BRIMAR

DESIGN DATA HANDBOOK

U.K. EDITION

Volume 2

EUROPEAN TYPES

TYPES STARTING WITH LETTERS

Receiving & Industrial Valves
Special Quality Valves
Teletubes

No Data Service is provided for this Handbook

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Head Office, Publicity Department and

SALES DEPARTMENTS

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BRIMAR

DESIGN DATA HANDBOOK

U.K. EDITION

Volume 1	American type valves	*VALVES and TELETUBES*
Volume 2	European type valves Teletubes	
Volume 3	General Information Phosphor Screens Graticules, Gauges Bases, Caps Oscilloscope tubes	*INDUSTRIAL CATHODE RAY TUBES*
Volume 4	Radar tubes Data Display and Monitor tubes Miscellaneous tubes Maintenance types	

Volumes 1 and 2 or Volumes 3 and 4 are sold as separate pairs, but single volumes are not available

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1972 CLASSIFICATION: VOLUME 2

The 1972 Classification List is given below indicating whether types are current (C) or maintenance (M). The list may also be used to check the contents and filing order of the data sheets in volume 2. Some maintenance valve types are given in the Abridged Data tables at the end of the valve section in Volume 2 and such types are marked with an asterisk in the Cross Reference Index.

DY86/DY87 (C)
DY802 (C)
E88CC (M)
EABC80 (M)
EBF89 (M)
ECC85 (M)
ECC88 (C)
ECC804 (M)
ECC807 (M)
ECF80 (M)
ECF82 (M)
ECF804 (M)
ECH81 (M)
ECH84 (M)
ECL82 (M)
ECL84 (M)
ECL86 (C)
EF80 (M)
EF85 (M)
EF86 (M)
EF183 (C)
EF184 (C)
EH90 (M)
EL34 (M)
EL84 (C)
EL506 (M)
EM87 (M)
EY83 (M)
EY86/EY87 (M)
EZ80 (M)
EZ81 (M)
GZ34 (M)
HY90 (M)

PC86 (M)
PC88 (M)
PC97 (C)
PC900 (M)
PCC84 (M)
PCC89 (M)
PCC189 (M)
PCE82 (M)
PCF80 (C)
PCF82 (M)
PCF86 (M)
PCF801 (M)
PCF802 (M)
PCF805 (C)
PCF806 (M)
PCL82 (C)
PCL83 (M)
PCL84 (C)
PCL86 (C)
PCL805/PCL85 (C)
PFL200 (C)
PL36 (C)
PL81 (M)
PL81A (C)
PL83 (M)
PL84 (M)
PL302 (C)
PL500 (M)
PL504 (C)
PY33 (M)
PY83 (M)
PY88 (C)
PY800 (C)

PY801 (C)
R20 (M)
UABC80 (M)
UBF89 (M)
UCC85 (M)
UCH81 (M)
UCL82 (M)
UCL83 (M)
UF89 (M)
UL84 (C)
UY85 (C)
VR75/30(M)
VR105/30 (M)
VR150/30 (M)

Teletubes

A47-13W (M)
A47-25W (M)
A59-13W (M)
A59-25W (M)
AW47-91 (M)
C17AA (M)
C17AF (M)
C17SM (M)
C19AH (M)
C19AK/AW47-90(M)
C21AA (M)
C21AF (M)
C23AK/AW59-90(M)

USE OF THE CROSS REFERENCE INDEX

This index has two functions: -

(1) to locate data within the volumes and sections of the Design Data Handbook. These are indicated by a figure and letter code in the columns headed "Vol. & Section". The code is as follows:

VOLUME 1	1V	RECEIVING AND INDUSTRIAL VALVES SECTION
	1S	SPECIAL QUALITY VALVES SECTION
	1T	CURRENT TELETUBES SECTION
VOLUME 2	2V	MAINTENANCE VALVES SECTION
	2S	MAINTENANCE SPECIAL QUALITY VALVES SECTION
	2T	MAINTENANCE TELETUBES SECTION

(2) to give a complete cross reference between CV, Pro Electron, American and Brimar type numbers.

The cross reference index should be used to find the filing number when searching for data on types having CV, Pro Electron and American type numbers.

Index	Vol. & Section	Filed under Type No.	Equivalent Types	
0A2	2V	0A2	CV1832	150C2
0A3	2V	VR75/30	CV3798	
0B2	2V	0B2	CV1833	108C1
0C3	2V	VR105/30	CV686	
0D3	2V	VR150/30	CV216	150C3
1AB6	2V*	DK96		
1AH5	2V*	DAF96		
1AJ4	2V*	DF96		
1BQ2	1V	DY802		
1R5	2V*	1R5	CV782	DK91
1S2	1V	DY86/87	DY86	
1S2A	1V	DY86/87	DY87	
1S5	2V*	1S5	CV784	DAF91
1T4	2V*	1T4	CV785	DF91
1X2B	2V*	R19	CV5427	
2D21	2V	2D21	CV797	EN91
2J2	2V	R20	KY80	
3C4	2V*	DL96		
3S4	2V*	3S4	CV484 CV2370	CV820 DL92
3V4	2V*	3V4	CV2983	DL94
4CM4	2V	PC86		
4DL4	2V	PC88		
4FY5	1V	PC97		
4HA5	2V	PC900		
5AR4	2V	GZ34	CV1377	
5R4GY	2V	5R4GY	CV717	
5U4G	2V	5U4G	CV575	GZ31
5V4G	2V	5V4G	CV729	
5Y3GT	2V*	5Y3GT	CV1856	
5Z4G	2V	5Z4G	CV1863	GZ30
6AB8	2V*	6AB8	ECL80	
6AJ8	2V	ECH81	CV2128	
6AK5	2V	6AK5	CV850	EF95
6AK6	2V	6AK6	CV1762	
6AK8	2V	EABC80		
6AL5	2V	6AL5	CV140	EB91
6AM4	2V	6AM4	CV5073	
6AM5	2V*	6AM5	CV136	EL91
6AM6	1V	6AM6	CV138 8D3	EF91

* Included in Abridged Characteristics sheets.

CROSS REFERENCE INDEX

Index	Vol. & Sec- tion	Filed under Type No.	Equivalent Types	
6AQ5	2V	6AQ5	CV1862	EL90
6AQ8	2V	ECC85		
6AS7G	2V	6AS7G		
6AT6	2V	6AT6	CV452	EBC90
6AU6	2V	6AU6	CV2524	EF94
6BA6	1V	6BA6	CV454	EF93
6BD7A	2V*	EBC81		
6BE6	2V	6BE6	CV453	EK90
6BH6	2V	6BH6	CV3908	
6BJ6	2V	6BJ6	CV3909	
6BK8	2V	EF86	CV2901	6267
6BM8	2V	ECL82		
6BQ5	1V	EL84	CV2975	
6BQ7A	2V	6BQ7A	CV5365	
6BR7	2V	6BR7	CV2135	
6BR8	2V	6BR8		
6BS7	2V	6BS7	CV5086	
6BW6	1V	6BW6	CV2136	
6BW7	2V	6BW7	CV5817	
6BX6	1V	EF80	CV1376	
6BY7	2V	EF85	CV1375	
6C4	2V	6C4	CV133	EC90
6CA4	2V	EZ81	CV5072	
6CA7	2V	EL34	CV1741	
6CD6G	2V	6CD6G	CV5729	
6CF8	2V	EF86	6267	
6CH6	2V	6CH6	CV2127	EL821
6CL6	2V	6CL6	CV5041	
6CS6	2V	EH90		
6CU7	2V*	ECH42	CV3888	
6CW7	2V	ECC84	CV5281	
6DA6	2V	EF89	CV5156	
6DC8	2V	EBF89		
6DJ8	1V	ECC88	CV5358	
6DX8	1V	ECL84		
6EH7	1V	EF183	CV5831	
6EJ7	1V	EF184	CV5810	
6ES8	2V	ECC189	CV5331	
6GA8	1V	ECC804	CV5264	
6GW8	1V	ECL86		
6HU6	1V	EM87		
6JX8	2V	ECH84		
6L6G	2V	6L6G	CV1947	
6L6GA	2V	6L6G	CV2817	
6N8	2V*	EBF80		

Index	Vol. & Sec- tion	Filed under Type No.	Equivalent Types	
6S2	1V	EY86/87	CV2966	EY86
6S2A	1V	EY86/87	EY87	
6SL7GT	2V*	6SL7GT	CV1985	
6SN7GT	2V*	6SN7GT	CV1988	ECC32
6U8	2V	ECF82	CV5065	
6V4	2V	EZ80	CV1535	
6V6G	2V*	6V6G	CV509	
6V6GT	2V	6V6GT	CV511	
6X2	2V*	R12	CV426	EY51
6X4	2V	6X4	CV493	EZ90
6X5GT	2V*	6X5GT	CV574	EZ35
7AN7	2V	PCC84	CV5192	
7B7	2V*	7B7	CV522	
7ES8	2V	PCC189		
7FC7	2V	PCC89		
7GV7	1V	PCF805		
7S7	2V*	7S7		
8D3	1V	6AM6	CV138	EF91
8D8	2V	8D8		
8GJ7	2V	PCF801		
8HG8	2V	PCF86		
9A8	1V	PCF80		
9JW8	2V	PCF802		
9U8	2V	PCF82		
12AE6	2V	12AE6		
12AT6	2V	12AT6	HBC90	
12AT7	1V	12AT7	CV455	ECC81
12AU7	1V	12AU7	CV491	ECC82
12AX7	1V	12AX7	CV492	ECC83
12BA6	2V	12BA6	CV1928	HF93
12BH7	2V	12BH7	CV5042	
13D3	2V	13D3	CV2212	
13D8	2V	13D8		
13D9	2V	13D9		
14GW8	1V	PCL86		
15A6	2V	PL83		
15CW5	2V	PL84		
15DQ8	1V	PCL84		
16A5	2V*	PL82		
16A8	1V	PCL82		
16Y9	1V	PFL200		
17CVP4	2T	C17AA	AW43-88	
17Z3	1V	PY800	PY81	
18D3	2V	ECF804	CV5948	
18GV8	1V	PCL805	PCL85	

* Included in Abridged Characteristics sheets.

Index	Vol. & Section	Filed under Type No.	Equivalent Types	
19D8	2V	UCH81		
19FL8	2V	UBF89		
19Y3	2V*	PY82		
21A6	2V	PL81	CV5077	
23DGP4	2T	A59-13W	C23/10AP	
23DHP4	2T	A59-13W	C23/10AP	
25E5	1V	PL36		
27GB5	2V	PL500		
30AE3	1V	PY88		
35L6GT	2V*	35L6GT	CV562	
35W4	2V	35W4	HY90	
38A3	1V	UY85		
45B5	1V	UL84		
50BM8	2V	UCL82		
50CD6G	2V*	50CD6G		
108C1	2V	0B2	CV1833	
150C2	2V	0A2	CV1832	
150C3	2V	VR150/30	CV216	0D3
807	2V	807	CV124	
5726	2S	5726	CV4007	M8212
5749	2S	5749	CV4009	
5750	2S	5750	CV4012	
5763	1V	5763	CV2129	
5965	2S	5965	CV5843	
6057	2S	6057	CV4004	M8137
6058	2S	6058	CV4025	M8079
6059	2S	6059	CV4006	
6060	2S	6060	CV4024	M8162
6061	2S	6061	CV4043	
6062	1S	6062	CV4039	M8096
6064	1S	6064	CV4014	M8083
6065	2S	6065	CV4015	M8161
6067	2S	6067	CV4003	M8136
6080	2V	6080	CV2984	ECC230
6100	2S	6100	CV4058	M8080
6132	2S	6132	CV4055	
6146	1V	6146	CV3523	
6158	2S	6158	CV4068	
6267	2V	EF86		
6870	2S	6870	CV5121	
6922	1S	E88CC	ÇV2492	
A47-13W	2T	A47-13W	C19/10AP	
A47-25W	2T	A47-25W		
A59-13W	2T	A59-13W	C23/10AP	23DGP4
			23DHP4	A59-16W

Index	Vol. & Section	Filed under Type No.	Equivalent Types	
A59-16W	2T	A59-13W		
A59-25W	1T	A59-25W		
AW43-80Z	2T	C17SM		
AW43-88	2T	C17AA	17CVP4	
AW47-90	2T	C19AK	C19/7A	
AW47-91	2T	AW47-91	C19/10A	
AW53-88	2T	C21AA	C21/7A	
AW59-90	2T	C23AK	C23/7A	
C17AA	2T	C17AA	AW43-88	17CVP4
C17AF	2T	C17AF		
C17SM	2T	C17SM	AW43-80Z	
C19/7A	2T	C19AK	AW47-90	
C19/10A	2T	AW47-91		
C19/10AP	2T	A47-13W		
C19AH	2T	C19AH		
C19AK	2T	C19AK	AW47-90	C19/7A
C21/7A	2T	C21AA	AW53-88	
C21AA	2T	C21AA	AW53-88	C21/7A
C21AF	2T	C21AF		
C23/7A	2T	C23AK	AW59-90	
C23/10AP	2T	A59-13W	23DGP4	23DHP4
C23AG	2T	C23AG		
C23AK	2T	C23AK	AW59-90	C23/7A
CV133	2V	6C4	EC90	
CV136	2V*	6AM5	EL91	
CV138	1V	6AM6	EF91	8D3
CV140	2V	6AL5	EB91	
CV452	2V	6AT6	EBC90	
CV454	1V	6BA6	EF93	
CV455	1V	12AT7	ECC81	
CV491	1V	12AU7	ECC82	
CV492	1V	12AX7	ECC83	
CV493	2V	6X4	EZ90	
CV511	2V	6V6GT		
CV717	2V	5R4GY		
CV729	2V	5V4G		
CV782	2V*	1R5	DK91	
CV850	2V	6AK5	EF95	
CV1376	1V	EF80	6BX6	
CV1535	2V	EZ80	6V4	
CV1762	2V	6AK6		
CV1856	2V*	5Y3GT		
CV1862	2V	6AQ5	EL90	
CV1863	2V	5Z4G	GZ30	
CV1947	2V	6L6G		

* Included in Abridged Characteristics sheets.

Index	Vol. & Section	Filed under Type No.	Equivalent Types	
CV1988	2V*	6SN7GT		
CV2127	2V	6CH6	EL821	
CV2129	1V	5763		
CV2135	2V	6BR7		
CV2136	1V	6BW6		
CV2212	2V	13D3		
CV2492	1S	E88CC	6922	
CV2524	2V	6AU6	EF94	
CV2966	1V	EY86/87	EY86	6S2
CV2975	1V	EL84	6BQ5	
CV3523	1V	6146		
CV3908	2V	6BH6		
CV3909	2V	6BJ6		
CV4002	1S	6064	F/6064	M8140
CV4003	2S	6067	M8136	
CV4004	2S	6057	M8137	
CV4006	2S	6059		
CV4007	2S	5726	M8212	
CV4009	2S	5749		
CV4012	2S	5750		
CV4014	1S	6064	M8083	
CV4024	2S	6060	M8162	
CV4025	2S	6058	M8079	
CV4033	2S	6060	F/6060	M8144
CV4034	2S	6067	F/6067	M8149
CV4035	2S	6057	F/6057	M8214
CV4039	1S	6062	M8096	
CV4043	2S	6061		
CV4045	2S	6061	F/6061	
CV4049	2S	5726	F/5726	M8237
CV4055	2S	6132		
CV4056	2S	6132	F/6132	
CV4058	2S	6100	M8080	
CV4068	2S	6158		
CV4069	2S	6158	F/6158	
CV5042	2V	12BH7		
CV5065	2V	ECF82	6U8	
CV5072	2V	EZ81	6CA4	
CV5073	2V	6AM4		
CV5086	2V	6BS7		
CV5121	2S	6870		
CV5215	2V	ECF80		
CV5264	1V	ECC804	6GA8	
CV5358	1V	ECC88	6DJ8	
CV5365	2V	6BQ7A		

Index	Vol. & Section	Filed under Type No.	Equivalent Types	
CV5810	1V	EF184	6EJ7	
CV5817	2V	6BW7		
CV5843	2S	5965		
CV5948	2V	ECF804	18D3	
DAF91	2V*	DAF91	CV784	1S5
DAF96	2V*	DAF96	1AH5	
DF91	2V*	DF91	CV785	1T4
DF96	2V*	DF96	1AJ4	
DK91	2V*	DK91	CV782	1R5
DK96	2V*	DK96	1AB6	
DL92	2V*	DL92	CV484	CV820
			CV2370	3S4
DL94	2V*	DL94	CV2983	3V4
DL96	2V*	DL96	3C4	
DY86	1V	DY86/87	1S2	
DY87	1V	DY86/87	1S2A	
DY802	1V	DY802	1BQ2	
E88CC	1S	E88CC	CV2492	6922
EABC80	2V	EABC80	6AK8	
EB91	2V	6AL5	CV140	
EBC81	2V*	EBC81	6BD7A	
EBC90	2V	6AT6	CV452	
EBF80	2V*	EBF80	6N8	
EBF89	2V	EBF89	6DC8	
EC90	2V	6C4	CV133	
ECC32	2V*	6SN7GT	CV181	
ECC81	1V	12AT7	CV455	
ECC82	1V	12AU7	CV491	
ECC83	1V	12AX7	CV492	
ECC84	2V	ECC84	CV5281	6CW7
ECC85	2V	ECC85	6AQ8	
ECC88	1V	ECC88	CV5358	6DJ8
ECC189	2V	ECC189	CV5331	6ES8
ECC230	2V	6080	CV2984	
ECC804	1V	ECC804	CV5264	6GA8
ECC807	1V	ECC807		
ECF80	2V	ECF80	CV5215	
ECF82	2V	ECF82	CV5065	6U8
ECF804	2V	ECF804	CV5948	18D3
ECH42	2V*	ECH42	CV3888	6CU7
ECH81	2V	ECH81	CV2128	6AJ8
ECH84	2V	ECH84	6JX8	
ECL80	2V*	ECL80	6AB8	
ECL82	2V	ECL82	6BM8	
ECL84	1V	ECL84	6DX8	

* Included in Abridged Characteristics sheets.

Index	Vol. & Section	Filed under Type No.	Equivalent Types	
ECL86	1V	ECL86	6GW8	
EF80	1V	EF80	CV1376	6BX6
EF85	2V	EF85	CV1375	6BY7
EF86	2V	EF86	6CF8	6267
EF89	2V	EF89	CV5156	6DA6
EF91	1V	6AM6	CV138	8D3
EF93	1V	6BA6	CV454	
EF94	2V	6AU6	CV2524	
EF95	2V	6AK5	CV850	
EF183	1V	EF183	CV5831	6EH7
EF184	1V	EF184	CV5810	6EJ7
EH90	2V	EH90	6CS6	
EK90	2V	6BE6	CV453	
EL34	2V	EL34	CV1741	6CA7
EL84	1V	EL84	CV2975	6BQ5
EL90	2V	6AQ5	CV1862	
EL91	2V*	6AM5	CV136	
EL506	1V	EL506		
EL821	2V	6CH6	CV2127	
EM87	1V	EM87	6HU6	
EN91	2V	2D21	CV797	
EY51	2V*	EY51	CV426	6X2
			R12	
EY83	2V	EY83		
EY86	1V	EY86/87	CV2966	6S2
EY87	1V	EY86/87	6S2A	
EZ35	2V*	EZ35	CV574	6X5GT
EZ80	2V	EZ80	CV1535	6V4
EZ81	2V	EZ81	CV5072	6CA4
EZ90	2V	6X4	CV493	
F/5726	2S	5726	CV4049	M8237
F/6057	2S	6057	CV4035	M8214
F/6060	2S	6060	CV4033	M8144
F/6061	2S	6061	CV4045	
F/6062	1S	6062		
F/6064	1S	6064	CV4002	M8140
F/6067	2S	6067	CV4034	M8149
F/6132	2S	6132	CV4056	
F/6158	2S	6158	CV4069	
GZ30	2V	5Z4G	CV1863	
GZ31	2V	5U4G	CV575	
GZ34	2V	GZ34	CV1377	5AR4
HBC90	2V	12AT6		
HF93	2V	12BA6	CV1928	
HY90	2V	HY90		

Index	Vol. & Section	Filed under Type No.	Equivalent Types	
KY80	2V	R20	2J2	
M8079	2S	6058	CV4025	
M8080	2S	6100	CV4058	
M8083	1S	6064	CV4014	
M8096	1S	6062	CV4039	
M8136	2S	6067	CV4003	
M8137	2S	6057	CV4004	
M8140	1S	6064	CV4002	F/6064
M8144	2S	6060	CV4033	F/6060
M8149	2S	6067	CV4034	F/6067
M8161	2S	6065	CV4015	
M8162	2S	6060	CV4024	
M8212	2S	5726	CV4007	
M8214	2S	6057	CV4035	F/6057
M8237	2S	5726	CV4049	F/5726
PC86	2V	PC86	4CM4	
PC88	2V	PC88	4DL4	
PC97	1V	PC97	4FY5	
PC900	2V	PC900	4HA5	
PCC84	2V	PCC84	CV5192	7AN7
PCC89	2V	PCC89	7FC7	
PCC189	2V	PCC189	7ES8	
PCE82	2V	PCE82		
PCF80	1V	PCF80	9A8	
PCF82	2V	PCF82	9U8	
PCF86	2V	PCF86	8HG8	
PCF801	2V	PCF801	8GJ7	
PCF802	2V	PCF802	9JW8	
PCF805	1V	PCF805	7GV7	
PCF806	2V	PCF806		
PCL82	1V	PCL82	16A8	
PCL83	2V	PCL83	CV5144	
PCL84	1V	PCL84	15DQ8	
PCL85	1V	PCL805	18GV8	
PCL86	1V	PCL86	14GW8	
PCL805	1V	PCL805		
PFL200	1V	PFL200	16Y9	
PL36	1V	PL36	25E5	
PL81	2V	PL81	CV5077	21A6
PL81A	1V	PL81A		
PL82	2V*	PL82	16A5	
PL83	2V	PL83	15A6	
PL84	2V	PL84	15CW5	
PL302	1V	PL302		
PL500	2V	PL500	27GB5	

* Included in Abridged Characteristics sheets.

Index	Vol. & Section	Filed under Type No.	Equivalent Types	
PL504	1V	PL504		
PY32	2V*	PY32		
PY33	2V	PY33		
PY81	1V	PY800	17Z3	
PY82	2V*	PY82	19Y3	
PY83	2V	PY83		
PY88	1V	PY88	30AE3	
PY800	1V	PY800		
PY801	1V	PY801		
R12	2V*	R12	CV426 6X2	EY51
R19	2V*	R19	CV5427	1X2B
R20	2V	R20	KY80	2J2
UABC80	2V	UABC80		
UBC81	2V*	UBC81		
UBF89	2V	UBF89	19FL8	
UCC85	2V	UCC85		
UCH81	2V	UCH81	19D8	
UCL82	2V	UCL82	50BM8	
UCL83	2V	UCL83		
UF89	2V	UF89		
UL84	1V	UL84	45B5	
UY85	1V	UY85	38A3	
VR75/30	2V	VR75/30	CV3798	0A3
VR105/30	2V	VR105/30	CV686	0C3
VR150/30	2V	VR150/30	CV216	0D3

* Included in Abridged Characteristics sheets.

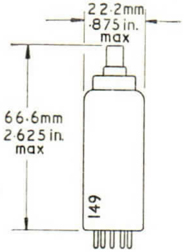
Note:

This information is supplied for the convenience of customers but no guarantee is intended as regards the degree of equivalence of secondary parameters.

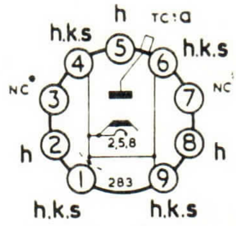
BRIMAR

VALVES

DY86
DY87



HIGH VOLTAGE RECTIFIERS



B9A Base, CT1 Cap

GENERAL

These high voltage half-wave rectifiers are for use in television receivers employing line flyback EHT. The DY87 is electrically identical to the DY86 but has a chemically treated envelope which avoids flash-over under conditions of high humidity and low atmospheric pressure (45 cm.Hg.).

Heater Voltage	V_h	1·4	V
Heater Current	I_h	0·55	A

DESIGN CENTRE RATINGS

(The following ratings refer to normal television flyback EHT operation.)

Maximum Peak Inverse Voltage	$P.I.V_{max}$	22†	kV
Maximum Peak Anode Current	$i_{a(pk)max}$	40‡	mA
Maximum D.C. Anode Current	$I_{out(max)}$	0·5	mA

† The measured PIV must take into account the fact that during the scanning stroke, the anode of the EHT rectifier is at a potential negative with respect to chassis by an amount depending upon the transformer turns ratio. In addition, there is a damped leakage reactance oscillation assumed in the rating to have a peak to peak value not less than 10 per cent of the total PIV.

‡ Maximum duration 10 per cent of a line scanning cycle with a maximum of 10 μs.

INTER-ELECTRODE CAPACITANCE§

Anode to Heater, Cathode and Shield	$c_{a-h,k,s}$	1·55	pF

§ In fully shielded socket, without can (I.E.C. Publication 100).

Notes

X-ray shielding is advisable to give protection against possible danger of personal injury arising from prolonged exposure at close range to this valve whilst it is in use at a PIV in excess of 16 kV design centre.

Precautions must be taken to prevent corona discharge from the connections to this valve by ensuring that no sharp points or bends occur in the wiring and adequate spacing must be left between the valve and surrounding components.

* Pins 3 and 7 may be connected to points in the heater circuit only and must not be earthed. No low potential circuits should be connected to any base pins.

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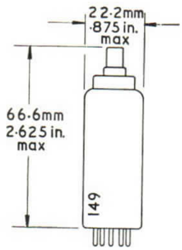
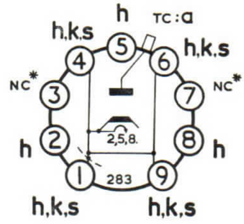


HIGH VOLTAGE RECTIFIER



B9A Base, CT1 Cap

GENERAL

This high voltage half-wave rectifier is for use in television receivers employing line flyback E.H.T.

Heater Voltage	V_h	1·4†	V
Heater Current	I_h	0·6	A

† Heater voltage tolerances: $I_{out} < 200\mu A$, $\pm$ 15%; $I_{out} > 200\mu A$, $\pm$ 7%.

DESIGN CENTRE RATINGS

(The following ratings refer to normal television flyback E.H.T. operation.)

Maximum Inverse Voltage	$V_{inv(max)}$	20‡	kV
Maximum Peak Inverse Voltage	P.I.V.$_{max}$	25§	kV
Maximum Peak Inverse Voltage (Absolute maximum)	P.I.V.$_{max}$	30§	kV
Maximum Peak Anode Current	$i_{a(pk)max}$	50	mA
Maximum D.C. Anode Current	$I_{out(max)}$	0·5‖	mA
Maximum Reservoir Capacitor	C_{max}	3000	pF

‡ D.C. component.

§ Maximum duration 22% of a line scanning cycle with a maximum of 18μs. The negative peak anode voltage due to ringing in the line output transformer must be taken into account.

‖ During short periods as in T.V. operation, $I_{out(max)} = 800\mu A$.

INTER-ELECTRODE CAPACITANCE¶

Anode to Heater, Cathode and Shield	$c_{a-h,k,s}$	1·0	pF

¶ In fully shielded socket, without can (I.E.C. Publication 100).

OPERATING CHARACTERISTICS

Output Current	I_{out}	200	μA
Output Voltage	V_{out}	20	kV

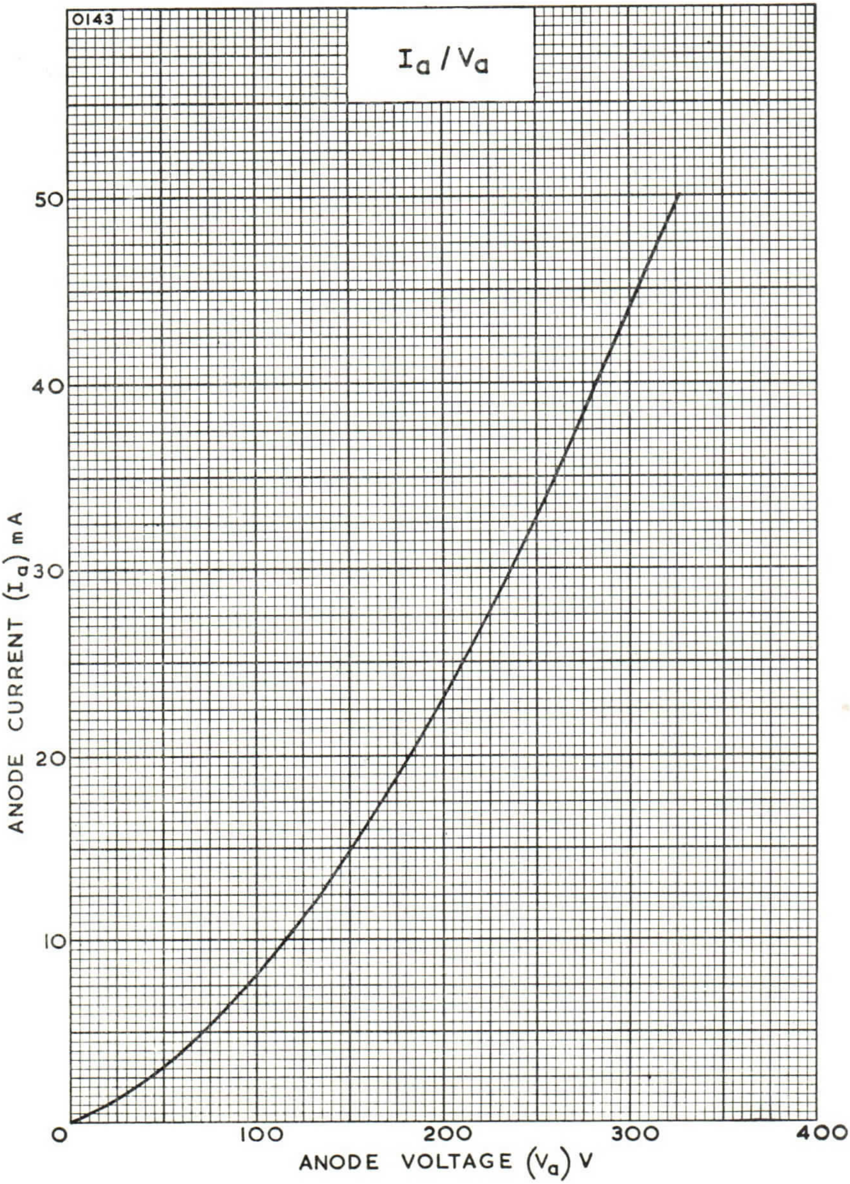
Notes

X-ray shielding is advisable to give protection against possible danger of personal injury arising from prolonged exposure at close range to this valve whilst it is in use at a P.I.V. in excess of 16 kV design centre.

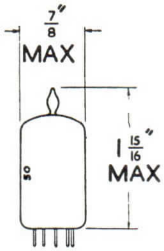
Precautions must be taken to prevent corona discharge from the connections to this valve by ensuring that no sharp points or bends occur in the wiring and adequate spacing must be left between the valve and surrounding components.

* Pins 3 and 7 may be connected to points in the heater circuit only and must not be earthed. No low potential circuits should be connected to any base pins.

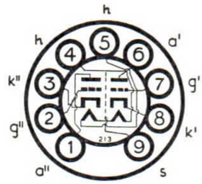
Pins 1, 4, 6 and 9 may be used for fixing an anti-corona shield.


0143
I_a / V_a
ANODE CURRENT (I_a) mA
50
40
30
20
10
0
100
200
300
400
ANODE VOLTAGE (V_a) V

BRIMAR VALVES



TYPE **E88CC**
LONG LIFE
MINIATURE
DOUBLE TRIODE



The BRIMAR E88CC is a miniature double triode featuring a high mutual conductance and low drift of characteristics over long periods of operation.

RATINGS

Heater Voltage ...	6.3	volts
Heater Current ...	0.3	amp.
Max. Anode Voltage (Ia = 0) ...	400	volts
Max. Anode Voltage (Pa = 1.5 W) ...	220	volts
Max. Anode Dissipation (each section) ...	1.5	watts
Max. Total Anode Dissipation ...	3.0	watts
Max. Grid Dissipation ...	30	milliwatts
Max. Grid Circuit Resistance ...	1.0	MΩ
Max. Negative Anode Voltage ...	100	volts
*Max. Peak Negative Grid Voltage ...	200	volts
Max. Cathode Current ...	20	mA
*Max. Peak Cathode Current ...	100	mA
Max. Heater-Cathode Voltage (k + ve) ...	120	volts
Max. Heater-Cathode Voltage (k − ve) ...	60	volts
Max. Bulb Temperature ...	170	°C

**Max. duty cycle = 10%; max. pulse duration 200μ secs.*

OPERATING CHARACTERISTICS

Vh = 6.3 V, Va(b) = 100 V, Vg = + 9 V, Rk = 680 ohms, Ck = 1,000 μF

	Min.	Bogey	Max.	
Anode Current ...	14.2	15.0	15.8	mA
Mutual Conductance ...	10.5	12.5	15	mA/V
Amplification Factor ...		33		
Anode Impedance ...		2.65		kΩ

COMPUTER OPERATION

Anode Supply Voltage ...	150	volts
Anode Load Resistor ...	2.5	kΩ
Grid Supply Voltage ...	150	volts
Grid Resistor ...	300	kΩ
*Anode Current ...	33 ± 5	mA
Grid Voltage for Ia = 100 μA ...	−7.0±1.5	V
Difference in cut-off voltage (between sections) ...	<2	volts

** This condition is not suitable for continuous operation as the cathode current rating is exceeded.*

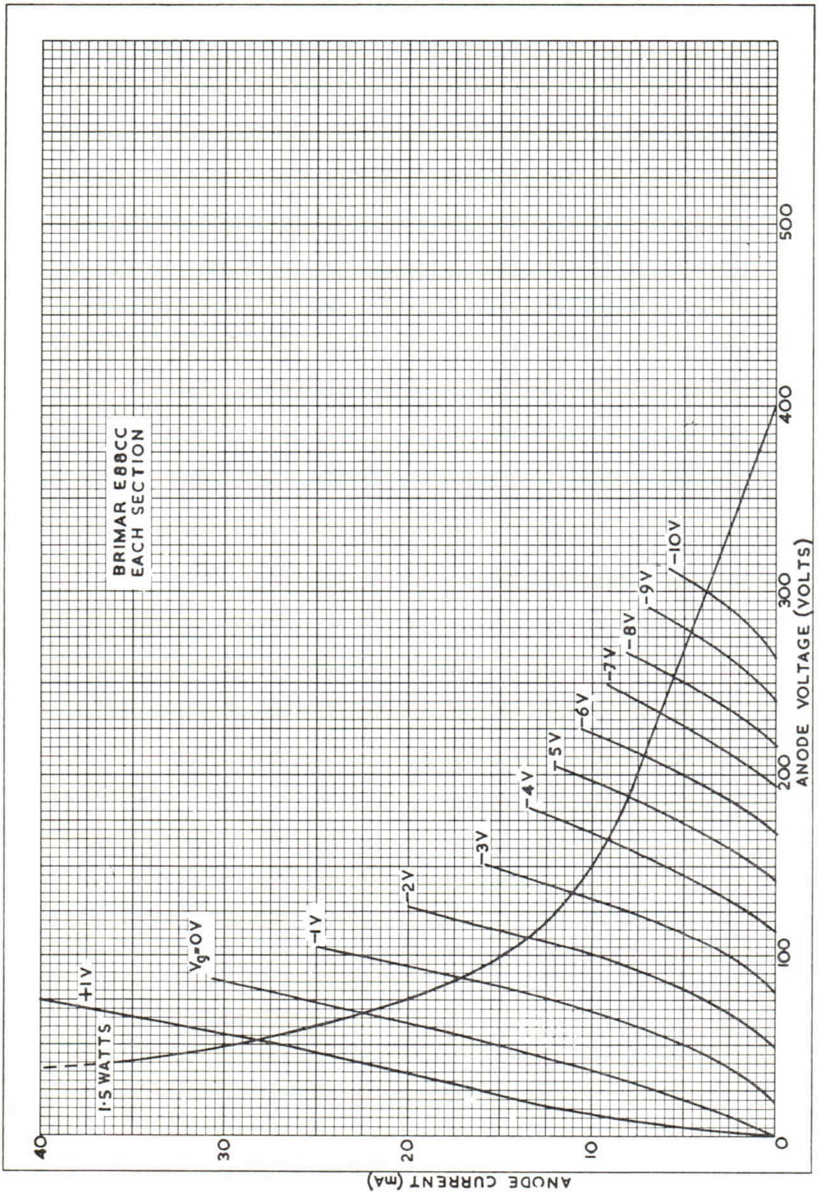
INTER-ELECTRODE CAPACITANCES*

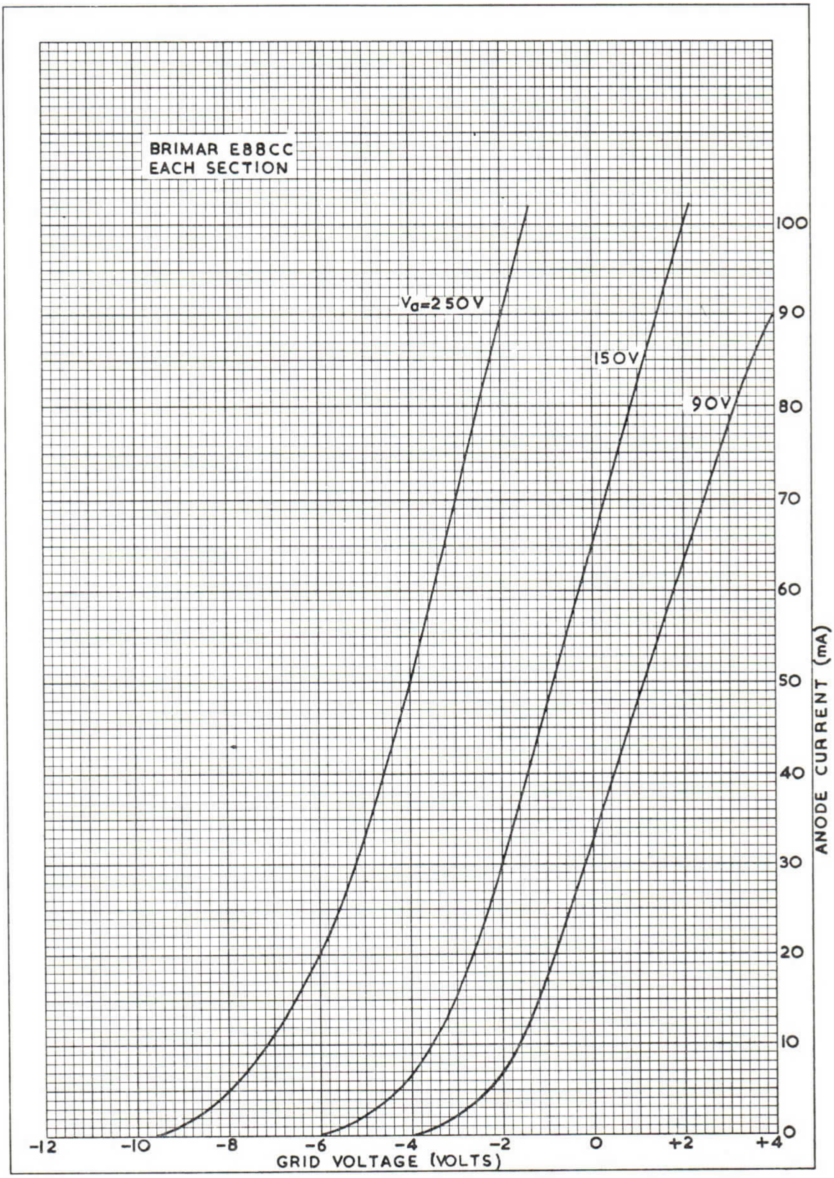
Ca′ − g′; Ca″ − g″ ...	1.4 ± 0.2	pF
Ca′ − k′; Ca″ − k″ ...	0.18 ± 0.05	pF
Ca′ − s; Ca″ − s ...	1.3 ± 0.2	pF
Cg′ − k′ + h; Cg″ − k″ + h ...	3.3 ± 0.6	pF
Ca′ − k′ + h + s ...	1.75 ± 0.2	pF
Ca″ − k″ + h + s ...	1.65 ± 0.2	pF
Ck′ − h ...	2.6	pF
Ck″ − h ...	2.7	pF

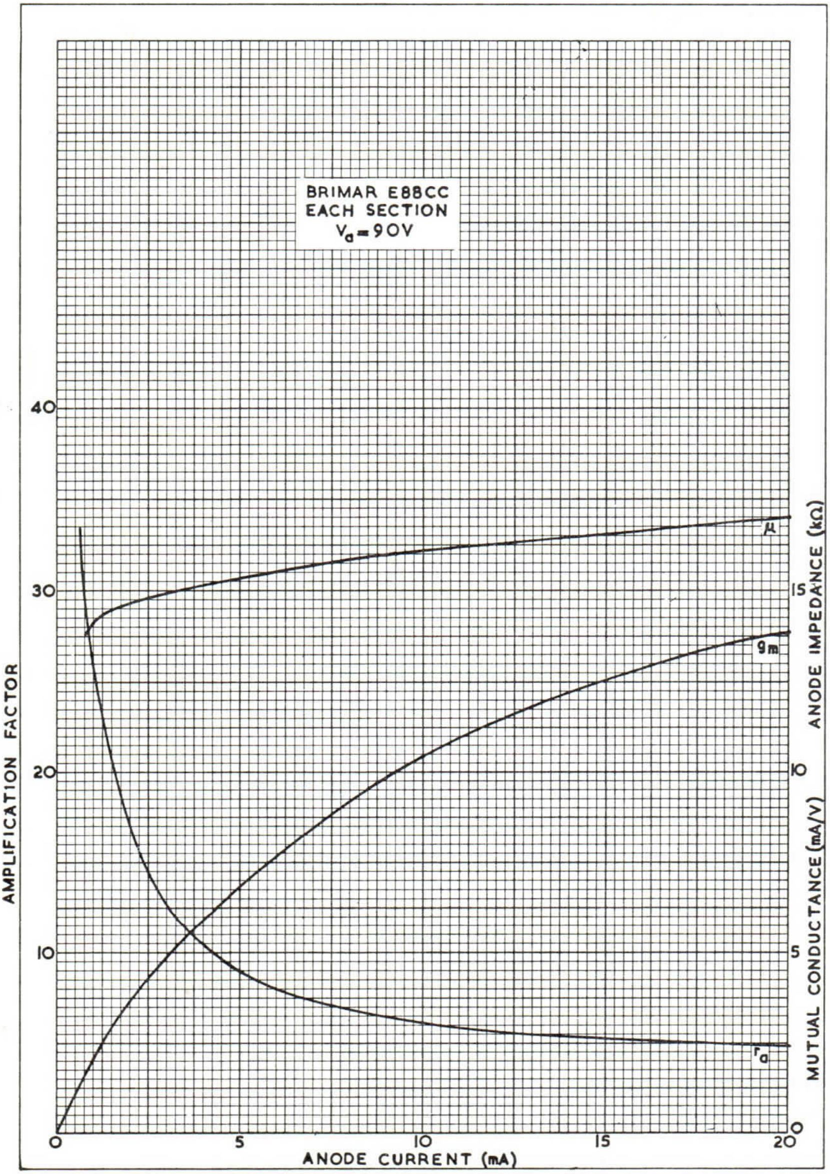
**With external shield*

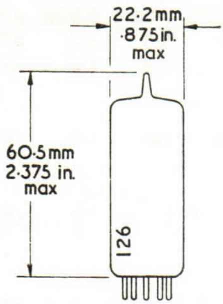
VALVES

BRIMAR

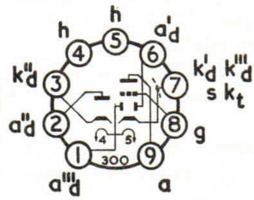



BRIMAR E88CC
EACH SECTION
Va=250V
150V
90V
100
90
80
70
60
50
40
30
20
10
0
ANODE CURRENT (mA)
-12
-10
-8
-6
-4
-2
0
+2
+4
GRID VOLTAGE (VOLTS)


BRIMAR E88CC
EACH SECTION
$V_a = 90V$
AMPLIFICATION FACTOR
ANODE IMPEDANCE (kΩ)
MUTUAL CONDUCTANCE (mA/V)
ANODE CURRENT (mA)
μ
gm
r_a
0
5
10
15
20
30
40



TRIPLE DIODE TRIODE



B9A Base

GENERAL

This triple diode triode is intended for use in FM and AM/FM, AC mains receivers. The first diode is for AM detection with the second and third diodes designed for use as the FM ratio detector. The high μ triode is for audio amplification.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·45	A

RATINGS

Maximum Triode Anode Dissipation	$p_{a(max)}$	1	W
Maximum Triode Anode Voltage	$V_{a(max)}$	300	V
Maximum Triode Heater to Cathode Voltage (d.c.)	$V_{h\text{-}kt(max)}$	150	V
Maximum Peak Inverse Voltage (All diodes)	$PIV_{(max)}$	350	V
Maximum Triode Cathode Current	$I_{kt(max)}$	5	mA
Maximum Anode Current. Diode 1	$I_{a'd(max)}$	1	mA
Maximum Anode Current. Diode 2	$I_{a''d(max)}$	10	mA
Maximum Anode Current. Diode 3	$I_{a'''d(max)}$	10	mA
Ratio Anode Resistance ($\delta v_a/\delta i_a$) Diode 2 to Diode 3		0·65 to 1·5	

INTER-ELECTRODE CAPACITANCES

		†	‡	§	
Grid to Earth	$c_{g\text{-}E}$	1·9	2·2	3·0	pF
Anode Triode to Earth	$c_{a\text{-}E}$	1·4	1·9	2·6	pF
Anode Triode to Grid	$c_{a\text{-}g}$	2·0	2·1	2·4	pF
Anode Triode to Anode Diode 1	$c_{a\text{-}a'd}$	0·08	0·09	0·10	pF
Anode Triode to Anode Diode 3	$c_{a\text{-}a'''d}$	0·05	0·11	0·22	pF
Anode Triode to Cathode Diode 2	$c_{a\text{-}k''d}$	0·006	0·011	0·016	pF
Grid to Anode Diode 1	$c_{g\text{-}a'd}$	0·06	0·07	0·10	pF
Grid to Anode Diode 3	$c_{g\text{-}a'''d}$	0·012	0·021	0·035	pF

Inter-electrode Capacitances (continued overleaf)

THORN — AEI RADIO VALVES & TUBES LTD.

		†	‡	§	
Grid to Cathode Diode 2	$c_{g\text{-}k''d}$	0·0025	0·0044	0·0066	pF
Cathode Diode 2 to All	$c_{k''d\text{-}all}$	4·9	5·3	6·4	pF
Anode Diode 3 to All	$c_{a'''d\text{-}all}$	5·1	5·6	6·6	pF
Anode Diode 1 to Heater, Cathodes Triode, Diode 1, Diode 3 and Shield	$c_{a'd\text{-}h,kt,k'd,k'''d,s}$	0·8	1·1	1·7	pF
Anode Diode 2 to Heater, Cathodes Diode 2, Triode, Diode 1, Diode 3 and Shield	$c_{a''d\text{-}h,k''d,kt,k'd,k'''d,s}$	4·8	5·0	5·4	pF

† In fully shielded socket without can.

‡ With holder capacity balanced out (Holder as below).

§ Total capacity including B9A nylon phenolic holder without skirt or radial shield (AEI holder type VH19/902).

"Earth" denotes the electrodes of any second valve section and the remaining earthy potential electrodes of the section under measurement, heater and shields joined to cathode.

TRIODE CHARACTERISTICS

Anode Voltage	V_a	100	V
Anode Current	I_a	0·8	mA
Grid Voltage	V_g	−1	V
Amplification Factor	μ	70	
Mutual Conductance	g_m	1·45	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	48	kΩ

TYPICAL OPERATION AS RESISTANCE COUPLED AMPLIFIER

(Grid current bias)

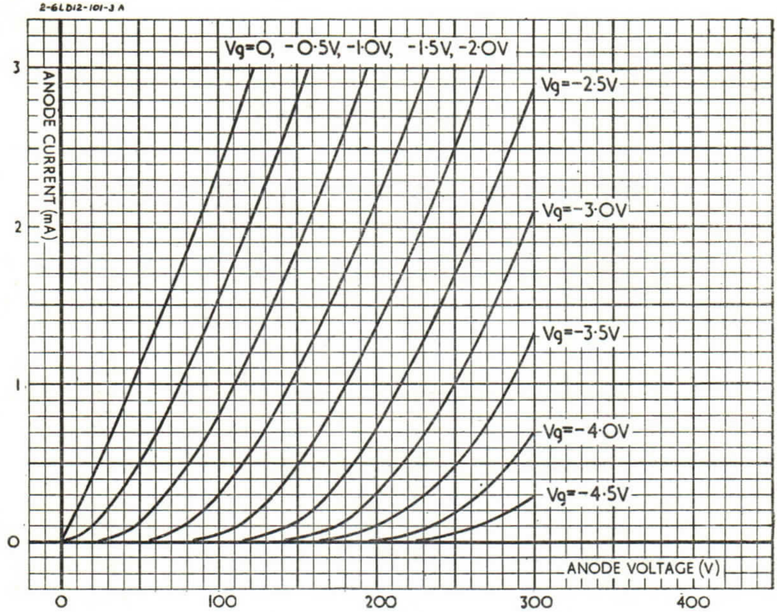
Supply Voltage	V_b	170	170	170	200	200	200	V
Anode Load Resistance	R_a	47	100	220	47	100	220	kΩ
Grid Resistor	R_g	10	10	10	10	10	10	MΩ
Anode Current	I_a	1·25	0·82	0·46	1·6	1·0	0·56	mA
Grid Resistor of Following Valve		150	330	680	150	330	680	kΩ
Voltage Amplification		32	42	51	34	44	53	
Total Distortion	D_{tot}							
for $V_{out\ (r.m.s.)} = 3V$		0·6	0·5	0·4	0·5	0·4	0·3	%
for $V_{out\ (r.m.s.)} = 5V$		1·1	0·8	0·5	0·9	0·6	0·4	%
for $V_{out\ (r.m.s.)} = 8V$		2·0	1·3	1·1	1·5	1·0	0·9	%

MOUNTING POSITION—Unrestricted.

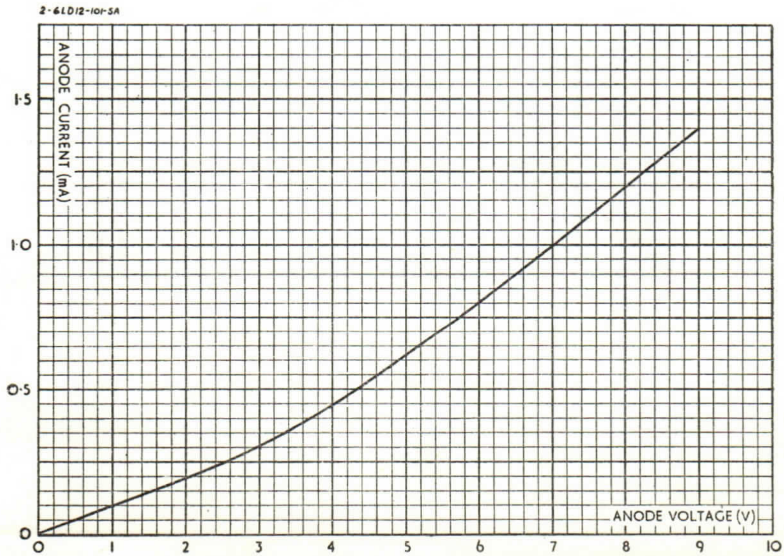
APPROXIMATE WEIGHT

Net	0·5 oz
Packed	0·75 oz

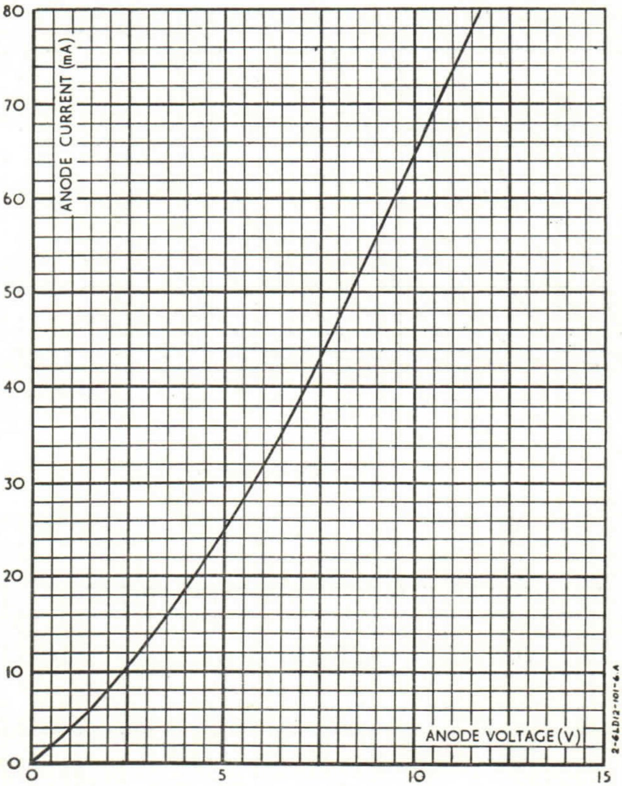
I_a/V_a : Triode Section

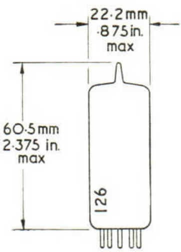


I_a/V_a : Diode Section 1

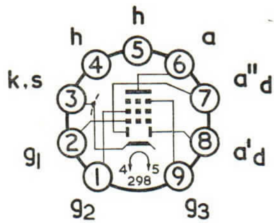


I_a/V_a : Diode Section 2 or 3





DOUBLE DIODE VARIABLE-MU R.F. PENTODE



B9A Base

GENERAL

This double diode variable-mu R.F. pentode is intended for use with the pentode as an R.F. Amplifier or I.F. Amplifier and the diode sections only for A.M. detection.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·3	A

RATINGS

Pentode Section			
Maximum Anode Dissipation	$P_{a(max)}$	2·25	W
Maximum Screen Grid Dissipation	$P_{g2(max)}$	0·45	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	V
Maximum Anode Voltage	$V_{a(max)}$	300*	V
Maximum Screen Grid Supply Voltage	$V_{g2(b)max}$	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$		
$I_a < 4$mA		300*	V
$I_a > 8$mA		125	V
Maximum Negative Control Grid Voltage ($I_{g1}=0·3\mu$A)	$-V_{g1(Ig1=0·3\mu A)}$	1·3	V
Maximum Heater to Cathode Voltage	$V_{h-k(max)}$	100†	V
Maximum Cathode Current	$I_{k(max)}$	16·5	mA
Maximum Control Grid to Cathode Resistance	$R_{g1-k(max)}$	3·0	MΩ
Grid Current Biasing		22	MΩ
Maximum Grid 3 to Cathode Resistance	$R_{g3-k(max)}$	10	kΩ
Maximum Heater to Cathode Resistance	$R_{h-k(max)}$	20	kΩ

Diode Sections (each section)			
Maximum Peak Inverse Voltage	P.I.V. max	200	V
Maximum Mean Anode Current	$I_{a(av)max}$	0·8	mA
Maximum Peak Anode Current	$i_{a(pk)max}$	5·0	mA

* If the heater, anode and screen grid voltages are obtained from an accumulator by means of a vibrator, $V_{a(max)}=250$V, $V_{g2(max)}=250$V.

† Measured with respect to higher potential heater pin.

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INTER-ELECTRODE CAPACITANCES

Input	c_{in}	5·0	pF
Output	c_{out}	5·2	pF
Anode to Grid 1	$c_{a\text{-}g1}$	<0·0025	pF
Grid 1 to Heater	$c_{g1\text{-}h}$	0·05	pF
Anode′ Diode to Cathode	$c_{a'd\text{-}k}$	2·5	pF
Anode″ Diode to Cathode	$c_{a''d\text{-}k}$	2·5	pF
Anode′ Diode to Anode″ Diode	$c_{a'd\text{-}a''d}$	<0·25	pF
Grid 1 to Anode″ Diode	$c_{g1\text{-}a''d}$	<0·0008	pF
Grid 1 to Anode′ Diode	$c_{g1\text{-}a'd}$	<0·001	pF
Anode′ Diode to Heater	$c_{a'd\text{-}h}$	<0·003	pF
Anode″ Diode to Heater	$c_{a''d\text{-}h}$	<0·015	pF
Anode Pentode to Anode′ Diode	$c_{ap\text{-}a'd}$	<0·025	pF
Anode Pentode to Anode″ Diode	$c_{ap\text{-}a''d}$	<0·15	pF

CHARACTERISTICS

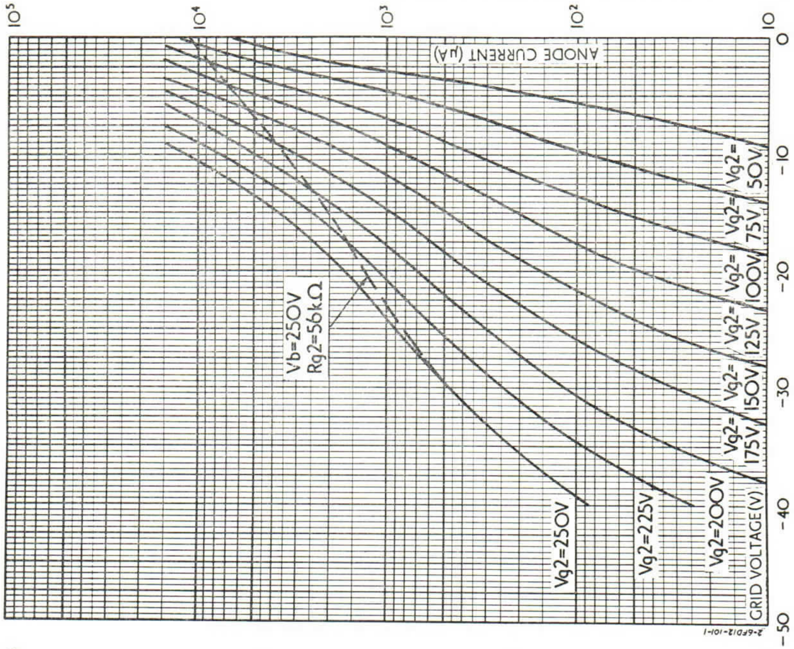
Anode Voltage	V_a	250	V
Screen Grid Voltage	V_{g2}	100	V
Control Grid Voltage	V_{g1}	−2·0	V
Anode Current	I_a	9·0	mA
Screen Grid Current	I_{g2}	2·7	mA
Mutual Conductance	g_m	3·8	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	1·0	MΩ
Inner Amplification Factor	$\mu_{g1\text{-}g2}$	20	

TYPICAL OPERATION

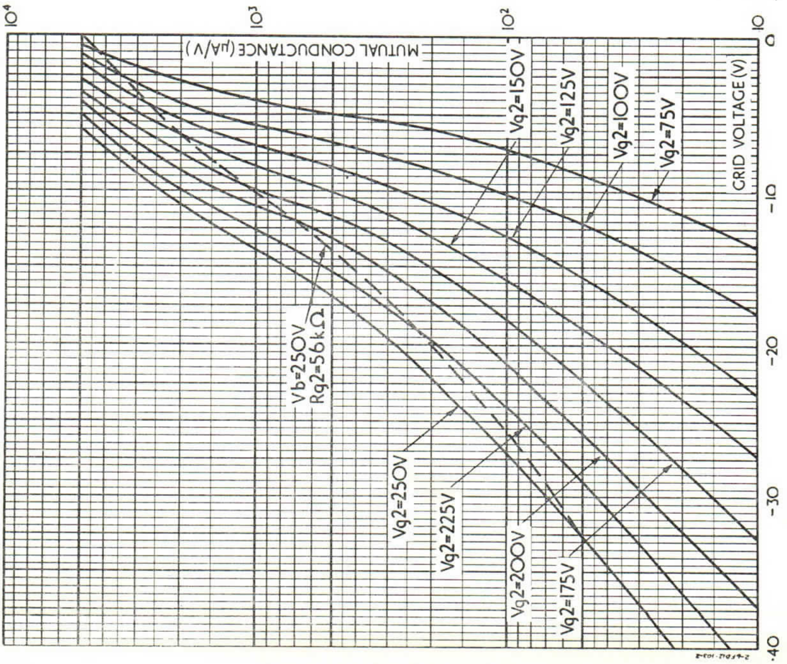
Supply Voltage	V_b	200	200	250	250	V
Anode Voltage	V_a	200	200	250	250	V
Control Grid Voltage	V_{g1}	−0·5*	−1·5	−0·5*	−2·0	V
Screen Grid Resistance	R_{g2}	47	30	82	56	kΩ
Cathode Resistance	R_k	—	105	—	170	Ω
Anode Current	I_a	9·5	11	8·0	9·0	mA
Screen Grid Current	I_{g2}	2·8	3·3	2·2	2·7	mA
Mutual Conductance	g_m	5·0	4·5	4·7	3·8	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	0·6	0·6	0·8	1·0	MΩ
Equivalent Grid Noise Resistance	R_{eq}	2·5	3·5	2·3	4·0	kΩ
Mutual Conductance for $V_{g1}=-20V$	$g_{m(Vg1=-20V)}$	115	120	180	200	μA/V

* This voltage is produced by the grid current flowing through the grid resistor and the steady current of the diode. If this condition is not acceptable the negative grid bias should be increased to −1·5V at $V_a=200V$ and −2·0V at $V_a=250V$.

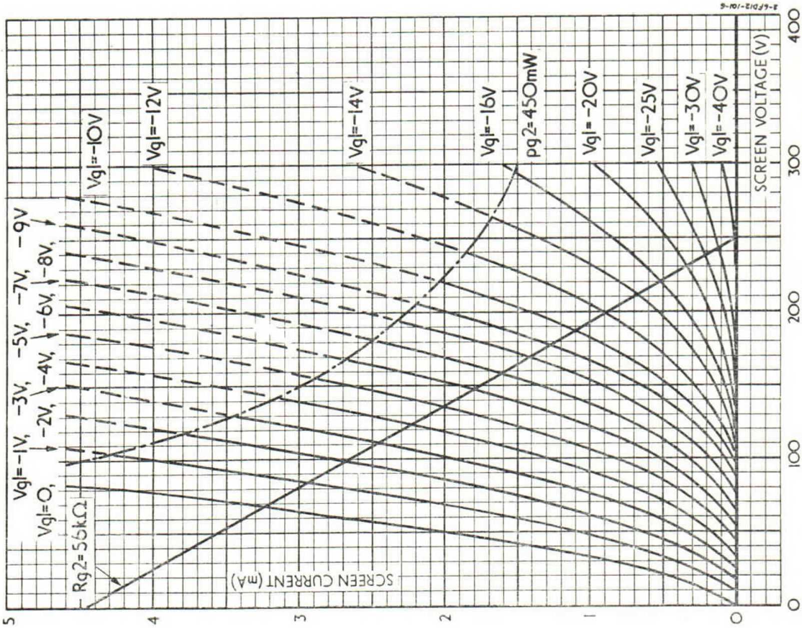
CHARACTERISTIC CURVES : I_a/V_g ($V_a = 250V$)



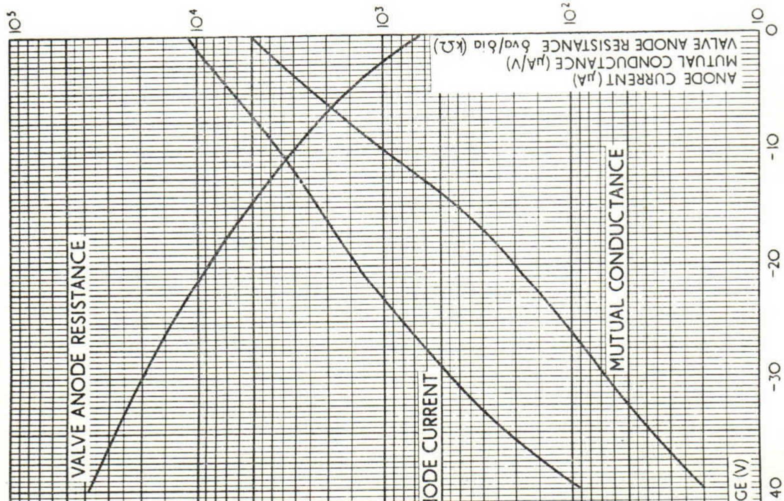
CHARACTERISTIC CURVES : g_m/V_g ($V_a = 250V$)



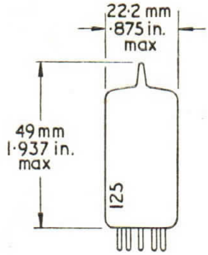
CHARACTERISTIC CURVES: I_{g2}/V_{g2} (V_a=250V)



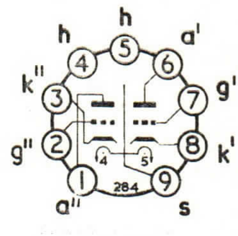
CHARACTERISTIC CURVES: I_a, g_m, r_a/V_g
V_b=250V R_{g2}=56kΩ



BRIMAR VALVES ECC85



DOUBLE TRIODE



B9A Base

GENERAL

This valve is a double triode primarily intended for use as an R.F. amplifier and self-oscillating mixer in F.M. receivers.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·435	A

RATINGS

Maximum Anode Dissipation (either section)	$p_{a(max)}$	2·5	W
Maximum Total Anode Dissipation	$p_{a(tot)max}$	4·5	W
Maximum Anode Voltage	$V_{a(max)}$	300	V
Maximum Heater to Cathode Voltage (D.C.)	$V_{h-k(max)}$	90	V
Maximum Cathode Current	$I_{k(max)}$	15	mA
Maximum Grid to Cathode Resistance	$R_{g-k(max)}$	1	MΩ

INTER-ELECTRODE CAPACITANCES

		*	‡	§	
Grid′ to Cathode′, Heater, Shield	$c_{g'-k',h,s}$	2·8	3·1	4·0	pF
Grid″ to Cathode″, Heater, Shield	$c_{g''-k'',h,s}$	2·8	3·2	4·0	pF
Anode′ to Cathode′, Heater, Shield	$c_{a'-k',h,s}$	1·2	1·6	2·5	pF
Anode′ to Cathode′, Heater, Shield†	$c_{a'-k',h,s}$	1·8	1·9	2·7	pF
Anode″ to Cathode″, Heater, Shield	$c_{a''-k'',h,s}$	1·15	1·6	2·4	pF
Anode″ to Cathode″, Heater, Shield †	$c_{a''-k'',h,s}$	1·8	2·0	2·7	pF
Anode′ to Grid′	$c_{a'-g'}$	1·5	1·6	1·8	pF
Anode″ to Grid″	$c_{a''-g''}$	1·5	1·6	1·6	pF
Anode′ to Anode″	$c_{a'-a''}$	0·028	0·032	0·033	pF
Anode′ to Anode″†	$c_{a'-a''}$	0·003	0·0067	0·0081	pF
Anode″ to Cathode′	$c_{a''-k'}$	0·006	0·014	0·02	pF

† Measured with can.

* In fully shielded socket. Without can, except where stated otherwise.

‡ With holder capacitance balanced out (holder as below).

§ Total capacitance including, where applicable, Plessey B9A ceramic type holders CP180900/1 (without can) or CP180024/3 (with can).

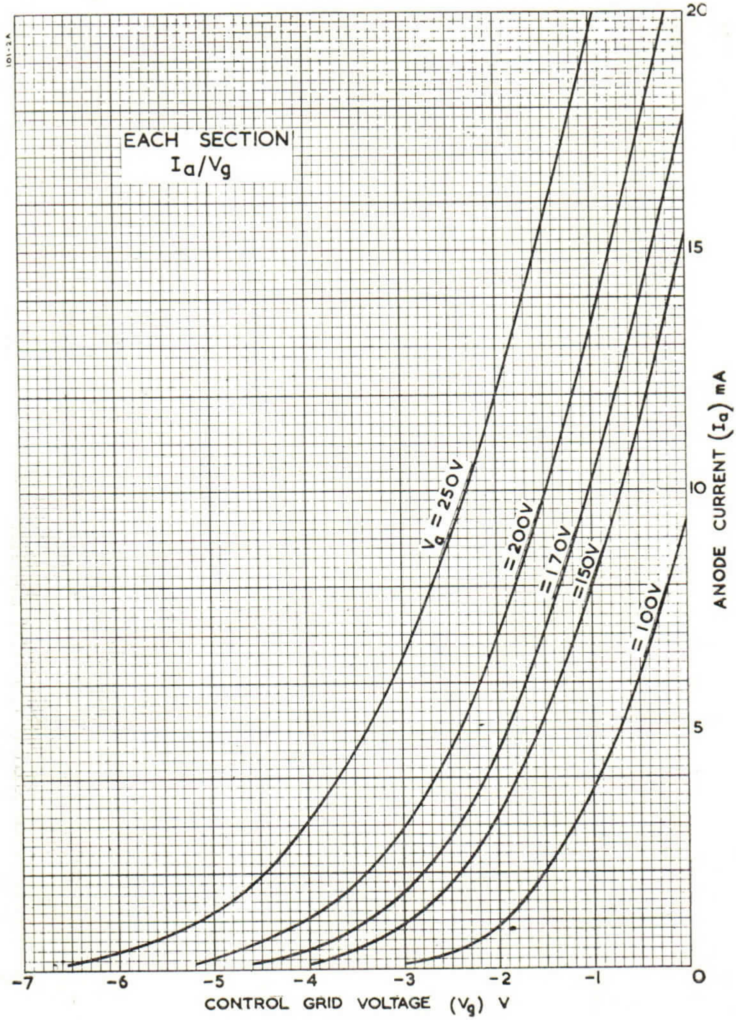
TYPICAL OPERATION AS R.F. AMPLIFIER

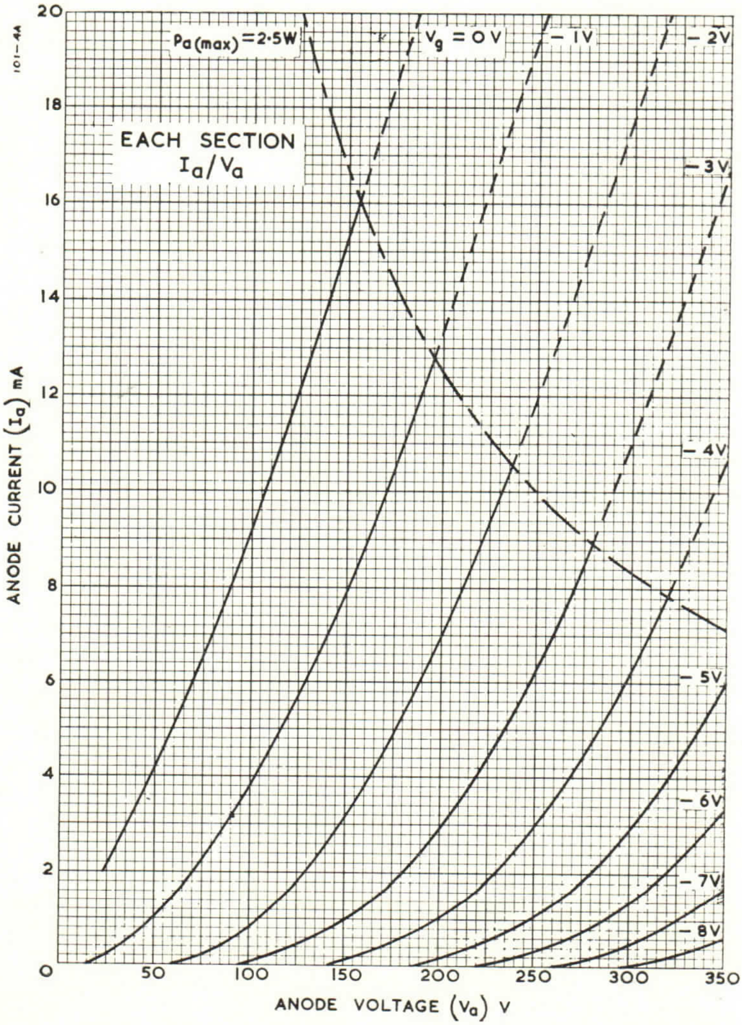
Supply Voltage	V_b	250	V
Anode Voltage	V_a	230	V
Anode Current	I_a	10	mA
Anode Load Resistance	R_a	1·8	kΩ
Grid Bias Voltage	V_g	—2	V
Mutual Conductance	g_m	6	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	9·7	kΩ
Amplification Factor	μ	58	
Input Loss at 100 Mc/s		6	kΩ
Equivalent Grid Noise Resistance	R_{eq}	500	Ω

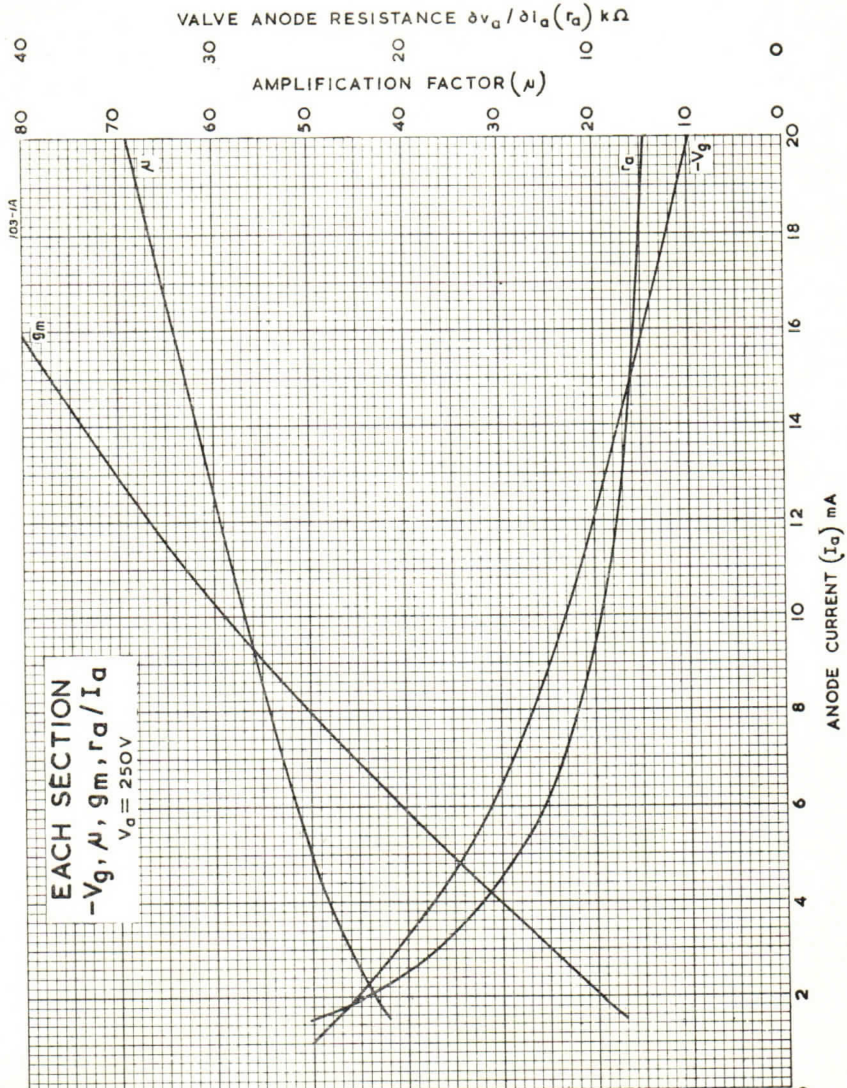
TYPICAL OPERATION AS SELF-OSCILLATING MIXER

Supply Voltage	V_b	250	V
Anode Load Resistance	R_a	12	kΩ
Grid to Cathode Resistance	R_{g-k}	1	MΩ
Anode Current	I_a	5·2	mA
Peak Heterodyne Voltage	$v_{(pk)het}$	3·3	V
Conversion Conductance	g_c	2·3	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	22	kΩ

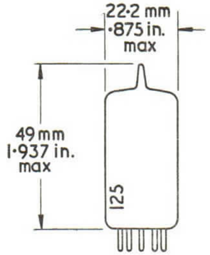
MOUNTING POSITION—Unrestricted.


EACH SECTION
I_a/V_g
$V_a = 250V$
$= 200V$
$= 170V$
$= 150V$
$= 100V$
20
15
10
5
0
ANODE CURRENT (I_a) mA
-7
-6
-5
-4
-3
-2
-1
CONTROL GRID VOLTAGE (V_g) V

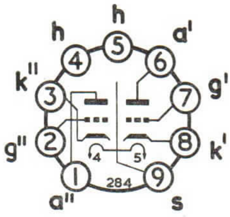

101—4A
$P_a(max)$ = 2·5W
V_g = 0 V
— 1V
— 2V
— 3V
— 4V
— 5V
— 6V
— 7V
— 8V
EACH SECTION
I_a/V_a
ANODE CURRENT (I_a) mA
ANODE VOLTAGE (V_a) V
0
2
4
6
8
10
12
14
16
18
20
50
100
150
200
250
300
350


VALVE ANODE RESISTANCE $\partial v_a / \partial i_a (r_a)$ kΩ
AMPLIFICATION FACTOR (μ)
ANODE CURRENT (I_a) mA
MUTUAL CONDUCTANCE (g_m) mA/V
NEGATIVE GRID VOLTAGE ($-V_g$)V
EACH SECTION
$-V_g, \mu, g_m, r_a / I_a$
$V_a = 250V$
103-1A

BRIMAR VALVES ECC88



DOUBLE TRIODE



Base B9A

GENERAL

This high slope double triode is primarily intended for use as a V.H.F. cascode low noise amplifier. It may also be used in wide band amplifier applications and high-speed switching circuits.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·365	A (nominal)

RATINGS—Each Section

Maximum Anode Dissipation	$p_{a(max)}$	1·8	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	V
Maximum Anode Voltage	$V_{a(max)}$	130	V
Maximum Negative Grid Voltage	$-V_{g(max)}$	50	V
Maximum Heater to Cathode Voltage,	$V_{h\text{-}k(max)}$		
Heater Negative		150	V
Heater Positive		60	V
Maximum Cathode Current	$I_{k(max)}$	25	mA
Maximum Grid to Cathode Resistance (Fixed Bias)	$R_{g\text{-}k(max)}$	1·0	MΩ
Maximum Heater to Cathode Resistance	$R_{h\text{-}k(max)}$	20	kΩ

In order not to exceed the maximum permissible anode voltage when the cascode amplifier is controlled, it is necessary to use a voltage divider for the grid of the grounded grid output section (a″, g″, k″). With grid current biasing for the grounded cathode input section (a′, g′, k′), the anode voltage across this section should not be more than 75V in the non-controlled condition.

CHARACTERISTICS—Each Section

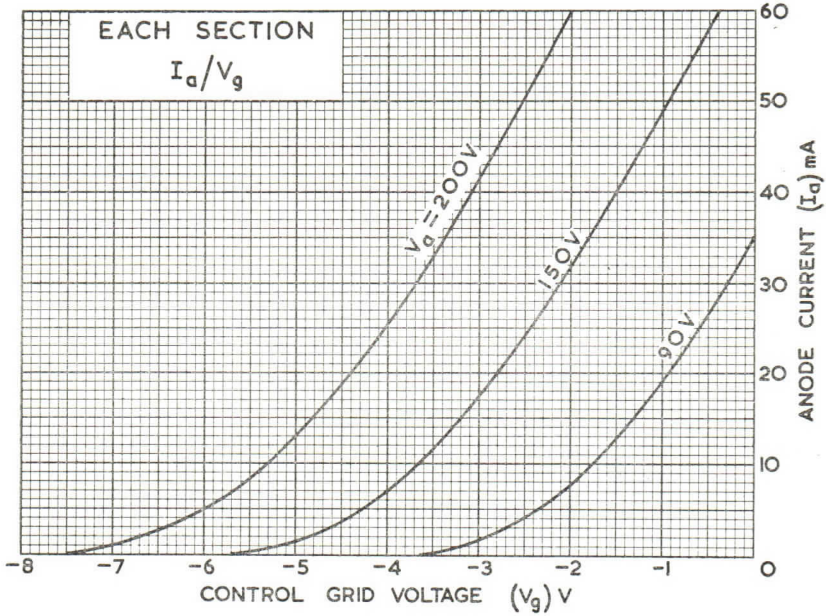
Anode Voltage	V_a	90	V
Grid Voltage	V_g	−1·3	V
Anode Current	I_a	15	mA
Mutual Conductance	g_m	12·5	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	2·6	kΩ
Amplification Factor	μ	33	
Equivalent Grid Noise Resistance	R_{eq}	300	Ω

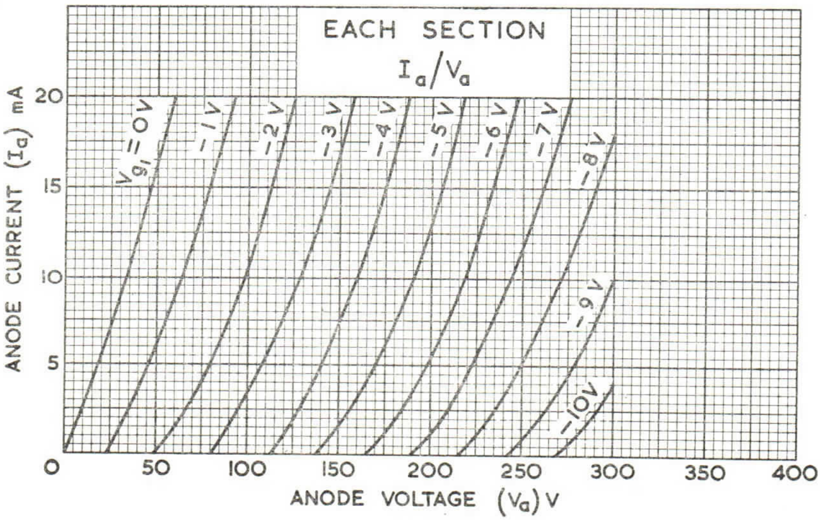
INTER-ELECTRODE CAPACITANCES*

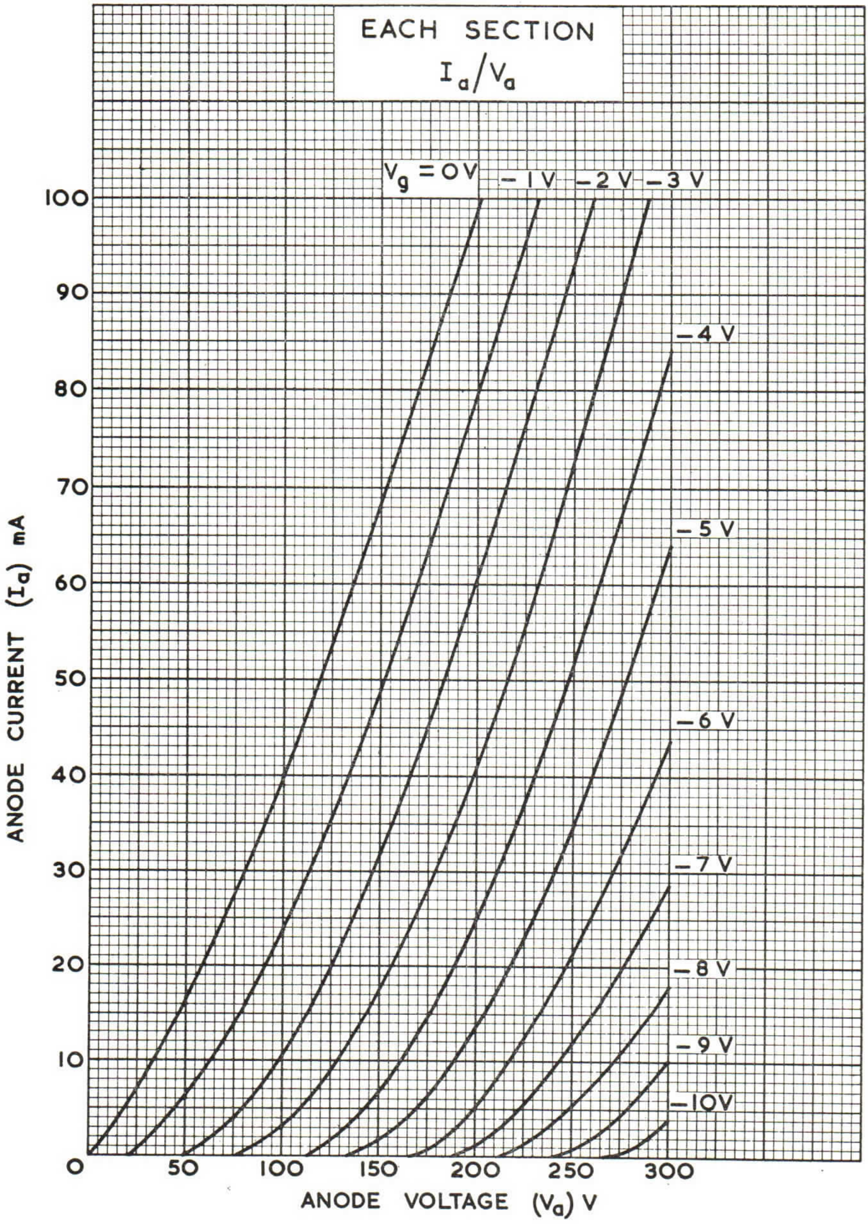
Input (Each section)	c_{in}	3·3	pF
Output (Each section)	c_{out}	1·8	pF
Anode to Grid (Each section)	$c_{a\text{-}g}$	1·4	pF
Anode′ to Anode″	$c_{a'\text{-}a''}$	<0·045	pF

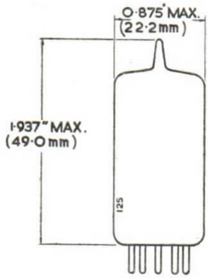
* Measured without an external shield.

MOUNTING POSITION—Unrestricted

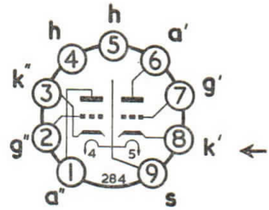

EACH SECTION
I_a/V_g
V_a = 200V
150V
90V
60
50
40
30
20
10
0
ANODE CURRENT (I_a) mA
−8
−7
−6
−5
−4
−3
−2
−1
CONTROL GRID VOLTAGE (V_g) V


EACH SECTION
I_a/V_a
V_{g_1} = 0V
−1V
−2V
−3V
−4V
−5V
−6V
−7V
−8V
−9V
−10V
20
15
10
5
ANODE CURRENT (I_a) mA
0
50
100
150
200
250
300
350
400
ANODE VOLTAGE (V_a) V


EACH SECTION
I_a/V_a
V_g = 0 V
−1 V
−2 V
−3 V
−4 V
−5 V
−6 V
−7 V
−8 V
−9 V
−10V
ANODE CURRENT (I_a) mA
0
10
20
30
40
50
60
70
80
90
100
50
100
150
200
250
300
ANODE VOLTAGE (V_a) V



GENERAL PURPOSE TWIN TRIODE



B9A Base

GENERAL

This general purpose twin triode is intended for use in AC or AC/DC television receivers. The two triodes have identical characteristics.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·3	A

RATINGS

Maximum Anode Dissipation (either section)	$P_{a(max)}$	2·0*	W
Maximum Total Anode Dissipation	$P_{a(tot)max}$	2·5*	W
Maximum Anode Voltage	$V_{a(max)}$	250	V
Maximum Heater to Cathode Voltage (R.M.S.)	$V_{h\text{-}k(r.m.s.)max}$	150†	V

* The permissible anode dissipation rating is a function of the grid to cathode resistance and circuit employed. For the values quoted, the grid to cathode resistance should not exceed 0·25MΩ with cathode self bias.

† Measured with respect to the higher potential heater pin.

INTER-ELECTRODE CAPACITANCES

		‡	§	
Grid′ to Earth	$c_{g'\text{-}E}$	2·5	3·5	pF
Grid″ to Earth	$c_{g''\text{-}E}$	2·4	3·5	pF
Anode′ to Earth	$c_{a'\text{-}E}$	2·1	3·2	pF
Anode″ to Earth	$c_{a''\text{-}E}$	2·0	2·9	pF
Anode′ to Grid′	$c_{a'\text{-}g'}$	2·5	2·8	pF
Anode″ to Grid″	$c_{a''\text{-}g''}$	2·5	2·8	pF
Anode′ to Anode″	$c_{a'\text{-}a''}$	0·038	0·038	pF
Grid′ to Grid″	$c_{g'\text{-}g''}$	0·006	0·0064	pF
Grid′ to Anode″	$c_{g'\text{-}a''}$	0·014	0·015	pF
Grid″ to Anode′	$c_{g''\text{-}a'}$	0·012	0·012	pF

‡ With holder capacity balanced out.

§ Total capacity including B9A ceramic holder (Carr Fastener holder type 77/076)

" Earth " denotes the electrodes of any second valve section and the remaining earthy potential electrodes of the section under measurement, heater and shields joined to cathode.

CHARACTERISTICS (Each section)

Anode Voltage	V_a	200	V
Anode Current	I_a	10	mA
Grid Voltage	V_g	−7·7	V
Mutual Conductance	g_m	3·4	mA/V
Amplification Factor	μ	18	

MOUNTING POSITION—Unrestricted

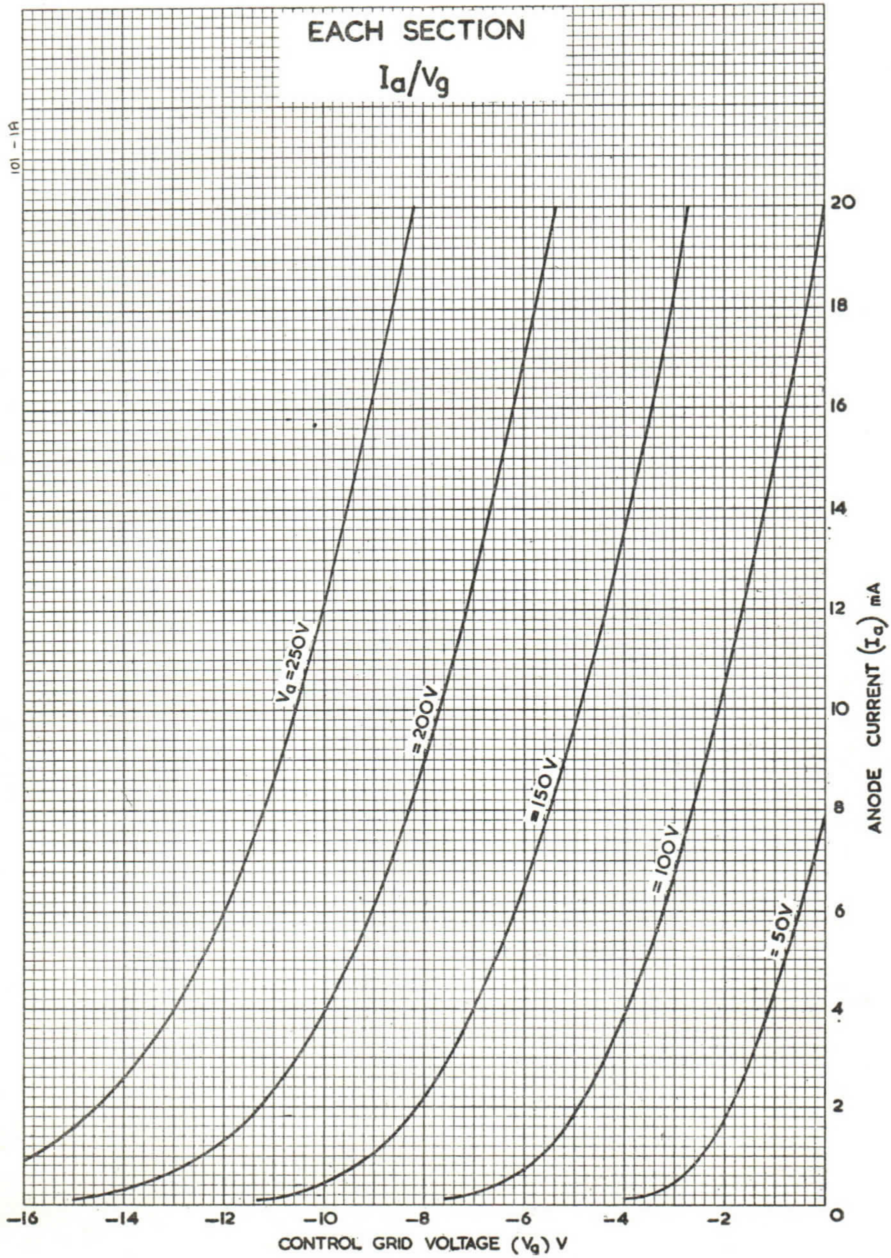
APPROXIMATE WEIGHT

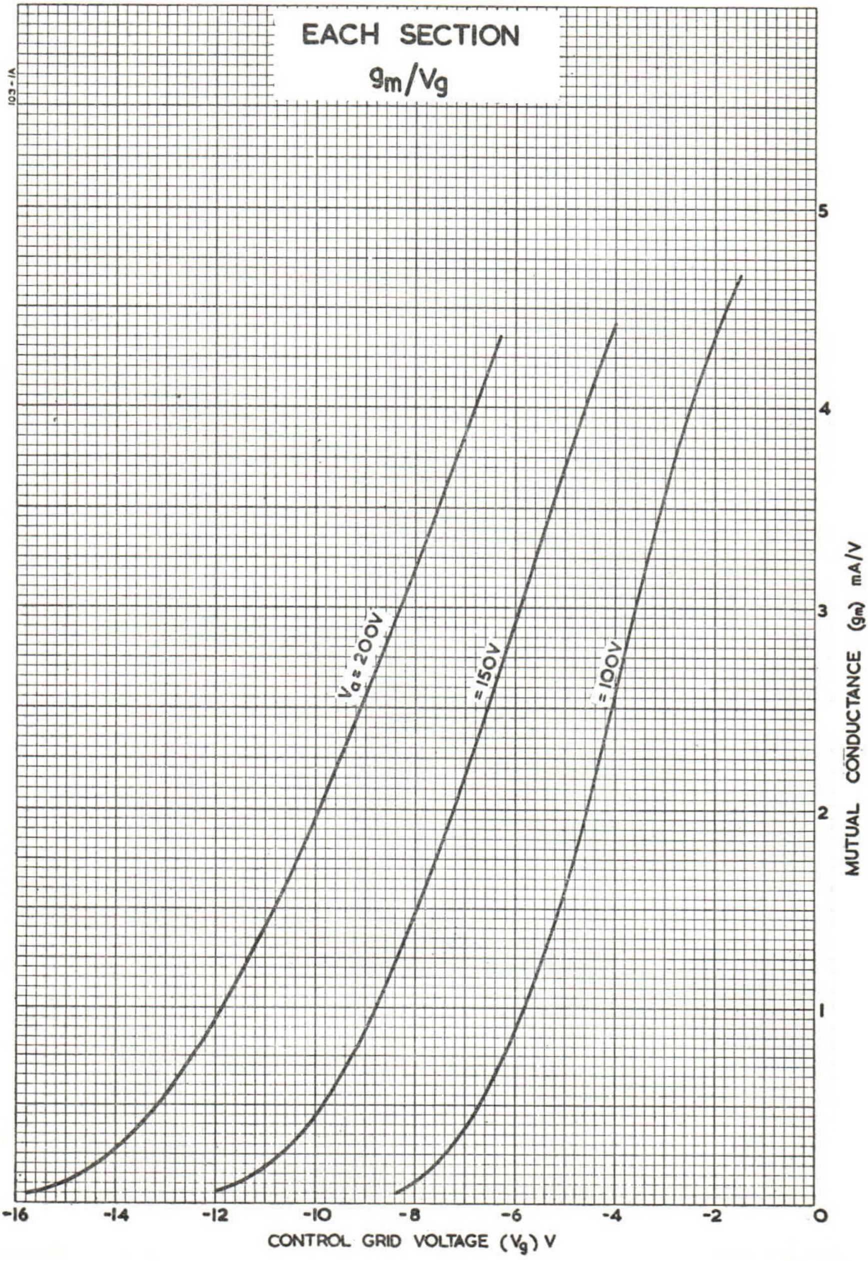
Net	0·5	oz
Packed	0·75	oz

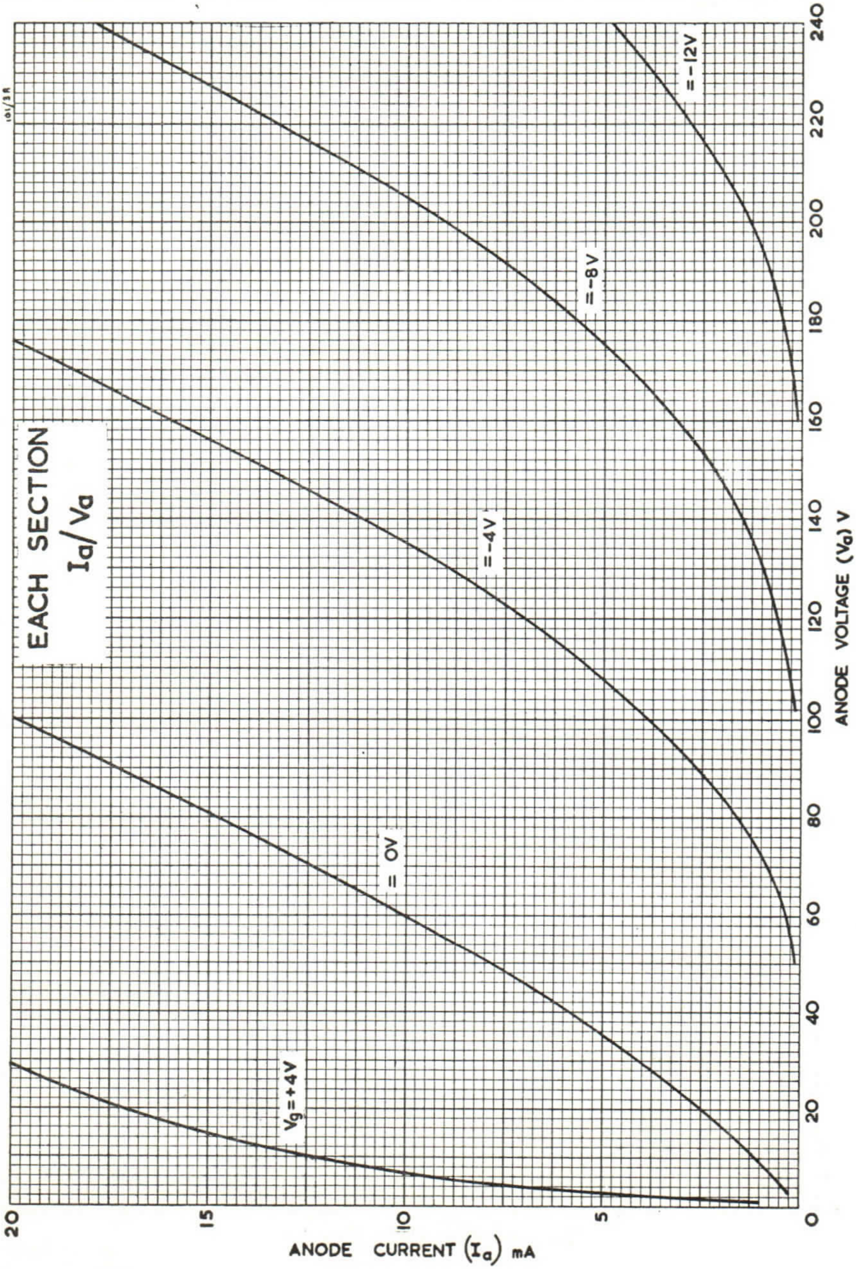
NOTE. The potential of the internal shield must not be positive to that of either cathode.

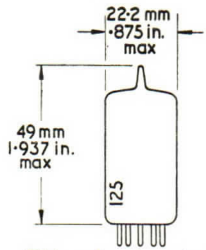
Indicates a change ←

THORN — A E I RADIO VALVES & TUBES LTD.

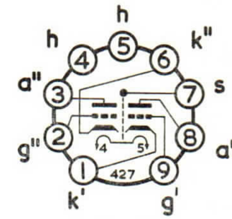

EACH SECTION
I_a/V_g
V_a=250V
=200V
=150V
=100V
=50V
20
18
16
14
12
10
8
6
4
2
0
ANODE CURRENT (I_a) mA
−16
−14
−12
−10
−8
−6
−4
−2
0
CONTROL GRID VOLTAGE (V_g) V
101 - 1A


EACH SECTION
gm/Vg
103-1A
Va = 200V
= 150V
= 100V
5
4
3
2
1
0
MUTUAL CONDUCTANCE (gm) mA/V
-16
-14
-12
-10
-8
-6
-4
-2
CONTROL GRID VOLTAGE (Vg) V


EACH SECTION
I_a/V_a
=-12V
=-8V
=-4V
= 0V
V_g=+4V
0
20
40
60
80
100
120
140
160
180
200
220
240
ANODE VOLTAGE (V_a) V
20
15
10
5
0
ANODE CURRENT (I_a) mA



DOUBLE TRIODE



Base B9A

GENERAL

This valve is a double triode specifically designed for use in high gain pre-amplifier stages operating from low level inputs.

Heater Voltage	V_h	6·3 V
Heater Current	I_h	0·3 A

RATINGS (Each Section)

Maximum Anode Dissipation	$p_{a(max)}$	1·0	W
Maximum Anode Voltage ($I_a = 0$)	$V_{a(b)max}$	550	V
Maximum Anode Voltage	$V_{a(max)}$	300	V
Maximum Negative Grid Voltage	$-V_{g(max)}$	50	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$	150	V
Maximum Cathode Current	$I_{k(max)}$	8	mA
Maximum Grid to Cathode Resistance	$R_{g\text{-}k(max)}$		
Fixed Bias		1·0	MΩ
Cathode Bias		2·2	MΩ
Grid Current Bias		22	MΩ

INTER-ELECTRODE CAPACITANCES (Each Section)

Input	c_{in}	2·0	pF
Output	c_{out}	1·35	pF
Anode to Grid	$c_{a\text{-}g}$	2·3	pF

CHARACTERISTICS (Each Section)

Anode Voltage	V_a	250	V
Grid Voltage	V_g	−1·5	V
Anode Current	I_a	1·3	mA
Mutual Conductance	g_m	2·4	mA/V
Amplification Factor	μ	150	
Negative Grid Voltage for $I_g = 0{\cdot}3\mu A$	$-V_g$ ($I_g = 0{\cdot}3\mu A$)	<1·3	V

TYPICAL OPERATION (Each Section)

Anode Supply Voltage	$V_{a(b)}$	250	250	250	250	V
Anode Load Resistor	R_a	100	100	220	220	kΩ
Cathode Resistor ($C_k = 100\mu F$)	R_k	0	1·0*	0	2·2*	kΩ
Grid Resistor	R_g	8·2†	1·0	15†	1·0	MΩ
Grid Resistor of Following Stage		470	470	470	470	kΩ
Generator Resistance		50	50	100	100	kΩ
Anode Current	I_a	0·91	0·93	0·5	0·5	mA
Input Voltage (R.M.S.)	$V_{in(r.m.s.)}$	100	100	90	100	mV
Output Voltage (R.M.S.)	$V_{out(r.m.s.)}$	7·1	6·9	6·8	6·9	V
Stage Gain		71	69	76	69	
Total Harmonic Distortion	D_{tot}	1·0	2·0	1·5	2·0	%

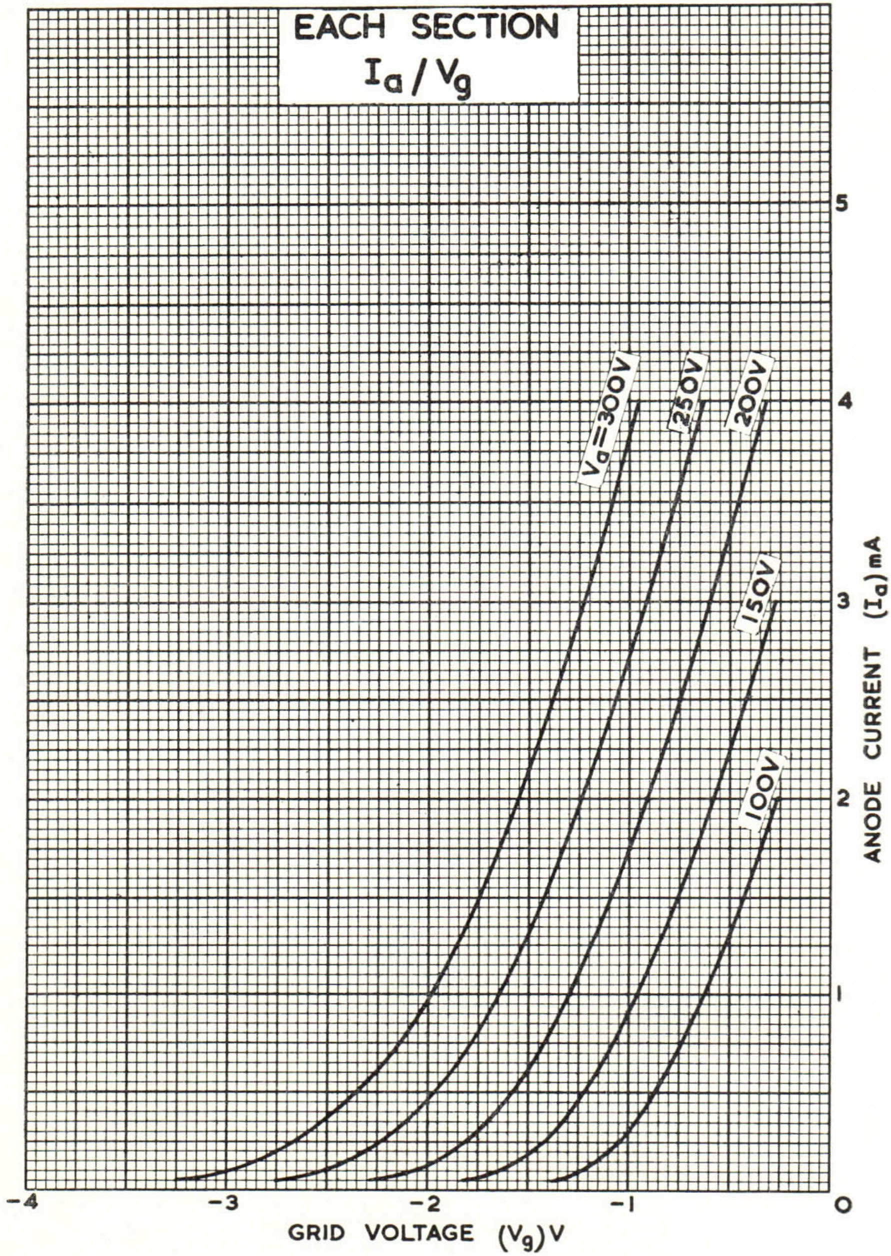
Notes:

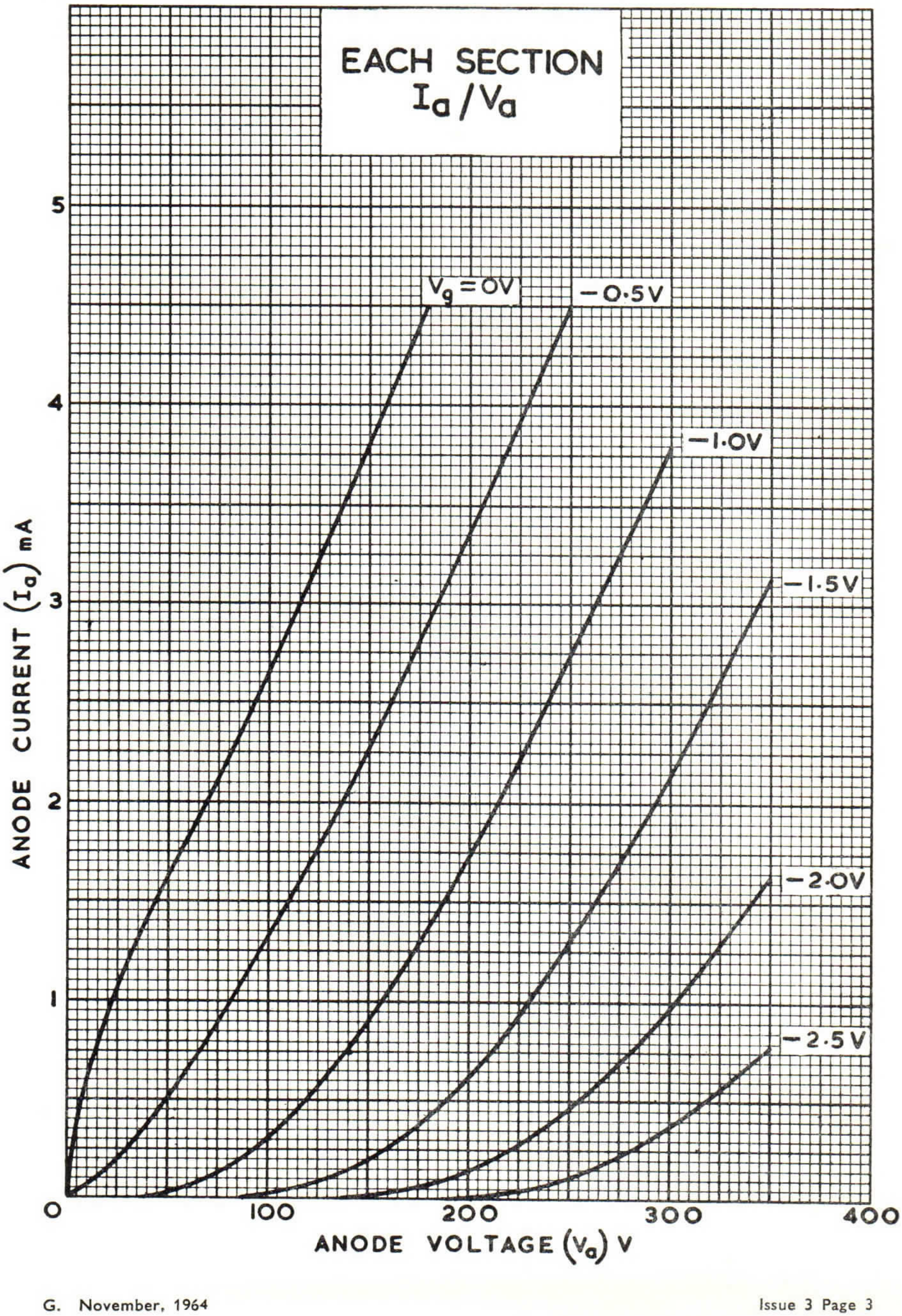
When used in cascade, section 1 should be employed as the input stage, as this section has the lower grid hum level of $3\mu V$ r.m.s. average with a maximum of $5\mu V$ r.m.s. Measured with a low pass filter (cut-off = 350 c/s).

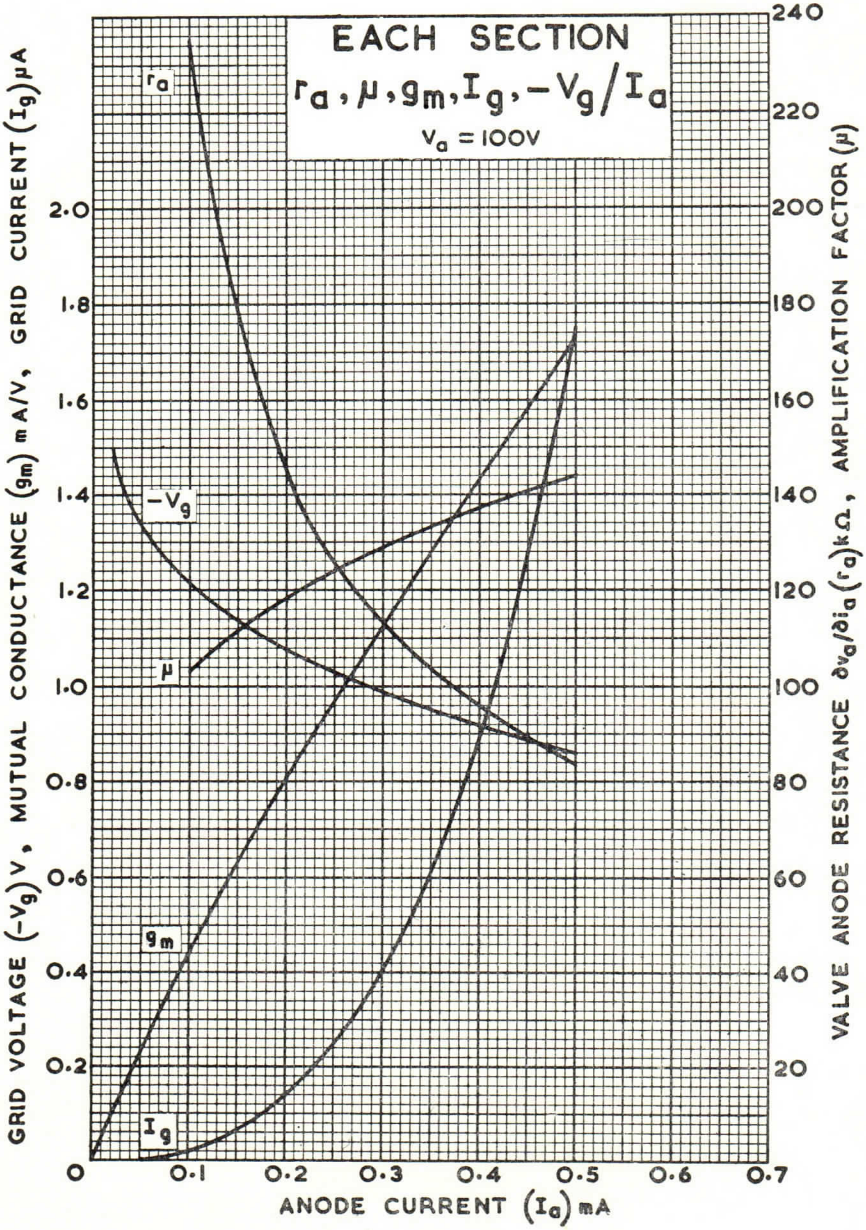
If either side of the heater is earthed rather than the centre tap, the maximum value of hum would be of the order of $10\mu V$ r.m.s.

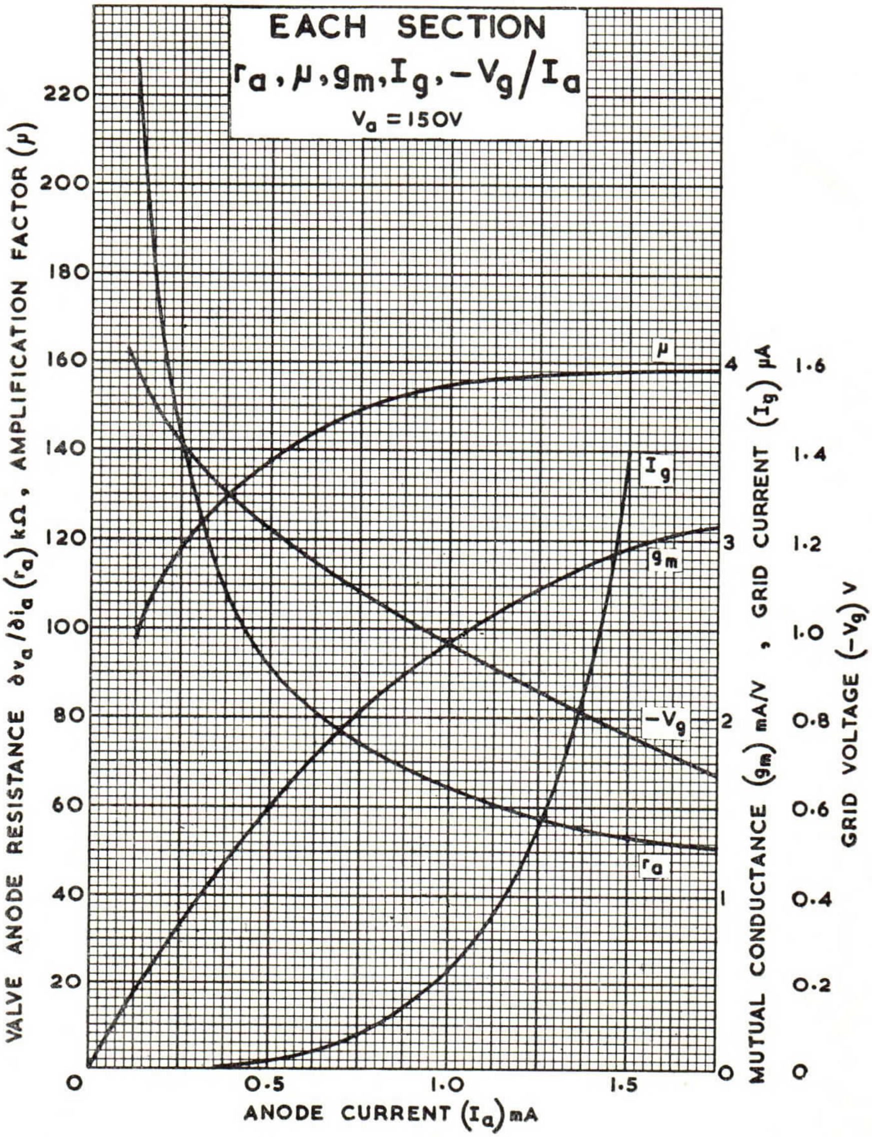
* ±5%. † ±10%.

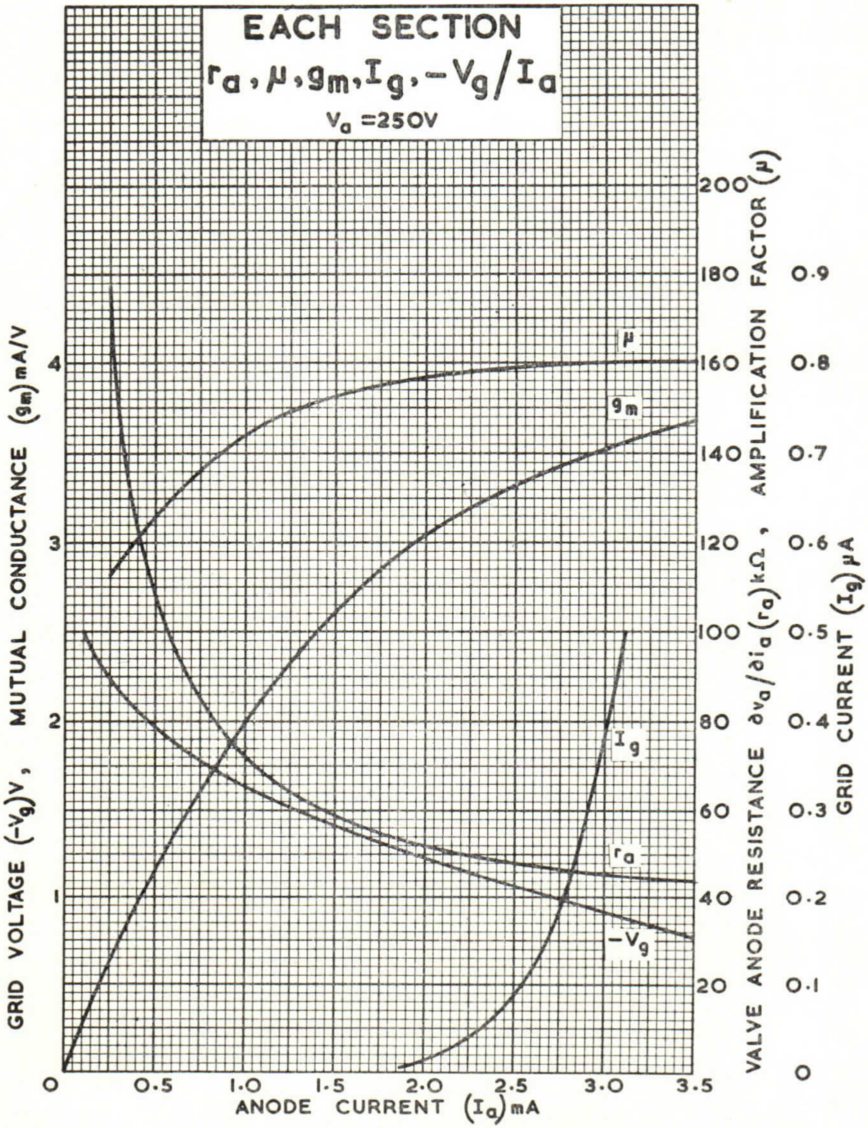
THORN—AEI RADIO VALVES & TUBES LTD.


EACH SECTION
I_a / V_g
V_a=300V
250V
200V
150V
100V
5
4
3
2
1
0
ANODE CURRENT (I_a) mA
−4
−3
−2
−1
GRID VOLTAGE (V_g) V


EACH SECTION
I_a / V_a
$V_g = 0V$
−0·5V
−1·0V
−1·5V
−2·0V
−2·5V
ANODE CURRENT (I_a) mA
ANODE VOLTAGE (V_a) V
0
1
2
3
4
5
100
200
300
400


EACH SECTION
$r_a, \mu, g_m, I_g, -V_g / I_a$
$V_a = 100V$
r_a
$-V_g$
μ
g_m
I_g
GRID VOLTAGE $(-V_g)$ V, MUTUAL CONDUCTANCE (g_m) mA/V, GRID CURRENT (I_g) µA
VALVE ANODE RESISTANCE $\partial v_a / \partial i_a (r_a)$ kΩ, AMPLIFICATION FACTOR (µ)
ANODE CURRENT (I_a) mA
0
0·1
0·2
0·3
0·4
0·5
0·6
0·7
0·2
0·4
0·6
0·8
1·0
1·2
1·4
1·6
1·8
2·0
20
40
60
80
100
120
140
160
180
200
220
240

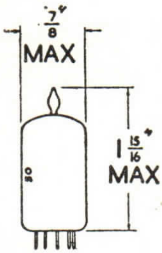

EACH SECTION
$r_a, \mu, g_m, I_g, -V_g / I_a$
$V_a = 150V$
VALVE ANODE RESISTANCE $\partial v_a/\partial i_a (r_a)$ kΩ , AMPLIFICATION FACTOR (μ)
220
200
180
160
140
120
100
80
60
40
20
0
0.5
1.0
1.5
ANODE CURRENT (I_a) mA
μ
I_g
g_m
$-V_g$
r_a
MUTUAL CONDUCTANCE (g_m) mA/V , GRID CURRENT (I_g) μA
4
3
2
1
0
GRID VOLTAGE ($-V_g$) V
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0



EACH SECTION
r_a, μ, g_m, I_g, $-V_g$/I_a
V_a =250V
GRID VOLTAGE $(-V_g)$V, MUTUAL CONDUCTANCE (g_m) mA/V
VALVE ANODE RESISTANCE $\partial v_a/\partial i_a$ (r_a) kΩ, AMPLIFICATION FACTOR (μ)
GRID CURRENT (I_g) μA
ANODE CURRENT (I_a) mA
μ
g_m
I_g
r_a
$-V_g$
0
0·5
1·0
1·5
2·0
2·5
3·0
3·5
1
2
3
4
20
40
60
80
100
120
140
160
180
200
0·1
0·2
0·3
0·4
0·5
0·6
0·7
0·8
0·9

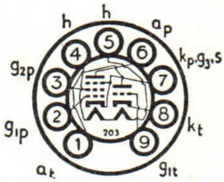
BRIMAR VALVES

Current Equipment Type



B9A (Noval) Base

TYPE **ECF80**
MINIATURE TRIODE PENTODE FREQUENCY CHANGER



The BRIMAR ECF80 is a triode pentode with separate cathodes designed for use as a frequency changer in television equipment up to 220 Mc/s.

Heater Current	0.43 amp.
Heater Voltage	6.3 volts

RATINGS

	Triode	Pentode	
Anode Voltage (Ia = 0)	550	550	volts max.
Anode Voltage	250	250	volts max.
Anode Dissipation	1.5	1.7	watts max.
Screen Voltage (Ia = 0)	—	550	volts max.
Screen Voltage (Ik = 14 mA)	—	175	volts max.
Screen Voltage (Ik $\leqslant$ 10 mA)	—	200	volts max.
Screen Dissipation (Pa > 1.2 W)	—	0.5	watts max.
Screen Dissipation (Pa < 1.2 W)	—	0.75	watts wax.
Cathode Current	14	14	mA max.
Control Grid Resistance	500	—	k Ω max.
Control Grid Resistance (cathode bias)	—	1.0	M Ω max.
Control Grid Resistance (fixed bias)	—	500	k Ω max.
Heater-Cathode Potential (cathode negative)	100	100	volts max.
Heater-Cathode Potential (cathode positive)*	200	200	volts max.

* *Maximum d.c. component 120 volts.*

CHARACTERISTICS

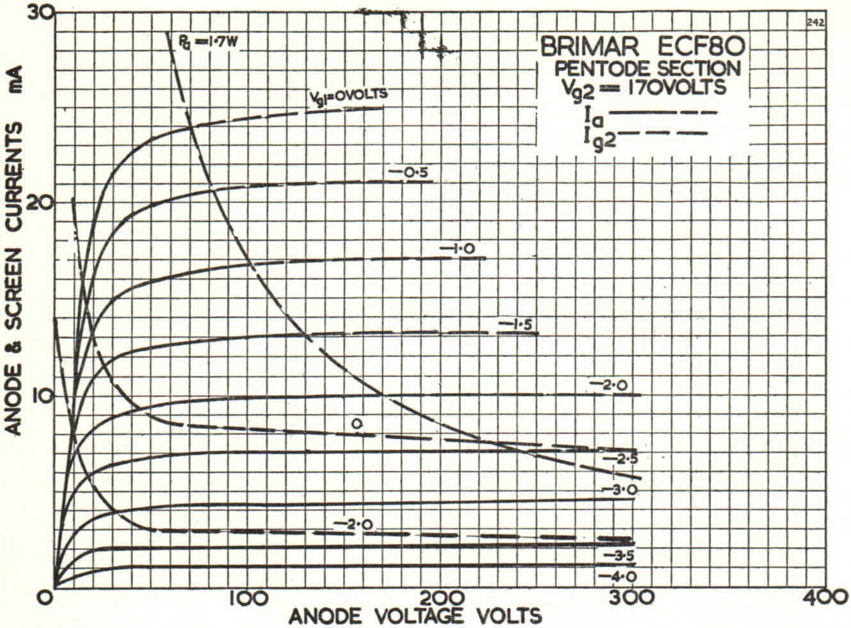
	Triode	Pentode	
Anode Voltage	100	170	volts
Screen Voltage	—	170	volts
Control Grid Voltage	—2	—2	volts
Anode Current	14	10	mA
Screen Current	—	2.8	mA
Mutual Conductance	5	6.2	mA/V
Amplification Factor	20	—	
Inner Amplification Factor ($\mu g_1 - g_2$)	—	47	
Anode Impedance (approx.)	4	400	k Ω
Input Impedance at 50 Mc/s.	—	10	k Ω
Equivalent noise resistance	—	1.5	k Ω

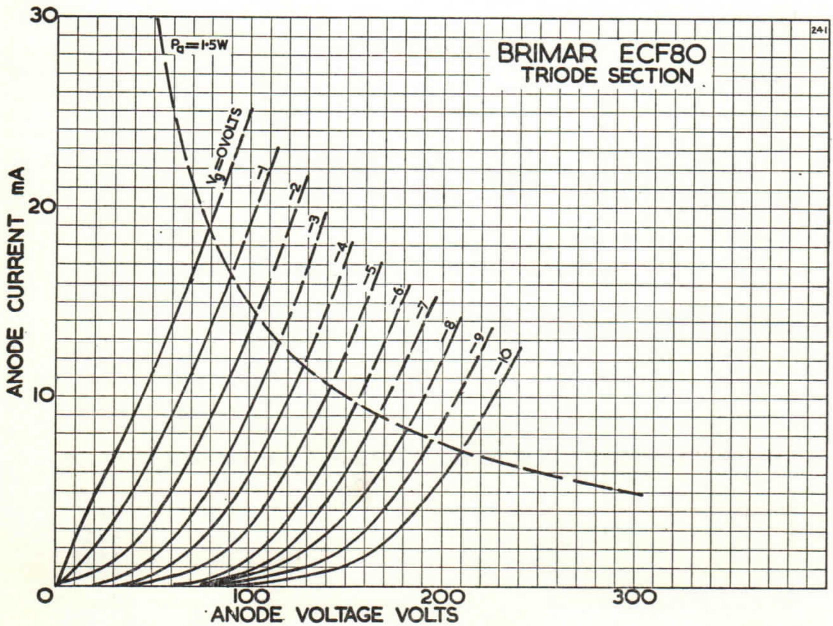
TYPICAL OPERATION AS A MIXER (Pentode Section)

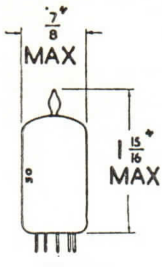
Anode Voltage	170	170	volts
Screen Voltage	170	170	volts
Grid Leak Resistor	100	100	k Ω
Cathode Bias Resistor	330	820	k Ω
Heterodyne Voltage	3.5	3.5	volts rms
Anode Current	6.5	5.2	mA
Screen Current	2.0	1.5	mA
Grid Current	20	0	μA
Conversion Conductance	2.2	2.1	mA/V
Input Impedance	800	870	k Ω

INTER-ELECTRODE CAPACITANCES (measured without external shield)

Pentode Grid 1 to Pentode Anode	0.025 pF
Pentode Input	5.2 pF
Pentode Output	3.4 pF
Triode Grid to Triode Anode	1.5 pF
Triode Grid to Triode Cathode and Heater	2.5 pF
Triode Anode to Triode Cathode and Heater	1.8 pF
Pentode Anode to Triode Anode	0.07 pF
Pentode Anode to Triode Grid	0.02 pF
Pentode Grid 1 to Triode Anode	0.16 pF


BRIMAR ECF80
PENTODE SECTION
Vg2 = 170VOLTS
Ia
Ig2
242
Pa =1·7W
Vg1=OVOLTS
−0·5
−1·0
−1·5
−2·0
0
−2·5
−3·0
−2·0
−3·5
−4·0
ANODE & SCREEN CURRENTS mA
30
20
10
0
100
200
300
400
ANODE VOLTAGE VOLTS

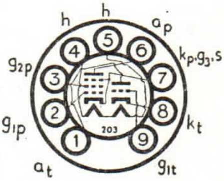

BRIMAR ECF80
TRIODE SECTION
241
Pa=1·5W
Vg=OVOLTS
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
ANODE CURRENT mA
30
20
10
0
100
200
300
ANODE VOLTAGE VOLTS



B9A Base

Current Equipment Type

TYPE ECF82 MINIATURE TRIODE PENTODE FREQUENCY CHANGER



The BRIMAR ECF82 is a triode-pentode frequency changer featuring a high slope triode and a high input impedance pentode of high slope suitable for use in television receivers for Band III. The high input impedance at 200 Mc/s permits a sensibly constant conversion gain to be obtained over Bands I and III. The low value of C_{ag} for the pentode and $C_{ap,\ at}$ facilitate the reduction of oscillator radiation. The use of low oscillator grid current to obtain the required heterodyne voltage reduces the frequency drift of the oscillator to a minimum.

Heater Current	0.45 amp.
Heater Voltage	6.3 volts (nom.)

RATINGS

	Triode	Pentode
Heater—Cathode Potential (cathode positive)		220 volts max.
Heater—Cathode Potential (cathode negative)		90 volts max.
Anode Voltage ($I_a = 0$)	550	550 volts max.
Anode Voltage	300	300 volts max.
Screen (g_2) Voltage	—	300 volts max.
Anode Dissipation	2.7	2.8 watts max.
Screen Dissipation	—	0.5 watts max.
Positive D.C. Grid No. 1 Voltage	0	0 volts max.
Cathode Current	20	20 mA max.
Grid Resistance	1	1 megohm max.

CHARACTERISTICS

	Triode	Pentode
Anode Voltage	150	250 volts
Screen Voltage	—	110 volts
Cathode Bias Resistor	56	68 ohms
Anode Current	18	10 mA
Screen Current	—	3.5 mA
Mutual Conductance	8.5	5.2 mA/V
Anode Impedance (approx.)	5	400 k ohms
Amplification Factor	40	—
Grid No. 1 Voltage (for I_a = 10μA)	−12	−10 volts

TYPICAL OPERATION AS MIXER

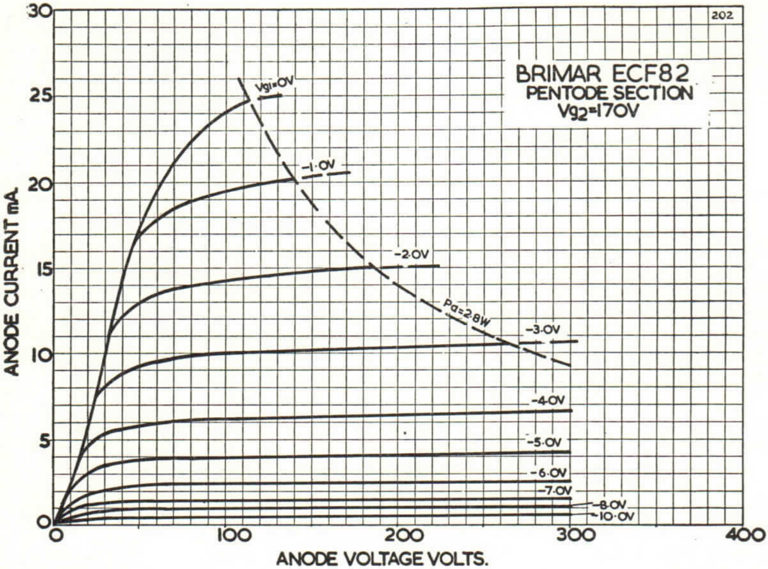
	Triode		Pentode
Anode Voltage	100	170	170 volts
Screen Voltage	—	110	170 volts
Cathode Bias Resistor	0	0	680 ohms
Grid Leak Resistor	27	270	100 k ohms
Anode Current	7.0	5.5	6.6 mA
Screen Current	—	2.0	2.5 mA
Heterodyne Voltage	—	3.0	5.0 volts peak
Conversion Conductance	—	1.6	1.65 mA/V

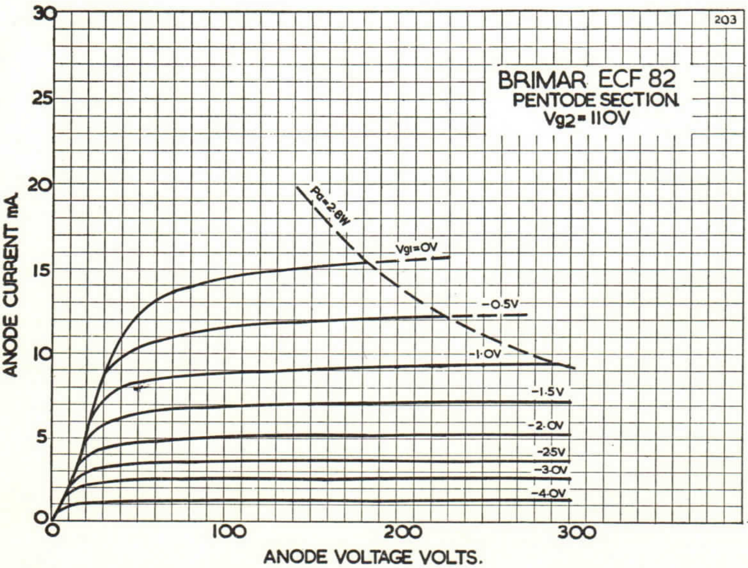
INTER-ELECTRODE CAPACITANCES *

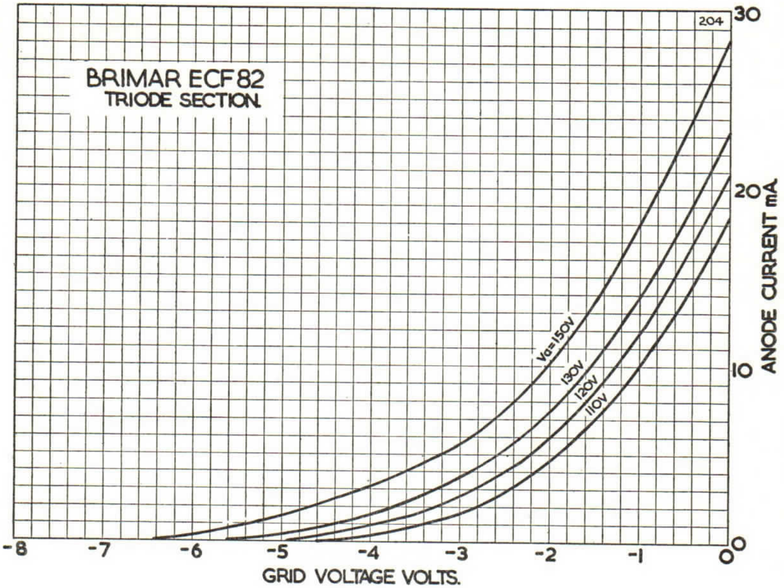
Pentode Grid No. 1 to Pentode Anode	0.006 pF
Pentode Input	5.0 pF
Pentode Output	3.5 pF
Triode Grid to Triode Anode	1.8 pF
Triode Grid to Cathode	2.5 pF
Triode Anode to Cathode	1.0 pF
Cathode to Heater (either section) approx.	3.0 pF

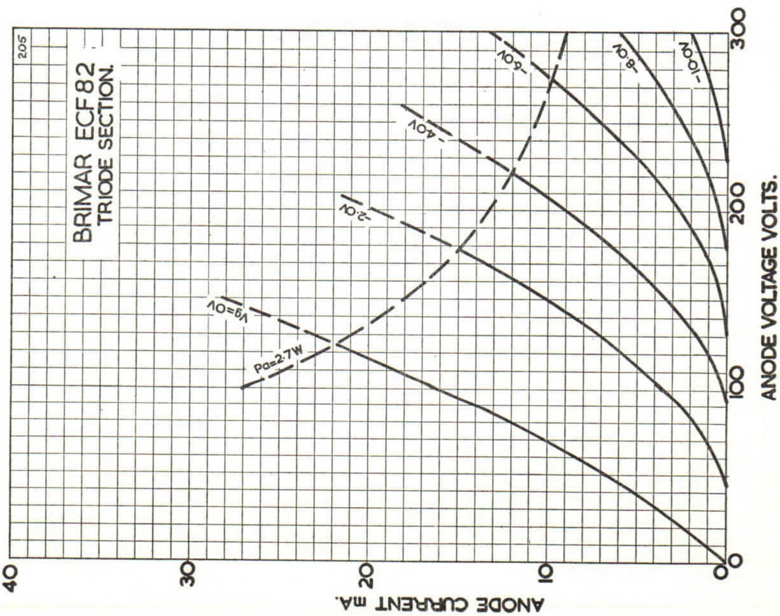
** Measured with external shield.*

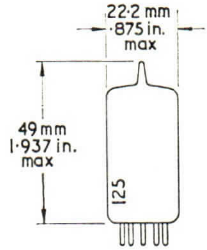
Type ECF82 *is a commercial equivalent of the* CV5063.


202
BRIMAR ECF82
PENTODE SECTION
V_{g2}=170V
ANODE CURRENT mA.
ANODE VOLTAGE VOLTS.
0
5
10
15
20
25
30
100
200
300
400
Vg1=0V
-1·0V
-2·0V
-3·0V
-4·0V
-5·0V
-6·0V
-7·0V
-8·0V
-10·0V
Pa=2·8W

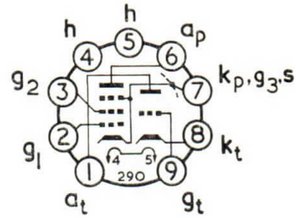

203
BRIMAR ECF 82
PENTODE SECTION
V_{g2}= 110V
ANODE CURRENT mA.
ANODE VOLTAGE VOLTS.
0
5
10
15
20
25
30
100
200
300
Pa=2·8W
Vg1=0V
-0·5V
-1·0V
-1·5V
-2·0V
-2·5V
-3·0V
-4·0V


204
BRIMAR ECF82
TRIODE SECTION.
Va=150V
130V
120V
110V
ANODE CURRENT mA
GRID VOLTAGE VOLTS.
-8 -7 -6 -5 -4 -3 -2 -1 0
0 10 20 30


205
BRIMAR ECF82
TRIODE SECTION.
Vg=0V
-2·0V
-4·0V
-6·0V
-8·0V
-10·0V
Pa=2·7W
ANODE VOLTAGE VOLTS.
ANODE CURRENT mA.
40 30 20 10 0
0 100 200 300



TRIODE
PENTODE



B9A Base

GENERAL

This triode pentode is intended for use in wide band amplifiers and instrumentation applications where high gain is required.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·45	A

RATINGS

		Triode	Pentode	
Maximum Anode Dissipation	$p_{a(max)}$	2·0	1·5	W
Maximum Screen Grid Dissipation	$p_{g_2(max)}$	—	0·5	W
Maximum Anode Voltage	$V_{a(max)}$	250	250	V
Maximum Screen Grid Supply Voltage	$V_{g_2(b)max}$	—	250	V
Maximum Screen Grid Voltage	$V_{g_2(max)}$	—	175	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$	150	150	V
Maximum Cathode Current	$I_{k(max)}$	20	20	mA
Maximum Control Grid to Cathode Resistance Fixed Bias	$R_{g_1\text{-}k(max)}$	0·5	0·5	MΩ

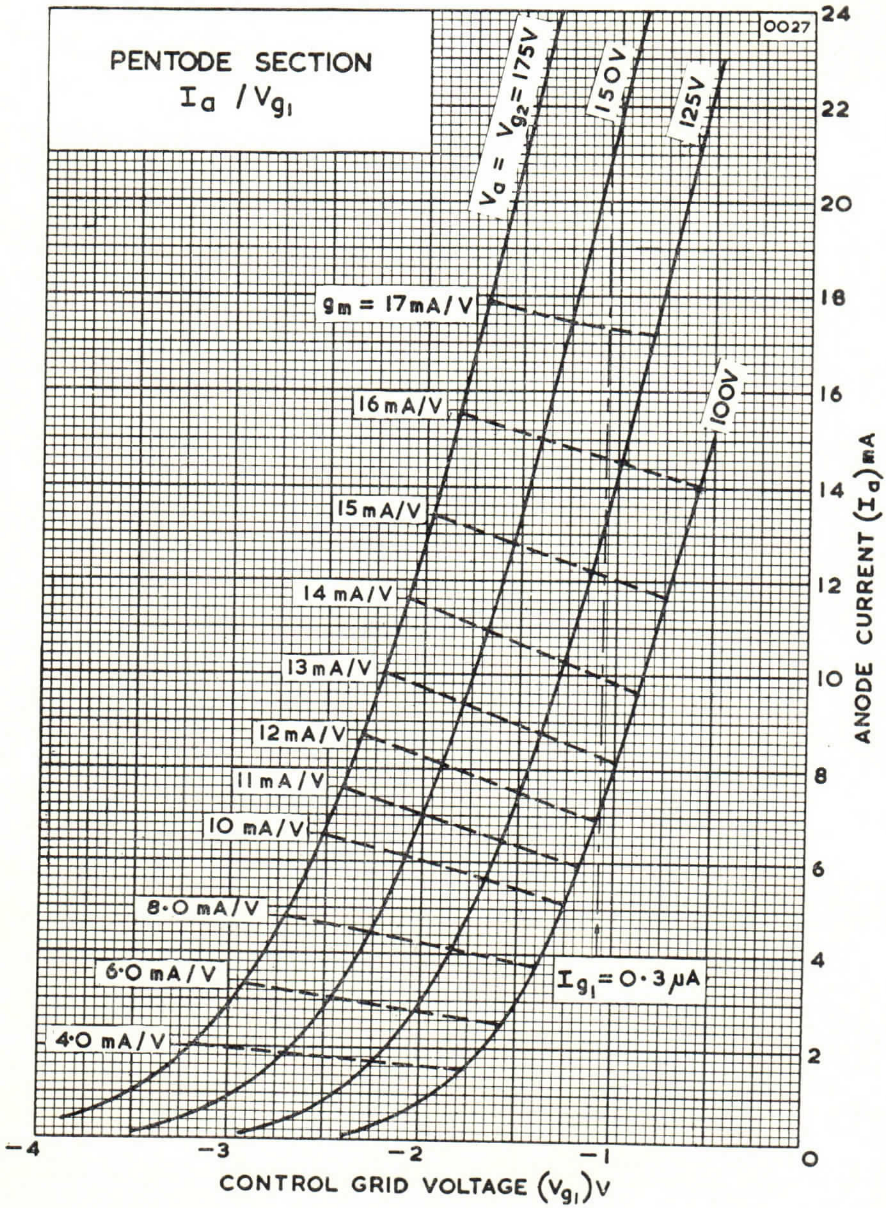
INTER-ELECTRODE CAPACITANCES

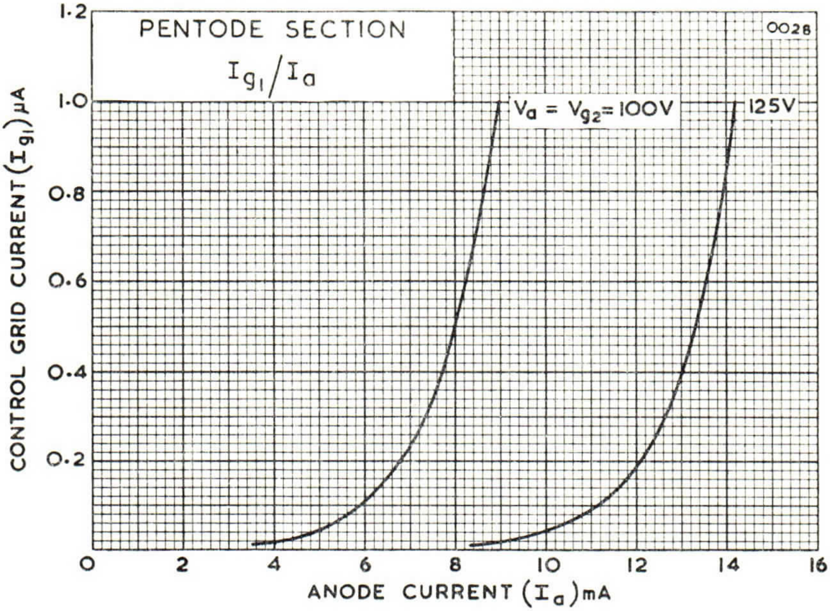
		Triode	Pentode	
Input	c_{in}	2·5	7·0	pF
Output	c_{out}	1·5	3·1	pF
Control Grid to Anode	$c_{g_1\text{-}a}$	1·8	$<$0·02	pF
Heater to Cathode	$c_{h\text{-}k}$	3·0	3·7	pF

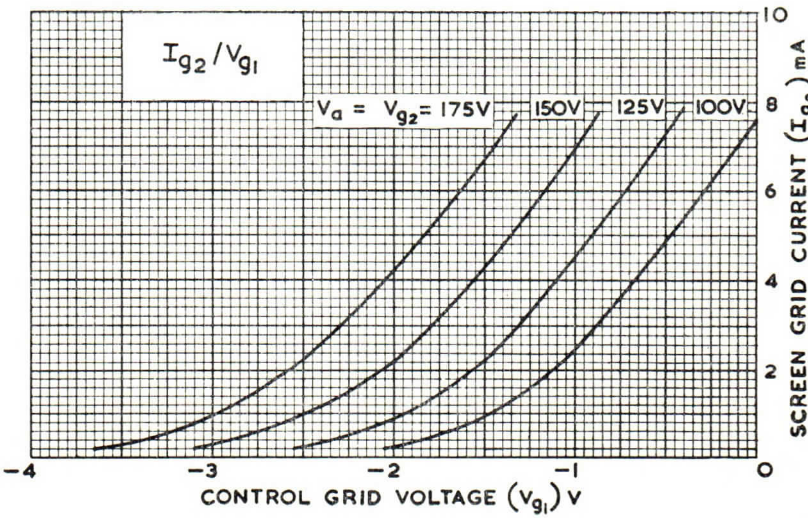
CHARACTERISTICS

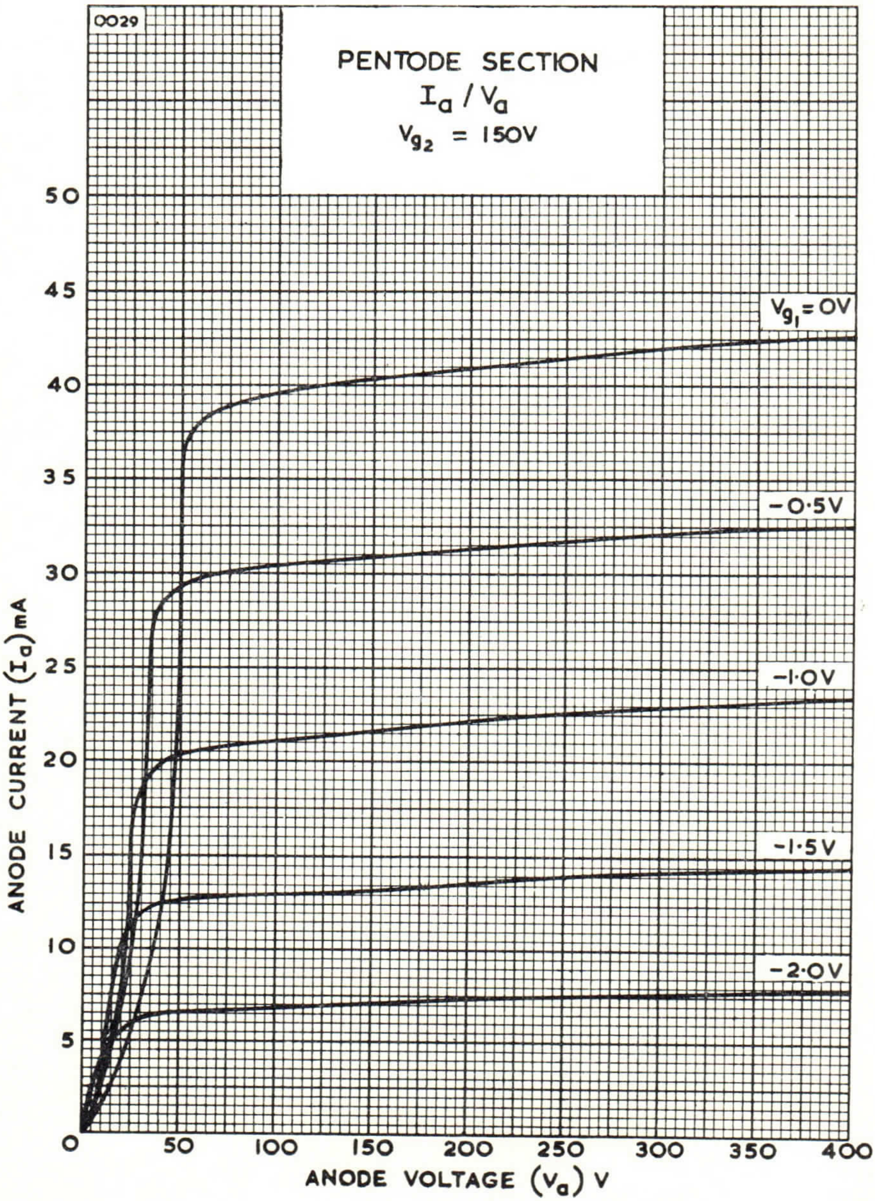
		Triode	Pentode	
Anode Voltage	V_a	150	150	V
Screen Grid Voltage	V_{g_2}	—	150	V
Control Grid Voltage	V_{g_1}	−1·5	−2·0	V
Anode Current	I_a	13·5	7·0	mA
Screen Grid Current	I_{g_2}	—	2·2	mA
Mutual Conductance	g_m	7·2	11	mA/V
Valve Anode Resistance ($\delta V_a/\delta i_a$)	r_a	5·3	350	kΩ
Amplification Factor	μ	38	—	
Inner Amplification Factor	$\mu_{g_1\text{-}g_2}$	—	55	
Control Grid Voltage for $I_a = 100\ \mu A$	$V_{g_1}(I_a = 100\mu A)$	—	−3·5	V

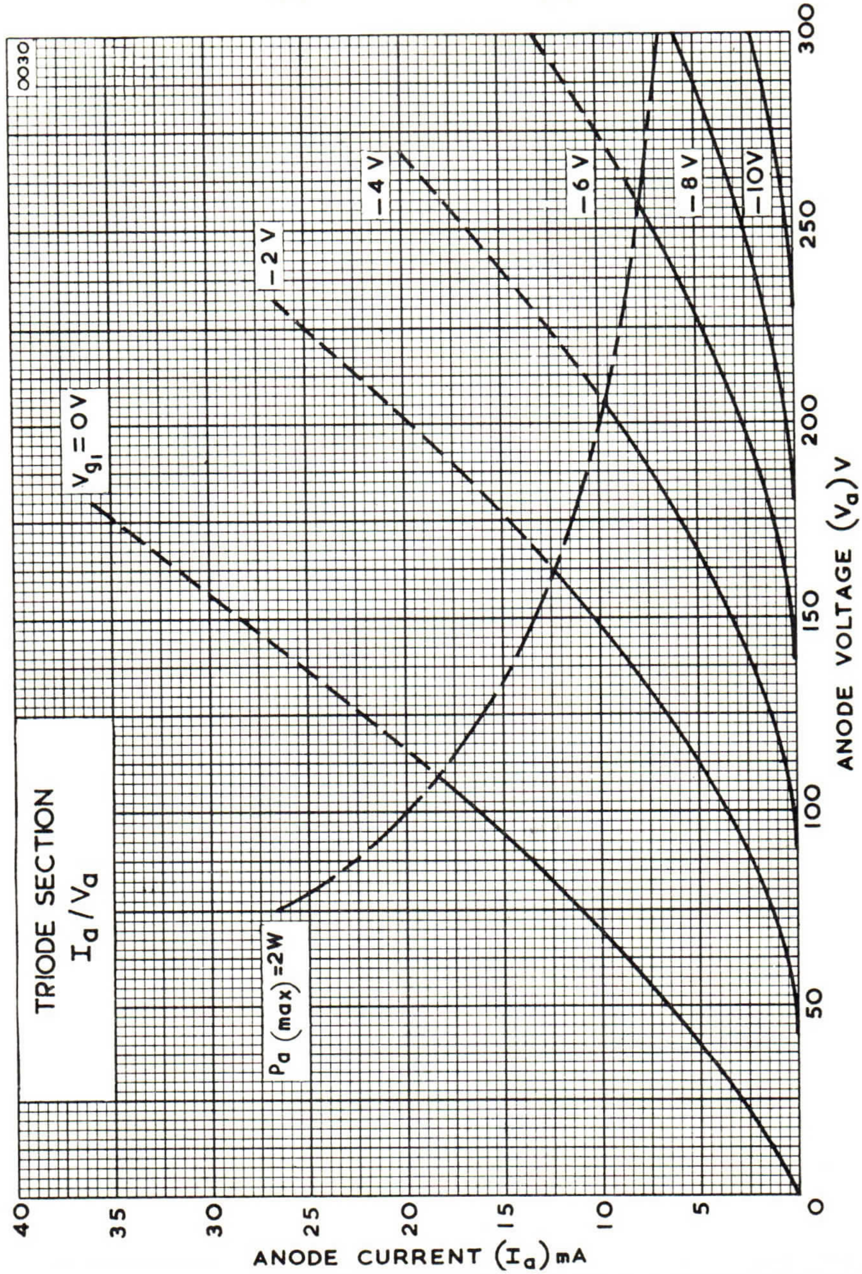
THORN—A E I RADIO VALVES & TUBES LTD.

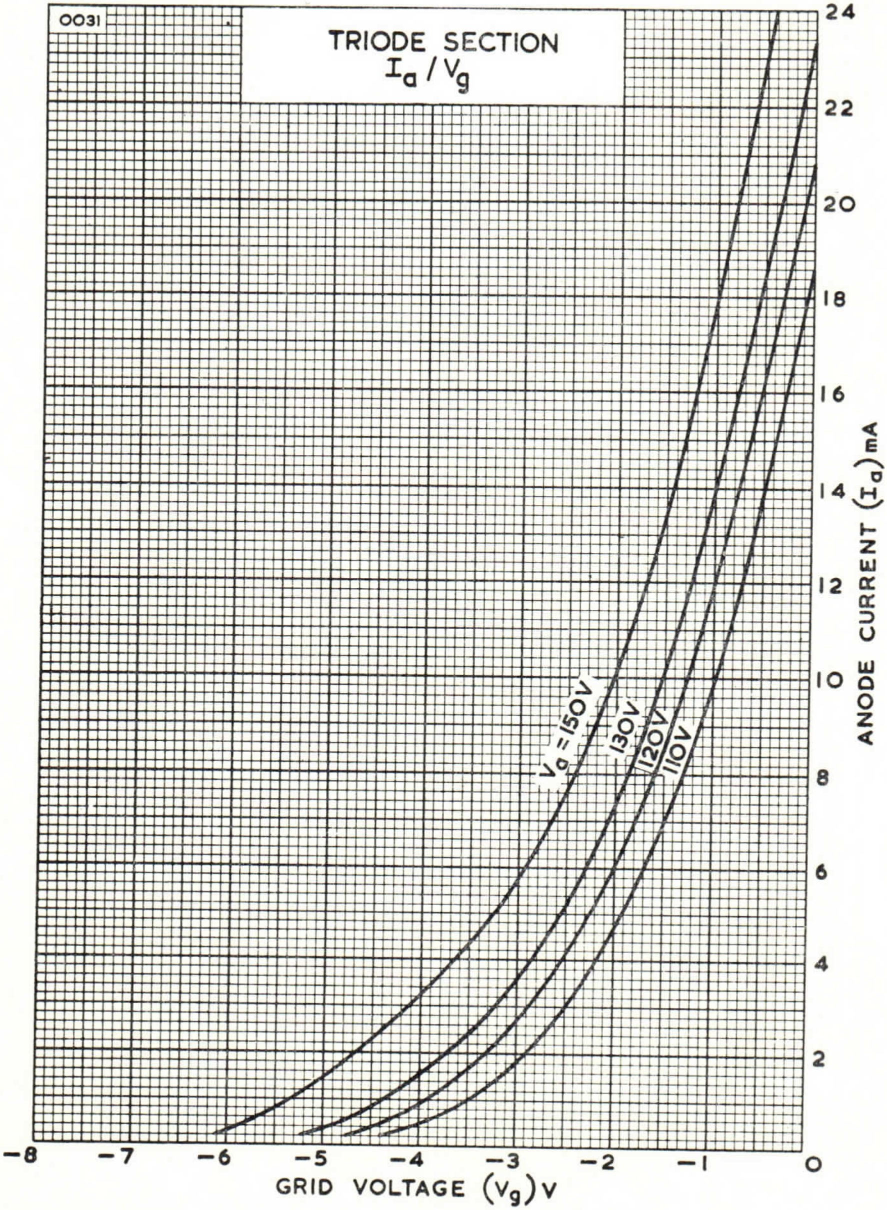

PENTODE SECTION
I_a / V_{g_1}
0027
$V_a = V_{g_2} = 175V$
150V
125V
100V
$g_m = 17mA/V$
16mA/V
15mA/V
14 mA/V
13mA/V
12mA/V
11mA/V
10 mA/V
8·0 mA/V
6·0 mA/V
4·0 mA/V
$I_{g_1} = 0·3\mu A$
24
22
20
18
16
14
12
10
8
6
4
2
−4
−3
−2
−1
0
CONTROL GRID VOLTAGE (V_{g_1})V
ANODE CURRENT (I_a)mA

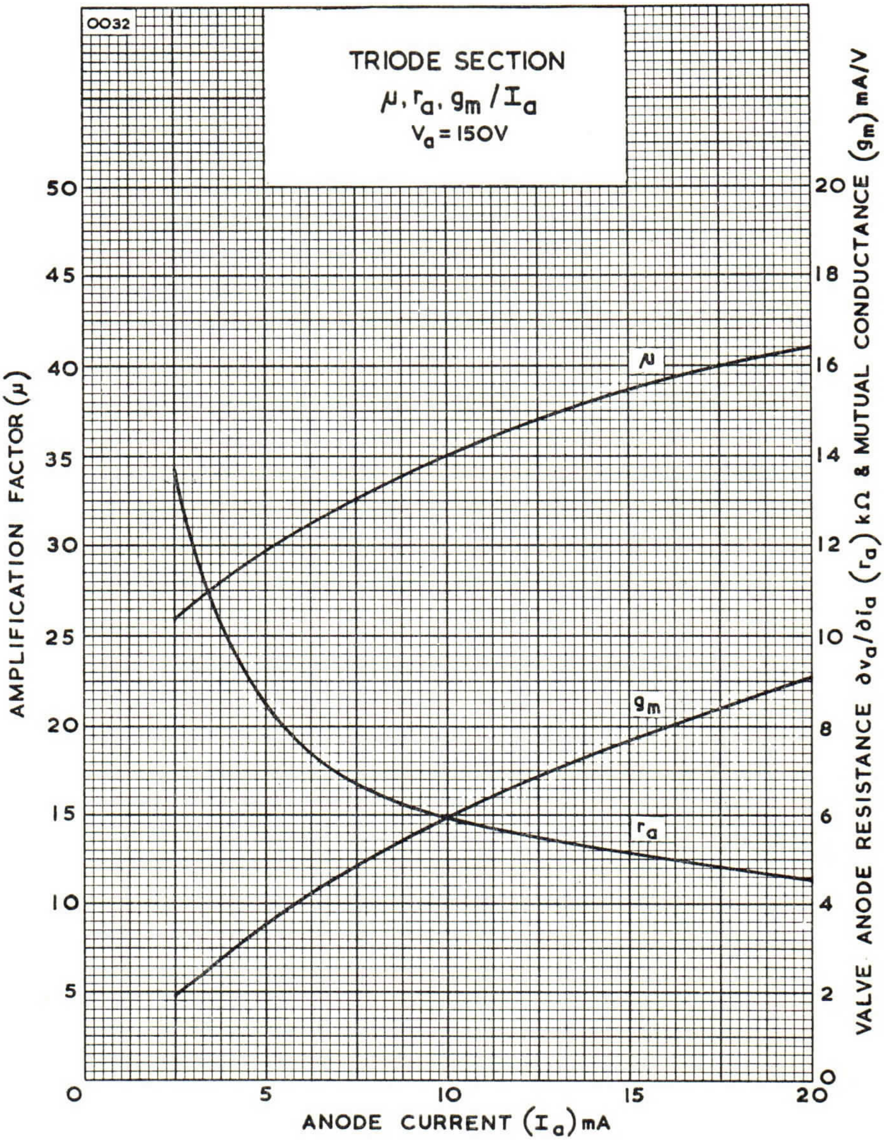

PENTODE SECTION
I_{g_1}/I_a
0028
$V_a = V_{g_2} = 100V$
125V
CONTROL GRID CURRENT (I_{g_1}) µA
1·2
1·0
0·8
0·6
0·4
0·2
0
2
4
6
8
10
12
14
16
ANODE CURRENT (I_a) mA

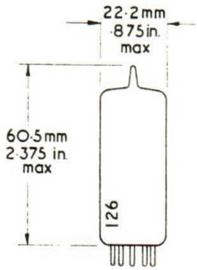

I_{g_2}/V_{g_1}
$V_a = V_{g_2} = 175V$
150V
125V
100V
SCREEN GRID CURRENT (I_{g_2}) mA
10
8
6
4
2
0
−4
−3
−2
−1
CONTROL GRID VOLTAGE (V_{g_1}) V


0029
PENTODE SECTION
I_a / V_a
$V_{g_2} = 150V$
$V_{g_1} = 0V$
−0·5V
−1·0V
−1·5V
−2·0V
ANODE CURRENT (I_a) mA
50
45
40
35
30
25
20
15
10
5
0
50
100
150
200
250
300
350
400
ANODE VOLTAGE (V_a) V

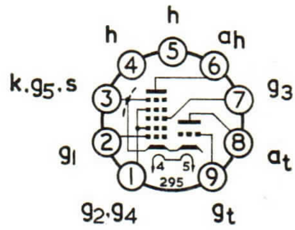

TRIODE SECTION
I_a / V_a
$V_{g1} = 0V$
−2 V
−4 V
−6 V
−8 V
−10V
P_a (max) = 2W
ANODE VOLTAGE (V_a) V
ANODE CURRENT (I_a) mA
0
5
10
15
20
25
30
35
40
50
100
150
200
250
300
0030


0031
TRIODE SECTION
I_a / V_g
$V_a = 150V$
130V
120V
110V
ANODE CURRENT (I_a) mA
24
22
20
18
16
14
12
10
8
6
4
2
−8
−7
−6
−5
−4
−3
−2
−1
0
GRID VOLTAGE (V_g) V


0032
TRIODE SECTION
$\mu, r_a, g_m / I_a$
$V_a = 150V$
AMPLIFICATION FACTOR (μ)
VALVE ANODE RESISTANCE $\partial v_a/\partial i_a$ (r_a) kΩ & MUTUAL CONDUCTANCE (g_m) mA/V
ANODE CURRENT (I_a) mA
μ
g_m
r_a
0
5
10
15
20
25
30
35
40
45
50
2
4
6
8
10
12
14
16
18
20



TRIODE HEPTODE FREQUENCY CHANGER



B9A Base

GENERAL

This triode heptode valve combination, with separate electrode structures, is for use in AM/FM broadcast radio AC mains receivers. The valve is intended to be used as a frequency changer for AM signals with the triode as local oscillator and the heptode switched to operate as an I.F. amplifier for FM signals.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·3	A

RATINGS

		Triode	Heptode	
Maximum Anode Dissipation	$p_{a(max)}$	0·8	1·7	W
Maximum Screen Grids Dissipation	$p_{g2+g4(max)}$	—	1	W
Maximum Anode Voltage	$V_{a(max)}$	250	300	V
Maximum Screen Grids Voltage	$V_{g2+g4(max)}$	—	125	V
Maximum Screen Grids Voltage ($I_a < 1$ mA)		—	300	V
Maximum Heater to Cathode Voltage (D.C.)	$V_{h\text{-}k(max)}$	100*		V
Maximum Mean Cathode Current	$I_{k(av)max}$	6·5	12·5	mA

* Measured with respect to the higher potential heater pin.

INTER-ELECTRODE CAPACITANCES

		Triode	Heptode	
Output	c_{out}	2·1	7·9	pF
Input (g_1)	$c_{in(g1)}$	2·6	4·8	pF
Input (g_3)	$c_{in(g3)}$	—	6	pF
Grid 1 to Anode	$c_{g1\text{-}a}$	1	<0·006	pF
Grid 1 to Grid 3	$c_{g1\text{-}g3}$	—	<0·3	pF
Grid 1 to Grid 3, Grid Triode	$c_{g1\text{-}g3gt}$	<0·45		pF
Grid 1 to Grid Triode	$c_{g1\text{-}gt}$	<0·17		pF
Anode Heptode to Anode Triode	$c_{ah\text{-}at}$	0·2		pF

Inter-electrode capacitances measured with holder capacitances balanced out.

THORN—A E I RADIO VALVES & TUBES LTD.

