

*Standard
Valves*

*Standard Telephones and Cables Limited
London.*

Ref...



The Registered Number of this Handbook is :

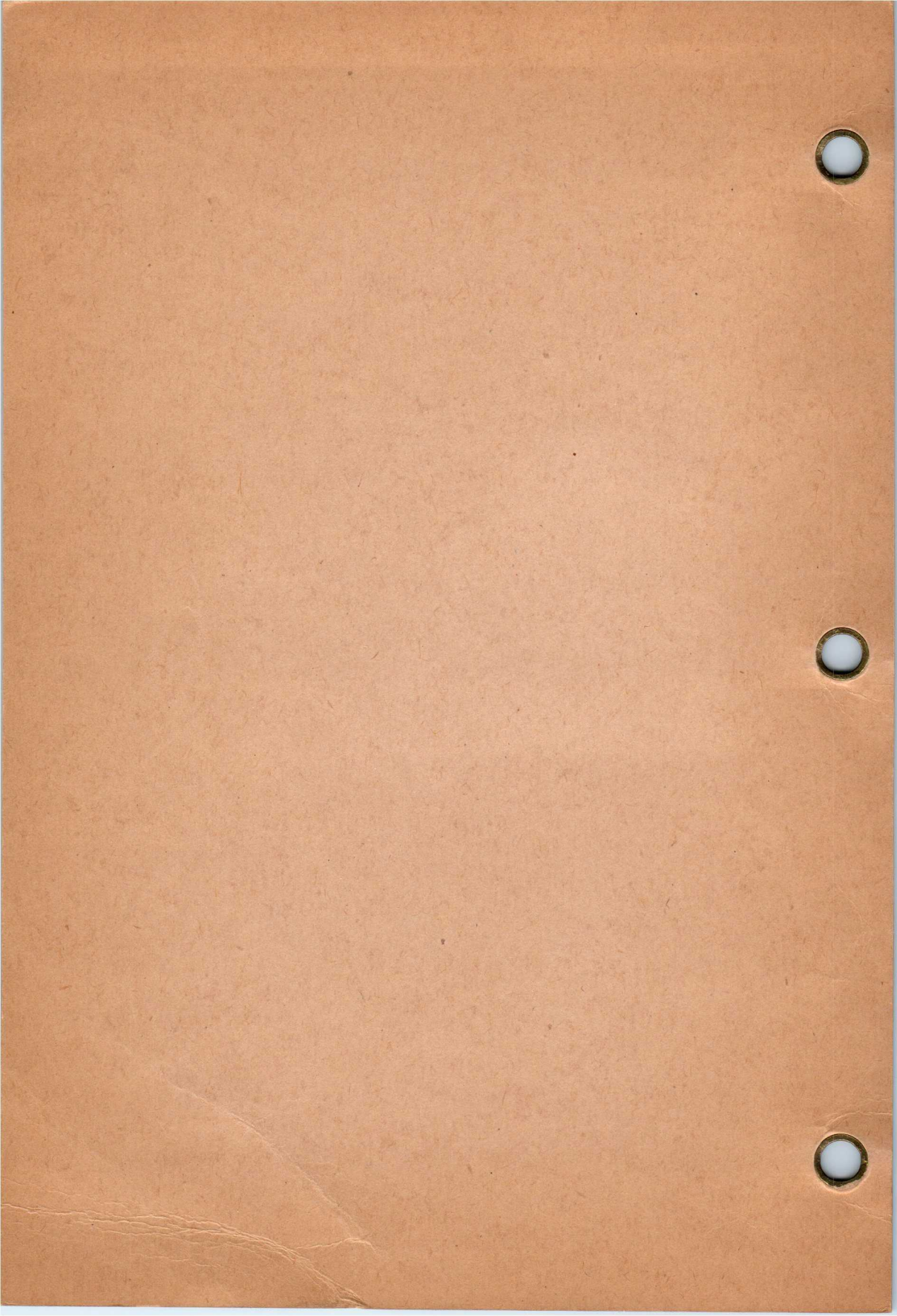
2484

Any correspondence concerning additional copies, maintenance, etc. should bear this number, and be addressed to :

STANDARD TELEPHONES & CABLES LTD.,
(Publicity Department)

CONNAUGHT HOUSE, ALDWYCH, W. C. 2.

For technical enquiries please see page A.2.



—Standard Valves—

ERRATA

OCTOBER, 1941.

To avoid unnecessary re-issue of data sheets during the period of National Emergency, will you please make the following corrections to your copy of the Valve Handbook.

Sheet No.	Correction.
V.4061-A.1 Nov., 1937	Under "Base," add "Anode top cap Type B."
V.4064-A.1 Sept., 1938	Under "Dimensions," Anode cap for 4064-A should read "Type C" instead of "Type D."
V.4069-A.1 Sept., 1938	Under "Base" add "Anode top cap Type C." Capacities should read:— Grid-anode capacity "0.1 $\mu\mu\text{F}$ " instead of "0.02 $\mu\mu\text{F}$." Input capacity "19.0 $\mu\mu\text{F}$ " instead of "15.5 $\mu\mu\text{F}$." Output capacity "13.0 $\mu\mu\text{F}$ " instead of "5.5 $\mu\mu\text{F}$."
V.4081-A.1 Sept., 1938	Under "Water Jacket," read "Type PL.122.696" instead of "Type PL.122.676."
V.4242-A.2 Jan., 1940	The Anode Voltage (Volts) on abscissa to read "200, 400, etc." instead of "100, 400, etc."
V.4264-A.1 Nov., 1937	In Basing diagram insert "P" to upper, and "G" to lower blank pins on the right hand side.
V.4328-A.1 Sept., 1938	Net weight to read "0.11 lbs. (50 gms.)" instead of "0.11 db."
W.5C/450-A.1 Jan., 1940	Maximum overall length to read "12 $\frac{1}{2}$ " (31.8 cms.)" instead of "13 $\frac{1}{4}$ " (33.6 cms.)" Capacities should read:— Grid-anode capacity 0.2 $\mu\mu\text{F}$. Input capacity "45 $\mu\mu\text{F}$ " instead of "26 $\mu\mu\text{F}$." Output capacity "27 $\mu\mu\text{F}$ " instead of "39 $\mu\mu\text{F}$." A and G3 terminals to be deleted in sketch leaving caps as shown, thus making overall length of valve "12 $\frac{1}{2}$ " instead of "13 $\frac{1}{4}$."
MC.4018-A.1 Nov., 1937	Anode voltage should read "300-1500 volts" instead of "300-2000 volts."
MC.4050-1 Jan., 1940	Anode voltage should read "350-1500 volts" instead of "350-2000 volts," and sensivity $\frac{370}{V}$ instead of $\frac{350}{V}$.
MC.VLS.492-A.1 Jan., 1940	Heater voltage should read "2 volts" instead of "4 volts" and nominal heater current "1.6 amps." instead of "1 amp."
MC.4096-AB.1 Sept. 1398	Date in lower right hand corner to read "Sept. 1938" and not "Sept. 1398."

POST CARD

Postage
Stamp

STANDARD TELEPHONES & CABLES LTD..
(PUBLICITY DEPARTMENT),

CONNAUGHT HOUSE,

63, ALDWYCH,

LONDON, W.C.2.

CHANGE OF ADDRESS OR OWNERSHIP.

Please make the following changes to the address to which new and replacement sheets for my Standard Valve Handbook should be sent:

NAME AND TITLE

.....

ADDRESS

.....

HANDBOOK No. DATE

This card may conveniently be filed in the front of your handbook.

Standard Valves



Standard Telephones and Cables Limited

(VALVE DIVISION)

NORTH WOOLWICH, LONDON, E.16.

Telegrams : Westophone

Telephone : Albert Dock 1401.

Registered Offices :

CONNAUGHT HOUSE, ALDWYCH, LONDON, W.C.2.

Telephone : Holborn 8765 (20 lines).

Telegrams : Relay, Telex, London.

Works :

NORTH WOOLWICH AND NEW SOUTHGATE.

Branch Offices and Stores :

Glasgow

Leeds

Cairo

Calcutta

Dublin

Pretoria

Representatives in Australia and New Zealand :

STANDARD TELEPHONES & CABLES (AUSTRALASIA), LTD.,

SYDNEY, MELBOURNE, AND WELLINGTON.

PRICE 7/6.

—Standard Valves—

AGENTS

- Anglo-Egyptian Sudan** - Sudan Mercantile Co. (Engrs.) Ltd., P.O. Box 97, Khartoum.
- Burma** - - - - Sydney Webster & Co. Ltd., 88 Strand Road, Rangoon.
- Ceylon** - - - - Brown & Co. Ltd., Darley Road, Colombo.
Josts Engineering Co. Ltd., Harawala Building, Wittet Road,
Ballard Estate, Bombay.
Crompton Engineering Co. (Madras) Ltd., P.O. Box 205,
1st Line Beach, Madras.
- Iraq** - - - - Austin Eastwood, 24/1 Karradat Mariam, Baghdad.
- Kenya, Uganda, Tanganyika
and Zanzibar** - - - Dalgety & Company Ltd., Livingstone House, Nairobi.
- Malaya** - - - - Paterson Simons & Co. Ltd., Collyer Quay, Singapore.
and at:—
1 and 3, Old Market Square, Kuala Lumpur.
9, Weld Quay, Penang.
- Northern Rhodesia** - - Wilfrid Watson, Cecil Avenue, Ndola.
- Palestine** - - - - Engineering Corporation of Palestine Ltd., P.O. Box 200,
Jaffa.
- Portuguese East Africa** - Empreza de Commercio Sul-Africana Lda., 56 Avenida Alvares
Cabral, Lourenco Marques.
Empreza Portugeza de Agencias (Beira) Ltd., Caixa Postal
599, Beira.
- Siam** - - - - International Engineering Co. Inc., P.O. Box, 39, Bangkok.
- South Africa** - - - Evans, Barnes & Fitz (Pty) Ltd., 33 Terminus Street,
Britannia Arcade, East London.
Frost & Holmes (Pty) Ltd., 13, Russell Road, Port Elizabeth.
W. D. Hearn & Co., Hout Street, Cape Town.
Rice & Diethelm Ltd., 86/91 Standard Bank Chambers,
Commissioner Street, Johannesburg.
Woolf Engineering Co. Ltd., Fichard Street, Bloemfontein.
J. M. Moir, 12 Morrison Street, Durban.
- South West Africa** - - T. J. Carlisle, Post Street, Windhoek.
- Southern Rhodesia** - - J. Mann & Co., 8th Avenue, Bulawayo.
(*and at Salisbury*).

—Standard Valves—

VALVE HANDBOOK

This handbook is designed to meet the demand for comprehensive technical information on all types of *Standard Valves*, Cathode Ray Tubes, Ballast Lamps, Vacuum Condensers and Vacuum Thermocouples.

In the body of the handbook information and curves on valves will be found arranged in numerical order. Comprehensive indices and explanatory material will be found in the introductory section.

Additional loose sheets will be issued periodically and posted to all registered holders of the handbook.

Please address all technical enquiries to

The Chief Valve Engineer,
Standard Telephones & Cables Ltd.,
(VALVE DIVISION),
NORTH WOOLWICH, LONDON, E.16

—Standard Valves—

VALVE HANDBOOK

NOTICE

The information given in this handbook is intended as a guide to the design of equipment using the valves and other apparatus described therein.

The constants and curves are to be taken as average values and the outputs given in 'operating conditions' are those to be expected from average valves.

The Company reserve the right to make any improvements or modifications to the valves. Relative sheets will be sent to all registered holders of this handbook at the earliest possible moment.

The valves used in broadcast receiving sets are not included in this handbook. Reference should be made to a separate list, a copy of which will be sent on request.

—Standard Valves—

NOTATIONS.

The notations used in the table of Standard Valve characteristics have the following significance :—

The letter (R) preceding the valve type indicates that the valve is for replacement purposes only.

W_p	=	Anode dissipation.
g_m	=	Mutual conductance.
μ	=	Amplification Factor.
Z	=	Impedance.
I_p	=	Direct Anode Current.
V_p	=	Direct Anode Voltage.
V_F	=	Filament Voltage.
I_F	=	Filament current.
I_s	=	Total Emission.
K	=	Type of Cathode.
OCF	=	Oxide coated filament.
IHOC	=	Indirectly heated oxide coated cathode.
TF	=	Tungsten filament.
TTF	=	Thoriated tungsten filament.

Standard Valves

NOTATIONS

The notations used in the table of Standard Valve Characteristics have the following significance

The letter 'A' preceding the valve type indicates that the valve is for

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----

TRIODES.

TRIODES below 10 watts anode dissipation.

Type	Max. Wp watts	gm mA/V.	μ	Z ohms	Max. Ip amps.	Max. Vp volts	Vf volts	If amps.	K	Maximum Frequency	
										Full Rating Mc.	Reduced Rating Mc.
(R) 4215-A	—	0.24	6	25,000	0.0022	100	1-0	0.25	OCF	—	—
4102-D, -E, -G	—	0.5	30	60,000	0.0015	190	2	0.97	OCF	—	—
3A/102-B	—	0.5	30	60,000	0.0015	190	2-1	1-0	IHOC	—	—
4264-A	—	0.54	7	12,900	0.0028	100	1.5	0.3	OCF	—	—
4020-A, -B, -C	—	0.6	30	50,000	—	190	2	0.25	OCF	—	—
4101-D, -E, -G	—	1-0	6	5,600	0.012	190	4.5	1-0	OCF	—	—
3A/101-B	—	1-0	5.8	5,700	—	200	4.5	1-0	IHOC	—	—
4104-D, -E, -G	—	1.15	2.3	2,000	—	190	4.4	0.97	OCF	—	—
4019-A, -B	—	1.27	7	5,500	—	190	4	0.25	OCF	—	—
3A/105-B	—	2.1	40	19,000	0.015	250	13	0.19	IHOC	—	—
4022-AR, -B	—	2.2	12	5,500	—	190	4	0.25	OCF	—	—
4074-A(3)	5	3-0	14	4,700	0.050	300	6.3	0.8	IHOC	—	—
4021-A, -B, -C	—	3	6	2,000	—	190	4	0.25	OCF	—	—
3B/101-B	—	5	50	10,000	0.025	200	4	1-0	IHOC	—	—

(3) Twin triode—Characteristics given are for one section only, both sections being identical.

— Standard Valves —

TRIODES.

Radiation Cooled TRIODES above 10 watts anode dissipation.

Type	Max. Wp watts	gm mA/V.	μ	Z ohms	Max. Ip amps.	Max. Vp volts	Vf volts	If amps.	Is amps.	K	Maximum Frequency	
											Full Rating Mc.	Reduced Rating Mc.
3B/100-B	10	6.2	13	2,000	0.050	200	4	1.1	—	IHOC	—	—
(R) 4024-B	10	12	12.6	1,050	0.050	350	4	1	—	IHOC	—	—
4205-E	15	2	7	3,500	0.050	400	4.5	1.6	—	OCF	15	30
4275-A	17	2.8	2.8	1,000	0.080	300	5	1.2	—	OCF	2	10
3B/200-B	20	5	25	5,000	0.135	600	6	1.1	—	OCF	2	10
4033-A, -AA, -AF	25	9.0	15	1,670	0.170	600	6	1.4	—	IHOC	2	10
4316-A	30	2.4	6.5	2,700	0.080	450	2	3.65	—	TTF	300	750
(R) 4011-B	30	2.5	4.2	1,650	0.150	350	8	1.6	—	OCF	—	—
4056-A, -B	35	2.2	12	5,500	0.100	1,000	6	1.9	—	TTF	15	30
(R) 4043-A, -B	35	2.3	8	3,500	0.110	600	7.5	1.2	—	OCF	2	10
4043-C, -D	35	2.3	8	3,500	0.110	600	7.5	1.2	—	OCF	2	10
4097-A	35	3.3	10	3,000	0.135	500	6	1.1	—	OCF	2	10
4300-A	40	5.4	3.9	720	0.100	450	5	1.2	—	OCF	—	—
4304-B, -BB	50	2.0	11	5,500	0.100	1,250	7.5	3.25	1	TTF	100	300
(R) 4211-D & E	65	4	12	3,000	0.200	1,000	10	3	—	OCF	—	—
4062-A	75	1.0	22	22,000	0.123	2,000	12	1.85	—	TTF	15	30
4242-A	85	4.2	13	3,100	0.150	1,250	10	3.25	1.5	TTF	6	30
4094-A	85	4	37	9,300	0.150	1,250	10	3.25	1.5	TTF	6	30
3C/150-A	150	5.0	18	3,600	0.200	2,500	10	3.4	—	TTF	20	60
4060-A	200	1.17	20	17,000	0.110	4,000	12.5	6	0.4	TF	10	—
(R) 4212-D	200	8	16	2,000	0.300	2,000	14	6	—	OCF	1.5	4.5
4308-B	250	7.5	8	1,070	0.325	2,250	14	6	4	TTF	1.5	4.5
4212-E	275	8.4	16	1,900	0.350	3,000	14	6	4	TTF	1.5	4.5
4270-A	350	5.7	16	2,800	0.375	3,000	10	9.75	4	TTF	7.5	22.5
4016-A	400	2	30	15,000	0.300	4,000	14	18	4	TF	33	50
4016-B	400	2.2	17	7,700	0.300	4,000	14	18	1.2	TF	33	50
4251-A & -AX	1,000	3.8	10.5	2,750	0.600	3,000	10	16	6	TTF	30	50
4279-A	1,200	5	10	2,000	0.800	3,000	10	21	8	TTF	20	40
4015-A	1,500	2.5	20	8,000	0.600	5,000	11(1)	41	2.5	TF	—	—

— Standard Valves —

TRIODES. Water Cooled TRIODES.

Type	Max. Wp watts	gm mA/V.	μ	Z ohms	Max. Ip amps.	Max. Vp volts	Vf volts	If amps.	Is amps.	K	Maximum Frequency	
											Full Rating Mc.	Reduced Rating Mc.
3073-A	2,500	2.4	40	17,400	0.9	7,500	10	54	3.6	TF	50	100
4013-C	5,000	3.7	21	5,700	0.7	6,000	14(1)	36	2.8	TF	15	22
4013-D	5,000	5.0	21	4,200	1.5	6,000	20(1)	41	6	TF	15	22
4228-A	5,000	8.2	18	2,200	1.5	6,000	22(1)	41	6	TF	3	6
4006-A	10,000	5.3	40	7,500	1.5	13,000	20(1)	50	6	TF	3	6
4047-B	10,000	5.3	40	7,500	1.5	13,000	19(1)	59	6	TF	3	6
4220-C	10,000	5.3	40	7,500	1.5	13,000	22(1)	41	6	TF	1	2
4014-A	12,000	5.3	40	7,500	1.5	12,000	21.5(1)	41	6	TF	15	22
4058-B	12,000	5.4	26	4,800	2.5	14,000	20(1)	61	10	TF	3	6
4053-A	12,000	7.8	6.5	830	—	11,000	19.5(1)	67	7	TF	—	22
SS.1971	15,000	6.0	21	3,500	2.75	12,000	20(1)	64	11	TF	15	22
4081-A	20,000	5.5	33	6,000	—	17,500	20	59	7.5	TF	—	6
4009-B	20,000	6.7	40	6,000	2.5	17,500	20(1)	61	10	TF	3	22
4030-A	80,000	16.3	36	2,200	11	17,500	21(1)	215	45	TF	2	22
4030-C	80,000	20	36	1,800	11	17,500	25(1)	250	45	TF	2	22
3067-A	160,000	40	36	900	25	17,500	35	240(2)	100	TF	2	22
3068-A	160,000	40	36	900	25	17,500	30	320(2)	100	TF	2	22

(1) exact filament voltage marked on bulb.

(2) per phase.

— Standard Valves —

TETRODES AND PENTODES.

Radiation Cooled TETRODES.

Type	Max. Wp watts	gm mA. per volt	μ	Z ohms	Max. Vp volts	Max. V _{G2} volts	Max. W _{G2} watts	Ip amps.	Vf volts	If amps.	Is amps.	K
4305-A	60	1.4	56	40,000	1,000	200	6	0.125	10	3.1	—	TTF
4282-B, -BZ	70	1.4	100	70,000	1,000	250	5	0.100	10	3	1.25	TTF
4260-A	100	1.1	200	175,000	3,000	300	15	0.100	10	3.25	1.5	TTF
4278-A	800	3.8	400	105,000	3,000	750	75	0.600	10	15.6	6	TTF

Radiation Cooled PENTODES.

4328-A	—	1.9	—	—	250	180	—	—	7.5	0.425	—	IHOC
5A/102-A	—	2.5	110	43,000	180	150	—	0.050	7.5	0.85	—	IHOC
4046-A	—	3	2,400	800,000	250	100	—	—	4	0.95	—	IHOC
4066-A	—	10	600	60,000	250	250	—	0.040	4	2	—	IHOC
4061-A	—	2.5	500	200,000	500	250	8	—	6.3	0.8	—	IHOC
4307-A & -AF	15	3.7	—	—	500	300	6	0.060	5.5	1.0	—	OCF
5B/300-B & -BF	30	6	—	—	500	300	6	0.060	10	0.8	—	IHOC
5B/500-B	50	4.5	—	—	1,250	400	10	—	10	1.3	—	IHOC
5B/501-B & -BF	50	4.5	—	—	1,250	400	10	—	13	1.0	—	IHOC
4052-A	60	3.0	1,500	500,000	1,500	300	20	—	7.5	3.0	—	TTF
4069-A	100	4.5	—	—	2,000	400	35	—	10	5.4	—	TTF
5D/100-A	1,000	4.5	—	—	3,000	850	250	—	10	16	6	TTF

PRINTED IN ENGLAND

— Standard Valves —

STANDARD RECTIFIERS.

High Vacuum RECTIFIERS.

Type	Max. inverse peak voltage Volts	Max. peak anode current Amps.	VF Volts	IF Amps.	IS Amps.	K	Output	
							V Volts	A Amps.
4274-A	—	—	5	2	—	OCF	550 (c) 450 (d)	0.200 (c) 0.150 (d)
4065-A	20,000	0.001	5	2.2	—	TF	For use with electrostatic voltmeter 6,000 (b) 7,500 (a) 14,000 (a) 14,000 (a) 14,000 (a)	0.003 (b)
4075-A	15,000	0.010	2	1.2	—	OCF		0.23 (a)
4059-A	25,000	0.35	12.5	6	0.4	TF		3 (a)
4007-A	45,000	—	20.5	50	6	TF		3 (a)
4008-B	45,000	—	19	59	6	TF		3 (a)
4222-A	45,000	—	22	41	6	TF		3 (a)

Hot Cathode Mercury Vapour RECTIFIERS.

4037-A	1,000	0.8	4	2	—	OCF	300 (b)	0.25 (b)
22V/310-A	1,400	0.8	5	3	—	OCF	(Full wave)	rectifier
4048-A	1,600	0.75	5	1.8	—	OCF	500 (a)	0.45 (a)
4017-B	7,000	1.5	2.7	8	—	OCF	2,500 (a)	0.9 (a)
4049-C	10,000	5	4	9.5	—	OCF	3,200 (a)	2.5 (a)
4064-A,-B	10,000	5	5	6.75	—	OCF	3,200 (a)	2.5 (a)
4077-A	16,000	5	5	10	—	OCF	5,150 (a)	2.5 (a)
4078-A	20,000	10	5	20	—	OCF	6,400 (a)	5 (a)
4079-A	20,000	20	5	40	—	OCF	6,400 (a)	12.5 (a)
4080-A	16,000	50	5	100	—	OCF	5,150 (a)	31 (a)

- (a) For 2 valves in single phase full wave circuit.
- (b) For 1 valve in single phase half wave circuit.
- (c) Output with choke input filter.
- (d) Output with condenser input filter.

STANDARD RECEIPTS

- (a) On the 1st day of the month...
- (b) On the 1st day of the month...
- (c) On the 1st day of the month...
- (d) On the 1st day of the month...
- (e) On the 1st day of the month...
- (f) On the 1st day of the month...

Account	Particulars	Debit	Credit	Balance	Receipts	Payments	Balance
A-1000							
A-1001							
A-1002							
A-1003							
A-1004							
A-1005							
A-1006							
A-1007							
A-1008							
A-1009							
A-1010							
A-1011							
A-1012							
A-1013							
A-1014							
A-1015							
A-1016							
A-1017							
A-1018							
A-1019							
A-1020							
A-1021							
A-1022							
A-1023							
A-1024							
A-1025							
A-1026							
A-1027							
A-1028							
A-1029							
A-1030							
A-1031							
A-1032							
A-1033							
A-1034							
A-1035							
A-1036							
A-1037							
A-1038							
A-1039							
A-1040							
A-1041							
A-1042							
A-1043							
A-1044							
A-1045							
A-1046							
A-1047							
A-1048							
A-1049							
A-1050							
A-1051							
A-1052							
A-1053							
A-1054							
A-1055							
A-1056							
A-1057							
A-1058							
A-1059							
A-1060							
A-1061							
A-1062							
A-1063							
A-1064							
A-1065							
A-1066							
A-1067							
A-1068							
A-1069							
A-1070							
A-1071							
A-1072							
A-1073							
A-1074							
A-1075							
A-1076							
A-1077							
A-1078							
A-1079							
A-1080							
A-1081							
A-1082							
A-1083							
A-1084							
A-1085							
A-1086							
A-1087							
A-1088							
A-1089							
A-1090							
A-1091							
A-1092							
A-1093							
A-1094							
A-1095							
A-1096							
A-1097							
A-1098							
A-1099							
A-1100							

PRINTED IN ENGLAND

—Standard Valves—

MISCELLANEOUS.

Mercury Vapour Relay.

Type	V _H	I _H	Peak V _p	Peak Instantaneous Anode current	Grid control ratio
4039-A	4v.	1 amp.	500 v.	200 mA.	30 to 50

Ballast Lamps.

Type	Current (amps.)	Voltage (volts)	Overall Length (")	Diameter (")
4003-A	0.94 — 1.01	3 — 9.5	5	1 $\frac{1}{4}$
4004-A	0.24 — 0.26	7 — 14	4	1 $\frac{1}{2}$
4004-B	0.24 — 0.26	3 — 9	4	1 $\frac{1}{2}$
4004-C	0.254 — 0.276	3 — 9	4	1 $\frac{1}{4}$
4007-A	3.3 — 3.4	9 — 14	7 $\frac{1}{2}$	2
4008-A	1.7 — 2.2	5.5 — 12	5 $\frac{1}{2}$	2
4120-AA	0.39 — 0.47	5.5 — 12	4	1 $\frac{1}{2}$
4121-AA	0.78 — 0.94	5.5 — 12	4 $\frac{1}{2}$	1.89

Cathode Ray Tubes.

Type	Screen		Overall Length	V _p volts
	Max. dia.	Colour		
High Vacuum.				
4096-AB	3"	Blue	10 $\frac{3}{8}$ "	800 — 2,000 max.
4063-AB	6 $\frac{1}{4}$ "	Blue	21"	5,000 max.
4063-YB	6 $\frac{1}{4}$ "	Blue	21"	5,000 max.
Gas Filled.				
4018-AB*	4 $\frac{1}{2}$ "	Blue	13"	300 — 2,000 max.
4018-AD*	4 $\frac{1}{2}$ "	Delay	13"	300 — 2,000 max.
4018-AG*	4 $\frac{1}{2}$ "	Green	13"	300 — 2,000 max.
4018-BB*	7"	Blue	19"	300 — 2,000 max.
4018-BD*	7"	Delay	19"	300 — 2,000 max.
4018-BG*	7"	Green	19"	300 — 2,000 max.
4050-AB	4 $\frac{1}{2}$ "	Blue	13"	300 — 2,000 max.
4050-AD	4 $\frac{1}{2}$ "	Delay	13"	300 — 2,000 max.
4050-AG	4 $\frac{1}{2}$ "	Green	13"	300 — 2,000 max.
4050-BB	7"	Blue	18 $\frac{1}{2}$ "	300 — 2,000 max.
4050-BD	7"	Delay	18 $\frac{1}{2}$ "	300 — 2,000 max.
4050-BG	7"	Green	18 $\frac{1}{2}$ "	300 — 2,000 max.

* For replacement purposes only.

Microfuse.

Type 4013-A (See information sheet)

Neon Indicator Lamp.

Type VLS. 405 (See information sheet)

—Standard Valves—

MISCELLANEOUS.

Thermocouples.

Thermocouples are supplied in three different mountings, and are coded 4001, 4002, and 4003. The suffix letter indicates the characteristics of the thermocouple, and the following is a table showing the types available.

Suffix letter	Resistance (Ω) $\pm 10\%$		Max. safe heater current (mA.)	Heater current (mA) required to produce in couple an open-circuit voltage of:	
	Heater	Couple		5 millivolts	15 millivolts
A	0.3	3	1,000	400 — 500	750 — 1000
B	0.6	3	500	180 — 205	360 — 500
C	5	3	75	30 — 37	58 — 75
D	35	12	16	6 — 8	12 — 16
E	43	30	15	5.5 — 7.5	11 — 15
F	46.5	12	15	5 — 7.5	10 — 15
G	200	12	15	3 — 6.5	6.5 — 15
H	400	12	7	1.8 — 3.5	4 — 7
J	600	12	5	1.5 — 2	3.5 — 5
K	750	12	5	1.3 — 1.8	3 — 4.2
L	1,000	12	4	1.2 — 1.6	3 — 4
M	1,120	12	7	1.8 — 3.5	4 — 7
N	46.5	12	15	5 — 7.5	10 — 15
P	600	45	5	1.5 — 2	3.5 — 5
R	1.3	12	160	67 — 85	130 — 160
S	10	12	35	13 — 17	26 — 35
U	600	22	5	1.5 — 2	3.5 — 5
AM	90	12	9	3.0 — 4.5	6 — 9
HJ	550	12	6	1.6 — 2.5	3.6 — 5.8

Vacuum Condensers.

Type	Capacity ($\mu\mu\text{F.}$)	Test Voltage (v.RMS)	Overall Length (ins.)	Diameter (ins.)
4034-A	26	40,000	15½	2½
4035-A	40	40,000	17	3½

—Standard Valves—

DEFINITIONS

Grids.

When more than one grid is employed the grid nearest the cathode is referred to as the "first grid," the next grid is the "second grid," etc.

In tetrodes the first grid is normally the control grid and the second grid the screen grid.

In pentodes the first grid is normally the control grid, the second grid the screen grid and the third grid the suppressor grid.

Constant Voltage Type Heater or Filament.

A heater or filament designed to operate at a fixed voltage. The current may vary slightly from the nominal value from valve to valve, and also during the life of a valve.

Constant Current Type Heater or Filament.

A heater or filament designed to operate at a fixed current. The voltage may vary slightly from the nominal value from valve to valve, and also during the life of a valve. This type is used when a number of valves are connected with filaments or heaters in series.

Impedance or Internal Resistance.

The rate of change of anode voltage with anode current, control grid voltage being kept constant.

Amplification Factor.

The rate of change of anode voltage with control grid voltage, anode current being kept constant. It is equal to the theoretical voltage amplification that would be obtained if the output circuit impedance were infinitely high.

Mutual Conductance.

The rate of change of anode current with control grid voltage, anode voltage being kept constant. It follows from the above definitions that it is equal to the amplification factor divided by the impedance.

Total Emission.

The maximum instantaneous electronic current that can be drawn from the filament. No figure for total emission is given for oxide coated cathodes, as they cannot be operated near the maximum obtainable current without injury to the emitting surface.

Input Capacity.

The direct static capacity between the control grid and all other electrodes except the anode. In the case of a triode it is the grid to cathode capacity.

—Standard Valves—

The effective dynamic input capacity is greater by an amount depending on the voltage amplification of the stage and the grid to anode capacity. Where the output impedance is effectively a pure resistance, the dynamic capacity is given by :—

$$C = C_{in} + C_{gp} \left(1 + \frac{V_p}{V_g} \right)$$

where C_{in} = input capacity.

C_{gp} = grid to anode capacity.

$\frac{V_p}{V_g}$ = voltage amplification ratio of the stage.

Output Capacity.

The direct static capacity between the anode and all other electrodes except the first grid.

Grid to Anode Capacity.

The direct static capacity between the control grid and the anode.

Maximum Direct Anode Voltage.

The maximum direct voltage applied to the anode at which it is safe to operate the valve for any class of operation except anode modulation. It is recommended that a somewhat lower value be used to allow for variations in mains voltage, etc. It should be noted that the instantaneous anode voltage may rise to approximately double this figure.

Maximum Direct Anode Voltage for Anode Modulation.

The maximum direct voltage applied to the anode at which it is safe to operate the valve when it is used as a anode modulated amplifier. Under these circumstances the instantaneous anode voltage may rise to approximately four times this figure.

Maximum Direct Anode Current.

The maximum direct current passing between cathode and anode which can safely be used for any class of operation.

Maximum Continuous Anode Dissipation.

The maximum permissible power that can be dissipated by the anode in addition to that received by radiation from the filament. The published figure should not be exceeded.

Maximum Grid Dissipation.

The maximum power that can safely be dissipated by the grid. All *Standard* valves are so designed that the permissible grid dissipation will not be exceeded if the valve is used within the recommended operating conditions.

—Standard Valves—

Maximum RF Grid Current.

Standard Valves are so designed that, provided the operating conditions stated are adhered to, no precaution need be taken to limit the RF grid current.

Maximum Frequency for Full Rating.

The valve may be operated at the maximum ratings defined above for any frequency up to this figure. For higher frequencies the anode voltage should be reduced. The anode current and anode dissipation figures may be regarded as unaltered for the higher frequencies although it will usually be found that these figures are automatically reduced when the lower anode voltage is used.

Maximum Anode Voltage at Higher Frequencies.

This figure gives a guide to the value of anode voltage that may be used at frequencies above the limit for full rating. At any specified frequency between these limits the permissible voltage may be obtained by interpolation of the values given.

Signals.

In these notes and in the valve data sheets the term 'signal' is used in a very wide sense to include any alternating voltage applied to the input of an amplifier. The output voltage is a function (ideally a linear function) of the 'signal.'

Output Power.

The power delivered by the valve to the output circuit. It is equal to the product of the alternating components of current and voltage of the anode. The losses in the output circuit will reduce the output from the stage to a lower figure, and allowance for these losses must be made in designing apparatus to have a given output.

Class A Amplification.

Operation with such voltages and applied signal that anode current does not cease to flow at any period during the cycle of the applied signal and the grid does not at any time become positive with respect to any part of the cathode.

—Standard Valves—

Class A Voltage Amplifier.

Fig. 1 shows the circuit conditions for Class A Voltage Amplification.

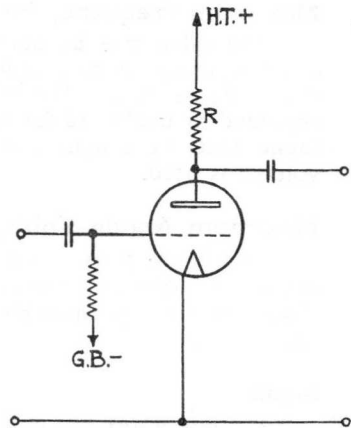
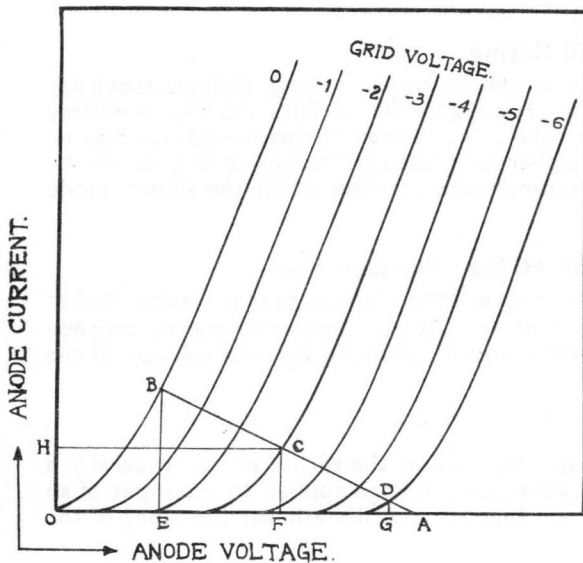


Fig. 1.

The point A is taken on the anode voltage corresponding to the voltage of the anode supply. The line AB is drawn at such an angle that the ratio $AE/BE = R$ (the anode series resistance) to cut the zero grid line at B. The "working point" C is chosen on this line, slightly nearer to B than A, and the working bias is found by noting which grid voltage curve passes through this point. The point D is taken when the grid voltage is twice the working grid voltage. The voltage amplification ratio is given by the voltage EG divided by the grid voltage of D. The maximum voltage output (peak value) is $EG/2$. The anode current is given by OH.

The proportion of second harmonic to fundamental at full output on a voltage basis is approximately

$$\frac{EF - FG}{2 \times EG}$$

The above analysis assumes that the anode-cathode capacity and the dynamic input capacity of the next stage are sufficiently small to be neglected. This will only be true up to a certain frequency, and as a result the stage gain will fall off sharply at higher frequencies. The magnitude of this effect may be calculated approximately as follows:—The slope of the tangent at C is the working conductance of the valve ($= 1/Z$ say) the sum of the anode-cathode

—Standard Valves—

capacity and the effective input capacity of the next stage = C say ; then the loss in gain at a frequency such that $Z = \frac{1}{2\pi fC}$ will be approximately 3 decibels.

From the above it will be seen that the value of R should be as large as possible subject to the limitation imposed by the previous paragraph. In practice a value of three to five times the nominal impedance of the valve will be found suitable, lower values being used when an exceptionally wide frequency band is to be covered.

Class A Power Amplification.

Figure 2 shows the circuit conditions and load line diagram for Class A power amplification.

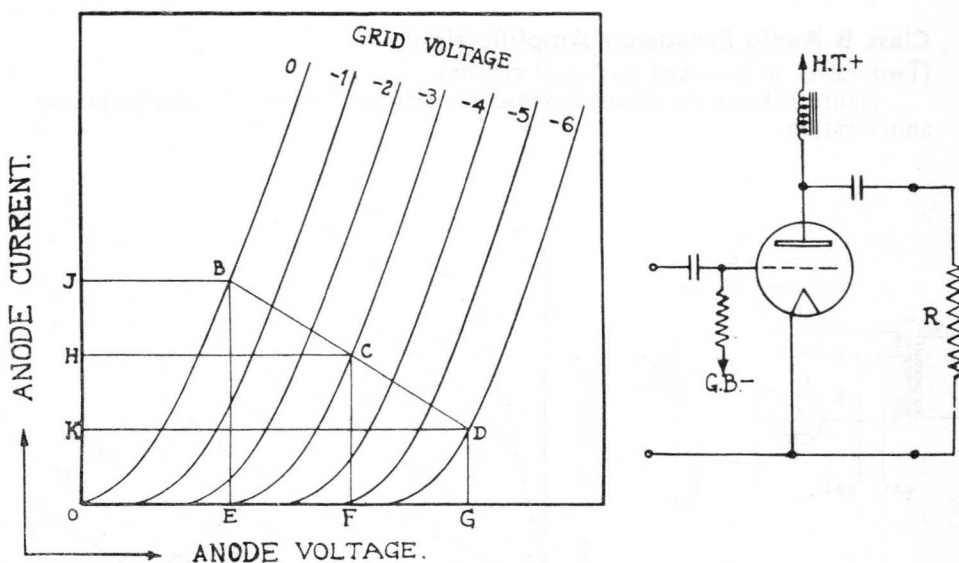


Fig. 2.

The point C is taken with OF equal to the supply voltage and OH equal to the standing anode current. These are limited by the maximum permissible anode voltage, and the maximum permissible anode dissipation. The load line BD is drawn with slope equal to the load resistance R. The point B is on the zero grid voltage curve and the point D on the curve corresponding to twice the grid voltage of C. The maximum power is then

$$(EG \times JK) / 8$$

and the proportion of second harmonic to fundamental at full output on a voltage basis is approximately

$$\frac{EF - FG}{2 \times EG}$$

It will be seen that the choice of the point C and the value of output impedance offer a number of alternative operating conditions. It is found in

—Standard Valves—

practice that the maximum output for a given anode voltage and given permissible distortion occurs when the load resistance is equal to twice the working impedance of the valve (reciprocal of the slope of the tangent at C). The maximum gain, that is maximum output for a given grid input voltage, however, occurs when the load resistance is equal to the working impedance of the valve. The higher the load resistance the lower will be the percentage of second harmonic.

Class B Amplification.

Operation with such voltages that the anode current flows for approximately half the cycle of the applied signal. The amplitude of the signal may be such that the grid is driven positive. For audio frequency applications two valves are connected in a balanced push-pull circuit.

Class B Audio Frequency Amplification.

(Two valves in balanced push-pull circuit).

Figure 3 shows the circuit and load line diagram for Class B audio frequency amplification.

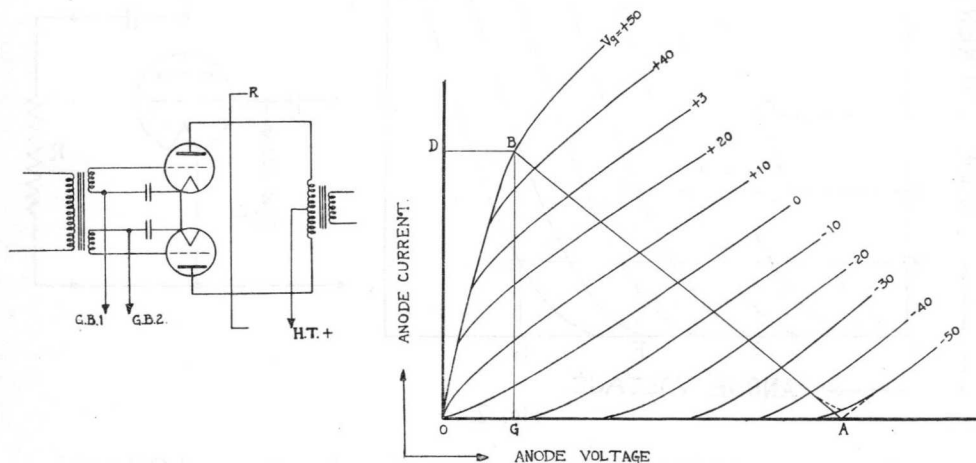


Fig. 3.

The slope of the load line is $R/4$ when R is the anode to anode impedance of the load. The power output for the two valves is given by $AG \times BG/2$.

The following method has been used for arriving at the optimum working conditions and has been found to give satisfactory results. In the case of water cooled valves the limitation is the maximum available emission from the filament. The direct anode current for maximum signal is taken as one fifth of the total emission. The peak anode current (BG on diagram) is π times this figure. The efficiency is taken as 55% and the output power is therefore equal to the direct anode current multiplied by the supply voltage multiplied

—Standard Valves—

by 0.55. This determines the value of AG , since $AG \times BG/4$ is the output power per valve. The anode dissipation is 45% of the input power.

The grid is biased to such a value that the zero signal anode current is approximately one-fifth of the direct anode current for maximum signal. The peak value of the driving voltage required for each valve is the algebraic difference between the grid bias and grid voltage corresponding to the point B. In practice, separate adjustment of grid bias should be provided for the two valves.

In the case of radiation cooled valves the limitation is generally the maximum permissible anode dissipation. In this case, therefore, the figure of direct anode current for maximum signal is obtained by making the input power equal to $100/45$ times the anode dissipation and proceeding as before.

Radio Frequency Amplifier Class B Telephony.

Modulated Carrier applied to the grid.

This type of working is used in radio transmitters in stages following that at which modulation is carried out. The valve has to be capable of dealing with input and output voltages equal to twice those of the unmodulated carrier condition.

For water cooled valves the direct anode current is taken as one-eighth of the total emission for long and medium wavelengths, and one-tenth of the total emission for short wave operation, and the efficiency as $33\frac{1}{3}\%$. For radiation cooled valves the input power must be limited to 1.5 times the permissible anode dissipation. The output impedance is calculated as for the case of Class B Audio Amplification, but the exact value is best found by experiment after the circuit has been set up. The impedance should be made as high as possible consistent with absence of distortion of the modulation envelope.

The value of grid bias used is not critical but may conveniently be made such that the anode current with signal removed is about one-fifth of the direct anode current.

Class C Amplification.

Operation with such voltages that the anode current flows for less than half the cycle of the applied signal. The amplitude of the signal is such that the grid is driven positive.

Class C Telephony. Anode modulated.

This type of working is used to modulate the carrier in a radio transmitter either in the final or earlier stages. The grid is biased beyond cut off and a steady radio frequency alternating voltage is applied to the grid. The audio frequency modulating e.m.f. is connected in series with the H.T. supply. This has the effect of doubling the H.T. supply during the peaks of modulation, and for this reason it is necessary to use a lower mean value of H.T. voltage.

The direct anode current is taken as one-eighth of the total emission, and the efficiency is taken as $66\frac{2}{3}\%$. The power taken from the source of modulating e.m.f. is equal to half the anode input power.

—Standard Valves—

The grid bias should be adjusted by experiment for optimum results, suitable values being between two and three times that required for cut off of the anode current in the absence of grid signal. A portion of this bias should be obtained by means of a resistance in the grid circuit as this tends to stabilise the output and also improves the efficiency by automatically adjusting the bias during the modulation cycle.

Class C Telephony. Unmodulated.

This type of working is used in all applications when a steady unmodulated output wave is required.

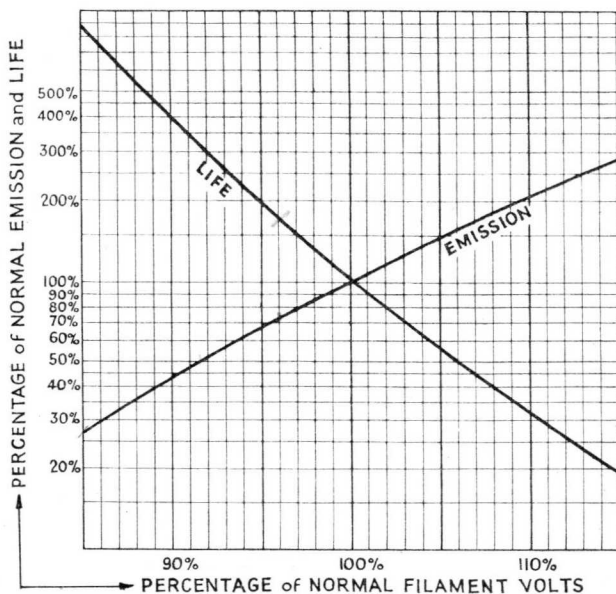
The direct anode current is taken as one-quarter of the total emission and the efficiency is taken as $66\frac{2}{3}\%$. The grid bias should be adjusted for optimum results, suitable values being between two and three times that required for cut off of the anode current in the absence of grid signal.

—Standard Valves—

CATHODES

Tungsten.

In some of the transmitting valves tungsten filaments are used. In order to produce the necessary emission the filament must be operated at a high temperature, thus causing evaporation of the metal and consequent reduction in diameter of the filament. The life of the valve thus depends on the rate of evaporation of the tungsten and failure will occur through decreased emission or burn-out of the filament. Where valves are to be operated at less than their full rated output economy can be effected by reducing the filament voltage according to the following curve.



Thoriated Tungsten.

Certain valves employ a thoriated tungsten filament, which operates at a much lower temperature than pure tungsten. The filament should always be operated at its rated value.

In cases where severe overload has temporarily impaired the emission, the activity can sometimes be restored by operating the filament, with anode and grid voltages at zero, at 30% above the normal filament voltages for 10 minutes and then at normal filament voltage for 20—30 minutes.

—Standard Valves—

Oxide Coated.

A coating of alkaline—earth compounds on a metallic filament when heated, forms a source of electron emission.

These may be of the directly heated or filamentary type, or indirectly heated or cathode type. The latter type consist of a small metallic cylinder coated on the outside with alkaline earth compounds. Inside the cylinder is the heater which is usually electrically insulated from the cathode.

—Standard Valves—

VALVE BASES AND SOCKETS

	Base.	Valve Socket.
Screw	Edison Miniature	Edison Miniature
	Edison Medium	Edison Medium
	Edison Goliath	Edison Goliath
2-pin	Special	4022-C
4 pin	Standard British	4015-A
	American Tapered Small	4012-A or 4020-A
	American Medium	4012-A or 4020-A
	American Medium-bayonet	4012-A or 4020-A
	Miniature bayonet thrust	4001
	Medium bayonet thrust	4002
	Medium bayonet thrust with offset pin	4002-A
	Medium bayonet thrust with offset pin for thermocouple	4004-A
	Large bayonet	4009-C
	Extra large bayonet	4009-A
Special low loss	Special low loss	
5 pin	Standard British	4015-A
	American Medium	4020-B
	American Giant	4026-A
7 pin	Standard British	4015-B
	American Medium	4026-B
8 pin	American Octal	4015-D
9 pin	Standard British	4015-C
12 contact	Special	G.E.C. 12 terminal

— Standard Tables —

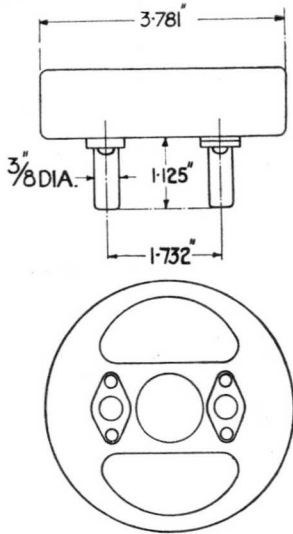


PRINTED IN
ENGLAND

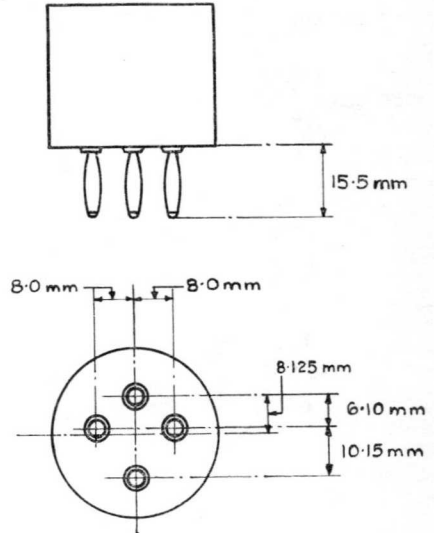
—Standard Valves—

BASE DIMENSIONS

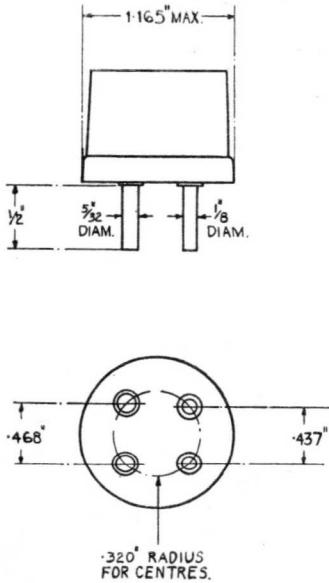
Special 2-pin Base



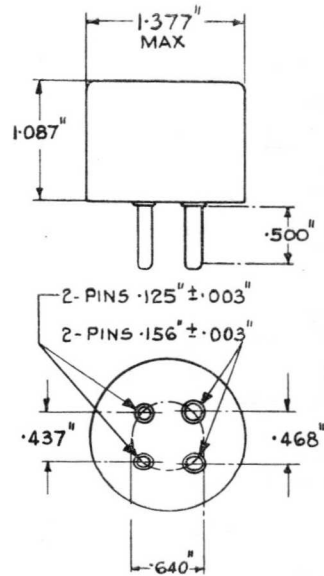
Standard British 4-pin



American Tapered Small 4-pin

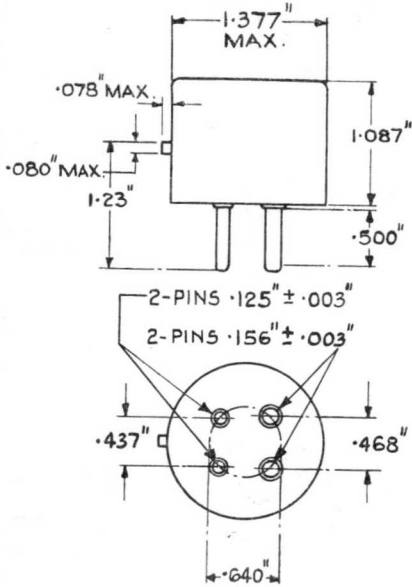


American Medium 4-pin

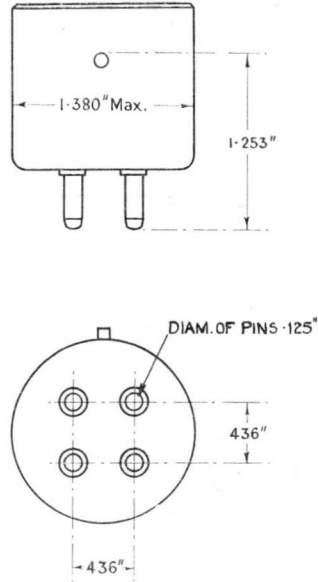


—Standard Valves—

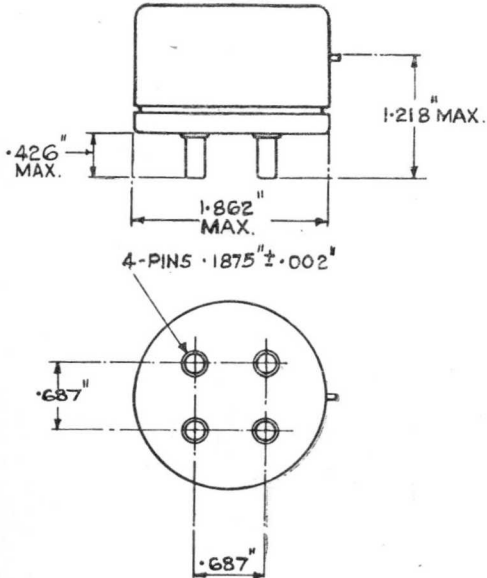
American Medium
4-pin bayonet



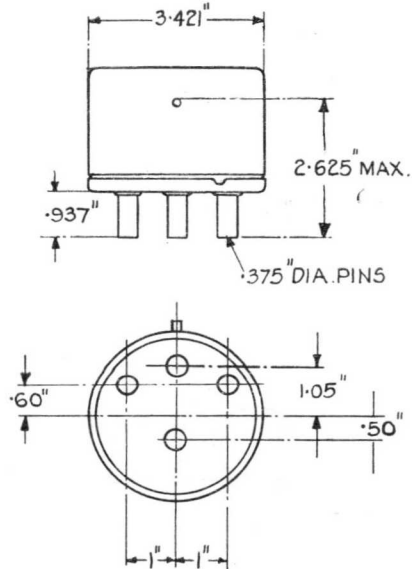
Medium 4-pin
Bayonet Thrust



Large 4-pin
Bayonet

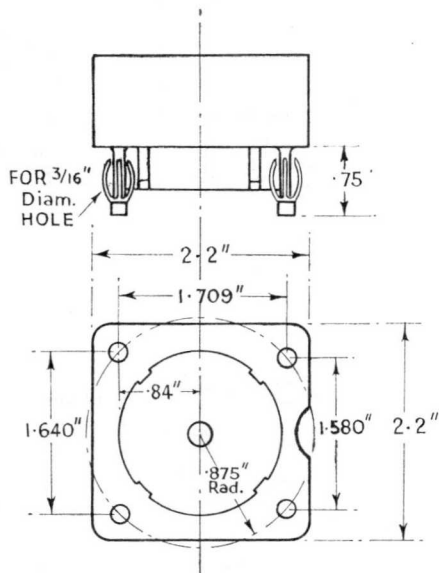


Extra Large
4-pin Bayonet

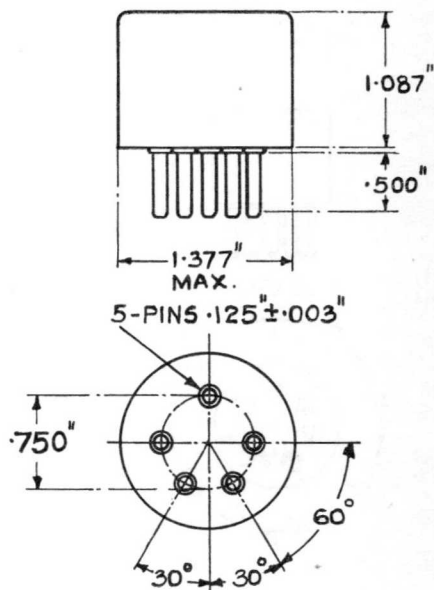


—Standard Valves—

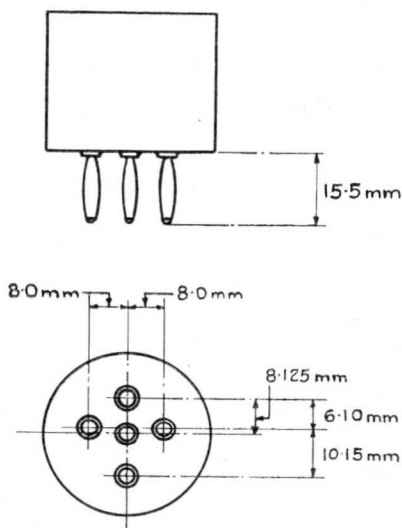
Special 4-pin
Low Loss



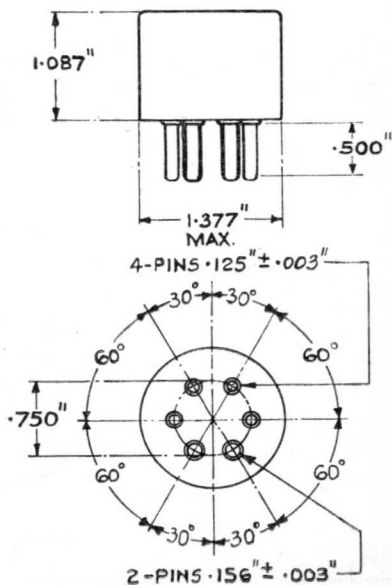
American Medium
5-pin



Standard British
5-pin

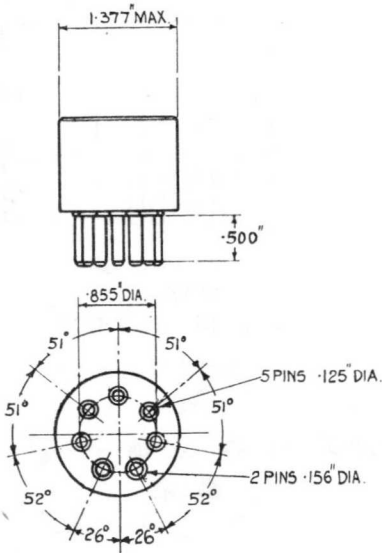


American Medium
6-pin

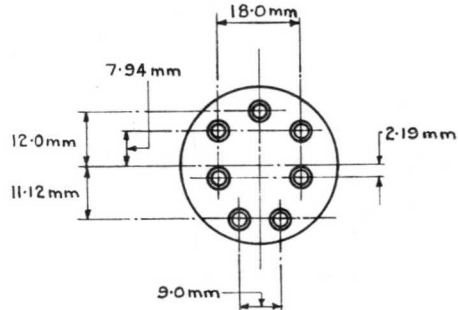
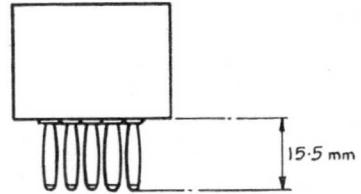


—Standard Valves—

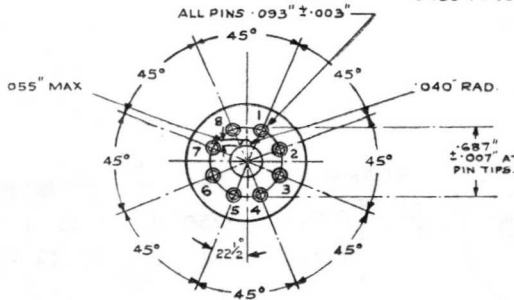
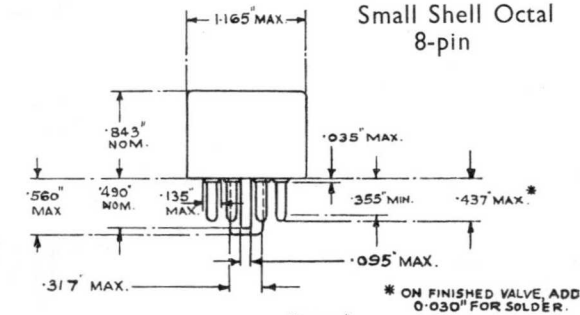
American Medium
7-pin



British 7-pin



Small Shell Octal
8-pin



BOTTOM VIEW OF BASE.

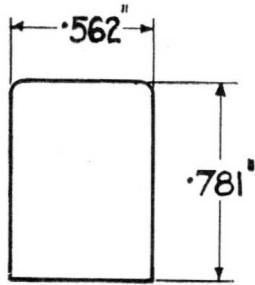
PRINTED IN
ENGLAND

SMALL SHELL OCTAL 7-PIN BASE
AS ABOVE, OMITTING PIN NO 8

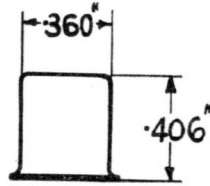
SMALL SHELL OCTAL 6-PIN BASE
AS ABOVE, OMITTING PINS NO 4 & 6

—Standard Valves—

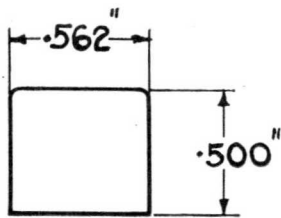
VALVE CAPS



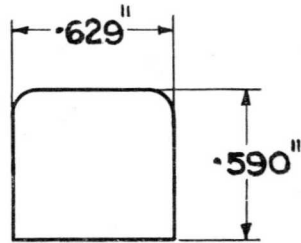
Type A



Type B



Type C



Type D

Standard Vices

PRINTED IN
ENGLAND

WATER COOLED VALVES

Standard water cooled valves are made for all purposes and include :—

Water cooled diodes.

Water cooled triodes for long and medium wave operations.

Water cooled triodes for short and ultra short wave operations.

These valves are listed in this handbook with their characteristics and operating conditions.

Among the special features of these valves are :—

1. Copper-glass seals of the Houskeeper type.

These seals are used for anodes and filament and grid leads and many years of experience have proved their remarkable properties. These seals can be relied upon as absolutely vacuum tight and can withstand very considerable temperature changes. It is thus possible to operate valves without any special cooling means for these seals, such as air blast or water circulation.

2. Owing to the use of exceptionally gas free copper and the very highly controlled methods of exhausting, the vacuum is not impaired under heavy overloads.

3. Every valve is carefully tested during manufacture and individually radiographed. The measurements made are very complete and include that of total emission. Every valve is retested prior to despatch.

Special Notes on the Operation and Maintenance of Water Cooled Valves.

Filaments.

With each valve is packed a card giving the exact filament voltage measured at the terminals of the valve necessary to give the marked emission. This card also gives curves showing how the emission and expected life vary with the applied filament voltage. Maximum life will be obtained with the filament operated at the minimum voltage necessary to give the required total emission. Filaments should be operated with A.C. ; if direct current is used the polarity should be reversed at intervals (e.g., once a week to obtain maximum life.)

When lighting filaments the instantaneous switching current should not be allowed to exceed twice times the normal running current.

Water Cooling.

The design of the cooling system is important and it must be capable of providing the necessary flow at a positive pressure in the jacket. The water should preferably be distilled and the mineral content should not exceed 0.03 gm. per litre.

The specific resistance of the water should be greater than 50,000 ohms per cubic centimetre.

—Standard Valves—

The water system should be designed to avoid aeration and no large water surfaces in the tanks should be exposed to air. The dissolved oxygen content should be maintained at less than 1 cu. cm. per litre.

An approximate figure for the average waterflow is given for each water cooled valve. The outlet temperature of the water should be kept below 60°C.

Mounting of the Valve.

The valves should always be operated with their axes vertical. As the bulbs become quite hot, free air ventilation by unimpeded natural circulation is necessary. No apparatus should be mounted within 10 cms. of the glass bulb. This precaution becomes of increasing importance at the higher frequencies.

Operating Conditions.

The maximum conditions given in this handbook are for the real maximum and they should not be exceeded when the circuits are being adjusted or at any other time.

Water Jackets.

In double ended water cooled valves the water jacket forms part of the valve.

For single ended water cooled valves the following water jackets are available :—

Anode Dissipation.

Up to 6 Kw.

6 — 15 Kw.

Over 15 Kw.

Water Jacket.

MS.1362-1 Valve Socket.

MS.1362-20 Valve Socket for below panel connection.

223 LU. 1A.

PL.122075.

Special Water Jackets :—

PL.120705/B used on 4053-A Valve.

PL.121438/A used on 3073-A Valve.

—Standard Valves—

HOT CATHODE MERCURY VAPOUR RECTIFIERS

The characteristics of hot cathode mercury vapour rectifiers either with or without control grids are rated or defined by the majority of manufacturers by the maximum instantaneous current and the maximum inverse voltage which the valves can support.

This definition is not complete ; different authorities have indicated that the maximum current and inverse tension supported by a given type of valve depends enormously on the circuit in which the valve is used. The inverse current, *i.e.*, the current passing across the valve during the period when the anode is negative, would be one of the factors determining the probability of a short circuit in a rectifier valve. The presence of the inverse current in hot cathode mercury vapour rectifier valves and its influence on the performance of these valves, is allied with the principle of the valve itself, which is the employment of an ionised medium for carrying the rectified current.

In a mercury vapour valve, the ignition or striking voltage is that voltage which sets up ionisation by collision of the mercury vapour with electrons coming from the cathode. This tension varies with the pressure of the mercury vapour and lies between 12 and 20 v. for valves of the type 4017. The ionised mercury vapour does not resume instantly its de-ionised condition, but passes through a certain number of levels corresponding to the stable or metastable conditions of the mercury vapour ; each change of level is accompanied by a loss of energy with emission of monochromatic light whose wavelength is determined by the difference in energy of the two consecutive levels.

The voltage drop in a rectifier is the average value of the voltage which gives to the electrons drawn from the cathode, the energy sufficient to reach the anode, *i.e.*, the average value of the voltage which gives to electrons sufficient energy to bring molecules of mercury to the ionisation condition. The fact that the voltage drop is less than the ignition voltage shows that the mercury vapour does not resume instantaneously its de-ionised or neutral condition. At any instant in a valve, the quantity of mercury vapour, which is in a condition different from the neutral state, depends on the value of the current at that instant, and also on the value of the current at the time immediately preceding the moment under consideration.

At the moment of the apparent extinction of the valve, *i.e.*, at the moment at which the characteristics of the rectifier cause the current in the valve to pass through zero, all the mercury vapour is not in the neutral or de-ionised state, the inverse voltage begins to increase at the terminals of the valve and two opposing phenomena are set up :—

1. The mercury vapour tends to resume its neutral state.
2. The voltage applied between anode and cathode tends to set up the re-ionisation of the mercury vapour.

It may be said very approximately that if the first phenomenon is preponderant, the valve will support the inverse voltage, but if the second phenomenon preponderates, the valve will not support the inverse voltage.

—Standard Valves—

(This explanation supposes that the arc back is not caused accidentally, as for example by the formation of a cathodic spot on the anode due to the presence of mercury in the region of the anode or some electronic emission of the anode due to the presence of barium on its surface. Such accidental effects give, in general, arc backs at inverse voltages less than 10,000 volts.)

Following on the hypothesis set out above, if it is desired to increase the inverse voltage supported by the valves, it is necessary to increase the speed at which the mercury vapour resumes its normal state and to decrease the influence of the inverse voltage on the speed of recombination.

The two phenomena may be changed by two different methods :—

1. By modifying the characteristics of the rectifier valve.
2. By modifying the wave-shape of the rectified current and of the inverse current.

For example following on (1) above in a given valve the decrease of temperature of the mercury vapour, *i.e.*, its pressure, increases the speed of recombination. The increase of the surface of the electrodes by the employment of grids and screens can increase also the speed of recombination. The form of these screens, anodes, etc., decreases the electric field in the valves during the period at which it carries the inverse voltage and can thus reduce the influence of the inverse voltage.

On the other hand, (2) above by changing the characteristics of the circuit it is possible to change the manner in which the valve will support the inverse voltage. Residual ionisation in the valve is only troublesome immediately after the instant at which the inverse tension is applied. The quantity of mercury vapour ionised depends on the instantaneous value of the current in the valve and when the current decreases the quantity of vapour ionised decreases also, but with a delay, and it is evident that if the current stops abruptly, the de-ionisation time would be longer than if the current decreases progressively. The wave-shape of the inverse voltage applied to the valve can also change the properties of the latter. If, immediately after the extinction of the valve, the inverse voltage increases very rapidly, its influence can easily become more important than that of the recombination of the mercury vapour.

OPERATING INSTRUCTIONS.

Light the filament of a new valve at its normal current for 15 minutes before applying anode voltage for the first time. Never apply the anode voltage until the cathode is quite hot. As it is dangerous to draw anode current with reduced cathode temperature, the valves must never be used with heater voltage or heater current lower than the rated value. It is more satisfactory to control the heater current than the voltage across the heater bus bars, so as to avoid errors due to valves becoming unscrewed. If large main supply voltage variations are expected, it would be preferable to regulate the heater supply to $\pm 2\%$. In order to compensate the variations of the heater supply and the variations of the heater resistances from valve to valve it is necessary to adjust the normal working conditions in such a manner that

—Standard Valves—

in any case the valves are not under-heated. In the case of valves heated in parallel or with common filament meters, adjust the meter readings at 5% above the normal conditions. The anode voltage must be removed if the heater power falls below its proper value.

The output circuit must be connected to the cathode of the indirectly heated valves.

These valves must always be used in a vertical position with filament connections at the lower end. Rectifiers types 4017-A and -B must always be well ventilated so that the maximum temperature of the filament cap, and about 22mm. of the glass bulb near the filament cap is **50°C. (120°F.) or lower.** This means that with normal natural ventilation by convection, the valves can be used in air temperature ranging from 5°C. (40°F.) to 35°C. (95°F.).

When the valves are working under proper conditions, it is possible to see a blue glow between the cathode and the anode. Under the proper conditions, the glow will be a clear pale blue and will be localised in the upper middle portion of the bulb. If the bulb is completely full of glow, the valve is too cold.

— Standard Notes —



PRINTED IN
ENGLAND

—Standard Valves—

SS 1971
Valve

SS 1971 VALVE

DOUBLE ENDED WATER COOLED TRIODE.

SPECIFICATION.

Cathode.

Pure Tungsten filament.
Constant voltage type.

Dimensions.

Net weight 7 lbs. (3,200 gms.)
Overall length $26\frac{1}{2}$ " (67.5 cms.)
Bulb diameter $3\frac{1}{2}$ " (8.9 cms.)

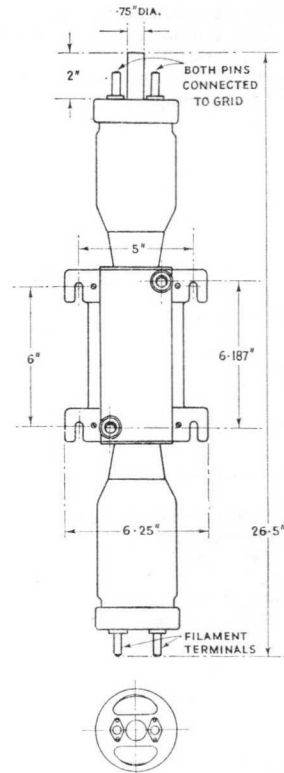
Water Flow.

5 gallons per minute.

Constants.

Filament voltage 19–21 volts
(exact filament voltage marked
on bulb).
Nominal filament current 64 amps.
Total emission 11 amps.
*Impedance 3,500 ohms
*Amplification factor 21
Grid-anode capacity 20 $\mu\mu\text{F}$.
Anode-filament capacity 5.5 $\mu\mu\text{F}$.
Grid-filament capacity 8 $\mu\mu\text{F}$.

* at anode current of 1.0 amp.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	12,000 volts
Maximum direct anode voltage for anode modulation	9,000 volts
Maximum direct anode current	2.75 amps.
Maximum anode dissipation	15 Kw.
Maximum grid dissipation	250 watts
Maximum frequency for above ratings	15 Mc.
Anode voltage for frequency of 22 Mc.	10,000 volts

Note :—No water jacket required as it forms part of the valve.

V.1971-I
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class B. A.F. Amp. For balanced 2 valve circuit.
Direct anode voltage	10,000 volts
Grid bias	—250 to —350 volts
Direct anode current per valve—zero signal	0.45 amps.
Direct anode current per valve—maximum signal	2.2 amps.
Load resistance—anode to anode	4,000 ohms.
Maximum signal output—2 valves	24 Kw.
Anode dissipation	10 Kw.

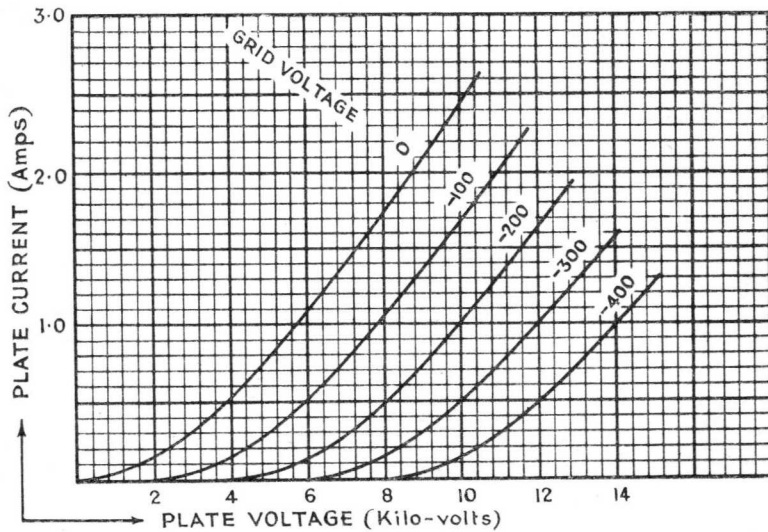
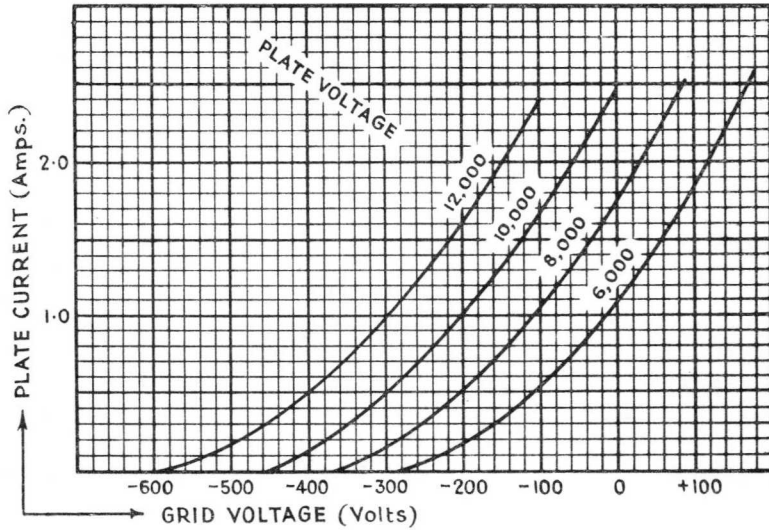
RADIO FREQUENCY OPERATION.

	Class B Telephony	Class C Telephony	Class C Telegraphy
	Modulated Carrier applied to grid	Subject to anode modulation	Unmodulated
Direct anode voltage	10,000	7,000	10,000 volts
Direct anode current	1.5	1.5	3 amps.
Grid bias	—400	—650	—900 to —1,300 volts
Anode dissipation	10	3.5	10 Kw.
Carrier output	5	7	20 Kw.

—Standard Valves—

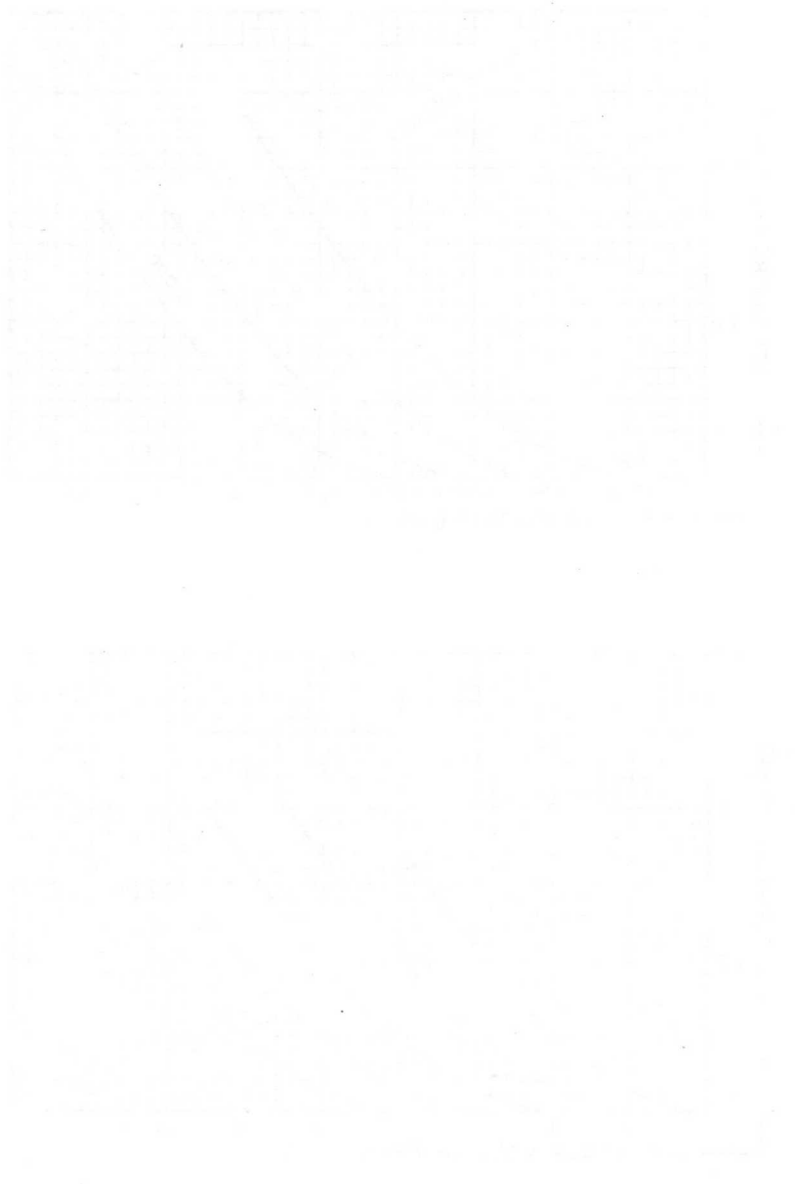
SS 1971
Valve

These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



V.1971.2
Nov. 1937

— 2011 1000000 —



PRINTED IN
ENGLAND

—Standard Valves—

3067-A
Valve

3067-A VALVE

SINGLE ENDED WATER COOLED TRIODE.
FOR USE WITH D.C., SINGLE OR TWO PHASE A.C.

SPECIFICATION.

Cathode.

Pure Tungsten filament.
Constant voltage type.

Water Jacket.

Type PL.122642/A

Water Flow.

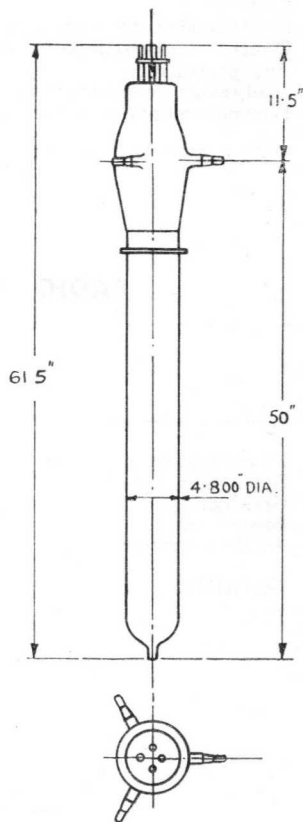
40 gallons per minute.

Dimensions.

Overall length $61\frac{1}{2}$ " (156 cms.)
Anode diameter $4\frac{7}{8}$ " (12.2 cms.)
Net Weight 40 lbs. (18,000 gms.)

Constants.

Filament voltage 35 volts
Nominal filament current 240 amps.
Total emission 100 amps.
Impedance 900 ohms.
Amplification factor 36
Grid-anode capacity 145 $\mu\mu\text{F}$.
Anode-filament capacity 38 $\mu\mu\text{F}$.
Grid-filament capacity 110 $\mu\mu\text{F}$.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	17,500 volts
Maximum direct anode current	25 amps.
Maximum anode dissipation	160 Kw.
Maximum grid dissipation	3,000 watts
Maximum frequency for above ratings	2 Mc.
Maximum anode voltage for frequency of 22 Mc.	15,000 volts

Note :—All enquiries should be addressed to :—

Les Laboratoires L.M.T.,
46, Avenue de Breteuil,
Paris.

Tentative data

V.3067-A.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class B A.F. Amp. and Mod. For balanced 2 valve circuit
Direct anode voltage	12.5 Kv.
Grid bias	—250 volts
Direct anode current per valve—zero signal	2.6 amps.
Direct anode current per valve—maximum signal	13 amps.
Anode dissipation	73 Kw.
Load resistance—anode to anode	850 ohms.
Maximum output—2 valves	180 Kw.

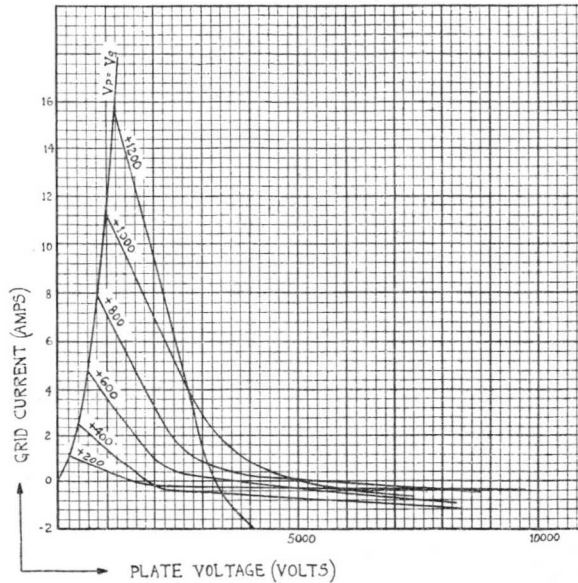
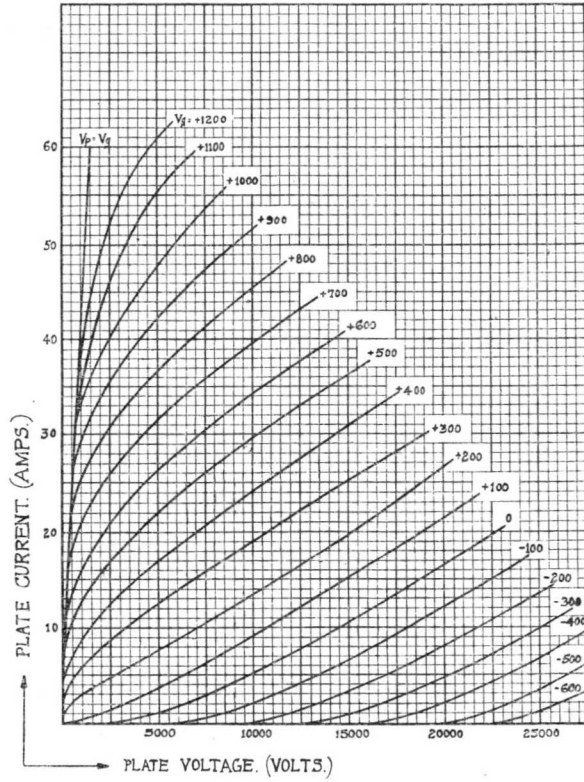
RADIO FREQUENCY OPERATION.

	Class B Telephony			
	Modulated Carrier applied to grid			
Direct anode voltage	17.5	15	12	10 Kv.
Direct anode current	9.6	9.6	9.6	9.6 amps.
Grid bias	—400	—300	—200	—150 volts
Power output	50	43	34	24 Kw.
Anode dissipation	118	101	81	72 Kw.
FREQUENCY	2	12	19	22 Mc.

	Class C Telephony				Class C Telegraphy			
	Subject to anode modulation				Unmodulated			
Direct anode voltage	12	11	10	9	17.5	15	12	10 Kv.
Direct anode current	10	10	10	10	19.2	19.2	19.2	19.2 amp.
Grid bias	—500	—450	—400	—350	—500	—300	—200	—150 to
Carrier output	80	70	60	40	—650	—450	—350	—300 volts
Anode dissipation	40	40	40	50	200	172	136	96 Kw.
FREQUENCY	2	12	19	22	136	112	94	96 Kw.
					2	12	19	22 Mc.

—Standard Valves—

3067-A
Valve



Tentative data

V.3067-A.2
Nov. 1937

STANDARD FORM NO. 64

PRINTED IN
ENGLAND

—Standard Valves—

3068-A
Valve

3068-A VALVE

SINGLE ENDED WATER COOLED TRIODE.
FOR THREE PHASE OPERATION.

SPECIFICATION.

Cathode.

Pure Tungsten filament.
Constant voltage type.

Water Jacket.

Type PL.122642/A.

Water Flow.

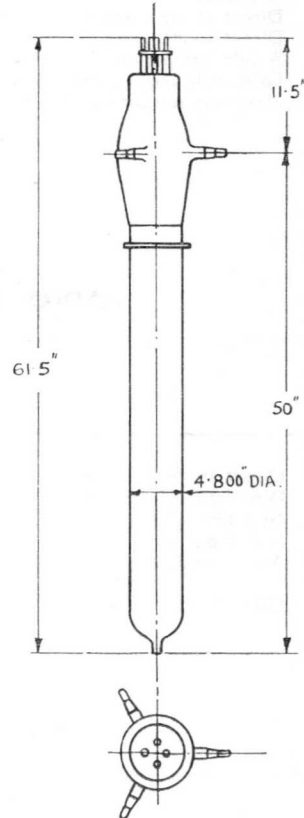
40 gallons per minute.

Dimensions.

Overall length $61\frac{1}{2}$ " (156 cms.)
Anode diameter $4\cdot8$ " (12.2 cms.)
Net Weight 40 lbs. (18,000 gms.)

Constants.

Filament voltage 30 volts
Nominal filament current 320 amps.
Total emission 100 amps.
Impedance 900 ohms
Amplification factor 36
Grid-anode capacity $145 \mu\mu\text{F.}$
Anode-filament capacity $38 \mu\mu\text{F.}$
Grid-filament capacity $110 \mu\mu\text{F.}$



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct voltage	17,500 volts
Maximum direct anode current	25 amps.
Maximum anode dissipation	160 Kw.
Maximum grid dissipation	3,000 watts
Maximum frequency for above ratings	2 Mc.
Maximum anode voltage for frequency of 22 Mc.	15,000 volts

Note :—All enquiries should be addressed to :—

Les Laboratoires L.M.T.,
46 Avenue de Breteuil,
Paris.

Tentative data

V.3068-A.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class B A.F. Amp. and Mod. For balanced 2 valve circuit
Direct anode voltage	12.5 Kv.
Grid bias	—250 volts
Direct anode current—zero signal	2.6 amps.
Direct anode current—maximum signal	13 amps.
Anode dissipation	73 Kw.
Load resistance—anode to anode	850 ohms
Maximum output—2 valves	180 Kw.

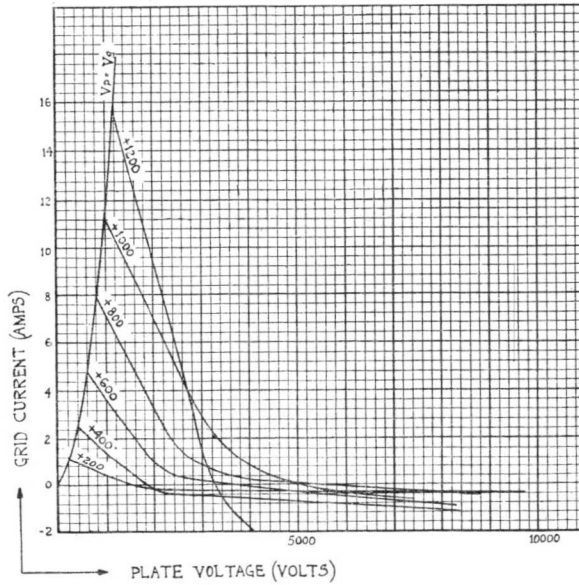
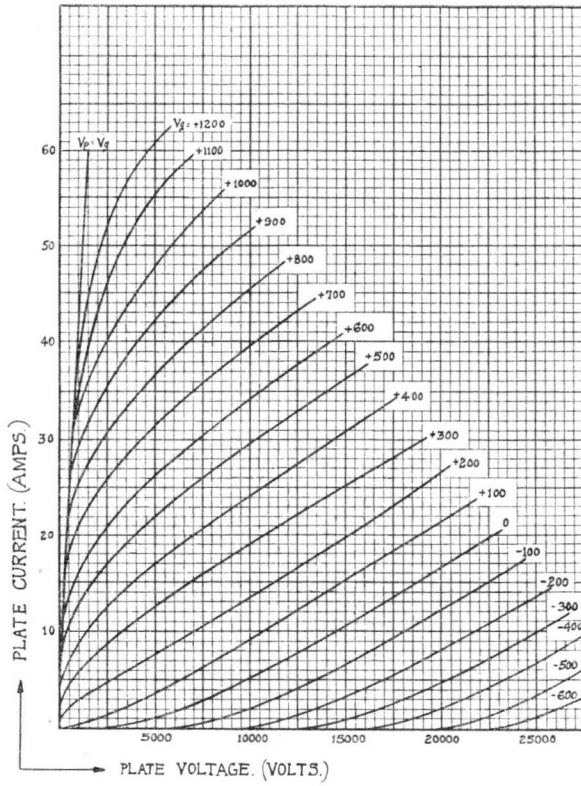
RADIO FREQUENCY OPERATION.

	Class B Telephony			
	Modulated Carrier applied to grid			
Direct anode voltage	17.5	15	12	10 Kv.
Direct anode current	9.6	9.6	9.6	9.6 amps.
Grid bias	—400	—300	—200	—150 volts
Power output	50	43	34	24 Kw.
Anode dissipation	118	101	81	72 Kw.
FREQUENCY	2	12	19	22 Mc.

	Class C Telephony				Class C Telegraphy			
	Subject to anode modulated				Unmodulated			
Direct anode voltage	12	11	10	9	17.5	15	12	10 Kv.
Direct anode current	10	10	10	10	19.2	19.2	19.2	19.2 amp.
Grid bias	—500	—450	—400	—350	—500	—300	—200	—150 volts
Carrier output	80	70	60	40	200	172	136	96 Kw.
Anode dissipation	40	40	40	50	136	112	94	96 Kw.
FREQUENCY	2	12	19	22	2	12	19	22 Mc.

