oxide Coated	
Heater Voltage	5·0	V
Heater Current	20	A
Cathode Heating Time (Minimum)	5·0	minutes
Inter-electrode Capacitances:		
Grid to Anode	7·0	pF
Grid to Cathode	25	pF

Mechanical

Overall Length (excluding flexible leads)	15·750 inches (390·1 mm)	Max
Overall Diameter	6·125 inches (155·6 mm)	Max
Net Weight	2¼ pounds (1·0 kg)	Approx
Mounting Position		Vertical, base down
Connections		Flexible Leads

Cooling Natural

MAXIMUM AND MINIMUM RATINGS

	Min	*Max*	
Peak Forward or Inverse Anode Voltage	—	15	kV
Peak Anode Current	—	75	A
Mean Anode Current (averaging time 30 sec max)	—	12·5	A
Fault Anode Current (Peak)	—	750	A
Duration of Fault Current	—	0·1	sec
Condensed Mercury Temperature	40	70	°C
Negative Grid Voltage:			
Before Conduction	—	500	V
During Conduction	—	10	V
Mean Grid Current	—	250	mA
Recommended Grid Resistor	5·0	20	kΩ
Cathode Heating Time	5·0	—	minutes

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CHARACTERISTICS

Voltage Drop	16	V Approx
Ionisation Time	10	μsec Approx
Recovery Time	1·0	msec Approx
Condensed Mercury Temperature Rise:		
At no load	25	°C Approx
At full load	35	°C Approx

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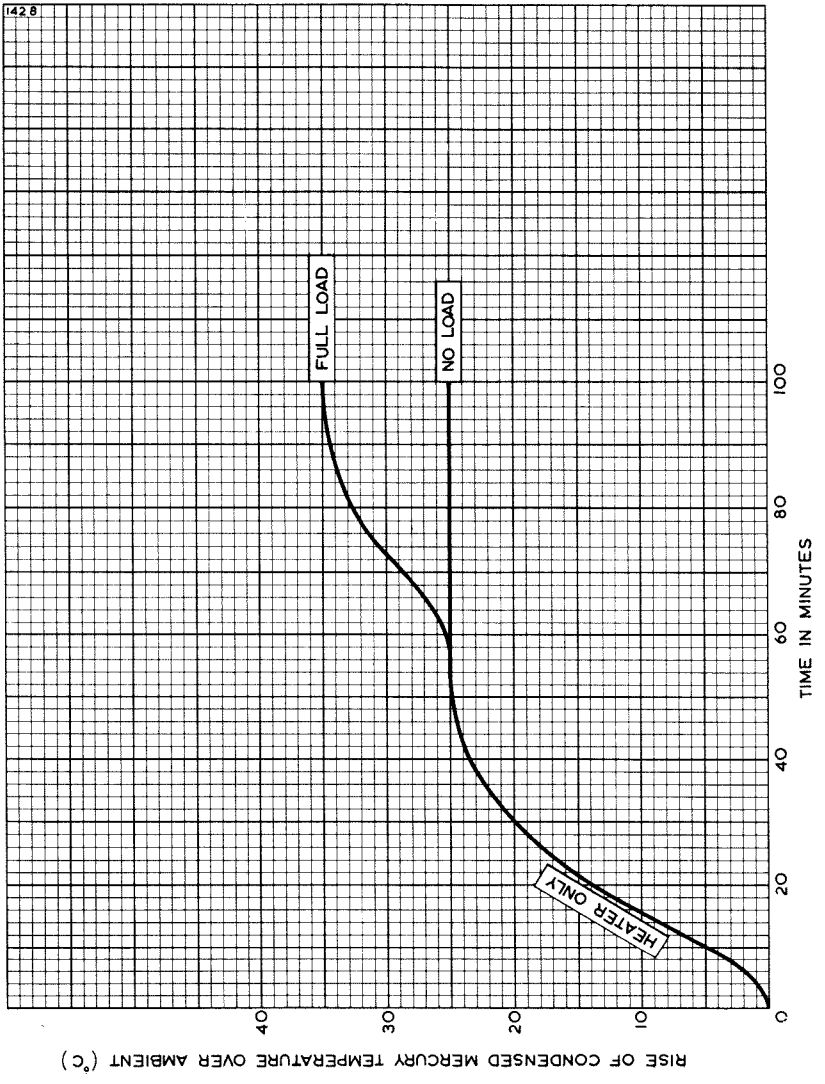
HEATING CHARACTERISTIC



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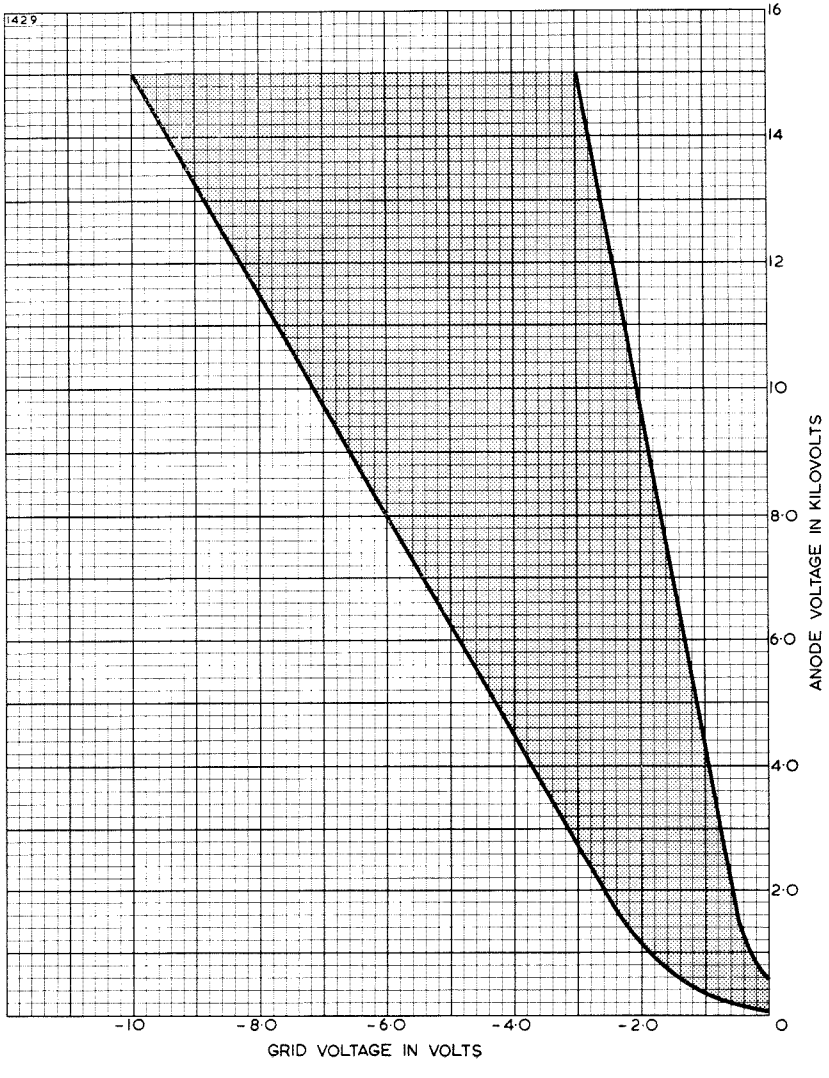
CONTROL CHARACTERISTIC



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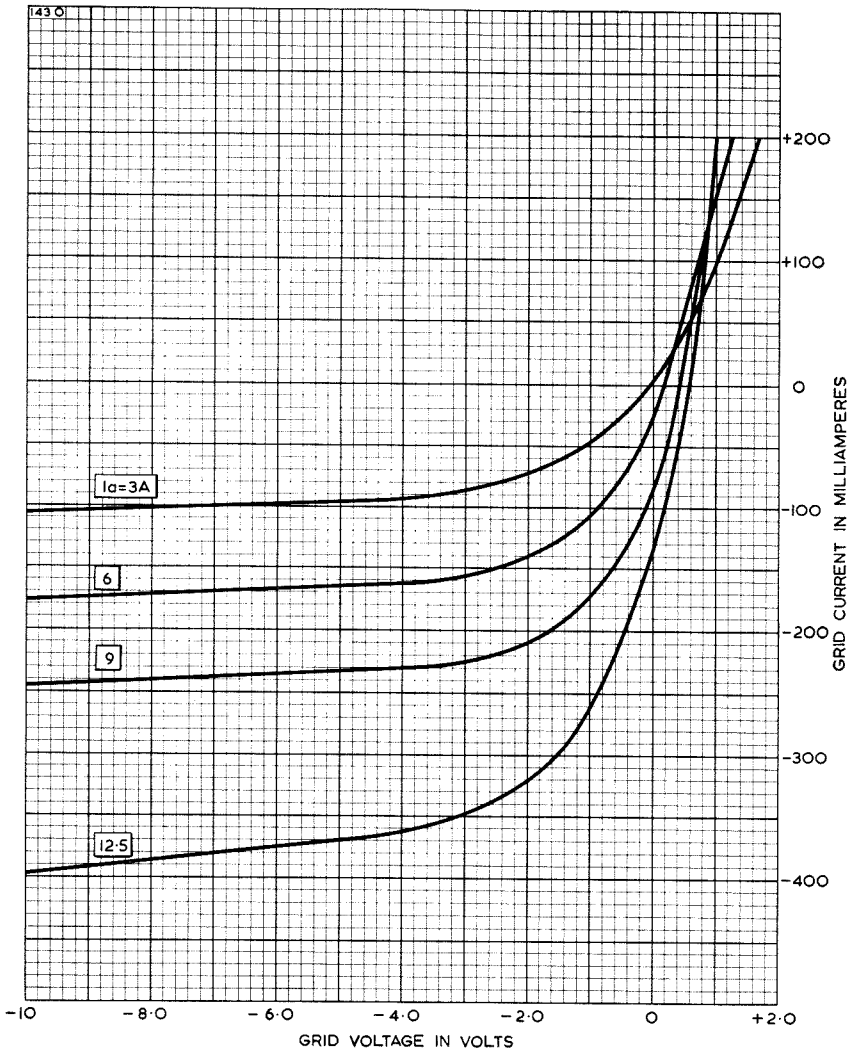
GRID CURRENT CHARACTERISTICS



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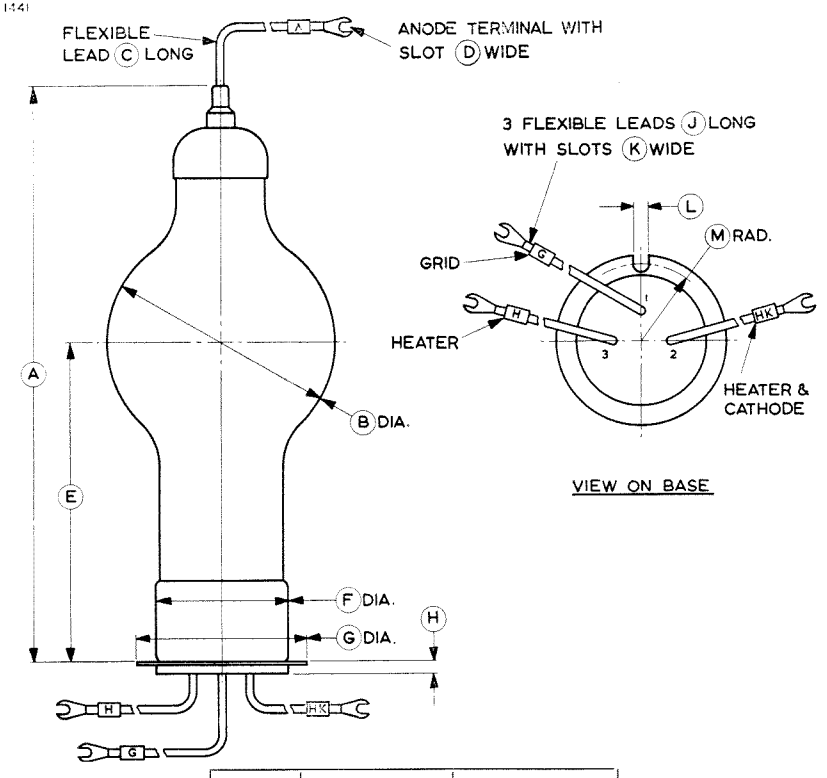
ENGLISH ELECTRIC

OUTLINE

1341



Ref.	Inches	Millimetres
A	15·125 ± 0·375	384·2 ± 9·5
B	6·125 Max	155·6 Max
C	5·875 ± 0·250	149·2 ± 6·4
D	0·265	6·73
E	8·375 ± 0·500	212·7 ± 12·7
F	3·500 Max	88·90 Max
G	4·531 Max	115·1 Max
H	0·250	6·35
J	6·500 ± 0·250	165·1 ± 6·4
K	0·265	6·73
L	0·344 ± 0·016	8·74 ± 0·41
M	2·000 ± 0·016	50·80 ± 0·41

Millimetre dimensions have been derived from inches.

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XENON FILLED THYRATRON

BT89

ABRIDGED DATA

Xenon Thyratron for industrial control applications.

Peak Forward Anode Voltage	1·0 kV Max
Peak Inverse Anode Voltage	1·5 kV Max
Peak Anode Current	2·0 A Max
Mean Anode Current	0·5 A Max

GENERAL

Electrical

Filament	Oxide Coated	
Filament Voltage	2·5	V
Filament Current	5·0	A
Filament Heating Time (Minimum)	10	sec
Inter-electrode Capacitances:		
Grid to Anode	4·0	pF
Grid to Filament	10	pF

Mechanical

Overall Length	4·875 inches (123·8 mm)	Max
Overall Diameter	1·560 inches (39·6 mm)	Max
Net Weight	2 ounces (60 gm)	Approx
Mounting Position		Any
Base		British 4-pin
Top Cap		B.S.448–CT2

Cooling .. .. Natural

MAXIMUM AND MINIMUM RATINGS

	Min	*Max*	
Peak Forward Anode Voltage	—	1·0	kV
Peak Inverse Anode Voltage	—	1·5	kV
Peak Anode Current	—	2·0	A
Mean Anode Current (averaging time 15 sec max)	—	0·5	A
Fault Anode Current (Peak)	—	40	A
Duration of Fault Current	—	0·1	sec
Ambient Temperature	−55	+70	°C
Negative Grid Voltage:			
Before Conduction	—	250	V
During Conduction	—	10	V
Mean Grid Current	—	50	mA
Recommended Grid Resistor	10	100	kΩ
Commutation Factor (*See Note*)	—	10	
Filament Heating Time	10	—	sec

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CHARACTERISTICS

Voltage Drop	12	V Approx
Ionisation Time	10	μsec Approx
Recovery Time	500	μsec Approx

Note The product of the rate of decrease of anode current in amperes per microsecond immediately prior to current extinction and the rate of increase of inverse voltage in volts per microsecond immediately after current extinction.

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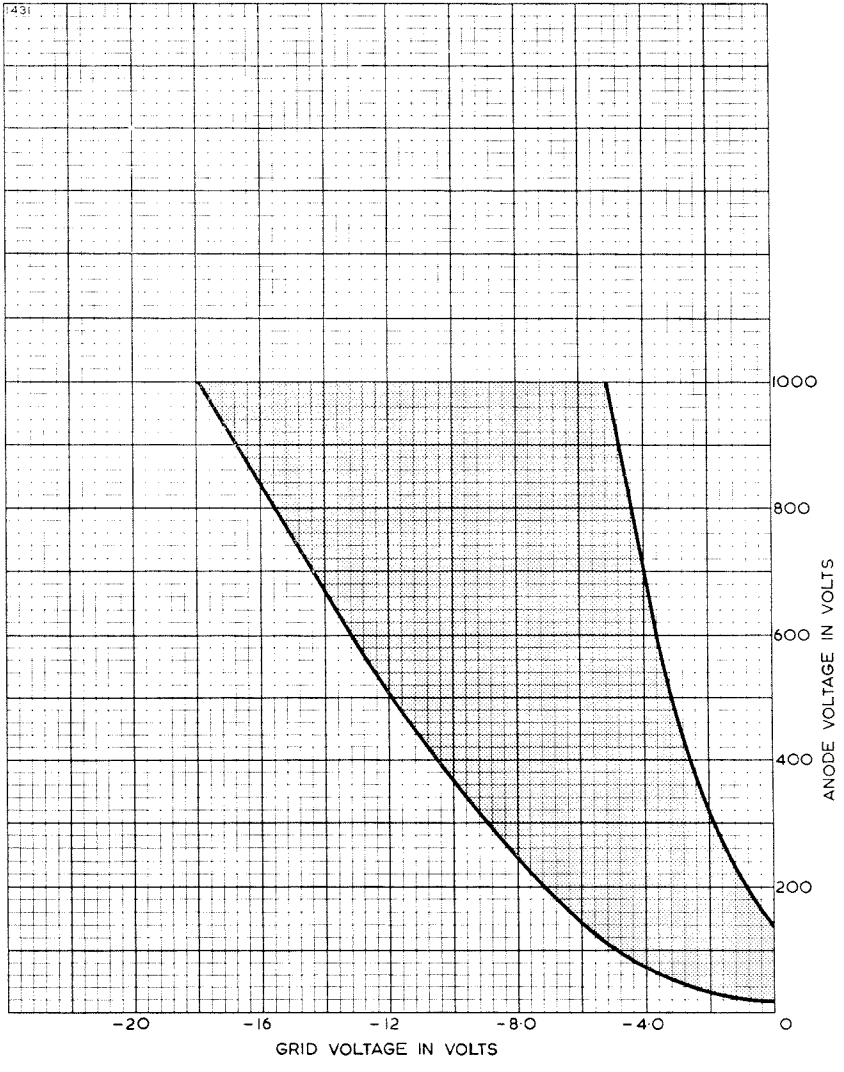
CONTROL CHARACTERISTIC



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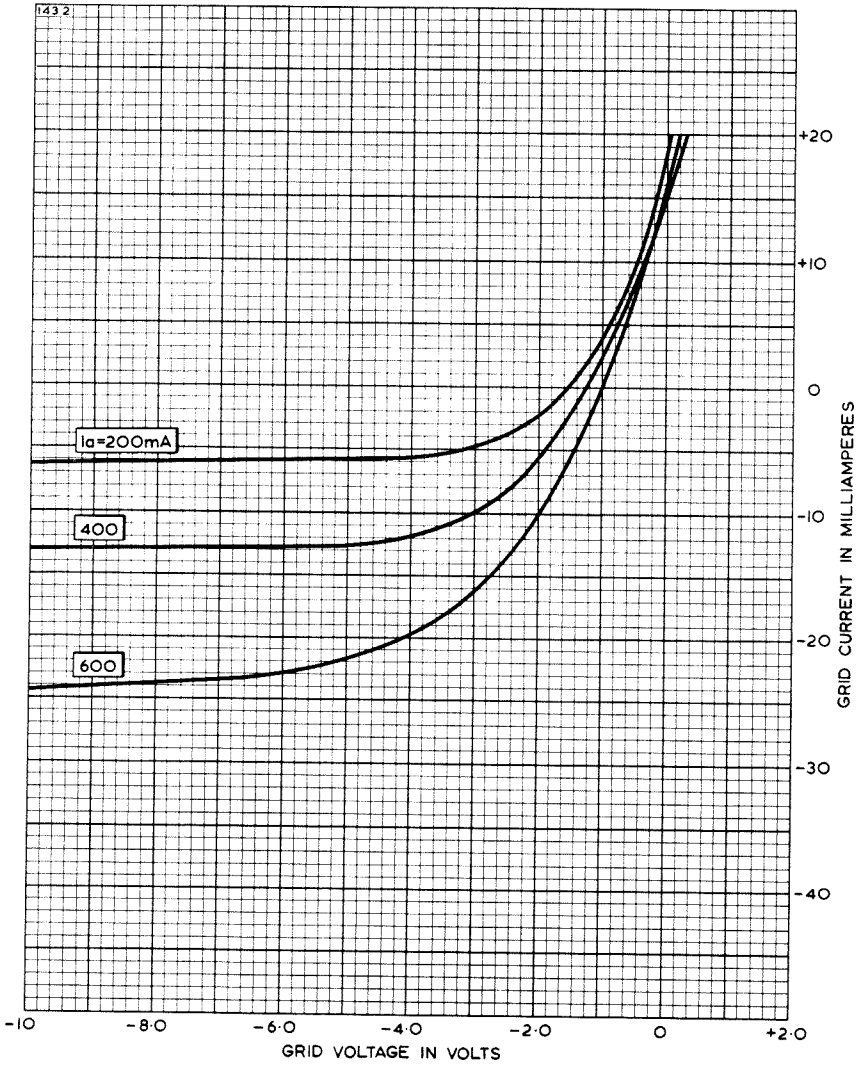
GRID CURRENT CHARACTERISTICS



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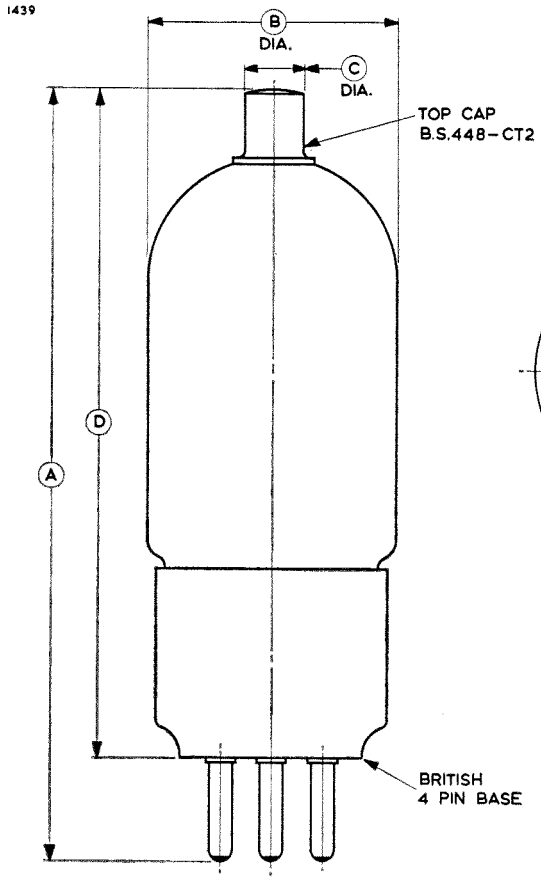
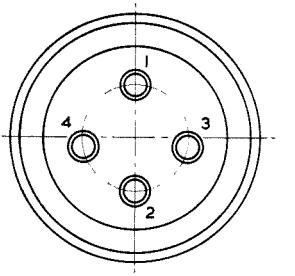
OUTLINE





VIEW FROM BELOW

BASE CONNECTIONS

Pin	Element
1	No Pin
2	Grid
3	Filament
4	Filament
Cap	Anode

Ref.	Inches	Millimetres
A	4·625 ± 0·250	117·5 ± 6·4
B	1·560 Max	39·62 Max
C	0·360	9·14
D	4·000 ± 0·250	101·6 ± 6·4

Millimetre dimensions have been derived from inches.

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MERCURY VAPOUR THYRATRON

BT95

ABRIDGED DATA

Mercury Vapour Thyratron for high voltage industrial control applications.

Peak Forward or Inverse Anode Voltage	15	kV Max
Peak Anode Current	12	A Max
Mean Anode Current	1·5	A Max

GENERAL

Electrical

Filament	Oxide Coated	
Filament Voltage	2·5	V
Filament Current	20	A
Filament Heating Time (Minimum)	5·0	minutes
Inter-electrode Capacitances:		
Grid to Anode	8·0	pF
Grid to Filament	18	pF

Mechanical

Overall Length (excluding flexible leads)	11·000 inches (279·4 mm)	Max
Overall Width	4·000 inches (101·6 mm)	Nom
Net Weight	1 pound (0·5 kg)	Approx
Mounting Position	Vertical, base down	
Base	Flying leads	
Top Cap	*See Outline*	

Cooling Natural

MAXIMUM AND MINIMUM RATINGS

	Min	*Max*	*Min*	*Max*	
Peak Forward or Inverse Anode Voltage	—	10	—	15	kV
Peak Anode Current	—	16	—	12	A
Mean Anode Current (averaging time 15 sec max)	—	2·0	—	1·5	A
Fault Anode Current (Peak)	—	200	—	200	A
Duration of Fault Current	—	0·1	—	0·1	sec
Ambient Temperature	40	75	40	70	°C
Negative Grid Voltage:					
Before Conduction			—	500	V
During Conduction			—	10	V
Mean Grid Current			—	250	mA
Recommended Grid Resistor			5·0	50	kΩ
Filament Heating Time			5·0	—	minutes

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MERCURY VAPOUR THYRATRON

BT95

ENGLISH ELECTRIC

CHARACTERISTICS

Voltage Drop	16	V Approx
Ionisation Time	10	μsec Approx
Recovery Time	1·0	msec Approx
Condensed Mercury Temperature Rise:		
At no load	28	C Approx
At full load	31	C Approx

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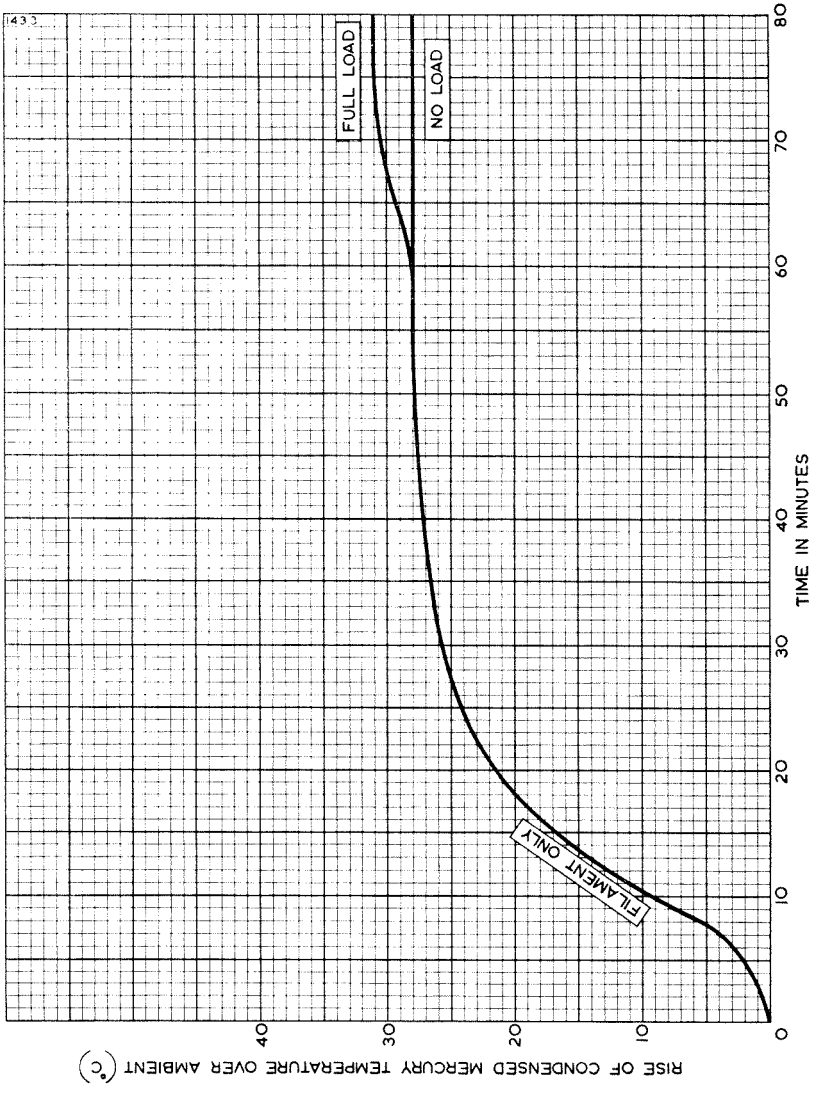
HEATING CHARACTERISTIC



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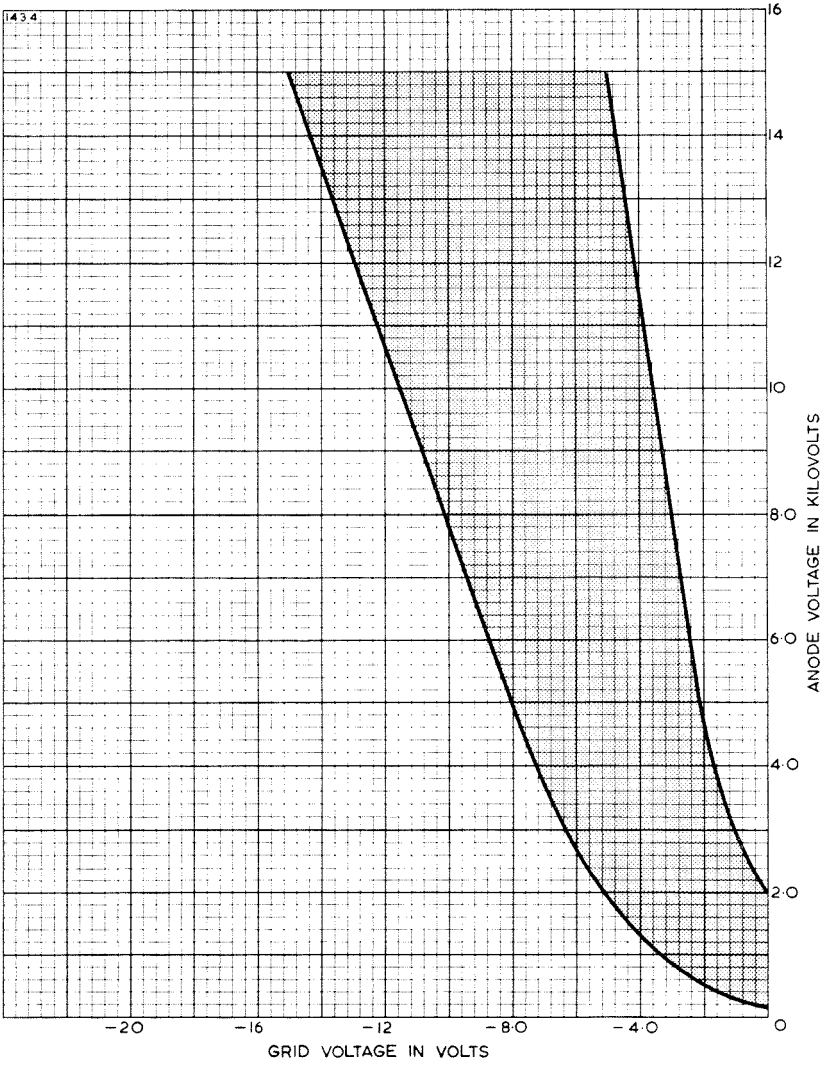
CONTROL CHARACTERISTIC



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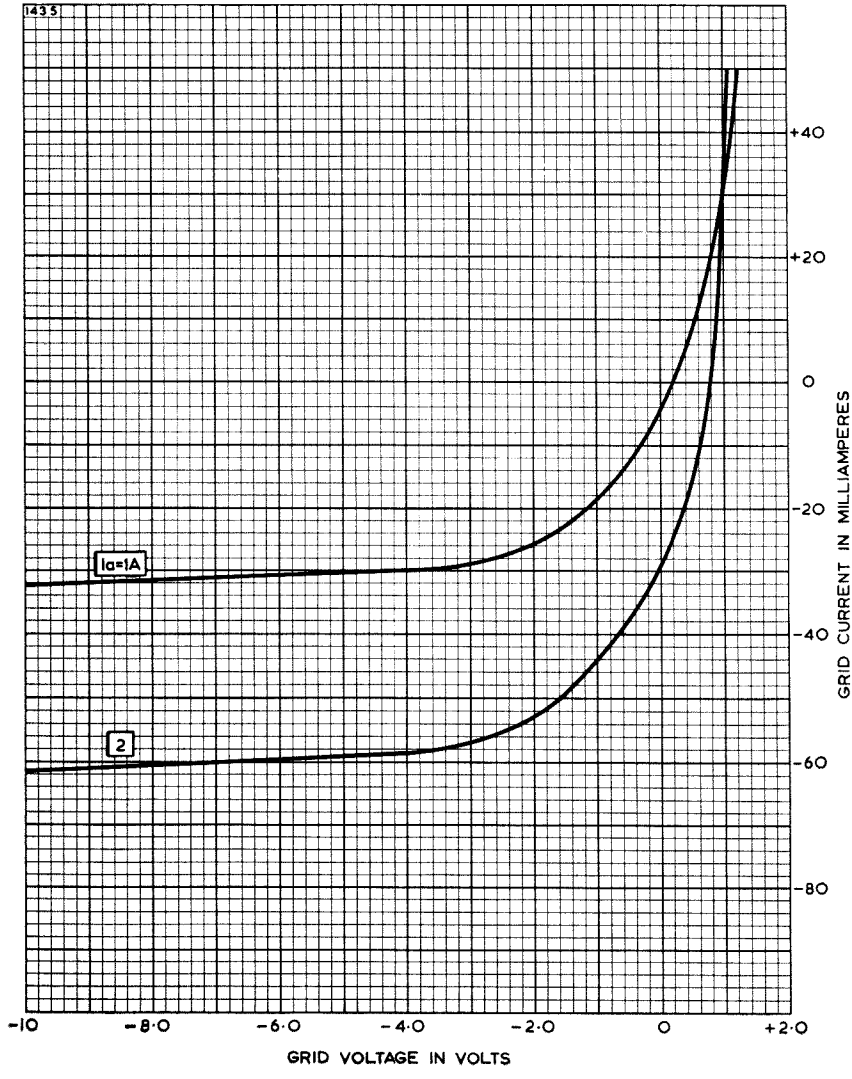
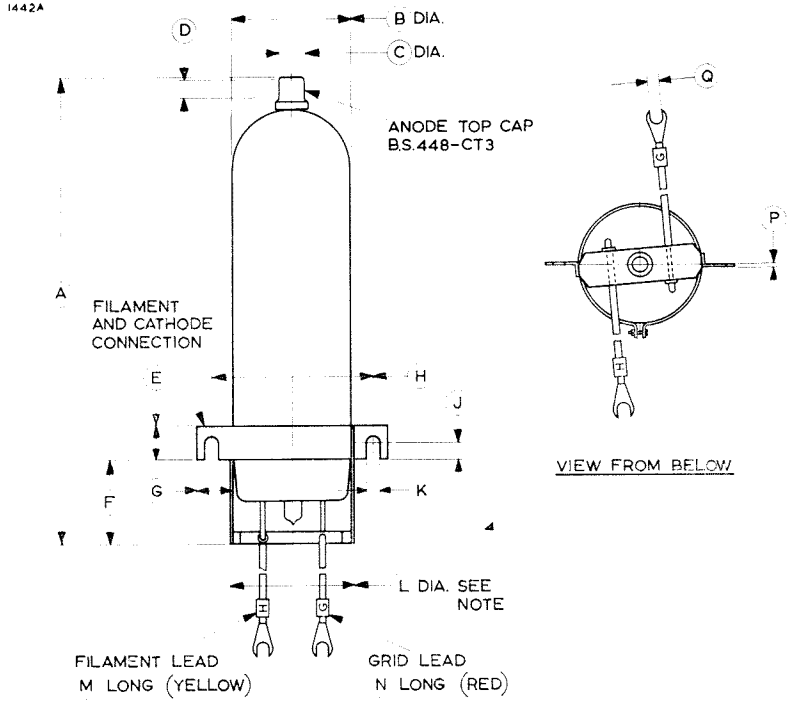
GRID CURRENT CHARACTERISTIC



ENGLISH ELECTRIC

OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
→ A	9·750 ± 0·500	247·7 ± 12·7	J	0·375	9·53
B	2·500	63·50	K	0·250	6·35
→ C	0·566 ± 0·015	14·38 ± 0·38	L	2·875	73·03
→ D	0·380 Min	9·65 Min	M	4·312 ± 0·250	109·5 ± 6·4
E	0·750 ± 0·031	19·05 ± 0·79	N	4·562 ± 0·250	115·9 ± 6·4
F	1·750	44·45	P	0·080	2·03
G	0·750	19·05	Q	0·265	6·73
→ H	3·406 ± 0·062	86·51 ± 1·57			

Millimetre dimensions have been derived from inches.

Note The base will pass through a hole of this diameter up to the terminal lugs.

→ Indicates a change

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IGNITRONS

December 1965

ENGLISH ELECTRIC VALVE CO. LTD.