CHARACTERISTICS

		Triode	Heptode	
Anode Voltage	V_a	100	250	V
Screen Grids Voltage	V_{g2+g4}	—	100	V
Grid 3 Voltage	V_{g3}	—	0	V
Control Grid Voltage	V_{g1}	−1	−2	V
Anode Current	I_a	10	6·5	mA
Mutual Conductance	g_m	3·2	2·4	mA/V
Amplification Factor	μ	19	—	
Inner Amplification Factor	$\mu_{g1-(g2+g4)}$	—	20	

TYPICAL OPERATION AS R.F. or I.F. AMPLIFIER

Heptode Section

Supply Voltage	V_b	250	V
Anode Voltage	V_a	250	V
Screen Grids Resistance	R_{g2+g4}	39	kΩ
Screen Grids Voltage (Initial)	V_{g2+g4}	100	V
Grid 3 Voltage	V_{g3}	0	V
Control Grid Voltage	V_{g1}	−2	V
Anode Current (approximately)	I_a	6·5	mA
Screen Grids Current (approximately)	I_{g2+g4}	3·8	mA
Mutual Conductance	g_m	2·4	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	0·7	MΩ
Equivalent Grid Noise Resistance	R_{eq}	8·5	kΩ
Input Resistance at 100 Mc/s		2	kΩ
Grid 1 Voltage for 100 : 1 reduction of Mutual Conductance		−42	V

TYPICAL OPERATION AS A.M. FREQUENCY CHANGER

Heptode Section

Supply Voltage	V_b	250	V
Anode Voltage	V_a	250	V
Screen Grids Resistance	R_{g2+g4}	22	kΩ
Screen Grids Voltage (Initial)	V_{g2+g4}	103	V
Control Grid Voltage	V_{g1}	−2	V
Anode Current (approximately)	I_a	3·25	mA
Screen Grids Current (approximately)	I_{g2+g4}	6·7	mA
Heptode Grid 3 and Triode Grid Current	I_{g3+gt}	200	μA
Heptode Grid 3 and Triode Grid Resistance	R_{g3+gt}	47	kΩ
Peak Heterodyne Voltage	$v_{(pk)het}$	12	V
Conversion Conductance	g_c	775	μA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	1	MΩ
Equivalent Grid Noise Resistance	R_{eq}	70	kΩ
Grid Voltage for 100 : 1 reduction of Conversion Conductance		−28·5	V

Triode

Anode Voltage	V_a	100	V
Anode Current (Average)	$I_{a(av)}$	4·5	mA

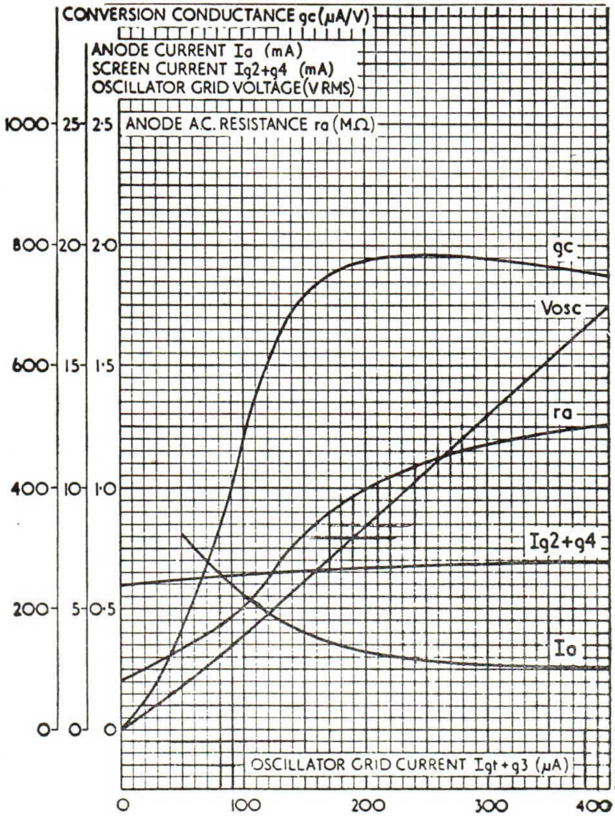
MOUNTING POSITION—Unrestricted

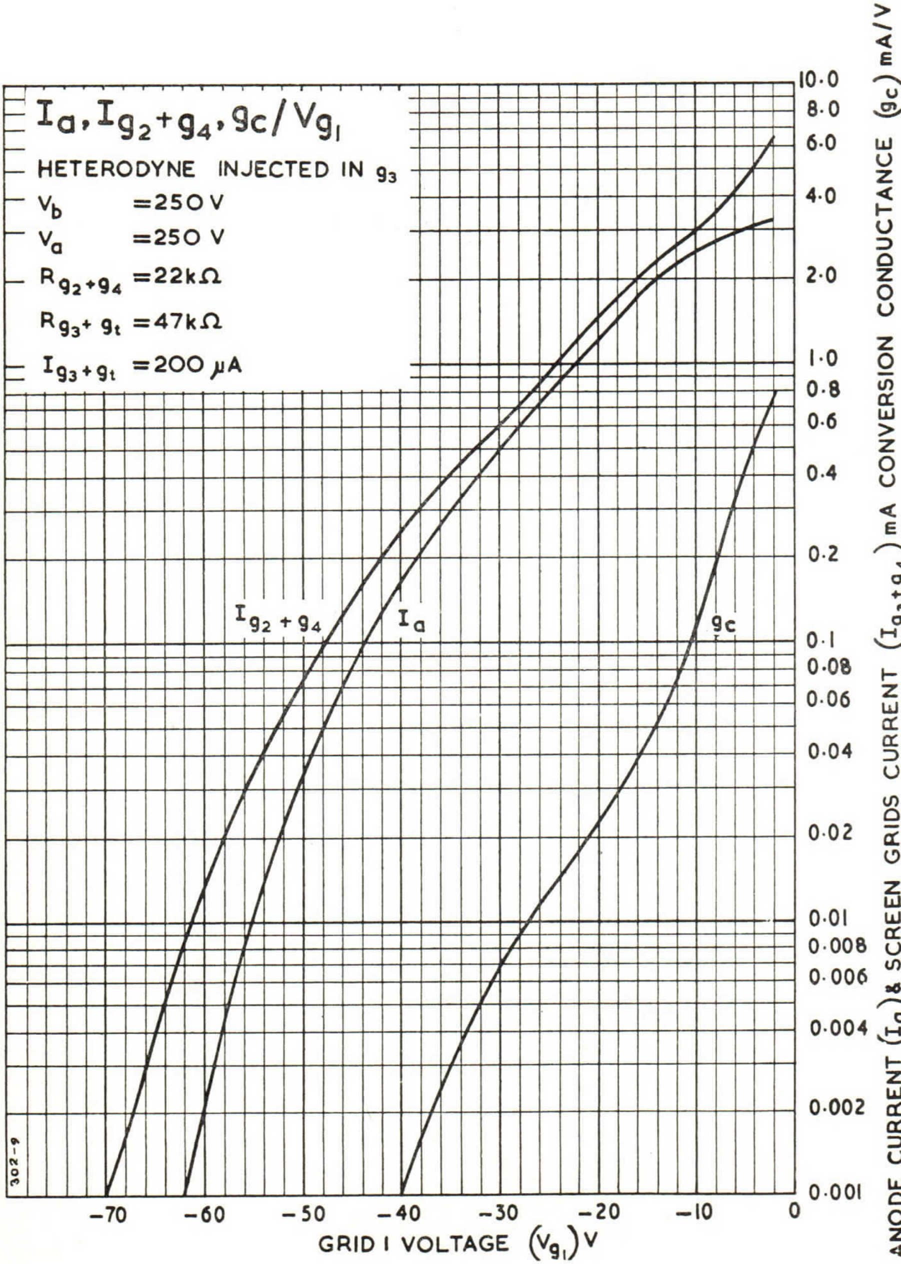
APPROXIMATE WEIGHT

Net	0·5	oz
Packed	0·75	oz

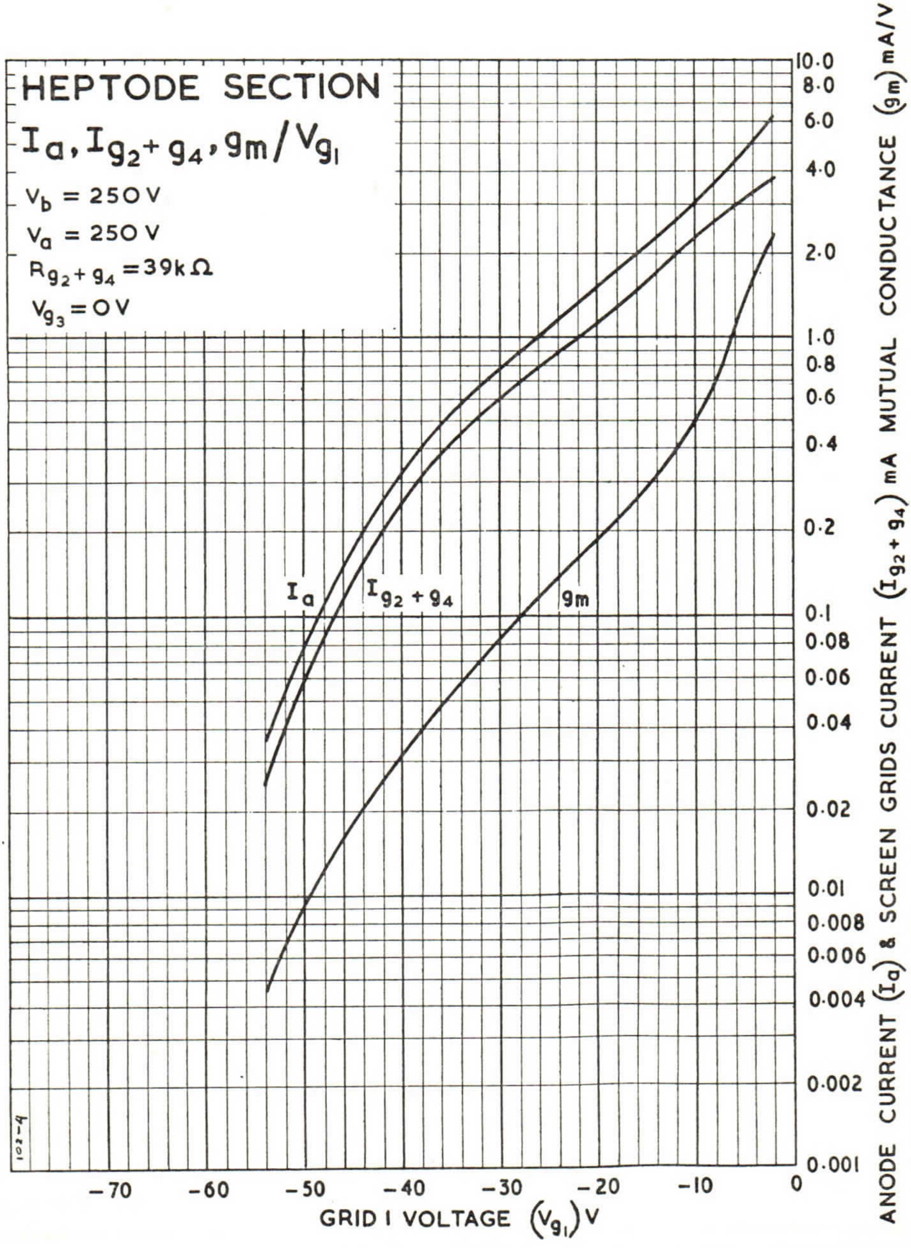
AVERAGE CHARACTERISTIC CURVES:
$I_a, I_{g2}, g_c, r_a, V_{osc}/I_{gt+g3}$

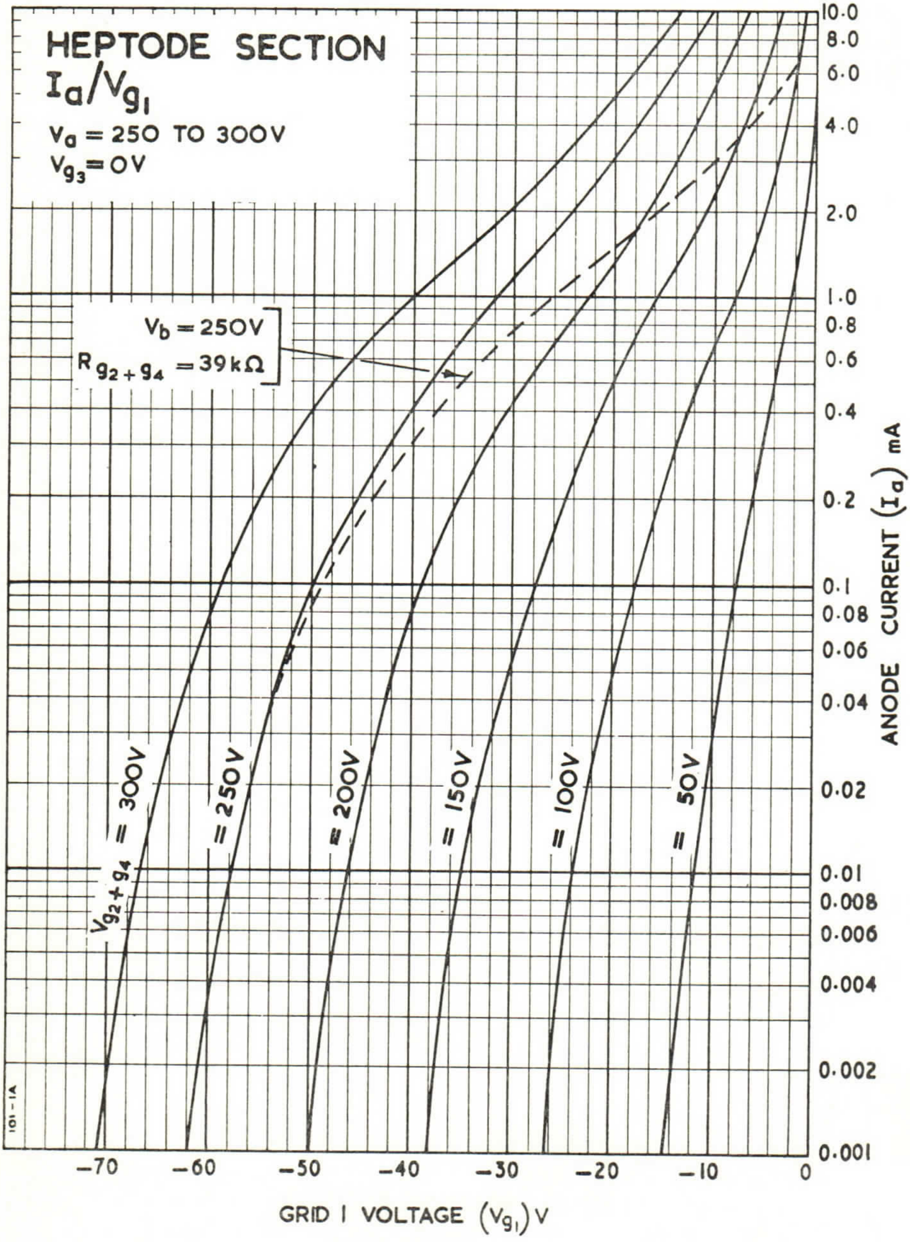
$V_a = 250V$ $R_{g2+g4} = 22k\Omega$
$V_{g1} = -2V$ $R_{gt+g3} = 47k\Omega$

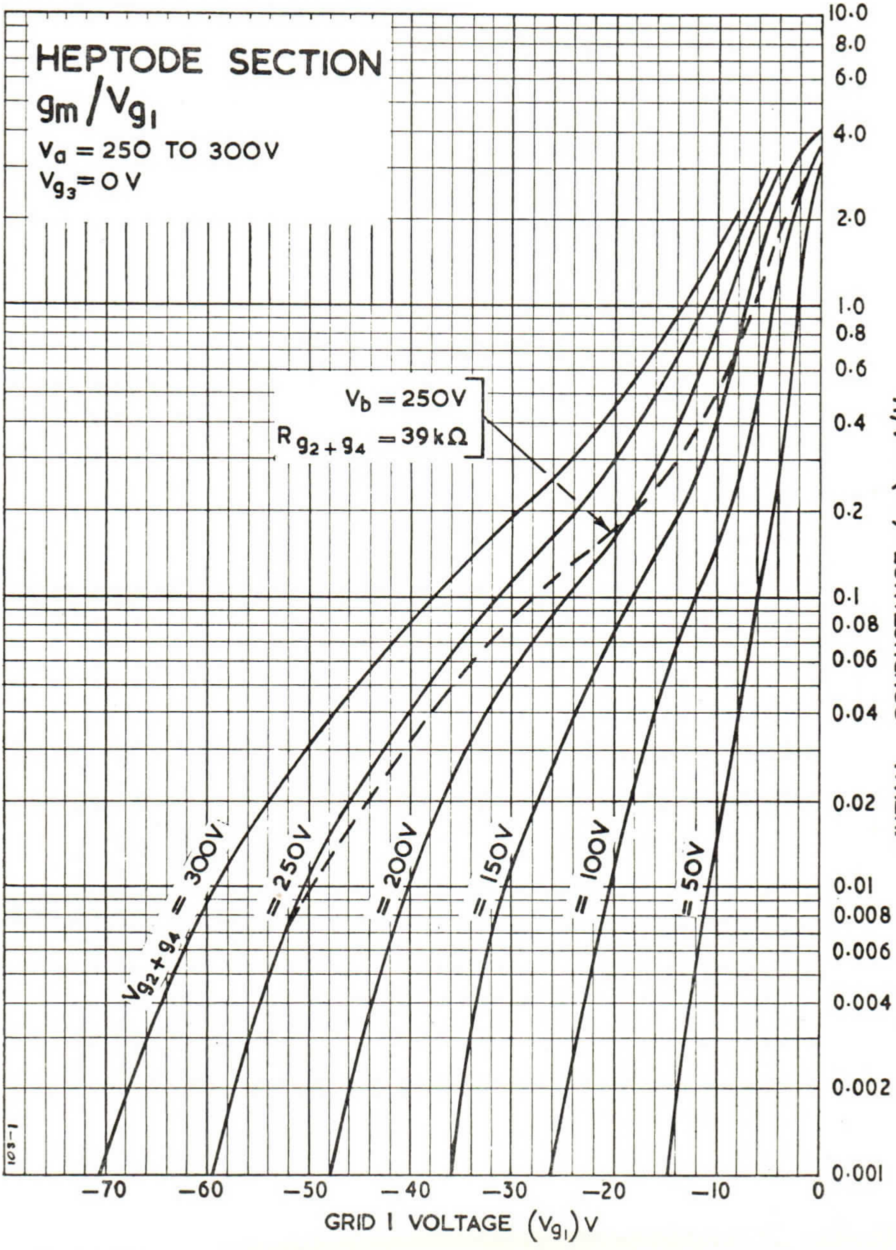


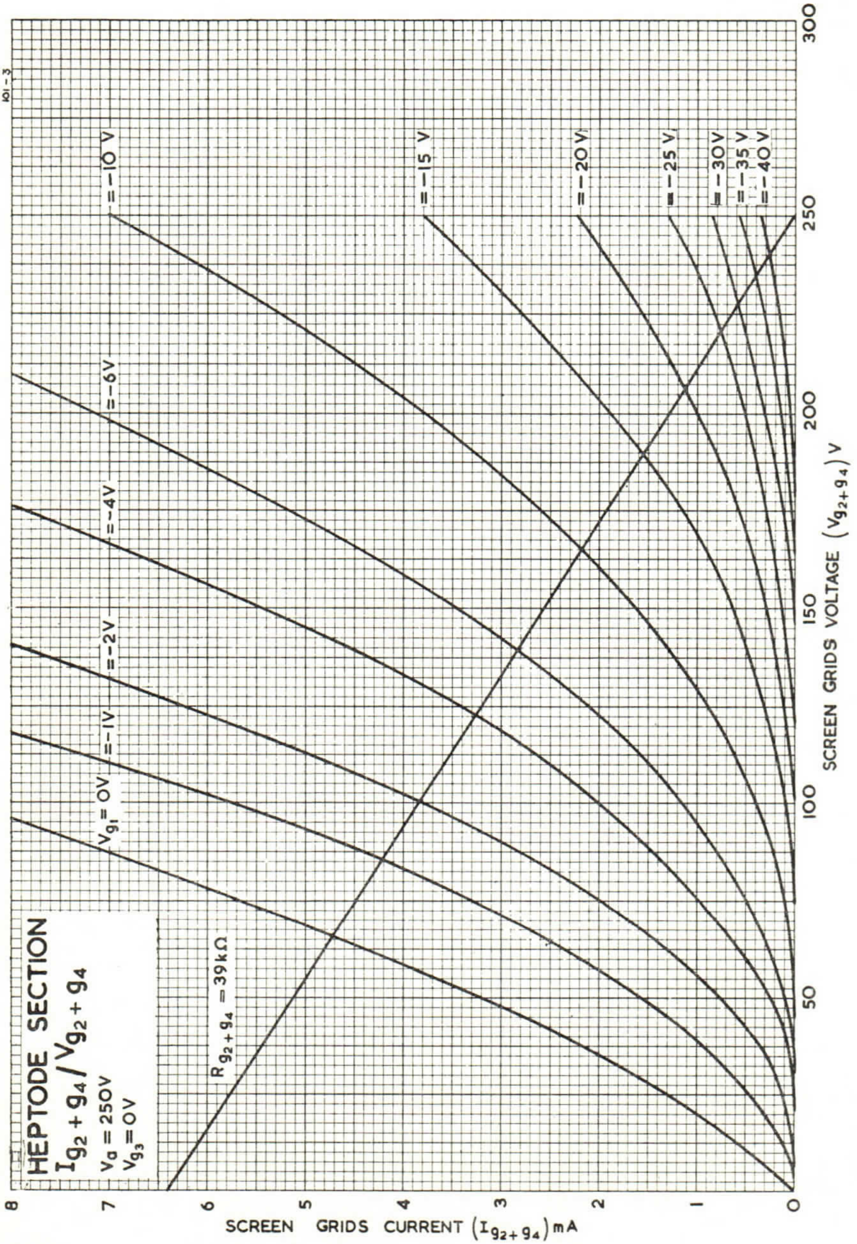


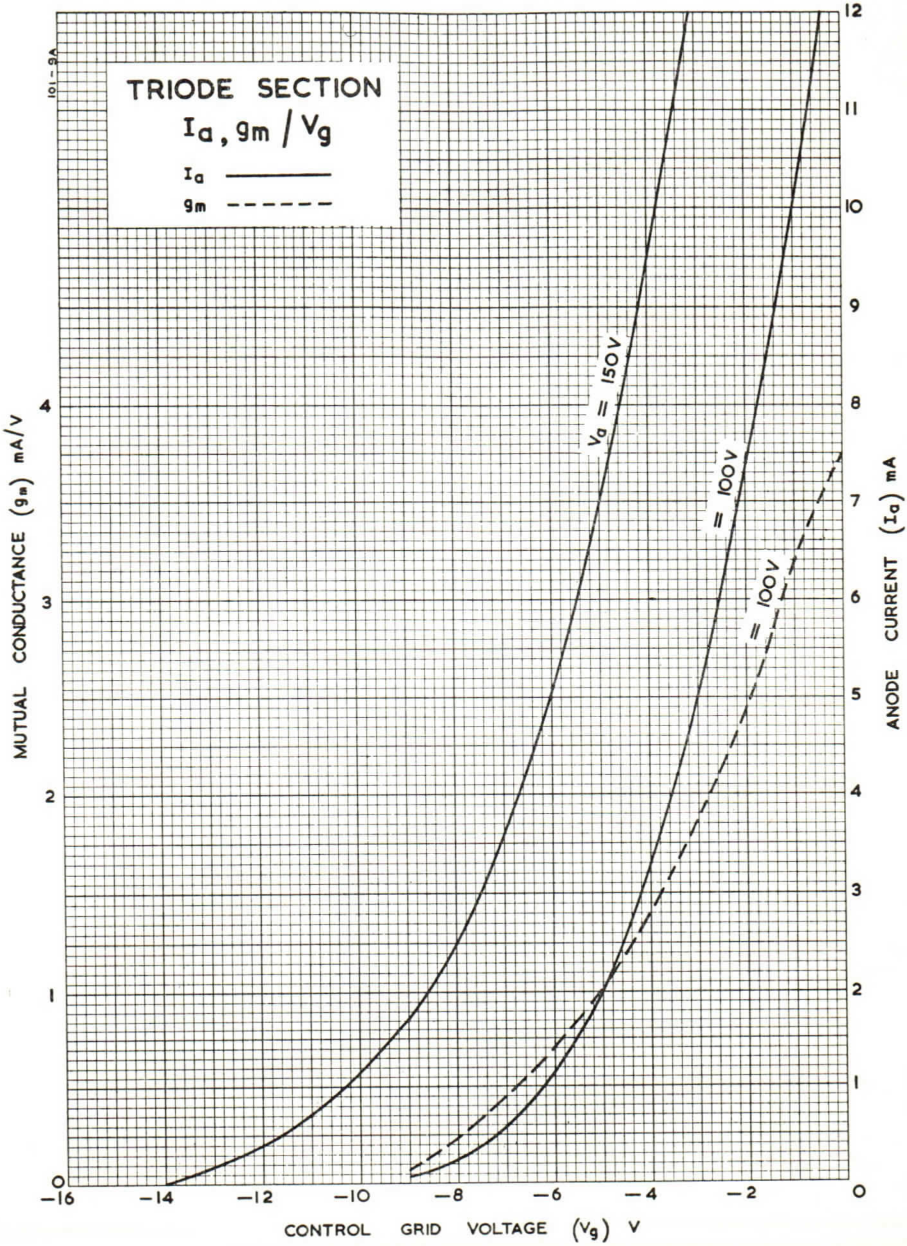
Ia, Ig2+g4, gc/Vg1
HETERODYNE INJECTED IN g3
Vb =250 V
Va =250 V
Rg2+g4 =22kΩ
Rg3+gt =47kΩ
Ig3+gt =200 µA
Ig2 + g4
Ia
gc
10·0
8·0
6·0
4·0
2·0
1·0
0·8
0·6
0·4
0·2
0·1
0·08
0·06
0·04
0·02
0·01
0·008
0·006
0·004
0·002
0·001
−70
−60
−50
−40
−30
−20
−10
0
GRID 1 VOLTAGE (Vg1) V
ANODE CURRENT (Ia) & SCREEN GRIDS CURRENT (Ig2+g4) mA CONVERSION CONDUCTANCE (gc) mA/V
302-9


HEPTODE SECTION
$I_a, I_{g_2+g_4}, g_m/V_{g_1}$
$V_b = 250$ V
$V_a = 250$ V
$R_{g_2+g_4} = 39$ kΩ
$V_{g_3} = 0$ V
I_a
$I_{g_2+g_4}$
gm
10.0
8.0
6.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
0.08
0.06
0.04
0.02
0.01
0.008
0.006
0.004
0.002
0.001
−70
−60
−50
−40
−30
−20
−10
0
GRID I VOLTAGE (V_{g_1}) V
ANODE CURRENT (I_a) & SCREEN GRIDS CURRENT $(I_{g_2+g_4})$ mA MUTUAL CONDUCTANCE (g_m) mA/V
102-4

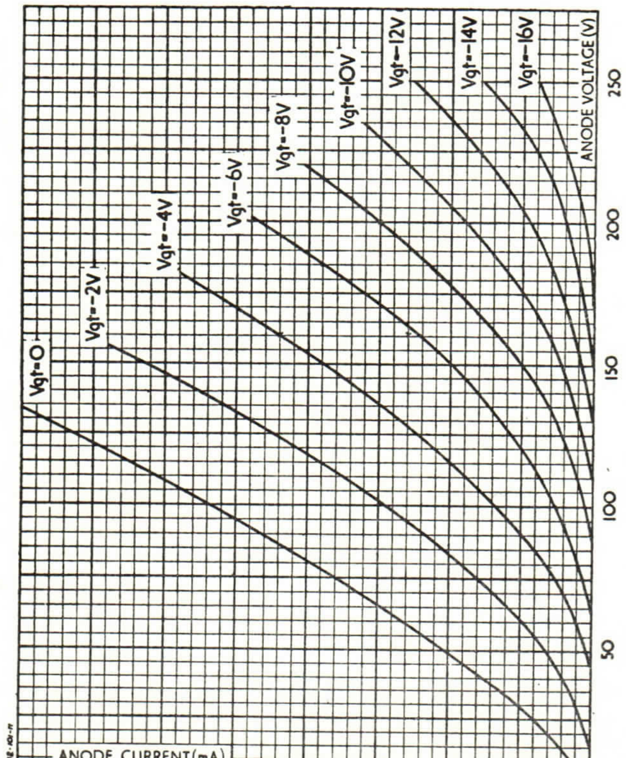

HEPTODE SECTION
I_a/V_{g_1}
V_a = 250 TO 300V
V_{g_3}= 0V
V_b = 250V
$R_{g_2+g_4}$ = 39kΩ
$V_{g_2+g_4}$ = 300V
= 250V
= 200V
= 150V
= 100V
= 50V
10.0
8.0
6.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
0.08
0.06
0.04
0.02
0.01
0.008
0.006
0.004
0.002
0.001
ANODE CURRENT (I_a) mA
−70
−60
−50
−40
−30
−20
−10
0
GRID I VOLTAGE (V_{g_1}) V
101-1A

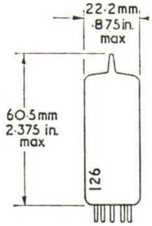

HEPTODE SECTION
g_m/V_{g_1}
$V_a = 250$ TO 300V
$V_{g_3} = 0$ V
$V_b = 250$V
$R_{g_2+g_4} = 39$kΩ
$V_{g_2+g_4} = 300$V
= 250V
= 200V
= 150V
= 100V
= 50V
10.0
8.0
6.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
0.08
0.06
0.04
0.02
0.01
0.008
0.006
0.004
0.002
0.001
MUTUAL CONDUCTANCE (g_m) mA/V
−70
−60
−50
−40
−30
−20
−10
0
GRID 1 VOLTAGE (V_{g_1}) V
103-1


HEPTODE SECTION
$I_{g_2+g_4}/V_{g_2+g_4}$
$V_a = 250V$
$V_{g_3} = 0V$
$V_{g_1} = 0V$
= −1V
= −2V
= −4V
= −6V
= −10 V
= −15 V
= −20 V
= −25 V
= −30 V
= −35 V
= −40 V
$R_{g_2+g_4} = 39k\Omega$
SCREEN GRIDS CURRENT $(I_{g_2+g_4})$ mA
SCREEN GRIDS VOLTAGE $(V_{g_2+g_4})$ V
8
7
6
5
4
3
2
1
0
50
100
150
200
250
300

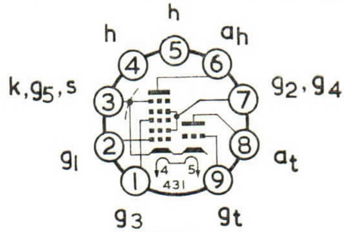

TRIODE SECTION
$I_a, g_m / V_g$
I_a
g_m
$V_a = 150V$
$= 100V$
$= 100V$
MUTUAL CONDUCTANCE (g_m) mA/V
ANODE CURRENT (I_a) mA
CONTROL GRID VOLTAGE (V_g) V
−16
−14
−12
−10
−8
−6
−4
−2
0
1
2
3
4
5
6
7
8
9
10
11
12

CHARACTERISTIC CURVES: I_a/V_a
Triode Section





TRIODE HEPTODE



B9A Base

GENERAL

This triode heptode is intended for use as a noise cancelled synchronising pulse separator and time base oscillator.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·3	A

RATINGS

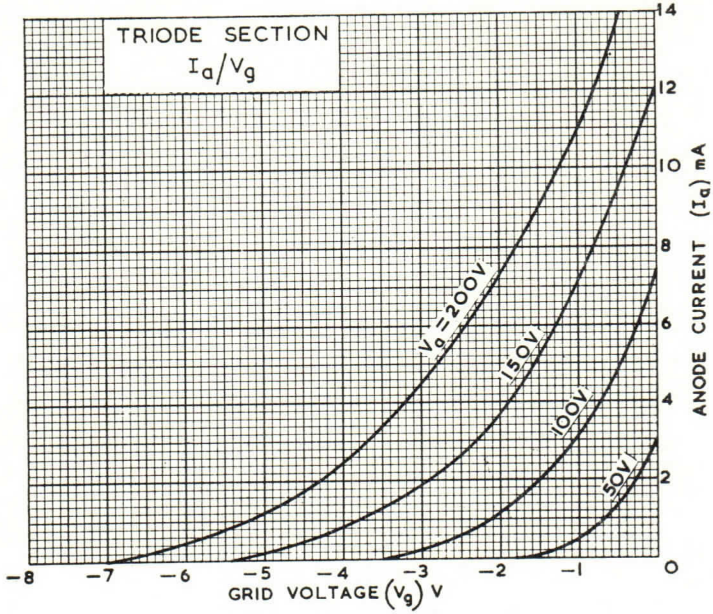
		Triode	Heptode	
Maximum Anode Dissipation	$p_{a(max)}$	1·3	1·7	W
Maximum Screen Grids Dissipation	$p_{g2+g4(max)}$	—	0·8	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	550	V
Maximum Anode Voltage	$V_{a(max)}$	250	250	V
Maximum Screen Grids Supply Voltage	$V_{g2+g4(b)max}$	—	550	V
Maximum Screen Grids Voltage	$V_{g2+g4(max)}$	—	250	V
Minimum Screen Grids Voltage	$V_{g2+g4(min)}$	—	10	V
Maximum Peak Negative Control Grid Voltage	$-V_{g1(pk)max}$	200	150	V
Maximum Peak Negative Grid 3 Voltage	$-V_{g3(pk)max}$	—	150	V
Maximum Cathode Current	$I_{k(max)}$	10	12·5	mA
Maximum Control Grid to Cathode Resistance	$R_{g1\text{-}k(max)}$	3·0	3·0	MΩ
Maximum Grid 3 to Cathode Resistance	$R_{g3\text{-}k(max)}$	—	3·0	MΩ
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$	—	100	V

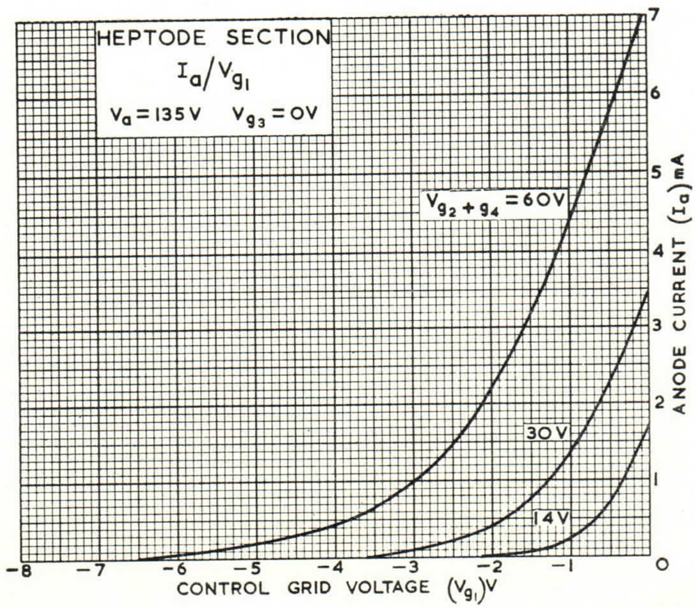
INTER-ELECTRODE CAPACITANCES

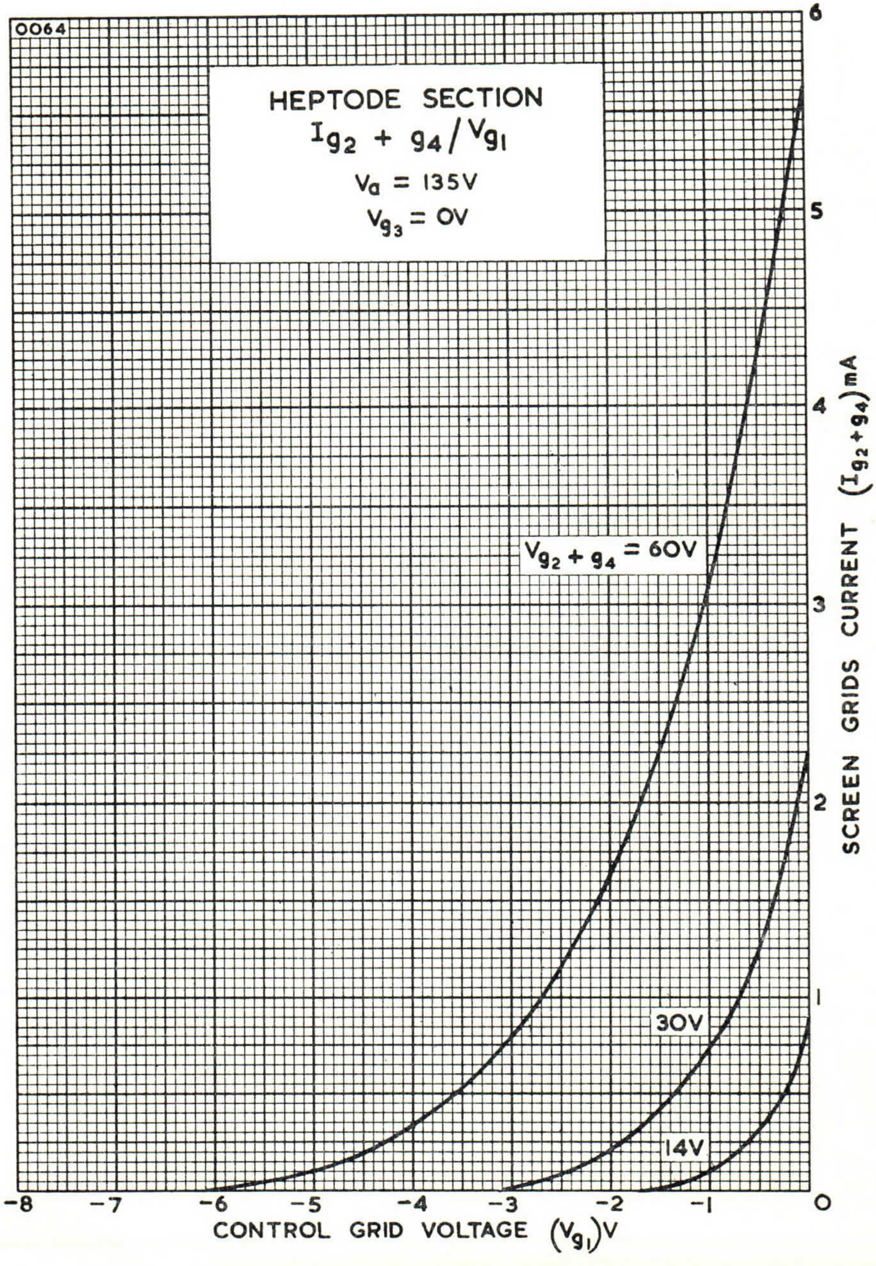
Anode Heptode to Anode Triode	$c_{ah\text{-}at}$	<0·25	pF
Anode Heptode to Grid Triode	$c_{ah\text{-}gt}$	<0·09	pF
Grid 1 to Anode Triode	$c_{g1\text{-}at}$	<0·08	pF
Grid 1 to Grid Triode	$c_{g1\text{-}gt}$	<0·10	pF
Grid 3 to Anode Triode	$c_{g3\text{-}at}$	<0·13	pF
Anode Heptode to Grid 1	$c_{ah\text{-}g1}$	<0·009	pF
Triode Input	$c_{in(t)}$	3·0	pF
Anode Triode to Grid Triode	$c_{at\text{-}gt}$	1·1	pF

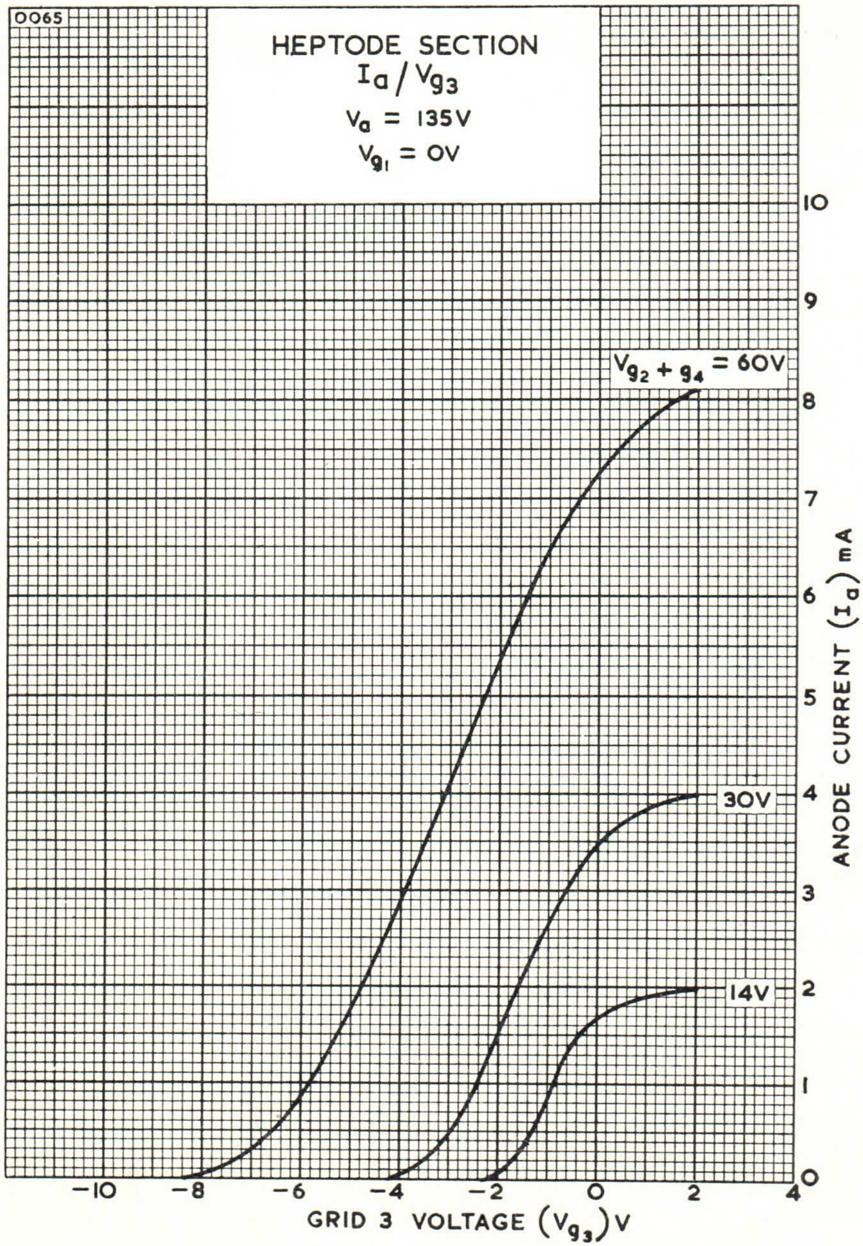
CHARACTERISTICS

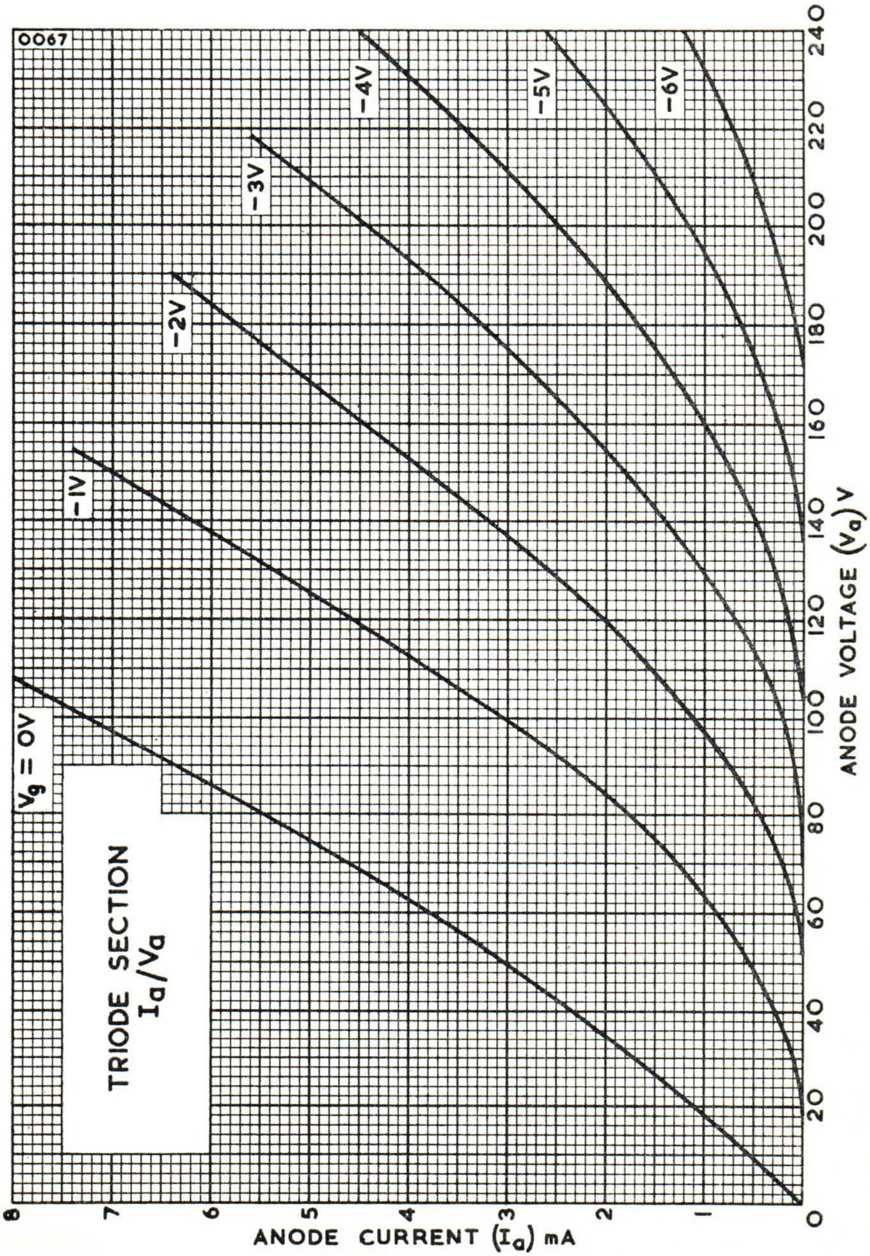
		Triode	Heptode	
Anode Voltage	V_a	50	135	V
Screen Grids Voltage	V_{g2+g4}	—	14	V
Grid 3 Voltage	V_{g3}	—	0	V
Control Grid Voltage	V_{g1}	0	0	V
Anode Current	I_a	3·0	1·7	mA
Screen Grids Current	I_{g2+g4}	—	0·9	mA
Mutual Conductance	g_m	3·7	2·2	mA/V
Amplification Factor	μ	50	—	
Grid 3 Voltage for $I_a = 20\ \mu A$	V_{g3}	—	−2·0	V
Control Grid Voltage for $I_a = 20\ \mu A$	V_{g1}	—	−1·9	V
Anode Current ($V_a = 200$ V, $V_g = -11$ V)	I_a	<100	—	μA
Maximum Negative Grid 3 Voltage ($I_{g3} = +0·3\mu A$)		—	1·3	V
Maximum Negative Grid 1 Voltage ($I_{g1} = +0·3\mu A$)		1·3	1·3	V

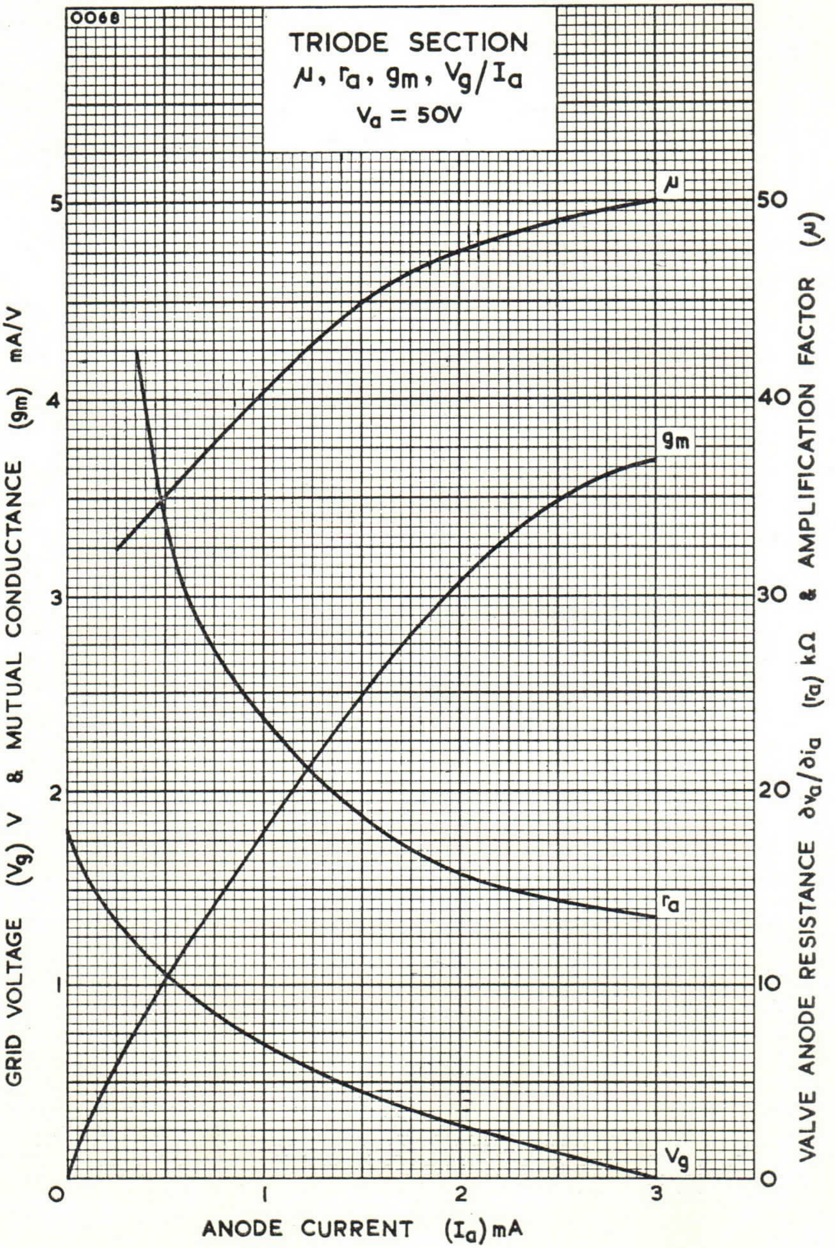

TRIODE SECTION
I_a/V_g
$V_a = 200V$
150V
100V
50V
ANODE CURRENT (I_a) mA
GRID VOLTAGE (V_g) V
0
2
4
6
8
10
12
14
−8
−7
−6
−5
−4
−3
−2
−1
0

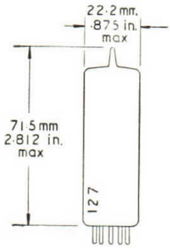

HEPTODE SECTION
I_a/V_{g_1}
$V_a = 135V$ $V_{g_3} = 0V$
$V_{g_2+g_4} = 60V$
30V
14V
ANODE CURRENT (I_a) mA
CONTROL GRID VOLTAGE (V_{g_1})V
0
1
2
3
4
5
6
7
−8
−7
−6
−5
−4
−3
−2
−1
0


0064
HEPTODE SECTION
$I_{g_2+g_4}/V_{g_1}$
$V_a = 135V$
$V_{g_3} = 0V$
$V_{g_2+g_4} = 60V$
30V
14V
6
5
4
3
2
1
0
−8 −7 −6 −5 −4 −3 −2 −1
CONTROL GRID VOLTAGE (V_{g_1})V
SCREEN GRIDS CURRENT $(I_{g_2+g_4})$mA

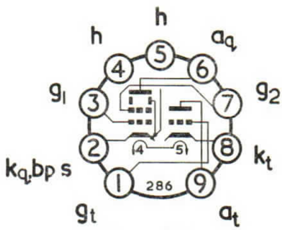

0065
HEPTODE SECTION
Ia / Vg3
Va = 135V
Vg1 = 0V
Vg2 + g4 = 60V
30V
14V
10
9
8
7
6
5
4
3
2
1
0
ANODE CURRENT (Ia) mA
−10
−8
−6
−4
−2
0
2
4
GRID 3 VOLTAGE (Vg3) V


0067
$V_g = 0V$
−1V
−2V
−3V
−4V
−5V
−6V
TRIODE SECTION
I_a/V_a
ANODE VOLTAGE (V_a) V
ANODE CURRENT (I_a) mA


0068
TRIODE SECTION
μ, r_a, g_m, V_g/I_a
$V_a = 50V$
μ
g_m
r_a
V_g
GRID VOLTAGE (V_g) V & MUTUAL CONDUCTANCE (g_m) mA/V
VALVE ANODE RESISTANCE $\partial v_a/\partial i_a$ (r_a) kΩ & AMPLIFICATION FACTOR (μ)
ANODE CURRENT (I_a) mA
0
1
2
3
4
5
10
20
30
40
50



TRIODE OUTPUT BEAM TETRODE



Base B9A

GENERAL

This triode output beam tetrode is for use in television receivers with the triode as A.F. amplifier or time base oscillator and the tetrode as audio or field output valve.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·78	A

RATINGS

		Triode	Tetrode	
Maximum Anode Dissipation	$p_{a(max)}$			
For $V_a \leqslant 250V$		1·0	7·0	W
For $V_a > 250V$		—	5·0	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	—	1·8	W
For speech and music		—	3·2	W
Maximum Anode Supply Voltage ($I_a=0$)	$V_{a(b)max}$	550	550	V
Maximum Anode Voltage	$V_{a(max)}$	300	300	V
Maximum Peak Anode Voltage	$v_{a(pk)max}$			
Pulse Positive		0·6*	2·5†	kV
Pulse Negative		—	500	V
Maximum Screen Grid Supply Voltage ($I_{g2}=0$)	$V_{g2(b)max}$	—	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	—	300	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$	100‡	100‡	V
Maximum Mean Cathode Current	$I_{k(av)max}$	15	50	mA
Maximum Resistance Grid 1 to Cathode	$R_{g1\text{-}k(max)}$			
Self Bias		3	2	MΩ
Fixed Bias		1	1	MΩ
Grid Current Bias		22	—	MΩ
Maximum Resistance Heater to Cathode	$R_{h\text{-}k(max)}$	20	20	kΩ

* Maximum pulse duration 200μs.
† Maximum pulse duration 4 per cent. of one cycle with a maximum of 800μs.
‡ Measured with respect to the higher potential heater pin.

INTER-ELECTRODE CAPACITANCES

		§	¶	‖	
Tetrode Input	$c_{in(q)}$	9·3	9·6	10·7	pF
Tetrode Output	$c_{out(q)}$	9·0	9·3	10·4	pF
Tetrode Anode to Grid 1	$c_{aq\text{-}g1}$	0·35	0·37	0·38	pF
Triode Input	$c_{in(t)}$	3·0	3·2	4·1	pF
Triode Output	$c_{out(t)}$	4·3	4·5	5·4	pF
Grid Triode to Anode Triode	$c_{gt\text{-}at}$	4·2	4·3	4·4	pF
Anode Tetrode to Anode Triode	$c_{aq\text{-}at}$	0·15	0·18	0·19	pF
Grid 1 to Grid Triode	$c_{g1\text{-}gt}$	0·011	0·030	0·063	pF
Grid 1 to Anode Triode	$c_{g1\text{-}at}$	0·017	0·023	0·028	pF
Grid Triode to Anode Tetrode	$c_{gt\text{-}aq}$	0·014	0·020	0·022	pF
Grid Triode to Heater	$c_{gt\text{-}h}$	0·018	0·031	0·042	pF
Grid 1 to Heater	$c_{g1\text{-}h}$	0·24	0·38	0·71	pF

§ In fully-shielded socket without can.
¶ With holder capacitance balanced out (holder as below).
‖ Total inter-electrode capacitances including B9A nylon phenolic holder without skirt or radial shield (AEI holder type VH19/902).

CHARACTERISTICS

		Triode	Tetrode	
Anode Voltage	V_a	100	200	V
Screen Grid Voltage	V_{g2}	—	200	V
Anode Current	I_a	3·5	35	mA
Screen Grid Current	I_{g2}	—	7	mA
Control Grid Voltage	V_{g1}	0	–16	V
Mutual Conductance	g_m	2·5	6·4	mA/V
Amplification Factor	μ	70	—	
Inner Amplification Factor	$\mu_{g1\text{-}g2}$	—	9·5	

TYPICAL OPERATION

Single Valve as Class A Audio Output

Anode Voltage	V_a	200	250	V
Screen Grid Voltage	V_{g2}	200	250	V
Undecoupled Screen Grid Resistor	R_{g2}	0	2·2	kΩ
Cathode Resistor	R_k	390	680	Ω
Grid Bias Voltage	V_{g1}	–16	–22·5	V
Quiescent Anode Current	$I_{a(o)}$	35	28	mA
Quiescent Screen Grid Current	$I_{g2(o)}$	7	5·5	mA
Power Output for 10 per cent. total distortion	P_{out}	3·5	3·4	W
Anode Load Resistance	R_a	5·6	9·0	kΩ
Input Swing Voltage (R.M.S.)	$V_{in(r.m.s.)}$	6·6	9·5	V
Input Swing for 50 mW output (R.M.S.)		0·6	0·78	V

Field Scanning

The field scan output stage should be designed to allow for valve spread and deterioration during life in addition to component variation. Values of total tetrode peak anode current available for a new average valve and at the assumed end of life point on any valve are as follows :—

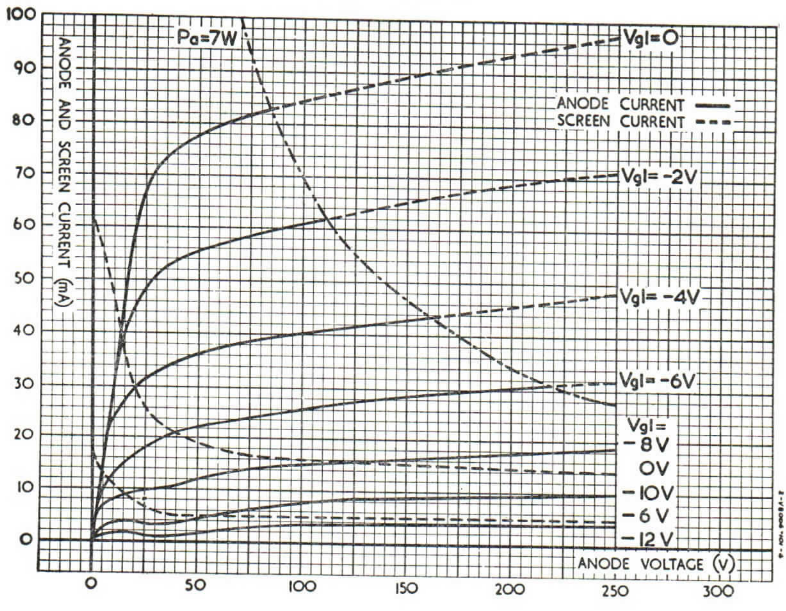
		*	†	
Anode Voltage	V_a	50	50	V
Screen Grid Voltage	V_{g2}	170	170	V
Anode Current	I_a	135	85	mA

Where V_{g1} is adjusted so that $I_{g1} = +0{\cdot}3\mu A$.
* Average new valve.
† Assumed end of life condition.

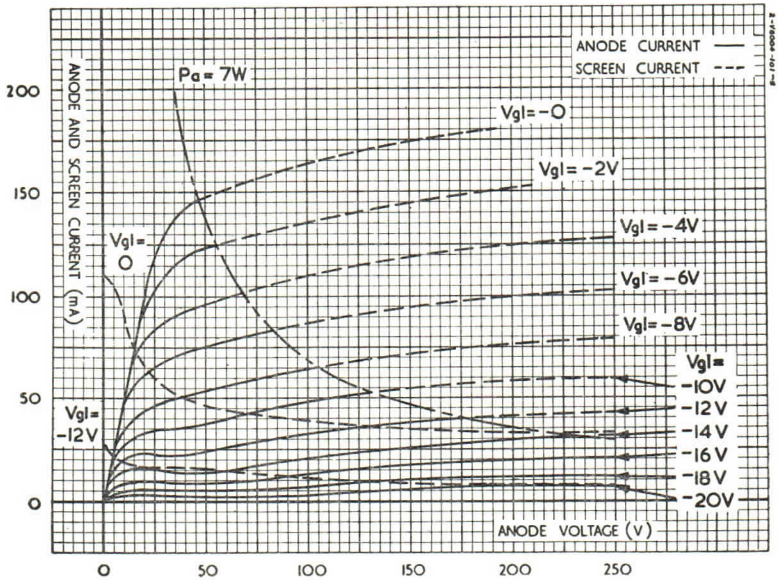
MOUNTING POSITION—Unrestricted

CHARACTERISTIC CURVES

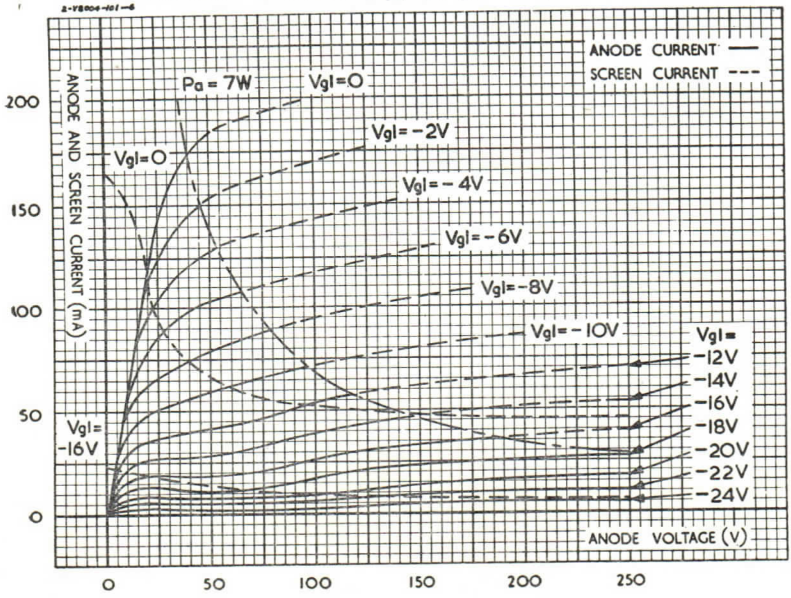
$I_a, I_{g2}/V_a$ ($V_{g2}=100V$)
Tetrode Section



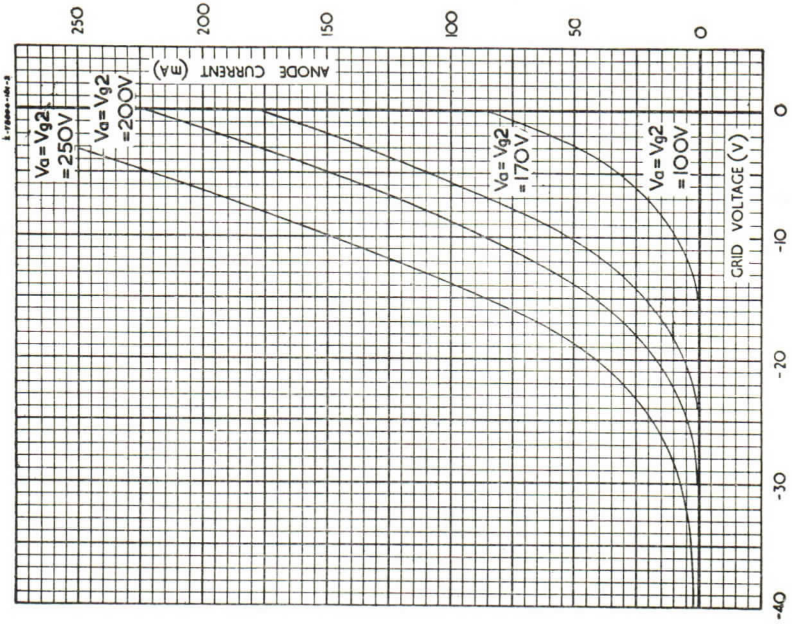
CHARACTERISTIC CURVES: $I_a, I_{g2}/V_a$ ($V_{g2} = 170V$) — Tetrode Section



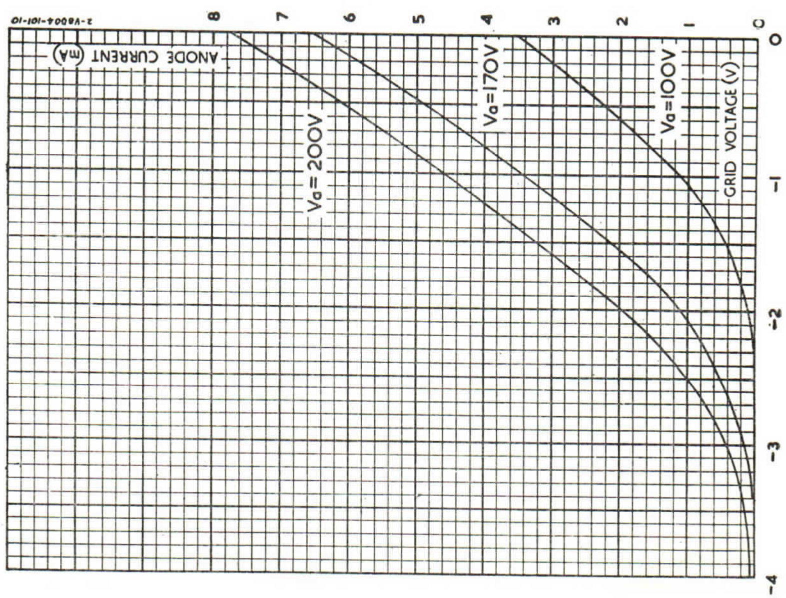
CHARACTERISTIC CURVES: $I_a, I_{g2}/V_a$ ($V_{g2} = 200V$) — Tetrode Section



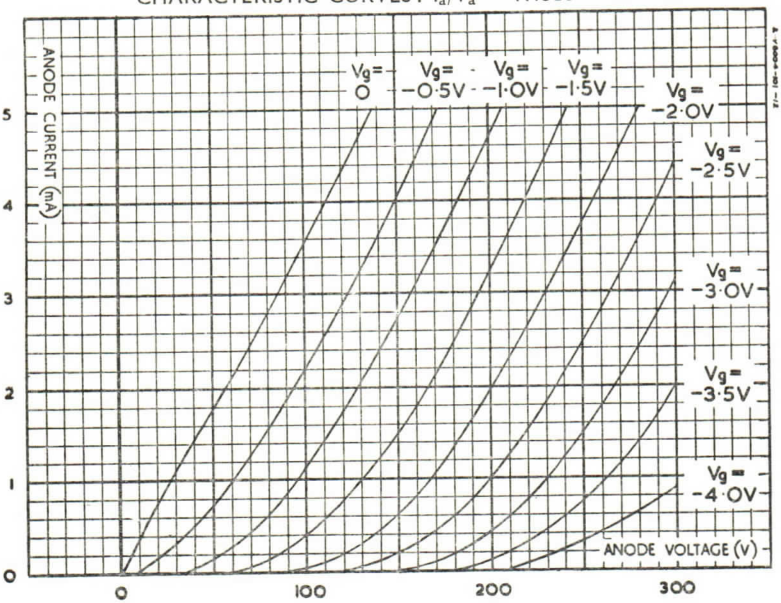
CHARACTERISTIC CURVES : I_a/V_{g1} — Tetrode Section



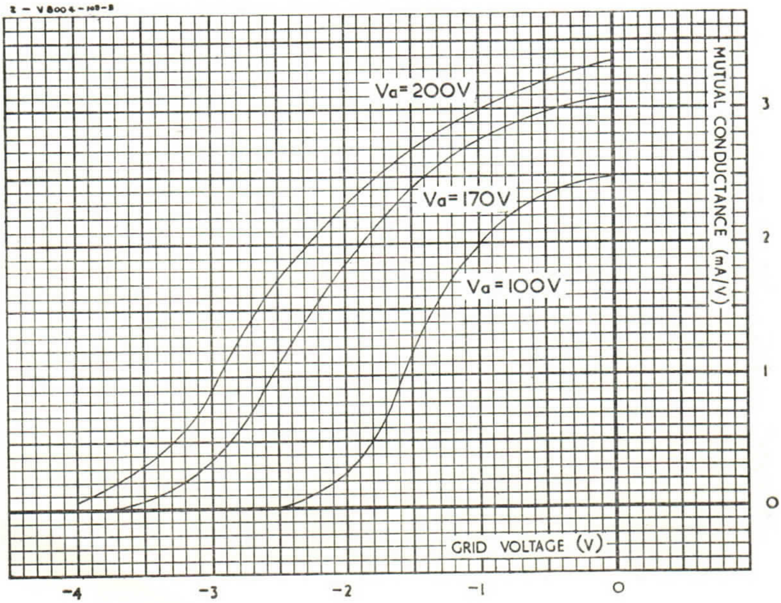
CHARACTERISTIC CURVES : I_a/V_g — Triode Section

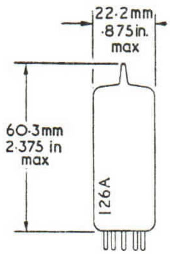


CHARACTERISTIC CURVES: I_a/V_a — Triode Section

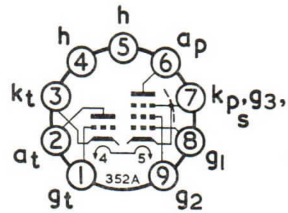


CHARACTERISTIC CURVES: g_m/V_g — Triode Section





TRIODE PENTODE



B9A Base

GENERAL

This triode pentode valve with separate cathodes is primarily intended for use in the video output stage of television receivers. The triode may be used in a variety of ways such as sync. separator, A.G.C. and noise suppression circuits.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·72	A

RATINGS

		Triode	Pentode	
Maximum Anode Dissipation	$p_{a(max)}$	1·0	4·0	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	—	1·7	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	±550	550	V
Maximum Anode Voltage	$V_{a(max)}$	±250	250	V
Maximum Peak Anode Voltage (I_a < 0·1mA)	$v_{a(pk)max}$	600*	—	V
Maximum Screen Grid Supply Voltage	$V_{g2(b)max}$	—	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	—	250	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$	200	200	V
Maximum Cathode Current	$I_{k(max)}$	12	40	mA
Maximum Peak Cathode Current	$i_{a(pk)max}$	160†	—	mA
Maximum Grid 1 to Cathode Resistance	$R_{g\text{-}k(max)}$			
Self Bias		3·0	2·0	MΩ
Fixed Bias		1·0	1·0	MΩ
Maximum Heater to Cathode Resistance	$R_{h\text{-}k(max)}$	20	20	kΩ

* Maximum pulse duration 18% of a cycle with a maximum of 18μs.

† Maximum pulse duration = 800μs.

INTER-ELECTRODE CAPACITANCES

		‡	
Pentode Input	$c_{in(p)}$	8·7	pF
Pentode Output	$c_{out(p)}$	4·2	pF
Grid 1 to Anode Pentode	$c_{g1\text{-}ap}$	<0·1	pF
Grid 1 to Heater	$c_{g1\text{-}h}$	<0·1	pF
Triode Input	$c_{in(t)}$	3·8	pF
Triode Output	$c_{out(t)}$	2·3	pF
Anode Triode to Grid Triode	$c_{at\text{-}gt}$	2·7	pF
Grid Triode to Grid 1	$c_{gt\text{-}g1}$	<0·01	pF
Anode Triode to Grid 1	$c_{at\text{-}g1}$	<0·01	pF
Grid Triode to Heater	$c_{gt\text{-}h}$	<0·1	pF

‡ Inter-electrode capacitances in fully shielded socket without can.

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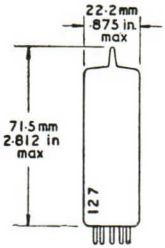
CHARACTERISTICS

		Triode	Pentode			
Anode Voltage	V_a	200	170	200	220	V
Screen Grid Voltage	V_{g2}	—	170	200	220	V
Control Grid Voltage	V_{g1}	−1·7	−2·1	−2·9	−3·4	V
Anode Current	I_a	3·0	18	18	18	mA
Screen Grid Current	I_{g2}	—	3·0	3·0	3·0	mA
Mutual Conductance	g_m	4·0	11	10·4	10	mA/V
Amplification Factor	μ	65	—	—	—	
Inner Amplification Factor	μ_{g1-g2}	—	36	36	36	
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	16·2	100	130	150	kΩ

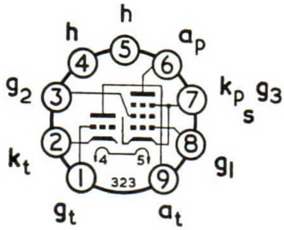
TYPICAL OPERATION
Pentode Section as Video Output Valve

Supply Voltage	V_b	170	200	220	V
Screen Grid Voltage	V_{g2}	170	200	220	V
Control Grid Voltage	V_{g1}	−2·0	−2·8	−3·3	V
Anode Load Resistance	R_a	3·0	3·0	3·0	kΩ
Anode Current	I_a	18	18	18	mA
Screen Grid Current	I_{g2}	3·2	3·1	3·1	mA
Mutual Conductance	g_m	10·4	10	9·7	mA/V

The characteristic curves for the ECL84 are identical to those given for the PCL84.



TRIODE
PENTODE



B9A Base

GENERAL

This high-μ triode and output pentode combination is for use in audio amplifier circuits.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·66	A

RATINGS

		Triode	Pentode	
Maximum Anode Dissipation	$p_{a(max)}$	0·5	9·0	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	—	1·8	W
For speech and music		—	3·0	W
Maximum Anode Supply Voltage ($I_a = 0$)	$V_{a(b)max}$	550	550	V
Maximum Anode Voltage	$V_{a(max)}$	300	300	V
Maximum Screen Grid Supply Voltage ($I_{g2} = 0$)	$V_{g2(b)max}$	—	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	—	300	V
Maximum Heater to Cathode Voltage	$V_{h-k(max)}$	100	100	V
Maximum Cathode Current	$I_{k(max)}$	4·0	55	mA
Maximum Grid 1 to Cathode Resistance	$R_{g1-k(max)}$			
Fixed Bias		1·0	1·0	MΩ
Self Bias		2·0	—	MΩ
Grid Current Bias		22	—	MΩ
Maximum Heater to Cathode Resistance	$R_{h-k(max)}$	20*	20	kΩ

* When used as a phase inverter immediately preceding the output stage $R_{h-k(max)}$ may be 120kΩ.

INTER-ELECTRODE CAPACITANCES†

Pentode input	$c_{in(p)}$	10	pF
Grid 1 to Anode Pentode	c_{g1-ap}	<0·4	pF
Grid 1 to Heater	c_{g1-h}	<0·24	pF
Triode Input	$c_{in(t)}$	2·3	pF
Triode Output	$c_{out(t)}$	2·5	pF
Grid Triode to Anode Triode	c_{gt-at}	1·4	pF
Grid Triode to Heater	c_{gt-h}	<0·006	pF
Grid Triode to Grid 1	c_{gt-g1}	<0·02	pF
Grid Triode to Anode Pentode	c_{gt-ap}	<0·006	pF
Anode Triode to Anode Pentode	c_{at-ap}	<0·15	pF
Anode Triode to Grid 1	c_{at-g1}	<0·2	pF

† In fully shielded socket without can (I.E.C. Publication 100).

CHARACTERISTICS

		Triode	Pentode	
Anode Voltage	V_a	250	250	V
Screen Grid Voltage	V_{g2}	—	250	V
Control Grid Voltage	V_{g1}	−1·9	−7·0	V
Anode Current	I_a	1·2	36	mA
Screen Grid Current	I_{g2}	—	6·0	mA
Mutual Conductance	g_m	1·6	10	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	62	48	kΩ
Amplification Factor	μ	100	—	
Inner Amplification Factor	μ_{g1-g2}	—	21	

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TYPICAL OPERATION

Pentode as Class A Audio Output Stage

Anode Voltage	V_a	250	250	V
Screen Grid Voltage	V_{g2}	250	250	V
Cathode Resistor	R_k	270	170	Ω
Anode Resistor	R_a	10	7·0	kΩ
Anode Current	I_a	27	37	mA
Screen Grid Current	I_{g2}	8·2	10	mA
Power Output	P_{out}	2·8	4·0	W
Total Distortion	D_{tot}	10	10	%
Input Voltage (R.M.S.)	$V_{in(r.m.s.)}$	2·7	3·2	V
Input Voltage (R.M.S.) for 50mW output		280	300	mV

Pentodes—Two Valves in Push-Pull (Cathode Bias)

Anode Supply Voltage	$V_{a(b)}$	250	300	V
Screen Supply Voltage	$V_{g2(b)}$	250	300	V
Cathode Resistor (per valve)	R_k	180	260	Ω
Anode to Anode Load Resistor	R_{a-a}	8·2	9·1	kΩ
Anode Current (Quiescent)	$I_{a(o)}$	2×32·5	2×31	mA
Anode Current (max. sig.)	$I_{a(max.\ sig.)}$	2×35·5	2×37	mA
Screen Grid Current (Quiescent)	$I_{g2(o)}$	2× 5·6	2× 5·5	mA
Screen Grid Current (max. sig.)	$I_{g2(max.\ sig.)}$	2× 8·9	2×10·6	mA
Power Output	P_{out}	10	13·6	W
Total Distortion	D_{tot}	5·0	4·0	%
Input Voltage (R.M.S.) Grid to Grid	$V_{in(g1-g1)r.m.s.}$	11	16·8	V
Input Voltage (R.M.S.) for 50mW output		480	520	mV

Triode as Resistance Coupled A.F. Amplifier

Cathode Self Bias*

Supply Voltage	V_b	200	250	250	300	V
Anode Load Resistance	R_a	220	220	220	220	kΩ
Cathode Self Bias Resistance	R_k	2·6	1·75	1·75	1·2	kΩ
Grid Resistance of Following Valve		0·68	0·68	10	10	MΩ
Anode Current	I_a	0·42	0·6	0·6	0·8	mA
Voltage Amplification		66	70	75	80	
R.M.S. Output Voltage		3·2	3·2	5·0	9·0	V
Total Harmonic Distortion	D_{tot}	0·6	0·4	0·4	0·4	%

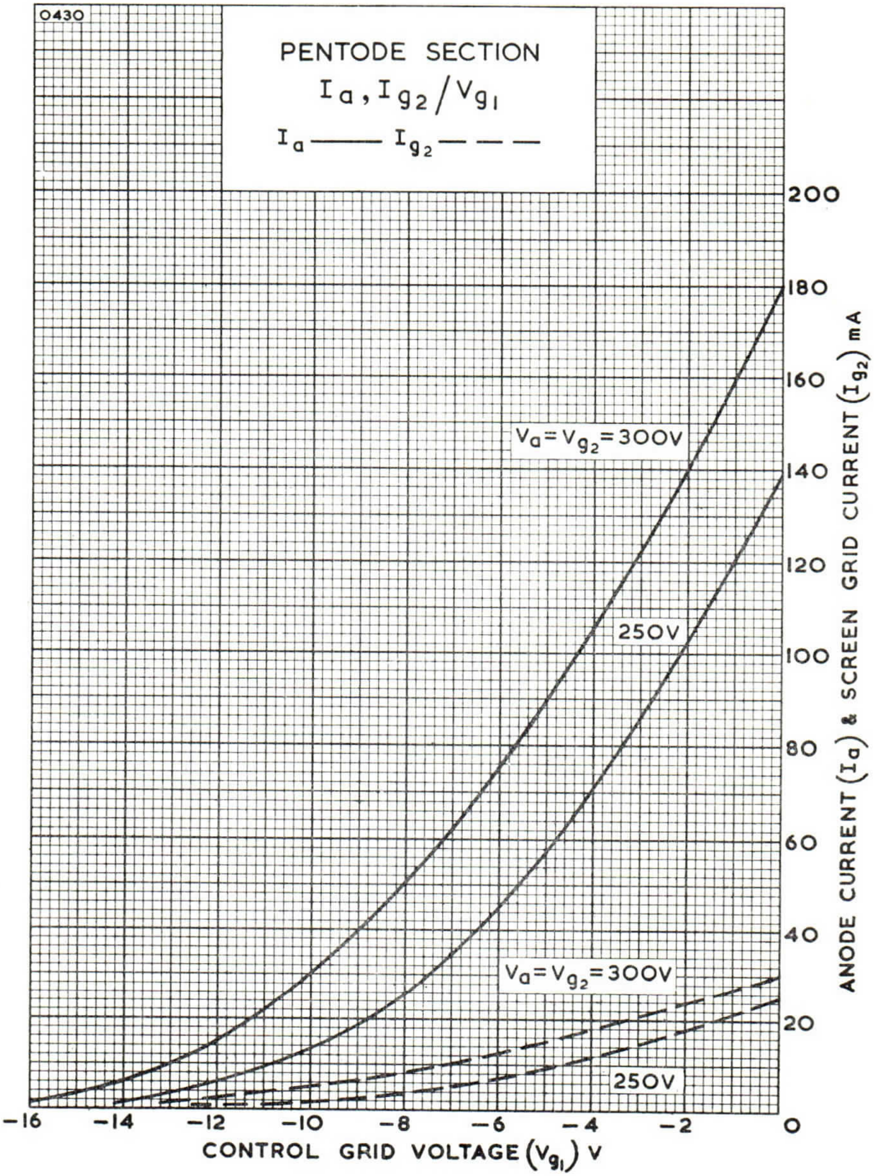
* At lower values of supply voltage grid current bias should be used.

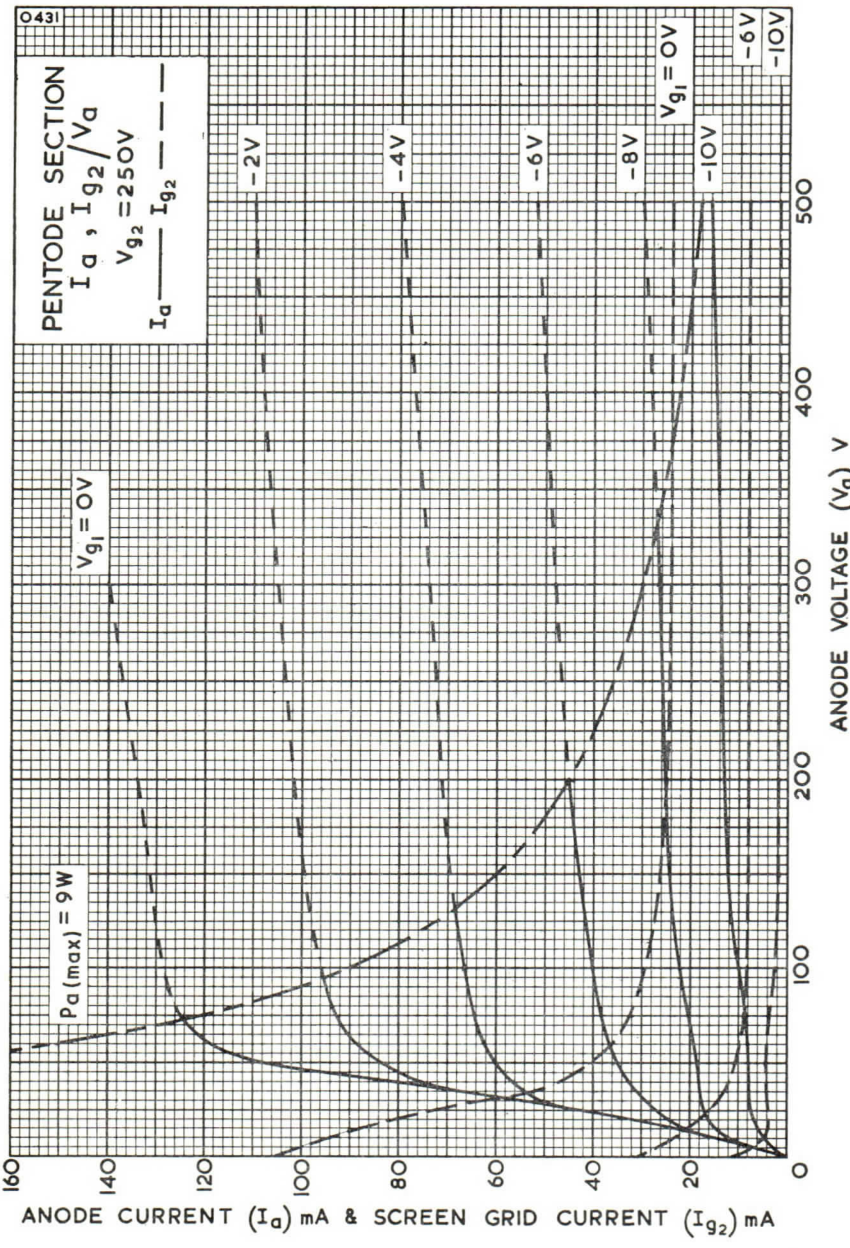
Grid Current Bias ($R_g = 10\ M\Omega$)

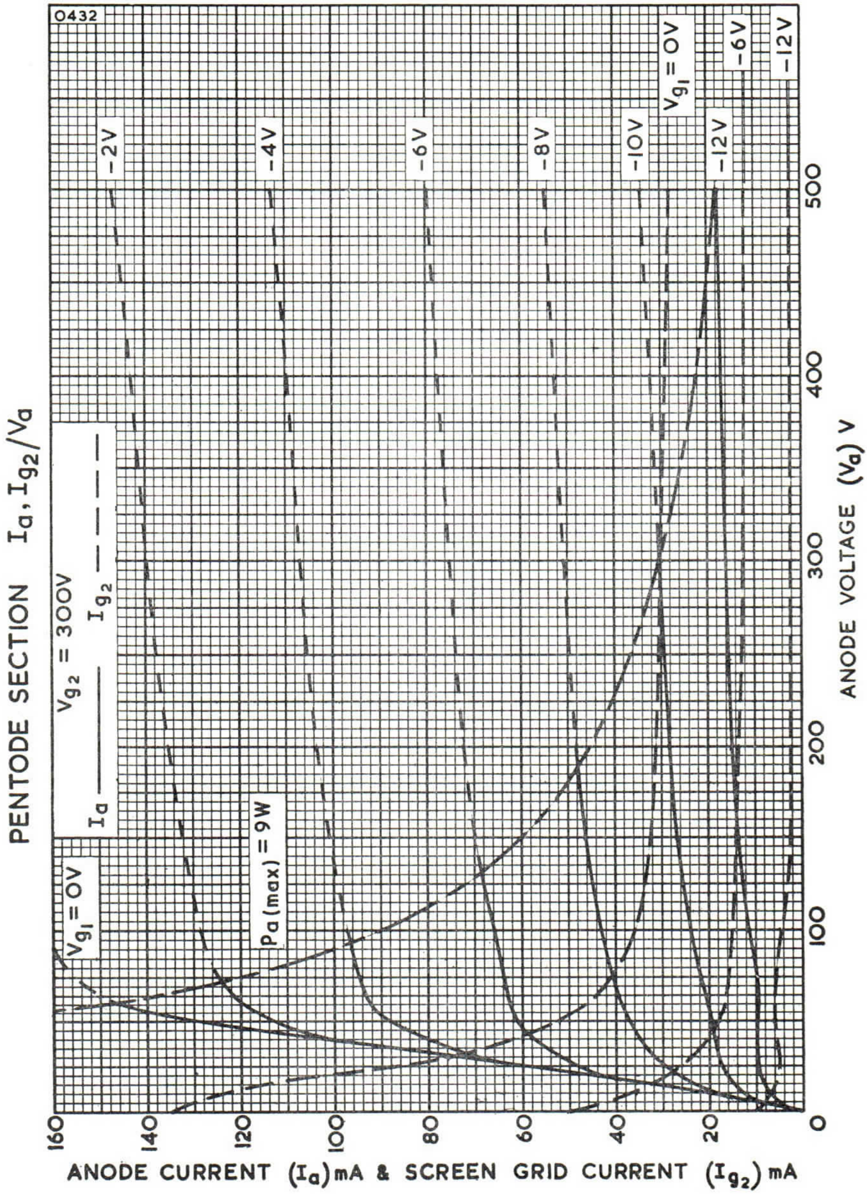
Supply Voltage	V_b	200	250	250	300	V
Anode Load Resistance	R_a	220	220	220	220	kΩ
Grid Resistance of Following Valve		0·68	0·68	10	10	MΩ
Anode Current	I_a	0·42	0·6	0·6	0·8	mA
Signal source impedance	Z_s	47	47	47	47	kΩ
Voltage amplification		66	70	75	80	
R.M.S. Output Voltage		3·2	3·2	5·0	9·0	V
Total Harmonic Distortion	D_{tot}	0·6	0·4	0·4	0·4	%

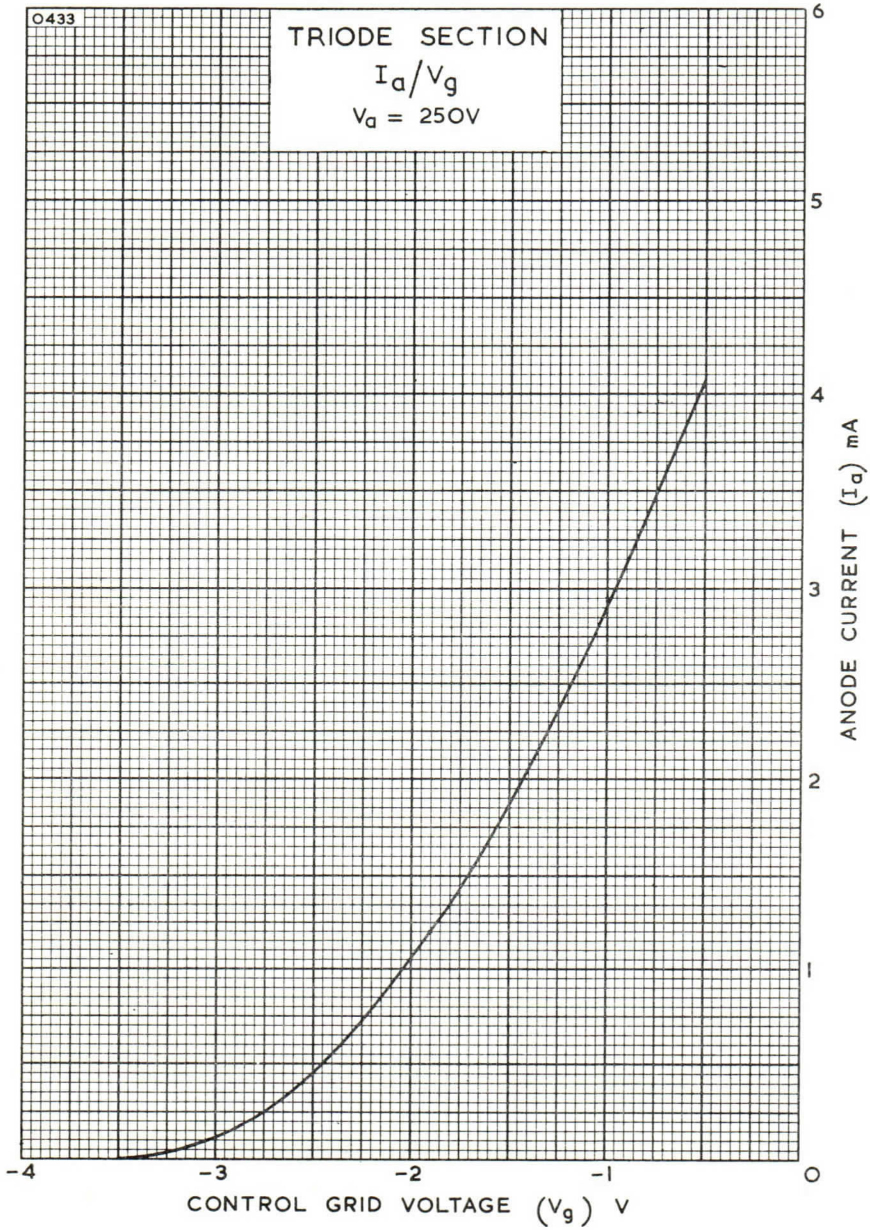
Note: Microphony. This valve may be used without special precautions against microphony in equipment where the input voltage is not less than 4 mV for an output of 50 mW.

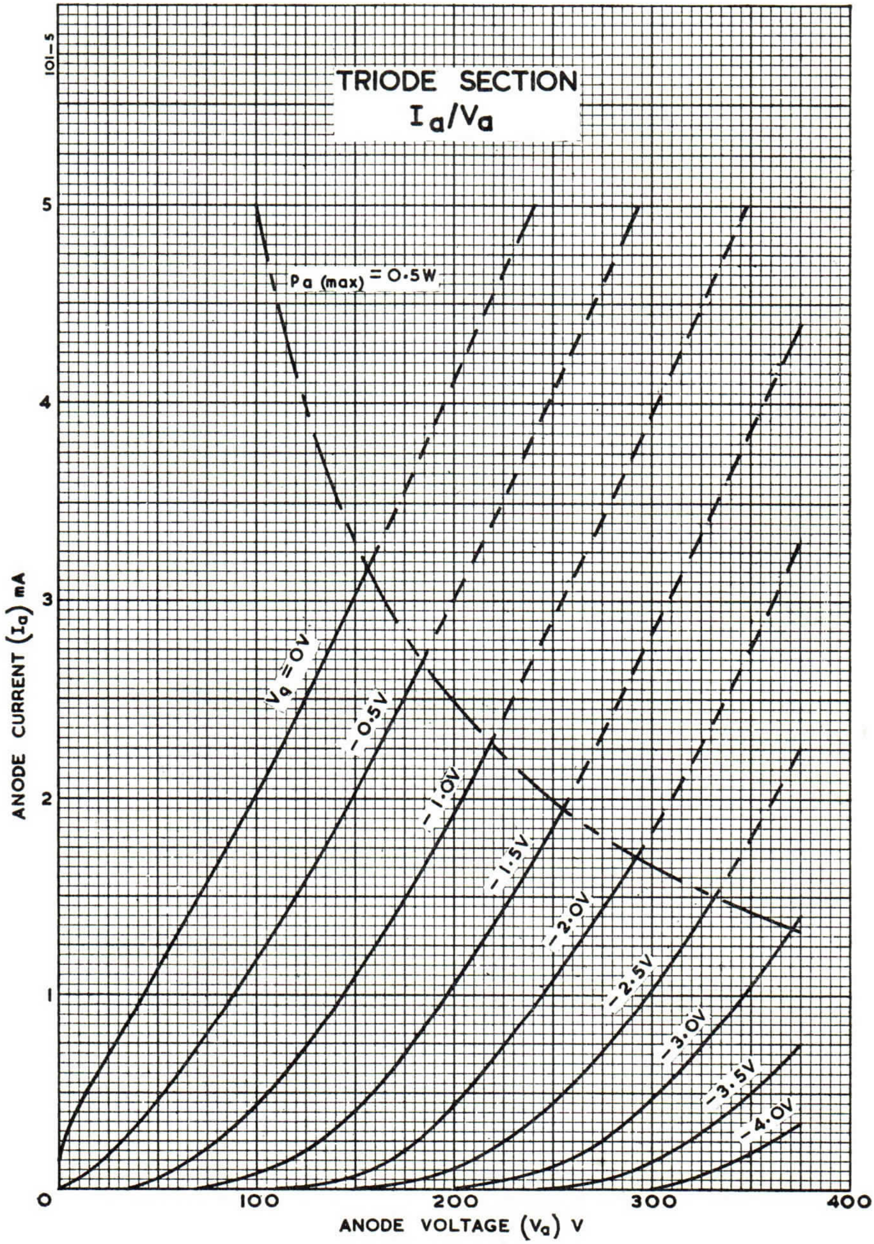
MOUNTING POSITION—Unrestricted

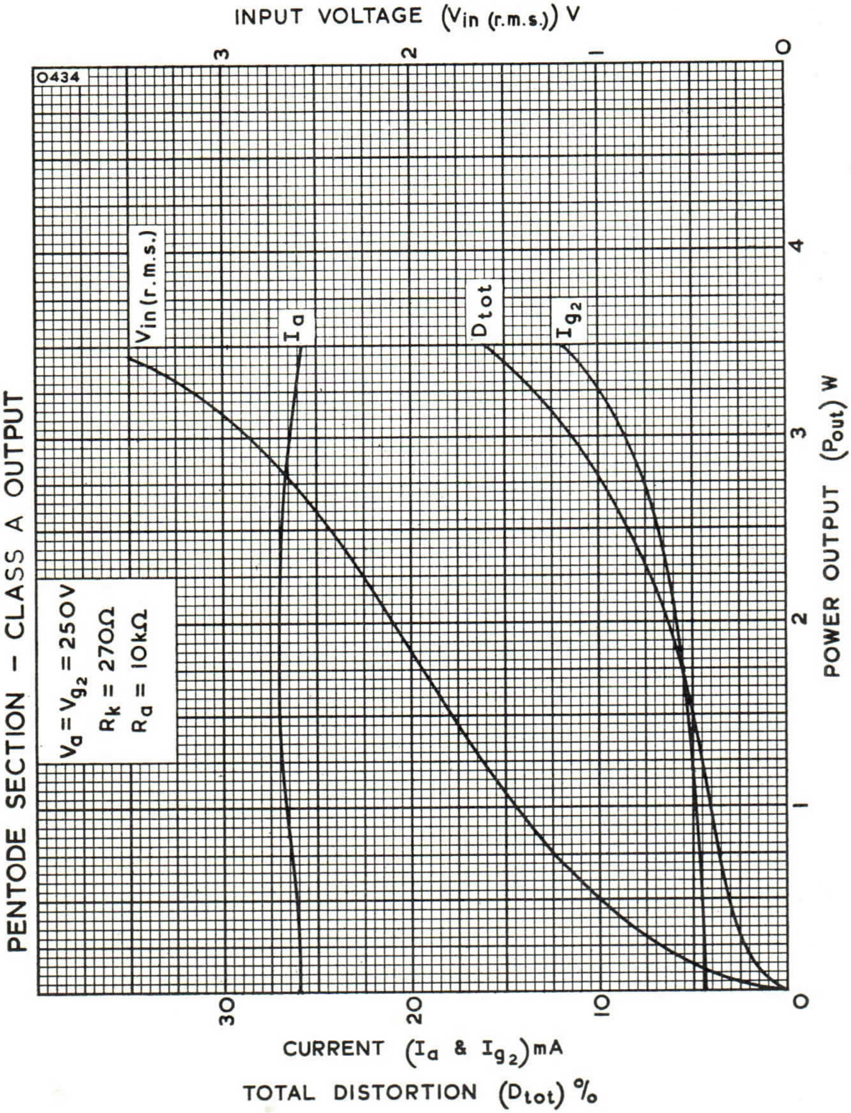

0430
PENTODE SECTION
Ia, Ig2/Vg1
Ia ——— Ig2 — — —
Va=Vg2=300V
250V
Va=Vg2=300V
250V
200
180
160
140
120
100
80
60
40
20
0
ANODE CURRENT (Ia) & SCREEN GRID CURRENT (Ig2) mA
−16
−14
−12
−10
−8
−6
−4
−2
CONTROL GRID VOLTAGE (Vg1) V

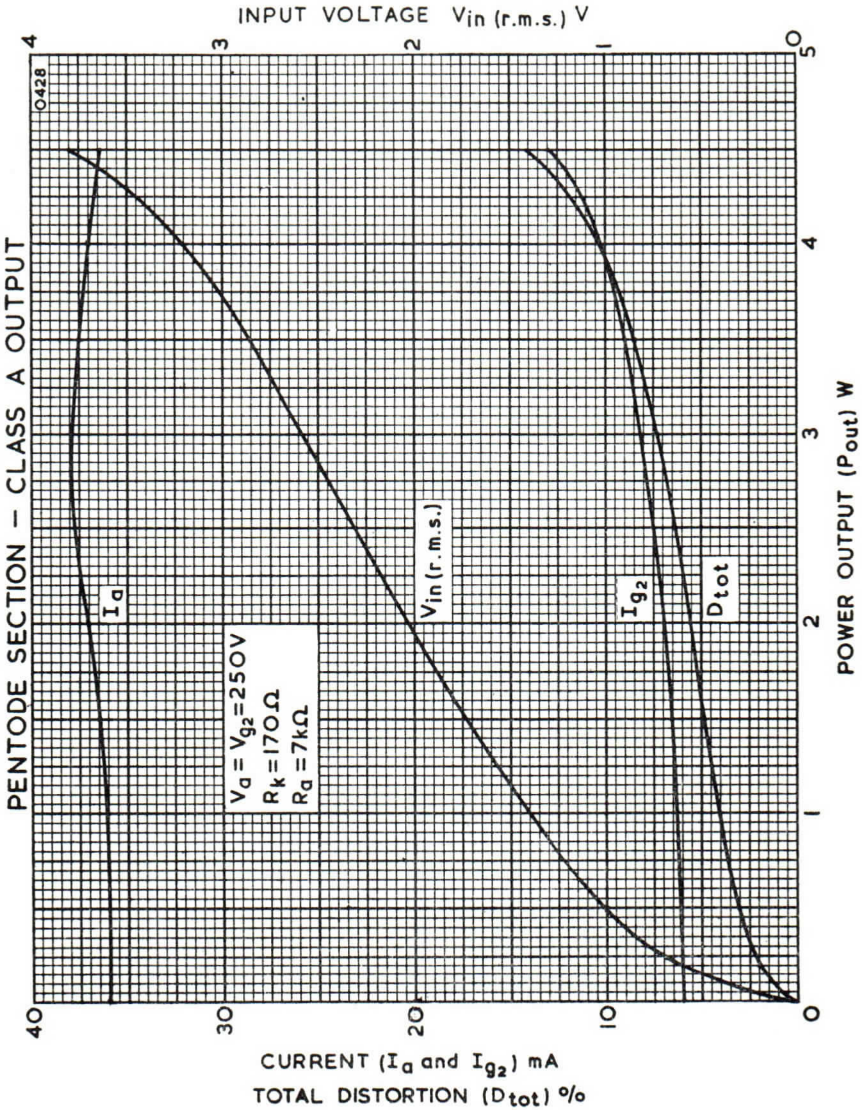

0431
PENTODE SECTION
I_a , I_{g2}/V_a
V_{g2} = 250V
I_a ——— I_{g2} - - -
V_{g1} = 0V
-2V
-4V
-6V
-8V
-10V
V_{g1} = 0V
-6V
-10V
$P_{a(max)}$ = 9W
0
100
200
300
400
500
ANODE VOLTAGE (V_a) V
160
140
120
100
80
60
40
20
0
ANODE CURRENT (I_a) mA & SCREEN GRID CURRENT (I_{g2}) mA

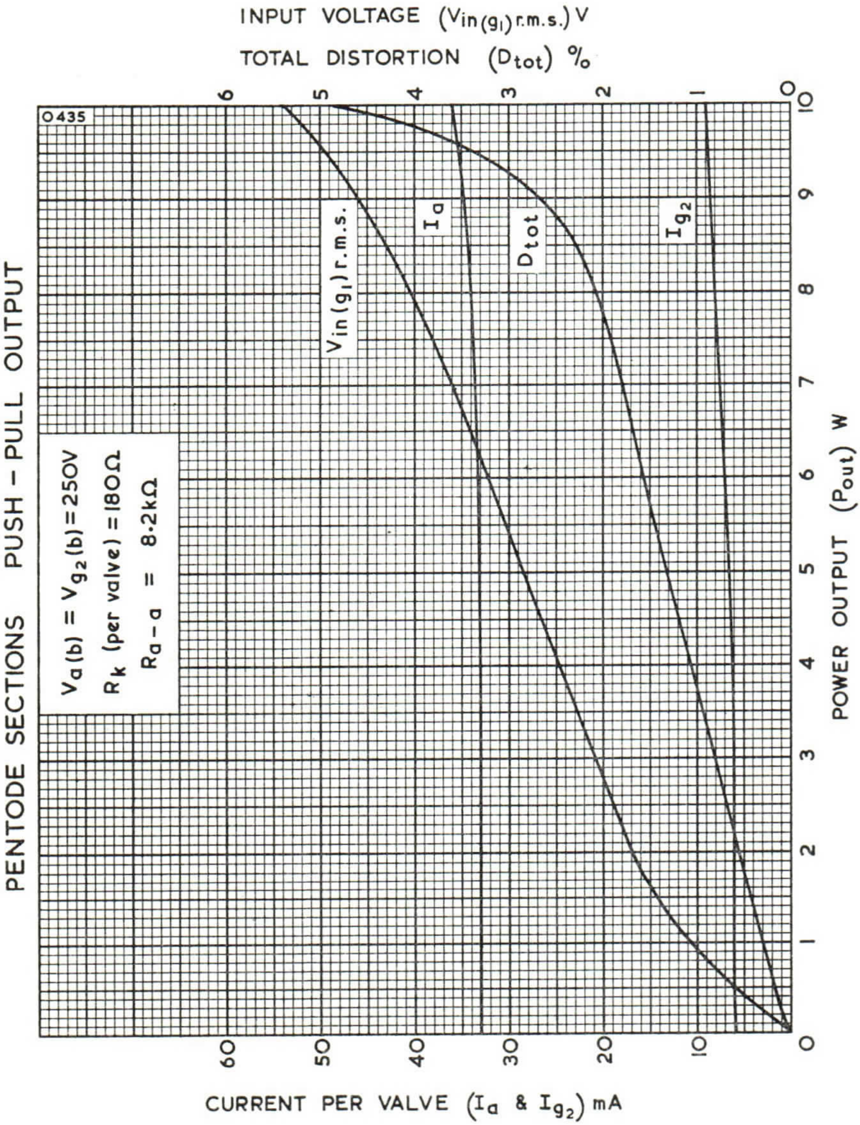

0432
PENTODE SECTION $I_a, I_{g_2}/V_a$
V_{g_2} = 300V
I_a ———
I_{g_2} — — —
V_{g_1} = 0V
-2V
-4V
-6V
-8V
-10V
-12V
V_{g_1} = 0V
-6V
-12V
P_a(max) = 9W
ANODE VOLTAGE (V_a) V
0
100
200
300
400
500
160
140
120
100
80
60
40
20
0
ANODE CURRENT (I_a) mA & SCREEN GRID CURRENT (I_{g_2}) mA


0433
TRIODE SECTION
I_a/V_g
$V_a = 250V$
6
5
4
3
2
1
0
-4
-3
-2
-1
CONTROL GRID VOLTAGE (V_g) V
ANODE CURRENT (I_a) mA

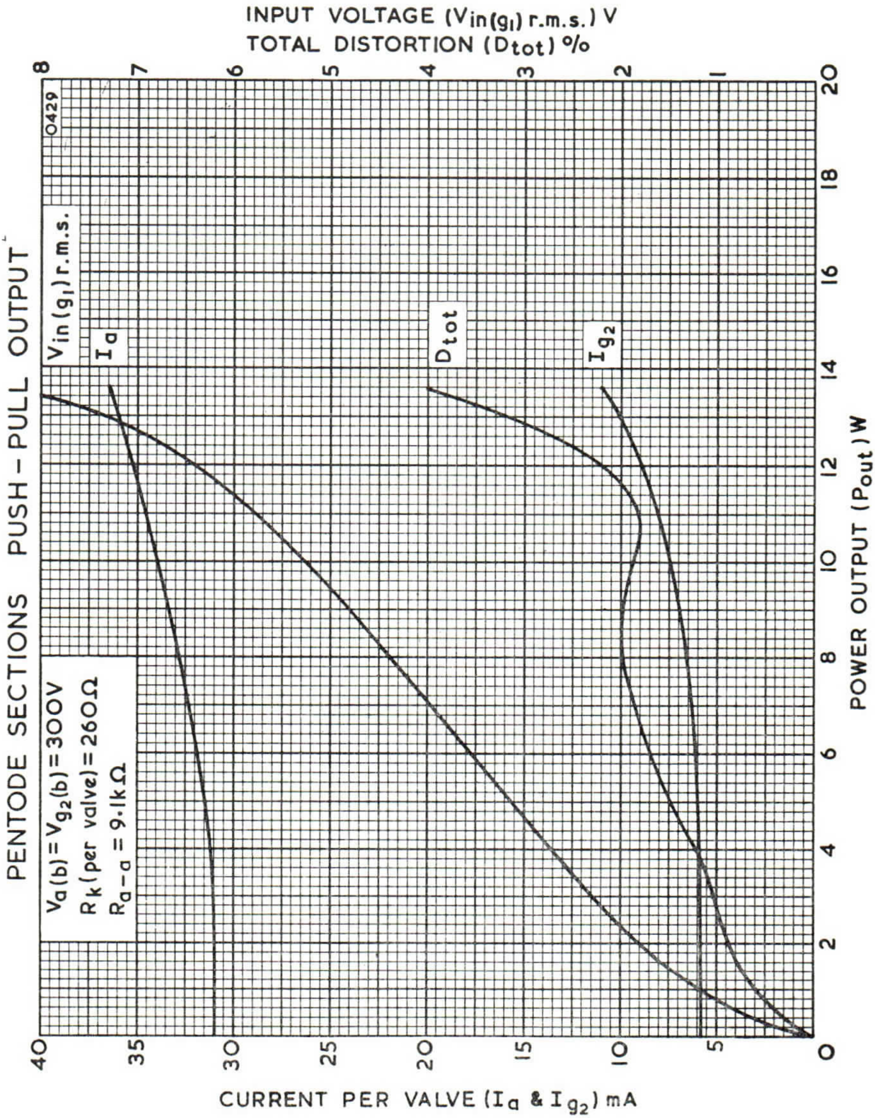

101-5
TRIODE SECTION
I_a/V_a
P_a (max) = 0·5W
V_g = 0V
−0·5V
−1·0V
−1·5V
−2·0V
−2·5V
−3·0V
−3·5V
−4·0V
ANODE CURRENT (I_a) mA
0
1
2
3
4
5
100
200
300
400
ANODE VOLTAGE (V_a) V


INPUT VOLTAGE ($V_{in\ (r.m.s.)}$) V
3
2
1
0
0434
$V_{in\ (r.m.s.)}$
I_a
D_{tot}
I_{g_2}
PENTODE SECTION - CLASS A OUTPUT
$V_a = V_{g_2} = 250V$
$R_k = 270\Omega$
$R_a = 10k\Omega$
4
3
2
1
0
POWER OUTPUT (P_{out}) W
30
20
10
0
CURRENT (I_a & I_{g_2}) mA
TOTAL DISTORTION (D_{tot}) %

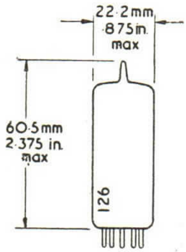

INPUT VOLTAGE Vin (r.m.s.) V
4
3
2
1
0
0428
PENTODE SECTION – CLASS A OUTPUT
Ia
Va = Vg2 = 250V
Rk = 170Ω
Ra = 7kΩ
Vin (r.m.s.)
Ig2
Dtot
POWER OUTPUT (Pout) W
5
4
3
2
1
0
40
30
20
10
CURRENT (Ia and Ig2) mA
TOTAL DISTORTION (Dtot) %



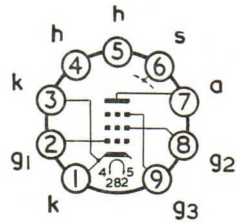
INPUT VOLTAGE ($V_{in(g_1)}$ r.m.s.) V
TOTAL DISTORTION (D_{tot}) %
0435
PENTODE SECTIONS PUSH - PULL OUTPUT
$V_{a(b)} = V_{g_2(b)} = 250V$
R_k (per valve) = 180Ω
R_{a-a} = 8·2kΩ
$V_{in(g_1)}$ r.m.s.
I_a
D_{tot}
I_{g_2}
POWER OUTPUT (P_{out}) W
CURRENT PER VALVE (I_a & I_{g_2}) mA


INPUT VOLTAGE (Vin(g1) r.m.s.) V
TOTAL DISTORTION (Dtot) %
PENTODE SECTIONS PUSH-PULL OUTPUT
Va(b) = Vg2(b) = 300V
Rk (per valve) = 260Ω
Ra-a = 9·1kΩ
Vin(g1) r.m.s.
Ia
Dtot
Ig2
POWER OUTPUT (Pout) W
CURRENT PER VALVE (Ia & Ig2) mA
0429

BRIMAR VALVES EF80



R.F. PENTODE



B9A Base

GENERAL

This valve is a high slope Pentode for R.F. or I.F. Amplification in television receivers. It is also suitable for use as a video output and synchronising pulse separator.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·3	A

RATINGS

Maximum Anode Dissipation	$p_{a(max)}$	2·5	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	0·7	W
Maximum Anode Voltage	$V_{a(max)}$	300	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	300	V
Maximum Heater to Cathode Voltage (R.M.S.)	$V_{h\text{-}k(r.m.s)max}$	150	V
Maximum Cathode Current	$I_{k(max)}$	15	mA
Maximum Resistance Control Grid to Cathode	$R_{g1\text{-}k(max)}$		
Fixed Bias		0·5	MΩ
Self Bias		1	MΩ

INTER-ELECTRODE CAPACITANCES

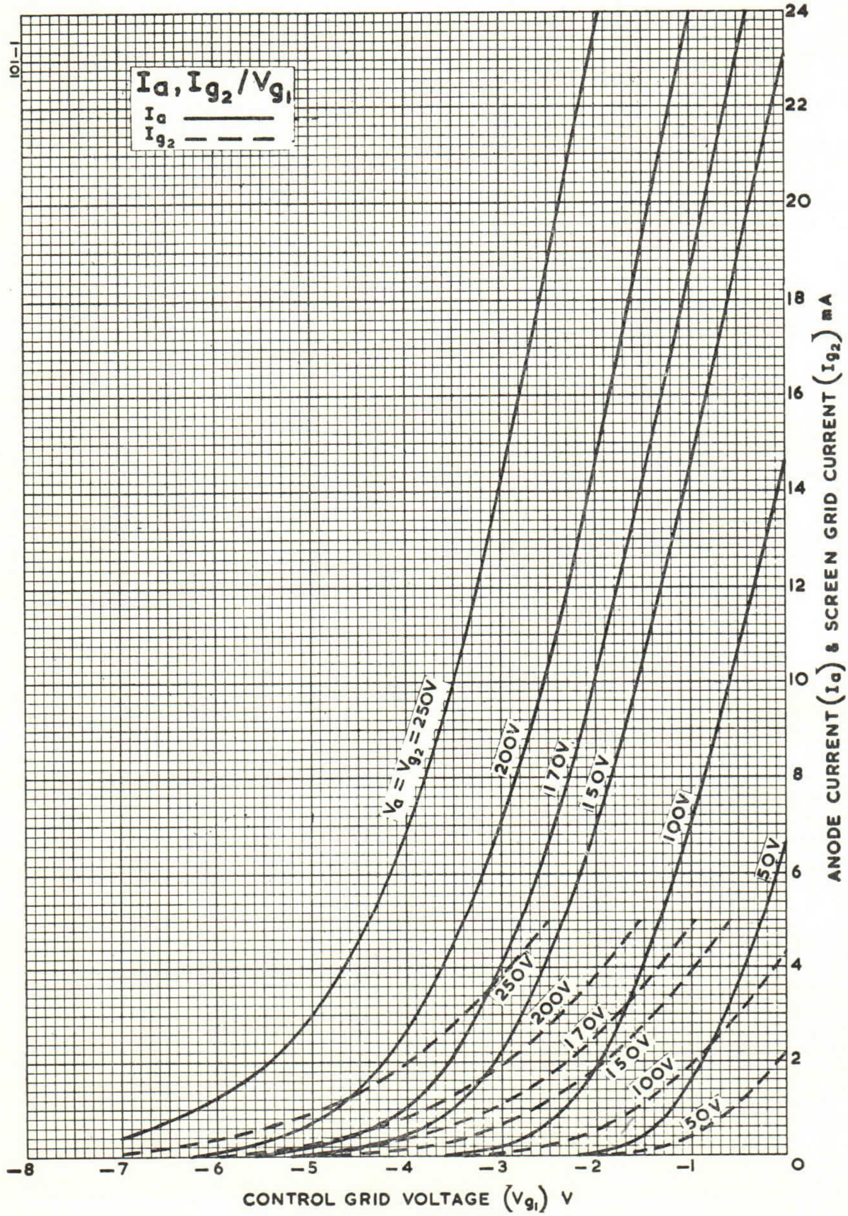
		*	
Input	c_{in}	7·5	pF
Output	c_{out}	3·3	pF
Grid 1 to Anode	$c_{g1\text{-}a}$	<0·007	pF
Grid 1 to Grid 2	$c_{g1\text{-}g2}$	2·6	pF
Grid 2 to all	$c_{g2\text{-}all}$	5·4	pF
Anode to Cathode	$c_{a\text{-}k}$	<0·01	pF
Grid 1 to Heater	$c_{g1\text{-}h}$	<0·15	pF

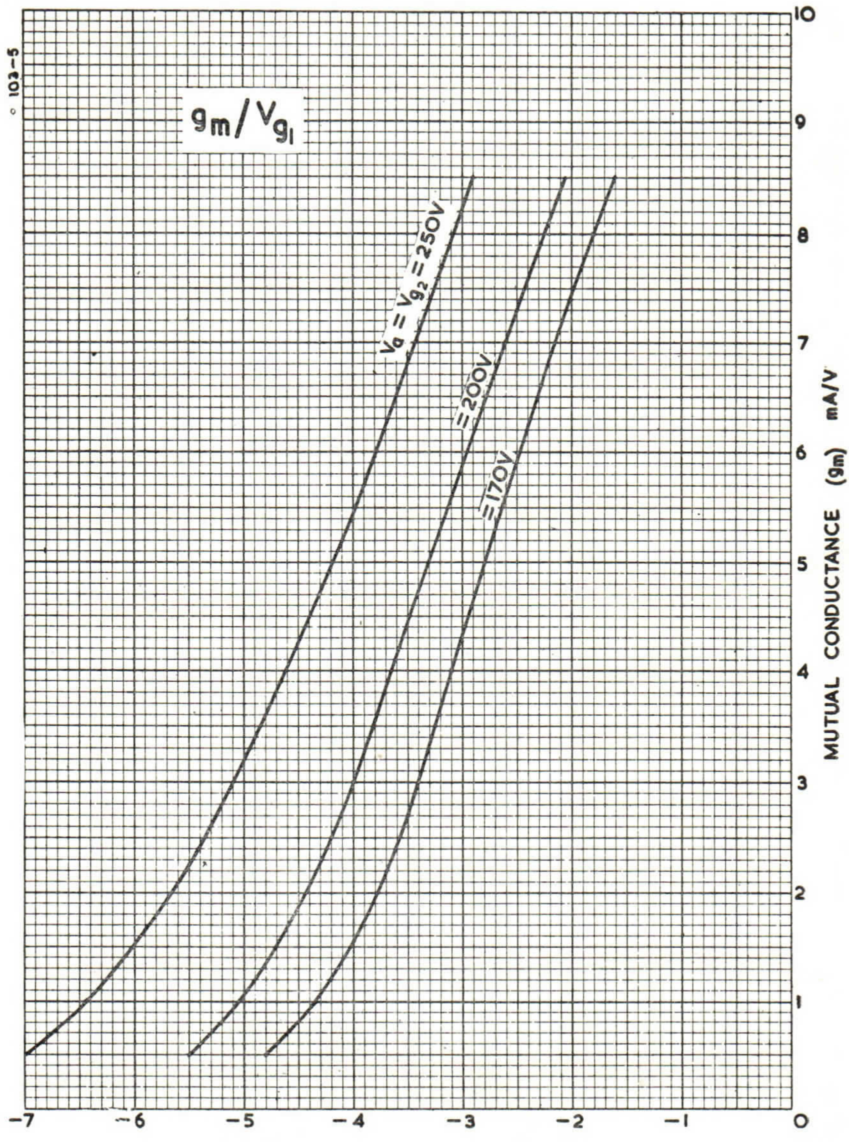
* In fully-shielded socket without can (I.E.C. Publication 100).

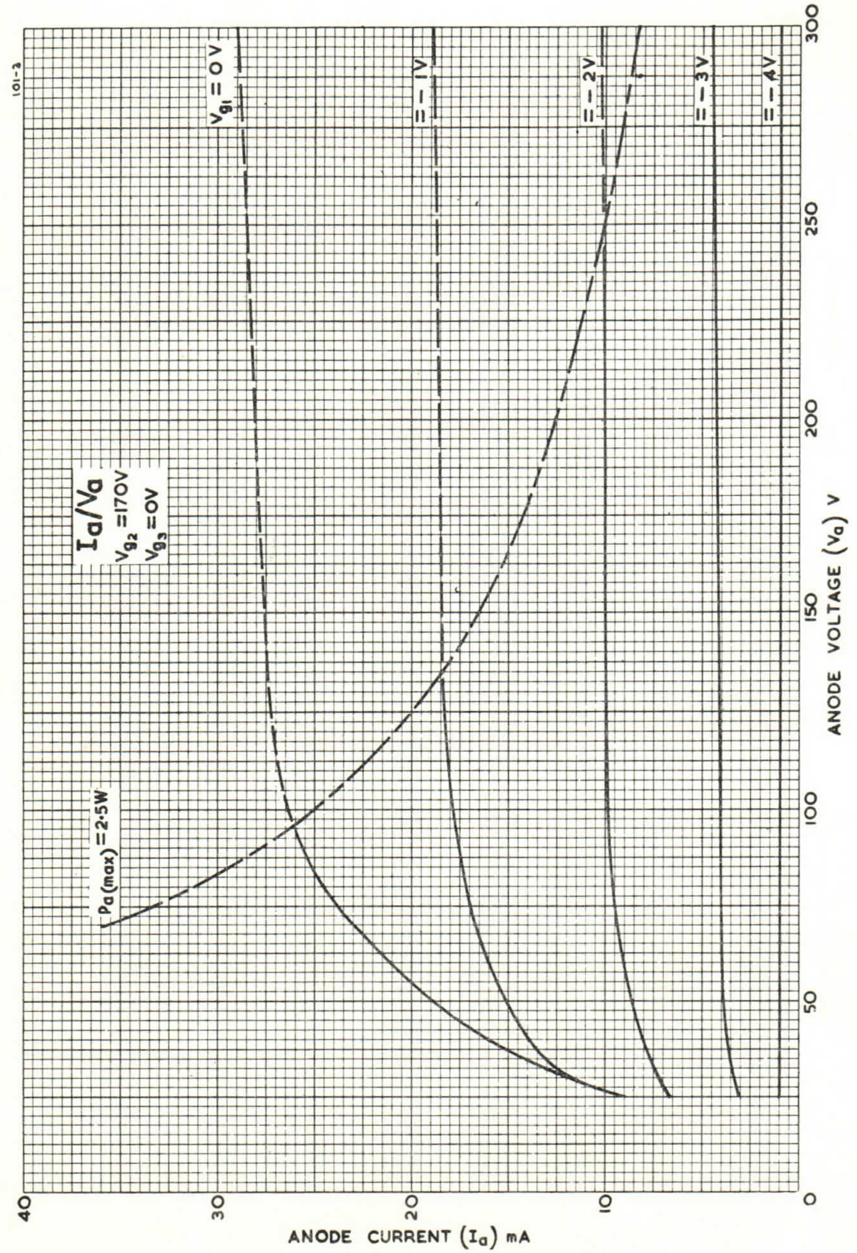
CHARACTERISTICS

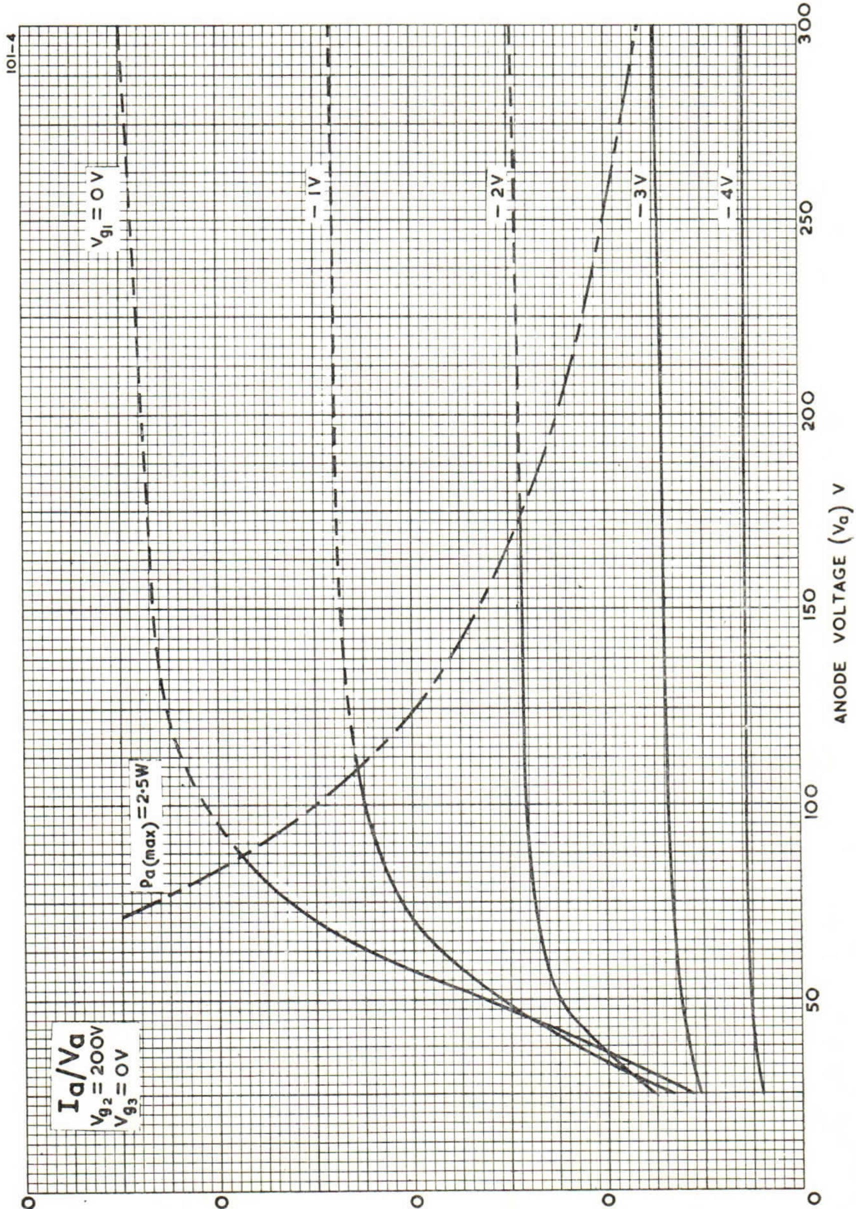
Anode Voltage	V_a	170	200	250	V
Screen Grid Voltage	V_{g2}	170	200	250	V
Anode Current	I_a	10	10	10	mA
Screen Grid Current	I_{g2}	2·5	2·6	2·8	mA
Mutual Conductance	g_m	7·4	7·1	6·8	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	0·5	0·55	0·65	MΩ
Inner Amplification Factor	$\mu_{g1\text{-}g2}$	50	50	50	
Input Resistance at 50 Mc/s	$r_{in(50Mc/s)}$	10	12	15	kΩ

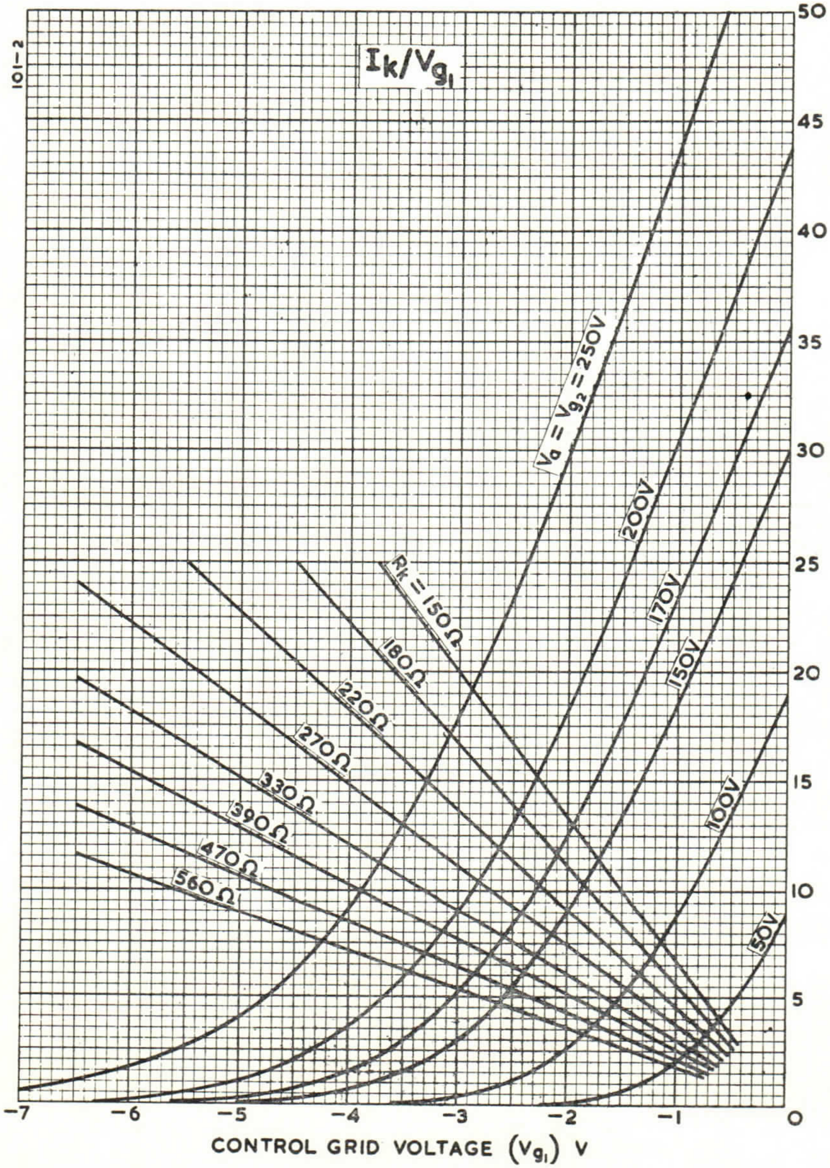
MOUNTING POSITION—Unrestricted

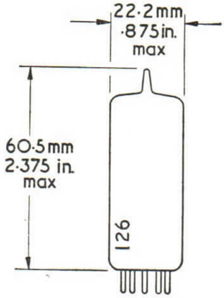

101-1
$I_a, I_{g_2}/V_{g_1}$
I_a ———
I_{g_2} — — —
$V_a = V_{g_2} = 250V$
200V
170V
150V
100V
50V
250V
200V
170V
150V
100V
50V
24
22
20
18
16
14
12
10
8
6
4
2
0
−8
−7
−6
−5
−4
−3
−2
−1
0
CONTROL GRID VOLTAGE (V_{g_1}) V
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g_2}) mA


103-5
g_m/V_{g_1}
$V_a = V_{g_2} = 250V$
= 200V
= 170V
10
9
8
7
6
5
4
3
2
1
0
MUTUAL CONDUCTANCE (g_m) mA/V
−7
−6
−5
−4
−3
−2
−1
0
CONTROL GRID VOLTAGE (V_{g_1}) V

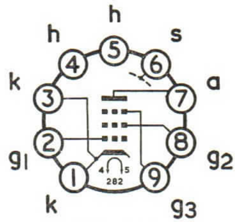

101-3
Ia/Va
Vg2 = 170V
Vg3 = 0V
Vg1 = 0 V
= -1V
= -2V
= -3V
= -4V
Pa(max) = 2·5W
0
50
100
150
200
250
300
ANODE VOLTAGE (Va) V
40
30
20
10
0
ANODE CURRENT (Ia) mA


101-4
Ia/Va
Vg2 = 200V
Vg3 = 0V
Vg1 = 0V
– 1V
– 2V
– 3V
– 4V
pa(max) = 2·5W
ANODE VOLTAGE (Va) V
ANODE CURRENT (Ia) mA
0
50
100
150
200
250
300
10
20
30
40


101-2
Ik/Vg1
50
45
40
35
30
25
20
15
10
5
0
-7
-6
-5
-4
-3
-2
-1
CONTROL GRID VOLTAGE (Vg1) V
CATHODE CURRENT (Ik) mA
Va = Vg2 = 250V
200V
170V
150V
100V
50V
Rk = 150Ω
180Ω
220Ω
270Ω
330Ω
390Ω
470Ω
560Ω



VARIABLE-MU R.F. PENTODE



B9A Base

GENERAL

This valve is a variable-mu R.F. pentode primarily intended for use in A.C. or A.C./D.C. television receivers.

Heater Voltage	V_h	6·3 V
Heater Current	I_h	0·3 A

RATINGS

Maximum Anode Dissipation	$P_{a(max)}$	2·5	W
Maximum Screen Grid Dissipation	$P_{g2(max)}$	0·65	W
Maximum Anode Voltage	$V_{a(max)}$	300	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	300	V
Maximum Cathode Current	$I_{k(max)}$	15	mA
Maximum Heater to Cathode Voltage (DC)	$V_{h\text{-}k(max)}$	150*	V
Maximum Grid 1 to Cathode Resistance	$R_{g1\text{-}k(max)}$	3	MΩ
Maximum Heater to Cathode Resistance	$R_{h\text{-}k(max)}$	20	kΩ

* From cathode to higher potential heater pin.

INTER-ELECTRODE CAPACITANCES †

Grid to Earth	c_{in}	7·2	pF
Anode to Earth	c_{out}	3·7	pF
Grid 1 to Anode	$c_{g1\text{-}a}$	$<$·007	pF
Grid 1 to Heater	$c_{g1\text{-}h}$	$<$·15	pF

† Inter-electrode capacitance in fully shielded socket without can.

" Earth " denotes the remaining earthy potential electrodes, heater and shields joined to cathode.

TYPICAL OPERATION

Anode Voltage	V_a	250	250	V
Screen Grid Voltage	V_{g2}	100	250	V
Control Grid Voltage	V_{g1}	−2		V
Anode Current	I_a	10		mA
Screen Grid Current	I_{g2}	2·5		mA
Mutual Conductance	g_m	6		mA/V
Inner Amplification Factor	$\mu_{g1\text{-}g2}$	25		
Anode Resistance ($\delta v_a/\delta i_a$)	r_a	0·5		MΩ
Grid Bias to give Mutual Conductance of 60 μA/V	V_{g1}		−35	V
Equivalent Grid Noise Resistance	R_{eq}	1·5		kΩ

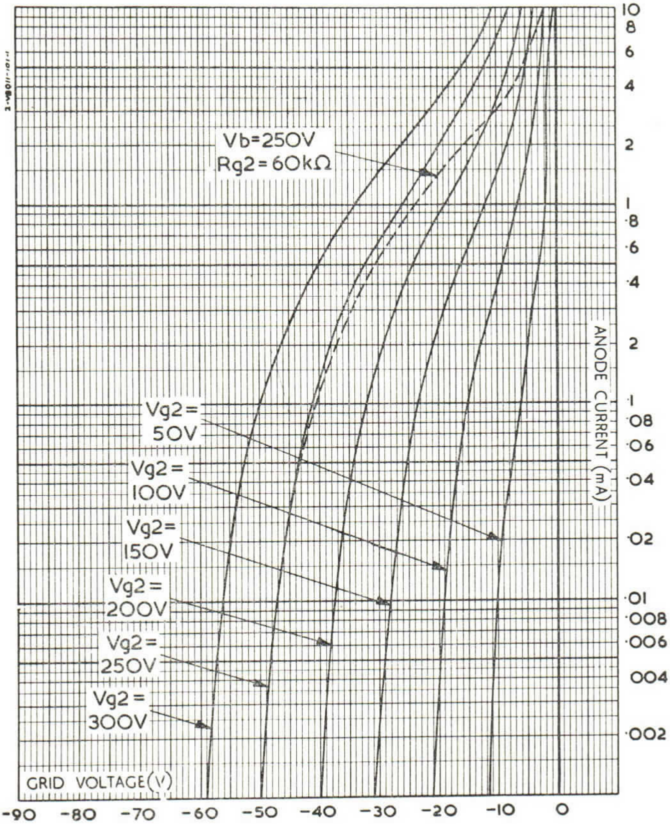
MOUNTING POSITION—Unrestricted.

APPROXIMATE WEIGHT

Net	0·5	oz
Packed	0·75	oz

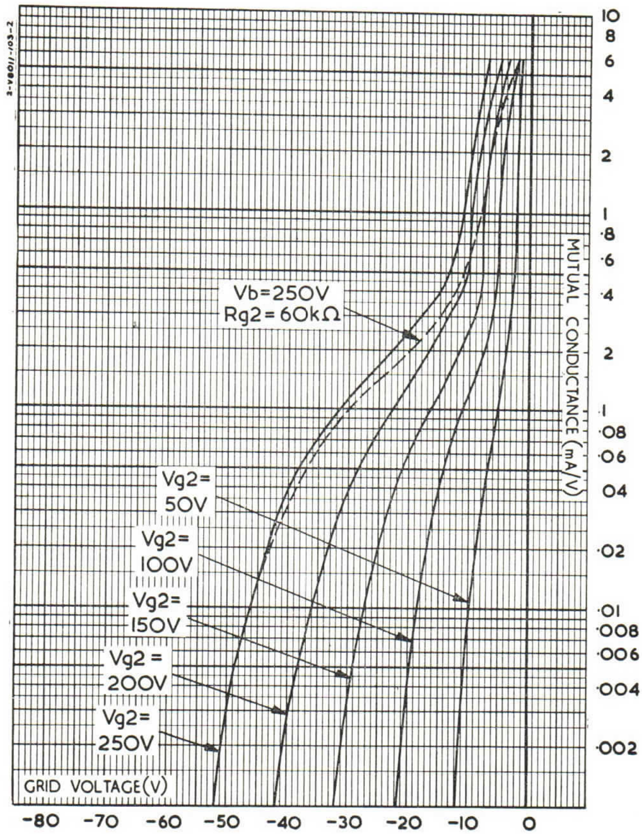
THORN — AEI RADIO VALVES & TUBES LTD.

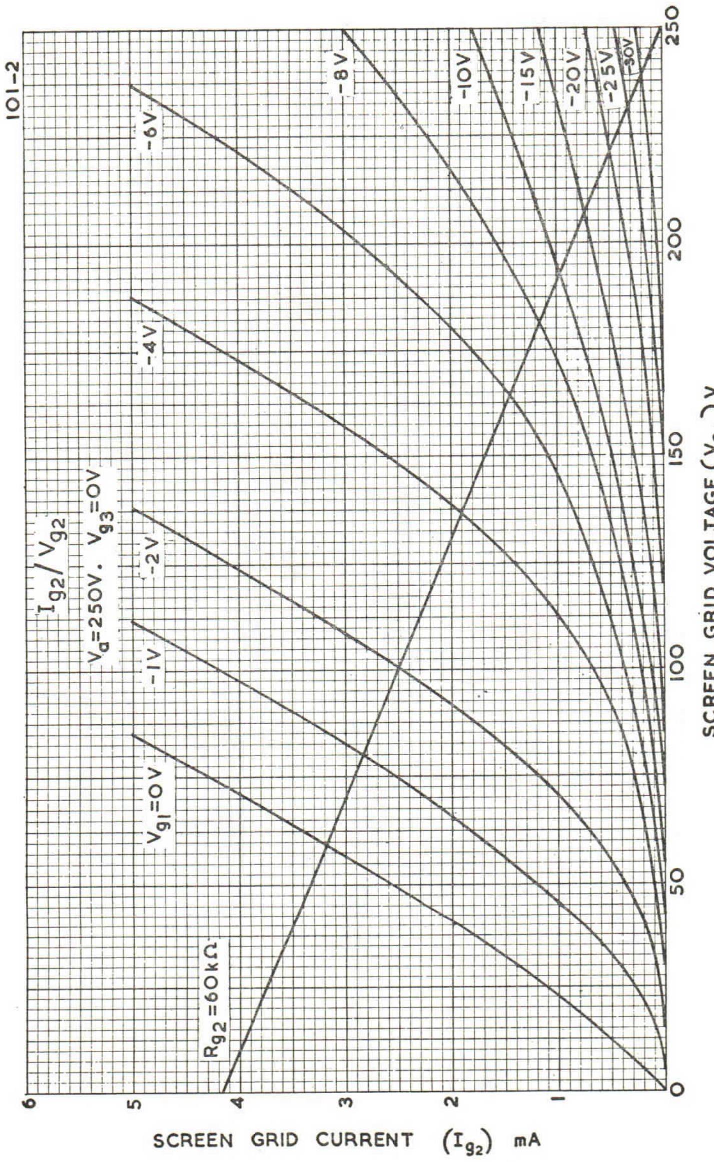
CHARACTERISTIC CURVES: I_a/V_{g1}
($V_a = 250V$, $V_{g3} = 0V$, $V_h = 6.3V$)



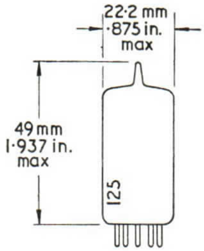
THORN — AEI RADIO VALVES & TUBES LTD.

CHARACTERISTIC CURVES: g_m/V_{g1}
(V_a=250V, V_{g3}=OV, V_h=6.3V)

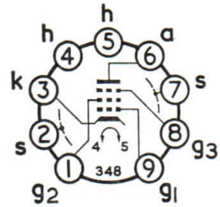




THORN — A E I RADIO VALVES & TUBES LTD.



LOW NOISE PENTODE



B9A Base

GENERAL

This low noise pentode is particularly suitable for use in the early stages of high gain audio amplifiers, microphone pre-amplifiers and tape recorders.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·2	A

RATINGS

Maximum Anode Dissipation	$p_{a(max)}$	1·0	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	0·2	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	V
Maximum Anode Voltage	$V_{a(max)}$	300	V
Maximum Screen Grid Supply Voltage	$V_{g2(b)max}$	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	200	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$		
Heater Negative		100	V
Heater Positive		50	V
Maximum Cathode Current	$I_{k(max)}$	6·0	mA
Maximum Control Grid to Cathode Resistance	$R_{g1\text{-}k(max)}$		
$p_a > 200$ mW		3·0	MΩ
$p_a < 200$ mW		10	MΩ

INTER-ELECTRODE CAPACITANCES*

Input	c_{in}	3·8	pF
Output	c_{out}	5·1	pF
Anode to Grid 1	$c_{a\text{-}g1}$	<0·05	pF
Grid 1 to Heater	$c_{g1\text{-}h}$	<0·0025	pF

* Measured without an external shield.

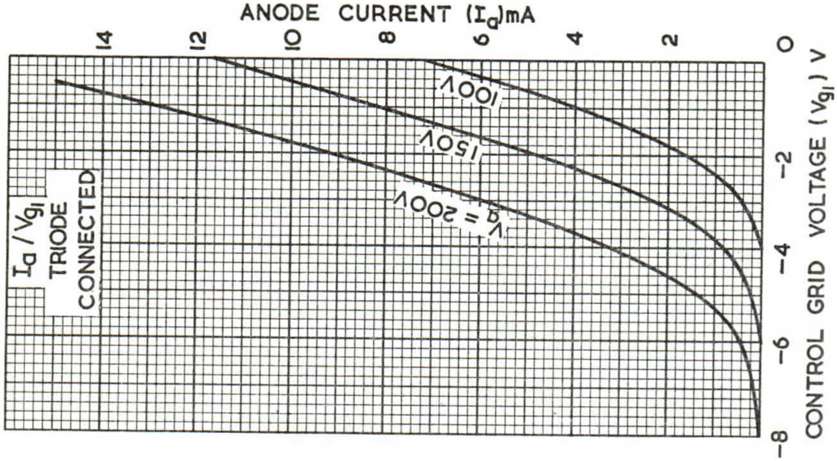
CHARACTERISTICS

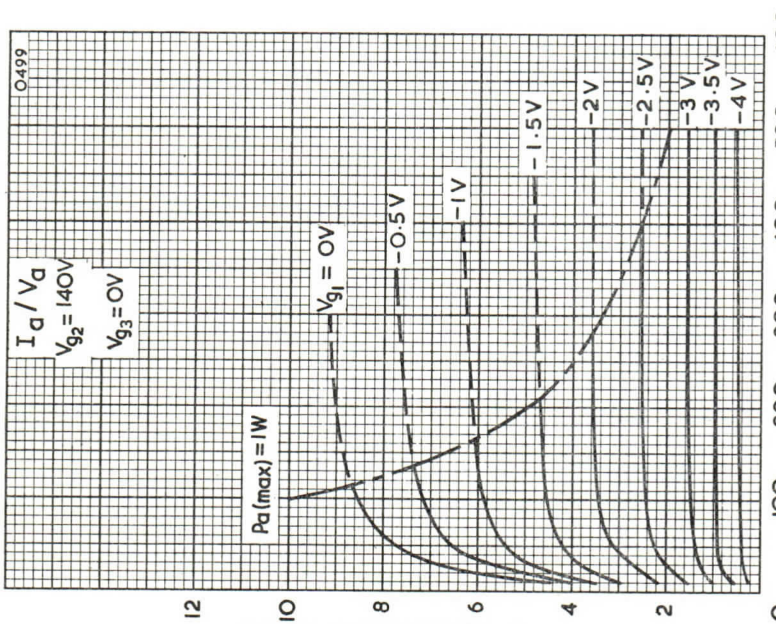
Anode Voltage	V_a	250	V
Screen Grid Voltage	V_{g2}	140	V
Control Grid Voltage	V_{g1}	−2·2	V
Anode Current	I_a	3·0	mA
Screen Grid Current	I_{g2}	0·6	mA
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	2·5	MΩ
Mutual Conductance	g_m	2·2	mA/V
Inner Amplification Factor	$\mu_{g1\text{-}g2}$	38	

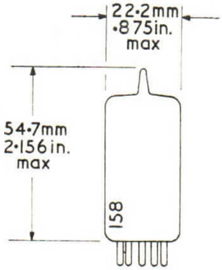
TYPICAL OPERATION—As an R.C. coupled A.F. Amplifier

Anode Supply Voltage	$V_{a(b)}$	200	250	300	400	V
Screen Grid Supply Voltage	$V_{g2(b)}$	200	250	300	400	V
Anode Load Resistance	R_a	220	220	220	220	kΩ
Series Screen Grid Resistance	R_{g2}	1·0	1·0	1·0	1·0	MΩ
Cathode Bias Resistance	R_k	2·2	2·2	2·2	2·2	kΩ
Grid Resistor of following stage		680	680	680	680	kΩ
R.M.S. Output Voltage at $D_{tot} = 5\%$	$V_{out(r.m.s.)}$	35	44	53	72	V
Voltage Gain		173	185	194	210	
Cathode Current	I_k	0·75	0·9	1·1	1·45	mA

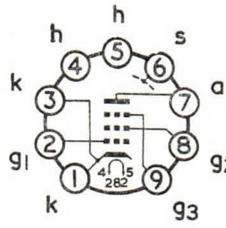
THORN—AEI RADIO VALVES & TUBES LTD.


ANODE CURRENT (I_a)mA
14
12
10
8
6
4
2
0
CONTROL GRID VOLTAGE (V_{g1}) V
-2
-4
-6
-8
I_a / V_{g1}
TRIODE CONNECTED
V_a = 200V
150V
100V


0499
I_a / V_a
V_{g2} = 140V
V_{g3} = 0V
V_{g1} = 0V
-0.5V
-1V
-1.5V
-2V
-2.5V
-3V
-3.5V
-4V
Pa(max) = 1W
ANODE VOLTAGE (V_a)V
600
500
400
300
200
100
0
12
10
8
6
4
2
ANODE CURRENT (I_a)mA



VARIABLE-MU R.F. PENTODE



B9A Base

GENERAL

This valve is a variable-mu frame grid R.F. pentode for use as an A.G.C. controlled, high gain I.F. amplifier in A.C. or A.C./D.C. television receivers.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·3	A

RATINGS

Maximum Anode Dissipation	$p_{a(max)}$	2·5	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	0·65	W
Maximum Anode Voltage	$V_{a(max)}$	250	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	250	V
Maximum Heater to Cathode Voltage (R.M.S.)	$V_{h-k(r.m.s.)max}$	150	V
Maximum Control Grid to Cathode Resistance	$R_{g1-k(max)}$	1	MΩ

INTER-ELECTRODE CAPACITANCES

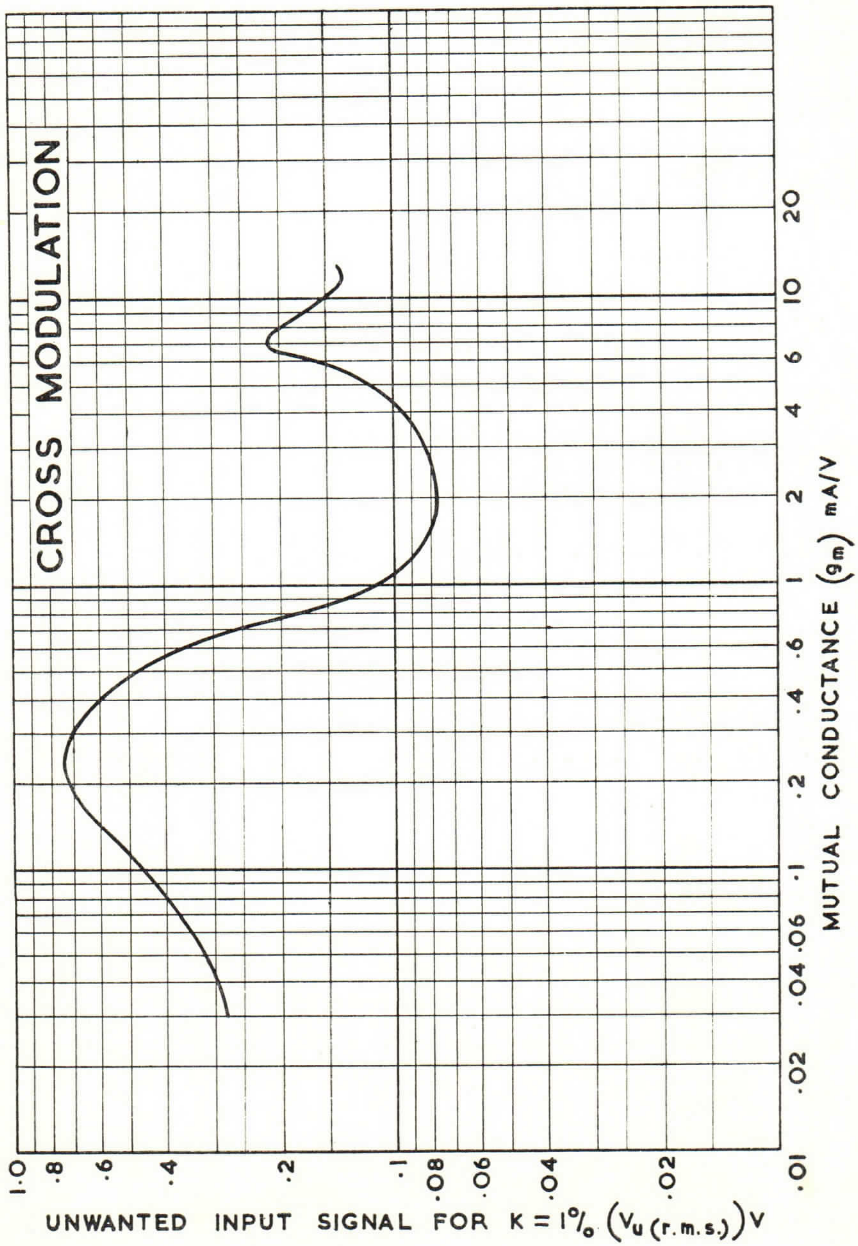
		*	†	‡	
Input	c_{in}	9·5	9·9	11·0	pF
Output	c_{out}	3·0	3·4	3·5	pF
Grid 1 to Anode	c_{g1-a}	<0·0055	<0·0065	<0·0075	pF
Grid 1 to Grid 2	c_{g1-g2}	2·8	2·8	2·8	pF

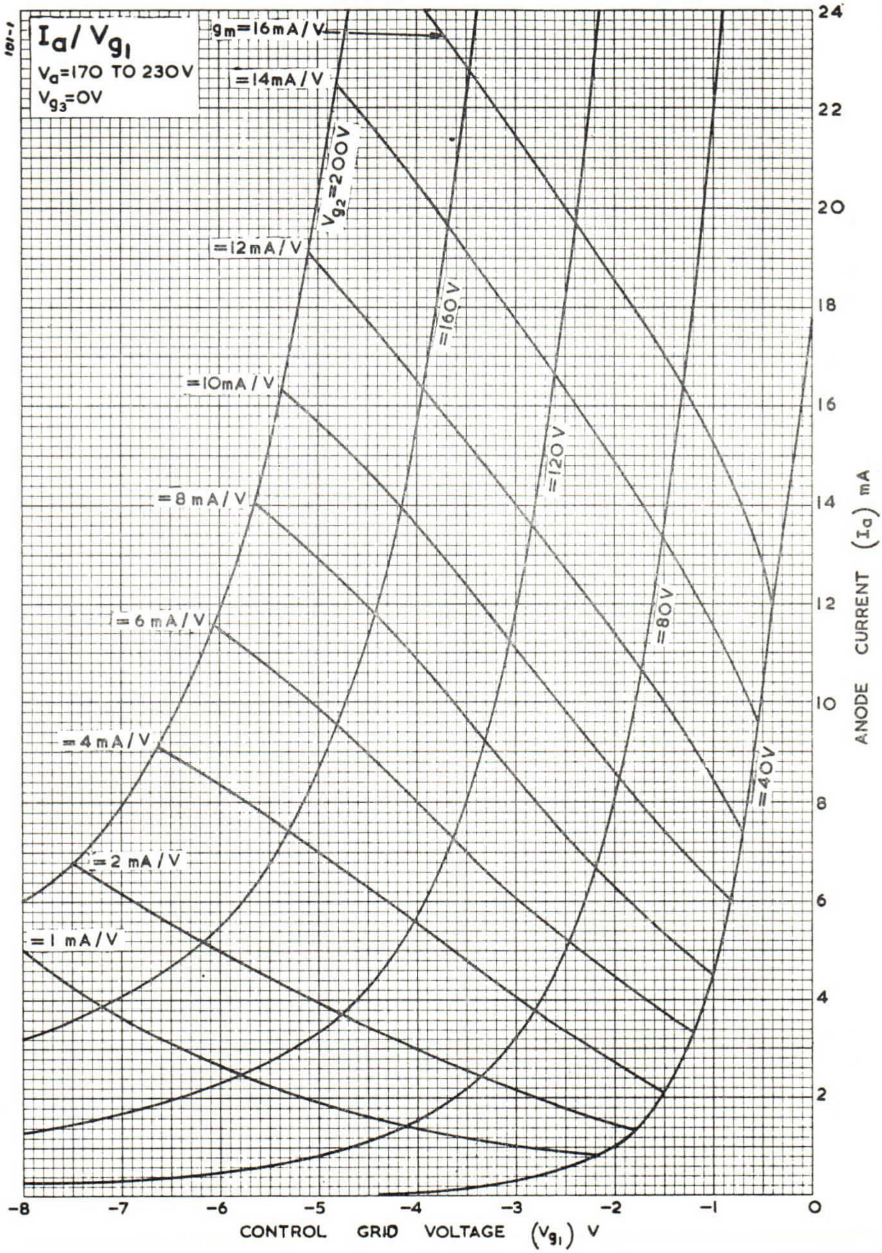
* In fully shielded socket without can.
† With holder capacitance balanced out. (Holder as below.)
‡ Total capacitance including B9A ceramic holder without skirt or radial shield. (Plessey holder type CP180900/1.)

CHARACTERISTICS AND TYPICAL OPERATION

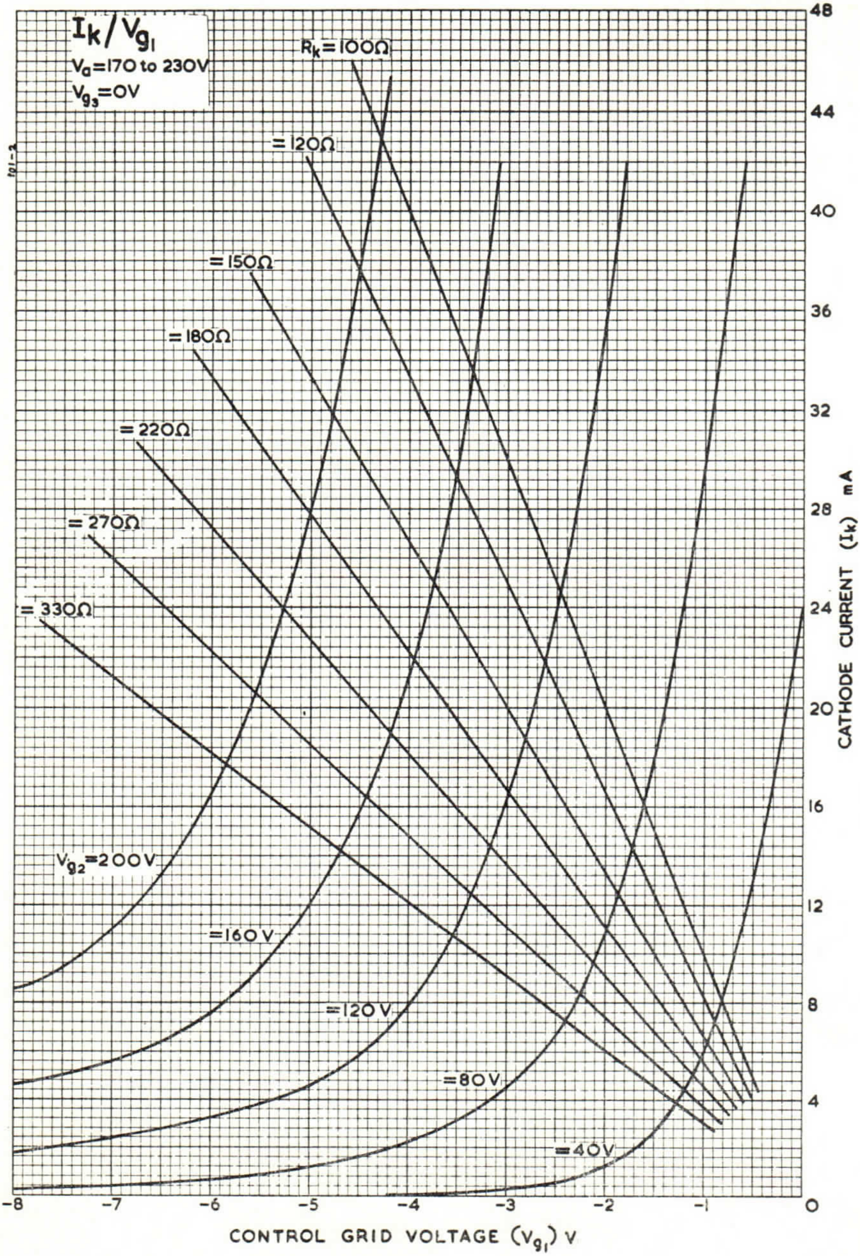
Supply Voltage	V_b	—	—	—	200	V
Anode Voltage	V_a	170	200	230	188	V
Screen Grid Voltage	V_{g2}	90	90	90	92	V
Screen Grid Resistance	R_{g2}	—	—	—	24	kΩ
Self Bias Resistance	R_k	—	—	—	120	Ω
Grid Bias Voltage	V_{g1}	−1·8	−2·0	−2·1	—	V
Anode Current	I_a	14	12	10·5	12	mA
Screen Grid Current	I_{g2}	5·3	4·5	3·6	4·5	mA
Mutual Conductance	g_m	14	12·5	10·6	12·5	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	350	500	650	—	kΩ
Valve Input Resistance at 40 Mc/s	r_{g1}	11·6	13	15·3	—	kΩ
Equivalent Grid Noise Resistance at 40 Mc/s	R_{eq}	—	490	—	—	Ω
Grid Voltage for $g_m/10$	$V_{g1}(g_m/10)$	—	—	—	−5·5	V
Grid Voltage for $g_m/100$	$V_{g1}(g_m/100)$	—	—	—	−19	V

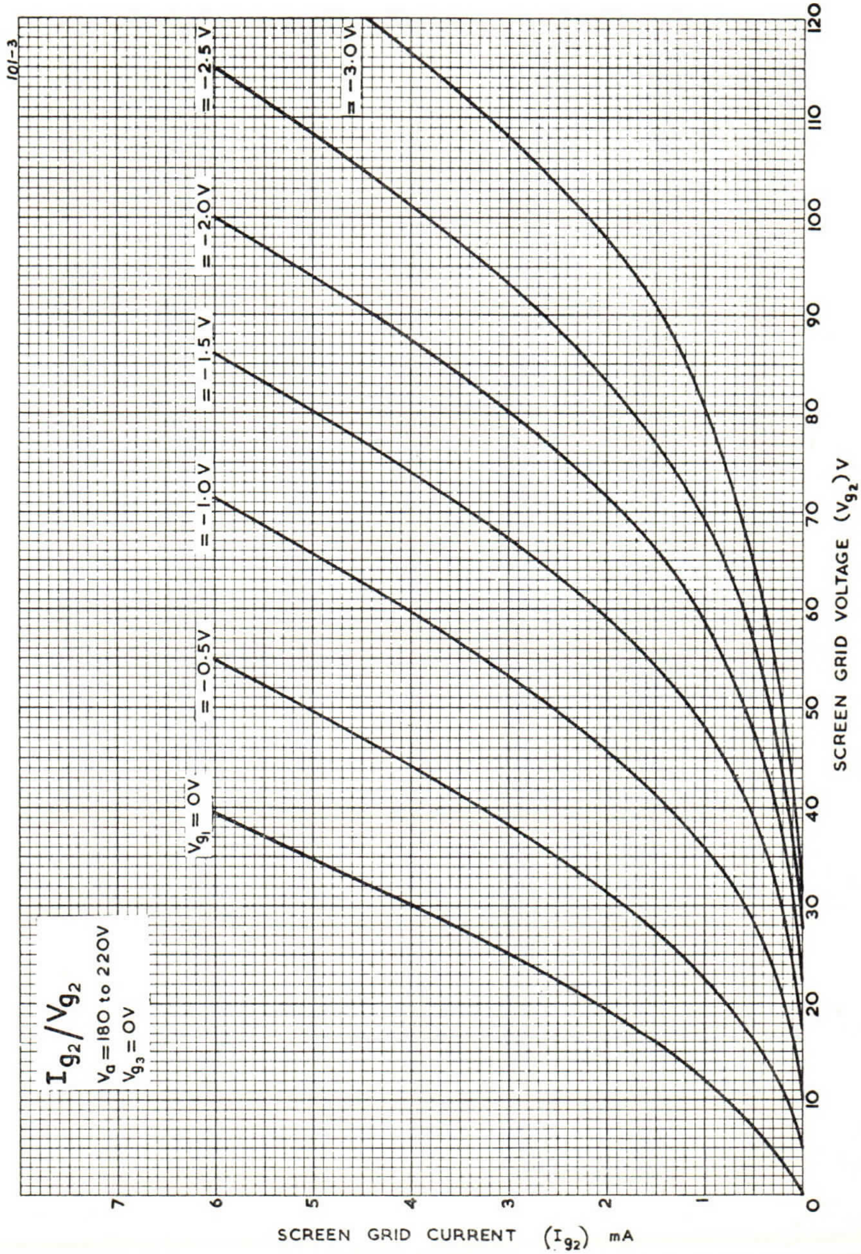
THORN—A E I RADIO VALVES & TUBES LTD.