—Standard Valves—

3068-A
Valve



Tentative data

V.3068-A.2
Nov. 1937

Standard of Work

—Standard Valves—

3073-A
Valve

3073-A VALVE

SINGLE ENDED WATER COOLED TRIODE.

SPECIFICATION.

Cathode.

Pure Tungsten filament.
Constant voltage type.

Water Jacket.

Type PL.121438/A.

Water Flow.

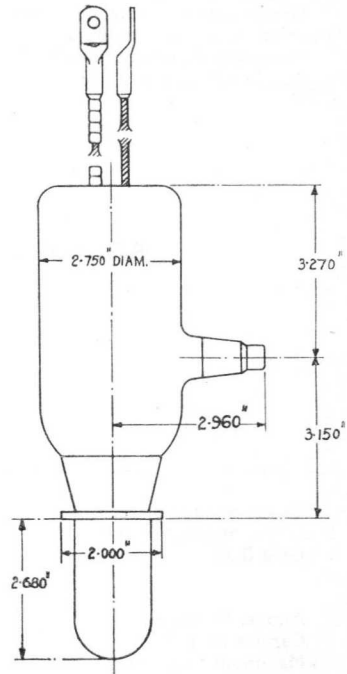
3 gallons per minute.

Dimensions.

Overall length $9\frac{1}{8}$ " (23.2 cms.)
Bulb diameter $2\frac{3}{4}$ " (7 cms.)
Net weight 1.2 lbs. (550 gms.)

Constants.

Filament voltage (exact filament voltage marked on bulb)	10 volts
Nominal filament current	54 amps.
Total emission	3.6 amps.
*Impedance	17,400 ohms
*Amplification factor	40
Grid-anode capacity	9 $\mu\mu\text{F}$.
Anode-filament capacity	1.5 $\mu\mu\text{F}$.
Grid-filament capacity	7 $\mu\mu\text{F}$.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	7,500 volts
Maximum direct anode voltage for anode modulation	6,000 volts
Maximum direct anode current	0.9 amps.
Maximum anode dissipation	2.5 Kw.
Maximum grid dissipation	200 watts
Maximum frequency for above ratings	50 Mc.
Maximum anode voltage for frequency of 100 Mc.	5,000 volts

Note :—All enquiries should be addressed to :—

Les Laboratoires L.M.T.
46, Avenue de Breteuil,
Paris.

Tentative data

V.3073-A.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

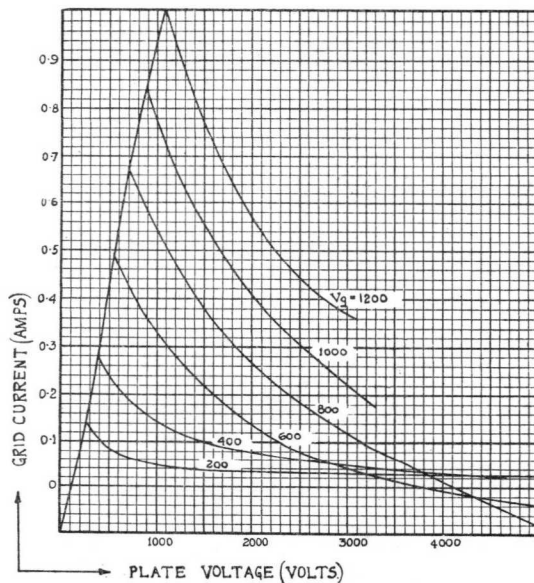
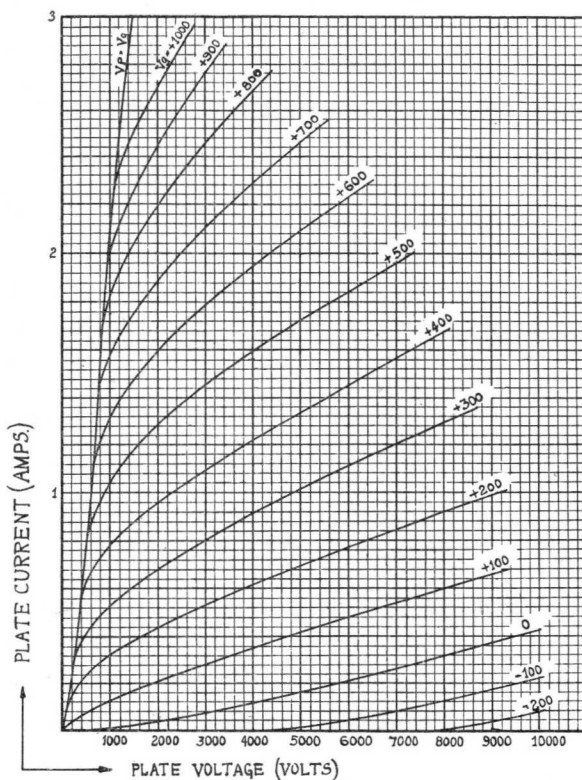
	Class B A.F. Amp. For balanced 2 valve circuit
Direct anode voltage	7,500 volts
Grid bias	—75 to —100 volts
Direct anode current per valve—zero signal	0.12 amps.
Direct anode current per valve—maximum signal	0.6 amps.
Load resistance—anode to anode	11,000 ohms
Maximum signal output—2 valves	4.9 Kw.
Anode dissipation	2 Kw.

RADIO FREQUENCY OPERATION.

	Class B Telephony		Class C Telephony		Class C Telegraphy	
	Modulated Carrier applied to grid		Subject to anode modulation		Unmodulated	
Direct anode voltage	7,500	5,000	6,000	4,500	7,500	5,000 volts
Direct anode current	0.4	0.3	0.4	0.3	0.9	0.8 amps
Grid Bias	—150	—80	—250	—200	—250 to —350	—200 volts to —300
Anode dissipation	2.0	1.0	0.8	0.45	2.25	1.3 Kw.
Carrier output	1.0	0.5	1.6	0.9	4.5	2.7 Kw.
Maximum frequency	50	100	50	100	50	100 Mc.

—Standard Valves—

3073-A
Valve



Tentative data

V.3073-A.2
Nov. 1937

3073-A
valve

Standard Valves



PRINTED IN
ENGLAND

Standard Valves

—Standard Valves—

4006-A
Valve

4006-A VALVE

SINGLE ENDED WATER COOLED TRIODE.

SPECIFICATION.

Cathode.

Pure Tungsten Filament.
Constant Voltage Type.

Water Jacket.

Type MS.1362 Grp. I for anode dissipation up to 6 Kw.

Type MS.1362 Grp.20 used for below panel connection for anode dissipation up to 6 Kw.

Type 223 LU 1A for anode dissipation over 6 Kw.

Water Flow.

5 gallons per minute.

Dimensions.

Overall length $21\frac{3}{8}"$ (54 cms.).
Bulb diameter $3\frac{1}{2}"$ (8.9 cms.).
Net weight $2\frac{1}{2}$ lb. (1,150 gms.)

Constants.

Filament voltage 19.5–20.5 volts
(exact filament voltage marked on bulb)

Nominal filament current 50 amps.

Total emission 6 amps.

*Impedance 7,500 ohms.

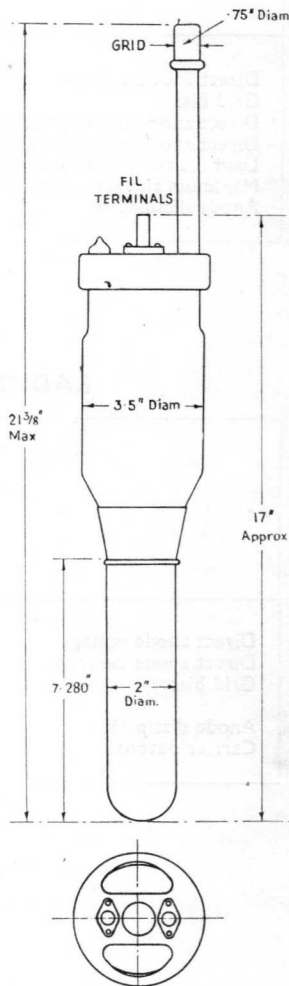
*Amplification factor 40

Grid–anode capacity 20.5 $\mu\mu\text{F}$.

Anode–filament capacity 3 $\mu\mu\text{F}$.

Grid–filament capacity 20 $\mu\mu\text{F}$.

* at anode current of 0.75 amp.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	13,000 volts.
Maximum direct anode voltage for anode modulation	9,000 volts.
Maximum direct anode current	1.5 amps.
Maximum anode dissipation	10 Kw.
Maximum grid dissipation	200 watts.
Maximum frequency for above ratings	3 Mc.
Maximum anode voltage for frequency of 6 Mc.	7,500 volts.

V.4006-A.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS

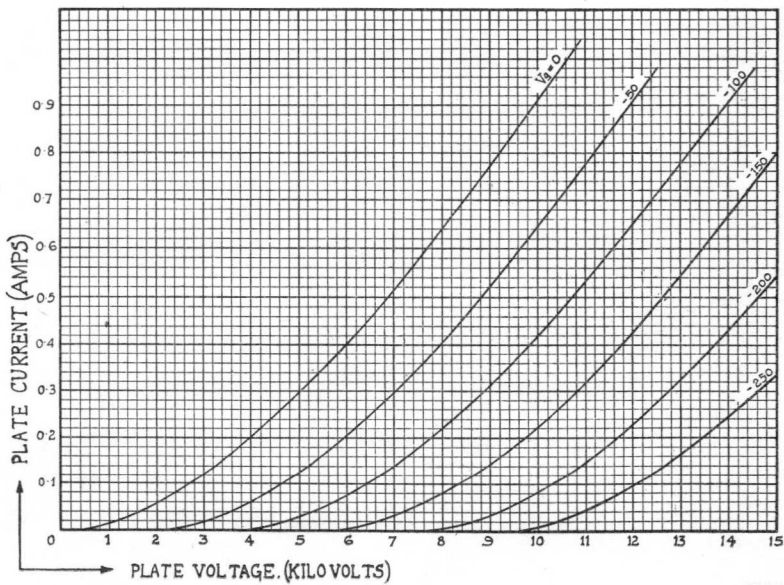
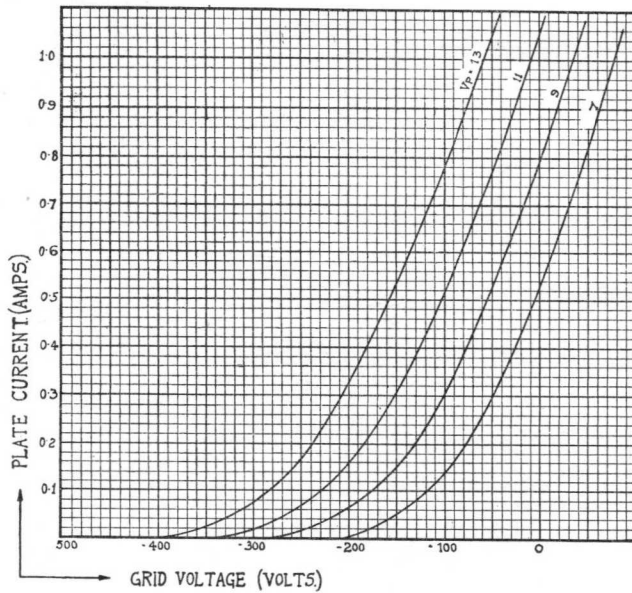
	Class B A.F. Amp. For balanced 2 valve circuit.
Direct anode voltage	10,000 volts
Grid Bias	—120 to —170 volts
Direct anode current per valve zero signal	0.25 amps.
Direct anode current per valve maximum signal	1.2 amps.
Load resistance—anode to anode	7,450 ohms.
Maximum signal output—2 valves	13.2 Kw.
Anode dissipation	5.4 Kw.

RADIO FREQUENCY OPERATION

	Class B Telephony	Class C Telephony	Class C Telegraphy
	Modulated Carrier applied to grid	Subject to anode modulation	Unmodulated
Direct anode voltage	10,000	7,000	10,000 volts
Direct anode current	0.75	0.75	1.5 amps.
Grid bias	—210	—350	—500 to —700 volts
Anode dissipation	5	1.75	5 Kw.
Carrier output	2.5	3.5	10 Kw.

—Standard Valves—

4006-A
Valve



V.4006-A.2
Nov. 1937

405-A
1957

Standard Valves

PRINTED IN
ENGLAND

—Standard Valves—

4007-A
Valve

4007-A VALVE

HALF WAVE WATER COOLED RECTIFIER.

SPECIFICATION.

Cathode.

Pure Tungsten filament.
Constant voltage type.

Water Jacket.

Type MS.1362 Grp. 1 for anode dissipation
up to 6 Kw.
Type 223 LU 1A for anode dissipation over
6 Kw.
Type MS.1362 Grp. 20 for anode dissipation
up to 6 Kw. used for below panel
connection.

Water Flow.

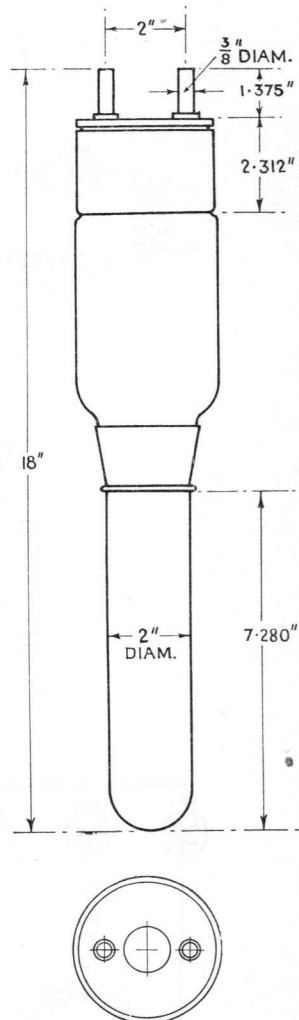
2 gallons per minute.

Dimensions.

Overall length	18" (46 cms.)
Bulb diameter	$3\frac{1}{8}$ " (8.9 cms.)
Net weight	$2\frac{1}{4}$ lbs. (1,050 gms.)

Constants.

Filament voltage	20–21 volts (exact filament voltage is marked on bulb of each valve)
Nominal filament current	50 amps.
Total emission	6 amps.
Maximum peak inverse voltage	45,000 volts
Maximum anode dissipation	10 Kw.

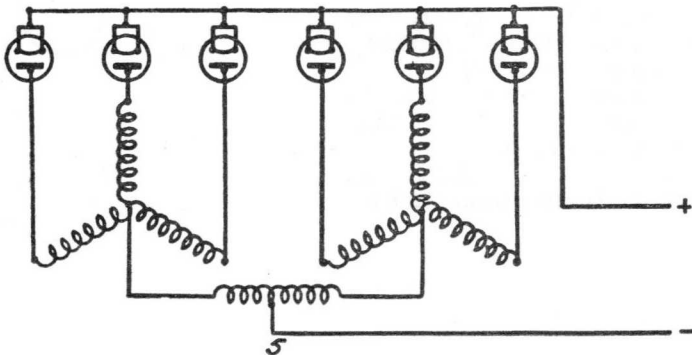
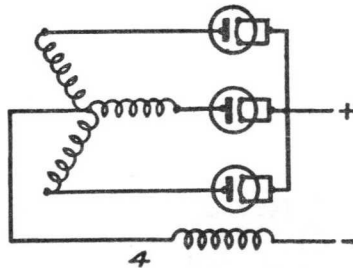
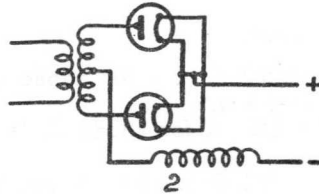
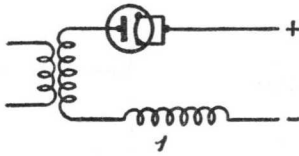


V.4007-A.1
Nov. 1937

—Standard Valves—

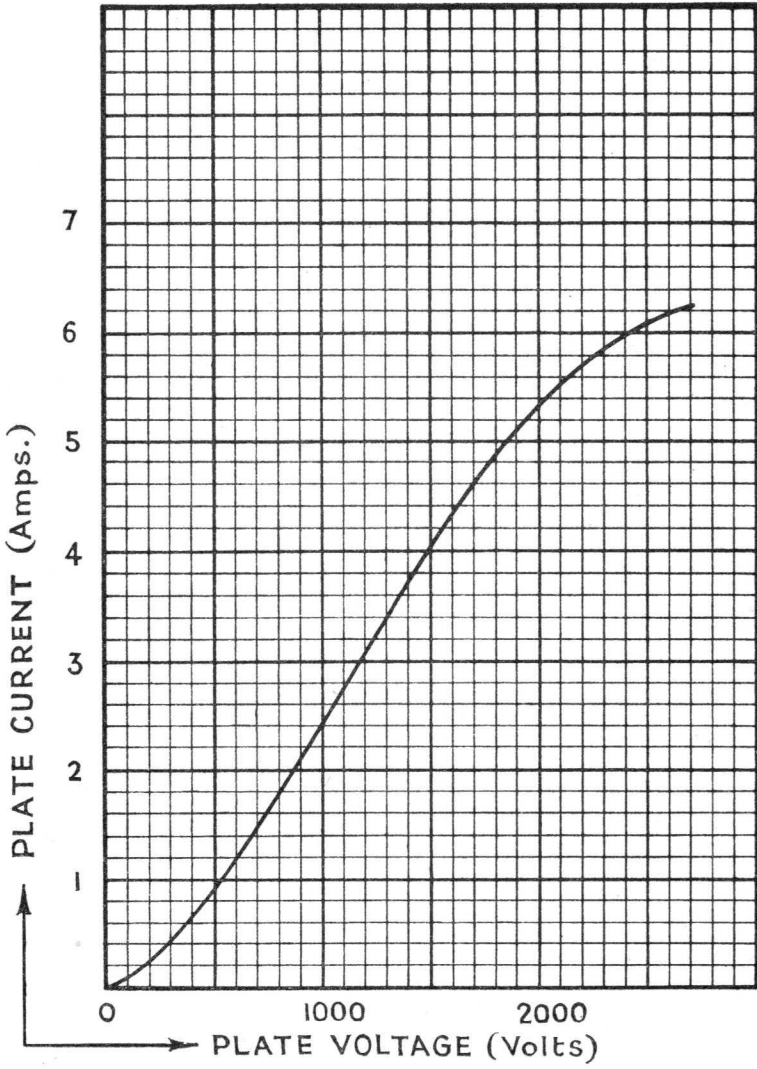
TYPICAL OPERATING CONDITIONS.

Circuit	Number of valves	Load potential in volts	Load current in amps.
1	1	7,000	1.5
2	2	14,000	3.0
4	3	22,500	4.3
5	6	22,500	8.5



—Standard Valves—

4007-A
Valve



V.4007-A.2
Nov. 1937

1954
1954

— Standard Notes —

PRINTED IN
ENGLAND

—Standard Valves—

4008-B
Valve

4008-B VALVE

HALF WAVE WATER COOLED RECTIFIER.

SPECIFICATION.

Cathode.

Pure Tungsten filament.
Constant voltage type.

Water Jacket.

Type MS.1362 Grp. 1 for anode dissipation
up to 6 Kw.

Type 223 LU.1A for anode dissipation over
6 Kw.

Type MS.1362 Grp. 20 used for below panel
connection up to 6 Kw. anode dissipation.

Water Flow.

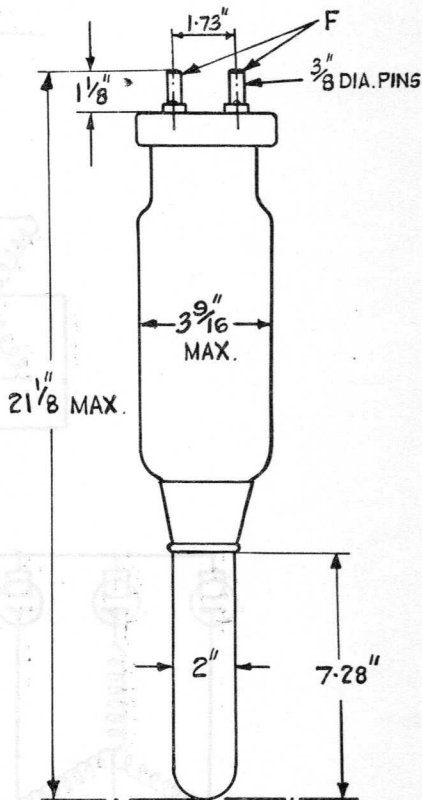
2 gallons per minute.

Dimensions.

Max. overall length $21\frac{1}{8}$ " (53.6 cms.)
Max. bulb diameter $3\frac{9}{16}$ " (9 cms.)
Net weight $3\frac{1}{2}$ lbs. (1,600 gms.)

Constants.

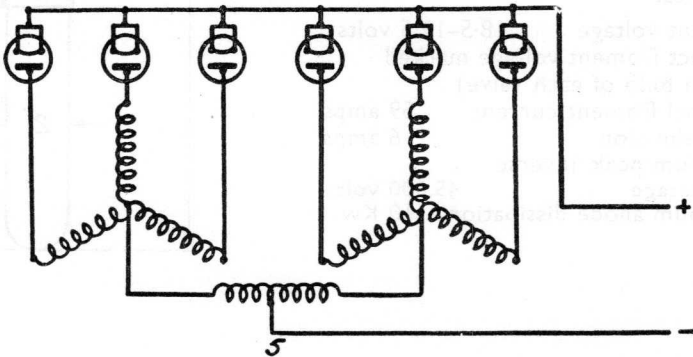
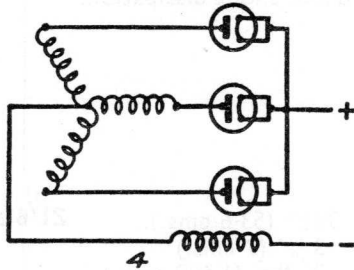
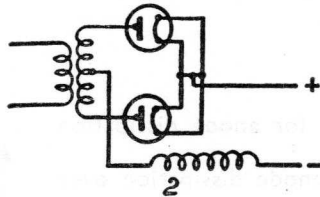
Filament voltage 18.5–19.5 volts
(exact filament voltage marked
on bulb of each valve)
Nominal filament current 59 amps.
Total emission 6 amps.
Maximum peak inverse
voltage 45,000 volts
Maximum anode dissipation 10 Kw.



— Standard Valves —

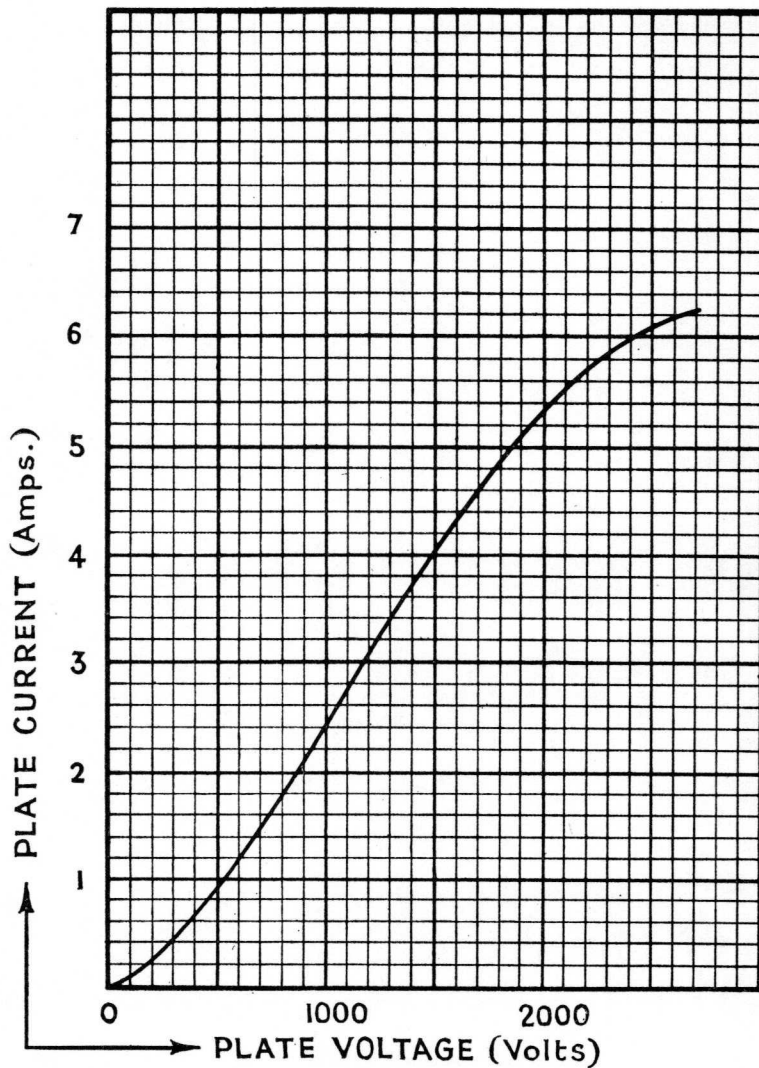
TYPICAL OPERATING CONDITIONS.

Circuit	Number of Valves	Load potential in volts	Load current in amps.
2	2	14,000	3.0
4	3	22,500	4.3
5	6	22,500	8.5



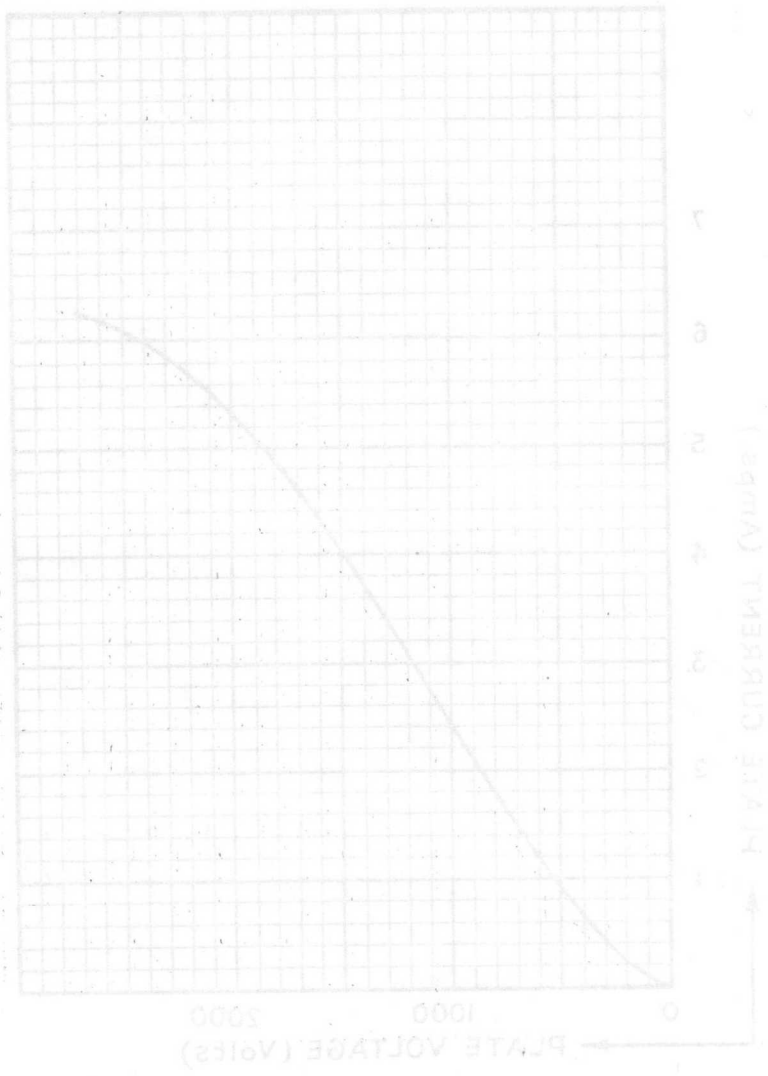
—Standard Valves—

4008-B
Valve



V.4008-B.2
March, 1939

Standard Valves



PRINTED IN
ENGLAND

4009-B VALVE

(Replaces the 4009-A Valve which has now been abandoned.)

SINGLE ENDED WATER COOLED TRIODE.

Cathode. SPECIFICATION.

Pure Tungsten filament.
Constant voltage type.

Water Jacket.

Type MS.1362 Grp. 1 for anode dissipation up to 6 Kw.
Type MS.1362 Grp. 20 used up to 6 Kw. anode dissipation for below panel connection.
Type 223 LU.1A for anode dissipation from 6-15 Kw.
Type PL.122.01 I/A for anode dissipation over 15 Kw.

Water Flow.

12 gallons per minute.

Dimensions.

Max. overall length $21\frac{1}{4}$ " (54 cms.)
Max. bulb diameter $3\frac{9}{16}$ " (9.05 cms.)
Net weight $3\frac{3}{4}$ lbs. (1,700 gms.)

Constants.

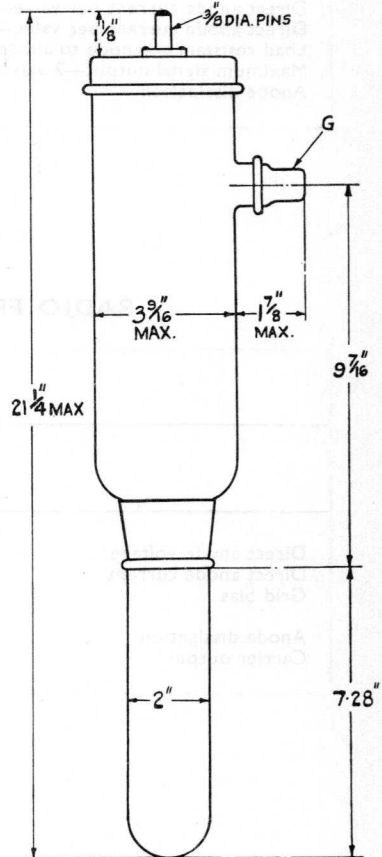
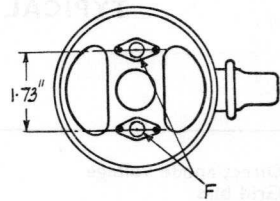
Filament voltage	20 volts
(exact filament voltage marked on bulb)	
Nominal filament current	61 amps.
Total emission	10 amps.
*Impedance	6,000 ohms
*Amplification factor	40
*Mutual Conductance	6.7 mA per volt
Grid-anode capacity	24 $\mu\mu\text{F}$.
Anode-filament capacity	1.8 $\mu\mu\text{F}$.
Grid-filament capacity	17 $\mu\mu\text{F}$.

* at anode current of 1.0 amp.

LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	17,500 volts
Maximum direct anode voltage for anode modulation	14,000 volts
Maximum direct anode current	2.5 amps.
Maximum anode dissipation	20 Kw.
Maximum grid dissipation	300 watts
Maximum frequency for above rating	3 Mc.
Maximum anode voltage for frequency of 6 Mc.	10,000 volts

NOTE.—The characteristics of this valve are identical with those of the 4009-A, but the grid lead has been brought out through the side of the bulb. When the 4009-B is used to replace the 4009-A new grid connectors will be required. These connectors type ES.5706-1 should be ordered with the valve.



—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class B A.F. Amp. For balanced 2 valve circuit.
Direct anode voltage	15,000 volts
Grid bias	—200 to —250 volts
Direct anode current per valve—zero signal	0.4 amps.
Direct anode current per valve—maximum signal	2.0 amps.
Load resistance—anode to anode	6,700 ohms
Maximum signal output—2 valves	33 Kw.
Anode dissipation	13.5 Kw.

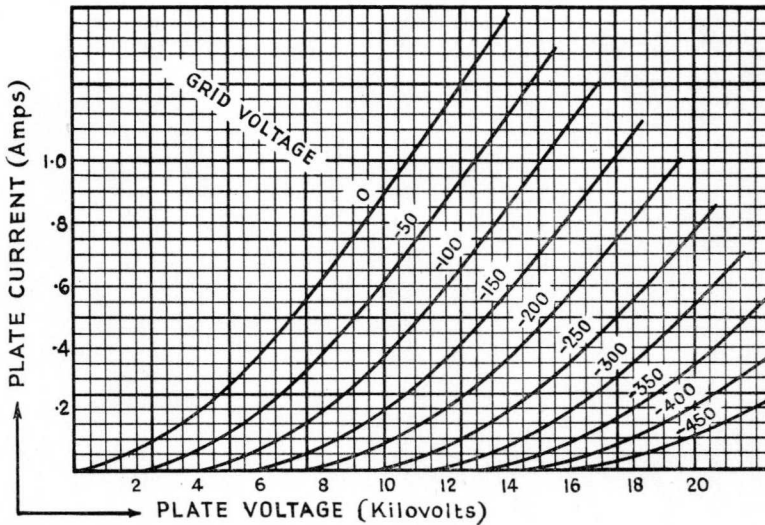
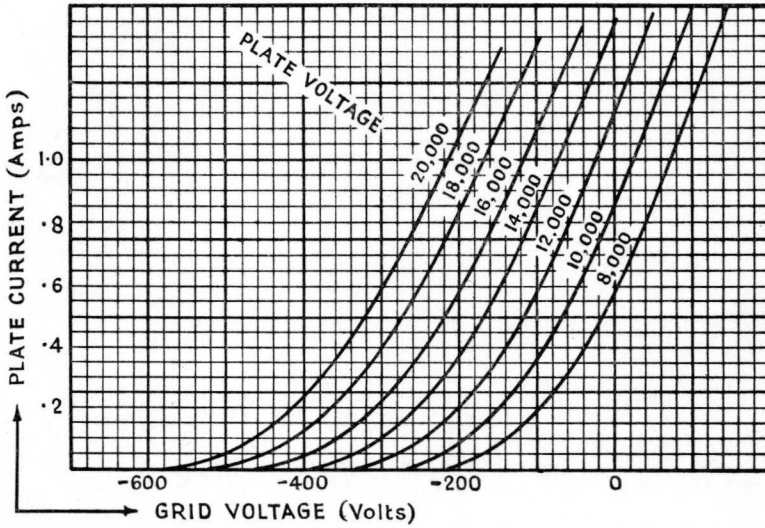
RADIO FREQUENCY OPERATION.

	Class B Telephony	Class C Telephony	Class C Telegraphy
	Modulated Carrier applied to grid	Subject to anode modulation	Unmodulated
Direct anode voltage	15,000	10,000	15,000 volts
Direct anode current	1.25	1.25	2.5 amps.
Grid bias	—300	—500	—800 to —1,200 volts
Anode dissipation	12.5	4.17	12.5 Kw.
Carrier output	6.25	8.33	25 Kw.

—Standard Valves—

4009-B
Valve

These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



Stunbord knives



Graph showing curves for Stunbord knives.



Graph showing curves for Stunbord knives.

—Standard Valves—

4011-B
Valve

4011-B VALVE

· TRIODE.

For replacement purposes only.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant voltage type.

Base.

Large 4-pin bayonet thrust.

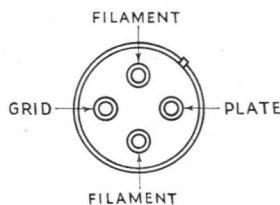
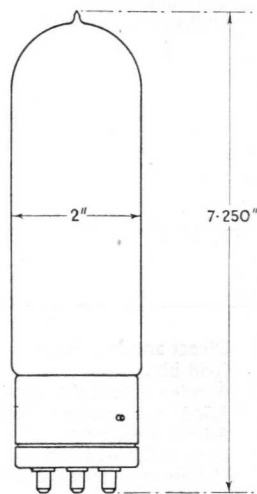
Dimensions.

Overall length $7\frac{1}{4}"$ (18.4 cms.)
Maximum diameter 2" (5.1 cms.)
Net weight 0.42 lbs. (190 gms.)

Constants.

Filament voltage 8 volts
Nominal filament current 1.6 amps.
* Impedance 1,650 ohms.
* Amplification factor 4.2
Grid-anode capacity 9.5 $\mu\mu\text{F}$.
Anode-filament capacity 4 $\mu\mu\text{F}$.
Grid-filament capacity 4.5 $\mu\mu\text{F}$.

* at anode current of 0.060 amps.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage 350 volts
Maximum direct anode current 0.150 amps.
Maximum anode dissipation 30 watts

Note :—This valve should be mounted so that the filament is operated in a vertical plane.

V.4011-B.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

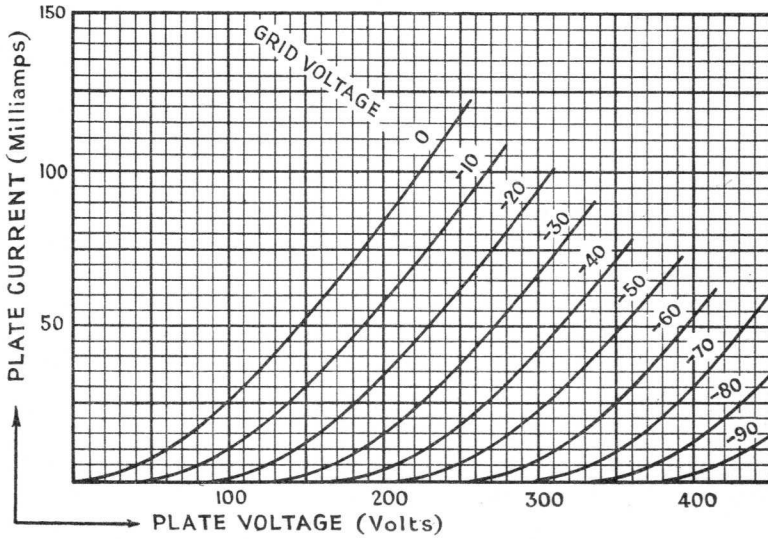
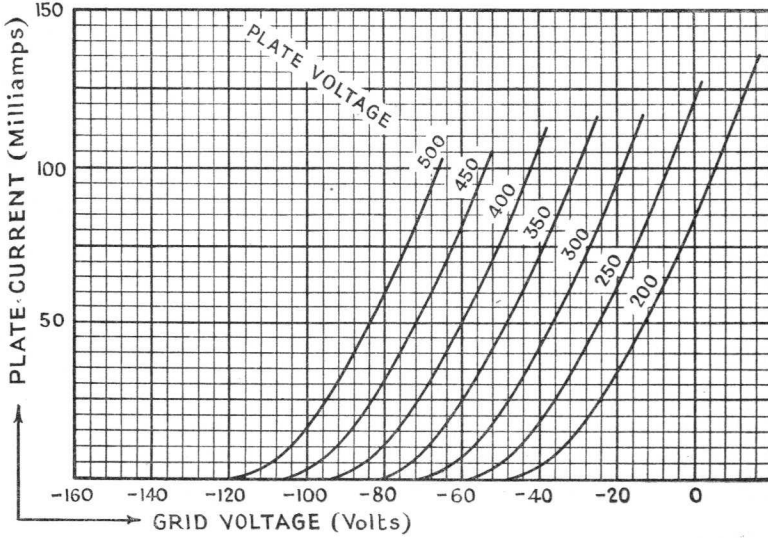
	Class A A.F. Amp.
Direct anode voltage	350 volts
Grid bias	—45 volts
Direct anode current	0.060 amps.
Anode dissipation	18.9 watts
Load impedance	2,000 ohms
Undistorted output	2.1 watts

	Class B A.F. Amp. and Mod. For balanced 2 valve circuit
Direct anode voltage	350 volts
Grid bias	—55 to —65 volts
Anode current per valve—zero signal	0.030 amps.
Anode current per valve—maximum signal	0.150 amps.
Anode dissipation	25 watts
Load resistance—anode to anode	2,100 ohms
Maximum output—2 valves	60 watts

—Standard Valves—

4011-B
Valve

These curves are taken with direct filament heating, grid and anode voltages being referred to negative end of filament.



V.4011-B.2
Nov. 1937

Standard Form 100



PRINTED IN
ENGLAND

—Standard Valves—

4013-C
Valve

4013-C VALVE

SINGLE ENDED WATER COOLED TRIODE.

SPECIFICATION.

Cathode.

Pure Tungsten filament.
Constant voltage type.

Water Jacket.

Type MS.1362 Grp. 1.
Type MS.1362 Grp. 20 used for below panel
connection.

Water Flow.

3 gallons per minute.

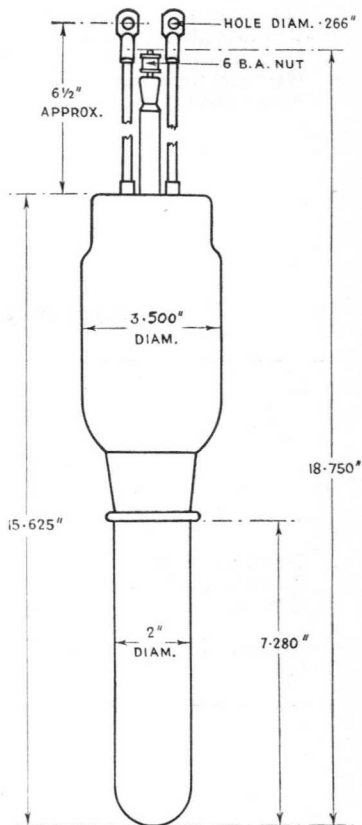
Dimensions.

Overall length $18\frac{3}{4}$ " (47.7 cms.)
Bulb diameter $3\frac{1}{2}$ " (8.9 cms.)
Net weight $2\frac{1}{2}$ lbs. (1,150 gms.)

Constants.

Filament voltage	13.5–14.5 volts
(exact filament voltage marked on bulb)	
Nominal filament current	36 amps.
Total emission	2.8 amps.
* Impedance	5,700 ohms.
* Amplification factor	21
Grid–anode capacity	18 $\mu\mu\text{F}$.
Anode–filament capacity	2 $\mu\mu\text{F}$.
Grid–filament capacity	14 $\mu\mu\text{F}$.

* at anode current of 0.3 amp.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	6,000 volts
Maximum direct anode voltage for anode modulation	4,000 volts
Maximum direct anode current	0.7 amps.
Maximum anode dissipation	5 Kw.
Maximum grid dissipation	100 watts
Maximum frequency for above ratings	15 Mc.
Anode voltage for frequency of 22 Mc.	5,000 volts

V.4013-C.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class B A.F. Amp. For balanced 2 valve circuit
Direct anode voltage	5,000 volts
Grid bias	—150 to —175 volts
Direct anode current per valve—zero signal	0.12 amps.
Direct anode current per valve—maximum signal	0.6 amps.
Load resistance—anode to anode	7,440 ohms
Maximum signal output—2 valves	3.3 Kw.
Anode dissipation	1.35 Kw.

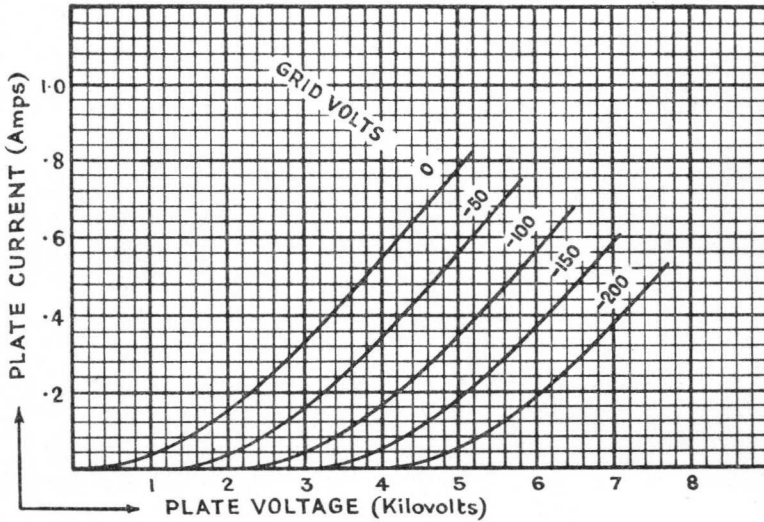
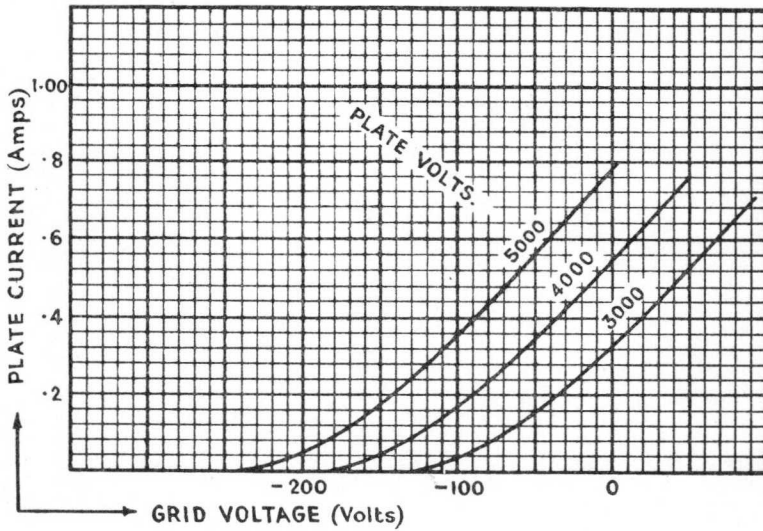
RADIO FREQUENCY OPERATION.

	Class B Telephony	Class C Telephony	Class C Telegraphy
	Modulated Carrier applied to grid	Subject to anode modulation	Unmodulated
Direct anode voltage	5,000	3,500	5,000 volts
Direct anode current	0.35	0.35	0.7 amps.
Grid bias	—200	—300	—500 to —700 volts
Anode dissipation	1.17	0.41	1.17 Kw.
Carrier output	0.58	0.82	2.34 Kw.

—Standard Valves—

4013-C
Valve

These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



V.4013-C.2
Nov. 1937

Standard Valves

Standard Valves are available in a wide range of sizes and materials to suit your requirements. They are designed for long life and reliable service.



FIGURE 1



FIGURE 2

PRINTED IN
ENGLAND

—Standard Valves—

4013-D
Valve

4013-D VALVE

SINGLE ENDED WATER COOLED TRIODE.

SPECIFICATION.

Cathode.

Pure Tungsten filament.
Constant voltage type.

Water Jacket.

Type MS.1362 Grp. 1.
Type MS.1362 Grp. 20. For below panel
connection.

Water Flow.

3 gallons per minute.

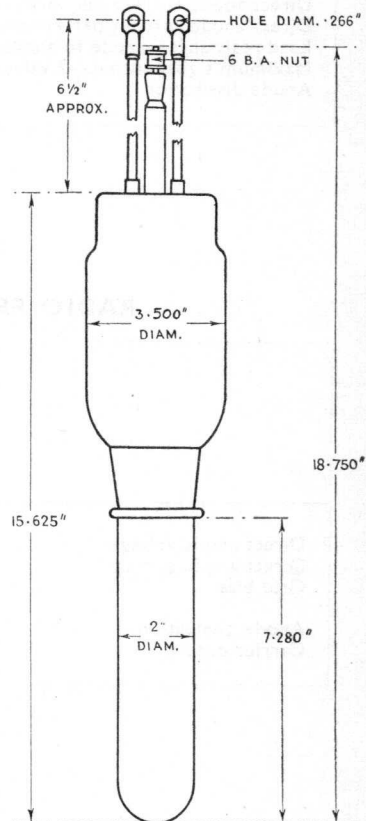
Dimensions.

Overall length $18\frac{3}{4}$ " (47.7 cms.)
Bulb diameter $3\frac{1}{2}$ " (8.9 cms.)
Net weight $2\frac{1}{2}$ lbs. (1,150 gms.)

Constants.

Filament voltage	19-21 volts.
(exact filament voltage marked on bulb)	
Nominal filament current	41 amps.
Total emission	6 amps.
*Impedance	4,200 ohms
*Amplification factor	21
Grid-anode capacity	21 $\mu\mu\text{F}$.
Anode-filament capacity	2.5 $\mu\mu\text{F}$.
Grid-filament capacity	16 $\mu\mu\text{F}$.

* at anode current of 0.75 amp.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	6,000 volts
Maximum direct anode voltage for anode modulation	4,000 volts
Maximum direct anode current	1.5 amps.
Maximum anode dissipation	5 Kw.
Maximum grid dissipation	100 watts
Maximum frequency for above ratings	15 Mc.
Maximum anode voltage for frequency of 22 Mc.	5,000 volts

V.4013-D.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class B A.F. Amp. For balanced 2 valve circuit
Direct anode voltage	5,000 volts
Grid bias	—100 to —150 volts
Direct anode current per valve—zero signal	0.25 amps.
Direct anode current per valve—maximum signal	1.2 amps.
Load resistance—anode to anode	3,700 ohms
Maximum signal output—2 valves	6.6 Kw.
Anode dissipation	2.7 Kw.

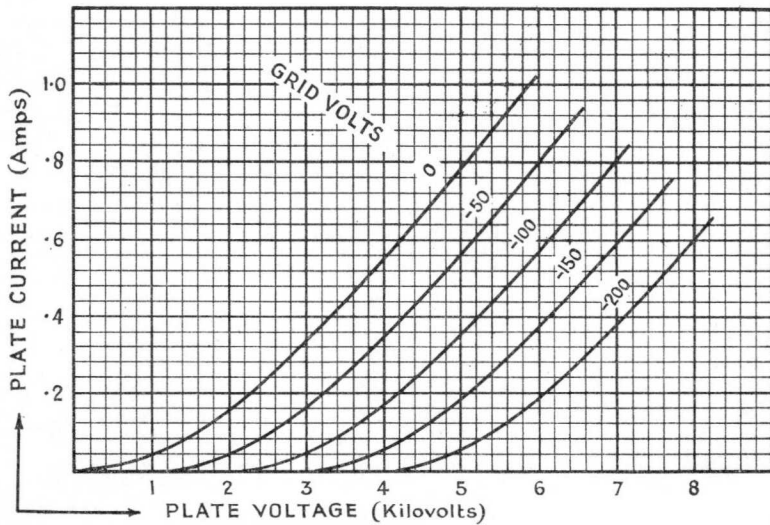
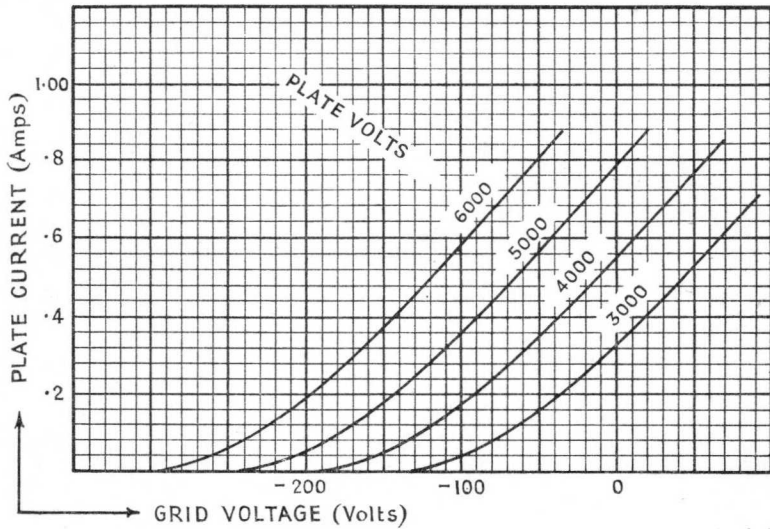
RADIO FREQUENCY OPERATION.

	Class B Telephony	Class C Telephony	Class C Telegraphy
	Modulated Carrier applied to grid	Subject to anode modulation	Unmodulated
Direct anode voltage	5,000	3,500	5,000 volts
Direct anode current	0.75	0.75	1.5 amps.
Grid bias	—190	—300	—500 to —750 volts
Anode dissipation	2.5	0.9	2.5 Kw.
Carrier output	1.25	1.8	5 Kw.

—Standard Valves—

4013-D
Valve

These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



V.4013-D2.
Nov. 1937

Standard Valves



4014-A VALVE

DOUBLE ENDED WATER COOLED TRIODE.

SPECIFICATION.

Cathode.

Pure Tungsten filament.
Constant voltage type.

Dimensions.

Overall length $28\frac{1}{4}"$ (72 cms.)
Bulb diameter $3\frac{1}{2}"$ (8.9 cms.)
Net weight 7 lbs. (3,200 gms.)

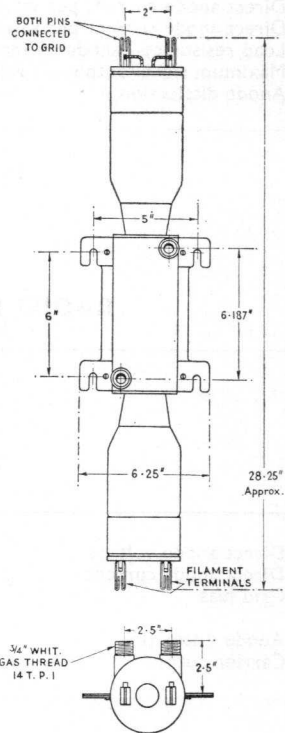
Water Flow.

5 gallons per minute.

Constants.

Filament voltage	21–22 volts
(exact filament voltage marked on bulb)	
Nominal filament current	41 amps.
Total emission	6 amps.
*Impedance	7,500 ohms
*Amplification factor	40
Grid–anode capacity	23 $\mu\mu\text{F}$.
Anode–filament capacity	6.5 $\mu\mu\text{F}$.
Grid–filament capacity	8 $\mu\mu\text{F}$.

* at anode current of 0.75 amp.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	12,000 volts
Maximum direct anode voltage for anode modulation	9,000 volts
Maximum direct anode current	1.5 amps.
Maximum anode dissipation	12 Kw.
Maximum grid dissipation	200 watts
Maximum frequency for above ratings	15 Mc.
Maximum anode voltage for frequency of 22 Mc.	10,000 volts

Note :—No water jacket required as it forms part of the valve.

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class B A.F. Amp. For balanced 2 valve circuit
Direct anode voltage	10,000 volts
Grid bias	—125 to —175 volts
Direct anode current per valve—zero signal	0.25 amps.
Direct anode current per valve—maximum signal	1.2 amps.
Load resistance—anode to anode	3,700 ohms
Maximum signal output—2 valves	13.2 Kw.
Anode dissipation	5.4 Kw.

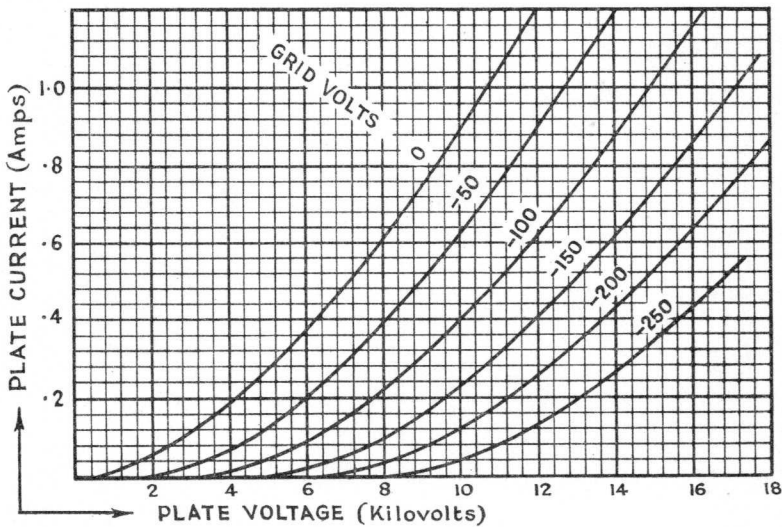
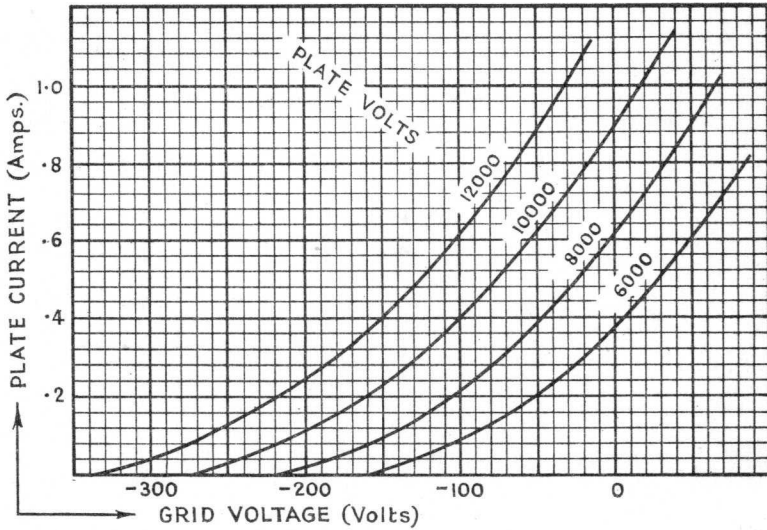
RADIO FREQUENCY OPERATION.

	Class B Telephony	Class C Telephony	Class C Telegraphy
	Modulated Carrier applied to grid	Subject to anode modulation	Unmodulated
Direct anode voltage	10,000	7,000	10,000 volts
Direct anode current	0.75	0.75	1.5 amps.
Grid bias	—230	—400	— 700 to —1,000 volts
Anode dissipation	5	1.75	5 Kw.
Carrier output	2.5	3.5	10 Kw.

—Standard Valves—

4014-A
Valve

These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



V.4014-A.2
Nov. 1937

Standard Valves

These curves show the relationship between the flow coefficient (Cv) and the pressure drop (ΔP) for standard valves. The curves are based on a flow of 100 gpm of water at 60°F. The Cv is defined as the flow in gpm of water at 60°F through a valve with a pressure drop of 1 psi.



—Standard Valves—

4015-A
Valve

4015-A VALVE

TRIODE.

SPECIFICATION.

Cathode.

Pure tungsten filament.
Constant voltage type.

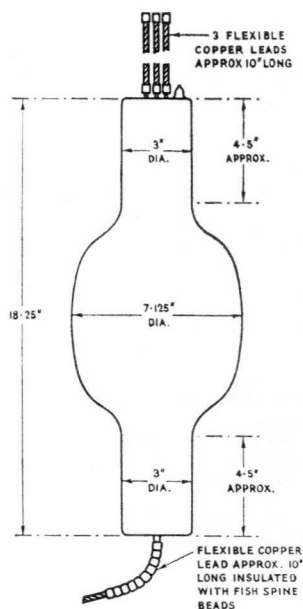
Dimensions.

Overall length $18\frac{1}{4}"$ (46.4 cms.)
Maximum diameter $7\frac{1}{8}"$ (18.1 cms.)
Net weight $3\frac{1}{4}$ lbs. (1,500 gms.)

Constants.

Filament voltage 10.5–11.5 volts
(exact filament voltage marked
on bulb)
Nominal filament current 41 amps.
Total emission 2.5 amps.
*Impedance 8,000 ohms
*Amplification factor 20
*Mutual conductance 2.5 mA. per volt
Grid–anode capacity $10.3 \mu\mu\text{F.}$
Anode–filament capacity $0.5 \mu\mu\text{F.}$
Grid–filament capacity $15.2 \mu\mu\text{F.}$

* at $V_p = 4,000$ volts, $I_p = 0.3$ amps.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	5,000 volts
Maximum direct anode current	0.6 amps.
Maximum anode dissipation	1.5 Kw.
Maximum direct grid current	0.080 amps.

V.4015-A.1
Sept. 1938

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class B A.F. Amp. and Mod. For balanced 2 valve circuit.
Direct anode voltage Grid bias Anode current per valve—zero signal Anode current per valve—maximum signal Anode dissipation Load resistance—anode to anode Maximum output—2 valves	5,000 volts —100 to —150 volts 0.12 amps. 0.6 amps. 1.4 Kw. 7,100 ohms 3.2 Kw.

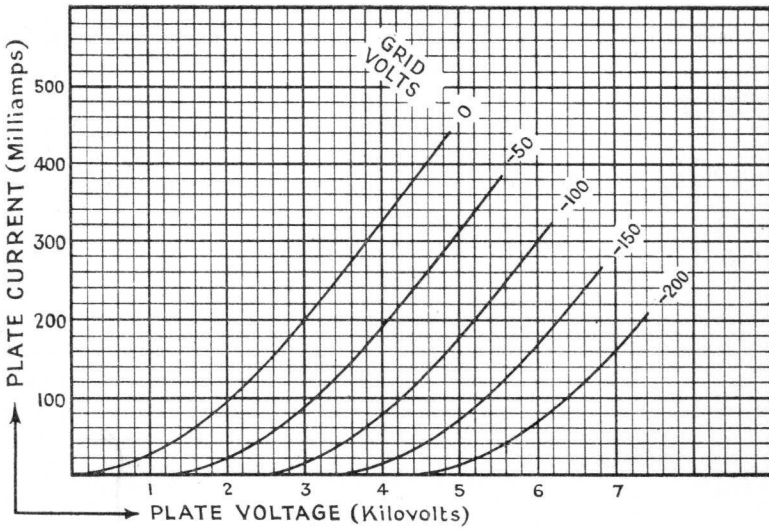
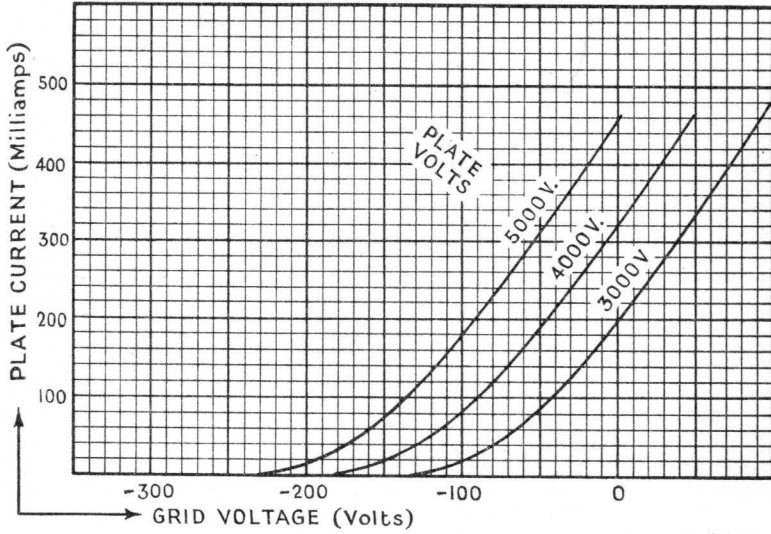
RADIO FREQUENCY OPERATION.

	Class B Telephony	Class C Telephony	Class C Telegraphy
	Modulated Carrier applied to grid	Subject to anode modulation	Unmodulated
Direct anode voltage Direct anode current Grid bias	5,000 0.28 —190	4,000 0.3 —350	5,000 volts 0.6 amps. —450 to —600 volts
Anode dissipation Carrier output	980 420	400 800	1,000 watts 2,000 watts

—Standard Valves—

4015-A
Valve

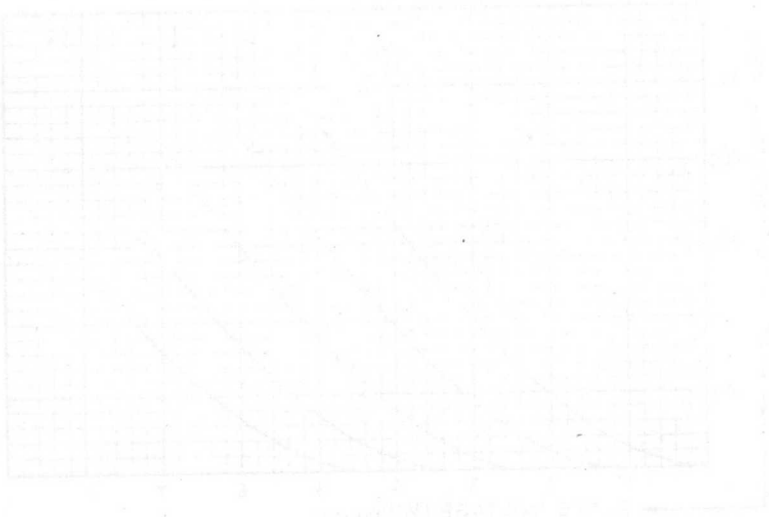
These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



V.4015-A.2
Nov. 1937

Standard Valves

These curves are based on the following conditions: 1. Inlet and outlet valves are fully open. 2. The flow is steady state. 3. The inlet and outlet temperatures are 20°C and 30°C respectively. 4. The inlet and outlet pressures are 10 bar and 1 bar respectively.



—Standard Valves—

4016-A
Valve

4016-A VALVE

TRIODE.

SPECIFICATION.

Cathode.

Pure Tungsten filament.
Constant voltage type.

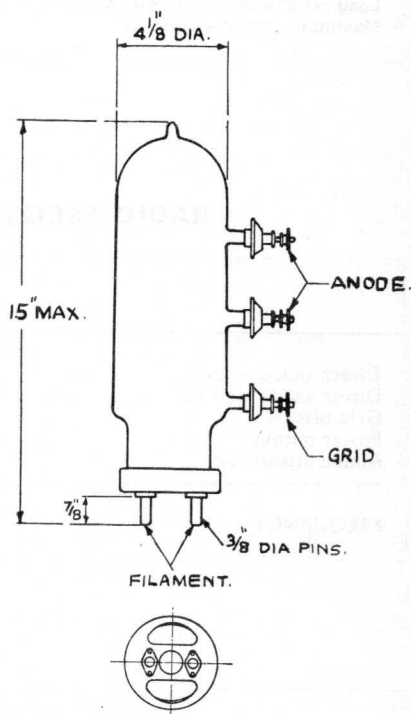
Dimensions.

Overall length 15" (38 cms.)
Bulb diameter $4\frac{1}{8}$ " (10.5 cms.)
Net weight $2\frac{1}{4}$ lbs. (1,000 gms.)

Constants.

Filament voltage 14 volts
Nominal filament current 18 amps.
Total emission 1.2 amps.
*Impedance 15,000 ohms
*Amplification factor 30
*Mutual conductance 2 mA per volt
Grid-anode capacity $10 \mu\text{F}$.
Anode-filament capacity $2.5 \mu\text{F}$.
Grid-filament capacity $10 \mu\text{F}$.

* at anode current of 0.100 amps,
 $V_p = 4,000$



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	4,000 volts
Maximum direct anode current	0.3 amps.
Maximum anode dissipation	400 watts
Maximum grid dissipation	100 watts
Maximum frequency for above ratings	33 Mc.
Maximum anode voltage for frequency of 50 Mc.	3,500 volts

V.4016-A.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class B A.F. Amp. and Mod. for balanced 2 valve circuit
Direct anode voltage	4,000 volts
Grid bias	—100 volts
Direct anode current per valve—zero signal	0.03 amps.
Direct anode current per valve—maximum signal	0.16 amps.
Anode dissipation	280 watts
Load resistance—anode to anode	23,000 ohms
Maximum output—2 valves	700 watts

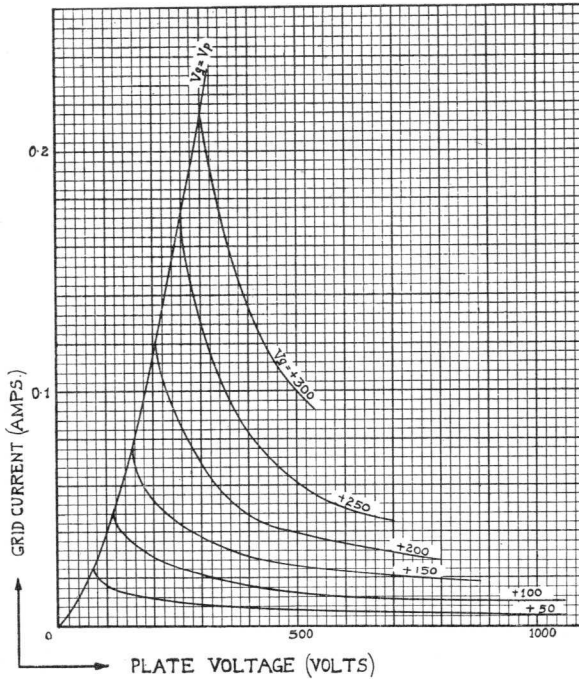
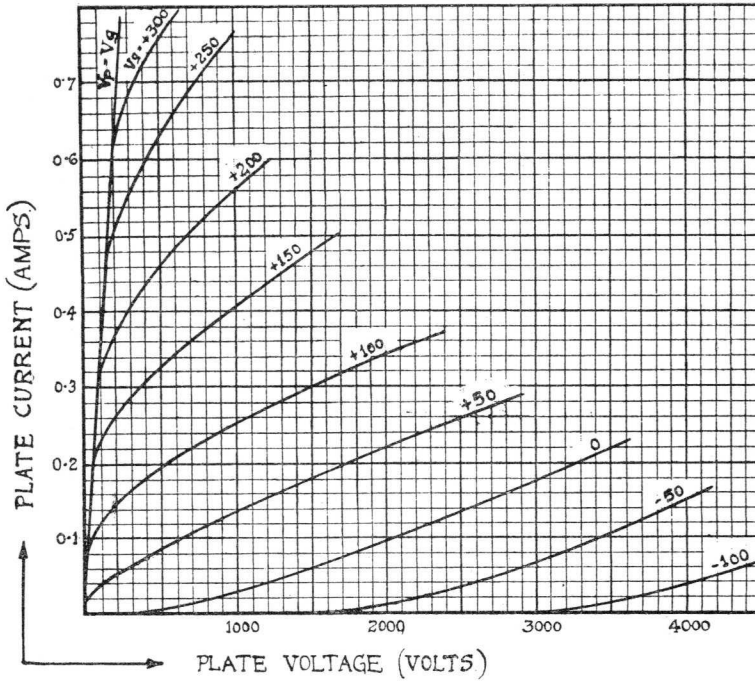
RADIO FREQUENCY OPERATION.

	Class B Telephony Modulated carrier applied to grid			
Direct anode voltage	4,000	4,000	4,000	3,500 volts
Direct anode current	0.12	0.12	0.12	0.10 amps.
Grid bias	—130	—130	—130	—100 volts
Power output	0.15	0.14	0.12	0.10 Kw.
Anode dissipation	0.33	0.34	0.36	0.25 Kw.
FREQUENCY	6	10	33	50 Mc.

	Class C Telephony				Class C Telegraphy			
	Subject to anode modulation				Unmodulated			
Direct anode voltage	3,000	3,000	3,000	2,500	4,000	4,000	4,000	3,500 volts
Direct anode current	0.2	0.2	0.2	0.16	0.2	0.2	0.2	0.16 amps.
Grid bias	—200	—200	—200	—150	—300	—300	—300	—250 to —350 volts
Carrier output	0.4	0.375	0.36	0.18	0.5	0.45	0.4	0.3 Kw.
Anode dissipation	0.2	0.225	0.24	0.22	0.3	0.35	0.4	0.22 Kw.
FREQUENCY	6	10	33	50	6	10	33	50 Mc.

—Standard Valves—

4016-A
Valve



V.4016-A.2
Nov. 1937

Standard Form

PRINTED IN
ENGLAND

—Standard Valves—

4016-B
Valve

4016-B VALVE

TRIODE.

SPECIFICATION.

Cathode.

Pure Tungsten filament.
Constant voltage type.

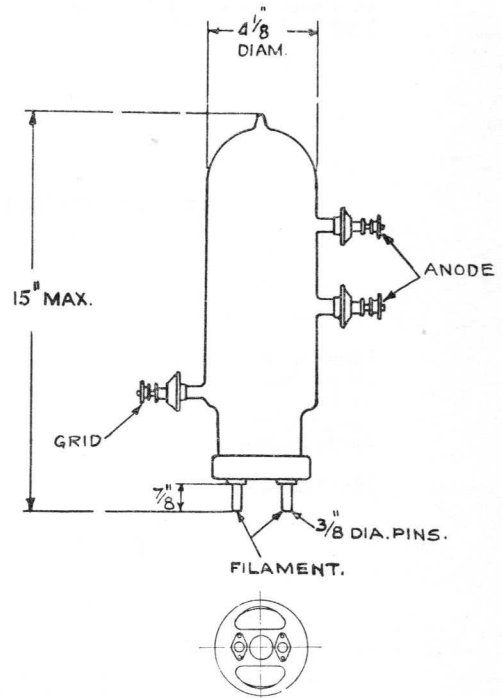
Dimensions.

Overall length 15" (38 cms.)
Bulb diameter $4\frac{1}{8}$ " (10.5 cms.)
Net weight $2\frac{1}{4}$ lbs. (1,000 gms.)

Constants.

Filament voltage 14 volts
Nominal filament current 18 amps.
Total emission 1.2 amp.
*Impedance 7,700 ohms
*Amplification factor 17
*Mutual conductance 2.2 m.a. per volt
Grid-anode capacity 10 $\mu\mu\text{F}$.
Anode-filament capacity 2.5 $\mu\mu\text{F}$.
Grid-filament capacity 10 $\mu\mu\text{F}$.

* at anode current of 0.1 amps,
 $V_p = 4,000$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	4,000 volts
Maximum direct anode current	0.3 amps.
Maximum anode dissipation	400 watts
Maximum grid dissipation	100 watts
Maximum frequency for above ratings	33 Mc.
Maximum anode voltage for frequency of 50 Mc.	3,500 volts

Tentative data.

V.4016-B.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class B (A.F. Amp. and Mod.) for balanced 2 valve circuit
Direct anode voltage	4,000 volts
Grid bias	—100 volts
Direct anode current per valve—zero signal	0.03 amps.
Direct anode current per valve—maximum signal	0.16 amps.
Anode dissipation	280 watts
Load resistance—anode to anode	23,000 ohms
Maximum output—2 valves	700 watts

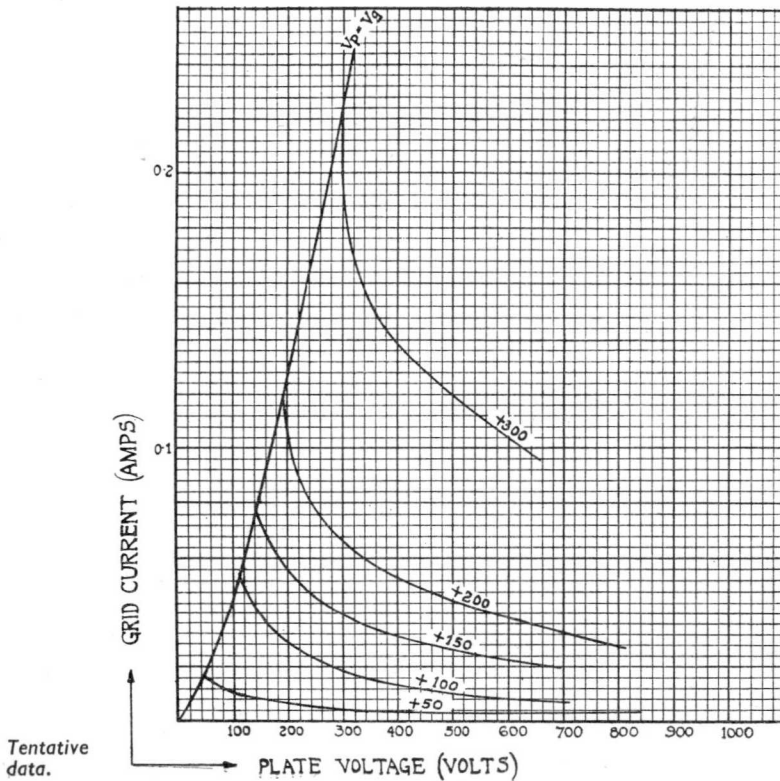
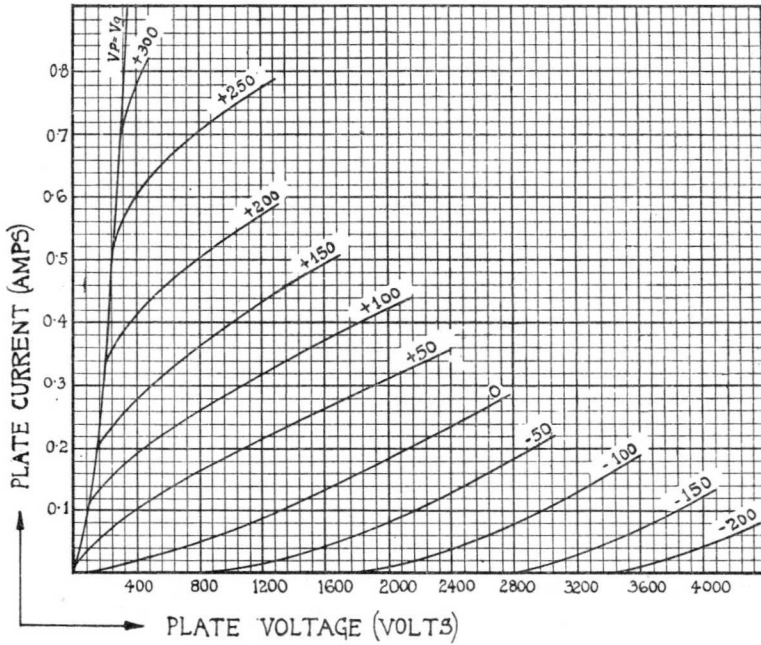
RADIO FREQUENCY OPERATION.

	Class B Telephony Modulated carrier applied to grid			
Direct anode voltage	4,000	4,000	4,000	3,500 volts
Direct anode current	0.12	0.12	0.12	0.10 amps.
Grid bias	—130	—130	—130	—100 volts
Power output	0.15	0.14	0.12	0.10 Kw.
Anode dissipation	0.33	0.34	0.36	0.25 Kw.
FREQUENCY	6	10	33	50 Mc.

	Class C Telephony				Class C Telegraphy			
	Subject to anode modulation				Unmodulated			
Direct anode voltage	3,000	3,000	3,000	2,500	4,000	4,000	4,000	3,500 volts
Direct anode current	0.2	0.2	0.2	0.16	0.2	0.2	0.2	0.16 amps.
Grid bias	—200	—200	—200	—150	—300	—300	—300	—250 to —350 volts
Carrier output	0.4	0.375	0.36	0.18	0.5	0.45	0.4	0.3 Kw.
Anode dissipation	0.2	0.225	0.24	0.22	0.3	0.35	0.4	0.22 Kw.
FREQUENCY	6	10	33	50	6	10	33	50 Mc.

—Standard Valves—

4016-B
Valve



V.4016-B.2
Nov. 1937

8-3107
3/15/57

— Standard 11/100 —

PRINTED IN
ENGLAND

—Standard Valves—

4017-B
Valve

4017-B VALVE

HALF WAVE, HOT CATHODE MERCURY VAPOUR
RECTIFIER.

SPECIFICATION.

Cathode.

Oxide coated filament (shielded).
Constant current type.

Base.

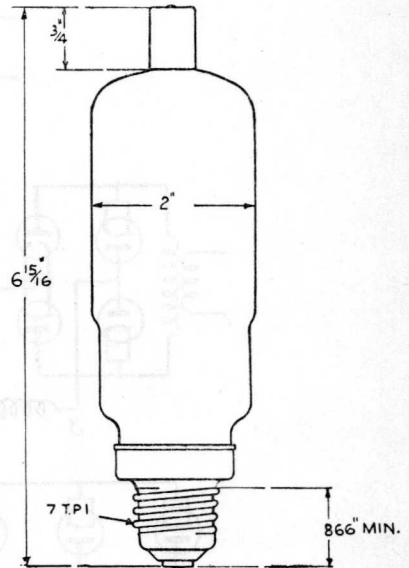
Edison medium screw.
Anode connected to top cap type A.

Dimensions.

Overall length $6\frac{15}{16}$ " (17.5 cms.)
Overall diameter 2" (5.1 cms.)
Net weight 0.22 lbs. (100 gms.)

Constants.

Filament current 8.25 amps.
Nominal filament voltage 2.7 volts
Maximum peak inverse voltage 7,000 volts
Maximum peak anode current 1.5 amps.
Time delay 30 seconds
Heating period after transport 15 mins.
Recommended ambient temperature range 10°C.—50°C.



Heating Time.

For ambient temperature 15°C and above. 30 seconds.
10°C.—15°C. 5 minutes.

Note :—For further information on H.C.M.V. rectifiers, see sheet G.I.

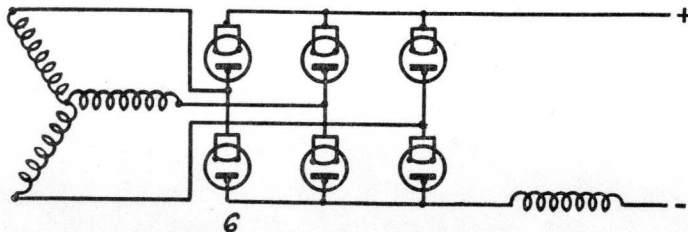
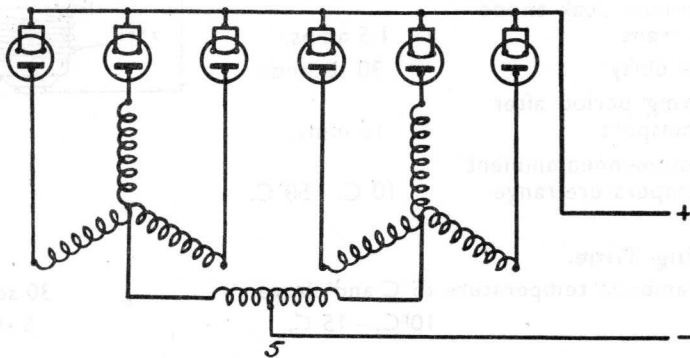
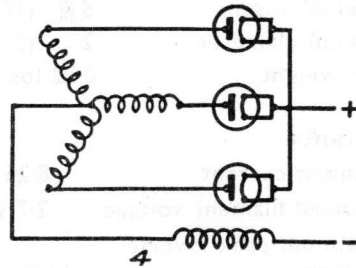
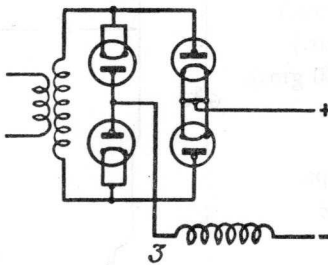
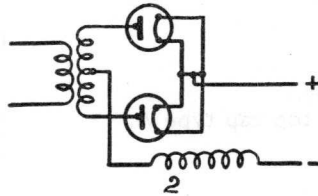
V.4017-B.1
March, 1939

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

Circuit	Number of valves	Load potential in volts	Load current in amps.
2	2	2,500	0.9
3	4	5,000	0.9
4	3	3,000	1.2
5	6	3,000	2.4
6	6	6,000	1.5

Important.—This rectifier being directly heated, the output circuit must be connected to the mid-point of the filament transformer.



PRINTED IN
ENGLAND

—Standard Valves—

4019-A Valve
-B Valve

4019-A AND 4019-B VALVES

TRIODES.

SPECIFICATION.

Cathode.

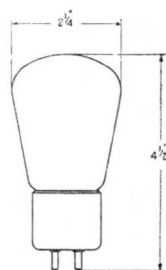
Oxide coated filament.
Constant current type.

Base.

4019-A Medium 4-pin bayonet thrust.
4019-B Standard British 4-pin.

Dimensions.

		4019-A	4019-B
Max. overall length	ins.	$4\frac{1}{2}$	$4\frac{9}{16}$
	cms.	11.4	11.6
Bulb diameter—	ins.	$2\frac{1}{4}$	$2\frac{1}{4}$
	cms.	5.7	5.7
Net weight	lbs.	0.14	0.14
	gms.	65	65

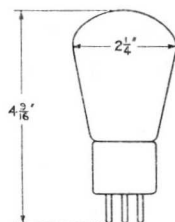


4019-A

Constants.

Filament current	0.25 amps.
Nominal filament voltage	4 volts
* Impedance	5,500 ohms
* Amplification factor	7
* Mutual conductance	1.27 mA per volt
Maximum direct anode voltage	190 volts
Grid-anode capacity	$5.4 \mu\mu\text{F.}$
Anode-filament capacity	$4.8 \mu\mu\text{F.}$
Grid-filament capacity	$7.3 \mu\mu\text{F.}$

* at $V_p = 130$ volts, $V_{g1} = -8$ volts.



4019-B

—Standard Valves—

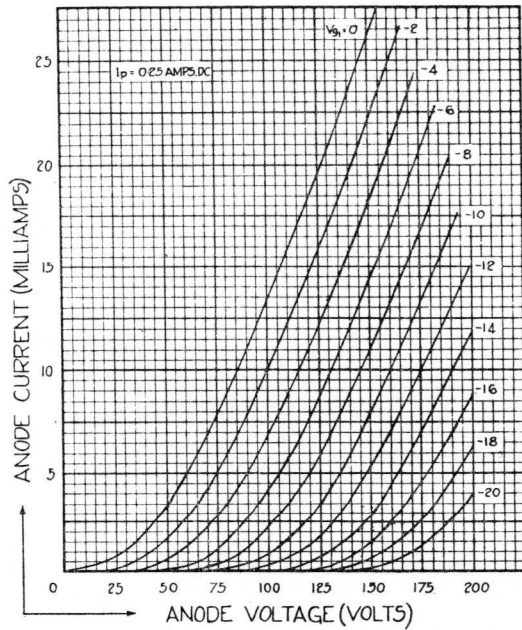
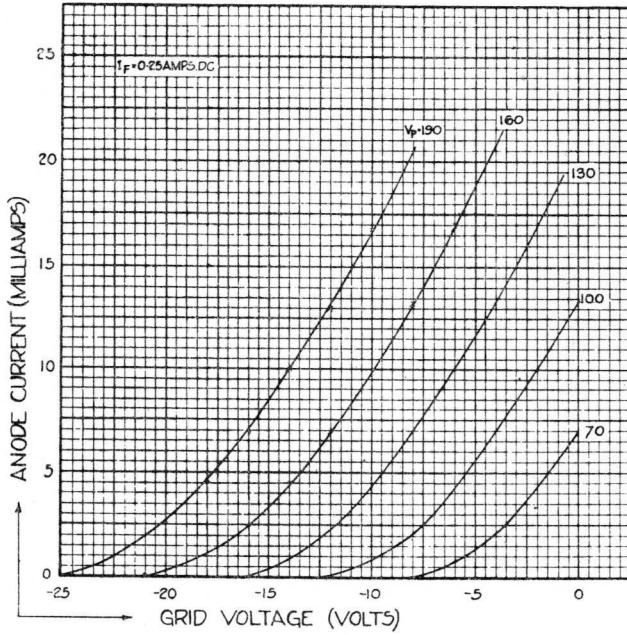
TYPICAL OPERATING CONDITIONS.

Anode voltage volts	Grid bias volts	Anode current mA	Anode Resistance ohms	Resistance Load ohms	Output Power mW.	Total Harmonics db below fundamental
130	—6	9.7	4,800	4,600	54	30
				9,200	49	34
				13,800	36	37
130	—8	6.8	5,500	5,500	83	24
				11,000	74	30
				16,500	61	32
130	—10	4.3	6,500	5,500	100	16
				11,000	85	23
				16,500	80	27
160	—10	9.8	4,700	4,600	150	24
				9,200	132	30
				13,800	112	37
160	—12	7.1	5,300	5,500	180	19
				11,000	156	23
				16,500	130	31
190	—14	9.7	4,900	5,500	290	23
				11,000	240	30
				16,500	180	33

Note :—Decreasing the output by N db below the value given in the table improves the harmonic level by N db.

—Standard Valves—

4019-A Valve
-B Valve



V.4019-AB.2
Sept. 1938

4018-A Valve
4018-B Valve

Standard Valves

PRINTED IN
ENGLAND

—Standard Valves—

4020-A Valve
-B Valve
-C Valve

4020-A, 4020-B, 4020-C VALVES

TRIODES.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant current type.

Base.

4020-A Medium 4-pin bayonet thrust.
4020-B Standard British 4-pin.
4020-C Medium 4-pin bayonet thrust, grid connected to top cap.

Dimensions.

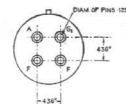
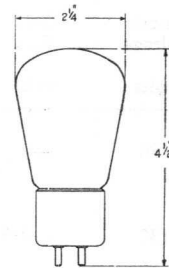
	4020-A	4020-B	4020-C
Overall length	ins. $4\frac{1}{2}$ cms. 11.4	ins. $4\frac{9}{16}$ cms. 11.6	ins. 5 cms. 12.7
Maximum diameter—			
ins.	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$
cms.	5.7	5.7	5.7
Net weight	lbs. 0.14 gms. 65	lbs. 0.14 gms. 65	lbs. 0.14 gms. 65

Constants.

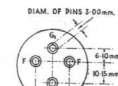
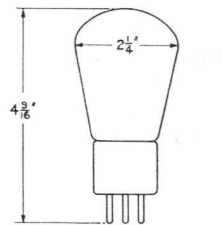
Filament current	0.25 amps.
Nominal filament voltage	2 volts
*Impedance	50,000 ohms
*Amplification factor	30
*Mutual conductance	0.6 mA per volt.

	4020-A	4020-B	4020-C
Grid-anode capacity	6.3	6.3	7.9 $\mu\mu\text{F}$.
Anode-filament capacity	4.4	4.4	5.3 $\mu\mu\text{F}$.
Grid-filament capacity	6.2	6.2	5.8 $\mu\mu\text{F}$.

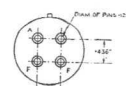
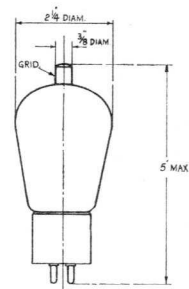
* at anode current of 0.8 mA.



4020-A



4020-B.



