SYLVANIA TUBE SUBSTITUTION MANUAL

Quick references for substitutions of
critical Radio and Television Tubes

A Technical Publication of

SYLVANIA ELECTRIC PRODUCTS INC.

EMPORIUM, PENNA.

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TABLE OF CONTENTS

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GENERAL TUBE CLASSIFICATIONS

The following classified listing has been prepared to assist service technicians and engineers in selecting substitutions for types not listed in the charts or when a major change in power supply is undertaken.

The characteristics selected for listing do not mean that the others are not important. The intention is to enable the user to select a group of possible tubes and then eliminate those which for other reasons may be undesirable.

The classifications into which the types have been grouped are those which our experience has found most useful. Television, of course, being so new, has required the addition of two groups of scanning tubes and the high voltage rectifiers. Other television tube functions have been included with the corresponding radio receiving types. One exception is the television converter tube which being usually a high frequency duo-triode is listed with the H.F. triodes.

As an example of its use let us consider the selection of an F.M. diode triode to replace Type 7K7. The first thing to note is that 7K7 has the diode cathodes separate from the triode cathode. This limits the selection immediately and brings up the possibility of using separate diodes, either in a tube, using a miniature if there are space limitations, or germanium crystals. To find the nearly direct replacements run down the column for amplification constant in the diode triodes; since the 7K7 has a mu of 70, select those having a value between 50 and 100 and having 6.3 volt heaters. There are 20 of these, but a quick check of the basing diagrams in the Sylvania Receiving Tubes Characteristics Chart eliminates all but 6S8GT and 6T8 (Type 7X7 has one separate diode and one on the triode cathode.) If none of these are available the separate diode alternatives must be considered. If that is the case all 20 of the selected types in the diode triode table as well as the high mu types in the general purpose triodes can be tried.

AMPLIFIERS (REMOTE CUT-OFF R-F)
Pentodes — Tetrodes

Type	Ef	If	Style	Gm
1A4P	2.0	0.06	ST-12	625 725
1A4T	2.0	0.06	ST-12	625 650
1AB5	1.2	0.13	Lock-in	1100 1350
1D5GP	2.0	0.06	ST-12	625 725
1D5GT	2.0	0.06	ST-12	625 650
1P5GT	1.4	0.05	GT	750
1SA6GT	1.4	0.05	GT	750 950 970
1T4	1.4	0.05	Min.	700 900
6AB7	6.3	0.45	Metal	3500
6BA6	6.3	0.30	Min.	4300 4400
6BD6	6.3	0.30	Min.	2000 2350
6BJ6	6.3	0.15	Min.	3600 3650
6D6	6.3	0.30	ST-12	1500 1600
6E7	6.3	0.30	ST-12	1500 1600
6K7/G	6.3	0.30	Metal/ST-12	1650 1450
6K7GT	6.3	0.30	GT	1650 1450
6R6G	6.3	0.3	ST-12	1160
6S7/G	6.3	0.15	Metal/ST-12	1250 1750
6SD7GT*	6.3	0.30	GT	3350 3600
6SG7*	6.3	0.30	Metal	4100 4700 4000
6SG7GT*	6.3	0.30	GT	4100 4700 4000
6SK7/GT	6.3	0.30	Metal/GT	2350 2000
6SS7	6.3	0.15	Metal	1950 1850

Type	Ef	If	Style	Gm
6U7G	6.3	0.30	ST-12	1500 1600
7A7	6.3	0.30	Lock-in	2350 2000
7AH7	6.3	0.15	Lock-in	3300
7B7	6.3	0.15	Lock-in	1675 1750
7H7	6.3	0.30	Lock-in	4000
7T7	6.3	0.3	Lock-in	4900 4000
12BA6	12.6	0.15	Min.	4300 4400
12BD6	12.6	0.15	Min.	2000 2350
12K7GT	12.6	0.15	GT	2350 2000
12SG7	12.6	0.15	Metal	4100 4700 4000
12SK7/GT	12.6	0.15	Metal/GT	2300 2000
14A7	12.6	0.15	Lock-in	2350 2000
14H7	12.6	0.15	Lock-in	4000
26A6	26.5	0.07	Min.	2000 4000
34..	2.0	0.06	ST-14	560 600 620
35/51	2.5	1.75	ST-14	1020 1050
35S/51S	2.5	1.75	ST-14	1020 1050
39/44	6.3	0.30	ST-12	960 1000 1050
58/58S	2.5	1.0	ST-12	1500 1600
58AS	6.3	0.40	ST-12	1500 1600
78	6.3	0.30	ST-12	1275 1100 1450
5590*	6.3	0.15	Min.	2000
5725	6.3	0.175	Min.	
9001*	6.3	0.15	Min.	1400

*Semi-remote

AMPLIFIERS (SHARP CUT-OFF RF)
Pentodes — Tetrodes

Type	Ef	If	Style	Gm
1AE4	1.25	0.10	Min.	1550
1AF4	1.4	0.025	Min.	825 950
1B4P	2.0	0.06	ST-12	560 650
1E5GP	2.0	0.06	ST-12	560 650
1L4	1.4	0.05	Min.	925 1025
1LC5	1.4	0.05	Lock-in	750 775
1LG5	1.4	0.05	Lock-in	800 800 1050
1LN5	1.4	0.05	Lock-in	800
1N5GT	1.4	0.05	GT	750
1U4	1.4	0.05	Min.	900
3E6	1.4 2.8	0.10 0.05	Lock-in	2100 1800
6AC7	6.3	0.45	Metal	6750
6AG5	6.3	0.30	Min.	4750 5100 5000
6AH6	6.3	0.45	Min.	9000
6AJ5	6.3	0.175	Min.	2750
6AK5	6.3	0.175	Min.	5000 4300 5100
6AM6	6.3	0.30	Min.	7500
6AS6	6.3	0.175	Min.	3500
6AU6	6.3	0.30	Min.	3900 4450 5200
6BC5	6.3	0.30	Min.	4900 6100 5700
6BH6	6.3	0.15	Min.	3400 4600
6C6	6.3	0.30	ST-12	1185 1225
6CB6	6.3	0.30	Min.	6200
6D7	6.3	0.30	ST-12	1185 1225
6J7	6.3	0.30	Metal	1225
6J7G	6.3	0.30	ST-12	1225

Amplifiers (Sharp cut-off RF) Cont'd

Type	Ef	If	Style	Gm
6J7GT	6.3	0.30	GT	1225
6SE7GT	6.3	0.30	GT	3100 3400
6SH7	6.3	0.30	Metal	4000 4900
6SH7GT	6.3	0.30	GT	4000 4900
6SJ7/GT	6.3	0.30	Metal/GT	1575 1650
6W7G	6.3	0.15	ST-12	1225
7AB7	6.3	0.15	Lock-in	1800
7AD7	6.3	0.60	Lock-in	9500
7AG7	6.3	0.15	Lock-in	4200
7AJ7	6.3	0.3	Lock-in	2275 1575
7AK7	6.3	0.8	Lock-in	6500
7C7	6.3	0.15	Lock-in	1225 1300
7G7	6.3	0.45	Lock-in	4500
7L7	6.3	0.30	Lock-in	3000 3100
7V7	6.3	0.45	Lock-in	5800
7W7	6.3	0.45	Lock-in	5800
12AU6	12.6	0.15	Min.	3900 4450 5200
12AW6	12.6	0.15	Min.	5000 5100 4750
12J7GT	12.6	0.15	GT	1225
12SH7/GT	12.6	0.15	Metal/GT	4000 4900
12SJ7	12.6	0.15	Metal	1575 1650
12SJ7GT	12.6	0.15	GT	1575 1650
14C7	12.6	0.15	Lock-in	2275 1575
14W7	12.6	0.225	Lock-in	5800
15	2.0	0.22	ST-12	710 750
22	3.3	0.132	ST-14	125
24A/24S	2.5	1.75	ST-14	1000 1050
32	2.0	0.06	ST-14	640 650
36	6.3	0.30	ST-12	1000 1050 1080
EF50	6.3	0.30	Metal/Glass	6300
57/57S	2.5	1.0	ST-12	1185 1225
57AS	6.3	0.40	ST-12	1185 1225
77	6.3	0.30	ST-12	1100 1250
1221	6.3	0.30	ST-12	1185 1225
1223	6.3	0.30	ST-12	1185 1225
1229	2.0	0.06	ST-12	Spec. Type 32
1231	6.3	0.45	Lock-in	5500 6500
1273	6.3	0.30	Lock-in	2275 1575
1280	12.6	0.15	Lock-in	2275 1575
5591	6.3	0.15	Min.	5000 4300 5100
5654	6.3	0.175	Min.	5000
5693	6.3	0.3	Metal	1650
5847	6.3	0.3	T-6½	12500
5879	6.3	0.15	T-6½	1000
5901	1.4	0.05	Min.	900
9003	6.3	0.15	Min.	1800

CONVERTERS

Type	Ef	If	Style	Gc
1A6	2.0	0.06	ST-12	275 300
1A7GT	1.4	0.05	GT	250
1B7GT	1.4	0.10	GT	350
1C6	2.0	0.12	ST-12	300 325
1C7G	2.0	0.12	ST-12	300 325
1C8	1.25	0.04	T-3	100
1D7G	2.0	0.06	ST-12	275 300
1L6	1.4	0.05	Min.	300
1LA6	1.4	0.05	Lock-in	250
1LB6	1.4	0.05	Lock-in	100
1LC6	1.4	0.05	Lock-in	250 275
1R5	1.4	0.05	Min.	235 300
1U6	1.4	0.025	Min.	260 275
2A7/2A7S	2.5	0.80	ST-12	360 550
6A7/6A7S	6.3	0.30	ST-12	360 550
6A8	6.3	0.30	Metal	360 550
6A8G	6.3	0.30	ST-12	360 550
6A8GT	6.3	0.30	GT	360 550
6AN7	6.3	0.23	T-6½	750
6BA7	6.3	0.30	T-6½	900 950
6BE6	6.3	0.30	Min.	455 475
6D8G	6.3	0.15	ST-12	325 550
6J8G	6.3	0.30	ST-12	290
6K8	6.3	0.30	Metal	350
6K8G/GT	6.3	0.30	ST-12/GT	350
6L7	6.3	0.30	Metal	350*
6L7G	6.3	0.30	ST-12	350*
7A8	6.3	0.15	Lock-in	375 550
7B8	6.3	0.3	Lock-in	360 550
7J7	6.3	0.30	Lock-in	280 290
7Q7	6.3	0.30	Lock-in	525 550
7S7	6.3	0.30	Lock-in	500 525
12A8GT	12.6	0.15	GT	360 550
12BA7	12.6	0.15	T-6½	900 950
12BE6	12.6	0.15	Min.	455 475
12K8	12.6	0.15	Metal	350
12K8GT	12.6	0.15	GT	350
12SA7	12.6	0.15	Metal	425 450
12SA7GT	12.6	0.15	GT	425 450
12SY7	12.6	0.15	Metal	450
14B8	12.6	0.15	Lock-in	360 550
14J7	12.6	0.15	Lock-in	280 290
14Q7	12.6	0.15	Lock-in	525 550
14S7	12.6	0.15	Lock-in	500 525
26D6	26.5	0.07	Min.	270 455 475
FM1000	6.3	0.30	Lock-in	...
1612	6.3	0.30	Metal	350*

*require separate oscillator

DIODE DETECTORS
Single and Double

Type	Ef	If	Style	Output Current Ma/plate
1A3	1.4	0.150	Min.	0.5
1R4	1.4	0.150	Lock-in	1.0
2S/4S	2.5	1.35	ST-12	40.0
6AL5	6.3	0.30	Min.	9.0
6AN6	6.3	0.20	Min.	8.0
6BC7	6.3	0.45	T-6½	12.0
6H4GT	6.3	0.15	GT	4.0
6H6/GT	6.3	0.30	Metal/GT	8.0
7A6	6.3	0.15	Lock-in	8.0
7C4	6.3	0.15	Lock-in	5.0
12AL5	12.6	0.15	Min.	9.0
12H6	12.6	0.15	Metal	8.0
5679	6.3	0.15	Lock-in	8.0
5726	6.3	0.30	Min.	9.0
9006	6.3	0.15	Min.	5.0

DIODE-PENTODES

Type	Ef	If	Style	Gm
1AF5	1.4	0.025	Min.	500 600
1F6	2.0	0.06	ST-12	650
1F7G	2.0	0.06	ST-12	650
1F7GV	2.0	0.06	ST-12	650
1LD5	1.4	0.05	Lock-in	550 575
1N6G	1.4	0.05	GT	800
1S5	1.4	0.05	Min.	625
1SB6GT	1.4	0.05	GT	665 500
1U5	1.4	0.05	Min.	625
2B7/2B7S	2.5	0.80	ST-12	950
6B8/G	6.3	0.30	Metal/ST-12	950
6B8GT	6.3	0.30	GT	950
6N8	6.3	0.30	T-6½	2200
6SF7	6.3	0.30	Metal	1975 2050
6SV7	6.3	0.30	Metal	3600
7E7	6.3	0.30	Lock-in	1600 1300
7R7	6.3	0.30	Lock-in	2100 3000
12C8	12.6	0.15	Metal	950
12SF7	12.6	0.15	Metal	1975 2050
14E7	12.6	0.15	Lock-in	1600 1300
14R7	12.6	0.15	Lock-in	2100 3000

DIODE TRIODES
(DETECTOR-AMPLIFIER)
Single Diode Triode
Duo Diode Triode
Triple Diode Triode

Type	Ef	If	Style	μ
1B5	2.0	0.06	ST-12	20
1H4G	2.0	0.06	ST-12	9.3
1H5GT	1.4	0.05	GT	65
1H6G	2.0	0.06	ST-12	20
1LH4	1.4	0.05	Lock-in	65
2A6	2.5	0.80	ST-12	100
6AQ6	6.3	0.15	Min.	70
6AQ7GT	6.3	0.30	GT	70
6AT6	6.3	0.30	Min.	70
6AV6	6.3	0.30	Min.	100
6AW7GT	6.3	0.30	GT	80
6B6G	6.3	0.30	ST-12	100
6BD7	6.3	0.23	T-6½	70
6BF6	6.3	0.30	Min.	16
6BK6	6.3	0.30	Min.	100
6BT6	6.3	0.30	Min.	70

GENERAL TUBE CLASSIFICATIONS

Diode Triode (Continued)

Type	Ef	If	Style	μ
6BU6	6.3	0.30	Min.	16.5 16.0
6C7	6.3	0.30	ST-12	20
6Q7	6.3	0.30	Metal	70
6Q7G	6.3	0.30	ST-12	70
6Q7GT	6.3	0.30	GT	70
6R7	6.3	0.30	Metal	16
6R7GT	6.3	0.30	GT	16
6R8	6.3	0.45	T-6½	16
6S8GT	6.3	0.30	GT	100
6SQ7GT	6.3	0.30	GT	16
6SR7/GT	6.3	0.30	Metal/GT	16
6ST7	6.3	0.15	Metal	16
6SZ7	6.3	0.15	Metal	70
6T7G	6.3	0.15	ST-12	65
6T8	6.3	0.45	T-6½	70
6V7G	6.3	0.30	ST-12	8.3
7B6	6.3	0.30	Lock-in	100
7C6	6.3	0.15	Lock-in	85 100
7E6	6.3	0.30	Lock-in	16 16.5
7K7	6.3	0.30	Lock-in	70
7X7	6.3	0.30	Lock-in	85 100
12AT6	12.6	0.15	Min.	70
12AV6	12.6	0.15	Min.	100
12BF6	12.6	0.15	Min.	16
12BK6	12.6	0.15	Min.	100
12BT6	12.6	0.15	Min.	70
12BU6	12.6	0.15	Min.	16.5 16.0
12Q7GT	12.6	0.15	GT	70
12S8GT	12.6	0.15	GT	100
12SQ7/GT	12.6	0.15	Metal/GT	100
12SR7	12.6	0.15	Metal	16
12SW7	12.6	0.15	Metal	17 16
14B6	12.6	0.15	Lock-in	100
14E6	12.6	0.15	Lock-in	16 16.5
14X7	12.6	0.15	Lock-in	85 100
19C8	18.9	0.15	T-6½	100
19T8	18.9	0.15	Min.	70
26BK6	26.5	0.07	Min.	100
26C6	26.5	0.07	Min.	17 16
55/55S	2.5	1.0	ST-12	8.3
75 or 75S	6.3	0.30	ST-12	100
85	6.3	0.30	ST-12	8.3
85AS	6.3	0.30	ST-12	20

DUO-TRIODES

Type	Ef	If	Style	Gm	μ
2C21	6.3	0.60	ST-12	1375	10.4
2C51	6.3	0.30	T-6½	5500	35.0
2C52	12.6	0.30	GT	1900	100.0
3A5	1.4 2.8	0.22 0.11	Min.	1800	15.0
3B7	2.8 1.4	0.110 0.220	Lock-in	1900	
3C6	1.4 2.8	0.10 0.05	Lock-in	1300 1300 1100	
6AE7GT	6.3	0.50	GT	3000	14.0
6AH7GT	6.3	0.30	GT	1550 1900	16.0
6BQ7	6.3	0.40	T-6½	6000	35.0
6C8G	6.3	0.30	ST-12		36.0
6F8G	6.3	0.30	ST-12	2600	20.0
6J6	6.3	0.45	Min.	5300	38.0
6N7/GT	6.3	0.80	Metal/GT	3100 3200	35.0
6SC7/GT	6.3	0.30	Metal/GT	1325	70.0
6SL7GT 6SL7WGT	6.3	0.30	GT	1600	70.0
6SN7GT 6SN7WGT	6.3	0.60	GT	3000 2600	20.0
6SU7GTY	6.3	0.30	GT	1600	70.0
7AF7	6.3	0.30	Lock-in	2600 1900 2100	17.0 16.0
7F7	6.3	0.30	Lock-in	1125 1600	70.0
7F8	6.3	0.30	Lock-in	3300	
7N7	6.3	0.60	Lock-in	3000 2600	20.0
12AH7GT	12.6	0.15	GT	1550 1900	16.0
12AT7	6.3 12.6	0.30 0.15	T-6½	4000 6600 5500	54.0 62.0 55.0
12AU7	12.6 6.3	0.15 0.30	T-6½	2200 3100	17.0 19.5
12AV7	12.6 6.3	0.225 0.450	T-6½	6100 8500	37.0 41.0
12AX7	12.6 6.3	0.15 0.30	T-6½	1250 1600	100.0
12AY7	12.6	0.15	T-6½	1750	40.0
12SC7	12.6	0.15	Metal	1325	70.0
12SL7GT	12.6	0.15	GT	1600	70
12SN7GT	12.6	0.15	GT	3000 2600	20
12SX7GT	12.6	0.30	GT	1800 3000 2600	21 20
14AF7/XXD	12.6	0.15	Lock-in	2600 1900 2100	17 16
14F7	12.6	0.15	Lock-in	1125 1600	70
14N7	12.6	0.15	Lock-in	3000 2600	20
19J6	18.9	0.15	Min.	1900	38
5608-A	2.5	2.0	ST-14	2200 2450	16 17
5687	6.3 12.6	0.90 0.45	T-6½	5200 8100	16
5691	6.3	0.6	GT	1600	70
5692	6.3	0.6	GT	2200	20
5694	6.3	0.8	ST-14	3100 3200	35

INDICATORS

Type	Ef	If	Style	Target Current Ma.
2E5	2.5	0.80	T-9	1.0 4.0
6AB5/6N5	6.3	0.15	T-9	2.0
6AD6G	6.3	0.15	T-9	
6AF6G	6.3	0.15	T-9	
6AL7GT	6.3	0.90	GT	
6E5	6.3	0.30	T-9	1.0 4.0
6T5	6.3	0.15	ST-12	3.0
6U5	6.3	0.30	T-9	1.0 4.0
1629	12.6	0.15	GT	1.0 4.0

MULTI-PURPOSE TUBES

Type	Ef	If	Style	Gm	Class
1B8GT	1.4	0.10	GT	275 1150	Diode-Triode Pent.
1D8GT	1.4	0.100	GT	325 925	Diode-Triode Pent.
2B7	2.5	0.80	ST-12	950 840 1000	Triode Pentode
3A8GT	1.4 2.8	0.10 0.05	GT	325 750	Diode-Triode Pent.
6AD7G	6.3	0.85	ST-14	325 2500	Triode Pentode
6B7/S	6.3	0.30	ST-12	950 840 1000	Triode Pentode
7G8	6.3	0.30	Lock-in	2100	Dual Tetrode
12B8GT	12.6	0.30	GT	1800 2400	Triode Pentode
25A7GT	25.0	0.30	GT	1800	Rectifier-Pentode
25B8GT	25.0	0.15	GT	2000 1500	Triode Pentode
25D8GT	25.0	0.15	GT	1100 1900	Triode Pentode
28D7/W	28.0	0.40	Lock-in	3400	Dual Tetrode
32L7GT	32.5	0.30	GT	6000	Rectifier-Beam Amp.
70A7GT	70.0	0.15	GT	5800	Rectifier-Beam Amp.
70L7GT	70.0	0.15	GT	7500	Rectifier-Beam Amp.
117L7/M7GT	117.0	0.09	GT	5300	Rectifier-Beam Amp.
117N7GT	117.0	0.09	GT	7000	Rectifier-Beam Amp.
117P7GT	117.0	0.09	GT	5300	Rectifier-Beam Amp.