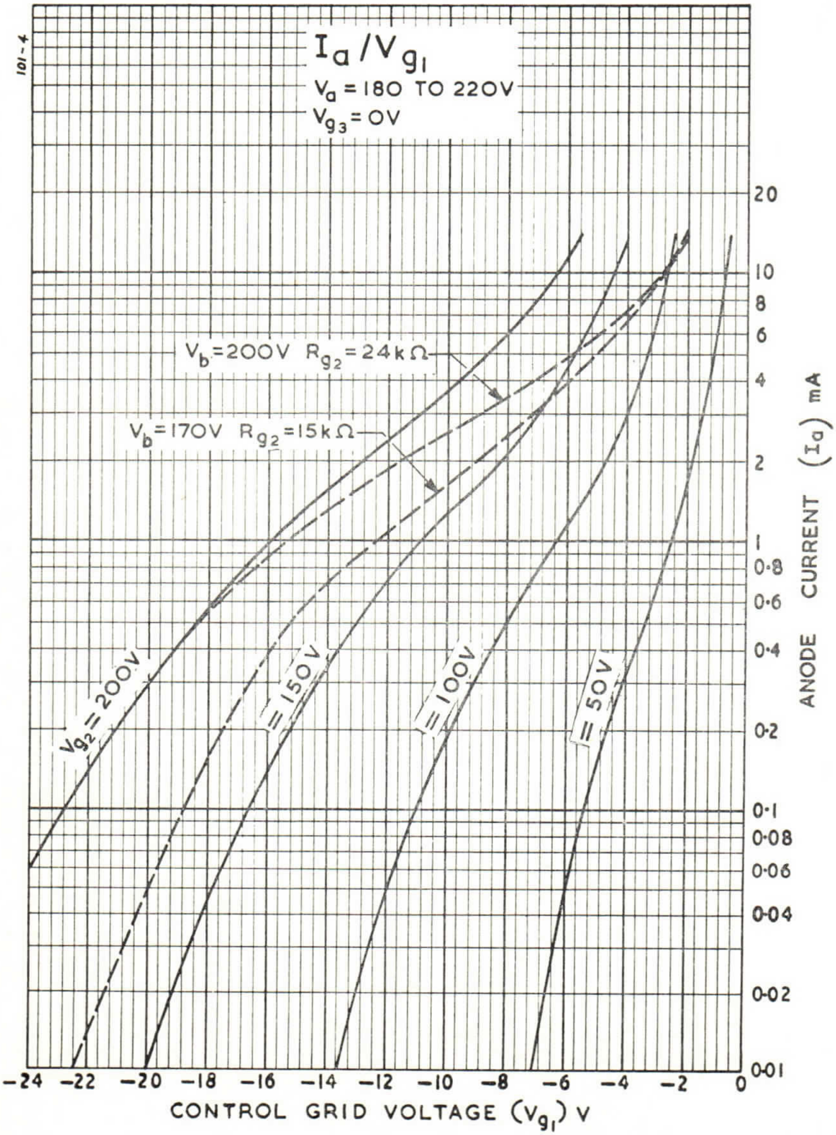

CROSS MODULATION
MUTUAL CONDUCTANCE (gm) mA/V
.01 .02 .04 .06 .1 .2 .4 .6 1 2 4 6 10 20
1.0 .8 .6 .4 .2 .1 .08 .06 .04 .02 .01
UNWANTED INPUT SIGNAL FOR K = 1% (Vu (r.m.s.)) V

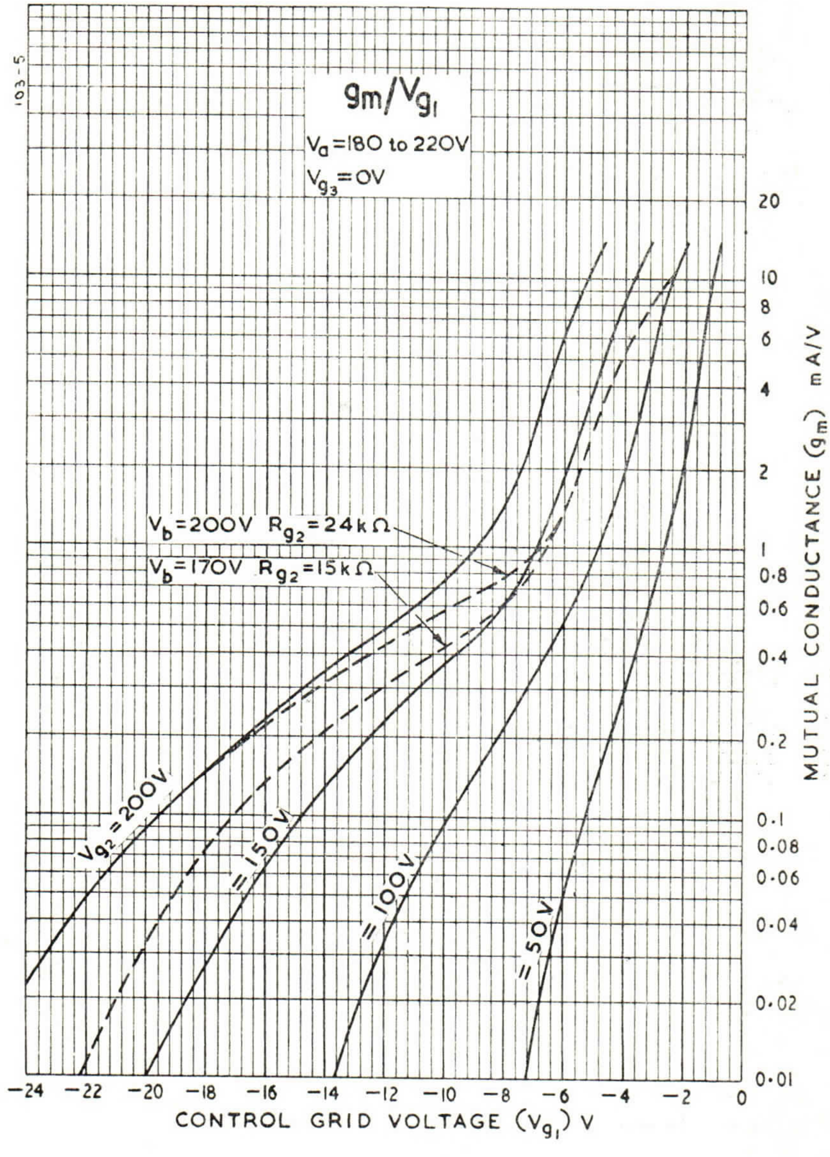


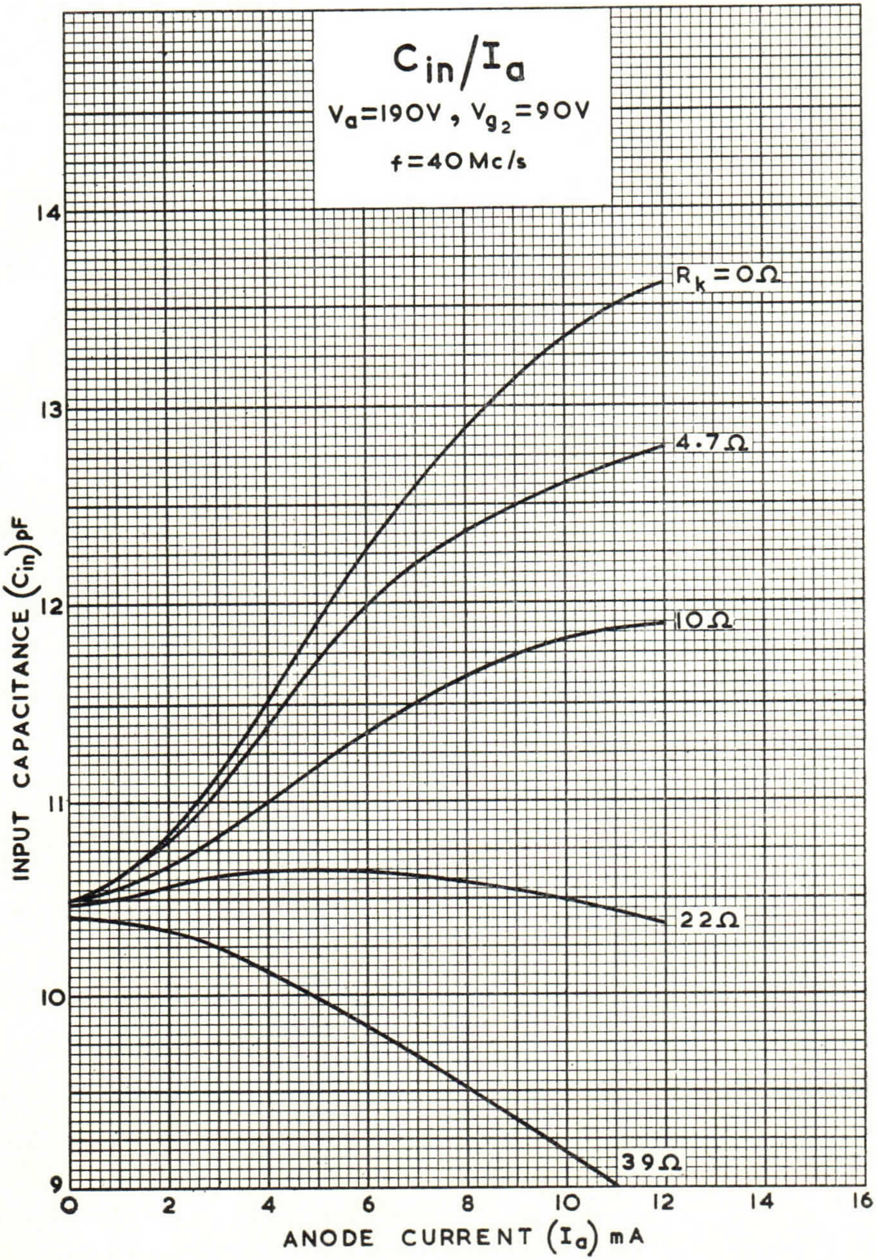
101-1
I_a/V_{g_1}
V_a=170 TO 230V
V_{g_3}=0V
g_m=16mA/V
=14mA/V
=12mA/V
=10mA/V
=8 mA/V
=6 mA/V
=4 mA/V
=2 mA/V
=1 mA/V
V_{g_2}=200V
=160V
=120V
=80V
=40V
24
22
20
18
16
14
12
10
8
6
4
2
0
ANODE CURRENT (I_a) mA
-8
-7
-6
-5
-4
-3
-2
-1
0
CONTROL GRID VOLTAGE (V_{g_1}) V

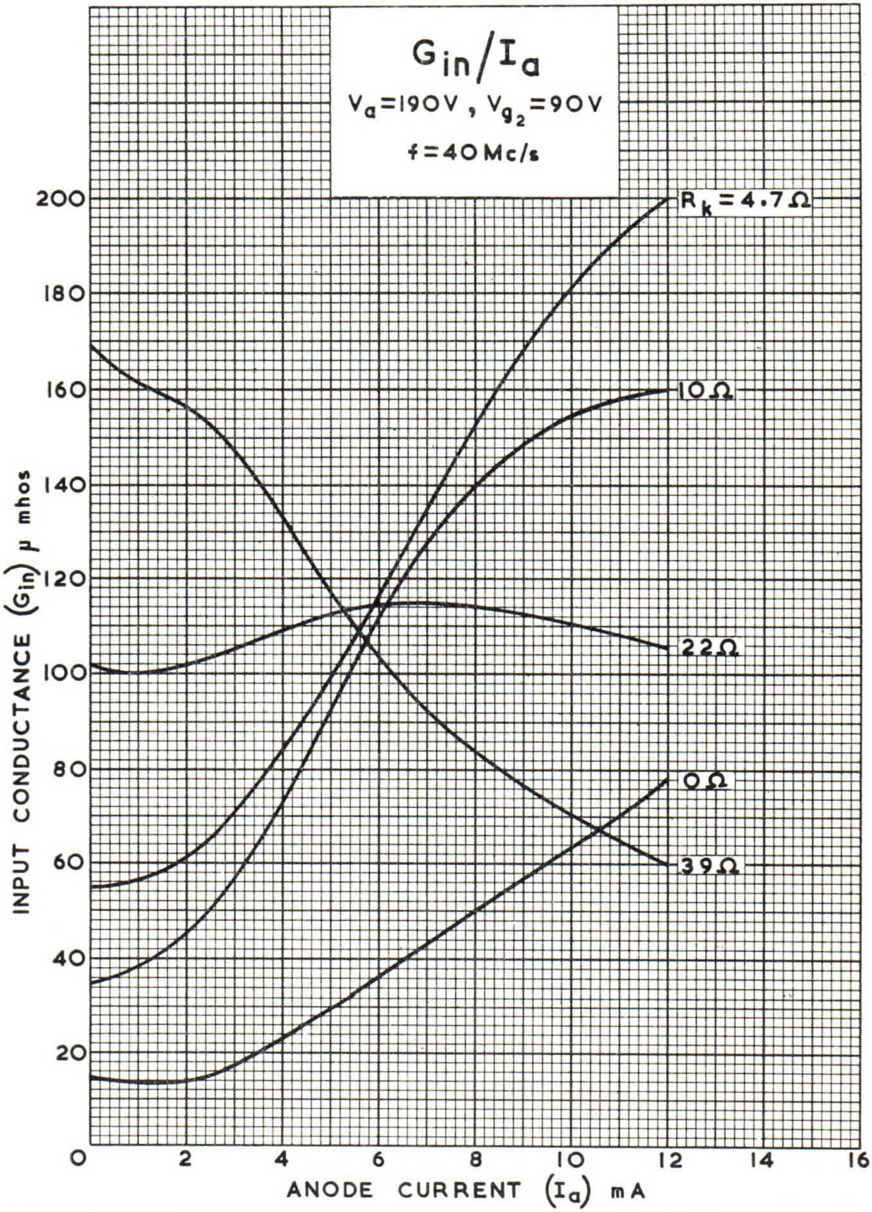

I_k/V_{g_1}
V_a=170 to 230V
V_{g_3}=0V
R_k=100Ω
=120Ω
=150Ω
=180Ω
=220Ω
=270Ω
=330Ω
V_{g_2}=200V
=160V
=120V
=80V
=40V
-8 -7 -6 -5 -4 -3 -2 -1 0
4 8 12 16 20 24 28 32 36 40 44 48
CONTROL GRID VOLTAGE (V_{g_1}) V
CATHODE CURRENT (I_k) mA

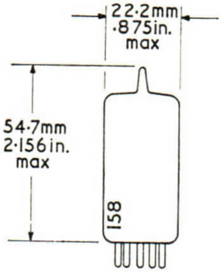

101-3
I_{g_2}/V_{g_2}
V_a = 180 to 220V
V_{g_3} = 0V
V_{g_1} = 0V
= −0.5V
= −1.0V
= −1.5V
= −2.0V
= −2.5V
= −3.0V
SCREEN GRID VOLTAGE (V_{g_2}) V
0 10 20 30 40 50 60 70 80 90 100 110 120
SCREEN GRID CURRENT (I_{g_2}) mA
0 1 2 3 4 5 6 7


101-4
I_a/V_{g_1}
V_a = 180 TO 220V
V_{g_3} = 0V
V_b = 200V R_{g_2} = 24kΩ
V_b = 170V R_{g_2} = 15kΩ
V_{g_2} = 200V
= 150V
= 100V
= 50V
20
10
8
6
4
2
1
0·8
0·6
0·4
0·2
0·1
0·08
0·06
0·04
0·02
0·01
ANODE CURRENT (I_a) mA
−24 −22 −20 −18 −16 −14 −12 −10 −8 −6 −4 −2 0
CONTROL GRID VOLTAGE (V_{g_1}) V

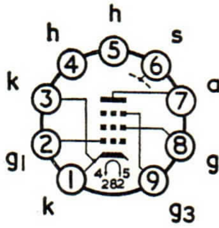

103-5
g_m/V_{g_1}
V_a=180 to 220V
V_{g_3}=0V
V_b=200V R_{g_2}=24kΩ
V_b=170V R_{g_2}=15kΩ
V_{g_2}=200V
=150V
=100V
=50V
20
10
8
6
4
2
1
0·8
0·6
0·4
0·2
0·1
0·08
0·06
0·04
0·02
0·01
MUTUAL CONDUCTANCE (g_m) mA/V
−24 −22 −20 −18 −16 −14 −12 −10 −8 −6 −4 −2 0
CONTROL GRID VOLTAGE (V_{g_1}) V


C_{in}/I_a
V_a=190V, V_{g_2}=90V
f=40Mc/s
R_k=0Ω
4.7Ω
10Ω
22Ω
39Ω
INPUT CAPACITANCE (C_{in})pF
ANODE CURRENT (I_a) mA
9
10
11
12
13
14
0
2
4
6
8
10
12
14
16


G_{in}/I_a
$V_a = 190V$, $V_{g_2} = 90V$
$f = 40 Mc/s$
$R_k = 4.7\Omega$
10Ω
22Ω
0Ω
39Ω
INPUT CONDUCTANCE (G_{in}) μ mhos
200
180
160
140
120
100
80
60
40
20
0
2
4
6
8
10
12
14
16
ANODE CURRENT (I_a) mA



HIGH SLOPE
R.F. PENTODE



B9A Base

GENERAL

This valve is a sharp cut-off frame grid R.F. Pentode for use as an I.F. amplifier in A.C. or A.C./D.C. television receivers.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·3	A

RATINGS

Maximum Anode Dissipation	$p_{a(max)}$	2·5	W
Maximum Screen Grid Dissipation	$p_{g_2(max)}$	0·9	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	V
Maximum Anode Voltage	$V_{a(max)}$	250	V
Maximum Screen Grid Supply Voltage	$V_{g_2(b)max}$	550	V
Maximum Screen Grid Voltage	$V_{g_2(max)}$	250	V
Maximum Peak Negative Grid Voltage	$-v_{g_1(pk)max}$	50	V
Maximum Heater to Cathode Voltage (R.M.S.)	$V_{h\text{-}k(max)r.m.s.}$	150	V
Maximum Cathode Current	$I_{k(max)}$	25	mA
Maximum Control Grid to Cathode Resistance	$R_{g\text{-}k(max)}$	1·0	MΩ
Maximum Heater to Cathode Resistance	$R_{h\text{-}k(max)}$	20	kΩ
Maximum Bulb Temperature	$T_{bulb(max)}$	180	°C

INTER-ELECTRODE CAPACITANCES

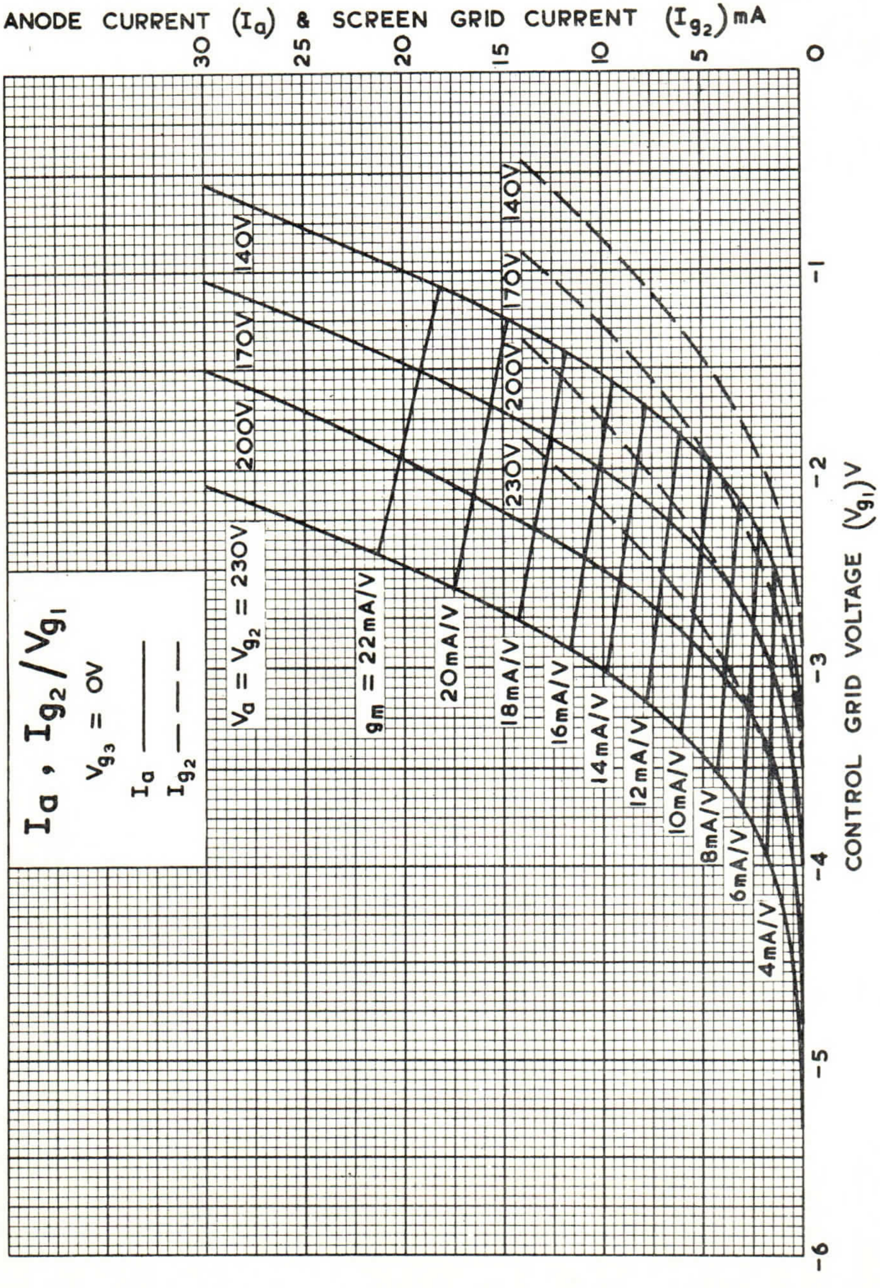
		*	†	‡	
Input	c_{in}	10	10·4	11·5	pF
Output	c_{out}	3·0	3·4	4·5	pF
Anode to Grid 1	$c_{a\text{-}g_1}$	<0·0055	<0·0065	<0·0075	pF
Grid 1 to Grid 2	$c_{g_1\text{-}g_2}$	2·8	2·8	2·8	pF

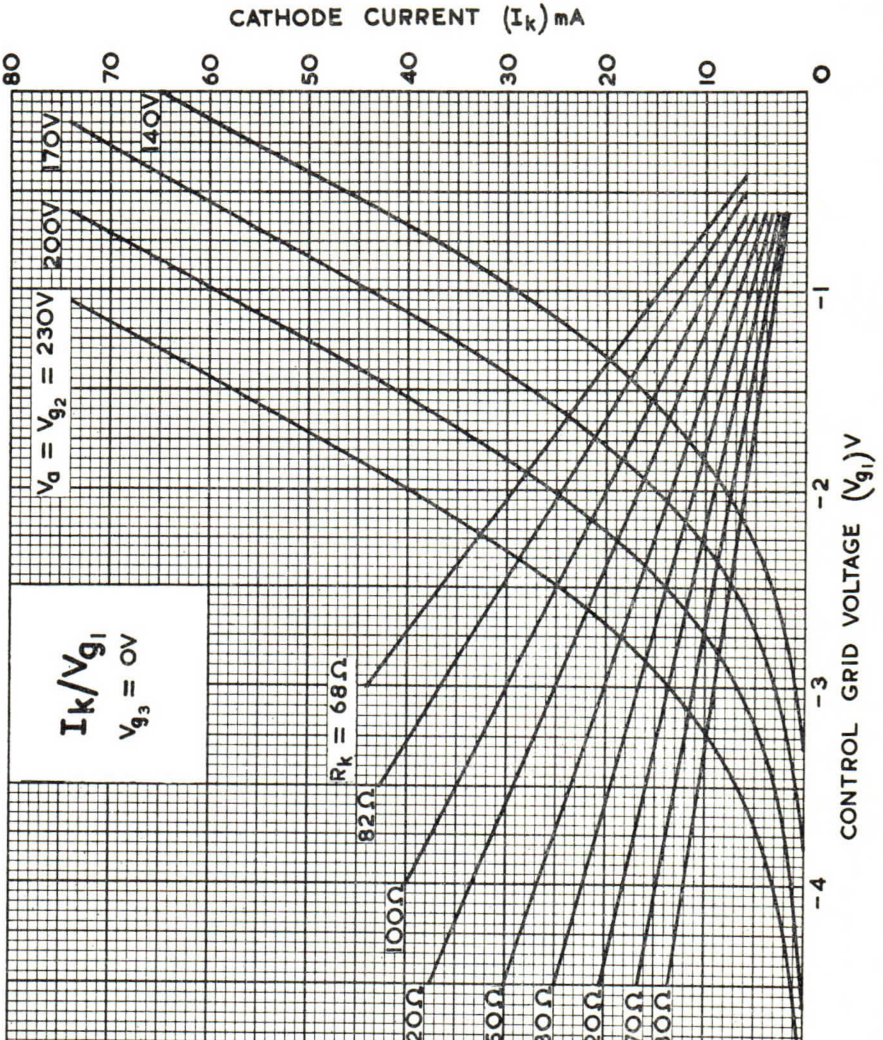
* In fully shielded socket without can (I.E.C. Publication 100).
† With holder capacitance balanced out (Holder as below).
‡ Total capacitance including B9A ceramic holder without skirt or radial shield (Plessey holder type CP180900/1).

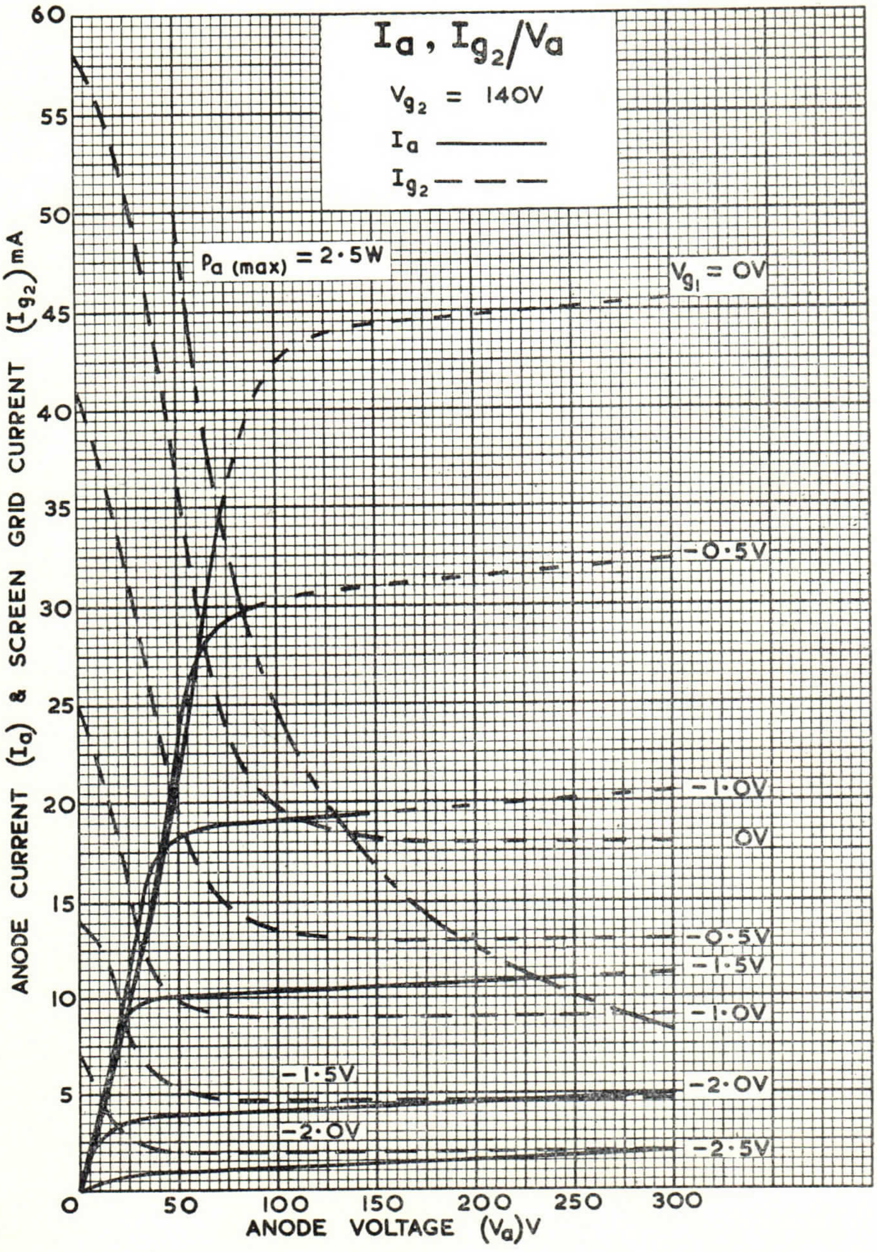
TYPICAL OPERATION

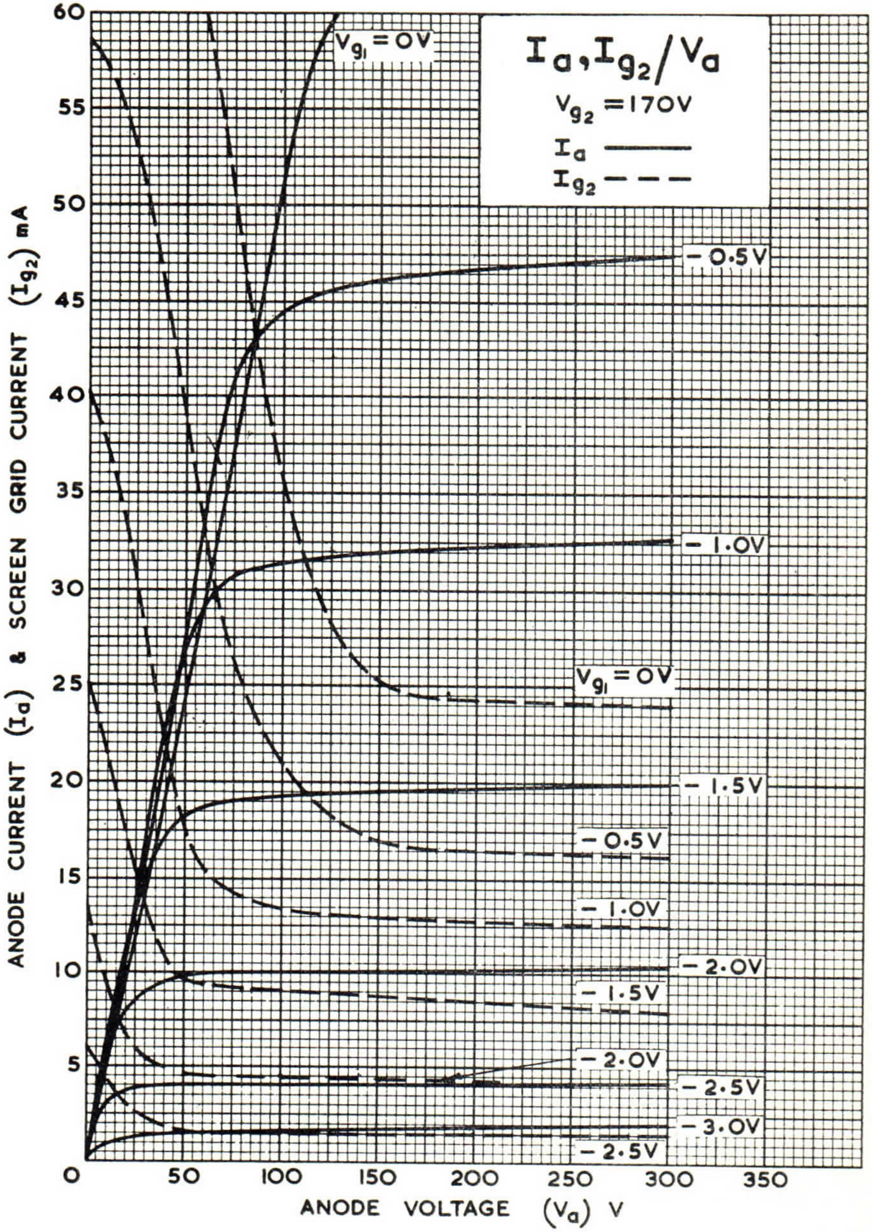
Anode Supply Voltage	$V_{a(b)}$	170	200	230	200	V
Screen Grid Supply Voltage	$V_{g_2(b)}$	170	200	230	200	V
Suppressor Grid Supply Voltage	$V_{g_3(b)}$	0	0	0	0	V
Control Grid Voltage	V_{g_1}	—	—	—	−2·5	V
Anode Current	I_a	10	10	10	10	mA
Screen Grid Current	I_{g_2}	4·1	4·1	4·1	4·1	mA
Screen Grid Resistance	R_{g_2}	0	7·5	15	—	kΩ
Cathode Bias Resistance	R_k	140	140	140	—	Ω
Mutual Conductance	g_m	15·6	15·6	15·6	15	mA/V
Inner Amplification Factor	$\mu_{g_1\text{-}g_2}$	—	—	—	60	
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	330	510	680	380	kΩ
Valve Input Resistance at 38 Mc/s	r_{g_1}	11	11	11	12	kΩ
Equivalent Grid Noise Resistance at 38 Mc/s	R_{eq}	300	300	300	330	Ω
Working Input Capacitance	$c_{in(w)}$	—	—	—	15*	pF

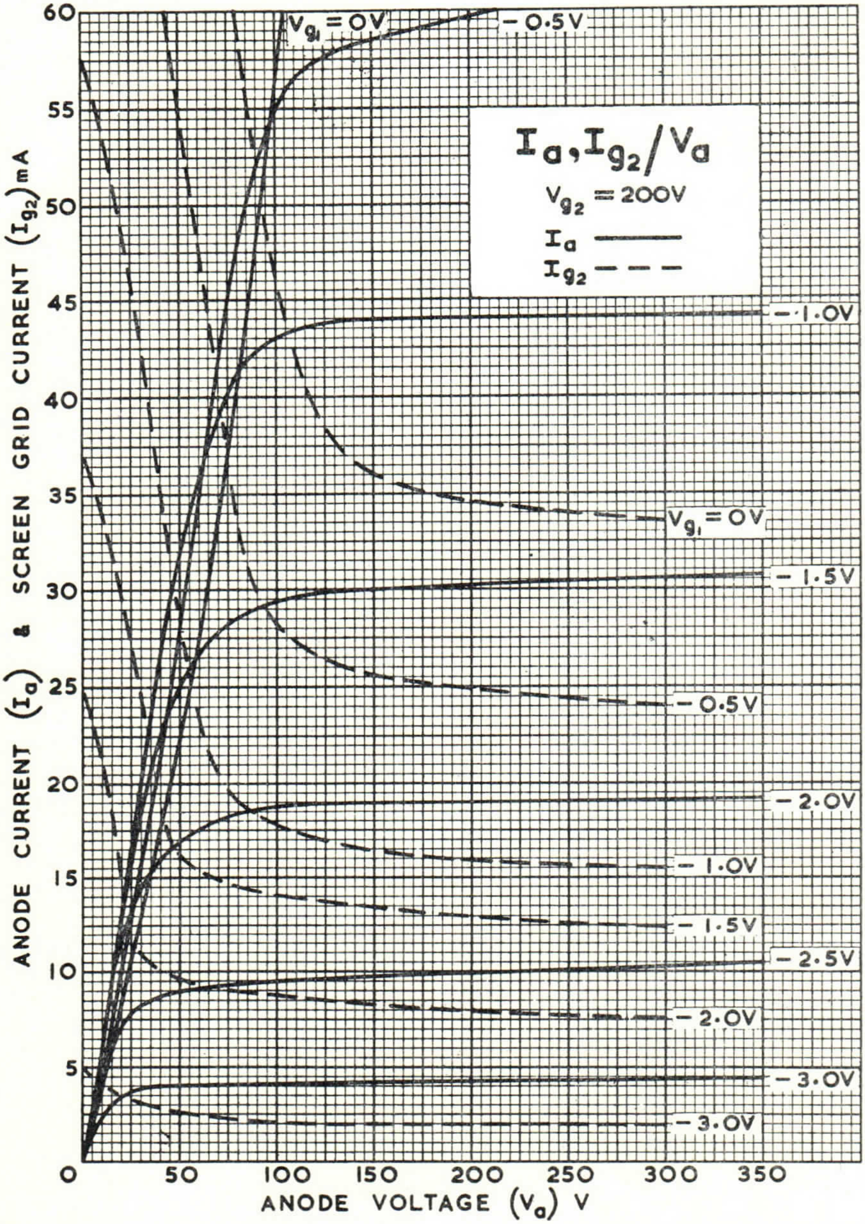
THORN—AEI RADIO VALVES & TUBES LTD.

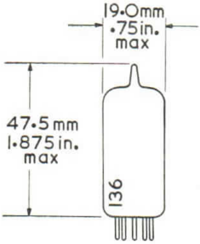

ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g_2}) mA
30
25
20
15
10
5
0
CONTROL GRID VOLTAGE (V_{g_1}) V
-1
-2
-3
-4
-5
-6
I_a, I_{g_2}/V_{g_1}
V_{g_3} = 0V
I_a
I_{g_2}
V_a = V_{g_2} = 230V
200V
170V
140V
230V
200V
170V
140V
g_m = 22mA/V
20mA/V
18mA/V
16mA/V
14mA/V
12mA/V
10mA/V
8mA/V
6mA/V
4mA/V


CATHODE CURRENT (I_k) mA
80
70
60
50
40
30
20
10
0
CONTROL GRID VOLTAGE (V_{g_1}) V
-1
-2
-3
-4
-5
$V_a = V_{g_2} = 230V$
200V
170V
140V
I_k/V_{g_1}
$V_{g_3} = 0V$
$R_k = 68\Omega$
82Ω
100Ω
120Ω
150Ω
180Ω
220Ω
270Ω
330Ω

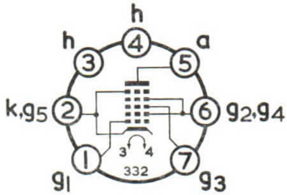

I_a, I_{g_2}/V_a
V_{g_2} = 140V
I_a ————
I_{g_2} — — —
$P_{a\,(max)}$ = 2·5W
V_{g_1} = 0V
−0·5V
−1·0V
0V
−0·5V
−1·5V
−1·0V
−1·5V
−2·0V
−2·0V
−2·5V
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g_2}) mA
ANODE VOLTAGE (V_a)V
0
5
10
15
20
25
30
35
40
45
50
55
60
50
100
150
200
250
300


$I_a, I_{g2}/V_a$
$V_{g2} = 170V$
I_a ———
I_{g2} – – –
$V_{g1} = 0V$
−0.5V
−1.0V
−1.5V
−2.0V
−2.5V
−3.0V
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA
ANODE VOLTAGE (V_a) V
0
5
10
15
20
25
30
35
40
45
50
55
60
50
100
150
200
250
300
350


$I_a, I_{g2}/V_a$
$V_{g2} = 200V$
I_a
I_{g2}
$V_{g1} = 0V$
$-0.5V$
$-1.0V$
$V_{g1} = 0V$
$-1.5V$
$-0.5V$
$-2.0V$
$-1.0V$
$-1.5V$
$-2.5V$
$-2.0V$
$-3.0V$
$-3.0V$
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA
0
5
10
15
20
25
30
35
40
45
50
55
60
50
100
150
200
250
300
350
ANODE VOLTAGE (V_a) V



DUAL CONTROL HEPTODE



Base B7G

GENERAL

This valve is a dual control heptode intended for use in television receivers.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·3	A

RATINGS

Maximum Anode Dissipation	$p_{a(max)}$	1·0	W
Maximum Screen Grids Dissipation	$p_{g2+g4(max)}$	1·0	W
Maximum Anode Voltage	$V_{a(max)}$	300	V
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	V
Maximum Screen Grids Voltage	$V_{g2+g4(max)}$	100	V
Maximum Screen Grids Supply Voltage	$V_{g2+g4(b)max}$	300	V
Maximum Cathode Current	$I_{k(max)}$	14	mA
Maximum Control Grid to Cathode Resistance	$R_{g1\text{-}k(max)}$	470	kΩ
Maximum Grid 3 to Cathode Resistance	$R_{g3\text{-}k(max)}$	2·2	MΩ
For $V_{g2+g4} \leqslant 30V$		5·0	MΩ
Maximum Heater to Cathode Voltage,	$V_{h\text{-}k(max)}$		
Cathode Positive		200	V
Cathode Negative		100	V

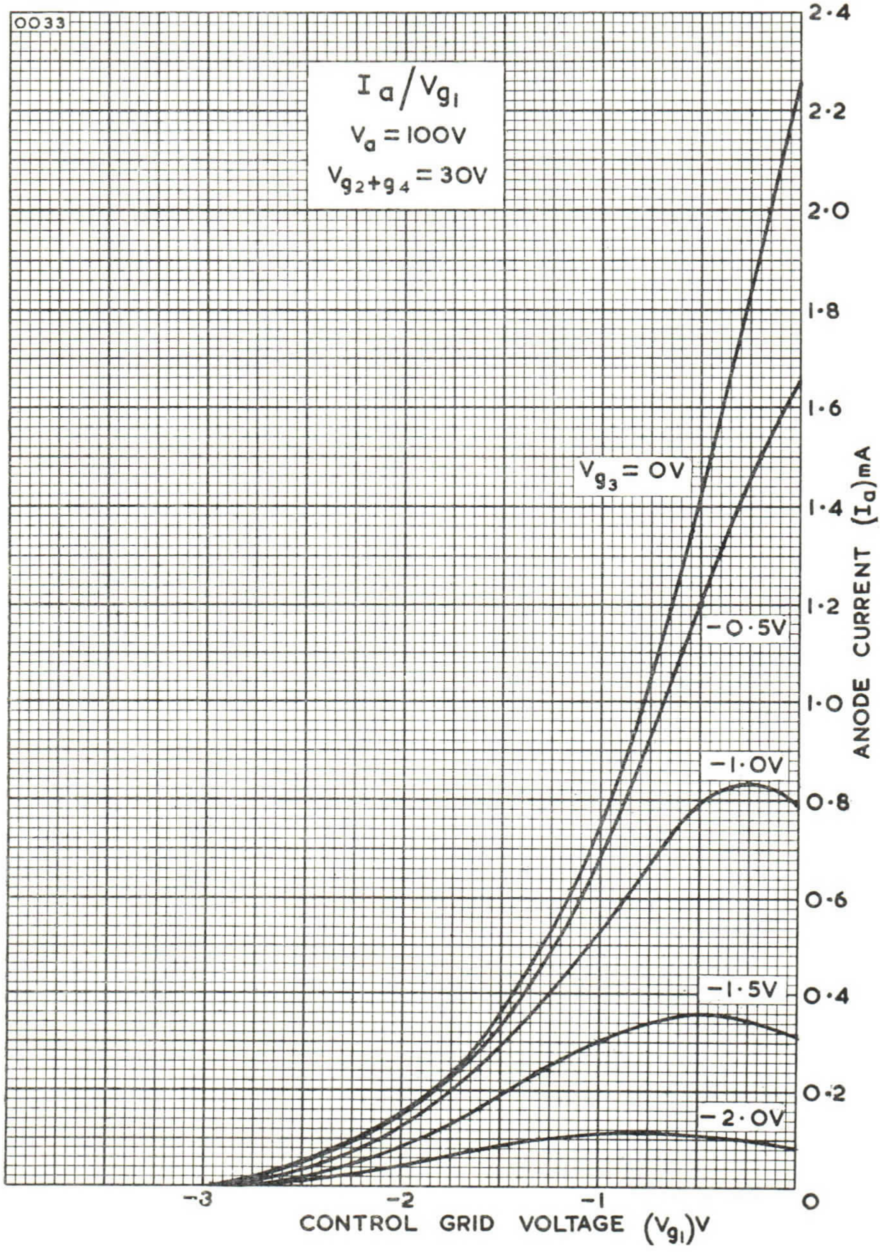
INTER-ELECTRODE CAPACITANCES

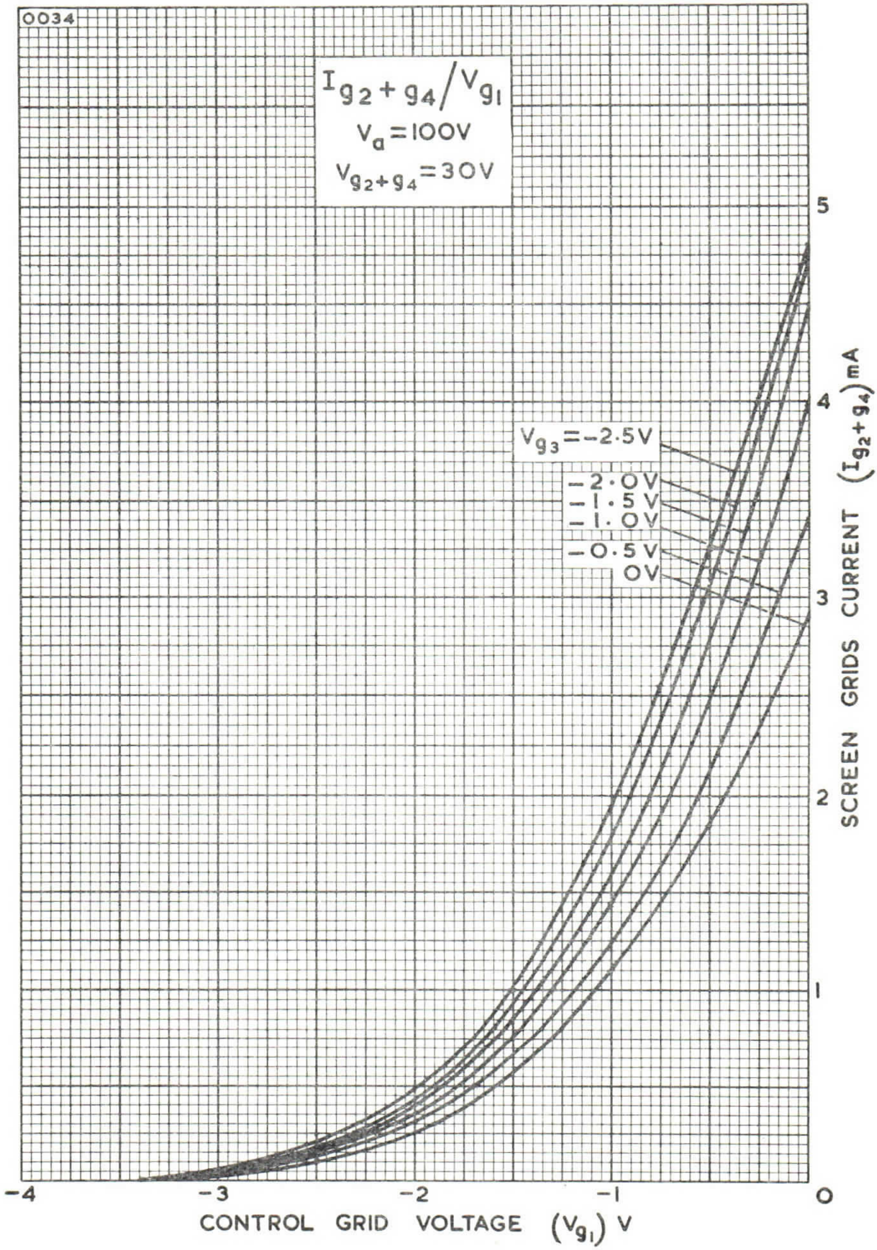
Anode to Grid 1	$c_{a\text{-}g1}$	<0·07	pF
Anode to Grid 3	$c_{a\text{-}g3}$	<0·36	pF
Grid 1 Input	$c_{in(g1)}$	5·5	pF
Grid 3 Input	$c_{in(g3)}$	7·0	pF
Output	c_{out}	7·5	pF
Grid 1 to Grid 3	$c_{g1\text{-}g3}$	<0·22	pF

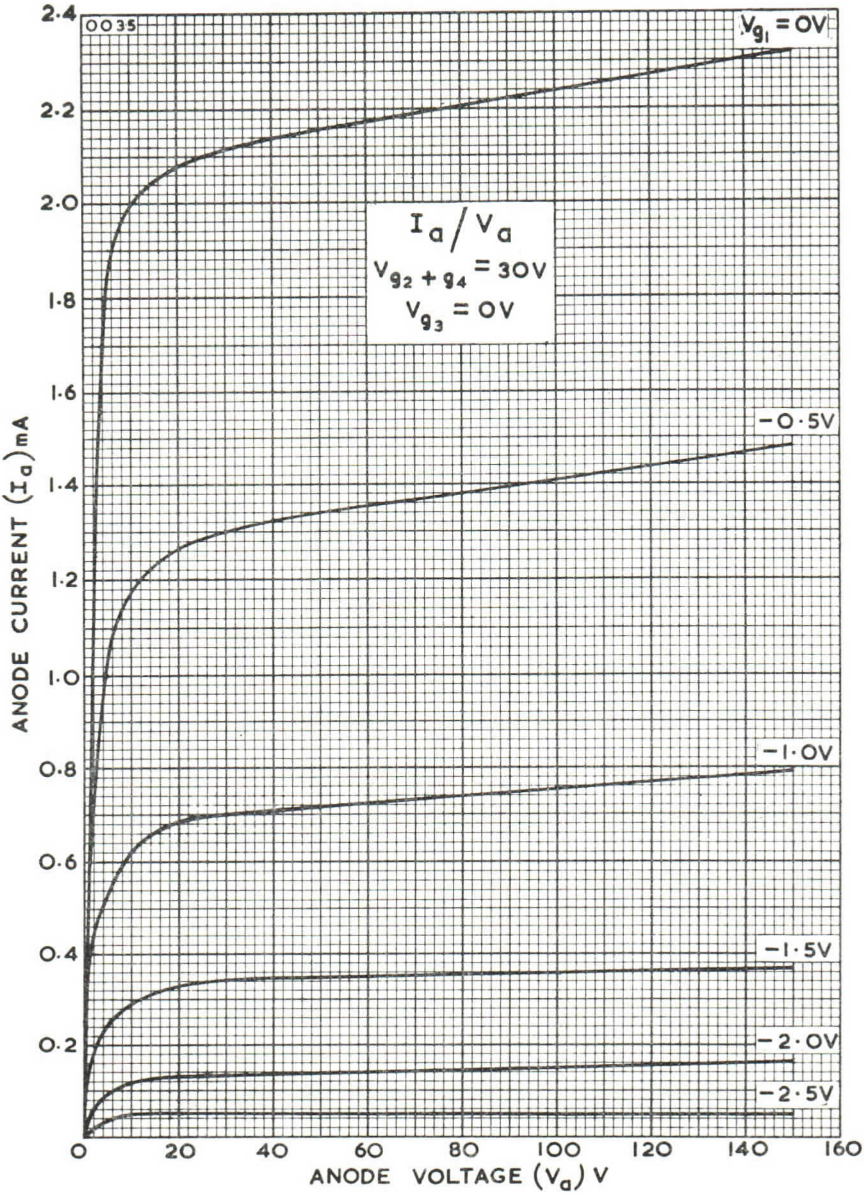
CHARACTERISTICS

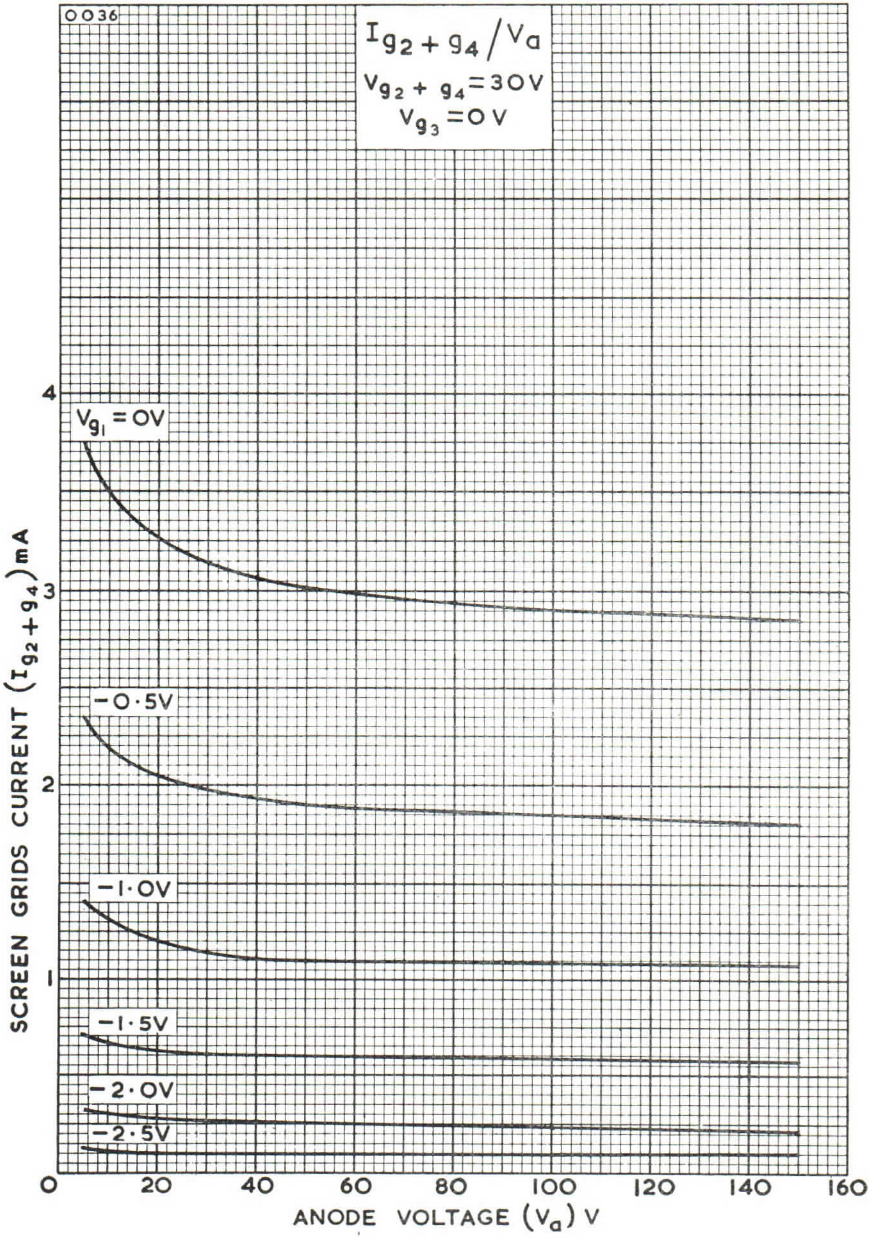
Anode Voltage	V_a	10	100	100	V
Screen Grids Voltage	V_{g2+g4}	30	30	30	V
Control Grid Voltage	V_{g1}	0	0	−1·0	V
Grid 3 Voltage	V_{g3}	0	−1·0	0	V
Anode Current	I_a	2·0	0·8	0·75	mA
Screen Grids Current	I_{g2+g4}	3·5	4·0	1·1	mA
Mutual Conductance (Control Grid to Anode)	$g_{m(g1\text{-}a)}$	—	—	1·2	mA/V
Mutual Conductance (Grid 3 to Anode)	$g_{m(g3\text{-}a)}$	—	1·55	—	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	—	400	900	kΩ
Control Grid Voltage ($I_a = 50\mu A$)	V_{g1}	—	—	−2·5	V
Grid 3 Voltage ($I_a = 50\mu A$)	V_{g3}	—	−2·2	—	V

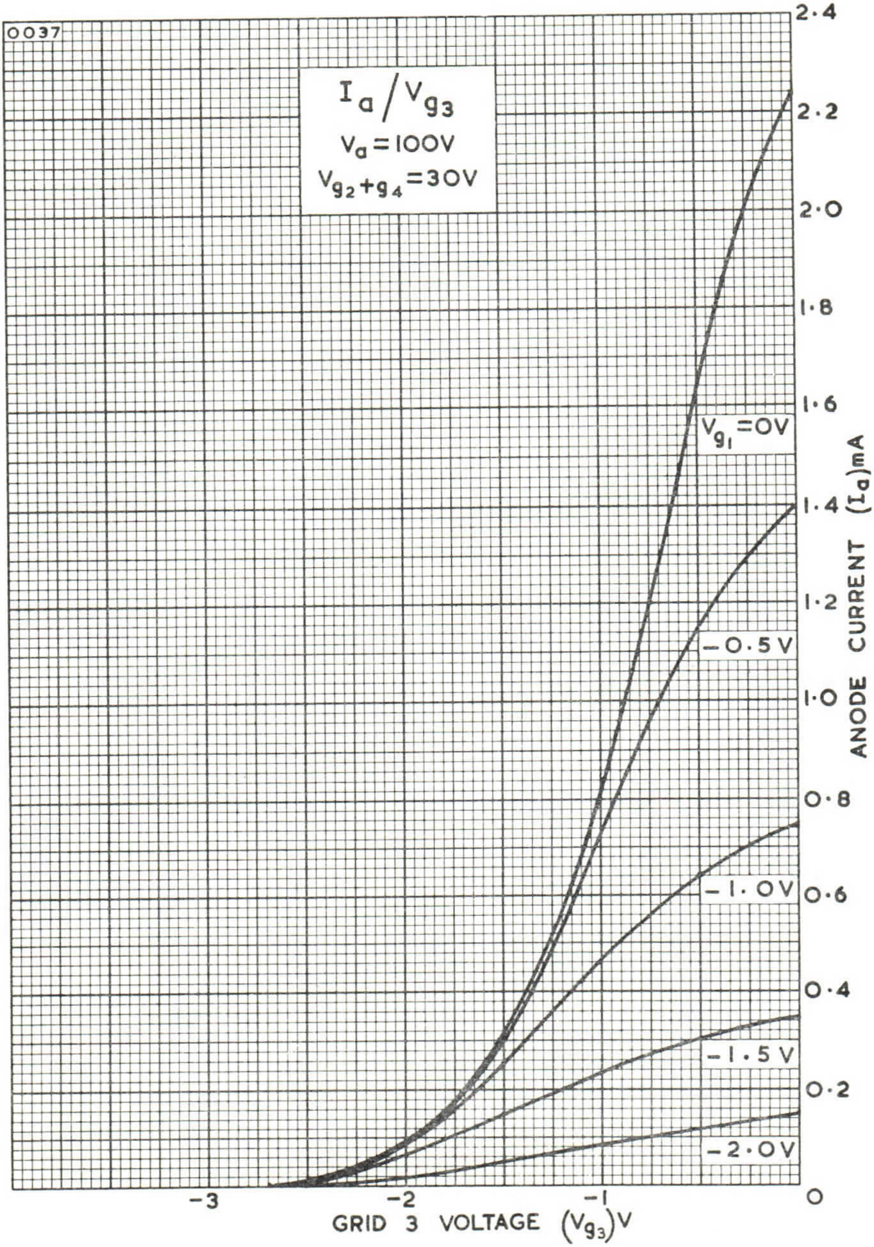
THORN — A E I RADIO VALVES & TUBES LTD.

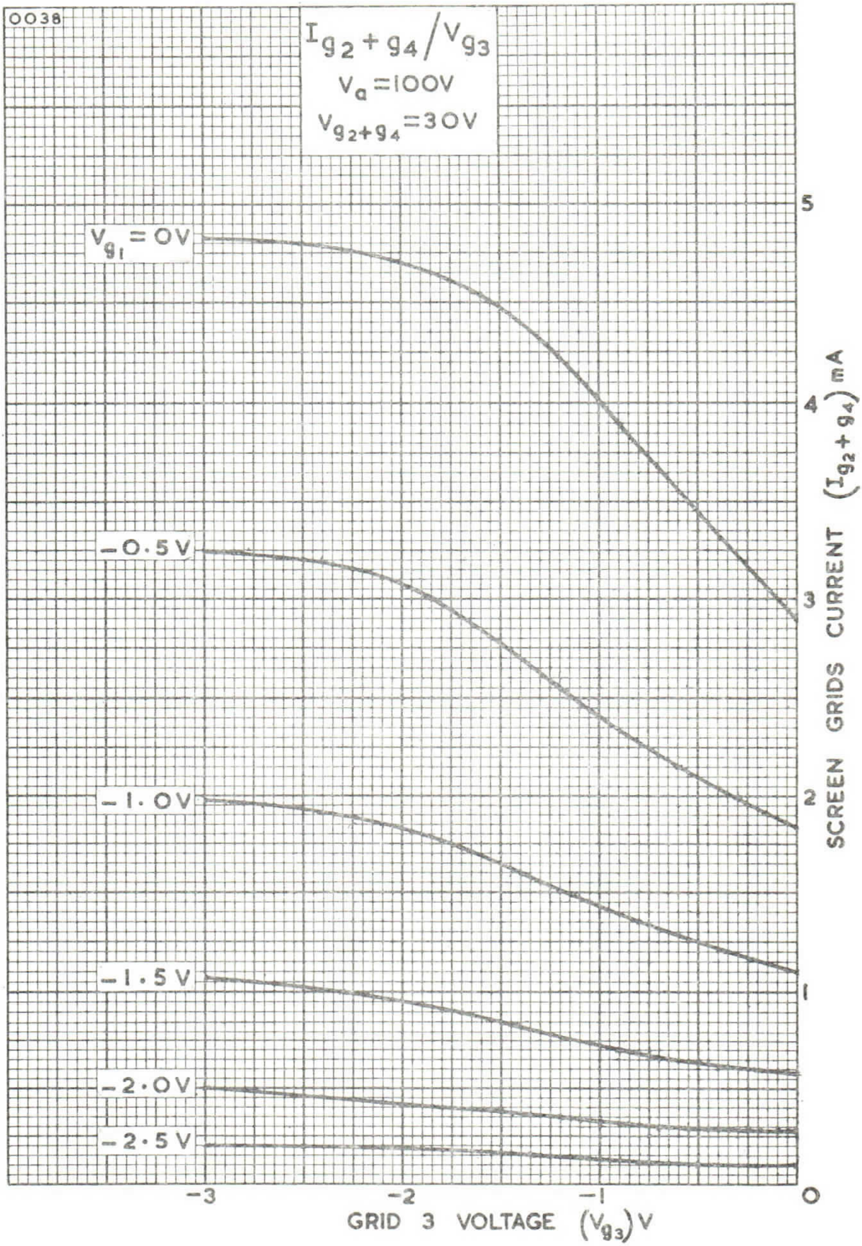

0033
I_a / V_{g_1}
$V_a = 100V$
$V_{g_2+g_4} = 30V$
$V_{g_3} = 0V$
−0·5V
−1·0V
−1·5V
−2·0V
2·4
2·2
2·0
1·8
1·6
1·4
1·2
1·0
0·8
0·6
0·4
0·2
0
ANODE CURRENT (I_a)mA
−3
−2
−1
CONTROL GRID VOLTAGE (V_{g_1})V

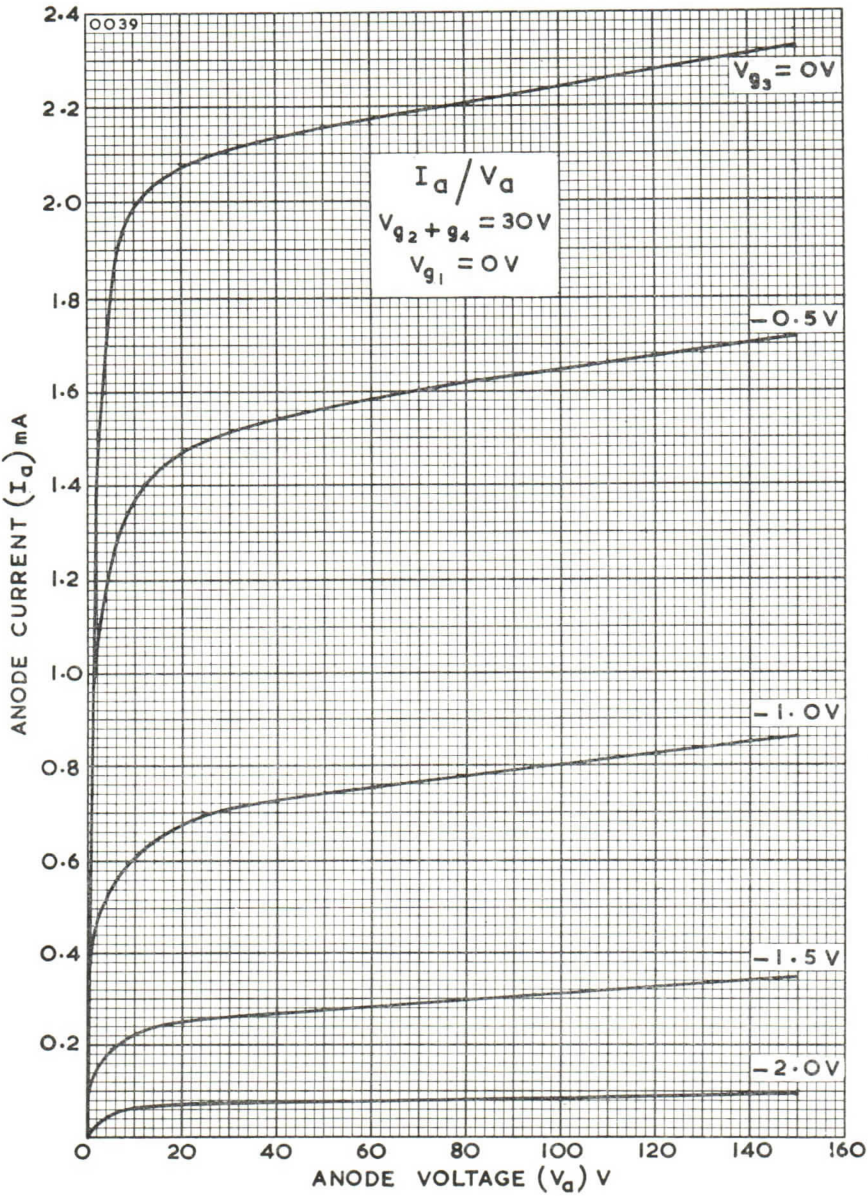

0034
$I_{g_2+g_4}/V_{g_1}$
$V_a = 100V$
$V_{g_2+g_4} = 30V$
$V_{g_3} = -2.5V$
$-2.0V$
$-1.5V$
$-1.0V$
$-0.5V$
$0V$
SCREEN GRIDS CURRENT $(I_{g_2+g_4})$ mA
CONTROL GRID VOLTAGE (V_{g_1}) V
−4
−3
−2
−1
0
1
2
3
4
5

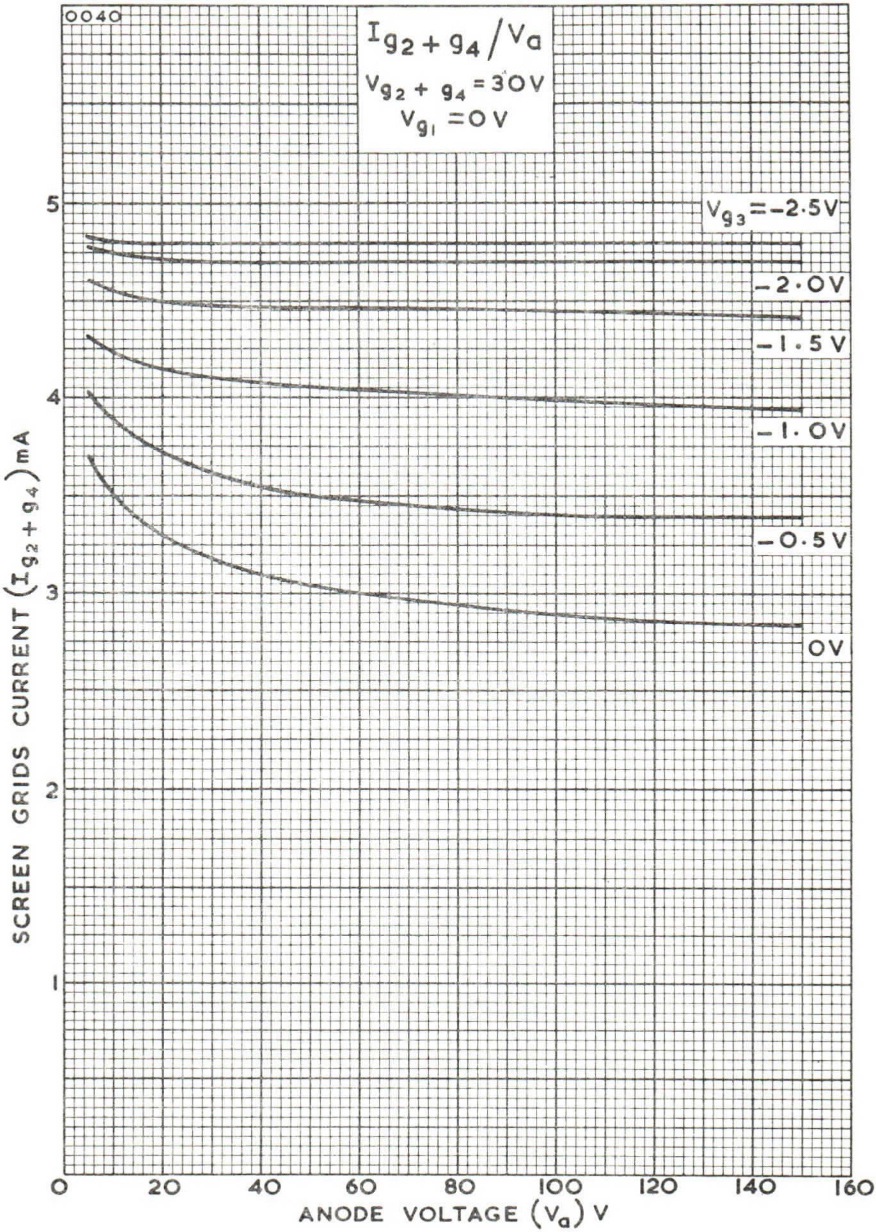

0035
I_a / V_a
$V_{g_2+g_4} = 30V$
$V_{g_3} = 0V$
$V_{g_1} = 0V$
−0·5V
−1·0V
−1·5V
−2·0V
−2·5V
2·4
2·2
2·0
1·8
1·6
1·4
1·2
1·0
0·8
0·6
0·4
0·2
0
20
40
60
80
100
120
140
160
ANODE CURRENT (I_a) mA
ANODE VOLTAGE (V_a) V


0036
I_{g2+g4}/V_a
$V_{g2+g4}=30V$
$V_{g3}=0V$
$V_{g1}=0V$
−0·5V
−1·0V
−1·5V
−2·0V
−2·5V
SCREEN GRIDS CURRENT (I_{g2+g4}) mA
0
1
2
3
4
20
40
60
80
100
120
140
160
ANODE VOLTAGE (V_a) V

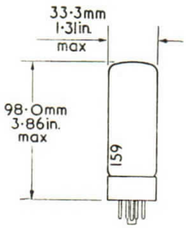

0037
I_a / V_{g3}
$V_a = 100V$
$V_{g2+g4} = 30V$
$V_{g1} = 0V$
$-0.5V$
$-1.0V$
$-1.5V$
$-2.0V$
2·4
2·2
2·0
1·8
1·6
1·4
1·2
1·0
0·8
0·6
0·4
0·2
0
ANODE CURRENT (I_a)mA
−3
−2
−1
GRID 3 VOLTAGE (V_{g3})V


0038
I_{g2+g4}/V_{g3}
$V_a = 100V$
$V_{g2+g4} = 30V$
$V_{g1} = 0V$
−0.5V
−1.0V
−1.5V
−2.0V
−2.5V
5
4
3
2
1
0
−3
−2
−1
SCREEN GRIDS CURRENT $(I_{g2}+g_4)$ mA
GRID 3 VOLTAGE (V_{g3}) V

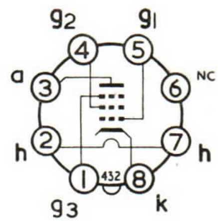

0039
I_a / V_a
$V_{g_2+g_4} = 30V$
$V_{g_1} = 0V$
$V_{g_3} = 0V$
−0.5 V
−1.0 V
−1.5 V
−2.0 V
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
ANODE CURRENT (I_a) mA
0
20
40
60
80
100
120
140
160
ANODE VOLTAGE (V_a) V


0040
$I_{g_2+g_4}/V_a$
$V_{g_2+g_4} = 30V$
$V_{g_1} = 0V$
$V_{g_3} = -2.5V$
$-2.0V$
$-1.5V$
$-1.0V$
$-0.5V$
$0V$
SCREEN GRIDS CURRENT $(I_{g_2+g_4})$ mA
ANODE VOLTAGE (V_a) V
0
20
40
60
80
100
120
140
160
1
2
3
4
5

BRIMAR VALVES EL34



OUTPUT PENTODE



I.O. Base

GENERAL

This valve is a high slope output pentode designed for operation in A.C. operated or mobile equipment.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	1·5	A

RATINGS

Maximum Anode Dissipation	$p_{a(max)}$	25	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	8	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	2	kV
Maximum Anode Voltage	$V_{a(max)}$	800	V
Maximum Screen Grid Supply Voltage	$V_{g2(b)max}$	800	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	500	V
Maximum Heater to Cathode Voltage	$V_{h-k(max)}$	100	V
Maximum Cathode Current	$I_{k(max)}$	150	mA
Maximum Grid 1 to Cathode Resistance	$R_{g1-k(max)}$	500	kΩ
Maximum Heater to Cathode Resistance	$R_{h-k(max)}$	20	kΩ

INTER-ELECTRODE CAPACITANCES

		*	
Output	c_{out}	8·4	pF
Input	c_{in}	15·2	pF
Anode to Grid 1	c_{a-g1}	<1·0	pF
Grid 1 to Heater	c_{g1-h}	<1·0	pF
Heater to Cathode	c_{h-k}	11	pF

* Measured in fully shielded socket without can.

CHARACTERISTICS

Anode Voltage	V_a	250	V
Screen Grid Voltage	V_{g2}	250	V
Anode Current	I_a	100	mA
Screen Grid Current	I_{g2}	15	mA
Control Grid Voltage	V_{g1}	−12·2	V
Mutual Conductance	g_m	11	mA/V
Anode Resistance ($\delta v_a/\delta i_a$)	r_a	15	kΩ
Inner Amplification Factor	μ_{g1-g2}	11	

THORN—AEI RADIO VALVES & TUBES LTD.

OPERATION AS CLASS A SINGLE VALVE AMPLIFIER

Anode Voltage	V_a	250	300	V
Screen Grid Voltage	V_{g2}	250	300	V
Suppressor Grid Voltage	V_{g3}	0	0	V
Cathode Resistor	R_k	106	190	Ω
Anode Load Resistance	R_a	2	3·5	kΩ
Anode Current (Zero signal)	$I_{a(o)}$	100	83	mA
Screen Grid Current (Zero signal)	$I_{g2(o)}$	15	13	mA
R.M.S. Input Voltage (for P_{out} = 50mW)	$V_{in(r.m.s.)}$ (P_{out} = 50mW)	500	450	mV
R.M.S. Input Voltage	$V_{in(r.m.s.)}$	8	8·2	V
Power Output	*P_{out}	11	11	W
Total Distortion	*D_{tot}	10	10	%

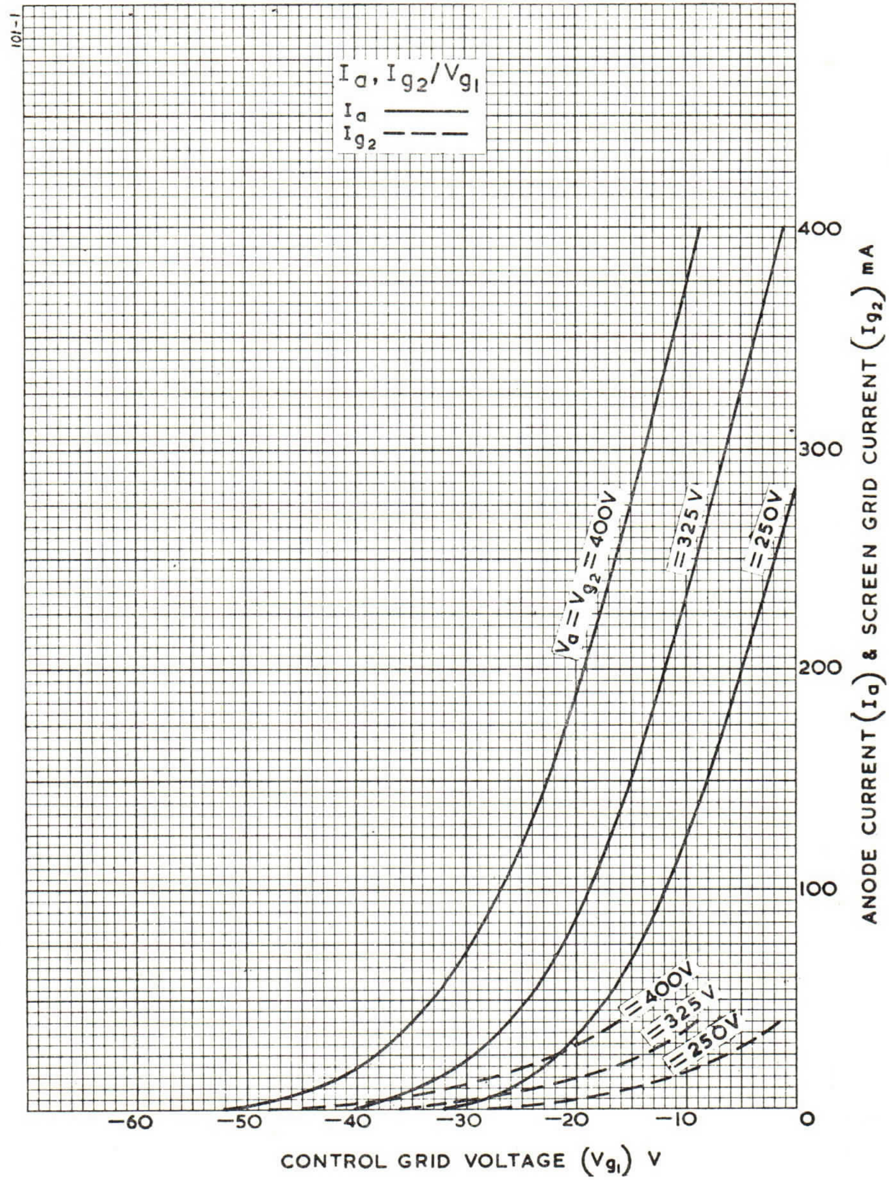
PUSH PULL OPERATION FOR TWO VALVES

(Fixed Bias)

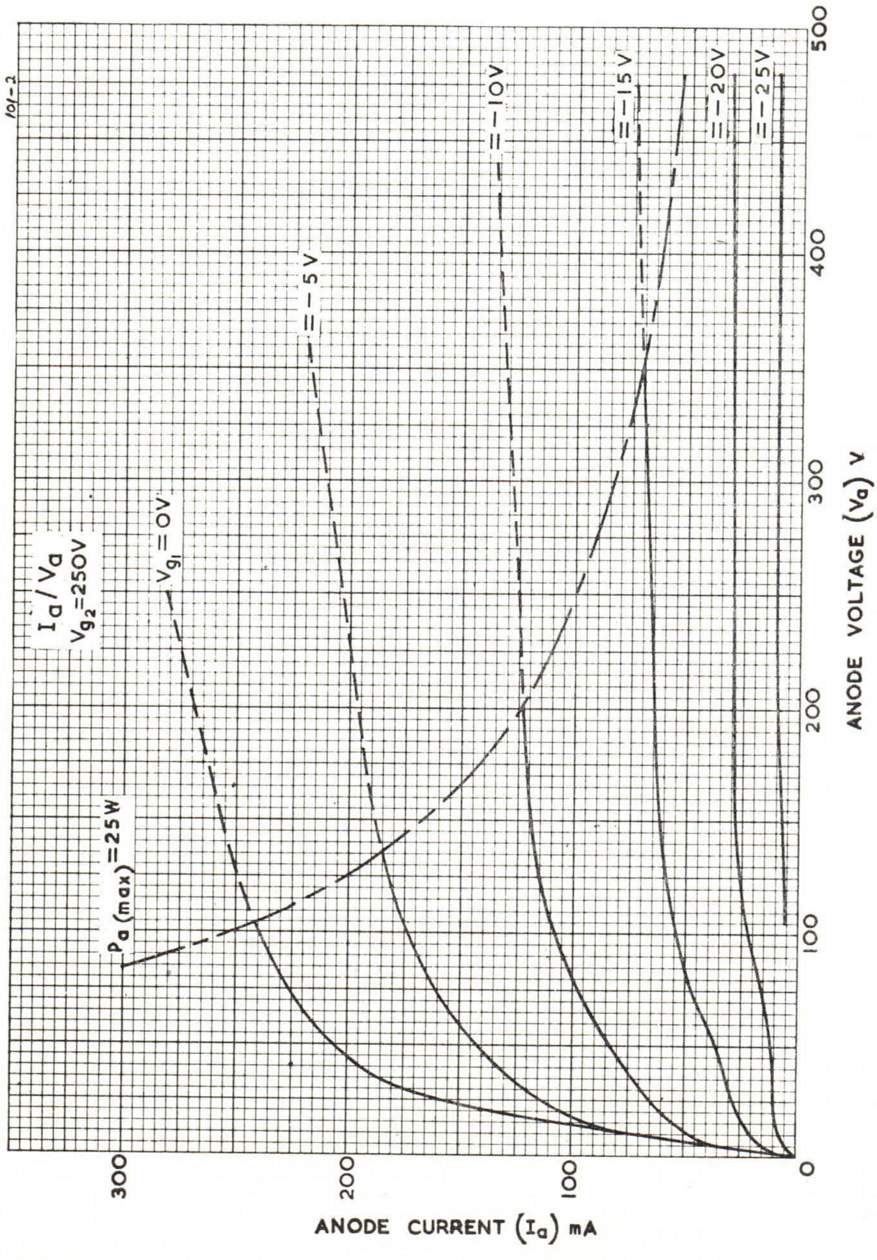
Supply Voltage	V_b	375	400	V
Suppressor Grid Voltage	V_{g3}	0	0	V
Screen Grid Resistor	R_{g2}	600†	800†	Ω
Control Grid Voltage	V_{g1}	−33	−36	V
Anode Load Resistance	R_{a-a}	3·5	3·5	kΩ
Total Anode Current (Zero signal)	$I_{a(o)tot}$	60	60	mA
Total Screen Grid Current (Zero signal)	$I_{g2(o)tot}$	9·4	9	mA
R.M.S. Input Voltage	$V_{in(g1-g1)r.m.s.}$	46·7	50	V
Power Output	P_{out}	48	54	W
Total Distortion	D_{tot}	2·8	1·6	%
Total Anode Current (Maximum Signal)	$I_{a(max.sig.)tot}$	215	221	mA
Total Screen Grid Current (Maximum Signal)	$I_{g2(max.sig.)tot}$	47	46	mA

* Under Speech and Music conditions.

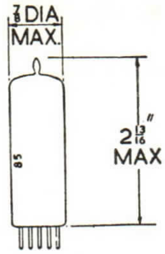
† Screen-grid resistor common to both valves.



101-1
Ia, Ig2/Vg1
Ia
Ig2
Va = Vg2 = 400V
= 325 V
= 250V
= 400V
= 325 V
= 250V
400
300
200
100
0
−60
−50
−40
−30
−20
−10
CONTROL GRID VOLTAGE (Vg1) V
ANODE CURRENT (Ia) & SCREEN GRID CURRENT (Ig2) mA



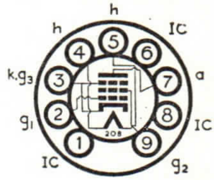
101-2
I_a / V_a
V_{g_2}=250V
V_{g_1}=0V
=−5V
=−10V
=−15V
=−20V
=−25V
P_a(max)=25W
ANODE CURRENT (I_a) mA
ANODE VOLTAGE (V_a) V
0
100
200
300
400
500



B9A Base

Current Equipment Type

TYPE **EL84**
MINIATURE OUTPUT PENTODE



The BRIMAR type EL84 is a miniature indirectly heated high slope output pentode. The heater is intended for operation in parallel with other valves in A.C. operated or mobile equipment. The valve is primarily designed as an audio output stage in receivers or amplifiers, either singly or in push-pull.

Heater Voltage ...	6.3 volts
Heater Current ...	0.76 amp.

RATINGS

Anode Voltage ...	300 volts max.
Anode Dissipation ...	12 watts max.
Screen Voltage ...	300 volts max.
Screen Dissipation (Zero Signal) ...	2 watts max.
Screen Dissipation (Max. Signal) ...	4 watts max.
Cathode Current ...	65 mA max.

OPERATING CHARACTERISTICS

	Single Valve Class A		Push Pull Class AB1 (2 Valves)	
Anode Voltage ...	200	250	300	volts
Anode Current (Zero Signal)	50	48	80	mA
Anode Current (Max. Signal)...	—	—	92.5	mA
Screen Voltage ...	200	250	300	volts
Screen Current (Zero Signal)...	5.65	5.5	8.5	mA
Screen Current (Max. Signal)...	—	—	20	mA
Control Grid Voltage ...	—4.6	—7.3	—10.4	volts
Cathode Bias Resistor ...	82	140	130	ohms
Anode Impedance ...	—	38	—	k Ω
Mutual Conductance ...	—	11.3	—	mA/V
Optimum Load ...	4	5.2	8	k Ω
Power Output ...	3.3	5.7	17	watts
Harmonic Distortion ...	6.5	10	3.18	per cent.

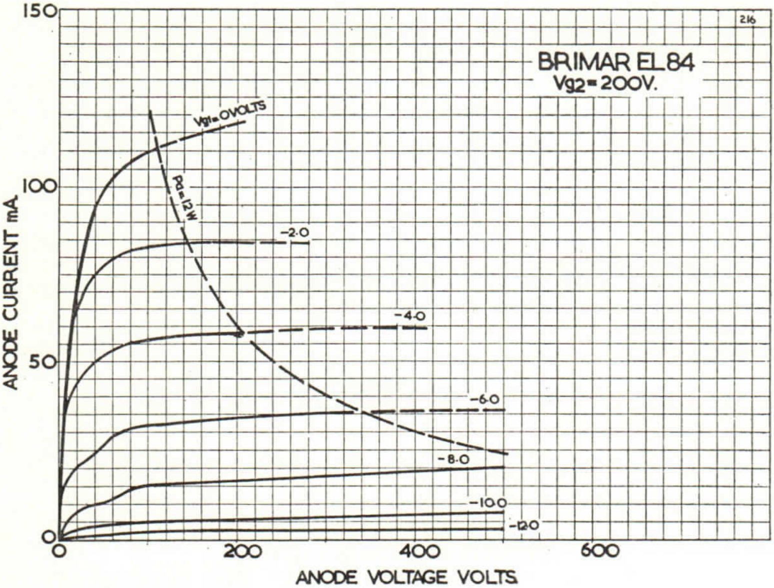
OPERATION AS A TRIODE (Anode and Screen Strapped)
CLASS AB1 PUSH PULL (2 Valves)

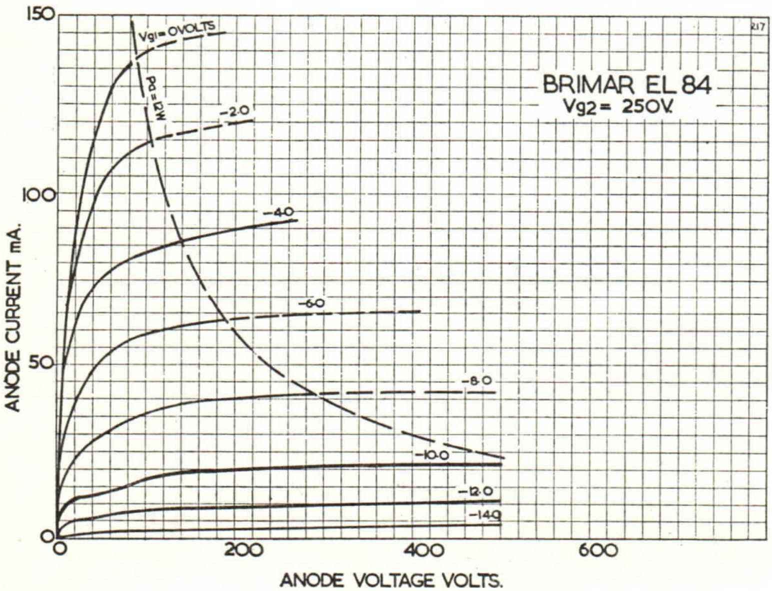
Anode Voltage ...	250	300	volts
Anode Current (Zero Signal) ...	41	49	mA
Anode Current (Max. Signal) ...	45	54	mA
Cathode Bias Resistor ...	270	270	ohms
Optimum Load (anode to anode) ...	10	10	k Ω
Power Output ...	3.4	5.2	watts
Total Distortion ...	1.8	2.0	per cent.

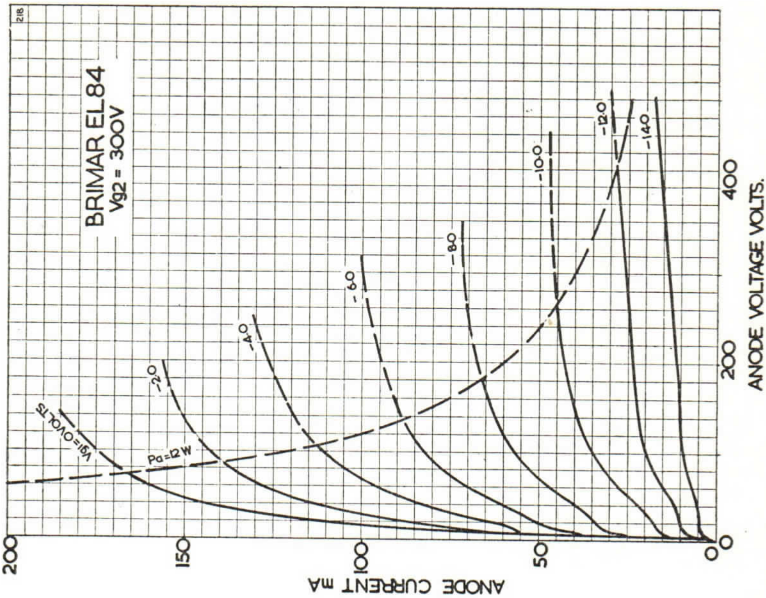
INTER-ELECTRODE CAPACITANCES*

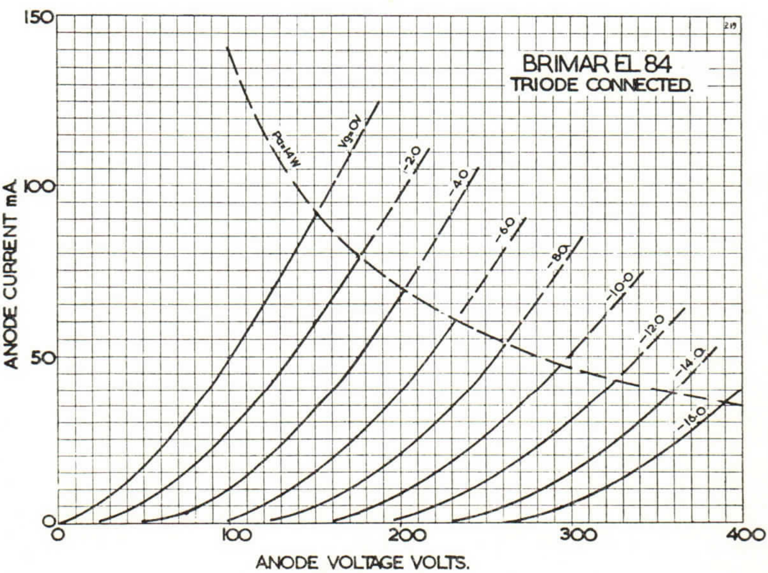
Input ...	11.0 pF
Output ...	6.0 pF
Anode to Control Grid ...	0.5 pF max.
Heater to Control Grid ...	0.25 pF max.

* *With no external shield.*

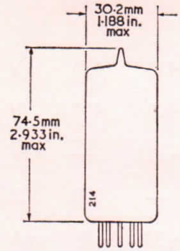

216
BRIMAR EL84
Vg2=200V.
Vg1=0VOLTS
Pa=12W
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
150
100
50
0
200
400
600
ANODE CURRENT mA.
ANODE VOLTAGE VOLTS.


217
BRIMAR EL 84
Vg2= 250V.
Vg1= 0VOLTS
Pa=12W
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
150
100
50
0
200
400
600
ANODE CURRENT mA.
ANODE VOLTAGE VOLTS.


BRIMAR EL 84
Vg2 = 300V
Vg1=OVOLTS
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
Pa=12W
ANODE CURRENT mA
ANODE VOLTAGE VOLTS.
0
50
100
150
200
0
200
400

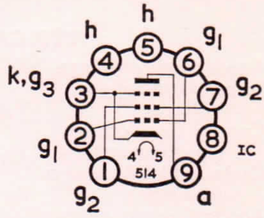

BRIMAR EL 84
TRIODE CONNECTED.
Pa=14W
Vg=OV
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
-16.0
ANODE CURRENT mA.
ANODE VOLTAGE VOLTS.
0
50
100
150
0
100
200
300
400

BRIMAR VALVES EL506



PRELIMINARY DATA

POWER PENTODE



B9D Base

GENERAL

This power pentode is primarily intended for use in the output stages of high-fidelity audio amplifiers.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·8	A

RATINGS
(Design Maximum Values)

Maximum Anode Dissipation	$p_{a(max)}$	19	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	3·3	W
For Speech and Music		6·0	W
Maximum Anode Voltage	$V_{a(max)}$	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	440	V
Maximum Peak Heater to Cathode Voltage,	$v_{h-k(pk)max}$		
Heater Negative		200	V
Heater Positive		200*	V
Maximum Mean Cathode Current	$I_{k(av)max}$	85	mA
Maximum Control Grid to Cathode Resistance,	$R_{g1-k(max)}$		
Fixed Bias		0·1	MΩ
Self Bias		0·33	MΩ

* D.C. component must not exceed 100 V.

INTER-ELECTRODE CAPACITANCES (approximately)†

Grid 1 to Anode	c_{g1-a}	<0·4	pF
Grid 1 to Cathode, Grid 3, Grid 2 and Heater	$c_{g1-k,g3,g2,h}$	9·0	pF
Anode to Cathode, Grid 3, Grid 2 and Heater	$c_{a-k,g3,g2,h}$	4·0	pF

† Measured without an external shield.

TYPICAL OPERATION—Class A Single-ended

Anode Voltage	V_a	300	V
Screen Grid Voltage	V_{g2}	300	V
Control Grid Voltage (approximate)	V_{g1}	−10‡	V
Anode Current (Quiescent)	$I_{a(o)}$	60	mA
Anode Current (max. sig.: speech and music)	$I_{a(max.sig.)}$	75	mA
Screen Grid Current (Quiescent)	$I_{g2(o)}$	8·0	mA
Screen Grid Current (max. sig.: speech and music)	$I_{g2(max.sig.)}$	15	mA
Peak A.F. Control Grid Voltage	$v_{g1(pk)}$	10	V
Mutual Conductance	g_m	10·2	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	25	kΩ
Anode Load Resistance	R_a	3·0	kΩ
Power Output	P_{out}	10	W
Total Harmonic Distortion	D_{tot}	13	%

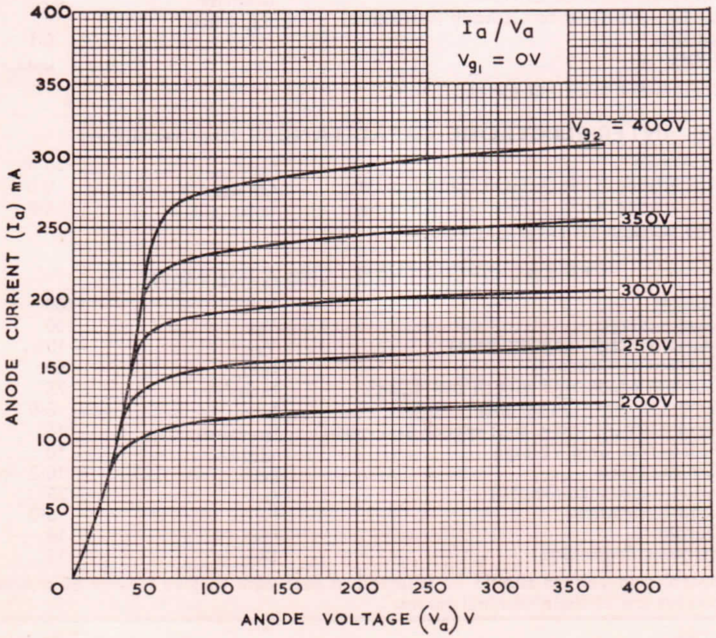
‡ The control grid voltage should be adjusted in each case to give $I_{a(o)} = 60$ mA when other voltages are at their nominal values.

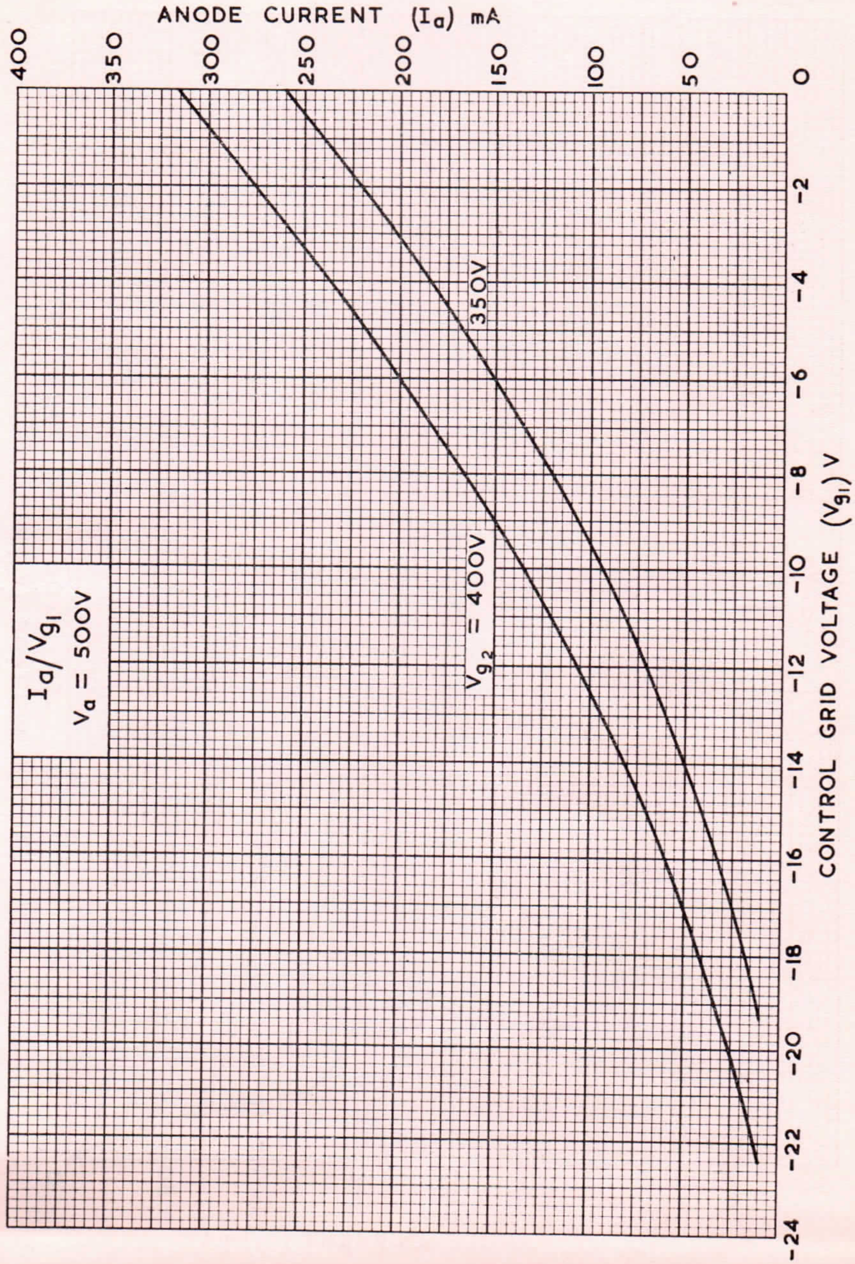
THORN—AEI RADIO VALVES & TUBES LTD.

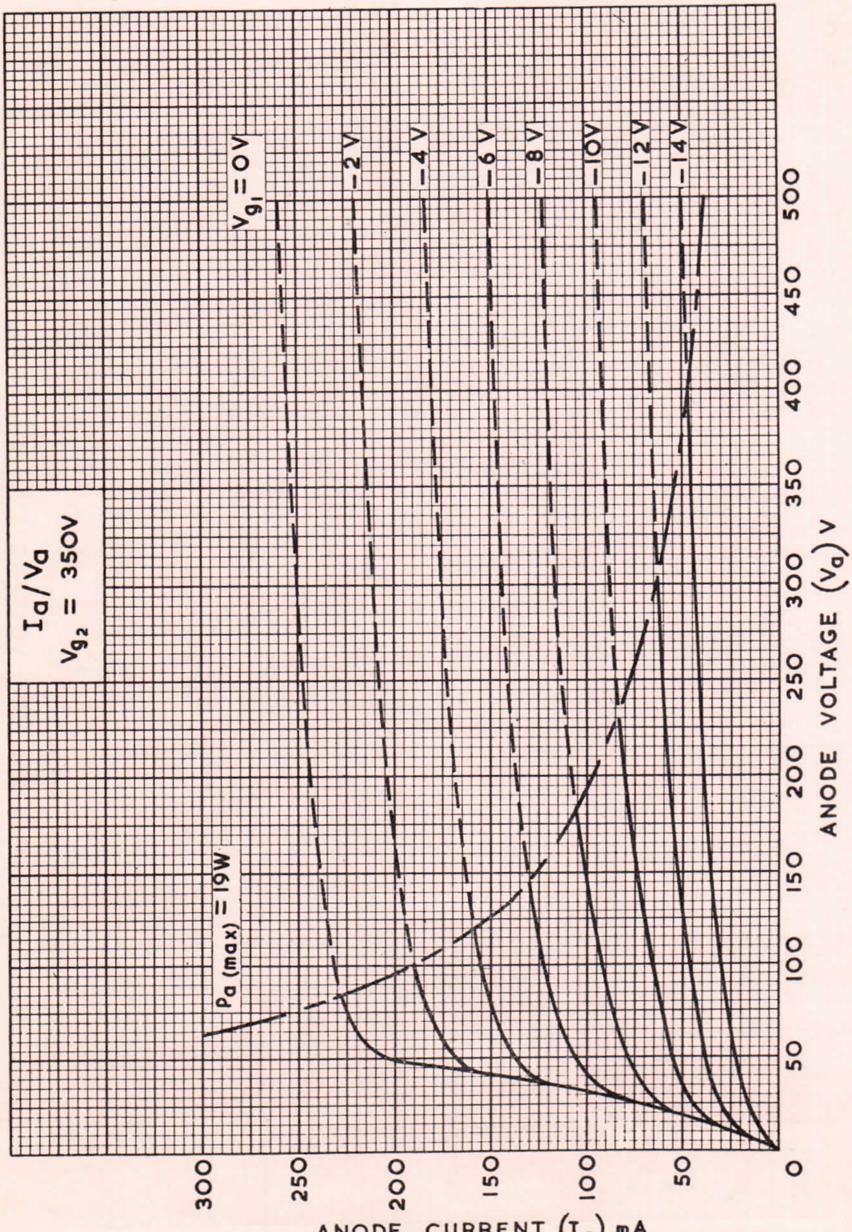
TYPICAL OPERATION—Class AB_1 Push-Pull

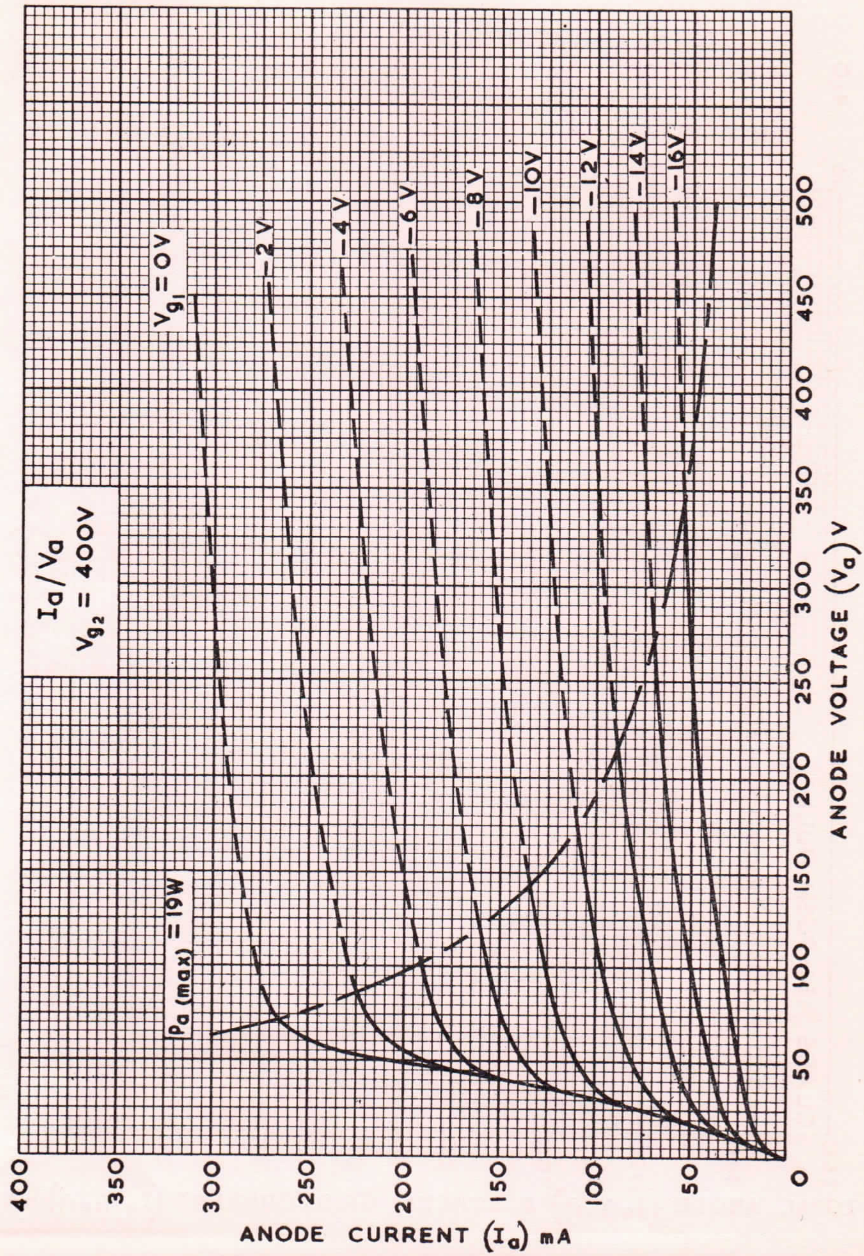
Anode Supply Voltage	$V_{a(b)}$	300	350	400	450	450	450	V
Screen Grid Supply Voltage	$V_{g2(b)}$	300	350	350	350	400	400	V
Control Grid Voltage (approximately)	V_{g1}	−12·5‡	−15·5‡	−16‡	−16·5‡	−21‡	—	V
Cathode Bias Resistance (common)	R_k	—	—	—	—	—	170	Ω
Anode Current (Quiescent)	$I_{a(o)}$	2×43	2×46	2×42·5	2×38·5	2×33	2×41	mA
Anode Current (maximum signal)	$I_{a(max\ sig)}$	2×58	2×65	2×71·5	2×76·5	2×72	2×47	mA
Screen Grid Current (Quiescent)	$I_{g2(o)}$	2×6·3	2×6·5	2×5·5	2×4·8	2×4·7	2×5·8	mA
Screen Grid Current (max sig)	$I_{g2(max\ sig)}$	2×13	2×14·3	2×13·5	2×13·5	2×15	2×11	mA
Peak A.F. Grid to Grid Voltage	$v_{g1\text{-}g1(pk)}$	25	31	32	33	42	31	V
Anode to Anode Load Resistance	$R_{a\text{-}a}$	6·6	6·6	6·6	6·6	6·6	9·0	kΩ
Power Output	P_{out}	23	30	37	43	45	28	W
Total Harmonic Distortion	D_{tot}	2·5	2·0	1·5	1·5	1·5	2·0	%

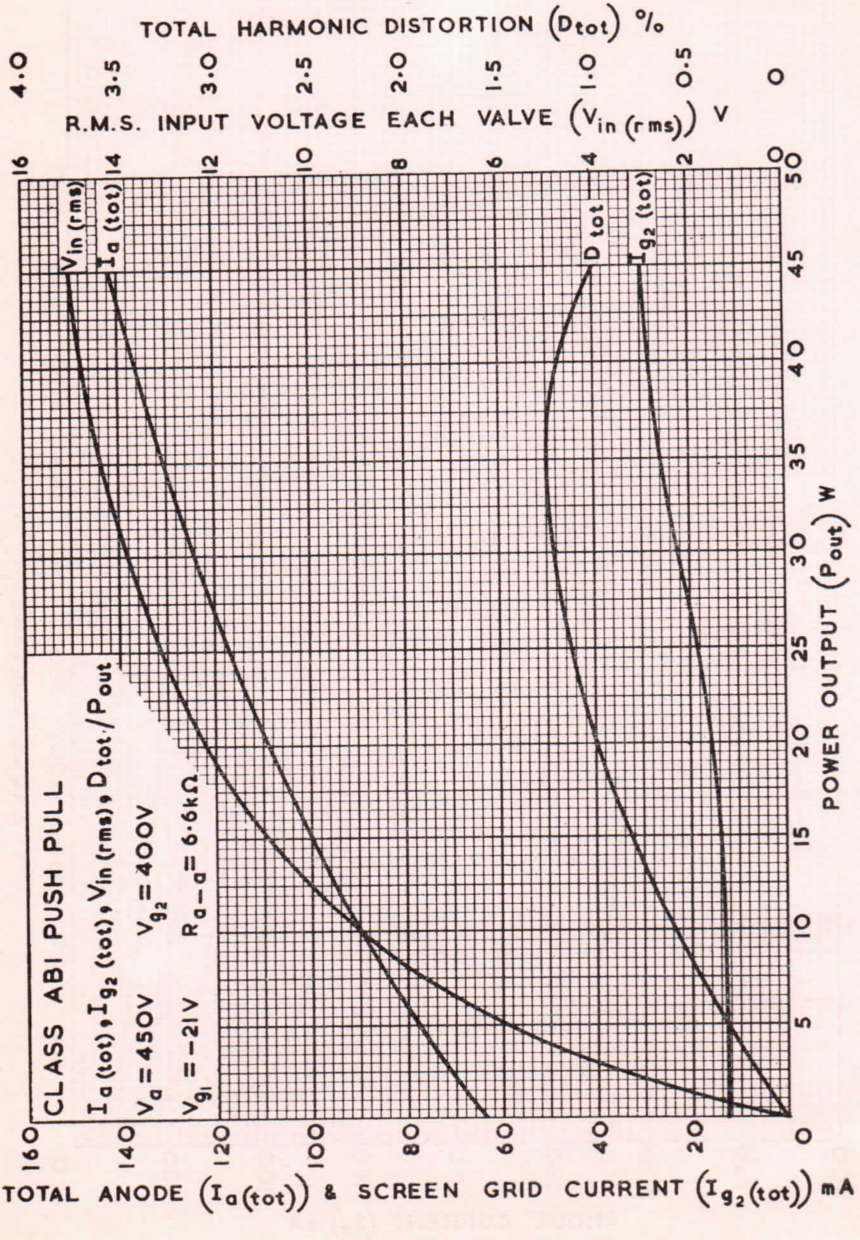
‡ The control grid voltage should be adjusted in each valve to give the stated quiescent anode current when other voltages are at their nominal values.

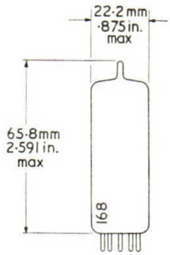



ANODE CURRENT (I_a) mA
400
350
300
250
200
150
100
50
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
CONTROL GRID VOLTAGE (V_{g_1}) V
I_a/V_{g_1}
V_a = 500V
V_{g_2} = 400V
350V

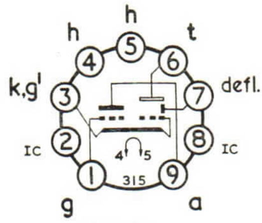

I_a/V_a
$V_{g_2} = 350V$
$V_{g_1} = 0V$
−2V
−4V
−6V
−8V
−10V
−12V
−14V
$P_a(max) = 19W$
ANODE VOLTAGE (V_a) V
0
50
100
150
200
250
300
350
400
450
500
ANODE CURRENT (I_a) mA
0
50
100
150
200
250
300


Ia/Va
Vg2 = 400V
Vg1 = 0V
−2 V
−4 V
−6 V
−8 V
−10V
−12 V
−14 V
−16V
Pa (max) = 19W
0
50
100
150
200
250
300
350
400
450
500
ANODE VOLTAGE (Va) V
0
50
100
150
200
250
300
350
400
ANODE CURRENT (Ia) mA


TOTAL HARMONIC DISTORTION (Dtot) %
4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0
R.M.S. INPUT VOLTAGE EACH VALVE (Vin (rms)) V
16 14 12 10 8 6 4 2 0
Vin (rms)
Ia (tot)
D tot
Ig2 (tot)
CLASS AB1 PUSH PULL
Ia (tot), Ig2 (tot), Vin (rms), Dtot./Pout
Va = 450V
Vg2 = 400V
Vg1 = −21V
Ra−a = 6·6kΩ
160 140 120 100 80 60 40 20 0
TOTAL ANODE (Ia(tot)) & SCREEN GRID CURRENT (Ig2(tot)) mA
0 5 10 15 20 25 30 35 40 45 50
POWER OUTPUT (Pout) W



TUNING INDICATOR



B9A Base

GENERAL

This tuning indicator has a short grid-base and is suitable for use in tape recorders.

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·3	A

RATINGS

Maximum Anode Dissipation	$p_{a(max)}$	0·6	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	V
Maximum Anode Voltage	$V_{a(max)}$	300	V
Maximum Deflector Supply Voltage	$V_{def(b)max}$	550	V
Maximum Deflector Voltage	$V_{def(max)}$	300	V
Maximum Target Supply Voltage	$V_{t(b)max}$	550	V
Maximum Target Voltage	$V_{t(max)}$	300	V
Minimum Target Voltage	$V_{t(min)}$	170	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$	250	V
Maximum Cathode Current	$I_{k(max)}$	5·0	mA
Maximum Grid to Cathode Resistance	$R_{g\text{-}k(max)}$	3·0	MΩ
Maximum Heater to Cathode Resistance	$R_{h\text{-}k(max)}$	100	kΩ
Maximum Bulb Temperature	$T_{bulb(max)}$	120	°C

TYPICAL OPERATION (Deflector connected to Anode)

Supply Voltage	V_b		250		V
Target Voltage	V_t		250		V
Anode Resistance	R_a		100		kΩ
Grid to Cathode Resistance	$R_{g\text{-}k}$		3·0		MΩ
Grid Supply Voltage	$V_{g(b)}$	0	−10	−15	V
Anode Current	I_a	2·0	0·5	0·2	mA
Target Current	I_t	1·0	1·8	2·0	mA
Length of column	L	21	0	−1·5*	mm

* This is a 1·5 mm overlap which can be utilised to indicate overloading.

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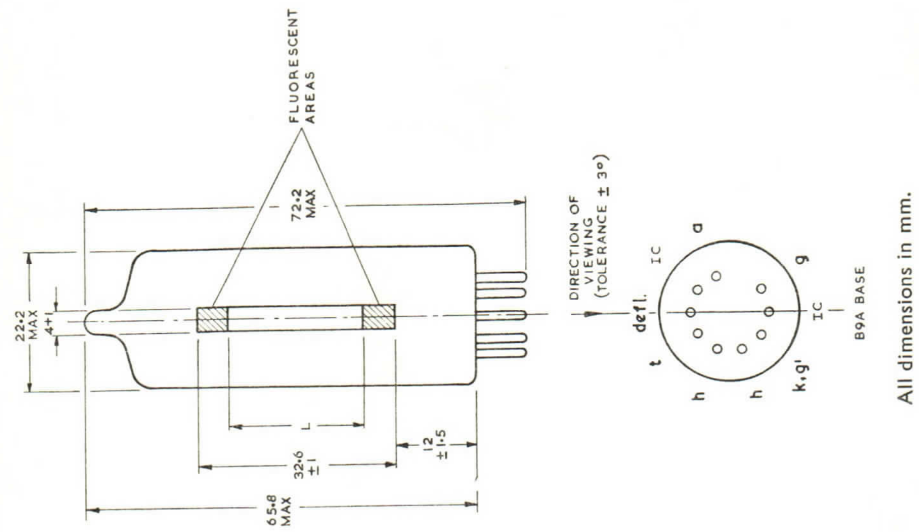
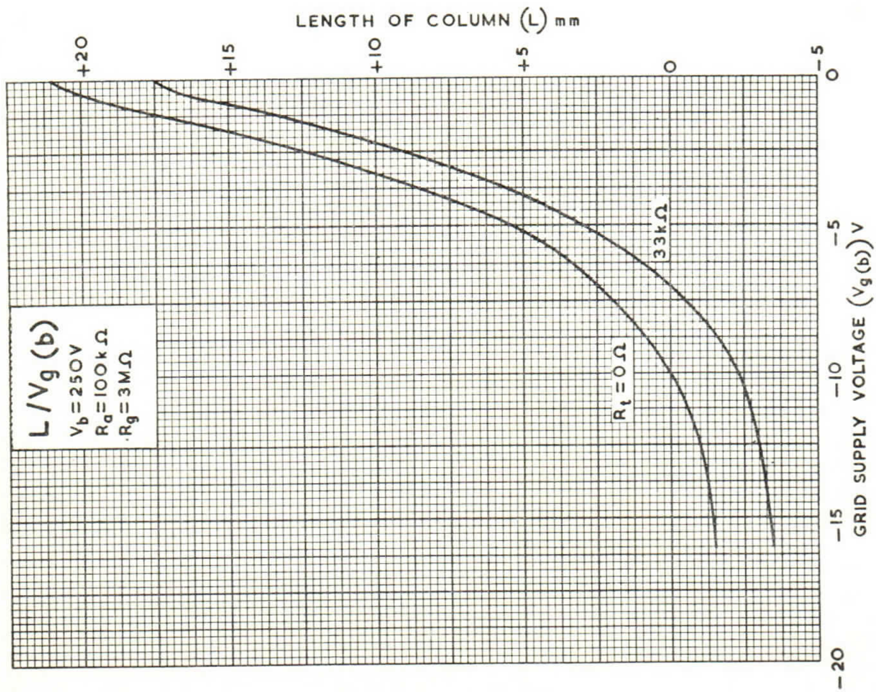
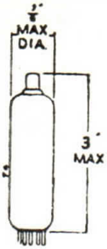

FLUORESCENT AREAS
72.2 MAX
22.2 MAX
4±1
L
32.6 ±1
12 ±1.5
65.8 MAX
DIRECTION OF VIEWING (TOLERANCE ± 3°)
defl.
IC
a
g
IC
k,g'
h
h
t
B9A BASE
All dimensions in mm.

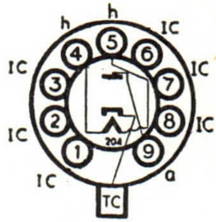

LENGTH OF COLUMN (L) mm
+20
+15
+10
+5
0
-5
0
-5
-10
-15
-20
GRID SUPPLY VOLTAGE ($V_{g(b)}$) V
$L/V_g(b)$
$V_b = 250V$
$R_a = 100k\Omega$
$R_g = 3M\Omega$
$R_t = 0\Omega$
$33k\Omega$

BRIMAR VALVES

Current Equipment Type



TYPE **EY83**
MINIATURE
BOOSTER DIODE



B9A (Noval) Base

The BRIMAR EY83 is an indirectly heated booster diode designed for operation in A.C./D.C. television receivers. The high working peak heater to cathode potential renders the use of a separate, highly insulated heater winding unnecessary.

Heater Current	1.0 amp.
Heater Voltage	6.3 volts

RATINGS

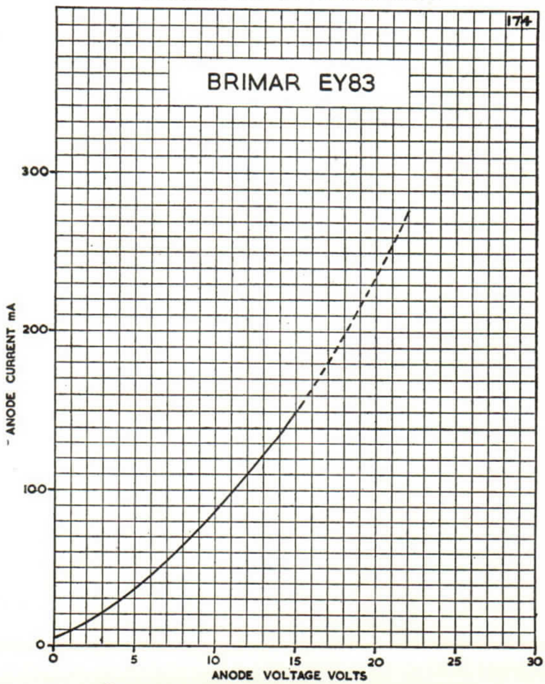
Peak Anode Current	500 mA max.
Mean Anode Current	175 mA max.
Heater-Cathode potential during flyback (heater negative with respect to cathode)†	5,000 volts max.
Peak Inverse Voltage†	5,000 volts max.

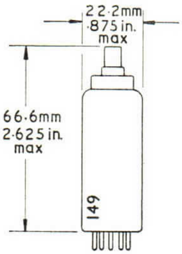
† *Maximum pulse duration* 15 *per cent. of one cycle with a maximum of* 15 *μsecs.*

INTER-ELECTRODE CAPACITANCES*

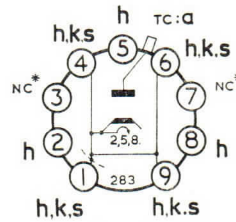
Anode to Cathode	6.2 pF
Heater to Cathode	2.1 pF

* *Measured with no external shield.*





HIGH VOLTAGE RECTIFIERS



B9A Base, CT1 Cap

GENERAL

These high voltage half-wave rectifiers are for use in television receivers employing line flyback EHT. The EY87 is electrically identical to the EY86 but has a chemically treated envelope which avoids flash-over under conditions of high humidity and low atmospheric pressure (45 cm. Hg.).

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·09	A

DESIGN CENTRE RATINGS

(The following ratings refer to normal television flyback EHT operation.)

Maximum Peak Inverse Voltage	$P.I.V_{max}$	22†	kV
Maximum Peak Anode Current	$i_{a(pk)max}$	40‡	mA
Maximum D.C. Anode Current	$I_{out(max)}$	0·8	mA

† The measured PIV must take into account the fact that during the scanning stroke, the anode of the EHT rectifier is at a potential negative with respect to chassis by an amount depending upon the transformer turns ratio. In addition, there is a damped leakage reactance oscillation assumed in the rating to have a peak to peak value not less than 10 per cent of the total PIV.

‡ Maximum duration 10 per cent of a line scanning cycle with a maximum of 10 μs.

INTER-ELECTRODE CAPACITANCE §

Anode to Heater, Cathode and Shield	$c_{a-k,h,s}$	1·7	pF

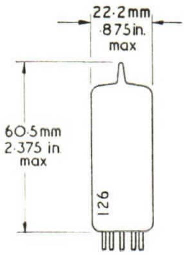
§ In fully shielded socket, without can (I.E.C. Publication 100).

Notes

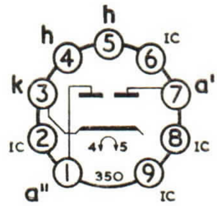
X-ray shielding is advisable to give protection against possible danger of personal injury arising from prolonged exposure at close range to this valve whilst it is in use at a PIV in excess of 16 kV design centre.

Precautions must be taken to prevent corona discharge from the connections to this valve by ensuring that no sharp points or bends occur in the wiring and adequate spacing must be left between the valve and surrounding components.

* Pins 3 and 7 may be connected to points in the heater circuit only and must not be earthed. No low potential circuits should be connected to any base pins.



FULL-WAVE
RECTIFIER



Base B9A

GENERAL

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·6	A

RATINGS

Maximum Peak Inverse Voltage	PIV_{max}	980	V
Maximum Peak Current (each Anode)	$i_{a(pk)max}$	270	mA
Maximum D.C. Output Current	$I_{out(max)}$	See Rating Chart 1	
Maximum Anode Supply Voltage	$V_{a(r.m.s.)max}$	See Rating Chart 1	
Maximum Peak Heater to Cathode Voltage (Heater Negative)	$v_{h\text{-}k(pk)max}$	500	V
Maximum Reservoir Capacitor	C_{max}	50	μF

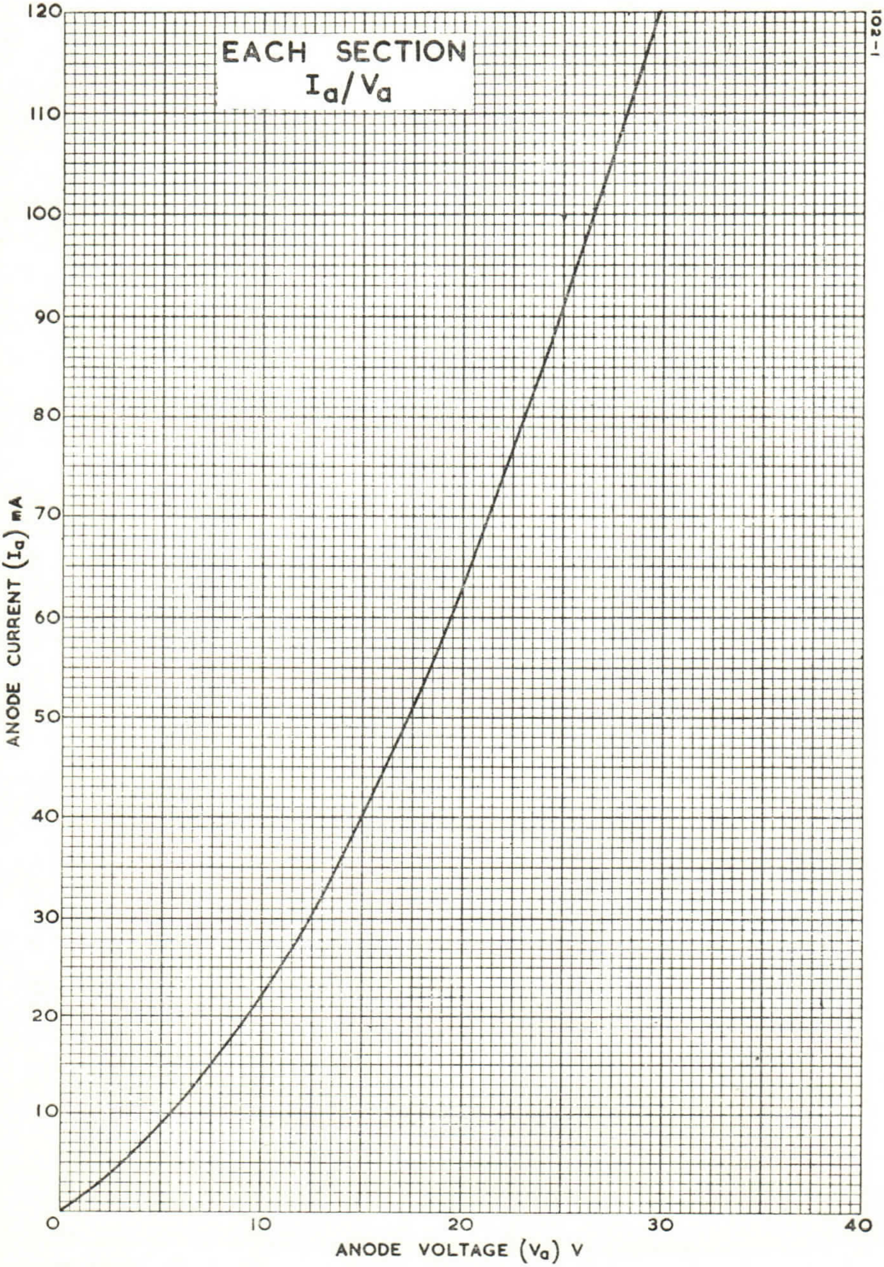
TYPICAL OPERATION AS A FULL-WAVE RECTIFIER

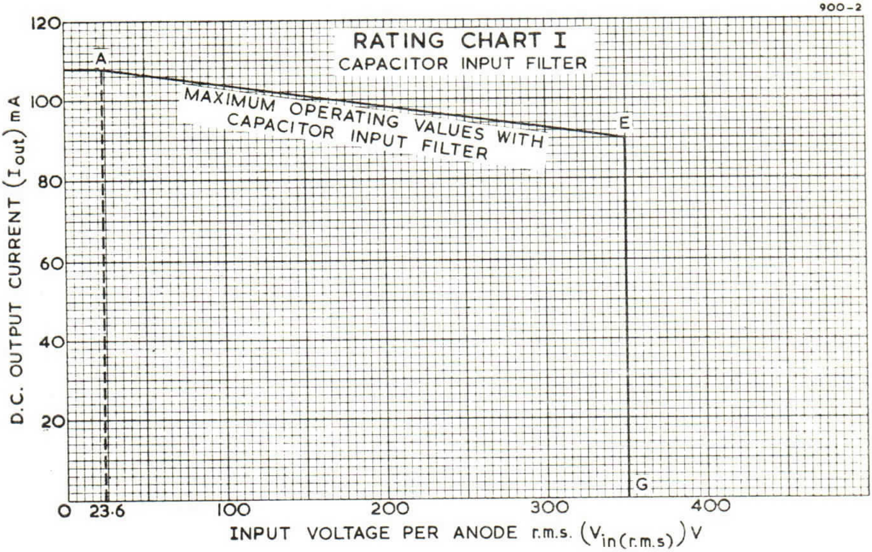
Capacitor Input

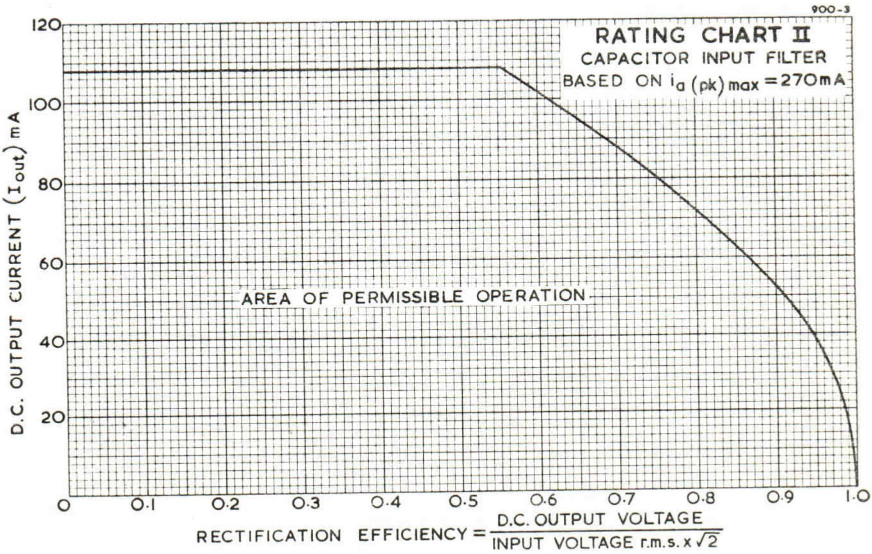
Input Voltage per Anode (r.m.s.)	$V_{in(r.m.s.)}$	250	275	300	350	V
D.C. Output Current	I_{out}	90	90	90	90	mA
D.C. Output Voltage	V_{out}	265	285	310	360	V
Minimum Limiting Resistance each Anode	$R_{lim(min)}$ per anode	125	175	215	300	Ω
Reservoir Capacitor	C	50	50	50	50	μF

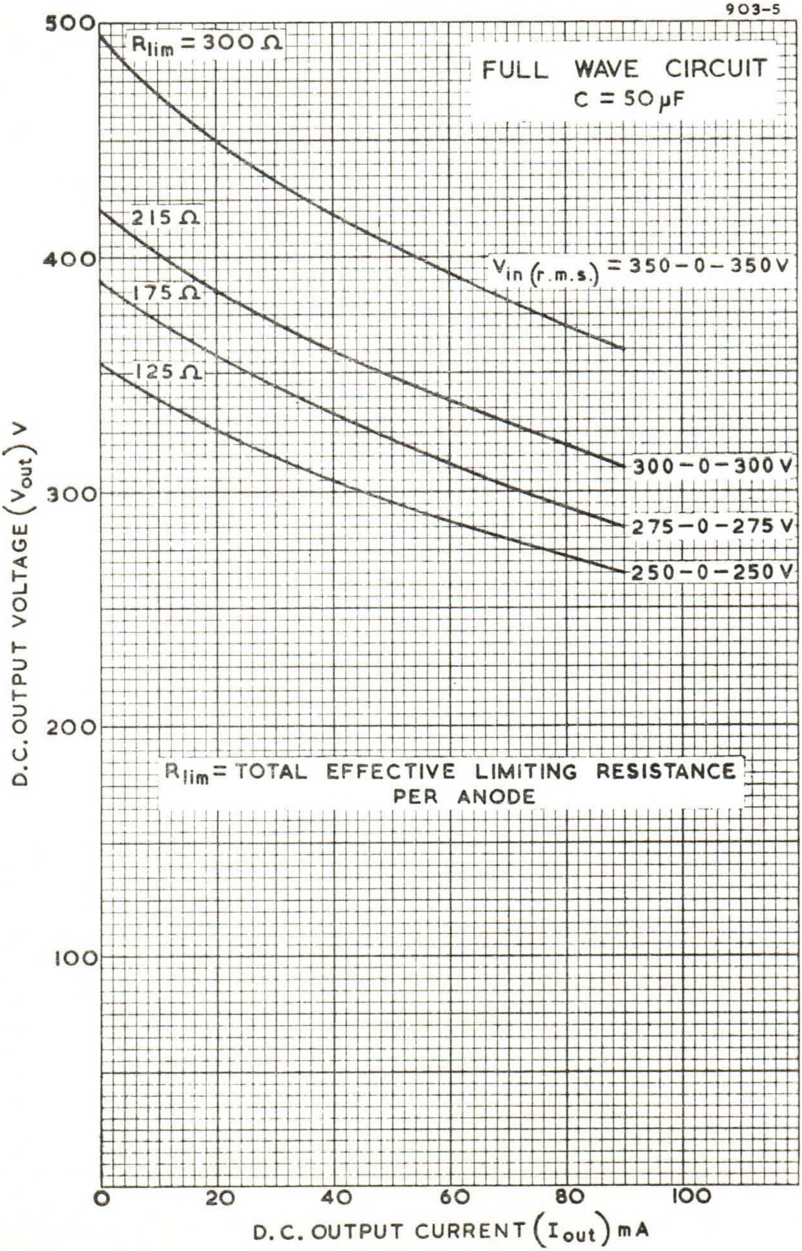
MOUNTING POSITION—Unrestricted.

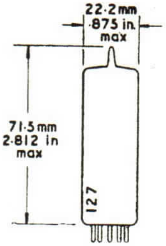
THORN — A E I RADIO VALVES & TUBES LTD.


EACH SECTION
I_a/V_a
102-1
ANODE CURRENT (I_a) mA
ANODE VOLTAGE (V_a) V
0
10
20
30
40
50
60
70
80
90
100
110
120

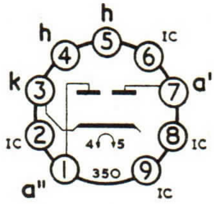

900-2
RATING CHART I
CAPACITOR INPUT FILTER
MAXIMUM OPERATING VALUES WITH CAPACITOR INPUT FILTER
A
E
G
120
100
80
60
40
20
0
23.6
100
200
300
400
D.C. OUTPUT CURRENT (I_{out}) mA
INPUT VOLTAGE PER ANODE r.m.s. ($V_{in(r.m.s)}$) V


900-3
RATING CHART II
CAPACITOR INPUT FILTER
BASED ON i_a (pk) max = 270mA
AREA OF PERMISSIBLE OPERATION
120
100
80
60
40
20
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
D.C. OUTPUT CURRENT (I_{out}) mA
RECTIFICATION EFFICIENCY = $\frac{\text{D.C. OUTPUT VOLTAGE}}{\text{INPUT VOLTAGE r.m.s.} \times \sqrt{2}}$


903-5
FULL WAVE CIRCUIT
C = 50 μF
R lim = 300 Ω
215 Ω
175 Ω
125 Ω
V in (r.m.s.) = 350-0-350 V
300-0-300 V
275-0-275 V
250-0-250 V
R lim = TOTAL EFFECTIVE LIMITING RESISTANCE PER ANODE
D.C. OUTPUT VOLTAGE (V out) V
500
400
300
200
100
0
20
40
60
80
100
D.C. OUTPUT CURRENT (I out) mA



FULL-WAVE RECTIFIER



B9A Base

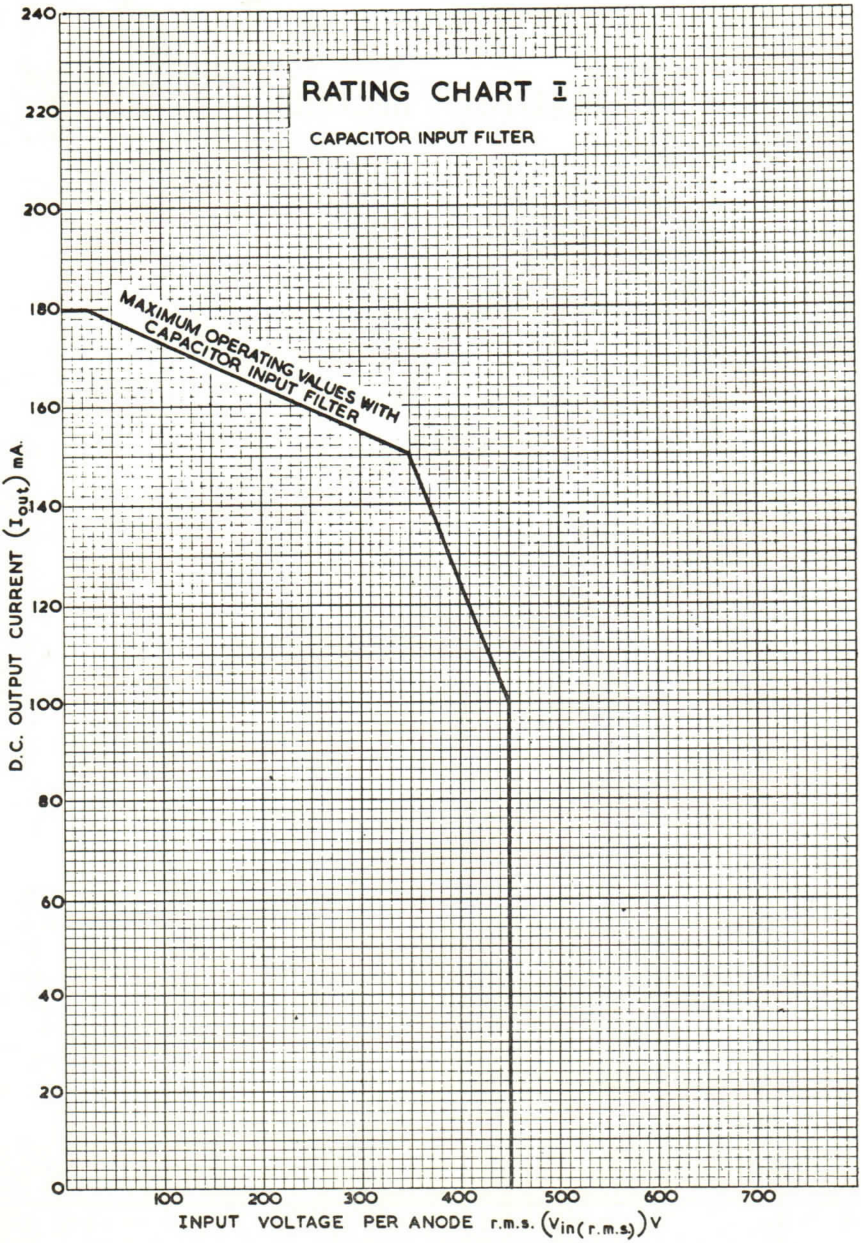
Heater Voltage	V_h	6·3	V
Heater Current	I_h	1	A

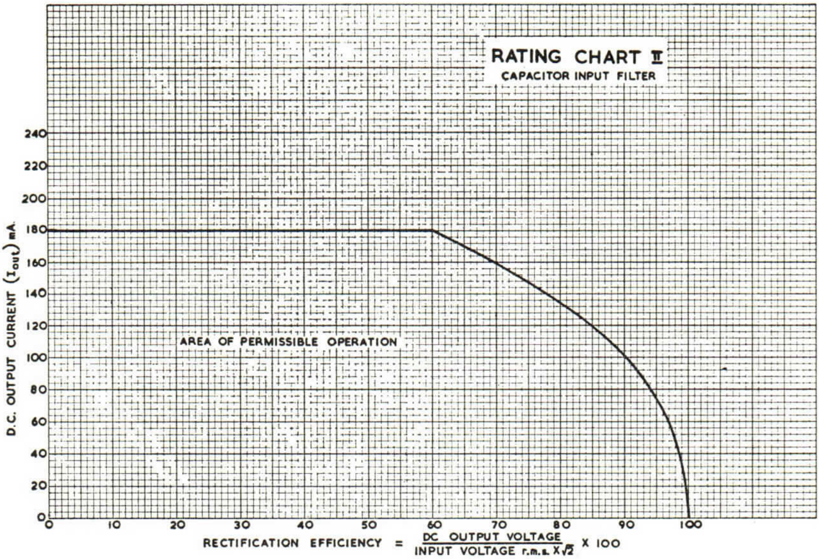
RATINGS

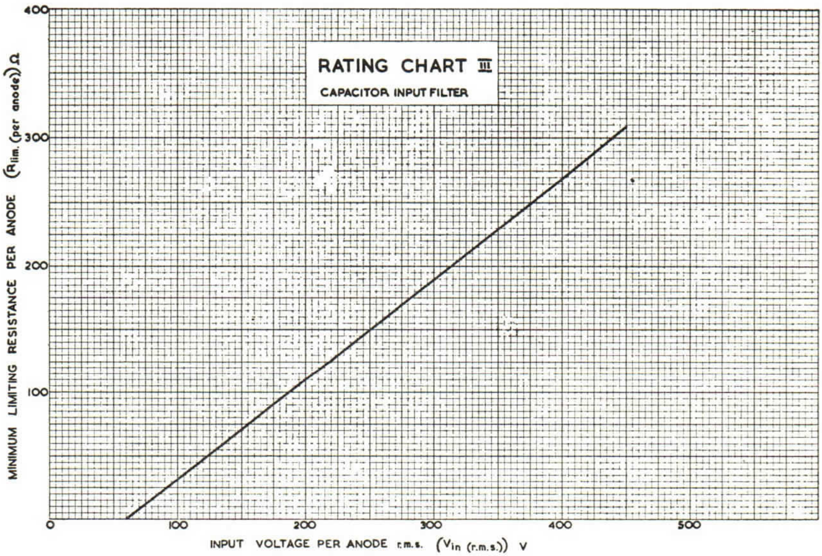
Maximum Peak Inverse Voltage	P.I.V.(max)	1·3	kV
Maximum Peak Current (each Anode)	$i_{a(pk)max}$	500	mA
Maximum Surge Current (each Anode)	$i_{a(sur)max}$	1·8	A
Maximum Anode Supply Voltage	$V_{a(b)max}$	See Rating Chart 1	
Maximum DC Output Current	$I_{out(max)}$	See Rating Chart 1	
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$	500	V

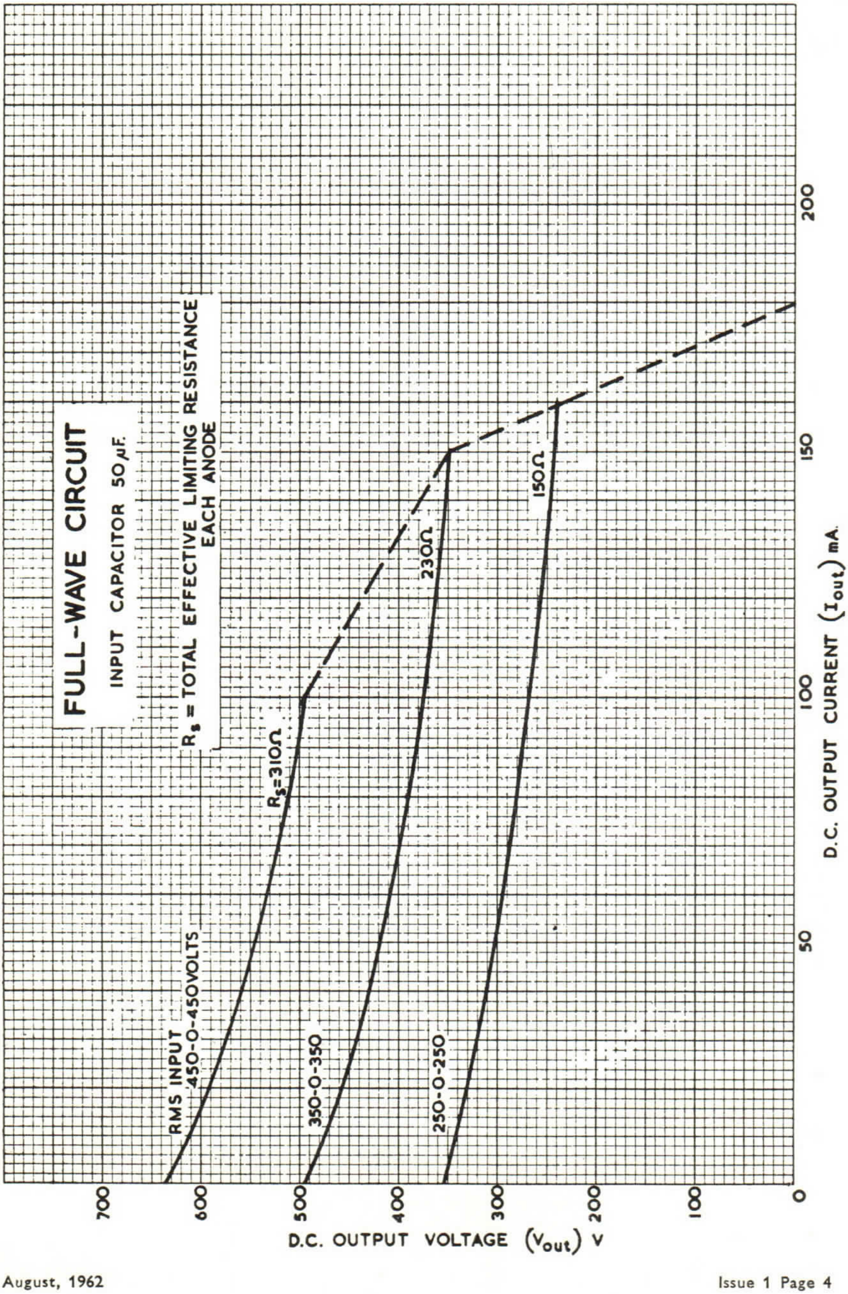
TYPICAL OPERATION AS A FULL-WAVE RECTIFIER

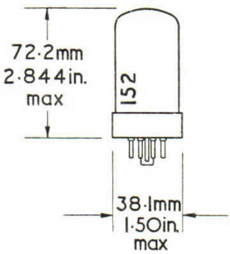
CAPACITOR INPUT					
Input Voltage per Anode (r.m.s.)	$V_{in(r.m.s.)}$	250	350	450	V
DC Output Current	I_{out}	160	150	100	mA
DC Output Voltage	V_{out}	245	352	497	V
Limiting Resistance each Anode	R_{lim} (per anode)	150	230	310	Ω
Reservoir Capacitor	C	50	50	50	μF


RATING CHART I
CAPACITOR INPUT FILTER
MAXIMUM OPERATING VALUES WITH CAPACITOR INPUT FILTER
D.C. OUTPUT CURRENT (I out) mA.
0
20
40
60
80
100
120
140
160
180
200
220
240
100
200
300
400
500
600
700
INPUT VOLTAGE PER ANODE r.m.s. (Vin(r.m.s.)) V

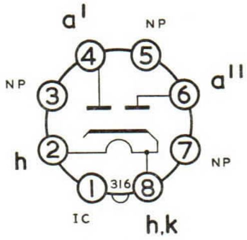

RATING CHART II
CAPACITOR INPUT FILTER
AREA OF PERMISSIBLE OPERATION
D.C. OUTPUT CURRENT (I_{out}) mA.
0
20
40
60
80
100
120
140
160
180
200
220
240
0 10 20 30 40 50 60 70 80 90 100
RECTIFICATION EFFICIENCY = $\frac{\text{DC OUTPUT VOLTAGE}}{\text{INPUT VOLTAGE r.m.s.} \times \sqrt{2}} \times 100$


RATING CHART III
CAPACITOR INPUT FILTER
MINIMUM LIMITING RESISTANCE PER ANODE ($R_{lim.}$ (per anode)) Ω
100
200
300
400
0 100 200 300 400 500
INPUT VOLTAGE PER ANODE r.m.s. ($V_{in\ (r.m.s.)}$) V


FULL-WAVE CIRCUIT
INPUT CAPACITOR 50µF.
R_s = TOTAL EFFECTIVE LIMITING RESISTANCE EACH ANODE
R_s=310Ω
230Ω
150Ω
RMS INPUT
450-0-450VOLTS
350-0-350
250-0-250
D.C. OUTPUT CURRENT (I_{out}) mA.
0
50
100
150
200
D.C. OUTPUT VOLTAGE (V_{out}) V
700
600
500
400
300
200
100
0



FULL-WAVE RECTIFIER



Base I.O.

GENERAL

This valve is an indirectly heated full-wave rectifier for use in medium power A.C. operated equipment.

Heater Voltage	V_h	5·0	V
Heater Current	I_h	1·9	A

RATINGS

Maximum Peak Inverse Voltage	$P.I.V._{(max)}$			1·5	kV
Maximum Peak Anode Current	$i_{a(pk)max}$			750	mA
Maximum Reservoir Capacitor	$C_{(max)}$			60	μF
Anode Voltage	$V_{a(r.m.s.)}$	2x350	2x450	2x550	V
CAPACITOR INPUT					
Maximum Output Current	$I_{out(max)}$	250	250	160	mA
Minimum Limiting Resistance (per anode)	$R_{lim(min)}$	75	125	175	Ω
CHOKE INPUT					
Maximum Output Current	$I_{out(max)}$	250	250	225	mA
Minimum Limiting Resistance (per anode)	$R_{lim(min)}$	0	0	0	Ω

TYPICAL OPERATION AS A FULL-WAVE RECTIFIER

CAPACITOR INPUT ($C=60\mu F$)

Anode Voltage	$V_{a(r.m.s.)}$	2x350	2x450	2x550	V
Limiting Resistance (per anode)	R_{lim}	100	150	200	Ω
Output Current	I_{out}	250	250	160	mA
Output Voltage	V_{out}	380	480	640	V

CHOKE INPUT ($L=10H$)

Anode Voltage	$V_{a(r.m.s.)}$	2x350	2x450	2x550	V
Limiting Resistance (per anode)	R_{lim}	0	0	0	Ω
Output Current	I_{out}	250	250	225	mA
Output Voltage	V_{out}	290	375	465	V

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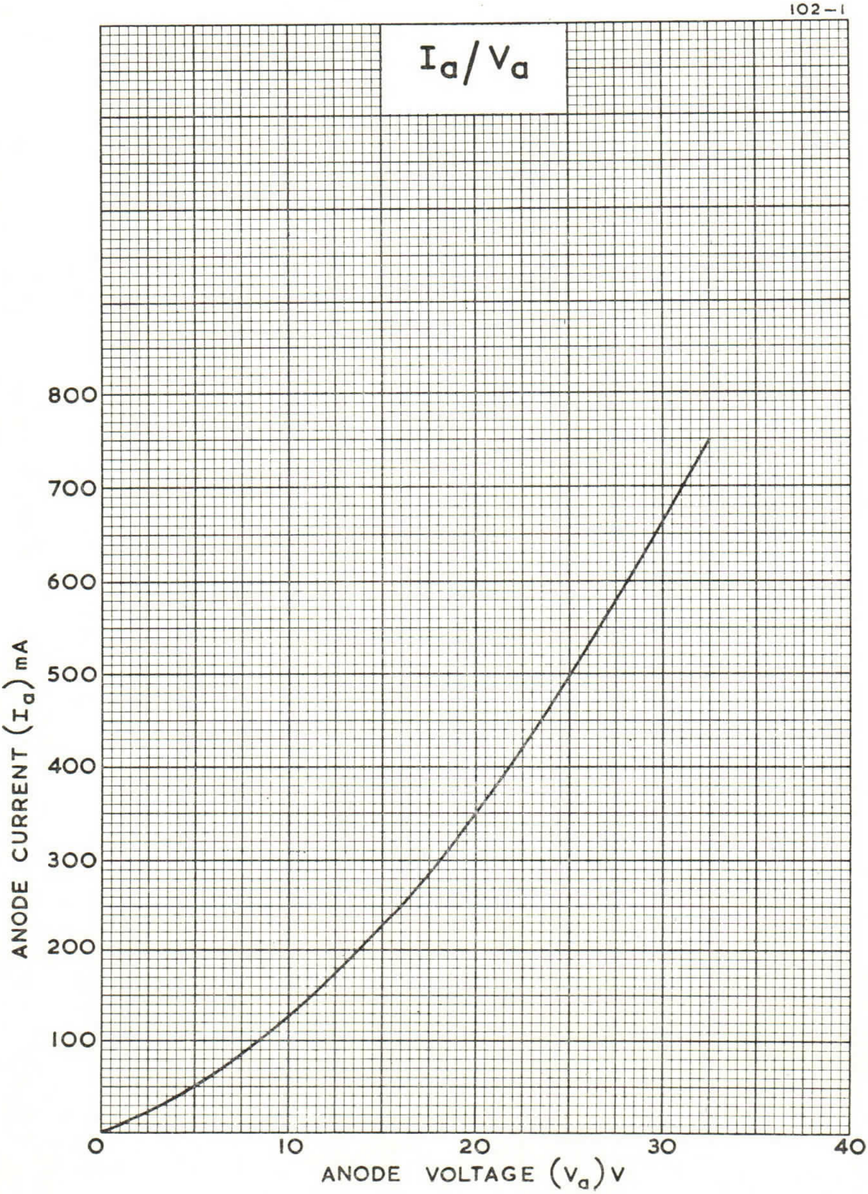
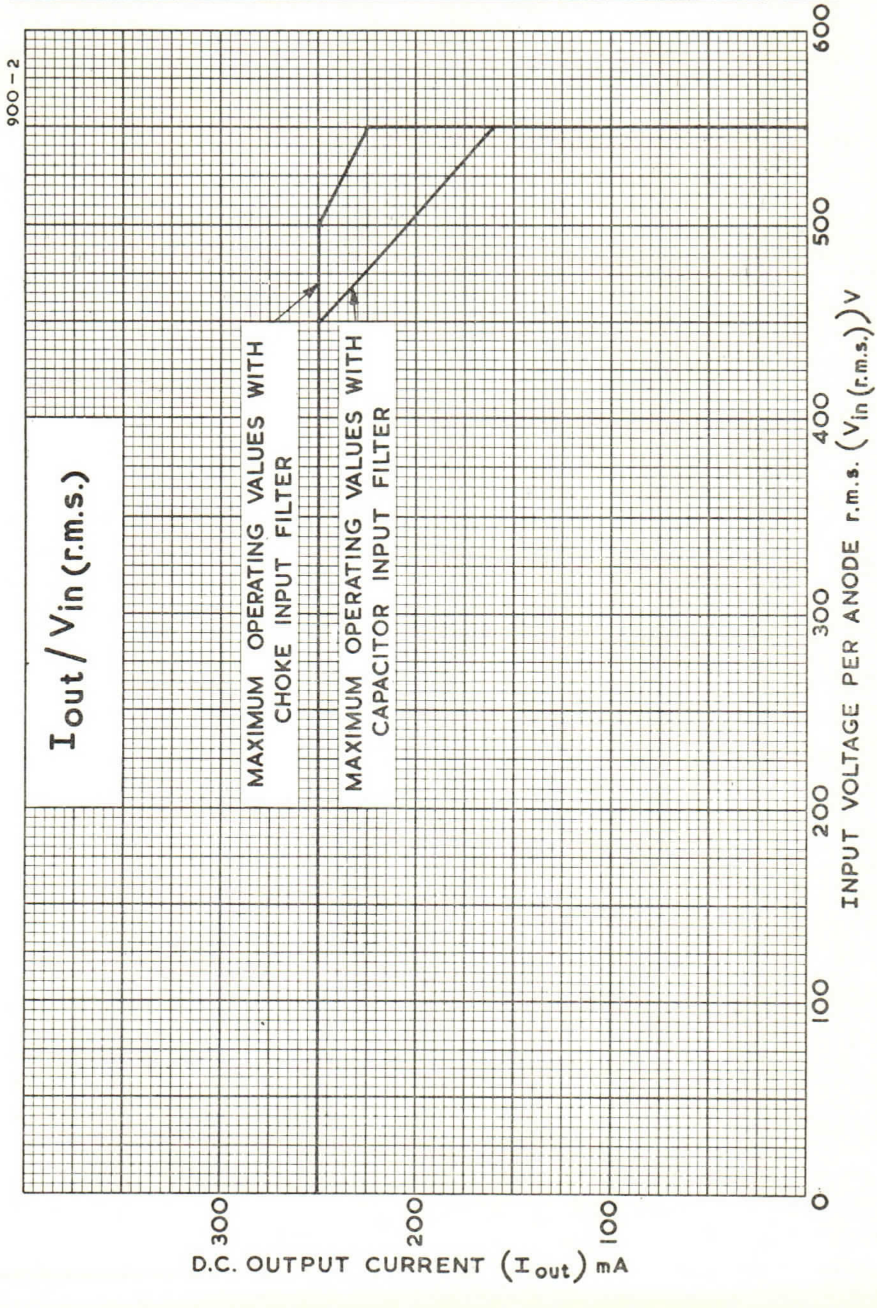
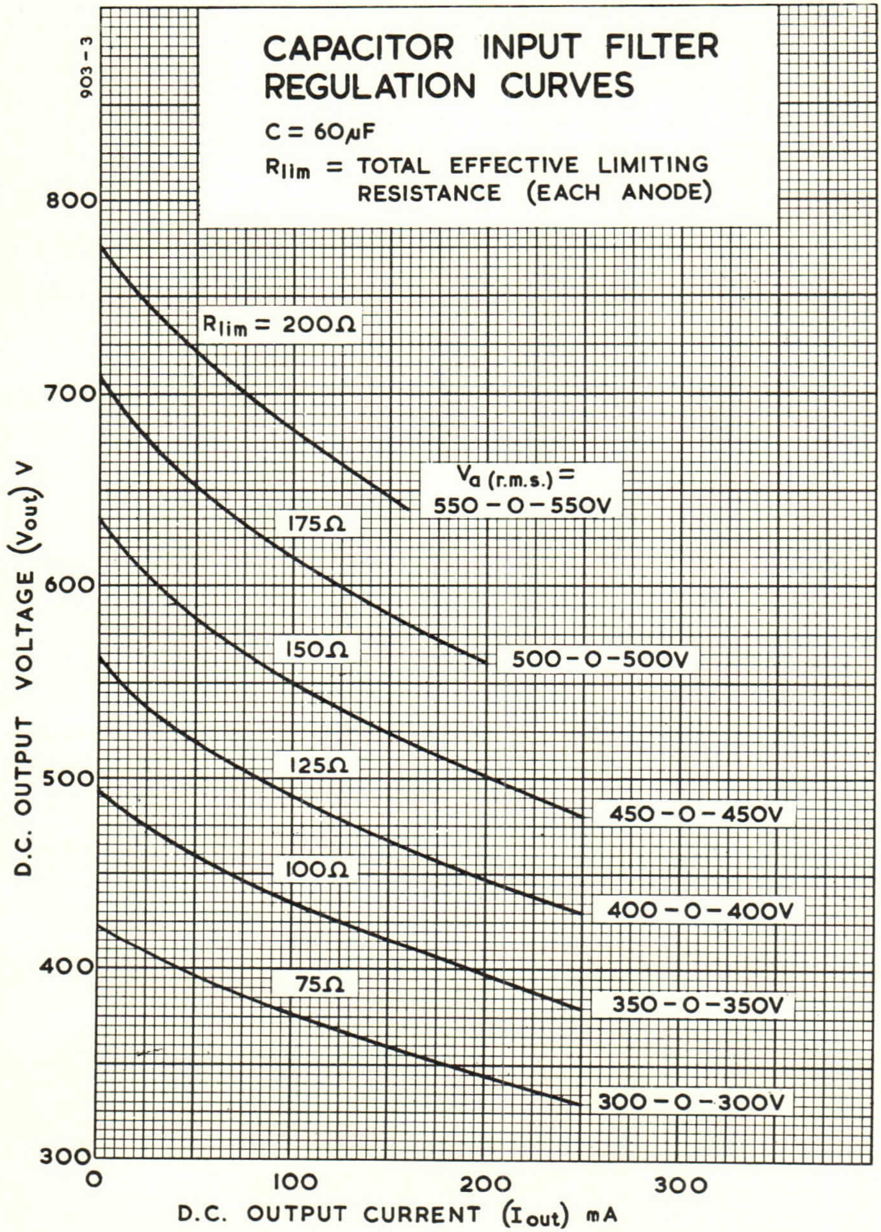
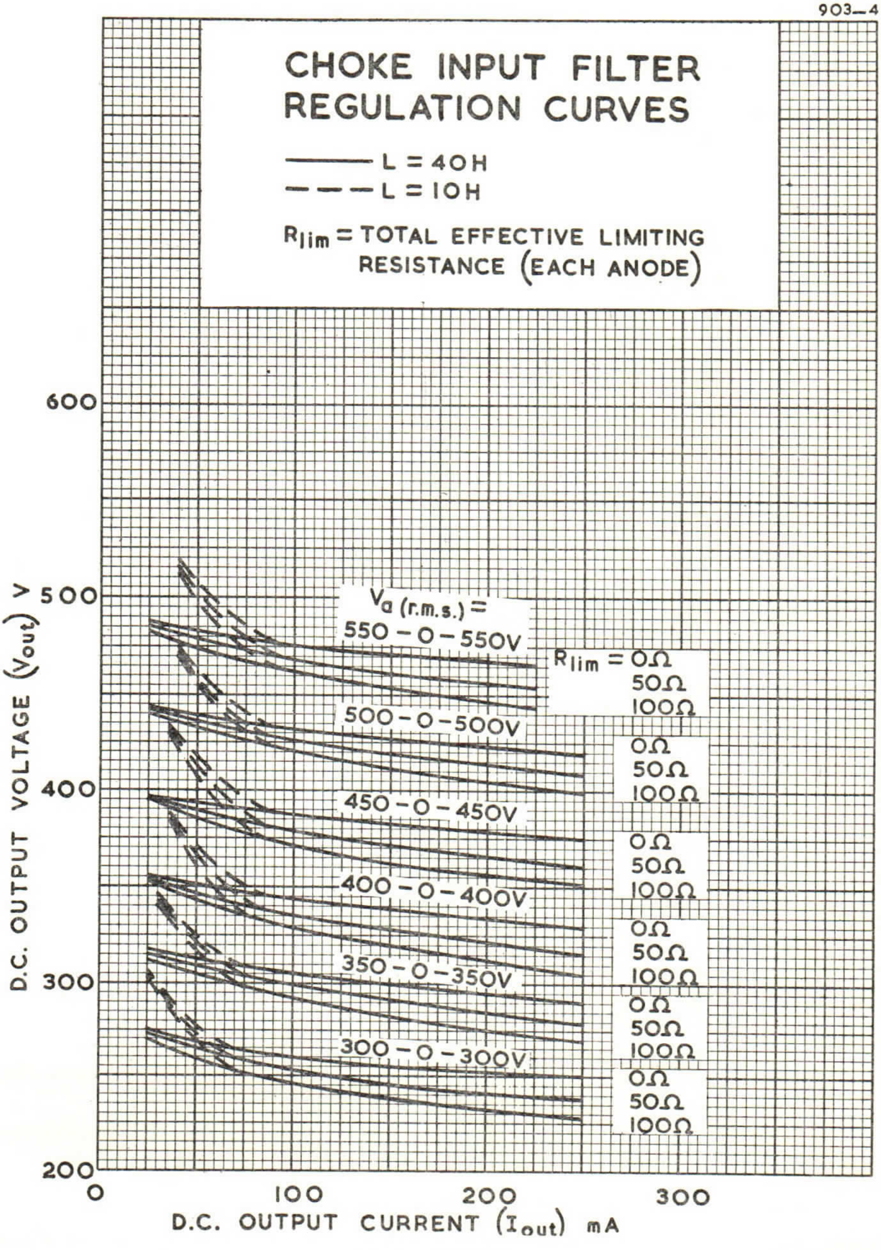
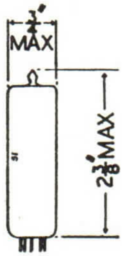

102—1
I_a/V_a
800
700
600
500
400
300
200
100
0
10
20
30
40
ANODE CURRENT (I_a) mA
ANODE VOLTAGE (V_a) V


900 – 2
Iout / Vin (r.m.s.)
MAXIMUM OPERATING VALUES WITH CHOKE INPUT FILTER
MAXIMUM OPERATING VALUES WITH CAPACITOR INPUT FILTER
INPUT VOLTAGE PER ANODE r.m.s. (Vin (r.m.s.)) V
0
100
200
300
400
500
600
D.C. OUTPUT CURRENT (Iout) mA
300
200
100


903-3
CAPACITOR INPUT FILTER
REGULATION CURVES
C = 60μF
Rlim = TOTAL EFFECTIVE LIMITING RESISTANCE (EACH ANODE)
Rlim = 200Ω
175Ω
150Ω
125Ω
100Ω
75Ω
Va (r.m.s.) =
550-0-550V
500-0-500V
450-0-450V
400-0-400V
350-0-350V
300-0-300V
D.C. OUTPUT VOLTAGE (Vout) V
800
700
600
500
400
300
0
100
200
300
D.C. OUTPUT CURRENT (Iout) mA


903—4
CHOKE INPUT FILTER
REGULATION CURVES
L = 40H
L = 10H
Rlim = TOTAL EFFECTIVE LIMITING RESISTANCE (EACH ANODE)
Va (r.m.s.) =
550 - 0 - 550V
Rlim = 0Ω
50Ω
100Ω
500-0-500V
450-0-450V
400-0-400V
350-0-350V
300-0-300V
600
500
400
300
200
0
100
200
300
D.C. OUTPUT VOLTAGE (Vout) V
D.C. OUTPUT CURRENT (Iout) mA

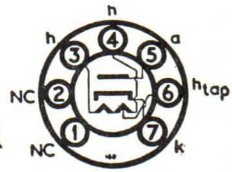
BRIMAR VALVES



B7G Base

Current Equipment Type

TYPE **HY90**
MINIATURE
HALF WAVE RECTIFIER



Heater Current	0.15 amp.
Heater Voltage	35 volts

RATINGS

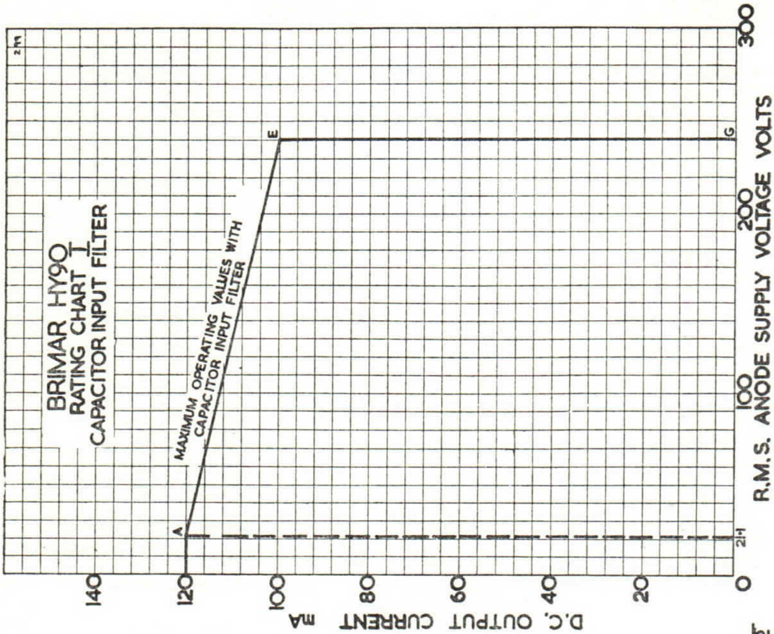
Peak Inverse Voltage	700 volts max.
Peak Current	600 mA max.
Peak Surge Current	2 amps. max.
Anode Supply Voltage	—see Rating Chart I
D.C. Output Current	—see Rating Chart I
Peak Heater Cathode Potential (D.C.)	350 volts max.

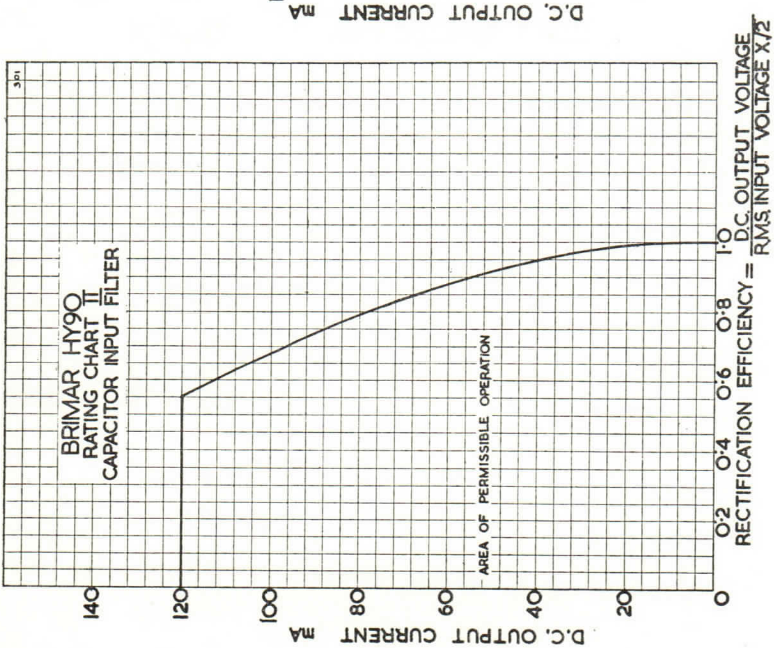
CHARACTERISTICS AS A HALF-WAVE RECTIFIER

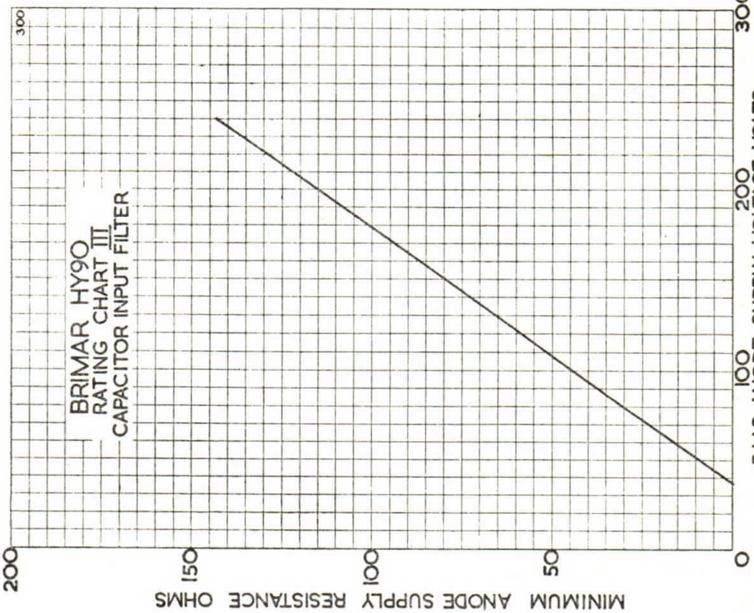
CAPACITOR INPUT:

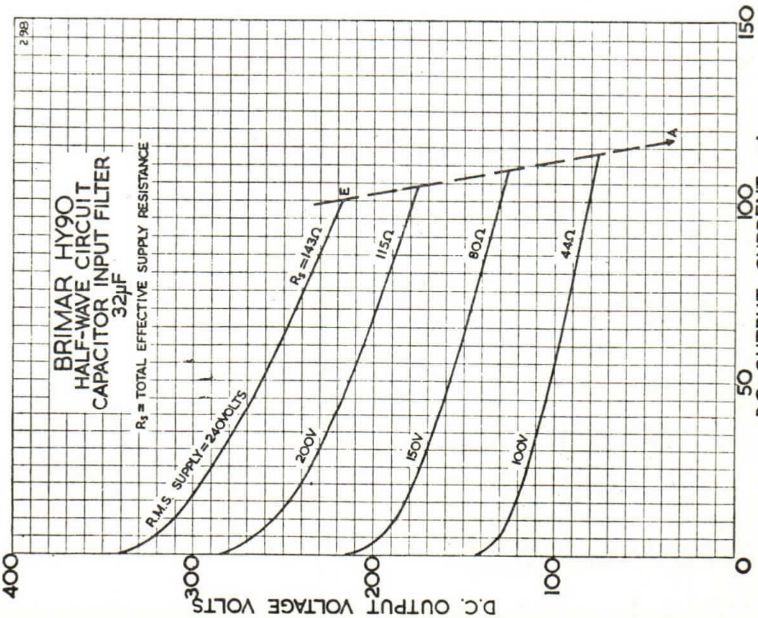
R.M.S. Input Voltage	240 volts
Rectified Current	100 mA
D.C. Output Voltage	215 volts
Supply Impedance	143 Ω
Reservoir Capacitor	32 μF

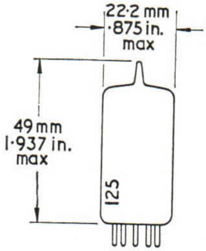
For notes on use of rating charts, refer to "Valve Ratings" section


BRIMAR HY90
RATING CHART I
CAPACITOR INPUT FILTER
MAXIMUM OPERATING VALUES WITH CAPACITOR INPUT FILTER
A
E
G
2·H
0
20
40
60
80
100
120
140
D.C. OUTPUT CURRENT mA
100
200
300
R.M.S. ANODE SUPPLY VOLTAGE VOLTS

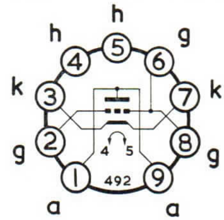

BRIMAR HY90
RATING CHART II
CAPACITOR INPUT FILTER
AREA OF PERMISSIBLE OPERATION
0
20
40
60
80
100
120
140
D.C. OUTPUT CURRENT mA
0·2
0·4
0·6
0·8
1·0
RECTIFICATION EFFICIENCY = D.C. OUTPUT VOLTAGE / R.M.S. INPUT VOLTAGE X√2


BRIMAR HY90
RATING CHART III
CAPACITOR INPUT FILTER
MINIMUM ANODE SUPPLY RESISTANCE OHMS
R.M.S. ANODE SUPPLY VOLTAGE VOLTS
0
50
100
150
200
300


BRIMAR HY90
HALF-WAVE CIRCUIT
CAPACITOR INPUT FILTER
32µF
Rs = TOTAL EFFECTIVE SUPPLY RESISTANCE
R.M.S. SUPPLY=240VOLTS
200V
150V
100V
Rs=143Ω
115Ω
80Ω
44Ω
E
A
D.C. OUTPUT VOLTAGE VOLTS
D.C. OUTPUT CURRENT mA
0
50
100
150
200
300
400



U.H.F. TRIODE



B9A Base

GENERAL

This frame grid triode is for use as a grounded grid U.H.F. oscillator and mixer for bands IV and V.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	3·8	V

RATINGS

Maximum Anode Dissipation	$p_{a(max)}$	2·2	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	V
Maximum Anode Voltage	$V_{a(max)}$	220	V
Maximum Negative Grid Voltage	$-V_{g(max)}$	50	V
Maximum Heater to Cathode Voltage (R.M.S.)	$V_{h\text{-}k(r.m.s.)max}$	90	V
Maximum Cathode Current	$I_{k(max)}$	20	mA
Maximum Grid to Cathode Resistance	$R_{g\text{-}k(max)}$	1·0	MΩ

INTER-ELECTRODE CAPACITANCES

		*	†	
Anode to Grid	$c_{a\text{-}g}$	2·2		pF
Anode to Cathode	$c_{a\text{-}k}$	0·24		pF
Grid to Cathode	$c_{g\text{-}k}$	3·5		pF
Grid to Heater	$c_{g\text{-}h}$	0·3		pF
Cathode to Grid, Heater	$c_{k\text{-}g,h}$	6·3		pF
Grid to Cathode, Heater	$c_{g\text{-}k,h}$	3·8		pF
Anode to Cathode, Heater	$c_{a\text{-}k,h}$	0·35		pF
Anode to Grid, Heater	$c_{a\text{-}g,h}$	2·3		pF
Anode to Grid, Shield	$c_{a\text{-}g,s}$		3·3	pF
Cathode, Heater to Grid, Shield	$c_{k,h\text{-}g,s}$		4·1	pF
Anode to Cathode, Heater	$c_{a\text{-}k,h}$		0·3	pF

* In fully shielded socket without can (I.E.C. Publication 100).
† In fully shielded socket with can (I.E.C. Publication 100).