4020-C

V.4020-ABC.1
Nov. 1937

4020-A Valve
 -B Valve
 -C Valve

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

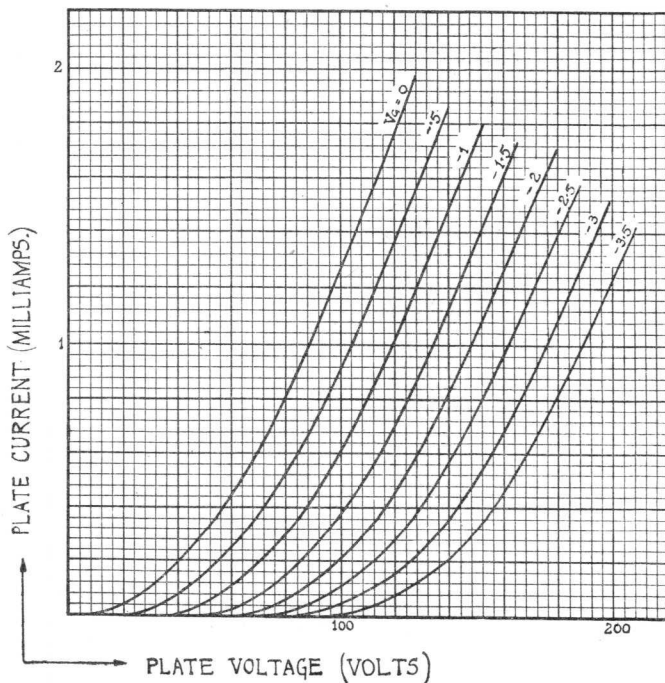
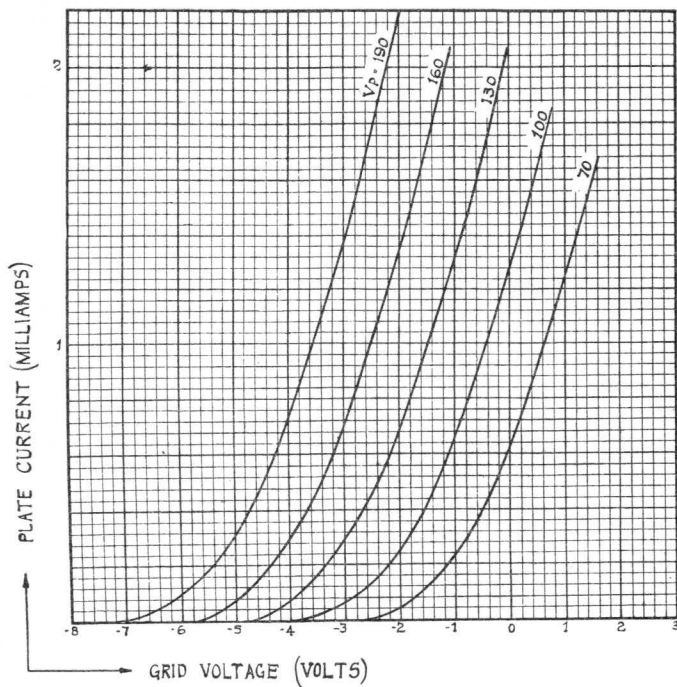
Anode voltage volts	Grid Bias volts	Anode current mA.	Anode Resistance ohms	Load ohms	Output voltage peak volts	Total Harmonic db below fundamental
130	—1	1.26	43,000	43,000	18.5	34.5
				86,000	20.3	37
				129,000	20.6	37
130	—1.5	0.92	46,000	46,000	21.4	30
				92,000	25.4	35.3
				138,000	26.2	37
130	—2	0.64	52,000	52,000	12.1	21.7
				104,000	14.8	28
				156,000	17.6	30.5
160	—1.5	1.63	41,000	41,000	24	35.2
				82,000	30.2	38.2
				123,000	35	38.5
160	—2	1.28	44,000	44,000	37	29
				88,000	42	35
				132,000	45.6	36

Note :—Decreasing the output by N db below the value given in the table improves the harmonic level by N db.

PRINTED IN
 ENGLAND

— Standard Valves —

4020-A Valve
 -B Valve
 -C Valve



V.4020-ABC.2
 Nov. 1937

Value
Value
Value

Standard Value

Year	Value
1950	100
1951	105
1952	110
1953	115
1954	120
1955	125
1956	130
1957	135
1958	140
1959	145
1960	150
1961	155
1962	160
1963	165
1964	170
1965	175
1966	180
1967	185
1968	190
1969	195
1970	200
1971	205
1972	210
1973	215
1974	220
1975	225
1976	230
1977	235
1978	240
1979	245
1980	250
1981	255
1982	260
1983	265
1984	270
1985	275
1986	280
1987	285
1988	290
1989	295
1990	300
1991	305
1992	310
1993	315
1994	320
1995	325
1996	330
1997	335
1998	340
1999	345
2000	350
2001	355
2002	360
2003	365
2004	370
2005	375
2006	380
2007	385
2008	390
2009	395
2010	400
2011	405
2012	410
2013	415
2014	420
2015	425
2016	430
2017	435
2018	440
2019	445
2020	450
2021	455
2022	460
2023	465
2024	470
2025	475

PRINTED IN
ENGLAND

—Standard Valves—

4021-A Valve
-B Valve
-C Valve

4021-A, 4021-B AND 4021-C VALVES

TRIODES.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant current type.

Base.

4021-A Medium 4-pin bayonet thrust.
4021-B Standard British 4-pin.
4021-C Medium 4-pin bayonet thrust, grid connected to top cap.

Dimensions.

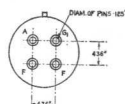
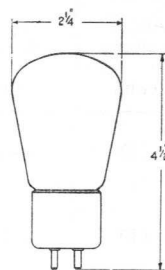
	4021-A	4021-B	4021-C
Overall length			
ins.	$4\frac{1}{2}$	$4\frac{9}{16}$	5
cms.	11.4	11.6	12.7
Maximum diameter			
ins.	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$
cms.	5.7	5.7	5.7
Net weight lbs.	0.14	0.14	0.14
gms.	65	65	65

Constants.

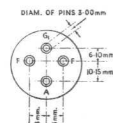
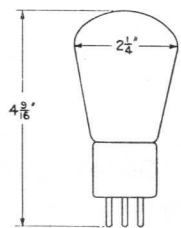
Filament current	0.25 amps.
Nominal filament voltage	4 volts
*Impedance	2,000 ohms
*Amplification factor	6
*Mutual conductance	3 mA per volt

	4021-A	4021-B	4021-C
Grid-anode capacity	9.1	9.1	$9.7 \mu\mu\text{F.}$
Anode-filament capacity	4.6	4.6	$5.5 \mu\mu\text{F.}$
Grid-filament capacity	8.0	8.0	$7.3 \mu\mu\text{F.}$

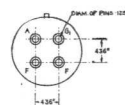
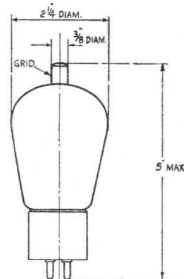
* at anode current of 23 mA.



4021-A



4021-B



4021-C

4021-A Valve
 -B Valve
 -C Valve

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

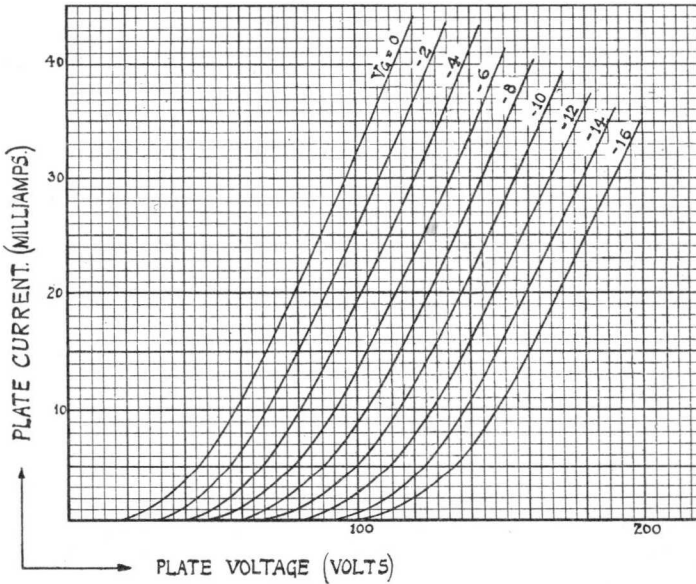
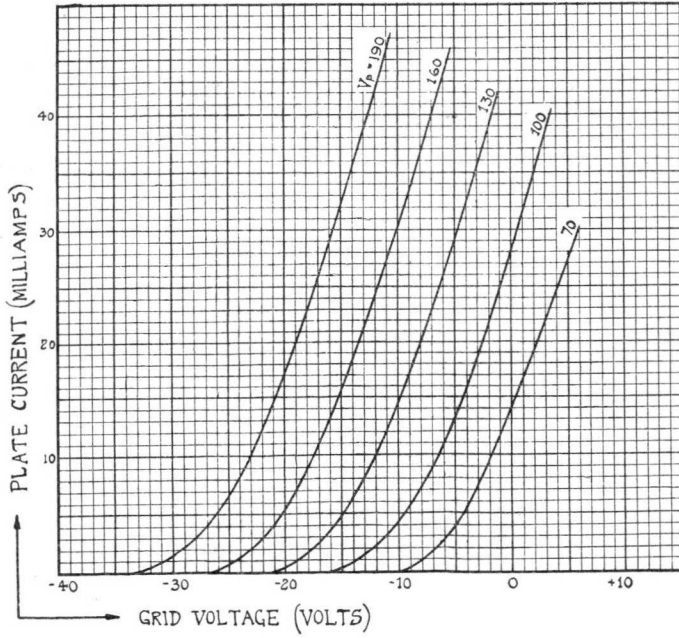
Anode voltage volts	Grid Bias volts	Anode current mA.	Anode resistance ohms	Load impedance ohms	Output mW.	Total Harmonic db below fundamental
130	—8	22.5	2,050	2,050	140	27
				4,100	100	31.5
				6,150	87	35
130	—6	28.4	1,750	1,750	65	31
				2,900	63	32.5
				5,250	56	38
130	—10	17	2,100	2,100	160	24
				4,200	125	30.4
				6,300	107	33
160	—10	32.5	1,800	1,800	250	28
				3,600	180	33.5
				5,400	158	35.5

Note :—Decreasing the output by N db below the value given in the table improves the harmonic level by N db.

PRINTED IN
 ENGLAND

— Standard Valves —

4021-A Valve
 -B Valve
 -C Valve



1001-A Valve
1001-B Valve
1001-C Valve

Standard Valves

PRINTED IN
ENGLAND

—Standard Valves—

4022-AR Valve
-B Valve

4022-AR AND 4022-B VALVES

TRIODES.

All 4022 type valves are made to meet the specification for the 4022-AR valve, the limits of which are closer than those of the 4022-A valve which has now been abandoned.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant current type.

Base.

4022-A Medium 4-pin bayonet thrust.
4022-B Standard British 4-pin.

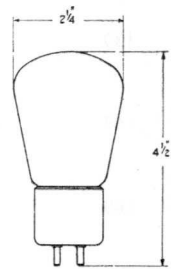
Dimensions.

	4022-AR	4022-B
Overall length ins.	$4\frac{1}{2}$	$4\frac{9}{16}$
cms.	11.4	11.6
Maximum diameter ins.	$2\frac{1}{4}$	$2\frac{1}{4}$
cms.	5.7	5.7
Net weight lbs.	0.14	0.14
gms.	65	65

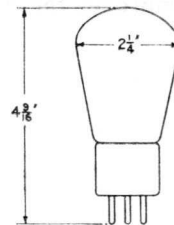
Constants.

Filament current	0.25 amps.
Nominal filament voltage	4 volts
* Impedance	5,500 ohms
* Amplification factor	12
* Mutual conductance	2.2 mA per volt
Max. direct anode voltage	190 volts
Grid-anode capacity	$9.6 \mu\mu\text{F.}$
Anode-filament capacity	$4.3 \mu\mu\text{F.}$
Grid-filament capacity	$8.1 \mu\mu\text{F.}$

* at $V_p = 130$ volts, $V_{g1} = -4.5$ volts.



4022-AR



4022-B

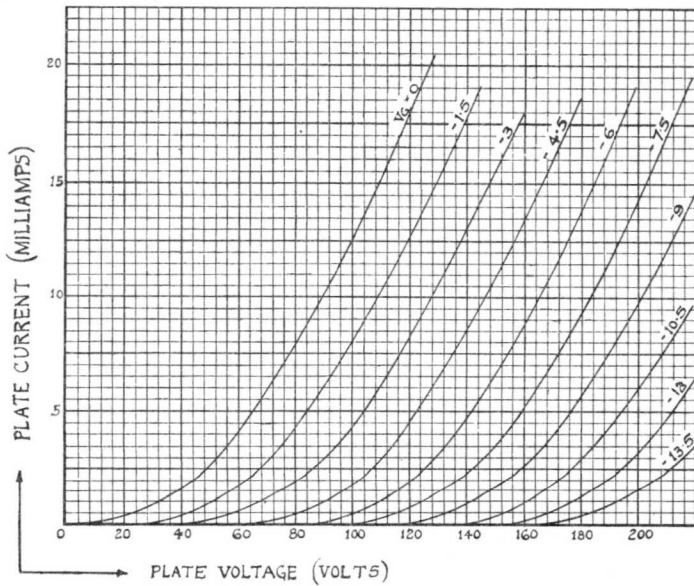
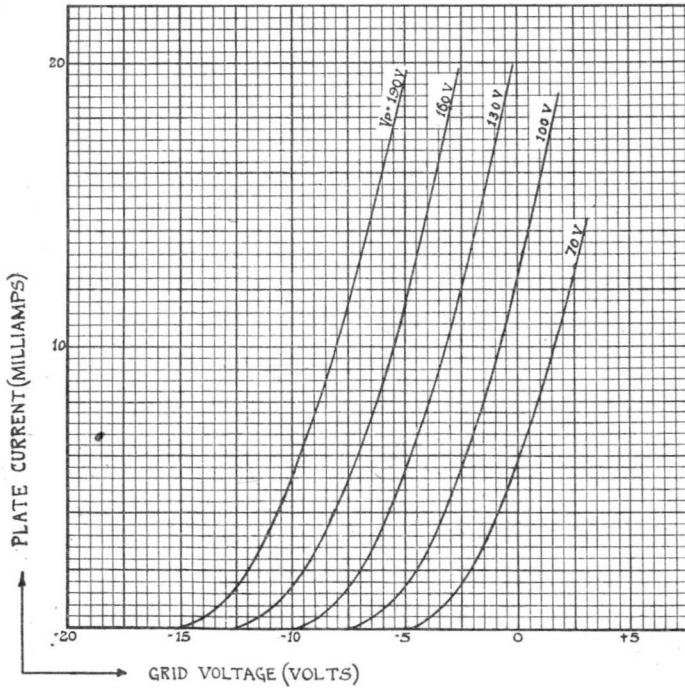
—Standard Valves—**TYPICAL OPERATING CONDITIONS.**

Anode voltage volts	Grid bias volts	Anode current mA.	Load resistance ohms	Output power mW.	2nd Harmonic db below fundamental	3rd Harmonic db below fundamental
130	—6	3.5	6,500	67	27	47
			13,000	65	35	48
			19,500	63	38	—
130	—4.5	6.5	5,000	120	18	30
			10,000	90	20	35
			15,000	75	33	—
130	—3	10.6	4,000	60	16	35
			8,000	50	16	36
			12,000	30	26	45
160	—6	8.8	4,000	110	34	40
			8,000	100	38	45
			12,000	80	41	—
160	—4.5	13.2	4,000	120	20	33
			8,000	100	20	37
			12,000	85	40	50
190	—6	16.2	4,000	160	34	41
			8,000	125	33	44
			12,000	85	46	—

Note :—Decreasing the output by N db below the value given in the table improves the harmonic level by N db.

— Standard Valves —

4022-AR Valve
-B Valve



V.4022-AB.2
Nov. 1937

Standard Lines

PRINTED IN
ENGLAND

—Standard Valves—

4030-A
Valve

4030-A VALVE

DOUBLE ENDED WATER COOLED TRIODE.

SPECIFICATION.

Cathode.

Pure Tungsten filament.
Constant voltage type.

Water Flow.

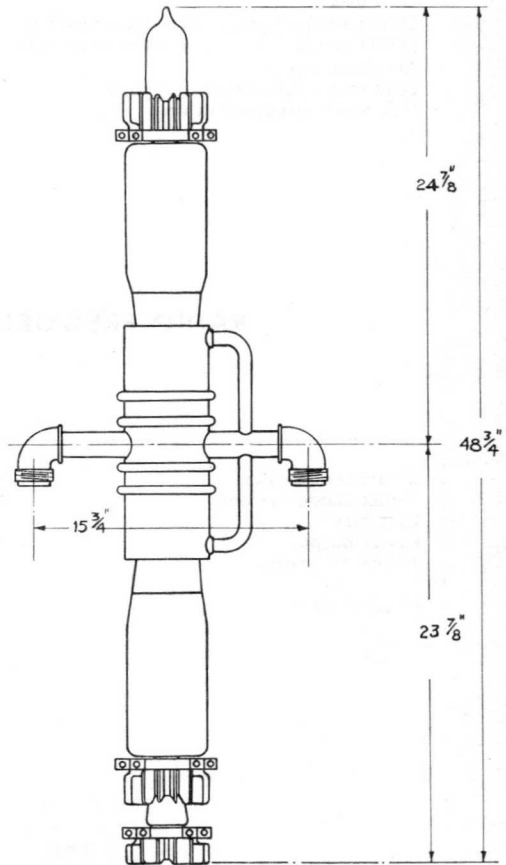
22 gallons per minute.

Dimensions.

Overall length $48\frac{3}{4}$ " (124 cms.)
Jacket diameter—
 $5\frac{3}{8}$ " (13.5 cms.)
Net weight 32 lbs. (14,500 gms.)

Constants.

Filament voltage 21 volts
(exact filament voltage marked
on bulb)
Nominal filament
current 215 amps.
Total Emission 45 amps.
Impedance 2,200 ohms
Amplification factor 36
Grid-anode capacity $51 \mu\mu\text{F.}$
Anode-filament
capacity $14 \mu\mu\text{F.}$
Grid-filament
capacity $40 \mu\mu\text{F.}$



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	17,500 volts
Maximum direct anode current	11 amps.
Maximum anode dissipation	80 Kw.
Maximum grid dissipation	1,500 watts
Maximum frequency for above ratings	2 Mc.
Maximum anode voltage for frequency of 22 Mc.	15,000 volts

V.4030-A.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class B A.F. Amp. and Mod. for balanced 2 valve circuit
Direct anode voltage	12,500 volts
Grid bias	—150 volts
Direct anode current per valve—zero signal	1.3 amps.
Direct anode current per valve—maximum signal	6.5 amps.
Anode dissipation	36.6 Kw.
Load resistance—anode to anode	1,700 ohms
Maximum output—2 valves	90 Kw.

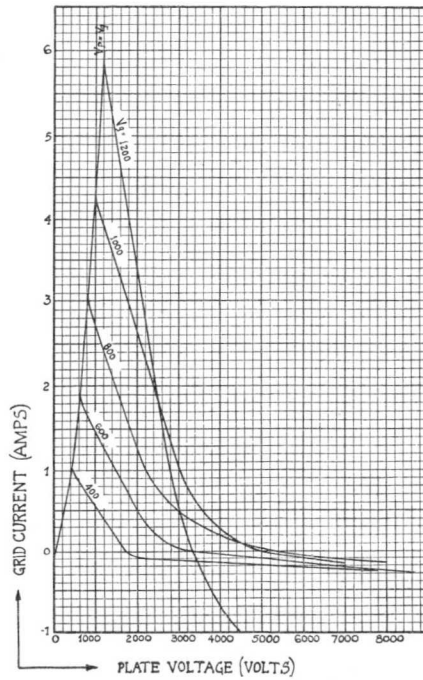
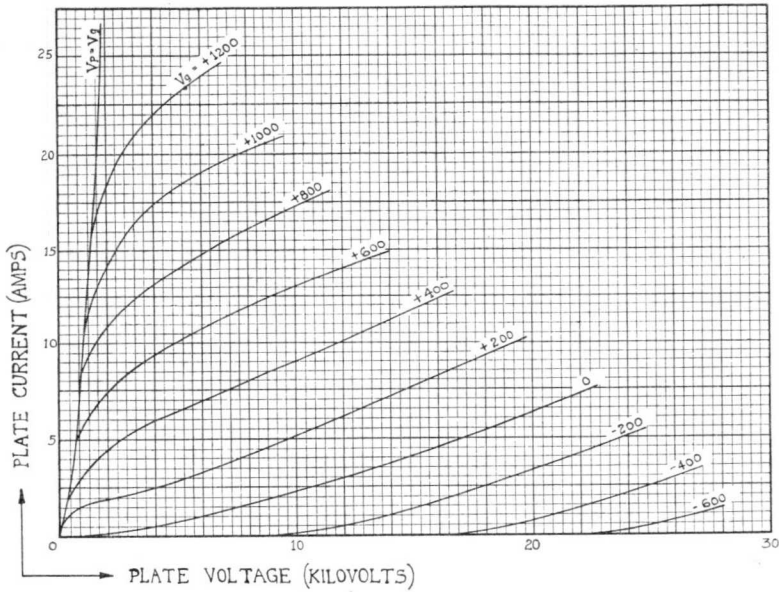
RADIO FREQUENCY OPERATION.

	Class B Telephony Modulated carrier applied to grid			
Direct anode voltage	17.5	15	12	10 Kv.
Direct anode current	4.8	4.8	4.8	4.8 amps.
Grid bias	—400	—300	—250	—150 volts
Power output	25	22	17	12 Kw.
Anode dissipation	59	50	40	36 Kw.
FREQUENCY	2	12	19	22 Mc.

	Class C Telephony				Class C Telephony			
	Subject to anode modulation				Unmodulated			
Direct anode voltage	12	11	10	9	17.5	15	12	10 Kv.
Direct anode current	5	5	5	5	9.6	9.6	9.6	9.6 amps.
Grid bias	—600	—500	—450	—400	—600	—500	—450	—400 to
Carrier output	40	35	30	20	—800	—700	—600	—550 volts
Anode dissipation	20	20	20	25	100	88	68	48 Kw.
					68	56	47	48 Kw.
FREQUENCY	2	12	19	22	2	12	19	22 Mc.

—Standard Valves—

4030-A
Valve



V.4030-A.2
Nov. 1937

A-DECH
1974

Stardom 1974

PRINTED IN
ENGLAND

—Standard Valves—

4030-C
Valve

4030-C VALVE

DOUBLE ENDED WATER COOLED TRIODE.

SPECIFICATION.

Cathode.

Pure tungsten filament.
Constant voltage type.

Water Circulation.

Normal flow—22 gallons per minute.
Pressure drop in water jacket at normal flow
9 lbs. per sq. in. (0.63 Kg. per sq. cm.)
Maximum water pressure in water jacket—
35 lbs. per sq. in. (2.5 Kg. per sq. cm.)

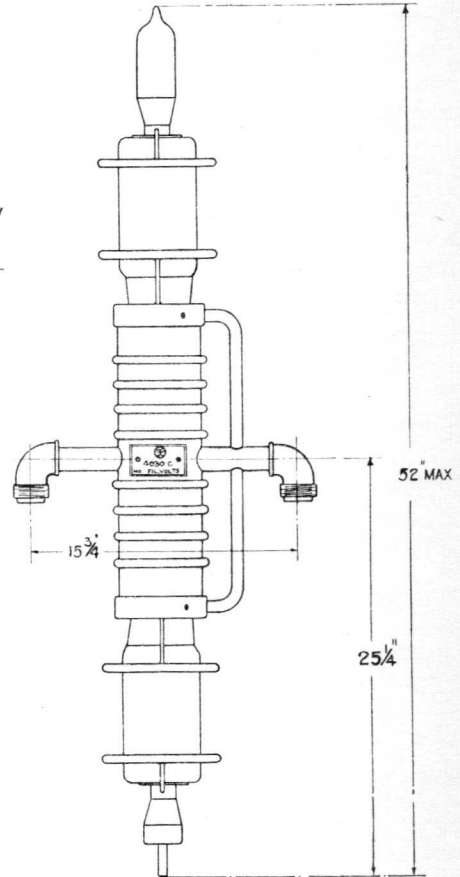
Dimensions.

Max. overall length 52" (132 cms.)
Jacket diameter $5\frac{3}{8}$ " (13.5 cms.)
Packing crate See dwg.
Net weight 35 lbs. (16,000 gms.)

Constants.

Filament voltage 25 volts
(exact filament voltage marked
on valve)
Nominal filament current 250 amps.
Total emission 45 amps.
* Impedance 1,800 ohms
* Amplification factor 36
* Mutual conductance 20 mA per volt
Grid-anode capacity 61 $\mu\mu\text{F}$.
Anode-filament capacity 15 $\mu\mu\text{F}$.
Grid-filament capacity 45 $\mu\mu\text{F}$.

* at $V_p = 17 \text{ KV}$, $I_p = 5 \text{ amps}$.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	17,500 volts
Maximum direct anode current	11 amps.
Maximum anode dissipation	80 Kw.
Maximum grid dissipation	1,500 watts
Maximum frequency for above ratings	2 Mc.
Maximum anode voltage for frequency of 22 Mc.	15,000 volts

Note.—The 4030-C Valve is shipped with Corona rings already fitted but is not supplied with grid and filament radiators or connectors. The code numbers of these parts, which must be ordered as a separate item, are as follows:—

Grid and filament radiators	type LP.77880	Filament connection	type Det.105
Filament radiator	type LP.77883	Filament connection	type Det.105A

V.4030-C.1
Sept. 1938

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class B A.F. Amp. and Mod. For balanced 2 valve circuit
Direct anode voltage	14,000 volts
Grid bias	—150 volts
Direct anode current per valve—zero signal	1.3 amps.
Direct anode current per valve—maximum signal	6.5 amps.
Anode dissipation	41 kW.
Load resistance—anode to anode	1,900 ohms
Maximum output—2 valves	100 kW.

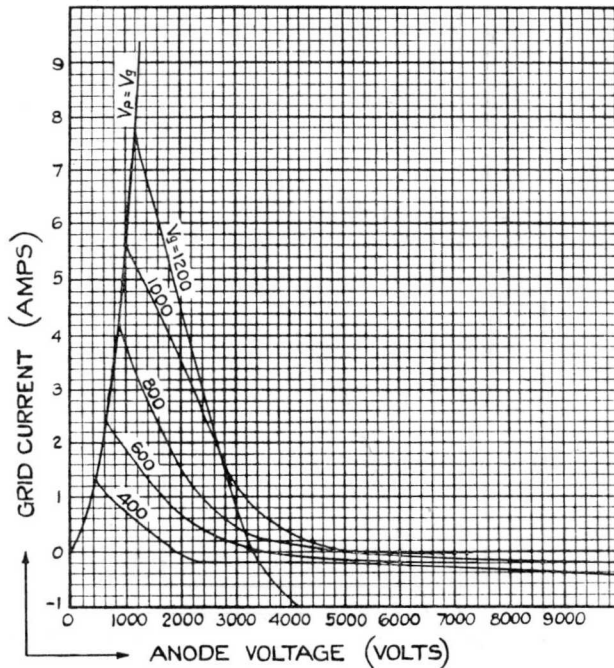
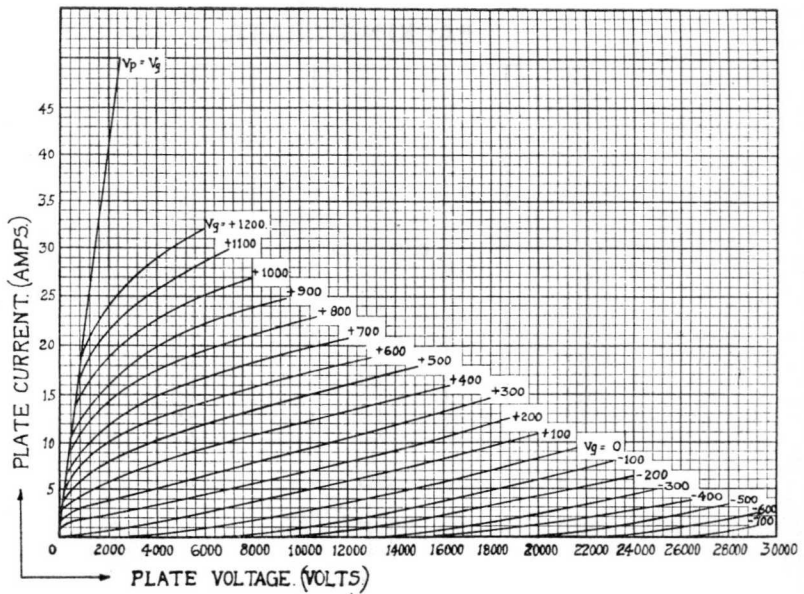
RADIO FREQUENCY OPERATION.

	Class B Telephony Modulated carrier applied to grid			
Direct anode voltage	17.5	15	12	10 kV.
Direct anode current	4.8	4.8	4.8	4.8 amps.
Grid bias	—400	—300	—250	—150 volts
Power output	25	22	17	12 kW.
Anode dissipation	59	50	40	36 kW.
FREQUENCY	2	12	19	22 Mc.

	Class C Telephony				Class C Telegraphy			
	Subject to anode modulation				Unmodulated			
Direct anode voltage	12	11	10	9	17.5	15	12	10 kV.
Direct anode current	5	5	5	5	9.6	9.6	9.6	9.6 amps.
Grid bias	—600	—500	—450	—400	—600	—500	—450	—400 to —550 volts
Carrier output	40	35	30	20	100	88	68	48 kW.
Anode dissipation	20	20	20	25	68	56	47	48 kW.
FREQUENCY	2	12	19	22	2	12	19	22 Mc.

—Standard Valves—

4030-C
Valve

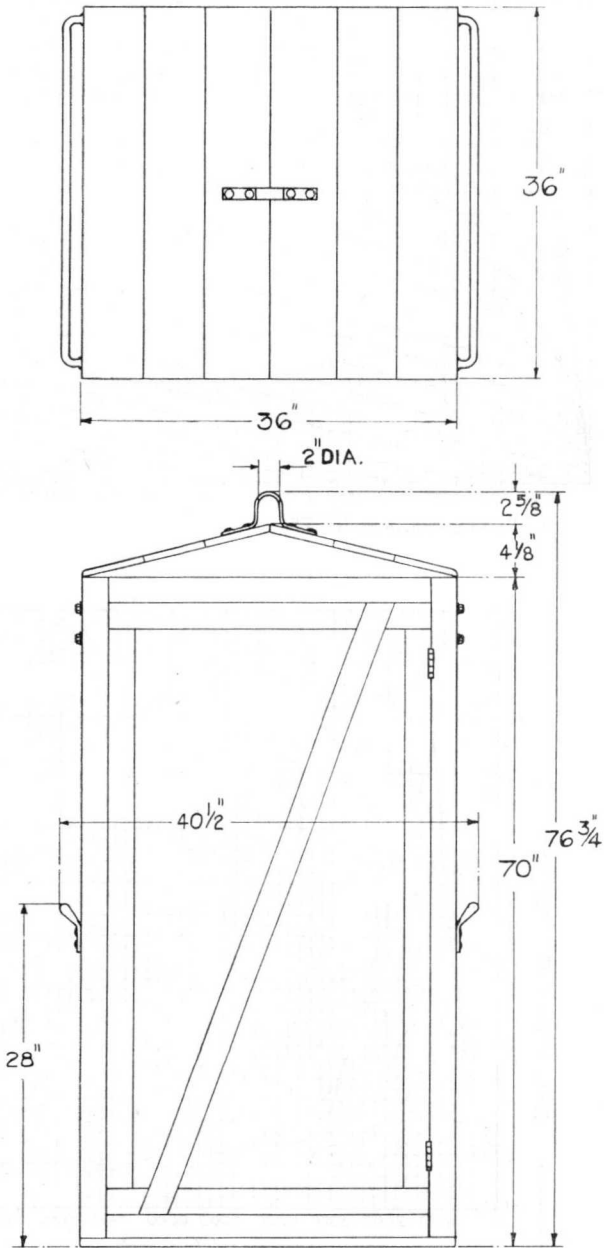


Tentative data

V.4030-C.2
Sept. 1938

—Standard Valves—

PACKING CRATE.



—Standard Valves—

4033-A Valve
-AA Valve
-AF Valve

4033-A, -AA AND -AF VALVES TRIODES.

The 4033-AF valve is identical with the 4033-A valve ; the -F code indicates that the valve has passed special tests for use in Standard Aircraft radio.

SPECIFICATION.

Cathode.

Indirectly heated oxide coated.
Constant voltage type.

Base.

4033-A and -AF Standard British 5-pin.
4033-AA American Medium 5-pin.

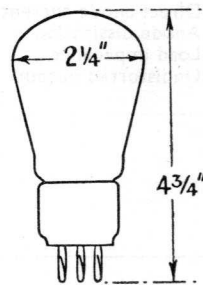
Dimensions.

Overall length $4\frac{3}{4}$ " (12 cms.)
Maximum diameter $2\frac{1}{4}$ " (5.8 cms.)
Net weight 0.14 lbs. (65 gms.)

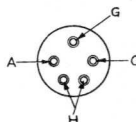
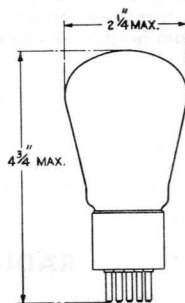
Constants.

Heater voltage 6 volts
Nominal heater current 1.4 amps.
*Impedance 1,670 ohms
*Amplification factor 15
*Mutual conductance 9 mA per volt
Grid-anode capacity $8 \mu\mu\text{F}$.
Anode-filament capacity $2.7 \mu\mu\text{F}$.
Grid-filament capacity $11.9 \mu\mu\text{F}$.

* at $V_p = 300$ volts, $I_p = 50$ mA.



4033-A and -AF



4033-AA

LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	600 volts
Maximum direct anode current	0.170 amps.
Maximum anode dissipation	25 watts
Maximum direct grid current	0.030 amps.
Maximum frequency for above ratings	2 Mc.
Maximum anode voltage for frequency of 10 Mc.	500 volts

V.4033-A.1
Mar. 1939

4033-A Valve
 -AA Valve
 -AF Valve

— Standard Valves —

TYPICAL OPERATING CONDITIONS.

	Class A A.F. Amp.
Direct anode voltage	400 volts
Grid bias	(approx.) —20 volts
Direct anode current	0.050 amps.
Anode dissipation	16 watts
Load impedance	7,000 ohms
Undistorted output	4 watts

	Class B A.F. Amp. and Mod. For balanced 2 valve circuit
Direct anode voltage	600 volts
Grid bias	—30 to —40 volts (individual biasing required for each valve)
Anode current per valve—zero signal	20 mA
Anode current per valve—maximum signal	80 mA
Anode dissipation	23 watts
Load resistance—anode to anode	7,200 ohms
Peak AF grid to grid voltage	130 volts
Grid current per valve	8 mA
Maximum output—2 valves	50 watts

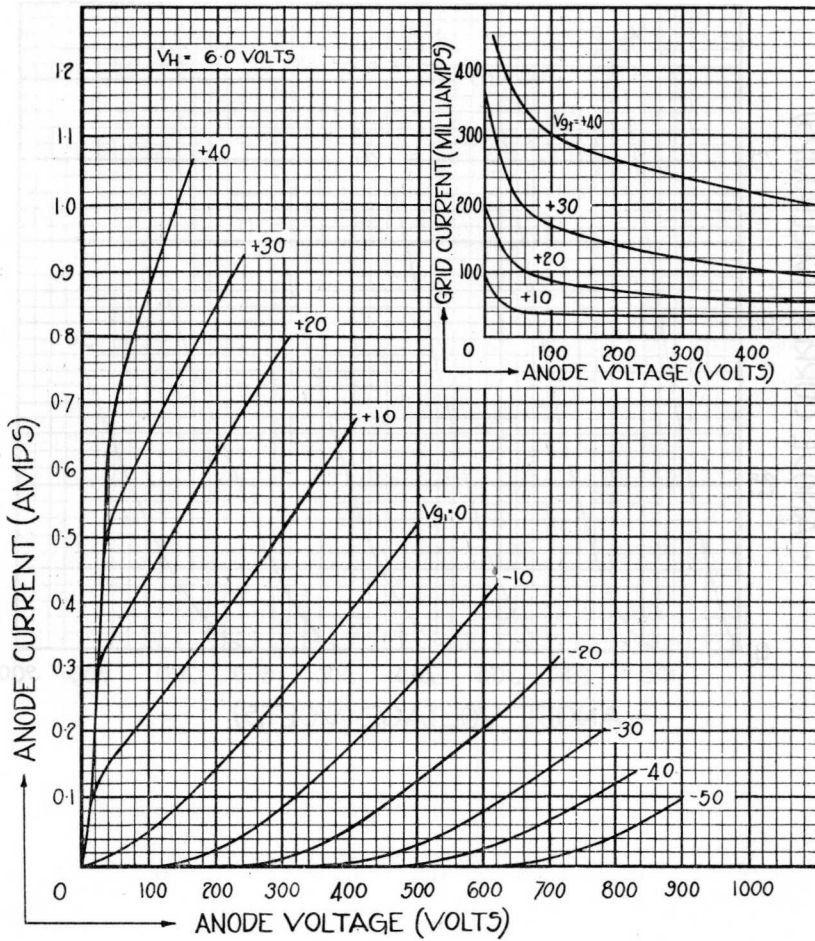
RADIO FREQUENCY OPERATION.

	Class B Telephony	Class C Telephony	Class C Telegraphy
	Modulated carrier applied to grid	Subject to anode modulation	Unmodulated
Direct anode voltage	600	400	600 volts
Direct anode current	0.063	0.094	0.09 amps.
Grid bias	—45	—70	—100 to —150 volts
Anode dissipation	25	12.5	18 watts
Carrier output	12.5	25	36 watts

PRINTED IN
ENGLAND

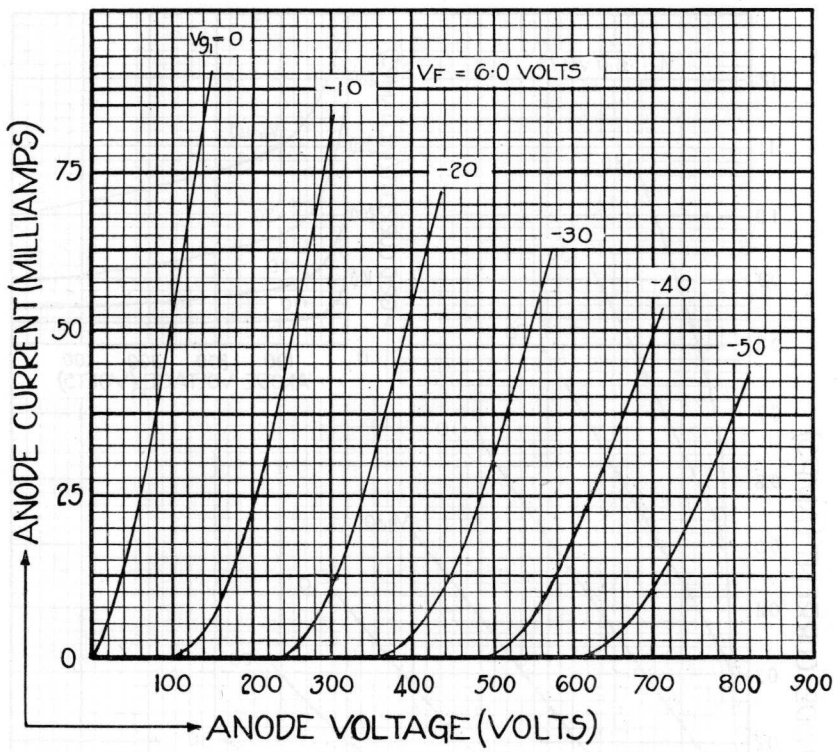
—Standard Valves—

4033-A Valve
-AA Valve
-AF Valve



4033-A Valve
-AA Valve
-AF Valve

—Standard Valves—



PRINTED IN ENGLAND

—Standard Valves—

4037-A
Valve

4037-A VALVE

HOT CATHODE MERCURY VAPOUR
RECTIFIER.

SPECIFICATION.

Cathode.

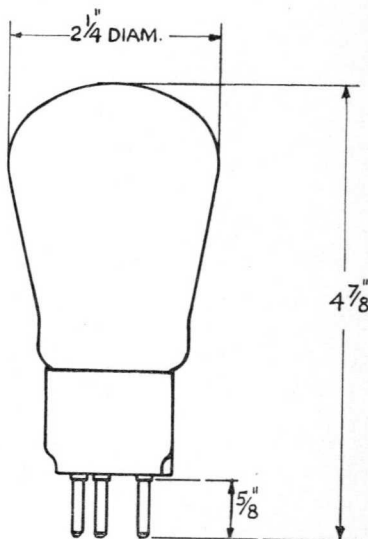
Oxide coated filament.
Constant voltage type.

Base.

Standard British 4 pin.

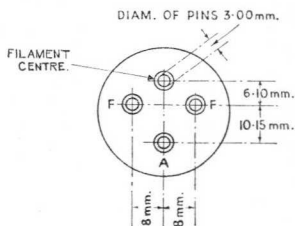
Dimensions.

Overall length	$4\frac{7}{8}$ " (12.4 cms.)
Overall diameter	$2\frac{1}{4}$ " (5.7 cms.)
Net weight	0.13 lbs. (60 gms.)



Constants.

Filament voltage	4 volts
Nominal filament current	2 amps.
Maximum peak inverse voltage	1,000 volts
Maximum peak anode current	0.8 amps.



OUTPUT AS HALF WAVE RECTIFIER.

250 mA. at 300 volts.

V.4037-A.1
Nov. 1937

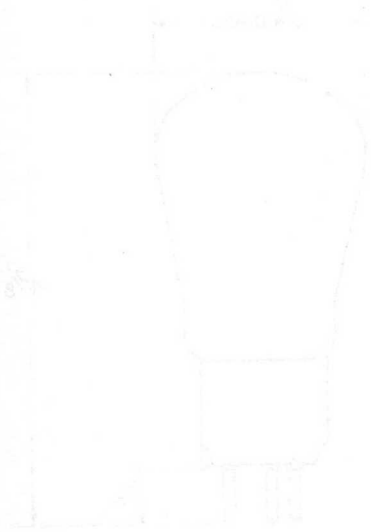
Standard Valves

4037-A VALVE

HOT CATHODE MERCURY VAPOR

REC. 1000

DESCRIPTION



Operating
 Lead and filament
 Control valve type

Base
 Pin and pin number

Dimensions
 Overall length
 Overall diameter
 Pin pitch

Characteristics
 Filament voltage
 Filament current
 Maximum peak-to-peak
 voltage
 Maximum peak-to-peak
 current

OUTPUT AS HALF WAVE RECTIFIER

150 mA at 200 V_{pk}

—Standard Valves—

4043-A Valve
-B Valve

4043-A AND 4043-B VALVE

TRIODE.

For replacement purposes only.
Replaced by 4043-C and -D valves.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant voltage type.

Base.

4043-A American medium 4-pin.
4043-B standard British 4-pin.

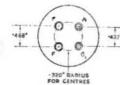
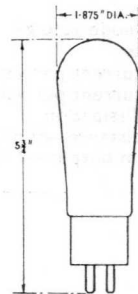
Dimensions.

Overall length $5\frac{3}{4}$ " (14.6 cms.)
Maximum diameter $1\frac{7}{8}$ " (4.8 cms.)
Net weight 0.2 lbs. (90 gms.)

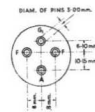
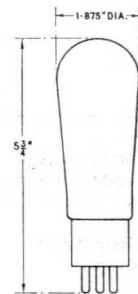
Constants.

Filament voltage 7.5 volts
Nominal filament current 1.2 amps.
* Impedance 3,500 ohms
* Amplification factor 8
Grid-anode capacity 13.3 $\mu\mu\text{F}$.
Anode-filament capacity 4.8 $\mu\mu\text{F}$.
Grid-filament capacity 7.0 $\mu\mu\text{F}$.

* at anode current of 0.050 amps.



4043-A



4043-B

LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	600 volts
Maximum direct anode current	0.110 amps.
Maximum anode dissipation	35 watts
Maximum direct grid current	0.030 amps.
Maximum frequency for above ratings	2 Mc.
Maximum anode voltage for frequency of 10 Mc.	500 volts

V.4043-AB.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

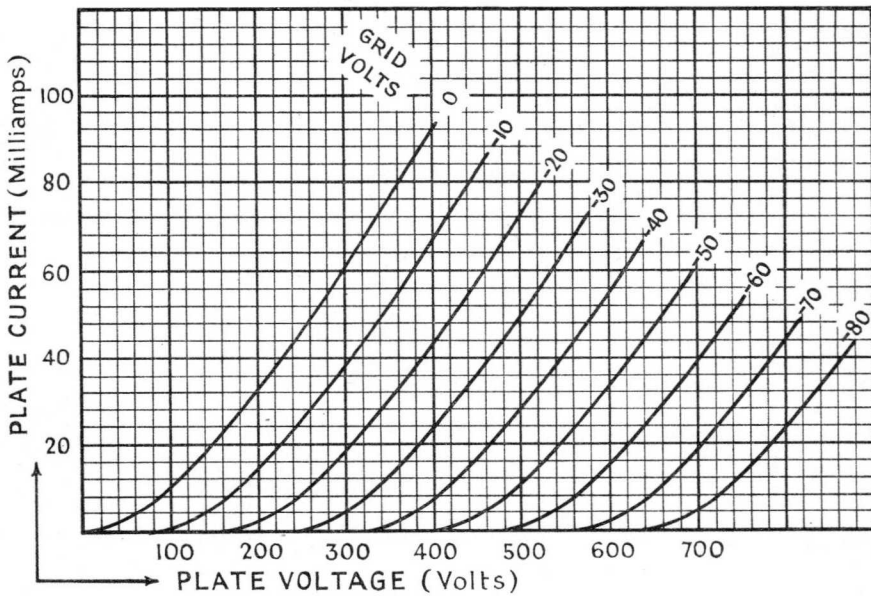
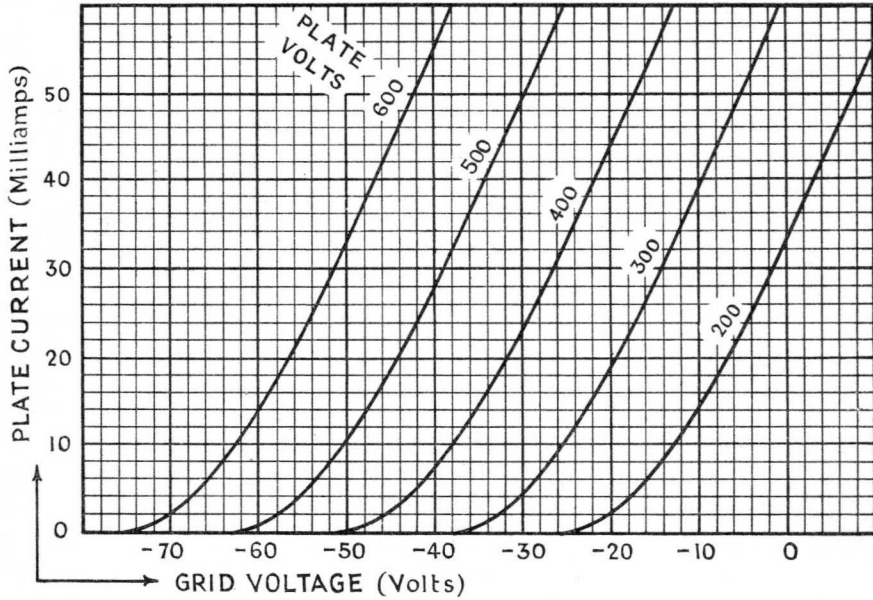
	Class B A.F. Amp. and Mod. For balanced 2 valve circuit
Direct anode voltage	600 volts
Grid bias	—55 to —65 volts
Anode current per valve—zero signal	0.012 amps.
Anode current per valve—maximum signal	0.090 amps.
Anode dissipation	25 watts
Load resistance—anode to anode	6,000 ohms
Maximum output—2 valves	60 watts

RADIO FREQUENCY OPERATION.

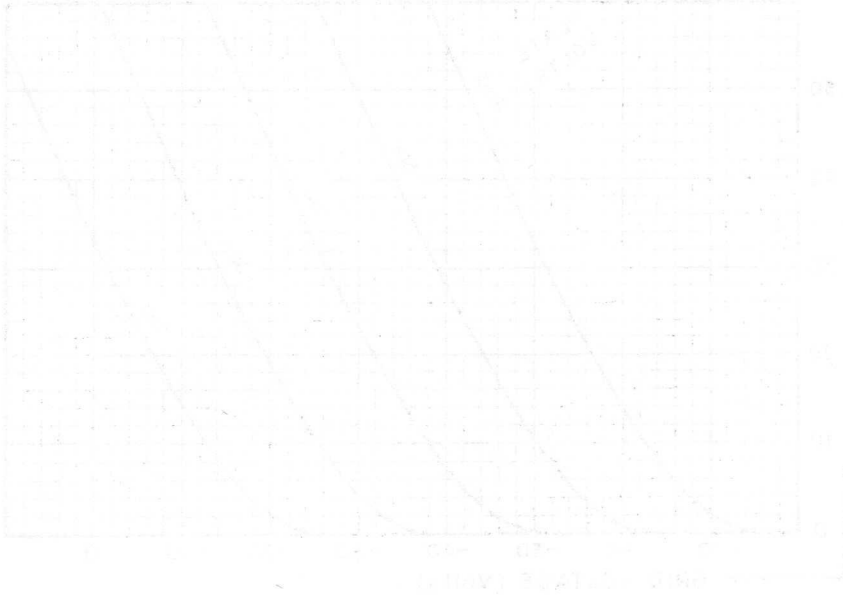
	Class B Telephony	Class C Telephony	Class C Telegraphy
	Modulated carrier applied to grid	Subject to anode modulation	Unmodulated
Direct anode voltage	600	400	600 volts
Direct anode current	0.087	0.131	0.130 amps.
Grid bias	—65	—100	—150 to —200 volts
Anode dissipation	35	17.5	26 watts
Carrier output	17.5	35	52 watts

—Standard Valves—

4043-A Valve
-B Valve



Standard Valves



—Standard Valves—

4043-C Valve
-D Valve

4043-C AND 4043-D VALVES

TRIODES.

Similar to 4043-A and -B, but have grid designed to reduce grid emission. It is thus possible to drive the grid further positive and to obtain greater undistorted output than for 4043-A and -B Valves.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant voltage type.

Base.

4043-C American medium 4-pin.
4043-D standard British 4-pin.

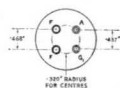
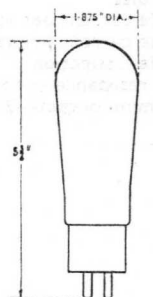
Dimensions.

Overall length	$5\frac{3}{4}$ " (14.6 cms.)
Maximum diameter	$1\frac{7}{8}$ " (4.8 cms.)
Net weight	0.2 lbs. (90 gms.)

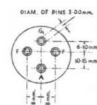
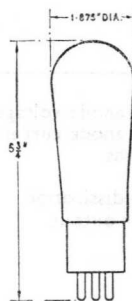
Constants.

Filament voltage	7.5 volts
Nominal filament current	1.2 amps.
*Impedance	3,500 ohms
*Amplification factor	8
Grid-anode capacity	13.3 $\mu\mu\text{F}$.
Anode-filament capacity	4.8 $\mu\mu\text{F}$.
Grid-filament capacity	7.0 $\mu\mu\text{F}$.

* at anode current of 0.050 amps.



4043-C



4043-D

LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	600 volts
Maximum direct anode current	0.110 amps.
Maximum anode dissipation	35 watts
Maximum direct grid current	0.030 amps.
Maximum frequency for above ratings	2 Mc.
Maximum anode voltage for frequency of 10 Mc.	500 volts

V.4043-CD.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

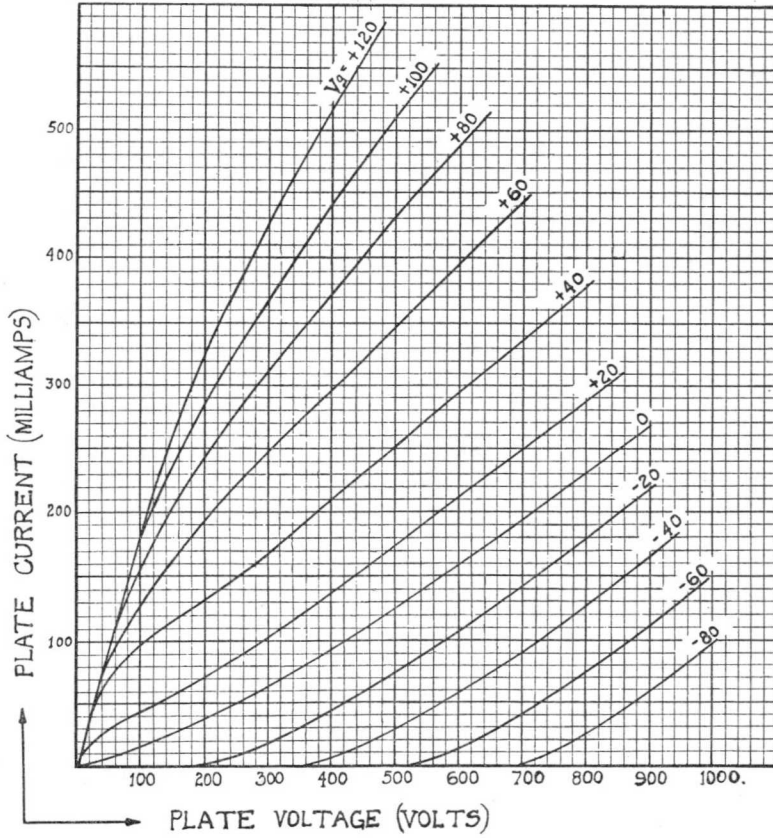
	Class B A.F. Amp. and Mod. For balanced 2 valve circuit
Direct anode voltage	600 volts
Grid bias	—55 to —65 volts
Anode current per valve—zero signal	0.012 amps.
Anode current per valve—maximum signal	0.11 amps.
Anode dissipation	30 watts
Load resistance—anode to anode	6,000 ohms
Maximum output—2 valves	73 watts

RADIO FREQUENCY OPERATION.

	Class B Telephony	Class C Telephony	Class C Telegraphy
	Modulated carrier applied to grid	Subject to anode modulation	Unmodulated
Direct anode voltage	600	400	600 volts
Direct anode current	0.087	0.131	0.130 amps.
Grid bias	—65	—100	—150 to —200 volts
Anode dissipation	35	17.5	26 watts
Carrier output	17.5	35	52 watts

—Standard Valves—

4043-C Valve
-D Valve



400-C-Yale
-D-Yale

Standard Yale



PRINTED IN
ENGLAND

—Standard Valves—

4046-A
Valve

4046-A VALVE

PENTODE.

SPECIFICATION.

Cathode.

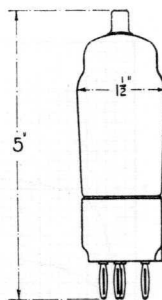
Indirectly heated oxide coated.
Constant voltage type.

Base.

Standard British 5-pin. Anode connected to top cap type B.
Bulb metallised and connected to cathode.

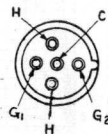
Dimensions.

Max. overall length $5\frac{1}{4}$ " (13.3 cms.)
Bulb diameter $1\frac{1}{2}$ " (3.8 cms.)
Net weight 0.13 lbs. (60 gms.)



Constants.

Heater voltage 4 volts
Nominal heater current 0.95 amp.
*Impedance 800,000 ohms
*Amplification factor 2,400
Grid-anode capacity 0.007 $\mu\mu\text{F}$.
Input capacity 10.7 $\mu\mu\text{F}$.
Output capacity 8 $\mu\mu\text{F}$.



* at $V_p = 200$, $V_{g_2} = 100$, $V_{g_1} = -1.5$ Volts.

LIMITING CONDITIONS FOR SAFE OPERATION.

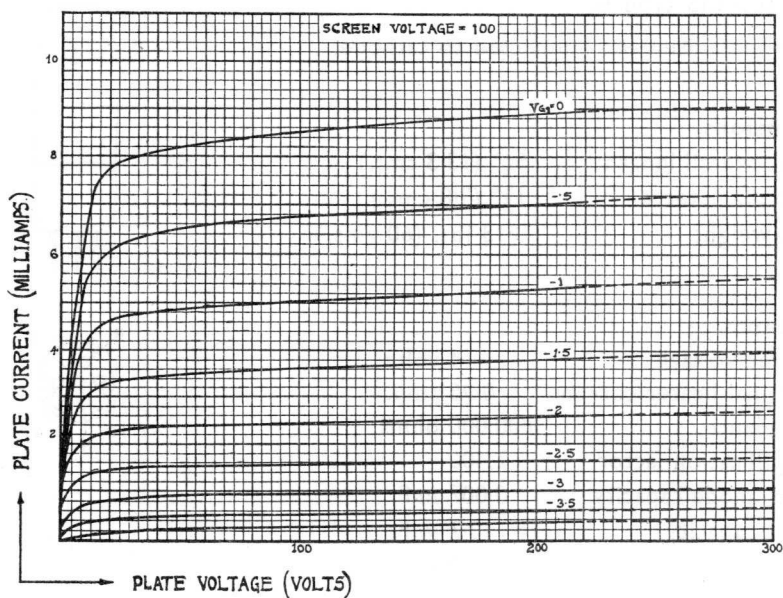
Maximum direct anode voltage 250 volts
Maximum direct screen voltage 100 volts

V.4046-A.1
Sept. 1938

— Standard Valves —

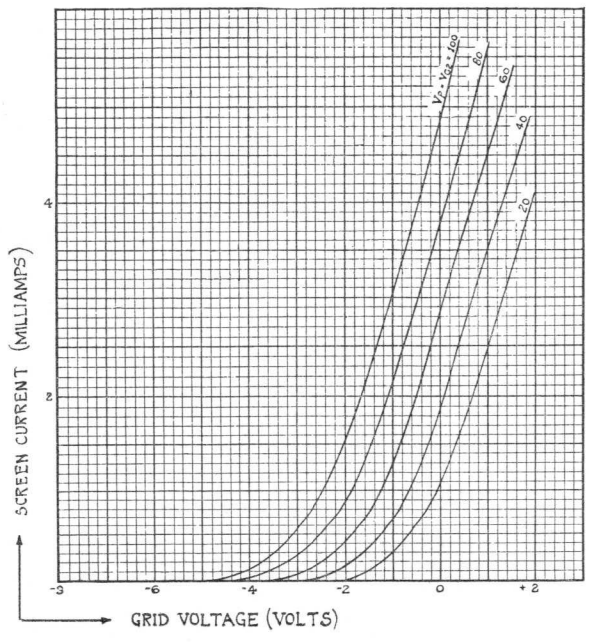
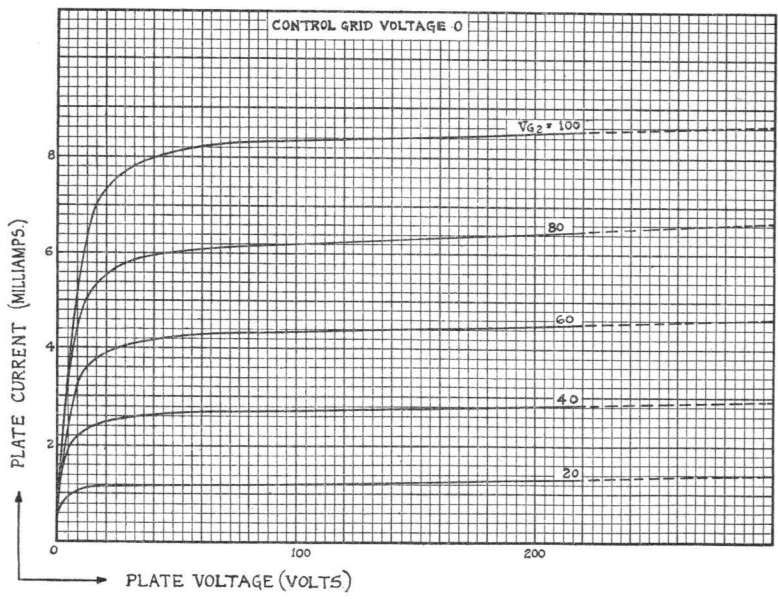
TYPICAL OPERATING CONDITIONS.

Anode voltage	250	200	150 volts
Control grid bias	—1.5	—1.5	—1.5 volts
Screen grid voltage	100	100	100 volts
Anode current	3.9	3.8	3.7 mA.
Anode resistance	800,000	800,000	800,000 ohms
Load	50,000	46,000	30,000 ohms
Output	0.315	0.258	0.175 watts
2nd harmonic — %	8.6	8.75	11.5
— db	21.3	20.7	19



—Standard Valves—

4046-A
Valve



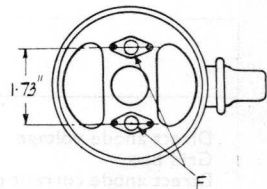
V.4046-A.2
Nov. 1937

Standard Notes

4047-B VALVE

(Replaces the 4047-A Valve
which has now been abandoned)

SINGLE ENDED
WATER COOLED TRIODE.



Cathode.

Pure tungsten filament.
Constant voltage type.

Water Jacket.

Type MS.1362 Grp. 1 for anode dissipation
up to 6 Kw.

Type MS.1362 Grp. 20 for anode dissipation
up to 6 Kw., used for below panel
connection.

Types 223 LU 1A or PL 122011 (3001-A) for
anode dissipation over 6 Kw.

Water Flow.

5 gallons per minute.

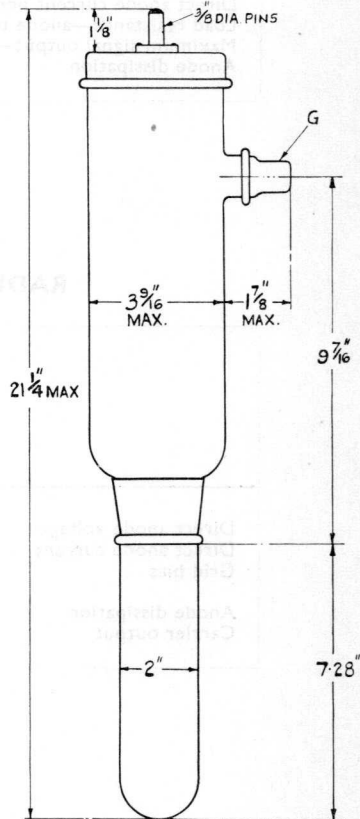
Dimensions.

Max. overall length $21\frac{1}{4}$ " (54 cms.)
Max. bulb diameter $3\frac{9}{16}$ " (9.05 cms.)
Net weight $3\frac{3}{4}$ lbs. (1,700 gms.)

Constants.

Filament voltage 18—20 volts
(exact filament voltage
marked on bulb)
Nominal filament current 59 amps.
Total emission 6 amps.
*Impedance 7,500 ohms
*Amplification factor 40
*Mutual conductance 5.3 mA. per volt
Grid-anode capacity 24 $\mu\mu\text{F}$.
Anode-filament capacity 2 $\mu\mu\text{F}$.
Grid-filament capacity 17 $\mu\mu\text{F}$.

* at anode current of 0.75 amp.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	13,000 volts
Maximum direct anode voltage for anode modulation	10,000 volts
Maximum direct anode current	1.5 amp.
Maximum anode dissipation	10 Kw.
Maximum grid dissipation	200 watts
Maximum frequency for above ratings	3 Mc.
Maximum anode voltage for frequency of 6 Mc.	7,500 volts

NOTE.—The characteristics of this valve are identical with those of the 4047-A Valve but the grid lead has been brought out through the side of the bulb. When the 4047-B is used to replace the 4047-A new grid connectors will be required. These connectors type ES.5706-1 should be ordered with the valve.

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class B A.F. Amp. or Mod. For balanced 2 valve circuit
Direct anode voltage	10,000 volts
Grid bias	—120 to —170 volts
Direct anode current per valve—zero signal	0.25 amps.
Direct anode current per valve—maximum signal	1.2 amps.
Load resistance—anode to anode	7,500 ohms
Maximum signal output—2 valves	13.2 Kw.
Anode dissipation	5.4 Kw.

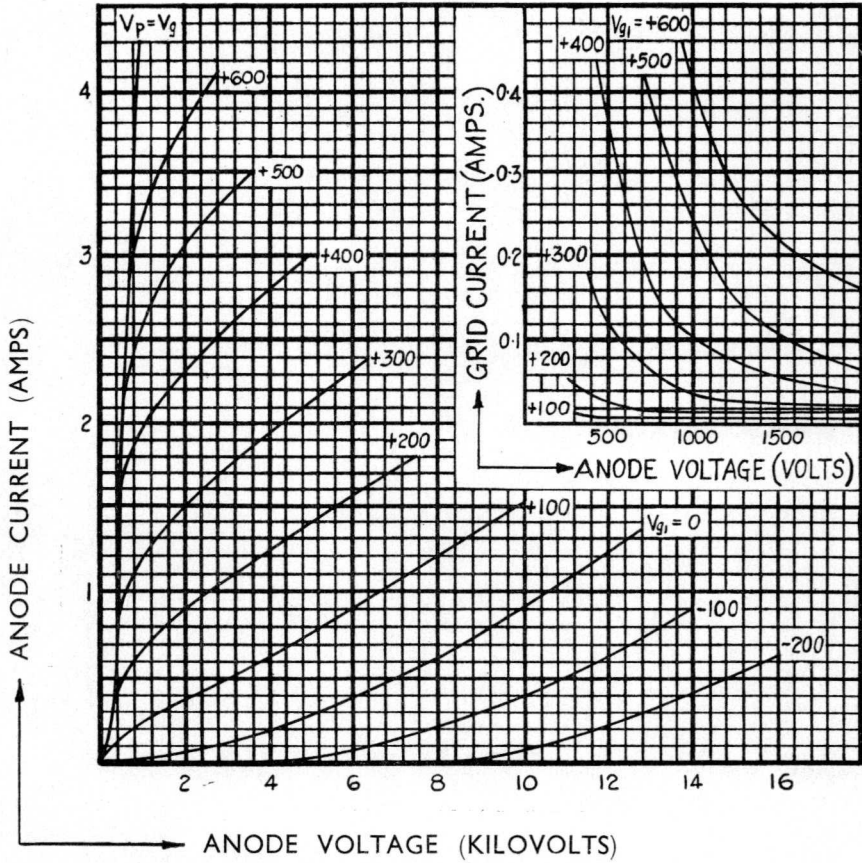
RADIO FREQUENCY OPERATION.

	Class B Telephony	Class C Telephony	Class C Telegraphy
	Modulated carrier applied to grid	Subject to anode modulation	Unmodulated
Direct anode voltage	10,000	7,000	10,000 volts
Direct anode current	0.75	0.75	1.5 amps.
Grid bias	—200	—300	—500 to —750 volts
Anode dissipation	5	1.75	5 Kw.
Carrier output	2.5	3.5	10 Kw.

—Standard Valves—

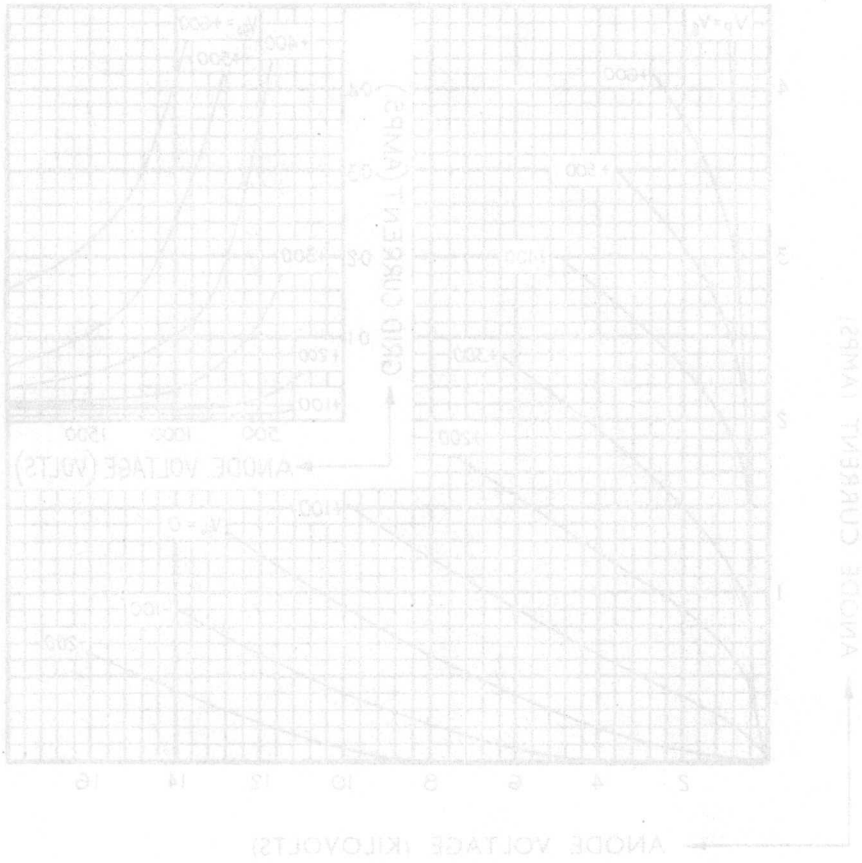
4047-B
Valve

These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



Standard Valves

These curves are taken with A.C. filament heating and anode voltages being referred to the centre point of the filament.



—Standard Valves—

4048-A
Valve

4048-A VALVE

HALF WAVE, HOT CATHODE MERCURY VAPOUR RECTIFIER.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant current type.

Base.

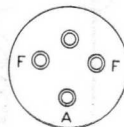
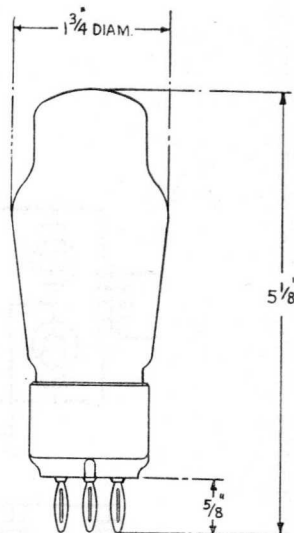
Standard British 4-pin.

Dimensions.

Overall length $5\frac{1}{8}$ " (13 cms.).
Bulb diameter $1\frac{3}{4}$ " (4.5 cms.).
Net weight 0.1 lbs. (45 gms.)

Constants.

Filament current 5 amps.
Nominal filament voltage 1.8 volts
Maximum peak inverse voltage 1,600 volts
Maximum peak anode current 0.75 amps.
Time delay 30 secs.
Heating period after transport 15 mins.
Recommended ambient temperature range $10^{\circ}\text{C}.$ — $50^{\circ}\text{C}.$



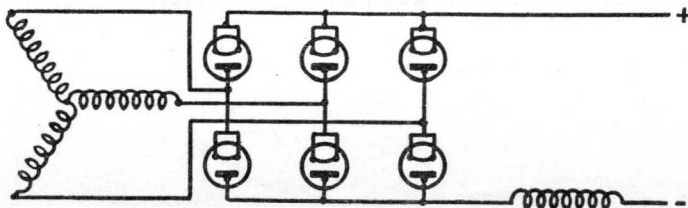
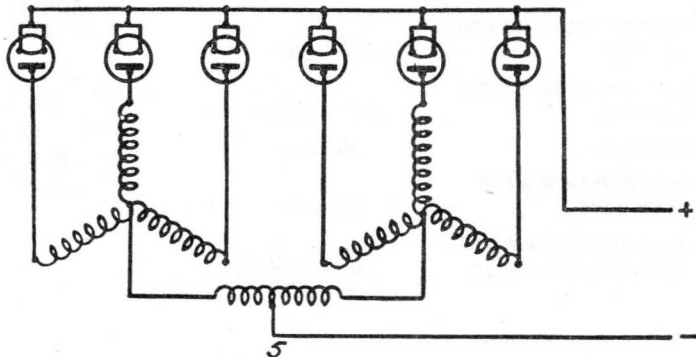
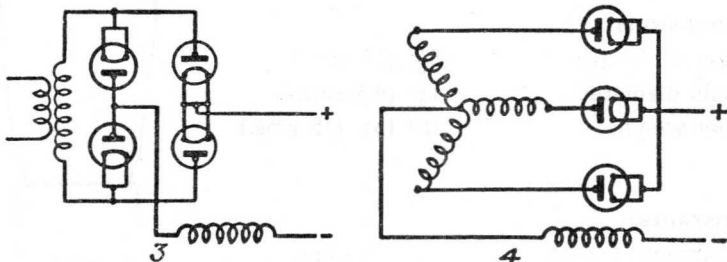
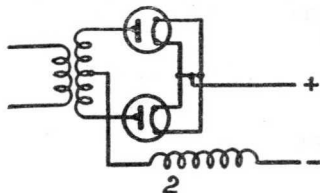
Note :—For further information on H.C.M.V. rectifiers, see sheet G.I.

—Standard Valves—

TYPICAL OPERATING CONDITIONS:

Circuit	Number of valves	Load potential in volts	Load current in amps.
2	2	500	0.45
3	4	1,000	0.45
4	3	750	0.55
5	6	750	1.4
6	6	1,500	0.7

Important.—This rectifier being directly heated, the output circuit must be connected to the mid-point of the filament transformer.



4049-C VALVE

HALF WAVE, HOT CATHODE MERCURY VAPOUR RECTIFIER.

SPECIFICATION.

Cathode.

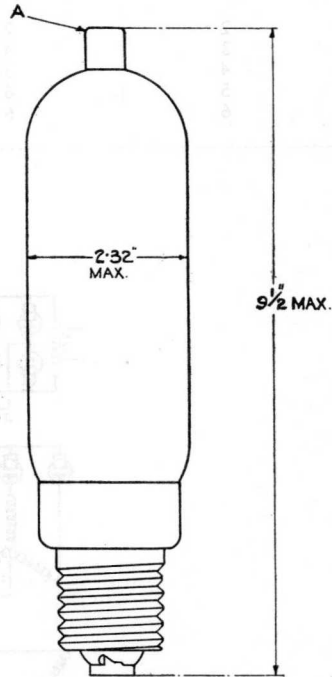
Oxide coated filament (shielded).
Constant voltage type.

Base.

Edison screw Goliath.

Dimensions.

Maximum overall length 9 $\frac{1}{2}$ " (24.1 cms.)
Maximum diameter 2.32" (5.9 cms.)
Anode cap Type D.
Net weight 0.33 lbs. (150 gms.)



Constants.

Filament voltage 4 volts
Nominal filament current 9.5 amps.
Maximum peak anode current 5 amps.
Maximum peak inverse voltage 10,000 volts
Max. average anode current 1.25 amps.
Ambient temperature range 5°C. min.
70°C. max.
Condensed mercury temperature range 20°C. min.
70°C. max.

Recommended Temperature Conditions.

	Peak Inverse Voltage.	
	Less than 5,000 volts.	5,000—10,000 volts.
Natural ventilation	15°C.—55°C.	15°C.—45°C.
Forced ventilation	15°C.—70°C.	15°C.—60°C.

Cathode Heating Time.

Ambient temperature 5°C.—10°C. 10°C.—15°C. Greater than 15°C.
Heating period 10 5 1* mins.

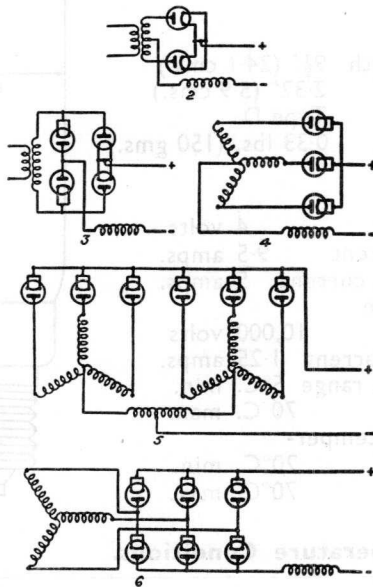
* This time may be reduced to 30 seconds if absolutely essential.

Note:—After shipment the filament must be run at full voltage for 30 minutes, before any anode voltage is applied, so that the mercury shall be distributed correctly.

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

Circuit	Number of Valves	Approx. D.C. Output Volts	Maximum D.C. Load Current
2	2	3,200 volts	2.5 amps.
3	4	6,400 volts	2.5 amps.
4	3	4,550 volts	3.75 amps.
5	6	4,550 volts	7.5 amps.
6	6	9,100 volts	3.75 amps.



Important.

This rectifier being directly heated, the output circuit must be connected to the mid-point of the filament transformer. The filament transformer should be so connected that the anode and filament voltages are 90° out of phase. The maximum peak anode current and output current should be reduced by 50 per cent., if quadrature operation of the filament and anode voltages is not possible.

Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation which causes the condensed mercury temperature to be about $15^\circ\text{C}.$ — $20^\circ\text{C}.$ above the ambient temperature, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

For further information on H.C.M.V. rectifiers, see sheet G.1.

—Standard Valves—

4052-A
Valve

4052-A VALVE

PENTODE.

SPECIFICATION.

Cathode.

Thoriated tungsten filament.
Constant voltage type.

Base.

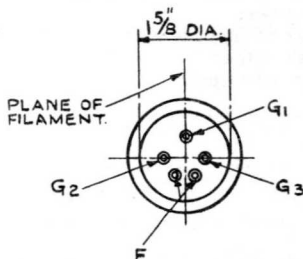
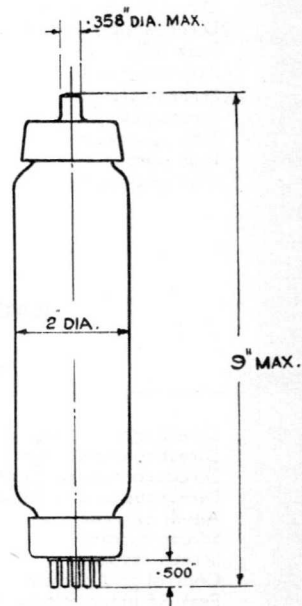
American medium 5-pin.
Anode connected to top cap.

Dimensions.

Max. overall length 9" (22.9 cms.)
Bulb diameter 2" (5.25 cms.)
Net weight 0.48 lbs. (220 gms.)

Constants.

Filament voltage 7.5 volts
Nominal filament current 3 amps.
*Impedance 500,000 ohms
*Amplification factor 1,500
Control grid-anode capacity 0.012 $\mu\mu\text{F}$.
Input capacity 11 $\mu\mu\text{F}$.
Output capacity 10 $\mu\mu\text{F}$.
* at $V_p = 1,250$ volts $V_{g_1} = -13$ volts,
 $V_{g_2} = 300$ volts $V_{g_3} = 0$



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	1,500 volts
Maximum direct screen voltage	300 volts
Maximum direct suppressor voltage	45 volts
Maximum anode dissipation	60 watts
Maximum screen dissipation	20 watts
Maximum direct control grid current	10 mA.
Maximum RF control grid current	5 amps.

Tentative Data.

V.4052-A.1
Sept. 1938.

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

Class B Telephony	
Direct anode voltage	1,250 volts
Direct screen voltage	300 volts
Direct control grid voltage	—30 volts
Direct suppressor voltage	0 volts
Peak R.F. input	70 volts
Anode current	43 mA.
Screen current	15 mA.
Screen resistor	60,000 ohms
Driving power	0.5 watts
Peak output	64 watts
Carrier output	16 watts

RADIO FREQUENCY OPERATION.

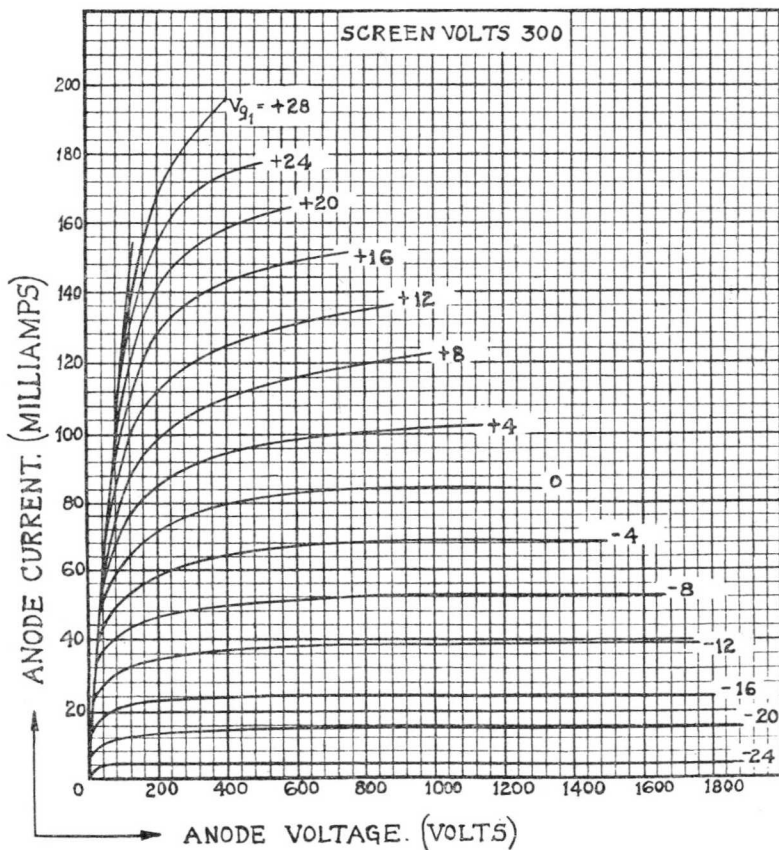
Class C Telephony — Control grid modulated	
Direct anode voltage	1,250 volts
Direct screen voltage	300 volts
Direct control grid voltage	—140 volts
Direct suppressor voltage	0 volts
Anode current	42 mA.
Screen current	10 mA.
Screen resistor	95,000 ohms
Control grid current	1.8 mA.
Peak RF input voltage (V_{g1})	160 volts
Peak AF input volts (V_{g1})	60 volts
AF power	0.75 watts
Peak RF input power	2 watts
Peak output	72 watts
Carrier output	18 watts

Class C Telegraphy — Unmodulated	
Direct anode voltage	1,250 volts
Direct screen voltage	300 volts
Direct control grid voltage	—100 volts
Direct suppressor voltage	0 volts
Anode current	80 mA.
Screen current	37 mA.
Screen resistor	26,000 ohms
Control grid current	5 mA.
Peak RF input volts	175 volts
RF input power	0.9 watts
Output	64 watts

—Standard Valves—

4052-A
Valve

Class C Telephony, Suppressor and Screen Modulated		
	Suppressor	Screen
Direct anode voltage	1,250	1,250 volts
Direct screen voltage	300	300 volts
Direct control grid voltage	-100	-100 volts
Direct suppressor voltage	-45	-40 volts
Peak AF suppressor voltage	75	75 volts
Peak AF screen voltage	9	150 volts
Peak RF input	175	175 volts
Anode current	43	47 mA.
Screen current	36	36 mA.
Screen Resistor	25,000	25,000 ohms
Control grid current	5	5 mA.
RF input power	0.9	0.9 watts
AF power	0.3	0.8 watts
Peak output	72	84 watts
Carrier output	18	21 watts



Tentative data

V.4052-A.2
Nov. 1937

4320
1957

— Standard Paper —



PRINTED IN
ENGLAND

4053-A VALVE

SINGLE ENDED WATER COOLED TRIODE.

SPECIFICATION.

Cathode.

Pure Tungsten filament.
Constant voltage type.

Water Jacket.

Type PL.120705/B.

Water Flow.

7 gallons per minute.

Dimensions.

Overall length	29.2" (74 cms.)
Bulb diameter	3½" (8.9 cms.)
Net weight	4½ lbs. (2,100 gms.)

Constants.

Filament voltage 17.5—19.5 volts
(exact filament voltages for 3 amps.
and 7 amps. emission are marked
on bulb)

Nominal filament
current 64.5—66.8 amps.

Total emission 3—7 amps.

*Impedance 830 ohms

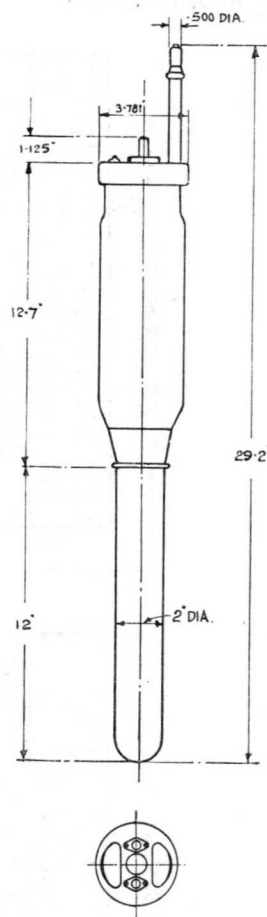
*Amplification factor 6.5

Grid-anode capacity 40.5 μμF.

Anode-filament capacity 3.5 μμF.

Grid-filament capacity 36.5 μμF.

* at anode current of 1 amp.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage
Maximum anode dissipation

11,000 volts
12 Kw.

V.4053-A.1
Nov. 1937

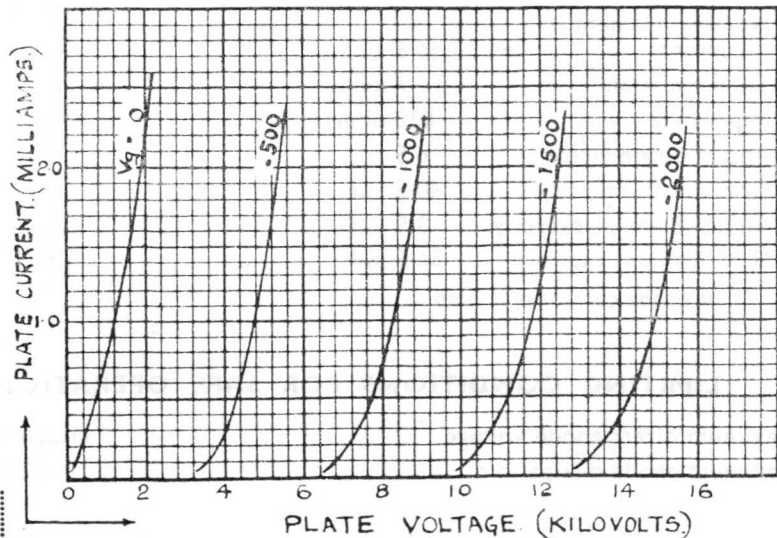
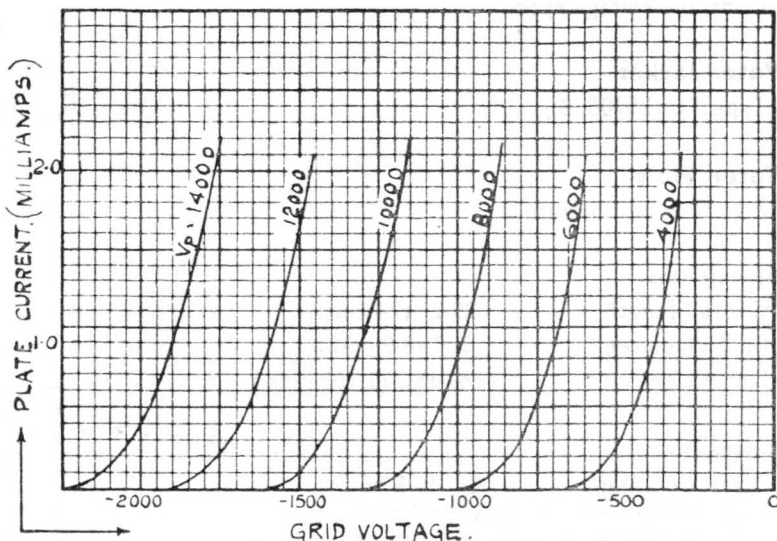
—Standard Valves—

TYPICAL OPERATING CONDITIONS.

Class A — Audio frequency Modulator
For Series Modulation

Total H.T. voltage across mod. and mod. amp. in series
Anode voltage
Anode current
Grid bias
Peak AF grid voltage
Peak AF output voltage
AF output power

18,000 volts
12,000 volts
0.75 amps.
—1,600 to —1,800 volts
850 volts
6,000 volts
4.5 Kw.



—Standard Valves—

4056-A Valve
-B Valve

4056-A AND 4056-B VALVES

TRIODES.

SPECIFICATION.

Cathode.

Thoriated Tungsten filament.
Constant voltage type.

Base.

4056-A Special 4-pin low loss.
4056-B Large 4-pin bayonet.

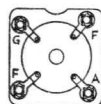
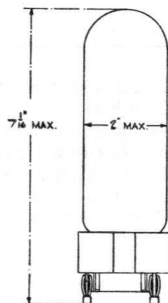
Dimensions.

	4056-A.	4056-B.
Max. overall length	$7\frac{1}{16}$ " (17.9 cms.)	$7\frac{5}{16}$ " (18.5 cms.)
Max. diameter	2" (5.1 cms.)	2" (5.1 cms.)
Net weight	0.57lb. (260 gms.)	0.46lbs. (210 gms.)

Constants.

Filament voltage	6 volts
Nominal filament current	1.9 amps.
*Impedance	5,500 ohms
*Amplification factor	12
*Mutual conductance	2.2 mA per volt
Grid-anode capacity	8.4 $\mu\mu\text{F}$.
Anode-filament capacity	4.8 $\mu\mu\text{F}$.
Grid-filament capacity	5.0 $\mu\mu\text{F}$.

* at $V_p = 500$ Vg = 0 volts.



4056-A



4056-B

LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	1,000 volts
Maximum direct anode current	100 mA
Maximum anode dissipation	35 watts
Maximum direct grid current	0.030 amps.
Maximum frequency for above ratings	15 Mc.
Maximum anode voltage for frequency of 30 Mc.	800 volts

V.4056-AB.1
Mar. 1939

4056-A Valve
 -B Valve

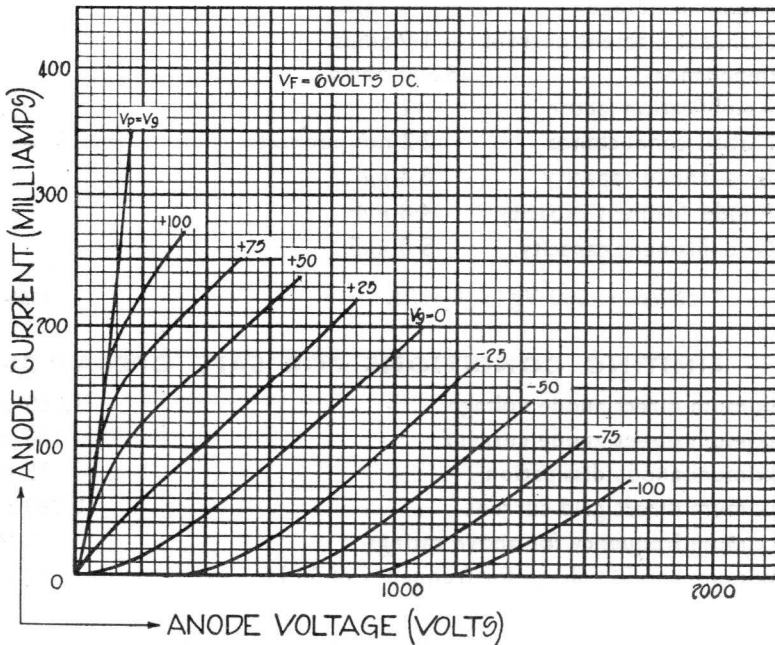
—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class B A.F. Amp. and Mod. For balanced 2 valve circuits
Direct anode voltage	1,000 volts
Grid bias	—70 volts (approx.)
Anode current per valve—zero signal	0.013 amps.
Anode current per valve—maximum signal	0.067 amps.
Anode dissipation	30 watts
Load resistance—anode to anode	13,000 ohms
Maximum output—2 valves	73 watts

RADIO FREQUENCY OPERATION.

