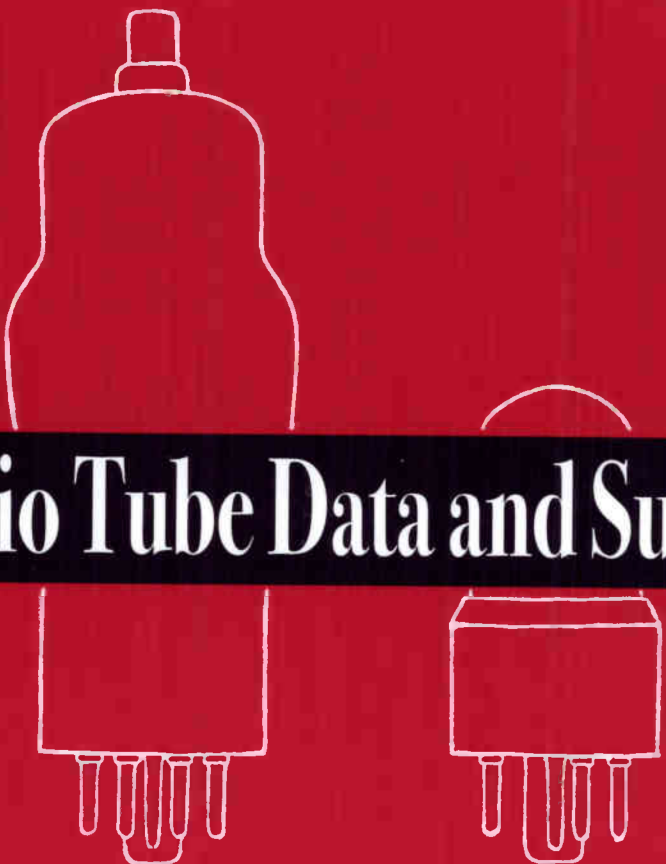
RAYTHEON

Radio Tube Data and Substitution Chart



Raytheon's recognized leadership in the electronic field is based on precepts of painstaking research and manufacturing proficiency. Raytheon has long dedicated manifold and skilled talents to the advancement of the science of electronics. For more than two decades Raytheon has been the foremost specialist in the manufacture of radio and electronic tubes. Numerous developments and improved techniques have continually been attained and adopted. In the large Raytheon plants and laboratories of today many of the latest and far-reaching electronic refinements have been developed — and to the further pursuit of technical achievement devoted research is constantly maintained.

Raytheon radio-electronic tubes are of the highest quality. In manufacture the most constant care is given to their every precision detail by expert tube technicians. Before each tube receives the Raytheon brand of approval it must completely satisfy the most rugged and exacting Raytheon specifications of tube testing. Raytheon tubes have a *plus-extra* performance quality — infixed through Raytheon craftsmanship.

RAYTHEON tubes fulfill the demands of the most exacting electronic applications. RAYTHEON tubes fulfill the demands of the most discriminating in radio performance. For complete satisfaction install RAYTHEONS.

Radio Tube Data
and Substitution Chart
by Raytheon Manufacturing Company
circa 1945

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INTRODUCTION

Raytheon through the years has continued to furnish the results of its abundant study to those rendering service and research to the radio trade.

In publishing this new edition of Raytheon Tube Data a very comprehensive summary of the vital information on American Receiving Tubes has been made. A considerable amount of information not previously available has now been organized and included. Every currently used tube bearing RMA type designation appears with its essential features and operating characteristics. A vast quantity of new tube types has been incorporated for the first time, along with many new special purpose types. All these will be found arranged in proper RMA sequence. For each active tube type listed complete information **on** the following is offered, effectively described and diagrammed:

Electrical Characteristics — Basing Connections
Style and Size of Base — Style and Size of Bulb
Outline Dimension of Complete Tube

The technical data on Raytheon Flat Hearing Aid Tubes also have been introduced into this manual. These tubes are the acknowledged choice of Hearing Aid manufacturers and are used extensivly in their products.

During the war period shortages in many of the popular types of receiving tubes have developed. A most complete substitution chart therefore comprises a part of this booklet. In this chart an attempt has been made to work out every conceivable tube type substitution. Some of these substitutions have been previously published, but never in so complete a form as here. This substitution chart should prove indispensable to those concerned in the servicing and maintenance of radio and electronic equipment.

The Raytheon Radio Receiving Tube Division publishes this newest edition of Radio Tube Data, now all inclusive, confident that it will prove of even greater usefulness and value than its predecessors. This is only one of many Service and Sales Helps available to the Trade. For complete information, consult your nearest Raytheon Distributor.

BEFORE USING THE TUBE DATA CHART

Please read the following notes carefully. They explain the symbols and abbreviations which are used.

The following system for describing the type of base and for referring to the base connection diagram is used in the column headed "Basing Data":

The symbol at the left of the hyphen refers to the base connection diagram.

The symbol at the right of the hyphen indicates the type of base and the number of contact pins in accordance with the following:

First Letter — M=Miniature Base
O=Octal Base
L=Locking Base
S=Standard Base

Second Letter — B=Button Base (a shell is not incorporated)
M=Medium Shell (bakelite)
S=Small Shell (bakelite)
W=Wafer Base (metal tube or bantam tube with metal shell)
GT=Intermediate (bantam) Shell (bakelite)

Numeral indicates the number of pins in base.

"B" after numeral indicates bayonet pin in base.

Examples:

4C-SS4B	Diagram 4C, standard small shell with bayonet, 4 pin.
6G-SM6	Diagram 6G, standard medium shell, 6 pin.
7Q-OW7	Diagram 7Q, octal wafer base, 7 pin.

The column headed "Max Size View" shows the number of the tube outline drawing which gives dimensions. Although the letter in the symbol is arbitrarily chosen, the number refers to the bulb size. Thus 14C means that the tube has a size 14 bulb and that its outline drawing and dimensions are given in the "C" drawing for size 14 bulbs. Since the unit of bulb size is ⅛", a size 14 bulb is nominally 1¾" at its largest diameter.

* Indicates that capacitance is measured with standard tube shield connected to cathode. In the case of a metal type, the metal shell is connected to cathode.

"C" after figure in "Mutual Conductance" column indicates that value is for conversion transconductance. (Used for converter types only.)

"S" after figure in "Plate Volts" column indicates that value shown is anode supply voltage and that it is applied through the indicated value of G_2 resistor. (Also used only for converter types.)

Capacities shown for converter types are for the mixer section only.

Values of Plate Ma., Screen Ma., and Ouput Watts for push-pull operation are for two tubes, and value of load resistance is from plate to plate.

Values of Grid Volts for filament type tubes are measured from the negative filament terminal.

Values of Cutoff Bias are approximate.

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TYPE	DESIGN	CATHODE HTR OR FIL TYPE	VOLTS	AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	IN mmfds	OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
00A	TRIODE	FIL	5.0	.25	4D-SM4B	14B	8.5	3.2	2.0	DETECTOR	45	0		1.5		20	30000	666				00A
01A	TRIODE	FIL	5.0	.25	4D-SM4B	14D	8.1	3.1	2.2	AMP CL A	135	—9		3		8	10000	800				01A
0A3/VR75	DIODE	COLD			4AJ-OS8	12E	GAS FILLED			VOLT REG	75v OUTPUT THROUGH A CURRENT RANGE 5-30ma											0A3/VR75
0A4G	GAS TRI	COLD			4V-OS6	12E				RELAY TUBE	MAX PEAK CATHODE CURRENT 100ma, MAX DC CATHODE CURRENT 25ma, STARTER ANODE DROP APPROX 60v, ANODE DROP APPROX 70v											0A4G
0B3/VR90	DIODE	COLD			4AJ-OS8	12E	GAS FILLED			VOLT REG	90v OUTPUT THROUGH A CURRENT RANGE 5-30ma											0B3/VR90
0C3/VR105	DIODE	COLD			4AJ-OS8	12E	GAS FILLED			VOLT REG	105v OUTPUT THROUGH A CURRENT RANGE 5-30ma											0C3/VR105
0D3/VR150	DIODE	COLD			4AJ-OS8	12E	GAS FILLED			VOLT REG	150v OUTPUT THROUGH A CURRENT RANGE 5-30ma											0D3/VR150
0Z4 0Z4G	TWIN DIODE	COLD			4R-OW6 4R-OT5	8D 7A				FULL WAVE RECTIFIER	300 RMS MAX 75 ma MAX 30 ma MIN TUBE DROP 24v											0Z4 0Z4G
0Z4A/1003	TWIN DIODE	COLD			4R-OW6	8D				FULL WAVE RECTIFIER	265 RMS MAX 85ma MAX — 30ma MIN. TUBE DROP 24v CONDITION I = SINGLE TUBE OPERATION (Applies to above) 365 RMS MAX 85ma MAX — 30ma MIN. TUBE DROP 24v CONDITION II = RESISTANCE PARALLEL OPERATION (Applies to above)											0Z4A/1003
1A3	DIODE	HTR	1.4	0.15	5AP-MB7	5B				DETECTOR	117 MAX 0.5 MAX											1A3
1A4P	PENTODE	FIL	2.0	.06	4M-SS4	12H	.007*	5.0*	12*	AMP CL A	180	—3	67.5	2.3	0.8		1 MEG	750			—15	1A4P
1A4-T	TETRODE	FIL	2.0	.06	4K-SS4	12H	.012*	4.6	11	AMP CL A	180	—3	67.5	2.3	0.7	720	.96MEG	750			—15	1A4-T
1A5GT/G	PENTODE	FIL	1.4	.05	6X-OGT7	9H				POWER AMP CLASS A	90 85	—4.5 —4.5	90 85	4.0 3.5	0.8 0.7		.3 MEG .3 MEG	850 800	.115 .100	25000 25000		1A5GT/G
1A6	HEPTODE	FIL	2.0	.06	6L-SS6	12H	 .25*	 10.5	 9.0	OSC SECT MIXER	135S 180	.05MEG —3	 67.5	2.3 1.3	 2.4		GRID #2 RES. .5 MEG	 300C	.02 MEG		 —22.5	1A6
1A7G 1A7GT	HEPTODE	FIL	1.4	.05	7Z-OS8 7Z-OW8	9P 9F	 .30*	 6.5*	 11*	OSC SECT MIXER	90 90	.2 MEG 0	 45	1.2 0.55	 0.6		 .6 MEG	 250C			 —3	1A7G 1A7GT
1B4/951	PENTODE	FIL	2.0	.06	4M-SS4	12H	.007*	5.0	11	AMP CL A	180 90	—3 —3	67.5 67.5	1.7 1.6	0.6 0.7	975 600	1.5MEG 1 MEG	650 600			—8 —8	1B4/951
1B5/25S	DUO-DI TRIODE	FIL	2.0	.06	6M-SS6	12B	3.6	2.0	3.0	AMPLIFIER CLASS A	135	—3		0.8		20	35000	575				1B5/25S
1B7G 1B7GT	HEPTODE	FIL	1.4	.1	7Z-OS8 7Z-OW8	9P 9F	 .34*	 7.0*	 7.5*	OSC SECT MIXER	90 90	.2 MEG 0	 45	1.6 1.5	 1.3		 .35MEG	 350C			 —14.5	1B7G 1B7GT
1B8GT	DI-TRI PENTODE	FIL	1.4	0.1	8AJ-OS8	9F				TRI CL A PENT CL A	90 90	0 —6.0	 90	0.15 6.3	 1.4	66	0.24	275 1150	 .210	 14000		1B8GT
1C5GT/G	PENTODE	FIL	1.4	.1	 6X-OGT7	 9H				POWER AMP CLASS A	90 83	—7.5 —7	90 83	7.5 7.0	1.6 1.6	180 165	.12MEG .11MEG	1550 1500	.240 .200	8000 9000		1C5GT/G
1C6 1C7G	HEPTODE	FIL	2.0	.12	6L-SS6 7Z-OS8	12H 12F	.3* .26*	10 10*	10 14*	OSC SECT MIXER	180S 180	.05MEG —3	 67.5	3.3 1.5	 2.0		GRID #2 RES. .7 MEG	 325C	.02 MEG		 —14	1C6 1C7G
1D5G-P	PENTODE	FIL	2.0	.06	5Y-OS7	12F	.007*	5.0*	11*	AMPLIFIER CLASS A	180 90	—3 —3	67.5 67.5	2.3 2.2	0.8 0.9	750 425	1 MEG .6 MEG	750 720			—15 —15	1D5G-P
1D5GT	TETRODE	FIL	2.0	.06	5R-OS7	12F	.012*	4.6*	11*	AMP CL A	180	—3	67.5	2.3	0.7		.96MEG	750			—15	1D5GT
1D7G	HEPTODE	FIL	2.0	.06	7Z-OS8	12F	 .30*	 10*	 14*	OSC SECT MIXER	180S 180	.05MEG —3	 67.5	2.3 1.3	 2.4		GRID #2 RES. .5 MEG	 300C	.02 MEG		 —22.5	1D7G

SEE PAGE 5 FOR DATA CHART REFERENCE NOTES

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TYPE	DESIGN	CATHODE TYPE	CATHODE HTR OR FIL VOLTS	CATHODE FIL AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	CAPACITIES IN mmfds	CAPACITIES OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
1D8GT	DI-TRI PENTODE	FIL	1.4	.1	8AJ-OGT8	9J				TRI CL A PENT CL A	90 90	0 —9	 90	1.1 5.0	 1.0	25	43500 .2 MEG	575 925	 .200	 12000		1D8GT
1E4G	TRIODE	FIL	1.4	.05	5S-OS7	9N	2.4	2.4	6.0	AMPLIFIER CLASS A	90 90	—3 0		1.4 4.5		14.5 14.5	19000 11200	760 1300				1E4G
1E5G-P	PENTODE	FIL	2.0	.06	5Y-OS7	12F	.007*	5.5*	12*	AMPLIFIER CLASS A	180 90	—3 —3	67.5 67.5	1.7 1.6	0.6 0.7	975 600	1.5MEG 1 MEG	650 600			—8 —8	1E5G-P
1E7G	TWIN PENTODE	FIL	2.0	.24	8C-OS8	12E		 PUSH-PULL		CL A 1 SECT CL A 2 SECT	135 135	—4.5 —7.5	135 135	7.5 14	2.2 4.0		.26MEG	1425	.290 .575	16000 24000		1E7G
1F4 1F5G	PENTODE	FIL	2.0	.12	5K-SM5 6X-OM7	14D 14C		 PUSH-PULL		PR AMP CL A CL AB 2 TUBE	135 180	—4.5 —7.5	135 180	8.0 19	2.4 5.5		.20MEG	1700	.310 1.25	16000 20000		1F4 1F5G
1F6 1F7G-H	DUO-DI PENTODE	FIL	2.0	.06	6W-SS6 7AD-OS8	12H 12F	.007* .01*	4 3.8*	9 9.5*	AMPLIFIER CLASS A	180	—1.5	67.5	2.2	0.7		1 MEG	650			—12	1F6 1F7G-H
1G4GT/G	TRIODE	FIL	1.4	.05	5S-OGT7	9H				AMP CL A	90	—6		2.3		8.8	10700	825				1G4GT/G
1G5G	PENTODE	FIL	2.0	.12	6X-OM7	14C				POWER AMP CLASS A	135 90	—13.5 —6	135 90	8.7 8.5	2.5 2.5		.16MEG .13MEG	1550 1500	.550 .250	9000 8500		1G5G
1G6GT/G	TWIN TRIODE	FIL	1.4	.1	7AB-OGT8	9H				CL A 1 SECT CL B 2 SECT	90 90	0 0		1.0 2.0 MAX SIG PLATE CUR—14ma		30	45000	675	 .675	 12000		1G6GT/G
1H4G	TRIODE	FIL	2.0	.06	5S-OS6	12E	5.0*	3.0*	3.0*	AMP CL A CL B 2 TUBE	180 157.5	—13.5 —15		3.1 1.0		9.3	10300	900	(SEE TYPE 30 ALSO) 2.1	 8000		1H4G
1H5G 1H5GT/G	DIODE TRIODE	FIL	1.4	.05	5Z-OS7 5Z-OW7	9P 9F	1.1	.36	4.0	AMPLIFIER CLASS A	90	0		0.15		65	.24MEG	275				1H5G 1H5GT/G
1H6G	DUO-DI TRIODE	FIL	2.0	.06	7AA-OS8	12E	3.6*	2.0*	3.0*	AMPLIFIER CLASS A	135	—3		0.8		20	35000	575				1H6G
1J5G	PENTODE	FIL	2.0	.12	6X-0M7	14C				PR AMP CL A	135	—16.5	135	7.0	2.0	100	.1 MEG	1000	.45	13500		1J5G
1J6G	TWIN TR	FIL	2.0	.24	7AB-OS8	12E				CLASS B TWO SECT	135 135	0 —6		10 NO SIG 0.1 NO SIG					2.1 1.6	10000 10000		1J6G
1L4	PENTODE	FIL	1.4	0.05	6AR-MB7	5B	0.008	3.6	7.5	AMP CL A	90 90	0 0	90 67.5	4.5 2.9	2.0 1.2		0.35 0.6	1025 925			—8 —6	1L4
1LA4	PENTODE	FIL	1.4	.05	5AD-L8	9A				POWER AMP CLASS A	90 85	—4.5 —4.5	90 85	4.0 3.5	0.8 0.7		.3 MEG .3 MEG	850 800	.115 .100	25000 25000		1LA4
1LA6	HEPTODE	FIL	1.4	.05	7AK-L8	9A	.40	7.7	8.0	OSC SECT MIXER	90 90	.2 MEG 0	 45	1.2 0.55	 0.6		 .6 MEG	 250C			 —3	1LA6
1LB4	PENTODE	FIL	1.4	.05	5AD-L8	9A				PR AMP CL A	90 45	—9 —4.5	90 45	5.0 1.6	1.0 0.3		.2 MEG .3 MEG	925 650	.200 .035	12000 20000		1LB4
1LB6	HEPTODE	FIL	1.4	0.05	8AX-L8	9A	0.20	8.0	7.0	MIXER SECT OSC SECT	90 OSC Grid Volt = 0	0	67.5	0.40 Peak OSC Grid Voltage Applied to Grid #3 = 10 min Volts	2.2		2 MEG	100C			—4.5	1LB6
1LC5	PENTODE	FIL	1.4	0.05	7AO-L8	9A	0.007	3.2	7.0	AMP CL A	90 45	0 0	45 45	1.15 1.10	0.20 0.25		1.5 0.7	775 750			—3 —3	1LC5
1LC6	HEPTODE	FIL	1.4	0.05	7AK-L8	9A	0.28	9.0	5.5	MIXER SECT OSC SECT	90 45	0 .2 MEG	35	0.75 1.4	0.70		.65	275C			—3	1LC6
1LD5	DI-PENT	FIL	1.4	0.05	6AX-L8	9A	0.20	3.2	6.0	AMP CL A	90 45	0 0	45 45	0.60 0.55	0.10 0.12		0.95 0.90	600 550				1LD5
1LE3	TRIODE	FIL	1.4	0.05	4AA-L8	9A	1.7	1.7	3.0	AMP CL A	90 90	—3 0		1.4 4.5			19000 11200	760 1300				1LE3

SEE PAGE 5 FOR DATA CHART REFERENCE NOTES

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TYPE	DESIGN	TYPE	CATHODE HTR OR FIL VOLTS	CATHODE HTR OR FIL AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	CAPACITIES IN mmfds	CAPACITIES OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
1LH4	DI-TRI	FIL	1.4	.05	5AG-L8	9A	1.2	2.0	2.4	AMP CL A	90	0		0.15		65	.24MEG	275				1LH4
1LN5	PENTODE	FIL	1.4	.05	7AO-L8	9A	.007	3.4	8.0	AMP CL A	90	0	90	1.6	0.35	880	1.1MEG	800			—4.5	1LN5
1N5G 1N5GT/G	PENTODE	FIL	1.4	.05	5Y-OS7 5Y-OW7	9P 9F	.007*	3.0	10.0	AMP CL A	90	0	90	1.2	0.3	1160	1.5MEG	750			—4	1N5G 1N5GT/G
1N6G 1N6GT	DI-PENT	FIL	1.4	.05	7AM-OS8 7AM-OW8	9N 9H				PR AMP CL A	90	—4.5	90	3.4	0.7		.3 MEG	800	.10	25000		1N6G 1N6GT
1P5GT/G	PENTODE	FIL	1.4	.05	5Y-OW7	9F	.007*	3.0	10.0	AMP CL A	90	0	90	2.3	0.7		.8 MEG	750			—12	1P5GT/G
1Q5GT/G	BEAM PWR AMP	FIL	1.4	.1	6AF-OGT7	9H				POWER AMP CLASS A	90 85	—4.5 —5.0	90 85	9.5 7.0	1.3 0.8			2200 1950	.27 .25	8000 9000		1Q5GT/G
1R4/1294	DIODE	HTR	1.4	0.15	4AH-L8	9A				DETECTOR	10 MAX		5.0 MAX									1R4/1294
1R5	HEPTODE	FIL	1.4	.05	7AT-MB7	5B	.4	7.0	7.0	OSC SECT MIXER	OSC GRID RES — .1 MEG 90	 0	 67.5	OSC GRID CUR — .25 MA 1.7	 3.0		 .5 MEG	 300C			—15	1R5
1S4	PENTODE	FIL	1.4	.1	7AV-MB7	5B				PR AMP CL A	90 45	—7 —4.5	67.5 45	7.4 3.8	1.4 0.8		.1 MEG .1 MEG	1575 1250	.270 .065	8000 8000		1S4
1S5	DIODE PENTODE	FIL	1.4	.05	6AU-MB7	5B				DETECTOR AMP CL A	67.5	0	67.5	1.8	0.4		.6 MEG	625				1S5
1SA6GT	PENTODE	FIL	1.4	0.05	6BD-OW8	9E	0.01	5.2	8.6	AMP CL A	90 45	0 0	67.5 45	2.45 1.10	0.68 0.30		0.8 0.7	970 750			—5.5 —3.5	1SA6GT
1SB6GT	DI-PENT	FIL	1.4	0.05	6BE-OS7	9H	0.25	3.2	3.0	DET AMP CL A	90 45	0 0	67.5 45	1.45 0.6	0.38 0.16		0.7 0.9	665 500				1SB6GT
1T4	PENTODE	FIL	1.4	.05	6AR-MB7	5B	.01	3.6	7.5	AMP CL A	90 45	0 0	67.5 45	3.5 1.7	1.4 0.7		.5 MEG .35MEG	900 700			—16 —10	1T4
1T5GT	BM PWR	FIL	1.4	.05	6X-OGT7	9H				PR AMP CL A	90	—6	90	6.5	0.8			1150	.17	14000		1T5GT
1-V	DIODE	HTR	6.3	.3	4G-SS4	12B				H W RECT	325 RMS MAX			45 DC MAX TUBE DROP 20v AT 90ma DC								1-V
2A3	TRIODE	FIL	2.5	2.5	4D-SM4	16B				PR AMP CL A PUSH-PULL CL AB 2 TUBE	250 300 300	—45 —62 SELF		60 80 80	 780 OHM BIAS RES	4.2	800	5250	3.5 15 10	2500 3000 5000		2A3
2A4G	GAS TRI	FIL	2.5	2.5	5S-OS7	12E				THYRATRON	200 RMS MAX			100 DC MAX TUBE DROP 12v							—9	2A4G
2A5	PENTODE	HTR	2.5	1.75	6B-SM6	14D	TRIODE CONNECTION			PR AMP CL A CL AB 2 TUBE	250 350	—20 —38		31 48	 (SEE TYPE 6F6G ALSO)	6.8	2600		.85 13.0	4000 6000		2A5
2A6	DUO-DI TRIODE	HTR	2.5	.8	6G-SS6	12H	1.7	2.0	3.5	AMPLIFIER CLASS A	250	—2		0.9		100	91000	1100				2A6
2A7 2A7S	HEPTODE	HTR	2.5	.8	7C-SS7 7C-SS7	12H	.3*	8.5	9.0	OSC SECT MIXER	250S 250	.05MEG —3	 100	4.0 3.5	 2.7		GRID #2 RES .02 MEG .36MEG	 550C			—35	2A7 2A7S
2B7 2B7S	DUO-DI PENTODE	HTR	2.5	.8	7D-SS7 7D-SS7	12H	.007*	3.5	9.5	AMPLIFIER CLASS A	250 100	—3 —3	125 100	9.0 5.8	2.3 1.7		.65MEG .30MEG	1125 950			—21 —17	2B7 2B7S
2C22	TRIODE	HTR	6.3	0.3	4AM-OW8	9S	3.6	2.2	0.7	AMP CL A	300	—10.5		11		20	6600	3000				2C22
2E5	ELEC RAY	HTR	2.5	.8	6R-SS6	12B				TUNING IND	250 THRU 1 MEG, TARGET 250v, GRID 0v FOR 90°, —8v FOR 0°											2E5
2S/4S	DUO DIODE	HTR	2.5	1.35	5D-SS5					DETECTOR				40 APPROX PER PLATE AT 50v DC								2S/4S

SEE PAGE 5 FOR DATA CHART REFERENCE NOTES

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TYPE	DESIGN	CATHODE HTR OR FIL TYPE	VOLTS	AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	IN mmfds	OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
2W3GT	DIODE	FIL	2.5	1.5	4X-OW5	9E				H W RECT	350 RMS MAX 55 DC MAX											**2W3GT**
2X2/879	DIODE	HTR	2.5	1.75	4AB-OS4	12H				H W RECT	4500 RMS MAX 7.5 DC MAX											**2X2/879**
3A4	BM PWR	FIL	1.4	0.2	7B-MB7	5B	0.2	4.8	4.2	PR AMP CL A	150 135	—8.4 —7.5	90 90	13.3 14.8	2.2 2.6		0.10 0.09	1900 1900	700 600	8000 8000		**3A4**
3A5	TWIN TRIODE	FIL	1.4 or 2.8	.22 .11	7BC-MB7	5B	3.2L 3.2R	0.9L 0.9R	1.0L 1.0R	H F AMP	90	—2.5		3.7		15	8300	1800				**3A5**
3A8GT	DI-TRI PENTODE	FIL	1.4 or 2.8	.1 .05	8AS-OGT8	9L	2.0 .012	2.6* 3.0	4.2 10*	TRI CL A PENT CL A	90 90	—FIL —FIL	 90	0.20 1.5	 0.5		.20MEG .8 MEG	325 750				**3A8GT**
3B5GT	BM PWR	FIL	1.4 or 2.8	0.10 0.05	7AP-OGT7	9H	PARALLEL FIL SERIES FIL			PR AMP CL A	45 67.5	—4.5 —7	45 67.5	4.4 6.7	0.3 0.5		0.1 0.1	1400 1500	.070 .180	8000 5000		**3B5GT**
3B7/1291	TWIN TRIODE	FIL	1.4	.22	7BE-L8	9A	2.6L 2.6R	1.4L 1.4R	1.8L 2.6R	AMP OSC CLASS B	135 90	0		19 10.4		20 20		1900 1850	1.5 1.0	16000 8000		**3B7/1291**
3C5GT	BM PWR	FIL	1.4 or 2.8	0.1 0.05	7AP-OGT7	9H	PARALLEL FIL SERIES FIL			PR AMP CL A	90 90	—9 —9	90 90	6 6	1.4 1.4			1550 1450	.240 .260	10000 10000		**3C5GT**
3D6/1299	BM PWR	FIL	1.4 or 2.8	.220 .110	6BB-L8	9A	PARALLEL FIL SERIES FIL			PR AMP CL A	150 135	—4.5 —4.5	90 90	9.8 9.8	1.0 1.2			2400 2400	.600 .500	14000 12000		**3D6/1299**
3LE4	BM PWR	FIL	1.4 or 2.8	0.1 0.05	6BA-L8	9A	PARALLEL FIL SERIES FIL			PR AMP CL A	90 90	—9 —9	90 90	10.0 8.8	2 1.8		0.10 0.11	1700 1600	.325 .300	6000 6000		**3LE4**
3LF4	BM PWR	FIL	1.4 or 2.8	0.1 0.05	6BA-L8	9A	PARALLEL FIL SERIES FIL			PR AMP CL A	90 90	—4.5 —4.5	90 90	9.5 8.0	1.3 1.0		0.75 0.80	2200 2000	.270 .230	8000 8000		**3LF4**
3Q4	BM PWR	FIL	1.4 or 2.8	0.1 0.05	7BA-MB7	5B	PARALLEL FIL SERIES FIL			PR AMP CL A	90 90	—4.5 —4.5	90 90	9.5 7.7	2.1 1.7		0.10 0.12	2150 2000	.250 .240	10000 10000		**3Q4**
3Q5GT/G	BM PWR	FIL	1.4 or 2.8	.1 .05	7AP-OGT7	9H	PARALLEL FIL SERIES FIL			PR AMP CL A	90 90	—4.5 —4.5	90 90	9.5 8.0	1.3 1.0		.075MEG .08 MEG	2200 2000	.270 .230	8000 8000		**3Q5GT/G**
3S4	PENTODE	FIL	1.4 or 2.8	.1 .05	7BA-MB7	5B	PARALLEL FIL SERIES FIL			POWER AMP CLASS A	90 90	—7 —7	67.5 67.5	7.4 6.1	1.4 1.1		.1 MEG .1 MEG	1550 1425	.270 .235	8000 8000		**3S4**
4A6G	TWIN TRIODE	FIL	2.0 or 4.0	.12 .06	8L-OS8	12E				CL A 1 SECT CL B 2 SECT	90 90	—1.5 —1.5		1.1 1.1	 MAX SIG PLATE CUR—10.8ma	20	26600	750	 1.0	 8000		**4A6G**
5R4GY	TWIN DIODE	FIL	5.0	2.0	5T-OM5	16A				FULL WAVE RECTIFIER	1000 RMS MAX COND IN 150 DC MAX TUBE DROP 50v AT 175ma DC 950 RMS MAX CHOKE IN 175 DC MAX											**5R4GY**
5T4	TWIN DIODE	FIL	5.0	2.0	5T-OW5	10C				FULL WAVE RECTIFIER	450 RMS MAX COND IN 225 DC MAX TUBE DROP 45v AT 225ma DC 550 RMS MAX CHOKE IN 225 DC MAX											**5T4**
5U4G	TWIN DIODE	FIL	5.0	3.0	5T-OM8	16A				FULL WAVE RECTIFIER	450 RMS MAX COND IN 225 DC MAX TUBE DROP 58v AT 225ma DC 550 RMS MAX CHOKE IN 225 DC MAX											**5U4G**
5V4G	TWIN DIODE	HTR	5.0	2.0	5L-OM5	14C				FULL WAVE RECTIFIER	375 RMS MAX COND IN 175 DC MAX TUBE DROP 23v AT 175ma DC 500 RMS MAX CHOKE IN 175 DC MAX											**5V4G**
5W4 **5W4GT/G**	TWIN DIODE	FIL	5.0	1.5	5T-OW5 5T-OGT5	8H 9HB				FULL WAVE RECTIFIER	350 RMS MAX COND IN 100 DC MAX TUBE DROP 45v AT 100ma DC 500 RMS MAX CHOKE IN 100 DC MAX											**5W4** **5W4GT/G**
5X3	TWIN DI	FIL	5.0	2.0	4C-SM4	14D				F W RECT	1275 RMS MAX COND IN 30 DC MAX											**5X3**
5X4G	TWIN DI	FIL	5.0	3.0	5Q-OM8	16A				F W RECT	450 RMS MAX COND IN 225 DC MAX TUBE DROP 58v AT 225ma DC 550 RMS MAX CHOKE IN 225 DC MAX											**5X4G**