POWER AMPLIFIERS
Triodes
Pentodes
Beam Amplifiers
Tetrodes
Class B Duo Triodes

Type	Ef	If	Style	Power Output Mw.
1A5GT	1.4	0.05	GT	100
				115
1AC5	1.25	0.04	T-3	450
				600
				700
1C5GT	1.4	0.10	GT	200
				240
1E7G	2.0	0.24	ST-12	575
1F4	2.0	0.12	ST-12	310
1F5G	2.0	0.12	ST-12	310
1G5G	2.0	0.12	ST-14	250
1G6GT	1.4	0.10	GT	675
1J5G	2.0	0.12	ST-14	575
1J6G	2.0	0.24	ST-12	2100
				1900
				1600
1LA4	1.4	0.05	Lock-in	100
				115
1LB4	1.4	0.05	Lock-in	35
				100
				200
1Q5GT	1.4	0.10	GT	270
1S4	1.4	0.10	Min.	65
				270
1T5GT	1.4	0.05	GT	170
1W4	1.4	0.05	Min.	35
				90
				100
				200
2A3	2.5	2.50	ST-16	3500
				15000
2A5	2.5	1.75	ST-14	3200
				4800
				11000
				18000
3A4	1.4	0.20	Min.	600
	2.8	0.10		700
3B5GT	1.4	0.10	GT	70
	2.8	0.05		180
3C5GT	1.4	0.10	GT	1550
	2.8	0.05		1450
3D6	2.8	0.110	Lock-in	600
	1.4	0.220		1400
3E5	1.4	0.050	Min.	100
	2.8	0.025		200
				90
				175
3LE4	2.8	0.05	Lock-in	300
	1.4	0.10		325
3LF4	1.4	0.10	Lock-in	250
				270
	2.8	0.05		400
				230
				330
3Q4	1.4	0.10	Min.	250
	2.8	0.05		270
				240
3Q5GT	1.4	0.10	GT	270
	2.8	0.05		230
3S4	1.4	0.10	Min.	270
	2.8	0.05		235
3V4	1.4	0.10	Min.	250
	2.8	0.05		270
				240
4A6G	2.0	0.12	ST-12	
	4.0	0.06		1000
5A6	5.0	0.230	T-6½	2800
	2.5	0.460		3100
6A3	6.3	1.00	ST-16	3200
				1500
				1000
6A4/LA	6.3	0.30	ST-14	700
				1500
6A5G	6.3	1.25	ST-16	3750
				15000
6A6	6.3	0.80	ST-14	10000
6AB6G	6.3	0.50	ST-12	3500
6AC5GT	6.3	0.40	GT	3700
				8000
6AC6GT	6.3	1.1	GT	3600
6AG7	6.3	0.65	Metal	3000
6AH5G	6.3	0.9	ST-16	10800
6AK6	6.3	0.15	Min.	1100
6AK7	6.3	0.65	Metal	3000
6AL6G	6.3	0.9	ST-16	10800
6AM5	6.3	0.2	Min.	1400
6AN5	6.3	0.45	Min.	1300
6AQ5	6.3	0.45	Min.	4500
				2000
6AR5	6.3	0.40	Min.	3200
				3400
6AS5	6.3	0.80	Min.	2200
6AS7G	6.3	2.5	GT	
6B4G	6.3	1.00	ST-16	3200
				1500
				1000
6B5	6.3	0.80	ST-14	4000
6BF5	6.3	1.2	Min.	
6BG6G	6.3	0.90	ST-16	
6CD6G	6.3	2.5	ST-16	
6E6	6.3	0.60	ST-14	750
				1600
6F6	6.3	0.70	Metal	3200
6F6G/GT	6.3	0.70	ST-14/GT	4800
				11000
				18000
6G6G	6.3	0.15	ST-12	600
				1100
6K6GT	6.3	0.40	GT	350
				3400
				4500
6L6	6.3	0.90	Metal	6500
6L6G	6.3	0.90	ST-16	10800
6L6GA	6.3	0.90	ST-14	17500
				26500
				47000
6M5	6.3	0.71	T-6½	3900
6N6G	6.3	0.80	ST-14	4000
6U6GT	6.3	0.75	GT	2000
				5500
6V6/GT	6.3	0.45	Metal/GT	2000
				4500
				5500
				10000
				14000
6W6GT	6.3	1.20	GT[W]	2100
				3800
6Y6G	6.3	1.25	ST-14	3600
				6000
6Y7G	6.3	0.60	ST-12	5500
				8000
6Z7G	6.3	0.30	ST-12	2500
				4200
7A5	6.3	0.75	Lock-in	1500
				2200
7B5	6.3	0.40	Lock-in	350
				3400
				4500
7C5	6.3	0.45	Lock-in	2000
				4500
				5500
				10000
				14000
10	7.5	1.25	ST-16	400
				900
				1600
12A5	12.6	0.30		800
	6.3	0.60	ST-12	3400
12A6	12.6	0.15	Metal	3400
12A6GT	12.6	0.15	GT	3400
12A7	12.6	0.3	ST-12	550
12L8GT	12.6	0.15	GT	300
				1000
14A5	12.6	0.15	Lock-in	2800
14C5	12.6	0.15	Lock-in	2000
				4500
				5500
				10000
				14000
18	14.0	0.30	ST-14	4800
				11000
				18000
19	2.0	0.26	ST-12	2100
				1900
				1600
19BG6G	18.9	0.30	ST-16	
20	3.3	0.132	T-8	50
				130
25A6/GT	25	0.30	Metal/GT	900
				2000
				2200
25A7GT	25	0.30	GT	770
25AC5GT	25	0.30	GT	2000
25B5	25	0.30	ST-12	2000
				3800
25B6G	25	0.30	ST-14	2400
				7100
25C6G	25	0.30	ST-14	3600
				6000
25L6	25	0.30	Metal	2100
				4300
25L6GT	25	0.30	GT	2100
				4300
25N6G	25	0.30	ST-12	2000
				3800
26A7GT	26.5	0.6	GT	5500
31	2.0	0.13	ST-12	185
				375
32L7GT	32.5	0.30	GT	1000
33	2.0	0.26	ST-14	70
				90
35A5	35.0	0.15	Lock-in	1500
				1300
35B5	35.0	0.15	Min.	1500
35C5	35.0	0.15	Min.	1500
35L6GT	35.0	0.15	GT	1500
				3300
38	6.3	0.30	ST-12	925
				1050
				1200
41	6.3	0.40	ST-12	350
				3400
				4500
42	6.3	0.65	ST-14	4800
				11000
				18000
43	25.0	0.30	ST-14	900
45	2.5	1.50	ST-14	830
				1600
				2000
46	2.5	1.75	ST-16	1250
47	2.5	1.75	ST-16	2700
48	30.0	0.40	ST-16	2000
				3000
49	2.0	0.12	ST-14	170
				3500
50	7.5	1.25	ST-16	1600
				2400
				3400
				4600
50A5	50.0	0.15	Lock-in	2100
				4300
50B5	50.0	0.15	Min.	1900
50C5	50.0	0.15	Min.	1900
50C6G	50.0	0.15	ST-14	3600
				6000
50L6GT	50.0	0.15	GT	2100
				4300
VT52	7.7	5.0	ST-17	1000
53	2.5	2.0	ST-14	10000
59	2.5	2.0	ST-16	1250
				3000
71A	5.0	0.25	ST-14	125
				400
				790
79	6.3	0.60	ST-12	5500
				8000
89	6.3	0.40	ST-12	300
				1500
				3500
182B/482B	5.0	1.25	ST-14	1350
183/483	5.0	1.25	ST-14	1800

GENERAL TUBE CLASSIFICATIONS

Power Amplifiers (Cont'd)

Type	Ef	If	Style	Power Output Mw.
210-T	7.5	1.25	ST-16	400
				900
				1600
950	2.0	0.12	ST-14	1000
1276	6.3	1.00	ST-16	3200
				1500
				1000
5686	6.3	0.35	T-6½	2700
5824	25	0.30	ST-14	4300
5932	6.3	0.90	T-12	10800

RECTIFIERS (GENERAL PURPOSE)
Including Voltage Doublers

Type	Ef	If	Style	Current Output Ma.
OY4	...	...	Metal	75
OY4G	...	...	T-7	75
OZ4	...	...	Metal	90
OZ4A	...	...	Metal	110
OZ4G	...	...	T-7	90
1V	6.3	0.30	ST-12	45
2W3GT	2.5	1.50	GT	55
2Z2/G84	2.5	1.50	ST-12	50
5AX4GT	5.0	2.25	GT	150
5AZ4	5.0	2.0	Lock-in	125
5R4GY	5.0	2.0	ST-16	150
				175
5T4	5.0	2.0	Metal	225
5U4G	5.0	3.0	ST-16	225
5U4WG	5.0	3.0	T-12	225
5V4G	5.0	2.0	ST-14	175
5W4	5.0	1.50	Metal	110
5W4GT	5.0	1.50	GT	110
5X3	5.0	2.0	ST-14	110
				30
5X4G	5.0	3.0	ST-16	225
				125
5Y3GT	5.0	2.0	GT	125
5Y4G	5.0	2.0	ST-14	125
5Z3	5.0	3.0	ST-16	225
5Z4	5.0	2.0	Metal	125
5Z4GT	5.0	2.0	GT	125
6AX5GT	6.3	1.2	GT	125
6AX6GT+	6.3	2.5	ST-14	250
6BY5G+	6.3	1.6	ST-14	175
6U4GT	6.3	1.2	GT	125
6V4	6.3	0.60	T-6½	90
6W4GT	6.3	1.2	GT	125
6X4	6.3	0.60	Min.	70
6X5	6.3	0.60	Metal	70
6X5GT	6.3	0.60	GT	70
6X5WGT	6.3	0.60	GT	70
6Y5	6.3	0.80	ST-12	50
6Z4	6.3	0.60	ST-12	60
6Z5	6.3	0.80		
	12.6	0.40	ST-12	60
6ZY5G	6.3	0.30	ST-12	40
7X6+	6.3	1.2	Lock-in	75
7Y4	6.3	0.50	Lock-in	70
7Z4	6.3	0.90	Lock-in	100
12Z3	12.6	0.30	ST-12	55
14Y4	12.6	0.30	Lock-in	70
25W4GT	25	0.30	GT	125
25X6GT+	25	0.15	GT	60
25Z4	25	0.30	Metal	125
25Z6+	25	0.30	Metal	75
25Z6GT+	25	0.30	GT	75
28Z5	28.0	0.24	Lock-in	100
35W4	35.0	0.15	Min.	60
				100
35Y4	35.0	0.15	Lock-in	60
				100
35Z3	35.0	0.15	Lock-in	100
35Z4GT	35.0	0.15	GT	100
35Z5GT	35.0	0.15	GT	100
35Z6G+	35.0	0.30	ST-14	110
40Z5/ 45Z5GT	45.0	0.15	GT	60
				100
45Z3	2.5	1.50	ST-14	65
50AX6G+	50.0	0.30	ST-14	250
50Y6GT+	50.0	0.15	GT	75
50Z6G+	50	0.30	ST-12	250
80	5.0	2.0	ST-14	125
81	7.5	1.25	ST-16	85
82	2.5	3.0	ST-14	115
83	5.0	3.0	ST-16	225
83V	5.0	2.0	ST-14	175
84/6Z4	6.3	0.50	ST-12	60
117Z3	117	0.04	Min.	90
117Z4GT	117	0.04	GT	90
117Z6GT+	117.0	0.075	GT	60
1005/ CK1005	6.3	0.1	Metal	70
1274	6.3	0.60	GT	70
1275	6.3	0.60	ST-16	225
5517/ CK1013	Cold K		Min.	6
5931	5.0	3.0	T-12	225

+These types may also be used as voltage doublers.

RECTIFIERS (HIGH VOLTAGE TV)

Type	Ef	If	Style	Output Current
1B3GT	1.25	0.20	GT	2.0 Ma.
1V2	0.625	0.30	T-6½	0.5 Ma.
1X2	1.25	0.20	T-6½	1.0 Ma.
1Y2	1.5	0.29	Min.	2.0 Ma.
1Z2	1.5	0.30	Min.	2.0 Ma.
2V3G	2.5	5.0	ST-12	2.0 Ma.
2X2 (A)	2.5	1.75	ST-12	7.5 Ma.
6Y3G	6.3	0.7	ST-12	7.5 Ma.
5642	1.25	0.140	T-3	0.2 Ma.

RELAY TUBES
Gas Triodes and Tetrodes

Type	Ef	If	Style	Cath. Ma.
OA4G	Cold K		ST-12	25
2A4G	2.5	2.50	ST-12	100 Max.
2C4	2.5	0.65	Min.	5
2D21	6.3	0.60	Min.	100 Max.
6D4	6.3	0.25	Min.	25
884	6.3	0.60	ST-12	300 Peak
885	2.5	1.50	ST-12	300 Peak
1267	Cold K		GT	25
2050	6.3	0.60	ST-12	100 Max.
2051	6.3	0.60	ST-12	75 Max.

TV SCANNERS (Horizontal)

Type	Ef	If	Style	Gm
6AR6G	6.3	1.20	T-11	5400
				4300
6AU5GT	6.3	1.25	GT	
6AV5GT	6.3	1.20	GT	5500
6BD5GT	6.3	0.90	GT	
6BG6G	6.3	0.90	ST-16	
6BQ6GT	6.3	1.20	GT	
6CD6G	6.3	2.50	ST-16	7500
25AV5GT	25.0	0.30	GT	5500
25BQ6GT	25.0	0.30	GT	

TV SCANNERS (Vertical)

6AQ5	6.3	0.45	Min.	4100
				3700
6BF5	6.3	1.20	Min.	4200
6BL7GT	6.3	1.50	T-9	
6K6GT	6.3	0.40	GT	1500
				2300
				2100
6S4	6.3	0.60	T-6½	4500
6SL7GT	6.3	0.30	GT	1600
6SN7GT	6.3	0.30	GT	3000
				2600
6V6GT	6.3	0.45	GT	3700
				4100
				3750
6Y6G	6.3	1.25	ST-14	7000
				7100
7C5	6.3	0.45	Lock-in	3700
				4100
				3750
12BH7	12.6	0.30	T-6½	6200
	6.3	0.60		3100

TRIODES (GENERAL PURPOSE)

Type	Ef	If	Style	μ
1C3	1.4	0.05	Min.	14.5
1E4G	1.4	0.05	GT	14.5
				14.0
1G4GT	1.4	0.05	GT	8.8
1LE3	1.4	0.05	Lock-in	14.5
				14.0
2C22	6.3	0.3	T-9	20.0
6AD5G/GT	6.3	0.30	ST-12/GT	100
6AE5GT	6.3	0.30	GT	4.2
6AF5G	6.3	0.30	ST-12	7.4
6C4	6.3	0.15	Min.	17
				19.5
6C5/GT	6.3	0.30	Metal/GT	20
6F5/GT	6.3	0.30	Metal/GT	100
6J4	6.3	0.40	Min.	55
6J5/GT	6.3	0.30	Metal/GT	20
6K5G/GT	6.3	0.30	ST-12/GT	70
6L5G	6.3	0.15	ST-12	15
				17
6N4	6.3	0.20	Min.	32
6P5	6.3	0.30	GT	13.8
6Q4	6.3	0.48	T-6½	80
6SF5/GT	6.3	0.30	Metal/GT	100
7A4	6.3	0.30	Lock-in	20
7B4	6.3	0.30	Lock-in	100
12A	5.0	0.25	ST-14	8.5
12A4	6.3	0.60	T-6½	20
	12.6	0.30		
12E5GT	12.6	0.15	GT	13.8
12F5GT	12.6	0.15	GT	100
12J5GT	12.6	0.15	GT	20
12SF5/GT	12.6	0.15	Metal/GT	100
14A4	12.6	0.15	Lock-in	20
26	1.5	1.05	ST-14	8.3
27, 27S	2.5	1.75	ST-12	9.0
30	2.0	0.06	ST-12	9.3
37	6.3	0.30	ST-12	
40	5.0	0.25	ST-14	
56/56S	2.5	1.00	ST-12	13.8
56AS	6.3	0.40	ST-12	
76	6.3	0.30	ST-12	13.8
V-99	3.3	0.063	T-8	6.6
X-99	3.3	0.063	T-9	6.6
485	3.0	1.25	ST-12	12.5
864	1.1	0.25	T-9	8.2
1230	Special Type 30			
9002	6.3	0.15	Min.	25
XXL	6.3	0.30	Lock-in	25
				30

TRIODES H.F. — OSCILLATORS H.F.
Single Triodes — Duo Triodes

Type	Ef	If	Style	Gm
3A5	1.4	0.22	Min.	1800
	2.8	0.11		
6AB4	6.3	0.15	Min.	5500
6BQ7	6.3	0.40	T-6½	6000
6C4	6.3	0.15	Min.	2200
				3100
6F4	6.3	0.225	Acorn	5800
6J4	6.3	0.40	Min.	12000
6J6	6.3	0.45	Min.	5300
6L4	6.3	0.225	Acorn	6400
6R4	6.3	0.20	T-6½	5500
7A4	6.3	0.30	Lock-in	3000
				2600
7E5	6.3	0.15	Lock-in	3000
7F8, 7F8W	6.3	0.30	Lock-in	5200
12AT7	6.3	0.30	T-6½	4000
	12.6	0.15		6600
				5500
14F8	6.3	0.30	Lock-in	5200
19J6	18.9	0.15	Min.	1900
1293	1.4	0.11	Lock-in	1500
1626	12.6	0.25	ST-12	

SPECIAL PURPOSE TUBES

Type	Ef	If	Style	Use
6AE6G	6.3	0.15	ST-12	
6BN6	6.3	0.3	Min.	Limiter-Disc'r
12BN6	12.6	0.15	Min.	Limiter-Disc'r
5722	4.9	1.6	Min.	For Noise Gen.
X6030	3.0	0.6	Lock-in	For Noise Gen

CIRCUIT MODIFICATIONS REQUIRING ADDITIONAL RESISTORS

This article, originally printed in "Sylvania News," covers the essential information service technicians need to know in order to substitute tubes in series strings when either the voltage or current is different from that of the original tube type.

SERVICE technicians should have little trouble making tube substitutions in AC-DC sets as long as the substitute tube operates on the same current as the original tube. If the voltage is different, a slight change in the series resistor will be required. However, when the tube current is either higher or lower, the resistor changes are more complicated. The principles involved for both cases are explained in the following examples which can be applied to any substitution desired.

Fig. 1 shows a typical 300 ma. filament string including a series resistance of approximately 150 ohms exclusive of the tapped section. The resistor is shown as a tapped resistor since in many cases ballast resistors with the tap

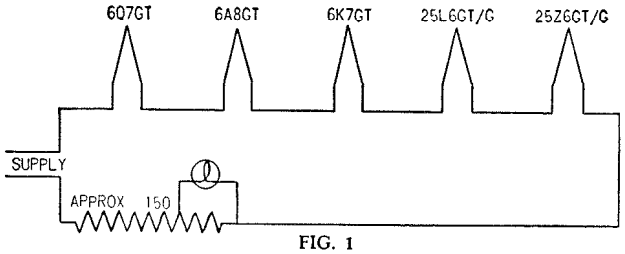

FIG. 1

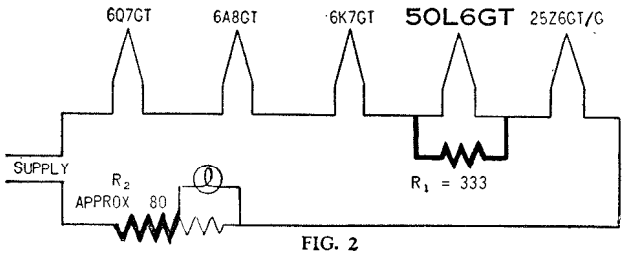

FIG. 2

$$R1 = \frac{\text{Filament Volts of 150 ma. tube}}{.150}$$

$$R2 = \frac{\text{120 minus sum of tube voltages}}{.300}$$

were used. In this case the pilot lamp rating will be less than 300 ma. Many receivers were built in which a 300 ma. pilot lamp was employed and no resistance was shunted across it. For those cases the resistor shunting the pilot light in Fig. 1 may be considered to be open.

Let us now suppose that the 25L6GT/G tube has burned out and that it is impossible to obtain another output tube of this type. Assume that the only power output tube obtainable is the 50L6GT. This tube requires only 150 ma. and, therefore, we must shunt the filament with a resistance which will by-pass 150 ma. of the total heater current. This will require a resistance of 333 ohms. A 300 ohm resistor will be perfectly satisfactory in this application. Originally the total voltage drop across the tubes was 68.9 volts leaving 48.1 volts drop across the series resistor. In the revised circuit the total voltage drop across the filaments of the tubes for proper operation will now be 93.9 volts. This means, therefore that the series resistor must be reduced in value to approximately 80 ohms in order that 300 ma. will flow through the filament string. This series resistor may be in the form of a line cord or actually may be a resistor mounted in the receiver itself. If it is in the line cord, a resistor of from 150 to 175 ohms may be shunted across the cord provided room may be found to locate this resistor. This resistor will, of course, become quite warm and must be placed in such a position that the added heat from the resistor will not cause wax in condensers to melt. If the resistor is mounted in the receiver to begin with, and if a 75 to 80 ohm resistor of the same physical size can be obtained, then it should be substituted for the one which was originally in the receiver.

The same general procedure must be followed if we wish to replace any one of the other tubes in the string with a 150 ma. tube. Fig. 2 illustrates in heavy lines the changes which must be made.

To summarize, there are three things which must be done in making a change of this kind:

1. The filament of the 150 ma. tube must be shunted.

2. The series resistor must be reduced in value so that 300 ma. is still available for the filament string.

3. These resistors must be located in such a place that the added heat will not cause trouble.

Let us now consider the filament string shown in Fig. 3. A great many more receivers are on the market employing a circuit similar to the one shown. This differs from the circuit shown in Fig. 1 in that no series resistor is employed and that the pilot light is lighted from a tap on the 35Z5GT/G filament.

No series resistor is necessary since the sum of the voltages required across the entire filament string is 122.8 volts. A receiver with such a circuit comes in to be repaired and the 50L6GT has an open filament. Let us assume that the only output type available from the jobber is a type 25L6G. This tube requires 300 ma.

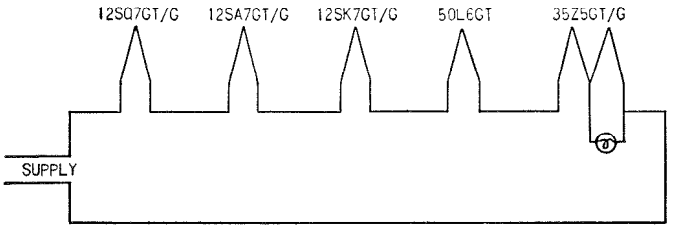

FIG. 3

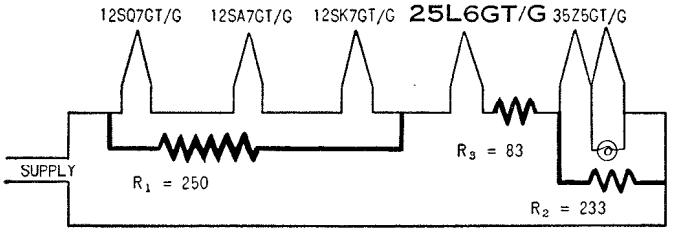

FIG. 4

$$R1 \text{ or } R2 = \frac{\text{Sum or tube voltages across resistor}}{.150}$$

$$R3 = \frac{\text{Old tube volts—new tube volts}}{.300}$$

filament current. However, it can be employed provided we rewire the circuit in such a manner that 300 ma. can be supplied to the filament of the 25L6GT/G. This can be accomplished by shunting the three 12-volt tubes with a 250 ohm resistor as shown in Fig. 4 and by shunting the 35Z5GT/G with a 233 ohm resistor (250 ohms would be satisfactory).

The sum of the voltages across all of the filaments now adds up to 97.8 volts, therefore, a series resistor must be added to the string so that the total will add up to approximately the line voltage. The value of this resistor should be approximately 83 ohms. This resistor may be added at any place in the string but it must be added in such a position that the total 300 ma. flows through that resistor. If the tube which has to be replaced is located at either end of the filament string such as the 35Z5GT/G or the 12SQ7GT/G in Fig. 3, then only one shunting resistor would be required. The biggest problem may very well be to find a place for the three resistors which will be required in most instances.

The power dissipated in these resistors will be considerable and precautions must be observed to prevent the heat developed from causing damage to the receiver. The wattage dissipated by a receiver changed over in the manner indicated in Fig. 4 dissipates twice the wattage that the receiver originally was designed for and all of that heat must be gotten rid of so that permanent damage to condensers and other parts in the receiver will not result. As in Fig. 2, the final changes are indicated in Fig. 4 with heavy lines.

The wattage rating of the resistors required in these circuits is found by multiplying the resistor current in amperes by the voltage across the resistor.

$$W = E \cdot I$$

Thus in the example shown as figures 3 and 4 the watts dissipated in R1 will be

$$37.8 \times .150 = 5.7 \text{ Watts}$$

37.8 comes from 3 tubes at 12.6 volts each, and the .150 amperes is the current through the resistor, another .150 amperes flows through the tubes.

Similarly the watts dissipated in R3 will be

$$25 \times .300 = 7.5 \text{ Watts}$$

The wattage rating of a resistor is the amount it can safely dissipate in the open air.

Unfortunately it is nearly always impossible to place these resistors in the open, and for use in confined spaces, like under the chassis, a factor of safety of at least 2 and preferably 3 is necessary, making the above values 15 and 20 Watts respectively.

To summarize, when a 300 ma. tube is used to replace a 150 ma. tube, there are three things which must be observed:

1. Shunt resistors must be added to the 150 ma. tubes in the receiver so that the tube which is being used as a replacement can obtain its full 300 ma.

2. A series resistor which will carry 300 ma. must be added to restore the voltage distribution across the filament string to its original value.

3. The series and shunt resistors must be placed in such a manner that the additional heat now developed in the receiver will not cause permanent damage.

Obviously there are many changes which may have to be made in equipment other than those indicated but the examples given were chosen as typical ones which you no doubt will have to make in the future. It is hoped that these suggestions will save you time in keeping your customers' receivers in condition.