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ENGLAND

Telephone:
Chelmsford 3491

Printed in England

A.C. RESISTANCE WELDING

Type	International Letter Size	Single-phase Service‡			Three-phase Service (at 1500V Peak)		
		Maximum Demand (kVA)	Corresponding Average Anode Current (A)	Maximum Average Anode Current (Reduced Demand) (A)	Maximum Peak Anode Current (A)	Corresponding Average Anode Current (A)	Maximum Average Anode Current (Reduced Peak) (A)
BK24/5552A	C	1200	75·6	140	—	—	—
BK42/5551A	B	600	30·2	56	480	4·0	18
BK66/5550	A	300	12·1	22·4	—	—	—
BK146/5553B	D	2400	192	355	2400	32	112
BK168/5822A	C	—	—	—	1200	16	56
BK442/7669	B	Coaxial version of BK42/5551A					
BK444/7671	C	Coaxial version of BK24/5552A					
BK446/7673	D	Coaxial version of BK146/5553B					
BK468/7672	C	Coaxial version of BK168/5822A					

‡Ratings are for two valves in inverse parallel, at any voltage between 250 and 600$V_{r.m.s.}$
Ignitor requirements (anode firing) 12A, 200V, for all a.c. resistance welding types.

POWER RECTIFICATION AND CONTROL

Type	International Letter Size	Maximum Peak Anode Current (A)	Maximum Average Continuous Current (A)	Ignitor Voltage required to fire (V)	Ignitor Current required to fire (A)	Maximum Peak Auxiliary Anode Current (A)	Maximum Average Auxiliary Anode Current (A)
BK44/5554	C	900* 600†	100* 75†	450	45	30	9·0
BK46/5555	D	1800* 1200†	200* 150†	450	45	30	9·0

*At peak anode voltage (forward and inverse) = 900V.
†At peak anode voltage (forward and inverse) = 2100V.

ENGLISH ELECTRIC

CAPACITOR DISCHARGE, PULSE DUTY

Type	International Letter Size	Maximum Ratings					
		Peak Forward or Inverse Anode Voltage (kV)	Peak Anode Current (A)	Mean Anode Current (A)	Ampere-seconds per pulse (A.sec)	Duration of current (msec)	Pulse Frequency (p.p.s.)
BK178	D	25	100 000	40	200	150	0·2
BK478	D	Coaxial version of BK178					

**Rated for 20μsec oscillatory current discharges.

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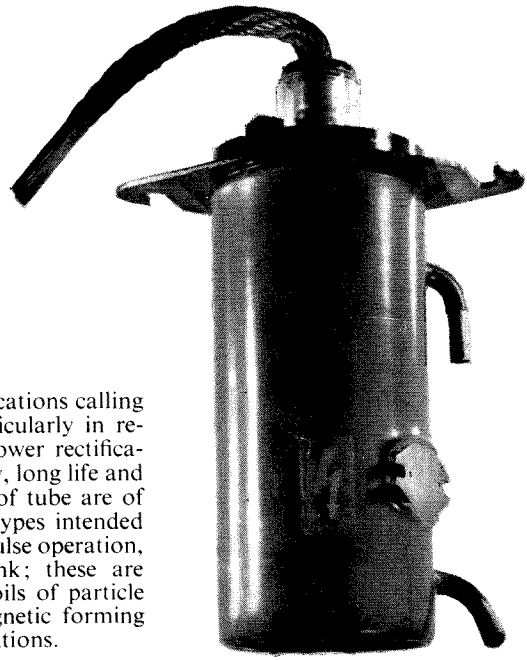
INTRODUCTION

The ignitron is a high-current rectifier with a mercury pool cathode, usually in a water-cooled steel envelope. In its simplest form it consists of a cylindrical vacuum envelope with a heavy anode supported from the top by a glass insulator and a small ignitor electrode, also glass-insulated, dipping into the mercury pool at the bottom. For some applications, tubes may be provided with additional ignitors, auxiliary anodes and internal baffles.

Size C Ignitron BK444/7671



Ignitrons are used in applications calling for high current levels, particularly in resistance welding and high power rectification, where the high efficiency, long life and ease of control of this type of tube are of great value. There are also types intended for very high current single-pulse operation, discharging a capacitor bank; these are used to pulse the magnet coils of particle accelerators, for electro-magnetic forming of metals, and similar applications.

SIZE CLASSIFICATION

It is usual to classify ignitrons into five groups according to size; this is determined by the diameter of the envelope and the groups are identified by letters.

Size	A	B	C	D	E
Approximate Diameter	2	$2\frac{3}{4}$	4	$5\frac{1}{2}$	9 inches

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PRINCIPLES OF OPERATION

The ignitron operates as a controlled rectifier; the action is similar to a thyratron in that a control signal is needed to start conduction, which then continues until the current falls to zero. Where the tube is operating as an a.c. rectifier it conducts during one half-cycle of the supply frequency and must be ignited every alternate half-cycle for as long as it is required to conduct.

The ignitor is a small rod of semi-conducting material, with a pointed end dipping into the cathode pool. When a suitable current pulse is passed through the ignitor-mercury junction, the ignitor being positive, a cathode spot is formed on the surface of the mercury and free electrons are emitted. If the anode is sufficiently positive with respect to cathode at this time, an arc will form between cathode and anode; once the arc has struck the ignitor has no further control over it and the tube continues to conduct until the voltage across it falls below the ionisation potential of the mercury vapour.

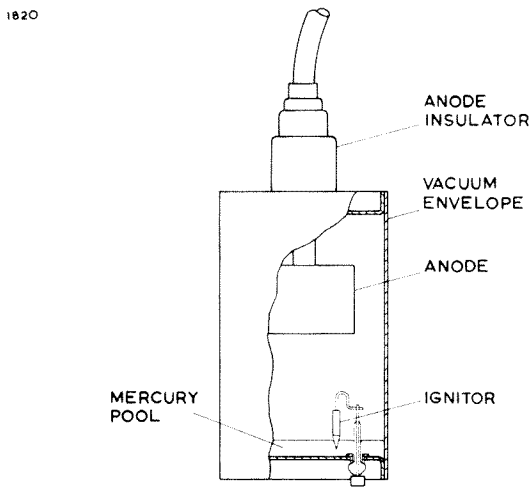

Fig. 1. Essential components of a simple ignitron

The internal construction of an ignitron varies according to the application for which it is intended. Tubes used in single-phase welding control equipment need only the basic elements shown in Fig. 1, but other applications usually require additional components. In a three-phase welding control circuit, the ignitron must de-ionise quickly in order to hold off the high inverse voltage which immediately follows the conduction cycle. This is accomplished by including a baffle which operates at cathode potential; no additional connections are involved but the voltage drop across the tube is increased slightly.

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For power rectification at higher voltages, more elaborate baffles may be used and an auxiliary anode is also provided. The auxiliary anode is used to strike a small arc in a low-voltage circuit separate from the main load. This maintains the cathode spot at low load currents, ensuring stable operation under these conditions. Power rectifier service places a continuous heavy load on the ignitor, and ignitrons intended for this duty are normally fitted with two ignitors which may be used in succession, although both tend to deteriorate together.

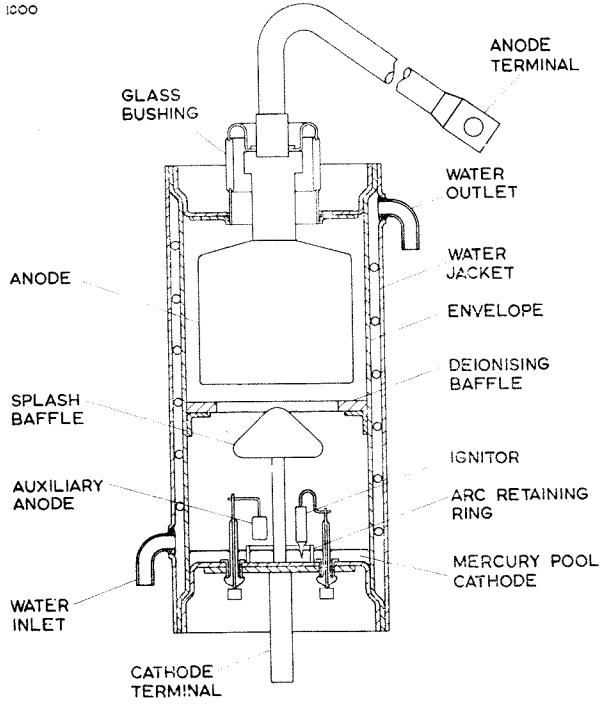

Fig. 2. Cross-section of a rectifier ignitron

The large tubes designed for single-pulse operation are also fitted with two ignitors and an auxiliary anode which may be used to prolong the ignition arc. Little or no baffling is used so as to keep the arc voltage drop as low as possible.

STORAGE, INSTALLATION AND MAINTENANCE

Where spare ignitrons are to be stored for extended periods, they should preferably be kept in the original packing under dry conditions, and with the tubes upright.

When an ignitron is being installed, or handled for any other reason, it should be remembered that it has two or more glass-to-metal seals. Any damage to these seals caused by excessive shock, or strain on the terminals, is liable to admit air which would destroy the tube. All high voltage ignitrons should preferably be kept upright at all times, to prevent mercury reaching the upper parts of the tube and possibly causing voltage breakdown.

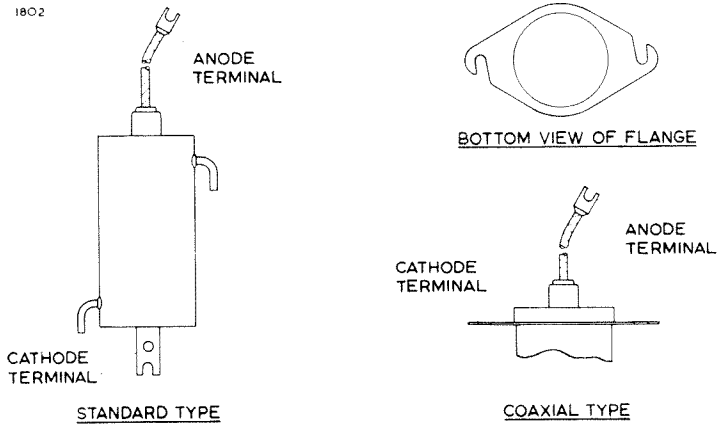

Fig. 3. Standard and coaxial type cathode terminals

Ignitrons are normally mounted by the cathode terminal; this may be either a heavy copper bar extending downwards from the base of the tube or, on the more recent coaxial types, a slotted flange at the top of the envelope (See Fig. 3). In the coaxial type, the current flows via the arc from anode to cathode, then returns up the wall of the envelope to the cathode terminal. This has the effect of neutralising the magnetic field which would otherwise tend to deflect the arc towards the envelope walls at high peak currents.

All types of ignitron should be mounted in a vertical position, within 3°, to ensure correct operation. It is essential that the connections to anode and cathode have very low resistance, owing to the large currents carried. The contact areas should be cleaned when a tube is installed, and the terminals securely bolted together. Shakeproof washers or nuts should be used, in case of vibration in the equipment.

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Ignitrons used for capacitor discharge require special attention when first installed in an equipment. Since these valves may have to hold off very high voltages, it is particularly important that there should be no mercury condensed in the region of the anode seal. This is ensured by maintaining the seal region at a temperature well above that of the rest of the valve not only for a period before operation but also while the equipment is operating and during short shut-down periods. A newly installed valve should also be aged, after heating the anode seal, to hold off a voltage higher than the working voltage of the equipment. Details of this process are given in individual data sheets.

An ignitron should not normally require maintenance unless it is operated in a corrosive atmosphere, when the connections may deteriorate and need cleaning. It may also be necessary to clean out deposits from the water jacket if the cooling water is not adequately filtered, and this may be done by chemical means.

COOLING

The water used for cooling ignitrons must be reasonably clean and free from corrosive chemicals; it is advisable to incorporate a filter in the system. Chloride ion concentrations exceeding 20 parts per million are likely to cause corrosion of the water jacket.

Tap water suitable for drinking is normally satisfactory; if a suitable water supply is not available in a particular application then a closed-circuit system can be used with a heat exchanger.

Two types of water connector as showh in Fig. 4 are used on EEV ignitrons, either a plain pipe or a screwed union being available as required.

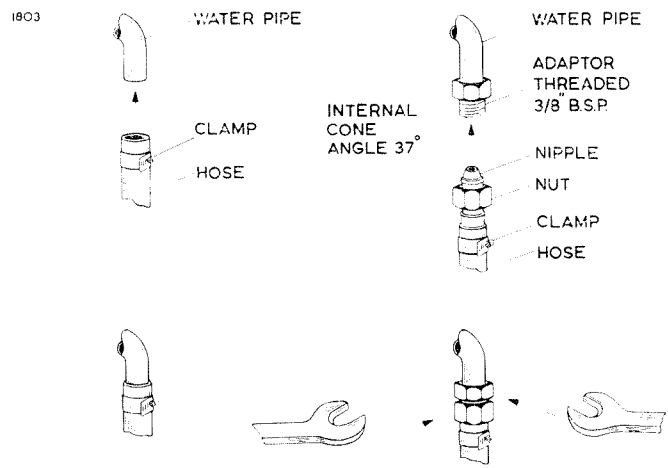

Fig. 4. Alternative water connections

The normal circuit arrangement results in the water jackets being at mains voltage with respect to earth; therefore the water connections must be made with insulating tubing. The water jackets of up to three tubes may be connected in series, provided that the temperature ratings are not exceeded by any tube.

Ignitrons designed for use in welders, where the operation may be of an intermittent nature, are usually fitted with a thermostat mounting platform.

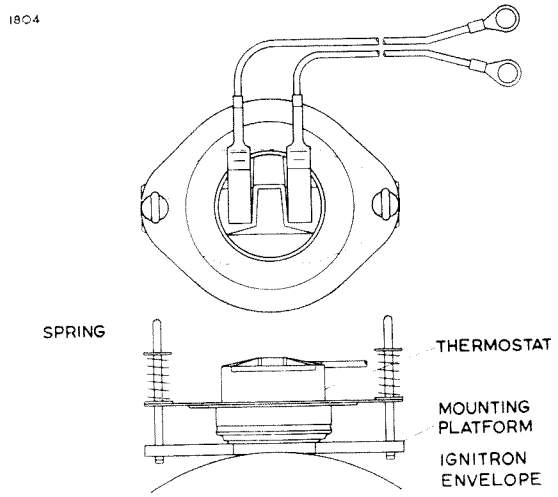

Fig. 5. Thermostat mounting arrangement

This is a metal plate, attached to the side of the tube and making good thermal contact with the inner vacuum envelope. A thermostat mounted on this platform may be used to switch on the water flow when the tube reaches a certain temperature and the water saving can be appreciable. To guard against overheating, which would result from blockages or failures in the water supply, another thermostat is used to switch off the mains voltage before the temperature reaches a dangerous level. In a typical welder the water jackets of two or three tubes are connected in series and the over-temperature protection thermostat is mounted on the last tube in the line (the hottest). Only one thermostat can be fitted to each tube.

There is a short time-lag in the operation of the thermostat, and if the equipment is switched on at full load while the water jacket is empty the ignitron may be damaged before the thermostat can operate. This can happen when a tube is removed from the equipment for checking or replacement, or if the water outlet position is such that the contents of a water jacket can be siphoned out when the water is turned off. Since the water control valve is operated by the water saving thermostat, it prevents an immediate flow of water when the equipment is switched on from cold, and other means must be provided to fill the water jackets before the equipment is switched on.

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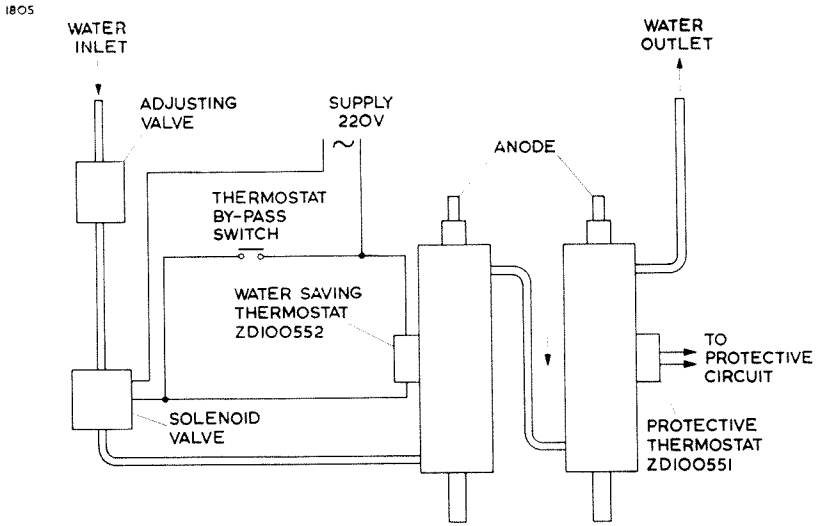

Fig. 6. Typical cooling system

When an ignitron is operating near maximum ratings, the anode may become red-hot. If the flow of cooling water is stopped simultaneously with switching off the load, the heat stored in the hot anode may be sufficient to damage the tube. The data sheet for each valve type gives a minimum time for which the water flow must be maintained after switching off.

RATINGS

The method used to determine the ratings of an ignitron varies according to the application and it is necessary to consider the various types separately. It must be understood that the ratings given in individual data sheets are absolute limits. They are not design centre ratings and it is the responsibility of the equipment designer to ensure that they cannot be exceeded under the worst possible conditions of component tolerance, mains voltage fluctuation and load variation. Transient over-voltages in the mains supply may be neglected unless the contrary is stated.

Single-phase Welding Control

Ignitrons for this application normally have non-simultaneous maximum ratings for average anode current and demand kVA. These ratings are shown in graphical form in the data sheets, the region enclosed by the line being the permitted operating area. Another graph is used to relate the maximum ratings for line demand current and duty cycle at various voltages.

In cases where phase control is used, the average anode current must be

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calculated for the full-cycle conduction condition, even if it is not used in practice, and the duty cycle is to be defined as the percentage of supply frequency cycles during which conduction occurs. The reason for this is that delayed firing of an ignitron in the usual inverse parallel welding circuit applies a high inverse voltage to the other tube, which has just ceased conducting. In order to compensate for the increased risk of arc-back it is necessary to de-rate the tubes under these conditions and this is done by requiring full-cycle conduction to be assumed in calculations.

Three-phase Welding Control
In this case there are non-simultaneous maximum ratings for peak anode current and average anode current, and a graph is provided in the data sheets to show the permitted operating area.

Power Rectifiers
These ignitrons have maximum peak and average anode current ratings given for two values of peak anode voltage. Short-period average anode current ratings are also quoted. Tubes designed for power rectifier service may also be used for resistance welding control at high voltages, and the ratings quoted for this purpose are applied in the same way as those for the normal welder ignitrons.

Capacitor Discharge
The maximum coulomb-per-second transfer capability of the ignitron is basically constant. In uni-directional current applications, this capability is defined by specifying the maximum average anode current and the averaging time. In applications with current reversal (ringing), it is more convenient to specify the maximum energy that can be switched per minute as a function of peak anode voltage and percentage reversal. A maximum peak anode current rating is also given.

IGNITOR FIRING

Anode Firing
This is the less expensive form of ignitor control and is used in most welder circuits. Fig. 7 shows a typical single phase welder circuit with a thyristor used as the control switch. In this circuit, as the anode of ignitron 1 goes positive, current may flow via D_4, the thyristor, the zener diode and D_1 to the ignitor of ignitron 1. By controlling the gate voltage of the thyristor the firing can be stopped completely or delayed to any desired point in the positive half cycle. On the succeeding half cycle the process is repeated through D_3, D_2 and ignitron 2. As soon as the ignitron fires the ignitron anode voltage falls to the arc drop value and the ignitor voltage is reduced correspondingly. It is necessary to put a zener diode (20V breakdown) in series with the thyristor as the voltage drop across the thyristor is considerably less than the arc voltage of the ignitron and an excessive current would otherwise persist for the entire period of conduction. The diodes D_1 and D_2 are necessary to prevent inverse voltage appearing across the ignitor. A failure of any of the four diodes would allow the full power current to flow and so 2A fuses must be incorporated as a protection.

In the past it was customary to use two thyratrons instead of the thyristor.

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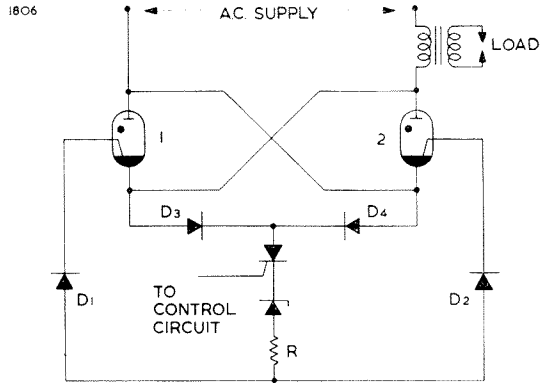

Supply Voltage	250	440	600	1000	2000	2500	$V_{r.m.s.}$
Resistance R	2	3	4	10	35	50	Ω

Fig. 7. Single phase welder circuit, with SCR ignitor firing

No diodes were then required and each thyratron was separately connected through a fuse and resistor from the anode to the ignitor of each ignitron.

Separate Excitation

Separate excitation must be used when the anode voltage of the ignitron is not sufficient for anode firing to be used. A capacitor is discharged through the ignitor to cause ignition (see Fig. 8). An inductance of about 1mH is used in series so that a resonant circuit is formed which supplies a single current pulse of approximately sinusoidal shape. The pulse width is $\pi\sqrt{LC}$ and the circuit impedance $\sqrt{L/C}$, where L and C are in henries and farads respectively. Suitable values of

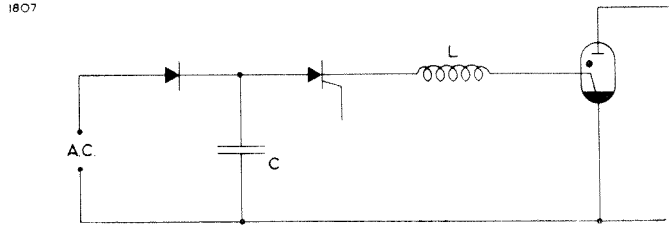

Fig. 8. Typical capacitor firing circuit

capacitance and voltage are 5μF at 600V, or 12μF at 450V. The ratings for separate excitation differ from those of anode firing and are specified on the individual data sheets of the valves.

IGNITRON CIRCUITS

Welding Control

A typical spot or seam welder incorporates a power transformer which provides the high welding current at a low voltage. Switching on and off is accomplished by ignitrons in the high voltage side of the circuit. Coarse adjustment can be provided by transformer taps but fine control is only achieved with ignitrons. For seam welding the number of non-conducting cycles must also be closely controlled. For welding some materials it is necessary to allow for a preheat cycle, consisting of a few conduction cycles at a low power level to heat the weld area before the actual weld is made. During the weld pressure may be reduced in order to obtain higher effective resistance and then a post-heating period with increased pressure may be useful to forge the weld. Fig. 9 shows a typical welding cycle for spot welding thick steel sheets.

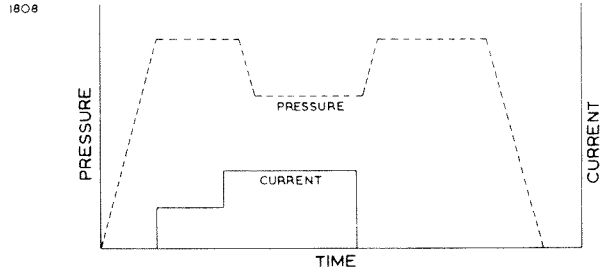

Fig. 9. Example of current and pressure sequence for a spot welder

Single-Phase Welding Control

The usual circuit for this application provides full wave control by connecting two ignitrons in inverse parallel as is shown in Fig. 7. As the load is inductive the current will lag behind the voltage, and under steady state conditions there would be a natural delay angle ϕ between the voltage and current. If the ignitron is first fired at the natural point of zero current, that is ϕ after voltage zero, the current will rise smoothly from zero and reach its natural peak level. If, however, the ignitron is fired earlier the current will be excessive in the first half cycle and could reach twice the normal peak current. This will set up transient surges which may damage electrical components and also cause a d.c. component in the transformer primary which may result in saturation. Therefore for full cycle conduction the ignitron is fired at a time ϕ after voltage zero. Later firing than this (phase delay) is used to reduce the weld current and will not cause any serious transients provided the firing angle is the same for each conducting cycle.

It is important that both ignitrons fire for an equal number of half cycles as otherwise there would be a d.c. component of current which might saturate the transformer core after repeated welds.

At low duty these effects may not be serious, but for heavy duty it is essential to have synchronous control to ensure correct timing of every cycle, especially the first.

Three-phase Welding Control

Although the single-phase system described above is very widely used, it has serious disadvantages for very large welding equipments. As the physical dimensions of the welder are increased the secondary circuit reactance becomes appreciable, giving a poor power factor, and the current loads involved are sufficient to seriously unbalance the supply if taken from a single phase. Both of these problems can be overcome by the three-phase frequency changing system, which produces a synthesised single-phase voltage at a frequency lower than that of the mains supply. The simplest method of doing this requires a four-wire supply, and the neutral wire has to carry the full primary current, so that it may be more economical to have a local delta-star transformer to supply the welding load only, as in Fig. 10.

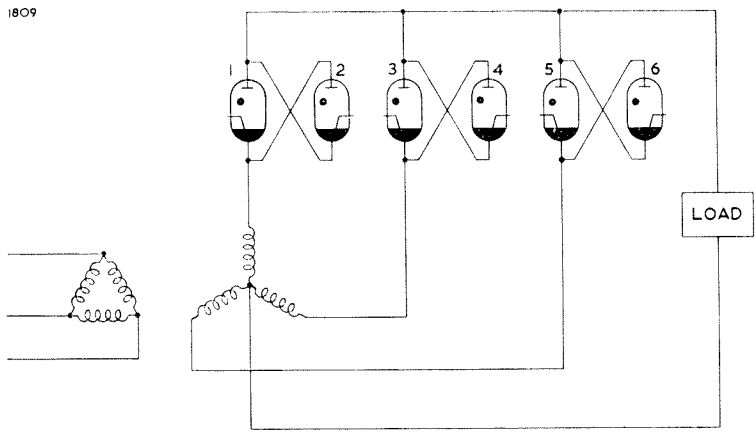

Fig. 10. Three-phase welder with local delta-star transformer

If the welding transformer is provided with three isolated primary windings and a single secondary, the ignitron pairs can be delta connected directly to the supply lines with a primary winding in series with each ignitron pair.

Both circuits operate by firing the ignitrons in sequence, so that a rectified voltage pulse of approximately square waveform is applied to the transformer. For example, if the ignitrons numbered 1, 3 and 5 are fired in sequence, each conducts for one-half of a supply voltage cycle, the half-cycle pulses overlapping during commutation. The three tubes are fired in sequence until the required pulse length is achieved; then after a short non-conducting interval the other three tubes are fired to pass the second half of the low-frequency cycle. The

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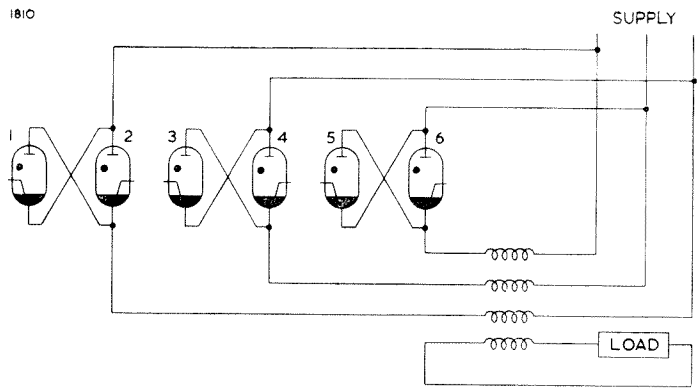

Fig. 11. Three-phase welder with delta connected primary circuit

interval between the long pulses is necessary so that the last tube to carry the current has time to extinguish; as the current cannot transfer to another phase it continues to flow for an extended period. The current also increases steadily

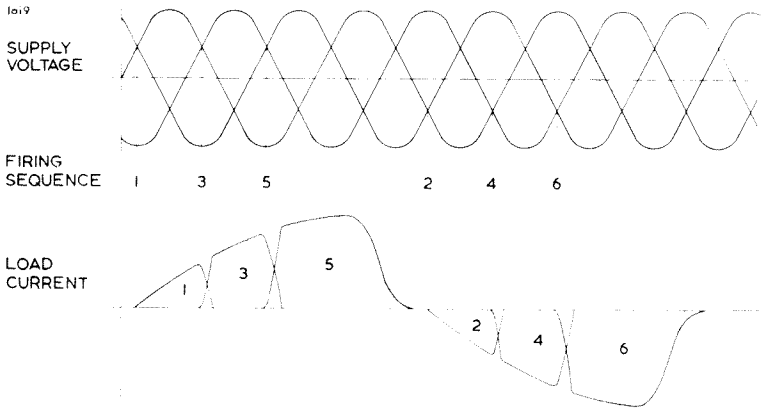

Fig. 12. Voltage and current waveforms in a three-phase frequency changing welder

during the long pulse so that the last tube to conduct carries a much larger total current than the other two. If the same tube terminates every alternate long pulse, the average current in this tube will be the limiting factor in the ratings.

Power Rectification

Rectifier ignitrons can supply large d.c. loads from single phase or multiphase a.c. mains. The provision of variable phase delay of ignitor firing allows control of the output voltage over a wide range.

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Where the load presents a counter e.m.f., as in battery charging, the driving voltage may be relatively low being the value of the supply less the counter e.m.f., and at low values of ignitron main anode current it may be necessary to use the auxiliary anode to maintain conduction. If the load is a d.c. motor, this also presents a counter e.m.f. and the current may fall to a low value when the motor is lightly loaded. In cases where a counter e.m.f. is present this must be allowed for when considering the inverse voltage across the ignitrons.

It is not possible to operate ignitrons in parallel to obtain higher currents, unless each tube has sufficient impedance connected in series to ensure that both will conduct. Without this series impedance, the fall in voltage as the first arc strikes will prevent the second arc from establishing itself.

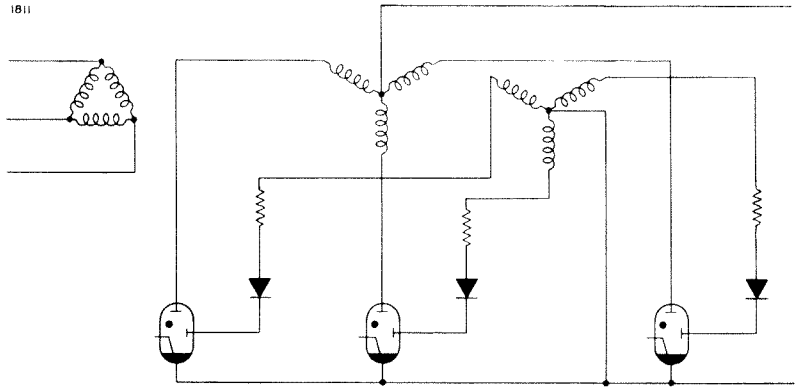

Fig. 13. Auxiliary anode supplies for a three phase rectifier

The usual half-wave and full-wave rectifier circuits can be employed, with additional transformer windings to supply the auxiliary anodes and ignitor firing circuits. In multiphase equipments, the phase delay of the ignitor circuits may be controlled by a phase-shifting transformer. The circuits for the auxiliary anodes must observe the maximum voltage and current ratings given in the valve data sheets, and must also meet the minimum requirements necessary to strike and maintain the auxiliary arc. A voltage of 55 to 110$V_{r.m.s.}$ will normally give satisfactory operation but it should be noted that operation at low temperatures may involve compromising on stability in order to observe the ratings. In order to meet the limits on inverse voltage, a diode may be necessary in the lead to the auxiliary anode of each tube.

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Basic circuits for rectifier service

The values given do not allow for arc loss, phase delay, commutation or voltage drops in transformers.

Circuit	Fig.	$V_{r.m.s.}$	I_{av}	P.I.V. on Ignitron
Single-phase half-wave	14	$2{\cdot}22 \times V_{dc}$	I_{dc}	$3{\cdot}14 \times V_{dc}$
Single-phase full-wave	15	$1{\cdot}11 \times V_{dc}$	$0{\cdot}5 \times I_{dc}$	$3{\cdot}14 \times V_{dc}$
Single-phase bridge	16	$1{\cdot}11 \times V_{dc}$	$0{\cdot}5 \times I_{dc}$	$1{\cdot}57 \times V_{dc}$
Three-phase half-wave	17	$0{\cdot}855 \times V_{dc}$	$0{\cdot}333 \times I_{dc}$	$2{\cdot}09 \times V_{dc}$
Three-phase full-wave	18	$0{\cdot}427 \times V_{dc}$	$0{\cdot}333 \times I_{dc}$	$1{\cdot}045 \times V_{dc}$
Six-phase half-wave	19	$0{\cdot}741 \times V_{dc}$	$0{\cdot}167 \times I_{dc}$	$2{\cdot}09 \times V_{dc}$

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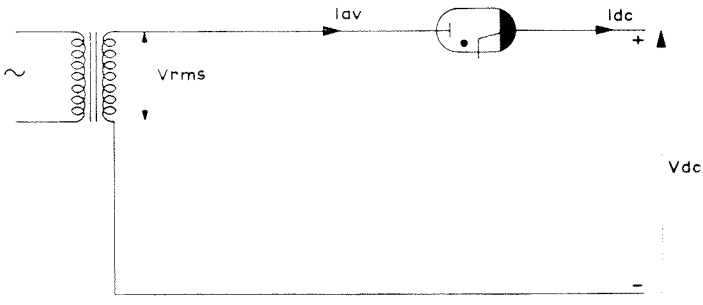

Fig. 14. Single-phase half-wave circuit

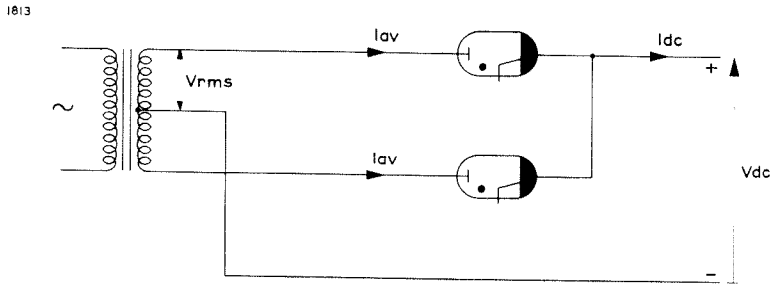

Fig. 15. Single-phase full-wave circuit

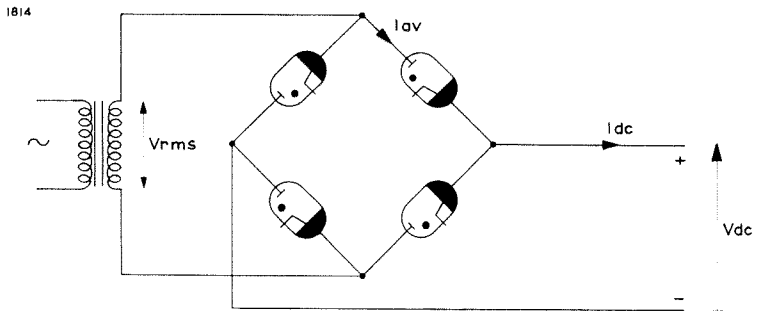

Fig. 16. Single-phase bridge circuit

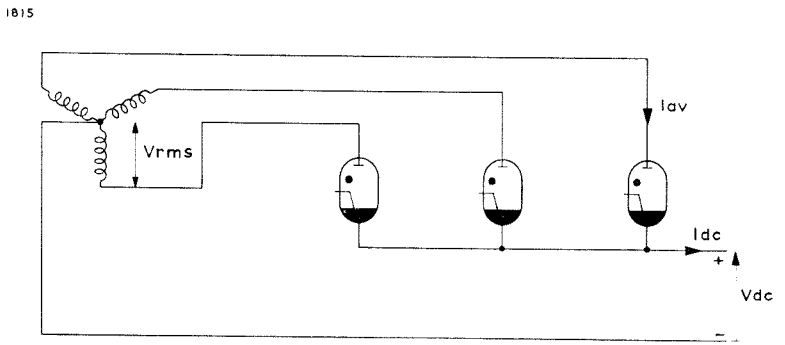

Fig. 17. Three-phase half-wave circuit

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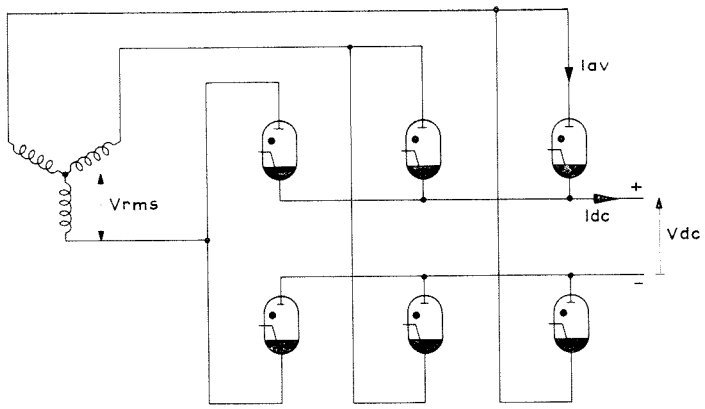

Fig. 18. Three-phase full-wave circuit

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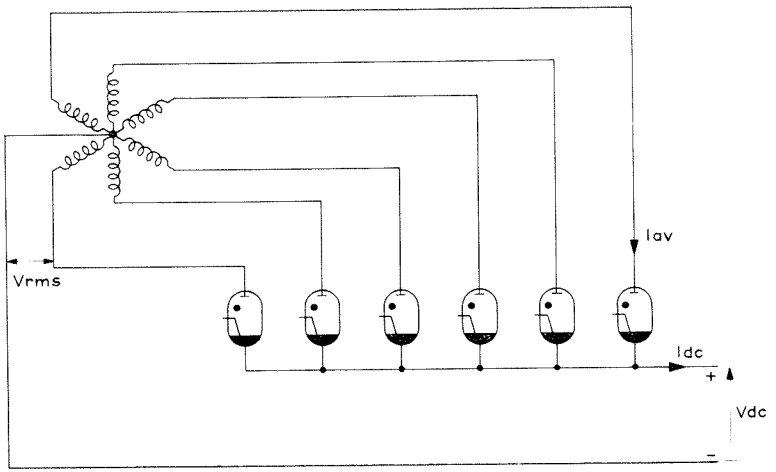

Fig. 19. Six-phase half-wave circuit

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Capacitor Discharge

Ignitrons used for capacitor discharge service may be required to reach a fully conductive state very quickly and at an accurately controlled point in time. To achieve this it is usual to fire the ignitors by discharging a small capacitor, charged to a voltage high enough to ensure rapid firing, through the ignitor. Individual tube data sheets give details of the recommended values.

