Mullard

Valve and Service Guide

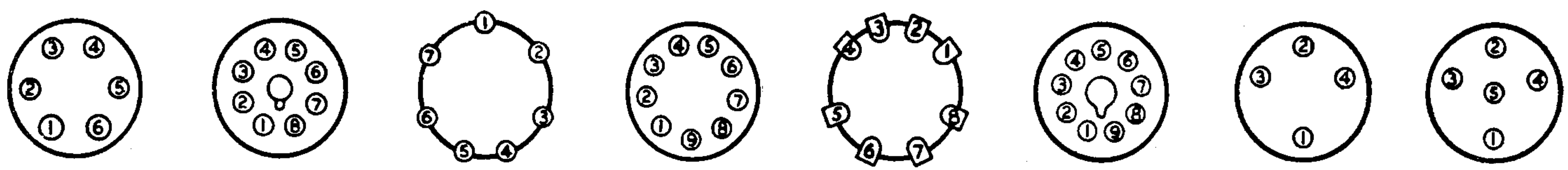
INDEX

December, 1946

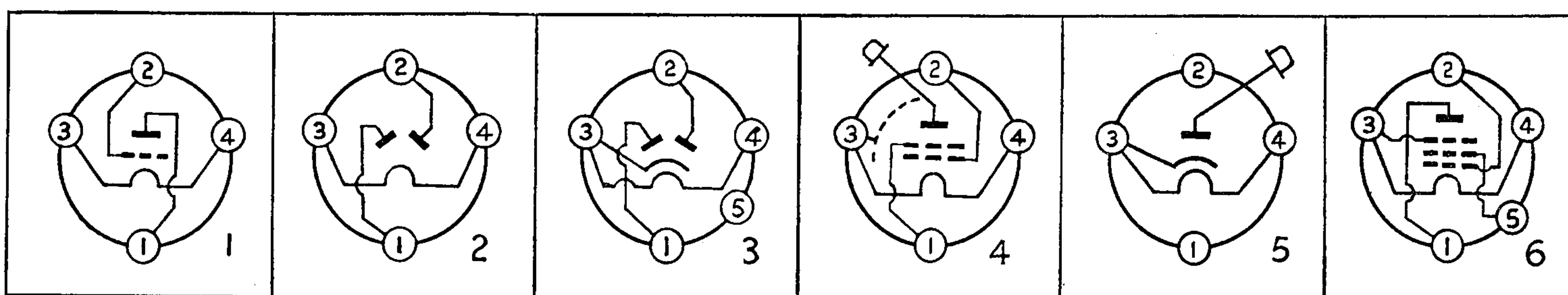
Mullard VALVE BASES

(VIEWED FROM FREE END OF BASE)

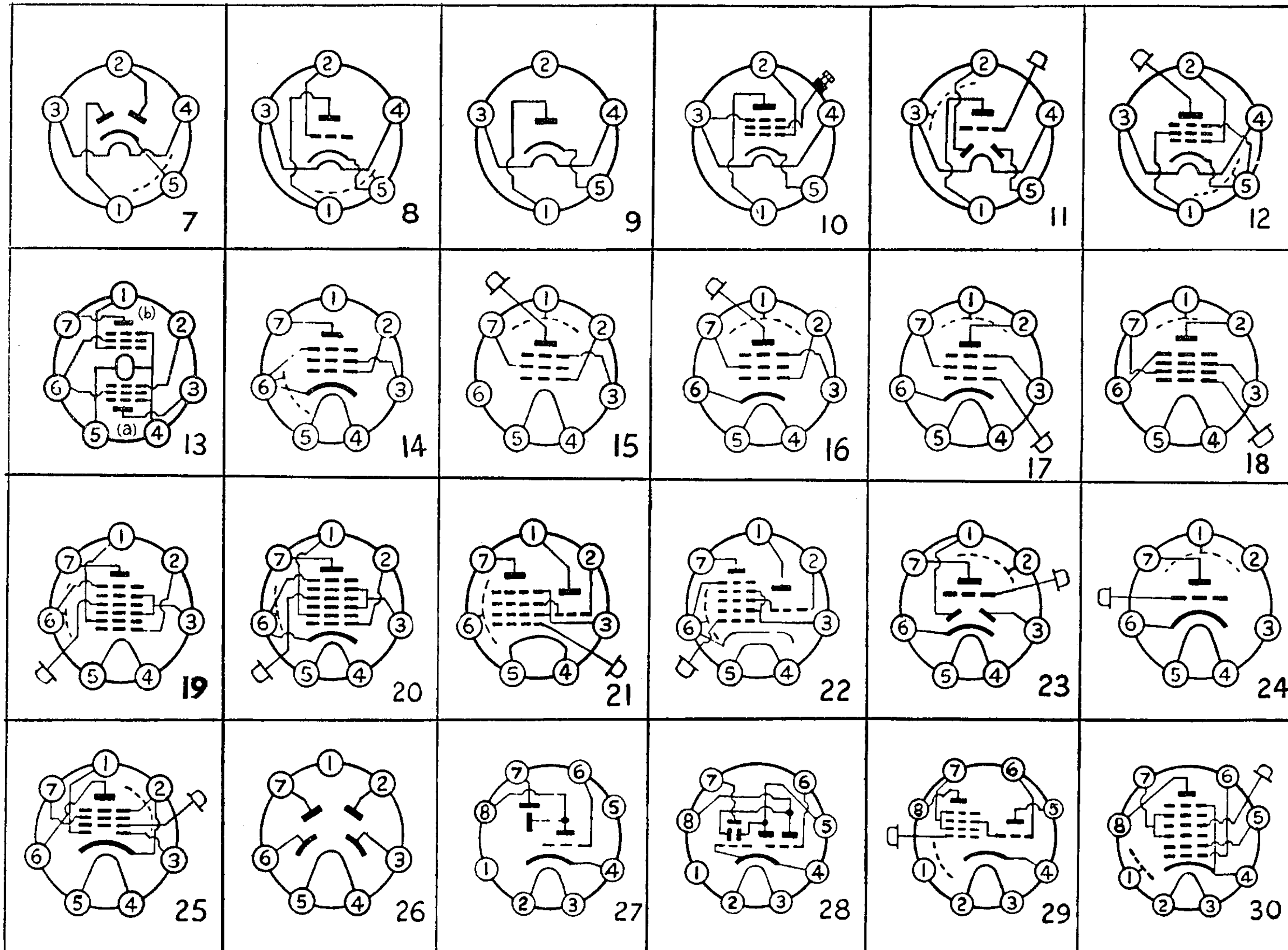
Top Cap  **Metallising**  **Side Terminal**  **Screen** - - - - -



6-Pin UX | **American Octal K Base** | **British 7-Pin M Base** | **British 9-Pin R Base** | **British 8-Side Contact P Base** | **9-Pin All-Glass** | **British 4-Pin A Base** | **British 5-Pin O Base**