CHARACTERISTICS

Anode Voltage	V_a	175	V
Grid Voltage	V_g	−1·5	V
Anode Current	I_a	12	mA
Mutual Conductance	g_m	14	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	4·85	kΩ
Amplification Factor	μ	68	
Equivalent Grid Noise Resistance	R_{eq}	230	Ω

TYPICAL OPERATION—As a Self-Oscillating Mixer

		‡	§	
Anode Supply Voltage	$V_{a(b)}$	220	220	V
Anode Resistance	R_a	5·6	5·6	kΩ
Grid Resistance	R_g	—	47	kΩ
Cathode Bias Resistance	R_k	220	—	Ω
Anode Current	I_a	12	12	mA
Grid Current	I_g	—	50	μA
Conversion Conductance	g_c	5·5	5·5	mA/V

‡ Cathode self bias § Grid current bias

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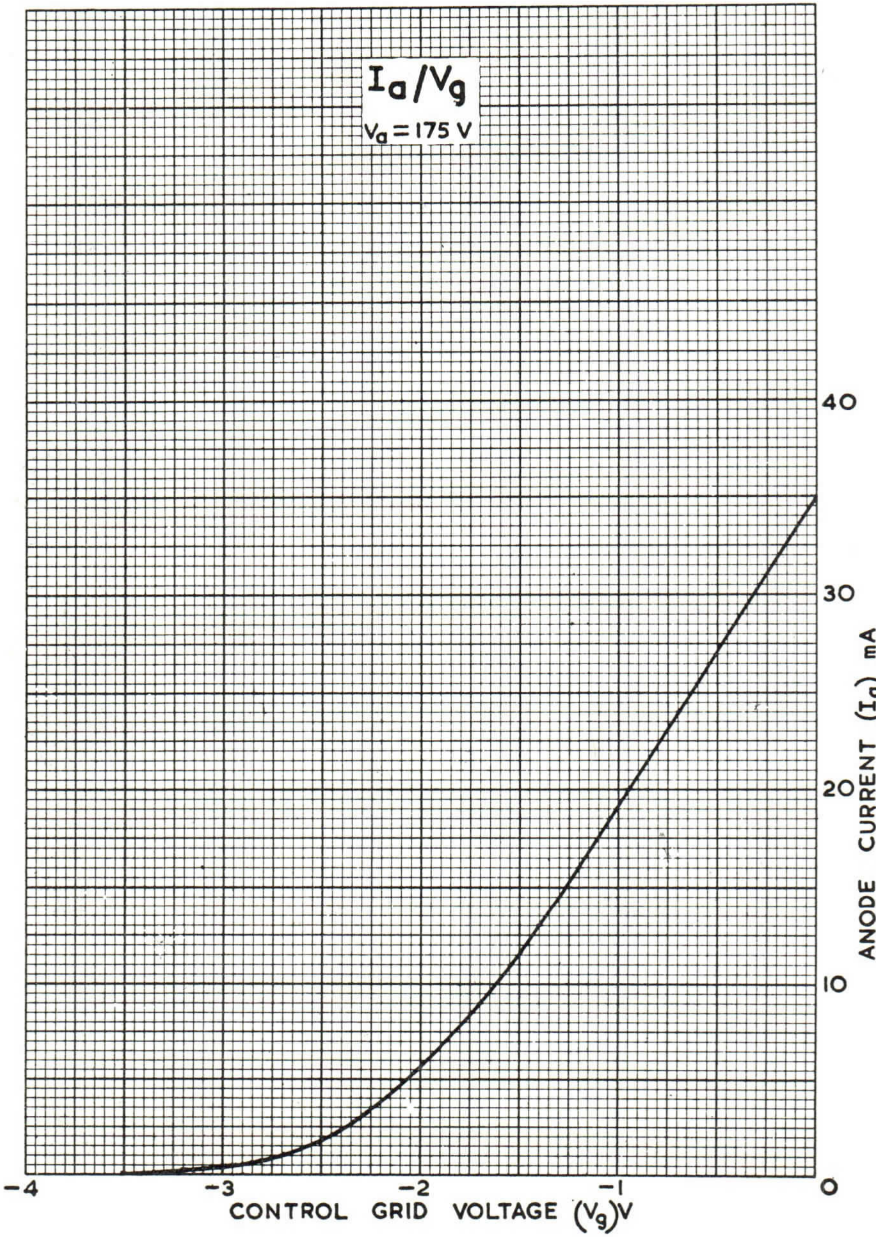
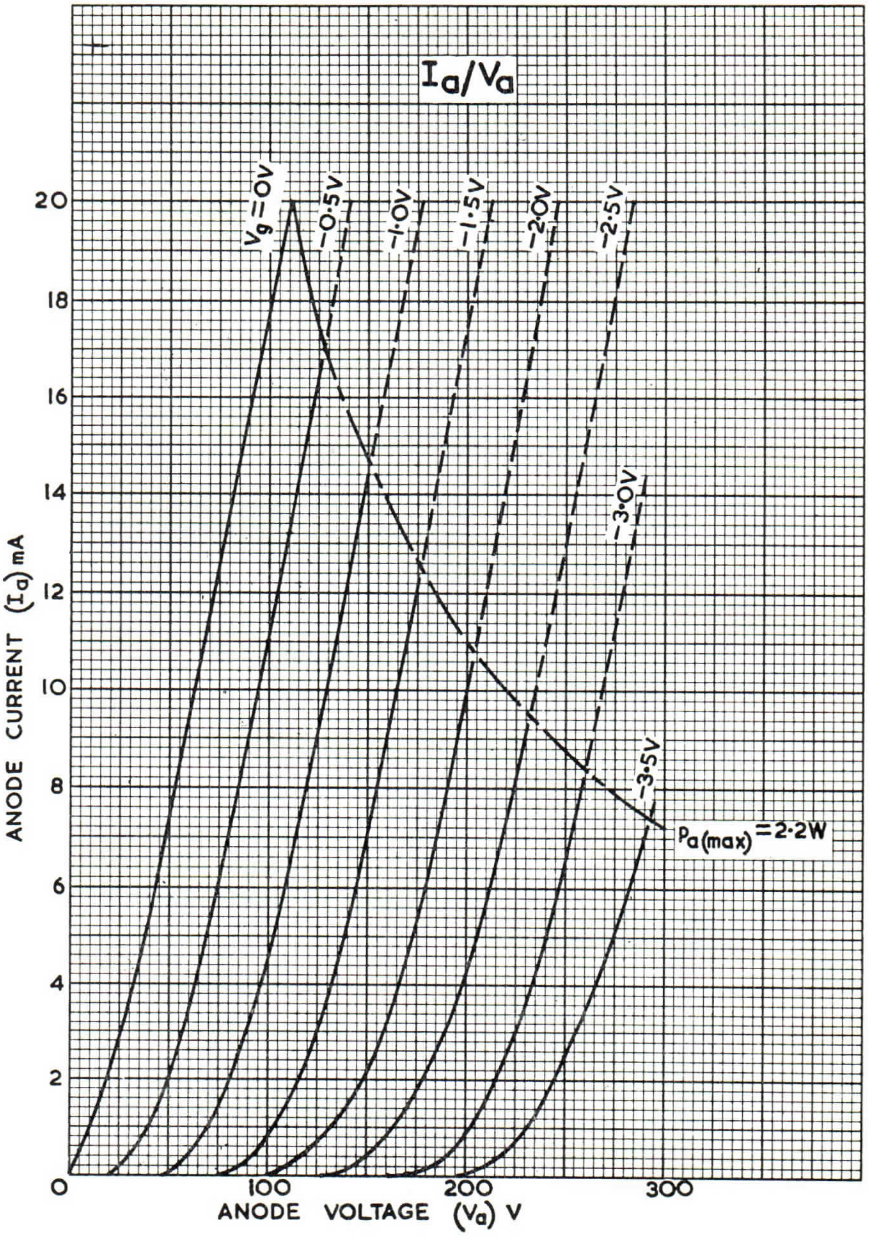
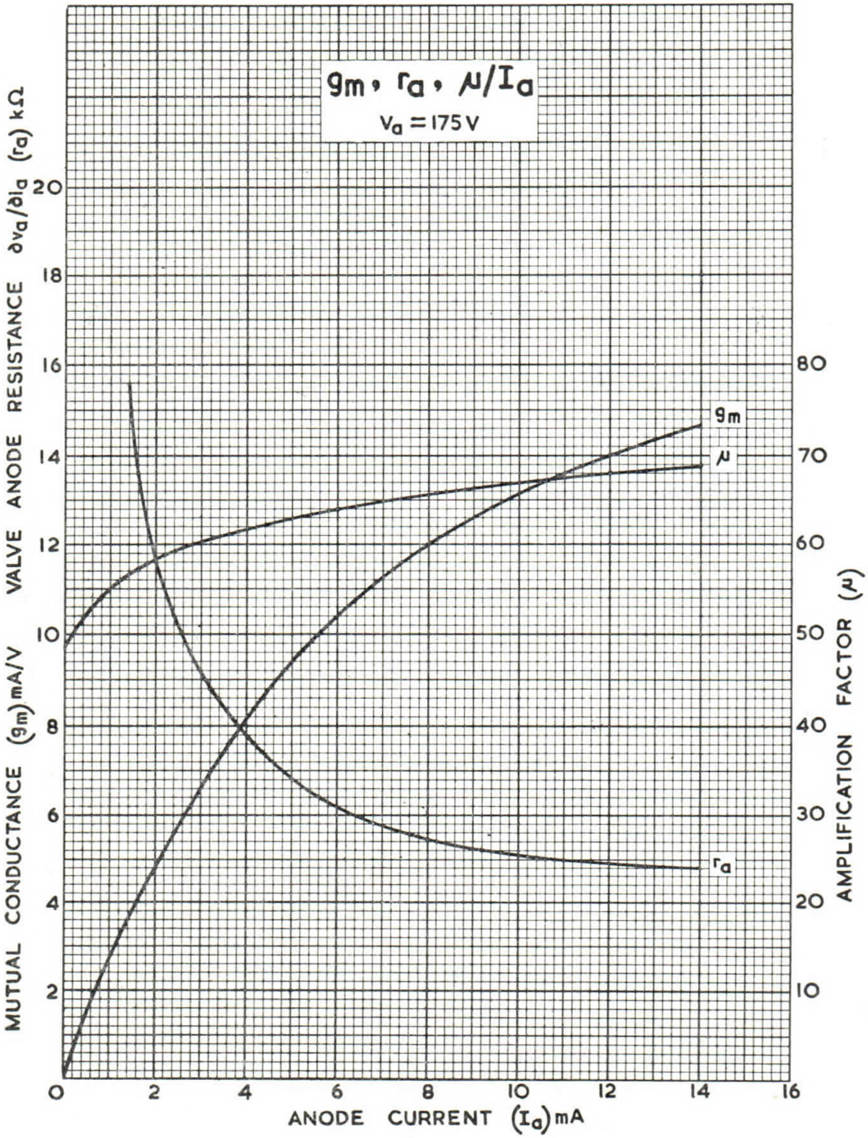
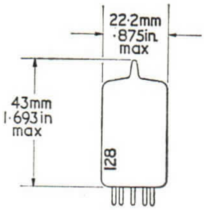

I_a/V_g
$V_a = 175$ V
40
30
20
10
0
ANODE CURRENT (I_a) mA
−4
−3
−2
−1
CONTROL GRID VOLTAGE (V_g)V



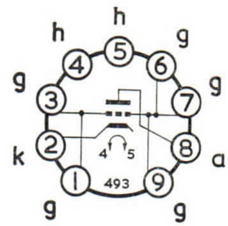
I_a/V_a
$V_g=0V$
$-0{\cdot}5V$
$-1{\cdot}0V$
$-1{\cdot}5V$
$-2{\cdot}0V$
$-2{\cdot}5V$
$-3{\cdot}0V$
$-3{\cdot}5V$
$P_{a(max)}=2{\cdot}2W$
ANODE CURRENT (I_a) mA
20
18
16
14
12
10
8
6
4
2
0
100
200
300
ANODE VOLTAGE (V_a) V



g_m, r_a, μ/I_a
$V_a = 175V$
VALVE ANODE RESISTANCE $\partial v_a/\partial I_a$ (r_a) kΩ
MUTUAL CONDUCTANCE (g_m) mA/V
AMPLIFICATION FACTOR (μ)
ANODE CURRENT (I_a) mA
g_m
μ
r_a
0
2
4
6
8
10
12
14
16
18
20
10
20
30
40
50
60
70
80



U.H.F. TRIODE



B9A Base

GENERAL

This frame grid triode is for use as a grounded grid U.H.F. Amplifier for bands IV and V.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	3·8	V

RATINGS

Maximum Anode Dissipation	$p_{a(max)}$	2·0	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	V
Maximum Anode Voltage	$V_{a(max)}$	175	V
Maximum Negative Grid Voltage	$-V_{g(max)}$	50	V
Maximum Heater to Cathode Voltage (R.M.S.)	$V_{h\text{-}k(r.m.s.)max}$	70	V
Maximum Cathode Current	$I_{k(max)}$	13	mA
Maximum Grid to Cathode Resistance	$R_{g\text{-}k(max)}$	1·0	MΩ

INTER-ELECTRODE CAPACITANCES

		*	†	
Anode to Grid	$c_{a\text{-}g}$	1·2		pF
Anode to Grid, Shield	$c_{a\text{-}g,s}$		1·7	pF
Cathode, Heater to Grid, Shield	$c_{k,h\text{-}g,s}$		3·8	pF
Anode to Cathode, Heater	$c_{a\text{-}k,h}$		0·055	pF

* In fully shielded socket without can (I.E.C. Publication 100).
† In fully shielded socket with can (I.E.C. Publication 100).

CHARACTERISTICS

Anode Voltage	V_a	160	V
Grid Voltage	V_g	−1·25	V
Anode Current	I_a	12·5	mA
Mutual Conductance	g_m	13·5	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	4·8	kΩ
Amplification Factor	μ	65	
Equivalent Grid Noise Resistance	R_{eq}	240	Ω

TYPICAL OPERATION

Anode Voltage	V_a	160	V
Cathode Resistance	R_k	100	Ω
Anode Current	I_a	12·5	mA
Mutual Conductance	g_m	13·5	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	4·8	kΩ
Amplification Factor	μ	65	
Noise Factor		10	dB

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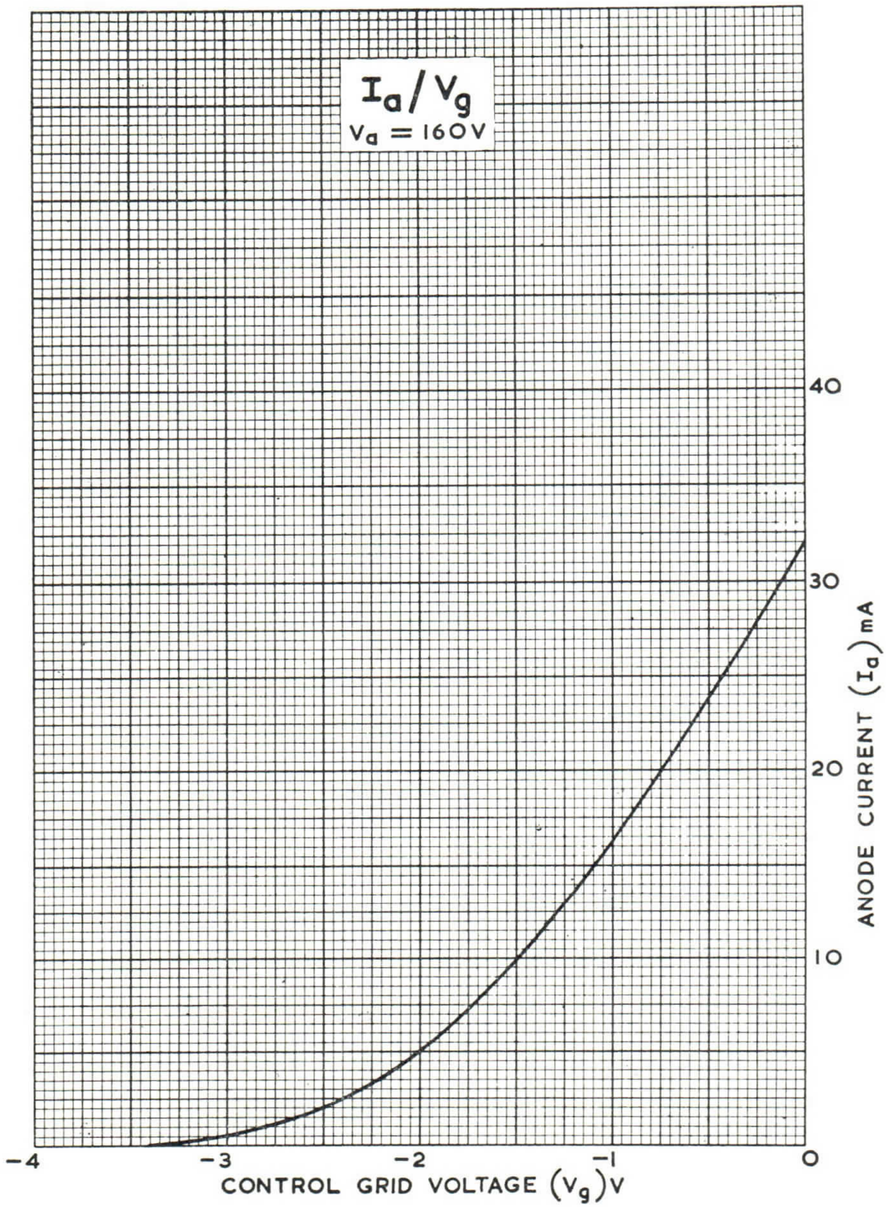
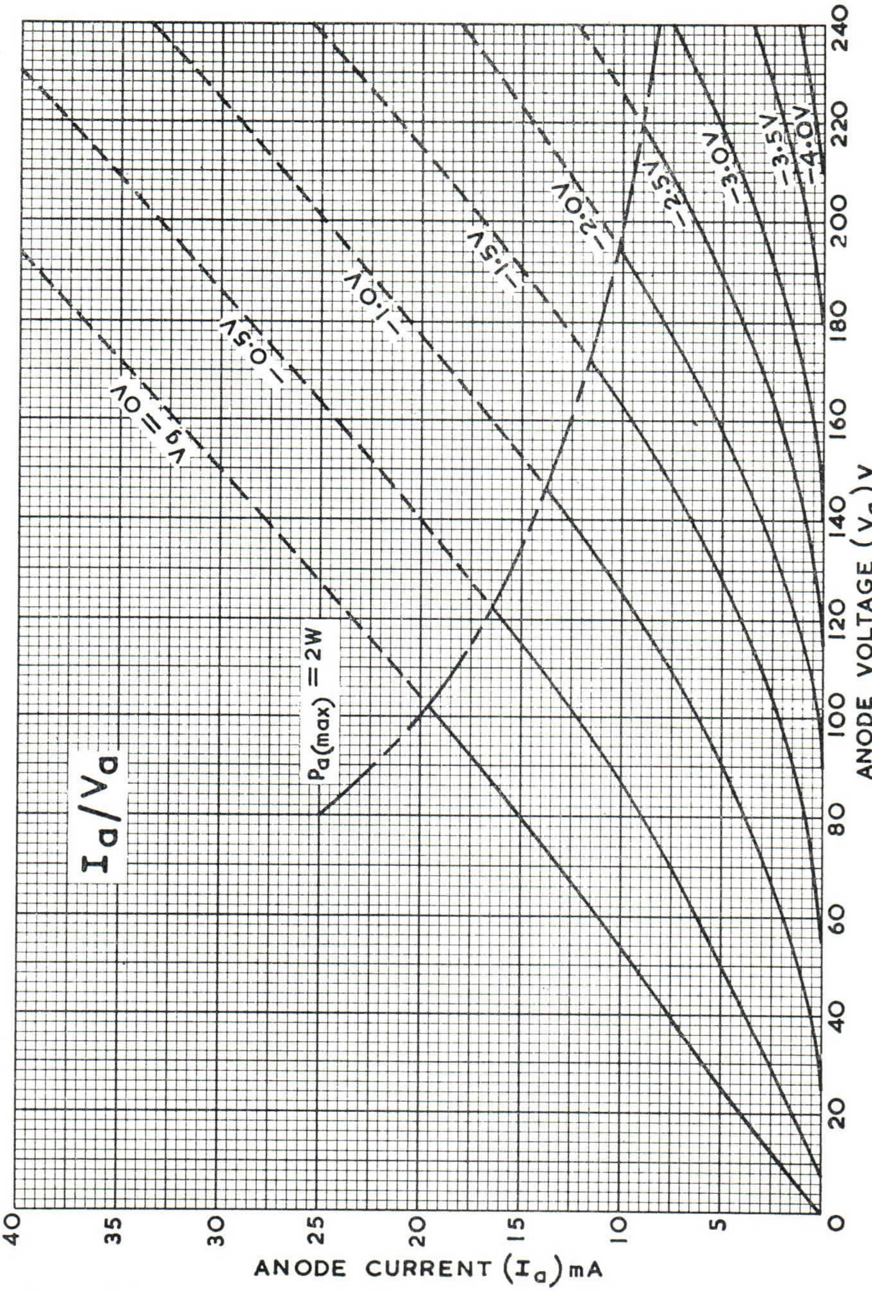
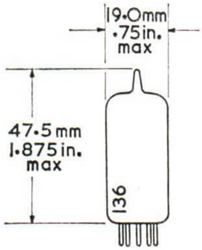

I_a/V_g
$V_a = 160V$
40
30
20
10
ANODE CURRENT (I_a) mA
−4
−3
−2
−1
0
CONTROL GRID VOLTAGE (V_g)V

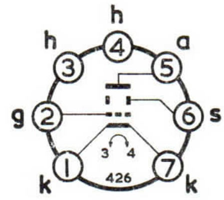


I_a/V_a
$P_a(max) = 2W$
Vg = 0V
−0.5V
−1.0V
−1.5V
−2.0V
−2.5V
−3.0V
−3.5V
−4.0V
ANODE VOLTAGE (V_a) V
ANODE CURRENT (I_a) mA

BRIMAR VALVES PC97



V.H.F. FRAME GRID TRIODE



B7G Base

GENERAL

This valve is a high slope, frame grid triode with low anode to grid capacitance for use as an R.F. amplifier in V.H.F. television tuners. The low anode to grid capacitance simplifies the problems of neutralising, and is achieved by specially shaped anodes and an internal shield.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	4·5	V

RATINGS

Maximum Anode Dissipation	$p_{a(max)}$	2·2	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	V
Maximum Anode Voltage	$V_{a(max)}$	200	V
Maximum Negative Grid Voltage	$-V_{g(max)}$	50	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$	100	V
Maximum Cathode Current	$I_{k(max)}$	20	mA
Maximum Grid to Cathode Resistance	$R_{g1\text{-}k(max)}$	1·0	MΩ

INTER-ELECTRODE CAPACITANCES

		*	†	
Anode to Grid	$c_{a\text{-}g}$	0·48	0·5	pF
Grid to Cathode	$c_{g\text{-}k}$	3·2	3·2	pF
Anode to Cathode	$c_{a\text{-}k}$	0·21	0·25	pF
Grid to Cathode, Heater and Shield	$c_{g\text{-}k,h,s}$	5·0	5·0	pF
Anode to Cathode, Heater and Shield	$c_{a\text{-}k,h,s}$	4·2	3·3	pF
Grid to Heater	$c_{g\text{-}h}$	0·28	0·28	pF
Cathode to Heater	$c_{k\text{-}h}$	2·5	2·5	pF

* With shield.
† Without shield.

CHARACTERISTICS

Anode Voltage	V_a	135	V
Grid Voltage	V_g	−1·0	V
Anode Current	I_a	11	mA
Amplification Factor	μ	65	
Mutual Conductance	g_m	13	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	5·0	kΩ
Grid Voltage for g_m reduction 20 : 1	$V_{g(gm/20)}$	−3·1	V
Grid Voltage for g_m reduction 100 : 1	$V_{g(gm/100)}$	−5·0	V
Grid Voltage for $I_a = 100\ \mu A$	$V_{g(Ia = 100\ \mu a)}$	−5·0	V

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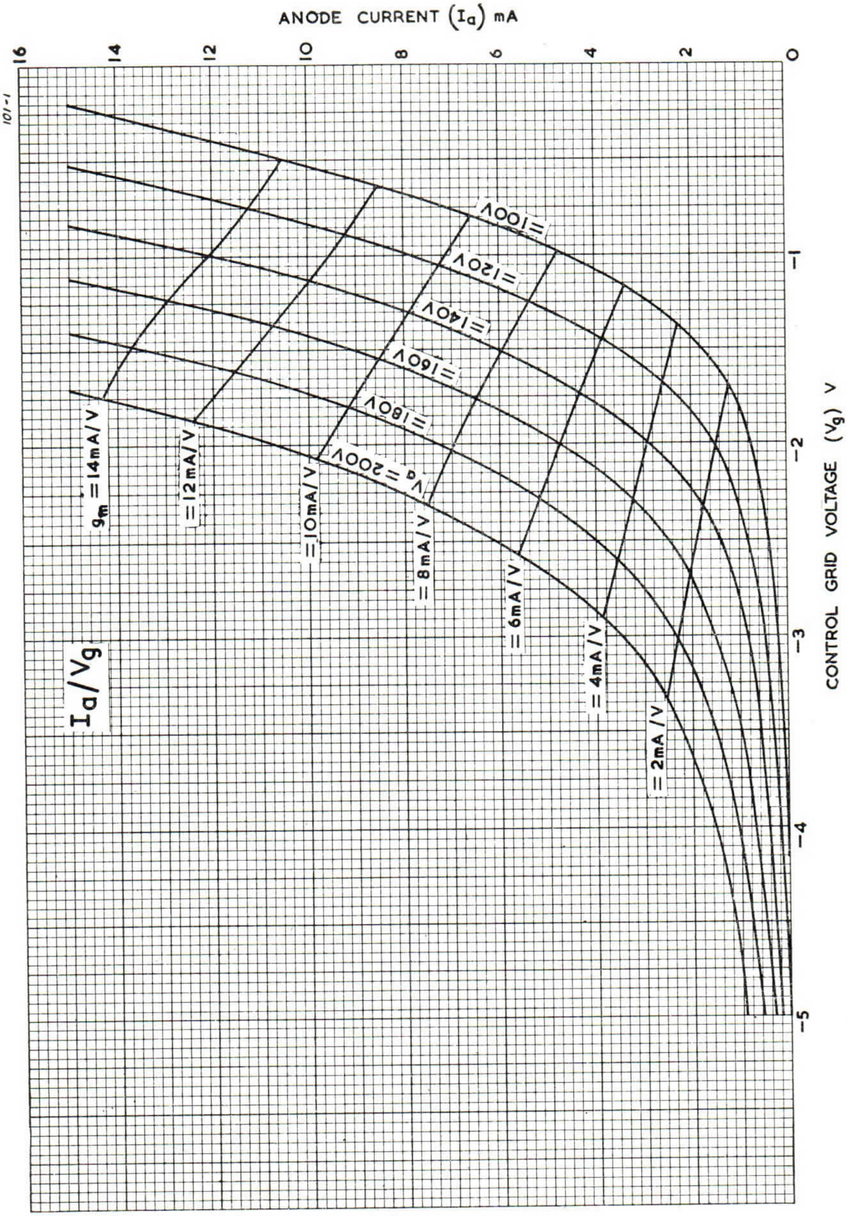
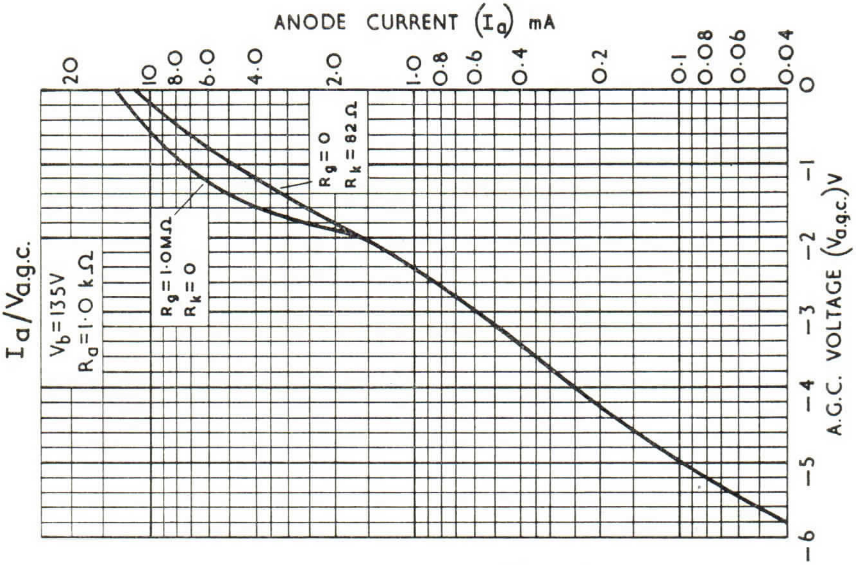
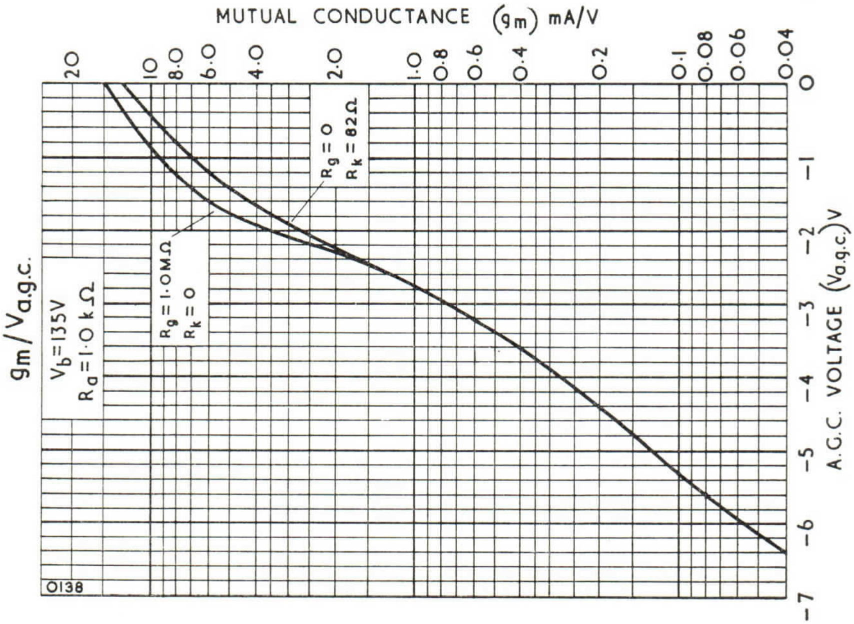
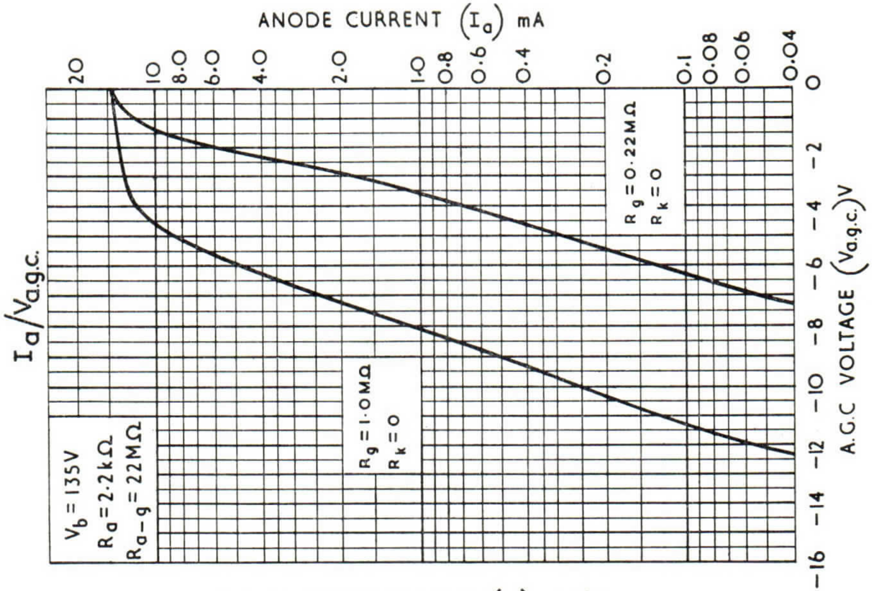
TYPICAL OPERATION

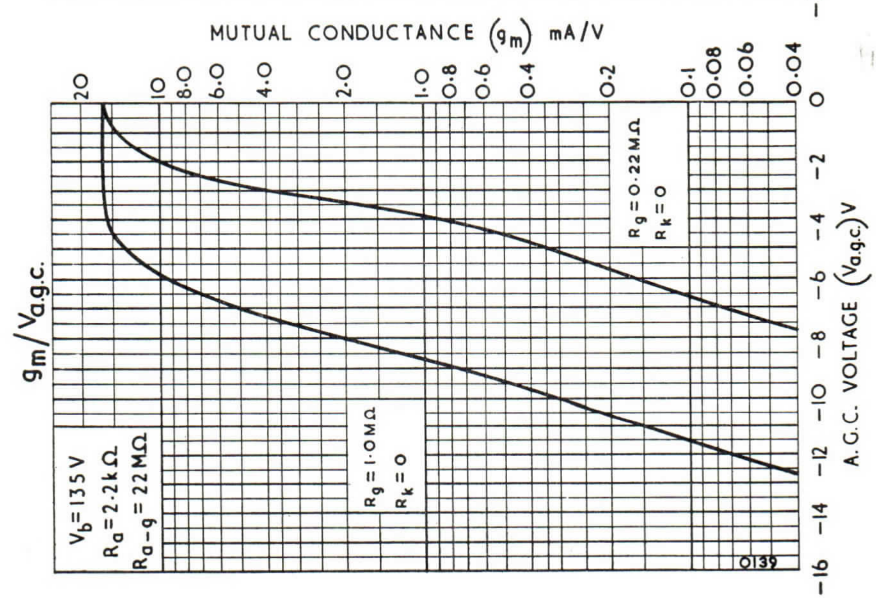
Supply Voltage	V_b	135	135	135	135	200	200	200	200	V
Anode Load Resistance	R_a	1·0	1·0	2·2	2·2	5·6	5·6	6·8	6·8	kΩ
Cathode Resistance	R_k	82	0	0	0	82	0	0	0	Ω
Grid Resistance	R_g	0	1·0	0·22	1·0	0	1·0	0·22	0·56	MΩ
Grid to Anode Resistance	R_{g-a}	—	—	22	22	—	—	22	22	MΩ
Anode Current	I_a	10·5	13	14	14	12	13	14	14	mA
Mutual Conductance	g_m	13	15·5	16	16	14	15·5	16	16	mA/V
Grid Voltage for g_m reduction 100 : 1		−5·0	−4·8	−6·0	−11	−7·5	−7·3	−9·0	−12·5	V

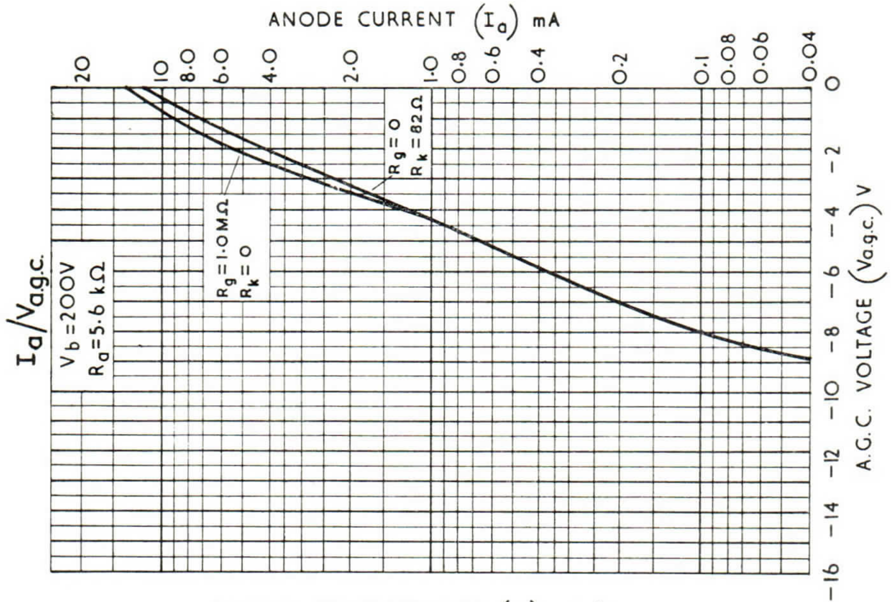

ANODE CURRENT (I_a) mA
16
14
12
10
8
6
4
2
0
CONTROL GRID VOLTAGE (V_g) V
−1
−2
−3
−4
−5
I_a/V_g
V_a = 200V
= 180V
= 160V
= 140V
= 120V
= 100V
g_m = 14mA/V
= 12mA/V
= 10mA/V
= 8mA/V
= 6mA/V
= 4mA/V
= 2mA/V
101-1

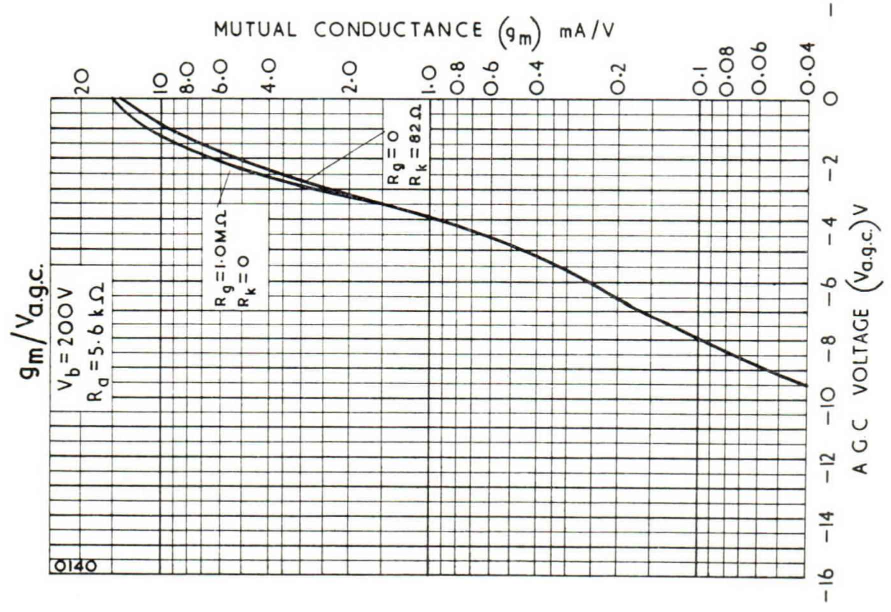

ANODE CURRENT (I_a) mA
20
10
8·0
6·0
4·0
2·0
1·0
0·8
0·6
0·4
0·2
0·1
0·08
0·06
0·04
$I_a/V_{a.g.c.}$
$V_b = 135V$
$R_a = 1·0\ k\Omega$
$R_g = 1·0M\Omega$
$R_k = 0$
$R_g = 0$
$R_k = 82\Omega$
A.G.C. VOLTAGE $(V_{a.g.c.})$V
0
−1
−2
−3
−4
−5
−6

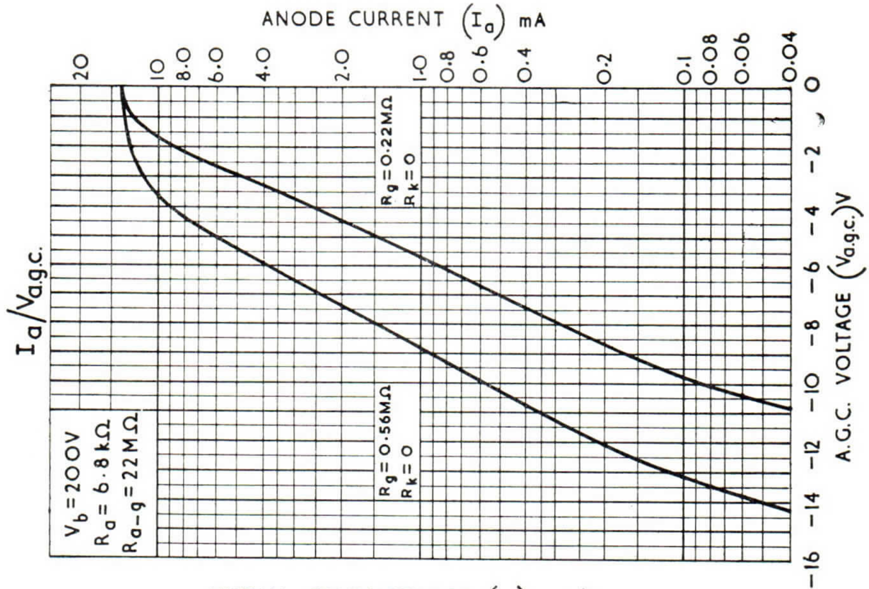

MUTUAL CONDUCTANCE (g_m) mA/V
20
10
8·0
6·0
4·0
2·0
1·0
0·8
0·6
0·4
0·2
0·1
0·08
0·06
0·04
$g_m/V_{a.g.c.}$
$V_b = 135V$
$R_a = 1·0\ k\Omega$
$R_g = 1·0M\Omega$
$R_k = 0$
$R_g = 0$
$R_k = 82\Omega$
A.G.C. VOLTAGE $(V_{a.g.c.})$V
0
−1
−2
−3
−4
−5
−6
−7
0138


ANODE CURRENT (I_a) mA
$I_a/V_{a.g.c.}$
A.G.C VOLTAGE $(V_{a.g.c.})$ V
$R_g = 0{\cdot}22\,M\Omega$
$R_k = 0$
$R_g = 1{\cdot}0\,M\Omega$
$R_k = 0$
$V_b = 135\,V$
$R_a = 2{\cdot}2\,k\Omega$
$R_{a-g} = 22\,M\Omega$

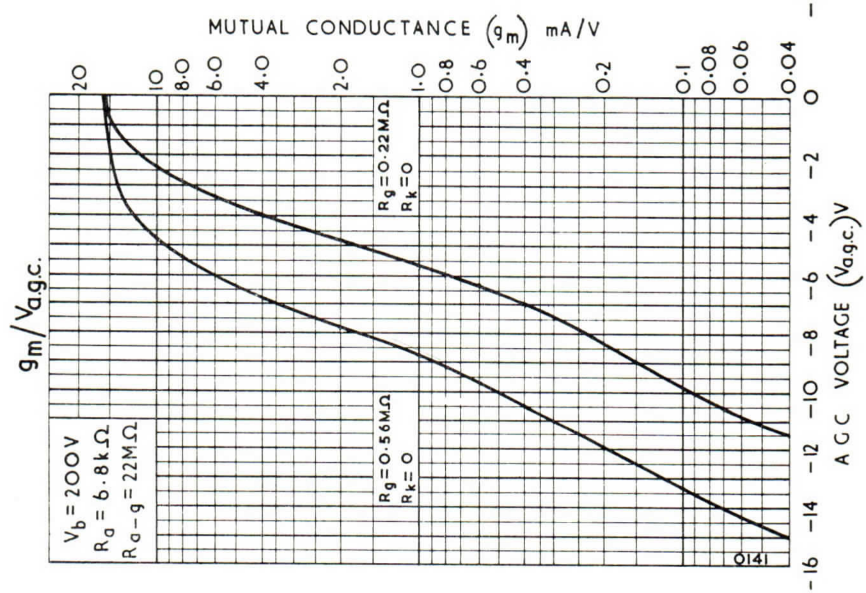

MUTUAL CONDUCTANCE (g_m) mA/V
$g_m/V_{a.g.c.}$
A.G.C. VOLTAGE $(V_{a.g.c.})$ V
$R_g = 0{\cdot}22\,M\Omega$
$R_k = 0$
$R_g = 1{\cdot}0\,M\Omega$
$R_k = 0$
$V_b = 135\,V$
$R_a = 2{\cdot}2\,k\Omega$
$R_{a-g} = 22\,M\Omega$
0139


ANODE CURRENT (I_a) mA
20
10
8.0
6.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
0.08
0.06
0.04
$I_a/V_{a.g.c.}$
$V_b = 200V$
$R_a = 5.6\ k\Omega$
$R_g = 1.0M\Omega$
$R_k = 0$
$R_g = 0$
$R_k = 82\ \Omega$
A.G.C. VOLTAGE $(V_{a.g.c.})$ V
0
-2
-4
-6
-8
-10
-12
-14
-16

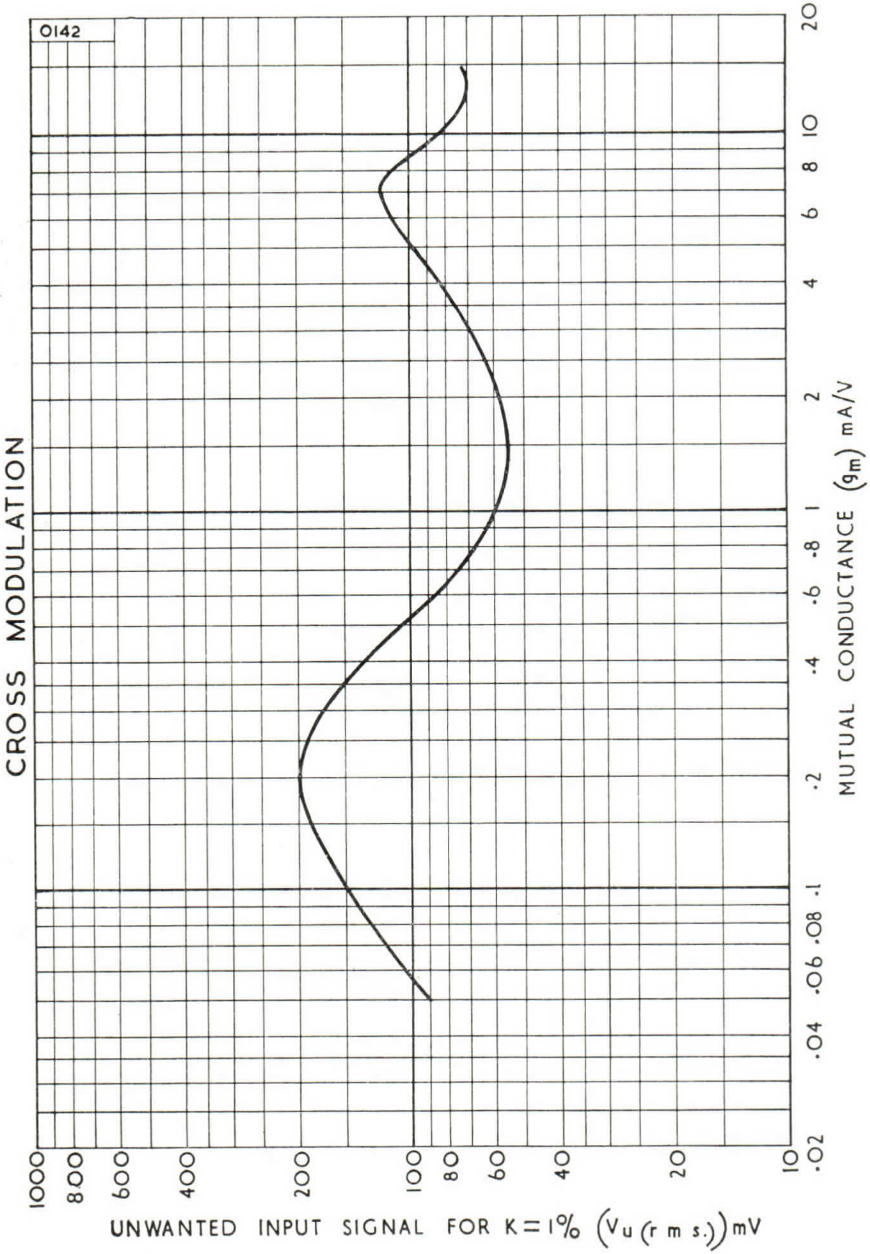

MUTUAL CONDUCTANCE (g_m) mA/V
20
10
8.0
6.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
0.08
0.06
0.04
$g_m/V_{a.g.c.}$
$V_b = 200V$
$R_a = 5.6\ k\Omega$
$R_g = 1.0M\Omega$
$R_k = 0$
$R_g = 0$
$R_k = 82\ \Omega$
A.G.C. VOLTAGE $(V_{a.g.c.})$ V
0
-2
-4
-6
-8
-10
-12
-14
-16
0140

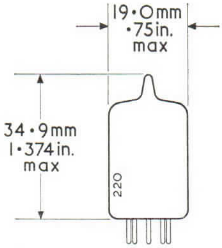


ANODE CURRENT (I_a) mA
20
10
8.0
6.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
0.08
0.06
0.04
$I_a/V_{a.g.c.}$
$R_g = 0{\cdot}22\,M\Omega$
$R_k = 0$
$R_g = 0{\cdot}56\,M\Omega$
$R_k = 0$
$V_b = 200V$
$R_a = 6{\cdot}8\,k\Omega$
$R_{a-g} = 22\,M\Omega$
A.G.C. VOLTAGE $(V_{a.g.c.})$ V
0
-2
-4
-6
-8
-10
-12
-14
-16

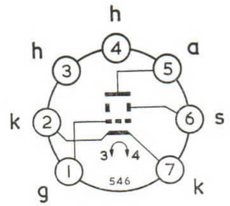


MUTUAL CONDUCTANCE (g_m) mA/V
20
10
8.0
6.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
0.08
0.06
0.04
$g_m/V_{a.g.c.}$
$R_g = 0{\cdot}22\,M\Omega$
$R_k = 0$
$R_g = 0{\cdot}56\,M\Omega$
$R_k = 0$
$V_b = 200V$
$R_a = 6{\cdot}8\,k\Omega$
$R_{a-g} = 22\,M\Omega$
AGC VOLTAGE $(V_{a.g.c.})$ V
0
-2
-4
-6
-8
-10
-12
-14
-16
0141


0142
CROSS MODULATION
MUTUAL CONDUCTANCE (g_m) mA/V
20
10
8
6
4
2
1
·8
·6
·4
·2
·1
·08
·06
·04
·02
1000
800
600
400
200
100
80
60
40
20
10
UNWANTED INPUT SIGNAL FOR K=1% $(V_u$ (r m s.)) mV



R.F. TRIODE



B7G Base

GENERAL

This triode, having low anode to grid capacitance, is for use as an R.F. amplifier in V.H.F. television receivers.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	3·9	V

DESIGN CENTRE RATINGS

Maximum Anode Dissipation	$p_{a(max)}$	2·2	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	V
Maximum Anode Voltage	$V_{a(max)}$	200	V
Maximum Negative Grid Voltage	$-V_{g(max)}$	50	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$	100*	V
Maximum Cathode Current	$I_{k(max)}$	20	mA
Maximum Grid to Cathode Resistance	$R_{g\text{-}k(max)}$	1·0†	MΩ

* To fulfil modulation hum requirement, $V_{h\text{-}k}$ should not exceed 55Vr.m.s.
† In a.g.c. circuits $R_{g\ k(max)}$ may be 3·0 MΩ.

INTER-ELECTRODE CAPACITANCES (Shielded)

Anode to Grid	$c_{a\text{-}g}$	0·35	pF
Grid to Cathode	$c_{g\text{-}k}$	3·3	pF
Anode to Cathode	$c_{a\text{-}k}$	0·08	pF
Grid to Cathode, Heater and Shield	$c_{g\text{-}k,h,s}$	4·5	pF
Anode to Cathode, Heater and Shield	$c_{a\text{-}k,h,s}$	3·0	pF
Grid to Heater	$c_{g\text{-}h}$	<0.07	pF
Cathode to Heater	$c_{k\text{-}h}$	2·3	pF

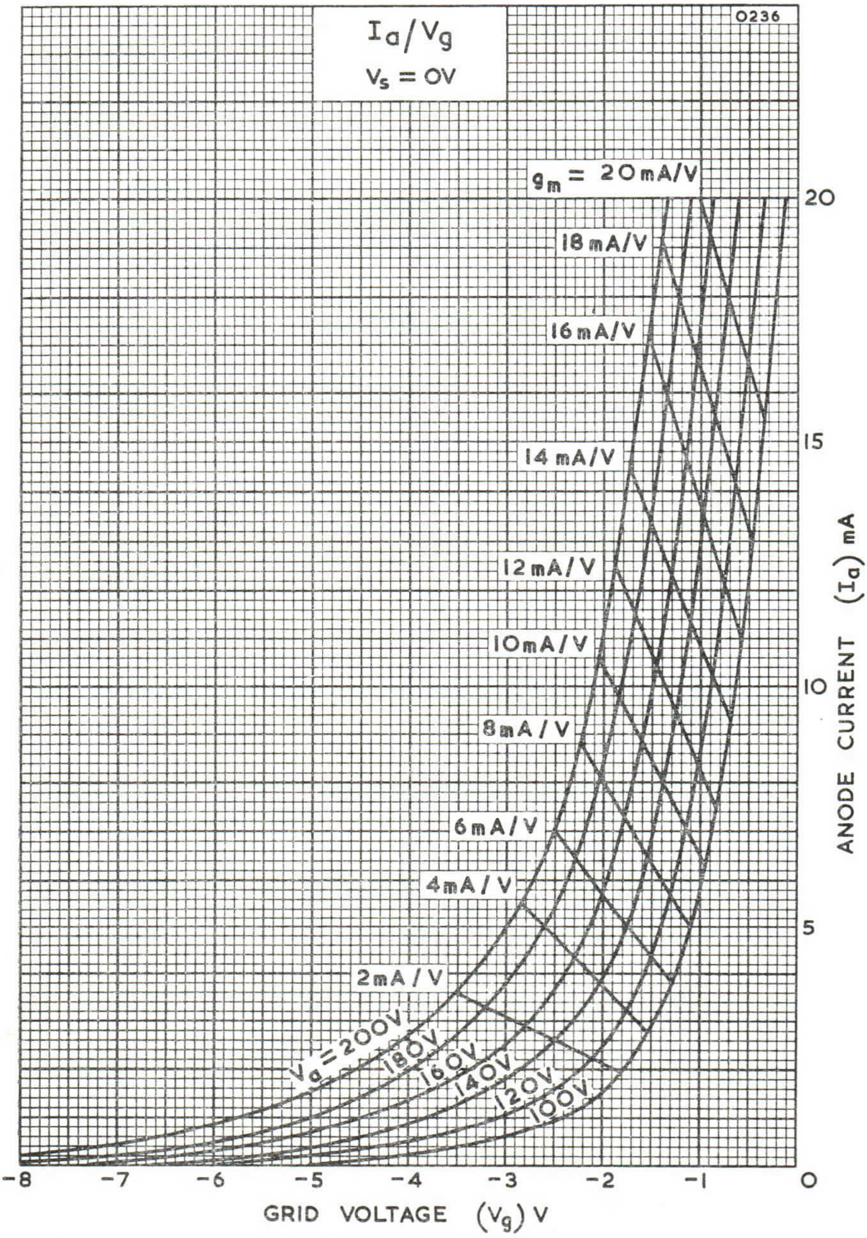
CHARACTERISTICS

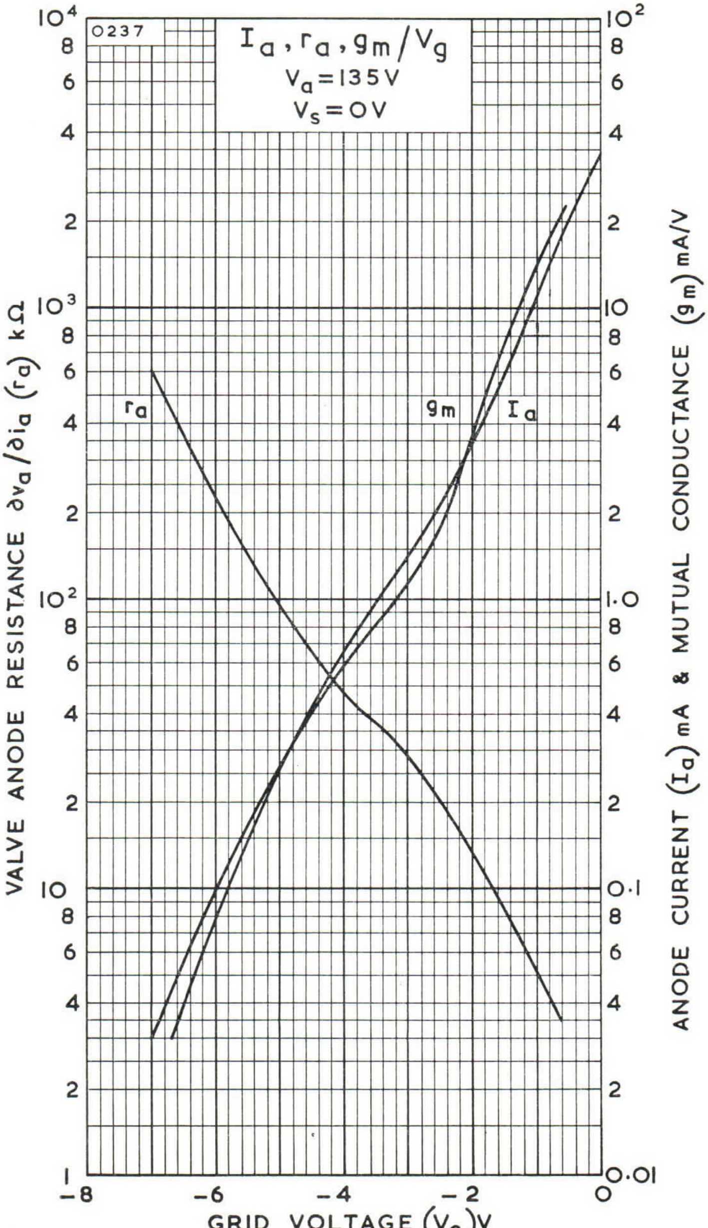
Anode Voltage	V_a	135	V
Shield Voltage	V_s	0	V
Grid Voltage	V_g	–1·0	V
Anode Current	I_a	11·5	mA
Mutual Conductance	g_m	14·5	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	5·25	kΩ
Amplification Factor	μ	76	

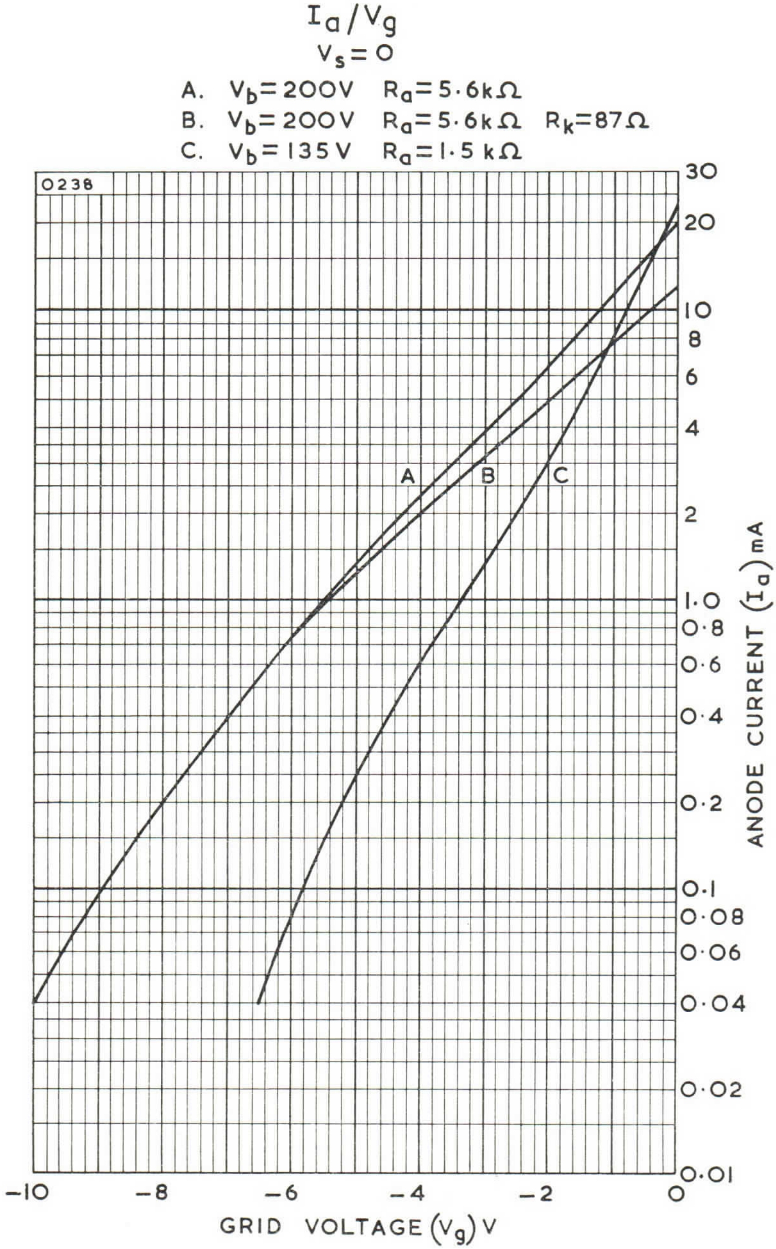
TYPICAL OPERATION

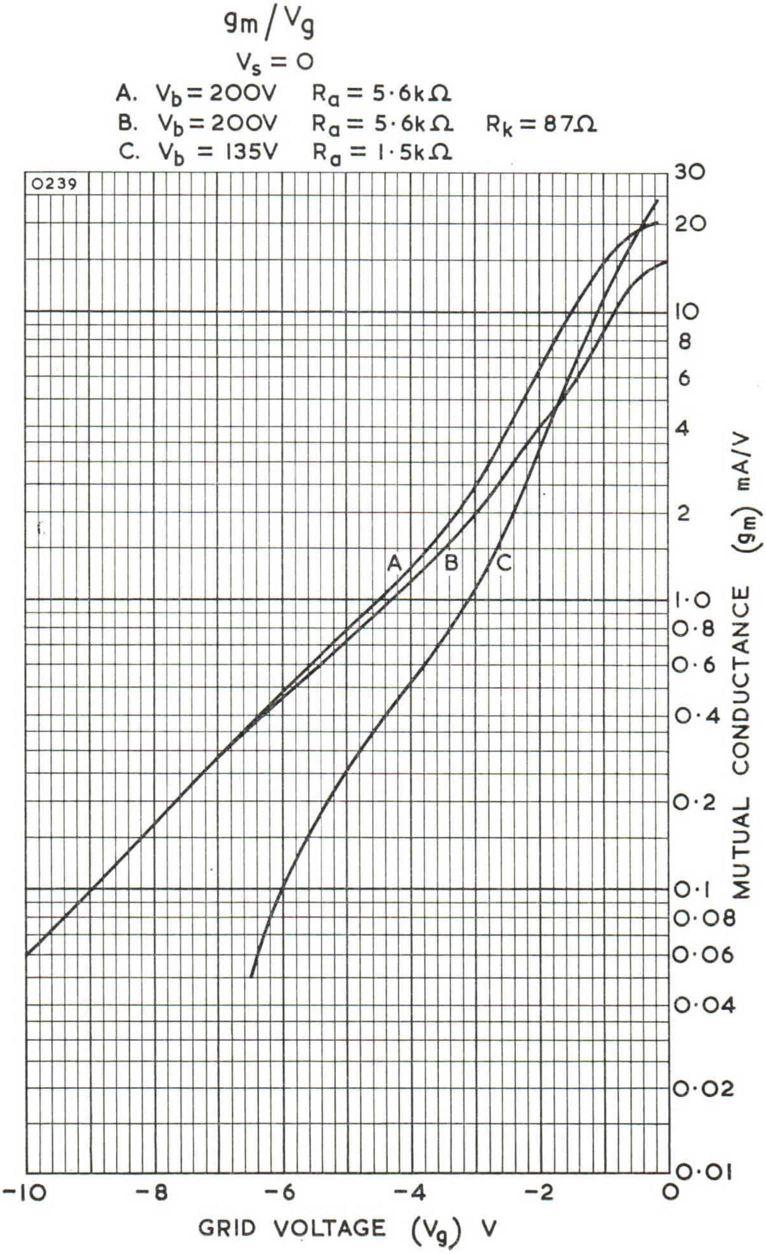
Supply Voltage	V_b	135	200	200	V
Anode Load Resistance	R_a	1·5	5·6	5·6	kΩ
Shield Voltage	V_s	0	0	0	V
Cathode Resistance	R_k	0	0	87	Ω
Anode Current	I_a	16·5	16·5	11·5	mA
Grid Current	I_g	20	20	0	μA
Mutual Conductance	g_m	20	20	14·5	mA/V
Amplification Factor	μ	84	84	76	
Grid Voltage for gm reduction 10 : 1	$V_{g(gm/10)}$	–2·3	–3·2	–3·8	V
Grid Voltage for gm reduction 100 : 1	$V_{g(gm/100)}$	–5·3	–7·7	–8·3	V

THORN — A E I RADIO VALVES & TUBES LTD.

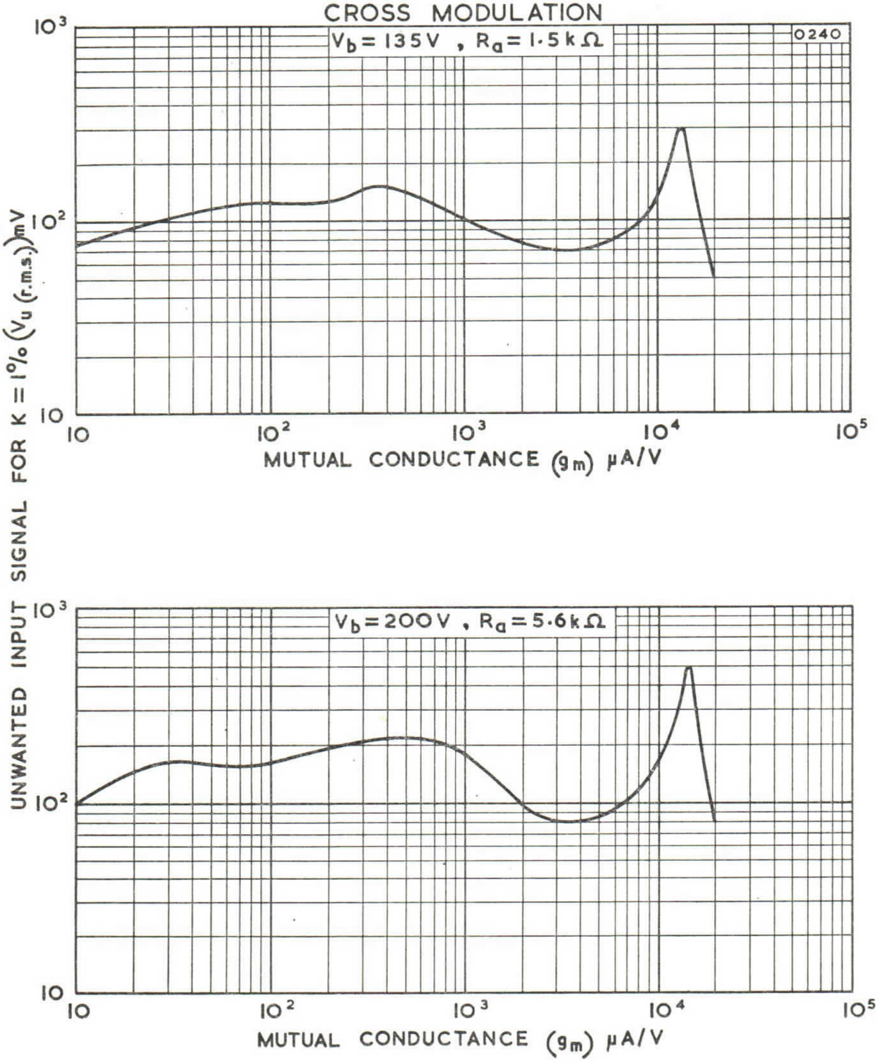

0236
I_a/V_g
$V_s = 0V$
g_m = 20mA/V
18 mA/V
16 mA/V
14 mA/V
12 mA/V
10mA/V
8mA/V
6mA/V
4mA/V
2mA/V
V_a=200V
180V
160V
140V
120V
100V
20
15
10
5
0
ANODE CURRENT (I_a) mA
−8
−7
−6
−5
−4
−3
−2
−1
GRID VOLTAGE (V_g) V


0237
$I_a, r_a, g_m / V_g$
$V_a = 135V$
$V_s = 0V$
r_a
g_m
I_a
10^4
8
6
4
2
10^3
8
6
4
2
10^2
8
6
4
2
10
8
6
4
2
1
10^2
8
6
4
2
10
8
6
4
2
1.0
8
6
4
2
0·1
8
6
4
2
0·01
−8
−6
−4
−2
0
GRID VOLTAGE (V_g)V
VALVE ANODE RESISTANCE $\partial v_a/\partial i_a$ (r_a) kΩ
ANODE CURRENT (I_a) mA & MUTUAL CONDUCTANCE (g_m) mA/V


I_a/V_g
$V_s=0$
A. $V_b=200V$ $R_a=5{\cdot}6k\Omega$
B. $V_b=200V$ $R_a=5{\cdot}6k\Omega$ $R_k=87\Omega$
C. $V_b=135V$ $R_a=1{\cdot}5k\Omega$
0238
A
B
C
30
20
10
8
6
4
2
1.0
0·8
0·6
0·4
0·2
0·1
0·08
0·06
0·04
0·02
0·01
ANODE CURRENT (I_a) mA
−10
−8
−6
−4
−2
0
GRID VOLTAGE (V_g) V

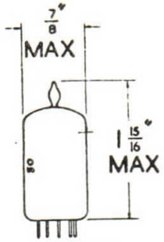

gm / Vg
Vs = O
A. Vb = 200V Ra = 5·6kΩ
B. Vb = 200V Ra = 5·6kΩ Rk = 87Ω
C. Vb = 135V Ra = 1·5kΩ
0239
A
B
C
30
20
10
8
6
4
2
1·0
0·8
0·6
0·4
0·2
0·1
0·08
0·06
0·04
0·02
0·01
MUTUAL CONDUCTANCE (gm) mA/V
−10
−8
−6
−4
−2
0
GRID VOLTAGE (Vg) V

CROSS MODULATION



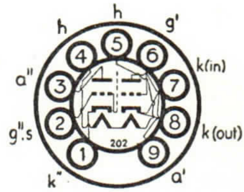
BRIMAR VALVES

Current Equipment Type



B9A Base

TYPE **PCC84**
MINIATURE
HIGH SLOPE
DOUBLE TRIODE



The BRIMAR PCC84 consists of two separate high slope triode units designed for use in VHF cascode amplifiers. Normally, triode 1 is operated as a grounded cathode stage directly coupled to triode 2 which is connected as a grounded grid stage. This gives a low noise input amplifier for use in television receivers for Band III. The shield connected to the grid of triode 2 keeps coupling between the two units to a minimum.

Heater Current	0.3 amp.
Heater Voltage	7.0 volts

RATINGS

Anode Voltage ($I_a = 0$)	550 volts max.
Anode Voltage	180 volts max.
Anode Dissipation (either triode separately)	2.0 watts max.
Total Anode Dissipation (both triodes operating)	2.5 watts max.
Negative Grid Voltage	−50 volts max.
Grid Resistance Triode 1	500 k ohms max.
Grid Resistance Triode 2 (with autobias)†	20 k ohms max.
Grid Resistance Triode 2 (with fixed bias)	500 k ohms max.
Cathode Current (each triode)	18 mA max.
Heater-Cathode 1 potential	90 volts max.
Heater-Cathode 2 potential (heater positive)	90 volts max.
Heater-Cathode 2 potential (heater negative)*	250 volts max.
Resistor between Heater and Cathode	20 k ohms max.

** Maximum D.C. component 180 volts.*

† In direct coupled cascode circuits.

OPERATING CHARACTERISTICS

Anode Voltage	90 volts
Grid Voltage	−1.5 volts
Anode Current	12 mA
Mutual Conductance	6.0 mA/V
Amplification Factor	24
Anode Impedance	4,000 ohms
Input Impedance of Triode 1 at 200 Mc/s:	
Separate Cathodes	4,000 ohms
Strapped Cathodes	2,000 ohms

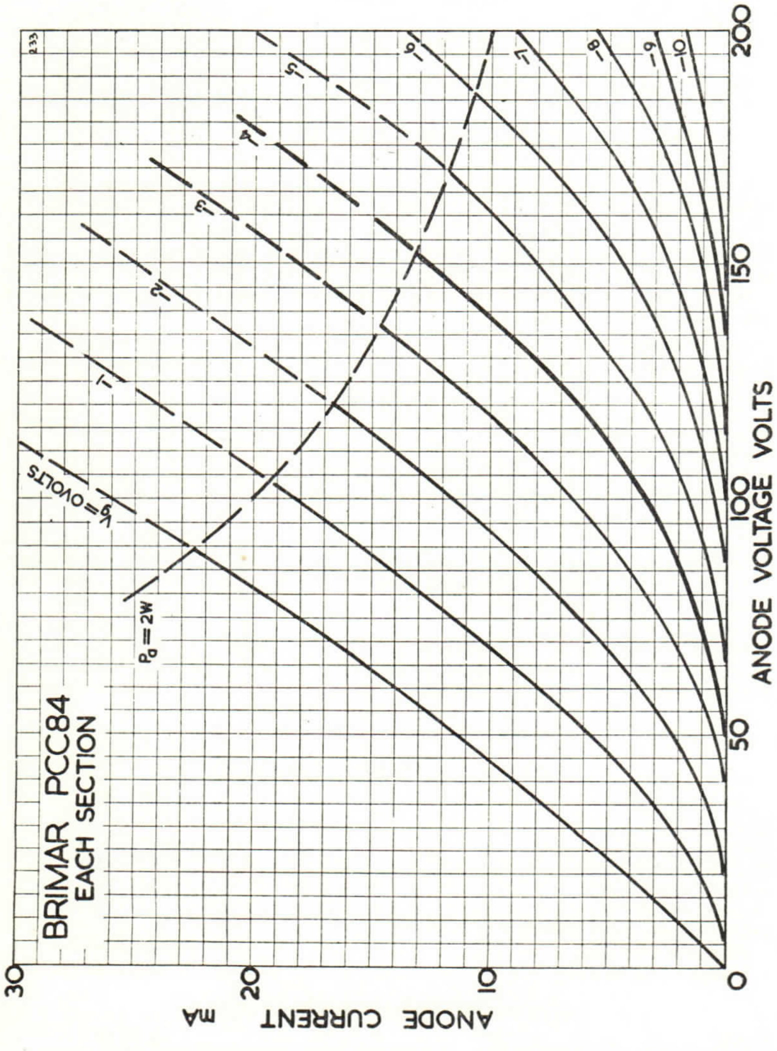
INTER-ELECTRODE CAPACITANCES *

$C_{a'-g'}$	1.1 pF	$C_{a''-k''}$	0.16 pF
$C_{in'}$	2.3 pF	$C_{k''-g''+h}$	4.9 pF
$C_{out'}$	0.5 pF	$C_{h-k''}$	2.8 pF
$C_{g'-h}$	0.25 pF max.	$C_{g'-a''}$	0.006 pF max.
$C_{a''-g''}$	2.3 pF	$C_{a'-a''}$	0.035 pF
$C_{a''-g''+h}$	2.5 pF	$C_{a'-k'+h+g''}$ ...	1.2 pF

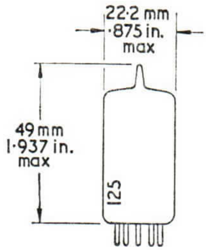
** Measured without external shield.*

VALVES

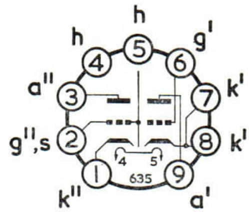
BRIMAR



BRIMAR VALVES PCC89



V.H.F.
DOUBLE TRIODE



B9A Base

GENERAL

This variable-mu frame grid double triode is intended for use as a cascode R.F. amplifier at frequencies up to 220 MHz.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	7·5	V

RATINGS—Each Section

Maximum Anode Dissipation	$p_{a(max)}$	1·8	W
Maximum Anode Voltage	$V_{a(max)}$	130	V
Maximum Negative Grid Voltage	$-V_{g(max)}$	50	V
Maximum Heater to Cathode″ Voltage Heater Negative	$V_{h\text{-}k''(max)}$	200	V
Maximum Cathode Current	$I_{k(max)}$	18	mA
Maximum Grid′ to Cathode′ Resistance	$R_{g'\text{-}k'(max)}$	1·0	MΩ
Maximum Grid″ to Cathode″ Resistance	$R_{g''\text{-}k''(max)}$	500	kΩ
Maximum Heater to Cathode Resistance	$R_{h\text{-}k(max)}$	20	kΩ

To fulfil hum requirements, $V_{h\text{-}k'(r.m.s.)}$ must be less than 50 V.

INTER-ELECTRODE CAPACITANCES*

Grid′ to Cathode′, Heater, Grid″, Shield	$c_{g'\text{-}k',h,g'',s}$	3·8	pF
Anode′ to Cathode′, Heater, Grid″, Shield	$c_{a'\text{-}k',h,g'',s}$	2·5	pF
Anode″ to Grid″, Heater, Shield	$c_{a''\text{-}g'',h,s}$	4·5	pF
Cathode″ to Grid″, Heater, Shield	$c_{k''\text{-}g'',h,s}$	6·3	pF
Anode′ to Grid′	$c_{a'\text{-}g'}$	1·9	pF
Grid′ to Heater	$c_{g'\text{-}h}$	<0·3	pF
Anode′ to Anode″	$c_{a'\text{-}a''}$	<0·015	pF
Grid′ to Anode″	$c_{g'\text{-}a''}$	<0·005	pF
Anode″ to Grid″	$c_{a''\text{-}g''}$	4·1	pF
Anode″ to Cathode″	$c_{a''\text{-}k''}$	<0·2	pF
Cathode″ to Heater	$c_{k''\text{-}h}$	2·9	pF

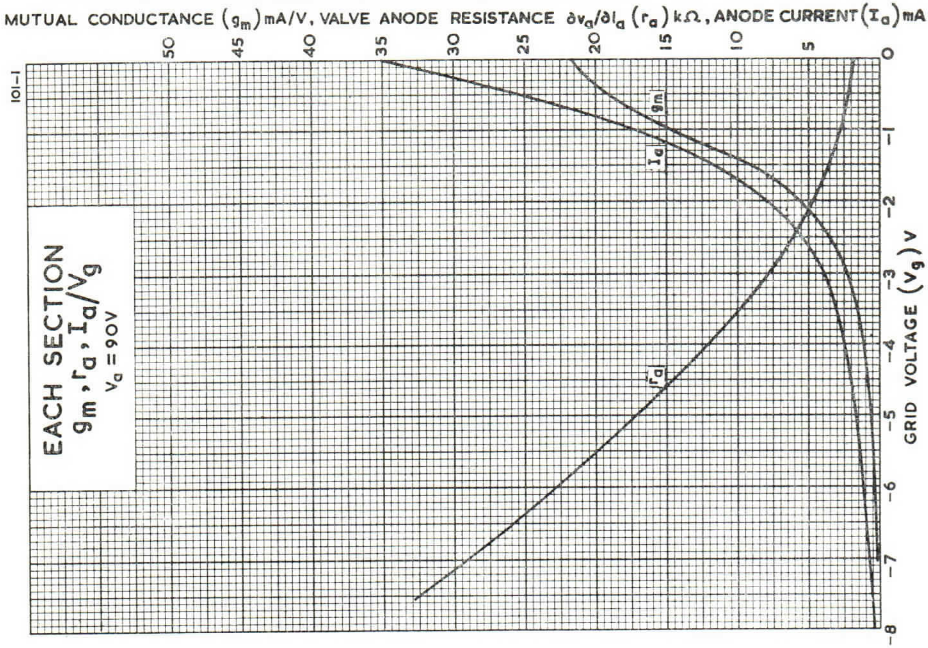
* Measured with an external shield.

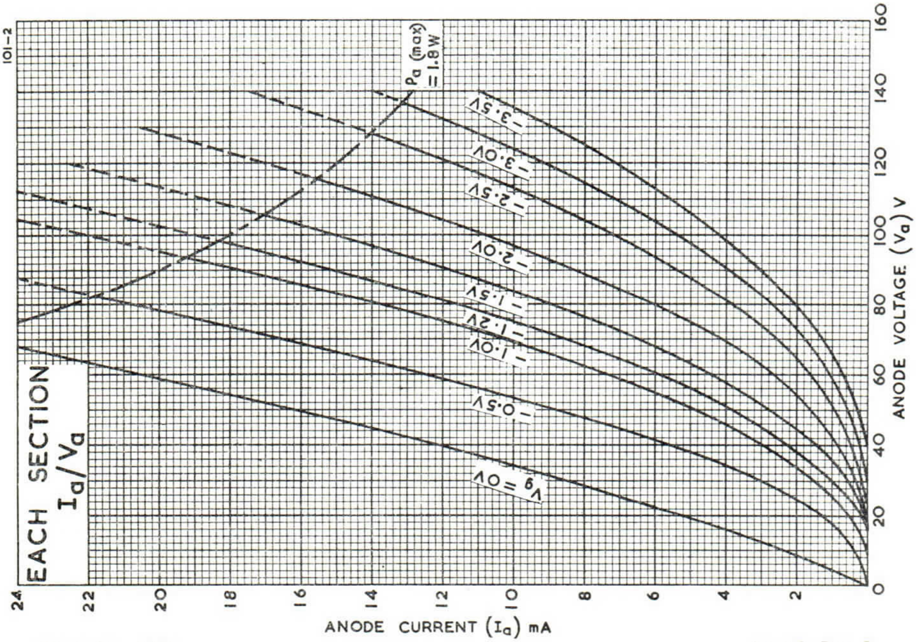
CHARACTERISTICS—Each Section

Anode Voltage	V_a	90	V
Grid Voltage	V_g	−1·2	V
Anode Current	I_a	15	mA
Mutual Conductance	g_m	12·3	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	2·9	kΩ
Amplification Factor	μ	36	

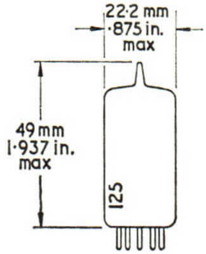
NOTE.—The triode on pins 6, 7, 8 and 9 should have the grounded cathode connection and that on pins 1, 2 and 3 should have the grounded grid connection. It is recommended that pins 7 and 8 be strapped.

THORN—A E I RADIO VALVES & TUBES LTD.

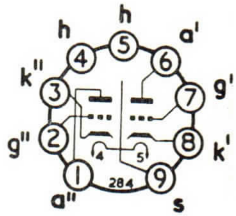

MUTUAL CONDUCTANCE (g_m) mA/V, VALVE ANODE RESISTANCE $\partial v_a/\partial I_a$ (r_a) kΩ, ANODE CURRENT (I_a) mA
GRID VOLTAGE (V_g) V
EACH SECTION
g_m, r_a, I_a/V_g
V_a = 90V
g_m
I_a
r_a
101-1


EACH SECTION
I_a/V_a
ANODE VOLTAGE (V_a) V
ANODE CURRENT (I_a) mA
P_a (max) = 1.8W
V_g = 0V
−0.5V
−1.0V
−1.2V
−1.5V
−2.0V
−2.5V
−3.0V
−3.5V
101-2

BRIMAR VALVES PCC189



V.H.F.
HIGH SLOPE
DOUBLE TRIODE



B9A Base

GENERAL

This variable-mu, low noise, high slope frame grid double triode is intended for use as a V.H.F. cascode amplifier.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	7·6	V

RATINGS—Each Section

Maximum Anode Dissipation	$p_{a(max)}$	1·8	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	V
Maximum Anode Voltage	$V_{a(max)}$	130	V
Maximum Negative Grid Voltage	$-V_{g(max)}$	50	V
Maximum Heater to Cathode′ Voltage	$V_{h-k'(max)}$	80	V
Maximum Heater to Cathode″ Voltage	$V_{h-k''(max)}$		
Heater Negative		180	V
Maximum Cathode Current	$I_{k(max)}$	22	mA
Maximum Grid′ to Cathode′ Resistance	$R_{g'-k'(max)}$	1·0	MΩ
Maximum Grid″ to Cathode″ Resistance	$R_{g''-k''(max)}$	500	kΩ
Maximum Heater to Cathode Resistance	$R_{h-k(max)}$	20	kΩ

INTER-ELECTRODE CAPACITANCES

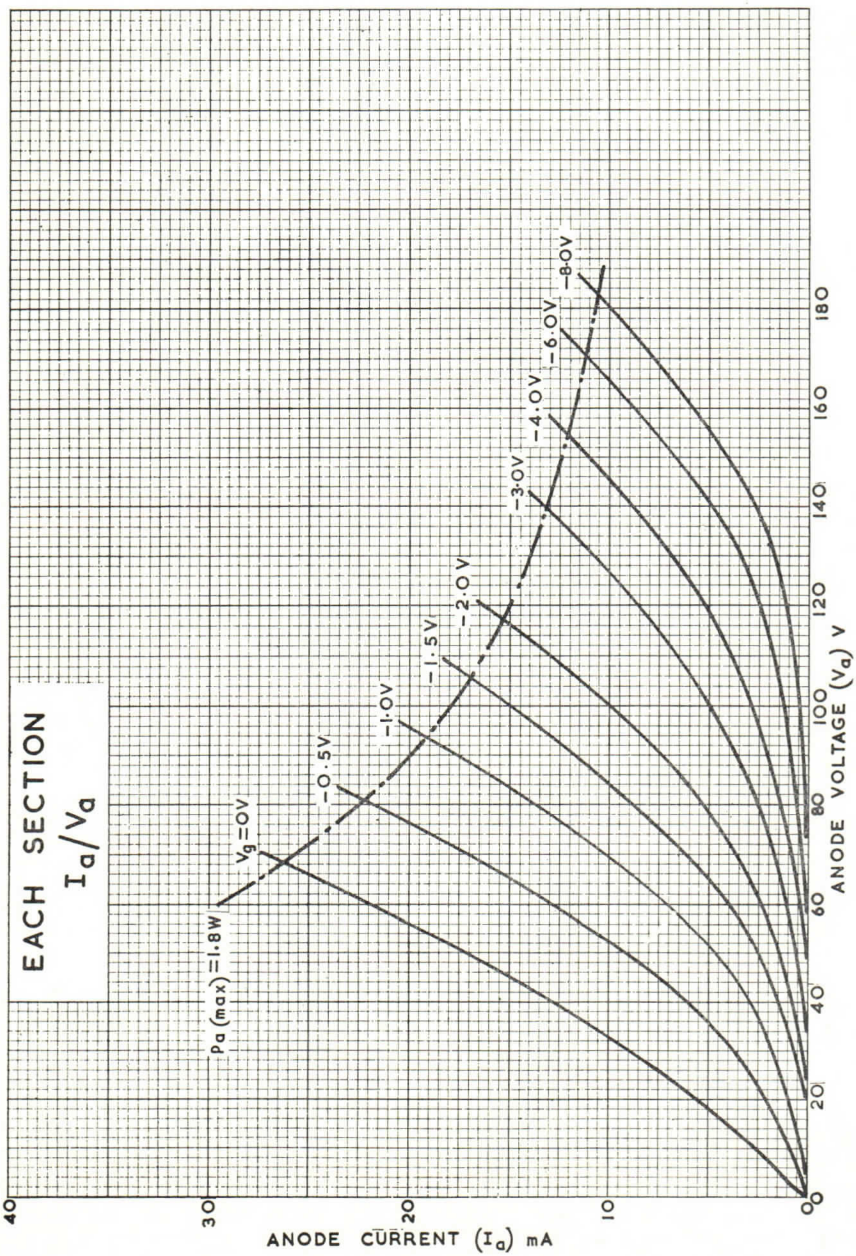
		Shielded	Unshielded	
Anode′ to Anode″	$c_{a'-a''}$	<0·015	<0·045	pF
Grid′ to Anode″	$c_{g'-a''}$	<0·004	<0·004	pF
Anode′ to Grid′	$c_{a'-g'}$	1·9	1·9	pF
Grid′ to Cathode′, Heater and Shield	$c_{g'-k',h,s}$	3·5	3·5	pF
Anode′ to Cathode′, Heater and Shield	$c_{a'-k',h,s}$	2·3	1·7	pF
Grid′ to Heater	$c_{g'-h}$	<0·28	<0·28	pF
Anode″ to Grid″	$c_{a''-g''}$	1·9	1·9	pF
Cathode″ to Grid″, Heater and Shield	$c_{k''-g'',h,s}$	6·0	6·0	pF
Anode″ to Grid″, Heater and Shield	$c_{a''-g'',h,s}$	4·0	3·4	pF
Cathode″ to Heater	$c_{k''-h}$	3·0	3·0	pF
Anode″ to Cathode″	$c_{a''-k''}$	0·17	0·18	pF

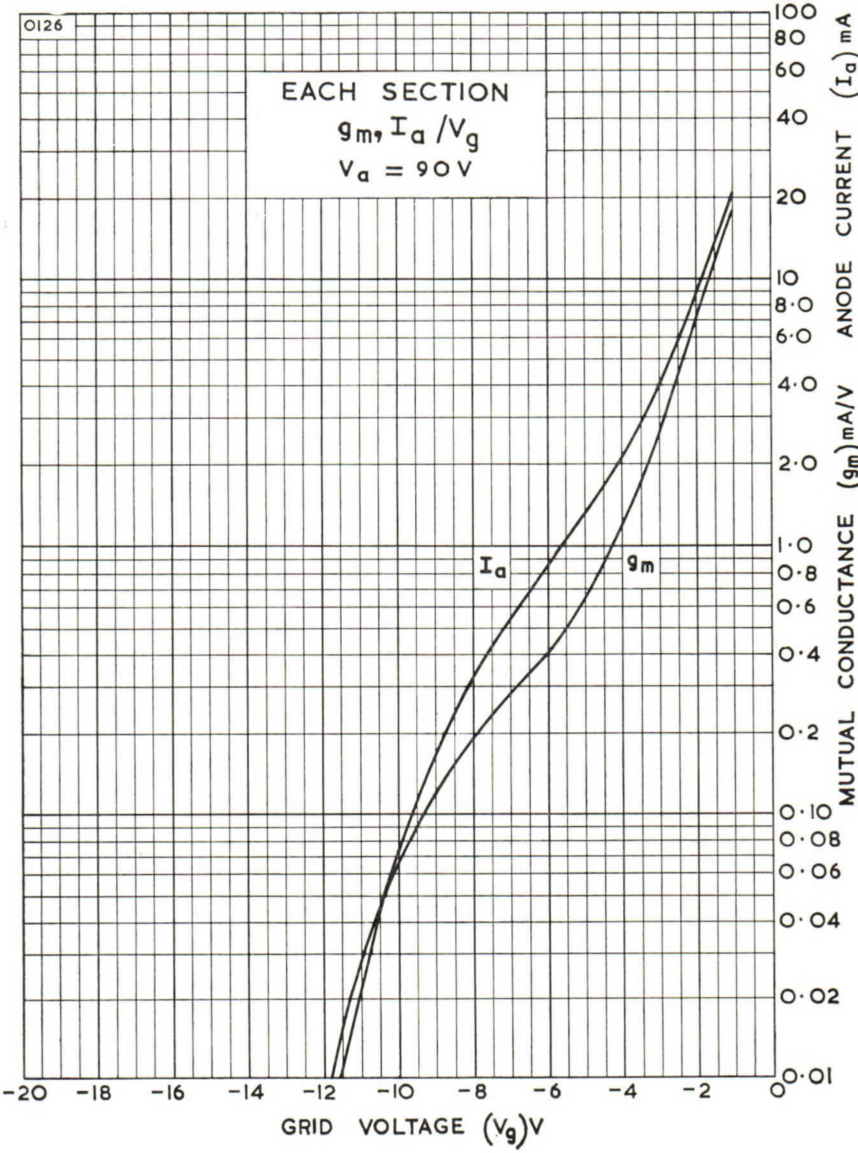
CHARACTERISTICS—Each Section

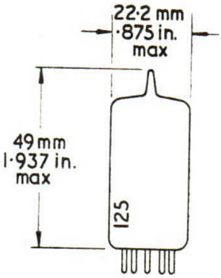
Anode Voltage	V_a	90	V
Grid Voltage	V_g	−1·4	V
Anode Current	I_a	15	mA
Mutual Conductance	g_m	12·5	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	2·5	kΩ
Amplification Factor	μ	34	
Grid Voltage for $g_m/20$	$V_{g(gm/20)}$	−5·0	V
Grid Voltage for $g_m/100$	$V_{g(gm/100)}$	−9·0	V

NOTE.—The triode on pins 6, 7 and 8 should have the grounded cathode connection and that on pins 1, 2 and 3 should have the grounded grid connection.

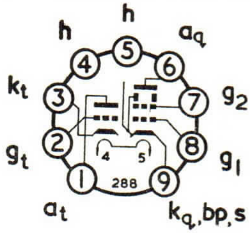
THORN—AEI RADIO VALVES & TUBES LTD.


EACH SECTION
I_a/V_a
V_g=0V
−0·5V
−1·0V
−1·5V
−2·0V
−3·0V
−4·0V
−6·0V
−8·0V
Pa (max) = 1·8W
ANODE VOLTAGE (V_a) V
ANODE CURRENT (I_a) mA
0 20 40 60 80 100 120 140 160 180
0 10 20 30 40


0126
EACH SECTION
$g_m, I_a / V_g$
$V_a = 90V$
I_a
g_m
100
80
60
40
20
10
8·0
6·0
4·0
2·0
1·0
0·8
0·6
0·4
0·2
0·10
0·08
0·06
0·04
0·02
0·01
ANODE CURRENT (I_a) mA
MUTUAL CONDUCTANCE (g_m) mA/V
−20 −18 −16 −14 −12 −10 −8 −6 −4 −2 0
GRID VOLTAGE (V_g) V



TRIODE BEAM TETRODE



B9A Base

GENERAL

This valve is a triode beam tetrode intended for use in the video output stages of A.C./D.C. mains television receivers. The characteristics of the triode section are identical to those of the ECC804 triode.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	10	V

RATINGS

		Triode	Tetrode	
Maximum Anode Dissipation	$p_{a(max)}$	1·5	2·5	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	—	1·3	W
Maximum Anode Voltage	$V_{a(max)}$	250	250	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	—	250	V
Maximum Heater to Cathode Voltage (R.M.S.)	$V_{h\text{-}k(r.m.s.)max}$	150*	150*	V

* Measured with respect to the higher potential heater pin.

INTER-ELECTRODE CAPACITANCES

		†	‡	§	
Grid 1 to Earth	$c_{g1\text{-}E}$	8·1	8·4	9·5	pF
Anode Tetrode to Earth	$c_{aq\text{-}E}$	2·7	3·0	4·1	pF
Grid 1 to Anode Tetrode	$c_{g1\text{-}aq}$	0·04	0·05	0·08	pF
Grid Triode to Earth	$c_{gt\text{-}E}$	2·2	2·4	3·2	pF
Anode Triode to Earth	$c_{at\text{-}E}$	1·9	2·1	2·8	pF
Grid Triode to Anode Triode	$c_{gt\text{-}at}$	2·4	2·5	2·8	pF
Anode Triode to Anode Tetrode	$c_{at\text{-}aq}$	0·012	0·017	0·019	pF
Grid Triode to Grid 1	$c_{gt\text{-}g1}$	0·004	0·007	0·011	pF
Anode Triode to Grid 1	$c_{at\text{-}g1}$	0·01	0·02	0·03	pF
Anode Tetrode to Grid Triode	$c_{aq\text{-}gt}$	0·004	0·007	0·01	pF

† In fully shielded socket without can.

‡ With holder capacitance balanced out. (Holder as below.)

§ Total capacitance including B9A nylon phenolic holder without skirt or radial shield. (AEI holder type VH19/902.)

"Earth" denotes the electrodes of any second valve section and the remaining earthy potential electrodes of the section under measurement, heater and shields joined to cathode.

THORN—A E I RADIO VALVES & TUBES LTD.

CHARACTERISTICS

		Triode	Tetrode	
Anode Voltage	V_a	150	180	V
Screen Grid Voltage	V_{g2}	—	180	V
Anode Current	I_a	10	10	mA
Mutual Conductance	g_m	3·7	12·5	mA/V
Amplification Factor	μ	18	—	

TYPICAL OPERATION—Video Amplifier

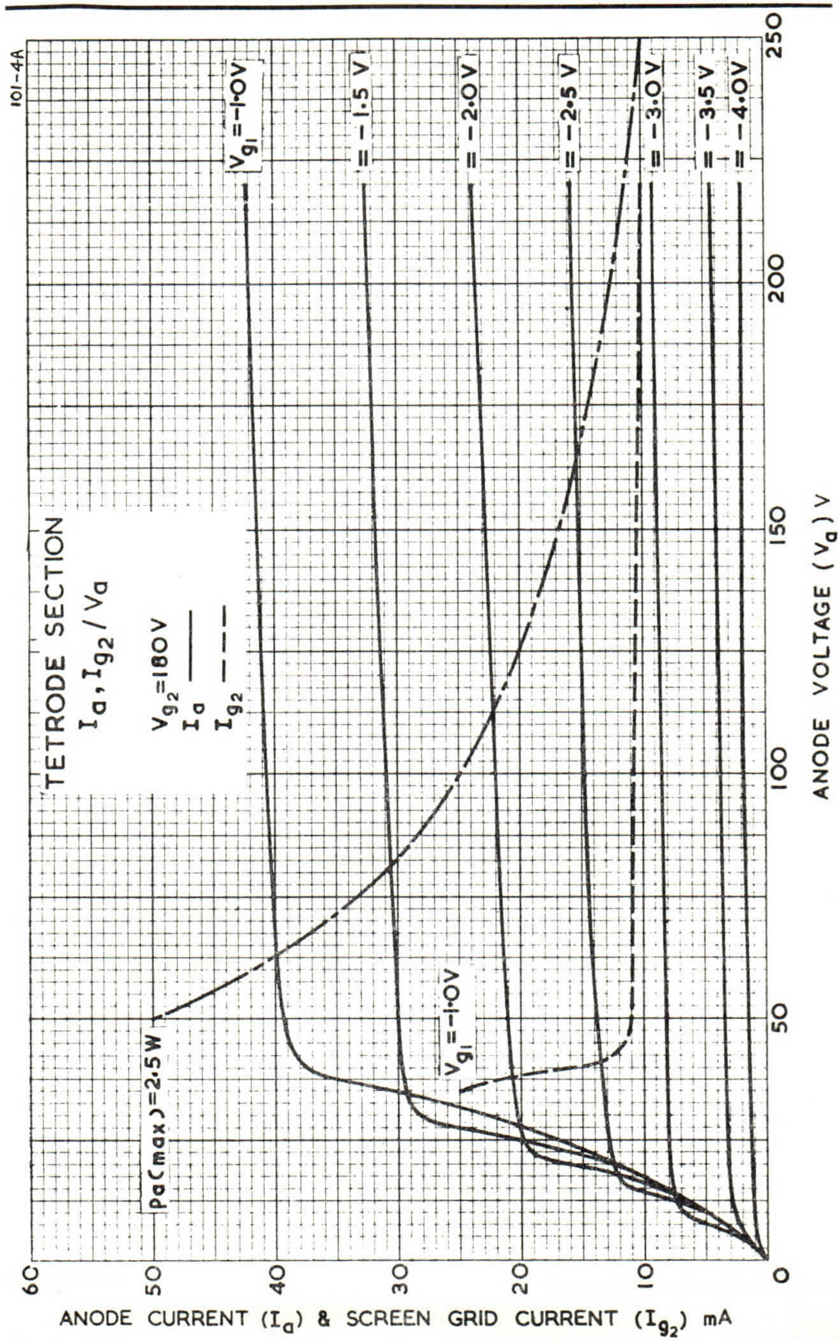
The stage should be designed to allow for valve spread and deterioration during life in addition to component variations. Values of peak anode current available for a new average valve and at the assumed end of life point for any valve are as follows:

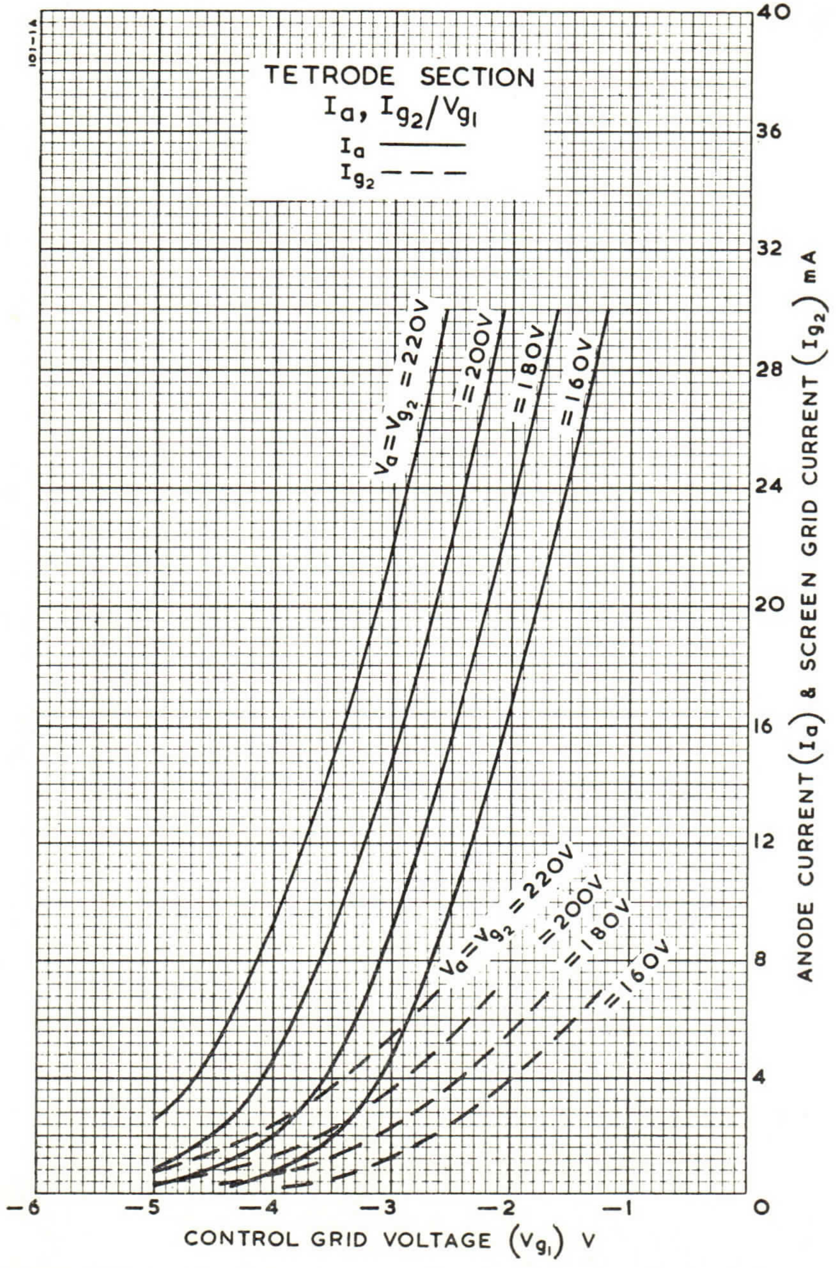
		ϕ	‖	
Anode Voltage	V_a	70	60	V
Screen Grid Voltage	V_{g2}	180	180	V
Grid Bias Voltage	V_{g1}	−1	−1	V
Anode Current	I_a	40	25	mA

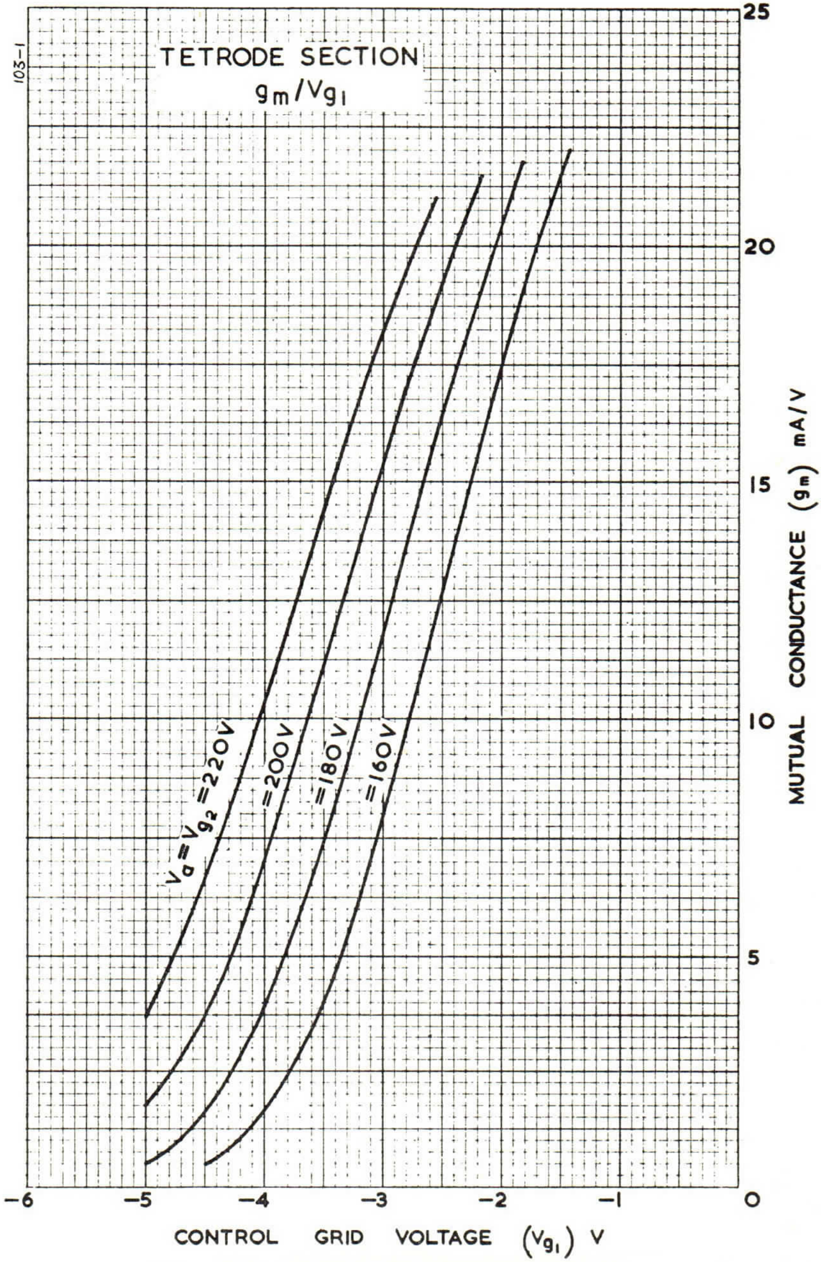
ϕ Average New Valve.

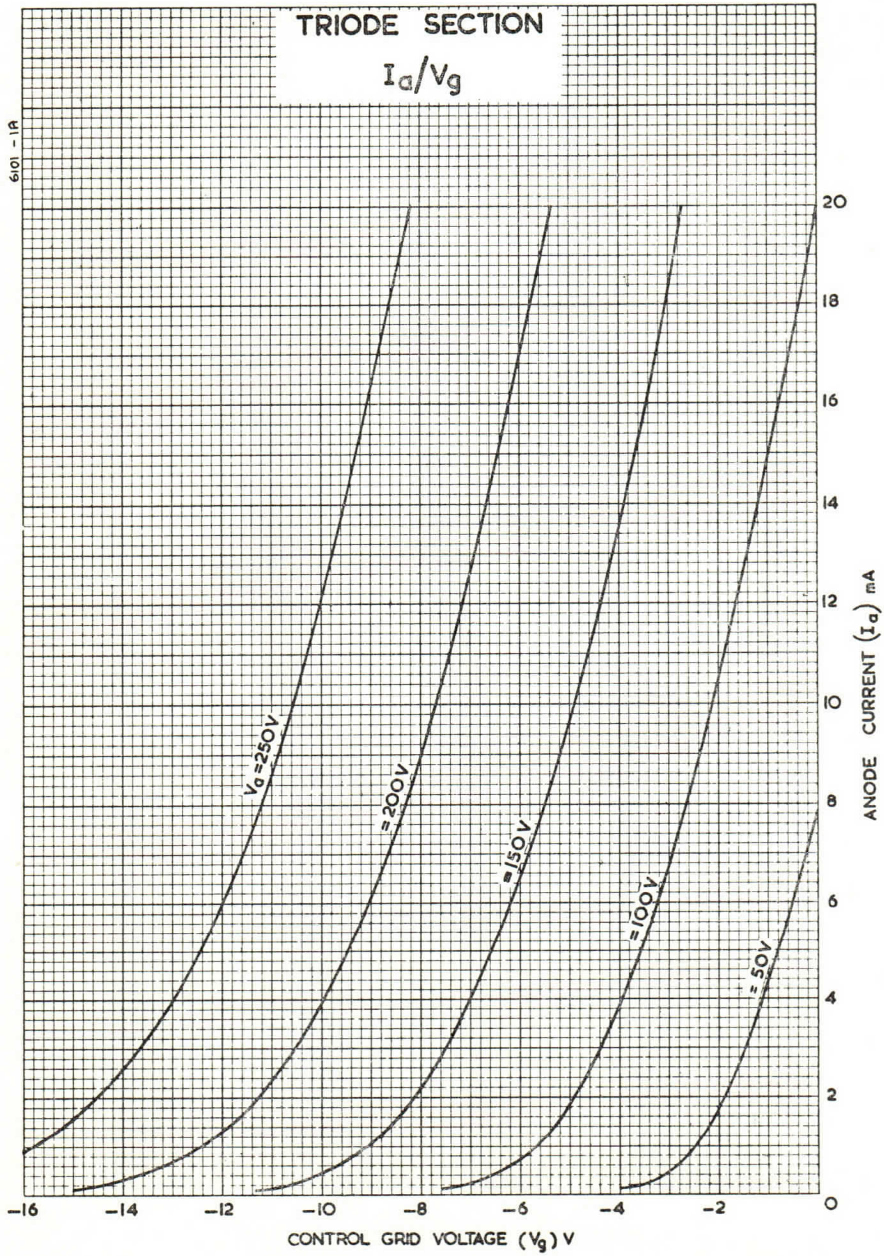
‖ Assumed End of Life Condition.

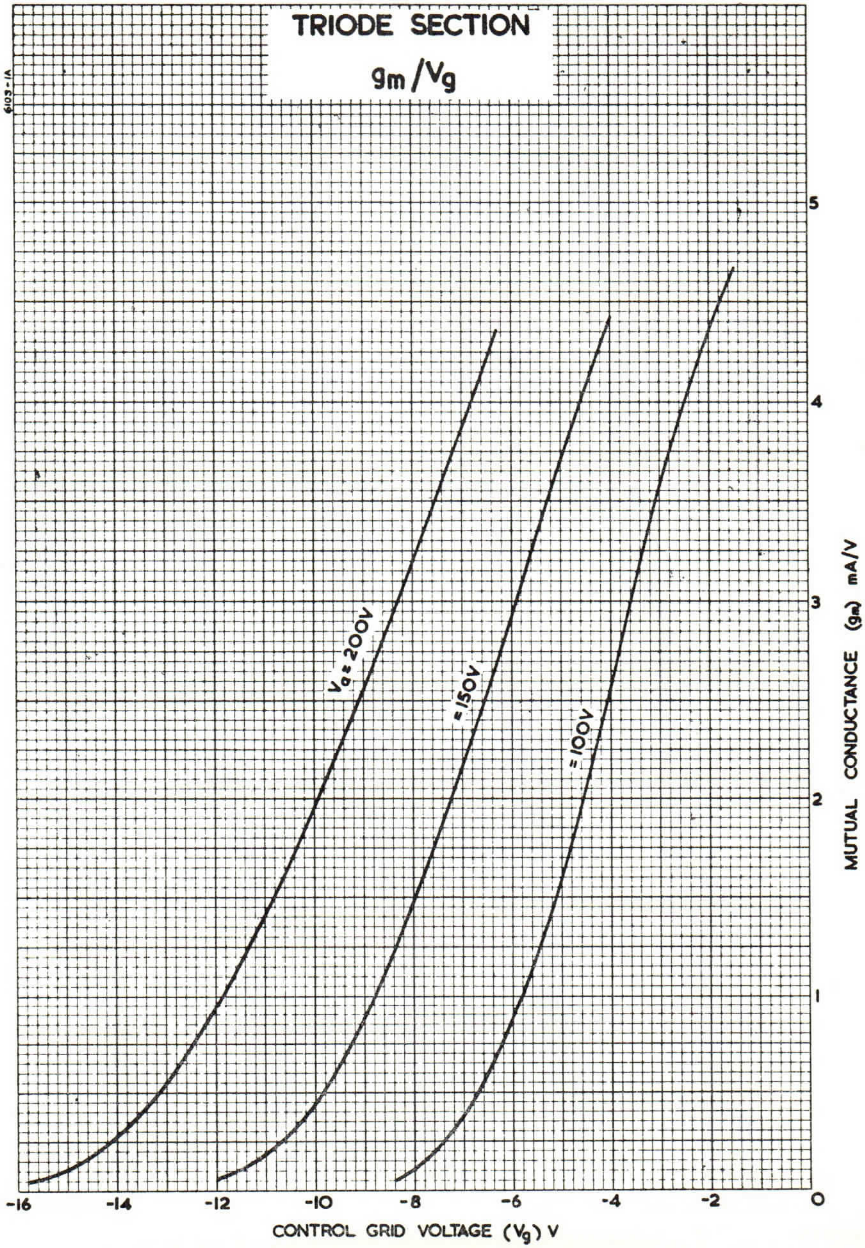
MOUNTING POSITION—Unrestricted


101-4A
TETRODE SECTION
$I_a, I_{g2} / V_a$
V_{g2}=180V
I_a ———
I_{g2} – – –
V_{g1}=-1·0V
=-1·5 V
=-2·0V
=-2·5 V
=-3·0V
=-3·5 V
=-4·0V
V_{g1}=-1·0V
pa(max)=2·5W
ANODE VOLTAGE (V_a) V
0
50
100
150
200
250
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA
60
50
40
30
20
10
0

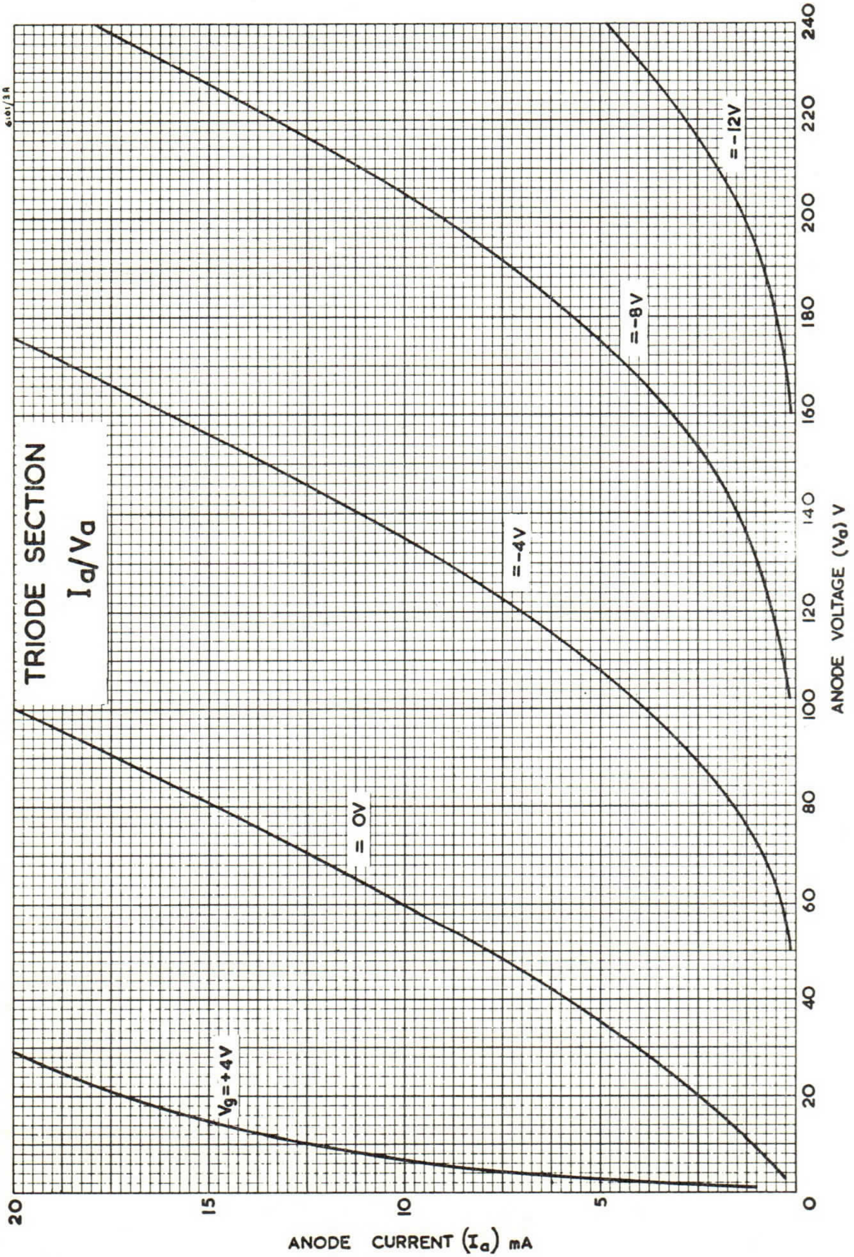

101-1A
TETRODE SECTION
Ia, Ig2/Vg1
Ia
Ig2
Va=Vg2 =220V
=200V
=180V
=160V
Va=Vg2 =220V
=200V
=180V
=160V
40
36
32
28
24
20
16
12
8
4
0
−6
−5
−4
−3
−2
−1
CONTROL GRID VOLTAGE (Vg1) V
ANODE CURRENT (Ia) & SCREEN GRID CURRENT (Ig2) mA

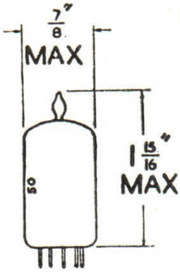

103-1
TETRODE SECTION
g_m/V_{g_1}
$V_a=V_{g_2}=220V$
$=200V$
$=180V$
$=160V$
25
20
15
10
5
0
−6
−5
−4
−3
−2
−1
CONTROL GRID VOLTAGE (V_{g_1}) V
MUTUAL CONDUCTANCE (g_m) mA/V


TRIODE SECTION
I_a/V_g
6101 - 1A
V_a=250V
=200V
=150V
=100V
= 50V
20
18
16
14
12
10
8
6
4
2
0
ANODE CURRENT (I_a) mA
−16
−14
−12
−10
−8
−6
−4
−2
CONTROL GRID VOLTAGE (V_g) V



TRIODE SECTION
gm/Vg
Va = 200V
= 150V
= 100V
5
4
3
2
1
0
-16
-14
-12
-10
-8
-6
-4
-2
CONTROL GRID VOLTAGE (Vg) V
MUTUAL CONDUCTANCE (gm) mA/V

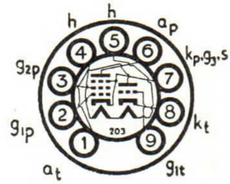

TRIODE SECTION
Ia/Va
Vg=+4V
= 0V
=-4V
=-8V
=-12V
0 20 40 60 80 100 120 140 160 180 200 220 240
ANODE VOLTAGE (Va) V
20 15 10 5 0
ANODE CURRENT (Ia) mA



B9A (Noval) Base

Current Equipment Type

TYPE **PCF80** MINIATURE TRIODE PENTODE FREQUENCY CHANGER



The BRIMAR PCF80 is a triode pentode with separate cathodes designed for use as a frequency changer in television equipment up to 220 Mc/s.

Heater Current	0.3 amp.
Heater Voltage	9.0 volts

RATINGS

	Triode	Pentode	
Anode Voltage (Ia = 0)	550	550	volts max.
Anode Voltage	250	250	volts max.
Anode Dissipation	1.5	1.7	watts max.
Screen Voltage (Ia = 0)	—	550	volts max.
Screen Voltage (Ik = 14 mA)	—	175	volts max.
Screen Voltage (Ik = 10 mA)	—	200	volts max.
Screen Dissipation (Pa > 1.2 W)	—	0.5	watts max.
Screen Dissipation (Pa < 1.2 W)	—	0.75	watts max.
Cathode Current	14	14	mA max.
Control Grid Resistance	500	—	k Ω max.
Control Grid Resistance (cathode bias)	—	1.0	M Ω max.
Control Grid Resistance (fixed bias)	—	500	k Ω max.
Heater-Cathode Potential (cathode negative)	100	100	volts max.
Heater-Cathode Potential (cathode positive)*	200	200	volts max.

* *Maximum d.c. component* 120 *volts.*

CHARACTERISTICS

	Triode	Pentode	
Anode Voltage	100	170	volts
Screen Voltage	—	170	volts
Control Grid Voltage	−2	−2	volts
Anode Current	14	10	mA
Screen Current	—	2.8	mA
Mutual Conductance	5	6.2	mA/V
Amplification Factor	20	—	
Inner Amplification Factor ($\mu g_1 - g_2$)	—	47	
Anode Impedance (approx.)	4	400	k Ω
Input Impedance at 50 Mc/s.	—	10	k Ω
Equivalent noise resistance	—	1.5	k Ω

TYPICAL OPERATION AS A MIXER (Pentode Section)

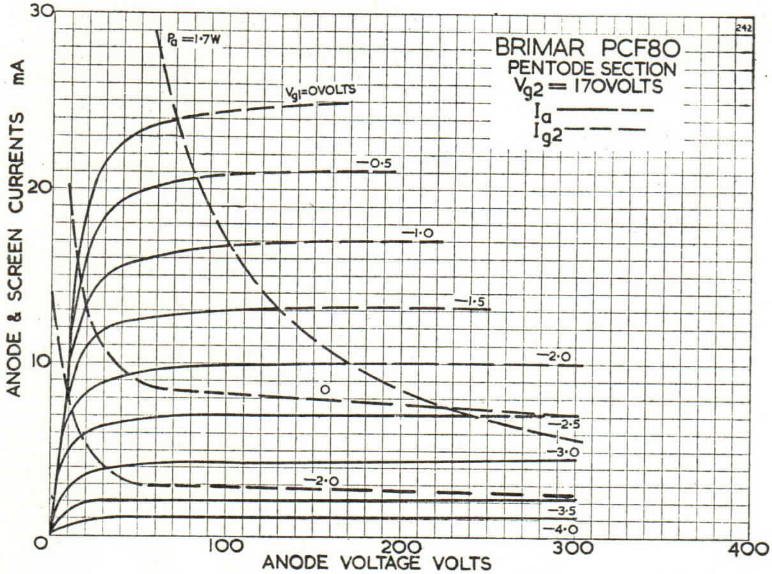
Anode Voltage	170	170	volts
Screen Voltage	170	170	volts
Grid Leak Resistor	100	100	k Ω
Cathode Bias Resistor	330	820	Ω
Heterodyne Voltage	3.5	3.5	volts rms
Anode Current	6.5	5.2	mA
Screen Current	2.0	1.5	mA
Grid Current	20	0	μA
Conversion Conductance	2.2	2.1	mA/V
Input Impedance	800	870	k Ω

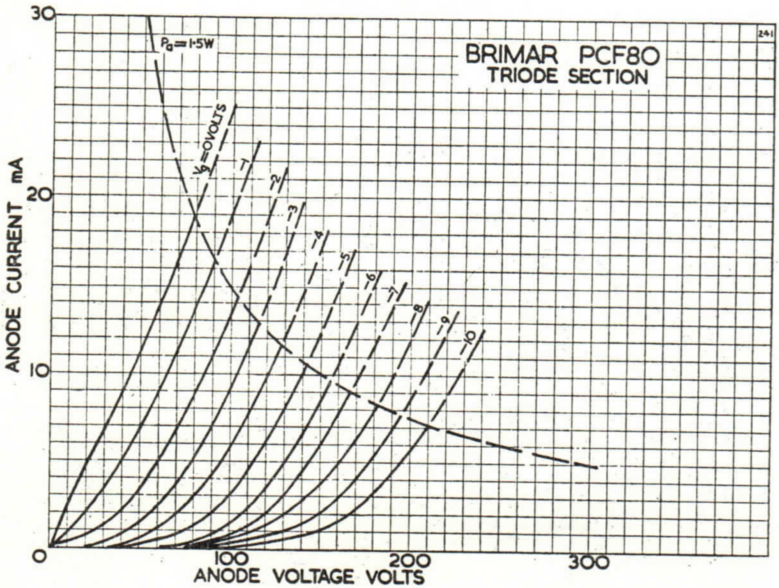
INTER-ELECTRODE CAPACITANCES (measured without external shield)

Pentode Grid 1 to Pentode Anode	0.025 pF
Pentode Input	5.2 pF
Pentode Output	3.4 pF
Triode Grid to Triode Anode	1.5 pF
Triode Grid to Triode Cathode and Heater	2.5 pF
Triode Anode to Triode Cathode and Heater	1.8 pF
Pentode Anode to Triode Anode	0.07 pF
Pentode Anode to Triode Grid	0.02 pF
Pentode Grid 1 to Triode Anode	0.16 pF

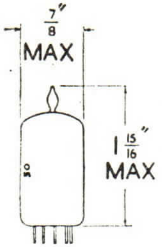
VALVES

BRIMAR





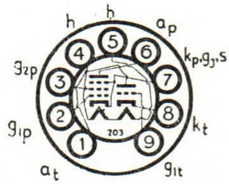
BRIMAR VALVES



B9A Base

Current Equipment Type

TYPE **PCF82**
MINIATURE
TRIODE PENTODE
FREQUENCY CHANGER



The BRIMAR PCF82 is a triode-pentode frequency changer featuring a high slope triode and a high input impedance pentode of high slope suitable for use in television receivers for Band III. The high input impedance at 200 Mc/s permits a sensibly constant conversion gain to be obtained over Bands I and III. The low value of C_{ag} for the pentode and $C_{ap,\ at}$ facilitate the reduction of oscillator radiation. The use of low oscillator grid current to obtain the required heterodyne voltage reduces the frequency drift of the oscillator to a minimum.

Heater Current ...	0.3 amp.
Heater Voltage ...	9.5 volts (nom.)

RATINGS

Heater—Cathode Potential (cathode positive) ...		220 volts max.
Heater—Cathode Potential (cathode negative) ...		90 volts max.
	Triode	*Pentode*
Anode Voltage ($I_a = 0$) ...	550	550 volts max.
Anode Voltage ...	300	300 volts max.
Screen (g_2) Voltage ...	—	300 volts max.
Anode Dissipation ...	2.7	2.8 watts max.
Screen Dissipation ...	—	0.5 watts max.
Positive D.C. Grid No. 1 Voltage ...	0	0 volts max.
Cathode Current ...	20	20 mA max.
Grid Resistance ...	1	1 megohm max.

CHARACTERISTICS

	Triode	*Pentode*
Anode Voltage ...	150	250 volts
Screen Voltage ...	—	110 volts
Cathode Bias Resistor ...	56	68 ohms
Anode Current ...	18	10 mA
Screen Current ...	—	3.5 mA
Mutual Conductance ...	8.5	5.2 mA/V
Anode Impedance (approx.) ...	5	400 k ohms
Amplification Factor ...	40	—
Grid No. 1 Voltage (for $I_a = 10\mu A$) ...	−12	−10 volts

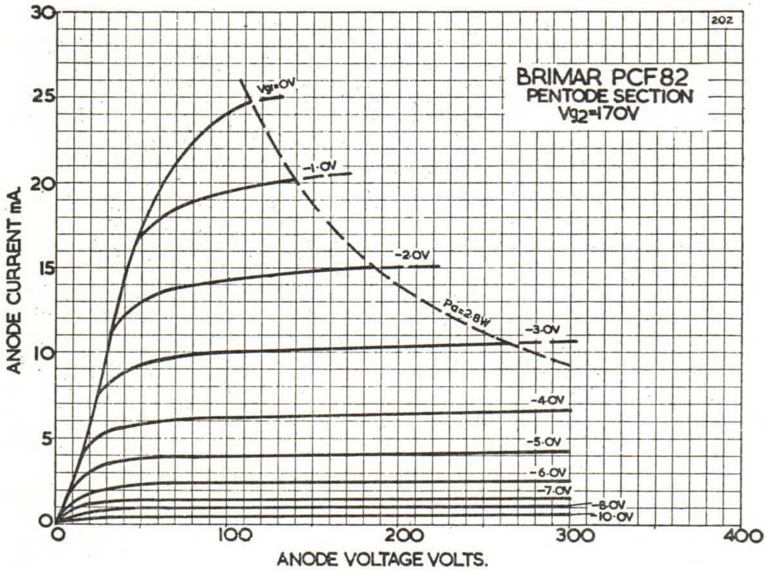
TYPICAL OPERATION AS MIXER

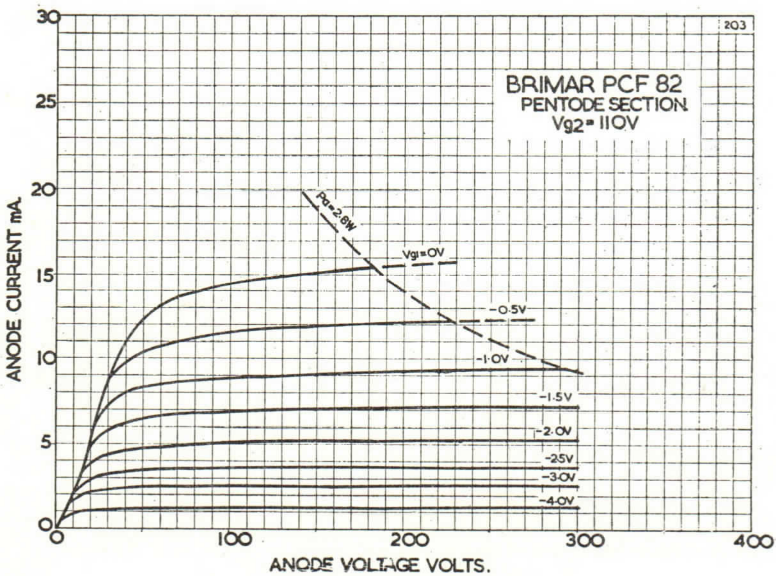
	Triode		*Pentode*
Anode Voltage ...	100	170	170 volts
Screen Voltage ...	—	110	170 volts
Cathode Bias Resistor ...	0	0	680 ohms
Grid Leak Resistor ...	27	270	100 k ohms
Anode Current ...	7.0	5.5	6.6 mA
Screen Current ...	—	2.0	2.5 mA
Heterodyne Voltage ...	—	3.0	5.0 volts peak
Conversion Conductance ...	—	1.6	1.65 mA/V

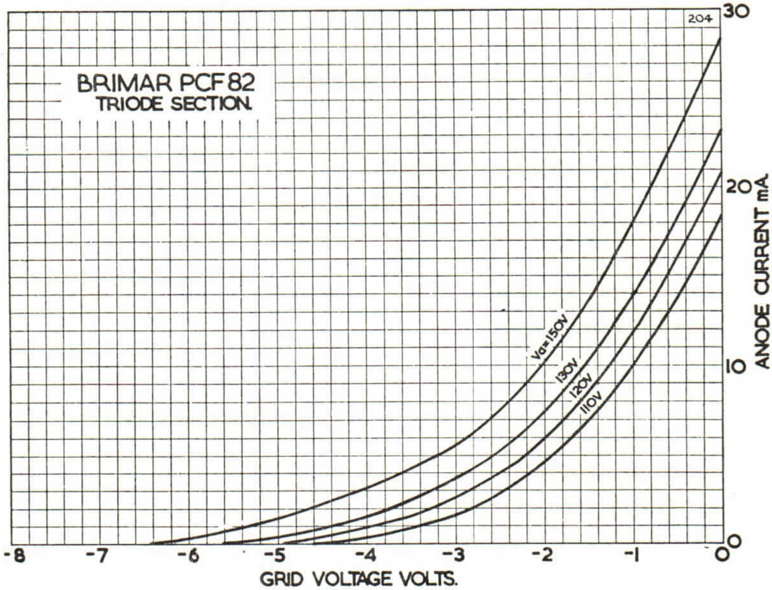
INTER-ELECTRODE CAPACITANCES *

Pentode Grid No. 1 to Pentode Anode ...	0.006 pF
Pentode Input ...	5.0 pF
Pentode Output ...	3.5 pF
Triode Grid to Triode Anode ...	1.8 pF
Triode Grid to Cathode ...	2.5 pF
Triode Anode to Cathode ...	1.0 pF
Cathode to Heater (either section) approx. ...	3.0 pF

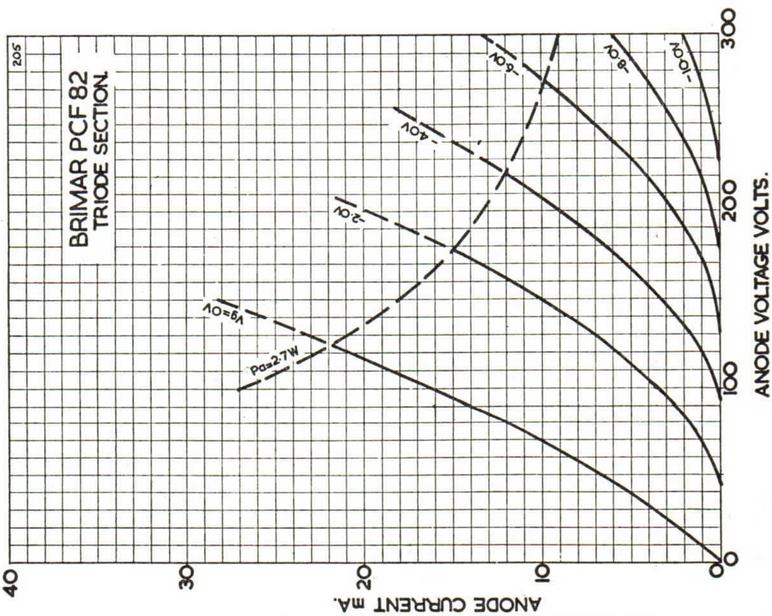
* *Measured with external shield.*


202
BRIMAR PCF82
PENTODE SECTION
Vg2=170V
Vg1=OV
-1·OV
-2·OV
Pa=2·8W
-3·OV
-4·OV
-5·OV
-6·OV
-7·OV
-8·OV
-10·OV
ANODE CURRENT mA.
0
5
10
15
20
25
30
100
200
300
400
ANODE VOLTAGE VOLTS.

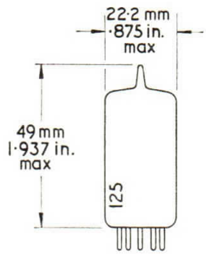

203
BRIMAR PCF 82
PENTODE SECTION
Vg2=110V
Pa=2·8W
Vg1=OV
-0·5V
-1·OV
-1·5V
-2·OV
-2·5V
-3·OV
-4·OV
ANODE CURRENT mA.
0
5
10
15
20
25
30
100
200
300
400
ANODE VOLTAGE VOLTS.



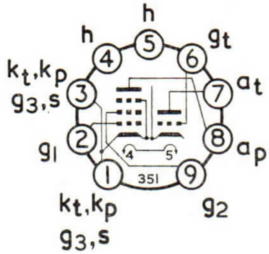
204
BRIMAR PCF82
TRIODE SECTION.
Va=150V
130V
120V
110V
30
20
10
0
ANODE CURRENT mA
-8
-7
-6
-5
-4
-3
-2
-1
0
GRID VOLTAGE VOLTS.



205
BRIMAR PCF 82
TRIODE SECTION.
Vg=0V
-2·0V
-4·0V
-6·0V
-8·0V
-10·0V
Pa=2·7W
300
200
100
0
ANODE VOLTAGE VOLTS.
40
30
20
10
0
ANODE CURRENT mA.



V.H.F.
TRIODE
PENTODE



B9A Base

GENERAL

This triode pentode is designed for use as a V.H.F. frequency changer. It has high conversion conductance and input impedance at 200 Mc/s.

Heater Current	I_h	0·3 A
Heater Voltage	V_h	8·0 V

RATINGS

		Pentode	Triode	
Maximum Anode Dissipation	$p_{a(max)}$	2·0	1·5	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	0·5	—	W
Maximum Anode Voltage	$V_{a(max)}$	250	125	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	150	—	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$	—	100*	V
Maximum Cathode Current	$I_{k(max)}$	18	15	mA
Maximum Grid to Cathode Resistance	$R_{g1\text{-}k(max)}$	250	500	kΩ

* To fulfil hum requirements on A.M. sound, it will be necessary for $V_{h\text{-}k}$ to be less than 50 V r.m.s. For intercarrier receivers $V_{h\text{-}k}$ should not exceed 75 V r.m.s.

INTER-ELECTRODE CAPACITANCES†

Input Pentode	$c_{in(p)}$	5·8	pF
Output Pentode	$c_{out(p)}$	3·5	pF
Grid 1 to Anode Pentode	$c_{g1\text{-}ap}$	0·012	pF
Grid 1 to Grid 2	$c_{g1\text{-}g2}$	1·7	pF
Grid Triode to Anode Triode	$c_{gt\text{-}at}$	2·0	pF
Grid Triode to Cathode and Heater	$c_{gt\text{-}k,h}$	2·4	pF
Anode Triode to Cathode and Heater	$c_{at\text{-}k,h}$	1·1	pF
Anode Pentode to Anode Triode	$c_{ap\text{-}at}$	0·125	pF
Anode Pentode to Grid Triode	$c_{ap\text{-}gt}$	0·014	pF
Grid 1 to Anode Triode	$c_{g1\text{-}at}$	<0·01	pF
Grid 1 to Grid Triode	$c_{g1\text{-}gt}$	<0·01	pF

† Measured without an external shield.

CHARACTERISTICS

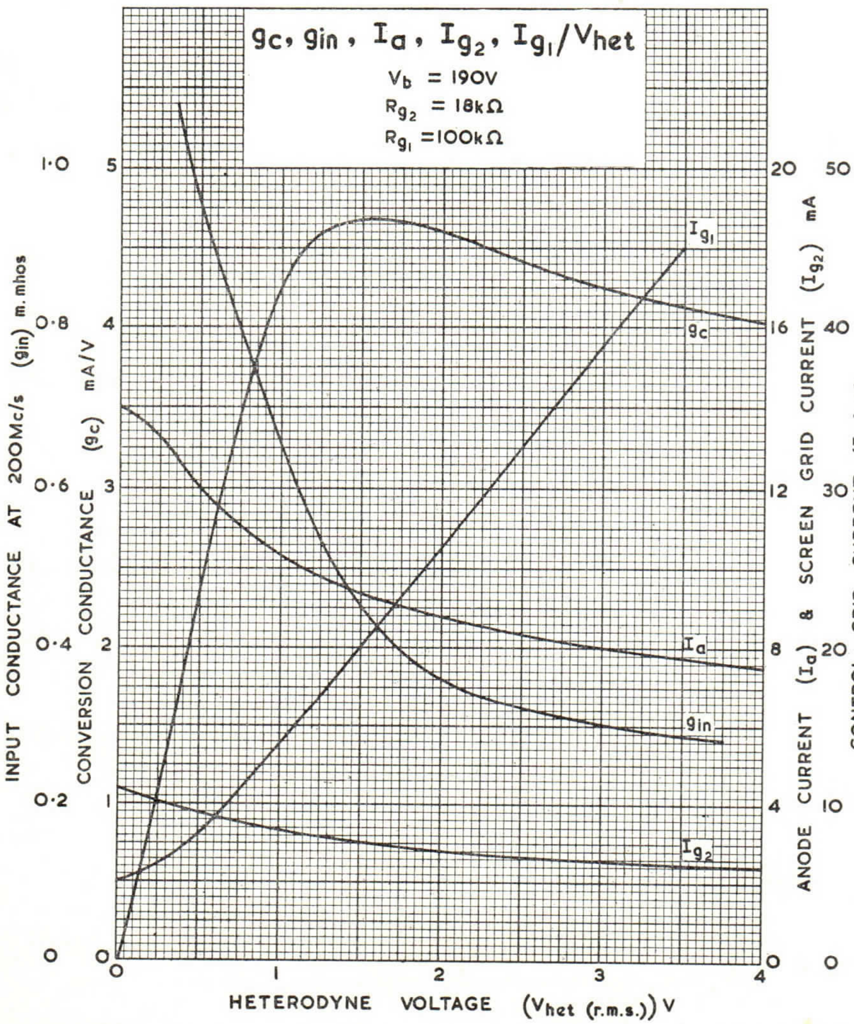
		Pentode	Triode	
Anode Voltage	V_a	170	100	V
Screen Grid Voltage	V_{g2}	150	—	V
Control Grid Voltage	V_{g1}	−1·2	−3·0	V
Anode Current	I_a	10	14	mA
Screen Grid Current	I_{g2}	3·3	—	mA
Mutual Conductance	g_m	12	5·7	mA/V
Amplification Factor	μ	—	17	
Inner Amplification Factor	$\mu_{g1\text{-}g2}$	70	—	
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	>350	—	kΩ
Equivalent Grid Noise Resistance	R_{eq}	1·0	—	kΩ

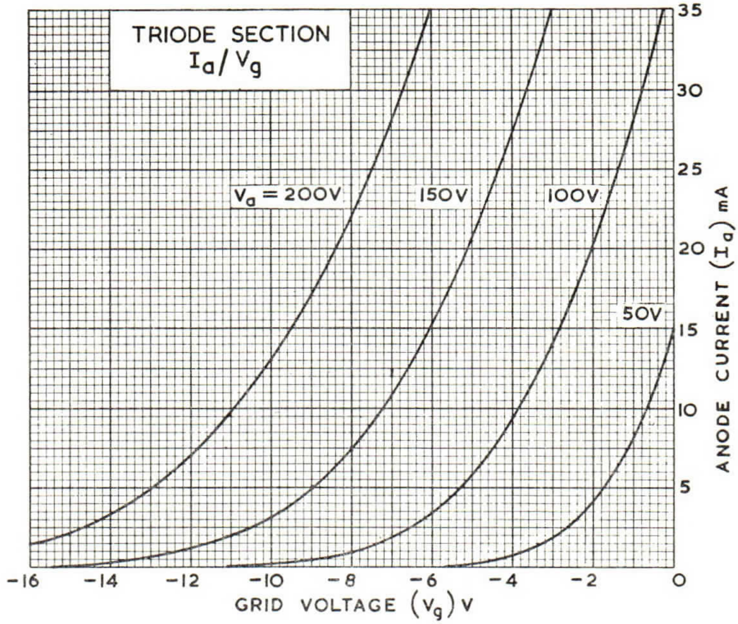
THORN—AEI RADIO VALVES & TUBES LTD.

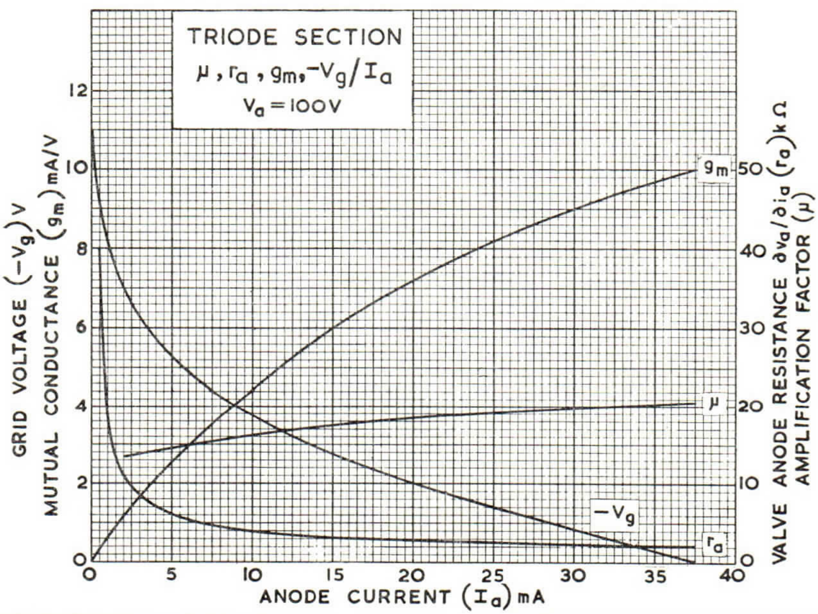
TYPICAL OPERATION—As a Frequency Changer

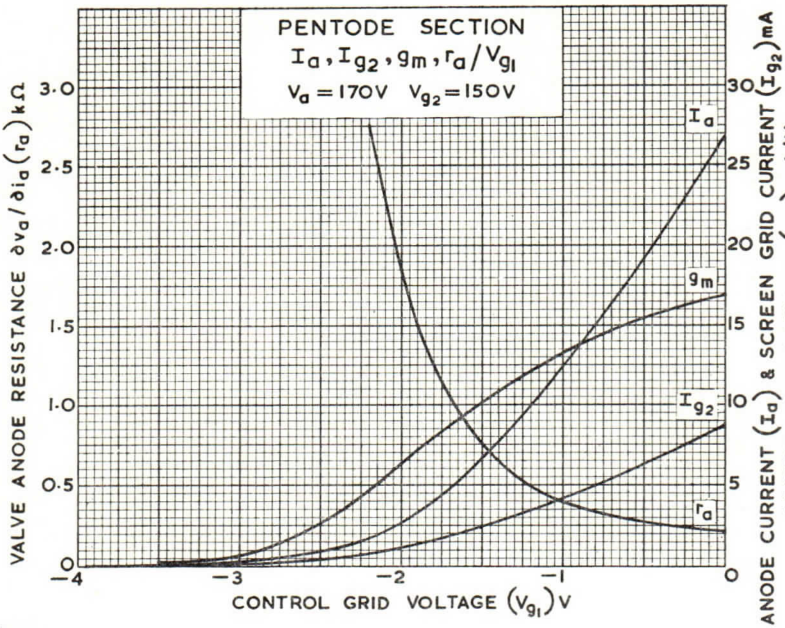
Anode Voltage	V_a	190	V
Screen Supply Voltage ($R_{g2} = 18k\Omega$)	$V_{g2(b)}$	190	V
Control Grid Resistance	R_{g1}	100	kΩ
Heterodyne Voltage (R.M.S.)	$V_{het(r.m.s.)}$	2·3	V
Anode Current	I_a	8·5	mA
Screen Grid Current	I_{g2}	2·7	mA
Conversion Conductance	g_c	4·5	mA/V

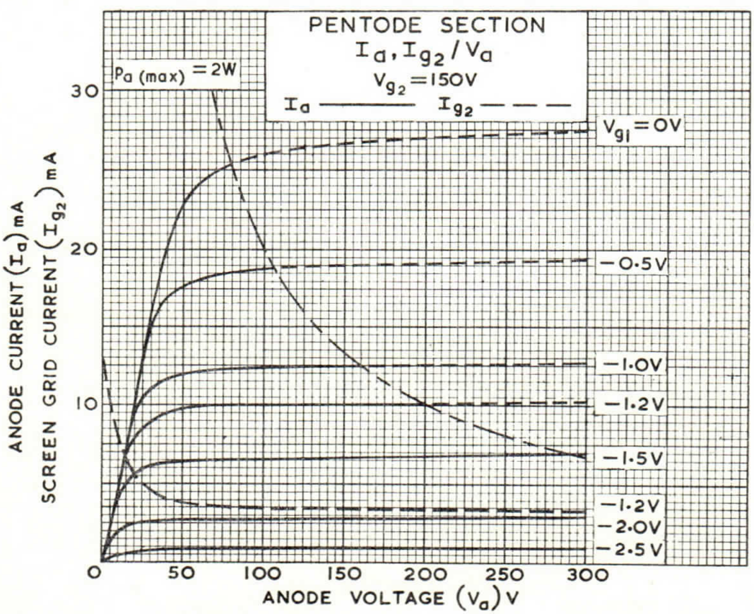
MOUNTING POSITION:—Unrestricted

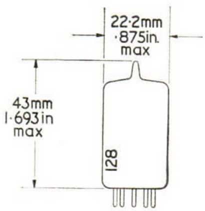



TRIODE SECTION
I_a/V_g
$V_a = 200V$
150V
100V
50V
ANODE CURRENT (I_a) mA
GRID VOLTAGE (V_g) V
−16 −14 −12 −10 −8 −6 −4 −2 0
0 5 10 15 20 25 30 35

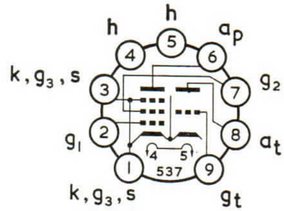

TRIODE SECTION
$\mu, r_a, g_m, -V_g/I_a$
$V_a = 100V$
g_m
μ
$-V_g$
r_a
GRID VOLTAGE $(-V_g)$ V
MUTUAL CONDUCTANCE (g_m) mA/V
VALVE ANODE RESISTANCE $\partial v_a/\partial i_a$ (r_a) kΩ
AMPLIFICATION FACTOR (μ)
ANODE CURRENT (I_a) mA
0 5 10 15 20 25 30 35 40
0 2 4 6 8 10 12
0 10 20 30 40 50


PENTODE SECTION
$I_a, I_{g2}, g_m, r_a / V_{g1}$
$V_a = 170V$ $V_{g2} = 150V$
I_a
g_m
I_{g2}
r_a
VALVE ANODE RESISTANCE $\partial v_a / \partial i_a (r_a)$ kΩ
3·0
2·5
2·0
1·5
1·0
0·5
0
−4
−3
−2
−1
0
CONTROL GRID VOLTAGE (V_{g1}) V
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA
MUTUAL CONDUCTANCE (g_m) mA/V
30
25
20
15
10
5


PENTODE SECTION
$I_a, I_{g2} / V_a$
$V_{g2} = 150V$
I_a ——— I_{g2} – – –
$p_{a\,(max)} = 2W$
$V_{g1} = 0V$
−0·5V
−1·0V
−1·2V
−1·5V
−1·2V
−2·0V
−2·5V
ANODE CURRENT (I_a) mA
SCREEN GRID CURRENT (I_{g2}) mA
30
20
10
0
50
100
150
200
250
300
ANODE VOLTAGE (V_a) V



V.H.F. TRIODE PENTODE



B9A Base

GENERAL

This combined triode and variable-mu, frame grid pentode is for use as a frequency changer and I.F. amplifier at frequencies up to 200 Mc/s in television receivers.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	8·5	V

RATINGS

		Triode	Pentode	
Maximum Anode Dissipation	$p_{a(max)}$	1·5	2·0	W
Maximum Screen Grid Dissipation ($V_{g1}=0$ V)	$p_{g2(max)}$	—	0·45†	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	550	V
Maximum Anode Voltage	$V_{a(max)}$	125	250	V
Maximum Screen Grid Supply Voltage	$V_{g2(b)max}$	—	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	—	250	V
Maximum Heater to Cathode Voltage	$V_{h-k(max)}$	100*	100*	V
Maximum Negative Control Grid Voltage	$-V_{g1(max)}$	50	50	V
Maximum Cathode Current	$I_{k(max)}$	20	18	mA
Maximum Grid to Cathode Resistance	$R_{g-k(max)}$	0·5	1·0	MΩ

* To fulfil hum requirements on A.M. sound it will be necessary for V_{h-k} to be less than 50 V r.m.s.

† For V_{g1} equal to or more negative than 5·2 V then $p_{g2(max)} = 0·2$ W.

INTER-ELECTRODE CAPACITANCES (Shielded)

Pentode Input	$c_{in(p)}$	6·2	pF
Pentode Output	$c_{out(p)}$	3·7	pF
Pentode Anode to Grid 1	c_{ap-g1}	0·009	pF
Pentode Anode to Grid 1	c_{ap-g1}	<0·012	pF
Grid 1 to Grid 2	c_{g1-g2}	1·6	pF
Triode Input	$c_{in(t)}$	3·3	pF
Triode Output	$c_{out(t)}$	1·7	pF
Anode Triode to Grid Triode	c_{at-gt}	1·8	pF
Anode Pentode to Anode Triode	c_{ap-at}	<0·025	pF
Anode Pentode to Grid Triode	c_{ap-gt}	<0·010	pF
Grid 1 to Anode Triode	c_{g1-at}	<0·010	pF
Grid 1 to Grid Triode	c_{g1-gt}	<0·010	pF

CHARACTERISTICS

		Triode	Pentode	
Anode Voltage	V_a	100	170	V
Screen Grid Voltage	V_{g2}	—	120	V
Control Grid Voltage	V_{g1}	−3·0	−1·4	V
Anode Current	I_a	15	10	mA
Screen Grid Current	I_{g2}	—	3·0	mA
Mutual Conductance	g_m	9·0	11	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	2·2	>350	kΩ
Inner Amplification Factor	μ_{g1-g2}	—	55	
Amplification Factor	μ	20	—	
Equivalent Grid Noise Resistance	R_{eq}	—	1·5	kΩ

THORN—AEI RADIO VALVES & TUBES LTD.