For details of changes indicated, Refer to page 13

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A NO CHANGES	B FIL. VOLTS	C FIL. CURRENT	D REWIRE SOCKET	E CHANGE SOCKET	F REALIGN	G ADD TOP CAP CONNECTION	H REMOVE TOP CAP CONNECTION	K CHANGE BIAS OR PLATE VOLTS	NOTE NO.
1A4 (P or T)	1A4 (P or T)	A									
	1D5G					E	F				
	1E5G (P)					E	F				
	1LN5		B	C		E	F		H		1
	1N5GT		B	C		E	F				1
	1LC5		B	C		E	F		H		1
	1T4		B	C		E	F		H		1
	1L4		B	C		E	F		H		
	34						F				
	32						F				1
1A5GT	1LA4					E					8
	1LB4					E				K	
	1T5GT									K	2
	1N6G				D					K	
	1C5GT									K	
	1Q5GT			C						K	2
	1W4					E				K	2
	3Q5GT			C	D					K	2
	3D6			C		E				K	2
	3Q4			C		E				K	2
	3S4			C		E				K	2
	3V4			C		E					2
	1S4			C		E				K	2
	3LF4			C		E				K	2
1A6	1C6			C			F				
	1D7G					E	F				
	1C7G			C		E	F				
	1A7GT		B	C		E	F		H	K	
	1LA6		B	C		E	F		H	K	
	1LC6		B	C		E	F		H	K	
1A7GT	1L6					E	F		H		
	1LC6					E	F		H		6
	1LA6					E	F		H		
	1B7GT			C			F				
	1D8GT			C	D		F				9
	3A8GT			C	D		F				9
	1R5					E	F		H		11
1B4 (P or T)	32						F				
	1E5G (P or T)					E	F				
	1LN5		B	C		E	F		H		
	1LC5		B	C		E	F		H		
	1T4		B	C		E	F		H		
	1N5GT					E	F				
	1P5GT					E	F				
1B7GT	1A7GT			C			F				
	1LC6			C		E	F				6
	1LA6			C		E	F				
	3A8GT				D		F				9
1B8GT	1S5 / 1W4	Adaptor with / 2 Min. sockets							H		
	1U5 / 1W4	Adaptor with / 2 Min. sockets							H		
1C5GT	1A5GT			C						K	2
	1LA4			C		E				K	2
	1LB4			C		E				K	2
	1Q5GT									K	
	1S4			C		E				K	
	1T5GT									K	2
	1W4					E				K	2
	3D6			C		E				K	
	3LF4			C		E				K	
	3Q4					E				K	
	3Q5GT				D					K	
	3S4					E				K	
	3V4					E				K	
1C6	1A6			C			F				
	1C7G					E	F				
1C6 (Continued)	1D7G			C		E	F				
	1A7GT		B	C		E	F			K	
	1LA6		B	C		E	F		H	K	
	1B7GT		B	C		E	F			K	
	1LC6		B	C		E	F		H	K	6
1C7G	1A6			C		E	F				
	1C6					E	F				
	1D7G			C			F				
	1A7GT		B	C			F			K	
	1LA6		B	C		E	F		H	K	
	1B7GT		B	C			F			K	
	1LC6		B	C		E	F		H	K	6
1D5G (P or T)	1A4 (P or T)					E	F				
	34					E	F				
	1N5GT		B	C			F			K	1
	1E5G (P or T)						F				1
	1B4 (P or T)						F				1
	32						F				1
	1P5GT		B	C			F				
	1LN5		B	C		E	F		H	K	1
	1LC5		B	C		E	F		H	K	6–1
1D7G	1A6					E	F				
	1C7G			C			F				
	1C6			C		E	F				
	1A7GT		B				F			K	
	1LA6		B	C		E	F		H	K	
	1B7GT		B	C			F			K	
	1LC6		B	C		E	F		H	K	6
1D8GT	1N6G / 1E4G / 1LB4 / 1LH4 / 1C3 / 1W4	Requires room for 2 sockets, no single replacement type. / Requires room for 2 sockets, no single replacement type. / Adaptor with / 2 Min. sockets							H		5
1E4G	1G4GT									K	
	1LE3					E				K	
	1N5GT				D			G		K	4
1E5G (P or T)	1B4					E	F				
	32					E	F				
	1N5GT		B	C			F			K	
	1D5G (P or T)						F				1
	1A4 (P or T)					E	F				1
	34					E	F				1
	1LN5		B	C		E	F		H	K	
	1LC5		B	C		E	F		H	K	6
1E7G	2 type 1F5G / 2 type 1F4 / 2 type 1S4 / 2 type 1W4	requires room for 2 sockets, no single type. / Adaptor with / 2 min. sockets	B	C						K	
1F4	1F5G					E					
	33			C						K	2
	1G5G					E				K	2
	1A5GT		B	C		E				K	2
	1C5GT		B	C		E				K	2
	1Q5GT		B	C		E				K	2
	1LB4		B	C		E				K	2
	3D6		B	C		E				K	2
	3LF4		B	C		E				K	2
1F5G	1F4					E					
	33					E					
	1G5G									K	2
	1A5GT		B	C						K	2
	1C5GT		B	C						K	2
	1Q5GT		B	C						K	2
	1LB4		B	C						K	2
	3D6		B	C						K	2

The G, GT or GT/G Types may be used interchangeably when space permits.

For details of changes indicated Refer to page 13

REQUIRED TYPE	POSSIBLE REPLACEMENTS	NO CHANGES	FIL. VOLTS	FIL. CURRENT	REWIRE SOCKET	CHANGE SOCKET	REALIGN	ADD TOP CAP CONNECTION	REMOVE TOP CAP CONNECTION	CHANGE BIAS OR PLATE VOLTS	NOTE NO.
		A	B	C	D	E	F	G	H	K	
1F5G	1J5G									K	
(Continued)	3LF4		B	C		E				K	2
1F6	1F7G					E	F				
	3A8GT		B	C		E	F			K	
	1S5		B	C		E	F			K	
	1LD5		B	C		E	F			K	
1F7G	1F6					E	F				
	3A8GT		B	C	D		F			K	9
	1S5		B	C		E	F			K	
	1LD5		B	C		E	F			K	
1G4GT	1E4G									K	
	1LE3					E				K	
1G5G	1F5G									K	2
	1F4					E				K	2
	33					E					2
	1T5GT		B	C						K	2
	1A5GT		B	C						K	2
	1C5GT		B	C						K	
	1Q5GT		B	C						K	
	1LA4		B	C		E				K	2
	1LB4		B	C		E				K	2
	3D6		B	C		E				K	
	3LE4		B	C		E				K	2
	3LF4		B	C		E				K	
	3Q5G		B	C	D					K	
	1J5G	A									
1G6GT	1J6G		B	C							
	19		B	C		E					
	3B7		B	C		E					
1H4G	30					E					
	1E4G		B	C						K	
	1G4GT		B	C						K	
	1LE3		B	C		E				K	
1H5GT	1C3					E			H		5
	1H6G		B	C	D				H	K	
	1LH4					E			H		8
	3A8GT				D				H		9
	1LD5					E			H		3
1H6G	1B5					E					
	1H5GT		B	C						K	5
	1LH4		B	C		E				K	5
	3A8GT				D					K	9–5
1J5G	1G5G	A									
	1F5G									K	
	1F4					E				K	
	33					E				K	
	1A5GT		B	C						K	2
	3LF4		B	C		E				K	2
	1C5GT		B	C						K	2
	1Q5GT		B	C						K	2
	3Q5GT		B	C	D					K	
	3D6		B	C		E				K	2
	1D8GT		B	C						K	9
	1T5GT		B	C						K	
1J6G	19					E					
	1G6G		B	C							
	3B7		B	C		E					
1L4	1T4						F				1
	1U4						F				1
	1AF4			C			F				
1L6	1R5				D		F				11–6
	1LA6					E	F				
	1LC6					E	F				

For details of changes indicated Refer to page 13

REQUIRED TYPE	POSSIBLE REPLACEMENTS	NO CHANGES	FIL. VOLTS	FIL. CURRENT	REWIRE SOCKET	CHANGE SOCKET	REALIGN	ADD TOP CAP CONNECTION	REMOVE TOP CAP CONNECTION	CHANGE BIAS OR PLATE VOLTS	NOTE NO.
		A	B	C	D	E	F	G	H	K	
1LA4	1A5GT					E					
	1C5GT			C		E				K	2
	1Q5GT			C		E					2
	1D8GT			C		E				K	9–2
	3D6			C							2
	3Q5GT			C		E					2
	1LB4									K	2
	3LF4			C	D						2
1LA6	1A7GT					E	F		H		
	1LC6						F				6
	3A8GT			C		E	F				9–2
1LB4	1LA4									K	2
	3D6			C	D					K	
	3LE4			C	D						2
	3LF4			C	D					K	2
	1T5GT					E				K	
	1A5GT					E					
	1C5GT			C		E				K	2
	1S4			C		E				K	2
	1W4					E					
	3V4			C		E				K	
	3Q4			C		E				K	
1LC5	1LN5						F			K	
	1L4					E	F				
	1N5GT					E	F				7
	1U4					E	F				
	1LG5					E	F				
	3A8GT			C		E	F				9–7
	5910					E	F				
1LC6	1A7GT					E	F				7
	1LA6						F				7
	1L6					E	F				
	1R5					E	F				11
	3A8GT			C		E	F	G			9
1LD5	1S5					E	F				
	1D8GT			C		E	F			K	9–7
	1N6G					E	F			K	7
	1U5					E					
	1L4					E					5
	3A8GT			C		E	F				9–7
1LE3	1G4GT					E				K	
	1E4G					E					
	1D8GT					E				K	9
	1C3					E					
	1L4					E					4
1LH4	1H5GT					E					
	3A8GT					E					9
	1LN5				D						3
1LN5	1N5GT					E	F				
	1LC5						F				6
	1L4					E	F			K	
	1U4					E	F				
	3A8GT			C		E	F				9
1N5GT	1T4					E	F		H		8
	1L4					E	F		H		
	1LN5					E	F		H		8
	1LC5					E	F		H		6
	1U4					E	F		H		
	3A8GT				D		F				9
1N6G	1A5GT				D						5
	1D8GT			C	D						9
	1LA4					E					5
	1LB4					E				K	5–2
	1Q5GT			C	D						5–2
	1T5GT				D						5–2
	1W4					E				K	5–2

The G, GT or GT/G Types may be used interchangeably when space permits.

For details of changes indicated — Refer to page 13

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A NO CHANGES	B FIL. VOLTS	C FIL. CURRENT	D REWIRE SOCKET	E CHANGE SOCKET	F REALIGN	G ADD TOP CAP CONNECTION	H REMOVE TOP CAP CONNECTION OR PLATE TOP CAP	K CHANGE BIAS VOLTS	NOTE NO.
1P5GT	1N5GT						F				1
	1L4					E	F				1
	1LG5					E	F				
	1LN5					E	F				1
	1LC5					E	F				1–6
	1T4					E	F				6
	1U4					E	F				1
	3A8GT				D		F				9–1
	5910					E	F				1
1Q5GT	1T5GT			C						K	2
	1C5GT									K	
	1A5GT			C							2
	1D8GT			C						K	9–2
	3D6			C		E					
	1LA4			C		E					2
	1LB4					E				K	2
	1S4					E					6
	1W4			C		E				K	2
	3LF4					E					
1R5	1LA6					E	F				11
	1LC6					E	F				11
	1L6				D		F				11
	1A7G					E	F				11
1S4	1A5GT			C		E				K	2
	1LA4			C		E				K	2
	1LB4			C		E				K	2
	1Q5GT					E				K	
	1W4			C	D					K	2
	3Q4				D					K	
	3Q5GT					E				K	
	3S4				D						
	3V4				D					K	
1S5	1L4				D						5
	1LD5					E					6
	1T4				D					K	5
	1U4				D					K	5
	3A8GT			C		E		G			
1T4	1L4						F				1
	1LN5					E					1–7
	1LC5					E					1–6
	1P5GT					E		G			7
	1U4										1
	5910										1
1T5GT	1A5GT									K	2
	1Q5GT			C						K	2
	1C5GT			C						K	2
	1D8GT			C						K	9
	1LA4					E				K	2
	1LB4					E				K	
	3D6					E				K	2
	3LF4					E				K	2
1U4	1L4						F				
	1T4						F				10
	1AF4			C			F				
3A8GT	1LH4	Requires room for two sockets no single replacement H									
	1LN5										
	1H5G	Requires room for two sockets no single replacement H									
	1N5G										
	1C3	Adaptor with 2 Min. sockets								K	5
	1L4									K	
	1C3	Adaptor with 2 Min. sockets								K	
	1S5									K	
3LF4	3V4					E					
	3Q4					E					
	3S4					E				K	10
	3Q5GT					E					
3Q5GT (At 1.4 Volts only)	1Q5GT				D						
	1C5GT				D					K	
	1T5GT				D					K	2
	3D6			C		E					
	1A5GT			C	D					K	2
	1D8GT				D					K	9–2
	1LA4			C		E				K	2
	1LB4			C		E				K	2
	1W4			C		E				K	
	1S4					E				K	
	3A4			C		E				K	
(At any Volt.)	3B5GT									K	
	3LF4					E					
	3Q4					E					2
	3S4					E				K	6
	3V4					E					2
3Q4	3V4				D						
	3S4									K	
3S4 (At 1.4 Volts only)	1W4			C	D					K	
	3A4			C	D					K	
	1Q5GT					E				K	7
	1S4				D						
	3D6			C		E				K	
	1C5GT					E					7
	1LB4			C		E				K	2–7
(At any Volt.)	3Q4									K	7
	3LF4					E				K	
	3Q5GT					E				K	7
	3V4									K	7
3V4	3Q4				D					K	
	3S4				D					K	10
19	1J6G					E					
	1G6GT		B	C		E					
30	1H4G					E					
	1E4G		B	C		E				K	
	1G4GT					E				K	
	1LE3		B	C		E				K	
32	1B4 (P or T)						F				
	1E5G					E	F				
	1LN5		B	C		E	F		H	K	7
	1LC5		B	C		E	F		H	K	6
	34						F				
	1A4 (P or T)						F				
33	1F4			C						K	2
	1F5G			C		E				K	2
	1G5G			C		E					
	1J5G			C		E				K	2
	1A5GT		B	C		E				K	2
	1C5GT		B	C		E				K	
	1Q5GT		B	C		E				K	
	1T5GT		B	C		E				K	2
34	1A4 (P or T)						F				
	1D5G (P or T)					E	F				
	1P5GT		B	C		E	F			K	
	1B4 (P or T)						F				1
	32						F				1
	1E5 (G or P)					E	F				1

For 117 volt types sometimes used with Battery Types, see page 24.

The G, GT or GT/G Types may be used interchangeably when space permits.

NOTES FOR BATTERY TYPES SUBSTITUTIONS

A. This is shown only when the tubes are directly interchangeable for all published ratings. Unusual operating conditions may require analysis.

B. This means that the filament voltage on the substitute tube is different from the required type. In most cases this can be allowed for by use of a small resistor to drop the voltage to that required. In some cases a complete change over of all tubes so as to use a new supply may be advisable. No listing is made for 2.0 volt tubes replacing 1.4 volt tubes because the additional battery and best circuit changes must be determined for each case.

C. Indicates that the filament current of the substitute tube differs from that of the required type. If all tubes are used directly from the battery this will affect battery life only, but in many cases a series resistor or ballast may have to be changed, adjusted, or shunted. If in series on an AC-DC set a substitute with no change in current is required.

D. Uses the same socket but pin connection is different. Watch out for tie points not used in the former tube which may be used in the substitute tube.

E. Requires a different type of socket. Watch out for tie points as in "D".

F. Realignment is recommended as good practice in all cases of RF and IF changes.

G. Provision must be made for connection to the top cap of the substitute tube which was not originally required.

H. The former top cap connection will have to be changed to connect to a base pin or to the side of the adapter when one is used.

K. Indicates that the substitute tube operates at a different bias for the applied plate voltage than the original tube. If some of the newer types are substituted good performance and improved battery life can be obtained by reducing the plate voltage to the rating of the new tube and applying its rated bias.

(1) The use of a sharp cut-off RF pentode in place of a remote cut-off tube may cause great distortion in locations where strong signals are available. If no other substitute is available all tubes on the A.V.C. system should be changed.

(2) The optimum load resistance for these types is more than 20% off. If tone is noticeably poor, transformer tap adjustment or a new transformer may be required.

(3) Requires addition of screen voltage, resistor and bypass condenser. Select resistor to give screen volts approximately equal to the actual plate volts.

(4) This type can be used as a triode by tying screen and suppressor to the plate.

(5) A type 1N34 crystal may be used in place of one diode section of the original tube.

(6) If voltage at screen is greater than rated value it should be reduced.

(7) Screen voltage may be increased for use with this type.

(8) Circuit for this substitution is given on last few pages of this booklet.

(9) Unused elements should be tied to negative filament.

(10) Decrease screen voltage when using this type.

(11) This converter substitution is tricky. Some experimentation may be required to find the best connection for each set. Adaptor circuits in the back of this book may help.

The G, GT, or GT/G types may be used interchangeably where space permits.

For details of changes indicated Refer to page 18

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A NO CHANGES	B FIL. VOLTS	C FIL. CURRENT	D REWIRE SOCKET	E CHANGE SOCKET	F REALIGN	G CHANGE BIAS OR PLATE VOLTS	H REMOVE TOP CAP CONNECTION ADD TOP CAP	K NOTE NO.
6D8G	7A8					E	F		H	
	14J7		B			E	F		H	
	14S7		B			E	F		H	
	14B8		B			E	F		H	
	12A8GT		B				F			
	12K8GT		B				F			
	25B8GT		B		D		F			11
	For 300 ma. types see type 6A8G and for procedure see article on page 8.									
6G6G	12L8GT		B		D					
	14A5		B			E			K	2
	35A5		B			E			K	2
	35L6GT		B						K	2
	50A5		B			E			K	2
	50L6GT		B						K	2
	50C6G		B						K	2
	For 300 ma. types see type 12A5 and for procedure see article on page 8.									
6L5G	12J5GT		B							
	14A4		B			E				
	14E6		B			E				9
	12J7GT		B		D		G			4
	12SJ7GT		B		D					4
	7C7					E				4
	14C7		B			E				4
	6W7G				D		G			4
	For 300 ma. types see type 6C5G and for procedure see article on page 8.									
6S7G	6SS7				D		F		H	
	12SK7GT		B		D		F		H	
	12K7GT		B				F			
	7B7					E	F		H	6
	14A7/12B7		B			E	F		H	6
	14E7		B			E	F		H	
	14H7		B			E	F		H	6
	12J7GT		B				F			1
	12SJ7GT		B		D		F		H	1
	7C7					E	F		H	1
	14C7		B			E	F		H	1–6
	For 300 ma. types see type 6K7G and for procedure see article on page 8.									
6T7G	12Q7GT		B							
	12SQ7GT		B		D				H	
	7C6					E			H	
	14B6		B			E			H	
	14E7		B			E			H	3
	14R7		B			E			H	3
	12SF7		B		D				H	3
	12C8		B		D					5
	For 300 ma. types see type 6Q7GT and for procedure see article on page 8.									
6W7G	12J7GT		B				F			
	12SJ7GT		B		D		F		H	
	12SH7		B		D		F		H	6
	7C7					E	F		H	
	14C7		B			E	F		H	
	12C8		B		D		F			9
	14R7		B			E	F		H	9
	For 300 ma. types see 6J7GT and for procedure see article on page 8.									
	For use as audio amplifiers types under 6S7G may also be used.									
7A6	12AL5		B			E				
	12H6G		B			E				
	14F7		B		D					4
	12SL7GT		B			E				4

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A NO CHANGES	B FIL. VOLTS	C FIL. CURRENT	D REWIRE SOCKET	E CHANGE SOCKET	F REALIGN	G CHANGE BIAS OR PLATE VOLTS	H REMOVE TOP CAP CONNECTION ADD TOP CAP	K NOTE NO.
7A6 (Continued)	XXD		B		D					4
	14AF7		B		D					4
	5679				D					
	For 300 ma. types see 6H6GT and for procedure see article on page 8.									
7A8	14B8		B				F			
	14J7		B				F			
	14S7		B				F			
	12A8GT		B				F	G		
	12K8GT		B				F	G		
	6D8G					E	F	G		
	25B8GT		B			E	F	G		11
	For 300 ma. types see 6A8GT and for procedure see article on page 8.									
7B7	7AH7						F		K	
	14A7/12B7		B				F			
	14H7		B				F			6
	6BJ6					E	F		K	
	6S7G					E	F	G		
	6SS7					E	F			
	12SG7		B			E	F			6
	12SK7G		B			E	F			
	12K7GT		B			E	F	G		
	5590					E	F			
	9001					E	F			
	For 300 ma. types see 6K7GT and for procedure see article on page 8. See also types under 7C7 and note 1.									
7C6	6AQ6					E				
	6SZ7					E				
	6T7G					E		G		
	12AX7		B			E				5
	12BK6		B			E				
	12BT6		B			E				
	12F5GT		B			E		G		5
	12Q7GT		B			E		G		
	12SF5GT		B			E				5
	12SQ7GT		B			E				
	14B6		B							
	For 300 ma. types see 6Q7GT and for procedure see article on page 8.									
7C7	6BH6					E	F		K	
	6W7G					E		G		
	7AB7				D		F			
	7AG7						F		K	
	12AU6		B			E	F		K	
	12C8		B			E		G		9
	12J7GT		B			E		G		
	12SH7G		B			E				6
	12SJ7GT		B			E				
	14C7		B							
	14R7		B		D					9
	5879					E	F		K	
	For 300 ma. types see 6J7GT and for procedure see article on page 8.									
	For use in audio amplifiers types under 7B7 may also be used.									
12A8GT	7A8		B			E	F		H	8
	12K8GT						F			11
	6D8G		B				F			11
	14B8					E	F		H	8
	14J7					E	F		H	8
	14S7					E	F		H	8
	25B8GT		B			E	F			8
	For 300 ma. types see 6A8GT and for procedure see article on page 8.									

These substitutions are for AC-DC series sets. For transformer operated sets the above substitutions are possibls if tubes requiring no voltage change are used. Substitutes from either the 150 or 300 ma. chart may be used.