THE MULLARD WIRELESS SERVICE CO., LTD., CENTURY HOUSE, SHAFTESBURY AVENUE, LONDON, W.C.2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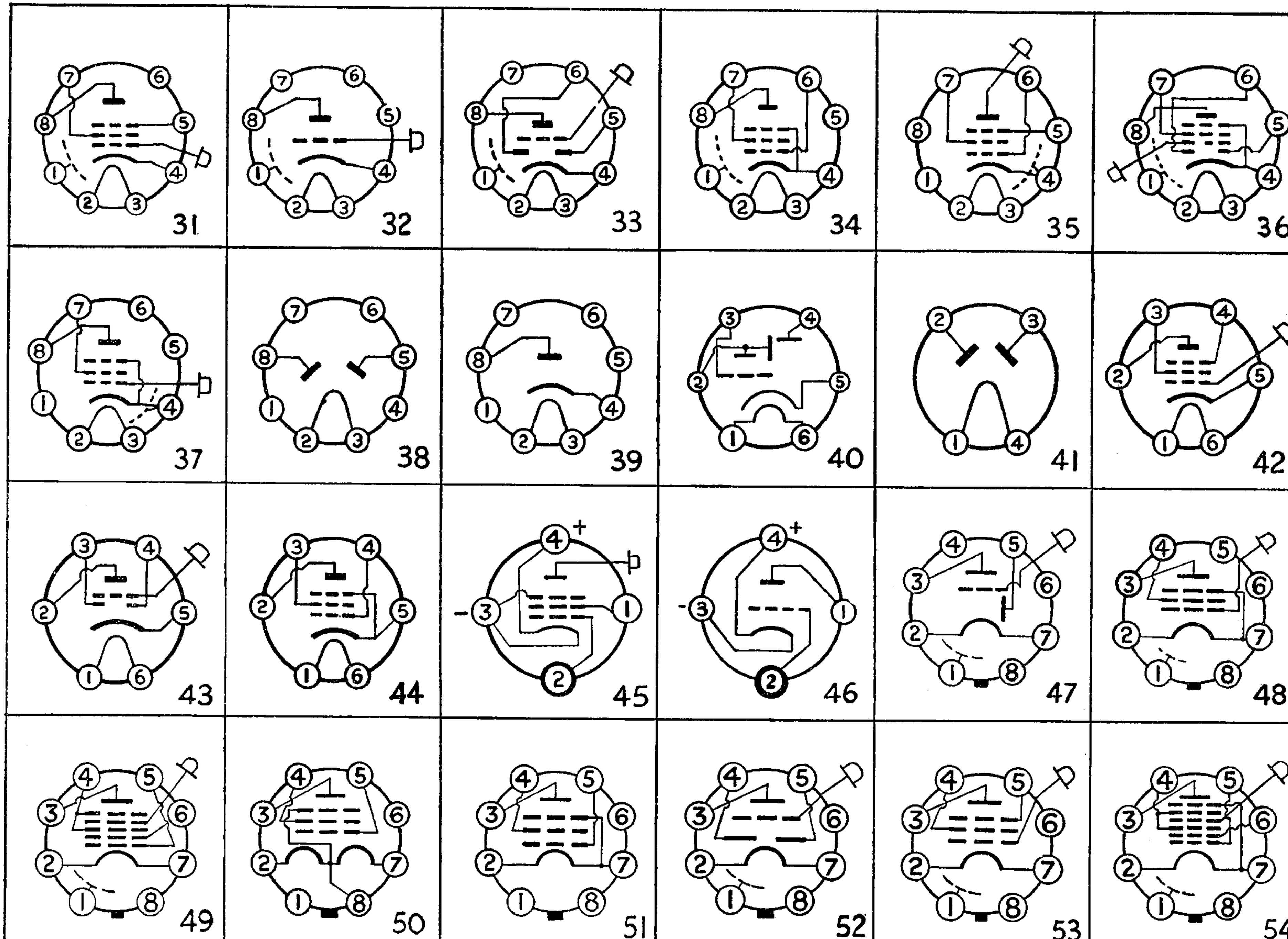

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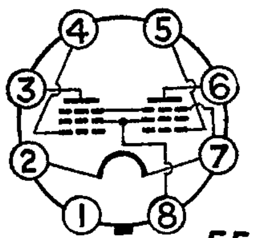
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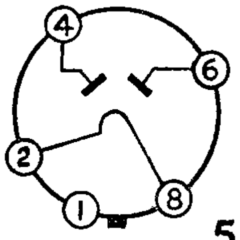
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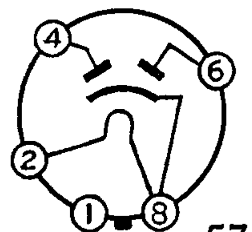
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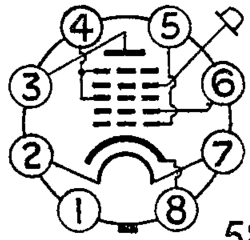
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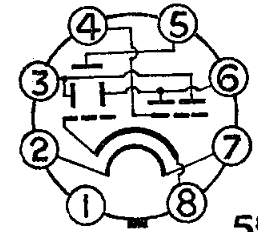
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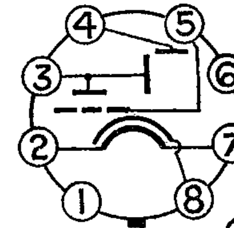
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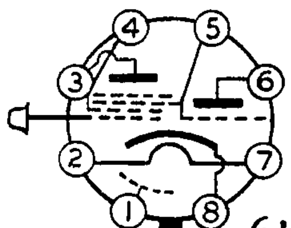
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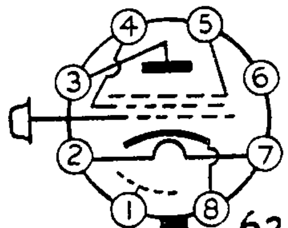
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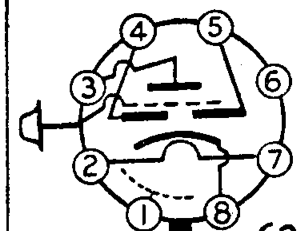
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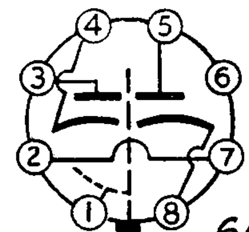
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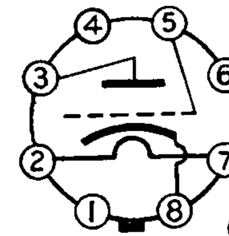
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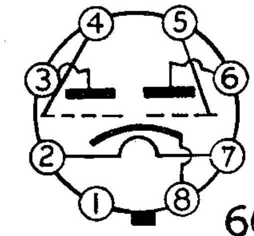
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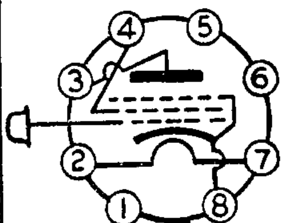
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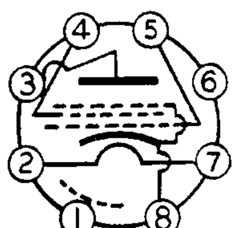
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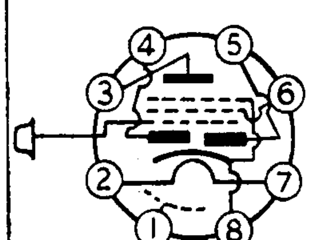
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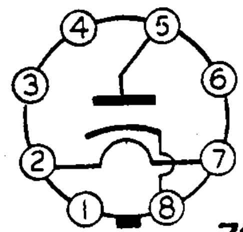
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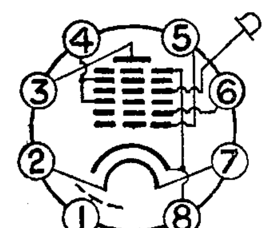
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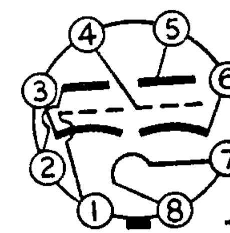
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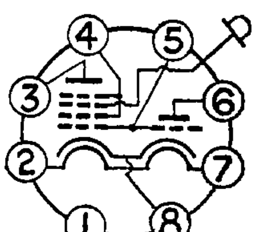
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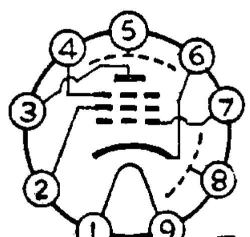
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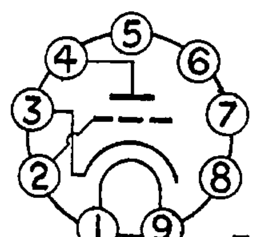
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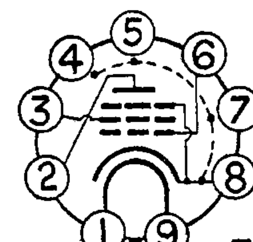
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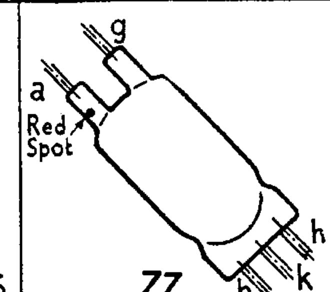