TYPICAL OPERATION

Pentode as Frequency Changer

Anode Supply Voltage	$V_{a(b)}$	200	200	V
Screen Grid Supply Voltage	$V_{g2(b)}$	200	200	V
Anode Load Resistance	R_a	2·7	4·7	kΩ
Screen Grid Resistance	R_{g2}	27	27	kΩ
Control Grid Resistance	R_{g1}	0·1	1·0	MΩ
Anode Current	I_a	10	9·3	mA
Screen Grid Current	I_{g2}	3·0	2·9	mA
Control Grid Current	I_{g1}	8·0	2·3	μA
Control Grid Supply Voltage	$V_{g1(b)}$	−1·4	0	V
R.M.S. Heterodyne Voltage	$V_{het(r.m.s.)}$	1·6	1·6	V
Conversion Conductance	g_c	5·0	4·7	mA/V

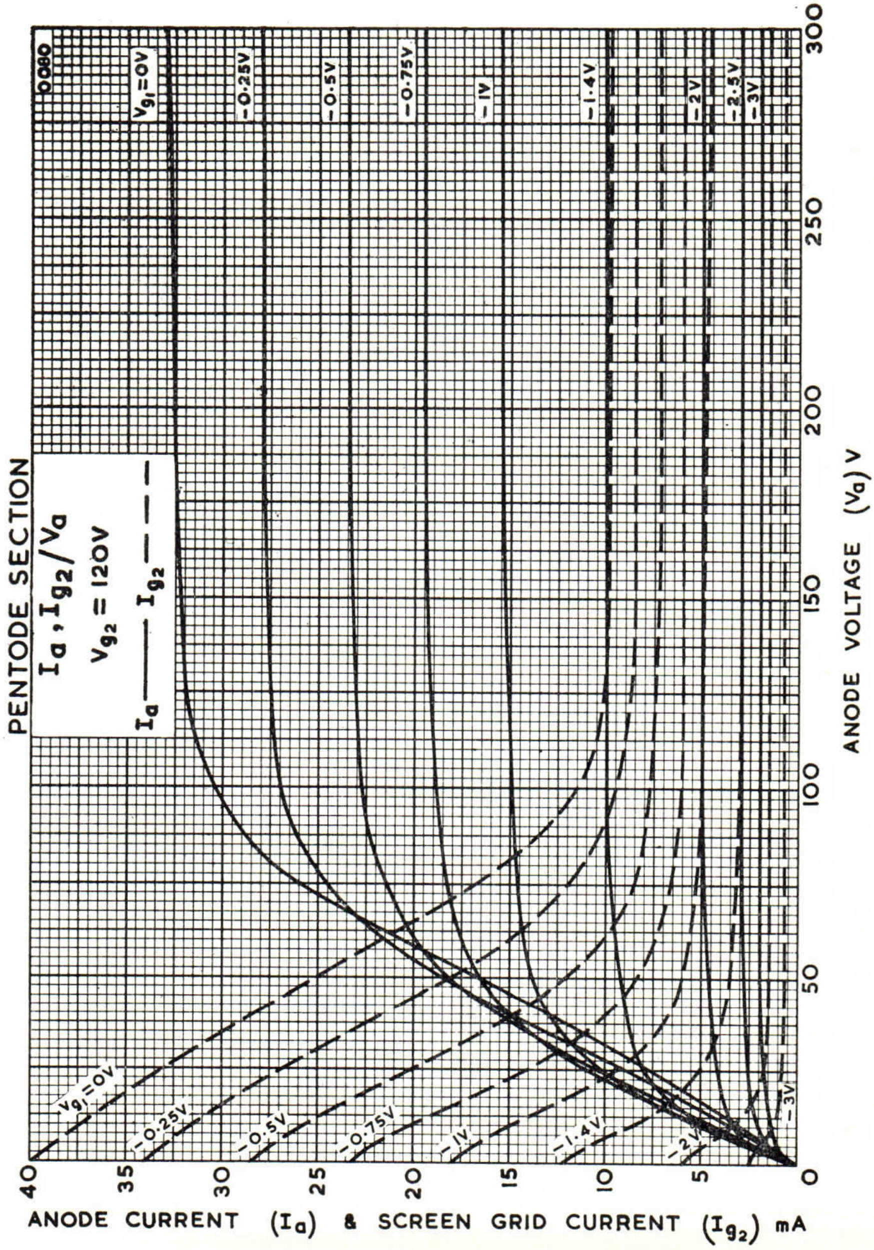
Pentode as I.F. Amplifier

Anode Supply Voltage	$V_{a(b)}$	200	200	V
Screen Grid Supply Voltage	$V_{g2(b)}$	200	200	V
Anode Load Resistance	R_a	2·7	4·7	kΩ
Screen Grid Resistance	R_{g2}	27	27	kΩ
Control Grid Resistance	R_{g1}	0·1	1·0	MΩ
Anode Current	I_a	10	13	mA
Screen Grid Current	I_{g2}	3·0	3·9	mA
Control Grid Supply Voltage	$V_{g1(b)}$	−1·4	0	V
Mutual Conductance	g_m	11	14·5	mA/V
Control Grid Voltage for $g_m = 0{\cdot}11$ mA/V	V_{g1}	−12	—	V
Input Resistance at 50 Mc/s	R_{in}	10	10	kΩ

Triode as Oscillator

Anode Supply Voltage	$V_{a(b)}$	200	200	V
Anode Load Resistance	R_a	8·2	12	kΩ
Grid Resistance	R_g	10	10	kΩ
R.M.S. Heterodyne Voltage	$V_{het(r.m.s.)}$	4·5	3·3	V
Anode Current	I_a	16	12	mA
Mutual Conductance	g_m	3·7	3·7	mA/V

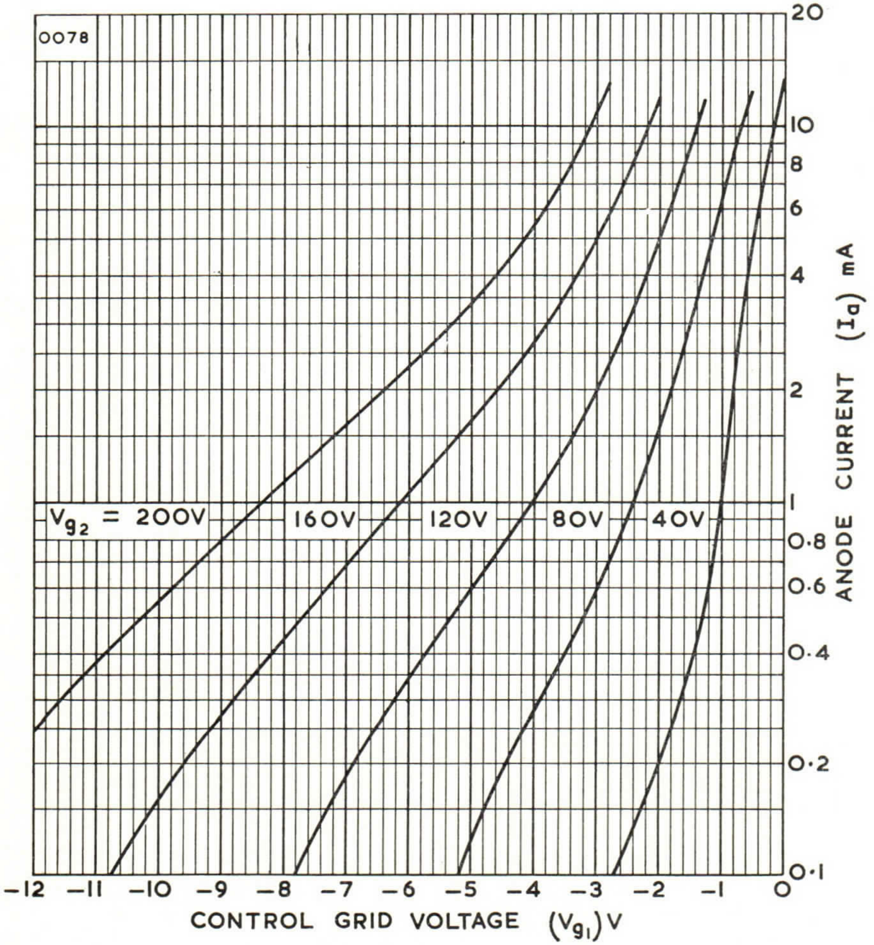
MOUNTING POSITION—Unrestricted


PENTODE SECTION
I_a, I_{g2}/V_a
V_{g2} = 120V
I_a ——— I_{g2} - - -
V_{g1}=0V
−0·25V
−0·5V
−0·75V
−1V
−1·4V
−2V
−2·5V
−3V
0080
ANODE VOLTAGE (V_a) V
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA

PENTODE SECTION

I_a/V_{g_1}

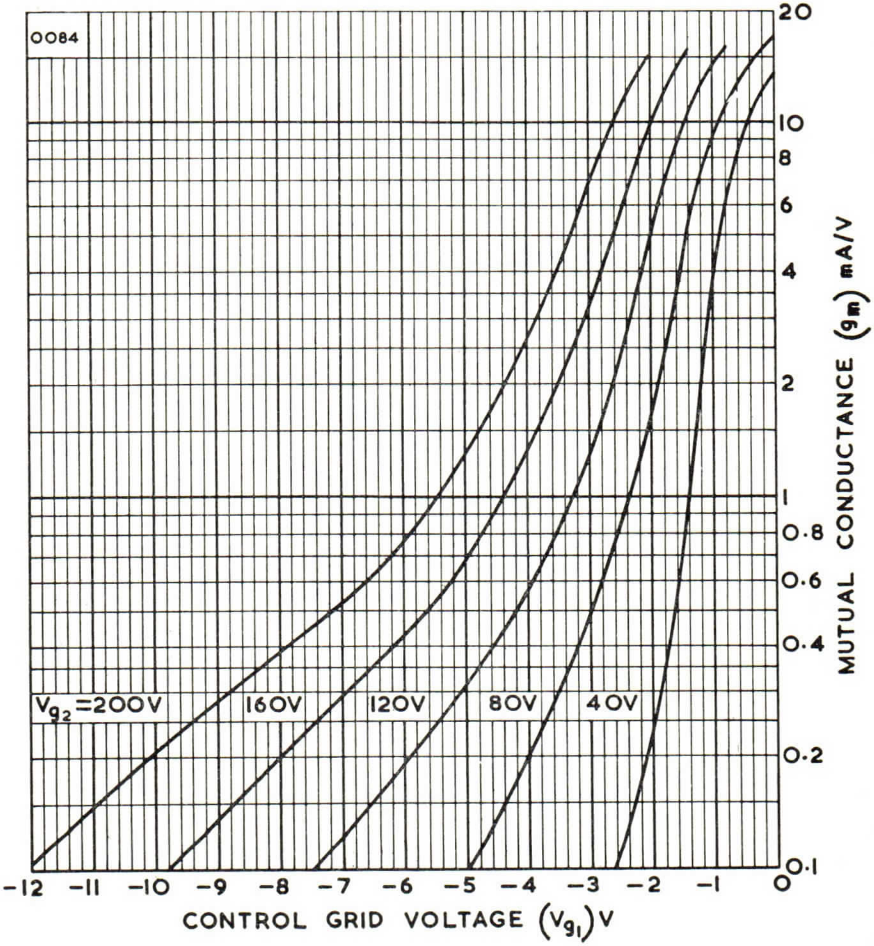
$V_a = 170V$

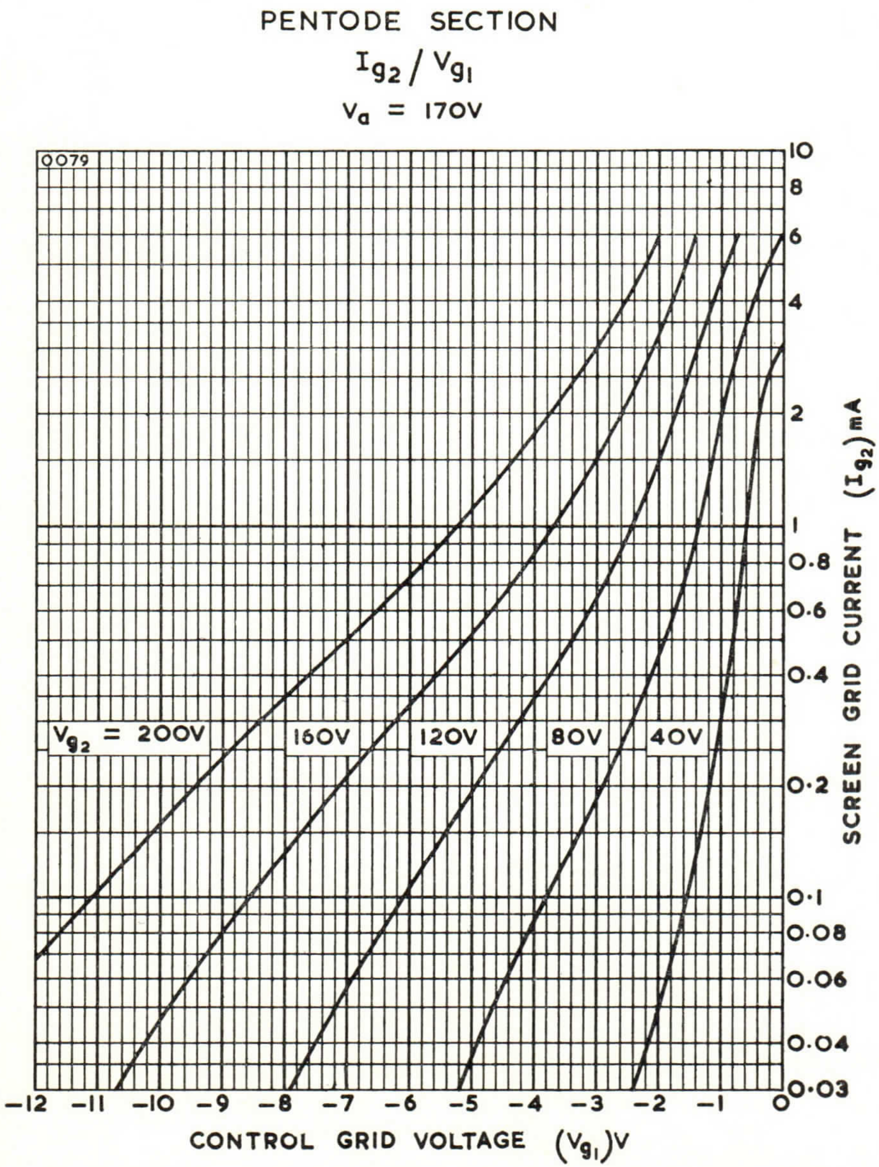


PENTODE SECTION

g_m / V_{g_1}

$V_a = 170V$

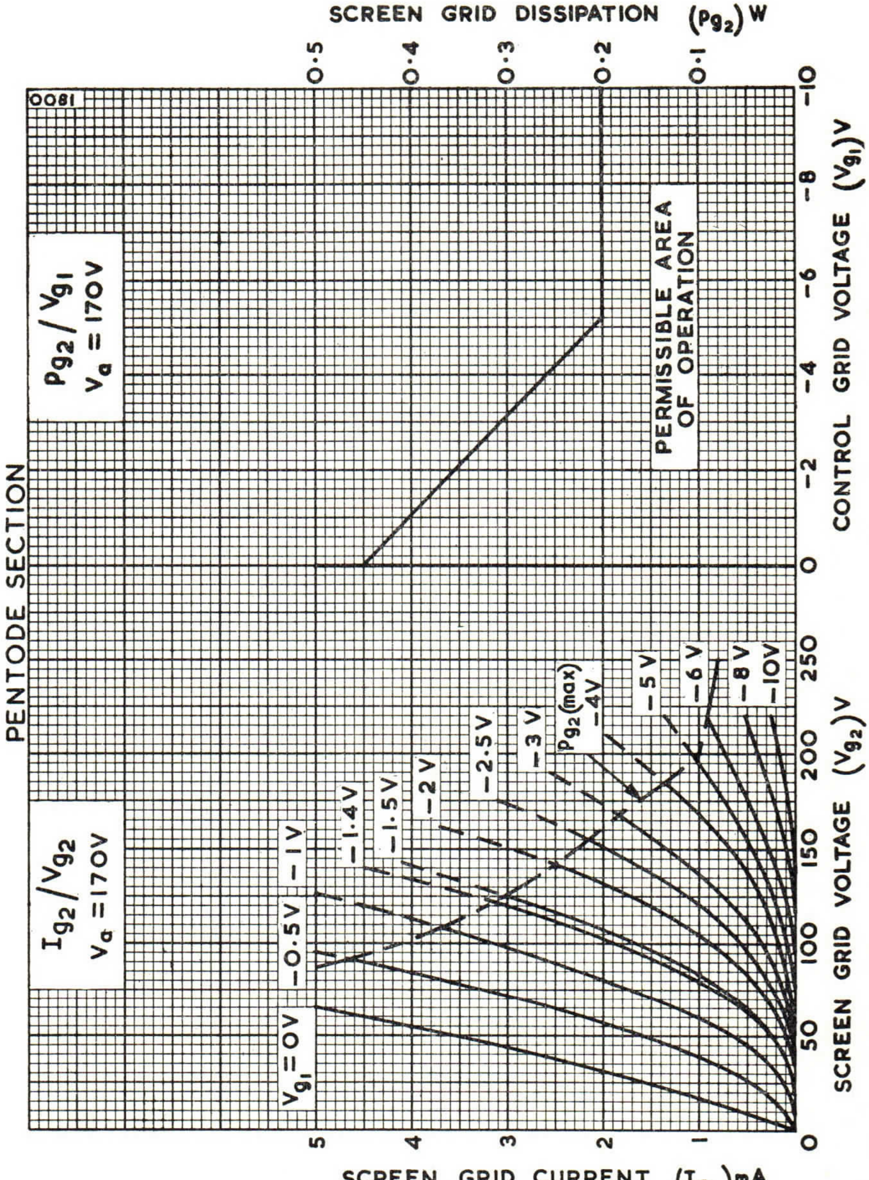



PENTODE SECTION
I_{g2} / V_{g1}
$V_a = 170V$
0079
$V_{g2} = 200V$
160V
120V
80V
40V
10
8
6
4
2
1
0·8
0·6
0·4
0·2
0·1
0·08
0·06
0·04
0·03
SCREEN GRID CURRENT (I_{g2}) mA
−12 −11 −10 −9 −8 −7 −6 −5 −4 −3 −2 −1 0
CONTROL GRID VOLTAGE (V_{g1})V

BRIMAR

VALVES

PCF801



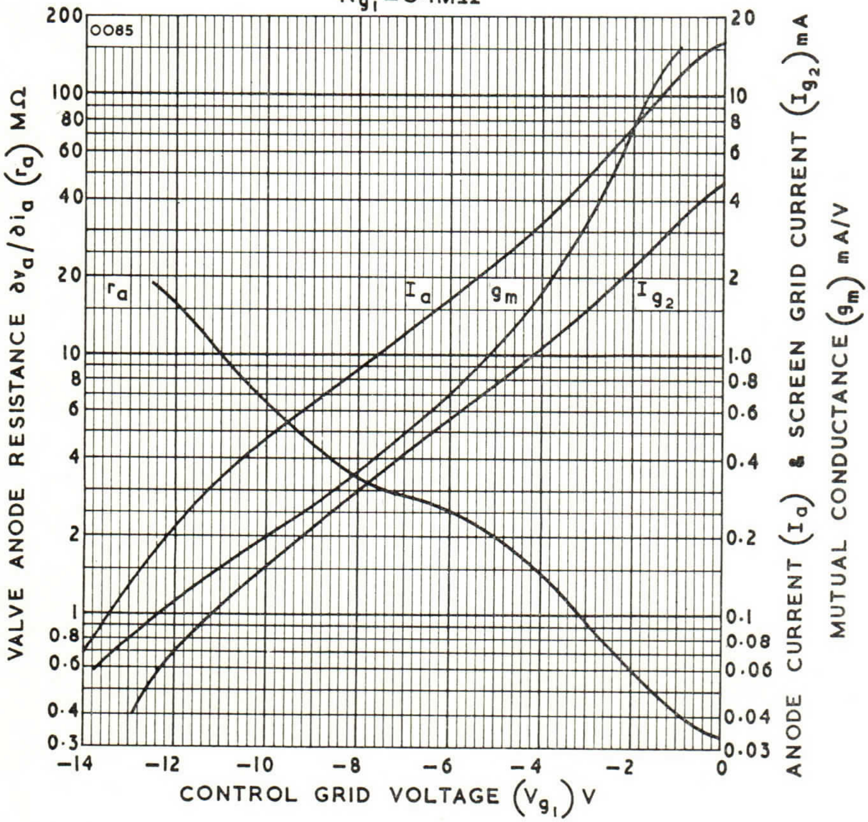
PENTODE SECTION

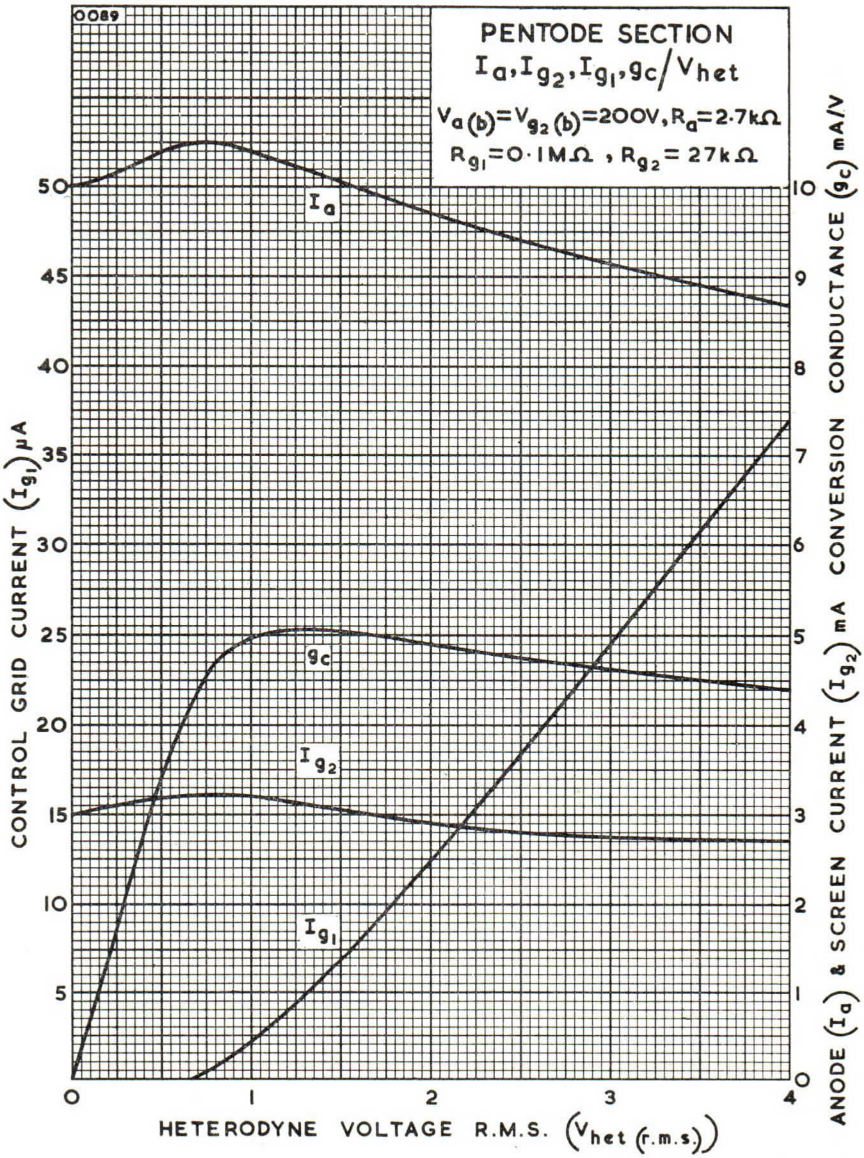
$r_a, g_m, I_a, I_{g2} / V_{g1}$

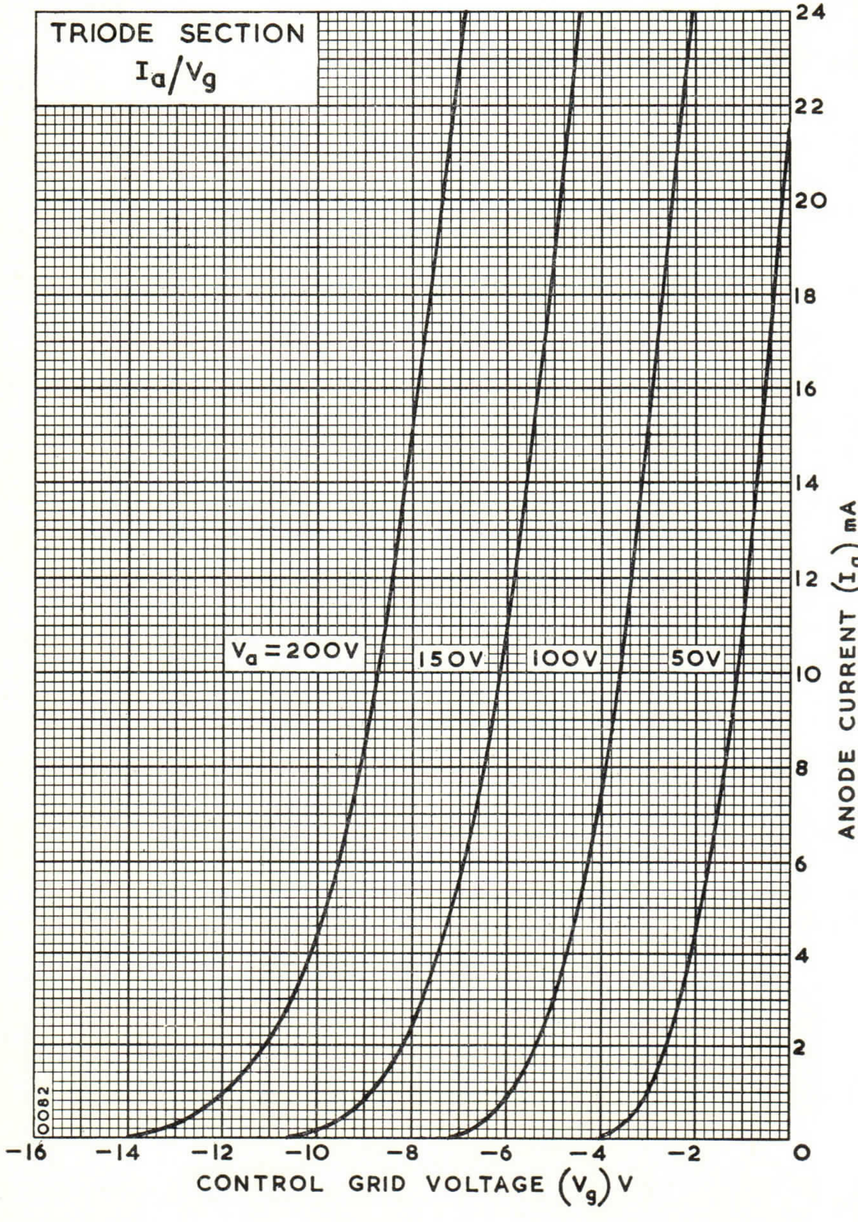
$V_{a(b)} = 200V$ $R_a = 2.7k\Omega$

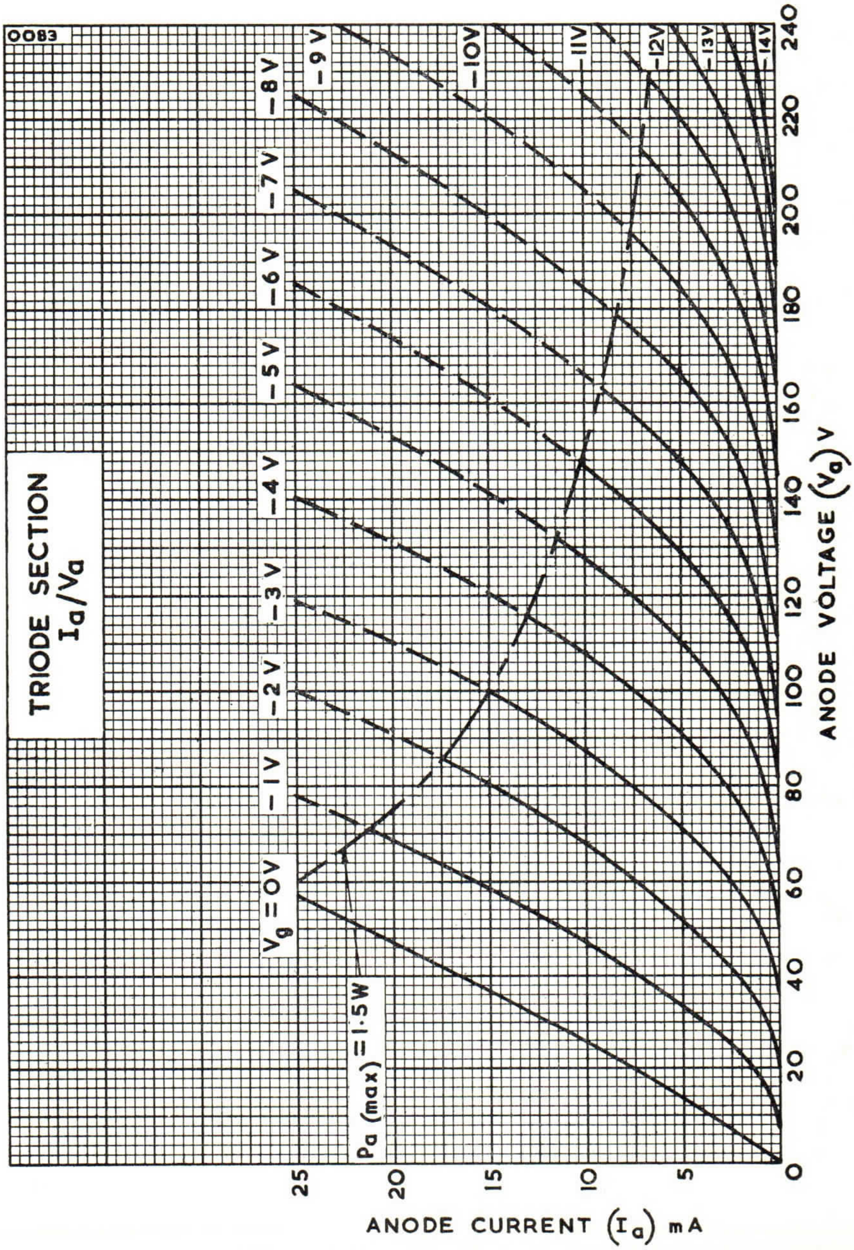
$V_{g2(b)} = 200V$ $R_{g2} = 27k\Omega$

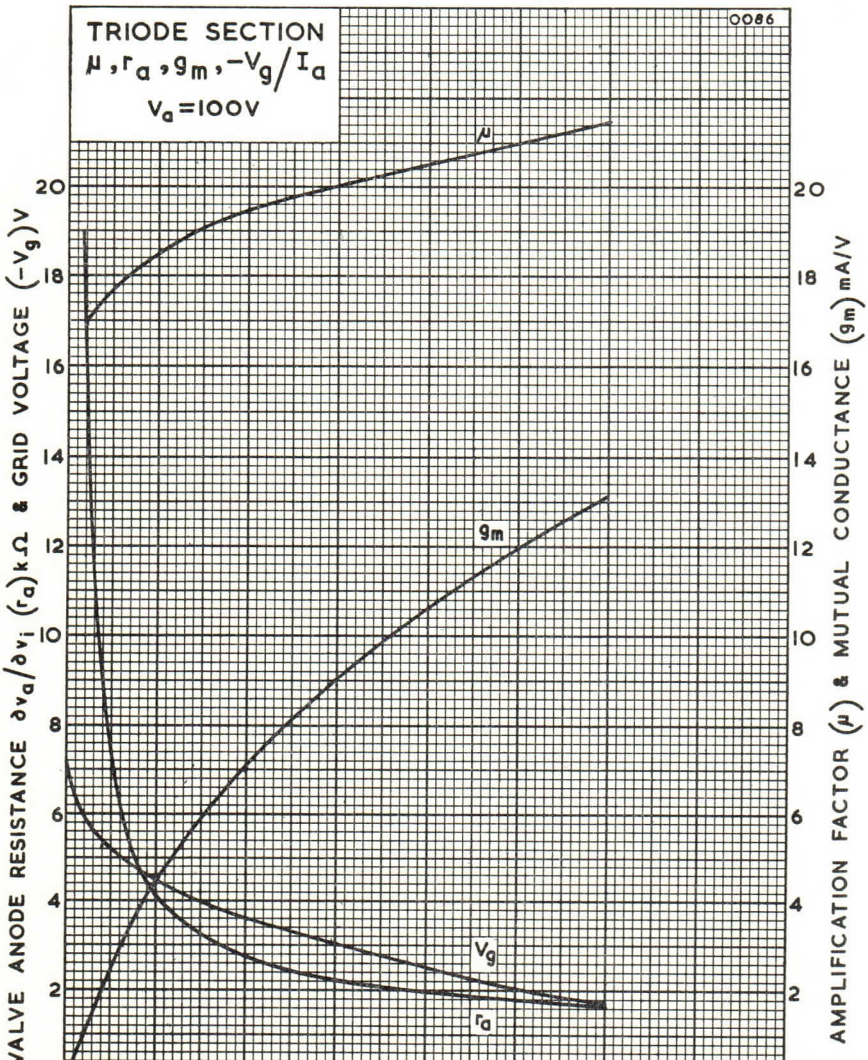
$R_{g1} = 0.1M\Omega$

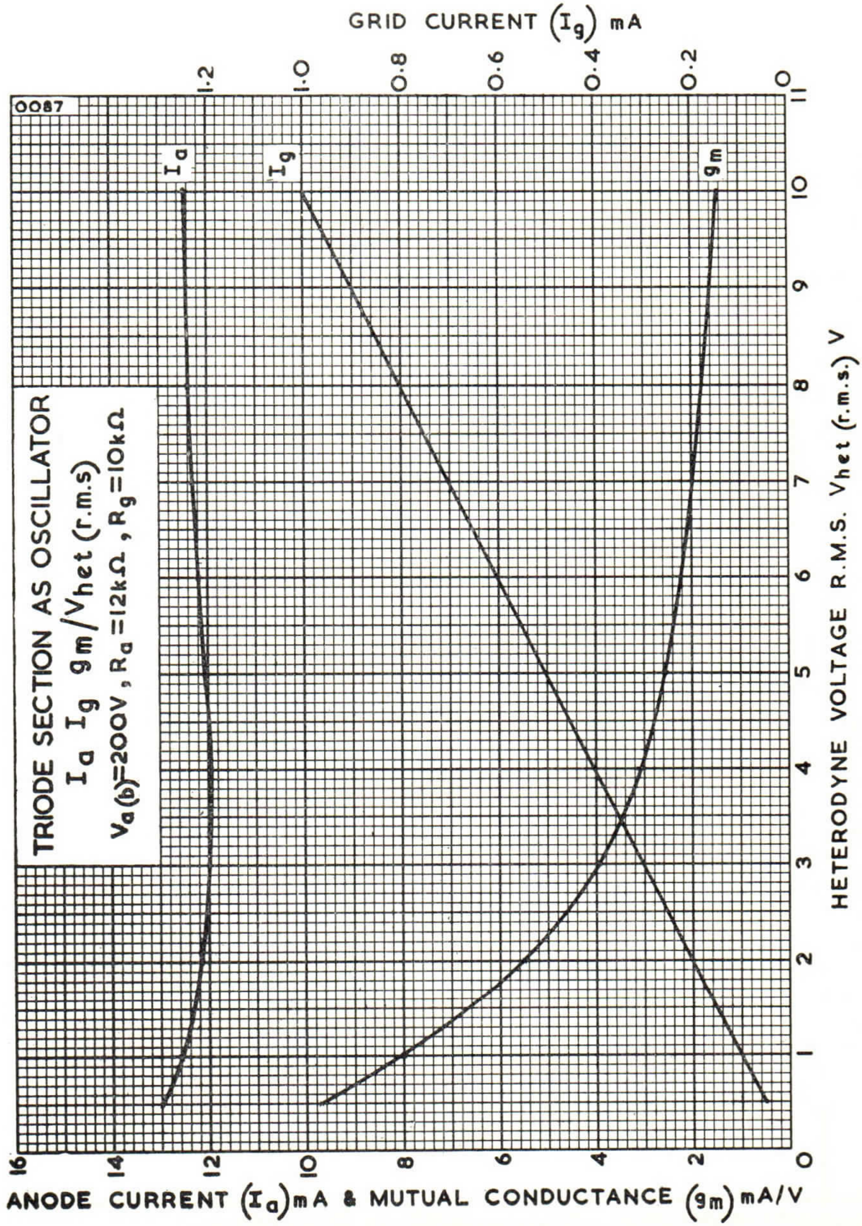


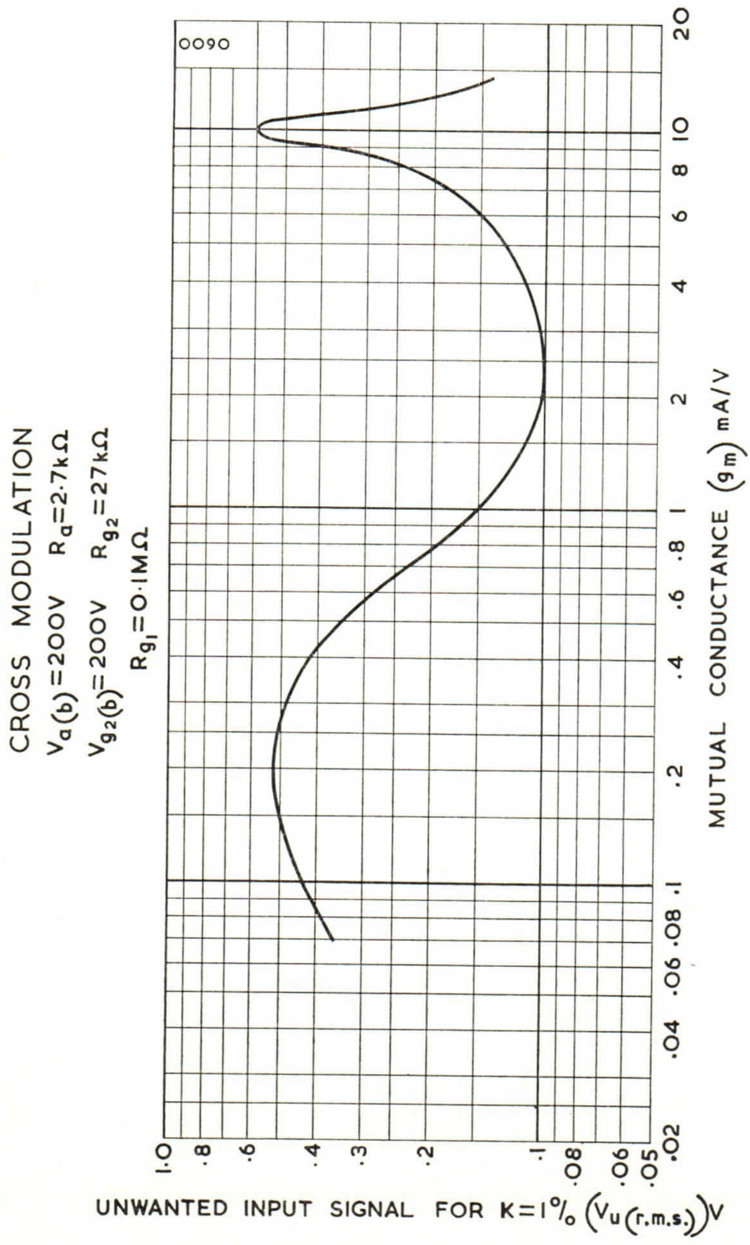

0089
PENTODE SECTION
Ia, Ig2, Ig1, gc / Vhet
Va(b)=Vg2(b)=200V, Ra=2·7kΩ
Rg1=0·1MΩ , Rg2=27kΩ
Ia
gc
Ig2
Ig1
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
10
9
8
7
6
5
4
3
2
1
0
CONTROL GRID CURRENT (Ig1) µA
ANODE (Ia) & SCREEN CURRENT (Ig2) mA CONVERSION CONDUCTANCE (gc) mA/V
HETERODYNE VOLTAGE R.M.S. (Vhet (r.m.s.))

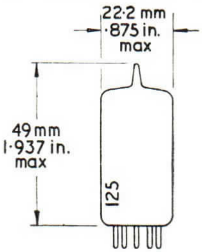

TRIODE SECTION
I_a/V_g
V_a = 200V
150V
100V
50V
24
22
20
18
16
14
12
10
8
6
4
2
0
−16
−14
−12
−10
−8
−6
−4
−2
CONTROL GRID VOLTAGE (V_g) V
ANODE CURRENT (I_a) mA
0082


0083
TRIODE SECTION
I_a/V_a
$V_g = 0V$
$-1V$
$-2V$
$-3V$
$-4V$
$-5V$
$-6V$
$-7V$
$-8V$
$-9V$
$-10V$
$-11V$
$-12V$
$-13V$
$-14V$
$P_a\,(max) = 1{\cdot}5W$
ANODE VOLTAGE (V_a) V
ANODE CURRENT (I_a) mA
0
20
40
60
80
100
120
140
160
180
200
220
240
5
10
15
20
25

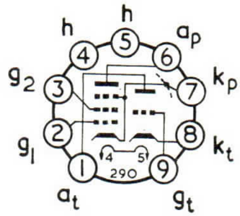

TRIODE SECTION
$\mu, r_a, g_m, -V_g / I_a$
$V_a = 100V$
0086
μ
g_m
V_g
r_a
VALVE ANODE RESISTANCE $\partial v_a / \partial v_i$ (r_a) kΩ & GRID VOLTAGE $(-V_g)$ V
AMPLIFICATION FACTOR (μ) & MUTUAL CONDUCTANCE (g_m) mA/V
ANODE CURRENT (I_a) mA
0
5
10
15
20
25
30
35
40
2
4
6
8
10
12
14
16
18
20


GRID CURRENT (I_g) mA
1.2
1.0
0.8
0.6
0.4
0.2
0
0087
I_a
I_g
g_m
TRIODE SECTION AS OSCILLATOR
I_a I_g g_m/V_{het} (r.m.s)
$V_{a(b)}$=200V, R_a=12kΩ, R_g=10kΩ
HETERODYNE VOLTAGE R.M.S. V_{het} (r.m.s.) V
0
1
2
3
4
5
6
7
8
9
10
11
16
14
12
10
8
6
4
2
0
ANODE CURRENT (I_a) mA & MUTUAL CONDUCTANCE (g_m) mA/V


0090
CROSS MODULATION
Va(b)=200V Ra=2·7kΩ
Vg2(b)=200V Rg2=27kΩ
Rg1=0·1MΩ
20
10
8
6
4
2
1
.8
.6
.4
.2
.1
.08
.06
.04
.02
MUTUAL CONDUCTANCE (gm) mA/V
1·0
.8
.6
.4
.3
.2
.1
.08
.06
.05
UNWANTED INPUT SIGNAL FOR K=1% (Vu(r.m.s.))V



TIME BASE TRIODE PENTODE



B9A Base

GENERAL

This triode pentode is for use in line oscillator circuits with the pentode section as an oscillator and the triode section as a reactance valve.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	9·0	V

DESIGN CENTRE RATINGS

		Triode	Pentode	
Maximum Anode Dissipation	$p_{a(max)}$	1·4	1·2	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	—	0·8	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	550	V
Maximum Anode Voltage	$V_{a(max)}$	250	250	V
Maximum Screen Grid Supply Voltage	$V_{g2(b)max}$	—	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	—	250	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$	100†	100†	V
Maximum Cathode Current	$I_{k(max)}$	10	15	mA
Maximum Peak Cathode Current	$i_{k(pk)max}$	—	50*	mA
Maximum Grid to Cathode Resistance	$R_{g\text{-}k(max)}$			
Fixed Bias		3·0	0·56	MΩ

* Maximum Duty Factor 30 per cent, maximum pulse duration 30 μs.
† To avoid hum interference the A.C. component should not exceed 65 V at $Z_g(max) = 50$ kΩ (f=50 c/s)

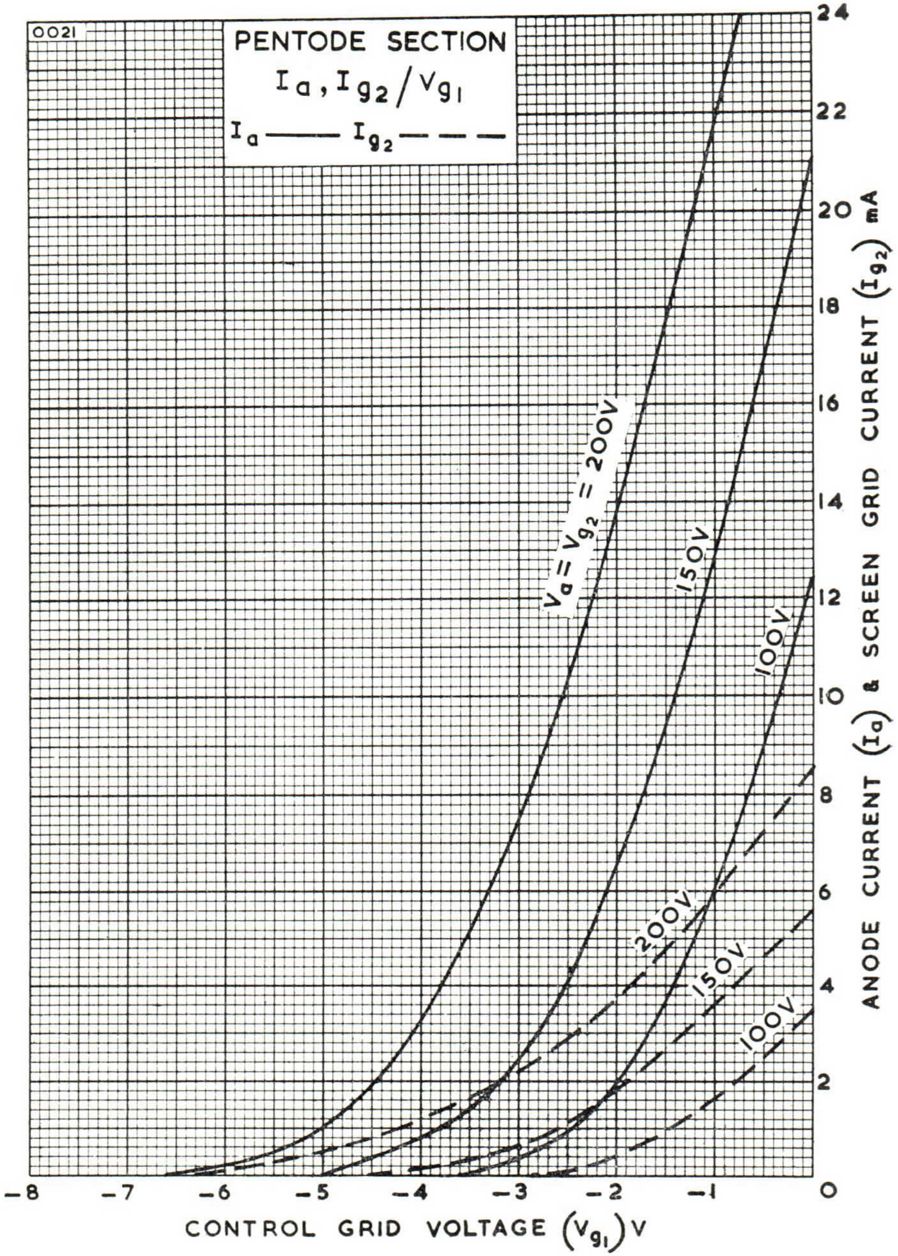
INTER-ELECTRODE CAPACITANCES

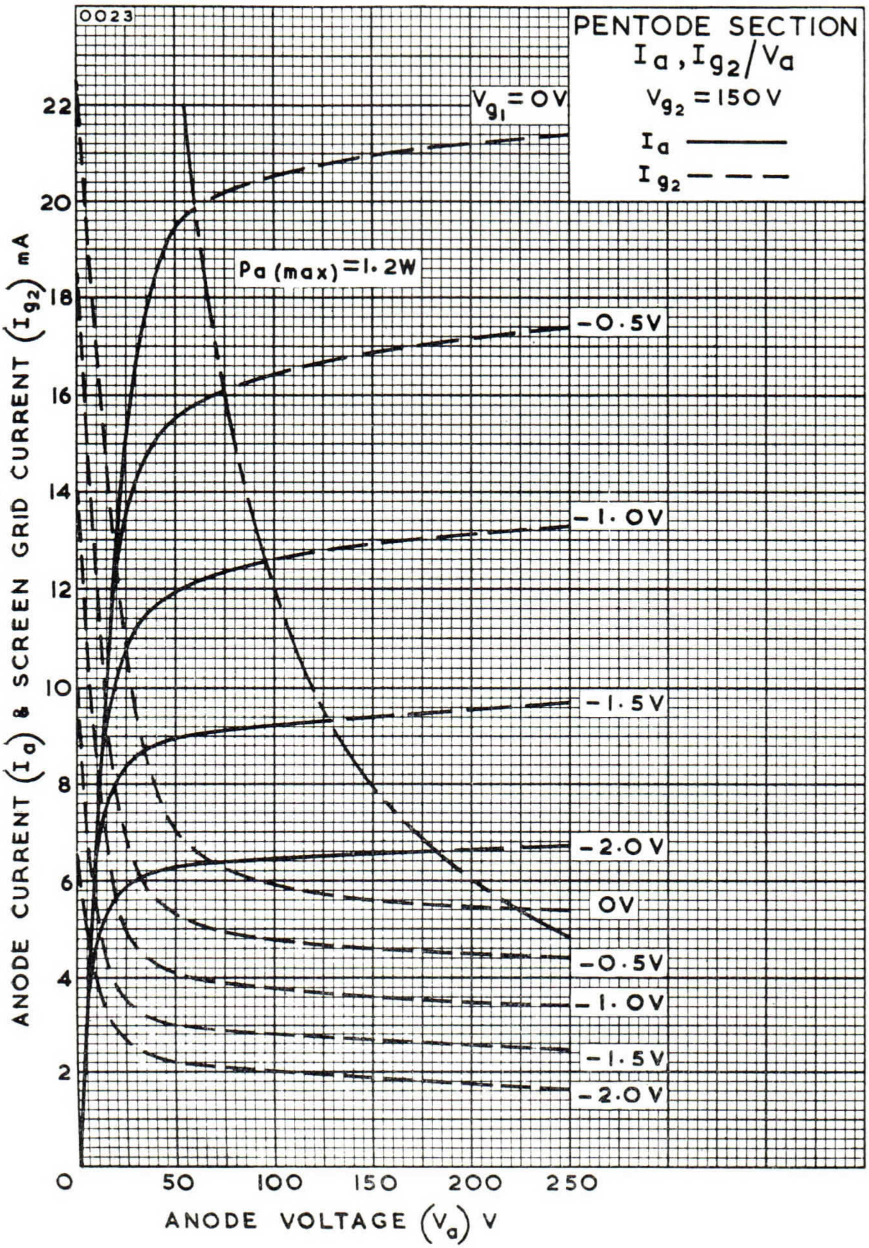
		Triode	Pentode	
Input	c_{in}	2·4	5·4	pF
Anode to Grid 1	$c_{a\text{-}g1}$	1·5	0·06	pF
Grid 1 to Heater	$c_{g1\text{-}h}$	<0·1	<0·1	pF

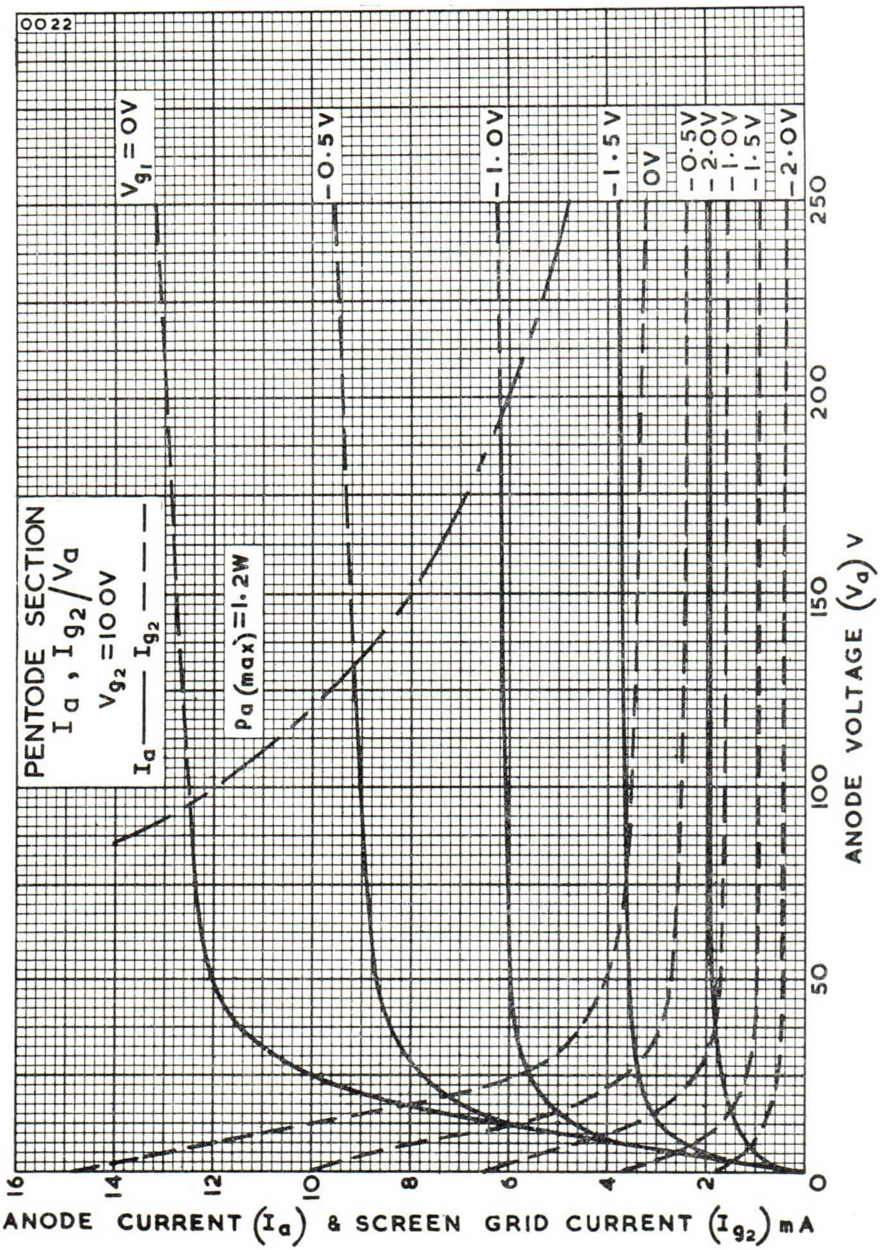
CHARACTERISTICS

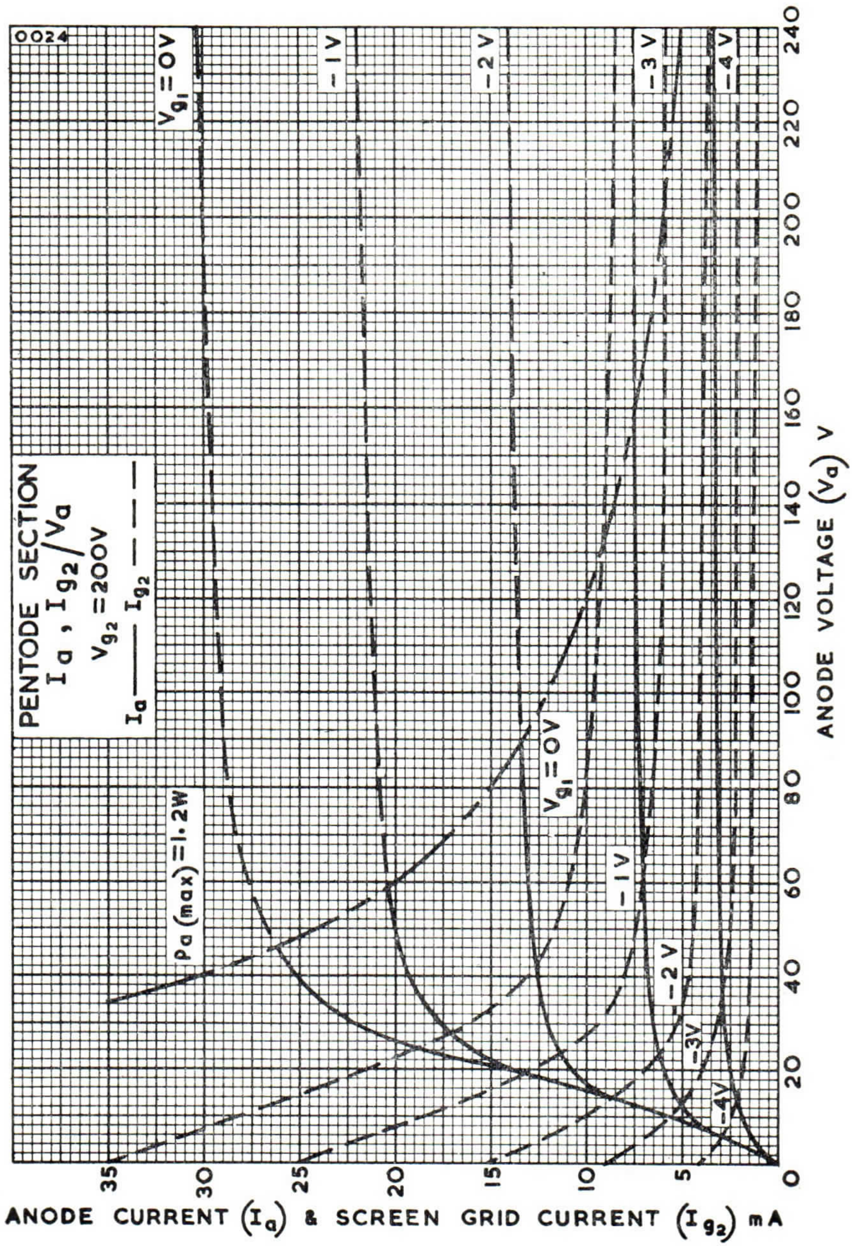
		Triode	Pentode	
Anode Voltage	V_a	200	100	V
Screen Grid Voltage	V_{g2}	—	100	V
Control Grid Voltage	V_{g1}	−2·0	−1·0	V
Anode Current	I_a	3·5	6·0	mA
Screen Grid Current	I_{g2}	—	1·7	mA
Mutual Conductance	g_m	3·5	5·5	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	20	400	kΩ
Amplification Factor	μ	70	—	
Inner Amplification Factor	$\mu_{g1\text{-}g2}$	—	47	
Anode Current at $V_{g1} = 0$ V		—	12·5	mA
Screen Grid Current at $V_{g1} = 0$ V		—	3·5	mA
Anode Current at $I_g = +10\ \mu$A, $V_a = 200$ V		10	—	mA
Negative Grid Voltage at $V_a = V_{g2} = 200$ V, $I_a = 10\ \mu$A		—	<16	V
Negative Grid Voltage at $I_g = +0·3\ \mu$A		<1·3	<1·3	V

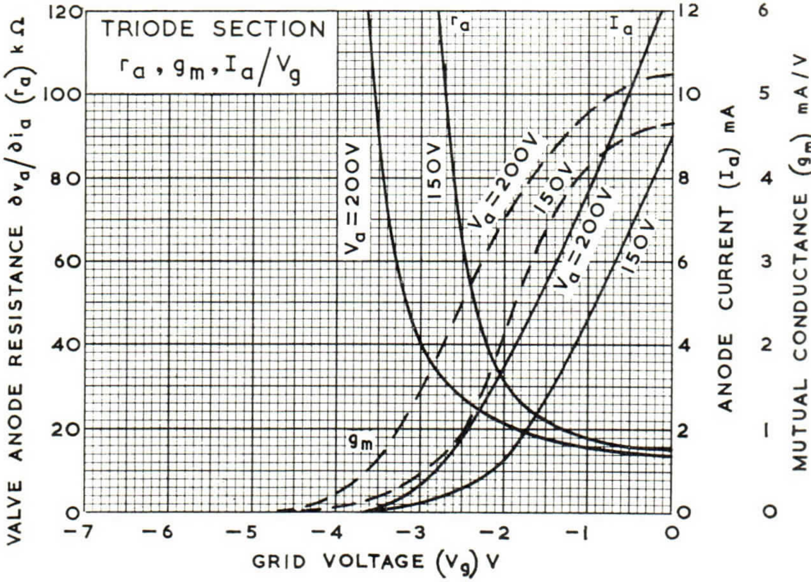
THORN—AEI RADIO VALVES & TUBES LTD.

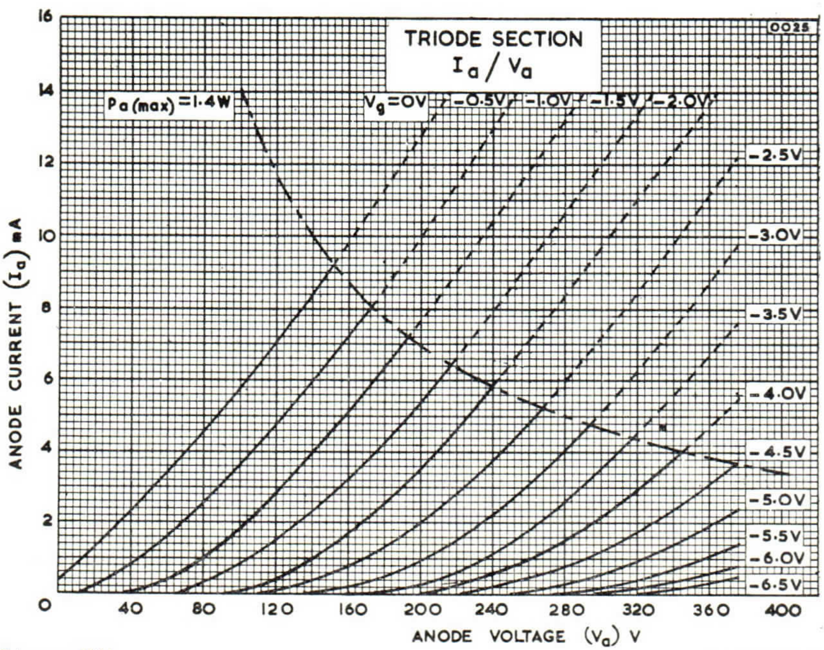

0021
PENTODE SECTION
$I_a, I_{g2}/V_{g1}$
I_a —— I_{g2} – – –
$V_a = V_{g2} = 200V$
150V
100V
200V
150V
100V
24
22
20
18
16
14
12
10
8
6
4
2
0
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA
−8
−7
−6
−5
−4
−3
−2
−1
0
CONTROL GRID VOLTAGE (V_{g1}) V

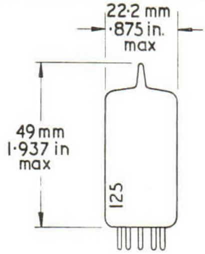

0023
PENTODE SECTION
$I_a, I_{g2}/V_a$
$V_{g2} = 150V$
I_a ———
I_{g2} — — —
$V_{g1} = 0V$
Pa (max) = 1·2W
−0·5V
−1·0V
−1·5V
−2·0V
0V
−0·5V
−1·0V
−1·5V
−2·0V
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA
0
2
4
6
8
10
12
14
16
18
20
22
50
100
150
200
250
ANODE VOLTAGE (V_a) V


0022
V_{g1} = 0V
−0.5V
−1.0V
−1.5V
0V
−0.5V
−2.0V
−1.0V
−1.5V
−2.0V
PENTODE SECTION
I_a, I_{g2}/V_a
V_{g2} = 100V
I_a —— I_{g2} – – –
p_a(max) = 1.2W
ANODE VOLTAGE (V_a) V
0 50 100 150 200 250
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA
16 14 12 10 8 6 4 2 0

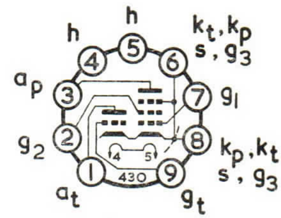

0024
PENTODE SECTION
Ia , Ig2/Va
Vg2 =200V
Ia —— Ig2 – – –
Vg1=0V
-1V
-2V
-3V
-4V
Pa (max)=1.2W
ANODE VOLTAGE (Va) V
0 20 40 60 80 100 120 140 160 180 200 220 240
ANODE CURRENT (Ia) & SCREEN GRID CURRENT (Ig2) mA
35 30 25 20 15 10 5 0


TRIODE SECTION
r_a, g_m, I_a/V_g
VALVE ANODE RESISTANCE $\partial v_a/\partial i_a$ (r_a) kΩ
ANODE CURRENT (I_a) mA
MUTUAL CONDUCTANCE (g_m) mA/V
GRID VOLTAGE (V_g) V
V_a=200V
150V
r_a
I_a
g_m


TRIODE SECTION
I_a/V_a
0025
Pa (max)=1·4W
V_g=0V
-0·5V
-1·0V
-1·5V
-2·0V
-2·5V
-3·0V
-3·5V
-4·0V
-4·5V
-5·0V
-5·5V
-6·0V
-6·5V
ANODE CURRENT (I_a) mA
ANODE VOLTAGE (V_a) V



V.H.F.
TRIODE PENTODE



†B9A Base

GENERAL

This triode and variable mu pentode valve combination, with the pentode of frame grid construction, is for use in television tuners. It is primarily intended to be used as a variable gain V.H.F. frequency changer with the triode as local oscillator but the pentode is also designed for use as a high gain controlled I.F. amplifier following a U.H.F. tuner.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	7·4	V

RATINGS

		Pentode	Triode	
Maximum Anode Dissipation	$p_{a(max)}$	2	2	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	0·5	—	W
Maximum Anode Voltage	$V_{a(max)}$	250	250	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	230	—	V
Maximum Heater to Cathode Voltage (R.M.S.)	$V_{h\text{-}k(r.m.s.)max}$	200	200	V
Maximum Cathode Current	$I_{k(max)}$	18	15	mA
Maximum Grid to Cathode Resistance (Fixed Bias)	$R_{g1\text{-}k(max)}$	250	500	kΩ

INTER-ELECTRODE CAPACITANCES

		*	‡	△	
Grid 1 to all	$c_{g1\text{-}all}$	6·7	7·1	8·2	pF
Anode Pentode to all	$c_{ap\text{-}all}$	2·7	3·1	4·2	pF
Grid 1 to Anode Pentode	$c_{g1\text{-}ap}$	·007	·008	·009	pF
Anode Triode to Earth	$c_{at\text{-}E}$	2·2	2·5	3·5	pF
Grid Triode to Earth	$c_{gt\text{-}E}$	2·4	2·7	3·7	pF
Anode Pentode to Grid Triode	$c_{ap\text{-}gt}$	·001	·003	·005	pF
Grid Triode to Anode Triode	$c_{gt\text{-}at}$	2·0	2·05	2·1	pF
Anode Pentode to Anode Triode	$c_{ap\text{-}at}$	·014	·027	·046	pF
Grid 1 to Grid Triode	$c_{g1\text{-}gt}$	·008	·018	·037	pF
Grid 1 to Anode Triode	$c_{g1\text{-}at}$	·002	·004	·006	pF

* In fully-shielded socket with can. (I.E.C. Publication 100.)
‡ With holder capacitance balanced out but with can. (Holder as below.)
△ Total capacitance including B9A ceramic holder with skirt and screening can (Plessey holder type CP180024/3).
"Earth" denotes the electrodes of the other section and the remaining earthy potential electrodes of the section under measurement, heater and shields joined to cathode.

CHARACTERISTICS

		Pentode	Triode	
Anode Voltage	V_a	125	100	V
Screen Grid Voltage	V_{g2}	125	—	V
Control Grid Voltage	V_{g1}	−1·5	−3	V
Anode Current	I_a	10	14	mA
Screen Grid Current	I_{g2}	3·1	—	mA
Mutual Conductance	g_m	11	5·5	mA/V
Amplification Factor	μ	—	17	
Inner Amplification Factor	$\mu_{g1\text{-}g2}$	50	—	

† Shield completely surrounds pentode.
Basing arranged to minimise pentode cathode lead inductance effects with the shorter lead to pin 8.

THORN — A E I RADIO VALVES & TUBES LTD.

TYPICAL OPERATION AS FREQUENCY CHANGER AND I.F. AMPLIFIER

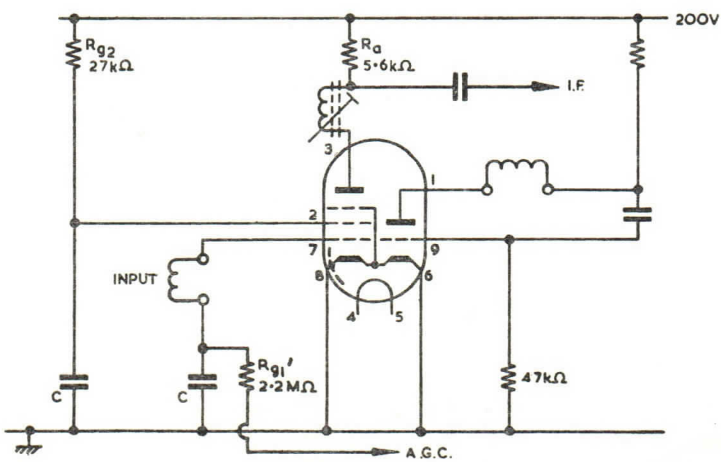
Grid current bias operation with A.G.C. Oscillator voltage injected into grid 1.

Pentode		F.C.	I.F.*	
Frequency	f	200	36	Mc/s
Supply Voltage	V_b	200	200	V
Anode Voltage (Decoupling Resistance, $R_a = 5{\cdot}6k\Omega$) (approx)	V_a	155	125	V
Screen Grid Voltage ($R_{g2} = 27k\Omega$) (approx)	V_{g2}	135	92	V
Current through Grid 1 resistance $R_{g1'}$ ($R_{g1'} = 2{\cdot}2M\Omega$)	I_{g1}	1·3	0·3	μA
Anode Current (approx)	I_a	7·8	13·2	mA
Screen Grid Current (approx)	I_{g2}	2·4	4·0	mA
D.C. Voltage on Pentode Control Grid at maximum gain		−3·0	—	V
Conversion Conductance at 1 Mc/s (V_b, R_a, R_{g1}, R_{g2} as above)	g_c	4·7	—	mA/V
Grid Voltage for Conversion Conductance reduction 10 : 1	$V_{g1(gc/10)}$	−6·8	—	V
Mutual Conductance (V_b, R_a, R_{g1}, R_{g2} as above)	g_m	—	15·2	mA/V
Grid Voltage for Mutual Conductance reduction 10 : 1	$V_{g1(gm/10)}$	—	−5·0	V
Grid Voltage for Mutual Conductance reduction 100 : 1	$V_{g1(gm/100)}$	—	−6·8	V
Valve Input Resistance (Anode short circuited)	r_{g1}	—	9	kΩ
Working Input Capacitance	$c_{in(w)}$	—	11†	pF
Change in Input Capacitance by biasing valve to cut-off	$\Delta c_{in(w)}$	—	2·8	pF

Triode			
Anode Voltage	V_a	77	V
Anode Current	I_a	7·8	mA
Rectified Grid Voltage (Grid Resistance $= 47k\Omega$)	V_g	6·5	V

* Supply voltage removed from triode.

† With holder capacitance balanced out but with can.



C = DECOUPLING CAPACITORS

TYPICAL OPERATION AS FREQUENCY CHANGER AND I.F. AMPLIFIER

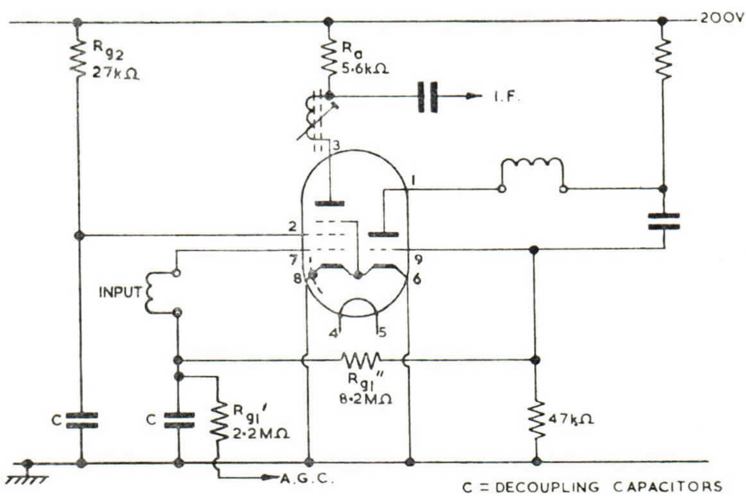
Partial grid current bias can be used for the frequency changer operation when a rectified voltage of greater than 8V d.c. is available from the triode grid resistor. This reduces the delay in the initial $V_{a.g.c.}/g_c$ characteristic as shown on page 12. The heterodyne voltage is injected into grid 1.

Pentode		F.C.	I.F.*	
Frequency	f	200	36	Mc/s
Supply Voltage	V_b	200	200	V
Anode Voltage (Decoupling Resistance, R_a=5·6kΩ) approx	V_a	160	125	V
Screen Grid Voltage (R_{g2}=27kΩ) approx	V_{g2}	140	92	V
Current through resistance $R_{g1'}$ ($R_{g1'}$=2·2MΩ)		1·6	0·3	μA
Resistance to provide Bias from Triode Grid	$R_{g1''}$	8·2	8·2	MΩ
Anode Current (approx)	I_a	7·0	13·2	mA
Screen Grid Current (approx)	I_{g2}	2·2	4·0	mA
D.C. Voltage on Pentode Control Grid at maximum gain		−3·5	—	V
Conversion Conductance at 1 Mc/s (V_b, R_a, R_{g1}, R_{g2} as above)	g_c	4·7	—	mA/V
Grid Voltage for Conversion Conductance reduction 10 : 1	$V_{g1(gc/10)}$	−5·8	—	V
Mutual Conductance (V_b, R_a, R_{g1}, R_{g2} as above)	g_m	—	15·2	mA/V
Grid Voltage for Mutual Conductance reduction 10 : 1	$V_{g1(gm/10)}$	—	−6·2	V
Grid Voltage for Mutual Conductance reduction 100 : 1	$V_{g1(gm/100)}$	—	−8·5	V
Valve Input Resistance (Anode short circuited)	r_{g1}	—	9	kΩ
Working Input Capacitance	$c_{in(w)}$	—	11†	pF
Change in Input Capacitance by biasing valve to cut-off	$\Delta c_{in(w)}$	—	2·8	pF

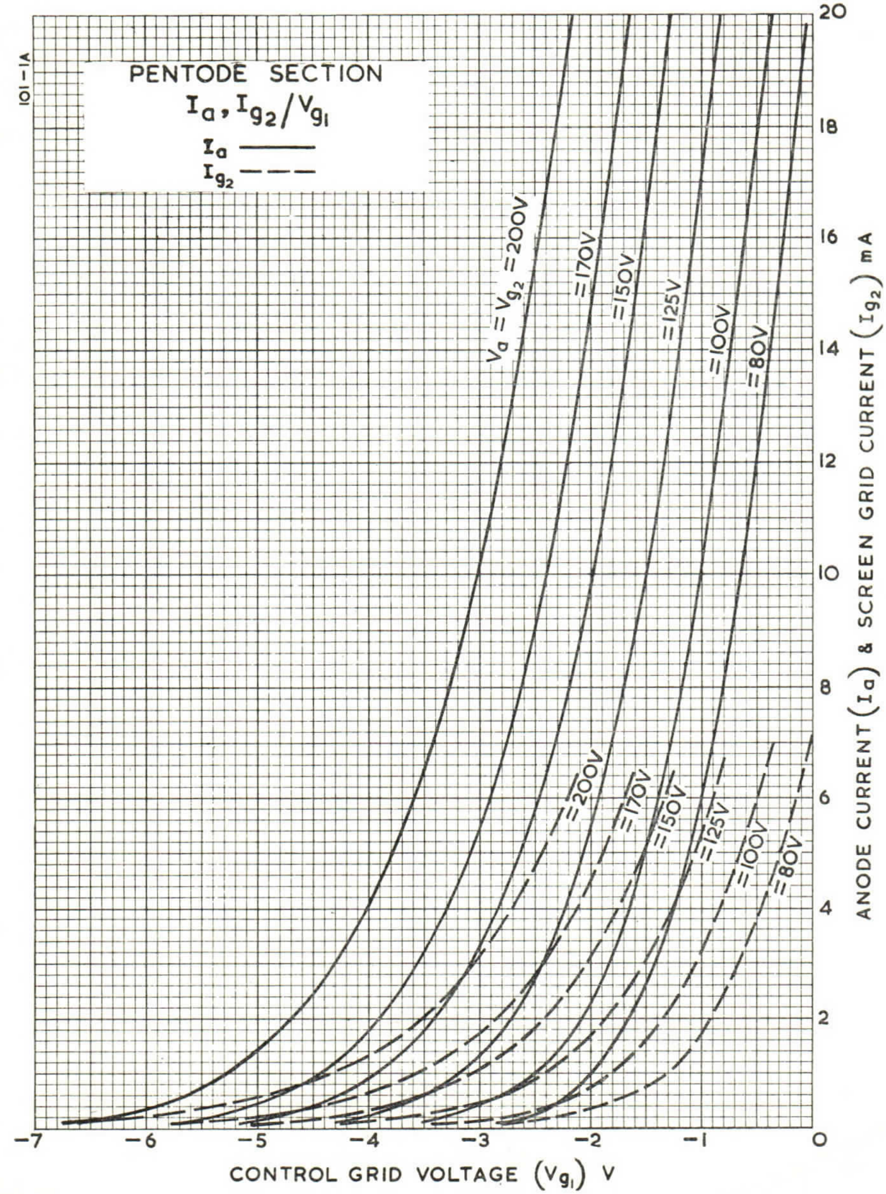
Triode			
Anode Voltage	V_a	110	V
Anode Current	I_a	10·5	mA
Rectified Grid Voltage (Grid Resistance=47kΩ)	V_g	11	V

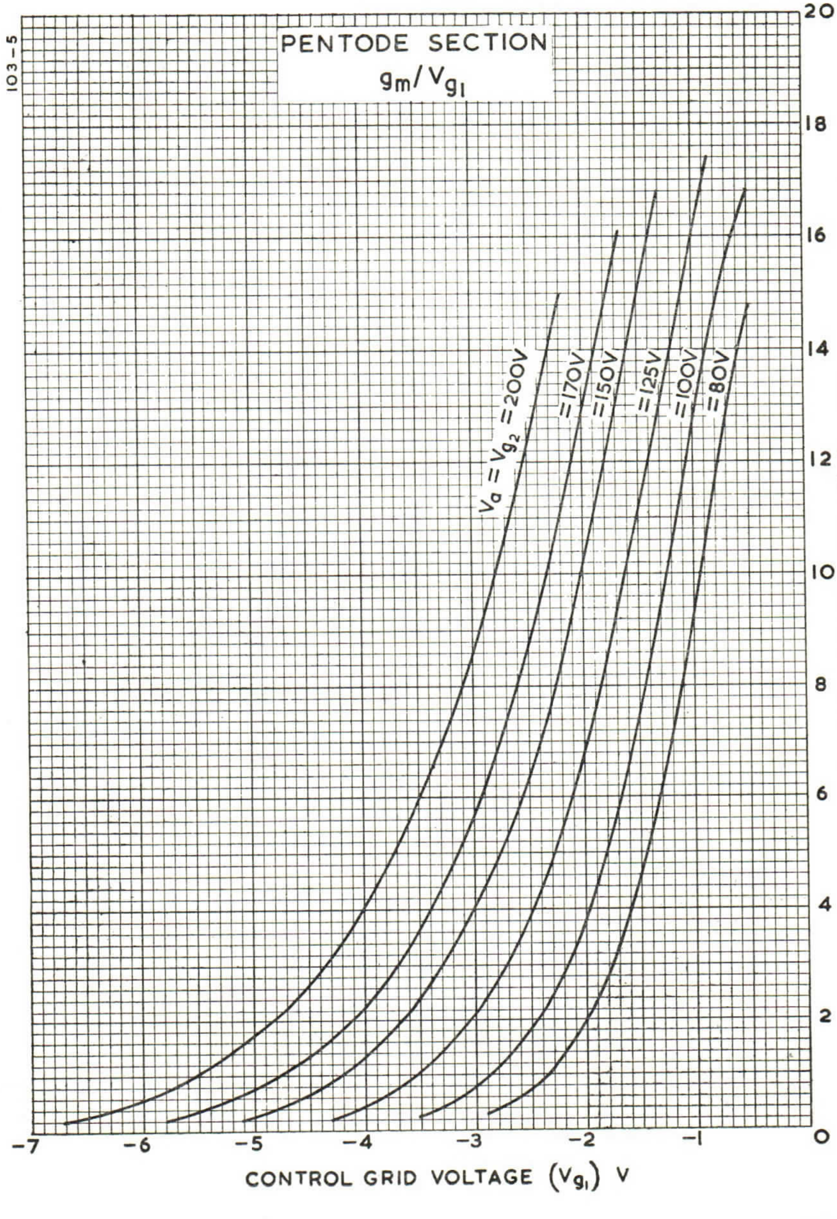
* Supply voltage removed from triode.

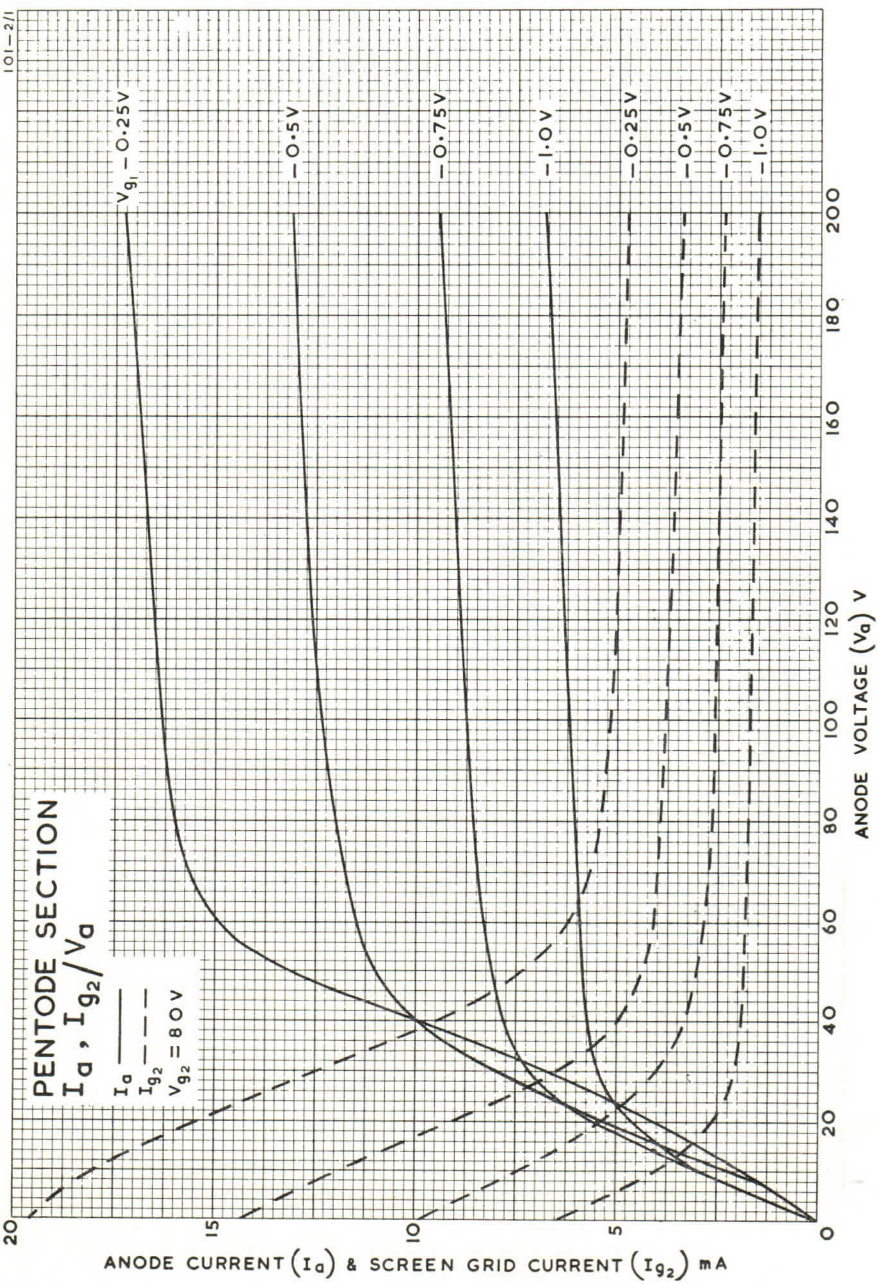
† With holder capacitance balanced out but with can.

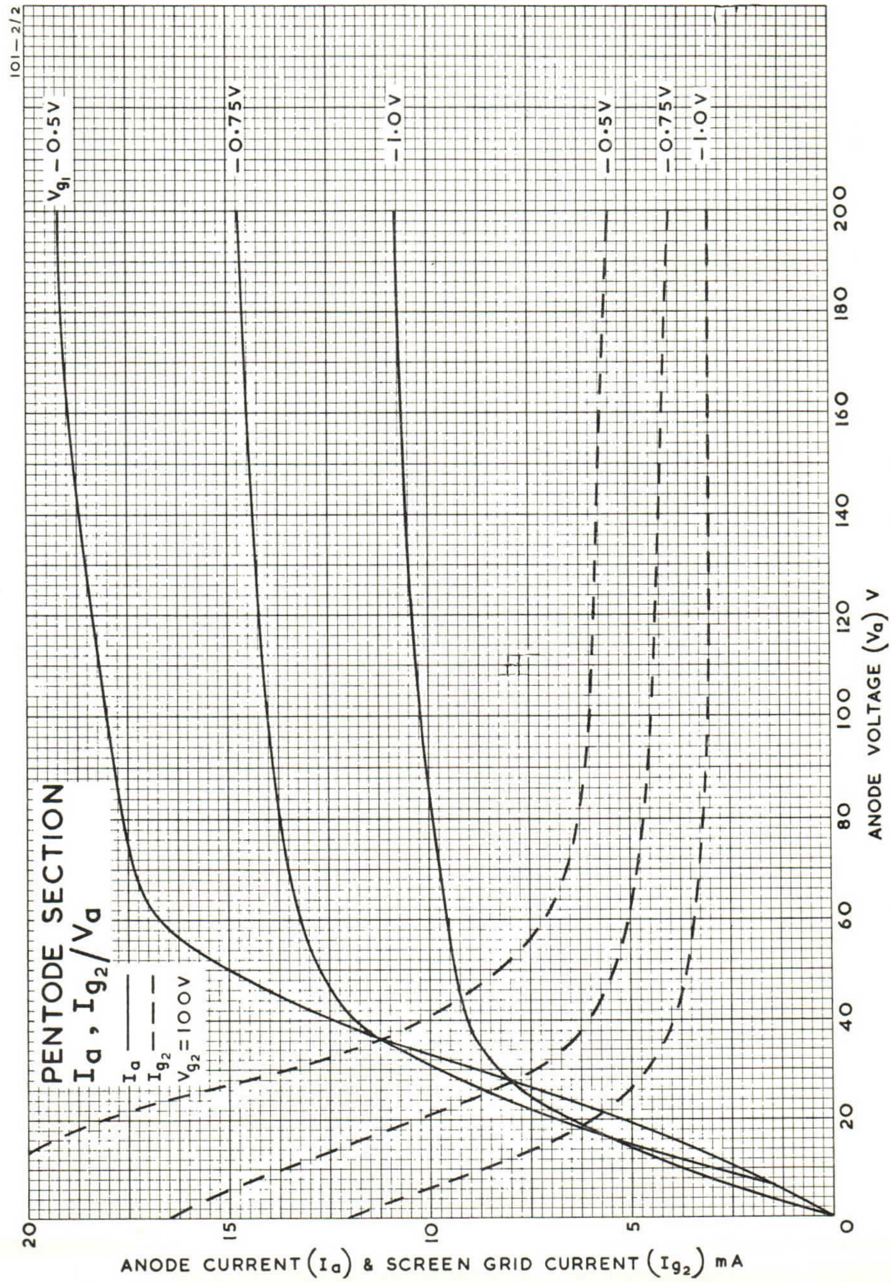


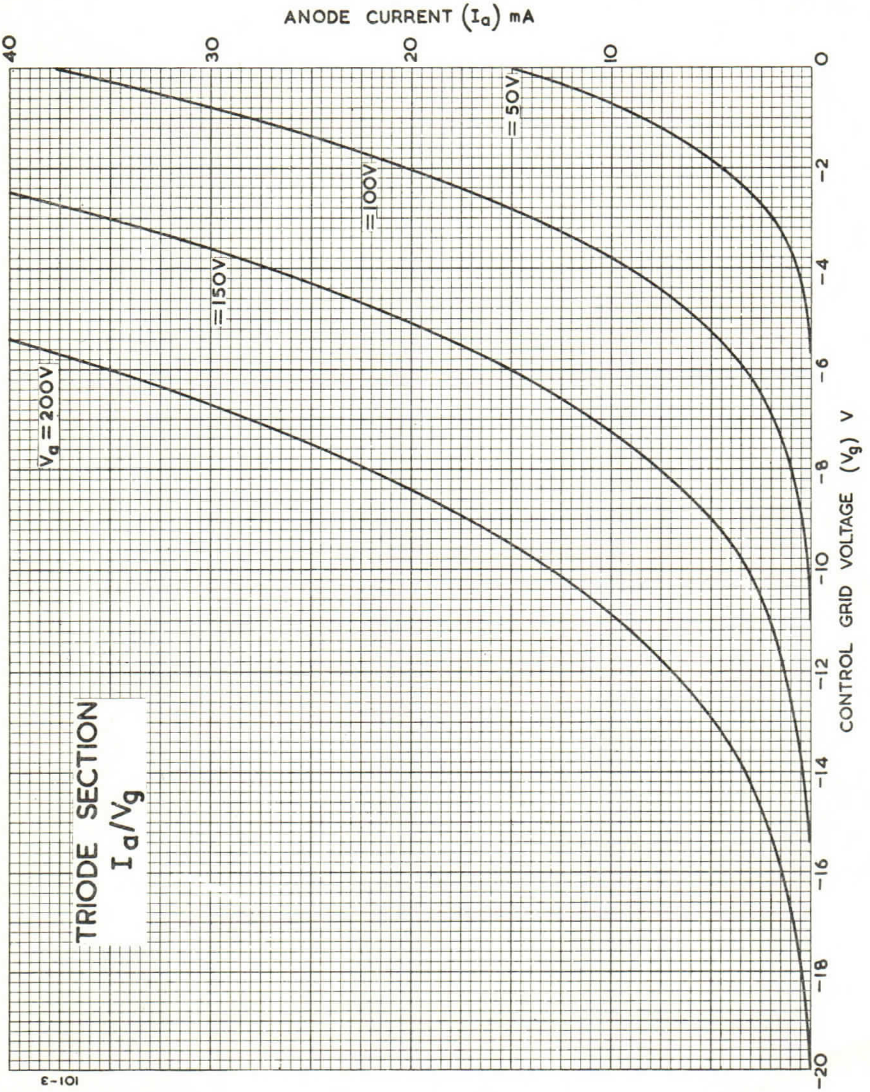
MOUNTING POSITION—Unrestricted

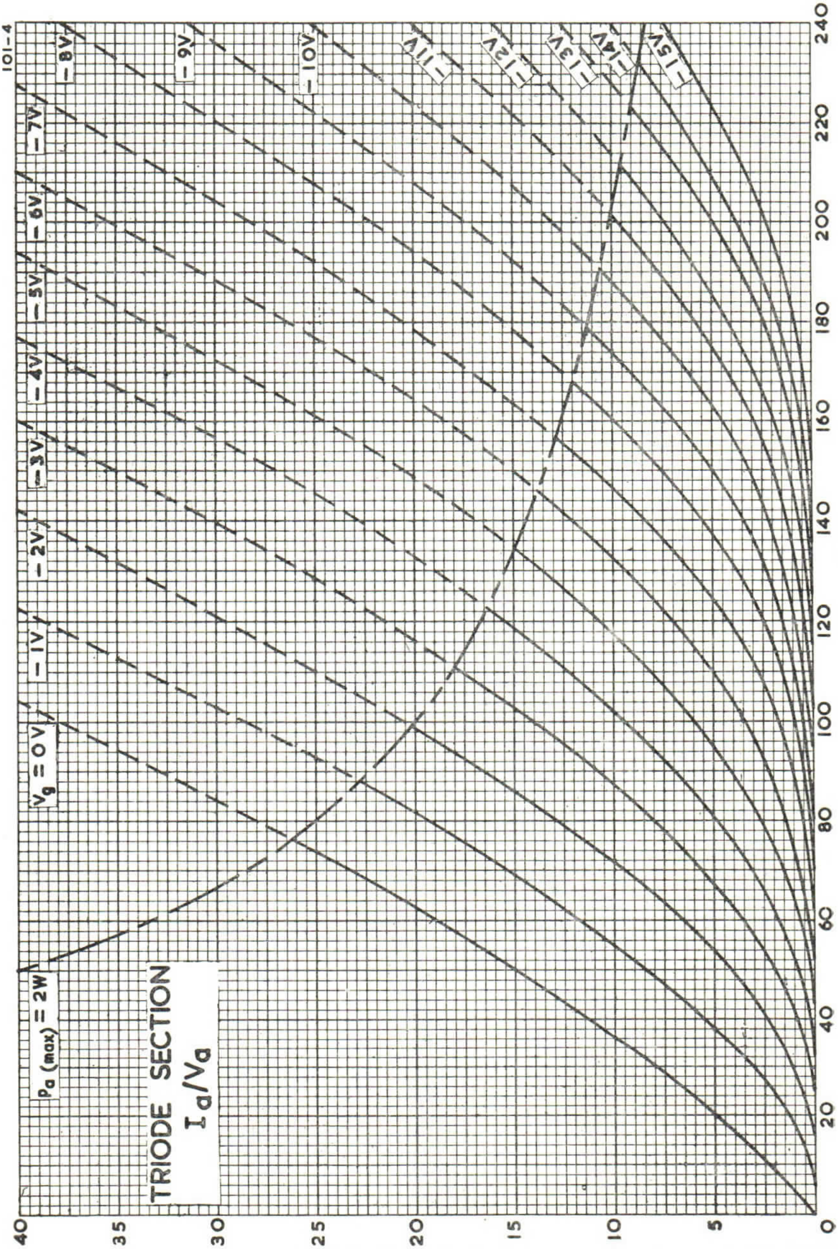

101-1A
PENTODE SECTION
Ia, Ig2/Vg1
Ia ———
Ig2 – – –
Va = Vg2 = 200V
= 170V
= 150V
= 125V
= 100V
= 80V
= 200V
= 170V
= 150V
= 125V
= 100V
= 80V
20
18
16
14
12
10
8
6
4
2
0
−7
−6
−5
−4
−3
−2
−1
ANODE CURRENT (Ia) & SCREEN GRID CURRENT (Ig2) mA
CONTROL GRID VOLTAGE (Vg1) V

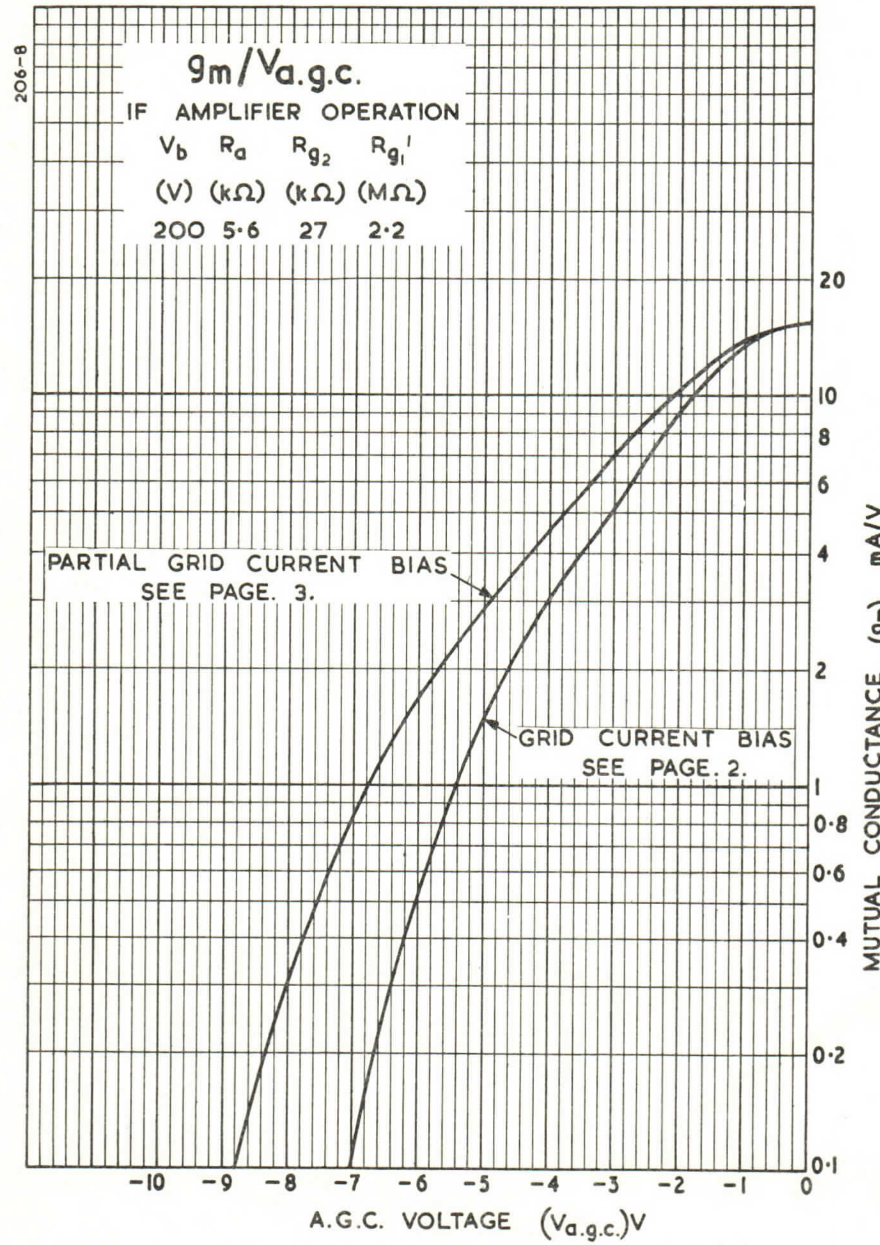

103-5
PENTODE SECTION
g_m/V_{g_1}
$V_a = V_{g_2} = 200V$
$= 170V$
$= 150V$
$= 125V$
$= 100V$
$= 80V$
20
18
16
14
12
10
8
6
4
2
0
MUTUAL CONDUCTANCE (g_m) mA/V
−7
−6
−5
−4
−3
−2
−1
CONTROL GRID VOLTAGE (V_{g_1}) V

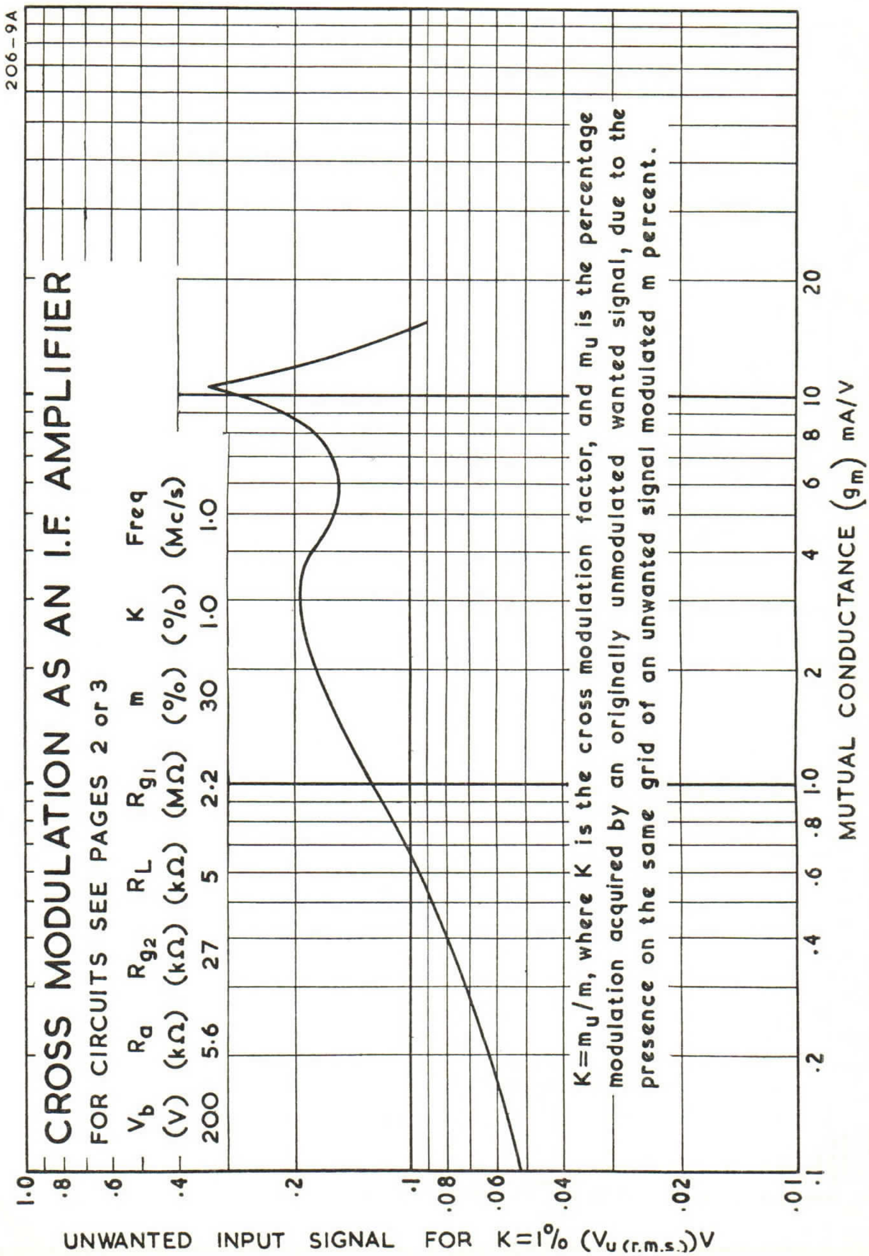

101—2/1
PENTODE SECTION
Ia , Ig2/Va
Ia ———
Ig2 — — —
Vg2 = 80 V
Vg1 −0·25V
−0·5V
−0·75V
−1·0V
−0·25V
−0·5V
−0·75V
−1·0V
ANODE VOLTAGE (Va) V
0
20
40
60
80
100
120
140
160
180
200
ANODE CURRENT (Ia) & SCREEN GRID CURRENT (Ig2) mA
20
15
10
5
0

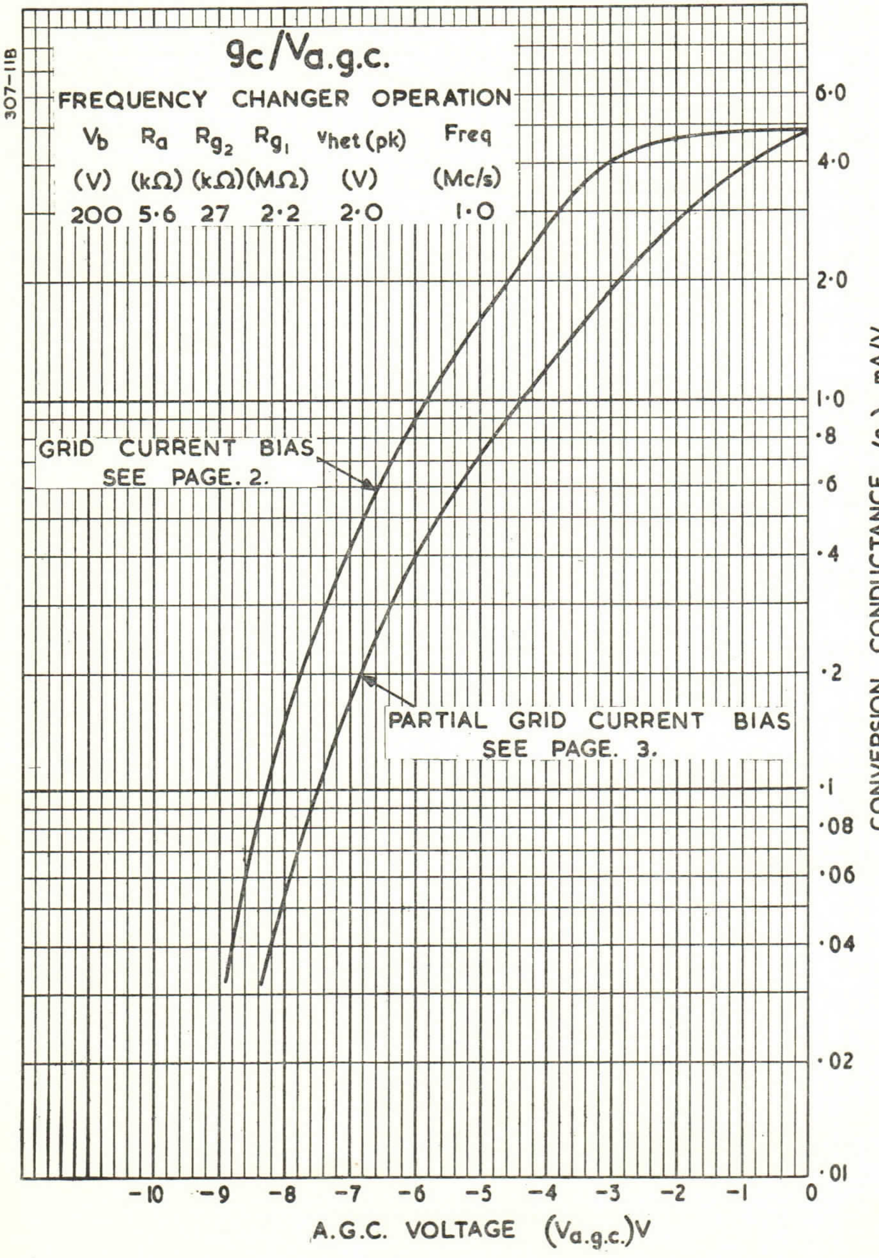

101—2/2
PENTODE SECTION
Ia , Ig2/Va
Ia ——
Ig2 – – –
Vg2 = 100V
Vg1 −0·5V
−0·75V
−1·0V
−0·5V
−0·75V
−1·0V
0
20
40
60
80
100
120
140
160
180
200
ANODE VOLTAGE (Va) V
20
15
10
5
0
ANODE CURRENT (Ia) & SCREEN GRID CURRENT (Ig2) mA

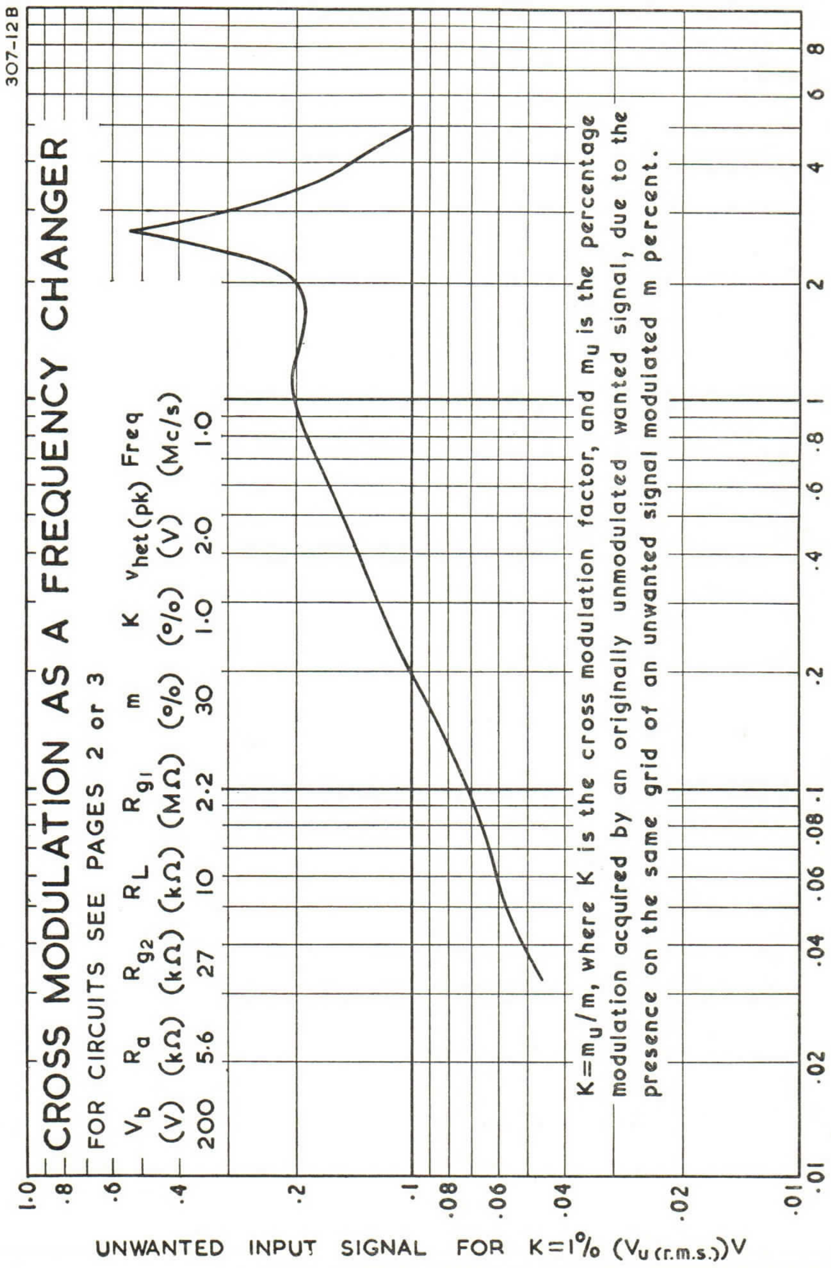

ANODE CURRENT (I_a) mA
40
30
20
10
0
V_a = 200V
= 150V
= 100V
= 50V
CONTROL GRID VOLTAGE (V_g) V
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
TRIODE SECTION
I_a/V_g
E-101

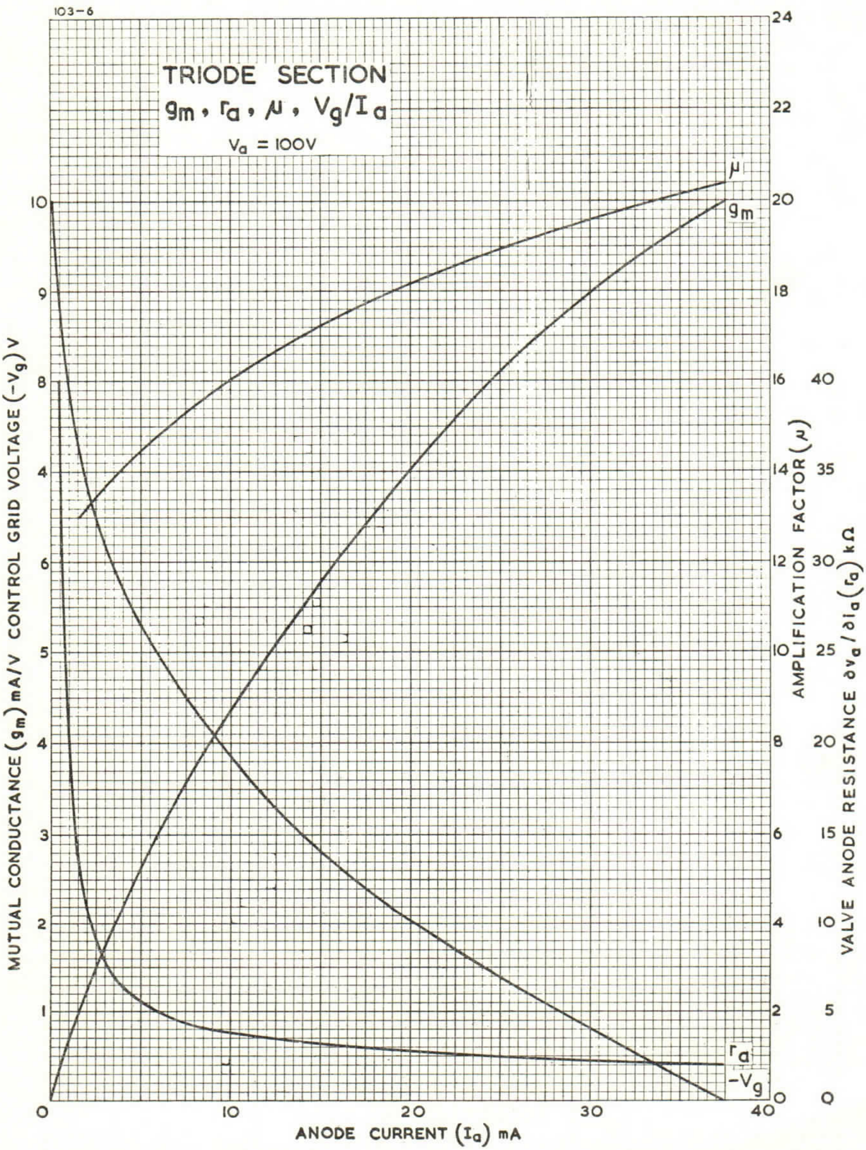

TRIODE SECTION
I_a/V_a
P_a (max) = 2W
V_g = 0V
− 1V
− 2V
− 3V
− 4V
− 5V
− 6V
− 7V
− 8V
− 9V
− 10V
− 11V
− 12V
− 13V
− 14V
− 15V
101-4
ANODE CURRENT (I_a) mA
ANODE VOLTAGE (V_a) V


206-8
$g_m/V_{a.g.c.}$
IF AMPLIFIER OPERATION
V_b R_a R_{g_2} R_{g_1}'
(V) (kΩ) (kΩ) (MΩ)
200 5·6 27 2·2
PARTIAL GRID CURRENT BIAS
SEE PAGE. 3.
GRID CURRENT BIAS
SEE PAGE. 2.
20
10
8
6
4
2
1
0·8
0·6
0·4
0·2
0·1
MUTUAL CONDUCTANCE (g_m) mA/V
−10 −9 −8 −7 −6 −5 −4 −3 −2 −1 0
A.G.C. VOLTAGE ($V_{a.g.c.}$)V

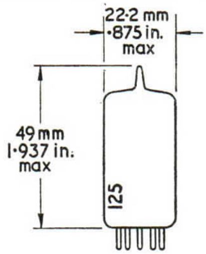

206-9A
CROSS MODULATION AS AN I.F. AMPLIFIER
FOR CIRCUITS SEE PAGES 2 or 3
Vb Ra Rg2 RL Rg1 m K Freq
(V) (kΩ) (kΩ) (kΩ) (MΩ) (%) (%) (Mc/s)
200 5.6 27 5 2.2 30 1.0 1.0
K=mu/m, where K is the cross modulation factor, and mu is the percentage modulation acquired by an originally unmodulated wanted signal, due to the presence on the same grid of an unwanted signal modulated m percent.
·1 ·2 ·4 ·6 ·8 1·0 2 4 6 8 10 20
MUTUAL CONDUCTANCE (gm) mA/V
1·0 ·8 ·6 ·4 ·2 ·1 ·08 ·06 ·04 ·02 ·01
UNWANTED INPUT SIGNAL FOR K=1% (Vu (r.m.s.))V


307-11B
gc/Va.g.c.
FREQUENCY CHANGER OPERATION
Vb Ra Rg2 Rg1 vhet (pk) Freq
(V) (kΩ) (kΩ) (MΩ) (V) (Mc/s)
200 5·6 27 2·2 2·0 1·0
GRID CURRENT BIAS
SEE PAGE. 2.
PARTIAL GRID CURRENT BIAS
SEE PAGE. 3.
6·0
4·0
2·0
1·0
·8
·6
·4
·2
·1
·08
·06
·04
·02
·01
CONVERSION CONDUCTANCE (gc) mA/V
−10 −9 −8 −7 −6 −5 −4 −3 −2 −1 0
A.G.C. VOLTAGE (Va.g.c.)V

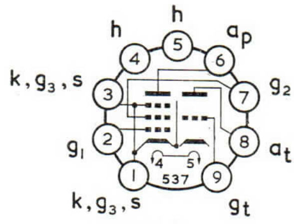

307-12B
CROSS MODULATION AS A FREQUENCY CHANGER
FOR CIRCUITS SEE PAGES 2 or 3
V_b (V) 200 | R_a (kΩ) 5.6 | R_{g2} (kΩ) 27 | R_L (kΩ) 10 | R_{g1} (MΩ) 2.2 | m (%) 30 | K (%) 1.0 | $v_{het(pk)}$ (V) 2.0 | Freq (Mc/s) 1.0
K=m_u/m, where K is the cross modulation factor, and m_u is the percentage modulation acquired by an originally unmodulated wanted signal, due to the presence on the same grid of an unwanted signal modulated m percent.
CONVERSION CONDUCTANCE (g_c) mA/V
UNWANTED INPUT SIGNAL FOR K=1% ($V_{u\,(r.m.s.)}$)V
.01 .02 .04 .06 .08 .1 .2 .4 .6 .8 1 2 4 6 8
1.0 .8 .6 .4 .2 .1 .08 .06 .04 .02 .01


103-6
TRIODE SECTION
g_m, r_a, μ, V_g/I_a
V_a = 100V
μ
g_m
r_a
$-V_g$
MUTUAL CONDUCTANCE (g_m) mA/V CONTROL GRID VOLTAGE ($-V_g$) V
AMPLIFICATION FACTOR (μ)
VALVE ANODE RESISTANCE $\partial v_a/\partial I_a$ (r_a) kΩ
ANODE CURRENT (I_a) mA
0
10
20
30
40
1
2
3
4
5
6
7
8
9
10
0
2
4
6
8
10
12
14
16
18
20
22
24
0
5
10
15
20
25
30
35
40

BRIMAR VALVES PCF806



V.H.F.
TRIODE
PENTODE



B9A Base

GENERAL

This combined triode and high slope frame grid pentode is for use as a frequency changer at frequencies up to 220 Mc/s in television tuners.

Heater Current	I_h	0·3 A
Heater Voltage	V_h	8·0 V

RATINGS

		Pentode	Triode	
Maximum Anode Dissipation	$p_{a(max)}$	2·0	1·5	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	0·5	—	W
Maximum Anode Voltage	$V_{a(max)}$	250	125	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	150	—	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$	100*	100*	V
Maximum Cathode Current	$I_{k(max)}$	18	15	mA
Maximum Grid to Cathode Resistance	$R_{g1\text{-}k(max)}$	250	500	kΩ

* To fulfil hum requirements on A.M. sound, it will be necessary for $V_{h\text{-}k}$ to be less than 50 V r.m.s.

INTER-ELECTRODE CAPACITANCES†

Input Pentode	$c_{in(p)}$	6·0	pF
Output Pentode	$c_{out(p)}$	3·3	pF
Grid 1 to Anode Pentode	$c_{g1\text{-}ap}$	0·012	pF
Grid 1 to Grid 2	$c_{g1\text{-}g2}$	1·6	pF
Grid Triode to Anode Triode	$c_{gt\text{-}at}$	2·0	pF
Grid Triode to Cathode and Heater	$c_{gt\text{-}k,h}$	2·2	pF
Anode Triode to Cathode and Heater	$c_{at\text{-}k,h}$	1·2	pF
Anode Pentode to Anode Triode	$c_{ap\text{-}at}$	<0·03	pF
Anode Pentode to Grid Triode	$c_{ap\text{-}gt}$	<0·01	pF
Grid 1 to Anode Triode	$c_{g1\text{-}at}$	<0·01	pF
Grid 1 to Grid Triode	$c_{g1\text{-}gt}$	<0·01	pF

† Measured without an external shield

CHARACTERISTICS

		Pentode	Triode	
Anode Voltage	V_a	170	100	V
Screen Grid Voltage	V_{g2}	150	—	V
Control Grid Voltage	V_{g1}	−1·2	−3·0	V
Anode Current	I_a	10	14	mA
Screen Grid Current	I_{g2}	3·3	—	mA
Mutual Conductance	g_m	12	5·5	mA/V
Amplification Factor	μ	—	17	
Inner Amplification Factor	$\mu_{g1\text{-}g2}$	70	—	
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	>350	—	kΩ
Equivalent Grid Noise Resistance	R_{eq}	1·0	—	kΩ

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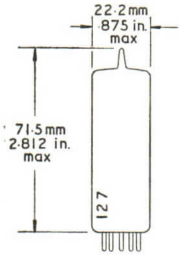
TYPICAL OPERATION—As a Frequency Changer

Anode Voltage	V_a	190	V
Screen Supply Voltage ($R_{g2} = 18k\Omega$)	$V_{g2(b)}$	190	V
Control Grid Resistance	R_{g1}	100	kΩ
Heterodyne Voltage (R.M.S.)	$V_{het(r.m.s.)}$	2·3	V
Anode Current	I_a	8·5	mA
Screen Grid Current	I_{g2}	2·7	mA
Conversion Conductance	g_c	4·5	mA/V

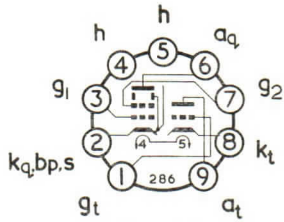
MOUNTING POSITION:—Unrestricted

For characteristic curves see PCF86

BRIMAR VALVES PCL82



TRIODE OUTPUT BEAM TETRODE



Base B9A

GENERAL

This triode output beam tetrode is for use in television receivers with the triode as A.F. amplifier or time base oscillator and the tetrode as audio or field output valve.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	16	V

RATINGS

		Triode	Tetrode	
Maximum Anode Dissipation	$p_{a(max)}$			
For $V_a \leqslant 250V$		1·0	7·0	W
For $V_a > 250V$		—	5·0	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	—	1·8	W
For speech and music		—	3·2	W
Maximum Anode Supply Voltage ($I_a = 0$)	$V_{a(b)max}$	550	550	V
Maximum Anode Voltage	$V_{a(max)}$	250	250	V
Maximum Peak Anode Voltage	$v_{a(pk)max}$			
Pulse Positive		0·6†	2·5*	kV
Pulse Negative		—	500	V
Maximum Screen Grid Supply Voltage ($I_{g2} = 0$)	$V_{g2(b)max}$	—	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	—	250	V
Maximum Heater to Cathode Voltage (R.M.S.)	$V_{h\text{-}k(r.m.s.)max}$	200‡	200‡	V
Maximum Mean Cathode Current	$I_{k(av)max}$	15	50	mA
Maximum Resistance Grid 1 to Cathode	$R_{g1\text{-}k(max)}$			
Self Bias		3	2	MΩ
Fixed Bias		1	1	MΩ
Grid Current Bias		22	—	MΩ
Maximum Resistance Heater to Cathode	$R_{h\text{-}k(max)}$	20	20	kΩ

* Maximum pulse duration 4 per cent. of one cycle with a maximum of 800μs.

† Maximum pulse duration 200μs.

‡ Measured with respect to the higher potential heater pin.

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INTER-ELECTRODE CAPACITANCES

		§	¶	‖	
Tetrode Input	$c_{in(q)}$	9·3	9·6	10·7	pF
Tetrode Output	$c_{out(q)}$	9·0	9·3	10·4	pF
Tetrode Anode to Grid 1	c_{aq-g1}	0·35	0·37	0·38	pF
Triode Input	$c_{in(t)}$	3·0	3·2	4·1	pF
Triode Output	$c_{out(t)}$	4·3	4·5	5·4	pF
Grid Triode to Anode Triode	c_{gt-at}	4·2	4·3	4·4	pF
Anode Tetrode to Anode Triode	c_{aq-at}	0·15	0·18	0·19	pF
Grid 1 to Grid Triode	c_{g1-gt}	0·011	0·030	0·063	pF
Grid 1 to Anode Triode	c_{g1-at}	0·017	0·023	0·028	pF
Grid Triode to Anode Tetrode	c_{gt-aq}	0·014	0·020	0·022	pF
Grid Triode to Heater	c_{gt-h}	0·018	0·031	0·042	pF
Grid 1 to Heater	c_{g1-h}	0·24	0·38	0·71	pF

§ In fully shielded socket without can.

¶ With holder capacitance balanced out (Holder as below).

‖ Total inter-electrode capacitances including B9A nylon phenolic holder without skirt or radial shield (AEI holder type VH19/902).

CHARACTERISTICS

		Triode	Tetrode	
Anode Voltage	V_a	100	200	V
Screen Grid Voltage	V_{g2}	—	200	V
Anode Current	I_a	3·5	35	mA
Screen Grid Current	I_{g2}	—	7	mA
Control Grid Voltage	V_{g1}	0	−16	V
Mutual Conductance	g_m	2·5	6·4	mA/V
Amplification Factor	μ	70	—	
Inner Amplification Factor	μ_{g1-g2}	—	9·5	

TYPICAL OPERATION

Single Valve as Class A Audio Output

Anode Voltage	V_a	170	200	V
Screen Grid Voltage	V_{g2}	170	200	V
Grid Bias Voltage	V_g	−11·5	−16	V
Quiescent Anode Current	$I_{a(o)}$	41	35	mA
Quiescent Screen Grid Current	$I_{g2(o)}$	8	7	mA
Power Output for 10 per cent. total distortion	P_{out}	3·3	3·5	W
Anode Load Resistance	R_a	3·9	5.6	kΩ
Input Swing Voltage (R.M.S.)	$V_{in(r.m.s.)}$	6	6·6	V
Input Swing for 50mW output (R.M.S.)		0·59	0·6	V

Field Scanning

The field scan output stage should be designed to allow for valve spread and deterioration during life in addition to component variation. Values of total tetrode peak anode current available for a new average valve and at the assumed end of life point on any valve are as follows :—

		*	†	
Anode Voltage	V_a	50	50	V
Screen Grid Voltage	V_{g2}	170	170	V
Anode Current	I_a	135	85	mA

Where V_{g1} is adjusted so that $I_{g1} = +0{\cdot}3\mu A$.

* Average new valve.

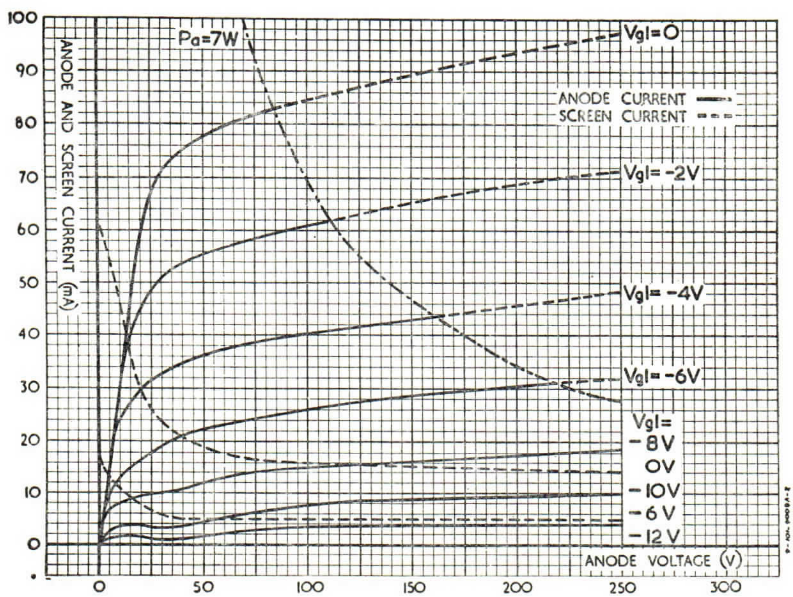
† Assumed end of life condition.

MOUNTING POSITION—Unrestricted

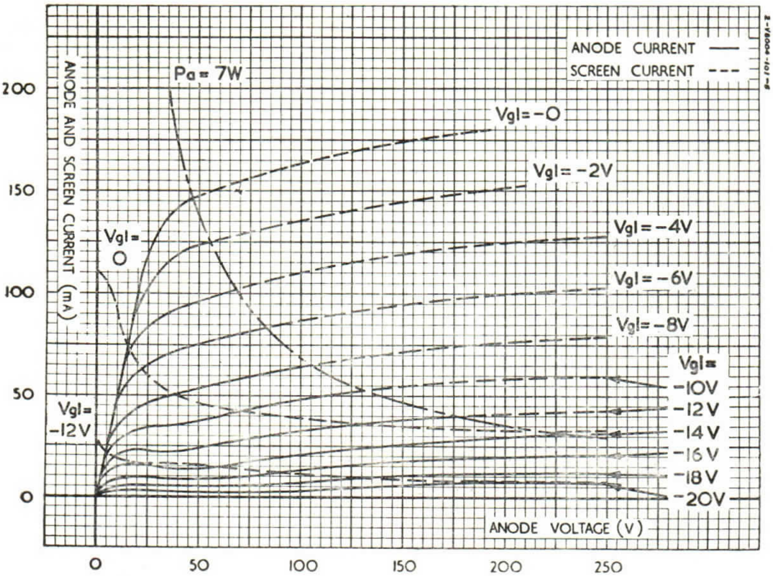
CHARACTERISTIC CURVES

$I_a, I_{g2}/V_a$ (V_{g2}=100V)

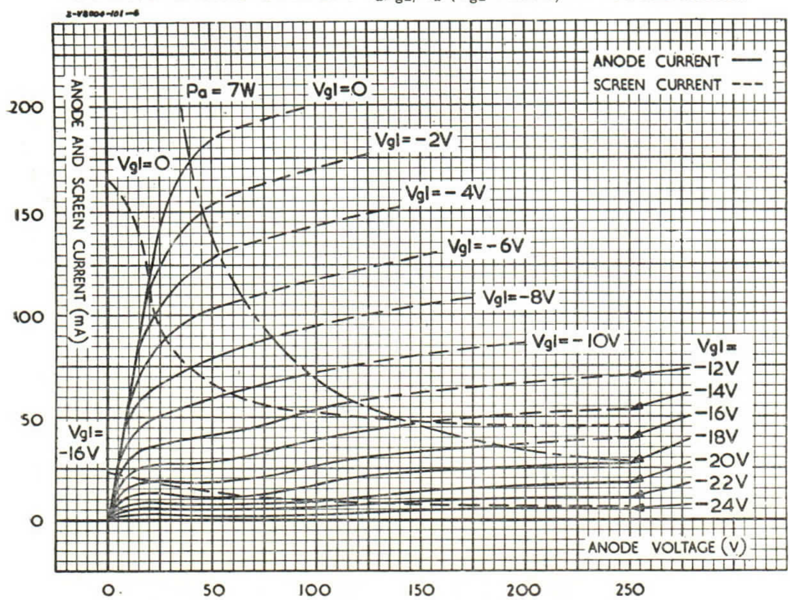
Tetrode Section



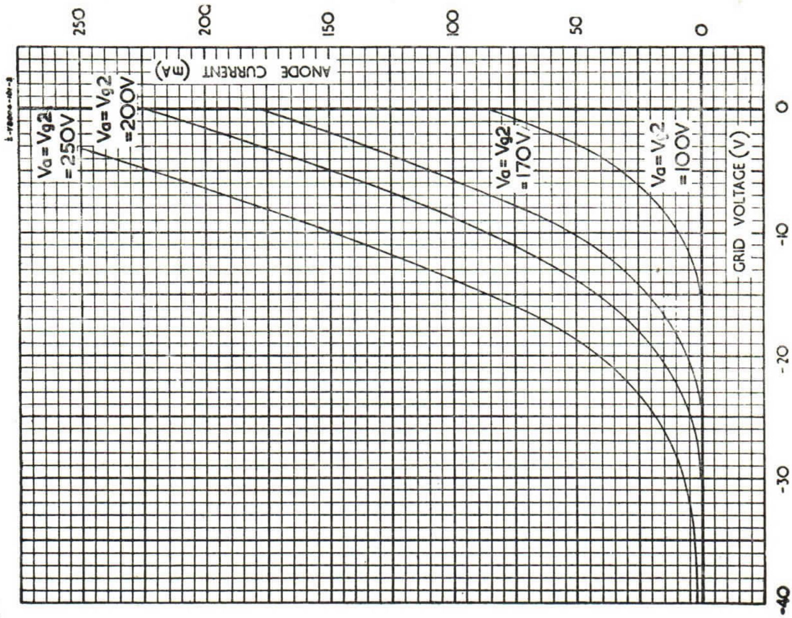
CHARACTERISTIC CURVES: $I_a, I_{g2}/V_a$ ($V_{g2} = 170V$) — Tetrode Section



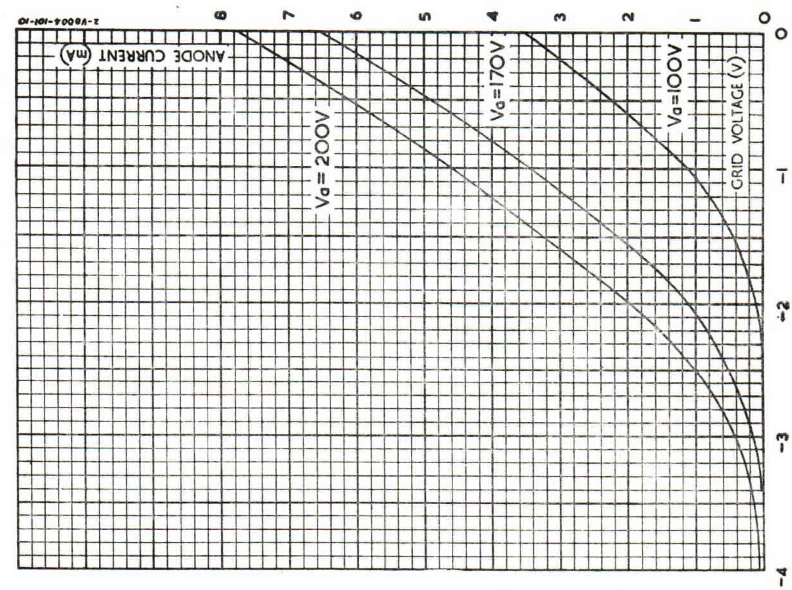
CHARACTERISTIC CURVES: $I_a, I_{g2}/V_a$ ($V_{g2} = 200V$) — Tetrode Section



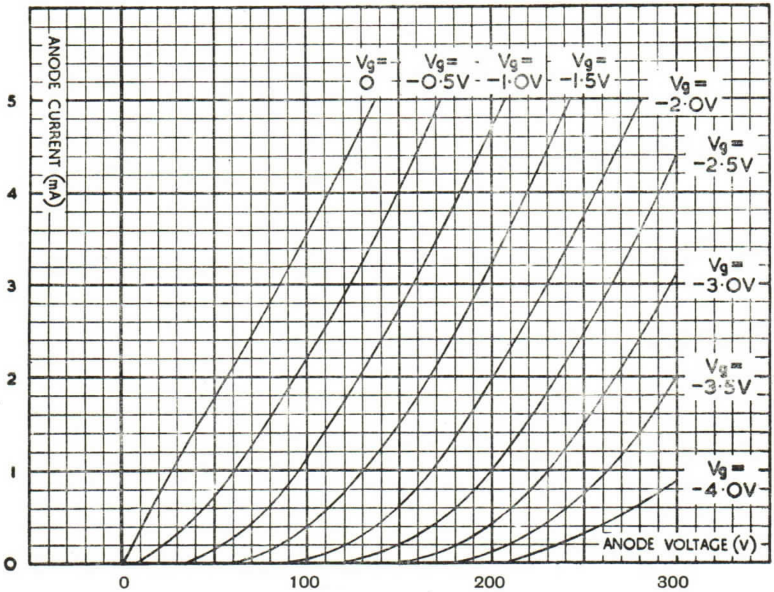
CHARACTERISTIC CURVES: I_a/V_{g1} — Tetrode Section



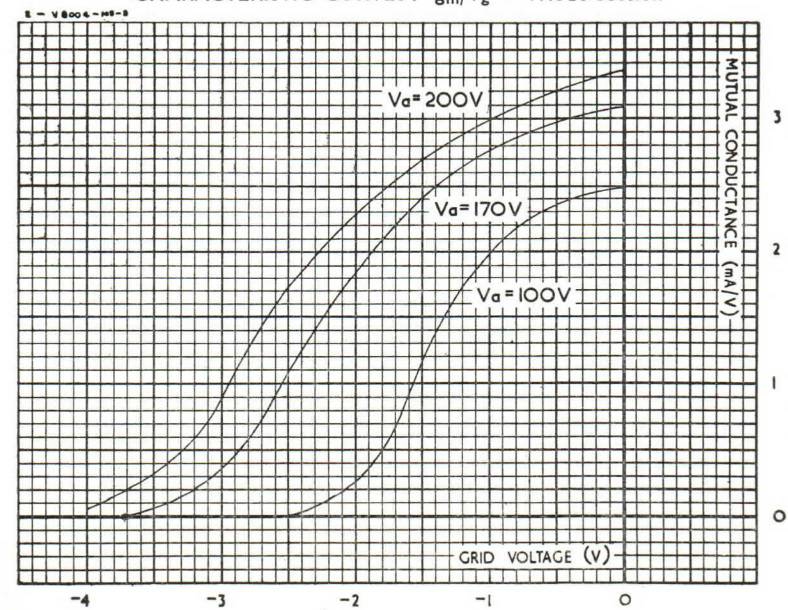
CHARACTERISTIC CURVES: I_a/V_g — Triode Section

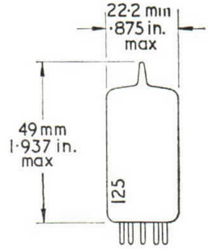


CHARACTERISTIC CURVES: I_a/V_a — Triode Section

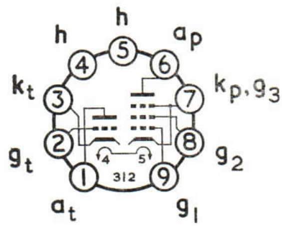


CHARACTERISTIC CURVES: g_m/V_g — Triode Section





TIME BASE TRIODE PENTODE



B9A Base

GENERAL

This triode pentode is for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	12·6	V

RATINGS

		Triode	Pentode	
Maximum Anode Dissipation	$p_{a(max)}$	3·5	5·4	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	—	1·2	W
Speech and Music		—	2·4	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	550	V
Maximum Anode Voltage	$V_{a(max)}$	250	250	V
Maximum Peak Positive Anode Voltage	$v_{a(pk)max}$	—	2·0	kV
Maximum Screen Grid Supply Voltage	$V_{g2(b)max}$	—	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	—	250	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$			
Heater Positive		100	100	V
Maximum Cathode Current	$I_{k(max)}$	15	45	mA
Maximum Control Grid to Cathode Resistance	$R_{g1\text{-}k(max)}$			
Self Bias		—	500	kΩ
Fixed Bias		1·0	0·25	MΩ
Grid Current Bias		22	—	MΩ

INTER-ELECTRODE CAPACITANCES

		Triode	Pentode	
Input	c_{in}	2·3	5·7	pF
Output	c_{out}	0·32	4·7	pF
Anode to Control Grid	$c_{a\text{-}g1}$	1·6	<0·2	pF
Control Grid to Heater	$c_{g1\text{-}h}$	—	0·4	pF

OPERATING CHARACTERISTICS

		Triode	Pentode	
Anode Voltage	V_a	250	170	V
Screen Grid Voltage	V_{g2}	—	170	V
Control Grid Voltage	V_{g1}	−8·5	−9·5	V
Anode Current	I_a	10·5	30	mA
Screen Grid Current	I_{g2}	—	5·0	mA
Mutual Conductance	g_m	2·2	5·5	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	7·7	53	kΩ
Amplification Factor	μ	17	—	
Inner Amplification Factor	$\mu_{g1\text{-}g2}$	—	10	

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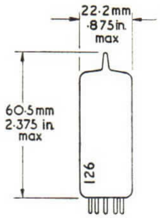
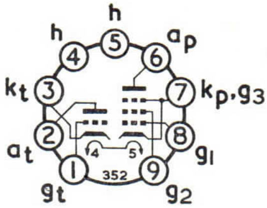
BRIMAR VALVES PCL84



TRIODE PENTODE



B9A Base

GENERAL

This triode pentode valve with separate cathodes is primarily intended for use in the video output stage of television receivers. The triode may be used in a variety of ways such as sync. separator, A.G.C. and noise suppression circuits.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	15	V

RATINGS

		Triode	Pentode	
Maximum Anode Dissipation	$p_{a(max)}$	1	4	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	—	1·7	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	550	V
Maximum Anode Voltage	$V_{a(max)}$	250*	250	V
Maximum Screen Grid Supply Voltage	$V_{g2(b)max}$	—	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	—	250	V
Maximum Heater to Cathode Voltage (Heater Positive)	$V_{h\text{-}k(max)}$	150	200	V
Maximum Heater to Cathode Voltage (Heater Negative)	$V_{h\text{-}k(max)}$	350†	200	V
Maximum Cathode Current	$I_{k(max)}$	12‡	40	mA
Maximum Grid 1 to Cathode Resistance	$R_{g\text{-}k(max)}$			
Self Bias		3	2	MΩ
Fixed Bias		1	1	MΩ

* Maximum peak anode voltage ($I_a < 0{\cdot}1$mA) = 600V
† Maximum D.C. component = 200V
‡ Maximum peak cathode current = 160mA for maximum pulse duration = 800μs.

INTER-ELECTRODE CAPACITANCES

		§	
Pentode Input	$c_{in(p)}$	8·7	pF
Pentode Output	$c_{out(p)}$	4·2	pF
Grid 1 to Anode Pentode	$c_{g1\text{-}ap}$	<0·1	pF
Triode Input	$c_{in(t)}$	3·8	pF
Triode Output	$c_{out(t)}$	2·3	pF
Anode Triode to Grid Triode	$c_{at\text{-}gt}$	2·7	pF
Grid Triode to Grid 1	$c_{gt\text{-}g1}$	<0·01	pF
Anode Triode to Grid 1	$c_{at\text{-}g1}$	<0·01	pF
Grid Triode to Heater	$c_{gt\text{-}h}$	<0·1	pF

§ Inter-electrode capacitances in fully shielded socket without can.

CHARACTERISTICS

		Triode	Pentode			
Anode Voltage	V_a	200	170	200	220	V
Screen Grid Voltage	V_{g2}	—	170	200	220	V
Control Grid Voltage	V_{g1}	−1·7	−2·1	−2·9	−3·4	V
Anode Current	I_a	3	18	18	18	mA
Screen Grid Current	I_{g2}	—	3	3	3	mA
Mutual Conductance	g_m	4	11	10·4	10	mA/V
Amplification Factor	μ	65	—	—	—	
Inner Amplification Factor	$\mu_{g1\text{-}g2}$	—	36	36	36	
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	16·2	100	130	150	kΩ

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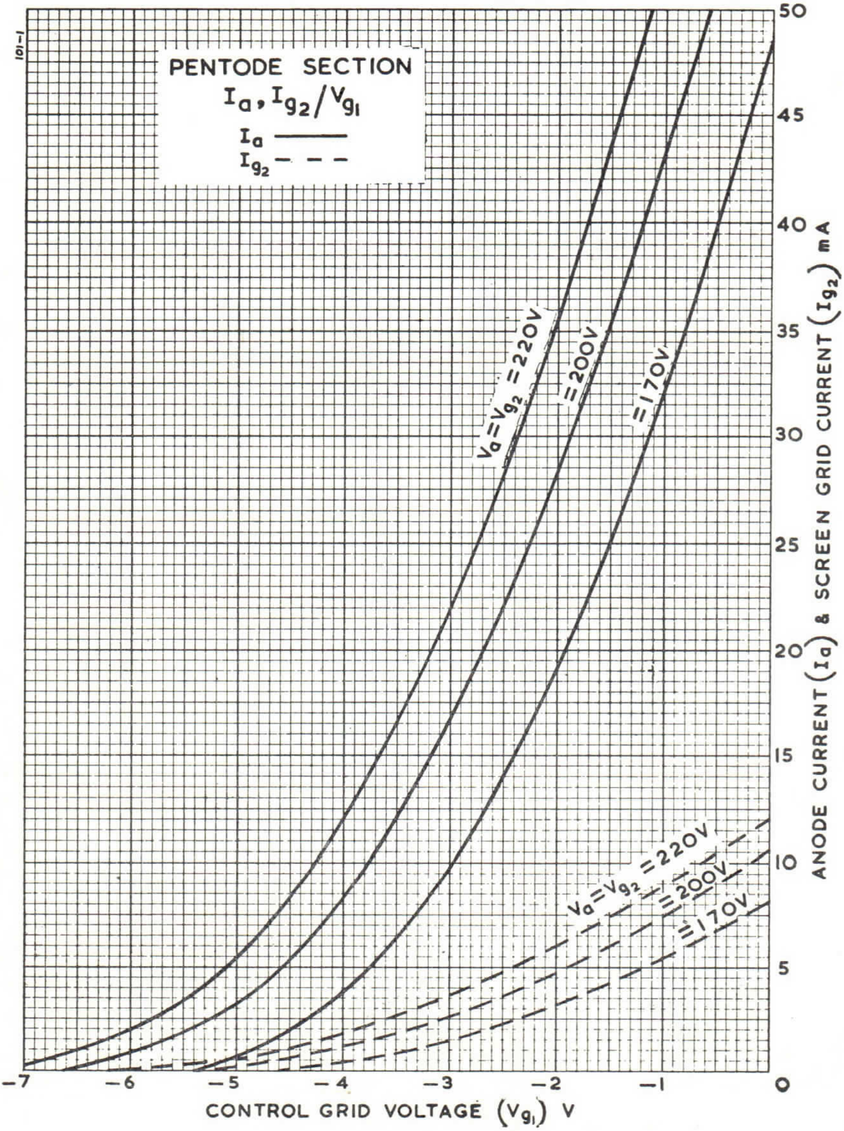
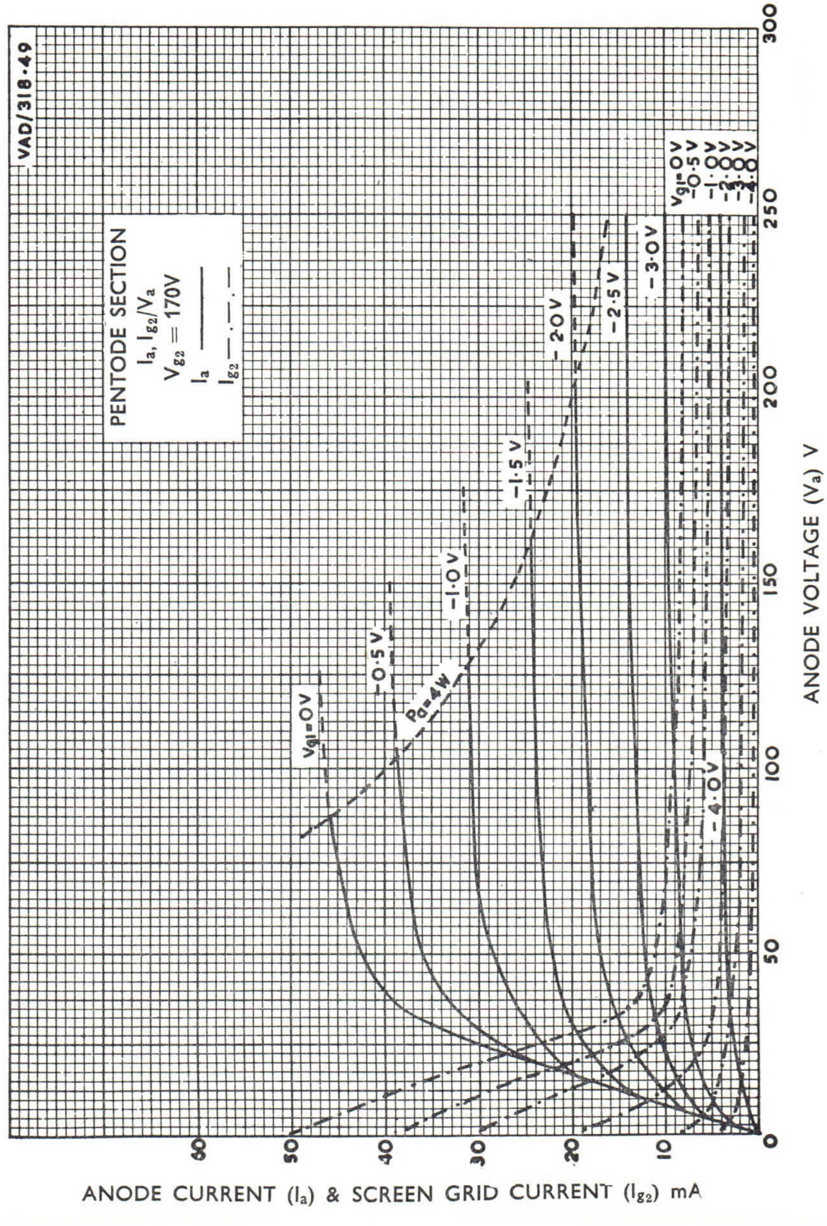
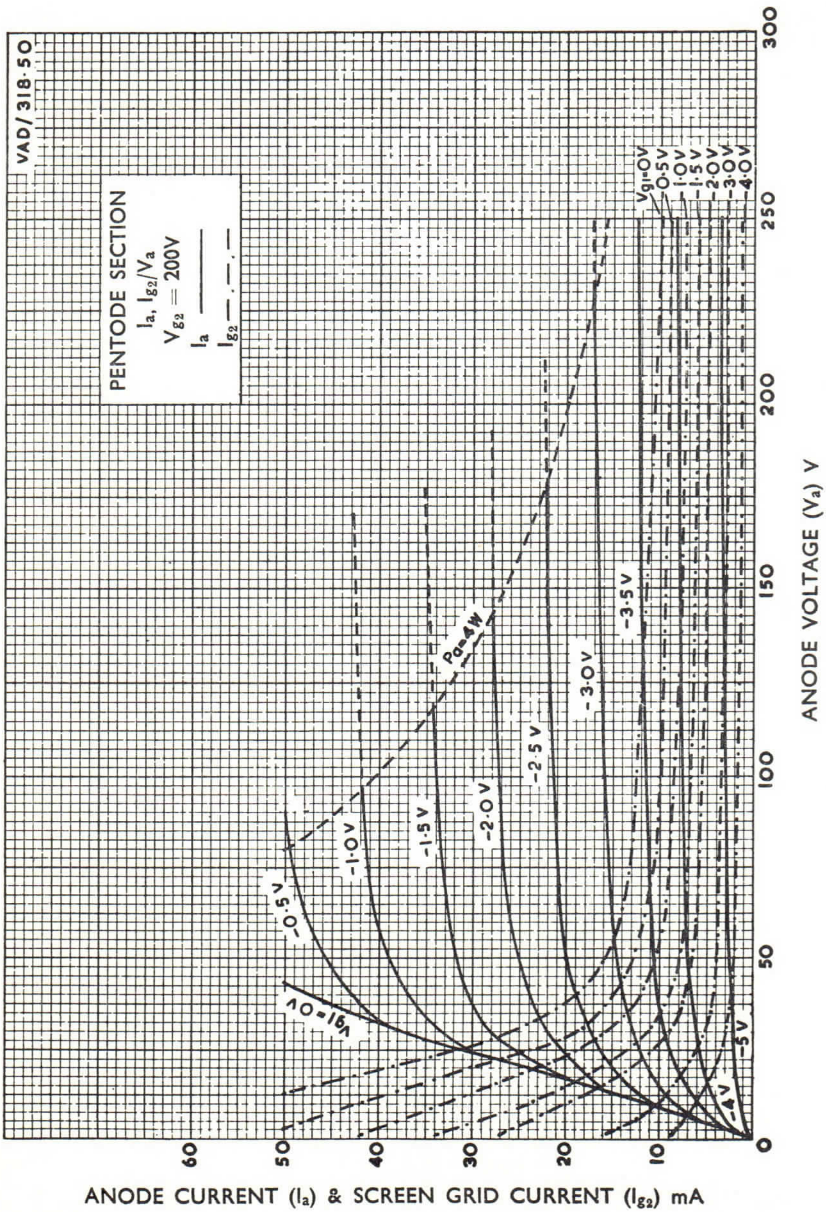
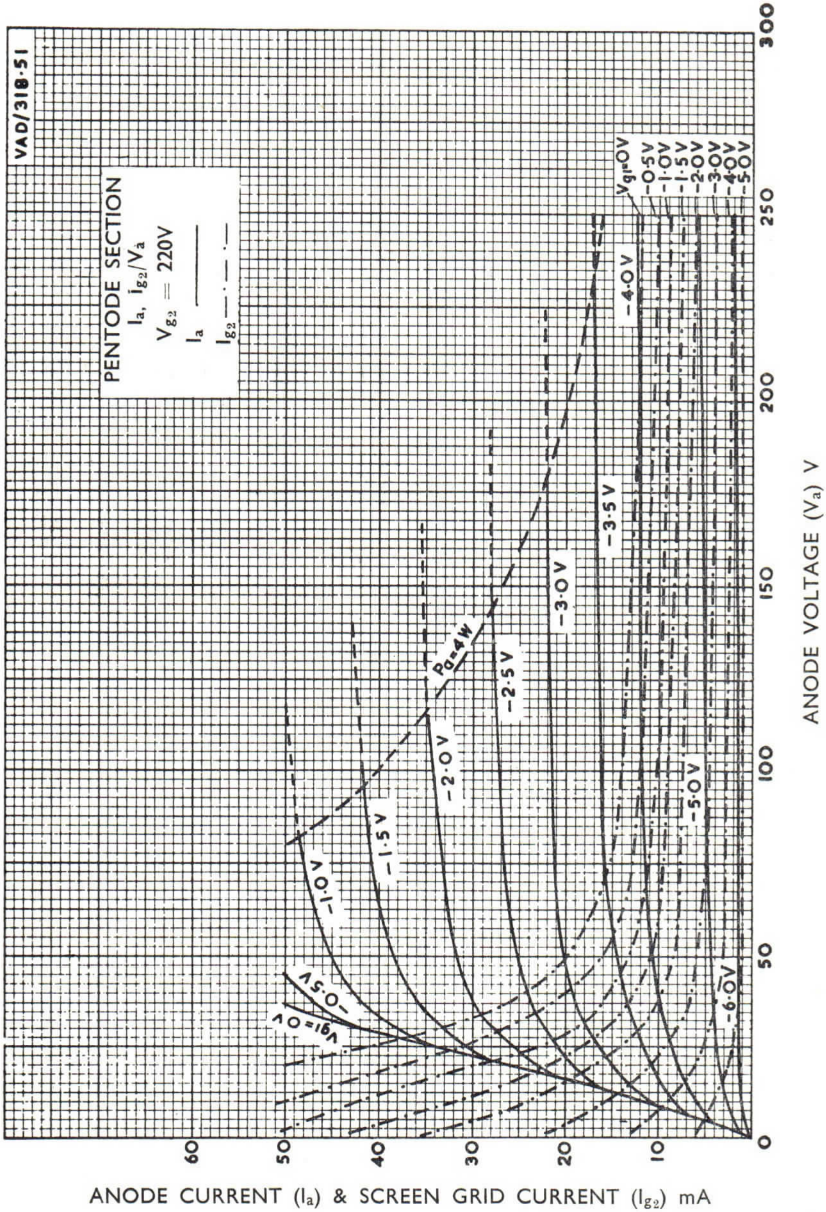
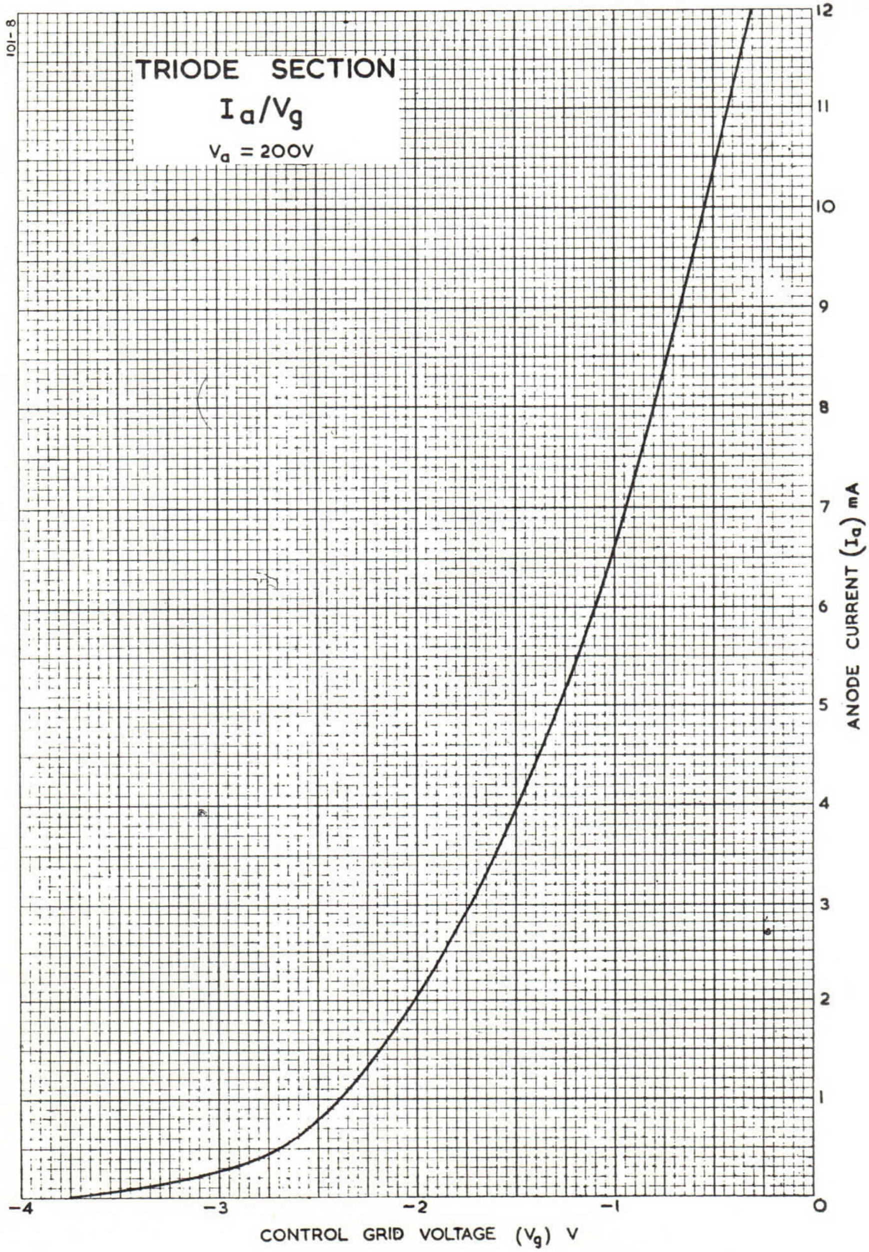
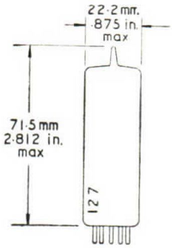

PENTODE SECTION
$I_a, I_{g2}/V_{g1}$
I_a ———
I_{g2} - - -
$V_a=V_{g2}=220V$
$=200V$
$=170V$
$V_a=V_{g2}=220V$
$=200V$
$=170V$
50
45
40
35
30
25
20
15
10
5
0
−7
−6
−5
−4
−3
−2
−1
CONTROL GRID VOLTAGE (V_{g1}) V
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA


VAD/318-49
PENTODE SECTION
I_a, I_{g2}/V_a
$V_{g2} = 170V$
I_a ———
I_{g2} —·—·—
V_{g1}=0V
−0·5V
−1·0V
−1·5V
−2·0V
−2·5V
−3·0V
−4·0V
Pa=4W
ANODE VOLTAGE (V_a) V
0
50
100
150
200
250
300
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA
0
10
20
30
40
50
60

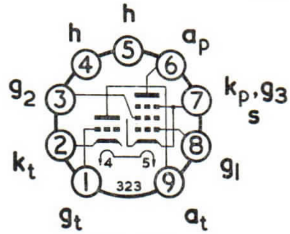

VAD/318·50
PENTODE SECTION
I_a, I_{g2}/V_a
$V_{g2} = 200V$
I_a ———
I_{g2} — · — ·
Pa=4W
V_{g1}=0V
−0·5 V
−1·0 V
−1·5 V
−2·0 V
−2·5 V
−3·0 V
−3·5 V
−4 V
−5 V
V_{g1}=0V
0·5V
1·0V
1·5V
2·0V
3·0V
4·0V
0
50
100
150
200
250
300
ANODE VOLTAGE (V_a) V
0
10
20
30
40
50
60
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA


VAD/318·51
PENTODE SECTION
Ia, Ig2/Va
Vg2 = 220V
Ia ——
Ig2 —·—·—
Vg1=0V
-0·5V
-1·0V
-1·5V
-2·0V
-2·5V
-3·0V
-3·5V
-4·0V
-5·0V
-6·0V
Pa=4W
ANODE VOLTAGE (Va) V
0
50
100
150
200
250
300
ANODE CURRENT (Ia) & SCREEN GRID CURRENT (Ig2) mA
10
20
30
40
50
60


101-8
TRIODE SECTION
I_a/V_g
$V_a = 200V$
12
11
10
9
8
7
6
5
4
3
2
1
0
ANODE CURRENT (I_a) mA
−4
−3
−2
−1
CONTROL GRID VOLTAGE (V_g) V



TRIODE
PENTODE



B9A Base

GENERAL

This high-μ triode and output pentode is for use in the audio amplifier stage of television receivers.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	13·6	V

RATINGS

		Triode	Pentode	
Maximum Anode Dissipation	$p_{a(max)}$	0·5	9·0	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	—	1·8	W
For speech and music		—	3·0	W
Maximum Anode Supply Voltage ($I_a = 0$)	$V_{a(b)max}$	550	550	V
Maximum Anode Voltage	$V_{a(max)}$	250	250	V
Maximum Screen Grid Supply Voltage ($I_{g2} = 0$)	$V_{g2(b)max}$	—	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	—	250	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$	100	100	V
Maximum Cathode Current	$I_{k(max)}$	4·0	55	mA
Maximum Grid 1 to Cathode Resistance	$R_{g1\text{-}k(max)}$			
Fixed Bias		1·0	1·0	MΩ
Self Bias		2·0	—	MΩ
Grid Current Bias		22	—	MΩ
Maximum Heater to Cathode Resistance	$R_{h\text{-}k(max)}$	20*	20	kΩ

* When used as a phase inverter immediately preceding the output stage $R_{h\text{-}k(max)}$ may be 120kΩ.

INTER-ELECTRODE CAPACITANCES†

Pentode Input	$c_{in(p)}$	10	pF
Grid 1 to Anode Pentode	$c_{g1\text{-}ap}$	<0·4	pF
Grid 1 to Heater	$c_{g1\text{-}h}$	<0·24	pF
Triode Input	$c_{in(t)}$	2·3	pF
Triode Output	$c_{out(t)}$	2·5	pF
Grid Triode to Anode Triode	$c_{gt\text{-}at}$	1·4	pF
Grid Triode to Heater	$c_{gt\text{-}h}$	<0·006	pF
Grid Triode to Grid 1	$c_{gt\text{-}g1}$	<0·02	pF
Grid Triode to Anode Pentode	$c_{gt\text{-}ap}$	<0·006	pF
Anode Triode to Anode Pentode	$c_{at\text{-}ap}$	<0·15	pF
Anode Triode to Grid 1	$c_{at\text{-}g1}$	<0·2	pF

† In fully shielded socket without can (I.E.C. Publication 100).

CHARACTERISTICS

		Triode	Pentode	
Anode Voltage	V_a	230	230	V
Screen Grid Voltage	V_{g2}	—	230	V
Control Grid Voltage	V_{g1}	−1·7	−5·7	V
Anode Current	I_a	1·2	39	mA
Screen Grid Current	I_{g2}	—	6·5	mA
Mutual Conductance	g_m	1·6	10·5	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	62	45	kΩ
Amplification Factor	μ	100	—	
Inner Amplification Factor	$\mu_{g1\text{-}g2}$	—	21	

THORN—A E I RADIO VALVES & TUBES LTD.

TYPICAL OPERATION

Pentode as Class A Audio Output Stage

Anode Voltage	V_a	200	230	V
Screen Grid Voltage	V_{g2}	200	230	V
Cathode Resistor	R_k	115	125	Ω
Quiescent Anode Current	$I_{a(o)}$	35	39	mA
Quiescent Screen Grid Current	$I_{g2(o)}$	6·0	6·5	mA
Anode Load Resistor	R_a	5·6	5·1	kΩ
Input Voltage (R.M.S.)	$V_{in(r.m.s.)}$	3·2	3·6	V
Input Voltage (R.M.S.) for 50mW output		0·29	0·3	V
Power Output	P_{out}	3·1	4·1	W
Total Distortion	D_{tot}	10	10	%

Triode as Resistance Coupled A.F. Amplifier

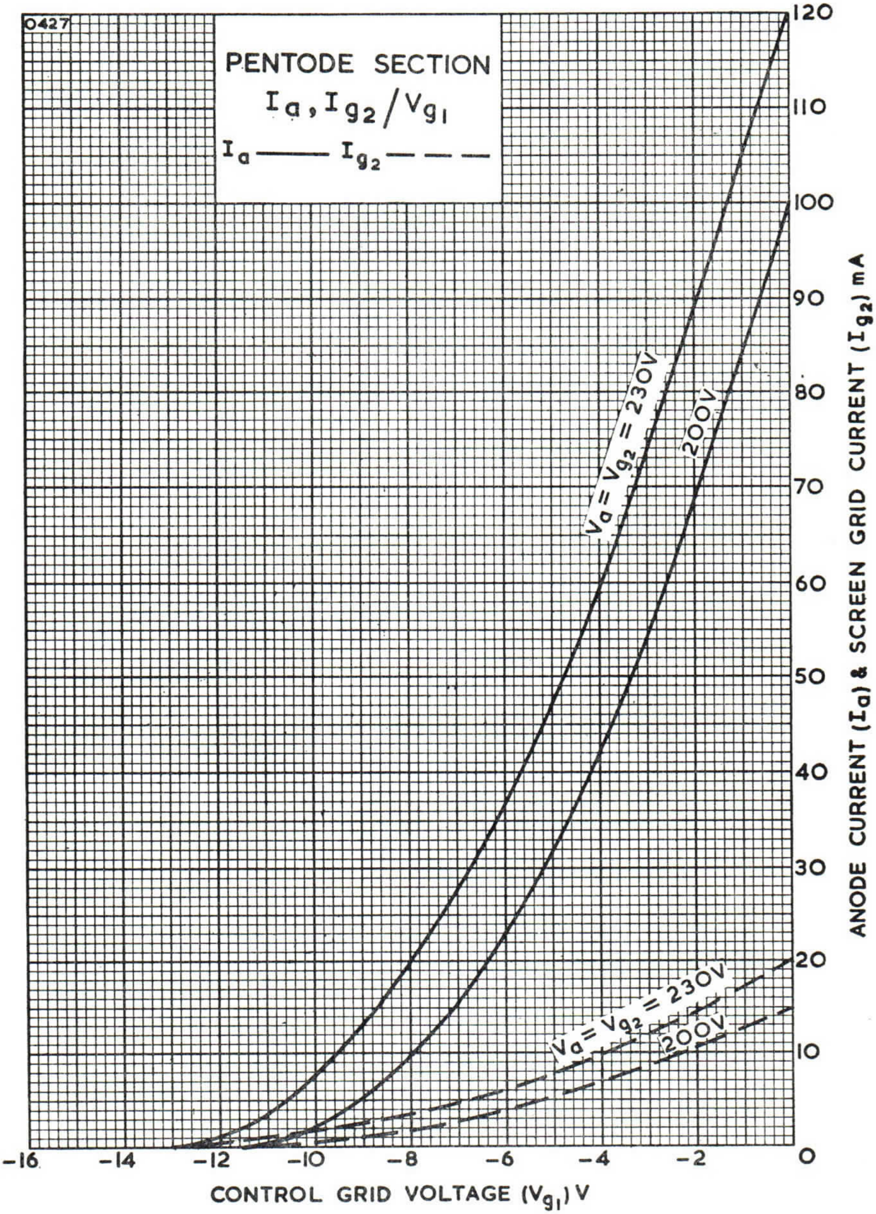
Grid Current Bias ($R_g = 10M\Omega$)

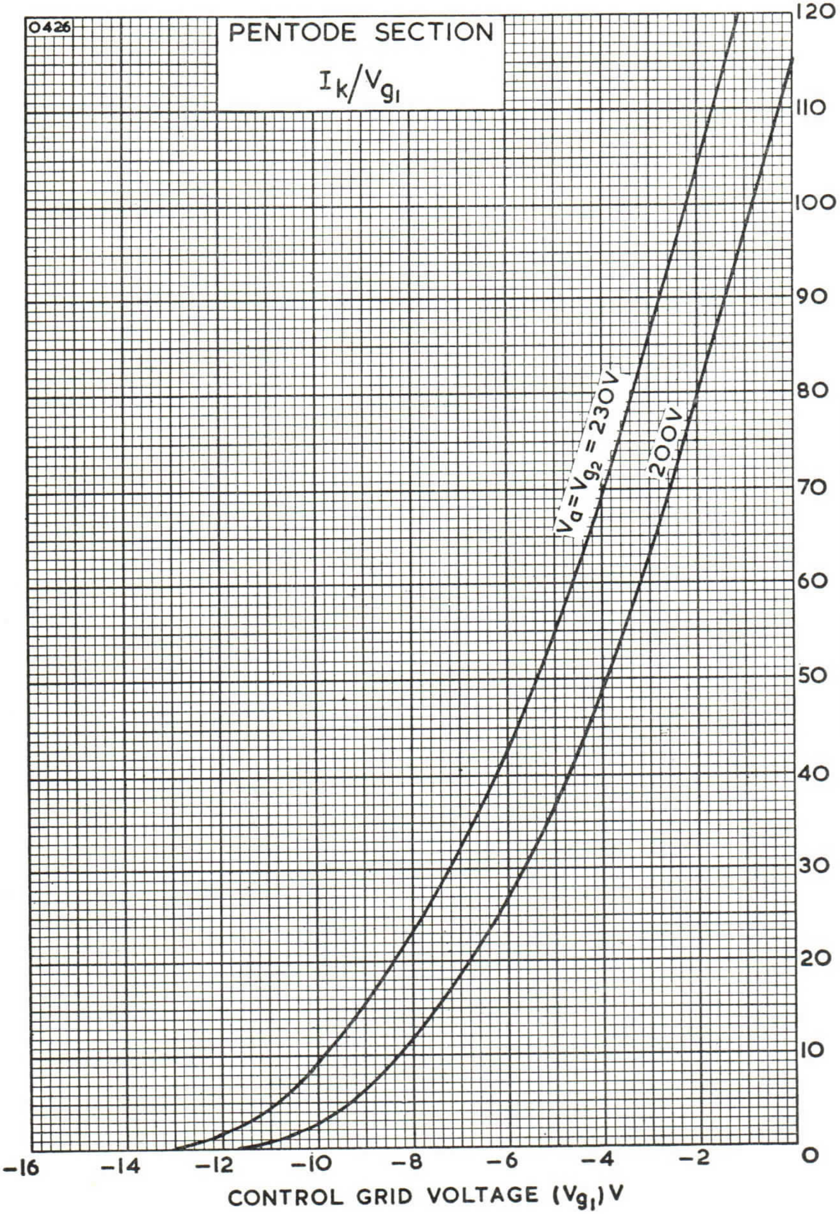
Supply Voltage	V_b	170	170	170	230	230	230	V
Anode Load Resistance	R_a	47	100	220	47	100	220	kΩ
Grid Resistance of Following Valve		150	330	680	150	330	680	kΩ
Anode Current	I_a	0·82	0·58	0·37	1·37	0·9	0·57	mA
Signal Source Impedance, $Z_s = 0\Omega$								
Voltage Amplification for $V_{in(r.m.s.)} = 100mV$		36	53	67	40	57	72	
R.M.S. Output Voltage for 5% total distortion		9	13	15	15	22	26	V
Signal Source Impedance, $Z_s = 220k\Omega$								
Voltage Amplification for $V_{in(r.m.s.)} = 100mV$		29	42	52	32	45	55	
R.M.S. Output Voltage for 5% total distortion*		11	16	21	18	26	33	V

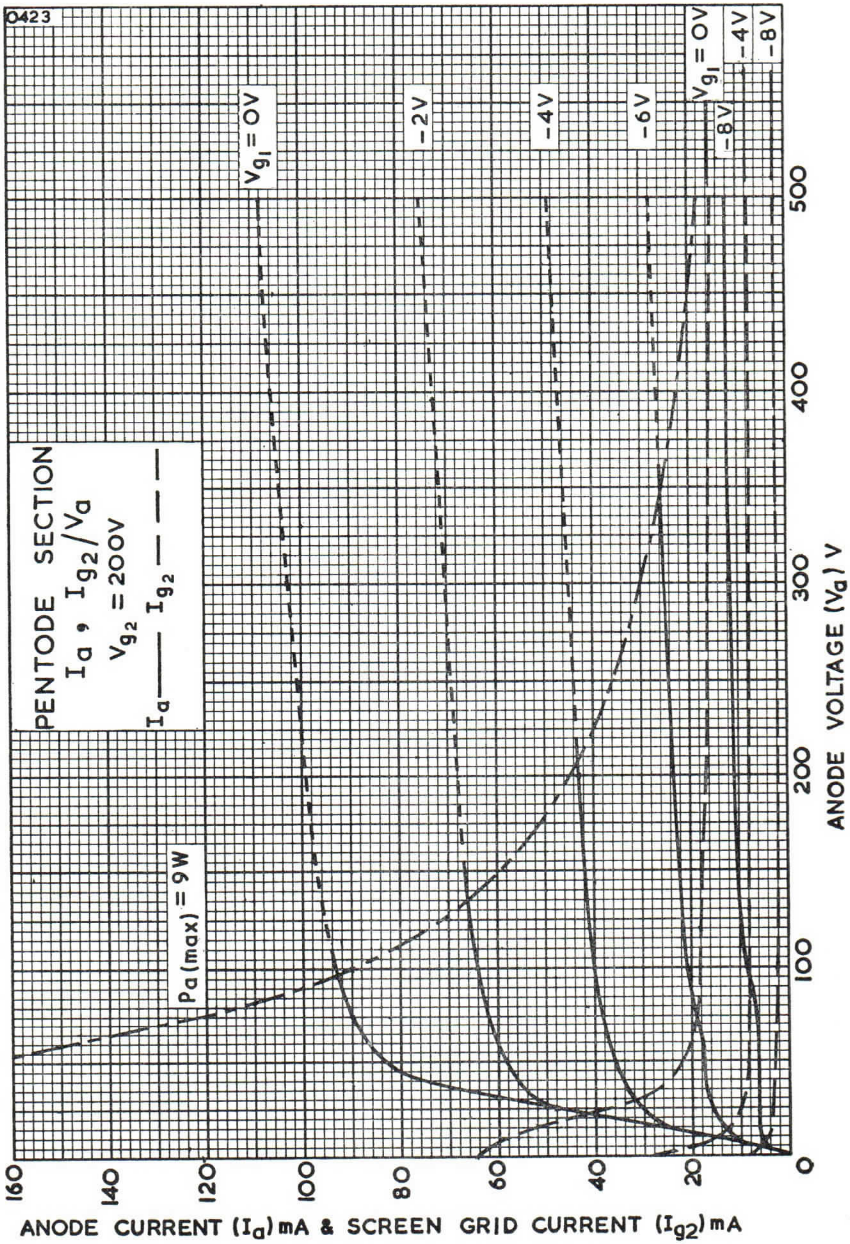
* When operating this valve with grid current bias and a high source impedance, the second harmonic distortion rises to a peak at quite low levels of output (about 10V r.m.s.) and then falls with increasing drive. The third harmonic then begins to rise, and D_{tot} finally reaches 5% at a much higher output level than with zero source impedance. The maximum value of this distortion peak varies inversely with the anode load, being about 5·5% with $R_a = 47k\Omega$, 4·5% with $R_a = 100k\Omega$ and 4% with $R_a = 220k\Omega$.

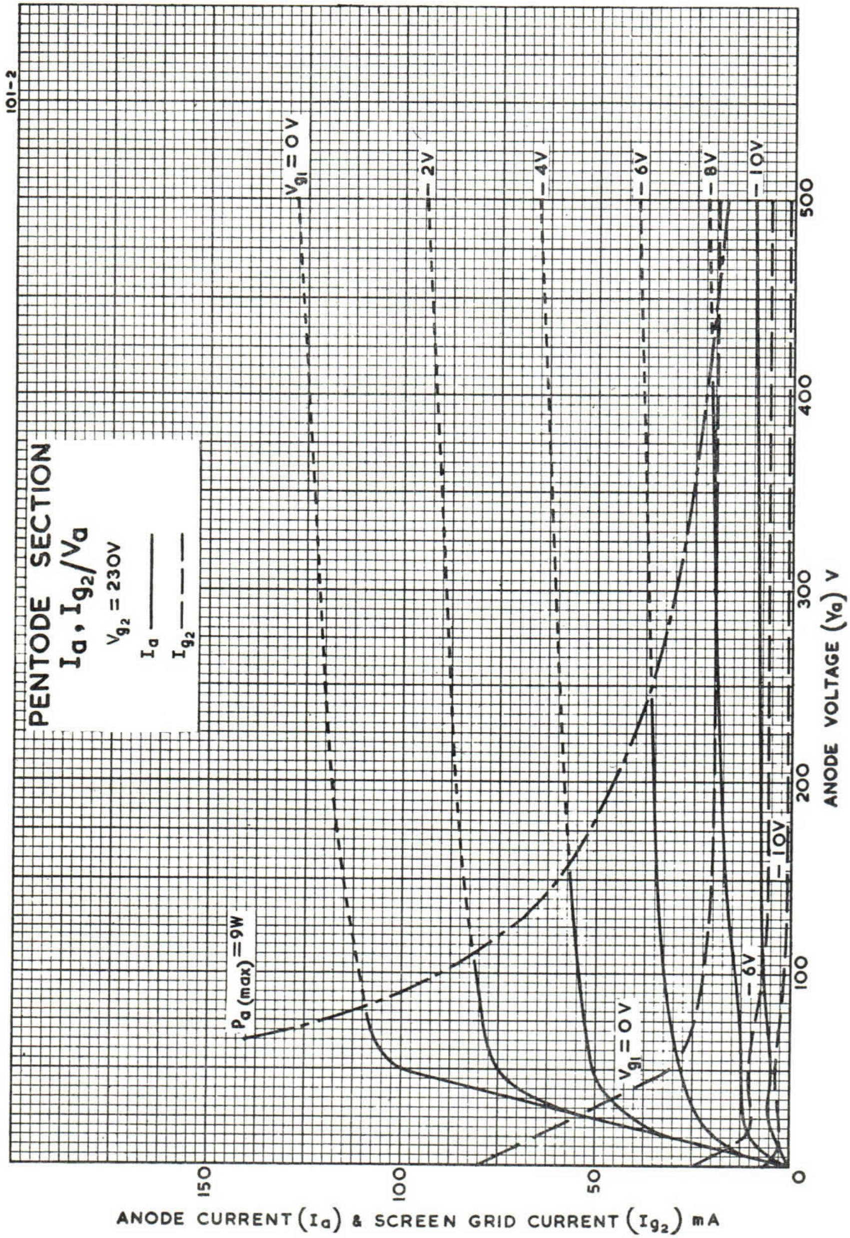
Note: Microphony. This valve may be used without special precautions against microphony in equipment where the input voltage is not less than 10mV for an output of 50 mW.

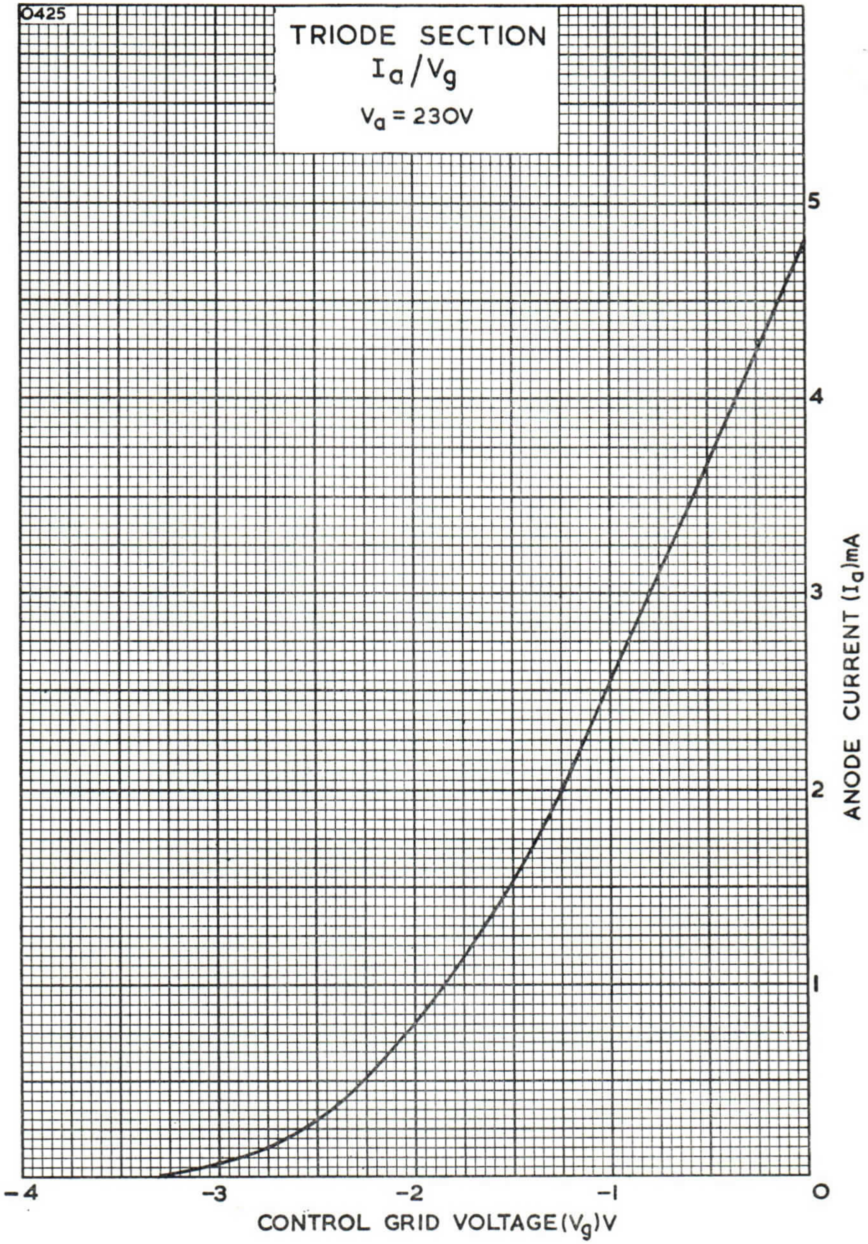
MOUNTING POSITION—Unrestricted.