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K	NOTE NO.
For details of changes indicated Refer to page 18		NO CHANGES	FIL. VOLTS	FIL. CURRENT	REWIRE SOCKET	CHANGE SOCKET	REALIGN	ADD TOP CAP CONNECTION	REMOVE TOP CAP CONNECTION	CHANGE BIAS OR PLATE VOLTS	
12BA6	6BJ6		B		D		F				
	7AH7		B			E	F			K	
	12BD6						F			K	
	12SG7					E	F			K	
	12K7GT					E	F	G		K	
	12SK7GT					E	F			K	
	14A7					E	F			K	
	14H7					E	F			K	
12BE6	6D8G		B			E	F	G			11
	12BA7					E	F				
	12K8GT					E	F	G			11
	12SA7GT					E	F				
	12SY7					E	F				
	14B8					E	F				11
	14J7					E	F				11
	14Q7					E	F				
	14S7					E	F				11
12C8	12SF7				D		F		H	K	
	14E7					E	F		H		
	14R7					E	F		H	K	
	For 300 ma. types see 6B8G and for procedure see article on page 8.										
12F5GT	6T7G		B		D						9
	7C6		B			E			H		9
	12SF5GT				D				H		
	12SL7GT				D				H		9
	12Q7GT				D						9
	12SQ7GT				D				H		9
	14B6					E			H		9
	For 300 ma. types see 6F5GT and for procedure see article on page 8.										
12J5GT	6C4		B			E					
	6L5G		B								
	6W7G		B		D			G			4
	7C7		B			E					4
	12BF6					E					4
	12BU6					E					4
	12J7GT				D			G			4
	12SJ7GT				D						4
	14A4					E					
	14C7					E					4
	14E6					E					9
	9002		B			E				K	
	For 300 ma. types see 6J5GT and for procedure see article on page 8.										
12J7GT	6BH6		B			E	F	G		K	
	6W7G		B				F				
	7AG7		B			E	F	G		K	
	7C7		B			E	F		H		8
	12AU6					E	F	G		K	
	12AW6					E	F	G		K	
	12C8				D		F				9
	12SH7G				D		F		H		6
	12SJ7GT				D		F		H		
	14C7					E	F		H		8
	14R7					E	F		H		9
	5879		B			E	F	G		K	
	9003		B			E	F	G		K	
	For 300 ma. types see 6J7GT and for procedure see article on page 8. For use as audio amplifiers types under 12K7G may also be used.										
12K7GT	6BJ6		B			E	F		H	K	
	6S7G		B				F				
	6SS7		B		D		F		H		
	7AH7		B			E	F		H	K	

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K	NOTE NO.
For details of changes indicated Refer to page 18		NO CHANGES	FIL. VOLTS	FIL. CURRENT	REWIRE SOCKET	CHANGE SOCKET	REALIGN	ADD TOP CAP CONNECTION	REMOVE TOP CAP CONNECTION	CHANGE BIAS OR PLATE VOLTS	
12K7GT (Continued)	7B7		B			E	F		H		
	12BA6					E	F		H	K	
	12BD6					E	F		H	K	
	12SG7				D		F		H	K	
	12SK7G				D		F		H		
	14A7/12B7					E	F		H		8
	14E7					E	F		H		9
	14H7					E	F		H		8-6
	25B8GT		B		D		F				9
	5590					E	F		H		
	9001					E	F		H	K	
	For 300 ma. types see 6K7G and for procedure see article on page 8. See also types under 12J7GT and note 1.										
12K8GT	7A8		B			E	F		H		8
	12A8GT						F				11
	14J7					E	F		H		8
	14S7					E	F		H		11
	6D8G		B				F				11
	25B8GT		B		D		F				11
	14B8					E	F		H		8
	For 300 ma. types see type 6K8G and for procedure see article on page 8.										
12Q7GT	6AQ6		B			E			H		
	6T7G		B								
	7B4		B			E			H		5
	7C6		B			E			H		8
	12AT6					E			H		
	12AV6					E			H		
	12BK6					E			H		
	12BT6					E			H		
	12F5GT				D						5
	12SF5GT				D				H		5
	12SF7				D				H		3
	12SQ7GT				D				H		
	14B6					E			H		8
	14E7					E			H		
	14R7					E			H		
	14X7					E			H		
	For 300 ma. types see type 6Q7GT for procedure see article on page 8.										
12SA7GT	6D8G		B		D		F	G			11
	7A8		B			E	F				11
	12A8GT				D		F	G			11
	12K8GT				D		F	G			11
	14B8					E	F				11
	14J7					E	F				11
	14Q7					E	F				8
	14S7					E	F				11
	For 300 ma. types see type 6SA7 and for procedure see article on page 8.										
12SF5GT	6T7G		B		D			G			
	7C6		B			E					
	12F5GT				D			G			
	12Q7GT				D			G			
	12SL7GT				D						
	12SQ7GT				D						
	14B6					E					
	For 300 ma. types see type 6SF5 and for procedure see article on page 8.										
12SG7	6BJ6		B			E	F				
	7AH7		B			E	F				
	12BA6					E	F				
	12BD6					E	F				
	14H7					E	F				

These substitutions are for AC-DC series sets. For transformer operated sets the above substitutions are possible if tubes requiring no voltage change are used. Substitutes from either the 150 or 300 ma. chart may be used.

For details of changes indicated Refer to page 18

REQUIRED TYPE	POSSIBLE REPLACEMENTS	NO CHANGES	FIL. VOLTS	FIL. CURRENT	REWIRE SOCKET	CHANGE SOCKET	REALIGN	ADD OR REMOVE CAP CONNECTION	CHANGE BIAS OR PLATE VOLTS	NOTE NO.
		A	B	C	D	E	F	G	H	K
12SJ7GT	6BH6		B			E	F			K
	6W7G		B		D		F	G		
	7AG7		B			E	F			K
	7C7		B			E	F			8
	12AU6					E	F			K
	12AW6					E	F			K
	12C8				D		F	G		
	12J7GT				D		F	G		
	12SH7G				D		F			6
	14C7					E	F			8
	14R7					E	F			
	5879					E	F			K
	9003					E	F			
	For use in audio amplifier types under 12SK7GT may also be used.									
	For 300 ma. types see type 6SJ7G and for procedure see article on page 8.									
12SK7GT	6BJ6		B			E	F			K
	6S7G		B				F	G		
	6SS7		B				F			
	7AH7		B			E	F			K
	7B7		B			E	F			
	12BA6					E	F			K
	12B7/14A7					E	F			8
	12BD6					E	F			K
	12K7GT				D		F	G		
	12SG7				D		F			K 6
	14E7					E	F			
	14H7					E	F			8
	5590					E	F			
	9001					E	F			K
	See also types under 12SJ7 and note 1.									
	For 300 ma. types see type 6K7G and for procedure see article on page 8.									
12SQ7GT	6AQ6		B			E				
	6T7G		B		D			G		
	7B4		B			E				5
	7C6		B			E				
	12AT6					E				
	12AV6					E				
	12BK6					E				
	12BT6					E				
	12F5GT				D			G		5
	12Q7GT				D			G		
	12SF5GT				D					5
	12SF7				D					3
	14B6					E				8
	14E7					E				
	14R7					E				
	14X7					E				
	For 300 ma. types see type 6Q7GT and for procedure, see article on page 8.									
12SR7GT	6C4		B			E				5
	6L5G		B		D					5
	6ST7		B							
	12BF6					E				
	12C8					E		G		4
	12E5GT				D				K	5
	12SF7					E				4
	14E6					E				
	For 300 ma. types see type 6R7G and for procedure see article on page 8.									
14A4	6L5G		B			E				
	6ST7		B			E				
	12J5GT					E				
	12SR7					E				
	14E6				D					9
	For 300 ma. types see type 6J5G and for procedure see article on page 8.									
14A5	12A6					E				
	35A5		B							K 2
	50A5		B							K 2
	50C6G		B			E				K 2
	6G6G		B			E				K 2
	35L6GT		B			E				K 2
	50L6GT		B			E				K 2
	For 300 ma. types see type 12A5 and for procedure see article on page 8.									
14A7	7B7		B				F			
	14H7						F			6
	6S7G		B			E	F	G		
	6SS7		B			E	F			
	12SK7GT					E	F			
	12SG7					E	F			6
	12K7GT					E	F	G		
	For 300 ma. types see type 6K7GT and for procedure see article on page 8.									
14B6	7C6		B							
	6T7G		B			E		G		
	12C8					E		G		3
	12Q7GT					E		G		
	12SF7					E				3
	12SQ7GT					E				
	For 300 ma. types see type 6Q7GT and for procedure see article on page 8.									
14B8	7A8		B				F			
	14J7						F			
	14S7						F			
	12A8GT					E	F	G		
	12K8GT					E	F	G		
	25B8GT		B			E	F	G		11
	6D8G		B			E	F	G		
	For 300 ma. types see type 6A8GT and for procedure see article on page 8.									
14C7	7C7		B							
	6W7G		B			E		G		
	12SH7					E				6
	12SJ7GT					E				
	12J7GT					E		G		
	For use as audio amplifiers see also types under 14A7.									
	For 300 ma. types see type 6J7GT and for procedure see article on page 8.									
14E6	6C4		B			E				5
	6L5G		B			E				5
	6ST7		B			E				
	12BF6					E				
	12C8					E		G		4
	12E5GT					E			K	5
	12SF7					E				4
	12SR7					E				
	For 300 ma. types see type 6V7G and for procedure see article on page 8.									
14J7	6D8G		B			E	F	G		
	7A8		B				F			
	12A8GT					E	F	G		
	12B8GT					E	F	G		
	12K8GT					E	F	G		
	14B8						F			
	14S7						F			
	For 300 ma. types see type 6A8G and for procedure see article on page 8.									

These substitutions are for AC-DC series sets. For transformer operated sets the above substitutions are possible if tubes requiring no voltage change are used. Substitutes from either the 150 or 300 ma. chart may be used.

For details of changes indicated Refer to page 18

REQUIRED TYPE	POSSIBLE REPLACEMENTS	NO CHANGES	FIL. VOLTS	FIL. CURRENT	REWIRE SOCKET	CHANGE SOCKET	REALIGN	ADD TOP CAP CONNECTION	REMOVE TOP CAP CONNECTION	CHANGE BIAS OR PLATE VOLTS	NOTE NO.
14Q7	6D8G		B			E		F	G		11
	7A8		B		D			F			11
	12A8GT					E		F	G		11
	12BA7					E		F			
	12BE6					E		F			
	12K8GT*					E		F	G		11
	12SA7GT*					E		F			
	12SY7					E		F			
	14B8				D			F			11
	12SY7					E		F			
	14B8				D			F			11
	14J7				D			F			11
	14S7				D			F			11
	For 300 ma. types see type 6SA7 and for procedure see article on page 8.										
14R7	7B7		B		D						5
	7C7		B		D						5
	12C8					E			G	K	
	12SF7					E				K	
	14A7				D						5
	14C7				D						5
	14E7									K	
	14H7				D						5
	For 300 ma. types see type 6B8G and for procedure see article on page 8.										
25B8GT	No good single tube; Types 12SF5 and 12K7G together.										
	12B8GT		B	C				F			
	6P7G		B	C	D			F		K	
	6F7		B	C		E		F		K	
	12AT6 and 12BA6	Use adaptor with 2 Min. Sockets						F	H		9
	12AV6 and 12BD6	Use adaptor with 2 Min. Sockets						F	H		9
	12BK6 and 12BA6	Use adaptor with 2 Min. Sockets						F	H		9
	12BT6 and 12BD6	Use adaptor with 2 Min. Sockets						F	H		9
25D8GT	12AT6 and 12BA6	Use adaptor with 2 Min. Sockets						F	H		9
	Others same as 25B8GT using one of the diodes.										
35A5	12A6		B			E				K	2
	14A5		B							K	2
	50A5		B								
	35B5					E					
	50B5		B			E					
	35C5					E					
	50C5		B			E					
	50C6G		B			E				K	
	35L6GT					E					
	50L6GT		B			E					
	70L7GT		B			E					9
	For 300 ma. types see type 25L6GT and for procedure see article on page 8.										
35L6GT	12A6		B							K	2
	14A5		B			E				K	2
	35A5					E					8
	50A5		B			E					
	35B5					E					
	50B5		B			E					
	35C5					E					
	50C5		B			E					
	50C6G		B								
	50L6GT		B								
	70L7GT		B		D						9
	For 300 ma. types see type 25L6GT and for procedure see article on page 8.										

For details of changes indicated Refer to page 18

REQUIRED TYPE	POSSIBLE REPLACEMENTS	NO CHANGES	FIL. VOLTS	FIL. CURRENT	REWIRE SOCKET	CHANGE SOCKET	REALIGN	ADD TOP CAP CONNECTION	REMOVE TOP CAP CONNECTION	CHANGE BIAS OR PLATE VOLTS	NOTE NO.
35Y4	70L7GT		B					E			9–10
	35W4							E			
	50X6		B		D						10
	50Y6GT		B					E			10
	35Z3				D						10
	35Z4GT							E			10
	35Z5GT							E			
	40Z5		B					E			10
	45Z3		B	C				E			10
	45Z5GT		B					E			
	50Z7G		B					E			
35Z3	70L7GT		B					E			9
	35W4							E			
	35Y4				D						
	50Y6GT		B					E			
	35Z4GT							E			
	35Z5GT							E			
	40Z5		B					E			
	45Z3		B	C				E			
	45Z5GT		B					E			
	50Z7GT		B					E			
35Z4GT	70L7GT		B		D						9
	35W4							E			
	35Y4							E			
	50Y6GT		B		D						
	35Z3							E			
	35Z5GT				D						
	40Z5		B					E			
	45Z3		B	C				E			
	45Z5GT		B		D						
	50Z7GT		B		D						
35Z5GT	70L7GT		B								9–10
	35Y4							E			
	50Y6GT		B		D						10
	35Z3							E			8–10
	35Z4GT										10
	40Z5		B								
	45Z3		B	C				E			10
	45Z5GT		B								
	50Z7GT		B		D						
45Z5GT	70L7GT		B		D						10
	35Y4		B					E			
	50Y6GT		B		D						10
	35Z3		B					E			10
	35Z4GT		B		D						10
	35Z5GT		B								
	40Z5			A							
	45Z3				C			E			10
	50Z7GT		B		D						10
50A5	12A6		B					E			K
	14A5		B								K
	35A5		B								
	50B5				D						
	50C5				D						
	50C6G							E			
	35L6GT		B					E			
	50L6GT							E			
	70L7GT		B					E			10
	For 300 ma. types see type 25L6GT and for procedure see article on page 8.										
50B5	35B5		B								
	35C5		B		D						
	50C5				D						

These substitutions are for AC-DC series sets. For transformer operated sets the above substitutions are possible if tubes requiring no voltage change are used. Substitutes from either the 150 or 300 ma. chart may be used.

For details of changes indicated Refer to page 18

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A NO CHANGES	B FIL. VOLTS	C FIL. CURRENT	D REWIRE SOCKET	E CHANGE SOCKET	F REALIGN	G ADD TOP CAP CONNECTION	H REMOVE TOP CAP CONNECTION OR PLATE TOP	K CHANGE BIAS OR PLATE VOLTS	NOTE NO.
50C6G	12A6		B							K	
	14A5		B			E				K	
	35A5		B			E				K	
	50A5					E				K	
	35L6GT		B							K	
	50L6GT									K	
	70L7GT		B		D					K	10
	For 300 ma. types see type 25C6G and for procedure see article on page 8.										
50L6GT	12A6		B							K	2
	14A5		B			E				K	2
	35A5		B			E					
	50A5					E					8
	35B5		B			E					
	50B5					E					
	35C5		B			E					
	50C5					E					
	50C6G									K	
	35L6GT		B								
	70L7GT		B		D						
	For 300 ma. types see type 25L6GT and for procedure see article on page 8.										
50X6	50Y6GT					E					
	50Y7GT					E					
	50Z7G					E					
	117Z6GT		B	C		E					
	See also types under 50Y6GT for use as a half wave rectifier.										

For details of changes indicated Refer to page 18

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A NO CHANGES	B FIL. VOLTS	C FIL. CURRENT	D REWIRE SOCKET	E CHANGE SOCKET	F REALIGN	G ADD TOP CAP CONNECTION	H REMOVE TOP CAP CONNECTION OR PLATE TOP	K CHANGE BIAS OR PLATE VOLTS	NOTE NO.
50Y6GT	117Z6GT		B	C							12
	50X6					E					10
	50Z7G				D						12
	70L7G				D						4
	For 300 ma. types see type 25Z6 and for procedure see article on page 8.										
	When used as a half-wave rectifier the following will substitute, if load is not too great.										
	35Z3		B			E					12
	35Z4GT		B		D						12
	35Z5GT		B		D						12
	45Z5GT				D						12
	35Y4		B			E					12
	70L7GT		B		D						9
	117Z4GT		B	C	D						12
50Z7G	50Y6GT				D						10
	70L7GT		B		D						4–10
	117Z6GT		B	C	D						10
	See also type 50Y6GT above.										
70L7GT	70A7GT				D						
	117P7GT		B	C	D					K	2
	117N7GT		B	C	D						2
	117L7/M7GT		B	C	D						2
XXD	14AF7	A									
	14F7									K	
	12SL7GT					E				K	
	12AH7GT					E					
	12SC7					E				K	

NOTES FOR 150 MA., 300 MA., TRANSFORMER AND AUTO TYPES

A. This is shown only when the tubes are directly interchangeable for all published ratings. Unusual operating conditions may require analysis.

B. This means that the heater voltage on the substitute tube is different from the required type. In most cases this can be taken care of by changing or shorting out a section of the series resistor. In cases where the resistor is in the line cord this is difficult unless the total voltage can be increased enough to make a line resistor unnecessary.
In transformer and auto sets this indicates that a series resistor is required to drop the voltage to that required by the substitute tube.

C. Indicates that the heater current of the substitute tube is different from the desired tube and that parallel resistors must be used as explained in the article on Page 8.
In transformer and auto sets tubes requiring more current should be used cautiously to avoid overloading the filament circuit. When more than one substitution is required in the same set it is sometimes possible for one to require a lower current keeping the total the same.

D. In these cases the tube socket is the same but some rearrangement of the connections may be necessary. It may only be necessary to be sure that contacts connected to elements of the substitute tube which are not required in that circuit are not used as tie points.

E. Requires a different type of socket. Watch out for tie points as in "D".

F. Realignment is recommended as good practice in all cases of RF and IF tube changes.

G. Provision must be made for connection to the top cap of the substitute tube which was not originally required.

H. The former top-cap connection will have to be changed to connect to a base pin.

K. Indicates that the substitute tube operates at a different bias for the applied plate voltage than the original tubes. Self bias circuits give some automatic correction but this should be measured and changed if necessary to prevent early failures.

(1) The use of a sharp cut-off pentode in place of a remote cutoff tube may cause great distortion in locations when strong signals are available. If no other substitute can be found all tubes on the A.V.C. system should be changed.

(2) The optimum load resistance for these types is more than 20% off. If tone or volume is noticeably poor, transformer tap adjustment or a new transformer may be required.

(3) Requires addition of screen voltage, resistor and bypass condenser. Select resistor to give screen volts approximately equal to actual plate volts.

(4) This type can be used as a triode by tying screen and suppressor to the plate. As a rectifier tie all grids to plate.

(5) A type 1N34 crystal may be used in place of the diode section of the original tube.

(6) If voltage at screen is greater than rated value it should be reduced.

(7) Screen voltage may be increased for this type.

(8) Circuit for this substitution is given on last few pages of this booklet.

(9) Unused elements should be connected to chassis or cathode terminal.

(10) Pilot lamp may be omitted or provided for by other means.

(11) This converter substitution is tricky. Some experimentation may be required to find the best connection for each set. Adaptor circuits in the back of this book may help.

(12) Check load current to be sure it is within ratings of substitute tube.

These substitutions are for AC-DC series sets. For transformer operated sets the above substitutions are possible if tubes requiring no voltage change are used. Substitutes from either the 150 or 300 ma. chart may be used.

For details of changes indicated Refer to page 18

REQUIRED TYPE	POSSIBLE REPLACEMENTS	NO CHANGES	FIL. VOLTS	FIL. CURRENT	REWIRE SOCKET	CHANGE SOCKET	REALIGN	ADD TOP CAP CONNECTION	REMOVE OR PLATE OVER TOP CAP	CHANGE BIAS OR PLATE VOLTS	NOTE NO.
		A	B	C	D	E	F	G	H	K	
1V	12Z3		B								
	76					E					4
	37					E					4
	6J5GT					E					4
	12A7		B			E					9
	14Y4		B			E					
	Any type listed under 35Z3 in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)										
6A7	6A8GT					E	F				8
	6AN7			C		E					
	6J8G					E	F				8
	6K8GT					E	F				8
	7B8					E	F				
	7J7					E	F				
	7S7					E	F				
	Any type listed under 6D8G in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)										
6A8G	6J8G						F				
	6K8GT						F				
	6A7					E	F				8
	7B8					E	F				8
	7J7					E	F				8
	7S7					E	F				
	12B8GT		B		D		F				8
	Any type listed under 6D8G in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)										
6AE5GT/G	6C5GT									K	
	6AF5G									K	
	6J5GT									K	
	6P5GT									K	
	7A4					E				K	
	Any type listed under 6L5G in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.) See also type 25AC5GT.										
6AF5G	6J5G									K	
	6C5GT									K	
	6P5GT									K	
	7A4					E				K	
	6AE5GT									K	
	76					E				K	
6B7	6B8G					E					
	6SF7					E				K	
	7E7					E					
	7R7					E				K	
	Any type listed under 12C8 in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)										
6B8G	6B7					E					
	6SF7				D					K	
	7E7					E					
	7R7					E				K	
	Any type listed under 12C8 in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)										
6BE6	6A8GT					E	F	G			11
	7Q7					E	F				
	6SA7GT					E	F				
	6AN7					E	F				11
	6D8G			C		E	F	G			11
	6J8G					E	F	G			11
	6K8GT					E	F	G			11
	7A8					E	F				11
	7B8					E	F				11

For details of changes indicated Refer to page 18

REQUIRED TYPE	POSSIBLE REPLACEMENTS	NO CHANGES	FIL. VOLTS	FIL. CURRENT	REWIRE SOCKET	CHANGE SOCKET	REALIGN	ADD TOP CAP CONNECTION	REMOVE OR PLATE OVER TOP CAP	CHANGE BIAS OR PLATE VOLTS	NOTE NO.
		A	B	C	D	E	F	G	H	K	
6BE6 (Continued)	7J7					E	F				11
	6BA7					E	F				
	12BE6		B	C			F				
	12SY7		B	C		E	F				
6C5GT	7A4					E					8
	6J5GT	A									
	6AF5G									K	
	76					E				K	
	6P5GT									K	
	37					E				K	
	6AE5G									K	
	6V7G				D					K	
	85					E				K	
	6R7G				D			G			
	6SR7G				D						
	Any type listed under 6L5G in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)										
6C6	77						F				
	6J7GT					E	F				
	6SH7GT					E	F		H		6
	6SJ7GT					E	F		H		
	7L7					E	F		H		6
	7H7					E	F		H		6
	7G7					E	F		H		6
	36					E	F				
	6D7					E	F				
	Also types under 6D6, but see Note 1. Any types listed under 6W7G in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)										
6D6	78						F				
	39/44					E	F				
	6K7GT					E	F				
	6SK7GT					E	F		H		
	6U7G					E	F				
	6SD7GT					E	F		H		6
	6SG7					E	F		H		6
	7A7					E	F		H		
	6E7					E	F				
	Also types under 6C6, but see note 1. Any types listed under 6S7G in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)										
6F5GT	6K5GT				D						
	6SF5GT					E			H		
	6SL7GT				D						9
	6Q7GT				D						9
	6SQ7GT				D				H		9
	75					E					9
	6B6G				D						9
	6B8G				D						3
	6SF7				D				H		3
	6F7					E					3–9
	6P7G				D						3–9
	6B7					E					3
	7B4					E					8
	7B6					E					8–9
	Any type listed under 12F5G in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)										
6F7	6F7S						F				
	6P7G					E	F				
	12B8GT		B			E	F			K	
	25B8GT		B	C		E	F			K	
6H6GT	6C8G				D			G			4
	12A7		B		D			G			4

These substitutions are for AC-DC series sets. For transformer operated sets the above substitutions are possible if tubes requiring no voltage change are used. Substitutes from either the 150 or 300 ma. chart may be used.

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K	NOTE NO.
	For details of changes indicated Refer to page 18	NO CHANGES	FIL. VOLTS	FIL. CURRENT	REWIRE SOCKET	CHANGE SOCKET	REALIGN	ADD TOP CAP CONNECTION	REMOVE TOP CAP CONNECTION	CHANGE BIAS OR PLATE VOLTS	
6H6GT (Continued)	7F7					E					4
	14N7		B			E					4
	14Y4		B			E					
	Any type listed under 7A6 in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)										
6J5GT	6C5GT	A									
	See also 6C5GT in this table.										
6J7GT	7L7					E	F		H		6–8
	6SJ7GT				D		F		H		
	77					E	F				
	6C6					E	F				
	6SH7GT				D		F		H		6
	7H7					E	F		H		6
	Any type listed under 6W7G in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)										
6J8G	6A8GT						F				
	6K8GT						F				
	6A7					E	F				
	7B8					E	F		H		8
	7J7					E	F		H		8
	7S7					E	F		H		8
	6F7					E	F				
	6P7G				D		F				
	Any type listed under 6D8G in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)										
6K5GT	See 6F5GT										
6K7GT	7H7					E	F		H		6–8
	6U7G						F				
	6SK7GT				D		F		H		
	39/44					E	F				
	78					E	F				
	6D6					E	F				
	36					E	F				
	6SG7				D		F		H		6
	7A7					E	F		H		8
	Types under 6J7GT, but see note 1. Any type listed under 6S7G in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)										
6K8GT	6J8G						F				
	6A8GT						F				
	6A7					E	F				
	7B8					E	F				
	7J7					E	F				
	7S7					E	F				
	Any type listed under 6D8G in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)										
6P5GT	See 6C5GT—Bias change may not be required.										
6P7G	6F7					E	F				
	12B8GT		B		D		F			K	
	25B8GT		B	C	D		F			K	
6Q7GT	6B6G	A									
	6SQ7GT				D				H		
	75					E					8
	7B6					E			H		8
	7K7					E			H		
	XXFM					E			H		
	6B7					E					3
	6B8G				D						3
	6SF7				D				H		3
6Q7GT (Continued)	7E7					E			H		3
	7R7					E			H		3
	Any type listed under 6T7G in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)										
6R7GT	6V7G									K	
	85					E				K	
	6SR7GT				D				H		
	6B7					E				K	4
	6B8G				D					K	4
	6SF7				D				H	K	4
	7E7					E			H	K	4
	7R7					E			H	K	4
	7E6					E			H	K	4
6SA7GT	6A8GT				D			G			11
	6J8G				D			G			11
	6K8GT				D			G			11
	7B8					E					11
	7Q7					E					8
	7J7					E					11
	7S7					E					11
	Any type listed under 12SA7GT in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)										
6SJ7GT	7L7					E	F				6
	6J7GT				D		F	G			
	77					E	F	G			
	6C6					E	F	G			
	6SH7GT				D		F				6
	7H7					E	F				6
	7C7			C		E	F				
	7A7			C		E	F				
	6AG5					E	F				6
	6W7G			C	D		F	G			
	7AJ7					E	F				
6SK7GT	6BJ6					E	F				
	6K7GT				D		F	G			
	78					E	F	G			
	6D6					E	F	G			
	7B7			C		E	F				
	6U7G				D		F	G			
	7A7					E	F				
	6SG7GT				D		F				6
	6S7G			C	D		F	G			
	6SS7			C			F				
	6BJ6			C		E	F				
6SQ7GT	7B6					E					
	7K7					E					
	7X7 (XXFM)					E					
	75					E		G			
	6AT6					E					
	6AV6					E					
	6AW7GT				D						
	6B6G					E		G			
	6BD7			C		E					
	6BK6					E					
	6BT6					E					
	6Q7GT				D			G			
	6S8GT				D						
	6T7G			C	D			G			
	6T8			C		E					
	7C6			C		E					
	6SZ7			C							
	Also any triode like 6F5G plus one or two 1N34 crystals in place of the diodes.										
6U7G	6K7GT						F			K	
	6SK7GT				D		F		H	K	
	6SD7				D		F		H		6

These substitutions are for AC-DC series sets. For transformer operated sets the above substitutions are possible if tubes requiring no voltage change are used. Substitutes from either the 150 or 300 ma. chart may be used.