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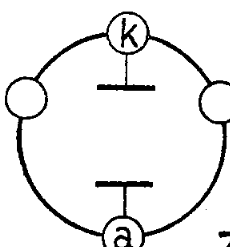

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CHARACTERISTICS AND OPERATING DATA

Vf —Filament or Heater Voltage. (V)
If —Filament or Heater Current. (A)
Va —Anode Voltage. (V)
Vg2 —Auxiliary Grid or Screen Voltage. (V)
Vg —Control Grid Voltage. (V)

Ia —Anode Current. (mA)
ra —Anode Impedance. (ohms)
μ —Amplification Factor.
g_m or g_c—Mutual or Conversion Conductance.(mA/V)
W out—Audio Output Power. (Watts)

C —Clear Bulb.
M —Metallised Bulb.
P Base—Side Contact Base.
Octal —8-Pin Base with Locating Key.

Prices shown are exclusive of Purchase Tax.

"D" SERIES. Vf = 1.4 V.

Type	Description	No. of Base Pins	Working Conditions					Characteristics at Working Conditions				Optimum Load Ohms	Price	Type
			If	Va	Vg2	–Vg	Ia	ra	μ	g_m or g_c	W out			
DK32	Heptode Frequency Changer	Octal	0.05	90	90•	0	0.6	600,000	—	0.25	—	—	10/6	DK32
DF33	H.F. Pentode	Octal	0.05	90	90	0	1.2	1,500,000	—	0.75	—	—	9/–	DF33
DAC32	Single-diode Triode	Octal	0.05	90	—	0	0.15	240,000	65	0.275	—	—	7/6	DAC32
DL33	Output Pentode	Octal	0.05‡ 0.1	110 110	110 110	6.6 6.6	8.5 10.0	110,000 100,000	— —	2.0 2.2	0.33 0.4	8,000 8,000	9/–	DL33
DL35	Output Pentode	Octal	0.1	90	90	7.5	7.8	115,000	—	1.55	0.24	8,000	9/–	DL35

• Vg3 + 5 = 45 V.

‡ Filament Arrangement : Series Parallel
Voltage 2.8 1.4 V.
Current 0.05 0.1 A.

"K" SERIES. Vf = 2.0 V.

Type	Description	No. of Base Pins	Working Conditions					Characteristics at Working Conditions				Optimum Load Ohms	Price	Type
			If	Va	Vg2	–Vg	Ia	ra	μ	g_m or g_c	W out			
KK32	Octode Frequency Changer	Octal	0.13	135•	45‡	0.5	0.7	2,500,000	—	0.27	—	—	10/6	KK32
KF35	H.F. Pentode	Octal	0.05	120	60	1.5	1.45	1,500,000	1,500	1.0	—	—	9/–	KF35
KBC32	Double Diode Triode	Octal	0.05	120	—	1.5	1.8	21,000	25	1.2	—	—	7/6	KBC32
KL35	Output Pentode	Octal	0.15	135	135	4.5	5.6	150,000	33	2.2	0.34	19,000	9/–	KL35
KLL32	QPP Double Pentode	Octal	0.3	120	120	10.3	3.3	—	—	2.6¶	1.0	15,500	12/6	KLL32