This type of application frequently involves a highly inductive load, such as a magnet coil, and it is necessary either to allow for an oscillatory current through the ignitron or to prevent it by including a clamping valve in parallel with the load.

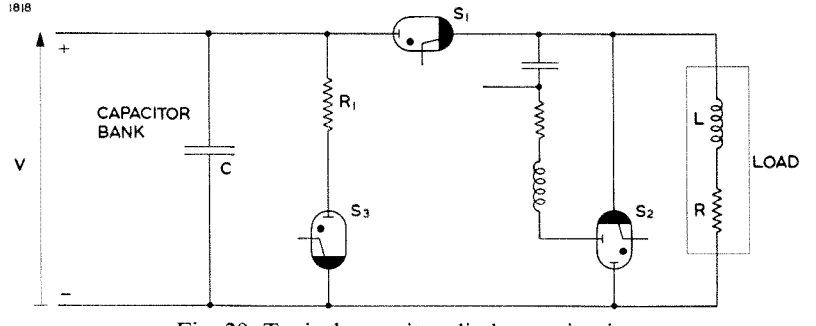

Fig. 20. Typical capacitor discharge circuit

In Fig. 20, firing S_1 discharges the capacitor into the load, and as the capacitor voltage reaches zero the load current is transferred to S_2, which can be fired simultaneously with S_1 and held conductive by an arc to the auxiliary anode. In order to ensure rapid commutation of the current from S_1 to S_2 the auxiliary anode current may be quite large, about 50A. In a typical case a 30μF capacitor charged to 200V is discharged through the auxiliary anode circuit and a limiting resistance. A series inductance may be included to improve the shape of the auxiliary current pulse. The load current decays exponentially after transferring to S_2, and it should be noted that the ampere-second product carried by S_2 may considerably exceed the original charge on the capacitor.

The current carrying capacity of each ignitron is a function of the energy dissipated per pulse. This is the product of the average arc voltage drop, the pulse length and the current, and is measured in joules. At the high peak currents involved, the arc drop may be considerably higher than in other ignitron applications particularly during ionisation at the start of the current pulse. High rates of rise of current cause severe conditions and lead to shorter life.

For S_1 the current pulse approximates to one-quarter of a sine wave cycle, the current rising to a peak value

$$I = V\sqrt{\frac{C}{L}}$$

The ampere-second product of the S_1 pulse = CV, the initial capacitor charge.

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The ampere-second product of the S_2 pulse is $\frac{IL}{R}$. The rate of rise of current in S_2 during commutation is also very high, and since S_2 must also be able to hold off the full capacitor voltage in the inverse direction when S_1 is fired and S_2 itself may have been fired simultaneously on the auxiliary anode, the clamping valve operates in all respects under the most severe conditions of the three. The discharge valve, S_3, is included so that the capacitor can be discharged quickly under fault conditions or when the load is disconnected.

DEFINITIONS

Average Anode Current
The arithmetic mean anode current, averaged over a time not exceeding the rated Maximum Averaging Time.

Maximum Fault-Current
The highest anode current that the ignitron can carry for a short time without serious damage. The maximum time for which this current may be carried is also quoted.

Repeated fault current loadings may reduce the life of a tube.

Line Demand Current
The r.m.s. current passed by a pair of ignitrons connected in inverse parallel, under full-cycle conduction conditions.

Demand kVA
The product of the Line Demand Current and the r.m.s. line voltage.

Duty Cycle
The percentage of mains-voltage cycles for which the ignitrons conduct during a period not exceeding the Maximum Averaging Time.

Maximum Averaging Time
The longest period over which the anode current may be integrated to determine its average value.

Arc Voltage Drop
The potential difference between anode and cathode during normal conduction.

Voltage Polarities
A forward voltage on any electrode of the ignitron is one which makes that electrode positive with respect to the cathode.

Full Cycle Conduction
The condition where each valve is ignited as early as possible in its forward voltage cycle.

Ignitor Circuit Requirements
The minimum values of ignitor voltage and current given are those which will produce ignition within the specified time.

Ignition
The production of an arc between the cathode and the upper end of the ignitor, accompanied by a drop in ignitor voltage.

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THYRATRON (Triode) RARE GAS FILLED

6D4 (AFX212)

Service Type CV1949 **American Designation 6D4**

INTRODUCTION

The 6D4 is a miniature indirectly-heated, triode Thyratron with rare gas filling. It is mounted on a B7G glass base and is intended primarily for use as a wide band noise source.

GENERAL DATA

Electrical

Cathode	Oxide Coated	
Heater Voltage	6·3	V
Heater Current	250	mA
Cathode Heating Time (Minimum)	30	seconds

Mechanical

Overall Length	2·13 inches	(54 mm)	Max
Overall Diameter	0·75 inches	(19 mm)	Max
Mounting Position			Any
Cooling			Natural

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MINIMUM AND MAXIMUM RATINGS

(Absolute Values)

	Min	*Max*	
Heater Voltage	5·7	6·9	V
Cathode Heating Time	30	—	seconds
Ambient Temperature	−55 to +90		°C
Peak Inverse Anode Voltage	—	350	V
Peak Forward Anode Voltage	—	350	V
D.C. Anode Voltage	—	250	V
Anode Current:			
Peak	—	110	mA
Mean	—	25	mA
D.C. Negative Grid Voltage	—	110	V
Heater-Cathode Voltage:			
Heater Negative	—	110	V
Duty Cycle	—	0·0075	
Tube Drop at 100mA	—	18	V
Noise Output (peak to peak) (*See Note* 1)	10	—	V

NOTES

1. The valve is placed in the circuit shown in figure 1, and in a constant magnetic field of 375±20% gauss which is perpendicular to the normal electron path, and in such a direction as to deflect the electron beam towards the top of the valve. Proper alignment will be obtained if the field is directed parallel to a centre line through the valve base passing half way between pins 3 and 4, although some rotary adjustment should be provided to compensate for slight manufacturing deviations.

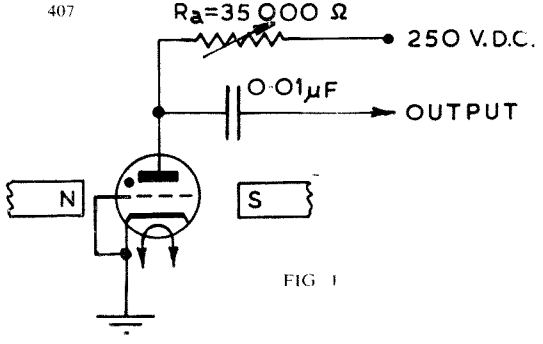
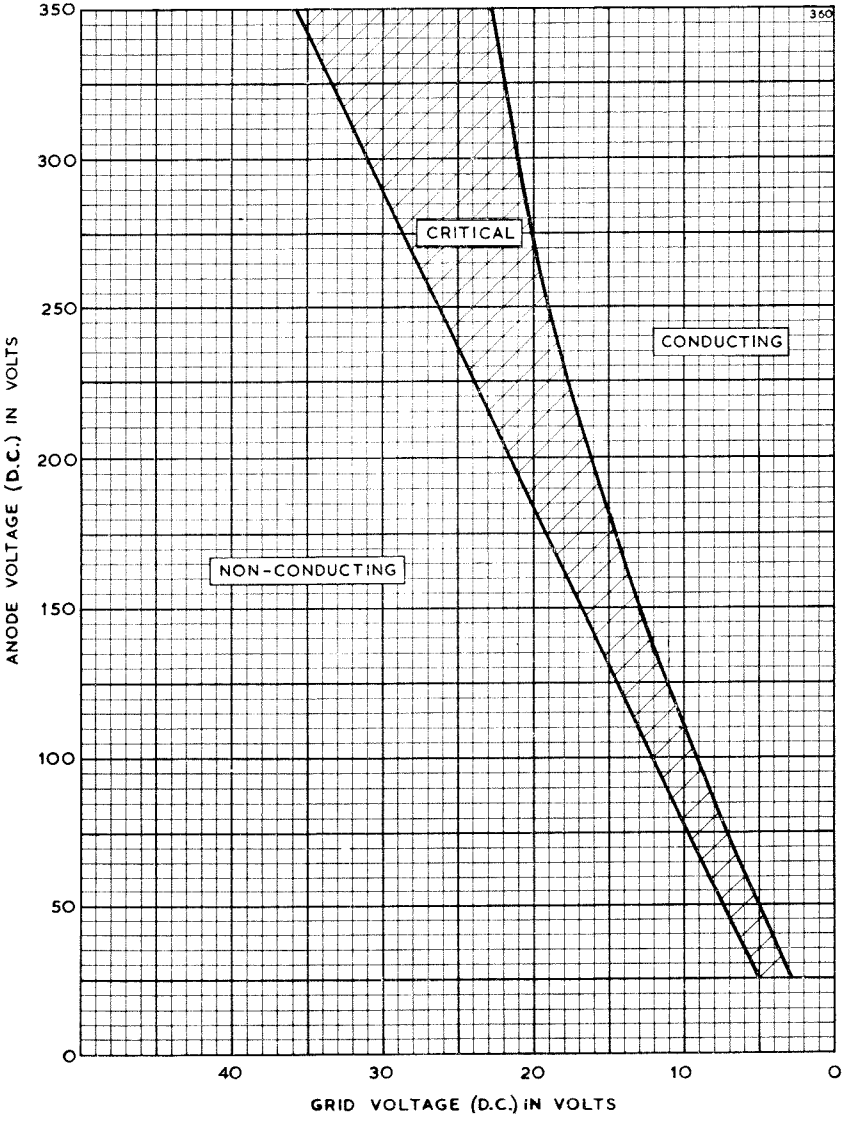


FIG 1

The anode series resistance Ra should be set to limit the anode current to between 6 and 7mA. The anode supply voltage may be as high as 300 volts, but erratic firing may occur if a supply of less than 250 volts is used. A suitable magnet is 'Alcomax II' M.C. 690 from Marrison & Catherall Ltd.

CONTROL CHARACTERISTIC



THYRATRON (Triode) RARE GAS FILLED

6D4 (AFX212)

OUTLINE

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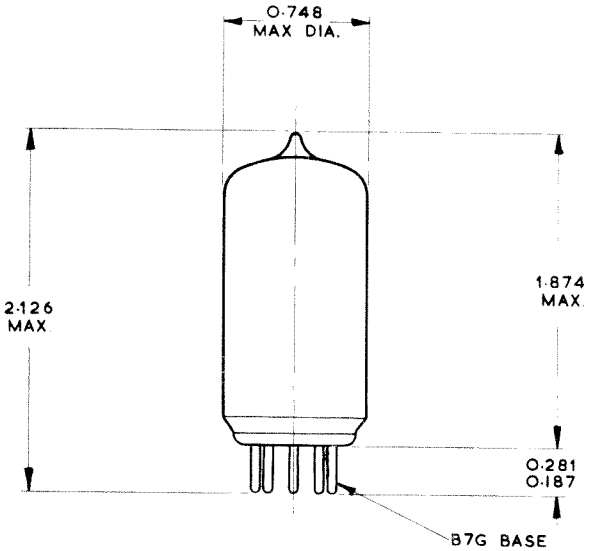

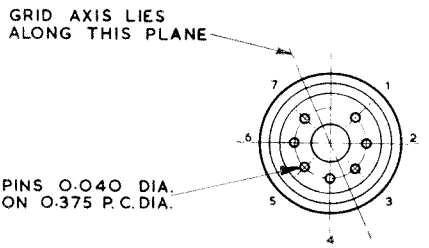

PIN	ELEMENT
1	GRID
2	NO CONNECTION
3	HEATER
4	HEATER
5	CATHODE
6	NO CONNECTION
7	ANODE

ALL DIMENSIONS IN INCHES

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THYRATRON (Triode) RARE GAS FILLED

AFX203

Service Type CV2868 **American Equivalent C1A (Near)**

INTRODUCTION

The AFX203 is a directly-heated triode Thyratron with rare gas filling.

GENERAL DATA

Electrical

Filament	Oxide Coated	
Filament Voltage	2·5	V
Filament Current	5·0	A
Filament Heating Time (Minimum)	40	seconds

Mechanical

Overall Length	7·0 inches (176 mm)	Max
Overall Diameter	2·25 inches (57 mm)	Max
Mounting Position		Any
Cooling		Natural

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MINIMUM AND MAXIMUM RATINGS
(Absolute Values)

	Min	*Max*	
Heater Voltage	2·25	2·75	V
Ambient Temperature	−55 to	+70	°C
Peak Inverse Anode Voltage	—	340	V
Peak Forward Anode Voltage	—	170	V
Anode Current:			
Peak	—	7·7	A
Mean	—	0·64	A
Under fault conditions (0·1 seconds Max duration)	—	77	A
Tube Drop at 0·4A	—	11	V
Operating Frequency	—	380	c/s

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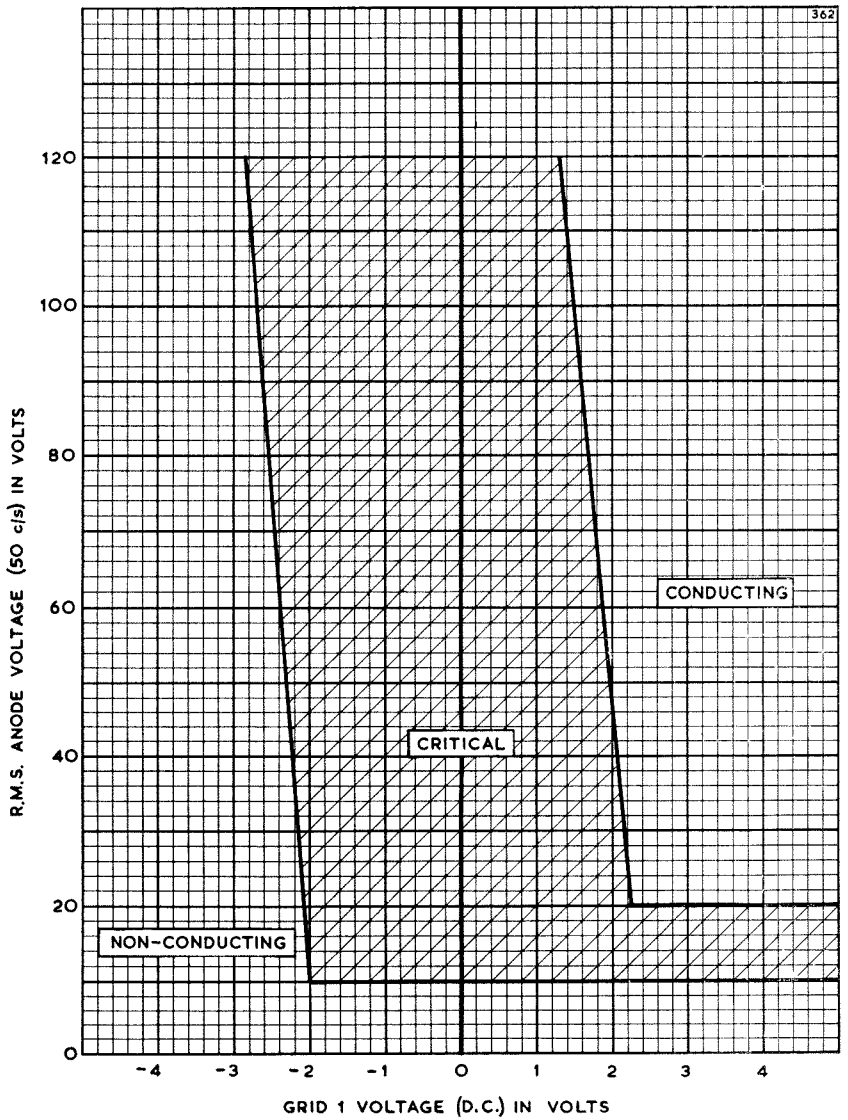
CONTROL CHARACTERISTIC

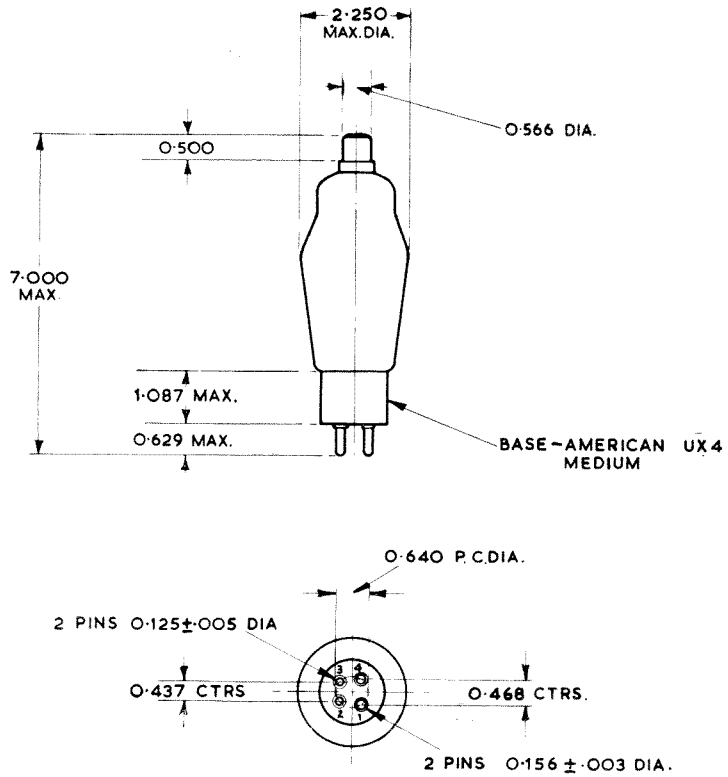


THYRATRON (Triode) RARE GAS FILLED

AFX203

OUTLINE

363



PIN	ELEMENT
1	FILAMENT
2	NO CONNECTION
3	GRID
4	FILAMENT
CAP	ANODE

ALL DIMENSIONS IN INCHES

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THYRATRON (Triode) RARE GAS FILLED

AFX234

Service Type CV5023

INTRODUCTION

The AFX234 is a miniature indirectly-heated triode Thyratron with rare gas filling. It has similar electrical characteristics to the 6D4 but is designed for pulse applications and has increased cathode area to ensure improved operation and life under these conditions.

GENERAL DATA

Electrical

Cathode	Oxide Coated	
Heater Voltage	6·3	V
Heater Current	490	mA
Cathode Heating Time (Minimum)	30	seconds
Tube Drop	16	V Approx

Mechanical

Overall Length	2·13 inches	(54 mm)	Max
Overall Diameter	0·75 inches	(19 mm)	Max
Mounting Position			Any
Cooling			Natural

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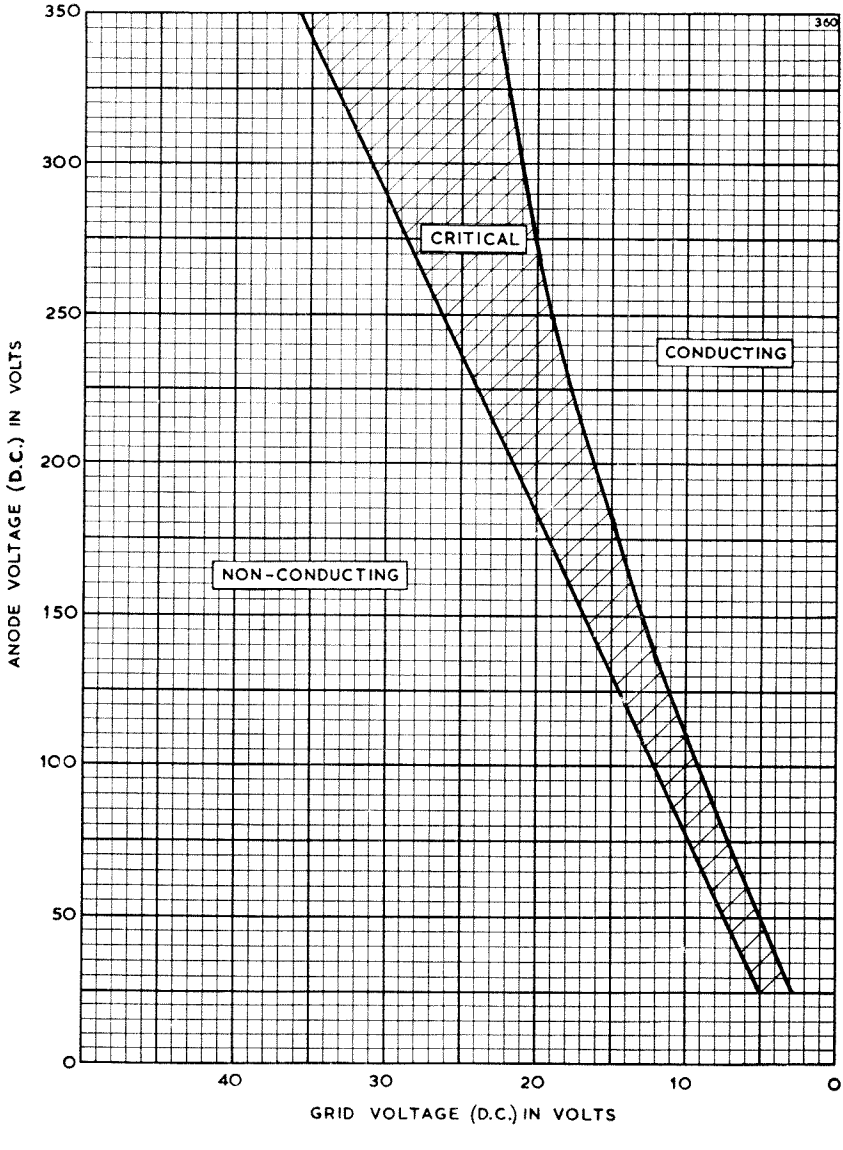
MINIMUM AND MAXIMUM RATINGS
(Absolute Values)

	Min	*Max*	
Heater Voltage	5·7	6·9	V
Cathode Heating Time	30	—	seconds
Ambient Temperature	−50 to	+90	°C
Peak Inverse Anode Voltage	—	350	V
Peak Forward Anode Voltage	—	350	V
D.C. Anode Voltage	—	250	V
Anode Current:			
Peak	—	1·2	A
Mean	—	45	mA
D.C. Negative Grid Voltage	—	110	V
Heater-Cathode Voltage:			
Heater Negative	—	110	V

CONTROL CHARACTERISTIC

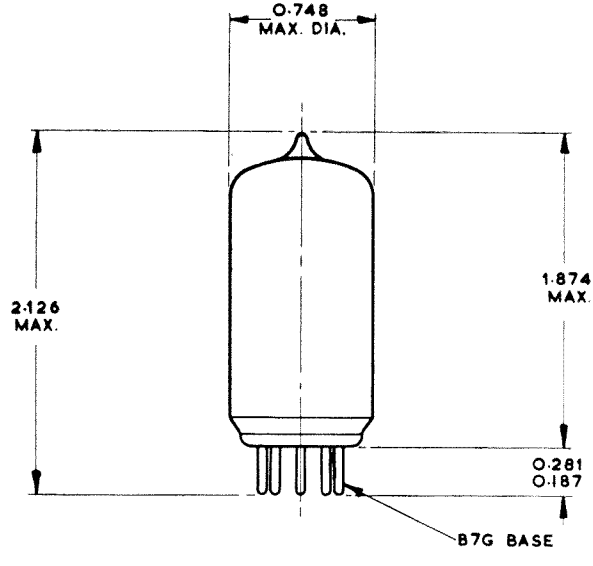


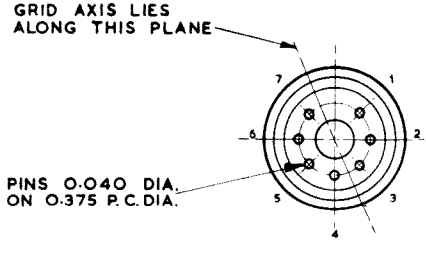
THYRATRON (Triode) RARE GAS FILLED

AFX234

OUTLINE

361





PIN	ELEMENT
1	GRID
2	NO CONNECTION
3	HEATER
4	HEATER
5	CATHODE
6	NO CONNECTION
7	ANODE

ALL DIMENSIONS IN INCHES

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IGNITRON BK24/5552A

ENGLISH ELECTRIC

Equivalent to 5552A

ABRIDGED DATA

Size C, stainless-steel-jacketed, water-cooled Ignitron intended primarily for single-phase resistance welding control applications. It has a platform for mounting a detachable thermostat for temperature control.

For an electrically identical version with coaxial cathode terminal see BK444/7671.

Supply Voltage (R.M.S.)	250 to 600	V
Maximum Demand (2 valves in inverse parallel, average current not exceeding 75·6A)	1200	kVA
Maximum Average Anode Current (for demand not exceeding 400kVA)	140	A

GENERAL

Electrical

Number of Electrodes:		
Main Anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc Voltage Drop (Approx):		
at 440A peak current	14	V
at 6800A peak current	28	V

Mechanical

Overall Length (excluding flexible lead)	14·750 inches (374·7 mm)	Max
Overall Width	7·250 inches (184·2 mm)	Max
Body Diameter	4·625 inches (117·5 mm)	Max
Net Weight	8½ pounds (3·9 kg)	Approx
Mounting Position	Vertical, anode terminal up	

Accessories

Water Control Thermostat (normally open, closes at 36°C approx)		ZD100552
Over-temperature Thermostat (normally closed, opens at 52°C approx)		ZD100551
Thermostat Contact Ratings:		
A.C. Voltage	125 250 440 600	V Max
A.C. Current	3·0 1·5 1·0 0·5	A Max
Voltage between switch contacts and ignitron envelope (peak)	1·0	kV Max
Ignitor Lead		ZD100222

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MAXIMUM AND MINIMUM RATINGS
(Absolute Values)

Single-phase Resistance Welding Control Service

Ratings are for two valves connected in inverse parallel. Full cycle conduction must be assumed whether phase control is used or not.

	Min	*Max*	
Anode			
Supply Voltage (R.M.S.) (frequency range 25 to 60c/s)	250	600	V
Demand (for average current not exceeding 75·6A)	—	1200	kVA
Anode Current (Average) (for demand not exceeding 400kVA)	—	140	A
Anode Current Averaging Time:			
at $600V_{r.m.s.}$	—	5·9	sec
at $440V_{r.m.s.}$	—	8·0	sec
at $250V_{r.m.s.}$	—	14	sec
Fault Current (Peak):			
at $600V_{r.m.s.}$	—	5600	A
at $250V_{r.m.s.}$	—	13 450	A
Duration of Fault Current	—	0·15	sec
Ignitor			
Peak Inverse Ignitor Voltage	—	5·0	V
Ignitor Current:			
Peak	—	100	A
R.M.S.	—	10	A
Average	—	1·0	A
Averaging Time	—	5·0	sec
Ignitor Circuit Requirements			
Anode Firing			
Ignitor Voltage required to fire	200	Anode Voltage	V
Ignitor Current required to fire	12	100	A
Starting Time at required voltage or current	—	100	μsec
Separate Excitation			
Open-circuit Voltage of excitation circuit	450	—	V
Short-circuit Current of excitation circuit	45	—	A
Firing Pulse Length (approx sine wave, average anode current greater than 20A)	150	—	μsec
Recommended Pulse Length (approx sine wave)		500	μsec

MAXIMUM AND MINIMUM RATINGS (Continued)

	Min	*Max*	
Cooling			
Water Flow Rate (*See Note*)	1·5	—	Imp. gal/min
	7·0	—	l./min
Water Temperature:			
Inlet	10	—	C
Outlet	—	40	C
Rise across jacket	—	6·0	C

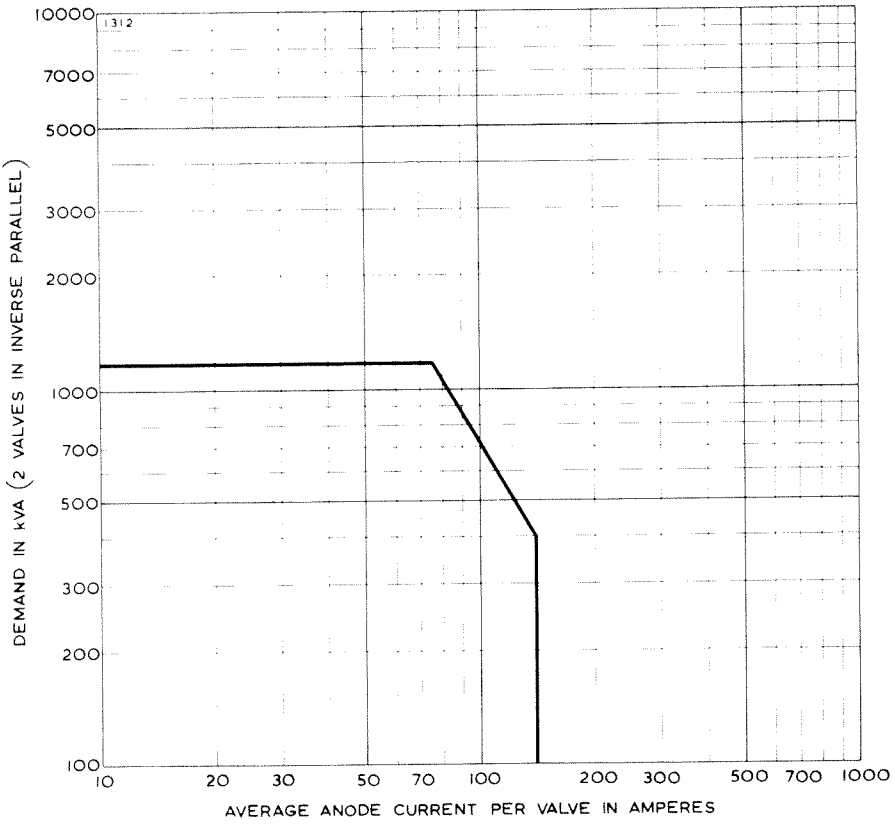
Note (a) At the minimum flow rate of 1·5gal/min, the pressure drop across the jacket will be 4·5lb/sq.in (0·32kg/sq.cm) approx.

(b) It is essential that the flow of water be maintained for 15 minutes after switching off.

ENGLISH ELECTRIC

DEMAND kVA—AVERAGE ANODE CURRENT (MAXIMUM RATINGS)

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



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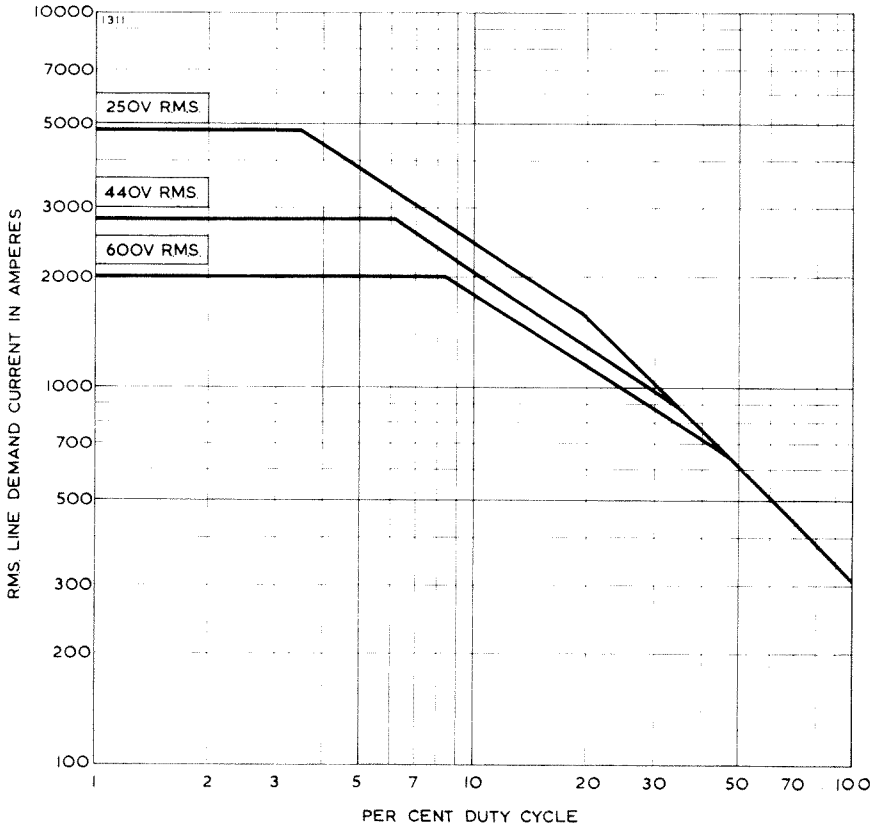
LINE DEMAND CURRENT—DUTY CYCLE (MAXIMUM RATINGS)

Two valves in inverse parallel for welder control



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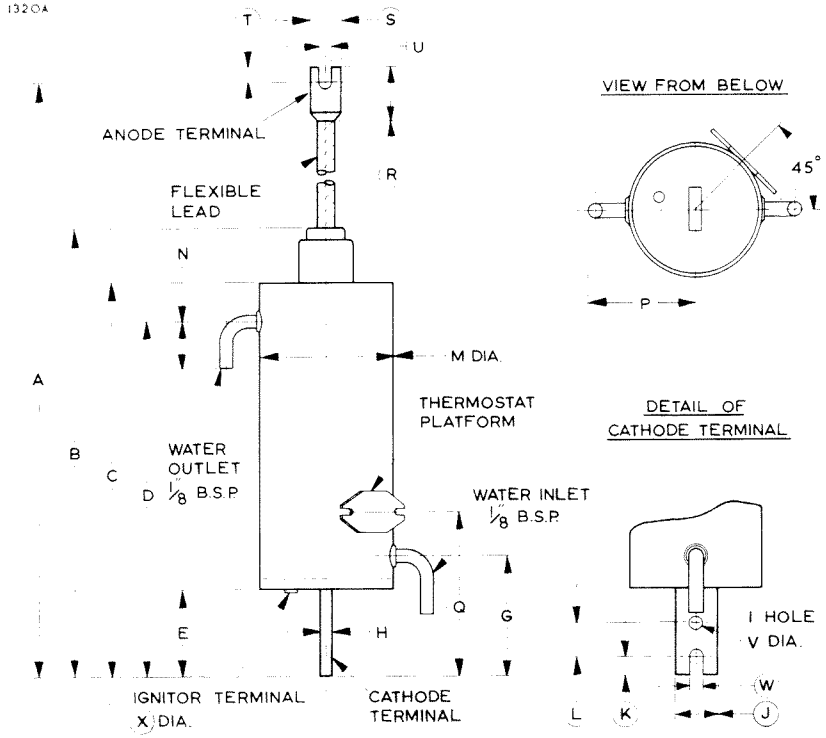

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	24·250 Min	617·0 Min	N	2·500 Max	63·50 Max
B	14·750 Max	374·7 Max	P	3·625 Max	92·08 Max
C	12·500 Max	317·5 Max	Q	5·500 ± 0·375	139·7 ± 9·53
D	10·750	273·1	R	3·000 Max	76·20 Max
E	2·375 Min	60·33 Min	S	1·250 Max	31·75 Max
G	3·750	95·25	T	1·000 Max	25·40 Max
H	0·500 ± 0·031	12·70 ± 0·79	U	0·437 ± 0·062	11·10 ± 1·57
J	1·250 ± 0·062	31·75 ± 1·57	V	0·437 ± 0·031	11·10 ± 0·79
K	0·625 ± 0·062	15·88 ± 1·57	W	0·437 ± 0·031	11·10 ± 0·79
L	1·000 ± 0·031	25·40 ± 0·79	X	0·250 ± 0·005	6·35 ± 0·13
M	4·625 Max	117·5 Max			

Millimetre dimensions have been derived from inches.