	Class B Telephony	Class C Telephony	Class C Telegraphy
	Modulated Carrier applied to grid	Subject to anode modulation	Unmodulated
Direct anode voltage	1,000	750	1,000 volts
Direct anode current	0.053	0.070	0.078 amps.
Grid bias	—80	—130	—180 to —250 volts
Anode dissipation	35	17.5	26 watts
Carrier output	17.5	35	52 watts



PRINTED IN
ENGLAND

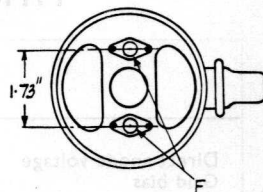
—Standard Valves—

4058-B
Valve

4058-B VALVE

(Replaces the 4058-A valve which has now been abandoned).

SINGLE ENDED
WATER COOLED TRIODE.



Cathode.

Pure tungsten filament.
Constant voltage type.

Water Jackets.

Type MS.1362 Grp. 1 for anode dissipation up to 6 Kw.

Type MS.1362 Grp. 20 for anode dissipation up to 6 Kw. used for below panel connection.

Types 223 LU.1A or PL.122011 (3001-A) for anode dissipation over 6 Kw.

Water Flow.

7 gallons per minute.

Dimensions.

Max. overall length $21\frac{1}{4}$ " (54 cms.)
Max. bulb diameter $3\frac{9}{16}$ " (9.05 cms.)
Net weight $3\frac{3}{4}$ lbs. (1,700 gms.)

Constants.

Filament voltage 19—20 volts
(exact filament voltages for 6 amps. and 10 amps. emission are marked on bulb)

Nominal filament current 58—61 amps.

Total emission 6—10 amps.

*Impedance 4,800 ohms

*Amplification factor 26

*Mutual conductance 5.4 mA. per volt

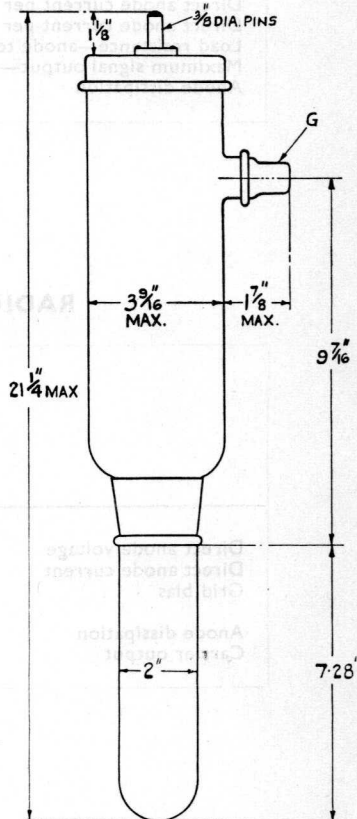
Grid-anode capacity 34.5 $\mu\mu\text{F}$.

Anode-filament capacity 0.4 $\mu\mu\text{F}$.

Grid-filament capacity 27 $\mu\mu\text{F}$.

* at anode current of 1.0 amp.

SPECIFICATION.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	14,000 volts
Maximum direct anode voltage for anode modulation	10,000 volts
Maximum direct anode current	2.5 amps.
Maximum anode dissipation	12 Kw.
Maximum grid dissipation	250 watts
Maximum frequency for above ratings	3 Mc.
Maximum anode voltage for frequency of 6 Mc.	8,000 volts

NOTE.—The characteristics of the 4058-B Valve are identical with those of the 4058-A Valve but the grid lead has been brought out through the side of the bulb. Where the 4058-B is used to replace the 4058-A new grid connectors will be required. These connectors, type ES.5706-1, should be ordered with the valve.

V.4058-B.1
Mar. 1939

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

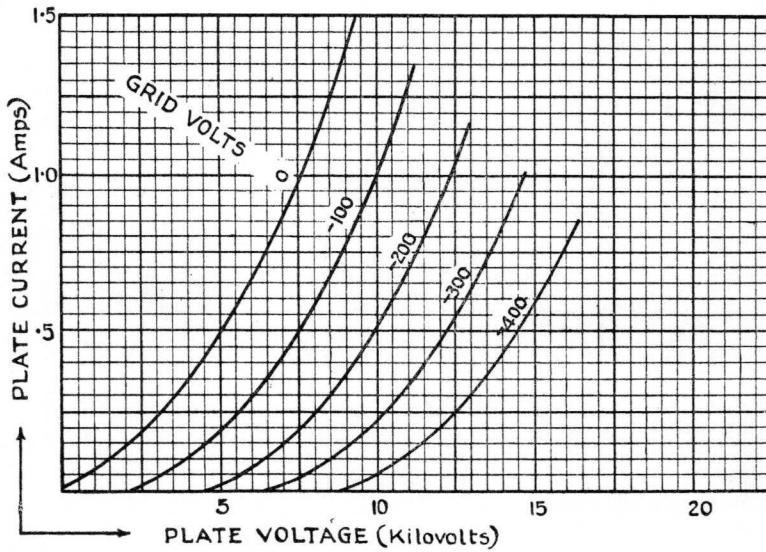
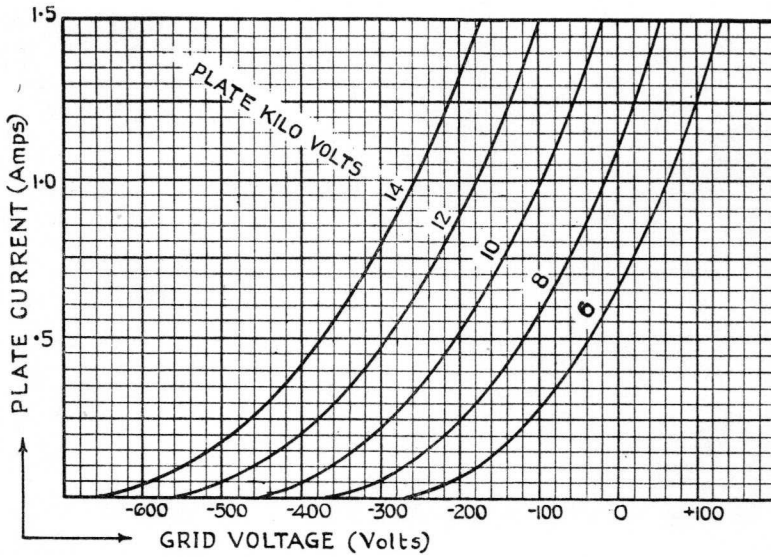
	Class B A.F. Amp. For balanced 2 valve circuit
Direct anode voltage	12,000 volts
Grid bias	—300 to —350 volts
Direct anode current per valve—zero signal	0.4 amp.
Direct anode current per valve—maximum signal	2.0 amps.
Load resistance—anode to anode	5,400 ohms
Maximum signal output—2 valves	26.4 Kw.
Anode dissipation	10.8 Kw.

RADIO FREQUENCY OPERATION.

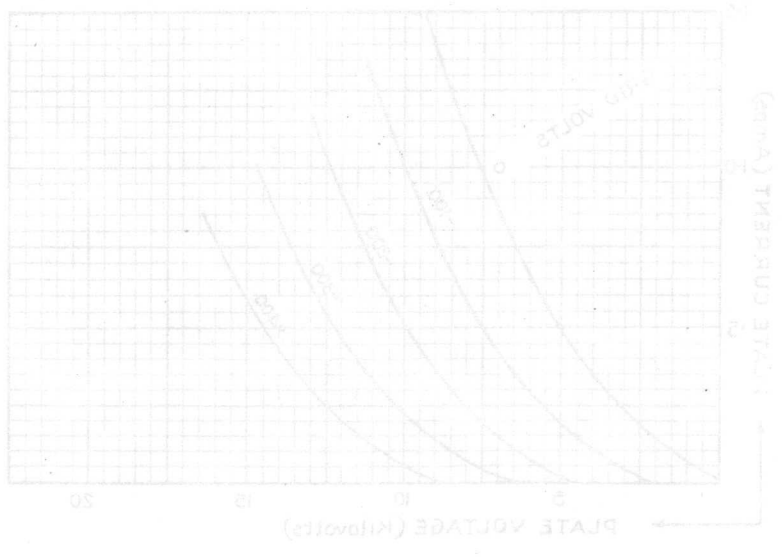
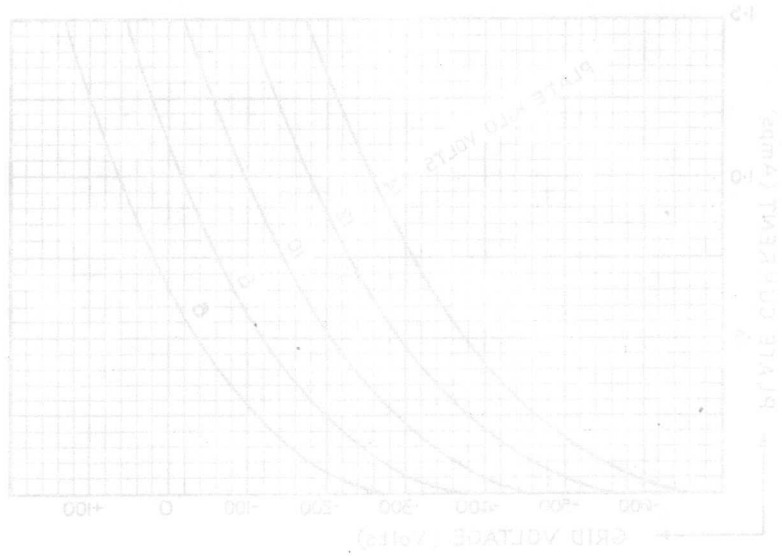
	Class B Telephony	Class C Telephony	Class C Telegraphy
	Modulated carrier applied to grid	Subject to anode modulation	Unmodulated
Direct anode voltage	12,000	8,000	12,000 volts
Direct anode current	1.25	1.25	2.5 amps.
Grid bias	—420	—700	—1,100 to —1,750 volts
Anode dissipation	10	3.3	10 Kw.
Carrier output	5	6.7	20 Kw.

—Standard Valves—

4058-B
Valve



Standard Valves



—Standard Valves—

4059-A
Valve

4059-A VALVE

HALF WAVE RADIATION COOLED THERMIONIC RECTIFIER.

SPECIFICATION.

Cathode.

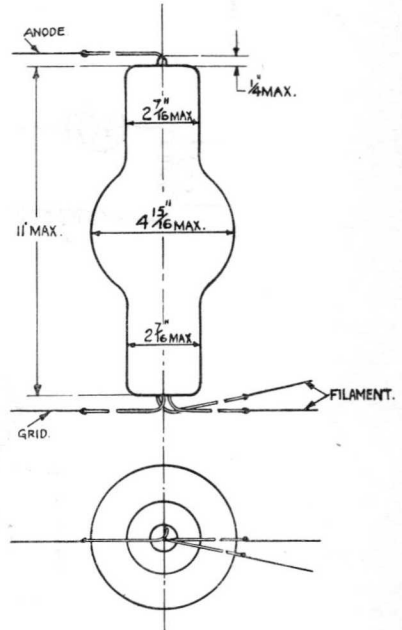
Pure Tungsten filament.
Constant voltage type.

Dimensions.

Neck diameter	$2\frac{7}{16}$ " (6.2 cms.)
Overall length	11" (28 cms.)
Overall diameter	$4\frac{15}{16}$ " (12.5 cms.)
Net weight	0.7 lbs. (320 gms.)

Constants.

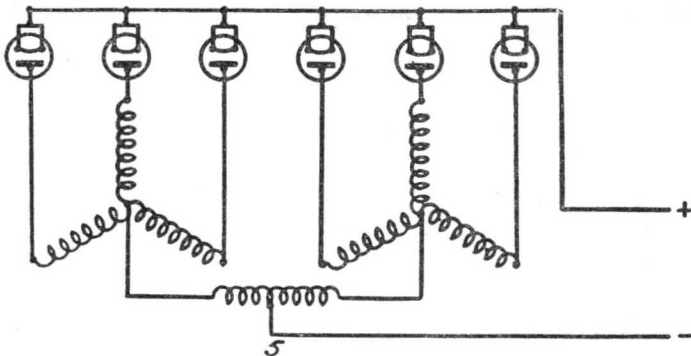
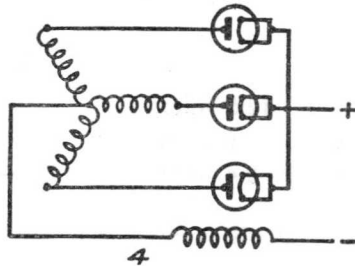
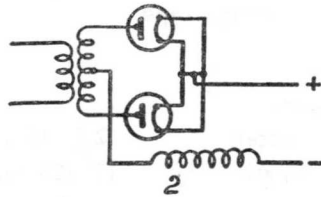
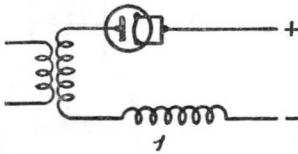
Filament voltage	12.5 volts
Nominal filament current	6 amps.
Total emission	0.4 amps.
Maximum peak inverse voltage	25,000 volts
Maximum peak anode current	350 mA.
Maximum continuous anode dissipation	300 watts



—Standard Valves—

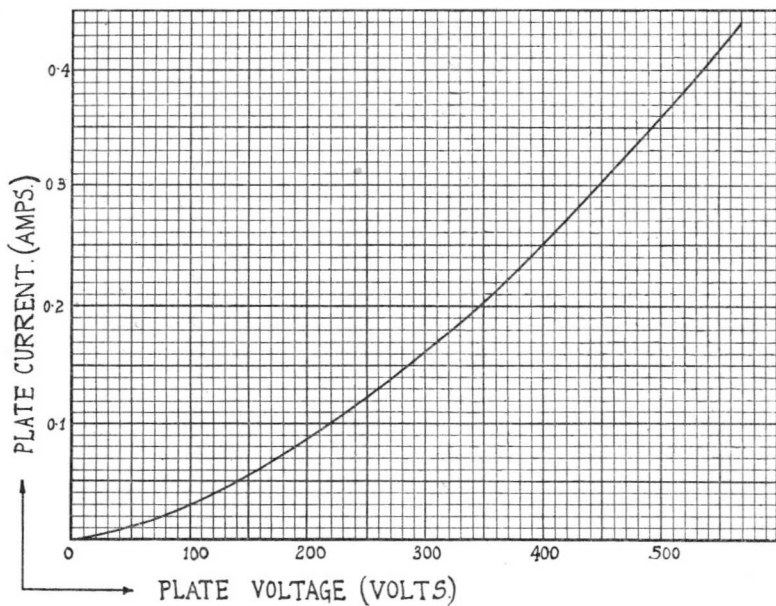
TYPICAL OPERATING CONDITIONS.

Circuit	Number of valves	Load potential in volts	Load current in amps.
1	1	3,750	0.12
2	2	7,500	0.23
4	3	10,000	0.35
5	6	10,000	0.7



—Standard Valves—

4059-A
Valve



V.4059-A.2
Nov. 1937

Standard Notes



PRINTED IN
ENGLAND

—Standard Valves—

4060-A
Valve

4060-A VALVE

TRIODE.

SPECIFICATION.

Cathode.

Pure Tungsten filament.
Constant voltage type.

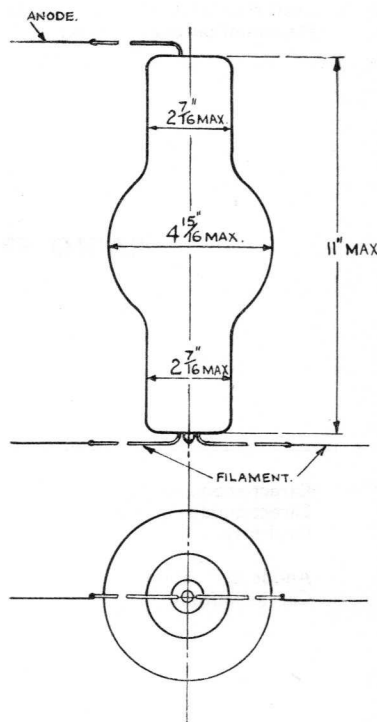
Dimensions.

Neck diameter	$2\frac{7}{16}$ " (6.2 cms.)
Overall length	11" (28 cms.)
Maximum diameter	$4\frac{15}{16}$ " (12.5 cms.)
Net weight	0.85 lbs. (390 gms.)

Constants.

Filament voltage	12.5 volts
Nominal filament current	6 amps.
Total emission	0.4 amps.
*Impedance	17,000 ohms
*Amplification factor	20
Grid-anode capacity	$6\ \mu\mu\text{F.}$
Anode-filament capacity	$0.4\ \mu\mu\text{F.}$
Grid-filament capacity	$7\ \mu\mu\text{F.}$

* at $V_p = 2,000$ $V_g = 0$



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	4,000 volts
Maximum direct anode current	0.110 amps.
Maximum anode dissipation	200 watts
Maximum direct grid current	0.030 amps.
Maximum frequency for above ratings	10 Mc.

V.4060-A.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

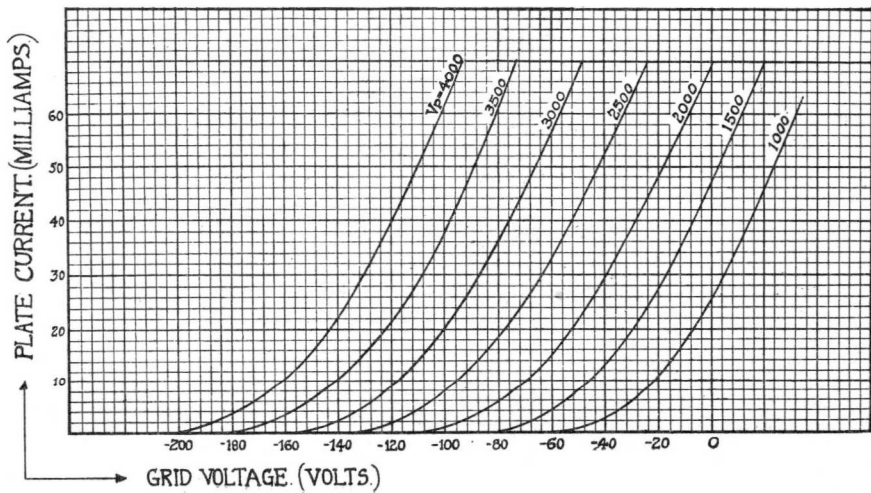
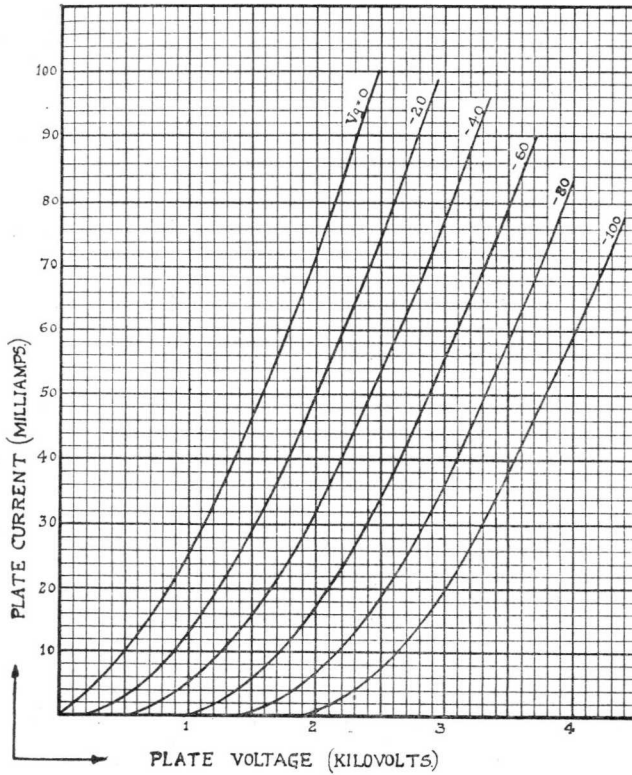
	Class B A.F. Amp. and Mod. For balanced 2 valve circuit
Direct anode voltage	4,000 volts
Grid bias	—120 to —160 volts
Anode current per valve—zero signal	0.014 amps.
Anode current per valve—maximum signal	0.070 amps.
Anode dissipation	125 watts
Load resistance—anode to anode	50,000 ohms
Maximum output—2 valves	300 watts

RADIO FREQUENCY OPERATION.

	Class B Telephony	Class C Telephony	Class C Telegraphy
	Modulated Carrier applied to grid	Subject to anode modulation	Unmodulated
Direct anode voltage	4,000	3,000	4,000 volts
Direct anode current	0.056	0.075	0.081 amps.
Grid bias	—180	—300	—300 to —500 volts
Anode dissipation	150	75	110 watts
Carrier output	75	150	220 watts

—Standard Valves—

4060 A
Valve



V.4060-A.2
Nov. 1937

1000
1000

Standard Paper

PRINTED IN
ENGLAND

—Standard Valves—

4061-A
Valve

4061-A VALVE

PENTODE.

SPECIFICATION.

Cathode.

Indirectly heated oxide coated.
Constant voltage type.

Base.

American medium 7-pin.

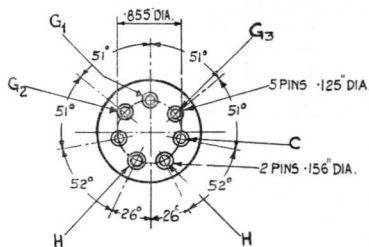
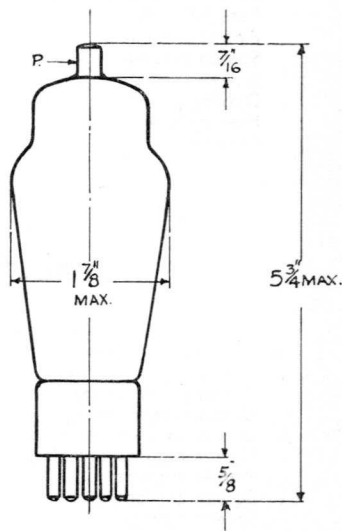
Dimensions.

Overall length $5\frac{3}{4}$ " (14.6 cms.)
Maximum diameter $1\frac{7}{8}$ " (4.6 cms.)
Net weight 0.17 lbs. (77 gms.)

Constants.

Heater voltage 6.3 volts
Nominal heater current 0.8 amps.
*Impedance 200,000 ohms
*Amplification factor 500
Grid-anode capacity 0.02 $\mu\mu\text{F}$.
Input capacity 10 $\mu\mu\text{F}$.
Output capacity 10 $\mu\mu\text{F}$.

* at $V_p = 400$ $V_{g1} = -16.5$
 $V_{g2} = 200$ $V_{g3} = 0$



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	500 volts
Maximum direct screen voltage	250 volts
Maximum direct suppressor voltage	45 volts
Maximum anode dissipation	10 watts
Maximum screen dissipation	8 watts
Maximum direct control grid current	10 mA.
Maximum RF control grid current	4 amps.

Tentative data

V.4061-A.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

Class B Telephony — R.F. Amp.	
Direct anode voltage	500 volts
Direct screen voltage	200 volts
Direct control grid voltage	—38 volts
Direct suppressor voltage	0 volts
Peak RF input	80 volts
Anode current	30 mA.
Screen current	12 mA.
Screen resistor	25,000 ohms
Driving power	0.24 watts
Peak output	20 watts
Carrier output	5 watts

RADIO FREQUENCY OPERATION.

Class C Telephony — Control grid Modulated		
Direct anode voltage	500	500 volts
Direct screen voltage	200	200 volts
Direct control grid voltage	—125	—125 volts
Direct suppressor voltage	0	45 volts
Anode current	32	34 mA.
Screen current	20	20 mA.
Screen resistor	20,000	20,000 ohms
Control grid current	1.5	1.5 mA.
Peak RF input voltage (V_{g1})	150	150 volts
Peak AF input volts (V_{g1})	45	45 volts
AF power	0.5	0.55 watts
Peak RF input power	1.2	1.3 watts
Peak output	22	26 watts
Carrier output	5.5	6.5 watts

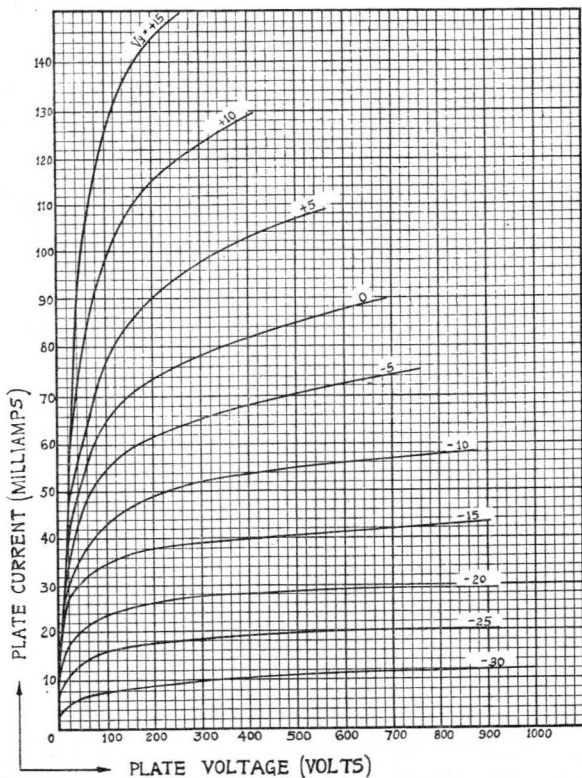
Class C Telegraphy — Unmodulated. RF Amp. and Osc.		
Direct anode voltage	500	500 volts
Direct screen voltage	200	200 volts
Direct control grid voltage	—90	—90 volts
Direct suppressor voltage	0	45 volts
Anode current	50	55 mA.
Screen current	40	35 mA.
Screen resistor	7,500	8,500 ohms
Control grid current	6	6 mA.
Peak RF input volts	135	135 volts
RF input power	0.8	0.8 watts
Output	18	24 watts

—Standard Valves—

4061-A
Valve

Class C Telephony, Suppressor and Screen modulated		
	Suppressor	Screen
Direct anode voltage	500	500 volts
Direct screen voltage	200	200 volts
Direct control grid voltage	-90	-90 volts
Direct suppressor voltage	-45	-40 volts
Peak AF suppressor voltage	75	75 volts
Peak AF screen voltage	0	100 volts
Peak RF input	135	135 volts
Anode current	32	35 mA.
Screen current	40	40 mA.
Screen resistor	7,500	7,500 ohms
Control grid current	6	6 mA.
RF input power	0.82	0.82 watts
AF power	0.30	0.75 watts
Peak output	22	26 watts
Carrier output	5.5	6.5 watts

These curves are taken with $V_H = 6.3$ volts, $V_{g_2} = 200$ volts, $V_{g_3} = 0$ volts.



V.4061-A.2
Sept. 1938.

Standard Valves

PRINTED IN
ENGLAND

—Standard Valves—

4062-A
Valve

4062-A VALVE

TRIODE.

SPECIFICATION.

Cathode.

Thoriated Tungsten filament.
Constant voltage type.

Base.

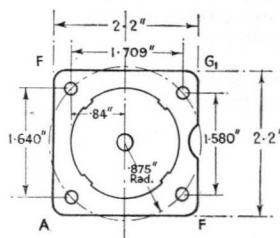
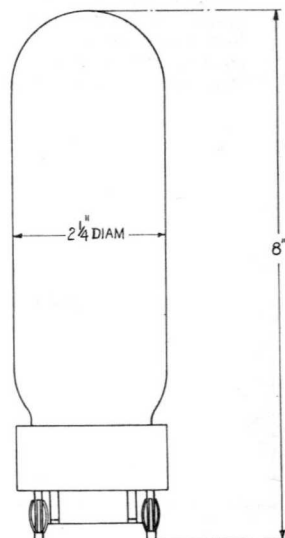
Special 4-pin low loss.

Dimensions.

Overall length	8" (20.3 cms.)
Bulb diameter	$2\frac{1}{4}$ " (5.7 cms.)
Net weight	0.5 lbs. (230 gms.)

Constants.

Filament voltage	12 volts
Nominal filament current	1.85 amps.
Impedance	22,000 ohms
Amplification factor	22
Grid-anode capacity	13 $\mu\mu\text{F}$.
Anode-filament capacity	5.3 $\mu\mu\text{F}$.
Grid-filament capacity	6 $\mu\mu\text{F}$.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	2,000 volts
Maximum direct anode current	0.123 amps.
Maximum anode dissipation	75 watts
Maximum direct grid current	0.030 amps.
Maximum frequency for above ratings	15 Mc.

V.4062-A.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

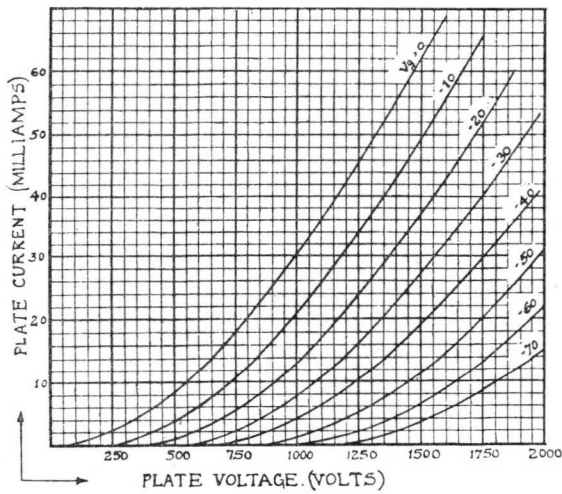
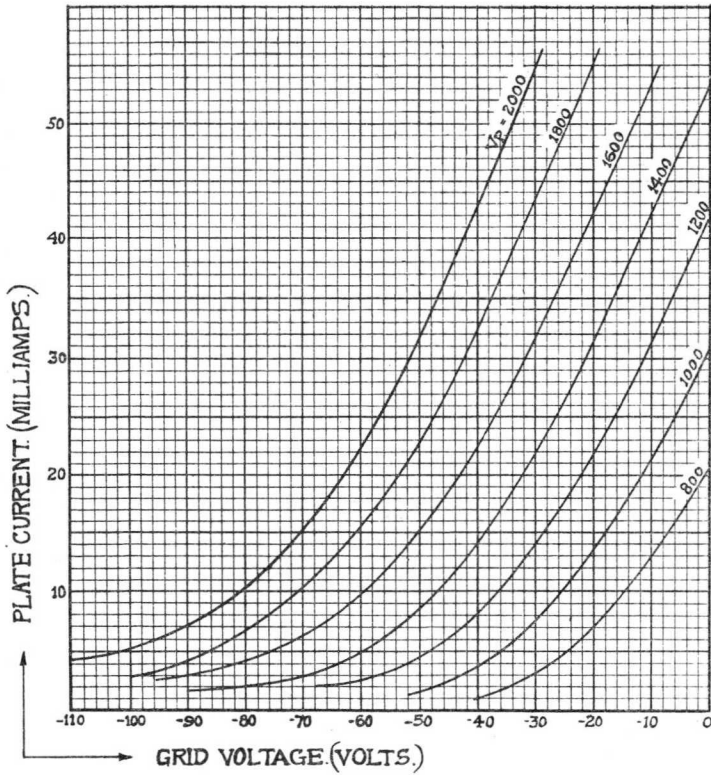
	Class B A.F. Amp. and Mod. For balanced 2 valve circuit
Direct anode voltage	2,000 volts
Grid bias	—50 to —60 volts
Anode current per valve—zero signal	0.014 amps.
Anode current per valve—maximum signal	0.070 amps.
Anode dissipation	65 watts
Load resistance—anode to anode	25,000 ohms
Maximum output—2 valves	150 watts

RADIO FREQUENCY OPERATION.

	Class B Telephony	Class C Telephony	Class C Telegraphy
	Modulated Carrier applied to grid	Subject to anode modulation	Unmodulated
Direct anode voltage	2,000	1,500	2,000 volts
Direct anode current	0.056	0.075	0.081 amps.
Grid bias	—95	—200	—300 to —500 volts
Anode dissipation	75	37.5	55 watts
Carrier output	37.5	75	110 watts

—Standard Valves—

4062-A
Valve



V.4062-A.2
Nov. 1937

4050A
0417

Standard Notes

PRINTED IN
ENGLAND

—Standard Valves—

4064-A Valve
-B Valve

4064-A AND 4064-B VALVES

HALF WAVE, HOT CATHODE MERCURY VAPOUR RECTIFIER.

SPECIFICATION.

Cathode.

Oxide coated filament (Shielded).
Constant voltage type.

Base.

4064-A Edison screw Goliath.
4064-B Large 4-pin bayonet.

Dimensions.

	4064-A	4064-B
Max. Overall length	9½" (24.1 cms.)	8½" (21.6 cms.)
Max. diameter	2.32" (5.9 cms.)	2.32" (5.9 cms.)
Anode cap	Type D.	Type C.

Constants.

Filament voltage	5 volts
Nominal filament current	6.75 amps.
Maximum peak anode current	5 amps.
Max. peak inverse voltage	10,000 volts
Max. Av. anode current	1.25 amps.
Ambient temperature range	5°C. min. 70°C. max.
Condensed mercury temperature range	20°C. min. 70°C. max.

Recommended Temperature Conditions.

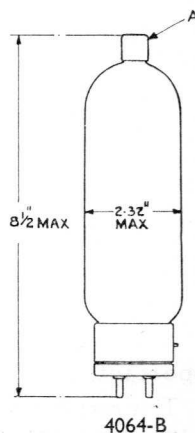
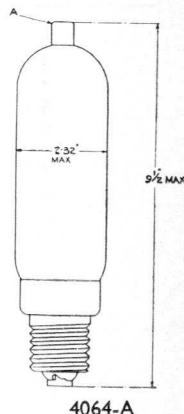
	Peak Inverse Voltage.	
	Less than 5,000 volts.	5,000—10,000 volts.
Natural ventilation	15°C.—55°C.	15°C.—45°C.
Forced ventilation	15°C.—70°C.	15°C.—60°C.

Cathode Heating Time.

Ambient temperature	5°C.—10°C.	10°C.—15°C.	greater than 15°C.
Heating period	10	5	1* mins.

* This time may be reduced to 30 seconds if absolutely essential.

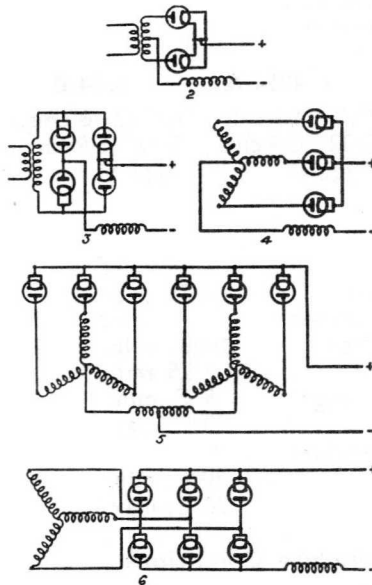
Note :—After shipment the filament must be run at full voltage for 30 minutes before any anode voltage is applied, so that the mercury shall be distributed correctly.



—Standard Valves—

TYPICAL OPERATING CONDITIONS.

Circuit	Number of Valves	Approx. D.C. Output volts	Max. D.C. Load Current
2	2	3200 volts	2.5 amps.
3	4	6400 "	2.5 "
4	3	4550 "	3.75 "
5	6	4550 "	7.5 "
6	6	9100 "	3.75 "



Important.

This rectifier being directly heated, the output circuit must be connected to the mid-point of the filament transformer. The filament transformer should be so connected that the anode and filament voltages are 90° out of phase. The maximum peak anode current and output current should be reduced by 50 per cent. if quadrature operation of the filament and anode voltages is not possible.

Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation which causes the condensed mercury temperature to be about 15°C—20°C. above the ambient temperature, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

For further information on H.C.M.V. rectifiers, see sheet G.I.

—Standard Valves—

4065-A
Valve

4065-A VALVE

DIODE.

SPECIFICATION.

Cathode.

Pure tungsten filament.
Constant voltage type.

Base.

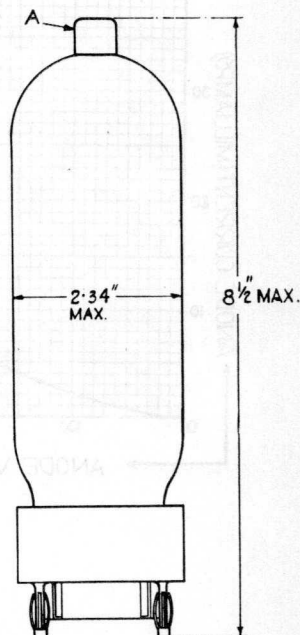
Special 4-pin low loss.
Anode connected to top cap type C.

Dimensions.

Max. overall length	8½" (21.6 cms.)
Max. bulb diameter	2.34" (6.0 cms.)
Net weight	0.5 lbs. (225 gms.)

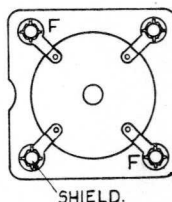
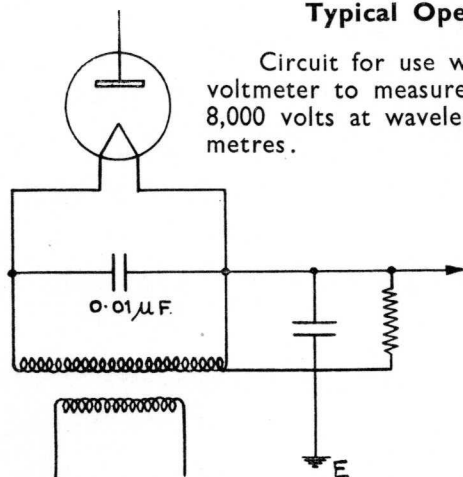
Constants.

Filament voltage	2.5 volts
Nominal filament current	8 amps.
Maximum direct current	1 mA.
Maximum inverse peak voltage	20,000 volts



Typical Operation.

Circuit for use with electrostatic voltmeter to measure voltages up to 8,000 volts at wavelengths of 13—80 metres.



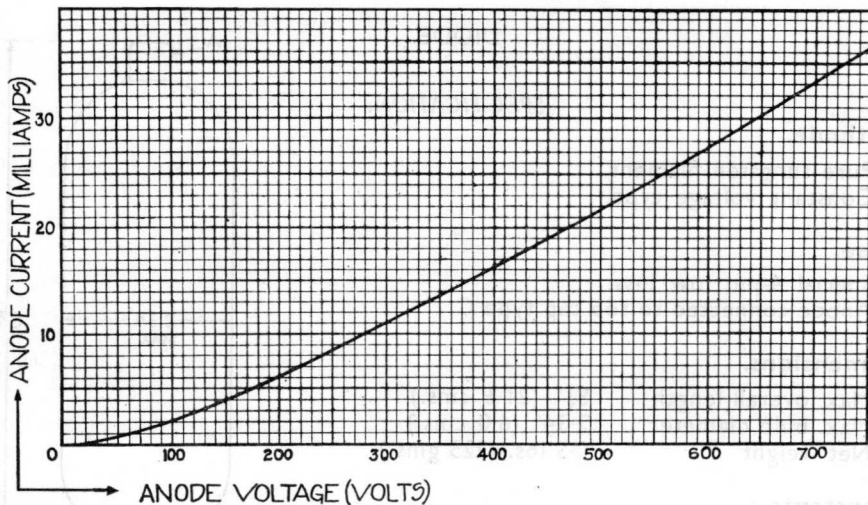
Transformer insulation resistance to earth to be at least 20,000 megohms. Suitable transformer for operation from 240 volt mains is the 4600-12 transformer.

Tentative data

V.4065-A.1
March, 1939

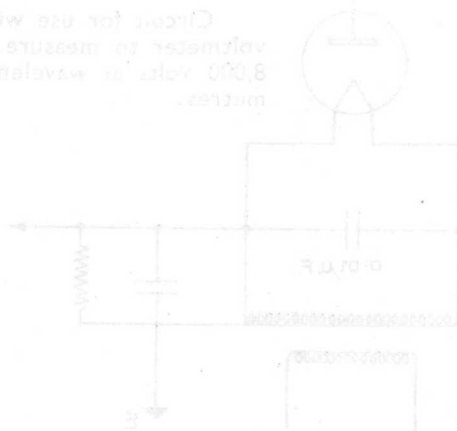
4065-A
Valve

— Standard Valves —



Typical Operation.
Circuit for use with electrostatic voltmeter to measure voltages up to 8,000 volts in waveforms of 13-80 cycles.

TO ELECTROSTATIC
VOLT-METER
0-8,000 VOLTS



Transformer for operation from 240 volt mains is the 4600-12 transformer. Transformer insulation resistance to earth to be at least 20,000 megohms.

PRINTED IN
ENGLAND

—Standard Valves—

4066-A
Valve

4066-A VALVE

PENTODE.

SPECIFICATION.

Cathode.

Indirectly heated oxide coated.
Constant voltage type.

Base.

Standard British 7-pin.

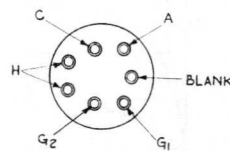
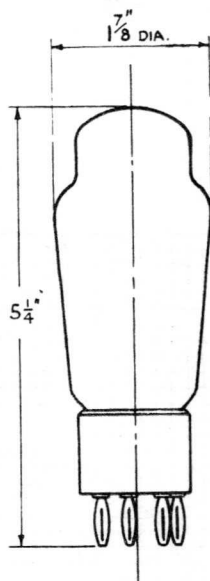
Dimensions.

Overall length	5 $\frac{1}{4}$ " (13.3 cms.)
Maximum diameter	1 $\frac{7}{8}$ " (4.7 cms.)
Net weight	0.13 lbs. (60 gms.)

Constants.

Heater voltage	4 volts
Nominal heater current	2 amps.
*Impedance	60,000 ohms
*Amplification factor	600
Grid-anode capacity	1.6 μ F.
Input capacity	17.5 μ F.
Output capacity	10.3 μ F.

* $V_p = V_{g_2} = 250$ volts, $V_{g_1} = -6$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

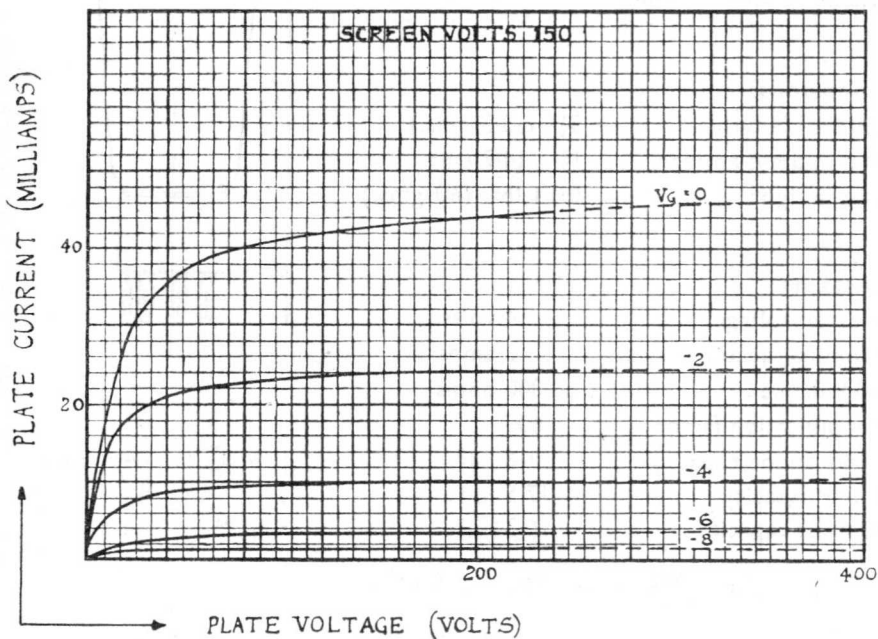
Maximum direct anode voltage	250 volts
Maximum direct anode current	40 mA.
Maximum screen voltage	250 volts

V.4066-A.1
Sept. 1938

—Standard Valves—

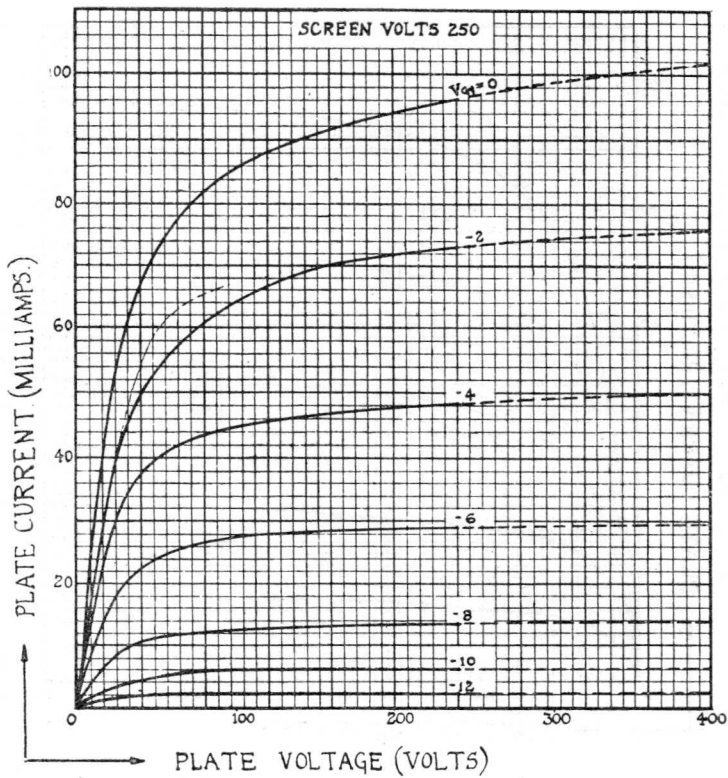
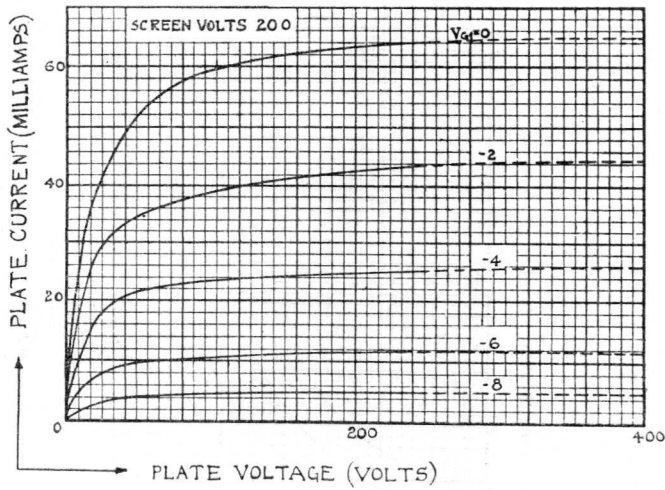
TYPICAL OPERATING CONDITIONS.

Anode voltage	250	200	150 volts
Control grid bias	—6	—4	—2 volts
Screen grid voltage	250	200	150 volts
Anode current	29	24.5	23 mA.
Anode resistance	60,000	80,000	100,000 ohms
Load	3,900	5,800	9,000 ohms
Output	2.75	1.45	0.75 watts
2nd harmonic—%	10	9.3	2
—db	20	21	34



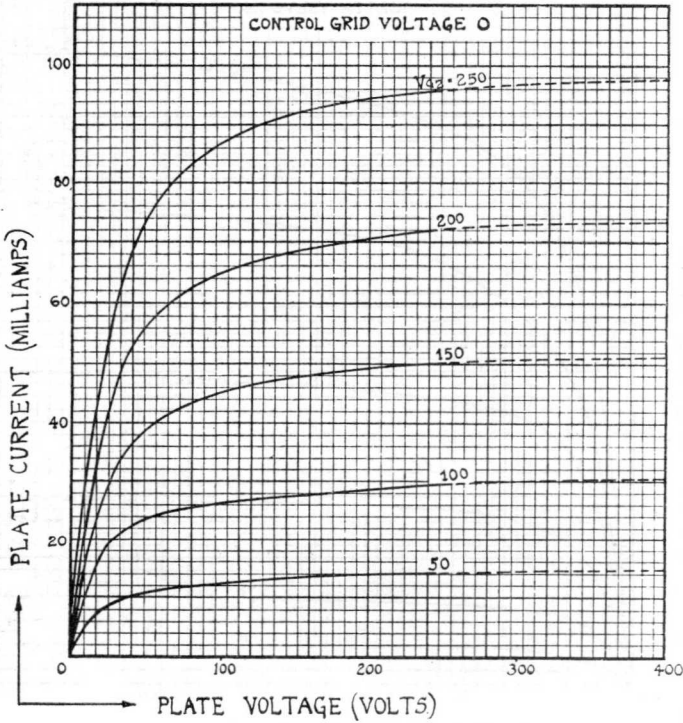
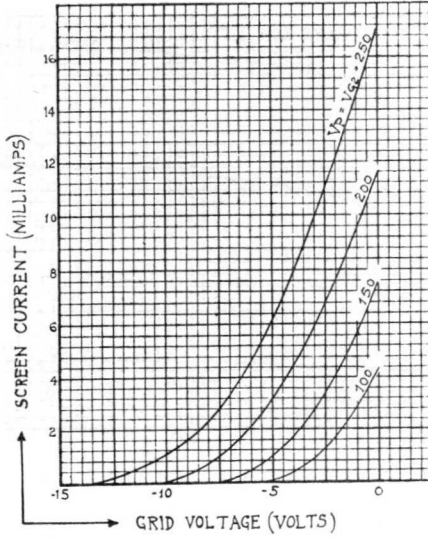
—Standard Valves—

4066-A
Valve



V.4066-A.2
Sept. 1938

—Standard Valves—



—Standard Valves—

4069-A
Valve

4069-A VALVE

PENTODE.

SPECIFICATION.

Cathode.

Thoriated tungsten filament.
Constant voltage type.

Base.

American Giant 5-pin.

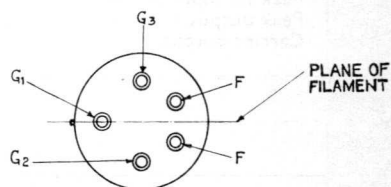
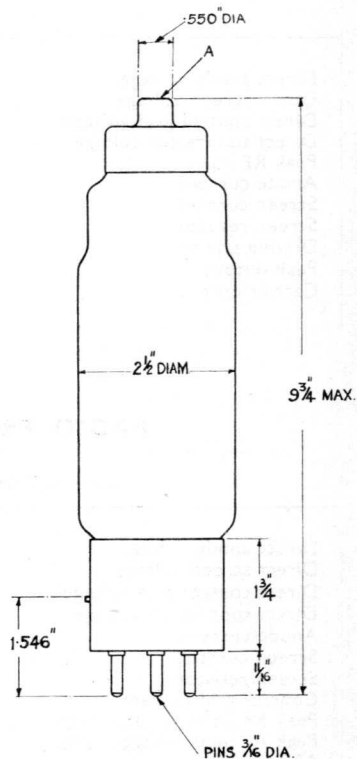
Dimensions.

Max. overall length	9 $\frac{3}{4}$ " (24.7 cms.)
Bulb diameter	2 $\frac{1}{2}$ " (6.4 cms.)
Anode cap diameter	0.55" (1.4 cms.)
Net weight	0.75 lbs. (340 gms.)

Constants.

Filament voltage	10 volts
Nominal filament current	5.4 amps.
*Mutual conductance	4.5 mA. per volt
Grid-anode capacity	0.02 $\mu\mu\text{F}$.
Input capacity	15.5 $\mu\mu\text{F}$.
Output capacity	5.5 $\mu\mu\text{F}$.

* at $V_p = 2,000$ volts, $V_{g_2} = 400$ volts,
 $V_{g_1} = -20$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	2,000 volts
Maximum direct screen voltage	400 volts
Maximum direct suppressor voltage	45 volts
Maximum anode dissipation	100 watts
Maximum screen dissipation	35 watts
Maximum direct control grid current	25 mA.
Maximum RF control grid current	8 amps.

Tentative data

V.4069-A.1
Sept. 1938

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

Class B Telephony	
Direct anode voltage	2,000 volts
Direct screen voltage	400 volts
Direct control grid voltage	—38 volts
Direct suppressor voltage	0 volts
Peak RF input	90 volts
Anode current	75 mA.
Screen current	30 mA.
Screen resistor	55,000 ohms
Driving power	0.9 watts
Peak output	200 watts
Carrier output	50 watts

RADIO FREQUENCY OPERATION.

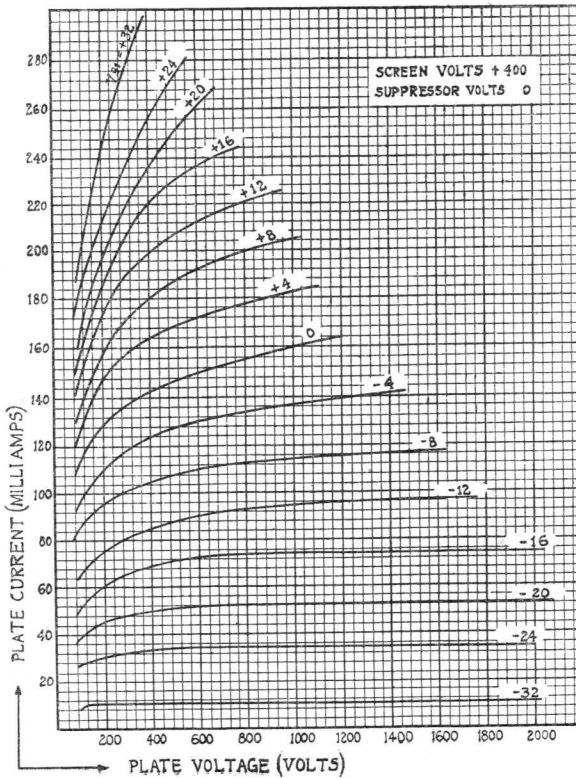
Class C Telephony — Control grid modulated	
Direct anode voltage	2,000 volts
Direct screen voltage	400 volts
Direct control grid voltage	—140 volts
Direct suppressor voltage	0 volts
Anode current	85 mA.
Screen current	20 mA.
Screen resistor	80,000 ohms
Control grid current	2.8 mA.
Peak RF input voltage (V_{g1})	170 volts
Peak AF input voltage (V_{g1})	60 volts
AF power	1.0 watts
Peak RF input power	3.0 watts
Peak output	280 watts
Carrier output	70 watts

Class C Telegraphy	
Direct anode voltage	2,000 volts
Direct screen voltage	400 volts
Direct control grid voltage	—100 volts
Direct suppressor voltage	0 volts
Anode current	120 mA.
Screen current	75 mA.
Screen resistor	21,000 ohms
Control grid current	10 mA.
Peak RF input volts	180 volts
RF input power	1.8 watts
Output	160 watts

—Standard Valves—

4069-A
Valve

Class C Telephony — Suppressor and Screen modulated		
	Suppressor	Screen
Direct anode voltage	2,000	2,000 volts
Direct screen voltage	400	400 volts
Direct control grid voltage	—100	—100 volts
Direct suppressor voltage	—50	—45 volts
Peak AF suppressor voltage	90	90 volts
Peak AF screen voltage	0	200 volts
Peak RF input	180	180 volts
Anode current	80	85 mA.
Screen current	85	85 mA.
Screen resistor	20,000	20,000 ohms.
Control grid current	11	11 mA.
RF input power	2.7	2.0 watts
AF input	1.2	6.2 watts
Peak output	240	280 watts
Carrier output	60	70 watts



Tentative data

V.4069-A.2
Nov. 1937

PRINTED IN
ENGLAND

4074-A VALVE

DOUBLE TRIODE.

The characteristics given below are for one section only unless otherwise specified. Both sections of this valve are identical.

SPECIFICATION.

Cathode.

Indirectly heated oxide coated.
Constant voltage type.

Base.

American medium 7-pin.
Anode connected to top cap type B.

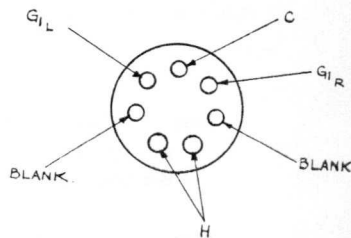
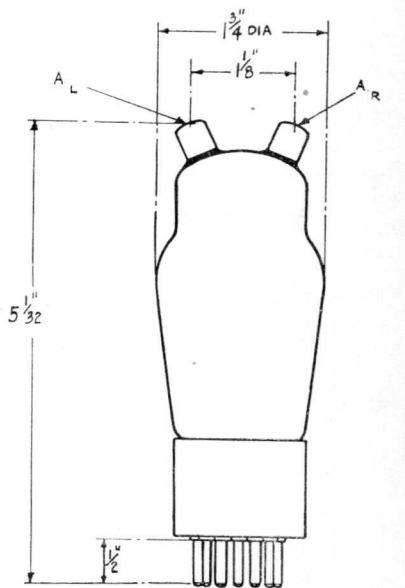
Dimensions.

Max. overall length $5\frac{1}{32}$ " (12.8 cms.)
Max. diameter $1\frac{13}{16}$ " (4.6 cms.)
Net weight 0.15 lbs. (68 gms.)

Constants.

Heater voltage	6.3 volts
Nominal heater current	0.8 amps.
*Amplification factor	14
*Impedance	4,700 ohms.
*Mutual conductance	3.0 mA. per volt
Grid-anode capacity	2.7 $\mu\mu\text{F}$.
Grid-cathode capacity	6.0 $\mu\mu\text{F}$.
Anode-cathode capacity	2.1 $\mu\mu\text{F}$.

* For one section measured at $V_p = 250$ volts,
 $V_{g1} = -7$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum anode voltage	300 volts
Maximum anode dissipation	5 watts
Maximum anode current	50 mA.

Tentative data.

V.4074A.1
Sept., 1938

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class A. A.F. Amp. (See Note 1)
Anode voltage	300 volts
Grid bias	—13 volts
Total anode current for 2 sections	30 mA.
Load resistance	5,000 ohms
Nominal power output for 2 sections	0.8 watt

	Class B. A.F. Amp. (See Note 3)	
Anode voltage	180	300 volts
Grid bias	—8	—16 volts
Anode current per section—zero signal	7	7 mA.
maximum signal	37	37 mA.
Load resistance—anode to anode	4,000	7,000 ohms
Peak AF grid to grid voltage	100	120 volts
Anode dissipation per section	3	5 watts
Power output—two sections	7	12 watts

	Class C Push Pull Amp. or Osc.
Anode voltage	300 volts
Grid bias (See Note 2)	—36 volts
Average anode current	80 mA.
Grid current	18 mA.
Grid resistor	2,000 ohms
Power output	14 watts

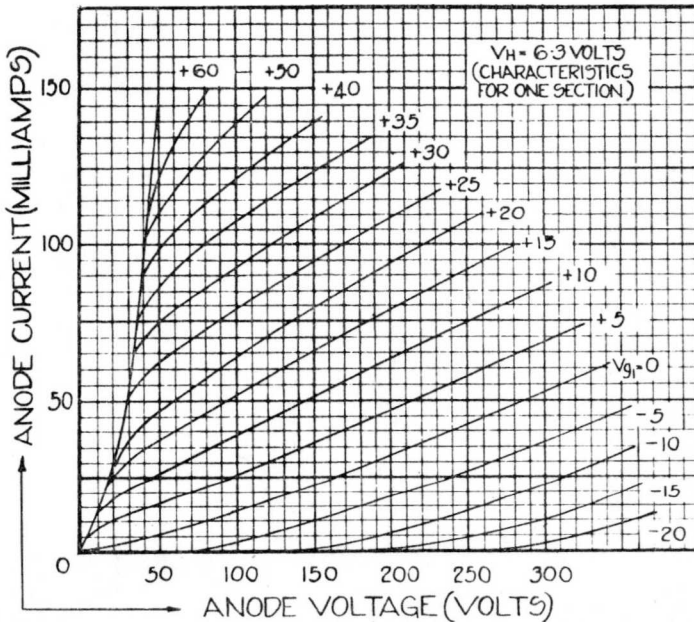
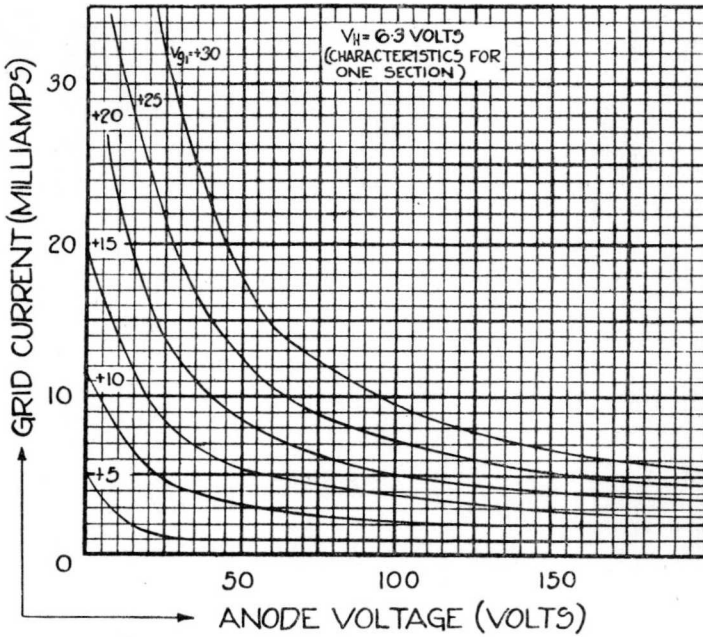
Note 1.—Two sections connected in parallel at the socket, anode to anode and grid to grid. The output power may be increased to 1.0 watt by connecting the two halves in push-pull.

Note 2.—The fixed bias should be at least 15 volts to protect the valve in case of failure to oscillate.

Note 3.—Two sections connected in push pull.

—Standard Valves—

4074-A
Valve



Tentative data

V.4074A.2
Sept., 1938

Standard Valves

PRINTED IN
ENGLAND

—Standard Valves—

4075-A
Valve
(VLS.61)

4075-A VALVE (Previously Coded VLS.61 Valve).

• HALF WAVE HIGH VACUUM RECTIFIER.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant voltage type.

Base.

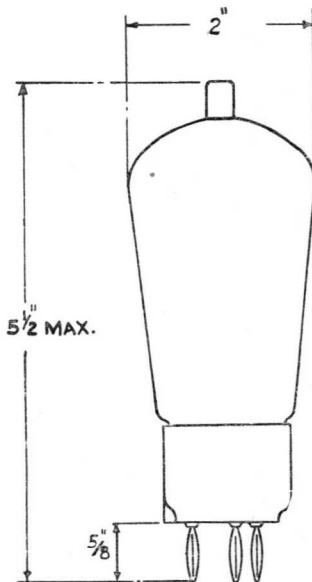
Standard British 4-pin.
Anode connected to top cap.

Dimensions.

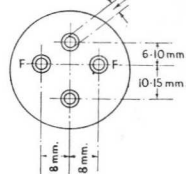
Overall length	5½" (14 cms.)
Overall diameter	2" (5.1 cms.)
Net weight	0.12 lbs. (55 gms.)

Constants.

Filament voltage	2 volts
Nominal filament current	1.2 amps.
Maximum peak inverse voltage	15,000 volts
Maximum peak anode current	10 mA.



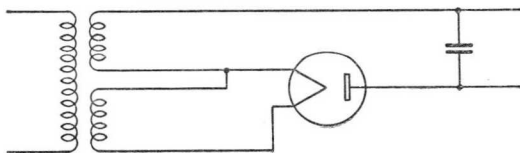
DIAM. OF PINS 3.00mm.



OUTPUT AS HALF WAVE RECTIFIER.

3 milliamps at 6,000 volts.

Typical Circuit :—



V.4075-A.1
Nov. 1937

A-210
S-124
(122)

Standard

PRINTED IN
ENGLAND

—Standard Valves—

4077-A
Valve

4077-A VALVE

HALF WAVE, HOT CATHODE MERCURY VAPOUR RECTIFIER.

SPECIFICATION.

Cathode.

Shielded, oxide coated filament.
Constant voltage type.

Base.

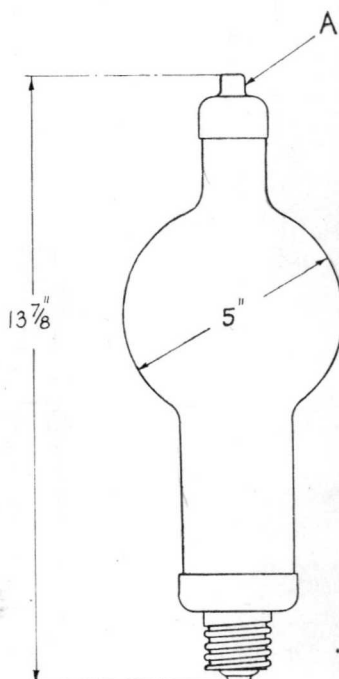
Edison screw Goliath.

Dimensions.

Maximum overall length $14\frac{1}{32}$ " (35.7 cms.)
Bulb diameter 5" (12.7 cms.)
Net weight 0.9 lb. (410 gms.)
Anode cap diameter 0.55" (1.4 cms.)

Constants.

Filament voltage 5 volts
Filament current 10 amps.
Max. peak anode current 5 amps.
Max. peak inverse voltage 16,000 volts
Max. average anode current 1.25 amps.
Ambient temperature range
10°C. min.
65°C. max.
Condensed mercury temperature range
25°C. min.
65°C. max.



Recommended Ambient Temperature Conditions.

	Peak Inverse Voltage.			
	Less than 7,500 v.	7,500— 10,000 v.	10,000— 12,500 v.	Greater than 12,500 v.
Natural ventilation	15°C.—50°C.	15°C.—40°C.	—	—
Forced ventilation	15°C.—65°C.	15°C.—55°C.	15°C.—45°C.	15°C.—40°C.

Cathode Heating Time.

Ambient temperature 10°C.—15°C. 15°C.—20°C. 20°C. and above
Heating period 30 15 5 * mins.

* This time may be reduced to 1 minute if absolutely essential.

Note :—After shipment the filament must be run at full voltage for 30 minutes before any anode voltage is applied, so that the mercury shall be distributed correctly.

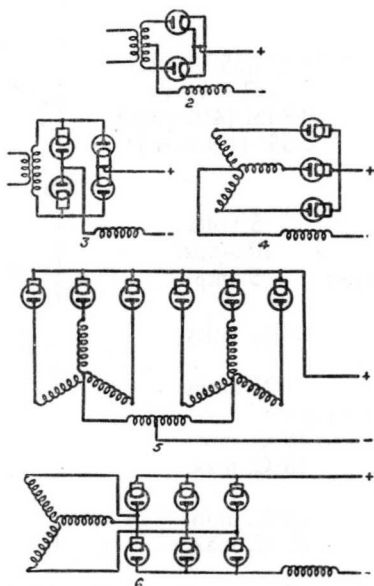
Tentative data

V.4077A-1.
Sept. 1938

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

Circuit	Number of Valves	Approx. D.C. Output volts	Max. D.C. Load Current
2	2	5150 volts	2.5 amps.
3	4	10300 "	2.5 "
4	3	7250 "	3.75 "
5	6	7250 "	7.5 "
6	6	14500 "	3.75 "



Important.

This rectifier being directly heated, the output circuit must be connected to the mid-point of the filament transformer. The filament transformer should be so connected that the anode and filament voltages are 90° out of phase. The maximum peak anode current and output current should be reduced by 50 per cent. if quadrature operation of the filament and anode voltages is not possible.

Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation which causes the condensed mercury temperature to be about $15^\circ\text{C}.$ — $20^\circ\text{C}.$ above the ambient temperature, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

For further information on H.C.M.V. rectifiers, see Sheet G.1.

4078-A VALVE

HALF WAVE, HOT CATHODE MERCURY VAPOUR RECTIFIER.

SPECIFICATION.

Cathode.

Shielded, Oxide coated filament.
Constant voltage type.

Base.

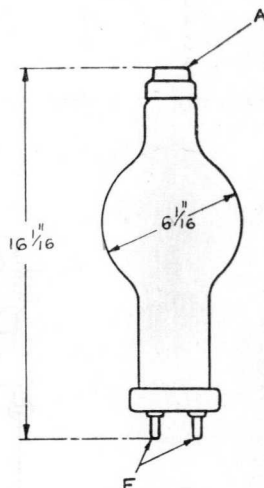
Special 2-pin.

Dimensions.

Maximum overall length $16\frac{1}{16}$ " (40.8 cms.)
Bulb diameter $6\frac{1}{16}$ " (15.4 cms.)
Net weight 1.9 lbs. (860 gms.)
Anode cap diameter 1.42" (3.6 cms.)

Constants.

Filament voltage 5 volts
Filament current 20 amps.
Maximum peak anode current 10 amps.
Maximum peak inverse voltage 20,000 volts
Maximum average anode current 2.5 amps.
Ambient temperature range 10°C. min.
65°C. max.
Condensed mercury temperature range 25°C. min.
65°C. max.



Recommended Ambient Temperature Conditions.

	Peak Inverse Voltage.			
	Less than 7,500 v.	7,500— 10,000 v.	10,000— 12,500 v.	Greater than 12,500 v.
Natural ventilation	15°C.—50°C.	15°C.—40°C.	—	—
Forced ventilation	15°C.—65°C.	15°C.—55°C.	15°C.—45°C.	15°C.—40°C.

Cathode Heating Time.

Ambient temperature 10°C.—15°C. 15°C.—20°C. 20°C and above
Heating period 30 15 5* mins.

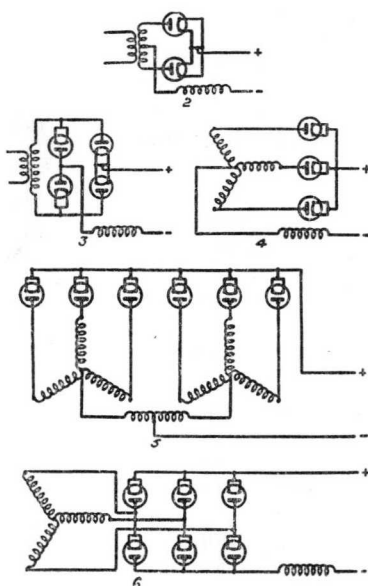
* If absolutely essential, this time may be reduced to 2 minutes.

Note :—After shipment the filament must be run at full voltage for 30 minutes before any anode voltage is applied, so that the mercury shall be distributed correctly.

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

Circuit	Number of Valves	Approx. D.C. Output Volts	Maximum D.C. Load Current
2	2	6,400 volts	5 amps.
3	4	12,800 volts	5 amps.
4	3	9,100 volts	7.5 amps.
5	6	9,100 volts	15 amps.
6	6	18,200 volts	7.5 amps.



Important.

This rectifier being directly heated, the output circuit must be connected to the mid-point of the filament transformer. The filament transformer should be so connected that the anode and filament voltages are 90° out of phase. The maximum peak anode current and output current should be reduced by 50 per cent. if quadrature operation of the filament and anode voltages is not possible.

Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation which causes the condensed mercury temperature to be about 15°C.—20°C. above the ambient temperature, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

For further information on H.C.M.V. rectifiers, see sheet G.I.

—Standard Valves—

4079-A
Valve

4079-A VALVE

HALF WAVE, HOT CATHODE MERCURY VAPOUR RECTIFIER.

SPECIFICATION.

Cathode.

Shielded, Oxide coated filament.
Constant voltage type.

Base.

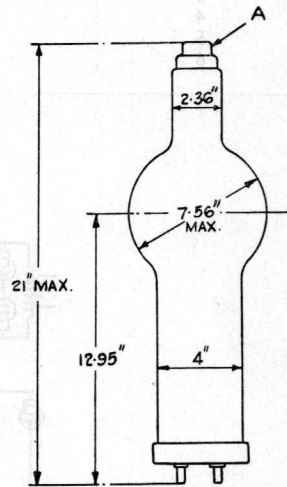
Special 2-pin.

Dimensions.

Maximum overall length 21" (53.4 cms.)
Maximum bulb diameter 7.56" (19.2 cms.)
Net weight 3 lbs. (1350 gms.)
Anode cap diameter 1.42" (3.6 cms.)

Constants.

Filament voltage	5 volts
Filament current	40 amps.
Maximum peak anode current	20 amps.
Maximum peak inverse voltage	20,000 volts
Maximum average anode current	7.5 amps.
Ambient temperature range	10°C. min. 60°C. max.
Condensed mercury temperature range	25°C. min. 60°C. max.



Recommended Ambient Temperature Conditions.

	Peak Inverse Voltage			
	Less than 7,500 v.	7,500—10,000 v.	10,000—12,500 v.	Greater than 12,500 v.
Natural ventilation	15°C.—45°C.	15°C.—35°C.	—	—
Forced ventilation	15°C.—60°C.	15°C.—50°C.	15°C.—40°C.	15°C.—35°C.

Cathode Heating Time.

Ambient temperature	10°C.—15°C.	15°C.—20°C.	20°C. and above
Heating period	30	15	5 mins.

Note :—After shipment the filament must be run at full voltage for 30 minutes before any anode voltage is applied, so that the mercury shall be distributed correctly.

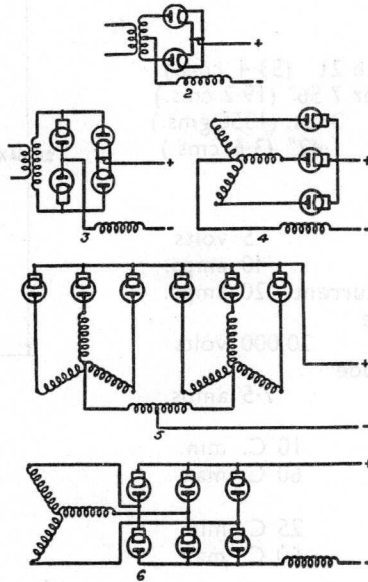
Tentative Data

V.4079-A.1
Mar. 1939

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

Circuit	Number of Valves	Approx. D.C. Output Volts	Maximum D.C. Load Current
2	2	6,400 volts	12.5 amps.
3	4	12,800 volts	12.5 amps.
4	3	9,100 volts	15.4 amps.
5	6	9,100 volts	30.8 amps.
6	6	18,200 volts	18.8 amps.



Important.

This rectifier being directly heated, the output circuit must be connected to the mid-point of the filament transformer. The filament transformer should be so connected that the anode and filament voltages are 90° out of phase. The maximum peak anode current and output current should be reduced by 50 per cent. if quadrature operation of the filament and anode voltages is not possible.

Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation which causes the condensed mercury temperature to be about 15°C.—20°C. above the ambient temperature, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

For further information on H.C.M.V. rectifiers, see sheet G.1.

—Standard Valves—

4080-A
Valve

4080-A VALVE

HALF WAVE, HOT CATHODE MERCURY VAPOUR RECTIFIER.

SPECIFICATION.

Cathode.

Shielded, Oxide coated filament.
Constant voltage type.

Base.

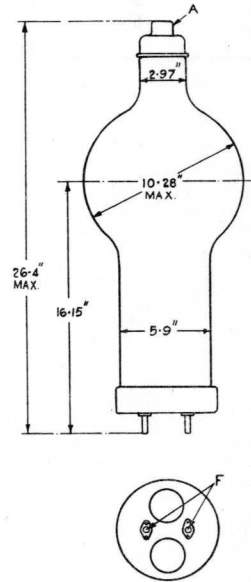
Special 2-pin.

Dimensions.

Maximum overall length 26.4" (67.1 cms.)
Maximum bulb diameter 10.28" (26.1 cms.)
Net weight 9 lbs. (4050 gms.)
Anode cap diameter 1.42" (3.6 cms.)

Constants.

Filament voltage	5 volts
Filament current	100 amps.
Maximum peak anode current	50 amps.
Maximum peak inverse voltage	16,000 volts
Maximum average anode current	20 amps.
Ambient temperature range	15°C. min. 60°C. max.
Condensed mercury temperature range	30°C. min. 60°C. max.



Recommended Ambient Temperature Conditions.

	Peak Inverse Voltage.			
	Less than 7,500 v.	7,500—10,000 v.	10,000—12,500 v.	Greater than 12,500 v.
Natural ventilation	15°C.—45°C.	15°C.—35°C.	—	—
Forced ventilation	15°C.—60°C.	15°C.—50°C.	15°C.—40°C.	15°C.—35°C.

Cathode Heating Time.

Ambient temperature	15°C.—20°C.	20°C. and above
Heating period	30	10 mins.

Note :—After shipment the filament must be run at full voltage for 30 minutes before any anode voltage is applied, so that the mercury shall be distributed correctly.

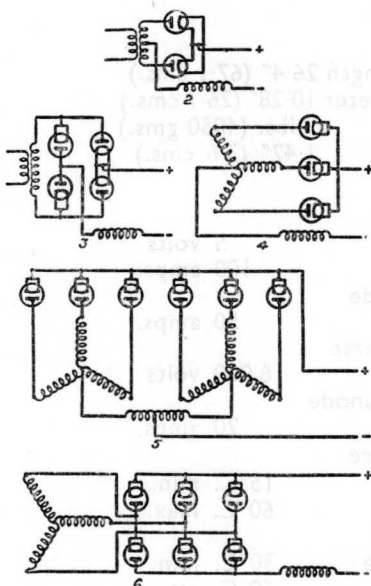
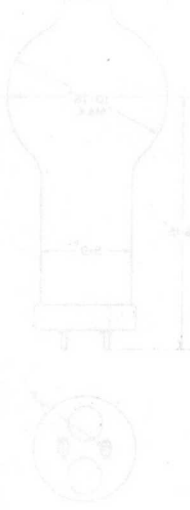
Tentative Data

V.4080-A.1
Mar. 1939

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

Circuit	Number of Valves	Approx. D.C. Output Volts	Maximum D.C. Load Current
2	2	5,150 volts	31 amps.
3	4	10,300 volts	31 amps.
4	3	7,250 volts	38 amps.
5	6	7,250 volts	76 amps.
6	6	14,500 volts	47 amps.



Important.

This rectifier being directly heated, the output circuit must be connected to the mid-point of the filament transformer. The filament transformer should be so connected that the anode and filament voltages are 90° out of phase. The maximum peak anode current and output current should be reduced by 50 per cent. if quadrature operation of the filament and anode voltages is not possible.

Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation which causes the condensed mercury temperature to be about 15°C.—20°C. above the ambient temperature, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

For further information on H.C.M.V. rectifiers, see sheet G.I.

—Standard Valves—

4081-A
Valve

4081-A VALVE

SINGLE ENDED WATER COOLED TRIODE.

SPECIFICATION.

Cathode.

Pure tungsten filament.
Constant voltage type.

Dimensions.

Max. overall length $23\frac{3}{4}$ " (60.2 cms.)
Bulb diameter 5" (12.7 cms.)

Water Jacket.

Type PL 122.676.

Water Circulation.

Normal water flow—11 gallons per minute
(50 litres per minute).

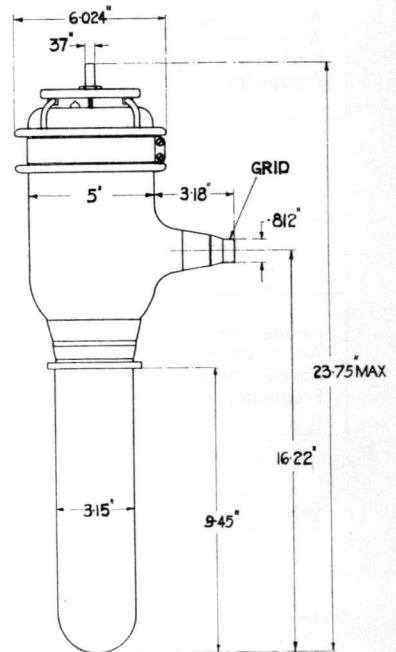
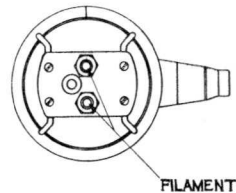
Pressure drop for normal flow—14 lbs. per
sq. in. (1.0 Kg. per sq. cm.)

Maximum water pressure—50 lbs. per sq. in.
(3.5 Kg. per sq. cm.)

Constants.

Filament voltage	20 volts
(exact filament voltage marked on bulb)	
Nominal filament current	59 amps.
Total emission	7.5 amps.
*Amplification factor	33
*Impedance	6,000 ohms
*Mutual conductance	5.5 mA. per volt
Grid-anode capacity	18.6 $\mu\mu\text{F}$.
Grid-filament capacity	18.4 $\mu\mu\text{F}$.
Anode-filament capacity	3.8 $\mu\mu\text{F}$.

* $V_p = 16,000$ volts, $I_p = 1.0$ amp.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	17,500 volts
Maximum anode dissipation	20 kW.
Maximum grid dissipation	1.2 kW.
Maximum frequency for above ratings	5 Mc.

Tentative data.

V.4081-A.1
Sept., 1938

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

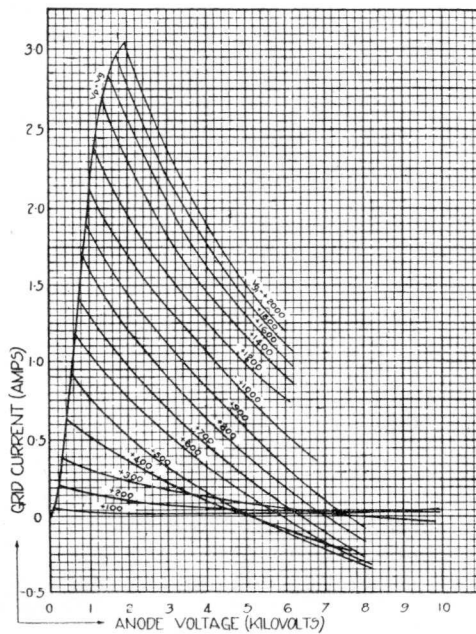
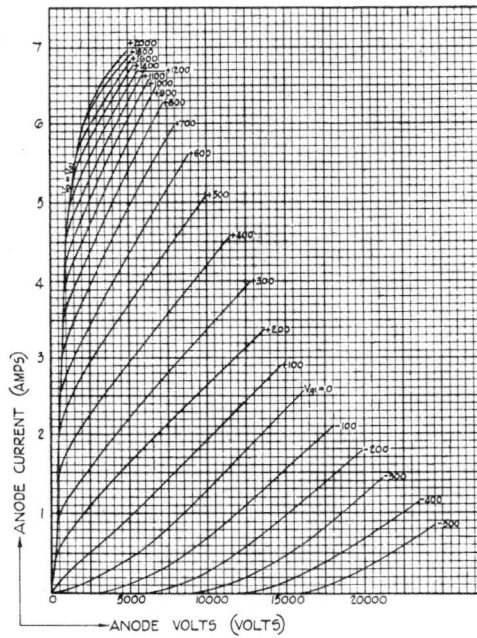
	Class B. A.F. Amp or Mod.
Anode voltage Anode current Power output	17,500 volts 1.05 amps. 11 kW.

	Class B Telephony Modulated carrier applied to grid.		
Anode voltage Anode current Carrier output Frequency	17,500 0.83 5 5	15,000 0.83 3.75 25	13,000 volts 0.83 amps. 2.75 kW. 50 Mc.

	Class C Telephony Subject to anode modulation.		
Anode voltage Anode current Carrier output Frequency	12,500 0.83 6.75 5	10,600 0.83 5.25 25	9,100 volts 0.83 amps. 3.75 kW. 50 Mc.

—Standard Valves—

4081-A
Valve



Tentative data.

V.4081-A.2
Sept. 1938

1954
1955

— Standard Valves —

PRINTED IN
ENGLAND

—Standard Valves—

4094-A
Valve

4094-A VALVE

TRIODE.

This valve is similar to the 4012-A valve but employs a thoriated tungsten filament, molybdenum anode and hard glass bulb.

SPECIFICATION.

Cathode.

Thoriated tungsten filament.
Constant voltage type.

Base.

Large 4-pin bayonet.

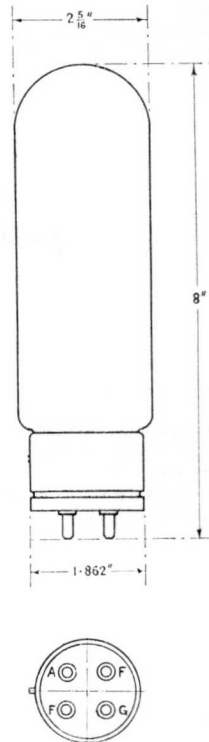
Dimensions.

Maximum overall length 8" (20.4 cms.)
Maximum bulb diameter $2\frac{5}{16}$ " (5.9 cms.)
Net weight 0.36 lb. (164 gms.)

Constants.

Filament voltage	10 volts
Nominal filament current	3.25 amps.
Total emission	1.5 amps.
* Impedance	9,300 ohms.
* Amplification factor	37
* Mutual conductance	4 mA. per volt.
Anode-grid capacity	14 μ F.
Grid-filament capacity	9 μ F.
Anode-filament capacity	4 μ F.

* at $V_p = 1,000$ volts, $I_p = 30$ mA.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	1,250 volts
Maximum direct anode current	0.150 amps.
Maximum anode dissipation	85 watts
Maximum direct grid current	0.050 amps.
Maximum frequency for above ratings	6 Mc.
Maximum anode voltage for frequency of 30 Mc.	600 volts

Note :—This valve should be mounted so that the plane of the filament is vertical.

Tentative data

V.4094-A.1
Sept. 1938

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class B. A.F. Amp. and Mod. For balanced 2-valve circuits.	
Direct anode voltage	1,250	1,000 volts
Grid bias (approx.)	—25	—17 volts
Anode current per valve—zero signal	0.030	0.030 amps.
Maximum signal	0.150	0.150 amps.
Anode dissipation	80	70 watts
Load resistance—anode to anode	8,000	6,000 ohms
Maximum output—2 valves	200	160 watts

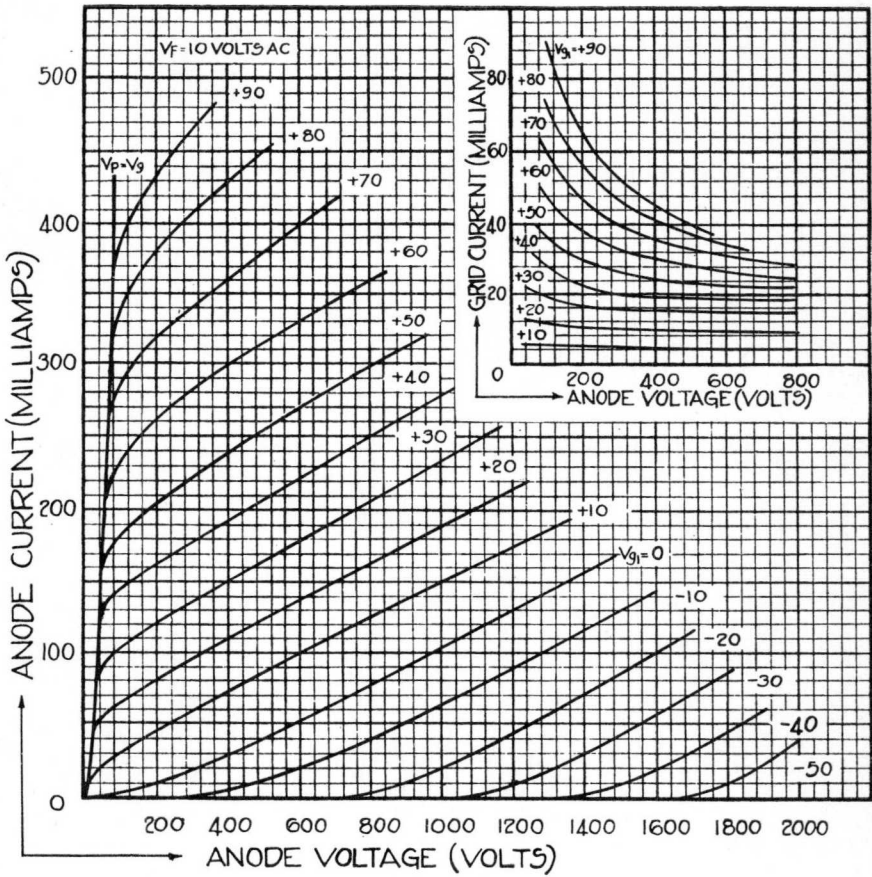
RADIO FREQUENCY OPERATION.

	Class B. Telephony	
	Modulated carrier applied to grid	
Direct anode voltage	1,250	1,000 volts
Direct anode current	0.105	0.130 amps.
Grid bias	—30	—20 volts
Carrier output	45	43 watts
Anode dissipation	85	87 watts

	Class C. Telephony		Class C. Telegraphy	
	Subject to anode modulation		Unmodulated	
Direct anode voltage	1,000	750	1,250	1,000 volts
Direct anode current	0.150	0.130	0.150	0.150 amps.
Grid bias	—60	—40	—70 to —120	—60 to —100 volts
Carrier output	100	65	130	100 watts
Anode dissipation	50	32	57.5	50 watts

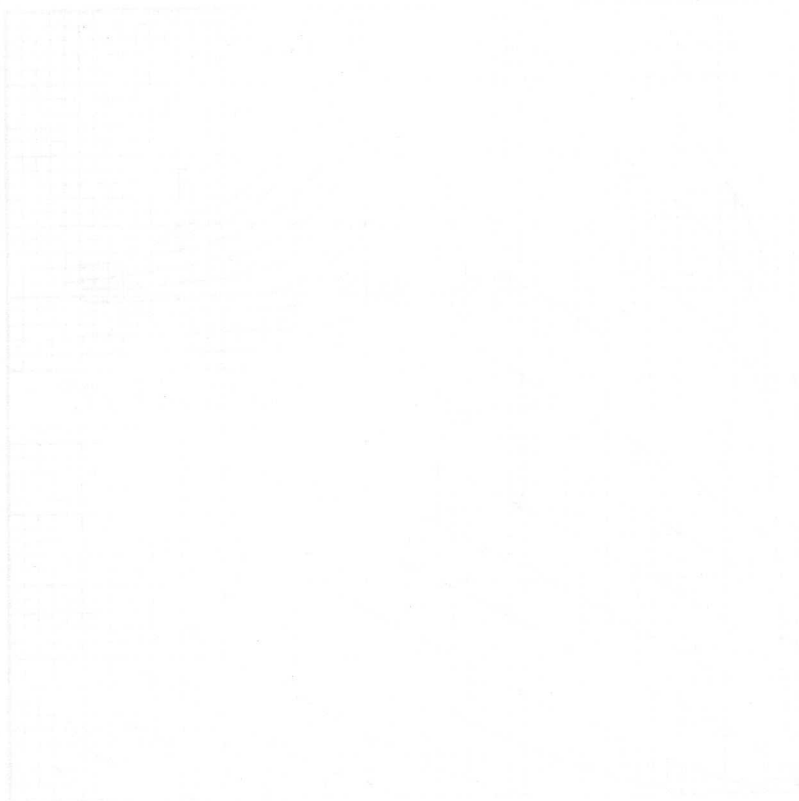
—Standard Valves—

4094-A
Valve



Tentative Data.