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TYPE	DESIGN	TYPE	CATHODE HTR OR FIL VOLTS	AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	IN mmfds	OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
5Y3GT/G 5Y4G	TWIN DIODE	FIL	5.0	2.0	5T-OM5 5Q-OM8	9HB 14C				FULL WAVE RECTIFIER	350 RMS MAX COND IN 125 DC MAX 500 RMS MAX CHOKE IN 125 DC MAX						TUBE DROP 60v AT 125ma DC					5Y3GT/G 5Y4G
5Z3	TWIN DI	FIL	5.0	3.0	4C-SM4	16B				F W RECT	450 RMS MAX COND IN 225 DC MAX 550 RMS MAX CHOKE IN 225 DC MAX						TUBE DROP 58v AT 225ma DC					5Z3
5Z4 5Z4GT/G	TWIN DIODE	HTR	5.0	2.0	5L-OW5 5L-OGT5	8H 9H				FULL WAVE RECTIFIER	350 RMS MAX COND IN 125 DC MAX 500 RMS MAX CHOKE IN 125 DC MAX						TUBE DROP 20v AT 125ma DC					5Z4 5Z4GT/G
6A3	TRIODE	FIL	6.3	1.0	4D-SM4	16B	16	7	5	PR AMP CL A PUSH-PULL CL AB 2 TUBE	250 325 325	—45 —68 SELF		60 80 80	 750 OHM BIAS RES	4.2	800	5250	3.2 15 10	2500 3000 5000		6A3
6A4/LA	PENTODE	FIL	6.3	.3	5B-SM5	14D				PR AMP CL A PUSH-PULL CL AB 2 TUBE	180 250	—12 SELF	180 230	22 32	3.9 700 OHM BIAS RES	100	45500	2200	1.4 4.2	8000 16000		6A4/LA
6A5G	TRIODE	HTR	6.3	1.25	6T-OM8	16A	16	7	5	PR AMP CL A PUSH-PULL CL AB 2 TUBE	250 325 325	—45 —68 —SELF		60 80 80	 850 OHM BIAS RES	4.2	800	5250	3.75 15 10	2500 3000 5000		6A5G
6A6	TWIN TRIODE	HTR	6.3	.8	7B-SM7	14D	(SEE TYPE 6N7G ALSO)			AMP CL A TRI IN PAR'L	294 250	—6 —5		7 6		35 35	11000 11300	3200 3100				6A6
6A7 6A7S 6A8 6A8G 6A8GT	HEPTODE	HTR	6.3	.3	7C-SS7 7C-SS7 8A-OW8 8A-OS8 8A-OW8	12H 8F 12F 9F	.3* .03 .26* .26*	8.5 12.5 9.5* 9.5*	9.0 12.5 12* 12*	OSC SECT MIXER	250S 100 250 100	.05MEG .05MEG —3 —1.5	 100 50	4.0 2.0 3.5 1.1	 2.7 1.3		GRID #2 RES .02 MEG .36MEG .6 MEG	 550C 360C			 —35 —20	6A7 6A7S 6A8 6A8G 6A8GT
6AB5/6N5	ELEC RAY	HTR	6.3	.15	6R-SS6	9R				TUNING IND	135 THRU .25 MEG, TARGET 135v, GRID 0v FOR 90°, —10.0v FOR 0°											6AB5/6N5
6AB6G	DUO TRIODE	HTR	6.3	0.5	7AU-OS7	12K	DRIVER TRIODE OUTPUT TRIODE			DIR C'P'D AMP	250 250	0 +		5 34		72	4000	1800	3.5	8000		6AB6G
6AB7/1853	PENTODE	HTR	6.3	.45	8N-OW8	8E	.015	8	5	HIGH FREQ AMPLIFIER	300 300	—3 —3	200 300 THRU .03 MEG (OTHER VALUES SAME AS ABOVE)	12.5	3.2		.7 MEG	5000			—15 —22.5	6AB7/1853
6AC5G 6AC5GT	TRIODE	HTR	6.3	.4	6Q-OS6 6Q-OGT6	12E 9H	ONE 76 DRIVER TWO 76 DRIVERS			DIR C'P'D AMP PUSH-PULL CL B 2 TUBE	250 250 250	SUPPLIED BY DRIVERS 0		32 64 5 NO SIGNAL		125	36700	3400	3.7 9.5 8	7000 10000 10000		6AC5G 6AC5GT
6AC6GT	DUO TRIODE	HTR	6.3	1.1	7AU-OGT7	9H	DRIVER TRIODE OUTPUT TRIODE			DIR C'P'D AMP	180 180	0 +		7 45		54	18000	3000	3.8	4000		6AC6GT
6AC7/1852	PENTODE	HTR	6.3	.45	8N-OW8	8E	.015	11	5	HIGH FREQ AMPLIFIER	300 300	SELF SELF	150 300 THRU .06 MEG (OTHER VALUES SAME AS ABOVE) REMOTE	10	2.5		1.0MEG	9000	160 OHM—BIAS RES			6AC7/1852
6AD5G	TRIODE	HTR	6.3	0.3	6Q-OS6	12E	3.3	4.1	3.9	AMP CL A	250	—2		0.9		100	66000	1500				6AD5G
6AD6G	TWIN ELEC RAY	HTR	6.3	.15	7AG-OW7	9C				TUNING INDICATOR	TARGET 150v CONTROL ELECTRODE 75v AT 0°, 8v AT 90°, —50v AT 135° TARGET 100v CONTROL ELECTRODE 45v AT 0°, 0v AT 90°, —23v AT 135°											6AD6G
6AD7G	TRIODE PENTODE	HTR	6.3	.85	8AY-OM8	14C	TRIODE SEC PENTODE SEC			AMP CL A PR AMP CL A	250 250	—25 —16.5	 250	3.7 34	 6.5	6	19000 80000	325 2500	 3.2	 7000		6AD7G
6AE5GT/G	TRIODE	HTR	6.3	.3	6Q-OGT6	9H				AMP CL A	95	—15		7		4.2	3500	1200				6AE5GT/G
6AE6G	DUO TRIODE	HTR	6.3	.15	7AH-OS7	12E				CONTROL FOR 6AD6G-6AF6G	250 250	—1.5 —1.5		6.5 4.5		25 33		1000 950	PLATE R PLATE L		—35 —9.5	6AE6G

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TYPE	DESIGN	CATHODE TYPE	HTR OR FIL VOLTS	HTR OR FIL AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	CAPACITIES IN mmfds	CAPACITIES OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
6AE7GT	TWIN TRIODE	HTR	6.3	.5	7AX-OGT8	9H				DRIVER 1 SEC TRIODE	250	—13.5		5		14	9300	1500				6AE7GT
6AF5G	TRIODE	HTR	6.3	.3	6Q-OS6	12E				AMP CL A	180	—18		7		7.4	4900	1500				6AF5G
6AF6G	TWIN ELEC RAY	HTR	6.3	.15	7AG-OS7	9M				TUNING INDICATOR	TARGET 135v CONTROL ELECTRODE 81v AT 0°, 0v AT 100° TARGET 100v CONTROL ELECTRODE 60v AT 0°, 0v AT 100°												6AF6G
6AG5	PENTODE	HTR	6.3	0.3	7BD-MB7	5B	0.025	6.5	1.8	AMP CL A	250	—2	150	7	2		0.8MEG	5000			—8	6AG5
6AG7	PENTODE	HTR	6.3	.65	8Y-OW8	8H	.06*	13.0*	7.5*	AMP CL A	300	—10.5	300	25	6.5		.1 MEG	7700		3500		6AG7
6AH5G	PWR AMP	HTR	6.3	0.9	6AP-OM8	16A				PR AMP CL A	350	—18	250	54	2.5		33000	5200	10.8	4200		6AH5G
6AH7GT	TWIN TRI	HTR	6.3	.3	8BE-OGT8	9D	2.2(1) 3.0(2)	3.2(1) 2.9(2)	3.0(1) 2.6(2)	CL A 1 SECT	250 100	—9 —3.6		12 3.7		16 16	6600 10300	2400 1550			—30 —8.5	6AH7GT
6AK5	PENTODE	HTR	6.3	0.175	7BD-MB7	5A	0.01	4.3	2.1	AMP CL A	180	—2	120	7.7	2.4		0.69MEG	5100			—12	6AK5
6AK6	PENTODE	HTR	6.3	0.15	7BK-MB7	5B	0.12	3.6	4.2	POWER AMPLIFIER	180 135	—9 —6	180 135	15 11.5	2.5 2.0	400 360	.19MEG .17MEG	2300 2100	1.1 0.6	10000 12000		6AK6
6AL6G	BEAM PWR AMP	HTR	6.3	.9	6AM-OM7	16C				POWER AMP CLASS A	250 250	—14 SELF	250 250	72 75	5 5.4	 170 OHM BIAS RES	22500	6000	6.5 6.5	2500 2500		6AL6G
6B4G	TRIODE	FIL	6.3	1.0	5S-OM8	16A	16	7	5	PR AMP CL A PUSH-PULL CL AB 2 TUBE	250 325 325	—45 —68 SELF		60 80 80	 750 OHM BIAS RES	4.2	800	5250	3.2 15 10	2500 3000 5000		6B4G
6B5	DUO-TRI	HTR	6.3	.8	6AS-SM6	14D	DRIVER TRIODE OUTPUT TRIODE			DIR C'P'D AMP 2 TUBES CL A	325 325	0 +		9 51				See Type 6N6G Also	 13.5	 10000		6B5
6B6G	DUO-DI TRIODE	HTR	6.3	.3	7V-OS7	12F	1.3	2.7	4.5	AMPLIFIER CLASS A	250	—2		0.9		100	91000	1100				6B6G
6B7 6B7S	DUO-DI PENTODE	HTR	6.3	.3	7D-SS7 7D-SS7	12H	.007*	3.5	9.5	AMPLIFIER CLASS A	250 100	—3 —3	125 100	9.0 5.8	2.3 1.7		.6 MEG .3 MEG	1125 950			—21 —17	6B7 6B7S
6B8 6B8G 6B8GT	DUO-DI PENTODE	HTR	6.3	.3	8E-OW8 8E-OS8 8E-OW8	8F 12F 9G	.005 .01* 0.005*	6 3.6* 4.5*	9 9.5* 10*	AMPLIFIER CLASS A	250 100	—3 —3	125 100	10 5.8	2.3 1.7		.6 MEG .3 MEG	1325 950			—21 —17	6B8 6B8G 6B8GT
6C4	TRIODE	HTR	6.3	0.15	6BG-MB7	5B	1.6	1.8	1.3	H-F POWER TRIODE	250 100	—8.5 0		10.5 11.8			7700 6250	2200 3100				6C4
6C5 6C5G 6C5GT/G	TRIODE	HTR	6.3	.3	6Q-OW6 6Q-OS6 6Q-OW6	8D 12E 9E	2.0 2.2* 2.2*	3.0 4.4* 4.4*	11 12* 12*	AMPLIFIER CLASS A	250	—8		8		20	10000	2000				6C5 6C5G 6C5GT/G
6C6	PENTODE	HTR	6.3	.3	6F-SS6	12J	.007*	5.0	6.5	AMPLIFIER CLASS A	250 100	—3 —3	100 100	2.0 2.0	.5 .5		1.5MEG 1 MEG	1226 1185			—7 —7	6C6
6C7	DUO-DI TRIODE	HTR	6.3	.3	7G-SS7					AMP CL A	250	—9		5.5		20	16000	1250				6C7
6C8G	TWIN TR	HTR	6.3	.3	8G-OS8	12F				CL A 1 SECT	250	—4.5		3.2		36	22500	1600				6C8G
6D6	PENTODE	HTR	6.3	.3	6F-SS6	12J	.007*	4.7	6.5	AMP CL A	250 100	—3 —3	100 100	8.2 8.0	2.0 2.2		.8 MEG .25MEG	1600 1500			—50 —50	6D6

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TYPE	DESIGN	CATHODE HTR OR FIL TYPE	VOLTS	AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	IN mmfds	OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
6D7	PENTODE	HTR	6.3	.3	7H-SS7					AMP CL A	250 100	—3 —3	100 100	2.0 2.0	.5 .5		1.5MEG 1 MEG	1226 1185			—7 —7	6D7
6D8G	HEPTODE	HTR	6.3	.15	8A-OS8	12F	.2*	8.0*	11*	OSC SECT MIXER	250S 250	.05MEG —3	 100	4.3 3.5	 2.6		GRID #2 RES .02 MEG .4 MEG	 550C			 —35	6D8G
6E5	ELEC RAY	HTR	6.3	.3	6R-SS6	9R				TUNING IND	250 THRU 1 MEG, TARGET 250v, GRID 0v FOR 90°, —8v FOR 0°											6E5
6E6	TWIN TRI	HTR	6.3	.6	7B-SM7	14D	PUSH-PULL			CL A 1 SECT CL A 2 SECT	250 250	—27.5 —27.5		18 36		6	3500	1700	 1.6	 14000		6E6
6E7	PENTODE	HTR	6.3	.3	7H-SS7					AMP CL A	250 100	—3 —3	100 100	8.2 8.0	2.0 2.2		.8 MEG .25MEG	1600 1500			—50 —50	6E7
6F5 6F5G 6F5GT	TRIODE	HTR	6.3	.3	5M-OW5 5M-OS5 5M-OW5	8F 12F 9J	2.0 2.0 2.0*	6.0 2.5 6.0*	12 3.5 12*	AMPLIFIER CLASS A	250 100	—2 —1		0.9 0.4		100 100	66000 85000	1500 1150				6F5 6F5G 6F5GT
6F6 6F6G	PENTODE	HTR	6.3	.7	7S-OW7 7S-OM7	8H 14C	PENTODE CONNECTION			PR AMP CL A PUSH-PULL CL AB 2 TUBE	285 250 375 315	—20 —16.5 —26 —24	285 250 .250 285	38 34 34 62	7 6.5 5 12	 (SEE TYPE 2A5 ALSO)	78000 80000	2550 2500	4.8 3.2 18.5 11	7000 7000 10000 10000		6F6 6F6G
6F7 6F7S	TRIODE PENTODE	HTR	6.3	.3	7E-SS7 7E-SS7	12H	2.0 .008*	2.5 3.2	3.0 12.5	TRI CL A PENT CL A	100 250	—3 —3	 100	3.5 6.5	 1.5	8 900	16000 .85MEG	500 1100	(SEE 6P7G ALSO)		 —35	6F7 6F7S
6F8G	TWIN TR	HTR	6.3	.6	8G-OS8	12F	4.0L 3.6R	3.2L 3.0R	3.2L 3.8R	AMP CL A ONE SECT	250 90	—8 0		9.0 10.0		20 20	7700 6700	2600 3000				6F8G
6G6G	PENTODE	HTR	6.3	.15	7S-OS7	12E				POWER AMP CLASS A	180 135	—9 —6	180 135	15 11.5	2.5 2.0	400 360	.18MEG .17MEG	2300 2100	1.1 0.6	10000 12000		6G6G
6H4GT	DIODE	HTR	6.3	.15	5AF-OGT5	9H				DETECTOR	100 MAX			4 MAX			1000 AT .25ma					6H4GT
6H6 6H6G 6H6GT	TWIN DIODE	HTR	6.3	.3	7Q-OW7 7Q-OS7 7Q-OW7	8C 12E 9E	.1PP .1PP .1PP			DETECTOR	150 MAX			4 MAX EACH DIODE								6H6 6H6G 6H6GT
6J5 6J5GT/G	TRIODE	HTR	6.3	.3	6Q-OW6 6Q-OW6	8E 9E	3.4 3.8*	3.4 4.2*	3.6 5.0*	AMPLIFIER CLASS A	250 90	—8 0		9.0 10.0		20 20	7700 6700	2600 3000				6J5 6J5GT/G
6J6	TWIN TRIODE	HTR	6.3	0.45	7BF-MB7	5B	1.6	2.2	0.4	OSCILLATOR	100	—1		8.5		38	6000	5300				6J6
6J7 6J7G 6J7GT	PENTODE	HTR	6.3	.3	7R-OW7 7R-OS7 7R-OW7	8F 12F 9F	.005 .005* .005*	7 4.6* 4.6*	12 12* 12*	AMP CL A PENT CONN TRI CONN	250 100 250	—3 —3 —8	100 100	2.0 2.0 6.5	0.5 0.5	 20	1.5MEG 1.0MEG 10500	1225 1185 1900			—7 —7	6J7 6J7G 6J7GT
6J8G	TRIODE HEPTODE	HTR	6.3	.3	8H-OS8	12F	.01*	4.6*	10.5*	OSC-TRIODE MIXER HEPT	250S 250	.05MEG —3	 100	5.0 1.2	 2.9		TRIODE PLATE RESISTOR .02 MEG 4 MEG	 290C			 —20	6J8G
6K5G	TRIODE	HTR	6.3	.3	5U-OS7	12F	2.0	2.4	3.6	AMP CL A	250	—3		1.1		70	50000	1400				6K5G
6K6GT/G	PENTODE	HTR	6.3	.4	7S-OGT7	9H				POWER AMP CLASS A	315 250	—21 —18	250 250	25.5 32	4.0 5.5		75000 68000	2100 2300	4.5 3.4	9000 7600		6K6GT/G
6K7 6K7G 6K7GT	PENTODE	HTR	6.3	.3	7R-OW7 7R-OS7 7R-OW7	8F 12F 9F	.005 .007* .005*	7 5* 4.6*	12 12* 12*	AMPLIFIER CLASS A	250 250 100	—3 —3 —1	125 100 100	10.5 7.0 9.5	2.6 1.7 2.7		.6 MEG .8 MEG .15MEG	1650 1450 1650			—52.5 —42.5 —38.5	6K7 6K7G 6K7GT

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TYPE	DESIGN	TYPE	CATHODE HTR OR FIL VOLTS	AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	IN mmfds	OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
6K8 6K8G 6K8GT	TRIODE HEXODE	HTR	6.3	.3	8K-OW6 8K-OS8 8K-OW8	8GA 12F 9GA	.03 .08* .08*	6.6 4.6* 4.6*	3.5 4.8* 4.8*	OSC-TRIODE MIXER HEX	100 250 100	.05MEG —3 —3	100 100	3.8 2.5 2.3	6.0 6.2		.6 MEG .4 MEG	3000 350C 325C	(TRIODE GRID 0v)		—30 —30	6K8 6K8G 6K8GT
6L5G	TRIODE	HTR	6.3	.15	6Q-OS6	12E	2.7*	3*	5*	AMP CL A	250	—9		8		17	8900	1900			—20	6L5G
6L6 6L6G	BEAM PWR AMP	HTR	6.3	.9	7AC-OW7 7AC-OM8	10C 16A	2 TUBES 2 TUBES 2 TUBES			POWER AMP CLASS A PP CL A PP CL AB PP CL AB 2	350 250 270 360 360	—18 —14 —17.5 —22.5 —22.5	250 250 270 270 270	54 72 134 88 88	2.5 5.0 11 5 5		33000 22500 23500	5200 6000 5700	10.8 6.5 17.5 26.5 47	4200 2500 5000 6600 3800		6L6 6L6G
6L7 6L7G	HEPTODE	HTR	6.3	.3	7T-OW7 7T-OS7	8F 12F	.001 .005*	7.5 6*	11 10*	AMP CL A MIXER	250 250	—3 —6	100 150	5.3 3.3	6.5 9.2	870	.6 MEG 1 MEG	1100 350C	G3 AT — 3v G3 AT —15v		—15 —45	6L7 6L7G
6M8GT	TRIODE PENTODE	HTR	6.3	0.6	8AU-OGT8	9L	2.5 0.015	3.7 5.2	4.3 1.0	CL A TRIODE CL A PENTODE	100 100	—1 —3	100	0.5 8.5	2.7	100	91000 0.2MEG	1100 1900			—35	6M8GT
6N6G	DUO TRI	HTR	6.3	.8	7AU-OM7	14C	DRIVER TRIODE OUTPUT TRIODE			DIR C'P'D AMP	300 300	0 +		8 45	(SEE TYPE 6B5 ALSO)		24000	2400	4	7000		6N6G
6N7 6N7G	TWIN TRIODE	HTR	6.3	.8	8B-OW8 8B-OM8	8H 14C	(SEE TYPE 6A6 ALSO)			POWER AMP CL B 2 SECT	300	0		35	MAX SIG PLATE CUR—70ma				10	8000		6N7 6N7G
6P5G 6P5GT	TRIODE	HTR	6.3	.3	6Q-OS6 6Q-OGT6	12E 9H	2.6*	3.4*	5.5*	AMPLIFIER CLASS A	250 100	—13.5 —5		5 2.5		13.8 13.8	9500 12000	1450 1150				6P5G 6P5GT
6P7G	TRIODE-PENTODE	HTR	6.3	.3	7U-OS8	12F	2.0* .008*	3.5* 3.5*	3.0* 12*	OSC-TRIODE MIXER PENT	100 250	—3	100	2.4 2.8	0.6		(SEE TYPE 6F7 ALSO) 2 MEG	300C				6P7G
6Q7 6Q7G 6Q7GT	DUO-DIODE TRIODE	HTR	6.3	.3	7V-OW7 7V-OS7 7V-OW7	8F 12F 9F	1.5 1.3 1.6*	5.5 2.7 2.2*	5.0 4.5 5.0*	AMPLIFIER CLASS A	250 100	—3 —1.0		1.0 0.8		70 70	58000 58000	1200 1200				6Q7 6Q7G 6Q7GT
6R6G	PENTODE	HTR	6.3	0.3	6AW-OS6	12F	0.007	4.5	11	AMPLIFIER TELEVISION CIRCUITS	250	—3	100	7.0	1.7	1160	0.8MEG	1450			—42.5	6R6G
6R7 6R7G 6R7GT	DUO DI TRIODE	HTR	6.3	.3	7V-OW7 7V-OS7 7V-OGT7	8F 12F 9J	2.5 3.5	5.5 2.5	4.0 4.5	AMPLIFIER CLASS A	250	—9		9.5		16	8500	1900	.28	10000		6R7 6R7G 6R7GT
6S7 6S7G	PENTODE	HTR	6.3	.15	7R-OW7 7R-OS7	8GA 12F	.005 .008*	6.5 4.4*	10.5 8.0*	AMPLIFIER CLASS A	250 135	—3 —3	100 67.5	8.5 3.7	2.0 0.9		1 MEG 1 MEG	1750 1250			—38.5 —25	6S7 6S7G
6SA7 6SA7GT/G	HEPTODE	HTR	6.3	.3	8R-OW8 8AD-OW8	8E 9E	.13 .20	9.5 11.0	12 12	OSC SECT MIXER	OSC GRID RES — .02 MEG 250	—2	100	3.5	OCS GRID CUR — .5ma 8.5		1.0MEG	450C			—35	6SA7 6SA7GT/G
6SC7 6SC7GT	TWIN TRI	HTR	6.3	.3	8S-OW8 8S-OW8	8E 9H				CL A 1 SECT	250	—2		2		70	53000	1325				6SC7 6SC7GT
6SD7GT	PENTODE	HTR	6.3	.3	8N-OW8	9E	.0035	9.0	7.5	AMP CL A	250 100	—2 —2	100 100	6.0 5.7	1.9 2.0		1.0MEG .25MEG	3600 3350			—11 —11	6SD7GT
6SE7GT	PENTODE	HTR	6.3	0.3	8N-OW8	9E	0.005	8.0	7.5	AMP CL A	250	—1.5	100	4.5	1.5		1.0MEG	3100			—5	6SE7GT
6SF5 6SF5GT	TRIODE	HTR	6.3	.3	6AB-OW6 6AB-OGT6	8E 9H	2.6 2.6*	4.2 4.2*	3.8 3.8*	AMPLIFIER CLASS A	250 100	—2 —1		0.9 0.4		100 100	66000 85000	1500 1150				6SF5 6SF5GT
6SF7	DIODE PENTODE	HTR	6.3	.3	7AZ-OW8	8E				AMP CL A	250 100	—1 —1	100 100	12.4 12.0	3.3 3.4		.7 MEG .2 MEG	2050 1975			—35 —35	6SF7