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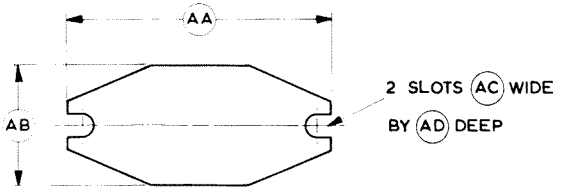

DETAIL OF THERMOSTAT MOUNTING PLATE

Ref.	Inches	Millimetres
AA	2·750	69·85
AB	1·250	31·75
AC	0·219	5·56
AD	0·375	9·53

Millimetre dimensions have been derived from inches.

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BK42/5551A

Equivalent to 5551A

ABRIDGED DATA

Size B, stainless-steel-jacketed, water-cooled Ignitron intended primarily for single-phase or three-phase (frequency changing) resistance welding control applications. It has a platform for mounting a detachable thermostat for temperature control.

For an electrically identical version with coaxial cathode terminal see BK442/7669.

Supply Voltage (R.M.S.)	250 to 600	V
Maximum Demand (2 valves in inverse parallel, average current not exceeding 30·2A)	600	kVA
Maximum Average Anode Current (for demand not exceeding 200kVA)	56	A

GENERAL

Electrical

Number of Electrodes:		
Main Anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc Voltage Drop (Approx):		
at 150A peak current	13	V
at 3400A peak current	26	V

Mechanical

Overall Length (excluding flexible lead)	13·000 inches (330·2 mm)	Max
Overall Width	5·750 inches (146·1 mm)	Max
Body Diameter	3·250 inches (82·55 mm)	Max
Net Weight	3¾ pounds (1·7 kg)	Approx
Mounting Position	Vertical, anode terminal up	

Accessories

Water Control Thermostat (normally open, closes at 36°C approx)					ZD100552
Over-temperature Thermostat (normally closed, opens at 52°C approx)					ZD100551
Thermostat Contact Ratings:					
A.C. Voltage	125	250	440	600	V Max
A.C. Current	3·0	1·5	1·0	0·5	A Max
Voltage between switch contacts and ignitron envelope (peak)				1·0	kV Max
Ignitor Lead					ZD100222

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MAXIMUM AND MINIMUM RATINGS
(Absolute Values)
Single-phase Resistance Welding Control Service

Ratings are for two valves connected in inverse parallel. Full cycle conduction must be assumed whether phase control is used or not.

	Min	*Max*	
Anode			
Supply Voltage (R.M.S.) (frequency range 25 to 60c/s)	250	600	V
Demand (for average current not exceeding 30·2A)	—	600	kVA
Anode Current (Average) (for demand not exceeding 200kVA)	—	56	A
Anode Current Averaging Time:			
at $600V_{r.m.s.}$	—	7·5	sec
at $440V_{r.m.s.}$	—	10·2	sec
at $250V_{r.m.s.}$	—	18	sec
Fault Current (Peak):			
at $600V_{r.m.s.}$	—	2800	A
at $250V_{r.m.s.}$	—	6720	A
Duration of Fault Current	—	0·15	sec

Three-phase (Frequency Changing) Welding Control or Power Rectifier Service (Intermittent Duty)

Anode

	Peak Anode Voltage 1·2kV	*Peak Anode Voltage* 1·5kV	
Anode Current (Peak)	600	480	A Max
Corresponding Average	5·0	4·0	A Max
Anode Current (Average)	22·5	18	A Max
Corresponding Peak	135	108	A Max
Averaging Time	10	10	sec Max
Peak Fault Current	7500	6000	A Max
Duration of Fault Current	0·15	0·15	sec Max
Frequency Range	25 to 60		c/s

MAXIMUM AND MINIMUM RATINGS (Continued)

Ignitor			
Peak Inverse Ignitor Voltage	—	5·0	V
Ignitor Current:			
Peak	—	100	A
R.M.S.	—	10	A
Average	—	1·0	A
Averaging Time	—	5·0	sec
Ignitor Circuit Requirements			
Anode Firing			
Ignitor Voltage required to fire	200	Anode Voltage	V
Ignitor Current required to fire	12	100	A
Starting Time at required voltage or current	—	100	μsec
Separate Excitation			
Open-circuit Voltage of excitation circuit	450	—	V
Short-circuit Current of excitation circuit	45	—	A
Firing Pulse Length (approx sine wave, average anode current greater than 20A)	150	—	μsec
Recommended Pulse Length (approx sine wave)		500	μsec

Cooling

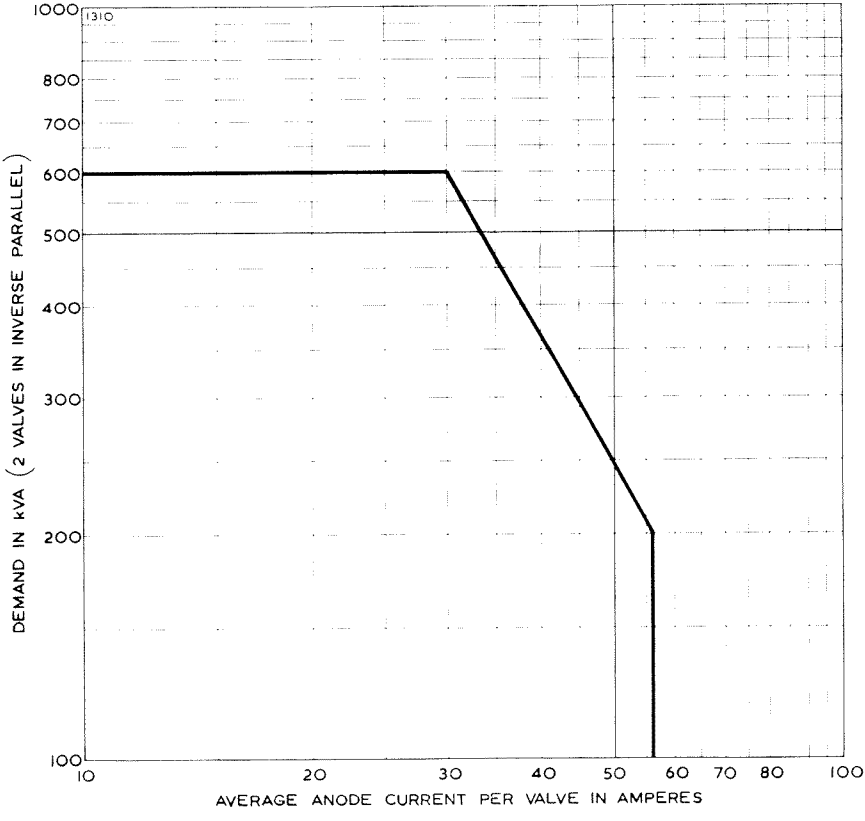
	Min	*Max*	
Water Flow Rate (*See Note*)	1·0	—	Imp.gal/min
	4·5	—	l./min
Water Temperature:			
Inlet	10	—	C
Outlet	—	40	C
Rise across jacket	—	4·0	C

Note (a) At the minimum flow rate of 1·0gal/min, the pressure drop across the jacket will be 1·8lb/sq.in (0·13kg/sq.cm) approx.

(b) It is essential that the flow of water be maintained for 10 minutes after switching off.

DEMAND kVA—AVERAGE ANODE CURRENT (MAXIMUM RATINGS)

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



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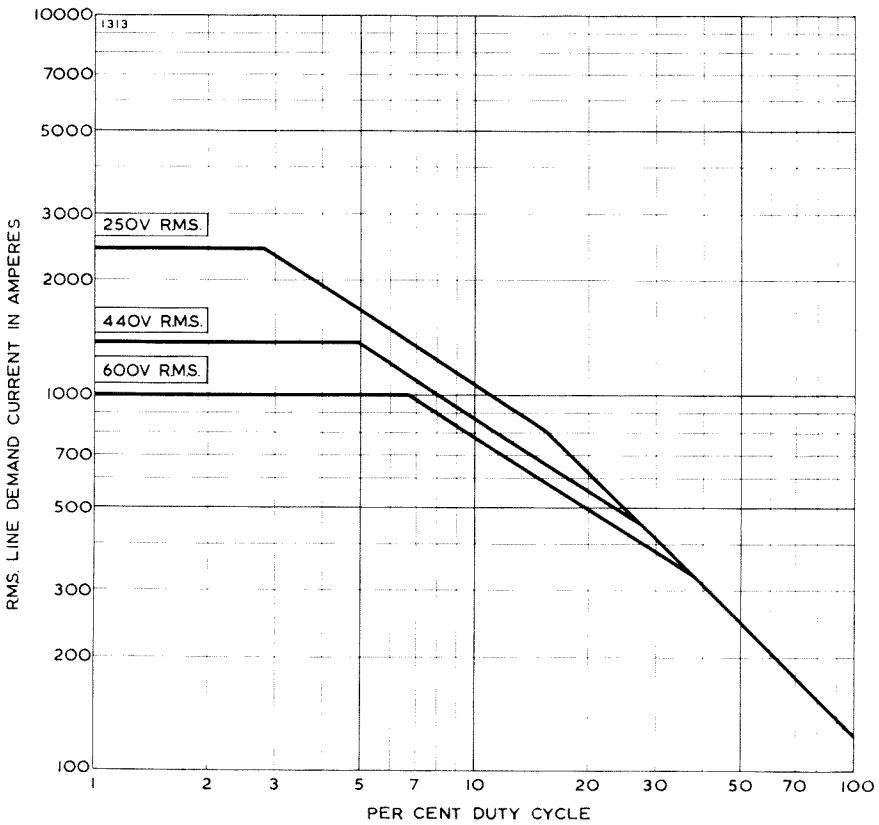
LINE DEMAND CURRENT—DUTY CYCLE (MAXIMUM RATINGS)

Two valves in inverse parallel for welder control service



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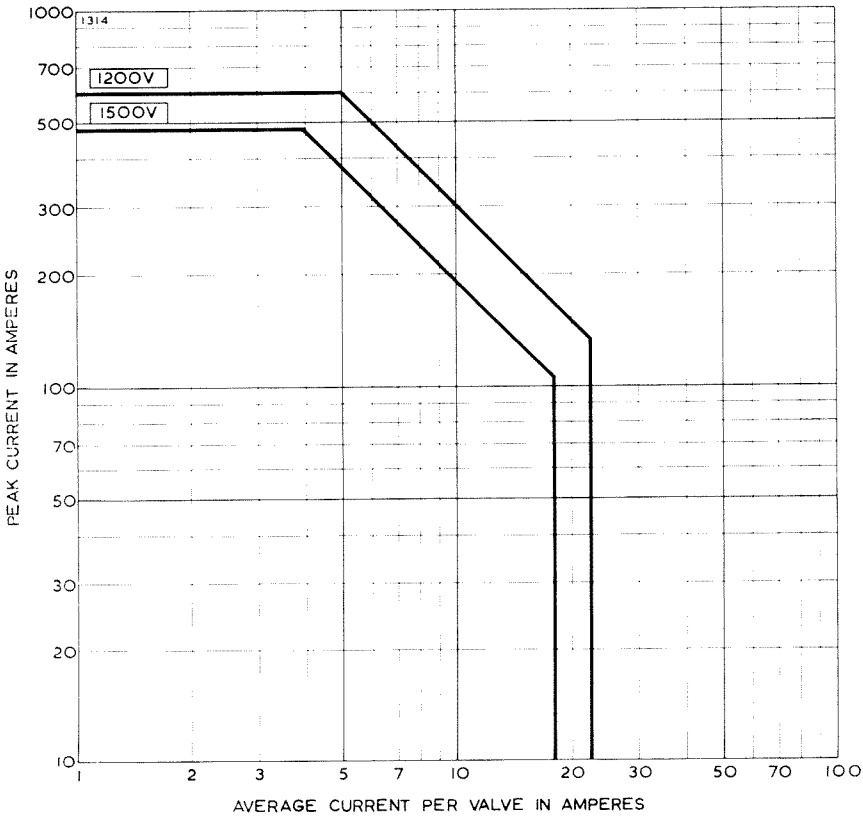
PEAK CURRENT—AVERAGE CURRENT PER VALVE (MAXIMUM RATINGS)

Three-phase welder control service



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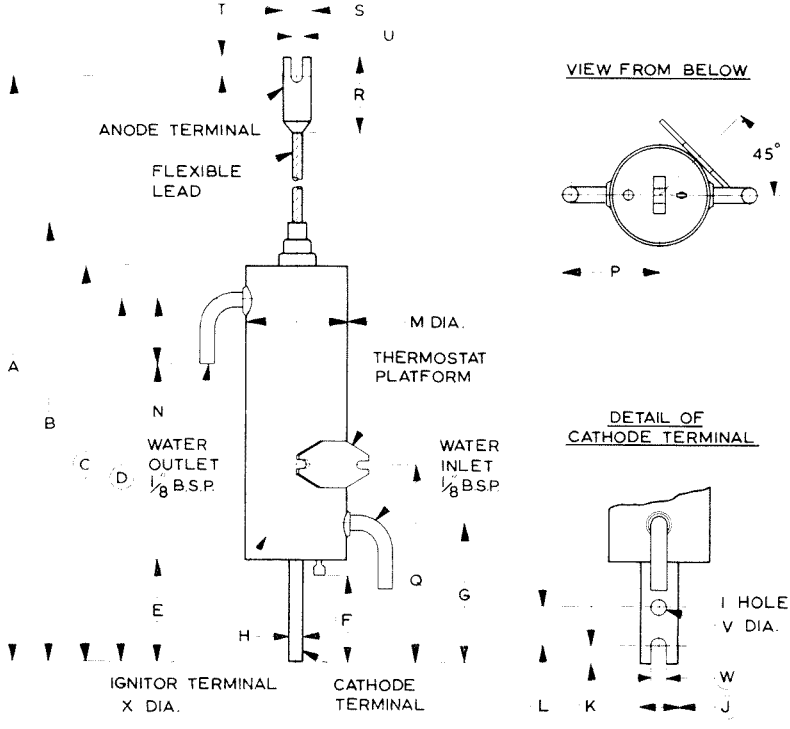

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	21·750 Min	552·5 Min	M	3·250 Max	82·55 Max
B	13·000 Max	330·2 Max	N	2·500 Max	63·50 Max
C	11·000 Max	279·4 Max	P	2·875 Max	73·03 Max
D	9·500	241·3	Q	5·125 ± 0·250	130·18 ± 6·35
E	2·375 Min	60·33 Min	R	2·375 Max	60·33 Max
F	2·000 Min	50·80 Min	S	1·000 Max	25·40 Max
G	3·625	92·08	T	0·812 Max	20·62 Max
H	0·375 ± 0·031	9·53 ± 0·79	U	0·406 ± 0·031	10·31 ± 0·79
J	1·000 ± 0·062	25·40 ± 1·57	V	0·437 ± 0·031	11·10 ± 0·79
K	0·500 ± 0·062	12·70 ± 1·57	W	0·437 ± 0·031	11·10 ± 0·79
L	1·000 ± 0·031	25·40 ± 0·79	X	0·250 ± 0·005	6·35 ± 0·13

Millimetre dimensions have been derived from inches.

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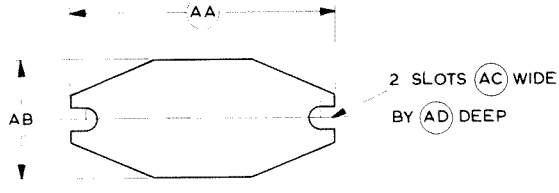

DETAIL OF THERMOSTAT MOUNTING PLATE

Ref.	Inches	Millimetres
AA	2·750	69·85
AB	1·250	31·75
AC	0·219	5·56
AD	0·375	9·53

Millimetre dimensions have been derived from inches.

IGNITRON

BK44/5554

ENGLISH ELECTRIC

Service Type CV1742 **Equivalent to 5554**

ABRIDGED DATA

Size C, stainless-steel-jacketed, water-cooled Ignitron intended primarily for rectifier service. It is also suitable for high-voltage resistance welding control.

Power Rectifier

Peak Anode Voltage	900	2100	V
Maximum Continuous Average Anode Current	100	75	A

Welder Control

Supply Voltage (R.M.S.)	2400	V
Maximum Demand (2 valves in inverse parallel, average current not exceeding 75A)	1200	kVA
Maximum Average Anode Current (for demand not exceeding 600kVA)	113	A

GENERAL

Electrical

Number of Electrodes:		
Main Anode	1	
Cathode (mercury pool)	1	
Ignitors	2	
Auxiliary Anode	1	
Arc Voltage Drop (Approx):		
at 300A peak current	14	V
at 600A peak current	17	V

Mechanical

Overall Length (excluding flexible lead)	17·000 inches (432 mm)	Max
Overall Width	7·250 inches (184·2 mm)	Max
Body Diameter	4·125 inches (104·8 mm)	Max
Net Weight	13 pounds (5·9 kg)	Approx
Mounting Position	Vertical, anode terminal up	

Accessories

Ignitor Lead	ZD100222
Auxiliary Anode Lead	ZD100222

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MAXIMUM AND MINIMUM RATINGS
(Absolute Values)

Anode Ratings—Power Rectifier Service

	Peak Anode Voltage 900V	*Peak Anode Voltage 2100V*	
Peak Anode Current	900	600	A Max
Average Anode Current:			
Continuous	100	75	A Max
Two hours (averaging time 2 minutes)	150	113	A Max
One minute (averaging time 1 minute)	200	150	A Max
Fault Current (Peak)	6000	4500	A Max
Duration of Fault Current	0·15	0·15	sec Max
Frequency Range	25 to 60		c/s

Anode Ratings—Welder Control Service

Ratings are for two valves connected in inverse parallel. Full cycle conduction must be assumed whether phase control is used or not.

Supply Voltage (R.M.S.)	2400	V
Frequency Range	25 to 60	c/s
Demand (for average current not exceeding 75A)	1200	kVA Max
Anode Current (Average) (for demand not exceeding 600kVA)	113	A Max
Anode Current Averaging Time (at 2400V)	1·5	sec Max
Fault Current (Peak)	3000	A Max
Duration of Fault Current	0·15	sec Max

Auxiliary Anode

Peak Forward Voltage	160	V Max
Peak Inverse Voltage:		
Main Anode conducting	25	V Max
Main Anode not conducting	160	V Max
Current:		
Peak	30	A Max
R.M.S.	15	A Max
Average	9	A Max
Averaging Time	10	sec Max

Ignitor

Peak Inverse Ignitor Voltage	5·0	V Max
Ignitor Current:		
Peak	100	A Max
R.M.S.	15	A Max
Average	2·0	A Max
Averaging Time	10	sec Max

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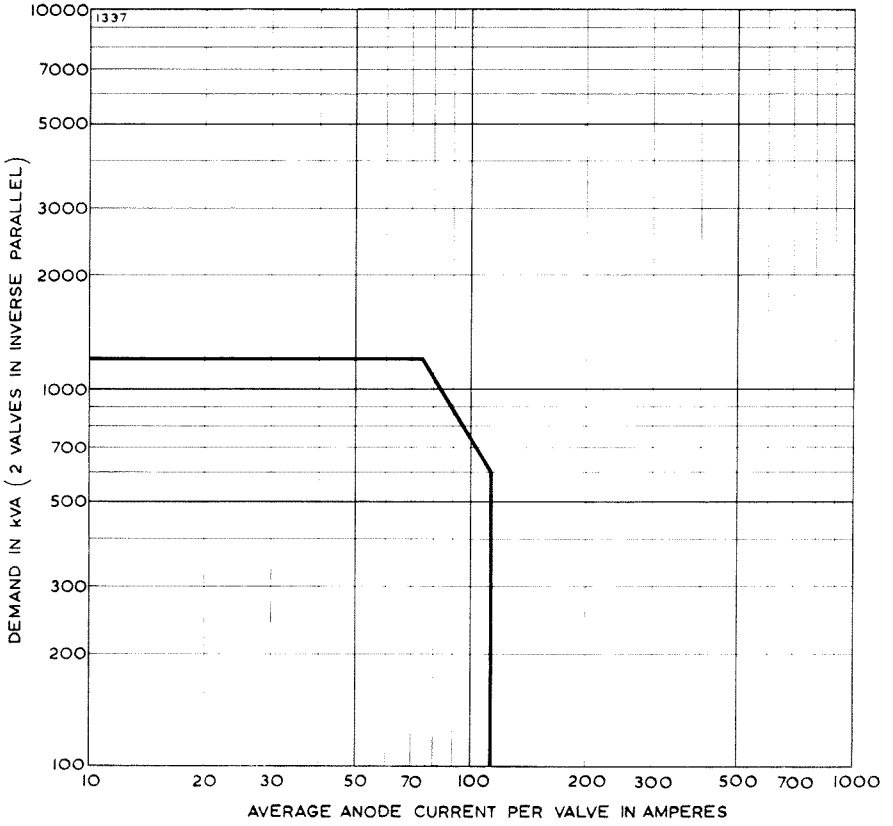
MAXIMUM AND MINIMUM RATINGS (Continued)

	Min	*Max*	
Ignitor Circuit Requirements			
Anode Firing			
Ignitor Voltage required to fire ..	450	Anode Voltage	V
Ignitor Current required to fire ..	45	100	A
Starting Time at required voltage or current	—	100	μsec
Separate Excitation			
Open-circuit Voltage of excitation circuit	450	—	V
Short-circuit Current of excitation circuit	45	—	A
Firing Pulse Length (approx sine wave, average anode current greater than 20A)	500	—	μsec
Recommended Pulse Length (approx sine wave)		800	μsec
Cooling			
Water Flow Rate (*See Note*)	1·5	—	Imp. gal/min
	7·0	—	l./min
Water Temperature:			
Inlet	6·0	—	°C
Outlet:			
Rectifier service at 900V	—	60	°C
Rectifier service at 2100V	—	45	°C
Welder service at 2400V	—	30	°C
Rise across jacket	—	6·0	°C

Note: (a) At the minimum flow rate of 1·5gal/min, the pressure drop across the jacket will be 5lb/sq.in (0·35kg/sq.cm) approx.

(b) It is essential that the flow of water be maintained for 15 minutes after switching off.

DEMAND kVA—AVERAGE ANODE CURRENT (MAXIMUM RATINGS)
Two valves in inverse parallel for welder control at 2400 volts



ENGLISH ELECTRIC VALVE CO. LTD.

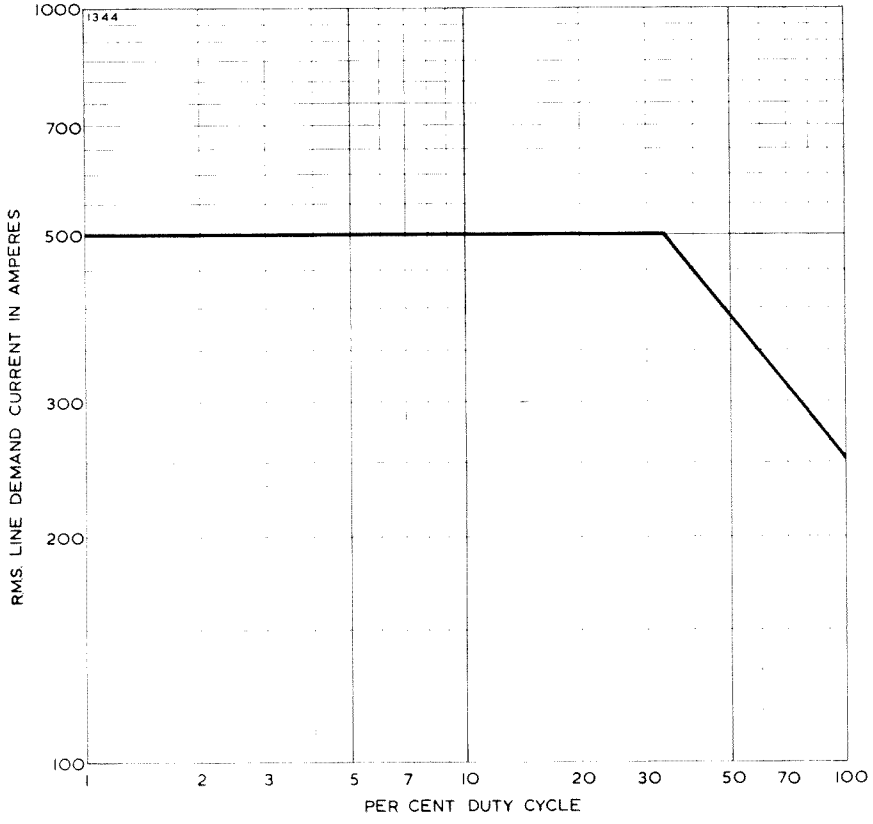
CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

LINE DEMAND CURRENT—DUTY CYCLE (MAXIMUM RATINGS)

Two valves in inverse parallel for welder control at 2400 volts



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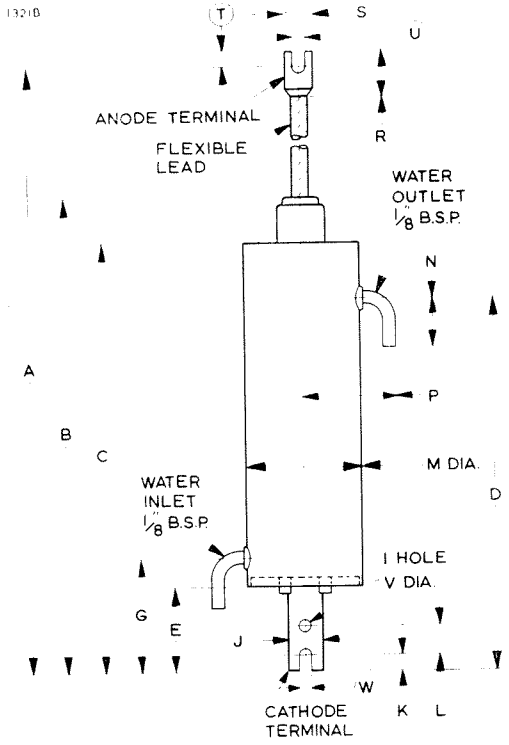
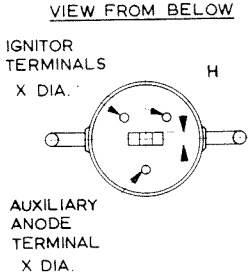
OUTLINE





Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	25·187 Min	639·7 Min	M	4·000 ± 0·125	101·6 ± 3·2
B	17·000 Max	431·8 Max	N	2·500 Max	63·50 Max
C	15·250 Max	387·4 Max	P	3·625 Max	92·08 Max
D	12·750	323·9	R	3·000 Max	76·20 Max
E	2·375 Min	60·33 Min	S	1·250 Max	31·75 Max
G	3·750	95·25	T	1·000 Max	25·40 Max
H	0·500 ± 0·031	12·70 ± 0·79	U	0·437 ± 0·062	11·10 ± 1·57
J	1·250 ± 0·062	31·75 ± 1·57	V	0·437 ± 0·031	11·10 ± 0·79
K	0·625 ± 0·062	15·88 ± 1·57	W	0·437 ± 0·031	11·10 ± 0·79
L	1·000 ± 0·031	25·40 ± 0·79	X	0·250 ± 0·005	6·35 ± 0·13

Millimetre dimensions have been derived from inches.

ENGLISH ELECTRIC VALVE CO. LTD.

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ENGLAND

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Printed in England

IGNITRON BK46/5555

Equivalent to 5555

ABRIDGED DATA

Size D, stainless-steel-jacketed, water-cooled Ignitron intended primarily for rectifier service. It is also suitable for high-voltage resistance welding control.

Power Rectifier

Peak Anode Voltage	900	2100	V
Maximum Continuous Average Anode Current	200	150	A

Welder Control

Supply Voltage (R.M.S.)	2400	V
Maximum Demand (2 valves in inverse parallel, average current not exceeding 135A)	2400	kVA
Maximum Average Anode Current (for demand not exceeding 1105kVA)	207	A

GENERAL

Electrical

Number of Electrodes:		
Main Anode	1	
Cathode (mercury pool)	1	
Ignitors	2	
Auxiliary Anode	1	
Arc Voltage Drop (Approx):		
at 600A peak current	16	V
at 1200A peak current	19	V

Mechanical

Overall Length (excluding flexible lead)	21·000 inches (533·4 mm)	Max
Overall Width	8·625 inches (219·1 mm)	Max
Body Diameter	5·750 inches (146·1 mm)	Max
Net Weight	25 pounds (11·3 kg)	Approx
Mounting Position	Vertical, anode terminal up	

Accessories

Ignitor Lead	ZD100222
Auxiliary Anode Lead	ZD100222

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MAXIMUM AND MINIMUM RATINGS
(Absolute Values)

Anode Ratings—Power Rectifier Service

	Peak Anode Voltage 900V	*Peak Anode Voltage 2100V*	
Peak Anode Current	1800	1200	A Max
Average Anode Current:			
Continuous	200	150	A Max
Two hours (averaging time 2 minutes)	300	225	A Max
One minute (averaging time 1 minute)	400	300	A Max
Fault Current (Peak)	12 000	9000	A Max
Duration of Fault Current	0·15	0·15	sec Max
Frequency Range	25 to 60		c/s

Anode Ratings—Welder Control Service

Ratings are for two valves connected in inverse parallel. Full cycle conduction must be assumed whether phase control is used or not.

Supply Voltage (R.M.S.)	2400	V
Frequency Range	25 to 60	c/s
Demand (for average current not exceeding 135A)	2400	kVA Max
Anode Current (Average) (for demand not exceeding 1105kVA)	207	A Max
Anode Current Averaging Time	1·66	sec Max
Fault Current (Peak)	6000	A Max
Duration of Fault Current	0·15	sec Max

Auxiliary Anode

Peak Forward Voltage	160	V Max
Peak Inverse Voltage:		
Main Anode conducting	25	V Max
Main Anode not conducting	160	V Max
Current:		
Peak	30	A Max
R.M.S.	15	A Max
Average	9·0	A Max
Current Averaging Time	10	sec Max

Ignitor

Peak Inverse Ignitor Voltage	5·0	V Max
Ignitor Current:		
Peak	100	A Max
R.M.S.	15	A Max
Average	2·0	A Max
Averaging Time	10	sec Max

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MAXIMUM AND MINIMUM RATINGS (Continued)

	Min	*Max*	
Ignitor Circuit Requirements			
Anode Firing			
Ignitor Voltage required to fire	450	Anode Voltage	V
Ignitor Current required to fire	45	100	A
Starting Time at required voltage or current	—	100	μsec
Separate Excitation			
Open-circuit Voltage of excitation circuit	450	—	V
Short-circuit Current of excitation circuit	45	—	A
Firing Pulse Length (approx sine wave, average anode current greater than 20A)	500	—	μsec
Recommended Pulse Length (approx sine wave)		800	μsec
Cooling Requirements			
Water Flow Rate (*See Note*)	3·0	—	Imp. gal/min
	14	—	l./min
Water Temperature:			
Inlet	6·0	—	C
Outlet:			
Rectifier service at 900V	—	60	°C
Rectifier service at 2100V	—	45	°C
Welder service at 2400V	—	30	°C
Rise across jacket	—	4·5	°C

Note (a) At the minimum flow rate of 3·0gal/min, the pressure drop across the jacket will be 6·0lb/sq.in (0·42kg/sq.cm) max.

(b) It is essential that the flow of water be maintained for 30 minutes after switching off.

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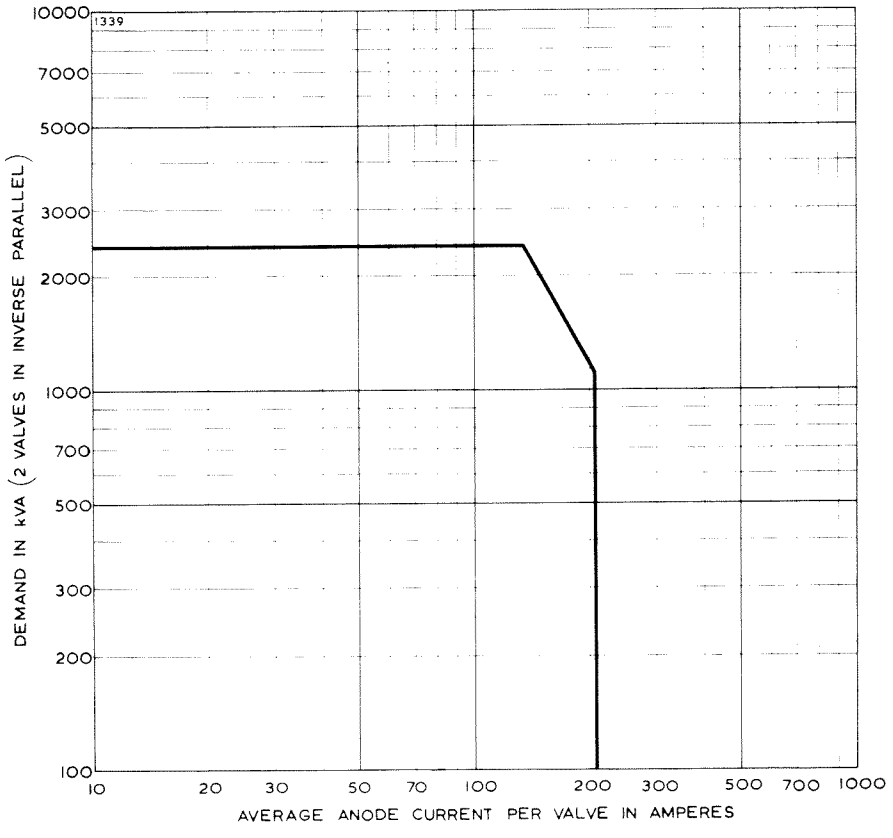
DEMAND kVA—AVERAGE ANODE CURRENT (MAXIMUM RATINGS)

Two valves in inverse parallel for welder control at 2400 volts



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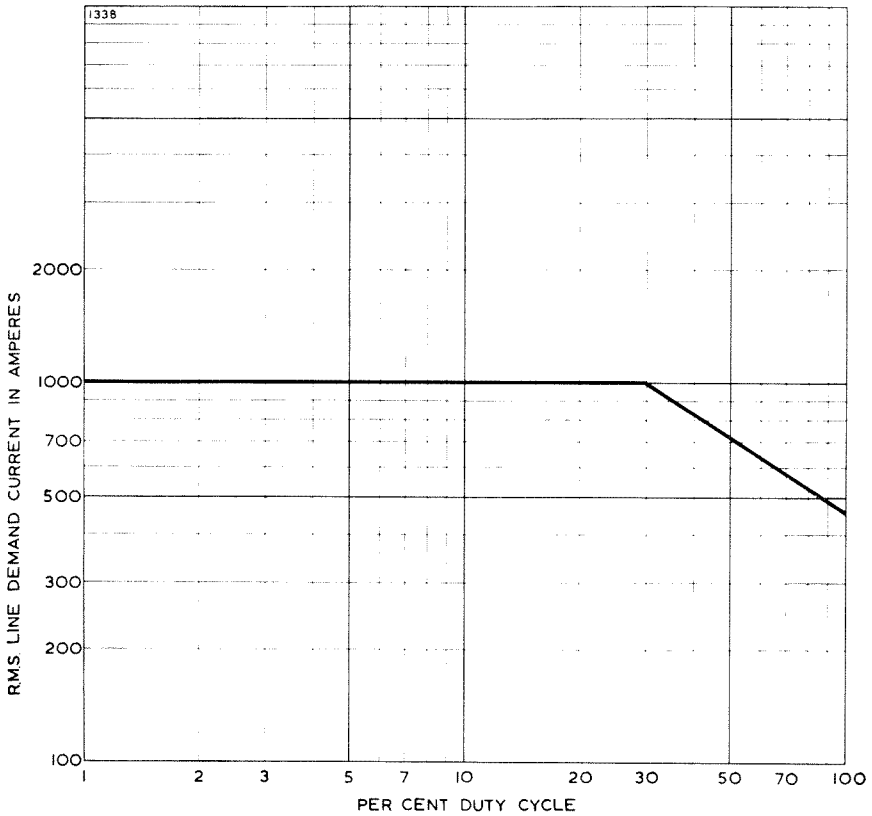
LINE DEMAND CURRENT—DUTY CYCLE (MAXIMUM RATINGS)

Two valves in inverse parallel for welder control at 2400 volts



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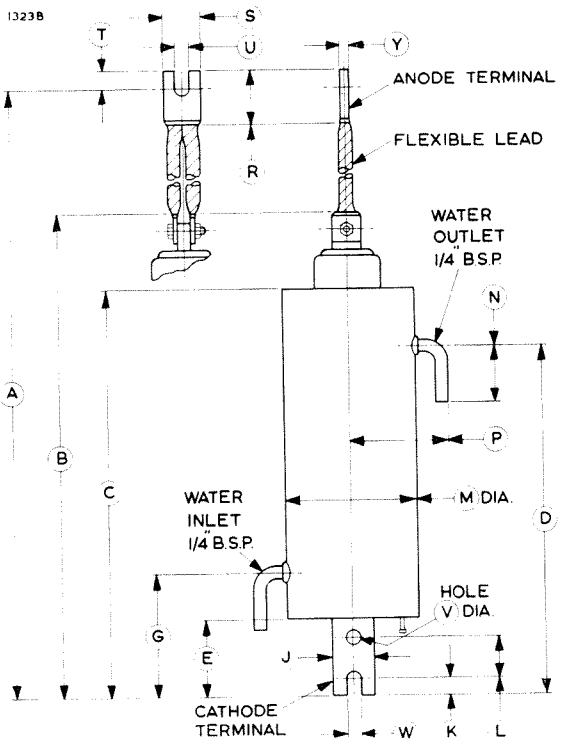

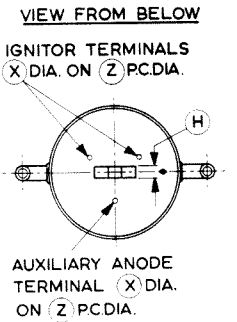

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	27·375 Min	695·3 Min	N	3·000 Max	76·20 Max
B	21·000 Max	533·4 Max	P	4·312 Max	109·5 Max
C	17·500 Max	444·5 Max	R	3·750 Max	95·25 Max
D	14·500	368·3	S	1·750 Max	44·45 Max
E	3·125 Min	79·38 Min	T	1·500 Max	38·10 Max
G	5·125	130·2	U	0·562 ± 0·062	14·27 ± 1·57
H	0·500 ± 0·031	12·70 ± 0·79	V	0·562 ± 0·031	14·27 ± 0·79
J	1·750 ± 0·062	44·45 ± 1·57	W	0·562 ± 0·031	14·27 ± 0·79
K	0·750 ± 0·062	19·05 ± 1·57	X	0·250 ± 0·005	6·35 ± 0·13
L	1·750 ± 0·031	44·45 ± 0·79	Y	0·312	7·93
M	5·750 Max	146·1 Max	Z	2·250	57·15

Millimetre dimensions have been derived from inches.