V.4094-A.2.
Sept. 1938.



PRINTED IN
ENGLAND

—Standard Valves—

4097-A
Valve

4097-A VALVE

TRIODE.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant voltage type.

Base.

Standard British 4-pin.

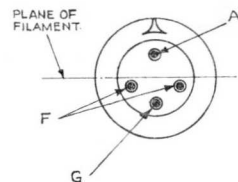
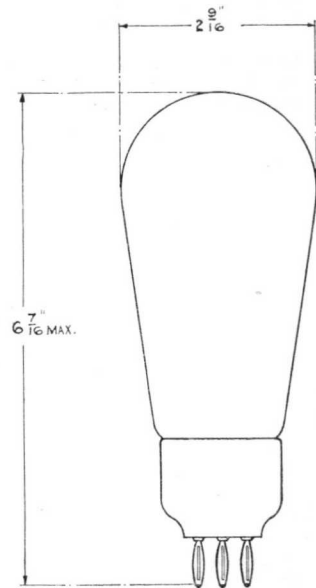
Dimensions.

Maximum overall length $6\frac{7}{16}$ " (16.3 cm.)
Maximum diameter $2\frac{9}{16}$ " (6.5 cm.)

Constants.

Filament voltage	6 volts
Nominal filament current	1.1 amps.
*Impedance	3,000 ohms
*Amplification factor	10
*Mutual conductance	3.3 mA per volt
Grid-anode capacity	8.5 $\mu\mu\text{F}$.
Grid-filament capacity	12.5 $\mu\mu\text{F}$.
Anode-filament capacity	10.5 $\mu\mu\text{F}$.

* At $V_p = 500$ volts. $I_p = 50$ mA.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	500 volts
Maximum anode dissipation	35 watts
Maximum direct anode current	135 mA.
Maximum frequency for above ratings	2 Mc.
Maximum anode voltage for frequency of 10 Mc.	400 volts

Tentative data

V.4097-A.1
Sept. 1938

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

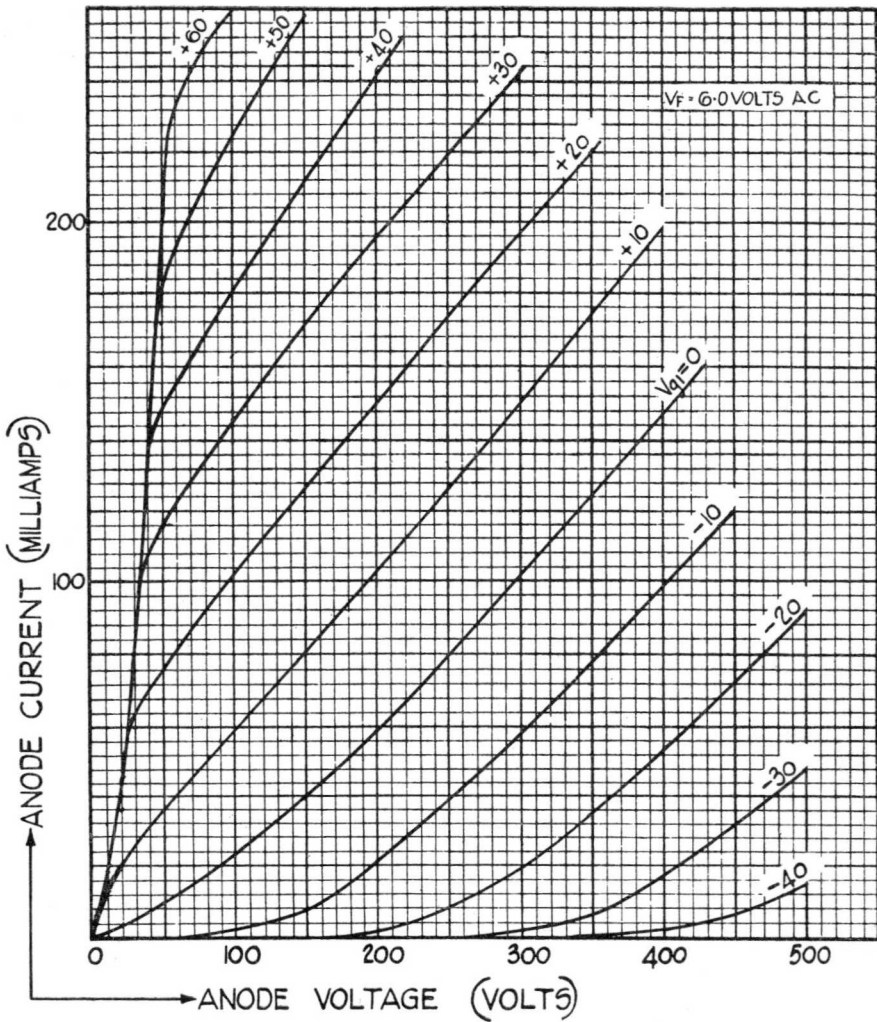
	Class B. A.F. Amp. and Mod. For balanced 2-valve circuit
Direct anode voltage	500 volts
Grid bias (approx).	—38 volts
Direct anode current per valve—zero signal	25 mA.
maximum signal	135 mA.
Load resistance, anode to anode	3,300 ohms
Anode dissipation per valve	30 watts
Maximum signal output—2 valves	75 watts

RADIO FREQUENCY OPERATION.

	Class B Telephony	Class C Telephony	Class C Telegraphy
	Modulated carrier applied to grid	Subject to anode modulation	Unmodulated
Direct anode voltage	500	350	500 volts
Direct anode current	100	130	120 mA.
Control grid bias	—45	—80	—100 to —150 volts
Anode dissipation	33	15	20 watts
Power output	17	30	40 watts

—Standard Valves—

4097-A
Valve



Tentative data

V.4097-A.2
Sept. 1938

Standard forms

PRINTED IN
ENGLAND

—Standard Valves—

4101-D Valve
-E Valve
-G Valve

4101-D, -E AND -G VALVES

TRIODES.

The 4101-D, -E, -G valves have similar characteristics. The 4101-E valve has the filament designed to reduce sputter noise.

The 4101-G is similar to 4101-E but has the anode lead brought out through the stem to increase the grid-anode insulation.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant current type.

Base.

Medium 4-pin bayonet thrust.

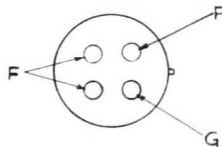
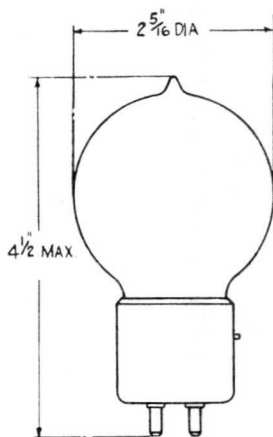
Dimensions.

Max. overall length $4\frac{1}{2}$ " (11.2 cms.)
Bulb diameter $2\frac{5}{16}$ " (5.9 cms.)
Net weight 0.14 lbs. (65 gms.)

Constants.

Filament current 1.0 amps.
Nominal filament voltage 4.5 volts
*Impedance 5,600 ohms
*Amplification factor 6
*Mutual conductance 1.07 mA. per volt
Anode-grid capacity 6.0 $\mu\mu\text{F}$.
Anode-filament capacity 4.5 $\mu\mu\text{F}$.
Grid-filament capacity 5.5 $\mu\mu\text{F}$.

* at $V_p = 130$ volts, $V_{g1} = -9$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage 190 volts
Maximum direct anode current 12 mA.

V.4101-DEG.1
Sept. 1938

4101-D Valve
 -E Valve
 -G Valve

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

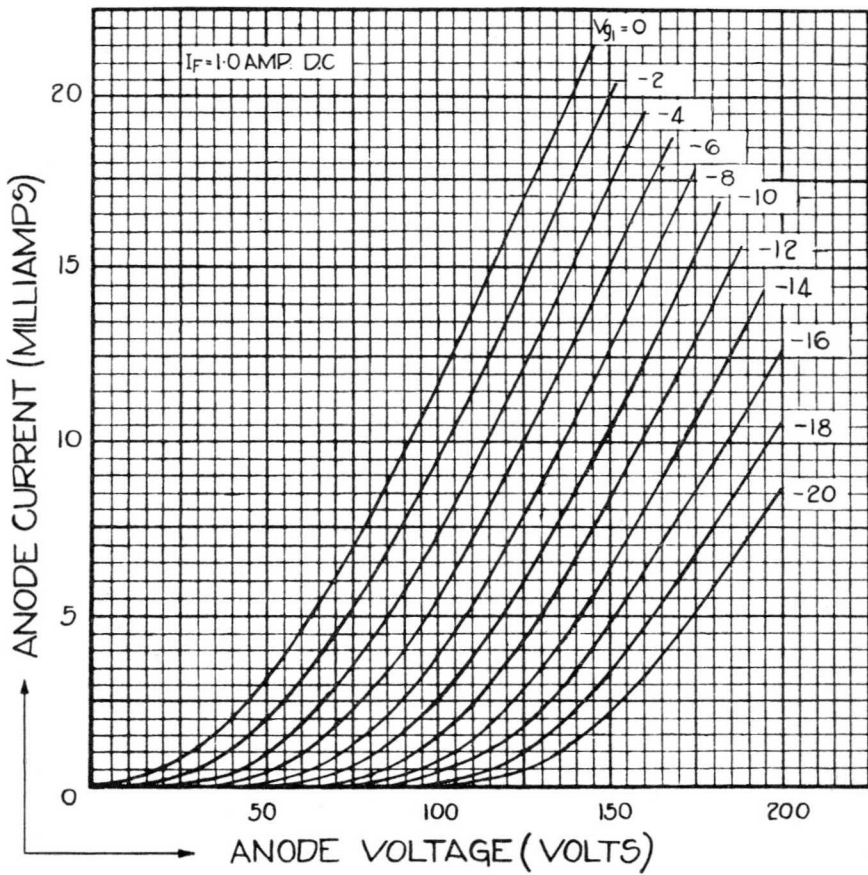
Anode voltage	volts	100	100	130	130	130	130	160	160	160	160	190	190	190	190	*
Grid bias	volts	-4	-6	-9	-12	-10	-12	-12	-12	-10	-12	-16	-18	-20	-20	*
Anode current	mA.	7.3	5.5	7.8	5.0	12.3	10.1	6.3	11	9.0	7.2	11	9.0	7.2	7.2	*
Amplification factor		6.1	6.0	6.0	5.9	6.1	6.0	5.9	6.0	5.9	5.9	6.0	5.9	5.9	5.9	*
Impedance Z_0	ohms	5,500	6,200	4,900	5,700	7,000	5,200	6,600	5,100	5,600	6,300	5,100	5,600	6,300	6,300	*
For load impedance $Z = Z_0$.																
Output	mW.	14	26	35	65	90	100	130	175	235	265	235	265	285	285	*
2nd harmonic	db	33	27	32	26	21	29	25	19	24	21	24	21	19	19	*
For load impedance $Z = 2Z_0$.																
Output	mW.	12	24	30	60	80	90	115	155	210	235	210	235	250	250	*
2nd harmonics	db	38	32	38	31	26	34	30	25	29	26	29	26	24	24	*

* Maximum operating conditions.

PRINTED IN
 ENGLAND

—Standard Valves—

4101-D Valve
-E Valve
-G Valve



101-3 Valve
101-4 Valve
101-5 Valve

Standard Valves

PRINTED IN
ENGLAND

—Standard Valves—

4102-D Valve
-E Valve
-G Valve

4102-D, -E AND -G VALVES

TRIODES.

4102-D, -E, -G valves have similar characteristics.

4102-E valve has a filament designed to reduce sputter noise.

4102-G valve is similar to 4102-E valve but has the anode lead brought out through the stem to increase grid-anode insulation.

SPECIFICATION.

Cathode.

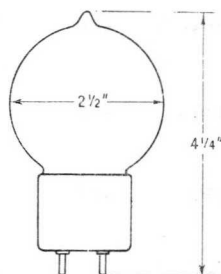
Oxide coated filament.
Constant current type.

Base.

Medium 4-pin bayonet thrust.

Dimensions.

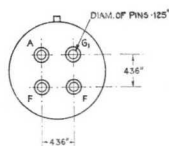
Overall length $4\frac{1}{4}"$ (10.8 cms.)
Bulb diameter $2\frac{1}{2}"$ (6.4 cms.)
Net weight 0.14 lbs. (65 gms.)



Constants.

Filament current 0.97 amps.
Nominal filament voltage 2 volts
*Impedance 60,000 ohms
*Amplification factor 30
*Mutual conductance 0.5 mA. per volt
Grid-anode capacity 5.6 $\mu\mu\text{F.}$
Anode-filament capacity 2.3 $\mu\mu\text{F.}$
Grid-filament capacity 3.8 $\mu\mu\text{F.}$

* at anode current of 0.75 mA.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage 190 volts
Maximum direct anode current 1.5 mA.

V.4102-DEG.1
Nov. 1937

4102-D Valve
 -E Valve
 -G Valve

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

Anode voltage	Grid Bias	Anode current	Amplification factor	Anode resistance	Load resistance	Output voltage	Second harmonic
volts	volts	milliamps		ohms rp	R	peak volts	db
130	—2.0	0.36	29.4	80,000	R=rp	27	20
					R=3rp	38	24
					R=5rp	41	25
130	—1.5	0.58	29.8	63,000	R=rp	20	26
					R=3rp	30	31
					R=5rp	34	33
130	—1.0	0.85	30.1	53,000	R=rp	15	33
					R=3rp	20	39
					R=5rp	23	40
160	—3.0	0.34	29.2	81,000	R=rp	40	18
					R=3rp	57	21
					R=5rp	62	22
160	—2.0	0.80	29.9	54,000	R=rp	28	27
					R=3rp	42	33
					R=5rp	45	34
160	—1.0	1.45	30.3	42,000	R=rp	15	38
					R=3rp	21	43
					R=5rp	24	48
*190	—3.0	0.83	29.8	54,000	R=rp	42	23
					R=3rp	63	28
					R=5rp	68	30
*190	—2.0	1.46	30.2	43,000	R=rp	30	31
					R=3rp	43	38
					R=5rp	48	41

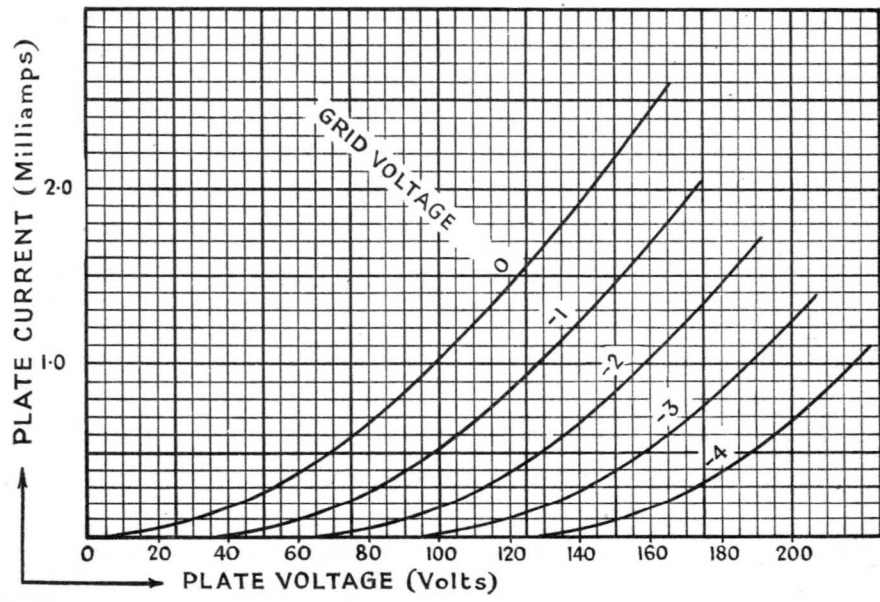
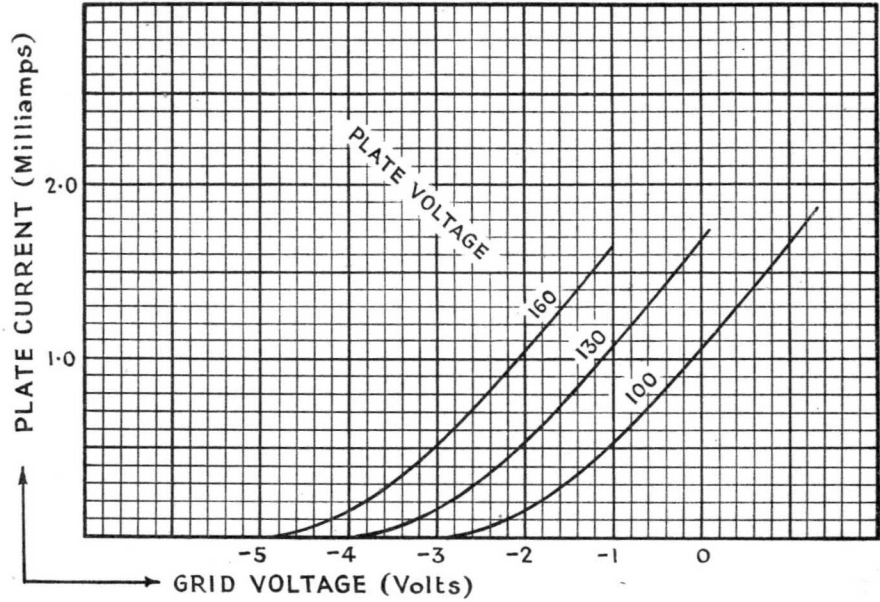
* Maximum operating conditions.

PRINTED IN ENGLAND

—Standard Valves—

4102-D Valve
-E Valve
-G Valve

These curves are taken with direct filament heating, grid and anode voltages being referred to negative end of filament.



101-D-V-100
101-D-V-100
101-D-V-100

Standard

PRINTED IN
ENGLAND

—Standard Valves—

4104-D Valve
-E Valve
-G Valve

4104-D, -E AND -G VALVES

TRIODES.

4104-D, -E, -G valves have similar characteristics.

4104-E valve has a filament designed to reduce sputter noise.

4104-G valve is similar to 4104-E but has anode lead brought out through the stem to increase the grid-anode insulation.

SPECIFICATION.

Cathode.

Oxide coated filament.

Constant current type.

Base.

Medium 4-pin bayonet thrust.

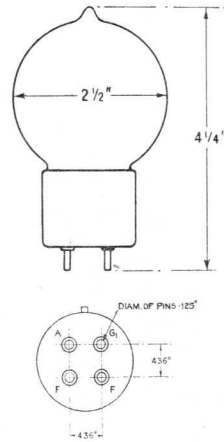
Dimensions.

Overall length	$4\frac{1}{4}"$ (10.8 cms.)
Bulb diameter	$2\frac{1}{2}"$ (6.4 cms.)
Net weight	0.14 lbs. (65 gms.)

Constants.

Filament current	0.97 amps.
Nominal filament voltage	4.4 volts
Maximum steady anode voltage	160 volts
Maximum continuous anode dissipation	5 watts
* Impedance	2,000 ohms
* Amplification factor	2.3
* Mutual conductance	1.15 mA. per volt
Grid-anode capacity	$5.9 \mu\mu\text{F.}$
Anode-filament capacity	$3.7 \mu\mu\text{F.}$
Grid-filament capacity	$5.2 \mu\mu\text{F.}$

* at anode current of 20 mA.

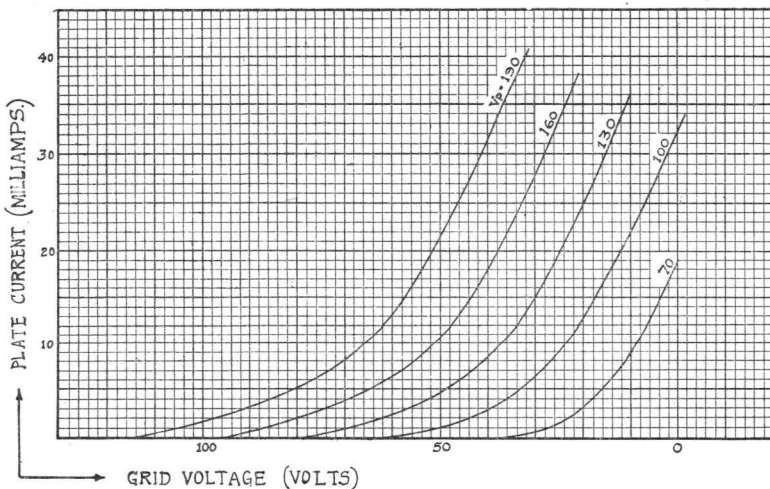


4104-D Valve
 -E Valve
 -G Valve

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

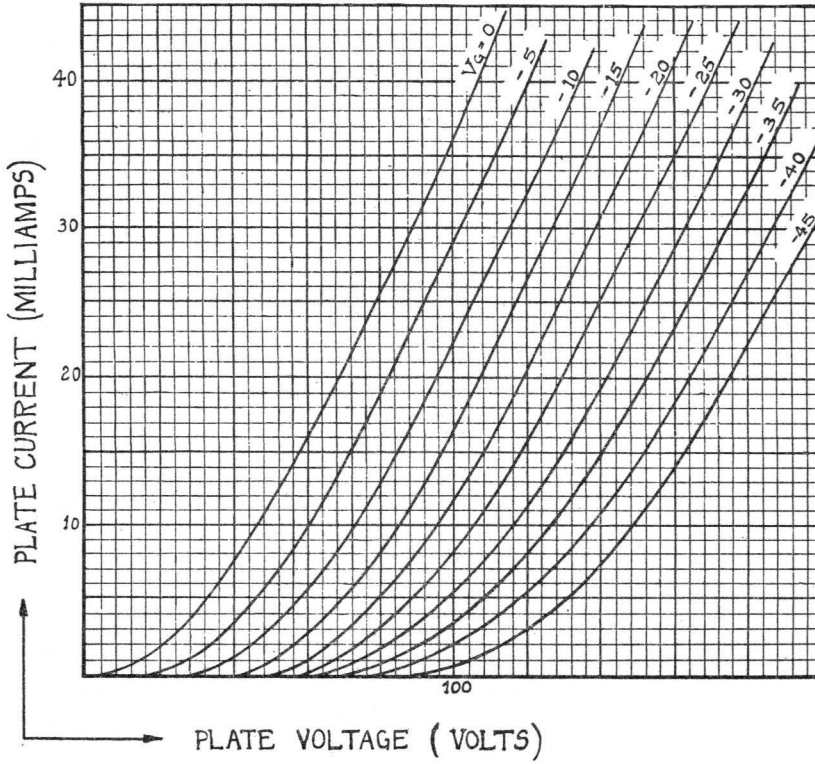
Anode voltage volts	Grid bias volts	Anode current mA.	Anode resistance ohms	Load impedance ohms	Output watts	2nd Harmonic db below fundamental
130	—15	31.3	1,900	1,900	.090	27.6
				3,800	.078	28.4
				5,700	.065	26.6
130	—20	25.2	2,000	2,000	.135	25
				4,000	.126	28.2
				6,000	.103	28.4
130	—25	20.5	2,100	2,100	.190	25.6
				4,200	.167	28.2
				6,300	.145	30
160	—25	35	1,900	1,900	.230	27.8
				3,800	.177	31.4
				5,700	.170	33.2
160	—30	29	1,900	1,900	.300	26.2
				3,800	.284	27.2
				5,700	.236	30.2



PRINTED IN
 ENGLAND

—Standard Valves—

4104-D Valve
-E Valve
-G Valve



avis V G-4012
avis V 3.
avis V



PRINTED IN
ENGLAND

—Standard Valves—

4205-E Valve
M.4205-E Valve

4205-E AND M.4205-E VALVES

TRIODE.

M.4205-E valve is similar to 4205-E but has the grid and anode specially treated to reduce secondary emission.

SPECIFICATION.

Cathode.

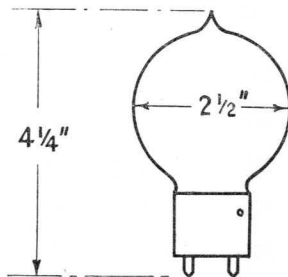
Oxide coated filament.
Constant current type.

Base.

Medium 4-pin bayonet thrust, with offset pin.

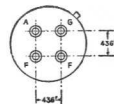
Dimensions.

Overall length	$4\frac{1}{4}"$ (10.8 cms.)
Bulb diameter	$2\frac{1}{2}"$ (6.4 cms.)
Net weight	0.14 lbs. (65 gms.)



Constants.

Filament current	1.6 amps.
Nominal filament voltage	4.5 volts
*Impedance	3,500 ohms
*Amplification factor	7
*Mutual conductance	2 mA. per volt
Anode-grid capacity	4.8 $\mu\mu\text{F}$.
Anode-filament capacity	3.3 $\mu\mu\text{F}$.
Grid-filament capacity	5.2 $\mu\mu\text{F}$.



* at anode current of 30 mA.

LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	400 volts
Maximum direct anode current	50 mA.
Maximum anode dissipation	15 watts
Maximum direct grid current	10 mA.
Maximum frequency for above ratings	15 Mc.
Maximum anode voltage for frequency of 30 Mc.	300 volts

V.4205-E.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

Anode voltage	Grid bias	Anode current	Amplification factor	Anode resistance	Load resistance	Power output	Second Harmonic
volts	volts	mA.		ohms	ohms	mW.	db
200	—6	22.5	7.4	4,000	4,000	60	35
250	—22	9	6.9	6,000	8,000	55	40
					6,000	500	18
250	—15	19	7.2	4,350	12,000	450	22
					18,000	380	26
					4,350	310	26
250	—10	27.5	7.4	3,800	8,700	280	30
					3,800	180	33
250	—5	37.5	7.5	3,500	7,600	160	38
					3,500	50	40
300	—30	8	6.7	6,700	7,000	45	43
					6,700	800	15
300	—24	15.5	7.1	4,800	13,400	720	20
					19,100	600	24
					4,800	750	20
300	—18	25	7.3	4,000	9,600	670	25
					4,000	540	27
350	—22.5	29	7.3	3,800	8,000	480	31
					3,800	875	26
375	—30	22	7.1	4,300	7,600	800	30
					4,300	1,300	20
*300	—10	41	7.4	3,350	8,600	1,200	26
					3,350	200	37
*350	—20	34	7.3	3,600	6,700	180	41
					3,600	750	28
*375	—24	32	7.3	3,650	7,200	675	32
					3,650	1,000	26
*400	—29	30	7.2	3,800	7,300	900	30
					3,800	1,400	23
					7,600	1,300	28

* Maximum operating conditions.

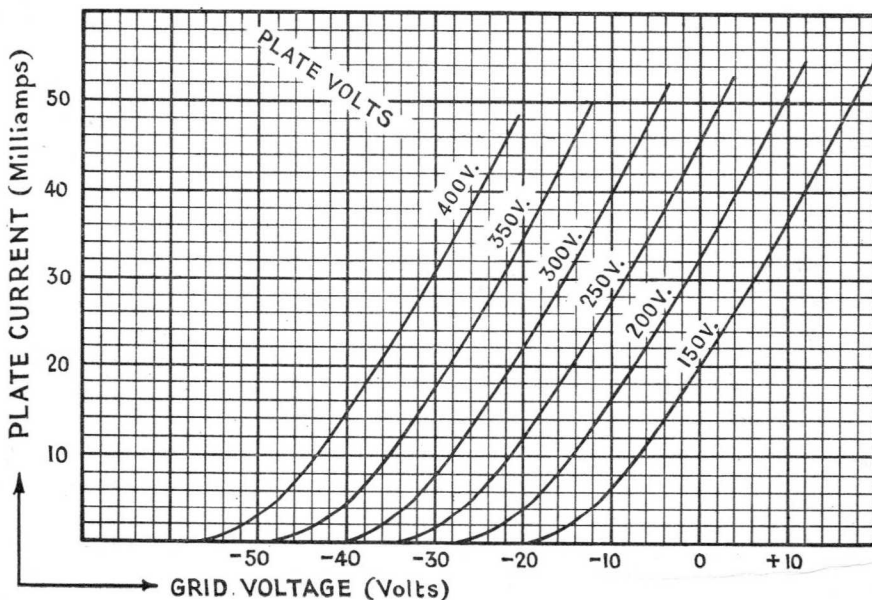
—Standard Valves—

4205-E Valve
M.4205-E Valve

RADIO FREQUENCY OPERATION.

	Class B Telephony		Class C Telephony		Class C Telegraphy	
	Modulated Carrier applied to grid		Subject to anode modulation		Unmodulated	
Direct anode voltage	350	400	300	350	350	400 volts
Direct anode current	28	28	35	35	45	45 mA.
Grid bias	-48	-56	-120	-144	-96	-112 volts
Driving voltage—						
Carrier	69	73	—	—	—	— peak volts
A-F peak	138	146	—	—	—	— volts
Driving voltage	—	—	205	229	186	202 peak volts
Power output—						
Carrier	2.5	3.0	—	—	—	— watts
A-F peak	10	12	—	—	—	— watts
Power output	—	—	6.0	7.1	8.3	10.0 watts
Effective load—						
Resistance	3,100	3,700	4,000	5,000	3,750	4,500 ohms
Peak driving—						
Power-peak	1	1	—	—	—	— watts
Driving power	—	—	1.3	1.7	1.3	1.5 watts

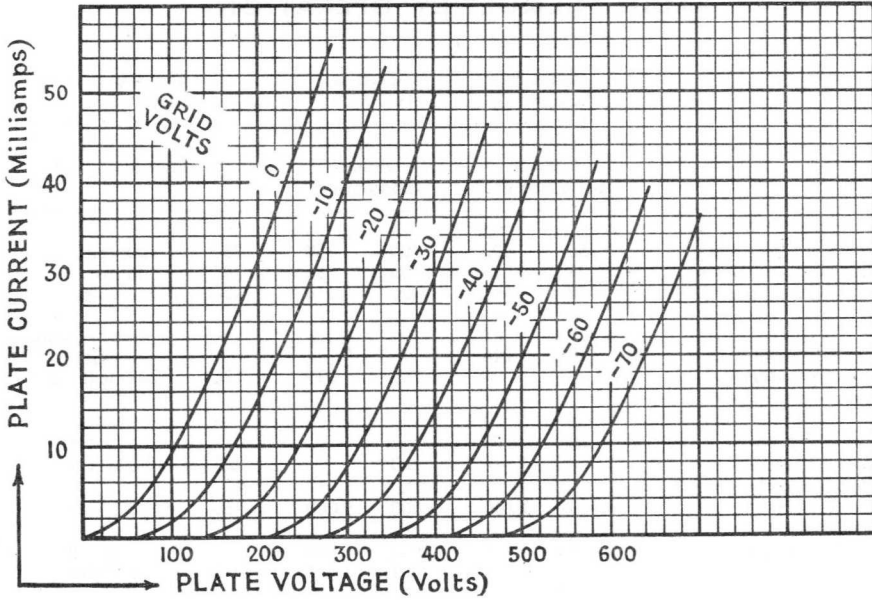
These curves are taken with direct filament heating, grid and anode voltages being referred to negative end of filament.



V.4205-E.2
Nov. 1937

4205-E Valve
M.4205-E Valve

—Standard Valves—



PRINTED IN
ENGLAND

—Standard Valves—

4211-D Valve
-E Valve

4211-D AND 4211-E VALVE

TRIODE.

For replacement purposes only.

The 4211-E valve is similar to 4211-D valve but has small chokes (approximately one microhenry) connected in series with the grid and anode leads to prevent spurious oscillations at ultra high frequencies. These valves have been replaced by the 4242-A valve.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant voltage type.

Base.

Large 4-pin bayonet.

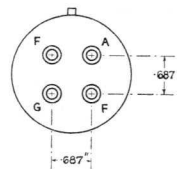
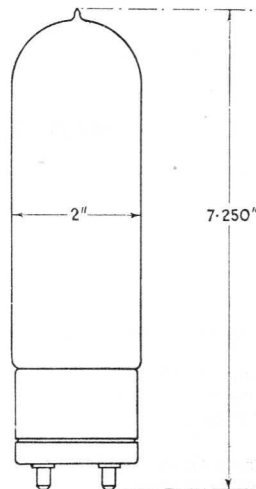
Dimensions.

Overall length $7\frac{1}{4}"$ (18.4 cms.)
Bulb diameter 2" (5.1 cms.)
Net weight 0.4 lbs. (180 gms.)

Constants.

Filament voltage 10 volts
Nominal filament current 3 amps.
*Impedance 3,000 ohms
*Amplification factor 12
*Mutual conductance 4 mA. per volt
Grid-anode capacity $8.9 \mu\mu\text{F.}$
Anode-filament capacity $4.5 \mu\mu\text{F.}$
Grid-filament capacity $6.9 \mu\mu\text{F.}$

* at anode current of 65 mA.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage 1,000 volts
Maximum direct anode current 0.200 amps.
Maximum anode dissipation 65 watts
Maximum direct grid current 0.045 amps.

Note :—This valve should be mounted so that the filament is operated in a vertical plane.

V.4211-DE.1
Nov. 1937

4211-D Valve
-E Valve

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class A AF Amp.
Direct anode voltage	900 volts
Grid bias	—45 volts
Direct anode current	0.055 amps.
Anode dissipation	45 watts
Load impedance	10,000 ohms
Undistorted output	8.1 watts
% Harmonics	4.5

RADIO FREQUENCY OPERATION.

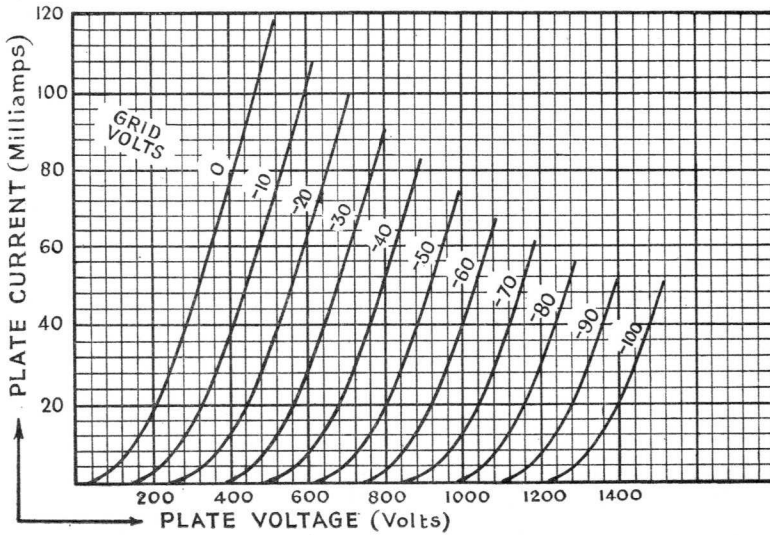
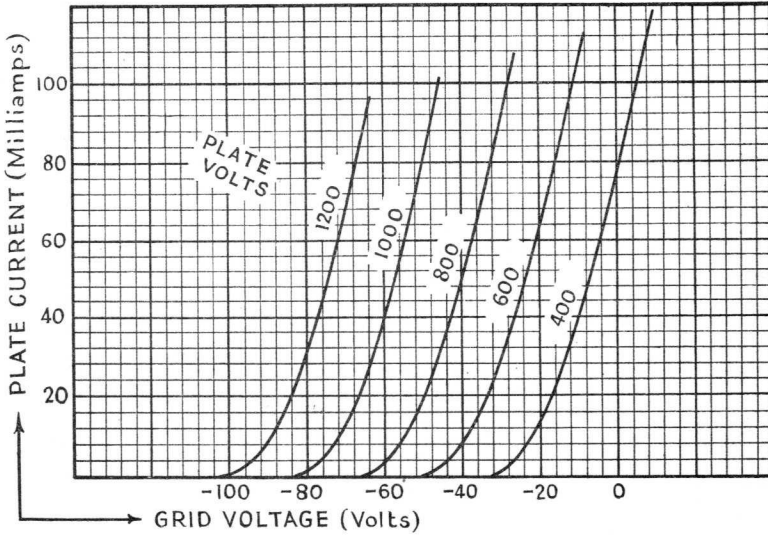
	Class B Telephony	Class C Telephony	Class C Telegraphy
	Modulated Carrier applied to grid	Subject to anode modulation	Unmodulated
Direct anode voltage	1,000	750	1,000 volts
Direct anode current	0.075	0.100	0.135 amps.
Grid bias	—75	—120	—200 to —250 volts
Anode dissipation	50	25	45 watts
Carrier output	25	50	90 watts

PRINTED IN
ENGLAND

—Standard Valves—

4211-D Valve
-E Valve

These curves are taken with direct filament heating, grid and anode voltages being referred to negative end of filament.



4311-D Vaire
-E Vaire

PRINTED IN
ENGLAND

—Standard Valves—

4212-D
Valve

4212-D VALVE

TRIODE.

For replacement purposes only.

The 4212-D valve employs an oxidised nickel anode and has been replaced by the 4212-E valve.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant voltage type.

Base.

Extra large 4-pin bayonet.

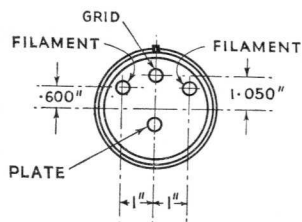
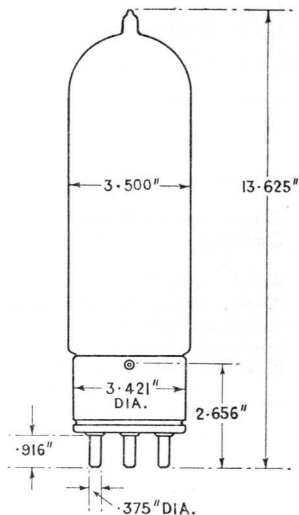
Dimensions.

Overall length $13\frac{5}{8}$ " (34.5 cms.)
Maximum diameter $3\frac{1}{2}$ " (8.9 cms.)
Net weight $1\frac{5}{8}$ lbs. (750 gms.)

Constants.

Filament voltage 14 volts
Nominal filament current 6 amps.
*Impedance 2,000 ohms
*Amplification factor 16
*Mutual conductance 8 mA. per volt
Grid-anode capacity $18.5 \mu\mu\text{F.}$
Anode-filament capacity $6 \mu\mu\text{F.}$
Grid-filament capacity $18.5 \mu\mu\text{F.}$

* at anode current of 130 mA.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	2,000 volts
Maximum direct anode current	300 mA.
Maximum anode dissipation	200 watts
Maximum direct grid current	75 mA.
Maximum frequency for above ratings	1.5 Mc.
Maximum anode voltage for frequency of 4.5 Mc.	750 volts

Note :—This valve should be mounted so that the filament is operated in a vertical plane.

V.4212-D.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class A AF Amp.
Direct anode voltage	1,500 volts
Grid bias	—67 volts
Direct anode current	130 mA.
Anode dissipation	150 watts
Load impedance	4,000 ohms
Undistorted output	45 watts

	Class B AF Amp. and Mod. For balanced 2 valve circuit		
Direct anode voltage	1,600	1,600	volts
Grid bias	—80	—70	to
	—100	—90	volts
Anode current per valve—zero signal	33	50	mA.
Anode current per valve—maximum signal	167	250	mA.
Anode dissipation	122	175	watts
Load resistance—anode to anode	8,000	6,000	ohms
Maximum output—2 valves	290	450	watts

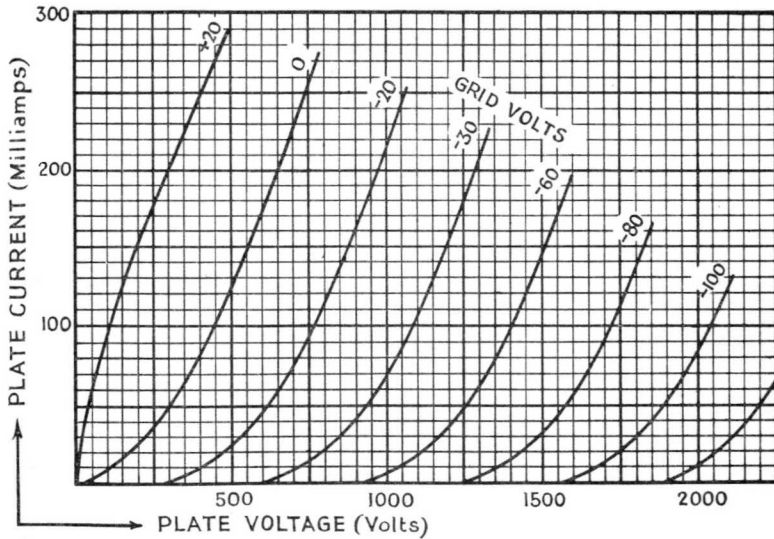
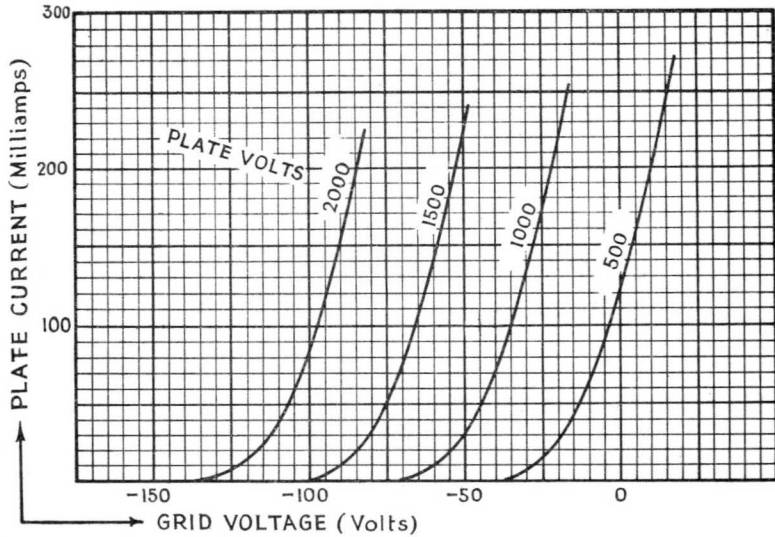
RADIO FREQUENCY OPERATION.

	Class B Telephony		Class C Telephony		Class C Telegraphy	
	Modulated Carrier applied to grid		Subject to anode modulation		Unmodulated	
Direct anode voltage	1,000	1,500	750	1,000	1,000	1,500 volts
Direct anode current	250	200	250	250	250	250 mA.
Grid bias	—50	—80	—100	—140	—140	—200 to
					—200	—300 volts
Anode dissipation	167	200	62	83	83	125 watts
Carrier output	83	100	125	167	167	250 watts

—Standard Valves—

4212-D
Valve

These curves are taken with direct filament heating, grid and anode voltages being referred to negative end of filament.



013-D
valley

Standard

PRINTED IN
ENGLAND

—Standard Valves—

4212-E
Valve

4212-E VALVE

TRIODE.

The 4212-E valve employs a molybdenum anode and hard glass bulb.

SPECIFICATION.

Cathode.

Thoriated tungsten filament.
Constant voltage type.

Base.

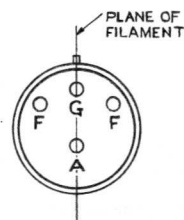
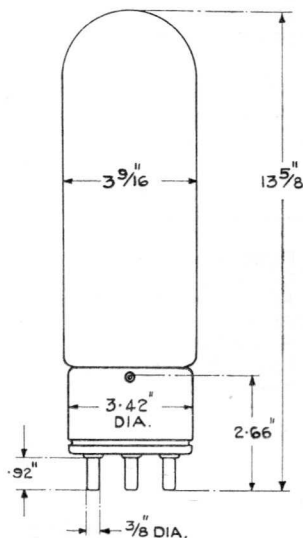
Extra large 4-pin bayonet.

Dimensions.

Max. overall length $13\frac{5}{8}$ " (34.6 cms.)
Bulb diameter $3\frac{9}{16}$ " (9.1 cms.)
Net weight 1.6 lbs. (725 gms.)

Constants.

Filament voltage 14 volts
Nominal filament current 6 amps.
Total emission 4 amps.
*Impedance 1,900 ohms
*Amplification factor 16
*Mutual conductance 8.4 mA per volt
Grid-anode capacity 18.8 $\mu\mu\text{F}$.
Anode-filament capacity 8.6 $\mu\mu\text{F}$.
Grid-filament capacity 14.9 $\mu\mu\text{F}$.
* at $V_p = 2,000$ volts. $V_g = -90$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage 3,000 volts
Maximum direct anode current 350 mA.
Maximum anode dissipation 275 watts
Maximum direct grid current 75 mA.
Maximum frequency for above ratings 1.5 Mc.
Maximum anode voltage for frequency of 4.5 Mc. 1,000 volts

Note :—This valve should be mounted so that the plane of the filament is vertical.

V.4212-E.1
Sept. 1938

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class A AF Amp. and Mod.		
Direct anode voltage	1,500	1,250	volts
Grid bias	—57	—40	volts
Direct anode current	170	200	milliamps
Load impedance	5,000	3,000	ohms
Undistorted output	50	40	watts

	Class B AF Amp. and Mod. For balanced 2 valve circuit		
Direct anode voltage	2,000	1,500	volts
Grid bias	—105	—75	volts
Anode current per valve—zero signal	40	50	mA.
Anode current per valve—maximum signal	300	300	mA.
Anode dissipation	250	200	watts
Load resistance—anode to anode	8,000	5,900	ohms
Maximum output, 2 Valves	650	500	watts

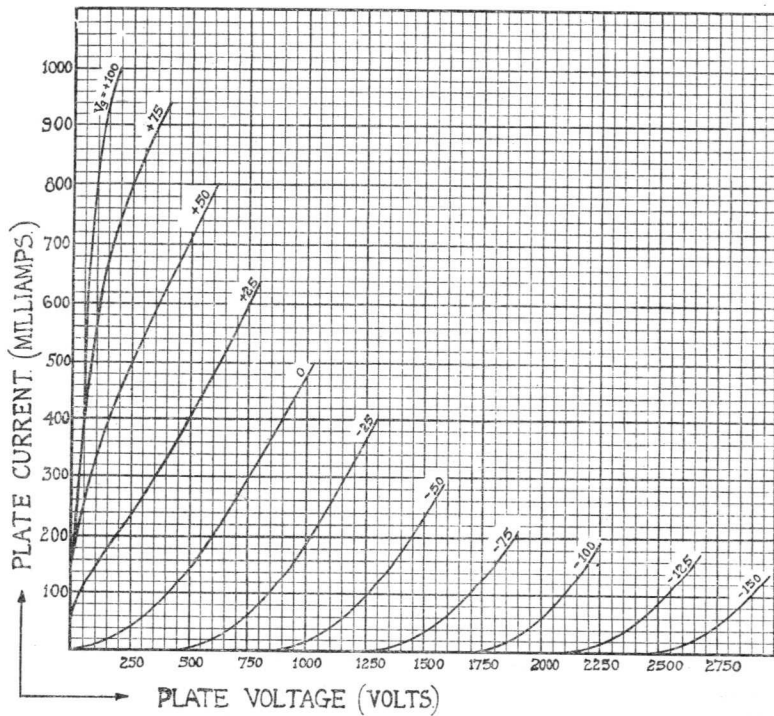
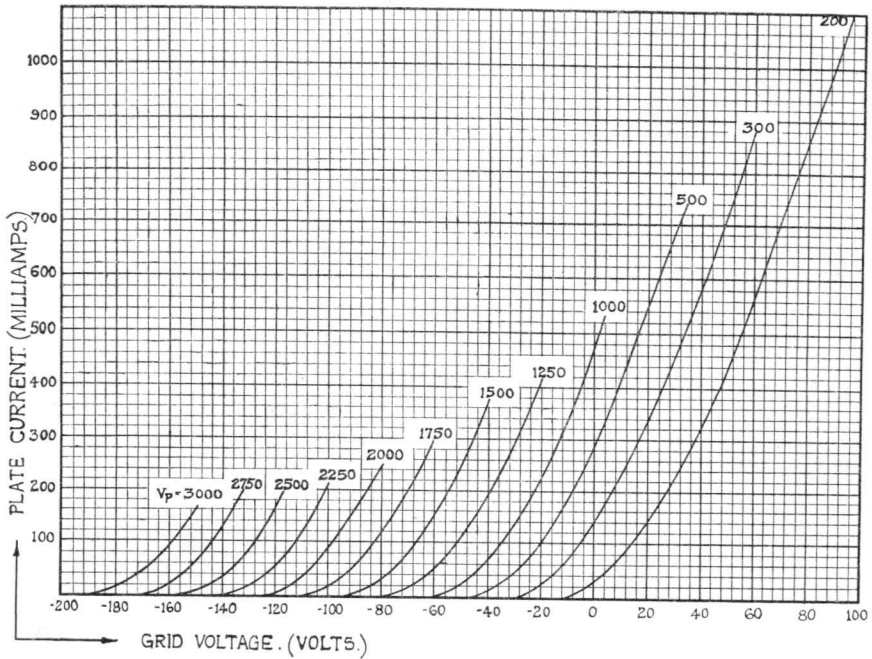
RADIO FREQUENCY OPERATION

	Class B Telephony		Class C Telephony		Class C Telegraphy	
	Modulated carrier applied to grid		Subject to anode modulation		Unmodulated	
Direct anode voltage	2,000	1,500	1,500	1,000	2,000	1,500 volts
Direct anode current	0.206	0.275	0.300	0.300	0.300	0.300 amps.
Grid bias	—120	—90	—200	—125	—185	—150 to
					—250	—200 volts
Anode dissipation	275	275	150	100	200	150 watts
Carrier output	137	137	300	200	400	300 watts

The curves shown on sheet V.4212-E.2 are taken with direct filament heating, grid and anode voltages being referred to the negative end of the filament.

—Standard Valves—

4212-E
Valve



V.4212-E.2
Nov. 1937

100

Standard



PRINTED IN
ENGLAND

—Standard Valves—

4215-A
Valve

4215-A VALVE

TRIODE.

For replacement purposes only.

SPECIFICATION.

Cathode.

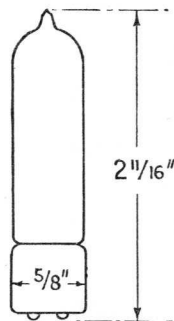
Oxide coated filament.
Constant current type.

Base.

Miniature 4-pin bayonet thrust.

Dimensions.

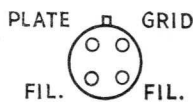
Overall length	$2\frac{11}{16}$ " (6.9 cms.)
Maximum diameter	$\frac{5}{8}$ " (1.6 cms.)
Net weight	0.02 lbs. (10 gms.)



Constants.

Filament current	0.25 amps.
Nominal filament voltage	1.1 volts
*Impedance	25,000 ohms
*Amplification factor	6
*Mutual conductance	0.24 mA. per volt
Grid-anode capacity	3.5 $\mu\mu\text{F}$.
Anode-filament capacity	1.5 $\mu\mu\text{F}$.
Grid-filament capacity	2.0 $\mu\mu\text{F}$.

* at anode current of 1 mA.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	100 volts
Maximum direct anode current	2.2 mA.

V.4215-A.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

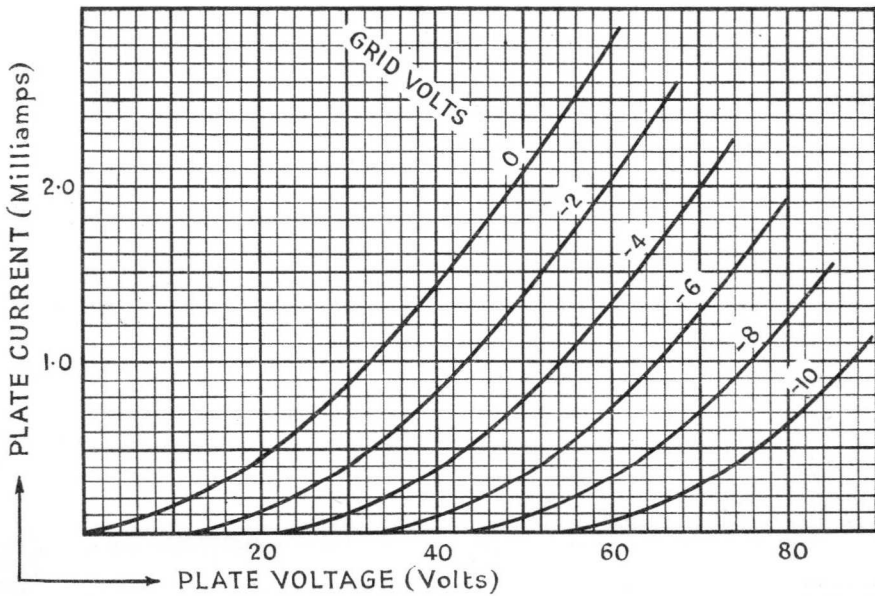
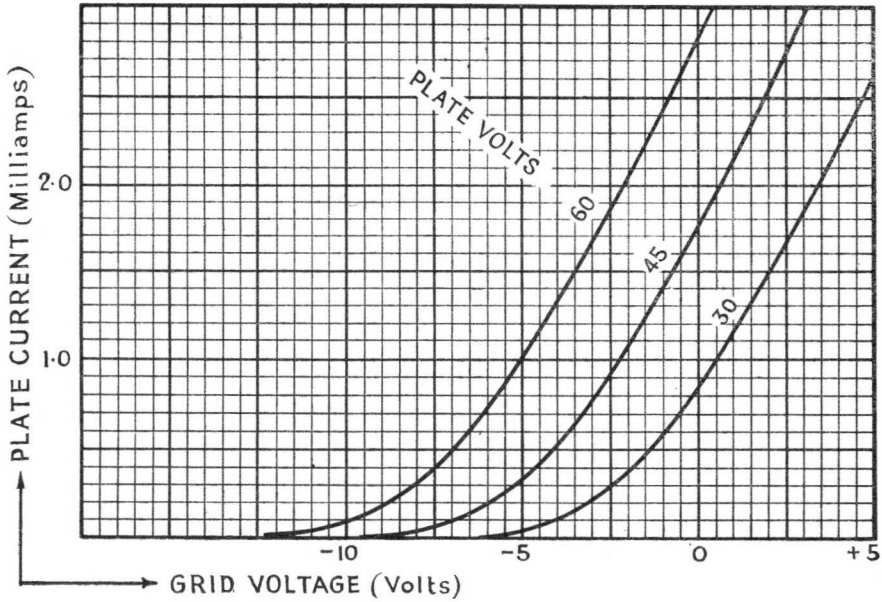
Anode voltage	Grid bias	Anode current	Amplification factor	Anode resistance	Load resistance	Power output	Voltage output	Second harmonic
volts	volts	mA.		ohms rp	R	mW.	peak volts	db
45.0	—3.0	1.0	5.7	16,500	R=rp R=2rp R=5rp	2.2 1.9	14.0	29 34 39
45.0	—1.5	1.6	5.8	14,500	R=rp R=2rp R=5rp	0.60 0.55	7.2	40 45 49
60.0	—3.0	2.0	5.7	13,500	R=rp R=2rp R=5rp	2.9 2.6	14.5	35 40 45
67.5	—6.0	1.4	5.6	15,500	R=rp R=2rp R=5rp	9.4 8.3	28.5	25 30 35
67.5	—4.5	2.0	5.7	14,000	R=rp R=2rp R=5rp	6.0 5.5	22.0	31 36 40
*67.5	—4.0	2.0	5.7	13,500	R=rp R=2rp R=5rp	5.0 4.5	19.5	34 38 43
*90.0	—8.0	2.2	5.6	14,000	R=rp R=2rp R=5rp	18 16	40.0	26 31 37
*100.0	—10.0	2.1	5.6	14,500	R=rp R=2rp R=5rp	26 23	47.0	24 29 36
22.5 45.0 67.5	—4.0 —9.0 —14.0	0.01 0.01 0.01	} Anode current detection					
22.5 *45.0	+1.0 +1.0	1.0 2.6	} Grid current detection. Grid bias usually obtained by connecting grid return to positive end of filament.					

* Maximum operating conditions.

—Standard Valves—

4215-A
Valve

These curves are taken with direct filament heating, grid and anode voltages being referred to negative end of filament.



V.4215-A.2
Nov. 1937

Standard Values

—Standard Valves—

4220-C
Valve

4220-C VALVE

SINGLE ENDED
WATER COOLED TRIODE.
SPECIFICATION.

Cathode.

Pure Tungsten filament.
Constant voltage type.

Water Jacket.

Type MS.1362 Grp. 1 for anode dissipation up to 6 Kw.
Type MS.1362 Grp. 20 used for below panel connection for anode dissipation up to 6 Kw.
Type 223 LU 1A for anode dissipation over 6 Kw.

Water Flow.

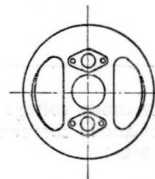
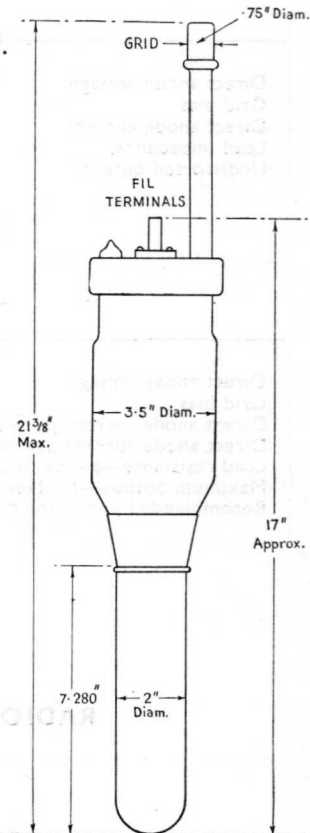
5 gallons per minute.

Dimensions.

Overall length $21\frac{3}{8}"$ (54.6 cms.)
Bulb diameter $3\frac{1}{2}"$ (9.1 cms.)
Net weight $2\frac{7}{8}$ lbs. (1,300 gms.)

Constants.

Filament voltage 22 volts
(exact filament voltage marked on bulb)
Nominal filament current 41 amps.
Total emission 6 amps.
*Impedance 7,500 ohms
*Amplification factor 40
*Mutual conductance 5.3 mA per volt
Grid-anode capacity $20.5 \mu\mu\text{F}$
Grid-filament capacity $20 \mu\mu\text{F}$
Anode-filament capacity $3 \mu\mu\text{F}$
* at $V_p = 10\text{kV}$ $I_p = 0.8$ amp.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	13,000 volts
Maximum direct anode voltage for anode modulation	9,000 volts
Maximum direct anode current	1.5 amps.
Maximum anode dissipation	10 Kw.
Maximum grid dissipation	200 watts
Maximum frequency for above ratings	1 Mc.
Maximum anode voltage for frequency of 2 Mc.	7,500 volts

V.4220-C.1
March, 1939

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class A AF Amp. and Mod.		
	Direct anode voltage	10,000	12,000
Grid bias	—150	—200	volts
Direct anode current	0.30	0.38	amps.
Load impedance	17,500	10,000	ohms
Undistorted output	325	545	watts

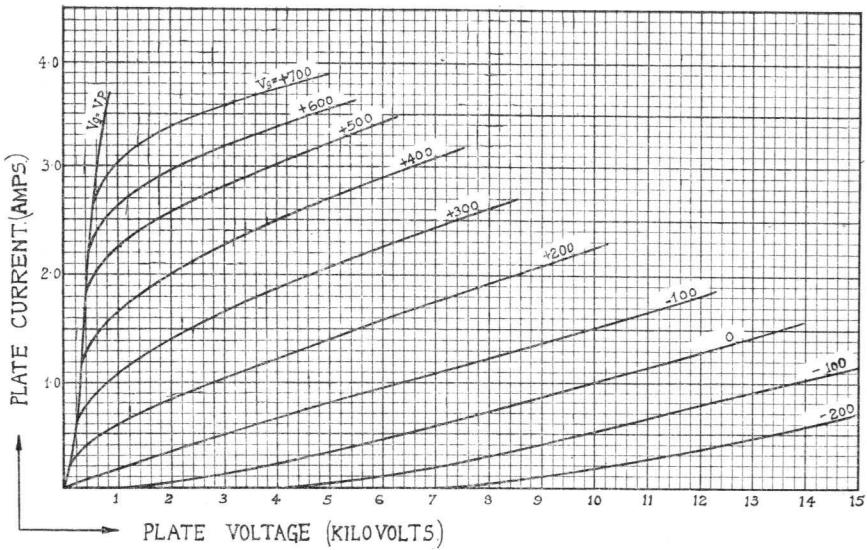
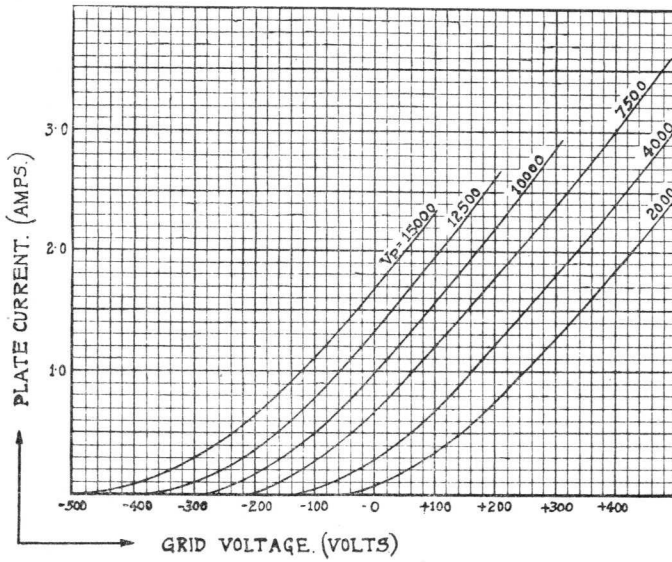
	Class B AF Amp. and Mod. For balanced 2 valve circuit		
	Direct anode voltage	10,000	5,000
Grid bias	—190	—75	volts
Direct anode current per valve—zero signal	0.20	0.10	amps.
Direct anode current per valve—maximum signal	1.3	1.3	amps.
Load resistance—anode to anode	7,000	3,480	ohms
Maximum output—2 valves	14,500	7,200	watts
Recommended power for driving stage	2,000	2,000	watts

RADIO FREQUENCY OPERATION.

	Class B Telephony		Class C Telephony		Class C Telegraphy	
	Modulated Carrier applied to grid		Subject to anode modulation		Unmodulated	
Direct anode voltage	12,000	10,000	7,500	5,000	10,000	7,500 volts
Direct anode current	0.6	0.6	0.6	0.6	1.1	1.1 amps
Grid bias	—350	—300	—600	—300	—470	—350 to
Anode dissipation	4,850	4,100	1,350	1,100	—550	—450 volts
Carrier output	2,350	1,900	3,150	1,900	3,500	2,650 watts
					7,500	5,600 watts

—Standard Valves—

4220-C
Valve



V.4220-C.2
Nov. 1937

4320-C
Valve

Standard Valves

PRINTED IN
ENGLAND

—Standard Valves—

4222-B
Valve

4222-B VALVE

HALF WAVE WATER COOLED RECTIFIER.

SPECIFICATION.

Cathode.

Pure Tungsten filament.
Constant voltage type.

Water Jacket.

Type MS.1362 Grp. 1 for anode dissipation up to 6 Kw.

Type MS.1362 Grp. 20 for below panel connection for anode dissipation up to 6 Kw.

Type 223 LU 1A for anode dissipation over 6 Kw.

Dimensions.

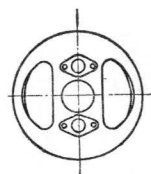
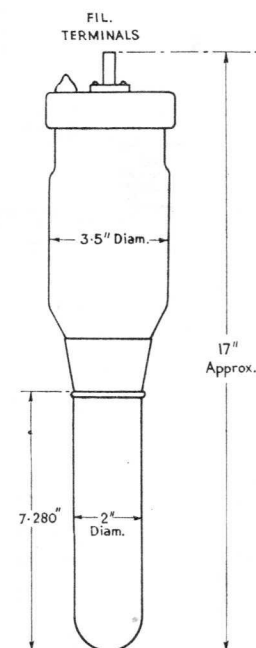
Overall length 17" (43 cms.)
Overall diameter $3\frac{1}{2}$ " (8.9 cms.)
Net weight $2\frac{1}{2}$ lbs. (1,150 gms.)

Water Flow.

2 gallons per minute.

Constants.

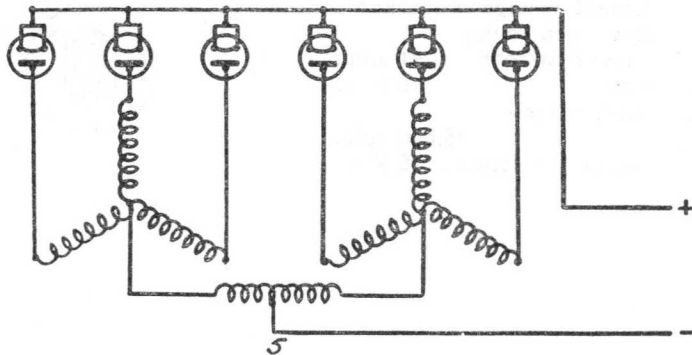
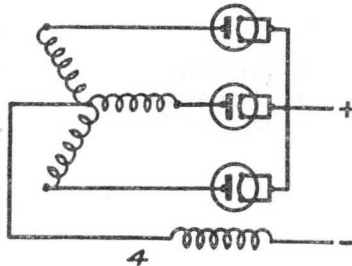
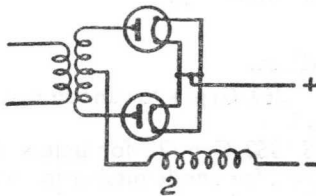
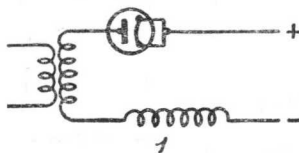
Filament voltage 22 volts
(exact filament voltage is marked on bulb of each valve)
Nominal filament current 41 amps.
Total emission 6 amps.
Maximum peak inverse voltage 45,000 volts
Maximum anode dissipation 10 Kw.



—Standard Valves—

TYPICAL OPERATING CONDITIONS.

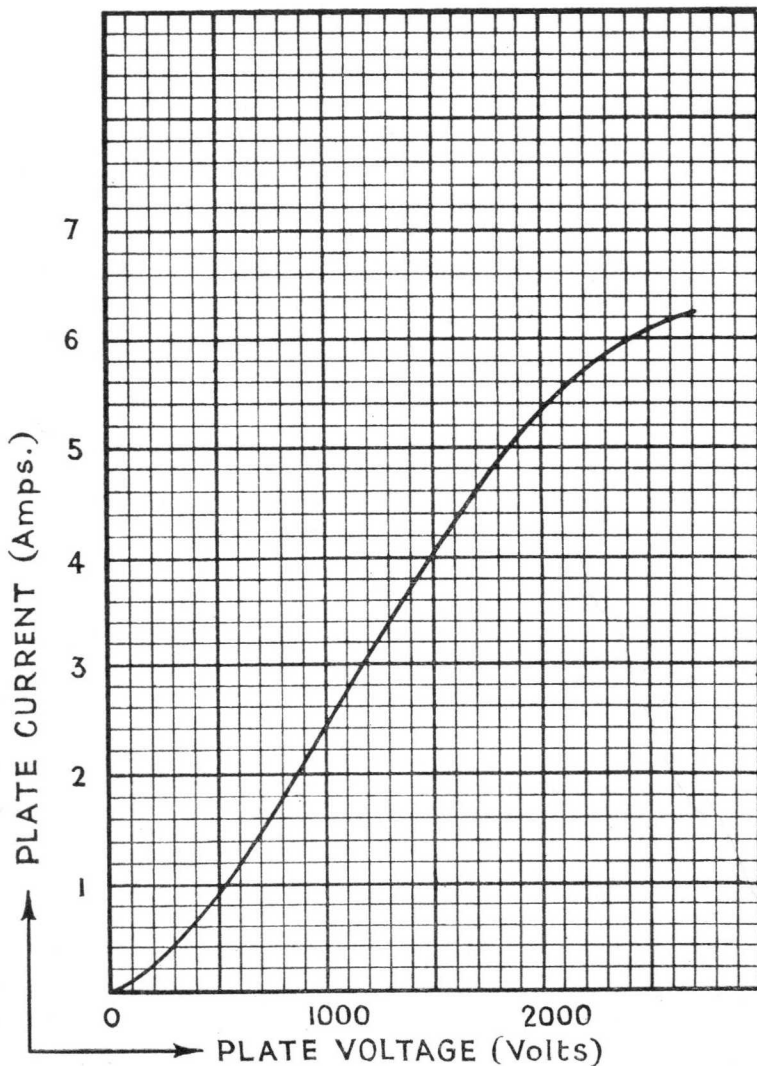
Circuit	Number of valves	Load potential in volts	Load current in amps.
1	1	7,000	1.5
2	2	14,000	3.0
4	3	22,500	4.3
5	6	22,500	8.5



—Standard Valves—

4222-B
Valve

This curve is taken with A.C. filament heating, anode voltages being referred to the centre point of the filament.



—Standard Valves—

4228-A
Valve

4228-A VALVE

SINGLE ENDED WATER COOLED TRIODE.

SPECIFICATION.

Cathode.

Pure Tungsten filament.
Constant voltage type.

Water Jacket.

Type MS.1362 Grp. 1
Type MS.1362 Grp. 20 for below panel
connection.

Dimensions.

Overall length 18" (45.7 cms.)
Bulb diameter $3\frac{1}{8}$ " (8.9 cms.)
Net weight $2\frac{1}{2}$ lbs. (1,150 gms.)

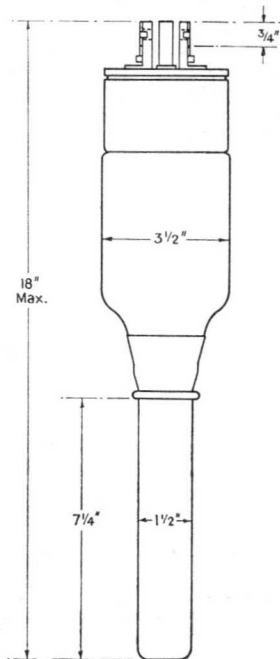
Water Flow.

5 gallons per minute.

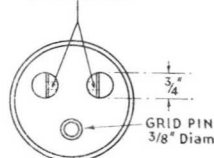
Constants.

Filament voltage	22 volts
(exact filament voltage marked on bulb)	
Nominal filament current	41 amps.
Total emission	6 amps.
*Impedance	2,200 ohms
*Amplification factor	18
Grid-anode capacity	24 $\mu\mu\text{F}$.
Anode-filament capacity	3.1 $\mu\mu\text{F}$.
Grid-filament capacity	25 $\mu\mu\text{F}$.

* at anode current of 0.75 amp.



FIL. TERMINALS



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	6,000 volts
Maximum direct anode voltage for anode modulation	4,000 volts
Maximum direct anode current	1.5 amps.
Maximum anode dissipation	5 Kw.
Maximum grid dissipation	100 watts
Maximum frequency for above ratings	3 Mc.
Maximum anode voltage for frequency of 6 Mc.	3,000 volts

V.4228-A.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

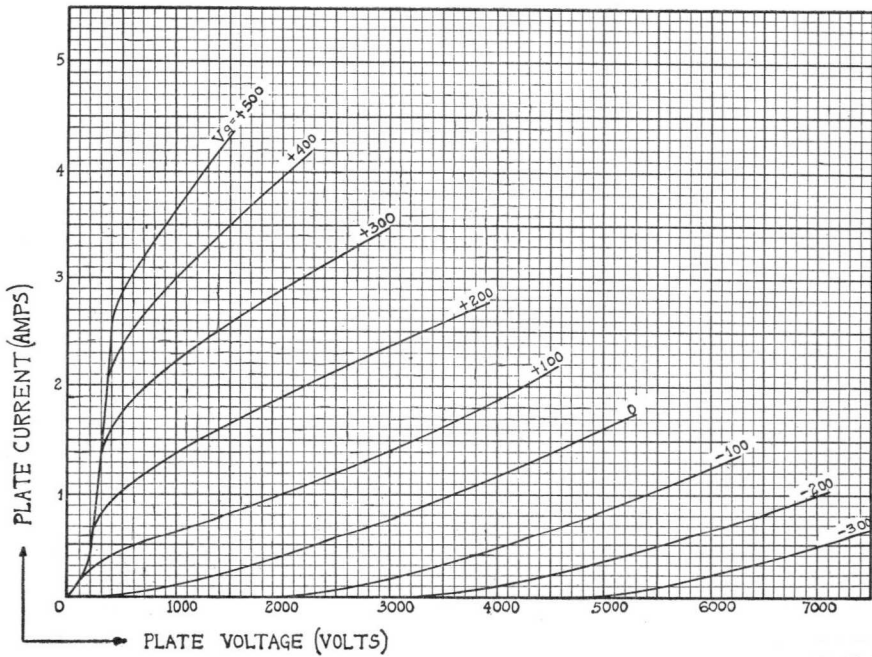
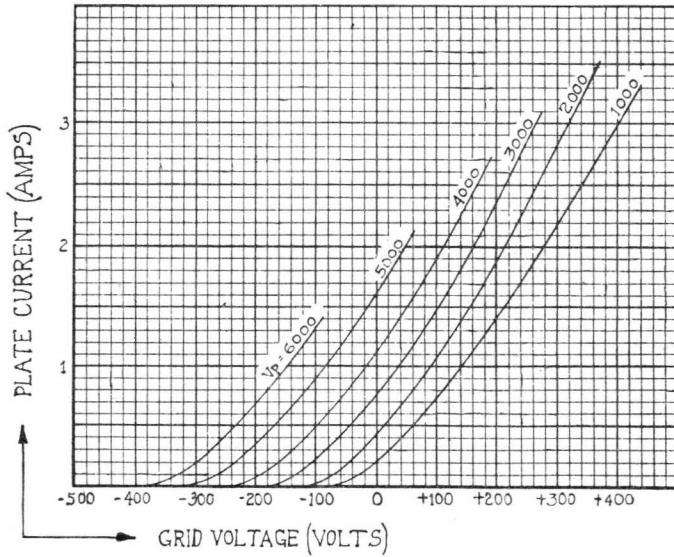
	Class B AF Amp. For balanced 2 valve circuit	
Direct anode voltage	5,000	4,000 volts
Grid bias	—265	—200 volts
Direct anode current per valve—zero signal	0.15	0.15 amps.
Direct anode current per valve—maximum signal	0.6	0.7 amps.
Load resistance—anode to anode	8,400	5,000 ohms
Maximum signal output—2 valves	3.75	3.0 Kw.
Anode dissipation	1.125	1.3 Kw.

RADIO FREQUENCY OPERATION.

	Class B Telephony		Class C Telephony		Class C Telegraphy	
	Modulated Carrier applied to grid		Subject to anode modulation		Unmodulated	
Direct anode voltage	5,000	4,000	4,000	3,000	6,000	4,000 volts
Direct anode current	0.65	0.65	1.25	1.3	1.25	1.25 amps.
Grid bias	—325	—275	—500	—300	—600 —800	—450 to —550 volts
Anode dissipation	2.15	1.7	2.5	1.9	2.5	1.7 Kw.
Carrier output	1.1	0.9	2.5	2	5	3.3 Kw.

—Standard Valves—

4228-A
Valve



V.4228-A.2
Nov. 1937

PRINTED IN
ENGLAND

—Standard Valves—

4242-A
Valve

4242-A VALVE

TRIODE.

The 4242-A valve is similar to the 4211-D valve but employs a molybdenum anode and hard glass bulb.

SPECIFICATION.

Cathode.

Thoriated tungsten filament.
Constant voltage type.

Base.

Large 4-pin bayonet.

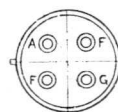
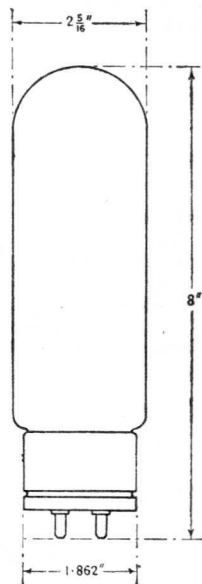
Dimensions.

Max. overall length 8" (20.4 cms.)
Max. bulb diameter $2\frac{5}{16}$ " (5.9 cms.)
Net weight 0.36 lbs. (164 gms.)

Constants.

Filament voltage	10 volts
Nominal filament current	3.25 amps.
Total emission	1.5 amps.
*Impedance	3,100 ohms
*Amplification factor	13
*Mutual conductance	4.2 mA per volt
Grid-anode capacity	13 $\mu\mu\text{F}$.
Anode-filament capacity	4 $\mu\mu\text{F}$.
Grid-filament capacity	6.5 $\mu\mu\text{F}$.

* at $V_p = 1,250$ volts, $V_{g1} = -55$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	1,250 volts
Maximum direct anode current	0.150 amps.
Maximum anode dissipation	85 watts
Maximum direct grid current	0.050 amps.
Maximum frequency for above ratings	6 Mc.
Maximum anode voltage for frequency of 30 Mc.	600 volts

Note :—This valve should be mounted so that the plane of the filament is vertical.

V.4242-A.1
Sept. 1938

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class A AF Amp. and Mod.		
	Direct anode voltage	1,250	1,000
Grid bias	—70	—46	volts
Direct anode current	0.060	0.075	amps.
Load impedance	10,000	7,000	ohms
Undistorted output	18	12	watts

	Class B AF Amp. and Mod. For balanced 2 valve circuits.		
	Direct anode voltage	1,250	1,000
Grid bias	—80	—55	volts
Anode current per valve—zero signal	0.030	0.030	amps.
Anode current per valve—maximum signal	0.150	0.150	amps.
Anode dissipation	80	70	watts
Load resistance—anode to anode	8,000	6,000	ohms
Maximum output—2 valves	200	160	watts

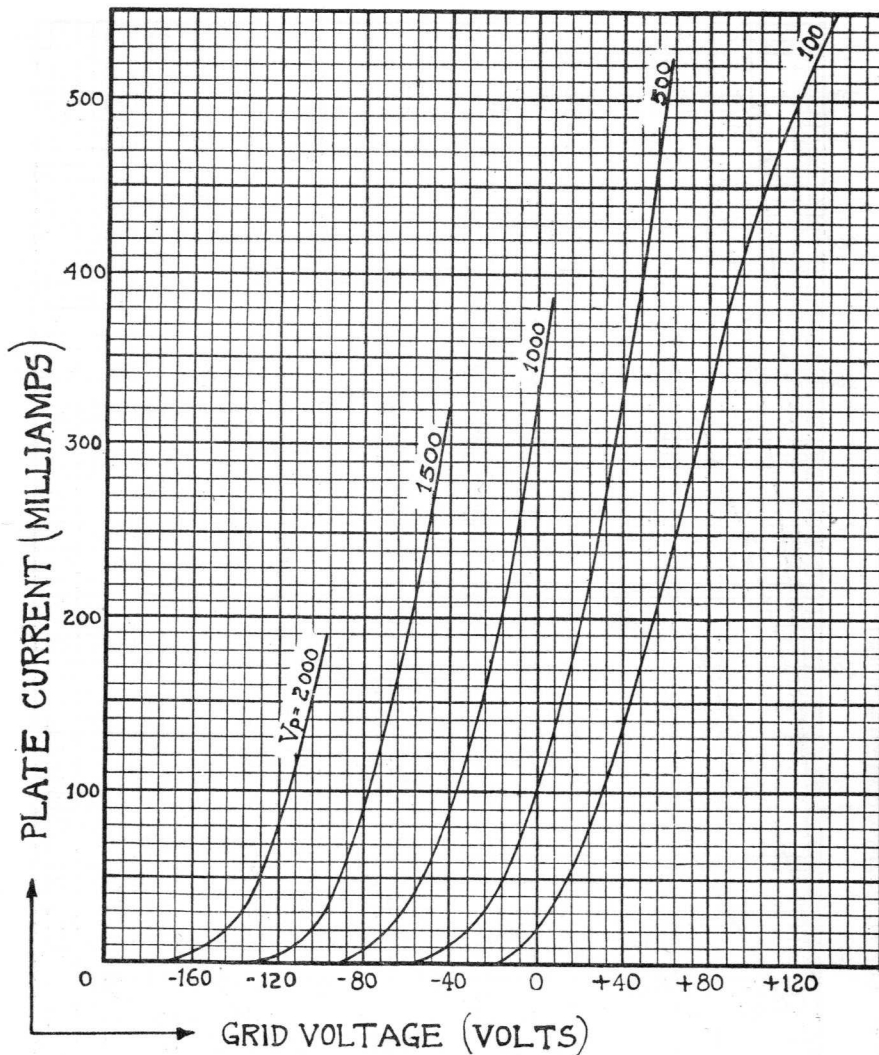
RADIO FREQUENCY OPERATION.

	Class B Telephony		Class C Telephony		Class C Telegraphy	
	Modulated carrier applied to grid		Subject to anode modulation		Unmodulated	
Direct anode voltage	1,250	1,000	1,000	750	1,250	1,000 volts
Direct anode current	0.106	0.130	0.150	0.130	0.150	0.150 amps.
Grid bias	—90	—70	—160	—120	—150	—120 to
Carrier output	44	43	100	64	—200	—160 volts
Anode dissipation	85	85	50	32	130	100 watts
					58	50 watts

The curves on sheet V.4242-A.2 are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.

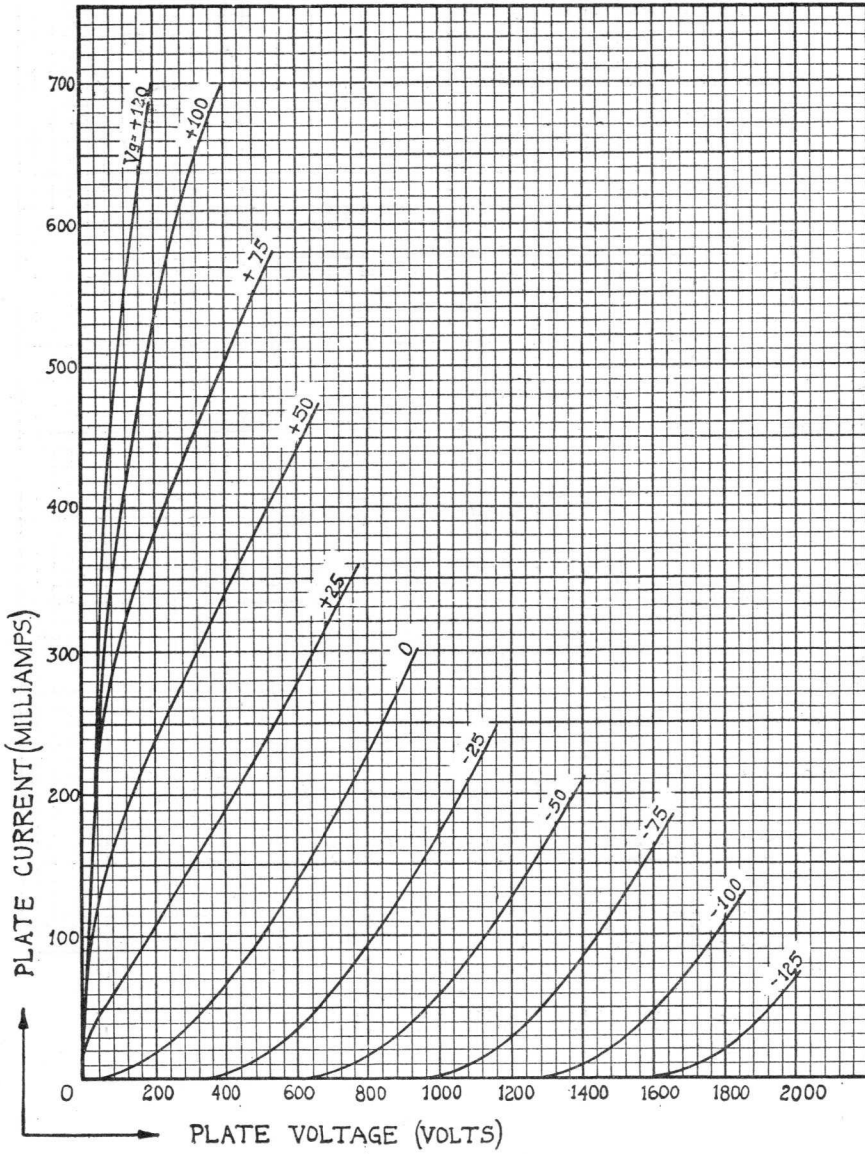
—Standard Valves—

4242-A
Valve



V.4242-A.2
Nov. 1937

—Standard Valves—



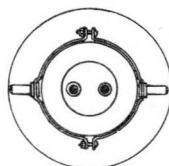
—Standard Valves—

4251-A
Valve

4251-A VALVE

TRIODE.

SPECIFICATION.



Cathode.

Thoriated tungsten filament.
Constant voltage type.

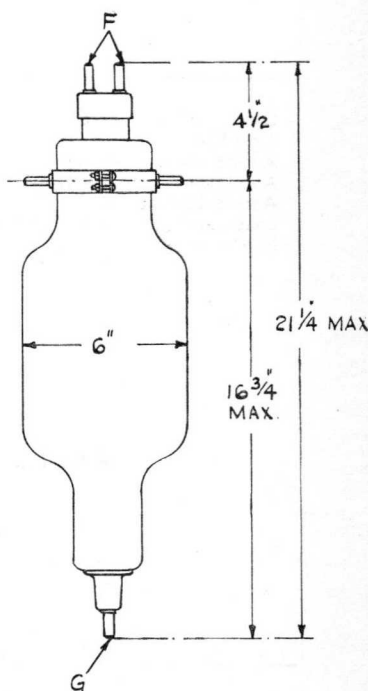
Dimensions.

Max. overall length $21\frac{1}{4}$ " (54 cms.)
Bulb diameter 6" (15.2 cms.)
Net weight 3.3 lbs. (1,500 gms.)

Constants.

Filament voltage	10 volts
Nominal filament current	16 amps.
Total emission	6 amps.
*Impedance	2,750 ohms
*Amplification factor	10.5
*Mutual conductance	3.8 mA. per volt
Grid-anode capacity	8 $\mu\mu\text{F}$.
Anode-filament capacity	6 $\mu\mu\text{F}$.
Grid-filament capacity	10 $\mu\mu\text{F}$.

* at $V_p = 2,500$ volts, $I_p = 200$ mA.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	3,000 volts
Maximum direct anode current	0.600 amps.
Maximum anode dissipation	1,000 watts
Maximum grid dissipation	50 watts
Maximum frequency for above ratings	30 Mc.
Maximum anode voltage for frequency of 50 Mc.	2,000 volts

V.4251-A.1
Sept. 1938

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class A	A.F. Amp. and Mod.	
Direct anode voltage	2,500	2,000	volts
Grid bias	—150	—90	volts
Direct anode current	0.240	0.300	amps.
Load impedance	6,500	4,000	ohms
Undistorted output	130	85	watts

	Class B	A.F. Amp. and Mod. For balanced 2 valve circuit	
Direct anode voltage	3,000	2,500	volts
Grid bias	—250	—200	volts
Anode current per valve—zero signal	0.075	0.075	amps.
Anode current per valve—maximum signal	0.600	0.600	amps.
Anode dissipation	800	675	watts
Load resistance—anode to anode	4,500	3,700	ohms
Maximum output—2 valves	2,000	1,650	watts

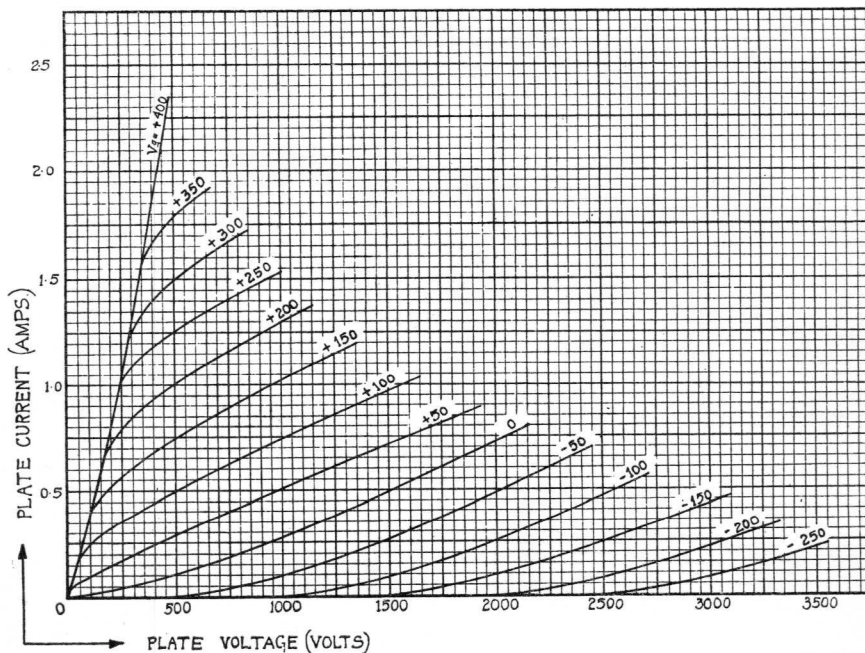
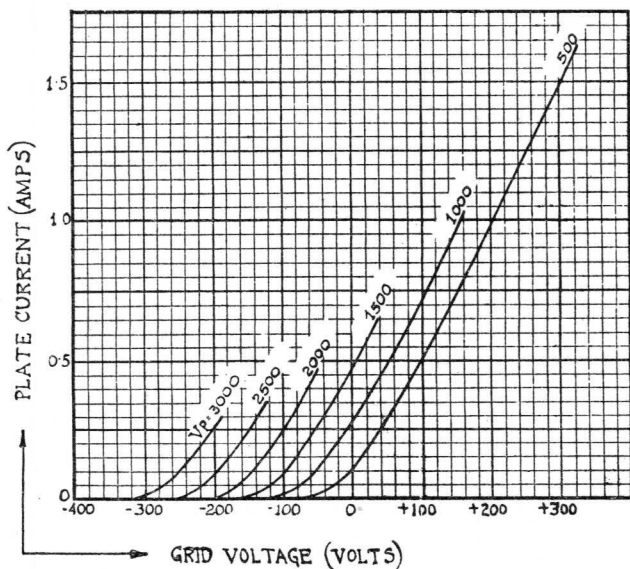
RADIO FREQUENCY OPERATION.