For details of changes indicated Refer to page 18

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A NO CHANGES	B FIL. VOLTS	C FIL. CURRENT	D REWIRE SOCKET	E CHANGE SOCKET	F REALIGN	G CAP CONNECTION OR REMOVE TOP CAP CONNECTION ADD TOP CAP CONNECTION	H CHANGE BIAS OR PLATE VOLTS	K NOTE NO.
6U7G (Continued)	39/44					E	F			
	78					E	F			K
	6D6					E	F			
	7A7					E	F		H	
	6B7					E	F			9
	6B8G				D		F			9
	6SF7				D		F		H	K 9
	6F7					E	F			9
	6P7G				D		F			9
	12B8GT		B		D		F			9
	36					E	F			
	Any type listed under 6S7G in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)									
6V7G	85					E				
	See type 6R7G, Bias change may not be required									
12A5	25B6G		B			E				2
	38		B			E		G		K 2
	25A6		B			E				
	43		B			E				
	14C5			C		E				K
	25A7G		B			E				
	25L6GT		B			E				K 2
	25C6G		B			E				K 2
	25N6G		B			E				K 2
	32L7GT		B			E				K 2
	12A7				D			G		K 2
	Any type listed under 6G6G in 150 ma. chart may be used with simple resistor changes. (See article on Page 8.)									
12A7	32L7GT		B			E			H	K 2
	25A7GT		B			E			H	K 2
	Any type listed under 70L7GT in 150 ma. chart may be used with simple resistor changes. (See article on page 8.)									
12B8GT	12AT6 and 12BA6 — Make adaptor with 2 min. sockets						F		H	9
	12AV6 and 12BD6 — Make adaptor with 2 min. sockets						F		H	9
	12BK6 and 12BA6 — Make adaptor with 2 min. sockets						F		H	9
	12BT6 and 12BD6 — Make adaptor with 2 min. sockets						F		H	9
	6F7		B							K
	6P7G		B							K
	25B8GT		B	C						
12Z3	1V		B							
	12A7					E		G		4
	76		B			E				4
	37		B			E				4
	6J5G		B			E				4
	14Y4					E				
	28Z5		B	C		E				
	Any type listed under 35Z3 in 150 ma. chart may be used with simple resistor changes. (See article on page 8.)									
25A6GT	14C5		B	C		E				8
	25B6G									2
	25N6G									K 2
	25L6GT									K 2
	43					E				
	12A5		B			E				
	38		B			E		G		K 2–8
	25C6G									K 2
	32L7GT		B		D					K 9–2
	25A7GT				D					9
	12A7		B			E		G		K 9–2

For details of changes indicated Refer to page 19

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A NO CHANGES	B FIL. VOLTS	C FIL. CURRENT	D REWIRE SOCKET	E CHANGE SOCKET	F REALIGN	G CAP CONNECTION OR REMOVE TOP CAP CONNECTION ADD TOP CAP CONNECTION	H CHANGE BIAS OR PLATE VOLTS	K NOTE NO.
25A6GT (Continued)	Any type listed under 35A5 in 150 ma. chart may be used with simple resistor changed. (See article on page 8.)									
25A7GT	12A7		B			E		G		K 2
	32L7GT		B							K 2
	Any type listed under 70L7GT on 150 ma. chart may be used with simple resistor changes. (See article on page 8.)									
25AC5GT	Same types as 25A6GT. (Driver no longer required.)									
25B6G	25N6G									K
	25L6GT									K
	25C6G									K
	12A5		B			E				2
	38		B			E		G		K 2
	25A6GT									2
	25A7GT				D					2–9
	12A7		B			E		G		K 2–9
	25B5					E				K
	43					E				2
	32L7GT		B		D					K 2–9
	Any type listed under 35A5 in 150 ma. chart may be used with simple resistor changes. (See article on page 8.)									
25C6G	25N6G									K 2
	25L6GT									K 2
	25A6GT									K 2
	43					E				K 2
	12A5		B			E				K 2
	38		B			E		G		2
	25B6G									K 2
	32L7GT		B		D					K 2–9
	25A7GT				D					K 2–9
	12A7		B			E		G		2–9
	25B5					E				K 2
	Any type listed under 35L6GT in 150 ma. chart may be used with simple resistor changes. (See article on page 8.)									
25L6GT	14C5		B	C		E				8
	25N6G									K
	25A6GT									K 2
	25B6G									K
	25C6G									K 2
	43					E				K 2–8
	12A5		B			E				K 2
	38		B			E		G		K 2
	32L7GT		B		D					9
	25A7GT				D					K 2–9
	12A7		B			E		G		K 2–9
	25B5					E				K
	Any type listed under 35L6GT in 150 ma. chart may be used with simple resistor changes. (See article on page 8.)									
25Y5	25Z5	A								
	25Z6GT					E				
	50Y6GT		B	C		E				
	50Z7G		B	C		E				
	When used as a half-wave rectifier, add types under 12Z3.									
25Z5	Same as 25Y5 above.									
25Z6GT	25Z5					E				8
	25Y5					E				
	50Y6GT		B	C						
	50Z7G		B	C	D					
	When used as a half-wave rectifier add types under 12Z3.									

These substitutions are for AC-DC series sets. For transformer operated sets the above substitutions are possible if tubes requiring no voltage change are used. Substitutes from either the 150 or 300 ma. chart may be used.

For details of changes indicated Refer to page 18

REQUIRED TYPE	POSSIBLE REPLACEMENTS	NO CHANGES	FIL. VOLTS	FIL. CURRENT	REWIRE SOCKET	CHANGE SOCKET	REALIGN	ADD TOP CAP CONNECTION	REMOVE TOP CAP CONNECTION	CHANGE BIAS OR PLATE VOLTS	NOTE NO.
		A	B	C	D	E	F	G	H	K	
32L7GT	25A7GT		B							K	2
	12A7		B			E		G		K	2
	70L7GT		B	C	D					K	
36	6C6					E	F				6
	77					E	F				6
	6J7GT					E	F				6
	6SH7GT					E	F		H		6
	6SJ7GT					E	F		H		6
	7L7					E	F		H		6
	7H7					E	F		H		6
	7G7					E	F		H		6
	Also types under 6D6, but see note 1. Any type listed under 6W7G in 150 ma. chart may be used with simple resistor changes. (See article on page 8.)										
37	76	A									
	Also types shown under 6C5GT, add note E.										
38	12A7					E					9
	Also types shown under type 12A5.										

For details of changes indicated Refer to page 18

REQUIRED TYPE	POSSIBLE REPLACEMENTS	NO CHANGES	FIL. VOLTS	FIL. CURRENT	REWIRE SOCKET	CHANGE SOCKET	REALIGN	ADD TOP CAP CONNECTION	REMOVE TOP CAP CONNECTION	CHANGE BIAS OR PLATE VOLTS	NOTE NO.
		A	B	C	D	E	F	G	H	K	
39/44	78					E	F				
	6D6					E	F				
	See also type 6D6.										
43	25A6GT					E					
	See also type 25A6GT and add note E.										
75	6Q7G					E					8
	See also type 6Q7G and add note E.										
76	37	A									
	Also types shown under 6C5GT and add note E.										
77	6C6						F				
	Also types under 6C6.										
78	6D6						F				
	Also types under 6D6.										
85	6R7GT					E				K	
	Also types under 6R7GT and add note E.										

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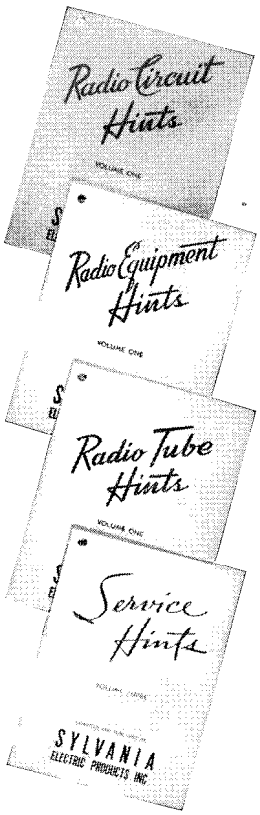

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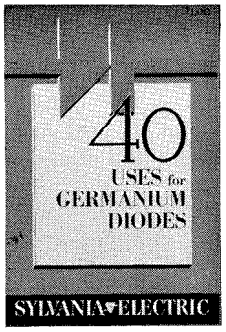

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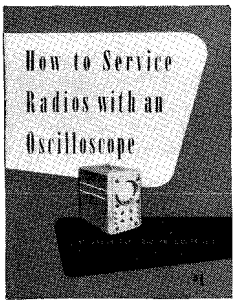

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These substitutions are for AC-DC series sets. For transformer operated sets the above substitutions are possible if tubes requiring no voltage change are used. Substitutes from either the 150 or 300 ma. chart may be used.

For details of changes indicated Refer to page 18

REQUIRED TYPE	POSSIBLE REPLACEMENTS	NO CHANGES	FIL. VOLTS	FIL. CURRENT	REWIRE SOCKET	CHANGE SOCKET	REALIGN	ADD TOP CAP CONNECTION	REMOVE TOP CAP CONNECTION OR PLATE TOP CAP	CHANGE BIAS OR PLATE VOLTS	NOTE NO.
		A	B	C	D	E	F	G	H	K	
OZ4 (G)	84		B			E					
	6X5		B		D						
	(Sometimes already wired)										
	7Y4		B			E					
2A3	2A5					E				K	
	59					E				K	
	47					E				K	
	46					E				K	
2A5	47					E				K	
	59					E				K	
2A6	2B7					E					3
5U4G	5X4G				D						
	83					E					
	83V					E					
	5V4G				D						
5V4G	83V (See also type 83)					E					
5W4G	5Y3G	A									
	80					E					
	5Y4G				D						
	5Z4				D						
5X4G	5U4G				D						
	83					E					
	83V					E					
	5Z3					E					
5Y3G	5AZ4					E					
	5V4G				D						
	5W4G	A									
	5Z4				D						
	80					E					
	83V					E					
	5Y4G				D						
5Y4G	Same as 5Y3G above. (Add note D.)										
5Z3	5U4G					E					
	5X4G					E					
	83	A									
	83V	A									
5Z4	5V4G	A									
	5W4G				D						
	5Y3G	A									
	5Y4G				D						
	80					E					
	83V					E					
6A3	6A5G					E					
	6B4G					E					
6A5G	6B4G				D						
	6A3					E					
6A6	79					E				K	2
	6N7G					E					
	6Y7G					E				K	2
	6Z7G					E				K	2
6B4G	6A3					E					
	6A5G				D						
6B5	6N6G					E					
	42									K	
	6F6					E				K	
	41									K	
	7B5					E				K	
	7C5					E				K	
6F6G	42					E					8
	41					E				K	8
	7C5					E				K	2
	7B5					E				K	
	6B5					E				K	
6F8G	6C8G									K	
	6N7G				D					K	
	6SN7GT				D						
	7N7					E					
6K6GT	6V6GT			C						K	
	6F6G			C						K	
	6U6GT			C						K	
	7A5			C		E				K	
	7B5					E					
	7C5			C		E				K	
	42			C		E				K	8
	41					E					8
	6B5			C		E				K	
6L6G	6L6GA	A									
	6AH5G				D						
	6F6G			C						K	2
	42			C		E				K	2
6N6G	6B5					E					
	42					E				K	
	6F6									K	
	41					E				K	
	7B5					E				K	
	7C5					E				K	2
6N7G	6Y7G										2
	6Z7G										2
	6A6					E					2
	79					E		G			
6U5/6G5	6E5	A									
	6AB5/6N5			C							
	2E5		B	C							
	6T5	A									
	6H5	A									
6U6GT	See type 6K6GT										
6V6GT	See type 6K6GT										
6X5GT	6ZY5G			C							2
	84					E					8
	6Z5				D						
	7Y4					E					8
	6Y5			C		E					
7B5	6V6GT			C		E				K	2
	6K6GT					E					
	6F6G					E				K	
	6U6GT			C		E				K	2
	7C5			C						K	2
	6B5			C		E				K	
	41					E					
	42					E					

See also 150 Ma. and 300 Ma. tables. Any type which does not require a voltage change may be used. Some types commonly used in television receivers are listed in the table starting on Page 26.

For details of changes indicated Refer to page 18

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A NO CHANGES	B FIL. VOLTS	C FIL. CURRENT	D REWIRE SOCKET	E CHANGE SOCKET	F REALIGN	G ADD TOP CAP CONNECTION OR REMOVE TOP CAP CONNECTION	H CHANGE BIAS OR PLATE VOLTS	K NOTE NO.
7C5	6V6GT					E				
	6K6GT			C		E				K 2
	6F6G			C		E				K 2
	6U6GT			C		E				K 2
	7B5			C						K 2
	41			C		E				K 2
	42			C		E				K 2
7N7	6N7G			C		E				K
	6F8G					E				
	6C8G			C		E		G		K
	6SN7GT					E				
12A	O1A									K
24A	57			C		E	F			
	35						F			
26	27		B	C		E	F			
	56		B	C		E	F			
35/51	24						F			1
	58			C			F			
	57			C			F			1
41	42			C						K
	6K6G			C		E				
	6F6G					E				
	6U6GT			C		E				K 2
	6B5			C						K
	6N6G			C		E				K
	7A5			C		E				K 2
	7B5					E				8
	7C5			C		E				K
	6V6GT			C		E				K
42	41			C						K
	6K6G			C		E				K
	6F6G			C		E				
	6U6GT			C		E				K 2
	6B5			C						K
	6N6G			C		E				K
	7A5			C		E				K 2
	7B5			C		E				K 8
	7C5			C		E				K 2
	6V6GT			C		E				K 2
45	2A3			C						K
	46			C		E				K
	47			C		E				K
	59			C		E				K
46	47									K
	59			C		E				K
56	27			C						K
57	58									K
	24A			C		E				
	35/51			C		E				
58	Same as 57. See note (1).									
59	46			C		E				K
	47When used as pen.			C		E				K
	45When used as tri.			C		E				K
71A	182B			C						K
	183			C						K
	12A									K

For details of changes indicated Refer to page 18

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A NO CHANGES	B FIL. VOLTS	C FIL. CURRENT	D REWIRE SOCKET	E CHANGE SOCKET	F REALIGN	G ADD TOP CAP CONNECTION OR REMOVE TOP CAP CONNECTION	H CHANGE BIAS OR PLATE VOLTS	K NOTE NO.
80	5Y4G					E				
	5Y3GT					E				
	5W4GT			C		E				
	5Z4					E				
	5V4G					E				
	83			C						2
	83V									2
	5Z3			C						2
	5X4G			C		E				2
	5U4G			C		E				2
83	83V	A								
	5Z3	A								
	5X4G					E				
	5U4G					E				
84	6X5			C		E				
	6Y5			C						
	6Z5			C		E				
	6ZY5G			C		E				
	7Y4					E				8
89	89Y	A								
	41				D					K
	6K6G					E				K
117L7/M7GT	117N7GT				D					K
	117P7GT				D					
	70L7GT		B	C	D					K 2
	70A7GT		B	C	D					2
117N7GT	117L7/M7GT				D					K 2
	117P7GT									K
	70L7GT		B	C	D					K 2
	70A7GT		B	C	D					K 2
117P7GT	117L7/M7GT				D					
	117N7GT									K
	70L7GT		B	C	D					K 2
	70A7GT		B	C	D					K 2
117Z6GT	117L7/M7GT			C	D					4
	117N7GT			C	D					4
	70L7GT		B	C	D					4
	117P7GT			C	D					4
	70A7GT		B	C	D					4
	50Y6GT		B	C						
	50Z7G		B	C	D					
	When used as a half-wave rectifier, additional types may be found under 50Y6GT.									
182B/482B	183/483									K
	71A			C						K
	45		B		D					K
	46		B			E				K
	2A3		B							K
183/483	182B/482B									K
	12A			C						K
	45		B		D (Series Fil.)					K
	46		B			E " "				K
	2A3		B		D (Series Fil.)					K
485	27		B							K
	56		B							K

See also 150 Ma. and 300 Ma. tables. Any type which does not require a voltage change may be used.
Some types commonly used in television receivers are listed in the table starting on page 26.

TUBE SUBSTITUTIONS IN TELEVISION RECEIVERS

Many television receiver circuits demand tube performances beyond those required by standard broadcast receivers. New functions, higher frequencies and often higher voltages result in a very limited number of tube types suitable for most television receiver sockets. As a result, only the simplest of the substitutions listed are suggested for satisfactory performance. Even so, each receiver model should be considered individually with particular reference to the manufacturer's instruction manuals and servicing data. The following general comments on various functions may also be of aid in selecting a substitute type.

RF—CONVERTER—IF STAGES: The use of one higher or lower Gm tube in the RF or IF stages will not be likely to give trouble. If it causes oscillation which cannot be removed by alignment, the screen voltage may be lowered slightly. The effect of one low mutual conductance tube in the IF section probably would be negligible, but more than one would be almost certain to give noticeably poor results. Tubes with the same base, and if possible the same basing, should be selected, as any disturbance to the original wiring might make it difficult, if not impossible, to realign the stage properly. Where the substitute tube has a different value of screen current a change in the series screen resistor may be required.

DETECTORS: When diodes are used, very little trouble need be expected with any reasonable substitution. There are, however, receivers using duo-triodes with the other section of the tube possibly in a more critical circuit.

SYNC STRIPPERS AND SEPARATORS: These circuits depend on the correct matching of the tube characteristics if the applied signal is to give the exact magnitude and wave-shape required for the output. Changes in load resistors, bleeders, or input signal may be required for satisfactory operation of a substitute. An oscilloscope should be used to check for the proper wave form.

HORIZONTAL OSCILLATOR: In general, this is a very difficult circuit to readjust for a substitute tube. Since this tube is used in the AFC circuit any change in current or bias could completely upset the tuning adjustments.

HORIZONTAL OUTPUT: Since many of the suggested substitutions require the use of two tubes in parallel, trouble may be encountered due to parasitic oscillations. The addition of a 100-ohm resistor in each grid lead, a 50-ohm resistor in each screen lead, and the use of separate cathode resistors, each twice the value required for the original single tube, is generally effective in eliminating this difficulty. A 50-ohm resistor in each plate lead, close to the socket, may be required in a few cases.

VERTICAL OUTPUT: The usual difficulty with substitutions in this stage is obtaining linearity. This is largely due to a mismatch between tube and load. If the adjustment does not give a good picture, little can be done other than try another substitute.

DAMPER DIODES: These are critical in two ratings seldom considered seriously in the broadcast receiver. They are the peak inverse voltage rating, and, in some circuits, the maximum permissible heater - cathode voltage. Differences in the heater-cathode voltage rating can be taken care of by using an isolation transformer in the heater circuit, but the peak inverse rating can only be increased by adding tubes in series which is not practical. Damper tubes also require a high current rating making it difficult to find a suitable substitute.

HIGH VOLTAGE RECTIFIERS: There are at least three circuits commonly used in high voltage sections: (1) RF Oscillator, (2) Fly-back transformer, (3) Fly-back transformer with voltage-doubler. The peak inverse voltage requirements of the RF and fly-back type circuits are quite different from one another. Although it is possible to change from one system to another, a great deal of careful study of this circuit on the part of the serviceman is urged before such an alteration is attempted.

For details of changes indicated, Refer to page 28

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A NO CHANGES	B FIL. VOLTS	C FIL. CURRENT	D REWIRE SOCKET	E CHANGE SOCKET	F REALIGN	G ADD TOP CAP CONNECTION	H REMOVE TOP CAP CONNECTION OR PLATE VOLTS	K CHANGE BIAS	NOTE NO.
1B3GT	1X2 (A)					E					13
	1Y2		B	C		E					
	5642					E					13
1V2	1B3GT		B	C		E		G			
	1X2 (A)		B	C	D			G			
	5642		B	C		E		G			
	1Y2		B	C		E		G			
1X2 (A)	1V2		B	C	D				H		13
	5642		B	C		E		G			13
	1B3GT					E					
6AG5	6AK5			C			F			K	
	6BC5						F				
	6BH6			C			F				
	6AU6				D		F				
	6CB6				D		F				
	6AS6			C	D		F				
	12AU6		B	C	D		F				
	12AW6		B	C	D						
	5591			C			F			K	
	5654			C			F				
6AK5	6AG5			C			F			K	
	6BC5			C			F			K	
	6BH6			C			F			K	
	6AU6			C			F			K	
	6CB6			C	D		F				
	6AS6						F				
	12AU6		B	C			F			K	
	12AW6		B	C	D		F			K	
	5591			C			F				
	5654						F				
6AL5	12AL5		B	C							
	5726	A									
	6AQ7GT					E					11
	6AW7GT					E					11
	6BC7			C		E					
	6H6GT					E					
	7A6			C		E					
	14A6		B			E					
	12AT7					E					11
	12AU7					E					11
	12AV7					E					11
	12AX7					E					11
	12AY7					E					11
	1N34	Use 2 if necessary.									
	1N60	Use 2 if necessary.									
6AQ5 (when used as a pentode or triode)	6AR5			C	D					K	
	5686			C		E					
	6V6GT					E					
	7C5					E					
	6BF5			C							
	6K6GT			C		E				K	
6AQ5 (when used as a triode only)	6SN7GT			C		E				K	22
	6BF5			C							4
	6W6GT					E					4
	6S4			C		E				K	
	12BH7			C		E				K	22
6AT6	6AQ6			C							
	6AQ7GT					E					
	6AV6										
	6AW7GT					E					
	6B6G					E		G			
	6BD7			C		E					
	6BK6	A									
	6BT6	A									

For details of changes indicated, Refer to Page 28

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A NO CHANGES	B FIL. VOLTS	C FIL. CURRENT	D REWIRE SOCKET	E CHANGE SOCKET	F REALIGN	G ADD TOP CAP CONNECTION	H REMOVE TOP CAP CONNECTION OR PLATE VOLTS	K CHANGE BIAS	NOTE NO.
6AU5GT	6AV5GT			C							
	6BG6G			C	D			G			
	6BQ6GT			C	D			G			
	6L6G (A)			C	D						23
	807 (W)			C		E		G			
	6AL6G			C	D			G			
	6AH5G			C	D						
6AU6	Same as type 6AK5										
6AV5GT	6AU5GT			C							
	6BG6G			C	D			G			
	6BQ6GT				D			G			
	6L6G (A)			C	D						23
	6AL6G			C	D			G			
	807 (W)			C		E		G			
	6AH5G			C	D						
6BC5	6AG5						F				
	6AK5			C			F			K	
	6AU6				D		F				
	6BH6			C	D		F				
	6CB6				D		F				
	6SH7GT					E	F				15
	7AG7			C		E	F				15
	5654			C			F			K	
	5591			C			F			K	
6BD5GT	6AU5GT			C						K	6
	6AV5GT			C						K	6
	6BG6G				D			G		K	6
	6BQ6GT			C	D			G		K	6
	6L6G (A)				D						
	807 (W)					E		G		K	6
6BG6G	6CD6G			C			F				10
	6BQ6GT			C	D		F				10–14
	6AV5GT			C	D		F				
	6AU5GT			C	D		F				
	807 (W)					E	F				
	19BG6G		B	C			F				
	25BQ6GT		B	C	D		F				14
6BQ6GT	6BG6G			C	D		F				7
	6CD6G			C	D		F				7
	6AU5GT				D		F		H		
	6AV5GT				D		F		H		
	807 (W)					E	F				7
	19BG6G		B	C	D		F				7
	25BQ6GT		B	C			F				
6CB6	6AK5			C	D		F			K	
	6AG5				D		F				
	6BC5				D		F				
	6BH6			C			F				
	6AU6				D		F				
	6AS6			C			F			K	
	12AU6		B	C	D		F				
	12AW6		B	C			F				
	5591			C	D		F			K	
	5654			C	D		F			K	
6CD6	6AU5GT					E		G			12
	6BQ6GT			C		E		G			12
	807 (W)			C		E		G			12
	19BG6G		B	C		E		G			12
	25BQ6GT		B	C		E		G			12
	6BG6G			C		E		G			12
	6AV5GT			C		E		G			12

These substitutions apply particularly for television sets but may be used anywhere providing all changes, particularly B and C are considered.