IGNITRON BK66/5550

ENGLISH ELECTRIC

Equivalent to 5550

ABRIDGED DATA

Size A, stainless-steel-envelope Ignitron intended primarily for single-phase resistance welding control applications. It is cooled by means of a removable water cooled clamp which also acts as a cathode terminal and provides means for mounting the ignitron.

Supply Voltage (R.M.S.)	250 to 600	V
Maximum Demand (2 valves in inverse parallel, average current not exceeding 12·1A)	300	kVA
Maximum Average Anode Current (for demand not exceeding 100kVA)	22·4	A

GENERAL

Electrical

Number of Electrodes:		
Main Anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc Voltage Drop (Approx):		
at 70A peak current	12	V
at 1700A peak current	25	V

Mechanical

Overall Length (excluding flexible lead)	9·000 inches (228·6 mm)	Max
Body Diameter	2·140 inches (54·35 mm)	Max
Net Weight	1½ pounds (0·68 kg)	Approx
Mounting Position	Vertical, anode terminal up	

Accessories

Water-cooled Clamp	ZD100365
Ignitor Lead	ZD100222

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MAXIMUM AND MINIMUM RATINGS
(Absolute Values)
Single-phase Resistance Welding Control Service

Ratings are for two valves connected in inverse parallel. Full cycle conduction must be assumed whether phase control is used or not.

	Min	*Max*	
Anode			
Supply Voltage (R.M.S.) (frequency range 25 to 60c/s)	250	600	V
Demand (for average current not exceeding 12·1A)	—	300	kVA
Anode Current (Average) (for demand not exceeding 100kVA)	—	22·4	A
Anode Current Averaging Time:			
at $600V_{r.m.s.}$	—	9·2	sec
at $440V_{r.m.s.}$	—	11	sec
at $250V_{r.m.s.}$	—	22	sec
Fault Current (Peak):			
at $600V_{r.m.s.}$	—	1400	A
at $250V_{r.m.s.}$	—	3360	A
Duration of Fault Current	—	0·15	sec
Ignitor			
Peak Inverse Ignitor Voltage	—	5·0	V
Ignitor Current:			
Peak	—	100	A
R.M.S.	—	10	A
Average	—	1·0	A
Averaging Time	—	5·0	sec
Ignitor Circuit Requirements			
Anode Firing			
Ignitor Voltage required to fire	200	Anode Voltage	V
Ignitor Current required to fire	12	100	A
Starting Time at required voltage or current	—	100	μsec
Separate Excitation			
Open-circuit Voltage of excitation circuit	450	—	V
Short-circuit Current of excitation circuit	45	—	A
Firing Pulse Length (approx sine wave, average anode current greater than 20A)	150	—	μsec
Recommended Pulse Length (approx sine wave)		500	μsec

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MAXIMUM AND MINIMUM RATINGS (Continued)

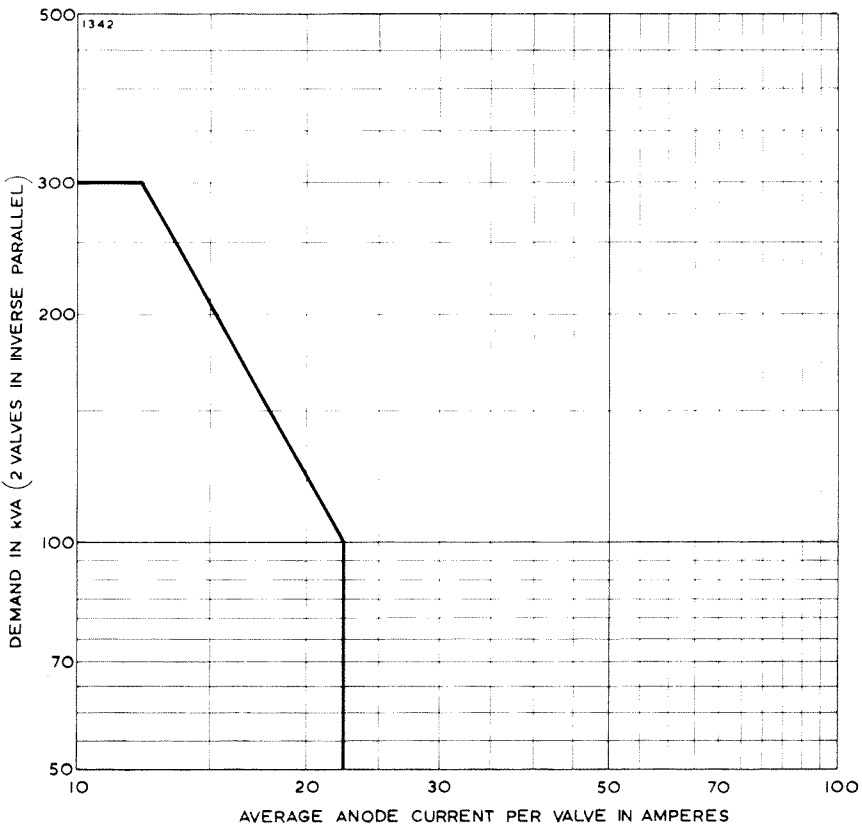
	Min	*Max*	
Cooling			
Water Flow Rate (*See Note*)	1·0	—	Imp. gal/min
	4·5	—	l./min
Cooling Clamp Temperature	10	50	°C

Caution

The cooling clamp must be in good thermal contact with the ignitron envelope. Accidental damage to the inside of the clamp may produce areas of poor contact. The ignitron and clamp should both be wiped clean before assembly, as small dirt particles can cause severe local heating.

Note. It is essential that the flow of water be maintained for 5 minutes after switching off.

DEMAND kVA—AVERAGE ANODE CURRENT (MAXIMUM RATINGS)
Two valves in inverse parallel for welder control at 250 to 600 volts



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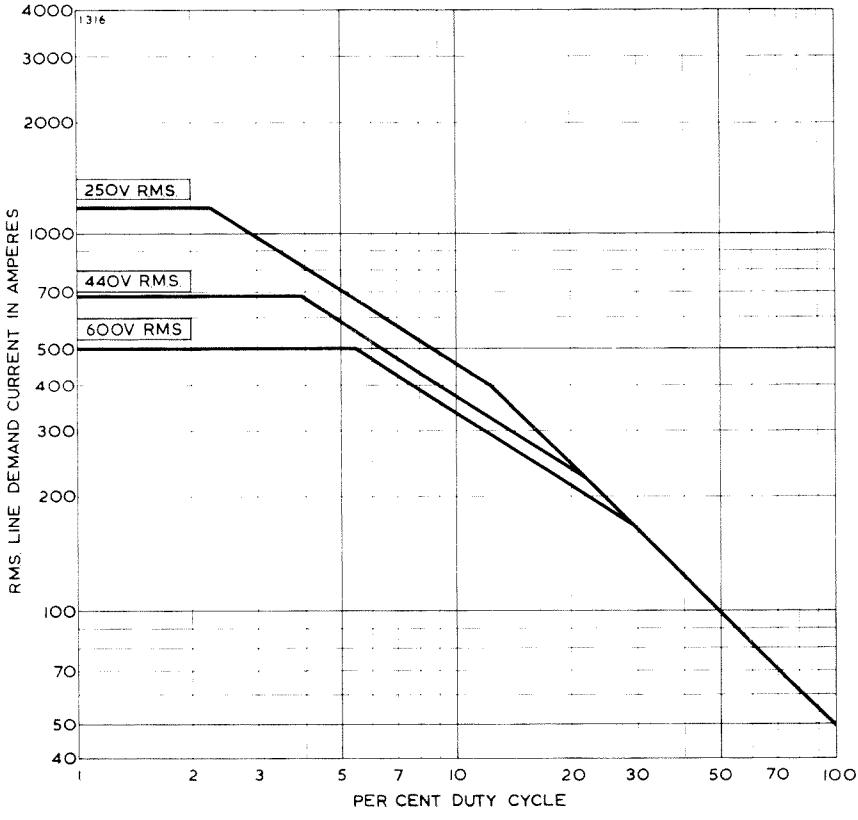
LINE DEMAND CURRENT—DUTY CYCLE (MAXIMUM RATINGS)

Two valves in inverse parallel for welder control



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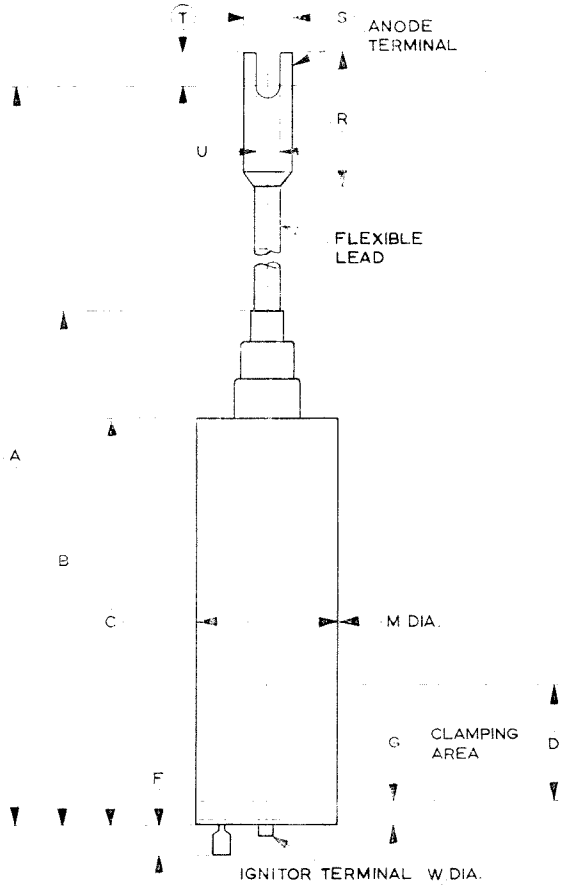
OUTLINE

1324A



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	14·375 Min	365·1 Min	M	2·130 ± 0·010	54·10 ± 0·25
B	8·250 Max	209·6 Max	R	2·375 Max	60·33 Max
C	5·500 ± 0·125	139·7 ± 3·2	S	1·000 Max	25·40 Max
D	1·750 Min	44·45 Min	T	0·812 Max	20·62 Max
F	0·750 Max	19·05 Max	U	0·406 ± 0·031	10·31 ± 0·79
G	0·375	9·53	W	0·250 ± 0·005	6·35 ± 0·13

Millimetre dimensions have been derived from inches.

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Printed in England

BK146/5553B

Equivalent to 5553B

ABRIDGED DATA

Size D, stainless-steel-jacketed, water-cooled Ignitron intended primarily for single-phase or three-phase (frequency changing) resistance welding control applications. It has a platform for mounting a detachable thermostat for temperature control.

For an electrically identical version with coaxial cathode terminal see BK446/7673

Supply Voltage (R.M.S.)	250 to 600	V
Maximum Demand (2 valves in inverse parallel, average current not exceeding 192A)	2400	kVA
Maximum Average Anode Current (for demand not exceeding 800kVA)	355	A

GENERAL

Electrical

Number of Electrodes:		
Main Anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc Voltage Drop (Approx):		
at 1115A peak current	17	V
at 13 600A peak current	36	V

Mechanical

Overall Length (excluding flexible lead)	20·000 inches (508·0 mm)	Max
Overall Width	9·375 inches (238·1 mm)	Max
Body Diameter	7·125 inches (181·0 mm)	Max
Net Weight	21 pounds (9·5 kg)	Approx
Mounting Position	Vertical, anode terminal up	

Accessories

Water Control Thermostat (normally open, closes at 36°C approx)						ZD100552
Over-temperature Thermostat (normally closed, opens at 52°C approx)						ZD100551
Thermostat Contact Ratings:						
A.C. Voltage	125	250	440	600		V Max
A.C. Current	3·0	1·5	1·0	0·5		A Max
Voltage between switch contacts and ignitron envelope (peak)					1·0	kV Max
Ignitor Lead						ZD100222

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MAXIMUM AND MINIMUM RATINGS
(Absolute Values)

Single-phase Resistance Welding Control Service

Ratings are for two valves connected in inverse parallel. Full cycle conduction must be assumed whether phase control is used or not.

	Min	*Max*	
Anode			
Supply Voltage (R.M.S.) (frequency range 25 to 60c/s)	250	600	V
Demand (for average current not exceeding 192A)	—	2400	kVA
Anode Current (Average) (for demand not exceeding 800kVA)	—	355	A
Anode Current Averaging Time:			
at $600V_{r.m.s.}$	—	4·6	sec
at $440V_{r.m.s.}$	—	6·3	sec
at $250V_{r.m.s.}$	—	11	sec
Fault Current (Peak):			
at $600V_{r.m.s.}$	—	11 200	A
at $250V_{r.m.s.}$	—	27 000	A
Duration of Fault Current	—	0·15	sec

Three-phase (Frequency Changing) Welding Control or Power Rectifier Service (Intermittent Duty)

Anode

	Peak Anode Voltage 0·6kV	*Peak Anode Voltage 1·2kV*	*Peak Anode Voltage 1·5kV*	
Anode Current (Peak) ..	4000	3000	2400	A Max
Corresponding Average ..	54	40	32	A Max
Anode Current (Average) ..	190	140	112	A Max
Corresponding Peak ..	1140	840	672	A Max
Averaging Time ..	6·25	6·25	6·25	sec Max
Peak Fault Current ..	50 000	37 500	30 000	A Max
Duration of Fault Current ..	0·15	0·15	0·15	sec Max
Frequency Range ..	50 to 60	50 to 60	50 to 60	c/s

MAXIMUM AND MINIMUM RATINGS (Continued)

	Min	*Max*	
Ignitor			
Peak Inverse Ignitor Voltage	—	5·0	V
Ignitor Current:			
Peak	—	100	A
R.M.S.	—	10	A
Average	—	1·0	A
Averaging Time	—	5·0	sec
Ignitor Circuit Requirements			
Anode Firing			
Ignitor Voltage required to fire	200	Anode Voltage	V
Ignitor Current required to fire	12	100	A
Starting Time at required voltage or current	—	100	μsec
Separate Excitation			
Open-circuit Voltage of excitation circuit	450	—	V
Short-circuit Current of excitation circuit	45	—	A
Firing Pulse Length (approx sine wave, average anode current greater than 20A)	150	—	μsec
Recommended Pulse Length (approx sine wave)		500	μsec
Cooling			
Water Flow Rate (*See Note*)	3·0	—	Imp. gal/min
	14		l./min
Water Temperature:			
Inlet	10	—	°C
Outlet	—	40	°C
Rise across jacket	—	9·0	°C

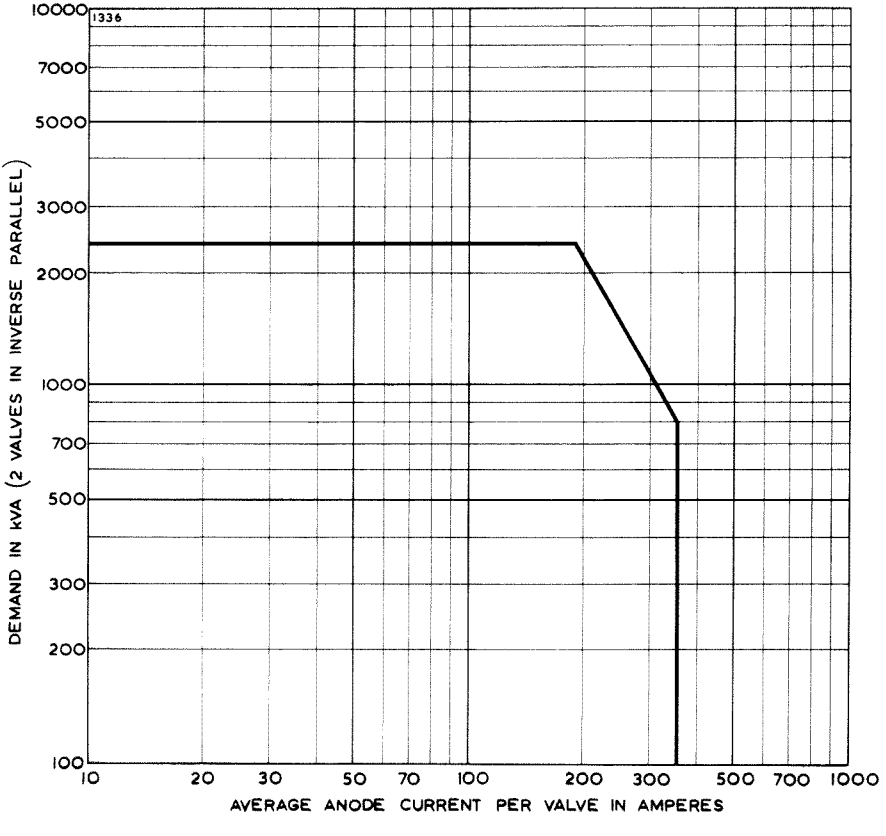
Note (a) At the minimum flow rate of 3·0gal/min, the pressure drop across the jacket will be 5·0lb/sq.in (0·35kg/sq.cm) approx.

(b) It is essential that the flow of water be maintained for 30 minutes after switching off.

ENGLISH ELECTRIC

DEMAND kVA—AVERAGE ANODE CURRENT (MAXIMUM RATINGS)

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



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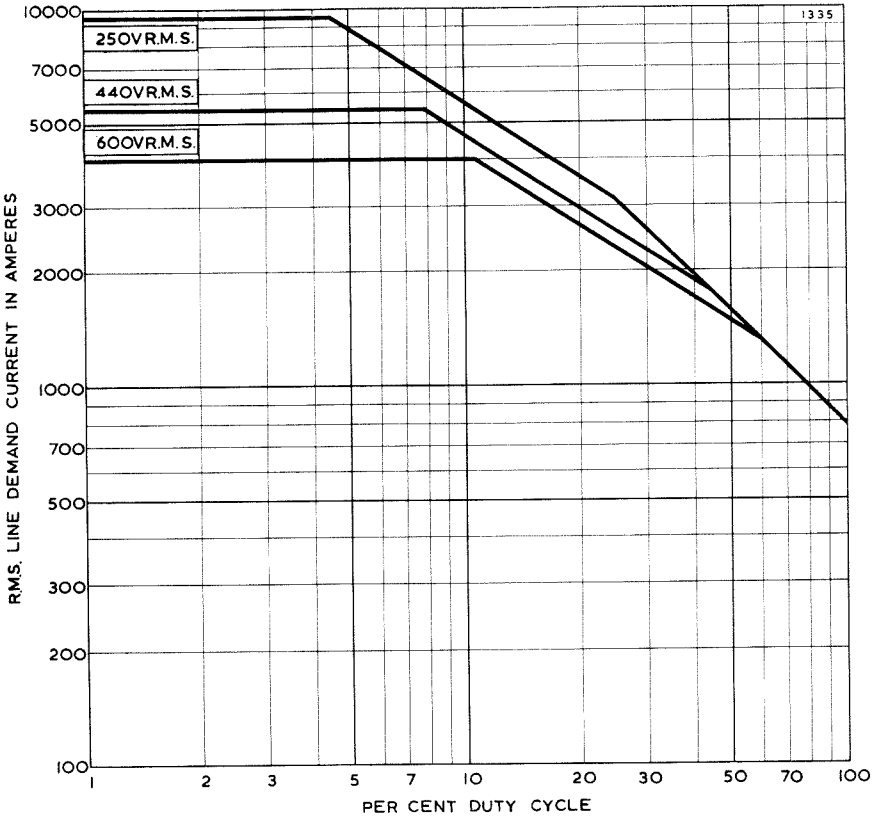
ENGLISH ELECTRIC

LINE DEMAND CURRENT—DUTY CYCLE (MAXIMUM RATINGS)

Two valves in inverse parallel for welder control service



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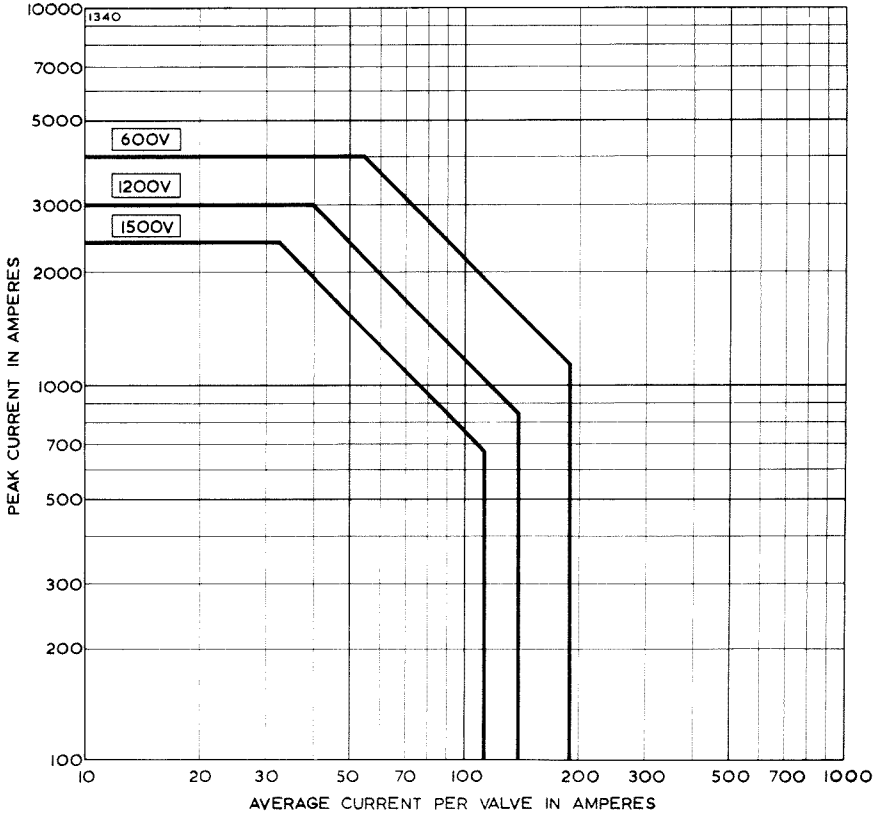
PEAK CURRENT—AVERAGE CURRENT PER VALVE (MAXIMUM RATINGS)

Three-phase welder control service



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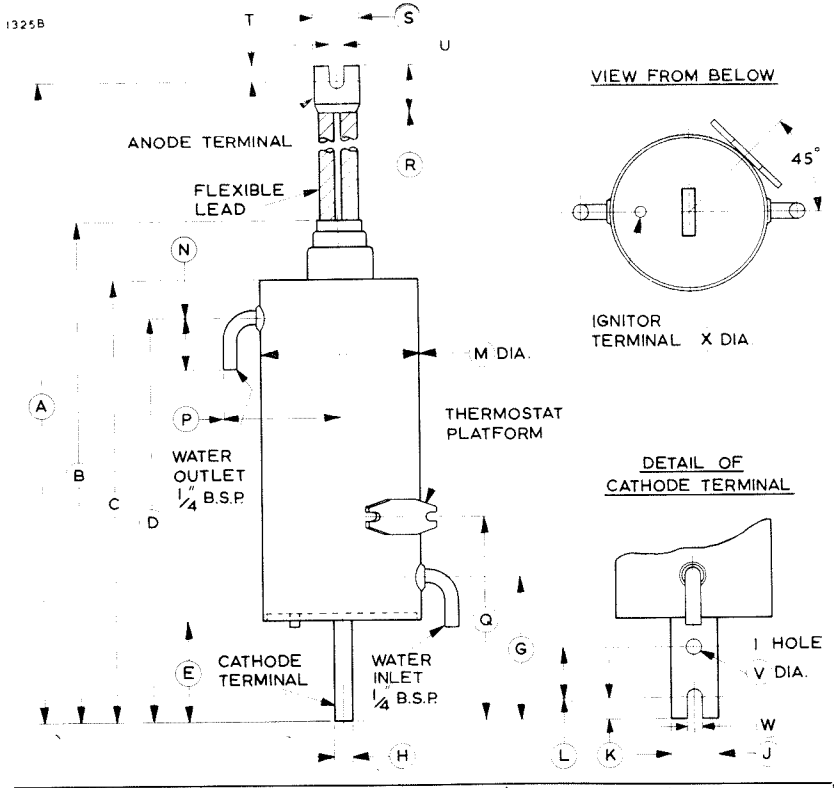
OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	27·375 Min	695·3 Min	N	3·000 Max	76·20 Max
B	20·000 Max	508·0 Max	P	4·687 Max	119·0 Max
C	17·000 Max	431·8 Max	Q	7·125 ± 0·500	181·0 ± 12·7
D	14·000	355·6	R	3·750 Max	95·25 Max
E	3·125 Min	79·38 Min	S	1·750 Max	44·45 Max
G	5·000	127·0	T	1·500 Max	38·10 Max
H	0·500 ± 0·031	12·70 ± 0·79	U	0·562 ± 0·062	14·27 ± 1·57
J	1·750 ± 0·062	44·45 ± 1·57	V	0·562 ± 0·031	14·27 ± 0·79
K	0·750 ± 0·062	19·05 ± 1·57	W	0·562 ± 0·031	14·27 ± 0·79
L	1·750 ± 0·031	44·45 ± 0·79	X	0·250 ± 0·005	6·35 ± 0·13
M	7·125 Max	181·0 Max			

Millimetre dimensions have been derived from inches.

ENGLISH ELECTRIC VALVE CO. LTD.

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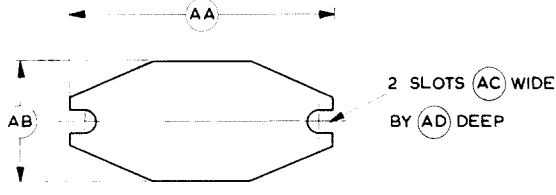
OUTLINE DETAIL

1346



DETAIL OF THERMOSTAT MOUNTING PLATE

Ref.	Inches	Millimetres
AA	2·750	69·85
AB	1·250	31·75
AC	0·219	5·56
AD	0·375	9·53

Millimetre dimensions have been derived from inches.

IGNITRON BK168/5822A

ENGLISH ELECTRIC

Equivalent to 5822A

ABRIDGED DATA

Size C, stainless-steel-jacketed, water-cooled Ignitron intended primarily for three-phase (frequency-changing) resistance welding control applications. It has a platform for mounting a detachable thermostat for temperature control.

For an electrically identical version with coaxial cathode terminal see BK468/7672.

Peak Forward or Inverse Anode Voltage ..	1200	1500	V
Maximum Peak Anode Current	1500	1200	A
Corresponding Average	20	16	A
Maximum Average Anode Current	70	56	A
Corresponding Peak	420	336	A

GENERAL

Electrical

Number of Electrodes:		
Main Anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc Voltage Drop (Approx) at 1500A peak	25	V

Mechanical

Overall Length (excluding flexible lead)	14·750 inches (374·7 mm)	Max
Overall Width	7·250 inches (184·2 mm)	Max
Body Diameter	4·625 inches (117·5 mm)	Max
Net Weight	8½ pounds (3·9 kg)	Approx
Mounting Position	Vertical, anode terminal up	

Accessories

Water Control Thermostat (normally open, closes at 36°C approx)	ZD100552
Over-temperature Thermostat (normally closed, opens at 52°C approx)	ZD100551

Thermostat Contact Ratings:

A.C. Voltage	125	250	440	600	V Max
A.C. Current	3·0	1·5	1·0	0·5	A Max

Voltage between switch contacts and ignitron envelope (peak)	1·0	kV Max
Ignitor Lead		ZD100222

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CHELMSFORD
ENGLAND

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MAXIMUM AND MINIMUM RATINGS
(Absolute Values)

Three-phase (Frequency Changing) Welding Control or Power Rectifier Service (Intermittent Duty)

	Peak Anode Voltage 1·2kV	*Peak Anode Voltage 1·5kV*	
Anode			
Anode Current (Peak)	1500	1200	A Max
Corresponding Average	20	16	A Max
Anode Current (Average)	70	56	A Max
Corresponding Peak	420	336	A Max
Averaging Time	6·25	6·25	sec Max
Peak Fault Current	18 750	15 000	A Max
Duration of Fault Current	0·15	0·15	sec Max
Frequency Range	50 to 60	50 to 60	c/s

	Min	*Max*	
Ignitor			
Peak Inverse Ignitor Voltage	—	5·0	V
Ignitor Current:			
Peak	—	100	A
R.M.S.	—	10	A
Average	—	1·0	A
Averaging Time	—	5·0	sec

Ignitor Circuit Requirements			
Anode Firing			
Ignitor Voltage required to fire	200	Anode Voltage	V
Ignitor Current required to fire	12	100	A
Starting Time at required voltage or current	—	100	μsec
Separate Excitation			
Open-circuit Voltage of excitation circuit	450	—	V
Short-circuit Current of excitation circuit	45	—	A
Firing Pulse Length (approx sine wave, average anode current greater than 20A)	150	—	μsec
Recommended Pulse Length (approx sine wave)		500	μsec

MAXIMUM AND MINIMUM RATINGS (Continued)

Cooling

	Min	*Max*	
Water Flow Rate (*See Note*)	1·5	—	Imp. gal/min
	7·0	—	l./min
Water Temperature:			
Inlet	10	—	°C
Outlet	—	40	°C
Rise across jacket	—	6·0	°C

Note (a) At the minimum flow rate of 1·5gal/min, the pressure drop across the jacket will be 4·5lb/sq.in (0·32kg/sq.cm) approx.

(b) It is essential that the flow of water be maintained for 15 minutes after switching off.

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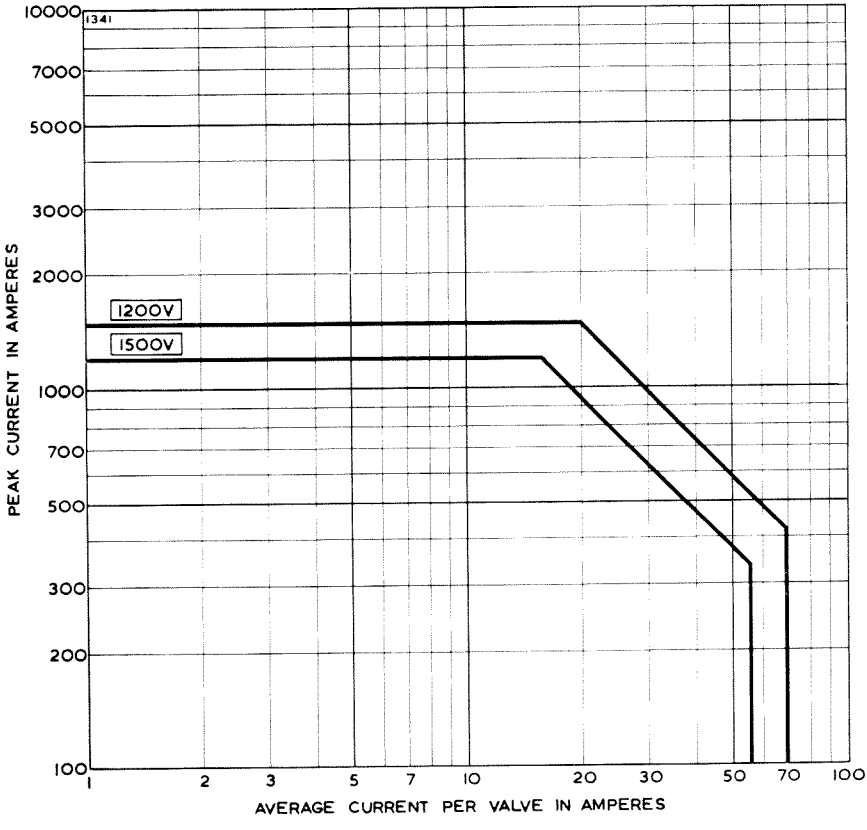
ENGLISH ELECTRIC

PEAK CURRENT—AVERAGE CURRENT PER VALVE (MAXIMUM RATINGS)



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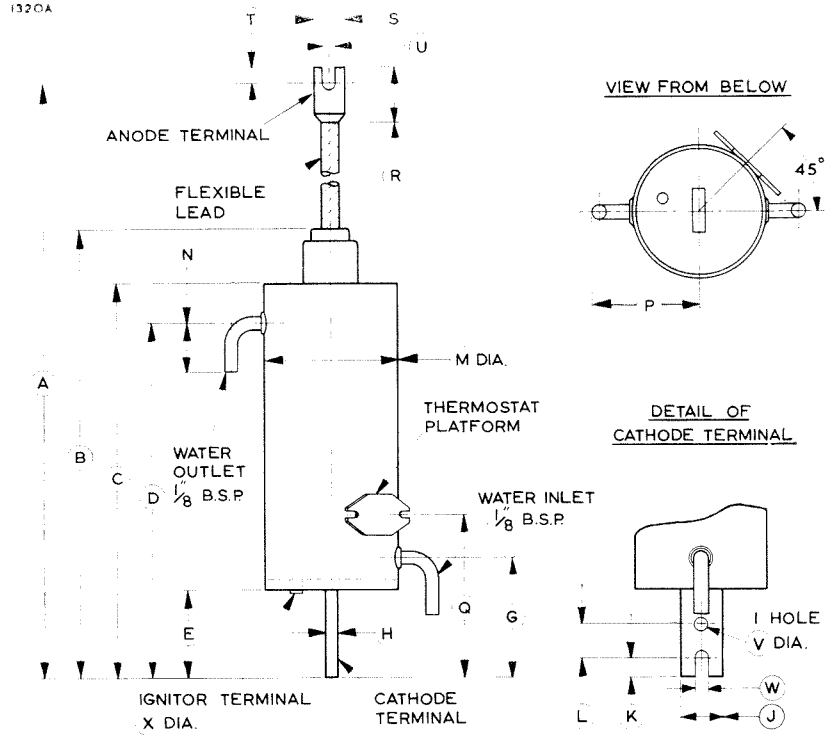
OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	24·250 Min	617·0 Min	N	2·500 Max	63·50 Max
B	14·750 Max	374·7 Max	P	3·625 Max	92·08 Max
C	12·500 Max	317·5 Max	Q	5·500 ± 0·375	139·7 ± 9·53
D	10·750	273·1	R	3·000 Max	76·20 Max
E	2·375 Min	60·33 Min	S	1·250 Max	31·75 Max
G	3·750	95·25	T	1·000 Max	25·40 Max
H	0·500 ± 0·031	12·70 ± 0·79	U	0·437 ± 0·062	11·10 ± 1·57
J	1·250 ± 0·062	31·75 ± 1·57	V	0·437 ± 0·031	11·10 ± 0·79
K	0·625 ± 0·062	15·88 ± 1·57	W	0·437 ± 0·031	11·10 ± 0·79
L	1·000 ± 0·031	25·40 ± 0·79	X	0·250 ± 0·005	6·35 ± 0·13
M	4·625 Max	117·5 Max			

Millimetre dimensions have been derived from inches.