2 VOLT RANGE

Type	Description	No. of Base Pins	If	Va	Vg2	–Vg	Ia	ra	μ	g_m or g_c	W out	Optimum Load Ohms	Price	Type
TH2	Triode Hexode Frequency Changer ...	7	0.23	135	60	5.0	0.95	600,000	—	0.43	—	—	10/6	TH2
FC2	Octode Frequency Changer	7	0.1	135•	70†	0	0.95	—	—	0.2	—	—	10/6	FC2
FC2A	Octode Frequency Changer	7	0.13	135•	45‡	0.5	0.7	2,500,000	—	0.27	—	—	10/6	FC2A
VP2	Vari-mu H.F. Pentode	7	0.18	135	135	0–7	3.0	400,000	—	1.5	—	—	9/–	VP2
VP2B	Vari-mu H.F. Pentode	7	0.14	135	60	1.5	2.0	1,300,000	—	1.4	—	—	9/–	VP2B
SP2	H. F. Pentode	7	0.18	135	135	0	3.0	700,000	1,200	1.8	—	—	9/–	SP2
PM12M	Vari-mu Screened Tetrode (M. or C.) ...	4	0.18	150	90	0–7	2.5	—	—	1.4	—	—	9/–	PM12M
TDD2A	Double-diode Triode	5	0.12	135	—	1.5	1.95	25,000	30	1.2	—	—	7/6	TDD2A
PM2HL	Medium Indepedence Triode (M. or C.) ...	4	0.1	135	—	1.5	2.2	21,500	30	1.4	—	—	4/9	PM2HL
PM2A	Output Triode	4	0.2	135	—	6.0	5.0	6,000	12	2.0	0.15	7,000	6/–	PM2A
PM202	Super power Triode...	4	0.2	150	—	12–15	14.0	2,000	7	3.5	—	3,700	11/6	PM202
PM22A	Output Pentode	5	0.15	135	135	4.5	5.6	150,000	—	2.2	0.34	19,000	9/–	PM22A
PM22D	High Sensitivity Output Pentode	5	0.3	135	135	2.4	5.0	—	—	3.0	0.3	24,000	9/–	PM22D
PM2B	Class B Double Triode	7	0.2	120	—	0	—	—	—	—	1.25	14,000	10/6	PM2B
QP22B	Q.P.P. Double Pentode	7	0.3	135	135	11.7	3.8	—	—	2.6¶	1.33	14,700	12/6	QP22B

• Va = Vg2 = 135. † Vg3 + 5 = 70 V. ‡ Vg3 + 5 = 45 V. ¶ Va = Vg2 = 100 and Vgl = 0

"E" SERIES. Vf = 6.3 V.

Type	Description	No. of Base Pins	Working Conditions					Characteristics at Working Conditions				Optimum Load Ohms	Price	Type
			If	Va	Vg2	–Vg	Ia	ra	μ	gm or gc	W out			
EM1	Tuning Indicator	P. Base	0.2	250	—	0–5	—	—	—	—	—	—	9/–	EM1
EM4 EM34	Tuning Indicator	P. Base Octal	0.2	250	—	0–16	—	—	—	—	—	—	9/–	EM4 EM34
EM35	Tuning Indicator	Octal	0.3	250	—	0–22	—	—	—	—	—	—	9/–	EM35
ECH3	Triode Hexode Frequency Changer ...	P. Base	0.2	250	100	2.0	3.0	1,300,000	—	0.65	—	—	11/6	ECH3
ECH35	Triode Hexode Frequency Changer ...	Octal	0.3	250	100	2.0	3.0	1,300,000	—	0.65	—	—	11/6	ECH35
EK2 EK32	Octode Frequency Changer	P. Base Octal	0.2	250	200*	2.0	1.0	2,000,000	—	0.55	—	—	11/6	EK2 EK32
EF6	H.F. Pentode	P. Base	0.2	250	100	2.0	3.0	2,500,000	4,500	1.8	—	—	11/6	EF6
EF 9 EF39	Sliding Screen H.F. Pentode	P. Base Octal	0.2 0.2 0.2	250 250 250	100 100 250	2.0 2.5 49.0	3.0 6.0 —	2,500,000 1,250,000 10,000,000	4,500 — —	1.8 2.2 0.0045	— — —	— — —	10/6	EF 9 EF39
EF36 EF37	H.F. Pentode ... ... Low Microphony H.F. Pentode	Octal	0.2	250	100	2.0	3.0	2,500,000	4,500	1.8	—	—	11/6	EF36 EF37
EC52	Short-Wave Triode	9-pin all-glass	0.43	250	—	2.6	10	9,500	60	6.5	—	—	15/–	EC52
EC53	U.H.F. Triode	Special 3-pin	0.25	200	—	3.3	7.5	11,500	33.5	2.9	—	—	25/–	EC53
EF50	Short-wave H.F. Pentode	Loctal 9-pin	0.3	250	250	2.0	10.0	1,000,000	—	6.5	—	—	17/6	EF50
EF54	Short-wave Pentode	9-pin all-glass	0.3	250	250	1.7	10.0	500,000	—	7.7	—	—	17/6	EF54
EC31	Low Impedance Triode	Octal	0.65	250	—	16.0	20.0	3,300	10.5	3.2	0.5	10,000	10/–	EC31
EB34	Double Diode (separate cathodes) ...	Octal	0.2	200 (peak)	—	—	0.8	—	—	—	—	—	5/6	EB34
EBC3 EBC33	Double-diode Triode	P. Base Octal	0.2	275	—	6.25	5.0	15,000	30	2.0	—	—	9/6	EBC3 EBC33
ECC31 ECC32	Double Triode ... ... Double Triode (Separate Cathodes) ...	Octal	0.95	250	—	4.6	6.0	14,000	32	2.3	—	—	15/–	ECC31 ECC32
EL2 EL32	Output Pentode	P. Base Octal	0.2	250	250	18.0	32.0	70,000	—	2.8	3.6	8,000	11/6	EL2 EL32
EL3 EL33	Output Pentode	P. Base Octal	0.9	250	250	6.0	36.0	50,000	—	9.0	4.5	7,000	10/6	EL3 EL33
EL35	Output Pentode	Octal	1.35	250	250	15.5	72.0	15,500	—	5.0	6.0	2,500	15/–	EL35
EL37	Output Pentode	Octal	1.4	400	400	34.5	2×141	—	—	—	66.0†	3,250	15/–	EL37
EL50	Output Pentode	P. Base	1.35	250	275	14.0	72.0	22,000	—	8.5	8.8	3,500	20/–	EL50
EBL1 EBL31	Double-diode Output Pentode	P. Base Octal	1.5	250	250	6.0	36.0	50,000	—	9.5	4.3	7,000	12/6	EBL1 EBL31

* $V_{g3} + 5 = 50$ V. † Data for 2 × EL37 in Class AB_1 push-pull

DIRECTLY-HEATED RANGE. Vf = 4.0 V. unless otherwise stated.

Type	Description	No. of Base Pins	Working Conditions					Characteristics at Working Conditions				Optimum Load Ohms	Price	Type
			If	Va	Vg2	–Vg	Ia	ra	μ	gm or gc	W out			
AC044	Output Triode	4	1.0	300	—	38.0	50.0	1,200	6.0	5.0	3.5	2,300	9/6	AC044
AC042	Output Triode	4	2.0V 2.0A	300	—	38.0	50.0	1,200	6.0	5.0	3.5	2,300	9/6	AC042
PM24A	Output Pentode	5	0.275	300	200	22.5	20.0	—	—	2.0	—	10,000	15/–	PM24A
PM24M	Output Pentode	5	1.1	250	250	17.0	30.0	43,000	130	3.0	2.8	7,000	10/6	PM24M
D024	Output Triode	4	1.85	400	—	40.0	63.0	1,070	8.0	7.5	7.1	3,200	20/–	D024
D026	Output Triode	4	2.0	400	—	92.0	63.0	950	3.6	3.8	7.5	3,000	25/–	D026
D030	Output Triode	4	2.0	500	—	134	60.0	580	4.0	6.9	11	6,000	25/–	D030

INDIRECTLY-HEATED 4.0 V. A.C. RANGE.