	Class B Telephony		Class C Telephony		Class C Telegraphy	
	Modulated carrier applied to grid		Subject to anode modulation		Unmodulated	
Direct anode voltage	3,000	2,500	2,250	1,750	3,000	2,500 volts
Direct anode current	0.400	0.500	0.400	0.500	0.600	0.600 amps.
Grid bias	—300	—250	—450	—360	—450 —600	—375 to —500 volts
Carrier output	400	420	600	585	1,200	1,000 watts
Anode dissipation	800	830	300	290	600	500 watts

—Standard Valves—

4251-A
Valve

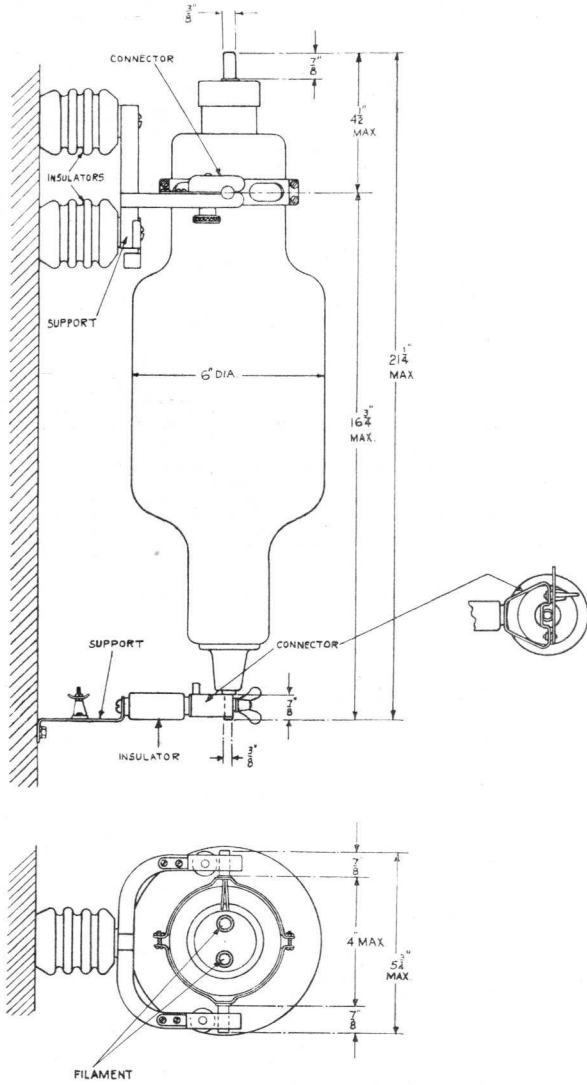
These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



V.4251-A.2
Sept. 1938

4251-A
Valve

—Standard Valves—



PRINTED IN
ENGLAND

—Standard Valves—

4251-AX
Valve

4251-AX VALVE

TRIODE.

SPECIFICATION.

Cathode.

Thoriated tungsten filament.
Constant voltage type.

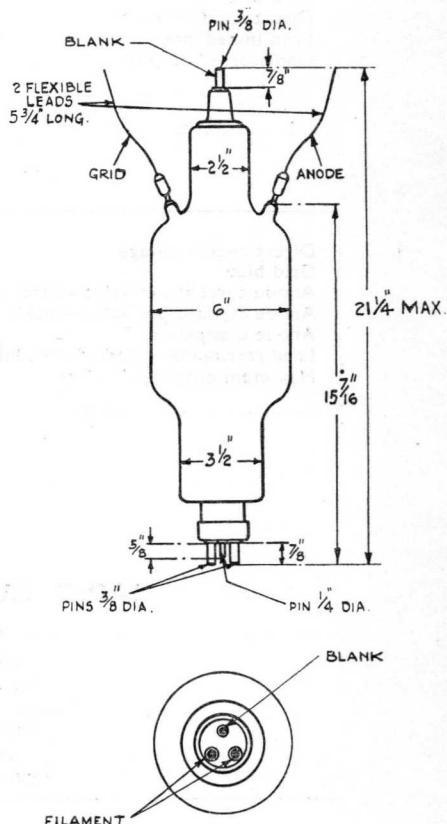
Dimensions.

Max. overall length $21\frac{1}{4}$ " (54 cms.)
Bulb diameter 6" (15.2 cms.)
Net weight $2\frac{3}{4}$ lbs. (1,250 gms.)

Constants.

Filament voltage 10 volts
Nominal filament current 16 amps.
Total emission 6 amps.
*Impedance 2,750 ohms
*Amplification factor 10.5
*Mutual conductance 3.8 mA. per volt.
Grid-anode capacity 8.6 μ F.
Anode-filament capacity 5.2 μ F.
Grid-filament capacity 12 μ F.

* at $V_p = 2,500$ volts, $I_p = 200$ mA.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	3,000 volts
Maximum direct anode current	0.600 amps.
Maximum anode dissipation	1,000 watts
Maximum grid dissipation	50 watts
Maximum frequency for above ratings	30 Mc.
Maximum anode voltage for frequency of 50 Mc.	2,000 volts

V.4251-AX.1
March, 1939

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class A A.F. Amp. and Mod.	
Direct anode voltage	2,500	2,000 volts
Grid bias	—150	—90 volts
Direct anode current	0.240	0.300 amps.
Load impedance	6,500	4,000 ohms
Undistorted output	130	85 watts

	Class B A.F. Amp. and Mod. For balanced 2 valve circuit	
Direct anode voltage	3,000	2,500 volts
Grid bias	—250	—200 volts
Anode current per valve—zero signal	0.075	0.075 amps.
Anode current per valve—maximum signal	0.600	0.600 amps.
Anode dissipation	800	675 watts
Load resistance—anode to anode	4,500	3,700 ohms
Maximum output—2 valves	2,000	1,650 watts

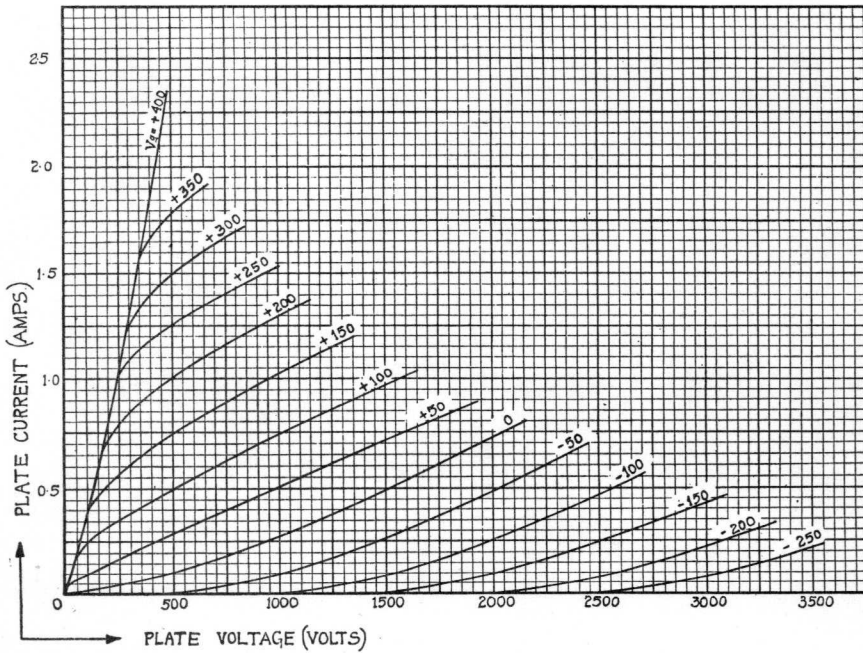
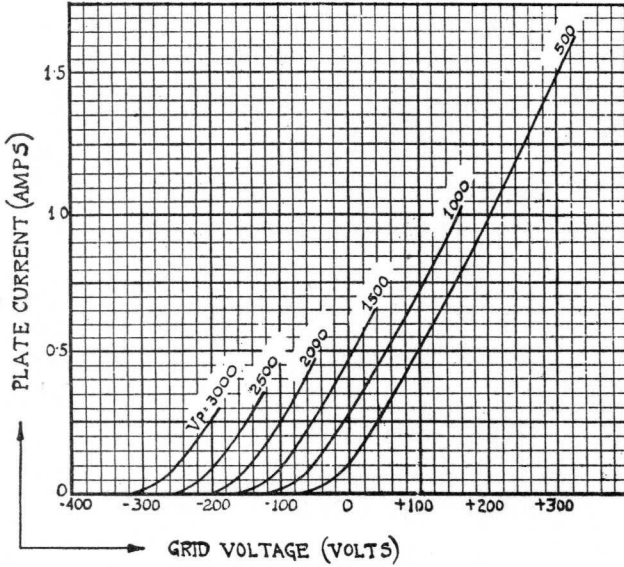
RADIO FREQUENCY OPERATION.

	Class B Telephony		Class C Telephony		Class C Telegraphy	
	Modulated carrier applied to grid		Subject to anode modulation		Unmodulated	
Direct anode voltage	3,000	2,500	2,250	1,750	3,000	2,500 volts
Direct anode current	0.400	0.500	0.400	0.500	0.600	0.600 amps.
Grid bias	—300	—250	—450	—360	—450	—375 to
					—600	—500 volts
Carrier output	400	420	600	585	1,200	1,000 watts
Anode dissipation	800	830	300	290	600	500 watts

—Standard Valves—

4251-AX
Valve

These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



Standard Valves

These curves show the relationship between the valve lift and the valve velocity for the various valve sizes and lift heights.



Figure 1. Valve Lift vs. Valve Velocity

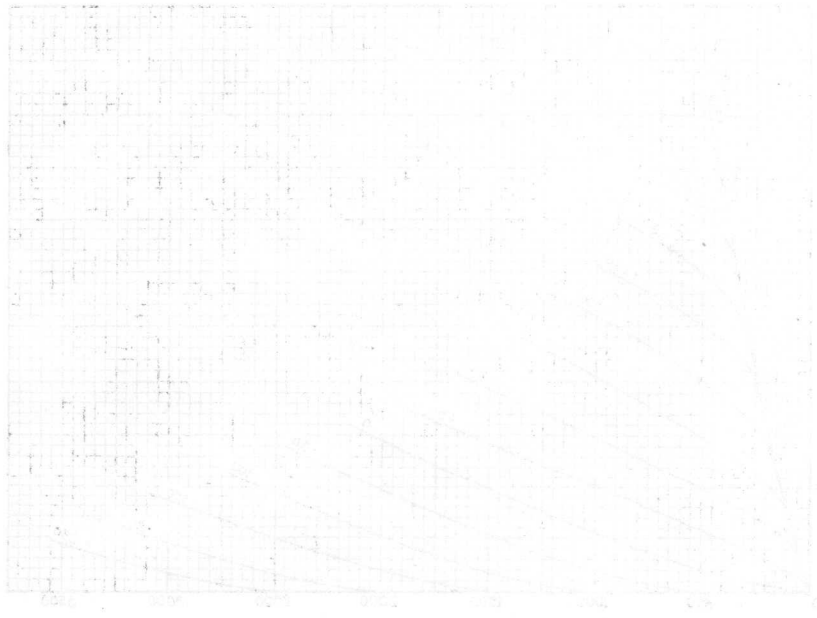


Figure 2. Valve Lift vs. Valve Velocity

—Standard Valves—

4260-A
Valve

4260-A VALVE

TETRODE.

SPECIFICATION.

Cathode.

Thoriated Tungsten filament.
Constant voltage type.

Base.

American medium 4-pin bayonet.

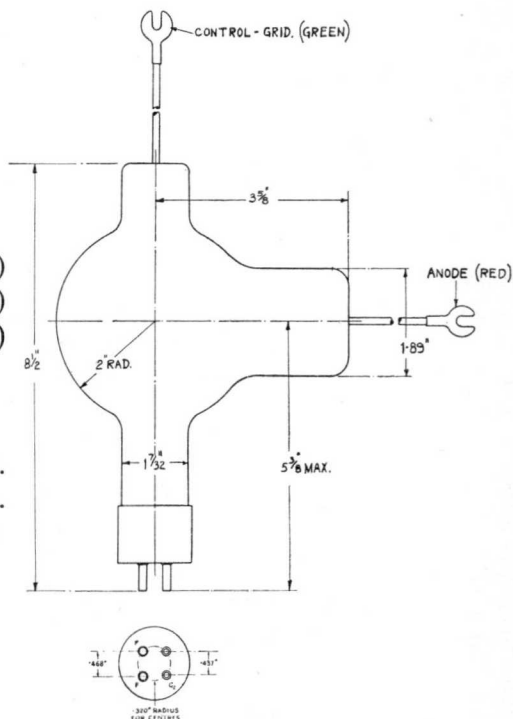
Dimensions.

Overall length $8\frac{1}{2}$ " (21.6 cms.)
Maximum width $5\frac{5}{8}$ " (14.3 cms.)
Net weight 0.5 lbs. (225 gms.)

Constants.

Filament voltage 10 volts
Nominal filament current 3.25 amps.
Total emission 1.5 amps.
*Impedance 175,000 ohms
*Amplification factor 200
Grid-anode capacity 0.09 $\mu\mu\text{F}$.
Input capacity 7.8 $\mu\mu\text{F}$.
Output capacity 6.75 $\mu\mu\text{F}$.

* at anode current of 0.033 amps.



LIMITING CONDITIONS FOR SAFE OPERATION.

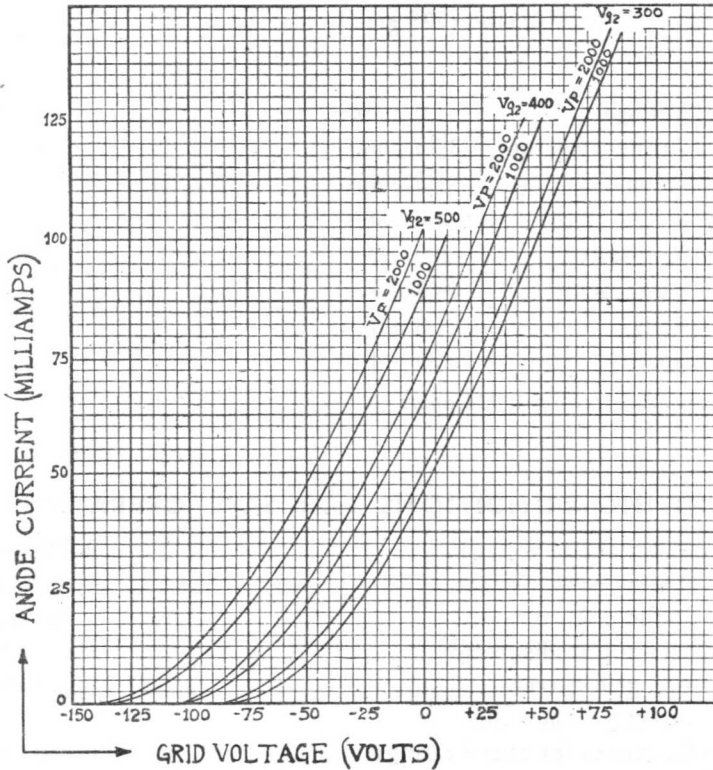
Maximum direct anode voltage	3,000 volts
Maximum direct anode current	0.100 amps.
Maximum anode dissipation	100 watts
Maximum screen grid dissipation	15 watts
Maximum R.F. grid current	10 amps.
Maximum direct grid current	40 mA.
Maximum frequency for above ratings	30 Mc.
Maximum anode voltage for frequency of 40 Mc.	2,500 volts

V.4260-A.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS. RADIO FREQUENCY OPERATION.

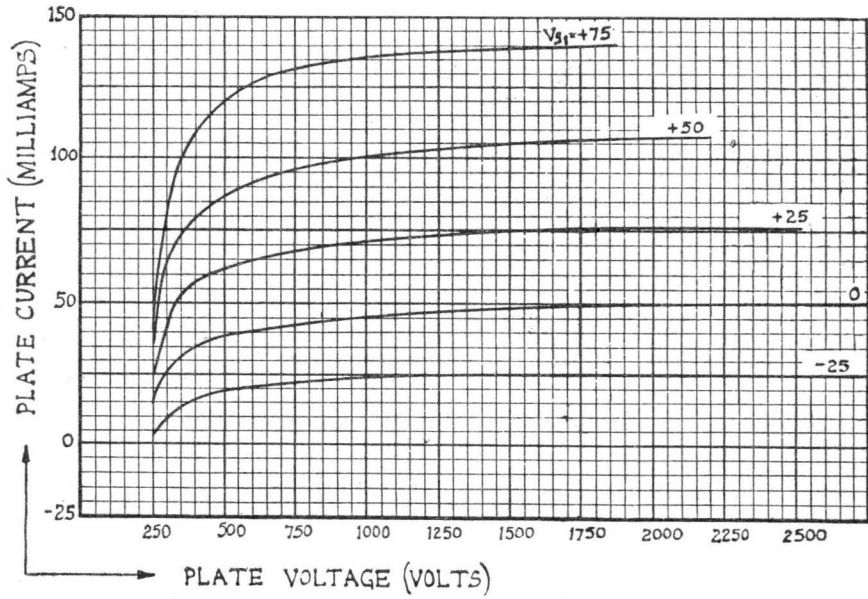
	Class B Telephony		Class C Telephony		Class C Telegraphy	
	Modulated Carrier applied to grid		Subject to anode modulation		Unmodulated	
Direct anode voltage	3,000	2,000	2,000	1,500	3,000	2,000 volts
Control-grid bias	-100	-100	-200	-200	-150	-150 to -200
Direct screen-grid voltage	300	300	300	300	300	300 volts
Direct anode current	0.050	0.075	0.100	0.100	0.100	0.100 amps.
Anode dissipation	100	100	65	50	100	65 watts
Carrier output	50	50	135	100	200	135 watts



PRINTED IN
ENGLAND

—Standard Valves—

4260-A
Valve



A-637
3/1/67

Chamberlain, W. H. 1967



PRINTED IN
ENGLAND

—Standard Valves—

4264-A
Valve

4264-A VALVE

TRIODE.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant current type.

Base.

American tapered small 4-pin.

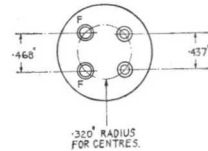
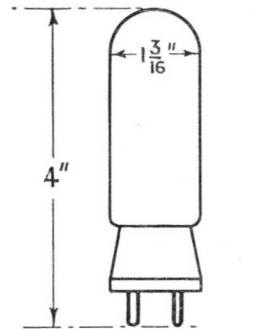
Dimensions.

Overall length 4" (10.2 cms.)
Bulb diameter $1\frac{3}{16}$ " (3.0 cms.)
Net weight 0.07 lbs. (30 gms.)

Constants.

Filament current 0.3 amp.
Nominal filament voltage 1.5 volts
*Impedance 12,900 ohms
*Amplification factor 7.0
*Mutual conductance 0.54 mA. per volt
Grid-anode capacity 5.3 $\mu\mu\text{F}$.
Anode-filament capacity 2.2 $\mu\mu\text{F}$.
Grid-filament capacity 3.5 $\mu\mu\text{F}$.

* at anode current of 2.0 mA.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage 100 volts
Maximum direct anode current 2.8 mA.

V.4264-A.1
Nov. 1937

—Standard Valves—

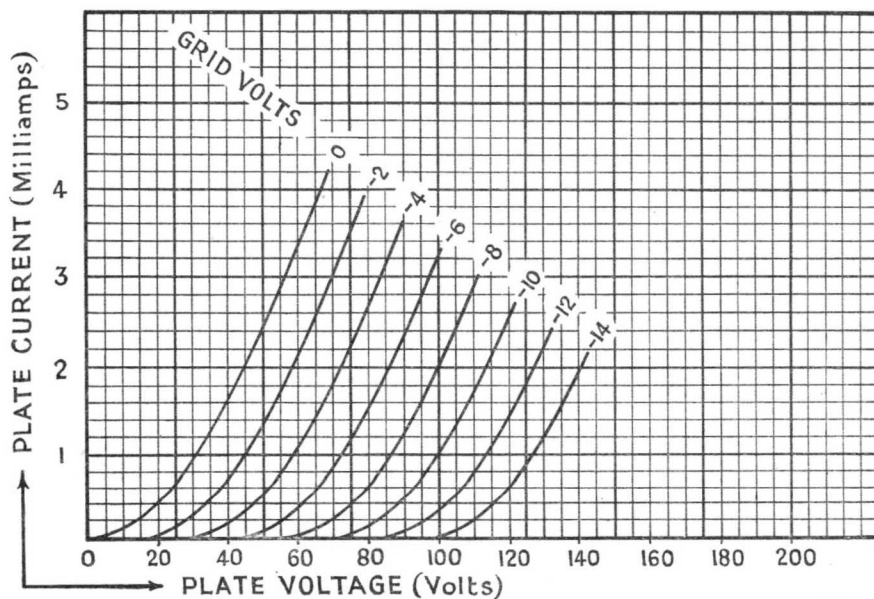
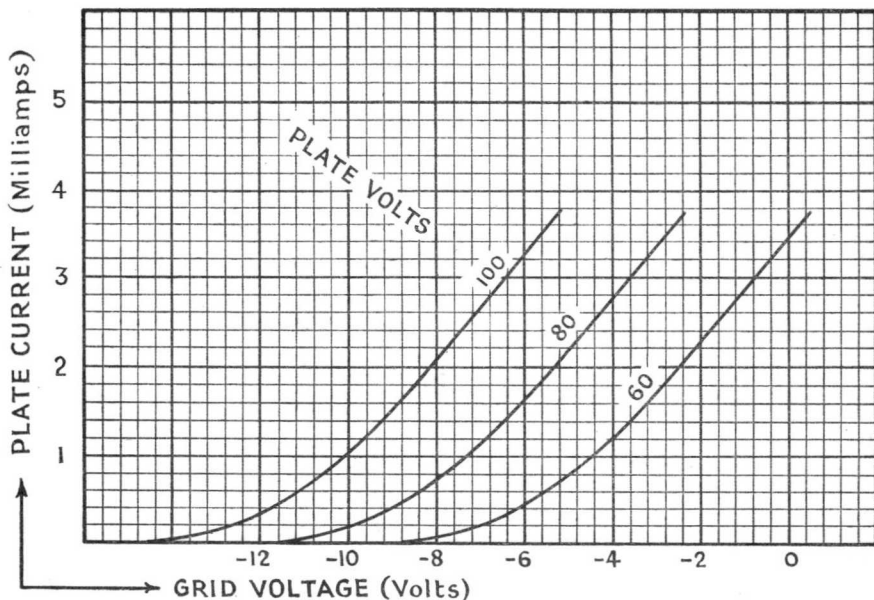
TYPICAL OPERATING CONDITIONS.

Anode voltage	Grid bias	Anode current	Amplification factor	Anode resistance	Load resistance	Power output	Voltage output	Second harmonic
volts	volts	mA.		ohms	R	mW.	peak volts	db
60	-2.0	2.35	7.3	11,700	R=rp	2.4	—	38
					R=2rp	2.1	—	44
					R=5rp	—	12	51
90	-7.0	1.90	7.2	12,800	R=rp	25	—	24
					R=2rp	23	—	31
					R=5rp	—	41	39
100	-8.0	2.10	7.2	12,400	R=rp	33	—	24
					R=2rp	30	—	31
					R=5rp	—	48	39
90	-5.5	2.80	7.2	11,300	R=rp	18	—	30
					R=2rp	16	—	36
					R=5rp	—	33	44
100	-7.0	2.70	7.2	11,400	R=rp	28	—	28
					R=2rp	25	—	34
					R=5rp	—	42	42

—Standard Valves—

4264-A
Valve

These curves are taken with direct filament heating, grid and anode voltages being referred to the negative end of the filament.



A 1851

— Standard —

PRINTED IN
ENGLAND

—Standard Valves—

4270-A
Valve

4270-A VALVE

TRIODE.

SPECIFICATION.

Cathode.

Thoriated Tungsten filament.
Constant voltage type.

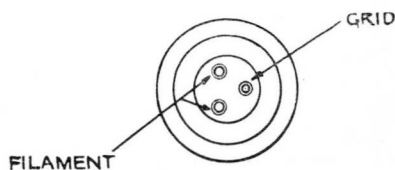
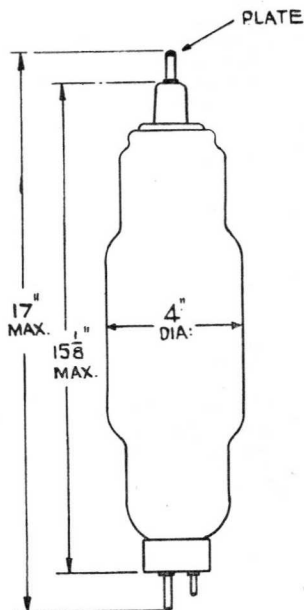
Dimensions.

Overall length 17" (43 cms.)
Maximum diameter 4" (10.2 cms.)
Net weight 1 $\frac{1}{3}$ lbs. (600 gms.)

Constants.

Filament voltage 10 volts
Nominal filament current 9.75 amps.
Total emission 4.0 amps.
*Impedance 2,800 ohms
*Amplification factor 16
Grid-anode capacity 21 $\mu\mu\text{F}$.
Anode-filament capacity 2 $\mu\mu\text{F}$.
Grid-filament capacity 18 $\mu\mu\text{F}$.

* at anode current of 0.12 amps.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	3,000 volts
Maximum direct anode current	0.375 amps.
Maximum anode dissipation	350 watts
Maximum direct grid current	0.075 amps.
Maximum frequency for above ratings	7.5 Mc.
Maximum anode voltage for frequency of 22.5 Mc.	1,000 volts

V.4270-A.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class A A.F. Amp. or Mod.	
Direct anode voltage	2,500	2,000 volts
Grid bias	—130	—95 volts
Direct anode current	0.120	0.150 amps.
Anode dissipation	300	300 watts
Load impedance	15,000	10,000 ohms
Undistorted output	90	70 watts

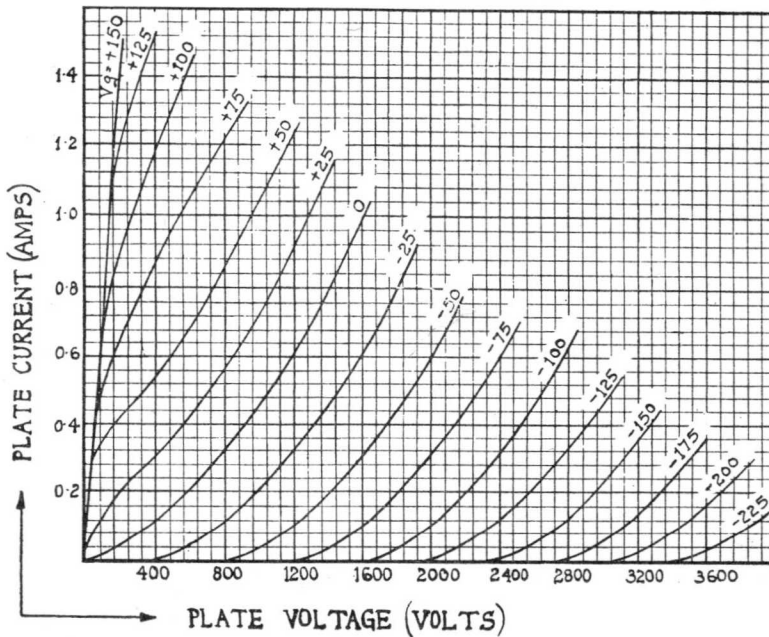
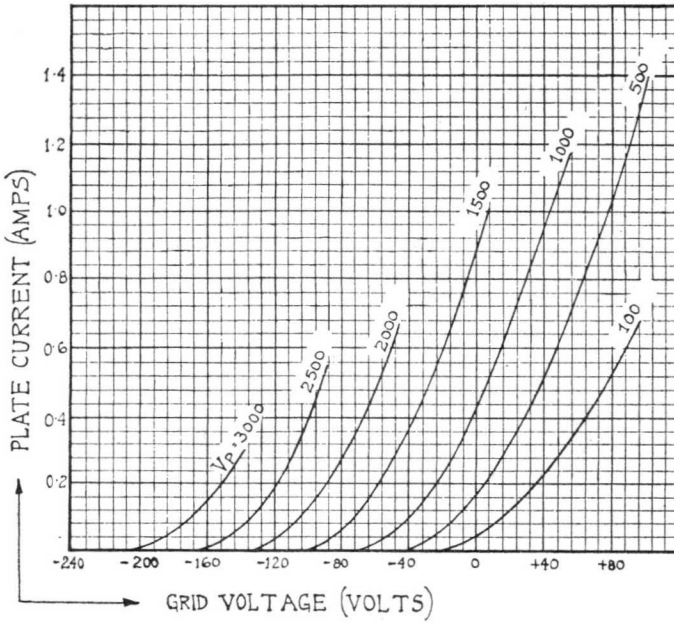
	Class B A.F. Amp. and Mod. For balanced 2 valve circuit	
Direct anode voltage	2,500	2,000 volts
Grid bias	—140	—105 volts
Anode current per valve—zero signal	0.060	0.060 amps.
Anode current per valve—maximum signal	0.375	0.375 amps.
Load resistance—anode to anode	8,000	6,000 ohms
Anode dissipation	350	350 watts
Maximum output—2 valves	1,000	850 watts

RADIO FREQUENCY OPERATION.

	Class B Telephony		Class C Telephony		Class C Telegraphy	
	Modulated Carrier applied to grid		Subject to anode modulation		Unmodulated	
Direct anode voltage	3,000	2,500	2,250	1,750	3,000	1,750 volts
Direct anode current	0.175	0.210	0.300	0.350	0.350	0.350 amps.
Grid bias	—180	—140	—300	—240	—315	—225 to
Carrier output	175	175	450	410	—420	—340 volts
Anode dissipation	350	350	225	200	700	585 watts
					350	290 watts

—Standard Valves—

4270-A
Valve



V.4270-A.2
Nov. 1937

4011
WCV

2000 1000 1000 1000

PRINTED IN
ENGLAND

—Standard Valves—

4274-A
Valve

4274-A VALVE

FULL WAVE THERMIONIC HIGH VACUUM RECTIFIER.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant voltage type.

Base.

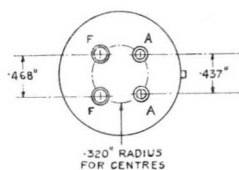
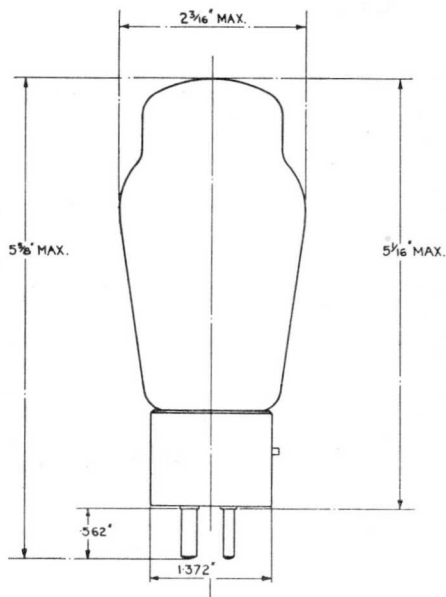
American medium 4-pin bayonet.

Dimensions.

Overall length $5\frac{5}{8}"$ (14.3 cms.)
Overall diameter $2\frac{3}{16}"$ (5.5 cms.)
Net weight 0.12 lbs. (55 gms.)

Constants.

Filament voltage 5 volts
Nominal filament current 2 amps.



V.4274-A.1
Nov. 1937

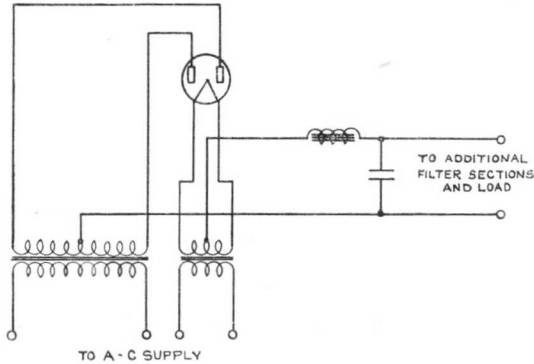
—Standard Valves—

TYPICAL OPERATING CONDITIONS.

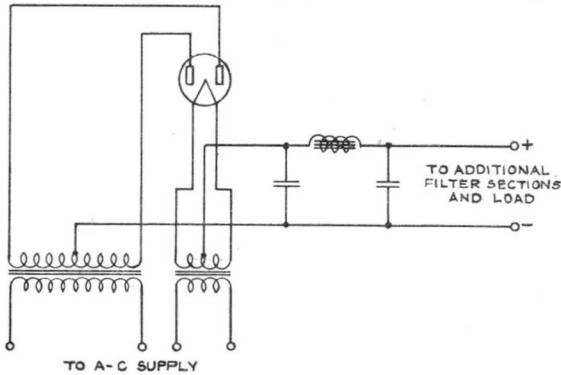
Input Filter	R.M.S. A.C. voltage per anode	Total rectified current—mA.
Choke—circuit A	550	160
	*550	200
	*660	160
Condenser—Circuit B	450	140
	*450	†150

* Maximum operating conditions.

† 4 u/F. max. input filter capacity.



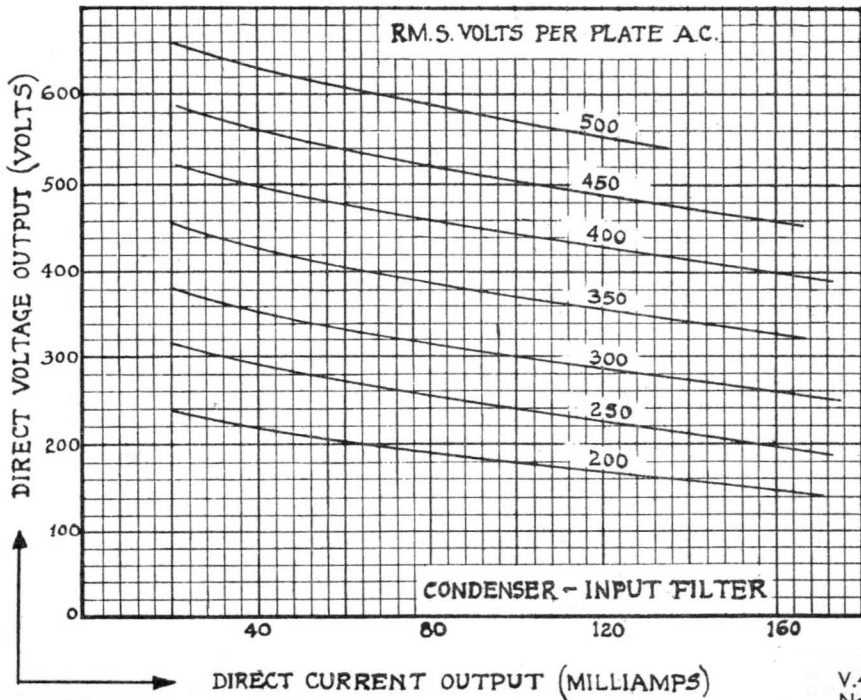
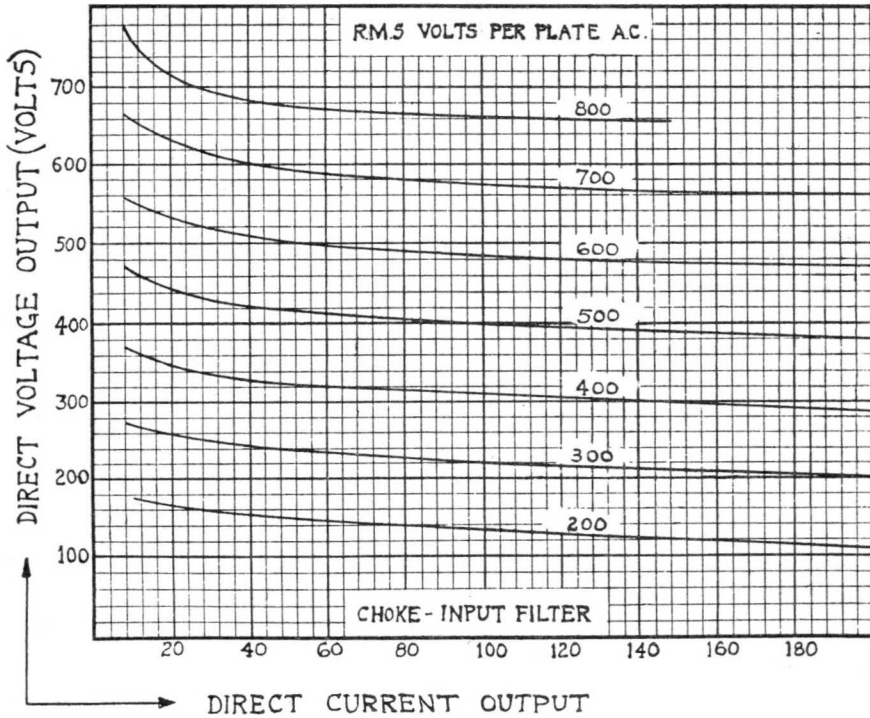
CHOKE INPUT FILTER
CIRCUIT A



CONDENSER INPUT FILTER
CIRCUIT B

—Standard Valves—

4274-A
Valve



V.4274-A.2
Nov. 1937

40
185

STANDARD FORM NO. 64

PRINTED IN
ENGLAND

—Standard Valves—

4275-A
Valve

4275-A VALVE

TRIODE.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant voltage type.

Base.

American medium 4-pin bayonet.

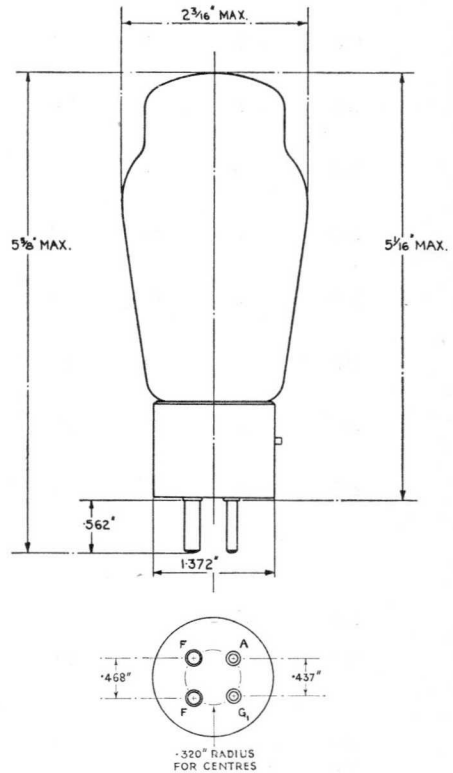
Dimensions.

Overall length $5\frac{3}{8}$ " (14.3 cms.)
Diameter $2\frac{3}{16}$ " (5.5 cms.)
Net weight 0.12 lbs. (55 gms.)

Constants.

Filament voltage 5 volts
Nominal filament current 1.2 amps.
*Amplification factor 2.8
*Impedance 1,000 ohms
Grid-anode capacity $12 \mu\text{F}$.
Anode-filament capacity $3.2 \mu\text{F}$.
Grid-filament capacity $6.8 \mu\text{F}$.

* at anode current of 53 mA.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum anode voltage	300 volts
Maximum anode dissipation	17 watts
Maximum anode current of average valve for fixed grid bias	70 mA.
Maximum anode current for manually adjusted grid bias or self-biasing circuit	80 mA.

V.4275-A.1
Nov. 1937

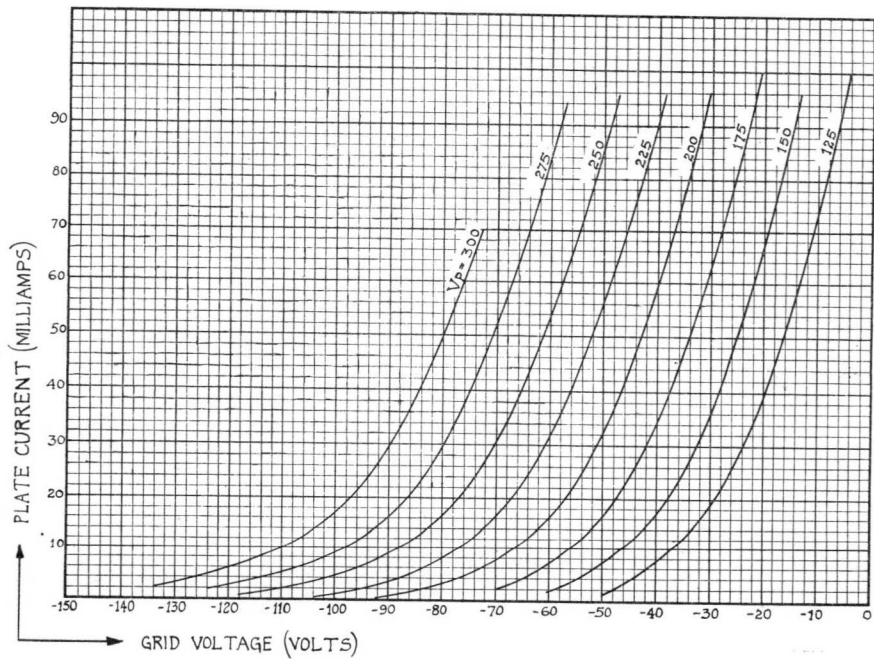
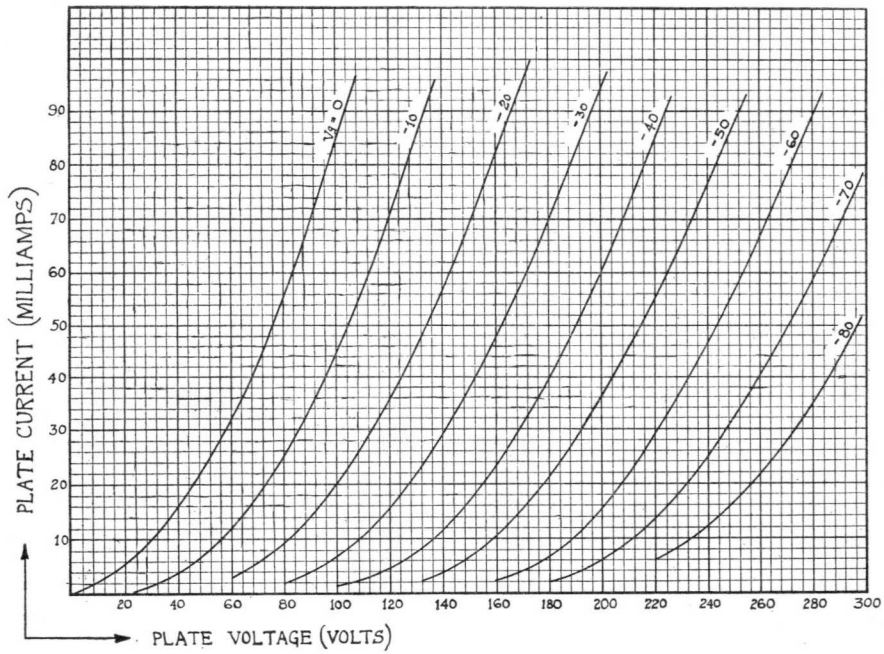
—Standard Valves—

Anode voltage	Grid bias	Anode current	Amplification factor	Anode resistance	Mutual conductance	Load resistance	Power output	Second harmonic
volts	volts	mA.		ohms	mA. per v	ohms	watts	db
150	—40	17	2.6	1,630	1.600	3,260 6,520	0.81 0.58	19 23
150	—30	38	2.8	1,065	2.700	1,065 2,130 4,260	0.86 0.77 0.56	19 24 29
150	—20	70	3.0	810	3.700	810 1,620 3,240	0.55 0.49 0.36	26 30 34
200	—55	24	2.6	1,530	1.750	1,530 3,060 6,120	2.0 1.6 1.2	15 19 23
200	—50	34	2.7	1,230	2.250	1,230 2,460 4,920	2.0 1.8 1.3	16 20 25
200	—45	47	2.8	1,030	2.770	1,030 2,060 4,120	1.9 1.7 1.3	18 22 27
200	—40	61	2.9	885	3.270	885 1,770 3,540	1.8 1.6 1.2	20 25 29
250	—70	30	2.6	1,400	1.880	3,000 6,000 10,000	2.8 2.0 1.4	18 23 26
250	—65	41	2.7	1,170	2.330	2,000 4,000 8,000	3.2 2.5 1.5	19 23 28
250	—60	53	2.8	1,000	2.780	2,000 3,000 4,000 6,000 8,000 10,000	3.1 2.6 2.3 1.7 1.4 1.2	21 23 25 28 29 30
*200	—35	78	2.9	780	3.750	1,560 3,120	1.5 1.1	27 31
*250	—55	68	2.8	870	3.220	1,000 3,000 6,000 8,000	3.3 2.4 1.6 1.2	19 26 30 31
*300	—100	18	2.4	2,420	1.000	9,680	2.3	20
*300	—95	23	2.5	1,910	1.280	7,640	2.6	21
*300	—90	30	2.6	1,560	1.630	6,240	3.0	22
*300	—85	41	2.6	1,300	2.030	2,600 5,200	4.7 3.3	18 23
*300	—80	51	2.7	1,100	2.450	2,200 4,400	4.9 5.5	19 24

* Maximum operating conditions.

—Standard Valves—

4275-A
Valve



V.4275-A.2
Nov. 1937

A-250

PRINTED IN
ENGLAND

—Standard Valves—

4278-A
Valve

4278-A VALVE

TETRODE.

SPECIFICATION.

Cathode.

Thoriated Tungsten filament.
Constant voltage type.

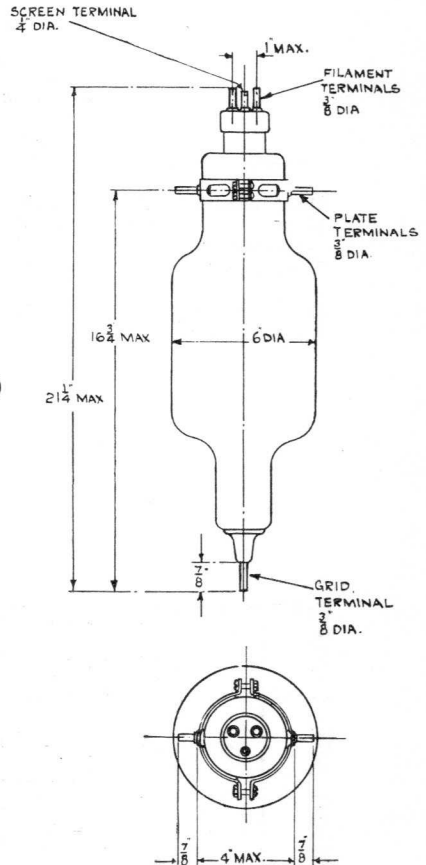
Dimensions.

Overall length $21\frac{1}{4}$ " (54 cms.)
Maximum diameter 6" (15.2 cms.)
Net weight $3\frac{1}{8}$ lbs. (1,500 gms.)

Constants.

Filament voltage 10 volts
Nominal filament current 15.6 amps.
Total emission 6 amps.
*Impedance 105,000 ohms
*Amplification factor 400
Control grid-anode capacity 0.60 $\mu\mu\text{F}$.
Input capacity 31 $\mu\mu\text{F}$.
Output capacity 29.4 $\mu\mu\text{F}$.

* at $V_p = 3,000$ volts, $V_{g_1} = 75$ volts.
 $V_{g_2} = 750$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

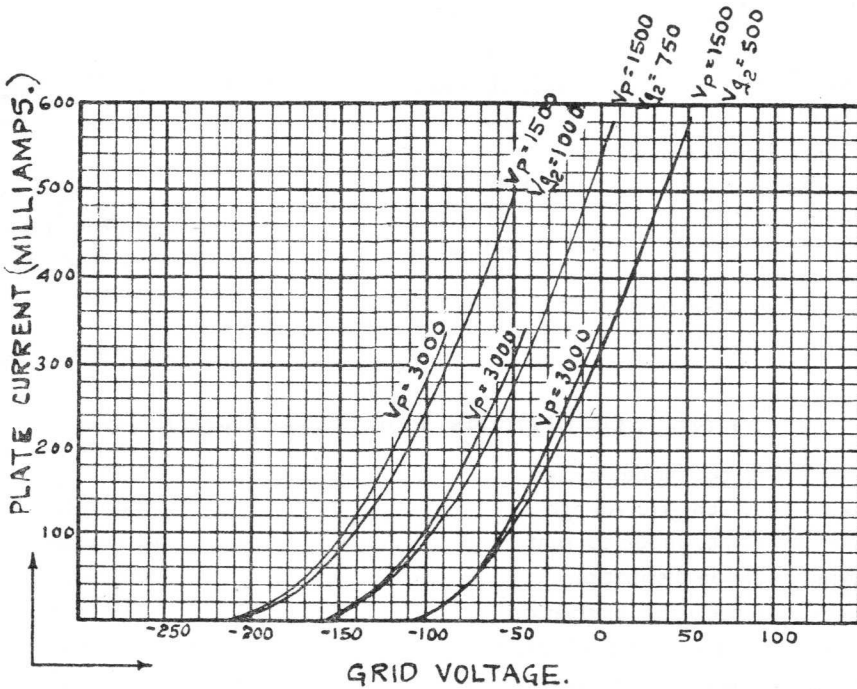
Maximum direct anode voltage	3,000 volts
Maximum screen-grid voltage	750 volts
Maximum direct anode current	0.600 amps.
Maximum anode dissipation	800 watts
Maximum screen-grid dissipation	75 watts
Maximum control-grid dissipation	50 watts
Maximum frequency for above ratings	30 Mc.
Maximum anode voltage for frequency of 50 Mc.	2,000 volts

V.4278-A-1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS. RADIO FREQUENCY OPERATION.

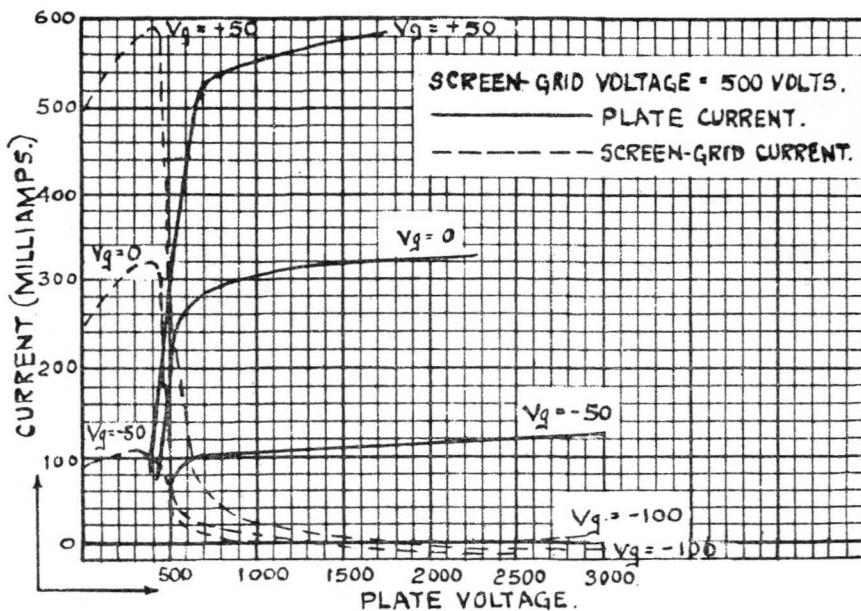
	Class B Telephony		Class C Telephony		Class C Telegraphy	
	Modulated Carrier applied to grid		Subject to anode modulation		Unmodulated	
Direct anode voltage	3,000	2,500	2,250	1,750	3,000	2,500 volts
Direct anode current	0.400	0.480	0.400	0.500	0.500	0.500 amps.
Direct screen-grid voltage	500	500	500	500	500	500 volts
Control grid bias	-110	-110	-165	-165	-165	-165 to -220
Carrier output	400	400	600	580	1,000	850 watts
Anode dissipation	800	800	300	295	500	400 watts



PRINTED IN
ENGLAND

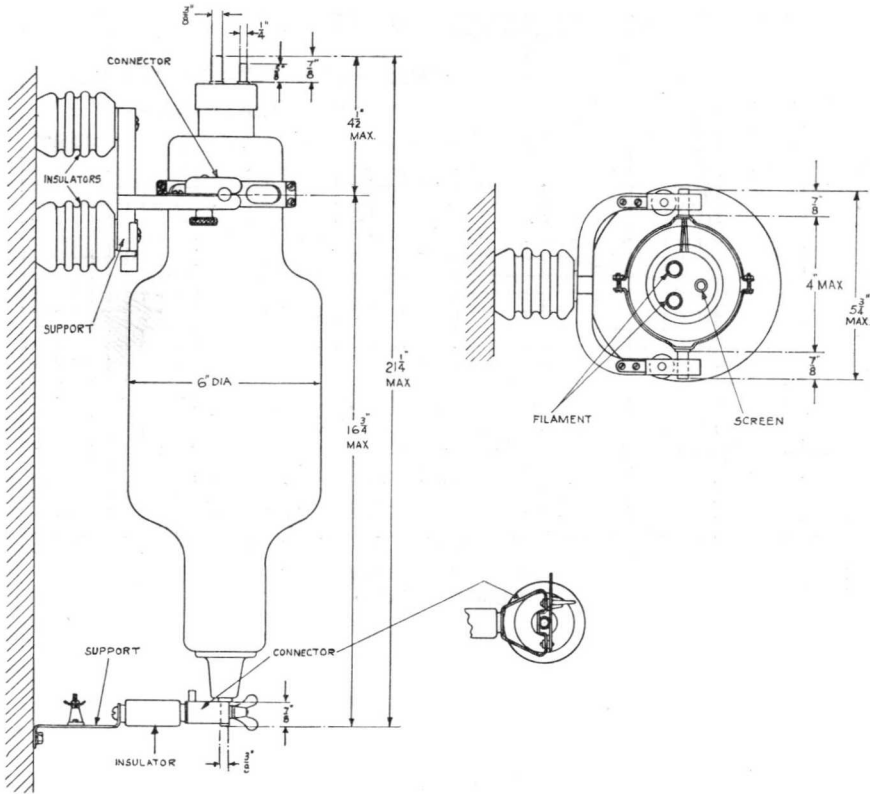
—Standard Valves—

4278-A
Valve



V.4278-A.2
Nov. 1937

—Standard Valves—



—Standard Valves—

4279-A
Valve

4279-A VALVE

TRIODE.

SPECIFICATION.

Cathode.

Thoriated Tungsten filament.
Constant voltage type.

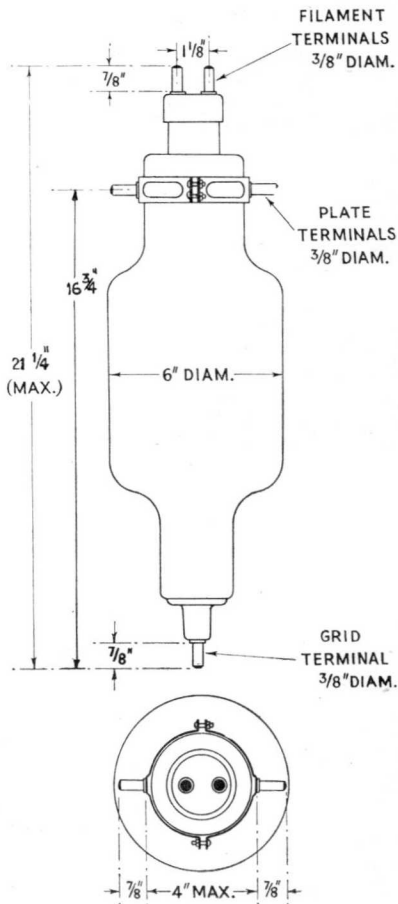
Dimensions.

Overall length $21\frac{1}{4}$ " (54 cms.)
Maximum diameter 6" (15.2 cms.)
Net weight $3\frac{1}{8}$ lbs. (1,500 gms.)

Constants.

Filament voltage 10 volts
Nominal filament current 21 amps.
Total emission 8 amps.
*Impedance 2,000 ohms
*Amplification factor 10
Grid-anode capacity $18\ \mu\mu\text{F}$.
Anode-filament capacity $7\ \mu\mu\text{F}$.
Grid-filament capacity $15\ \mu\mu\text{F}$.

* at anode current of 300 mA.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	3,000 volts
Maximum direct anode current	0-800 amps.
Maximum anode dissipation	1,200 watts
Maximum direct grid current	100 mA.
Maximum frequency for above ratings	20 Mc.
Maximum anode voltage for frequency of 40 Mc.	1,500 volts

V.4279-A.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class A A.F. Amp. and Mod.		
Direct anode voltage	2,500	2,000	volts
Grid bias	—170	—110	volts
Direct anode current	0.300	0.375	amps.
Anode dissipation	750	750	watts
Load impedance	4,500	2,000	ohms
Undistorted output	155	85	watts

	Class B A.F. Amp. and Mod. For balanced 2 valve circuit		
Direct anode voltage	2,500	2,000	volts
Grid bias	—200	—150	volts
Direct anode current per valve—zero signal	0.150	0.110	amps.
Anode current per valve—maximum signal	0.800	0.800	amps.
Anode dissipation	900	720	watts
Load resistance—anode to anode	2,800	2,240	ohms
Maximum output—2 valves	2,200	1,760	watts

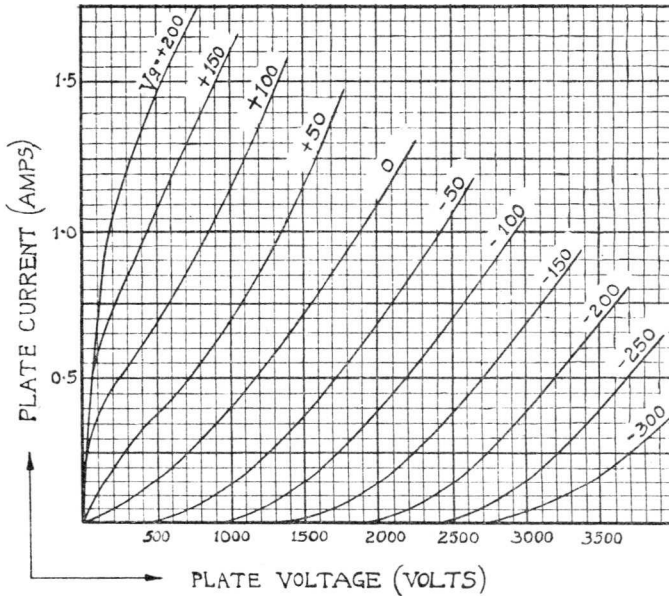
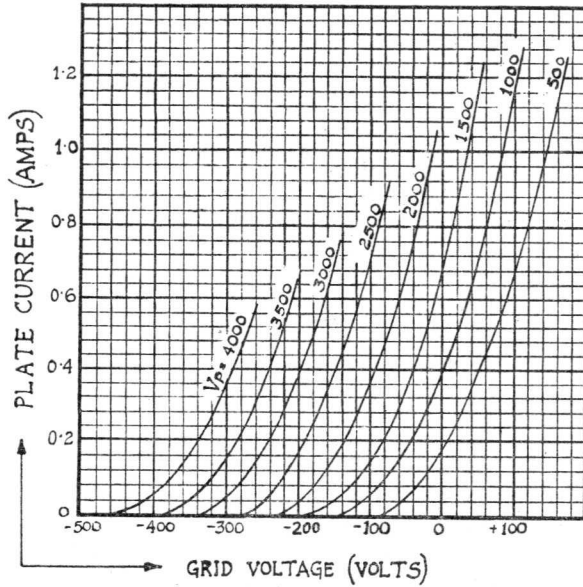
RADIO FREQUENCY OPERATION.

	Class B Telephony		Class C Telephony		Class C Telegraphy	
	Modulated Carrier applied to grid		Subject to anode modulation		Unmodulated	
Direct anode voltage	3,000	2,500	2,250	1,750	3,000	2,500 volts
Direct anode current	0.600	0.720	0.600	0.700	0.800	0.800 amps.
Grid bias	—325	—275	—450	—360	—500 —650	—400 to —540 volts
Carrier output	600	600	900	830	1,600	1,300 watts
Anode dissipation	1,200	1,200	450	395	800	700 watts

—Standard Valves—

4279-A
Valve

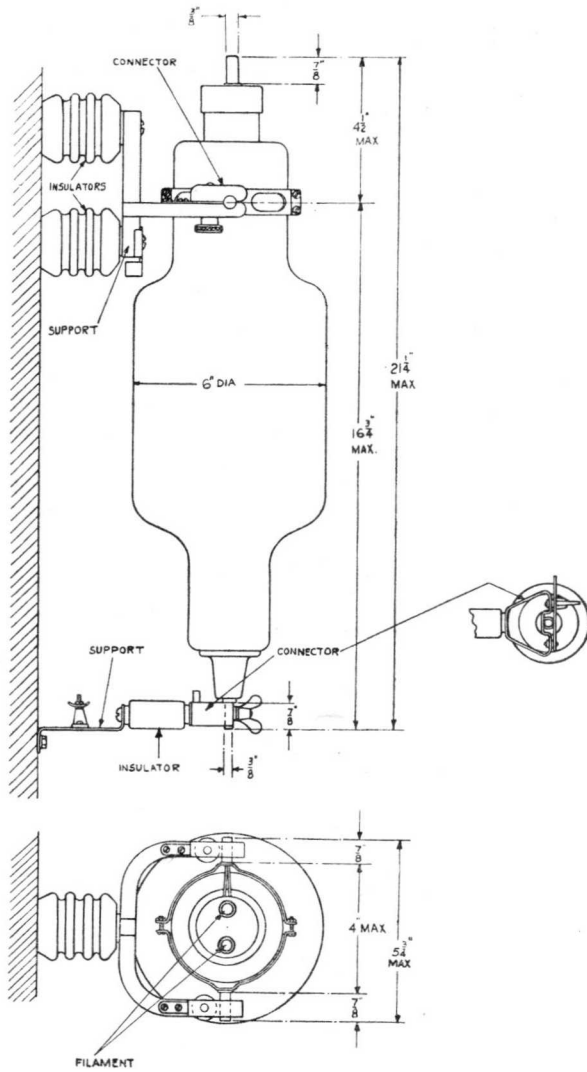
These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



V.4279-A.2
Sept. 1938.

4279-A
Valve

—Standard Valves—



PRINTED IN
ENGLAND

—Standard Valves—

4282-B Valve
-BZ Valve

4282-B, 4282-BZ VALVES

TETRODES.

SPECIFICATION.

Cathode.

Thoriated Tungsten filament.
Constant voltage type.

Base.

4282-B American medium 4-pin. Anode connected to top cap.
4282-BZ—Special 4-pin low loss. Anode connected to top cap.

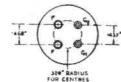
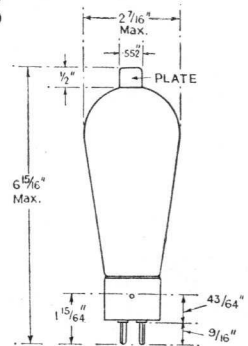
Dimensions.

	4282-B	4282-BZ
Overall length	6 $\frac{15}{16}$ " (17.7 cms.)	6" (15.2 cms.)
Maximum diameter	2 $\frac{7}{16}$ " (6.2 cms.)	2 $\frac{7}{16}$ " (6.2 cms.)
Net weight	0.2 lbs. (90 gms.)	0.3 lbs. (140 gms.)

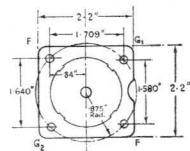
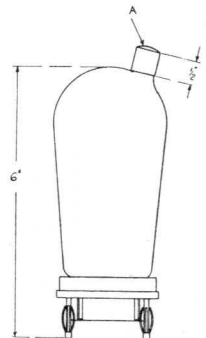
Constants.

Filament voltage	10 volts
Nominal filament current	3 amps.
Total emission	1.25 amps.
*Impedance	70,000 ohms
*Amplification factor	100
Control grid-anode capacity	0.2 $\mu\mu\text{F}$.
Input capacity	12.2 $\mu\mu\text{F}$.
Output capacity	6.8 $\mu\mu\text{F}$.

* at $V_p = 1,000$ volts, $V_{g_2} = 150$ volts,
 $I_p = 70$ mA.



4282-B



4282-BZ

LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	1,000 volts
Maximum direct anode current	0.100 amps.
Maximum anode dissipation	70 watts
Maximum direct grid current	0.050 amps.
Maximum screen-grid voltage	250 volts
Maximum screen-grid dissipation	5 watts
Maximum frequency for above ratings	30 Mc.
Maximum anode voltage for frequency of 60 Mc.	500 volts

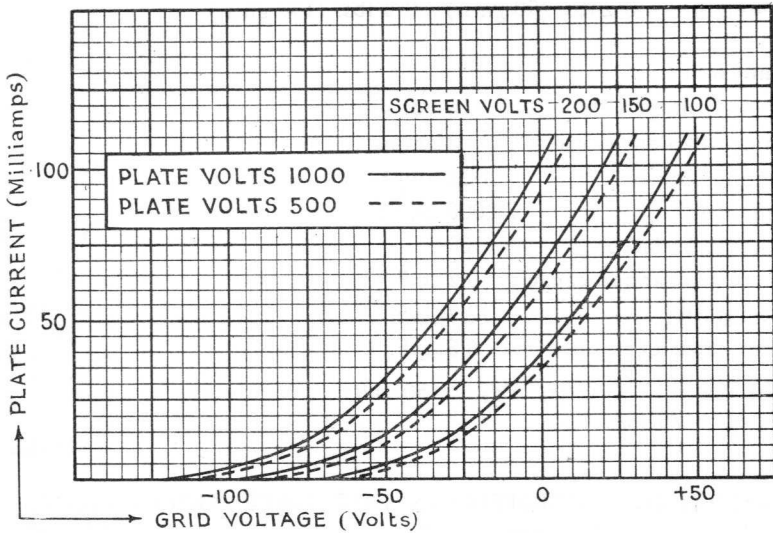
V.4282-BBZ.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

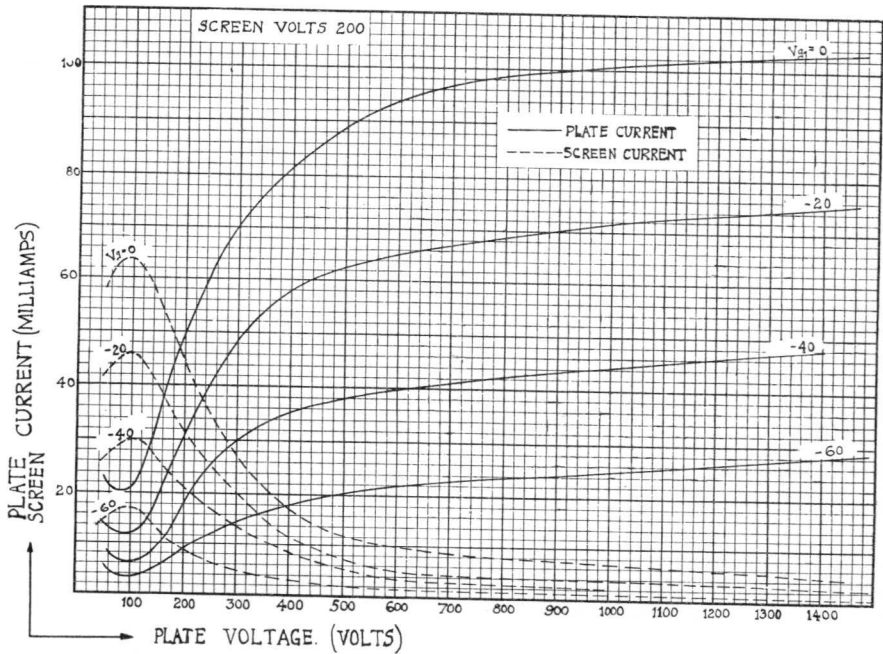
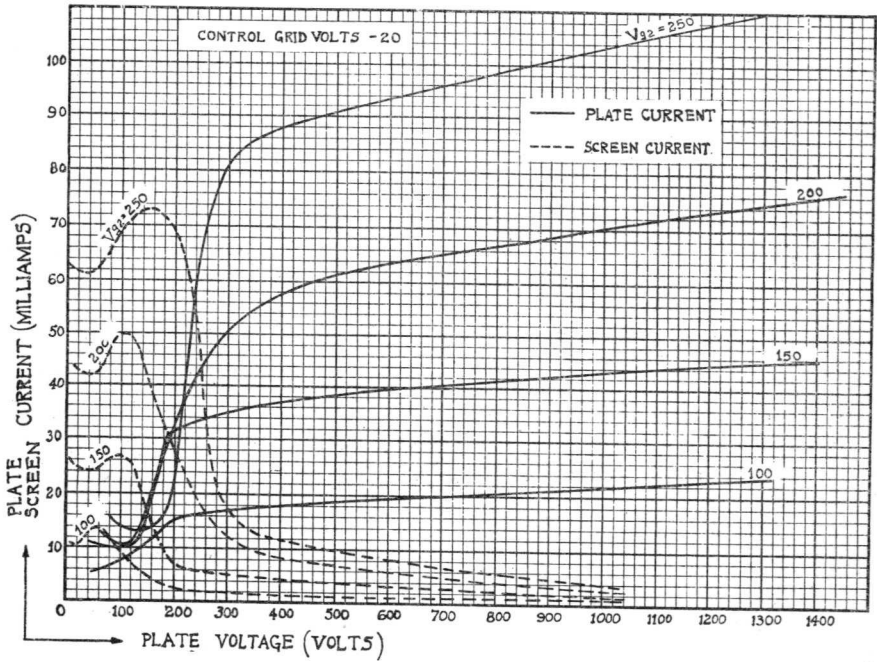
RADIO FREQUENCY OPERATION.

	Class B Telephony		Class C Telephony		Class C Telegraphy	
	Modulated Carrier applied to grid		Subject to anode modulation		Unmodulated	
Direct anode voltage	1,000	750	750	500	1,000	750 volts
Direct anode current	0.100	0.100	0.100	0.100	0.100	0.100 amps.
Control grid bias	-90	-90	-180	-180	-135 -180	-135 to -180 volts
Direct screen-grid voltage	150	150	150	150	150	150 volts
Carrier output	33	25	50	33	67	50 watts
Anode dissipation	67	50	27	17	33	25 watts



—Standard Valves—

4282-B Valve
-BZ Valve



431-8 Valve
431-8 Valve

Station

PRINTED IN
ENGLAND

—Standard Valves—

4300-A
Valve

4300-A VALVE

TRIODE.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant voltage type.

Base.

American medium 4-pin bayonet.

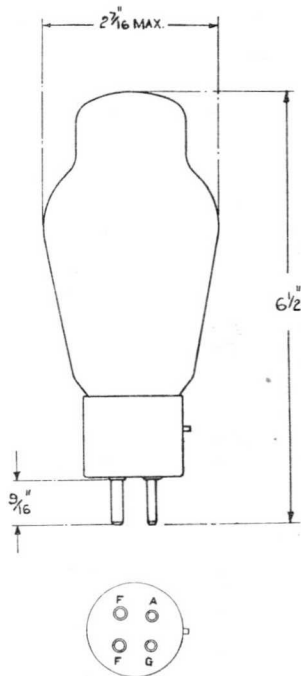
Dimensions.

Maximum overall length $6\frac{1}{2}$ " (16.5 cms.)
Maximum diameter $2\frac{7}{16}$ " (5.9 cms.)
Net weight 0.15 lbs (70 gms.)

Constants.

Filament voltage	5.0 volts
Nominal filament current	1.2 amps.
*Amplification factor	3.9
*Impedance	720 ohms
*Mutual conductance	5.4 mA. per volt
Grid-anode capacity	15 $\mu\mu\text{F}$.
Grid-filament capacity	9 $\mu\mu\text{F}$.
Anode-filament capacity	4.3 $\mu\mu\text{F}$.

* at $V_p = 300$ volts, $V_{g_1} = -61.5$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum anode voltage	450 volts
Maximum anode dissipation	40 watts
Maximum anode current of average valve for fixed grid bias	70 mA.
Maximum anode current for manually adjusted grid bias or self-biasing circuit	100 mA.

V.4300-A.1
Sept. 1938

—Standard Valves—

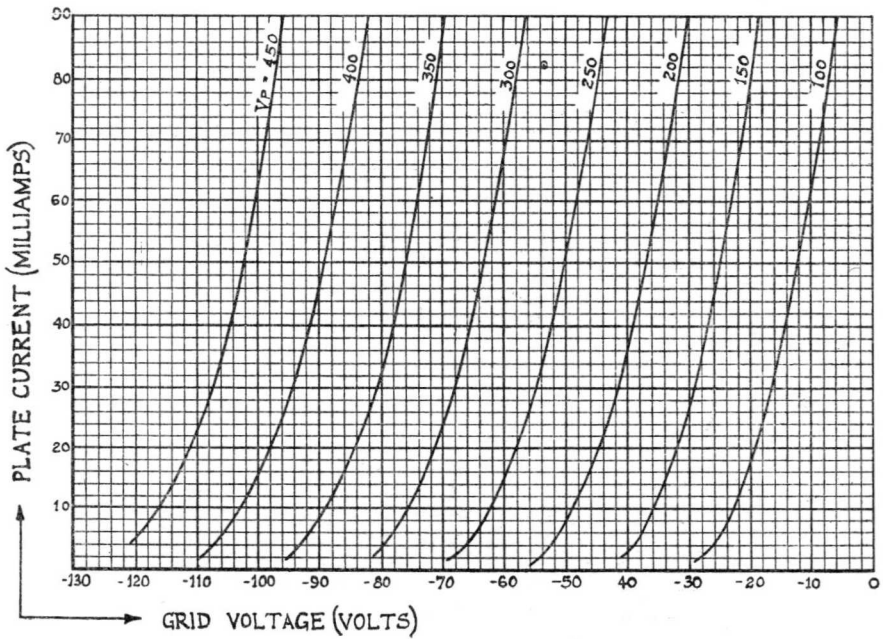
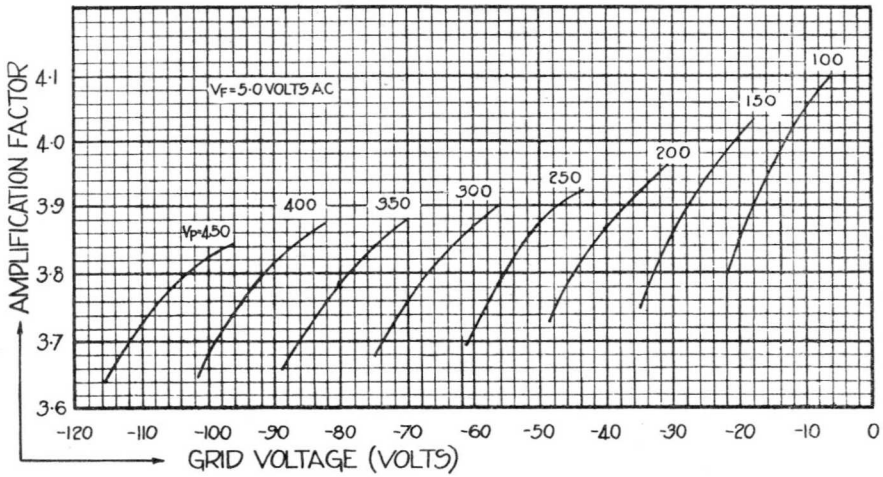
TYPICAL OPERATING CONDITIONS.

Anode voltage	Grid bias	Anode current	Load resistance	Power output	Second harmonic
volts	volts	milliamperes	ohms	watts	db
200	—42	30	2,000	3.0	20
200	—39	40	2,500	2.6	26
200	—37	50	2,500	2.5	30
250	—55	30	2,000	4.9	18
250	—55	30	4,500	3.2	27
250	—52	40	3,000	4.0	26
250	—50	50	2,500	4.4	26
250	—48	60	2,000	4.7	26
250	—48	60	2,700	4.1	30
250	—45	80	1,500	5.0	26
300	—65	40	2,500	6.7	20
300	—63	50	2,000	7.2	21
300	—63	50	3,000	6.1	26
300	—61	60	2,400	6.6	26
300	—61	60	3,400	5.6	30
300	—58	80	1,700	7.5	26
350	—76	50	3,600	7.8	26
350	—76	50	5,000	6.2	30
350	—74	60	2,000	10.2	21
350	—74	60	3,000	8.3	26
350	—74	60	4,000	7.0	30
350	—71	80	2,200	9.6	26
400	—91	40	5,000	8.4	26
400	—89	50	3,000	11.5	21
400	—89	50	4,000	9.4	25
400	—87	60	3,500	10.5	26
400	—87	60	5,000	8.3	30
400	—84	80	2,500	12.5	25
*450	—104	40	6,000	9.5	26
*450	—102	50	5,000	10.7	27
*450	—102	50	6,500	9.0	30
*450	—100	60	4,000	12.5	26
*450	—100	60	5,500	10.1	30
*450	—97	80	2,000	17.8	21
*450	—97	80	3,000	14.6	26
*450	—97	80	4,500	11.5	31

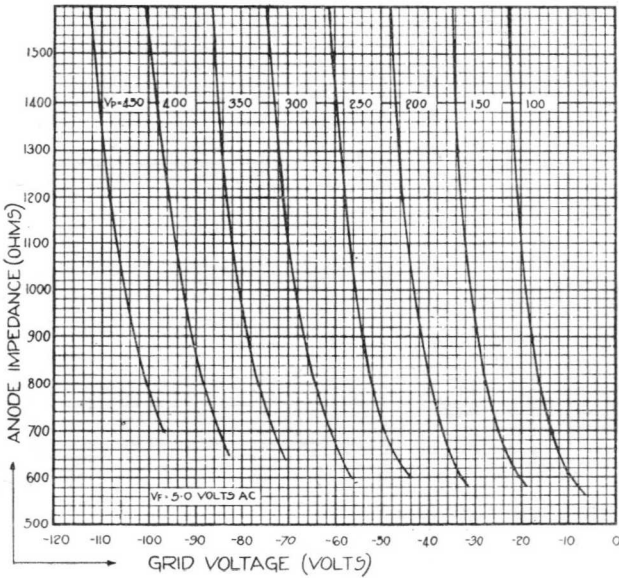
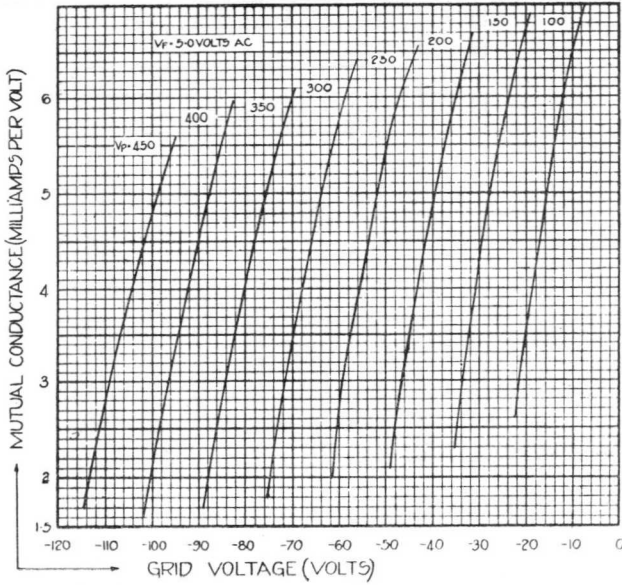
* Maximum operating conditions.

—Standard Valves—

4300-A
Valve



—Standard Valves—



—Standard Valves—

4304-B Valve
-BB Valve

4304-B AND 4304-BB VALVES

TRIODES.

SPECIFICATION.

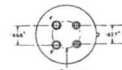
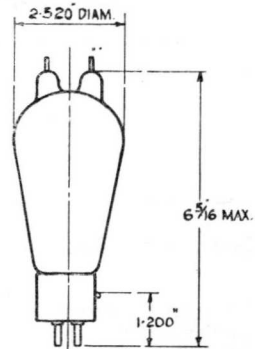
Cathode.

Thoriated Tungsten filament.
Constant voltage type.

Base.

4304-B—American medium 4-pin bayonet
4304-BB—Standard British 4-pin.

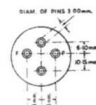
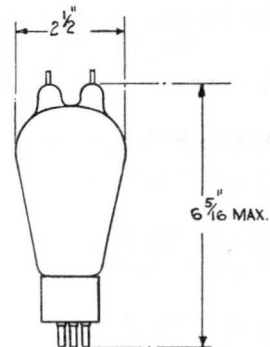
Control grid and anode brought out separately at top of bulb.



4304-B

Dimensions.

	4304-B	4304-BB
Overall length	6 $\frac{7}{8}$ " (17.5 cms.)	6 $\frac{7}{8}$ " (17.5 cms.)
Diameter	2 $\frac{7}{16}$ " (6.2 cms.)	2 $\frac{1}{2}$ " (6.4 cms.)
Net weight	0.15 lbs. (70 gms.)	0.15 lbs. (70 gms.)



4304-BB

Constants.

Filament voltage	7.5 volts
Nominal filament current	3.25 amps.
Total emission	1 amp.
Amplification factor	11
Impedance	5,500 ohms
Grid-anode capacity	2.5 $\mu\mu\text{F}$.
Anode-filament capacity	0.7 $\mu\mu\text{F}$.
Grid-filament capacity	2.0 $\mu\mu\text{F}$.

LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	1,250 volts
Maximum direct anode current	0.100 amps.
Maximum anode dissipation	50 watts
Maximum direct grid current	0.025 amps.
Maximum frequency for above ratings	100 Mc.
Maximum anode voltage for frequency of 300 Mc.	750 volts

V.4304-B.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS. RADIO FREQUENCY OPERATION.

	Class B Telephony		Class C Telephony		Class C Telegraphy	
	Modulated Carrier applied to grid		Subject to anode modulation		Unmodulated	
Direct anode voltage	1,250	1,000	1,000	750	1,250	1,000 volts
Grid bias	—110	—85	—180	—135	—180	—135 to
Direct anode current	0.060	0.060	0.100	0.100	—225	—180 volts
Carrier output	25	20	65	50	0.100	0.100 amps.
Anode dissipation	50	40	35	25	85	65 watts
					40	35 watts

Ultra High Frequency Operation.

For frequencies above 100 megacycles, the maximum plate voltage must be reduced as follows :—

Frequency 100 150 200 250 300 megacycles.

Anode Voltage :—

Class B Amplifier 1,250 1,125 1,000 875 750 volts

Class C Oscillator or
Amplifier—unmodulated 1,250 1,125 1,000 875 750 volts

Class C Oscillator or
Amplifier—anode
modulated 1,000 900 800 700 600 volts

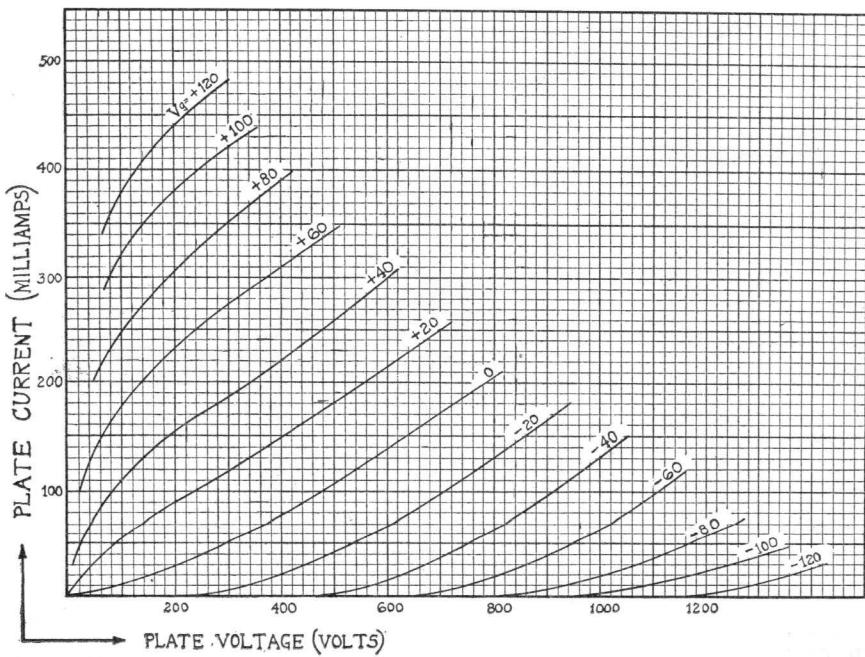
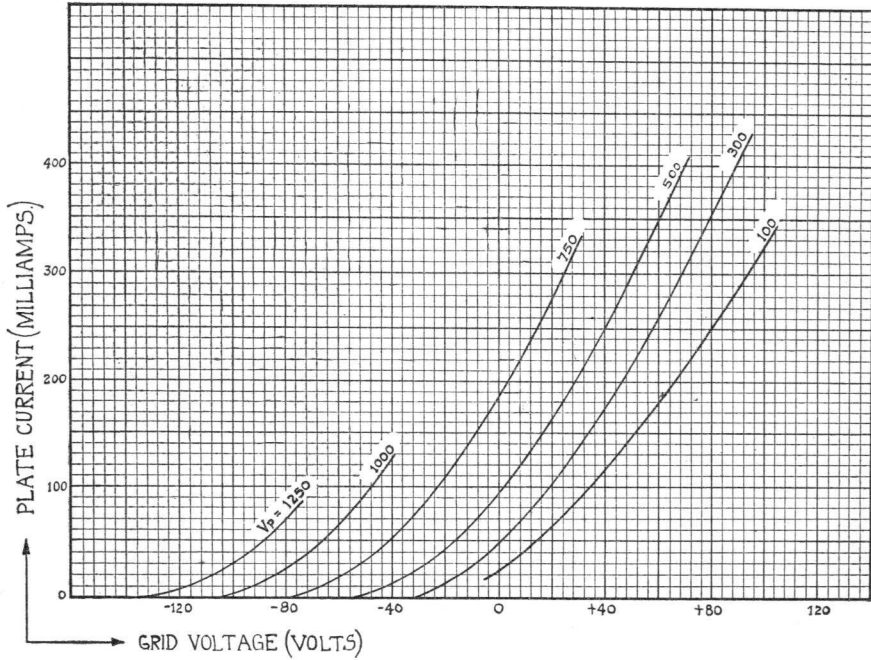
Nominal power obtainable in a load for Class C unmodulated operation is approximately as follows :—

Frequency 100 200 300 megacycles
Anode voltage 1,250 1,000 750 volts
Power output 60 35 13 watts
Efficiency 48 35 17 per cent.

Limit of oscillation, approximately 400 Mc.

—Standard Valves—

4304-B Valve
-BB Valve



V.4304-B.2
Nov. 1937

030 B Value
01/1/73

Director's Office



PRINTED IN
ENGLAND

—Standard Valves—

4305-A
Valve

4305-A VALVE

TETRODE.

SPECIFICATION.

Cathode.

Thoriated tungsten filament.

Constant voltage type.

Base.

American medium 4-pin. Screen, anode and filament centre connections made to tungsten rods brought out separately through top of bulb.

Dimensions.

Max. overall length $7\frac{5}{16}$ " (19.3 cms.)

Max. Diameter $2\frac{1}{8}$ " (6.1 cms.)

Net weight 0.2 lbs. (90 gms.)

Constants.

Filament voltage 10 volts

Nominal filament current 3.1 amps.

*Amplification factor 56

*Impedance 40,000 ohms

*Mutual conductance 1.4 mA. per volt

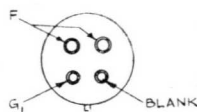
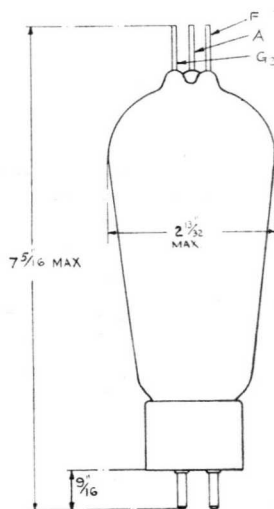
Total emission 1 amp.

Grid-anode capacity $0.14\ \mu\mu\text{F}$.

Input capacity $10.5\ \mu\mu\text{F}$.

Output capacity $5.4\ \mu\mu\text{F}$.

* at $V_p = 1,000$ volts, $I_p = 60$ mA.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	1,000 volts
Maximum direct anode current	0.125 amps.
Maximum anode dissipation	60 watts
Maximum screen-grid voltage	200 volts
Maximum screen-grid dissipation	6 watts
Maximum direct grid current	0.040 amps.
Maximum frequency for above ratings	50 Mc.
Maximum anode voltage for frequency of 100 Mc.	500 volts

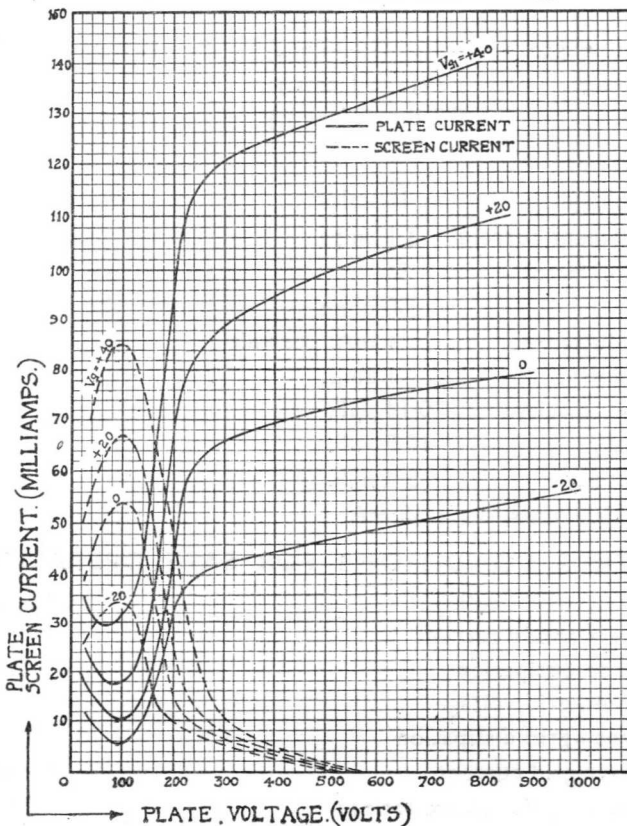
V.4305-A.1
Sept. 1938

—Standard Valves—

TYPICAL OPERATING CONDITIONS. RADIO FREQUENCY OPERATION.

	Class B Telephony		Class C Telephony		Class C Telegraphy	
	Modulated Carrier applied to grid		Subject to anode modulation		Unmodulated	
Direct anode voltage	1,000	750	800	500	1,000	750 volts
Control grid bias	-135	-100	-270	-200	-200	-150 to -200 volts
Direct screen-grid voltage	200	150	200	200	200	200 volts
Direct anode current	90	120	125	125	125	125 mA.
Anode dissipation	60	60	30	30	40	29 watts
Carrier output	30	30	70	42	85	65 watts

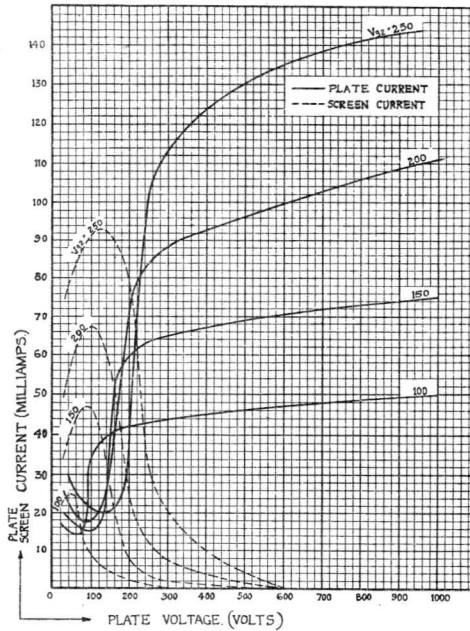
These curves are taken at: $-V_F = 10.0$ volts D.C. $V_{g_2} = 200$ volts.