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TYPE	DESIGN	CATHODE TYPE	HTR OR FIL VOLTS	HTR OR FIL AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	CAPACITIES IN mmfds	CAPACITIES OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
6SG7	PENTODE	HTR	6.3	.3	8BK-OW8	8E				AMP CL A	250 100	—1 —1	125 100	11.8 8.2	4.4 3.2		.9 MEG .25MEG	4700 4100			—14 —11.5	6SG7
6SH7GT	PENTODE	HTR	6.3	0.3	8BK-OW8	9E	0.003	8.5	7.0	AMPLIFIER CLASS A	250 100	—1 —1	150 100	10.8 5.3	4.1 2.1		0.9MEG 0.35MEG	4900 4000			—5.5 —4	6SH7GT
6SJ7 6SJ7GT	PENTODE	HTR	6.3	.3	8N-OW8 8N-OW8	8E 9E	.005	6.0	7.0	AMPLIFIER CLASS A	250 100	—3 —3	100 100	3.0 2.9	0.8 0.9	2500 1100	1.5MEG 0.7MEG	1650 1575			—8 —8	6SJ7 6SJ7GT
6SK7 6SK7GT/G	PENTODE	HTR	6.3	.3	8N-OW8 8N-OW8	8E 9E	.003 .005*	6.0 6.5*	7.0 7.5*	AMPLIFIER CLASS A	250 100	—3 —1	100 100	9.2 13.0	2.6 4.0	2000 2350	0.8MEG .12MEG	2000 2350			—35 —35	6SK7 6SK7GT/G
6SL7GT	TWIN TR	HTR	6.3	0.3	8BD-OGT8	9H				CL A 1 SECT	250	—2		2.3		70	44000	1600				6SL7GT
6SN7GT	TWIN TR	HTR	6.3	.60	8BD-OGT8	9H	4L 4R	3.2L 3.8R	3.4L 2.6R	CL A 1 SECT	250 90	—8 0		9 10		20 20	7700 6700	2600 3000				6SN7GT
6SQ7 6SQ7GT/G	DUO-DI TRIODE	HTR	6.3	.3	8Q-OW8 8Q-OW8	8E 9E	1.8	4.2	3.4	AMPLIFIER CLASS A	250 100	—2 —1		0.9 0.4		100 100	91000 110000	1100 900				6SQ7 6SQ7GT/G
6SR7 6SR7GT	DUO-DI TRIODE	HTR	6.3	.3	8Q-OW8 8Q-OGT8	8E 9H	2.0 2.3*	3.4 3.5*	2.8 3.8*	AMP CL A	250	—9		9.5		16	8500	1900				6SR7 6SR7GT
6SS7	PENTODE	HTR	6.3	0.15	8N-OW8	8E	0.004	5.5	7.0	AMPLIFIER CLASS A	250 100	—3 —1	100 100	9.0 12.2	2.0 3.1		1.0MEG 0.12MEG	1850 1930			—35 —35	6SS7
6ST7	DIO-DI TRIODE	HTR	6.3	0.15	8Q-OW8	8E	1.5	2.8	3.0	AMP CL A	250	—9		9.5		16	8500	1900				6ST7
6T7G	DUO-DI TRIODE	HTR	6.3	.15	7V-OS7	12F	1.3	2.7	4.5	AMPLIFIER CLASS A	250 135	—3 —1.5		1.2 0.9		65 65	62000 65000	1050 1000				6T7G
6U5/6G5	ELEC RAY	HTR	6.3	.3	6R-SS6	9R				TUNING IND	250 THRU 1 MEG TARGET 250v, GRID 0v FOR 90°, —22v FOR 0° 100 THRU .5 MEG TARGET 100v, GRID 0v FOR 90°, — 8v FOR 0°											6U5/6G5
6U6GT	BEAM PWR AMP	HTR	6.3	.75	7AC-OGT7	9H				POWER AMP CLASS A	200 110	—14 —10.5	135 110	55 44	3 4		20000 10000	6200 5600	5.5 2.0	3000 2000		6U6GT
6U7G	PENTODE	HTR	6.3	.3	7R-OS7	12L	.007*	5*	9*	AMP CL A	250 100	—3 —3	100 100	8.2 8.0	2.0 2.2		.8 MEG .25MEG	1600 1500			—50 —50	6U7G
6V6 6V6GT/G	BEAM POWER AMP	HTR	6.3	.45	7AC-OW7 7AC-OW7	8H 9H		2 TUBES		AMPLIFIER CLASS A PP CL AB	315 250 250 285	—13 —12.5 —15 —19	225 250 250 285	34 45 70 70	2.2 4.5 5.0 4.0		77000 52000 60000 65000	3750 4100 3750 3600	5.5 4.5 10 14	8500 5000 10000 8000		6V6 6V6GT/G
6V7G	DUO-DI TRIODE	HTR	6.3	.3	7V-OS7	12F	1.7	2.0	3.5	AMPLIFIER CLASS A	250 180	—20 —13.5		8 6		8.3 8.3	7500 8500	1100 975	.35 .16	20000 20000		6V7G
6W5G	TWIN DI	HTR	6.3	.9	6S-OS6	12E				FULL WAVE RECTIFIER	325 RMS MAX COND IN 90 DC MAX TUBE DROP 24v AT 90ma DC 450 RMS MAX CHOKE IN 90 DC MAX											6W5G
6W6GT	TETRODE PWR AMP	HTR	6.3	1.25	7AC-OGT7	9H				AMPLIFIER CLASS A	135	—9.5	135	58	2.8	215	24000	9000	3.3	2000		6W6GT
6W7G	PENTODE	HTR	6.3	.15	7R-OS7	12F	.007*	5.0*	8.5*	AMP CL A	250	—3	100	2.0	0.5		1.5MEG	1225			—7	6W7G
6X5 6X5GT/G	TWIN DIODE	HTR	6.3	.6	6S-OW6 6S-OGT6	8H 9H				FULL WAVE RECTIFIER	325 RMS MAX COND IN 70 DC MAX TUBE DROP 22v AT 70ma DC 450 RMS MAX CHOKE IN 70 DC MAX											6X5 6X5GT/G

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TYPE	DESIGN	CATHODE TYPE	CATHODE HTR OR FIL VOLTS	CATHODE HTR OR FIL AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	CAPACITIES IN mmfds	CAPACITIES OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
6Y5	TWIN DIODE	HTR	6.3	.8	6J-SS6	12E	(MERCURY VAPOR)			FULL WAVE RECTIFIER	325 RMS MAX COND IN 60 DC MAX 450 RMS MAX CHOKE IN 60 DC MAX						TUBE DROP 20v AT 60ma DC					6Y5
6Y6G	BEAM PWR AMP	HTR	6.3	1.25	7AC-OM7	14C				POWER AMP CLASS A	200 135	—14 —13.5	135 135	61 58	2.2 3.5		18300 9300	7100 7000	6.0 3.6	2600 2000		6Y6G
6Y7G	TWIN TRIODE	HTR	6.3	.6	8B-OS8	12E				CL B AMP 2 SECTIONS	250 180	0 0		10.6 NO SIG 7.6 NO SIG					8 5.5	14000 7000		6Y7G
6Z5	TWIN DIODE	HTR	12.6 or 6.3	.4 .8	6K-SS6	12B				FULL WAVE RECTIFIER	325 RMS MAX COND IN 60 DC MAX 450 RMS MAX CHOKE IN 60 DC MAX						TUBE DROP 20v AT 60ma DC					6Z5
6Z7G	TWIN TRIODE	HTR	6.3	.3	8B-OS8	12E				CL B AMP 2 SECTIONS	180 135	0 0		8.4 NO SIG 6.0 NO SIG					4.2 2.5	12000 9000		6Z7G
6ZY5G	TWIN DI	HTR	6.3	.3	6S-OS6	12E				FULL WAVE RECTIFIER	325 RMS MAX COND IN 40 DC MAX 450 RMS MAX CHOKE IN 40 DC MAX						TUBE DROP 18v AT 40ma DC					6ZY5G
7A4	TRIODE	HTR	6.3	.3	5AC-L8	9A	4	3.4	3.0	AMPLIFIER CLASS A	250 90	—8 0		9 10		20 20	7700 6700	2600 3000				7A4
7A5	PENTODE	HTR	6.3	.75	6AA-L8	9B				POWER AMP CLASS A	125 110	—9 —7.5	125 110	44.0 40.0	3.3 3.0		17000 14000	6000 5800	2.2 1.5	2700 2500		7A5
7A6	DUO-DI	HTR	6.3	.15	7AJ-L8	9A	.05PP			DETECTOR	150 RMS MAX			8 DC MAX			TUBE DROP 11v AT 16ma DC					7A6
7A7	PENTODE	HTR	6.3	.3	8V-L8	9A	.005	6.0	7.0	AMP CL A	250 100	—3 —1	100 100	9.2 13.0	2.6 4.0	1600 1600	.8 MEG .12MEG	2000 2350			—35 —35	7A7
7A8	OCTODE	HTR	6.3	.15	8U-L8	9A	.15	7.5	9.0	OSC SECT MIXER	250S 250	.05MEG —3	100	4.2 3.0	3.2		GRID #2 RES .02 MEG .7 MEG	550C			—30	7A8
7B4	TRIODE	HTR	6.3	.3	5AC-L8	9A	1.6*	3.6*	3.4*	AMP CL A	100 250	—1 —2		0.5 0.9		100 100	85000 66000	1175 1500				7B4
7B5	PENTODE	HTR	6.3	.4	6AE-L8	9B				POWER AMP CLASS A	315 100	—24 —7	250 100	25.5 9.0	4.0 1.6		75000 .1 MEG	2100 1500	4.5 .35	9000 12000		7B5
7B6	DUO-DI TRIODE	HTR	6.3	.3	8W-L8	9A	1.5	3.0	3.0	AMPLIFIER CLASS A	250 100	—2 —1		0.9 0.4		100 100	91000 110000	1100 900				7B6
7B7	PENTODE	HTR	6.3	.15	8V-L8	9A	.007	5.0	6.0	AMP CL A	250 100	—3 —3	100 100	8.5 8.2	1.7 1.8		.7 MEG .3 MEG	1700 1675			—40 —40	7B7
7B8	HEPTODE	HTR	6.3	.3	8X-L8	9A	.2	10.0	9.0	OSC SECT MIXER	250S 100 250 100	.05MEG .05MEG —3 —1.5	100 50	4.0 2.0 3.5 1.1	2.7 1.3		GRID #2 RES .02 MEG .36MEG .6 MEG	550C 360C			—35 —20	7B8
7C4/1203A	DIODE	HTR	6.3	0.150	4AH-L8	9A	0.8	2.2	3.0	DETECTOR	117 MAX			5 MAX								7C4/1203A
7C5	BEAM PWR AMP	HTR	6.3	.45	6AA-L8	9B	PUSH-PULL			AMPLIFIER CLASS A PP CL AB	315 250 250 285	—13 —12.5 —15 —19	225 250 250 285	34 45 70 70	2.2 4.5 5.0 4.0		77000 52000 60000 65000	3750 4100 3750 3600	5.5 4.5 10 14	8500 5000 10000 8000		7C5
7C6	DUO-DI TRIODE	HTR	6.3	.15	8W-L8	9A	1.4	2.4	3.0	AMPLIFIER CLASS A	250 100	—1 0		1.3 1.0		100 85	.1 MEG .1 MEG	1000 850				7C6

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TYPE	DESIGN	CATHODE			BASING DATA	MAX SIZE VIEW	CAPACITIES			USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
		TYPE	HTR OR FIL VOLTS	AMPS			G-P mmfds	IN mmfds	OUT mmfds													
7C7	PENTODE	HTR	6.3	.15	8V-L8	9A	.007*	5.5*	6.5*	AMPLIFIER CLASS A	250	—3	100	2.0	0.5		2 MEG	1300			—7	7C7
7E5/1201	TRIODE	HTR	6.3	.150	8BN-L8	9A	1.5	3.6	2.8	AMPLIFIER	180	—3.0		5.5		36	12000	3000				7E5/1201
7E6	DUO-DI TRIODE	HTR	6.3	.3	8W-L8	9A	1.5	3.0	3.4	AMP CL A	250	—9		9.5		16	8500	1900				7E6
7E7	DUO-DI PENTODE	HTR	6.3	.3	8AE-L8	9A	.005*	4.6*	4.6*	AMPLIFIER CLASS A	250 100	—3 —1	100 100	7.5 10.0	1.6 2.7		.7 MEG .15MEG	1300 1600			—42.5 —36.0	7E7
7F7	TWIN TR	HTR	6.3	.3	8AC-L8	9A				CL A 1 SECT	250	—2		2.3		70	44000	1600				7F7
7G7/1232	PENTODE	HTR	6.3	.45	8V-L8	9A	.007*	9.0*	7.0*	AMP CL A	250	—2	100	6.0	2.0		.8 MEG	4500			—6	7G7/1232
7H7	PENTODE	HTR	6.3	.3	8V-L8	9A	.007*	8.0*	7.0*	AMP CL A	250 100	—2.5 —1	150 100	9.5 8.2	3.5 3.3		.8 MEG .25MEG	3800 3800			—19 —12	7H7
7J7	TRI HEX	HTR	6.3	.3	8AR-L8	9A	.01*	5.5*	7.5*	OSC-TRIODE MIXER HEX	250S 250	.05MEG —3	 100	5.4 1.3	 2.9	TRIODE PLATE RESISTOR .02 MEG	 1.5MEG	 300C			 —20	7J7
7K7	DUO- DIODE	HTR	6.3	.3	8BF-L8	9A				AMPLIFIER CLASS A	250	—2		2.3		70	44000	1600				7K7
7L7	PENTODE	HTR	6.3	.3	8V-L8	9A	.01*	8.0*	6.5*	AMP CL A	250 100	—1.5 —1	100 100	4.5 5.5	1.5 2.4		1 MEG .1 MEG	3100 3000			—5 —5	7L7
7N7	TWIN TRIODE	HTR	6.3	.3	8AC-L8	9B	3.0L* 3.0R*	3.4L* 2.9R*	2.0L* 2.4R*	CL A 1 SECT	250 90	—8 0		9 10		20 20	7700 6700	2600 3000				7N7
7Q7	HEPTODE	HTR	6.3	.3	8AL-L8	9A	 .2*	 9.0*	 9.0*	OSC SECT MIXER	OSC GRID RES — .02 MEG OSC GRID CUR — .5ma 250	 —2	 100	 3.5	 8.5		 1.0MEG	 550C			 —35	7Q7
7R7	DUO-DI PENTODE	HTR	6.3	.3	8AE-L8	9A	.004	5.6	5.3	AMP CL A	250 100	—1 —1	100 100	5.7 5.5	1.7 2.0		1.0MEG .35MEG	3200 3000			—20 —16	7R7
7S7	TRI HEX	HTR	6.3	0.30	8AR-L8	9A	0.04	5.5	9.0	OSC-TRIODE MIXER HEX	250S 250	.05MEG —2	 100	5.0 1.7	 2.2		TRIODE PLATE RESISTOR .02 MEG 2 MEG	 600C			 —21	7S7
7T7	PENTODE	HTR	6.3	0.3	8V-L8	9A	0.005	7.5	5.5	AMP CL A	250 100	—1 —1	150 100	10.8 5.3	4.1 2.1		0.9MEG 0.3MEG	4900 4000			—5.5 —4.0	7T7
7V7	PENTODE	HTR	6.3	0.45	8V-L8	9A	0.004	9.5	6.5	HIGH FREQ AMPLIFIER	300	—2	150	9.6	3.9		.3 MEG	5800			—6	7V7
7W7	PENTODE	HTR	6.3	0.45	8BJ-L8	9A	0.0025	9.5	7.0	HIGH FREQ AMPLIFIER	300 300	—2 —2	150 300 THRU .04 MEG (OTHER VALUES SAME AS ABOVE)	10.0	3.9		.3 MEG	5800			—6 —14	7W7
7Y4	TWIN DI	HTR	6.3	.5	5AB-L8	9A				F W RECT	325 RMS MAX COND IN 60 DC MAX TUBE DROP 20v AT 60ma DC 450 RMS MAX CHOKE IN 60 DC MAX											7Y4
7Z4	TWIN DI	HTR	6.3	0.90	5AB-L8	9B				F W RECT	325 RMS MAX COND IN 100 DC MAX TUBE DROP 40v AT 60ma DC 450 RMS MAX CHOKE IN 100 DC MAX											7Z4
10	TRIODE	FIL	7.5	1.25	4D-SM4	16B	7	4	3	POWER AMP CLASS A	425 350	—39 —22.0		18 10		8 8	5000 6000	1600 1330	1.6 0.4	10200 13000		10
12A	TRIODE	FIL	5.0	.25	4D-SM4B	14D	7.5	4.0	3.0	AMPLIFIER CLASS A	180 135	—13.5 —9		7.7 6.2		8.5 8.5	4700 5100	1800 1650	.285 .130	10650 9000		12A

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TYPE	DESIGN	CATHODE TYPE	HTR OR FIL VOLTS	HTR OR FIL AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	CAPACITIES IN mmfds	CAPACITIES OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
12A5	PENTODE	HTR	12.6 or 6.3	.3 .6	7F-SS7	12B				POWER AMP CLASS A	180 100	—25 —15	180 100	45 17	8 3		35000 50000	2400 1700	3.4 .08	3300 4500		12A5
12A6GT	BEAM PWR AMP	HTR	12.6	0.15	7AC-OGT7	9H	0.6	9.0	9.0	AMPLIFIER CLASS A	250	—12.5	250	30	3.5			3000	3.0	7500		12A6GT
12A7	DIODE PENTODE	HTR	12.6	.3	7K-SS7	12H				H W RECT AMP CL A	125 RMS MAX 135	 —13.5	 135	30 DC MAX 9	 2.5	 100	TUBE DROP 15v AT 60ma DC .1 MEG	 975	 .55	 13500		12A7
12A8GT	HEPTODE	HTR	12.6	.15	8A-OW8	9F	2.6*	9.5*	12*	OSC SECT MIXER	250S 100 250 100	.05MEG .05MEG —3 —1.5	 100 50	4.0 2.0 3.5 1.1	 2.7 1.3		GRID #2 RES .02 MEG .36MEG .6 MEG	 550C 360C			 —35 —20	12A8GT
12AH7GT	TWIN TR	HTR	12.6	.150	8BE-OGT8	9D	3.0L 2.2R	2.9L 3.2R	2.6L 3.0R	CL A 1 SECT	250 100	—9 —3.6		12 3.7		16 16	6600 10300	2400 1550			—30.0 —8.5	12AH7GT
12B8GT	TRIODE PENTODE	HTR	12.6	.3	8T-OGT8	9L	2.3 0.15	5.0 5.2	6.3 9.6	AMP TRIODE CLASS A AMP PENT CLASS A	100 90 100 90	—1 0 —3 —3	 100 90	0.6 2.8 8 7	 2 2	110 90 360 360	73000 37000 .17MEG .20MEG	1500 2400 2100 1800			—2.5 —2.5 —42.5	12B8GT
12C8	DUO-DI PENTODE	HTR	12.6	.15	8E-OW7	8F	.005	6	9	AMPLIFIER CLASS A	250 100	—3 —3	125 100	10 5.8	2.3 1.7		.6 MEG .3 MEG	1325 950			—21 —17	12C8
12E5GT	TRIODE	HTR	12.6	0.15	6Q-OGT6	9E	2.8	3.8	2.6	AMP CL A	250 100	—13.5 —5		5.0 2.5		13.8 13.8	9500 12000	1450 1150				12E5GT
12F5GT	TRIODE	HTR	12.6	.15	5M-OW5	9J	2.0*	6*	12*	AMPLIFIER CLASS A	250 100	—2 —1		0.9 0.4		100 100	66000 85000	1500 1150				12F5GT
12H6	DUO DI	HTR	12.6	0.15	7Q-OW7	8C	3.0	3.4	0.10	DETECTOR	150 MAX			8 MAX EACH DIODE								12H6
12J5GT	TRIODE	HTR	12.6	.15	6Q-OW6	9H	3.8*	4.2*	5.0*	AMPLIFIER CLASS A	250 90	—8 0		9.0 10.0		20 20	7700 6700	2600 3000				12J5GT
12J7GT	PENTODE	HTR	12.6	.15	7R-OW7	9F	.005*	4.6*	12*	AMP CL A PENT CONN TRI CONN	250 100 250	—3 —3 —8	100 100	2.0 2.0 6.5	0.5 0.5	 20	1.5MEG 1.0MEG 10500	1225 1185 1900			—7 —7	12J7GT
12K7GT	PENTODE	HTR	12.6	.15	7R-OW7	9F				AMPLIFIER CLASS A	250 250 100	—3 —3 —1	125 100 100	10.5 7.0 9.5	2.6 1.7 2.7		.6 MEG .8 MEG .15MEG	1650 1450 1650			—52.5 —42.5 —38.5	12K7GT
12K8GT	TRIODE HEXODE	HTR	12.6	.15	8K-OW8	9GA	.08*	4.6*	4.8*	OSC TRIODE MIXER HEX	100 250 100	.05MEG —3 —3	 100 100	3.8 2.5 2.3	 6.0 6.2		 .6 MEG .4 MEG	3000 350C 325C	(TRIODE GRID 0v)		 —30 —30	12K8GT
12L8GT	TWIN PENTODE	HTR	12.6	0.15	8BU-OGT8	9H	0.7	5.0	6.0	POWER AMP CLASS A	180	—9	180	13	2.4		0.16MEG	2150	1.0	10000		12L8GT
12Q7GT	DUO-DI TRIODE	HTR	12.6	.15	7V-OW7	9F	1.6*	2.2*	5*	AMPLIFIER CLASS A	250 100	—3 —1.0		1.0 0.8		70 70	58000 58000	1200 1200				12Q7GT
12SA7 12SA7GT/G	HEPTODE	HTR	12.6	.15	8R-OW8 8AD-OW8	8E 9E	.13 .20	9.5 11.0*	12 12.0*	OSC SECT MIXER	OSC GRID RES — .02 MEG 250	 —2	 100	 3.5	 8.5	OSC GRID CUR — .5ma	 1.0MEG	 450C			—35	12SA7 12SA7GT/G
12SC7	TWIN TRI	HTR	12.6	.15	8S-OW8	8E				AMP CL A 1 SEC	250	—2		2		70	53000	1325				12SC7
12SF5 12SF5GT	TRIODE	HTR	12.6	.15	6AB-OW6 6AB-OGT6	8E 9H	2.6 2.6*	4.2 4.2*	3.8 3.8*	AMPLIFIER CLASS A	250 100	—2 —1		0.9 0.4		100 100	66000 85000	1500 1150				12SF5 12SF5GT

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TYPE	DESIGN	CATHODE HTR OR FIL TYPE	VOLTS	AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	IN mmfds	OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
12SF7	DIODE PENTODE	HTR	12.6	0.15	7AZ-OW8	8E	0.004	5.5	6.5	AMP CL A	250 100	—1 —1	125 100	12.4 12	3.3 3.4		0.7MEG 0.2MEG	2050 1975			—35 —35	12SF7
12SG7	PENTODE	HTR	12.6	0.15	8BK-OW8	8E	0.003	8.5	7.0	AMP CL A	250 100	—1 —1	125 100	11.8 8.2	4.4 3.2		0.9MEG 0.25MEG	4700 4100			—14 —11.5	12SG7
12SH7	PENTODE	HTR	12.6	0.15	8BK-OW8	8E	0.003	8.5	7.0	AMP CL A	250 100	—1 —1	100 100	10.8 5.3	4.1 2.1		0.9MEG 0.35MEG	4900 4000			—5.5 —4	12SH7
12SJ7 12SJ7GT	PENTODE	HTR	12.6	.15	8N-OW8 8N-OW8	8E 9E	.005	6.0	7.0	AMPLIFIER CLASS A	250 100	—3 —3	100 100	3.0 2.9	0.8 0.9	2500 1100	1.5MEG 0.7MEG	1650 1575			—9 —9	12SJ7 12SJ7GT
12SK7 12SK7GT/G	PENTODE	HTR	12.6	.15	8N-OW8 8N-OW8	8E 9E	.003 .005	6.0 6.5	7.0 7.5	AMPLIFIER CLASS A	250 100	—3 —1	100 100	9.2 13.0	2.6 4.0	2000 2350	0.8MEG .12MEG	2000 2350			—35 —35	12SK7 12SK7GT/G
12SL7GT	TWIN TRI	HTR	12.6	0.15	8BD-OGT8	9H				CL A 1 SECT	250	—2		2.3		70	44000	1600				12SL7GT
12SN7GT	TWIN TRI	HTR	12.6	0.3	8BD-OGT8	9H	4L 4R	3.2L 3.8R	3.4L 2.6R	CL A 1 SECT	250 90	—8 0		9 10		20 20	7700 6700	2600 3000				12SN7GT
12SQ7 12SQ7GT/G	DUO-DI TRIODE	HTR	12.6	.15	8Q-OW8 8Q-OW8	8E 9E	1.8	4.2	3.4	AMPLIFIER CLASS A	250 100	—2 —1		0.9 0.4		100 100	91000 110000	1100 900				12SQ7 12SQ7GT/G
12SR7 12SR7GT	DUO-DI TRIODE	HTR	12.6	.15	8Q-OW8 8Q-OGT8	8E 9H	2.3*	3.5*	3.8*	AMP CL A	250	—9		9.5		16	8500	1900				12SR7 12SR7GT
12Z3	DIODE	HTR	12.6	.3	4G-SS4	12B				H W RECT	235 RMS MAX			55 DC MAX			TUBE DROP 17v AT 110ma DC					12Z3
14A4	TRIODE	HTR	12.6	0.15	5AC-L8	9A	4.0	3.4	3.0	AMP CL A	250 90	—8 0		9 10		20 20	7700 6700	2600 3000				14A4
14A5	PENTODE	HTR	12.6	0.15	6AA-L8	9B				POWER AMP CLASS A	250	—12.5	250	30	3.5		50000	3000	2.5	7500		14A5
14A7/12B7	PENTODE	HTR	12.6	.15	8V-L8	9A	.005*	5.5*	7.0*	AMP CL A	250 100	—3 —1	100 100	9.2 13.0	2.6 4.0	1600 1600	.8 MEG .12MEG	2000 2350			—35 —35	14A7/12B7
14AF7	TWIN TRI	HTR	12.6	0.150	8AC-L8	9A	2.3L 2.3R	2.2L 2.2R	1.6L 1.6R	CL A 1 SECT	250 100	—10 0		9.0 10.8		16 17	7600 6500	2100 2600				14AF7
14B6	DUO-DI TRIODE	HTR	12.6	0.15	8W-L8	9A				DETECTOR AMPLIFIER	250 100	—2 —1		0.9 0.4		100 100	91000 110000	1100 900				14B6
14B8	HEPTODE	HTR	12.6	0.15	8X-L8	9A	0.20	10	9.0	OSC SECT MIXER	250S 250	.05MEG —3	 100	4.0 3.5	 2.7		GRID #2 RES .02 MEG .36MEG	 550C			 —35	14B8
14C5	BEAM PWR AMP	HTR	12.6	0.225	6AA-L8	9B				PR AMP CL A CL AB 2 TUBE	315 285	—13 —19	225 285	34 70	2.2 4		77000 65000	3750 3600	5.5 14	8500 8000		14C5
14C7	PENTODE	HTR	12.6	0.15	8V-L8	9A	0.007	6.0	6.5	AMP CL A	250 100	—3 —1	100 100	2.2 5.7	0.7 1.8		1 MEG 0.325	1575 2275			—9 —9	14C7
14E6	DUO-DI TRIODE	HTR	12.6	0.15	8W-L8	9A				AMP CL A	250 100	—9 —3		9.5 3.9		16 16.5	8500 11000	1900 1500				14E6
14E7	DUO-DI PENTODE	HTR	12.6	0.15	8AE-L8	9A	0.005	4.6	5.3	DETECTOR AMPLIFIER	250 100	—3 —1	100 100	7.5 10	1.6 2.7		0.7MEG 0.15MEG	1300 1600			—42.5 —36	14E7
14F7	TWIN TRI	HTR	12.6	0.15	8AC-L8	9A				CL A 1 SECT	250 100	—2 —1		2.3 0.65		70 70	44000 62000	1600 1125				14F7
14H7	PENTODE	HTR	12.6	.15	8V-L8	9A	.007*	8.0*	7.0*	AMP CL A	250 100	—2.5 —1	150 100	9.5 8.2	3.5 3.3		.8 MEG .25MEG	3800 3800			—19 —12	14H7