Type	Description	No. of Base Pins	Working Conditions					Characteristics at Working Conditions				Optimum Load Ohms	Price	Type
			If	Va	Vg2	–Vg	Ia	ra	μ	gm or gc	W out			
TH4B	Triode Hexode	7	1.45	250	100	2.5	3.25	1,500,000	—	0.75	—	—	11/6	TH4B
FC4	Octode Frequency Changer	7	0.65	250	90*	1.5	1.6	—	—	0.6	—	—	11/6	FC4
VP4	Vari-mu H.F. Pentode	5 or 7	1.0	200	100	2–50	4.5	1,000,000	2,000	2.3	—	—	10/6	VP4
VP4A	Vari-mu H.F. Pentode	5 or 7	1.2	200	100	2.0	4.25	1,400,000	3,500	2.5	—	—	10/6	VP4A
VP4B	Vari-mu H.F. Pentode	7	0.65	250	250	3.0	11.5	—	—	2.0	—	—	10/6	VP4B
SP4	H.F. Pentode (M. or C.)	5 or 7	1.0	200	100	2.0	3.0	2,200,000	5,000	2.3	—	—	10/6	SP4
SP4B	H.F. Pentode	7	0.65	250	250	2.4	4.0	2,000,000	6,800	3.4	—	—	10/6	SP4B
TSP4	Television Pentode	7	1.3	200	200	2.5	8.0	1,590,000	7,630	4.73	—	—	17/6	TSP4
2D4A	Double-diode	5	0.65	200	—	—	0.8	—	—	—	—	—	5/6	2D4A
TDD4	Double-diode Triode	7	0.65	250	—	7.0	4.0	13,500	27	2.0	—	—	9/6	TDD4
904V	High Impedance Triode	5	0.65	200	—	2.0	2.2	20,600	72	3.5	—	—	7/6	904V
354V	Medium Impedance Triode (M. or C.) ...	5	0.65	250	—	4.5	6.5	11,500	40	3.5	—	—	7/6	354V
164V	Medium Impedance Triode	5	0.65	200	—	8.5	13.0	3,640	16.4	4.5	—	—	14/-	164V
Pen4VA	Output Pentode	5 or 7	1.35	250	250	22.0	36.0	40,000	—	2.8	3.8	6,000	10/6	Pen4VA
PenA4	Output Pentode	7	1.95	250	250	5.8	36.0	50,000	—	9.5	3.8	8,000	10/6	PenA4
PenB4	Output Pentode	7	2.1	250	275	14.0	72.0	22,000	—	8.5	8.8	3,500	12/-	PenB4
Pen4DD	Double-diode Output Pentode	7	2.25	250	250	6.0	36.0	50,000	—	9.5	4.3	7,000	12/6	Pen4DD
Pen428	Output Pentode	7	2.1	375	275	20.5	2×48	—	—	2.8	8.0	6,500†	25/-	Pen428

* Vg3 + 5 = 70 V. † Data for 2 × Pen428 in ClassAB Push-pull

DC/AC VALVES.

Type	Description	No. of Base Pins	Working Conditions						Characteristics at Working Conditions				Optimum Load Ohms	Price	Type
			Vf	If	Va	Vg2	–Vg	Ia	ra	μ	gm or gc	W out			
EM1	Tuning Indicator	P. Base	6.3	0.2	250	—	0–5	—	—	—	—	—	—	9/-	EM1
CCH35	Triode Hexode Frequency Changer ...	Octal	7.0	0.2	250	100	2.0	3.0	1,300,000	—	0.65	—	—	11/6	CCH35
TH21C	Triode Hexode Frequency Changer ...	7	21.0	0.2	250	70	1.5	4.0	1,500,000	—	1.0	—	—	12/6	TH21C
TH30C	Triode Heptode Frequency Changer ...	7	29.0	0.2	250	100	2.5	3.25	1,500,000	—	0.75	—	—	11/6	TH30C
FC13	Octode Frequency Changer	P. Base	13.0	0.2	200	90*	1.5	1.6	—	—	0.6	—	—	11/6	FC13
FC13C	Octode Frequency Changer	7	13.0	0.2	200	90*	1.5	1.6	—	—	0.6	—	—	11/6	FC13C
VP13A	Vari-mu H.F. Pentode	P. Base	13.0	0.2	200	100	2.0	4.0	—	2,200	2.2	—	—	10/6	VP13A
VP13C	Vari-mu H.F. Pentode	7	13.0	0.2	200	200	2.0	9.0	—	—	2.2	—	—	10/6	VP13C
SP13	H.F. Pentode	P. Base	13.0	0.2	200	100	2.0	3.3	1,300,000	3,000	2.2	—	—	10/6	SP13
SP13C	H.F. Pentode	7	13.0	0.2	200	200	2.2	2.5	2,500,000	7,000	2.8	—	—	10/6	SP13C
2D13C	Double-diode...	5	13.0	0.2	200	—	—	0.8	—	—	—	—	—	7/6	2D13C
HL13	Medium Impedance Triode (m)	P. Base	13.0	0.2	200	—	3.7	5.0	12,000	40	3.3	—	—	7/6	HL13
HL13C	Medium Impedance Triode (M)	7	13.0	0.2	200	—	3.7	5.0	12,000	40	3.3	—	—	7/6	HL13C
TDD13C	Double-diode Triode	7	13.0	0.2	200	—	5.0	4.0	13,500	27	2.0	—	—	9/6	TDD13
Pen36C / CL33	Output Pentode	7 / Octal	33.0	0.2	200	200	8.5	45.0	35,000	—	8.0	4.0	4,500	10/6	Pen36C / CL33
Pen40DD	Double-diode Output Pentode	7	44.0	0.2	200	200	8.5	45.0	35,000	—	8.0	4.0	4,500	12/6	Pen40DD
CBL1 / CBL31	Double-diode Output Pentode	P. Base / Octal	44.0	0.2	200	200	8.5	45.0	35,000	—	8.0	4.0	4,500	12/6	CBL1 / CBL31
CL4	Output Pentode	P. Base	33.0	0.2	200	200	8.5	45.0	35,000	—	8.0	4.0	4,500	10/6	CL4

* Vg3 + 5 = 70 V.

RECTIFIERS.