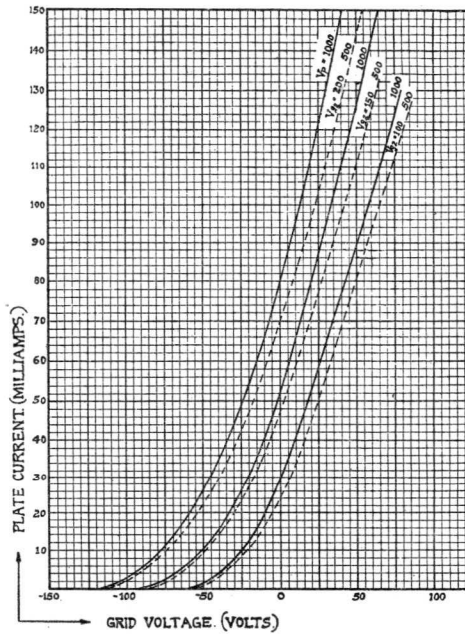
—Standard Valves—

4305-A
Valve

These curves are taken at $:-V_F = 10.0$ volts D.C. $V_{g_1} = +20$ volts.



These curves are taken at $:-V_F = 10.0$ volts D.C.



V.4305-A.2
Sept. 1938.

Standard Notes

—Standard Valves—

4307-A Valve.
-AF Valve.

4307-A AND -AF VALVES

PENTODES.

The 4307-AF Valve is identical to the 4307-A Valve and the -F code indicates that the valve has passed special tests for use in Standard Aircraft Radio.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant voltage type.

Base.

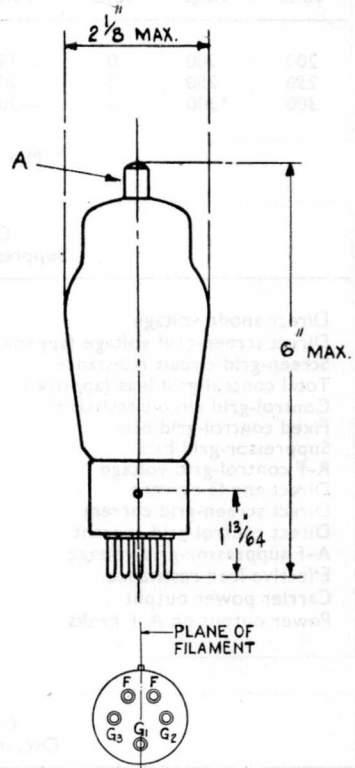
American medium 5-pin.
Anode connected to top cap type B.

Dimensions.

Max. overall length 6" (15.3 cms.)
Max. Diameter $2\frac{1}{8}$ " (5.4 cms.)
Net weight 0.16 lbs. (75 gms.)

Constants.

Filament voltage 5.5 volts
Nominal filament current 1.0 amps.
Grid-anode capacity 0.55 $\mu\mu\text{F}$.
Input capacity 15 $\mu\mu\text{F}$.
Output capacity 12 $\mu\mu\text{F}$.



LIMITING CONDITIONS FOR SAFE OPERATION.

	Class A Amplifier	Class C Amplifier or Oscillator	Class B or Suppressor Modulated Class C Amplifier
Maximum direct anode voltage	500	500	500 volts
Maximum direct screen-grid voltage	300	250	250 volts
Maximum direct anode current	60	60	45 mA.
Maximum direct screen-grid current	25	25	25 mA.
Maximum direct control-grid current	—	7	7 mA.
Maximum anode dissipation	15	15	15 watts
Maximum screen-grid dissipation	6	6	6 watts
Maximum instantaneous control-grid voltage on positive swing of input	—	+30	+30 volts

V.4307-A.1
March, 1939

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

Anode voltage	Screen Grid voltage	Suppressor voltage	Control grid bias	Anode current	Screen grid current	Load resistance	Maximum power output	Maximum second harmonic
volts	volts	volts	volts	mA.	mA.	ohms	watts	db
200	200	0	—15	36.5	3.4	4,000	2.9	23.5
250	250	0	—20	50	4.0	4,000	5.7	24
300	*300	0	—30	43	2.6	4,500	9.1	21

* Maximum operating condition.

Class C Telephony. Suppressor modulated R.F. Amp.

Direct anode voltage	500 volts
Direct screen-grid voltage (approx.)	200 volts
Screen-grid circuit resistance	14,000 ohms
Total control-grid bias (approx.)	—35 volts
Control-grid circuit resistance	10,000 ohms
Fixed control-grid bias	—20 volts
Suppressor-grid bias	—50 volts
R-F control-grid voltage	50 peak volts
Direct anode current	40 milliamperes
Direct screen-grid current	20 milliamperes
Direct control-grid current	1.5 milliamperes
A-F suppressor-grid voltage	50 peak volts
Effective load resistance	4,000 ohms
Carrier power output	6 watts
Power output on A-F peaks	24 watts

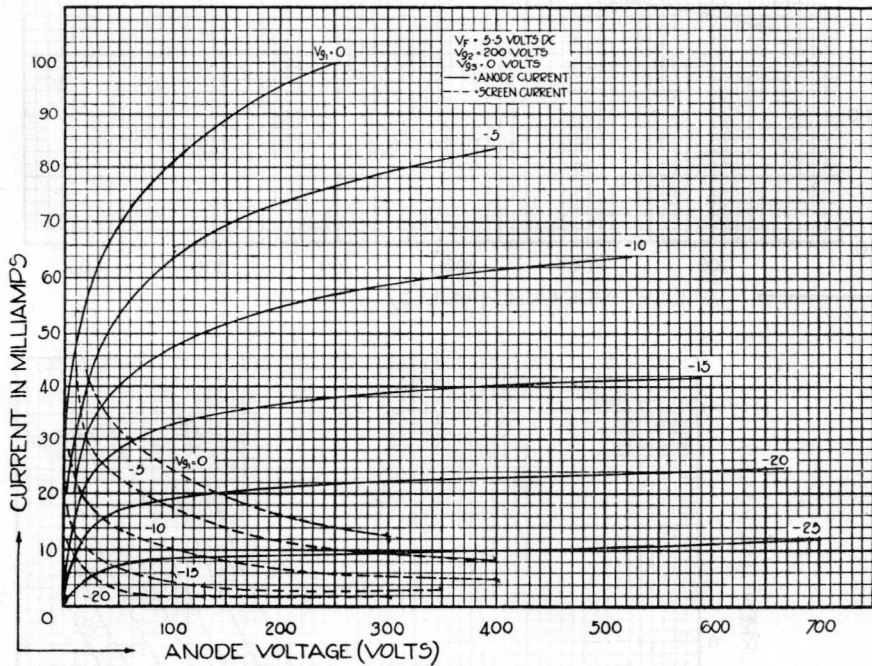
Class C Telegraphy Osc. or RF amp. unmodulated.

Direct anode voltage	500	500 volts
Direct screen-grid voltage (approx)	250	250 volts
Screen-grid circuit resistance	20,000	20,000 ohms
Total control-grid bias (approx)	—35	—35 volts
Control-grid circuit resistance	10,000	10,000 ohms
Fixed control-grid bias	—20	—20 volts
Suppressor-grid bias	0	0 volts
R-F control-grid voltage	50	50 peak volts
Direct anode-current	45	60 mA.
Direct screen-grid current	12	13 mA.
Direct control-grid current	1.3	1.4 mA.
A-F suppressor-grid voltage	0	0 peak volts
Effective load resistance	6,500	5,000 ohms
Carrier power output	15	20 watts

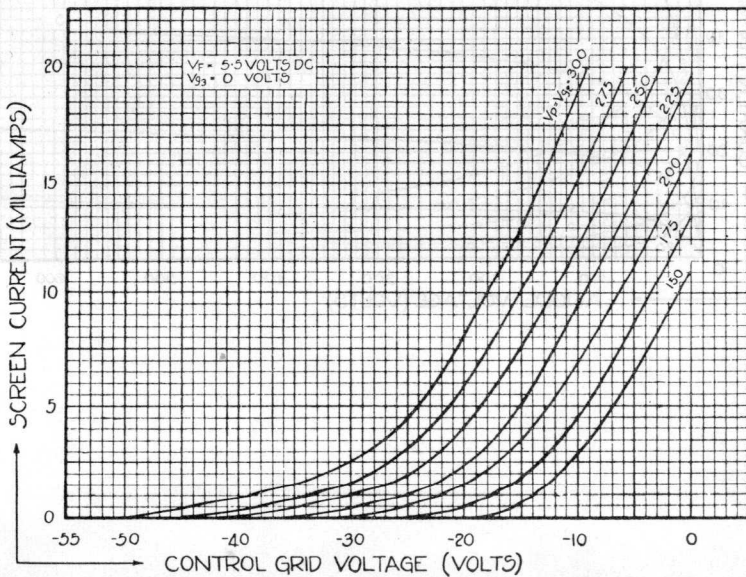
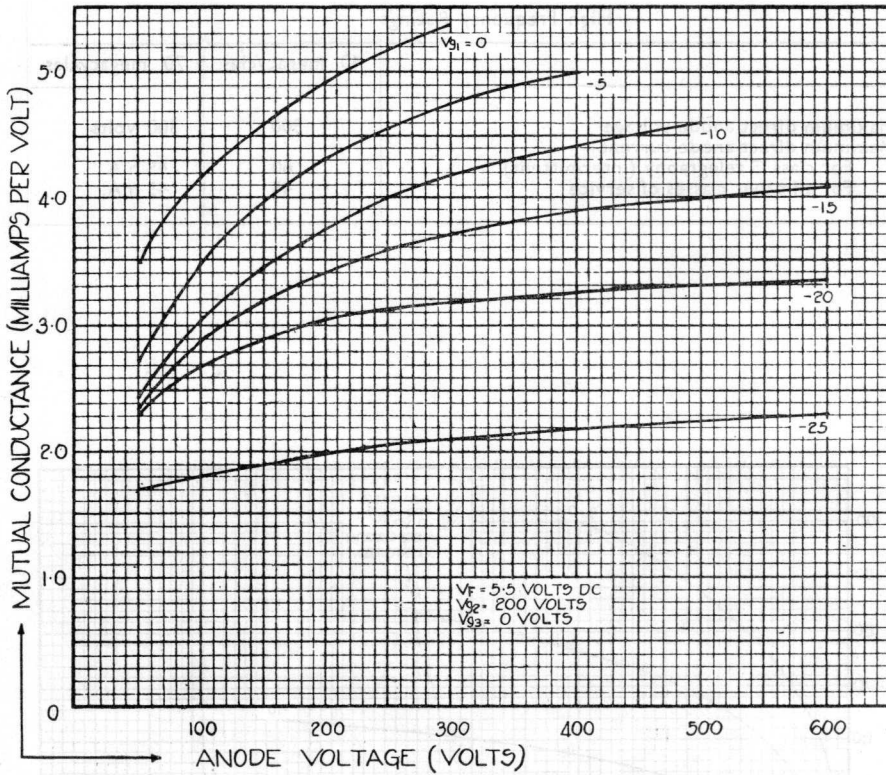
—Standard Valves—

4307-A Valve
-AF Valve

High Frequency Ratings		
	40 megacycles	70 megacycles
Maximum direct anode voltage	500	300 volts
Maximum direct anode current— For class C telegraphy (intermittent) For all other classes of service	60 45	45 mA. 45 mA.



—Standard Valves—



PRINTED IN ENGLAND

—Standard Valves—

4308-B
Valve

4308-B VALVE

TRIODE.

SPECIFICATION.

Cathode.

Thoriated tungsten filament.
Constant voltage type.

Base.

Extra large 4-pin bayonet.

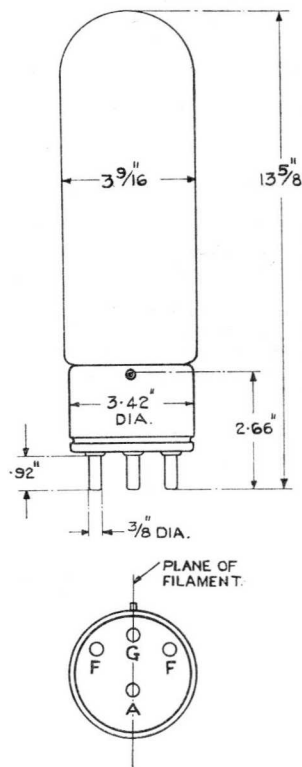
Dimensions.

Overall length $13\frac{5}{8}$ " (34.7 cms.)
Maximum diameter $3\frac{3}{8}$ " (9.2 cms.)
Net weight 1.6 lbs. (725 gms.)

Constants.

Filament voltage 14 volts
Nominal filament current 6 amps.
Total emission 4 amps.
*Amplification factor 8
*Impedance 1,070 ohms.
*Mutual conductance 7.5 mA. per volt
Grid-anode capacity 17.4 $\mu\mu\text{F}$.
Grid-filament capacity 13.6 $\mu\mu\text{F}$.
Anode-filament capacity 9.3 $\mu\mu\text{F}$.

* at $V_p = 1,500$ volts, $V_g = -150$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	2,250 volts
Maximum direct anode current	325 mA.
Maximum direct grid current	75 mA.
Maximum anode dissipation	250 watts
Maximum frequency for above ratings	1.5 Mc.
Maximum anode voltage for frequency of 4.5 Mc.	750 volts

Tentative data

V.4308-B.1
Sept. 1938

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class A AF. Amp or Mod.	
	Direct anode voltage	1,500
Grid bias	—155	—80 volts
Direct anode current	135	210 mA.
Load impedance	13,000	3,000 ohms
Undistorted output	50	35 watts

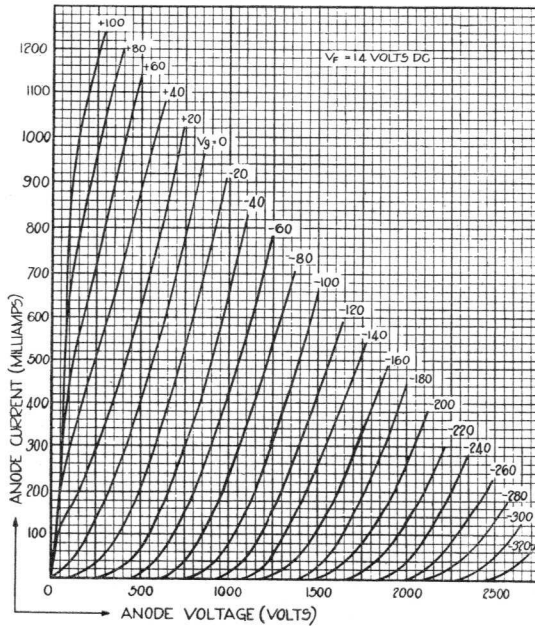
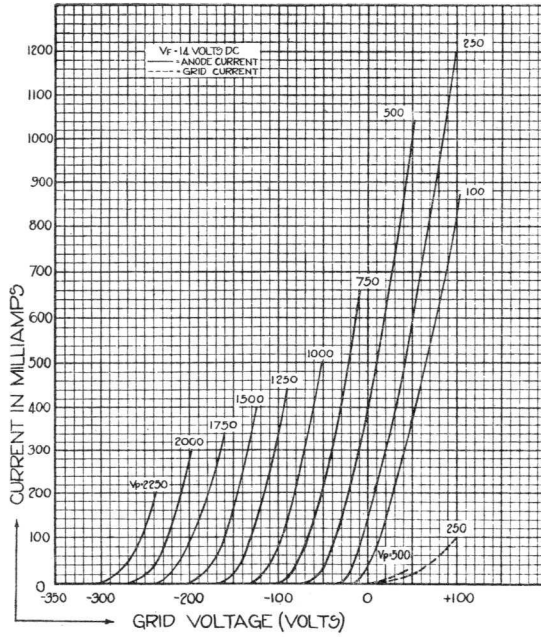
	Class B. A.F. Amp or Mod. For balanced 2 valve circuit.	
	Direct anode voltage	1,750
Grid bias	—215	—180 volts
Direct anode current per valve—Zero signal	30	25 mA.
Maximum signal	300	300 mA.
Anode dissipation	240	210 watts
Load resistance—anode to anode	5,200	4,280 watts
Power output—2 valves	575	475 watts
Recommended power for driving stage	35	35 watts

RADIO FREQUENCY OPERATION.

	Class B Telephony		Class C Telephony		Class C Telegraphy	
	Modulated carrier applied to grid		Subject to anode modulated		Unmodulated	
Direct anode voltage	1,750	1,500	1,250	1,000	1,750	1500 volts
Direct anode current	215	250	300	300	300	300 mA.
Grid bias	—230	—200	—320	—260	—345	—300 to —460
Anode dissipation	250	250	125	100	175	150 watts
Carrier output	125	125	250	200	350	300 watts

—Standard Valves—

4308-B
Valve



Tentative Data

V.4308-B.2.
Sept. 1938.

Standard 1000

PRINTED IN
ENGLAND

—Standard Valves—

4316-A
Valve

4316-A VALVE

TRIODE.

SPECIFICATION.

Cathode.

Thoriated Tungsten filament.
Constant voltage type.

Mounting.

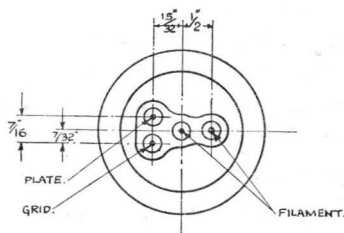
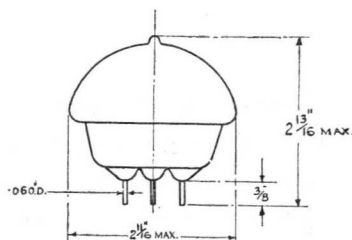
The grid, anode and filament leads are tungsten rods projecting from a flat face of the bulb. The valve may be supported by these leads providing flexibility is maintained so that no glass strains are produced. It is recommended that small brass or copper sleeves equipped with set screws be used for connectors. Soldering direct to the rods should not be attempted.

Dimensions.

Overall length	$2\frac{13}{16}$ " (7.1 cms.)
Diameter	$2\frac{11}{16}$ " (6.8 cms.)
Net weight	0.12 lbs. (55 gms.)

Constants.

Filament voltage	2 volts
Nominal filament current	3.65 amps.
Amplification factor	6.5
Impedance	2,700 ohms
Mutual conductance	2.4 mA. per volt
Grid-anode capacity	1.6 $\mu\mu\text{F}$.
Anode-filament capacity	0.8 $\mu\mu\text{F}$.
Grid-filament capacity	1.2 $\mu\mu\text{F}$.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	450 volts
Maximum direct anode current	0.080 amps.
Maximum direct grid current	0.012 amps.
Maximum anode dissipation	30 watts

V.4316-A.1
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class C Telephony	Class C Telegraphy
	Subject to anode modulation	Unmodulated
Direct anode voltage	400	450 volts
Direct anode current	80	80 mA.
Direct grid current	12	12 mA.
Carrier output	6.5	7.5 watts

Ultra High Frequency Operation.

When the 4316-A valve is used at frequencies above 300 megacycles, several precautions must be observed in the circuit design in order to obtain good efficiency. It is necessary to provide tuning in the filament to ground circuit. The use of adjustable concentric lines of approximately $\frac{3}{8}$ wavelength for each filament lead is probably the most satisfactory method. It is also desirable to avoid the use of dielectric material as much as possible and to confine that which is necessary for mounting circuit elements to points of low r.f. voltage. The grid and anode supply leads should be connected at nodal points if possible. A schematic of an oscillator circuit which will function at frequencies as high as 600 megacycles is shown. For operation at 500 megacycles, the area enclosed by the circuit A should be about $1\frac{1}{2}$ square inches outside of the valve envelope and the capacity about 1.75 mmF. It is important that a reference ground such as a sheet of copper underneath the circuit, or a copper box enclosing the circuit be used and that by-passes be made directly to this ground with as short leads as possible.

When the circuit is operated initially, the following procedure should be observed.

Place a 1,000 ohm resistor in series with the anode supply source. Apply 2.0 volts to the filament and with the grid leak set at 15,000 ohms apply anode voltage and adjust the filament tuning for greatest amplitude of oscillation as evidenced by the highest grid current. However, the grid current should not

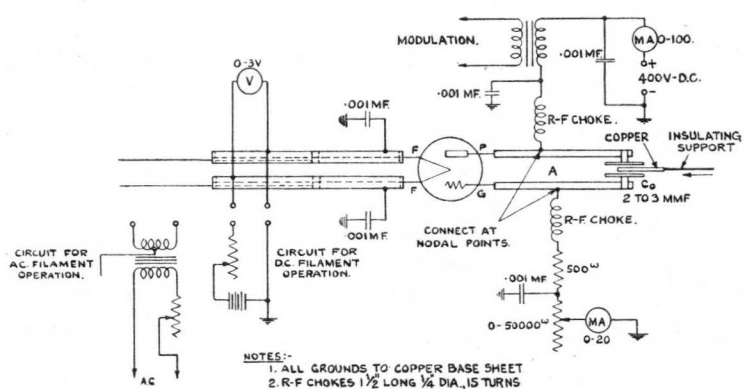
—Standard Valves—

4316-A
Valve

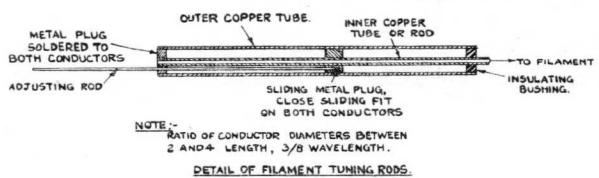
be allowed to exceed 12 milliamperes. Measure the wavelength and adjust the tuning condenser, correcting the filament tuning at the same time, until the circuit oscillates at the desired wavelength. Couple the load inductively, remove the 100 ohm resistor from the anode supply, and adjust the filament tuning and grid leak for best output at rated input of 80 milliamperes. The load coupling and filament tuning will both be found fairly critical for best efficiency.

The following table indicates the nominal output obtainable from a 4316-A valve as an unmodulated oscillator with an input of 400 volts and 80 milliamperes d.c.

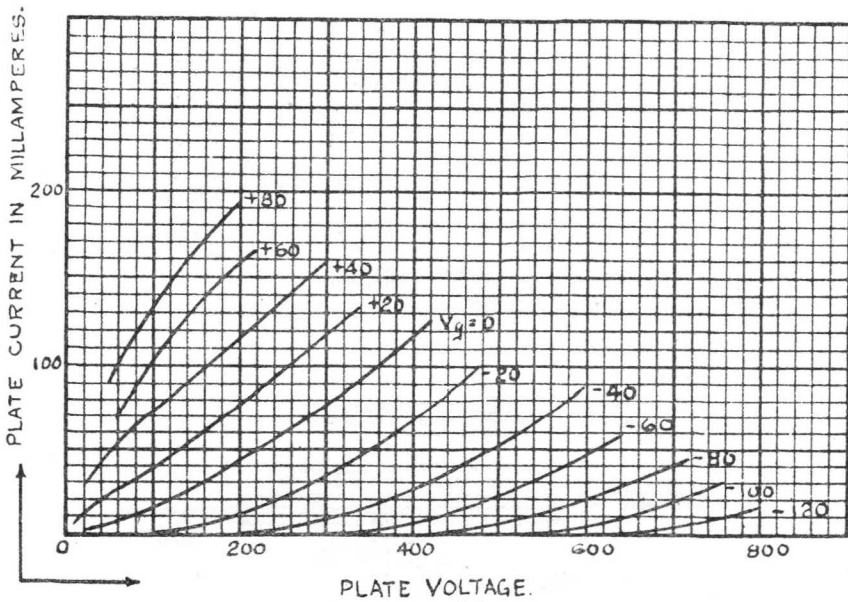
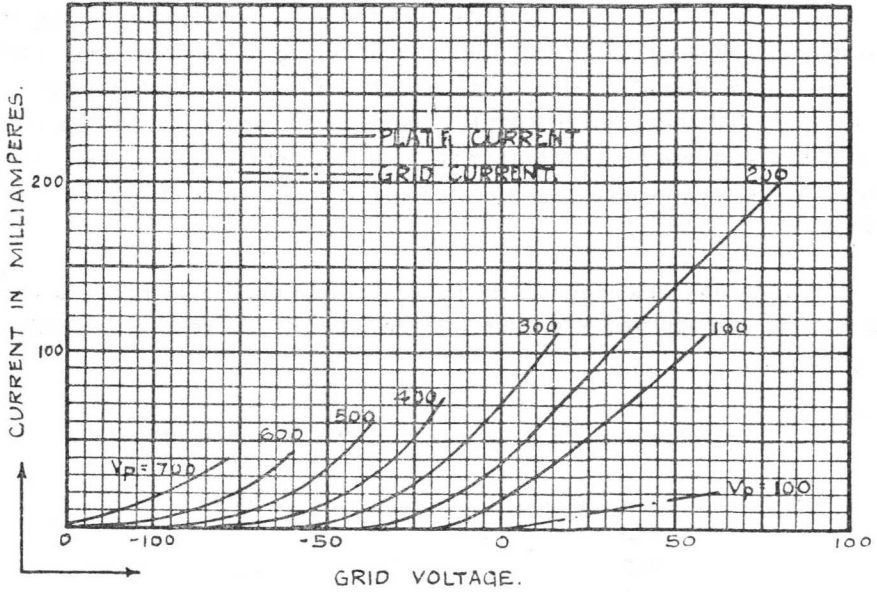
Frequency—Mc.	Power Output— watts
300	8.5
400	8.0
500	6.5
600	4.0
750	Limit of oscillation.



- NOTES:-
1. ALL GROUNDS TO COPPER BASE SHEET
 2. R-F CHOKES $1\frac{1}{2}$ LONG $\frac{1}{4}$ DIA., 15 TURNS
32 B & S COPPER WIRE.



—Standard Valves—



—Standard Valves—

4328-A
Valve

4328-A VALVE

PENTODE.

SPECIFICATION.

Cathode.

Indirectly heated oxide coated.
Constant current type.

Base.

American small 6-pin.

Control grid connected to top cap type B.

The cathode should preferably be connected to the heater. If voltage must be applied between cathode and heater it should not exceed 150 volts.

Dimensions.

Maximum overall length 4.9" (12.5 cms.)

Maximum diameter 1.52" (3.8 cms.)

Net weight 0.11 db (50 gms.)

Constants.

Nominal heater voltage 7.5 volts

Heater current 0.425 amps.

*Mutual conductance 1.9 mA. per volt

Inter-electrode Capacities.

Control grid to anode 0.025 $\mu\mu\text{F}$.

Suppressor grid to anode 12.5 $\mu\mu\text{F}$.

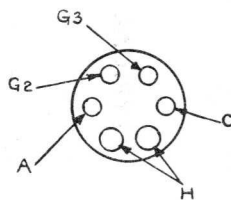
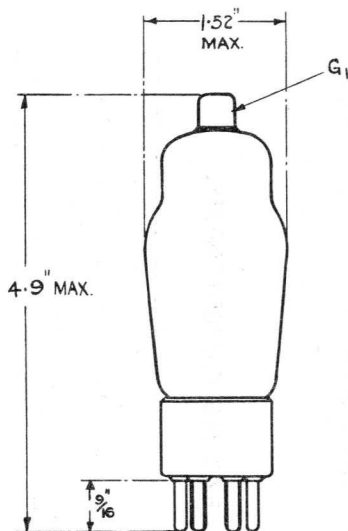
Anode to heater, cathode
and screen grid 2.2 $\mu\mu\text{F}$.

Control grid to suppressor
grid 1.8 $\mu\mu\text{F}$.

Control grid to heater,
cathode and screen grid 4.0 $\mu\mu\text{F}$.

Suppressor grid to heater,
cathode and screen grid 7.5 $\mu\mu\text{F}$.

* $V_p = 250\text{v}$. $V_{g_2} = 180\text{v}$. $V_{g_3} = 0$.
 $V_{g_1} = -5.5\text{v}$.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	250 volts
Maximum direct screen voltage	180 volts
Maximum cathode current (screen current + anode current).	10 mA.
Maximum screen current	2.5 mA.

Note :—When this valve is used in series with other valves of a different type, protection should be provided for the heaters at the moment of switching on. For this purpose the 4120-AA and 4121-AA Ballast Lamps are available.

Tentative data.

V.4328-A.1
Sept. 1933

— Standard Valves —

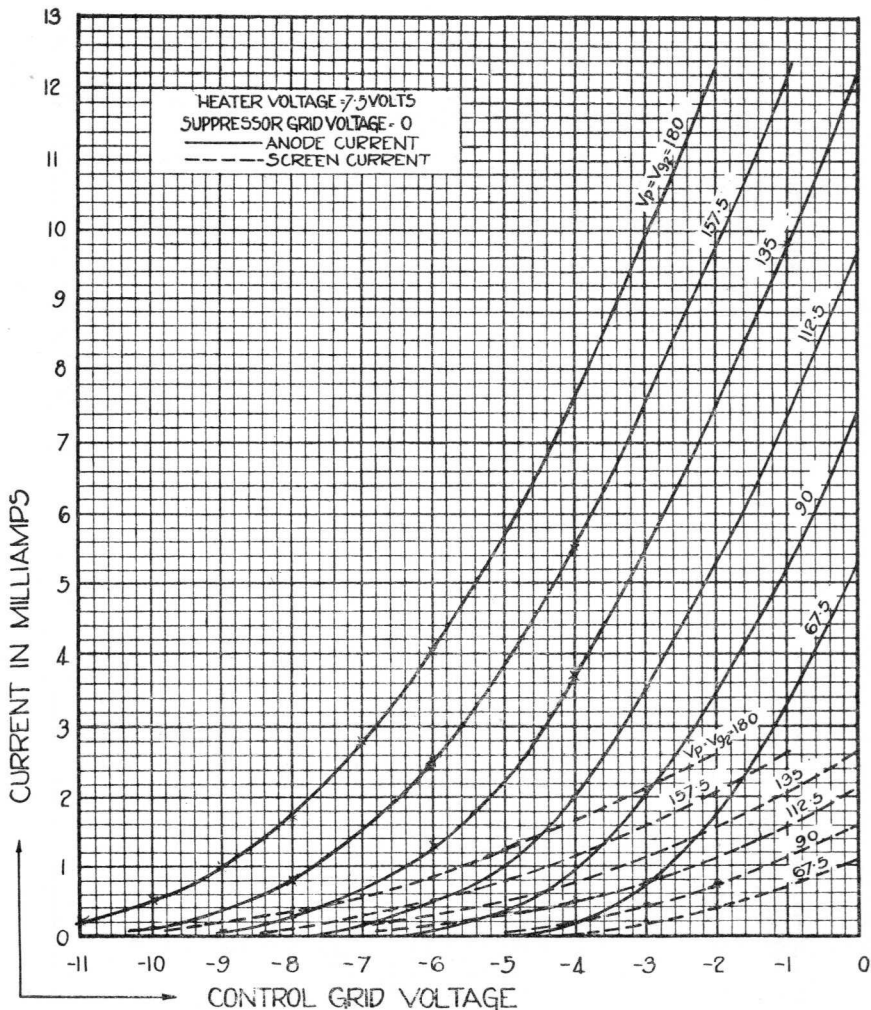
TYPICAL OPERATING CONDITIONS.

Anode voltage	135	135	135	135	135	180	180	225	225	*	250	250	250	250	250	250	250	250	volts
Screen grid voltage	135	135	135	135	135	135	135	135	135	135	135	135	135	135	135	135	135	135	volts
Control grid bias	—3	—3	—3	—3	—3	—3	—3	—3	—3	—3	—3	—3	—3	—3	—3	—3	—3	—3	volts
Suppressor grid voltage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	volts
Anode current	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	mA.
Load resistance	20000	60000	60000	100000	100000	40000	100000	60000	100000	60000	60000	60000	100000	100000	100000	100000	100000	100000	ohms
Input voltage	3.00	1.60	0.95	1.15	0.57	0.40	2.70	1.50	2.70	1.80	2.70	1.20	2.10	1.50	1.50	1.50	1.50	1.50	peak volts
Output voltage	—	—	—	100	75	50	—	175	—	220	—	—	250	200	200	200	200	200	peak volts
Output power	250	130	60	—	—	—	340	—	425	—	480	110	—	—	—	—	—	—	mW
Second harmonic	22	26	35	33	35	40	26	26	27	27	26	30	26	30	26	30	26	30	db
Third harmonic	30	28	45	39	50	55	28	30	27	31	30	55	29	43	29	43	29	43	db

* Maximum operating conditions.

—Standard Valves—

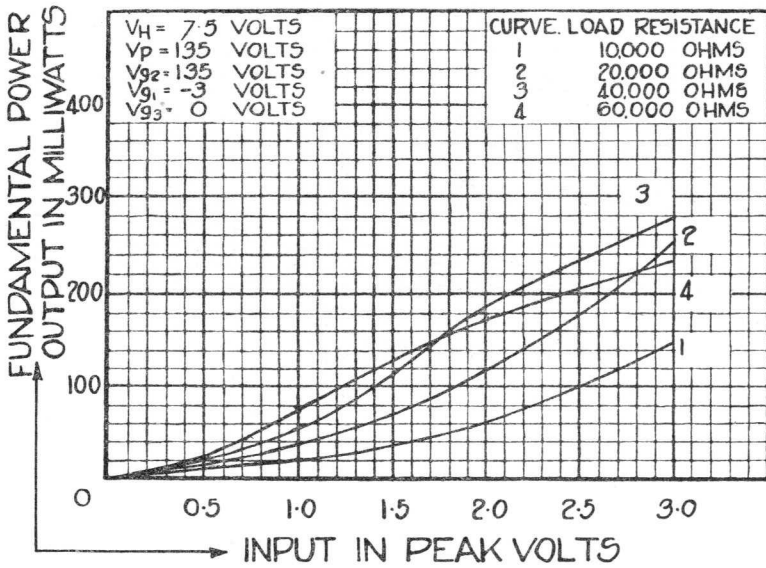
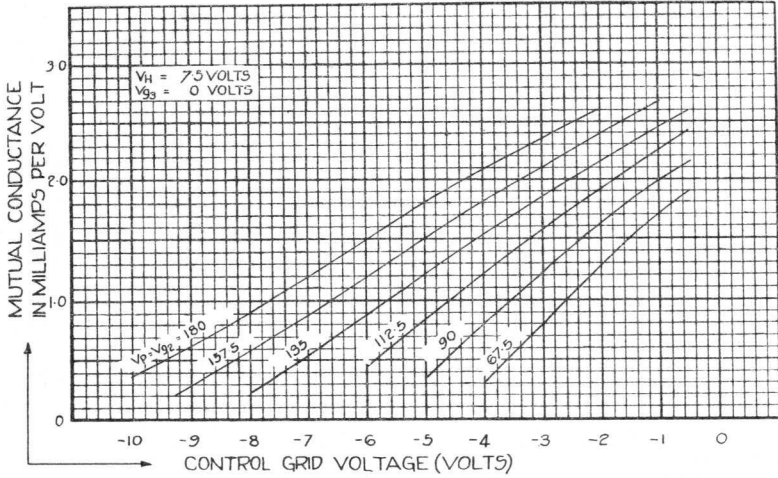
4328-A
Valve



Tentative data

V.4328-A.2
Sept. 1938

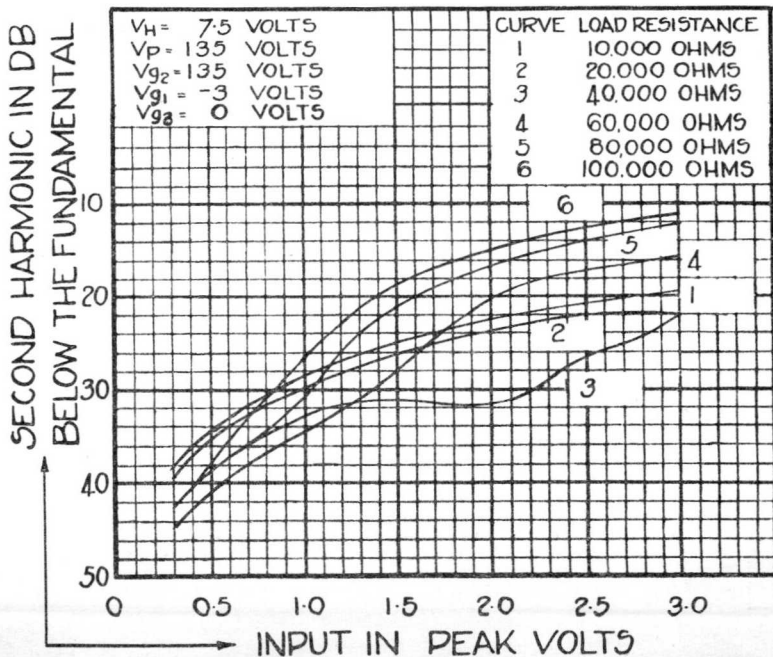
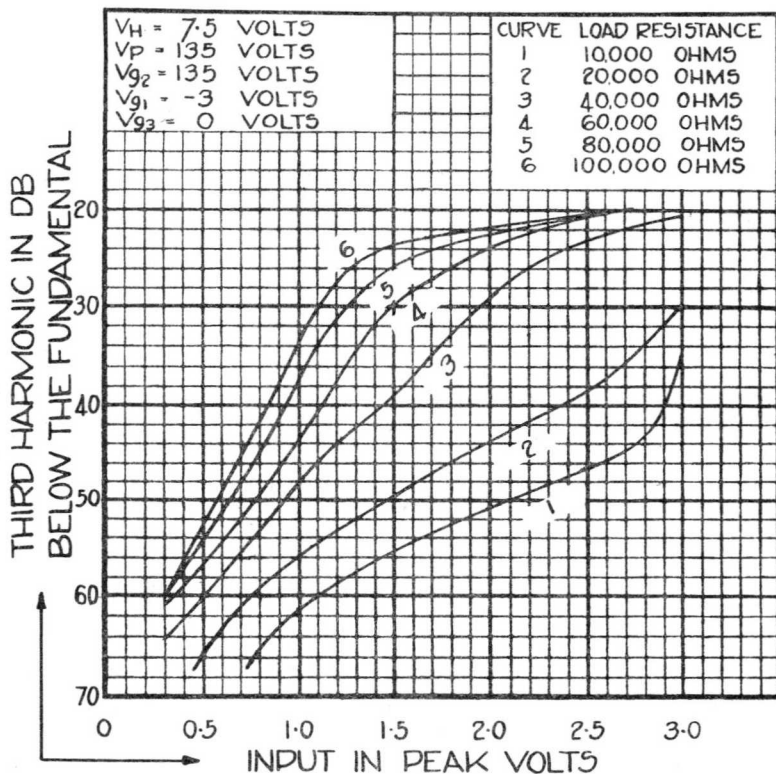
—Standard Valves—



—Standard Valves—

4328-A
Valve

4328.A VALVE



Tentative data

V.4328-A.3
Sept. 1938

1950-1951



PRINTED IN
ENGLAND

0 03 10 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100

—Standard Valves—

3A/101-B

VALVE TYPE 3A/101-B

(Previously coded VLS.350 valve).

TRIODE.

SPECIFICATION.

Cathode.

Indirectly heated oxide coated.
Constant current type.

Base.

Standard British 5-pin.

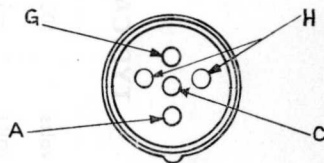
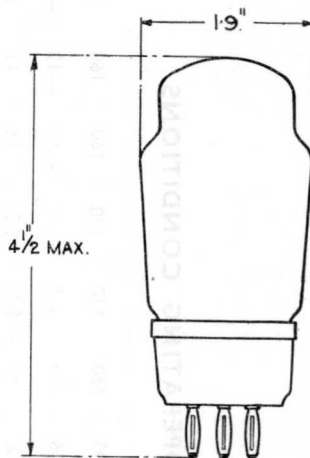
Dimensions.

Maximum overall length $4\frac{1}{2}$ " (11.4 cms.)
Bulb diameter 1.9" (4.9 cms.)
Net weight 0.11 lb. (50 gms.)

Constants.

Heater current 1.0 amps.
Nominal heater voltage 4.5 volts
*Impedance 5,700 ohms.
*Amplification factor 5.8
*Mutual conductance 1.0 mA per volt
Anode-grid capacity $4.2 \mu\text{F}$.
Grid-cathode capacity $4.2 \mu\text{F}$.
Anode-cathode capacity $4.4 \mu\text{F}$.

* at $V_p = 130$ volts, $V_g = -9$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage 200 volts
Maximum anode dissipation 5 watts

Tentative data

W.3A/101-B.1
March, 1939

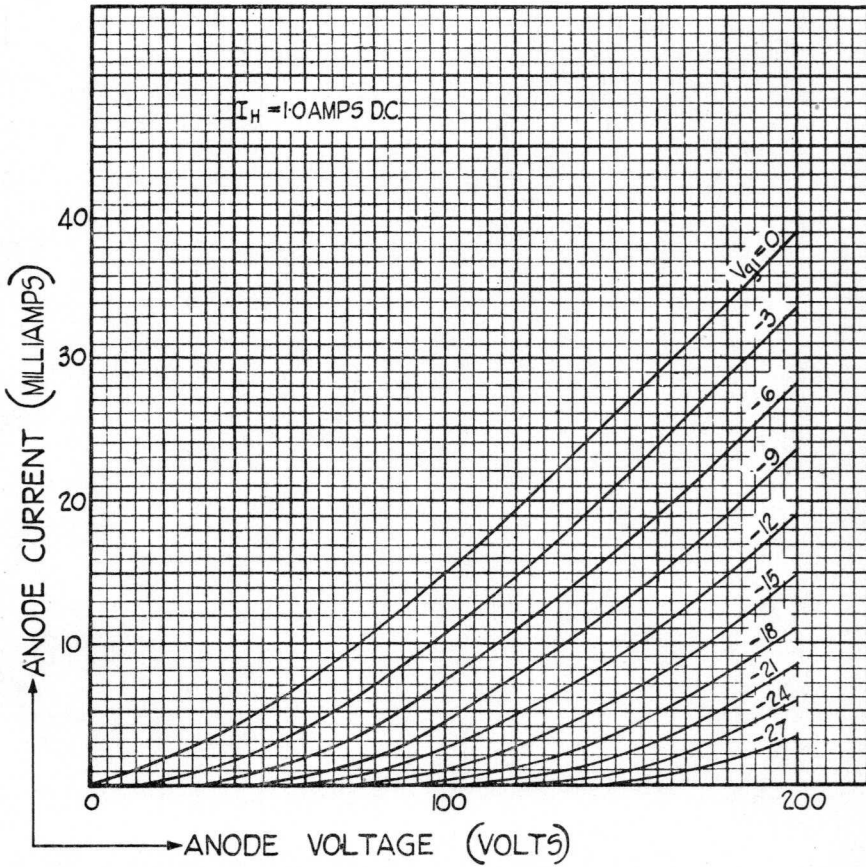
— Standard Valves —

TYPICAL OPERATING CONDITIONS.

Anode voltage	volts	100	100	130	130	160	160	160	190	190	190	190
Grid bias	volts	—4	—6	—9	—12	—10	—12	—16	—16	—18	—20	—20
Anode current	mA.	10	13	9.5	6.2	14	11	12	12	9.5	8	8
Anode resistance	Z_o	5,000	5,000	5,700	6,500	5,000	5,500	6,500	5,000	5,300	6,000	6,000
For load resistance, $R_L = Z_o$												
Output	mW.	14	26	35	90	100	130	175	235	265	285	285
Total harmonic distortion	db	38	29	29	22	30	22	20	22	20	18	18
For load resistance, $R_L = 2Z_o$												
Output	mW.	12	24	30	80	90	115	155	210	235	250	250
Total harmonic distortion	db.	35	35	37	26	33	28	23	27	25	22	22

—Standard Valves—

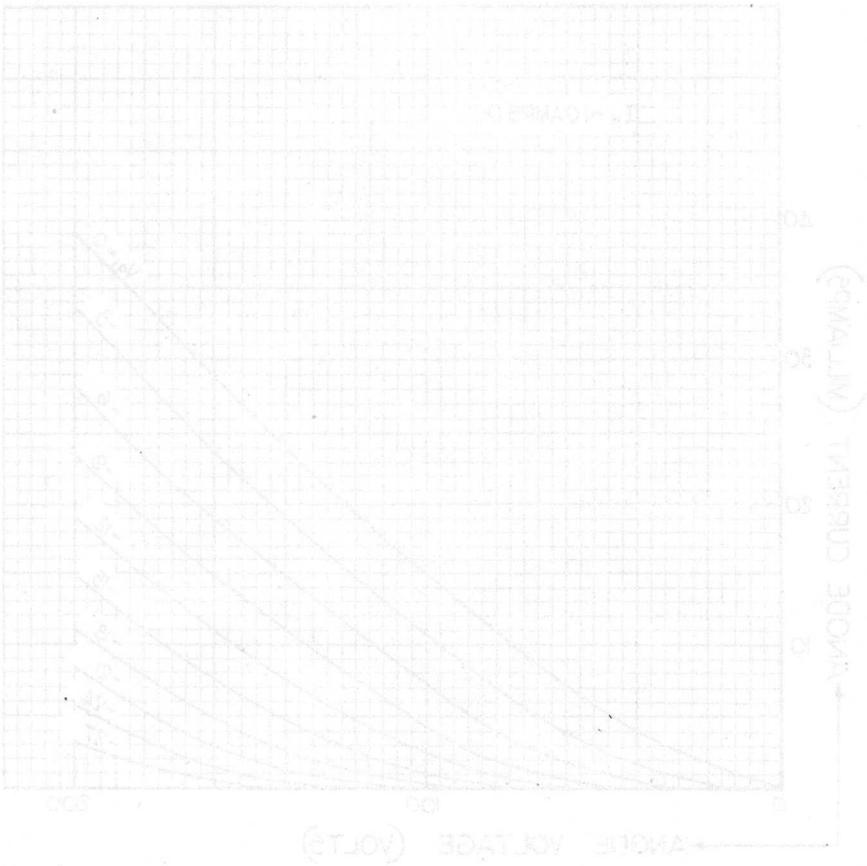
3A/101-B



Tentative data

W.3A/101-B.2
March, 1939

Standard Valves



—Standard Valves—

VALVE TYPE 3A/102-B

(Previously coded VLS.407 valve).

TRIODE.

SPECIFICATION.

Cathode.

Indirectly heated oxide coated.
Constant current type.

Base.

Small British 5 pin.
Anode connected to top cap type B.

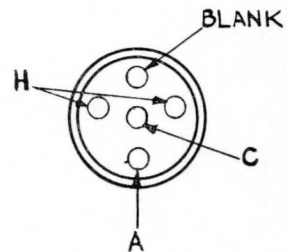
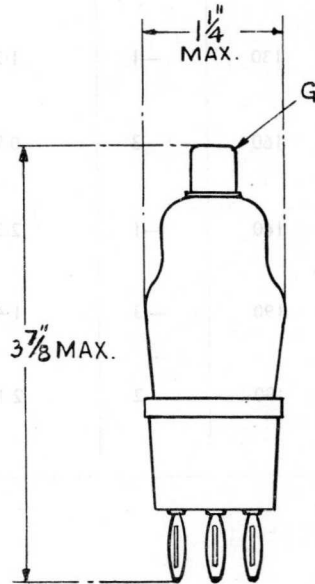
Dimensions.

Max. overall length $3\frac{7}{8}$ " (9.8 cms.)
Max. bulb diameter $1\frac{1}{4}$ " (3.2 cms.)

Constants.

Heater current	1.0 amp.
Nominal heater voltage	2.1 volts
*Amplification factor	30
*Mutual conductance	0.5 mA. per volt
*Impedance	60,000 ohms
Grid-anode capacity	1.7 $\mu\mu\text{F}$.
Grid-cathode capacity	1.5 $\mu\mu\text{F}$.
Anode-cathode capacity	3.9 $\mu\mu\text{F}$.

* at $V_p = 130$ volts, $I_p = 0.75$ mA.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	190 volts
Maximum direct anode current	1.5 mA.

Tentative data

W.3A/102-B.1
March, 1939

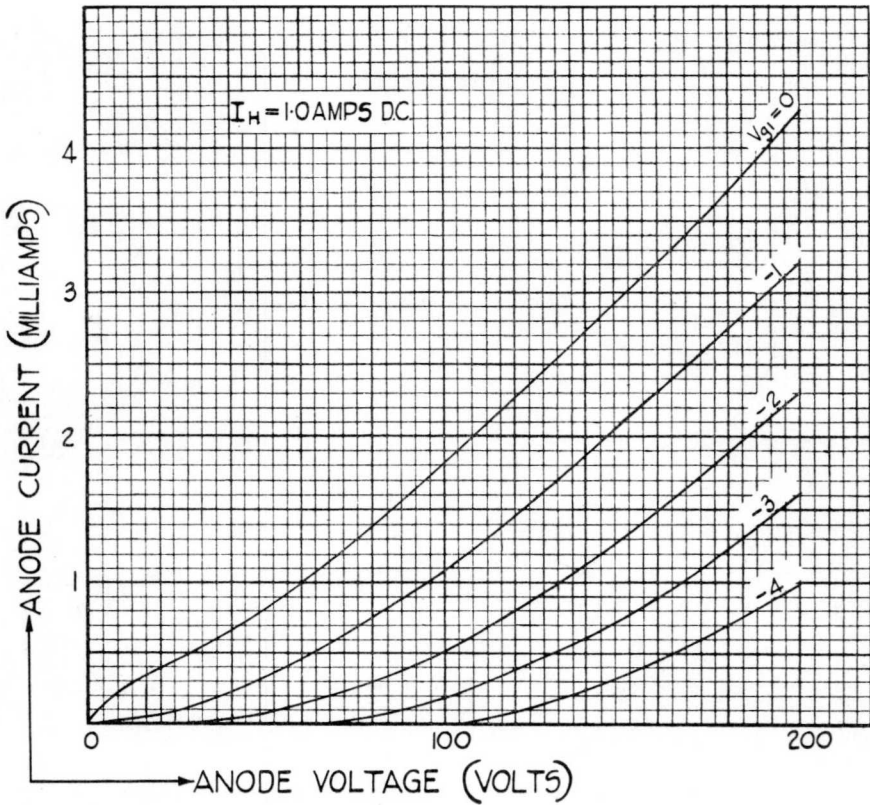
—Standard Valves—

TYPICAL OPERATING CONDITIONS.

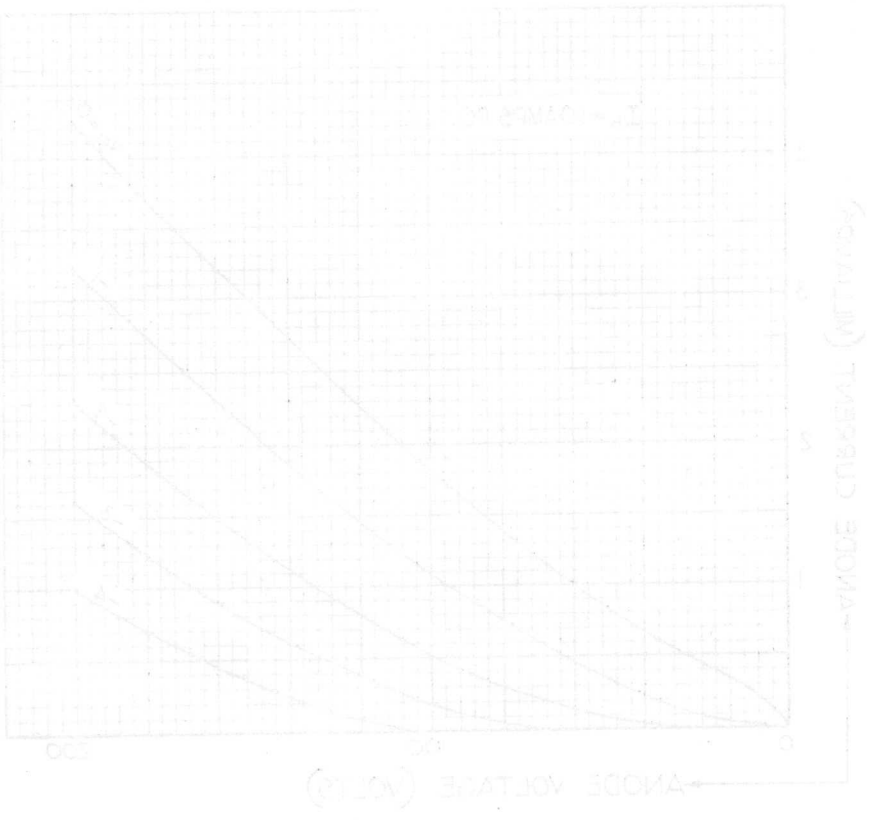
Anode voltage volts	Grid Bias volts	Anode Current mA.	Load Resistance ohms	Output voltage peak volts	Total harmonic distortion in db below fundamental
130	-2	1.0	80,000	27	35
			160,000	38	32
			240,000	41	31
130	-1	1.7	50,000	15	34
			100,000	20	31
			150,000	23	32
160	-3	0.9	80,000	40	36
			160,000	57	32
			240,000	62	32
160	-1	2.3	40,000	15	33
			80,000	21	32
			120,000	24	31
190	-3	1.4	50,000	42	36
			100,000	63	32
			150,000	68	31
190	-2	2.1	40,000	30	33
			80,000	43	31
			120,000	48	32



—Standard Valves—



Standard Valves



PRINTED IN ENGLAND

Test tube code

—Standard Valves—

3A/105-B

VALVE TYPE 3A/105-B

LOW NOISE TRIODE.

SPECIFICATION.

Cathode.

Indirectly heated oxide coated.
Constant voltage type.

Base.

British small 4-pin.
Grid connected to top cap type B.

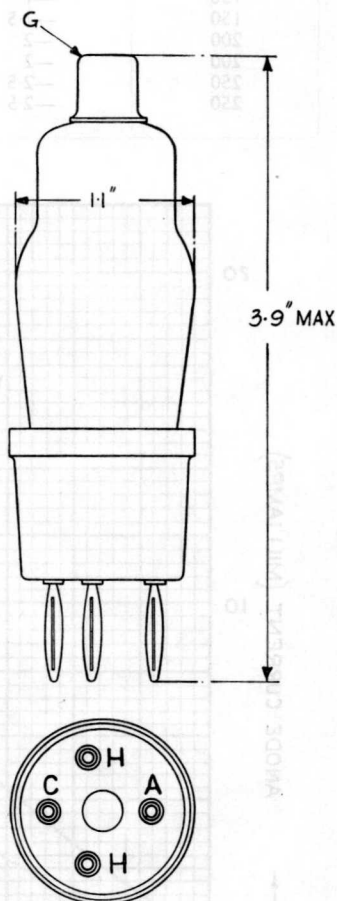
Dimensions.

Maximum overall length 3.9" (9.9 cms.)
Maximum diameter 1.1" (2.8 cms.)

Constants.

Heater voltage	13 volts
Heater current	0.19 amps.
*Amplification factor	40
*Impedance	19,000 ohms
*Mutual conductance	2.1 mA. per volt
Grid-anode capacity	1.5 $\mu\mu\text{F}$.
Grid-cathode capacity	2.4 $\mu\mu\text{F}$.
Anode-cathode capacity	4.5 $\mu\mu\text{F}$.

* at $V_p = 130$ volts, $V_{g1} = -1.5$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	250 volts
Maximum anode dissipation	2.5 watts
Maximum direct anode current	15 mA.

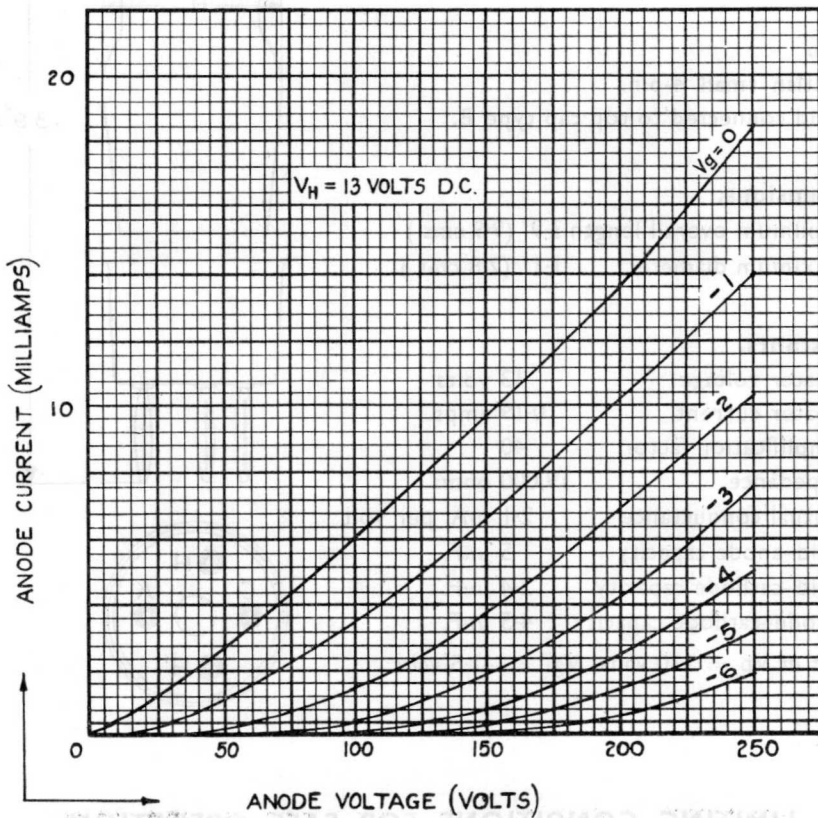
Tentative data

W.3A/105-B.1
April 1939

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

Anode Voltage Volts	Grid Bias Volts	Load Resistance Ohms	Output mW.	Total Harmonics db
130	-1	9,000	3	26
150	-1.5	11,000	3	29
200	-2	14,000	5	30
200	-2	14,000	15	25
250	-2.5	18,000	5	32
250	-2.5	18,000	30	27



PM 442

—Standard Valves—

3B/100-B
Valve

VALVE TYPE 3B/100-B

TRIODE.

SPECIFICATION.

Cathode.

Indirectly heated oxide coated.
Constant voltage type.

Base.

Standard British 5-pin.

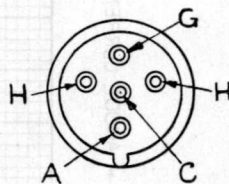
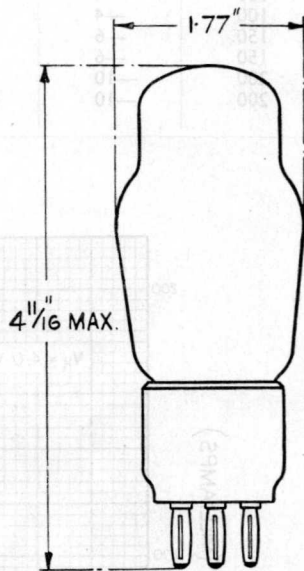
Dimensions.

Maximum overall length $4\frac{11}{16}$ " (11.9 cms.)
Bulb diameter 1.77" (4.5 cms.)
Net weight 0.11 lbs. (50 gms.)

Constants.

Heater voltage	4 volts
Heater current	1.1 amps.
*Amplification factor	13
*Impedance	2,000 ohms.
*Mutual conductance	6.5 mA per volt
Grid-anode capacity	7.5 $\mu\mu\text{F}$.
Grid-cathode capacity	10.3 $\mu\mu\text{F}$.
Anode-cathode capacity	4.8 $\mu\mu\text{F}$.

* at $V_p = 200$ $V_{g1} = -10$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	200 volts
Maximum direct anode current	50 mA.
Maximum anode dissipation	10 watts

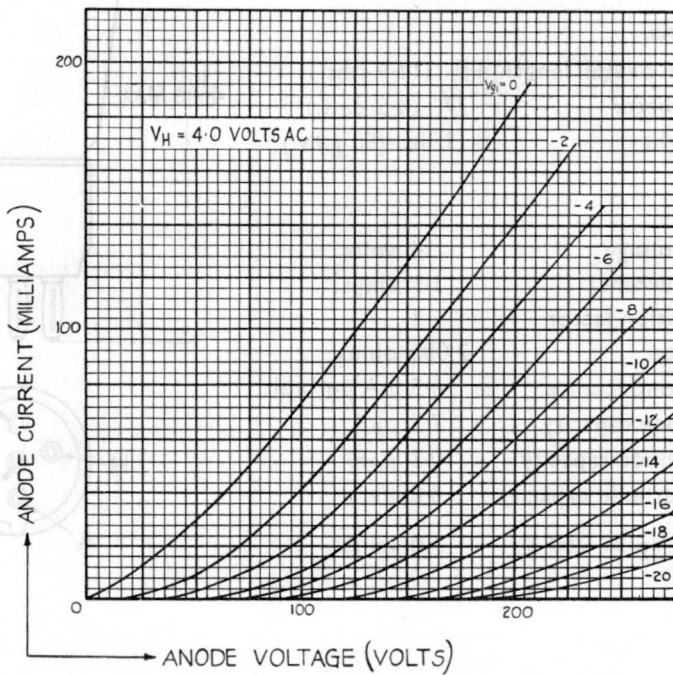
Tentative Data

W.3B/100-B.1
Feb. 1939

—Standard Valves—

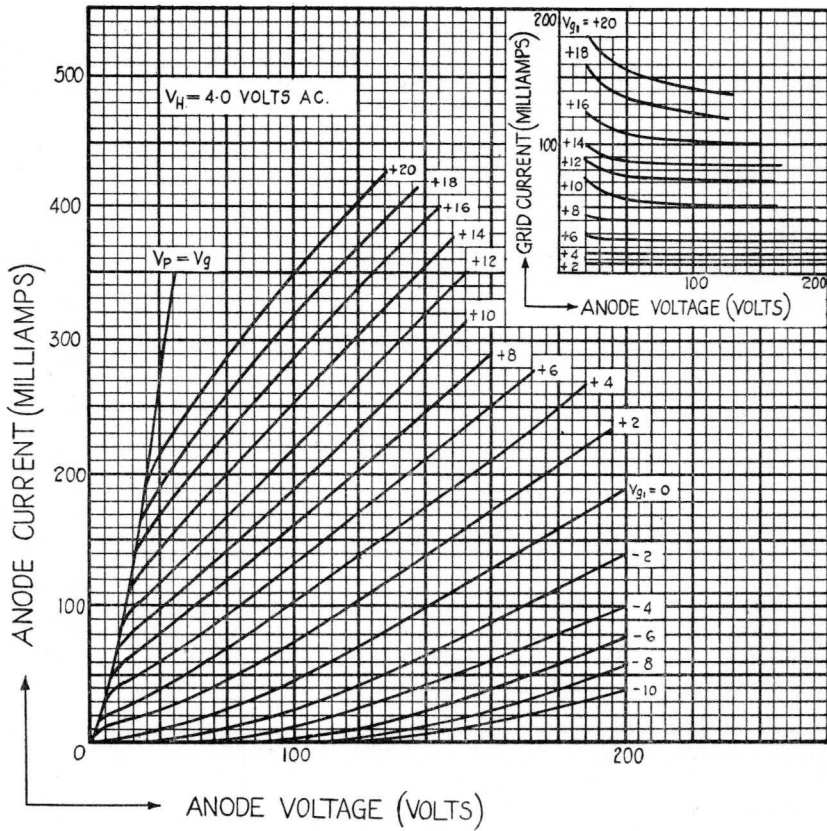
TYPICAL OPERATING CONDITIONS.

Class A. AF Amplifier					
Anode Voltage volts	Grid Bias volts	Anode Current mA.	Load Resistance ohms	Power Output mW.	Total Harmonics db.
100	—4	23	8,000	10	38
100	—4	23	8,000	50	31
150	—6	40	10,000	50	35
150	—6	40	10,000	100	32
200	—10	40	10,000	50	37
200	—10	40	10,000	250	30



—Standard Valves—

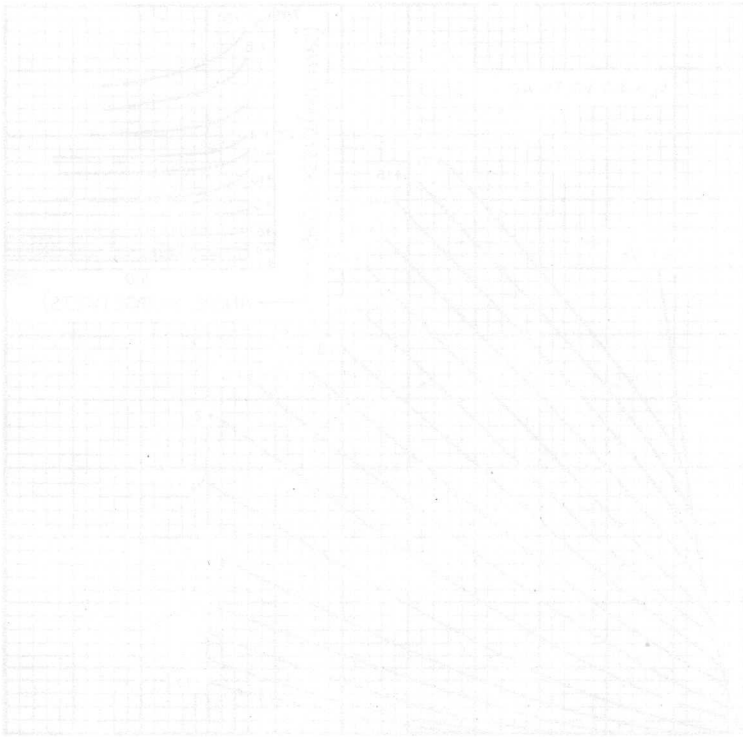
3B/100-B
Valve



Tentative data
FY 12

W.3B/100-B.2
Feb. 1939

Standard Waives



MADE IN GREAT BRITAIN

PRINTED IN
ENGLAND

Printed in
Great Britain

—Standard Valves—

3B/101-B

VALVE TYPE 3B/101-B

TRIODE.

SPECIFICATION.

Cathode.

Indirectly heated oxide coated.
Constant voltage type.

Base.

Standard British 5-pin.

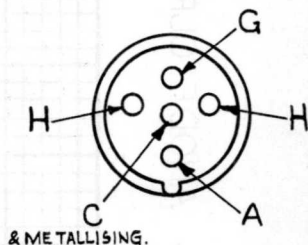
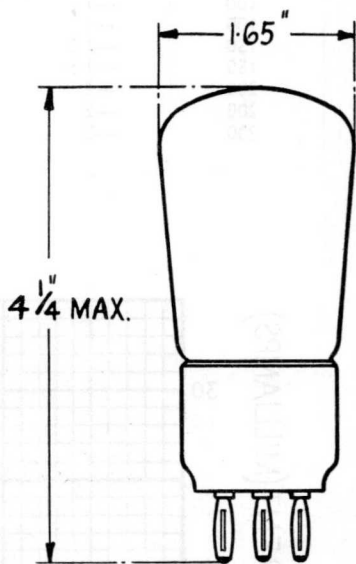
Dimensions.

Maximum overall length $4\frac{1}{4}"$ (10.8 cms.)
Bulb diameter 1.65" (4.2 cms.)
Net weight 0.11 lbs. (50 gms.)

Constants.

Heater voltage 4 volts
Nominal heater current 1.0 amps.
*Amplification factor 50
*Impedance 10,000 ohms
*Mutual conductance 5.0 mA. per volt
Grid-anode capacity 5.3 μF .
Grid-cathode capacity 10.5 μF .
Anode-cathode capacity 7.5 μF .

* at $V_p = 200$, $V_{g_1} = -2$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	200 volts
Maximum direct anode current	25 mA.

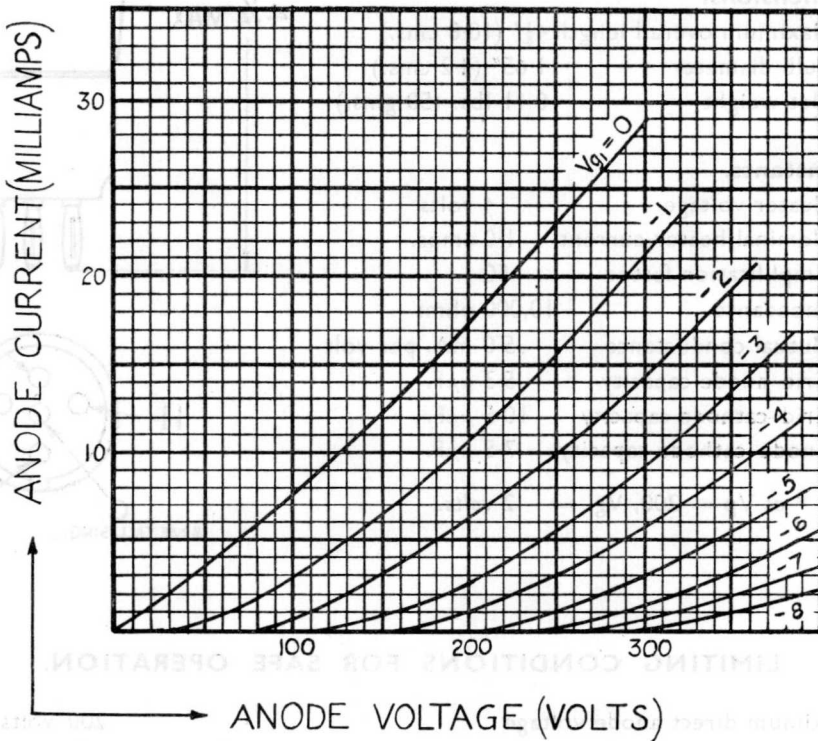
Tentative data

W.3B/101-B.1
April 1939

—Standard Valves—

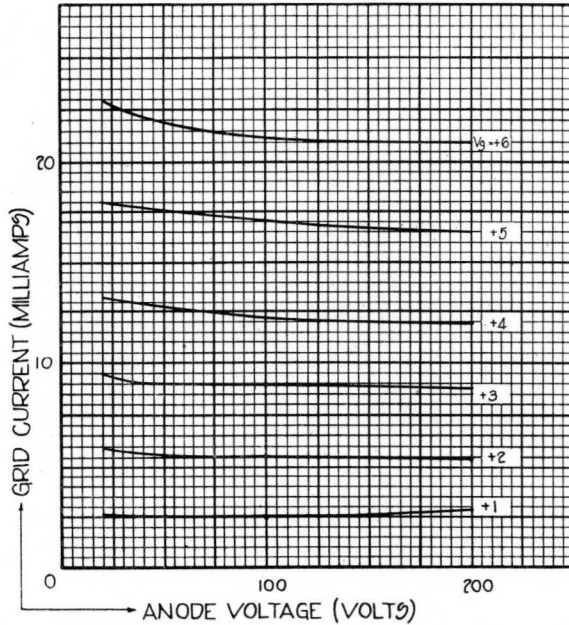
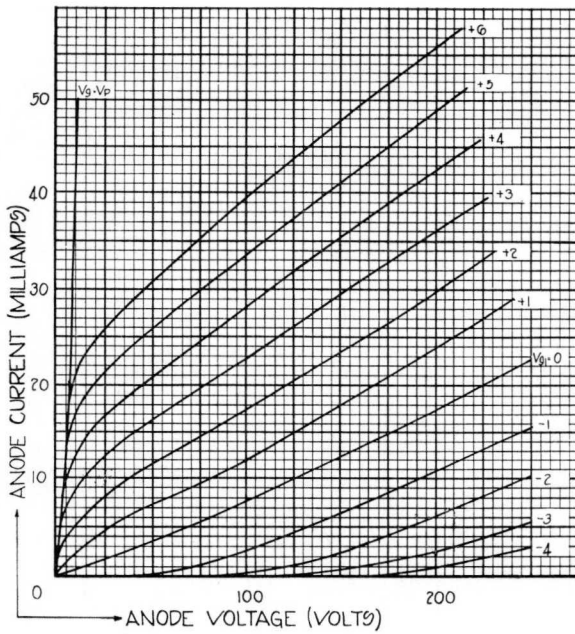
TYPICAL OPERATING CONDITIONS.

Anode Voltage Volts	Grid Bias Volts	Anode Current mA.	Load Resistance Ohms	Power Output mW.	Total Harmonics db.
100	-1	2.8	22,000	5	31.5
100	-1	2.8	22,000	10	31
150	-1.5	4.5	28,000	5	32
150	-1.5	4.5	28,000	20	27
200	-2	6.0	34,000	5	34
200	-2	6.0	34,000	20	29
200	-2	6.0	34,000	30	27



—Standard Valves—

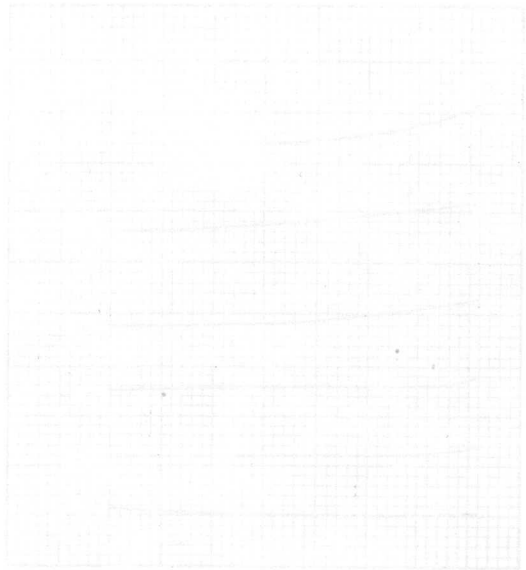
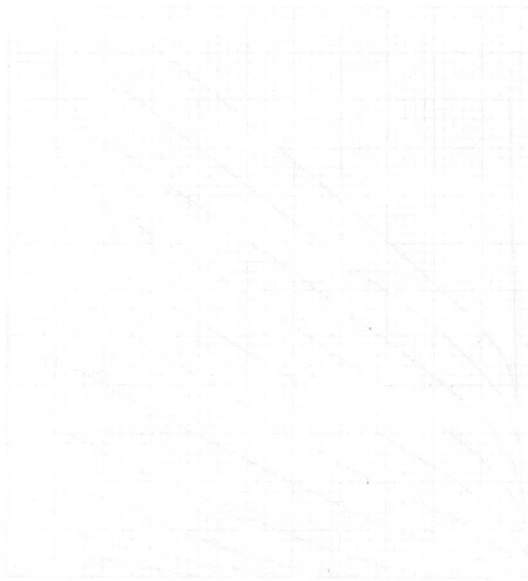
3B/101-B



Tentative data
FR 143

W.3B/101-B.2
April, 1939

Standard Valves



PRINTED IN ENGLAND

—Standard Valves—

3B/200-B

VALVE TYPE 3B/200-B

(Previously coded VLS.417-B valve).

TRIODE.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant voltage type.

Base.

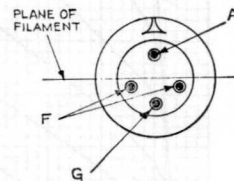
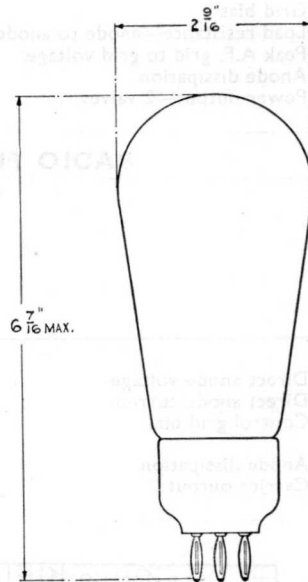
Standard British 4 pin.

Dimensions.

Max. Overall length $6\frac{7}{16}$ " (16.3 cms.)
Bulb diameter $2\frac{9}{16}$ " (6.5 cms.)
Net weight $\frac{3}{8}$ lb. (170 gms.)

Constants.

Filament voltage 6 volts
Nominal filament current 1.1 amps.
*Amplification factor 25
*Mutual conductance 5 mA. per volt
*Impedance 5,000 ohms.
Grid-anode capacity $9.9\ \mu\mu\text{F.}$
Grid-filament capacity $7.5\ \mu\mu\text{F.}$
Anode-filament capacity $5.7\ \mu\mu\text{F.}$
* at $V_p = 400$ volts, $I_p = 50$ mA.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	600 volts
Maximum anode dissipation	20 watts
Maximum direct anode current	135 mA.
Maximum frequency for above ratings	2 Mc.
Maximum direct anode voltage for frequency of 10 Mc.	500 volts

Tentative data

W.3B/200-B.1
March, 1939

—Standard Valves—

3C/150-A

VALVE TYPE 3C/150-A

HIGH FREQUENCY TRIODE.

SPECIFICATION.

Cathode.

Thoriated tungsten filament.
Constant voltage type.

Dimensions.

Maximum overall length $9\frac{15}{16}$ " (25.2 cm.)
Bulb diameter 2.83" (7.2 cm.)
Net weight 0.7 lbs. (320 gms.)

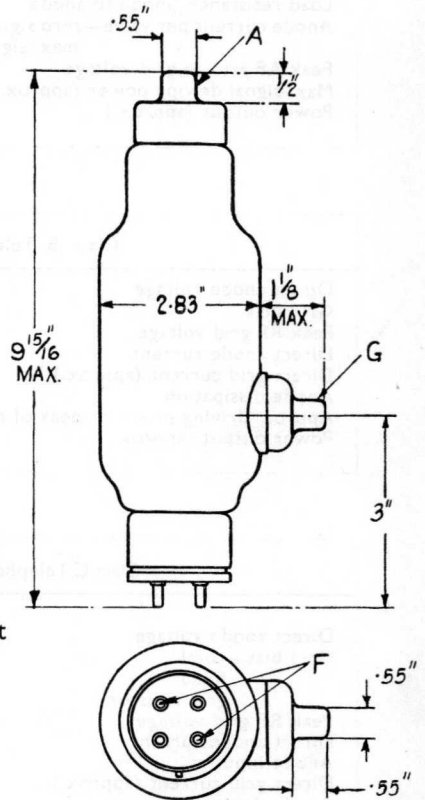
Base.

Large 4-pin bayonet.

Constants.

Filament voltage	10 volts
Filament current	3.4 amps.
*Impedance	3,800 ohms.
*Amplification factor	18
*Mutual conductance	4.75 mA. per volt
Grid-anode capacity	7.3 $\mu\mu\text{F}$.
Grid-filament capacity	8.6 $\mu\mu\text{F}$.
Anode-filament capacity	1.1 $\mu\mu\text{F}$.

* at $V_p = 1,000$ volts, $I_p = 150$ mA.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	2,500 volts
Maximum anode dissipation	150 watts
Maximum direct anode current	200 mA.
Maximum RF grid current	10 amps.
Maximum frequency for above ratings	20 Mc.
Maximum anode voltage for frequency of 60 Mc.	2,000 volts

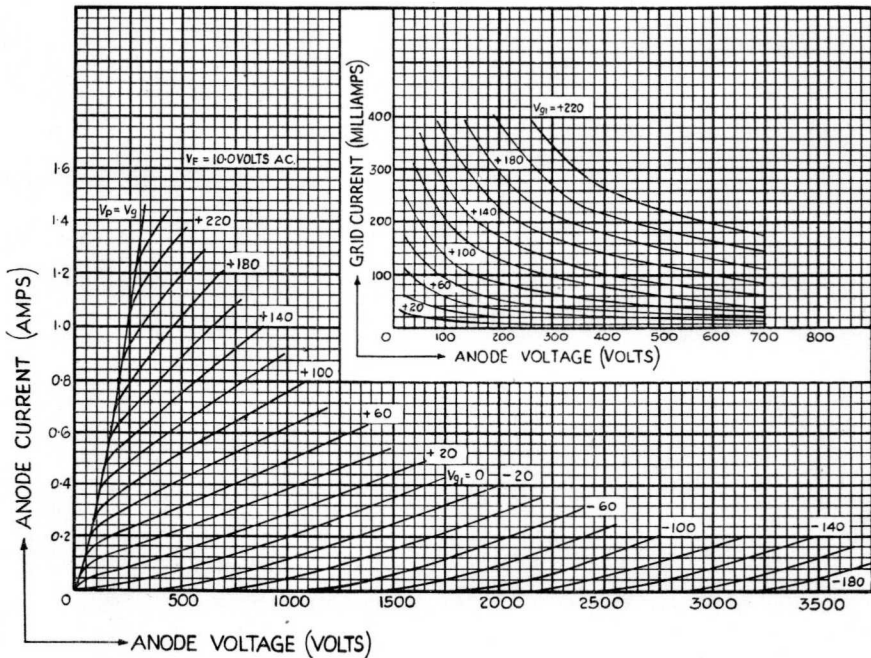
Tentative data

W.3C/150-A.1
March 1939

—Standard Valves—

3C/150-A

Class C Telegraphy—Unmodulated		
Direct anode voltage	2,000	2,500 volts
Grid bias	—250	—300 volts
Peak RF grid voltage	410	455 volts
Direct anode current	200	200 mA.
Direct grid current (approx.)	23	18 mA.
Anode dissipation	100	120 watts
Driving power (approx.)	9	8 watts
Output power (approx.)	300	380 watts



Tentative data
HD 3

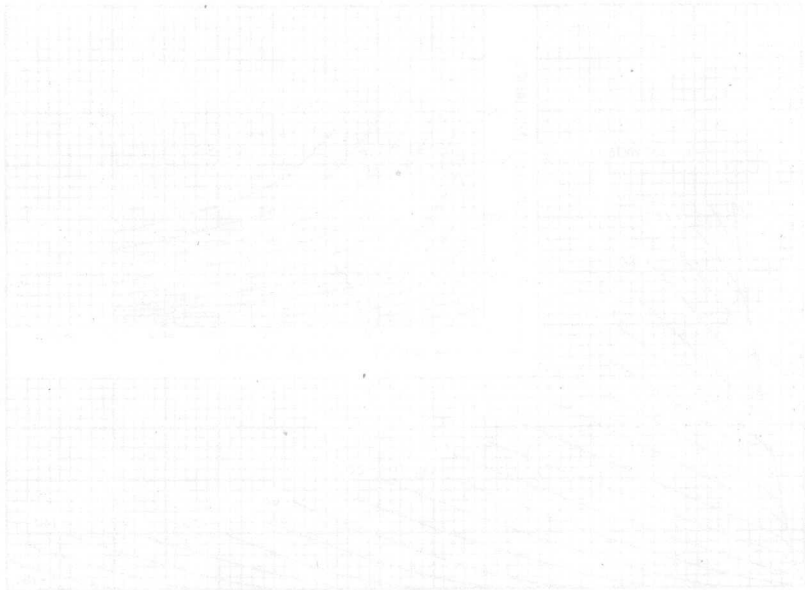
W.3C/150-A.2
March 1939

Standard Values

Table 1. Standard Values

100	100
200	200
300	300
400	400
500	500
600	600
700	700
800	800
900	900
1000	1000

Standard values for various parameters are listed in this table. The values are based on a standard set of conditions and are intended for use as a reference. The values are given in the units indicated in the table.



—Standard Valves—

5A/102-A

VALVE TYPE 5A/102-A

(previously coded VLS.452).

OUTPUT PENTODE.

SPECIFICATION.

Cathode.

Indirectly heated oxide coated.
Constant current type.

Base.

American medium 6-pin—Control grid connected to top cap type B.

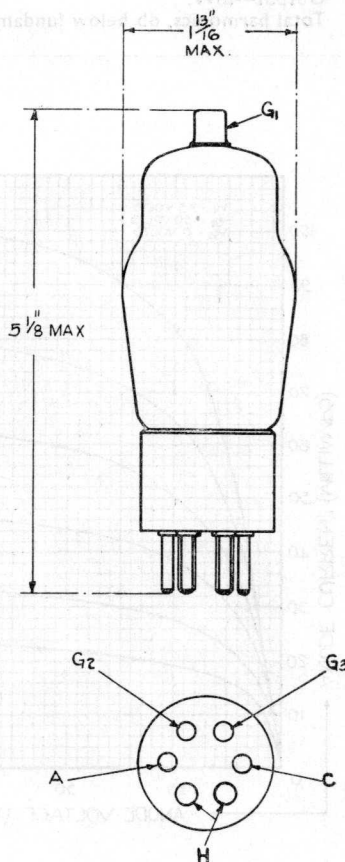
Dimensions.

Max. overall length $5\frac{1}{8}$ " (13 cms.)
Max. diameter $1\frac{13}{16}$ " (4.6 cms.)
Net weight 0.11 lbs. (50 gms.)

Constants.

Nominal heater voltage 7.5 volts
Heater current 0.85 amps.
*Amplification factor 110
*Impedance 43,000 ohms
*Mutual conductance 2.5 mA. per volt
Grid-anode capacity 0.5 $\mu\mu\text{F}$.
Input capacity 6.8 $\mu\mu\text{F}$.
Output capacity 9 $\mu\mu\text{F}$.

* at $V_p = 180$ $V_{g_2} = 150$, $V_{g_1} = -18$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	180 volts
Maximum direct anode current	50 mA.
Maximum direct screen voltage	150 volts
Maximum direct screen current	10 mA.
Maximum control grid resistance (using auto-bias).	500,000 ohms

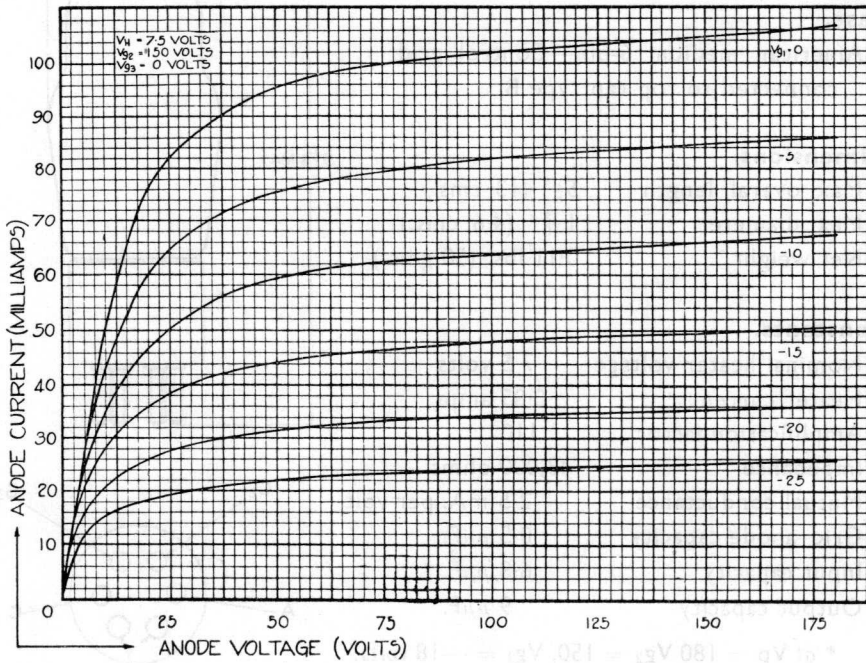
Tentative data

W.5A/102-A.1
March, 1939

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

Anode voltage	180 volts
Control grid voltage	—18 volts
Screen voltage	150 volts
Suppressor voltage	0 volts
Load resistance	4,000 ohms
Output—mW.	50 100 250 500 750 1,000
Total harmonics, db below fundamental	34 31 28 26 25 24



LIMITING CONDITIONS FOR SAFE OPERATION

Maximum direct anode voltage
 Maximum direct anode current
 Maximum direct screen voltage
 Maximum direct screen current
 Maximum control grid resistance
 Maximum control grid current

PRINTED IN ENGLAND

—Standard Valves—

5B/300-B
5B/300-BF

VALVE TYPES 5B/300-B AND 5B/300-BF

RF. PENTODES.

The 5B/300-B and 5B/300-BF Valves are identical and the -F code indicates that the valve has passed special tests for use in Standard Aircraft Radio.

SPECIFICATION.

Cathode.

Indirectly heated oxide coated.
Constant voltage type.

Base.

Standard British 7-pin.
Anode connected to top cap type B.

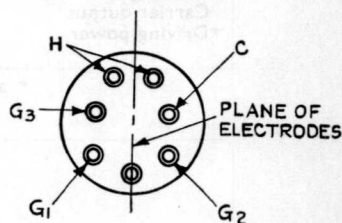
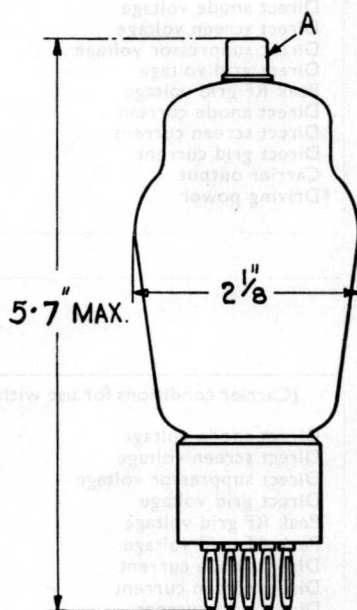
Dimensions.

Maximum overall length 5.7" (14.5 cms.)
Bulb diameter $2\frac{1}{8}$ " (5.4 cms.)
Net weight 0.145 lbs. (66 gms.)

Constants.

Heater voltage 10 volts
Nominal heater current 0.80 amps.
*Mutual conductance 6 mA. per volt
Grid-anode capacity 1.2 $\mu\mu\text{F}$.
Input capacity 16 $\mu\mu\text{F}$.
Output capacity 8 $\mu\mu\text{F}$.