For details of changes indicated Refer to page 28

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A NO CHANGES	B FIL. VOLTS	C FIL. CURRENT	D REWIRE SOCKET	E CHANGE SOCKET	F REALIGN	G ADD TOP CAP CONNECTION	H REMOVE TOP CAP CONNECTION OR CHANGE PLATE VOLTS	K CHANGE BIAS	NOTE NO.
6J6	12AT7			C		E	F				
	12AU7			C		E	F				15
	12AV7					E	F				15
	12AY7					E	F				15
	19J6		B	C			F				
	5687					E	F			K	
	7F8 (W)			C		E	F				15
6S4	6SN7GT					E	F				22
	6SN7WGT					E	F				22
	5692					E	F				22
	6BL7GT			C		E	F				22
	12BH7				D		F				22
	7N7					E	F				22
	6AQ5			C		E	F				4
	12SN7GT		B	C		E	F				22
	12SX7GT		B	C		E	F				22
	14N7		B	C		E	F				22
	5687			C	D		F				22
6SL7GT	2C52		B				F				
	6C8G				D		F	G		K	
	6SL7WGT						F				
	6SU7GTY						F				
	7F7					E	F				
	7F8					E	F			K	
	7F8W					E	F			K	
	12AT7					E	F			K	
	12AV7			C		E	F			K	
	12AX7					E	F				
	12AY7					E	F			K	
	12SL7GT		B	C			F				
	14F7		B	C		E	F				
	14F8		B	C		E	F			K	
	5691			C			F				
	5694			C	D		F			K	
6SN7GT	6SN7WGT	A									
	6BL7GT			C							
	5692	A									
	6AH7GT			C	D		F				
	6F8G						F	G			
	7AF7			C		E	F				
	7N7					E	F				
	12AH7GT		B	C	D		F				
	12AU7			C		E	F				
	12SN7GT		B	C			F				
	12SX7GT		B	C			F				
	14N7		B	C		E	F				
	5687			C		E	F			K	
6T8	6S8GT			C		E		G			
	7K7			C		E					5
	6AQ6			C		E					5
	6AT6			C		E					5
	6AV6			C		E					5
	6BD7			C	D						5
	6BK6			C		E					5
	6BT6			C		E					5
	7C6			C		E					5
	19T8		B	C							
6V6GT	7C5					E					
	6BF5			C							
	6K6GT			C							
	6AQ5					E					
	6W6GT			C							
	6U6GT			C							
	6F6GT			C							
	41			C		E					
	42			C		E					
6W4GT	6U4GT	A									
	6BY5G			C	D						20
	6AX5GT				D						20
	6AX6GT			C	D						20
	5V4G		B	C	D						20–17
	25W4GT		B	C							
	6V4			C		E					20
	7Z4			C		E					20
6W6GT	6V6GT			C							
	7C5			C		E					
	6BF5					E					
	6K6GT			C							
	6AQ5			C		E					
(as a triode)	6S4			C		E					
" "	6BL7GT			C	D						
7F8	6SL7GT					E	F			K	15
	5691			C		E	F			K	15
	6SL7WGT					E	F			K	15
	6SU7GTY					E	F			K	15
	7F7						F			K	15
	7F8W	A					F				
	12AT7					E	F				
	12AV7			C		E	F				15
	6J6										16
	6SL7W					E	F			K	15
	12SL7GT		B	C		E	F			K	15
	14F7		B	C			F			K	15
	14F8		B	C			F				
12AT7	12AV7			C			F				15
any Voltage	12AX7						F			K	15
6.3 V. only	6J6			C		E	F				16
" "	6SL7GT					E	F			K	15
" "	6SL7WGT					E	F			K	15
" "	6SU7GTY					E	F			K	15
" "	7F8					E	F				
" "	7F8W					E	F				15
" "	5691			C		E	F			K	15
" "	5694			C		E	F			K	15
12 V. only	12SL7GT					E	F			K	15
" "	14F8					E	F				
12AU7	5692			C		E	F				
6 V. service	5687			C	D		F				
" "	12AV7			C			F			K	
" "	6AH7GT					E	F			K	
" "	6F8G			C		E	F				
" "	6SN7GT			C		E	F				
" "	7AF7					E	F				
" "	7N7			C		E	F				
150 ma. service	12AH7GT					E	F				
12AV7	12AT7			C							
(at 6.3 volts)	12AU7			C							
" "	2C51			C	D						
" "	6BQ7			C	D					K	
" "	6C8G			C		E					
" "	6J6					E					
" "	5694			C		E					
(at 12 volts)	12AT7			C							
" "	12AU7			C							
12AX7	6SC7GT					E					
(at 6.3 volts)	6SL7GT					E					
" "	6SU7GT					E					
" "	7F7					E					
" "	5691			C		E					
(at 12.6 volts)	12SC7					E					
" "	12SL7GT					E					
" "	14F7					E					

These substitutions apply particularly for television sets but may be used anywhere providing all changes, particularly B and C are considered.

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K	NOTE NO.
	For details of changes indicated Refer to page 28	NO CHANGES	FIL. VOLTS	FIL. CURRENT	REWIRE SOCKET	CHANGE SOCKET	REALIGN	ADD TOP CAP CONNECTION	REMOVE TOP CAP CONNECTION OR PLATE VOLTS	CHANGE BIAS	
12SN7GT	12AH7GT			C	D		F			K	
	12AU7			C		E	F				
	12AV7					E	F			K	
	12SX7GT						F				
	14N7					E	F				
	5687			C		E	F				
	5694		B	C	D		F			K	
	6SN7GT		B	C			F				
	5692		B	C			F				
	14AF7			C		E	F				
	6F8G		B	C		E	F				
	12BH7					E	F				
19BG6G	25BQ6GT		B		D		F				14
	807 (W)		B	C		E	F				
	6CD6G		B	C			F				10
19BG6G (Continued)	6BQ6GT		B	C	D		F				10–14
	6BG6G		B	C			F				
25BQ6GT	19BG6G		B		D		F				
	807 (W)		B	C		E	F				
	6CD6G		B	C	D		F				
	6BQ6GT		B	C			F				
	6BG6G		B	C	D		F				
25W4GT	25Z6					E					19
	25Z5					D					19
	35Z3		B	C		E					19, 21
	35Y4		B	C		E					19, 21
	50AX6G		B		D						19
	50X6		B	C		E					19
	6W4GT		B	C							
	6U4GT		B	C							

NOTES FOR USE WITH TELEVISION TUBE TABLE

A. This is shown only when the tubes are directly interchangeable for all published ratings. Unusual operating conditions may require analysis.

B. This means that the heater voltage of the substitute type is different from the required type. A slight decrease can be taken care of by adding a series resistor but other changes may require a complete change in the power circuits or the addition of an extra transformer to provide the required voltage.

C. Indicates that the heater current of the substitute tube is different from the required type. On transformer operated sets this is not too important unless the total current, particularly when more than one substitution is made, causes the transformer rating to be exceeded.

D. In these cases the tube socket is the same but some rearrangement of the connections may be necessary. It may only be necessary to be sure that contacts connected to elements of the substitute tube which are not required in that circuit are not used as tie points.

E. Requires a different type of socket. Watch out for tie points as in "D".

F. Realignment is recommended as good practice in all cases of RF and IF tube changes.

G. Provision must be made for connection to the top cap of the substitute tube which was not originally required.

H. The former top-cap connection will have to be changed to connect to a base pin.

K. Indicates that the substitute tube operates at a different bias for the applied plate voltage than the original tubes. Self bias circuits give some automatic correction but this should be measured and changed if necessary to prevent early failures.

(1) The use of a sharp cut-off pentode in place of a remote cut-off tube may cause great distortion in locations when strong signals are available. If no other substitute can be found all tubes on the A.V.C. system should be changed.

(2) The optimum load resistance for these types is more than 20% off. If tone or volume is noticeably poor transformer tap adjustment or a new transformer may be required.

(3) Requires addition of screen voltage, resistor and bypass condenser. Select resistor to give screen volts approximately equal to actual plate volts.

(4) This type can be used as a triode by tying screen and suppressor to the plate. As a rectifier tie all grids to plate.

(5) If separate cathode connections to the diodes are required one or two type 1N34 crystals may be used.

(6) Screen voltage should be decreased to prevent oscillation with this higher gm tube or to keep within tube ratings.

(7) Screen voltage may be increased for this type.

(8) Circuit for this substitution is given on last few pages of this booklet.

(9) Unused elements should be connected to chassis or cathode terminal.

(10) Pilot lamp may be omitted or provided for by other means.

(11) Connect triode elements together to form two diodes having separate cathodes.

(12) Usable only when space is available for two tubes of this type connected in parallel.

(13) Usable only in fly-back type power supplies and when peak inverse voltage does not exceed tube rating.

(14) In many of the older sets a high efficiency transformer and/or yoke may also be required.

(15) The substitution of these types in RF or mixer oscillator stage is not recommended. Changes in lead length or capacity may make it impossible to align.

(16) Not usable in circuits requiring separate cathode leads.

(17) If circuit requires voltage between cathode and heater do not use this type.

(18) Connect grid and screen to plate to obtain diode characteristics.

(19) Not recommended for damper service as peak inverse rating is too low.

(20) These types do not have as high a heater-cathode peak voltage rating as the original tube but may be used in most cases. An isolation transformer insulated for 2500 volts may be used.

(21) Check load current to be sure it is within ratings of substitute tube.

(22) Connect triode sections in parallel.

(23) If arcing occurs peak voltage rating is being exceeded. A type having a higher peak rating will be required.

These substitutions apply particularly for television sets but may be used anywhere providing all changes particularly B and C are considered.

SUBSTITUTION CHART
FOR TELEVISION PICTURE TUBES

THE following tables show some of the possible substitutions which may be made when the required type is temporarily unobtainable. Individual listings of all tube types bearing an A or B suffix have not been included in this table. These letters generally indicate a difference only in face, plate or screen treatment not materially affecting the tube's application. A copy of Sylvania's Television Picture Tube Characteristics Chart lists these types bearing suffixes and indicates their face plate characteristics. The tables have been extended slightly to show a few larger type tubes that may be used when it is desired to increase the size of the picture.

Before undertaking any of the more radical changes, the ease of adjustment provided by the receiver under consideration should be examined. If the focus coil and yoke supporting assembly are not adjustable in the direction of the long axis of the tube, it may be too difficult to use any tube having a longer cone. The wide variety of cabinets will also require that each case be examined carefully to be sure that there is room in the cabinet for the tube. Some designs of deflection and focus coils are longer than others so that short neck tubes cannot be directly interchanged. This fact is indicated in the notes when a short-neck tube would usually be a good replacement.

The tables indicate the important physical and electrical changes required but it was necessary to make the following assumptions: (a) Since the usual tolerance in the overall length of a picture tube is $\pm\frac{3}{8}''$ the dimension shown under B is given only to the nearest $\frac{1}{4}''$. (b) Since the new wide-angle picture tubes require more scanning power than the older tubes, and since there is usually some adjustment in the receiver circuit, we have assumed that a major coil change will not be required unless the replacement tube's deflection angle is greater than the original tube's by more than 4 degrees. (c) Besides the major changes in bulb dimensions considered under columns A and B there are also small changes in the radius of curvature of the bulb face and the shape of the picture area. This affects the mask dimensions and might give trouble in some sets if the adjustments are not flexible. Small changes in curvature radius of the cone may also be encountered, particularly between glass and metal types.

In a few cases we have listed replacement types smaller than the originals, because there are few or no tubes of the same or larger sizes which would, in our opinion, make practical substitutes.

For details of changes indicated Refer to page 34

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A BULB DIAMETER	B BULB LENGTH	C CONNECTOR	D ADD ION TRAP MAG.	E REMOVE ION TRAP MAG.	F CHANGE OPERATING VOLTS	G CHANGE DEFLECTION CIRCUIT	H CHANGE TUBE SOCKET	K ADD FILTER CAPACITANCE	NOTE NO
3KP4	3GP1A								H		2
	3JP1		—1½						H		
3NP4	None										
5BP4	5NP4	No changes									
	7EP4	A	—1¼								
5HP4	5NP4	No changes									
5TP4	None										
7DP4	10DP4	A	+3½							K	
7EP4	5BP4-A	A	+1¼								
	7JP4		—1						H		
7GP4	7JP4	No changes									
	10HP4	A	+4¾								
	8BP4	A	+2								
7JP4	7GP4						F				
	10HP4	A	+4¾								
	8BP4	A	+2								
8AP4	10MP4	A	+2¾	C	D2						4, 1
	12VP4	A	+3¾	C	D2						4, 1
	10BP4	A	+3½	C	D2						8, 4
	10FP4	A	+3½	C		E					1, 8, 4
	12JP4	A	+3	C		E					8, 1
	12UP4	A	+4½		D2						8, 1
9AP4	12AP4	A	+4⅜								
10BP4	10CP4		—1	C		E					
	10FP4					E					
	12JP4	A		C		E				K	
	12KP4	A				E					

For details of changes indicated Refer to page 34

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A BULB DIAMETER	B BULB LENGTH	C CONNECTOR	D ADD ION TRAP MAG.	E REMOVE ION TRAP MAG.	F CHANGE OPERATING VOLTS	G CHANGE DEFLECTION CIRCUIT	H CHANGE TUBE SOCKET	K ADD FILTER CAPACITANCE	NOTE NO
10BP4 (Continued)	12LP4	A	+1								
	12UP4	A	+1	C						K	6
	14BP4□	A						G			
	14CP4 □	A	—1		D1			G			
10CP4	10BP4		+1	C	D2						
	10FP4		+1	C							
	12JP4	A	+½								
	12KP4	A	+1	C							
	12LP4	A	+1¾	C	D2						
	12UP4	A	+2	C	D2					K	6
	14BP4□	A		C	D2			G			
	14CP4 □	A		C		E		G			
10DP4	7DP4	A	—3½				F				4
10FP4	10BP4				D2						
	10CP4		—1	C							
	12JP4	A		C						K	
	12KP4	A									
	12LP4	A	+1		D2						
	12UP4	A	+1	C	D2					K	6
	14BP4□	A	—1		D2			G			
	14CP4 □	A	—1		D1			G			
10HP4	7GP4	A	—4¾				F				
	7JP4	A	—4¾				F				
	10GP4		—¾								
	8BP4	A	—2¾								
10MP4	8AP4	A	—2¾	C	D1		F				6
	12VP4	A	+1		D1						1, 6
	Also 10" types under 10BP4 but add note										8
12AP4	9AP4	A	—4¼								
12JP4	12KP4	A		C							4

□ Indicates rectangular tubes

SAFETY FIRST: Wear goggles and gloves when handling Picture Tubes. Be sure power supply is turned off before working on high-voltage circuits.

For details of changes indicated Refer to page 34

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A BULB DIAMETER	B BULB LENGTH	C CONNECTOR	D ADD ION TRAP MAG.	E REMOVE ION TRAP MAG.	F CHANGE OPERATING VOLTS	G CHANGE DEFLECTION CIRCUIT	H CHANGE TUBE SOCKET	K ADD FILTER CAPACITANCE	NOTE NO.
12JP4 (Cont'd)	12LP4	A	+1¼	C	D2						4
	12QP4	A			D1						
	12RP4				D1					K	
	12TP4	A	+1¼	C	D2						
	12UP4	A	+1¼	C	D2						6
	14BP4 □	A	−¾	C	D2			G			4
	14CP4 □	A	−¾	C	D1			G			
12KP4	12JP4	A		C						K	
	12LP4		+¾		D2						
	12QP4			C	D1					K	
	12RP4	A		C	D1					K	
	12TP4		+¾		D2					K	
	12UP4	A	+1	C	D2					K	6
	14BP4 □	A	−1		D2			G			
	14CP4 □	A	−1		D1			G			
	16LP4	A	+4½		D2						
	16TP4 □	A	+½		D1			G			7
12LP4	12JP4	A	−1¼	C		E				K	
	12QP4		−1¼	C	D1					K	
	12RP4	A	−1¼	C	D1					K	
	12TP4									K	
	12UP4	A		C						K	6
	14BP4 □	A	−2					G			
	14CP4 □	A	−2		D1			G			
	16LP4	A	+3½								
	16TP4 □	A	−½		D1			G			7
	12KP4		−¾			E					
12QP4	12JP4	A				E					
	12LP4		+1¼	C	D2						4
	12RP4	A									
	12TP4		+1¼	C	D2						
	12UP4	A	+1	C	D2						6
	14BP4 □	A	−¾	C	D2			G			4
	14CP4 □	A	−¾	C				G			4
	16LP4	A	+4¾	C	D2					K	
	16TP4 □	A	+½	C				G			4, 7
	12KP4			C		E					
12TP4	12JP4	A	−¾	C		E					4
	12LP4									K	
	12QP4		−¾	C	D1						
	12RP4	A	−¾	C	D1						
	12UP4	A		C							6
	14BP4 □	A	−2					G			4
	14CP4 □	A	−2		D1			G			4
	16LP4	A	+3½								4
	16TP4 □	A	−¾		D1			G			7
	12KP4		−1			E					4
12UP4	12JP4	A	−1	C		E					
	12KP4		−1	C		E					4
	12LP4			C							4
	12QP4		−1	C	D1						
	12RP4	A	−1	C	D1						
	12TP4			C							
	14BP4 □	A	−2¼	C				G			4
	14CP4 □	A	−2	C	D1			G			4
	16LP4	A	+3¾	C							4
	16TP4 □	A	−½	C	D1			G			4, 7
	16GP4	A	−1		D1			G			7
12VP4	10MP4	A	−1				F				
	8AP4	A		C	D1		F			K	6
	12LP4		+¾								8
	Other 12" types under 12LP4 but add note										8
14BP4 □	14CP4 □				D1						
	14DP4 □									K	
	14EP4 □		−½		D1						7
	16KP4 □	A	+2		D1						
	16TP4 □	A	+1½		D1						
	16UP4 □	A	+1½		D1					K	7
14BP4 □ (Cont'd)	17AP4 □	A	+2		D1						7
	17BP4 □	A	+2¾		D1						
	If cabinet space permits, round types listed under type 16SP4 may also be used. Add 1" to dimension change B.										
14CP4 □	14BP4 □				D2						
	14DP4 □				D2					K	
	14EP4 □		−½								7
	16KP4 □	A	+2								
	16TP4 □	A	+1½								7
	16UP4 □	A	+1½							K	7
	17AP4 □	A	+2								7
	17BP4 □	A	+2¾								
	If cabinet space perimts, round types listed under 16YP4 may also be used. Add ¾" to dimension change B.										
14DP4 □	14BP4 □										4
	14CP4 □				D1						4
	14EP4 □		−½		D1						4, 7
	16KP4 □	A	+2		D1					K	4
	16TP4 □	A	+1½		D1					K	4, 7
	16UP4 □	A	+1½		D1						4, 7
	17AP4 □	A	+2		D1					K	4, 7
	17BP4 □	A	+2¾		D1					K	4
	If cabinet space permits, round types listed under type 16WP4 may also be used. Add 1" to dimension change B.										
14EP4 □	14BP4 □		+½		D2						
	14CP4 □		+½								
	14DP4 □		+½		D2					K	
	16KP4 □	A	+2½								
	16TP4 □	A	+2								
	16UP4 □	A	+2							K	
	17AP4 □	A	+2½								7
	17BP4 □	A	+3¼								
	If cabinet space permits, round types listed under type 16YP4 may also be used. Add 1" to dimension change B.										
15AP4	15CP4		+1	C	D2						
	15DP4				D2						
	16AP4	A	+1¾	C	D2						6
	16CP4	A	+1	C	D2						
	16DP4	A	+¾	C	D2						
	16EP4	A	−1	C	D2						6
	16FP4	A	−¼		D1						
	16GP4	A	−3	C	D1			G			6, 7
	16HP4	A	+¾	C	D2						4
	16JP4	A	+¼	C	D2			G			4
	16KP4 □	A	−1¾	C	D1			G			4
	16LP4	A	+1¾	C	D2						4
	16QP4 □	A	−1½	C	D2			G			
	16RP4 □	A	−1¾	C	D1			G			4
	16SP4	A	−3¼	C	D2			G			4, 7
	16TP4 □	A	−2¼	C	D1			G			4, 7
	16UP4 □	A	−2¼	C	D1			G			7
	16VP4	A	−3¼	C	D1			G			7
	16WP4	A	−2¾	C	D2			G			
	16WP4A	A	−2¾	C	D2			G			4
	16XP4 □	A	−1¾	C	D2			G			
	16YP4	A	−3¼	C	D1			G			4, 7
	16ZP4	A	+1¾	C	D2						4
	17AP4 □	A	−2	C	D1			G			4, 7
	17BP4 □	A	−1¼	C	D1			G			4
	20BP4	A	+8¼	C							
15CP4	15AP4		−1	C		E					
	15DP4		−1	C				G			
	16AP4	A	+¾	C							6
	16CP4	A									
	16DP4	A	−¾					G			
	16EP4	A	−2	C				G			6

□ Indicates rectangular tubes

SAFETY FIRST: Wear goggles and gloves when handling Picture Tubes. Be sure power supply is turned off before working on high-voltage circuits.