Type	Description	No. of Base Pins	Vf	If	Max. Va (RMS)	Max. Rectified Output (mA)	Price	Type
DW2	Directly-heated Full-wave Rectifier	4	4.0	1.0	250–0–250	60	9/–	DW2
DW4/350	Directly-heated Full-wave Rectifier	4	4.0	2.0	350–0–350	120	9/–	DW4/350
IW4/350	Indirectly-heated Full-wave Rectifier	4	4.0	2.0	350–0–350	120	9/–	IW4/350
IW4/500	Indirectly-heated Full-wave Rectifier	4	4.0	2.4	500–0–500	120	10/6	IW4/500
FW4/500	Directly-heated Full-wave Rectifier	4	4.0	3.0	500–0–500	250	15/–	FW4/500
FW4/800	Directly-heated Full-wave Rectifier	4	4.0	3.0	850–0–850	125	15/–	FW4/800
CY1, CY31	Half-wave Rectifier	P. Base Octal	20	0.2	250	75	9/–	CY1, CY31
UR1C	Half-wave Rectifier	5	20	0.2	250	75	9/–	UR1C
UR3C	Multiple Rectifier	7	30	0.2	250–0–250	120	9/–	UR3C
AZ1, AZ31	Directly-heated Full-wave Rectifier	P. Base Octal	4.0	1.1	300–0–300	100	9/–	AZ1, AZ31
AZ50	Directly-heated Full-wave Rectifier	4	4.0	3.0	500–0–500	250	15/–	AZ50
HVR2	High Voltage Rectifier	4	4.0	0.65	6,000	3.0	20/–	HVR2
HVR2A	High Voltage Rectifier	4	2.0	1.5	6,000	3.0	20/–	HVR2A

MISCELLANEOUS TYPES.

Type	Description	No. of Base Pins	Working Conditions					Characteristics at Working Conditions				Optimum Load Ohms	Price	Type
			If	Va	Vg2	–Vg	Ia	ra	μ	gm or gc	W out			
DA3	Output Triode for Deaf Aids	Miniature 4	2.0V 0.05A	40	—	2.8	1.8	7,600	4.7	0.62	—	—	15/–	DA3
DF51	Amplifying Pentode for Deaf Aids ...	Miniature 4	1.5V 0.067A	45	13.5	0	0.125	—	—	0.17	—	—	17/6	DF51
7475	Neon Stabilising Tube	4	Burning voltage = 90–110 V.					Quiescent Current = 4 mA.					12/6	7475

AMERTY RANGE (OCTAL TYPES).

Type	Description	Price	Type	Description	Price
1A7G	Battery Pentagrid Frequency Changer	10/6	6A8G	Pentagrid Frequency Changer	11/6
1C5G	Battery Output Pentode	9/–	6F6G	Output Pentode	10/6
1H5G	Battery Single-diode Triode	7/6	6H6G	Double-diode (separate cathodes)	5/6
1N5G	Battery H.F. Pentode	9/–	6K7G	Vari-mu H.F. Pentode	10/6
3Q5GT	Battery Beam Power Tetrode	9/–	6K8G	Triode Hexode Frequency Changer	11/6
5U4G	Directly-heated Full-wave Rectifier	15/–	6L6G	Beam Power Tetrode	15/–
5V4G	Indirectly-heated Full-wave Rectifier	9/–	6Q7G	Double-diode Triode	9/6
5Y3G	Directly-heated Full-wave Rectifier	9/–	6R7G	Double-diode Triode	9/6
5Z4GT	Indirectly-heated Full-wave Rectifier	9/–	25A6G	Output Pentode	10/6

AMERTY RANGE (U.X. and U.Y. TYPES).

Type	Description	Price	Type	Description	Price
6G5/6U5	Tuning Indicator	8/6	75	Double-diode Triode	9/6
18	Output Pentode	10/6	78	Vari-mu H.F. Pentode	10/6
42	Output Pentode	10/6	80	Directly-heated Full-wave Rectifier	9/–
43	Output Pentode	10/6			

EQUIVALENT TABLES

2-VOLT VALVES

Cossor	Ever-Ready	Ferranti	Mullard	Marconi-Osram	Mazda	Brimar
220TH	—	—	TH2	X23, X24	—	—
210PG 210SPG	K80A	VHT2 VHT2A	FC2	X21	—	—
210PGA	K80B	—	FC2A	X22	—	—
210VPT 210VPA	K50M	—	VP2	VP21, W21	VP215 VP210	—
—	K50N	—	VP2B	—	—	—
210SPT	—	—	SP2	Z21	SP215 SP210	—
220VS 220VSG	K40N	VS2	PM12M	VS24	S215VM	—
210DDT	K23B	H2D	TDD2A	HD22 HD23 HD24	HL2/1DD	—
210HL	K30K	—	PM2HL	HL2 HL21	HL210 HL2	HLB1
220PA	K30G	L2	PM2A	LP2	P220	PB1
220B 240B	K33A	HP2	PM2B	—	PD220	—
220HPT 220/OT	K70B	PT2	PM22A	PT2, KT2	Pen220	PenB1
—	K70D	—	PM22D	KT21 KT24	Pen231	—
230XP	—	—	PM202	P2/B P240	P220A P240	—
240QP	—	—	QP22B	—	QP230	—

INDIRECTLY-HEATED A.C. VALVES

Cossor	Ever-Ready	Ferranti	Mullard	Marconi-Osram	Mazda	Brimar
4THA	A36C A36B	—	TH4B	—	AC/TH1	20A1
41MPG 41PGD	A80A	VHT4	FC4	MX40 X42	—	15A2
MVS/Pen	A50M	VPT4 VPT4A	VP4	VPM4	AC/VP1	9A1
—	A50N	VPT4B	VP4A	VMP4G	—	—
MVSPenB	A50P	—	VP4B	—	AC/VP2	—
MS/PenA	A50A	SPT4 SPT4A	SP4	MSP4	AC/S2Pen	8A1
MS/PenB	A50B	—	SP4B	—	—	—
DD4 DDL4	A20B	—	2D4A	D41	AC/DD V914	DDA1
DDT	A23A	H4D	TDD4	MHD4 DH42	AC/HLDD	11A1 11A2
41MTB	A30B	—	904V	MH41	AC2/HL	HLA1
41MHF 41MTL	A30D	D4	354V	MH4	AC/HL	HLA2

INDIRECTLY-HEATED A.C. VALVES—continued.