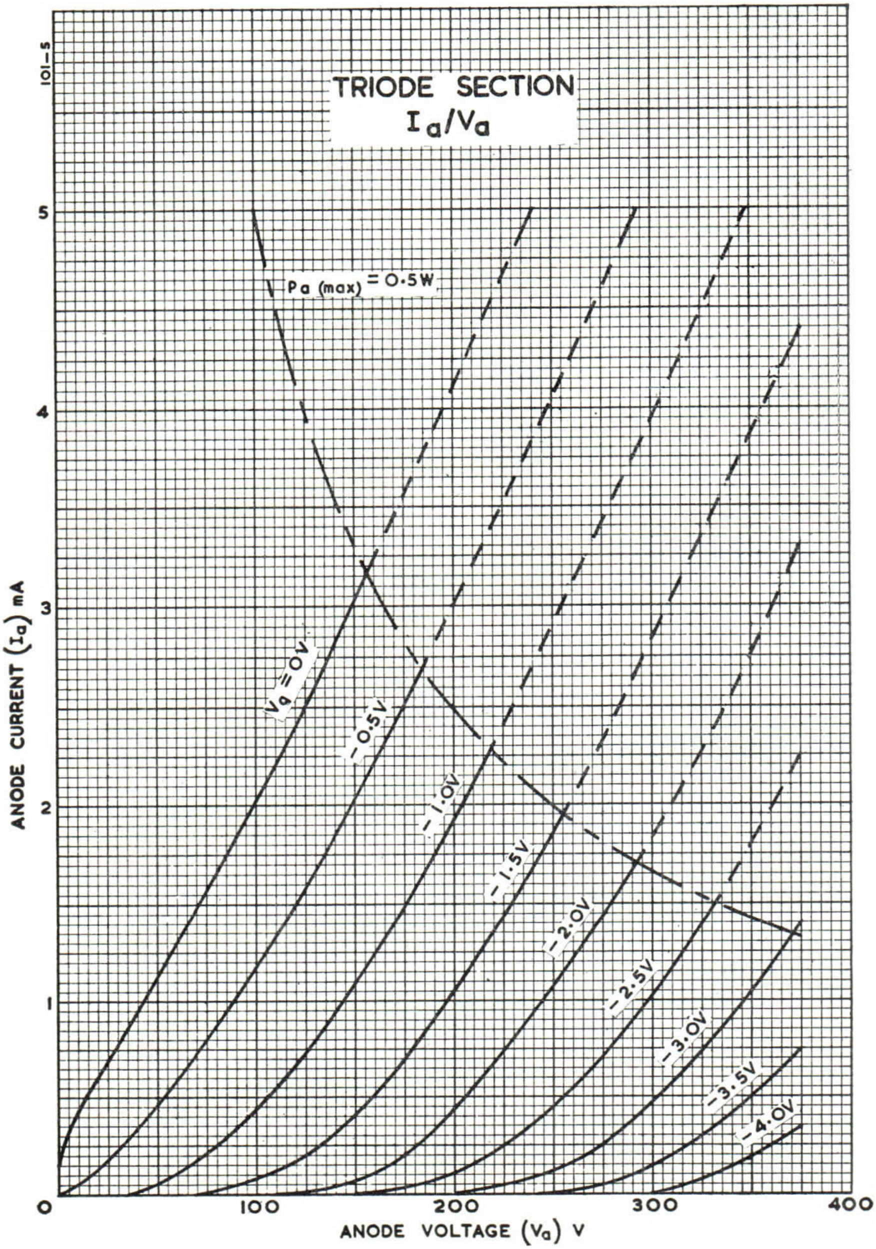

0427
PENTODE SECTION
$I_a, I_{g2}/V_{g1}$
I_a ——— I_{g2} — — —
$V_a = V_{g2} = 230V$
200V
$V_a = V_{g2} = 230V$
200V
120
110
100
90
80
70
60
50
40
30
20
10
0
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA
−16
−14
−12
−10
−8
−6
−4
−2
CONTROL GRID VOLTAGE (V_{g1}) V


0426
PENTODE SECTION
I_k/V_{g_1}
$V_a = V_{g_2} = 230V$
200V
120
110
100
90
80
70
60
50
40
30
20
10
0
CATHODE CURRENT (I_k) mA
−16
−14
−12
−10
−8
−6
−4
−2
CONTROL GRID VOLTAGE (V_{g_1}) V

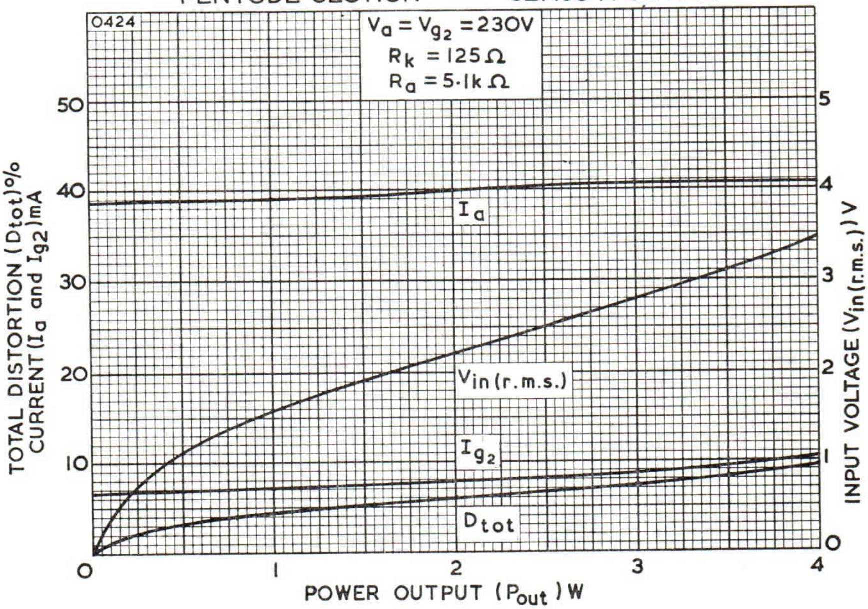

0423
PENTODE SECTION
I_a, I_{g2}/V_a
$V_{g2} = 200V$
I_a —— I_{g2} – – –
$V_{g1} = 0V$
$-2V$
$-4V$
$-6V$
$-8V$
$-4V$
$-8V$
$P_{a(max)} = 9W$
ANODE VOLTAGE (V_a) V
0
100
200
300
400
500
ANODE CURRENT (I_a) mA & SCREEN GRID CURRENT (I_{g2}) mA
20
40
60
80
100
120
140
160

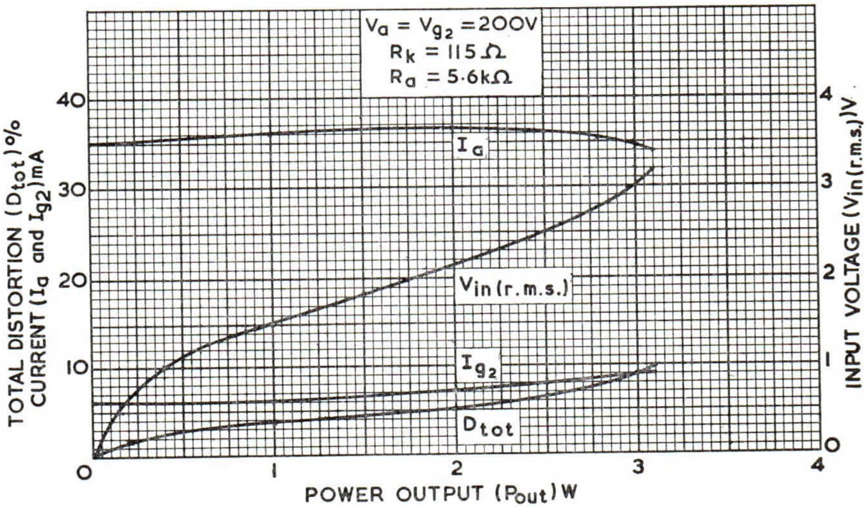

PENTODE SECTION
I_a, I_{g2}/V_a
V_{g2} = 230V
I_a ———
I_{g2} — — —
V_{g1} = 0V
−2V
−4V
−6V
−8V
−10V
$P_{a\,(max)}$ = 9W
V_{g1} = 0V
−6V
−10V
101-2
0
100
200
300
400
500
ANODE VOLTAGE (V_a) V
0
50
100
150
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA


0425
TRIODE SECTION
I_a / V_g
$V_a = 230V$
5
4
3
2
1
0
ANODE CURRENT (I_a)mA
−4
−3
−2
−1
CONTROL GRID VOLTAGE(V_g)V


101-5
TRIODE SECTION
I_a/V_a
$P_{a\ (max)} = 0{\cdot}5W$
$V_g = 0V$
$-0{\cdot}5V$
$-1{\cdot}0V$
$-1{\cdot}5V$
$-2{\cdot}0V$
$-2{\cdot}5V$
$-3{\cdot}0V$
$-3{\cdot}5V$
$-4{\cdot}0V$
ANODE CURRENT (I_a) mA
1
2
3
4
5
0
100
200
300
400
ANODE VOLTAGE (V_a) V

PENTODE SECTION — CLASS A OUTPUT

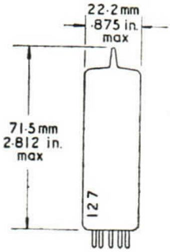




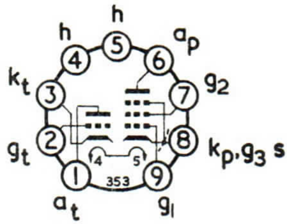
BRIMAR

VALVES

PCL805
PCL85



TRIODE
FIELD OUTPUT
PENTODES



B9A Base

GENERAL

Combined triode pentode with separate cathodes for use as a field oscillator and field output valve in television receivers. Data is applicable to both types.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	17·5	V

RATINGS

		Triode	Pentode	
Maximum Anode Dissipation	$p_{a(max)}$	0·5	8·0*	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	—	1·5†	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	550	V
Maximum Anode Voltage	$V_{a(max)}$	300	300	V
Maximum Peak Anode Voltage	$v_{a(pk)max}$	—	2·0‡	kV
Maximum Screen Grid Supply Voltage	$V_{g2(b)max}$	—	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	—	250	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$	200§	200	V
Maximum Cathode Current	$I_{k(max)}$	15	75	mA
Maximum Peak Cathode Current	$i_{k(pk)max}$	150‖	—	mA
Maximum Peak Cathode Current	$i_{k(pk)max}$	100¶	—	mA
Maximum Grid 1 to Cathode Resistance	$R_{g1\text{-}k(max)}$			
Fixed Bias		1·0	1·0	MΩ
Self Bias		3·3	2·2	MΩ

* For a nominal tube at the worst probable operating conditions and at normal picture height p_a should not exceed 10·5 W.

† For a nominal tube at the worst probable operating conditions and at normal picture height p_{g2} should not exceed 2·0 W.

‡ Maximum pulse duration 5% of one cycle with a maximum of 1·0 ms.

§ During warming up the maximum d.c. component is 315 V, heater negative.

‖ Maximum pulse duration 2% of one cycle with a maximum of 400 μs.

¶ Maximum pulse duration 4% of one cycle with a maximum of 800 μs.

INTER-ELECTRODE CAPACITANCES

Anode Pentode to Grid Triode	$c_{ap\text{-}gt}$		<0·03	pF
Anode Triode to Grid 1	$c_{at\text{-}g1}$		<0·08	pF
		Triode	Pentode	
Anode to Grid 1	$c_{a\text{-}g1}$	—	<0·6	pF
Grid 1 to Heater	$c_{g1\text{-}h}$	<0·15	<0·2	pF

THORN RADIO VALVES AND TUBES LTD.

CHARACTERISTICS

Triode Section

Anode Voltage	V_a	100	100	V
Control Grid Voltage	V_g	−0·85	0	V
Anode Current	I_a	5·0	10·5	mA
Mutual Conductance	g_m	5·5	7·0	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	11	9·0	kΩ
Amplification Factor	μ	60	63	

Pentode Section—Field Output Application

Anode Voltage	V_a	50	65	V
Screen Grid Voltage	V_{g2}	170	210	V
Control Grid Voltage	V_{g1}	−1·0	−1·0	V
Peak Anode Current	$i_{a(pk)}$	200	285	mA
Peak Screen Grid Current	$i_{g2(pk)}$	35	45	mA

CIRCUIT DESIGN

Note.—The curves on page 7 can be used to derive the minimum I_a to be expected as a result of the spread of valve characteristics, valve deterioration during life and decrease of the mains voltage to 10% below the nominal value by decreasing by 40% the I_a values on the curve A–B at the V_{g2} occurring at the decreased mains voltage.

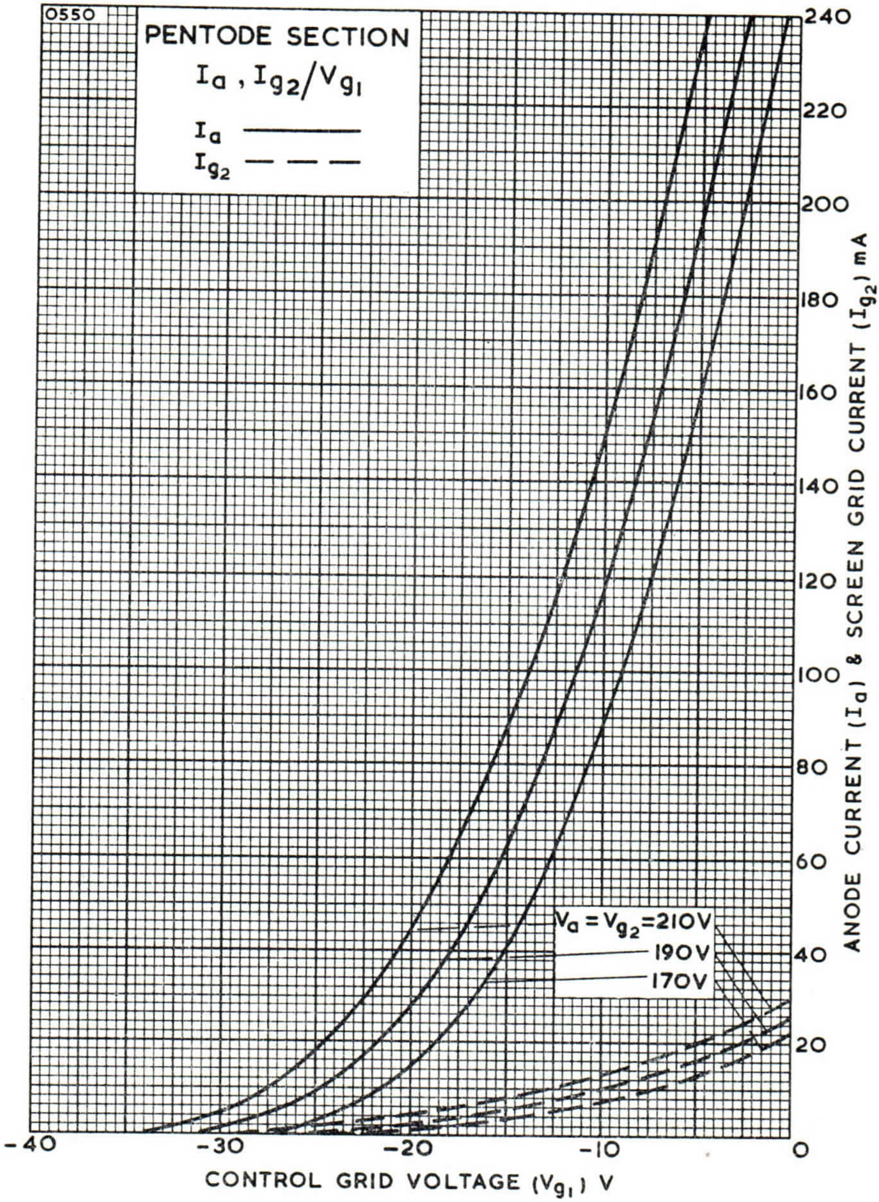
In order that the maximum permissible value of screen grid dissipation is not exceeded, the circuit should be designed in such a way that the anode voltage should never be lower than the value determined by curve A–B at the relevant V_{g2} value.

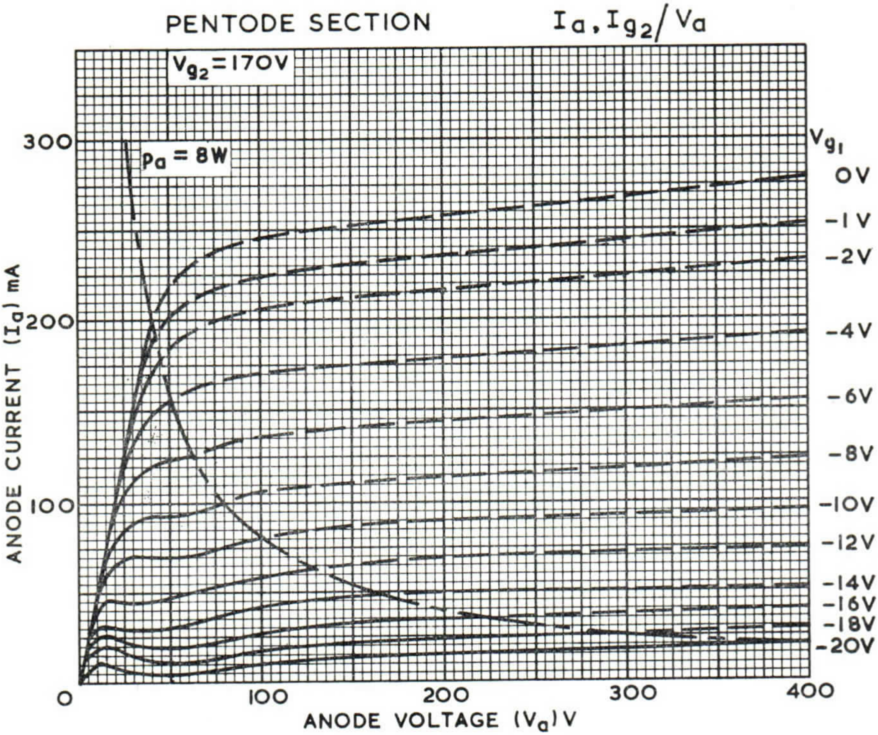
HUM

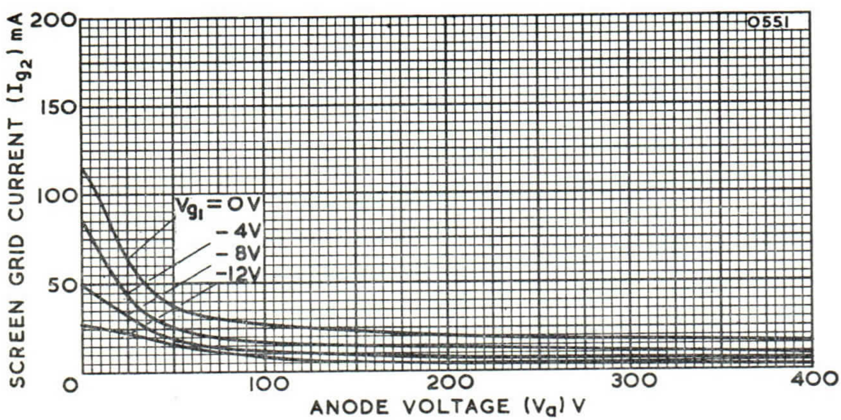
The equivalent pentode grid hum voltage without negative feedback is $\leqslant$ 10 mV when

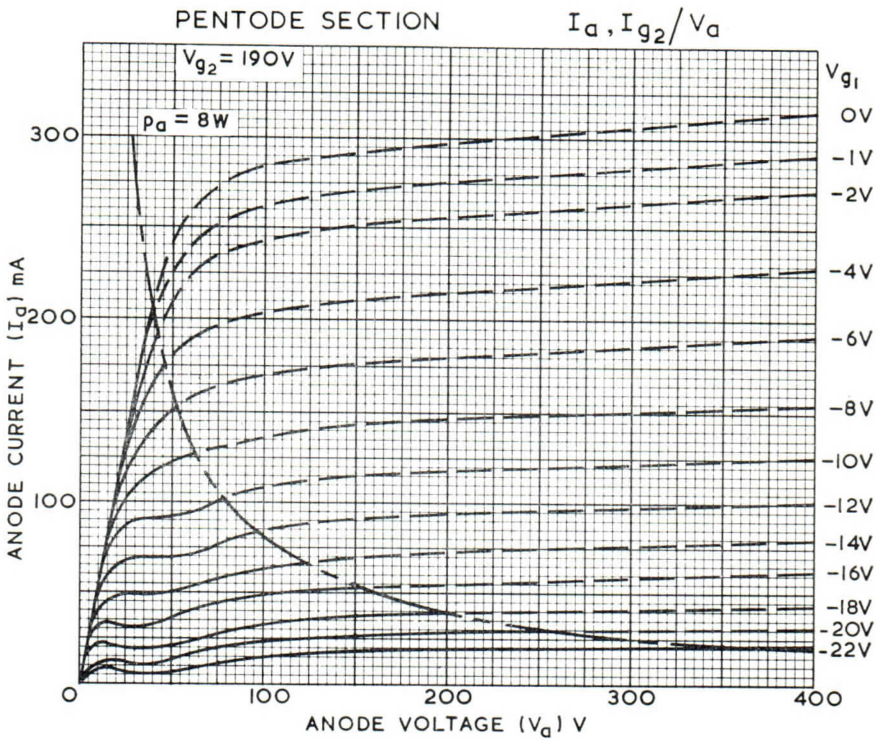
$$Z_{g1}\ (f = 50\ \text{Hz}) \leqslant 500\ \text{k}\Omega$$
$$C_{g1\text{-}h} = 0{\cdot}2\ \text{pF}$$
$$V_{h\text{-}k\ (r.m.s.)} = 150\ \text{V}$$

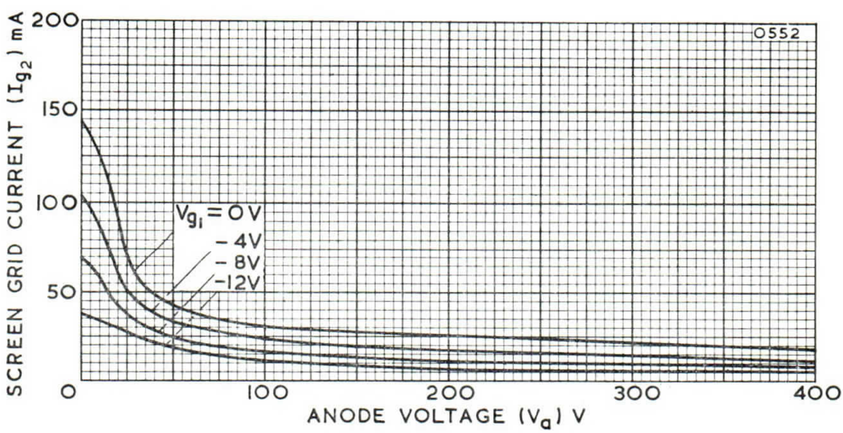
MOUNTING POSITION—Unrestricted

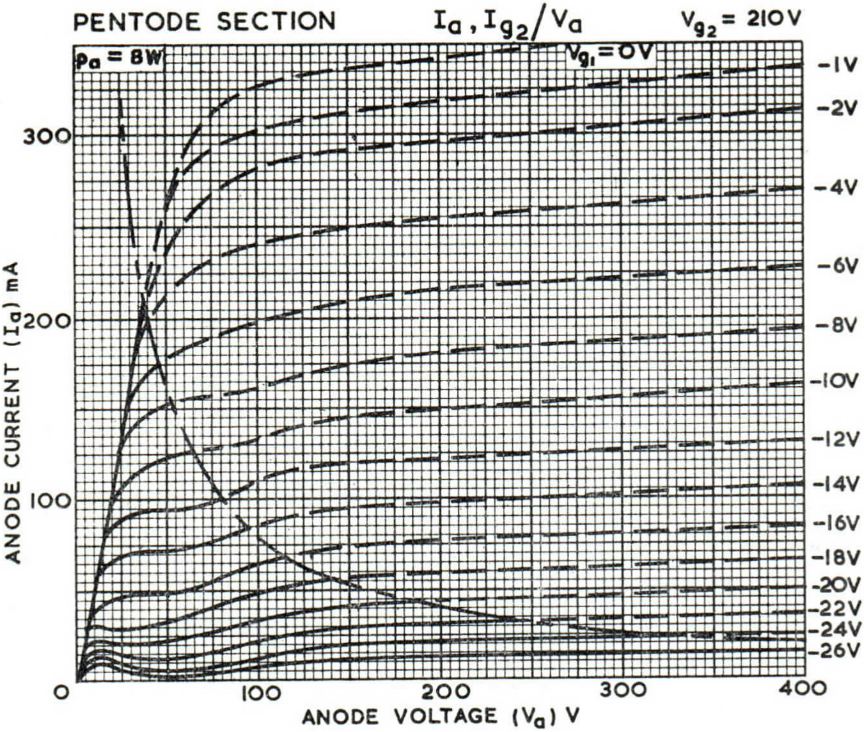

0550
PENTODE SECTION
Ia , Ig2/Vg1
Ia
Ig2
Va = Vg2=210V
190V
170V
240
220
200
180
160
140
120
100
80
60
40
20
ANODE CURRENT (Ia) & SCREEN GRID CURRENT (Ig2) mA
-40
-30
-20
-10
0
CONTROL GRID VOLTAGE (Vg1) V

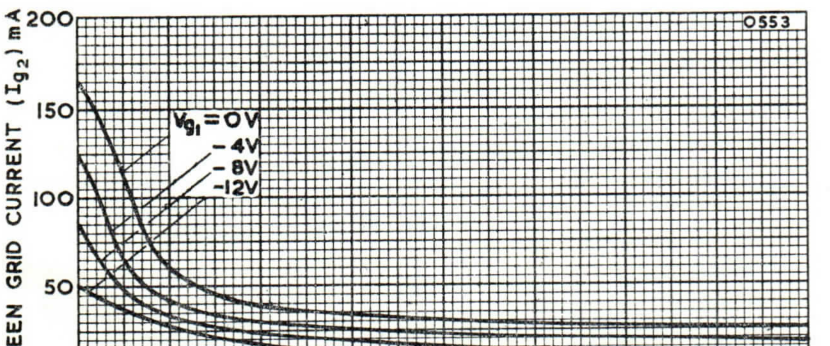

PENTODE SECTION
$I_a, I_{g2}/V_a$
V_{g2}=170V
p_a = 8W
V_{g1}
0V
-1V
-2V
-4V
-6V
-8V
-10V
-12V
-14V
-16V
-18V
-20V
ANODE CURRENT (I_a) mA
300
200
100
0
100
200
300
400
ANODE VOLTAGE (V_a) V

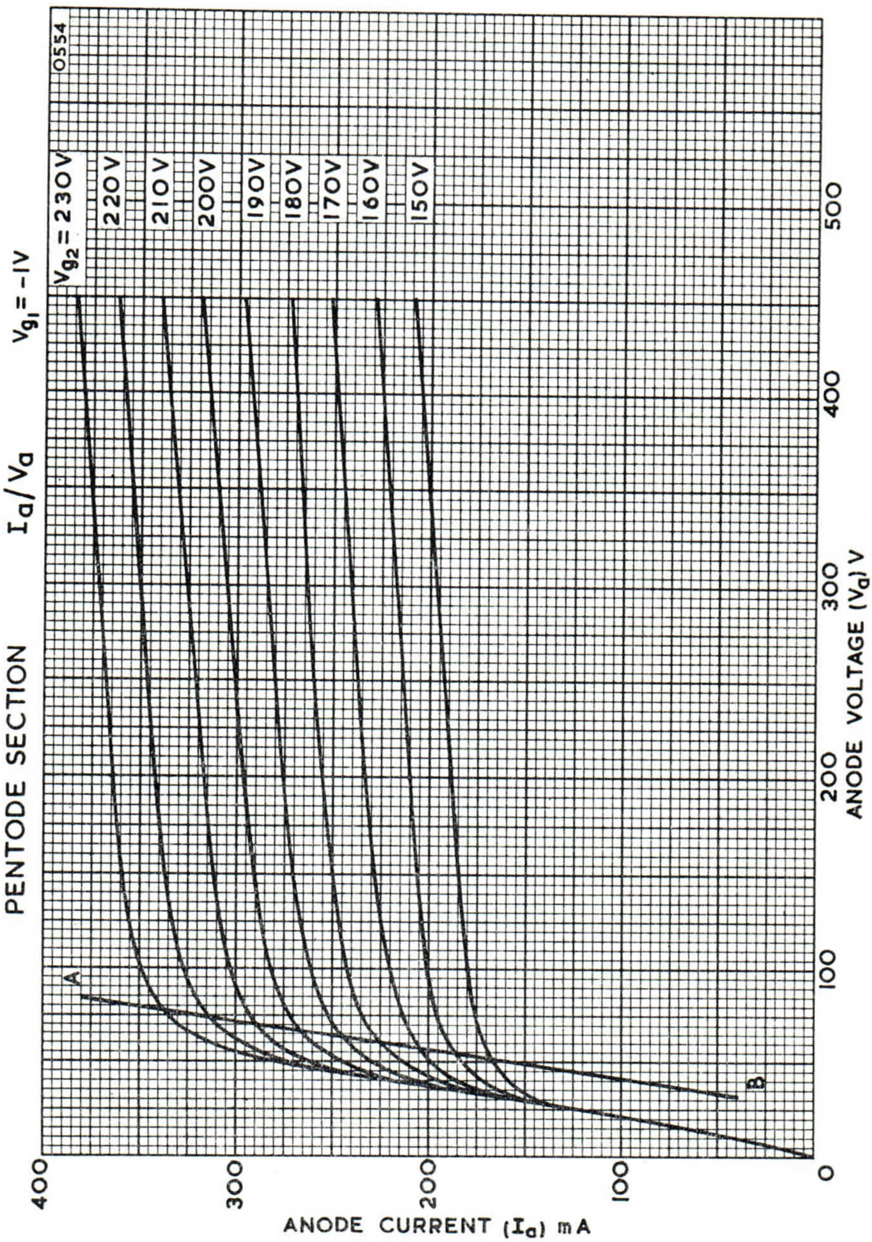

SCREEN GRID CURRENT (I_{g2}) mA
200
150
100
50
0
0551
V_{g1}=0V
-4V
-8V
-12V
100
200
300
400
ANODE VOLTAGE (V_a) V


PENTODE SECTION
$I_a, I_{g2}/V_a$
V_{g2} = 190V
p_a = 8W
V_{g1}
0V
-1V
-2V
-4V
-6V
-8V
-10V
-12V
-14V
-16V
-18V
-20V
-22V
ANODE CURRENT (I_a) mA
300
200
100
0
100
200
300
400
ANODE VOLTAGE (V_a) V

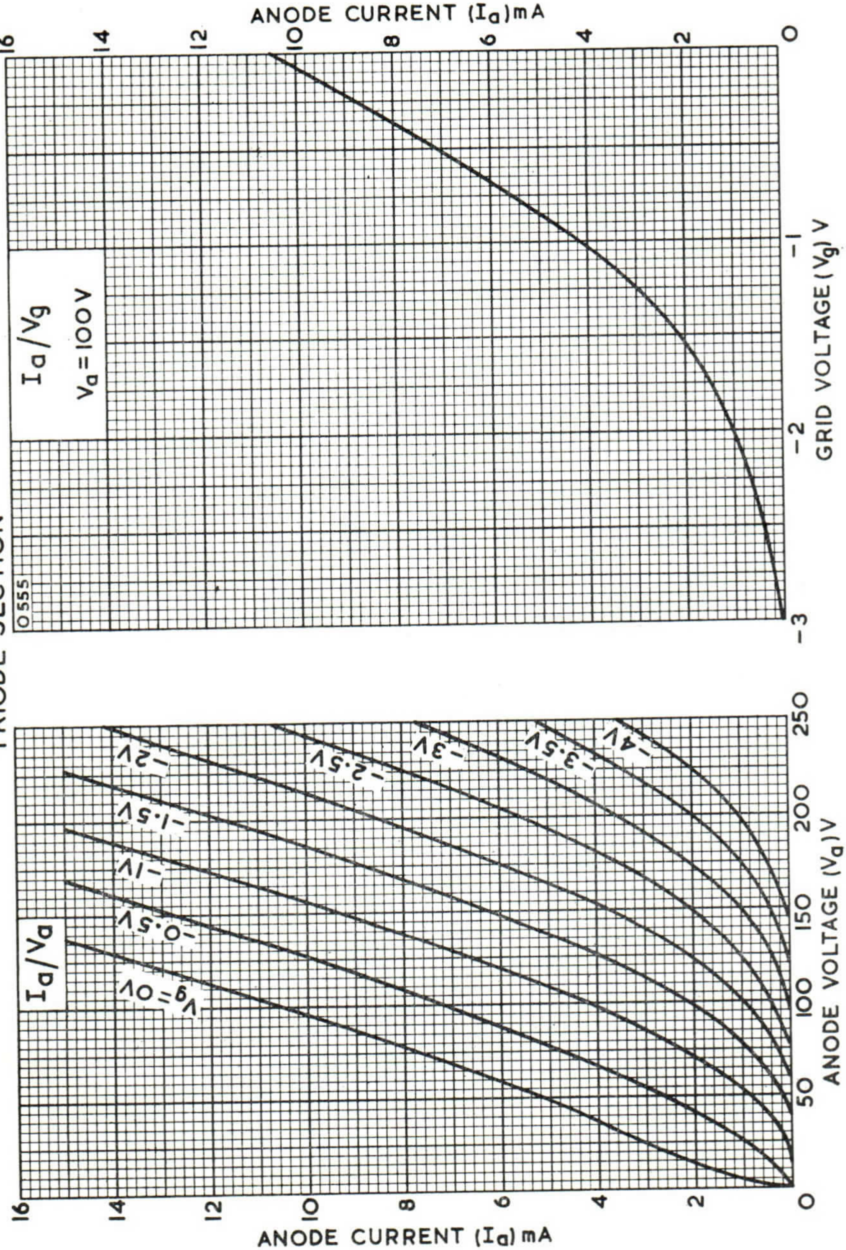

0552
V_{g1} = 0V
- 4V
- 8V
-12V
SCREEN GRID CURRENT (I_{g2}) mA
200
150
100
50
0
100
200
300
400
ANODE VOLTAGE (V_a) V

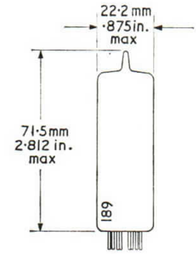

PENTODE SECTION
$I_a, I_{g2}/V_a$
V_{g2} = 210V
p_a = 8W
V_{g1}=0V
-1V
-2V
-4V
-6V
-8V
-10V
-12V
-14V
-16V
-18V
-20V
-22V
-24V
-26V
ANODE CURRENT (I_a) mA
300
200
100
0
100
200
300
400
ANODE VOLTAGE (V_a) V


0553
SCREEN GRID CURRENT (I_{g2}) mA
200
150
100
50
0
V_{g1}=0V
-4V
-8V
-12V
100
200
300
400
ANODE VOLTAGE (V_a) V

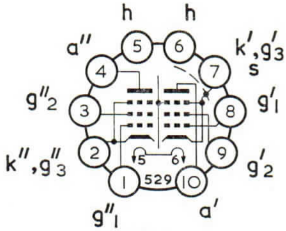

PENTODE SECTION
I_a/V_a
$V_{g_1} = -1V$
$V_{g_2} = 230V$
220V
210V
200V
190V
180V
170V
160V
150V
0554
A
B
ANODE VOLTAGE (V_a) V
0
100
200
300
400
500
ANODE CURRENT (I_a) mA
400
300
200
100
0

TRIODE SECTION





DOUBLE PENTODE



B10B Base

GENERAL

This double pentode, is intended for use in television receivers with the 'L' section as a high gain video output stage and the 'F' section as a sync separator, A.G.C. amplifier or I.F. amplifier. Particular care has been taken in the design of the valve to reduce coupling between sections to a minimum. The 'L' section is on pins 7, 8, 9 and 10.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	17	V

RATINGS

		Output 'L' Section′	Amplifier 'F' Section″	
Maximum Anode Dissipation	$p_{a(max)}$	5·0	1·5	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	2·5	0·5	W
Intermittent rating, short duration		3·2	—	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	—	550	V
Maximum Anode Voltage	$V_{a(max)}$	250	250	V
Maximum Screen Grid Supply Voltage	$V_{g2(b)max}$	—	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	250	250	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$	200	200	V
Maximum Cathode Current	$I_{k(max)}$	60	15	mA
Intermittent rating, short duration		85	—	mA
Maximum Grid 1 to Cathode Resistance	$R_{g1\text{-}k(max)}$	1·0	1·0	MΩ

INTER-ELECTRODE CAPACITANCES*

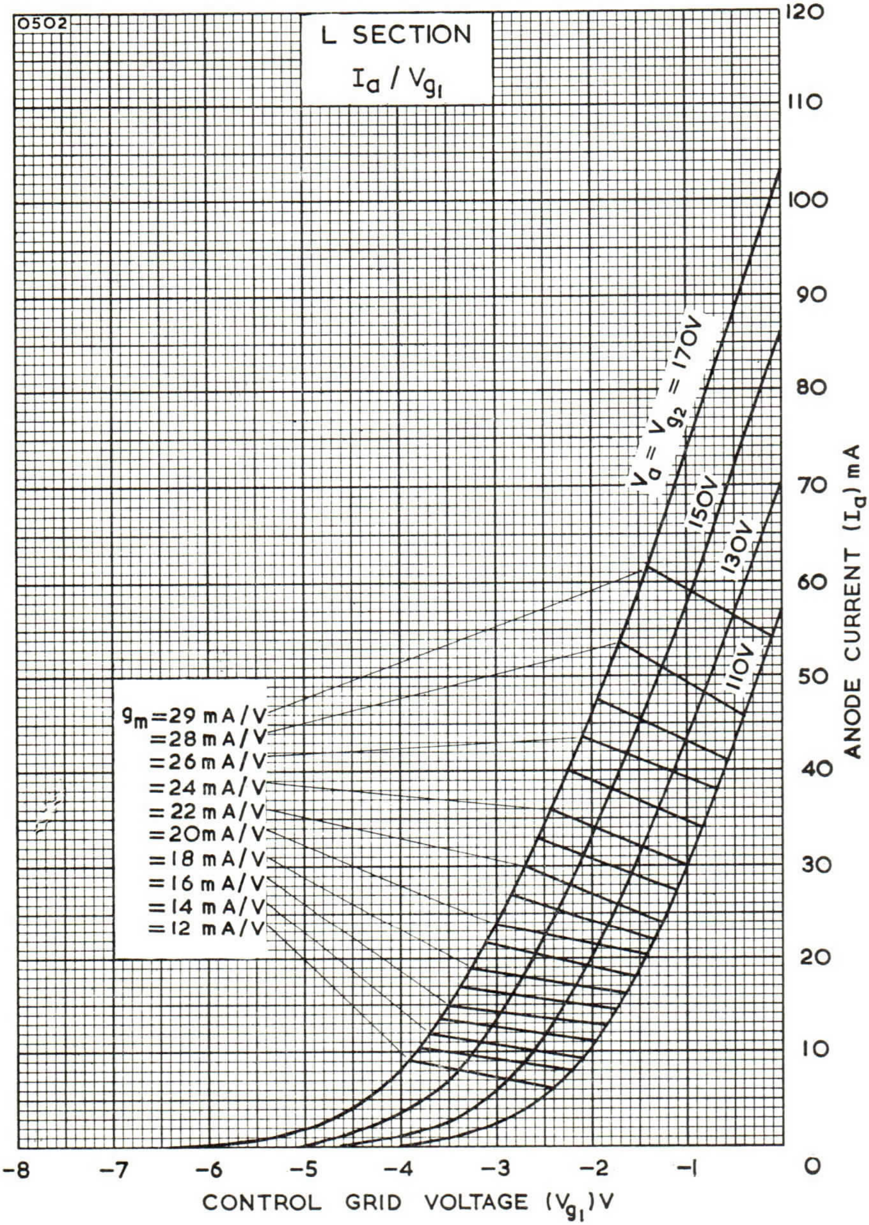
		Output 'L' Section′		Amplifier 'F' Section″	
Input	c_{in}	12·5		10·5	pF
Output	c_{out}	6·5		10·5	pF
Anode to Grid 1	$c_{a\text{-}g1}$	0·1		0·15	pF
Anode′ to Anode″	$c_{a'\text{-}a''}$		<0·15		pF
Grid′1 to Grid″1	$c_{g'1\text{-}g''1}$		<0·01		pF
Anode′ to Grid″1	$c_{a'\text{-}g''1}$		<0·10		pF
Grid′1 to Anode″	$c_{g'1\text{-}a''}$		<0·005		pF
Grid″1 to Heater	$c_{g''1\text{-}h}$		<0·15		pF

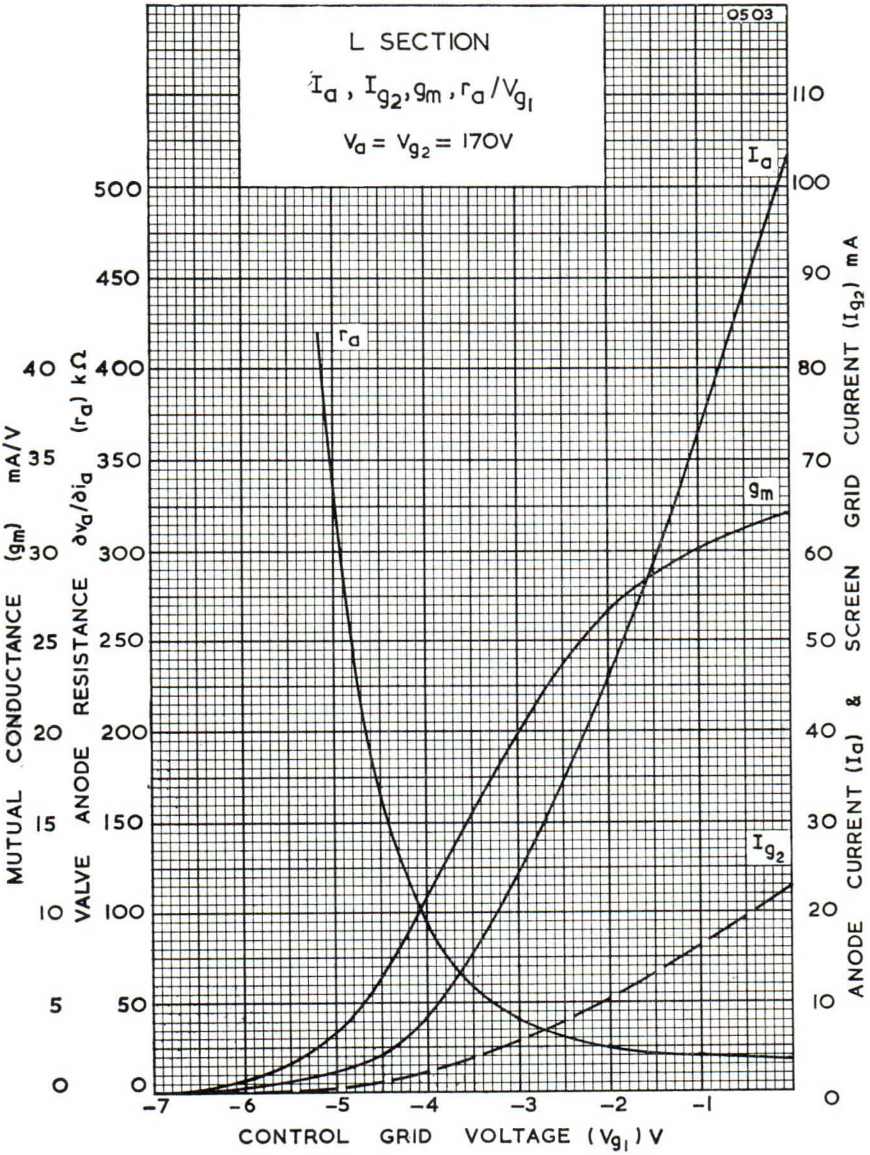
* Measured without an external shield.

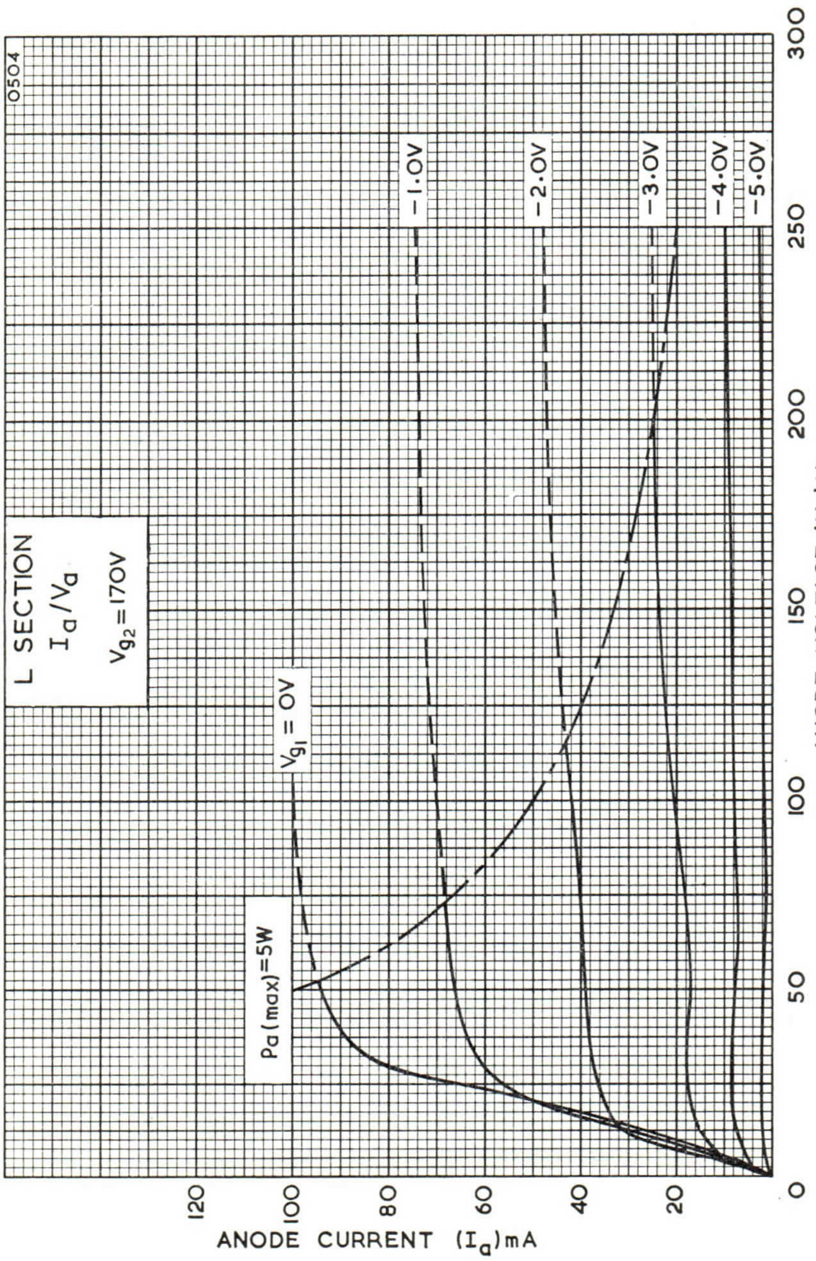
CHARACTERISTICS

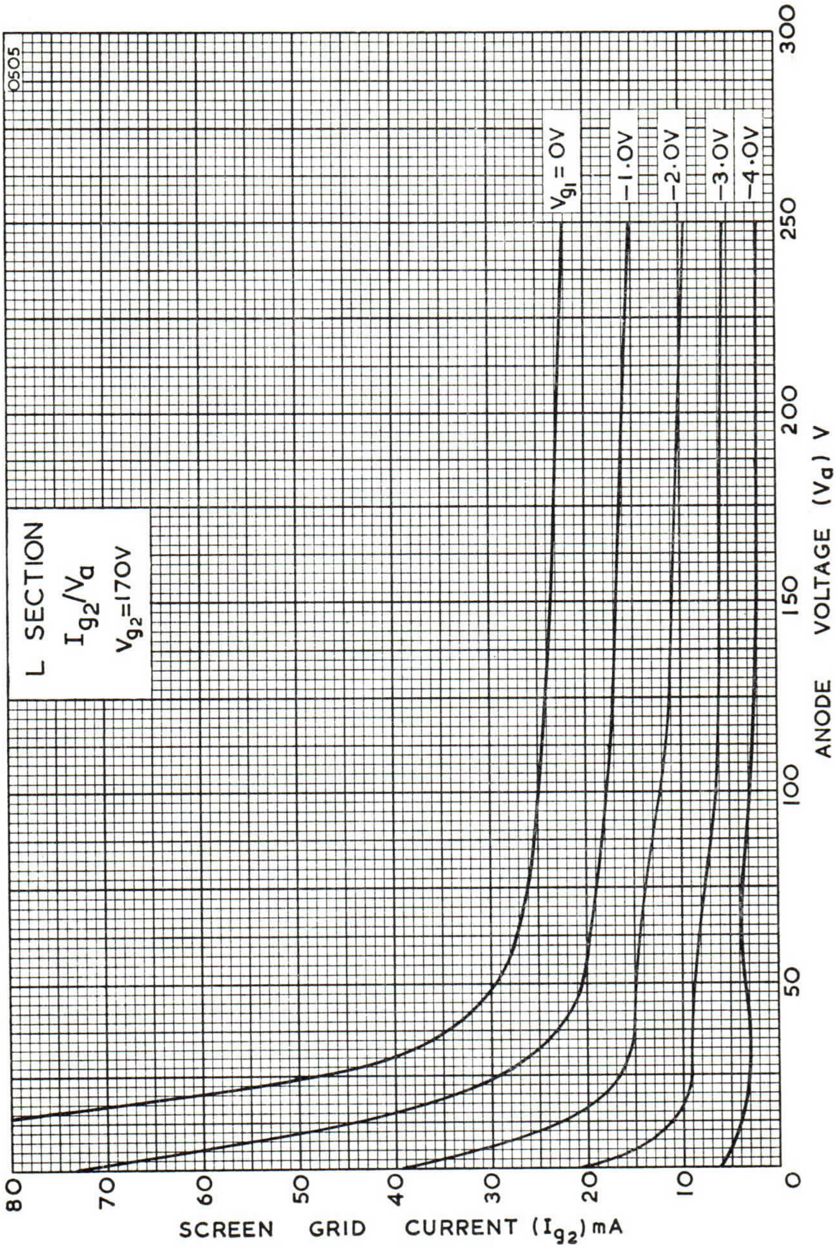
		Output 'L' Section′	Amplifier 'F' Section″		
Anode Voltage	V_a	170	150	50	V
Screen Grid Voltage	V_{g2}	170	150	75	V
Control Grid Voltage	V_{g1}	−2·7	−2·1	−0·65	V
Anode Current	I_a	30	10	5·0	mA
Screen Grid Current	I_{g2}	7·0	3·0	1·6	mA
Mutual Conductance	g_m	22	8·5	6·8	mA/V
Inner Amplification Factor	$\mu_{g1\text{-}g2}$	38	38	34	
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	33	150	110	kΩ

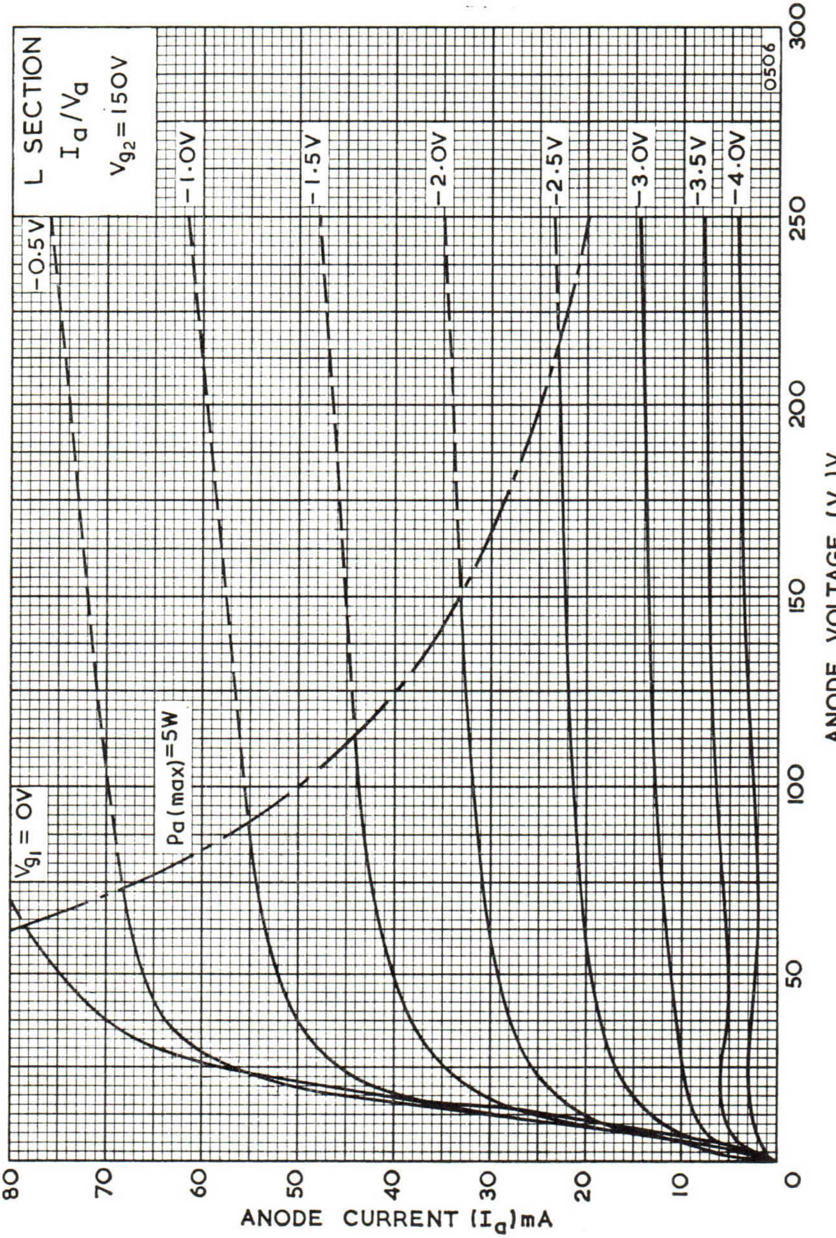
THORN RADIO VALVES AND TUBES LTD.

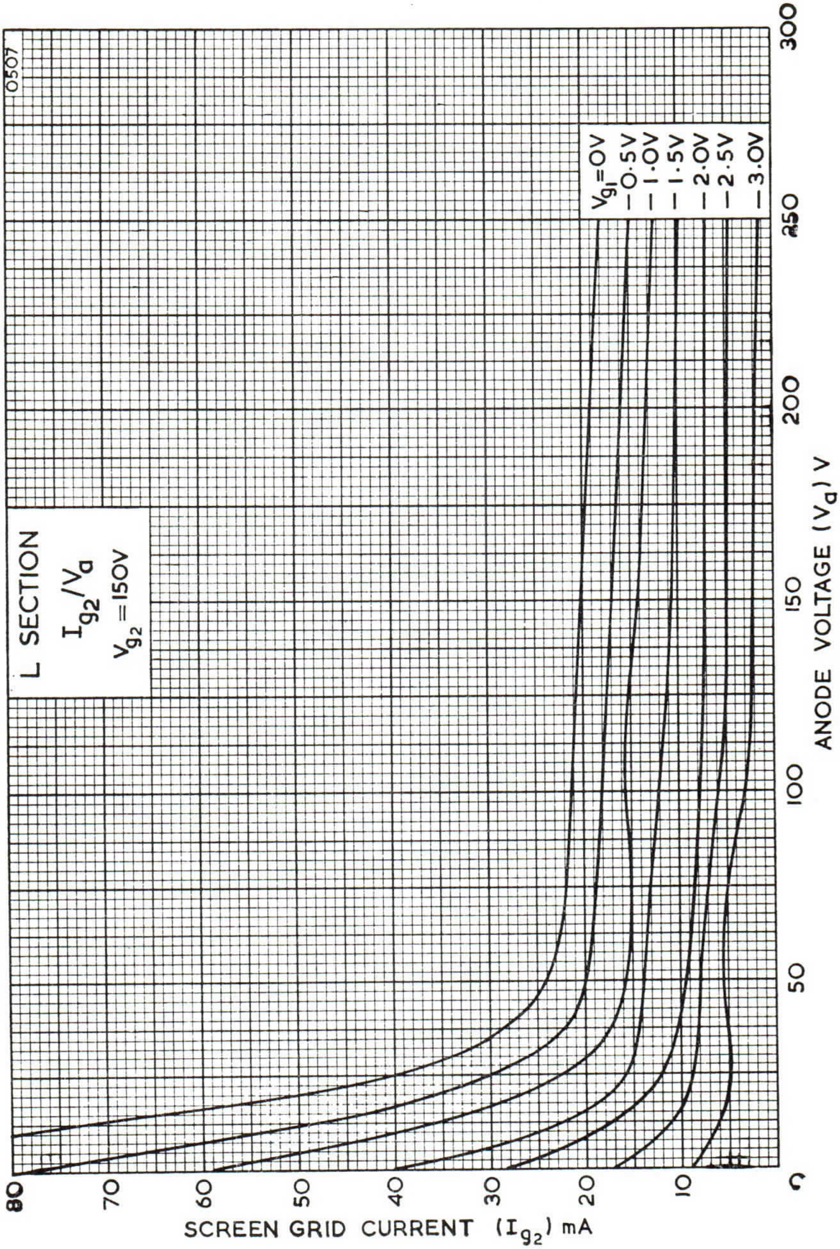

0502
L SECTION
I_a / V_{g_1}
$V_a = V_{g_2} = 170V$
150V
130V
110V
g_m=29 mA/V
=28 mA/V
=26 mA/V
=24 mA/V
=22 mA/V
=20 mA/V
=18 mA/V
=16 mA/V
=14 mA/V
=12 mA/V
120
110
100
90
80
70
60
50
40
30
20
10
0
ANODE CURRENT (I_a) mA
−8
−7
−6
−5
−4
−3
−2
−1
CONTROL GRID VOLTAGE (V_{g_1})V

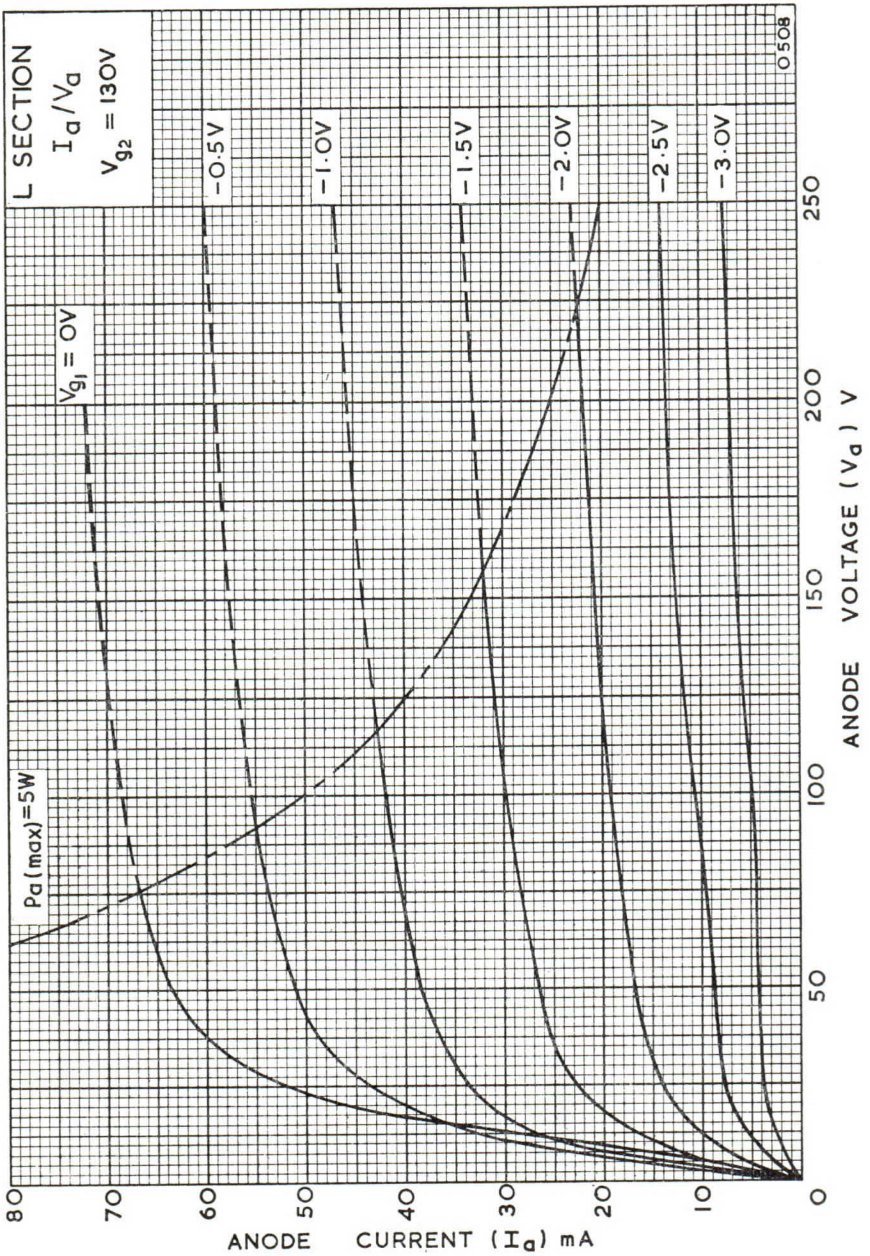

0503
L SECTION
I_a, I_{g2}, g_m, r_a/V_{g1}
$V_a = V_{g2} = 170V$
I_a
g_m
r_a
I_{g2}
MUTUAL CONDUCTANCE (g_m) mA/V
VALVE ANODE RESISTANCE $\partial v_a/\partial i_a$ (r_a) kΩ
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA
CONTROL GRID VOLTAGE (V_{g1}) V
0
5
10
15
20
25
30
35
40
0
50
100
150
200
250
300
350
400
450
500
0
10
20
30
40
50
60
70
80
90
100
110
−7
−6
−5
−4
−3
−2
−1

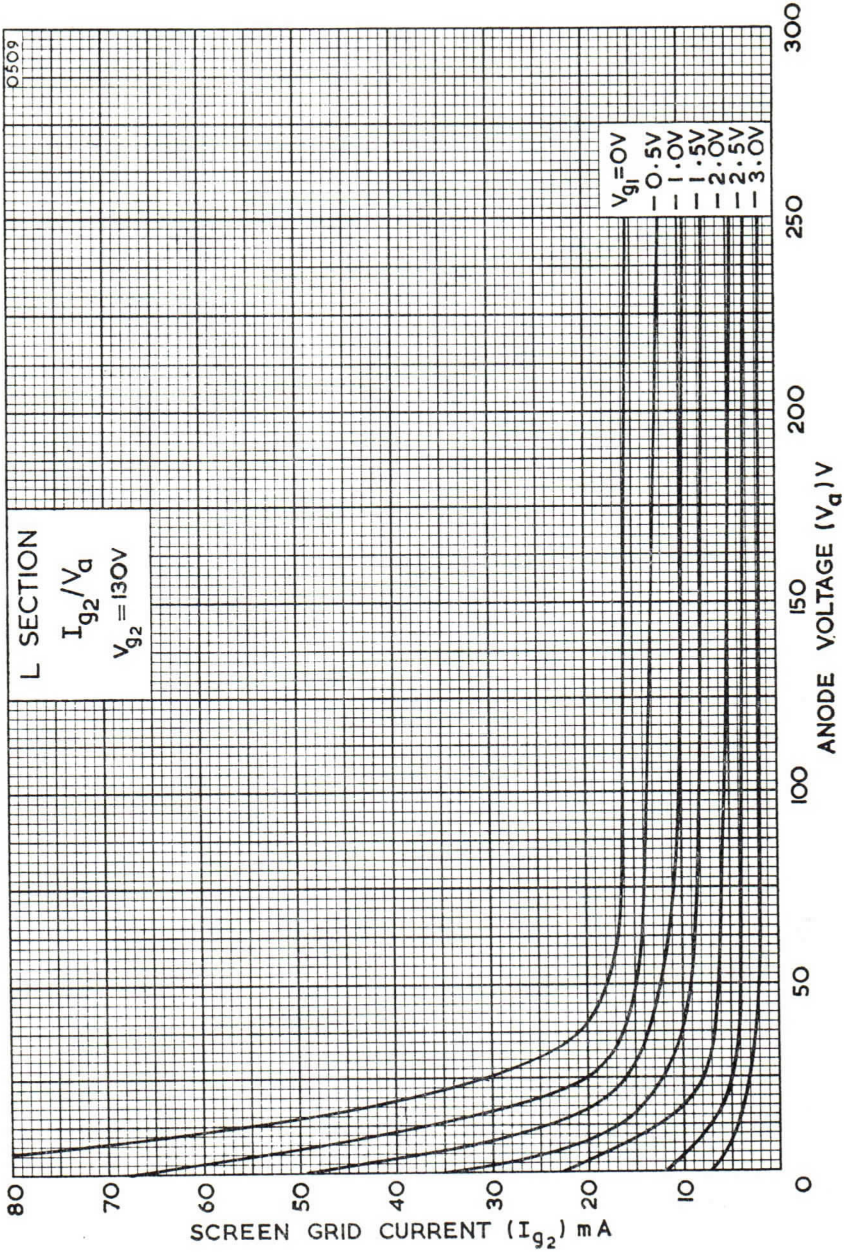

0504
L SECTION
I_a/V_a
$V_{g_2}=170V$
$V_{g_1} = 0V$
$P_a(max)=5W$
−1·0V
−2·0V
−3·0V
−4·0V
−5·0V
ANODE VOLTAGE (V_a) V
0
50
100
150
200
250
300
ANODE CURRENT (I_a) mA
20
40
60
80
100
120

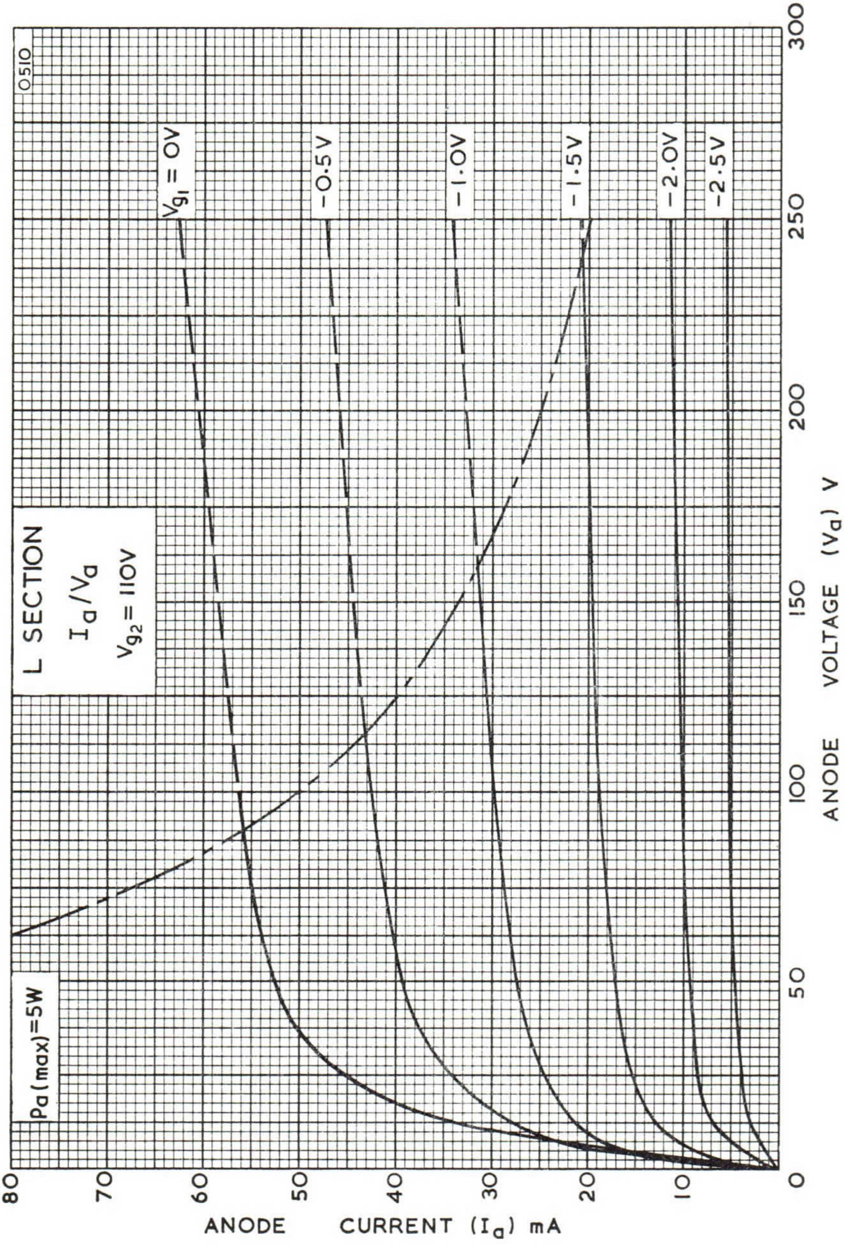

0505
L SECTION
I_{g2}/V_a
V_{g2}=170V
V_{g1}=0V
−1·0V
−2·0V
−3·0V
−4·0V
0
50
100
150
200
250
300
ANODE VOLTAGE (V_a) V
80
70
60
50
40
30
20
10
0
SCREEN GRID CURRENT (I_{g2}) mA

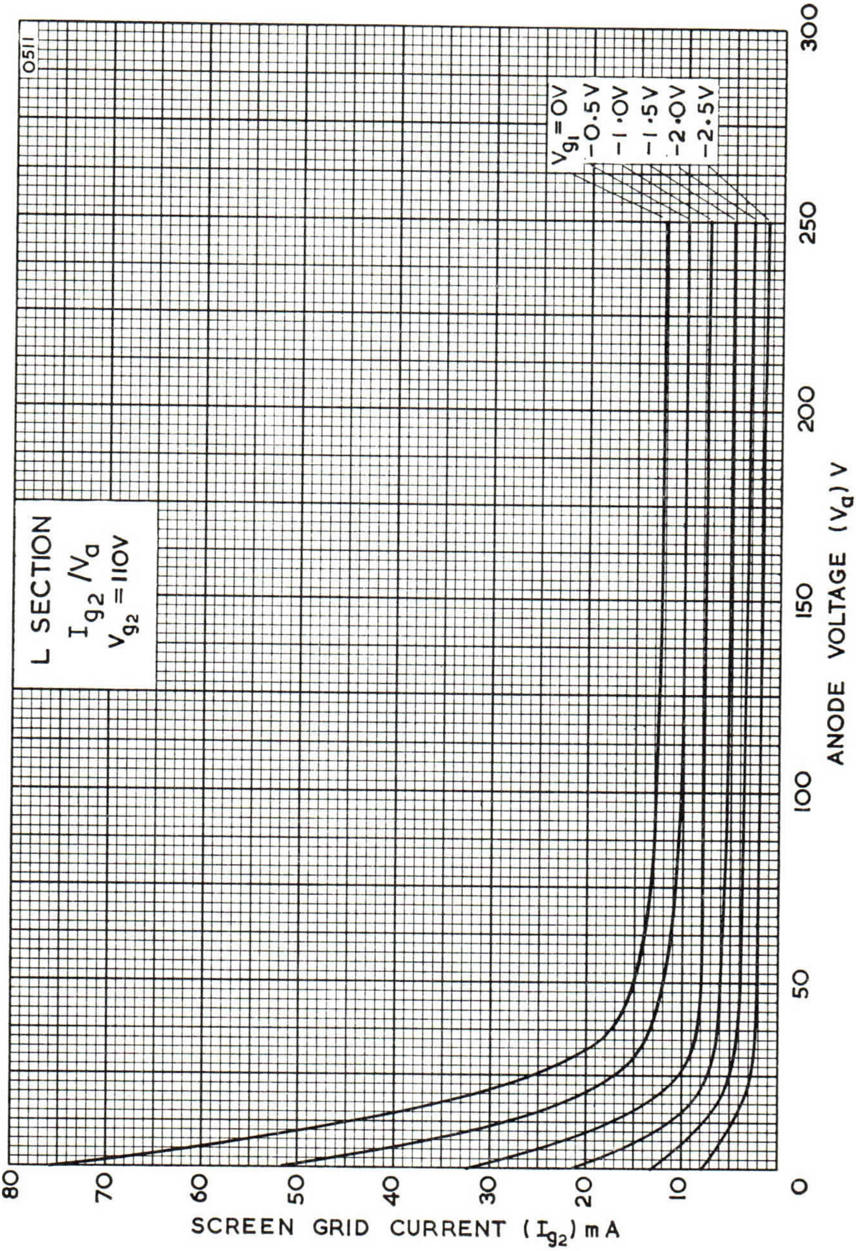

L SECTION
I_a/V_a
$V_{g2}=150V$
$V_{g1}=0V$
−0.5V
−1.0V
−1.5V
−2.0V
−2.5V
−3.0V
−3.5V
−4.0V
$P_a(max)=5W$
0506
ANODE CURRENT (I_a)mA
ANODE VOLTAGE (V_a)V
0
10
20
30
40
50
60
70
80
0
50
100
150
200
250
300


0507
L SECTION
I_{g2}/V_a
$V_{g2}=150V$
$V_{g1}=0V$
−0·5V
−1·0V
−1·5V
−2·0V
−2·5V
−3·0V
ANODE VOLTAGE (V_a) V
0
50
100
150
200
250
300
SCREEN GRID CURRENT (I_{g2}) mA
80
70
60
50
40
30
20
10


L SECTION
I_a/V_a
$V_{g2} = 130V$
$V_{g1} = 0V$
−0.5V
−1.0V
−1.5V
−2.0V
−2.5V
−3.0V
Pa(max)=5W
0508
ANODE VOLTAGE (V_a) V
0
50
100
150
200
250
ANODE CURRENT (I_a) mA
80
70
60
50
40
30
20
10
0

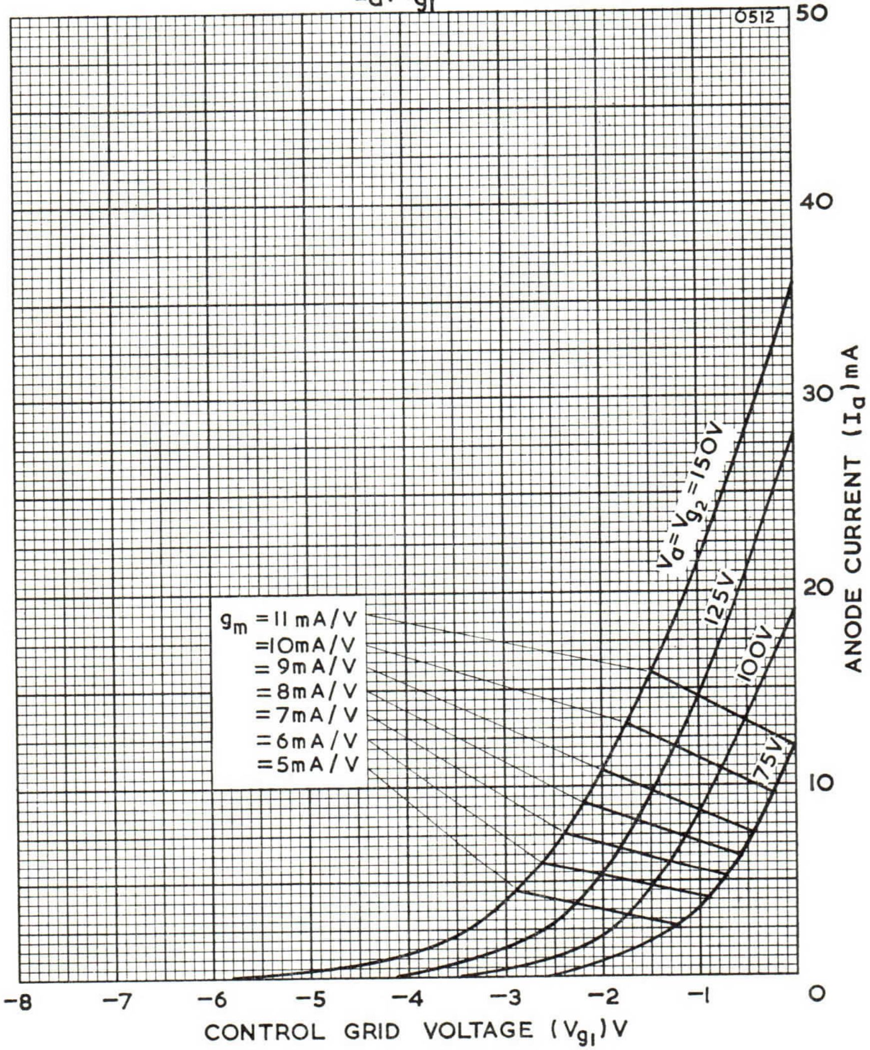

L SECTION
I_{g_2}/V_a
$V_{g_2}=130V$
$V_{g_1}=0V$
$-0.5V$
$-1.0V$
$-1.5V$
$-2.0V$
$-2.5V$
$-3.0V$
ANODE VOLTAGE (V_a) V
0
50
100
150
200
250
300
SCREEN GRID CURRENT (I_{g_2}) mA
80
70
60
50
40
30
20
10
0509


0510
L SECTION
I_a/V_a
V_{g_2} = 110V
V_{g_1} = 0V
−0.5V
−1.0V
−1.5V
−2.0V
−2.5V
P_a (max)=5W
0
50
100
150
200
250
300
ANODE VOLTAGE (V_a) V
80
70
60
50
40
30
20
10
0
ANODE CURRENT (I_a) mA


L SECTION
I_{g2}/V_a
$V_{g2}=110V$
$V_{g1}=0V$
$-0.5V$
$-1.0V$
$-1.5V$
$-2.0V$
$-2.5V$
0511
ANODE VOLTAGE (V_a) V
0
50
100
150
200
250
300
SCREEN GRID CURRENT (I_{g2}) mA
80
70
60
50
40
30
20
10
0

F SECTION

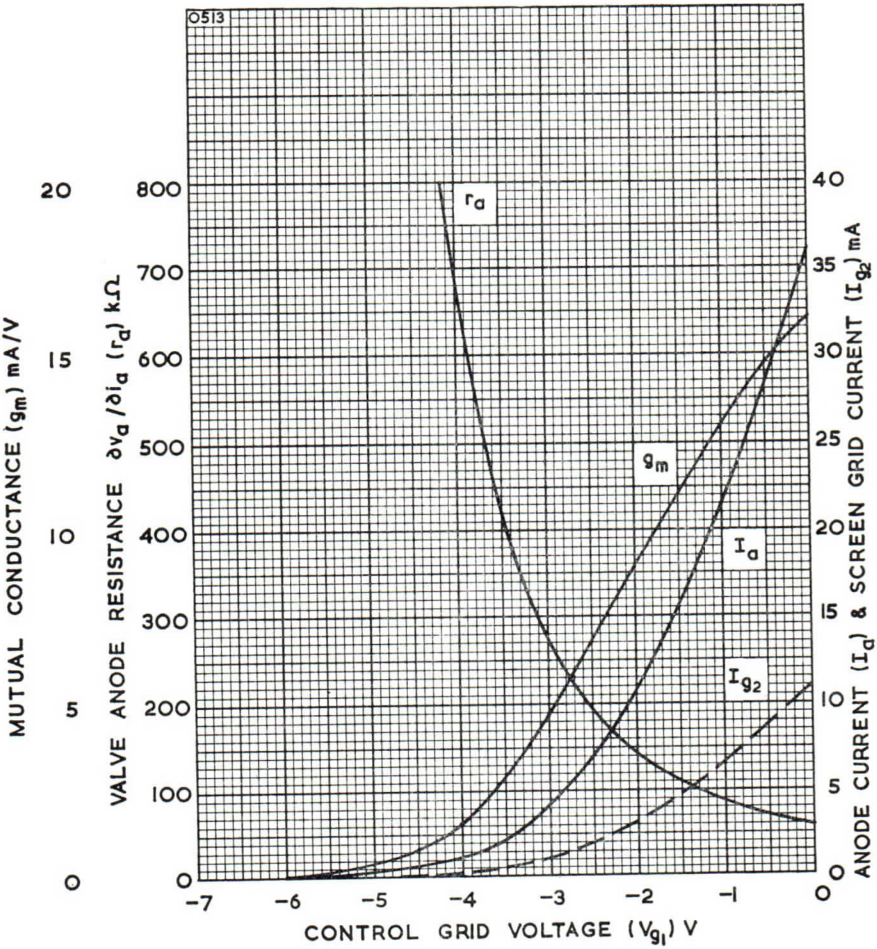
I_a/V_{g_1}

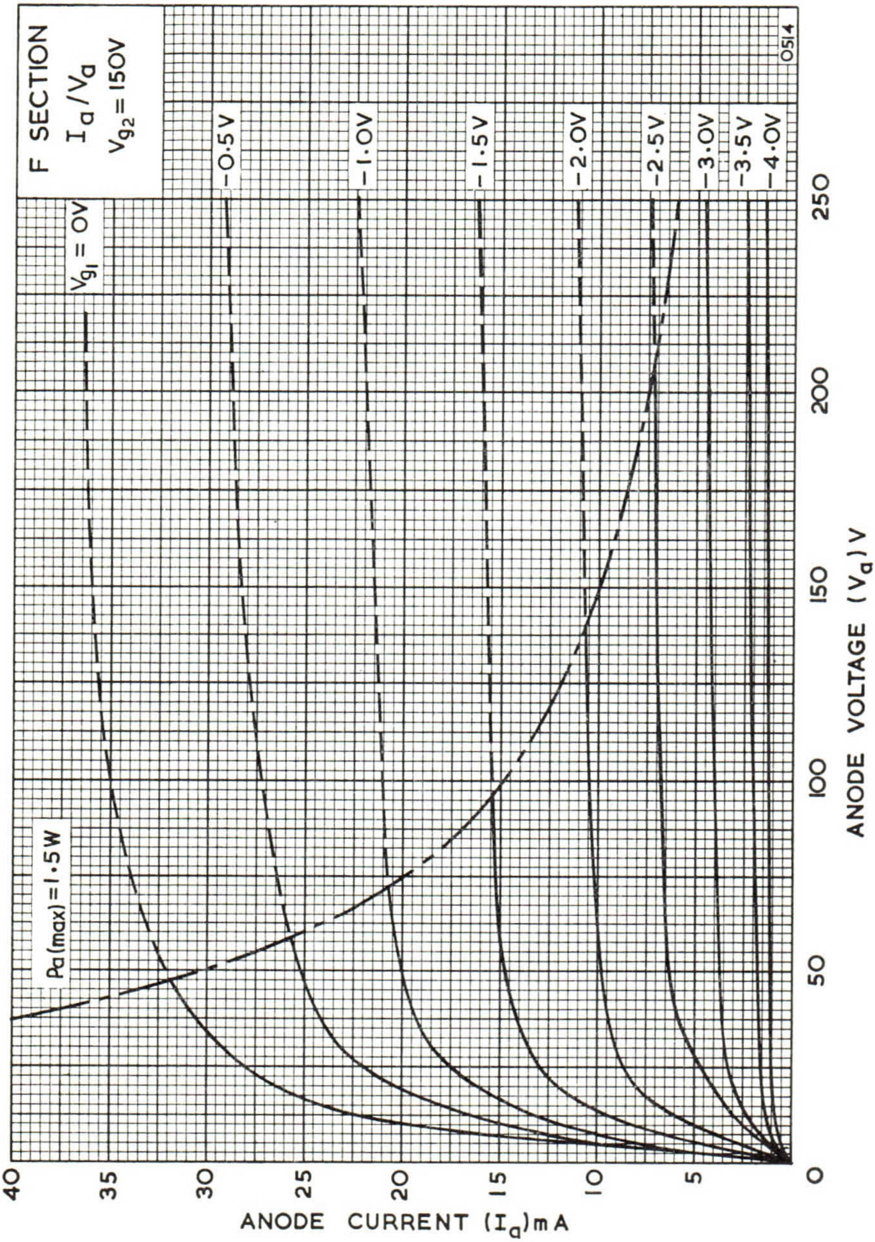


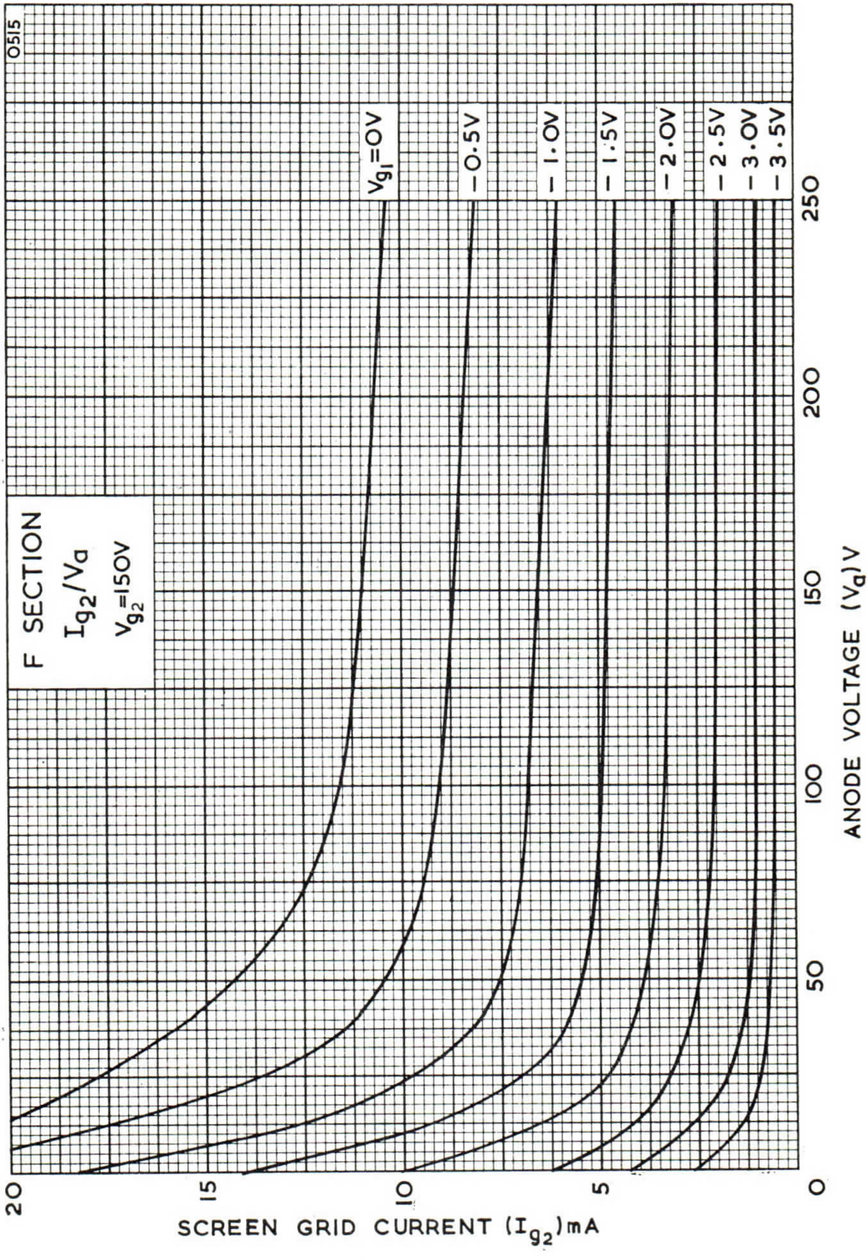
F SECTION

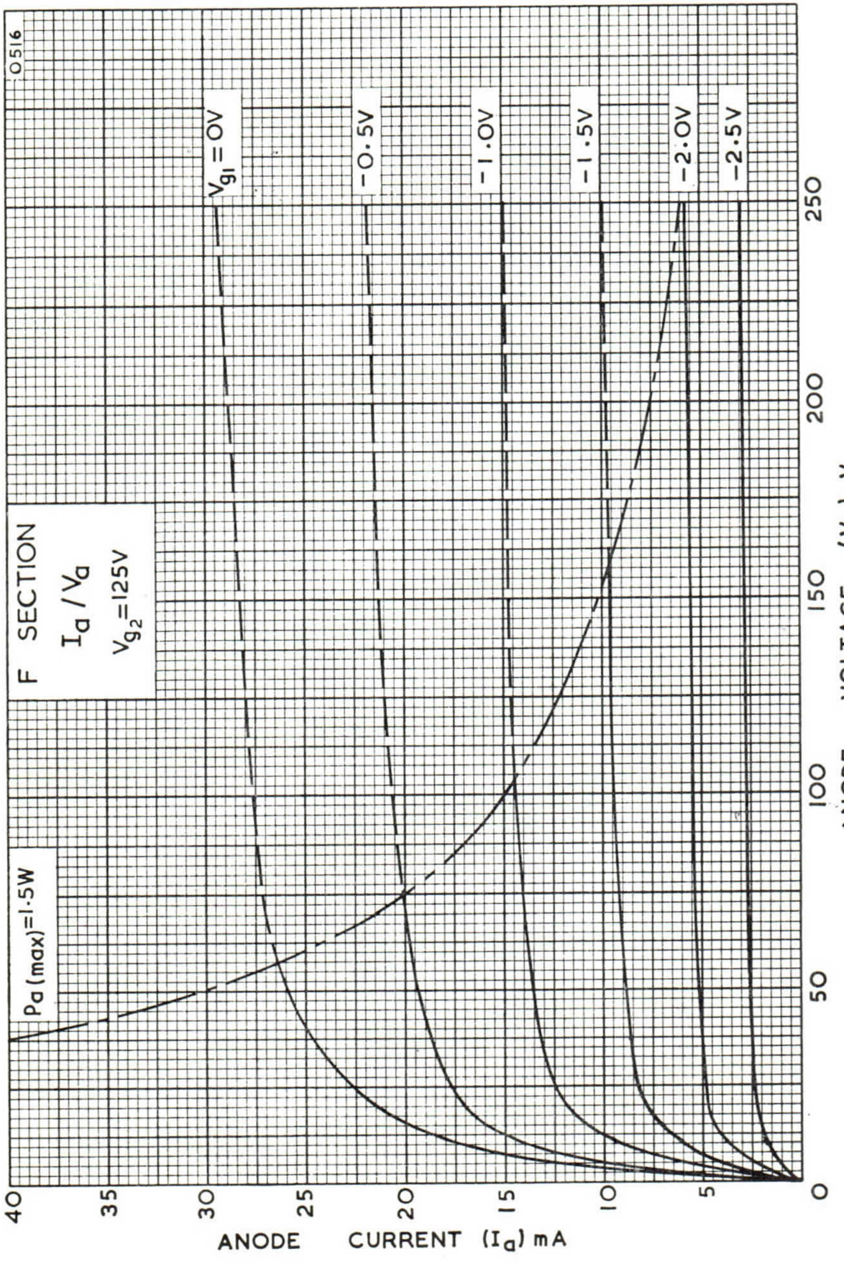
$I_a, I_{g2}, r_a, g_m / V_{g1}$

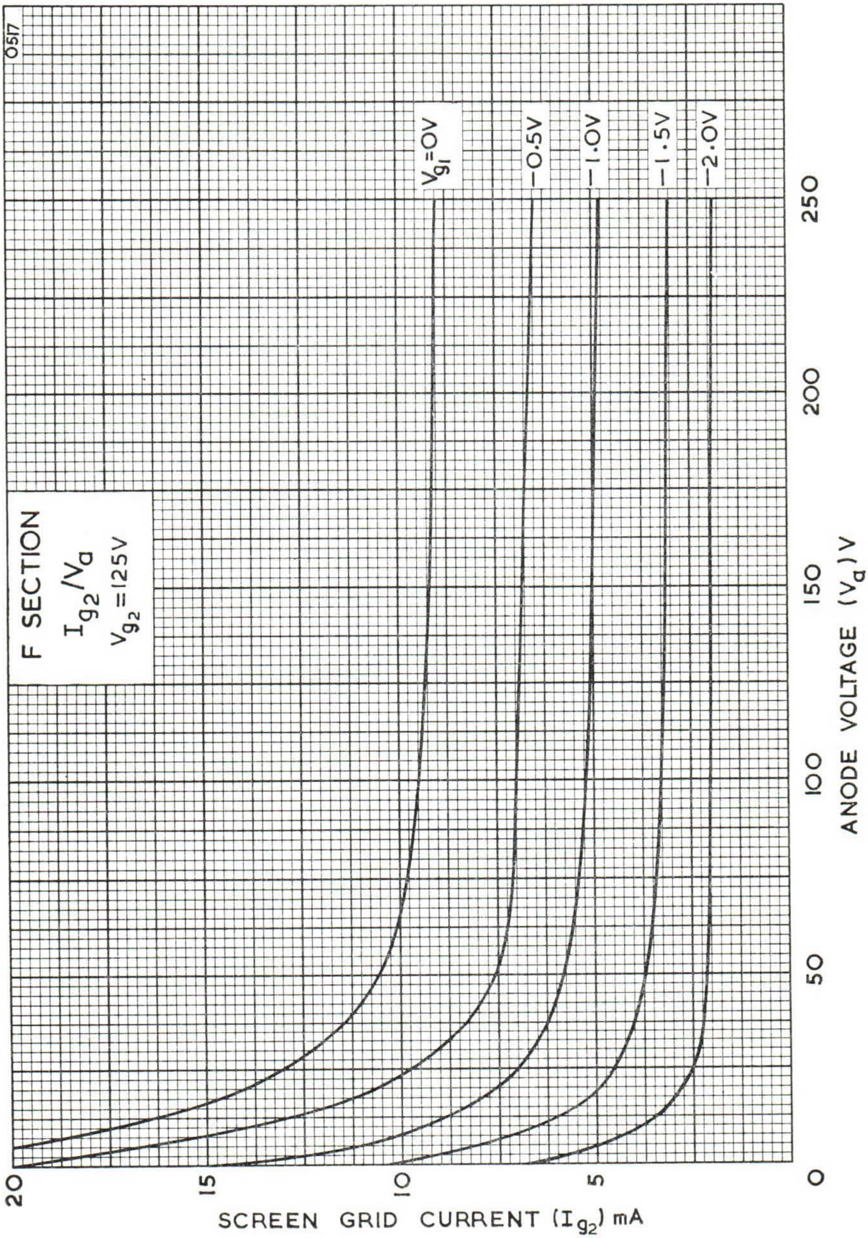
$V_a = V_{g2} = 150V$

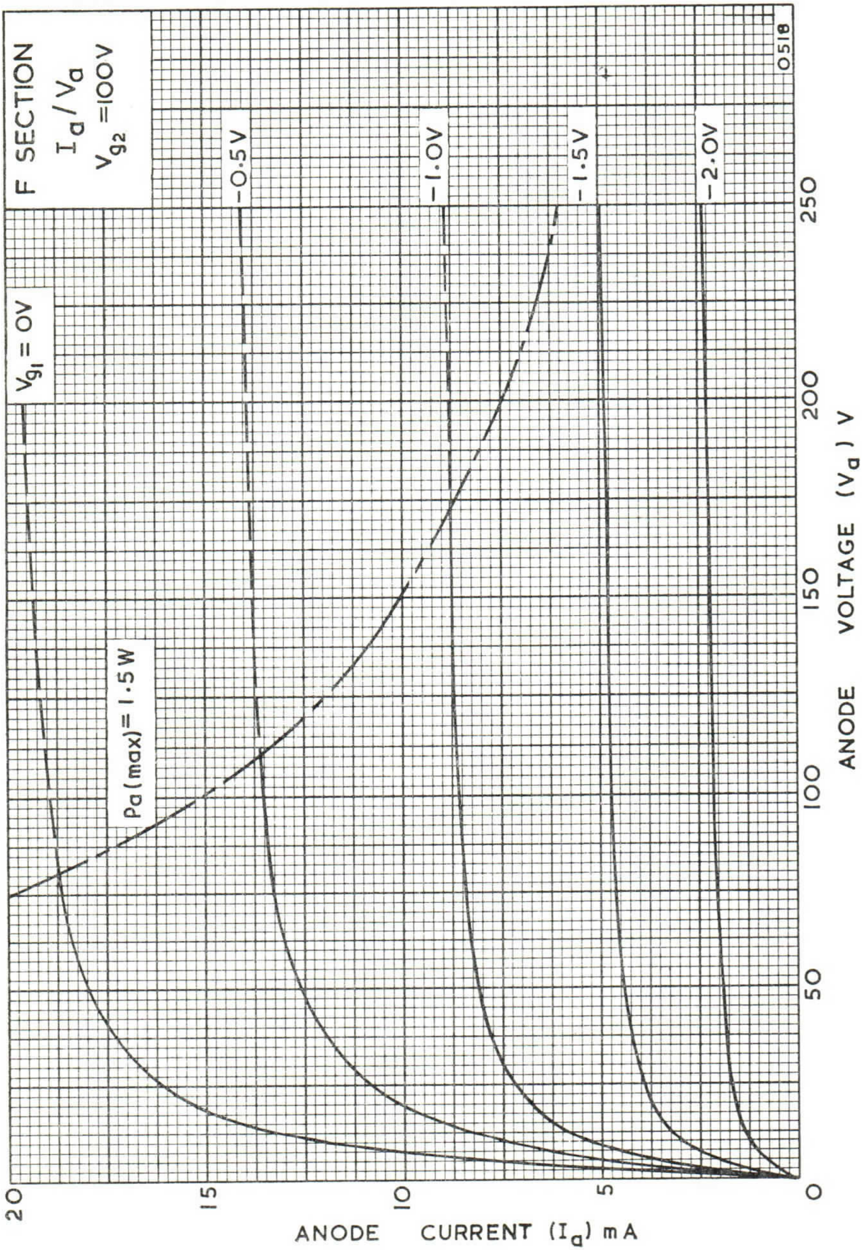


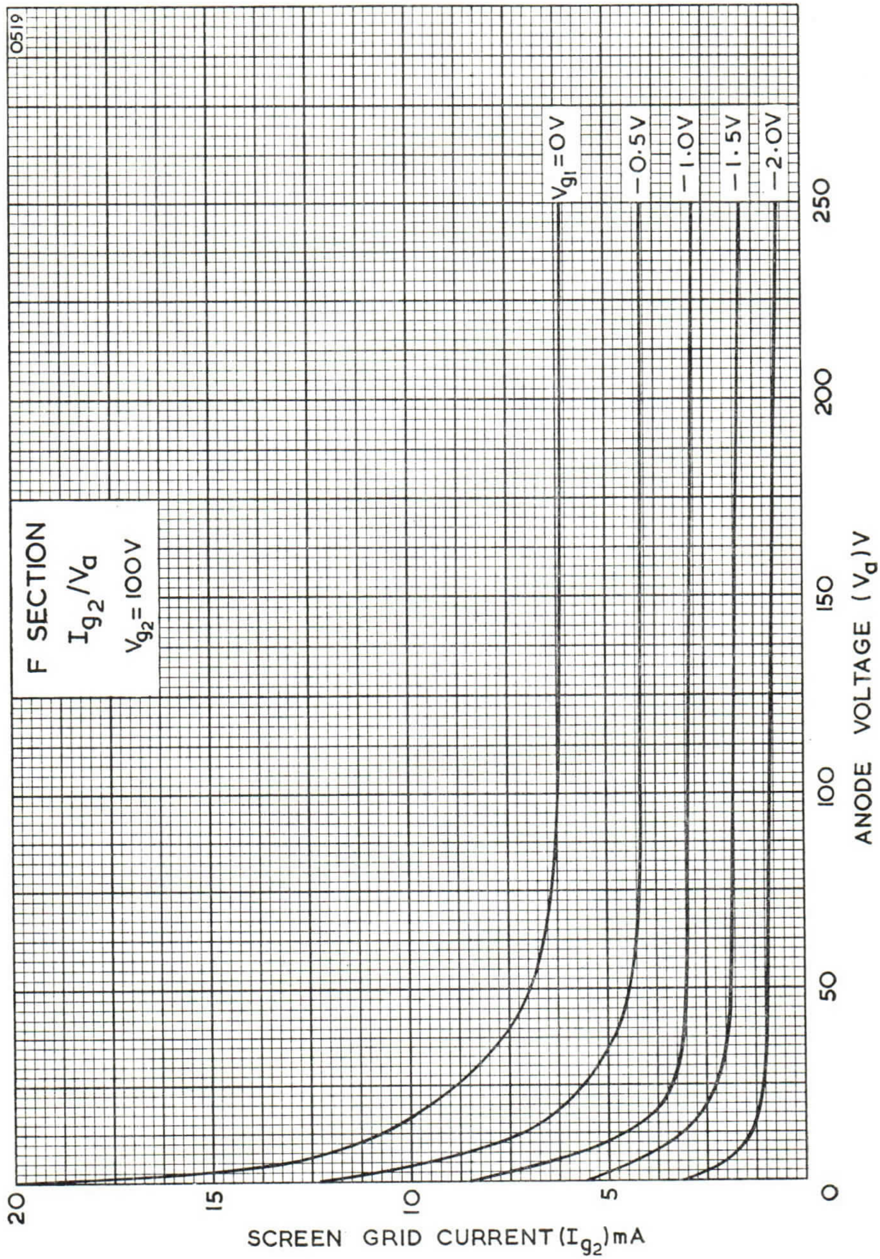

F SECTION
I_a/V_a
$V_{g2}=150V$
0514
$V_{g1}=0V$
−0·5V
−1·0V
−1·5V
−2·0V
−2·5V
−3·0V
−3·5V
−4·0V
Pa(max)=1·5W
ANODE VOLTAGE (V_a) V
ANODE CURRENT (I_a) mA
0
50
100
150
200
250
40
35
30
25
20
15
10
5

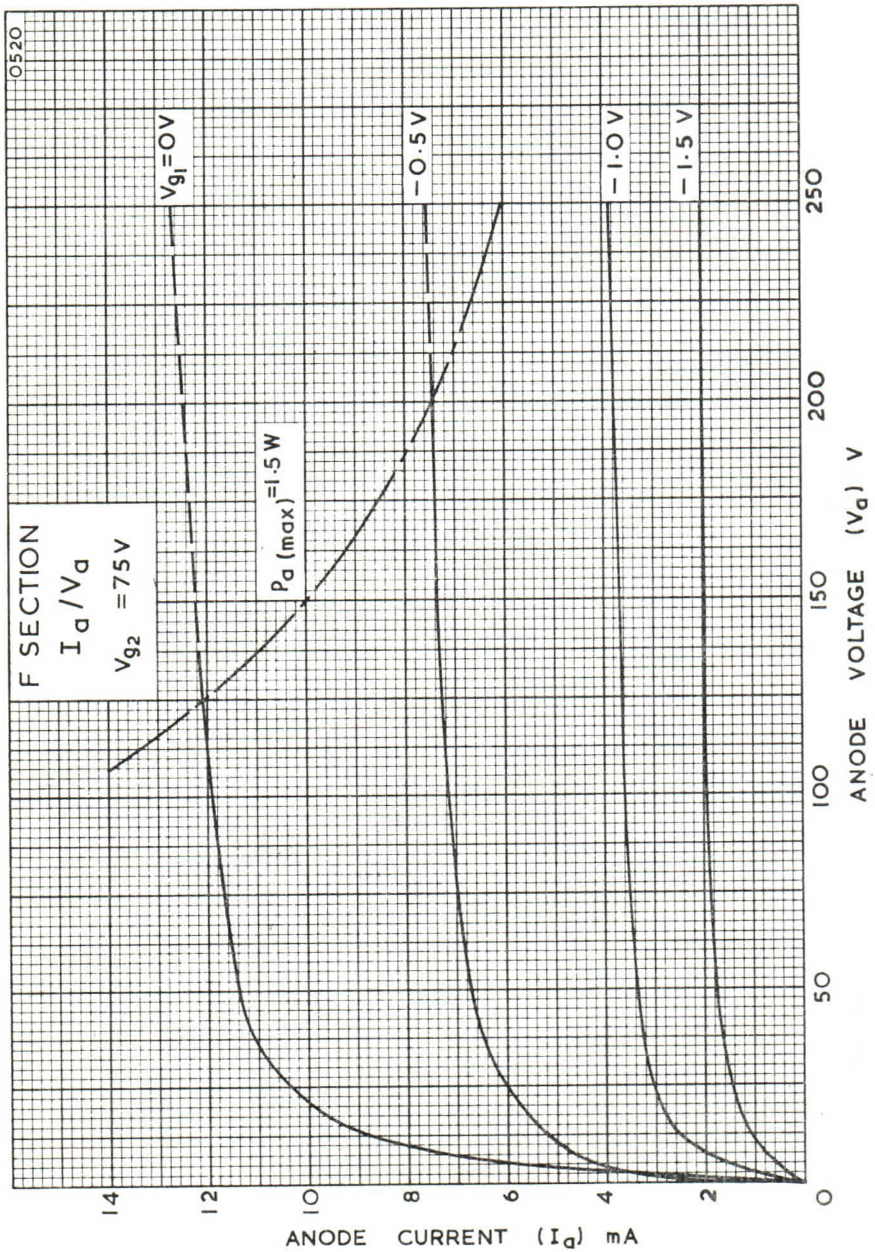

0515
V_{g1}=0V
−0.5V
−1.0V
−1.5V
−2.0V
−2.5V
−3.0V
−3.5V
F SECTION
I_{g2}/V_a
V_{g2}=150V
250
200
150
100
50
0
ANODE VOLTAGE (V_a) V
20
15
10
5
SCREEN GRID CURRENT (I_{g2}) mA

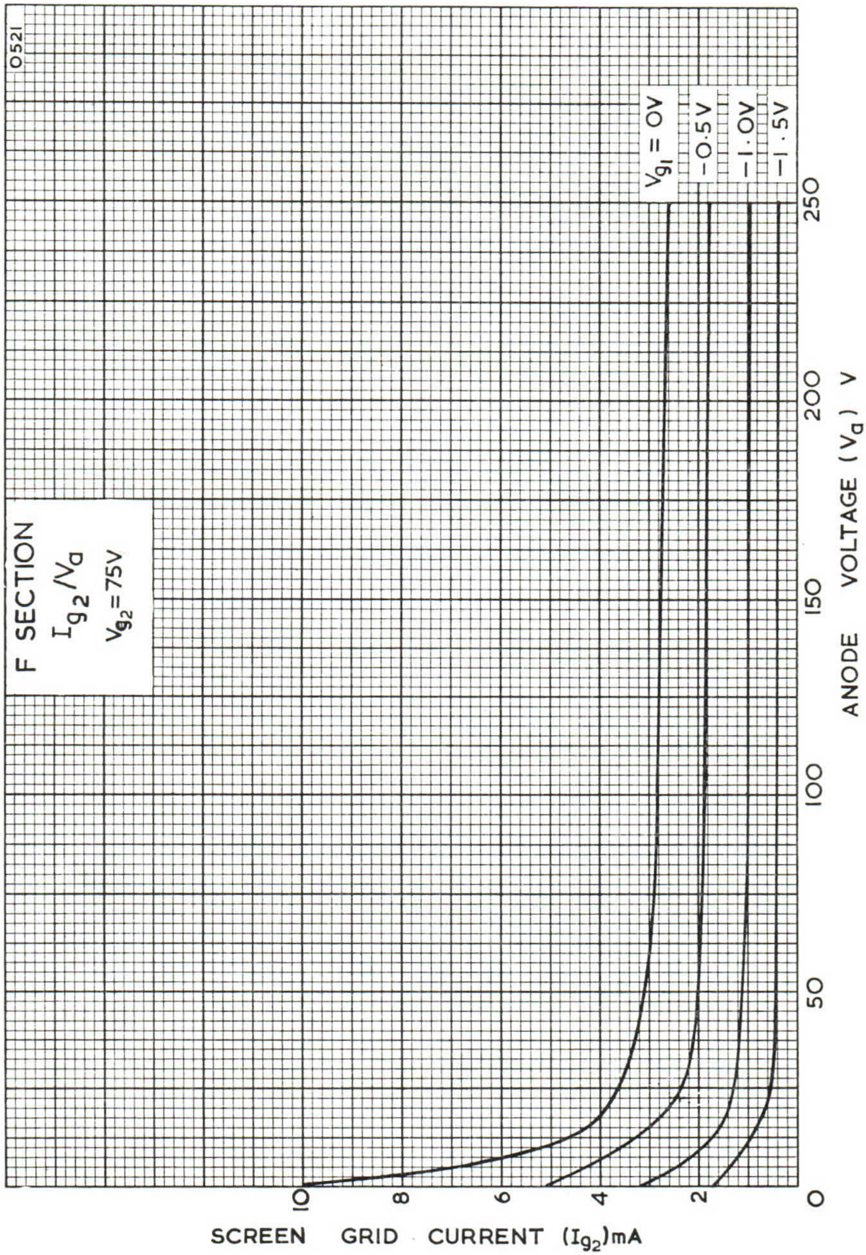

0516
F SECTION
I_a / V_a
V_{g2}=125V
V_{g1}=0V
-0.5V
-1.0V
-1.5V
-2.0V
-2.5V
P_a(max)=1·5W
ANODE VOLTAGE (V_a) V
0
50
100
150
200
250
ANODE CURRENT (I_a) mA
40
35
30
25
20
15
10
5
0

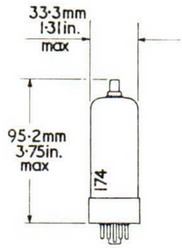

0517
F SECTION
I_{g2}/V_a
$V_{g2}=125V$
$V_{g1}=0V$
−0.5V
−1.0V
−1.5V
−2.0V
0
50
100
150
200
250
ANODE VOLTAGE (V_a) V
20
15
10
5
0
SCREEN GRID CURRENT (I_{g2}) mA


F SECTION
I_a/V_a
$V_{g2}=100V$
0518
$V_{g1}=0V$
−0.5 V
−1.0V
−1.5 V
−2.0V
Pa (max)= 1.5 W
0
50
100
150
200
250
ANODE VOLTAGE (V_a) V
20
15
10
5
0
ANODE CURRENT (I_a) mA

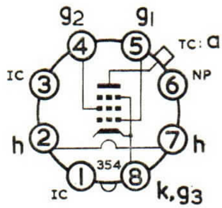

0519
F SECTION
I_{g_2}/V_a
V_{g_2}=100V
V_{g_1}=0V
−0·5V
−1·0V
−1·5V
−2·0V
0
50
100
150
200
250
ANODE VOLTAGE (V_a) V
20
15
10
5
0
SCREEN GRID CURRENT (I_{g_2}) mA


0520
F SECTION
I_a/V_a
V_{g2} =75 V
V_{g1}=0V
−0·5 V
−1·0 V
−1·5 V
$P_{a\,(max)}$=1·5 W
ANODE VOLTAGE (V_a) V
ANODE CURRENT (I_a) mA
0
50
100
150
200
250
2
4
6
8
10
12
14


F SECTION
I_{g_2}/V_a
$V_{g_2}=75V$
$V_{g_1} = 0V$
$-0.5V$
$-1.0V$
$-1.5V$
0521
0
50
100
150
200
250
ANODE VOLTAGE (V_a) V
10
8
6
4
2
0
SCREEN GRID CURRENT (I_{g_2})mA



LINE OUTPUT
PENTODE



I.O. Base, CT1 Top Cap

GENERAL

This valve is an output pentode intended for use as the line time base output valve in AC/DC television receivers having series connected heaters.

Heater Current	I_h	0·3 A
Heater Voltage	V_h	25 V

RATINGS

Maximum Anode Dissipation	$p_{a(max)}$	See rating chart	
Maximum Screen Grid Dissipation	$p_{g2(max)}$	See rating chart*	
Maximum Peak Anode Voltage,	$v_{a(pk)max}$		
Pulse Positive		7·0†	kV
Pulse Negative		1·5†	kV
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	V
Maximum Anode Voltage	$V_{a(max)}$	250	V
Maximum Screen Grid Supply Voltage	$V_{g2(b)max}$	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	250	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$		
Cathode Positive		250	V
Cathode Negative		200	V
Maximum Cathode Current	$I_{k(max)}$	200	mA
Maximum Control Grid to Cathode Resistance	$R_{g1\text{-}k(max)}$	500	kΩ

* Maximum average screen dissipation is 7·0 watts during the period between the commencement of screen current flow and the instant when the anode current attains one half of its normal operating value.

† Maximum duration 22 per cent of one cycle with a maximum duration of 18 μs.

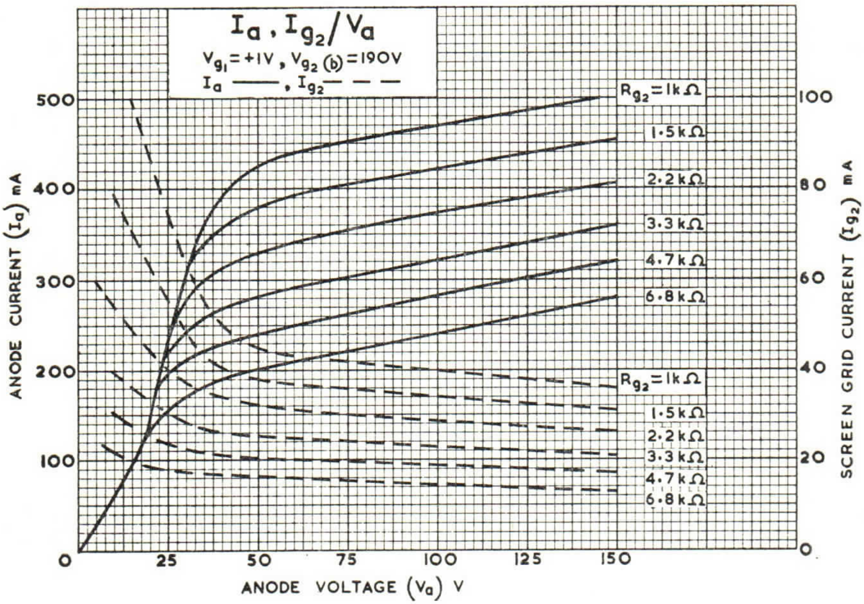
INTER-ELECTRODE CAPACITANCES

Input	c_{in}	17·5	pF
Output	c_{out}	8·0	pF
Anode to Control Grid	$c_{a\text{-}g1}$	<1·1	pF

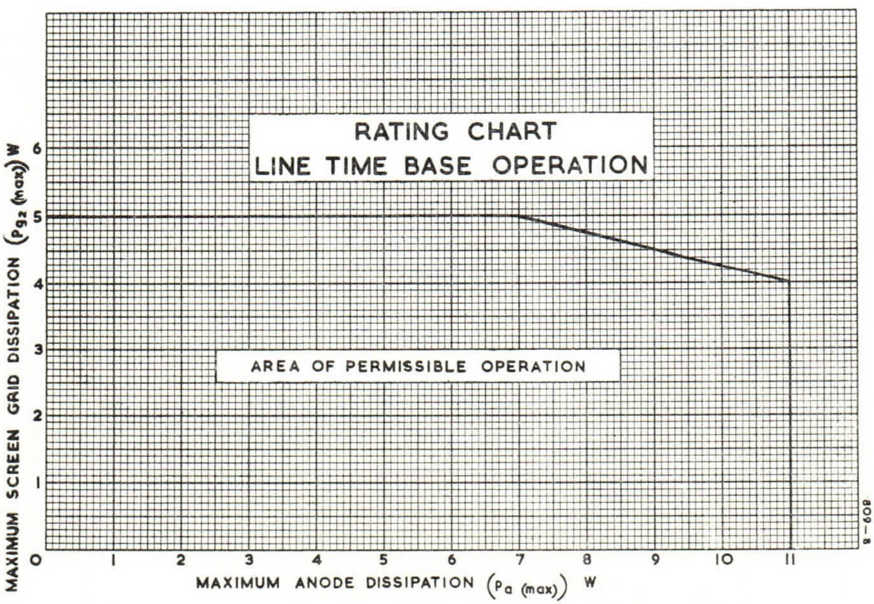
CHARACTERISTICS

Anode Voltage	V_a	100	V
Screen Grid Voltage	V_{g2}	100	V
Control Grid Voltage	V_{g1}	−8·2	V
Anode Current	I_a	100	mA
Screen Grid Current	I_{g2}	7·0	mA
Mutual Conductance	g_m	14	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	5·0	kΩ
Inner Amplification Factor	$\mu_{g1\text{-}g2}$	5·6	

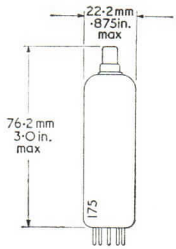
THORN—AEI RADIO VALVES & TUBES LTD.



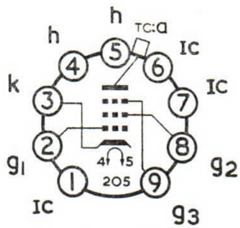
$I_a, I_{g_2}/V_a$
$V_{g_1}=+1V$, $V_{g_2(b)}=190V$
I_a ——— , I_{g_2} — — —
$R_{g_2}=1k\Omega$
$1{\cdot}5k\Omega$
$2{\cdot}2k\Omega$
$3{\cdot}3k\Omega$
$4{\cdot}7k\Omega$
$6{\cdot}8k\Omega$
ANODE CURRENT (I_a) mA
SCREEN GRID CURRENT (I_{g_2}) mA
ANODE VOLTAGE (V_a) V



RATING CHART
LINE TIME BASE OPERATION
AREA OF PERMISSIBLE OPERATION
MAXIMUM SCREEN GRID DISSIPATION $(p_{g_2\,(max)})$ W
MAXIMUM ANODE DISSIPATION $(p_{a\,(max)})$ W



LINE OUTPUT PENTODE



B9A Base, CT1 Cap

GENERAL

This valve is a line output pentode designed for use as the line time base output valve in AC/DC television receivers having series connected heaters.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	21·5	V

DESIGN CENTRE RATINGS

Maximum Anode Dissipation	$p_{a(max)}$		
For $p_{g2} \leqslant$ 2·0W		7·5	W
For $p_{g2} =$ 4·5W		5·0	W
Maximum Anode and Screen Grid Dissipation	$p_{a+g2(max)}$	See Rating Chart	
Maximum Screen Grid Dissipation	$p_{g2(max)}$		
For $p_a \leqslant$ 5·0W		4·5	W
For $p_a =$ 7·5W		2·0	W
Maximum Anode Supply Voltage (I_a=0)	$V_{a(b)max}$	550	V
Maximum Anode Voltage	$V_{a(max)}$	250	V
Maximum Peak Anode Voltage, Pulse Positive	$v_{a(pk)max}$	7·0*	kV
Maximum Screen Grid Supply Voltage	$V_{g2(b)max}$	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	250	V
Maximum Heater to Cathode Voltage	$V_{h\text{-}k(max)}$	200	V
Maximum Cathode Current	$I_{k(max)}$	180	mA
Maximum Control Grid to Cathode Resistance	$R_{g1\text{-}k(max)}$	0·5†	MΩ

* Maximum pulse duration 22 per cent of one cycle, with a maximum of 18 μs.
† For television line scan applications $R_{g1\text{-}k(max)}$ may be 3·3 MΩ.

INTER-ELECTRODE CAPACITANCES§

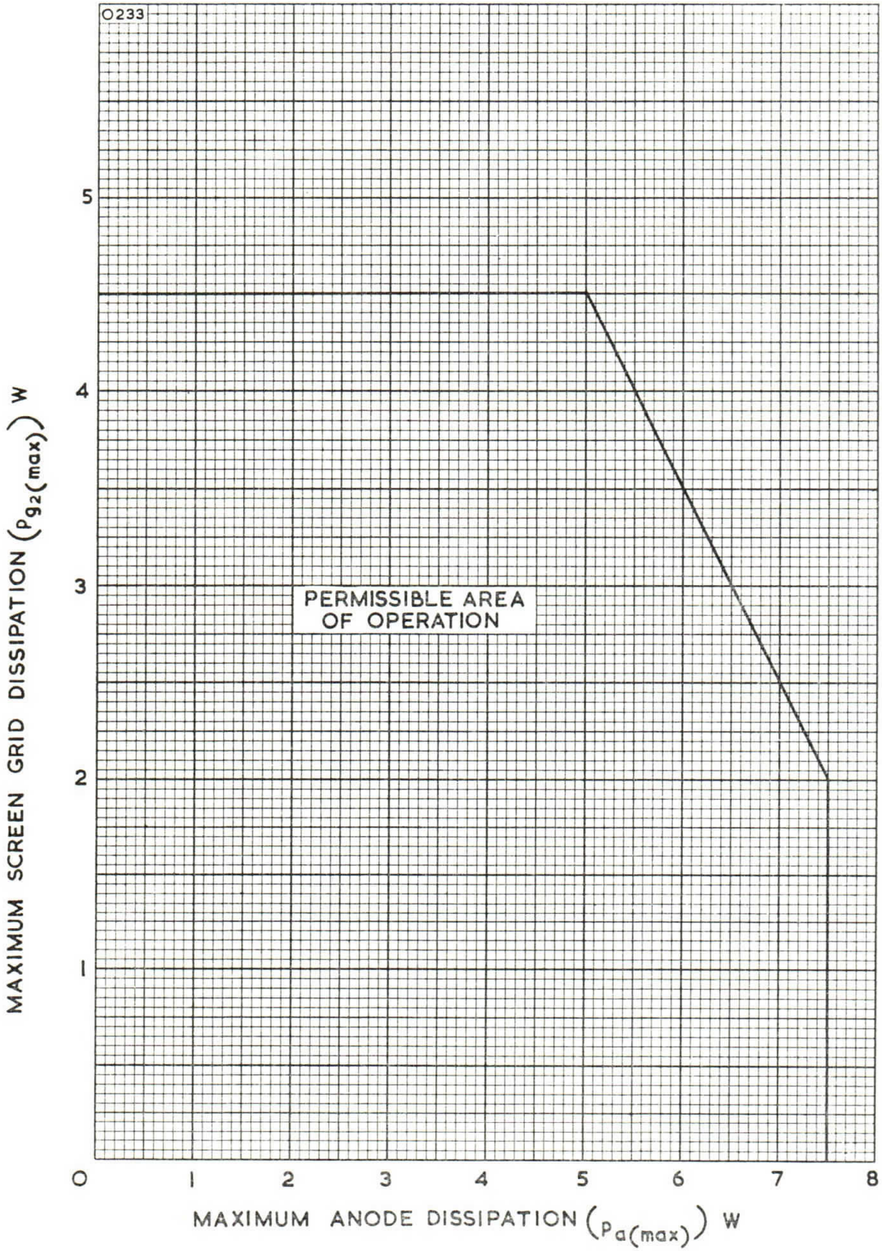
Input	c_{in}	14·7	pF
Output	c_{out}	6·0	pF
Anode to Grid 1	$c_{a\text{-}g1}$	<0·8	pF
Grid 1 to Heater	$c_{g1\text{-}h}$	<0·2	pF
Anode to Cathode	$c_{a\text{-}k}$	<0·1	pF

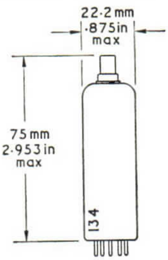
§ Measured without an external shield.

CHARACTERISTICS

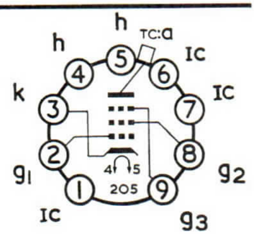
Anode Voltage	V_a	170	V
Screen Grid Voltage	V_{g2}	170	V
Control Grid Voltage	V_{g1}	–22	V
Anode Current	I_a	45	mA
Screen Grid Current	I_{g2}	2·9	mA
Mutual Conductance	g_m	6·2	mA/V
Inner Amplification Factor	$\mu_{g1\text{-}g2}$	5·3	
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	10	kΩ

THORN—A E I RADIO VALVES & TUBES LTD.


0233
PERMISSIBLE AREA OF OPERATION
MAXIMUM SCREEN GRID DISSIPATION ($P_{g2(max)}$) W
MAXIMUM ANODE DISSIPATION ($P_{a(max)}$) W
0
1
2
3
4
5
6
7
8



LINE OUTPUT PENTODE



B9A Base, CT1 Cap

GENERAL

This output pentode is primarily intended for use in the line timebase of AC/DC portable television receivers.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	21·5	V

DESIGN CENTRE RATINGS

Maximum Anode Dissipation	$p_{a(max)}$		
For $p_{g2} \leqslant 2{\cdot}0$W		7·5	W
For $p_{g2} = 4{\cdot}5$W		5·0	W
Maximum Anode and Screen Grid Dissipation	$p_{(a+g2)max}$	See Rating Chart	
Maximum Screen Grid Dissipation	$p_{g2(max)}$		
For $p_a \leqslant 5{\cdot}0$W		4·5	W
For $p_a = 7{\cdot}5$W		2·0	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	650	V
Maximum Anode Voltage	$V_{a(max)}$	250	V
Maximum Peak Anode Voltage	$v_{a(pk)max}$	7·0*	kV
Maximum Screen Grid Supply Voltage	$V_{g2(b)max}$	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	250	V
Maximum Peak Control Grid Voltage	$v_{g1(pk)max}$	1·0	kV
Maximum Heater to Cathode Voltage	$V_{h-k(max)}$	200	V
Maximum Cathode Current	$I_{k(max)}$	180	mA
Maximum Control Grid to Cathode Resistance	$R_{g1-k(max)}$	500†	kΩ
Maximum Heater to Cathode Resistance	$R_{h-k(max)}$	20	kΩ
Maximum Bulb Temperature	$T_{bulb(max)}$	240	°C

* Maximum pulse duration 22 per cent of one cycle, with a maximum of 18 μs.

† In line timebase applications $R_{g1-k(max)}$ may be 2·2 MΩ.

INTER-ELECTRODE CAPACITANCES§

Input	c_{in}	14	pF
Output	c_{out}	6·0	pF
Anode to Grid 1	c_{a-g1}	<0·8	pF
Grid 1 to Heater	c_{g1-h}	<0·2	pF
Anode to Cathode	c_{a-k}	<0·1	pF

§ Measured without an external shield.

CHARACTERISTICS

Anode Voltage	V_a	170	V
Screen Grid Voltage	V_{g2}	170	V
Control Grid Voltage	V_{g1}	–24·5	V
Anode Current	I_a	45	mA
Screen Grid Current	I_{g2}	2·2	mA
Mutual Conductance	g_m	6·0	mA/V
Inner Amplification Factor	μ_{g1-g2}	4·9	
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	11·5	kΩ

LINE OUTPUT VALVE CIRCUIT DESIGN

It is recommended that the valve be operated so that the anode potential at the end of the scan is above the knee of the anode characteristic. An effective feedback stabilising circuit should be employed.

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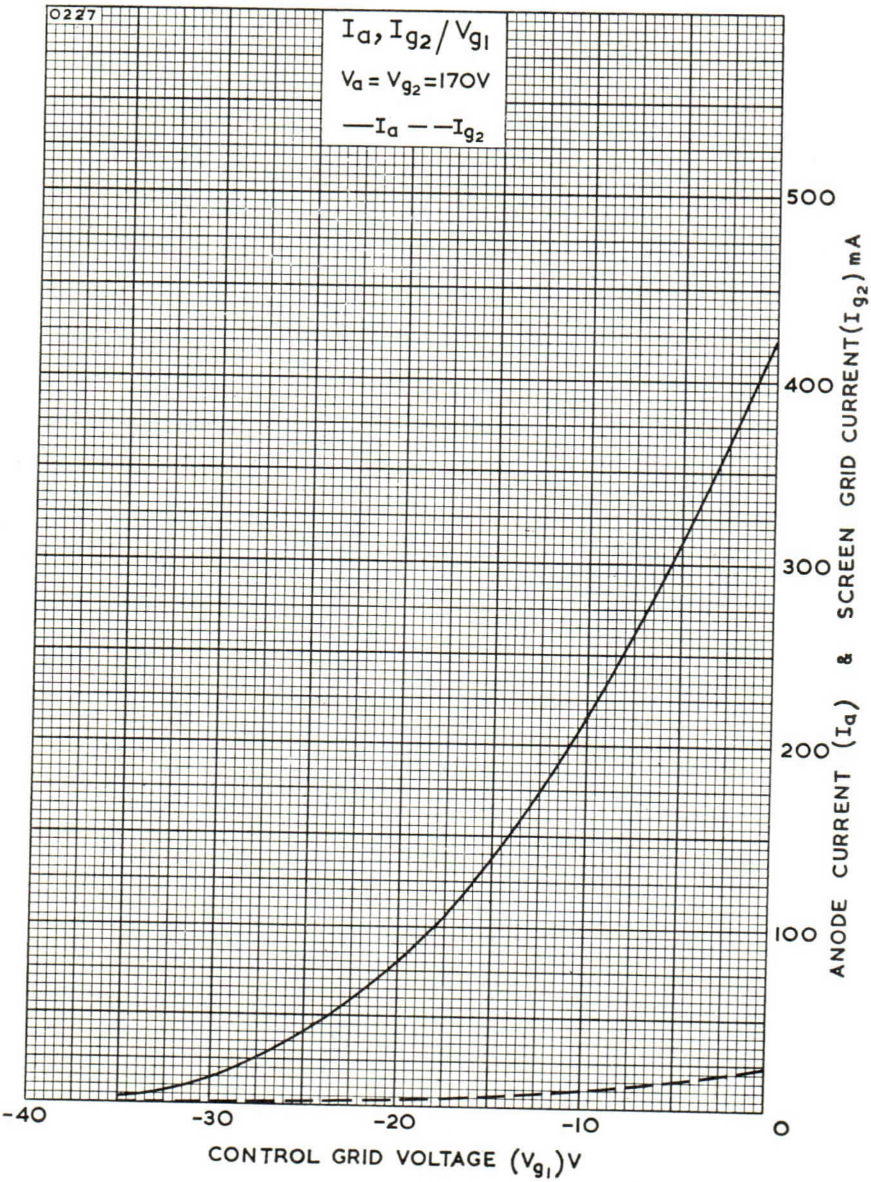
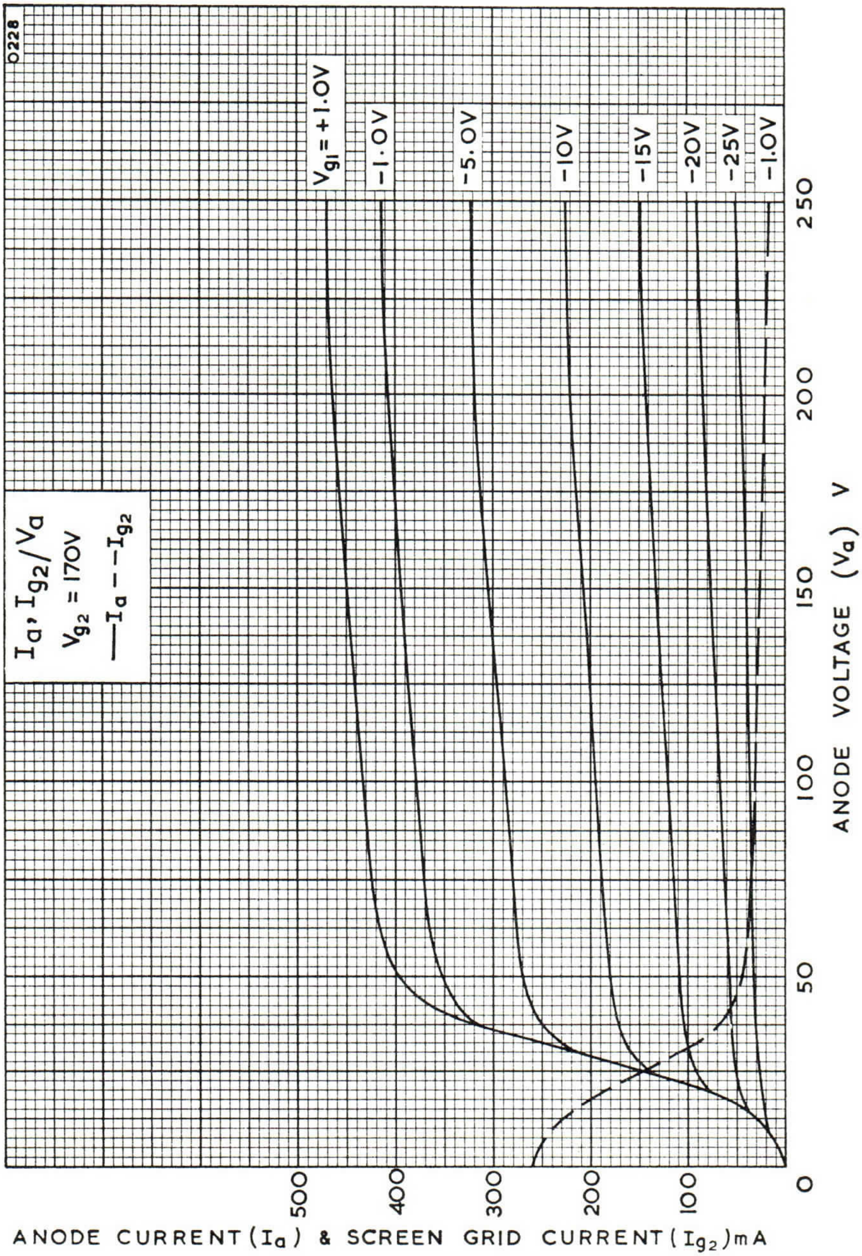
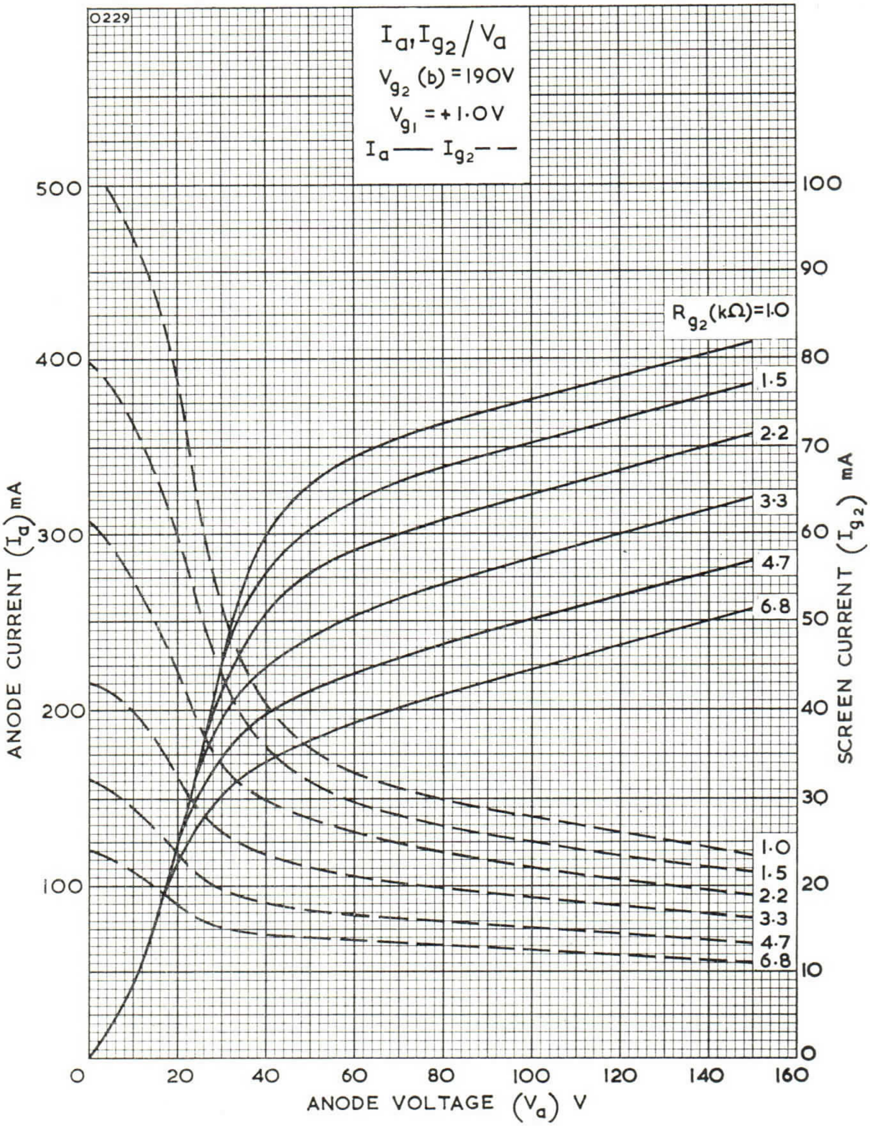
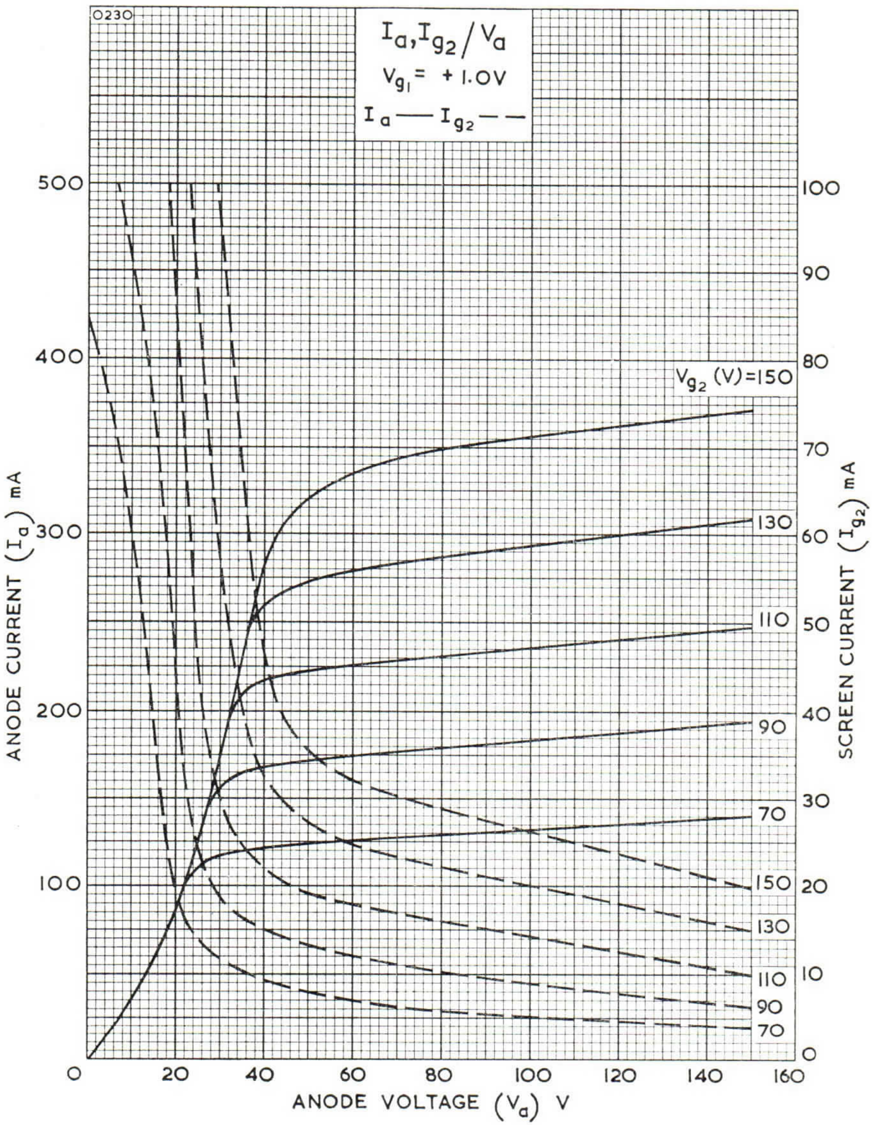
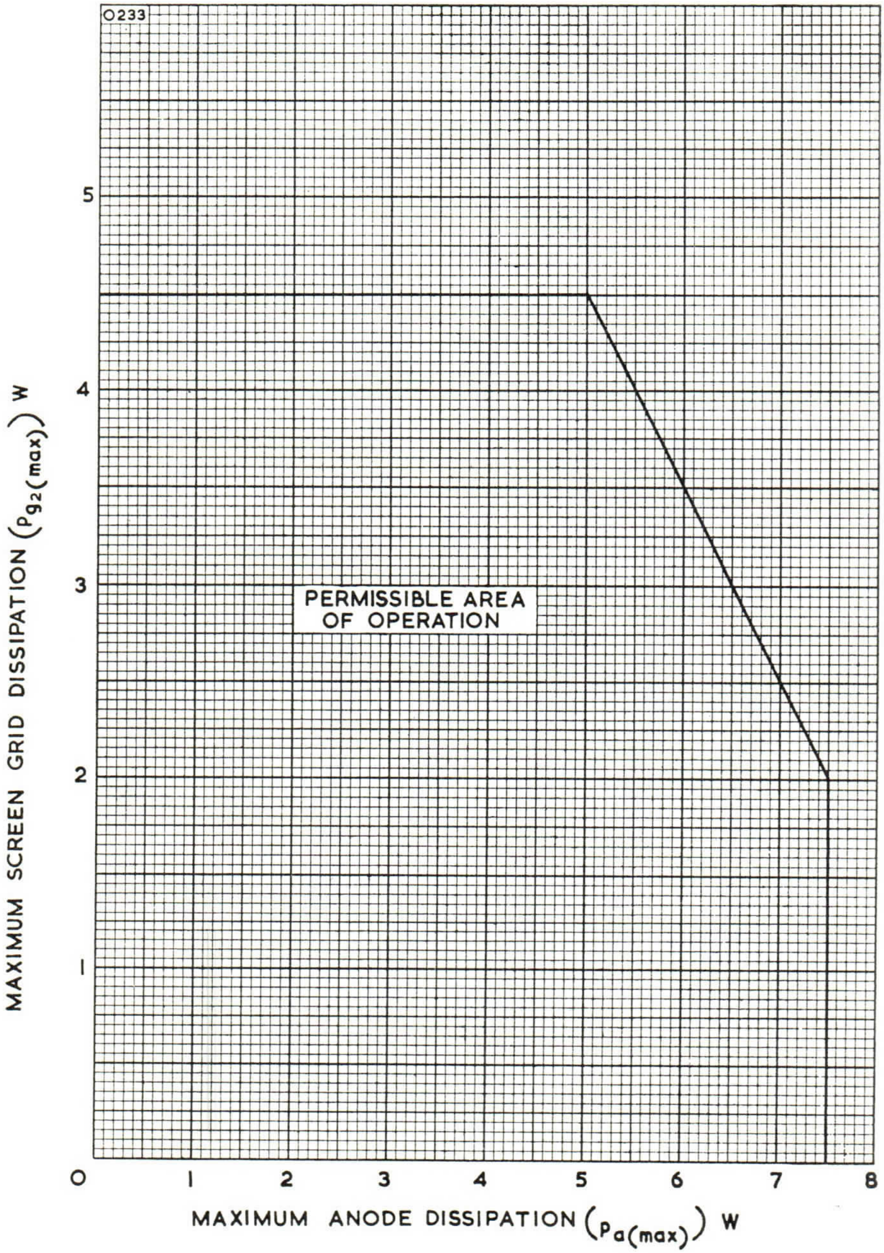

0227
$I_a, I_{g2}/V_{g1}$
$V_a = V_{g2} = 170V$
— I_a — — I_{g2}
500
400
300
200
100
0
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA
-40
-30
-20
-10
CONTROL GRID VOLTAGE (V_{g1})V

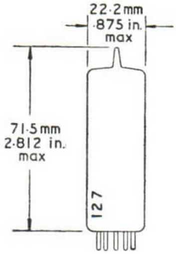


0228
$I_a, I_{g2}/V_a$
$V_{g2} = 170V$
—— I_a - - I_{g2}
$V_{g1} = +1.0V$
-1.0V
-5.0V
-10V
-15V
-20V
-25V
-1.0V
0
50
100
150
200
250
ANODE VOLTAGE (V_a) V
500
400
300
200
100
0
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA

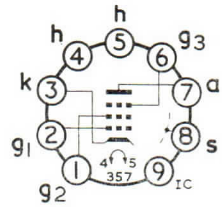

O229
$I_a, I_{g_2} / V_a$
V_{g_2} (b) = 190V
V_{g_1} = + 1·0 V
I_a —— I_{g_2} – –
R_{g_2} (kΩ) = 1·0
1·5
2·2
3·3
4·7
6·8
1·0
1·5
2·2
3·3
4·7
6·8
ANODE CURRENT (I_a) mA
SCREEN CURRENT (I_{g_2}) mA
ANODE VOLTAGE (V_a) V
0
100
200
300
400
500
10
20
30
40
50
60
70
80
90
100
20
40
60
80
100
120
140
160


0230
$I_a, I_{g2}/V_a$
V_{g1} = +1.0V
I_a —— I_{g2} – –
V_{g2} (V)=150
130
110
90
70
150
130
110
90
70
ANODE CURRENT (I_a) mA
SCREEN CURRENT (I_{g2}) mA
ANODE VOLTAGE (V_a) V
0
20
40
60
80
100
120
140
160
100
200
300
400
500
10
20
30
40
50
60
70
80
90
100


0233
PERMISSIBLE AREA OF OPERATION
MAXIMUM SCREEN GRID DISSIPATION $(P_{g2(max)})$ W
MAXIMUM ANODE DISSIPATION $(P_{a(max)})$ W
0
1
2
3
4
5
6
7
8



VIDEO OUTPUT PENTODE



B9A Base

GENERAL

This video output pentode is particularly suitable for use in projection television receivers or with high definition television systems.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	15	V

RATINGS

Maximum Anode Dissipation	$p_{a(max)}$	9·0	W
Maximum Screen Grid Dissipation	$p_{g2(max)}$	2·0	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	V
Maximum Anode Voltage	$V_{a(max)}$	250	V
Maximum Screen Grid Supply Voltage	$V_{g2(b)max}$	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	250	V
Maximum Heater to Cathode Voltage	$V_{h-k(max)}$	150	V
Maximum Cathode Current	$I_{k(max)}$	70	mA
Maximum Control Grid to Cathode Resistance	$R_{g1-k(max)}$		
Self Bias		1·0	MΩ
Fixed Bias		500	kΩ
Maximum Heater to Cathode Resistance	$R_{h-k(max)}$	20	kΩ

INTER-ELECTRODE CAPACITANCES

Input	c_{in}	10·4	pF
Output	c_{out}	6·6	pF
Anode to Control Grid	c_{a-g1}	<0·06	pF
Control Grid to Heater	c_{g1-h}	<0·15	pF

CHARACTERISTICS

Anode Voltage	V_a	170	200	V
Screen Grid Voltage	V_{g2}	170	200	V
Control Grid Voltage	V_{g1}	−2·3	−3·5	V
Anode Current	I_a	36	36	mA
Screen Grid Current	I_{g2}	5·0	5·0	mA
Mutual Conductance	g_m	10	10	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	100	100	kΩ
Inner Amplification Factor	μ_{g1-g2}	24	24	

TYPICAL OPERATION

(Driving a cathode ray tube with cathode injection)

Supply Voltage	V_b	170	V
Screen Grid Voltage	V_{g2}	170	V
Control Grid Voltage	V_{g1}	−6·7	V
Anode Current	I_a	4·0	mA
Screen Grid Current	I_{g2}	0·25	mA
Anode Load Resistance	R_a	2·2	kΩ
Peak Output Voltage	$v_{out(pk)}$	>70	V

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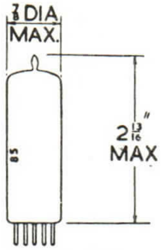
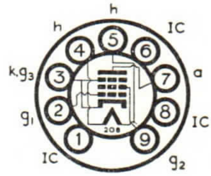


B9A (Noval) Base

Current Equipment Type

TYPE **PL84**
MINIATURE FRAME TIME BASE OUTPUT PENTODE



The BRIMAR PL84 is designed for frame time base output service in television receivers using series connected heaters. It is particularly suitable for use with 110° tubes at the relatively low levels of H.T. voltage available in A.C./D.C. receivers.

Heater Current	0.3 amp.
Heater Voltage	15 volts

RATINGS

Anode Supply Voltage (Ia = 0)	550 volts max.
Anode Voltage	250 volts max.
Peak Positive Anode Voltage	2.0 kV max.
Peak Negative Anode Voltage	500 volts max.
Anode Dissipation	12 watts max.
Screen Supply Voltage ($Ig_2 = 0$)	550 volts max.
Screen Voltage	200 volts max.
Screen Dissipation	1.75 watts max.
Direct Cathode Current	100 mA max.
Grid Circuit Resistance (cathode bias)	1.0 M Ω max.
Heater-Cathode Voltage	200 volts max.

CHARACTERISTICS

Anode Voltage	100	170	volts
Screen Voltage	100	170	volts
Anode Current	43	70	mA
Screen Current	3	5	mA
Control Grid Voltage	−6.7	−12.5	volts
Mutual Conductance	9	10	mA/V
Anode Impedance	23	23	k Ω
Inner Amplification Factor ($\mu g_1 - g_2$)	8	8	

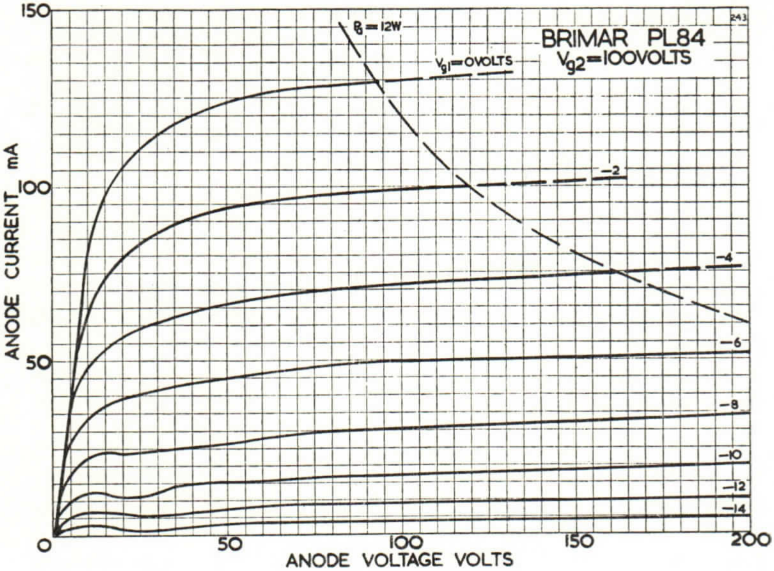
INTER-ELECTRODE CAPACITANCES*

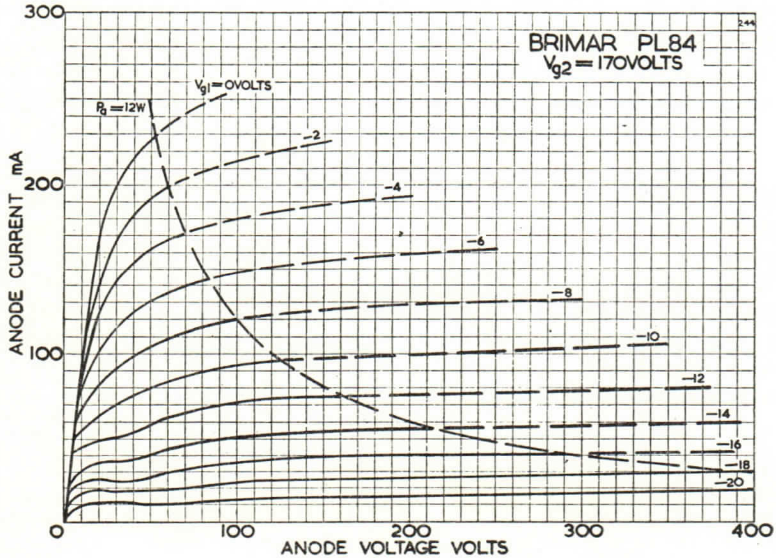
Input	11.8 pF
Output	6.0 pF
Control Grid to Anode	0.6 pF max.

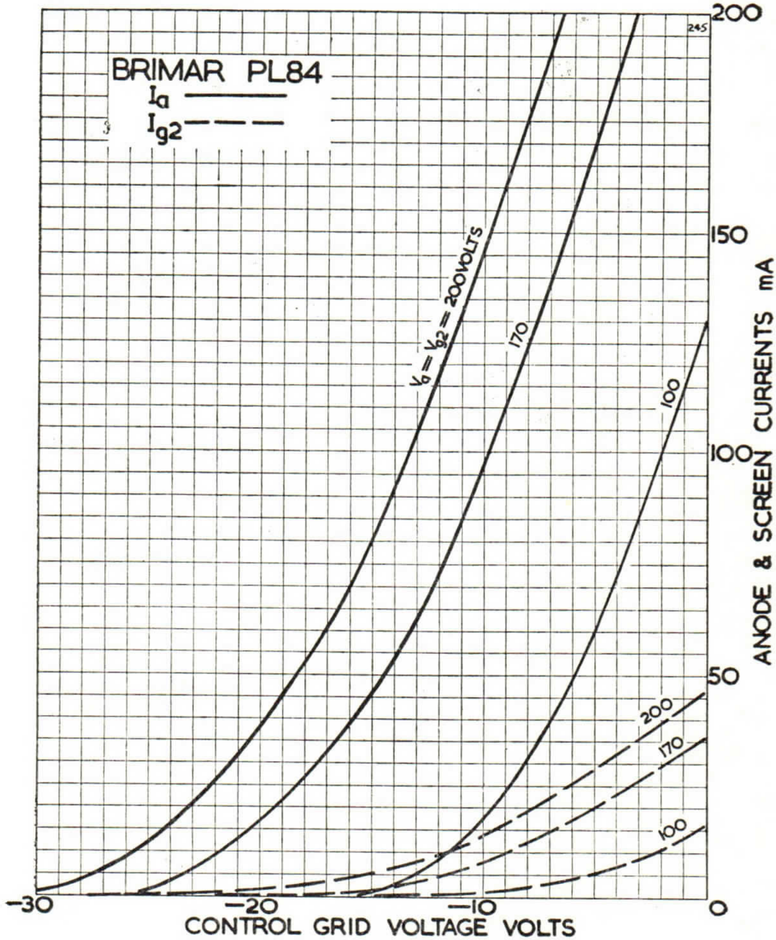
** With no external shield*

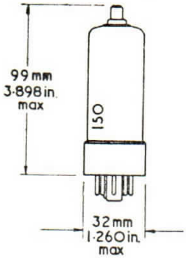
VALVES

BRIMAR

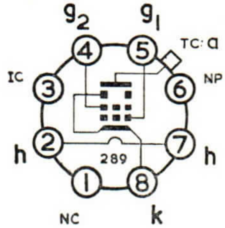





BRIMAR PL84
I_a
I_{g2}
$V_a = V_{g2} = 200$ VOLTS
170
100
200
170
100
200
150
100
50
0
ANODE & SCREEN CURRENTS mA
−30
−20
−10
CONTROL GRID VOLTAGE VOLTS



LINE OUTPUT
BEAM TETRODE



I.O. Base
CT1 Top cap

GENERAL

This valve is an output beam tetrode primarily intended for use in both stabilised and non-stabilised time base output stages of AC/DC, 405/625 line television receivers with series connected heaters.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	25	V

RATINGS

Maximum Anode Dissipation	$p_{a(max)}$	See rating chart	
Maximum Screen Grid Dissipation	$p_{g2(max)}$	See rating chart	
Maximum Peak Anode Voltage (Pulse positive)	$v_{a(pk)max}$	7*†	kV
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	V
Maximum Anode Voltage	$V_{a(max)}$	250	V
Maximum Peak Screen Grid Voltage (Pulse negative)	$v_{g2(pk)max}$	2*	kV
Maximum Screen Grid Voltage	$V_{g2(max)}$	250	V
Maximum Heater to Cathode Voltage (R.M.S.)	$V_{h\text{-}k(r.m.s.)max}$	200‡	V
Maximum Cathode Current	$I_{k(max)}$	200	mA
Maximum Grid to Cathode Resistance	$R_{g1\text{-}k(max)}$	3·3**	MΩ

* The pulse ratings are for television line scan where the applied voltage pulse does not exceed 22 per cent of one scanning cycle or 18 μs duration.

** For television line scan applications.

† 7 kV is a design centre rating, the absolute rating of 8·5 kV must not be exceeded.

‡ Measured with respect to the higher potential heater pin.

INTER-ELECTRODE CAPACITANCES

		§	ϕ	‖	
Grid 1 to Earth	c_{in}	18	18·5	20	pF
Anode to Earth	c_{out}	11	12	12	pF
Anode to Grid 1	$c_{a\text{-}g1}$	0·25	0·3	0·3	pF

§ In fully shielded socket without can.

ϕ With holder capacitance balanced out. (Holder as below.)

‖ Total capacitance including McMurdo amphenol international octal holder type B8/U.

"Earth" denotes the remaining earthy potential electrodes, heater and shields joined to cathode.

MOUNTING POSITION—Unrestricted

If mounted horizontally it is recommended that pins 4 and 8 should be in a vertical plane.

APPROXIMATE WEIGHT

Net	1 5	oz
Packed	4	oz

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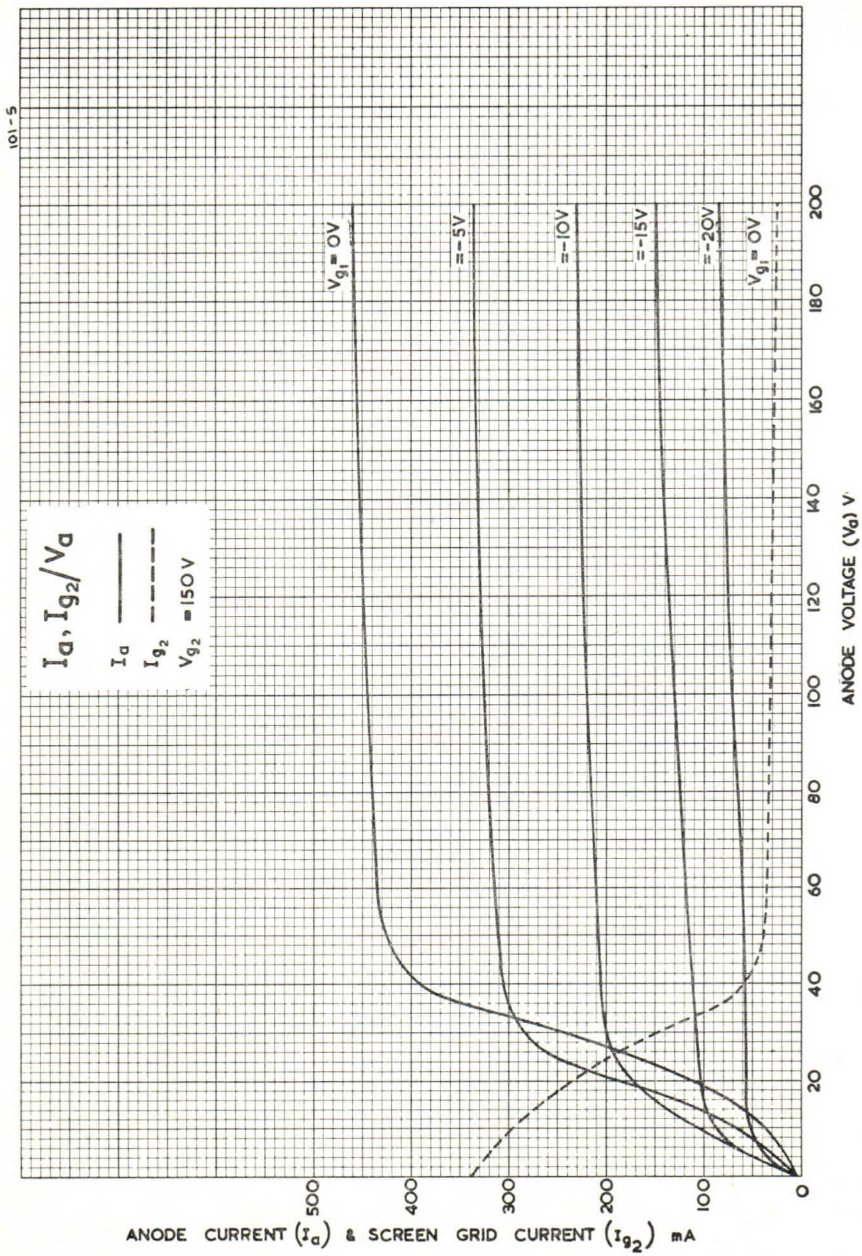
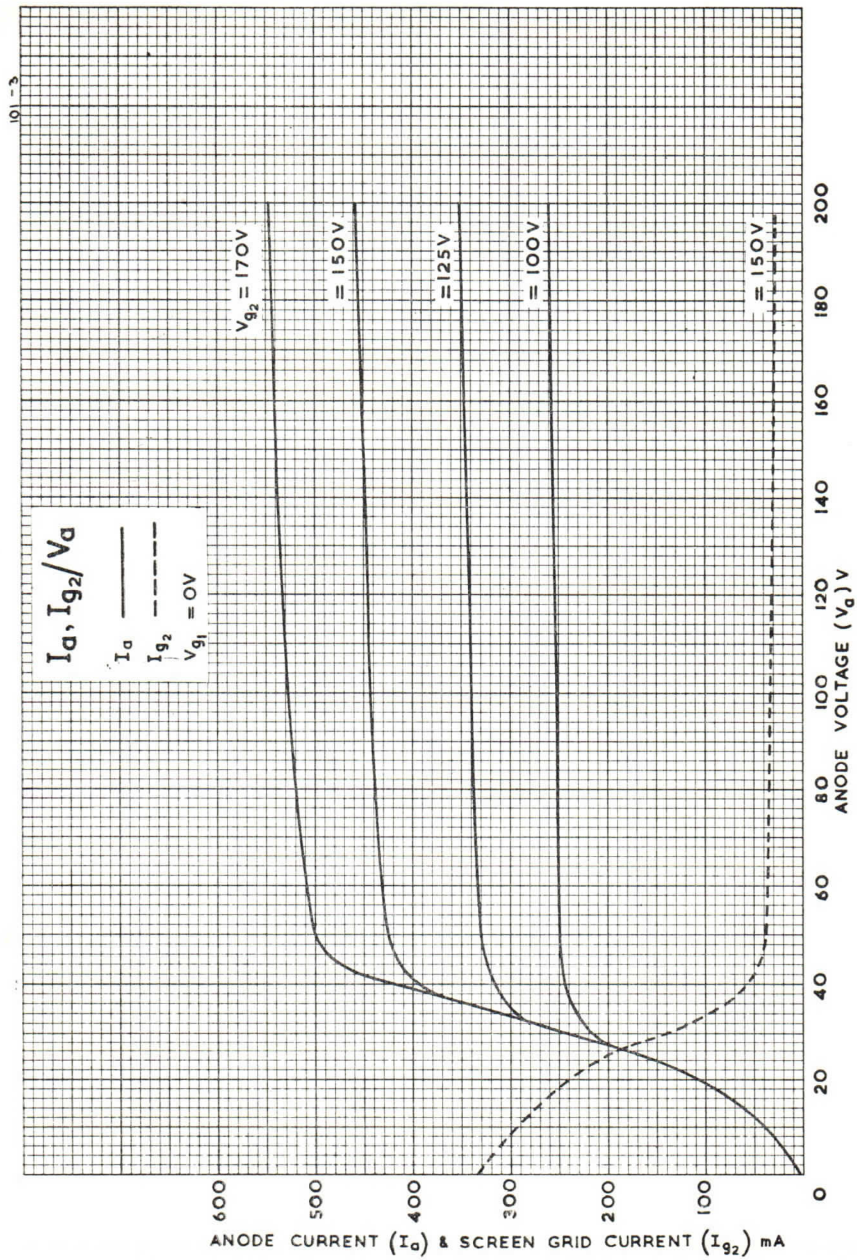
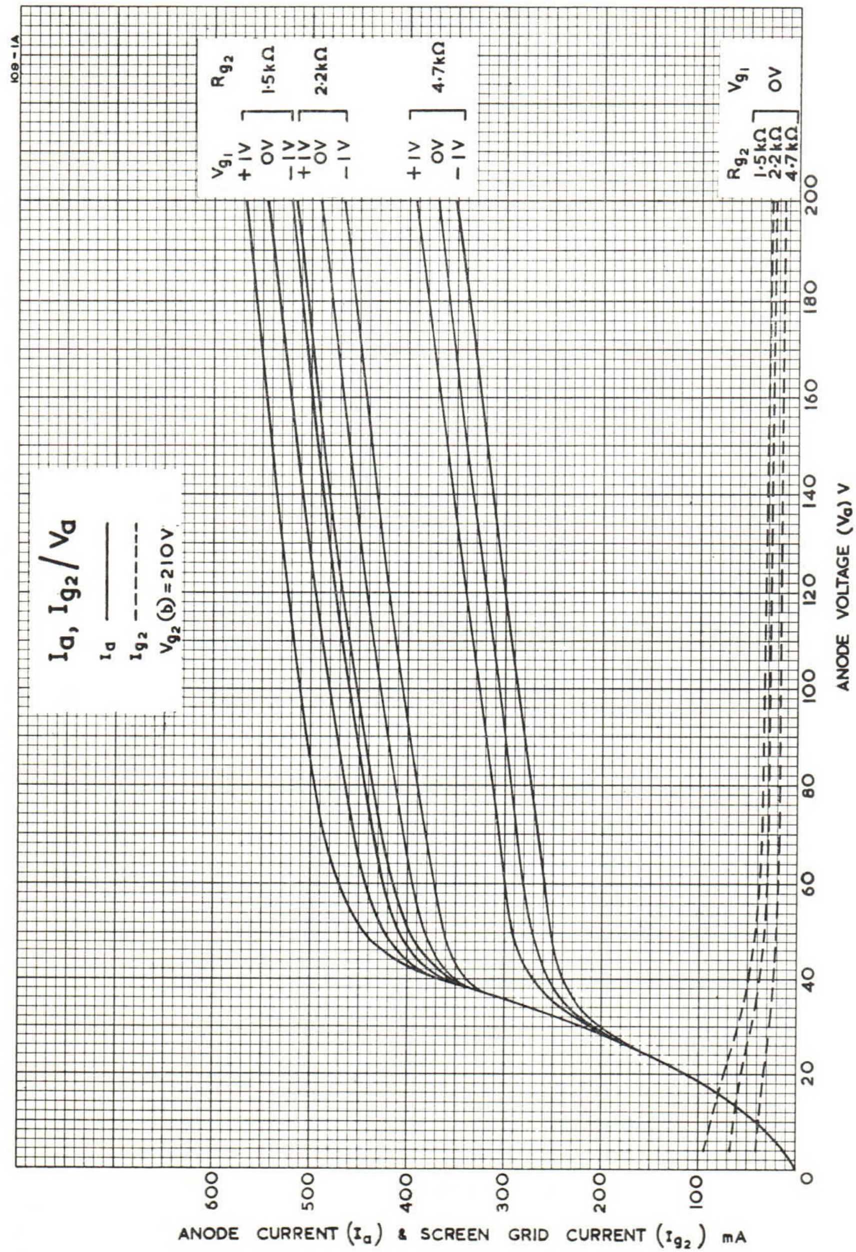
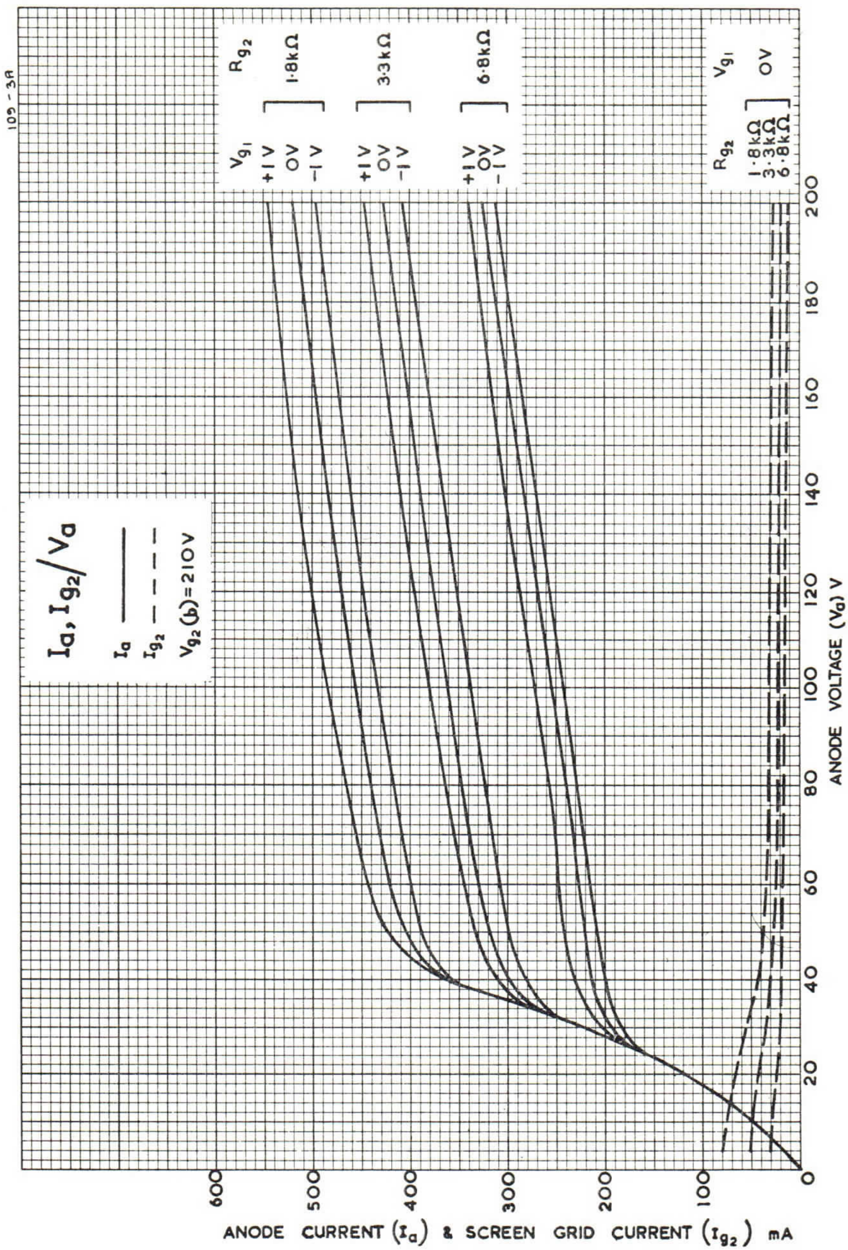


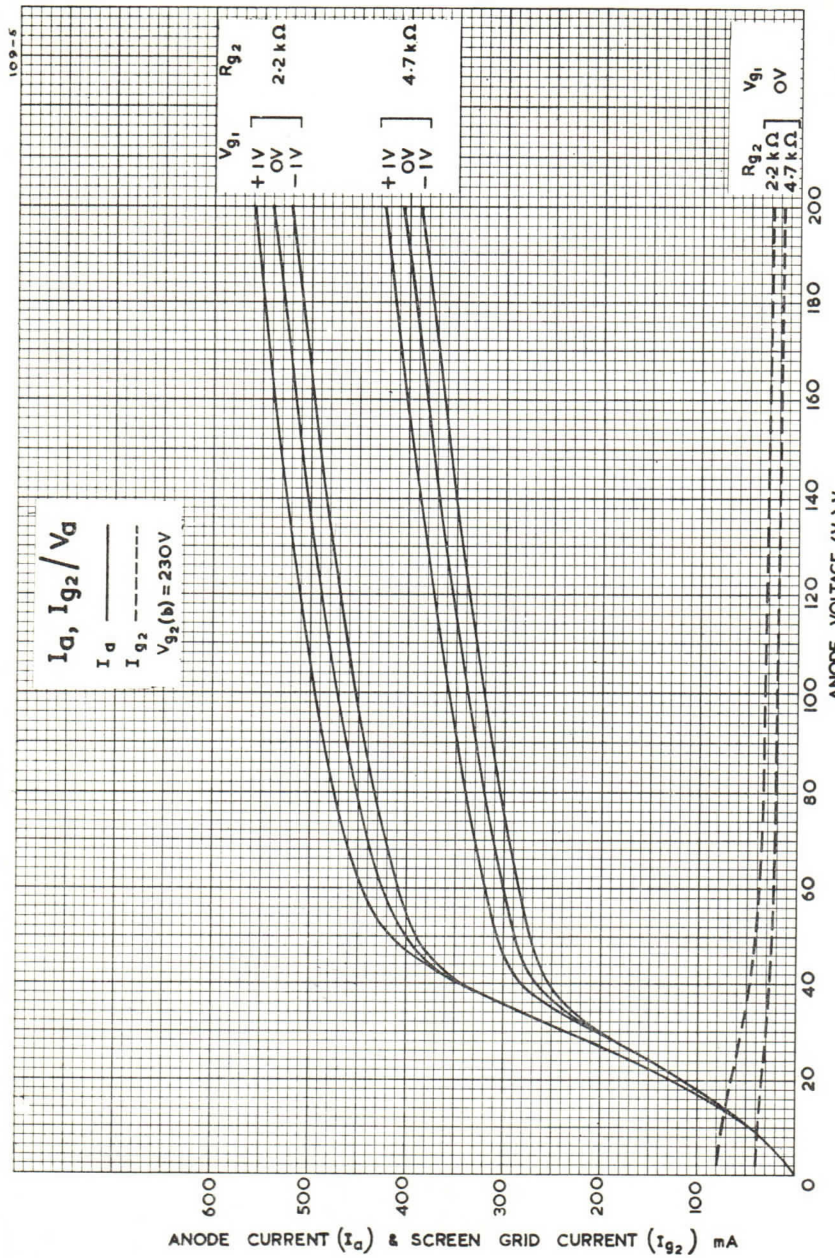
101-5
$I_a, I_{g2}/V_a$
I_a
I_{g2}
V_{g2} = 150 V
V_{g1} = 0V
= -5V
= -10V
= -15V
= -20V
V_{g1} = 0V
0
20
40
60
80
100
120
140
160
180
200
ANODE VOLTAGE (V_a) V
100
200
300
400
500
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA


$I_a, I_{g2}/V_a$
I_a ———
I_{g2} - - - -
$V_{g1} = 0V$
$V_{g2} = 170V$
$= 150V$
$= 125V$
$= 100V$
$= 150V$
ANODE VOLTAGE (V_a) V
0
20
40
60
80
100
120
140
160
180
200
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA
100
200
300
400
500
600
101-3

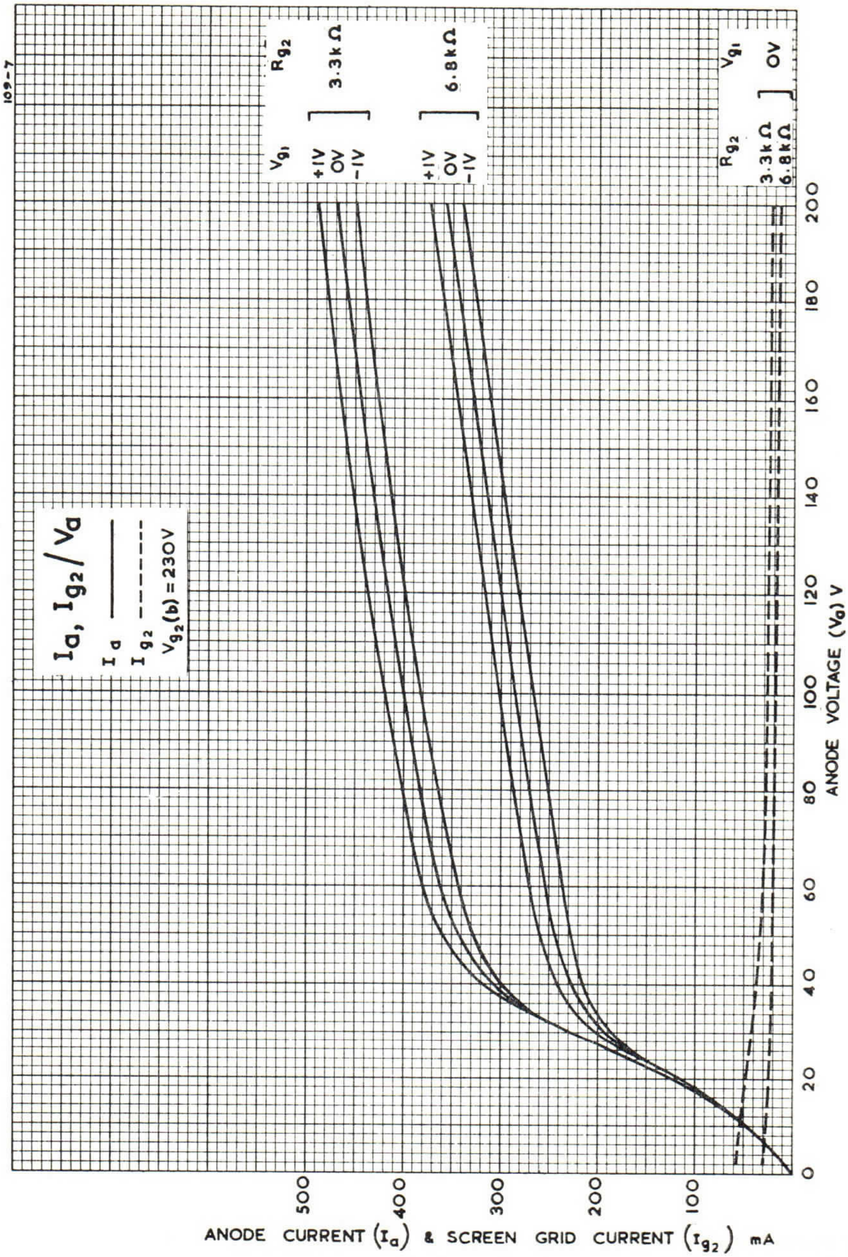


109-1A
I_a, I_{g2} / V_a
I_a ———
I_{g2} - - - - -
$V_{g2}(b) = 210V$
V_{g1} R_{g2}
+1V, 0V, −1V — 1·5kΩ
+1V, 0V, −1V — 2·2kΩ
+1V, 0V, −1V — 4·7kΩ
R_{g2} V_{g1}
1·5kΩ, 2·2kΩ, 4·7kΩ — 0V
0 20 40 60 80 100 120 140 160 180 200
ANODE VOLTAGE (V_a) V
0 100 200 300 400 500 600
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA

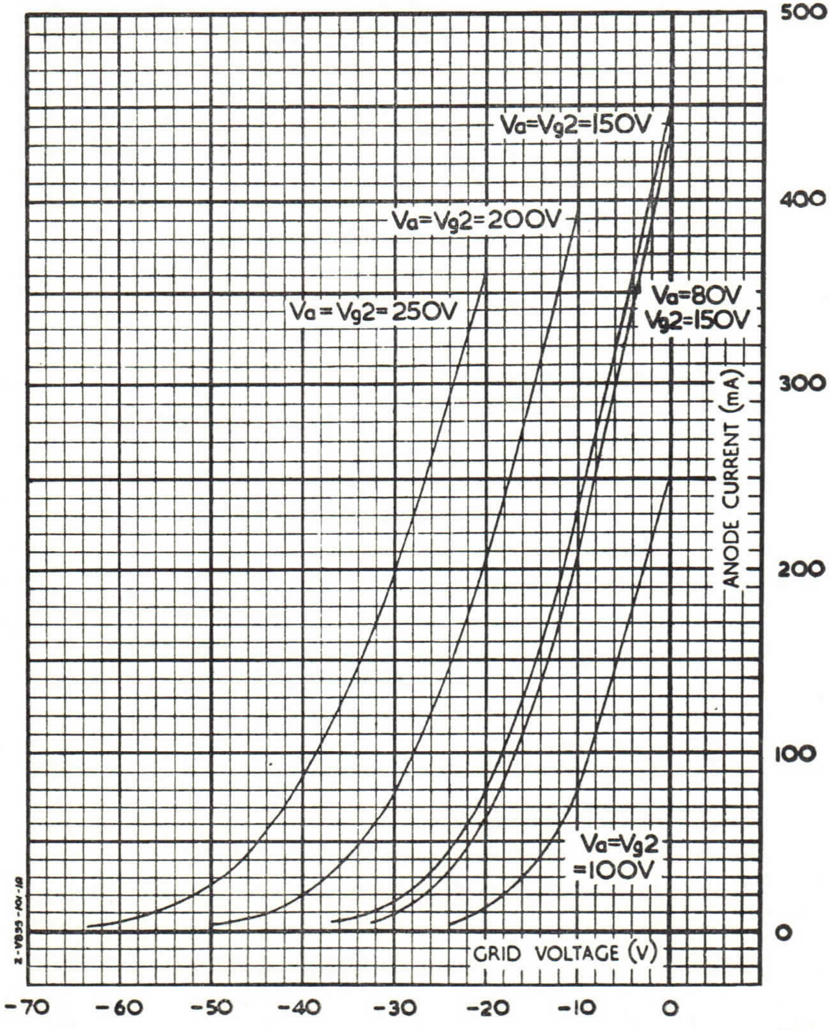

$I_a, I_{g2}/V_a$
I_a ————
I_{g2} – – – –
$V_{g2}(b) = 210V$
V_{g1}
+1 V
0V
−1 V
R_{g2}
1·8kΩ
3·3kΩ
6·8kΩ
R_{g2}
1·8kΩ
3·3kΩ
6·8kΩ
V_{g1}
0V
0
20
40
60
80
100
120
140
160
180
200
ANODE VOLTAGE (V_a) V
100
200
300
400
500
600
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA
109 - 3A

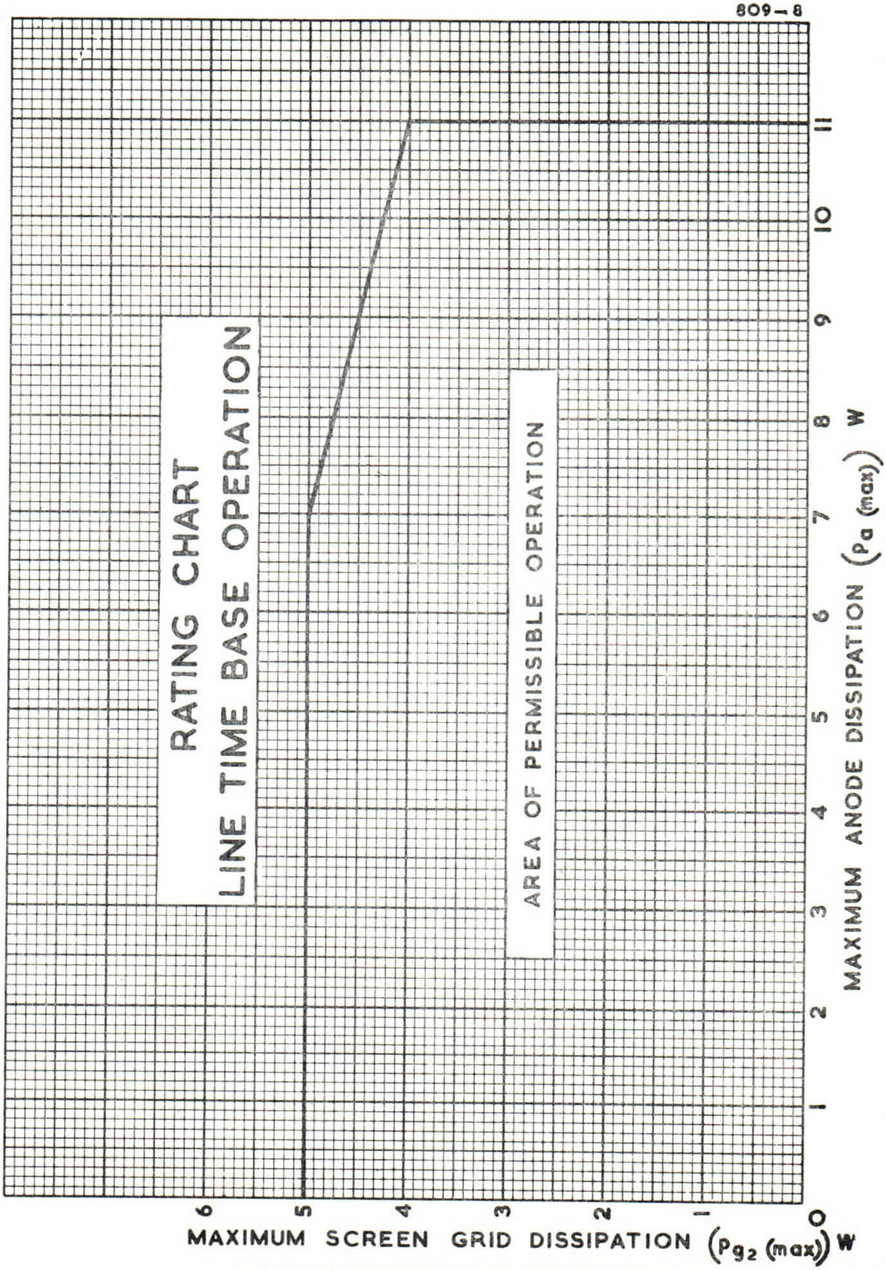


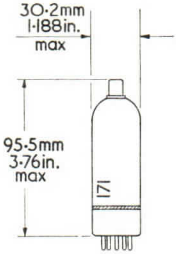
109-5
$I_a, I_{g2}/V_a$
I_a ————
I_{g2} - - - - -
$V_{g2(b)} = 230V$
V_{g1}
R_{g2}
+1V
0V
−1V
2·2 kΩ
4·7 kΩ
V_{g1} 0V
R_{g2} 2·2 kΩ 4·7 kΩ
0
20
40
60
80
100
120
140
160
180
200
ANODE VOLTAGE (V_a) V
100
200
300
400
500
600
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA


109-7
I_a, I_{g2} / V_a
I_a ———
I_{g2} - - - - -
$V_{g2(b)}$ = 230V
V_{g1} R_{g2}
+1V 0V −1V 3.3kΩ
+1V 0V −1V 6.8kΩ
V_{g1} 0V
R_{g2} 3.3kΩ 6.8kΩ
0 20 40 60 80 100 120 140 160 180 200
ANODE VOLTAGE (V_a) V
100 200 300 400 500
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA

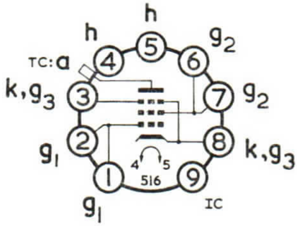
I_a/V_{g1}


Va=Vg2=150V
Va=Vg2=200V
Va=Vg2=250V
Va=80V
Vg2=150V
Va=Vg2
=100V
ANODE CURRENT (mA)
GRID VOLTAGE (V)
500
400
300
200
100
0
-70
-60
-50
-40
-30
-20
-10
0


809—8
RATING CHART
LINE TIME BASE OPERATION
AREA OF PERMISSIBLE OPERATION
MAXIMUM ANODE DISSIPATION (Pa (max)) W
0 1 2 3 4 5 6 7 8 9 10 11
MAXIMUM SCREEN GRID DISSIPATION (Pg2 (max)) W
6 5 4 3 2 1 0



LINE OUTPUT PENTODE



Base B9D, Cap CT1

GENERAL

This output pentode is primarily intended for use in the line timebase of television receivers.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	27	V

RATINGS

Maximum Anode Dissipation	$P_{a(max)}$		
$P_{g2} \leqslant 4{\cdot}0W$		12	W
$P_{g2} = 5{\cdot}0W$		8·0	W
Maximum Anode and Screen Grid Dissipation	$P_{(a+g2)max}$	See Rating Chart	
Maximum Screen Grid Dissipation	$P_{g2(max)}$		
$P_a \leqslant 8{\cdot}0W$		5·0	W
$P_a = 12W$		4·0	W
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	V
Maximum Anode Voltage	$V_{a(max)}$	250	V
Maximum Peak Anode Voltage	$v_{a(pk)max}$	7·0*	kV
Maximum Screen Grid Supply Voltage	$V_{g2(b)max}$	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	250	V
Maximum Heater to Cathode Voltage (R.M.S.)	$V_{h-k(r.m.s.)max}$	220†	V
Maximum Cathode Current	$I_{k(max)}$	250	mA
Maximum Control Grid to Cathode Resistance	$R_{g1-k(max)}$	500‡	kΩ

* Maximum pulse duration 22% of one cycle with a maximum of 22 μs.