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TYPE	DESIGN	CATHODE TYPE	HTR OR FIL VOLTS	HTR OR FIL AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	CAPACITIES IN mmfds	CAPACITIES OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
14J7	TRI HEX	HTR	12.6	0.15	8AR-L8	9A	0.01	5.5	7.5	OSC-TRIODE MIXER HEX	250S 250	.05MEG. —3	100	5.4 1.3	2.9	TRIODE PLATE RESISTOR .02 MEG	1.5MEG	300C			—20	14J7
14N7	TWIN TRI	HTR	12.6	0.30	8AC-L8	9B	3.0R 3.0L	2.9R 3.4R	2.4R 2.0L	CL A 1 SECT	250 90	—8 0		9 10		20 20	7700 6700	2600 3000				14N7
14Q7	HEPTODE	HTR	12.6	0.15	8AL-L8	9A	.2	9.0	9.0	OSC SECT MIXER	OSC GRID RESIS — .02 MEG 250	—2	100	3.5	8.5	OSC GRID CUR — .5ma	1.0MEG	550C			—35	14Q7
14R7	DUO-DI PENTODE	HTR	12.6	0.150	8AE-L8	9A	0.004	3.6	5.3	AMP CL A	250 100	—1 —1	100 100	5.7 5.5	1.7 2.0		1.0 0.35	3200 3000			—20 —16	14R7
14S7	TRI HEX	HTR	12.6	0.15	8AR-L8	9A	0.02	5.0	8.0	OSC-TRIODE MIXER	250 250	—2	100	5.0 1.8	3.0	TRIODE PLATE RESIS .02 MEG	1.25MEG	525C			—21	14S7
14V7	PENTODE	HTR	12.6	0.225	8V-L8	9A	0.004	9.5	6.5	HI FREQ AMP	300	—2	150	9.6	3.9		.3 MEG	5800			—6	14V7
14W7	PENTODE	HTR	12.6	0.225	8BJ-L8	9A	0.0025	9.5	7.0	AMP CL A	300 300	—2 —2	150 300 THRU .04 MEG (OTHER VALUES SAME AS ABOVE)	10.0	3.9		.3 MEG	5800			—6 —14	14W7
14Y4	TWIN DI	HTR	12.6	0.3	5AB-L8	9B				F W RECT	325 RMS MAX COND IN 60 DC MAX 450 RMS MAX CHOKE IN 60 DC MAX					TUBE DROP 20v AT 60ma DC						14Y4
15	PENTODE	HTR	2.0	.22	5F-SS5	12H	.01*	2.4	7.8	AMPLIFIER CLASS A	135 67.5	—1.5 —1.5	67.5 67.5	1.85 1.85	0.3 .3	600 450	.8 MEG .63MEG	750 710				15
19	TWIN TR	FIL	2.0	.26	6C-SS6	12B				CLASS B TWO SECT	135 135	0 —6		10 NO SIG 0.1 NO SIG					2.1 1.6	10000 10000		19
20	TRIODE	FIL	3.3	.132	4D-SS4	9Q	4.1	2.0	2.3	PR AMP CL A	135	—22.5		6.5		3.3	6300	525	.11	6500		20
22	TETRODE	FIL	3.3	.132	4K-SM4	14E	.02*	3.3	12	AMP CL A	135	—1.5	67.5	3.7	1.3		.33MEG	500				22
24A 24S	TETRODE	HTR	2.5	1.75	5E-SM5 5E-SM5	14E	.007*	5.3	10.5	AMPLIFIER CLASS A	250 180	—3 —3	90 90	4 4	1.7 1.7	630 400	.6 MEG .4 MEG	1050 1000				24A 24S
25A6 25A6G 25A6GT	PENTODE	HTR	25	.3	7S-OW7 7S-OM7 7S-OW7	8H 14C 9H				AMPLIFIER CLASS A	160 135 95	—18 —20 —15	120 135 95	33 37 20	6.5 8 4		42000 35000 45000	2375 2450 2000	2.2 2.0 0.9	5000 4000 4500		25A6 25A6G 25A6GT
25A7GT/G	DIODE PENTODE	HTR	25	.3	8F-OGT8	14C 9H				H W RECT AMP CL A	117 RMS MAX 100	—15	100	75 DC MAX 20.5	4	TUBE DROP 23v AT 150ma DC 90	50000	1800	.77	4500		25A7GT/G
25AC5G 25AC5GT	TRIODE	HTR	25	.3	6Q-OS6 6Q-OGT6	12K 9H	6AE5G DRIVER			DIR C'P'D AMP	110 FROM DRIVER			45					2	2000		25AC5G 25AC5GT
25B5	DUO-TRI	HTR	25	0.3	6AS-SS6	14D	DRIVER TRIODE OUTPUT TRIODE			DIR C'P'D AMP 2 TUBES CL A	180 180	—20 +		5.8 46			15200	2300	3.8	4000		25B5
25B6G	PENTODE	HTR	25	.3	7S-OM7	14C				POWER AMP CLASS A	200 135 105	—23 —22 —16	135 135 105	62 61 48	1.8 2.5 2.0		18000 15000 15500	5000 5000 4800	7.1 4.3 2.4	2500 1700 1700		25B6G
25B8GT	TRIODE PENTODE	HTR	25	.15	8T-OGT8	9L				CL A TRIODE CL A PENTODE	100 100	—1 —3	100	0.6 7.6	2.0	113	.08MEG .19MEG	1500 2000			—2.5 —41	25B8GT
25C6G	BM PWR	HTR	25	.3	7AC-OM7	14C				POWER AMP CLASS A	200 135	—14 —13.5	135 135	61 58	2.2 3.5		18300 9300	7100 7000	6.0 3.6	2600 2000		25C6G
25D8GT	DIODE TRIODE PENTODE	HTR	25	0.15	8AU-OGT8	9HA	2.5 0.015	3.7 5.2	4.5 10	DETECTOR CL A TRIODE CL A PENTODE	100 100	—1 —3	100	0.5 8.5	2.7	100	91000 0.2MEG	1100 1900			—35	25D8GT

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TYPE	DESIGN	CATHODE TYPE	HTR OR FIL VOLTS	HTR OR FIL AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	CAPACITIES IN mmfds	CAPACITIES OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
25L6 25L6GT/G	BEAM PWR AMP	HTR	25	.3	7AC-OW7 7AC-OGT7	8H 9H				POWER AMP CLASS A	110 200	—7.5 —8.0	110 110	49 50	4 1.5		10000 35000	8200 8250	2.1 4.3	2000 3000		25L6 25L6GT/G
25N6G	DUO-TRIODE	HTR	25	0.3	7AU-OM7	14C	DRIVER TRIODE OUTPUT TRIODE			DIR C'P'D AMP	180 180	—20 +		5.8 4.6		 35	 15200	 2300	 3.8	 4000		25N6G
25X6GT	TWIN DIODE	HTR	25	0.15	7Q-OGT7	9H				H W RECT V DOUBLER	250 RMS MAX 125 RMS MAX			60 DC MAX 60 DC MAX			TUBE DROP 25v AT 120ma DC					25X6GT
25Y4GT	DIODE	HTR	25	0.15	5AF-OGT7	9H				H W RECT	125 RMS MAX			75 DC MAX			TUBE DROP 18v AT 125ma DC					25Y4GT
25Y5	TWIN DIODE	HTR	25	.3	6E-SS6	12B				H W RECT V DOUBLER	250 RMS MAX 117 RMS MAX			85 DC MAX 85 DC MAX			(EXPORT TYPE)					25Y5
25Z4GT	DIODE	HTR	25	0.3	5AF-OGT7	9H				H W RECT	125 RMS MAX			125 DC MAX			TUBE DROP 12v AT 125ma DC					25Z4GT
25Z5 25Z6 25Z6GT/G	TWIN DIODE	HTR	25	.3	6E-SS6 7Q-OW7 7Q-OGT7	12B 8H 9H				H W RECT V DOUBLER	235 RMS MAX 117 RMS MAX			75 DC MAX 75 DC MAX			TUBE DROP 22v AT 150 ma DC					25Z5 25Z6 25Z6GT/G
26	TRIODE	FIL	1.5	1.05	4D-SM4	14D	8.1	3.5	2.2	AMP CL A	180	—14.5		6.2		8.3	7300	1140				26
27 27S	TRIODE	HTR	2.5	1.75	5A-SS5 5A-SS5	12B	3.3	3.5	3.0	AMPLIFIER CLASS A	250 135	—21 —9		5.2 4.5		9 9	9250 9000	975 1000				27 27S
28D7	TW PENT	HTR	28	0.40	8BS-L8	9B				PR AMP CL A	28	—3.5	28	12.5	1.0		3000	3000	.1	4000		28D7
28Z5	TWIN DI	HTR	28	0.24	6BJ-L8	9B				FULL WAVE RECTIFIER	325 RMS MAX COND IN 100 DC MAX 450 RMS MAX CHOKE IN 100 DC MAX						TUBE DROP 40v AT 100ma DC					28Z5
30	TRIODE	FIL	2.0	.06	4D-SS4	12B	6.0	3.7	2.1	AMP CL A BIAS DET	180 180	—13.5 —18		3.1 0.2 WITH NO SIGNAL		9.3	10300	900	(SEE 1H4G ALSO)			30
31	TRIODE	FIL	2.0	.13	4D-SS4	12B	5.7	3.5	2.7	AMPLIFIER CLASS A	180 135	—30 —22.5		12.3 8		3.8 3.8	3600 4100	1050 925	.375 .185	5700 7000		31
32	TETRODE	FIL	2.0	.06	4K-SM4	14E	.015*	5.3	10.5	AMPLIFIER CLASS A	180 135	—3 —3	67.5 67.5	1.7 1.7	0.4 0.4	780 610	1.2MEG .95MEG	650 640				32
32L7GT	DIODE BM PWR	HTR	32.5	.3	8Z-OGT8	9H				H W RECT POWER AMP CLASS A	125 RMS MAX 110 90	 —7.5 —7	 110 90	60 DC MAX 40 27	 3 2		 15000 17000	 6000 4800	 1.5 1.0	 2500 2600		32L7GT
33	PENTODE	FIL	2.0	.26	5K-SM5	14D				POWER AMP CLASS A	180 135	—18 —13.5	180 135	22 14.5	5 3	90 70	55000 50000	1700 1450	1.4 0.7	6000 7000		33
34	PENTODE	FIL	2.0	.06	4M-SM4	14E	.015*	6.0	11.5	AMPLIFIER CLASS A	180 67.5	—3 —3	67.5 67.5	2.8 2.7	1.0 1.1	620 224	1 MEG 0.4MEG	620 560			—22.5 —22.5	34
35/51 35S/51S	TETRODE	HTR	2.5	1.75	5E-SM5 5E-SM5	14E	.007*	5.3	10.5	AMPLIFIER CLASS A	250 180	—3 —3	90 90	6.5 6.3	2.5 2.5	420 305	0.4MEG 0.3MEG	1050 1020			—40.0 —40.0	35/51 35S/51S
35A5	BM PWR	HTR	32	.15	6AA-L8	9B				POWER AMP CLASS A	110 200	—7.5 —8.0	110 110	40 41	3.0 2.0		14000 40000	5800 5900	1.5 3.3	2500 4500		35A5
35L6GT/G	BM PWR	HTR	35	.15	7AC-OGT7	9H				POWER AMP CLASS A	110 200	—7.5 —8.0	110 110	40 41	3.0 2.0		13800 40000	5800 5900	1.5 3.3	2500 4500		35L6GT/G
35Y4	DIODE	HTR	35	0.15	5AL-L8	9B				H W RECT LAMP TAP	235 RMS MAX			100 DC MAX or 60 DC MAX WITH 6.3v — 150ma PANEL LAMP			TUBE DROP 18v AT 200ma DC					35Y4
35Z3	DIODE	HTR	32	.15	4Z-L8	9B				H W RECT	235 RMS MAX			100 DC MAX			TUBE DROP 20v AT 200ma DC					35Z3

SEE PAGE 5 FOR DATA CHART REFERENCE NOTES

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TYPE	DESIGN	CATHODE HTR OR FIL TYPE	VOLTS	AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	IN mmfds	OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
35Z4GT	DIODE	HTR	35	.15	5AA-OGT6	9H				H W RECT	235 RMS MAX			100 DC MAX			TUBE DROP 18v AT 200ma DC					35Z4GT
35Z5GT/G	DIODE	HTR TAP	35 7.5	.15 .15	6AD-OGT6	9H				H W RECT LAMP TAP	235 RMS MAX			100 DC MAX OR 60 DC MAX WITH 6.3v — 150ma PANEL LAMP			TUBE DROP 18v AT 200ma DC					35Z5GT/G
35Z6G	TWIN DIODE	HTR	35	.3	7Q-OM7	14C				H W RECT V DOUBLER	235 RMS MAX 117 RMS MAX			110 DC MAX 110 DC MAX			TUBE DROP 20v AT 220ma DC					35Z6G
36	TETRODE	HTR	6.3	.3	5E-SS5	12H	.007*	3.7	9.2	AMP CL A BIAS DET	250 250	—3 —8	90 90	3.2 0.1 WITH NO SIGNAL	1.7	595	.55MEG	1080				36
37	TRIODE	HTR	6.3	.3	5A-SS5	12B	2.0	3.5	2.2	AMP CL A BIAS DET	250 250	—18 —28		7.5 .2 WITH NO SIGNAL		9.2	8400	1100				37
38	PENTODE	HTR	6.3	.3	5F-SS5	12H	.3	3.5	7.5	POWER AMP CLASS A	250 135	—25 —13.5	250 135	22 9	3.8 1.5	120 120	.1 MEG .13MEG	1200 925	2.5 0.55	10000 13500		38
39/44	PENTODE	HTR	6.3	.3	5F-SS5	12H	.007*	3.5	10	AMPLIFIER CLASS A	250 90	—3 —3	90 90	5.8 5.6	1.4 1.6	1050 360	1.0MEG .38MEG	1050 950			—42.5 —42.5	39/44
40	TRIODE	FIL	5.0	.25	4D-SM4	14D	8.8	3.4	1.5	AMP CL A	180	—3		0.2		30	15MEG	200 PL RESISTOR .25MEG				40
41	PENTODE	HTR	6.3	.4	6B-SS6	12B				POWER AMP CLASS A	315 250	—21 —18	250 250	25.5 32	4.0 5.5		75000 68000	2100 2300	4.5 3.4	9000 7600		41
42	PENTODE	HTR	6.3	.7	6B-SM6	14D				PR AMP CL A CL AB 2 TUBE PUSH-PULL	285 250 375 315	—20 —16.5 —26 —24	285 250 250 285	38 34 34 62	7 6.5 5 12 (SEE TYPE 2A5 ALSO)		78000 80000	2550 2500	4.8 3.2 18.5 11	7000 7000 10000 10000		42
43	PENTODE	HTR	25	.3	6B-SM6	14D				AMPLIFIER CLASS A	160 135 95	—18 —20 —15	120 135 95	33 37 20	6.5 8 4		42000 35000 45000	2375 2450 2000	2.2 2.0 0.9	5000 4000 4500		43
45	TRIODE	FIL	2.5	1.5	4D-SM4	14D	7 PUSH-PULL	4	3	POWER AMP CLASS A CL AB 2 TUBE	275 180 275	—56 —31.5 —68		36 31 28		3.5 3.5	1700 1650	2050 2125	2 .825 18	4600 2700 3200		45
45Z3	DIODE	HTR	45	0.075	5AM-MB7	5B				H W RECT	117 RMS MAX			65 DC MAX			TUBE DROP 23v AT 130ma DC					45Z3
45Z5GT	DIODE	HTR	45	.15	6AD-OGT6	9H				H W RECT LAMP TAP	235 RMS MAX			100 DC MAX OR 60 DC MAX WITH 6.3v — 150ma PANEL LAMP			TUBE DROP 16v AT 200ma DC					45Z5GT
46	DUAL GRID TRIODE	FIL	2.5	1.75	5C-SM5	16B	G2 TIED TO P G1 TIED TO G2			PR AMP CL A PR AMP CL B 2 TUBES	250 400 300	—33 0 0		22 12 NO SIGNAL 8 NO SIGNAL		5.6	2380	2350	1.25 20 16	6400 5800 5200		46
47	PENTODE	FIL	2.5	1.75	5B-SM5	16B				PR AMP CL A	250	—16.5	250	31	6	150	60000	2500	2.7	7000		47
48	PENTODE	HTR	30	.4	6B-SM6	16B				PR AMP CL A	125	—20	100	56	9.5			3900	2.5	1500		48
49	DUAL GRID TRIODE	FIL	2.0	.12	5C-SM5	14D	G2 TIED TO P G1 TIED TO G2			PR AMP CL A PR AMP CL B 2 TUBES	135 180 135	—20 0 0		6 4 NO SIGNAL 2.6 NO SIGNAL		4.7	4175	1125	.17 3.5 2.3	11000 12000 8000		49
50	TRIODE	FIL	7.5	1.25	4D-SM4B	19A				POWER AMP CLASS A	450 350	—84 —63		55 45		3.8 3.8	1800 1900	2100 2000	4.6 2.4	4350 4100		50
50A5	PENTODE	HTR	50	0.15	6AA-L8	9B				PR AMP CL A	200	—8	110	50	1.5		35000	8250	4.7	3000		50A5
50C6G	BM PWR	HTR	50	.15	7AC-OM7	14C				POWER AMP CLASS A	200 135	—14 —13.5	135 135	61 58	2.2 3.5		18300 9300	7100 7000	6.0 3.6	2600 2000		50C6G
50L6GT	BM PWR	HTR	50	.15	7AC-OGT7	9H				POWER AMP CLASS A	110 200	—7.5 —8.0	110 110	49 50	4 1.5		10000 35000	8200 8250	2.1 4.3	2000 3000		50L6GT

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TYPE	DESIGN	CATHODE	HTR OR FIL		BASING DATA	MAX SIZE VIEW	CAPACITIES			USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
		TYPE	VOLTS	AMPS			G-P mmfds	IN mmfds	OUT mmfds													
50Y6GT/G	TWIN DIODE	HTR	50	.15	7Q-OM7	9H				H W RECT V DOUBLER	235 RMS MAX 117 RMS MAX			75 DC MAX 75 DC MAX			TUBE DROP 22v AT 150ma DC					50Y6GT/G
50Z7G	TWIN DIODE	HTR	50	.15	8AN-OS7	12E				H W RECT V DOUBLER LAMP TAP	117 RMS MAX 117 RMS MAX 2.5v — 150ma PANEL LAMP			65 DC MAX 65 DC MAX			TUBE DROP 21v AT 130ma DC					50Z7G
52	2 GRID TRIODE	FIL	6.3	.3	5C-SM5	14D	G2 TIED TO P G1 TIED TO G2			PR AMP CL A CL B 2 TUBE	110 180	0 0		43 3 NO SIGNAL		5.2	1750	3000	1.5 5	2000 10000		52
53	TWIN TRIODE	HTR	2.5	2.0	7B-SM7	14D				POWER AMP CL B 2 SECT	300	0		35	MAX SIG PL CUR—70ma (SEE TYPE 6A6 ALSO)				10	8000		53
55 55S	DUO-DI TRIODE	HTR	2.5	1.0	6G-SS6 6G-SS6	12H	1.7	2.0	3.5	AMPLIFIER CLASS A	250 135	—20 —10.5		8 3.7		8.3 8.3	7500 11000	1100 750	.3 .075	20000 25000		55 55S
56 56S 56AS	TRIODE	HTR	2.5 2.5 6.3	1.0 1.0 .3	5A-SS5 5A-SS5 5A-SS5	12B	3.2	3.2	2.2	AMPLIFIER CLASS A BIAS DET	250 100 250	—13.5 —5 —20		5 2.5 0.2 WITH NO SIGNAL		13.8 13.8	9500 12000	1450 1150				56 56S 56AS
57 57S 57AS	PENTODE	HTR	2.5 2.5 6.3	1.0 1.0 .4	6F-SS6 6F-SS6 6F-SS6	12J	.007*	5.0	6.5	AMPLIFIER CLASS A	250 100	—3 —3	100 100	2 2	0.5 0.5	1500 1185	1.5MEG 1.0MEG	1225 1185			—7 —7	57 57S 57AS
58 58S 58AS	PENTODE	HTR	2.5 2.5 6.3	1.0 1.0 .4	6F-SS6 6F-SS6 6F-SS6	12J	.007*	5.0	6.5	AMPLIFIER CLASS A	250 100	—3 —3	100 100	8.2 8	2 2.2	1280 375	.8 MEG .25MEG	1600 1500			—50 —50	58 58S 58AS
59	PENTODE	HTR	2.5	2.0	7A-SM7	16B	PENT CONN G_2,G_3 TO PL 2 TUBES G_3 TO P			PR AMP CL A TRI CONN PR AMP CL B G_1 TO G_2	250 250 400 300	—18 —28 0 0	250	35 26 26 NO SIGNAL 20 NO SIGNAL	9	100 6	40000 2300	2500 2600	3 1.25 20 15	6000 5000 6000 4600		59
70A7GT	DI BEAM PR AMP	HTR	70	.15	8AB-OGT8	9H				H W RECT PR AMP CL A	125 RMS MAX 110	 —7.5	 110	60 DC MAX 40	 3	 80	TUBE DROP 14v AT 120ma DC	 5800	 1.5	 2500		70A7GT
70L7GT	DIODE BM PWR	HTR	70	.15	8AA-OGT8	9H				H W RECT PR AMP CL A	125 RMS MAX 110	 —7.5	 110	70 DC MAX 40	 3		TUBE DROP 20v AT 140ma DC 15000	 7500	 1.8	 2000		70L7GT
71A	TRIODE	FIL	5	.25	4D-SM4B	14D				POWER AMP CLASS A	180 90	—40.5 —16.5		20 10		3 3	1750 2170	1700 1400	.79 .125	4800 3000		71A
75 75S	DUO-DI TRIODE	HTR	6.3	.3	6G-SS6 6G-SS6	12H	1.7	2.0	3.5	AMPLIFIER CLASS A	250	—2		0.9		100	91000	1100				75 75S
76	TRIODE	HTR	6.3	.3	5A-SS5	12B				AMPLIFIER CLASS A BIAS DET	250 100 250	—13.5 —5 —20		5 2.5 0.2 WITH NO SIGNAL		13.8 13.8	9500 12000	1450 1150				76
77	PENTODE	HTR	6.3	.3	6F-SS6	12H	.007*	4.7	11	AMPLIFIER CLASS A	250 100	—3 —1.5	100 60	2.3 1.7	0.5 0.4		1.5MEG 0.6MEG	1250 1100			—7.5 —5.5	77
78	PENTODE	HTR	6.3	.3	6F-SS6	12H	.007*	4.5	11	AMPLIFIER CLASS A	250 250 100	—3 —3 —1	125 100 100	10.5 7.0 9.5	2.6 1.7 2.7		.6 MEG .8 MEG .15MEG	1650 1450 1650			—52.5 —42.5 —38.5	78
79	TWIN TR	HTR	6.3	.6	6H-SS6	12H				CL B AMP 2 SECTIONS	250 180	0 0		10.6 7.6	NO SIG NO SIG				8 5.5	14000 7000		79
80	TWIN DI	FIL	5.0	2.0	4C-SM4	14D				FULL WAVE RECTIFIER	350 RMS MAX COND IN 125 DC MAX 500 RMS MAX CHOKE IN 125 DC MAX						TUBE DROP 60v AT 125ma DC					80
81	DIODE	FIL	7.5	1.25	4B-SM4	16B				H W RECT	700 RMS MAX			85 DC MAX			TUBE DROP 91v AT 170ma DC					81

SEE PAGE 5 FOR DATA CHART REFERENCE NOTES

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TYPE	DESIGN	TYPE	CATHODE HTR OR FIL VOLTS	AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	IN mmfds	OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
82	TWIN DI	FIL	2.5	3.0	4C-SM4	14D	(MERCURY VAPOR)			FULL WAVE RECTIFIER	450 RMS MAX COND IN 115 DC MAX 550 RMS MAX CHOKE IN 115 DC MAX						TUBE DROP 15v					82
83	TWIN DI	FIL	5.0	3.0	4C-SM4	16B	(MERCURY VAPOR)			FULL WAVE RECTIFIER	450 RMS MAX COND IN 225 DC MAX 550 RMS MAX CHOKE IN 225 DC MAX						TUBE DROP 15v					83
83V	TWIN DI	HTR	5.0	2.0	4AD-SM4	14D				FULL WAVE RECTIFIER	375 RMS MAX COND IN 175 DC MAX 500 RMS MAX CHOKE IN 175 DC MAX						TUBE DROP 23v AT 175ma DC					83V
84/6Z4	TWIN DI	HTR	6.3	.5	5D-SS5	12B				FULL WAVE RECTIFIER	325 RMS MAX COND IN 60 DC MAX 450 RMS MAX CHOKE IN 60 DC MAX						TUBE DROP 20v AT 60ma DC					84/6Z4
85	DUO-DI TRIODE	HTR	6.3	.3	6G-SS6	12H	1.7	2.0	3.5	AMP CL A	250 180	—20 —13.5		8 6		8.3 8.3	7500 8500	1100 975	.35 .16	20000 20000		85
85AS	DUO-DI TRIODE	HTR	6.3	0.3	6G-SS6					AMP CL A	250	—9		5.5		20		1250				85AS
89	PENTODE	HTR	6.3	.4	6F-SS6	12H	G_3 TIED TO K			PENT PR AMP CLASS A	250 135	—25 —13.5	250 135	32 14	5.5 2.2	125 125	70000 92500	1800 1350	3.4 0.75	6750 9200		89
							G_1 TIED TO G_2			CL B 2 TUBE	180	0		6 NO SIGNAL			G_2 TIED TO P 3.5			9400		
V99 X99	TRIODE	FIL	3.3	.063	4E-SV4 4D-SS4	8A 9Q	3.3	2.5	2.5	AMP CL A BIAS DET	90 90	—4.5 —10.5		2.5 0.2 WITH NO SIGNAL		6.6	15500	425				V99 X99
117L/M7GT	DI BEAM PR AMP	HTR	117	.09	8AO-OGT8	9HA				H W RECT PR AMP CL A	117 RMS MAX 105	 —5.2	 105	75 DC MAX 43	 4		TUBE DROP 16v AT 160ma DC 17000	 5300	 85	 4000		117L/M7GT
117N7GT	DI BEAM PR AMP	HTR	117	.09	8AV-OGT8	9HA				H W RECT PR AMP CL A	117 RMS MAX 100	 —6	 100	75 DC MAX 51	 6.0		TUBE DROP 16v AT 150ma DC 16000	 7000	 1.2	 3000		117N7GT
117P7GT	DI BEAM PWR AMP	HTR	117	0.09	8AV-OGT8	9HA				H W RECT PR AMP CL A	117 RMS MAX 105	 —5.2	 105	75 DC MAX 43	 4		TUBE DROP 16v AT 50ma DC 17000	 5300	 0.85	 4000		117P7GT
117Z4GT	DIODE	HTR	117	0.04	5AA-OGT6	9H				H W RECT	117 RMS MAX			90 DC MAX			TUBE DROP 22.5v AT 180ma DC					117Z4GT
117Z6GT	TWIN DIODE	HTR	117	.075	7Q-OGT7	9H				RECTIFIER V DOUBLER	235 RMS MAX 117 RMS MAX			60 DC MAX 60 DC MAX			TUBE DROP 15.5v AT 125ma DC					117Z6GT
182B/482B	TRIODE	FIL	5.0	1.25	4D-SM4	14D				PR AMP CL A	250	—35		18		5		1500				182B/482B
183/483	TRIODE	FIL	5.0	1.25	4D-SM4	14D				PR AMP CL A	250	—58		20		3		1500				183/483
485	TRIODE	HTR	3.0	1.25	5A-SS5	12B				AMP CL A	180	—10		5.2		12.8		1300				485
950	PENTODE	FIL	2.0	.12	5K-SM5	14D				PR AMP CL A	135	—16.5	135	7.0	2.0	100	.1 MEG	1000	.45	13500		950
BA	TWIN DI	COLD			4J-SM4	19B	GAS FILLED			F W RECT	350 RMS MAX			350 DC MAX			TUBE DROP 80v					BA
BH	TWIN DI	COLD			4J-SM4	14A	GAS FILLED			F W RECT	350 RMS MAX			125 DC MAX			TUBE DROP 90v					BH
BR	DIODE	COLD			4H-SM4	12A	GAS FILLED			H W RECT	300 RMS MAX			50 DC MAX			TUBE DROP 60v					BR
CK1003/ 0Z4A		SEE 0Z4A/1003																				CK1003/ 0Z4A
VR75-30		SEE 0A3/VR75																				VR75-30
VR90-30		SEE 0B3/VR90																				VR90-30
VR105-30		SEE 0C3/VR105																				VR105-30
VR150-30		SEE 0D3/VR150																				VR150-30
XXD	TWIN TRIODE	HTR	12.6	.15	8AC-L8	9A	2.3	2.2	1.6	AMP CL A 1 SEC	250 100	—10 0		9 10.8		16 17	7600 6500	2100 2600				XXD
XXL	TRIODE	HTR	6.3	.3	5AC-L8	9A	2.0	3.4	2.6	AMP CL A	250 100	—8 0		8 10		20 25	8700 7000	2300 3600				XXL

SEE PAGE 5 FOR DATA CHART REFERENCE NOTES

RAYTHEON SPECIAL PURPOSE TUBES RAYTHEON

TYPE	DESIGN	CATHODE TYPE	HTR OR FIL VOLTS	HTR OR FIL AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	CAPACITIES IN mmfds	CAPACITIES OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	AMP FACT	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	CUT OFF VOLTS	TYPE
717A	PENTODE	HTR	6.3	0.175	8BK-OGT8	9T	.025	4.8	3.2	AMP CL A	120	—2.0	120	7.5	2.5		.39MEG	4000				717A
954	PENTODE	HTR	6.3	0.15	954	4A	0.007	3.4	3.0	AMP CL A	250	—3	100	2.0	0.7		1.5MEG	1300			—7	954
955	TRIODE	HTR	6.3	0.15	955	4B	1.4	1.0	0.6	AMP OSC	250	—7		6.3		25	11400	2200				955
956	PENTODE	HTR	6.3	0.15	956	4A	0.007	3.4	3.0	AMP CL A	250	—3	100	6.7	2.7		0.7MEG	1800			—45	956
957	TRIODE	FIL	1.25	0.05	957	4B	1.2	0.3	0.7	AMP OSC	135	—5		2.0			24600	650				957
1005/ CK1005	TWIN DIODE	FIL	6.3	0.1	5AQ-OW8	8E				FULL WAVE RECTIFIER	160			70 DC MAX — 0ma MIN. — TUBE DROP 20v AT 70ma								1005/ CK1005
1006/ CK1006	TWIN DIODE	COLD FIL	1.75	2.00	4C-SM4	14D				FULL WAVE RECTIFIER	560 560			200 DC MAX — (70 DC MIN.) — TUBE DROP 30v AT 200ma 200 DC MAX — (0 DC MIN.) — TUBE DROP 25v AT 200ma								1006/ CK1006
CK1007	TWIN DIODE	COLD FIL	1.0	1.2	1007-OW6	8E				FULL WAVE RECTIFIER	285 285			110 DC MAX — (30 DC MIN.) — TUBE DROP 24v AT 110ma 110 DC MAX — (0 DC MIN.) — TUBE DROP 24v AT 110ma								CK1007
9001	PENTODE	HTR	6.3	0.15	7BD-MB7	5A	0.01	3.6	3.0	AMPLIFIER CLASS A	250 90	—3 —3	100 90	2.0 1.2	0.7 0.5		1.5MEG 1.0MEG	1400 1100			—8 —6	9001
9002	TRIODE	HTR	6.3	0.15	6BG-MB7	5A	1.4	1.2	1.1	AMP OSC	250 90	—7 —2.5		6.3 2.5		25 25	11400 14700	2200 1700				9002
9003	PENTODE	HTR	6.3	0.15	7BD-MB7	5A	0.01	3.4	3.0	AMP CL A	250	—3	100	6.7	2.7		0.7MEG	1800			—45	9003
9006	DIODE	HTR	6.3	0.15	6BH-MB7	5A	2.0	0.6	3.2	DETECTOR	300 RMS MAX			5ma MAX			RESONANT FREQUENCY 700mc					9006

RAYTHEON FLAT HEARING AID TUBES RAYTHEON

TYPE	DESIGN	CATHODE TYPE	HTR OR FIL VOLTS	HTR OR FIL AMPS	BASING DATA	MAX SIZE VIEW	CAPACITIES G-P mmfds	CAPACITIES IN mmfds	CAPACITIES OUT mmfds	USED AS	PLATE VOLTS	GRID VOLTS	SCR VOLTS	PLATE MA	SCR MA	VOLTAGE GAIN	PLATE RESIS OHMS	MUT COND mmho	OUT PUT WATTS	LOAD RESIS OHMS	TUBE WEIGHT OUNCES	TYPE
CK502AX	PENTODE	FIL	1.25	0.030	Term Conn. See Max. Size View	3C				POWER OUTPUT	45	—1.5	45	.45	.11		.25MEG	500	.006	0.1MEG	.09	CK502AX
CK503AX	PENTODE	FIL	1.25	0.030	Term Conn. See Max. Size View	3C				POWER OUTPUT	45	—2.5	45	0.5	.18		.4 MEG	475	.010	0.05MEG	.09	CK503AX
CK505AX	PENTODE	FIL	0.625	0.030	Term Conn. See Max. Size View	3B				VOLTAGE AMPLIFIER	30	0	30	.20	.07	35	.5 MEG	180		1MEG	.07	CK505AX
CK506AX	PENTODE	FIL	1.25	0.050	Term Conn. See Max. Size View	3C				POWER OUTPUT	45	—4.5	45	1.25	0.4			500	.025	.03MEG	.09	CK506AX
CK507AX	PENTODE	FIL	1.25	0.050	Term Conn. See Max. Size View	3C				POWER OUTPUT	45	—2.5	45	.6	.21		.3 MEG	500	.012	0.05MEG	.09	CK507AX
CK509AX	TRIODE	FIL	0.625	0.030	Term Conn. See Max. Size View	3A				VOLTAGE AMPLIFIER	45	0		.15		16	.15MEG	160		1MEG	.07	CK509AX

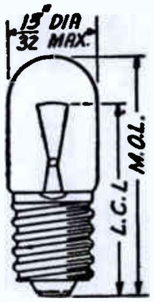
SEE PAGE 5 FOR DATA CHART REFERENCE NOTES

RADIO PANEL LAMPS

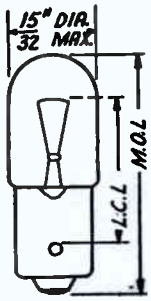
Raytheon Dependable Radio Panel Lamps are of the highest quality and are designed especially to meet the requirements of the renewal market.