* at $V_p = 500$, $V_{g_2} = 250$, $V_{g_1} = -8$,
 $V_{g_3} = 0$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	500 volts
Maximum direct screen voltage	300 volts
Maximum direct anode current	60 mA.
Maximum direct screen current	25 mA.
Maximum anode dissipation	30 watts
Maximum screen dissipation	6 watts
Maximum frequency for above ratings	40 Mc.
Maximum anode voltage for frequency of 70 Mc.	300 volts

Tentative data

W.5B/300-B.1
April 1939

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Grid Modulated RF Power Amplifier Class B Telephony
(Carrier conditions for use with mod. factor of 1.0)	
Direct anode voltage	500 volts
Direct screen voltage	250 volts
Direct suppressor voltage	0 volts
Direct grid voltage	—20 volts
Peak RF grid voltage	22 volts
Direct anode current	35 mA.
Direct screen current	6 mA.
Direct grid current	1 mA.
Carrier output	4.8 watts
*Driving power	0.3 watts

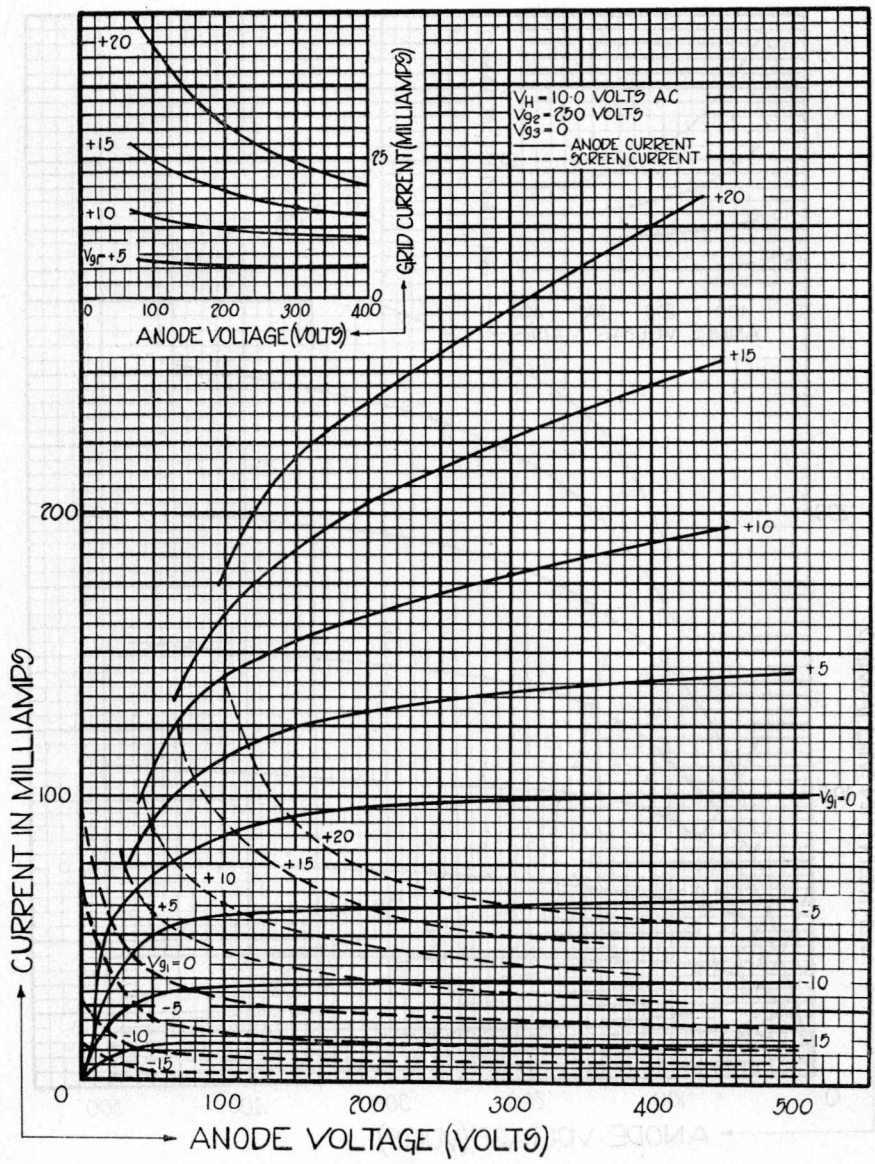
	Grid Modulated RF Power Amplifier Class C Telephony
(Carrier conditions for use with mod. factor of 1.0)	
Direct anode voltage	500 volts
Direct screen voltage	250 volts
Direct suppressor voltage	0 volts
Direct grid voltage	—70 volts
Peak RF grid voltage	77 volts
Peak AF grid voltage	27 volts
Direct anode current	35 mA.
Direct screen current	7 mA.
Direct grid current	1.5 mA.
Carrier output	5 watts
*Driving power	0.7 watts

* at crest of AF cycle with modulation factor of 1.0.

	RF Power Amplifier or Oscillator Class C Telephony
Direct anode voltage	500 volts
Direct screen voltage	250 volts
Direct suppressor voltage	0 volts
Direct grid voltage	—50 volts
Peak RF grid voltage	75 volts
Direct anode current	60 mA.
Direct screen current	22 mA.
Direct grid current	10 mA.
Power output	18 watts
Driving power	0.7 watts

— Standard Valves —

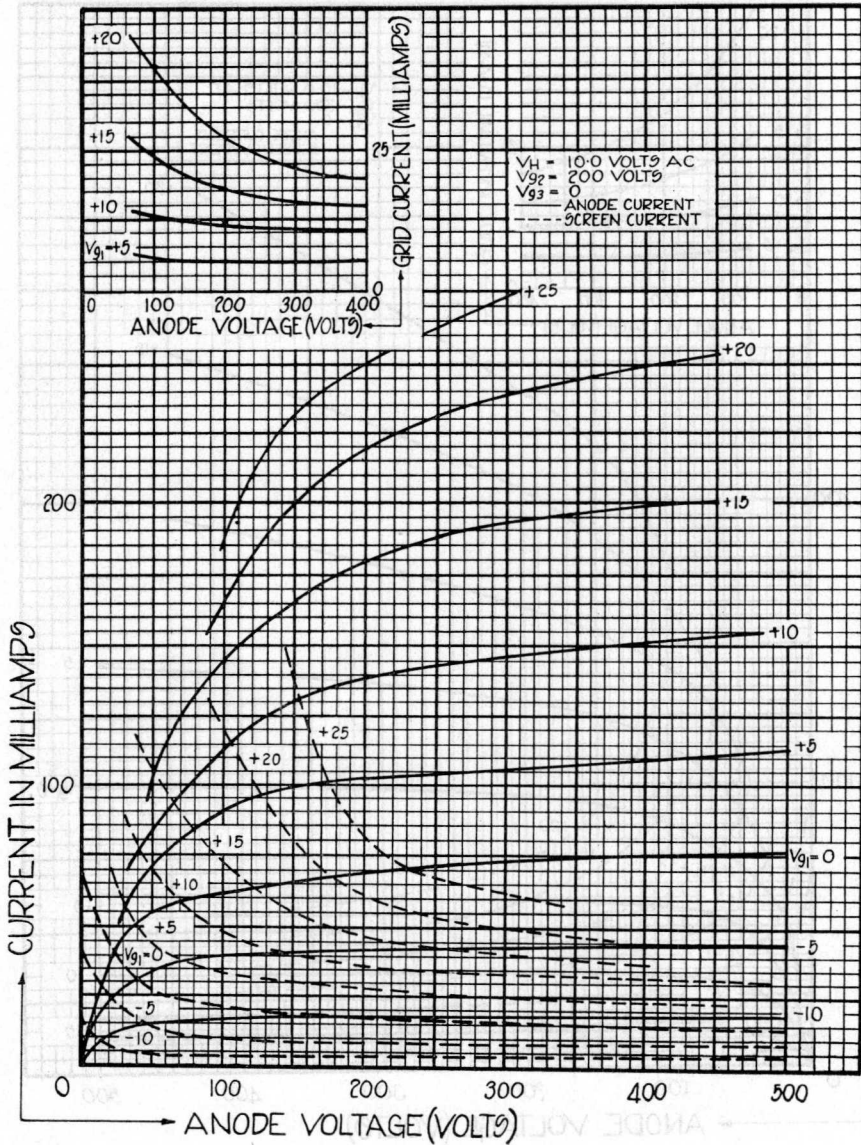
5B/300-B
5B/300-BF



Tentative data
P.J.298

W.5B/300-B.2
April 1939

—Standard Valves—



—Standard Valves—

VALVE TYPE 5B/500-B

RF PENTODE.

SPECIFICATION.

Cathode.

Indirectly heated oxide coated.
Constant voltage type.

Base.

Special British 7-pin.
Anode connected to top cap type B.

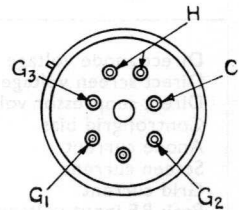
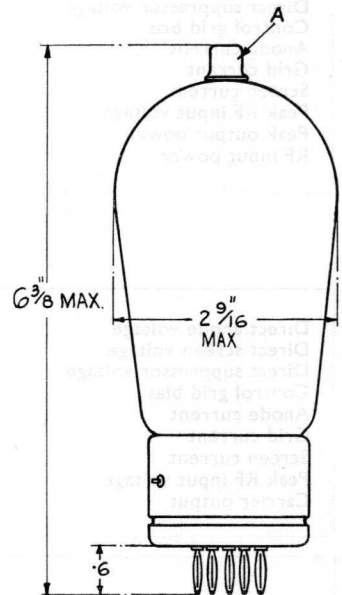
Dimensions.

Max. overall length $6\frac{3}{8}"$ (15.9 cms.)
Maximum diameter $2\frac{9}{16}"$ (6.45 cms.)
Net weight 0.4 lbs. (180 gms.)

Constants.

Heater voltage 10 volts
Nominal heater current 1.3 amps.
*Mutual conductance 4.5 mA. per volt
Grid-anode capacity $0.15 \mu\text{F}$.
Input capacity $20 \mu\text{F}$.
Output capacity $7 \mu\text{F}$.

* at $V_p = 1,000$, $V_{g1} = -16$,
 $V_{g2} = 200$, $V_{g3} = 0$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	1,250 volts
Maximum direct screen voltage	400 volts
Maximum direct suppressor voltage	40 volts
Maximum anode dissipation	50 watts
Maximum screen dissipation	10 watts
Maximum frequency for above ratings	20 Mc.

Tentative data

W.5B/500-B.1
March 1939

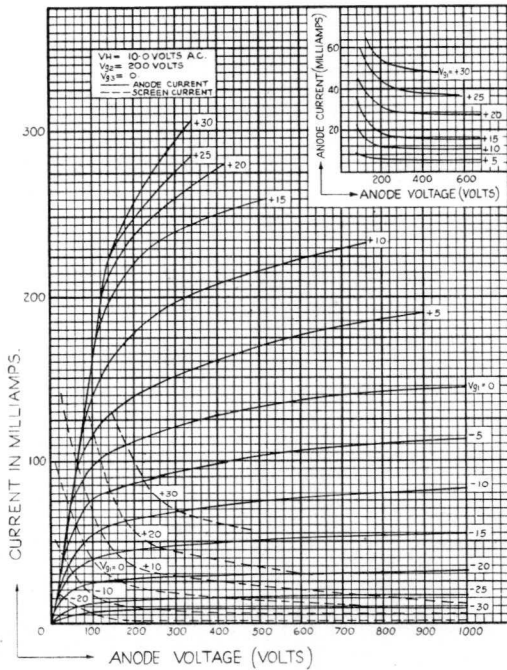
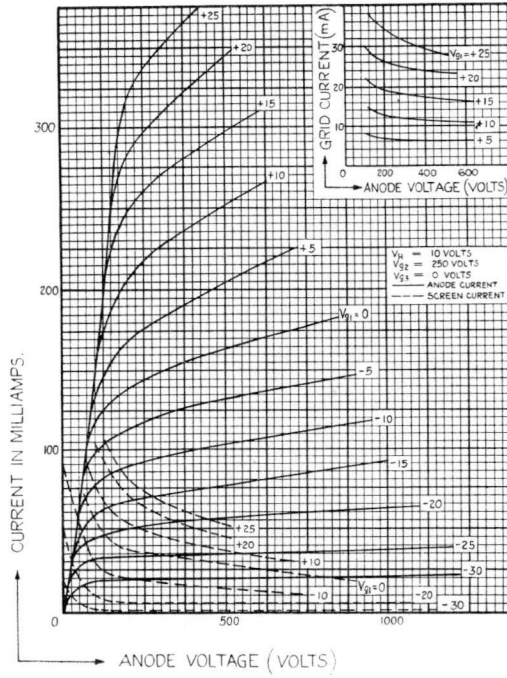
—Standard Valves—

TYPICAL OPERATING CONDITIONS.

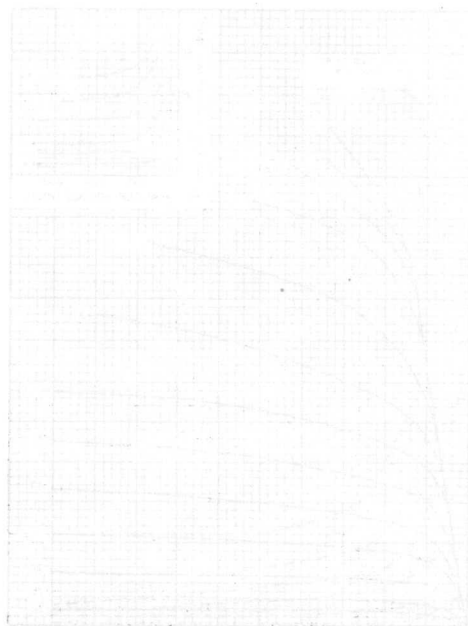
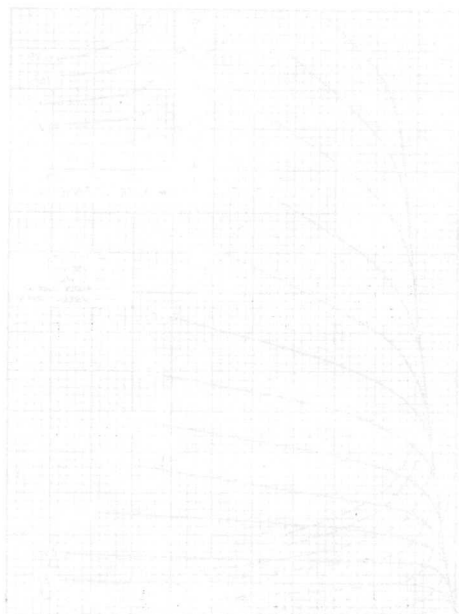
	Class C Amplifier Unmodulated
Direct anode voltage	1,200 volts
Direct screen voltage	200 volts
Direct suppressor voltage	0 volts
Control grid bias	—70 volts
Anode current	77 mA.
Grid current	10 mA.
Screen current	14 mA.
Peak RF input voltage	100 volts
Peak output power	60 watts
RF input power	0.9 watts
	Class C Amplifier Suppressor grid modulated
Direct anode voltage	1,200 volts
Direct screen voltage	200 volts
Direct suppressor voltage	—60 volts
Control grid bias	—70 volts
Anode current	38 mA.
Grid current	10 mA.
Screen current	14 mA.
Peak RF input voltage	100 volts
Carrier output	15 watts
	Class C Telephony Grid Modulated
Direct anode voltage	1,200 volts
Direct screen voltage	200 volts
Direct suppressor voltage	0 volts
Control grid bias	—145 volts
Anode current	45 mA.
Screen current	4 mA.
Grid current	1.5 mA.
Peak RF input voltage	150 volts
Peak power output	64 watts
Carrier output	16 watts
	Class B Telephony Grid Modulated
Direct anode voltage	1,200 volts
Direct screen voltage	200 volts
Direct suppressor voltage	0 volts
Control grid bias	—30 volts
Anode current	40 mA.
Screen current	3 mA.
Peak output power	56 watts
Carrier output	14 watts

—Standard Valves—

5B/500-B



Standard Valves



PRINTED IN ENGLAND

—Standard Valves—

5B/501-B
5B/501-BF

VALVE TYPES 5B/501-B and 5B/501-BF

RF. PENTODES.

The 5B/501-B and 5B/501-BF Valves have identical characteristics and the -F code indicates that the valve has passed special tests for use in Standard Aircraft Radio.

SPECIFICATION.

Cathode.

Indirectly heated oxide coated.
Constant voltage type.

Base.

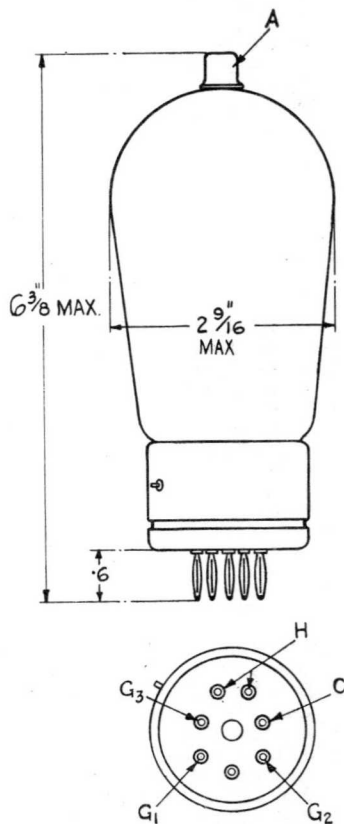
Special British 7-pin.
Anode connected to top cap type B.

Dimensions.

Max. overall length $6\frac{3}{8}$ " (15.9 cms.)
Maximum diameter $2\frac{9}{16}$ " (6.45 cms.)
Net weight 0.4 lbs. (180 gms.)

Constants.

Heater voltage 13 volts
Nominal heater current 1.0 amps.
*Mutual conductance 4.5 mA. per volt
Grid-anode capacity 0.15 $\mu\mu\text{F}$.
Input capacity 20 $\mu\mu\text{F}$.
Output capacity 7 $\mu\mu\text{F}$.
* at $V_p = 1,000$, $V_{g_1} = -16$,
 $V_{g_2} = 200$, $V_{g_3} = 0$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	1,250 volts
Maximum direct screen voltage	400 volts
Maximum direct suppressor voltage	40 volts
Maximum anode dissipation	50 watts
Maximum screen dissipation	10 watts
Maximum frequency for above ratings	20 Mc.

Tentative data

W.5B/501-B.1
March 1939

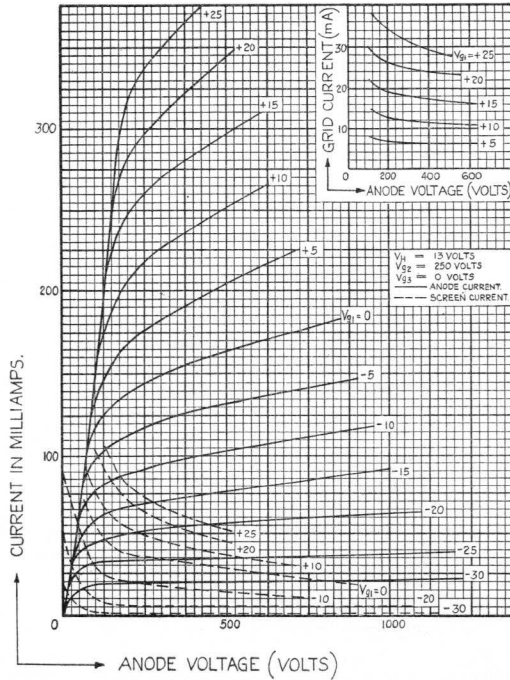
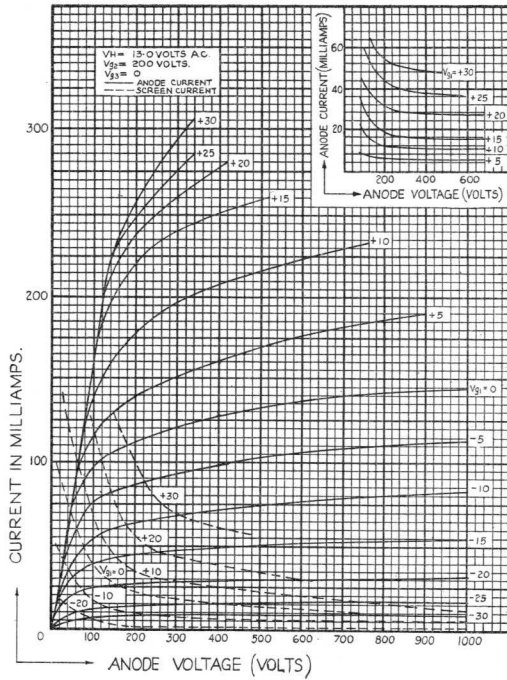
—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class C Amplifier Unmodulated
Direct anode voltage	1,200 volts
Direct screen voltage	200 volts
Direct suppressor voltage	0 volts
Control grid bias	—70 volts
Anode current	77 mA.
Grid current	10 mA.
Screen current	14 mA.
Peak RF input voltage	100 volts
Peak output power	60 watts
RF input power	0.9 watts
	Class C Amplifier Suppressor grid modulated
Direct anode voltage	1,200 volts
Direct screen voltage	200 volts
Direct suppressor voltage	—60 volts
Control grid bias	—70 volts
Anode current	38 mA.
Grid current	10 mA.
Screen current	14 mA.
Peak RF input voltage	100 volts
Carrier output	15 watts
	Class C Telephony Grid Modulated
Direct anode voltage	1,200 volts
Direct screen voltage	200 volts
Direct suppressor voltage	0 volts
Control grid bias	—145 volts
Anode current	45 mA.
Screen current	4 mA.
Grid current	1.5 mA.
Peak RF input voltage	150 volts
Peak power output	64 watts
Carrier output	16 watts
	Class B Telephony Grid Modulated
Direct anode voltage	1,200 volts
Direct screen voltage	200 volts
Direct suppressor voltage	0 volts
Control grid bias	—30 volts
Anode current	40 mA.
Screen current	3 mA.
Peak output power	56 watts
Carrier output	14 watts

—Standard Valves—

5B/501-B
5B/501-BF



8-102 83
8-102 83

STANDARD PAPER

PRINTED IN
ENGLAND

8-102 83
8-102 83

8-102 83
8-102 83

—Standard Valves—

VALVE TYPE 5C/450-A

PENTODE.

SPECIFICATION.

Cathode.

Thoriated tungsten filament.
Constant voltage type.

Base.

Diameter of pins and pin spacing identical with that of extra large 4 pin bayonet base.

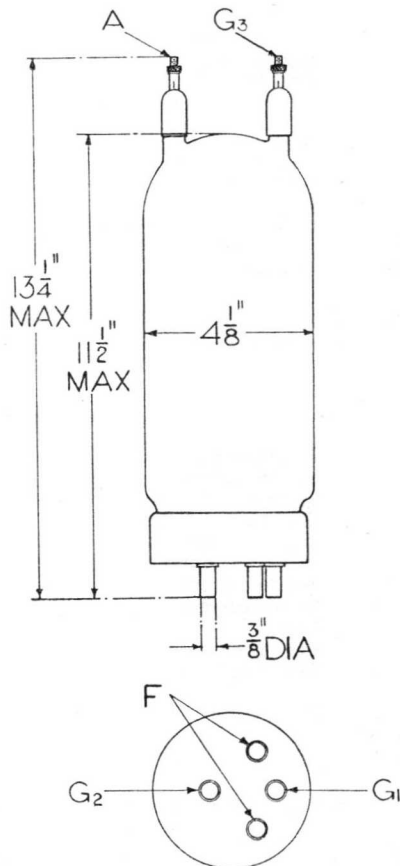
Dimensions.

Max. overall length $13\frac{1}{4}"$ (33.6 cm.)
Max. diameter $4\frac{1}{8}"$ (10.5 cm.)
Net weight 2 lb. (940 gm.)

Constants.

Filament voltage 10 volts
Nominal filament current 12.5 amps.
Total emission 5 amps.
*Mutual conductance 6.5 mA. per volt
Grid-anode capacity $0.2 \mu\mu\text{F.}$
Input capacity $26 \mu\mu\text{F.}$
Output capacity $39 \mu\mu\text{F.}$

* at $V_p = 3,000$, $V_{g2} = 600$ volts,
 $I_p = 0.2$ amps.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	3,000 volts
Maximum direct screen voltage	650 volts
Maximum anode dissipation	450 watts
Maximum screen dissipation	100 watts
Maximum frequency for above ratings	10 Mc.
Maximum anode voltage for frequency of 20 Mc.	2,250 volts

For intermediate or higher frequencies the anode voltage should be reduced proportionately.

Tentative data
(500)

W.5C/450-A.1
Jan., 1940

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

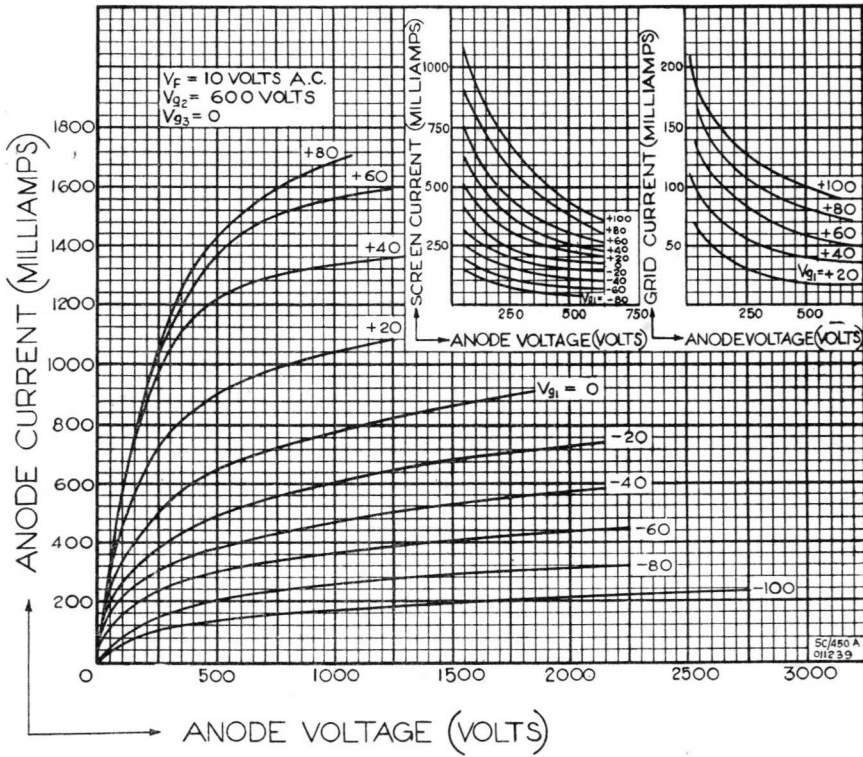
	Unmodulated Amplifier for Frequencies below 12 Mc.	
Anode voltage	2,000	2,500 volts
Screen voltage	650	600 volts
Suppressor voltage	+90	+110 volts
Grid bias—Grid resistor	1,000	3,500 ohms
Fixed bias	—110	—100 volts
Total	—136	—165 volts
Anode current	520	590 mA.
Screen current	80	80 mA.
Grid current	16	19 mA.
Screen resistor	—	2,500 ohms
Driving power (approx.)	3	4.5 watts
Output power	760	1,070 watts
Efficiency	73	73 %

	Class C Amplifier— Suppressor Grid Modulation.	
Anode voltage	2,500	volts
Screen voltage	530	volts
Suppressor voltage	—90	volts
Grid bias—Grid resistor	3,500	ohms
Fixed bias	—100	volts
Total	—165	volts
Anode current	300	mA.
Screen current	110	mA.
Grid current	19	mA.
Carrier output	300	watts
Screen resistor	2,500	ohms
Distortion less than 5% at 80% modulation.		

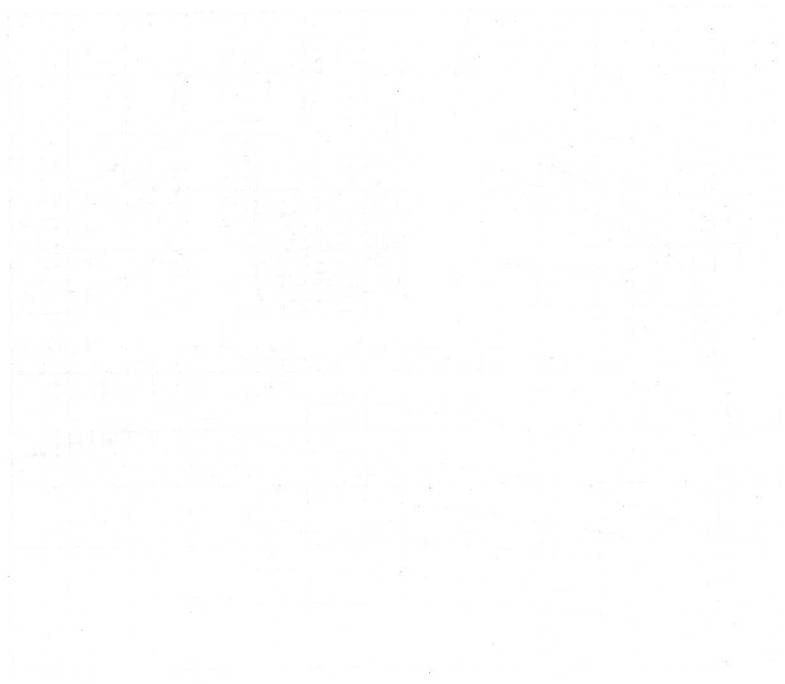
NOTE.—This Valve operates at a high temperature. Free circulation of air is absolutely essential. When the valve is housed in a confined space, such as a cabinet, circulation of air should preferably be provided by means of a fan. The inside of cabinet walls should be matt finished and should, on no account, be polished.

-Standard Valves-

5C/450-A



W.5C/450-A.2
Jan. 1940



—Standard Valves—

5D/100-A

VALVE TYPE 5D/100-A

RF POWER PENTODE.

SPECIFICATION.

Cathode.

Thoriated tungsten filament.
Constant voltage type.

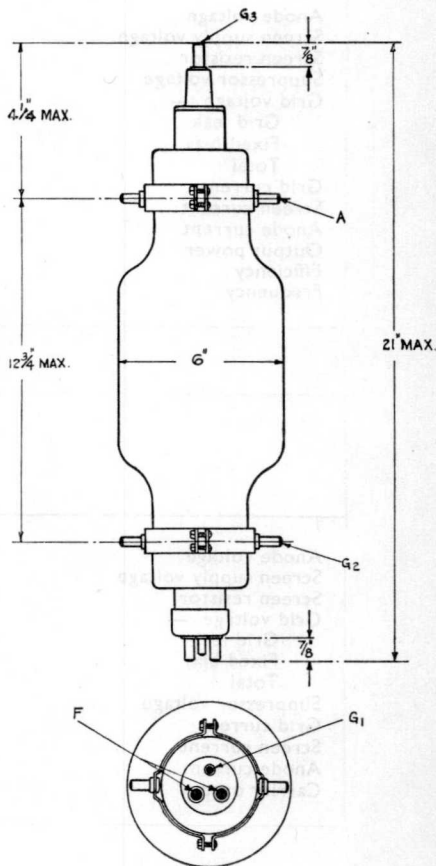
Dimensions.

Max. overall length 21" (53.3 cm.)
Bulb diameter 6" (15.2 cm.)
Net weight 3.65 lb. (1,650 gms.)

Constants.

Filament voltage 10 volts
Nominal filament current 16 amps.
Total emission 6 amps.
*Mutual conductance 4.5 mA. per volt
Grid-anode capacity 0.1 $\mu\mu\text{F}$
Input capacity 42 $\mu\mu\text{F}$
Output capacity 32.8 $\mu\mu\text{F}$.

* at $V_p = 3,000$, $V_{g_2} = 800$, $V_{g_3} = 0$.
 $V_{g_1} = -21$ volts.



LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage	3,000 volts
Maximum anode dissipation	1,000 watts
Maximum direct screen grid voltage	850 volts
Maximum direct screen grid dissipation	250 watts
Maximum frequency for above ratings	10 Mc.
Maximum direct anode voltage for frequency of 20 Mc.	2,500 volts

For higher frequencies the anode voltage should be reduced proportionately.

Tentative data

W.5D/100-A.1
March, 1939

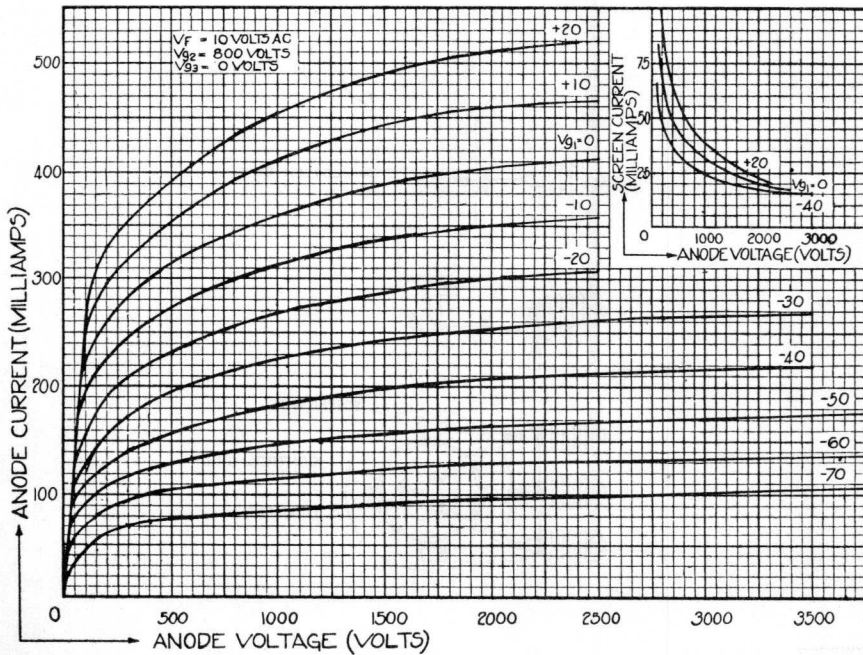
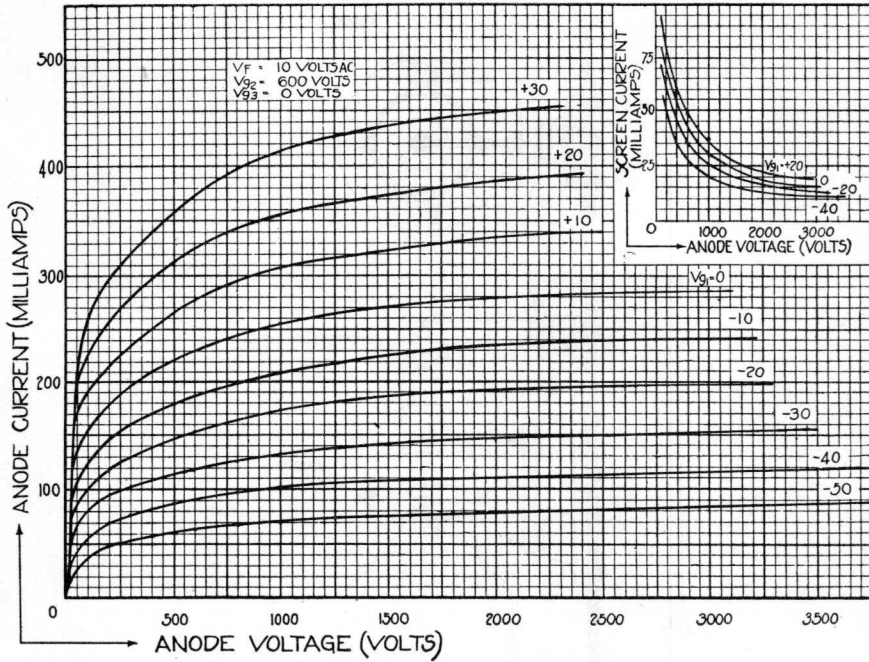
—Standard Valves—

TYPICAL OPERATING CONDITIONS.

	Class C Amplifier Unmodulated		
Anode voltage	2,500	3,000	volts
Screen supply voltage	850	950	volts
Screen resistor	2,500	2,500	ohms
Suppressor voltage	200	200	volts
Grid voltage :—			
Grid leak	6,700	3,700	ohms
Fixed bias	—40	—40	volts
Total	—540	—390	volts
Grid current	75	94	mA.
Screen current	120	140	mA.
Anode current	540	650	mA.
Output power	1,000	1,300	watts
Efficiency	77	67	per cent.
Frequency	10	10	Mc.

	Class C Amplifier—Suppressor Modulated (Distortion less than 5% at 80% modulation)		
Anode voltage		3,000	volts
Screen supply voltage		950	volts
Screen resistor		2,500	ohms
Grid voltage :—			
Grid leak		3,700	ohms
Fixed bias		—40	volts
Total		—390	volts
Suppressor voltage		—50	volts
Grid current		95	mA.
Screen current		190	mA.
Anode current		450	mA.
Carrier output		400	watts

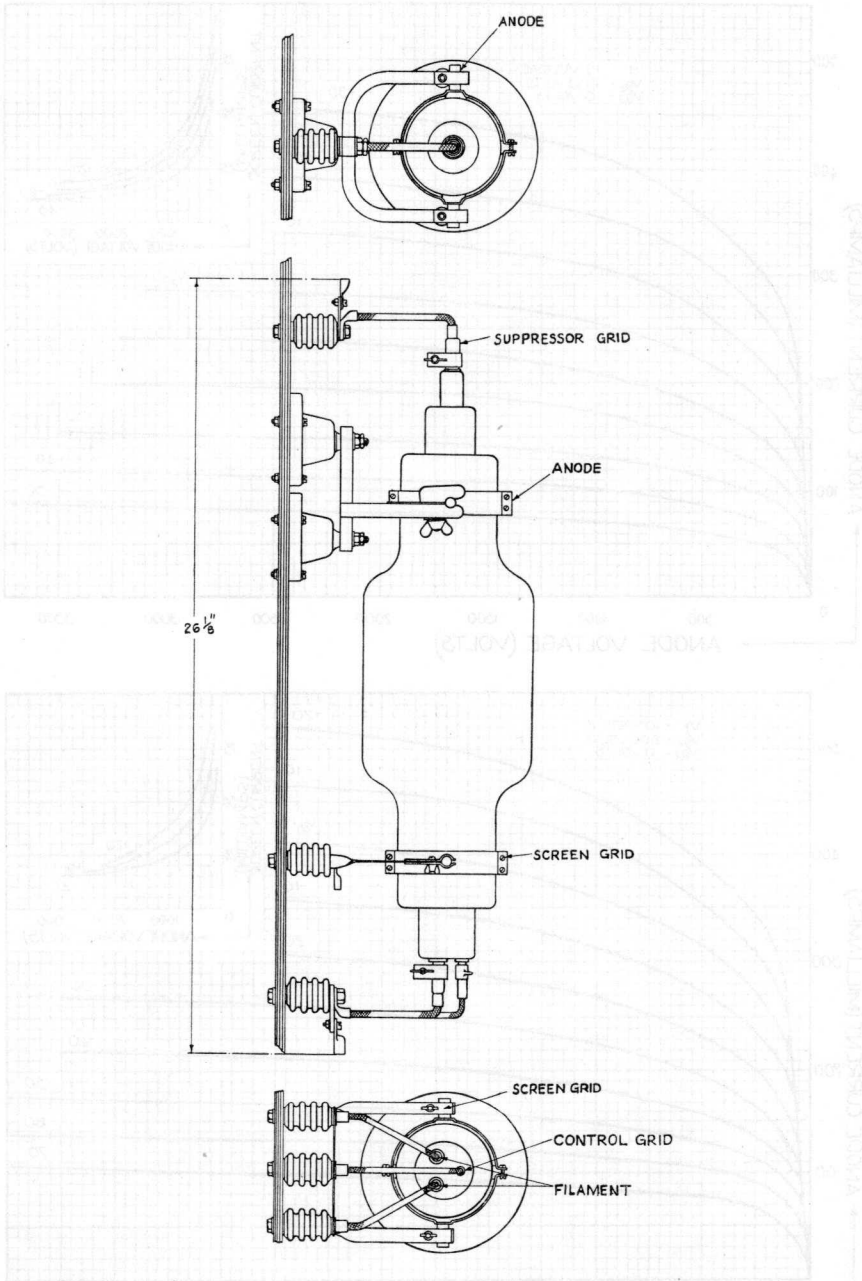
—Standard Valves—



Tentative data
HF 13

W.5D/100-A.2
March, 1939

—Standard Valves—



PRINTED IN ENGLAND

—Standard Valves—

22V/310-A

VALVE TYPE 22V/310-A

FULL WAVE MERCURY VAPOUR RECTIFIER.

SPECIFICATION.

Cathode.

Oxide coated filament.
Constant voltage type.

Base.

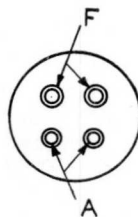
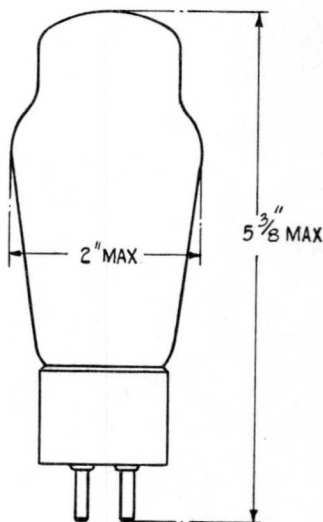
American Medium 4-pin.

Dimensions.

Maximum overall length $5\frac{3}{8}$ " (13.6 cms.)
Maximum diameter 2" (5.1 cms.)
Net weight 0.13 lbs. (60 gms.)

Constants.

Filament voltage	5 volts
Nominal filament current	3 amps.
Maximum peak inverse voltage	1,400 volts
Maximum peak anode current	0.8 amps.
D.C. output current continuous	250 mA.



Operation.

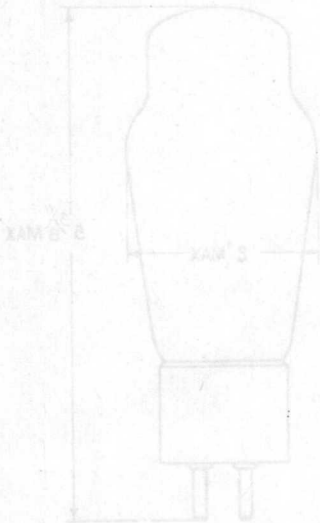
When this valve is operated with the anodes in parallel, a resistance of not less than 50 ohms should be connected in series with each anode in order that each shall carry its proper share of the load. The resistances should be increased to 100 ohms each if the load is less than 75 per cent. of the maximum current rating of the valve.

Standard Valves

VALVE TYPE 22V 310-A

FULL WAVE MERCURY VAPOUR RECTIFIER

SPECIFICATION



Cathode.
Oxide coated filament
Constant voltage type

Base.
American Medium 4-pin

Dimensions.
Maximum overall length 5 7/8" (13.6 cms.)
Maximum diameter 2 1/2" (5.1 cms.)
Net weight 0.13 lbs. (60 gms.)

Constants.
Filament voltage 2 volts
Nominal filament current 3 amps
Maximum peak inverse voltage 1,400 volts
Maximum peak anode current 0.8 amps
D.C. output current (no load) 250 mA

Operation.
When this valve is operated with the anodes in parallel, a resistance of not less than 50 ohms should be connected in series with each anode in order that each shall carry its proper share of the load. The resistances should be increased to 100 ohms each if the load is less than 75 per cent of the maximum current rating of the valve.

PRINTED IN ENGLAND

MISCELLANEOUS

—Standard Valves—

4039-A
Valve

4039-A VALVE MERCURY VAPOUR RELAY.

In this mercury vapour relay the grid will maintain control with zero anode current as long as it is more negative than a certain critical value. When the grid voltage becomes less negative than this value, anode current starts to flow and the grid loses all further control. The maximum anode current which then flows must be kept within the peak instantaneous anode current limit mentioned below otherwise the valve may be damaged.

The grid can only regain control after interruption of the flow of anode current instantaneously. This can be done by using A.C. on the anode or by special circuit arrangements.

The cathode of this valve must not be operated at less than its rated voltage otherwise the valve may be damaged.

SPECIFICATION.

Cathode.

Indirectly heated oxide coated.
Constant voltage type.

Base.

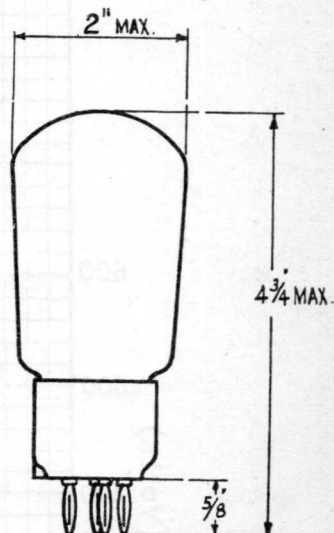
Standard British 5-pin.

Dimensions.

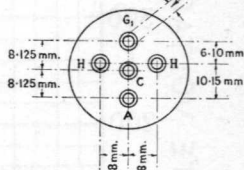
Overall height $4\frac{3}{4}$ " (12.1 cms.)
Bulb diameter 2" (5 cms.)
Net weight 0.12 lbs. (55 gms.)

Constants.

Heater voltage 4.0 volts
Nominal heater current 1.0 amp.
Peak instantaneous anode current 200 mA.
Continuous anode current 100 mA.
Anode peak voltage 500 volts
Grid control ratio 30 to 50
Time delay 30 secs.



DIAM. OF PINS 3.00mm



OPERATING INSTRUCTIONS.

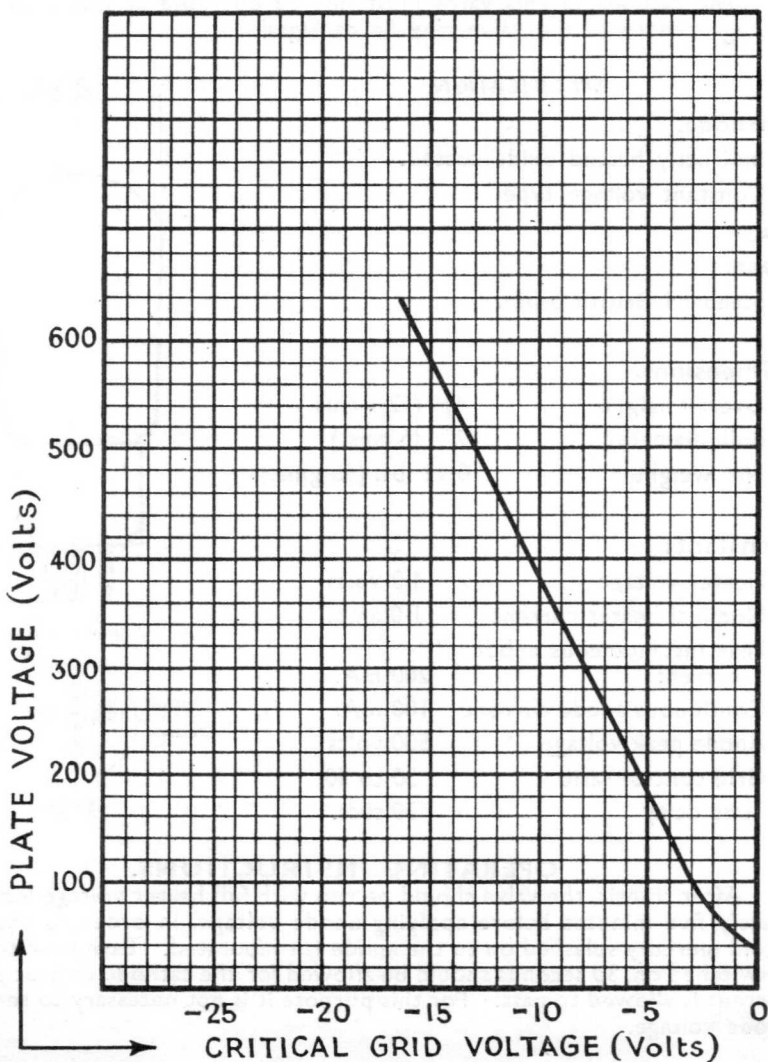
After transit, the valve should be run with full heater voltage for approximately five minutes before applying anode voltage, in order to ensure that liquid mercury splashed on to the anode is evaporated. Each time the circuit is switched on, 30 seconds should be allowed for the cathode to heat up before current is allowed to pass. For this purpose it is not necessary to remove the anode voltage.

MA.4039-A.1
Nov. 1937

—Standard Valves—

When passing current the potential drop across the valve is 10–15 volts and is nearly independent of the current. The current must be limited to an instantaneous value of 200 mA. by means of an external resistance. For continuous operation the mean value of the current should not exceed 100 mA.

The grid control ratio, which will be found to vary slightly with the temperature of the mercury, is defined as the ratio of the positive anode voltage to the minimum negative grid voltage which is sufficient to prevent anode current flowing. It is very nearly independent of anode voltage for values of the latter over 30 volts. If the grid is liable to be driven positive, it is advisable to connect a high resistance (say 0.5 megohm) in series with it to prevent appreciable current from flowing in the grid circuit.



—Standard Valves—

Ballast
Lamps

BALLAST LAMPS

In telephone repeaters it is essential that the filaments of the amplifying valves should be supplied with a constant current. As the battery voltage is liable to variation it is often necessary to use a ballast lamp to supply a constant current for a considerable voltage fluctuation.

The following types of ballast lamps are available :—

Type	Overall length ins.	Diameter ins.	Voltage limits volts	Current limits amps.	Net weight	
					lbs.	gms.
4003-A	5	1 $\frac{1}{4}$	3—9.5	0.94 — 1.01	0.1	45
4004-A	4	1 $\frac{1}{4}$	7—14	0.24 — 0.26	0.08	35
4004-B	4	1 $\frac{1}{4}$	3—9	0.24 — 0.26	0.1	45
4004-C	4	1 $\frac{1}{4}$	3—9	0.254—0.276	0.1	45
4007-A	7 $\frac{1}{2}$	2	9—14	3.3 — 3.4	0.3	140
4008-A	5 $\frac{1}{2}$	2	5.5—12	1.7 — 2.2	0.17	75
4120-AA	4	1 $\frac{1}{4}$	5.5—12	0.39 — 0.47	0.07	30
4121-AA	4 $\frac{1}{2}$ "	1.89"	5.5—12	0.78 — 0.94	0.1	45

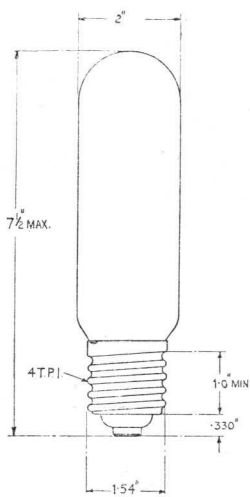
Base.

4003-A	Edison medium screw.
4004-A, -B, -C	Edison medium screw.
4007-A	Edison Goliath screw.
4008-A	Edison medium screw.
4120-AA	Edison medium screw.
4121-AA	Edison medium screw.

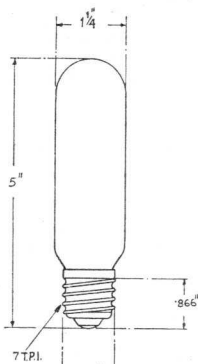
Tentative data.

MB.347.1
Sept. 1938

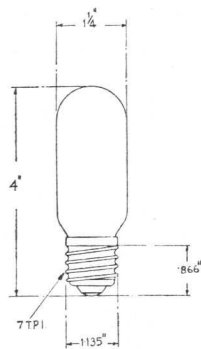
—Standard Valves—



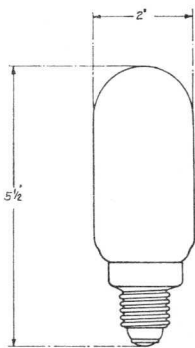
4007-A



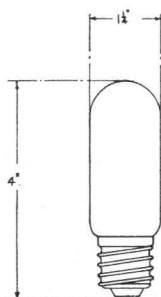
4003-A



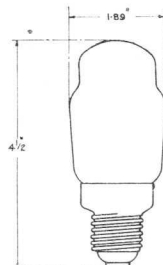
4004-A, -B, -C



4008-A



4120-AA



4121-AA

—Standard Valves—

4018-AB Valve
-AD Valve
-AG Valve

GAS FILLED CATHODE RAY TUBE TYPE 4018-AB, 4018-AD, 4018-AG

For replacement purposes only (See note at bottom of page).

Characteristics.

Filament voltage drop	0.75 volts
Filament current	0.7 to 1.1 amps.
Anode voltage	300 to 2,000 volts
Normal anode voltage	350 volts
Shield voltage (from a potentiometer)	0—50 volts

4018-AB has screen giving blue spot for photographic work.

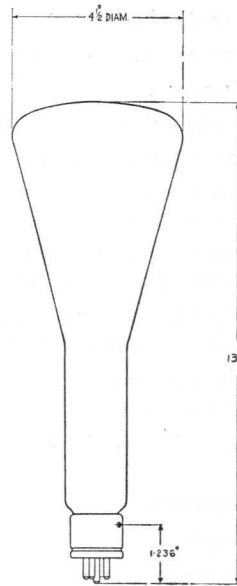
4018-AD has screen giving long afterglow of 10—15 seconds in the dark.

4018-AG has screen giving green spot for visual work.

The \times plates are those nearest to the screen.

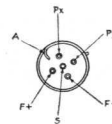
Dimensions.

Length	13" (33 cms.)
Maximum diameter	4½" (11.5 cms.)
Net weight	¾ lbs. (340 gms.)



Operation.

A 2,000 ohm protective resistance should be included in the shield circuit as well as in the anode circuit.



Note:—In the 4018-AB, -AD, -AG valves one plate of each pair of deflecting plates is connected to the anode.

These valves have been replaced by the 4050-AB, -AD, -AG valves which are provided with standard British 9-pin bases, all deflector plates being brought out separately.

MC.4018-A.1
Nov. 1937

4018-BB Valve
-BD Valve
-BG Valve

—Standard Valves—

GAS FILLED CATHODE RAY TUBE TYPE 4018-BB, 4018-BD, 4018-BG

For replacement purposes only
(see note at bottom of page).

Characteristics.

Filament voltage drop 0.75 volts

Filament current 0.7 to 1.1 amps.

Anode voltage 300 to 2,000 volts

Normal anode voltage 350 volts

Shield voltage (from a potentiometer) 0—50 volts

4018-BB has a screen giving blue spot for photographic work.

4018-BD has screen giving long afterglow of 10—15 seconds in the dark.

4018-BG has screen giving green spot for visual work.

The × plates are those nearest to the screen.

Dimensions.

Length 19" (48 cms.)

Maximum diameter 7" (18 cms.)

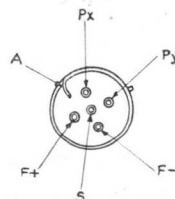
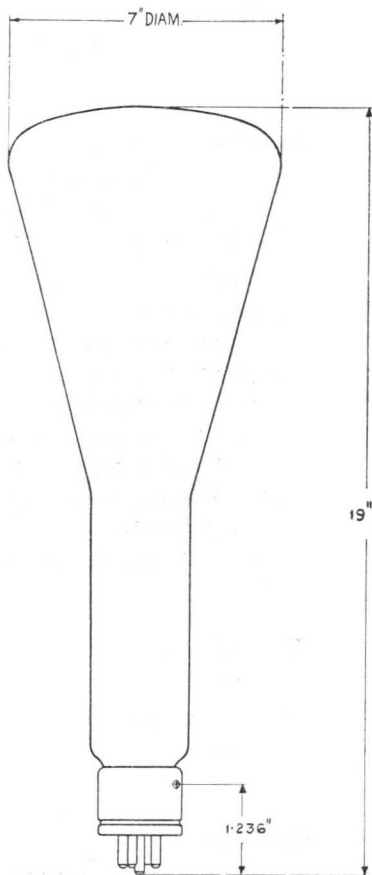
Net weight 2.1 lbs. (940 gms.)

Operation.

A 2,000 ohm protective resistance should be included in the shield circuit as well as in the anode circuit.

Note:—In the 4018-BB, -BD, -BG valves one plate of each pair of deflecting plates is connected to the anode.

These valves have been replaced by the 4050-BB, -BD, -BG valves which are provided with standard British 9-pin bases, all deflector plates being brought out separately.



—Standard Valves—

4050-AB Valve
-AD Valve
-AG Valve

GAS FILLED CATHODE RAY TUBE TYPE 4050-AB, 4050-AD, 4050-AG

Characteristics.

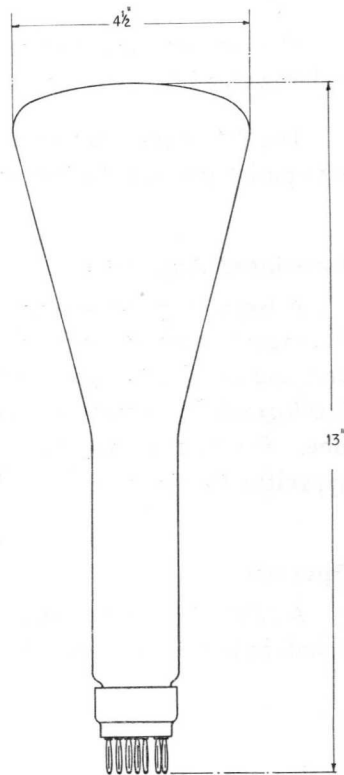
Filament voltage	0.75 volts
Filament current	0.7 to 1.1 amps.
Anode voltage	300 to 2,000 volts
Normal anode voltage	350 volts
Capacity between either pair of deflecting plates including the socket	5.5 $\mu\mu\text{F}$. (approx.)
Capacity of any single plate to the anode including the socket	7—8 $\mu\mu\text{F}$.
Conductance of each pair of deflecting plates	1 μmho (approx.)
Shield voltage (from a potentiometer)	0—50 volts
Sensitivity (approx.)	$\frac{260 \text{ mm. per}}{\text{V}} \text{ volt}$
4050-AB has screen giving blue spot for photographic work.	
4050-AD has screen giving long afterglow of 10—15 seconds in the dark.	
4050-AG has screen giving green spot for visual work.	

Dimensions.

Length	13" (33 cms.)
Maximum diameter	4½" (11.5 cms.)
Net weight	0.75 lbs. (340 gms.)

Base.

Standard British 9-pin.

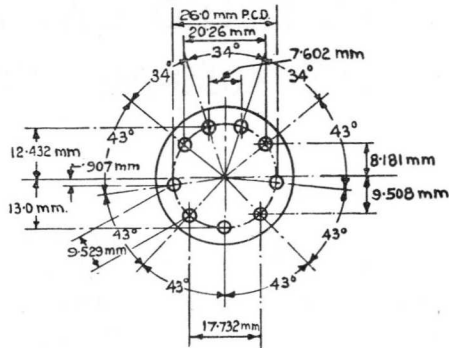


4050-AB Valve
-AD Valve
-AG Valve

—Standard Valves—

Connections to Pins.

- Pin 1—deflecting plate PY2.
- Pin 2—deflecting plate PX2.
- Pin 3—not used.
- Pin 4—filament.
- Pin 5—filament.
- Pin 6—shield.
- Pin 7—deflecting plate PX1.
- Pin 8—deflecting plate PY1.
- Pin 9—anode.



The pins are numbered in a clockwise direction looking at the valve from underneath ; the arrow points between pin 4 and pin 5.

The PX plates produce horizontal deflection when the tube is mounted with pins 4 and 5 at the bottom.

Associated Apparatus.

A large range of apparatus is made for use with the Cathode Ray Tube. The most important units are the 74300 Type Tube Unit, 74300 Type Mains Unit and the 74300 Type Linear Time Base Unit. The 74310 Cathode Ray Oscillograph Equipment is a complete portable equipment incorporating this tube. For further particulars refer to the Standard Transmission Testing Apparatus Catalogue.

Operation.

A 2,000 ohm protective resistance should be included in the shield circuit as well as in the anode circuit.

PRINTED IN
ENGLAND

—Standard Valves—

4050-BB Valve
-BD Valve
-BG Valve

GAS FILLED CATHODE RAY TUBE TYPE 4050-BB, 4050-BD, 4050-BG

Characteristics.

Filament voltage drop 0.75 volts
Filament current 0.7 to 1.1 amps.
Anode voltage 300 to 2,000 volts
Normal anode voltage 350 volts

Capacity between either
pair of deflecting plates
including the socket 5.5 $\mu\mu\text{F}$.
(approx.)

Capacity of any single
plate to the anode
including the socket 7—8 $\mu\mu\text{F}$.

Conductance of each pair of
deflecting plates 1 μmho
(approx.)

Shield voltage (from a
potentiometer) 0—50 volts

Sensitivity (approx.) $\frac{440 \text{ mm. per}}{\text{V}} \text{ volt}$

4050-BB has screen giving blue spot for
photographic work.

4050-BD has screen giving long afterglow of
10—15 seconds in the dark.

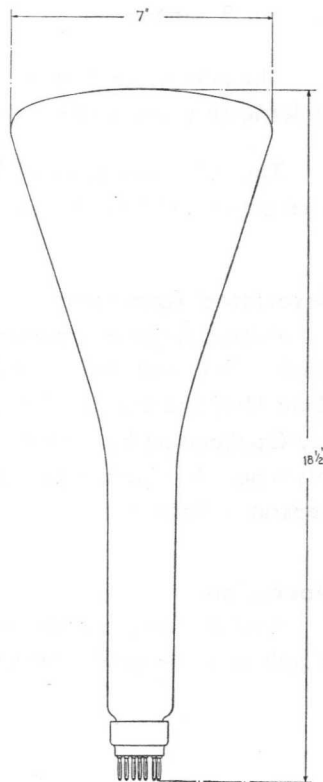
4050-BG has screen giving green spot for
visual work.

Dimensions.

Length $18\frac{1}{2}$ " (46 cms.)
Maximum diameter 7" (18 cms.)
Net weight 2.1 lbs. (940 gms.)

Base.

Standard British 9-pin.

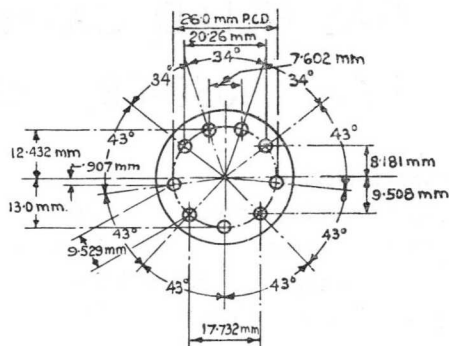


4050-BB Valve
-BD Valve
-BG Valve

—Standard Valves—

Connections to Pins.

- Pin 1—deflecting plate PY2.
- Pin 2—deflecting plate PX2.
- Pin 3—not used.
- Pin 4—filament.
- Pin 5—filament.
- Pin 6—shield.
- Pin 7—deflecting plate PX1.
- Pin 8—deflecting plate PY1.
- Pin 9—anode.



The pins are numbered in a clockwise direction looking at the valve from underneath ; the arrow points between pin 4 and pin 5.

The PX plates produce horizontal deflection when the tube is mounted with pins 4 and 5 at the bottom.

Associated Apparatus.

A large range of apparatus is made for use with the Cathode Ray Oscillograph. The most important units are the 74300 Type Tube Unit, 74300 Type Mains Unit and the 74300 Type Linear Time Base Unit. The 74310 Cathode Ray Oscillograph Equipment is a complete portable equipment incorporating this tube. For further particulars refer to the Standard Transmission Testing Apparatus Catalogue.

Operation.

A 2,000 ohm protective resistance should be included in the shield circuit as well as in the anode circuit.

PRINTED IN
ENGLAND

—Standard Valves—

4063 AB Valve
-YB Valve

4063-AB AND 4063-YB VALVES

HIGH VACUUM CATHODE RAY TUBES.

SPECIFICATION.

	4063-AB.	4063-YB.
Dimensions.		
Maximum overall length	21" (53.5 cms.)	21" (53.5 cms.)
Maximum diameter	6 $\frac{1}{4}$ " (15.6 cms.)	6 $\frac{1}{4}$ " (15.6 cms.)
Screen diameter	5.5" (14 cms.)	5.5" (14 cms.)
Net weight	2 $\frac{1}{2}$ lbs. (1,100 gms.)	2.65 lbs. (1,200 gms.)
Base.	Special 12 contact.	Special 12 contact.
Screen Colour.	Blue.	Blue.
Constants.		
Heater voltage	2 volts	2 volts
Nominal heater current	1.8—2 amps.	1.8—2 amps.
Maximum final anode voltage	5,000 volts	5,000 volts
*Sensitivity (approx.)	$\left\{ \begin{array}{l} \text{x plates } \frac{600}{V_{a3}} \text{ mm./volt} \\ \text{y plates } \frac{700}{V_{a3}} \text{ mm./volt} \end{array} \right.$	$\left\{ \begin{array}{l} 600 \text{ mm./volt} \\ \frac{600}{V_{a3}} \text{ mm./volt} \\ 700 \text{ mm./volt} \\ \frac{700}{V_{a3}} \text{ mm./volt} \end{array} \right.$
Maximum Input power to screen	0.01 watts per sq. cm.	0.01 watts per sq. cm.
Capacities (approx.)		
x ₁ to x ₂	2.0 $\mu\mu\text{F.}$	2.0 $\mu\mu\text{F.}$
x ₁ or x ₂ to E	16 $\mu\mu\text{F.}$	16.0 $\mu\mu\text{F.}$
y ₁ to y ₂	1.1 $\mu\mu\text{F.}$	1.2 $\mu\mu\text{F.}$
y ₁ or y ₂ to E	10 $\mu\mu\text{F.}$	3.5 $\mu\mu\text{F.}$
G to E	18 $\mu\mu\text{F.}$	18.0 $\mu\mu\text{F.}$
Conductance of any plate pair	$< \frac{1}{10} \mu\text{Mho.}$	$< \frac{1}{10} \mu\text{Mho.}$
* V _{a3} is third anode voltage.		

OPERATING CONDITIONS.

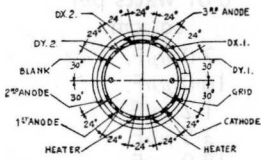
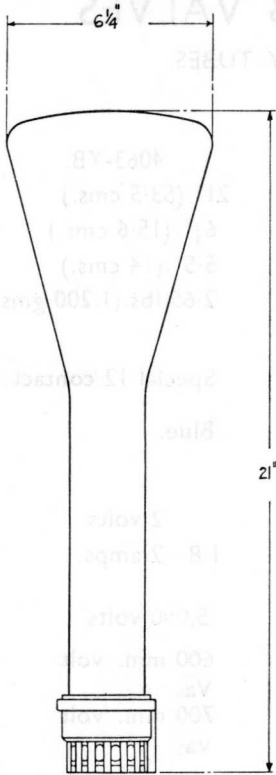
3rd anode voltage	5,000 volts
2nd " "	approx. 0.27 × V _{a3} (adjust for focus)
1st " "	150 volts
Grid bias for maximum brilliancy	0 to —5 volts
" " cut-off	—30 volts (approx.)
" " base for modulation	30 volts

Tentative data

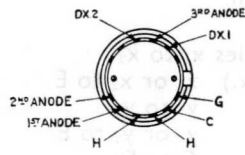
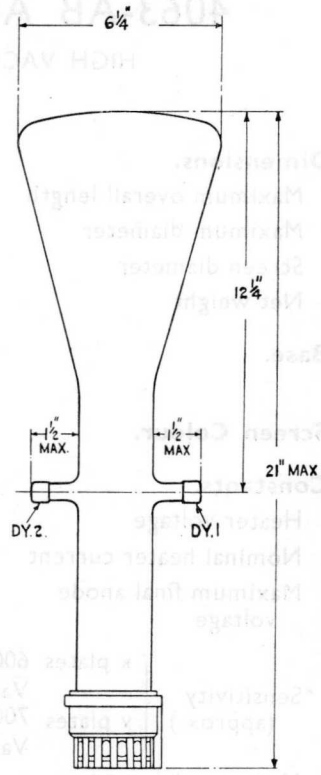
MC.4063-A.1
March 1939

4063 AB Valve
-YB Valve

— Standard Valves —



4063-AB.



4063-YB.

PRINTED IN
ENGLAND

—Standard Valves—

VLS.405-A
Valve
VLS.405-AS
Valve.

VLS. 405-A AND -AS VALVES

NEON INDICATOR LAMPS.

SPECIFICATION.

This indicator lamp is not supplied with a base but in special applications a cap has been fitted. No resistances are supplied inside this cap but it is recommended that the current under normal working conditions be kept as small as possible. A suitable series resistance is 100,000 ohms.

The characteristics of this lamp are as follows :—

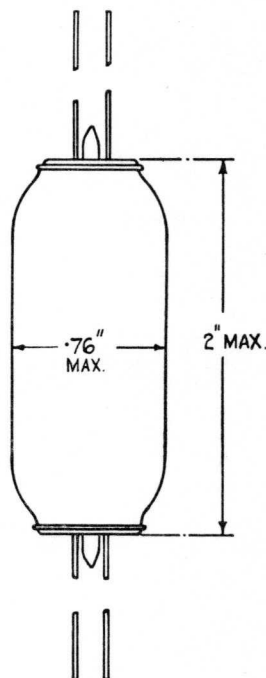
	VLS.405-A	VLS.405-AS
Striking voltage	87.5 ± 5	90 ± 5 volts in each direction
Maximum current	500	500 microamps.
Operating current	0.1	0.1 milliamps.
Capacity	2	2 $\mu\mu\text{F}$

Photo electrical effect.—Approximately 1 volt difference between striking voltage measured in daylight and in darkness.

If the current is kept low (less than 70 microamps) the maintaining voltage under these conditions is not less than 75% of the striking voltage (approximately 65 volts.)

Dimensions.

Overall length	2" max. (5.08 cms.)
Maximum diameter	0.76" max. (1.93 cms.)
Net weight	0.02 lb. (10 gm.)



VLS 402-A
Valve
VLS 402-A2
Valve

Standard Valves

VLS 402-A AND -A2 VALVES

LEAK INDICATOR VALVES



APPLICATION

The indicator ring is not supplied with a cap. In typical applications a cap should be fitted. The indicator is supplied inside the cap and is recommended that the correct cap should be used. A suitable cap should be used. A suitable cap should be used.

The characteristics of the ring are as follows:

Item	Value
1. Ring length	1.50 in (38.1 mm)
2. Ring diameter	0.75 in (19.0 mm)
3. Ring weight	0.02 in (0.51 gm)

Please refer to the data sheet for further information. The indicator is not supplied with a cap.

The indicator is supplied with a cap. The cap should be used. The cap should be used.

Item	Value
1. Overall length	1.50 in (38.1 mm)
2. Ring diameter	0.75 in (19.0 mm)
3. Ring weight	0.02 in (0.51 gm)

PRINTED IN ENGLAND

—Standard Valves—

4013-A
Fuse

4013-A FUSE

VACUUM MICRO FUSE.

The 4013-A Fuse consists of a nickel wire in an evacuated glass bulb. It is intended to blow on currents ranging from 18 to 25 milliamps.

Safe Current.

11 milliamps for 1 hour.
or 5 milliamps for an indefinite period.

Resistance.

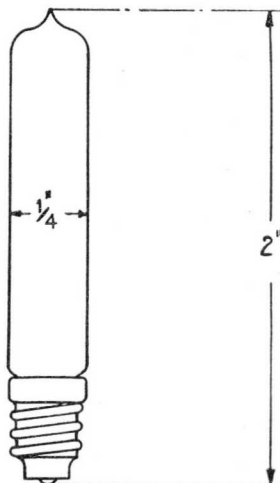
45—55 ohms.

Dimensions.

Overall length	2" (5.1 cms.)
Maximum diameter	$\frac{1}{4}$ " (0.6 cms.)
Net weight	0.01 lbs. (5 gms.)

Base.

Edison miniature screw base.



Note :—Orders for special fuses may be placed. Quotations will be sent on request.

MF.4013-A.1
Nov. 1937

100-1

Standard Tables

100-1

—Standard Valves—

4096-AB
Valve

4096 AB VALVE

HIGH VACUUM CATHODE RAY TUBE.

SPECIFICATION.

Dimensions.

Max. overall length	$10\frac{5}{8}$ " (27 cms.)
Maximum diameter	3" (7.6 cms.)
Screen diameter	$2\frac{1}{2}$ " (6.4 cms.)
Net weight	0.22 lbs. (100 gms.)

Base.

American Small Shell Octal 8-pin.

Screen Colour.

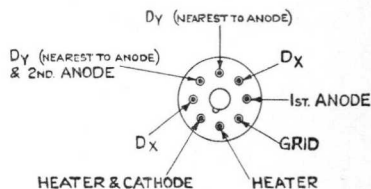
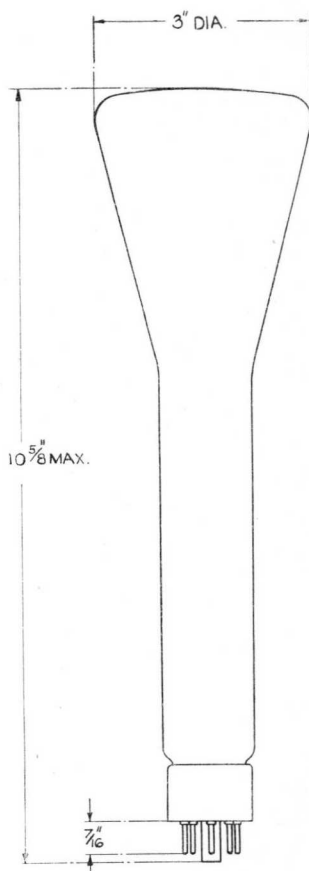
Blue.

Constants.

Heater voltage	2 volts
Nominal heater current	1.7 amps.
1st anode voltage approximately $\frac{1}{8}$ of 2nd anode voltage.	
2nd anode voltage	800—2,000 volts
Control electrode bias	0 to —20 volts
Sensitivity at 2,000 volts—	
X plates	0.13 mm per volt
Y plates	0.135 mm. per volt
Sensitivity at 1,000 volts—	
X plates	0.26 mm. per volt
Y plates	0.27 mm. per volt
Cut off voltage at 2,000 volts—	
—35 to —45 volts	
Max. current to 1st anode	300 μ A

Capacities.

X1 to X2	0.8 μ F.
Y1 to Y2	4.3 μ F.
X1 to all other electrodes strapped	6.6 μ F.
Y1 to all other electrodes strapped	6.0 μ F.
Control electrode to all others strapped	8.5 μ F.



TYPICAL OPERATING CONDITIONS.

1st anode voltage	120	240 volts
2nd anode voltage	1,000	2,000 volts
Grid bias	0 to —5	—10 to —15 volts

Tentative data

MC.4096-AB.1
Sept., 1938

100-1000

Standard Notes

PRINTED IN
ENGLAND

—Standard Valves—

4034-A Valve
4035-A Valve

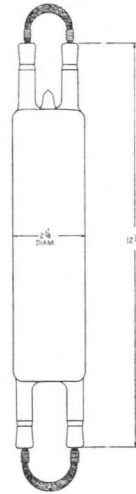
4034-A VALVE

VACUUM CONDENSER.

SPECIFICATION.

Dimensions.

Overall length	15½" (40 cms.)
Diameter	2¼" (5.7 cms.)
Capacity	26 μμF approx.
Test voltage	40,000 volts R.M.S.
Net weight	0.8 lbs. (360 gms.)



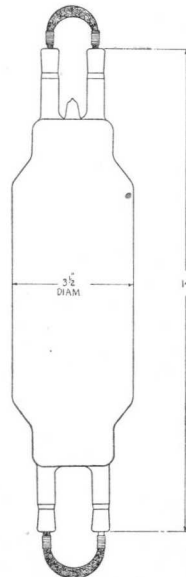
4035-A VALVE

VACUUM CONDENSER.

SPECIFICATION.

Dimensions.

Overall length	17" (43 cms.)
Diameter	3½" (8.9 cms.)
Capacity	40 μμF. approx.
Test voltage	40,000 R.M.S.
Net weight	1.2 lbs. (540 gms.)



Note :—These condensers are intended only for balancing purposes in high power radio transmitters. They must not be used in 50 ω supply without protective resistors.

Ordering.

Please order as :—

“ 4034-A or 4035-A valve
(vacuum condenser).”

MV.40345-A.1
Nov. 1937

4011A Valve
4012A Valve

Standard Valves

4011A Valve

1/2" NPT

1/2" NPT

1/2" NPT

1/2" NPT

1/2" NPT

1/2" NPT

1/2" NPT

1/2" NPT

1/2" NPT

1/2" NPT

1/2" NPT

1/2" NPT

1/2" NPT

1/2" NPT

1/2" NPT

1/2" NPT

1/2" NPT

1/2" NPT

PRINTED IN
ENGLAND

—Standard Valves—

Vacuum
Thermo-
couples

VACUUM THERMOCOUPLES

The Type 4001, 4002 and 4003 Vacuum Thermocouples are all essentially the same, the difference being only in the type of case. They are of the "Contact" type in which the heater wire is in direct metallic contact with a thermo-junction, the whole being mounted in an evacuated glass bulb.

Dimensions.

4001 and 4003	$3\frac{1}{8}$ " long \times $1\frac{3}{8}$ " diameter (8 \times 3.5 cms.).	Net weight 0.12 lbs. (55 gms.)
4002	4" high \times 3" \times 3" (10.2 \times 7.6 \times 7.6 cms.).	Net weight 0.38 lbs. (170 gms.)

Sockets.

The 4001 Type Thermocouple requires to be used in a No. 4004-A Valve Socket.

Types available—

Type 4001 is mounted in a tubular metal case, the connections being brought out to 4 pins at one end, the whole plugging into a 4004-A valve socket.

Type 4002 is mounted in a rectangular mahogany box fitted with four terminals on the top.

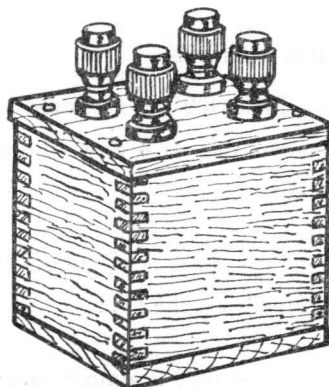
Type 4003 is almost exactly similar to 4001, except that the four pins are replaced by four soldering tags and two small lugs are fitted at the opposite end of the case for base board mounting.

—Standard Valves—

Each of these three types is available in a number of different ranges denoted by letter suffixes as follows :—

Suffix letter	Resistance (ohms) $\pm 10\%$		Maximum safe heater current (mA.)	Heater current (mA.) required to produce in couple an open circuit voltage of :—	
	Heater	Couple		5 millivolts	15 millivolts
A	0.3	3	1,000	400 — 500	750 — 1,000
B	0.6	3	500	180 — 205	360 — 500
C	5	3	75	30 — 37	58 — 75
D	35	12	16	6 — 8	12 — 16
*E	43	30	15	5.5 — 7.5	11 — 15
*F	46.5	12	15	5 — 7.5	10 — 15
G	200	12	15	3 — 6.5	6.5 — 15
H	400	12	7	1.8 — 3.5	4 — 7
J	600	12	5	1.5 — 2	3.5 — 5
K	750	12	5	1.3 — 1.8	3 — 4.2
L	1,000	12	4	1.2 — 1.6	3 — 4
*M	1,120	12	7	1.8 — 3.5	4 — 7
N	46.5	12	15	5 — 7.5	10 — 15
*P	600	45	5	1.5 — 2	3.5 — 5
R	1.3	12	160	67 — 85	130 — 160
S	10	12	35	13 — 17	26 — 35
*U	600	22	5	1.5 — 2	3.5 — 5
AM	90	12	9	3 — 4.5	6 — 9
HJ	550	12	6	1.6 — 2.5	3.6 — 5.8

* Note.—To meet special requirements it is sometimes necessary to provide adjusting resistance in either the couple or heater circuit. This resistance is non-inductively wound on a tubular former slipped over the glass bulb, thus forming an integral part of the thermocouple. In the case of the 'E,' 'F' and 'P' codes, the resistance of the couple element is increased in this way in order that they shall meet specific current requirements when used with certain types of galvanometer. The resistance of the heater circuit on the 'M' and 'U' codes is also built up in this way to the stated values.



Type 402

—Standard Valves—

Vacuum
Thermo-
couples

Accuracy.

Measurements can be made and repeated to $\pm 1\%$.

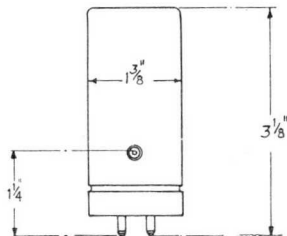
Reactance.

Inductance of heater approximately $5 \times 10^{-8} \text{H}$.

Capacity of heater approximately $2 \mu\mu\text{F}$.

Heating Time.

In the smaller sizes, the heating time is negligible ; the largest size takes approximately 30 seconds to attain maximum value.



Type 4001

Standard
Valves
Company

Standard Valves

PRINTED IN
ENGLAND

BRIMAR B.V.A. VALVES

ENGLISH TYPES

Type Number	Application	Heater		Anode Voltage Normal	Screen Voltage Normal	Grid Voltage Normal	Anode Current mA	Screen Current mA	Amplification Factor	Impedance Ohms	Mutual Conductance mA/V	Optimum Load Ohms.	Auto Bias Resistor	Power Output in Watts	Price
		Volts	Amps.												
20A1	Triode Hexode F.C.	4.0	1.2	250	80	-2 -30	1.4	1.4	—	750,000	650*	—	300	—	11/6
15D1	Frequency Changer	13.0	0.2	250	100	-3 -40	3.5	2.2	—	360,000	550* 2*	—	300	—	11/6
9D2	Vari-Mu H.F. Pentode	13.0	0.2	250	125	-3 -40	10.0	2.6	1000	600,000	1.65 .01	—	200	—	10/6
11D3	Double Diode Triode	13.0	0.2	250	—	-2	0.4	—	100	90,000	1.1	—	5000	—	9/6
10D1	Double Diode	13.0	0.2	—	—	—	—	—	—	—	—	—	—	—	5/6
4D1	Triode	13.0	0.2	200	—	-3	5.0	—	40	10,000	4.0	—	800	—	7/6
7D6	Power Pentode	40.0	0.2	250	250	-6	32.0	6.0	600	60,000	10.0	8500	150	3.75	10/6
7D8	"	13.0	0.6	250	250	-6	32.0	6.0	600	60,000	10.0	8500	150	3.75	10/6
7A3	"	4.0	2.0	250	250	-6	32.0	6.0	600	60,000	10.0	8500	150	3.75	10/6
7D3	"	40.0	0.2	180 135	135 135	-20	38.0 37.0	7.5 8.0	100	40,000	2.5	5000	440	2.75 2.0	10/6
7D5	"	13.0	0.35	250 315	250 315	-16.5 -20.0	34.0 42.0	6.5 8.0	190 260	80,000 100,000	2.35 2.6	7000	410 440	3.0 5.0	10/6
1D5	A.C./D.C. Rectifier	40.0	0.2	Max. A.C. Voltage 250 R.M.S.				Max. Rectified Current 75 Milliamps.						9/-	
R2	A.C. Rectifier	4.0	2.5	Max. A.C. Voltage Per Anode 350 R.M.S.				Max. Rectified Current 120 Milliamps.						9/-	
R3	"	4.0	2.5	Max. A.C. Voltage Per Anode 500 R.M.S.				Max. Rectified Current 120 Milliamps.						9/-	

AMERICAN U.X. TYPES

6A7	Frequency Changer	6.3	0.3	250	100	-3 -40	3.5	2.2	—	360,000	550* 2*	—	300	—	11/6
6B5	Double Output Triode	6.3	0.8	300	—	—	43.0	—	54	24,000	2.25	7000	0	5.0	15/-
6B7	Double Diode Pentode	6.3	0.3	250	125	-3	9.0	2.3	730	650,000	1.1	—	250	—	12/6
6C6	H.F. Pentode	6.3	0.3	250	125	-3	2.0	0.5	1900	1.5 Megohms	1.25	—	600	—	10/6
6D6	Vari-Mu H.F. Pentode	6.3	0.3	250	125	-3 -40	8.2	2.0	1280	800,000	1.6 .01	—	200	—	10/6
18	Power Pentode	14.0	0.3	250	250	-16.5	34.0	6.5	190	80,000	2.35	7000	410	3.0	10/6
24A	Screened Tetrode	2.5	1.75	250	90	-3.0	4.0	1.7	630	600,000	1.05	—	500	—	10/6
25Z5	A.C./D.C. Rectifier	25.0	0.3	Max. A.C. Voltage 250 R.M.S.				Max. Rectified Current 85 Milliamps.						9/-	
36	Screened Tetrode	6.3	0.3	250	90	-3.0	3.2	1.0	595	550,000	1.08	—	850	—	10/6
39/44	H. F. Pentode	6.3	0.3	250	90	-3.0	5.8	1.4	1050	1,000,000	1.05	—	400	—	10/6
42	Power Pentode	6.3	0.7	250 315	250 315	-16.5 -20.0	34.0 42.0	6.5 8.0	190 260	80,000 100,000	2.35 2.60	7000	410 440	3.0 5.0	10/6
43	"	25.0	0.3	180 135	135 135	-20	38.0 37.0	7.5 8.0	100	40,000	2.5	5000	440	2.75 2.0	10/6
47	"	2.5	1.75	250	250	-16.5	31.0	6.0	150	60,000	2.5	7000	450	2.7	10/6
75	Double Diode Triode	6.3	0.3	250	—	-2.0	0.4	—	100	90,000	1.1	—	5000	—	9/6
77	H.F. Pentode	6.3	0.3	250	100	-3.0	2.3	0.5	1500	1.5 Megohms	1.25	—	1000	—	10/6
78	Vari-Mu H.F. Pentode	6.3	0.3	250	125	-3 -40	10.5 —	2.6 —	1000	600,000	1.65	—	200	—	10/6
78E	"	6.3	0.3	250	100	-3	10.5	2.6	1000	700,000	1.4	—	300	—	10/6
80	A.C. Rectifier	5.0	2.0	Max. A.C. Voltage Per Anode 350 R.M.S.				400 R.M.S.						9/-	
				Max. Rectified Current Milliamps 125				110							

INTERNATIONAL OCTAL TYPES

5U4G	A.C. Rectifier	5.0	3.0	Max. A.C. Voltage Per Anode 500 R.M.S.				Max. Rectified Current 250 Milliamps.						15/-	
5V4G	"	5.0	2.0	Max. A.C. Voltage Per Anode 400 R.M.S.				Max. Rectified Current 200 Milliamps.						9/-	
5Z4G	"	5.0	2.0	Max. A.C. Voltage Per Anode 350 R.M.S.				Max. Rectified Current 125 Milliamps.						9/-	
6A8G	Frequency Changer	6.3	0.3	250	100	-3 -40	3.5	2.2	—	360,000	550* 2*	—	300	—	11/6
6B8G	Double Diode Pentode	6.3	0.3	250	125	-3	9.0	2.3	800	600,000	1.35	—	—	—	12/6
6C5G	Triode	6.3	0.3	250	—	—	8.0	—	20	10,000	2.0	—	1000	—	7/6
6F6G	Power Pentode	6.3	0.7	250 315	250 315	-16.5 -20.0	34.0 42.0	6.5 8.0	190 260	80,000 100,000	2.35 2.60	7000	410 440	3.0 5.0	10/6
6H6G	Double Diode	6.3	0.3	—	—	—	—	—	—	—	—	—	—	—	5/6
6J7G	H.F. Pentode	6.3	0.3	250	125	-3	2.0	0.5	1900	1,500,000	1.25	—	600	—	10/6
6K7G	Vari-Mu H.F. Pentode	6.3	0.3	250	125	-3	10.5	2.6	1000	600,000	1.65	—	200	—	10/6
6L6G	Power Pentode	6.3	0.9	250	250	-14	72.0	5.0	135	22,500	6.0	2500	170	6.5	15/-
6L7G	Frequency Changer	6.3	0.3	250	150	-3	3.3	8.3	—	1,000,000	350*	—	260	—	10/6
6N6G	Double Output Triode	6.3	0.8	325	—	0	43.0	—	54	24,000	2.25	7000	0	5.0	15/-
6P8G	Triode Hexode F.C.	6.3	0.8	250	80	-2.0 -30.0	1.4	1.4	—	750,000	650*	—	300	—	11/6
6Q7G	Double Diode Triode	6.3	0.3	250	—	-2.0	1.1	—	70	58,000	1.2	—	4000	—	9/6
6R7G	"	6.3	0.3	250	—	-9.0	9.5	—	16	8,500	1.9	—	10,000	—	9/6
6U7G	Vari-Mu H.F. Pentode	6.3	0.3	250	125	-3.0 -40.0	8.2 —	2.0 —	1280	800,000	1.6 .01	—	200	—	10/6
6V6G	Power Pentode	6.3	0.45	250	250	-12.5	45.0	4.5	218	52,000	4.1	5000	240	4.25	10/6
25A6G	"	25.0	0.3	180 135	135 135	-20	38.0 37.0	7.5 8.0	100	40,000	2.5	5000	440	2.75 2.00	10/6
25L6G	"	25.0	0.3	110	110	-7.5	49.0	4.0	82	10,000	8.2	2000	140	2.2	10/6
25Z6G	A.C./D.C. Rectifier	25.0	0.3	Max. A.C. Voltage 250 R.M.S.				Max. Rectified Current 85 Milliamps.						9/-	

NOTE

The Brimar Type Numbers in the U.X. and Octal Ranges correspond exactly with existing American Type Numbers, i.e. The Brimar 6A7 will replace any 6A7 of American manufacture.

*Conversion Conductance in Micromhos.

BRIMAR

VALVES

ENGLISH TYPES
AMERICAN U.X. TYPES
INTERNATIONAL OCTAL TYPES
 (See previous page).

REPLACEMENT TYPES

Type No.	Application	Price
PENB1	Battery Power Pentode ..	9/-
HLA2	A.C. General Purpose Triode	9/6
PA1	A.C. High Slope Output Triode	12/6
15A2	A.C. Heptode Frequency Changer	11/6
9A1*	A.C. Vari-Mu H.F. Pentode	10/6
8A1*	A.C. H.F. Pentode	10/6
11A2	A.C. Double Diode Triode	9/6
7A2†	A.C. Power Pentode ..	10/6
PENA1	A.C. Power Pentode ..	10/6
R1	A.C. Rectifier 250 volt 60mA	9/-
4215A	Battery General Purpose Triode	10/-

*Available with 5 and 7 pin bases.

†Available with 5 pin base and side terminal.

RECTIFIERS

Type No.	Cathode		Max. A.C. Anode Voltage	D.C. Output		Price
	Volts.	Amps.		Volts.	Milliamps.	
R1	4.0	1.0	250—0—250 R.M.S.	260†	60	9/-
R2	4.0	2.5	350—0—350 R.M.S.	380†	120	9/-
R3	4.0	2.5	500—0—500 R.M.S.	580†	120	9/-
1D5	40.0	0.2	250 R.M.S.	300	75	9/-
80	5.0	2.0	350—0—350 R.M.S.	380†	125	9/-
5U4G	5.0	3.0	500—0—500 R.M.S.	520†	250	15/-
5V4G	5.0	2.0	400—0—400 R.M.S.	440†	200	9/-
5Z4G	5.0	2.0	350—0—350 R.M.S.	380†	125	9/-
25Z5	25.0	0.3	250 R.M.S.	285*	85	9/-
25Z6G	25.0	0.3	250 R.M.S.	285*	85	9/-

†Taken with 4 MFD. Reservoir Condenser.

*Taken with 16 MFD. Reservoir Condenser and 100 ohms in each anode.

EDWARD EVERARD LTD.
— PRINTERS —
BRISTOL AND LONDON.