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ENGLISH ELECTRIC

OUTLINE DETAIL

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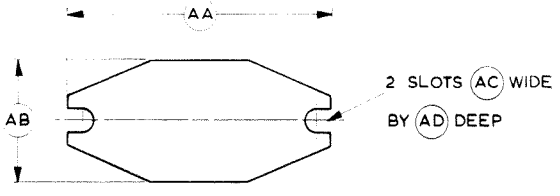

DETAIL OF THERMOSTAT MOUNTING PLATE

Ref.	Inches	Millimetres
AA	2·750	69·85
AB	1·250	31·75
AC	0·219	5·56
AD	0·375	9·53

Millimetre dimensions have been derived from inches.

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IGNITRON BK178

ENGLISH ELECTRIC

ABRIDGED DATA

Size D, stainless-steel-jacketed, water-cooled Ignitron intended primarily for use as a switch in capacitor discharge circuits.

For an electrically identical version with coaxial cathode terminal see BK478.

Maximum Peak Forward or Inverse Anode Voltage ..	25	kV
Maximum Peak Anode Current	100	kA
Maximum Ampere-seconds per Pulse	200	A.sec
Maximum Pulse Repetition Rate	1 pulse per 5	sec

GENERAL

Electrical

Number of Electrodes:							
Main Anode	1						
Cathode (mercury pool)	1						
Ignitors	2						
Auxiliary Anode	1						
Arc Voltage Drop (Approx):							
Instantaneous Current ..	5	10	20	30	40	kA	
Voltage Drop	20	25	35	45	60	V	

Mechanical

Overall Length	21·000 inches (533·4 mm)	Max
Overall Width	8·625 inches (219·1 mm)	Max
Body Diameter	5·750 inches (146·1 mm)	Max
Net Weight	21 pounds (9·5 kg)	Approx
Mounting Position	Vertical, anode terminal up	

Accessories

Ignitor Lead	ZD100222
Auxiliary Anode Lead	ZD100222

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ENGLISH ELECTRIC

MAXIMUM AND MINIMUM RATINGS
(Absolute Values)

Capacitor Discharge Service

Main Anode

Peak Forward or Inverse Anode Voltage	25	kV Max
Peak Anode Current	100	kA Max
Rate of Rise of Current	1000	A/μsec Max
Ampere-seconds per Pulse	200	A.sec Max
Duration of Pulse	150	msec Max
Pulse Repetition Rate	1 pulse per 5 sec	Max

Auxiliary Anode

Peak Forward Voltage	160	V Max
Peak Inverse Voltage:		
Main Anode conducting	25	V Max
Main Anode not conducting	160	V Max
Current:		
Peak	30	A Max
R.M.S.	15	A Max
Average	9·0	A Max
Averaging Time	10	sec Max

Ignitor Circuit Requirements

The recommended excitation circuit consists of a 0·25μF capacitor, charged to between 1500 and 4000 volts and discharged through the ignitor-cathode circuit and a current limiting resistor of 2 to 6 ohms. The peak inverse ignitor voltage must never exceed 5·0 volts.

Cooling

	Min	*Max*	
Water Flow Rate (*See Note*)	1·0	—	Imp. gal/min
	4·5	—	l./min
Water Temperature:			
Inlet	15	—	°C
Outlet	—	30	°C
Rise across jacket	—	4·0	°C

Note At the minimum flow rate of 1·0gal/min, the pressure drop across the jacket will be 0·5lb/sq.in (0·04kg/sq.cm) approx.

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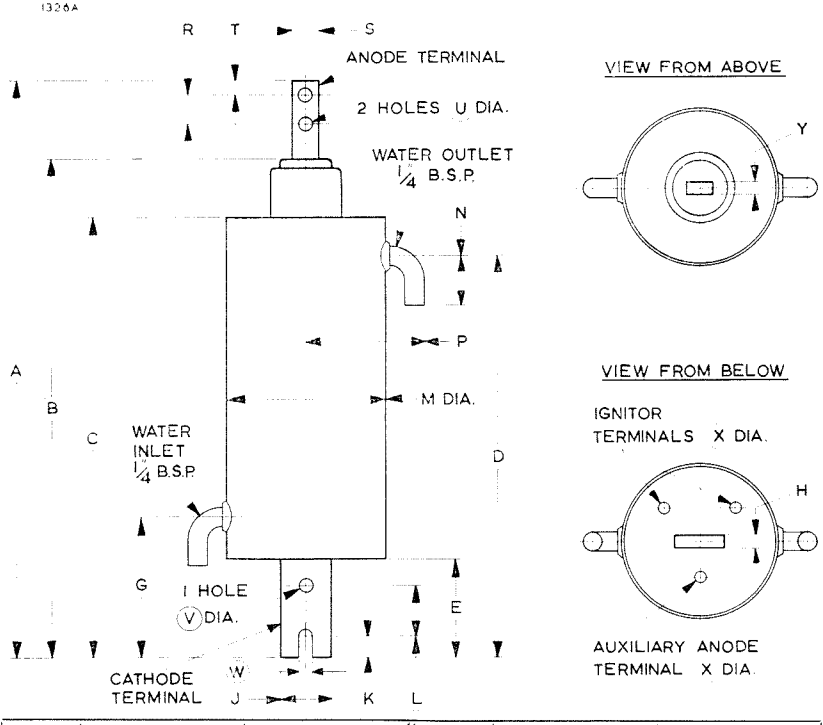
OPERATING INSTRUCTIONS

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

It is recommended that before an ignitron is put into service, it should be aged to withstand a peak voltage of 30–35kV in either direction for one minute without breakdown. This may be accomplished by the application of a variable voltage, either a.c. or d.c., through a current limiting resistance of 0·1 to 0·2 megohm. It is useful to connect a capacitor of around 500pF between anode and cathode, and when the supply is d.c. the series resistance may be increased to some tens of megohms, to limit the frequency of breakdowns for convenience of observation.

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

OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	20·250 ± 0·750	514·4 ± 19·1	N	3·000 Max	76·20 Max
B	18·500 Max	469·9 Max	P	4·312 Max	109·5 Max
C	15·375 ± 0·750	390·5 ± 19·1	R	1·000 ± 0·031	25·40 ± 0·79
D	14·000	355·6	S	1·000 ± 0·062	25·40 ± 1·57
E	3·125 Min	79·38 Min	T	0·500 ± 0·062	12·70 ± 1·57
G	5·000	127·0	U	0·500 ± 0·031	12·70 ± 0·79
H	0·500 ± 0·031	12·70 ± 0·79	V	0·562 ± 0·031	14·27 ± 0·79
J	1·750 ± 0·062	44·45 ± 1·57	W	0·562 ± 0·031	14·27 ± 0·79
K	0·750 ± 0·062	19·05 ± 1·57	X	0·250 ± 0·005	6·35 ± 0·13
L	1·750 ± 0·031	44·45 ± 0·79	Y	0·500 ± 0·031	12·70 ± 0·79
M	5·750 Max	146·1 Max			

Millimetre dimensions have been derived from inches.

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ABRIDGED DATA

Size E, stainless-steel-jacketed, water-cooled Ignitron intended primarily for use as a switch in capacitor discharge circuits.

Maximum Peak Forward or Inverse Anode Voltage	25	kV
Maximum Peak Anode Current	100	kA
Maximum Ampere-seconds per Pulse	400	A.sec
Maximum Pulse Repetition Rate	1 pulse per 5	sec

GENERAL

Electrical

Number of Electrodes:

Main Anode	1
Cathode (mercury pool)	1
Ignitors	2
Auxiliary Anode	1

Arc Voltage Drop (Approx):

Instantaneous Current	20	40	60	80	kA
Voltage Drop	22	28	42	52	V

Mechanical

Overall Length	22·500 inches (571·5 mm)	Max
Overall Width	12·000 inches (304·8 mm)	Max
Body Diameter	9·062 inches (230·2 mm)	Max
Net Weight	45 pounds (20 kg)	Approx
Mounting Position	Vertical, anode terminal up	

Accessories

The ignitor and auxiliary anode terminals on the ignitron are P.E.T. ref. 132 sockets. Suitable plugs for use with UR70 coaxial cable are supplied with the ignitron.

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ENGLISH ELECTRIC

MAXIMUM AND MINIMUM RATINGS
(Absolute Values)

Capacitor Discharge Service

Main Anode

Peak Forward or Inverse Anode Voltage	25	kV Max
Peak Anode Current	100	kA Max
Rate of Rise of Current	2000	A/μsec Max
Ampere-seconds per Pulse	400	A.sec Max
Duration of Pulse	150	msec Max
Pulse Repetition Rate	1 pulse per 5	sec Max

Auxiliary Anode

Peak Forward Voltage	160	V Max
Peak Inverse Voltage:		
Main Anode conducting	25	V Max
Main Anode not conducting	160	V Max
Current:		
Peak	30	A Max
R.M.S.	15	A Max
Average	9·0	A Max
Averaging Time	10	sec Max

Ignitor Circuit Requirements

The recommended excitation circuit consists of a 0·25μF capacitor, charged to between 1500 and 4000 volts and discharged through the ignitor-cathode circuit and a current limiting resistor of 2 to 6 ohms. The peak inverse ignitor voltage must never exceed 5·0 volts.

Cooling

	Min	*Max*	
Water Flow Rate (*See Note*)	1·0	—	Imp.gal/min
	4·5	—	l./min
Water Temperature:			
Inlet	15	—	°C
Outlet	—	30	°C

Note At the minimum flow rate of 1·0gal/min, the pressure drop across the jacket will be 0·5lb/sq.in (0·04kg/sq.cm) approx.

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OPERATING INSTRUCTIONS

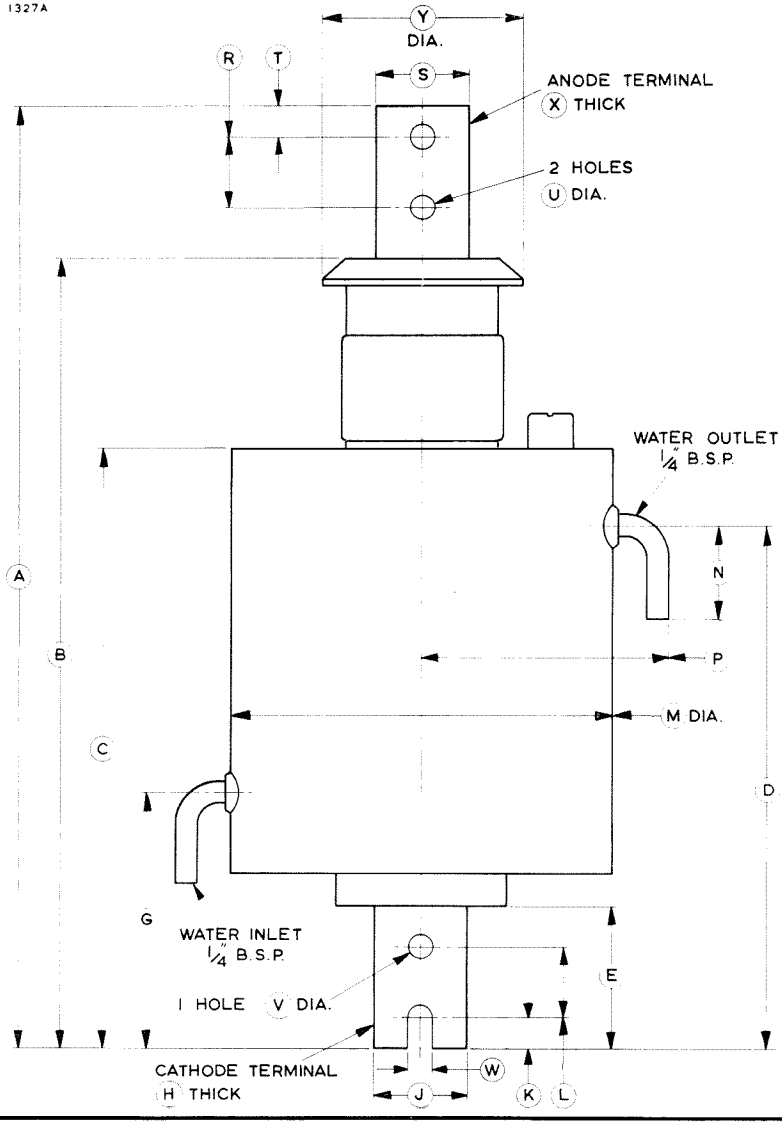
Care should be taken to keep the glass bushing, the anode lead and the stress shields free from mercury. The ignitron should always be kept upright and not tilted far enough to allow mercury to flow into the anode end. Before the ignitron is operated, the bushing and anode terminal assembly should be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

It is recommended that before an ignitron is put into service, it should be aged to withstand a peak voltage of 30–35kV in either direction for one minute without breakdown. This may be accomplished by the application of a variable voltage, either a.c. or d.c., through a current limiting resistance of 0·1 to 0·2 megohm. It is useful to connect a capacitor of around 500pF between anode and cathode, and when the supply is d.c. the series resistance may be increased to some tens of megohms, to limit the frequency of breakdowns for convenience of observation.

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

ENGLISH ELECTRIC

OUTLINE



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OUTLINE

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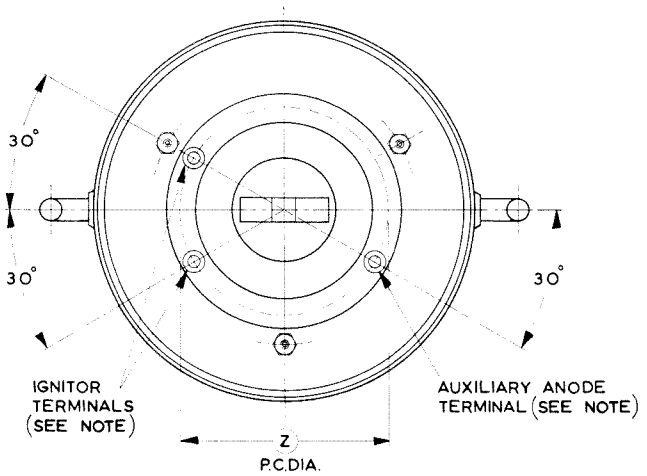

VIEW FROM BELOW

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	22·000 ± 0·500	558·8 ± 12·7	N	3·000 Max	76·20 Max
B	18·500 ± 0·500	469·9 ± 12·7	P	6·000 Max	152·4 Max
C	14·000 ± 0·500	355·6 ± 12·7	R	1·750 ± 0·031	44·45 ± 0·79
D	12·250	311·2	S	1·750 ± 0·062	44·45 ± 1·57
E	3·750 ± 0·250	95·25 ± 6·35	T	0·750 ± 0·062	19·05 ± 1·57
G	6·000	152·4	U	0·562 ± 0·031	14·27 ± 0·79
H	0·500 ± 0·031	12·70 ± 0·79	V	0·562 ± 0·031	14·27 ± 0·79
J	1·750 ± 0·062	44·45 ± 1·57	W	0·562 ± 0·031	14·27 ± 0·79
K	0·750 ± 0·062	19·05 ± 1·57	X	0·500 ± 0·031	12·70 ± 0·79
L	1·750 ± 0·031	44·45 ± 0·79	Y	4·750 ± 0·062	120·65 ± 1·57
M	8·938 ± 0·125	227·0 ± 3·2	Z	4·875	123·83

Millimetre dimensions have been derived from inches.

Note P.E.T. ref. 132 sockets for ignitor and auxiliary anode terminals. Plugs supplied for UR70 coaxial cable.

ENGLISH ELECTRIC VALVE CO. LTD.

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Printed in England

COAXIAL IGNITRON

BK442/7669

ENGLISH ELECTRIC

Coaxial version of BK42/5551A **Equivalent to 7669**

ABRIDGED DATA

Size B, stainless-steel-jacketed, water-cooled Ignitron intended primarily for single-phase or three-phase (frequency changing) resistance welding control applications. It features a coaxial cathode terminal and has a platform for mounting a detachable thermostat for temperature control.

Supply Voltage (R.M.S.)	250 to 600	V
Maximum Demand (2 valves in inverse parallel, average current not exceeding 30·2A)	600	kVA
Maximum Average Anode Current (for demand not exceeding 200kVA)	56	A

GENERAL

Electrical

Number of Electrodes:		
Main Anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc Voltage Drop (Approx):		
at 150A peak current	13	V
at 3400A peak current	26	V

Mechanical

Overall Length (excluding flexible lead)	11·625 inches (295·3 mm)	Max
Overall Width	8·125 inches (206·4 mm)	Max
Body Diameter	3·250 inches (82·55 mm)	Max
Net Weight	3¾ pounds (1·7 kg)	Approx
Mounting Position	Vertical, anode terminal up	

Accessories

Water Control Thermostat (normally open, closes at 36°C approx)		ZD100552
Over-temperature Thermostat (normally closed, opens at 52°C approx)		ZD100551
Thermostat Contact Ratings:		
A.C. Voltage	125 250 440 600	V Max
A.C. Current	3·0 1·5 1·0 0·5	A Max
Voltage between switch contacts and ignitron envelope (peak)	1·0	kV Max
Ignitor Lead		ZD100222

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MAXIMUM AND MINIMUM RATINGS
(Absolute Values)

Single-phase Resistance Welding Control Service

Ratings are for two valves connected in inverse parallel. Full cycle conduction must be assumed whether phase control is used or not.

	Min	*Max*	
Anode			
Supply Voltage (R.M.S.) (frequency range 25 to 60c/s)	250	600	V
Demand (for average current not exceeding 30·2A)	—	600	kVA
Anode Current (Average) (for demand not exceeding 200kVA)	—	56	A
Anode Current Averaging Time:			
at $600V_{r.m.s.}$	—	7·5	sec
at $440V_{r.m.s.}$	—	10·2	sec
at $250V_{r.m.s.}$	—	18	sec
Fault Current (Peak):			
at $600V_{r.m.s.}$	—	2800	A
at $250V_{r.m.s.}$	—	6720	A
Duration of Fault Current	—	0·15	sec

Three-phase (Frequency Changing) Welding Control or Power Rectifier Service (Intermittent Duty)

Anode

	Peak Anode Voltage 1·2k*V*	*Peak Anode Voltage* 1·5k*V*	
Anode Current (Peak)	600	480	A Max
Corresponding Average	5·0	4·0	A Max
Anode Current (Average)	22·5	18	A Max
Corresponding Peak	135	108	A Max
Averaging Time	10	10	sec Max
Peak Fault Current	7500	6000	A Max
Duration of Fault Current ..	0·15	0·15	sec Max
Frequency Range	50 to 60		c/s

MAXIMUM AND MINIMUM RATINGS (Continued)

	Min	*Max*	
Ignitor			
Peak Inverse Ignitor Voltage	—	5·0	V
Ignitor Current:			
Peak	—	100	A
R.M.S.	—	10	A
Average	—	1·0	A
Averaging Time	—	5·0	sec
Ignitor Circuit Requirements			
Anode Firing			
Ignitor Voltage required to fire	200	Anode Voltage	V
Ignitor Current required to fire	12	100	A
Starting Time at required voltage or current	—	100	μsec
Separate Excitation			
Open-circuit Voltage of excitation circuit	450	—	V
Short-circuit Current of excitation circuit	45	—	A
Firing Pulse Length (approx. sine wave, average anode current greater than 20A)	150	—	μsec
Recommended Pulse Length (approx. sine wave)		500	μsec
Cooling			
Water Flow Rate (*See Note*)	1·0	—	Imp.gal/min
	4·5	—	l./min
Water Temperature:			
Inlet	10	—	°C
Outlet	—	40	°C
Rise across jacket	—	4·0	°C

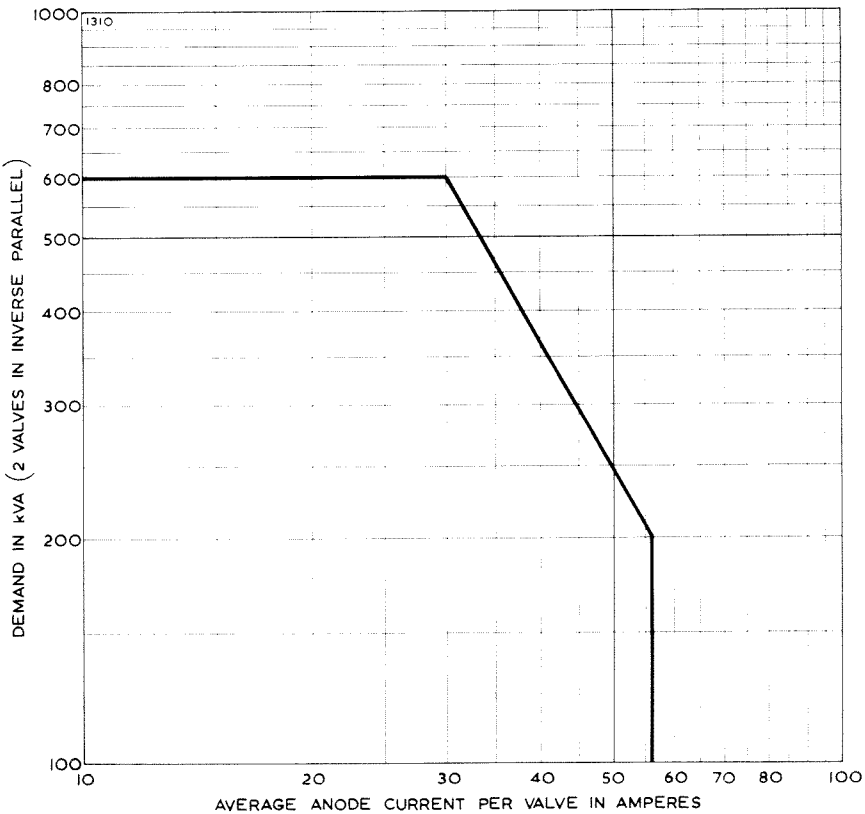
Note (a) At the minimum flow rate of 1·0gal/min, the pressure drop across the jacket will be 1·8lb/sq.in (0·13kg/sq.cm) approx.

(b) It is essential that the flow of water be maintained for 10 minutes after switching off.

ENGLISH ELECTRIC

DEMAND kVA—AVERAGE ANODE CURRENT (MAXIMUM RATINGS)

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



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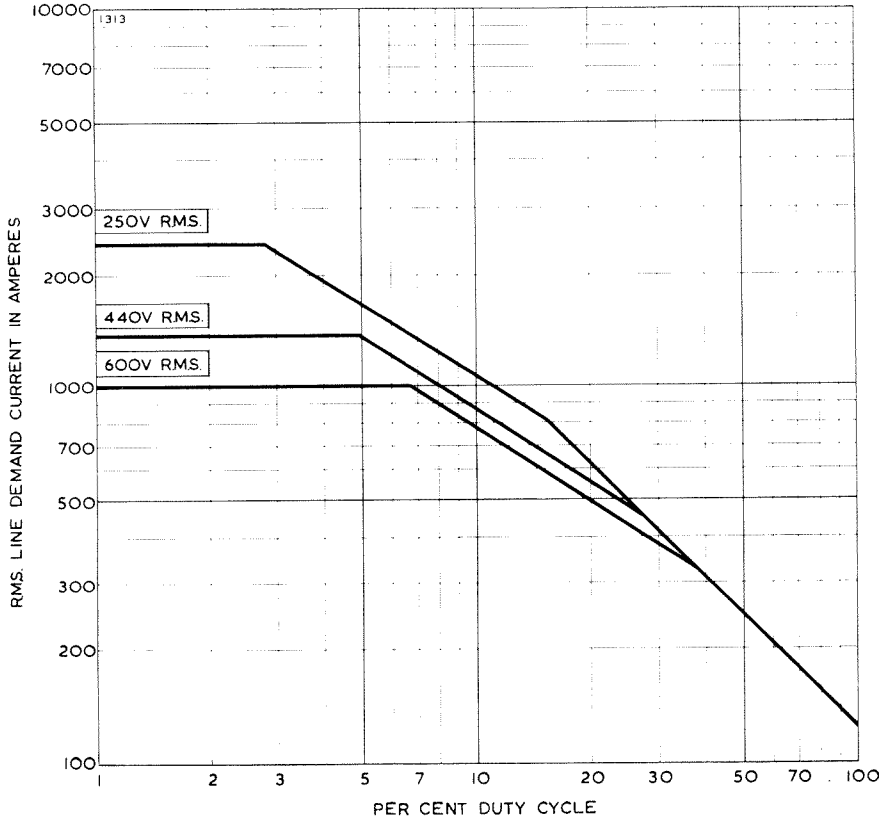
LINE DEMAND CURRENT—DUTY CYCLE (MAXIMUM RATINGS)

Two valves in inverse parallel for welder control service



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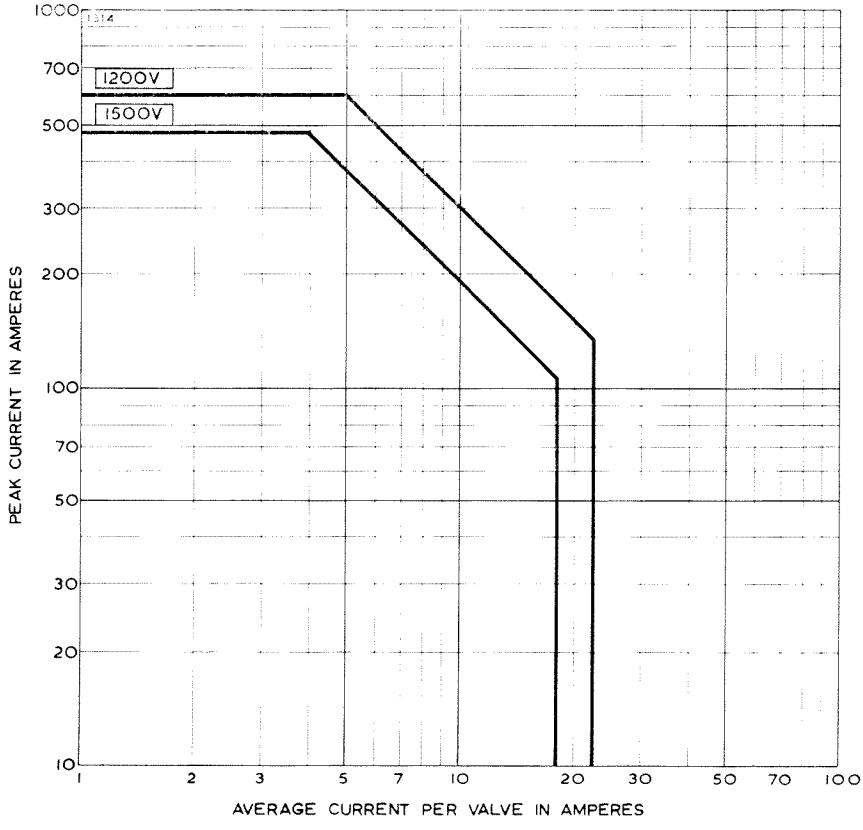
PEAK CURRENT—AVERAGE CURRENT PER VALVE
(MAXIMUM RATINGS)
Three-phase welder control service



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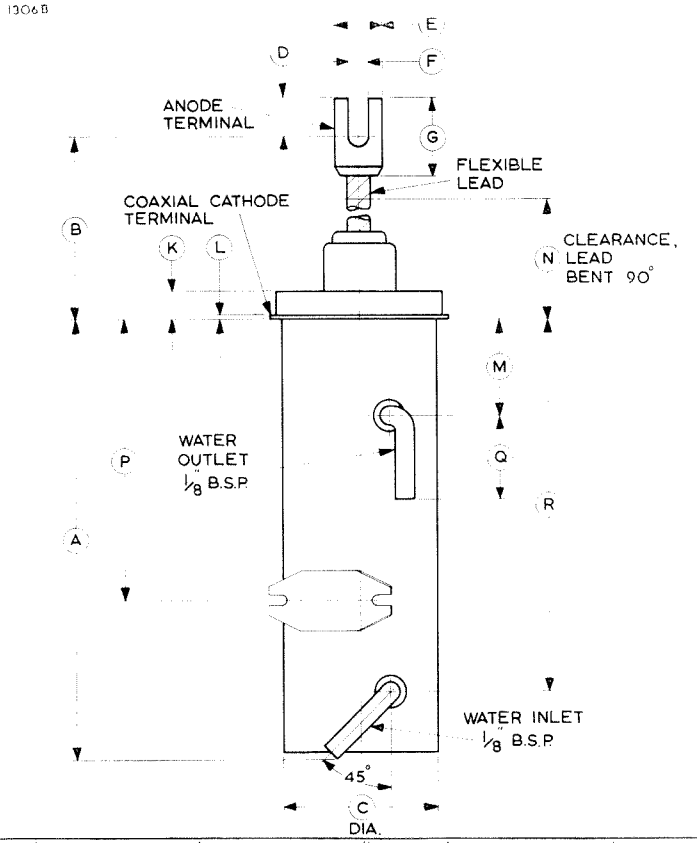
CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	9·000 Max	228·6 Max	K	1·250 Max	31·75 Max
B	10·500 ± 0·500	266·7 ± 12·7	L	0·125	3·18
C	3·250 Max	82·55 Max	M	1·500	38·10
D	0·812 Max	20·62 Max	N	4·000 Min	101·6 Min
E	1·000 Max	25·40 Max	P	5·875 Max	149·2 Max
F	0·406 ± 0·031	10·31 ± 0·79	Q	2·500 Max	63·50 Max
G	2·375 Max	60·33 Max	R	6·250	158·8

Millimetre dimensions have been derived from inches.

ENGLISH ELECTRIC VALVE CO. LTD.

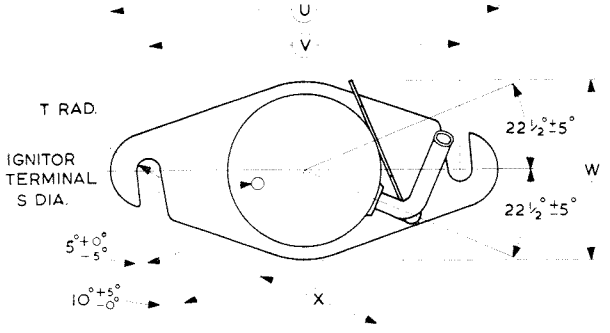
CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

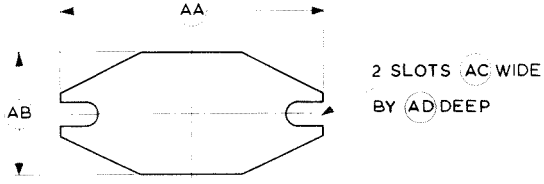
Printed in England

OUTLINE DETAILS

1297B



VIEW FROM BELOW



DETAIL OF THERMOSTAT
MOUNTING PLATE

Ref.	Inches	Millimetres
S	0·250 ± 0·005	6·35 ± 0·13
T	0·219	5·56
U	8·125 Max	206·4 Max
V	6·500 ± 0·032	165·1 ± 0·81
W	3·750 Max	95·25 Max
X	2·625 Max	66·68 Max
AA	2·750	69·85
AB	1·250	31·75
AC	0·219	5·56
AD	0·375	9·53

Millimetre dimensions have been derived from inches.

COAXIAL IGNITRON

BK444/7671

ENGLISH ELECTRIC

Coaxial version of BK24/5552A **Equivalent to 7671**

ABRIDGED DATA

Size C, stainless-steel-jacketed, water-cooled Ignitron intended primarily for single-phase resistance welding control applications. It features a coaxial cathode terminal and has a platform for mounting a detachable thermostat for temperature control.

Supply Voltage (R.M.S.)	250 to 600	V
Maximum Demand (2 valves in inverse parallel, average current not exceeding 75·6A)	1200	kVA
Maximum Average Anode Current (for demand not exceeding 400kVA)	140	A

GENERAL

Electrical

Number of Electrodes:		
Main Anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc Voltage Drop (Approx):		
at 440A peak current	14	V
at 6800A peak current	28	V

Mechanical

Overall Length (excluding flexible lead)	12·750 inches	(323·9 mm)	Max
Overall Width	8·125 inches	(206·4 mm)	Max
Body Diameter	4·625 inches	(117·5 mm)	Max
Net Weight	8½ pounds	(3·9 kg)	Approx
Mounting Position	Vertical, anode terminal up		

Accessories

Water Control Thermostat (normally open, closes at 36°C approx)	ZD100552
Over-temperature Thermostat (normally closed, opens at 52°C approx)	ZD100551

Thermostat Contact Ratings:

A.C. Voltage	125	250	440	600	V Max
A.C. Current	3·0	1·5	1·0	0·5	A Max

Voltage between switch contacts and ignitron envelope (peak)	1·0	kV Max
Ignitor Lead		ZD100222

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
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MAXIMUM AND MINIMUM RATINGS
(Absolute Values)
Single-phase Resistance Welding Control Service

Ratings are for two valves connected in inverse parallel for single-phase welding control. Full cycle conduction must be assumed whether phase control is used or not.

	Min	*Max*	
Anode			
Supply Voltage (R.M.S.) (frequency range 25 to 60c/s)	250	600	V
Demand (for average current not exceeding 75·6A)	—	1200	kVA
Anode Current (Average) (for demand not exceeding 400kVA)	—	140	A
Anode Current Averaging Time:			
at $600V_{r.m.s.}$	—	5·9	sec
at $440V_{r.m.s.}$	—	8·0	sec
at $250V_{r.m.s.}$	—	14	sec
Fault Current (Peak):			
at $600V_{r.m.s.}$	—	5600	A
at $250V_{r.m.s.}$	—	13 450	A
Duration of Fault Current	—	0·15	sec
Ignitor			
Peak Inverse Ignitor Voltage	—	5·0	V
Ignitor Current:			
Peak	—	100	A
R.M.S.	—	10	A
Average	—	1·0	A
Averaging Time	—	5·0	sec
Ignitor Circuit Requirements			
Anode Firing			
Ignitor Voltage required to fire	200	Anode Voltage	V
Ignitor Current required to fire	12	100	A
Starting Time at required voltage or current	—	100	μsec
Separate Excitation			
Open-circuit Voltage of excitation circuit	450	—	V
Short-circuit Current of excitation circuit	45	—	A
Firing Pulse Length (approx sine wave, average anode current greater than 20A)	150	—	μsec
Recommended Pulse Length (approx sine wave)		500	μsec

MAXIMUM AND MINIMUM RATINGS (Continued)

	Min	*Max*	
Cooling			
Water Flow Rate (*See Note*)	1·5	—	Imp.gal/min
	7·0	—	l./min
Water Temperature:			
Inlet	10	—	°C
Outlet	—	40	°C
Rise across jacket	—	6·0	°C

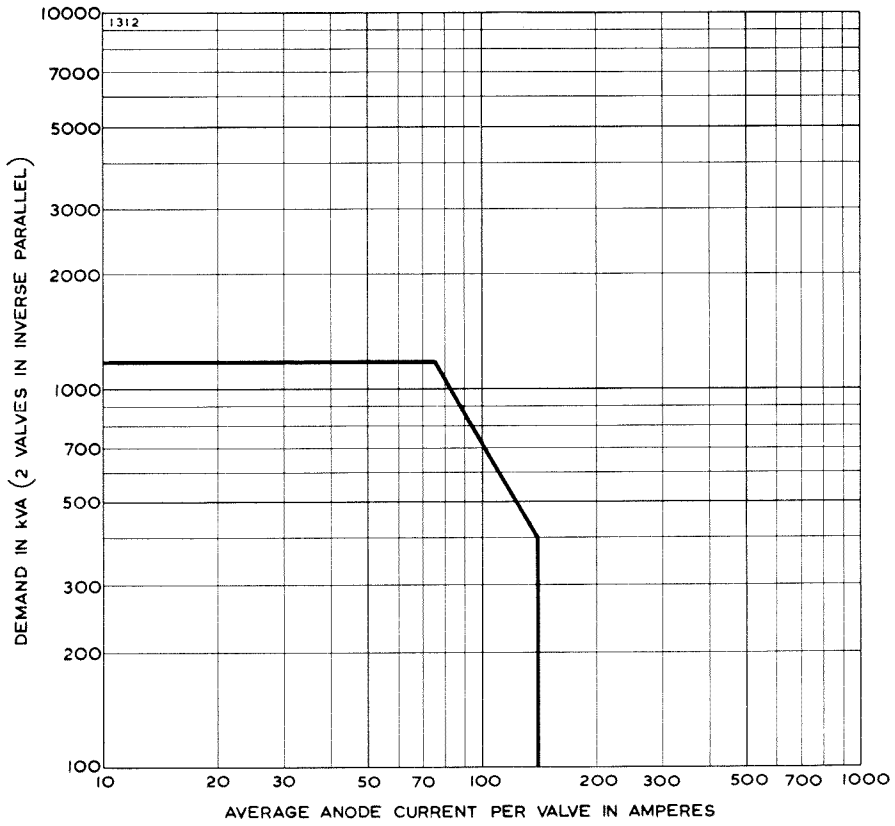
Note (a) At the minimum flow rate of 1·5gal/min, the pressure drop across the jacket will be 4·5lb/sq.in (0·32kg/sq.cm) approx.