TYPE NO.	VOLTS	AMPS.	APPROX. CANDLE POWER	BULB	BASE	BEAD COLOR	LIGHT CENTER LENGTH	MAX. OVERALL LENGTH	TYPE NO.
40	6-8	0.15	0.5	T-3¼	Min. Screw	Brown	23/32"	1⅛"	**40**
40-A	6-8	0.15	0.5	T-3¼	Min. Bayonet	Brown	23/32"	1⅛"	**40-A**
41	2.5	0.5	0.5	T-3¼	Min. Screw	White	23/32"	1⅛"	**41**
42	3.2	0.5	0.75	T-3¼	Min. Screw	Green	23/32"	1⅛"	**42**
43	2.5	0.5	0.5	T-3¼	Min. Bayonet	White	23/32"	1⅛"	**43**
44	6-8	0.25	0.8	T-3¼	Min. Bayonet	Blue	23/32"	1⅛"	**44**
45	3.2	0.5	0.75	T-3¼	Min. Bayonet	Green	23/32"	1⅛"	**45**
46	6-8	0.25	0.8	T-3¼	Min. Screw	Blue	23/32"	1⅛"	**46**
47	SAME CHARACTERISTICS AS 40A, WITH WHICH IT IS INTERCHANGEABLE								**47**
48	2.0	0.06	0.03	T-3¼	Min. Screw	Pink	23/32"	1⅛"	**48**
49	2.0	0.06	0.03	T-3¼	Min. Bayonet	Pink	23/32"	1⅛"	**49**
49-A	2.1	0.12	0.07	T-3¼	Min. Bayonet	White	23/32"	1⅛"	**49-A**
50	6-8	0.2	1.0	G-3½	Min. Screw	White	23/32"	15/16"	**50**
51	6-8	0.2	1.0	G-3½	Min. Bayonet	White	½"	15/16"	**51**
55	6-8	0.4	1.5	G-4½	Min. Bayonet	White	½"	1 1/16"	**55**
292	2.9	0.17	0.3	T-3¼	Min. Screw	White	23/32"	1⅛"	**292**
292-A	2.9	0.17	0.3	T-3¼	Min. Bayonet	White	23/32"	1⅛"	**292-A**

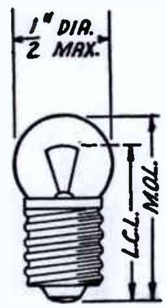
Note: The color of the bead inside the lamp bulb may be used to identify the more common Raytheon types. This information is shown in the column headed "Bead Color."



40
41
42
46
48
292



40A
43
44
45
49
49A
292A



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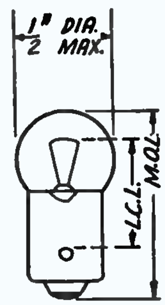
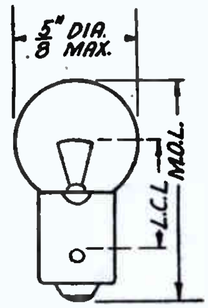
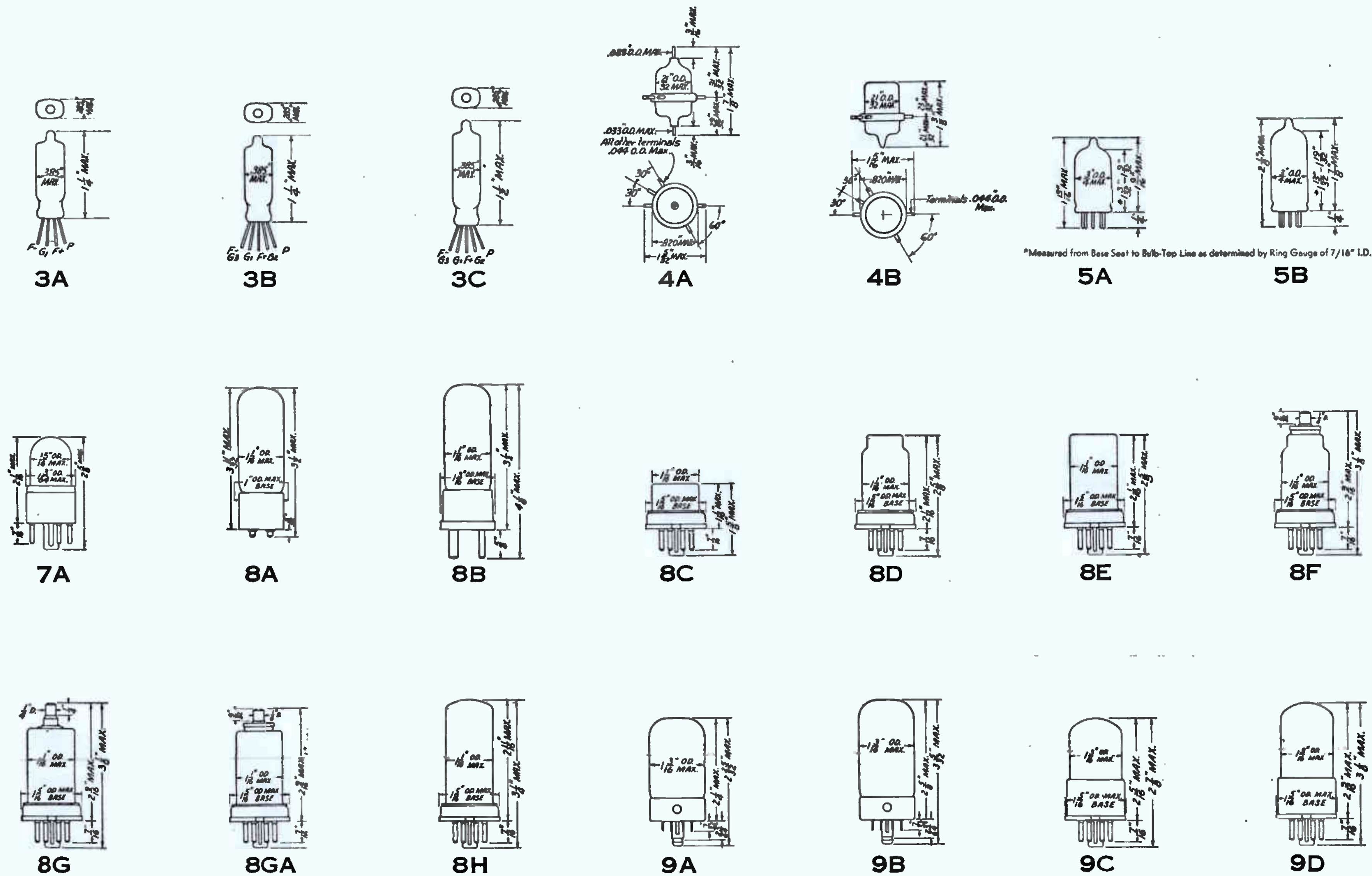


51

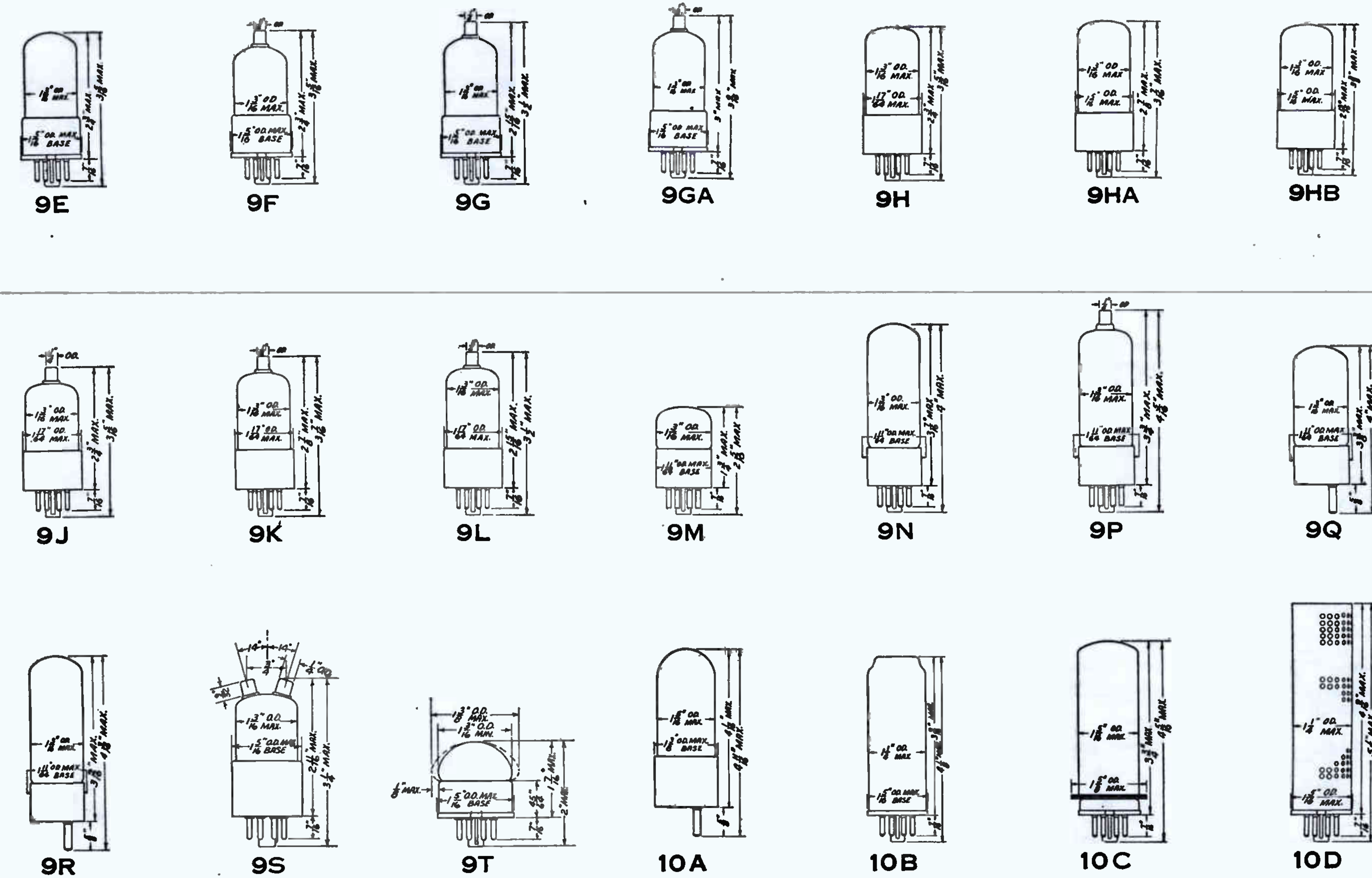


55

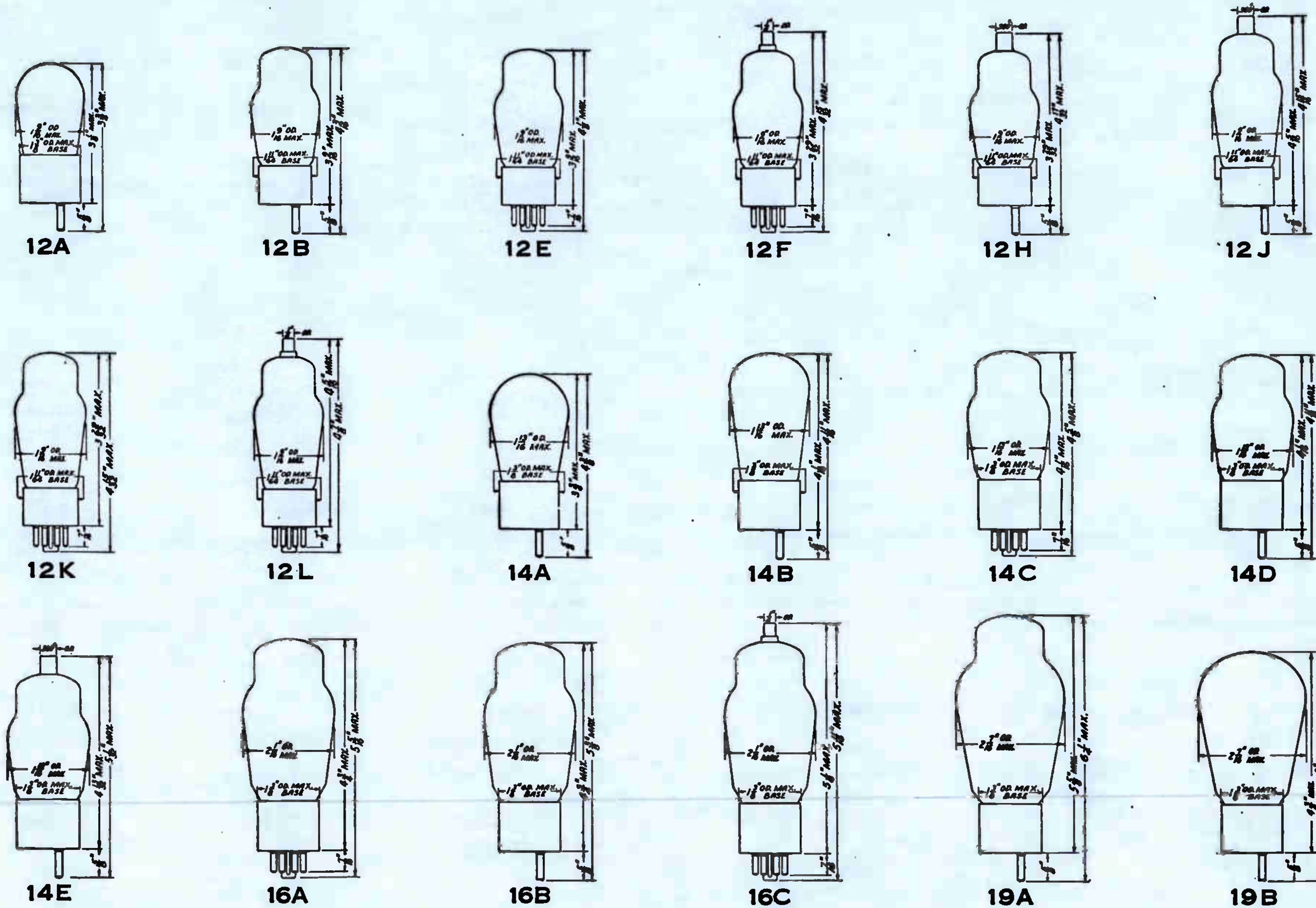


*Measured from Base Seat to Bulb-Top Line as determined by Ring Gauge of 7/16" I.D.

TUBE OUTLINE DRAWINGS



TUBE OUTLINE DRAWINGS



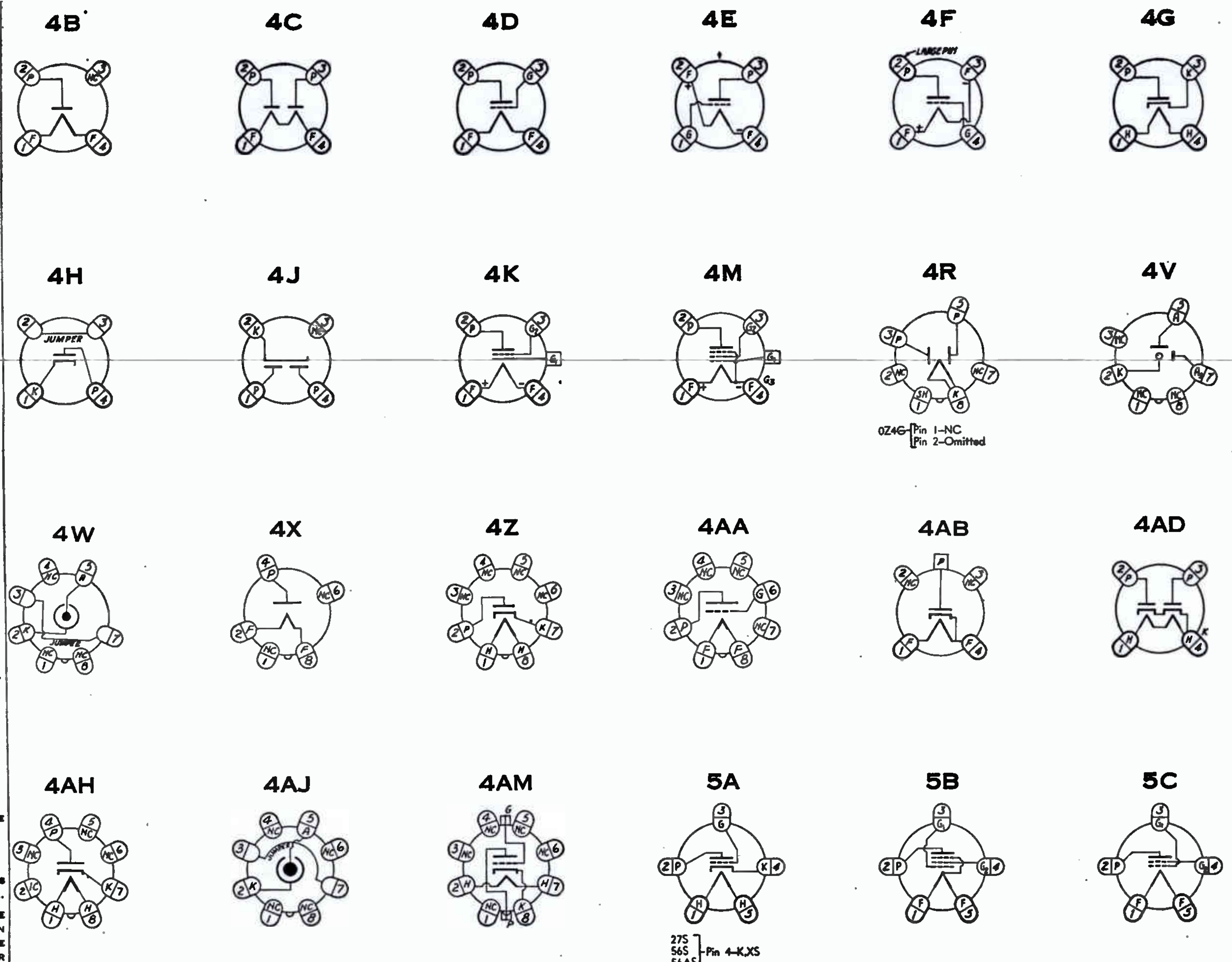
TUBE OUTLINE DRAWINGS

LIST OF SYMBOLS

A	ANODE
A_S	STARTER ANODE
D	DIODE PLATE
D_B	DIODE PLATE—BOTTOM
D_L	DIODE PLATE—LEFT
D_R	DIODE PLATE—RIGHT
D_T	DIODE PLATE—TOP
DEF	DEFLECTOR PLATES
E_C	CONTROL ELECTRODE
F	FILAMENT
F_T	FILAMENT TAP
G	GRID
G_1	GRID NO. 1
G_2	GRID NO. 2
G_3	GRID NO. 3
G_4	GRID NO. 4
G_5	GRID NO. 5
G_6	GRID NO. 6
G_{1H}	HEPTODE GRID NO. 1
G_{2H}	HEPTODE GRID NO. 2
G_{3H}	HEPTODE GRID NO. 3
G_{4H}	HEPTODE GRID NO. 4
G_{5H}	HEPTODE GRID NO. 5
G_{1HX}	HEXODE GRID NO. 1
G_{2HX}	HEXODE GRID NO. 2
G_{3HX}	HEXODE GRID NO. 3
G_{4HX}	HEXODE GRID NO. 4
G_{1L}	GRID NO. 1—LEFT
G_{1P}	PENTODE GRID NO. 1
G_{2P}	PENTODE GRID NO. 2
G_{3P}	PENTODE GRID NO. 3
G_{1R}	GRID NO. 1—RIGHT
G_{IN}	GRID—INPUT SECT.
G_L	GRID—LEFT
G_R	GRID—RIGHT
G_T	TRIODE GRID
H	HEATER
H_T	HEATER TAP
IS	INTERNAL SHIELD
K	CATHODE
K_D	DIODE CATHODE
K_L	CATHODE—LEFT
K_O	CATHODE—OUTPUT SECT.
K_P	PENTODE CATHODE
K_R	CATHODE—RIGHT
K_T	TRIODE OR TETRODE CATH.
NC	NO CONNECTION
P	PLATE
P_H	HEPTODE PLATE
P_{HX}	HEXODE PLATE
P_{IN}	PLATE—INPUT SECT.
P_L	PLATE—LEFT
P_O	PLATE—OUTPUT SECT.
P_P	PENTODE PLATE
P_R	PLATE—RIGHT
P_T	TRIODE OR TETRODE PLATE
SH	SHELL
T	TARGET
XS	EXTERNAL SHIELD

SH DESIGNATION FOR GT TYPES INDICATES METAL BASE SHELL.

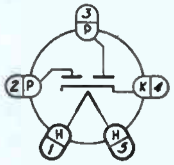
SUBSCRIPTS R & L INDICATE RIGHT & LEFT ELEMENTS WHEN LOOKING DOWN ON TOP OF TUBE WITH LOCATING LUG OF KEY OR FILAMENT PINS AT FRONT.



BASE CONNECTION DIAGRAMS

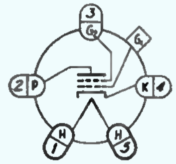
(VIEWED FROM BOTTOM OF BASE) (RMA NUMBERING SYSTEM)

5D



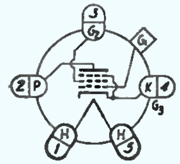
2S/4S Pin 4–K,XS

5E

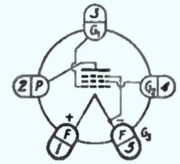


24S, 35S/51S — Pin 4–K,XS

5F



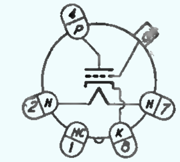
5K



5L

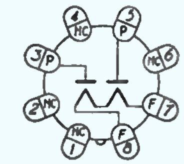
5V4G Pin 1–NC

5M

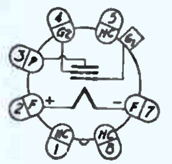


6F5, 6F5GT, 12F5GT — Pin 1–SH

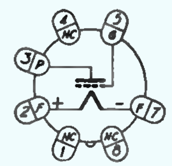
5Q



5R

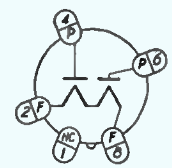


5S



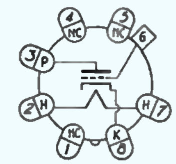
1E4G Pin 1–IS
2A4G, 6B4G — Pin 6–NC

5T

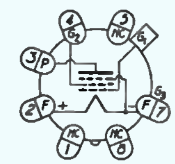


5T4, 5W4 — Pin 1–SH
5U4G Pins 3,5,7–NC

5U

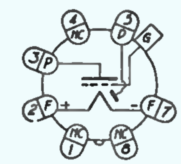


5Y



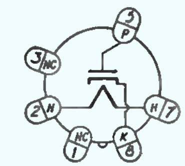
1N5GT Pin 1–SH

5Z

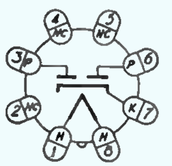


1H5GT Pin 1–SH

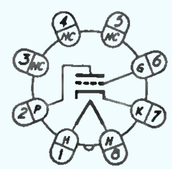
5AA



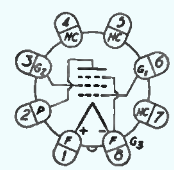
5AB



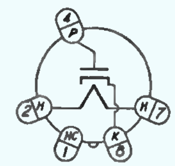
5AC



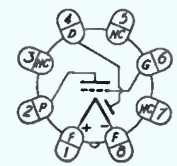
5AD



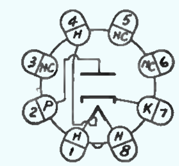
5AF



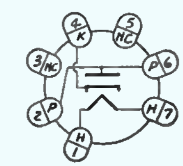
5AG



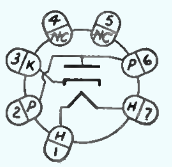
5AL



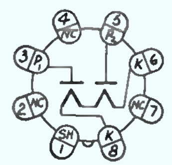
5AM



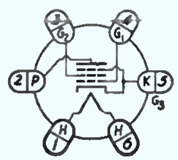
5AP



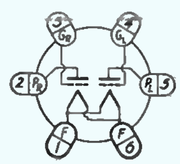
5AQ



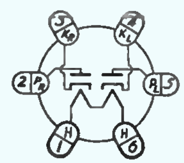
6B



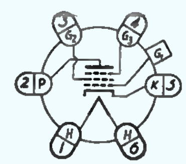
6C



6E

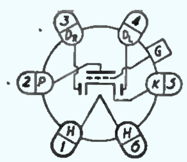


6F



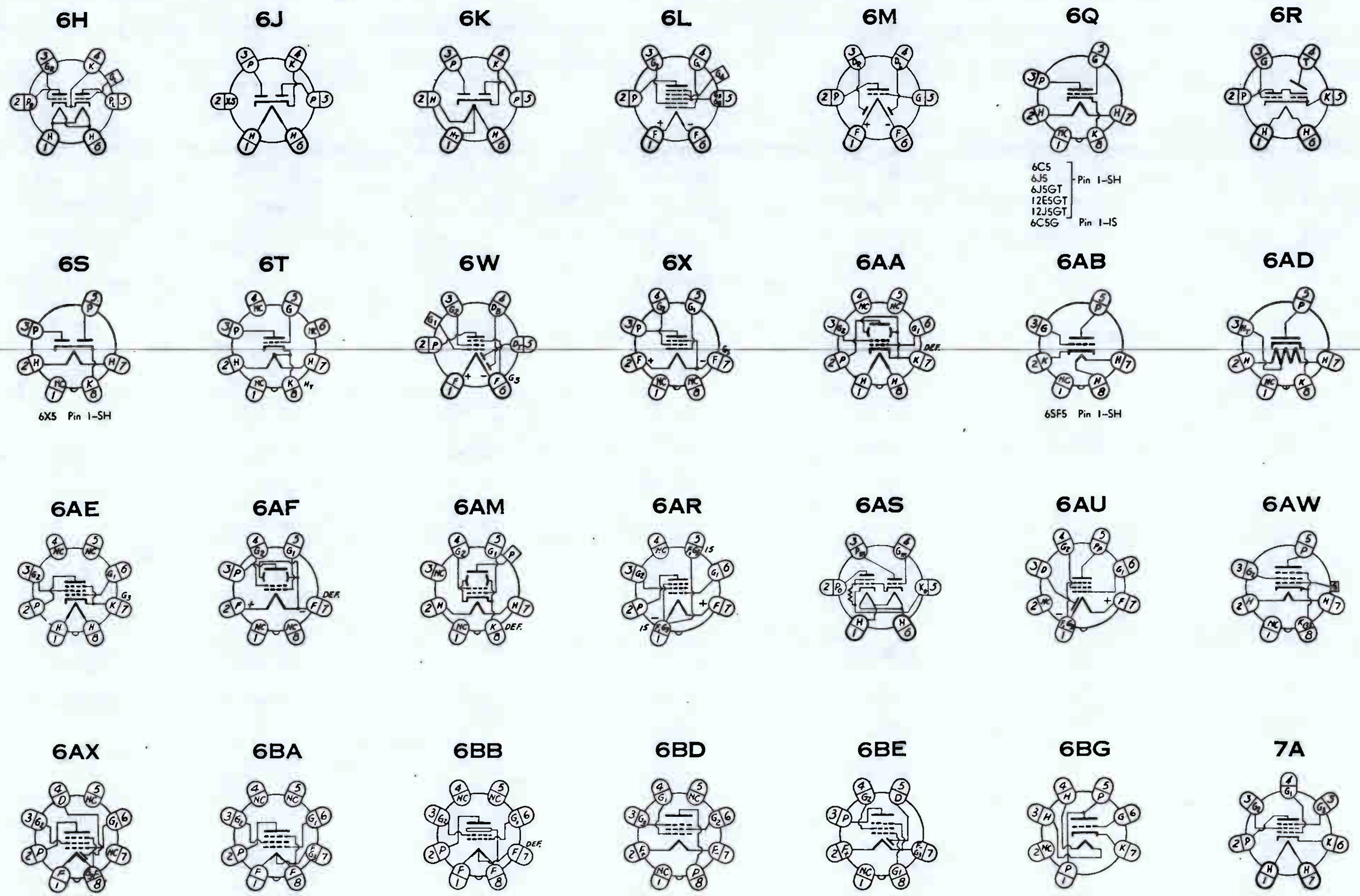
57S, 57AS, 58S, 58AS — Pin 5–K,XS

6G



55S, 75S — Pin 5–K,XS
85AS Pin 6–H,XS

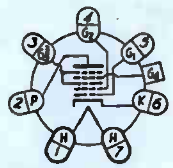
BASE CONNECTION DIAGRAMS
(VIEWED FROM BOTTOM OF BASE) (RMA NUMBERING SYSTEM)