† Measured with respect to the high potential heater pin.

‡ In line timebase applications $R_{g1-k(max)}$ may be 2·2MΩ.

INTER-ELECTRODE CAPACITANCES§

Input	c_{in}	22	pF
Output	c_{out}	9·0	pF
Anode to Grid 1	c_{a-g1}	<1·75	pF
Grid 1 to Heater	c_{g1-h}	<0·2	pF

§ Measured without external shield.

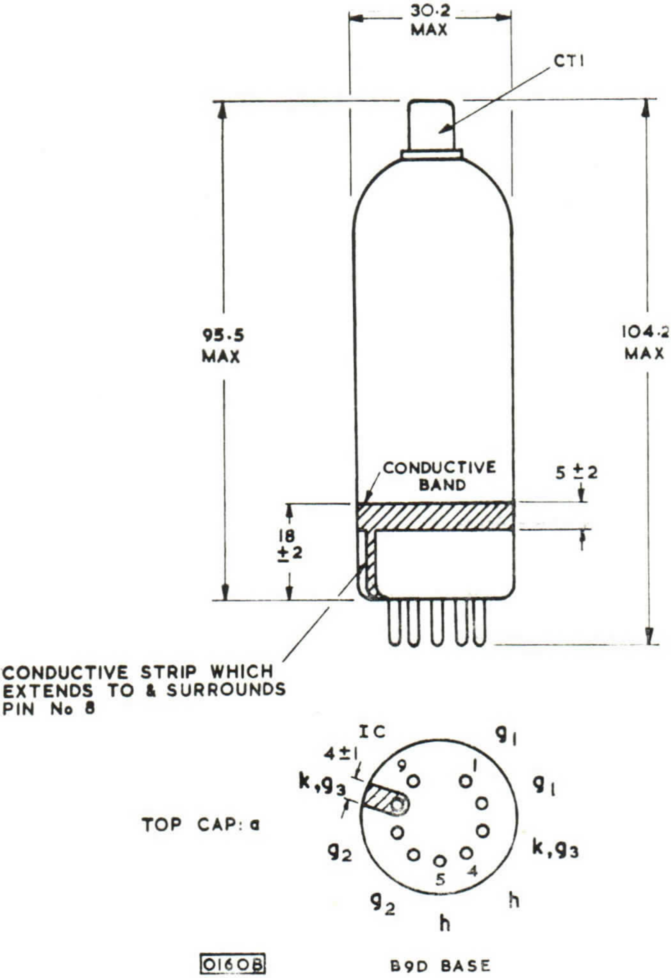
CHARACTERISTICS

Anode Voltage	V_a	75	V
Screen Grid Voltage	V_{g2}	200	V
Control Grid Voltage	V_{g1}	−10	V
Anode Current	I_a	440	mA
Screen Grid Current	I_{g2}	30	mA

LINE OUTPUT VALVE CIRCUIT DESIGN

When calculating the peak anode current for circuit design purposes the knee should be taken as the reference point. Operation so that the anode potential of the output valve at the end of scan is above the knee of the anode characteristic is only recommended when an effective feedback stabilising circuit is employed.

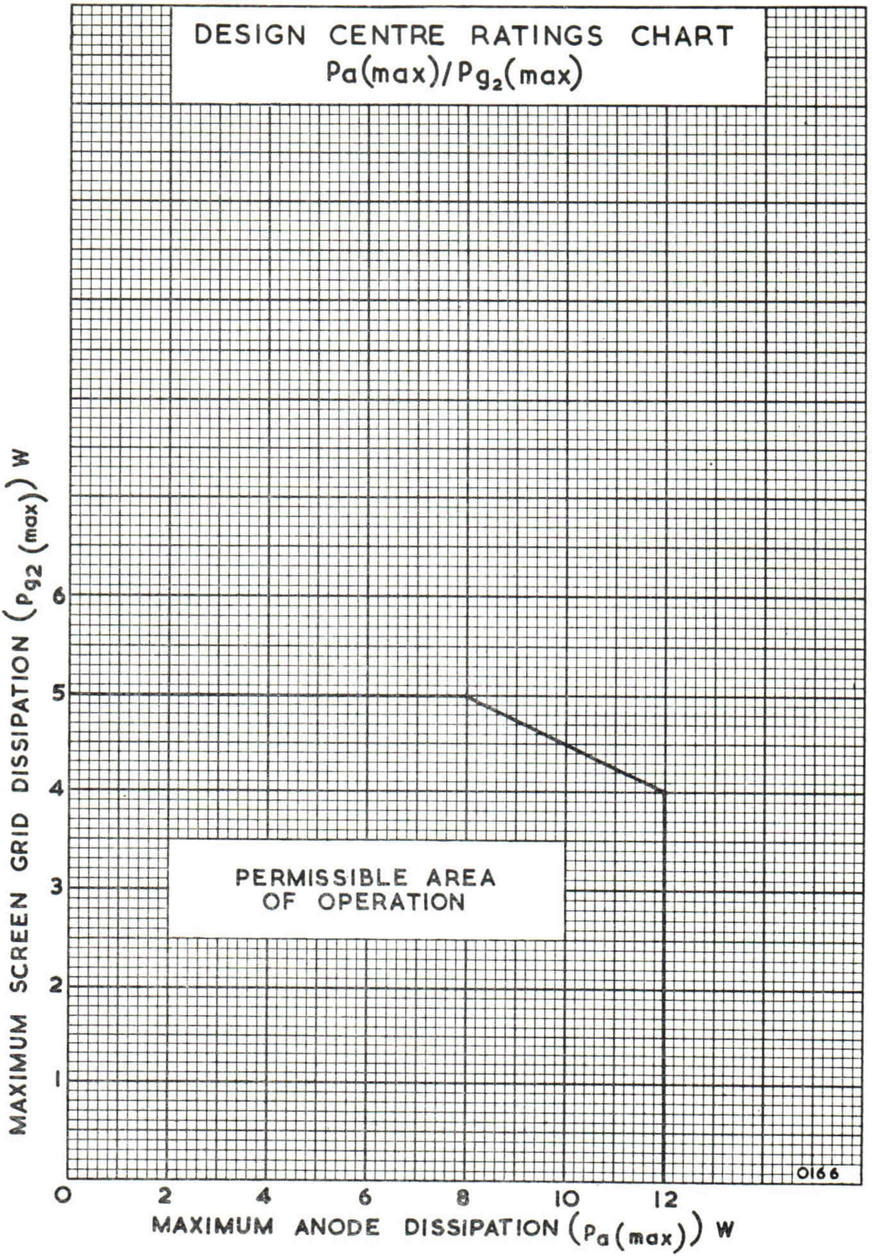
THORN RADIO VALVES AND TUBES LTD.

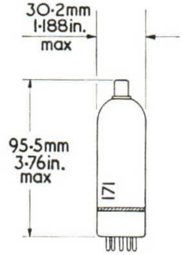


All dimensions in mm.

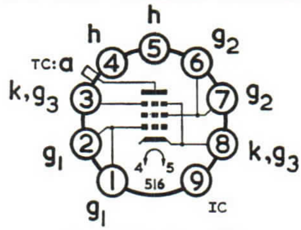
MOUNTING POSITION—Unrestricted.

Characteristic curves are as the PL504.


DESIGN CENTRE RATINGS CHART
Pa(max)/Pg2(max)
PERMISSIBLE AREA OF OPERATION
MAXIMUM SCREEN GRID DISSIPATION (Pg2 (max)) W
1
2
3
4
5
6
0
2
4
6
8
10
12
MAXIMUM ANODE DISSIPATION (Pa (max)) W
0166



LINE OUTPUT
PENTODE



Base B9D, Cap CT1

GENERAL

This output pentode is primarily intended for use in the line timebase of television receivers.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	27	V

RATINGS

Maximum Anode Dissipation	$P_{a(max)}$	See Rating Chart	
Maximum Anode and Screen Grid Dissipation	$P_{(a+g2)max}$	See Rating Chart	
Maximum Screen Grid Dissipation	$P_{g2(max)}$	See Rating Chart	
Maximum Anode Supply Voltage	$V_{a(b)max}$	550	V
Maximum Anode Voltage	$V_{a(max)}$	250	V
Maximum Peak Anode Voltage	$v_{a(pk)max}$	7·0*	kV
Maximum Screen Grid Supply Voltage	$V_{g2(b)max}$	550	V
Maximum Screen Grid Voltage	$V_{g2(max)}$	250	V
Maximum Heater to Cathode Voltage (R.M.S.)	$V_{h\text{-}k(r.m.s.)max}$	220†	V
Maximum Cathode Current	$I_{k(max)}$	250	mA
Maximum Control Grid to Cathode Resistance	$R_{g1\text{-}k(max)}$	500‡	kΩ

* Maximum pulse duration 22% of one cycle with a maximum of 22μs.

† Measured with respect to the high potential heater pin.

‡ In line timebase applications $R_{g1\text{-}k(max)}$ may be 2·2 MΩ.

INTER-ELECTRODE CAPACITANCES §

Input	c_{in}	22	pF
Output	c_{out}	9·0	pF
Anode to Grid 1	$c_{a\text{-}g1}$	<1·75	pF
Grid 1 to Heater	$c_{g1\text{-}h}$	<0·2	pF

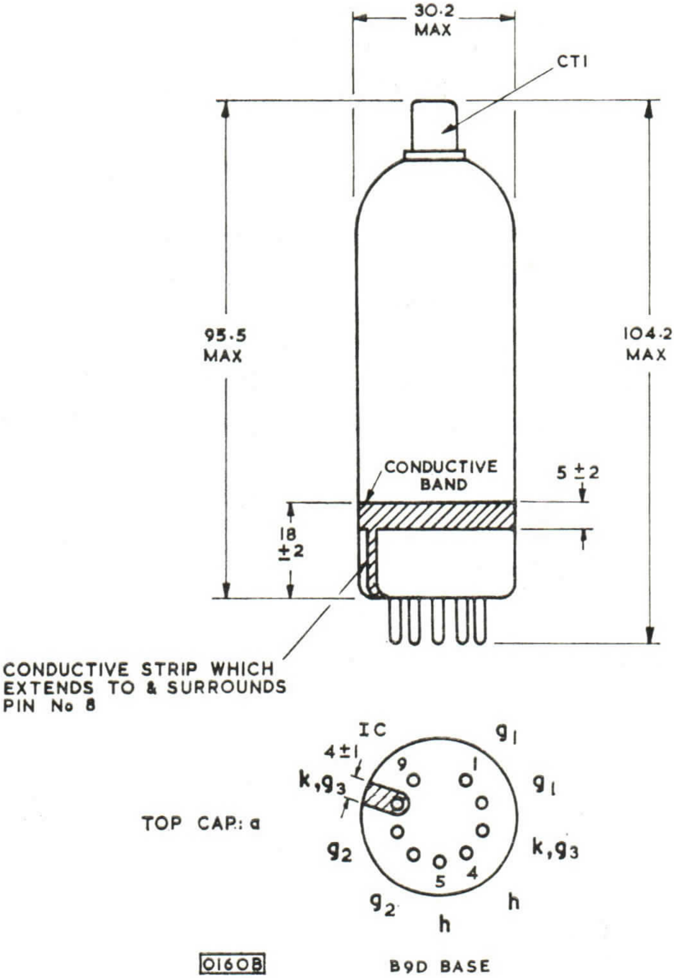
§ Measured without external shield.

CHARACTERISTICS

Anode Voltage	V_a	75	V
Screen Grid Voltage	V_{g2}	200	V
Control Grid Voltage	V_{g1}	−10	V
Anode Current	I_a	440	mA
Screen Grid Current	I_{g2}	30	mA

LINE OUTPUT VALVE CIRCUIT DESIGN

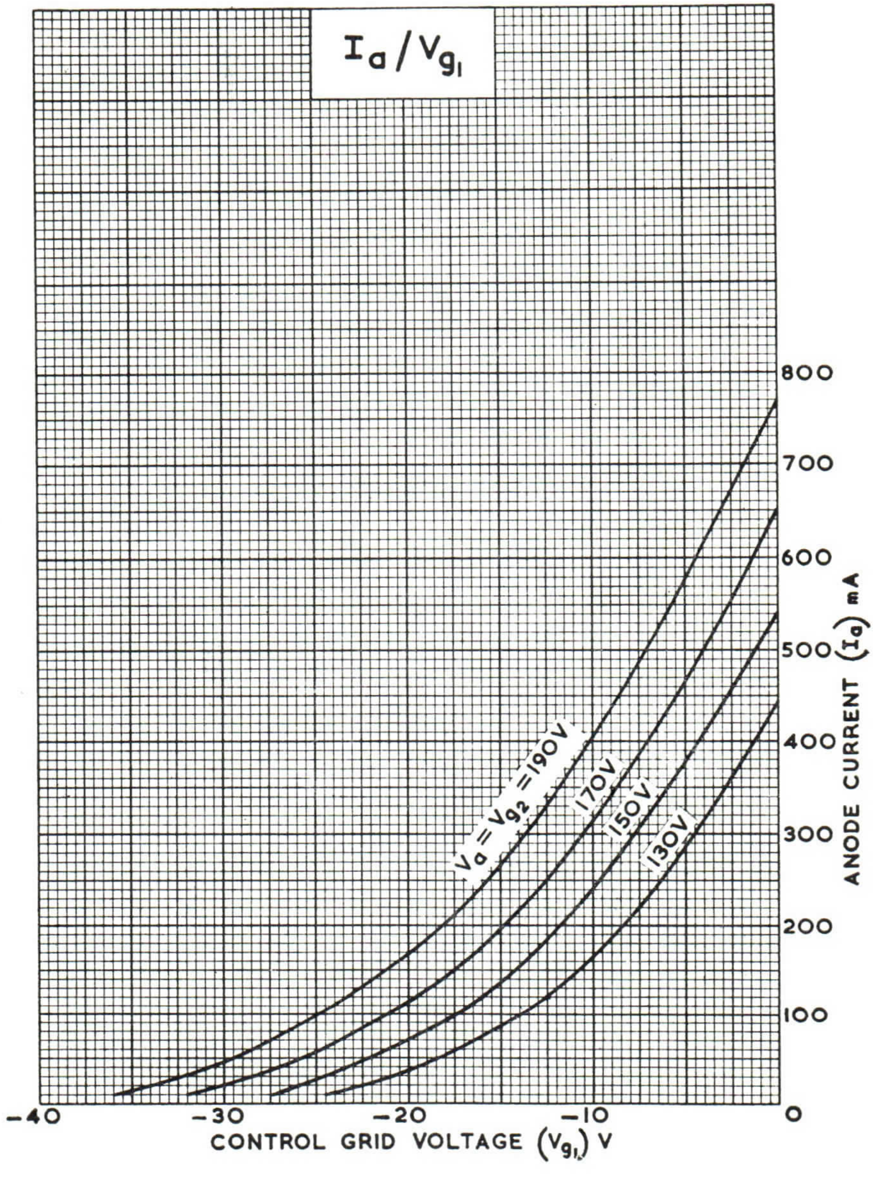
When calculating the peak anode current for circuit design purposes the knee should be taken as the reference point. Operation so that the anode potential of the output valve at the end of scan is above the knee of the anode characteristic is only recommended when an effective feedback stabilising circuit is employed.

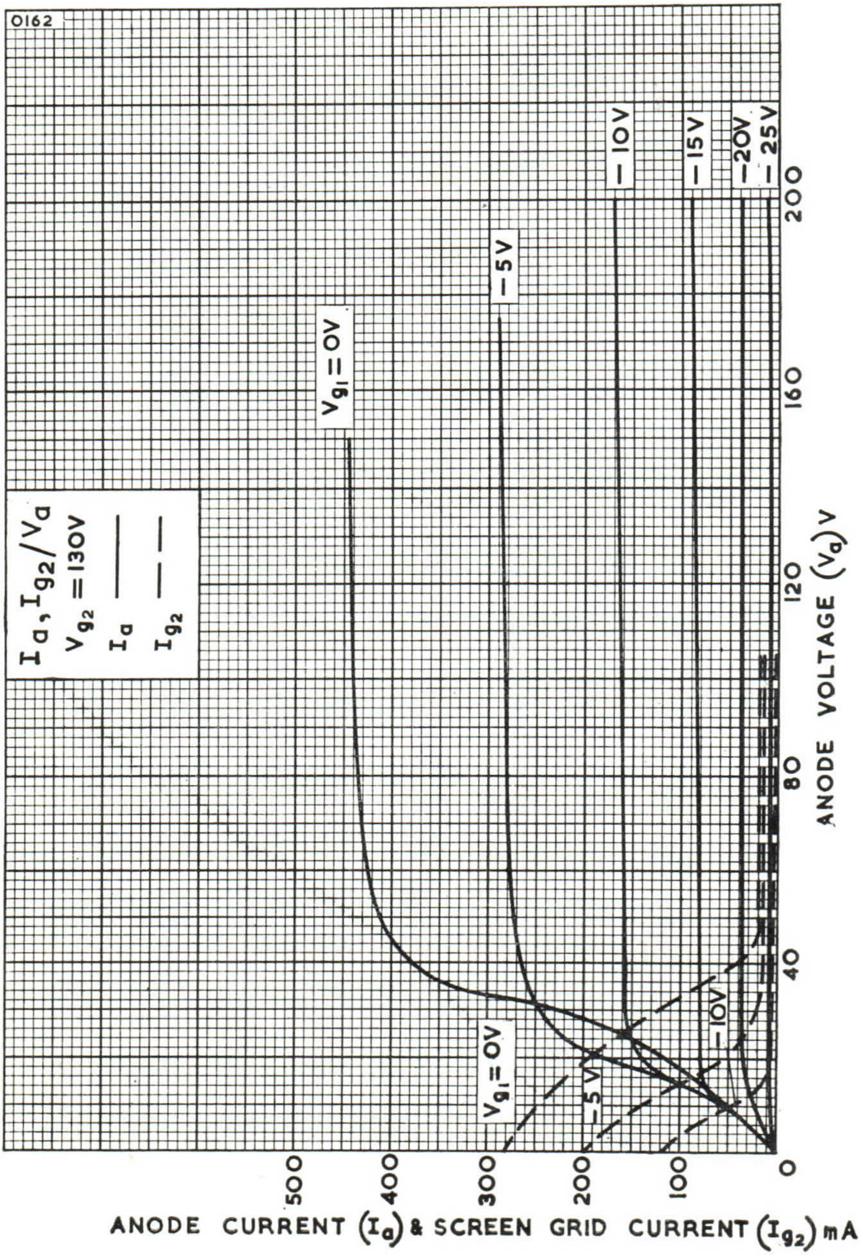


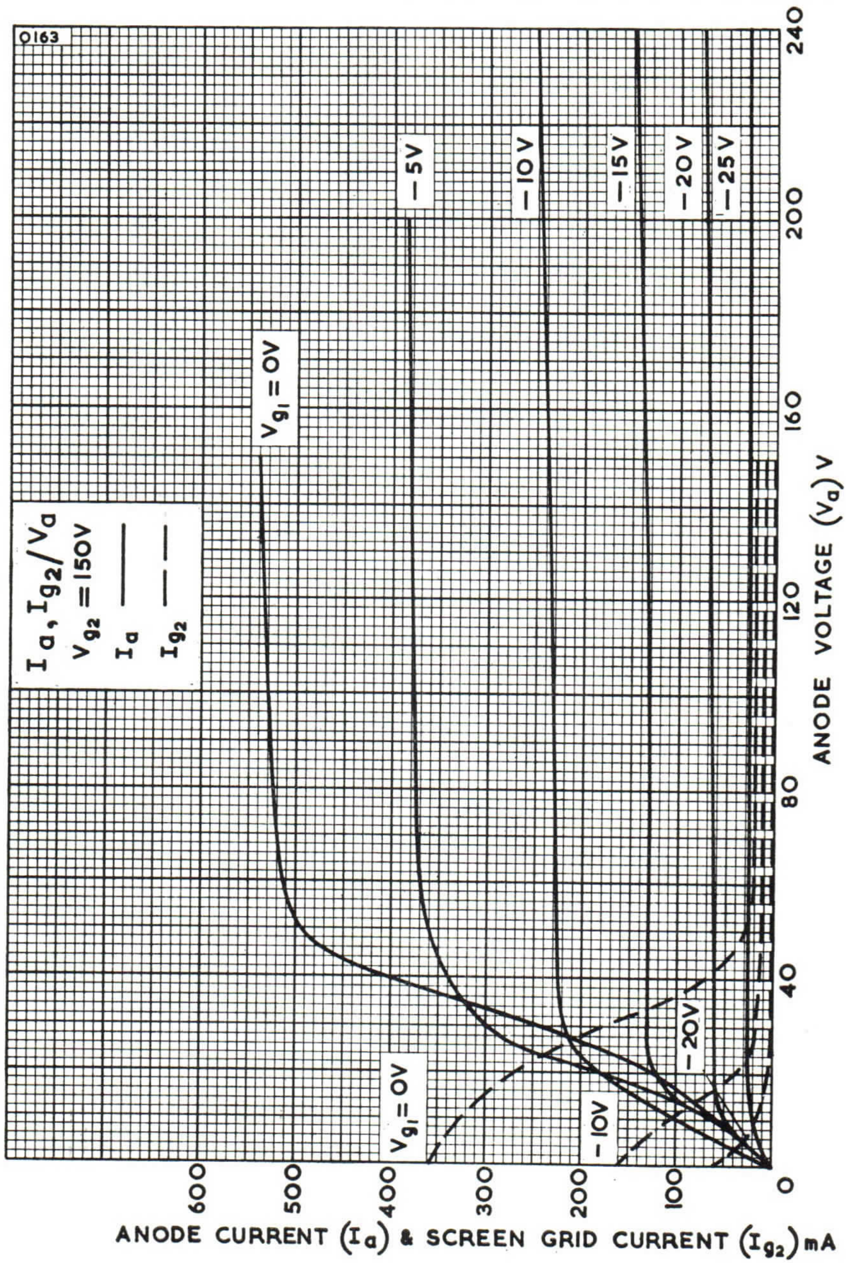
B9D BASE

All dimensions in mm.

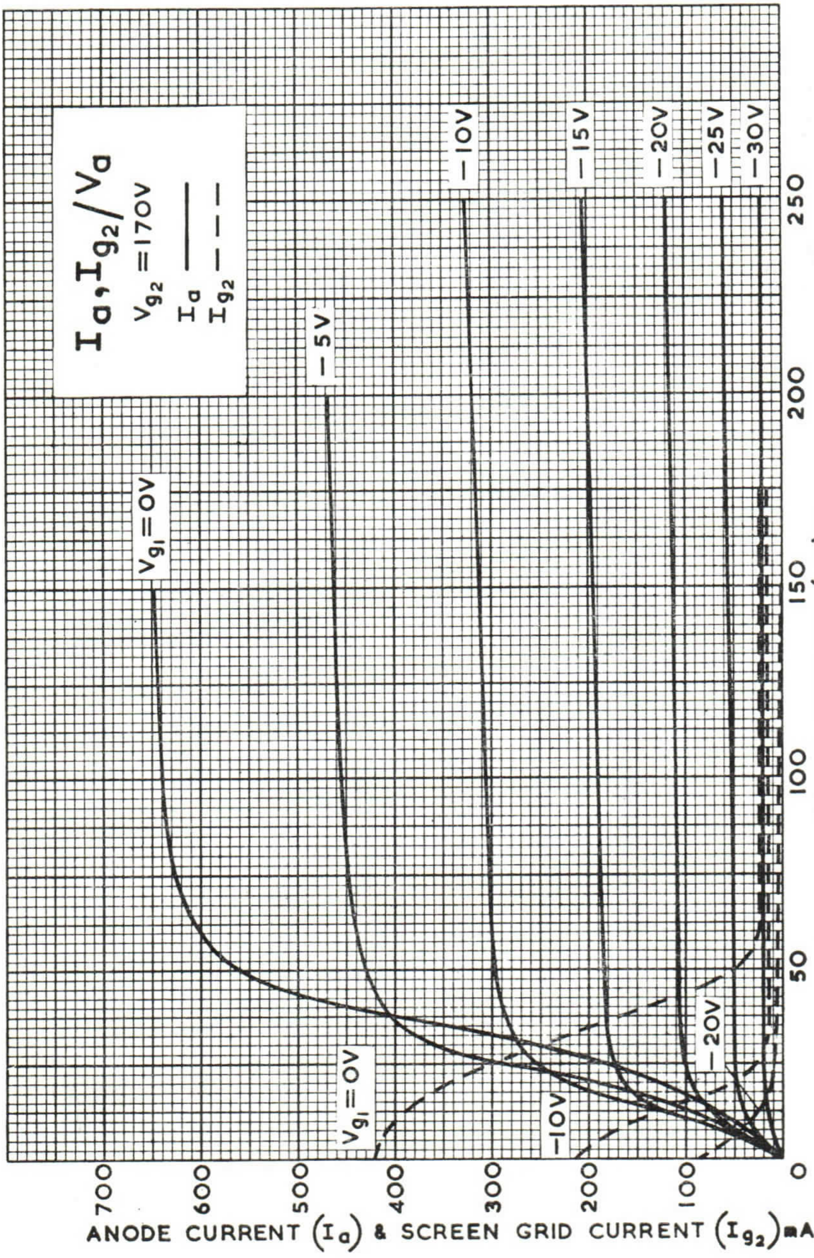
MOUNTING POSITION—Unrestricted


I_a / V_{g_1}
$V_a = V_{g_2} = 190V$
170V
150V
130V
800
700
600
500
400
300
200
100
0
ANODE CURRENT (I_a) mA
−40
−30
−20
−10
CONTROL GRID VOLTAGE (V_{g_1}) V

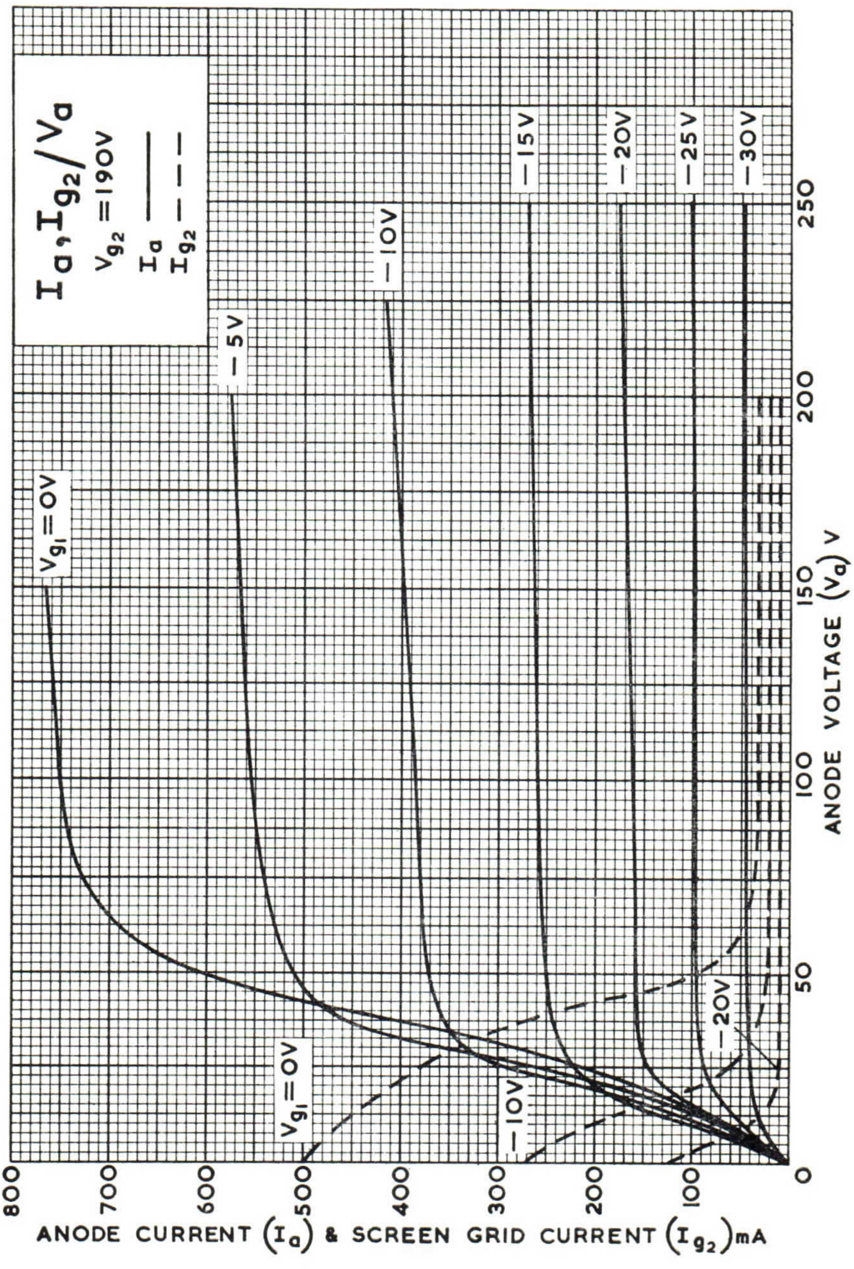

0162
$I_a, I_{g2}/V_a$
$V_{g2} = 130V$
I_a
I_{g2}
$V_{g1} = 0V$
$-5V$
$-10V$
$-15V$
$-20V$
$-25V$
$V_{g1} = 0V$
$-5V$
$-10V$
0
40
80
120
160
200
ANODE VOLTAGE (V_a) V
0
100
200
300
400
500
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA

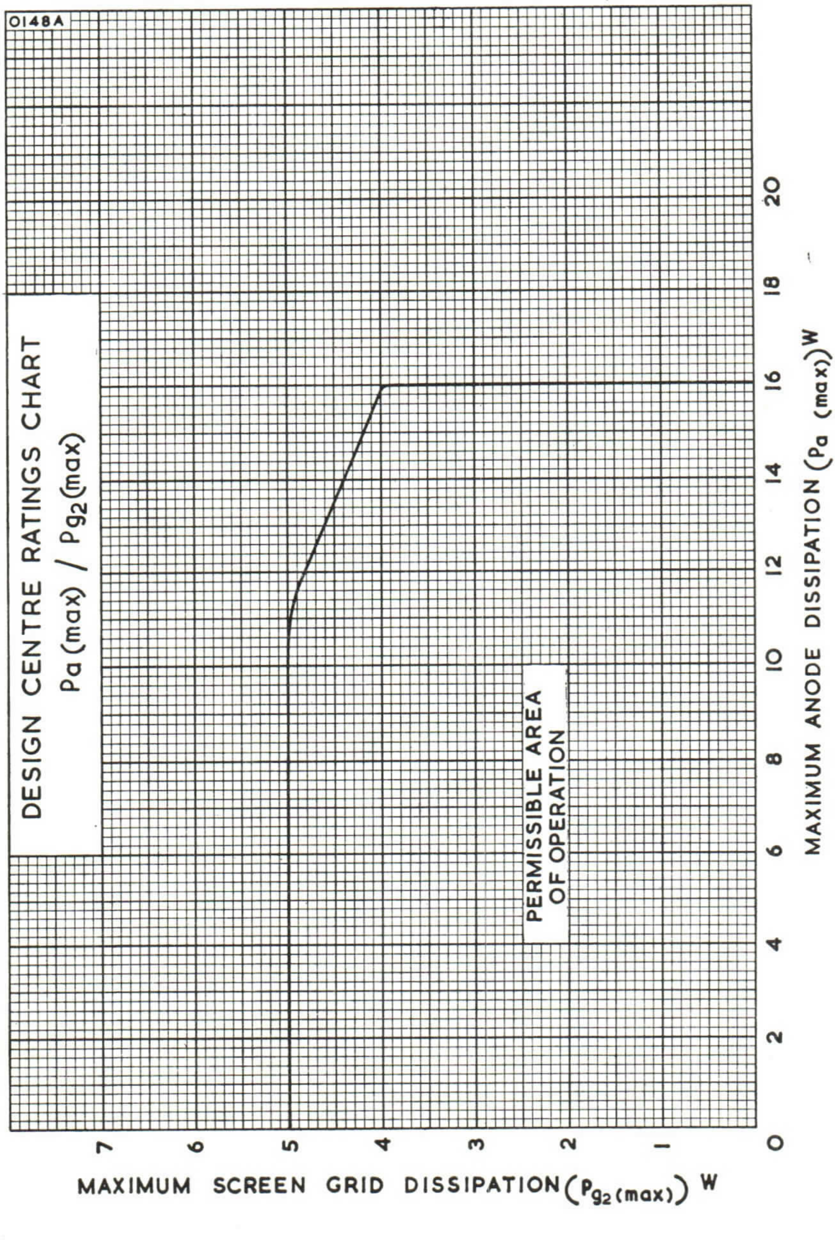


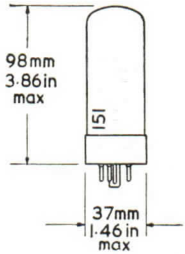
0163
$I_a, I_{g2}/V_a$
$V_{g2} = 150V$
I_a ———
I_{g2} — — —
$V_{g1} = 0V$
−5V
−10V
−15V
−20V
−25V
$V_{g1} = 0V$
−10V
−20V
240
200
160
120
80
40
0
ANODE VOLTAGE (V_a) V
600
500
400
300
200
100
0
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA



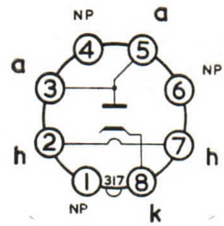
$I_a, I_{g2}/V_a$
$V_{g2} = 170V$
I_a ———
I_{g2} – – –
$V_{g1} = 0V$
− 5 V
− 10V
− 15 V
− 20V
− 25 V
− 30V
−10V
−20V
0
50
100
150
200
250
ANODE VOLTAGE (V_a) V
700
600
500
400
300
200
100
ANODE CURRENT (I_a) & SCREEN GRID CURRENT (I_{g2}) mA


Ia, Ig2/Va
Vg2 = 190V
Ia ———
Ig2 – – –
Vg1 = 0V
– 5V
– 10V
– 15V
– 20V
– 25V
– 30V
Vg1 = 0V
– 10V
– 20V
0
50
100
150
200
250
ANODE VOLTAGE (Va) V
800
700
600
500
400
300
200
100
0
ANODE CURRENT (Ia) & SCREEN GRID CURRENT (Ig2) mA


0148A
DESIGN CENTRE RATINGS CHART
Pa (max) / Pg2 (max)
PERMISSIBLE AREA OF OPERATION
MAXIMUM ANODE DISSIPATION (Pa (max)) W
0 2 4 6 8 10 12 14 16 18 20
MAXIMUM SCREEN GRID DISSIPATION (Pg2 (max)) W
7 6 5 4 3 2 1 0



HALF-WAVE RECTIFIER



Base 105‡

GENERAL

This indirectly heated half-wave rectifier is for use in television receivers employing series connected 0·3A heaters.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	29·0	V

RATINGS

Maximum Peak Inverse Voltage	PIV_{max}	700	V
Maximum Anode Voltage (R.M.S.)	$V_{a(r.m.s.)max}$	250	V
Maximum Mean Anode Current	$I_{a(av)max}$	325	mA
Maximum Peak Anode Current	$i_{a(pk)max}$	2·6	A
Maximum Surge Anode Current	$i_{a(surge)max}$	9·5	A
Maximum Reservoir Capacitor	C_{max}	200	µF
Maximum Peak Heater to Cathode Voltage			
Heater Negative	$v_{h\text{-}k(pk)max}$	625*	V

* Measured with respect to the higher potential heater pin.
Maximum D.C. component = 275V, Maximum A.C. component = 250V r.m.s.

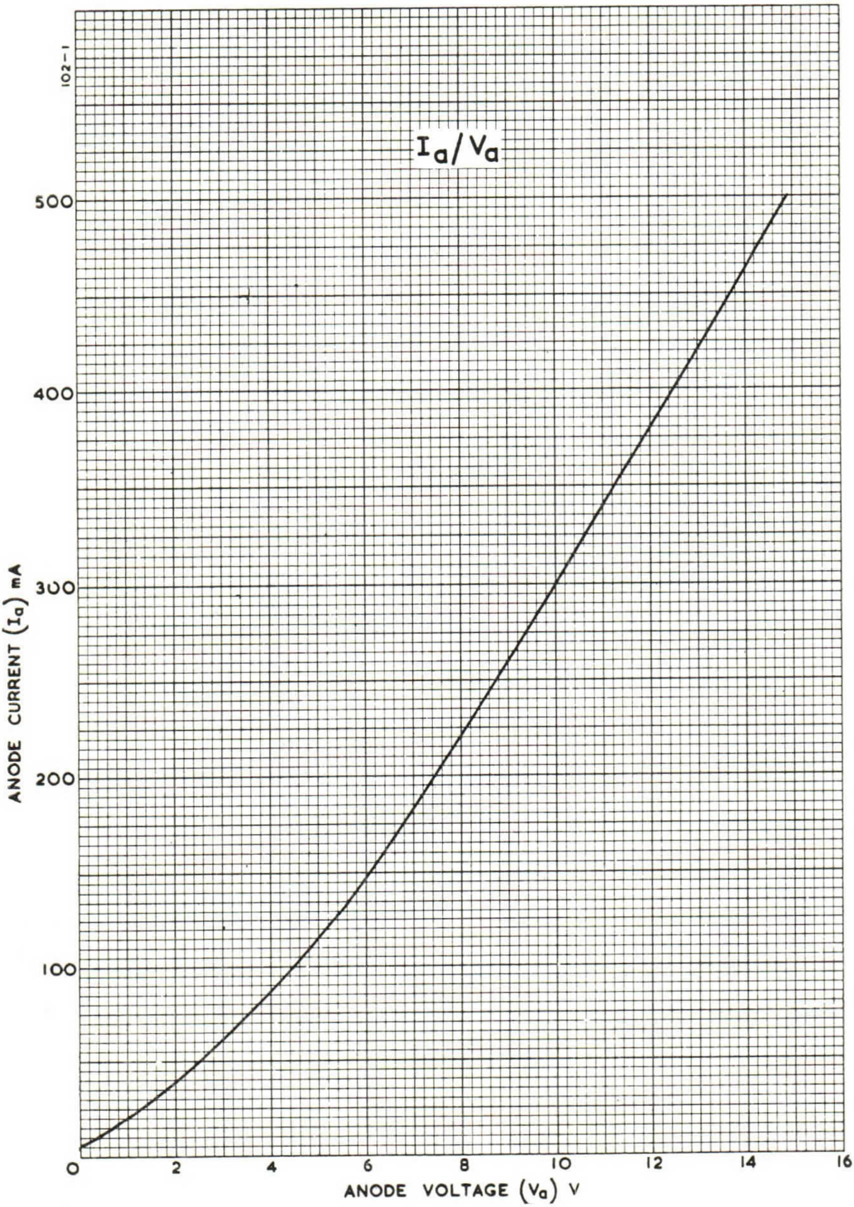
TYPICAL OPERATION†

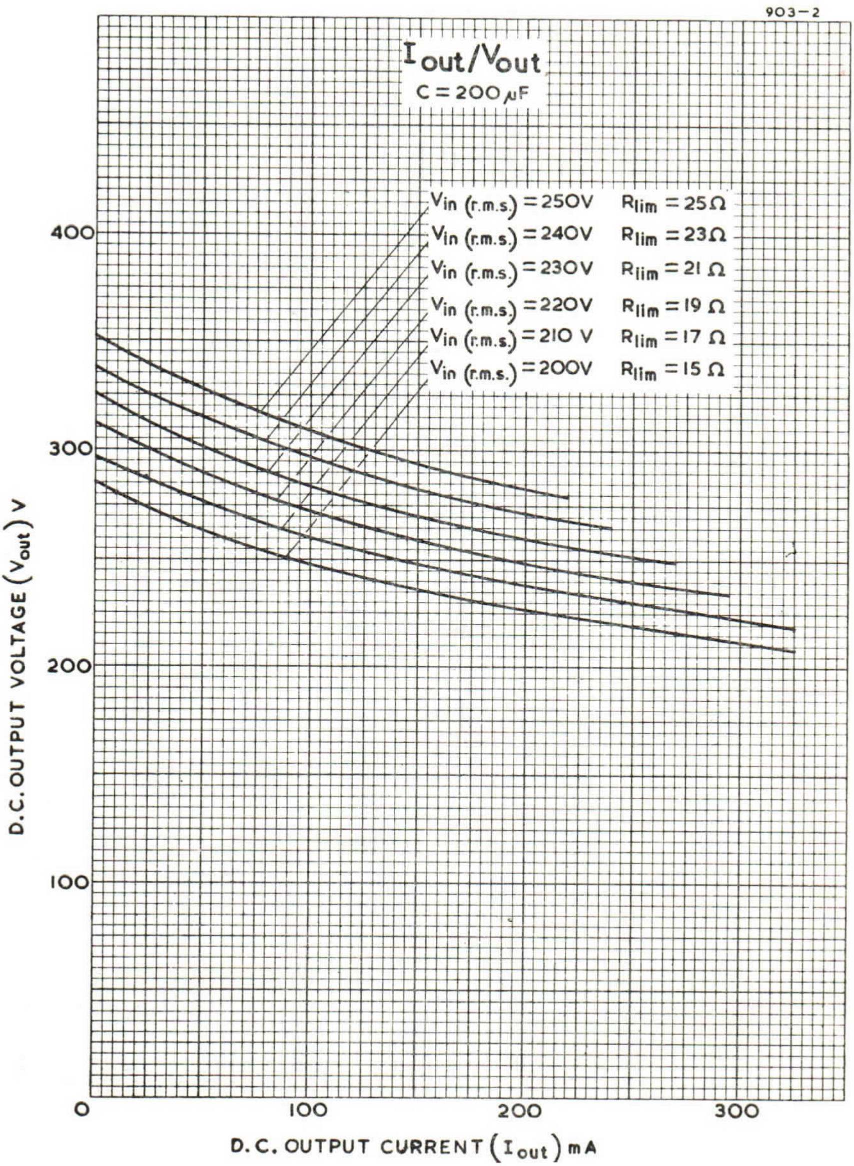
Input Anode Voltage (R.M.S.)	$V_{in(r.m.s.)}$	200	210	220	230	240	250	V
Output Current	I_{out}	325	325	295	270	240	220	mA
Reservoir Capacitor	C	200	200	200	200	200	200	µF
Minimum Surge limiting resistance	$R_{lim(min)}$	15	17	19	21	23	25	Ω
Output Voltage	V_{out}	209	219	234	249	264	280	V

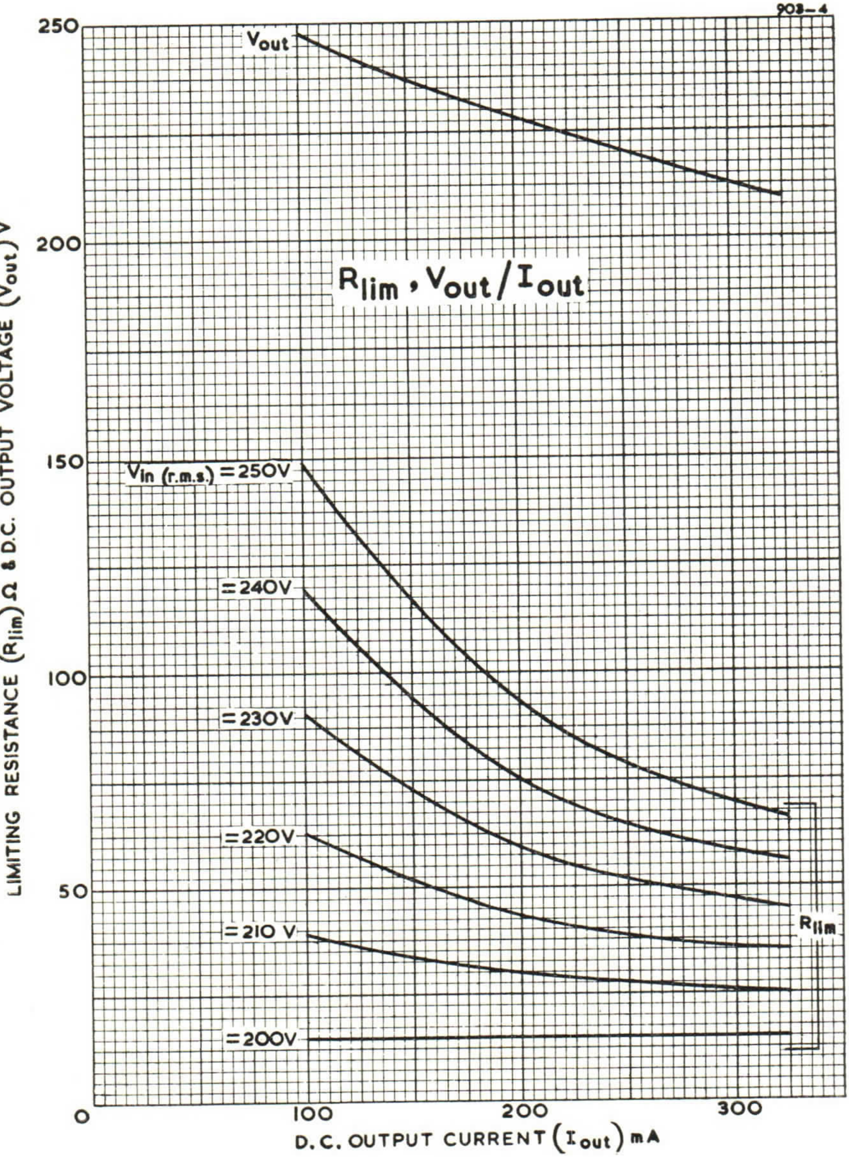
† For television receiver conditions see curves.

MOUNTING POSITION—Unrestricted

‡ Some PY33 valves may have an 107 base having pins 1 and 6 : NC.

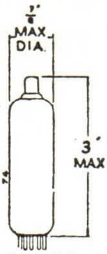

102-1
I_a/V_a
500
400
300
200
100
0
ANODE CURRENT (I_a) mA
2
4
6
8
10
12
14
16
ANODE VOLTAGE (V_a) V


903-2
I_{out}/V_{out}
C = 200 μF
V_{in} (r.m.s.) = 250V R_{lim} = 25Ω
V_{in} (r.m.s.) = 240V R_{lim} = 23Ω
V_{in} (r.m.s.) = 230V R_{lim} = 21 Ω
V_{in} (r.m.s.) = 220V R_{lim} = 19 Ω
V_{in} (r.m.s.) = 210 V R_{lim} = 17 Ω
V_{in} (r.m.s.) = 200V R_{lim} = 15 Ω
400
300
200
100
0
100
200
300
D.C. OUTPUT VOLTAGE (V_{out}) V
D.C. OUTPUT CURRENT (I_{out}) mA


903-4
R_{lim}, V_{out}/I_{out}
V_{out}
$V_{in\ (r.m.s.)}=250V$
=240V
=230V
=220V
=210 V
=200V
R_{lim}
LIMITING RESISTANCE (R_{lim}) Ω & D.C. OUTPUT VOLTAGE (V_{out}) V
D.C. OUTPUT CURRENT (I_{out}) mA
0
50
100
150
200
250
100
200
300

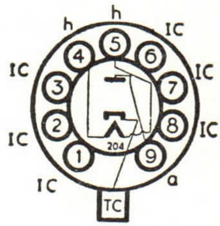
BRIMAR VALVES

Current Equipment Type



B9A (Noval) Base

TYPE **PY83**
MINIATURE
BOOSTER DIODE



The BRIMAR PY83 is an indirectly heated booster diode designed for operation in A.C./D.C. television receivers. The high working peak heater to cathode potential renders the use of a separate, highly insulated heater winding unnecessary.

Heater Current ...	0.3 amp.
Heater Voltage ...	20.0 volts nom.

RATINGS

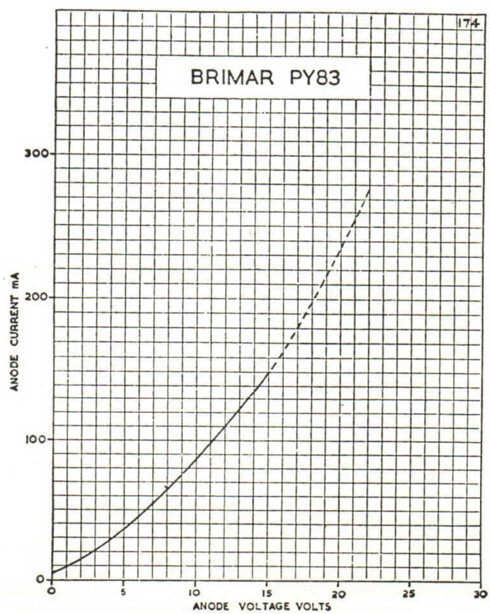
Peak Anode Current ...	500 mA max.
Mean Anode Current ...	175 mA max.
Heater-Cathode potential during flyback (heater negative with respect to cathode) † ...	5,000 volts max.
Peak Inverse Voltage † ...	5,000 volts max.

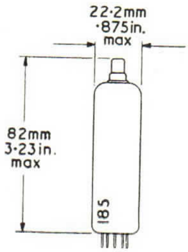
† Maximum pulse duration 15% of one cycle with a maximum of 15 μsecs.

INTER-ELECTRODE CAPACITANCES *

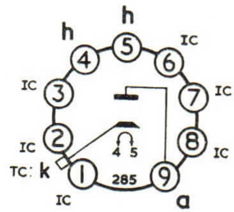
Anode to Cathode ...	6.2 pF
Heater to Cathode ...	2.1 pF

** Measured with no external shield.*





EFFICIENCY
DIODE



B9A Base

GENERAL

This efficiency diode is intended for use in line timebase circuits of television receivers using 110° cathode ray tubes.

Heater Current	I_h	0·3 A
Heater Voltage	V_h	30 V

RATINGS

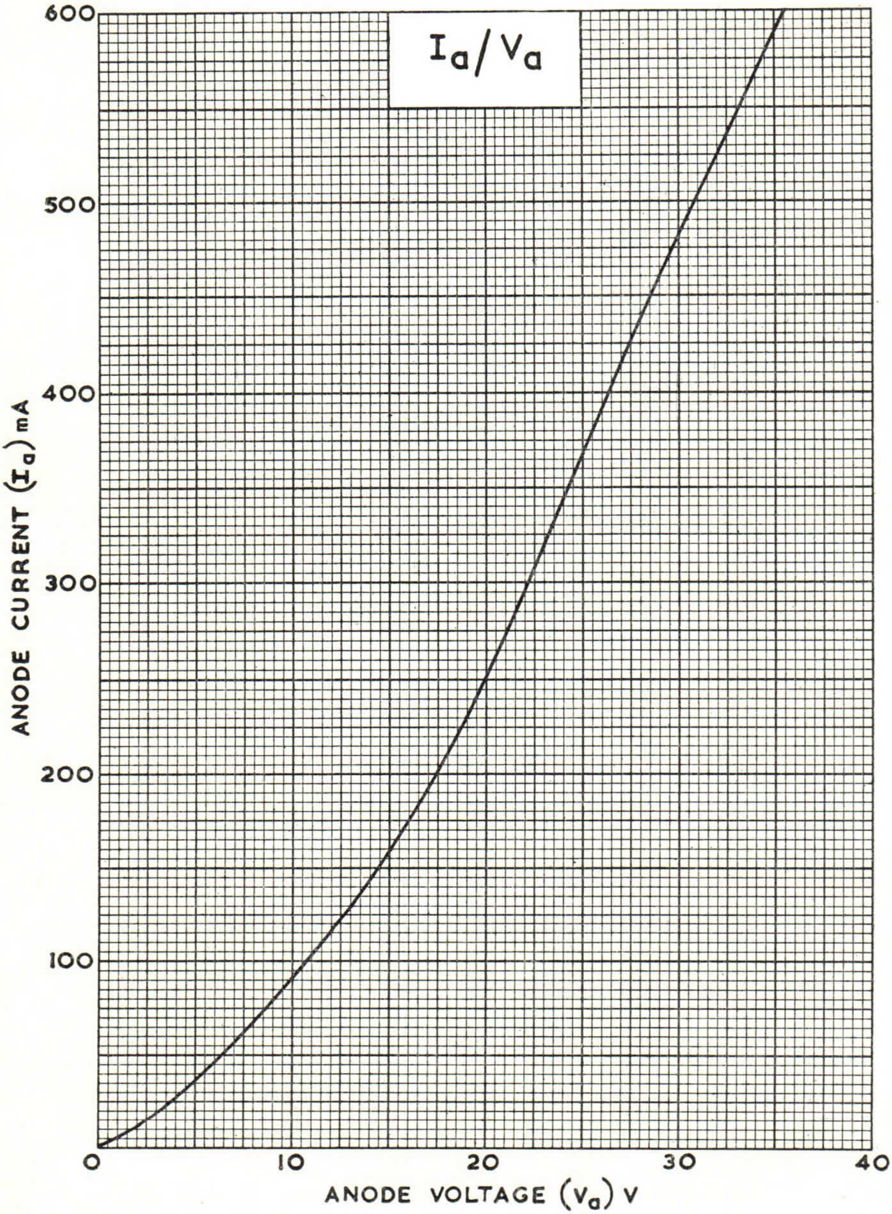
Maximum Peak Inverse Voltage	P.I.V.$_{max}$	6·6*	kV
Maximum Peak Heater to Cathode Voltage	$v_{h-k(pk)max}$		
Heater Negative		6·6*	kV
Maximum Heater to Earth Voltage (r.m.s.)	$V_{h-e(r.m.s.)max}$	220	V
Maximum Mean Anode Current	$I_{a(av)max}$	220	mA
Maximum Peak Anode Current	$i_{a(pk)max}$	550	mA

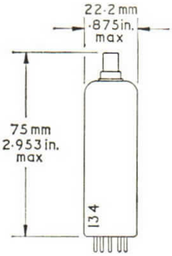
* Maximum pulse duration 22% of one cycle with a maximum of 18 μs.

INTER-ELECTRODE CAPACITANCES

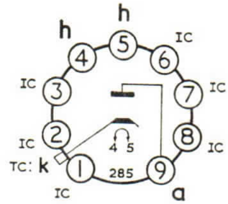
Anode to Cathode	c_{a-k}	8·6	pF
Heater to Cathode	c_{h-k}	2·0	pF

THORN—AEI RADIO VALVES & TUBES LTD.


I_a/V_a
600
500
400
300
200
100
0
10
20
30
40
ANODE CURRENT (I_a) mA
ANODE VOLTAGE (V_a) V



EFFICIENCY DIODE



B9A Base, CT1 Cap

GENERAL

This efficiency diode is designed for use in television receivers employing 110° cathode ray tubes.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	19	V

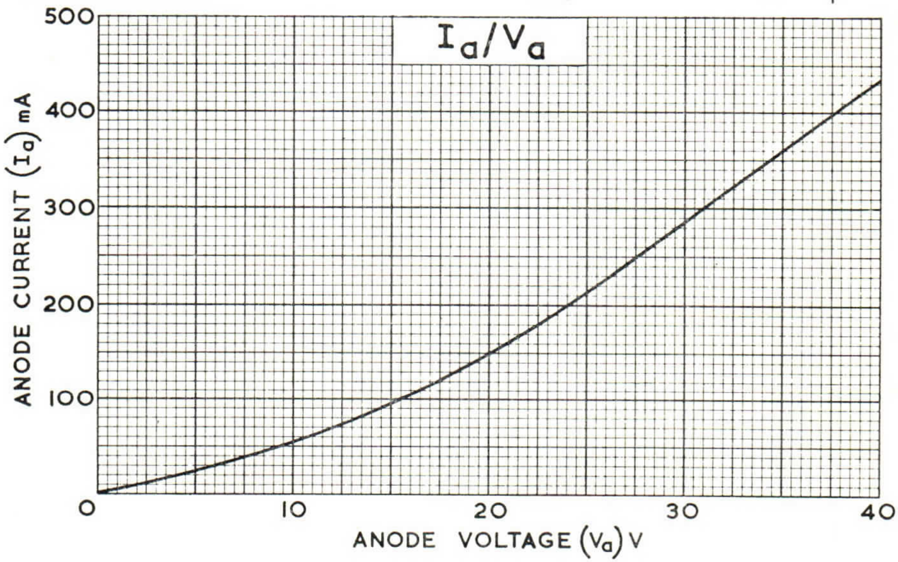
RATINGS

Maximum Peak Inverse Voltage	$P.I.V_{max}$	5·25*	kV
Maximum Peak Heater to Cathode Voltage	$v_{h-k(pk)max}$		
Heater Negative		5·75*	kV
Maximum Peak Anode Current	$i_{a(pk)max}$	350	mA
Maximum Mean Anode Current	$I_{a(av)max}$	150	mA

* Maximum pulse duration 22 per cent of one cycle with a maximum of 22 μs.

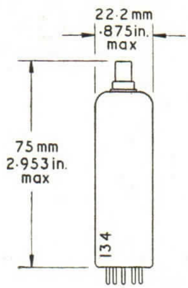
INTER-ELECTRODE CAPACITANCES

Anode to Cathode	c_{a-k}	4·7	pF
Heater to Cathode	c_{h-k}	1·9	pF

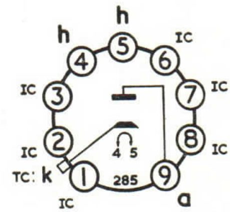


THORN—AEI RADIO VALVES & TUBES LTD.

BRIMAR VALVES PY801



EFFICIENCY DIODE



B9A Base
CT1 Top Cap

GENERAL

This valve is an Efficiency Diode designed for use in the line output stages of television receivers using 110° cathode ray tubes.

Heater Current	I_h	0·3	A
Heater Voltage	V_h	19	V

RATINGS

Maximum Peak Inverse Voltage	$PIV_{(max)}$	5·5*	kV	
Maximum Peak Heater to Cathode Voltage, Heater negative	$v_{h\text{-}k(pk)max}$	5·5*	kV	
Maximum Mean Anode Current	$I_{a(av)max}$	175	mA	←
Maximum Peak Anode Current	$i_{a(pk)max}$	450	mA	

* Rated for T.V. line scan where the duty cycle does not exceed 22% and the pulse duration does not exceed 18μs. ←

5·5 kV is a design centre rating, the absolute rating of 6·6 kV must not be exceeded.

INTER-ELECTRODE CAPACITANCES

		†	‡	§	
Anode to Heater and Cathode	$c_{a\text{-}k,h}$	6·5	7·8	10	pF
Cathode to Heater and Anode	$c_{k\text{-}a,h}$	7·7	8·0	8·0	pF

† In fully shielded socket, without can.

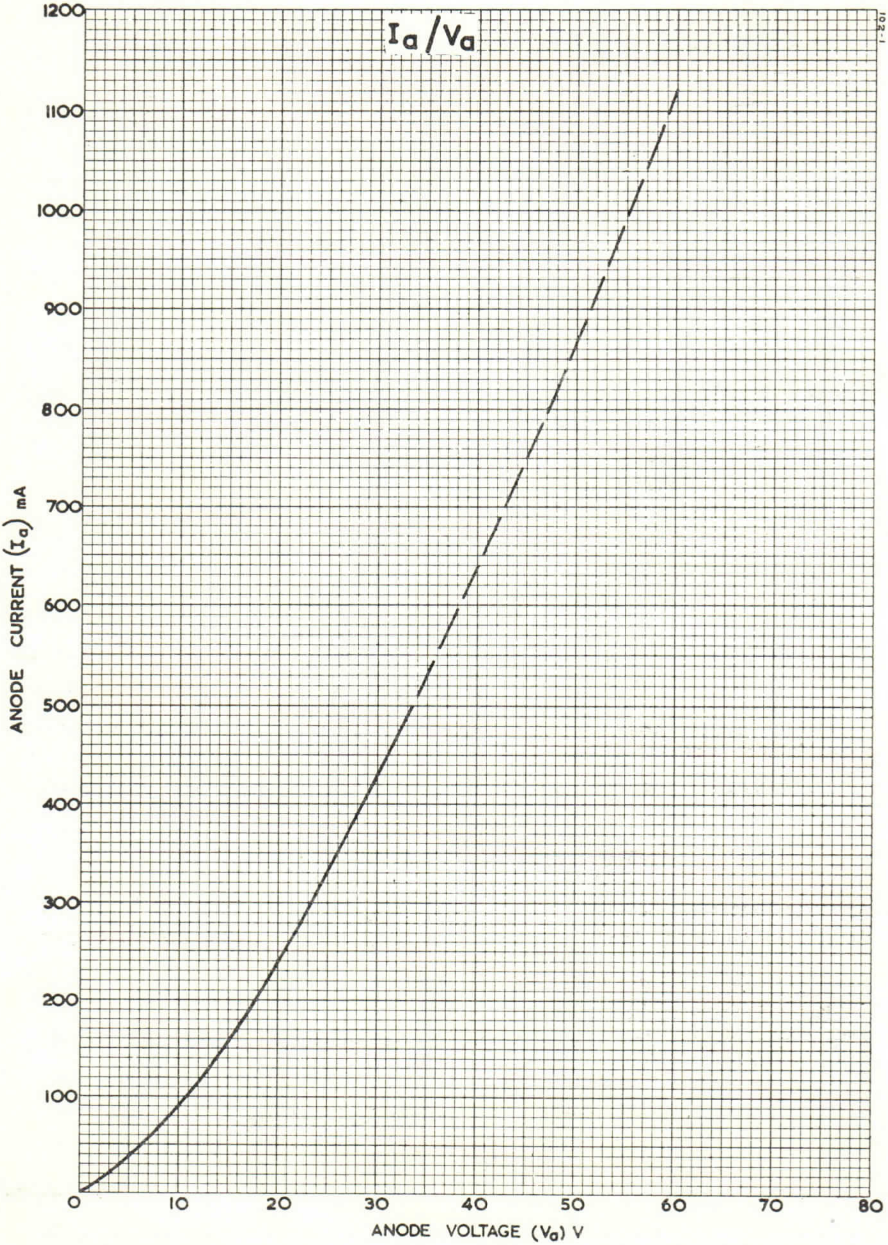
‡ With holder capacity balanced out.

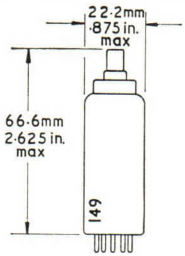
§ Total capacity including B9A nylon phenolic holder without skirt or radial shield (AEI holder type VH19/902)

MOUNTING POSITION—Unrestricted.

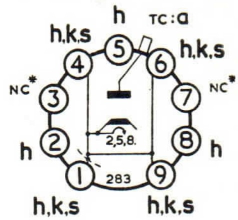
Indicates a change ←

THORN — A E I RADIO VALVES & TUBES LTD.


Ia/Va
1200
1100
1000
900
800
700
600
500
400
300
200
100
ANODE CURRENT (Ia) mA
0
10
20
30
40
50
60
70
80
ANODE VOLTAGE (Va) V



E.H.T.
RECTIFIER



B9A Base, CT1 Cap

GENERAL

This high voltage, half-wave rectifier is for use in television receivers employing line flyback EHT.

Heater Voltage	V_h	2·0	V
Heater Current	I_h	0·35	A

DESIGN CENTRE RATINGS

(The following ratings refer to normal television flyback EHT operation.)

Maximum Peak Inverse Voltage	$P.I.V_{max}$	22†	kV
Maximum Peak Anode Current	$i_{a(pk)max}$	40‡	mA
Maximum D.C. Anode Current	$I_{out(max)}$	0·8	mA

† The measured PIV must take into account the fact that during the scanning stroke the anode of the EHT rectifier is at a potential negative with respect to chassis by an amount depending upon the transformer turns ratio. In addition, there is a damped leakage reactance oscillation assumed in the rating to have a peak-to-peak value not less than 10 per cent of the total PIV.

‡ Maximum duration 10 per cent of a line scanning cycle with a maximum of 10 μs.

INTER-ELECTRODE CAPACITANCE§

Anode to Heater, Cathode and Shield	$c_{a-h,k,s}$	1·7	pF

§ In fully shielded socket, without can (I.E.C. Publication 100).

Notes

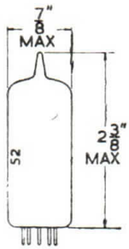
X-ray shielding is advisable to give protection against possible danger of personal injury arising from prolonged exposure at close range to this valve whilst it is in use at a PIV in excess of 16 kV design centre.

Precautions must be taken to prevent corona discharge from the connections to this valve by ensuring that no sharp points or bends occur in the wiring and adequate spacing must be left between the valve and surrounding components.

* Pins 3 and 7 may be connected to points in the heater circuit only and must not be earthed. No low potential circuits should be connected to any base pins.

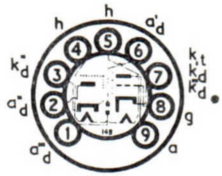
THORN—AEI RADIO VALVES & TUBES LTD.

BRIMAR VALVES



Current Equipment Type

TYPE UABC80
MINIATURE
TRIPLE DIODE TRIODE



B9A Base

The type UABC80 is primarily intended for use as the demodulator/1st A.F. Amplifier in A.M./F.M. Receivers, one diode having a separate cathode. Diodes 2 and 3 should be used for discriminator circuits, Diode 1 for A.M. demodulator and A.G.C. circuits.

RATINGS

Heater Voltage	28 volts
Heater Current	0.1 amp.
Diode 1 Current	1 mA max.
Diode 2 Current	10 mA max.
Diode 3 Current	10 mA max.

OPERATING CHARACTERISTICS

Anode Voltage	170 volts
Anode Current	1.0 mA
Grid Voltage	−1.85 volts
Anode Impedance	48 k ohm
Mutual Conductance	1.45 mA/V
Amplification Factor	70

OPERATION AS RESISTANCE COUPLED AMPLIFIER

Anode Supply Voltage	100	250	250	volts
Anode Load Resistor	0.5	0.25	0.22	meg.
Grid Resistor (following stage)	1.0	1.0	0.33	meg.
Cathode Bias Resistor	9,000	3,000	0	ohms
Peak Output	16	43	40	volts
* Stage Gain	33	42	42	
* Harmonic Distortion	2	1	5	per cent.

** Figures are for 12 volts peak output.*

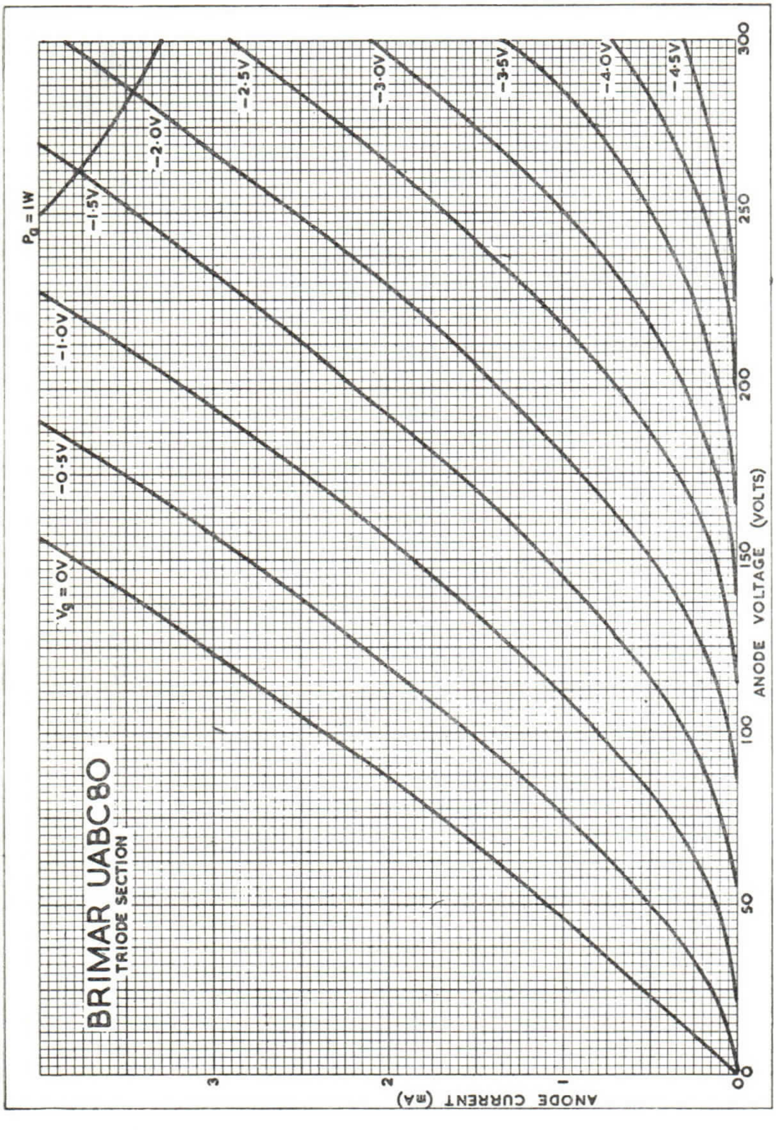
INTER-ELECTRODE CAPACITANCES *

Grid to Cathode	1.9 pF
Anode to Cathode	1.4 pF
Grid to Anode	2.0 pF

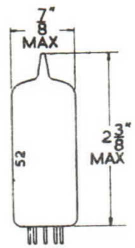
** With no external shield.*

VALVES

BRIMAR

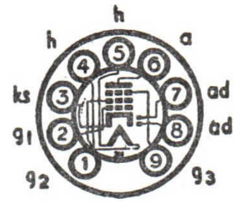


BRIMAR VALVES



Current Equipment Type

TYPE **UBF89**
DOUBLE DIODE
VARI-MU R.F.
PENTODE



The BRIMAR UBF89 is a double diode vari-mu pentode. The pentode section is designed primarily for use as an R.F. or I.F. amplifier and the diodes for A.M. detection.

Heater Current	0.1 amp.
Heater Voltage	19 volts

RATINGS
(Pentode)

Anode Supply Voltage ($I_a = 0$)	550 volts max.
Anode Voltage	250 volts max.
Anode Dissipation	2.25 watts max.
Screen Supply Voltage ($I_{g_2} = 0$)	550 volts max.
Screen Voltage	125 volts max.
Screen Dissipation	0.45 watts max.
Cathode Current	16.5 mA max.
Grid-Cathode Resistance	3.0 M ohm max.
Grid-Cathode Resistance (Grid current biasing) ...	22 M ohm max.
Heater-Cathode Resistance...	20 k ohm max.
Heater-Cathode Voltage	100 volts max.

(Diodes)

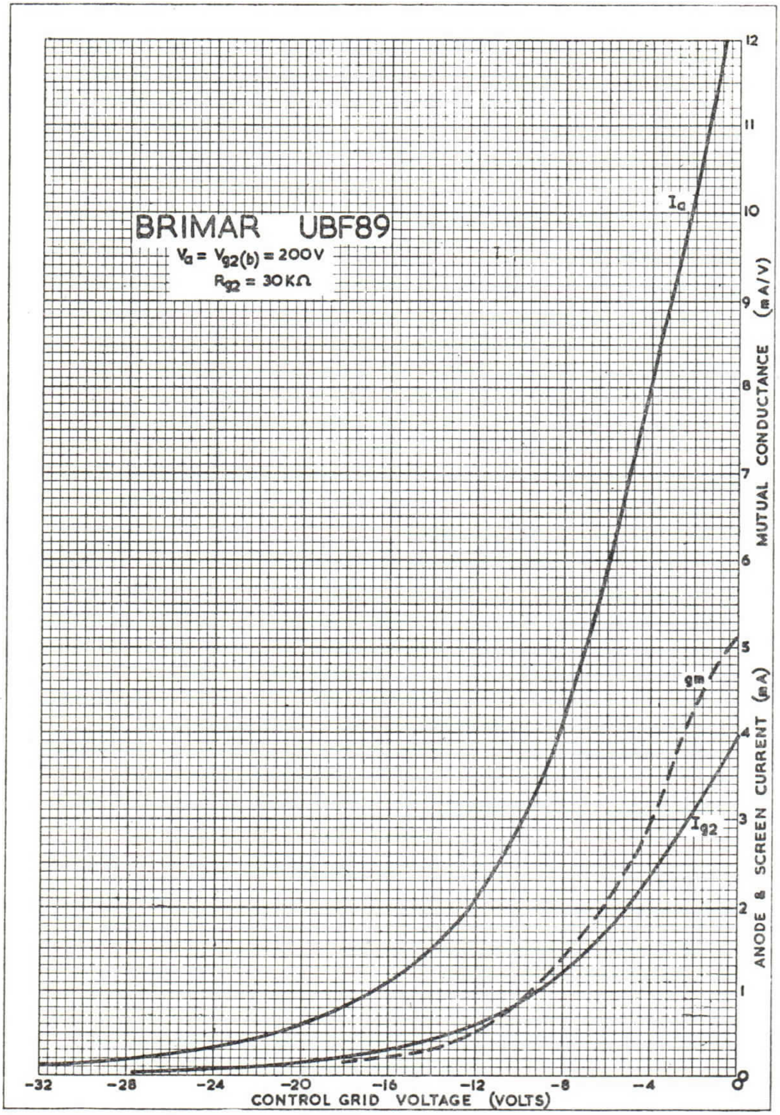
Peak Inverse Voltage	200 volts max.
Anode Current D.C.	0.8 mA max.
Peak Anode Current	5.0 mA max.
Heater-Cathode Resistance...	20 k ohm max.
Heater-Cathode Voltage	100 volts max.

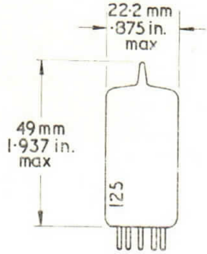
OPERATING CHARACTERISTICS

Anode Voltage	200 volts
Anode Current	11 mA
Screen Voltage	100 volts
Screen Current	3.3 mA
Control Grid Voltage	—1.5 volts
Mutual Conductance	4.5 mA/V
Anode Impedance	600 k ohm
Inner Amplification Factor (μg_1-g_2)	20
Control Grid Voltage (for gm/10)	—6.9 volts

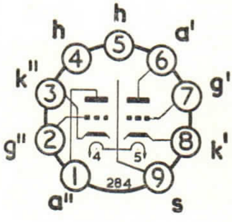
INTER-ELECTRODE CAPACITANCES

C_{a-g_1} (max.)	0.0025	pF
Cin	5.0	pF
Cout	5.2	pF
Grid to Heater	0.05	pF
Diode Anode to Cathode	2.5	pF


BRIMAR UBF89
$V_a = V_{g2(b)} = 200V$
$R_{g2} = 30K\Omega$
I_a
gm
I_{g2}
12
11
10
9
8
7
6
5
4
3
2
1
0
MUTUAL CONDUCTANCE (mA/V)
ANODE & SCREEN CURRENT (mA)
-32
-28
-24
-20
-16
-12
-8
-4
CONTROL GRID VOLTAGE (VOLTS)



DOUBLE TRIODE



B9A Base

GENERAL

This valve is a double triode primarily intended for use as an R.F. amplifier and self-oscillating mixer in F.M. receivers.

Heater Current	I_h	0·1	A
Heater Voltage	V_h	26	V

RATINGS

Maximum Anode Voltage	$V_{a(max)}$	250	V
Maximum Anode Dissipation (either section)	$p_{a(max)}$	2·5	W
Maximum Total Anode Dissipation	$p_{a(tot)max}$	4·5	W
Maximum Heater to Cathode Voltage (R.M.S.)	$V_{h\text{-}k(max)r.m.s.}$	90	V
Maximum Cathode Current	$I_{k(max)}$	15	mA
Maximum Grid to Cathode Resistance	$R_{g\text{-}k(max)}$	1	MΩ

INTER-ELECTRODE CAPACITANCES

		*	†	‡	
Anode′ to Grid′	$c_{a'\text{-}g'}$	1·5	1·6	1·8	pF
Anode″ to Grid″	$c_{a''\text{-}g''}$	1·5	1·6	1·6	pF
Anode′ to Cathode′, Heater, Shield	$c_{a'\text{-}k',h,s}$	1·2	1·6	2·5	pF
§ Anode′ to Cathode′, Heater, Shield	$c_{a'\text{-}k',h,s}$	1·9	2·0	2·8	pF
Anode″ to Cathode″, Heater, Shield	$c_{a''\text{-}k'',h,s}$	1·2	1·6	2·4	pF
§ Anode″ to Cathode″, Heater, Shield	$c_{a''\text{-}k'',h,s}$	1·9	2·1	2·8	pF
Grid′ to Cathode′, Heater, Shield	$c_{g'\text{-}k',h,s}$	3·0	3·3	4·2	pF
Grid″ to Cathode″, Heater, Shield	$c_{g''\text{-}k'',h,s}$	3·0	3·4	4·2	pF
Anode′ to Anode″	$c_{a'\text{-}a''}$	·028	·032	·033	pF
§ Anode′ to Anode″	$c_{a'\text{-}a''}$	·003	·0067	·0081	pF
Anode″ to Cathode′	$c_{a''\text{-}k'}$	·006	·014	·02	pF

CHARACTERISTICS (Each Section)

Anode Voltage	V_a	170	200	V
Anode Current	I_a	10	10	mA
Grid Voltage	V_g	−1·5	−2·1	V
Mutual Conductance	g_m	6·2	5·8	mA/V
Amplification Factor	μ	50	48	
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	8·1	8·3	kΩ

NOTES

* Measured in fully-shielded socket. Without can, except where stated otherwise.
† Measured with holder capacitance balanced out. (Holders as below).
‡ Total capacitance including, where applicable, Plessey B9A ceramic type holders CP180900/1 (without can) or CP180024/3 (with can).
§ Measured with can.

TYPICAL OPERATION AS R.F. AMPLIFIER

Supply Voltage	V_b	170	170	V
Anode Load Resistance	R_a	1·5	1·3	kΩ
Anode Voltage	V_a	155	160	V
Anode Current	I_a	8·7	6	mA
Grid Bias Voltage	V_g	−1·4	−2	V
Mutual Conductance	g_m	6	4·7	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	8·4	10·5	kΩ
Equivalent Grid Noise Resistance	R_{eq}	500	650	Ω
Input Loss at 100 Mc/s	r_g (100 Mc/s)	6	8	kΩ

TYPICAL OPERATION AS SELF-OSCILLATING MIXER ¶

Supply Voltage	V_b	170	200	V
Anode Load Resistance	R_a	4·7	8·2	kΩ
Grid to Cathode Resistance //	$R_{g\text{-}k}$	1	1	MΩ
Anode Current	I_a	4·8	5·2	mA
Peak Heterodyne Voltage	$v_{(pk)het}$	4	4	V
Conversion Conductance	g_c	2·2	2·3	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	16	15	kΩ

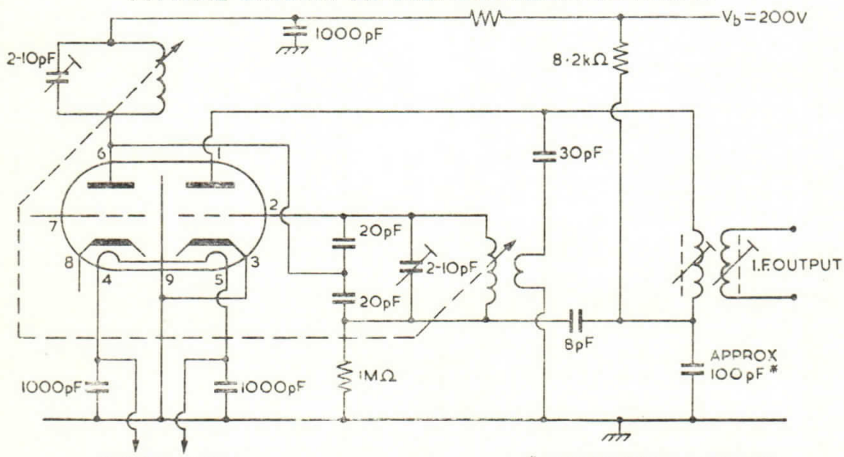
NOTES

The triode on pins 6, 7 and 8 should be used as the R.F. amplifier and that on pins 1, 2 and 3 as the self-oscillating mixer.

¶ For typical circuit as self-oscillating mixer see circuit below.

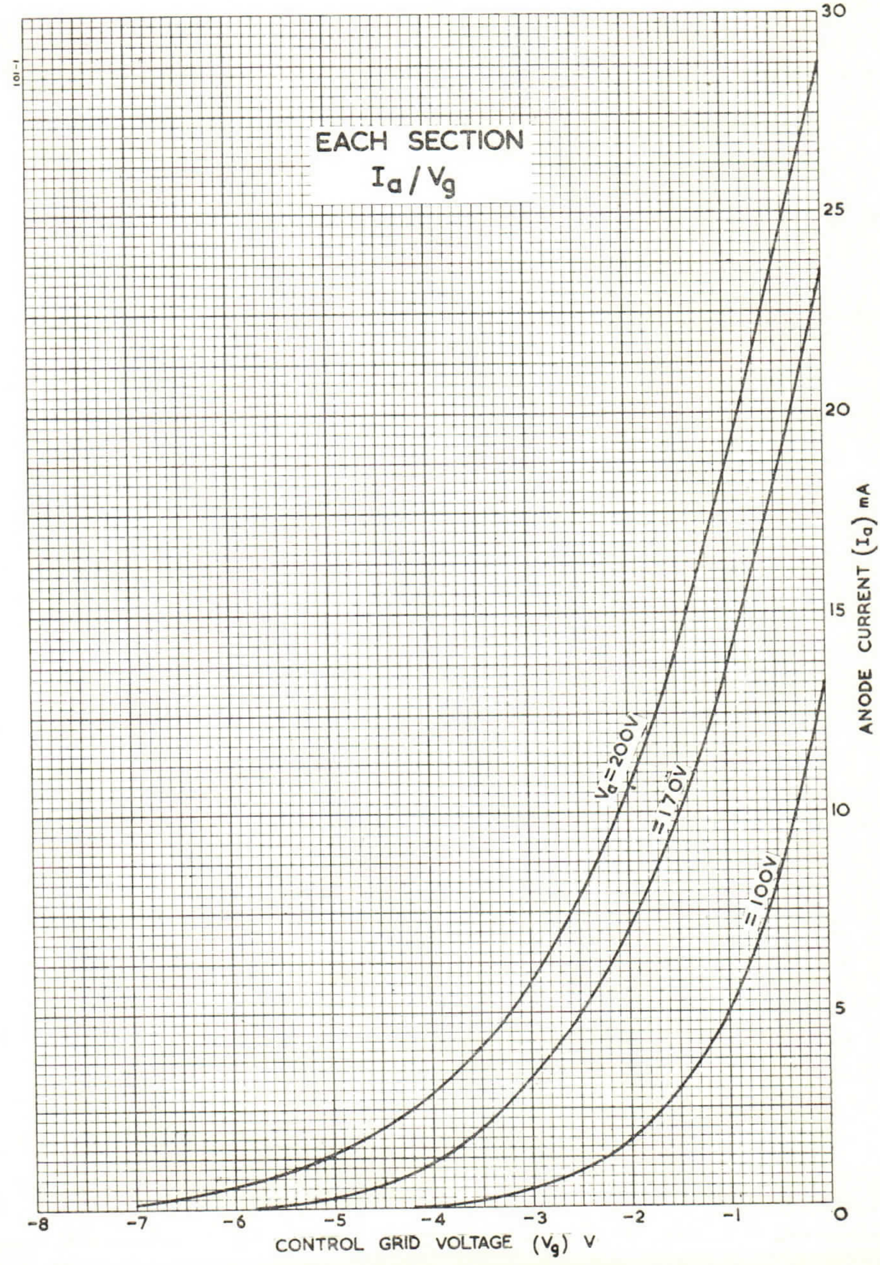
// I.F. feedback voltage tends to stabilise oscillator performance and permits this relatively high grid leak.

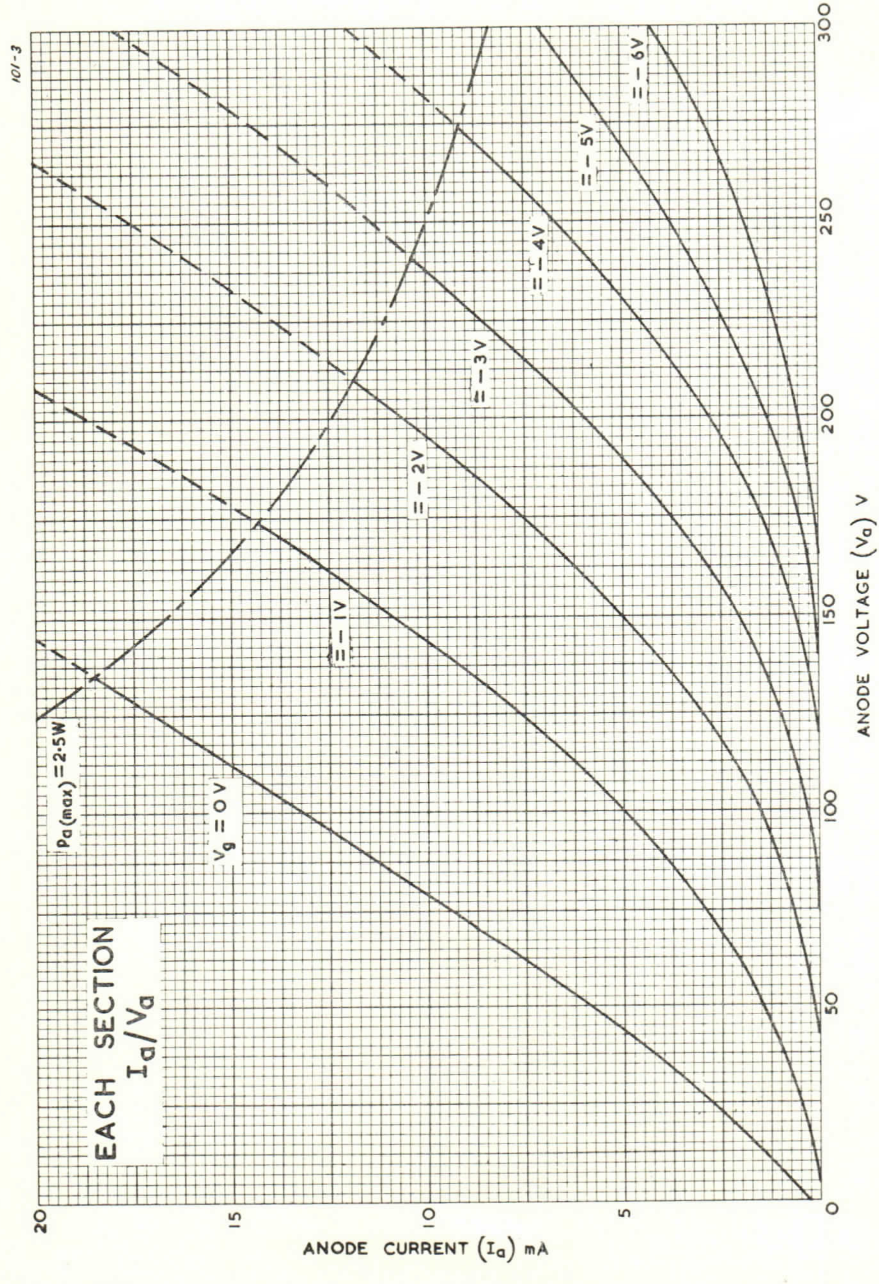
TYPICAL CIRCUIT AS SELF-OSCILLATING MIXER

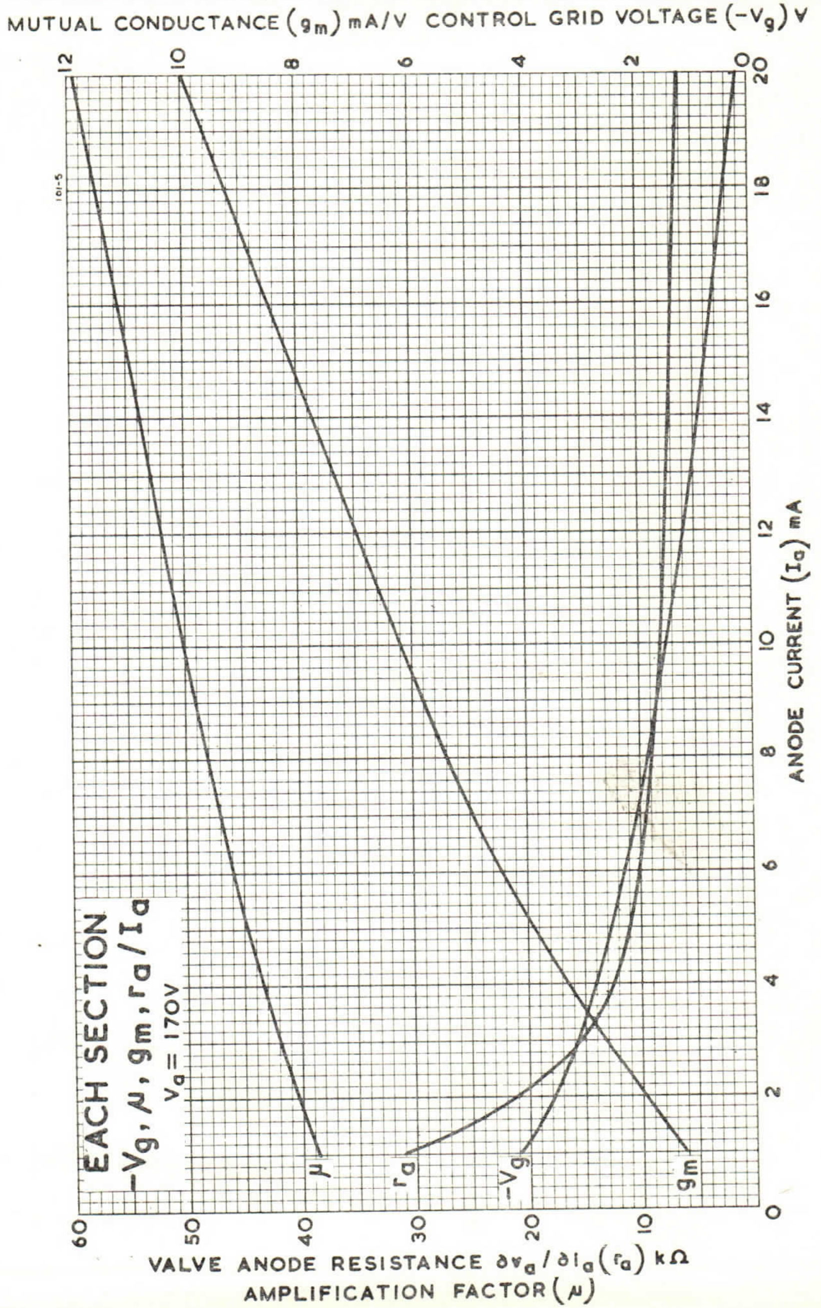


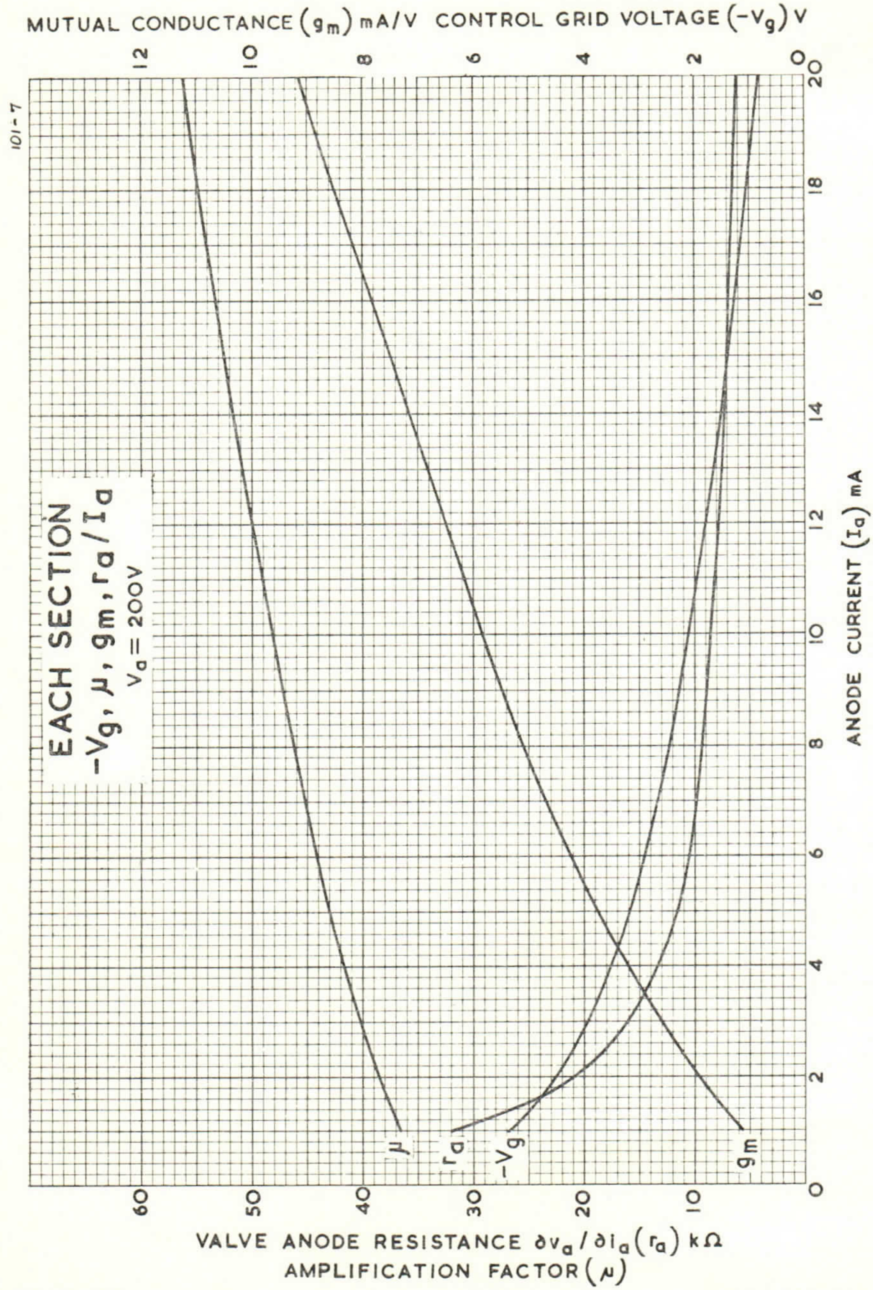
*I.F. FEEDBACK COMPONENT; VALUE DEPENDENT ON LAYOUT & TOLERANCES.

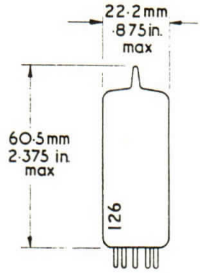
MOUNTING POSITION—Unrestricted


EACH SECTION
I_a / V_g
$V_a = 200V$
$= 170V$
$= 100V$
30
25
20
15
10
5
0
ANODE CURRENT (I_a) mA
-8
-7
-6
-5
-4
-3
-2
-1
0
CONTROL GRID VOLTAGE (V_g) V

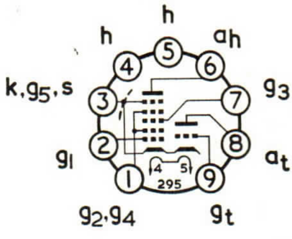

101-3
EACH SECTION
Ia/Va
Vg = 0 V
= -1V
= -2V
= -3V
= -4V
= -5V
= -6V
Pa(max) = 2·5W
ANODE VOLTAGE (Va) V
0
50
100
150
200
250
300
ANODE CURRENT (Ia) mA
20
15
10
5
0


MUTUAL CONDUCTANCE (g_m) mA/V CONTROL GRID VOLTAGE ($-V_g$) V
12
10
8
6
4
2
0
ANODE CURRENT (I_a) mA
0
2
4
6
8
10
12
14
16
18
20
EACH SECTION
$-V_g$, μ, g_m, r_a / I_a
V_a = 170V
μ
r_a
$-V_g$
g_m
60
50
40
30
20
10
0
VALVE ANODE RESISTANCE $\partial v_a / \partial i_a$ (r_a) kΩ
AMPLIFICATION FACTOR (μ)


MUTUAL CONDUCTANCE (g_m) mA/V CONTROL GRID VOLTAGE ($-V_g$) V
12 10 8 6 4 2 0
101-7
EACH SECTION
$-V_g$, μ, g_m, r_a / I_a
$V_a = 200V$
μ
r_a
$-V_g$
g_m
ANODE CURRENT (I_a) mA
0 2 4 6 8 10 12 14 16 18 20
60 50 40 30 20 10 0
VALVE ANODE RESISTANCE $\partial v_a / \partial i_a$ (r_a) kΩ
AMPLIFICATION FACTOR (μ)



TRIODE HEPTODE FREQUENCY CHANGER



B9A Base

GENERAL

This triode heptode valve combination, with separate electrode structures, is for use in AM/FM broadcast radio AC/DC receivers. The valve is intended to be used as a frequency changer for AM signals with the triode as local oscillator and the heptode switched to operate as an I.F. amplifier for FM signals.

Heater Current	I_h	0·1	A
Heater Voltage	V_h	19·0	V

RATINGS

		Triode	Heptode	
Maximum Anode Dissipation	$p_{a(max)}$	0·8	1·7	W
Maximum Screen Grids Dissipation	$p_{g2+g4(max)}$	—	1	W
Maximum Anode Voltage	$V_{a(max)}$	250	250	V
Maximum Screen Grids Voltage ($I_a = 7·6$mA)	$V_{g2+g4(max)}$	—	125	V
Maximum Screen Grids Voltage ($I_a < 1$mA)		—	250	V
Maximum Heater to Cathode Voltage (R.M.S.)	$V_{h\text{-}k(r.m.s.)max}$	100*		V
Maximum Mean Cathode Current	$I_{k(av)max}$	6·5	12·5	mA

* Measured with respect to the higher potential heater pin.

INTER-ELECTRODE CAPACITANCES

		Triode	Heptode	
Output	c_{out}	2·1	7·9	pF
Input (g_1)	$c_{in(g1)}$	2·6	4·8	pF
Input (g_3)	$c_{in(g3)}$	—	6	pF
Grid 1 to Anode	$c_{g1\text{-}a}$	1	<0·006	pF
Grid 1 to Grid 3	$c_{g1\text{-}g3}$	—	<0·3	pF
Grid 1 to Grid 3, Grid Triode	$c_{g1\text{-}g3gt}$	<0·45		pF
Grid 1 to Grid Triode	$c_{g1\text{-}gt}$	<0·17		pF
Anode Heptode to Anode Triode	$c_{ah\text{-}at}$	0·2		pF

Inter-electrode capacitances measured with holder capacitances balanced out.

THORN—A E I RADIO VALVES & TUBES LTD.

CHARACTERISTICS

		Triode	Heptode	
Anode Voltage	V_a	100	170	V
Screen Grids Voltage	V_{g2+g4}	—	102	V
Grid 3 Voltage	V_{g3}	—	0	V
Control Grid Voltage	V_{g1}	−1	−2·2	V
Anode Current	I_a	10	6·2	mA
Mutual Conductance	g_m	3·2	2·3	mA/V
Amplification Factor	μ	19	—	
Inner Amplification Factor	$\mu_{g1\text{-}(g2+g4)}$	—	20	

TYPICAL OPERATION AS R.F. or I.F. AMPLIFIER

Heptode Section

Supply Voltage	V_b	170	V
Anode Voltage	V_a	170	V
Screen Grids Resistance	R_{g2+g4}	18	kΩ
Screen Grids Voltage (Initial)	V_{g2+g4}	102	V
Grid 3 Voltage	V_{g3}	0	V
Control Grid Voltage	V_{g1}	−2·2	V
Anode Current (approximately)	I_a	6·2	mA
Screen Grids Current (approximately)	I_{g2+g4}	3·8	mA
Mutual Conductance	g_m	2·3	mA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	0·6	MΩ
Equivalent Grid Noise Resistance	R_{eq}	8·8	kΩ
Grid 1 Voltage for 100 : 1 reduction of Mutual Conductance		−28	

TYPICAL OPERATION AS A.M. FREQUENCY CHANGER

Heptode Section

Supply Voltage	V_b	170	V
Anode Voltage	V_a	170	V
Screen Grids Resistance	R_{g2+g4}	10	kΩ
Screen Grids Voltage (Initial)	V_{g2+g4}	102	V
Control Grid Voltage	V_{g1}	−2·2	V
Anode Current (approximately)	I_a	3·2	mA
Screen Grids Current (approximately)	I_{g2+g4}	6·8	mA
Heptode Grid 3 and Triode Grid Current	I_{g3+gt}	200	µA
Heptode Grid 3 and Triode Grid Resistance	R_{g3+gt}	47	kΩ
Peak Heterodyne Voltage	$v_{(pk)het}$	12	V
Conversion Conductance	g_c	750	µA/V
Valve Anode Resistance ($\delta v_a/\delta i_a$)	r_a	0·9	MΩ
Equivalent Grid Noise Resistance	R_{eq}	70	kΩ
Grid Voltage for 100 : 1 reduction of Conversion Conductance		−24	V

Triode

Anode Voltage	V_a	103	V
Anode Current (Average)	$I_{a(av)}$	4·5	mA

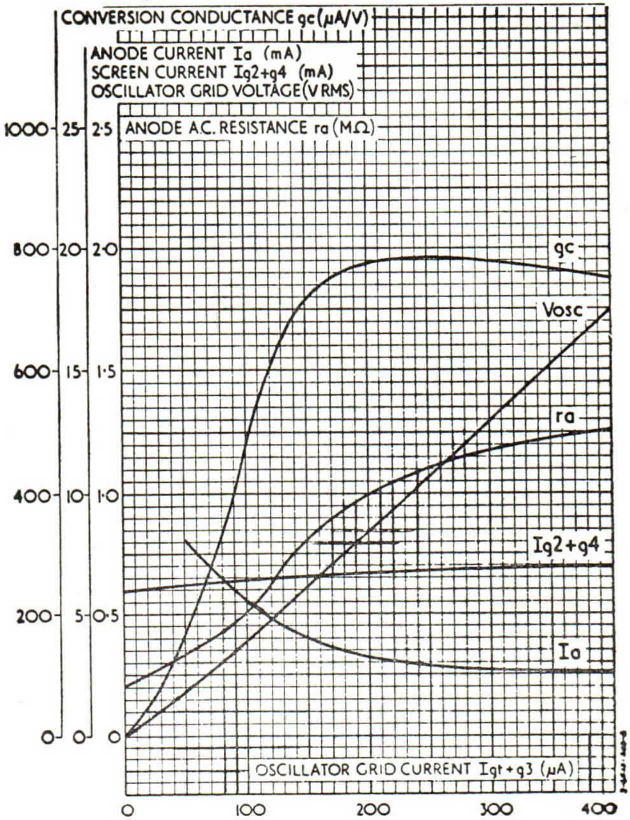
MOUNTING POSITION—Unrestricted

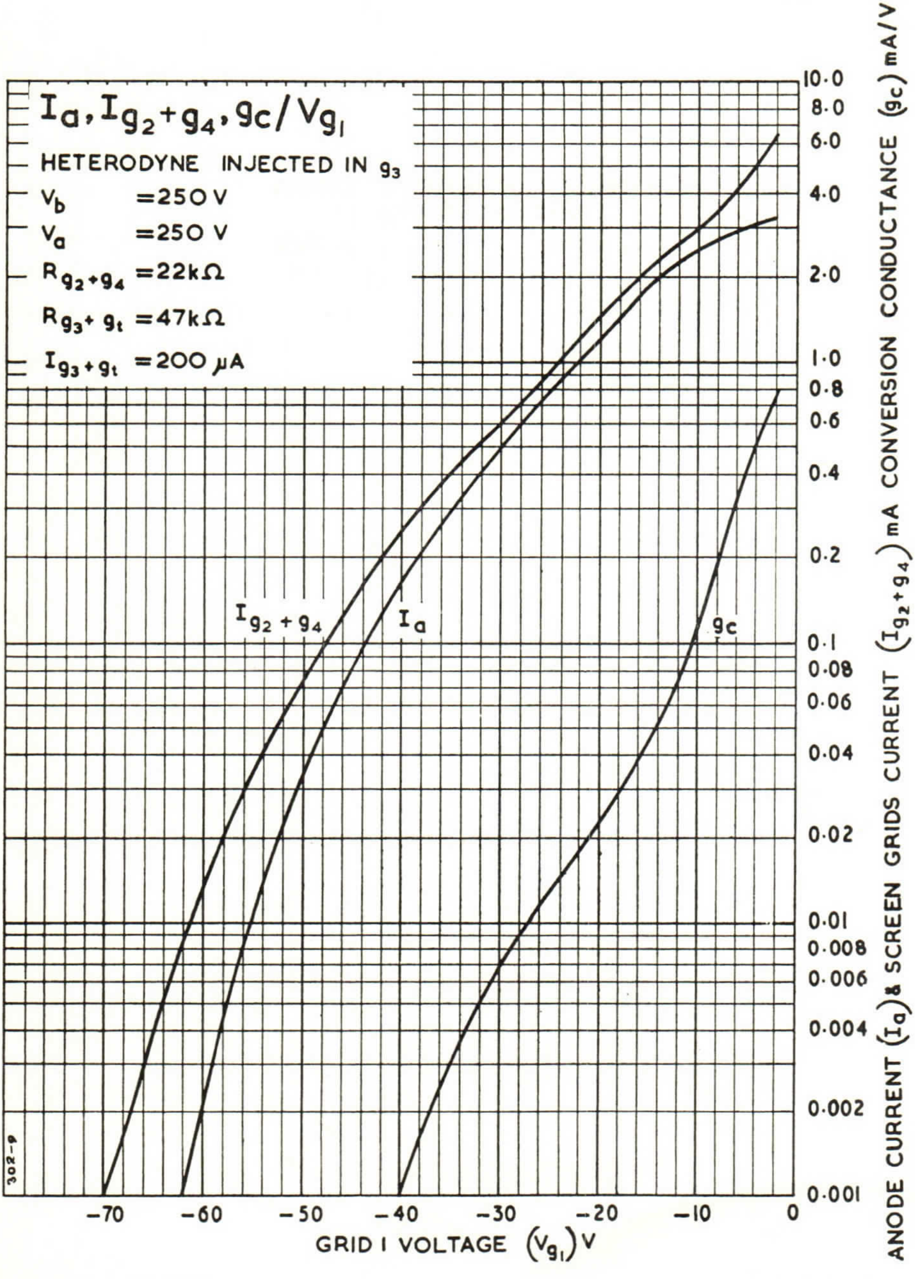
APPROXIMATE WEIGHT

Net	0·5	oz
Packed	0·75	oz

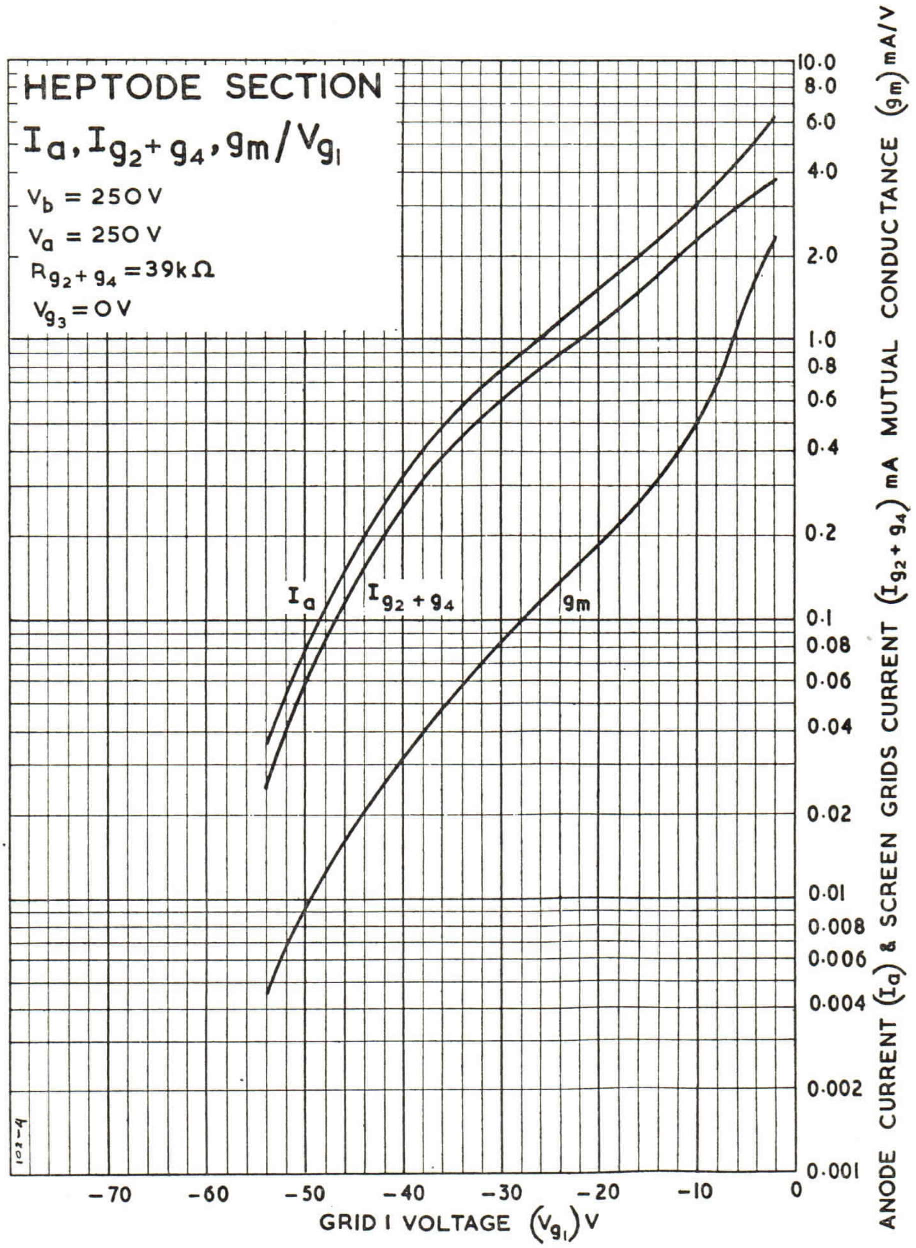
AVERAGE CHARACTERISTIC CURVES:
$I_a, I_{g2}, g_c, r_a, V_{osc}/I_{gt+g3}$

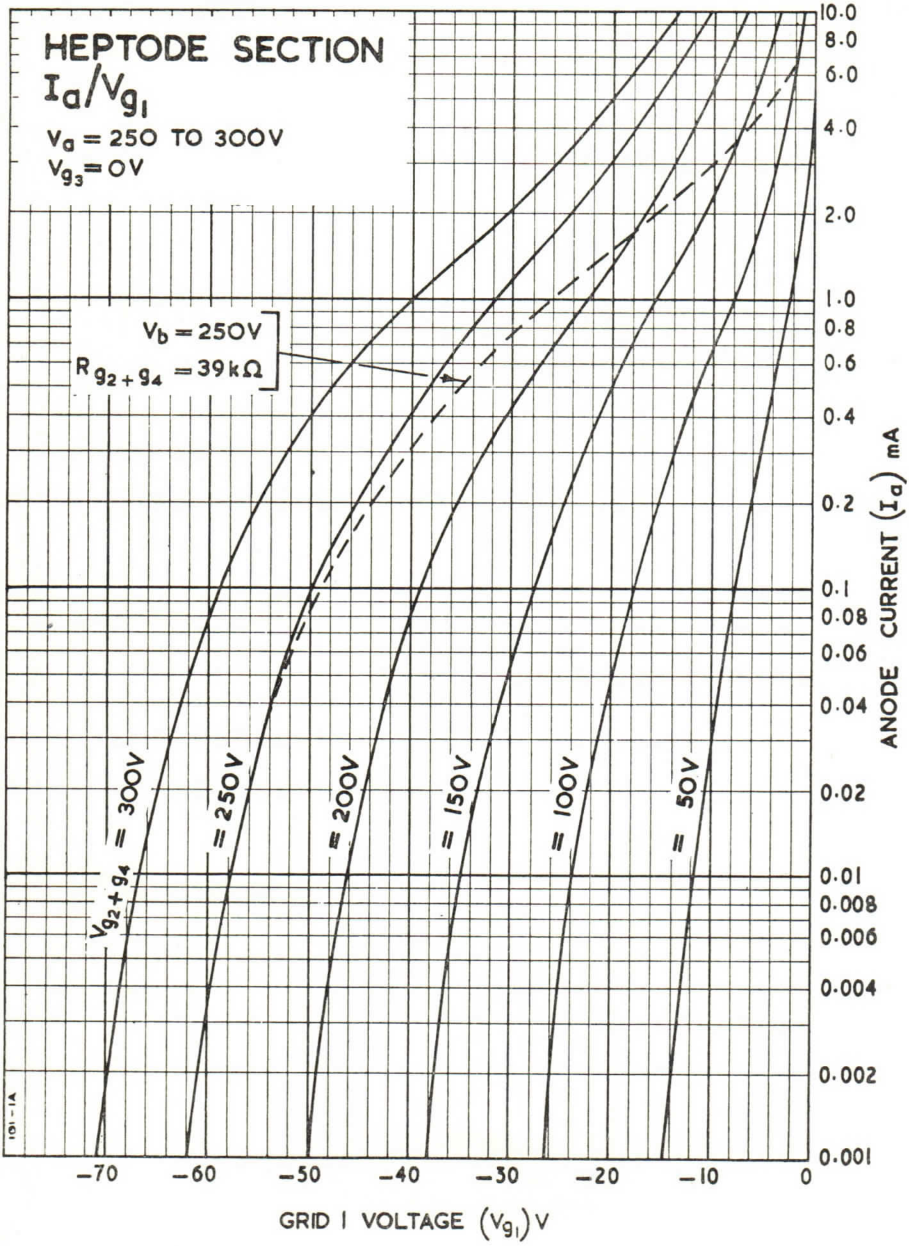
$V_a = 250V$ $R_{g2+g4} = 22k\Omega$
$V_{g1} = -2V$ $R_{gt+g3} = 47k\Omega$

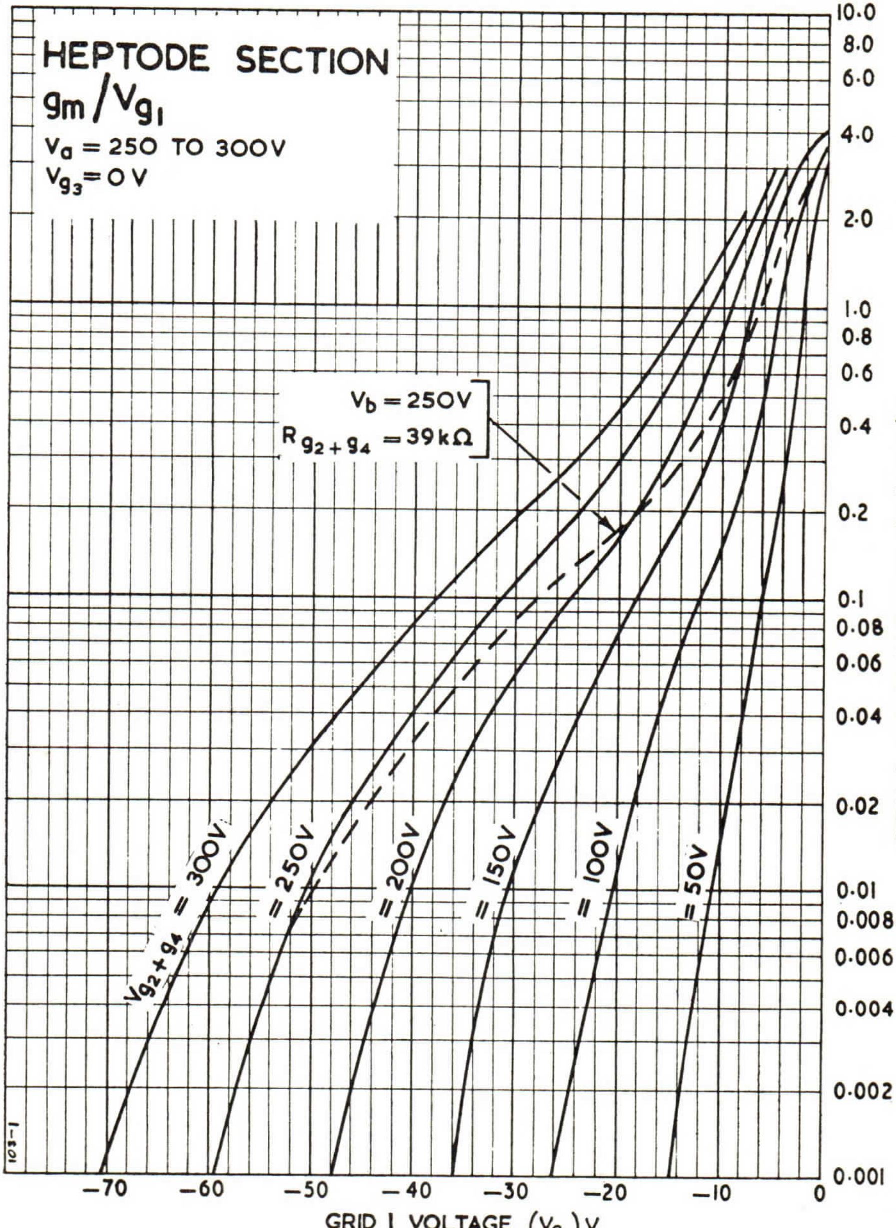


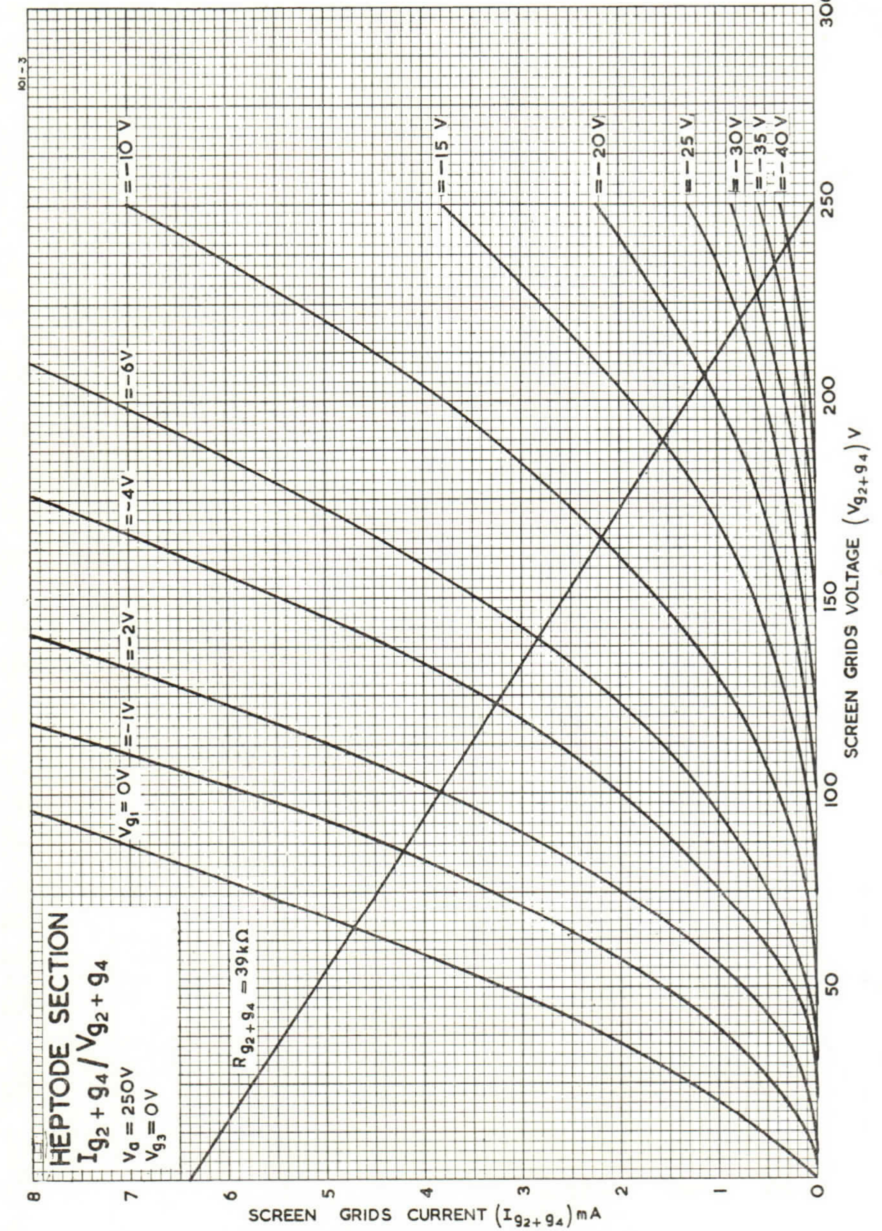


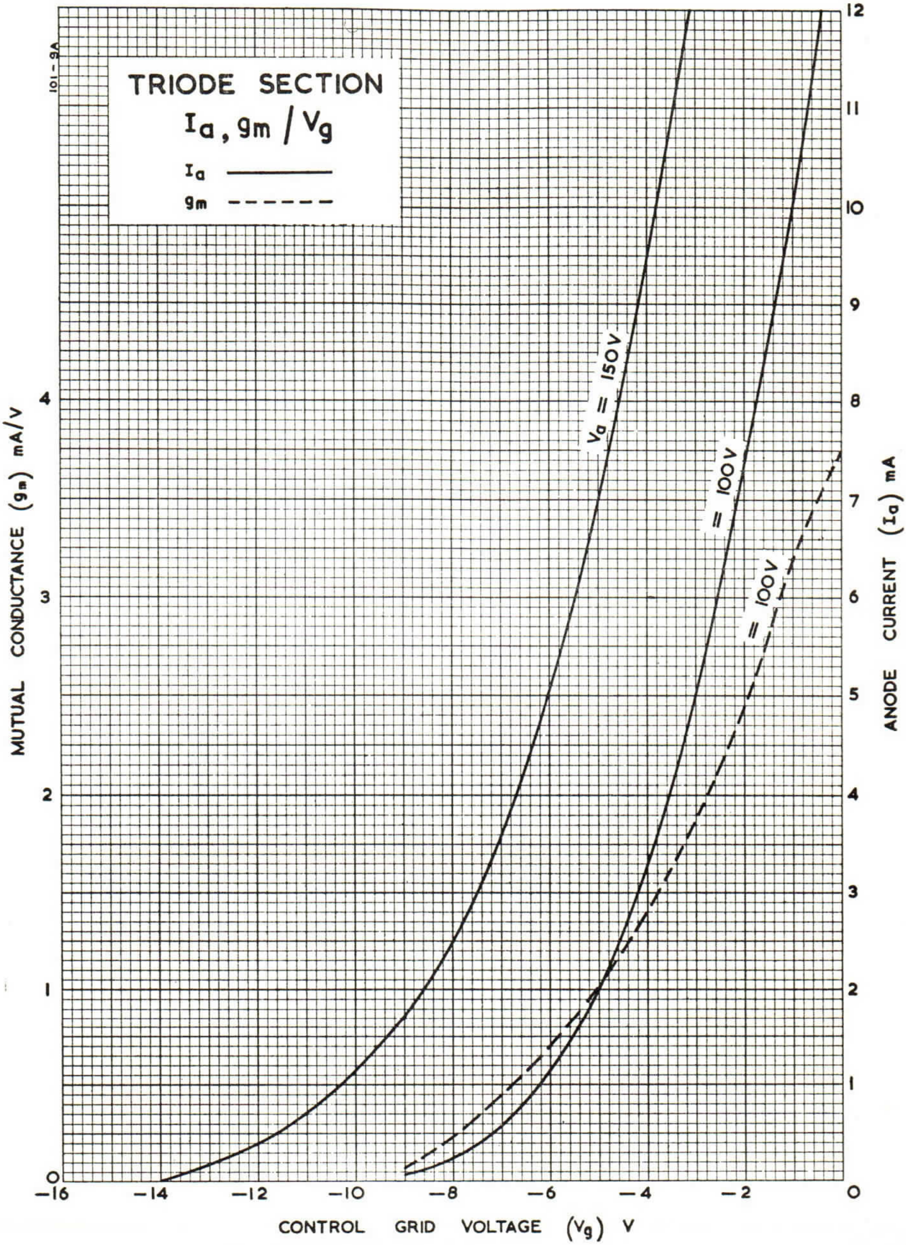
$I_a, I_{g_2+g_4}, g_c/V_{g_1}$
HETERODYNE INJECTED IN g_3
V_b = 250 V
V_a = 250 V
$R_{g_2+g_4}$ = 22kΩ
$R_{g_3+g_t}$ = 47kΩ
$I_{g_3+g_t}$ = 200 µA
$I_{g_2+g_4}$
I_a
g_c
302-9
10·0
8·0
6·0
4·0
2·0
1·0
0·8
0·6
0·4
0·2
0·1
0·08
0·06
0·04
0·02
0·01
0·008
0·006
0·004
0·002
0·001
−70
−60
−50
−40
−30
−20
−10
0
GRID I VOLTAGE (V_{g_1}) V
ANODE CURRENT (I_a) & SCREEN GRIDS CURRENT ($I_{g_2+g_4}$) mA CONVERSION CONDUCTANCE (g_c) mA/V


HEPTODE SECTION
$I_a, I_{g_2+g_4}, g_m / V_{g_1}$
$V_b = 250V$
$V_a = 250V$
$R_{g_2+g_4} = 39k\Omega$
$V_{g_3} = 0V$
I_a
$I_{g_2+g_4}$
gm
10.0
8.0
6.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
0.08
0.06
0.04
0.02
0.01
0.008
0.006
0.004
0.002
0.001
−70
−60
−50
−40
−30
−20
−10
0
GRID I VOLTAGE (V_{g_1}) V
ANODE CURRENT (I_a) & SCREEN GRIDS CURRENT $(I_{g_2+g_4})$ mA MUTUAL CONDUCTANCE (g_m) mA/V
102-4


HEPTODE SECTION
I_a/V_{g_1}
V_a = 250 TO 300V
V_{g_3} = 0V
V_b = 250V
$R_{g_2+g_4}$ = 39kΩ
$V_{g_2+g_4}$ = 300V
= 250V
= 200V
= 150V
= 100V
= 50V
10.0
8.0
6.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
0.08
0.06
0.04
0.02
0.01
0.008
0.006
0.004
0.002
0.001
ANODE CURRENT (I_a) mA
−70
−60
−50
−40
−30
−20
−10
0
GRID 1 VOLTAGE (V_{g_1}) V
101-1A

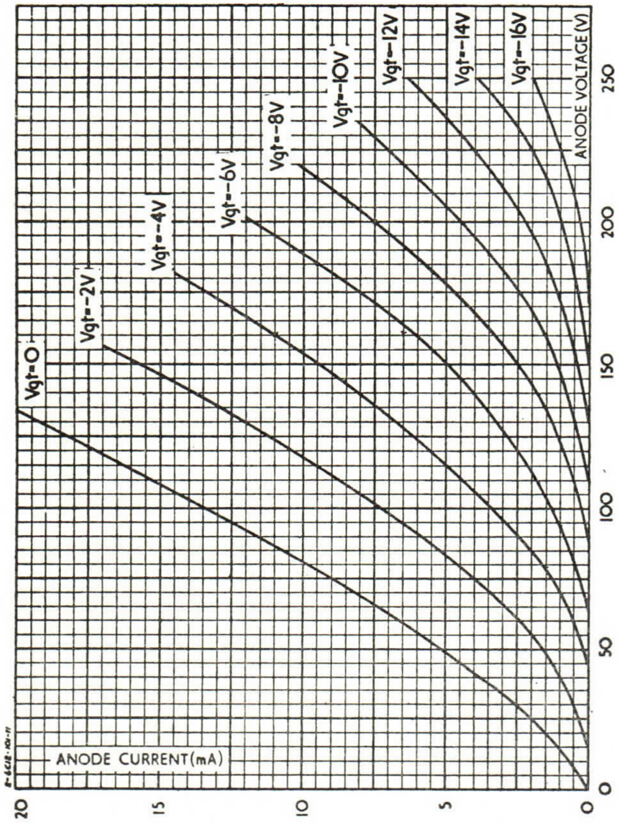

HEPTODE SECTION
gm/Vg1
Va = 250 TO 300V
Vg3 = 0 V
Vb = 250V
Rg2+g4 = 39kΩ
Vg2+g4 = 300V
= 250V
= 200V
= 150V
= 100V
= 50V
10.0
8.0
6.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
0.08
0.06
0.04
0.02
0.01
0.008
0.006
0.004
0.002
0.001
MUTUAL CONDUCTANCE (gm) mA/V
−70
−60
−50
−40
−30
−20
−10
0
GRID 1 VOLTAGE (Vg1) V
103-1


HEPTODE SECTION
$I_{g_2+g_4}/V_{g_2+g_4}$
$V_a = 250V$
$V_{g_3} = 0V$
$V_{g_1} = 0V$
$= -1V$
$= -2V$
$= -4V$
$= -6V$
$= -10 V$
$= -15 V$
$= -20 V$
$= -25 V$
$= -30 V$
$= -35 V$
$= -40 V$
$R_{g_2+g_4} = 39k\Omega$
SCREEN GRIDS CURRENT $(I_{g_2+g_4})$ mA
8 7 6 5 4 3 2 1 0
SCREEN GRIDS VOLTAGE $(V_{g_2+g_4})$ V
50 100 150 200 250 300
101-3

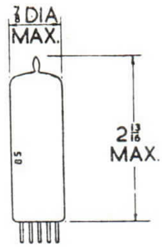

TRIODE SECTION
I_a, g_m / V_g
I_a
g_m
V_a = 150V
= 100V
= 100V
MUTUAL CONDUCTANCE (g_m) mA/V
ANODE CURRENT (I_a) mA
CONTROL GRID VOLTAGE (V_g) V
0
1
2
3
4
5
6
7
8
9
10
11
12
−16
−14
−12
−10
−8
−6
−4
−2
0
101 - 9A

CHARACTERISTIC CURVES: I_a/V_a

Triode Section



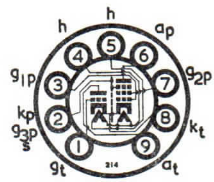
BRIMAR VALVES



B9A Base

Current Equipment Type

TYPE **UCL82**
MINIATURE
TRIODE PENTODE



The BRIMAR UCL82 is a noval triode pentode for use as a sound amplifier and output valve.

Heater Current	0.1 amp.
Heater Voltage	50 volts

RATINGS

	Triode	*Pentode*	
Anode Voltage ($I_a = 0$)	550	550	volts max.
Anode Voltage	250	250	volts max.
Anode Dissipation	1	7	watts max.
Screen Voltage ($Ig_2 = 0$)	—	550	volts max.
Screen Voltage	—	250	volts max.
Screen Dissipation	—	1.8	watts max.
Screen Dissipation (at full drive, speech and music.) ...	—	3.2	watts max.
Cathode Current	15	50	mA max.
Control Grid Resistance. Fixed Bias	1	1	M Ω max.
Cathode Bias	3	2	M Ω max.
Heater-Cathode Voltage	200	200	volts max.

CHARACTERISTICS

	Triode		*Pentode*		
Anode Voltage	100	100	170	200	volts
Screen Voltage	—	100	170	200	volts
Control Grid Voltage	0	—6	—11.5	—16	volts
Anode Current	3.5	26	41	35	mA
Screen Current	—	5	8	7	mA
Mutual Conductance	2.5	6.8	7.5	6.4	mA/V
Amplification Factor	70	—	—	—	
Inner Amplification Factor ($\mu g_1 - g_2$) ...	—	10	9.5	9.5	
Anode Impedance	—	15	16	20	k Ω

OPERATING CHARACTERISTICS

Pentode Section as an audio output stage.

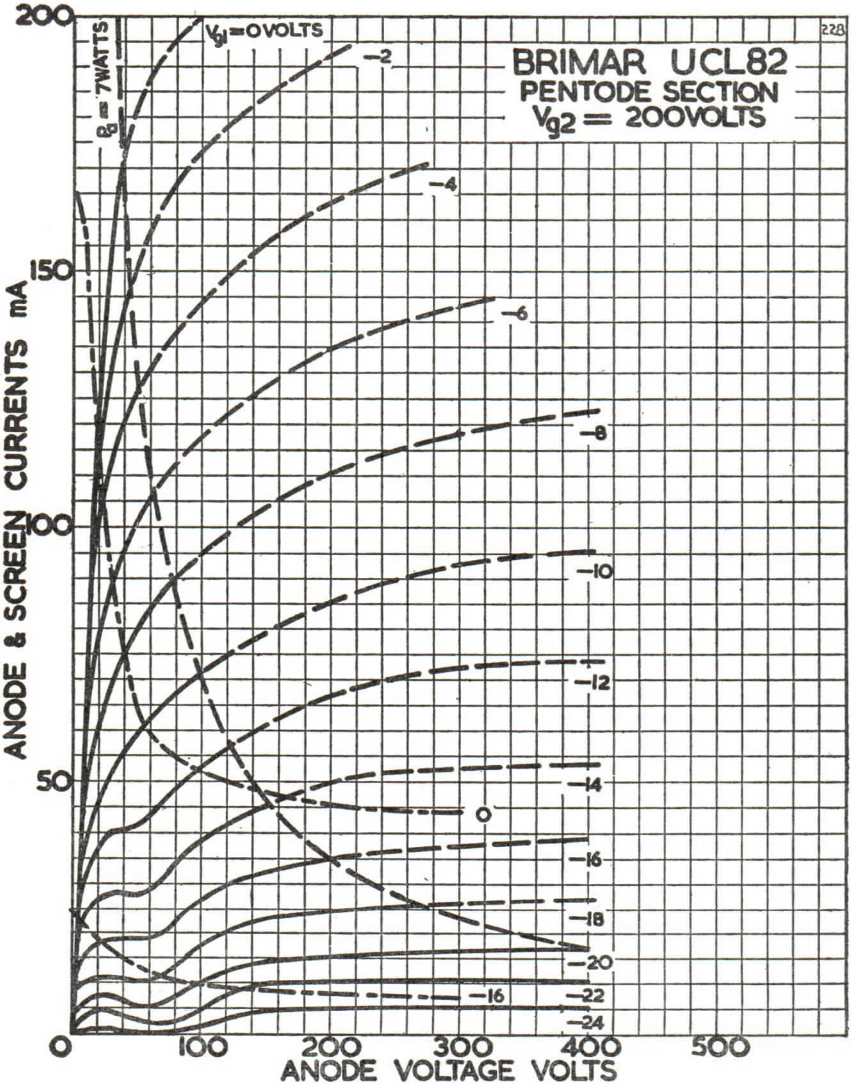
Anode and Screen Voltage	170	200	volts
Grid Voltage	—11.5	—16	volts
Anode Current	41	35	mA
Screen Current	8	7	mA
Optimum Load	3.9	5.6	k Ω
Power Output	3.3	3.5	watts
Distortion	10	10	per cent

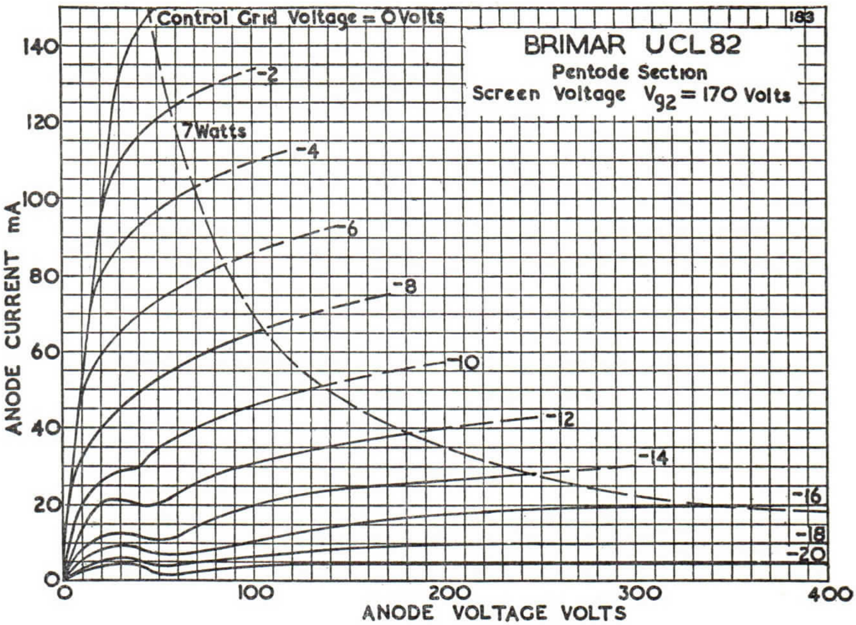
Triode Section as an A.F. amplifier.

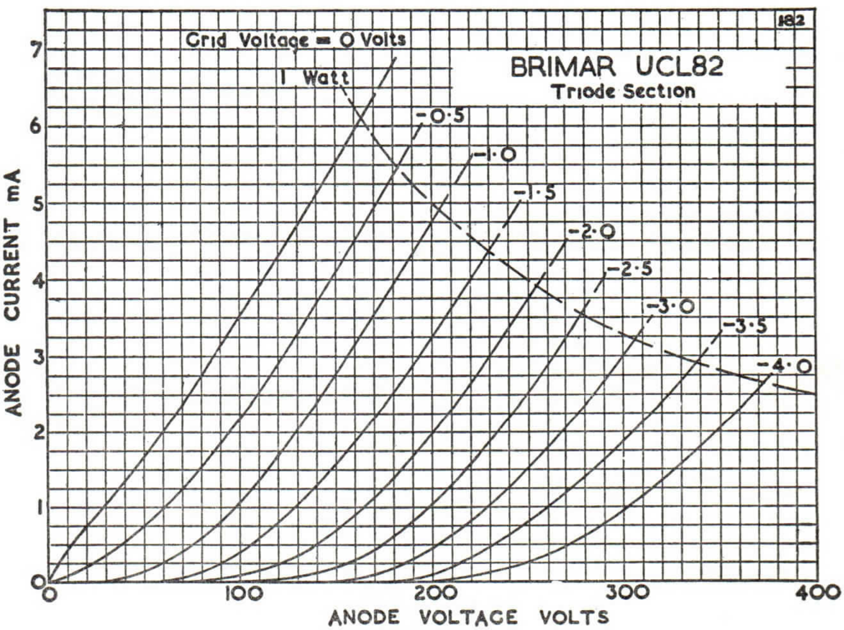
Anode Supply Voltage	170	200	volts
Cathode Bias Resistor	2.7	2.2	k Ω
Anode Resistor ...	220	220	k Ω
Maximum Output ...	25	26	V r.m.s.
Distortion	2.3	1.6	per cent
Gain	51	52	
Following Grid Resistor	680	680	k Ω

INTER-ELECTRODE CAPACITANCES

Triode Input	2.7 pF
Triode Output	4.3 pF
Triode Anode to Triode Grid	4.2 pF
Triode Grid to Heater ...	0.02 pF
Pentode Input	9.3 pF
Pentode Output	8 pF
Pentode Anode to Pentode Grid	0.3 pF
Pentode Grid to Heater ...	0.3 pF
Triode Anode to Pentode Grid	0.02 pF
Triode Grid to Pentode Anode	0.02 pF
Triode Grid to Pentode Grid	0.025 pF
Triode Anode to Pentode Anode	0.25 pF max.

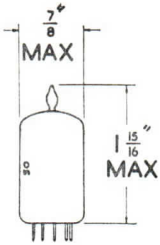

BRIMAR UCL82
PENTODE SECTION
V_{g2} = 200VOLTS
V_{g1} = 0 VOLTS
P_a = 7WATTS
228
−2
−4
−6
−8
−10
−12
−14
0
−16
−18
−20
−16
−22
−24
ANODE & SCREEN CURRENTS mA
200
150
100
50
0
100
200
300
400
500
ANODE VOLTAGE VOLTS


Control Grid Voltage = 0 Volts
183
BRIMAR UCL82
Pentode Section
Screen Voltage V_{g2} = 170 Volts
7 Watts
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
ANODE CURRENT mA
ANODE VOLTAGE VOLTS
0
20
40
60
80
100
120
140
100
200
300
400


Grid Voltage = 0 Volts
182
BRIMAR UCL82
Triode Section
1 Watt
-0·5
-1·0
-1·5
-2·0
-2·5
-3·0
-3·5
-4·0
ANODE CURRENT mA
ANODE VOLTAGE VOLTS
0
1
2
3
4
5
6
7
100
200
300
400

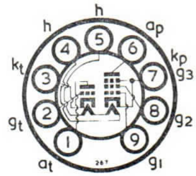
BRIMAR VALVES

Current Equipment Type



TYPE **UCL83**

TRIODE PENTODE



The BRIMAR UCL83 is a triode and output pentode with separate cathodes designed primarily for use in A.F. applications.

Heater Current	0.1 amp.
Heater Voltage	38 volts

RATINGS

	Pentode	*Triode*
Anode Supply Voltage ($I_a = 0$)	550	550 volts max.
Anode Voltage	250	250 volts max.
Anode Dissipation	5.4	3.5 watts max.
Screen Supply Voltage ($I_{g_2} = 0$) ...	550	— volts max.
Screen Voltage	250	— volts max.
Screen Dissipation	1.2	— watts max.
Screen Dissipation (Speech and music) ...	2.4	— watts max.
Cathode Current	45	15 mA max.
Grid Resistor (Self bias)	500	— k ohm max.
Grid Resistor (Fixed bias)	0.25	1.0 M ohm max.
Grid Resistor (Grid current bias)	—	22 M ohm max.
Heater-Cathode Voltage (Cathode negative)	100	100 volts max.

OPERATING CHARACTERISTICS

	Pentode	*Triode*	
Anode Voltage	170	170	volts
Screen Voltage	170	—	volts
Anode Current	30	1.6	mA
Screen Current	5.0	—	mA
Grid Voltage	—9.5	—1.5	volts
Mutual Conductance	5.5	2.1	mA/V
Anode Impedance	53	40	k ohm
Amplification Factor...	—	82	
Inner Amplification Factor (μg_1-g_2) ...	10	—	

INTER-ELECTRODE CAPACITANCES

Pentode Section

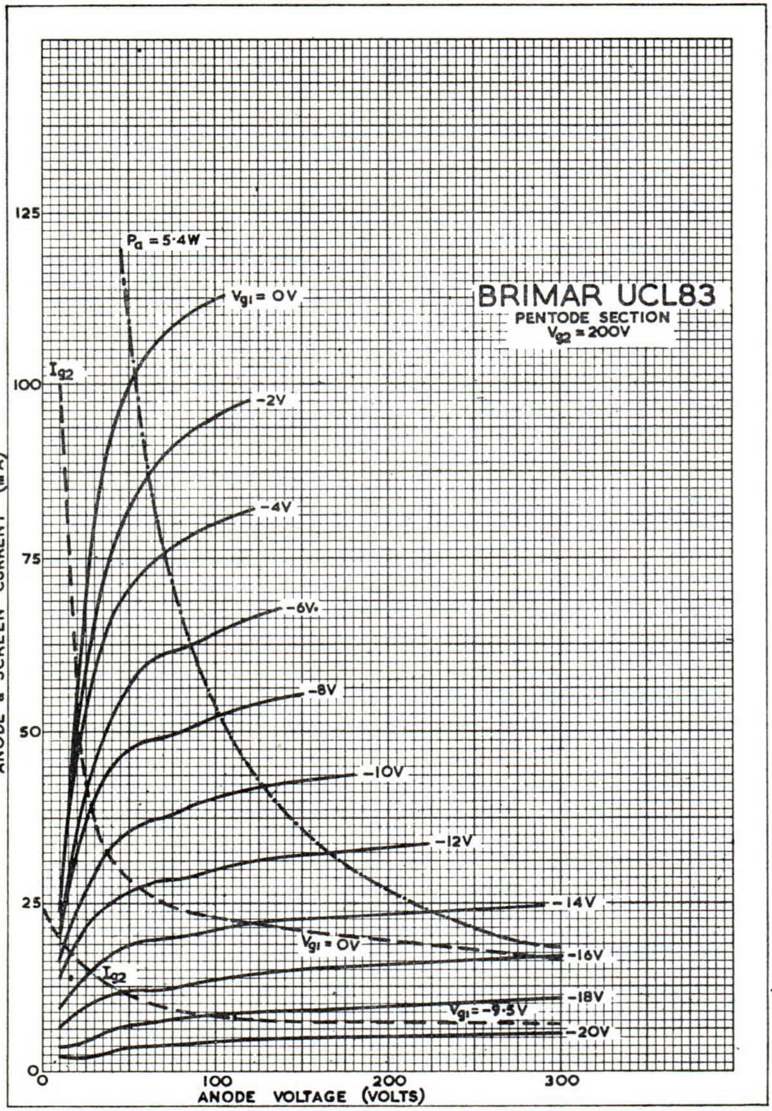
Cin	5.7 pF
Cout	4.7 pF
Cg_1-h	0.4 pF
Ca-g_1 (max.)	0.2 pF

Triode Section

Cin	2.3 pF
Cout	0.32 pF
Ca-g	1.6 pF

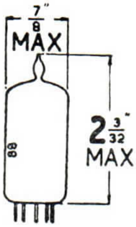
VALVES

BRIMAR

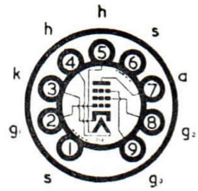


BRIMAR VALVES

Current Equipment Type



TYPE UF89
VARI-MU R.F. PENTODE



The BRIMAR UF89 is a vari-mu R.F. pentode designed primarily for use as an R.F. or I.F. amplifier.

Heater Current	0.1 amp.
Heater Voltage	12.6 volts

RATINGS

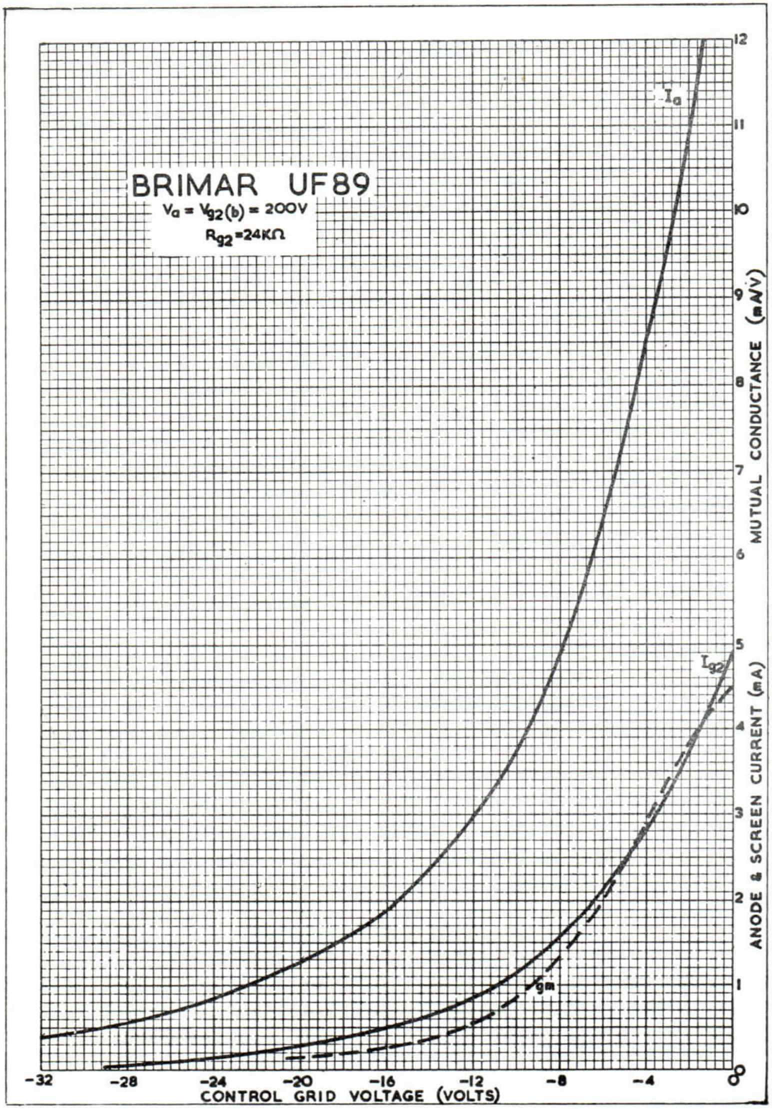
Anode Supply Voltage (Ia = 0)	550 volts max.
Anode Voltage	250 volts max.
Anode Dissipation	2.25 watts max.
Screen Supply Voltage (Ig_2 = 0)	550 volts max.
Screen Voltage	250 volts max.
Screen Dissipation	0.45 watts max.
Cathode Current	16.5 mA max.
Grid-Cathode Resistance	3.0 M ohm max.
Heater-Cathode Resistance...	20 k ohm max.
Heater-Cathode Voltage	150 volts max.

OPERATING CHARACTERISTICS

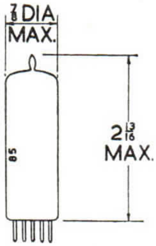
Anode Voltage	170 volts
Screen Voltage	110 volts
Control Grid Voltage	—2.0 volts
Anode Current	12 mA
Screen Current	3.9 mA
Mutual Conductance	3.8 mA/V
Anode Impedance	0.5 M ohm
Inner Amplification Factor (μg_1-g_2)	21
Control Grid Voltage (gm/10)	—10 volts

INTER-ELECTRODE CAPACITANCES

Cout	5.5 pF
Cin	5.1 pF
Ca-g_1 (max.)	0.002 pF
Grid to Heater	0.05 pF


BRIMAR UF89
$V_a = V_{g2(b)} = 200V$
$R_{g2} = 24K\Omega$
I_a
I_{g2}
gm
-32
-28
-24
-20
-16
-12
-8
-4
0
CONTROL GRID VOLTAGE (VOLTS)
0
1
2
3
4
5
6
7
8
9
10
11
12
ANODE & SCREEN CURRENT (mA)
MUTUAL CONDUCTANCE (mA/V)

BRIMAR VALVES

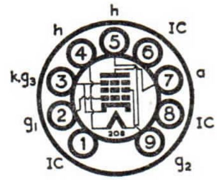


Current Equipment Type

TYPE **UL84**

MINIATURE

OUTPUT PENTODE



The BRIMAR type UL84 is a miniature, indirectly heated, high slope, output pentode for use in A.C./D.C. audio amplifiers and receivers.

Heater Current	0.1 amp.
Heater Voltage	45 volts

RATINGS

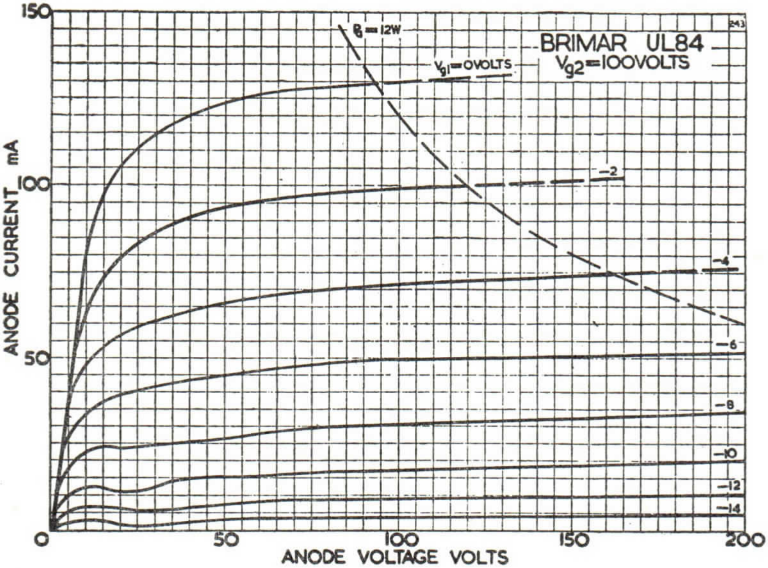
Anode Voltage (Ia = 0)	550 volts max.
Anode Voltage	250 volts max.
Anode Dissipation	12 watts max.
Screen Voltage (Ig_2 = 0)	550 volts max.
Screen Voltage	200 volts max.
Screen Dissipation	1.75 watts max.
Screen Dissipation (max. signal, speech and music) ...	6.0 watts max.
Cathode Current	100 mA max.
Grid Circuit Resistance (fixed bias)	300 kΩ max.
Grid Circuit Resistance (cathode bias)	1.0 MΩ max.

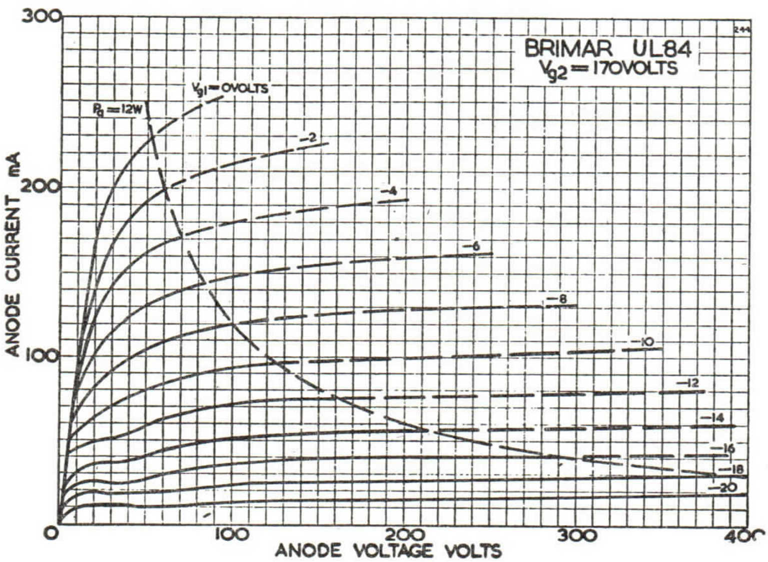
OPERATING CHARACTERISTICS

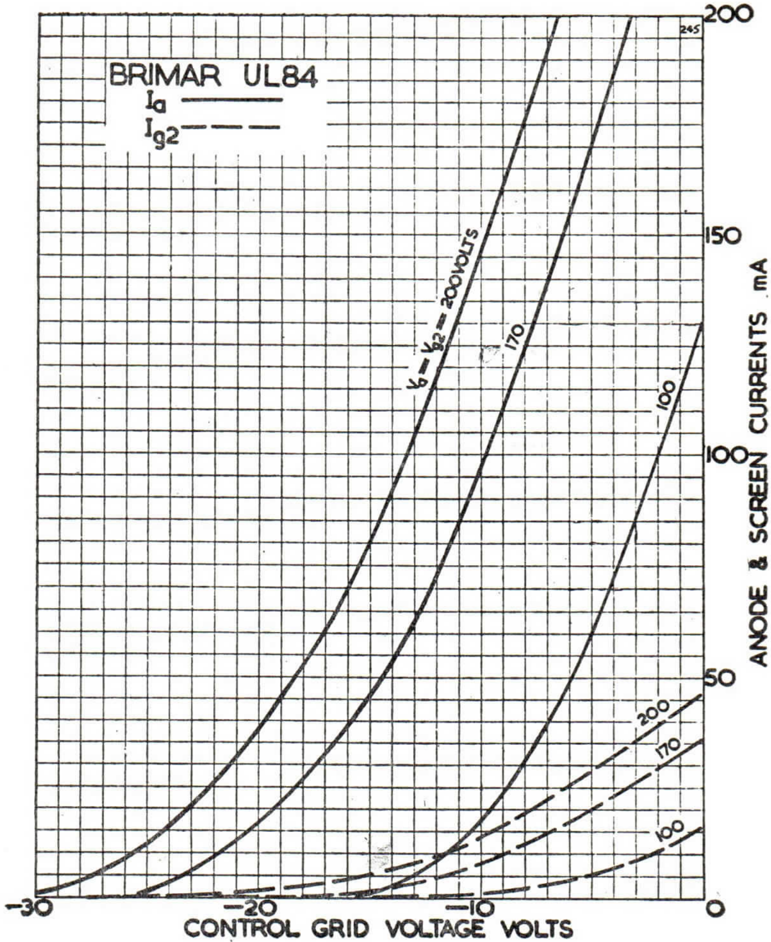
	Single valve Class A	Push-pull Class AB (Two valves)	
Anode Voltage	170	170	volts
Anode Current (zero signal)	70	113	mA
Anode Current (max. signal)	—	115	mA
Screen Voltage	170	170	volts
Screen Current (zero signal)	5.0	6.0	mA
Screen Current (max. signal)	—	41	mA
Control Grid Voltage	−12.5	—	volts
Cathode Bias Resistor	170	120	ohms
Anode Impedance	23	—	kΩ
Mutual Conductance	10	—	mA/V
Optimum Load	2.4	3.5	kΩ
Power Output	5.6	13	watts
Harmonic Distortion	10	4.5	per cent

INTER-ELECTRODE CAPACITANCES

Input	12 pF
Output	6.0 pF
Anode to Control Grid	0.6 pF
Heater to Control Grid	0.25 pF

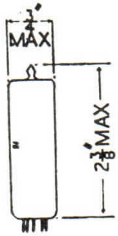

BRIMAR UL84
V_{g2}=100VOLTS
P_a=12W
V_{g1}=0VOLTS
-2
-4
-6
-8
-10
-12
-14
ANODE CURRENT mA
ANODE VOLTAGE VOLTS
0
50
100
150
200


BRIMAR UL84
V_{g2}=170VOLTS
P_a=12W
V_{g1}=0VOLTS
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
ANODE CURRENT mA
ANODE VOLTAGE VOLTS
0
100
200
300
400



BRIMAR UL84
Ia
Ig2
Va = Vg2 = 200VOLTS
170
100
200
170
100
245
200
150
100
50
0
ANODE & SCREEN CURRENTS mA
−30
−20
−10
CONTROL GRID VOLTAGE VOLTS

BRIMAR VALVES



Current Equipment Type

TYPE **UY85**

AC/DC HALF-WAVE

RECTIFIER

The BRIMAR Type UY85 is a half-wave rectifier for use in A.C./D.C. receivers where a 0.1 amp. series heater chain is employed.