(b) It is essential that the flow of water be maintained for 15 minutes after switching off.

Printed in England

DEMAND kVA—AVERAGE ANODE CURRENT (MAXIMUM RATINGS)

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



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ENGLAND

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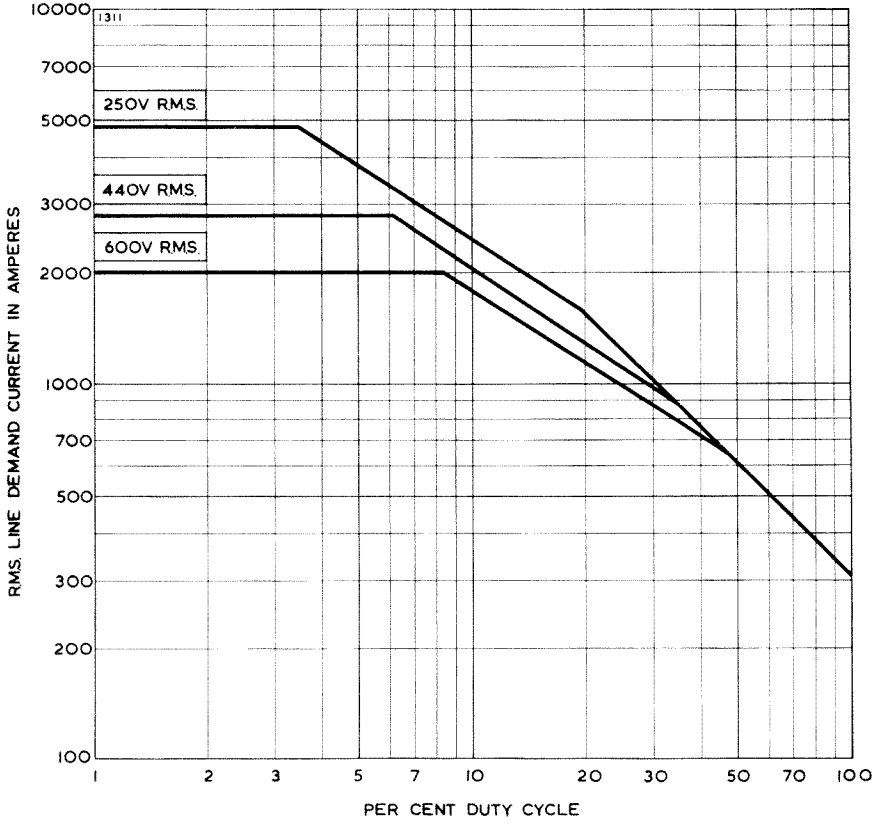
LINE DEMAND CURRENT—DUTY CYCLE (MAXIMUM RATINGS)

Two valves in inverse parallel for welder control service



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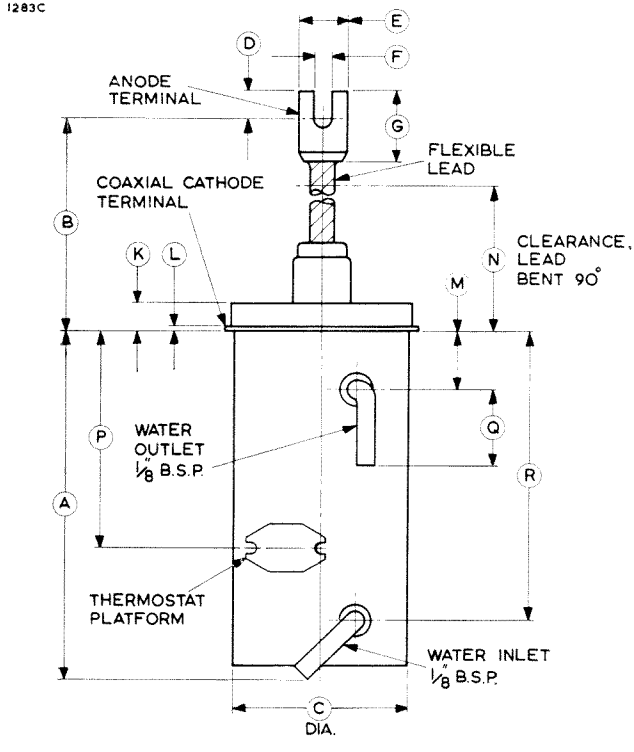
OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	9·500 Max	241·3 Max	K	1·250 Max	31·75 Max
B	10·500 ± 0·500	266·7 ± 12·70	L	0·125	3·18
C	4·625 Max	117·5 Max	M	1·500 Nom	38·10 Nom
D	1·000 Max	25·40 Max	N	4·750 Min	120·7 Min
E	1·250 Max	31·75 Max	P	6·875 Max	174·6 Max
F	0·437 ± 0·062	11·10 ± 1·57	Q	2·500 Max	63·50 Max
G	3·000 Max	76·20 Max	R	7·500 Nom	190·5 Nom

Millimetre dimensions have been derived from inches.

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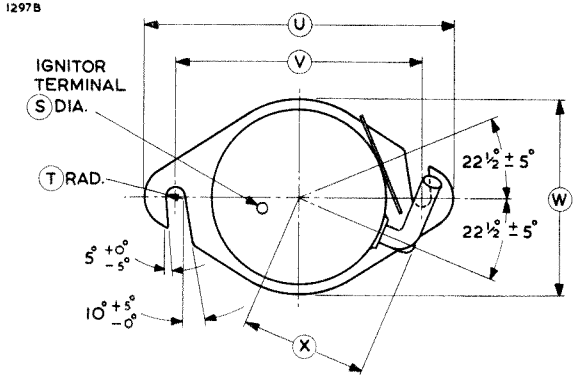
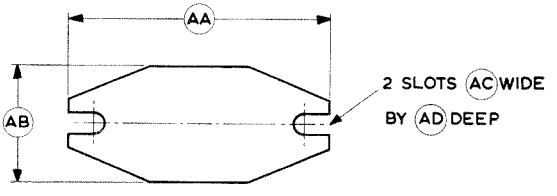
OUTLINE DETAILS



VIEW FROM BELOW



DETAIL OF THERMOSTAT MOUNTING PLATE

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
S	0·250 ± 0·005	6·35 ± 0·13	X	3·375 Max	85·73 Max
T	0·219	5·56	AA	2·750	69·85
U	8·125 Max	206·4 Max	AB	1·250	31·75
V	6·500 ± 0·032	165·1 ± 0·81	AC	0·219	5·56
W	5·125 Max	130·2 Max	AD	0·375	9·53

Millimetre dimensions have been derived from inches.

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD ENGLAND

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COAXIAL IGNITRON

BK446/7673

ENGLISH ELECTRIC

Coaxial version of BK146/5553B **Equivalent to 7673**

ABRIDGED DATA

Size D, stainless-steel-jacketed, water-cooled Ignitron intended primarily for single-phase or three-phase (frequency changing) resistance welding control applications. It features a coaxial cathode terminal and has a platform for mounting a detachable thermostat for temperature control.

Supply Voltage (R.M.S)	250 to 600	V
Maximum Demand (2 valves in inverse parallel, average current not exceeding 192A)	2400	kVA
Maximum Average Anode Current (for demand not exceeding 800kVA)	355	A

GENERAL

Electrical

Number of Electrodes:		
Main Anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc Voltage Drop (Approx):		
at 1115A peak current	17	V
at 13 600A peak current	36	V

Mechanical

Overall Length (excluding flexible lead)	16·875 inches	(428·6 mm)	Max
Overall Width	11·375 inches	(288·9 mm)	Max
Body Diameter	7·125 inches	(181 mm)	Max
Net Weight	21 pounds	(9·5 kg)	Approx
Mounting Position	Vertical, anode terminal up		

Accessories

Water Control Thermostat (normally open, closes at 36°C approx)	ZD100552
Over-temperature Thermostat (normally closed, opens at 52°C approx)	ZD100551

Thermostat Contact Ratings:

A.C. Voltage	125	250	440	600	V Max
A.C. Current	3·0	1·5	1·0	0·5	A Max
Voltage between switch contacts and ignitron envelope (peak)				1·0	kV Max

Ignitor Lead	ZD100222

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MAXIMUM AND MINIMUM RATINGS
(Absolute Values)

Single-phase Resistance Welding Control Service

Ratings are for two valves connected in inverse parallel. Full cycle conduction must be assumed whether phase control is used or not.

	Min	*Max*	
Anode			
Supply Voltage (R.M.S.) (frequency range 25 to 60c/s)	250	600	V
Demand (for average current not exceeding 192A)	—	2400	kVA
Anode Current (Average) (for demand not exceeding 800kVA)	—	355	A
Anode Current Averaging Time:			
at $600V_{r.m.s.}$	—	4·6	sec
at $440V_{r.m.s.}$	—	6·3	sec
at $250V_{r.m.s.}$	—	11	sec
Fault Current (Peak):			
at $600V_{r.m.s.}$	—	11 200	A
at $250V_{r.m.s.}$	—	27 000	A
Duration of Fault Current	—	0·15	sec

Three-phase (Frequency Changing) Welding Control or Power Rectifier Service (Intermittent Duty)

Anode

	Peak Anode Voltage 0·6kV	*Peak Anode Voltage 1·2kV*	*Peak Anode Voltage 1·5kV*	
Anode Current (Peak)	4000	3000	2400	A Max
Corresponding Average	54	40	32	A Max
Anode Current (Average)	190	140	112	A Max
Corresponding Peak	1140	840	672	A Max
Averaging Time	6·25	6·25	6·25	sec Max
Peak Fault Current	50 000	37 500	30 000	A Max
Duration of Fault Current	0·15	0·15	0·15	sec Max
Frequency Range	50 to 60	50 to 60	50 to 60	c/s

MAXIMUM AND MINIMUM RATINGS (Continued)

	Min	*Max*	
Ignitor			
Peak Inverse Ignitor Voltage	—	5·0	V
Ignitor Current:			
Peak	—	100	A
R.M.S.	—	10	A
Average	—	1·0	A
Averaging Time	—	5·0	sec
Ignitor Circuit Requirements			
Anode Firing			
Ignitor Voltage required to fire ..	200	Anode Voltage	V
Ignitor Current required to fire ..	12	100	A
Starting Time at required voltage or current	—	100	μsec
Separate Excitation			
Open-circuit Voltage of excitation circuit	450	—	V
Short-circuit Current of excitation circuit	45	—	A
Firing Pulse Length (approx sine wave, average anode current greater than 20A)	150	—	μsec
Recommended Pulse Length (approx sine wave)		500	μsec
Cooling			
Water Flow Rate (*See Note*)	3·0	—	Imp. gal/min
	14	—	l./min
Water Temperature:			
Inlet	10	—	C
Outlet	—	40	C
Rise across jacket	—	9·0	C

Note (a) At the minimum flow rate of 3·0gal/min, the pressure drop across the jacket will be 5·0lb/sq.in (0·35kg/sq.cm) approx.

(b) It is essential that the flow of water be maintained for 30 minutes after switching off.

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CHELMSFORD
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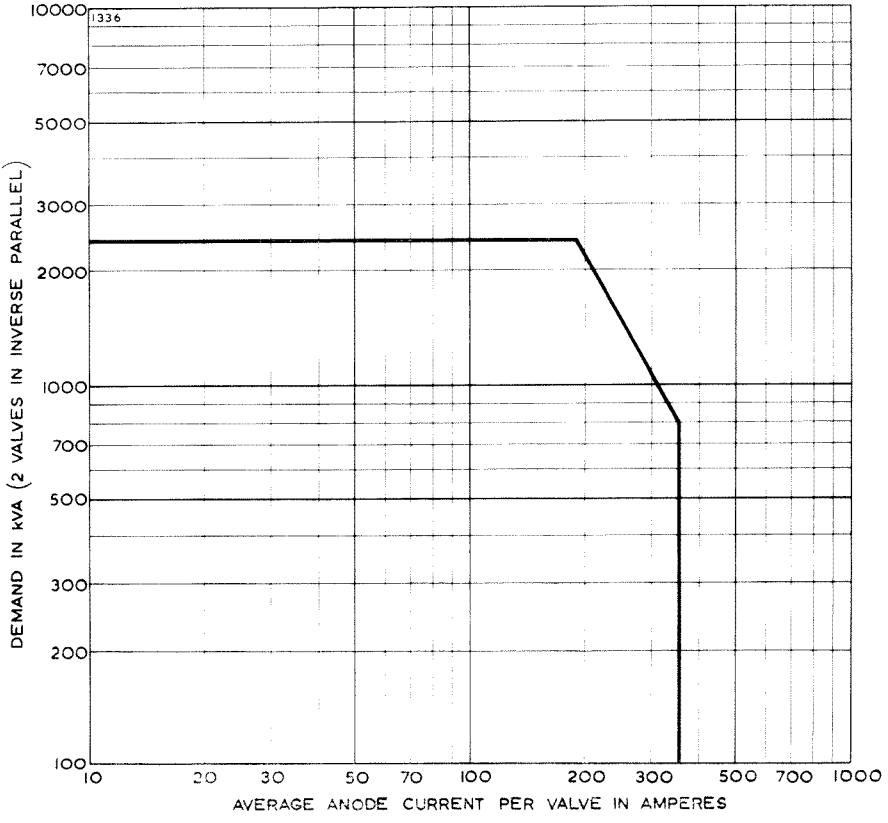
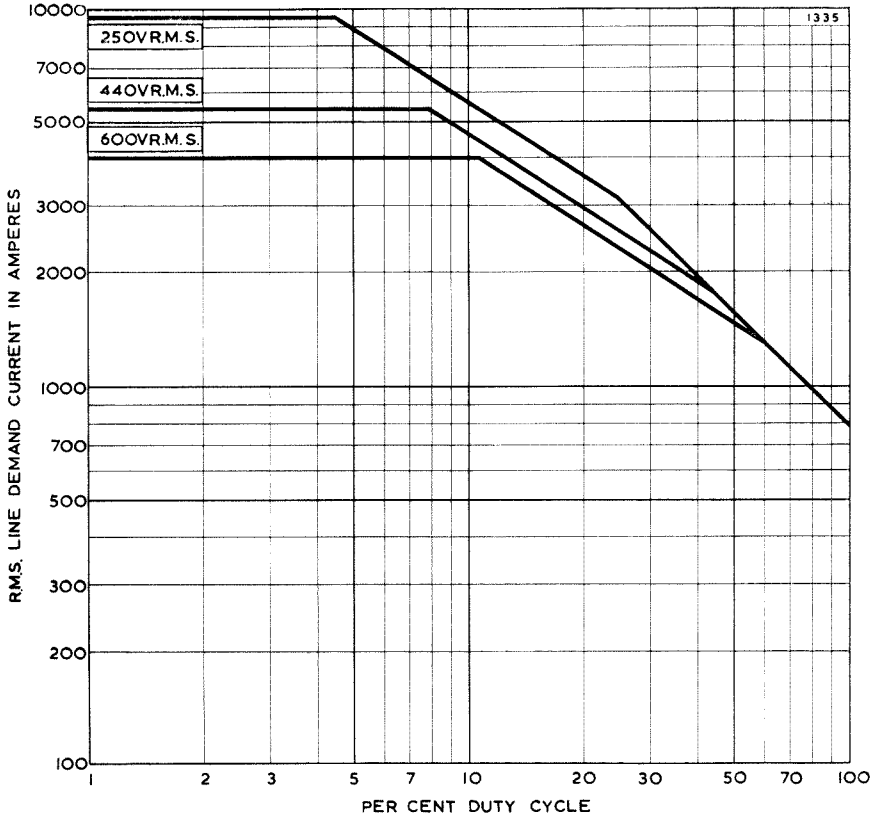
DEMAND kVA—AVERAGE ANODE CURRENT (MAXIMUM RATINGS)

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



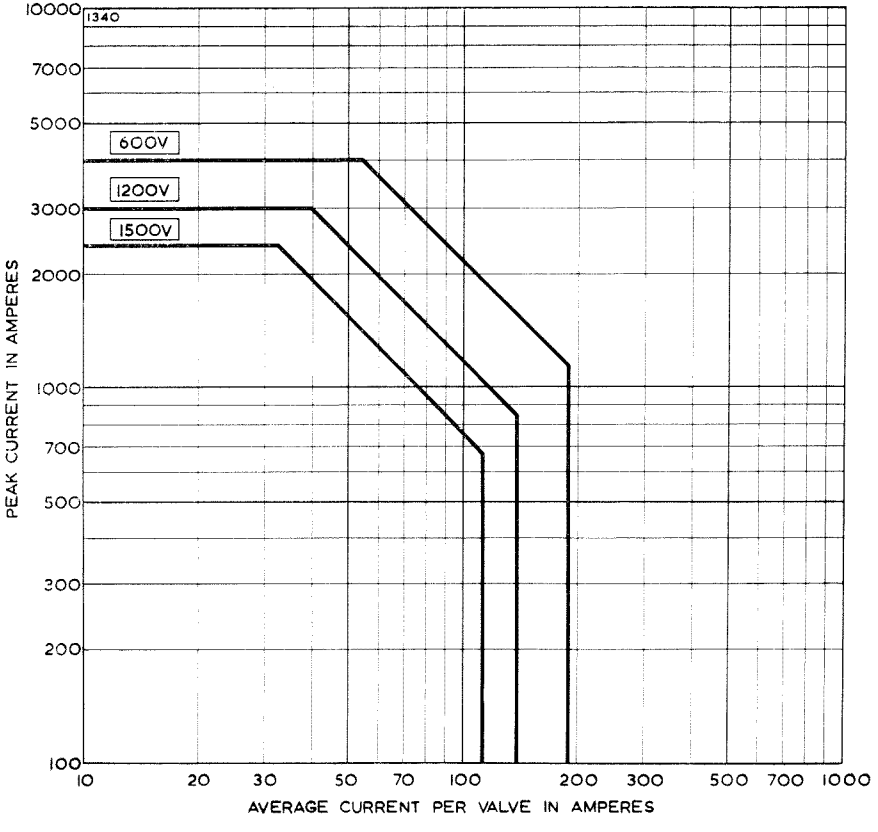
LINE DEMAND CURRENT—DUTY CYCLE (MAXIMUM RATINGS)

Two valves in inverse parallel for welder control service



PEAK CURRENT—AVERAGE CURRENT PER VALVE (MAXIMUM RATINGS)

Three-phase welder control service



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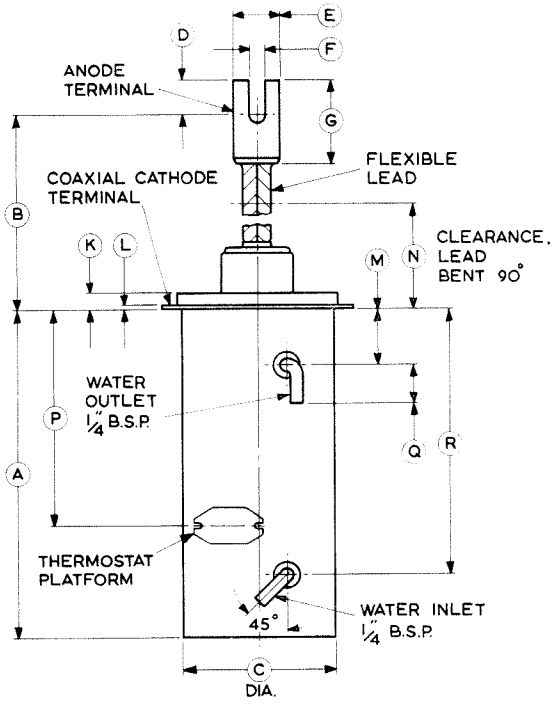
OUTLINE

1484



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	12·750 Max	323·9 Max	K	0·625 ± 0·125	15·88 ± 3·18
B	15·000 Min	381·0 Min	L	0·125	3·18
C	7·125 Max	181·0 Max	M	1·875	47·63
D	1·250 Max	31·75 Max	N	6·500 Min	165·1 Min
E	1·750 Max	44·45 Max	P	7·625 ± 0·500	193·7 ± 12·7
F	0·562 ± 0·032	14·27 ± 0·81	Q	3·000 Max	76·20 Max
G	3·500 Max	88·90 Max	R	9·312	236·5

Millimetre dimensions have been derived from inches.

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

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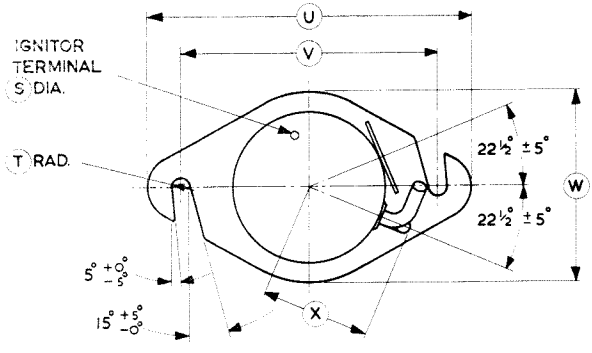
OUTLINE DETAILS

1485



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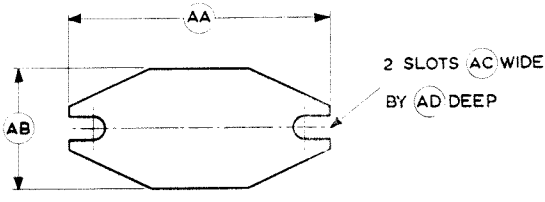

DETAIL OF THERMOSTAT MOUNTING PLATE

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
S	0·250 ± 0·005	6·35 ± 0·13	X	4·500 Max	114·3 Max
T	0·281	7·14	AA	2·750	69·85
U	11·375 Max	288·9 Max	AB	1·250	31·75
V	9·000 ± 0·032	228·6 ± 0·81	AC	0·219	5·56
W	7·125 Max	181·0 Max	AD	0·375	9·53

Millimetre dimensions have been derived from inches.

ENGLISH ELECTRIC VALVE CO. LTD.

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COAXIAL IGNITRON

BK468/7672

ENGLISH ELECTRIC

Coaxial version of BK168/5822A — **Equivalent to 7672**

ABRIDGED DATA

Size C, stainless-steel-jacketed, water-cooled Ignitron intended primarily for three-phase (frequency changing) resistance welding control applications. It features a coaxial cathode terminal and has a platform for mounting a detachable thermostat for temperature control.

Peak Forward or Inverse Anode Voltage ..	1200	1500	V
Maximum Peak Anode Current	1500	1200	A
Corresponding Average	20	16	A
Maximum Average Anode Current	70	56	A
Corresponding Peak	420	336	A

GENERAL

Electrical

Number of Electrodes:		
Main Anode	1	
Cathode (mercury pool)	1	
Ignitor	1	
Arc Voltage Drop (Approx) at 1500A peak	25	V

Mechanical

Overall Length (excluding flexible lead)	12·750 inches	(323·9 mm)	Max
Overall Width	8·125 inches	(206·4 mm)	Max
Body Diameter	4·625 inches	(117·5 mm)	Max
Net Weight	8½ pounds	(3·9 kg)	Approx
Mounting Position	Vertical, anode terminal up		

Accessories

Water Control Thermostat (normally open, closes at 36°C approx)						ZD100552
Over-temperature Thermostat (normally closed, opens at 52°C approx)						ZD100551
Thermostat Contact Ratings:						
A.C. Voltage ..	125	250	440	600		V Max
A.C. Current	3·0	1·5	1·0	0·5		A Max
Voltage between switch contacts and ignitron envelope (peak)				1·0		kV Max
Ignitor Lead						ZD100222

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

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MAXIMUM AND MINIMUM RATINGS
(Absolute Values)

Three-phase (Frequency Changing) Welding Control or Power Rectifier Service (Intermittent Duty)

Anode	*Peak Anode Voltage 1·2kV*	*Peak Anode Voltage 1·5kV*	
Anode Current (Peak)	1500	1200	A Max
Corresponding Average	20	16	A Max
Anode Current (Average)	70	56	A Max
Corresponding Peak	420	336	A Max
Averaging Time	6·25	6·25	sec Max
Peak Fault Current	18 750	15 000	A Max
Duration of Fault Current	0·15	0·15	sec Max
Frequency Range	50 to 60	50 to 60	c/s

	Min	*Max*	
Ignitor			
Peak Inverse Ignitor Voltage	—	5·0	V
Ignitor Current:			
Peak	—	100	A
R.M.S.	—	10	A
Average	—	1·0	A
Averaging Time	—	5·0	sec

Ignitor Circuit Requirements			
Anode Firing			
Ignitor Voltage required to fire	200	Anode Voltage	V
Ignitor Current required to fire	12	100	A
Starting Time at required voltage or current	—	100	μsec
Separate Excitation			
Open-circuit Voltage of excitation circuit	450	—	V
Short-circuit Current of excitation circuit	45	—	A
Firing Pulse Length (approx. sine wave, average anode current greater than 20A)	150	—	μsec
Recommended Pulse Length (approx sine wave)		500	μsec

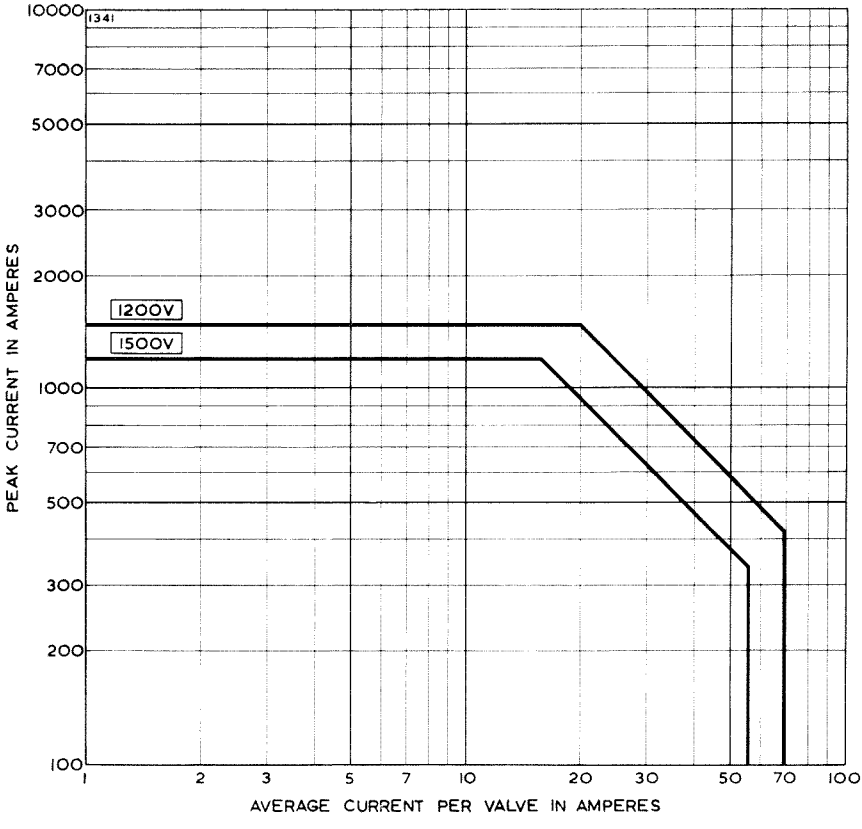
MAXIMUM AND MINIMUM RATINGS (Continued)

Cooling	*Min*	*Max*	
Water Flow Rate (*See Note*)	1·5	—	Imp. gal/min
		7·0	l./min
Water Temperature:			
Inlet	10	—	°C
Outlet	—	40	°C
Rise across jacket	—	6·0	°C

Note (a) At the minimum flow rate of 1·5gal/min, the pressure drop across the jacket will be 4·5lb/sq.in (0·32kg/sq.cm) approx.

(b) It is essential that the flow of water be maintained for 5 minutes after switching off.

PEAK CURRENT—AVERAGE CURRENT PER VALVE
(MAXIMUM RATINGS)



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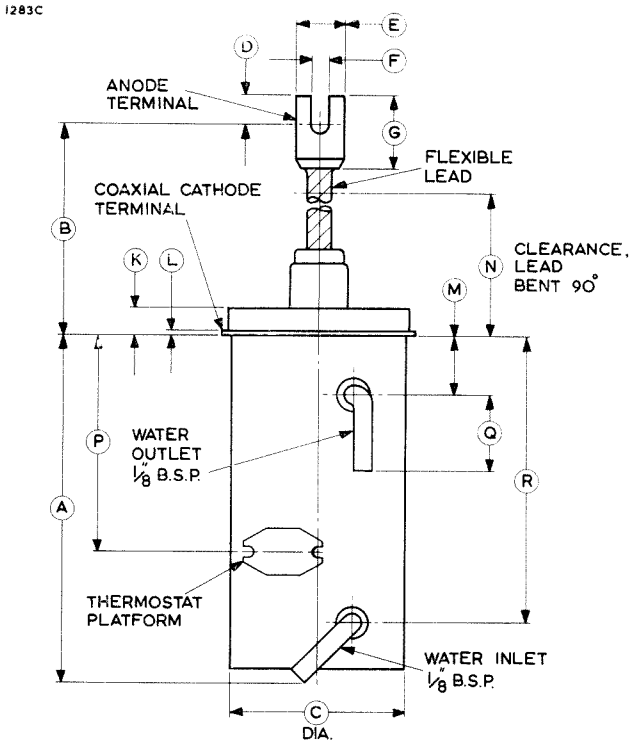


Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	9·500 Max	241·3 Max	K	1·250 Max	31·75 Max
B	10·500 ± 0·500	266·7 ± 12·70	L	0·125	3·18
C	4·625 Max	117·5 Max	M	1·500	38·10
D	1·000 Max	25·40 Max	N	4·750 Min	120·7 Min
E	1·250 Max	31·75 Max	P	6·875 Max	174·6 Max
F	0·437 ± 0·062	11·10 ± 1·57	Q	2·500 Max	63·50 Max
G	3·000 Max	76·20 Max	R	7·500	190·5

Millimetre dimensions have been derived from inches.

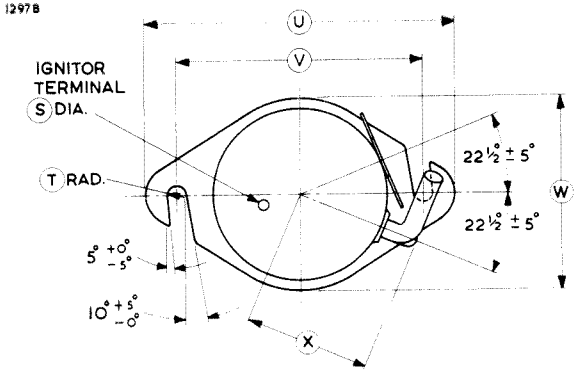
ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

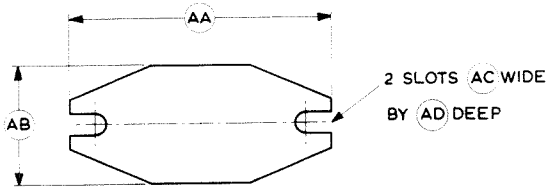
Telephone:
Chelmsford 3491

Printed in England

OUTLINE DETAILS



VIEW FROM BELOW



DETAIL OF THERMOSTAT MOUNTING PLATE

Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
S	0·250 ± 0·005	6·35 ± 0·13	X	3·375 Max	85·73 Max
T	0·219	5·56	AA	2·750	69·85
U	8·125 Max	206·4 Max	AB	1·250	31·75
V	6·500 ± 0·032	165·1 ± 0·81	AC	0·219	5·56
W	5·125 Max	130·2 Max	AD	0·375	9·53

Millimetre dimensions have been derived from inches.

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CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

COAXIAL IGNITRON

BK478

ENGLISH ELECTRIC

Coaxial version of BK178

ABRIDGED DATA

Size D, stainless-steel-jacketed, water-cooled Ignitron intended primarily for use as a switch in capacitor discharge circuits. It features a coaxial cathode terminal.

Maximum Peak Forward or Inverse Anode Voltage	25	kV
Maximum Peak Anode Current	100	kA
Maximum Ampere-seconds per Pulse	200	A.sec
Maximum Pulse Repetition Rate	1 pulse per 5	sec

GENERAL

lectrical

Number of Electrodes:							
Main Anode						1	
Cathode (mercury pool)						1	
Ignitors						2	
Auxiliary Anode						1	
Arc Voltage Drop (Approx):							
Instantaneous Current	5	10	20	30	40		kA
Voltage Drop	20	25	35	45	60		V

Mechanical

Overall Length	17·875 inches (454 mm)	Max
Overall Width	11·375 inches (288·9 mm)	Max
Body Diameter	5·625 inches (142·9 mm)	Max
Net Weight	21 pounds (9·5 kg)	Approx
Mounting Position	Vertical, anode terminal up	

Accessories

Ignitor Lead	ZD100222
Auxiliary Anode Lead	ZD100222

ENGLISH ELECTRIC VALVE CO. LTD.

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MAXIMUM AND MINIMUM RATINGS
(Absolute Values)

Capacitor Discharge Service

Main Anode

Peak Forward or Inverse Anode Voltage	25	kV Max
Peak Anode Current	100	kA Max
Rate of Rise of Current	1000	A/μsec Max
Ampere-seconds per Pulse	200	A.sec Max
Duration of Pulse	150	msec Max
Pulse Repetition Rate	1 pulse per 5	sec Max

Auxiliary Anode

Peak Forward Voltage	160	V Max
Peak Inverse Voltage:		
Main Anode conducting	25	V Max
Main Anode not conducting	160	V Max
Current:		
Peak	30	A Max
R.M.S.	15	A Max
Average	9·0	A Max
Averaging Time	10	sec Max

Ignitor Circuit Requirements

The recommended excitation circuit consists of a 0·25μF capacitor, charged to between 1500 and 4000 volts and discharged through the ignitor-cathode circuit and a current limiting resistor of 2 to 6 ohms. The peak inverse ignitor voltage must never exceed 5·0 volts.

Cooling

	Min	*Max*	
Water Flow Rate (*See Note*)	1·0	—	Imp. gal/min
	4·5	—	l./min
Water Temperature:			
Inlet	15	—	°C
Outlet	—	30	°C
Rise across jacket	—	4·0	°C

Note At the minimum flow rate of 1·0gal/min, the pressure drop across the jacket will be 0·5lb/sq.in (0·04kg/sq.cm) approx.

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OPERATING INSTRUCTIONS

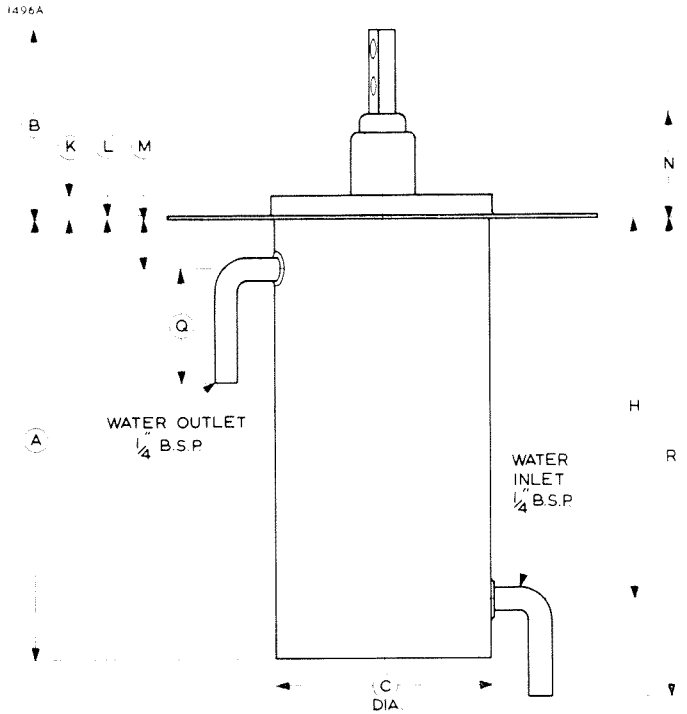
Care should be taken to keep the glass bushing, the anode lead and the stress shields free from mercury. The ignitron should always be kept upright and not tilted far enough to allow mercury to flow into the anode end. Before the ignitron is operated, the bushing and anode terminal assembly should be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

It is recommended that before an ignitron is put into service, it should be aged to withstand a peak voltage of 30–35kV in either direction for one minute without breakdown. This may be accomplished by the application of a variable voltage, either a.c. or d.c., through a current limiting resistance of 0·1 to 0·2 megohm. It is useful to connect a capacitor of around 500pF between anode and cathode, and when the supply is d.c. the series resistance may be increased to some tens of megohms, to limit the frequency of breakdowns for convenience of observation.