For details of changes indicated Refer to page 34

REQUIRED TYPE	POSSIBLE REPLACEMENTS	BULB DIAMETER	BULB LENGTH	CONNECTOR	ADD ION TRAP MAG.	REMOVE ION TRAP MAG.	CHANGE VOLTS OPERATING	CHANGE DEFLECTION CIRCUIT	CHANGE TUBE SOCKET	ADD FILTER CAPACITANCE	NOTE NO.
		A	B	C	D	E	F	G	H	K	
15CP4 (Cont'd)	16FP4	A	−1¼	C	D1			G			
	16HP4	A	−¼					G			4
	16JP4	A	−¾					G			4
	16LP4	A	+¾								4
	16ZP4	A	+¾								4
	20BP4	A	+7¼	C		E					
15DP4	15AP4					E					
	15CP4		+1	C							
	16AP4	A	+1¾	C							6
	16CP4	A	+1	C							
	16DP4	A	+¼	C							
	16EP4	A	−1	C							6
	16FP4	A	−¼		D1						
	16HP4	A	+¾	C							4
	16JP4	A	+¼	C							4
	16LP4	A	+1¾	C							4
	16ZP4	A	+1¾	C							4
	20BP4	A	+8¼	C		E					
	17AP4 □	A	−2	C	D1			G			4, 7
	17BP4 □	A	−1¼	C	D1			G			4
16AP4	16CP4		−¾	C							
	16LP4			C							4
	16ZP4			C							4
	20BP4	A	+6½	C		E					
	16GP4		+3¼		D1			G			7
	16TP4 □	A	−4¼	C	D1			G			4, 7
	17AP4 □	A	−4¼	C	D1			G			4, 7
	17BP4 □	A	−3	C	D1			G			4
	19AP4	A	−¾		D1			G			
	19DP4	A	−¾	C				G			4
	19EP4	A	−1	C	D1			G			4
16CP4	15AP4	A	−1	C		E					
	16AP4		+¾	C							
	16LP4		+¾								4
	16ZP4		+¾								4
	16GP4		−4¼	C	D1			G			6, 7
	16TP4 □	A	−3½		D1			G			4, 7
	17AP4 □	A	−3		D1			G			4, 7
	17BP4 □	A	−2¼		D1			G			4
	19AP4	A		C	D1			G			6
	19DP4	A						G			4
	19EP4	A	−¼		D1			G			4
	20BP4	A	+7¼	C		E		G			
16DP4	16AP4		+1½	C							6
	16CP4		+¾								
	16EP4		−1	C							6
	16FP4		−½	C	D1						
	16HP4		+½								4
	16JP4										4
	16KP4 □	A	−2		D1						4
	16LP4		+1½								4
	16QP4 □	A	−1½								
	16RP4 □	A	−2		D1						4, 7
	16TP4 □	A	−2½		D1						4
	16UP4 □	A	−2½		D1						7
	16XP4 □	A	−2								
	16ZP4		+1½								4
	17AP4 □	A	−2		D1						4, 7
	17BP4 □	A	−1½		D1						4
	19EP4	A	+¼		D1						4
	20BP4	A	+8	C		E					
16EP4	16AP4		+2¾								
	16CP4		+2	C							
	16DP4		+1¼	C							
	16FP4		+¾	C	D1						
	16HP4		+1¾	C							4
	16JP4		+1	C							4
	16KP4 □	A	−1	C	D1						4
	16LP4		+2¾	C							4

For details of changes indicated Refer to page 34

REQUIRED TYPE	POSSIBLE REPLACEMENTS	BULB DIAMETER	BULB LENGTH	CONNECTOR	ADD ION TRAP MAG.	REMOVE ION TRAP MAG	CHANGE VOLTS OPERATING	CHANGE DEFLECTION CIRCUIT	CHANGE TUBE SOCKET	ADD FILTER CAPACITANCE	NOTE NO.
		A	B	C	D	E	F	G	H	K	
16EP4 (Cont'd)	16QP4 □	A	−½	C							
	16RP4 □	A	−1	C	D1						4
	16TP4 □	A	−1½	C	D1						4, 7
	16UP4 □	A	−1½	C	D1						7
	16XP4 □	A	−1	C							
	16ZP4		+2¾	C							4
	17AP4 □	A	−1	C	D1						4, 7
	17BP4 □	A	−¼	C	D1						4
	19EP4	A	+1½	C	D1						4
	20BP4	A	+9	C		E					
16FP4	16AP4		+2	C	D2						6
	16CP4		+1¼	C	D2						
	16DP4		+½	C	D2						
	16EP4		−¾	C	D2						6
	16HP4		+1¾	C	D2						4
	16JP4		+1	C	D2						4
	16KP4 □	A	−1	C							4
	16LP4		+2½	C	D2						4
	16QP4 □	A	−½	C	D2						
	16RP4 □	A	−1	C							4
	16TP4 □	A	−1½	C							4, 7
	16UP4 □	A	−1½	C							7
	16XP4 □	A	−1	C	D2						
	16ZP4		+2½	C	D2						4
	17AP4 □	A	−1	C							4, 7
	17BP4 □	A	−¼	C							4
	19EP4	A	+1½	C							4
	20BP4	A	+8	C		E					
	19GP4	A	+1	C							
16GP4	16EP4		+2		D2						
	16SP4		−¼	C	D2						4
	16KP4 □	A	+1¼	C							4
	16QP4 □	A	+1½	C	D2						
	16RP4 □	A	+¾	C							4
	16TP4 □	A	+½	C							4
	16UP4 □	A	+½	C							
	16VP4		−¼	C							
	16WP4		−¼	C	D2						
	16WP4A		−¼	C	D2						4
	16XP4 □	A	+1¼	C	D2						
	16YP4		−¼	C							4
	17AP4 □	A	+1	C							4
	19AP4	A	+4								
	19DP4	A	+4	C	D2						4
	19EP4	A	+3½	C							4
	19FP4	A	+4½	C	D2						
	19GP4	A	+3¾	C							
	22AP4	A	+5½								
16HP4	16AP4		+1	C						K	6
	16CP4		+¼							K	
	16DP4		−½							K	
	16EP4		−1½	C						K	6
	16FP4		−1	C	D1					K	
	16JP4		−½								
	16KP4 □	A	−1½		D1						
	16LP4		+1								
	16QP4 □	A	−2							K	
	16RP4 □	A	−2½		D1						
	16TP4 □	A	−3		D1						7
	16UP4 □	A	−3		D1					K	7
	16XP4 □	A	−2½							K	
	16ZP4		+1								
	17AP4 □	A	−2½		D1						7
	17BP4 □	A	−2		D1						
	19EP4	A			D1						
	20BP4	A	+11	C		E				K	
16JP4	16AP4		+1½	C							6
	16CP4		+¾								
	16DP4	A								K	
	16EP4		+1	C							6

□ Indicates rectangular tubes.

SAFETY FIRST: Wear goggles and gloves when handling Picture Tubes. Be sure power supply is turned off before working on high-voltage circuits.

For details of changes indicated Refer to page 34

REQUIRED TYPE	POSSIBLE REPLACEMENTS	BULB DIAMETER	BULB LENGTH	CONNECTOR	ADD ION TRAP MAG	REMOVE ION TRAP MAG	CHANGE OPERATING VOLTS	CHANGE DEFLECTION CIRCUIT	CHANGE TUBE SOCKET	ADD FILTER CAPACITANCE	NOTE NO.
		A	B	C	D	E	F	G	H	K	
16JP4 (Cont'd)	16FP4		—½	C	D1						
	16HP4		+½								
	16KP4 □	A	—2		D1						
	16LP4		+1½								
	16MP4		+1								
	16QP4 □	A	—1½								
	16RP4 □	A	—2		D1						
	16TP4 □	A	+2½		D1						7
	16UP4 □	A	+2½		D1						7
	16XP4 □	A	—2								
	16ZP4		+1½								
	17AP4 □	A	—2		D1						7
	17BP4 □	A	—1½		D1						
	19EP4	A	+¼		D1						
	20BP4	A	+8	C		E					
16KP4 □	16RP4 □										
	16QP4 □		+½		D2					K	
	16TP4 □		—½								7
	16UP4 □		—½							K	7
	16XP4 □				D2					K	
	17AP4 □	A									7
	17BP4 □	A	+½								
	If cabinet space permits, round types listed under 16YP4 may also be used.										
16LP4	15AP4	A	—¼	C		E				K	
	15CP4	A	—¾							K	
	16AP4			C						K	6
	16CP4		—¾							K	
	16ZP4										
	16GP4		—4¾		D1			G		K	6, 7
	16TP4 □	A	—4		D1			G		K	7
	17AP4 □	A	—3¾		D1			G			7
	17BP4 □	A	—3		D1			G			
	19AP4	A	—¾	C	D1			G		K	6
	19DP4	A	—¾					G			
	19EP4	A	—1		D1			G			
	20BP4	A	+6½	C		E				K	
16MP4	16AP4		+½	C						K	6
	16CP4		—¼							K	
	16DP4		—1							K	
	16EP4		—2	C						K	6
	16FP4		—1½	C	D1					K	
	16HP4		—½								
	16JP4		—1								
	16KP4 □	A	—3		D1			G			
	16LP4		+½								
	16QP4 □	A	—2½					G		K	
	16RP4 □	A	—3		D1			G			
	16TP4 □	A	—3½		D1			G			7
	16UP4 □	A	—3½		D1			G		K	7
	16XP4 □	A	—3					G		K	
	16ZP4		+½								
	17AP4 □	A	—3		D1						7
	17BP4 □	A	—2½		D1						
	19EP4	A	—¾		D1						
	20BP4	A	+7	C		E				K	
16QP4 □	16KP4 □		—½		D1						4
	16RP4 □		—½		D1						4
	16TP4 □		—1		D1						4, 7
	16UP4 □		—1		D1						7
	16XP4 □		—½								
	17AP4 □	A	—½		D1						4, 7
	17BP4 □	A			D1						4
	If cabinet space permits, round types listed under 16WP4 may also be used.										
16RP4 □	16KP4 □										
	16QP4 □		+½		D2					K	
	16TP4 □		—¾								7
	16UP4 □		—¾							K	7

For details of changes indicated Refer to page 34

REQUIRED TYPE	POSSIBLE REPLACEMENTS	BULB DIAMETER	BULB LENGTH	CONNECTOR	ADD ION TRAP MAG	REMOVE ION TRAP MAG	CHANGE OPERATING VOLTS	CHANGE DEFLECTION CIRCUIT	CHANGE TUBE SOCKET	ADD FILTER CAPACITANCE	NOTE NO
		A	B	C	D	E	F	G	H	K	
16RP4 (Cont'd)	16XP4 □				D2					K	
	17AP4 □	A									7
	17BP4 □	A	+½								
	If cabinet space permits, round types listed under 16YP4 may also be used.										
16SP4	16AP4		+5	C						K	6
	16CP4		+4¼							K	
	16DP4		+3½							K	
	16EP4		+2¼	C						K	6
	16FP4		+3	C	D1					K	
	16GP4		+¼	C	D1					K	6
	16HP4		+4								
	16JP4		+3½								
	16KP4 □	A	+1½		D1						
	16LP4		+5								
	16MP4		+4½								
	16QP4 □	A	+1¾							K	
	16RP4 □	A	+1½		D1						
	16TP4 □	A	+¾		D1						
	16UP4 □	A	+¾		D1					K	
	16VP4				D1					K	
	16WP4		+½							K	
	16WP4A		+½								
	16XP4 □	A	+1½							K	
	16YP4				D1						
	16ZP4		+5								
	17AP4 □	A	+1¼		D1						
	17BP4 □	A	+2		D1						
	19AP4	A	+4¼	C	D1					K	6
	19DP4	A	+4¼								
	19EP4	A	+3¾		D1						
	19FP4	A	+4¾							K	
	19GP4	A	+4		D1					K	
	20BP4	A	+11½	C		E				K	
	22AP4	A	+5½	C	D1					K	6
16TP4 □	16KP4 □		+¾								
	16QP4 □		+1		D2					K	
	16RP4 □		+¾								
	16UP4 □									K	
	16XP4 □		+¾		D2					K	
	17AP4 □	A	+½								
	17BP4 □	A	+1¼								
	If cabinet space permits, round types listed under 16YP4 may also be used.										
16UP4 □	Same as listed above for type 16TP4 with deletion of note K when present and addition of note 4 for types not having note K.										
16VP4	16AP4		+5	C	D2						6
	16CP4		+4¼		D2						
	16DP4		+3½		D2						
	16EP4		+2¼	C	D2						6
	16FP4		+3	C							
	16GP4		+¼	C							6
	16HP4		+4		D2						4
	16JP4		+3½		D2						4
	16KP4 □	A	+1½								4
	16LP4		+5		D2						4
	16MP4		+4½		D2						4
	16QP4 □	A	+1¾		D2						
	16RP4 □	A	+1½								4
	16SP4 □				D2						4
	16TP4 □	A	+¾								4
	16UP4 □	A	+¾								
	16WP4		+½		D2						
	16WP4A		+½		D2						4
	16XP4 □	A	+1½		D2						
	16YP4										4
	16ZP4		+5		D2						4
	17AP4 □	A	+1¼								4

□ Indicates rectangular tubes.

SAFETY FIRST: Wear goggles and gloves when handling Picture Tubes. Be sure power supply is turned off before working on high-voltage circuits.

For details of changes indicated Refer to page 34

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A BULB DIAMETER	B BULB LENGTH	C CONNECTOR	D ADD ION TRAP MAG.	E REMOVE ION TRAP MAG.	F CHANGE VOLTS OPERATING	G CHANGE DEFLECTION CIRCUIT	H CHANGE TUBE SOCKET	K ADD FILTER CAPACITANCE	NOTE NO.
16VP4 (Cont'd)	17BP4 □	A	+2								4
	19AP4	A	+4¼	C							6
	19DP4	A	+4¼		D2						4
	19EP4	A	+3¾								4
	19FP4	A	+4¾		D2						
	19GP4	A	+4								
	20BP4	A	+11½	C		E					
	22AP4	A	+5½	C							6
16WP4	16AP4		+4½	C							6
	16CP4		+4								
	16DP4		+3								
	16EP4		+1¾	C							6
	16FP4		+2½	C	D1						
	16GP4		−¼	C	D1						7
	16HP4		+3½								4
	16JP4		+3								4
	16LP4		+4½								4
	16MP4		+4								4
	16QP4 □	A	+1¼								
	16KP4 □	A	+1		D1						4
	16RP4 □	A	+1		D1						4
	16SP4		−½								4, 7
	16TP4 □	A	+¼		D1						4, 7
	16UP4 □	A	+¼		D1						7
	16VP4		−½		D1						7
	16WP4A										4
	16XP4 □	A	+1								
	16YP4		−½		D1						4, 7
	16ZP4		+5½								4
	17AP4 □	A	+¾		D1						4, 7
	17BP4 □	A	+1½		D1						4
	19AP4	A	+3¾	C	D1						6
	19DP4	A	+3¾								4
	19EP4	A	+3¼		D1						4
	19FP4	A	+4¼								
	19GP4	A	+3½		D1						
	20BP4	A	+11	C		E					
	22AP4	A	+5	C	D1						6

16WP4A... Same as listed above for type 16WP4 with addition of note K for types not having note 4.

16XP4 □	16KP4 □				D1						4
	16QP4 □		+½								
	16RP4 □				D1						4
	16TP4 □		−½		D1						4, 7
	16UP4 □		−½		D1						7
	17AP4 □	A			D1						4, 7
	17BP4 □	A	+½		D1						4

If cabinet space permits, round types listed under 16WP4 may also be used.

16YP4.... Same types as listed for 16VP4 with addition of note K for types not having note 4.

16ZP4	16LP4										

Also any type listed under 16LP4 with same changes.

17AP4 □	16QP4 □	A	+½		D2					K	
	16KP4 □	A									
	16RP4 □	A									
	16TP4 □	A	−½								
	16UP4 □	A	−½							K	
	16XP4 □	A			D2					K	
	17BP4 □		+¾								

If cabinet space permits, round types listed under 16KP4 may also be used.

17BP4 □	17AP4 □		−¾								7
	16QP4 □	A			D2					K	
	16KP4 □	A	−½								
	16RP4 □	A	−½								
	16TP4 □	A	−1								7
	16UP4 □	A	−1							K	7
	16XP4 □	A	−½		D2					K	

For details of changes indicated Refer to page 34

REQUIRED TYPE	POSSIBLE REPLACEMENTS	A BULB DIAMETER	B BULB LENGTH	C CONNECTOR	D ADD ION TRAP MAG.	E REMOVE ION TRAP MAG.	F CHANGE VOLTS OPERATING	G CHANGE DEFLECTION CIRCUIT	H CHANGE TUBE SOCKET	K ADD FILTER CAPACITANCE	NOTE NO.
17BP4 (Cont'd)	If cabinet space permits, round types listed under 16YP4 may also be used.										
19AP4	17AP4 □	A	−3	C							4, 6, 7
	17BP4 □	A	−2¼	C							4, 6
	19DP4			C	D2						4, 6
	19EP4	A	−½	C							4, 6
	19FP4		+½	C	D2						6
	19GP4		−¼	C							6
	20BP4	A	+7¼	C		E					6
	22AP4	A	+1½								

Also other types listed under 16GP4 with addition of change A and 4″ decrease in length differential.

19DP4	17AP4 □	A	−3		D1						7
	17BP4 □	A	−2¼		D1						
	19AP4			C	D1					K	6
	19EP4	A	−½		D1						
	19FP4		+½							K	
	19GP4		−¼		D1					K	
	20BP4	A	+7¼	C		E				K	
	22AP4	A	+1½	C	D1					K	6

Also any 16″ types listed under 16SP4 with addition of change A and 4¼″ decrease in length differential

19EP4	17AP4 □	A	−2½								7
	17BP4 □	A	−2								
	20BP4	A	+7½	C		E				K	
	22AP4	A	+1¾	C						K	6

Also 16″ types listed under 16YP4 with 3¾″ decrease in length differential.

19FP4	17AP4 □	A	−3½		D1						7, 4
	17BP4 □	A	−2¾		D1						4
	19AP4		−½	C	D1						6
	19DP4		−½								4
	19EP4	A	−1		D1						4
	19GP4	A	−¾		D1						
	20BP4	A	+6¾	C		E					
	22AP4	A	+1	C	D1						6

Also 16″ types listed under 16WP4 with 4¼″ decrease in length differential.

19GP4	17AP4 □	A	−2¾								7, 4
	17BP4 □	A	−2								4
	19AP4		+¼	C							6
	19DP4		+¼		D2						4
	19EP4	A	−¼								4
	19FP4		+¾		D2						
	20BP4	A	+7½	C		E					
	22AP4	A	+1½	C							6

Also 16″ types listed under 16VP4 with 4″ decrease in length differential.

20BP4	16AP4	A	−6½	C	D2						
	16CP4	A	−7¼	C	D2						
	16LP4	A	−6½	C	D2						4
	16ZP4	A	−6½	C	D2						4
	16KP4 □	A	−10	C	D1		G				4
	16QP4 □	A	−9½	C	D2		G				
	16RP4 □	A	−10	C	D1		G				4
	16TP4 □	A	−10½	C	D1		G				4, 7
	16UP4 □	A	−10½	C	D1		G				7
	16XP4 □	A	−10	C	D2		G				
	17AP4 □	A	−10	C	D1		G				4, 7
	17BP4 □	A	−9½	C	D1		G				4
	22AP4	A	−6	C	D1		G				6
22AP4	19AP4	A	−1½								
	19DP4	A	−1½	C	D2						4
	19EP4	A	−1¾	C							4
	19FP4	A	−1	C	D2						
	19GP4	A	−1½	C							
	20BP4	A	+6	C		E					

Also 16″ types listed under 16GP4 with 5″ decrease in length differential.

□ Indicates rectangular tubes.

SAFETY FIRST: Wear goggles and gloves when handling Picture Tubes. Be sure power supply is turned off before working on high-voltage circuits.

NOTES FOR PICTURE TUBE SUBSTITUTION CHART

A. Make adjustment for different bulb diameter or shape.

B. Number of inches the replacement tube is longer (+) or shorter (−) than the original tube.

C. Change anode connector to type required for the substitute tube.

D. Add or change permanent magnet type ion trap magnet. D1 indicates single field and D2 double field type required. When no change is indicated by notes D or E the type of ion trap magnet used on the original tube should be used.

E. Remove the ion trap magnet. If the ion trap magnet is the permanent magnet type, just remove it with the tube; if it is the coil type magnet leave it in the circuit and put it somewhere in the cabinet, out of the way, so that no circuit changes will be necessary.

F. Suggested only if the operating conditions of the receiver do not exceed the maximum ratings of the substitute tube.

G. Requires change of deflection yoke to 70° type and possibly a new horizontal output transformer and/or tube.

H. Change in picture tube socket is required.

K. Original tube had an external coating which provided a high voltage filter capacitor. Additional external capacitance may be required to replace that normally supplied by the original picture tube.

(1) Increase in power supply voltage may be necessary for optimum performance.

(2) May be used only when no potential is required between heater and cathode.

(4) Replacement type has coating on bulb which provides filter capacitance. Be sure this coating is grounded. The underwriter's safety code requires that the total high voltage filter capacity be limited to 2000 μμf at the usual operating voltage. The original filter capacitance should be disconnected in most cases.

(6) Substitution of a metal cone tube for a coated glass tube may also require rearrangement of any parts near the metal cone to prevent corona discharge and removal of any contacts formerly grounding the bulb coating. Additional insulation is usually necessary at the cone lip since a wood cabinet alone is not sufficient to protect the user.

(7) Substitution of a short-neck, wide-angle picture tube for a long-neck tube may require a change in focus coil and/or deflection coil.

(8) Substitution of tetrode types for this triode type requires the addition of a 250-300 volt source of accelerator voltage. A voltage divider drawing 25 μa is a possible solution.

☐ Indicates rectangular tubes.

SAFETY FIRST: Wear goggles and gloves when handling Picture Tubes. Be sure power supply is turned off before working on high-voltage circuits.

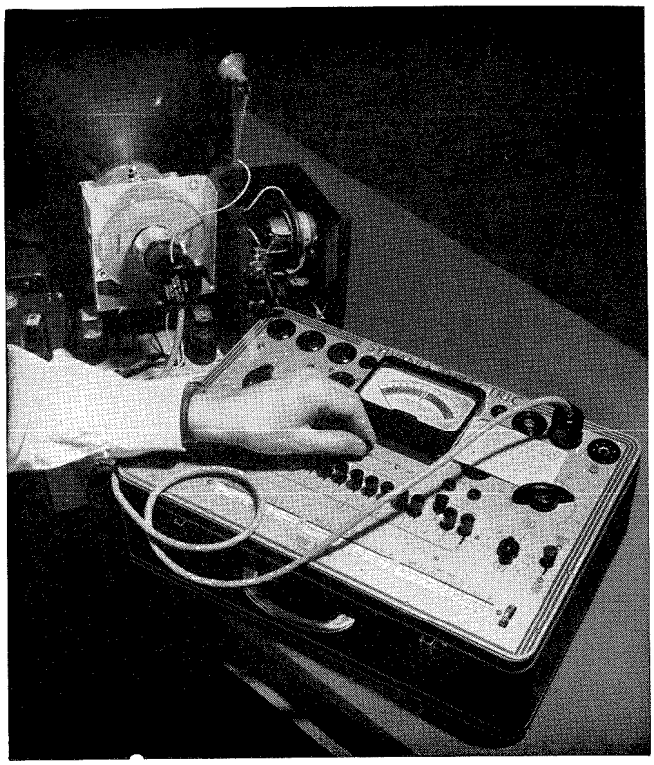
SYLVANIA CATHODE RAY TUBE TEST ADAPTOR

Standard procedure for testing television picture tubes today consists of the old-fashioned substitution method. That can all be changed if you own a Sylvania Tube Tester Model 139, 140, 219 or 220 and a Sylvania 228 CR Tube Test Adaptor. With this combination, all of the commonly used 10 to 19 inch magnetic types* can be checked.

By placing your Sylvania tube tester close to the chassis, the picture tube need not be removed from the cradle—a real time saver in many sets. After making sure the set is turned off, the adaptor is plugged in according to the instructions with the unit and settings determined from the accompanying card. Since only a few hundred volts are available, as compared to 10,000 or more in the receiver, comparative readings are taken from the small numerical scale rather than on the "GOOD-BAD" scale.

There are a few picture tube defects, such as gas, that show up only with high voltage, but this tester will determine 85% of cases where the picture tube should be replaced. Shorts, leakage, open circuits, and relative emission are easily determined. Most other defects, such as a damaged screen coating, can be determined by observing the picture.

The socket provided is the almost universal duodecal. Test settings are provided for such popular tubes as 10BP4, 10FP4, 12KP4, 12LP4, 14BP4, 14CP4, 16AP4, 16GP4, 16JP4, 16LP4, 16RP4, 16TP4, 16WP4, 16ZP4, 17AP4, 17BP4, 17CP4, 19AP4, 20CP4, 20DP4 and any A or B versions of these.