BASE CONNECTION DIAGRAMS
(VIEWED FROM BOTTOM OF BASE) (RMA NUMBERING SYSTEM)

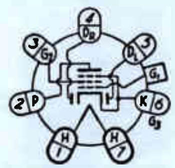
7B

7C



2A7S
6A7S
Pin 6–K,XS

7D

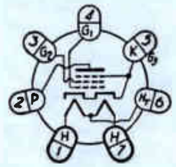


2B7S
6B7S
Pin 6–K,G5,XS

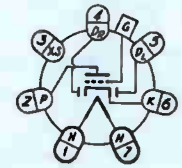
7E

6F7S Pin 6–K,G5,XS

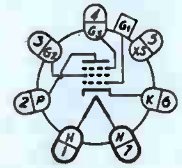
7F



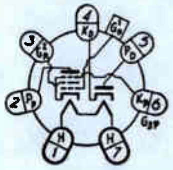
7G



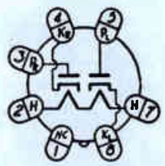
7H



7K

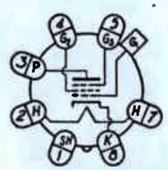


7Q



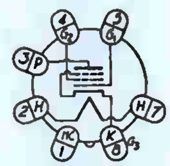
6H6 Pin 1–SH,IS
6H6G Pin 1–IS
6H6GT Pin 1–SH,IS
25Z6 Pin 1–SH

7R



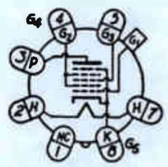
6J7G Pin 1–IS
6K7G
6S7G
6U7G
6W7G
Pin 1–NC
6J7GT Pin 1–SH,IS

7S



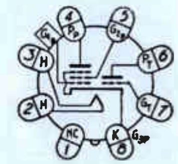
6F6
25A6
25A6GT
Pin 1–SH

7T

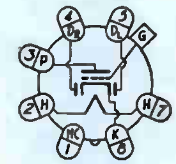


6L7 Pin 1–SH

7U

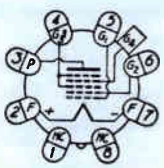


7V



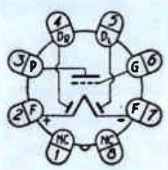
6Q7
6Q7GT
6R7
6R7GT
12Q7GT
Pin 1–SH

7Z

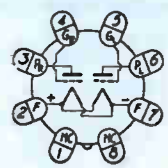


1A7GT Pin 1–SH

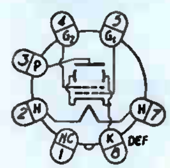
7AA



7AB

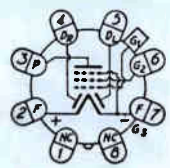


7AC

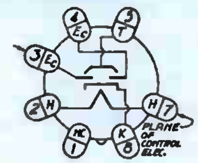


6L6
6V6
25L6
Pin 1–SH

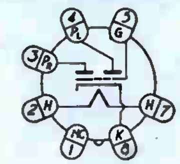
7AD



7AG



7AH



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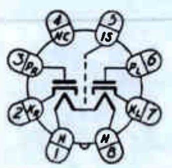

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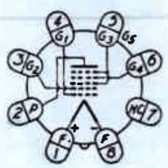

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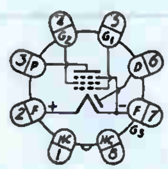

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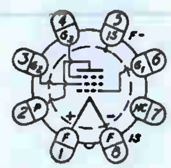

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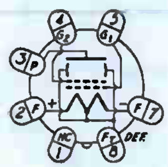

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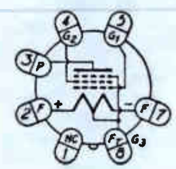

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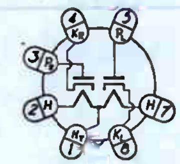
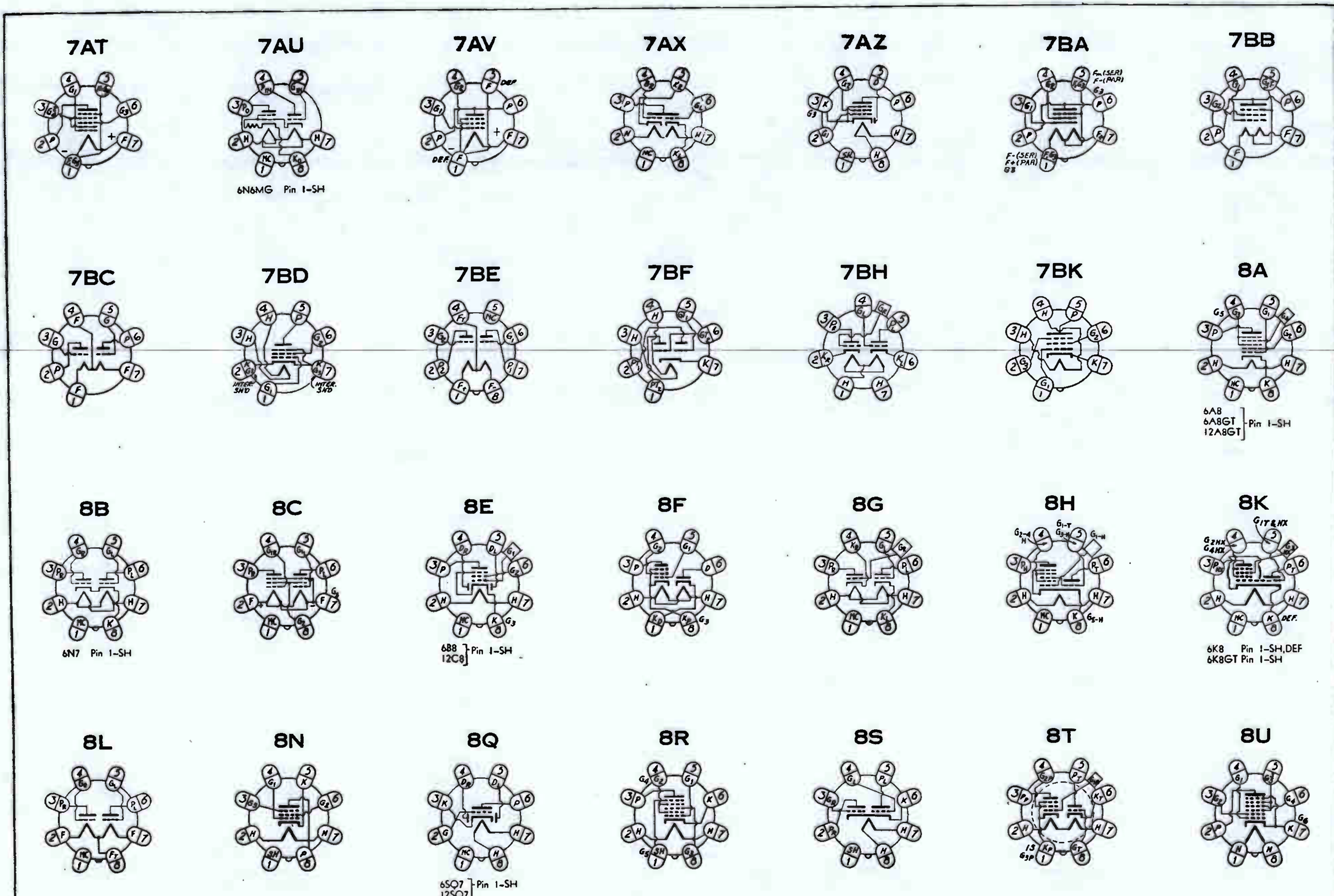


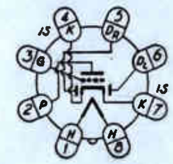
BASE CONNECTION DIAGRAMS
(VIEWED FROM BOTTOM OF BASE) (RMA NUMBERING SYSTEM)



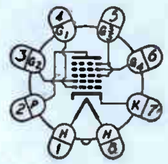
BASE CONNECTION DIAGRAMS
(VIEWED FROM BOTTOM OF BASE) (RMA NUMBERING SYSTEM)

8V

8W



8X



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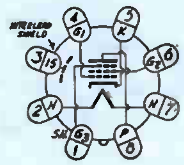

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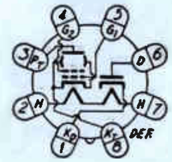

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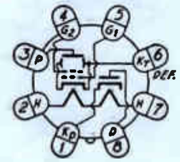

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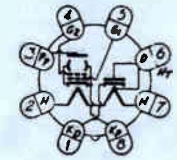

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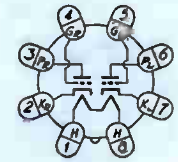

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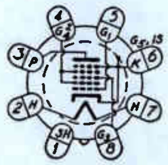
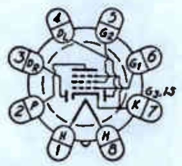
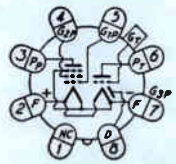


8AE



8AJ



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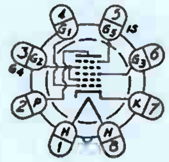

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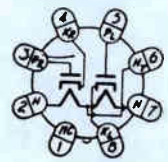
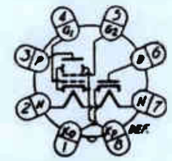
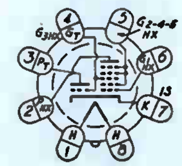


8AO



8AR



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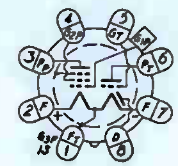

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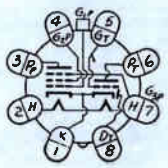

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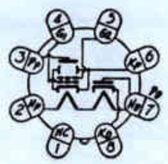

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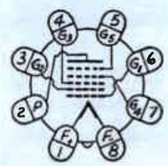

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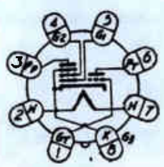
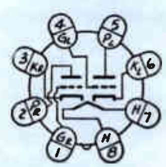


8BD



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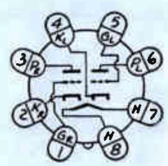

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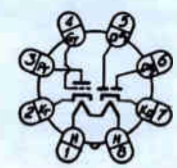

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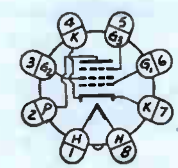
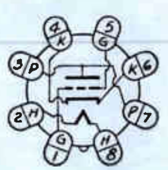
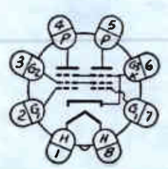


8BK

8BN



8BS



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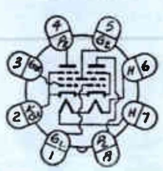
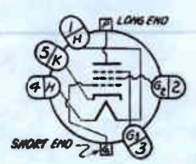


TYPE 954 OR 956



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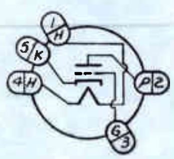

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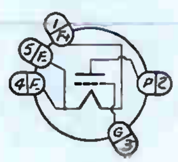
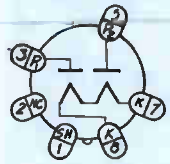


TYPE 1007



BASE CONNECTION DIAGRAMS
(VIEWED FROM BOTTOM OF BASE) (RMA NUMBERING SYSTEM)

TUBE SUBSTITUTION CHART

Before any tube substitution is attempted, the careful reading of the following explanatory information on the subject is essential.

The substitutions shown in this chart are successful in practically all cases. There conceivably could be a few instances where circuit sensitivity to slight differences in tube characteristics might prevent wholly satisfactory operation, or where the substitute tube type may have shorter life than the original even though operation is satisfactory. It is impossible, however, to cover all the exceptions because of the many deviations in circuit design.

There are a number of tube types for which this chart offers no substitutes. These types have, however, been listed in the event the user should discover a suitable substitute. The information may then be entered on the chart.

Cross reference in the chart will be found quite complete but not always reversible. For example, detector diodes such as type 6H6GT should not be substituted for power diodes such as 6X5GT since the substitute would be extremely short-lived in this application.

In most cases types of the 6-volt series have identical counterparts in the 12-volt series, the only difference being in heater voltage. As examples: except for heater ratings a 6SK7GT is the same as a 12SK7GT; and a 7A7 is the same as a 14A7. Rare exceptions to this rule to be noted are:

a 6B8 is similar to a 12C8, *not* a 12B8;

a 6A7 *is not* similar to a 12A7.

★ ★

Where series connection of heaters is used, care must be taken to insure the correct amount of current through each heater when the substitute has a different heater current than the original. If the current is too high, tube life will be shortened. If the current is too low, operation may not be satisfactory. Compensating resistors therefore must be added to adjust the current. The following two examples will assist in calculating these resistors:

1. To replace a 150-milliampere tube, such as a 7B7, with a 300-milliampere tube, such as a 7A7: The series heaters of the original tubes of the receiver have a normal current of 150 milliamperes. Since the substitute type operates at 300 milliamperes, shunt resistors must be connected across each of the other tubes. The value of each resistor must be equal to the heater resistance of the tube to which it is connected, *i.e.*, the heater resistance of any tube $= \frac{\text{Heater Voltage}}{\text{Heater Current}}$. No resistor should be connected across the substitute tube. In addition, a ballast tube or resistor cord, when used in the receiver, must be replaced by a unit having half the resistance of the original.

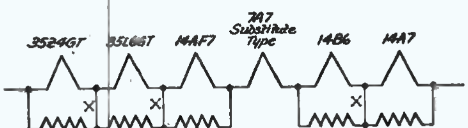


FIGURE (a)

Leads marked X in Figure (a) may be eliminated if care is observed that these are the only leads eliminated. This means that resistors A, B and C can be replaced with a single resistor equal to the sum of A, B and C. The same is true of resistors D and E.

★ ★

2. To replace a 300-milliampere tube, such as 7A7, with a 150-milliampere tube, such as a 7B7: The series heaters of the original tubes in the set have a current of 300 milliamperes. Since the substitute tube operates at 150 milliamperes, a shunt resistor equal in value to the resistance of the tube must be connected across it. The heater resistance of the 7B7 tube is equal to $\frac{\text{Heater Voltage}}{\text{Heater Current}} = \frac{6.3}{0.15} = 42$ ohms. See Figure (b).

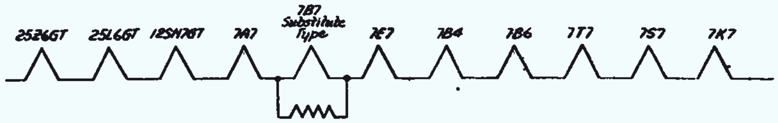


FIGURE (b)

The parallel combination will then pass twice the current of the tube, so that 150 milliamperes flow through the tube and 150 milliamperes through the 42-ohm shunting resistor. The current, flowing through the other tubes, will then be the same as in the original circuit.

★ ★

There are a number of cases where remote cutoff and sharp cutoff tubes may be interchanged. In some cases this may cause slight differences in the operation of the automatic volume control of the receiver. Metal, "G," "GT" and "GT/G" types are all directly interchangeable, although occasionally a tube shield may be necessary to prevent oscillation. Space limitations may prevent the use of the "G" types in certain installations.

★ ★

An adapter is strongly recommended in place of changing or reconnecting the socket. The use of the adapter permits the installation of the original tube type at a later date and avoids confusion in the use of published circuits for subsequent servicing. However, there will be some cases where necessary room for an adapter is not available, thereby requiring a change of the socket.

Many commercial adapters for substitute types are readily available, but an adapter can be easily assembled by the serviceman to meet his own requirements. The following suggestions on adapter construction may be helpful:

The use of a bakelite socket which fits snugly inside the top rim of the base makes a neater and more rugged wiring job. Number 20 tinned wire is ideal for connecting the top socket to the adapter base. Cut the leads about an inch longer than necessary, insulate with spaghetti to prevent short circuits, and pull leads taut when assembled. Cut leads flush with the end of the base pin, apply soldering flux and, holding the adapter upright, dip end of pin in a puddle of solder. A small hole drilled in the soldering iron tip will serve as a solder cup. Solder will flow up the pin, making a smooth, finished end. Where a top cap lead must be added, it should be shielded to avoid pick-up troubles.

The base diagrams of the original and substitute tube types should be used as a guide for the connection between the upper socket and the base adapter. Three examples are listed below to show the type of interconnection required:

(1) 6SA7GT replacing a 7Q7

Connect Top Socket Pin . . . . →	1	2	3	4	5	6	7	8
to Bottom Base Pin . . . . →	5	1	2	3	4	7	8	6

↑ Connect 5 and 7 together ↑

(2) 6SQ7GT replacing a 75

Connect Top Socket Pin . . . . . →	1	2	3	4	5	6	7	8
to Bottom Base Pin . . . . →	No Connection	Top Cap	5	4	3	2	6	1

(3) 75 replacing 6SQ7GT

Connect Top Socket Pin . . . . →	1	2	3	4	5	6	Top Cap
to Bottom Base Pin . . . . →	8	6	5	4	3	7	2

The continued operation of many receivers requiring tube types no longer readily available can be accomplished by the careful use of this tube substitution chart.

RAYTHEON

ORIGINAL	DIRECTLY INTER-CHANGEABLE	USE WITH ADAPTER	CHANGE OR ADD FIL VOLTAGE	ADAPTER PLUS FIL VOLT CHANGE
00A	01A, 40			
01A	00A, 40			
0A3	VR75/30			
0A4G				
0B3	VR90/30			
0C3	VR105/30			
0D3	VR150/30			
0Z4			6X5GT/G	7Y4, 84
0Z4A/1003			6X5GT/G	7Y4, 84
0Z4G			6X5GT/G	7Y4, 84
1A3		1R4/1294		
1A4	1B4	1D5G, 1E5G		
1A5GT/G	1Q5GT, 1T5GT, 1C5GT	1LA4, 1LB4, 3Q5GT		
1A6	1C6	1C7G, 1D7G		
1A7GT	1B7GT	1LA6, 1LC6		
1B4	1A4	1E5G, 1D5G		
1B5/25S		1H6G		
1B7GT	1A7GT	1LA6, 1LC6		
1B8GT				
1C5GT	1Q5GT, 1T5GT, 1A5GT	1LB4, 3Q5GT, 1LA4		
1C6	1A6	1C7G, 1D7G		
1C7G	1D7G	1A6, 1C6		
1D5G	1E5G	1A4, 1B4		
1D7G	1C7G	1A6, 1C6		
1D8GT				
1E4G	1G4GT, 1H4G	1LE3, 30		
1E5G	1D5G	1B4, 1A4		
1E7G		2-type 1F5G		
1F4		1F5G		

RAYTHEON

ORIGINAL	DIRECTLY INTER-CHANGEABLE	USE WITH ADAPTER	CHANGE OR ADD FIL VOLTAGE	ADAPTER PLUS FIL VOLT CHANGE
1F5G		1F4		
1F6		1F7G		
1F7G		1F6		
1G4GT	1E4G, 1H4G	1LE3, 30		
1G5G	1J5G	950		
1G6GT				
1H4G	1E4G, 1G4GT	1LE3, 30		
1H5GT/G		1LH4		
1H6G		1B5/25S		
1J5G	1G5G	950		
1J6G		19		
1L4				
1LA4		1A5GT		
1LA6	1LC6	1A7GT, 1B7GT		
1LB4	1LA6	1C5GT, 1Q5GT, 1T5GT, 3Q5GT, 1A5GT		
1LB6				
1LC5		1SA6GT		
1LC6	1LA6	1A7GT, 1B7GT		
1LD5		1SB6GT, 1S5		
1LE3		30, 1E4G, 1G4GT, 1H4G		
1LH4		1H5GT/G		
1LN5		1N5GT/G		
1N5GT/G		1LN5		
1N6GT				
1P5GT/G				
1Q5GT	1C5GT, 1T5GT, 1A5GT	1LB4, 3Q5GT, 1LA4		
1R4/1294		1A3		
1R5				
1S4				

READ EXPLANATORY NOTES (ON PAGE 35) BEFORE ATTEMPTING TUBE SUBSTITUTION

RAYTHEON

ORIGINAL	DIRECTLY INTER-CHANGEABLE	USE WITH ADAPTER	CHANGE OR ADD FIL VOLTAGE	ADAPTER PLUS FIL VOLT CHANGE
1S5		1SB6GT, 1LD5		
1SA6GT		1LC5		
1SB6GT		1LD5, 1S5		
1T4				
1T5GT	1Q5GT, 1C5GT, 1A5GT	1LB4, 3Q5GT, 1LA4		
1V			12Z3	
2A3	45		6A3	6B4G, 6A5G
2A4G				
2A5			42, 41	6K6GT/G, 6Y6G, 6F6G, 7B5, 7C5
2A6			75	6SQ7GT, 6Q7GT, 6T7G, 6Q6G, 7K7, 7C6, 7B6, 6B6G
2A7			8A7	6A8GT, 6D8G, 7A8, 6J8G, 7S7, 7B8, 7J7
2B7			6B7	6B8GT, 7E7
2C21				
2C22				
2C26				
2E5			6E5	
2W3GT				
3A4				
3A5				
3A8GT				
3B5GT		3S4		
3B7/1291		3A5		
3C5GT		3LE4		
3D6/1299	3LF4	3Q5GT, 3Q4		
3LE4		3C5GT		

RAYTHEON

ORIGINAL	DIRECTLY INTER-CHANGEABLE	USE WITH ADAPTER	CHANGE OR ADD FIL VOLTAGE	ADAPTER PLUS FIL VOLT CHANGE
3LF4	3D6/1299	3Q5GT, 3Q4		
3Q4		3Q5GT, 3LF4, 3D6/1299		
3Q5GT/G		3Q4, 3LF4, 3D6/1299		
3S4				
4A6G				
5R4GY				
5T4	5U4G	5Z3, 5X4G		
5U4G	5T4	5Z3, 5X4G		
5V4G	5Z4GT, 5W4GT 5Y3GT	83V, 5Y4G, 5X3, 80		
5W4GT/G	5Y3GT/G, 5V4G, 5Z4GT	80, 5Y4G, 5X3, 83V		
5X3	80, 83V	5Y3GT, 5W4GT, 5V4G, 5Y4G, 5Z4GT		
5X4G		5Z3, 5U4G, 5T4		
5Y3GT/G	5W4GT/G, 5V4G, 5Z4GT	80, 5Y4G, 5X3, 83V		
5Y4G		5X3, 5Y3GT, 80, 83V, 5W4G, 5V4G, 5Z4GT		
5Z3		5U4G, 5X4G, 5T4		
5Z4GT	5V4G, 5Y3GT, 5W4GT	83V, 5Y4G, 5X3, 80		
6A3		6B4G, 6AG5	45, 2A3	
6A4/LA	52			
6A5G	6B4G	6A3	45, 2A3	
6A6		6N7GT/G	53	
6A7		6A8GT, 6J8G, 6D8G, 7S7, 7J7, 7A8, 7B8	2A7	12A8GT, 14B7, 14J7, 14S7
6A8GT	6D8G	7A8, 7B8, 6A7	2A7, 12A8GT	14B8, 14J7, 14S7
6AB5-6N5	6E5		2E5	
6AB6G	6N6G	6B5		
6AB7/1853		7V7, 7W7		14W7
6AC5GT/G				

READ EXPLANATORY NOTES (ON PAGE 35) BEFORE ATTEMPTING TUBE SUBSTITUTION

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ORIGINAL	DIRECTLY INTER-CHANGEABLE	USE WITH ADAPTER	CHANGE OR ADD FIL VOLTAGE	ADAPTER PLUS FIL VOLT CHANGE
6AC6G				
6AC7/1853				
6AD5G		6SF5GT, 6K5GT, 6F5GT, 7B4		12SF5GT, 12F5GT
6AD6G				
6AD7G				
6AE5GT/G				
6AE6G				
6AE7GT				
6AF5G	6P5GT			27
6AF6G				
6AG5	6AK5	717A		
6AG7				
6AH5G		6L6G, 6AL6G		
6AH7GT		6SN7GT, 7N7, 6F8G	12AH7GT	14N7 14AF7, 12SN7GT
6AK5	6AG5	717A		
6AK6		6G6G		
6AL6G		6L6G, 6AH5G		
6B4G	6A5G	6A3		45, 2A3
6B5		6N6G, 6AB6G		
6B6G	6T7G-6Q7G, 6Q7GT	6SQ7GT, 7B6, 7C6, 75, 7K7		2A6, 14B6, 12SQ7GT, 12Q7GT
6B7		6B8GT, 7E7	2B7	12SF7, 12C8, 14E7
6B8GT		6B7, 7E7		2B7, 12SF7, 12C8, 14E7
6C4		6J5GT, 7A4, 6C5G, 6L5G		14A4, 12J5GT
6C5GT/G	6J5GT/G, 6L5G	7A4, 6C4		14A4, 12J5GT
6C6	77, 6D6, 78	6J7GT, 6SJ7GT, 7C7, 6W7G, 6K7GT, 6SK7GT, 7B7, 6SS7, 6U7G, 7A7, 6S7G	57, 58	12J7GT, 12SJ7GT, 12SK7GT, 12K7GT, 14A7/12B7, 14C7
6C8G		6SL7GT, 7F7, 6SC7GT		