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

ENGLISH ELECTRIC

OUTLINE



Ref.	Inches	Millimetres	Ref.	Inches	Millimetres
A	11·500 Max	292·1 Max	M	1·250 ± 0·500	31·75 ± 12·70
B	5·125 ± 0·250	130·2 ± 6·4	N	3·125 Max	79·38 Max
C	5·625 Max	142·9 Max	Q	3·000 Max	76·20 Max
D	0·500 ± 0·062	12·70 ± 1·57	R	12·500 Max	317·5 Max
E	1·000 ± 0·062	25·40 ± 1·57	S	0·250 ± 0·005	6·35 ± 0·13
F	0·500 ± 0·031	12·70 ± 0·79	T	2·250	57·15
G	1·000 ± 0·031	25·40 ± 0·79	U	4·500 Max	114·3 Max
H	9·750 ± 0·500	247·7 ± 12·7	V	11·375 Max	288·9 Max
J	0·500 ± 0·062	12·70 ± 1·57	W	9·000 ± 0·031	228·6 ± 0·79
K	0·625 ± 0·125	15·88 ± 3·18	X	6·500 ± 0·062	165·1 ± 1·57
L	0·125	3·18	Y	0·281	7·14

Millimetre dimensions have been derived from inches.

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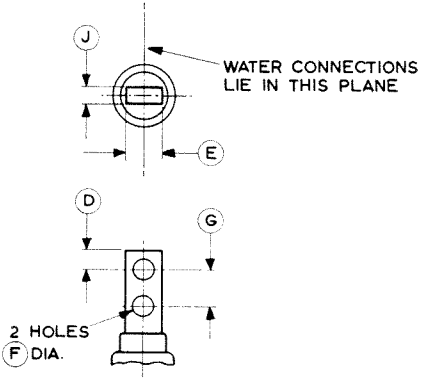
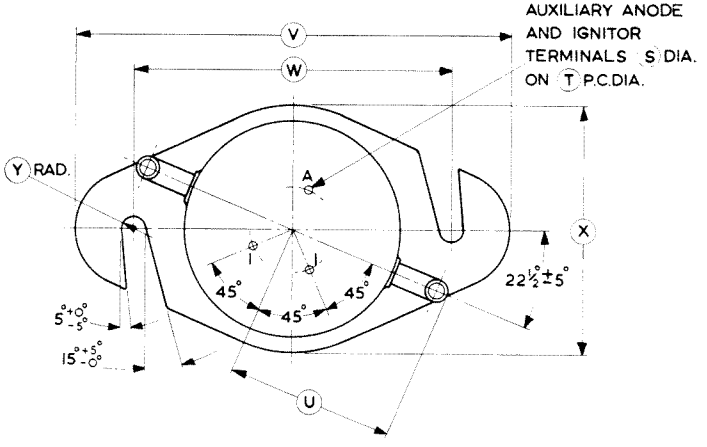
OUTLINE DETAILS

1500



DETAIL OF ANODE TERMINAL



VIEW FROM BELOW




BK542/1081

IGNITRON

Equivalent to 1081

ABRIDGED DATA

High power size B, stainless-steel-jacketed, water cooled Ignitron intended primarily for single-phase resistance welding control applications. It is capable of controlling 65% more power than the standard size B ignitron (5551A), while remaining within the same dimensions. It has a platform for mounting a detachable thermostat for temperature control.

Supply voltage (r.m.s.)	250 to 600	V
Maximum demand (2 valves in inverse parallel, average current not exceeding 43A)	1000	kVA
Maximum average anode current (for demand not exceeding 200kVA)	75	A

GENERAL

Electrical

Number of electrodes:		
main anode	1	
cathode (mercury pool)	1	
ignitor	1	
Arc voltage drop (approx):		
at 150A peak current	13	V
at 2828A peak current	22	V

Mechanical

Overall length (excluding flexible lead)	13.000 inches (330.2mm) max
Overall width	5.750 inches (146.1mm) max
Body diameter	3.250 inches (82.55mm) max
Net weight	4 pounds (1.8kg) approx
Mounting position	vertical, anode terminal up

Accessories

Water control thermostat (normally open, closes at 36°C approx)					ZD100552
Over-temperature thermostat (normally closed, opens at 52°C approx)					ZD100551
Thermostat contact ratings:					
a.c. voltage	125	250	440	600	V max
a.c. current	3.0	1.5	1.0	0.5	A max
voltage between switch contacts and ignitron envelope (peak)				1.0	kV max
Ignitor lead					ZD100222

MAXIMUM AND MINIMUM RATINGS (Absolute Values)

Maximum Operating Conditions for Single-phase Resistance Welding Control

Ratings are for two valves connected in inverse parallel. Full cycle conduction must be assumed whether phase control is used or not. Frequency range 25 to 60Hz.

At maximum demand

Supply voltage (r.m.s.)	250	440	500	600	V
Demand	500	880	1000	1000	kVA
Demand current (r.m.s.)	2000	2000	2000	1667	A
Average anode current	54	45	43	43	A
Corresponding duty cycle	6.0	5.0	4.8	5.8	%
Anode current averaging time	27	15.4	13.5	11.25	s

At maximum average current per valve

Supply voltage (r.m.s.)	250	440	500	600	V
Demand	200	200	200	200	kVA
Demand current (r.m.s.)	800	454	400	333	A
Average anode current	75	75	75	75	A
Corresponding duty cycle	21	37	42	50	%
Anode current averaging time	27	15.4	13.5	11.25	s

Continued on page 3

MAXIMUM AND MINIMUM RATINGS (Continued)

	Min	Max	
Ignitor			
Peak inverse ignitor voltage	–	5.0	V
Ignitor current:			
peak	–	100	A
r.m.s.	–	10	A
average	–	1.0	A
averaging time	–	5.0	s
Ignitor Circuit Requirements			
a) Anode Firing			
Ignitor voltage required to fire	200	anode voltage	V
Ignitor current required to fire	12	–	A
Typical ignitor current	5 to 9		A
Starting time at required voltage or current	–	100	μs
b) Separate Excitation			
Open-circuit voltage of excitation circuit	450	–	V
Short-circuit current of excitation circuit	45	–	A
Firing pulse length (approx sine wave, average anode current greater than 20A)	150	–	μs
Recommended pulse length (approx sine wave)	500		μs
Cooling			
Water flow rate (see note)	1.0	–	Imp.gal/min
	4.5	–	l./min
Water temperature:			
inlet	10	–	°C
outlet	–	40	°C
rise across jacket	–	4.0	°C

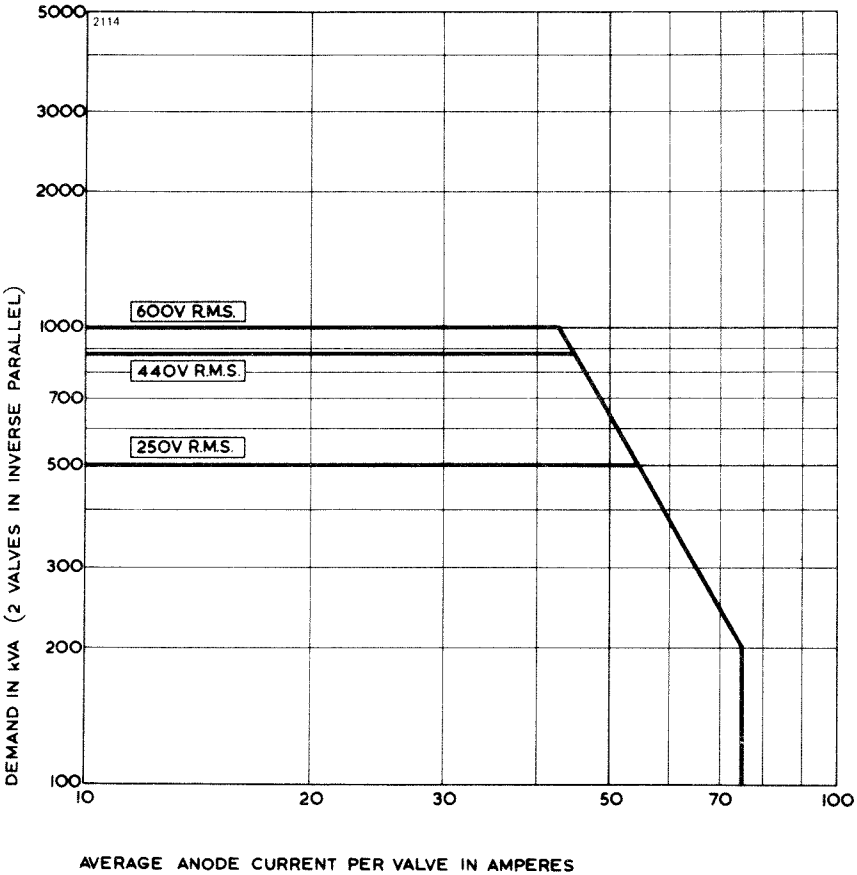
NOTE

a) At the minimum flow rate of 1.0gal/min, the pressure drop across the jacket will be 1.8 lb/in^2 (0.13kg/cm^2) approx.

b) It is essential that the flow of water be maintained for 10 minutes after switching off.

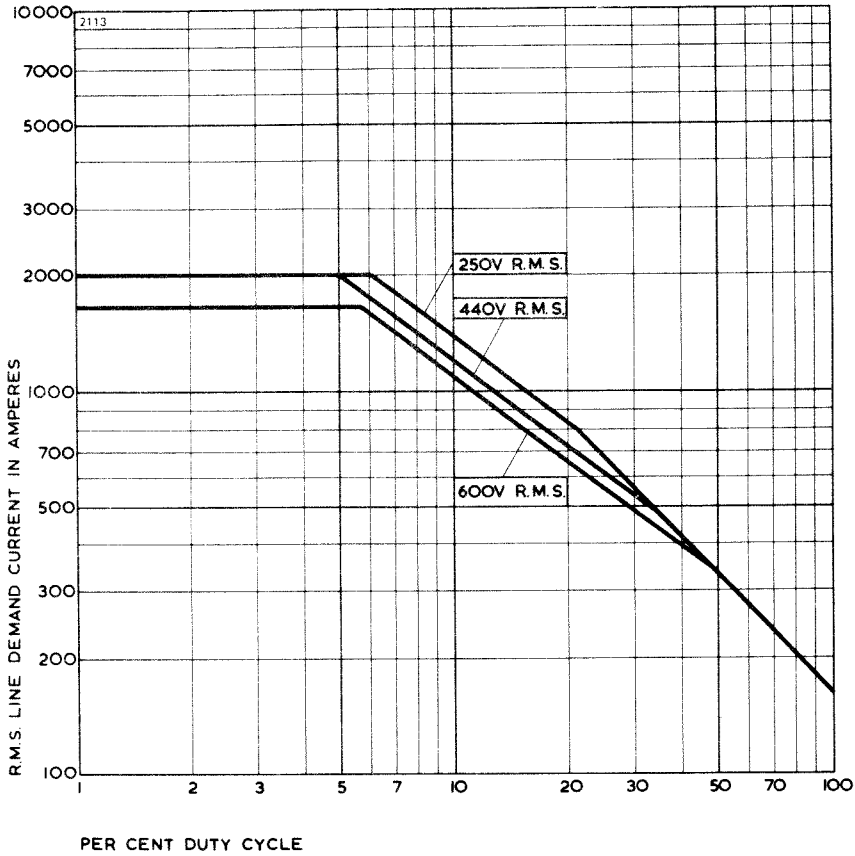
DEMAND kVA – AVERAGE ANODE CURRENT (MAXIMUM RATINGS)

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

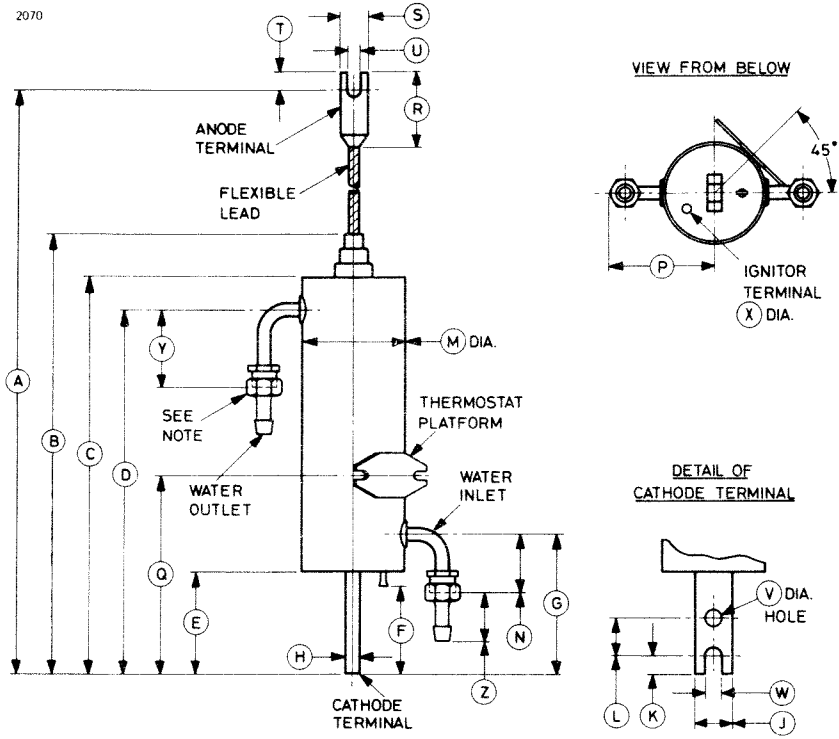


LINE DEMAND CURRENT – DUTY CYCLE (MAXIMUM RATINGS)

Two valves in inverse parallel for welder control service



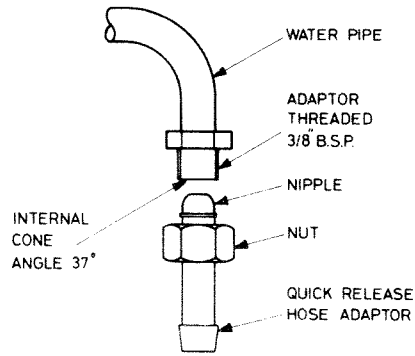
OUTLINE



Note The tube is supplied with two quick release hose adaptors, as shown.

Detail of Water Connections

2071

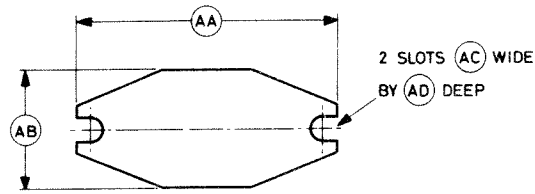


Ref	Inches	Millimetres	Ref	Inches	Millimetres
A	21.750 min	552.5 min	N	1.500	38.10
B	13.000 max	330.2 max	P	2.875 max	73.03 max
C	11.000 max	279.4 max	Q	5.125 ± 0.250	130.2 ± 6.4
D	9.500	241.3	R	2.375 max	60.33 max
E	2.375 min	60.33 min	S	1.000 max	25.40 max
F	2.000 min	50.80 min	T	0.812 max	20.62 max
G	3.625	92.08	U	0.406 ± 0.031	10.31 ± 0.79
H	0.375 ± 0.031	9.53 ± 0.79	V	0.437 ± 0.031	11.10 ± 0.79
J	1.000 ± 0.062	25.40 ± 1.57	W	0.437 ± 0.031	11.10 ± 0.79
K	0.500 ± 0.062	12.70 ± 1.57	X	0.250 ± 0.005	6.35 ± 0.13
L	1.000 ± 0.031	25.40 ± 0.79	Y	2.000	50.80
M	3.250 max	82.55 max	Z	1.250	31.75

Millimetre dimensions have been derived from inches.

Thermostat Mounting Plate

2072



Ref	Inches	Millimetres
AA	2.750	69.85
AB	1.250	31.75
AC	0.219	5.56
AD	0.375	9.53

Millimetre dimensions have been derived from inches.

WATER COOLED CLAMP

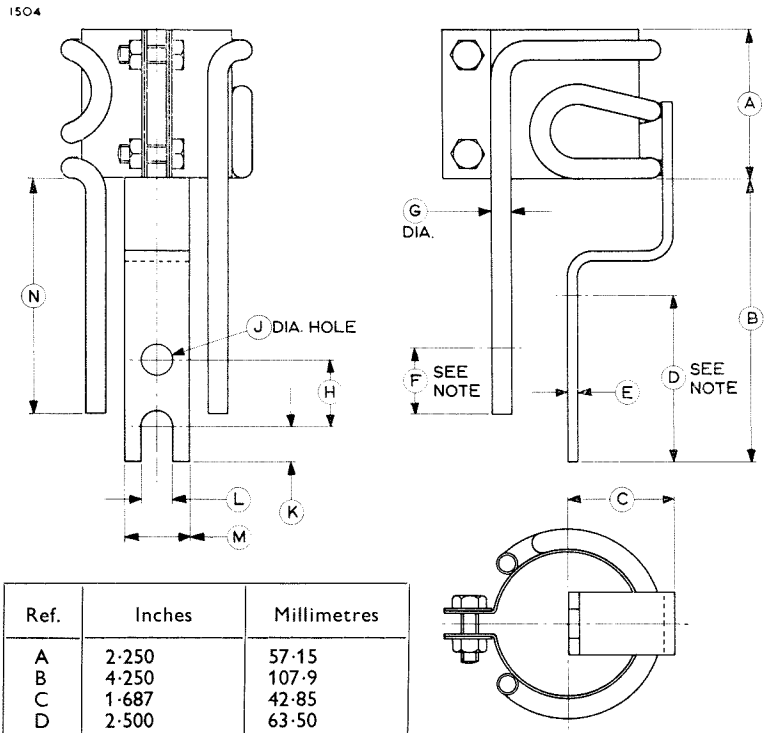
ZD100365

ENGLISH ELECTRIC

INTRODUCTION

ZD100365 is a water cooled clamp for use with size A Ignitrons.

OUTLINE



Ref.	Inches	Millimetres
A	2·250	57·15
B	4·250	107·9
C	1·687	42·85
D	2·500	63·50
E	0·187	4·75
F	1·000	25·40
G	0·344	8·74
H	1·000	25·40
J	0·437	11·10
K	0·562	14·27
L	0·437	11·10
M	1·000	25·40
N	3·500 Min	88·90 Min

Note: This area unpainted.

Millimetre dimensions have been derived from inches.

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
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Printed in England

ZD100551
ZD100552

THERMOSTATS

INTRODUCTION

Two types of thermostat are available for use with those ignitrons fitted with thermostat platforms. One (ZD100551) is for over temperature protection, and the other (ZD100552) is for water control.

Provision is made for clamping the thermostat to a copper platform brazed to the side of the ignitron and making thermal contact with the inner envelope.

Where more than one ignitron is using the same water supply in series, the over temperature thermostat should be fitted to the last ignitron in the chain. Only one thermostat can be mounted on each ignitron.

TEMPERATURE RATINGS

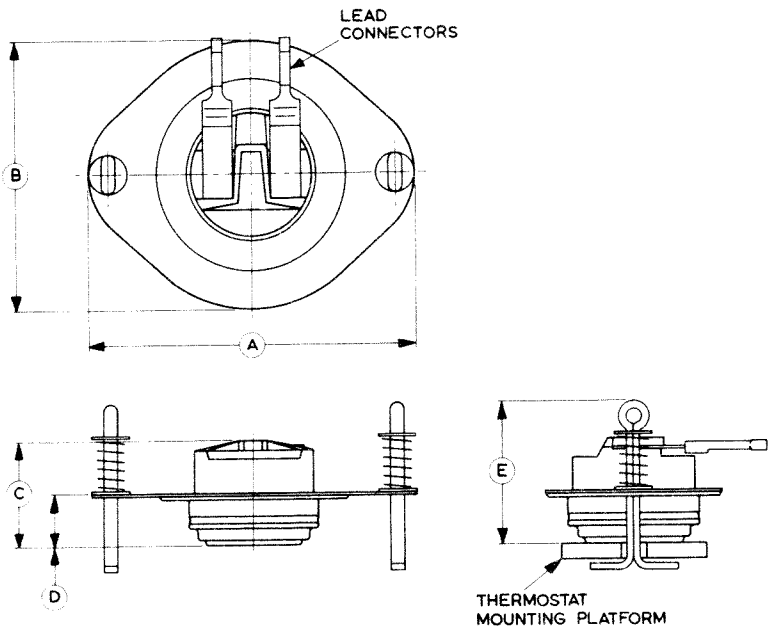
Over temperature thermostat type ZD100551 (normally closed):	
opens at	52 °C approx
Water control thermostat type ZD100552 (normally open):	
closes at	36 °C approx

ELECTRICAL RATINGS (Both types)

A.C. voltage	125	250	440	600	V max
A.C. current	3.0	1.5	1.0	0.5	A max
Maximum peak voltage between switch contacts and ignitron envelope				1000	V

OUTLINE

2194



Ref	Inches	Millimetres
A	2.750 max	69.85 max
B	2.250 max	57.15 max
C	0.875 approx	22.23 approx
D	0.437 approx	11.10 approx
E	1.312 max	33.32 max

Millimetre dimensions have been derived from inches.

INDEX
TO ALL VOLUMES

December 1963

ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD
ENGLAND

Telephone:
Chelmsford 3491

Printed in England

INDEX TO ALL VOLUMES

Abbreviations used in 'Section' Column

BWO	Backward Wave Oscillator (Vol. 2)
CCT	Cold Cathode Tube (Vol. 3)
CRT	Cathode Ray Tube (Vol. 3)
IGN	Ignitron (Vol. 1)
INT	Image Intensifier (Vol. 3)
ITH	Industrial Thyratron (Vol. 1)
KLY	Klystron (Vol. 2)
MAG	Magnetron (Vol. 2)
OP	Other Product (Vol. 3)
PM	Photomultiplier (Vol. 3)
REC	Rectifier (Vol. 1)
ST	Storage Tube (Vol. 3)
TET	Tetrode (Vol. 1)
THY	Hydrogen Thyratron (Vol. 3)
TCT	Television Camera Tube (Vol. 3)
TR	TR & TB Cell (Vol. 3)
TRI	Triode (Vol. 1)
TWT	Travelling Wave Tube (Vol. 2)
VC	Vacuum Capacitor (Vol. 3)

EEV Type	Section (see above)
0A2	CCT
0A2WA	CCT
0B2	CCT
0B2WA	CCT
0C2	CCT
1B59	CCT
2J30–34	MAG
2J42	MAG
2J42H	MAG
2J55	MAG
2J56	MAG
3B22	REC
3B24W	REC
3B28	REC
3C24	TRI
3K3000LQ	KLY
3KM3000LA	KLY
4B32	REC
4C35	THY
4CX1000A	TET
4CX1000K	TET
4CX5000A	TET
4CX10,000D	TET
4CX35,000C	TET
4D32	TET
4J31–35	MAG
4J43–44	MAG
4J50A	MAG
4J52A	MAG
4J53	MAG
4KM50,000LA	KLY
4KM50,000LQ	KLY
4KM50,000LR	KLY
5C22	THY
6D4	ITH
27M1	PM
27M1A	PM
27M2	PM
27M12A	PM
27M13	PM
813	TET
869B	REC
5586	MAG
5657	MAG

EEV Type	Section (see page 1)
5736	TRI
5762	TRI
5820A/E	TCT
5867	TRI
6027	MAG
6027H	MAG
6181	TET
6587	THY
6777	THY
6849	TCT
6861	TWT
7038	TCT
7182	MAG
7293B	TCT
7295C	TCT
7384	THY
7389C	TCT
7735A	TCT
7735B	TCT
8093B	TCT
8356	MAG
8357	MAG
8503	THY
8507	TCT
8541	TCT
8572	TCT
8625	TCT
8626	TCT
68504	REC
68506	REC
68530	REC
A207	REC
A235	REC
A237	REC
A292	REC
A296	REC
AFX203	ITH
AFX234	ITH
AH200	REC
AH205/857B	REC
AH211A	REC
AH213	REC
AH221	REC
AH238	REC
AX228	REC
B142	TRI
B1152	TRI
B1153	TRI
BD10	REC
BD12	REC
BK24/5552A	IGN
BK42/5551A	IGN
BK44/5554	IGN
BK46/5555	IGN
BK66/5550	IGN
BK146/5553B	IGN
BK168/5822A	IGN
BK178	IGN
BK442/7669	IGN
BK444/7671	IGN
BK446/7673	IGN
BK468/7672	IGN
BK542/1081	IGN
BM25L	MAG
BM1003	MAG
BM1004	MAG
BM1005	MAG
BM1026	MAG
BM1027	MAG
BM1028	MAG
BM1029	MAG
BM1030	MAG
BM1031	MAG
BM1032	MAG
BM1033	MAG
BM1034	MAG
BM1035	MAG
BM1036	MAG
BM1037	MAG
BM1040	MAG
BR128B	TRI
BR140	TRI
BR152B	TRI
BR153	TRI
BR155	TRI
BR161	TRI

EEV Type	Section (see page 1)
BR175	TRI
BR179	TRI
BR189	TRI
BR194	TRI
BR195	TRI
BR1102	TRI
BR1103	TRI
BR1106	TRI
BR1115	TRI
BR1121	TRI
BR1122	TRI
BR1124	TRI
BR1126	TRI
BR1129	TRI
BR1131	TRI
BR1132	TRI
BR1138	TRI
BR1143	TRI
BR1160	TRI
BR1161	TRI
BR1162	TRI
BR1165	TRI
BR1169	TRI
BR1181	TRI
BS48	TR
BS52	TR
BS82	TR
BS84	TR
BS92	TR
BS104	TR
BS114	TR
BS116	TR
BS118	TR
BS148	TR
BS154	TR
BS156	TR
BS158	TR
BS198	TR
BS200	TR
BS202	TR
BS204	TR
BS248	TR
BS272	TR

EEV Type	Section (see page 1)
BS280	TR
BS286	TR
BS310	TR
BS316	TR
BS324	TR
BS332	TR
BS384	OP
BS390	TR
BS426	TR
BS430	TR
BS440	TR
BS450	TR
BS452	TR
BS456	TR
BS458	TR
BS462	TR
BS466	TR
BS800	TR
BS810	TR
BS814	TR
BS816	TR
BS824	TR
BS826	TR
BS832	TR
BS834	TR
BS836	TR
BS838	TR
BS844	TR
BS846	TR
BS848	TR
BS850	TR
BT17	ITH
BT19	ITH
BT29	ITH
BT69	ITH
BT89	ITH
BT95	ITH
BW140	TRI
BW153	TRI
BW161	TRI
BW165	TRI
BW173	TRI
BW179	TRI

EEV Type	Section (see page 1)
BW189	TRI
BW194	TRI
BW1102	TRI
BW1102J2	TRI
BW1103	TRI
BW1121	TRI
BW1121J	TRI
BW1121J2	TRI
BW1122	TRI
BW1124	TRI
BW1124J1	TRI
BW1124J2	TRI
BW1126	TRI
BW1139	TRI
BW1143	TRI
BW1143J2	TRI
BW1144	TRI
BW1156	TRI
BW1162	TRI
BW1162J3	TRI
BW1165	TRI
BW1165J3	TRI
BW1169J3	TRI
BW1176J1	TRI
BW1176J2	TRI
BW1181J3	TRI
BW4027	TRI
BW4028	TRI
BW4029	TRI
BW4034	TRI
BW4035	TRI
BW4050	TRI
BW4070	TRI
BW4088	TRI
BY189A	TRI
BY194	TRI
BY1102	TRI
BY1121	TRI
BY1122	TRI
BY1124	TRI
BY1143	TRI
BY1144	TRI
BY1144L	TRI

EEV Type	Section (see page 1)
BY1156	TRI
BY1161	TRI
BY4030	TRI
BY4031	TRI
BY4032	TRI
BY4033	TRI
BY4036	TRI
BY4037	TRI
BY4038	TRI
BY4039	TRI
BY4048A	TRI
BY4049	TRI
BY4060	TRI
BY4063	TRI
BY4064	TRI
BY4093	TRI
C178A/5894	TET
C1108	TET
C1112	TET
C1134	TET
C1136	TET
C1148	TET
C1149/1	TET
C1150/1	TET
C1158	TET
C1166	TET
CR176	TET
CR192A	TET
CR1100	TET
CW1100	TET
CX1120	THY
CX1140	THY
CX1154	THY
CX1157	THY
CX1159	THY
CX1168	THY
CY1170J	TET
E702A	ST
E702B	ST
E702C	ST
E712A	ST
E713B	ST
FX215	THY

EEV Type	Section (see page 1)
FX227	THY
FX294	THY
FX297	THY
FX2503	THY
FX2505	THY
GX402	CCT
K211	KLY
K300	KLY
K302	KLY
K305	KLY
K308	KLY
K311	KLY
K324	KLY
K329	KLY
K335	KLY
K337	KLY
K342	KLY
K343	KLY
K346	KLY
K347A	KLY
K350	KLY
K351	KLY
K357	KLY
K359	KLY
K361	KLY
K361B	KLY
K364	KLY
K365	KLY
K366 Series	KLY
K367 Series	KLY
K376	KLY
K377	KLY
K383	KLY
K384	KLY
K385	KLY
K390	KLY
K391	KLY
K391A	KLY
K397	KLY
K3003	KLY
K3004	KLY
K3005	KLY
K3006	KLY

EEV Type	Section (see page 1)
K3007	KLY
K3014	KLY
K3015, K3016	KLY
K3017	KLY
K3018, K3019	KLY
K3020	KLY
K4001	See K390 (KLY)
K4019	KLY
K4019A	See K365 (KLY)
K4054	See K376 (KLY)
K4055	See K377 (KLY)
KY366 Series	KLY
KY367 Series	KLY
M502A	MAG
M503A	MAG
M504	MAG
M505	MAG
M506A	MAG
M508	MAG
M513A	MAG
M513B	MAG
M515	MAG
M521	MAG
M523	MAG
M525	MAG
M529	MAG
M537A	MAG
M538A	MAG
M539	MAG
M546	MAG
M547	MAG
M548	MAG
M549	MAG
M554	MAG
M561	MAG
M565	MAG
M566	MAG
M569	MAG
M570	MAG

EEV Type	Section (see page 1)
M573	MAG
M574	MAG
M575	MAG
M577B	MAG
M578B	MAG
M579	MAG
M581	MAG
M586	MAG
M591B	MAG
M595B	MAG
M596	MAG
M597	MAG
M598B	MAG
M599	MAG
M4011	See M566 Series (MAG)
M4016	See M554, M586 (MAG)
M4017	See M566 Series (MAG)
M5005	MAG
M5008	MAG
M5009	MAG
M5015	MAG
M5019	MAG
M5022	MAG
M5023	MAG
M5024	MAG
M5025	MAG
M5028	MAG
M5030	MAG
M5032	MAG
M5033	MAG
M5034	MAG
M5043	MAG
M5044	MAG
M5058	MAG
MA52	See (VC)
MA54	See (VC)
MA66	TRI
MA66A, MA66B	TRI
MA87	See 4CX5000A (TET)

EEV Type	Section (see page 1)
MA91, MA92	See CX1140 (THY)
MA100	See U2000/3/40B (VC)
MA104, MA104A	See 4CX5000A, 4CX10,000D (TET)
MA125	See (VC)
MA126	See (VC)
MA130, MA131	TRI
MA135, MA135A	TRI
MA136, MA137	See CR192A (TET)
MA146A,B	TRI
MA147A	TRI
MA149A	TRI
MA151	See T940 (CRT)
MA166, MA166B	See 4CX35,000C (TET)
N1001	TWT
N1002	TWT
N1004	TWT
N1010	BWO
N1013	TWT
N1016M	TWT
N1017M	TWT
N1024M	TWT
N1025M	TWT
N1029	TWT
N1031	TWT
N1032	TWT
N1033	TWT
N1034	BWO
N1038	TWT
N1042M	TWT
N1045M	TWT
N1047M	TWT
N1055	TWT
N1056	TWT
N1061	TWT

EEV Type	Section (see page 1)
N1062	TWT
N1063	TWT
N1064	TWT
N4001	TWT
N4003	TWT
N4004	TWT
N4006	TWT
N4021	TWT
N4041	TWT
N4047	TWT
N4051	TWT
N4074	See N1056 (TWT)
N4075	See N1056 (TWT)
N4085	See N1055 (TWT)
N4094	See N1055 (TWT)
N4115	See N1061 (TWT)
NFT1	OP
NFT2	OP
NFT3	OP
NFT4	OP
NFT5	OP
Ozotrons H,J	OP
P810	TCT
P829A,D	INT
P831	TCT
P833A,D	INT
P836A,D	INT
P844	TCT
P845A,D	INT
P848	TCT
P849	TCT
P860	TCT
P863	TCT
P865	TCT
P874	TCT
P875	TCT
P4046	INT
P4071	INT

EEV Type	Section (see page 1)
P4095	INT
QS75/20	CCT
QS75/60	CCT
QS92/10	CCT
QS95/10	CCT
QS108/45	CCT
QS150/15	CCT
QS150/45	CCT
QS1200	CCT
QS1202	CCT
QS1203	CCT
QS1209/5651	CCT
QS1212	CCT
QS1213	CCT
QS1215	CCT
T921	CRT
T922	CRT
T940B,G,R,W	CRT
T953S,Y,Z	CRT
T954S,T,Y	CRT
T957Y,Z	CRT
T958Z	CRT
T960W	CRT
T963D,Y,Z	CRT
T964Y,Z	CRT
T965Y,Z	CRT
T970D,Y,Z	CRT
T974Y,Z	CRT
T975D,S,Y	CRT
T977D,Y,Z	CRT
T979H,N,X	CRT
T980H,N,X	CRT
T982D,Y,Z	CRT
T983Z	CRT
T986D,Y,Z	CRT
U30/15/20	VC
U50/15/30	VC
U50/20/40	VC
U60/30/75	VC
U75/15/40	VC
U80/15/40	VC
U100/20/40	VC
U100/25/75	VC

EEV Type	Section (see page 1)
U150/15/40	VC
U150/25/75	VC
U200/8/20	VC
U200/10/40	VC
U200/15/40	VC
U200/20/75	VC
U300/10/40	VC
U300/15/40	VC
U300/20/75	VC
U400/10/40	VC
U500/5/40J	VC
U500/10/40	VC
U500/10/40A	VC
U500/15/75	VC
U600/8/40	VC
U750/5–20/40	VC
U750/5–20/40J	VC
U750/10/40	VC
U750/10/75J	VC
U750/15/75	VC
U1000/3/40	VC
U1000/3/40A	VC
U1000/10/75J	VC
U1000A/3/40J	VC
U1000A/3/40JA	VC
U1000A/3/40JB	VC
U1000A/10/75J	VC
U1000B/10/75	VC
U1000B/10/75A	VC
U1200/10/75J	VC
U1500/8/75	VC
U2000/3/40	VC

EEV Type	Section (see page 1)
U2000/3/40A	VC
U2000/3/40B	VC
U2000/8/75J	VC
U2000A/8/75	VC
U2000A/8/75A	VC
U3000/3/40J	VC
UC250/30/150J	VC
UC450/30/150J	VC
UC650/30/150J	VC
UC1000/10/125J	VC
UC1000/15/150J	VC
UC2000/12/150J	VC
UC2300/10/125J	VC
UF6/15/7	VC
UF10/15/7J	VC
UF800/3/50J	VC
UF900/3/50J	VC
UFC6/30/140J	VC
UFC12/30/140J	VC
UFC18/30/140J	VC
UFC34/30/140J	VC
XL601	CCT
XL602	CCT
XL607	OP
XL609	OP
XL612	OP
XL614	OP
XL615 Series	OP
ZD100365	IGN
ZD100551	IGN
ZD100552	IGN

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