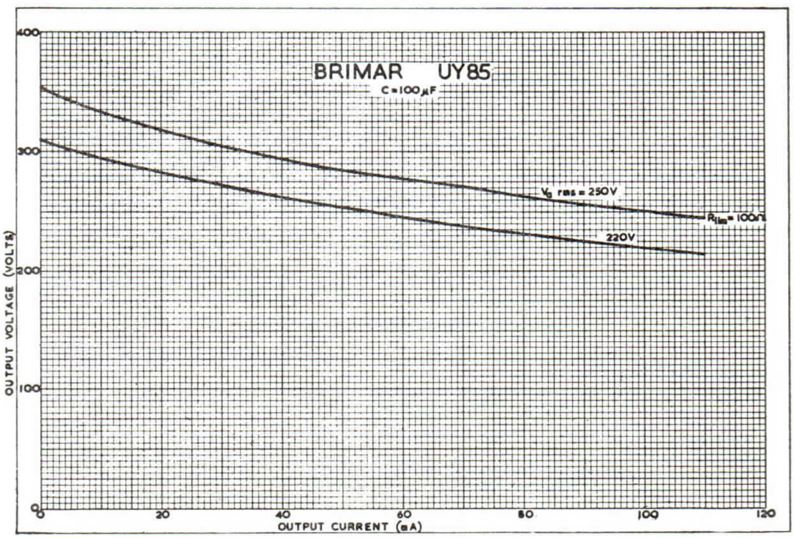
Heater Current	0.1 amp.
Heater Voltage	38 volts

RATINGS

Maximum P.I.V.	700 volts
Maximum Output Current	110 mA
Maximum Peak Current	660 mA
Maximum Heater Cathode Voltage (cathode positive)	550 volts

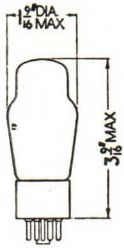
OPERATING CHARACTERISTICS

Input Voltage...	250 volts
Output Current	110 mA
Output Voltage	245 volts
Reservoir Capacitor	100 μF
Limiting Resistor	100 ohms

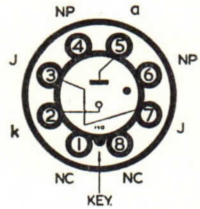


BRIMAR VALVES

Current Equipment Type



TYPE **VR75/30**
(OCTAL BASE)
VOLTAGE REGULATOR



The VR75/30 is a cold-cathode, gas-filled, voltage-stabiliser for use in industrial and radio equipment where a stable source of voltage is required. It is equivalent to the U.S.A. OA3 type.

CHARACTERISTICS

Maximum striking voltage	105 volts
Maximum stabilising voltage at 40 mA	81 volts
Minimum stabilising voltage at 5 mA	70 volts
Nominal stabilising voltage	75 volts
D.C. operating current	5 to 40 mA
Maximum peak current (10 seconds max.)	100 mA
Nominal regulation 5 to 30 mA	3 volts
Maximum regulation 5 to 30 mA	4.5 volts
Nominal regulation 5 to 40 mA	4.5 volts
Maximum regulation 5 to 40 mA	6.5 volts
Nominal drift in stabilising voltage (100 to 1 000 hours)	+1.1 volts
Temperature coefficient −20 to +70°C	±7 mV/°C
Ambient temperature range	−55 to +70°C

NOTE

With suitable socket connections the internal connection between pins 3 and 7 acts as a switch to open the supply or load circuit when the valve is removed.

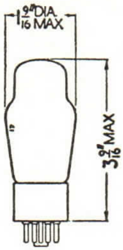
Not less than the maximum striking voltage should be provided to ensure starting during life.

Sufficient resistance must always be kept in series with this type to limit the current through the valve to 40 mA under steady state conditions. As stated above during the initial warming up period a maximum current of 100 mA is permissible providing that a period of several minutes duration of operation at normal current follows.

Operation with reversed polarity will damage this valve.

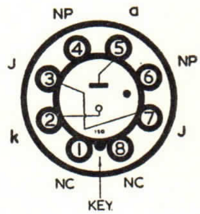
Type VR75/30 *is a commercial equivalent to the* CV3798.

BRIMAR VALVES



Current Equipment Type

TYPE **VR105/30** (OCTAL BASE) VOLTAGE REGULATOR



The VR105/30 is a cold-cathode, gas-filled, voltage-stabiliser for use in industrial and radio equipment where a stable source of voltage is required. It is equivalent to the U.S.A. OC3 type.

CHARACTERISTICS

Maximum striking voltage	127 volts
Minimum applied supply voltage	133 volts
Maximum stabilising voltage at 40 mA	112 volts
Minimum stabilising voltage at 5 mA	105 volts
Nominal stabilising voltage	108 volts
D.C. operating current	5 to 40 mA
Maximum peak current (10 seconds max.)	100 mA
Nominal regulation, 5 to 30 mA	1 volt
Maximum regulation, 5 to 30 mA	2 volts
Nominal regulation, 5 to 40 mA	1.3 volts
Maximum regulation, 5 to 40 mA	4 volts
Nominal drift in stabilising voltage (100 to 1 000 hours) ...	0.75 volts
Temperature coefficient, −20 to +70°C	±5 mV/°C
Ambient temperature range	−55 to +70°C

NOTE

With suitable socket connections the internal connection between pins 3 and 7 acts as a switch to open the supply or load circuit when the valve is removed.

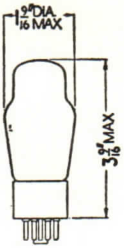
Not less than the quoted minimum supply voltage should be provided to ensure starting during life.

Sufficient resistance must always be kept in series with this type to limit the current through the valve to 40 mA under steady state conditions. As stated above during the initial warming up period a maximum current of 100 mA is permissible providing that a period of several minutes duration of operation at normal current follows.

Operation with reversed polarity will damage this valve.

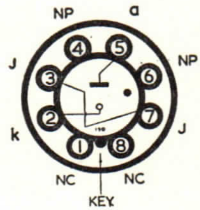
Type VR105/30 *is a commercial equivalent to the* CV686.

BRIMAR VALVES



Current Equipment Type

TYPE **VR150/30**
(OCTAL BASE)
VOLTAGE REGULATOR



The VR150/30 is a cold-cathode, gas-filled, voltage-stabiliser for use in industrial and radio equipment where a stable source of voltage is required. It is equivalent to the U.S.A. OD3 type.

CHARACTERISTICS

Maximum striking voltage ...	180 volts
Minimum applied supply voltage ...	185 volts
Maximum stabilising voltage at 40 mA ...	162 volts
Minimum stabilising voltage at 5 mA ...	145 volts
Nominal stabilising voltage ...	150 volts
D.C. operating current ...	5 to 40 mA
Maximum peak current (10 seconds max.) ...	100 mA
Nominal regulation, 5 to 30 mA ...	1.5 volts
Maximum regulation, 5 to 30 mA ...	4 volts
Maximum regulation, 5 to 40 mA ...	5.5 volts
Nominal drift in stabilising voltage (100 to 1 000 hours) ...	2.25 volts
Temperature coefficient, −20 to +70°C ...	−25 mV/°C
Ambient temperature range ...	−55 to +70°C

NOTE

With suitable socket connections the internal connection between pins 3 and 7 acts as a switch to open the supply or load circuit when the valve is removed.

Not less than the quoted minimum supply voltage should be provided to ensure starting during life.

Sufficient resistance must always be kept in series with this type to limit the current through the valve to 40 mA under steady state conditions. As stated above during the initial warming up period a maximum current of 100 mA is permissible providing that a period of several minutes duration of operation at normal current follows.

Operation with reversed polarity will damage this valve.

Type VR150/30 *is a commercial equivalent to the* CV216.

CHARACTERISTICS OF MAINTENANCE TYPES

THORN—AEI RADIO VALVES & TUBES LTD.

ABRIDGED CHARACTERISTICS OF MAINTENANCE TYPES

BRIMAR

TYPE NUMBER	APPLICATION	Heater V	Heater A	Anode Voltage Normal	Screen Voltage Normal	Grid Voltage Normal	Amplification Factor	Mutual Conductance mA/V	Optimum Load Ohms	Auto Bias Resistor	Power Output Watts
OZ4	Car Radio Rectifier	—	—	Max. A.C. Voltage per Anode 350V r.m.s. Rectified Current 30mA Min. 75mA Max.							
1AC6/DK92	Battery Heptode F.C.	1.4	0.05	85	60	0/−6	—	325†	—	—	—
1R5/DK91	Battery Heptode F.C.	1.4	0.05	90	67.5	0/−14	—	300†	—	—	—
1S5/DAF91	Battery Diode Pen.	1.4	0.05	67.5	67.5	0	—	0.63	—	—	—
1T2/R16	E.H.T. Rectifier	1.4	0.14	Max. P.I.V. 15 kV				Max. D.C. Output 2mA			
1T4/DF91	Battery Pentode	1.4	0.05	90	67.5	0/−16	—	0.9	—	—	—
1U5	Battery Diode Pen.	1.4	0.05	90	67.5	0	—	0.63	—	—	—
3A5/DCC90	Double Triode	2.8 1.4	0.11 0.22	90	—	−2.5	15	1.8	—	—	—
3S4/DL92	Battery Beam Tet.	1.4 2.8	0.1 0.05	90	67.5	−7	—	1.58	8,000	—	0.27
3V4/DL94	Battery Beam Tet.	1.4 2.8	0.1 0.05	90	90	−4.5	—	2.0	10,000	—	0.24
5Y3GT	A.C. Rectifier	5	2	Max. A.C. Voltage per Anode 350V r.m.s. Max. D.C. Output 125mA							
6AB8/ECL80	Triode Output Pen.	6.3	0.3	(P) 200 (T) 100	200 —	−8 −2.3	— 17.5	3.3 1.4	— —	— —	— —
6AK5	R.F. Pentode	6.3	0.175	180	120	−2/−8.5	—	5.1	—	180	—
6AM5	Power Pentode	6.3	0.2	250	250	−13.5	—	2.6	16,000	680	1.4
6AV6	Dbl. Diode Triode	6.3	0.3	250	—	−2	100	1.6	—	—	—
6BG6G	Line Output Tet.	6.3	0.9	300	250	−18	—	6	—	—	—
6J5G	Triode	6.3	0.3	250	—	−8	20	2.6	—	—	—
6K7G	R.F. Pentode	6.3	0.3	250	125	−3/−52	—	1.65	—	200	—
6K8G	Triode Hexode F.C.	6.3	0.3	250	100	−3/−30	—	360†	—	300	—
6Q7G	Dbl. Diode Triode	6.3	0.3	250	—	−3	70	1.2	—	—	—
6SL7GT	Double Triode	6.3	0.3	250	—	−2	70	1.6	—	—	—
6SN7GT	Double Triode	6.3	0.6	250	—	−8	20	2.6	—	—	—
6U4GT	Booster Diode	6.3	1.2	Pulse P.I.V. 3,850				Max. D.C. Output 138mA			
6U5/6G5	Tuning Indicator	6.3	0.3	250	—	0/−22	—	—	—	—	—
6V6G	Output Beam Tet.	6.3	0.45	250	250	−12.5	—	4.1	5,000	240	4.5
6X5G/EZ35	A.C. Rectifier	6.3	0.6	Max. A.C. Voltage per Anode 325V r.m.s. Max. D.C. Output 70mA							
7B7	R.F. Pentode	6.3	0.15	250	100	−3/−40	—	1.75	—	330	—
7C5	Output Beam Tet.	6.3	0.45	250	250	−12.5	—	4.1	5,000	240	4.5
7C6	Dbl. Diode Triode	6.3	0.15	250	—	−1	100	1	—	—	—
7S7	Triode Heptode F.C.	6.3	0.3	250	100	−2/−21	—	530†	—	200	—
7Y4	A.C. Rectifier	6.3	0.5	Max. A.C. Voltage per Anode 325V r.m.s. Max. D.C. Output 70mA							
9BW6	Output Tetrode	9	0.3	250	250	−12.5	—	4.1	5,000	250	4.5
9D6	R.F. Pentode	6.3	0.2	250	200	−2.5/−28	—	2.5	—	250	—

† Conversion Conductance in Micromhos

BRIMAR

BASE CONNECTIONS OF MAINTENANCE TYPES

TYPE NUMBER	BASE	Pin Connections 1	2	3	4	5	6	7	8	9	T.C.
0Z4	Octal	M	NP	a′	NP	a″	NP	NC	k	—	—
1AC6/DK92	B7G	f−	a	g_2	g_1	g_4	g_3	f+ g_5	—	—	—
1R5/DK91	B7G	g_5 f−	a	g_2 g_4	g_1	g_5 f−	g_3	f+	—	—	—
1S5/DAF91	B7G	g_3 f−	NC	ad	g_2	a	g_1	f+	—	—	—
1T2/R16	Wire ended										
1T4/DF91	B7G	g_3 f−	a	g_2	NC	g_3 f−	g_1	f+	—	—	—
1U5	B7G	g_3 f−	a	g_2	ad	NC	g_1	f+	—	—	—
3A5/DCC90	B7G	f−	a″	g″	f_{ct}	g′	a′	f+	—	—	—
3S4/DL92	B7G	f−	a	g_1	g_2	f_{tap}, bp	a	f+	—	—	—
3V4/DL94	B7G	f−	a	g_2	NC	f_{tap}, bp	g_1	f+	—	—	—
5Y3GT	Octal	NC	f	NP	a″	NP	a′	NP	f	—	—
6AB8/ECL80	B9A	a_t	g_t	k	h	h	a_p	g_3	g_2	g_1	—
6AK5	B7G	g_1	k, g_3, s	h	h	a	g_2	k, g_3, s	—	—	—
6AM5	B7G	g_1	k, g_3	h	h	a	NC	g_2	—	—	—
6AV6	B7G	g	k	h	h	a″d	a′d	a	—	—	—
6BG6G	Octal	NC	h	k	NP	g_1	NP	h	g_2	—	a
6J5G	Octal	NC	h	a	NP	g	NP	h	k	—	—
6K7G	Octal	NC	h	a	g_2	g_3	NP	h	k	—	g_1
6K8G	Octal	NC	h	a_h	g_2, g_4	g_1	a_t	h	k	—	g_3
6Q7G	Octal	NC	h	a	a″d	a′d	NP	h	k	—	g
6SL7GT	Octal	g_2	a″	k″	g′	a′	k′	h	h	—	—
6SN7GT	Octal	g″	a″	k″	g′	a′	k′	h	h	—	—
6U4GT	Octal	NC	NP	k	NP	a	NP	h	h	—	—
6U5/6G5	U.X.6	h	a	g	t	k	h	—	—	—	—
6V6G	Octal	NC	h	a	g_2	g_1	NP	h	k, bp	—	—
6X5G/EZ35 KT	Octal	NC	h	a″	NP	a′	NP	h	k	—	—
7B7	Loctal	h	a	g_2	g_3	s	g_1	k	h	—	—
7C5	Loctal	h	a	g_2	NC	NC	g_1	k, bp	h	—	—
7C6	Loctal	h	a	g	k	a″d	a′d	k	h	—	—
7S7	Loctal	h	a_h	a_t	g_3, g_t	g_4, g_2	g_1h	k, g_5, s	h	—	—
7Y4	Loctal	h	NC	a″	NC	NC	a′	k	h	—	—
9BW6	B9A	IC	g_1	k	h	h	NC	a	g_2	bp	—
9D6	B7G	g_1	k	h	h	a	g_3, s	g_2	—	—	—

ABRIDGED CHARACTERISTICS OF MAINTENANCE TYPES

BRIMAR

TYPE NUMBER	APPLICATION	Heater V	Heater A	Anode Voltage Normal	Screen Voltage Normal	Grid Voltage Normal	Amplification Factor	Mutual Conductance mA/V	Optimum Load Ohms	Auto Bias Resistor	Power Output Watts
12AV6	Dbl. Diode Triode	12.6	0.15	250	—	−2	100	1.6	—	—	—
12K7GT	R.F. Pentode	12.6	0.15	250	125	−3/−52	—	1.65	—	200	—
12K8GT	Triode Hex. F.C.	12.6	0.15	250	100	−3/−30	—	360†	—	300	—
12Q7GT	Dbl. Diode Triode	12.6	0.15	250	—	−3	70	1.2	—	—	—
12SL7GT	Double Triode	12.6	0.15	250	—	−2	70	1.6	—	—	—
14S7	Triode Hep. F.C.	12.6	0.15	250	100	−2/−21	—	530†	—	220	—
17Z3/PY81	Booster Diode	17	0.3	Pulse P.I.V. 4.5 kV				Max. D.C. Output 150mA			
25L6GT	Output Beam Tet.	25	0.3	110	110	−7.5	—	8.0	1,500	150	2.1
35L6GT	Output Beam Tet.	35	0.15	200	110	−8	—	5.9	4,500	185	3.3
35Z4GT	A.C. Rectifier	35	0.15	Max. A.C. Voltage per Anode 250V r.m.s. Max. D.C. Output 100mA							
50CD6G	Line Output Tet.	50	0.3	200	150	−30	—	6.7	—	—	—
50L6GT	Output Beam Tet.	50	0.15	200	110	−8	—	9.5	3,000	150	4.3
80	A.C. Rectifier	5	2	Max. A.C. Voltage per Anode 350V r.m.s. Max. D.C. Output 125mA							
807	Beam Power Amp.	6.3	0.9	400	300	−25	—	6.0	3,200*	—	55*
DAF91/1S5	Battery Diode Pen.	1.4	0.05	67.5	67.5	0	—	0.63	—	—	—
DAF96	Battery Diode Pen.	1.4	0.025	67.5	67.5	−1.5	—	0.17	—	—	—
DCC90/3A5	Double Triode	2.8 1.4	0.11 0.22	90	—	−2.5	15	1.8	—	—	—
DF91/1T4	Battery Pentode	1.4	0.05	90	67.5	0/−16	—	0.9	—	—	—
DF96	Battery Pentode	1.4	0.025	85	64	0/−5.5	—	0.85	—	—	—
DK91/1R5	Battery Hep. F.C.	1.4	0.05	90	67.5	0/−14	—	300†	—	—	—
DK92/1AC6	Battery Hep. F.C.	1.4	0.05	85	60	0/−6	—	325†	—	—	—
DK96	Battery Hep. F.C.	1.4	0.025	85	68	0	—	300†	—	—	—
DL92/3S4	Battery Beam Tetrode	1.4 2.8	0.1 0.05	90	67.5	−7	—	1.58	8,000	—	0.27
DL94/3V4	Battery Beam Tetrode	1.4 2.8	0.1 0.05	90	90	−4.5	—	2.0	10,000	—	0.24
DL96	Battery Output Pen.	1.4 2.8	0.05 0.025	85	85	−5.2	—	1.4	13,000	—	0.2
EBC41	Dbl. Diode Triode	6.3	0.23	250	—	−3	70	1.3	—	—	—
EBC81	Dbl. Diode Triode	6.3	0.23	250	—	−3	70	1.2	—	—	—
EBF80	Dbl. Diode Pen.	6.3	0.3	250	85	−2	—	2.2	—	—	—
ECH42	Triode Hex. F.C.	6.3	0.23	250	85	−2	—	750†	—	—	—
ECL80/6AB8	Triode Output Pen.	6.3	0.3	(P) 200 (T) 100	200 —	−8 −2.3	— 17.5	3.3 1.4	— —	— —	— —
ECL83	Triode Pentode	6.3	0.6	(P) 170 (T) 170	170 —	−9.5 −1.5	— 82	5.5 2.1	— —	— —	— —
EF41	R.F. Pentode	6.3	0.2	250	100	−2.5/−39	—	2.2	—	—	—
EF804	A.F. Pentode	6.3	0.2	250	140	−2	—	2	—	—	—

* For 2 valves in class AB2 † Conversion Conductance in Micromhos

BASE CONNECTIONS OF MAINTENANCE TYPES

TYPE NUMBER	BASE	Pin Connections									
		1	2	3	4	5	6	7	8	9	T.C.
12AV6	B7G	g	k	h	h	$a''d$	$a'd$	a	—	—	—
12K7GT	Octal	NC	h	a	g_2	g_3	NP	h	k	—	g_1
12K8GT	Octal	NC	h	ah	g_2, g_4	g_1	at	h	k	—	g_3
12Q7GT	Octal	NC	h	a	$a''d$	$a'd$	NP	h	k	—	g
12SL7GT	Octal	g_2''	a''	k''	g'	a'	k'	h	h	—	—
14S7	Loctal	h	a_h	a_t	g_3, g_t	g_4, g_2	$g_1 h$	k, g_5, s	h	—	—
17Z3/PX81	B9A	IC	IC	IC	h	h	IC	IC	IC	a	k
25L6GT	Octal	NC	h	a	g_2	g_1	NP	h	k, bp	—	—
35L6GT	Octal	NC	h	a	g_2	g_1	NP	h	k, bp	—	—
35Z4GT	Octal	NC	h	NC	NP	a	NP	h	k	—	—
50CD6G	Octal	NC	h	k, bp	NP	g_1	NP	h	g_2	—	a
50L6GT	Octal	NC	h	a	g_2	g_1	NP	h	k, bp	—	—
80	U.X.4	f	a''	a'	f	—	—	—	—	—	—
807	U.X.5	h	g_2	g_1	k, bp	h	—	—	—	—	a
DAF91/1S5	B7G	g_3 f−	NC	a_d	g_2	a	g_1	f+	—	—	—
DAF96	B7G	f− g_3	IC	a_d	g_2	a	g_1	f+	—	—	—
DCC90/3A5	B7G	f−	a''	g''	fct	g'	a'	f+	—	—	—
DF91/1T4	B7G	g_3 f−	a	g_2	NC	g_3 f−	g_1	f+	—	—	—
DF96	B7G	f− g_3	a	g_2	IC	f− g_3	g_1	f+	—	—	—
DK91/1R5	B7G	g_5 f−	a	g_2, g_4	g_1	f− g_5	g_3	f+	—	—	—
DK92/1AC6	B7G	f−	a	g_2	g_1	g_4	g_3	f+ g_5	—	—	—
DK96	B7G	f−	a	g_2	g_1	g_4	g_3	f+ g_5	—	—	—
DL92/3S4	B7G	f−	a	g_1	g_2	f_{tap}, bp	a	f+	—	—	—
DL94/3V4	B7G	f−	a	g_2	NC	f_{tap}, bp	g_1	f+	—	—	—
DL96	B7G	f−	a	g_2	NC	f_{tap}, g_3	g_1	f+	—	—	—
EBC41	B8A	h	a	g	s	a'' d	a' d	k	h	—	—
EBC81	B9A	a	g	k	h	h	a' d	s	a'' d	IC	—
EBF80	B9A	g_2	g_1	k, s	h	h	a	a' d	a'' d	g_3	—
ECH42	B8A	h	a_h	a_t	g_3, g_t	g_2, g_4	g_1	k	h	—	—
ECL80/6AB8	B9A	a_t	g_t	k	h	h	a_p	g_3	g_2	g_1	—
ECL83	B9A	a_t	g_t	k_t	h	h	a_p	k_p, g_3	g_2	g_1	—
EF41	B8A	h	a	k, g_3, s	k, g_3, s	g_2	g_1	k, g_3, s	h	—	—
EF804	B9A	g_3	s	k	h	h	s	a	g_2	g_1	—

ABRIDGED CHARACTERISTICS OF MAINTENANCE TYPES

BRIMAR

TYPE NUMBER	APPLICATION	Heater V	Heater A	Anode Voltage Normal	Screen Voltage Normal	Grid Voltage Normal	Amplification Factor	Mutual Conductance mA/V	Optimum Load Ohms	Auto Bias Resistor	Power Output Watts
EL41	Output Pentode	6.3	0.7	250	250	−7	—	10	7,000	—	4.2
EM81	Tuning Indicator	6.3	0.3	250	250	−1/−10.5	—	—	—	—	—
EM85	Tuning Indicator	6.3	0.3	250	—	0/−18	—	—	—	—	—
EY51/R12	E.H.T. Rectifier	6.3	0.09	Max. P.I.V. 17 kV				Max. D.C. Output 0.35mA			
EZ35/6X5GT	A.C. Rectifier	6.3	0.6	Max. A.C. Voltage per Anode 325V r.m.s. Max. D.C. Output 70mA							
EZ40	A.C. Rectifier	6.3	0.6	Max. A.C. Voltage per Anode 350V r.m.s. Max. D.C. Output 90mA							
PCL83	Triode Pentode	12.6	0.3	(P) 170 (T) 170	170 —	−9.5 −1.6	— 82	5.5 2.1	— —	— —	— —
PL82	Output Pentode	16.5	0.3	170	170	−10.4	—	9	3,000	—	4
PY32	A.C. Rectifier	29	0.3	Max. A.C. Voltage 250V r.m.s. Max. D.C. Output 325mA							
PY81/17Z3	Booster Diode	17	0.3	Pulse P.I.V. 4.5 kV				Max. D.C. Output 150mA			
PY82	A.C. Rectifier	19	0.3	Max. A.C. Voltage 250V r.m.s. Max. D.C. Output 250mA							
R12/EY51	E.H.T. Rectifier	6.3	0.09	Max. P.I.V. 17 kV				Max. D.C. Output 0.35mA			
R16/1T2	E.H.T. Rectifier	1.4	0.14	Max. P.I.V. 15 kV				Max. D.C. Output 2mA			
R17	A.C. Rectifier	6.3	0.8	Max. A.C. Voltage 500V r.m.s. Max. D.C. Output 125mA (at 350V r.m.s.)							
R18	A.C. Rectifier	6.3	1.1	Max. A.C. Voltage 625V r.m.s. Max. D.C. Output 150mA (at 500V r.m.s.)							
R19	E.H.T. Rectifier	1.25	0.2	Max. P.I.V. 25 kV				Max. D.C. Output 2mA			
UBC41	Dbl. Diode Triode	14	0.1	170	—	−1.6	70	1.65	—	—	—
UBC81	Dbl. Diode Triode	14	0.1	170	—	−1.6	70	1.65	—	—	—
UCH42	Triode Hex. F.C.	14	0.1	200	85	−2	—	750†	—	—	—
UF41	R.F. Pentode	12.6	0.1	200	116	−3/−34	—	2.3	—	—	—
UF80	R.F. Pentode	19	0.1	200	200	−2.55	—	7.1	—	—	—
UL41	Power Pentode	45	0.1	200	200	−14.2	—	8.2	4,300	—	4.2
UM80	Tuning Indicator	19	0.1	200	200	−1/−14	—	—	—	—	—
UY41	H.W. Rectifier	31	0.1	Max. A.C. Voltage 250V r.m.s. Max. D.C. Output 100mA							

† Conversion Conductance in Micromhos

BASE CONNECTIONS OF MAINTENANCE TYPES

TYPE NUMBER	BASE	Pin Connections									
		1	2	3	4	5	6	7	8	9	T.C.
EL41	B8A	h	a	IC	IC	g_2	g_1	k, g_3	h	—	—
EM81	B9A	g	k, g′	IC	h	h	IC	a	IC	t	—
EM85	B9A	g	IC	k	h	h	t	def.	IC	a	—
EY51/R12	Wire ended										
EZ35/6X5G T	Octal	NC	h	a″	NP	a′	NP	h	k	—	—
EZ40	B8A	h	a′	IC	IC	IC	a″	k	h	—	—
PCL83	B9A	a_t	g_t	k_t	h	h	ap	kp, g_3	g_2	g_1	—
PL82	B9A	IC	g_1	k, g_3	h	h	IC	a	IC	g_2	—
PY32	Octal	NP	h	a	NP	a	NP	h	k	—	—
PY81/17Z3	B9A	IC	IC	IC	h	h	IC	IC	IC	a	k
PY82	B9A	IC	IC	k	h	h	IC	IC	IC	a	—
R12/EY51	Wire ended										
R16/1T2	Wire ended										
R17	B9A	IC	IC	k	h	h	IC	IC	IC	IC	a
R18	B9A	IC	IC	k	h	h	IC	IC	IC	IC	[illegible]
R19	B9A	f, s	f	IC	f, s	f	f, s	IC	f	f, s	a
UBC41	Octal	h	a	g	s	a″ d	a′ d	k	h	—	—
UBC81	B9A	a	g	k	h	h	a′ d	s	a″ d	IC	—
UCH42	B8A	h	ah	a_t	g_3, g_t	g_2, g_4	g_1	k	h	—	—
UF41	B8A	h	a	IC	IC	g_2	g_1	k, g_3	h	—	—
UF80	B9A	k	g_1	k	h	h	s	a	g_2	g_3	—
UL41	B8A	h	a	IC	IC	g_2	g_1	k, g_3	h	—	—
UM80	B9A	g	k, g′	IC	h	h	IC	a	IC	t	—
UY41	B8A	h	a	IC	IC	IC	IC	k	h	—	—

BRIMAR

MAINTENANCE TELEVISION PICTURE TUBES

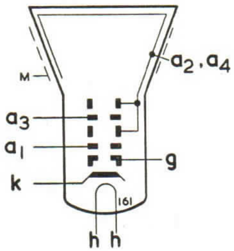
~~Superseded types still available for maintenance purposes~~

MAINTENANCE TELETUBES

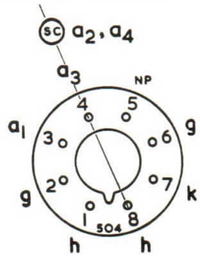
CLS 3M 8.67

Guide Card Issue 2

BRIMAR CATHODE RAY TUBES A47-13W



TELEVISION
PICTURE TUBE



B8H Base, CT8 Cap

GENERAL

Twin Panel	Tinted Grey Glass		
Deflection Angle	110° Diagonal		
Rectangular Face	19 in. Diagonal		
Light Transmission	65% Approximately		
Aluminised Screen	White Fluorescence		
Electrostatic Focus	Magnetic Deflection		
Short Neck	Straight Gun—non ion trap		
External Conductive Coating			
Heater Current	I_h	0·3	A
Heater Voltage	V_h	6·3	V

The cathode ray tube heater should always be connected at the chassis end if used in a series heater chain.

DESIGN CENTRE RATINGS

Maximum Second and Fourth Anode Voltage	$V_{a2,a4(max)}$	20*	kV
Minimum Second and Fourth Anode Voltage	$V_{a2,a4(min)}$	13	kV
Maximum Third Anode Voltage	$V_{a3(max)}$	+1000 to −500	V
Maximum First Anode Voltage	$V_{a1(max)}$	700	V
Maximum Heater to Cathode Voltage, Heater Negative (d.c.)	$V_{h\text{-}k(max)}$	250	V
Maximum Peak Heater to Cathode Voltage, Heater Negative	$v_{h\text{-}k(pk)max}$	400†‡	V
Maximum Impedance Grid to Cathode (50c/s)	$Z_{g\text{-}k(max)}$	0·5	MΩ
Maximum Resistance Grid to Cathode	$R_{g\text{-}k(max)}$	1·5	MΩ

All voltages referred to cathode.

* For $I_{a2+a4}=0$.

† Absolute rating.

‡ During a warming-up period not exceeding 45 seconds.

Note : The A47-13W is the AW47-91 with the addition of a tinted glass panel.

Tubes incorporating a B8H sparkguard base will have a suffix S after the type number. For details of the sparkguard base see separate sheet.

THORN — A E I RADIO VALVES & TUBES LTD.

INTER-ELECTRODE CAPACITANCES

		§	φ	
Cathode to all	$c_{k\text{-}all}$	3·0	3·5	pF
Grid to all	$c_{g\text{-}all}$	7·0	8·5	pF
Second and Fourth Anode to External Conductive Coating (approx.)	$c_{a2,a4\text{-}M}$	1250		pF

§ Inter-electrode capacitances with holder capacitance balanced out.

φ Total inter-electrode capacitances including AEI B8H holder VH68/81 (8 pin).

TYPICAL OPERATION—Grid Modulation (Voltage referred to cathode)

Second and Fourth Anode Voltage	$V_{a2,a4\text{-}k}$	18		18		kV
First Anode Voltage*	$V_{a1\text{-}k}$	400		500		V
Beam Current	I_{a2+a4}	350	500	350	500	μA
Third Anode Voltage Range for Focus	$V_{a3\text{-}k}$	0 to 400		0 to 400		V
Average Peak to Peak Picture Modulating Voltage		35·5	40·5	39·5	45	V
Grid to Cathode Voltage for Cut-off of Raster (See charts for limits)	$V_{g\text{-}k}$	−57		−69		V

TYPICAL OPERATION—Cathode Modulation (Voltage referred to grid)

Second and Fourth Anode Voltage	$V_{a2,a4\text{-}g}$	18		18		kV
First Anode Voltage*	$V_{a1\text{-}g}$	400		500		V
Beam Current	I_{a2+a4}	350	500	350	500	μA
Third Anode Voltage Range for Focus	$V_{a3\text{-}g}$	0 to 400		0 to 400		V
Average Peak to Peak Picture Modulating Voltage		31·5	35·5	34·5	39·5	V
Cathode to Grid Voltage for Cut-off of Raster (See charts for limits)	$V_{k\text{-}g}$	51		62		V

*Within this range a higher First Anode Voltage will provide an improved focus performance.

PICTURE CENTRING

Maximum magnet flux density at centre of neck should not be less than	17 G
Maximum distance of centre of magnetic field from reference line	53 mm

NOTE

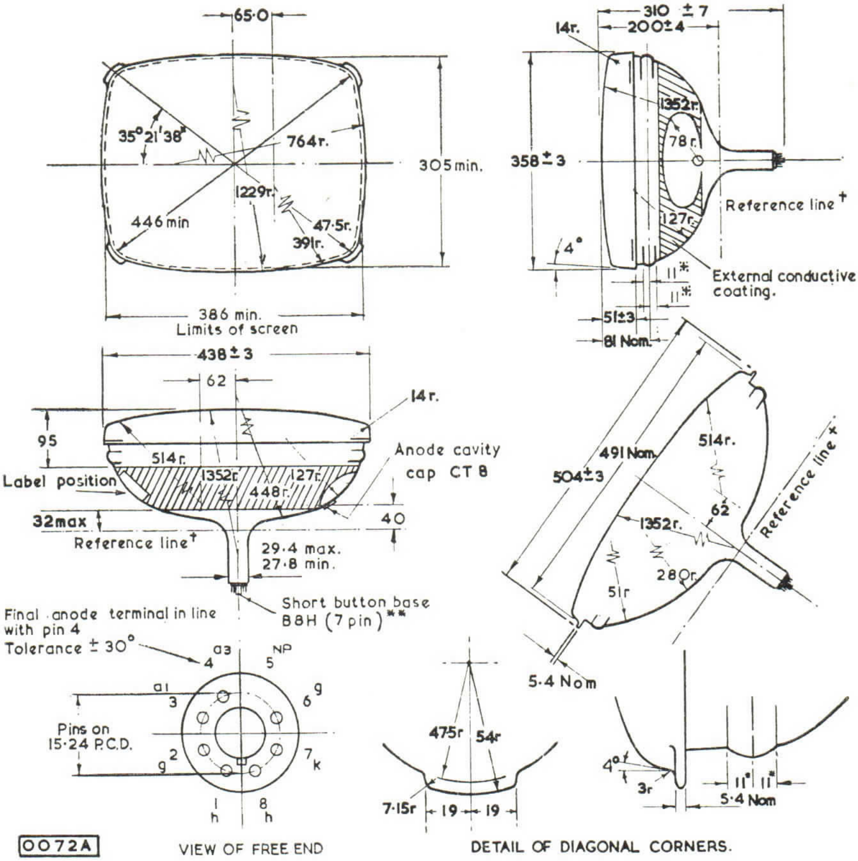
If this tube is operated at voltage in excess of 16kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

DEFLECTION ANGLES

Height	82°
Width	99°
Diagonal	110°

WEIGHT

Approximate Single Tube Weight : Net 22·5 lb (10·2 kg)



All dimensions in mm. Not to be scaled.

Notes :

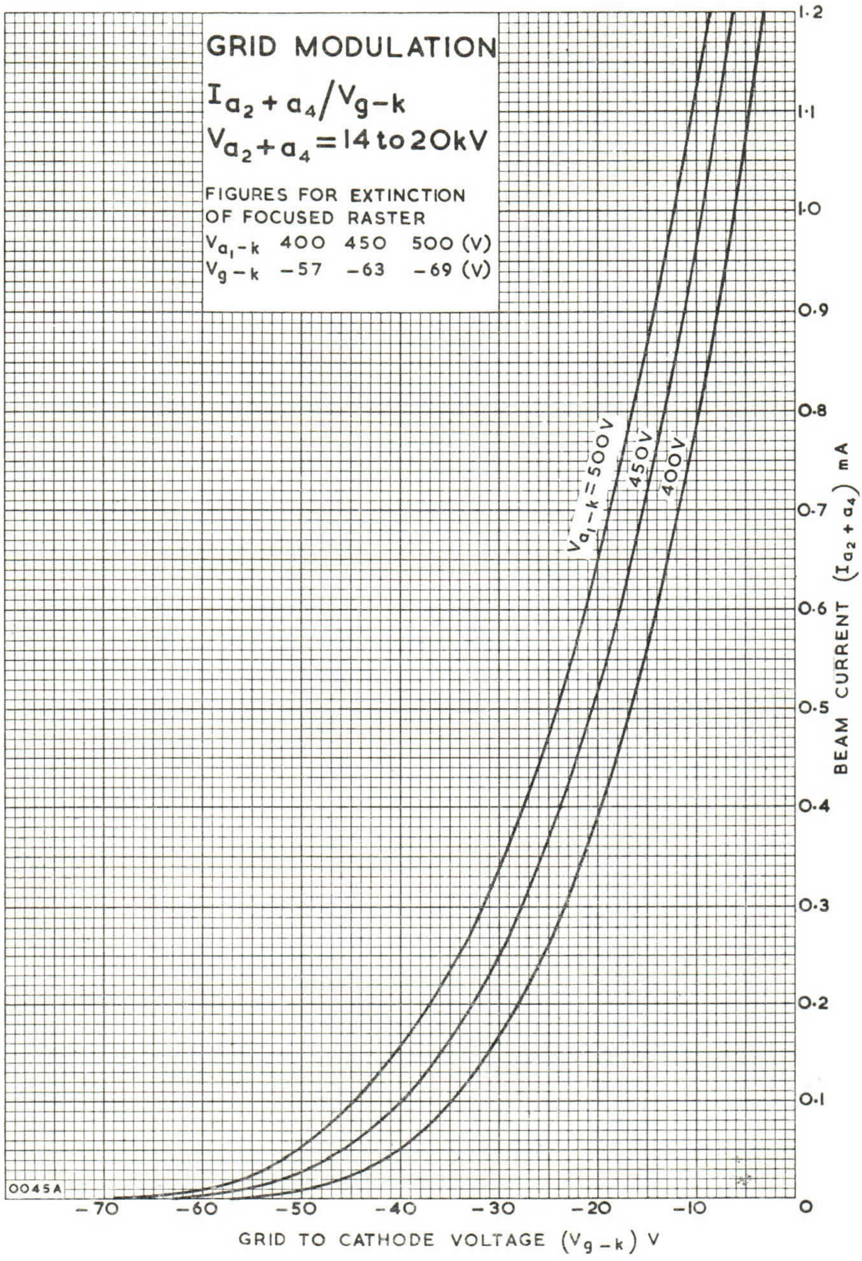
* During the face sealing operation the glass in this area (total 22mm) may be disturbed. As the shape of the contour within this area may be either convex or concave the bulb should not be gripped within this region unless special precautions are taken (such as the use of resilient packing material).

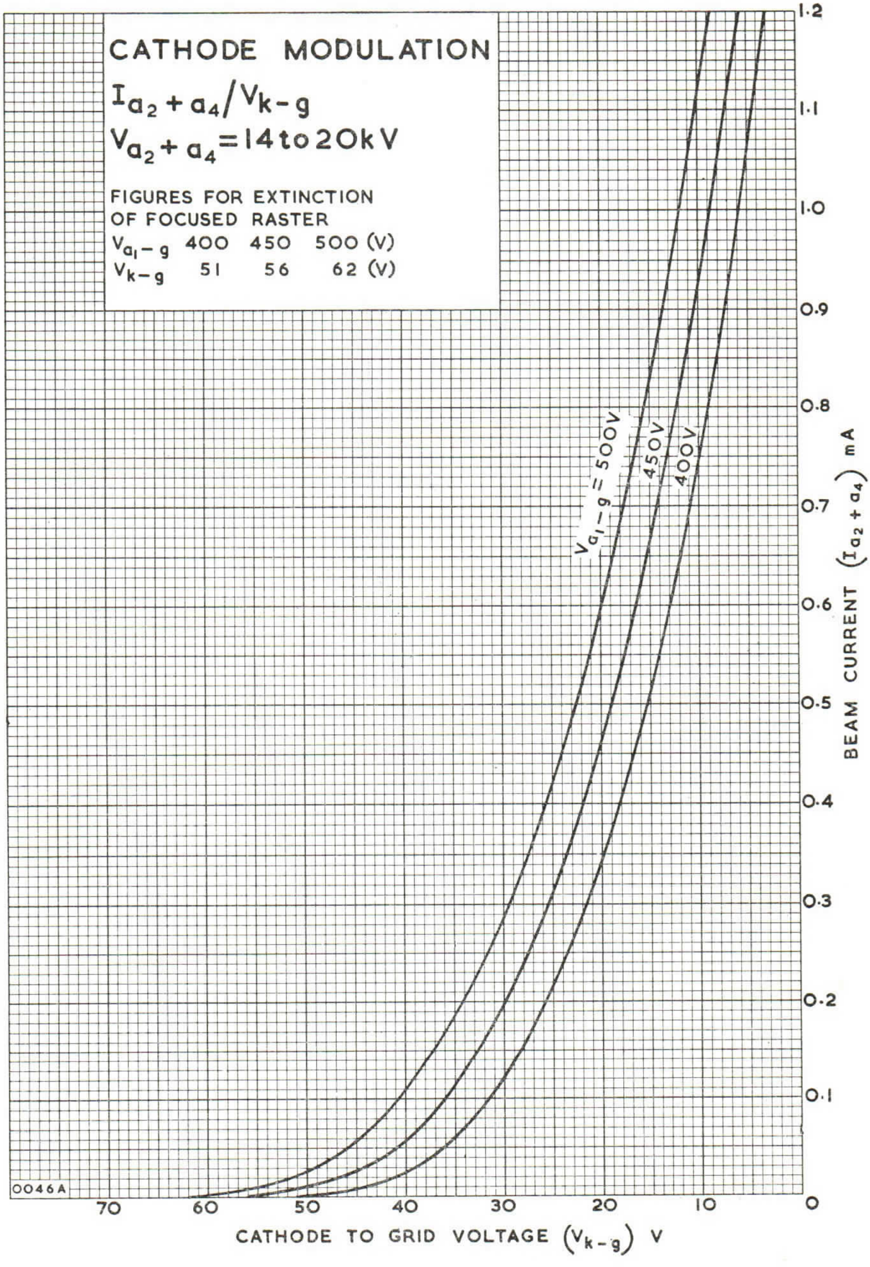
**The socket for the B8H button base should not be rigidly mounted, it should have flexible leads and be allowed to move freely. The design of the socket should be such that the wiring cannot impress lateral strains through the socket contacts on the base. Bottom circumference of base wafer will fall within a circle concentric with the bulb axis and having a diameter of 44mm.

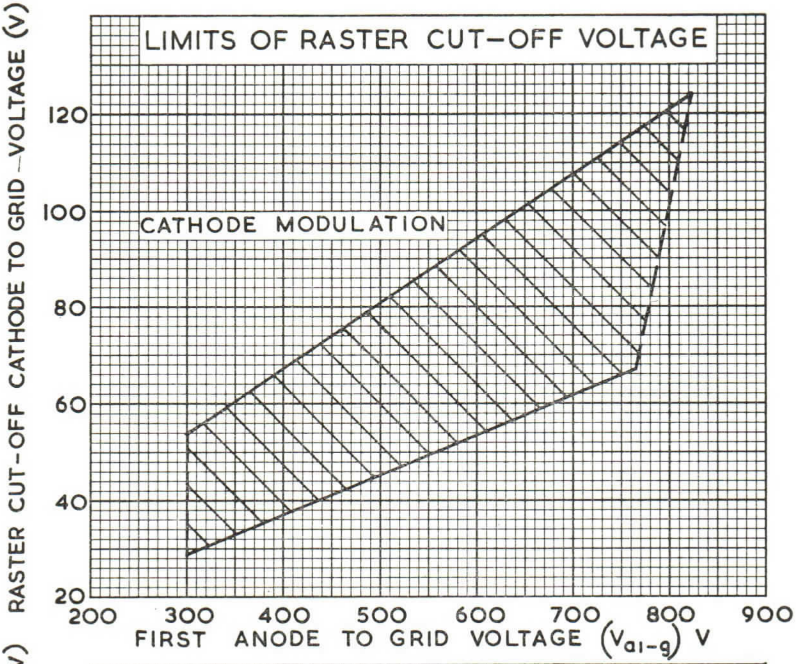
† Determined by Reference Gauge No. 16 (JEDEC 126).

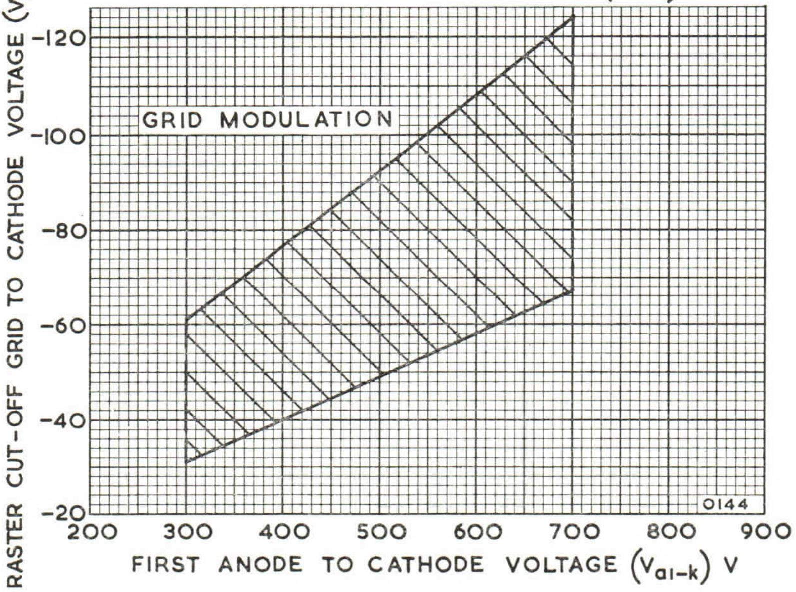
The tube may be supported by clamping to the mounting lugs provided at each corner of the protective panel.

Tube mounting clamps must be spaced from the tube by the use of cushioning pads.

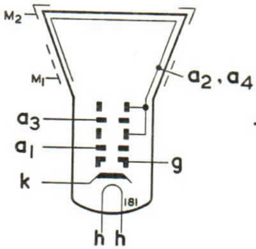

GRID MODULATION
$I_{a_2+a_4}/V_{g-k}$
$V_{a_2+a_4} = 14$ to 20kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
V_{a_1-k} 400 450 500 (V)
V_{g-k} −57 −63 −69 (V)
$V_{a_1-k} = 500$V
450V
400V
0045A
−70 −60 −50 −40 −30 −20 −10 0
GRID TO CATHODE VOLTAGE (V_{g-k}) V
1·2 1·1 1·0 0·9 0·8 0·7 0·6 0·5 0·4 0·3 0·2 0·1 0
BEAM CURRENT $(I_{a_2+a_4})$ mA


CATHODE MODULATION
$I_{a_2+a_4}/V_{k-g}$
$V_{a_2+a_4}$ = 14 to 20 kV
FIGURES FOR EXTINCTION
OF FOCUSED RASTER
V_{a_1-g} 400 450 500 (V)
V_{k-g} 51 56 62 (V)
V_{a_1-g} = 500V
450V
400V
0046A
70 60 50 40 30 20 10 0
CATHODE TO GRID VOLTAGE (V_{k-g}) V
1·2 1·1 1·0 0·9 0·8 0·7 0·6 0·5 0·4 0·3 0·2 0·1 0
BEAM CURRENT ($I_{a_2+a_4}$) mA

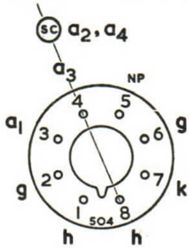

LIMITS OF RASTER CUT-OFF VOLTAGE
CATHODE MODULATION
RASTER CUT-OFF CATHODE TO GRID -VOLTAGE (V)
120
100
80
60
40
20
200 300 400 500 600 700 800 900
FIRST ANODE TO GRID VOLTAGE (V_{a1-g}) V


GRID MODULATION
RASTER CUT-OFF GRID TO CATHODE VOLTAGE (V)
-120
-100
-80
-60
-40
-20
0144
200 300 400 500 600 700 800 900
FIRST ANODE TO CATHODE VOLTAGE (V_{a1-k}) V

BRIMAR CATHODE RAY TUBES A47-25W



RIMGUARD II
TELEVISION PICTURE TUBE



B8H Base, CT8 Cap

GENERAL

Rectangular Face	19 in. Diagonal
Reinforced Envelope	Integral Mounting Lugs
Electrostatic Focus	Magnetic Deflection
Deflection Angle	110° Diagonal
Aluminised Screen	White Fluorescence
Grey Glass	50% Transmission (Approx.)
Straight Gun	Non Ion Trap

External Conductive Coating

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·3*	A

DESIGN CENTRE RATINGS

Maximum Second and Fourth Anode Voltage	$V_{a2,a4(max)}$	20†	kV
Minimum Second and Fourth Anode Voltage	$V_{a2,a4(min)}$	13	kV
Maximum Third Anode Voltage	$V_{a3(max)}$	+1000 to −500	V
Maximum First Anode Voltage	$V_{a1(max)}$	700	V
Maximum Heater to Cathode Voltage, Heater Negative (d.c.)	$V_{h\text{-}k(max)}$	250	V
Maximum Peak Heater to Cathode Voltage, Heater Negative	$v_{h\text{-}k(pk)max}$	400‡§	V
Maximum Impedance, Grid to Cathode (50 Hz)	$Z_{g\text{-}k(max)}$	0·5	MΩ
Maximum Resistance, Grid to Cathode	$R_{g\text{-}k(max)}$	1·5	MΩ

All voltages referred to cathode.

* The CRT heater should always be connected at the chassis end in a series heater chain.

† For $I_{a2+a4}=0$.

‡ Absolute rating.

§ During a warming-up period not exceeding 45 seconds.

The A47-25W is electrically identical to the AW47-91.

The mechanical fixing of this tube is interchangeable with other existing reinforced tubes.

Tubes incorporating a B8H sparkguard base will have a suffix S after the type number. For details of the sparkguard base see separate sheet.

INTER-ELECTRODE CAPACITANCES

		*	†	
Cathode to all	$c_{k\text{-}all}$	3·0	3·5	pF
Grid to all	$c_{g\text{-}all}$	7·0	8·5	pF
Anode 2 and Anode 4 to External Conductive Coating, M_1 (approx.)	$c_{a2,a4\text{-}M1}$	1000		pF
Anode 2 and Anode 4 to Shell, M_2 (approx.)	$c_{a2,a4\text{-}M2}$	250		pF

* Inter-electrode capacitances with holder capacitance balanced out.

† Total inter-electrode capacitances including an AEI B8H holder VH68/81 (8 pin).

TYPICAL OPERATION—Grid Modulation (Voltage referred to cathode)

Second and Fourth Anode Voltage	$V_{a2,a4\text{-}k}$	18		18		kV
First Anode Voltage‡	$V_{a1\text{-}k}$	400		500		V
Beam Current	I_{a2+a4}	350	500	350	500	µA
Third Anode Voltage Range for Focus	$V_{a3\text{-}k}$	0 to 400		0 to 400		V
Average Peak to Peak Picture Modulating Voltage		35·5	40·5	39·5	45	V
Grid to Cathode Voltage for cut-off of raster (See chart for limits)	$V_{g\text{-}k}$	−57		−69		V

TYPICAL OPERATION—Cathode Modulation (Voltage referred to grid)

Second and Fourth Anode Voltage	$V_{a2,a4\text{-}g}$	18		18		kV
First Anode Voltage ‡	$V_{a1\text{-}g}$	400		500		V
Beam Current	I_{a2+a4}	350	500	350	500	µA
Third Anode Voltage Range for Focus	$V_{a3\text{-}g}$	0 to 400		0 to 400		V
Average Peak to Peak Picture Modulating Voltage		31·5	35·5	34·5	39·5	V
Cathode to Grid Voltage for cut-off of raster (See chart for limits)	$V_{k\text{-}g}$	51		62		V

‡ Within this range a higher First Anode Voltage will provide an improved focus performance.

PICTURE CENTRING

Maximum magnet flux density at centre of neck should not be less than	17 G
Maximum distance of centre of magnetic field from reference line	53 mm

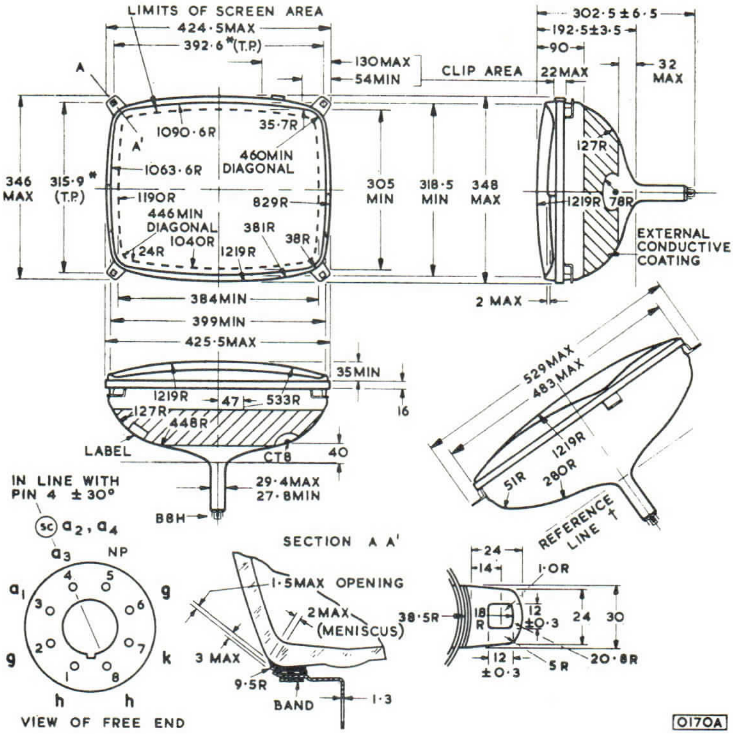
DEFLECTION ANGLES

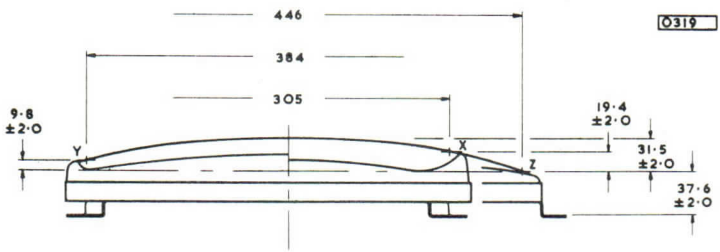
Height	82°
Width	99°
Diagonal	110°

TUBE WEIGHT (approx.)—Net 19lb (8·6 kg)

Note :

If this tube is operated at voltages in excess of 16 kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.





All dimensions in mm. Not to be scaled.

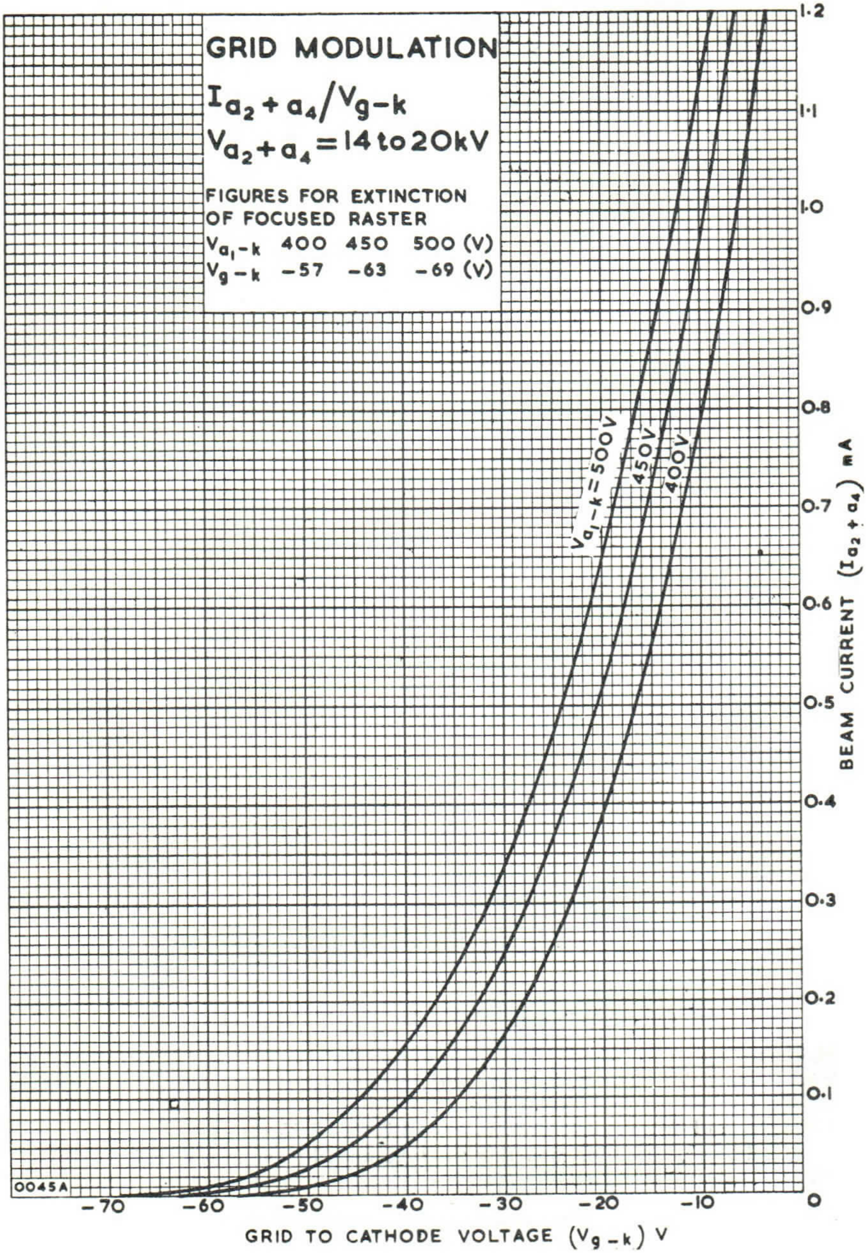
Notes :

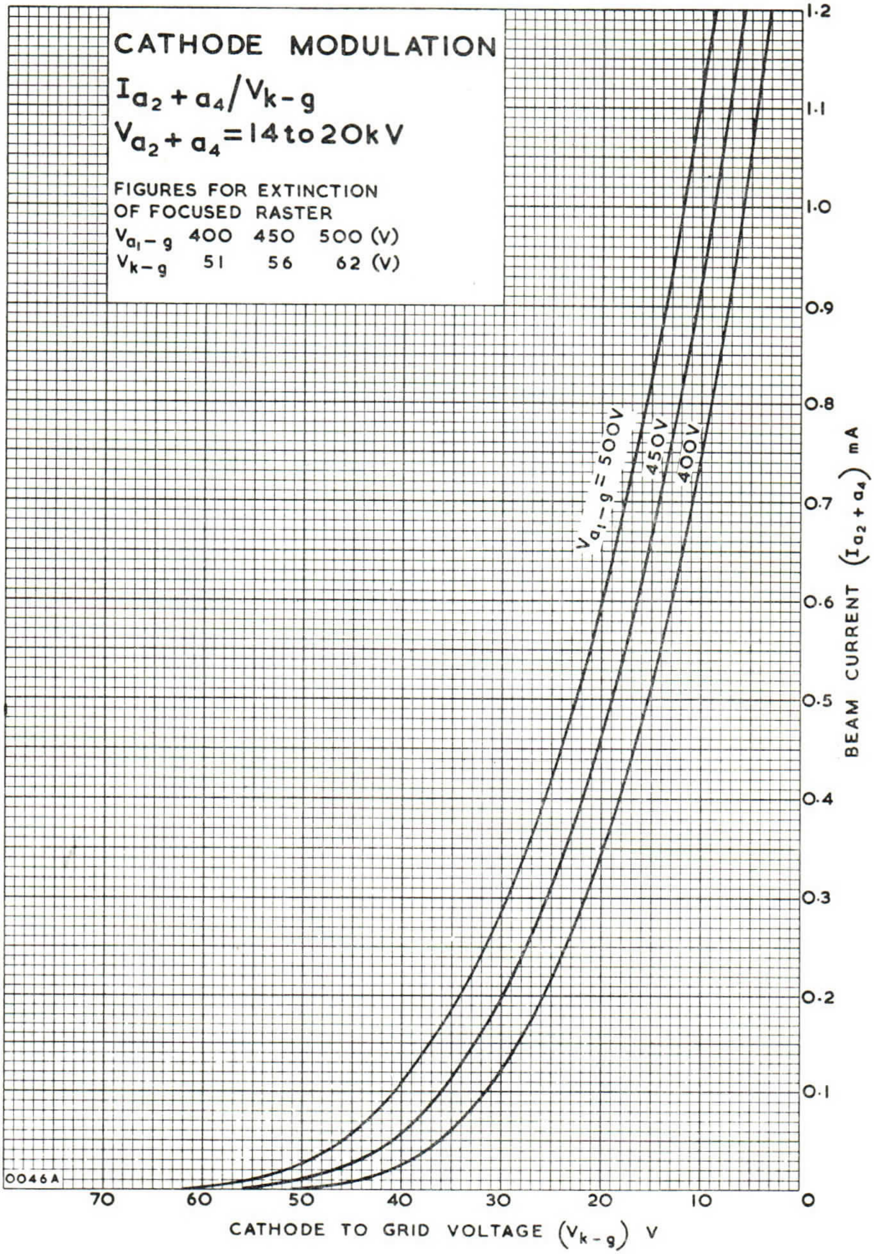
It is recommended that the mask used with this tube is flexible enough to take up small variations in fixing and bulb contours.

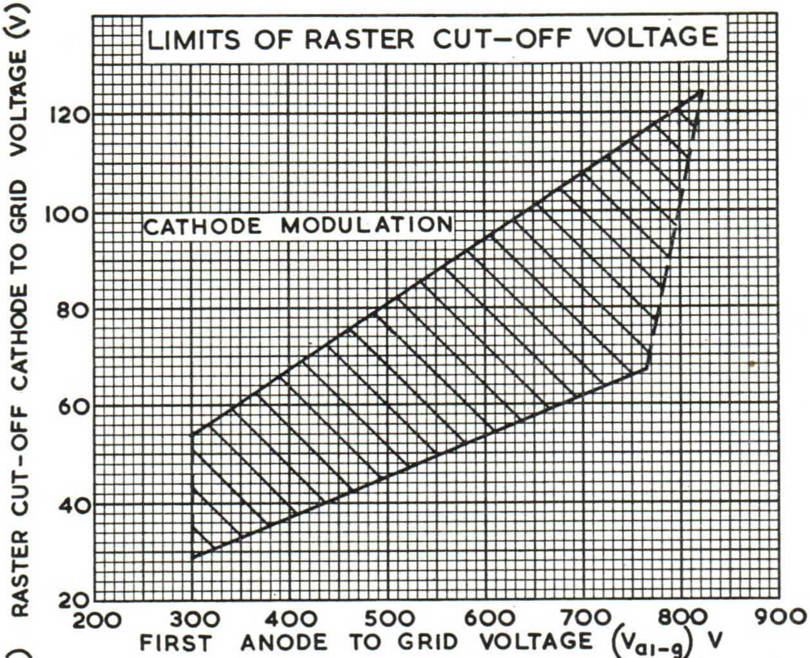
The metal shell M_2 must be connected to chassis via a 2MΩ resistor.

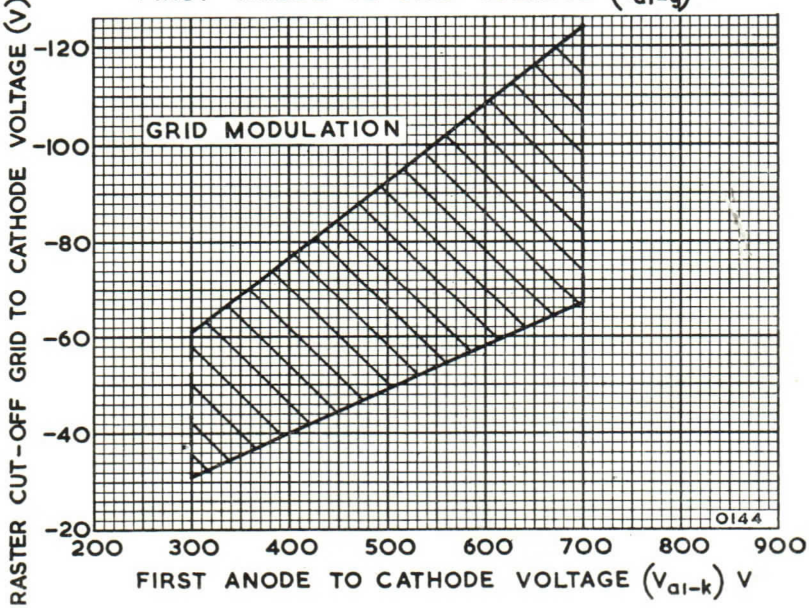
* The bolts to be used for mounting the tube must lie within the circles of 8·5 mm diameter centred on these true positions (Diagonal 504). One of the four lugs may deviate 2 mm maximum from the plane through the other three lugs.

† Determined by reference line gauge No. 16 (JEDEC No. 126).

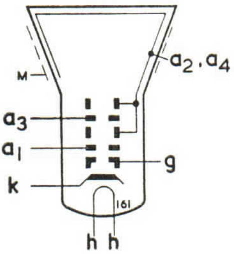

GRID MODULATION
$I_{a_2+a_4}/V_{g-k}$
$V_{a_2+a_4}$ = 14 to 20kV
FIGURES FOR EXTINCTION
OF FOCUSED RASTER
V_{a_1-k} 400 450 500 (V)
V_{g-k} −57 −63 −69 (V)
V_{a_1-k} = 500V
450V
400V
0045A
−70
−60
−50
−40
−30
−20
−10
0
GRID TO CATHODE VOLTAGE (V_{g-k}) V
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
BEAM CURRENT ($I_{a_2+a_4}$) mA


CATHODE MODULATION
$I_{a_2+a_4}/V_{k-g}$
$V_{a_2+a_4}$ = 14 to 20 kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
V_{a_1-g} 400 450 500 (V)
V_{k-g} 51 56 62 (V)
V_{a_1-g} = 500V
450V
400V
BEAM CURRENT $(I_{a_2+a_4})$ mA
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
70
60
50
40
30
20
10
CATHODE TO GRID VOLTAGE (V_{k-g}) V
0046A

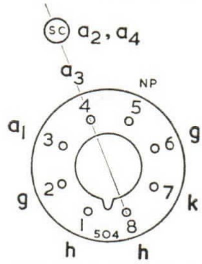

LIMITS OF RASTER CUT-OFF VOLTAGE
CATHODE MODULATION
RASTER CUT-OFF CATHODE TO GRID VOLTAGE (V)
20
40
60
80
100
120
200
300
400
500
600
700
800
900
FIRST ANODE TO GRID VOLTAGE (V_{a1-g}) V


GRID MODULATION
RASTER CUT-OFF GRID TO CATHODE VOLTAGE (V)
-20
-40
-60
-80
-100
-120
200
300
400
500
600
700
800
900
0144
FIRST ANODE TO CATHODE VOLTAGE (V_{a1-k}) V

BRIMAR CATHODE RAY TUBES A59-13W



TELEVISION PICTURE TUBE



B8H Base, CT8 Cap

GENERAL

Twin Panel	Tinted Grey Glass
Deflection Angle	110° Diagonal
Rectangular Face	23 in. Diagonal
Light Transmission	45% Approximately
Aluminised Screen	White Fluorescence
Electrostatic Focus	Magnetic Deflection
Short Neck	Straight Gun—non ion trap

External Conductive Coating

Heater Current	I_h	0·3	A
Heater Voltage	V_h	6·3	V

The cathode ray tube heater should always be connected at the chassis end if used in a series heater chain.

DESIGN CENTRE RATINGS

Maximum Second and Fourth Anode Voltage	$V_{a2,a4(max)}$	20*	kV
Minimum Second and Fourth Anode Voltage	$V_{a2,a4(min)}$	13	kV
Maximum Third Anode Voltage	$V_{a3(max)}$	+1000 to −500	V
Maximum First Anode Voltage	$V_{a1(max)}$	700	V
Maximum Heater to Cathode Voltage, Heater Negative (d.c.)	$V_{h\text{-}k(max)}$	250	V
Maximum Peak Heater to Cathode Voltage, Heater Negative	$v_{h\text{-}k(pk)max}$	400†‡	V
Maximum Impedance Grid to Cathode (50c/s)	$Z_{g\text{-}k(max)}$	0·5	MΩ
Maximum Resistance Grid to Cathode	$R_{g\text{-}k(max)}$	1·5	MΩ

All voltages referred to cathode.

* For $I_{a2+a4}=0$.

† Absolute rating.

‡ During a warming-up period not exceeding 45 seconds.

Note : The A59-13W is the AW59-91 with the addition of a tinted glass panel.

Tubes incorporating a B8H sparkguard base will have a suffix S after the type number. For details of the sparkguard base see separate sheet.

INTER-ELECTRODE CAPACITANCES

		§	ϕ	
Cathode to all	$c_{k\text{-all}}$	3·0	3·5	pF
Grid to all	$c_{g\text{-all}}$	7·0	8·5	pF
Second and Fourth Anode to External Conductive Coating (approx.)	$c_{a2,a4\text{-M}}$	2000		pF

§ Inter-electrode capacitances with holder capacitance balanced out.
ϕ Total inter-electrode capacitances including AEI B8H holder VH68/81 (8 pin).

TYPICAL OPERATION—Grid Modulation (Voltage referred to cathode)

Second and Fourth Anode Voltage	$V_{a2,a4\text{-}k}$	18		18		kV
First Anode Voltage*	$V_{a1\text{-}k}$	400		500		V
Beam Current	I_{a2+a4}	350	500	350	500	μA
Third Anode Voltage Range for Focus	$V_{a3\text{-}k}$	0 to 400		0 to 400		V
Average Peak to Peak Picture Modulating Voltage		35·5	40·5	39·5	45	V
Grid to Cathode Voltage for Cut-off of Raster (See charts for limits)	$V_{g\text{-}k}$	–57		–69		V

TYPICAL OPERATION—Cathode Modulation (Voltage referred to grid)

Second and Fourth Anode Voltage	$V_{a2,a4\text{-}g}$	18		18		kV
First Anode Voltage*	$V_{a1\text{-}g}$	400		500		V
Beam Current	I_{a2+a4}	350	500	350	500	μA
Third Anode Voltage Range for Focus	$V_{a3\text{-}g}$	0 to 400		0 to 400		V
Average Peak to Peak Picture Modulating Voltage		31·5	35·5	34·5	39·5	V
Cathode to Grid Voltage for Cut-off of Raster (See charts for limits)	$V_{k\text{-}g}$	51		62		V

* Within this range a higher First Anode Voltage will provide an improved focus performance.

PICTURE CENTRING

Maximum magnet flux density at centre of neck should not be less than	17 G
Maximum distance of centre of magnetic field from reference line	53 mm

NOTE

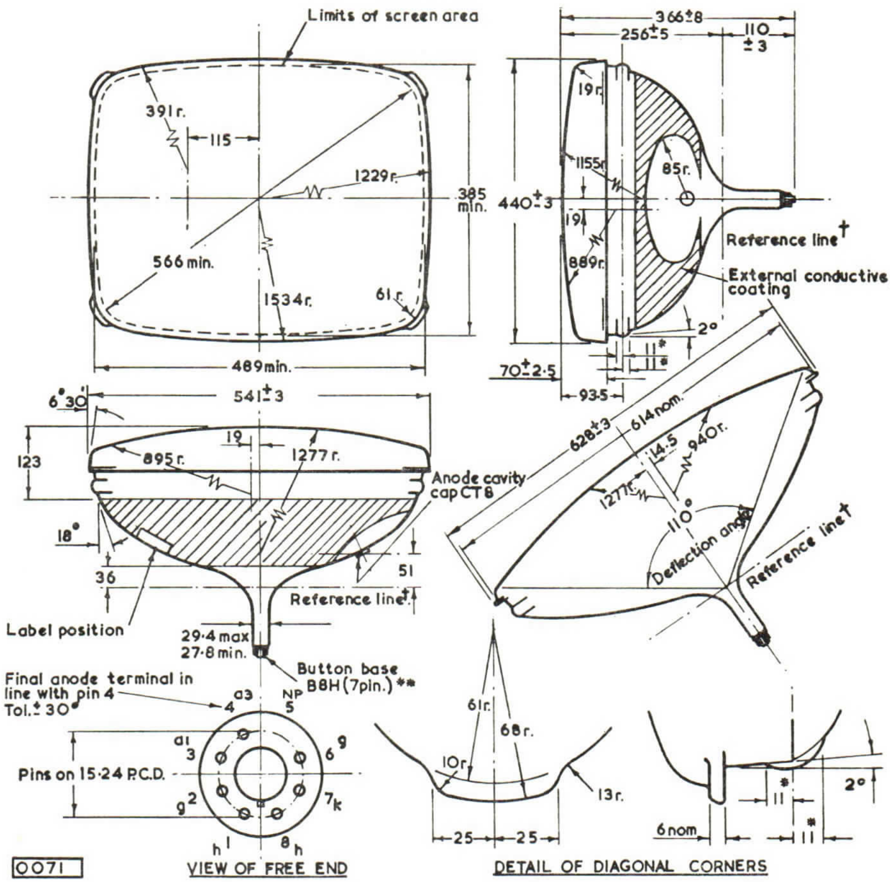
If this tube is operated at voltage in excess of 16kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.

DEFLECTION ANGLES

Height	82°
Width	99°
Diagonal	110°

WEIGHT

Approximate Single Tube Weight : Net 37·5 lb (17 kg)



All dimensions in mm. Not to be scaled.

Notes :

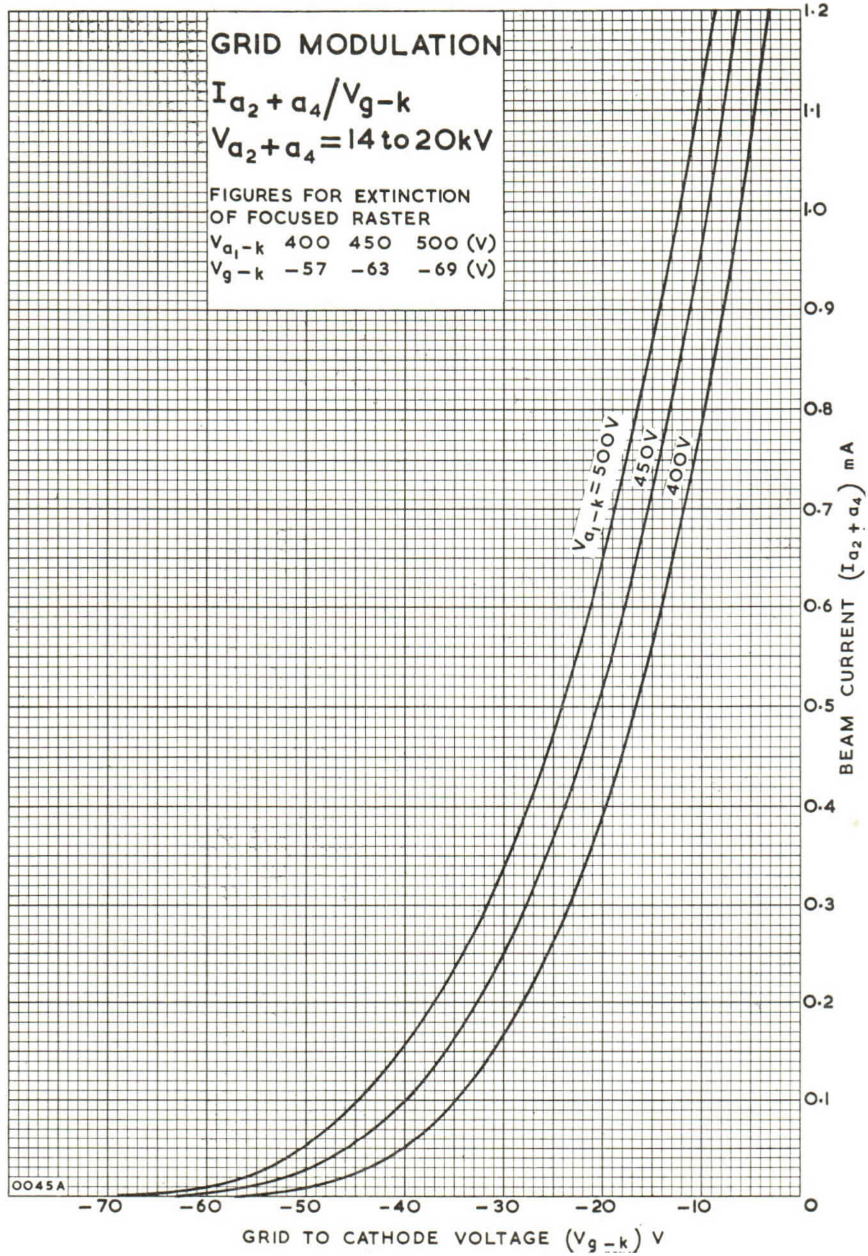
* During the face sealing operation the glass in this area (total 22mm) may be disturbed. As the shape of the contour within this area may be either convex or concave the bulb should not be gripped within this region unless special precautions are taken (such as the use of resilient packing material).

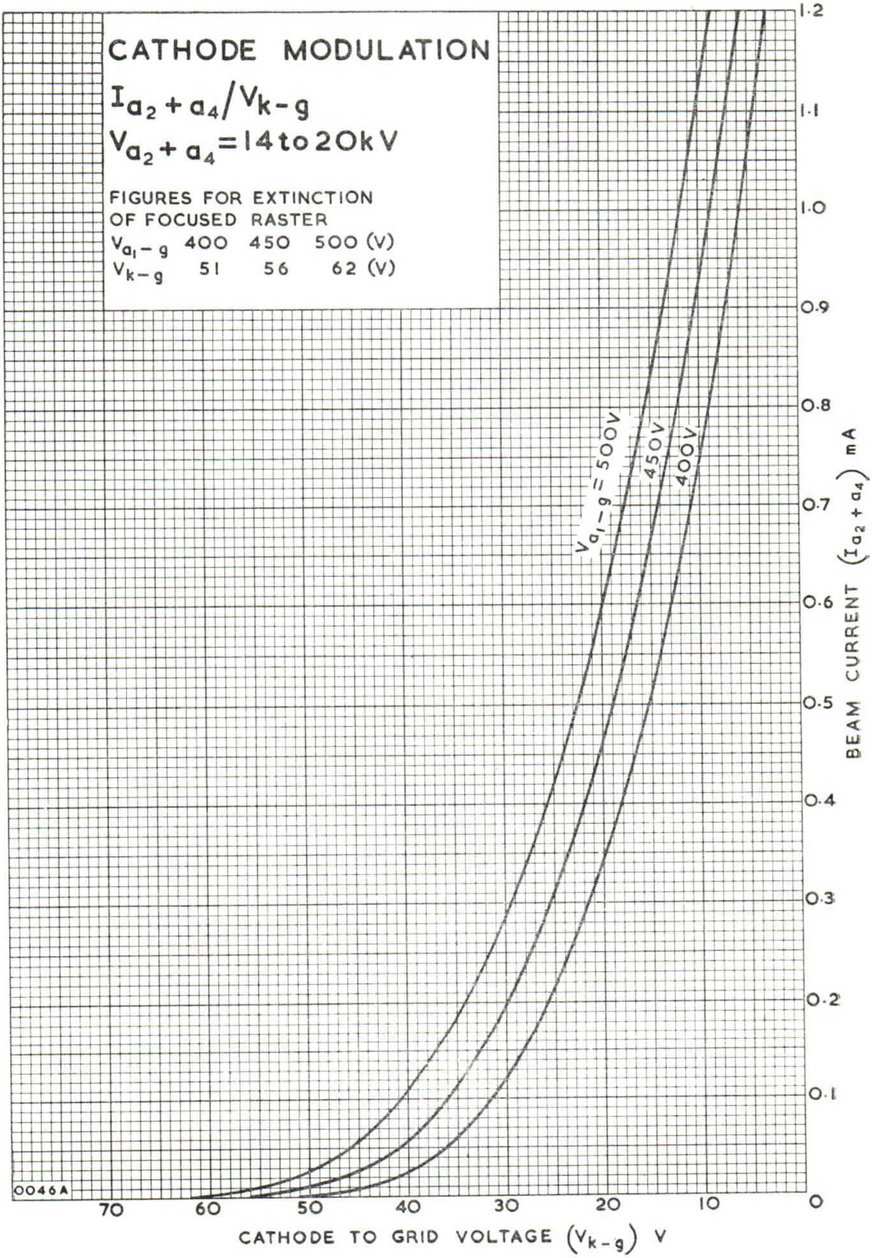
**The socket for the B8H button base should not be rigidly mounted, it should have flexible leads and be allowed to move freely. The design of the socket should be such that the wiring cannot impress lateral strains through the socket contacts on the base. Bottom circumference of base wafer will fall within a circle concentric with the bulb axis and have a diameter of 44mm.

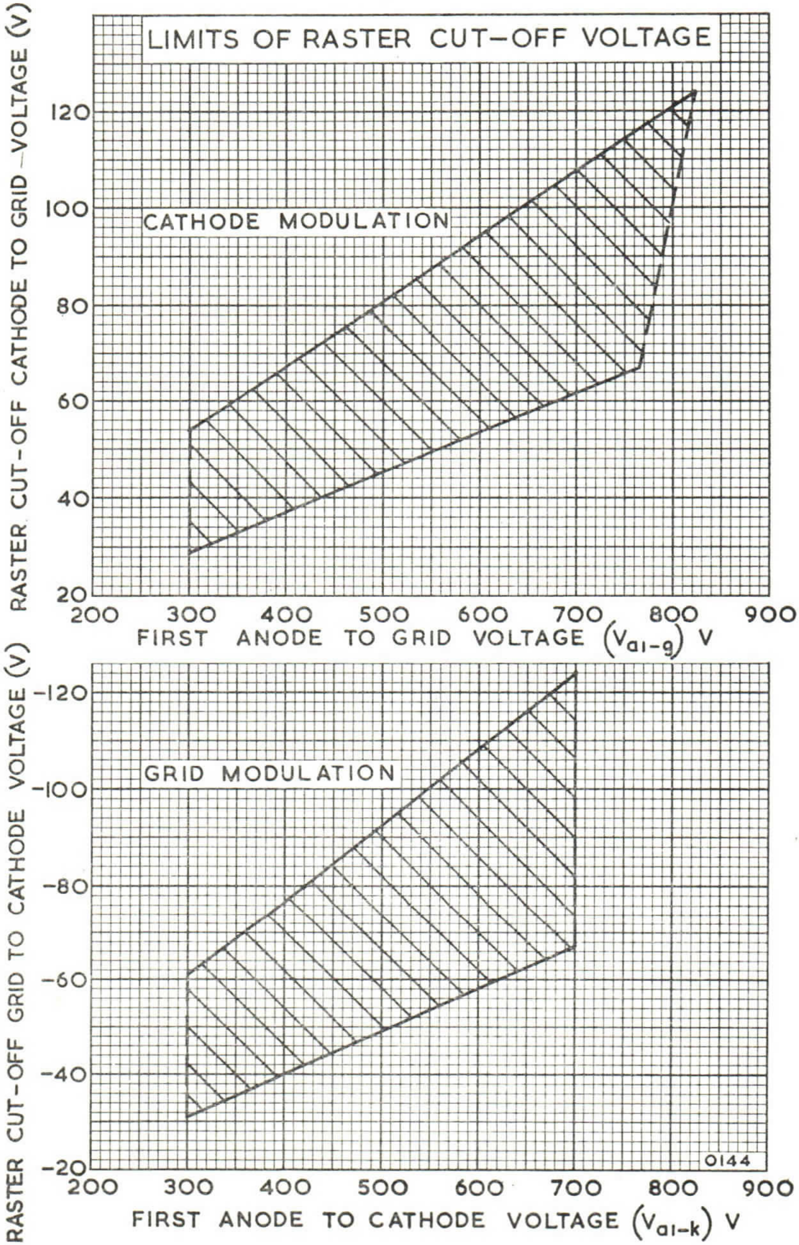
† Determined by Reference Gauge No.16 (JEDEC 126).

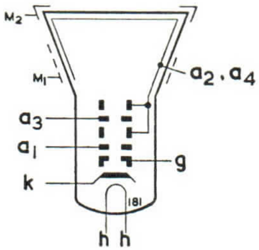
The tube may be supported by clamping to the mounting lugs provided at each corner of the protective panel.

Tube mounting clamps must be spaced from the tube by the use of cushioning pads.

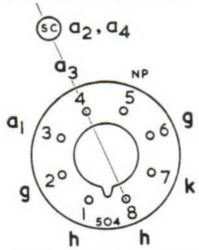

GRID MODULATION
$I_{a_2+a_4}/V_{g-k}$
$V_{a_2+a_4} = 14$ to 20kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
V_{a_1-k} 400 450 500 (V)
V_{g-k} −57 −63 −69 (V)
$V_{a_1-k} = 500$V
450V
400V
BEAM CURRENT $(I_{a_2+a_4})$ mA
GRID TO CATHODE VOLTAGE (V_{g-k}) V
0045A
−70 −60 −50 −40 −30 −20 −10 0
0 0·1 0·2 0·3 0·4 0·5 0·6 0·7 0·8 0·9 1·0 1·1 1·2


CATHODE MODULATION
Ia2 + a4/Vk-g
Va2 + a4 = 14 to 20 kV
FIGURES FOR EXTINCTION
OF FOCUSED RASTER
Va1-g 400 450 500 (V)
Vk-g 51 56 62 (V)
Va1-g = 500V
450V
400V
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
BEAM CURRENT (Ia2 + a4) mA
70
60
50
40
30
20
10
0
CATHODE TO GRID VOLTAGE (Vk-g) V
0046A


LIMITS OF RASTER CUT–OFF VOLTAGE
CATHODE MODULATION
RASTER CUT-OFF CATHODE TO GRID – VOLTAGE (V)
20
40
60
80
100
120
200 300 400 500 600 700 800 900
FIRST ANODE TO GRID VOLTAGE (V_{a1-g}) V
GRID MODULATION
RASTER CUT-OFF GRID TO CATHODE VOLTAGE (V)
-20
-40
-60
-80
-100
-120
200 300 400 500 600 700 800 900
FIRST ANODE TO CATHODE VOLTAGE (V_{a1-k}) V
0144



RIMGUARD II
TELEVISION PICTURE TUBE



B8H Base, CT8 Cap

GENERAL

Rectangular Face	23 in. Diagonal
Reinforced Envelope	Integral Mounting Lugs
Electrostatic Focus	Magnetic Deflection
Deflection Angle	110° Diagonal
Aluminised Screen	White Fluorescence
Grey Glass	45% Transmission (approx.)
Straight Gun	Non Ion Trap
	External Conductive Coating

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·3*	A

DESIGN CENTRE RATINGS

Maximum Second and Fourth Anode Voltage	$V_{a2,a4(max)}$	20†	kV
Minimum Second and Fourth Anode Voltage	$V_{a2,a4(min)}$	13	kV
Maximum Third Anode Voltage	$V_{a3(max)}$	+1000 to −500	V
Maximum First Anode Voltage	$V_{a1(max)}$	700	V
Maximum Heater to Cathode Voltage, Heater Negative (d.c)	$V_{h\text{-}k(max)}$	250	V
Maximum Peak Heater to Cathode Voltage, Heater Negative	$v_{h\text{-}k(pk)max}$	400‡§	V
Maximum Impedance, Grid to Cathode (50 Hz)	$Z_{g\text{-}k(max)}$	0·5	MΩ
Maximum Resistance, Grid to Cathode	$R_{g\text{-}k(max)}$	1·5	MΩ

All voltages referred to cathode.

* The CRT heater should always be connected at the chassis end in a series heater chain.

† For $I_{a2+a4}=0$.

‡ Absolute rating.

§ During a warming-up period not exceeding 45 seconds.

The A59-25W is electrically identical to the AW59-91.

The mechanical fixing of this tube is interchangeable with other existing reinforced tubes.

Tubes incorporating a B8H sparkguard base will have a suffix S after the type number. For details of the sparkguard base see separate sheet.

THORN — A E I RADIO VALVES & TUBES LTD.

INTER-ELECTRODE CAPACITANCES

		*	†	
Cathode to all	$c_{k\text{-}all}$	3·0	3·5	pF
Grid to all	$c_{g\text{-}all}$	7·0	8·5	pF
Anode 2 and Anode 4 to External Conductive Coating, M_1 (approx)	$c_{a2,a4\text{-}M1}$	1500		pF
Anode 2 and Anode 4 to Shell, M_2 (approx.)	$c_{a2,a4\text{-}M2}$	300		pF

* Inter-electrode capacitances with holder capacitance balanced out.

† Total inter-electrode capacitances including an AEI B8H holder VH68/81 (8 pin).

TYPICAL OPERATION—Grid Modulation (Voltage referred to cathode)

Second and Fourth Anode Voltage	$V_{a2,a4\text{-}k}$	18		18		kV
First Anode Voltage‡	$V_{a1\text{-}k}$	400		500		V
Beam Current	I_{a2+a4}	350	500	350	500	μA
Third Anode Voltage Range for Focus	$V_{a3\text{-}k}$	0 to 400		0 to 400		V
Average Peak to Peak Picture Modulating Voltage		35·5	40·5	39·5	45	V
Grid to Cathode Voltage for cut-off of raster (See chart for limits)	$V_{g\text{-}k}$	–57		–69		V

TYPICAL OPERATION—Cathode Modulation (Voltage referred to grid)

Second and Fourth Anode Voltage	$V_{a2,a4\text{-}g}$	18		18		kV
First Anode Voltage‡	$V_{a1\text{-}g}$	400		500		V
Beam Current	I_{a2+a4}	350	500	350	500	μA
Third Anode Voltage Range for Focus	$V_{a3\text{-}g}$	0 to 400		0 to 400		V
Average Peak to Peak Picture Modulating Voltage		31·5	35·5	34·5	39·5	V
Cathode to Grid Voltage for cut-off of raster (See chart for limits)	$V_{k\text{-}g}$	51		62		V

‡Within this range a higher First Anode Voltage will provide an improved focus performance.

PICTURE CENTRING

Maximum magnet flux density at centre of neck should not be less than	17 G
Maximum distance of centre of magnetic field from reference line	53 mm

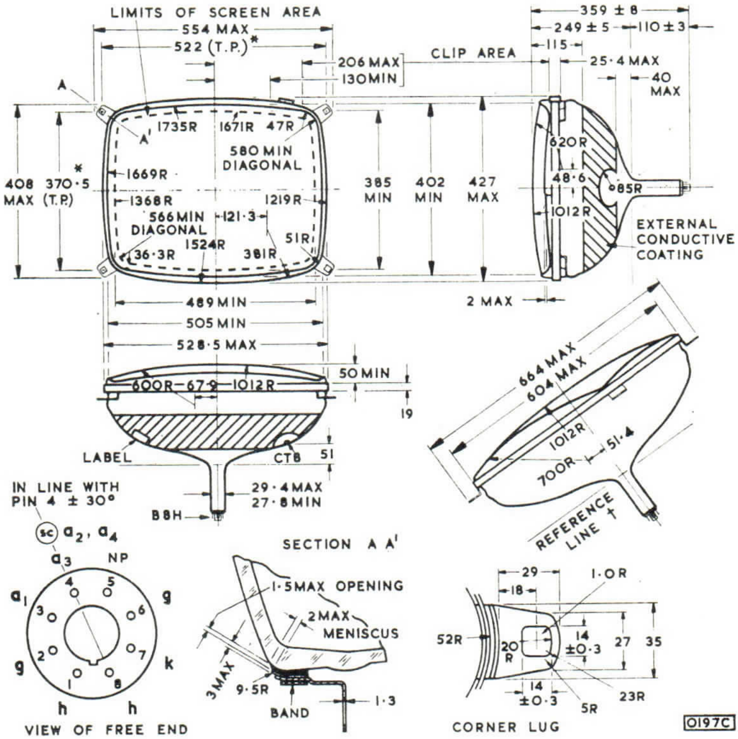
DEFLECTION ANGLES

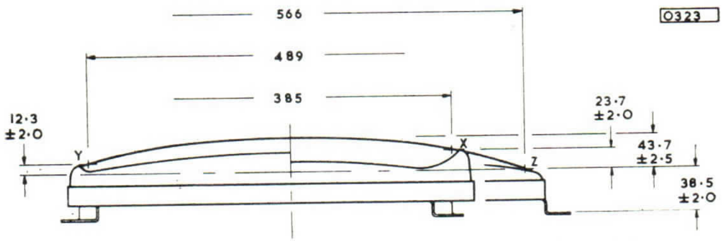
Height	82°
Width	99°
Diagonal	110°

TUBE WEIGHT (approx.)—Net 30 lb (13·5 kg)

Note :

If this tube is operated at voltages in excess of 16kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range.





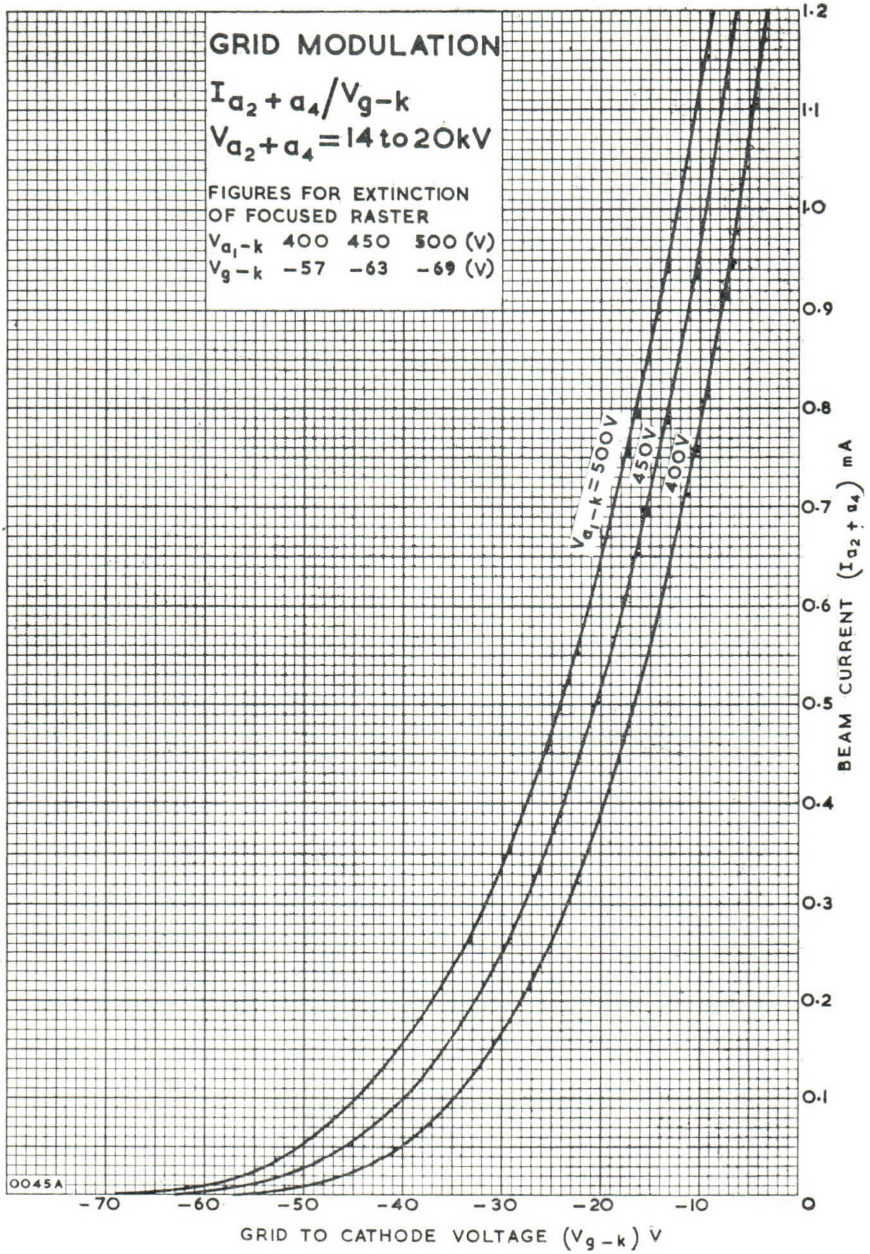
All dimensions in mm. Not to be scaled.

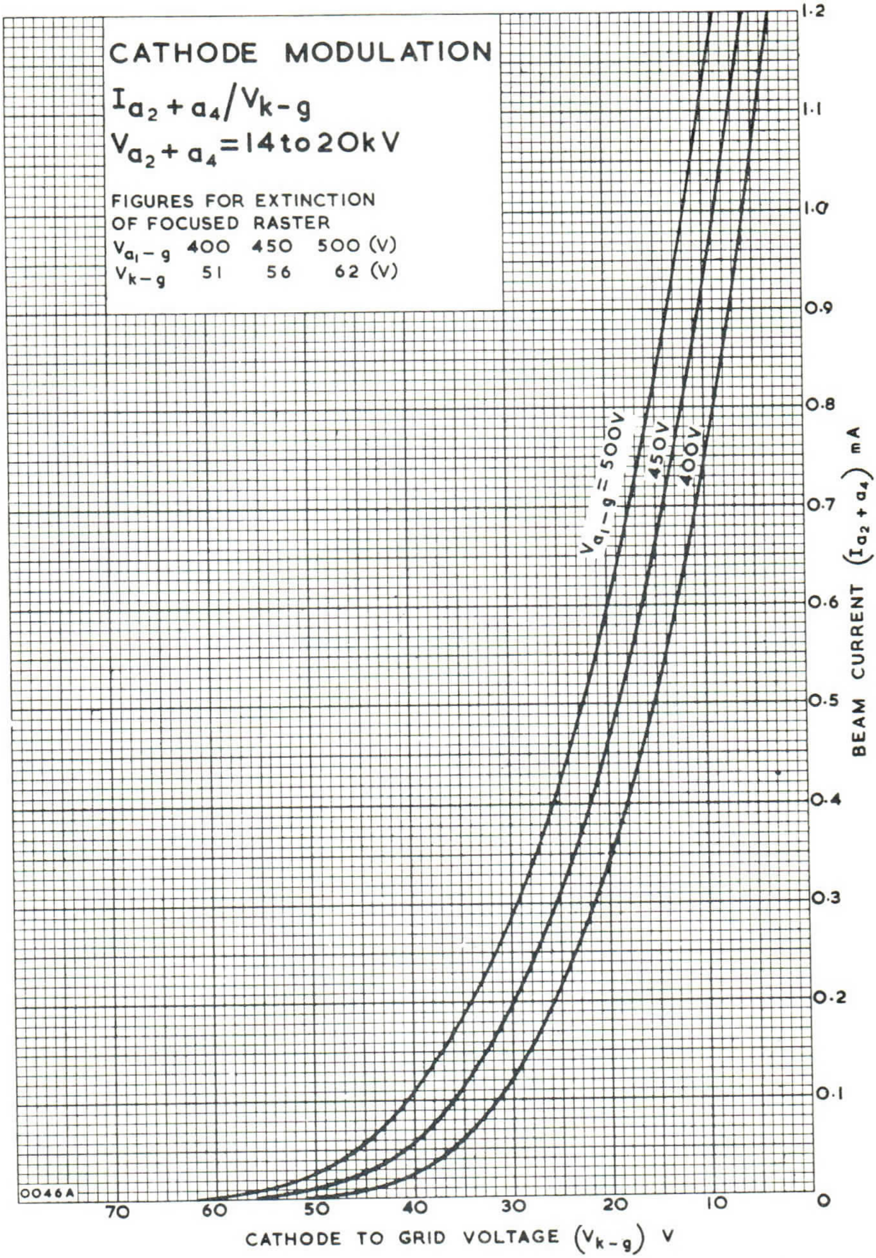
It is recommended that the mask used with this tube is flexible enough to take up small variations in fixing and bulb contours.

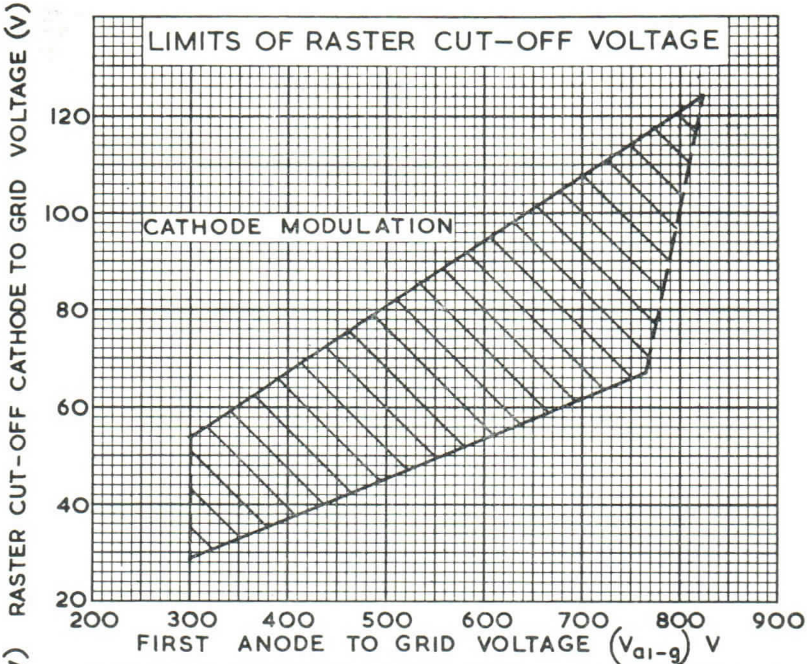
The metal shell M_2 must be connected to chassis via a 2MΩ resistor.

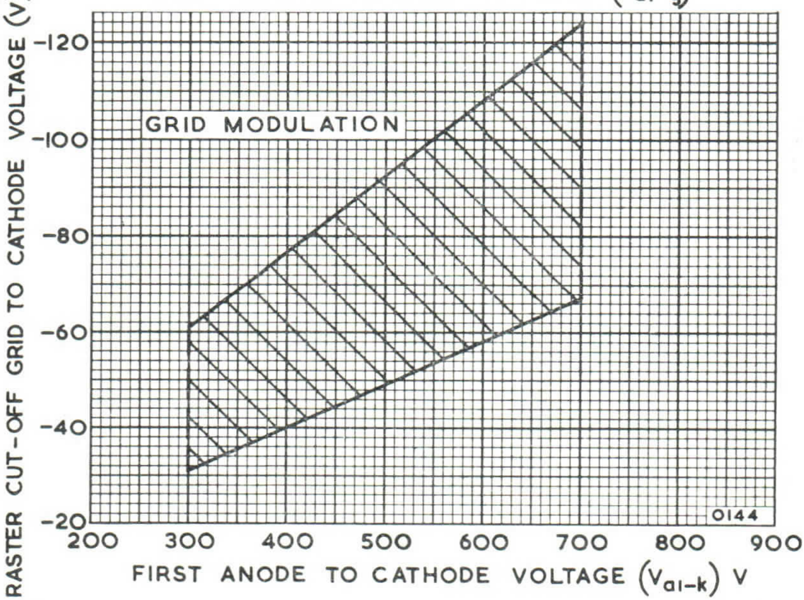
* The bolts to be used for mounting the tube must lie within circles of 9·5 mm diameter centred on these true positions (Diagonal 640). One of the four lugs may deviate 2 mm maximum from the plane through the other three lugs.

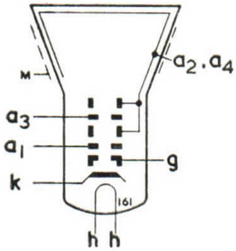
† Determined by reference line gauge No. 16 (JEDEC No. 126).


GRID MODULATION
$I_{a_2+a_4}/V_{g-k}$
$V_{a_2+a_4}$ = 14 to 20kV
FIGURES FOR EXTINCTION
OF FOCUSED RASTER
V_{a_1-k} 400 450 500 (V)
V_{g-k} −57 −63 −69 (V)
V_{a_1-k} = 500V
450V
400V
0045A
−70 −60 −50 −40 −30 −20 −10 0
GRID TO CATHODE VOLTAGE (V_{g-k}) V
0 0·1 0·2 0·3 0·4 0·5 0·6 0·7 0·8 0·9 1·0 1·1 1·2
BEAM CURRENT ($I_{a_2+a_4}$) mA

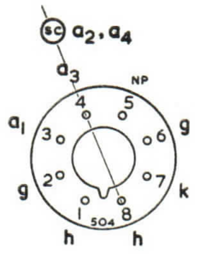

CATHODE MODULATION
$I_{a_2+a_4}/V_{k-g}$
$V_{a_2+a_4}$ = 14 to 20 kV
FIGURES FOR EXTINCTION
OF FOCUSED RASTER
V_{a_1-g} 400 450 500 (V)
V_{k-g} 51 56 62 (V)
V_{a_1-g} = 500V
450V
400V
BEAM CURRENT $(I_{a_2+a_4})$ mA
CATHODE TO GRID VOLTAGE (V_{k-g}) V
0046A
70
60
50
40
30
20
10
0
0·1
0·2
0·3
0·4
0·5
0·6
0·7
0·8
0·9
1·0
1·1
1·2


LIMITS OF RASTER CUT-OFF VOLTAGE
CATHODE MODULATION
RASTER CUT-OFF CATHODE TO GRID VOLTAGE (V)
20
40
60
80
100
120
200
300
400
500
600
700
800
900
FIRST ANODE TO GRID VOLTAGE (V_{a1-g}) V


GRID MODULATION
RASTER CUT-OFF GRID TO CATHODE VOLTAGE (V)
-20
-40
-60
-80
-100
-120
200
300
400
500
600
700
800
900
0144
FIRST ANODE TO CATHODE VOLTAGE (V_{a1-k}) V



TELEVISION PICTURE TUBE



B8H Base, CT8 Cap

GENERAL

Rectangular Face........................19 in. Diagonal
Electrostatic Focus ....Magnetic Deflection
Deflection Angle ....110° Diagonal
Aluminised Screen ....White Fluorescence
Grey Glass.......................................75% Transmission (approx.)
Straight Gun ....Non Ion Trap
External Conductive Coating

Heater Voltage	V_h	6·3	V
Heater Current	I_h	0·3	A

The cathode ray tube heater should always be connected at the chassis end if used in a series heater chain.

DESIGN CENTRE RATINGS

Maximum Second and Fourth Anode Voltage	$V_{a2,a4(max)}$	20*	kV
Minimum Second and Fourth Anode Voltage	$V_{a2,a4(min)}$	13	kV
Maximum Third Anode Voltage	$V_{a3(max)}$	+1000 to −500	V
Maximum First Anode Voltage	$V_{a1(max)}$	700	V
Maximum Heater to Cathode Voltage, Heater Negative (d.c.)	$V_{h\text{-}k(max)}$	250	V
Maximum Peak Heater to Cathode Voltage, Heater Negative	$v_{h\text{-}k(pk)max}$	400†‡	V
Maximum Impedance Grid to Cathode (50 Hz)	$Z_{g\text{-}k(max)}$	0·5	MΩ
Maximum Resistance Grid to Cathode	$R_{g\text{-}k(max)}$	1·5	MΩ

All voltages referred to cathode.

* For $I_{a2+a4}=0$.
† Absolute rating.
‡ During a warming-up period not exceeding 45 seconds.

Tubes incorporating a B8H sparkguard base will have a suffix S after the type number. For details of the sparkguard base see separate sheet.

THORN — A E I RADIO VALVES & TUBES LTD.

INTER-ELECTRODE CAPACITANCES

		§		ϕ	
Cathode to all	$c_{k\text{-}all}$	3·0		3·5	pF
Grid to all	$c_{g\text{-}all}$	7·0		8·5	pF
Second and Fourth Anode to External Conductive Coating (approx.)	$c_{a2,a4\text{-}M}$		1250		pF

§ Inter-electrode capacitances with holder capacitance balanced out.
ϕ Total inter-electrode capacitances including a typical B8H holder.

TYPICAL OPERATION—Grid Modulation (Voltage referred to cathode)

Second and Fourth Anode Voltage	$V_{a2,a4\text{-}k}$	18		18		kV
First Anode Voltage*	$V_{a1\text{-}k}$	400		500		V
Final Anode Current	I_{a2+a4}	350	500	350	500	μA
Third Anode Voltage Range for Focus	$V_{a3\text{-}k}$	0 to 400		0 to 400		V
Average Peak to Peak Picture Modulating Voltage		35·5	40·5	39·5	45	V
Grid to Cathode Voltage for Cut-off of Raster (See chart for limits)	$V_{g\text{-}k}$	−57		−69		V

TYPICAL OPERATION—Cathode Modulation (Voltage referred to grid)

Second and Fourth Anode Voltage	$V_{a2,a4\text{-}g}$	18		18		kV
First Anode Voltage*	$V_{a1\text{-}g}$	400		500		V
Final Anode Current	I_{a2+a4}	350	500	350	500	μA
Third Anode Voltage Range for Focus	$V_{a3\text{-}g}$	0 to 400		0 to 400		V
Average Peak to Peak Picture Modulating Voltage		31·5	35·5	34·5	39·5	V
Cathode to Grid Voltage for Cut-off of Raster (See chart for limits)	$V_{k\text{-}g}$	51		62		V

* Within this range a higher First Anode Voltage will provide an improved focus performance.

PICTURE CENTRING

Maximum magnet flux density at centre of neck should not be less than	17 Gs
Maximum distance of centre of magnetic field from reference line	53 mm

NOTE

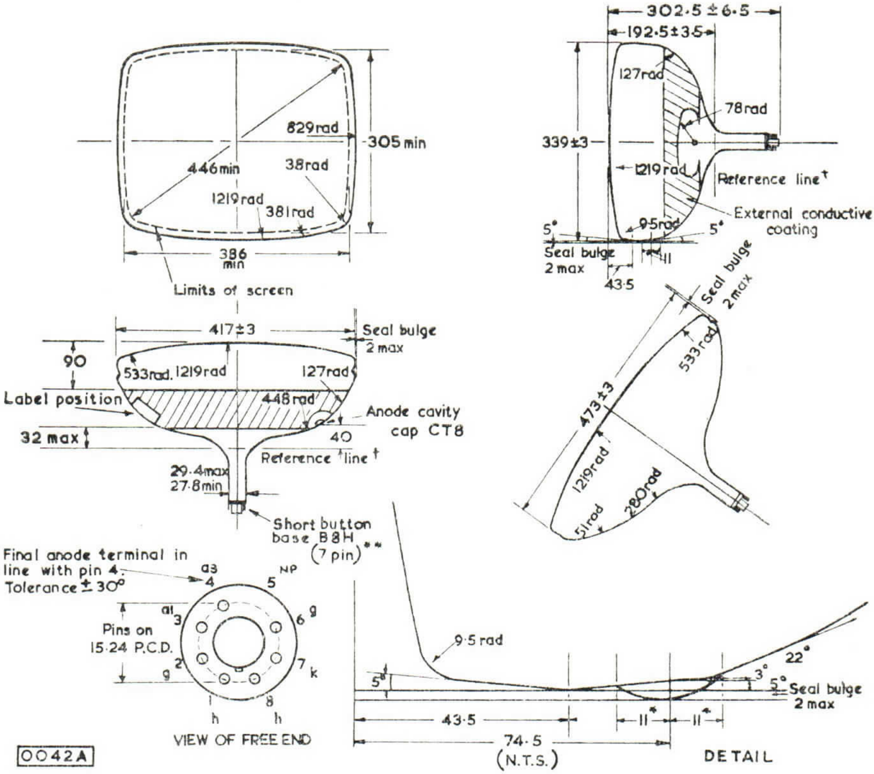
If this tube is operated at voltages in excess of 16kV, x-ray radiation shielding may be necessary to avoid possible danger of personal injury from prolonged exposure at close range. The normal glass protective viewing window may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0·5 milliröntgens per hour, the window will normally provide adequate protection.

DEFLECTION ANGLES

Height	82°
Width	99°
Diagonal	110°

WEIGHT

Approximate Single Tube Weight :	Net	7·2 kg (16 lb)
	Packed	9.1 kg (20 lb)



All dimensions in mm. Not to be scaled.

Notes:

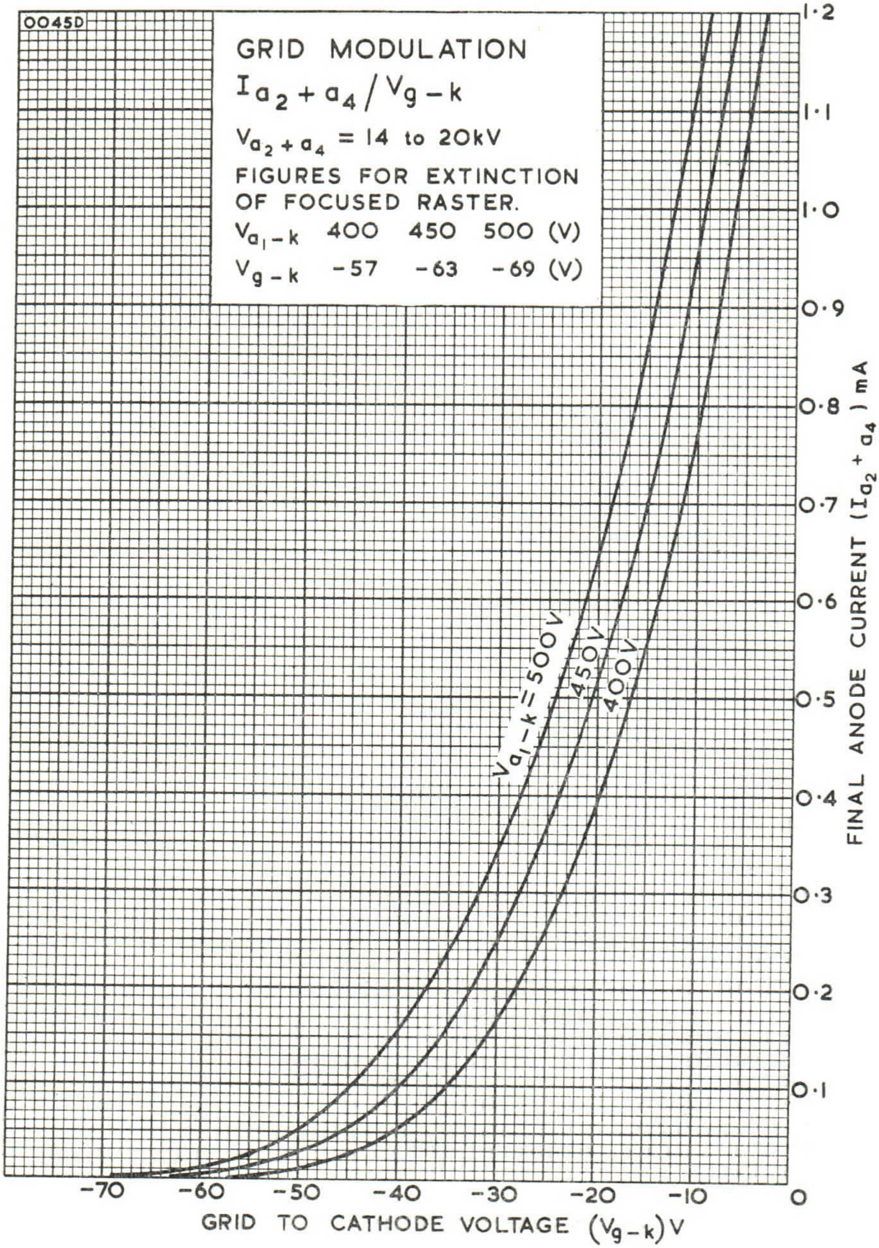
* During the face sealing operation the glass in this area (total 22mm) may be disturbed. As the shape of the contour within this area may be either convex or concave the bulb should not be gripped within this region unless special precautions are taken (such as the use of resilient packing material).

† Determined by Reference Gauge No. 16 (JEDEC No. 126).

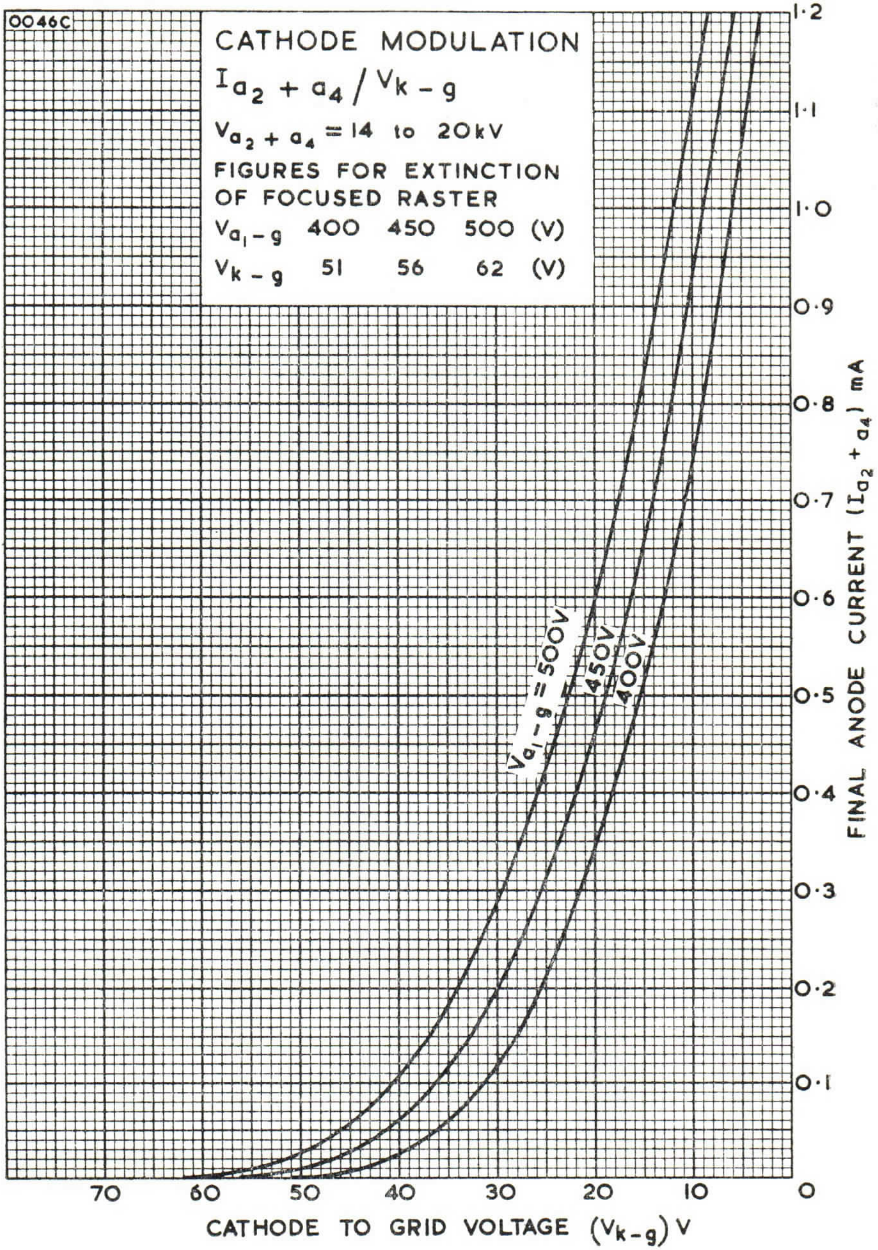
**The socket for the B8H button base should not be rigidly mounted, it should have flexible leads and be allowed to move freely. The design of the socket should be such that the wiring cannot impress lateral strains through the socket contacts on the base. Bottom circumference of base wafer will fall within a circle concentric with the bulb axis and having a diameter of 44mm.

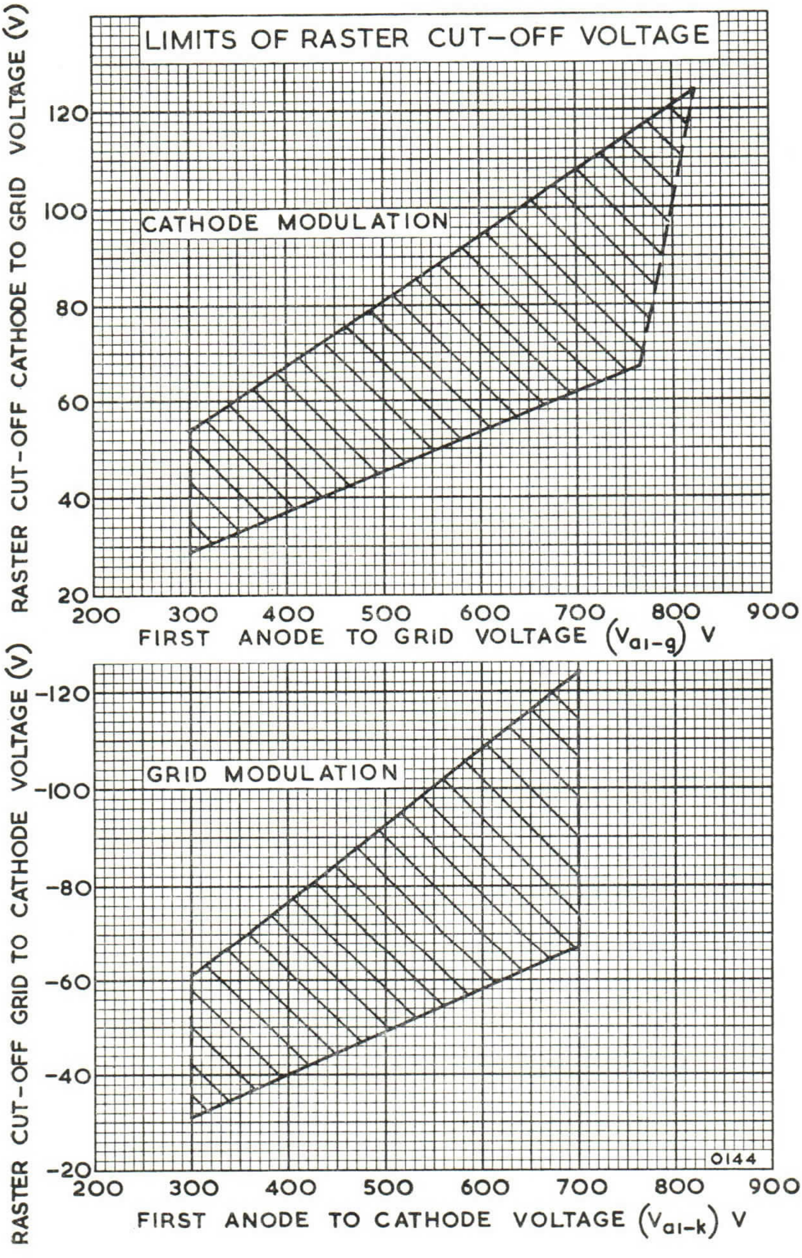
The maximum dimensions at the face seal may be 3·5 mm larger than the maximum face dimensions but at any point around the seal the bulge will not protrude more than 2 mm.

There is an annular region of anti-corona coating with diameters of 30 mm and 100 mm surrounding the CT8 cap, the tube should not be handled in this region.



0045D
GRID MODULATION
$I_{a_2+a_4}/V_{g-k}$
$V_{a_2+a_4}$ = 14 to 20kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER.
V_{a_1-k} 400 450 500 (V)
V_{g-k} −57 −63 −69 (V)
V_{a_1-k} = 500V
450V
400V
1·2
1·1
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
FINAL ANODE CURRENT ($I_{a_2+a_4}$) mA
−70
−60
−50
−40
−30
−20
−10
GRID TO CATHODE VOLTAGE (V_{g-k})V

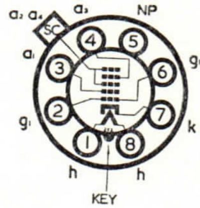

0046C
CATHODE MODULATION
$I_{a_2+a_4}/V_{k-g}$
$V_{a_2+a_4}$ = 14 to 20kV
FIGURES FOR EXTINCTION OF FOCUSED RASTER
V_{a_1-g} 400 450 500 (V)
V_{k-g} 51 56 62 (V)
V_{a_1-g} = 500V
450V
400V
70 60 50 40 30 20 10 0
CATHODE TO GRID VOLTAGE (V_{k-g}) V
1·2 1·1 1·0 0·9 0·8 0·7 0·6 0·5 0·4 0·3 0·2 0·1 0
FINAL ANODE CURRENT ($I_{a_2+a_4}$) mA


LIMITS OF RASTER CUT-OFF VOLTAGE
CATHODE MODULATION
RASTER CUT-OFF CATHODE TO GRID VOLTAGE (V)
20
40
60
80
100
120
200
300
400
500
600
700
800
900
FIRST ANODE TO GRID VOLTAGE (V_{a1-g}) V
GRID MODULATION
RASTER CUT-OFF GRID TO CATHODE VOLTAGE (V)
-20
-40
-60
-80
-100
-120
200
300
400
500
600
700
800
900
FIRST ANODE TO CATHODE VOLTAGE (V_{a1-k}) V
0144

BRIMAR VALVES

Current Equipment Type

TYPE C17AA
B8H BASE



The BRIMAR C17AA is a rectangular 110° deflection angle teletube with electrostatic focus, an aluminised screen and external conductive coating. The screen colour is white with a grey glass faceplate with a transmission of approximately 70 per cent.

RATINGS

Heater Voltage ...	6.3 volts
Heater Current...	0.3 amps.
Final Anode Voltage (V_{a2+4})	17.6 kilovolts abs. max.
Final Anode Voltage (V_{a2+4})	13 kilovolts min.
Focus Anode Voltage (V_{a3})	—500 to 1,000 volts max.
First Anode Voltage (V_{a1})	500 volts max.
First Anode Voltage (V_{a1})	250 volts min.
Grid Voltage (V_g) Peak	2 volts max.
Heater to Cathode Voltage (V_{hk}) Cathode Positive	200 volts max.
Heater to Cathode Voltage (V_{hk}) Cathode Positive *	410 volts max.
Heater to Cathode Voltage (V_{hk}) Cathode Negative	180 volts max.
Diagonal Deflection Angle	110° approx.

* *During warm-up, for a period not exceeding 45 seconds.*

OPERATING CHARACTERISTICS

Final Anode Voltage	16 kilovolts
Focus Anode Voltage	300 volts
First Anode Voltage	300 volts
Peak to Peak Modulating Voltage for Beam Current of 150μA	30 volts
Grid Voltage to Cut-off Beam Current	—30 to —72 volts

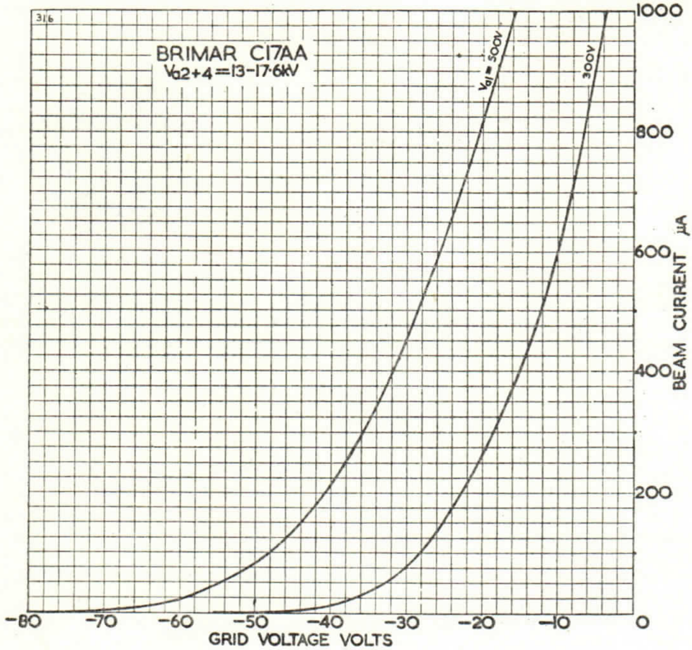
INTER-ELECTRODE CAPACITANCES

Grid to all	6.0 pF max.
Cathode to all	4.0 pF max.
Final Anode to External Coating	1,500 pF max.

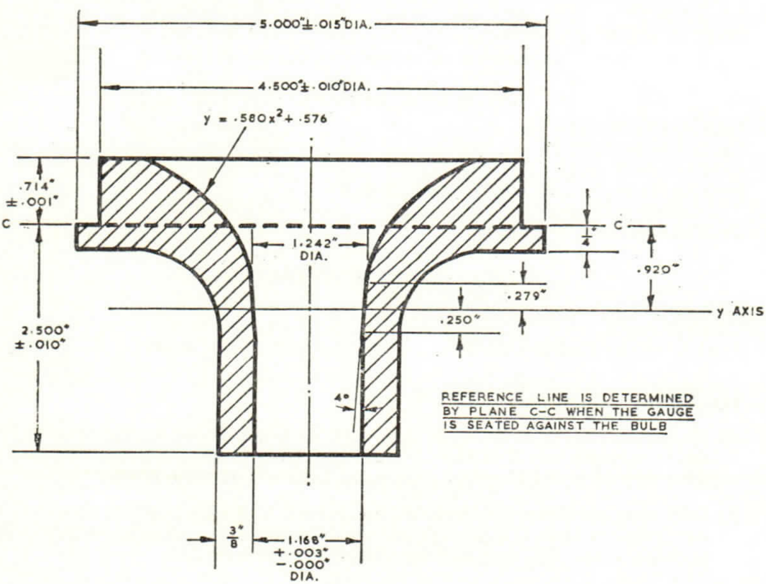
NOTES:

A. No harmful X-ray radiation is produced by this tube when operated at final anode voltages below 16 kV. At voltages above 16 kV some shielding may be necessary to protect against prolonged exposure at close range.

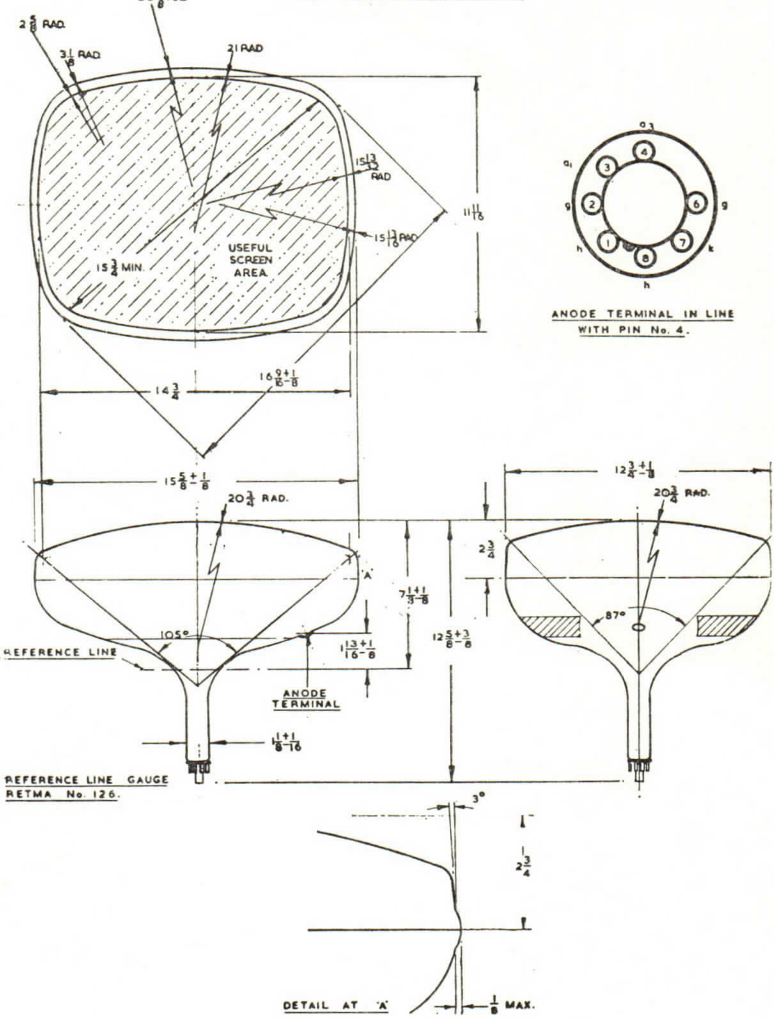
B. Shift magnets when used should be mounted in such a position that they do not inferfere with the passage of the electron beam through the gun. This position is normally immediately behind the scanning coils.



REFERENCE LINE GAUGE JETEC No. 126



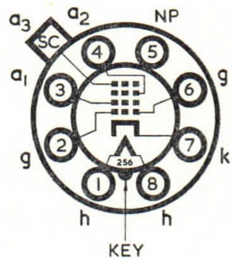
CATHODE RAY TUBE C17AA



Current Equipment Type

TYPE C17AF

B8H BASE



The BRIMAR type C17AF is a rectangular 110° deflection angle teletube with tripotential electrostatic focus, an aluminized screen and an external conductive coating. The screen colour is white with a grey glass faceplate with a transmission of approximately 70 per cent.

RATINGS

Heater Current	0.3 amp.
Heater Voltage	4.0 volts (nominal)
Final Anode Voltage (V_{a3})	*16 kilovolts max. 17.6kV ab. max.
Final Anode Voltage (V_{a3})	*13 kilovolts min.
Focus Anode Voltage (V_{a2}) positive ...	*750 volts max.
Focus Anode Voltage (V_{a2}) negative ...	*500 volts max.
First Anode Voltage (V_{a1})	*750 volts max.
First Anode Voltage (V_{a1})	*500 volts min.
Grid voltage (V_g) positive	*2 volts max.
Grid voltage (V_g) negative	*150 volts max.
Heater to cathode voltage (V_{hk}) cathode positive	200 volts max.
Heater to cathode voltage (V_{hk}) cathode negative	180 volts max.
Heater to cathode voltage (V_{hk}) cathode positive	†410 volts max.
A_2 supply source impedance	1.5 MΩ max.
A_1 supply source impedance	2.5 MΩ max.
R_{gk}	1.5 MΩ max.
Diagonal deflection angle	110° approx.

* Voltage with respect to cathode.

† During equipment warm-up not exceeding 45 seconds.

OPERATING CHARACTERISTICS

V_{a3} = 16 kilovolts.
V_{a2} = 0–450 volts (adjust for optimum focus).
V_{a1} = 600 volts
V_g for raster cut-off = −38 volts to −78 volts
Peak to peak modulating voltage for 150 μA beam current = 30 volts

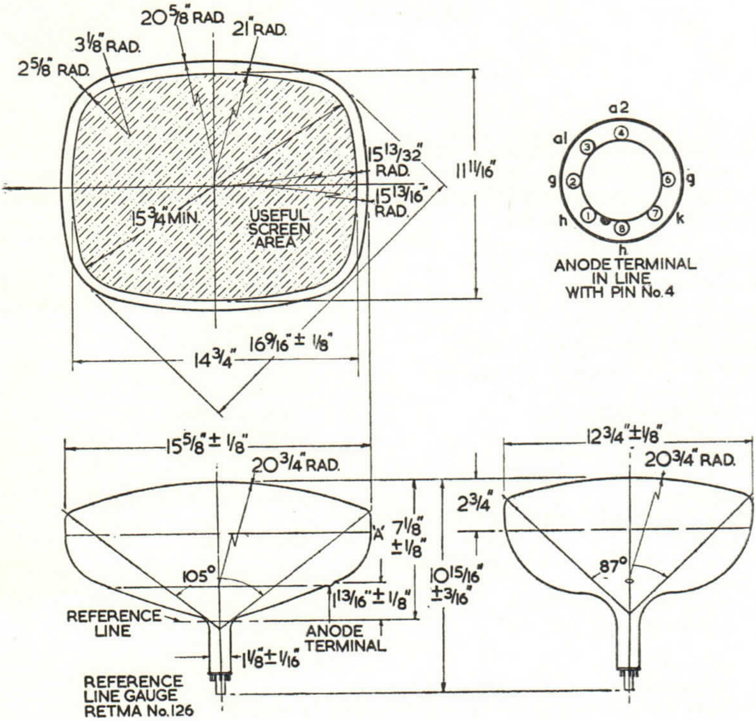
NOTE.—All voltages measured with respect to cathode.

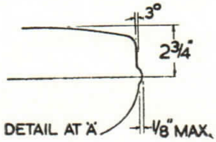
INTER-ELECTRODE CAPACITANCES

Grid to all	5 pF max.
Cathode to all	4 pF max.
Final anode to external coating	1 750 pF max.

NOTE.—This tube uses the standard B8H base with the longer spigot.

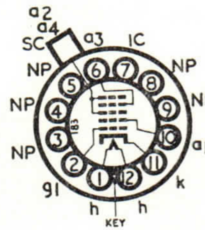
GENERAL NOTE.—No harmful X-ray radiation is produced by this tube when operated at final anode voltages below 16 kV. At voltages above 16 kV some shielding may be necessary to protect against prolonged exposure at close range.


20 5/8" RAD.
21" RAD.
3 1/8" RAD.
2 5/8" RAD.
15 13/32" RAD.
15 13/16" RAD.
11 1/16"
15 3/4" MIN.
USEFUL SCREEN AREA
14 3/4"
16 9/16" ± 1/8"
a2
a1
g
g
h
k
h
ANODE TERMINAL IN LINE WITH PIN No. 4
15 5/8" ± 1/8"
20 3/4" RAD.
'A'
7 1/8" ± 1/8"
105°
1 13/16" ± 1/8"
10 15/16" ± 3/16"
REFERENCE LINE
ANODE TERMINAL
1 1/8" ± 1/16"
REFERENCE LINE GAUGE RETMA No. 126
12 3/4" ± 1/8"
20 3/4" RAD.
2 3/4"
87°


3°
2 3/4"
DETAIL AT 'A'
1/8" MAX.

Current Equipment Type

TYPE C17SM
B12A (DUODECAL) BASE



The Brimar C17SM is a rectangular 90° deflection angle teletube with electrostatic focus, an aluminised screen and external conductive coating. The screen colour is white with a grey glass faceplate with a transmission of approximately 70 per cent.

RATINGS

Heater Voltage	6.3 volts
Heater Current	0.3 amp.
Final Anode Voltage (V_{a2+4})	18 kilovolts abs. max.
Final Anode Voltage (V_{a2+4})	12 kilovolts min.
Focus Anode Voltage (V_{a3})	—500 to 1,000 volts max.
First Anode Voltage (V_{a1})	500 volts max.
First Anode Voltage (V_{a1})	250 volts min.
Grid Voltage (V_g) Peak	2 volts max.
Heater to Cathode Voltage (V_{hk}) Cathode Positive ...	200 volts max.
Heater to Cathode Voltage (V_{hk}) Cathode Positive *	410 volts max.
Heater to Cathode Voltage (V_{hk}) Cathode Negative ...	180 volts max.
Diagonal Deflection Angle	90° approx.

** During warm-up, for a period not exceeding 45 seconds.*

OPERATING CHARACTERISTICS

Final Anode Voltage	16 kilovolts
Focus Anode Voltage	300 volts
First Anode Voltage	300 volts
Peak to Peak Modulating Voltage for Beam Current of 150 μA	30 volts
Grid Voltage to cut-off Beam Current...	—33 to —77 volts

For characteristic curve refer to type C21SM.

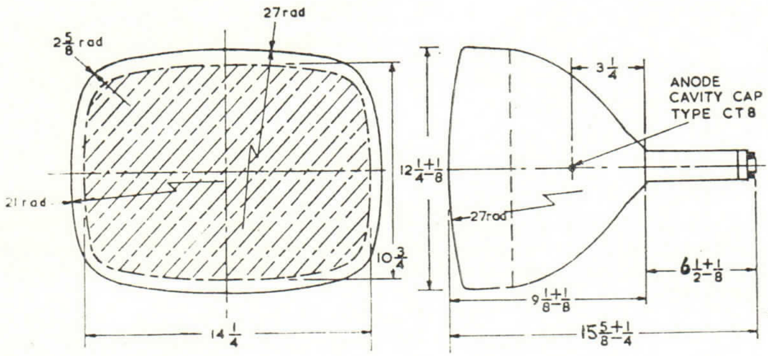
INTER-ELECTRODE CAPACITANCES

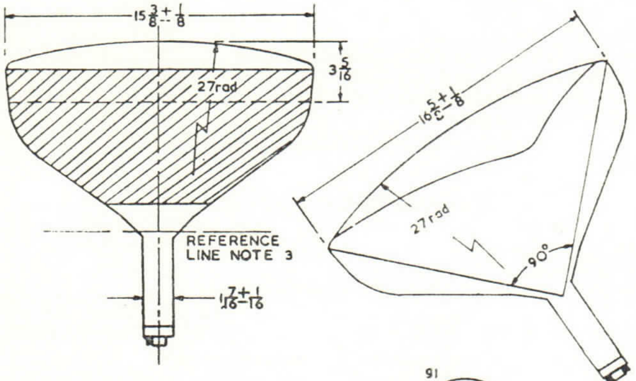
Grid to all	9.0 pF max.
Cathode to all	6.0 pF max.
Final Anode to External Coating	1,500 pF max.

NOTES:

A. No harmful X-ray radiation is produced by this tube when operated at final anode voltages below 16 kV. At voltages above 16 kV some shielding may be necessary to protect against prolonged exposure at close range.

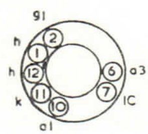
B. Shift magnets when used should be mounted in such a position that they do not interfere with the passage of the electron beam through the gun. This position is normally immediately behind the scanning coils.





NOTES
1 ALL DIMENSIONS IN INCHES
2 ANODE CAVITY CAP IN LINE ± 30° WITH VACANT BASE PIN No 6
3 REFERENCE LINE DETERMINED BY POSITION OF GAUGE RETMA No 116

(see page 299)



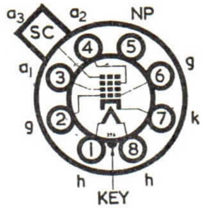
B12A
DUODECAL BASE

BRIMAR **VALVES**

Current Equipment Type

TYPE **C19AH**

B8H BASE



The BRIMAR C19AH is a rectangular 114° deflection angle teletube with tri-potential electrostatic focus, an aluminised screen and an external conductive coating. The screen colour is white with a grey glass faceplate (transmission 70 per cent approx.). The screen shape features much "squarer" corners than conventional 110° tubes.

Heater Current	0.3	amp.
Heater Voltage	4.0	volts

RATINGS

Final Anode Voltage	(V_{a3})		16.5	kV max.
Final Anode Voltage	(V_{a3})		13.0	kV min.
Focus Anode Voltage	(V_{a2})	positive	750	volts max.
Focus Anode Voltage	(V_{a2})	negative	500	volts max.
First Anode Voltage	(V_{a1})		700	volts max.
First Anode Voltage	(V_{a1})		500	volts min.
Grid Voltage	(V_g)	positive	2.0	volts max.
Grid Voltage	(V_g)	negative	150	volts max.
Heater to Cathode Voltage	(V_{hk})	k positive	200	volts max.
Heater to Cathode Voltage	(V_{hk})	k negative	180	volts max.
Heater to Cathode Voltage	(V_{hk})	k positive	*410	volts max.
Supply Source Impedance-a_2			1.5	MΩ max.
Supply Source Impedance-a_1			2.5	MΩ max.
Grid—Cathode Resistance (Rgk)			1.5	MΩ max.

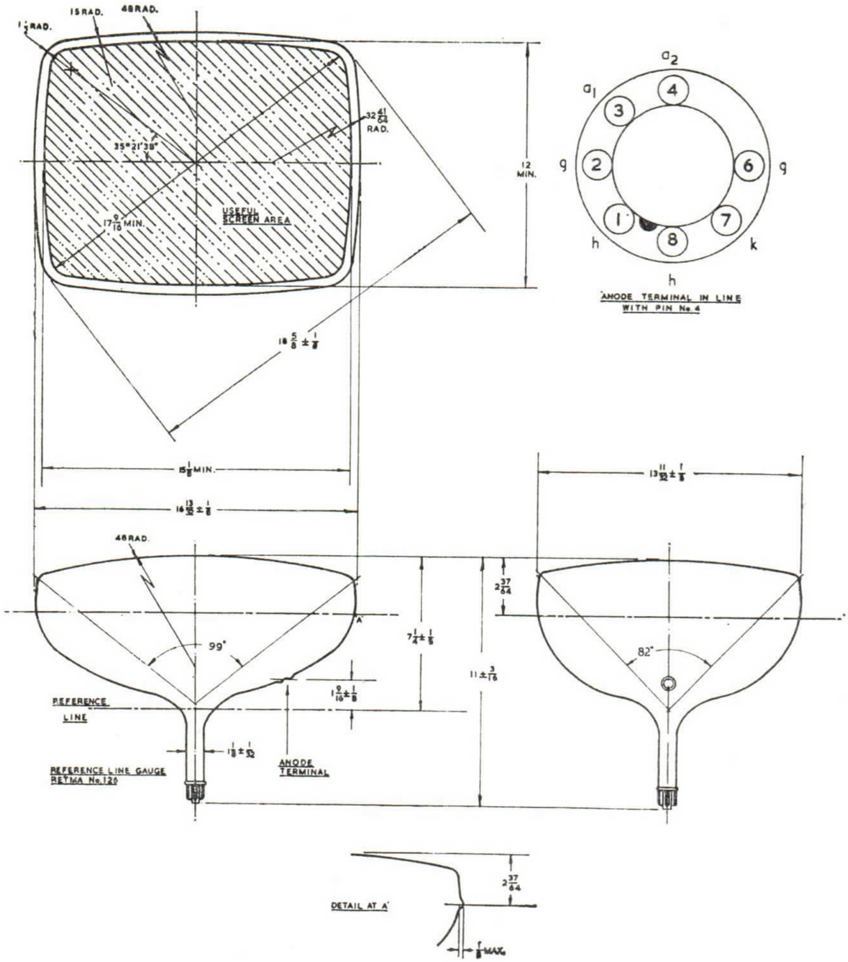
** During equipment warm-up not exceeding 45 seconds.*

OPERATING CHARACTERISTICS

Final Anode Voltage	(V_{a3})		16	kV
Focus Anode Voltage	(V_{a2})	(adjust for optimum focus)	0—450	volts
First Anode Voltage	(V_{a1})		550	volts
Grid Voltage for Raster off			−38 to −78	volts
Peak to Peak Modulation for 150 μA beam current			30	volts

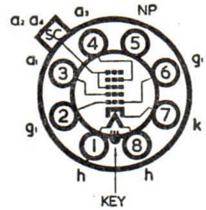
INTER-ELECTRODE CAPACITANCES

Grid to all	5.0	pF
Cathode to all	4.0	pF
Final Anode to external coating	1,750	pF


1½ RAD.
15 RAD.
48 RAD.
32 41/64 RAD.
35°21'38"
17 9/16 MIN.
USEFUL SCREEN AREA
12 MIN.
18 5/8 ± 1/8
15 1/8 MIN.
16 13/32 ± 1/8
a2
a1
g
g
h
k
h
1
2
3
4
6
7
8
ANODE TERMINAL IN LINE WITH PIN No. 4
48 RAD.
99°
A'
REFERENCE LINE
1 9/16 ± 1/8
7 1/4 ± 1/8
11 ± 3/16
2 37/64
13 11/32 ± 1/8
82°
1 1/8 ± 1/32
ANODE TERMINAL
REFERENCE LINE GAUGE RETMA No. 126
DETAIL AT A'
2 37/64
1/8 MAX.

BRIMAR VALVES

Current Equipment Type



TYPE
C19AK/AW47-90
B8H BASE

The BRIMAR C19AK/AW47-90 is a rectangular 110° deflection angle teletube with electrostatic focus, an aluminised screen and an external conductive coating. The screen colour is white with a grey glass faceplate (transmission 70 per cent approx.). The screen shape features much " squarer " corners than conventional 110° tubes.

Heater Voltage	6.3	volts
Heater Current	0.3	amps.

RATINGS

Final Anode Voltage	(V_{a2+a4})		16.0	kV. max.
Final Anode Voltage	(V_{a2+a4})		13.0	kV. min.
Focus Anode Voltage	(V_{a3})	positive	1.0	kV. max.
Focus Anode Voltage	(V_{a3})	negative	500	volts max.
First Anode Voltage	(V_{a1})		500	volts max.
First Anode Voltage	(V_{a1})		200	volts min.
Grid Voltage	(V_g)	peak	+2.0	volts max.
Heater to Cathode Voltage	(V_{hk})	k positive	200	volts max.
Heater to Cathode Voltage	(V_{hk})	k negative	125	volts max.
Heater to Cathode Voltage	(V_{hk})	k positive	*410	volts max.
Supply Source Impedance—$_{a2}$	...	... ...	1.5	MΩ max.
Supply Source Impedance—$_{a1}$	...	... ...	2.5	MΩ max.
Grid—Cathode Resistance	(R_{gk})		1.5	MΩ max.

** During equipment warm-up not exceeding 45 seconds.*

OPERATING CHARACTERISTICS

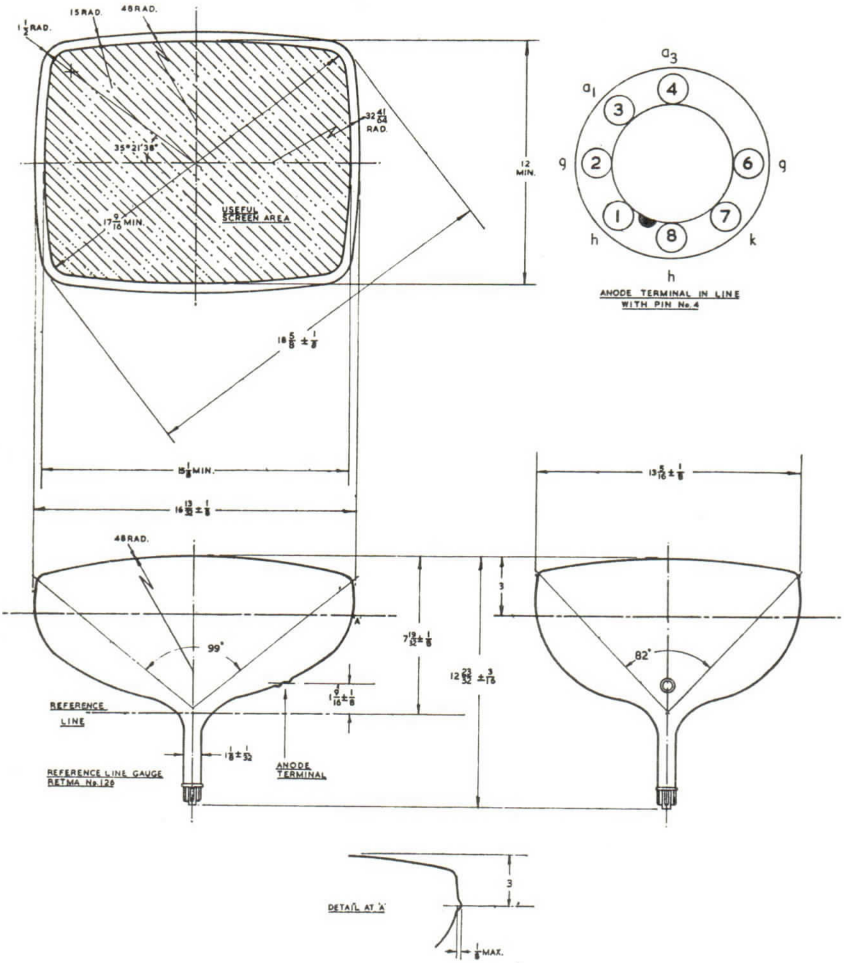
Final Anode Voltage	(V_{a2+a4})	16	kV.
Focus Anode Voltage	(V_{a3})	0 to 400	volts
First Anode Voltage	(V_{a1})	400	volts
Grid Voltage for Raster cut-off	... ...	−38 to −94	volts
Peak to Peak Modulation for 150 μA beam current		30	volts

INTER-ELECTRODE CAPACITANCES

Grid to all	6.0	pF
Cathode to all	4.0	pF
Final Anode to external coating	1,150	pF

VALVES

BRIMAR

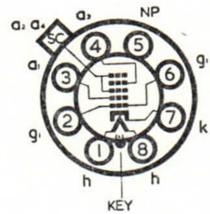


BRIMAR VALVES

Current Equipment Type

TYPE **C21AA**

B8H BASE



The BRIMAR C21AA is a rectangular 110° deflection angle teletube with electrostatic focus, an aluminised screen and external conductive coating. The screen colour is white with a grey glass faceplate with a transmission of approximately 70 per cent.

RATINGS

Heater Voltage	6.3 volts
Heater Current	0.3 amps.
Final Anode Voltage (V_{a_2+4})	17.6 kilovolts abs. max.
Final Anode Voltage (V_{a_2+4})	13 kilovolts min.
Focus Anode Voltage (V_{a_3})	—500 to 1 000 volts max.
First Anode Voltage (V_{a_1})	500 volts max.
First Anode Voltage (V_{a_1})	250 volts min.
Grid Voltage (V_g) Peak	2 volts max.
Heater to Cathode Voltage (V_{hk}) Cathode Positive	200 volts max.
Heater to Cathode Voltage (V_{hk}) Cathode Positive*	410 volts max.
Heater to Cathode Voltage (V_{hk}) Cathode Negative	180 volts max.
Diagonal Deflection Angle	110° approx.

* *During warm-up, for a period not exceeding* 45 *seconds.*

OPERATING CHARACTERISTICS

Final Anode Voltage	16 kilovolts
Focus Anode Voltage	300 volts
First Anode Voltage	300 volts
Peak to Peak Modulating Voltage for Beam Current of 150 μA	30 volts
Grid Voltage to Cut-off Beam Current	—30 to —72 volts

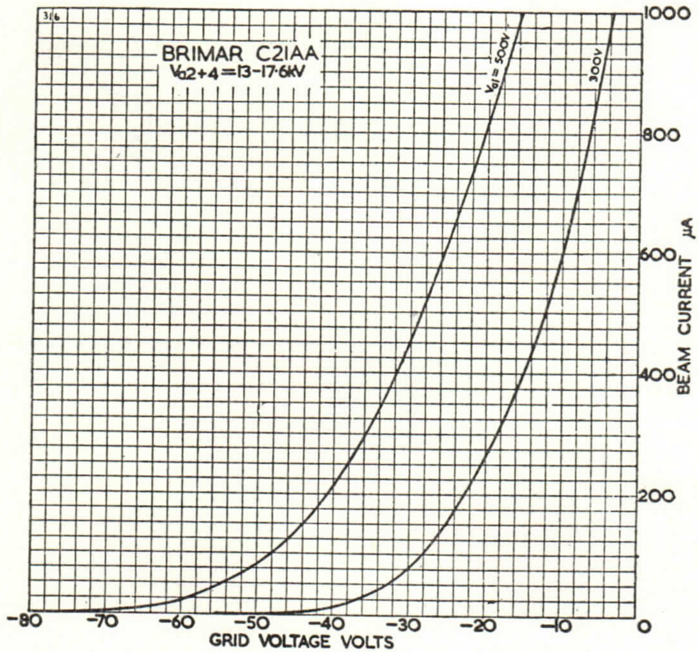
INTER-ELECTRODE CAPACITANCES

Grid to all	6.0 pF max.
Cathode to all	4.0 pF max.
Final Anode to External Coating	2 000 pF max.

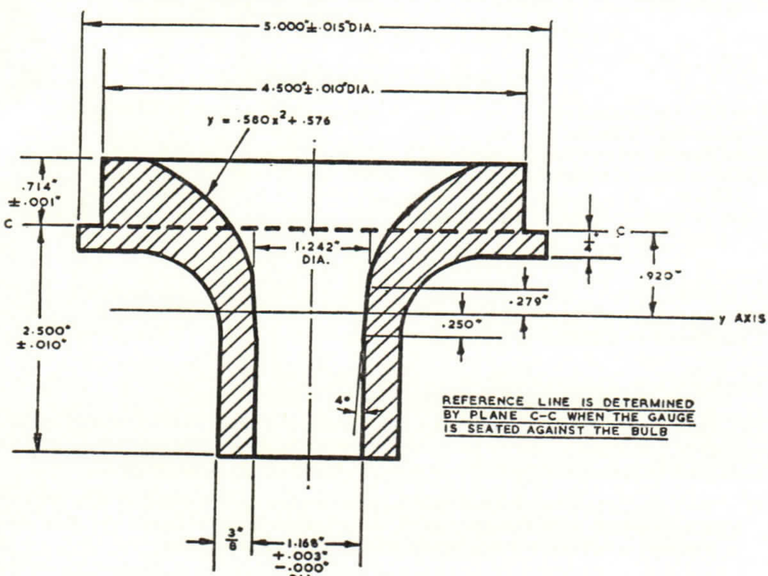
NOTES:

A. No harmful X-ray radiation is produced by this tube when operated at final anode voltages below 16 kV. At voltages above 16 kV some shielding may be necessary to protect against prolonged exposure at close range.

B. Shift magnets when used should be mounted in such a position that they do not interfere with the passage of the electron beam through the gun. This position is normally immediately behind the scanning coils.



REFERENCE LINE GAUGE JETEC No. 126

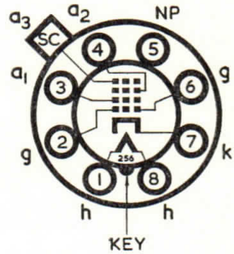


BRIMAR VALVES

Current Equipment Type

TYPE C21AF

B8H BASE



The BRIMAR type C21AF is a rectangular 110° deflection angle teletube with tripotential electrostatic focus, an aluminized screen and an external conductive coating. The screen colour is white with a grey glass faceplate with a transmission of approximately 70 per cent.

RATINGS

Heater Current	0.3 amp.
Heater Voltage	4.0 volts (nominal)
Final Anode Voltage (V_{a3})	*16 kilovolts max. 17.6kV ab. max.
Final Anode Voltage (V_{a3})	*13 kilovolts min.
Focus Anode Voltage (V_{a2}) positive ...	*750 volts max.
Focus Anode Voltage (V_{a2}) negative ...	*500 volts max.
First Anode Voltage (V_{a1})	*750 volts max.
First Anode Voltage (V_{a1})	*500 volts min.
Grid voltage (V_g) positive	*2 volts max.
Grid voltage (V_g) negative	*150 volts max.
Heater to cathode voltage (V_{hk}) cathode positive	200 volts max.
Heater to cathode voltage (V_{hk}) cathode negative	180 volts max.
Heater to cathode voltage (V_{hk}) cathode positive	†410 volts max.
A_2 supply source impedance	1.5 MΩ max.
A_1 supply source impedance	2.5 MΩ max.
R_{gk}	1.5 MΩ max.
Diagonal deflection angle	110° approx.

* Voltage with respect to cathode.
† During equipment warm-up not exceeding 45 seconds.

OPERATING CHARACTERISTICS

$V_{a3} = 16$ kilovolts.
$V_{a2} = 0$–450 volts (adjust for optimum focus).
$V_{a1} = 600$ volts.
V_g for raster cut-off $= -38$ volts to -78 volts.
Peak to peak modulating voltage for 150 μA beam current $= 30$ volts.
NOTE.—All voltages measured with respect to cathode.

INTER-ELECTRODE CAPACITANCES

Grid to all	5 pF max.
Cathode to all	4 pF max.
Final anode to external coating	1 750 pF max.

NOTE.—This tube uses the standard B8H base with the longer spigot.

GENERAL NOTE.—No harmful X-ray radiation is produced by this tube when operated at final anode voltages below 16 kV. At voltages above 16 kV some shielding may be necessary to protect against prolonged exposure at close range.

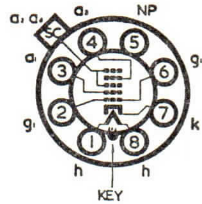
BRIMAR VALVES

Current Equipment Type

TYPE

C23AK/AW59-90

B8H BASE



The BRIMAR C23AK/AW59-90 is a rectangular 110° deflection angle teletube with electrostatic focus, an aluminised screen and an external conductive coating. The screen colour is white with a grey glass faceplate (transmission 70 per cent approx.). The screen shape features much " squarer " corners than conventional 110° tubes.

Heater Voltage	6.3	volts
Heater Current	0.3	amp.

RATINGS

Final Anode Voltage	(V_{a2+a4})		16.0	kV. max.
Final Anode Voltage	(V_{a2+a4})		13.0	kV. min.
Focus Anode Voltage	(V_{a3})	positive	1.0	kV. max.
Focus Anode Voltage	(V_{a3})	negative	500	volts max.
First Anode Voltage	(V_{a1})		500	volts max.
First Anode Voltage	(V_{a1})		200	volts min.
Grid Voltage	(V_g)	peak	+2.0	volts max.
Heater to Cathode Voltage	(V_{hk})	k positive	200	volts max,
Heater to Cathode Voltage	(V_{hk})	k negative	125	volts max.
Heater to Cathode Voltage	(V_{hk})	k positive	*410	volts max.
Supply Source Impedance—$_{a2}$	...	... ...	1.5	MΩ max.
Supply Source Impedance—$_{a1}$	...	... ...	2.5	MΩ max
Grid—Cathode Resistance	(R_{gk})		1.5	MΩ max.

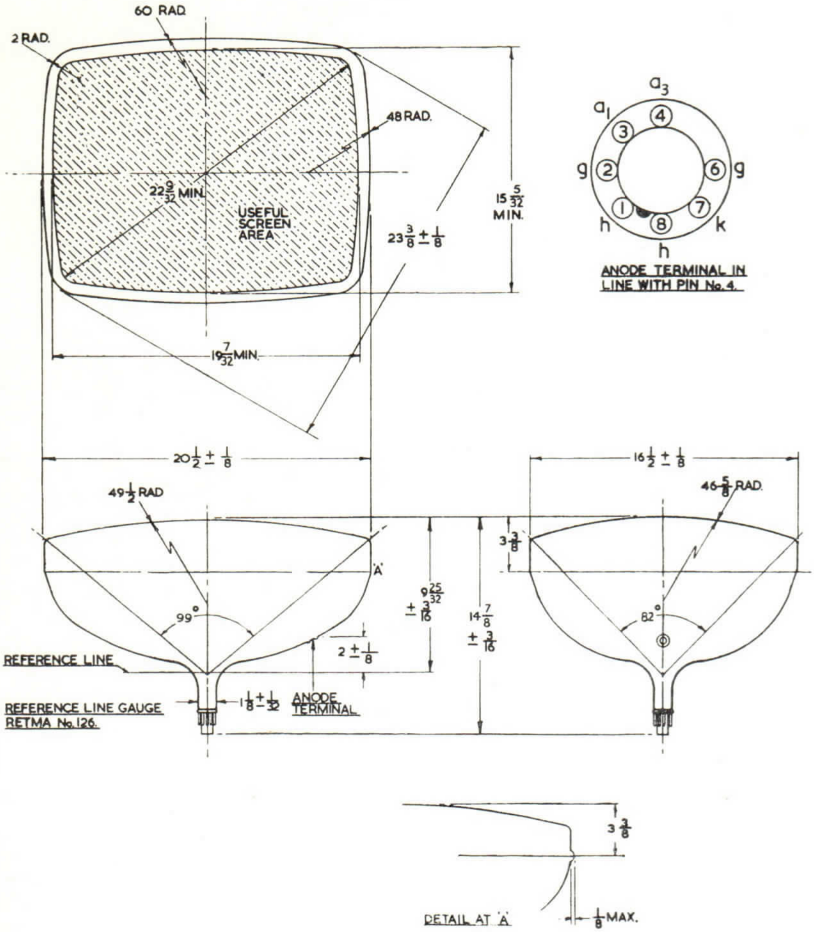
**During equipment warm-up not exceeding 45 seconds.*

OPERATING CHARACTERISTICS

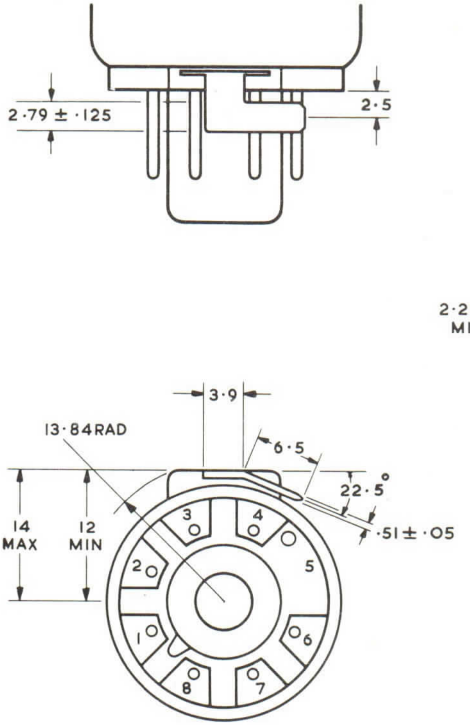
Final Anode Voltage	(V_{a2+a4})	16	kV
Focus Anode Voltage	(V_{a3})	0—400	volts
First Anode Voltage	(V_{a1})	400	volts
Grid Voltage for Raster cut-off	... ...	−38 to −94	volts
Peak to Peak Modulation for 150 uA beam current		30	volts.

INTER-ELECTRODE CAPACITANCES

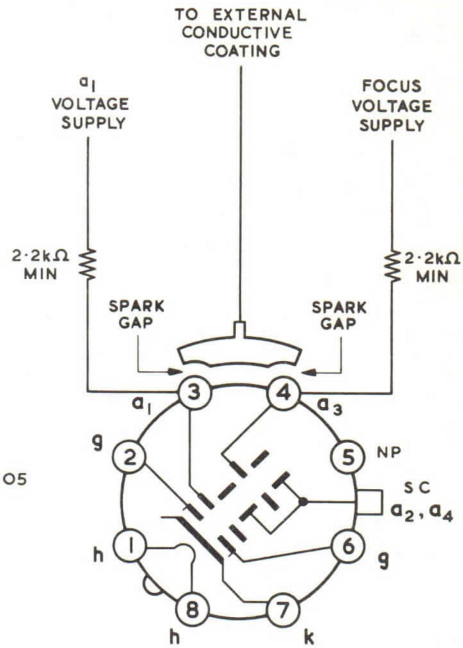
Grid to all	6.0	pF
Cathode to all	4.0	pF
Final Anode to external coating	1,800	pF


60 RAD.
2 RAD.
48 RAD.
$22\frac{9}{32}$ MIN.
USEFUL SCREEN AREA
$15\frac{5}{32}$ MIN.
$23\frac{3}{8} \pm \frac{1}{8}$
$19\frac{7}{32}$ MIN.
a_3
a_1
g
g
h
k
h
ANODE TERMINAL IN LINE WITH PIN No. 4.
$20\frac{1}{2} \pm \frac{1}{8}$
$49\frac{1}{2}$ RAD
'A'
99°
$9\frac{25}{32} \pm \frac{3}{16}$
$14\frac{7}{8} \pm \frac{3}{16}$
$2 \pm \frac{1}{8}$
REFERENCE LINE
REFERENCE LINE GAUGE RETMA No. 126.
$1\frac{1}{8} \pm \frac{1}{32}$
ANODE TERMINAL
$16\frac{1}{2} \pm \frac{1}{8}$
$46\frac{5}{8}$ RAD.
$3\frac{3}{8}$
82°
$3\frac{3}{8}$
DETAIL AT 'A'
$\frac{1}{8}$ MAX.

B8H SPARKGUARD S C.R.T. BASE



VIEW FROM FREE END



ELECTRICAL CONNECTIONS

A metal plate within the B8H base, which is taken out to a flat, side, earthing tag, forms a spark gap to the first anode and focus electrode. The plastic of Sparkguard S is coloured black.

Tube types fitted with this base have a suffix S after the type number. Sparkguard S tubes can be used in any set without circuit modification, but in sets designed for Sparkguard R protection the side tag must be bonded to pin 5 on the socket.

It is recommended that the earthing tag should be returned to the external conductive coating by the shortest possible route. The resistors of 2.2kΩ placed in series with the supply leads to the first anode and focus electrode should be such as to have a minimum surface leakage path between leads of 10 mm (e.g. at least 1/2 W size).

Connection to the earthing tag should be made by means of a push-on connector so that the connection may be removed whilst the deflector coil and other neck components are being fitted to the tube. An example of a suitable connector is the AMP "110 Series Faston Receptacle "(AMP of Great Britain Ltd., Terminal House, Stanmore, Middlesex).