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ORIGINAL	DIRECTLY INTER-CHANGEABLE	USE WITH ADAPTER	CHANGE OR ADD FIL VOLTAGE	ADAPTER PLUS FIL VOLT CHANGE
6D6	78, 77, 6C6	6J7GT, 6SJ7GT, 7C7, 6W7G, 6K7GT, 6SK7GT, 7B7, 6SS7, 6U7G, 7A7, 6S7G	57, 58	12J7GT, 12SJ7GT, 12SK7GT, 12K7GT, 14A7/12B7, 14C7
6D8G	6A8GT, 6J8G	6A7, 7A8, 7B8, 7J7, 7S7	2A7	
6E5	6AB5-6N5		2E5	
6E6				
6F5GT		6K5G, 6SF5GT, 7B4, 6AD5G		
6F6GT/G	6K6GT/G, 6V6GT/G	42, 41, 7C5, 7B5	2A5	14C5
6F7		6P7G		
6F8G		6SN7GT, 7N7, 6AH7GT		14N7, 12SN7GT
6G6G		6AK6		
6H4GT				
6H6GT/G	6X5GT/G, 6ZY5G	7A6, 7Y4, 7Z4, 84	12H6	14Y4
6J5GT/G	6C5GT, 6L5G	6C4, 7A4	12J5GT	14A4
6J6				
6J7GT	6W7G, 6S7G, 6U7G	6SJ7GT, 77, 7A7, 7B7, 7C7, 6C6, 6D6, 78, 6SK7GT, 6SS7	12J7GT, 12K7GT	12SJ7GT, 12SK7GT, 14C7, 58, 57, 14A7/12B7
6J8G	6A8GT, 6D8G	7J7, 7A8, 7B8, 7S7, 6A7	12A8GT	2A7, 14B8, 14J7, 14S7
6K5GT		7B4, 6AD5G, 6F5GT, 6SF5GT		12SF5GT, 12F5GT
6K6GT/G	6F6GT/G, 6V6GT/G	41, 42, 7B5, 7C5	2A5	14C5
6K7GT	6S7G, 6U7G, 6W7G	7A7, 7B7, 6SK7GT, 6D6, 78, 6SS7, 6C6, 6SJ7GT, 77	12J7GT, 12K7GT	12SK7GT, 12SJ7GT, 14A7/12B7, 14C7, 58, 57
6K8GT			12K8GT	
6L5G	6J5GT/G, 6C5GT	6C4, 7A4		14A4, 12J5GT
6L6G		6AH5G, 6AL6G		
6L7G				
6M8GT				

READ EXPLANATORY NOTES (ON PAGE 35) BEFORE ATTEMPTING TUBE SUBSTITUTION

RAYTHEON

ORIGINAL	DIRECTLY INTER-CHANGEABLE	USE WITH ADAPTER	CHANGE OR ADD FIL VOLTAGE	ADAPTER PLUS FIL VOLT CHANGE
6N6G	6AB6G	6B5	25N6G	25B5
6N7GT/G		6A6		53
6P5GT	6AF5G	76		
6Q7GT	6T7G/6Q6G	6SQ7GT, 7B6, 7C6, 75	12Q7GT	12SQ7GT, 2A6, 14B6
6R7GT		6SR7GT, 6ST7, 7E6		12SR7GT, 14E6
6S7G	6K7GT, 6U7G, 6W7G	7A7, 7B7, 6SK7GT, 6D6, 78, 6SS7, 77, 7C7, 6SJ7GT	12K7GT, 12J7GT	12SK7GT, 58, 57, 12SJ7GT, 14C7, 14A7/12B7
6SA7GT/G		7Q7	12SK7GT	14Q7
6SC7GT	6SL7GT	7F7, 6C8G	12SL7GT, 12SC7	14F7
6SD7GT	6SE7GT, 6SG7, 6SH7GT	7G7, 7H7, 7L7, 7T7	12SG7, 12SH7GT	14H7
6SE7GT	6SD7GT, 6SG7, 6SH7GT	7G7, 7H7, 7L7, 7T7	12SG7, 12SH7GT	14H7
6SF5GT		7B4, 6AD5G, 6F5GT, 6K5GT	12SF5GT	12F5GT
6SF7		7E7, 6B7, 6B8GT	12SF7	2B7, 14E7, 12C8
6SG7	6SH7GT, 6SD7GT, 6SE7GT	7G7, 7H7, 7L7, 7T7	12SG7, 12SH7GT	14H7
6SH7GT	6SG7, 6SD7GT, 6SE7GT	7G7, 7H7, 7L7, 7T7	12SG7, 12SH7GT	14H7
6SJ7GT/G	6SS7, 6SK7GT	6J7GT, 6W7G, 7C7, 6C6, 77, 6K7GT, 6U7G, 6S7G, 78, 7A7, 7B7, 6D6	12SJ7GT, 12SK7GT	12J7GT, 12K7GT, 14C7, 58, 57, 14A7/12B7
6SK7GT/G	6SS7, 6SJ7GT	6J7GT, 6W7G, 7C7, 6C6, 77, 6K7GT, 6U7G, 6S7G, 78, 7A7, 7B7, 6D6	12SK7GT, 12SJ7GT	12J7GT, 12K7GT, 14C7, 58, 57, 14A7/12B7
6SL7GT	6SC7GT	7F7, 6C8G	12SL7GT, 12SC7	14F7
6SN7GT		6AH7GT, 6F8G, 7N7	12SN7GT	14N7, 14AF7, 12AH7GT
6SQ7GT/G		6T7, 6Q6G, 6Q7GT, 7B6 6B6G, 75, 7K7, 7C6		2A6
6SR7GT	6ST7	6R7GT, 7E6	12SR7GT	14E6
6SS7	6SK7GT, 6SJ7GT	6K7GT, 6S7G, 6U7G, 6D6, 78, 7B7, 7A7, 6J7GT, 6W7G, 77, 7C7, 6C6	12SK7GT, 12SJ7GT	58, 12K7GT, 14C7, 14A7/12B7, 57, 12J7GT

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ORIGINAL	DIRECTLY INTER-CHANGEABLE	USE WITH ADAPTER	CHANGE OR ADD FIL VOLTAGE	ADAPTER PLUS FIL VOLT CHANGE
6ST7	6SR7GT	6R7GT, 7E6	12SR7GT	14E6
6T7G-6Q6G	6B6G, 6Q7GT	6SQ7GT, 7B6, 7C6, 7K7, 75	12Q7GT	2A6, 14B6, 12SQ7GT
6U5-6G5				
6U6GT	6W6GT, 6Y6G	7A5	12A6GT	14A5
6U7G	6K7GT, 6S7G, 6W7G, 6J7GT	6D6, 6SK7GT, 6SS7, 7A7, 78, 6C6, 6SJ7GT, 77, 7B7, 7C7	12K7GT, 12J7GT	14A7/12B7, 14C7, 12SK7GT, 12SJ7GT, 58, 57
6V6GT/G	6K6GT, 6F6GT	7C5, 41, 42, 7B5		2A5
6V7G		85		55
6W5G	6X5GT/G, 0Z4, 6ZY5G	7Y4, 7Z4, 84		14Y4
6W6GT	6U6GT, 6Y6G	7A5	12A6GT	14A5
6W7G	6J7GT, 6K7GT, 6S7G	77, 6C6, 7C7, 6SS7, 6SJ7GT, 7A7, 7B7, 6SK7GT, 6D6, 78	12J7GT, 12K7GT	12SJ7GT, 12SK7GT, 14A7/12B7, 14C7, 58, 57
6X5GT/G	6W5G, 0Z4, 6ZY5G	84, 7Y4, 7Z4		
6Y6G	6U6GT, 6W6GT	7A5	12A6GT	14A5
6Y7G		79		
6Z7G				
6ZY5G	6X5GT/G, 6W5G, 0Z4	7Y4, 7Z4, 84		14Y4
7A4		6J5GT, 6L5G, 6C4, 6C5GT	14A4	12J5GT
7A5		6U6GT, 6Y6G, 6W6GT	14A5	12A6GT
7A6	7Y4, 7Z4	6H6GT/G, 6X5GT/G, 6ZY5G, 84	14Y4	
7A7	7B7, 7C7	6SK7GT, 6SS7, 6D6, 6K7GT, 6S7G, 6U7G, 78, 77, 6C6, 6J7GT, 6SJ7GT, 6W7G	14A7/12B7, 14C7	12K7GT, 12SJ7GT, 12J7GT, 12SK7GT, 57, 58
7A8	7B8, 7S7, 7J7	6A7, 6A8GT, 6D8G, 6J8G	14B8, 14J7, 14S7	2A7, 12A8GT
7B4		6AD5G, 6SF5GT, 6F5GT, 6K5GT		12SF5GT, 12F5GT
7B5	7C5	6K6GT, 6F6GT, 41, 6V6GT, 42		2A5, 14C5

READ EXPLANATORY NOTES (ON PAGE 35) BEFORE ATTEMPTING TUBE SUBSTITUTION

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ORIGINAL	DIRECTLY INTER-CHANGEABLE	USE WITH ADAPTER	CHANGE OR ADD FIL VOLTAGE	ADAPTER PLUS FIL VOLT CHANGE
7B6	7C6	6SQ7GT, 6T7G-6Q6G, 6B6G, 6Q7GT, 7K7, 75	14B6	2A6, 12SQ7GT, 12Q7GT
7B7	7A7, 7C7	6SK7GT, 6SS7, 6D6, 6K7GT, 6S7G, 6U7G, 78, 77, 6C6, 6J7GT, 6SJ7GT, 6W7G	14A7/12B7, 14C7	58, 12K7GT, 12J7GT, 12SK7GT, 12SJ7GT, 57
7B8	7A8, 7S7, 7J7	6A7, 6A8GT, 6D8G, 6J8G	14B8, 14J7, 14S7	2A7, 12A8GT
7C5	7B5	6K6GT, 6V6GT, 41, 42, 6F6GT	14C5	2A5
7C6	7B6	6B6G, 6Q7GT, 6SQ7GT, 7K7, 6T7G-6Q6G, 75	14B6	2A6, 12SQ7GT, 12Q7GT
7C7	7A7, 7B7	77, 6C6, 6SJ7GT, 78, 6J7GT, 6W7G, 6SS7G, 6K7GT, 6SK7GT, 6S7G, 6U7G, 6D6	14A7/12B7, 14C7	12SJ7GT, 12SK7GT, 12K7GT, 12J7GT, 57, 58
7E5				
7E6		6R7GT, 6ST7, 6SR7GT	14E6	12SR7GT
7E7		6B8GT, 6B7	14E7	2B7, 12C8, 12SF7
7F7		6C8G, 6SL7GT, 6SC7GT	14F7	12SL7GT, 12SC7
7G7/1232	7H7, 7L7, 7T7	6SG7, 6SH7GT, 6SD7GT, 6SE7GT	14H7	12SG7GT, 12SH7GT
7H7	7G7, 7L7, 7T7	6SG7, 6SH7GT, 6SD7GT, 6SE7GT	14H7	12SG7GT, 12SH7GT
7J7	7A8, 7B8, 7S7	6A7, 6A8GT, 6D8G, 6J8G	14J7, 14B8, 14S7	2A7, 12A8GT
7K7		7B6, 7C6, 6SQ7GT, 6B6G, 6T7G-6Q6G, 6Q7GT, 75	14B6	2A6, 12SQ7GT, 12Q7GT
7L7	7G7, 7H7, 7T7	6SG7, 6SH7GT, 6SD7GT, 6SE7GT	14H7	12SG7, 12SH7GT
7N7		6F8G, 6SN7GT, 6AH7GT,	14N7, 14AF7	12SN7GT, 12AH7GT
7Q7		6SA7GT/G	14Q7	12SA7GT
7R7			14R7	
7S7	7J7, 7A8, 7B8	6A7, 6A8GT, 6D8G, 6J8G	14S7, 14J7, 14B8	2A7, 12A8GT
7T7	7L7, 7G7, 7H7	6SG7, 6SH7GT, 6SD7GT, 6SE7GT	14H7	12SG7, 12SH7GT
7V7		6AB7/1853	14W7	

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ORIGINAL	DIRECTLY INTER-CHANGEABLE	USE WITH ADAPTER	CHANGE OR ADD FIL VOLTAGE	ADAPTER PLUS FIL VOLT CHANGE
7W7		6AB7/1853	14W7	
7Y4	7Z4	84, 6W5G, 6X5GT/G, 0Z4, 6ZY5G	14Y4	
7Z4	7Y4	6X5GT/G, 6ZY5G, 0Z4, 84, 6W5G	14Y4	
10				
12A	71A			
12A6GT		14A5		
12A7				
12A8GT		14B8, 14J7, 14S7	6A8GT, 6D8G, 6J8G	2A7, 6A7, 7B8, 7J7, 7A8, 7S7
12AH7GT		12SN7GT, 14N7	6AH7GT	6SN7GT, 7N7, 6F8G
12B8GT				
12C8		14E7	6B8GT	6B7, 7E7
12E5GT				
12F5GT		12SF5GT	6F5GT, 6K5GT	6SF5GT, 7B4, 6AD5G
12H6			6H6GT	7A6
12J5GT		14A4	6J5GT, 6C5G, 6L5G	6C4, 7A4
12J7GT	12K7GT	14C7, 14A7/12B7, 12SJ7GT, 12SK7GT	6J7GT, 6W7G, 6U7G, 6K7GT, 6S7G	6SJ7GT, 6SK7GT, 6SS7, 7C7, 6C6, 57, 77, 7A7, 7B7, 58, 78, 6D6
12K7GT	12J7GT	12SK7GT, 12SJ7GT, 14C7, 14A7/12B7	6J7GT, 6W7G, 6U7G, 6K7GT, 6S7G	6SJ7GT, 6SK7GT, 6SS7, 7C7, 6C6, 57, 77, 7A7, 7B7, 58, 78, 6D6
12K8GT			6K8GT	
12L8GT				
12Q7GT		12SQ7GT, 14B6	6Q7GT, 6T7G	7B6, 7C6, 75, 2A6, 6SQ7GT
12SA7GT/G		14Q7	6SA7GT	7Q7
12SC7	12SL7GT	14F7	6SC7GT	7F7, 6C8G, 6SL7GT
12SF5GT		12F5GT	6SF5GT	6F5GT, 6K5GT, 7B4, 6AD5G

READ EXPLANATORY NOTES (ON PAGE 35) BEFORE ATTEMPTING TUBE SUBSTITUTION

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ORIGINAL	DIRECTLY INTER-CHANGEABLE	USE WITH ADAPTER	CHANGE OR ADD FIL VOLTAGE	ADAPTER PLUS FIL VOLT CHANGE
12SF7		14E7, 12C8	6SF7	7E7, 6B8GT, 6B7
12SG7		14H7, 12SH7GT	6SG7, 6SH7GT, 6SD7GT	7H7, 7G7, 7L7, 7T7
12SH7GT		12SG7GT, 14H7	6SG7, 6SH7GT, 6SD7GT	7H7, 7G7, 7L7, 7T7
12SJ7GT/G	12SK7GT/G	12K7GT, 12J7GT, 14A7/12B7, 14C7	6SJ7GT, 6SS7, 6SK7GT	6J7GT, 6K7GT, 57, 77, 6C6, 7C7, 6W7G, 58, 78, 6D6, 6U7G, 6S7G, 7B7, 7A7
12SK7GT/G	12SJ7GT/G	12K7GT, 12J7GT, 14A7/12B7, 14C7	6SJ7GT, 6SS7, 6SK7GT	6J7GT, 6K7GT, 57, 77, 6C6, 7C7, 6W7G, 58, 78, 6D6, 6U7G, 6S7G, 7B7, 7A7
12SL7GT	12SC7	14F7	6SL7GT	6SC7GT, 7F7, 6C8G
12SN7GT		14AF7, 12AH7GT, 14N7	6SN7GT	6SH7GT, 7N7, 6F8G, 6AH7GT
12SQ7GT		14B6	6SQ7GT	6Q7GT, 6T7G, 7B6, 75
12SR7GT		14E6	6SR7GT, 6ST7	7E6
12Z3				
14A4		12J5GT	7A4	6J5GT, 6C6G, 6L5G
14A5		12A6GT	7A5	6U6GT, 6Y6G, 6W6GT
14A7/12B7	14C7	12SK7GT/G, 12K7GT, 12J7GT, 12SJ7GT	7A7, 7B7, 7C7	6D6, 78, 58, 6K7GT, 77, 6SK7GT, 6SS7, 6S7G, 6U7G, 57, 6K7GT, 7B7, 7A7, 6C6
14AF7	14N7	12AH7GT, 12SN7GT	7N7	6SN7GT, 6F8G, 6AH7GT
14B6		12SQ7GT/G, 12Q7GT	7B6, 7C6	75, 6T7G, 6Q7GT, 6SQ7G
14B8	14J7, 14S7	12A8GT	7B8, 7A8, 7J7, 7S7	6A7, 6A8GT, 6J8G, 6D8G, 2A7
14C5			7C5, 7B5	6V6GT/G, 6K6GT, 41, 42, 6F6GT, 2A5

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ORIGINAL	DIRECTLY INTER-CHANGEABLE	USE WITH ADAPTER	CHANGE OR ADD FIL VOLTAGE	ADAPTER PLUS FIL VOLT CHANGE
14C7	14A7/12B7	12SJ7GT, 12J7GT, 12SK7GT, 12K7GT	7A7, 7B7, 7C7	57, 6C6, 6J7G, 6D6, 78, 58, 6K7GT, 6SK7GT, 6SS7, 6S7G, 6U7G, 6S7G, 6K7G, 7B7, 7A7
14E6		12SR7GT	7E6	6SR7GT, 6ST7
14E7		12C8, 12SF7	7E7	6SF7, 6B7, 6B8GT
14F7		12SC7GT, 12SL7GT	7F7	6SL7GT, 6SC7GT, 6C8G
14H7		12SG7, 12SH7GT	7H7, 7G7, 7L7, 7T7	6SD7GT, 6SG7, 6SH7GT
14J7	14B8, 14S7	12A8GT	7J7, 7A8, 7B8, 7S7	6A8GT, 6D8G, 6A7, 2A7, 6J8G
14N7	14AF7	12AH7GT, 12SN7GT	7N7	6SN7GT, 6AH7GT, 6F8G
14Q7		12SA7GT	7Q7	6SA7GT
14R7			7R7	
14S7	14B8, 14J7	12A8GT	7S7, 7A8, 7B8, 7J7	6A8GT, 6D8G, 6A7, 6J8G, 2A7
14W7			7W7	6AB7/1853
14Y4			7Y4, 7Z4	84, 6X5GT, 6W5G, 0Z4
15				
19		1J6G		
20				
22				
24A	35/51			
25A6GT/G		43		
25A7GT/G				
25AC5GT				
25B5		25N6G		
25B8G				
25B8GT				
25C6G			50C6G	

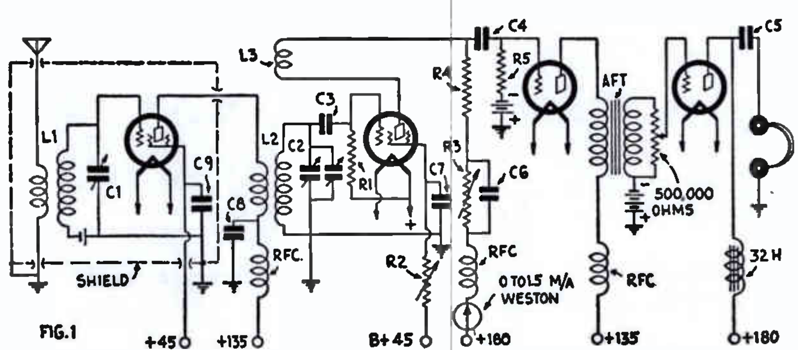
READ EXPLANATORY NOTES (ON PAGE 35) BEFORE ATTEMPTING TUBE SUBSTITUTION

The Superior Short Wave Receiver Used at G2DT

By E. T. SOMERSET,
Owner and Operator

This article gives the S-W "ham" an idea of what is being used in England for the reception of long distance signals.

THE receiver, seen in the photograph of experimental station G2DT, is designed for amateur code and broadcast phone reception. From the diagram, it will be seen that it employs a screen-grid T.R.F. stage, followed by a screen-grid detector. Out of fairness, I must state that the screen-grid tubes used here are "Mazda SG-215" which are identical in micromhos with the American '24; but their grid-to-plate capacity is five times less



Wiring diagram of G2DT short wave receiver, employing one shield grid R.F. stage ahead of regenerative detector, feeding into a resistance-coupled A.F. stage and then into a second transformer-coupled stage.

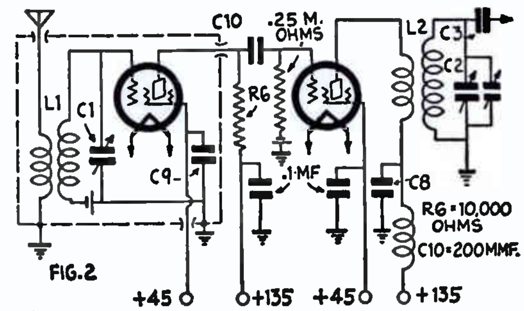
All values and coil-winding data are appended to the diagram.

C1 = 100 mmf.
C2 = Tank 94 mmf.
Vernier 18 mmf.
C3 = 150 mmf.
C4 = 0.01 mf. Mica
C5 = 4.0 mf.
C6 = 4.0 mf.
C7 = 0.1 mf.
C8 = 2.0 mf.
C9 = 0.1 mf.
R1 = 4 Mr.
R2 = 25,000 r.
R3 = 50,000 r.
R4 = 100,000 r.
Wire Wound.
R5 = 0.5 Mr.

One way of explaining this difference between the screen-grid tube and the ordinary "triode" is to say that, in the circuit of the latter, where the load impedance is usually higher than the plate resistance, the current through the load is determined more by the load impedance than by the plate resistance. In the screen-grid circuit, the plate resistance is almost invariably higher than the load impedance; and the current is determined mostly by the plate resistance instead of the load impedance.

The maximum output from the screen-grid tube, used as a detector, is obtained when the load resistance is equal to the plate resistance of the tube. This, however, is impracticable; as it would mean a plate resistor of the order of one megohm and would cause an appalling drop in the voltage applied to the plate of the tube. It is necessary, therefore, to strike a balance and, if 300 volts "B" is available, it is usual to use a plate resistor of the value of 250,000 ohms. If the available voltage is only 180, then it behooves us to use a resistor of 100,000 ohms, to obtain efficiency. This value is shown in the diagram at R4.

It will be observed that a variable resistor is shown at R2, and with good reason. The screen-grid tube is, in reality, extremely critical as to the screen-grid voltage, when functioning as a detector; and this control, when properly regulated, will show a reading of the order 0.8= to 1.0= milliampere upon the meter in the plate circuit. Such a reading will be indicative of correct functioning.



This diagram shows method of adding another R.F. untuned stage to G2DT's receiver.

The coil forms used are "R.E.L.," whose average diameter is 1¾ inches; they are of truly skeleton construction and, if wound with 27/42 D.S.C. Litzendraht wire, will be found to be extremely efficient. For C1 and the tank capacity C2, the Hammarlund "MC/23" condensers can be used as very little surplus metal appears in their construction. The vernier, which is wired in parallel with C2, is an "R.E.L." adjustable, but Cardwell's new type will serve just as well.

When the set is used as an amateur-band receiver, the tank C2 is set by means of a wavemeter in the desired band; and the stator of the vernier is adjusted at such a distance from the rotor that full dial-spread is obtained. When it is desired to listen to short-wave broadcasting, then the tuning is done on C2 and the vernier is used for an accurate setting of resonance.

INDUCTANCE DATA TURNS

	L1		L2		L3
3,500-Kc.	Prim: 9	Secy: 15	Prim: 9	Secy: 15	6
7,000-Kc.	Prim: 4⅓	Secy: 7	Prim: 4⅓	Secy: 7	6
14,000-Kc.	Prim: 2⅔	Secy: 3⅓	Prim: 2⅔	Secy: 3⅓	5
28,000-Kc.	Prim: 1	Secy: 1⅔	Prim: 1	Secy: 1⅔	5

SPACING BETWEEN TURNS

	L1		L2		L3
3,500-Kc.	Prim: 1/32"	Secy: 1/32"	Prim: 1/32"	Secy: 1/32"	1/32"
7,000-Kc.	Prim: 1/16"	Secy: 1/16"	Prim: 1/16"	Secy: 1/16"	1/32"
14,000-Kc.	Prim: ¼"	Secy: ¼"	Prim: ¼"	Secy: ¼"	1/32"
28,000-Kc.	Prim: ⅛"	Secy: 1/16"	Prim: ⅛"	Secy: 1/16"	⅛"

⅛" gap allowed between WINDINGS

How to Obtain Smooth Regeneration in S-W Receivers

By ROBERT (BOB) HERTZBERG

The author explains, in simple terms, how to connect the apparatus in short-wave receivers so that regeneration will be smooth over the entire dial. The cause of "dead spots" on the dial is explained, as well as the best hook-ups for the regenerative circuit.

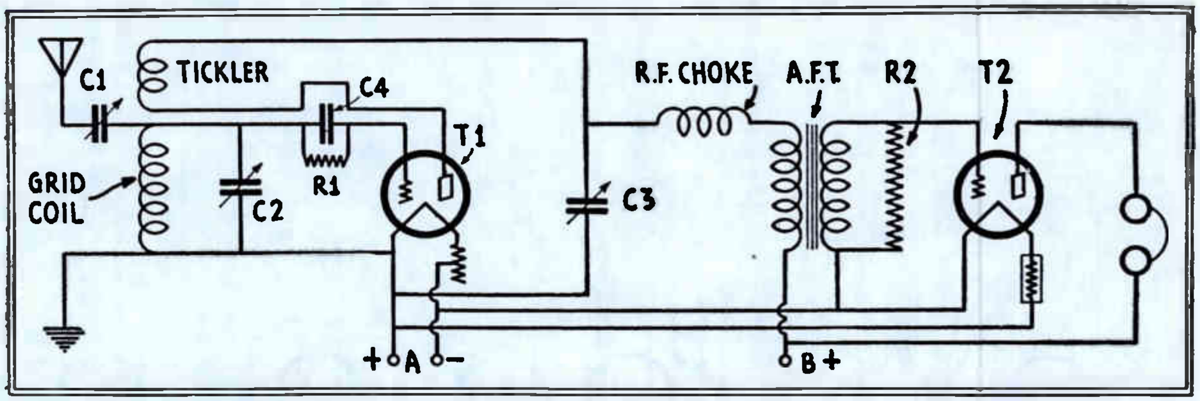


Fig. 1. The common regenerative circuit used for short wave reception is shown above. If the set breaks forth into a loud howl on the very point of oscillation, you should connect resistance R-2, of about 100,000 ohms value, across the secondary of the A. F. T.

CRITICAL, cranky regeneration controls are responsible more than any other single factor for the failure of short-wave receivers to produce satisfactory results. Many otherwise excellent sets are discarded in disgust by their purchasers when they show themselves to be difficult to operate, yet they can be adjusted properly without any trouble at all. An irregular regeneration control apparently makes the tuning unduly sharp, and even very high ratio tuning dials do not help.

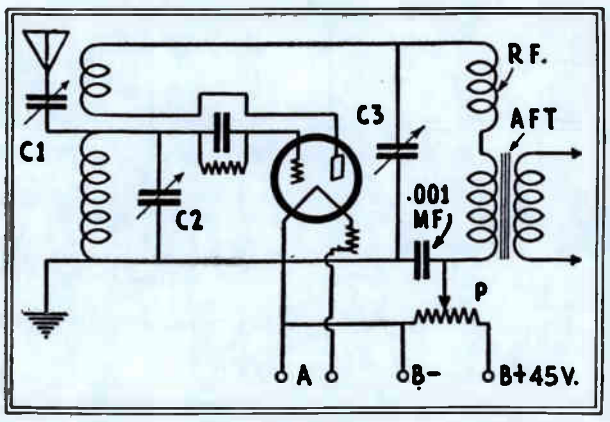


Fig. 2 above shows how to smooth up the regeneration control on short wave receivers—use a potentiometer at "P," to give fine control of the plate voltage.

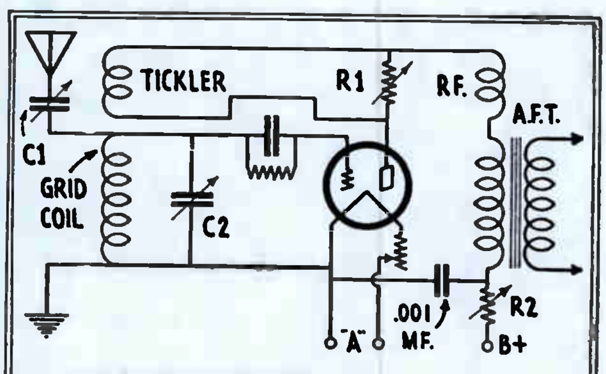


Fig. 3 shows still another way of controlling regeneration by varying the plate potential on the detector tube with a finely variable resistance R-2; and also by the variable resistor R-1.

It is best to provide a potentiometer P in the "B" circuit, as shown in Fig. 2. This should be of the 100,000 ohms size. One end goes to "B" plus 45, the other to "B" minus, and the arm to the "B" post of the audio transformer primary.

Many straight regenerative short-wave receivers have what are known as "dead spots"

The remedy is to adjust the antenna coupling condenser C1 or to use a smaller one.

This article will attempt to explain a few methods for taming down a too-lively circuit and for making it work smoothly and easily. The suggestions apply to all types of short-wave receivers, as they all use a regenerative detector, with and without tuned or untuned R.F. amplification and with one, two or three stages of resistance or transformer coupled A.F. amplification.