Cossor	Ever-Ready	Ferranti	Mullard	Marconi-Osram	Mazda	Brimar
MP/PenA	A70B	—	Pen4VA	N40 KT42	AC/Pen	7A2
42/OT 42MP/Pen	A70C A70D	PT4	Pen4VB PenA4	N41 KT41	AC2/Pen AC5/Pen	7A3
—	A70E	—	PenB4	—	AC4/Pen	—
—	A27D	—	Pen4DD	—	—	—
—	—	—	Pen428	—	—	—

DIRECTLY-HEATED A.C. OUTPUT VALVES

Cossor	Ever-Ready	Ferranti	Mullard	Marconi-Osram	Mazda	Brimar
4XP	S30C	LP4	ACO44	PX4	PP3/250	—
2XP	S30D	—	ACO42	—	PA20	—
—	—	—	PM24A	—	—	—
PT41	—	—	PM24M	PT4	—	PenA1
—	—	—	DO24	PX25	PP5/400	—
—	—	—	DO26	PX25A	—	—
—	—	—	DO30	DA30	PA40	—

RECTIFYING VALVES

Cossor	Ever-Ready	Ferranti	Mullard	Marconi-Osram	Mazda	Brimar	Philips
408BU 506BU	S11A	—	DW2	410	—	—	1821
442BU	S11D	R4	DW4/350	U12	UU120/350	—	1807
431U	A11D	—	IW4/350	—	—	—	—
441U	A11C	—	IW4/500	MU14 MU12/14	UU5	R3	1861
4100BU 451U	—	—	FW4/500	U18	—	—	FW4/500
40SUA	C10B	RZ	URIC	—	U4020	—	—

UNIVERSAL (A.C.–D.C.) VALVES

Cossor	Ever-Ready	Ferranti	Mullard	Marconi-Osram	Mazda	Brimar
202STH	C36A	—	TH21C	—	TH2320	—
302THA	C36C C36B	—	TH30C	—	TH2321	—
13PGA 202MPG	C80B	VHTA	FC13C	—	—	15D1
—	C50N	—	VP13C	—	VP1322	—
—	C50B	—	SP13C	—	—	—
—	C20C	ZD	2D13C	—	DD620	10D1
13DHA 202DDT	C23B	HAD	TDD13C	—	HL/DD1320	11D3
—	C30B	DA	HL13C	—	HL1320	4D1
—	C70D	—	Pen36C	—	Pen3520 Pen3820	7D6
—	C27D	—	Pen40DD	—	—	—

REPLACEMENT AND SUBSTITUTION TYPES

EXPLANATION OF ELECTRODE SYMBOLS

A, A1, A2	Anodes
Ao	Oscillator Anode
D, D1, D2	Diode Anodes
F	Filament
H	Heater
G	Grid. Grids marked G1, G2, etc., G1 being nearest the cathode
Go	Oscillator Grid
K, K1, K2	Cathode
M	Metallising
S	Screen

The symbol " TC " shown in the base connections is used to indicate the top cap.

Where marked with * there is no recommended substitute.

A radio set may not perform with the same degree of efficiency when a substitution is made for the original valve. The purpose of this information is to assist in keeping sets in operation under present conditions.

This list is issued subject to additions and alterations without notification.

Original Type	Base	Substitute Type	Base	Remarks
AC054	A	AC044	A	Redesign circuit
ACO64	A	ACO44	A	Redesign circuit — There is no valve which will directly replace these valves, and full working conditions of the ACO44 should be studied before substitution is made.
ACO84	A	ACO44	A	Redesign circuit
ACO84N	A	ACO44	A	Redesign circuit
AC104	A	ACO44	A	Redesign circuit
AL60	M	PenB4	M	Re-wire base, change cathode resistance to 175 ohms. Pin No. 1 2 3 4 5 6 7 Conn. — G1 G2 H H K A
AZ2	P	FW4/500	A	Pin No. 1 2 3 4 Conn. A1 A F F
AZ3	P	IW4/350	A	No circuit change. Pin No. 1 2 3 4 Conn. A1 A F F
AZ32	K	FW4/500	A	Pin. No. 1 2 3 4 Conn. A1 A F F
AZ33	K	IW4/350	A	No circuit change. Pin No. 1 2 3 4 Conn. A1 A F F
CL6	P	CL4	P	Change bias resistance to 170 ohms. Raise Vg2 to 200 V.
CY2	P	UR3C	M	No circuit change. Pin No. 1 2 3 4 5 6 7 Conn. — A1 K1 H H K2 A2

Original Type	Base	Substitute Type	Base	Remarks
CY32	K	UR3C	M	No circuit change. Pin No. 1 2 3 4 5 6 7 Conn. — A1 K1 H H K2 A2
DF1	P	DF33	K	No circuit change. Pin No. 1 2 3 4 5 6 7 8 TC Conn. m f+ a g2 — — f, g3 — g1
DK1	P	DK32	K	Pin No. 1 2 3 4 5 6 7 8 TC Conn. M H A G3, G5 G1 G2 H — G4
DAC1	P	DAC32	K	Pin No. 1 2 3 4 5 6 7 8 TC Conn. M H A — D — H — G1
DL2	P	DL35	K	Pin. No. 1 2 3 4 5 6 7 8 Conn. — H A G2 G1 — H —
*DL51	G	—	—	—
*DO20	A	—	—	—
DO25	A	DO26	A	Add series filament resistance of 1 ohm, 10 watts ; no further change.
DW3	A	DW4/350	A	No change.
DW4	A	FW4/500	A	No change.
EAB1	P	EB34	K	Redesign circuit. (See instructions at end of list.)
EB4	P	EB34	K	No circuit change. Pin No. 1 2 3 4 5 6 7 8 Conn. M, S H D1 K1 D2 — H K2
*EBF1	P	—	—	—
*EBF2	P	—	—	—
*EBF32	K	—	—	—
ECH2	P	ECH3	P	No change. ECH3 If=0.2A.
ECH33	K	CCH35	K	For A.C./D.C. receivers—CCH35. For A.C. receivers—ECH35.
EFM1	P	EF9	P	Redesign circuit without tuning indicator. (See instructions at end of list).
*EF1	P	—	—	—
EF2	P	EF9	P	EF9 has longer grid base. No change.
EF5	P	EF9	P	No change.
EF8	P	EF9	P	No change.
EH2	P	ECH3	P	Use hexode section only in extreme cases.
*EK1	P	—	—	—
EK3	P	EK2	P	Raise screen volts to 200. EK2 If=0.2A.
EL5	P	EL35	K	EL35 Vg2=250 V. max. Change bias resistance to 180 ohms. Pin No. 1 2 3 4 5 6 7 8 Conn. — H A G2 G1 — H G3, K