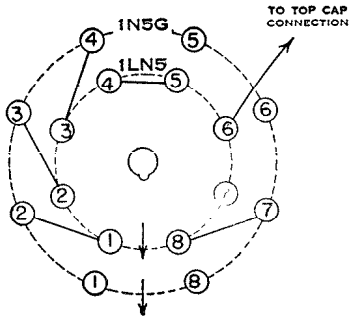


*Will not test electrostatic deflection type tubes or tubes with no accelerating electrode, such as the 10MP4 and 12VP4.

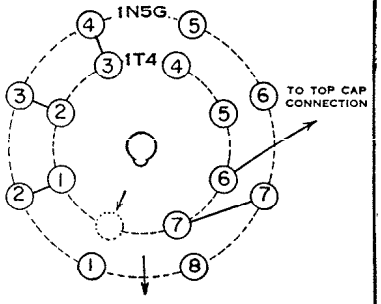
ADAPTOR CIRCUITS COMMONLY REQUIRED

AMPLIFIERS

TYPE 1LN5 REPLACING TYPE 1N5G

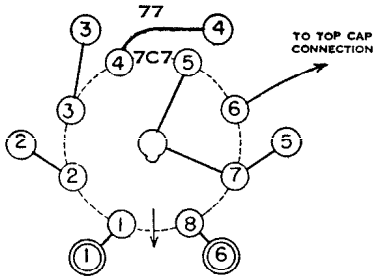


TYPE 1T4 REPLACING TYPE 1N5G



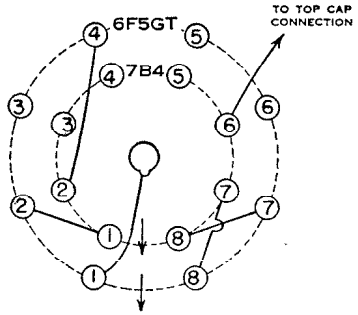
TYPE 7C7★ REPLACING TYPE 77 / 6C6

TYPE 7A7 / 7B7★ REPLACING TYPE 78 / 6D6

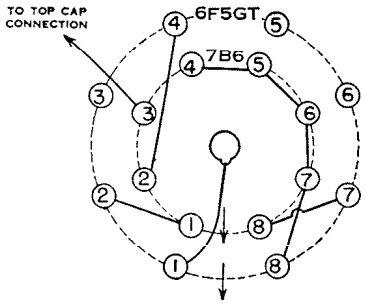


★ REQUIRES 42 TO 50 OHMS ACROSS HEATERS IN AC-DC SETS.

TYPE 7B4 REPLACING TYPE 6F5GT



TYPE 7B6 / 7C6★ REPLACING TYPE 6F5GT

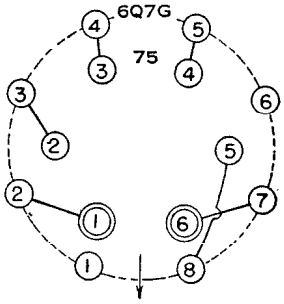


★ REQUIRES 42 TO 50 OHMS ACROSS HEATERS IN AC-DC SETS.

TYPE 75 REPLACING TYPE 6Q7G

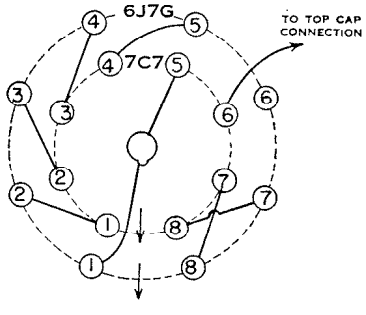
TYPE 43 REPLACING TYPE 25L6

TYPE 41 / 42 REPLACING TYPE 6F6 / 6K6 / 6U6 / 6V6



TYPE 7C7★ / 7L7 REPLACING TYPE 6J7GT

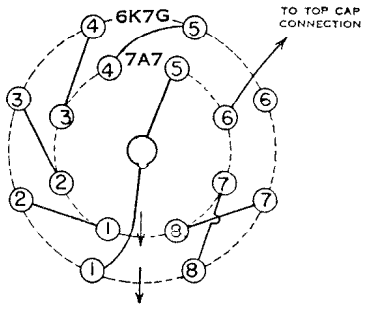
TYPE 14C7 / 7C7 REPLACING TYPE 12J7GT



★ REQUIRES 42 TO 50 OHMS ACROSS HEATERS IN AC-DC SETS.

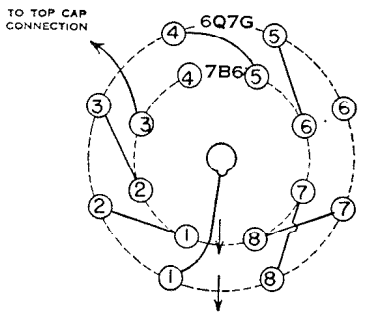
TYPE 7H7 / 7A7 REPLACING TYPE 6K7GT

TYPE 14H7 / 14A7 REPLACING TYPE 12K7GT



TYPE 7B6 / 7C6★ REPLACING TYPE 6Q7GT

TYPE 7C6 / 14B6 REPLACING TYPE 12Q7GT



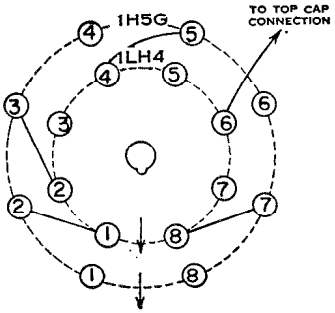
★ REQUIRES 42 TO 50 OHMS ACROSS HEATERS IN AC-DC SETS.

INNER CIRCLES REPRESENT THE PINS OF THE TYPE OF TUBE AVAILABLE FOR USE IN THE SOCKET WIRED FOR THE TYPE SHOWN AS THE OUTER CIRCLE. THE SOLID LINES SHOW THE WIRING FOR EITHER AN ADAPTOR OR FOR RECONNECTING TO THE SAME OR TO DIFFERENT SOCKETS.

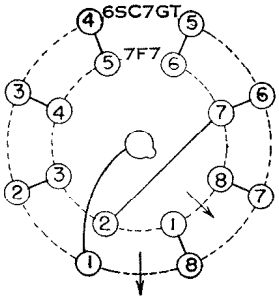
ADAPTOR CIRCUITS COMMONLY REQUIRED

AMPLIFIERS CONT'D

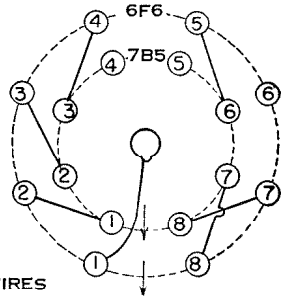
TYPE 1LH4 REPLACING TYPE 1H5GT



TYPE 7F7 REPLACING TYPE 6SC7GT

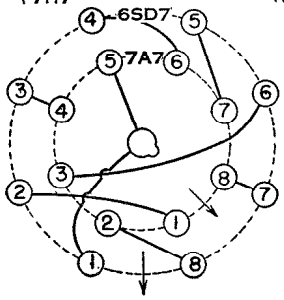


TYPE 1LA4 REPLACING TYPE 1A5G
TYPE 35A5 REPLACING TYPE 35L6
TYPE 50A5 REPLACING TYPE 50L6GT
TYPE 14C5 * REPLACING TYPE 25L6G, 25A6G
TYPE 7A4, XXL REPLACING TYPE 6C5GT
TYPE 7B5 REPLACING TYPE 6F6, 6K6, 6U6, 6V6



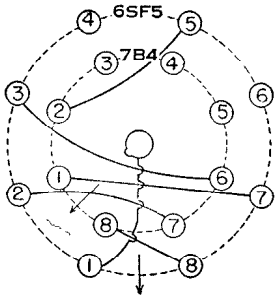
★ REQUIRES 175 OHMS ACROSS HEATERS IN AC-DC SETS AND 42 OHMS IN SERIES STRING.

TYPE 7C7, 14C7 REPLACING TYPE 12SJ7GT, 6SJ7GT ★
TYPE 14H7, 14A7 REPLACING TYPE 12SK7GT
TYPE 7A7, 7H7 REPLACING TYPE 6SD7GT, 6SK7GT

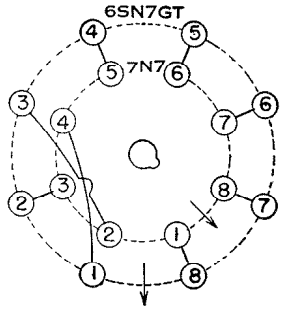


★ REQUIRES 42 TO 50 OHMS ACROSS HEATERS IN AC-DC SETS.

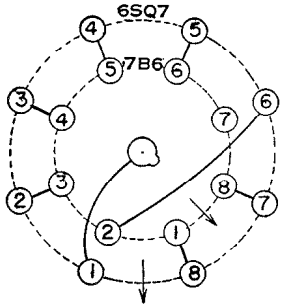
TYPE 7B4 REPLACING TYPE 6SF5



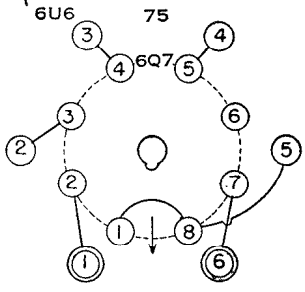
TYPE 7N7 REPLACING TYPE 6SN7GT



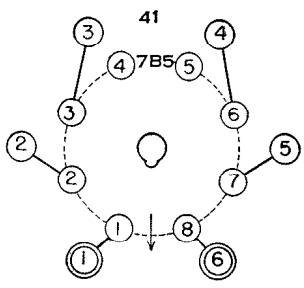
TYPE 7B6 REPLACING TYPE 6SQ7
TYPE 14B6 REPLACING TYPE 12SQ7



TYPE 6Q7GT REPLACING TYPE 75
TYPE 25L6 REPLACING TYPE 43
TYPE 6K6, 6V6, 6F6, 6U6 REPLACING TYPE 41, 42



TYPE 7B5 REPLACING TYPE 41, 42



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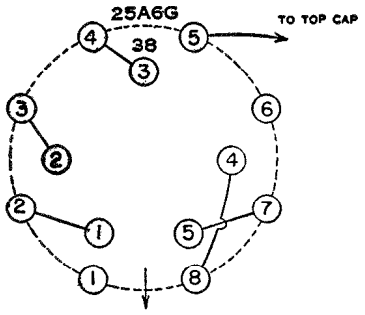
SYLVANIA

ADAPTOR CIRCUITS COMMONLY REQUIRED

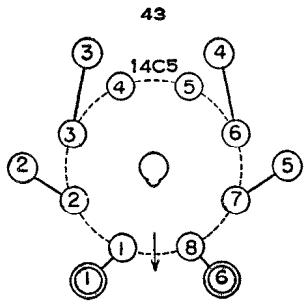
AMPLIFIERS CONT'D

TYPE 38 REPLACING TYPE 25A6G



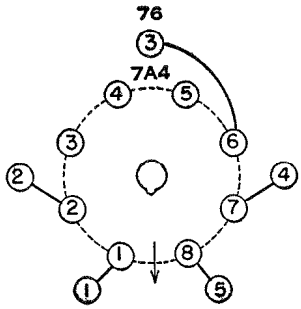
ADD 70 OHMS IN SERIES WITH HEATER IN AC-DC SETS.

TYPE 14C5 REPLACING TYPE 43



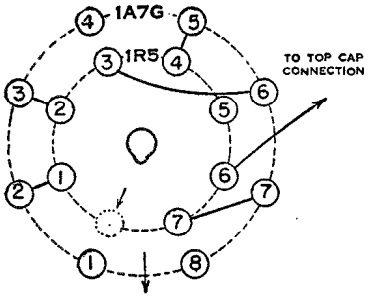
REQUIRES
175 OHMS ACROSS HEATERS IN AC-DC SETS AND 42 OHMS IN SERIES STRING.

TYPE 7A4 / XXL REPLACING TYPE 76



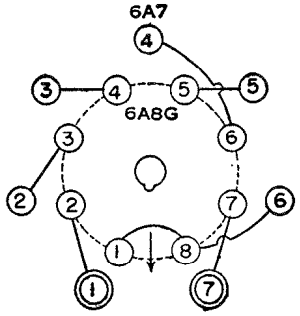
CONVERTERS

TYPE 1R5 REPLACING TYPE 1A7G

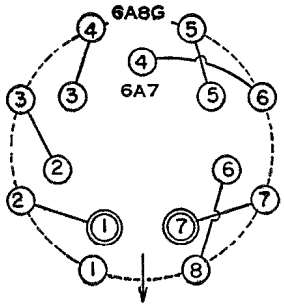


IN SOME LOCATIONS SENSITIVITY MAY BE TOO LOW FOR AVAILABLE SIGNAL STRENGTH.

TYPE 6K8G / 6J8G / 6A8G REPLACING TYPE 6A7

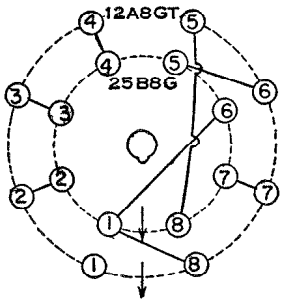


TYPE 6A7 REPLACING TYPE 6A8G



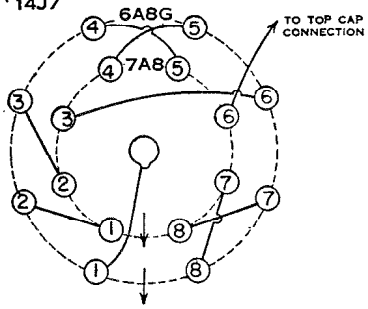
TYPE 25B8GT REPLACING TYPE 12A8GT

TYPE 12B8GT REPLACING TYPE 6A8G



TYPE 7B8 / 7A8 ★ / 7J7 REPLACING TYPE 6A8G / 6J8G / 6K8G

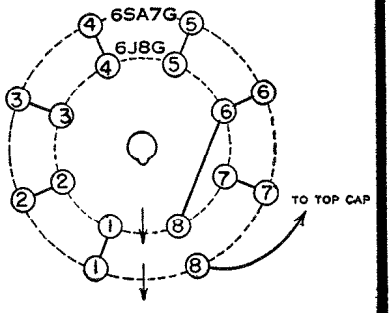
TYPE 7A8 / 14B8 / 14J7 REPLACING TYPE 12A8GT / 12K8G



★ REQUIRES 42 TO 50 OHMS ACROSS HEATERS IN AC-DC SETS.

TYPE 6J8G / 6A8G REPLACING TYPE 6SA7GT

TYPE 12K8G REPLACING TYPE 12SA7GT



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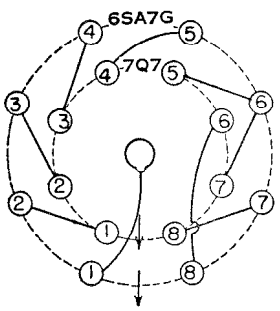
ADAPTOR CIRCUITS COMMONLY REQUIRED

TYPE 7Q7 REPLACING TYPE 6SA7GT

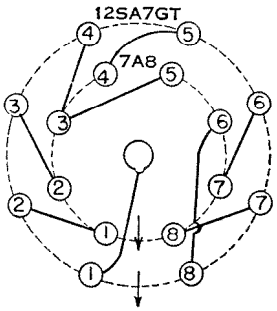
TYPE 14Q7 REPLACING TYPE 12SA7



CONVERTERS CONT'D

TYPE {7A8 / 14B8} REPLACING TYPE 12SA7GT

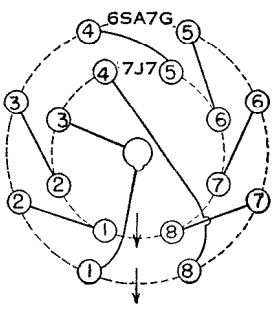
TYPE {7B8 / 7A8 ★} REPLACING TYPE 6SA7GT



★ REQUIRES 42 TO 50 OHMS ACROSS HEATERS IN AC-DC SETS.

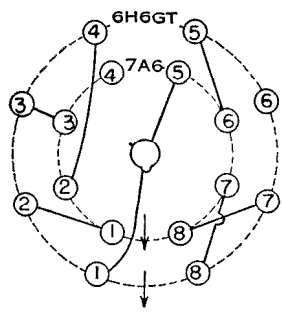
TYPE {14S7 / 14J7} REPLACING TYPE 12SA7GT

TYPE {7S7 / 7J7} REPLACING TYPE 6SA7GT



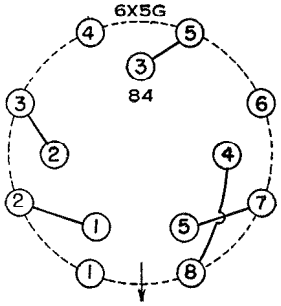
RECTIFIERS

TYPE 7A6 REPLACING TYPE 6H6GT

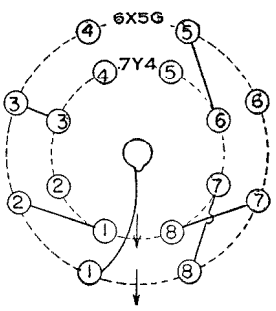


REQUIRES 42 TO 50 OHMS ACROSS HEATERS IN AC-DC SETS.

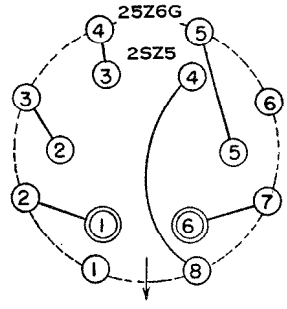
TYPE 84 REPLACING TYPE 6X5G



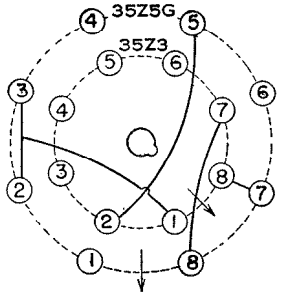
TYPE 7Y4 REPLACING TYPE 6X5G



TYPE 25Z5 REPLACING TYPE 25Z6G

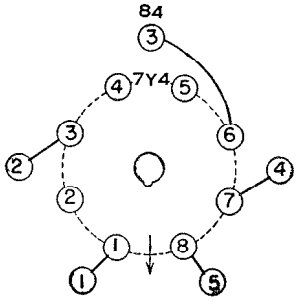


TYPE 35Z3 REPLACING TYPE 35ZSGT/G



OTHER PROVISION NECESSARY FOR PILOT LAMP.

TYPE 7Y4 REPLACING TYPE 84



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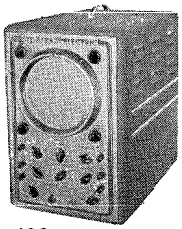
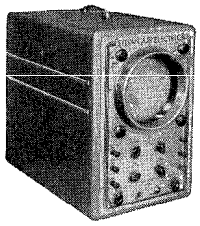
Look to SYLVANIA for the latest in ELECTRONIC TEST EQUIPMENT

Television Oscilloscope. An Exceptionally High-Gain, Wide-Band Oscilloscope Designed for Television. Accurately displays any TV pulse or wave-shape on a large, eye-saving 7″ screen. Sensitivity: 0.01 v./in. Vert. response useful to 4.0 mc. Hard-tube sweeps to 50 kc.; phasing control; pos. or neg. sync. control; many other outstanding features. Recommended for servicemen; laboratories; advanced schools and industry.



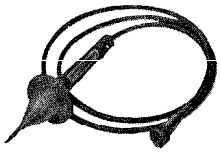
Type 400



Type 132Z

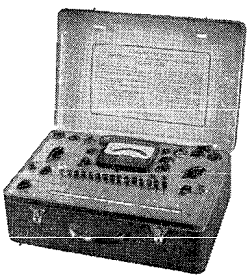
General Purpose Oscilloscope. A Versatile 7″ Scope with Many Features Found in Type 400 above, priced as low as oscilloscopes with smaller screens. Sensitivity: 0.10 v./in.; freq. response: exceeds 7 cps. to 70 kc. Widely used by servicemen, schools and industry for AM-FM-TV testing.

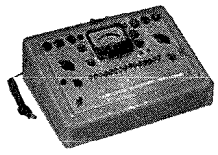
TV High-Voltage Probes. New, Quality Probes that Permit Measuring High TV Anode Voltages by increasing the dc range of Polymeters to 30,000 or 10,000 volts. Special conversion cartridge permits using 30 kv probes with ANY 1,000 volt scale 20,000 ohm/volt meter. Select correct probe from list below:



Type	Range	Use with
225	30 kv	Polymeter, Type 221 or 221Z.
224	30 kv	Earlier Polymeters, Types 134 and 134Z.
226	30 kv	Conversion cartridge for use with above Type 225 or 224 to convert ANY 20,000 ohm/volt meter with a 1000-volt scale to a kilovoltmeter
223	10 kv	Polymeter, Type 221 or 221Z.
222	10 kv	Earlier Polymeters, Types 134 and 134Z.

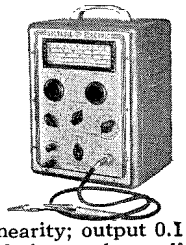
Tube Tester Type 220. Made By A Tube Manufacturer For Tube Users, these instruments test for ALL usual faults—not just one particular characteristic. New and exclusive ohmmeter-type shorts/leakage test indicates "GOOD" or "REPLACE" directly on the illuminated meter. Gas and a special heater-cathode leakage tests made in single operations. Single composite dynamic test for emission, transconductance and relative tube life. Panel-mounted roller-chart; convenient switches; provisions for future tubes. Portable Type 220 has durable metal case and handle; removable cover. Size: 6″ x 11¼″ x 17″.





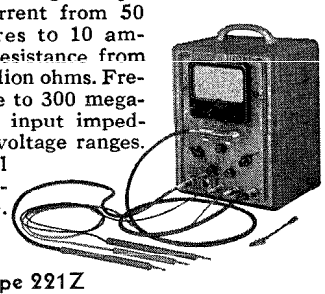
Tube Tester Type 219. The counter Type 219 is electrically equivalent to the portable type. Attractively housed in a streamlined wood and metal cabinet. Adaptable to any surroundings. Occupies small counter space. Size: 5⅞″ x 13″ x 18⅞″.

Type 500

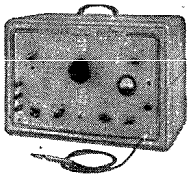


TV Signal Generator. An ALL ELECTRONIC Sweep Generator for TV and FM. Fundamental center frequencies: 2-25, 20-64, 60-120, and 140-230 mc. Two adjustable sweep widths: 0-600 kc./15 mc.; excellent sweep linearity; output 0.1 v. Edge-lighted dial; simplified controls; small size: 11½″ x 8½″ x 7″. May be used with any 'scope and marker including those shown at left and below.

Polymeter—TV Vacuum-Tube Voltmeter. A Sensitive DC, AC and RF Vacuum-Tube Voltmeter, Ohmmeter and DC Current Meter. The basic instrument for every TV, FM and AM shop. Ranges: rf to 300 volts (only 3 $\mu\mu$f shunt capacity); ac and dc to 1000 volts (10 or 30 kv dc using h.v. probes described at left); dc current from 50 microamperes to 10 amperes; and resistance from 0.5 to one billion ohms. Frequency range to 300 megacycles. High input impedance on all voltage ranges. Size identical to TV generator above.

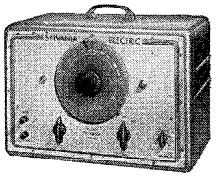


Type 221Z



FM-AM Signal Generator. *Useful as a TV Marker.* A versatile AM-FM generator, doubly useful for peaking alignment of TV and as a TV marker. Calibrated to 0.05%. Fundamentals 80 kc to 120 mc; harmonics to 240 mc. Modulation: 0-100% AM; 0-30/150/700 kc FM. 1.0 volt max. output. Low leakage. Built-in crystal circuit. Size same as audio oscillator below.

Type 216



Audio Oscillator. An Accurate Sine-Wave Generator for Better Equipped Shops and Sound Specialists. Maximum output: 22.5 volts, 20-20,000 cps, flat within 2 db. size 11⅜″ x 17 1/16″ x 9 9/16″

Type 145

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