First let us study the diagram of Fig. 1. This shows the usual straight regenerative short-wave circuit, with one stage of audio for headphone reception. The antenna

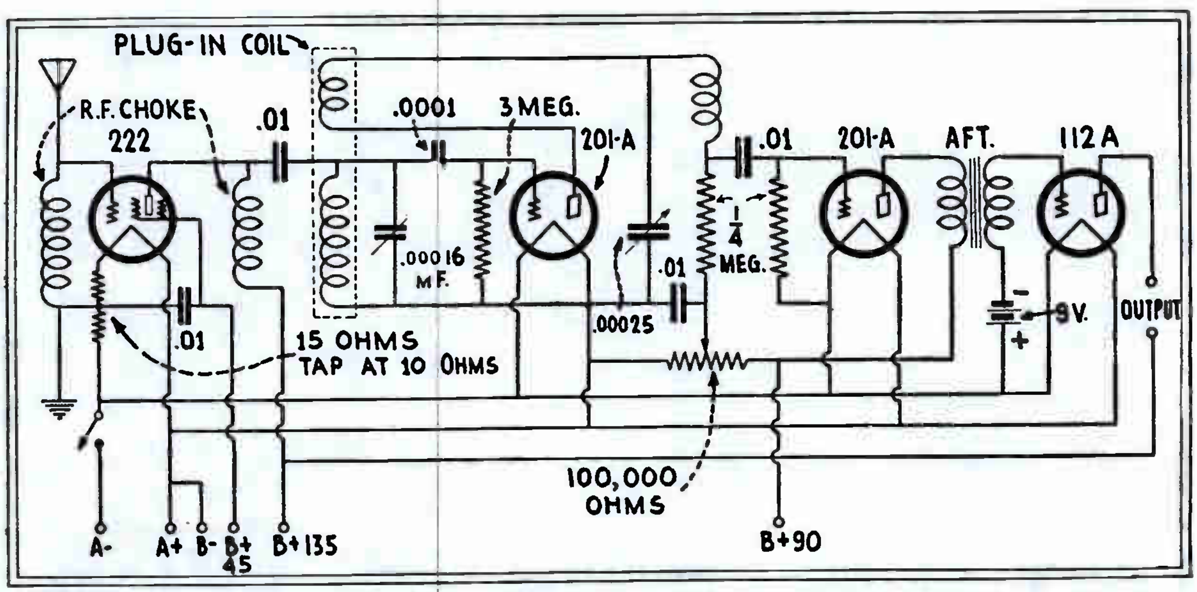


Fig. 4 above shows connection of a 222 tube in the RF circuit ahead of the detector, with detector feeding into a resistance-coupled stage of audio frequency amplification. The use of a screen grid tube eliminates dead spots on the tuning dial.

is coupled to the grid coil through a small condenser C1, the grid coil being tuned by a variable condenser C2, usually of .00016 mf. Regeneration is secured by means of a tickler coil wound over the same form holding the grid coil. The regenerative action is controlled by another variable condenser C3, of about .00025 mf. The detector T1 is led to an audio amplifier tube T2 through a standard A.F. transformer, AFT.

Causes of Regeneration

Now the tendency of the detector tube to regenerate is determined by several factors: the size of the tickler coil and its proximity to the grid coil, the value of the detector plate voltage, the setting of condenser C3, the characteristics of the particular tube, and to a lesser extent the quality of the R.F. choke in the transformer primary circuit. Contrary to general opinion, the grid leak is not at all critical, three megohms being just about right for practically all types of both battery and A.C. detector tubes.

If the tickler is of the right size and the plate voltage correct, the detector should slide into regeneration and finally oscillation with a soft, hushing sound as the condenser C3 is turned in. Furthermore, when the set is tuned to the high end of its wave range, with any particular plug-in coil in place, oscillation should take place as the condenser C3 reaches maximum

How to Eliminate Howling

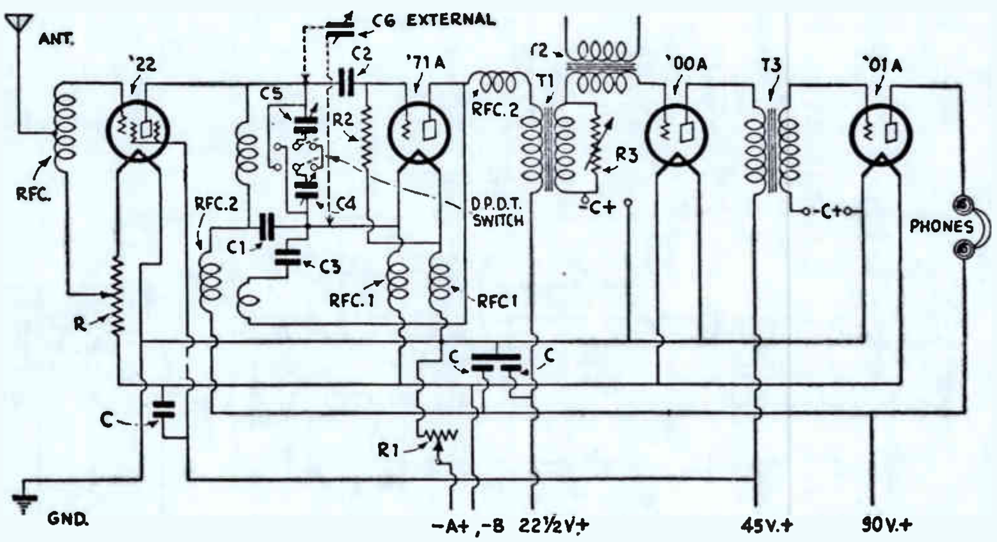
After the hushing sound has given way to the gentle "plunk" that indicates oscillation, you should hear nothing more than a few faint tube noises. If the set breaks forth into a loud howl on the very point of oscillation, you will have to connect a resistance R2 (Fig. 1) across the secondary of the audio transformer. This "fringe howl" effect is exceedingly annoying, as it occurs at the very point where weak stations are generally heard. The resistance R2 should be about 100,000 ohms (.1 megohm). Sometimes, but not always, adjustment of the grid leak R1 helps to eliminate this very undesirable howl.

If you find that the set jumps suddenly into oscillation, with little or no preliminary hushing sound, and with only a degree or two of condenser C3 dial movement, don't waste your time trying to tune for foreign stations, as you won't be successful. To smooth out the control, first try reducing the "B" voltage, if it is not already low Cut it down from 45 to 22½, and see if regeneration occurs more smoothly. If this reduction helps somewhat, but not enough, you must reduce it even more. It is quite surprising to see how easily most short-wave circuits oscillate with only eight or ten volts on the plate of the detector.

The "HAM'S OWN" Receiver

By NORMAN B. KRIM

This receiver has a "band-spreader," improved antenna coupling, a monitor circuit for use when transmitting, means to prevent howling and a range up to 700 meters.



Mr. Krim, the designer of this novel and improved short (and long) wave receiver has operated an amateur station and knows the points which a "ham" looks for in such a set. This set has a condenser switch which gives a "band - speaker" action when wanted, as on the amateur bands; improved antenna coupling through a tapped choke, and provision for tuning in the broadcast wavelengths, in fact waves up to 700 meters.

EACH year short-wave receivers have been designed and redesigned but, with radio in its present transient state, we can not decide on any particular type. New discoveries and new uses are constantly changing the short-wave receiver.

Considering these facts, a design has been formulated with evident appeal for both the licensed and the unlicensed amateurs who are searching for a receiver which has a number of new features. The set in mind was intended primarily for the transmitting amateur, who wants a single receiver to cover efficiently the waves from seven hundred down to five meters. Other features are a high-gain untuned stage of screen-grid R.F. amplification, adequate band spreading, very smooth control of regeneration and, lastly, excellent "DX" possibilities.

For anyone to guarantee distant reception on short waves is absurd; but to claim that, for given conditions, more distant reception is possible is well in order. The receiver to be described has proved itself selective by intercepting seventeen different Australian signals in one morning's operation, in a New York City apartment house—equipped with everything electrical from elevator to the Frigidaire.

Detailed constructional information is, many times, useless because each enthusiast assembles things according to his own methods. Nevertheless, there are a few salient features which must not be overlooked, if satisfactory operation is to be expected.

A modern four-tube screen-grid circuit has been redesigned to satisfy my needs. Either A.C. or D.C. power supply can be incorporated; although, on ultra-short waves, direct current is found to be better because of the objectionable hum A.C. supply introduces.

In these modern days of high power and selectivity, the receiving antenna is apt to be neglected; but reception can be seriously impaired by a poor aerial. A well-insulated wire, about fifty feet long, will suffice. On short waves the set operates more efficiently without a ground; on long waves a ground connection is requisite for good volume.

Some Circuit Details

The antenna choke coil is novel, because the antenna current is fed to the center tap instead of to the grid end. The effect of this change is an excellent increase in volume. The choke-coil constants are found to vary considerably for different sets. Below twenty meters the efficiency of the entire R.F. stage is so low that the screen-grid tube is removed from its socket and the antenna is coupled to the detector in any one of the popular ways, either by induction, capacity, or directly per usual hook-up. The last method is employed here because the receiving antenna at the writer's station is a twenty-meter transmitting aerial. With such a condition, signal strength is increased considerably on harmonics of twenty meters where this system is used.

The detector circuit is heavily guarded, against radio-frequency current leakage, by numerous chokes and by-pass condensers. Taking this precaution is well worth while, for regeneration is smooth. A long lead to the "B —" is one of the little known causes of audio howl; by shortening this connection to a foot, or even two, and placing an R.F. choke in the lead this tendency is vastly reduced. The lead from the coil socket, to the grid condenser, to the grid must be extremely short. It is good policy to solder the grid condenser to these sockets. The grid leak should be mounted to the tube socket on metal clips, also soldered. All radio-frequency leads in the detector stage must be direct. Care should be taken to keep the grid and plate leads apart; for, the closer they are, the higher the effective capacity in the detector tank and the more difficult it will be to operate on ultra-short waves. Grid leaks and grid condensers have not been found critical. A five-megohm resistance proved to be satisfactory with a .00015-mf. capacity. The higher the value of the afore-mentioned grid leak, the better the control of regeneration though at a sacrifice of sensitivity due to an excessive grid bias.

How Wide Tuning Range Is Covered

The two tuning condensers are .0001-mf. midgets. The vernier tuning dial is placed on one shaft; the other variable condenser is mounted behind the panel, very near to the first and to the detector unit. A Muter midget double-throw, double-pole switch is suspended on copper pieces drilled to fit the condensers. By means of the switch, the capacities can be put either in series or in parallel, affording not only amateur-band spread but a great extension on both sides of the assigned bands. Interlapping reception, on waves from five up to seven hundred meters, is the result. Another advantage lies in the fact that a set of commercial short-wave coils could be used for all the frequencies except the very high twenty-eight and fifty-six megacycle bands.

A large variable .001-mf. condenser is mounted in its own wooden box outside the receiver; a twisted lamp cord with two clips carries its leads to the set. This capacity is connected across the proper terminals for reception up to seven hundred meters, on the 200-550-meter coil, with more turns added to the tickler. Tuning, in this case, is effected by the large condenser.

The coil socket should be as sturdy as possible; the inner contact arms should also be very durable, for they are subject to many strains and stresses when changing plug-in inductances often.

A Monitor for Transmission

The audio system is conventional, except for the extra audio transformer. The primary is to be connected to the monitor or the audio oscillator. By inserting a double-pole single-throw switch in the filament leads of the receiver and either added circuit, the effect of putting the set off for transmission will automatically supply reception of the code which is being sent. This condition is almost required with a D.C. note and an automatic key.

A variable resistance across the secondary of the first transformer serves as an adequate volume control. A sure cure for a howling audio system is the use of a 200A in the first stage; although no trouble in this respect should be experienced with this circuit.

The subject of plug-in inductances can not be treated fully here; since each set requires different numbers of turns to tune to the same wave, because each set has a different natural capacity and inductance due to the variations in the wiring and other changing components. Some information on the very high-frequency coils will not be amiss.

Calibration of Ultra-Short-Wave Coils

The secondaries of the two smallest coils, for five and ten meters, are about one and a half and three turns respectively. The windings are on an old tube base and are spaced about one-quarter inch. The tickler windings should be placed in between these secondary turns. No accurate data can be given for these coils. The most efficient method to have the receiver on ten and five meters is to roughly calibrate it from a simple 201A oscillator, with any low plate supply, such as the house main; a Hartley circuit is excellent. Set the transmitter on twenty and listen to the receiver on forty where a note of the set will be heard if the apparatus is functioning as it should. (You will be listening, not to the transmitter's harmonic, but to the receiver's because an oscillator can not have harmonics over the fundamental wavelength.) Then adjust the inductance of the ten-meter coil until the transmitter note is heard.

This process can be speeded by making use of the following procedure: Wind about three turns on the grid coil and about the same on the tickler, after having removed the screen-grid tube, of course, and also the antenna which can be attached later. Adjust the tickler coil until oscillation is secured; if the note is not heard, turn the transmitter dial until it is. By noting which way the capacity was varied the coil can then either be decreased or increased until reception of the note is gained. The procedure for the five-meter coil is similar, except that the oscillator or transmitter is operated on ten meters.

Adding Untuned Radio Frequency Stage to Walker Flexi-Unit

No additional tuning control is added, generally speaking, and the increased strength of signal that is obtained when this stage of resistance-coupled, shield-grid amplification is added ahead of the Walker Flexi-unit, (or any other one tube short wave receiver for that matter) is very surprising and gratifying.

Where a fairly long aerial is used or in the event that too many dead spots are noticed in the tuning, the midget condenser connected between the terminals 6 and 8 on the Walker Flexi-unit, may be connected in series with the antenna and by turning this condenser the dead spots can be eliminated. In the writer's case varying the coupling condenser served a similar purpose.

The list of parts needed in adding this untuned radio frequency stage to the Walker Flexi-unit is as follows:

1—Variable resistor 10,000 to 100,000 ohms; Bradleyohm, Clarostat, etc.
1—Adjustable 6 to 10 ohm resistor
1—15 to 20 ohm filament rheostat
1—2 M.F. by-pass condenser, 250 volt rating
1—85 M.H. radio frequency choke
1—50 MMF. midget condenser for coupling plate circuit to Walker Flexi-unit
1—0 to 1,000 ohm variable resistor; Bradleyohm or Clarostat, etc.
1—Bradleystat or other filament rheostat to add in series with A battery to Walker Flexi-unit
1—'22 Screen Grid tube
1—Detector tube, '99, etc., depending upon filament voltage used.

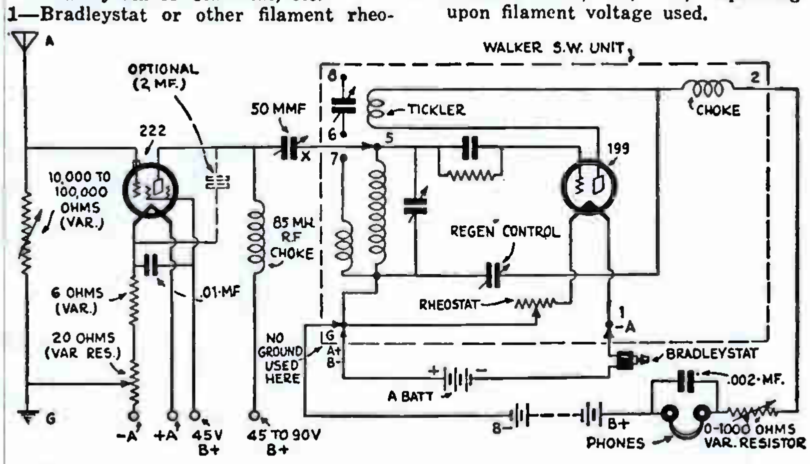


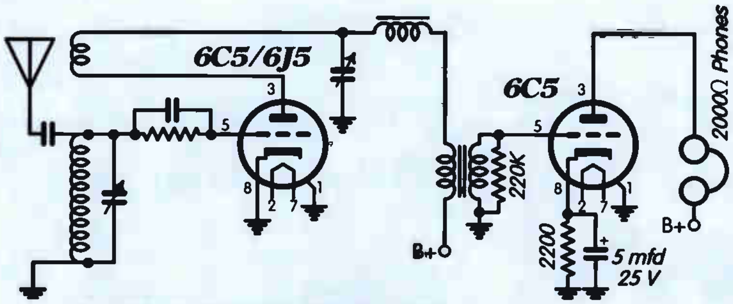
Diagram above shows how to add an untuned, screen grid, radio frequency stage to the "Walker Flexi-Unit", resulting in much stronger signals and pick-up range. This circuit was tried out with gratifying success.

Practical Ideas for Using Newer Tubes in Older Circuits

The circuits you find before 1927 or 1928 usually use hard-to-find triodes having only a filament, grid and plate, but no cathode. These tubes can be difficult to use because of unusual sockets, voltages, currents and lower gain. Later metal octal tubes on the other hand, can be plugged into common plastic relay sockets, use 6.3 volt AC on the filaments, and provide plenty of gain. And they're still readily available at reasonable prices.

How would an experimenter modify a very old schematic to use the newer tubes? Here are some ideas.

On page 30 of How to Make Shortwave Receivers (elsewhere in this manual) you'll find in figure 1 a two triode regenerative receiver. Converting it to octals is really quite straight forward. We redraw the circuit to get this:



Two Triode Regenerative Receiver

A pair of common 6C5 triodes should work fine. You might want to put a 6J5 in the detector. It has the same basing as the 6C5 but provides more gain at higher frequencies.

The grid leak is still the same as most: 100 or 200 pfd with a 1 to 5 meg resistor across it. With the grid-leak pair furnishing the negative bias voltage needed, no resistor is needed in the cathode lead. It can be tied directly to ground.

Capacitor C3 controls regeneration in the redrawn circuit just as it did in the original.

The "A.F.T." is an audio transformer. You can use a common interstage transformer taken from an old tube amplifier, or purchased new. I would use a 3:1 interstage with the 3 side connected to the second triode grid. The 220K resistor across the secondary should be enough to suppress fringe howl. Check more modern circuits and just use a choke if you have a large one.

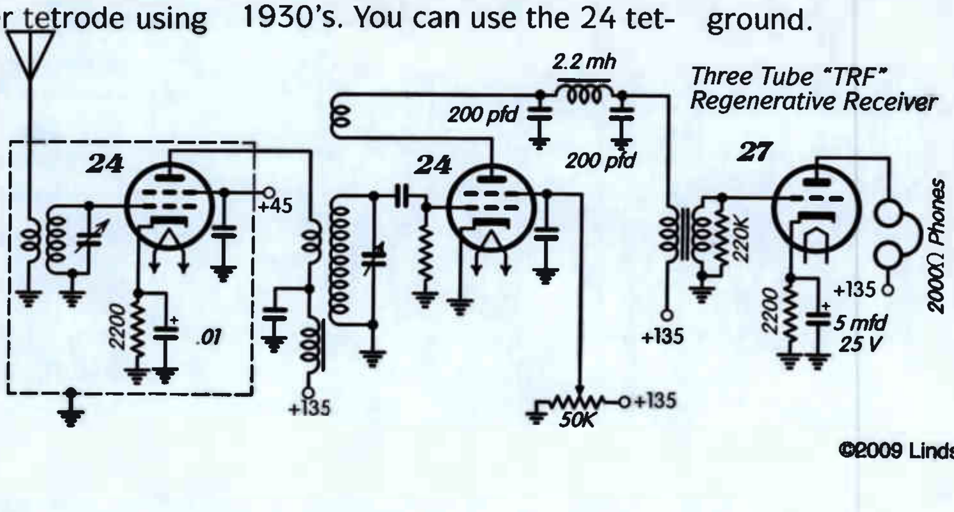
In using a 6C5 as an audio amplifier, you'll need to provide negative grid bias so that you get decent amplification with minimum distortion, or at the very least, to avoid overheating the tube through excessive current draw. That could also burn out the headphones. So the resistor and electrolytic capacitor in the cathode lead of the second 6C5 is vitally important.

In the main figure on page 50 of How to Make Shortwave Receivers (elsewhere in this manual) we see a four tube receiver. We have a tetrode running wide open as a tuned rf amplifier followed by another tetrode using ticklerfeedback. Regeneration is controlled by varying the screen grid voltage. Then a third tube, a triode, provides audio amplification while keeping RF from the detector stage out of the final AF stage.

You might want to try using 2.5 volt AC filament tubes that were popular from the late 1920's through the early 1930's. You can use the 24 tetrode and 27 triode to replace the original tubes. You should probably experiment with different resistors in the cathode circuits until you get about 3 volts between cathode and ground.

The detector circuit is almost unchanged, but the third tube has been eliminated. To keep RF out of the am-

Three Tube "TRF" Regenerative Receiver

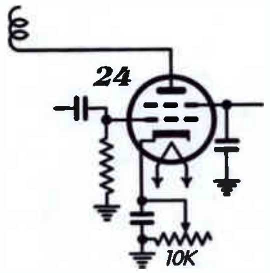


plifier tube, a 27 triode, it's important to put in a filter made up of the usual 2.5mH and 200 pfd capacitors.

The final 27 audio stage is essentially identical to the 6C5 stage above. The missing tube is not needed because the more modern tubes provide more than twice the gain of both of the original tubes put together.

The biggest changes come about in biasing in the RF amp and AF amp. The detector will work just the same with a grid-leak bias. If you examine the original schematic, you'll see batteries near R5 and at the 500,000 ohm pot in the audio stage. The batteries provide the bias in the old set that comes from cathode resistors in our redrawn version.

In using the 24 as a regenerative detector, you might want to try putting a 10K pot in the cathode lead to ground to radically change bias conditions

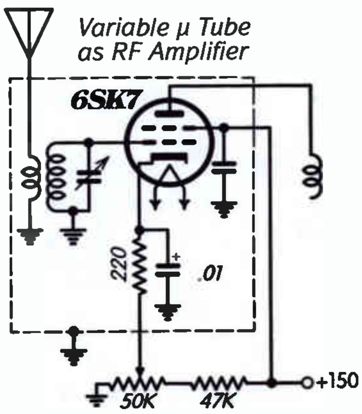


Experimental Biasing of Regenerative Detector Tube

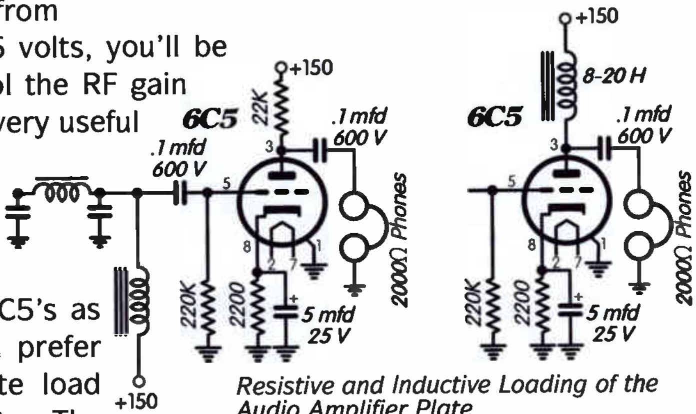
and see if better performance results. It's not really needed, but will allow some experimentation by adding more negative bias. The biggest problem I've encountered using 24's is their susceptibility to AC hum. The problem can be solved by putting a metal shield around the tube. If you don't have one, use a tin can that comfortably fits around the tube, anchoring it to the chassis or breadboard with brackets.

If you want to step up a notch you can use metal octal tubes. I would use a 6SK7 variable-mu pentode in the RF and detector stages. If you put a resistor circuit into the cathode lead of the 6SK7 so that you can vary the cathode voltage from 0 to about 35 volts, you'll be able to control the RF gain which can be very useful should you come across very powerful signals.

Variable μ Tube as RF Amplifier



In using 6C5's as audio amps, I prefer to add a plate load choke or resistor. The original 32 henry choke can be anything from 8 to 40 henries in our new circuit. The exact value is not at all critical. A power supply choke will often do the job, although they tend to be physically large since they need to handle lots of current. I commonly use a 22K resistor and 150 volts on the plate as shown.



Resistive and Inductive Loading of the Audio Amplifier Plate

How to Gain DETECTOR SENSITIVITY

By MANDER BARNETT

Several important factors bearing on detector operation and sensitivity are discussed; also the cause and cure of "howling".

WITH due respect to all the other parts which go to make up the average short-wave receiver, it can truthfully be said that the detector tube and its component parts, are the most important parts of *any* short-wave receiver and should, therefore, receive first attention.

Again, the short-wave receiver has to make use of a regeneration control—the average broadcast receiver has none—and, therefore, we have to set about making this control as easy and smooth working as possible:—not always quite so easy as it sounds.

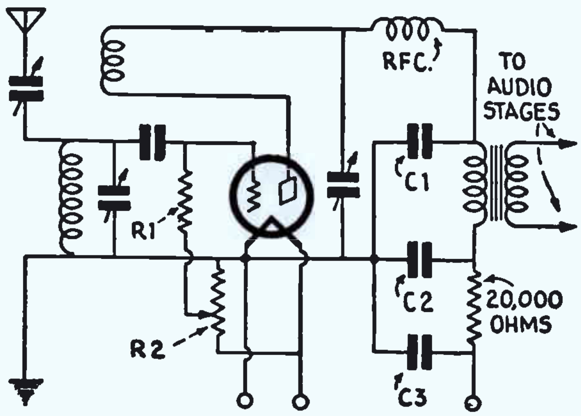
When somebody will design a short-wave R. F. amplifier with, say, three stages which will give as much amplification if they were being used on the ordinary broadcast band, then there will not be so much need to worry about extreme detector sensitivity as far as the short-waver is concerned. Nobody, however, seems to have done this yet, and we must devote our attention to the detector stage and spend much time and temper trying to make it perk.

At some time or other, practically every short-wave fan has met the receiver which stops oscillating at, say, 50 degrees on the regeneration dial (most modern short-wavers don't have the regeneration dial marked in degrees, but, for the sake of argument, we'll assume that they have) and then starts again at about 40. Well, it's absolutely hopeless trying to get China or Europe on a set that plays like that! So, if your own short-waver shows signs of this trouble, get down to it at once and see what can be done about it.

Grid Leak Value a Compromise

The commonest cause of trouble in this direction is the grid leak. Some short-wave fans prefer low resistance such as 2 megohms; while others always support the use of a much higher value, such as a 10 megohm leak. It is certainly true that the high value will practically always give you a smooth regeneration control; but, at the same time it results in a general loss of detector sensitivity and it will be found that the reproduction is not so clear-cut, because the higher notes of the musical range will be missing. The use of a 2 megohm leak cures this, but at the same time, very often introduces unstable regeneration effects. An excellent compromise between these two effects (or defects) is to use a low value (2 megs.) of grid-leak and, instead of connecting it directly to "A—" or "A+" (according to the type of detector used) connect it direct to the moving arm of a 200-ohm potentiometer R 2, the two remaining terminals of which are then connected across the "A" supply. The grid potential is then adjusted so as to coincide with the smoothest regeneration effects. The potentiometer may be of the baseboard-mounting type because, when the best adjustment has been found, it need not be altered very often. Thus, it does not mean an extra panel control, and the symmetrical appearance of the panel dials will not be upset.

A unique arrangement of by-pass condensers are used in this regenerative detector receiving circuit, which Mr. Barnett uses for short-wave reception in his English station. The detector circuit is the real heart of the short-wave receiver and we recommend all short-wave enthusiasts to read very carefully what Mr. Barnett has to say.



Other Problems of Regeneration Control

Too many turns on the tickler coil will cause unsteady regeneration effects and "regeneration-tuning" also; *i. e.*, a small adjustment of the regeneration control will cause a large change in wavelength, and this effect is *not* wanted in short-wavers!

Too much "B" supply on the detector tube will also prove a ready culprit. In this case, the remedy is obvious, plus a consequent saving in battery costs.

"Threshold howling" is generally prevalent in receivers which use one or more audio stages, if certain points are not observed. Frequently this fault is produced in the audio stages themselves, but sometimes it can be caused solely in the detector stage. A receiver which suffers from this fault is not much use at all, as the howl generally only occurs near the point of oscillation, when the receiver is in its most sensitive condition. The usual cure for this fault is to connect a high resistance across the secondary of the first audio transformer; but sometimes this resistance has to be of a fairly low value before the howl stops and this, of course, cuts down volume.

"Threshold howling" occurs sometimes in the detector stage when the antenna is too tightly coupled. Always have the antenna as loosely coupled as may be consistent with good results. This will also help to smooth out "dead spots" in the tuning, which are caused by the natural wavelength of the antenna. This trouble, of course, does not appear in receivers using a screen-grid tube in front of the detector.

In the accompanying diagram is shown a super-sensitive detector circuit in which every effort has been made to make it as smooth working as possible. R1 is a 2-meg. grid leak, and R2 is the 200-ohm potentiometer. C1 is a small by-pass condenser, about .0002-mf.; a larger capacity would possibly by-pass R. F. currents better, but would cause a cut-off in the notes of the higher musical scale. C2 is a 2-mf. condenser and this, together with the 20,000-ohm resistor, effectively de-couples the detector circuit from the other audio and R. F. stages. C3 is merely for R. F. by-passing purposes and must be kept very small—.0002-mf will do again here. This must be kept very small or otherwise it would tend to cancel out the effects of C2. Both R. F. and A. F. stages may, of course, be added to this detector circuit as required.

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