Original Type	Base	Substitute Type	Base	Remarks
EL6	P	EL35	K	EL35 Vg2=250 V max. Change bias resistance to 180 ohms. Pin No. 1 2 3 4 5 6 7 8 Conn. — H A G2 G1 — H G3, K
EL36	K	EL35	K	EL35 Vg2=250 V. max. Change bias resistance to 180 ohms.
*EM2	P	—	—	—
*EM3	P	—	—	—
*EZ2	P	—	—	—
*EZ3	P	—	—	—
*FZ1	P	—	—	—
*HL20	O	—	—	—
*HVR1	A	—	—	—
IW3	A	IW4/350	A	No change.
IW4	A	IW4/500	A	No change.
MM4V	O	VP4	O	No change. Volume control will not be so gradual in operation.
Pen4V	O	Pen4VA	O	Change grid bias to –22 volts. No change with automatic bias.
Pen4VB	M	PenA4	M	No change.
*Pen13	P	—	—	—
*Pen13C	M	—	—	—
*Pen20	O/M	—	—	—
Pen26	P	CL4	P	Change bias resistance to 170 ohms. CL4 Vg2=200 volts.
PM1A	A	PM2HL	A	No change.
PM1HF	A	PM2HL	A	No change.
PM1HL	A	PM2HL	A	No change.
PM1LF	A	PM2HL	A	Change grid bias to –1.5 volts.
PM2	A	PM2A	A	Change grid bias to –6.0 volts.
PM2BA	M	PM2B	M	Remove bias supply from the valve.
PM2DL	A	PM2HL	A	No change.
PM2DX	A	PM2HL	A	No change.
*PM4	A	—	—	—
*PM4DX	A	—	—	—
PM12	A	PM12M	A	Raise Vg2 to 90 volts.
PM12A	A	PM12M	A	Raise Vg2 to 90 volts.
*PM13	A/O	—	—	—
PM22	A/O	PM22A	A/O	Change grid bias to –4.5 volts at Va=Vg2=135 volts, and anode load to approx. 19,000 ohms.
*PM22C	O	—	—	—
PM24	A/O	PM24A	O	No circuit change. Pin No. 1 2 3 4 5 Conn. A G1 F F G2
PM24B	O	PM24M	O	Redesign circuit. PM24M Va=Vg2=250 volts max.
PM24C	O	PM24M	O	Redesign circuit. PM24M Va=Vg2=250 volts max.
*PM24D	O	—	—	—
*PM24E	O	—	—	—
*PM25	A/O	—	—	—
*PM26	O	—	—	—
PM252	A	PM2A	A	Anode load=7,000 ohms. Change bias to –6.0 volts.
*QP22A	R	—	—	—
SD4	M	TDD4	M	Redesign circuit. (See instructions at end of list).
*SD20	M	—	—	—
*SG20	O	—	—	—
*SP20	O	—	—	—
SP4C	P	SP4B	M	No circuit change. Pin No. 1 2 3 4 5 6 7 TC Conn. M A G3 H H K G2 G1
S4V	A/O	S4VB or SP4	O	No circuit change. Pin No. 1 2 3 4 5 TC Conn. G2 G1 H H K A
S4VA	O	S4VB or SP4	O	No change.
TDD2	O	TDD2A	O	Change grid bias to –1.5 volts. Not suitable as Class B driver.
TDD13	P	TDD13C	M	No circuit change. Pin No. 1 2 3 4 5 6 7 TC Conn. D1 M D2 H H K A G1
*TDD25	M	—	—	—
TH4	M	TH4B	M	Change bias resistance to 140 ohms. Grid leak to be increased to 50,000 ohms between grid and cathode.
TH4A	M	TH4B	M	No change.
*TH13C	M	—	—	—
TH22C	M	TH30C	M	No change.
TH62	K	{ CCH35 ECH35 }	K	For A.C./D.C. receivers—CCH35. For A.C. receivers—ECH35. No change.
*TT4	O	—	—	—
*TT4A	O	—	—	—
*TV4	P	—	—	—
TV6	P	EM1	P	No change.
UR1	P	CY1	P	No change.
UR2	P	UR3C	M	No circuit change. Pin No. 1 2 3 4 5 6 7 Conn. — A1 K1 H H K2 A2
UR3	P	UR3C	M	No circuit change. Pin No. 1 2 3 4 5 6 7 Conn. — A1 K1 H H K2 A2
VM4V	O	S4VB or VP4	O	No change. Volume control will not be so gradual in operation.
*VM20	O	—	—	—
*VP20	O	—	—	—

Original Type	Base	Substitute Type	Base	Remarks
O54V	O	ACO44	A	Redesign circuit.
2D2	O	TDD2A	—	,, ,, (see instructions at foot of page)
2D4	O	2D4A	O	No circuit change. Pin No. 1 2 3 4 5 Conn. D2 D1 H H K 2D4A has no top cap.
*2D4B	M	—	—	—
2D13	V	2D13C	O	No circuit change. Pin No. 1 2 3 4 5 Conn. D2 D1 H H K
2D13A	V	2D13C	O	No circuit change. Pin No. 1 2 3 4 5 Conn. D2 D1 H H K
*104V	O	—	—	—
154V	A	164V	O	No circuit change. Pin No. 1 2 3 4 5 Conn. A G1 H H K Cathode connected to side terminal.
244V	O	354V	O	No change.
484V	O	354V	O	Change grid bias to -4.5 volts or bias resistance to 700 ohms.
994V	O	904V	O	No change.
S4VB	O	SP4	O	No change.

MULLARD VALVE TYPE EFMI—No supplies available.

With circuit modification this valve may be replaced by the Mullard Type EF9 in Mullard and Philips sets as detailed :—

(1) Lead to contact 5 disconnected and insulated.

(2) Lead to contact 6 disconnected and extended, and fitted with top cap adaptor to reach the top cap of the EF9.

(3) Join together contacts 4 and 5.

(4) Reduce the anode coupling and resistances from approximately 130,000 ohms to 50,000 ohms. It may be necessary to continue the screening on the lead formerly to contact 6 as far as the top cap, though in many cases this will not be necessary. Should the top cap of the EF9 touch the tuning scale it may be necessary to bend the platform for the EFMI slightly so as to give a small clearance. Under these conditions the set should operate as before but without the tuning indicator.

SUBSTITUTION OF TDD4 FOR THE SD4

Change connections as below :—

Connections for SD4 Pin Number		Connections for TDD4 Pin Number
1	Not used with SD4	1
2	Disconnect and take this lead to	Top cap
3	Disconnect and insulate end of lead	
4	These connections remain as they are at present	4
5		5
6		6
7	Disconnect and take lead to	3
Top cap	Disconnect and take lead to	7

Join together pins 1 and 6.

In some cases the lead to the top cap may have to be screened.

SUBSTITUTION OF EB34 FOR THE EAB1

In Philips Receivers Types 753A and 895X, also Mullard MAS17, MAS109 and MAS112.

Circuit alterations :—

1. Change valve holder to octal type.
2. Change connections as opposite.

Contacts on—

EAB1 holder.		EB34 holder
No. 1	to	1
2	to	2
3	to	7
4	to	4
5	to	3
7	Insulate end of lead.	
8	to	5

Join together pins 4 and 8.

Under these conditions the set should operate as before, but without the A.V.C. delay characteristic.

SUBSTITUTION OF TDD2A FOR THE 2D2

Change connections as below :—

Connections for 2D2 Pin Number		Connections for TDD2A Pin Number
1	Disconnect and take wire to	5
2	As at present	2
3	As at present	3
4	As at present	4
5	Disconnect and insulate end of lead	—

Also connect the earth end of the speech diode load to LT+, care being taken not to short out the grid bias supply.

Under these conditions the receiver should operate as before, but with a reduction of volume due to the removal of the A.V.C. delay voltage.

Mullard